CBC-EVAL-12-34813

EnerChip™ RTC Evaluation Kit
CBC34813 Real-Time Clock with Integrated Backup Power

System Features and Overview

CBC-EVAL-12-34813 is a demonstration kit featuring the Cymbet CBC34813 EnerChip RTC - an integrated surface mount device combining an Ambiq Micro AM0813 Real-Time Clock (RTC), power management circuit, and solid state rechargeable EnerChip providing up to 100 hours of backup power to the RTC.

The kit demonstrates just how compact an RTC with integrated backup power can be using the low profile surface mount device from Cymbet. The combined solution occupies **only 0.25 cm²** of board space.

CBC-EVAL-12-34813 has the following elements:

- Low power RTC with SPI-interface bus
- Solid state rechargeable energy storage for real-time clock backup power
- Power fail detect with automatic switchover from main power to integrated backup power source
- Integrated battery management that controls battery charging and discharge cutoff, ensuring maximum service life of the on-board storage cell
- USB connector for easy demonstration and application development on personal computer
- Input/output access to board for easy connection to external microcontroller

Smallest RTC Power Backup Footprint

The block diagram of Figure 1 illustrates the CBC-EVAL-12-34813, an extremely compact low power RTC with integrated backup power source.
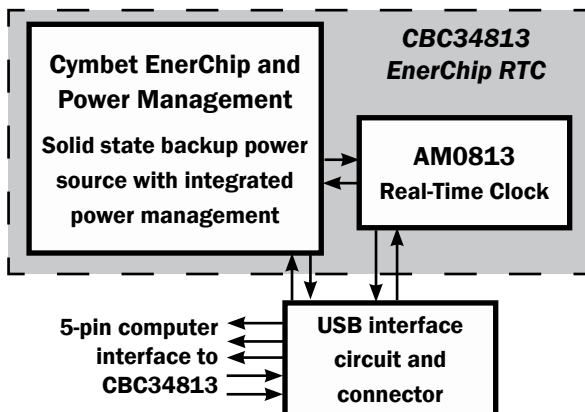

Figure 1: CBC-EVAL-12-34813 Block Diagram.

Figure 2 shows the USB Interface Board to the left, and the CBC34813 EnerChip RTC Tab Board to the right.

Figure 2: CBC-EVAL-12-34813 Demo Kit.

EVAL-12 Graphical User Interface

The CBC-EVAL-12-34813 includes a PC-based software application that communicates with the USB stick. Users can set the time of day, date, and countdown timer values to experiment with RTC power-back-up. The application also allows the user access to the RTC registers for viewing and modification. The software works with Microsoft Windows XP, Windows 7, and Windows 8 operating systems. Once the EVAL-12 USB stick is inserted into the PC, the Connect button is clicked in the GUI to establish communication over the USB port. The entire USB stick or just the CBC34813 Tab Board can then be removed from the PC and the RTC will be powered by the EnerChip rechargeable solid state battery that is integrated within the CBC34813 5mm x 5mm QFN package on the CBC34813 Tab Board.
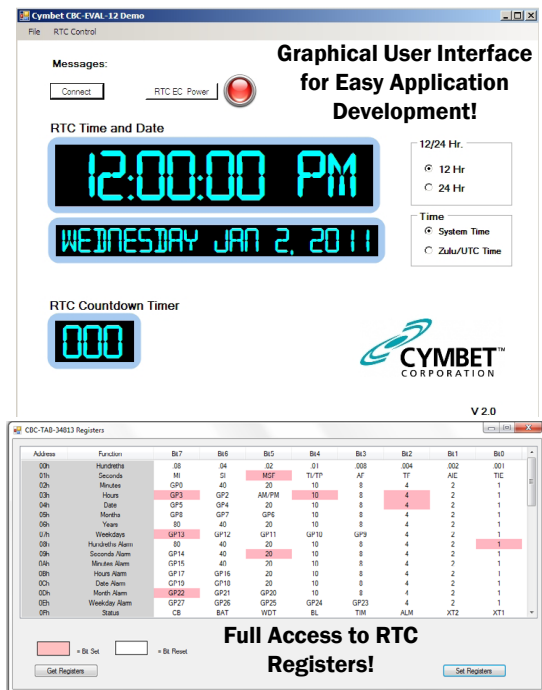
CBC-EVAL-12 Module Connector, Jumpers, and Test Points
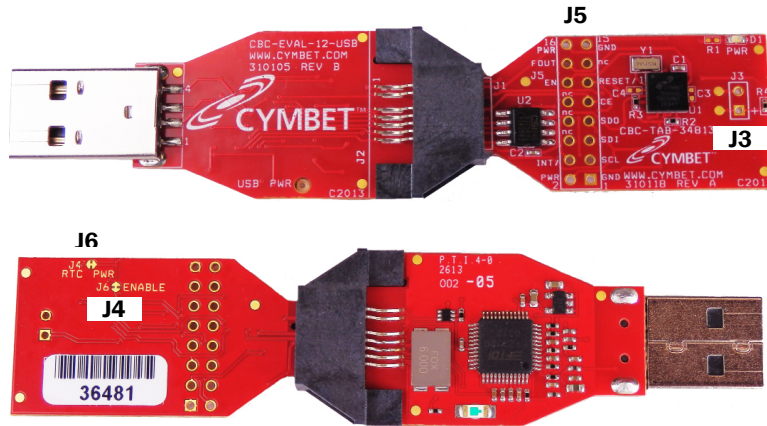
Figure 3: Locations of Jumpers.

JUMPERS AND CONNECTORS		
Jumper	Pin Number	Designation
J3	1	EXT ENERCHIP (+)
	2	EXT ENERCHIP (-)
J4	PCB Trace	RTC PWR - Cut jumper to disable RTC 'PWR' LED
J5	1	GND
	2	POWER
	3	SPI-SCL
	4	INT/
	5	SPI-SDI
	6	NC
	7	SPI-SDO
	8	NC
	9	SPI-CE
	10	NC
	11	RESET/
	12	EN
	13	NC
	14	FOUT
	15	GND
	16	POWER
J6	PCB Trace	ENABLE - Cut jumper to enable/disable the CBC34813 charge pump

Getting Started

BEFORE inserting the USB dongle into the USB port, proceed with the file downloads as described below.
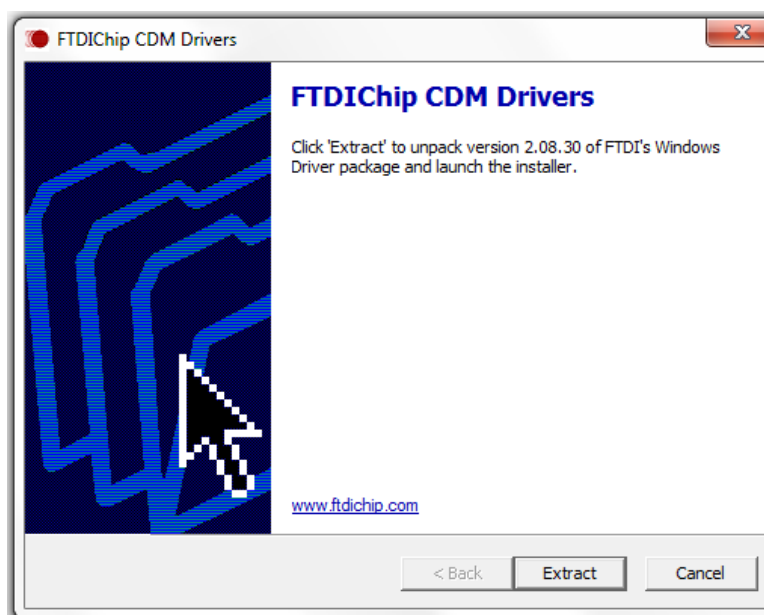
For first time users who have not installed the demonstration software, follow these steps:

