
CBC921 PMRTC Functions Demo Using CBC-EVAL-14 Tab Board

Introduction

This Application Note describes a demonstration platform for Cymbet's CBC921xxC Power Management with Real-Time Clock (PMRTC) product, providing standard C code that is used to demonstrate various functions of the CBC921 PMRTC. Two hardware development boards are utilized in this demo:

- CBC-921-TAB board from Cymbet's [CBC-EVAL-14 evaluation kit](#)
- Texas Instruments development kit [MSP-EXP430FR2355](#)

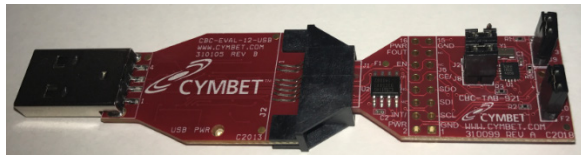
Both development boards are available through Digi-Key:

- CBC-EVAL-14: P/N [859-CBC-EVAL-14-PMRTC-32-ND](#) or P/N [859-CBC-EVAL-14-PMRTC-41-ND](#)
- MSP-EXP430FR2355: P/N [296-50211-ND](#)

Although the CBC-EVAL-14 evaluation kit contains both the CBC921 tab board and USB dongle for access to the tab board via a computer USB port, only the tab board is used in this demonstration. The CBC-EVAL-14 kit uses a separate Graphical User Interface (GUI) from the version described and used in this Application Note. Visit <https://www.cymbet.com/resources/documents-and-downloads/> for product data sheets and software downloads for the CBC921 PMRTC and CBC-EVAL-14 evaluation kit.

Project Requirements:

Cymbet CBC-EVAL-14 evaluation kit
(just the CBC-921-TAB board is used here)



Texas Instruments MSP-EXP430FR2355 development kit



Demo software download, located here:

<https://www.cymbet.com/resources/documents-and-downloads/>

Start-Up Installation

The C code development environment used is [TI Cloud Tools](#). This is a free, web-based development environment. This demo software can be downloaded at <https://www.cymbet.com/resources/documents-and-downloads/>. The download package is labeled **Cymbet CBC921 PMRTC Functions Demo**. Place this software package on the user's hard drive. After signing in to TI Cloud Tools, go to CCS Cloud to start a project. Upload the demo project by going into the File menu and selecting "Upload Local Files" then locating the demo folder on the user's hard drive. Next, under the Project menu, select "Build Project". Then select the Debug button to download the code into the TI development board. The code is heavily commented to guide the user through the CBC921 PMRTC functionality by using break points to observe PMRTC state conditions using "Watch Expressions" and scope/DVM.

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The MSP-EXP430FR2355 kit connects to the user's computer through a USB port. The following wire/jumpers are required to connect the TI development board to the CBC-EVAL-14 tab board:

MSP430 Dev. Board	CBC-EVAL-14 PMRTC	Description
1. P1.5	J5 P16	RTC switched power 3.3VDC
2. GND	J5 P1	RTC ground
3. P1.2	J5 P5	RTC SDA with J9 jumper
4. P1.3	J5 P3	RTC SCL

NOTE: The demo project code is standard C code, which can be ported to any development environment the user chooses to use.

- a. Set nPGD/IRQ Low
 - Write Output Control Reg 0x11 OUTA bits 0,1 = 0x3
- b Set nPGD/IRQ High
 - Write Output Control reg 0x11 OUTA bits 0,1 =0x3, bit 6 OUTA =1

Demo PMRTC Functions

The following RTC functions are demonstrated through code examples with proper sequencing of register assignments to perform the function.

1. Get Temperature

- a. set the WRTC bit 0 Control reg. 0x10
 - allows setting of the time & date regs.
- b. set the WBATMAN bit 1 Control reg. 0x10
 - allows setting the Battery Management Reg bits 0x24
 - Write CHGOFF bit 7 = 1 on Charging Control reg 0x1B – Charging uses ADC, also required for new temperature measurements
- c. toggle MEAS_TEMP bit 8 to low to high
 - Write 0 to the DataTransferCntrl Reg 0x22 // clears bit 7
 - Write 0x80 to DataTransferCntrl Reg 0x22 // toggles bit 7, requests a new temperature reading
- d. loop: check NEW_TEMP flag set when new temp is avail.
 - Read until DataTransferFlags reg. 0x23 bit 7 NEW_TEMP = 1 , new temp is avail.
- e. Get TempADC_Hi reading – upper 8 bits of ADC
 - Read TempADC_Hi reg. 0x1E
- f. Get TempADC_Lo reading - lower 2 bits of 10 bit ADC
 - Read TempADC_Lo reg 0x1F
- g. Calculate new Temperature
 - $ambient = ((TempADC_Hi * 2 + (TempADC_Lo \gg 6) * 0.5) - 273)$

2. Set Time & Date

- a. set the WRTC bit 0 Control reg. 0x10
 - allows setting of the time & date regs.
- b. Write the values for Time and date to shadow registers
 - Write data to registers 0x0 – 0x7 – this get placed in the shadow registers until loaded into serial port registers
- c. Toggle the LOAD DATA IN bit1 in reg 0x22 (Transfer Control Reg)
 - First clear the LOAD_DAT_IN bit 1 by reading the Control Reg 0x22 and then anding the read with 0xFD and writing it back
 - Now set the LOAD_DAT_IN bit 1 = 1 by writing to Control Reg 0x22
 - Clear LOAD_DAT_IN bit 1 to start the clock

