STR7 FAMILY

STR73x

SOFTWARE LIBRARY

USER MANUAL

Rev. 1

September 2005

USE IN LIFE SUPPORT DEVICES OR SYSTEMS MUST BE EXPRESSLY AUTHORIZED. STMicroelectronics PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF STMicroelectronics. As used herein:

1.Life support devices or systems are those which (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided with the product, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can reasonably be expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

1 INTRODUCTION

1.1 ABOUT THIS MANUAL

This document is the STR73x software library user manual. It describes the STR73x peripheral software library: a collection of routines, data structures and macros that cover the features of each peripheral.

This manual is structured as follows: some definitions, document conventions and software library rules are provided in Chapter 2. Chapter 3 gives some information about the required hardware and software environments. Chapter 4 provides a detailed description of the software library: The package content, the installation steps, the library structure and an example on how to use the library. Finally, Chapter 5 describes the software library, peripheral configuration structure and function descriptions for each peripheral in detail.

1.2 ABOUT STR73X LIBRARY

The STR73x software library is a software package consisting of device drivers for all standard STR73x peripherals. You can use any STR73x device in applications without in-depth study of each peripheral specification.

Each device driver consists of a set of functions covering the functionality of the peripheral. Since all the STR73x peripherals and their corresponding registers are memory-mapped, a peripheral can be easily controlled using ‘C’ code. The source code, developed in ‘C’, is fully documented. A basic knowledge of ‘C’ programming is required.

The library contains a complete software in ‘C’ that can be easily ported to any ARM compatible ‘C’ compiler.

Table of Contents

2 DOCUMENT AND LIBRARY RULES

The user manual document and the software library use the conventions described in the sections below.

2.1 ABBREVIATIONS

The table below describes the different abbreviations used in this document

Acronym	Peripheral / Unit
ADC	Analog to Digital Converter
BSPI	Buffered Serial Peripheral Interface
CMU	Clock Monitor Unit
CFG	System Configuration register
CAN	Controller Area Network
DMA	Direct Memory Access
EIC	Enhanced Interrupt Controller
GPIO	General Purpose Input Output
I2C	Inter-Integrated Circuit
PRCCU	Power, Reset and Clock Control Unit
PWM	Pulse width Modulator
RTC	Real Time Clock
TB	Timebase timer
TIM	Timer
UART	Universal Asynchronous Receiver Transmitter
WDG	Watchdog Timer
WUT	Wake-Up Timer
WIU	Wake-Up Interrupt Unit

2.2 STYLE AND SYMBOLS

The document uses the following style conventions:

- Program listings, program examples, structure definitions and function prototypes are shown in a special typeface. The following example is a function prototype shown in `courier typeface`.

```
void GPIO_DeInit (GPIO_TypeDef *GPIOx);
```

- Program portions, variables and function names quoted in a paragraph are in *italic typeface*.
- A comment in a program listing is shown in *italic typeface.* For example:

```
void GPIO_DeInit (GPIO_TypeDef *GPIOx));/* GPIO_DeInit function prototype*/
```

- File paths and file names quoted in a paragraph are in *italic typeface*: The file *73x_prccu.c* is located in the subdirectory *library\src*.

2.3 NAMING CONVENTIONS

The Software library uses the following naming conventions:

- ***PPP*** is used to reference to any peripheral acronym, e.g. ***TIM***. See the section above for more information on peripheral acronyms.
- System and source/header file names are preceded by '*73x_*', e.g. *73x_conf.h***.**
- Constants used in one file are defined within this file. A constant used in more than one file is defined in a header file. All constants use upper case characters.
- Registers are considered as constants. Their names are in upper case letters and have in most case the same acronyms as in the STR73x reference manual document.
- Peripheral function names are preceded with the corresponding peripheral acronym in upper case followed by an underscore. The first letter in each word is upper case, e.g. ***UART_SetTimeOutValue.*** Only one underscore is allowed in a function name to separate the peripheral acronym from the rest of the function name.
- Functions for initializing PPP peripheral according to the specified parameters in the PPP_InitTypeDef are named ***PPP_Init***, e.g. ***PRCCU_Init***.
- Functions for deinitializing PPP peripheral registers to their default reset values are named ***PPP_DeInit***, e.g. ***PRCCU_DeInit***.
- Functions for filling the PPP_InitTypeDef structure with the reset value of each member are named ***PPP_StructInit***, e.g. ***PRCCU_StructInit***.
- Functions for checking whether the specified PPP flag is set or not are named ***PPP_FlagStatus,*** e.g. ***TIM_FlagStatus.***
- Functions for clearing a PPP flag are named ***PPP_FlagClear***, e.g. ***TIM_FlagClear.***
- Functions for enabling or disabling the specified PPP peripheral are named ***PPP_Cmd***, e.g. ***ADC_Cmd.***
- Functions for enabling or disabling an interrupt source of the specified PPP peripheral are named ***PPP_ITConfig***, e.g. ***PRCCU_ITConfig.***
- Functions for enabling or disabling the DMA interface of the specified PPP peripheral are named ***PPP_DMAConfig***, e.g. ***TIM_DMAConfig.***
- Functions used to configure a peripheral function end with ***Config***, e.g. ***PRCCU_VRConfig.***

2.4 CODING RULES

The following rules are used in the Software Library.

- 16 specific types are defined for variables whose type and size are fixed. These types are defined in the file ***73x_type.h***:

```
typedef signed long    s32;
typedef signed short    s16;
typedef signed char    s8;
typedef volatile signed long    vs32;
typedef volatile signed short    vs16;
typedef volatile signed char    vs8;
typedef unsigned long    u32;
typedef unsigned short    u16;
typedef unsigned char    u8;
typedef volatile unsigned long    vu32;
typedef volatile unsigned short    vu16;
typedef volatile unsigned char    vu8;
typedef volatile unsigned long const  vuc32;  /* Read Only */
typedef volatile unsigned short const  vuc16; /* Read Only */
typedef volatile unsigned char const  vuc8;   /* Read Only */
```

- ***bool*** type is defined in the file ***73x_type.h*** as:

```
typedef enum
{
  FALSE = 0,
  TRUE  =!FALSE
} bool;
```

- ***FlagStatus*** type is defined in the file ***73x_type.h***. Two values can be assigned to this variable: ***SET*** or ***RESET***.

```
typedef enum
{
  RESET = 0,
  SET  =!RESET
} FlagStatus;
```

- ***FunctionalState*** type is defined in the file ***73x_type.h***. Two values can be assigned to this variable: ***ENABLE*** or ***DISABLE***.

```
typedef enum
{
  DISABLE = 0,
  ENABLE =!DISABLE
} FunctionalState;
```

- ***ErrorStatus*** type is defined in the file ***73x_type.h***. Two values can be assigned to this variable: ***SUCCESS*** or ***ERROR***.

```
typedef enum
{
 ERROR = 0,
 SUCCESS =!ERROR
} ErrorStatus;
```

- Pointers to peripherals are used to access the peripheral control registers. Peripheral pointers point to data structures that represent the mapping of the peripheral control registers. A structure is defined for each peripheral in the file ***73x_map.h***. The example below illustrates the '*GPIO* register structure declaration:

```
/*------------------ General Purpose IO ports----------------------*/
typedef struct
{
 vu16 PC0;
 u16 EMPTY1;
 vu16 PC1;
 u16 EMPTY2;
 vu16 PC2;
 u16 EMPTY3;
 vu16 PD;
} GPIO_TypeDef;
```

Register names are the register acronyms written in upper case for each peripheral. *EMPTYi* (*i* is an integer that indexes the reserved field) replaces a reserved field.

In some cases an enumeration is needed for a peripheral. This enumeration is called *PPP_Registers* and is declared in the file ***73x_ppp.h***, e.g:

```
typedef enum
{
  GPIOPC0 = 0x00,
  GPIOPC1 = 0x04,
  GPIOPC2 = 0x08,
  GPIOPD = 0x0C,
} GPIO_Registers;
```

Peripherals are declared in ***73x_map.h*** file. The following example shows the declaration of the *GPIO* peripheral:

```
#ifndef EXT
 #Define EXT extern
#endif
...
/* GPIO2 Base Address definition*/
#define GPIO2_BASE    (APB + 0x5420)
/* GPIO2 peripheral declaration*/
```

```
#ifdef DEBUG
 EXT GPIO_TypeDef *GPIO2;
...
#else
 #define GPIO2 ((GPIO_TypeDef *) GPIO2_BASE)
...
#endif
```

To enter debug mode you have to define the label *DEBUG* in the file ***73x_conf.h***. Debug mode allows you to see the contents of peripheral registers but it uses more memory space. In both cases *GPIO2* is a pointer to the first address of *GPIO2* port.

DEBUG variable is defined in the file ***73x_conf.h*** as follows:

```
#define DEBUG
```

DEBUG mode is initialized as follows in the ***73x_lib.c*** file:

```
#ifdef DEBUG
 void debug(void)
 {
...
 #ifdef _GPIO2
   GPIO2 = (GPIO_TypeDef *)GPIO2_BASE;
 #endif /*_GPIO2*/
...
}
#endif /* DEBUG*/
```

To include the *GPIO* peripheral library in your application, define the label *_GPIO* and to access the *GPIOn* peripheral registers, define the label *GPIOn*, i.e to access the registers of *GPIO2* peripheral, *_GPIO2* label must be defined in ***73x_conf.h*** file. *_GPIO* and *_GPIOn* labels are defined in the file ***73x_conf.h*** as follows:

```
#define _GPIO
#define _GPIO2
```

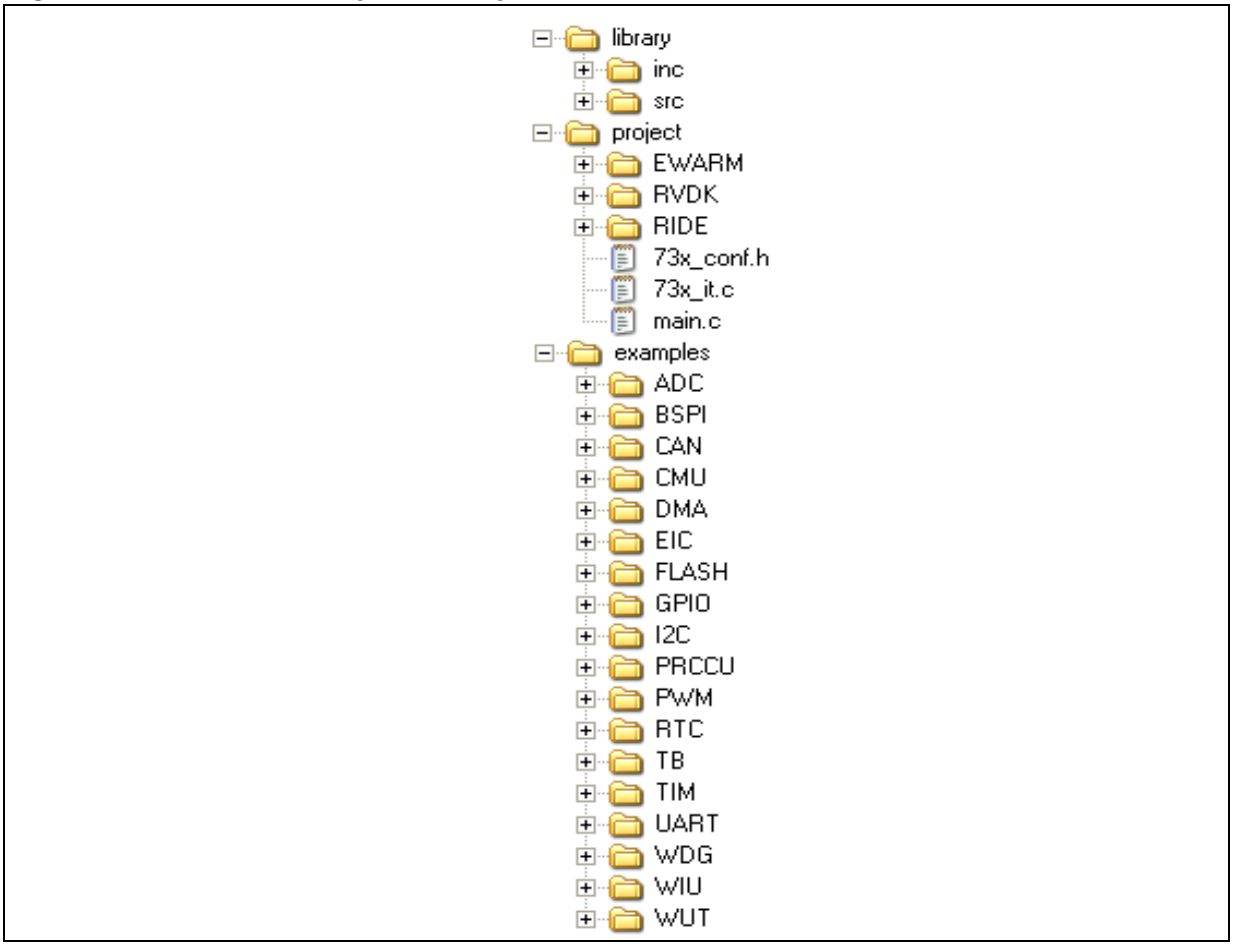
Each peripheral has several dedicated registers which contain different flags. Registers are defined within a dedicated structure for each peripheral. Flag definition is adapted to each peripheral case (defined in ***73x_ppp.h*** file). Flags are defined as acronyms written in upper case and prefixed by '*PPP*_Flag_' prefix.

3 SOFTWARE LIBRARY

3.1 PACKAGE DESCRIPTION

The software library is supplied in one single zip package. The extraction of the zip file will give the one folder "***STR73x\StdLib***" containing the following sub-directories:

Figure 1. Software Library Directory Structure



3.1.1 Library

This directory contains all required subdirectories and files that build the library core:

- ***inc*** sub-directory contains the software library header files that do not need to be modified by the user:

– *73x_type.h*: Contains the common data types and enumeration used in all other files,

– *73x_map.h*: Contains the peripherals memory mapping and registers data structures,

– *73x_lib.h*: Main header file including all other headers,

– 73x_*ppp.h* (one header file per peripheral): contains the function prototypes, data structures and enumeration.

- ***src*** sub-directory contains the software library source files that do not need to be modified by the user:

– *73x_ppp.c* (one source file per peripheral): contains the function bodies of each peripheral.

Note : all library files are coded in Strict ANSI-C and are independent from any software tool-chain.

3.1.2 Project

This directory contains toolchain sub-directory ,a standard template project program that compiles all library files and all the user modifiable files needed to create a new project :

– *73x_conf.h:* The configuration header file with all peripherals defined by default,

– *73x_it.c:* The source file containing the interrupt handlers (the function bodies are empty in this template),

– *main.c:* The main program body, that toggles for ever all GPIO4 port and print "Hello World" message in your software toolchain debugger console.

- ***EWARM, RVDK, RIDE****:* For each toolchain usage, refer to Readme.txt file available in the same sub-directory.

3.1.3 *Examples*

This directory contains for each peripheral sub-directory, the minimum set of files needed to run a typical example on how to use a peripheral:

– *Readme.txt*: a brief text file describing the example and how to make it work,

– *73x_conf.h*: the header file to configure used peripherals and miscellaneous defines,

– *73x_it.c*: the source file containing the interrupt handlers (the function bodies may be empty if not used)

– *main.c*: the example program.

Note : All examples are independent from any software tool chain.

3.2 FILE DESCRIPTION

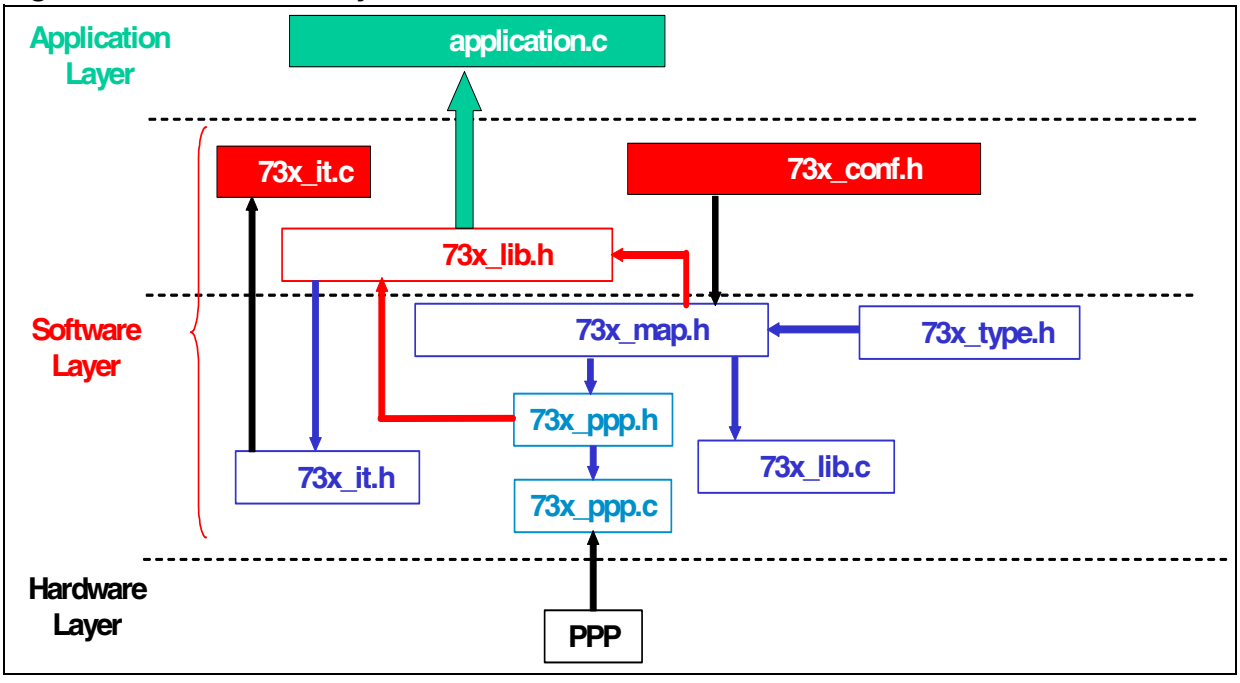
Several files are used in the software library. The following table enumerates and describes the different files used in the software library.

Table 1. Source/Header File List

Filename	Description
73x_conf.h	Parameter configuration file. It should be modified by the user to specify several parameters to interface with the library before running any application. You can enable or disable peripherals if you use the template and you can also change the value of your external Quartz value.
main.c	The main example program body.
73x_it.c	Peripheral interrupt functions file. You can modify it by including the code of interrupt functions used in your application. In case of multiple interrupt requests mapped on the same interrupt vector, the function polls the interrupt flags of the peripheral to establish the exact source of the interrupt. The names of these functions are already provided in the software library.
73x_lib.h	Header file including all the peripheral header files. It is the unique file to be included in the user application to interface with the library.
73x_lib.c	Debug mode initialization file. It includes the definition of variable pointers each one pointing to the first address of a specific peripheral and the definition of one function called when you choose to enter debug mode. This function initializes the defined pointers.
73x_map.h	This file implements memory mapping and physical registers address definition for both development and debug modes. This file is supplied with all peripherals.
73x_type.h	Common declarations file. It includes common types and constants used by all peripheral drivers.
73x_ppp.c	Driver source code file of *PPP* peripheral written in C language.
73x_ppp.h	Header file of *PPP* peripheral. It includes the definition of *PPP* peripheral functions and variables used within these functions.

The software library architecture and file inclusion relationship are shown in Figure 2.

Figure 2. Software Library File Architecture



Each peripheral has a source code 73x_*ppp.c* and a header 73x_*ppp.h* file. The *73x_ppp.c* file contains all the software functions required to use the corresponding peripheral. A single memory mapping file *73x_map.h* is supplied for all peripherals. This file contains all the register declarations for both development and debug modes.

The header file *73x_lib.h* includes all the peripheral header files. This is the only file that needs to be included in the user application to interface with the library.

3.3 HOW TO USE THE LIBRARY

This section describes step-by-step how to configure and initialize a PPP peripheral.

1) In your main application file, declare a ***PPP_InitTypeDef*** structure, e.g:

```
PPP_InitTypeDef PPP_InitStructure;
```

The `PPP_InitStructure` is a working variable located in data memory that allows you to initialize one or more PPP instances.

2) Fill the `PPP_InitStructure` variable with the allowed values of the structure member. There are two ways of doing this:

- Configuration of the whole structure: in this case you should proceed as follows:

```
PPP_InitStructure.member1 = val1;
PPP_InitStructure.member2 = val2;
PPP_InitStructure.memberN = valN; /* where N is the number of
                                     the structure members */
```

- Configuration of a few members of a structure: in this case you should modify the `PPP_InitStructure` variable that has been already filled by a call to the ***PPP_StructInit(..)*** function. This ensures that the other members of the `PPP_InitStructure` variable have appropriate values (in most case their reset values).

```
PPP_StructInit(&PPP_InitStructure);
PPP_InitStructure.memberX = valX;
PPP_InitStructure.memberY = valY; /* where X and Y are the only members that
                                     you want to configure */
```

3) You have to initialize the PPP peripheral by calling the ***PPP_Init(..)*** function.

```
PPP_Init(PPP, &PPP_InitStructure);
```

4) At this stage the PPP peripheral is initialized and can be enabled by making a call to ***PPP_Cmd(..)*** function.

```
PPP_Cmd(PPP, ENABLE);
```

To use the PPP peripheral, you can use a set of dedicated functions. These functions are specific to the peripheral and for more details refer to section 4 on page 25.

Note: ***PPP_DeInit(..)*** function can be used to set all PPP peripheral registers to their reset values.

```
PPP_DeInit(PPP);
```

Note: If after peripheral configuration, you want to modify one or more peripheral settings you should proceed as follows:

```
PPP_InitStucture.memberX = valX;
PPP_InitStructure.memberY = valY; /* where X and Y are the only members that
                                     user wants to modify*/
PPP_Init(PPP, &PPP_InitStructure);
```

4 PERIPHERAL SOFTWARE

This chapter describes in details each peripheral software library. The related functions are fully documented. An example of use of the function is given and some important considerations are also provided.

Functions are described in the format below:

Function name	The name of the peripheral function
Function prototype	Prototype declaration
Behavior Description	Brief explanation of how the functions are executed
Input Parameter {x}	Description of the input parameters
Output parameter {x}	Description of the output parameters
Return Value	Value returned by the function
Required Preconditions	Requirements before to call the function
Called Functions	Other library functions called by the function
See also	Related functions for reference

4.1 ANALOG TO DIGITAL CONVERTER (ADC)

The *ADC* driver may be used to manage the *ADC* in its two modes of conversion: one-shot or scan and to generate a maskable interrupt when a sample is ready.

The first section describes the data structures used in the *ADC* software library. The second one presents the software library functions.

4.1.1 Data structures

4.1.1.1 ADC Registers structure

The *ADC* peripheral register structure *ADC_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu16 CLR0;
 u16 EMPTY1;
 vu16 CLR1;
 u16 EMPTY2;
 vu16 CLR2;
 u16 EMPTY3;
 vu16 CLR3;
 u16 EMPTY4;
 vu16 CLR4;
 u16 EMPTY5;
 vu16 TRA0;
 u16 EMPTY6;
```

```
vu16 TRA1;
u16 EMPTY7;
vu16 TRA2;
u16 EMPTY8;
vu16 TRA3;
u16 EMPTY9;
vu16 TRB0;
u16 EMPTY10;
vu16 TRB1;
u16 EMPTY11;
vu16 TRB2;
u16 EMPTY12;
vu16 TRB3;
u16 EMPTY13;
vu16 DMAR;
u16 EMPTY14[7];
vu16 DMAE;
u16 EMPTY15;
vu16 PBR;
u16 EMPTY16;
vu16 IMR;
u16 EMPTY17;
vuc16 D0;
u16 EMPTY18;
vuc16 D1;
u16 EMPTY19;
vuc16 D2;
u16 EMPTY20;
vuc16 D3;
u16 EMPTY21;
vuc16 D4;
u16 EMPTY22;
vuc16 D5;
u16 EMPTY23;
vuc16 D6;
u16 EMPTY24;
vuc16 D7;
u16 EMPTY25;
vuc16 D8;
u16 EMPTY26;
vuc16 D9;
u16 EMPTY27;
vuc16 D10;
u16 EMPTY28;
vuc16 D11;
```

```
u16 EMPTY29;
vuc16 D12;
u16 EMPTY30;
vuc16 D13;
u16 EMPTY31;
vuc16 D14;
u16 EMPTY32;
vuc16 D15;
u16 EMPTY33;
} ADC_TypeDef;
```

The following table presents the *ADC* registers:

Register	Description
CLR0	ADC Control Logic register 0
CLR1	ADC Control Logic register *1*
CLR2	ADC Control Logic register 2
CLR3	ADC Control Logic register 3
CLR4	ADC Control Logic register 4
TRA0	ADC Threshold Detection Channel0 register A
TRA1	ADC Threshold Detection Channel1 register A
TRA2	ADC Threshold Detection Channel2 register A
TRA3	ADC Threshold Detection Channel3 register A
TRB0	ADC Threshold Detection Channel0 register B
TRB1	ADC Threshold Detection Channel1 register B
TRB2	ADC Threshold Detection Channel2 register B
TRB3	ADC Threshold Detection Channel3 register B
DMAR	ADC DMA register
DMAE	ADC DMA Enable register
PBR	ADC Pending Bit register
IMR	ADC Interrupt Mask Register
D0	*ADC* DATA register for channel 0
D1	*ADC* DATA register for channel 1
D2	*ADC* DATA register for channel 2
D3	*ADC* DATA register for channel 3
D4	*ADC* DATA register for channel 4
D5	*ADC* DATA register for channel 5
D6	*ADC* DATA register for channel 6
D7	*ADC* DATA register for channel 7
D8	*ADC* DATA register for channel 8
D9	*ADC* DATA register for channel 9

Register	Description
D10	*ADC* DATA register for channel 10
D11	*ADC* DATA register for channel 11
D12	*ADC* DATA register for channel 12
D13	*ADC* DATA register for channel 13
D14	*ADC* DATA register for channel 14
D15	*ADC* DATA register for channel 15

The *ADC* peripheral is declared in the same file:

```
...
#define APB 0xFFFF8000
...
#define ADC_BASE    (APB + 0x7800)
...
#ifndef DEBUG
...
 #define ADC ((ADC_TypeDef  *)ADC_BASE)
...
#else
...
 EXT ADC_TypeDef *ADC;
...
#endif
```

When debug mode is used, *ADC* pointer is initialized in *73x_lib.c* file:

```
void debug(void)
{
...
#ifdef _ADC
  ADC = (ADC_TypeDef *)ADC_BASE;
 #endif /* _ADC */
...
}
```

In debug mode, *_ADC* must be defined, in *73x_conf.h* file, to access the peripheral registers as follows:

```
#define _ADC
```

Some PRCCU functions are called, *_PRCCU* must be defined in *73x_conf.h* file, to make the P*RCCU* functions accessible:

```
#define _PRCCU
```

4.1.1.2 ADC_InitTypeDef Structure

The *ADC_InitTypeDef* structure defines the control setting for the ADC peripheral.

```
typedef struct
{
  u8 ADC_Calibration;
  u8 ADC_SamplingPrescaler;
  u8 ADC_ConversionPrescaler;
  u8 ADC_FirstChannel;
  u8 ADC_ChannelNumber;
  u16 ADC_CalibAverage;
  u16 ADC_AutoClockOff;
  u16 ADC_ConversionMode;
}ADC_InitTypeDef;
```

Members

- **ADC_Calibration**

  Enable/disable the calibration process. This member can be one of the following values:

ADC_Calibration	Meaning
ADC_Calibration_ON	Enable the calibration process
ADC_Calibration_OFF	Disable the calibration process

- **ADC_SamplingPrescaler**

  Select the sampling prescaler. Allowed values are from 0 to 7.

- **ADC_ConversionPrescaler**

  Select the sampling prescaler. Allowed values are from 0 to 7.

- **ADC_FirstChannel**

  Select the first channel to be converted.

ADC_FirstChannel	Meaning
ADC_CHANNEL0	select channel 0
ADC_CHANNEL1	select channel 1
ADC_CHANNEL2	select channel 2
ADC_CHANNEL3	select channel 3
ADC_CHANNEL4	select channel 4
ADC_CHANNEL5	select channel 5
ADC_CHANNEL6	select channel 6
ADC_CHANNEL7	select channel 7
ADC_CHANNEL8	select channel 8
ADC_CHANNEL9	select channel 9

ADC_FirstChannel	Meaning
ADC_CHANNEL10	select channel 10
ADC_CHANNEL11	select channel 11
ADC_CHANNEL12	select channel 12
ADC_CHANNEL13	select channel 13
ADC_CHANNEL14	select channel 14
ADC_CHANNEL15	select channel 15

- **ADC_ChannelNumber**

  Select the number of channels to be converted. The maximum number is 16 channels.

- **ADC_CalibAverage**

  Enable/disable the calibration average.

ADC_CalibAverage	Meaning
ADC_CalibAverage_Enable	Calibration average enabled
ADC_CalibAverage_Disable	Calibration average disabled

- **ADC_AutoClockOff**

  Enable/disable the auto clock off feature.

ADC_AutoClockOff	Meaning
ADC_AutoClockOff_Enable	AutoClockOff feature enabled
ADC_AutoClockOff_Disable	AutoClockOff feature disabled

- **ADC_ConversionMode**

  Select the conversion mode (one-shot model or scan mode).

ADC_ConversionMode	Meaning
ADC_ConversionMode_OneShot	One shot conversion mode Enabled
ADC_ConversionMode_Scan	Scan conversion mode Enabled

4.1.2 Common Parameter Values

4.1.2.1 ADC Modes of Conversion

The ADC modes of conversion are defined in the file 73x_*adc.h*:

Conversion modes	Meaning
ADC_ConversionMode_OneShot	Enables the one shot mode of conversion
ADC_ConversionMode_Scan	Enables the scan (multi-channel) mode of conversion

4.1.2.2 ADC Channels

The *ADC* channels are defined in the file 73x_*adc.h* as follows:

ADC Channels	Meaning
ADC_CHANNEL0	select channel 0
ADC_CHANNEL1	select channel 1
ADC_CHANNEL2	select channel 2
ADC_CHANNEL3	select channel 3
ADC_CHANNEL4	select channel 4
ADC_CHANNEL5	select channel 5
ADC_CHANNEL6	select channel 6
ADC_CHANNEL7	select channel 7
ADC_CHANNEL8	select channel 8
ADC_CHANNEL9	select channel 9
ADC_CHANNEL10	select channel 10
ADC_CHANNEL11	select channel 11
ADC_CHANNEL12	select channel 12
ADC_CHANNEL13	select channel 13
ADC_CHANNEL14	select channel 14
ADC_CHANNEL15	select channel 15

4.1.2.3 ADC Flags

The *ADC* flags are defined in the file 73x_*adc.h*:

ADC Flags	Meaning
ADC_FLAG_ECH	End of chain conversion
ADC_FLAG_EOC	End of channel conversion
ADC_FLAG_JECH	End of injected chain conversion
ADC_FLAG_JEOC	End of injected channel conversion
ADC_FLAG_AnalogWatchdog0_LowThresold	Low threshold comparison for analog watchdog0 interrupt cleared
ADC_FLAG_AnalogWatchdog0_HighThresold	High threshold comparison for analog watchdog0 interrupt cleared
ADC_FLAG_AnalogWatchdog1_LowThresold	Low threshold comparison for analog watchdog1 interrupt cleared

ADC Flags	Meaning
ADC_FLAG_AnalogWatchdog1_HighThresold	High threshold comparison for analog watchdog1 interrupt cleared
ADC_FLAG_AnalogWatchdog2_LowThresold	Low threshold comparison for analog watchdog2 interrupt cleared
ADC_FLAG_AnalogWatchdog2_HighThresold	High threshold comparison for analog watchdog2 interrupt cleared
ADC_FLAG_AnalogWatchdog3_LowThresold	Low threshold comparison for analog watchdog3 interrupt cleared
ADC_FLAG_AnalogWatchdog3_HighThresold	High threshold comparison for analog watchdog3 interrupt cleared

4.1.2.4 ADC IT

The *ADC* IT interrupts sources *are* defined in the file 73x_*adc.h*:

ADC_IT	Meaning
ADC_IT_ECH	ECH interrupt enabled
ADC_IT_EOC	EOC interrupt enabled
ADC_IT_JECH	JECH interrupt enabled
ADC_IT_JEOC	JEOC interrupt enabled
ADC_IT_AnalogWatchdog0_LowThresold	Low threshold comparison for analog watchdog0 interrupt enabled
ADC_IT_AnalogWatchdog0_HighThresold	High threshold comparison for analog watchdog0 interrupt enabled
ADC_IT_AnalogWatchdog1_LowThresold	Low threshold comparison for analog watchdog1 interrupt enabled
ADC_IT_AnalogWatchdog1_HighThresold	High threshold comparison for analog watchdog1 interrupt enabled
ADC_IT_AnalogWatchdog2_LowThresold	Low threshold comparison for analog watchdog2 interrupt enabled
ADC_IT_AnalogWatchdog2_HighThresold	High threshold comparison for analog watchdog2 interrupt enabled
ADC_IT_AnalogWatchdog3_LowThresold	Low threshold comparison for analog watchdog3 interrupt enabled
ADC_IT_AnalogWatchdog3_HighThresold	High threshold comparison for analog watchdog3 interrupt enabled

4.1.2.5 ADC Sampling and Conversion Prescalers

The ADC conversion and sampling prescalers *are* defined in the file 73x_*adc.h*:

ADC Prescalers	Meaning
ADC_Sampling_Prescaler	ADC Sampling Prescaler
ADC_Conversion_Prescaler	ADC Conversion Prescaler
ADC_Both_Prescalers	ADC Conversion and sampling Prescalers are equal

4.1.2.6 ADC Analog Watchdogs

The ADC watchdogs channels *are* defined in the file 73x_*adc.h*:

ADC Analog Watchdog	Meaning
ADC_AnalogWatchdog0	Analog Watchdog0 selected
ADC_AnalogWatchdog1	Analog Watchdog1 selected
ADC_AnalogWatchdog2	Analog Watchdog2 selected
ADC_AnalogWatchdog3	Analog Watchdog3 selected

4.1.2.7 ADC DMA Channels

The ADC DMA channels are defined in the file 73x_*adc.h*:

ADC DMA channels	Meaning
ADC_DMA_CHANNEL0	Enable channel0 DMA capability
ADC_DMA_CHANNEL1	Enable channel1 DMA capability
ADC_DMA_CHANNEL2	Enable channel2 DMA capability
ADC_DMA_CHANNEL3	Enable channel3 DMA capability
ADC_DMA_CHANNEL4	Enable channel4 DMA capability
ADC_DMA_CHANNEL5	Enable channel5 DMA capability
ADC_DMA_CHANNEL6	Enable channel6 DMA capability
ADC_DMA_CHANNEL7	Enable channel7 DMA capability
ADC_DMA_CHANNEL8	Enable channel8 DMA capability
ADC_DMA_CHANNEL9	Enable channel9 DMA capability
ADC_DMA_CHANNEL10	Enable channel10 DMA capability
ADC_DMA_CHANNEL11	Enable channel11 DMA capability
ADC_DMA_CHANNEL12	Enable channel12 DMA capability
ADC_DMA_CHANNEL13	Enable channel13 DMA capability
ADC_DMA_CHANNEL14	Enable channel14 DMA capability
ADC_DMA_CHANNEL15	Enable channel15 DMA capability

4.1.3 Software Library Functions

This driver manages the steps of conversion in the two mode of conversion supported by the 10 bit ADC. It configures also the prescaler in order to choose the oversampling frequency.

The following table describes the software interface of the STR73x library for the 10 bit ADC

Function Name	Description
ADC_Init	Configure the ADC according to the input passed parameters.
ADC_DeInit	Reset all the ADC registers to their default values
ADC_StructInit	Resets all the Init struct parameters to their default values
ADC_CalibrationStart	Start the calibration process.the user can enable and disable the calibration average
ADC_ConversionCmd	Starts or stop the ADC conversion in the selected mode.
ADC_Cmd	Enables or put in the power down mode the ADC peripheral.
ADC_AutoClockConfig	Enables /Disables the auto clock off feature.
ADC_ChannelsSelect	Selects the analog input channels to be converted. The user have to choose the first channel and the number of channels to be converted.
ADC_PrescalersConfig	Selects the Conversion and the Sampling prescalers to set the conversion frequency.
ADC_ITConfig	Enables /Disables the specified ADC interrupts.
ADC_FlagStatus	This function returns the status of the selected flags passed as parameters. It gives the status of the conversion.
ADC_FlagClear	This function the selected flags passed as parameters.
ADC_GetConversionValue	Reads the result of conversion from the appropriate data register.
ADC_AnalogWatchdogConfig	Defines the analog input channel to be used for the selected threshold detection channel.Defines the High and the Low thresholds values for the selected threshold detection channel.
ADC_AnalogWatchdogEnable	Enables /Disables the Analog watchdog detection feature for the selected channel
ADC_GetAnalogWatchdogResult	Returns the result of the comparison on the selected AnalogWatchdog

Function Name	Description
ADC_InjectedConversionStart	Start the conversion of the injected analog channels
ADC_InjectedChannelsSelect	Selects the injected analog input channels to be converted. The user have to choose the first injected channel and the number of the injected channels to be converted.
ADC_DMAConfig	Enables DMA capability for the selected channels
ADC_DMACmd	Enable/disable the DMA transfer from the ADC
ADC_DMAFirstEnabledChannel	Returns the first DMA enabled channel being converted when the DMA was enabled the last time

4.1.3.1 ADC_Init

Function Name	ADC_Init
Function Prototype	`void ADC_Init(ADC_InitTypeDef *ADC_InitStruct)`
Behavior Description	Configure the ADC according to the chosen mode by writing the corresponding value to the ADC registers.
Input Parameter	*ADC_InitStruct*: Address of an ADC_InitTypeDef structure containing the configuration information for the ADC peripheral. *ADC_InitTypeDef* parameters are detailed in section 4.1.1.2 on page 29.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to configure ADC calibration with average, conversion mode, prescaler and channels to be converted.

```
{
  /* Init Structure declarations for ADC*/
  ADC_InitTypeDef ADC_InitStructure;
  /*Configure ADC registers*/
  ADC_InitStructure.ADC_Calibration = ADC_Calibration_ON;
  ADC_InitStructure.ADC_CalibAverage = ADC_CalibAverage_Enable;
  ADC_InitStructure.ADC_ConversionMode = ADC_ConversionMode_Scan;
  ADC_InitStructure.ADC_SamplingPrescaler = 0x2;
  ADC_InitStructure.ADC_ConversionPrescaler = 0x4;
  ADC_InitStructure.ADC_FirstChannel = ADC_CHANNEL0;
  ADC_InitStructure.ADC_ChannelNumber = 1;
  ADC_Init (&ADC_InitStructure);
}
```

4.1.3.2 ADC_DeInit

Function Name	ADC_DeInit
Function Prototype	`void ADC_DeInit (void)`
Behavior Description	Reset all the ADC registers to their default values
Input Parameter	None
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to deinitialize *ADC* registers.

```
{
   ADC_DeInit (); /*Deinitialize ADC registers*/
}
```

4.1.3.3 ADC_StructInit

Function Name	ADC_StructInit
Function Prototype	`void ADC_StructInit(ADC_InitTypeDef *ADC_InitStruct)`
Behavior Description	Resets all the Init struct parameters to their default values
Input Parameter	*ADC_InitStruct*: Address of an ADC_InitTypeDef structure. *ADC_InitTypeDef* parameters are detailed in Section 4.1.1.2.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to initialize *ADC* init structure.