1. Download the CBC-EVAL-12-34813 files from the web site and save them to your computer:

The directory structure loaded to your computer will look like the following:
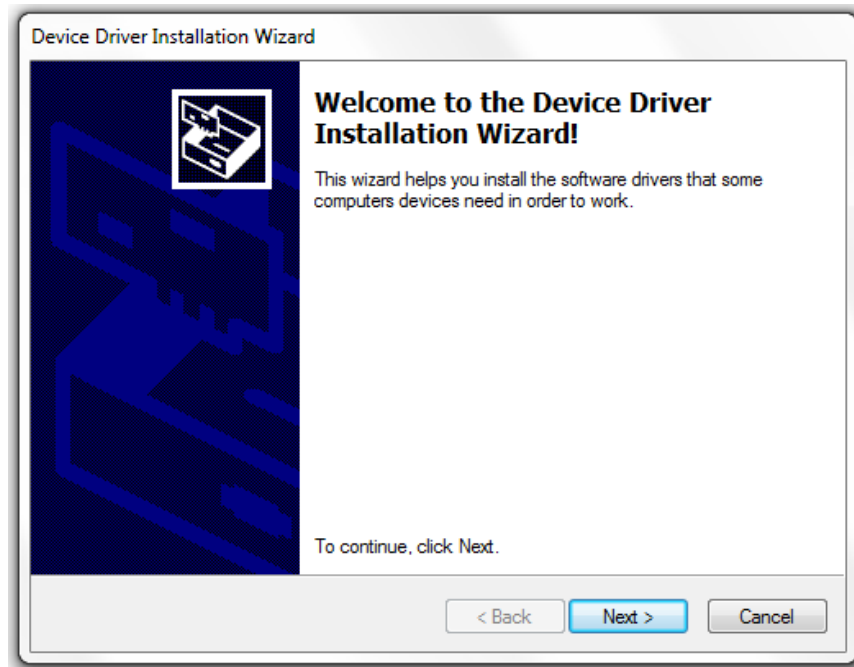
Name	Date modified	Type	Size
DotNetFX40Client	11/13/2013 9:34 AM	File folder	
Fonts Folder	11/13/2013 9:34 AM	File folder	
System Folder	11/13/2013 9:34 AM	File folder	
System32	11/13/2013 9:34 AM	File folder	
WindowsInstaller3_1	11/13/2013 9:34 AM	File folder	
CDM20830_Setup	11/22/2013 7:35 AM	Application	1,893 KB
cymbet_swirl	10/3/2008 4:45 PM	Icon	3 KB
EVAL12 Setup	11/13/2013 9:32 AM	Windows Installer ...	436 KB
EVAL12	11/5/2013 7:19 AM	Application	191 KB
Microsoft.VisualBasic.PowerPacks.Vs.dll	4/18/2011 3:38 PM	Application extens...	254 KB
setup	11/13/2013 9:32 AM	Application	418 KB

2. Do not yet insert any hardware into the USB port. Launch the application by clicking on CDM20830_Setup.

3. A dialog box will appear, asking: "Do you want to allow the following program to make changes to this computer?" Click the 'Yes' option.

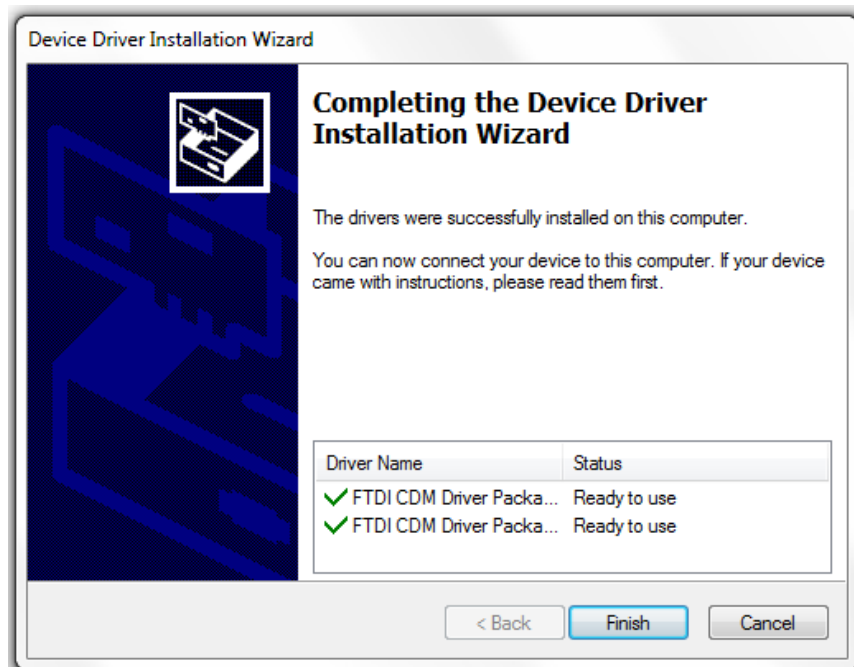4. The following window will appear. Click 'Extract.'

