Outlines

This application note is a reference material for developing products using Flash Memory (FLASH128_32-A) functions of M3H Group(1).
This document helps the user check operation of the product and develop its program.

Target sample program: Flash_Userboot
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1. Preface

This sample program is used to check the operation of Flash memory function. It writes the Flash memory and executes the program in the Flash memory.

Structure diagram of Sample program

![Structure diagram of Sample program](image)
2. Reference Document
- Datasheet
  TMPM3H group (1) datasheet Rev2.0 (Japanese edition)
- Reference manual
  Flash memory (FLASH128_32_A) Rev1.1 (Japanese edition)
- Other reference document
  TMPM3H(1) Group Peripheral Driver User Manual (Doxygen)

3. Function to Use

<table>
<thead>
<tr>
<th>IP</th>
<th>channel</th>
<th>port</th>
<th>Function / operation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash memory</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Asynchronous communication</td>
<td>ch1</td>
<td>PA1 (UT0TXDA) PA2 (UT0RXD)</td>
<td>UART mode</td>
</tr>
<tr>
<td>Input and output port</td>
<td>-</td>
<td>PN4 (Input Port)</td>
<td>Input</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>PB4 (Output Port) PB5 (Output Port) PB6 (Output Port) PB7 (Output Port)</td>
<td>Output</td>
</tr>
</tbody>
</table>

4. Target Device

The target devices of application note are as follows.

<table>
<thead>
<tr>
<th>TMPM3H6FWFG</th>
<th>TMPM3H6FUFG</th>
<th>TMPM3H6FSFG</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMPM3H6FWDFG</td>
<td>TMPM3H6FUDFG</td>
<td>TMPM3H6FSDFG</td>
</tr>
<tr>
<td>TMPM3H5FWFG</td>
<td>TMPM3H5FUFG</td>
<td>TMPM3H5FSFG</td>
</tr>
<tr>
<td>TMPM3H5FWDFG</td>
<td>TMPM3H5FUDFG</td>
<td>TMPM3H5FSDFG</td>
</tr>
<tr>
<td>TMPM3H4FWUG</td>
<td>TMPM3H4FUUG</td>
<td>TMPM3H4FSUG</td>
</tr>
<tr>
<td>TMPM3H4FWFG</td>
<td>TMPM3H4FUFG</td>
<td>TMPM3H4FSFG</td>
</tr>
<tr>
<td>TMPM3H3FWUG</td>
<td>TMPM3H3FUUG</td>
<td>TMPM3H3FSUG</td>
</tr>
<tr>
<td>TMPM3H2FWDUG</td>
<td>TMPM3H2FUDUG</td>
<td>TMPM3H2FSDUG</td>
</tr>
<tr>
<td>TMPM3H2FWQG</td>
<td>TMPM3H2FUQG</td>
<td>TMPM3H2FSQG</td>
</tr>
<tr>
<td>TMPM3H1FWUG</td>
<td>TMPM3H1FUUG</td>
<td>TMPM3H1FSUG</td>
</tr>
<tr>
<td>TMPM3H1FPUG</td>
<td>TMPM3H0FSDUG</td>
<td>TMPM3H0FMDUG</td>
</tr>
</tbody>
</table>

* This sample program operates on the evaluation board of TMPM3H6FWFG.
  If other function than the TMPM3H6 one is checked, it is necessary that CMSIS Core related files (C startup file and IO header file) should be changed properly.
  The BSP related file is dedicated to the evaluation board (TMPM3H6). If other function than the TMPM3H6 one is checked, the BSP related file should be changed properly.
### 5. Operation confirmation condition

<table>
<thead>
<tr>
<th>Used microcontroller</th>
<th>TMPM3H6FWFG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used board</td>
<td>TMPM3H6FWFG Evaluation Board (Product of Sensyst)</td>
</tr>
<tr>
<td>Unified development environment</td>
<td>IAR Embedded Workbench for ARM 8.11.2.13606</td>
</tr>
<tr>
<td>Unified development environment</td>
<td>μVision MDK Version 5.24.2.0</td>
</tr>
<tr>
<td>Terminal software</td>
<td>Tera Term V4.96</td>
</tr>
<tr>
<td>Sample program</td>
<td>V1100</td>
</tr>
</tbody>
</table>

For purchasing the board, refer to the following homepage. ([http://www.chip1stop.com/](http://www.chip1stop.com/))
6. Evaluation Board Setting

The following pin connections should be done on the evaluation board.