```
{
/* Init Structure declaration for ADC */
ADC_InitTypeDef ADC_InitStructure;
/* Initialize ADC structure*/
ADC_StructInit (&ADC_InitStructure);
}
```

4.1.3.4 ADC_CalibrationStart

Function Name	ADC_CalibrationStart
Function Prototype	`void ADC_CalibrationStart (u16 ADC_Calib)`
Behavior Description	Starts the calibration. Calibration average enabled/disabled.
Input Parameter	*ADC_Calib*: Enable or disable the calibration average. Allowed values are: *ENABLE*: enable the calibration average *DISABLE*: disable the calibration average
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to start the *ADC* calibration enabling the average

```
{
  /*Start the ADC calibration enabling the average*/
  ADC_CalibrationStart (ADC_CalibAverage_Enable);
}
```

4.1.3.5 ADC_ConversionCmd

Function Name	ADC_ConversionCmd
Function Prototype	`void ADC_ConversionCmd (u16 ADC_Cmd)`
Behavior Description	Starts or stop the ADC conversion.
Input Parameter	*ADC_Cmd*: designates the ADC command to apply. Allowed values are: *ADC_ConversionStart*: start the ADC conversion *ADC_ConversionStop*: stop the ADC conversion
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to start the *ADC* Conversion

```
{
  ADC_ConversionCmd (ADC_ConversionStart);/*Start the ADC conversion*/
}
```

4.1.3.6 ADC_Cmd

Function Name	ADC_Cmd
Function Prototype	`void ADC_Cmd(FunctionalState NewState)`
Behavior Description	Enables or put in power down mode the ADC peripheral
Input Parameter	*NewState*: this parameter specifies whether the ADC will be enabled or not. It must be one of the following values: *ENABLE*: to enable the ADC peripheral *DISABLE*: to put the ADC peripheral in the power down mode
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to enable the *ADC* peripheral

```
{
  ADC_Cmd (ENABLE);/*Enable the ADC peripheral*/
}
```

4.1.3.7 ADC_AutoClockConfig

Function Name	ADC_AutoClockOffConfig
Function Prototype	`void ADC_AutoClockOffConfig(FunctionalState NewState)`
Behavior Description	Enable or disable the Autoclock feature.
Input Parameter	*NewState*: this parameter specifies whether the AutoClockOff feature will be enabled or disabled. It must be one of the following values: *ENABLE*: to enable the AutoClockOff feature *DISABLE*: to disable the AutoClockOff feature
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to disable the *ADC* AutoClockOff feature

```
{
ADC_AutoClockOffConfig (DISABLE); /*Disable the ADC AutoClockOff feature*/}
```

4.1.3.8 ADC_ChannelsSelect

Function Name	ADC_ChannelsSelect
Function Prototype	`void ADC_ChannelsSelect(u8 FirstChannel,u8 ChannelNumber )`
Behavior Description	This routine is used to select channels to be converted.
Input Parameter 1	*FirstChannel*: designates the first ADC channel to be converted. For more details on the allowed values refer to Section 4.1.2.2.
Input Parameter 2	*ChannelNumber*: designates the number of ADC channels to be converted. Select the number of channels to be converted. The maximum number is 16 channels.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to select the *ADC* channels to be converted: Channel 0 to 2

```
{
/* Select Channel0 to Channel2 to be converted*/
ADC_ChannelsSelect (ADC_CHANNEL0, 3);
}
```

4.1.3.9 ADC_PrescalersConfig

Function Name	ADC_PrescalersConfig
Function Prototype	`void ADC_PrescalersConfig(u8 ADC_Selection, u8 ADC_Prescaler)`
Behavior Description	Set the desired prescaler value
Input Parameter 1	*ADC_Selection*: This parameter specifies the Prescaler to be set with passed prescaler value. Allowed values are: *ADC_Both_Prescalers*: Both Sampling and conversion Prescaler *ADC_Sampling_Prescaler*: Sampling conversion *ADC_Conversion_Prescaler*: Conversion conversion
Input Parameter 2	*ADC_Prescaler*: Designates the prescaler value to set Select a prescaler value from 0 to 7.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to configure sampling and conversion *ADC* prescalers

```
{
  /* Set ADC Sampling prescaler to 0x2 */
    ADC_PrescalersConfig (ADC_Sampling_Prescaler, 0x2);
  /* Set ADC Conversion prescaler to 0x4 */
    ADC_PrescalersConfig (ADC_Conversion_Prescaler, 0x4);
}
```

4.1.3.10 ADC_ITConfig

Function Name	ADC_ITConfig
Function Prototype	`void ADC_ITConfig(u16 IRQ_Mask, FunctionalState NewState)`
Behavior Description	Enables or put in the power down mode the ADC peripheral
Input Parameter 1	*IRQ_Mask*: This parameter specifies the ADC interrupts to be enabled or disabled. Allowed values are: Refer to Section 4.1.2.4 for details on the allowed values. Use the'| ' operator to select more than one interrupt source.
Input Parameter 2	*NewState*: this parameter specifies whether the selected ADC interrupts will be enabled or disabled. It must be one of the following values: *ENABLE*: to enable the selected ADC interrupts *DISABLE*: to disable the selected ADC interrupts
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to enable then disable EOC (End Of Conversion) interrupt source

```
{
  /*Enable EOC interrupt source *:
  ADC_ITConfig (ADC_IT_EOC, ENABLE);
 /*Disable EOC interrupt source*/
  ADC_ITConfig (ADC_IT_EOC, DISABLE);
}
```

4.1.3.11 ADC_FlagStatus

Function Name	ADC_FlagStatus
Function Prototype	`FlagStatus ADC_FlagStatus (u16 ADC_Flag)`
Behavior Description	This routine is used to check the RTC flags.
Input Parameter 1	*ADC_Flag*: designates the ADC flag to check. Refer to Section 4.1.2.3 for more details on the allowed values of this parameter.
OutPut Parameter	None
Return Parameter	One of the *FlagStatus* enum type, the available values are: *SET*: if the flag to check is set (equal to 1). *RESET*: if the flag to check is reset.
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to read the EOC flag status

```
{
FlagStatus EOC_Flag;                        /* EOC_Flag declaration*/
EOC_Flag = ADC_FlagStatus(ADC_FLAG_EOC);/* Read EOC flag status */
}
```

4.1.3.12 ADC_FlagClear

Function Name	ADC_FlagClear
Function Prototype	`void ADC_FlagClear (u16 ADC_Flag)`
Behavior Description	This routine is used to check the RTC flags.
Input Parameter 1	*ADC_Flag*: designates the ADC flag to check. Refer to Section 4.1.2.3 for more details on the allowed values of this parameter.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to clear the ADC_FLAG_AnalogWatchdog0_LowThreshold flag

```
{
/* Clear the ADC_FLAG_AnalogWatchdog0_LowThreshold flag*:
ADC_FlagClear(ADC_FLAG_AnalogWatchdog0_LowThreshold);
}
```

4.1.3.13 ADC_GetConversionValue

Function Name	ADC_GetConversionValue
Function Prototype	`u16 ADC_GetConversionValue( u16 ADC_Channel)`
Behavior Description	Read and return the result of conversion from the appropriate data register.
Input Parameter	*ADC_Channel*: the channel which its conversion value have to be returned. Allowed values are *ADC_CHANNELx* where x:0,1..15. Refer to Section 4.1.2.2 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	The returned value holds the conversion result of the selected channel.
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to read the result of Channel0 conversion

```
{
 /* Conv_Value declaration*/
 u16 Conv_Value;
 /* Read of Channel0 Conversion Value*/
 Conv_Value = ADC_GetConversionValue(ADC_CHANNEL0);
}
```

4.1.3.14 ADC_AnalogWatchdogConfig

Function Name	ADC_AnalogWatchdogConfig
Function Prototype	`void ADC_AnalogWatchdogConfig(u16 ADC_Watchdog, u8 ADC_Channel, u16 LowThreshold, u16 HighThreshold )`
Behavior Description	Enables or put in power down mode the ADC peripheral
Input Parameter 1	*ADC_Watchdog*: this parameter specifies the analog watchdog channel which will be affected to the desired converted channel. Refer to Section 4.1.2.6 for more details on the allowed values of this parameter.
Input Parameter 2	*ADC_Channel*: this parameter specifies the channel linked to the threshold detection selected in the first parameter. Refer to Section 4.1.2.2 for more details on the allowed values.
Input Parameter 3	*HighThreshold*: 10bit value selected by the user
Input Parameter 4	*LowThreshold*: 10bit value selected by the user
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to configure Analogwatchdog0 to channel4 with 0x55 as low threshold and 0x2FF as high threshold

```
{
 /* Configure AnalogWatchdog0*/
 ADC_AnalogWatchdogConfig (ADC_AnalogWatchdog0, ADC_CHANNEL4, 0x55, 2FF);
}
```

4.1.3.15 ADC_AnalogWatchdogEnable

Function Name	ADC_AnalogWatchdogCmd
Function Prototype	`void ADC_AnalogWatchdogCmd(u16 ADC_Watchdog, FunctionalState NewState)`
Behavior Description	Enables /Disables the Analog watchdog passed as parameter
Input Parameter 1	*ADC_Watchdog*: this parameter specifies the analog watchdog channel which will be enabled or disabled Refer to Section 4.1.2.6 for more details on the allowed values of this parameter.
Input Parameter 2	*NewState*: this parameter specifies if the selected analog watchdog will be enabled or disabled. It must be one of the following values: *ENABLE*: to enable the selected ADC Analog watchdog *DISABLE*: to disable the selected ADC Analog watchdog
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to enable Analogwatchdog0

```
{
 /* Enable AnalogWatchdog0 detection*/
 ADC_AnalogWatchdogCmd (ADC_AnalogWatchdog0, ENABLE);
}
```

4.1.3.16 ADC_GetAnalogWatchdogResult

Function Name	ADC_GetAnalogWatchdogResult
Function Prototype	`u16 ADC_GetAnalogWatchdogResult ( u16 ADC_Watchdog)`
Behavior Description	Return the result of the comparison on the selected Analog watchdog passed as parameter
Input Parameter 1	*ADC_Watchdog*: this parameter specifies the analog watchdog channel which its comparison result will be returned. Refer to Section 4.1.2.6 for more details on the allowed values of this parameter.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to read the comparison result of the Analog Watchdog0 detection

```
{
u16 Comp_Result; /*Comp_Result declaration */
Comp_Result = ADC_GetAnanlogWatchdogResult (ADC_AnanlogWatchdog0);
}
```

4.1.3.17 ADC_InjectedConversionStart

Function Name	ADC_InjectedConversionStart
Function Prototype	`void ADC_InjectedConversionStart (void)`
Behavior Description	Start by software the configured injected analog channels to be converted.
Input Parameter	None
OutPut Parameter	None
Return Parameter	The returned value holds the comparison result of the selected analog watchdog.
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to start the ADC injected conversion

```
{
  ADC_InjectedConversionStart (); /*Start the ADC injected conversion*/
}
```

4.1.3.18 ADC_InjectedChannelsSelect

Function Name	ADC_InjectedChannelsSelect
Function Prototype	`void ADC_InjectedChannelsSelect (u8 FirstChannel,u8 ChannelNumber)`
Behavior Description	Selects the injected analog input channels to be converted. The user have to choose the first injected channel and the number of the injected channels to be converted.
Input Parameter 1	*FirstChannel*: this parameter specifies the first injected channel to be converted. Allowed values are *ADC_CHANNELx* where x:0,1...15. Refer to section 4.1.2.7 on page 33 for more details on the allowed values.
Input Parameter 2	*ChannelNumber*: this parameter specifies the Number of the injected channels to be converted.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to select the *ADC* injected channels to be converted: Channel 0 to 2

```
{
  /* Select Channel0 to Channel2 as injected channels to be converted*/
   ADC_InjectedChannelsSelect (ADC_CHANNEL0, 3);
}
```

4.1.3.19 ADC_DMAConfig

Function Name	ADC_DMAConfig
Function Prototype	`void ADC_DMAConfig(u16 ADC_DMAChannel, FunctionalState NewState)`
Behavior Description	Selects the channels which their DMA capability will be enabled.
Input Parameter 1	*ADC_DMAChannel*: this parameter specifies the channels to be enabled. Allowed values are *ADC_DMA_CHANNELx* where x:0,1...15. Refer to Section 4.1.2.7 for more details on the allowed values. Use the "|" operator to select more than one channel.
Input Parameter 2	*NewState*: this parameter specifies if the DMA capability of the selected ADC channel will be enabled or disabled. It must be one of the following values: *ENABLE*: enable DMA capability of the selected ADC channel *DISABLE*: disable DMA capability of the selected ADC channel
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to configure and enable DMA capability for channel 0 and 1, then disable it.

```
{
/* Configure and enable DMA capability channels */
ADC_DMAConfig (ADC_CHANNEL0| ADC_CHANNEL1, ENABLE);
/* Configure and disable DMA capability channels */
ADC_DMAConfig (ADC_CHANNEL0| ADC_CHANNEL1, DISABLE);
}
```

4.1.3.20 ADC_DMACmd

Function Name	ADC_DMACmd
Function Prototype	`void ADC_DMACmd (FunctionalState NewState)`
Behavior Description	Enable/Disable and set the how the DMA feature will be enabled.
Input Parameter 1	*NewState*: This parameter enable / disable the DMA feature.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to enable *ADC DMA* transfer

```
{
  /* Enable ADC DMA transfer*/
  ADC_DMACmd (ENABLE);
  /* Disable ADC DMA transfer/
  ADC_DMACmd (DISABLE);
}
```

4.1.3.21 ADC_DMAFirstEnabledChannel

Function Name	ADC_DMAFirstEnabledChannel
Function Prototype	`u16 ADC_DMAFirstEnabledChannel ( void )`
Behavior Description	Return the first DMA enabled channel being converted when the DMA was enabled the last time
Input Parameter 1	None
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to get the first enabled channel

```
{
u16 First_Channel; /*First_Channel declaration */
/*Get the first enabled channel*/
First_Channel = ADC_DMAFirstEnabledChannel ();
}
```

4.2 BUFFERED SERIAL PERIPHERAL INTERFACE (BSPI)

The *BSPI* driver may be used to manage the *BSPI* in transmission and reception and to report the status of the action done.

The first section describes the data structures used in the *BSPI* software library. The second one presents the software library functions.

4.2.1 Data structures

4.2.1.1 BSPI Register Structure

The *BSPI_TypeDef* register structure is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vuc16 RXR;
 u16 EMPTY1;
 vu16 TXR;
 u16 EMPTY2;
 vu16 CSR1;
 u16 EMPTY3;
 vu16 CSR2;
 u16 EMPTY4;
 vu16 CLK;
 u16 EMPTY5;
 vu16 CSR3;
 u16 EMPTY6;
} BSPI_TypeDef;
```

The following table presents the *BSPI* registers:

Register	Description
RXR	*BSPI* Receive Register
TXR	*BSPI* Transmit Register
CSR1	*BSPI* Control/Status Register1
CSR2	*BSPI* Control/Status Register2
CLK	*BSPI* Master Clock Divider Register
CSR3	*BSPI* Control/Status Register3

The three *BSPI* interfaces are declared in the same file:

```
...
#define APB_BASE  0xFFFF8000
....
#define BSPI0_BASE    (APB + 0x5800)
#define BSPI1_BASE    (APB + 0x5C00)
#define BSPI2_BASE    (APB + 0x6000)
```

```
#ifndef DEBUG
...
#define BSPI0     ((BSPI_TypeDef *) BSPI0_BASE)
#define BSPI1     ((BSPI_TypeDef *) BSPI1_BASE)
#define BSPI2     ((BSPI_TypeDef *) BSPI2_BASE)
...
#else
...
EXT BSPI_TypeDef      *BSPI0;
EXT BSPI_TypeDef      *BSPI1;
EXT BSPI_TypeDef      *BSPI2;
...
#endif
```

When debug mode is used, *BSPI* pointer is initialized in *73x_lib.c* file:

```
#ifdef _BSPI0
BSPI0  = (BSPI_TypeDef *)BSPI0_BASE;
#endif /*_BSPI0 */
#ifdef _BSPI1
BSPI1  = (BSPI_TypeDef *)BSPI1_BASE;
#endif /*_BSPI1 */
#ifdef _BSPI2
BSPI2  = (BSPI_TypeDef *)BSPI2_BASE;
#endif /*_BSPI2 */
```

_BSPI, _BSPI0, *_BSPI1 and _BSPI2* must be defined, in *73x_conf.h* file, to access the peripheral registers as follows :

```
#define _BSPI
#define _BSPI0
#define _BSPI1
#define _BSPI2
...
```

4.2.1.2 BSPI_InitTypeDef Structure

The *BSPI_InitTypeDef* structure is defined in the file *73x_bspi.h*:

```
typedef struct
{
  u8 BSPI_RxFifoSize;
  u8 BSPI_TxFifoSize;
  u8 BSPI_SSPin;
  u8 BSPI_CLKDivider;
  u16 BSPI_CPOL;
  u16 BSPI_CPHA;
  u16 BSPI_WordLength;
  u16 BSPI_Mode;
```

```
} BSPI_InitTypeDef;
```

Members

- **BSPI_RxFifoSize**

  Specifies the size, in words, of the receive FIFO.

  This member must be a number between 1 and 16.

- **BSPI_TxFifoSize**

  Specifies the size, in words, of the transmit FIFO.

  This member must be a number between 1 and 16.

Note: A word can be 16 bits or 8 bits wide depending on the configuration set in BSPI_WordLength member.

- **BSPI_SSPin**

  Specifies whether the Slave Select pin is used when BSPI is in master mode.

  This member can be one of the following values:

BSPI_SSPin	Meaning
BSPI_SSPin_Masked	Slave Select pin is masked
BSPI_SSPin_Used	Slave Select pin is used

- **BSPI_CLKDivider**

  Specifies the clock divider value which will be used to divide the device clock in manner to control the baud rate of the BSPI communication.

  This member must be an even number greater than 5, i.e 6 is the lowest divide factor.

- **BSPI_CPOL**

  Specifies the steady state value of the serial clock.

  This member can be one of the following values:

BSPI_CPOL	Meaning
BSPI_CPOL_Low	Clock is active low
BSPI_CPOL_High	Clock is active high

- **BSPI_CPHA**

  Specifies on which clock transition the bit capture is made.

This member can be one of the following values:

BSPI_CPHA	Meaning
BSPI_CPHA_2Edge	Data is captured on the second edge
BSPI_CPHA_1Edge	Data is captured on the first edge

- **BSPI_WordLength**

  Specifies the word length operation of the receive and transit FIFO.

  This member can be one of the following values:

BSPI_WordLength	Meaning
BSPI_WordLength_16b	Word length is 16 bits
BSPI_WordLength_8b	Word length is 8 bits

- **BSPI_Mode**

  Specifies the BSPI operation mode. This member can be one of the following values:

BSPI_Mode	Meaning
BSPI_Mode_Master	BSPI is configured as a master
BSPI_Mode_Slave	BSPI is configured as a slave

4.2.2 Common Parameter Values

4.2.2.1 BSPI interrupts

The BSPI interrupts, defined in *73x_bspi.h*, are listed below:

BSPI_IT	Meaning
BSPI_IT_REI	Receive error interrupt mask
BSPI_IT_BEI	Bus error interrupt mask

4.2.2.2 BSPI transmit interrupt

The BSPI transmit interrupt, defined in *73x_bspi.h*, are listed below:

BSPI_TxIT	Meaning
BSPI_TxIT_NONE	No interrupt
BSPI_TxIT_TFE	Transmit FIFO empty interrupt mask
BSPI_TxIT_TUFL	Transmit underflow interrupt mask
BSPI_TxIT_TFF	Transmit FIFO full interrupt mask

4.2.2.3 BSPI receive interrupt

The BSPI receive interrupt, defined in *73x_bspi.h*, are listed below:

BSPI_RxIT	Meaning
BSPI_RxIT_NONE	No interrupt
BSPI_RxIT_RFNE	Receive FIFO not empty interrupt mask
BSPI_RxIT_RFF	Receive FIFO full interrupt mask

4.2.2.4 BSPI DMA requests

The BSPI DMA requests, defined in *73x_bspi.h*, are listed below:

BSPI_DMAReq	Meaning
BSPI_DMAReq_Tx	DMA transmit request mask
BSPI_DMAReq_Rx	DMA receive request mask

4.2.2.5 BSPI DMA transmit burst length

The BSPI DMA transmit burst length , defined in *73x_bspi.h*, are listed below:

BSPI_DMA_TxBurst	Meaning
BSPI_DMA_TxBurst_1Word	1 word transferred
BSPI_DMA_TxBurst_4Word	4 words transferred
BSPI_DMA_TxBurst_8Word	8 words transferred
BSPI_DMA_TxBurst_16Word	16 words transferred

4.2.2.6 BSPI DMA receive burst length

The BSPI DMA receive burst length , defined in *73x_bspi.h*, are listed below:

BSPI_DMA_RxBurst	Meaning
BSPI_DMA_RxBurst_1Word	1 word transferred
BSPI_DMA_RxBurst_4Word	4 words transferred
BSPI_DMA_RxBurst_8Word	8 words transferred
BSPI_DMA_RxBurst_16Word	16 words transferred

4.2.2.7 BSPI flags

The BSPI flags , defined in *73x_bspi.h*, are listed below:

BSPI_FLAG	Meaning
BSPI_FLAG_BERR	Bus error flag
BSPI_FLAG_RFNE	Receive FIFO not empty flag
BSPI_FLAG_RFF	Receive FIFO full flag

BSPI_FLAG	Meaning
BSPI_FLAG_ROFL	Receive FIFO overflow flag
BSPI_FLAG_TFE	Transmit FIFO empty flag
BSPI_FLAG_TUFL	Transmit underflow flag
BSPI_FLAG_TFF	Transmit FIFO full flag
BSPI_FLAG_TFNE	Transmit FIFO not empty flag

4.2.3 Software Library Functions

The following table enumerates the different functions of the BSPI library.

Function Name	Description
BSPI_DeInit	Deinitializes the BSPIx peripheral registers to their default reset values.
BSPI_Init	Initializes the BSPIx peripheral according to the specified parameters in the BSPI_InitTypeDef structure.
BSPI_StructInit	Fills in a BSPI_InitTypeDef structure with the reset value of each parameter.
BSPI_Cmd	Enables or disables the specified BSPI peripheral.
BSPI_RxFifoDisable	Disables the BSPIx receive FIFO.
BSPI_ITConfig	Enables or disables the specified BSPI interrupts.
BSPI_TxITConfig	Configures the transmit interrupt source.
BSPI_RxITConfig	Configures the receive interrupt source.
BSPI_DMAConfig	Enables or disables the transmit and/or receive DMA request.
BSPI_DMATxBurstConfig	Configures the transmit burst length of the BSPIx DMA interface.
BSPI_DMATxBurstConfig	Configures the receive burst length of the BSPIx DMA interface.
BSPI_DMACmd	Enables or disables the BSPIx DMA interface.
BSPI_WordSend	Transmits single word of data through the BSPIx peripheral.
BSPI_WordReceive	Returns the most recent received word by the BSPIx peripheral.
BSPI_BufferSend	Transmits data from a user defined buffer.
BSPI_BufferReceive	Receives number of data bytes and store them in user defined area.
BSPI_FlagStatus	Checks whether the specified BSPI flag is set or not.

4.2.3.1 BSPI_DeInit

Function Name	BSPI_DeInit
Function Prototype	`void BSPI_DeInit(BSPI_TypeDef* BSPIx)`
Behavior Description	Deinitializes the BSPIx peripheral registers to their default reset values.
Input Parameter	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Output Parameter	None
Return Parameter	None
Required preconditions	Before calling this function, switch on the clock source of BSPIx peripheral with *CFG_PeripheralClockConfig(...)* function.
Called Functions	None

Example:

The following example illustrates how to deinitialize the BSPI0.

```
{
 BSPI_DeInit(BSPI0);
}
```

4.2.3.2 BSPI_Init

Function Name	BSPI_Init
`Function Prototype`	`void BSPI_Init(BSPI_TypeDef* BSPIx, BSPI_InitTypeDef* BSPI_InitStruct)`
Behavior Description	Initializes the BSPIx peripheral according to the specified parameters in the BSPI_InitTypeDef structure.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*BSPI_InitStruct*: pointer to a BSPI_InitTypeDef structure that contains the configuration information for the specified BSPI peripheral. Refer to Section 4.2.1.2 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to configure the BSPI0.

```
{
BSPI_InitTypeDef BSPI_InitStructure;

BSPI_InitStructure.BSPI_RxFifoSize = 16;
BSPI_InitStructure.BSPI_TxFifoSize = 16;
BSPI_InitStructure.BSPI_SSPin = BSPI_SSPin_Masked;
BSPI_InitStructure.BSPI_CLKDivider = 6;
BSPI_InitStructure.BSPI_CPOL = BSPI_CPOL_High;
BSPI_InitStructure.BSPI_CPHA = BSPI_CPHA_1Edge;
BSPI_InitStructure.BSPI_WordLength = BSPI_WordLength_8b;
BSPI_InitStructure.BSPI_Mode = BSPI_Mode_Master;

BSPI_Init(BSPI0, &BSPI_InitStructure);
}
```

4.2.3.3 BSPI_StructInit

Function Name	BSPI_StructInit
Function Prototype	`void BSPI_StructInit(BSPI_InitTypeDef* BSPI_InitStruct)`
Behavior Description	Fills in a BSPI_InitTypeDef structure with the reset value of each parameter.
Input Parameter1	*BSPI_InitStruct*: pointer to a BSPI_InitTypeDef structure which will be initialized.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialize a BSPI_InitTypeDef structure.

```
{
BSPI_InitTypeDef BSPI_InitStructure;
BSPI_StructInit(&BSPI_InitStructure);
}
```

4.2.3.4 BSPI_Cmd

Function Name	BSPI_Cmd
Function Prototype	`void BSPI_Cmd(BSPI_TypeDef* BSPIx, FunctionalState NewState)`
Behavior Description	Enables or disables the specified BSPI peripheral.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*NewState*: new state of the BSPIx peripheral. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Parameter	None
Required preconditions	Before calling this function, configure the BSPI peripheral with the BSPI_Init(...) function.
Called Functions	None

Example:

The following example illustrates how to enable then disable BSPI0.

```
{
  BSPI_Cmd(BSPI0, ENABLE);  /* Enable BSPI0 */
  BSPI_Cmd(BSPI0, DISABLE); /* Disable BSPI0 */
}
```

4.2.3.5 BSPI_RxFifoDisable

Function Name	BSPI_RxFifoDisable
Function Prototype	`void BSPI_RxFifoDisable(BSPI_TypeDef* BSPIx)`
Behavior Description	Disables the BSPIx receive FIFO.
Input Parameter	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to disable the BSPI0 receive FIFO.

```
{
...
  BSPI_RxFIFODisable(BSPI0);
...
}
```

4.2.3.6 BSPI_ITConfig

Function Name	BSPI_ITConfig

Function Prototype	`void BSPI_ITConfig(BSPI_TypeDef* BSPIx,`
	`u16 BSPI_IT,`
	`FunctionalState NewState)`

Description	Enables or disables the specified BSPI interrupts.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*BSPI_IT*: specifies the BSPI interrupts sources to be enabled or disabled. Refer to Section 4.2.2.1 for more details on the allowed values of this parameter. The user can select more than one interrupt, by OR'ing them.
Input Parameter 3	*NewState*: new state of the specified BSPI interrupts. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Parameters	None
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable BSPI0 receive error and bus error interrupts.

```
{
...
BSPI_ITConfig(BSPI0, BSPI_IT_REI | BSPI_IT_BEI, ENABLE);
...
}
```

4.2.3.7 BSPI_TxITConfig

Function Name	BSPI_TxITConfig
Function Prototype	`void BSPI_TxITConfig(BSPI_TypeDef* BSPIx, u16 BSPI_TxIT)`
Description	Configures the BSPIx transmit interrupt source.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*BSPI_TxIT*: specifies the BSPI transmit interrupt source to be enabled. Refer to section 4.2.2.2 on page 54 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameters	None
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable BSPI0 transmit FIFO empty interrupt.

```
{
BSPI_TxITConfig(BSPI0, BSPI_TxIT_TFE);
}
```

4.2.3.8 BSPI_RxITConfig

Function Name	BSPI_RxITConfig
Function Prototype	`void BSPI_RxITConfig(BSPI_TypeDef* BSPIx, u16 BSPI_RxIT)`
Description	Configures the BSPIx receive interrupt source.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*BSPI_RxIT*: specifies the BSPI receive interrupt source to be enabled. Refer to section 4.2.2.3 on page 55 for more details on the allowed values of this parameter.
OutPut Parameter	None.
Return Parameters	None.
Required Preconditions	None.
Called Functions	None

Example:

The following example illustrates how to enable BSPI0 receive FIFO not empty interrupt.

```
{
BSPI_RxITConfig(BSPI0, BSPI_RxIT_RFNE);
}
```

4.2.3.9 BSPI_DMAConfig

Function Name	BSPI_DMAConfig
Function Prototype	`void BSPI_DMAConfig(BSPI_TypeDef* BSPIx, u8 BSPI_DMAReq, FunctionalState NewState)`
Description	Enables or disables the transmit and/or receive DMA request.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*BSPI_DMAReq*: specifies the DMA request to be enabled or disabled. Refer to section 4.2.2.4 on page 55 for more details on the allowed values of this parameter. The user can select more than one DMA request, by OR'ing them.
Input Parameter 3	*NewState*: new state of the specified DMA request. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Parameters	None
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable BSPI0 receive and transmit DMA requests.

```
{
...
 BSPI_DMAConfig(BSPI0, BSPI_DMAReq_Rx | BSPI_DMAReq_Tx, ENABLE);
...
}
```

4.2.3.10 BSPI_DMATxBurstConfig

Function Name	BSPI_DMATxBurstConfig
Function Prototype	`void BSPI_DMATxBurstConfig(BSPI_TypeDef* BSPIx, u8 BSPI_DMA_TxBurst)`
Description	Configures the transmit burst length of the BSPIx DMA interface.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*BSPI_DMA_TxBurst*: specifies the transmit burst length. Refer to section 4.2.2.5 on page 55for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameters	None
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to set the BSPI0 DMA transmit burst length to 1 word.

```
{
BSPI_DMATxBurstConfig(BSPI0, BSPI_DMA_TxBurst_1Word);
}
```

4.2.3.11 BSPI_DMARxBurstConfig

Function Name	BSPI_DMARxBurstConfig
Function Prototype	`void BSPI_DMARxBurstConfig(BSPI_TypeDef* BSPIx, u8 BSPI_DMA_RxBurst)`
Description	Configures the receive burst length of the BSPIx DMA interface.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*BSPI_DMA_RxBurst*: specifies the receive burst length. Refer to section 4.2.2.6 on page 55 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameters	None
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to set the BSPI0 DMA receive burst length to 1 word.

```
{
BSPI_DMARxBurstConfig(BSPI0, BSPI_DMA_RxBurst_1Word);
}
```

4.2.3.12 BSPI_DMACmd

Function Name	BSPI_DMACmd
Function Prototype	`void BSPI_DMACmd(BSPI_TypeDef* BSPIx, FunctionalState NewState)`
Description	Enables or disables the BSPIx DMA interface.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*NewState*: new state of the DMA interface. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Parameters	None
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable then disable BSPI0 DMA interface.

```
{
 BSPI_DMACmd(BSPI0, ENABLE);  /* Enable BSPI0 */
...
 BSPI_DMACmd(BSPI0, DISABLE); /* Disable BSPI0 */
}
```

4.2.3.13 BSPI_WordSend

Function Name	BSPI_WordSend
Function Prototype	`void BSPI_WordSend(BSPI_TypeDef* BSPIx, vu16 Data)`
Behavior Description	Transmits a single word through the BSPI peripheral.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*Data*: word to be transmitted.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to transmit word 0xA5 through the BSPI0 peripheral.

```
{
 BSPI_WordSend(BSPI0, 0xA5);
}
```

4.2.3.14 BSPI_BufferSend

Function Name	BSPI_BufferSend
Function Prototype	`ErrorStatus BSPI_BufferSend(BSPI_TypeDef *BSPIx, vu8* PtrToBuffer, vu8 NbOfBytes)`
Behavior Description	Transmits data from a user defined buffer. This function will fail if an error occurs.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*PtrToBuffer*: 'u8' pointer to the buffer that contains the data to be transmitted.
Input Parameter 3	*NbOfBytes*: specifies the number of bytes to be transferred from the buffer.
Output Parameter	None
Return Parameter	An ErrorStatus enumeration value: SUCCESS: transmission done without error ERROR: an error detected during transmission
Required preconditions	This function can be used only if the BSPI word length is set to 8-bit data.
Called Functions	*BSPI_FlagStatus*()

Example:

The following example illustrates how to transmit word 0xA5 through the BSPI0 peripheral.

```
{
u8 Tx_Buffer[] = "Hello World";
ErrorStatus Status;
Status = BSPI_BufferSend(BSPI0, Tx_Buffer, strlen(Tx_Buffer));
}
```

4.2.3.15 BSPI_WordReceive

Function Name	BSPI_WordReceive
Function Prototype	`u16 BSPI_WordReceive(BSPI_TypeDef* BSPIx)`
Behavior Description	Returns the most recent word received by the BSPI peripheral.
Input Parameter	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Output Parameter	None
Return Parameter	The value of the received word.
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to read the most recent word received by the BSPI0 peripheral.

```
{
u16 ReceivedData;
ReceivedData = BSPI_WordReceive(BSPI0);
}
```

4.2.3.16 BSPI_BufferReceive

Function Name	BSPI_BufferReceive

Function Prototype	`ErrorStatus BSPI_BufferReceive(`
	`BSPI_TypeDef* BSPIx,`
	`vu8* PtrToBuffer,`
	`vu8 NbOfBytes)`

Description	Receives number of data bytes and stores them in user defined buffer. This function will fail if an error occurs.
Input Parameter 1	*BSPIx*: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	*PtrToBuffer*: 'u8' pointer to the buffer that receives the data to be read.
Input Parameter 3	*NbOfBytes*: specifies the number of bytes to be read.
Output Parameter	None
Return Parameters	An ErrorStatus enumeration value: SUCCESS: reception done without error ERROR: an error was occurred during reception
Required Preconditions	This function can be used only if the BSPI word length is set to 8-bit data.
Called Functions	None

Example:

The following example illustrates how to read 16 words received by the BSPI0.

```
{
 u8 Rx_Buffer[16];
 ErrorStatus Status;
 Status = BSPI_BufferReceive(BSPI0, Rx_Buffer, 16);
}
```

4.2.3.17 BSPI_FlagStatus

Function Name	BSPI_FlagStatus
Function Prototype	`FlagStatus BSPI_FlagStatus (BSPI_TypeDef* BSPIx, u16 BSPI_Flag)`
Description	Checks whether the specified BSPI flag is set or not.
Input Parameter 1	BSPIx: where x can be 0, 1 or 2 to select the BSPI peripheral.
Input Parameter 2	BSPI_Flag: flag to check. Refer to section 4.2.2.7 on page 55 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameters	The status of the flag in *FlagStatus* type, the available value are: SET: if the flag to check is set. RESET: if the flag to check is reset.
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to test the BSPI0 Transmit FIFO Full flag is set or not.

```
{
 FlagStatus Status;
 Status = BSPI_FlagStatus(BSPI0, BSPI_FLAG_TFF);
}
```

4.3 CONTROLLER AREA NETWORK (CAN)

The *CAN* driver may be used to manage the *3 CAN* cells.

The first section describes the data structures used in the *CAN* software library. The second one presents the software library functions.

4.3.1 Data structures

4.3.1.1 CAN Registers structure

The *CAN* peripheral register structure *CAN_TypeDef* and *CAN_MsgObj_TypeDef* is defined in the *73x_map.h* file as follows

```
typedef struct
{
 vu16 CRR;
 u16 EMPTY1;
 vu16 CMR;
 u16 EMPTY2;
 vu16 M1R;
 u16 EMPTY3;
 vu16 M2R;
 u16 EMPTY4;
 vu16 A1R;
 u16 EMPTY5;
 vu16 A2R;
 u16 EMPTY6;
 vu16 MCR;
 u16 EMPTY7;
 vu16 DA1R;
 u16 EMPTY8;
 vu16 DA2R;
 u16 EMPTY9;
 vu16 DB1R;
 u16 EMPTY10;
 vu16 DB2R;
 u16 EMPTY11[27];
} CAN_MsgObj_TypeDef;
```

```
typedef struct
{
 vu16 CR;
 u16 EMPTY1;
 vu16 SR;
 u16 EMPTY2;
 vu16 ERR;
 u16 EMPTY3;
 vu16 BTR;
 u16 EMPTY4;
 vu16 IDR;
 u16 EMPTY5;
 vu16 TESTR;
 u16 EMPTY6;
 vu16 BRPR;
 u16 EMPTY7[3];
 CAN_MsgObj_TypeDef sMsgObj[2];
 u16 EMPTY8[16];
 vu16 TXR1R;
 u16 EMPTY9;
 vu16 TXR2R;
 u16 EMPTY10[13];
 vu16 ND1R;
 u16 EMPTY11;
 vu16 ND2R;
 u16 EMPTY12[13];
 vu16 IP1R;
 u16 EMPTY13;
 vu16 IP2R;
 u16 EMPTY14[13];
 vu16 MV1R;
 u16 EMPTY15;
 vu16 MV2R;
 u16 EMPTY16;
} CAN_TypeDef;
```

The following table summarises the *CAN* registers:

Register	Description
CR	CAN Control Register
SR	CAN Status Register
ERR;	CAN Error counter Register
BTR	CAN Bit Timing Register
IDR	CAN Interrupt Identifier Register

Register	Description
TESTR	CAN Test Register
BRPR	CAN BRP Extension Register
CRR	CAN IF1 Command request Register
CMR	CAN IF1 Command Mask Register
M1R	CAN IF1 Message Mask 1 Register
M2R	CAN IF1 Message Mask 2 Register
A1R	CAN IF1 Message Arbitration 1 Register
A2R	CAN IF1 Message Arbitration 2 Register
MCR	CAN IF1 Message Control Register
DA1R	CAN IF1 DATA A 1 Register
DA2R	CAN IF1 DATA A 2 Register
DB1R	CAN IF1 DATA B 1 Register
DB2R	CAN IF1 DATA B 2 Register
CRR	CAN IF2 Command request Register
CMR	CAN IF2 Command Mask Register
M1R	CAN IF2 Message Mask 1 Register
M2R	CAN IF2 Message Mask 2 Register
A1R	CAN IF2 Message Arbitration 1 Register
A2R	CAN IF2 Message Arbitration 2 Register
MCR	CAN IF2 Message Control Register
DA1R	CAN IF2 DATA A 1 Register
DA2R	CAN IF2 DATA A 2 Register
DB1R	CAN IF2 DATA B 1 Register
DB2R	CAN IF2 DATA B 2 Register
TXR1R	CAN Transmission request 1 Register
TXR2R	CAN Transmission Request 2 Register
ND1R	CAN New Data 1 Register
ND2R	CAN New Data 2 Register
IP1R	CAN Interrupt Pending 1 Register
IP2R	CAN Interrupt Pending 2 Register
MV1R	CAN Message Valid 1 Register
MV2R	CAN Message VAlid 2 Register

The *CAN* peripherals are declared in the same file:

```
...
#define APB 0xFFFF8000
...
#define CAN0_BASE    (APB + 0x4400)
```

```
#define CAN1_BASE    (APB + 0x4800)
#define CAN2_BASE    (APB + 0x4C00)
...
#ifndef DEBUG
...
 #define CAN0      ((CAN_TypeDef  *) CAN0_BASE)
 #define CAN1      ((CAN_TypeDef  *) CAN1_BASE)
 #define CAN2      ((CAN_TypeDef  *) CAN2_BASE)
...
#else
...
 EXT CAN_TypeDef       *CAN0;
 EXT CAN_TypeDef       *CAN1;
 EXT CAN_TypeDef       *CAN2;
...
#endif
```

When debug mode is used, *CAN* pointers are initialized in *73x_lib.c* file:

```
void debug(void)
{
...
#ifdef _CAN0
CAN0  = (CAN_TypeDef *)CAN0_BASE;
#endif /*CAN0 */

#ifdef _CAN1
CAN1  = (CAN_TypeDef *)CAN1_BASE;
#endif /*CAN1 */

#ifdef _CAN1
CAN2  = (CAN_TypeDef *)CAN2_BASE;
#endif /*CAN2 */
...
}
```

In debug mode, *_CAN0, _CAN1* and *_CAN2* must be defined, in *73x_conf.h* file, to access the peripheral registers as follows:

```
 #define _CAN0
 #define _CAN1
 #define _CAN2
```

4.3.1.2 CAN_InitTypeDef Structure

The *CAN_InitTypeDef* structure defines the control setting for the CAN peripheral.

```
typedef struct
{
  vu8 CAN_Mask;
  vu32 CAN_Bitrate;
}CAN_InitTypeDef;
```

Members

- **CAN_Mask**

  Any binary value formed from the CAN_CR_xxx defines.

CAN_Mask	Meaning
CAN_CR_TEST	Test mode enable
CAN_CR_CCE	Configuration change enable
CAN_CR_DAR	Disable automatic re transmission
CAN_CR_EIE	Error interrupt enable
CAN_CR_SIE	Status change interrupt enable
CAN_CR_IE	Module interrupt enable
CAN_CR_INIT	Initialization

- **CAN_Bitrate**

  One of the CAN_BITRATE_xxx defines.

CAN_Bitrate	Meaning
CAN_BITRATE_100K	100kbit/s bit rate
CAN_BITRATE_125K	125kbit/s bit rate
CAN_BITRATE_250K	250kbit/s bit rate
CAN_BITRATE_500K	500kbit/s bit rate
CAN_BITRATE_1M	1Mbit/s bit rate

4.3.2 Common Parameter Values

4.3.2.1 CAN Control

The CAN Control register bits are defined in the file 73x_*can.h*:

CAN Control	Meaning
CAN_CR_TEST	Test mode enable
CAN_CR_CCE	Configuration change enable

CAN Control	Meaning
CAN_CR_DAR	Disable automatic re transmission
CAN_CR_EIE	Error interrupt enable
CAN_CR_SIE	Status change interrupt enable
CAN_CR_IE	Module interrupt enable
CAN_CR_INIT	Initialization

4.3.2.2 CAN Status

The *CAN status register bits* are defined in the file 73x_*can.h* as follows:

CAN Status	Meaning
CAN_SR_BOFF	Bus off status
CAN_SR_EWARN	warning status
CAN_SR_EPASS	error passive
CAN_SR_RXOK	receive a message successfully
CAN_SR_TXOK	Transmitted a message successfully
CAN_SR_LEC	Last error code

4.3.2.3 CAN Test

The *CAN* test register bits are defined in the file 73x_*can.h*:

CAN Test	Meaning
CAN_TESTR_RX	Monitors the actual value of CAN_RX pin
CAN_TESTR_TX1	Control of CAN_TX pin
CAN_TESTR_TX0	Control of CAN_TX pin
CAN_TESTR_LBACK	Loop back mode
CAN_TESTR_SILENT	Silent mode
CAN_TESTR_BASIC	Basic mode

4.3.2.4 CAN IFn / Command Request

The *CAN* IFn/ Command request register bit *is* defined in the file 73x_*can.h*:

CAN Command request	Meaning
CAN_CRR_BUSY	Busy flag

4.3.2.5 CAN IFn / Command Mask

The CAN IFn / command mask bits *are* defined in the file 73x_*can.h*:

CAN IFn / Command Mask	Meaning
CAN_CMR_WRRD	Write / read
CAN_CMR_MASK	Access mask bits
CAN_CMR_ARB	Access arbitration bits
CAN_CMR_CONTROL	Access control bits
CAN_CMR_CLRINTPND	Clear interrupt pending bit
CAN_CMR_TXRQSTNEWDAT	Access transmission request bit
CAN_CMR_DATAA	Access data bytes 0-3
CAN_CMR_DATAB	Access data bytes 4-7

4.3.2.6 CAN IFn / Mask 2

The CAN IFn / Mask 2 bits *are* defined in the file 73x_*can.h*:

CAN IFn / Mask 2	Meaning
CAN_M2R_MXTD	Mask extended identifier
CAN_M2R_MDIR	Mask message direction

4.3.2.7 CAN IFn / Arbitration 2

The CAN IFn / Arbitration 2 bits are defined in the file 73x_*can.h*:

CAN IFn / Arbitration 2	Meaning
CAN_A2R_MSGVAL	Message valid
CAN_A2R_XTD	Extended identifier
CAN_A2R_DIR	Message direction

4.3.2.8 CAN IFn / Message Control

The CAN IFn / Message Control bits are defined in the file 73x_*can.h*:

CAN IFn / Message Control	Meaning
CAN_MCR_NEWDAT	New data
CAN_MCR_MSGLST	Message lost
CAN_MCR_INTPND	Interrupt pending
CAN_MCR_UMASK	Use acceptance mask

CAN IFn / Message Control	Meaning
CAN_MCR_TXIE	Transmit interrupt enable
CAN_MCR_RXIE	Receive interrupt enable
CAN_MCR_RMTEN	Remote enable
CAN_MCR_TXRQST	Transmit request
CAN_MCR_EOB	End of buffer

4.3.3 Software Library Functions

This paragraph describes the part of software library that implements functions to handle the CAN cell.

Note: Before using any CAN function, the I/O ports linked to the CAN0 RX, CAN0 TX, CAN1 RX, CAN1 TX, CAN2 RX and CAN2 TX pins must be set up as follows: GPIO 1.14 (CAN0 RX pin) must be input Tri-state CMOS, GPIO 1.15 (CAN0 TX pin) must be output alternate Push-pull, GPIO 2.1 (CAN1 RX pin) must be input Tri-state CMOS, GPIO 2.2 (CAN1 TX pin) must be output alternate Push-pull, GPIO 4.5 (CAN2 RX pin) must be input Tri-state CMOS, GPIO 4.4 (CAN2 TX pin) must be output alternate Push-pull.

The following table describes the software interface of the STR73x library for the CAN

Function Name	Description
CAN_Init	Initialize the CAN cell and set the bitrate.
CAN_DeInit	Reset all the CAN registers to their default values
CAN_StructInit	Reset all the Init struct parameters to their default values
CAN_EnterInitMode	Switch the CAN into initialization mode.
CAN_LeaveInitMode	Leave the initialization mode (switch into normal mode).
CAN_EnterTestMode	Switch the CAN into test mode.
CAN_LeaveTestMode	Leave the current test mode (switch into normal mode).
CAN_SetBitrate	Setup a standard CAN bitrate.
CAN_SetTiming	Setup the CAN timing with specific parameters.
CAN_SetUnusedMsgObj	Configure the message object as unused.
CAN_SetTxMsgObj	Configure the message object as TX.
CAN_SetRxMsgObj	Configure the message object as RX.
CAN_InvalidateAllMsgObj	Configure all the message objects as unused.
CAN_ReleaseMessage	Release the message object.
CAN_ReleaseTxMessage	Release the transmit message object.

Function Name	Description
CAN_ReleaseRxMessage	Release the receive message object.
CAN_SendMessage	Start transmission of a message.
CAN_ReceiveMessage	Get the message, if received.
CAN_WaitEndOfTx	Wait until current transmission is finished.
CAN_BasicSendMessage	Start transmission of a message in BASIC mode.