5. When the following window appears click 'Next.'

6. Once the files have loaded, the following window will appear. Click 'Finish.' This installs the files pertaining to the USB interface.
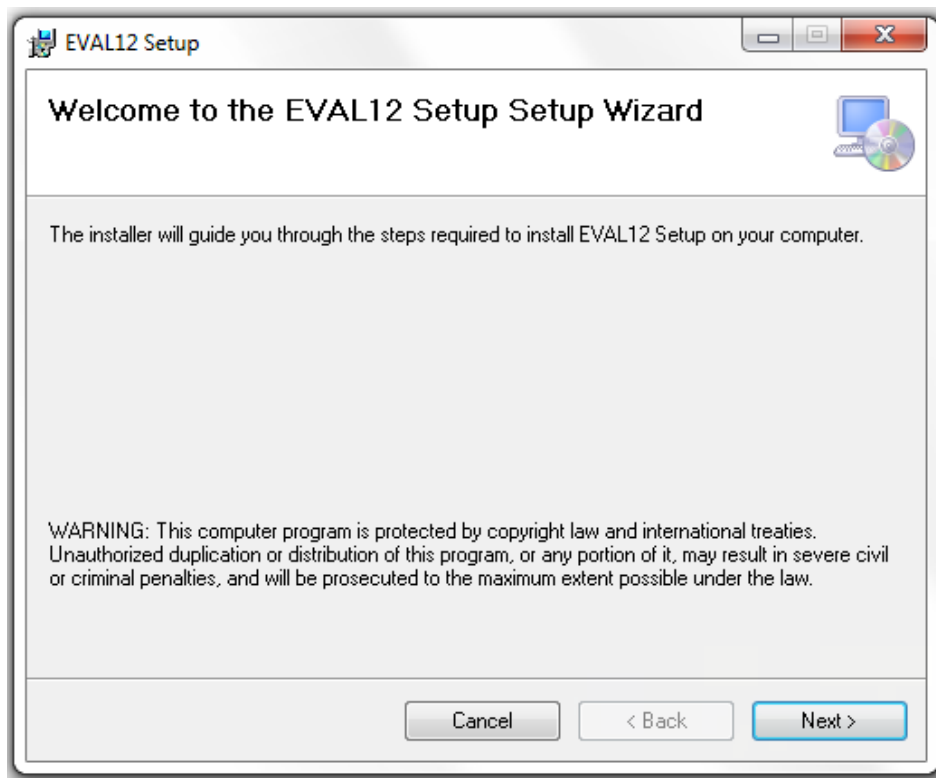

7. Next, launch the application by opening the setup file - as highlighted in the following diagram - located in the directory.

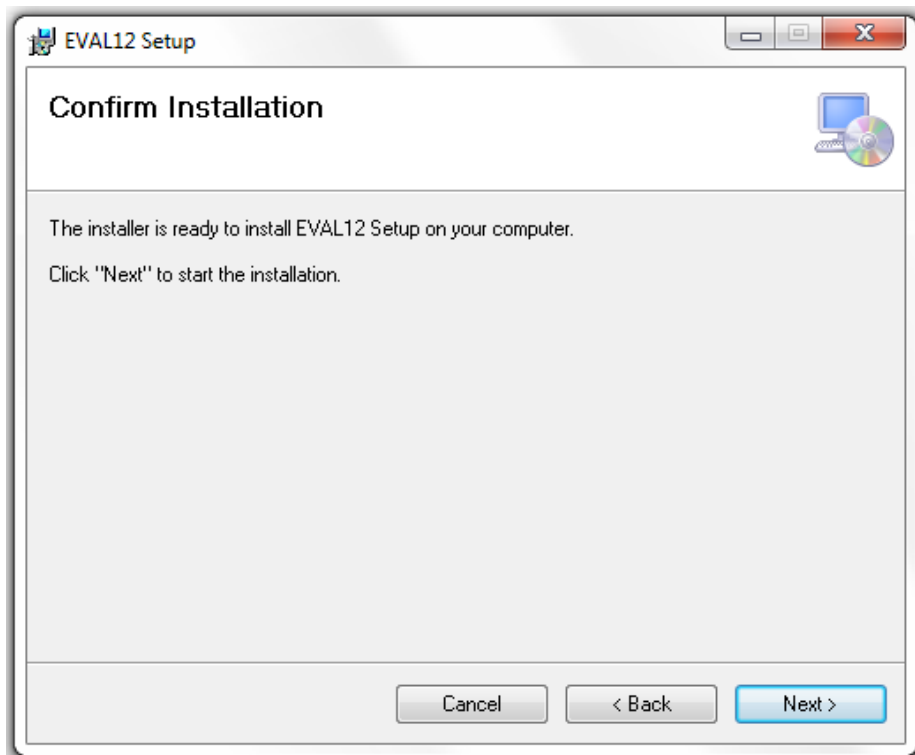| Name	Date modified	Type	Size
DotNetFX40Client	11/13/2013 9:34 AM	File folder	
Fonts Folder	11/13/2013 9:34 AM	File folder	
System Folder	11/13/2013 9:34 AM	File folder	
System32	11/13/2013 9:34 AM	File folder	
WindowsInstaller3_1	11/13/2013 9:34 AM	File folder	
CDM20830_Setup	11/22/2013 7:35 AM	Application	1,893 KB
cymbet_swirl	10/3/2008 4:45 PM	Icon	3 KB
EVAL12 Setup	11/13/2013 9:32 AM	Windows Installer ...	436 KB
EVAL12	11/5/2013 7:19 AM	Application	191 KB
Microsoft.VisualBasic.PowerPacks.Vs.dll	4/18/2011 3:38 PM	Application extens...	254 KB
setup	11/13/2013 9:32 AM	Application	418 KB

8. When the following window appears, click 'Next.'

EVAL12 Setup

Welcome to the EVAL12 Setup Setup Wizard

The installer will guide you through the steps required to install EVAL12 Setup on your computer.

WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.