<table>
<thead>
<tr>
<th>CN5</th>
<th>Use</th>
<th>Through-hole No.</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UART (RXD)</td>
<td>9-10</td>
<td>Connection</td>
</tr>
<tr>
<td></td>
<td>UART (TXD)</td>
<td>11-12</td>
<td>Connection</td>
</tr>
<tr>
<td></td>
<td>LED (D10)</td>
<td>27-28</td>
<td>Connection</td>
</tr>
<tr>
<td></td>
<td>LED (D9)</td>
<td>29-30</td>
<td>Connection</td>
</tr>
<tr>
<td></td>
<td>LED (D8)</td>
<td>31-32</td>
<td>Connection</td>
</tr>
<tr>
<td></td>
<td>LED (D7)</td>
<td>33-34</td>
<td>Connection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CN9</th>
<th>Use</th>
<th>Through-hole No.</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Push SW (S4)</td>
<td>19-20</td>
<td>Connection</td>
</tr>
</tbody>
</table>

7. Operation of Evaluation Board

Connect the PC and USB_UART terminal of the evaluation board with a USB cable. After PC starts terminal software (Tera Term), communication setting is executed. Push the reset button on the evaluation board.
8. Outline of Flash Memory function

The code flash which stores a program code, and the data flash which saves data are explained.
A code flash stores an instruction code, and CPU reads and executes it.
There is user information area which can be accessed in a code flash by bank change. Since user information area is not erased by a chip erasing command, for example, it can be written a unique management number etc. for every chip.
A data flash stores data, and even if power supply is intercepted, it keeps data.
9. Sample Program

The write of the Flash memory is done in the user boot mode.
Programs A and B with different LED display patterns are prepared in this sample program.

9.1. Initialization

The following initialization is done after power is supplied.
The port setting is executed after the initialization of each clock setting, the watchdog timer setting and the clock setting.

9.2. Sample program main operation

After the initialization operation, shift to the main function and do the following initialization.
1: Initialization of BSP (Board Support Package)
2: Initialization of variables
3: Initialize the driver
4: Initialize the application
5: Enable internal oscillation circuit

The following operations should be done on the terminal software (Tera Term) on PC.
The main procedure starts up, then, the user program (Program A) should be executed. The write procedure, Program A, and Program B should be stored to RAM by pushing the SW.
The Flash areas for Program A and B should be erased. Program B in RAM should be written to the Program A area in the Flash memory, and Program A in RAM should be written to the Program B area in the Flash memory.
The user program (Program B) should be executed by the main procedure. The similar procedure repeats with writing Program A and B alternately. The operation status is displayed via the UART interface.
9.3. Output Example of Sample Program

When the sample program operates, the command results are shown as follows;

```
AAAAAAAAAAAAA
Execute Data A
Please press the S4
RAM transferring.
Erasing.
Rewriting.
Finished.
AAAAAAAAAAAAA
Execute Data B
Please press the S4
RAM transferring.
Erasing.
Rewriting.
Finished.
AAAAAAAAAAAAA
Execute Data A
Please press the S4
```
9.3.1. Setting Example of Terminal Software

The operation of the terminal software (Tera Term) has been checked with the following settings.

**Tera Term: Serial port setup**
- **Port:** COM9
- **Baud rate:** 115200
- **Data:** 8 bit
- **Parity:** none
- **Stop:** 1 bit
- **Flow control:** none

Transmit delay
- 0 msec/char
- 0 msec/line

**Tera Term: Terminal setup**
- **Terminal size:** 80 X 24
- **New-line:**
  - **Receive:** AUTO
  - **Transmit:** CR+LF
- **Term size = win size**
- **Auto window resize**
- **Terminal ID:** VT100
- **Local echo**
- **Auto switch (VT<->TEK)**
9.4. Operating Flow of Sample program

The operating flows of the sample program are shown as follows.

**Memory map example**

<table>
<thead>
<tr>
<th>Address</th>
<th>Main Program Execution</th>
<th>SW Push-down</th>
<th>Erasing</th>
<th>Re-write and Completion</th>
<th>Main Program Execution</th>
<th>Repeat from “SW push-down”</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAM</td>
<td>Data B copy</td>
<td>Data B copy</td>
<td>Data B erase</td>
<td>Data B copy</td>
<td>RAM</td>
<td></td>
</tr>
<tr>
<td>0x0000_0000</td>
<td>Data A copy</td>
<td>Data A copy</td>
<td>Data A erase</td>
<td>Data A copy</td>
<td>Data B</td>
<td></td>
</tr>
<tr>
<td>0x0001_0000</td>
<td>Data table (Data A)</td>
<td>Data A copy</td>
<td>Data B erase</td>
<td>Data B write</td>
<td>Data table (Data B)</td>
<td></td>
</tr>
<tr>
<td>0x0000_0000</td>
<td>Re-write procedure</td>
<td>Re-write procedure</td>
<td>Re-write procedure</td>
<td>Re-write procedure</td>
<td>Re-write procedure</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>Execute Program A</td>
<td>RAM transferring</td>
<td>Erasing</td>
<td>Rewriting</td>
<td>Execute Program B</td>
<td></td>
</tr>
<tr>
<td>LED</td>
<td>Off Blink Off Blink</td>
<td>Off Blink Off Blink</td>
<td>Off Blink Off Blink</td>
<td>Off Blink Off Blink</td>
<td>Off Blink Off Blink</td>
<td></td>
</tr>
</tbody>
</table>

Please press the S7 button to execute the program.
10. Precaution

When using the sample program with CPU other than TMPM3H6, please check operation sufficiently.

11. Revision History

<table>
<thead>
<tr>
<th>Rev</th>
<th>Date</th>
<th>Page</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>2018-03-05</td>
<td>-</td>
<td>First release</td>
</tr>
</tbody>
</table>
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