4.3.3.1 CAN_Init

Function Name	CAN_Init
Function Prototype	`void CAN_Init(CAN_TypeDef *CANx, CAN_InitTypeDef *CAN_InitStruct);`
Behavior Description	Switch the CAN into initialization mode. Set the desired bitrate. Switch back the CAN into normal mode. Cancel any active test mode.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2
Input Parameter 2	*CAN_InitStruct*: Address of an CAN_InitTypeDef structure containing the configuration information for the CAN peripheral. *CAN_InitTypeDef* parameters are details above
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	CAN_EnterInitMode() CAN_SetBitrate() CAN_LeaveInitMode() CAN_LeaveTestMode()

Example:

This example illustrates how to initialize the CAN0 at 100 kbit/s and enable the interrupts.

```
{
 /* Init Structure declarations for CAN0*/
 CAN_InitTypeDef CAN0_InitStructure;

 /*Configure CAN0 registers*/
 CAN0_InitStructure.CAN_Mask = CAN_CR_IE;
 CAN0_InitStructure.CAN_Bitrate = CAN_BITRATE_100K;
 CAN_Init (CAN0, &CAN0_InitStructure)
}
```

4.3.3.2 CAN_DeInit

Function Name	CAN_DeInit
Function Prototype	void CAN_DeInit (CAN_TypeDef *CANx)
Behavior Description	Reset all the CAN registers to their default values
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to initialize *CAN*0 registers.

```
{
/*Initialize CAN registers*/
  CAN_DeInit (CAN0);
}
```

4.3.3.3 CAN_StructInit

Function Name	CAN_StructInit
Function Prototype	`void CAN_StructInit(CAN_InitTypeDef *CAN_InitStruct)`
Behavior Description	Resets all the Init struct parameters to their default values
Input Parameter	*CAN_InitStruct*: Address of an CAN_InitTypeDef structure. *CAN_InitTypeDef* parameters are detailed in section 4.3.1.2 on page 72.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to initialize *CAN0* init structure.

```
{
/*Init Structures declarations for CAN0 */
CAN_InitTypeDef CAN0_InitStructure;

/*Initialize CAN structure*/
CAN_StructInit (&CAN0_InitStructure);
}
```

4.3.3.4 CAN_EnterInitMode

Function Name	CAN_EnterInitMode
Prototype	`void CAN_EnterInitMode(CAN_TypeDef *CANx, u8 mask);`
Description	Switch the CAN into initialization mode. This function must be used in conjunction with *CAN_LeaveInitMode*().
Behavior	Set the INIT bit in the Control register, ORed with the mask. Reset the Status register.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0.. 2.
Input Parameter 2	Mask any binary value formed from the following defines: CAN_CR_CCE (configuration change enable) CAN_CR_DAR (disable automatic re-transmission) CAN_CR_EIE (error interrupt enable) CAN_CR_SIE (status interrupt enable) CAN_CR_IE (interrupt enable)
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to initialize the *CAN0* enable interrupts.

```
{
  CAN_EnterInitMode(CAN0, CAN_CR_IE);
}
```

4.3.3.5 CAN_LeaveInitMode

Function Name	CAN_LeaveInitMode
Prototype	`void CAN_LeaveInitMode(CAN_TypeDef *CANx);`
Description	Leave the initialization mode (switch into normal mode). This function must be used in conjunction with CAN_EnterInitMode().
Behavior	Clear the INIT and CCE bits in the Control register.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0.. 2
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to leave *CAN0* init mode.

```
{
CAN_Leave InitMode(CAN0);
}
```

4.3.3.6 CAN_EnterTestMode

Function Name	CAN_EnterTestMode
Prototype	`void CAN_EnterTestMode(CAN_TypeDef *CANx, u8 mask);`
Description	Switch the CAN into test mode. This function must be used in conjunction with CAN_LeaveTestMode().
Behavior	Set the TEST bit in the Control register to enable test mode. Update the Test register by ORing its value with the mask.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2.
Input Parameter 2	Mask any binary value formed from the following defines: CAN_TESTR_LBACK (loopback mode) CAN_TESTR_SILENT (silent mode) CAN_TESTR_BASIC (basic mode)
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to switch the CAN0 into Loopback mode, i.e. RX is disconnected from the bus, and TX is internally linked to RX.

```
{
   CAN_EnterTestMode(CAN0, CAN_TESTR_LBACK);
}
```

4.3.3.7 CAN_LeaveTestMode

Function Name	CAN_LeaveTestMode
Prototype	`void CAN_LeaveTestMode(CAN_TypeDef *CANx);`
Description	Leave the current test mode (switch into normal mode). This function must be used in conjunction with CAN_EnterTestMode().
Behavior	Set the TEST bit in the Control register to enable write access to the Test register. Clear the LBACK, SILENT and BASIC bits in the Test register. Clear the TEST bit in the Control register to disable write access to the Test register
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0.. 2
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to leave *CAN0* test mode.

```
{
  CAN_LeaveTestMode(CAN0);
}
```

4.3.3.8 CAN_SetBitrate

Function Name	CAN_SetBitrate
Prototype	void CAN_SetBitrate(`CAN_TypeDef *CANx,` vu32 bitrate);
Description	Setup a standard CAN bitrate.
Behavior	Write the pre-defined timing value in the Bit Timing register. Clear the BRPR register.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0 ..2.
Input Parameter 2	Bitrate , for more details, refer to section 4.3.1.2 on page 72
Output Parameter	None
Return Value	None
Required preconditions	CAN_EnterInitMode() must have been called before.
Called Functions	None

Example:

This example illustrates how to enable the configuration change bit, to be able to set the bitrate

```
{
  CAN_EnterInitMode(CAN0, CAN_CR_CCE);
  CAN_SetBitrate(CAN0, CAN_BITRATE_100K);
  CAN_LeaveInitMode(CAN0)
}
```

4.3.3.9 CAN_SetTiming

Function Name	CAN_SetTiming
Prototype	`void CAN_SetTiming(CAN_TypeDef *CANx, vu32 tseg1, vu32 tseg2, vu32 sjw, vu32 brp);`
Description	Setup the CAN timing with specific parameters.
Behavior	Write the timing value in the Bit Timing register, from the tseg1, tseg2, sjw parameters and bits 5..0 of brp parameter. Write the BRPR register with bits 9..0 of brp parameter. All written values are the real values decrement by one unit.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0 ..2
Input Parameter 2	tseg1 Time Segment before the sample point position It can take values from 1 to 16.
Input Parameter 3	tseg2 Time Segment after the sample point position It can take values from 1 to 8.
Input Parameter 4	sjw Synchronisation Jump Width It can take values from 1 to 4.
Input Parameter 5	brp Baud Rate Prescaler It can take values from 1 to 1024.
Output Parameter	None
Return Value	None
Required preconditions	CAN_EnterInitMode() must have been called before.
Called Functions	None

Example:

This example illustrates how to enable the configuration change bit, to be able to set the specific timing parameters: TSEG1=11, TSEG2=4, SJW=4, BRP=5

```
{
  CAN_EnterInitMode(CAN0, CAN_CR_CCE);
  CAN_SetTiming(CAN0, 11, 4, 4, 5);
  CAN_LeaveInitMode(CAN0);
}
```

4.3.3.10 CAN_SetUnusedMsgObj

Function Name	CAN_SetUnusedMsgObj
Prototype	`void CAN_SetUnusedMsgObj(CAN_TypeDef *CANx, vu32 msgobj);`
Description	Configure the message object as unused.
Behavior	Search for a free message interface from IF0 and IF1. Set the bits WR/RD, Mask, Arb, Control, DataA and DataB in the Command Mask register. Clear the Mask1 and Mask2 registers. Clear the Arb1 and Arb2 register. Clear the Message Control register. Clear the DataA1, DataA2, DataB1, DataB2 registers. Write the value 1+msgobj to the Command Request register.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2
Input Parameter 2	msgobj The message object number, from 0 to 31.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	CAN_GetFreeIF()

Example:

This example illustrates how to invalidate the message objects from 16 to 31: these ones will not be used by the hardware

```
{
   for (i=16; i<=31; i++)
   CAN_SetUnusedMsgObj(CAN0, i);
}
```

4.3.3.11 CAN_SetTxMsgObj

Function Name	CAN_SetTxMsgObj
Prototype	`void CAN_SetTxMsgObj(CAN_TypeDef *CANx, vu32 msgobj, vu32 idType);`
Description	Configure the message object as TX.
Behavior	Search for a free message interface from IF0 and IF1. Set the bits WR/RD, Mask, Arb, Control, DataA and DataB in the Command Mask register. Clear the Mask1 and Arb1 registers. Set the bits MDir in the Mask2 register, also the bit MXtd in case of extended ID. Set the bits MsgVal and Dir in the Arb2 register, also Xtd in case of extended ID. Set the bits TxIE and EoB in the Message Control register. Clear the DataA1, DataA2, DataB1, DataB2 registers. Write the value 1+msgobj to the Command Request register to copy the registers into the message RAM.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2.
Input Parameter 2	msgobj The message object number, from 0 to 31.
Input Parameter 3	idType The identifier type of the frames that will be transmitted using this message object. The value is one of the following: CAN_STD_ID (standard ID, 11-bit) CAN_EXT_ID (extended ID, 29-bit)
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	CAN_GetFreeIF()

Note: When defining which message object number to use for TX or RX, user must take into account the priority levels in the objects processing. The lower number (0) has the highest priority and the higher number (31) has the lowest priority, whatever their type. It is also not recommended to have “holes” in the objects list for optimal performance.

Example:

This example illustrates how to define the transmit message object 0 with standard identifiers

```
{
  CAN_SetTxMsgObj(CAN0, 0, CAN_STD_ID);
}
```

4.3.3.12 CAN_SetRxMsgObj

Function Name	CAN_SetRxMsgObj
Prototype	`void CAN_SetRxMsgObj(CAN_TypeDef *CANx, vu32 msgobj, vu32 idType, vu32 idLow, vu32 idHigh, bool singleOrFifoLast);`
Description	Configure the message object as RX.
Behavior	Search for a free message interface from IF0 and IF1. Set the bits WR/RD, Mask, Arb, Control, DataA and DataB in the Command Mask register. Write the ID mask value formed from idLow and idHigh in the Mask1 and Mask2 registers, and also set the bit MXtd in the Mask2 register in case of extended ID. Write the ID arbitration value formed from idLow and idHigh in the Arb1 and Arb2 registers, set the bit MsgVal, and also Xtd in the Arb2 register in case of extended ID.Set the bits RxIE and UMask in the Message Control register, and also EoB if the parameter singleOr-FifoLast is TRUE.Clear the DataA1, DataA2, DataB1, DataB2 registers. Write the value 1+msgobj to the Command Request register to copy the selected registers into the message RAM.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0.. 2.
Input Parameter 2	msgobj The message object number, from 0 to 31.
Input Parameter 3	idType The identifier type of the frames that will be transmitted using this message object. The value is one of the following: CAN_STD_ID (standard ID, 11-bit) CAN_EXT_ID (extended ID, 29-bit)
Input Parameter 4	idLow The low part of the identifier range used for acceptance filtering. It can take values from 0 to 0x7FF for standard ID, and values from 0 to 0x1FFFFFFF for extended ID.
Input Parameter 5	idHigh The high part of the identifier range used for acceptance filtering. It can take values from 0 to 0x7FF for standard ID, and values from 0 to 0x1FFFFFFF for extended ID. idHigh must be above idLow. For more convenience, use one of the following values to set the maximum ID: CAN_LAST_STD_ID or CAN_LAST_EXT_ID

Function Name	CAN_SetRxMsgObj
Prototype	`void CAN_SetRxMsgObj(CAN_TypeDef *CANx, vu32 msgobj, vu32 idType, vu32 idLow, vu32 idHigh, bool singleOrFifoLast);`
Description	Configure the message object as RX.
Input Parameter 6	SingleOrFifoLast End-of-buffer indicator, it can take the following values: -*TRUE* for a single receive object or a FIFO receive object that is the last one of the FIFO -*FALSE* for a FIFO receive object that is not the last one
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	CAN_GetFreeIF()

Note: Care must be taken when defining an ID range: all combinations of idLow and idHigh will not always produce the expected result, because of the way identifiers are filtered by the hardware.

The criteria applied to keep a received frame is as follows:

(received ID) AND (ID mask) = (ID arbitration), where AND is a bitwise operator.

Consequently, it is generally better to choose for idLow a value with some LSBs cleared, and for idHigh a value that “logically contains” idLow and with the same LSBs set.

Example: the range 0x100-0x3FF will work, but the range 0x100-0x2FF will not because 0x100 is not logically contained in 0x2FF (i.e. 0x100 & 0x2FF = 0).

Example:

This example illustrates how to define FIFOs and acceptance filtering

```
{
  /*Define a receive FIFO of depth 2 (objects 0 and 1) for standard
   identifiers, in which IDs are filtered in the range 0x400-0x5FF*/

   CAN_SetRxMsgObj(CAN0, 0, CAN_STD_ID, 0x400, 0x5FF, FALSE);
   CAN_SetRxMsgObj(CAN0, 1, CAN_STD_ID, 0x400, 0x5FF, TRUE);

   /* Define a single receive object for extended identifiers, in which all
      IDs are filtered in*/
   CAN_SetRxMsgObj(CAN0, 2, CAN_EXT_ID, 0, CAN_LAST_EXT_ID, TRUE);
 }
```

4.3.3.13 CAN_InvalidateAllMsgObj

Function Name	CAN_InvalidateAllMsgObj
Prototype	`void CAN_InvalidateAllMsgObj(CAN_TypeDef *CANx);`
Description	Configure all the message objects as unused.
Behavior	For each message object from 0 to 31, set it as unused.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0.. 2
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	CAN_SetUnusedMsgObj()

Example:

This example illustrates how to invalidate all the message objects of CAN0:

```
{
  CAN_InvalidateAllMsgObj(CAN0);
}
```

4.3.3.14 CAN_ReleaseMessage

Function Name	CAN_ReleaseMessage
Prototype	`void CAN_ReleaseMessage(CAN_TypeDef *CANx, vu3 msgobj);`
Description	Release the message object.
Behavior	Search for a free message interface from IF0 and IF1. Set the bits ClrIntPnd and TxRqst/NewDat in the Command Mask register. Write the value 1+msgobj to the Command Request register to copy the selected registers into the message RAM.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0 .. 2
Input Parameter 2	msgobj The message object number, from 0 to 31.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	CAN_GetFreeIF()

Example:

This example illustrates how to release the message object 0.

```
{
    CAN_ReleaseMessage(CAN0, 0);
}
```

4.3.3.15 CAN_ReleaseTxMessage

Function Name	CAN_ReleaseTxMessage
Prototype	`void CAN_ReleaseTxMessage(CAN_TypeDef *CANx, vu32 msgobj);`
Description	Release the transmit message object.
Behavior	Set the bits ClrIntPnd and TxRqst/NewDat in the Command Mask register of message interface 0. Write the value 1+msgobj to the Command Request register to copy the selected registers into the message RAM.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0.. 2
Input Parameter 2	msgobj The message object number, from 0 to 31.
Output Parameter	None
Return Value	None
Required preconditions	The message interface 0 must not be busy.
Called Functions	None

Example:

This example illustrates how to release the transmit message object 0.

```
{
  /* It is assumed that message interface 0 is always used for transmission*/
  /* Release the transmit message object 0*/
     CAN_ReleaseTxMessage(0);
}
```

4.3.3.16 CAN_ReleaseRxMessage

Function Name	CAN_ReleaseRxMessage
Prototype	`void CAN_ReleaseRxMessage(CAN_TypeDef *CANx, vu32 msgobj);`
Description	Release the receive message object.
Behavior	Set the bits ClrIntPnd and TxRqst/NewDat in the Command Mask register of message interface 1. Write the value 1+msgobj to the Command Request register to copy the selected registers into the message RAM.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2.
Input Parameter 2	msgobj The message object number, from 0 to 31.
Output Parameter	None
Return Value	None
Required preconditions	The message interface 1 must not be busy.
Called Functions	None

Example:

This example illustrates how to release the receive message object 0.

```
{
  // It is assumed that message interface 1 is always used for reception
  // Release the receive message object 0
   CAN_ReleaseRxMessage(0);
}
```

4.3.3.17 CAN_SendMessage

Function Name	CAN_SendMessage
Prototype	u32 CAN_SendMessage(`CAN_TypeDef *CANx`, vu32 msgobj, canmsg* pCanMsg);
Description	Start transmission of a message.
Behavior	Wait for the message interface 0 to be free. Read the Arbitration and Message Control registers. Wait for the message interface 0 to be free. Update the Arbitration, Message Control, DataA and DataB registers with the message contents. Write the value 1+msgobj to the Command Request register to copy the selected registers into the message RAM and to start the transmission.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0.. 2.
Input Parameter 2	msgobj The message object number, from 0 to 31.
Input Parameter 3	pCanMsg Pointer to the canmsg structure that contains the data to transmit: ID type, ID value, data length, data values.
Output Parameter	None
Return Value	1 if transmission was OK, else 0
Required preconditions	The message object must have been set up properly.
Called Functions	None

Example:

This example illustrates how to send a standard ID data frame containing 4 data value.

```
{
   canmsg CanMsg = {CAN_STD_ID, 0x111, 4, {0x10, 0x20, 0x40, 0x80}};
   /* Send a standard ID data frame containing 4 data values*/
   CAN_SendMessage(0, &CanMsg);
}
```

4.3.3.18 CAN_ReceiveMessage

Function Name	CAN_ReceiveMessage
Prototype	u32 CAN_ReceiveMessage(`CAN_TypeDef *CANx,` vu2 msgobj, bool release, canmsg* pCanMsg);
Description	Get the message, if received.
Behavior	Test the bit corresponding to the message object number in the NewData registers. Clear the bit RxOk in the Status register and copy the message contents from the message RAM to the registers and to the structure, and release the message object if asked.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2.
Input Parameter 2	msgobj The message object number, from 0 to 31.
Input Parameter 3	release The message release indicator, it can take the following values: -*TRUE*: the message object is released at the same time as it is copied from message RAM, then it is free for next reception -*FALSE*: the message object is not released, it is to the caller to do it
Input Parameter 4	pCanMsg Pointer to the canmsg structure where the received message is copied.
Output Parameter	None
Return Value	1 if reception was OK, else 0 (no message pending)
Required preconditions	The message object must have been set up properly.
Called Functions	CAN_IsMessageWaiting()

Example:

This example illustrates how to receive a message.

```
{
  canmsg CanMsg;
  /*Receive a message in the object 0 and ask for release*/
  if (CAN_ReceiveMessage(CAN0, 0, TRUE, &CanMsg))
   {
       /*Check or copy the message contents*/
  }
  else
   {
      /*Error handling*/
  }
}
```

4.3.3.19 CAN_WaitEndOfTx

Function Name	CAN_WaitEndOfTx
Prototype	`void CAN_WaitEndOfTx(CAN_TypeDef *CANx);`
Description	Wait until current transmission is finished. This function should be called between two consecutive transmissions to ensure the latest frame has been completely emitted on the bus, and therefore cannot be aborted anymore.
Behavior	Test the bit TxOk in the Status register, and loop until it is set. Clear this bit to prepare the next transmission.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2.
Output Parameter	None
Return Value	None
Required preconditions	A message must have been sent before.
Called Functions	None

Example:

This example illustrates how to send frames.

```
{
  /*Send consecutive data frames using message object 0*/
  for (i = 0; i < 10; i++)
   {
    CAN_SendMessage(CAN0, 0, CanMsgTable[i]);
    CAN_WaitEndOfTx(CAN0);
  }
}
```

4.3.3.20 CAN_BasicSendMessage

Function Name	CAN_BasicSendMessage
Prototype	`u32 CAN_BasicSendMessage(CAN_TypeDef *CANx, canmsg* pCanMsg);`
Description	Start transmission of a message in BASIC mode. This mode does not use the message RAM.
Behavior	Clear the bit NewDat in message interface 1. Write the Arbitration, Message Control, DataA and DataB registers of message interface 0, with the message contents. Write the value 1+msgobj to the Command Request register to start the transmission.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2.
Input Parameter 2	pCanMsg Pointer to the canmsg structure that contains the data to transmit: ID type, ID value, data length, data values.
Output Parameter	None
Return Value	1 if transmission was OK, else 0
Required preconditions	The CAN must have been switched into BASIC mode.
Called Functions	None

Example:

This example illustrates how to send frames.

```
{
 /*Send consecutive data frames using message object 0*/
 for (i = 0; i < 10; i++)
  {
    CAN_SendMessage(CAN0, 0, CanMsgTable[i]);
    CAN_WaitEndOfTx(CAN0);
 }
}
```

4.3.3.21 CAN_BasicReceiveMessage

Function Name	CAN_BasicReceiveMessage
Prototype	`u32 CAN_BasicReceiveMessage(CAN_TypeDef *CANx, canmsg* pCanMsg);`
Description	Get the message in BASIC mode, if received. This mode does not use the message RAM.
Behavior	Test the bit NewDat in the Message Control register of message interface 1. Clear the bit RxOk in the Status register. Copy the message contents from the message interface 1 registers to the structure.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2.
Input Parameter 2	pCanMsg Pointer to the canmsg structure where the received message is copied.
Output Parameter	None
Return Value	1 if reception was OK, else 0 (no message pending)
Required preconditions	The CAN must have been switched into BASIC mode.
Called Functions	None

Example:

This example illustrates how to receive frame in basic mode.

```
{
  canmsg CanMsg;
  /*Receive a message in BASIC mode*/
  if (CAN_BasicReceiveMessage(CAN0, &CanMsg))
   {
    /* Check or copy the message contents*/
  }
  else
   {
    /* Error handling*/
  }
}
```

4.3.3.22 CAN_IsMessageWaiting

Function Name	CAN_IsMessageWaiting
Prototype	`u32 CAN_IsMessageWaiting(CAN_TypeDef *CANx, vu32 msgobj);`
Description	Test the waiting status of a received message.
Behavior	Test the corresponding bit in the NewData 1 or 2 registers.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2
Input Parameter 2	msgobj The message object number, from 0 to 31.
Output Parameter	None
Return Value	A non-zero value if the corresponding message object has received a message waiting to be copied, else 0.
Required preconditions	The corresponding message object must have been set as RX.
Called Functions	None

Example:

This example illustrates how to test the new data registers for the message object 0.

```
{
 /* Test if a message is pending in the receive message object 0*/
 if (CAN_IsMessageWaiting(CAN0, 0))
  {
   /* Receive the message from this message object */
 }
}
```

4.3.3.23 CAN_IsTransmitRequested

Function Name	CAN_IsTransmitRequested
Prototype	`u32 CAN_IsTransmitRequested(CAN_TypeDef *CANx, vu32 msgobj);`
Description	Test the request status of a transmitted message.
Behavior	Test the corresponding bit in the Transmission Request 1 or 2 registers.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0.. 2
Input Parameter 2	msgobj The message object number, from 0 to 31.
Output Parameter	None
Return Value	A non-zero value if the corresponding message is requested to transmit, else 0.
Required preconditions	A message must have been sent before.
Called Functions	None

Example:

This example illustrates how to test the transmit request.

```
{
 /*Send a message using object 0*/
 CAN_SendMessage(CAN0, 0, &CanMsg);
 /*Wait for the end of transmit request*/
 while (CAN_IsTransmitRequested(CAN0, 0));
/*Now, the message is being processed by the priority handler of the CAN cell,
and ready to be emitted on the bus*/
}
```

4.3.3.24 CAN_IsInterruptPending

Function Name	CAN_IsInterruptPending
Prototype	`u32 CAN_IsInterruptPending(CAN_TypeDef *CANx, vu32 msgobj);`
Description	Test the interrupt status of a message object.
Behavior	Test the corresponding bit in the Interrupt Pending 1 or 2 registers.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2.
Input Parameter 2	msgobj The message object number, from 0 to 31.
Output Parameter	None
Return Value	A non-zero value if the corresponding message has an interrupt pending, else 0.
Required preconditions	The interrupts must have been enabled.
Called Functions	None

Example:

This example illustrates how to test interrupt pending.

```
{
  /*Send a message using object 0*/
  CAN_SendMessage(CAN0, 0, &CanMsg);
  /*Wait for the TX interrupt*/
  while (!CAN_IsInterruptPending(CAN0, 0));
}
```

4.3.3.25 CAN_IsObjectValid

Function Name	CAN_IsObjectValid
Prototype	u32 CAN_IsObjectValid(`CAN_TypeDef *CANx`, vu32 msgobj);
Description	Test the validity of a message object (ready to use). A valid object means that it has been set up either as TX or as RX, and so is used by the hardware.
Behavior	Test the corresponding bit in the Message Valid 1 or 2 registers.
Input Parameter 1	*CANx*: selects the CAN to be configured. x can be 0..2.
Input Parameter 2	msgobj The message object number, from 0 to 31.
Output Parameter	None
Return Value	A non-zero value if the corresponding message object is valid, else 0.
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to test the validity of message object 10.

```
{
 if (CAN_IsObjectValid(CAN0, 10))
  {
    /* Do something with message object 10*/
  }
}
```

4.4 CONFIGURATION REGISTER (CFG)

The *CFG* driver may be used to manage the *system configuration registers* in configuring some critical STR73x features, enabling or disabling reset and clock lines for each peripheral and also it reports the status of the system.

The first section describes the data structures used in the *CFG* software library. The second one presents the software library functions.

4.4.1 Data structures

4.4.1.1 CFG Register structure

The CFG registers structure *CFG_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu32 R0;
 vu32 EITE0;
 vu32 PCGR0;
 vu32 PCGR1;
 vu32 PECGR0;
 vu32 PECGR1;
 vu32 PCGRB0;
 vu32 PCGRB1;
 vu32 TIMSR;
 vu32 EITE1;
 vu32 EITE2;
 vu32 ESPR;
 vu32 R1;
 vuc32 DIDR;
}CFG_TypeDef;
```

The following table presents the *BSPI* registers:

Register	Description
R0	Configuration Register 0
EITE0	External Interrupt Trigger Event Register 0
PCGR0	Peripheral Clock Gating Register 0
PCGR1	Peripheral Clock Gating Register 1
PECGR0	Peripheral Emulation Clock Gating Register 0
PECGR1	Peripheral Emulation Clock Gating Register 1
PCGRB0	Peripheral Clock Gating Register B0
PCGRB1	Peripheral Clock Gating Register B1
TIMSR	TIM External Clock Select Register

Register	Description
EITE1	External Interrupt Trigger Event Register 1
EITE1	External Interrupt Trigger Event Register 2
ESPR	Emulation Serial Protection Register
R1	Configuration Register 1
DIDR	Device Identification Register

The CFG interface is declared in the same file:

```
...
#define CFG_BASE  0x40000000
...
#ifndef DEBUG
...
#define CFG     ((CFG_TypeDef *) CFG_BASE)
...
#else
...
EXT CFG_TypeDef      *CFG
...
#endif
```

When debug mode is used, *CFG* pointer is initialized in *73x_lib.c* file:

```
#ifdef _CFG
 CFG  = (CFG_TypeDef *)CFG_BASE;
#endif /*_CFG */
```

_CFG must be defined, in *73x_conf.h* file, to access the peripheral registers as follows :

```
#define _CFG
...
```

Note: It is recommended to declare this define in all projects since CFG is used in most of all user applications.

Note: Since the CFG peripheral is very critical and it defines the global configuration of the device, the CFG Software library is slightly different from the whole library: There are nor structure definition neither a structure initialization and CFG de-initialization. So user must take care of how to enable or disable a specific feature using the functions described in the following sections.

Note: Some CFG bit features are enabled or disabled in others Software peripheral libraries, such as DMA transfer, flash, EIC etc.

4.4.2 Common Parameter Values

4.4.2.1 Peripheral clock gating lines

The Peripheral clock & reset line, defined in *73x_cfg.h*, are listed below:

Peripheral clock gating line	Meaning
CFG_CLK_RAM	RAM clock & reset Line
CFG_CLK_I2C0	I²C0 clock & reset Line
CFG_CLK_WIU	WIU clock & reset Line
CFG_CLK_UART0	UART0 clock & reset Line
CFG_CLK_UART1	UART1 clock & reset Line
CFG_CLK_TIM0	TIM0 clock & reset Line
CFG_CLK_TIM1	TIM1 clock & reset Line
CFG_CLK_TB0	TB0 clock & reset Line
CFG_CLK_CAN0	CAN0 clock & reset Line
CFG_CLK_CAN1	CAN1 clock & reset Line
CFG_CLK_PWM0	PWM0 clock & reset Line
CFG_CLK_PWM1	PWM1 clock & reset Line
CFG_CLK_PWM2	PWM2 clock & reset Line
CFG_CLK_PWM3	PWM3 clock & reset Line
CFG_CLK_PWM4	PWM4 clock & reset Line
CFG_CLK_PWM5	PWM5 clock & reset Line
CFG_CLK_GPIO0	GPIO0 clock & reset Line
CFG_CLK_GPIO1	GPIO1 clock & reset Line
CFG_CLK_GPIO2	GPIO2 clock & reset Line
CFG_CLK_GPIO3	GPIO3 clock & reset Line
CFG_CLK_GPIO4	GPIO4 clock & reset Line
CFG_CLK_GPIO5	GPIO5 clock & reset Line
CFG_CLK_GPIO6	GPIO6 clock & reset Line
CFG_CLK_BSPI0	BSPI0 clock & reset Line
CFG_CLK_BSPI1	BSPI1 clock & reset Line
CFG_CLK_BSPI2	BSPI2 clock & reset Line
CFG_CLK_ADC	ADC clock & reset Line
CFG_CLK_EIC	EIC clock & reset Line
CFG_CLK_WUT	WUT clock & reset Line
CFG_CLK_I2C1	I²C1 clock & reset Line
CFG_CLK_TIM5	TIM5 clock & reset Line
CFG_CLK_TIM6	TIM6 clock & reset Line
CFG_CLK_TIM7	TIM7 clock & reset Line

Peripheral clock gating line	Meaning
CFG_CLK_TIM8	TIM8 clock & reset Line
CFG_CLK_TIM9	TIM9 clock & reset Line
CFG_CLK_UART2	UART2 clock & reset Line
CFG_CLK_UART3	UART3 clock & reset Line
CFG_CLK_TB1	ITB1 clock & reset Line
CFG_CLK_TB2	TB2 clock & reset Line
CFG_CLK_CAN2	CAN2 clock & reset Line
CFG_CLK_TIM2	TIM2 clock & reset Line
CFG_CLK_TIM3	TIM3 clock & reset Line
CFG_CLK_TIM4	TIM4 clock & reset Line
CFG_CLK_RTC	RTC clock & reset Line
CFG_CLK_DMA0	DMA0 clock & reset Line
CFG_CLK_DMA1	DMA1 clock & reset Line
CFG_CLK_DMA2	DMA2 clock & reset Line
CFG_CLK_DMA3	DMA3 clock & reset Line
CFG_CLK_NativeBusArbiter	NativeBusArbiter clock & reset Line
CFG_CLK_AHBArbiter	AHBArbiter clock & reset Line

4.4.2.2 CFG flags

The CFG flags, defined in *73x_cfg.h*, are listed below:

CFG flags	Meaning
CFG_FLAG_SYS	SystemMemory Mode flag
CFG_FLAG_BOOT	Boot mode flag
CFG_FLAG_USER1	User 1 mode flag
CFG_FLAG_USER2	User 2 mode flag
CFG_FLAG_JTBT	JTAG Boot Mode flag

4.4.2.3 CFG MEM Remap

The CFG flags, defined in *73x_cfg.h*, are listed below:

CFG MEM Remap	Meaning
CFG_MEM_RAM	Remap RAM at address 0h
CFG_MEM_FLASH	Remap Flash at address 0h

4.4.3 Software Library Functions

The following table enumerates the different functions of the CFG library.

Function Name	Description
CFG_PeripheralClockConfig	Switch on/off separately the clock of each module of the device. If switched off the peripheral is kept under reset
CFG_EmulationPeripheralClockConfig	Switch on/off separately the clock of each module of the device in case of the emulation mode.
CFG_RemapConfig	Remaps RAM or FLASH to address 0h.
CFG_PeripheralClockStop	Switches off separately the clock of each module of the device. if switched off the peripheral configuration is conserved.
CFG_PeripheralClockStart	Switch On separately the clock of each module of the device.
CFG_DeviceID	Returns the device IDentification number
CFG_FlashPowerOnDelay	Sets the delay on Flash PowerOn when the device exits from Low Power WFI mode
CFG_FlagStatus	Check whether the specified CFG flag is set or not.

4.4.3.1 CFG_PeripheralClockConfig

Function Name	CFG_PeripheralClockConfig
Prototype	`void CFG_PeripheralClockConfig(u8 CFG_CLK_Periph, FunctionalState NewStatus);`
Behavior description	Set to 1 or 0 the separate bit clock of a peripheral.
Input Parameter 1	CFG_CLK_Periph: for more details on the allowed values refer to section 4.4.2.1 on page 101.
Input Parameter 2	NewStatus: can be ENABLE or DISABLE
Output Parameter	None.
Return Value	None.
Required preconditions	None.
Called Functions	None.

Example:

This example illustrates how to enable the clock of the ADC peripheral

```
{
...
void CFG_PeripheralClockConfig(CFG_CLK_ADC, ENABLE);
...
}
```

4.4.3.2 CFG_EmulationPeripheralClockConfig

Function Name	CFG_EmulationPeripheralClockConfig
Prototype	`void CFG_EmulationPeripheralClockConfig(u8 CFG_CLK_Periph, FunctionalState NewStatus);`
Behavior description	Set to 1 or 0 the separate bit clock of a peripheral.
Input Parameter 1	CFG_CLK_Periph: for more details on the allowed values refer to section 4.4.2.1 on page 101.
Input Parameter 2	NewStatus: can be ENABLE or DISABLE
Output Parameter	None.
Return Value	None.
Required preconditions	None.
Called Functions	None.

Example:

This example illustrates how to enable the clock of the TIM0 peripheral

```
{
...
CFG_EmulationPeripheralClockConfig(CFG_CLK_TIM0, ENABLE);
...
}
```

4.4.3.3 CFG_RemapConfig

Function Name	CFG_RemapConfig
Prototype	`void CFG_RemapConfig(CFG_MEM_TypeDef CFG_Mem );`
Behavior description	Set to 1 or 0 the remapping (RAM/Flash) bit
Input Parameter 1	CFG_Mem: for more details on the allowed values refer to section 4.4.2.3 on page 102.
Output Parameter	None.
Return Value	None.
Required preconditions	None.
Called Functions	None.

Example:

This example illustrates how to remap the RAM at address 0h

```
{
...
CFG_RemapConfig(CFG_MEM_RAM);
...
}
```

4.4.3.4 CFG_PeripheralClockStop

Function Name	CFG_PeripheralClockStop
Prototype	`void CFG_PeripheralClockStop(u8 CFG_CLK_Periph);`
Behavior description	Set to 1 the separate bit clock of a peripheral.
Input Parameter 1	CFG_CLK_Periph: for more details on the allowed values refer to section 4.4.2.1 on page 101.
Output Parameter	None.
Return Value	None.
Required preconditions	None.
Called Functions	None.

Example:

This example illustrates how to stop the clock of the TIM1 peripheral

```
{
...
CFG_PeripheralClockStop(CFG_CLK_TIM1);
...
}
```

4.4.3.5 CFG_PeripheralClockStart

Function Name	CFG_PeripheralClockStart
Prototype	`void CFG_PeripheralClockStart(u8 CFG_CLK_Periph);`
Behavior description	Set to 0 the separate bit clock of a peripheral.
Input Parameter 1	CFG_CLK_Periph: for more details on the allowed values refer to section 4.4.2.1 on page 101.
Output Parameter	None.
Return Value	None.
Required preconditions	None.
Called Functions	None.

Example:

This example illustrates how to start the clock of the TIM1 peripheral, already stopped.

```
{
...
CFG_PeripheralClockStart(CFG_CLK_TIM1);
...
}
```

4.4.3.6 CFG_DeviceID

Function Name	CFG_DeviceID
Prototype	`u32 CFG_DeviceID();`
Behavior description	Returns the device IDentification number
Input Parameter 1	None.
Output Parameter	None.
Return Value	The DeviceID number.
Required preconditions	None.
Called Functions	None.

Example:

This example illustrates how to get the STR73x device ID.

```
{
...
u32 DevId = CFG_DeviceID();
...
}
```

4.4.3.7 CFG_FlashPowerOnDelay

Function Name	CFG_FlashPowerOnDelay
Prototype	`void CFG_FlashPowerOnDelay(u8 Delay);`
Behavior description	Sets the delay on Flash Power-On when the device exits from Low Power WFI mode
Input Parameter 1	Delay value (0..0xFF).
Output Parameter	None.
Return Value	None.
Required preconditions	None.
Called Functions	None.

Example:

This example illustrates how to set the Flash Power On delay when the device exits from Low Power WFI mode to 0x80.

```
{
...
CFG_FlashPowerOnDelay(0x80);
...
}
```

4.4.3.8 CFG_FlagStatus

Function Name	CFG_FlagStatus
Function Prototype	`FlagStatus CFG_FlagStatus (u16 BSPI_Flag)`
Description	Checks whether the specified CFG flag is set or not.
Input Parameter 1	CFG_Flag: flag to check. Refer to section 4.4.2.2 on page 102 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameters	The status of the flag in *FlagStatus* type, the available value are: SET: if the flag to check is set. RESET: if the flag to check is reset.
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to test CFG User 1 Boot flag is set or not.

```
{
 FlagStatus Status;
 Status = CFG_FlagStatus(CFG_FLAG_USER1);
}
```

4.5 CLOCK MONITOR UNIT (CMU)

The *CMU* makes safe the output clock, switching between external oscillator and back up clock supplied by RC oscillator.

The first section describes the data structures used in the *CMU* software library. The second section presents the *CMU* software library functions.

4.5.1 Data Structures

4.5.1.1 CMU Register Structure

The *CMU* register structure *CMU_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{vu16 RCCTL;
 u16 EMPTY1;
 vuc16 FDISP;
 uv16 EMPTY2;
 vu16 FRH;
 u16 EMPTY3;
 vu16 FRL;
 u16 EMPTY4;
 vu16 CTRL;
 u16 EMPTY5;
 vu16 STAT;
 u16 EMPTY6;
 vu16 IS;
 u16 EMPTY7;
 vu16 IM;
 u16 EMPTY8;
 vu16 EOCV;
 u16 EMPTY9;
 vu16 WE;
 u16 EMPTY10;
} CMU_TypeDef;
```

The following table describes the *CMU* structure fields:

Register	Description
RCCTL	RCOscillator Control Register
FDISP	Frequency Display Register
FRH	Frequency Reference High Register
FRL	Frequency Reference Low Register

Register	Description
CTRL	Control Register
IS	Interrupt StatusRegister
IM	Interrupt MaskRegister
EOCV	End Of CountvalueRegister
WE	Writing Enable Register

The *CMU* peripherals are declared in the same file:

```
...
#define APB           0xFFFF8000
#define CMU_BASE    (APB + 0x7600)
...
#ifndef DEBUG
...
 #define CMU      ((CMU_TypeDef  *) CMU_BASE)
...
#else
...
 EXT CMU_TypeDef       *CMU;
...
#endif
```

When debug mode is used, *CMU* pointers are initialized in the file *73x_lib.c*:

```
 #ifdef _CMU
CMU  = (CMU_TypeDef *)CMU_BASE;
#endif /*_CMU */
```

In debug mode, *_CMU* must be defined, in the file *73x_conf.h*, to access the peripheral registers as follows:

```
#define _CMU
```

4.5.1.2 CMU_InitTypeDef Structure

The *CMU_InitTypeDef* structure defines the control setting for the *CMU* peripheral.

```
typedef struct
{
  u8 CMU_RCOscControl;
  u8 CMU_EndCountValue;
  u16 CMU_FreqRef_High;
  u16 CMU_FreqRef_Low;
  u16 CMU_CKSEL0;
  u16 CMU_CKSEL1;
  u16 CMU_CKSEL2;
} CMU_InitTypeDef;
```

Members

- **CMU_RCOscControl**

  Specifies the value adjusts for frequency of RC oscillator.

  This member must be a number between 0 and 16.

- **CMU_EndCountValue**

  Specifies whether the oscillator counter (*OCNT*) reaches the value *EOCV[7:0]*512*,

  an *EOC* interrupt is generated if *EOCM* is set.

  This member must be a number between 0 and 255.

- **CMU_FreqRef_High**

  Specifies the frequency reference high.

  This member must be a number between 0 and 4096.

- **CMU_FreqRef_Low**

  Specifies the frequency reference low.

  This member must be a number between 0 and 4096.

- **CMU_CKSEL0**

  Select the clock source for *CKOUT*.

  This member can be one of the following values.

CMU_CKSEL0	Meaning
CMU_CKSEL0_CKRC	Select Backup Oscillator
CMU_CKSEL0_CKOSC	Select Main Oscillator

- **CMU_CKSEL1**

  Select the clock source for the Frequency Meter.

  This member can be one of the following values:

CMU_CKSEL1	Meaning
CMU_CKSEL1_CKOSC	Select Main Oscillator
CMU_CKSEL1_CKPLL	Select PLL output from PRCCU

- **CMU_CKSEL2**

  Select the clock source for driving the *CMU* logic (*fCMU*).

  This member can be one of the following values.

CMU_CKSEL2	Meaning
CMU_CKSEL2_CKRC	Select Backup Oscillator
CMU_CKSEL2_CKOSC	Select Main Oscillator

4.5.2 Common Parameter Values

4.5.2.1 CMU Oscillator Mode

The CMU Oscillator Modes, defined in *73x_cmu.h*, are listed below

CMU_OSCMode	Meaning
CMU_Stop_Low	CMU RC oscillator Frequency in Stop mode is low
CMU_Stop_High	CMU RC oscillator Frequency in Stop mode is high
CMU_Run_High	CMU RC oscillator Frequency in Run mode is high
CMU_Run_Low	CMU RC oscillator Frequency in Run mode is low

4.5.2.2 CMU interrupts

The CMU interrupts, defined in the *73x_cmu.h* file, are listed below:.

CMU_IT	Meaning
CMU_ITOSCLessRC	Oscillator frequency Less than RC frequency interrupt Mask bit
CMU_ITEndCounter	End of Counter interrupt Mask bit
CMU_ITFreqLessLowRef	Clock Frequency Less than Low reference interrupt Mask bit
CMU_ITReset	Reset ON Interrupt Mask bit

To enable or disable CMU interrupts, use a combination of one or more of the following values

4.5.2.3 CMU Stop Oscillator

The *CMU* stop oscillator modes, defined in the *73x_cmu.h* file, are listed below:

CMU_StopOsc	Meaning
CMU_RCoscSoftStop	Stop RC Oscillator in Run mode
CMU_RCoscHardStop	Stop RC Oscillator when Stop mode occurs
CMU_MainoscStop	Stop Quartz Oscillator

4.5.2.4 CMU Flag Status

The *CMU* flag status, defined in the *73x_cmu.h* file, are listed below:.

CMU_Flag	Meaning
CMU_Flag_CKON0bit	indicates which clock drives CKOUT.
CMU_Flag_CKON1bit	indicates which clock drives the Frequency Meter
CMU_Flag_CKON2bit	indicates which clock drives fCMU.
CMU_Flag_RONbit	CMU Reset condition ON status
CMU_Flag_CRFbit	CMU Reset Flag bit

4.5.3 Software Library Functions

The following table enumerates the different functions of the *CMU* library.

Function Name	Description
CMU_Init	Initialize the *CMU* peripheral according to the specified parameters in the *CMU_InitTypeDef* structure.
CMU_StructInit	Fill in a *CMU_InitTypeDef* structure with the reset value of each parameter.
CMU_DeInit	Deinitialize the *CMU* peripheral registers to their default reset values.
CMU_GetOSCFrequency	Get the current value of frequency measure register
CMU_ITClear	Clear the specific interrupt.
CMU_FlagClear	Clear the *CRF* bit in status register.
CMU_Lock	Enable or disable access to all *CMU* register.
CMU_StopOscConfig	Stop the specific source of oscillator clock.
CMU_FlagStatus	Check whether the specified *CMU* flag is set or not.
CMU_ITConfig	Enable or disable the specified *CMU* interrupts.
CMU_ResetConfig	Enable or disable Reset generation.
CMU_ModeOscConfig	Configure the *CMU* Mode frequency.

4.5.3.1 CMU_Init

Function Name	CMU_Init
Function Prototype	`void CMU_Init(CMU_InitTypeDef*CMU_InitStruct)`
Behavior Description	Initializes the *CMU* peripheral according to the specified parameters in the *CMU_InitTypeDef* structure.
Input Parameter	*CMU_InitStruct*: pointer to a *CMU_InitTypeDef* structure that contains the configuration information for the *CMU* peripheral.
Output Parameter	None.
Return Parameter	None.
Required preconditions	None.
Called Functions	None.

Example:

The following example illustrates how to configure the *CMU*:

```
{
...
  CMU_InitTypeDef CMU_Init_s;
  CMU_Init_s.CMU_RCOscControl = 0xD;
  CMU_Init_s.CMU_EndCountValue = 0xF;
  CMU_Init_s.CMU_FreqRef_High = 0xFF;
  CMU_Init_s.CMU_FreqRef_Low = 0xFE;
  CMU_Init_s.CMU_CKSEL0 = CMU_CKSEL0_CKOSC;
  CMU_Init_s.CMU_CKSEL1 = CMU_CKSEL1_CKPLL;
  CMU_Init_s.CMU_CKSEL2 = CMU_CKSEL2_CKOSC;
  CMU_Init(&CMU_Init_s);
...
}
```

4.5.3.2 CMU_DeInit

Function Name	CMU_DeInit
Function Prototype	`void CMU_DeInit(void)`
Behavior Description	Deinitializes the *CMU* peripheral registers to their default reset values.
Input Parameter	None.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to deinitialize the *CMU* peripheral:

```
{
...
CMU_DeInit();
...
}
```

4.5.3.3 CMU_StructInit

Function Name	CMU_StructInit
Function Prototype	`void CMU_StructInit(CMU_InitTypeDef* CMU_InitStruct)`
Behavior Description	Fills in a *CMU_InitTypeDef* structure with the reset value of each parameter.
Input Parameter	*CMU_InitStruct*: pointer to a *CMU_InitTypeDef* structure which will be initialized.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialize the *CMU* structure:

```
{
CMU_StructInit (&CMU_InitStruct);
...
}
```

4.5.3.4 CMU_GetOSCFrequency

Function Name	CMU_GetOSCFrequency
Function Prototype	`u16 CMU_GetOSCFrequency(void)`
Behavior Description	Get the current value of frequency measure register
Input Parameter 1	None
Output Parameter	None
Return Parameter	Return the value of *CMU_FDISP* register.
Required preconditions	User have to call *CMU_Lock(DISABLE)* function to access *CMU* registers.
Called Functions	None

Example:

The following example illustrates how to get the current value of frequency measure register:

```
{
 u16 MyFrequencyValue = 0x0";
...
 MyFrequencyValue = CMU_GetOSCFrequency();
...
}
```

4.5.3.5 CMU_ITClear

Function Name	CMU_ITClear
Function Prototype	`void CMU_ITClear(u16 ITClear)`
Behavior Description	Clear the specified interrupt.
Input Parameter	*ITClear*: specifies the CMU interrupts sources to be cleared Refer to section 4.5.2.2 on page 111 for more details on the allowed values of this parameter
Output Parameter	None
Return Parameter	None
Required preconditions	User have to call *CMU_Lock(DISABLE)* function to access *CMU* registers.
Called Functions	None

Example:

The following example illustrates how to clear reset on interrupt pending bit:

```
{
CMU_ITClear (CMU_ITReset):
...
}
```

4.5.3.6 CMU_FlagClear

Function Name	CMU_FlagClear
Function Prototype	`void CMU_FlagClear(void)`
Behavior Description	Clear the *CRF* flag in *status* register.
Input Parameter	None.
Output Parameter	None
Return Parameter	None
Required preconditions	User have to call *CMU_Lock(DISABLE)* function to access *CMU* registers.
Called Functions	None

Example:

The following example illustrates how to clear *CRF* flag:

```
{
...
  CMU_FlagClear( );
...
}
```

4.5.3.7 CMU_Lock

Function Name	CMU_Lock
Function Prototype	`void CMU_Lock (FunctionalState NewState)`
Behavior Description	Enable or disable access to all *CMU* register.
Input Parameter	*NewState*: new state of the *CMU* peripheral. This parameter can be: *ENABLE* or *DISABLE*
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable write access to all *CMU* registers:

```
{
...
   CMU_Lock(DISABLE);
...
}
```

4.5.3.8 CMU_StopOscConfig

Function Name	CMU_StopOscConfig
Function Prototype	void CMU_StopOscConfig (u16 CMU_StopOsc)
Behavior Description	Stop the specified source of oscillator clock.
Input Parameter	*CMU_StopOsc*: Source of clock will be stopped. Refer to the section '*CMU Stop oscillator*' for more details on the allowed values of this parameter
Output Parameter	None
Return Parameter	None
Required preconditions	CMU_Lock(..) function has to be used before calling this function.
Called Functions	None

Example:

The following example illustrates how to stop main oscillator:

```
{
 CMU_StopOscConfig (CMU_MainoscStop);
...
}
```

4.5.3.9 CMU_FlagStatus

Function Name	CMU_FlagStatus
Function Prototype	`FlagStatus CMU_FlagStatus (u8 CMU_Flag)`
Description	Checks whether the specified *CMU* flag is set or not.
Input Parameter	*CMU_Flag*: flag to check. Refer to section 4.2.3.17 on page 67 for more details on the allowed values of this parameter
OutPut Parameter	None
Return Parameters	The *NewState* of the *CMU_Flag* (*SET* or *RESET*).
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to test if the *CKOSC* drives the digital logic:

```
{
  FlagStatus Status;
...
  Status = CMU_FlagStatus(CMU_CKON0bit);
...
}
```

4.5.3.10 CMU_ITConfig

Function Name	CMU_ITConfig
Function Prototype	`void CMU_ITConfig (u8 CMU_IT, FunctionalState NewState)`
Behavior Description	Enables or disables the specified *CMU* interrupts.
Input Parameter 1	*CMU_IT*: specifies the *CMU* interrupts sources to be enabled or disabled. Refer to section 4.5.2.2 on page 111 for more details on the allowed values of this parameter
Input Parameter 2	*NewState*: new state of the specified CMU interrupts This parameter can be: *ENABLE* or *DISABLE*.
Output Parameter	None
Return Parameter	None
Required preconditions	*CMU_Lock(..)* function has to be used before calling this function.
Called Functions	None

Example:

The following example illustrates how to enable the end of counter interrupt:

```
{
 CMU_ITConfig (CMU_ITEndCounter, ENABLE );
}
```

4.5.3.11 CMU_ResetConfig

Function Name	CMU_ResetConfig
Function Prototype	`void CMU_ResetConfig (FunctionalState NewState)`
Behavior Description	Enable or disable Reset generation.
Input Parameter	*NewState*: new state of the *CMU* peripheral. This parameter can be: *ENABLE* or *DISABLE*.
Output Parameter	None
Return Parameter	None
Required preconditions	*CMU_Lock(..)* function has to be used before calling this function.
Called Functions	None

Example:

The following example illustrates how to enable the reset generation of the *CMU*:

```
{
 CMU_ResetConfig (ENABLE);
}
```

4.5.3.12 CMU_ModeOscConfig

Function Name	CMU_ModeOscConfig
Function Prototype	`void CMU_ModeOscConfig (u16 CMU_OSCMode)`
Behavior Description	Configures the *CMU* Mode frequency
Input Parameter	*CMU_OSCMode*: Choose the mode of oscillator. Refer to section 4.5.2.1 on page 111 for more details on the allowed values of this parameter
Output Parameter	None
Return Parameter	None
Required preconditions	*CMU_Lock(..)* function has to be used before calling this function.
Called Functions	None

Example:

The following example illustrates how to configure RC oscillator frequency in run mode is high

```
{
  CMU_ModeOscConfig (CMU_RunMode_High);
}
```

4.6 DIRECT MEMORY ACCESS (DMA)

The first section describes the data structures used in the *DMA* software library. The second one presents the software library functions.

