Rev 1; 5/08

DS28DG02 Evaluation Board/Evaluation System

General Description

The DS28DG02 evaluation system (EV system) consists of an evaluation board (EV board) and a Maxim CMAXQUSB command module. The EV board is a daughter card for the command module. PC connectivity is included in the kit and free evaluation software is available for download from the web page listed in *Support Resources*. The DS28DG02 is a mixed-signal memory device. It contains 2Kb of EEPROM memory, along with PIO, real-time clock (RTC), reset, battery monitor, and watchdog functions. Communication to the device is through the industry-standard Serial Peripheral Interface (SPI™) interface. The evaluation software runs under 32-bit Windows Vista®, XP, 2000, and 98SE operating systems, providing a handy user interface to exercise the DS28DG02 features.

Support Resources

1) DS28DG02 EV Kit Data Sheet and Software: **www.maxim-ic.com/DS28DG02EVKit**
2) User's Guide to the DS28DG02: **www.maxim-ic.com/AN4040**
3) Application Note 3601: *Troubleshooting Windows Plug-and-Play and USB for Maxim Evaluation Kits*: **www.maxim-ic.com/AN3601**
4) Listing of All Multifunction Memory EV Kits: **www.maxim-ic.com/memoryEVKits**
5) Technical Support: **www.maxim-ic.com/support**

Features

- ♦ **Proven PCB Layout**
- ♦ **Complete Evaluation System**
- ♦ **Convenient On-Board Test Points**
- ♦ **Easy Setup**
- ♦ **PC Connectivity Included**
- ♦ **Free Downloadable Evaluation Software Available**

Ordering Information

PART	TYPE
DS28DG02EVKIT	EV Kit

EV Kit Contents

DESIGNATION	QTY	DESCRIPTION
H1	4	2-pin shunts (for jumpering) Tyco/Amp 881545-2
H2	1	Small antistatic bag to hold H1 shunts
H3	1	DS28DG02 EV board
H4	1	Small antistatic bag to hold EV board
H5	1	Instruction sheet
H6	1	Box and packaging material to hold bagged EV board, bag of shunts, and instruction sheet (H1–H5)
H7	1	Boxed CMAXQUSB command module with USB cable
H8	1	Box and packaging material to hold EV kit contents (H1–H7)

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Component List

DESIGNATION	QTY	DESCRIPTION	SUPPLIER/PART NUMBER
B1	1	3V lithium 16mm coin battery with solderable tabs	Panasonic BR1632A/HA
C1, C2	2	0.1µF SMT capacitors (1206)	KMET C1206C104K1RACTU
D1, D6, D7	3	SMT red LEDs (1206)	LiteOn LTST-C150CKT
D2–D5	4	SMT green LEDs (1206)	LiteOn LTST-C150GKT
J1	1	100-mil centers, square-post, 2-pin terminal strip	Molex 22-28-4022
J2	1	100-mil centers, 40-pin (dual-row) female, right-angle header	Available from the following suppliers: Methode (Adam Tech) RS2R-40-G Oupiin 2044-2X20GRSN Samtec SSW-120-02-S-D-RA
J3–J4	2	100-mil centers, square-post, 3-pin terminal strip	Molex 22-28-4032
J6	1	100-mil centers, square-post, 12-pin terminal strip right angle	Molex 22-28-8120
R1	1	SMT 500Ω ±1% resistor (1206)	ROHM MCR18EZHF4990
R2	1	100Ω mechanical potentiometer through-mount, 3-pin	Available from the following suppliers: Copal Electronics CT6EP101 Murata PVC6A101C01B00
R3, R8, R9	3	10kΩ resistors (1206)	Panasonic-ECG ERJ-8ENF1002V
R5	1	Through-mount, 3-pin 500Ω mechanical potentiometer	Available from the following suppliers: Copal Electronics CT6EP501 Murata PVC6A501C01B00
R6	1	SMT 250Ω ±1% resistor (1206)	ROHM MCR18EZHF2490
R7	1	SMT 470Ω resistor (1206)	Panasonic-ECG ERJ-8ENF4700V
RP1	1	1kΩ resistor pack, 9 res, 10-pin	CTS Corporation 770101102P
RP2	1	100kΩ resistor pack, 9 res, 10-pin	CTS Corporation 770101104P
RP3	1	470Ω resistor pack, 9 res, 10-pin	CTS Corporation 770101471P
SB1	1	Jumper block with 8 built-in switches, 16-pin DIP	Grayhill Incorporated 76SB08ST
SW1	1	Momentary pushbutton switch	Panasonic-ECG EVQ-PJA04Q
TP1, TP2	2	Test points	Keystone 5011
U1	1	2Kb SPI EEPROM with PIO, RTC, reset, battery monitor and watchdog (4.4mm 28-pin TSSOP)	Maxim DS28DG02E-3C+
X1	1	32kHz time crystal	Citizen CFS145-32.768KDZF-UB