Cancel   < Back   Next >

9. When the following window appears, select an installation folder destination on your computer and click 'Next.'
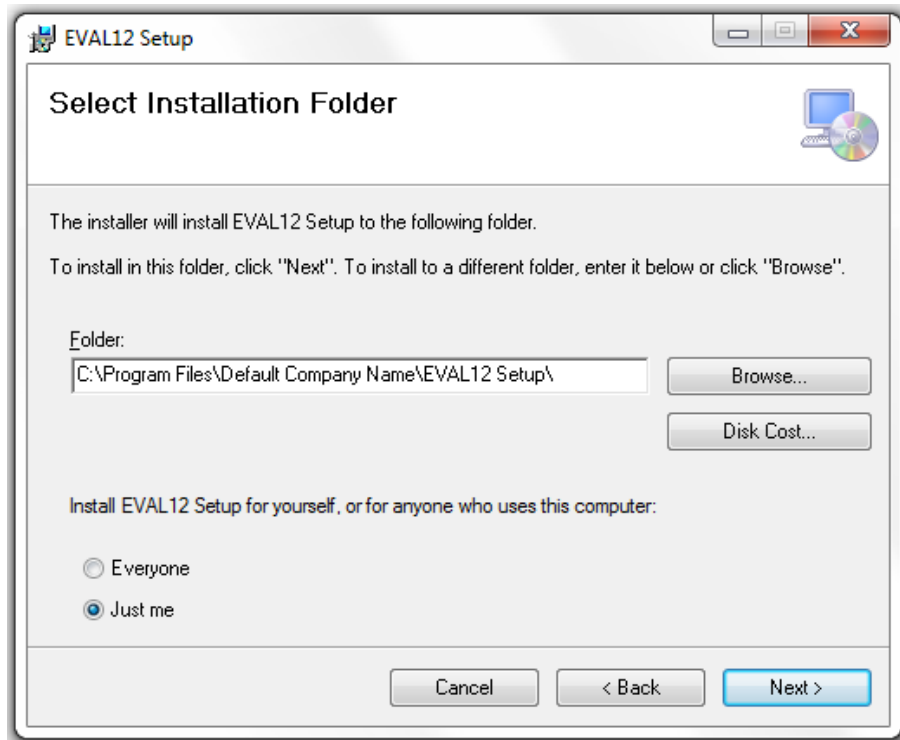
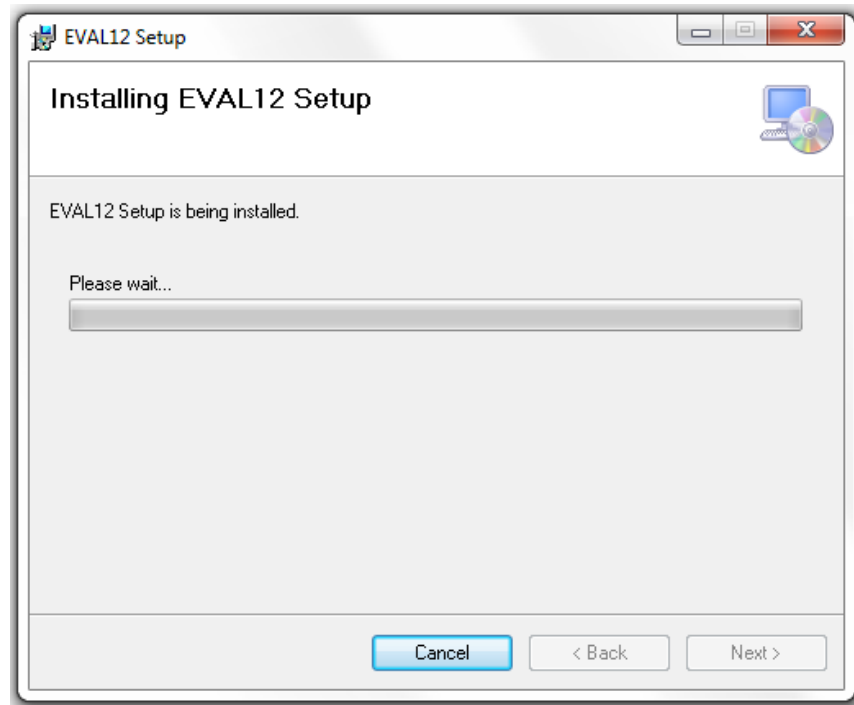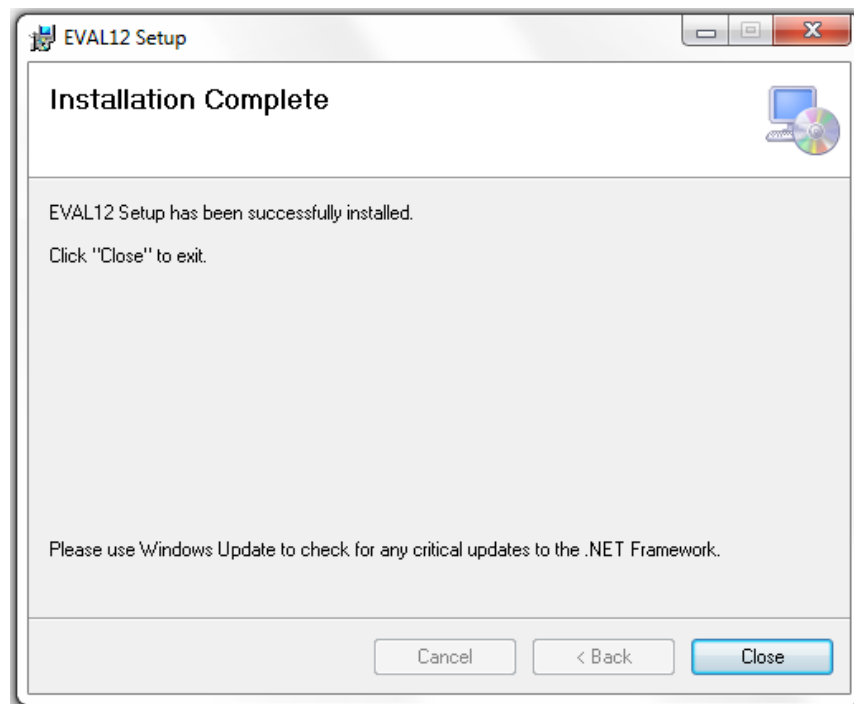10. The following window will appear. Again, click 'Next.'

11. The following window will appear. Allow the installation to continue and when the message "Do you want to allow the following program from an unknown publisher to make changes to this computer?" appears, answer 'Yes.'
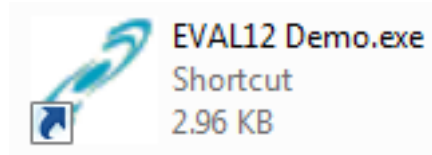

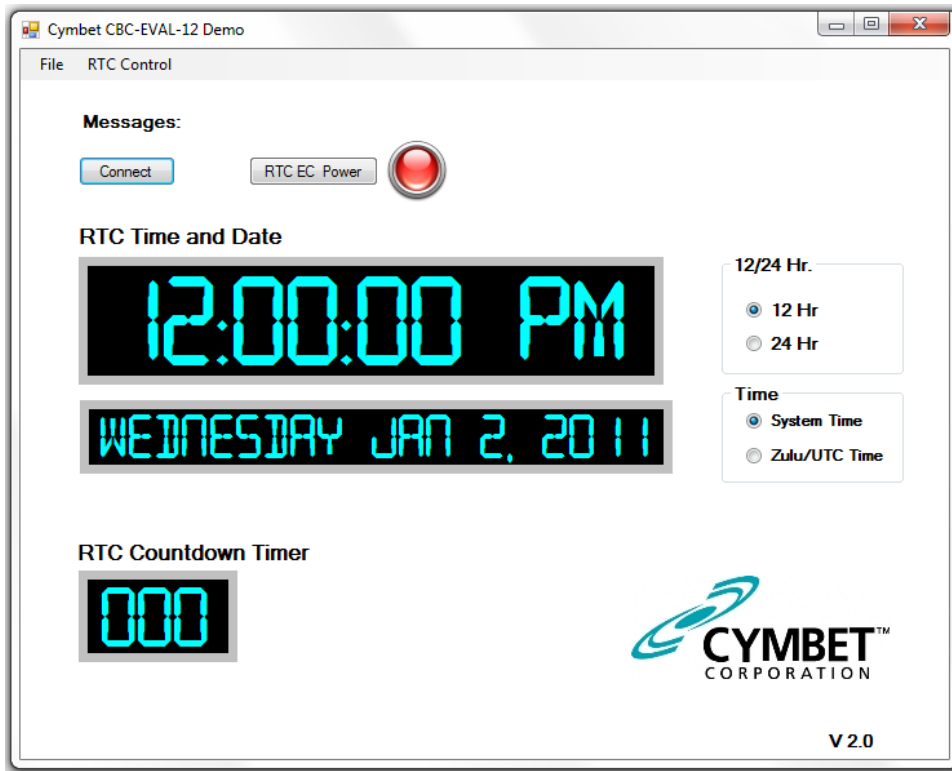12. Once the installation is complete, the following window will appear. Click 'Close.'

