

C Flash Drivers for T89C51RC/RB/IC2 and AT89C51RC/RB/IC2 for Keil Compilers

This application note describes C routines for Keil® compiler to perform In-application Programming/Self programming according to the “T89C51RC/RB/IC2 and AT89C51RC/RB/IC2 Datasheet”.

The T89C51RC/RB/IC2 and AT89C51RC/RB/IC2 provide an on-chip UART Bootloader which contains routines to perform In-Application Programming/Self Programming.

The routine may be called at one entry point but with varying values in global variables to perform the following operations:

- Read/Write Flash memory
- Read/Write Device ID
- Block Erase
- Read/Write Configuration Byte
- Bootloader start

The Flash_api library provides a mean to perform all operations by making function calls in C language. The Flash_api library provides a standard way to call these functions in C language. It has been done for Keil C-compilers parameter conventions but can be adapted for others. The library also provides Macros and pre-defined values to ease certain operations.



**8051
Microcontrollers**

**Application
Note**

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Interface with UART Bootloader

The interface is described in the T89C51RC/RB/IC2 and AT89C51RC/RB/IC2 UART Datasheets.

(see section In-Application Programming/Self Programming in the T89C51RC/RB/IC2 and AT89C51RC/RB/IC2 Datasheets.)

Library Usage

Adding to a Project

The library consists of two source files:

- flash_api.c
- flash_lib.a51

and two C header files:

- flash_api.h
- config.h

The library is dedicated to Keil 8051 compilers.

To use the library, simply add the source files "flash_api.c" and "flash_lib.a51" to your project and include "flash_api.h" in all C source files that use the library. The content of the config.h can easily be added to one of your include files. You also need to include the standar header SFR file.

The library can be easily configured with the "flash_api.h" file. Thus, only the needed functions can be compiled.

Execution Environment

Each function in the library modifies the configuration of the microcontroller in the following ways during the function call (the configuration is restored at the end of the function call):

- All interrupts are disabled during write access to code Flash.
- The Hardware Watchdog Timer is not disable. Thus, the user has to take care of it before launching a Flash operation (see T89C51RC/RB/IC2 and AT89C51RC/RB/IC2 Datasheets).

Description

Description of Types

Uchar : unsigned char

Uuint16 : unsigned short

ssb_t : enum

NO_SECURITY

WR_SECURITY

RD_WR_SECURITY

eeeprom_t : enum

EEPROM_NOT_BUSY

EEPROM_BUSY

block_t : enum

BLOCK_0

BLOCK_1

Functions

Function	Parameters	Return
__api_rd_code_byte	adress	value
__api_wr_code_byte	address, value	state
__api_wr_code_page	pt_code, pt_xram, nb_data	state
__api_erase_block	num_block	state
__api_rd_HSB	-	value
__api_set_X2	-	state
__api_clr_X2	-	state
__api_set_BLJB	-	state
__api_clr_BLJB	-	state
__api_rd_BSB	-	value
__api_wr_BSB	value	state
__api_rd_SBV	-	value
__api_wr_SBV	value	state
__api_erase_SBV	-	state
__api_rd_SSB	-	value
__api_wr_SSB	value	state
__api_rd_EB	-	value
__api_wr_EB	value	state
__api_rd_manufacturer	-	value
__api_rd_device_id1	-	value
__api_rd_device_id2	-	value

Function	Parameters	Return
__api_rd_device_id3	-	value
__api_rd_bootloader_version	-	value
__api_eeprom_busy)	-	state
__api_rd_eeprom_byte	address	value
__api_wr_eeprom_byte	address, value	state
__api_start_bootloader	-	-

Description of Functions

`__api_rd_code_byte`

This macro is used to read a byte value in Flash memory for a given address. Prototype:

– `Uchar __api_rd_code_byte (Uchar code * pt_address)`

- Input:
 - `pt_address`: address of the byte to read in the Flash memory
- Output:
 - return value read
- Example:

```
Uchar read_value;
read_value = __api_rd_code_byte (0x100);
```

`__api_wr_code_byte`

This function is used to write a byte in Flash memory on given address. To use this function `__API_WR_CODE_BYTE` constant must be defined in `flash_api.h` file, otherwise the function is not compiled.

- Prototype:
 - `Uchar __api_wr_code_byte (Uint16 pt_address, Uchar value)`
- Input:
 - `pt_address`: address where byte must be written
 - `value`: byte to write in Flash memory
- Output:
 - return = 0x00 -> program success
 - return != 0x00 -> program fail
- Example:

```
if (__api_wr_code_byte(0x500, 0x55) == 0x00)
/* program succeeded */
else
/* program failed */
```

`__api_wr_code_page`

This function writes up to 128 bytes from XRAM to Flash memory from a given start address. To use this function `__API_WR_CODE_PAGE` constant must be defined in `flash_api.h` file, otherwise the function is not compiled.

All data must be in the same page (see section “program code/memory” in the T89C51RC/RB/IC2 and AT89C51RC/RB/IC2 Datasheet).

