F²MC-8FX FAMILY
8-BIT MICROCONTROLLER
MB95410H/470H SERIES

ONE PHASE POWER METER (RN8209) SOLUTION

REAL TIME CLOCK AND DATA STORAGE OPERATION

APPLICATION NOTE
Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Updated by</th>
<th>Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0.0</td>
<td>6/1/2011</td>
<td>Funny Chen</td>
<td>First Draft : Write the user manual of realtime clock and data storage function.</td>
</tr>
</tbody>
</table>

This manual contains 14 pages.

Specifications are subject to change without notice. For further information please contact each office.

**All Rights Reserved.**

The contents of this document are subject to change without notice.

Customers are advised to consult with sales representatives before ordering.

The information, such as descriptions of function and application circuit examples, in this document are presented solely for the purpose of reference to show examples of operations and uses of FUJITSU SEMICONDUCTOR device; FUJITSU SEMICONDUCTOR does not warrant proper operation of the device with respect to use based on such information. When you develop equipment incorporating the device based on such information, you must assume any responsibility arising out of such use of the information. FUJITSU SEMICONDUCTOR assumes no liability for any damages whatsoever arising out of the use of the information.

FUJITSU SEMICONDUCTOR does not warrant proper operation of the device with respect to use based on such information. When you develop equipment incorporating the device based on such information, you must assume any responsibility arising out of such use of the information. FUJITSU SEMICONDUCTOR assumes no liability for any damages whatsoever arising out of the use of the information.

Any information in this document, including descriptions of function and schematic diagrams, shall not be construed as license of the use or exercise of any intellectual property right, such as patent right or copyright, or any other right of FUJITSU SEMICONDUCTOR or any third party or does FUJITSU SEMICONDUCTOR warrant non-infringement of any third-party's intellectual property right or other right by using such information. FUJITSU SEMICONDUCTOR assumes no liability for any infringement of the intellectual property rights or other rights of third parties which would result from the use of information contained herein.

The products described in this document are designed, developed and manufactured as contemplated for general use, including without limitation, ordinary industrial use, general office use, personal use, and household use, but are not designed, developed and manufactured as contemplated (1) for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could have a serious effect to the public, and could lead directly to death, personal injury, severe physical damage or other loss (i.e., nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system), or (2) for use requiring extremely high reliability (i.e., submersible repeater and artificial satellite).

Please note that FUJITSU SEMICONDUCTOR will not be liable against you and/or any third party for any claims or damages arising in connection with above-mentioned uses of the products.

Any semiconductor devices have an inherent chance of failure. You must protect against injury, damage or loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and...
Contents

REVISION HISTORY .............................................................................................................. 2

CONTENTS .......................................................................................................................... 4

1  INTRODUCTION .............................................................................................................. 5

2  BACKGROUND .................................................................................................................. 6
   2.1  Overview ...................................................................................................................... 6

3  HW DIAGRAM .................................................................................................................. 7
   3.1  The HW diagram of real time clock unit and data storage unit ............................ 7

4  HW REFERENCE SCH .................................................................................................... 8

5  FW DIAGRAM ................................................................................................................ 9
   5.1  Real time Clock Unit Communication Protocol ....................................................... 9
   5.2  Data Storage Unit Communication Protocol .......................................................... 11
   5.3  Firmware System Diagram ....................................................................................... 11

6  FW FUNCTION LIST ..................................................................................................... 12
   6.1  API ............................................................................................................................ 12
   6.2  HAL ........................................................................................................................... 12

7  ADDITIONAL INFORMATION ....................................................................................... 13

8  APPENDIX ..................................................................................................................... 14
   8.1  List of Figures and Tables ......................................................................................... 14
1 Introduction

This application note describes how to use One Phase Power Meter (RN8209) solution’s real time clock and data storage function.

Chapter 2 explains the background.

Chapter 3 explains the HW diagram of real time clock and data storage function.

Chapter 4 explains the HW reference SCH.

Chapter 5 explains the FW diagram.

Chapter 6 explains the FW function list.
2 Background

Background of Realtime Clock and Data Storage Function

2.1 Overview

In the power meter solution, real time clock unit is RX8025T, and data storage unit is AT24C64. The communication method between MCU and these two units is I²C communication.
3  HW Diagram

Hardware diagram of real time clock unit and data storage unit

3.1  The HW diagram of real time clock unit and data storage unit

![Diagram](image)

Figure 3-1: Hardware diagram
4 HW Reference SCH

Hardware reference SCH of real time clock unit and data storage unit

Figure 4-1: Realtime Clock Unit

Figure 4-2: Data Storage Unit
5  FW diagram

Firmware system diagram

5.1  Real time Clock Unit Communication Protocol

For RTC function’s communication protocol, refer to the IIC bus protocol which is shown in Figure 5-1.

Description is as below:

(1) Master sends a start condition and a byte data including 7 bits slave address and 1 bit R/W. RTC’s slave address is 0110010.

(2) Master waits ACK from slave.

(3) Master sends a byte RTC register address (0~F), which is shown in Figure 5-2.

(4) Master waits ACK from slave.

(5) Master sends n bytes data to slave. And at the end of each byte master needs to wait slave’s ACK.

(6) Master sends a stop condition to slave.