4.6.1 Data structures

4.6.1.1 DMA Register structure

The *DMA* registers structure *DMA_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu16 SOURCEL0;
 u16 EMPTY1;
 vu16 SOURCEH0;
 u16 EMPTY2;
 vu16 DESTL0;
 u16 EMPTY3;
 vu16 DESTH0;
 u16 EMPTY4;
 vu16 MAX0;
 u16 EMPTY5;
 vu16 CTRL0;
 u16 EMPTY6;
 vuc16 SOCURRH0;
 u16 EMPTY7;
 vuc16 SOCURRL0;
 u16 EMPTY8;
 vuc16 DECURRH0;
 u16 EMPTY9;
 vuc16 DECURRL0;
 u16 EMPTY10;
 vuc16 TCNT0;
 u16 EMPTY11;
 vu16 LUBUff0;
 u16 EMPTY12[9];
 vu16 SOURCEL1;
 u16 EMPTY13;
 vu16 SOURCEH1;
 u16 EMPTY14;
 vu16 DESTL1;
 u16 EMPTY15;
 vu16 DESTH1;
 u16 EMPTY16;
 vu16 MAX1;
 u16 EMPTY17;
```

```
vu16 CTRL1;
u16 EMPTY18;
vuc16 SOCURRH1;
u16 EMPTY19;
vuc16 SOCURRL1;
u16 EMPTY20;
vuc16 DECURRH1;
u16 EMPTY21;
vuc16 DECURRL1;
u16 EMPTY22;
vuc16 TCNT1;
u16 EMPTY23;
vu16 LUBUff1;
u16 EMPTY24[9];
vu16 SOURCEL2;
u16 EMPTY25;
vu16 SOURCEH2;
u16 EMPTY26;
vu16 DESTL2;
u16 EMPTY27;
vu16 DESTH2;
u16 EMPTY28;
vu16 MAX2;
u16 EMPTY29;
vu16 CTRL2;
u16 EMPTY30;
vuc16 SOCURRH2;
u16 EMPTY31;
vuc16 SOCURRL2;
u16 EMPTY32;
vuc16 DESCURRH2;
u16 EMPTY33;
vuc16 DESCURRL2;
u16 EMPTY34;
vuc16 TCNT2;
u16 EMPTY35;
vu16 LUBUff2;
u16 EMPTY36[9];
vu16 SOURCEL3;
u16 EMPTY37;
vu16 SOURCEH3;
u16 EMPTY38;
vu16 DESTL3;
u16 EMPTY39;
vu16 DESTH3;
```

```
u16 EMPTY40;
vu16 MAX3;
u16 EMPTY41;
vu16 CTRL3;
u16 EMPTY42;
vuc16 SOCURRH3;
u16 EMPTY43;
vuc16 SOCURRL3;
u16 EMPTY44;
vuc16 DECURRH3;
u16 EMPTY45;
vuc16 DECURRL3;
u16 EMPTY46;
vuc16 TCNT3;
u16 EMPTY47;
vu16 LUBUff3;
u16 EMPTY48;
vu16 MASK;
u16 EMPTY49;
vu16 CLR;
u16 EMPTY50;
vu16 STATUS;
u16 EMPTY51;
vu16 Last;
u16 EMPTY52;
} DMA_TypeDef;
```

The following table presents the *DMA* registers:

Register	Description
SOURCELx	*DMA Streamx* Source Base Address Low
SOURCEHx	*DMA Streamx* Source Base Address High
DESTLx	*DMA Streamx* Destination Base Address Low
DESTHx	*DMA Streamx* Destination Base Address High
MAXx	*DMA Streamx* Maximum Count Register
CTRLx	*DMA Streamx* Control Register
SOCURRHx	*DMA Streamx* Current Source Address High
SOCURRLx	*DMA Streamx* Current Source Address Low
DECURRHx	*DMA Streamx* Current Destination Address High
DECURRLx	*DMA Streamx* Current Destination Address Low
TCNTx	*DMA Streamx* Terminal Counter Register

Register	Description
LUBUffx	*DMA Streamx* Last Used Buffer location
MASK	*DMA* Interrupt Mask Register
CLR	*DMA* Interrupt Clear Register
STATUS	*DMA* Interrupt Status Register
Last	*DMA* Last Flag Register

The four *DMA* controllers are declared in the same file:

```
...
#define APB_BASE  0xFFFF8000
....
#define DMA0_BASE    (APB + 0x7000)
#define DMA1_BASE    (APB + 0x7100)
#define DMA2_BASE    (APB + 0x7200)
#define DMA3_BASE    (APB + 0x7300)

#ifndef DEBUG
...
#define DMA0     ((DMA_TypeDef  *) DMA0_BASE)
#define DMA1     ((DMA_TypeDef  *) DMA1_BASE)
#define DMA2     ((DMA_TypeDef  *) DMA2_BASE)
#define DMA3     ((DMA_TypeDef  *) DMA3_BASE)
...
#else
...
EXT DMA_TypeDef      *DMA0;
EXT DMA_TypeDef      *DMA1;
EXT DMA_TypeDef      *DMA2;
EXT DMA_TypeDef      *DMA3;
...
#endif
```

When debug mode is used, *DMA* pointer is initialized in *73x_lib.c* file:

```
#ifdef _DMA0
DMA0 = (DMA_TypeDef *)DMA0_BASE;
#endif /*_DMA0 */

#ifdef _DMA1
DMA1 = (DMA_TypeDef *)DMA1_BASE;
#endif /*_DMA1 */

#ifdef _DMA2
DMA2 = (DMA_TypeDef *)DMA2_BASE;
#endif /*_DMA2 */
```

```
#ifdef _DMA3
DMA3 = (DMA_TypeDef *)DMA3_BASE;
#endif /*_DMA3 */
```

_DMA, _DMA0, *_DMA1, _DMA2 and _DMA3* must be defined, in *73x_conf.h* file, to access the peripheral registers as follows :

```
#define _DMA
#define _DMA0
#define _DMA1
#define _DMA2
#define _DMA3
...
```

As the *DMA* driver uses some *NativeArbiter* registers, *_NativeArbiter* must be defined in *73x_conf.h* file, to access the peripheral registers as follows :

```
#define _Native Arbiter
```

Some *CFG* functions are called, *_CFG* must be defined, in *73x_conf.h* file, to make the *CFG* functions accessible :

```
#define _CFG
```

4.6.1.2 DMA_InitTypeDef Structure

The *DMA_InitTypeDef* structure is defined in the file *73x_dma.h*:

```
typedef struct
{
 u8 DMA_Stream;
 u16 DMA_BufferSize;
 u16 DMA_SRC;
 u16 DMA_DST;
 u16 DMA_SRCSize;
 u16 DMA_SRCBurst;
 u16 DMA_DSTSize;
 u16 DMA_Mode;
 u16 DMA_M2M;
 u16 DMA_Dir;
 u32 DMA_SRCBaseAddr;
 u32 DMA_DSTBaseAddr;
 u32 DMA_TriggeringSource;
}DMA_InitTypeDef;
```

Members

- **DMA_Stream**

  Specifies the DMA stream to be used.

  This member can be one of the following values.

DMA_Stream	Meaning
DMA_Stream0	Uses Stream0
DMA_Stream1	Uses Stream1
DMA_Stream2	Uses Stream2
DMA_Stream3	Uses Stream3

- **DMA_BufferSize**

  Specifies the buffer size, in data unit, of the specified stream.

  The data unit is equal to the configuration set in *DMA_SRCSize* member.

- **DMA_SRC**

  Specifies whether the current source register is incremented.

  This member can be one of the following values.

DMA_SRC	Meaning
DMA_SRC_INCR	Current source register incremented
DMA_SRC_NOT_INCR	Current source register unchanged

- **DMA_DST**

  Specifies whether the current destination register is incremented.

  This member can be one of the following values

DMA_DST	Meaning
DMA_DST_INCR	Current destination register incremented
DMA_DST_NOT_INCR	Current destination register unchanged

- **DMA_SRCSize**

  Specifies the data width for source to DMA stream data transfer.

  This member can be one of the following values.

DMA_SRCSize	Meaning
DMA_SRCSize_Byte	Data width is 8 bits
DMA_SRCSize_HalfWord	Data width is 16 bits
DMA_SRCSize_Word	Data width is 32 bits

- **DMA_SRCBurst**

  Specifies the number of words in the peripheral burst.

  This member can be one of the following values.

DMA_SRCBurst	Meaning
DMA_SRCBurst_1Word	1 word transferred
DMA_SRCBurst_4Word	4 words transferred
DMA_SRCBurst_8Word	8 words transferred
DMA_SRCBurst_16Word	16 words transferred

- **DMA_DSTSize**

  Specifies the data width for DMA stream to destination data transfer.

  This member can be one of the following values.

DMA_DSTSize	Meaning
DMA_DSTSize_Byte	Data width is 8 bits
DMA_DSTSize_HalfWord	Data width is 16 bits
DMA_DSTSize_Word	Data width is 32 bits

- **DMA_Mode**

  Specifies the operation mode of the DMAx stream.

  This member can be one of the following values.

DMA_Mode	Meaning
DMA_Mode_Circular	Circular buffer mode is used
DMA_Mode_Normal	Normal buffer mode is used

Note: The circular buffer mode cannot be used in the following situations:

– When buffer size (defined by the DMA_BufferSize member) is not a multiple of the configured burst size (defined by the DMA_SRCBurst member).

– When the memory to memory data transfer is configured on stream3.

- **DMA_M2M**

  Specifies whether stream3 memory to memory transfer is enabled.

  This member must be filled only if the stream3 is used.

  This member can be one of the following values:

DMA_M2M	Meaning
DMA_M2M_Enable	Stream3 configured for memory to memory transfer
DMA_M2M_Disable	Stream3 not configured for memory to memory transfer

- **DMA_Dir**

  Specifies if the peripheral is the source or the destination.

  This member can be one of the following values:

DMA_Dir	Meaning
DMA_Dir_PeriphDST	Peripheral is the destination
DMA_Dir_PeriphSRC	Peripheral is the source

- **DMA_SRCBaseAddr**

  Specifies the base address for streamx source DMA buffer.

- **DMA_DSTBaseAddr**

  Specifies the base address for streamx destination DMA buffer.

- **DMA_TriggeringSource**

  Specifies the triggering source for DMA0 Stream2 and DMA0 Stream3, DMA2 Stream3 and DMA3 Stream2. This member must be filled only if the stream to be used is one from those described above.

  This member can be one of the following values:.

DMA_TriggeringSource	Meaning
DMA_TriggeringSource_BSPI0	BSPI0 is the triggering source for both DMA0 Stream2 and DMA0 Stream3
DMA_TriggeringSource_BSPI1	BSPI1 is the triggering source for both DMA2 Stream3 and DMA3 Stream2
DMA_TriggeringSource_TIM8_TIM9	TIM8 is the triggering source for DMA2 Stream3 and TIM9 is the triggering source for DMA3 Stream2

4.6.2 Common Parameter Values

4.6.2.1 DMA priority

The DMA priorities, defined in *73x_dma.h*, are listed below:

DMA_Priority	Meaning
DMA_Priority_High	DMA has the highest priority on AHB bus.
DMA_Priority_Low	CPU has the highest priority on AHB bus.

4.6.2.2 DMA interrupts

The DMA interrupts, defined in *73x_dma.h*, are listed below:

DMA_IT	Meaning
DMA_IT_SI0	Stream0 transfer end interrupt mask
DMA_IT_SI1	Stream1 transfer end interrupt mask
DMA_IT_SI2	Stream2 transfer end interrupt mask
DMA_IT_SI3	Stream3 transfer end interrupt mask
DMA_IT_SE0	Stream0 transfer error interrupt mask
DMA_IT_SE1	Stream1 transfer error interrupt mask
DMA_IT_SE2	Stream2 transfer error interrupt mask
DMA_IT_SE3	Stream3 transfer error interrupt mask
DMA_IT_ALL	ALL DMA interrupts enable/disable mask

4.6.2.3 DMA flags

The DMA flags, defined in *73x_dma.h*, are listed below:

DMA_FLAG	Meaning
DMA_FLAG_INT0(1)(2)	Stream0 transfer end interrupt flag
DMA_FLAG_INT1(1)(2)	Stream1 transfer end interrupt flag
DMA_FLAG_INT2(1)(2)	Stream2 transfer end interrupt flag
DMA_FLAG_INT3(1)(2)	Stream3 transfer end interrupt flag
DMA_FLAG_ERR0(1)(2)	Stream0 transfer error interrupt flag
DMA_FLAG_ERR1(1)(2)	Stream1 transfer error interrupt flag
DMA_FLAG_ERR2(1)(2)	Stream2 transfer error interrupt flag
DMA_FLAG_ERR3(1)(2)	Stream3 transfer error interrupt flag
DMA_FLAG_ACT0(1)	Stream0 status
DMA_FLAG_ACT1(1)	Stream1 status
DMA_FLAG_ACT2(1)	Stream2 status
DMA_FLAG_ACT3(1)	Stream3 status

(1): Parameters for *DMA_FlagStatus()* function.

(2): Parameters for *DMA_FlagClear()* function only.

4.6.3 Software Library Functions

The following table enumerates the different functions of the DMA library.

Function Name	Description
DMA_DeInit	Deinitializes the DMA stream registers to their default reset values.
DMA_Init	Initializes the DMA stream according to the specified parameters in the DMA_InitTypeDef structure.
DMA_StructInit	Fills in a DMA_InitTypeDef structure with the reset value of each parameter.
DMA_AHBArbitrationConfig	Handles the arbitration between CPU and DMA on AHB bus.
DMA_TimeOutConfig	Sets DMA transaction time out.
DMA_Cmd	Enables or disables the specified DMA stream.
DMA_ITConfig	Enables or disables the specified DMA interrupts.
DMA_LastBufferSweepConfig	Activates the last buffer sweep mode for the DMA stream configured in circular buffer mode.
DMA_LastBufferAddrConfig	Configures the circular buffer position where the last data to be used by the specified DMA stream is located.
DMA_GetCurrDSTAddr	Returns the current value of the destination address pointer related to the specified DMA stream.
DMA_GetCurrSRCAddr	Returns the current value of the source address pointer related to the specified DMA stream.
DMA_GetTerminalCounter	Returns the number of data units remaining in the current DMA stream transfer.
DMA_FlagStatus	Checks whether the specified DMA controller flag is set or not.
DMA_FlagClear	Clears the pending interrupt flags corresponding to the specified DMA stream.

4.6.3.1 DMA_DeInit

Function Name	DMA_DeInit
Function Prototype	`void DMA_DeInit(DMA_TypeDef* DMAx, u8 DMA_Stream)`
Behavior Description	Deinitializes the DMAx stream registers to their default reset values.
Input Parameter1	*DMAx*: where x can be 0, 1, 2 or 3 to select the DMA controller.
Input Parameter2	*DMA_Stream*: specifies the DMA stream to be deinitialized.
Output Parameter	None
Return Parameter	None
Required preconditions	Before calling this function, switch on the clock source of the DMAx controller with *CFG_PeripheralClockConfig(...)* function.
Called Functions	None

Example:

The following example illustrates how to deinitialize the DMA3 stream3.

```
{
...
 DMA_DeInit(DMA3, DMA_Stream3);
...
}
```

4.6.3.2 DMA_Init

Function Name	DMA_Init
Function Prototype	`void DMA_Init(DMA_TypeDef* DMAx, DMA_InitTypeDef* DMA_InitStruct)`
Behavior Description	Initializes the DMAx stream according to the specified parameters in the DMA_InitTypeDef structure.
Input Parameter 1	*DMAx*: where x can be 0, 1, 2 or 3 to select the DMA controller.
Input Parameter 2	*DMA_InitStruct*: pointer to a DMA_InitTypeDef structure that contains the configuration information for the specified DMA stream. Refer to section 4.6.1.2 on page 124 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to configure the DMA3 stream3 to copy the "SRC_Buffer" array contents into "DST_Buffer".

```
{
  DMA_InitTypeDef DMA_InitStructure;
  u32 SRC_Buffer[4]={0x12121212, 0x34343434, 0x56565656, 0x78787878};
  u32 DST_Buffer[4];

  DMA_InitStructure.DMA_Stream = DMA_Stream3;
  DMA_InitStructure.DMA_BufferSize = 4;
  DMA_InitStructure.DMA_SRC = DMA_SRC_INCR;
  DMA_InitStructure.DMA_DST = DMA_DST_INCR;
  DMA_InitStructure.DMA_SRCSize = DMA_SRCSize_Word;
  DMA_InitStructure.DMA_SRCBurst = DMA_SRCBurst_1Word;
  DMA_InitStructure.DMA_DSTSize = DMA_DSTSize_Word;
  DMA_InitStructure.DMA_Mode = DMA_Mode_Normal;
  DMA_InitStructure.DMA_M2M = DMA_M2M_Enable;
  DMA_InitStructure.DMA_Dir = DMA_Dir_PeriphSRC;
  DMA_InitStructure.DMA_SRCBaseAddr = (u32)SRC_Buffer;
  DMA_InitStructure.DMA_DSTBaseAddr = (u32)DST_Buffer;
  DMA_Init(DMA3, &DMA_InitStructure);
}
```

4.6.3.3 DMA_StructInit

Function Name	DMA_StructInit
Function Prototype	`void DMA_StructInit(DMA_InitTypeDef* DMA_InitStruct)`
Behavior Description	Fills in a DMA_InitTypeDef structure with the reset value of each parameter.
Input Parameter	*DMA_InitStruct*: pointer to a DMA_InitTypeDef structure which will be initialized.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialize a DMA_InitTypeDef structure.

```
{
 DMA_InitTypeDef DMA_InitStructure;
 DMA_StructInit(&DMA_InitStructure);
}
```

4.6.3.4 DMA_AHBArbitrationConfig

Function Name	DMA_AHBArbitrationConfig
Function Prototype	`void DMA_AHBArbitrationConfig(u8 DMA_Priority)`
Behavior Description	Handles the arbitration between CPU and DMA on AHB bus.
Input Parameter	*DMA_Priority*: specifies the DMA priority on the AHB bus. Refer to section 4.6.2.1 on page 127 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	Before enabling any DMA stream, the user has to call this function with DMA_Priority_High as parameter to enable DMA transfer on the AHB bus.
Called Functions	CFG_PeripheralClockConfig(..) is called by this function

Example:

The following example illustrates how to set the DMA priority to highest on AHB bus.

```
{
...
DMA_AHBArbitrationConfig(DMA_Priority_High);
...
}
```

4.6.3.5 DMA_Cmd

Function Name	DMA_Cmd

Function Prototype	`void DMA_Cmd(DMA_TypeDef* DMAx,`
	`u8 DMA_Stream,`
	`FunctionalState NewState)`

Behavior Description	Enables or disables the specified DMA stream.
Input Parameter1	*DMAx*: where x can be 0, 1, 2 or 3 to select the DMA controller.
Input Parameter2	*DMA_Stream*: specifies the DMA stream to be enabled or disabled.
Input Parameter3	*NewState*: new state of the DMAx stream. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Parameter	None
Required preconditions	Before calling this function, configure the DMA stream with the *DMA_Init(...)* function.
Called Functions	None

Example:

The following example illustrates how to enable then disable DMA3 stream3.

```
{
 /* Enable DMA3 stream3*/
 DMA_Cmd(DMA3, DMA_Stream3, ENABLE);
...
 /* Disable DMA3 stream3 */
 DMA_Cmd(DMA3, DMA_Stream3, DISABLE);
}
```

4.6.3.6 DMA_TimeOutConfig

Function Name	DMA_TimeOutConfig
Function Prototype	`void DMA_TimeOutConfig(u16 TimeOut_Value)`
Behavior Description	Sets DMA transaction time out.
Input Parameter	*TimeOut_Value*: specifies the DMA Time Out value.
Output Parameter	None
Return Parameter	None
Required preconditions	Before setting the DMA time out, the user has to call the *DMA_AHBArbitrationConfig(...)* function with parameter set to DMA_Priority_High.
Called Functions	None

Note: The time-out value is used to set a count down 16 bit programmable register. When a DMA request will win the bus arbitration, if the DMA transaction is not completed before the counter reaches the time-out value, the DMA transaction itself will be stopped. When time-out elapses, the counter will reload the start value and the CPU will win the native bus arbitration until time-out elapses again. At this point, a new arbitration between CPU and DMA requests will start.

The reset value (0xFFFF) freezes the counter; user has to write the register with the desired value (different from 0xFFFF) to enable the counter. It is forbidden to write the value 0x0000 inside the register.

4.6.3.7 DMA_ITConfig

Function Name	DMA_ITConfig
Function Prototype	`void DMA_ITConfig(DMA_TypeDef* DMAx, u8 DMA_IT, FunctionalState NewState)`
Behavior Description	Enables or disables the specified DMA interrupts.
Input Parameter1	*DMAx*: where x can be 0, 1, 2 or 3 to select the DMA controller.
Input Parameter2	*DMA_IT*: specifies the DMA interrupts sources to be enabled or disabled. Refer to section 4.6.2.2 on page 128 for more details on the allowed values of this parameter. The user can select more than one interrupt, by OR'ing them.
Input Parameter3	*NewState*: new state of the specified DMA interrupts. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable DMA3 stream3 transfer end interrupt.

```
{
...
DMA_ITConfig(DMA3, DMA_IT_SI3, ENABLE);
...
}
```

4.6.3.8 DMA_GetCurrDSTAddr

Function Name	DMA_GetCurrDSTAddr
Function Prototype	`u32 DMA_GetCurrDSTAddr(DMA_TypeDef* DMAx, u8 DMA_Stream)`
Behavior Description	Returns the current value of the destination address pointer related to the specified DMA stream.
Input Parameter1	*DMAx*: where x can be 0, 1, 2 or 3 to select the DMA controller.
Input Parameter2	*DMA_Stream*: specifies the DMA stream to get its destination address pointer current value.
Output Parameter	None
Return Parameter	The current value of the destination address pointer related to the specified DMA stream.
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get DMA3 stream3 current destination address value.

```
{
u32 CurrDSTAddr;
...
CurrDSTAddr = DMA_GetCurrDSTAddr(DMA3, DMA_Stream3);
}
```

4.6.3.9 DMA_GetCurrSRCAddr

Function Name	DMA_GetCurrSRCAddr
Function Prototype	`u32 DMA_GetCurrSRCAddr(DMA_TypeDef* DMAx, u8 DMA_Stream)`
Behavior Description	Returns the current value of the source address pointer related to the specified DMA stream.
Input Parameter1	*DMAx*: where x can be 0, 1, 2 or 3 to select the DMA controller.
Input Parameter2	*DMA_Stream*: Specifies the DMA stream to get its source address pointer current value.
Output Parameter	None
Return Parameter	The current value of the source address pointer related to the specified DMA stream.
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get DMA3 stream3 current source address value.

```
{
 u32 CurrSRCAddr;
...
 CurrSRCAddr = DMA_GetCurrSRCAddr(DMA3, DMA_Stream3);
}
```

4.6.3.10 DMA_GetTerminalCounter

Function Name	DMA_GetTerminalCounter
Function Prototype	`u16 DMA_GetTerminalCounter(DMA_TypeDef* DMAx, u8 DMA_Stream)`
Behavior Description	Returns the number of data units remaining in the current DMAx stream transfer.
Input Parameter1	*DMAx*: where x can be 0, 1, 2 or 3 to select the DMA controller.
Input Parameter2	*DMA_Stream*: specifies the DMA stream to get its number of data units remaining in the current DMA transfer.
Output Parameter	None
Return Parameter	The number of data units remaining in the current DMAx stream transfer.
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the number of data units remaining in the current DMA3 stream3 transfer.

```
{
 u16 TerminalCount;
...
 TerminalCount = DMA_GetTerminalCounter(DMA3, DMA_Stream3);
...
}
```

4.6.3.11 DMA_LastBufferSweepConfig

Function Name	DMA_LastBufferSweepConfig
Function Prototype	`void DMA_LastBufferSweepConfig( DMA_TypeDef* DMAx, u8 DMA_Stream)`
Description	Activates the last buffer sweep mode for the DMAx stream configured in circular buffer mode.
Input Parameter1	*DMAx*: where x can be 0, 1, 2 or 3 to select the DMA controller.
Input Parameter2	*DMA_Stream*: specifies the DMA stream to start its last circular buffer sweep.
Output Parameter	None
Return Parameters	None
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to notify the DMA3 stream3 that last circular buffer sweep started.

```
{
...
 DMA_LastBufferSweepConfig(DMA3, DMA_Stream3);
...
}
```

4.6.3.12 DMA_LastBufferAddrConfig

Function Name	DMA_LastBufferAddrConfig
Function Prototype	`void DMA_LastBufferAddrConfig(DMA_TypeDef* DMAx, u8 DMA_Stream, u16 LastBufferAddr)`
Description	Configures the circular buffer position where the last data to be used by the specified DMA stream is located.
Input Parameter1	*DMAx*: where x can be 0, 1, 2 or 3 to select the DMA controller.
Input Parameter2	*DMA_Stream*: specifies the DMA stream to configure.
Input Parameter3	*LastBufferAddr*: specifies the circular buffer position where the last data to be used by the specified DMA stream is located.
Output Parameter	None
Return Parameters	None
Required Preconditions	This member must be a number between 0 and DMA_InitStructure.DMA_BufferSize-1
Called Functions	None

Example:

The following example illustrates how to configure the circular buffer position where the last data to be used by the DMA3 stream3 is located.

```
{
u16 LastBufferAddr = 12;
...
DMA_LastBufferAddrConfig(DMA3, DMA_Stream3, LastBufferAddr);
...
}
```

4.6.3.13 DMA_FlagStatus

Function Name	DMA_FlagStatus
Function Prototype	`FlagStatus DMA_FlagStatus(DMA_TypeDef* DMAx, u16 DMA_Flag)`
Description	Checks whether the specified DMA controller flag is set or not.
Input Parameter 1	*DMAx*: where x can be 0, 1, 2 or 3 to select the DMA controller.
Input Parameter 2	*DMA_Flag*: flag to check. Refer to section 4.6.2.3 on page 128 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameters	The status of the flag in *FlagStatus* type, the available value are: SET: if the flag to check is set (equal to 1). RESET: if the flag to check is reset.
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to test the DMA3 stream3 transfer end interrupt flag is set or not.

```
{
 FlagStatus Status;
...
 Status = DMA_FlagStatus(DMA3, DMA_FLAG_INT3);
...
}
```

4.6.3.14 DMA_FlagClear

Function Name	DMA_FlagClear
Function Prototype	`void DMA_FlagClear(DMA_TypeDef* DMAx, u16 DMA_Flag)`
Behavior Description	Clears the pending interrupt flags corresponding to the specified DMA stream.
Input Parameter 1	*DMAx*: where x can be 0, 1, 2 or 3 to select the DMA controller.
Input Parameter 2	*DMA_Flag*: flags to clear. Refer to section 4.6.2.3 on page 128 for more details on the allowed values of this parameter. The user can clear more than one flag, by OR'ing them.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to clear the DMA3 stream3 transfer end interrupt flag.

```
{
...
 DMA_FlagClear(DMA3, DMA_FLAG_INT3);
...
}
```

4.7 ENHANCED INTERRUPT CONTROLLER (EIC)

The driver may be used for several purposes, such as enabling and disabling interrupts (*IRQ*) and fast interrupts (*FIQ*), enabling and disabling individual *IRQ* channels, changing *IRQ* channel priorities, saving and restoring context and installing *IRQ* handlers.

The first and the second sections describe the data structure and the common parameter values. The second one presents the *EIC* software library functions.

4.7.1 Data Structures

4.7.1.1 EIC Register Structure

The *EIC* peripheral register structure *EIC_TypeDef* is defined in the file *73x_map.h* as follows:

```
typedef struct
{
 vu32 ICR;
 vuc32 CICR;
 vu32 CIPR;
 u32 EMPTY1;
 vu32 FIER;
 vu32 FIPR;
 vu32 IVR;
 vu32 FIR;
 vu32 IER0;
 vu32 IER1;
 u32 EMPTY3[6];
 vu32 IPR0;
 vu32 IPR1;
 u32 EMPTY4[6];
 vu32 SIRn[64];
} EIC_TypeDef;
```

The table below presents the *EIC* peripheral registers:

register	description
ICR	Interrupt Control Register
CICR	Current Interrupt Channel Register
CIPR	Current Interrupt Priority Register
FIER	Fast Interrupt Enable Register
FIPR	Fast Interrupt Pending Register
IVR	Interrupt Vector Register
FIR	Fast Interrupt Register
IER	Interrupt Enable Register
IPR	Interrupt Pending Register
SIR	Source Interrupt Registers.

EIC peripheral is declared in the *73x_map.h* file as follows:

```
...
/*EIC Base Address Definition*/
#define EIC_BASE     (APB + 0x7C00)
...
#ifdef DEBUG
...
 EXT EIC_TypeDef *EIC;
...
#else
...
 #define EIC  ((EIC_TypeDef  *)EIC_BASE)
...
#endif
```

When debug mode is used, *EIC* pointer is initialized in *73x_lib.c* file as follows:

```
 #ifdef _EIC
  EIC  = (EIC_TypeDef *)EIC_BASE;
 #endif /* _EIC */
```

In debug mode *_EIC* variable must be defined in *73x_conf.h* file to include the *EIC* library:

```
#define _EIC
```

4.7.1.2 EIC_InitTypeDef Structure

The *EIC_InitTypeDef* structure is defined in the file *73x_eic.h*:

```
typedef struct
{
u8 EIC_FIQChannel
u8 EIC_IRQChannel
FonctionnalState EIC_IRQCmd
FonctionnalState EIC_FIQCmd
u8 EIC_IRQChannelPriority
} EIC_InitTypeDef;
```

Members

- **EIC_FIQChannel**

  Specifies the FIQ channel to be Enabled or Disabled.

  It can be one of the following values:.

FIQChannel	Interrupt Source
EXTIT01_FIQChannel	External Interrupt INT1
TIM0_FIQChannel	TIM0 - Timer 0 Global Interrupt

- **EIC_IRQChannel**

  Specifies the IRQ channel to be Enabled or Disabled.

  It can be one or more of the following values

  The following table summarises the different values of IRQChannel variable:

IRQChannel	Peripheral Interrupt	Value
PRCCUCMU_IRQChannel	Clock Monitor Unit (CMU) / Power Reset and Clock Control unit (PRCCU)	0
EXTIT01_IRQChannel	External Interrupt INT1	1
EXTIT02_IRQChannel	External Interrupt INT2	2
EXTIT03_IRQChannel	External Interrupt INT3	3
EXTIT04_IRQChannel	External Interrupt INT4	4
EXTIT05_IRQChannel	External Interrupt INT5	5
EXTIT06_IRQChannel	External Interrupt INT6	6
EXTIT07_IRQChannel	External Interrupt INT7	7
EXTIT08_IRQChannel	External Interrupt INT8	8
EXTIT09_IRQChannel	External Interrupt INT9	9
EXTIT10_IRQChannel	External Interrupt INT10	10
EXTIT11_IRQChannel	External Interrupt INT11	11
EXTIT12_IRQChannel	External Interrupt INT12	12
EXTIT13_IRQChannel	External Interrupt INT13	13
EXTIT14_IRQChannel	External Interrupt INT14	14
EXTIT15_IRQChannel	External Interrupt INT15	15
DMATRERR_IRQChannel	DMA Transfer Error	16
TIM1_IRQChannel	Timer 1 global interrupt	17
TIM2_IRQChannel	Timer 2 global interrupt	18
TIM3_IRQChannel	Timer 3 global interrupt	19
TIM4_IRQChannel	Timer 4 global interrupt	20
TB0_IRQChannel	Timebase Unit 0 End of Count interrupt	21

IRQChannel	Peripheral Interrupt	Value
TB1_IRQChannel	Timebase Unit 1 End of Count interrupt	22
TB2_IRQChannel	Timebase Unit 2 End of Count interrupt	23
TIM5_IRQChannel	Timer 5 global interrupt	24
TIM6_IRQChannel	Timer 6 global interrupt	25
TIM7_IRQChannel	Timer 7 global interrupt	26
TIM8_IRQChannel	Timer 8 global interrupt	27
TIM9_IRQChannel	Timer 9 global interrupt	28
UART2_IRQChannel	UART 2 global interrupt	31
UART3_IRQChannel	UART 3 global interrupt	32
FLASHEOP_IRQChannel	Flash End of Write	33
PWM0_IRQChannel	PWM 0 Compare Period Interrupt	34
PWM1_IRQChannel	PWM 1 Compare Period Interrupt	35
PWM2_IRQChannel	PWM 2 Compare Period Interrupt	36
PWM3_IRQChannel	PWM 3 Compare Period Interrupt	37
PWM4_IRQChannel	PWM 4 Compare Period Interrupt	38
PWM5_IRQChannel	PWM 5 Compare Period Interrupt	39
WIU_IRQChannel	Wake-Up Unit Global Interrupt	40
WDGWUT_IRQChannel	Watchdog Timer (WDG) /Wake-Up Timer(WUT) End of Count	41
BSPI0_IRQChannel	BSPI 0 global interrupt	42
BSPI1_IRQChannel	BSPI 1 global interrupt	43
BSPI2_IRQChannel	BSPI 2 global interrupt	44
UART0_IRQChannel	UART 0 global interrupt	45
UART1_IRQChannel	UART 1 global interrupt	46
I2C0ITERR_IRQChannel	I2C 0 general/DMA interrupt	47
I2C1ITERR_IRQChannel	I2C 1 general/DMA interrupt	48
I2C0ITDDC_IRQChannel	I2C 0 general interrupt	51
I2C1ITDDC_IRQChannel	I2C 1 general interrupt	52
CAN0_IRQChannel	CAN 0 global interrupt	55
CAN1_IRQChannel	CAN 1 global interrupt	56
CAN2_IRQChannel	CAN 2 global interrupt	57
DMA0_IRQChannel	DMA 0 global interrupt	58

IRQChannel	Peripheral Interrupt	Value
DMA1_IRQChannel	DMA 1 global interrupt	59
DMA2_IRQChannel	DMA 2 global interrupt	60
DMA3_IRQChannel	DMA 3 global interrupt	61
ADC_IRQChannel	A/D Converter global interrupt	62
RTC_IRQChannel	RTC global interrupt	63

- **EIC_IRQCmd**

  Specifies whether to Enable or to Disable the specified IRQ channel.

  It can be ENABLE or DISABLE

- **EIC_FIQCmd**

  Specifies whether to Enable or to Disable the specified FIQ channel.

  It can be ENABLE or DISABLE

- **EIC_IRQChannelPriority**

  Specifies the IRQ channel priority which can varies from 0 to 15.

4.7.1.3 EXTIT_Trigger structure

The following enumeration defines the triggering edge or level of the external interrupt. EXTIT_TRIGGER_TypeDef enumeration is defined in the file 73x_eic.h:

```
typedef enum
{
 EXTIT_TRIGGER_Rising_Falling,
 EXTIT_TRIGGER_Rising,
 EXTIT_TRIGGER_Falling,
 EXTIT_TRIGGER_HIGH_Level,
 EXTIT_TRIGGER_LOW_Level
} EXTIT_TRIGGER_TypeDef;
```

The following table describes the different triggering edge or level of the external interrupt

EXTIT_TRIGGER_TypeDef	Triggering edge or level
EXTIT_TRIGGER_Rising_Falling	triggering Interrupt on Rising and Falling edges
EXTIT_TRIGGER_Rising	triggering Interrupt on Rising edges
EXTIT_TRIGGER_Falling	triggering Interrupt on Falling edges
EXTIT_TRIGGER_HIGH_Level	triggering Interrupt on HIGH level
EXTIT_TRIGGER_LOW_Level	triggering Interrupt on LOW level

4.7.2 Software Library Functions

The table below enumerates the different functions of the *EIC* library.

Function Name	Function Description
EIC_Init	Initializes the EIC peripheral according to the specified parameters in the EIC_InitTypeDef structure.
EIC_DeInit	Deinitializes the Interrupt Controller to be able to handle interrupt requests.
EIC_StructInit	Fills in a EIC_InitTypeDef structure with the reset value of each parameter.
EIC_CurrentPriorityLevelConfig	Change the current priority level of the served IRQ routine
EIC_IRQChannelConfig	Enable or Disable the selected IRQ Channel
EIC_ExternalITTriggerConfig	Select the edge or the level in which the external interrupt is issued
EIC_IRQCmd	Enables or disables EIC IRQ output request to CPU.
EIC_FIQCmd	Enables or disables EIC FIQ output request to CPU.
EIC_CurrentPriorityLevelValue	Returns the current priority level of the current served IRQ routine
EIC_CurrentIRQChannelValue	Returns the current served IRQ channel number
EIC_CurrentFIQChannelValue	Returns the current served FIQ channel number
EIC_FIQPendingBitClear	Clears the FIQ pending bit of the selected FIQ Channel
EIC_FIQChannelConfig	Configure the FIQ Channel
EIC_IRQChannelPriorityConfig	Configure the selected IRQ channel priority
EIC_ExternalITFilterConfig	Enable or Disable a digital filter on external interrupt

4.7.2.1 EIC_Init

Function Name	EIC_Init
Function Prototype	`void EIC_Init(EIC_InitTypeDef* EIC_InitStruct)`
Behavior Description	Initializes EIC peripheral according to the specified parameters in the *EIC_InitTypeDef* structure.
Input Parameter	*EIC_InitStruct*: pointer to a *EIC_InitTypeDef* structure that contains the configuration information for the specified EIC peripheral.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to configure the External interrupt 6 with priority 3

```
{
...
/* Initialize the EIC*/
 EIC_InitStructure.EIC_IRQChannel = EXTIT06_IRQChannel;
 EIC_InitStructure.EIC_FIQChannel = TIM0_FIQChannel;
 EIC_InitStructure.EIC_IRQCmd = ENABLE;
 EIC_InitStructure.EIC_FIQCmd = ENABLE;
 EIC_InitStructure.EIC_IRQChannelPriority = 3;
 EIC_Init (&EIC_InitStructure);
...
}
```

4.7.2.2 EIC_DeInit

Function Name	EIC_DeInit
Function Prototype	`void EIC_DeInit(void)`
Behavior Description	Initializes the Interrupt Controller to be able with the str73x library architecture to handle the interrupt request
Input Parameter	None
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to Initializes the Interrupt Controller to be able to handle interrupt requests

```
{
...
/* Deinitialize the EIC*/
EIC_DeInit();
...
}
```

4.7.2.3 EIC_StructInit

Function Name	EIC_StructInit
Function Prototype	`void EIC_StructInit(EIC_InitTypeDef* EIC_InitStruct)`
Behavior Description	Fills in the structure with the reset value of each parameter (which depend on the register reset value).
Input Parameter	*EIC_InitStruct*: pointer to a *EIC_InitTypeDef* structure which will be initialized.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialize a EIC_InitTypeDef structure.

```
{
 EIC_InitTypeDef EIC_InitStructure;
 EIC_StructInit(&EIC_InitStructure);
}
```

4.7.2.4 EIC_CurrentPriorityLevelConfig

Function Name	EIC_CurrentPriorityLevelConfig
Function Prototype	`void EIC_CurrentPriorityLevelConfig(u8 NewPriorityLevel)`
Behavior Description	Change the current priority level of the served IRQ routine
Input Parameter	NewPriorityLevel: New current priority.
Output Parameter	None
Return Value	None
Required preconditions	The new priority level must be higher than the current priority level.
Called Functions	None

Example:

The following example illustrates how reconfigure the current priority level to 15.

```
{
...
EIC_CurrentPriorityLevelConfig(0x0F);
...
}
```

4.7.2.5 EIC_IRQChannelConfig

Function Name	EIC_IRQChannelConfig
Function Prototype	`void EIC_IRQChannelConfig(u8 IRQChannel, FunctionalState NewStatus)`
Behavior Description	Sets or clears the corresponding channel bit located in EIC.IER register.
Input Parameter	- *IRQChannel*: the selected IRQ channel. Refer to section 4.7.1.2 on page 142 "IRQ Channels" for more details on allowed values of this parameter. - *NewState*: new state of the selected IRQ channel. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

```
{
...
// Enable global interrupts
EIC_IRQChannelConfig(EXTIT04_IRQChannel,ENABLE);
// Disable global interrupts
EIC_IRQChannelConfig(EXTIT04_IRQChannel,DISABLE);
...
}
```

4.7.2.6 EIC_ExternalITTriggerConfig

Function Name	EIC_ExternalITTriggerConfig
Function Prototype	`void EIC_ExternalITTriggerConfig(u8 IRQChannel, EXTIT_TRIGGER_TypeDef EXTIT_Trigger)`
Behavior Description	Configure the External Interrupt Trigger Event Registers, depending on the selected Edge or level and according to the External Interrupt Configuration Table
Input Parameter	-EXTERNAL_IT: the selected External IRQ channel line The allowed values of this parameter varies from EXTERNAL_IT0 to EXTERNAL_IT15. *-EXTIT_Trigger*: the selected triggering edge or level of the external interrupt. Refer to section 4.7.1.3 on page 145 "*EXTIT_TRIGGER*" section for details on allowed values of *EXTIT_Trigger* parameter.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

```
{
...
EIC_ExternalITTriggerConfig(EXTIT02_IRQChannel,EXTIT_TRIGGER_Rising);
...
}
```

4.7.2.7 EIC_IRQCmd

Function Name	EIC_IRQCmd
Function Prototype	`void EIC_IRQCmd( FunctionalState NewState)`
Behavior Description	Enables or disables EIC IRQ output request to CPU.
Input Parameter	*NewState*: new state of the EIC IRQ output request to CPU. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable global IRQ interrupt.

```
{
EIC_IRQCmd(ENABLE);
}
```

4.7.2.8 EIC_FIQCmd

Function Name	EIC_FIQCmd
Function Prototype	`void EIC_FIQCmd( FunctionalState NewState)`
Behavior Description	Enables or disables EIC FIQ output request to CPU
Input Parameter	*NewState*: new state of the EIC FIQ output request to CPU. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the FIQ interrupt to be recognized by the EIC.

```
{
EIC_FIQCmd(ENABLE);
}
```

4.7.2.9 EIC_CurrentPriorityLevelValue

Function Name	EIC_CurrentPriorityLevelValue
Function Prototype	`u8 EIC_CurrentPriorityLevelValue(void)`
Behavior Description	Returns the current priority level of the current served IRQ routine
Input Parameter	None
Output Parameter	None
Return Value	The current priority level
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the priority of the served interrupt.