13. There should now be an EVAL12 Demo Shortcut icon on your desktop, as shown below. Double-click on the icon to launch the Graphical User Interface (GUI).

GUI installation is now complete. The following window should appear.

14. Insert the CBC-EVAL-12-34813 dongle into the USB port. It can take up to a minute for the computer to recognize the new hardware.

15. Both red LEDs on the EVAL stick - one on the USB board and the other on the Tab Board - should be lit. Click the 'Connect' button on the GUI. The computer's system time should now appear active in the GUI. At the top right of the window, 'CBC-TAB-34813 Found' is indicated, along with 'Messages: RTC Connected' at the top left.
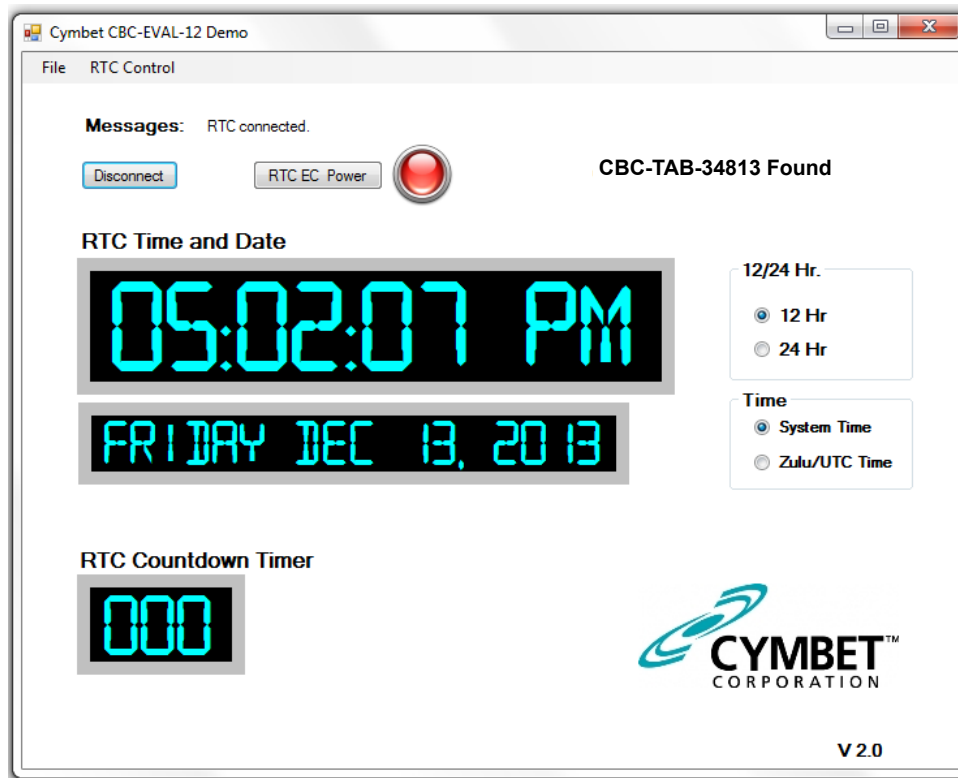
16. Click 'RTC EC Power' to disable power from the dongle. The 'RTC EC Power' indicator on the GUI will turn off, as will the 'PWR' LED on the CBC34813 Tab Board. Click 'RTC EC Power' to again apply power to the dongle.

17. There are several configuration options available to the user from the 'RTC Control' menu. To view the available options, open the 'RTC Control' drop-down menu and select from the 3 options as shown below.
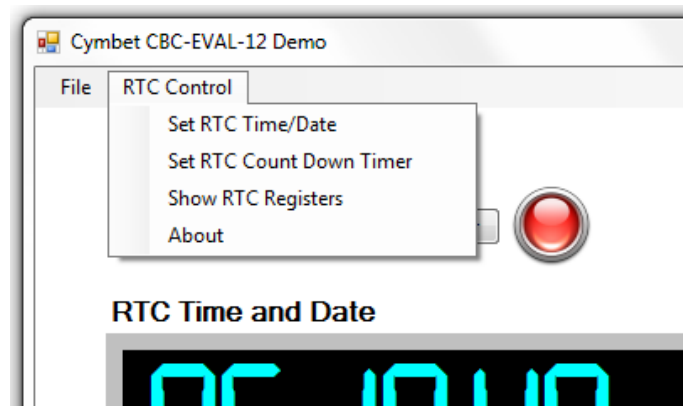
18. The 'Set RTC Date/Time' option allows the user to set a specific date and time. Enter any arbitrary date and time as the starting time, using either the drop-down calendar menu, or by manually entering the data. Click 'OK' to execute the command.
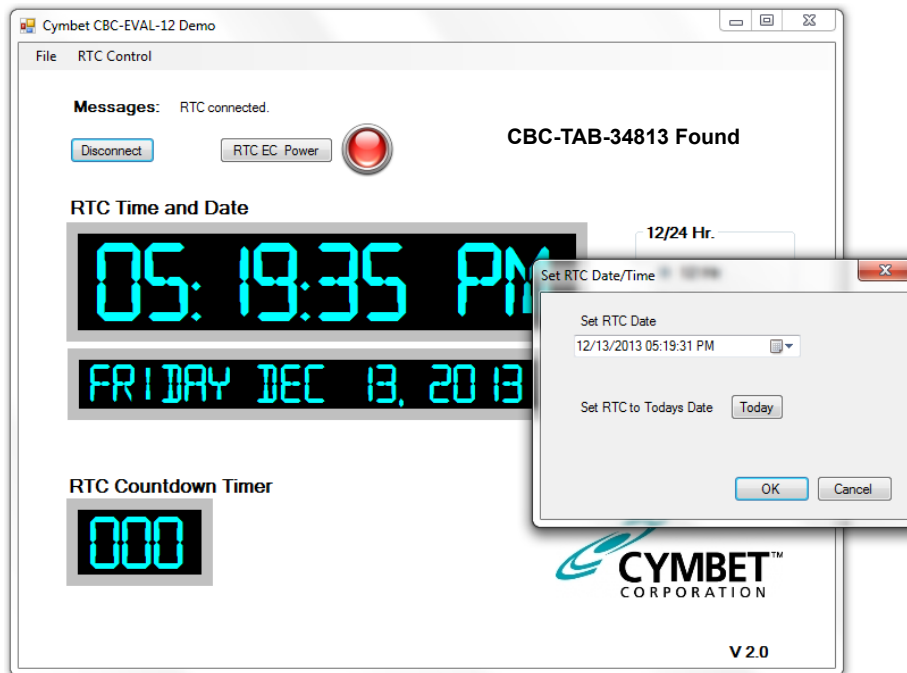
The 'RTC Count Down Timer' option allows the user to apply a value from 0 to 255 in 'Secs' field.
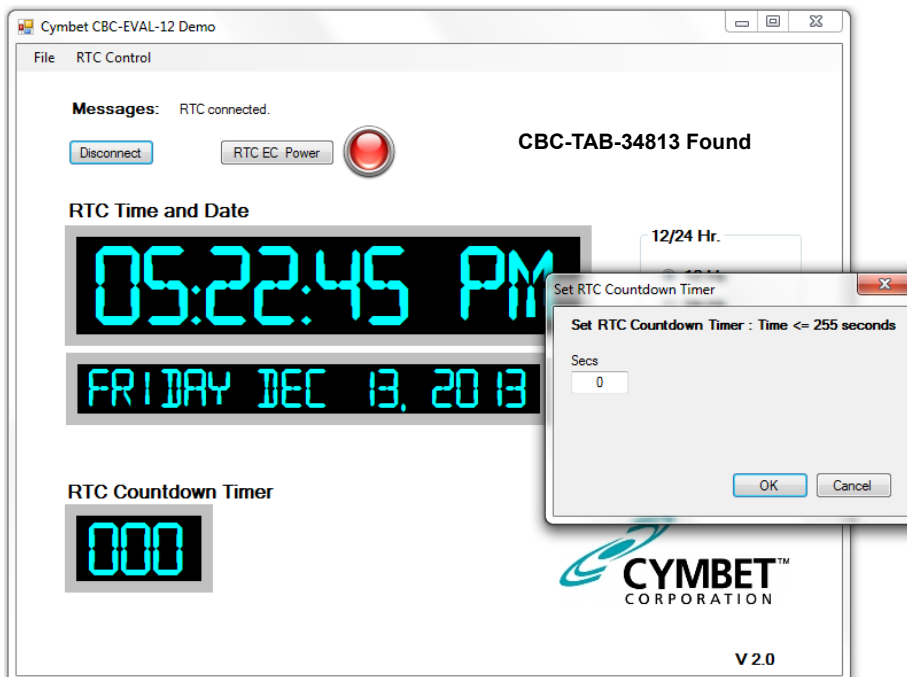
19. Enter a valid number and click 'OK' to execute the command. The timer will then be set and begin to count down to zero.