- Prototype:
 - `Uchar __api_wr_code_page (Uint16 pt_code, Uint16 pt_xram, Uchar nb_data)`
- Input:
 - `pt_code`: pointer on the first Flash memory address to write
 - `pt_xram`: pointer on the first XRAM data to read
 - `nb_data`: number of byte to write in Flash memory
No more than 128 bytes.

- Output:
 - return = 0x00 -> program success
 - return != 0x00 -> program fail

- Example:

```
xdata Uchar buffer[128] = {0x55,..., 0x55};
if(__api_wr_code_page(0x0000, &buffer[], 128)==0x00)
/* program succeeded */
else
/* program failed */
```

__api_erase_block

This function is used to erase one of the 3 blocks in Flash memory:

BLOCK_0: 0000h to 1FFFh

BLOCK_1: 2000h to 3FFFh

BLOCK_2: 4000h to 7FFFh

To use this function __API_FCT_SET_1 constant must be defined in flash_api.h file, otherwise the function is not compiled.

- Prototype:
 - Uchar __api_erase_block (block_t num_block)
- Input:
 - num_block: BLOCK_0, BLOCK_1 or BLOCK_2
- Output:
 - state: not used
- Example:


```
__api_erase_block (BLOCK_1);
```

Generic Reading Function

The following functions used the same generic reading function:

```
__api_rd_HSB
__api_rd_BSB
__api_rd_SBV
__api_rd_SSB
__api_rd_EB
__api_rd_manufacturer
__api_rd_device_id1
__api_rd_device_id2
__api_rd_device_id3
__api_rd_bootloader
```

To use these functions __API_FCT_SET_1 constant must be defined in flash_api.h file, otherwise the functions are not compiled.

- Prototype:
 - Uchar __api_rd_XX (void)
- Input:
 - void
- Output:

- XX read

- Example:

```
Uchar XX_value;
XX_value = __api_rd_XX ();
```

Generic Writing Function

The following functions use the same generic writing function:

```
__api_wr_BSB
__api_wr_SBV
__api_wr_EB
```

To use these functions `__API_FCT_SET_2` constant must be defined in `flash_api.h` file, otherwise the functions are not compiled.

- Prototype:
 - Uchar __api_wr_XX (Uchar XX)
- Input:
 - XX: value of XX to write
- Output:
 - state: not used
- Example:


```
__api_wr_XX (0x80);
```

__api_wr_SSB

This function is used to program SSB. To use this function `__API_FCT_SET_1` constant must be defined in `flash_api.h` file, otherwise the function is not compiled.

- Prototype:
 - Uchar __api_wr_SSB (ssb_t ssb)
- Input:
 - ssb : value of security to write (NO_SECURITY, WR_SECURITY or RD_WR_SECURITY)
- Output:
 - state: not used
- Example:


```
__api_wr_SSB (WR_SECURITY);
```

__api_erase_SBV

This function is used to erase SBV. To use this function `__API_FCT_SET_1` constant must be defined in `flash_api.h` file, otherwise the function is not compiled.

- Prototype:
 - Uchar __api_erase_SBV (void)
- Input:
 - void
- Output:
 - state: not used
- Example:


```
__api_erase_SBV ();
```

__api_set_X2

This function is used to set bit X2. To use this function `__API_FCT_SET_3` constant must be defined in `flash_api.h` file, otherwise the function is not compiled.

- Prototype:

- Uchar __api_set_X2 (void)
- Input:
 - void
- Output:
 - state: not used
- Example:


```
__api_set_X2 ();
```

__api_clr_X2

This function is used to clear bit X2. To use this function __API_FCT_SET_3 constant must be defined in flash_api.h file, otherwise the function is not compiled.

- Prototype:
 - Uchar __api_clr_X2 (void)
- Input:
 - void
- Output:
 - state: not used
- Example:


```
__api_clr_X2 ();
```

__api_set_BLJB

This function is used to set bit BLJB. To use this function __API_FCT_SET_3 constant must be defined in flash_api.h file, otherwise the function is not compiled.

- Prototype:
 - Uchar __api_set_BLJB (void)
- Input:
 - void
- Output:
 - state: not used
- Example:


```
__api_set_BLJB ();
```

__api_clr_BLJB

This function is used to clear bit BLJB. To use this function __API_FCT_SET_3 constant must be defined in flash_api.h file, otherwise the function is not compiled.

- Prototype:
 - Uchar __api_clr_BLJB (void)
- Input:
 - void
- Output:
 - state: not used
- Example:


```
__api_clr_BLJB ();
```

__api_start_bootloader

This function is used to start the bootloader at address F800h. To use this function `__API_START_BOOTLOADER` constant must be defined in `flash_api.h` file, otherwise the function is not compiled.

- Prototype:
 - `void __api_start_bootloader (void)`
- Input:
 - `void`
- Output:
 - `void`
- Example:

```
__api_start_bootloader();
```

References

- Datasheet T89C51RC/RB/IC2 and AT89C51RC/RB/IC2
- Datasheet Bootloader UART T89C51RC/RB/IC2 and AT89C51RC/RB/IC2



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