```
{
u8 bCurrentPriorityLeveValue;
bCurrentPriorityLeveValue = EIC_CurrentPriorityLevelValue();
}
```

4.7.2.10 EIC_CurrentIRQChannelValue

Function Name	EIC_CurrentIRQChannelValue
Function Prototype	`u8 EIC_CurrentIRQChannelValue(void)`
Behavior Description	Returns the current served IRQ channel number
Input Parameter	None
Output Parameter	None
Return Value	The current served IRQ channel number.
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the number of the served interrupt

```
{
...
u8 bCurrentIRQChannelValue;
bCurrentIRQChannelValue=EIC_CurrentIRQChannelValue();
...
}
```

4.7.2.11 EIC_CurrentFIQChannelValue

Function Name	EIC_CurrentFIQChannelValue
Function Prototype	`u8 EIC_CurrentFIQChannelValue(void)`
Behavior Description	Returns the current served FIQ channel number.
Input Parameter	None
Output Parameter	None
Return Value	The current served FIQ channel number
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the number of the served FIQ

```
{
...
u8 bCurrentFIQChannelValue;
bCurrentFIQChannelValue=EIC_CurrentFIQChannelValue();
...
}
```

4.7.2.12 EIC_FIQPendingBitClear

Function Name	EIC_FIQPendingBitClear
Function Prototype	`void EIC_FIQPendingBitClear(u8 FIQChannel)`
Behavior Description	Clears the selected FIQ Pending bit located in FIR register by writing 1to the corresponding bit.
Input Parameter	FIQ *channel*: the selected FIQ channel to clear its corresponding pending bit. Refer to section 4.7.1.2 on page 142 "*FIQ Channels*" for more details on allowed values of *this* parameter.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example clears the pending bit of *T0EFTI_FIQChannel*.

```
{
...
EIC_FIQPendingBitClear(T0EFTI_FIQChannel);
...
}
```

4.7.2.13 EIC_FIQChannelConfig

Function Name	EIC_FIQChannelConfig
Function Prototype	`void EIC_FIQChannelConfig(u8 FIQChannel, FunctionalState NewStatus)`
Behavior Description	Configure the FIQ Channel.
Input Parameter	- *FIQChannel*: the selected channel to change its status - *NewStatus*: the new status of FIQ channel it can be ENABLE or DISABLE
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example enables the *EXTIT01* fast Interrupt.

```
{
 /*Enable FIQ interrupts*/
 EIC_FIQChannelConfig(EXTIT01_FIQChannel,ENABLE);
}
```

4.7.2.14 EIC_IRQChannelPriorityConfig

Function Name	EIC_IRQChannelPriorityConfig
Function Prototype	`void EIC_IRQChannelPriorityConfig(u8 IRQChannel, u8 Priority)`
Behavior Description	Configure the selected IRQ channel priority
Input Parameter	*IRQChannel*: the selected IRQ channel. *Priority*: the priority to be configured for the IRQchannel
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example configures the priority of the TB1 peripheral IRQ to 5.

```
{
...
 EIC_IRQChannelPriorityConfig(TB1_IRQChannel,5);
...
}
```

4.8 FLASH

The first section describes the data structures used in the *Flash* software library. The second one presents the software library functions.

4.8.1 Data structures

The *Flash* registers are defined in two structures, *FLASHR_TypeDef* structure which describes the Flash Control/Data registers and *FLASHPR_TypeDef* structure which describes the Flash Protection registers.

4.8.1.1 Flash Register Structure

The *Flash* registers structure *FLASHR_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu32 CR0;
 vu32 CR1;
 vu32 DR0;
 vu32 DR1;
 vu32 AR;
 vu32 ER;
} FLASHR_TypeDef;
```

The following table presents the *Flash* registers:

Register	Description
CR0	*Flash* Control Register 0
CR1	*Flash* Control Register 1
DR0	*Flash* Data Register 0
DR1	*Flash* Data Register 1
AR	*Flash* Address Register
ER	*Flash* Error Register

The *Flash* Control/Data registers mapping is declared in the same file:

```
...
#define FLASHR_BASE     0x80100000
....
#ifndef DEBUG
...
#define FLASHR     ((FLASHR_TypeDef  *) FLASHR_BASE)
...
#else
...
EXT FLASHR_TypeDef     *FLASHR;
...
```

```
#endif
```

When debug mode is used, *Flash* Control/Data registers pointer is initialized in *73x_lib.c* file:

```
#ifdef _FLASHR
 FLASHR  = (FLASHR_TypeDef *) FLASHR_BASE;
#endif /*_FLASHR */
```

_FLASHR must be defined in *73x_conf.h* file, to access the *Flash* Control/Data registers, as follows :

```
#define _FLASHR
...
```

4.8.1.2 Flash Protection Register Structure

The *Flash* Protections registers structure *FLASHPR_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu32 NVWPAR;
 u32 EMPTY;
 vu32 NVAPR0;
 vu32 NVAPR1;
} FLASHPR_TypeDef;
```

The following table presents the *Flash* Protection registers:

Register	Description
NVWPAR	*Flash* Non Volatile Write Protection Register
NVAPR0	*Flash* Non Volatile Access Protection Register 0
NVAPR1	*Flash* Non Volatile Access Protection Register 1

The *Flash* Protection registers mapping is declared in the same file:

```
...
#define FLASHPR_BASE     0x8010DFB0
....
#ifndef DEBUG
...
#define FLASHPR    ((FLASHPR_TypeDef *) FLASHPR_BASE)
...
#else
...
EXT FLASHPR_TypeDef     *FLASHPR;
...
#endif
```

When debug mode is used, *Flash* Protection registers pointer is initialized in *73x_lib.c* file:

```
#ifdef _FLASHPR
 FLASHPR  = (FLASHPR_TypeDef *) FLASHPR_BASE;
#endif /*_FLASHPR */
```

_FLASHPR must be defined in *73x_conf.h* file, to access the *Flash* Protection registers, as follows :

```
#define _FLASHPR
...
```

4.8.2 Common Parameter Values

4.8.2.1 Bank0 Flash sectors

The Flash sectors, defined in *73x_flash.h*, are listed below:

Flash_Sector	Meaning
FLASH_Sector0	Bank0 Flash Sector 0
FLASH_Sector1	Bank0 Flash Sector 1
FLASH_Sector2	Bank0 Flash Sector 2
FLASH_Sector3	Bank0 Flash Sector 3
FLASH_Sector4	Bank0 Flash Sector 4
FLASH_Sector5	Bank0 Flash Sector 5
FLASH_Sector6	Bank0 Flash Sector 6
FLASH_Sector7	Bank0 Flash Sector 7
FLASH_Module	All Bank0 Flash Sectors

4.8.2.2 Operation to resume

The Flash operation that can be resumed after a suspend, defined in *73x_flash.h*, are listed below:

OperToResume	Meaning
FLASH_SER	The suspended Sector Erase operation will be resumed
FLASH_DWPG	The suspended Double Word Program operation will be resumed
FLASH_WPG	The suspended Word Program operation will be resumed

4.8.2.3 Flash flags

The Flash flags, defined in *73x_flash.h*, are listed below:

FLASH_FLAG	Meaning
FLASH_FLAG_BSY0[1]	Bank0 busy flag
FLASH_FLAG_LOCK[1]	Flash register access locked flag
FLASH_FLAG_JBL[1][2]	JTAG boot mode latched flag
FLASH_FLAG_INTP[1][2]	End of write interrupt pending flag
FLASH_FLAG_BSM[1][2]	Boot from system memory flag
FLASH_FLAG_ERR[1][2]	Write error flag
FLASH_FLAG_ERER[1][2]	Erase error flag
FLASH_FLAG_PGER[1][2]	Program error flag
FLASH_FLAG_10ER[1][2]	1 over 0 error flag
FLASH_FLAG_SEQER[1][2]	Sequence error flag
FLASH_FLAG_RESER[1][2]	Resume error flag
FLASH_FLAG_WPF[1][2]	Write protection flag

[1]: parameters for *FLASH_FlagStatus()* function.

[2]: parameters for *FLASH_FlagClear()* function only.

4.8.3 Software Library Functions

The following table enumerates the different functions of the Flash library.

Function Name	Description
FLASH_DeInit	Deinitializes Flash module registers to their default reset values.
FLASH_WordWrite	Writes a word at the specified address in the Flash.
FLASH_DWordWrite	Writes a double word at the specified address in the Flash.
FLASH_BlockWrite	Writes a block of data from the RAM to the Flash.
FLASH_WordRead	Reads a word from the specified address in the Flash.
FLASH_BlockRead	Reads a block of data from the Flash and store it in the RAM.
FLASH_SectorErase	Erases the specified Flash sectors.
FLASH_Suspend	Suspends an on-going operation on the Flash.
FLASH_Resume	Resumes a suspended operation on the Flash.
FLASH_PowerDownConfig	Enables or disables the Flash power down mode.
FLASH_ITConfig	Enables or disables the end of write interrupt(INTM).
FLASH_FlagStatus	Checks whether the specified Flash flag is set or not.
FLASH_FlagClear	Clears the specified Flash flag.
FLASH_WaitForLastTask	Waits for the end of last task.

4.8.3.1 FLASH_DeInit

Function Name	FLASH_DeInit
Function Prototype	`void FLASH_DeInit(void)`
Behavior Description	Deinitializes Flash module registers to their default reset values.
Input Parameter	None
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to deinitialize the Flash registers.

```
{
...
 FLASH_DeInit();
...
}
```

4.8.3.2 FLASH_WordWrite

Function Name	FLASH_WordWrite
Function Prototype	`void FLASH_WordWrite(u32 DestAddr, u32 Data)`
Behavior Description	Writes a word at the specified address in the Flash.
Input Parameter 1	*DestAddr*: address of the Flash to be programmed.
Input Parameter 2	*Data*: word to be written.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	FLASH_WaitForLastTask()

Example:

The following example illustrates how to write word 0x5A5A5A5A at address 0x1004 in the Flash.

```
{
...
 FLASH_WordWrite(0x1004, 0x5A5A5A5A);
...
}
```

4.8.3.3 FLASH_DWordWrite

Function Name	FLASH_DWordWrite
Function Prototype	`void FLASH_DWordWrite(u32 DestAddr, u32 Data0, u32 Data1)`
Behavior Description	Writes a double word at the specified address in the Flash.
Input Parameter 1	*DestAddr*: address of the Flash to be programmed, should be aligned on a double word boundary.
Input Parameter 2	*Data0*: first word to be written.
Input Parameter 3	*Data1*: second word to be written.
Output Parameter	None
Return Parameter	None
Required preconditions	The address to write to must be double word aligned.
Called Functions	FLASH_WaitForLastTask()

Example:

The following example illustrates how to write word 0x5A5A5A5A at address 0x1008 and word 0xA5A5A5A5 at address 0x100C in the Flash.

```
{
...
 FLASH_DWordWrite(0x1008, 0x5A5A5A5A, 0xA5A5A5A5);
...
}
```

4.8.3.4 FLASH_BlockWrite

Function Name	FLASH_BlockWrite

Function Prototype	`void FLASH_BlockWrite(u32 SourceAddr,`
	`u32 DestAddr,`
	`u32 NbrWordToWrite)`

Behavior Description	Writes a block of data from the RAM to the Flash.
Input Parameter 1	*SourceAddr* : specifies the RAM address of the block of data to be programmed in the Flash.
Input Parameter 2	*DestAddr*: specifies the address in the Flash where the block of data will be programmed.
Input Parameter 3	*NbrWordToWrite*: specifies the number of data to be programmed expressed in terms of words.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	*FLASH_DWordWrite()* and *FLASH_WordWrite*().

Example:

The following example illustrates how to copy a buffer of four words from the RAM to the Flash.

```
{
u32 SRC_Buffer[4] = {0x5A5A5A5A, 0xA5A5A5A5, 0x55AA55AA, 0xAA55AA55}
...
FLASH_BlockWrite((u32)&SRC_Buffer, 0x2000, 4);
...
}
```

4.8.3.5 FLASH_WordRead

Function Name	FLASH_WordRead
Function Prototype	`u32 FLASH_WordRead(u32 SourceAddr)`
Behavior Description	Reads a word from the specified address in the Flash.
Input Parameter	*SourceAddr*: address of the Flash to be read.
Output Parameter	None
Return Parameter	The data value at the specified address.
Required preconditions	None
Called Functions	FLASH_WaitForLastTask()

Example:

The following example illustrates how to read a word from address 0x1004 in the Flash.

```
{
 u32 Data;
...
 Data = FLASH_WordRead(0x1004);
...
}
```

4.8.3.6 FLASH_BlockRead

Function Name	FLASH_BlockRead

Function Prototype	`void FLASH_BlockRead(u32 SourceAddr,`
	`u32 DestAddr,`
	`u32 NbrWordToRead)`

Behavior Description	Reads a block of data from a specified address in the Flash and store it in the RAM.
Input Parameter 1	*SourceAddr*: specifies the address, in the Flash, of the block of data to be read.
Input Parameter 2	*DestAddr*: specifies the destination address in the RAM where that data will be copied.
Input Parameter 3	*NbrWordToRead* : specifies the number of words to be read from the Flash.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	FLASH_WaitForLastTask()

Example:

The following example illustrates how to read four words from the Flash and store them in the RAM.

```
{
 u32 DST_Buffer[4];
...
 FLASH_BlockRead(0x2000,(u32)&DST_Buffer, 4);
...
}
```

4.8.3.7 FLASH_SectorErase

Function Name	FLASH_SectorErase
Function Prototype	`void FLASH_SectorErase(u8 FLASH_Sector)`
Behavior Description	Erases the specified Flash sectors.
Input Parameter	*FLASH_Sector*: sectors to be erased. Refer to section 4.8.2.1 on page 157 for more details on the allowed values of this parameter. The user can select more than one sector to erase, by OR'ing them.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	FLASH_WaitForLastTask()

Example:

The following example illustrates how to erase the Flash sector1.

```
{
 ...
 FLASH_SectorErase(FLASH_Sector1);
...
}
```

4.8.3.8 FLASH_Suspend

Function Name	FLASH_Suspend
Function Prototype	`void FLASH_Suspend(void)`
Behavior Description	Suspends an on-going operation on the Flash.
Input Parameter	None
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	FLASH_WaitForLastTask()

Example:

The following example illustrates how to suspend the on-going Sector Erase operation on the Flash.

```
{
 FLASH_Suspend();
}
```

4.8.3.9 FLASH_Resume

Function Name	FLASH_Resume
Function Prototype	`void FLASH_Resume(u32 OperToResume)`
Behavior Description	Resumes a suspended operation on the Flash.
Input Parameter	*OperToResume*: specifies the operation that has been suspended and needs to be resumed. Refer to section 4.8.2.2 on page 157 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to resume the suspended Sector Erase operation on the Flash.

```
{
...
FLASH_Suspend(FLASH_SER);
...
}
```

4.8.3.10 FLASH_PowerDownConfig

Function Name	FLASH_PowerDownConfig
Function Prototype	`void FLASH_PowerDownConfig(FunctionalState NewtSate)`
Behavior Description	Enables or disables the Flash power down mode.
Input Parameter	*NewState*: new state of the Flash power down mode. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to put the Flash into power down mode.

```
{
...
FLASH_PowerDown(ENABLE);
```

```
...
}
```

4.8.3.11 FLASH_ITConfig

Function Name	FLASH_ITConfig
Function Prototype	`void FLASH_ITConfig(FunctionalState NewState)`
Behavior Description	Enables or disables the end of write interrupt(INTM).
Input Parameter	*NewState*: new state of end of write interrupt. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the Flash end of write interrupt.

```
{
...
FLASH_ITConfig(ENABLE);
...
}
```

4.8.3.12 FLASH_FlagStatus

Function Name	FLASH_FlagStatus
Function Prototype	`FlagStatus FLASH_FlagStatus(u8 FLASH_Flag)`
Behavior Description	Checks whether the specified Flash flag is set or not.
Input Parameter	*FLASH_Flag*: flag to check. Refer to section 4.8.2.3 on page 158 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	The status of the flag in *FlagStatus* type, the available value are: SET: if the flag to check is set. RESET: if the flag to check is reset.
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to test the status of the Flash write error flag.

```
{
FlagStatus Status;
```

```
...
 Status = FLASH_FlagStatus(FLASH_FLAG_ERR);
...
}
```

4.9 GENERAL PURPOSE INPUT OUTPUT (GPIO)

The *GPIO* driver may be used for several purposes, including pin configuration, reading a port pin and writing data into the port pin.

The first section describes the data structure used in the *GPIO* software library. The second section presents the *GPIO* software library functions.

4.9.1 Data Structures

4.9.1.1 GPIO Register Structure

The *GPIO* peripheral register structure *GPIO_TypeDef* is defined in the file *73x_map.h* as follows:

```
typedef struct
{
 u16 PC0;
 u16 EMPTY1;
 u16 PC1;
 u16 EMPTY2;
 u16 PC2;
 u16 EMPTY3;
 u16 PD;
 u16 EMPTY4;
} GPIO_TypeDef;
```

The table below describes the *GPIO* registers:

Register	Description
PC0	Port Configuration Register 0
PC1	Port Configuration Register 1
PC2	Port Configuration Register 2
PD	Data Register

GPIO peripheral is declared in the *73x_map.h* file as follows:

```
/* APB bridge Base Addresses definition */
#define APB        0xFFFF8000
/* GPIO0, GPIO1, GPIO2, GPIO3, GPIO4, GPIO5, GPIO6 and GPIO7 Base Address'
definitions */
#define GPIO0_BASE    (APB + 0x5400)
#define GPIO1_BASE    (APB + 0x5410)
#define GPIO2_BASE    (APB + 0x5420)
#define GPIO3_BASE    (APB + 0x5430)
#define GPIO4_BASE    (APB + 0x5440)
#define GPIO5_BASE    (APB + 0x5450)
#define GPIO6_BASE    (APB + 0x5460)
```

```
/* GPIO0, GPIO1, GPIO2, GPIO3, GPIO4, GPIO5 and GPIO6 peripheral declaration
*/
#ifndef DEBUG
#define GPIO0     ((GPIO_TypeDef *) GPIO0_BASE)
#define GPIO1     ((GPIO_TypeDef *) GPIO1_BASE)
#define GPIO2     ((GPIO_TypeDef *) GPIO2_BASE)
#define GPIO3     ((GPIO_TypeDef *) GPIO3_BASE)
#define GPIO4     ((GPIO_TypeDef *) GPIO4_BASE)
#define GPIO5     ((GPIO_TypeDef *) GPIO5_BASE)
#define GPIO6     ((GPIO_TypeDef *) GPIO6_BASE)
...
#else
EXT GPIO_TypeDef      *GPIO0;
EXT GPIO_TypeDef      *GPIO1;
EXT GPIO_TypeDef      *GPIO2;
EXT GPIO_TypeDef      *GPIO3;
EXT GPIO_TypeDef      *GPIO4;
EXT GPIO_TypeDef      *GPIO5;
EXT GPIO_TypeDef      *GPIO6;
...
#endif
```

When debug mode is used, *GPIO* pointer is initialized in *73x_lib.c* file:

```
#ifdef _GPIO0
GPIO0  = (GPIO_TypeDef *)GPIO0_BASE;
#endif /*_GPIO0*/

#ifdef _GPIO1
GPIO1  = (GPIO_TypeDef *)GPIO1_BASE;
#endif /*_GPIO1*/

#ifdef _GPIO2
GPIO2  = (GPIO_TypeDef *)GPIO2_BASE;
#endif /*_GPIO2*/

#ifdef _GPIO3
GPIO3  = (GPIO_TypeDef *)GPIO3_BASE;
#endif /*_GPIO3*/

#ifdef _GPIO4
GPIO4  = (GPIO_TypeDef *)GPIO4_BASE;
#endif /*_GPIO4*/

#ifdef _GPIO5
GPIO5  = (GPIO_TypeDef *)GPIO5_BASE;
```

```
#endif /*_GPIO5*/

#ifdef _GPIO6
GPIO6  = (GPIO_TypeDef *)GPIO6_BASE;
#endif /*_GPIO6*/
```

In debug mode the following variables are defined in *73x_conf.h* file:

_GPIO is defined to include the *GPIO* library

_GPIO0, *_GPIO1, _GPIO2*, *_GPIO3, _GPIO4*, *_GPIO5* and *_GPIO6* are defined to access the peripheral registers.

```
#define _GPIO
#define _GPIO0
#define _GPIO1
#define _GPIO2
#define _GPIO3
#define _GPIO4
#define _GPIO5
#define _GPIO6
```

4.9.1.2 GPIO_InitTypeDef Structure

The *GPIO_InitTypeDef* structure defines the control setting for the GPIO peripheral.

```
typedef struct
{
  u16 GPIO_Pins;
  u16 GPIO_Mode;
} GPIO_InitTypeDef;
```

Members

- **GPIO_Pins**

  Specifies GPIO pins to configure, (allows multiple pin configuration with the | operator), allowed values are:

GPIO_Pins	Meaning
GPIO_PIN_NONE	No pin slected
GPIO_PIN_0	Pin 0 selected
GPIO_PIN_1	Pin 1 selected
GPIO_PIN_2	Pin 2 selected
GPIO_PIN_3	Pin 3 selected
GPIO_PIN_4	Pin 4 selected
GPIO_PIN_5	Pin 5 selected

GPIO_Pins	Meaning
GPIO_PIN_6	Pin 6 selected
GPIO_PIN_7	Pin 7 selected
GPIO_PIN_8	Pin 8 selected
GPIO_PIN_9	Pin 9 selected
GPIO_PIN_10	Pin 10 selected
GPIO_PIN_11	Pin 11 selected
GPIO_PIN_12	Pin 12 selected
GPIO_PIN_13	Pin 13 selected
GPIO_PIN_14	Pin 14 selected
GPIO_PIN_15	Pin 15 selected
GPIO_PIN_ALL	All pins are selected

- **GPIO_Modes**

Specifies the working mode for the selected pins.

This must take one of the following values:

GPIO_Mode	Meaning
GPIO_Mode_HI_AIN_TRI	High impedance Analog Input
GPIO_Mode_IN_TRI_TTL	Standard TTL Input
GPIO_Mode_INOUT_WP	Bidirectional Weak Push-Pull
GPIO_Mode_OUT_OD	Open Drain Output
GPIO_Mode_OUT_PP	Push-Pull Output
GPIO_Mode_AF_OD	Open Drain Output Alternate-Function
GPIO_Mode_AF_PP	Push-Pull Output Alternate-Function

4.9.2 Common Parameter Values

4.9.2.1 GPIOx values

The following table shows the allowed values of GPIOx variable

GPIOx	Description
GPIO0	To select GPIO 0
GPIO1	To select GPIO 1
GPIO2	To select GPIO 2
GPIO3	To select GPIO 3
GPIO4	To select GPIO 4
GPIO5	To select GPIO 5
GPIO6	To select GPIO 6

4.9.2.2 GPIO pin values

The table below shows the GPIO Pin parameter values for each pin:

Port_Pin value	Corresponding pin
GPIO_PIN_0	port pin number 0.
GPIO_PIN_1	port pin number 1.
GPIO_PIN_2	port pin number 2.
GPIO_PIN_3	port pin number 3.
GPIO_PIN_4	port pin number 4.
GPIO_PIN_5	port pin number 5.
GPIO_PIN_6	port pin number 6.
GPIO_PIN_7	port pin number 7.
GPIO_PIN_8	port pin number 8.
GPIO_PIN_9	port pin number 9.
GPIO_PIN_10	port pin number 10.
GPIO_PIN_11	port pin number 11.
GPIO_PIN_12	port pin number 12.
GPIO_PIN_13	port pin number 13.
GPIO_PIN_14	port pin number 14.
GPIO_PIN_15	port pin number 15.

4.9.2.3 GPIO byte values

The following table shows the allowed values of GPIO byte parameter values

Port_byte value	Description
GPIO_MSB	To select MSB byte of the GPIO
GPIO_LSB	To select LSB byte of the GPIO

4.9.3 Software Library Functions

The following table enumerates the different functions of the *GPIO* library.

Function Name	Description
GPIO_Init	Enables and configures the selected GPIO I/O pins according to the input passed parameters.
GPIO_DeInit	Disables the selected GPIO port and resets its registers to their default values
GPIO_StructInit	Resets all the Init struct parameters to their default values
GPIO_BitRead	Reads the specified port pin depending on the input passed parameters and return its value
GPIO_ByteRead	Reads the specified data port byte (most or low significant eight bits) and returns its value.
GPIO_WordRead	Reads the specified data port word and returns its value.
GPIO_BitWrite	Sets or clears the selected data port bit.
GPIO_ByteWrite	Writes the passed byte value in to the selected port register.
GPIO_WordWrite	Writes the passed word value in to the selected port register.

4.9.3.1 GPIO_Init

Function Name	GPIO_Init
Function Prototype	`void GPIO_Init(GPIO_TypeDef *GPIOx, GPIO_InitTypeDef *GPIO_InitStruct)`
Behavior Description	Configure the selected GPIO ports pins according to the chosen mode by writing the corresponding value to the port configuration registers. Refer to section 4.9.1.2 on page 169 "GPIO_Modes" for more details on input modes, output modes and port names.
Input Parameter 1	*GPIOx*: selects the port to be configured. x can be 0,1,...6. Refer to section 4.9.2.1 on page 170 for details on the allowed values of this parameter.
Input Parameter 2	*GPIO_InitStruct*: Address of a GPIO_InitTypeDef structure containing the configuration information for the specified GPIO peripheral. Refer to section 4.9.1.2 on page 169 for more details on GPIO_InitTypeDef structure .
OutPut Parameter 1	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to configure *GPIO0*, *GPIO2*, *GPIO3* and *GPIO4* port pins in different modes.

```
{
/* Init Structure declarations for GPIO0, GPIO2 ,GPIO3 and GPIO4*/
GPIO_InitTypeDef GPIO0_InitStructure;
GPIO_InitTypeDef GPIO2_InitStructure;
GPIO_InitTypeDef GPIO3_InitStructure;
GPIO_InitTypeDef GPIO4_InitStructure;

  /*Configure GPIO0 pin P0.5 as IN_TRI_TTL*/
GPIO0_InitStructure.GPIO_Mode = GPIO_Mode_IN_TRI_TTL;
GPIO0_InitStructure.GPIO_Pins = GPIO_PIN_5;
GPIO_Init (GPIO0, &GPIO0_InitStructure);

  /*Configure GPIO2[8:15] as Alternate function Open Drain*/
GPIO2_InitStructure.GPIO_Mode = GPIO_Mode_AF_OD;
GPIO2_InitStructure.GPIO_Pins = GPIO_PIN_8 | GPIO_PIN_9 | GPIO_PIN_10|
GPIO_PIN_11 | GPIO_PIN_12 | GPIO_PIN_13 | GPIO_PIN_14| GPIO_PIN_15;
GPIO_Init (GPIO2, &GPIO2_InitStructure);

  /*Configure GPIO3 pins P3.0 and P3.15 as HI_AIN_TRI*/
GPIO3_InitStructure.GPIO_Mode = GGPIO_Mode_HI_AIN_TRI;
GPIO3_InitStructure.GPIO_Pins = GPIO_PIN_0 | GPIO_PIN_15;
GPIO_Init (GPIO3, &GPIO3_InitStructure);

 /*Configure All GPIO4 pins as Push-Pull Output*/
GPIO4_InitStructure.GPIO_Mode = GPIO_Mode_OUT_PP;
GPIO4_InitStructure.GPIO_Pins = GPIO_PIN_ALL;
GPIO_Init (GPIO4, &GPIO4_InitStructure);
 }
```

4.9.3.2 GPIO_DeInit

Function Name	GPIO_DeInit
Function Prototype	`void GPIO_DeInit (GPIO_TypeDef *GPIOx)`
Behavior Description	Reset all the *GPIOx* registers to their default values
Input Parameter 1	*GPIOx*: this parameter specifies the port. x can be 0,1,..6. Refer to section 4.9.2.1 on page 170 for details on the allowed values of this parameter.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to deinitialize *GPIO0*, *GPIO2* port pins.

```
{
  /*Deinitialize GPIO0 and GPIO2 ports registers*/
  GPIO_DeInit (GPIO0);
  GPIO_DeInit (GPIO2);
}
```

4.9.3.3 GPIO_StructInit

Function Name	GPIO_StructInit
Function Prototype	`void GPIO_StructInit(GPIO_InitTypeDef *GPIO_InitStruct)`
Behavior Description	Resets all the Init struct parameters to their default values
Input Parameter	*GPIO_InitStruct*: Address of a GPIO_InitTypeDef structure.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to initialize *GPIO0*, *GPIO2* port pins init structure.

```
{
GPIO_InitTypeDef GPIO0_InitStructure;
GPIO_InitTypeDef GPIO2_InitStructure;
GPIO_StructInit (&GPIO0_InitStructure);
 GPIO_StructInit (&GPIO2_InitStructure);
}
```

4.9.3.4 GPIO_BitRead

Function Name	GPIO_BitRead
Function Prototype	`u8 GPIO_BitRead (GPIO_TypeDef *GPIOx, u16 GPIO_Pin)`
Behavior Description	Read the specified data port bit and return its value.
Input Parameter 1	*GPIOx*: this parameter specifies the port. x can be 0, 1...6. Refer to section 4.9.2.1 on page 170 for details on the allowed values of this parameter.
Input Parameter 2	*GPIO_Pin*: this parameter specifies the bit to be read. *GPIO_Pin_x*. x can be 0, 1...15. *GPIO_PIN_0* corresponds to the least significant bit and *GPIO_PIN_15* corresponds to the most significant bit. Refer to section 4.9.2.2 on page 171 for more details on the allowed values of this parameter.
OutPut Parameter	None
Return Parameter	The port pin value
Required Preconditions	None
Called Functions	None

Example:

In the following example, the values of *GPIO2* port pin 0, *GPIO3* port pin 2 and *GPIO4* port pin 15 are read.

```
{
/*Read_Value used to hold the returned value*/
u8 Read_Value;
/*Get the P2.0 bit value*/
Read_Value = GPIO_BitRead (GPIO2,GPIO_PIN_0);
/*Get the P3.2 bit value*/
Read_Value = GPIO_BitRead (GPIO3,GPIO_PIN_2);
/*Get the P4.15 bit value*/
Read_Value = GPIO_BitRead (GPIO4,GPIO_PIN_15);
}
```

4.9.3.5 GPIO_ByteRead

Function Name	GPIO_ByteRead
Function Prototype	`u8 GPIO_ByteRead (GPIO_TypeDef *GPIOx, u8 GPIO_Byte)`
Behavior Description	Read the specified data port byte and return its value.
Input Parameter 1	*GPIOx*: this parameter specifies the port. x can be 0, 1...6. Refer to section 4.9.2.1 on page 170 for details on the allowed values of this parameter.
Input Parameter 2	*GPIO_Byte*: specifies which byte to be read. It must one of the following values: *GPIO_MSB*: corresponds to the upper byte. *GPIO_LSB*: corresponds to the lower byte.
OutPut Parameter	None
Return Parameter	The specified port byte value
Required Preconditions	None
Called Functions	None

Example:

In the following example *GPIO2* port lower byte and *GPIO3* port upper byte values are read.

```
{
 /*Read_Value used to hold the returned value*/
  u8 Read_Value;
 /* Get P2.[0:7] bits value*/
  Read_Value = GPIO_ByteRead (GPIO2, GPIO_LSB);
 /*Get P3.[8:15] bits value*/
  Read_Value = GPIO_ByteRead (GPIO3, GPIO_MSB);
}
```

4.9.3.6 GPIO_WordRead

Function Name	GPIO_WordRead
Function Prototype	`u16 GPIO_WordRead (GPIO_TypeDef *GPIOx)`
Behavior Description	Return the value of the specified data port register GPIOx.PD
Input Parameter 1	*GPIOx*: this parameter specifies the port. x can be 0, 1...6. Refer to section 4.9.2.1 on page 170 for more details on the allowed values of this parameter.
OutPut Parameter	None
Return Parameter	The specified port word value
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to read *GPIO4* port pin values.

```
{
  /* Read_Value used to hold the returned value*/
  u16 Read_Value;
 /*Get all GPIO4 pins value*/
  Read_Value = GPIO_WordRead (GPIO4);
}
```

4.9.3.7 GPIO_BitWrite

Function Name	GPIO_BitWrite
Function Prototype	`void GPIO_BitWrite (GPIO_TypeDef *GPIOx, u16 GPIO_Pin, BitAction Bit_Val)`
Behavior Description	Set or clear the selected data port bit
Input Parameter 1	*GPIOx*: this parameter specifies the port. x can be 0, 1...6. Refer to section 4.9.2.1 on page 170 for details on the allowed values of this parameter.
Input Parameter 2	*GPIO_Pin*: this parameter specifies the bit to be written. Refer to section 4.9.2.2 on page 171 for details on the allowed values of this parameter.
Input Parameter 3	*Bit_Val*: this parameter specifies the value to be written to the selected bit. *Bit_Val* must be one of the BitAction enum values: *Bit_RESET*: to clear the port pin *Bit_SET*: to set the port pin
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Note: When a port pin value is changed, the other port pins values stay unchanged.

Example:

The following example shows how to set the *GPIO1* port pin 0 and clear the *GPIO4* port pin 15.

```
{
 /* Set the P1.0 bit */
 GPIO_BitWrite(GPIO1,GPIO_PIN_0,Bit_SET);

 /* Clear the P4.15 bit*/
 GPIO_BitWrite(GPIO4,GPIO_PIN_15,Bit_RESET);
}
```

4.9.3.8 GPIO_ByteWrite

Function Name	GPIO_ByteWrite
Function Prototype	`void GPIO_ByteWrite (GPIO_TypeDef *GPIOx, u8 GPIO_Byte, u8 Byte_Val)`
Behavior Description	write the passed value in to the selected *GPIOx* byte
Input Parameter 1	*GPIOx*: this parameter specifies the port. x can be 0, 1...6.
Input Parameter 2	*GPIO_Byte*: specifies the write on which byte. It must be either *GPIO_MSB* or *GPIO_LSB* *GPIO_MSB* corresponds to the upper byte. *GPIO_LSB* corresponds to the lower byte.
Input Parameter 3	*Byte_Val*: The value to be written to the selected byte
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Note: When a port byte value is changed, the other port byte value stay unchanged.

Example:

The following example shows how to set all the *GPIO2[0:7]* port pins and clear all the *GPIO3[8:15]* port pins. the *GPIO2[8:15]* and *GPIO3[0:7]* remain unchanged.

```
{
 /*Set all the GPIO2[0:7] port pins*/
  GPIO_ByteWrite(GPIO2,GPIO_LSB,0xFF);

 /* Clear all the GPIO3[8:15] port pins*/
  GPIO_ByteWrite(GPIO3,GPIO_MSB,0x00);
}
```

4.9.3.9 GPIO_WordWrite

Function Name	GPIO_WordWrite
Function Prototype	`void GPIO_WordWrite (GPIO_TypeDef *GPIOx,u16 Port_Val)`
Behavior Description	Write the passed value in to the selected data *GPIOx* port register
Input Parameter 1	*GPIOx*: this parameter specifies the port. x can be 0, 1...6. Refer to section 4.9.2.1 on page 170 for more details on the allowed values of this parameter.
Input Parameter 2	*Port_Val*: The value to be written to the data port register.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

The following example sets all the *GPIO2* port pins, and write 0x5555 on GPIO4 port pins.

```
{
 /*Set all the GPIO2 port pins */
 GPIO_WordWrite(GPIO2,0xFFFF);

 /*Write 0x5555 on GPIO4 port pins*/
 GPIO_WordWrite(GPIO4,0x5555);
}
```

4.10 INTER-INTEGRATED CIRCUIT (I²C)

The I2C Bus interface module serves as interface between the microcontroller and the serial *I2C* bus. It provides both multi-master and slave functions, and controls all *I2C* bus-specific protocol, arbitration and timing.

The *I2C* driver may be used to manage the *I2C* in transmission and reception and it report the status of the action done.

The first section describes the data structures used in the *I2C* software library. The second one presents the software library functions.

4.10.1 Data structures

4.10.1.1 I2C Register Structure

The I2C registers structure *I2C_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu8 CR;
 u8 EMPTY1[3];
 vuc8 SR1;
 u8 EMPTY2[3];
 vuc8 SR2;
 u8 EMPTY3[3];
 vu8 CCR;
 u8 EMPTY4[3];
 vu8 OAR1;
 u8 EMPTY5[3];
 vu8 OAR2;
 u8 EMPTY6[3];
 u8 DR;
 u8  EMPTY7[3];
 vu8 ECCR;
 u8  EMPTY8[3];
} I2C_TypeDef;
```

The following table presents the *I2C* registers:

Register	Description
CR	*I2C* Control Register
SR1	*I2C* Status Register1
SR2	*2C* Status Register2
CCR	*I2C* Clock Control Register

Register	Description
ECCR	*I2C* Extended Clock Control Register
OAR1	*I2C* Own Address Register1
OAR2	*I2C* Own Address Register1
DR	*I2C* Data Register
ECCR	I2C Extended Clock Control Register

The two *I2C* interfaces are declared in the same file:

```
...
#define APB_BASE  0xFFFF8000
....
#define I2C0_BASE    (APB_BASE + 0x400)
#define I2C1_BASE    (APB_BASE + 0x800)
#ifndef DEBUG
...
 #define I2C0 ((I2C_TypeDef  *)I2C0_BASE)
 #define I2C1 ((I2C_TypeDef  *)I2C1_BASE)
...
#else
...
 EXT I2C_TypeDef *I2C0;
 EXT I2C_TypeDef *I2C1;
...
#endif
```

When debug mode is used, *I2C* pointer is initialized in *73x_lib.c* file:

```
#ifdef _I2C0
  I2C0 = (I2C_TypeDef *)I2C0_BASE;
 #endif /* _I2C0 */
 #ifdef _I2C1
  I2C1 = (I2C_TypeDef *)I2C1_BASE;
 #endif /* _I2C1 */
```

_I2C0 and *_I2C1* must be defined, in *73x_conf.h* file, to access the peripheral registers as follows :

```
#define _I2C0
#define _I2C1
...
```

Some P*RCCU* functions are called, *_PRCCU* must be defined, in *73x_conf.h* file, to make the P*RCCU* functions accessible :

```
#define _PRCCU
```

4.10.1.2 I2C_InitTypeDef Structure

The *I2C_InitTypeDef* structure is defined in the file *73x_i2c.h*:

```
typedef struct
{
  u8 I2C_GeneralCall;
  u8 I2C_Ack;
  u16 I2C_OwnAddress;
  u16 I2C_CLKSpeed;
}I2C_InitTypeDef;
```

Members

- **I2C_GeneralCall**

  Enable/disable the General call feature.

I2C_GeneralCall	Meaning
I2C_GeneralCallEnable	Enable the General call feature
I2C_GeneralCallDisable	Disable the General call feature

- **I2C_Ack**

  Enable/disable the Acknowledgement.

I2C_Ack	Meaning
I2C_AckEnable	Enable the Acknowledgement
I2C_AckDisable	Disable the Acknowledgement

- **I2C_OwnAddress**

  Select the sampling prescaler. Allowed values are from 0 to 7.

- **I2C_CLKSpeed**

  Select the Clock speed frequency. Allowed values are under 400kHz

4.10.2 Common Parameter Values

4.10.2.1 I2C Registers

The *I2C_Registers* and their offset values are defined in the file 73x_*i2c.h* as follows:

Register	Description
I2C_CR	*I2C* Control Register
I2C_SR1	*I2C* Status Register1
I2C_SR2	*I2C* Status Register2

Register	Description
I2C_CCR	*I2C* Clock Control Register
I2C_ECCR	*I2C* Extended Clock Control Register
I2C_OAR1	*I2C* Own Address Register1
I2C_OAR2	*I2C* Own Address Register1
I2C_DR	*I2C* Data Register

4.10.2.2 I2C Events

The I2C events are listed in the following table:

I2C Flags	Meaning
I2C_EVENT_SLAVE_ADDRESS_MATCHED	EV1
I2C_EVENT_SLAVE_BYTE_RECEIVED	EV2
I2C_EVENT_SLAVE_BYTE_TRANSMITTED	EV3
I2C_EVENT_SLAVE_ACK_FAILURE	EV4
I2C_EVENT_MASTER_MODE_SELECT	EV5
I2C_EVENT_MASTER_MODE_SELECTED	EV6
I2C_EVENT_MASTER_BYTE_RECEIVED	EV7
I2C_EVENT_MASTER_BYTE_TRANSMITTED	EV8
I2C_EVENT_MASTER_MODE_ADDRESS10	EV9
I2C_EVENT_SLAVE_STOP_DETECTED	EV3-1
I2C_SLAVE_GENERAL_CALL	General Call detection

4.10.2.3 I2C addressing modes

The *I2C_Addressing* values are defined in the file 73x_*i2c.h*. These following table defines the *I2C* addressing modes:

Addressing mode	Description
I2C_MODE_ADDRESS10	10 bit addressing mode
I2C_MODE_ADDRESS7	7 bit addressing mode

4.10.2.4 I2C transfer Direction

The *I2C_Direction* values are defined in the file 73x_*i2c*.h. These following table defines the *I2C* transfer direction:

I2C direction	Description
I2C_MODE_TRANSMITTER	Transmission
I2C_MODE_RECEIVER	Reception

4.10.2.5 I2C Flags

The *I2C_Flags* values are defined in the file 73x_*i2c.h*. These flags are described in the following table:

I2C Flags	Meaning
I2C_FLAG_SB	Start (Master mode) flag.
I2C_FLAG_M_SL	Master/Slave flag.
I2C_FLAG_ADSL	Address matched (Slave mode) flag.
I2C_FLAG_BTF	Byte transfer finished flag.
I2C_FLAG_BUSY	Bus busy flag.
I2C_FLAG_TRA	Transmitter/Receiver flag.
I2C_FLAG_ADD10	10-Bit addressing in master mode flag
I2C_FLAG_EVF	Event flag
I2C_FLAG_GCAL	General call (slave mode) flag
I2C_FLAG_BERR	Bus error flag
I2C_FLAG_ARLO	Arbitration lost flag
I2C_FLAG_STOPF	Stop detection (slave mode) flag
I2C_FLAG_AF	Acknowledge failure flag
I2C_FLAG_ENDAD	End of address transmission flag
I2C_FLAG_ACK	Acknowledge enabled flag

4.10.3 Software Library Functions

The I2C Bus interface module serves as interface between the microcontroller and the serial I2C bus. It provides both multi-master and slave functions, and controls all I2C bus-specific protocol, arbitration and timing.

The following table enumerates the different functions of the I2C library.

Function Name	Description
I2C_Init	Configure the I2C according to the input passed parameters.
I2C_DeInit	Reset all the I2C registers to their default values
I2C_StructInit	Reset all the Init struct parameters to their default values
I2C_Cmd	Enable or disables I2C peripheral.
I2C_STARTGenerate	Generate I2C communication START condition.
I2C_STOPGenerate	Generate I2C communication STOP condition.
I2C_AcknowledgeConfig	Enable or disable I2C acknowledge feature.
I2C_ITConfig	Enable or disable I2C interrupt feature.
I2C_RegisterRead	Read any I2C register and returns its value.
I2C_FlagStatus	Check whether any I2C Flag is set or not. The tested flag is passed as a parameter.

Function Name	Description
I2C_FlagClear	Clears any I2C Flag. The concerning flag is passed as a parameter.
I2C_AddressSend	Transmits the address byte to select the slave device.
I2C_ByteSend	Transmits single byte of data.
I2C_BufferSend	Transmits data from a buffer whose number of bytes is known. Data transmission will stop if any error occurs during transmission. The transmission status will be returned to the user.
I2C_ByteReceive	Returns the most recent received byte.
I2C_BufferReceive	Receives a number of data bytes and stores them in user defined area. The data reception will stop, if any error occurs during reception. The reception status will be returned to the user.
I2C_GetStatus	Get the I2Cx flags status in a 16 bit register: ACK, ENDAD, AF, STOPF, ARLO, BERR, GCAL, EVF, ADD10, TRA, BUSY, BTF, ADSL, M/SL, SB.
I2C_GetLastEvent	Get the I2Cx flags status in a 16 bit register: ENDAD, AF, STOPF, ARLO, BERR, GCAL, EVF, ADD10, TRA, BUSY, BTF, ADSL, M/SL, SB.
I2C_EventCheck	Check if the last occurred event is equal to the one passed as parameter.

4.10.3.1 I2C_Init

Function Name	I2C_Init
Function Prototype	`void I2C_Init (I2C_TypeDef *I2Cx, I2C_InitTypeDef *I2C_InitStruct)`
Behavior Description	Configure the selected I2C according to the chosen mode by writing the corresponding value to the I2C registers.
Input Parameter 1	*I2Cx*: selects the I2C to be configured. x can be 0 or 1.
Input Parameter 2	*I2C_InitStruct*: An I2C_InitTypeDef structure containing the configuration information for the I2C peripheral. *For more details refer to* section 4.10.1.2 on page 182.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to configure *I2C0 registers*: Speed, Ack, General Call and Own Address

```
{
  /*Init Structure declarations for I2C*/
  I2C_InitTypeDef I2C0_InitStructure;

   /* Enable I2C0*/
   I2C_Cmd (I2C0, ENABLE);

  /*Configure I2C0*/
  I2C0_InitStructure.I2C_GeneralCall = I2C_GeneralCallDisable;
  I2C0_InitStructure.I2C_Ack = I2C_AckEnable;
  I2C0_InitStructure.I2C_CLKSpeed = 10000;
  I2C0_InitStructure.I2C_OwnAddress = 0x03A0;
  I2C_Init(I2C0, &I2C0_InitStructure);
}
```

4.10.3.2 I2C_DeInit

Function Name	I2C_DeInit
Function Prototype	void I2C_DeInit (I2C_TypeDef *I2Cx)
Behavior Description	Reset all the I2Cx registers to their default values
Input Parameter 1	*I2Cx*: this parameter specifies the port. x can be 0 or 1.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to initialize *I2C0* registers.

```
{
  /*Initialize I2C0 registers*/
  I2C_DeInit (I2C0);
}
```

4.10.3.3 I2C_StructInit

Function Name	I2C_StructInit
Function Prototype	`void I2C_StructInit(I2C_InitTypeDef *I2C_InitStruct)`
Behavior Description	Resets all the Init struct parameters to their default values
Input Parameter	*I2C_InitStruct*: An I2C_InitTypeDef structure.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to initialize *I2C0* init structure.

```
{
 /*Init Structures declarations for I2C0 */
I2C_InitTypeDef I2C0_InitStructure;

/*Initialize I2C0 Init structure*/
I2C_StructInit (&I2C0_InitStructure);
}
```

4.10.3.4 I2C_Cmd

Function Name	I2C_Cmd
Function Prototype	`void I2C_Cmd (I2C_TypeDef *I2Cx, FunctionalState NewState)`
Description	Enables or disables I2C peripheral.
Input Parameter 1	*I2Cx*: This parameter specifies the port. x can be 0 or 1.
Input Parameter 2	*NewState*: specifies whether the I2C peripheral will be enabled. *ENABLE*: Enable I2C Peripheral. *DISABLE*: Disable I2C Peripheral.
OutPut Parameter	*PE bit* in *I2CCR* is modified according to NewState parameter.
Return Parameters	None.
Required Preconditions	I/O ports should be configured in their reset states.
Called Functions	None.