20. The system set-up is now complete. Once the countdown timer or date and time have been set, the integrated EnerChip battery can be used to maintain the timer or real time by either disabling power from the dongle by clicking the 'RTC EC Power' button or removing the dongle from the USB port. In the absence of USB power, the EnerChip will provide power to the AM0813 RTC for up to 100 hours. Simply re-insert the dongle or re-apply power to verify that the countdown timer or time and date were maintained while the dongle was not under USB power.

RTC Register Access

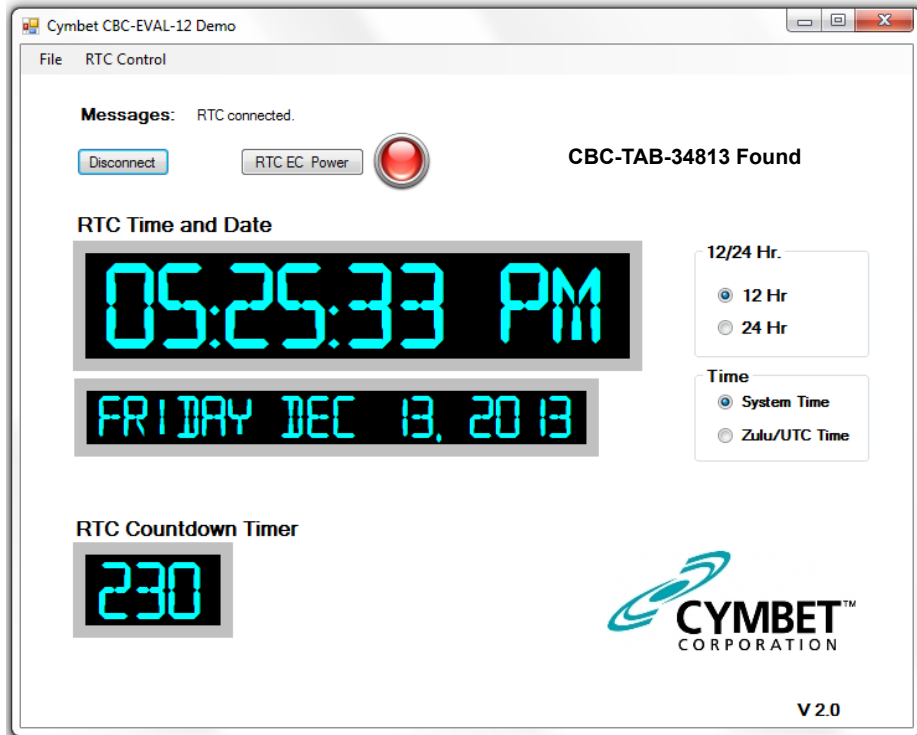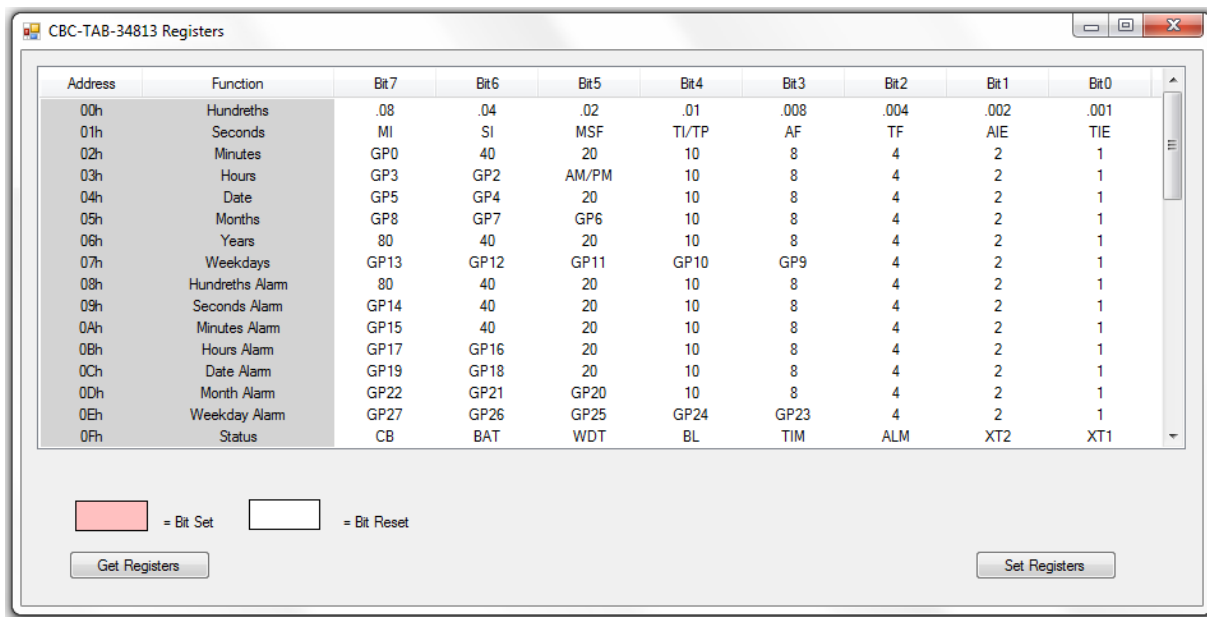The AM0813 registers are also accessible through the EVAL-12 GUI. Select the 'Show RTC Registers' option to view and modify the RTC register settings as shown below.