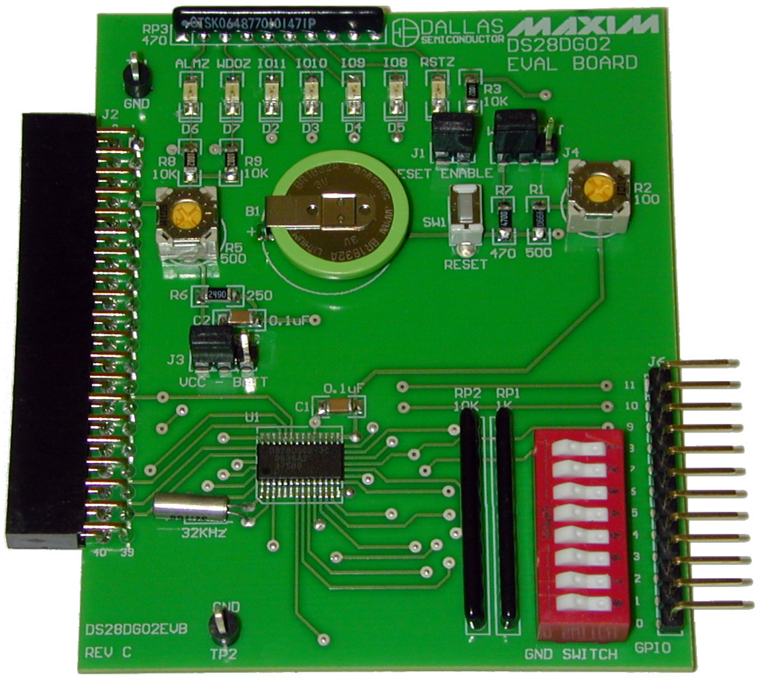

Figure 1. DS28DG02 EV Board

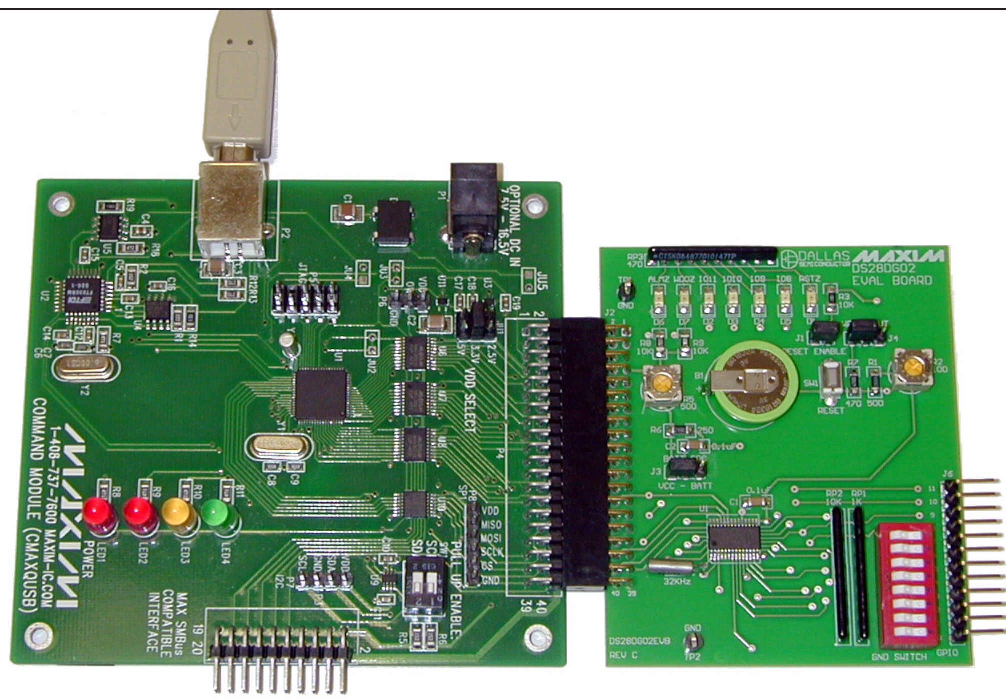

Figure 2. DS28DG02 EV Board Connected to CMAXQUSB

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Quick Start

Note: In the following sections software-related items are identified by bolding. Text in bold refers to items directly from the EV kit software. Items in bold and underline refer to items from the Windows operating system.

1) Before beginning, make sure the following equipment is available:
   - DS28DG02 (contains DS28DG02 EV board and CMAXQUSB module).
   - Computer with a Windows Vista/XP/2000/98SE operating system with a spare USB port.
2) Do the following before connecting to the PC:
   - Select 3.3V logic by setting the CMAXQUSB VDD SELECT jumper.
   - Set up the EV board by placing a jumper on the J3 jumper block (J3 BATT SRC). If you wish to evaluate the battery monitor function, choose VCC to prevent the battery from prematurely draining. Also, place a jumper on the J1 RESET ENABLE pins, along with a jumper on J4 WPZ INPUT (preferably in the rightmost position to prevent accidental write protection of the SPI Status Byte).
   - Connect the EV board to the CMAXQUSB board with the 40-pin connector at location P4 (the SPI pins). See Figure 2 for proper EV board orientation (component side up) when connecting the EV board to the CMAXQUSB board.
3) Download the evaluation software from the EV kit's Quick View: **www.maxim-ic.com/DS28DG02EVKit**. The evaluation software is provided as a *.zip archive file. Unzip the archive's contents into an empty or newly created directory.