Example:

This example illustrates how to enable then disable *I2C0*

```
{
 /* Enable I2C0*/
   I2C_Cmd (I2C0, ENABLE);

  /*Disable I2C0*/
  I2C_Cmd (I2C0, DISABLE);
}
```

4.10.3.5 I2C_STARTGenerate

Function Name	I2C_STARTGenerate
Function Prototype	`void I2C_STARTGenerate (I2C_TypeDef *I2Cx, FunctionalState NewState)`
Description	Enables or disables I2C start generation.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured. X. can be 0 or 1.
Input Parameter 2	*NewState*: specifies whether the start generation will be enabled. *ENABLE*: Start generation will be enabled. *DISABLE*: Start generation will be disabled.
OutPut Parameter	*SB bit* in *I2C_CR* is modified according to NewState parameter.
Return Parameters	None.
Required Preconditions	*I2Cx* peripheral should be enabled.
Called Functions	None.

Example:

This example illustrates how to generate a START condition on *I2C0*

```
{
  /* Generate a START condition on I2C0*/
   I2C_STARTGenerate (I2C0, ENABLE);
}
```

4.10.3.6 I2C_STOPGenerate

Function Name	I2C_STOPGenerate
Function Prototype	`void I2C_STOPGenerate (I2C_TypeDef *I2Cx, FunctionalState NewState)`
Description	Enables or disables I2C stop generation.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured. x can be 0 or 1.
Input Parameter 2	*NewState*: specifies whether the stop generation will be enabled or disabled. *ENABLE*: Stop generation will be enabled. *DISABLE*: Stop generation will be disabled.
OutPut Parameter	STOP bit in *I2CCR* is modified according to *NewState* parameter.
Return Parameters	None.
Required Preconditions	*I2Cx* peripheral should be enabled.
Called Functions	None.

Example:

This example illustrates how to generate a STOP condition on *I2C0*

```
{
 /* Generate a STOP condition on I2C0*/
I2C_STOPGenerate (I2C0, ENABLE);
}
```

4.10.3.7 I2C_AcknowledgeConfig

Function Name	I2C_AcknowledgeConfig
Function Prototype	`void I2C_AcknowledgeConfig (I2C_TypeDef *I2Cx, FunctionalState NewState)`
Description	Enables or disables I2C Acknowledgement.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured.x can be 0 or 1.
Input Parameter 2	*NewState*: specifies whether the Acknowledgement feature will be enabled or disabled for the selected I2C peripheral. *ENABLE*: enable Acknowledgement. *DISABLE*: disable Acknowledgement.
OutPut Parameter	None.
Return Parameters	None.
Required Preconditions	*I2Cx* peripheral should be enabled.
Called Functions	None.

Example:

This example illustrates how to enable then disable Acknowledgement on *I2C0*

```
{
  /*Enable Acknowledgement on I2C0*/
  I2C_AcknowledgeConfig (I2C0, ENABLE);

  /*Disable Acknowledgement on I2C0*/
  I2C_AcknowledgeConfig (I2C0, DISABLE);
}
```

4.10.3.8 I2C_ITConfig

Function Name	I2C_ITConfig
Function Prototype	`void I2C_ITConfig (I2C_TypeDef *I2Cx, FunctionalState NewState)`
Description	Enables or disables I2C interrupt feature.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured.x can be 0 or 1.
Input Parameter 2	*NewState*: specifies whether the interrupt feature will be enabled or disabled. *ENABLE*: enable interrupt. *DISABLE*: disable interrupt.
OutPut Parameter	*ITE* bit in *I2CCR* is modified according to Condition parameter.
Return Parameters	None.
Required Preconditions	*I2Cx* peripheral should be enabled.
Called Functions	None.

Example:

This example illustrates how to enable then disable interrupt on *I2C0*

```
{
  /*Enable Interrupt on I2C0*/
  I2C_ITConfig (I2C0, ENABLE);

   /*Disable Interrupt on I2C0*/
   I2C_ITConfig (I2C0, DISABLE);
}
```

4.10.3.9 I2C_RegisterRead

Function Name	I2C_RegisterRead
Function Prototype	`u8 I2C_RegisterRead (I2C_TypeDef *I2Cx, u8 I2C_Register)`
Description	Reads any register and returns its value.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured. x can be 0 or 1.
Input Parameter 2	*I2C_Register*: specifies the register to be read: Refer to section 4.10.2.1 on page 183 for more details on the allowed values of this parameter.
OutPut Parameter	The register to be read is accessed.
Return Parameters	The value of the read register. It should be an ‘u8’ type.
Required Preconditions	None.
Called Functions	None.

Example:

This example illustrates how to read the I2CCR register of *I2C0 peripheral*

```
{
   // Variable declaration
  u8 Register_Value;

   // Put the value of I2CCR register in Register_Value variable
Register_Value = I2C_RegisterRead(I2C0, I2C_CCR);
}
```

4.10.3.10 I2C_FlagStatus

Function Name	I2C_FlagStatus
Function Prototype	`Flagstatus I2C_FlagStatus (I2C_TypeDef *I2Cx, u16 I2C_Flag)`
Description	Check whether the I2C flag is set or not.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured.x can be 0 or 1.
Input Parameter 2	*I2C_Flag*: specifies the flag to check. Refer to section 4.10.2.5 on page 185 for more details on the allowed values of *I2C_Flag* parameter.
OutPut Parameter	The register containing the Flag to be tested is accessed.
Return Parameters	*Flagstatus*: the status of the specified I2C_Flag.it can be either: *SET*: if the tested flag is set. *RESET*: if the corresponding flag is reset.
Required Preconditions	None.
Called Functions	I2C_GetStatus.

Example:

This example illustrates how to read the I2C_FLAG_AF flag status of *I2C0 peripheral*

```
{
 /*Variable declaration*/
 Flagstatus Current_Status;

 /*Read the I2C_FLAG_AF flag status*/
 Current_Status = I2C_FlagStatus(I2C0, I2C_FLAG_AF);
}
```

4.10.3.11 I2C_FlagClear

Function Name	I2C_FlagClear
Function Prototype	`void I2C_FlagClear (I2C_TypeDef *I2Cx, u16 I2C_Flag,...)`
Description	Clears any *I2C flag* or bit using its corresponding software sequence. If any value needs to be written in the I2CDR to clear the chosen flag then this value will be transmitted as the fourth parameter in this function and should be an 'u8' parameter type.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured.x can be 0 or 1.
Input Parameter 2	*I2C_Flag*: specifies the flag to clear. Refer to section 4.10.2.5 on page 185 for more details on allowed values of this parameter.
OutPut Parameter	The software sequence needed to clear the chosen flag will be executed. This same software sequence could clear any other flag.
Return Parameters	None.
Required Preconditions	None.
Called Functions	I2C_Cmd.

Example:

This example illustrates how to clear the I2C_FLAG_STOPF flag of *I2C0 peripheral*

```
{
  /*Clear the I2C_FLAG_STOPF*/
  I2C_FlagStatus(I2C0, I2C_FLAG_STOPF);
}
```

4.10.3.12 I2C_AddressSend

Function Name	I2C_AddressSend
Function Prototype	`void I2C_AddressSend (I2C_TypeDef *I2Cx, u16 I2C_Address, u8 I2C_AddMode, u8 I2C_Direction)`
Description	Sends the slave address with which the next communication will be performed.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured.x can be 0 or 1.
Input Parameter 2	*I2C_Address*: specifies the slave address which will be transmitted. It is defined as follows depending on the addressing mode: *7-bit mode*: the LSB byte should contain the slave address. *10-bit mode*: the first 10 bits are used to indicate the slave address.
Input Parameter 3	*I2C_AddMode*: indicates whether the current addressing is 7-bit or 10-bit mode. This parameter can be: *I2C_MODE_ADDRESS7*: 7-bits addressing mode *I2C_MODE_ADDRESS10*: 10-bits addressing mode
Input Parameter 4	*I2C_Direction*: indicates whether the chosen I2C device will be a transmitter or a receiver. This parameter can be: *I2C_MODE_TRANSMITTER*: I2Cx is a transmitter. *I2C_MODE_RECEIVER*: I2Cx is a receiver.
OutPut Parameter	None.
Return Parameters	None.
Required Preconditions	None.
Called Functions	I2C_EventCheck. I2C_ByteSend. I2C_STARTGenerate().

Example:

This example illustrates how to send 0xA8 address in 7-bit addressing transmitter for I2C0 peripheral

```
{
  /*Send 0xA8 address in 7-bit addressing transmitter */
 I2C_AddressSend (I2C0, 0xA8, I2C_MODE_ADDRESS7, I2C_MODE_TRANSMITTER);
}
```

4.10.3.13 I2C_ByteSend

Function Name	I2C_ByteSend
Function Prototype	`void I2C_ByteSend (I2C_TypeDef *I2Cx, u8 I2C_Data)`
Description	Transmits a single byte.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured.x can be 0 or 1.
Input Parameter 2	*I2C_Data*: indicates the byte which will be transmitted.
OutPut Parameter	*I2C_DR* value will be modified.
Return Parameters	None.
Required Preconditions	None.
Called Functions	None.

Example:

This example illustrates how to send a data by the *I2C0 peripheral*

```
{
 /* Variable declaration*/
  u8 Send_Data;
 /* Send Data by I2C0*/
 I2C_ByteSend (I2C0, Send_Data);
}
```

4.10.3.14 I2C_BufferSend

Function Name	I2C_BufferSend
Function Prototype	`ErrorStatus I2C_BufferSend (I2C_TypeDef *I2Cx, u8 *PtrToBuffer, u8 NbOfBytes)`
Description	Transmits data from a buffer which number of bytes is known. This data transmission will stop if any error occurs. The transmission status will be returned.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured. x can be 0 or 1.
Input Parameter 2	*PtrToBuffer:* is an 'u8' pointer to the first byte of the buffer to be transmitted.
Input Parameter 3	*NbOfBytes:* this parameter indicates the number of bytes saved in the buffer to be sent.
OutPut Parameter	None.
Return Parameters	an *ErrorStatus* enumeration value: *SUCCESS*: transmission done without error *ERROR*: an error was occurred during transmission
Required Preconditions	START generation. Send slave address.
Called Functions	I2C_GetLastEvent

Example:

This example illustrates how to send a data buffer by the *I2C0 peripheral*

```
{
  /* Variables declaration*/
 u8 Buffer_Tx[5]={0x55,0xAA,0x00,0xFF,0xAA};
 Errorstatus Current_Status;

  /*Send Data buffer by I2C0*/
  Current_Status = I2C_BufferSend (I2C0, Buffer_Tx, 5);
}
```

4.10.3.15 I2C_ByteReceive

Function Name	I2C_ByteReceive
Function Prototype	`u8 I2C_ByteReceive (I2C_TypeDef *I2Cx)`
Description	Returns the most recent received byte.
Input Parameter	*I2Cx*: specifies the I2C to be configured.x can be 0 or 1.
OutPut Parameter	None.
Return Parameters	*I2C_DR* value.
Required Preconditions	None.
Called Functions	None.

Example:

This example illustrates how to receive a data from the *I2C0 peripheral*

```
{
  /*Variable declaration*/
  u8 Received_Data;

  /*Receive Data from I2C0*/
  Received_Data = I2C_ByteReceive (I2C0);
}
```

4.10.3.16 I2C_BufferReceive

Function Name	I2C_BufferReceive
Function Prototype	`ErrorStatus I2C_BufferReceive (I2C_TypeDef *I2Cx, u8 *PtrToBuffer, u8 NbOfBytes)`
Description	Receives number of data bytes and stores them in user defined area. The data reception will stop, if any error occurs during reception. The reception status will be returned to the user.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured.x can be 0 or 1.
Input Parameter 2	*PtrToBuffer:* is an ‘u8’ pointer to the first byte in the defined area to save the received buffer.
Input Parameter 3	*NbOfBytes:* parameter indicates the number of bytes to be received in the buffer.
OutPut Parameter	None.
Return Parameters	an *ErrorStatus* enumeration value: *SUCCESS*: reception done without error *ERROR*: an error was occurred during reception
Required Preconditions	START generation.
Called Functions	I2C_GetLastEvent

Example:

This example illustrates how to receive a data buffer from *I2C0 peripheral*

```
{
 /* Variables declaration*/
 u8 Buffer_Rx[8];
 Errorstatus Current_Status;

  /*Receive Data buffer from I2C0*/
  Current_Status = I2C_BufferSend (I2C0, Buffer_Rx, 8);
 }
```

4.10.3.17 I2C_GetStatus

Function Name	I2C_GetStatus
Function Prototype	`u16 I2C_GetStatus(I2C_TypeDef *I2Cx)`
Description	Get the value of I2Cx status register.
Input Parameter	*I2Cx*: specifies the I2C to be configured.x can be 0 or 1.
OutPut Parameter	None.
Return Parameters	a 16 bit register value
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to get the *I2C0 peripheral Status in a 16bit register*

```
{
  /*Variables declaration*/
  u16 Current_Status;

   /*Get I2C0 Status (All I2C0 flags in a same register) */
  Current_Status = I2C_GetStatus (I2C0);
}
```

4.10.3.18 I2C_GetLastEvent

Function Name	I2C_GetLastEvent
Function Prototype	`u16 I2C_GetLastEvent(I2C_TypeDef *I2Cx)`
Description	Get the Last I2C Event
Input Parameter 1	*I2Cx*: specifies the I2C to be configured.x can be 0 or 1.
OutPut Parameter	None.
Return Parameters	a 16 bit register flags status
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to get the last event value for *I2C0 peripheral*

```
{
  /*Variables declaration*/
  u16 Last_Event;

  /*Get I2C0 Last event */
  Last_Event = I2C_GetLastEvent (I2C0);
}
```

4.10.3.19 I2C_EventCheck

Function Name	I2C_EventCheck
Function Prototype	`ErrorStatus I2C_EventCheck(I2C_TypeDef *I2Cx, u16 I2C_Event )`
Description	Check if the last occurred event is equal to the one passed as parameter.
Input Parameter 1	*I2Cx*: specifies the I2C to be configured.x can be 0 or 1.
Input Parameter 2	*I2C_Event*: specifies the event which will be compared. Refer section 4.10.2.2 on page 184 for more details on all possible events values.
OutPut Parameter	None
Return Parameters	an *ErrorStatus* enumeration value: *SUCCESS*: reception done without error *ERROR*: an error was occurred during reception
Required Preconditions	None.
Called Functions	I2C_GetLastEvent.

Example:

This example illustrates how to check the last happened event *I2C0 peripheral*

```
{
  /*Variables declaration*/
  u8 Current_Status;

  /* Check if the last happened event is equal to
    I2C_EVENT_MASTER_BYTE_RECEIVED event */
  Current_Status = I2C_EventCheck(I2C0, I2C_EVENT_MASTER_BYTE_RECEIVED);
}
```

4.11 POWER RESET CLOCK CONTROL UNIT (PRCCU)

The PRCCU driver may be used for a variety of purposes, including power management configuration, low power mode selection and clock configuration.

The first section describes the data structures used in the PRCCU software library. The second section presents the PRCCU software library functions.

4.11.1 Data Structures

4.11.1.1 PRCCU Registers Structure

The *PRCCU* registers' structure *PRCCU_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu32 CCR;
 vu32 VRCTR;
 vu32 CFR;
 u32 EMPTY1[3];
 vu32 PLLCR;
 u32 EMPTY2;
 vu32 SMR;
 u32 EMPTY3;
 vu32 RTCPR;
} PRCCU_TypeDef;
```

The following table describes the *PRCCU* structure fields.:

Register	Description
CCR	Clock Control Register
VRCTR	Voltage Regulator Control Register
CFR	Clock Flag Register
PLLCR	PLL Configuration Register
SMR	System Mode Register
RTCPR	Real Time Clock Programming Register

The *PRCCU* peripheral is declared in the same file:

```
...
#define PRCCU_BASE      0x60000000
...
#ifdef DEBUG
...
 EXT PRCCU_TypeDef *PRCCU;
...
#else
...
 #define PRCCU  ((PRCCU_TypeDef  *)PRCCU_BASE)
```

```
...
#endif
```

When debug mode is used, *PRCCU* pointer is initialized in the file *73x_lib.c*:

```
#ifdef _PRCCU
 PRCCU  = (PRCCU_TypeDef *)PRCCU_BASE;
#endif /* _PRCCU */
```

In debug mode, *_PRCCU* must be defined, in the file *73x_conf.h*, to access the peripheral registers as follows:

```
#define _PRCCU
```

4.11.1.2 PRCCU_InitTypeDef Structure

The *PRCCU_InitTypeDef* structure defines the control setting for the PRCCU peripheral.

```
typedef struct
{
 FunctionalState PRCCU_DIV2;
 PRCCU_MCLKSRC  PRCCU_MCLKSRC_SRC;
 u8  PRCCU_PLLDIV;
 u8  PRCCU_PLLMUL;
 FunctionalState PRCCU_FREEN;
}PRCCU_InitTypeDef;
```

Members

- **PRCCU_DIV2**

  Enable or disable DIV2 dividider. Possible parameters are ENABLE or DISABLE..

PRCCU_DIV2	Description
ENABLE	Enable DIV2 divider
DISABLE	Disable DIV2 divider

- **PRCCU_MCLKSRC**

  Specifies whether MCLK is the output of the PLL, CLOCK2 or CLOCK2/16.

  This member can be one of the following values of the PRCCU_MCLKSRC enum:

PRCCU_MCLKSRC	Description
PRCCU_MCLKSRC_CLOCK2	Select CLOCK2 output
PRCCU_MCLKSRC_CLOCK2_16	Select CLOCK2/16 output
PRCCU_MCLKSRC_PLL	Select the PLL output

- **PRCCU_PLLMUL**

Specifies the Multiplication factors of the PLL.

PRCCU_PLLMUL	Description
PRCCU_PLLMUL_28	CLOCK2 * 28
PRCCU_PLLMUL_20	CLOCK2 * 20
PRCCU_PLLMUL_16	CLOCK2 * 16
PRCCU_PLLMUL_12	CLOCK2 * 12

- **PRCCU_PLLDIV**

Specifies the Divider factors of the PLL

PRCCU_PLLDIV	Description
PRCCU_PLLDIV_1	PLL CLOCK /1
PRCCU_PLLDIV_2	PLL CLOCK /2
PRCCU_PLLDIV_3	PLL CLOCK /3
PRCCU_PLLDIV_4	PLL CLOCK /4
PRCCU_PLLDIV_5	PLL CLOCK /5
PRCCU_PLLDIV_6	PLL CLOCK /6
PRCCU_PLLDIV_7	PLL CLOCK /7

- **PRCCU_FREEN**

Enable or disable the Free Running Mode for the PLL

PRCCU_FREEN	Description
ENABLE	Enable free running mode
DISABLE	Disable free running mode

4.11.1.3 PRCCU_OUTPUT

The following table describes the different PRCCU module outputs

PRCCU_OUTPUT	Description
PRCCU_CLOCK_EXT	EXT frequency to TIM, RTC, WDG and Timers TB
PRCCU_CLOCK_MCLK	MCLK frequency to CPU and peripherals

4.11.1.4 PRCCU Voltage Regulators

The following table describes the *PRCCU* voltage regulators

Voltage Regulators	Description
PRCCU_VR_LPWFI	Main Voltage Regulator in LPWFI Mode
PRCCU_VR_Run	Main Voltage Regulator in Run Mode

4.11.1.5 PRCCU Low Power Modes

The following table describes the different Low Power Modes:

Low Power Modes	Description
PRCCU_LPM_HALT	HALT Low power mode
PRCCU_LPM_WFI	WFI Low power mode
PRCCU_LPM_LPWFI	LPWFI Low power mode

4.11.1.6 PRCCU Flags

The PRCCU Flags defined in 73x_prccu.*h*, are listed below:

PRCCU Flags	Description
PRCCU_FLAG_STOP_I	STOP Interrupt pending bit
PRCCU_FLAG_CK2_16_I	CK2_16 switching Interrupt pending bit
PRCCU_FLAG_LOCK_I	LOCK Interrupt pending bit
PRCCU_FLAG_LVD_INT	Internal LVD reset flag
PRCCU_FLAG_WDGRES	Watchdog reset flag.
PRCCU_FLAG_SOFTRES	Software Reset Flag
PRCCU_FLAG_LOCK	PLL locked-in
PRCCU_FLAG_VROK	Voltage Regulator OK

4.11.1.7 PRCCU Interrupt

The PRCCU interrupts defined in 73x_prccu.*h*, are listed below:

PRCCU Interrupts	Description
PRCCU_IT_CK2_16	CLK2/16 divider interrupt mask.
PRCCU_IT_Lock	PLL Lock interrupt mask.
PRCCU_IT_Stop	Stop interrupt mask.

4.11.1.8 PRCCU LP Voltage Regulator Current Capability

The PRCCU Low Power VR Current values defined in 73x_prccu.*h*, are listed below:

PRCCU LPVR Current values	Description
PRCCU_LPVR_Current_2	LPVR Current equal to 2mA.
PRCCU_LPVR_Current_4	LPVR Current equal to 4mA.
PRCCU_LPVR_Current_6	LPVR Current equal to 6mA.

4.11.2 Software Library Functions

The following table enumerates the different functions of the *PRCCU* library.

Function Name	Description
PRCCU_Init	Initialize the PRCCU peripheral according to the specified parameters in the PRCCU_InitTypeDef structure.
PRCCU_DeInit	Deinitializes the PRCCU peripheral registers to their default reset values.
PRCCU_StructInit	Fill in a PRCCU_InitTypeDef structure with the reset value of each parameter.
PRCCU_FlagStatus	Check whether the specified PRCCU flag is set or not.
PRCCU_FlagClear	Clear the specified PRCCU flag.
PRCCU_ITConfig	Enable or disable the specified PRCCU interrupts.
PRCCU_EnterLPM	Enter the selected Low Power Mode.
PRCCU_GetFrequencyValue	Retrieve the value of the clock passed as parameter.
PRCCU_SetExtClkDiv	Set EXTCLK Divider factor.
PRCCU_LPVRCurrentConfig	select the Low-Power Voltage Regulator Current Capability.
PRCCU_SwResetGenerate	Generate a software reset.
PRCCU_VRCmd	Enable or Disable the main Voltage regulator in case of LP-WFI low power mode and in the case of run mode.

4.11.2.1 PRCCU_Init

Function Name	PRCCU_Init
Function Prototype	`void PRCCU_Init( PRCCU_InitTypeDef* PRCCU_InitStruct)`
Behavior Description	Configure PRCCU peripheral according to the specified parameters in the *PRCCU_InitTypeDef* structure.
Input Parameter	*PRCCU_InitStruct*: a *PRCCU_InitTypeDef* structure that contains the configuration information for the PRCCU.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialize the PRCCU peripheral with the configured item of the initialization structure:

```
{
...
/* initialize the PRCCU_InitStructure with the needed value */
PRCCU_InitStructure.PRCCU_DIV2 = ENABLE;
PRCCU_InitStructure.PRCCU_MCLKSRC_SRC = PRCCU_MCLKSRC_PLL;
PRCCU_InitStructure.PRCCU_PLLDIV = 2;
PRCCU_InitStructure.PRCCU_PLLMUL = PRCCU_PLLMUL_16;
PRCCU_InitStructure.PRCCU_FREEN = DISABLE;
/* Configure the PRCCU with the configured field of the PRCCU_InitStructure */
PRCCU_Init (&PRCCU_InitStructure);
...
}
```

4.11.2.2 PRCCU_DeInit

Function Name	PRCCU_DeInit
Function Prototype	`void PRCCU_DeInit(void)`
Behavior Description	Reset all PRCCU peripheral registers to their reset values.
Input Parameter	None
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example shows how to deinitialize the PRCCU peripheral registers with their reset values:

```
{
...
PRCCU_DeInit();
...
}
```

4.11.2.3 PRCCU_StructInit

Function Name	PRCCU_StructInit
Function Prototype	`void PRCCU_StructInit(PRCCU_InitTypeDef * PRCCU_InitStruct)`
Behavior Description	Fills in the structure with the reset value of each parameter (which depend on the register reset value).
Input Parameter	*PRCCU_InitStruct*: a *PRCCU_InitTypeDef* structure which will be initialized.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialise the *PRCCU_InitTypeDef* structure:

```
{
PRCCU_InitTypeDef PRCCU_InitStructure;
...
PRCCU_StructInit(&PRCCU_InitStructure);
...
}
```

4.11.2.4 PRCCU_FlagStatus

Function Name	PRCCU_FlagStatus
Function Prototype	`FlagStatus PRCCU_FlagStatus (u16 PRCCU_Flag)`
Behavior Description	Check whether the specified PRCCU flag is set or not.
Input Parameter	*PRCCU_Flag*: flag to check. Refer to section 4.11.1.6 on page 206 for more details on the allowed values of this parameter.
Output Parameter	None
Return Value	The status of the specified flag. It can be either SET or RESET:
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to check if the last reset was done by the watchdog:

```
{
...
  if (PRCCU_FlagStatus(PRCCU_FLAG_WDGRES))
  {
   ...
  }
...
}
```

4.11.2.5 PRCCU_FlagClear

Function Name	PRCCU_FlagClear
Function Prototype	Clear the specified PRCCU flag
Behavior Description	void PRCCU_FlagClear (u16 PRCCU_Flag);
Input Parameter	*PRCCU_Flag*: flag to clear. For more details on the allowed values, refer to section 4.11.1.6 on page 206
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to Clear the STOP_I flag in the PRCCU_CFR register :

```
{
...
PRCCU_FlagClear (PRCCU_FLAG_STOP_I);
...
}
```

4.11.2.6 PRCCU_ITConfig

Function Name	RCCU_ITConfig
Function Prototype	`void PRCCU_ITConfig(u16 PRCCU_IT, FunctionalState NewState)`
Behavior Description	Enables or disables the specified PRCCU interrupts.
Input Parameter	PRCCU_IT: specifies the PRCCU interrupts sources to be enabled or disabled. Refer to section 4.11.1.7 on page 206 for more details on the allowed values of this parameter.
Output Parameter	*NewState*: new state of the specified PRCCU interrupts. This parameter can be: ENABLE or DISABLE.
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the interrupt when CLK2/16 divider is selected :

```
{
...
PRCCU_ITConfig (PRCCU_IT_CK2_16, ENABLE);
...
}
```

4.11.2.7 PRCCU_EnterLPM

Function Name	PRCCU_EnterLPM
Function Prototype	`void PRCCU_EnterLPM( PRCCU_LPM NewLPM)`
Behavior Description	Enter the selected Low power mode
Input Parameter	*NewLPM*: low power mode to enter. Refer to section 4.11.1.5 on page 206 for more details on the allowed values of this parameter.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enter Low power WFI mode

```
{
...
PRCCU_EnterLPM(PRCCU_LPWFI);
...
}
```

4.11.2.8 PRCCU_GetFrequencyValue

Function Name	PRCCU_GetFrequencyValue
Function Prototype	`u32 PRCCU_GetFrequencyValue (PRCCU_OUTPUT PRCCU_CLOCK_Out)`
Behavior Description	Retrieves the value of the clock passed as parameter.
Input Parameter	*PRCCU_CLOCK_Out*: the Clock to get its value. Refer to section 4.11.1.3 on page 205 for more details on the allowed values of this parameter.
Output Parameter	None
Return Value	The value of the clock passed as parameter in Hz
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to Get the Main Clock value:

```
{
  u32 MainCLK;
  MainCLK= PRCCU_GetFrequencyValue(PRCCU_CLOCK_MCLK);
}
```

4.11.2.9 PRCCU_SetExtClkDiv

Function Name	PRCCU_SetExtClkDiv
Function Prototype	`void PRCCU_SetExtClkDiv(u16 ExtClkDiv)`
Behavior Description	Set EXTCLK Divider factor
Input Parameter	*ExtClkDiv*: the value of the of the divider factor to set the Real time clock prescaling factors. the allowed value are: 2,4,8,16,32,64,128,256,512,1024.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to set the EXTCLK clock divider to 1024

```
{
...
PRCCU_SetExtClkDiv(1024);
...
}
```

4.11.2.10 PRCCU_LPVRCurrentConfig

Function Name	PRCCU_LPVRCurrentConfig
Function Prototype	`void PRCCU_LPVRCurrentConfig (u8 Current_Capability)`
Behavior Description	Select the Low-Power Voltage Regulator Current Capability
Input Parameter	*Current_Capability*: the LPVR Output Current to configure. Refer to section 4.11.1.8 on page 207 for more details on the allowed values of this parameter.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to set to 4mA the current of the voltage regulator in low power mode:

```
{
...
PRCCU_LPVRCurrentConfig (PRCCU_LPVR_Current_4);
}
```

4.11.2.11 PRCCU_SwResetGenerate

Function Name	PRCCU_SwResetGenerate
Function Prototype	`void PRCCU_SwResetGenerate (void)`
Behavior Description	Generate the software reset.
Input Parameter	None
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to generate a software reset

```
{
...
PRCCU_SwResetGenerate();
...
}
```

4.11.2.12 PRCCU_VRCmd

Function Name	PRCCU_VRCmd
Function Prototype	`void PRCCU_VRCmd (u8 V_Regulator, FunctionalState NewState)`
Behavior Description	Enable or Disable the main Voltage regulator in case of LPWFI low power mode and in the case of run mode.
Input Parameter	- *V_Regulator*: the voltage regulator to enable or to disable in the selected mode. - *NewState*: new state of the specified PRCCU interrupts. This parameter can be: ENABLE or DISABLE.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to bypass the main voltage regulator in LPWFI mode:

```
{
PRCCU_VRCmd (PRCCU_VR_LPWFI, DISABLE);
}
```

4.12 PULSE WIDTH MODULATOR (PWM)

The PWM module can generate PWM signals with programmable period and duty cycle.

The first section describes the data structures used in the *PWM* software library. The second section presents the *PWM* software library functions.

4.12.1 Data Structures

4.12.1.1 PWM Register Structure

The *PWM* register structure *PWM_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu16 PRS0;
 u16 EMPTY1;
 vu16 PRS1;
 u16 EMPTY2;
 vu16 PEN;
 u16 EMPTY3;
 vu16 PLS;
 u16 EMPTY4;
 vu16 CPI;
 u16 EMPTY5;
 vu16 IM;
 u16 EMPTY6[3];
 vu16 DUT;
 u16 EMPTY7;
 vu16 PER;
 u16 EMPTY8;
} PWM_TypeDef;
```

The following table describes the *PWM* structure fields.:

Register	Description
PRS0	Prescaler 0 Register
PRS1	Prescaler 1 Register
PEN	PWM Enable Register
PLS	Output Polarity Level Selection Register
CPI	Compare Period Interrupt Status Register
IM	Interrupt Mask Register
DUT	Output Duty Register
PER	Output Period Register

The *PWM* peripherals are declared in the same file:

```
...
#define PWM0_BASE    (APB_BASE + 0x5000)
#define PWM1_BASE    (APB_BASE + 0x5040)
#define PWM2_BASE    (APB_BASE + 0x5080)
#define PWM3_BASE    (APB_BASE + 0x50C0)
#define PWM4_BASE    (APB_BASE + 0x5100)
#define PWM5_BASE    (APB_BASE + 0x5140)
...
#ifdef DEBUG
...
 EXT PWM_TypeDef *PWM0;
 EXT PWM_TypeDef *PWM1;
 EXT PWM_TypeDef *PWM2;
 EXT PWM_TypeDef *PWM3;
 EXT PWM_TypeDef *PWM4;
 EXT PWM_TypeDef *PWM5;
...
#else
...
 #define PWM0 ((PWM_TypeDef  *)PWM0_BASE)
 #define PWM1 ((PWM_TypeDef  *)PWM1_BASE)
 #define PWM2 ((PWM_TypeDef  *)PWM2_BASE)
 #define PWM3 ((PWM_TypeDef  *)PWM3_BASE)
 #define PWM4 ((PWM_TypeDef  *)PWM4_BASE)
 #define PWM5 ((PWM_TypeDef  *)PWM5_BASE)
...
#endif
```

When debug mode is used, *PWM* pointers are initialized in the file *73x_lib.c*:

```
 #ifdef _PWM0
  PWM0 = (PWM_TypeDef *)PWM0_BASE;
 #endif /* _PWM0 */
 #ifdef _PWM1
  PWM1 = (PWM_TypeDef *)PWM1_BASE;
 #endif /* _PWM1 */
 #ifdef _PWM2
  PWM2 = (PWM_TypeDef *)PWM2_BASE;
 #endif /* _PWM2 */
 #ifdef _PWM3
  PWM3 = (PWM_TypeDef *)PWM3_BASE;
 #endif /* _PWM3 */
#ifdef _PWM4
```

```
  PWM4 = (PWM_TypeDef *)PWM4_BASE;
 #endif /* _PWM4 */
#ifdef _PWM5
  PWM5 = (PWM_TypeDef *)PWM5_BASE;
 #endif /* _PWM5 */
```

In debug mode, *_PWMx* must be defined, in the file *73x_conf.h*, to access the peripheral registers as follows:

```
#define _PWMx (x=0..5)
```

4.12.1.2 PWM Values

The following table enumerates the different values of the PWMx:

PWM Value	Description
PWM0	Pulse Width Modulation 0
PWM1	Pulse Width Modulation 1
PWM2	Pulse Width Modulation 2
PWM3	Pulse Width Modulation 3
PWM4	Pulse Width Modulation 4
PWM5	Pulse Width Modulation 5

4.12.1.3 PWM_InitTypeDef Structure

The *PWM_InitTypeDef* structure defines the control setting for the Pulse Width Modulation peripheral.

```
typedef struct
{      u8 PWM_Prescaler0;
        u8 PWM_Prescaler1;
        u16 PWM_DutyCycle;
        u16 PWM_Period;
        u8 PWM_Polarity_Level;
} PWM_InitTypeDef;
```

Members

- **PWM_Prescaler0**

  Specifies the value of the Prescaler 0. The clock CK is divided by $2^{PR0(2:0)}$

  The PWM_Prescale0 value must be between 0 and 7.

- **PWM_Prescaler**

  Specifies the value of the Prescaler1. The clock CK is divided byPR1[4:0]+1.

  The PWM_Prescale1 value must be between 0 and 31.

- **PWM_DutyCycle**

Specifies the PWM out signal duty cycle value. The duty cycle can be either 0%:

PWM_DutyCycle = 0 or 100% only: PWM_DutyCycle > PWM_Period.

The maximum duty cycle is programmed to FFFFh.

- **PWM_Period**

  Specifies the PWM out signal period value. The minimum value of PWM_Period is 0h:

  This corresponds to a period of 1 clock cycle of CKPWM.

- **PWM_Polarity_Level**

  Specifies the mode at which the PWM OUT signals operates.

  This member can be one of the following values.

PWM_Polarity_Level	Meaning
PWM_Polaity_Low	PWM output is not inverted
PWM_Polarity_High	PWM output is inverted

4.12.2 Software Library Functions

The following table enumerates the different functions of the *PWM* library.

Function Name	Description
PWM_Init	Initialize PWM peripheral according to the specified parameters in the PWM_InitTypeDef structure.
PWM_DeInit	Deinitialize PWM peripheral registers to their default reset values.
PWM_StructInit	Fill in a PWM_InitTypeDef structure with the reset value of each parameter (which depend on the register reset value).
PWM_SetDutyCycle	Set the duty cycle of the PWM OUT signal.
PWM_GetDutyCycleValue	Get the duty cycle of the PWM OUT signal.
PWM_SetPeriod	Set the period of the PWM OUT signal.
PWM_GetPeriodValue	Get the period of the PWM OUT signal.
PWM_Cmd	Start/Stop the PWM peripheral.
PWM_FlagStatus	Check whether the specified PWM flag is set or not.
PWM_FlagClear	Clear the PWM pending flags.
PWM_ITConfig	Configure the PWM interrupt.
PWM_PolarityConfig	Configure the polarity level of the PWM_OUT signal.

4.12.2.1 PWM_Init

Function Name	PWM_Init
Function Prototype	`void PWM_Init (PWM_TypeDef *PWMx, PWM_InitTypeDef *PWM_InitStruct);`
Behavior Description	Initializes *PWM* peripheral according to the specified parameters in the *PWM_InitTypeDef* structure.
Input Parameter1	*PWMx* specifies the *PWM* to be used. Refer to the section *PWM* value for more details on the allowed values of this parameter.
Input Parameter2	*PWM_InitTypeDef* specifies the *PWM* configuration parameters. Refer to section 4.12.1.3 on page 217 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example: The following example illustrates how to configure the *PWM0*:

```
{
       PWM_InitTypeDef PWM_InitStructure;

       PWM_InitStructure.PWM_Prescaler0 = 0x03;
       PWM_InitStructure.PWM_Prescaler1 = 0xA0;
       PWM_InitStructure.PWM_DutyCycle = 0x7FFF;
       PWM_InitStructure.PWM_Period = 0xFFFF;
      PWM_InitStructure.PWM_Polarity_Level= PWM_Polarity_Low;

       PWM_Init (PWM0, &PWM_InitStructure);
}
```

4.12.2.2 PWM_DeInit

Function Name	PWM_DeInit
Function Prototype	`void PWM_DeInit (PWM_TypeDef *PWMx);`
Behavior Description	Deinitializes *PWM* peripheral registers to their default reset values.
Input Parameter	*PWMx* specifies the *PWM* to be initialized. Refer to section 4.12.1.2 on page 217 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to deinitialize the *PWM0*.

```
{
 PWM_DeInit (PWM0);
}
```

4.12.2.3 PWM_StructInit

Function Name	PWM_StructInit
Function Prototype	`void PWM_StructInit (PWM_InitTypeDef *PWM_InitStruct);`
Behavior Description	Fills in a *PWM_InitTypeDef* structure with the reset value of each parameter (which depends on the register reset value).
Input Parameter	*PWM_InitTypeDef* specifies the structure to be initialized.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialize the PWMx structure:

```
{
  PWM_StructInit (&PWM_InitStruct);
}
```

4.12.2.4 PWM_SetDutyCycle

Function Name	PWM_SetDutyCycle
Function Prototype	`void PWM_SetDutyCycle ( PWM_TypeDef *PWMx, u16 PWM_Duty);`
Behavior Description	This routine is used to set the *PWM* duty cycle value.
Input Parameter 1	*PWMx* specifies the *PWM* to be used. Refer to section 4.12.1.2 on page 217 for more details on the allowed values of this parameter.
Input Parameter 2	The value of duty cycle to be set.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to set the duty cycle of the *PWM3*.

```
{
  PWM_SetDutyCycle(PWM3, 0xFF05);
}
```

4.12.2.5 PWM_GetDutyCycleValue

Function Name	PWM_GetDutyCycleValue
Function Prototype	`u16 PWM_GetDutyCycleValue ( PWM_TypeDef *PWMx);`
Behavior Description	This routine is used to get the *PWM* duty cycle value.
Input Parameter 1	*PWMx* specifies the *PWM* to be used. Refer to section 4.12.1.2 on page 217 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	The duty cycle of the *PWM* OUT signal
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the duty cycle value of *PWM*3:

```
{
  u16 MyPWMDuty;
  MyPWMDuty = PWM_GetDutyCycleValue(PWM3);
}
```

4.12.2.6 PWM_SetPeriod

Function Name	PWM_SetPeriod
Function Prototype	`void PWM_SetPeriod ( PWM_TypeDef *PWMx, u16 PWM_Period);`
Behavior Description	This routine is used to set the PWM period value.
Input Parameter 1	*PWMx* specifies the *PWM* to be used. Refer to section 4.12.1.2 on page 217 for more details on the allowed values of this parameter.
Input Parameter 2	Period specifies the *PWM* Period to be set.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to set the *PWM3* period value.

```
{
 PWM_SetPeriod(PWM3, 0xFFF5);...
}
```

4.12.2.7 PWM_GetPeriodValue

Function Name	PWM_GetPeriodValue
Function Prototype	`u16 PWM_GetPeriodValue ( PWM_TypeDef *PWMx);`
Behavior Description	This routine is used to get the *PWM* period value.
Input Parameter	*PWMx* specifies the *PWM* to be used. Refer to section 4.12.1.2 on page 217 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	The period of the *PWM* OUT signal
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the PWM3 period value

```
{
  u16 MyPWMPeriod;
  MyPWMPeriod = PWM_GetPeriodValue(PWM3);
...
}
```

4.12.2.8 PWM_Cmd

Function Name	PWM_Cmd
Function Prototype	`void PWM_Cmd (PWM_TypeDef *PWMx, FunctionalState Newstate)`
Behavior Description	This routine is used to control the *PWM* counter.
Input Parameter 1	*PWMx* specifies the *PWM* to be used.
Input Parameter 2	*Newstate:* specifies the operation of the counter. *ENABLE:* Starts the *PWM* peripheral. *DISABLE:* Stops *PWM* peripheral.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the *PWM2*:

```
{
  PWM_Cmd ( PWM2, ENABLE );...
}
```

4.12.2.9 PWM_FlagStatus

Function Name	PWM_FlagStatus
Function Prototype	`FlagStatus PWM_FlagStatus (PWM_TypeDef *PWMx);`
Behavior Description	Check whether the specified *PWM* flag is set or not.
Input Parameter	*PWMx* specifies the *PWM* to be used.
Output Parameter	None
Return Parameter	The flag state (SET or RESET)
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to check the *PWM* flag

```
{
FlagStatus PWMFlagStatus;
PWMFlagStatus = PWM_FlagStatus (PWM0);
...
}
```

4.12.2.10 PWM_FlagClear

Function Name	PWM_FlagClear
Function Prototype	`void PWM_FlagClear (PWM_TypeDef *PWMx);`
Behavior Description	Clear the specified *PWM* flag.
Input Parameter	*PWMx* specifies the *PWM* to be used. Refer to section 4.12.1.2 on page 217 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to clear the compare period interrupt flag:

```
{
PWM_FlagClear ( PWM0 ) ;
}
```

4.12.2.11 PWM_ITConfig

Function Name	PWM_ITConfig
Function Prototype	`void PWM_ITConfig (PWM_TypeDef *PWMx,FunctionalState Newstate)`
Behavior Description	This routine is used to configure the *PWM* interrupts.
Input Parameter 1	*PWMx* specifies the *PWM* to be used.
Input Parameter 2	*Newstate:* specifies the *PWM* interrupt state whether it would be enabled or disabled. *ENABLE:* the corresponding *PWM* interrupt will be enabled. *DISABLE:* the corresponding *PWM* interrupt will be disabled.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the CPI of the *PWM1*:

```
{
  PWM_ITConfig (PWM1, ENABLE);
}
```

4.12.2.12 PWM_PolarityConfig

Function Name	PWM_PolarityConfig
Function Prototype	`void PWM_PolarityConfig (PWM_TypeDef *PWMx,u16 PWM_Polarity_Mode)`
Behavior Description	This routine is used to configure the *PWM* polarity.
Input Parameter 1	*PWMx* specifies the *PWM* to be used.
Input Parameter 2	*PWM_Polarity_Mode*: specifies the *PWM* polarity state whether it would be: *PWM_Polarity_Low: PWM* signal is not inverted. *PWM_Polarity_High: PWM* signal is inverted.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to invert the *PWM1* polarity:

```
{
PWM_PolarityConfig (PWM1, PWM_Polarity_High);
}
```

4.13 REAL TIME CLOCK (RTC)

The *RTC* driver may be used for a variety of purposes, including real time clock management and precise timing operations.

The first section describes the data structures used in the *RTC* software library. The second section presents the *RTC* software library functions.

