



The following document contains information on Cypress products. The document has the series name, product name, and ordering part numbering with the prefix “MB”. However, Cypress will offer these products to new and existing customers with the series name, product name, and ordering part number with the prefix “CY”.

How to Check the Ordering Part Number

1. Go to www.cypress.com/pcn.
2. Enter the keyword (for example, ordering part number) in the **SEARCH PCNS** field and click **Apply**.
3. Click the corresponding title from the search results.
4. Download the Affected Parts List file, which has details of all changes

For More Information

Please contact your local sales office for additional information about Cypress products and solutions.

About Cypress

Cypress is the leader in advanced embedded system solutions for the world's most innovative automotive, industrial, smart home appliances, consumer electronics and medical products. Cypress' microcontrollers, analog ICs, wireless and USB-based connectivity solutions and reliable, high-performance memories help engineers design differentiated products and get them to market first. Cypress is committed to providing customers with the best support and development resources on the planet enabling them to disrupt markets by creating new product categories in record time. To learn more, go to www.cypress.com.

FR Family, MB91460E Microcontroller Emulation System

This Application Note describing the Emulation tool for MB91460E series. As the emulation device MB91FV460B does not contain the shutdown register and standby RAM, these parts are emulated in Emulation RAM.

1 Introduction

This Application Note describing the Emulation tool for MB91460E series. As the emulation device MB91FV460B does not contain the shutdown register and standby RAM, these parts are emulated in Emulation RAM.

2 Differences between MB91F467E and Emulation System

The chapter describes the differences between the emulation system and MB91F467E series.

The MB91F467E offers a so called the shutdown mode, which is not available in Emulation system. However these missing parts are emulated.

2.1 Overview of the differences

Table 1. Differences of Emulation system and MB91F467E series

Feature	Emulation system	MB91F467E
Standby RAM address range	0x15C008 – 0x15FFFF	0xFFFFAC000 – 0xFFFFAFFFF
Shutdown Control register address	0x15C000 - 0x15C007	0x4D4 - 0x4DB
Shutdown mode	STOP mode will be used instead	available

2.2 Details of differences

2.2.1 Standby RAM address Range

The Emulation system EMA-MB91FV460B-00x does not support standby RAM. For this reason a part of Emulation RAM is used instead. The address range 0x15.0008 to 0x15.FFFF is used for this purpose.

The Emulation system does have 8 Byte less memory space for Standby RAM than series device.

In Emulation system the standby RAM area is always enabled. The RAMEN bit setting in SHDE register does not have any effect at emulation system.

Standby RAM address range using Emulation system: 0x15C008 – 0x15FFFF

Standby RAM address range using MB91F467E series: 0xFFFFAC000 – 0xFFFFAFFFF

In Softune Workbench template project for MB91F467E series, Linker settings are setup accordingly for the two configurations.

Note:

In Emulation system the standby RAM area is always accessible. Standby Ram size is 8 Byte less than series size.

2.2.2 Shutdown Control register address

The Emulation system EMA-MB91FV460B-00x does not support Shutdown register set. These missing register are emulated in Emulation RAM at address range 0x15C000 - 0x15C007. In MB91F467E series, the register address range is 0x04D4 - 0x04DB. The header files overcome the different addresses. The mb91467e.h header file does not contain the shutdown register. These are separated files, one for emulation system (shutdown_emu.h) and one for MB91F467E series (shutdown_flash.h). Depending on HW usage the according header file needs to be used for compilation.

2.2.3 Shutdown mode

As the Emulation system does not support the shutdown register set, it also does not support the shutdown mode. Using Emulation system STOP mode is used instead. Software routines to be included in Application will copy the Shutdown setup and setup the wakeup sources for STOP mode.

As wakeup shutdown mode will issue a reset this is also emulated by Software in emulation system. A software routine is copy the wakeup flags to the shutdown register, emulating a shutdown wakeup reset. In case RTC is used, another SW routine needs to be inserted in start-up code which re-initializes the RTC in emulation system.

Note:

Power consumption measurements in shutdown mode should be done with MB91F467E series.

2.3 Limitations

- **Using Hardware Watchdog in shutdown mode**

In emulation system Hardware watchdog will be enabled in STOP mode, however if HW watchdog reset occurs, no software emulation can be done. There is no possibility to distinguish if HW watchdog occurs in shutdown mode or other mode using emulation system. SHDINT register will not be updated.