3. Get Time and Date

- a. set the LATCH OUT bit 0 of DataTransferCntrl 0x22
 - Write 0x1 to DataTransferCntrl reg 0x22, this moves the time and date regs to the serial port for the taking
 - b. Loop: wait for Latch event
 - Keep reading until DataTransferFlags reg. 0x23 for bit 0 LATCH_CMPLT = 1
 - c. read the time & date regs
- Read registers 0x0 – 0x7 for time and date

4. Set Clock Out Frequency

- a. bit 7 SQWE = 1, bit 6 CLKOUT_EN = 1, bits 0:3 SQFS = User Freq desired
 - Write to Clock control Reg. 0x13

5. Set 32kHz on CLKOUT using XT (crystal oscillator) Input

- a. a. Set OSEL = 1 in Oscillator Config register 0x1C
- b. Set OUT1 = 1, need SQW out if SQWE=1 and FOUT_EN =1 in OutputControl reg 0x11
- c. Set SQWE=1,CLKOUT_EN =1, FOUT_EN=1 and SQFS=1 (32KHz) in Clock Control Reg 0x13

6. Set Countdown Timer

- a. Enable timer and set freq to 1Hz
 - Write bit 7 CDTE =1, bits 0,1 sets frequency to Timer Management Reg 0x18
- b. Now load user count in Countdown Timer Initial Value reg 0x1A
- c. toggle CDRPT to a 1 to be able to load the initial count value
 - Write CDRPT bit 6 = 1 to Timer Management Reg 0x18
- d. enable countdown timer and set freq = 1 Hz, repeat countdown
 - Write CDRPT bit 6 = 1, CDTE bit 7 = 1, CDTFREQ bits 0,1 = 0x1 to Timer Control 0x18

7. Get Countdown Timer

- a. Set the Latch CDT OUT bit to send the count to the serial port
 - Write LATCH_CDT_OUT bit 2 = 1 to DataTransferCntrl reg 0x22
- b. Loop: wait for the transfer to be completed
 - Read until DataTransferFlags reg 0x23 LATCH_CDT_CMPLT bit 2 = 1
- c. Read countdown
 - Read Countdown Timer reg 0x19

8. Toggle nPGD/IRQ pin 11 on RTC using OUTA state
 - a. Set nPGD/IRQ Low
 - Write Output Control Reg 0x11 OUTA bits 0,1 = 0x3
 - b Set nPGD/IRQ High
 - Write Output Control reg 0x11 OUTA bits 0,1 =0x3, bit 6 OUTA =1

9. Toggle PSW/IRQ2 pin 6 on RTC using OUTB state
 - a. Set PSW/IRQ2 Low
 - Write Output Control Reg 0x11 bits 2:4 = 0x7 = 0x1C to reg.
 - b Set PSW/IRQ2 High
 - Write Output Control reg 0x11 bits 2:4 = 0x7 , bit 5 OUTB =1, = 0x3C to reg

Reference Documents

CBC921 PMRTC Data Sheet: <https://www.cymbet.com/wp-content/uploads/2019/02/DS-72-46-CBC921-PMRTC-Data-Brief-v1.1.pdf>

CBC-EVAL-14 PMRTC Data Sheet: <https://www.cymbet.com/wp-content/uploads/2019/02/DS-72-48-CBC-EVAL-14-PMRTC-Eval-Kit-Datasheet-V1.1.pdf>

Ordering Information

Part Number	Description	Notes
CBC92141C-Q3	Power and Battery Management / Real-Time Clock I2C 4.1V Vchg 3x3x0.55 MLPQ-UT16 Package - Cut Tape	Digi-Key P/N: 859-CBC92141C-Q3-TR3CT-ND
CBC92141C-Q3-TR3	Power and Battery Management / Real-Time Clock I2C 4.1V Vchg 3x3x0.55 MLPQ-UT16 Package 3k Reel	Digi-Key P/N: 859-CBC92141C-Q3-TR3-ND
CBC92132C-Q3	Power and Battery Management / Real-Time Clock I2C 3.2V Vchg 3x3x0.55 MLPQ-UT16 Package - Cut Tape	Digi-Key P/N: 859-CBC92132C-Q3-TR3CT-ND
CBC92132C-Q3-TR3	Power and Battery Management / Real-Time Clock I2C 3.2V Vchg 3x3x0.55 MLPQ-UT16 Package 3k Reel	Digi-Key P/N: 859-CBC92132C-Q3-TR3-ND
CBC-EVAL-14-PMRTC-32	ENERCHIP PMRTC EVAL KIT 3.2V CHG	Digi-Key P/N: 859-CBC-EVAL-14-PMRTC-32-ND
CBC-EVAL-14-PMRTC-41	ENERCHIP PMRTC EVAL KIT 4.1V CHG	Digi-Key P/N: 859-CBC-EVAL-14-PMRTC-41-ND

U.S. Patent No. 8,144,508. Additional U.S. and Foreign Patents Pending.

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