4.13.1 Data Structures

4.13.1.1 RTC Register Structure

The *RTC* register structure *RTC_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu16 CRH;
 u16 EMPTY1;
 vu16 CRL;
 u16 EMPTY2;
 vu16 PRLH;
 u16 EMPTY3;
 vu16 PRLL;
 u16 EMPTY4;
 vu16 DIVH;
 u16 EMPTY5;
 vu16 DIVL;
 u16 EMPTY6;
 vu16 CNTH;
 u16 EMPTY7;
 vu16 CNTL;
 u16 EMPTY8;
 vu16 ALRH;
 u16 EMPTY9;
 vu16 ALRL;
 u16 EMPTY10;
} RTC_TypeDef;
```

The following table describes the *RTC* structure fields.

Register	Description
CRH	Control High register
EMPTY1	Empty register
CRL	Control Low register
EMPTY2	Empty register
PRLH	Prescaler Load High register
EMPTY3	Empty register

Register	Description
PRLL	Prescaler Load Low register
EMPTY4	Empty register
DIVH	Prescaler Divider High register
EMPTY5	Empty register
DIVL	Prescaler Divider Low register
EMPTY6	Empty register
CNTH	Counter High register
EMPTY7	Empty register
CNTL	Counter Low register
EMPTY8	Empty register
ALRH	Alarm High register
EMPTY8	Empty register
ALRL	Alarm Low register

The *RTC* peripheral is declared in the same file:

```
/* APB bridge Base Addresses definition*/
#define APB        0xFFFF8000
...
#define RTC_BASE      (APB + 0x7400)
...
#ifndef DEBUG
...
 #define RTC   ((RTC_TypeDef *) RTC_BASE)
...
#else
...
 EXT RTC_TypeDef  *RTC;
...
#endif
```

When debug mode is used, *RTC* pointer is initialized in the file *73x_lib.c*:

```
#ifdef _RTC
 RTC   = (RTC_TypeDef *) RTC_BASE;
 #endif /* _RTC */
```

In debug mode, *_RTC* must be defined, in the file *73x_conf.h*, to access the peripheral registers as follows:

```
#define _RTC
```

4.13.1.2 RTC_InitTypeDef Structure

The *RTC_InitTypeDef* structure is defined in the file *73x_rtc.h*:

```
typedef struct
{
  u32 RTC_Alarm;
  u32 RTC_Counter;
  u32 RTC_Prescaler;
} RTC_InitTypeDef;
```

Members

- **RTC_Prescaler**

  A 20bits value selected by the user to set the desired RTC counter period

- **RTC_Counter**

  A 32bits value selected by the user to set the RTC counter if needed

- **RTC_Alarm**

  A 32bits value slected by the user to set the RTC alarm register

4.13.2 Common Parameter Values

4.13.2.1 RTC Flags

The RTC flags, declared in the file *73x_rtc.h*, are listed in the following table:

RTC flags	Meaning
RTC_FLAG_GL	RTC Global Interrupt request
RTC_FLAG_OV	RTC Overflow Interrupt request
RTC_FLAG_ALA	RTC Alarm Interrupt request
RTC_FLAG_SEC	RTC Second Interrupt request

4.13.2.2 RTC interrupts

The RTC interrupt sources are listed in the following table:

RTC interrupts	Meaning
RTC_IT_GL	RTC Global Interrupt enable
RTC_IT_OV	RTC Overflow Interrupt enable
RTC_IT_ALA	RTC Alarm Interrupt enable
RTC_IT_SEC	RTC Second Interrupt enable
RTC_IT_ALL	All RTC Interrupt enabled

4.13.3 Software Library Functions

The following table enumerates the different functions of the RTC library.

Function Name	Description
RTC_Init	Configure the RTC according to the input passed parameters.
RTC_DeInit	Reset all the RTC registers to their default values
RTC_StructInit	Reset all the Init struct parameters to their default values
RTC_SetCounter	Set the RTC counter registers
RTC_SetPrescaler	Set the RTC prescaler registers.
RTC_SetAlarm	Set the RTC alarm registers.
RTC_GetCounterValue	Read and returns the current RTC counter value.
RTC_GetPrescalerValue	Read and returns the RTC prescaler value.
RTC_GetAlarmValue	Read and returns the RTC alarm value.
RTC_FlagStatus	Check the status of an RTC flag passed in parameter.
RTC_FlagClear	Clear the RTC flags passed in parameter.
RTC_ITConfig	Enable / disable the selected RTC interrupts sources passed in parameter.
RTC_ITStatus	Check the status of an RTC interrupt passed in parameter.
RTC_EnterCfgMode	This function is used to enter the RTC configuration mode.
RTC_ExitCfgMode	This routine is used to exit from the RTC configuration mode.
RTC_WaitForLastTask	This routine is used to verify if the last write operation has finished.

4.13.3.1 RTC_Init

Function Name	RTC_Init
Function Prototype	`void RTC_Init(RTC_InitTypeDef *RTC_InitStruct)`
Behavior Description	Configure the RTC according to the chosen mode by writing the corresponding value to the RTC registers.
Input Parameter	*RTC_InitStruct*: Address of an RTC_InitTypeDef structure containing the configuration information for the RTC peripheral. for more details, refer to section 4.13.1.2 on page 228.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to configure *RTC* Prescaler, Counter and Alarm.

```
{
  /*Init Structure declarations for RTC*/
  RTC_InitTypeDef RTC_InitStructure;

  /*Configure RTC registers*/
  RTC_InitStructure.RTC_Alarm = 0x6;
  RTC_InitStructure.RTC_Counter = 0x0;
  RTC_InitStructure.RTC_Prescaler = 0x3D09;
  RTC_Init (&RTC_InitStructure);
}
```

The same example could be coded as the following:

```
{
  /*Init Structure declaration for RTC and configuration*/
  RTC_InitTypeDef RTC_InitStructure = {0x6,0x0,0x3D09}
  RTC_Init (&RTC_InitStructure);
}
```

4.13.3.2 RTC_DeInit

Function Name	RTC_DeInit
Function Prototype	`void RTC_DeInit (void)`
Behavior Description	Reset all the RTC registers to their default values
Input Parameter	None
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to initialize *RTC* registers.

```
{
  /*Deinitialize RTC registers*/
  RTC_DeInit ();
}
```

4.13.3.3 RTC_StructInit

Function Name	RTC_StructInit
Function Prototype	`void RTC_StructInit(RTC_InitTypeDef *RTC_InitStruct)`
Behavior Description	Reset all the Init struct parameters to their default values
Input Parameter	*RTC_InitStruct*: Address of an RTC_InitTypeDef structure. RTC_InitTypeDef parameters are detailed in section 4.13.1.2 on page 228.
OutPut Parameter	None
Return Parameter	None
Required Preconditions	None
Called Functions	None

Example:

This example illustrates how to initialize *RTC* init structure.

```
{
 /*Init Structures declarations for RTC */
  RTC_InitTypeDef RTC_InitStructure;

 /*Initialize RTC structure*/
RTC_StructInit (&RTC_InitStructure);
}
```

4.13.3.4 RTC_SetCounter

Function Name	RTC_SetCounter
Function Prototype	`void RTC_SetCounter (u32 RTC_Counter)`
Behavior Description	This routine is used to set the RTC Counter register
Input Parameter	*RTC_Counter*: This parameter specifies the RTC Counter value to set in the RTC_CNT registers.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to set the *RTC* Counter register:

```
{
// Counter_Value declaration
u32 Counter_Value;

// Counter_Value affectation
Counter_Value = 0xFFFF5555;

// Set RTC Counter to Counter_Value
RTC_SetCounter(Counter_Value);
}
```

4.13.3.5 RTC_SetPrescaler

Function Name	RTC_SetPrescaler
Function Prototype	`void RTC_SetPrescaler (u32 RTC_prescaler)`
Behavior Description	This routine is used to set the RTC Prescaler register
Input Parameter	*RTC_prescaler*: this parameter specifies the RTC Prescaler value to set in the RTC_PRL registers.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Note: Only the bits [19:0] of the u32 value are useful (the RTC divider is a 20 bits value).

Example:

This example illustrates how to set the *RTC* Prescaler register

```
{
  /* Prescaler_Value declaration */
  u32 Prescaler_Value;

  /* Prescaler_Value affectation */
  Prescaler_Value = 0x55555;

  /*Set RTC Prescaler to Prescaler_Value*/
  RTC_SetPrescaler(Prescaler_Value);
}
```

4.13.3.6 RTC_SetAlarm

Function Name	RTC_SetAlarm
Function Prototype	`void RTC_SetAlarm (u32 RTC_Alarm)`
Behavior Description	This routine is used to set the RTC Alarm register
Input Parameter	*RTC_Alarm*: This parameter specifies the RTC Alarm value to be set in the RTC_ALR registers.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to set the *RTC* Alarm register

```
{
// Alarm_Value declaration
u32 Alarm_Value;

// Alarm_Value affectation
Alarm_Value = 0xFFFFFFF1;

// Set RTC Alarm to Alarm_Value
RTC_SetAlarm(Alarm_Value);
}
```

4.13.3.7 RTC_GetCounterValue

Function Name	RTC_GetCounterValue
Function Prototype	`u32 RTC_GetCounterValue (void)`
Behavior Description	This routine is used to get the current RTC Counter value
Input Parameter	None
Output Parameter	None
Return Parameter	The returned value holds the current RTC Counter value.
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to read the *RTC* Counter register

```
{
  /*Current_CounterVal declaration */
  u32 Current_CounterVal;

  /*Read of Counter Value*/
  Current_CounterVal = RTC_GetCounterValue();
}
```

4.13.3.8 RTC_GetPrescalerValue

Function Name	RTC_GetPrescalerValue
Function Prototype	`u32 RTC_GetPrescalerValue (void)`
Behavior Description	This routine is used to get the current RTC Prescaler value
Input Parameter	None
Output Parameter	None
Return Parameter	The returned value holds the current RTC Prescaler value.
Required preconditions	None
Called Functions	None

Note: Only the bits [19:0] of the u32 value returned by this function are useful (the Real Time clock divider value is 20 bits value).

Example:

This example illustrates how to read the *RTC* Prescaler register

```
{
  // Current_PrescalerVal declaration
  u32 Current_PrescalerVal;

  // Read of Prescaler Value
  Current_PrescalerVal = RTC_GetPrescalerValue();
}
```

4.13.3.9 RTC_GetAlarmValue

Function Name	RTC_GetAlarmValue
Function Prototype	`u32 RTC_GetAlarmValue (void)`
Behavior Description	This routine is used to get the current RTC Alarm value
Input Parameter	None
Output Parameter	None
Return Parameter	The returned value holds the current RTC Alarm value.
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to read the *RTC* Alarm register

```
{
  // Current_AlarmVal declaration
  u32 Current_AlarmVal;
  // Read of Alarm Value
  Current_AlarmVal = RTC_GetAlarmValue();
}
```

4.13.3.10 RTC_FlagStatus

Function Name	RTC_FlagStatus
Function Prototype	`FlagStatus RTC_FlagStatus (u16 RTC_Flag)`
Behavior Description	This routine is used to check the RTC flags.
Input Parameter	*RTC_Flag*: designates the RTC flag to check. Refer to section 4.13.2.2 on page 228 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	One of the *FlagStatus* enum type, the available values are: *SET*: if the flag to check is set (equal to 1). *RESET*: if the flag to check is reset.
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to read the Global Interrupt flag status

```
{
FlagStatus GIR_Flag; /*GIR_Flag declaration*/
GIR_Flag = RTC_FlagStatus(RTC_FLAG_GL); /*Read GL flag status*/
}
```

4.13.3.11 RTC_FlagClear

Function Name	RTC_FlagClear
Function Prototype	`void RTC_FlagClear (u16 RTC_Flag)`
Behavior Description	This routine is used to clear any RTC flag passed in parameter.
Input Parameter	*RTC_Flag*: designates the RTC flag to check. Refer to section 4.13.2.1 on page 228 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to clear the GlobaL Interrupt flag

```
{
  // Clear the GIR flag
  RTC_FlagClear(RTC_FLAG_GL);
}
```

4.13.3.12 RTC_ITConfig

Function Name	RTC_ITConfig
Function Prototype	`void RTC_ITConfig (u16 RTC_It, FunctionalState NewState)`
Behavior Description	This routine is used to configure Enable / Disable the RTC Interrupts request.
Input Parameter 1	*RTC_It*: Designates the RTC interrupt to enable/ disable (use | operator to specify more interrupts to enable). Refer to section 4.13.2.2 on page 228 for more details on the allowed values of this parameter.
Input Parameter 2	NewState: designates the new RTC interrupt state which can be one of the following value: *ENABLE*: The corresponding RTC interrupt is enabled. *DISABLE*: The corresponding RTC interrupt is disabled.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Note: if more than one interrupt are enabled, using the | operator, their corresponding bits in the RTC_CRH register will be set.

Example:

This example illustrates how to Enable Alarm and Overflow interrupts and disable Second interrupt

```
{
  /* Enable Alarm and Overflow interrupts */
  RTC_ITConfig(RTC_IT_ALA | RTC_IT_OV);

  /* Disable Second interrupt*/
  RTC_ITConfig(RTC_IT_SEC);
}
```

4.13.3.13 RTC_ITStatus

Function Name	RTC_ITStatus
Function Prototype	`FunctionalState RTC_ITStatus (u16 RTC_It)`
Behavior Description	This routine is used to check the RTC interrupts status.
Input Parameter 1	*RTC_It*: Designates the RTC interrupt to be checked. Refer to section 4.13.2.2 on page 228 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	Returns the RTC interrupt state which can be one of the following value: *ENABLE*: The corresponding RTC interrupt is enabled. *DISABLE*: The corresponding RTC interrupt is disabled.
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to check if the Alarm interrupt is enabled or not

```
{
// RTC_AlarmIT declaration
FunctionalState RTC_AlarmIT;

// Read the Alarm interrupt Setting
RTC_AlarmIT = RTC_ITStatus(RTC_IT_ALA);
}
```

4.13.3.14 RTC_EnterCfgMode

Function Name	RTC_EnterCfgMode
Function Prototype	`void RTC_EnterCfgMode(void)`
Behavior Description	This routine is used to enter RTC configuration mode.
Input Parameter 1	None
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to enter configuration mode:

```
{
  /*enter configuration mode*/
   RTC_EnterCfgMode();
}
```

4.13.3.15 RTC_ExitCfgMode

Function Name	RTC_ExitCfgMode
Function Prototype	`void RTC_ExitCfgMode(void)`
Behavior Description	This routine is used to exit from the RTC configuration mode.
Input Parameter 1	None
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to exit the configuration mode

```
{
  /*Exit the configuration mode */
  RTC_ExitCfgMode();
}
```

4.13.3.16 RTC_WaitForLastTask

Function Name	RTC_WaitForLastTask
Function Prototype	`void RTC_WaitForLastTask(void)`
Behavior Description	This routine is used to verify if the last write operation is finished.
Input Parameter	None
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to wait for the last task to be finished

```
{
 /* Wait for the last task to be finished */
  RTC_WaitForLastTask();
}
```

4.14 TIME BASE TIMER (TB)

The TB module may be used as a free-running timer to generate time base. The first section describes the data structures used in the *TB* software library. The second section presents the *TB* software library functions.

4.14.1 Data Structures

4.14.2 TB Register Structure

The *TB* register structure *TB_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu16 CR;
 u16 EMPTY1;
 vu16 PR;
 u16 EMPTY2;
 vu16 VR;
 u16 EMPTY3;
 vuc16 CNT;
 u16 EMPTY4;
 vu16 SR;
 u16 EMPTY5;
 vu16 MR;
 u16 EMPTY6;
} TB_TypeDef;
```

The following table describes the *TB* structure fields.:

Register	Description
CR	Control Register
PR	Prescaler Register
VR	Preload value Register
CNT	Counter Register
SR	Status Register
MR	Interrupt Mask Register

The *TB* peripherals are declared in the same file:

```
...
#define TB0_BASE    (APB_BASE + 0x1800)
#define TB1_BASE    (APB_BASE + 0x1900)
#define TB2_BASE    (APB_BASE + 0x1A00)
...
 #ifdef DEBUG
...
```

```
EXT TB_TypeDef *TB0;
EXT TB_TypeDef *TB1;
EXT TB_TypeDef *TB2;
...
#else
...
#define TB0 ((TB_TypeDef  *)TB0_BASE)
#define TB1 ((TB_TypeDef  *)TB1_BASE)
#define TB2 ((TB_TypeDef  *)TB2_BASE)
...
#endif
```

When debug mode is used, *TB* pointers are initialized in the file *73x_lib.c*:

```
#ifdef _TB0
 TB0 = (TB_TypeDef *)TB0_BASE;
#endif /* _TB0 */
#ifdef _TB1
 TB1 = (TB_TypeDef *)TB1_BASE;
#endif /* _TB1 */
#ifdef _TB2
 TB2 = (TB_TypeDef *)TB2_BASE;
#endif /* _TB2 */
```

In debug mode, *_TBx* must be defined, in the file *73x_conf.h*, to access the peripheral registers as follows:

```
#define _TBx    /* where (x=0..2) */
```

4.14.2.1 TB Values

The following table enumerates the different values of the TBx:

TB Value	Description
TB0	Timer Base 0
TB1	Timer Base 1
TB2	Timer Base 2

4.14.2.2 TB_InitTypeDef Structure

The TB_InitTypeDef structure defines the control setting for the Timer Base peripheral.

```
typedef struct
{      u16 TB_CLK_Source;
       u16 TB_Prescaler;
       u16 TB_Preload;
}TB_InitTypeDef;
```

Members

- **TB_Clock_Source**

  Specifies the clock source of the TB peripheral.

  This member can be one of the following values.

TB_Clock_Source	Meaning
TB_CLK_EXTERNAL	External clock source is used (CLK_EXT)
TB_CLK_INTERNAL	Main clock source is used (MCLK)

- **TB_Prescaler**

  Specifies the Prescaler value to divide the clock source.

  This member must be a number between 0 and 255.

- **TB_Preload**

  This value is loaded in the TB Counter when it starts counting.

  This member must be a number between 0 and 0xFFFF

4.14.3 Software Library Functions

The following table enumerates the different functions of the *TB* library

Function Name	Description
TB_Init	Initialize *TB* peripheral according to the specified parameters in the *TB_InitTypeDef* structure.
TB_DeInit	Deinitialize *TB* peripheral registers to their default reset values.
TB_StructInit	Fill in a *TB_InitTypeDef* structure with the reset value of each parameter (which depend on the register reset value).
TB_Cmd	Start or stop the free auto-reload timer to count down.
TB_ITConfig	Configure the TB interrupt.
TB_FlagClear	Clear the specified TB flag.
TB_FlagStatus	Return the end count status.
TB_GetCounter	Read and return the current TB counter value.

4.14.3.1 TB_Init

Function Name	TB_Init
Function Prototype	`void TB_Init (TB_TypeDef *TBx, TB_InitTypeDef *TB_InitStruct);`
Behavior Description	Initializes *TB* peripheral according to the specified parameters in the *TB_InitTypeDef* structure.
Input Parameter1	*TBx* specifies the *TB* to be used. Refer to section 4.14.2.1 on page 241 for more details on the allowed values of this parameter.
Input Parameter2	*TB_InitTypeDef* specifies the *TB* configuration parameters. Refer to section 4.14.2.2 on page 241 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to configure the *TB0*:

```
{
  TB_InitTypeDef Init_Structure;

  Init_Structure.TB_CLK_Source = TB_CLK_External;
  Init_Structure.TB_Prescaler = 0x0079;
  Init_Structure.TB_Preload = 0xFF00;

  TB_Init (TB0,&Init_Structure);
}
```

or:

```
{
  TB_InitTypeDef Init_Structure ={TB_CLK_External,0x0079,0xFF00};

  TB_Init (TB0,&Init_Structure);
}
```

4.14.3.2 TB_DeInit

Function Name	TB_DeInit
Function Prototype	`void TB_DeInit (TB_TypeDef *TBx);`
Behavior Description	Deinitialize *TB* peripheral registers to their default reset values.
Input Parameter	*TBx* specifies the *TB* to be initialized.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to deinitialize the *TB0*.

```
{
...
 TB_DeInit (TB0);
...
}
```

4.14.3.3 TB_StructInit

Function Name	TB_StructInit
Function Prototype	`void TB_StructInit (TB_InitTypeDef *TB_InitStruct);`
Behavior Description	Fills in a *TB_InitTypeDef* structure with the reset value of each parameter (which depends on the register reset value).
Input Parameter	*TB_InitTypeDef* specifies the structure to be initialized.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialize the *TBx* structure:

```
{
  TB_StructInit (&TB_InitStruct);
}
```

4.14.3.4 TB_Cmd

Function Name	TB_Cmd
Function Prototype	`void TB_Cmd(TB_TypeDef *TBx, FunctionalState Newstate)`
Behavior Description	Write the appropriate value in the control register in order to start or stop the timer
Input Parameter1	*TBx* specifies the *TB* to be used. Refer to section 4.14.2.1 on page 241 for more details on the allowed values of this parameter.
Input Parameter 2	Newstate: specifies the operation of the counter. *ENABLE:* Starts the *TB* peripheral. *DISABLE:* Stops *TB* peripheral.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the *TB2*:

```
{
  TB_Cmd (TB2, ENABLE);
}
```

4.14.3.5 TB_ITConfig

Function Name	TB_ITConfig
Function Prototype	`void TB_ITConfig (TB_TypeDef *TBx, FunctionalState Newststate)`
Behavior Description	Configures the TB interrupt.
Input Parameter1	*TBx* specifies the *TB* to be used.
Input Parameter2	Newstate: specifies the *TB* interrupt state whether it would be enabled or disabled. *ENABLE:* the corresponding *TB* interrupt will be enabled. *DISABLE:* the corresponding *TB* interrupt will be disabled.
Output Parameter	None
Return Parameter	None
Required preconditions	None

Example:

The following example illustrates how to enable the End Of Count Interrupt of the TB1:

```
{
...
   TB_ITConfig (TB1, ENABLE);
...
}
```

4.14.3.6 TB_FlagClear

Function Name	TB_FlagClear
Function Prototype	`void TB_FlagClear (TB_TypeDef *TBx);`
Behavior Description	Clear the specified *TB* flag.
Input Parameter	*TBx* specifies the *TB* to be used. Refer to section 4.14.2.1 on page 241 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to clear the end of count interrupt flag:

```
{
TB_FlagClear (TB0);
}
```

4.14.3.7 TB_FlagStatus

Function Name	TB_FlagStatus
Function Prototype	`FlagStatus TB_FlagStatus (TB_TypeDef *TBx);`
Behavior Description	Check whether the specified *TB* flag is set or not.
Input Parameter	*TBx* specifies the *TB* to be used. Refer to section 4.14.2.1 on page 241for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	the status of the EC flagstatus can be either *SET* or *RESET*: *SET*: the flag is set *RESET*: the flag is cleared.
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to test if the EC flag is set or cleared:

```
if (TB_FlagStatus(TB2) == SET)
{
...
}
```

4.14.3.8 TB_GetCounter

Function Name	TB_GetCounter
Function Prototype	`u16 TB_GetCounter (TB_TypeDef *TBx);`
Behavior Description	This routine is used to get the counter value.
Input Parameter 1	*TBx* specifies the *TB* to be used. Refer to section 4.14.2.1 on page 241 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	The value of CNT register: counter value
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the *TB2* counter value:

```
{
u16 Myvalue =TB_GetCounter(TB2);
}
```

4.15 EXTENDED FUNCTION TIMER (TIM)

The *TIM* driver may be used for a variety of purposes, including timing operations, external wave generation and measurement.

The first section describes the data structures used in the *TIM* software library. The second section presents the *TIM* software library functions.

4.15.1 Data Structures

4.15.2 TIM Register Structure

The *TIM* register structure *TIM_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vuc16 ICAR;
 u16 EMPTY1;
 vuc16 ICBR;
 u16 EMPTY2;
 vu16 OCAR;
 u16 EMPTY3;
 vu16 OCBR;
 u16 EMPTY4;
 vu16 CNTR;
 u16 EMPTY5;
 vu16 CR1;
 u16 EMPTY6;
 vu16 CR2;
 u16 EMPTY7;
 vu16 SR;
 u16 EMPTY8;
} TIM_TypeDef;
```

The following table describes the *TIM* structure fields.:

Register	Description
ICAR	Input capture A register
ICBR	Input capture B register
OCAR	Output Compare A register
OCBR	Output Compare B register
CNTR	Counter Register
CR1	Control Register 1
CR2	Control Register 2
SR	Status Register

The *TIM* peripherals are declared in the same file:

```
...
```

```
#define TIM0_BASE    (APB_BASE + 0x2800)
#define TIM1_BASE    (APB_BASE + 0x2C00)
#define TIM2_BASE    (APB_BASE + 0x6400)
#define TIM3_BASE    (APB_BASE + 0x6800)
#define TIM4_BASE    (APB_BASE + 0x6C00)
#define TIM5_BASE    (APB_BASE + 0x3000)
#define TIM6_BASE    (APB_BASE + 0x3080)
#define TIM7_BASE    (APB_BASE + 0x3100)
#define TIM8_BASE    (APB_BASE + 0x3180)
#define TIM9_BASE    (APB_BASE + 0x3200)
...
#ifdef DEBUG
...
 EXT TIM_TypeDef *TIM0;
 EXT TIM_TypeDef *TIM1;
 EXT TIM_TypeDef *TIM2;
 EXT TIM_TypeDef *TIM3;
 EXT TIM_TypeDef *TIM4;
 EXT TIM_TypeDef *TIM5;
 EXT TIM_TypeDef *TIM6;
 EXT TIM_TypeDef *TIM7;
 EXT TIM_TypeDef *TIM8;
 EXT TIM_TypeDef *TIM9;
...
#else
...
 #define TIM0 ((TIM_TypeDef  *)TIM0_BASE)
 #define TIM1 ((TIM_TypeDef  *)TIM1_BASE)
 #define TIM2 ((TIM_TypeDef  *)TIM2_BASE)
 #define TIM3 ((TIM_TypeDef  *)TIM3_BASE)
 #define TIM4 ((TIM_TypeDef  *)TIM4_BASE)
 #define TIM5 ((TIM_TypeDef  *)TIM5_BASE)
 #define TIM6 ((TIM_TypeDef  *)TIM6_BASE)
 #define TIM7 ((TIM_TypeDef  *)TIM7_BASE)
 #define TIM8 ((TIM_TypeDef  *)TIM8_BASE)
 #define TIM9 ((TIM_TypeDef  *)TIM9_BASE)
...
#endif
```

When debug mode is used, *TIM* pointers are initialized in the file *73x_lib.c*:

```
#ifdef _TIM0
 TIM0 = (TIM_TypeDef *)TIM0_BASE;
#endif /* _TIM0 */
#ifdef _TIM1
 TIM1 = (TIM_TypeDef *)TIM1_BASE;
```

```
#endif /* _TIM1 */
#ifdef _TIM2
 TIM2 = (TIM_TypeDef *)TIM2_BASE;
#endif /* _TIM2 */
#ifdef _TIM3
 TIM3 = (TIM_TypeDef *)TIM3_BASE;
#endif /* _TIM3 */
#ifdef _TIM4
 TIM4 = (TIM_TypeDef *)TIM4_BASE;
#endif /* _TIM4 */
#ifdef _TIM5
 TIM5 = (TIM_TypeDef *)TIM5_BASE;
#endif /* _TIM5 */
#ifdef _TIM6
 TIM6 = (TIM_TypeDef *)TIM6_BASE;
#endif /* _TIM6 */
#ifdef _TIM7
 TIM7 = (TIM_TypeDef *)TIM7_BASE;
#endif /* _TIM7 */
#ifdef _TIM8
 TIM8 = (TIM_TypeDef *)TIM8_BASE;
#endif /* _TIM8 */
#ifdef _TIM9
 TIM9 = (TIM_TypeDef *)TIM9_BASE;
#endif /* _TIM9 */
```

In debug mode, *_TIMx* must be defined, in the file *73x_conf.h*, to access the peripheral registers as follows:

```
#define _TIMx  /* where (x=0..9)*/
```

4.15.2.1 TIM Values

The following table enumerates the different values of the TIMx:

TIM Value	Description
TIM0	Timer 0
TIM1	Timer 1
TIM2	Timer 2
TIM3	Timer 3
TIM4	Timer 4

TIM Value	Description
TIM5	Timer 5
TIM6	Timer 6
TIM7	Timer 7
TIM8	Timer 8
TIM9	Timer 9

4.15.2.2 TIM_InitTypeDef Structure

The *TIM_InitTypeDef* structure defines the control setting for the Timer peripheral.

```
typedef struct
{      u16 TIM_Mode;
       u16 TIM_OCA_Modes;
       u16 TIM_OCB_Modes;
       u16 TIM_ICAPA_Modes;
       u16 TIM_ICAPB_Modes;
       u16 TIM_INPUT_Edge;
       u16 TIM_Clock_Source;
       u16 TIM_Clock_Edge;
       u16 TIM_Prescaler;
       u16 TIM_Pulse_Level_A;
       u16 TIM_Pulse_Level_B;
       u16 TIM_Period_Level;
       u16 TIM_Pulse_Length_A;
       u16 TIM_Pulse_Length_B;
       u16 TIM_Full_Period;
     } TIM_InitTypeDef;
```

Members

- **TIM_Mode**

Specifies the mode at which the TIM operates.

This member can be one of the following values.

TIM_Mode	Meaning
TIM_PWM	Pulse Width Modulation mode
TIM_OPM	One Pulse Mode
TIM_PWMI	Pulse Width Modulation Input Mode
TIM_OCM_CHANNELA	Output Compare Channel A Mode

TIM_Mode	Meaning
TIM_OCM_CHANNELB	Output Compare Channel B Mode
TIM_OCM_CHANNELAB	Output Compare Channels A&B Mode
TIM_ICAP_CHANNELA	Input Capture Channel A Mode
TIM_ICAP_CHANNELB	Input Capture Channel B Mode
TIM_ICAP_CHANNELAB	Input Capture Channel A&B Mode

- **TIM_OCA_Modes**

Specifies the mode at which the Output Compare A operates.

This member can be one of the following values.

TIM_OCA_Modes	Meaning
TIM_Timing	OCMPA pin is a general I/O
TIM_Wave	OCMPA pin is dedicated to the OCA capability of the TIM

- **TIM_OCB_Modes**

Specifies the mode at which the Output Compare B operates.

This member can be one of the following values.

TIM_OCB_Modes	Meaning
TIM_Timing	OCMPB pin is a general I/O
TIM_Wave	OCMPB pin is dedicated to the OCB capability of the TIM

- **TIM_ICAPA_Modes**

Specifies the mode at which the Input Capture A operates.

This member can be one of the following values.

TIM_ICAPA_Modes	Meaning
TIM_Rising	A rising edge triggers the capture
TIM_Falling	A falling edge triggers the capture

- **TIM_ICAPB_Modes**

Specifies the mode at which the Input Capture B operates.

This member can be one of the following values.

TIM_ICAPB_Modes	Meaning
TIM_Rising	A rising edge triggers the capture
TIM_Falling	A falling edge triggers the capture

- **TIM_INPUT_Edge**

Specifies the mode at which the Input Capture B operates.

This member can be one of the following values.

TIM_INPUT_Edge	Meaning
TIM_Rising	A rising edge triggers the capture
TIM_Falling	A falling edge triggers the capture

- **TIM_Clock_Source**

Specifies the clock source of the TIM peripheral.

This member can be one of the following values.

TIM_Clock_Source	Meaning
TIM_CLK_EXTERNAL	External clock is used (CLK_EXT)
TIM_CLK_INTERNAL	Internal clock is used (MCLK)
TIM_ICAP_0	External clock connected to ICAPA 0 pin
TIM_ICAP_1	External clock connected to ICAPA 1 pin
TIM_ICAP_2	External clock connected to ICAPA 2 pin
TIM_ICAP_3	External clock connected to ICAPA 3 pin
TIM_ICAP_4	External clock connected to ICAPA 4 pin
TIM_ICAP_5	External clock connected to ICAPA 5 pin
TIM_ICAP_6	External clock connected to ICAPA 6 pin
TIM_ICAP_7	External clock connected to ICAPA 7 pin
TIM_ICAP_8	External clock connected to ICAPA 8 pin
TIM_ICAP_9	External clock connected to ICAPA 9 pin

- **TIM_Clock_Edge**

Specifies the which type of level transition on the reference clock will trigger the counter

This member can be one of the following values.

TIM_Clock_Edge	Meaning
TIM_Rising	A rising edge triggers the counter
TIM_Falling	A falling edge triggers the counter

- **TIM_Prescaler**

Specifies the Prescaler value to divide the internal clock. Timer clock will be equal to

$$\frac{f_{CPU}}{Prescaler}$$

- **TIM_Pulse_Level_A**

When using PWM, OPM, OCMA or OCMAB mode, this parameter specifies the pulse level of the signal generated on OCMPA pin. This member can be one of the following values.

TIM_Pulse_Level_A	Meaning
TIM_High	OLVLA is High Level
TIM_Low	OLVLB is High Level

- **TIM_Pulse_Level_B**

When using OCMB or OCMAB mode, this parameter specifies the pulse level of the signal generated on OCMPB pin. This member can be one of the following values.

TIM_Pulse_Level_B	Meaning
TIM_High	OLVLB is High Level
TIM_Low	OLVLB is High Level

- **TIM_Period_Level**

  When using OPM mode, this parameter specifies the after pulse level of signal generated on OCMPA pin. This member can be one of the following values.

TIM_Period_Level	Meaning
TIM_High	OLVLA is High Level
TIM_Low	OLVLA is High Level

- **TIM_Pulse_Length_A**

  When using PWM, OPM, OCMA or OCMAB mode, this parameter specifies the pulse length to be loaded in the OCAR register.

- **TIM_Pulse_Length_B**

  When using OCMB or OCMAB mode, this parameter specifies the pulse length to be loaded in the OCBR register.

- **TIM_Full_Period**

  Specifies the period to be loaded in the OCBR register, when the PWM mode is used.

4.15.2.3 TIM Flags

The *TIM* flags, declared in the file *7x_tim.h* are described in the following table::

TIM Flags	Description
TIM_FLAG_ICA	*TIM* Input Capture channel A flag.
TIM_FLAG_OCA	*TIM* Output Compare channel A flag.
TIM_FLAG_TO	*TIM* Timer Overflow flag.
TIM_FLAG_ICB	*TIM* Input Capture channel B flag.
TIM_FLAG_OCB	*TIM* Output Compare channel B flag.

4.15.2.4 TIM DMA sources

The TIM DMA sources, declared in the file 7x_*tim.h* are defined is the following table:

TIM DMA sources	Description
TIM_DMA_ICA	*TIM* Input Capture Channel A DMA source.
TIM_DMA_OCA	*TIM* Output Compare channel A DMA source.
TIM_DMA_ICB	*TIM* Input Capture Channel A DMA source.
TIM_DMA_OCB	*TIM* Output Compare channel B DMA source.

4.15.2.5 TIM interrupts

The TIM interrupts, declared in the *73x_tim.h* file are described below:

TIM Interrupts	Description
TIM_IT_ICA	*TIM* Input Capture Channel A interrupt.
TIM_IT_OCA	*TIM* Output Compare channel A interrupt.
TIM_IT_TO	*TIM* Timer Overflow interrupt.
TIM_IT_ICB	*TIM* Input Capture Channel A interrupt.
TIM_IT_OCB	*TIM* Output Compare channel B interrupt.

4.15.3 Software Library Functions

The following table enumerates the different functions of the *TIM* library.

Function Name	Description
TIM_Init	Initializes TIM peripheral according to the specified parameters in the TIM_InitTypeDef structure.
TIM_DeInit	Deinitializes TIM peripheral registers to their default reset values.
TIM_StructInit	Fills in a TIM_InitTypeDef structure with the reset value of each parameter (which depend on the register reset value)
TIM_ClockSourceConfig	Configures the TIM clock source.
TIM_CounterCmd	Configures the TIM counter.
TIM_GetClockStatus	Gets the TIM clock source status.
TIM_PrescalerConfig	Configures the TIM prescaler Value.
TIM_GetPrescalerValue	Gets the TIM prescaler Value.
TIM_GetICAPAValue	Reads and returns the Input Capture A parameters.
TIM_GetICAPBValue	Reads and returns the Input Capture B parameters.
TIM_FlagStatus	Checks whether the specified TIM flag is set or not.
TIM_FlagClear	Clears the specified TIM flag.
TIM_GetPWMIPulse	Reads and returns the PWM input pulse parameter.
TIM_GetPWMIPeriod	Reads and returns the PWM input period parameter.
TIM_ITConfig	Configures the TIM interrupts.
TIM_DMAConfig	Configures the TIM DMA source.
TIM_DMACmd	Enables or disables the TIMx DMA interface.

4.15.3.1 TIM_Init

Function Name	TIM_Init
Function Prototype	`void TIM_Init (TIM_TypeDef *TIMx, TIM_InitTypeDef *TIM_InitStruct);`
Behavior Description	Initializes *TIM* peripheral according to the specified parameters in the *TIM_InitTypeDef* structure.
Input1 Parameter	*TIMx* specifies the *TIM* to be used. Refer to section 4.15.2.1 on page 250 for more details on the allowed values of this parameter.
Input2 Parameter	*TIM_InitTypeDef* specifies the *TIM* configuration parameters. Refer to section 4.15.2.2 on page 251 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None

Example:

The following example illustrates how to initialize all the *TIM* peripherals and to configure the *TIM0* peripheral as Output compare mode on channel A:

```
{
  TIM_InitTypeDef   Init_Structure;

  Init_Structure.TIM_Clock_Source = TIM_CLK_EXTERNAL;
  Init_Structure.TIM_Clock_Edge = TIM_Rising;
  Init_Structure.TIM_Prescaler = 0x0079;
  Init_Structure.TIM_Mode = TIM_OCM_CHANNELA;
  Init_Structure.TIM_OCA_Modes = TIM_Timing;
  Init_Structure.Pulse_Level_A = TIM_High;
  Init_Structure.Pulse_Length_A = 0xFF00;

   TIM_Init (TIM0, &Init_Structure);
 ...
}
```

4.15.3.2 TIM_DeInit

Function Name	TIM_DeInit
Function Prototype	`void TIM_DeInit (TIM_TypeDef *TIMx);`
Behavior Description	Deinitializes *TIM* peripheral registers to their default reset values.
Input Parameter	*TIMx* specifies the *TIM* to be initialized.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to deinitialize the *TIM0* timer.

```
{
...
 TIM_DeInit (TIM0);
...
}
```

4.15.3.3 TIM_StructInit

Function Name	TIM_StructInit
Function Prototype	`void TIM_StructInit (TIM_InitTypeDef *TIM_InitStruct);`
Behavior Description	Fills in a *TIM_InitTypeDef* structure with the reset value of each parameter (which depend on the register reset value)
Input Parameter	*TIM_InitTypeDef* specifies the structure to be initialized.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialize the *TIMx* structure:

```
{
  TIM_StructInit (&TIM_InitStruct);
}
```

4.15.3.4 TIM_ClockSourceConfig

Function Name	TIM_ClockSourceConfig
Function Prototype	`void TIM_ClockSourceConfig (TIM_TypeDef *TIMx, u16 TIM_Clock);`
Behavior Description	This routine is used to configure the source clock of the *TIM* peripheral.
Input Parameter 1	*TIMx* specifies the *TIM* to be used.
Input Parameter 2	*TIM_Clock* specifies the *TIM* source clock. Refer to section 4.15.2.2 on page 251 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

This example illustrates how to configure the *TIM0* to be clocked by the internal *MCLK clock*:

```
{
...
  TIM_ClockSourceConfig (TIM0, TIM_CLK_INTERNAL);
...
}
```

4.15.3.5 TIM_PrescalerConfig

Function Name	TIM_PrescalerConfig
Function Prototype	`void TIM_PrescalerConfig (TIM_TypeDef *TIMx, u8 TIM_Prescaler);`
Behavior Description	This routine is used to configure the TIM prescaler value.
Input Parameter	TIMx specifies the TIM to be initialized.
Input Parameter	Xprescaler: specifies the TIM prescaler value.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to configure the *TIM3* prescaler.

```
{
...
 TIM_PrescalerConfig ( TIM3, 0x7F )
...
}
```

4.15.3.6 TIM_GetPrescalerValue

Function Name	TIM_GetPrescalerValue
Function Prototype	`u8 TIM_GetPrescalerValue (TIM_TypeDef *TIMx)`
Behavior Description	This routine is used to get the Prescaler value.
Input Parameter 1	*TIMx* specifies the *TIM* to be used. Refer to section 4.15.2.1 on page 250 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the *TIM2* prescaler value.

```
{
...
  u8 MyPrescaler =TIM_GetPrescalerValue (TIM2);
...
}
```

4.15.3.7 TIM_GetICAPAValue

Function Name	TIM_GetICAPAValue
Function Prototype	`u16 TIM_GetICAPAValue (TIM_TypeDef *TIMx);`
Behavior Description	This routine is used to get the input capture value.
Input Parameter 1	*TIMx* specifies the *TIM* to be used.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the input capture A value of the *TIM2* timer

```
{
  ...
  u16 Myvalue = TIM_GetICAPAValue (TIM2);
  ...
}
```

4.15.3.8 TIM_GetICAPBValue

Function Name	TIM_GetICAPBValue
Function Prototype	`u16 TIM_GetICAPBValue (TIM_TypeDef *TIMx);`
Behavior Description	This routine is used to get the input capture value.
Input Parameter 1	*TIMx* specifies the *TIM* to be used.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the input capture B value of the *TIM2* timer

```
{
 ...
  u16 Myvalue = TIM_GetICAPBValue (TIM2);
 ...
}
```

4.15.3.9 TIM_GetPWMIPulse

Function Name	TIM_GetPWMIPulse
Function Prototype	`u16 TIM_GetPWMIPulse ( TIM_TypeDef *TIMx);`
Behavior Description	This routine is used to get the *PWM* input pulse value.
Input Parameter 1	*TIMx* specifies the *TIM* to be used.
Output Parameter	The pulse of the external signal.
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the Pulse value of the TIM3 timer

```
{
 ...
  u16 MyPWMPulse = TIM_GetPWMIPulse(TIM3);
 ...
}
```

4.15.3.10 TIM_GetPWMIPeriod

Function Name	TIM_GetPWMIPeriod
Function Prototype	`u16 TIM_GetPWMIPeriod ( TIM_TypeDef *TIMx);`
Behavior Description	This routine is used to get the *PWM* input period value.
Input Parameter 1	*TIMx* specifies the *TIM* to be used.
Output Parameter	The pulse of the external signal
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the Pulse value of the TIM3 timer

```
{
 ...
  u16 MyPWMIPeriod =TIM_GetPWMIPeriod(TIM3);
 ...
}
```

4.15.3.11 TIM_CounterCmd

Function Name	TIM_CounterCmd
Function Prototype	`void TIM_CounterCmd (TIM_TypeDef *TIMx, CounterOperations TIM_operation);`
Behavior Description	This routine is used to control the *TIM* counter.
Input Parameter 1	*TIMx* specifies the *TIM* to be used.
Input Parameter 2	*TIM_operation:* specifies the operation of the counter. *TIM_STOP:* Stop the TIM counter. *TIM_ENABLE:* Enable or resume the TIM counter. *TIM_CLEAR:* Clear the TIM counter value.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to stop the TIM2 counter:

```
{
...
 TIM_CounterCmd (TIM2, TIM_STOP);
...
}
```

4.15.3.12 TIM_FlagStatus

Function Name	TIM_FlagStatus
Function Prototype	`FlagStatus TIM_FlagStatus (TIM_TypeDef *TIMx, u16 TIM_Flag);`
Behavior Description	Check whether the specified *TIM* flag is set or not.
Input Parameter1	*TIMx* specifies the *TIM* to be used.
Input Parameter2	*TIM_Flag:* specifies the *TIM* flag to be tested. Refer to section 4.15.2.3 on page 256for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to check the Timer 3 overflow flag

```
{
 ...
  FlagStatus OverFlowStatus = TIM_FlagStatus ( TIM3, TIM_FLAG_TO);
 ...
}
```

4.15.3.13 TIM_FlagClear

Function Name	TIM_FlagClear
Function Prototype	`void TIM_FlagClear (TIM_TypeDef *TIMx, u16 TIM_Flag);`
Behavior Description	Clears the specified *TIM flag.*
Input Parameter1	*TIMx* specifies the *TIM* to be used.
Input Parameter2	*TIM_Flag:* specifies the *TIM* flag to be cleared. Refer to section 4.15.2.3 on page 256 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to clear the overflow interrupt flag:

```
{
...
TIM_FlagClear (TIM3, TIM_FLAG_TO);
...
}
```

4.15.3.14 TIM_ITConfig

Function Name	TIM_ITConfig
Function Prototype	`void TIM_ITConfig (TIM_TypeDef *TIMx, u16 New_IT, functionalstate Newstate)`
Behavior Description	This routine is used to configure the *TIM* interrupts.
Input Parameter 1	*TIMx* specifies the *TIM* to be used.
Input Parameter 2	*New_IT:* specifies the *TIM* interrupt to be configured. The user can specify one or more *TIM* interrupts to be configured using the logical operator 'OR'.
Input Parameter 3	Newstate: specifies the *TIM* interrupt state whether it would be enabled or disabled. *ENABLE:* the corresponding *TIM* interrupt(s) will be enabled. *DISABLE:* the corresponding *TIM* interrupt(s) will be disabled.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the *TIM3* overflow and input capture B interrupts.

```
{
 ...
  TIM_ITConfig (TIM3, TIM_IT_TO | TIM_IT_ICB, ENABLE);
 ...
}
```

4.15.3.15 TIM_DMAConfig

Function Name	TIM_DMAConfig
Function Prototype	`void TIM_DMAConfig (TIM_TypeDef *TIMx, u16 TIM_DMA_Sources);`
Behavior Description	This routine is used to enable the *DMA.*
Input Parameter1	*TIMx* specifies the *TIM* to be used.
Input Parameter2	*TIM_DMA_Sources* specifies the *DMA* source to be used. Refer to section 4.15.2.4 on page 256 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to configure the *DMA* for the *TIM0* peripheral and to choose *ICAPA* as a *DMA* source.