- **Using RTC in shutdown mode**

A shutdown wakeup reset does not clear the RTC register in MB91F467E series. In Emulation system the RTC is able to run in Stop mode, however a software reset executed in emulation will reset the register. For this reason the registers are stored in shadow register and restored during startup of application. That means RTC is not operating during Shutdown reset phase of emulation system.

- **Wake-up from shutdown mode**

The Emulation system is doing software reset at end of shutdown recovery, that means that in Reset Cause register a Software reset will be listed this is different to MB91F467E series where INIT cause is listed. The Shutdown wakeup flags (SHDINT and EXTF register) can be checked at the register addresses and contain same values beside of hardware watchdog.

- **Standby RAM size**

The Emulation system standby RAM size is 8Byte less than series standby RAM size.

3 MB91F467E template project

The chapter describes the template project of MB91F467E series.

Cypress is offering a template project for MB91F467E series. It includes some basic settings for e.g. Linker, C-Compiler which must be checked and modified in detail, corresponding to the user application.

3.1 Template file structure

The template project comes with following files:

- Start91460.asm
- Vectors.c / .h

- Mb91467e.h / .asm
- Shutdown.h / .asm
- shutdown_flash.h
- shutdown_emu.h
- Main.c
- shutdown_emulation.c / .h

3.1.1 Start91460.asm

The Start91460.asm file is used to initialize the MCU. Settings like stack size, Clock speed and Bus interface can be set in this file.

3.1.2 Vectors.c / .h

This file contains the Interrupt vector table. In addition the Interrupt level can be set via the ICRxx register.

3.1.3 Mb91467e.h / .asm

This file defines the I/O register of MB91F467E series. The shutdown register are defined in a separate file.

3.1.4 shutdown.h / .asm

The Emulation system and MB91F467E have different addresses for shutdown register. Select in this file which target system (STANDALONE or EMULATION) is used. Depending on this selection a header file is included with offset address for that target system.

Figure 1. shutdown.h file

```

/* SAMPLE CODE
/* ----- */
#define STANDALONE 1
#define EMULATION 2
/* ----- */
// #define TARGET_SYSTEM EMULATION /* macro is defined as project
setting */
/* ----- */
#if (TARGET_SYSTEM == STANDALONE)
#include "shutdown_flash.h"
#elif (TARGET_SYSTEM == EMULATION)
#include "shutdown_emu.h"
#else
#error Target system not supported!
#endif

```

3.1.5 Shutdown_flash.h

This file contains the register definition and addresses of shutdown register for Mb91F467E. (start address: 0x04d4)

3.1.6 Shutdown_emu.h

This file contains the register definition and addresses of shutdown register for Emulation system. (start address 0x150000)

3.1.7 Shutdown_emulation.c / .h

This file is used for emulation system standby emulation. It contains several functions to achieve same behavior of emulation system as MB91F467E series.

The function `Shutdown_SetEmulationWakeupSources()` copies the shut down wakeup sources set in wakeup register to corresponding register in emulation system. External interrupts, RTC and HW watchdog will be set accordingly. This function should be inserted in Application at shutdown emulation preparation stage, after shutdown registers are written by application.

The function `Shutdown_RecoveryEmulation()` is executed after shutdown wakeup occurred. As Emulation system is using STOP mode this function should be insert after Stop mode enter sequence. As it should be executed direct after wakeup. It copies the wakeup source to shutdown register and initializes several registers to default value to achieve same reset value, as shutdown reset will do. RTC and calibration Unit register are stored to be able to be restored again after reset, in case RTC is activated in shutdown mode.

The function `Shutdown_RestoreEmulationRTC()` is restoring the RTC and calibration Register settings. When RTC is active in shutdown mode, this register are not reset in shutdown mode wakeup reset using MB91F467E. The function should be called in the beginning of start-up file after stacks are initialized.

Document History

Document Title: AN205437 - FR Family, MB91460E Microcontroller Emulation System

Document Number: 002-05437

Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	—	NOFL	02/03/2010	V1.0 MSt First draft
			12/08/2010	V1.1 MSt Changed memory addresses for shutdown register and standby Ram Changed to new Company name
*A	5128489	NOFL	04/14/2016	Converted Spansion Application Note "MCU-AN-300118-E-V11" to cypress format.
*B	5872541	AESATMP9	09/04/2017	Updated logo and copyright.
*C	6054547	NOFL	02/12/2018	Update links Updated template

Worldwide Sales and Design Support

Cypress maintains a worldwide network of offices, solution centers, manufacturer's representatives, and distributors. To find the office closest to you, visit us at [Cypress Locations](#).