4) Connect the USB cable between the CMAXQUSB and the computer. When you plug in the CMAXQUSB board for the first time, the Windows plug-and-play system detects the new hardware and automatically runs the **Add New Hardware Wizard**. Be sure to specify the search location for the device driver, which is the directory where the evaluation software files were unzipped.
5) During device driver installation, Windows displays a warning message indicating that the device driver for the CMAXQUSB board does not contain a digital signature. This is not an error condition. It is safe to proceed with the installation.
6) If any problems occur during device driver installation, refer to Application Note 3601*: Troubleshooting Windows Plug-and-Play and USB for Maxim Evaluation Kits* for more details.
7) The Microsoft .NET framework Version 1.1 is required for the program to run. To verify if it is installed, look in **Control Panel** under **Add/Remove Software** for a listing. If no listing is found, go to **www.microsoft.com** and perform a site search for **.NET 1.1 redistributable**. Click on the first item in the results list. It should contain download and installation instructions.
8) Start the EV kit software by double-clicking the file, *DS28DG02_Evaluation_Program.exe,* in the file folder containing the unzipped evaluation software files.

Detailed Description of Software

Figure 3 shows the DS28DG02 software program's main window. Note that it consists of seven tabs, with each tab offering the ability to exercise a group of related DS28DG02 functional blocks. The sections are: **SPI**, **R/W**, **UserEE**, **MFC/MFS**, **GPIO**, **RTC**, and **WatchDog**. Each of these tabs is described in this section.