```
{
  TIM_DMAConfig (TIM0, TIM_DMA_ICAPA);
}
```

4.15.3.16 TIM_DMACmd

Function Name	TIM_DMACmd
Function Prototype	`void TIM_DMACmd(TIM_TypeDef* TIMx, FunctionalState NewState);`
Description	Enable or disable the *TIMx DMA* interface.
Input Parameter 1	*TIMx:* where x can be 0, 1 or 9 to select the *TIM* peripheral.
Input Parameter 2	*NewState:* new state of the *DMA* interface. This parameter can be: *ENABLE* or *DISABLE.*
Output Parameter	None
Return Parameters	None
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the *DMA* for the *TIM0* peripheral.

```
{
  TIM_DMACmd(TIM0, ENABLE);
}
```

4.16 UART (UART)

The *UART* driver may be used for a variety of purposes, including mode selection, Baud rate configuration and 8 and 9 bit byte reception and transmission.

The first section describes the data structures used in the *UART* software library. The second section presents the *UART* software library functions.

4.16.1 Data Structures

4.16.1.1 UART Register Structure

The *UART* register structure *UART_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu16 BRR;
 u16 EMPTY1;
 vu16 TxBUFR;
 uv16 EMPTY2;
 vuc16 RxBUFR;
 u16 EMPTY3;
 vu16 CR;
 u16 EMPTY4;
 vu16 IER;
 u16 EMPTY5;
 vuc16 SR;
 u16 EMPTY6;
 vu16 TOR;
 u16 EMPTY7;
 vu16 TxRSTR;
 u16 EMPTY8;
 vu16 RxRSTR;
 u16 EMPTY9;
} UART_TypeDef;
```

The following table describes the *UART* structure fields.:

Register	Description
BRR	Baud Rate Register
TxBUFR	Transmit Buffer Register
RxBUFR	Receive Buffer Register
CR	Control Register

Register	Description
IER	Interrupt Enable Register
SR	Status Register
TOR	Time Out Register
TxRSTR	Tx FIFO Reset Register
RxRSTR	Rx FIFO Reset Register

The *UARTs* peripherals are declared in the same file:

```
...
#define APB           0xFFFF8000
#define UART0_BASE    (APB + 0x1C00)
#define UART1_BASE    (APB + 0x2000)
#define UART2_BASE    (APB + 0x1E00)
#define UART3_BASE    (APB + 0x2200)
...
#ifdef DEBUG
...
 EXT UART_TypeDef *UART0;
 EXT UART_TypeDef *UART1;
 EXT UART_TypeDef *UART2;
 EXT UART_TypeDef *UART3;

...
#else
...
 #define UART0 ((UART_TypeDef *)UART0_BASE)
 #define UART1 ((UART_TypeDef *)UART1_BASE)
 #define UART2 ((UART_TypeDef *)UART2_BASE)
 #define UART3 ((UART_TypeDef *)UART3_BASE)

...
#endif
```

When debug mode is used, *UARTs* pointers are initialized in the file *73x_lib.c*:

```
 #ifdef _UART0
  UART0 = (UART_TypeDef *)UART0_BASE;
 #endif /* _UART0 */

 #ifdef _UART1
  UART1 = (UART_TypeDef *)UART1_BASE;
 #endif /* _UART1 */

 #ifdef _UART2
  UART2 = (UART_TypeDef *)UART2_BASE;
```

```
#endif /* _UART2 */

#ifdef _UART3
 UART3 = (UART_TypeDef *)UART3_BASE;
#endif /* _UART3 */
```

In debug mode, *_UARTx* must be defined, in the file *73x_conf.h*, to access the peripheral registers as follows:

```
#define _UART
#define _UART0
#define _UART1
#define _UART2
#define _UART3
```

The UART library use the P*RCCU* library. The *_PRCCU* must be defined, in the *73x_conf.h*, to access the *PRCCU* registers and library functions as follows:

```
#define _PRCCU
```

4.16.1.2 UART_InitTypeDef Structure

The *UART_InitTypeDef* structure defines the control setting for the *UART* peripheral.

```
typedef struct
{
  u16 UART_BaudRate;
  u16 UART_Mode;
  u16 UART_StopBits;
  u16 UART_Parity;
  u16 UART_Loop_Standard
  u16 UART_Rx;
  u16 UART_FIFO;
} UART_InitTypeDef;
```

Members

- **UART_BautRate**

Specifies the baudrate of the UART communication.

The baudrate is computed with this formula: *Baudrate = FCPU / (16 * UART_BaudRate)*

- **UART_Mode**

Specifies the mode control.

This member can be one of the following values:

UART_Mode	Meaning
UART_Mode_8D	8 bit data (without parity) mode
UART_Mode_7D_P	7 bit data mode with parity
UART_Mode_9D	9 bit data mode (without parity)
UART_Mode_8D_W	8 bit data mode with wake-up bit
UART_Mode_8D_P	8 bit data mode with parity

- **UART_StopBits**

Specify the number of stop bits. This member can be one of the following values:

UART_StopBits	Meaning
UART_StopBits_0_5	0.5 stop bits
UART_StopBits_1	1 stop bit
UART_StopBits_1_5	1.5 stop bit
UART_StopBits_2	2 stop bit

- **UART_Parity**

Specify the parity mode. This member can be one of the following values.

UART_Parity	Meaning
UART_Parity_Odd	Odd parity mode
UART_Parity_Even	Even parity mode

- **UART_Loop_Standard**

Specify the mode of transmit or receive. This member can be one of the following values.

UART_Loop_Standard	Meaning
UART_LoopBack	Loopback mode enable
UART_Standard	Standard transmit/receive mode

- **UART_Rx**

Specify whether the reception is enable or not.

This member can be one of the following values.

UART_Rx	Meaning
UART_Rx_Enable	Receive enabled
UART_Rx_Disable	Receive disabled

- **UART_FIFO**

Specify whether the FIFO is enable.

This member can be one of the following values.

UART_FIFO	Meaning
UART_FIFO_Enable	FIFO enabled
UART_FIFO_Disable	FIFO disabled

4.16.2 Common parameters values

4.16.2.1 Interrupt

The *UART* Interrupts, defined in the *73x_uart.h* file are described in the table below:

Interrupt	Description
UART_IT_TxFull	Transmit Buffer Full. (Status register only)
UART_IT_RxHalfFull	Receiver buffer Half Full.
UART_IT_TimeOutIdle	Time-out Idle.
UART_IT_TimeOutNotEmpty	Time-out Not Empty.
UART_IT_OverrunError	Overrun Error.
UART_IT_FrameError	Framing Error.
UART_IT_ParityError	Parity Error.
UART_IT_TxHalfEmpty	Transmit buffer Half Empty.
UART_IT_TxEmpty	Transmit buffer Empty.
UART_IT_RxBufFull	Receive Buffer Full.

4.16.2.2 Flags

The *UART* Flags, defined in the *73x_uart.h* file, are described below:

Flags	Description
UART_Flag_TxFull	Transmit Buffer Full. (Status register only)
UART_Flag_RxHalfFull	Receiver buffer Half Full.
UART_Flag_TimeOutIdle	Time-out Idle.
UART_Flag_TimeOutNotEmpty	Time-out Not Empty.
UART_Flag_OverrunError	Overrun Error.
UART_Flag_FrameError	Framing Error.
UART_Flag_ParityError	Parity Error.
UART_Flag_TxHalfEmpty	Transmit buffer Half Empty.
UART_Flag_TxEmpty	Transmit buffer Empty.
UART_Flag_RxBufFull	Receive Buffer Full.

4.16.2.3 UART Fifo Reset

The FIFO reset, defined in the *73x_uart.h* file, are described below: .

Fifo Reset	Description
UART_RxFIFO	Reset Receiver FIFO
UART_TxFIFO	Reset Transmitter FIFO

4.16.2.4 UARTx values

The following table describes the allowed values of *UARTx* variable.

UART values	Description
UART0	To select *UART*0
UART1	To select *UART*1

4.16.3 Software Library Functions

The following table enumerates the different functions of the *UART* library.

Function Name	Description
UART_Init	Initialize the *UART* peripheral according to the specified parameters in the *UART_InitTypeDef* structure.
UART_DeInit	Deinitialize the *UARTx* peripheral registers to their default reset values.
UART_StructInit	Fill in a *UART_InitTypeDef* structure with the reset value of each parameter.
UART_Cmd	Enable or disable *UART* peripheral.
UART_ByteSend	Transmit single Byte of data through the *UART* peripheral.
UART_9BitSend	Transmit 9 Bit of data through the *UART* peripheral.
UART_ByteBufferSend	Transmit data from a user defined buffer and returns the status of transmission.
UART_9BitBufferSend	Transmit 9 bits data from a user defined buffer and returns the status of transmission.
UART_StringSend	Transmit a string from a user defined string and returns the status of transmission.
UART_ByteReceive	Return the most recent received Byte by the *UARTx.*
UART_9BitReceive	Return the most recent received 9 bit by the *UARTx*.
UART_ByteBufferReceive	Receive number of data words (Byte), stores them in user defined area and returns the status of the reception.
UART_9BitBufferReceive	Receive number of data words (9 bits), stores them in user defined area and returns the status of the reception.
UART_StringReceive	Receive a string, stores it in a user defined area and returns the status of the reception.
UART_FlagStatus	Check whether the specified *UART* flag is set or not.
UART_FIFOReset	Reset the Rx and the Tx *FIFOs* of the selected *UARTx*.
UART_ITConfig	Enable or disables the specified *UARTx* interrupts.
UART_SetTimeOutValue	Configure the Time Out value.
UART_SetGuardTimeValue	Configure the Guard Time value.

4.16.3.1 UART_Init

Function Name	UART_Init
Function Prototype	`void UART_Init(UART_TypeDef *UARTx, UART_InitTypeDef* UART_InitStruct)`
Behavior Description	Initializes *UARTx* peripheral according to the specified parameters in the *UARTx_InitTypeDef* structure.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Input Parameter 2	*UART_InitStruct*: pointer to a *UART_InitTypeDef* structure that contains the configuration information for the specified *UART* peripheral.
Output Parameter	None
Return Parameter	None
Required preconditions	Before calling this function, switch on the clock source of *UARTx* peripheral with CFG_PeripheralClockConfig() function.
Called Functions	None

Example:

The following example illustrates how to configure the *UART0*:

```
{
...
  UART_InitTypeDef UART_Init_s;
...
UART_Init_s.UART_BaudRate = 9600;
UART_Init_s.UART_Mode = UART_Mode_7D_P;
UART_Init_s.UART_StopBits = UART_StopBits_0_5;
UART_Init_s.UART_Parity = UART_Parity_Even;
UART_Init_s.UART_Loop_Standard = UART_Standard;
UART_Init_s.UART_Rx = UART_Rx_Enable;
UART_Init_s.UART_FIFO = UART_FIFO_Enable;
UART_Init(UART0, &UART_Init_s);
...
}
```

4.16.3.2 UART_DeInit

Function Name	UART_DeInit
Function Prototype	`void UART_DeInit(UART_TypeDef *UARTx)`
Behavior Description	Deinitialize *UART* peripheral control and registers to their default reset values.
Input Parameter	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to deinitialize the *UART0* peripheral:

```
{
...
 UART_DeInit(UART0);
...
}
```

4.16.3.3 UART_StructInit

Function Name	UART_StructInit
Function Prototype	`void UART_StructInit(UART_InitTypeDef* UART_InitStruct);`
Behavior Description	Fill in a *UART_InitTypeDef* structure with the reset value of each parameter.
Input Parameter	*UART_InitStruct*: pointer to a *UART_InitTypeDef* structure which will be initialized.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialize the *UART* structure:

```
{
 UART_StructInit (&UART_InitStruct);
...
}
```

4.16.3.4 UART_Cmd

Function Name	UART_Cmd
Function Prototype	`void UART_Cmd(UART_TypeDef *UARTx, FunctionalState NewState);`
Behavior Description	Enables or disables *UART* peripheral.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Input Parameter 2	*NewState*: specifies the new state of the *UART* peripheral. This parameter can be: *ENABLE* or *DISABLE*.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the *UART0* peripheral:

```
{
 UART_Cmd(UART0, ENABLE);
...
}
```

4.16.3.5 UART_ByteSend

Function Name	UART_ByteSend
Function Prototype	`void UART_ByteSend(UART_TypeDef *UARTx,vu8 data)`
Behavior Description	Transmits single Byte of data through the *UARTx* peripheral.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Input Parameter 2	*data*: The data byte to send.
Output Parameter	None
Return Parameter	None
Required preconditions	None.
Called Functions	None

Example:

The following example illustrates how to send 0x55 via *UART1*:

```
{
UART_ByteSend(UART1,0x55);
...
}
```

4.16.3.6 UART_ByteBufferSend

Function Name	UART_ByteBufferSend
Function Prototype	`ErrorStatus UART_ByteBufferSend(UART_TypeDef *UARTx, u8* PtrToBuffer, u8 NbOfBytes);`
Behavior Description	Transmits data from a user defined buffer and returns the status of transmission.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Input Parameter 2	*PtrToBuffer*: A pointer to the data to send.
Input Parameter 3	*NbOfBytes*: The data length in bytes.
Output Parameter	None
Return Parameter	*ErrorStatus*: an ErrorStatus enumeration value: *SUCCESS*: transmission done without error *ERROR*: an error detected during transmission
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to send a buffer via *UART1*:

```
{...
 #define DataLength 5
 u8 Table[DataLength]={0,1,2,3,4};
...
 UART_ByteBufferSend(UART1,Table,DataLength);
...
}
```

4.16.3.7 UART_9BitBufferSend

Function Name	UART_9BitBufferSend
Function Prototype	`ErrorStatus UART_ByteBufferSend(UART_TypeDef *UARTx, u16* PtrToBuffer, u8 NbOfBytes);`
Behavior Description	Transmit data (9 bit)from a user defined buffer and returns the status of transmission.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the UART peripheral.
Input Parameter 2	*PtrToBuffer*: A pointer to the data to send.
Input Parameter 3	*NbOfBytes*: The data length in bytes.
Output Parameter	None
Return Parameter	*ErrorStatus*: an ErrorStatus enumeration value: *SUCCESS*: transmission done without error *ERROR*: an error detected during transmission
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to send a buffer via *UART1*:

```
{
 #define DataLength 4
  u16 Table[DataLength]={0x101,0x111,0x122,0x133};
...
 UART_9BitBufferSend(UART1,Table,DataLength);
}
```

4.16.3.8 UART_StringSend

Function Name	UART_StringSend
Function Prototype	`void UART_StringSend(UART_TypeDef *UARTx, u8 *PtrToString)`
Behavior Description	Transmits a string from a user defined string and returns the status of transmission.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Input Parameter 2	*PtrToString*: A pointer to the sting to send.
Output Parameter	None.
Return Parameter	None.
Required preconditions	None.
Called Functions	None.

Example:

The following example illustrates how to send string via *UART1*:

```
{
 u8 STRING[]="Hello World";
...
 UART_StringSend(UART1,STRING);
 UART_StringSend(UART1,(u8 *)"Hello World");
...
}
```

4.16.3.9 UART_ByteReceive

Function Name	UART_ByteReceive
Function Prototype	`u8 UART_ByteReceive(UART_TypeDef *UARTx)`
Behavior Description	Returns the most recent received Byte by the *UARTx* peripheral.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Output Parameter	None
Return Parameter	The received data.
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to receive byte via *UART* 1:

```
{
 ...
  u8 bRxData =UART_ByteReceive(UART1);
 ...
}
```

4.16.3.10 UART_9BitReceive

Function Name	UART_9BitReceive
Function Prototype	`u16 UART_9BitReceive(UART_TypeDef *UARTx)`
Behavior Description	Returns the most recent received 9 bits by the *UARTx* peripheral.
Input Parameter 1	*UARTx*: where x can be 0.. 3 to select the *UART* peripheral.
Output Parameter	None
Return Parameter	The received data.
Required preconditions	None.
Called Functions	None

Example:

The following example illustrates how receive 9 bits data via *UART1*:

```
{
...
u16 bRxData = UART_9BitReceive(UART1);
...
}
```

4.16.3.11 UART_ByteBufferReceive

Function Name	UART_ByteBufferReceive
Function Prototype	`ErrorStatus UART_ByteBufferReceive(UART_TypeDef *UARTx, u8 *PtrToBuffer, u8 NbOfBytes)`
Behavior Description	Receives number of data words (Byte), stores them in user defined area and returns the status of the reception.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Input Parameter 2	*PtrToBuffer*: A pointer to the buffer where the data will be stored.
Input Parameter 3	*NbOfBytes*: The data length.
Output Parameter	The received buffer.
Return Parameter	*ErrotState*: specifies the error state of the *UART*. The Error State value can be either *SUCCESS* or *ERROR*.
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to receive buffer via *UART1*:

```
{
#define DataLength 0x10
u8 *pData;
...
ErrorStatus ReceptionStatus
ReceptionStatus = UART_ByteBufferReceive(UART1,pDATA DataLength);
}
```

4.16.3.12 UART_9BitBufferReceive

Function Name	UART_9BitBufferReceive

Function Prototype	`ErrorStatus UART_9BitBufferReceive(`
	`  UART_TypeDef * UARTTx,`
	`  u16 *PtrToBuffer, u8 NbOfBytes)`

Behavior Description	Receives number of data words (9 bits), stores them in user defined area and returns the status of the reception.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Input Parameter 2	*PtrToBuffer*: A pointer to the buffer where the data will be stored.
Input Parameter 2	*NbOfBytes*: The data length.
Output Parameter	The received buffer.
Return Parameter	*ErrotState*: specifies the error state of the UART. The Error State value can be either *SUCCESS* or *ERROR*.
Required preconditions	None.
Called Functions	None

Example:

The following example illustrates how to receive 9 bit buffer via *UART1*:

```
{
#define DataLength 0x15
ErrorStatus ReceptionStatus;
u16 *pDATA;
...
ReceptionStatus = UART_9BitBufferReceive(UART1,pDATA,DataLength);
...
}
```

4.16.3.13 UART_StringReceive

Function Name	UART_StringReceive
Function Prototype	`ErrorStatus UART_StringReceive(UART_TypeDef *UARTx, vu8 *Data)`
Behavior Description	Receive a string, stores it in a user defined area and returns the status of the reception.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Input Parameter 2	*PtrToString*: A pointer to the buffer where the string will be stored.
Output Parameter	None
Return Parameter	The received string.
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to receive string via UART1:

```
{
u8 *pDATA;
...
ReceptionStatus = UART_StringReceive(UART1,pDATA);
...
}
```

4.16.3.14 UART_FlagStatus

Function Name	UART_FlagStatus
Function Prototype	`FlagStatus UART_FlagStatus (UART_TypeDef *UARTx, vu16 UART_Flag)`
Description	Checks whether the specified *UART* flag is set or not.
Input Parameter 1	*UARTx*: where x can be 0.. 3 to select the *UART* peripheral.
Input Parameter 2	*UART_Flag*: flag to check. Refer to section 4.16.2.2 on page 273 for more details on the allowed values of this parameter.
OutPut Parameter	None
Return Parameters	The status of the flag in FlagStatus type, the available value are: *SET*: if the flag to check is set (equal to 1). *RESET*: if the flag to check is reset.
Required Preconditions	None
Called Functions	None

Example:

The following example illustrates how to test if the *UART0* Tx Full (Transmit FIFO Full) flag is set or not:

```
{
...
 FlagStatus Status = UART_FlagStatus(UART0, UART_TxFull);
...
}
```

4.16.3.15 UART_ITConfig

Function Name	UART_ITConfig
Function Prototype	`void UART_ITConfig (UART_TypeDef *UARTx,u16 UART_IT, FunctionalState NewState)`
Behavior Description	Enables or disables the specified *UART* interrupts.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Input Parameter 2	*UART_IT*: specifies the *UART* interrupts sources to be enabled or disabled.
Input Parameter 3	*Newstate*: specifies the UART interrupt state whether it would be enabled or disabled: *ENABLE*: the corresponding *UART* interrupt will be enabled. *DISABLE*: the corresponding *UART* interrupt will be disabled.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the interrupt when Tx is full:

```
{
 ...
  UART_ITConfig (UART_ITRxBufFull, ENABLE);
 ...
}
```

4.16.3.16 UART_FifoReset

Function Name	UART_FifoReset
Function Prototype	`void UART_FifoReset(UART_TypeDef *UARTx , u16 FIFO_Reset)`
Behavior Description	Resets the Rx and the Tx FIFOs of the selected UART.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Input Parameter 2	*FIFO_Reset*: clear the FIFO *UART_RxFIFO* or *UART_TxFIFO*.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to reset the *UART1* RxFIFO:

```
{
 ...
  UART_FifoReset(UART1, UART_RxFIFO);
 ...
}
```

4.16.3.17 UART_SetTimeOutValue

Function Name	UART_SetTimeOutValue
Function Prototype	`void UART_SetTimeOutValue(UART_TypeDef *UARTx, u16 UART_TimeOut)`
Behavior Description	Configure the Time Out value.
Input Parameter 1	*UARTx*: where x can be 0, 1, 2 or 3 to select the *UART* peripheral.
Input Parameter 2	*UART_TimeOut*: The time-out period value.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to configure the Time Out value:

```
{
 ...
  UART_SetTimeOutValue(UART0,0xFF);
 ...
}
```

4.17 WATCHDOG TIMER (WDG)

The *WDG* driver may be used for a variety of purposes, including timing operations and watchdog functions.

The first section describes the data structures used in the *WDG* software library. The second section presents the *WDG* software library functions.

4.17.1 Data Structures

4.17.1.1 WDG Register Structure

The *CMU* register structure *WDG_TypeDef* is defined in the *73x_map.h* file as follows:

```
typedef struct
{
 vu16 CR;
 u16 EMPTY1;
 vu16 PR;
 uv16 EMPTY2;
 vu16 VR;
 u16 EMPTY3;
 vuc16 CNT;
 u16 EMPTY4;
 vu16 SR;
 u16 EMPTY5;
 vu16 MR;
 u16 EMPTY6;
 vu16 KR;
 u16 EMPTY7;
} WDG_TypeDef;
```

The following table describes the *WDG* structure fields.:

Register	Description
CR	Control Register
PR	Prescalar Register
VR	Pre-load Value Register
CNT	Counter Register
SR	Status Register
MR	Mask Register
KR	Key Register

The WDG peripherals are declared in the same file:

```
...
#define APB           0xFFFF8000
#define WDG_BASE    (APB + 0x2400)
...
```

```
#ifndef DEBUG
...
 #define WDG      ((WDG_TypeDef  *) WDG_BASE)
...
#else
...
 EXT WDG_TypeDef       *WDG;
...
#endif
```

When debug mode is used, *WDG* pointers are initialized in the file *73x_lib.c*:

```
 #ifdef _WDG
WDG  = (WDG_TypeDef *)WDG_BASE;
#endif /*_WDG */
```

In debug mode, *_WDG* must be defined, in the file *73x_conf.h*, to access the peripheral registers as follows:

```
#define _WDG
```

The WDG library use the P*RCCU* library. The *_PRCCU* must be defined, in the *73x_conf.h*, to access the *PRCCU* registers and library functions as follows:

```
#define _PRCCU
```

4.17.1.2 WDG_InitTypeDef Structure

The *WDG_InitTypeDef* defines the control setting for the Watchdog Timer peripheral.

```
typedef struct
{
 u16 WDG_Mode;
 u16 WDG_CLK_Source;
 u16 WDG_Prescaler;
 u16 WDG_Preload;
} RTC_InitTypeDef;
```

Members

- **WDG_Mode**

  Specifies the mode of the WDG peripheral. This member can be one of the following values.

WDG_Mode	Meaning
WDG_Mode_WDG	Watchdog Timer is configured in Watchdog mode
WDG_Mode_Timer	Watchdog Timer is configured in Timer mode

- **WDG_Clock_Source**

  Specifies the clock source of the WDG peripheral.

  This member can be one of the following values.

WDG_Clock_Source	Meaning
WDG_CLK_EXTERNAL	External clock source is used (CLK_EXT)
WDG_CLK_INTERNAL	Main clock source is used (MCLK)

- **WDG_Prescaler**

  Specifies the Prescaler value to divide the clock source.

  This member must be a number between 0 and 255.

- **WDG_Preload**

This value is loaded in the WDG Counter when it starts counting.

This member must be a number between 0 and 0xFFFF.

4.17.2 Software Library Functions

The following table enumerates the different functions of the *WDG* library.

Function Name	Description
WDG_Init	Initializes WDG peripheral according to the specified parameters in the WDG_InitTypeDef structure.
WDG_DeInit	Deinitializes WDG peripheral registers to their default reset values.
WDG_StructInit	Fills in a WDG_InitTypeDef structure with the reset value of each parameter.
WDG_Cmd	Enables or disables WDG peripheral.
WDG_ITConfig	Enable or disable the end count interrupt
WDG_FlagClear	Clears the end count flag
WDG_FlagStatus	Checks whether the end of counter flag is set or not
WDG_GetCounterValue	To get the current counter value.

4.17.2.1 WDG_Init

Function Name	WDG_Init
Function Prototype	`void WDG_Init(WDG_InitTypeDef *WDG_InitStruct);`
Behavior Description	Initializes WDG peripheral according to the specified parameters in the *WDG_InitTypeDef* structure.
Input Parameter1	*WDG_InitStruct*: pointer to a *WDG_InitTypeDef* structure that contains the configuration information for the specified *WDG* peripheral.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to configure the *WDG*:

```
{
...
  WDG_InitTypeDef Init_Structure;
  Init_Structure.WDG_Mode = WDG_Mode_Timer
  Init_Structure.WDG_CLK_Source = WDG_CLK_External;
  Init_Structure.WDG_Prescaler = 0x0079;
  Init_Structure.WDG_Preload = 0xFF00;
  WDG_Init (WDG0,&Init_Structure);
  ...
}
```

4.17.2.2 WDG_DeInit

Function Name	WDG_DeInit
Function Prototype	`void WDG_DeInit (void);`
Behavior Description	Deinitializes the *WDG* peripheral registers to their default reset values.
Input Parameter	None
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to deinitialize the *WDG* peripheral:

```
{
...
 WDG_DeInit();
...
}
```

4.17.2.3 WDG_StructInit

Function Name	WDG_StructInit
Function Prototype	`void WDG_StructInit (WDG_InitTypeDef *WDG_InitStruct);`
Behavior Description	Fills in a *WDG_InitTypeDef* structure with the reset value of each parameter.
Input Parameter	*WDG_InitStruct*: pointer to a *WDG_InitTypeDef* structure which will be initialized.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialize the *WDG* structure:

```
{
 ...
  WDG_StructInit (&WDG_InitStruct);
 ...
}
```

4.17.2.4 WDG_Cmd

Function Name	WDG_Cmd
Function Prototype	`WDG_Cmd(FunctionalState NewState)`
Behavior Description	Enables or disables *WDG* peripheral.
Input Parameter1	*NewState*: new state of the *WDG* peripheral. This parameter can be *ENABLE* or *DISABLE*.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the *WDG* peripheral:

```
{
...
WDG_Cmd (ENABLE);
...
}
```

4.17.2.5 WDG_ITConfig

Function Name	WDG_ITConfig
Function Prototype	`void WDG_ITConfig(FunctionalState NewState)`
Behavior Description	Enable or disable the end count interrupt
Input Parameter1	*NewState*: new state of the WDG peripheral. This parameter can be *ENABLE* or *DISABLE*.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the end of count interrupt:

```
{
...
WDG_ITConfig (Enable);
...
}
```

4.17.2.6 WDG_FlagClear

Function Name	WDG_FlagClear
Function Prototype	`void WDG_FlagClear (void)`
Behavior Description	Clear the end of count flag
Input Parameter	None
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to clear the end of count flag:

```
{
...
  WDG_FlagClear();
...
}
```

4.17.2.7 WDG_FlagStatus

Function Name	WDG_FlagStatus
Function Prototype	`FlagStatus WDG_FlagStatus (void)`
Behavior Description	Check whether the end of counter flag is set or not.
Input Parameter	None
Output Parameter	None
Return Parameter	The NewState of the end of counter (SET or RESET).
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to test if the *EC* flag is set or reset:

```
{
...
  if (WDG_FlagStatus() == SET)
 {
 }
...
}
```

4.17.2.8 WDG_GetCounter

Function Name	WDG_GetCounter
Function Prototype	`u16 WDG_GetCounter (void)`
Behavior Description	To get the current counter value.
Input Parameter 1	None
Output Parameter	None
Return Parameter	The value of *CNT* register: counter value
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get the counter value of the WDG timer:

```
{
  ...
    u16 Myvalue = WDG_GetCounter();
  ...
}
```

4.18 WAKE-UP INTERRUPT UNIT (WIU)

The *WIU* driver may be used for several purposes, such as enabling and disabling lines' interrupts, selecting the edge sensitivity, interrupt or Wake-up mode.

The first section describes the data structure used in the *WIU* software library. The second section presents the *WIU* software library functions.

4.18.1 Data Structures

4.18.1.1 WIU Register Structure

The *WIU* peripheral register structure *WIU_TypeDef* is defined in the file *73x_map.h* as follows:

```
typedef struct
{
 vu32 CTRL ;
 vu32 MR  ;
 vu32 TR  ;
 vu32 PR  ;
 vu32 INTR ;
} WIU_TypeDef;
```

The table below describes the *WIU* registers:

Register	Description
CTRL	*Wake-Up* Control Register
MR	*Wake-Up* Mask Register
TR	*Wake-Up* Trigger Register
PR	*Wake-Up* Pending Register
INTR	*Wake-Up* Software Interrupt Register

WIU peripheral is declared in the *73x_map.h* file as follows

```
/* WIU Base Address definition */
#define WIU_BASE     (APB + 0x3800)

/* WIU peripheral pointer declaration*/
#ifndef DEBUG
#define WIU   ((WIU_TypeDef *) WIU_BASE)
...
else
...
EXT WIU_TypeDef  *WIU;
...
#endif
```

When debug mode is used, *WIU* pointer is initialized in *73x_lib.c* file:

```
#ifdef _WIU
 WIU = (WIU_TypeDef *)WIU_BASE;
#endif /* _WIU */
```

In debug mode, *_WIU* must be defined, in *73x_conf.h* file, to include the *WIU* library

```
#define _WIU
```

Some CFG registers are used in the main application to enable the Clock of the peripheral, in the file *73x_conf.h*, to make the *CFG* accessible, user must define:

```
#define _CFG
```

4.18.1.2 WIU_InitTypeDef Structure

The *WIU_InitTypeDef* structure defines the control setting for the WIU cell.

```
typedef struct
{
  u8  WIU_Mode;
  u8  WIU_TriggerEdge;
  u32 WIU_Line;
}WIU_InitTypeDef;
```

Members

- **WIU_Mode**

  Specifies the WIU mode to be used.

  This member can be one of the following values.

WIU_Mode	Description
WIU_Mode_WakeUp	Wake-up lines will be used to Wake Up the system from the STOP mode.
WIU_Mode_Interrupt	Wake-up lines will be used to generate an interrupt on the WIU channel.
WIU_Mode_WakeUpInterrupt	Wake-up lines will be used to Wake Up the system from the STOP mode and generate an interrupt on the WIU channel.
WIU_Mode_SWInterrupt	Wake-up lines will be used to generate software interrupt on the WIU channel.

- **WIU_TriggerEdge**

  Specifies the triggering edge of the Wake-up line.

  This member can be one of the following values.

WIU_TriggerEdge	Description
WIU_FallingEdge	The Wake-Up event/interrupt will be set on the falling edge.
WIU_RisingEdge	The Wake-Up event/interrupt will be set on the rising edge.

- **WIU_Line**

  Specifies the wake-up line to be configured.

4.18.2 Common Parameter Values

4.18.2.1 WIU_Line

The table below shows the *WIU_Line* parameter value:

Lines value	Corresponding Line
WIU_Line0	wake-up line 0
WIU_Line1	wake-up line 1
WIU_Line2	wake-up line 2
WIU_Line3	wake-up line 3
WIU_Line4	wake-up line 4
WIU_Line5	wake-up line 5
WIU_Line6	wake-up line 6
WIU_Line7	wake-up line 7
WIU_Line8	wake-up line 8
WIU_Line9	wake-up line 9
WIU_Line10	wake-up line 10
WIU_Line11	wake-up line 11
WIU_Line12	wake-up line 12
WIU_Line13	wake-up line 13
WIU_Line14	wake-up line 14
WIU_Line15	wake-up line 15
WIU_Line16	wake-up line 16
WIU_Line17	wake-up line 17
WIU_Line18	wake-up line 18
WIU_Line19	wake-up line 19
WIU_Line20	wake-up line 20
WIU_Line21	wake-up line 21
WIU_Line22	wake-up line 22

Lines value	Corresponding Line
WIU_Line23	wake-up line 23
WIU_Line24	wake-up line 24
WIU_Line25	wake-up line 25
WIU_Line26	wake-up line 26
WIU_Line27	wake-up line 27
WIU_Line28	wake-up line 28
WIU_Line29	wake-up line 29
WIU_Line30	wake-up line 30
WIU_Line31	wake-up line 31

4.18.3 Software Library Functions

The following table enumerates the different functions of the *WIU* library.

Function Name	Description
WIU_Init	Initialize the WIU unit according to the specified parameters in the WIU_InitTypeDef structure.
WIU_DeInit	Deinitializes the WIU unit registers to their default reset values.
WIU_StructInit	Fill in a WIU_InitTypeDef structure with the reset value of each parameter.
WIU_EnterStopMode	Executes STOP mode entering sequence.
WIU_GetITLineValue	Return the value of the WIU line generating an interrupt.
WIU_PendingBitClear	Clear the pending bit of the selected WIU line

4.18.3.1 WIU_Init

Function Name	WIU_Init
Function Prototype	`void WIU_Init(WIU_InitTypeDef* WIU_InitStruct)`
Behavior Description	Initializes WIU peripheral according to the specified parameters in the WIU_InitTypeDef structure.
Input Parameter	*WIU_InitStruct*: pointer to a *WIU_InitTypeDef* structure that contains the configuration information for the specified WIU peripheral.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to configure the WIU unit:

```
{
 ...
 /* Set the a WIU_InitTypeDef structure with the needed configuration*/
 WIU_InitStructure.WIU_Mode = WIU_Mode_WakeUp;
 WIU_InitStructure.WIU_Line = WIU_Line11;
 WIU_InitStructure.WIU_TriggerEdge = WIU_FallingEdge;

 /* Configure the WIU unit*/
 WIU_Init(&WIU_InitStructure);

 ...
}
```

4.18.3.2 WIU_DeInit

Function Name	WIU_DeInit
Function Prototype	`void WIU_DeInit(void)`
Behavior Description	Deinitializes WIU peripheral registers to their default reset values.
Input Parameter	None
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialize the WIU registers to their reset value:

```
{
 ....
 WIU_DeInit();
 ....
}
```

4.18.3.3 WIU_StructInit

Function Name	WIU_StructInit
Function Prototype	`void WIU_StructInit(WIU_InitTypeDef* WIU_InitStruct)`
Behavior Description	Fill in a WIU_InitTypeDef structure with the reset value of each parameter (which depend on the register reset value).
Input Parameter	*WIU_InitStruct*: pointer to a *WIU_InitTypeDef* structure which will be initialized.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialise WIU Init Structure fields:

```
{

  WIU_InitTypeDef WIU_InitStructure;
 ...
  WIU_StructInit(&WIU_InitStructure);
 ...
}
```

4.18.3.4 WIU_EnterStopMode

Function Name	WIU_EnterStopMode
Function Prototype	`void WIU_EnterStopMode(void)`
Behavior Description	Executes STOP mode entering sequence.
Input Parameter	None
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enter stop mode:

```
{
  ...
  WIU_EnterStopMode():
  ...
}
```

4.18.3.5 WIU_GetITLineValue

Function Name	WIU_GetITLineValue
Function Prototype	`u32 WIU_GetITLineValue(void)`
Behavior Description	Return the value of the WIU line generating an interrupt
Input Parameter	None
Output Parameter	None
Return Value	The number of the line that generates the interrupt.
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to return the line number that generates the interrupt:

```
{
  ...
  u32 wLines = WIU_GetITLineValue();
  ...
}
```

4.18.3.6 WIU_PendingBitClear

Function Name	WIU_PendingBitClear
Function Prototype	`void WIU_PendingBitClear(u32 WIU_Line)`
Behavior Description	Clear the pending bit of the selected WIU line
Input Parameter	*WIU_Line* : Wake-up line to clear its pending bit. Refer to section 4.18.2 on page 296 for details on the allowed values of *WIU_Line* parameter.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example clears the WIU line3 pending bit:

```
{
 ...
 WIU_PendingBitClear(WIU_Line3);
 ...
}
```

4.19 WAKE-UP TIMER (WUT)

The *WUT* driver may be used for several purposes. The first section describes the data structure used in the *WUT* software library. The second section presents the *WUT* software library functions.

4.19.1 Data Structures

4.19.1.1 WUT Register Structure

The *WUT* peripheral register structure *WUT_TypeDef* is defined in the file *73x_map.h* as follows:

```
typedef struct
{
 vu16 CR  ;
 u16  EMPTY1;
 vu16 PR  ;
 u16  EMPTY2;
 vu16 VR  ;
 u16  EMPTY3;
 vuc16 CNT ;
 u16  EMPTY4;
 vu16 SR  ;
 u16  EMPTY5;
 vu16 MR  ;
 u16  EMPTY6;
} WUT_TypeDef;
```

The table below describes the *WUT* registers:

Register	Description
CR	*WUT* Control Register
PR	*WUT* Prescaler Register
VR	*WUT* Pre-load Value Register
CNT	*WUT* Counter Register
SR	*WUT* Status Register
MR	*WUT* Mask Register

WUT peripheral is declared in the *73x_map.h* file as follows

```
/* WIU Base Address definition */
#define WUT_BASE     (APB + 0x2600)

/* WUT peripheral pointer declaration*/
#ifndef DEBUG
#define WUT   ((WUT_TypeDef *) WUT_BASE)
```

```
...
else
...
EXT WIU_TypeDef  *WUT;
...
#endif
```

When debug mode is used, *WUT* pointer is initialized in *73x_lib.c* file:

```
#ifdef _WUT
  WUT = (WUT_TypeDef *)WUT_BASE;
#endif /* _WUT */
```

In debug mode, *_WUT* must be defined, in *73x_conf.h* file, to include the *WUT* library

```
#define _WUT
```

Some CFG registers are used in the main application to enable the Clock of the peripheral, in the file *73x_conf.h*, to make the *CFG* accessible, user must define:

```
#define _CFG
```

4.19.1.2 WUT_InitTypeDef Structure

The WUT_InitTypeDef structure defines the control setting for the Wake-Up Timer peripheral.

```
typedef struct
{       u16 WUT_Mode;
        u16 WUT_CLK_Source;
        u16 WUT_Prescaler;
        u16 WUT_Preload;
}WUT_InitTypeDef;
```

Members

- **WUT_Mode**

  Specifies the WUT peripheral mode.

  This member can be one of the following values

WUT Modes	Meaning
WUT_Mode_WakeUp	WUT in a WakeUp mode
WUT_Mode_Timer	WUT in a Timer mode

- **WUT_CLK_Source**

  Specifies the clock source of the WUT peripheral.

This member can be one of the following values.

WUT_CLK	Meaning
WUT_CLK_EXTERNAL	Internal RC source clockis used
WUT_CLK_INTERNAL	Main clock source is used (MCLK)

- **WUT_Prescaler**

  Specifies the Prescaler value to divide the clock source the allowed value from 0 to 0xFF.

- **WUT_Preload**

  This value is loaded in the Timer Counter when it starts counting.

4.19.2 Common parameters values

4.19.2.1 WUT_FLAGS

WUT flags	Meaning
WUT_FLAG_BSYVR	Reload Value Register Busy
WUT_FLAG_BSYPR	Prescaler Register Busy
WUT_FLAG_BSYCR	Control Register Busy
WUT_FLAG_EC	End of Count pending bit.

4.19.2.2 WUT Modes

4.19.3 Software Library Functions

The following table enumerates the different functions of the *WUT* library

Function Name	Description
WUT_DeInit	Deinitialises the WUT registers to their reset value
WUT_Init	Initialises the WUT by configuring its functionalities
WUT_Cmd	Start or stop the free auto-reload timer to count down.
WUT_StructInit	Fill in a WUT_InitTypeDef structure with the reset value of each parameter.
WUT_GetCounterValue	Reads and returns the current WUT counter value.
WUT_FlagStatus	returns the status of the flag passed as parameter.
WUT_ITConfig	Enable or disable the end of count interrupt
WUT_FlagClear	Clear the End of Counter flag.
WUT_SetBusySignal	Determines whether the software can read the busy bits in the WUTSR.

4.19.3.1 WUT_Init

Function Name	WUT_Init
Function Prototype	`void WUT_Init (WUT_InitTypeDef *WUT_InitStruct);`
Behavior Description	This routine is used to configure the WUT functionalities.
Input Parameter	WUT_InitStruct: the structure containing the initialisation parameter of the WUT. For more details refer to section 4.19.1.1 on page 302.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following examples illustrates how to configure the WUT peripheral

```
{
  ...
  WUT_Init (&Init_Structure);
  ...
}
```

4.19.3.2 WUT_DeInit

Function Name	WUT_DeInit
Function Prototype	`void WUT_DeInit(void)`
Behavior Description	Deinitializes WUT peripheral control and registers to their default reset values.
Input Parameter	None
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following examples illustrates how to de-initialize the WUT peripheral

```
{
  WUT_DeInit();
}
```

4.19.3.3 WUT_StructInit

Function Name	WUT_StructInit
Function Prototype	`void WUT_StructInit(WUT_InitTypeDef* WUT_InitStruct)`
Behavior Description	Fill in a WUT_InitTypeDef structure with the reset value of each parameter (which depend on the register reset value).
Input Parameter	*WUT_InitStruct*: pointer to a *WUT_InitTypeDef* structure which will be initialized.
Output Parameter	None
Return Value	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to initialise WUT Init Structure fields:

```
{
WUT_InitTypeDef WUT_InitStructure;
...
WUT_StructInit(&WUT_InitStructure);
}
```

4.19.3.4 WUT_Cmd

Function Name	WUT_Cmd
Function Prototype	`void WUT_Cmd(FunctionalState NewState)`
Behavior Description	Write the appropriate value in the control register in order to start or stop the timer
Input Parameter	ENABLE: to start the counter DISABLE: to stop the counter
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following examples illustrates how to enable then disable the WUT peripheral

```
{
WUT_Cmd (ENABLE);
...
WUT_Cmd (DISABLE);
}
```

4.19.3.5 WUT_FlagStatus

Function Name	WUT_FlagStatus
Function Prototype	`flagstatus WUT_FlagStatus (u16 WUT_Flag)`
Behavior Description	This routine returns the status of the specified flag.
Input Parameter	`WUT_Flag`: specifies the flag to test the status. Refer to section 4.19.2.1 on page 304 for more details on the allowed values of this parameter.
Output Parameter	None
Return Parameter	The status of the specified flag. SET: the flag is set. RESET: the flag is reset.
Required preconditions	None
Called Functions	None

Example:

The following examples illustrates how to check the FLAG_BSYVR of the WUT peripheral:

```
if (WUT_FlagStatus(WUT_FLAG_BSYVR))
{
 ...
}
```

4.19.3.6 WUT_Flagclear

Function Name	WUT_ECFlagClear
Function Prototype	`void WUT_FlagClear (void)`
Behavior Description	Clear the The End of Count flag
Input Parameter	None
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to clear the End Of Count Flag of the WUT :

```
{
 WUT_FlagClear();
}
```

4.19.3.7 WUT_GetCounterValue

Function Name	WUT_GetCountervalue
Function Prototype	`u16 WUT_GetCounterValue (void)`
Behavior Description	This routine is used to get the counter value.
Input Parameter	None
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to get tthe WUT counter value:

```
{
  u16 Myvalue = WUT_GetCounterValue();
}
```

4.19.3.8 WUT_ITConfig

Function Name	WUT_ITConfig
Function Prototype	`void WUT_ITConfig(FunctionalState NewState)`
Behavior Description	Enable or disable the end of count interrupt
Input Parameter1	*NewState*: new state of the WUT peripheral. This parameter can be *ENABLE* or *DISABLE*.
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to enable the end of count interrupt of the WUT:

```
{
...
 WUT_ITConfig (Enable);
...
}
```

4.19.3.9 WUT_SetBusySignal

Function Name	WUT_SetBusySignal
Function Prototype	`void WUT_SetBusySignal (fonctionalstate NewState)`
Behavior Description	This routine is used to determines whether the software can read the busy bits in the WUTSR.
Input Parameter	NewState: ENABLE: Busy bit are not masked. DISABLE: Busy bit are masked
Output Parameter	None
Return Parameter	None
Required preconditions	None
Called Functions	None

Example:

The following example illustrates how to read the busy bits in the WUT peripheral:

```
{
  WUT_SetBusySignal (ENABLE);
}
```

5 REVISION HISTORY

Date	Revision	Main changes
27-Sep-2005	1	First Revision

THE SOFTWARE INCLUDED IN THIS MANUAL IS FOR GUIDANCE ONLY. STMICROELECTRONICS SHALL NOT BE HELD LIABLE FOR ANY DIRECT, INDIRECT OR CONSEQUENTIAL DAMAGES WITH RESPECT TO ANY CLAIMS ARISING FROM USE OF THE SOFTWARE.