Products

Arm® Cortex® Microcontrollers	cypress.com/arm
Automotive	cypress.com/automotive
Clocks & Buffers	cypress.com/clocks
Interface	cypress.com/interface
Internet of Things	cypress.com/iot
Memory	cypress.com/memory
Microcontrollers	cypress.com/mcu
PSoC	cypress.com/psoc
Power Management ICs	cypress.com/pmic
Touch Sensing	cypress.com/touch
USB Controllers	cypress.com/usb
Wireless Connectivity	cypress.com/wireless

PSoC® Solutions

[PSoC 1](#) | [PSoC 3](#) | [PSoC 4](#) | [PSoC 5LP](#) | [PSoC 6 MCU](#)

Cypress Developer Community

[Community](#) | [Projects](#) | [Videos](#) | [Blogs](#) | [Training](#) | [Components](#)

Technical Support

cypress.com/support

All other trademarks or registered trademarks referenced herein are the property of their respective owners.



Cypress Semiconductor
198 Champion Court
San Jose, CA 95134-1709

© Cypress Semiconductor Corporation, 2010-2018. This document is the property of Cypress Semiconductor Corporation and its subsidiaries, including Spansion LLC ("Cypress"). This document, including any software or firmware included or referenced in this document ("Software"), is owned by Cypress under the intellectual property laws and treaties of the United States and other countries worldwide. Cypress reserves all rights under such laws and treaties and does not, except as specifically stated in this paragraph, grant any license under its patents, copyrights, trademarks, or other intellectual property rights. If the Software is not accompanied by a license agreement and you do not otherwise have a written agreement with Cypress governing the use of the Software, then Cypress hereby grants you a personal, non-exclusive, nontransferable license (without the right to sublicense) (1) under its copyright rights in the Software (a) for Software provided in source code form, to modify and reproduce the Software solely for use with Cypress hardware products, only internally within your organization, and (b) to distribute the Software in binary code form externally to end users (either directly or indirectly through resellers and distributors), solely for use on Cypress hardware product units, and (2) under those claims of Cypress's patents that are infringed by the Software (as provided by Cypress, unmodified) to make, use, distribute, and import the Software solely for use with Cypress hardware products. Any other use, reproduction, modification, translation, or compilation of the Software is prohibited.

TO THE EXTENT PERMITTED BY APPLICABLE LAW, CYPRESS MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARD TO THIS DOCUMENT OR ANY SOFTWARE OR ACCOMPANYING HARDWARE, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. No computing device can be absolutely secure. Therefore, despite security measures implemented in Cypress hardware or software products, Cypress does not assume any liability arising out of any security breach, such as unauthorized access to or use of a Cypress product. In addition, the products described in these materials may contain design defects or errors known as errata which may cause the product to deviate from published specifications. To the extent permitted by applicable law, Cypress reserves the right to make changes to this document without further notice. Cypress does not assume any liability arising out of the application or use of any product or circuit described in this document. Any information provided in this document, including any sample design information or programming code, is provided only for reference purposes. It is the responsibility of the user of this document to properly design, program, and test the functionality and safety of any application made of this information and any resulting product. Cypress products are not designed, intended, or authorized for use as critical components in systems designed or intended for the operation of weapons, weapons systems, nuclear installations, life-support devices or systems, other medical devices or systems (including resuscitation equipment and surgical implants), pollution control or hazardous substances management, or other uses where the failure of the device or system could cause personal injury, death, or property damage ("Unintended Uses"). A critical component is any component of a device or system whose failure to perform can be reasonably expected to cause the failure of the device or system, or to affect its safety or effectiveness. Cypress is not liable, in whole or in part, and you shall and hereby do release Cypress from any claim, damage, or other liability arising from or related to all Unintended Uses of Cypress products. You shall indemnify and hold Cypress harmless from and against all claims, costs, damages, and other liabilities, including claims for personal injury or death, arising from or related to any Unintended Uses of Cypress products.

Cypress, the Cypress logo, Spansion, the Spansion logo, and combinations thereof, WICED, PSoC, CapSense, EZ-USB, F-RAM, and Traveo are trademarks or registered trademarks of Cypress in the United States and other countries. For a more complete list of Cypress trademarks, visit cypress.com. Other names and brands may be claimed as property of their respective owners.