Note that a status pane exists at the very bottom of the window. The left-hand side gives the firmware string of the CMAXQUSB board (if connected), and the right-hand side gives status information (in the form of a small string) on the success or failure of the last operation attempted.

SPI

See Figure 3 for a screenshot of the **SPI** tab. This tab allows the user to input raw SPI commands and communicate to the DS28DG02 through this low-level serial protocol. The user can assert the chip select (CS) pin to enable communication to the device, and send data to the chip by inputting data into the master-out, slave-in (**MOSI**) text box and clicking the **Execute SPI Comm** button. MOSI is also read out from the chip during the data exchange.

R/W

Figure 4 shows a screenshot of the **R/W** tab. This tab exercises raw read and write functions. Be careful using this tab as the reading/writing extends to PIO and control/status registers. To use, simply give the starting address from which to perform the memory operation and the number of bytes to read or write. If performing a write operation, input the data to write in hexadecimal form (with a space between bytes) in the text box. Next, choose the type of operation (**Read Op** or **Write Op**), and click the **Execute Memory Op** button to perform the action. For reading and writing the user EEPROM areas, see the *UserEE* section.

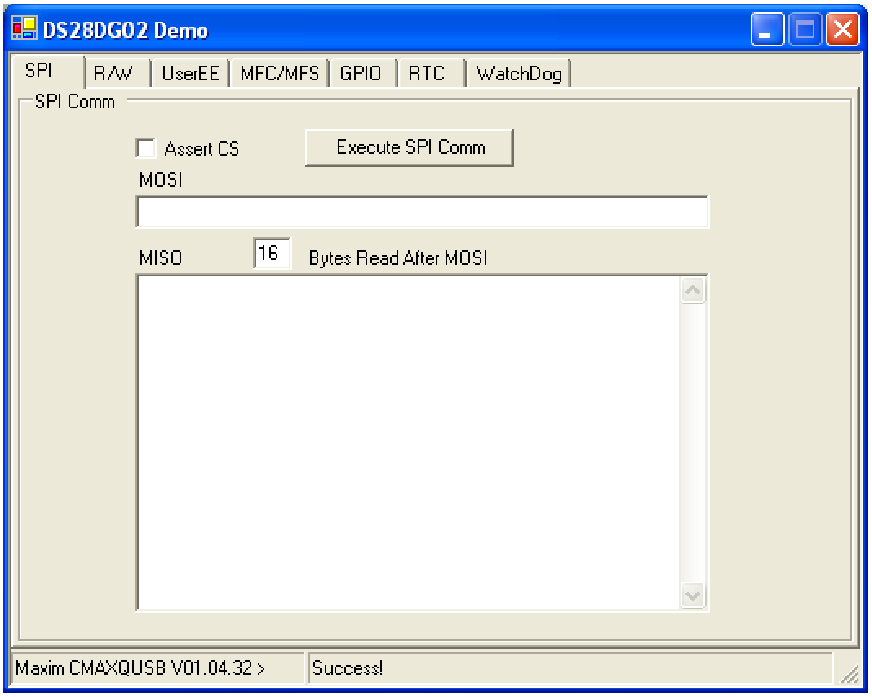

Figure 3. DS28DG02 Evaluation Software: Main Window

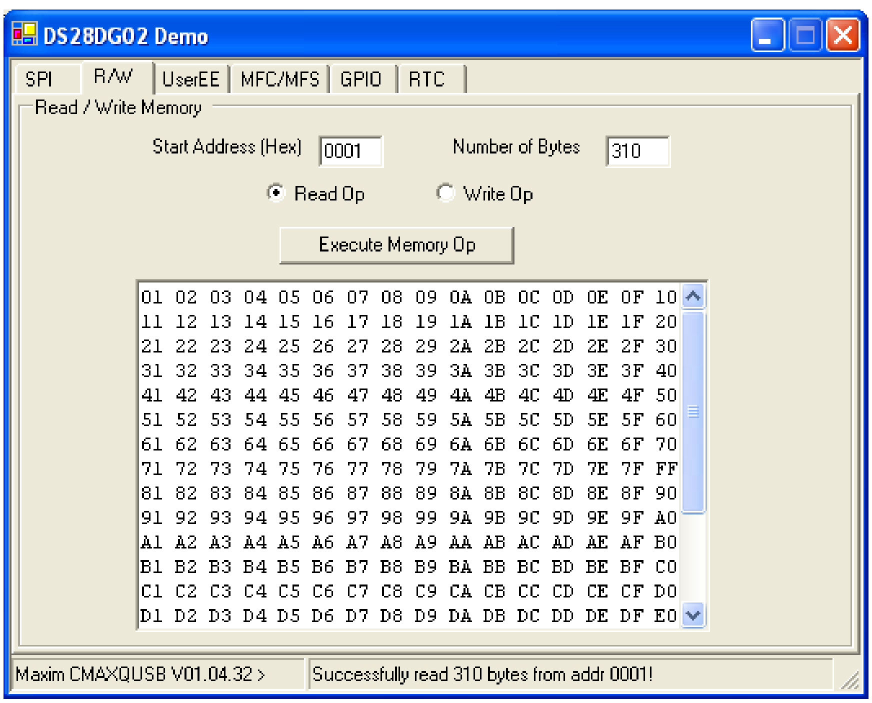

Figure 4. DS28DG02 Evaluation Software: R/W Tab

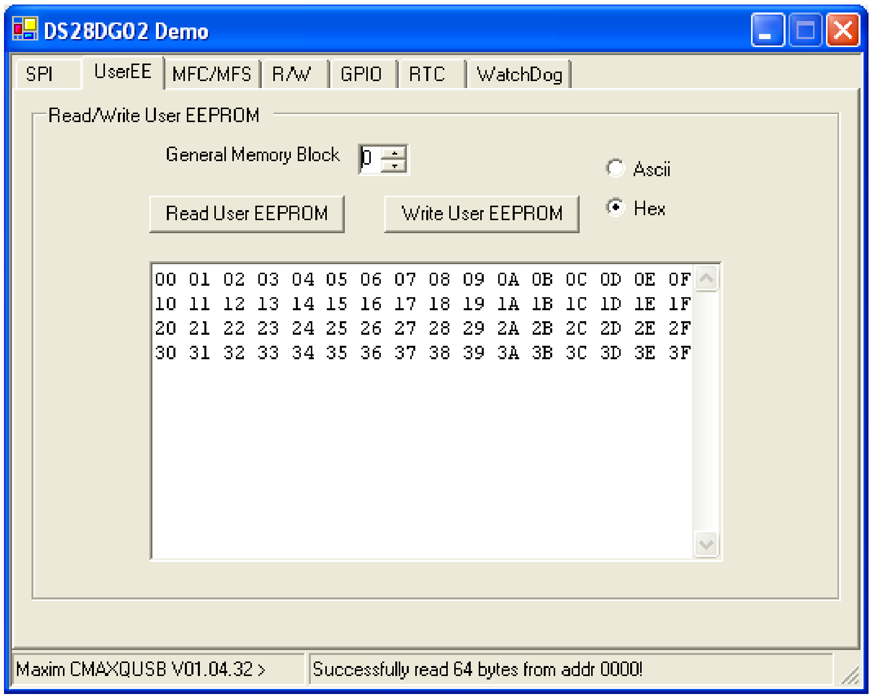

Figure 5. DS28DG02 Evaluation Software: UserEE Tab

UserEE

Figure 5 shows the **UserEE** tab. It allows a safe way to read and write to the user EEPROM memory areas of the DS28DG02. To use, first input which 64-byte block of EEPROM memory is read or written into the **General Memory Block** spin box. Valid numbers are 0, 1, 2, or 3. Next, choose the format type of the data to be displayed in the text box after a read operation or inputted before a write operation. The choices are ASCII or hex. Finally, choose which memory operation is desired by clicking on either the **Read User EEPROM** or **Write User EEPROM** buttons. Prior to writing to the part, make sure the data to write has been successfully entered into the text box in the correct format, either ASCII (no spaces) or hex (space between each byte).