Address	Function	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
00h	Hundreths	.08	.04	.02	.01	.008	.004	.002	.001
01h	Seconds	MI	SI	MSF	TI/TP	AF	TF	AIE	TIE
02h	Minutes	GP0	40	20	10	8	4	2	1
03h	Hours	GP3	GP2	AM/PM	10	8	4	2	1
04h	Date	GP5	GP4	20	10	8	4	2	1
05h	Months	GP8	GP7	GP6	10	8	4	2	1
06h	Years	80	40	20	10	8	4	2	1
07h	Weekdays	GP13	GP12	GP11	GP10	GP9	4	2	1
08h	Hundreths Alarm	80	40	20	10	8	4	2	1
09h	Seconds Alarm	GP14	40	20	10	8	4	2	1
0Ah	Minutes Alarm	GP15	40	20	10	8	4	2	1
0Bh	Hours Alarm	GP17	GP16	20	10	8	4	2	1
0Ch	Date Alarm	GP19	GP18	20	10	8	4	2	1
0Dh	Month Alarm	GP22	GP21	GP20	10	8	4	2	1
0Eh	Weekday Alarm	GP27	GP26	GP25	GP24	GP23	4	2	1
0Fh	Status	CB	BAT	WDT	BL	TIM	ALM	XT2	XT1

= Bit Set   = Bit Reset

Get Registers   Set Registers

From this window, click on the 'Get Registers' box to reveal the bit settings. An example of the register map is shown in the following window.

CBC-TAB-34813 Registers

Address	Function	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
00h	Hundreths	.08	.04	.02	.01	.008	.004	.002	.001
01h	Seconds	MI	SI	MSF	TI/TP	AF	TF	AIE	TIE
02h	Minutes	GP0	40	20	10	8	4	2	1
03h	Hours	GP3	GP2	AM/PM	10	8	4	2	1
04h	Date	GP5	GP4	20	10	8	4	2	1
05h	Months	GP8	GP7	GP6	10	8	4	2	1
06h	Years	80	40	20	10	8	4	2	1
07h	Weekdays	GP13	GP12	GP11	GP10	GP9	4	2	1
08h	Hundreths Alarm	80	40	20	10	8	4	2	1
09h	Seconds Alarm	GP14	40	20	10	8	4	2	1
0Ah	Minutes Alarm	GP15	40	20	10	8	4	2	1
0Bh	Hours Alarm	GP17	GP16	20	10	8	4	2	1
0Ch	Date Alarm	GP19	GP18	20	10	8	4	2	1
0Dh	Month Alarm	GP22	GP21	GP20	10	8	4	2	1
0Eh	Weekday Alarm	GP27	GP26	GP25	GP24	GP23	4	2	1
0Fh	Status	CB	BAT	WDT	BL	TIM	ALM	XT2	XT1

[ ] = Bit Set   [ ] = Bit Reset

Get Registers   Set Registers

To adjust the registers, click on either the 'Bit Set' or 'Bit Reset' box in the lower left corner of the register map, window then click on the field in one of the 'Bit' columns to set or reset, respectively, that register bit. When finished setting the register fields, click the 'Set Register' button in the lower right corner of the window.

CBC-TAB-34813 Registers

Address	Function	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
00h	Hundreths	.08	.04	.02	.01	.008	.004	.002	.001
01h	Seconds	MI	SI	MSF	TI/TP	AF	TF	AIE	TIE
02h	Minutes	GP0	40	20	10	8	4	2	1
03h	Hours	GP3	GP2	AM/PM	10	8	4	2	1
04h	Date	GP5	GP4	20	10	8	4	2	1
05h	Months	GP8	GP7	GP6	10	8	4	2	1
06h	Years	80	40	20	10	8	4	2	1
07h	Weekdays	GP13	GP12	GP11	GP10	GP9	4	2	1
08h	Hundreths Alarm	80	40	20	10	8	4	2	1
09h	Seconds Alarm	GP14	40	20	10	8	4	2	1
0Ah	Minutes Alarm	GP15	40	20	10	8	4	2	1
0Bh	Hours Alarm	GP17	GP16	20	10	8	4	2	1
0Ch	Date Alarm	GP19	GP18	20	10	8	4	2	1
0Dh	Month Alarm	GP22	GP21	GP20	10	8	4	2	1
0Eh	Weekday Alarm	GP27	GP26	GP25	GP24	GP23	4	2	1
0Fh	Status	CB	BAT	WDT	BL	TIM	ALM	XT2	XT1

[ ] = Bit Set   [ ] = Bit Reset

Get Registers   Set Registers

When finished using the CBC-EVAL-12-34813, click the 'RTC EC Power' button in the main GUI window to turn off power to the module. Then click on the 'Disconnect' button and remove the USB dongle from the computer.

Reference Documents

CBC34813 EnerChip RTC Data Sheet: http://www.cymbet.com/pdfs/DS-72-38.pdf .

Ambiq Micro Real-Time Clock Data Sheet: http://ambiqmicro.com

Guidelines for crystal selection and other important information pertaining to the AM0813: http://ambiqmicro.com/resource-center/