---

![Figure 5-1: RTC Communication Protocol](image-url)

---

**Figure 5-1: RTC Communication Protocol**

- S = START condition
- P = STOP condition
- A = acknowledge (SDA LOW)
- A̅ = not acknowledge (SDA HIGH)
- 'O' (write)
- \( n \) bytes + acknowledge
- from master to slave
- from slave to master

---
### RTC's register Description

<table>
<thead>
<tr>
<th>Address</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>SEC</td>
</tr>
<tr>
<td>1</td>
<td>MIN</td>
</tr>
<tr>
<td>2</td>
<td>HOUR</td>
</tr>
<tr>
<td>3</td>
<td>WEEK</td>
</tr>
<tr>
<td>4</td>
<td>DAY</td>
</tr>
<tr>
<td>5</td>
<td>MONTH</td>
</tr>
<tr>
<td>6</td>
<td>YEAR</td>
</tr>
<tr>
<td>7</td>
<td>RAM</td>
</tr>
<tr>
<td>8</td>
<td>MIN Alarm</td>
</tr>
<tr>
<td>9</td>
<td>HOUR Alarm</td>
</tr>
<tr>
<td>A</td>
<td>WEEK Alarm</td>
</tr>
<tr>
<td></td>
<td>DAY Alarm</td>
</tr>
<tr>
<td>B</td>
<td>Timer Counter 0</td>
</tr>
<tr>
<td>C</td>
<td>Timer Counter 1</td>
</tr>
<tr>
<td>D</td>
<td>Extension Register</td>
</tr>
<tr>
<td>E</td>
<td>Flag Register</td>
</tr>
<tr>
<td>F</td>
<td>Control Register</td>
</tr>
</tbody>
</table>

Figure 5-2: RTC’s register Description
5.2 Data Storage Unit Communication Protocol

For EEPROM function’s communication protocol, refer to the IIC bus protocol which is shown in Figure 5-1.

Description is as below:

(1) Master sends a start condition and a byte data including 7 bits slave address and 1 bit R/W. EEPROM’s slave address is 1010000.

(2) Master waits ACK from slave.

(3) Master sends 2 bytes EEPROM data address (0x0000~0xFFFF). First sends the address high byte. Then sends the address low byte. And in the end of each byte master needs to wait slave’s ACK.

(4) Master sends n bytes data to slave. And in the end of each byte master need to wait slave’s ACK.

(5) Master sends a stop condition to slave.

5.3 Firmware System Diagram

![Firmware System Diagram](image)

Figure 5-3: Firmware System Diagram
6 FW Function List

6.1 API

Table 6-1: FW API List

<table>
<thead>
<tr>
<th>Function Prototype</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>void RTC_Config(void)</td>
<td>Config working mode for RTC RX8025T</td>
</tr>
<tr>
<td>void RTC_IntDisable(void)</td>
<td>Disable interrupt output for RTC</td>
</tr>
<tr>
<td>void RTC_Read(void)</td>
<td>Read RTC RX8025T calendar data</td>
</tr>
<tr>
<td>void RTC_Write(void)</td>
<td>Set RTC RX8025T calendar data</td>
</tr>
<tr>
<td>void EEPROM_Write(INT8U *eeBuff)</td>
<td>Write a series of data byte to EEPROM</td>
</tr>
<tr>
<td>void EEPROM_Read(INT8U *eeBuff)</td>
<td>Read a series of data byte from EEPROM</td>
</tr>
<tr>
<td>INT8U EEPROM_Write_Verify(INT8U *eeBuff)</td>
<td>Write a series of data byte to EEPROM and verify the result</td>
</tr>
<tr>
<td>INT8U EEPROM_Read_Verify(INT8U *eeBuff)</td>
<td>Read a series of data byte from EEPROM and validate checksum</td>
</tr>
</tbody>
</table>

6.2 HAL

Table 6-2: FW HAL List

<table>
<thead>
<tr>
<th>Function Prototype</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>void IIC_Init(void)</td>
<td>Init IIC bus</td>
</tr>
<tr>
<td>INT8U IIC_Acknowledge(void)</td>
<td>waiting ACK from slave</td>
</tr>
<tr>
<td>INT8U IIC_Start(INT8U slave_address)</td>
<td>Master generates a START condition on IIC bus and transmit slave_address</td>
</tr>
<tr>
<td>INT8U IIC_Restart(INT8U slave_address)</td>
<td>Master generates a RESTART condition on IIC bus</td>
</tr>
<tr>
<td>INT8U IIC_Stop(void)</td>
<td>Master generates a STOP condition on IIC bus</td>
</tr>
<tr>
<td>INT8U IIC_SendByte(INT8U outDat)</td>
<td>Master send out a byte of data and return with ACK/NACK</td>
</tr>
<tr>
<td>INT8U IIC_Write(INT8U *buff, INT8U total)</td>
<td>Master write a string of bytes through IIC us</td>
</tr>
<tr>
<td>INT8U IIC_ReadByte(void)</td>
<td>Master read a byte of data and set ACK/NACK</td>
</tr>
<tr>
<td>INT8U IIC_Read(INT8U *buff, INT16U total)</td>
<td>Master read a string of data bytes through IIC us</td>
</tr>
</tbody>
</table>
7 Additional Information

For more Information on FUJITSU semiconductor products, visit the following websites:

English version address:

http://www.fujitsu.com/cn/fsp/services/mcu/mb95/application_notes.html

Chinese version address:

http://www.fujitsu.com/cn/fss/services/mcu/mb95/application_notes.html
8 Appendix

8.1 List of Figures and Tables

Table 6-1: FW API List .............................................................................................................. 12
Table 6-2: FW HAL List ............................................................................................................ 12

Figure 3-1: Hardware diagram ............................................................................................... 7
Figure 4-1: Realtime Clock Unit .............................................................................................. 8
Figure 4-2: Data Storage Unit .................................................................................................. 8
Figure 5-1: RTC Communication Protocol ............................................................................. 9
Figure 5-2: RTC’s register Description ................................................................................... 10
Figure 5-3: Firmware System Diagram .................................................................................. 11