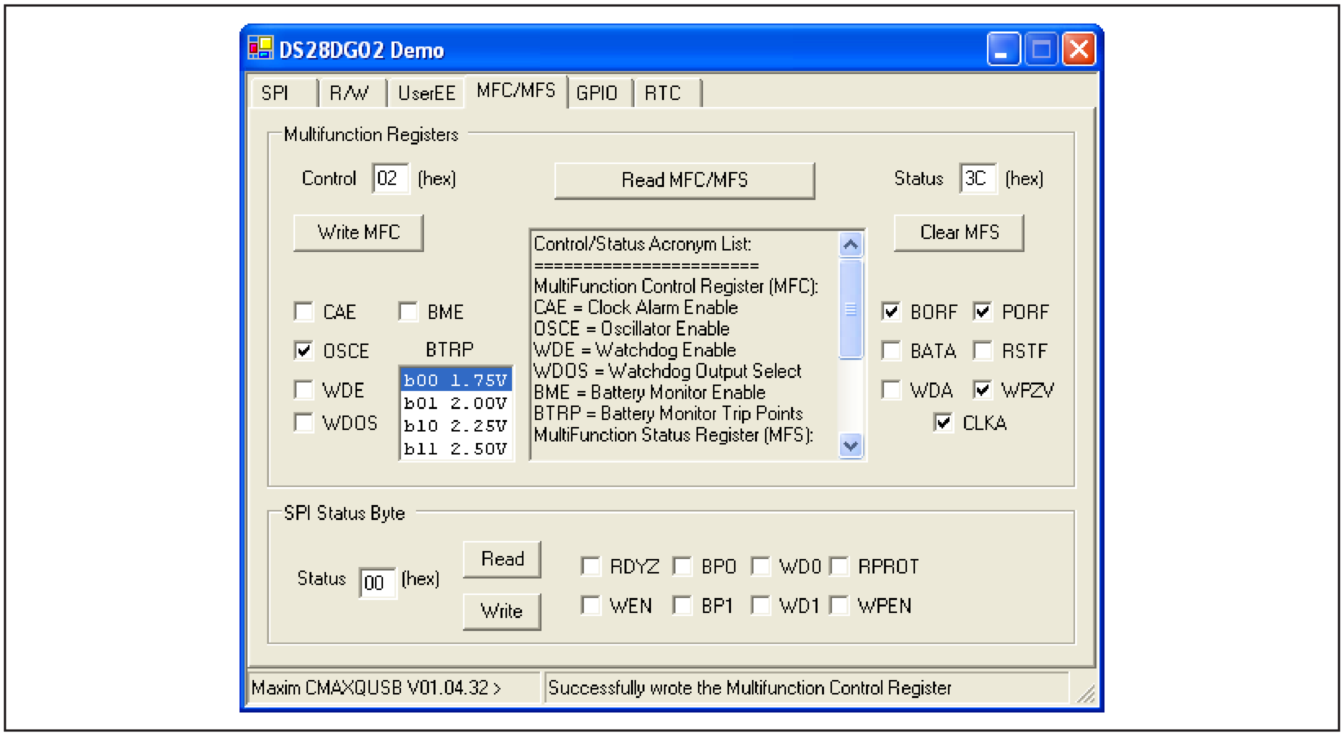

Figure 6. DS28DG02 Evaluation Software: MFC/MFS Tab

MFC/MFS

The **MFC/MFS** tab allows the user to read the status register for alarms and flags and write to the control register to enable the various monitors and timers and change other hardware settings. It also allows for exercising the SPI status register, which gives status on blocks of EEPROM memory that are write protected and specifies the duration of the watchdog timeout. See Figure 6 for a screenshot.

