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.

AN204359

Application to Reduce the Calculation Processing Time for F2MC-16LX/16FX Family 16-Bit Microcontroller

Associated Part Family: MB90340/MB96340

This document describes how to reduce the processing time of calculation formulas in source code of the F2MC-16LX/16FX.

1 Introduction

This document describes how to reduce the processing time of calculation formulas in source code of the F2MC-16LX/16FX.

Modifying divisions in a formula to multiplications reduces the processing time. The difference in processing time as a result of modifying a formula is indicated for cases with F2MC-16LX (MB90340) and F2MC-16FX (MB96340).

2 Modifying a Formula to Reduce the Processing Time

The following describes how to modify a formula to reduce the processing time.

2.1 How to Modify a Formula

Modify a division (B / C) to a multiplication (B * (1 / C)) to reduce the processing time as indicated by **(1)**.

<Modification method>

Formula:A =B/C ⟶ A = B *(1 / C)

(1)

While the result A is a variable, B and C can be either a variable or constant (numeric value).

For example, modify the formula in source code (C language) of F^{2}MC-16LX/16FX as indicated in the following Figure 1 and 2.

Figure 1. Formula before Modification

```
void Main(void){
int A, C, E;
int B = 800, D = 1;
A = B * 4 + 800;
C = D * 8;

(2)
E=(A / 25) / (C * 5); /* Formula 1 */

}          (3)
```

Figure 2. Formula after Modification

```
void Main(void){
int A, C, E;
int B = 800, D = 1;
A = B * 4 + 800;
C = D * 8;


E=(A * (1 / 25)) * (1 / (C * 5)); /* Formula 1 */

}
```

(2) and **(3)** in Formula 1 in Figure 1 are divisions. They are modified as shown in Figure 2.

(2) is modified as below.

A / 25 ⟶ A * (1 / 25)

Also, **(3)** is modified as below. The above **(2)** is replaced with **F** to simplify the formula.

F / (C *5) ⟶ F *(1 /(C *5))

The processing time is reduced after the above modification. The next section shows the actual processing results

3 Resulting Processing Time after Modifying a Formula

The following indicates the difference in processing time when the modified formula is executed by Softune.

3.1 Resulting Processing Time Executed by Softune

The following results are the processing time of formulas in Figure 1 and Figure 2 by Softune using F^{2}MC-16LX (MB90340) and F^{2}MC-16FX (MB96340).

Table 1. Processing Time of Formula 1 on F2MC-16LX (MB90340) and F2MC-16FX (MB96340)

CPU core		F^{2}MC-16LX		F^{2}MC-16FX	
Model		MB90340		MB96340	
Operating frequency		16 MHz	24 MHz	24 MHz	56 MHz
Processing time of Formula 1 (* number of cycles in parenthesizes)	**Before modification**	7.68 (µs) (148)	5.12 (µs)	3.00 (µs) (42)	1.28 (µs)
	After modification	4.88 (µs) (133)	3.28 (µs)	2.16 (µs) (32)	0.94 (µs)

As demonstrated above, modifying divisions to multiplications in source code of F^{2}MC-16LX/16FX reduced the processing time by approximately 30%. Therefore, modifying formulas is a very effective means of reducing processing time of F^{2}MC-16LX/16FX.

Document History

Document Title: AN204359 - Application to Reduce the Calculation Processing Time for F2MC-16LX/16FX Family 16-Bit Microcontroller

Document Number: 002-04359

Revision	ECN	Orig. of Change	Submission Dat	Description of Change
**	-	YUIS	09/28/2009	Initial Release
*A	5037988	YUIS	12/04/2015	Migrated Spansion Application Note from AN07-00214-1E to Cypress format
*B	5873442	AESATP12	09/06/2017	Updated logo and copyright.

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

Cypress Developer Community

Forums | WICED IOT Forums | 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, 2009-2017. 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. 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.