CBC-EVAL-12-34813 Circuit Schematic

The schematic of Figure 4 depicts the CBC-EVAL-12-34813 RTC board. For the purpose of supporting hardware development, CBC34813 package pins are accessible by way of through-hole vias 1-16 of J5 on the Tab Board. Additional backup run time is supported by connecting external EnerChips to the CBC34813 by way of through-hole vias 1-2 of J3.
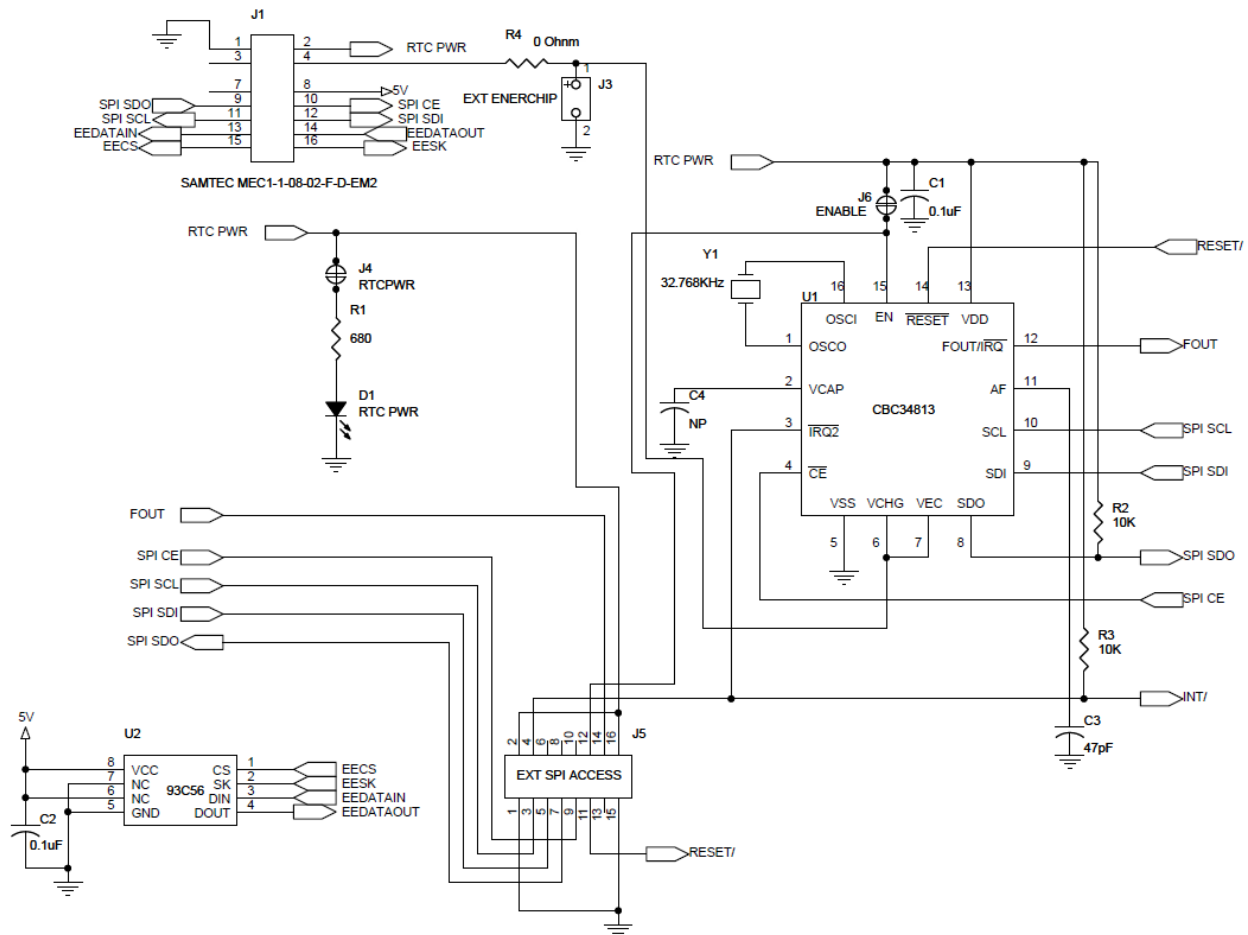
Figure 4: CBC-EVAL-12-34813 EnerChip RTC Board Circuit Schematic.

Table 1: CBC-EVAL-12-34813 EnerChip RTC Board Bill of Materials.

| Quantity	Ref. Designator	Manufacturer	Manufacturer Part #	Description	Distributor	Distributor Part #
1	R4	Stackpole Electronics Inc	RMCF0402ZT0R00	RES 0.0 OHM 1/16W JUMP 0402	DIGI-KEY	RMCF0402ZT0R00CT-ND
1	R1	Yageo	RC0402JR-07680RL	RES 680 OHM 1/16W 5% 0402 SMD	DIGI-KEY	311-680JRCT-ND
2	R2, R3	Vishay/Dale	CRCW040210K0FKED	RES 10.0K OHM 1/16W 1% 0402 SMD	DIGI-KEY	541-10.0KLCT-ND
2	C1, C2	Taiyo Yuden	LMK105BJ104KV-F	CAP CER 0.1UF 10V 10% X5R 0402	DIGI-KEY	587-1227-1-ND
1	D1	Lumex Opto/Components Inc	SML-LX0603IW-TR	LED 635NM RED DIFF 0603 SMD	DIGI-KEY	67-1548-1-ND
1	U1	Cymbet	CBC34813	RTC clock module with SPI interface	CYMBET	
1	U2	ON Semiconductor	CAT93C56VI-GT3	EEPROMs - Serial 256 X 8	DIGI-KEY	CAT93C56VI-GT3OSCT-ND
1	Y1	Micro Crystal Switzerland	CM7V-T1A	CRYSTAL 32.768KHz 9PF SMT		
1	PCB1	Cymbet	310118 REV A	PRINTED CIRCUIT BOARD	CYMBET	N/A
1	LABEL			SERIAL NUMBER LABEL - BAR CODE		
1	C4 No Stuff					

CBC-EVAL-12 Assembly Diagrams
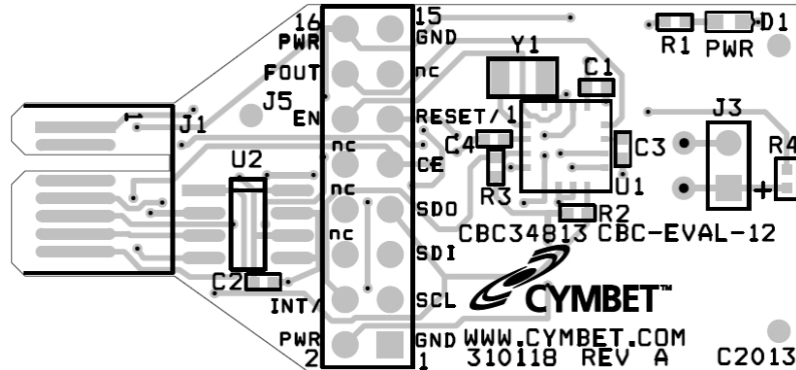
Figure 5: CBC-EVAL-12-34813 EnerChip RTC Board Assembly Diagram (Top View).
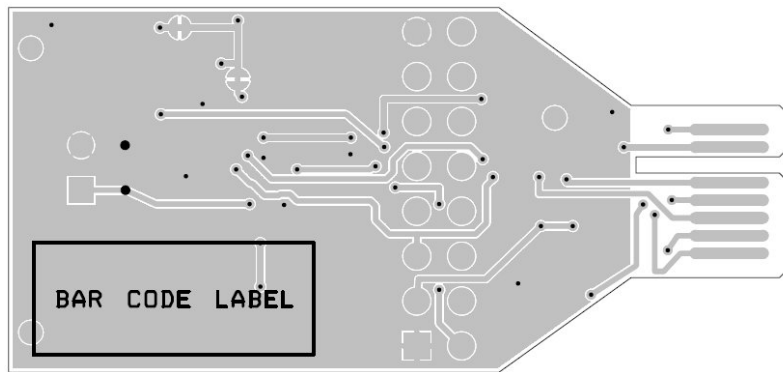

Figure 6: CBC-EVAL-12-34813 EnerChip RTC Board Assembly Diagram (Bottom View).

Ordering Information

EnerChip Part Number	Description	Notes
CBC34813-M5C	EnerChip RTC SPI 5uAh 0813 5x5 QFN -20-70C	Tube
CBC-EVAL-12-34813	EnerChip RTC CBC34813 Evaluation Kit USB and RTC Tab Board	
CBC-TAB-34813	EnerChip EVAL-12 CBC34813 Tab Board	