This tab is used extensively when experimenting with nonmemory functions of the DS28DG02, such as voltage monitor, watchdog, write protect, and RTC functions. To use the tab, start by reading the registers to see which flags and alarms have been set. Clicking the **Read MFC/MFS** button and the **Read** button in the **SPI Status Byte** section retrieves them. Once all the flags, alarms, and settings have been retrieved, the DS28DG02 can be reconfigured to the desired settings and any alarm conditions can be cleared.

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The **MFC/MFS** tab is divided into two sections: the **Multifunction Registers** section and the **SPI Status Byte** section. In the **Multifunction Registers** section, the left-hand side of the tab shows the control register's settings. To set these, just click in the checkbox next to the appropriate label. The last setting does not contain a checkbox, but rather, a listbox of four settings for the battery trip point (BTRP). Highlight the desired BTRP setting by clicking on it. See Table 1 for a list of control settings. Clicking on the MFC settings automatically writes the new setting to the part. A checkmark means a 1 has been written to the register bit, enabling the feature, and no checkmark means that a 0 has been written to the register bit, disabling the feature. The BTRP has four possible settings (requiring 2 bits). See Table 1 for a list of the possible battery monitor trip points. An alternate way to change the control register settings (besides clicking the checkboxes) is to calculate the byte value in hex of the control register, which consists of a single byte. See the BITS column of Table 1, keeping in mind a check is a 1 and an uncheck is a 0. After calculating this number, input it into the **Control** text box and click the **Write MFC** button.

Table 1. Control Register Settings

SETTING	BITS	DEFINITION
CAE: Clock Alarm Enable	b0	Enable/disable control of the RTC/calendar alarm. **check: enable** **uncheck: disable** (power-on default)
OSCE: RTC Oscillator Enable	b1	Run/halt control of the RTC's 32kHz oscillator. **check: enable** **uncheck: disable** (power-on default)
WDE: Watchdog Enable	b2	Enable/disable control of the watchdog and its alarm. **check: enable** **uncheck: disable** (power-on default)
WDOS: Watchdog Output Selection	b3	Pin selection for watchdog alarm signaling. **check: ALMZ pin (lights red D6 LED)** **uncheck: WDOZ pin (lights red D7 LED)** (power-on default)
BTRP: Battery Monitor Trip Point	b[5:4]	Selection of the **nominal** BTRP voltage. Select one of the following: b00 1.75V (power-on default) b01 2.00V b10 2.25V b11 2.50V
BME: Battery Monitor Enable	b6	Enable/disable control of the battery monitor and its alarm. **check: enable** **uncheck: disable** (power-on default) Notes: 1. The battery test takes place: a) after BME changes to 1 b) after V_{CC} ramps up c) every hour on the hour 2. The RTC must be running (OSCE enabled) for the battery monitor to function.

The other half of the **Multifunction Registers** section of the **MFC/MFS** tab consists of the DS28DG02's status register. Similar to the control register, a list of checkboxes are listed. A checkmark means an alarm or flag is set or active (giving a 1) and no checkmark means that the alarm or flag is not active (giving a 0). See Table 2 for a list of status register alarms and status flags. As with the control register, the status register is a single byte, with individual alarms and status flags taking up single bits. So, clicking on the **Read MFC/MFS** button gives a hex number representing the entire status byte. This number is displayed in the **Status** text box. Translating this number to binary gives the indvidual alarms/flags of the status register. See the BITS column in Table 2 for the bit designator. Note that writing to the control register, except for the WPZV status flag, clears all alarms/flags, and that when an alarm or flag is set, the **MFC/MFS** tab displays a checkmark in the appropriate alarm/flag checkbox.

The second section of the **MFC/MFS** software tab is the **SPI Status Byte**. This byte register contains control bits and two read-only status bits. Unlike the other control and status registers, it is not memory mapped and can only be updated through SPI instructions. It holds several bits that control an elaborate scheme to prevent inadvertent changes of data stored in the device. Complete details of this scheme can be found in the DS28DG02's data sheet in the *Principles of Operation* section. See Table 3 for a listing of the SPI Status Byte settings. To read these status/control bits, click on the **Read** button. There are two ways to write to the register. The first is to click on the checkboxes by the desired settings to be activated. Placing a checkmark in the boxes enables/activates the setting. This is equivalent to adding a 1 in the bit field. Unchecking the boxes deactivates/disables the settings. This is equivalent to adding a 0 in the bit field. Any mouse click on a checkbox writes immediately to the part. The second method of writing entails calculating the byte value in hex of the register. See the BITS column of Table 3 for which bit position goes with which setting. After calculating the byte value, input the resulting hex number into the **Status** text box and click the **Write** button.

Table 2. Status Register Alarms and Status Flags

ALARM/FLAG	BITS	DEFINITION
RSTF: Reset Flag	b0	RSTZ pin activity indicator; set whenever there is a pulse at RSTZ. V_{CC} ramp up: 1; V_{BAT} attach: 0
WDA: Watchdog Alarm	b1	Watchdog alarm indicator; set whenever the watchdog is enabled and the watchdog timer expires. V_{CC} ramp up: 0; V_{BAT} attach: 0
CLKA: Clock Alarm	b2	RTC/calendar alarm indicator; set whenever the clock alarm is enabled and RTC and RTC alarm register match. V_{CC} ramp up: 0; V_{BAT} attach: 0
BORF: Battery-On Reset Flag	b3	Battery attach indicator; set whenever the voltage at V_{BAT} ramps up above V_{BATmin}. V_{CC} ramp up: not affected; V_{BAT} attach: 1
PORF: Power-On Reset Flag	b4	Power-on reset indicator; set whenever the voltage at V_{CC} ramps up above V_{CCmin}. V_{CC} ramp up: 1; V_{BAT} attach: 0
WPZV: Hardware Write-Protect Value	b5	WPZ pin state readout; reports the logic state at the WPZ pin. V_{CC} ramp up: WPZ pin state; V_{BAT} attach: not affected
BATA: Battery Alarm	b6	Low battery indicator; set whenever the battery alarm is enabled and if, during a battery test, V_{BAT} is below the selected V_{BAT} trip point. V_{CC} ramp up: battery test if BME = 1; V_{BAT} attach: 0

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Table 3. SPI Status Register

SETTING	BITS	DEFINITION
RDYZ: Ready (Read-Only Bit)	b0	Indicates whether an EEPROM write cycle is in progress. **check: write cycle in progress** **uncheck: ready** (normal state)
WEN: Write Enabled (Read-Only Bit)	b1	Indicates whether the device accepts a WRITE instruction; set through the WREN instruction; cleared through the WRDI instruction or completion of a valid WRITE or a valid WRSR instruction. Refer to the data sheet for definitions of WREN, WRDI, and WRSR. **check: write enabled** (power-on default) **uncheck: write enabled**
BP[1:0]: Block Write Protect	b[3:2]	These bits specify which of the four user-memory blocks are write protected (independent of WPEN and WPZ). Here 1 means checked and 0 means unchecked. Settings: 00b not protected (factory default) 01b block 3 (0C0h to 0FFh) protected 10b blocks 2 and 3 (080h to 0FFh) protected 11b blocks 0 to 3 (000h to 0FFh) protected
WD[1:0]: Watchdog Timeout	b[5:4]	These bits specify the duration of the watchdog timeout if the watchdog is enabled (WDE at address 134h = 1). Settings: 00b 1.64s (factory default) 01b 820ms 10b 410ms 11b 200ms These are nominal values. For tolerances, refer to the *Electrical Characteristics* in the DS28DG02 data sheet.
RPROT: Register Protection	b6	Specifies whether the writeable addresses in the range of 120h and higher are write protected (independent of WPEN and WPZ). **check: protected** **uncheck: not protected** (factory default)
WPEN: Hardware Write-Protect Enable	b7	Specifies whether b7:b2 of the SPI status register (nonvolatile bits) are writeable or whether the WPZ pin state controls the write protection. **check: protection controlled by WPZ pin state** If WPEN = 1 and WPZ pin state is 0 the SPI status register is write protected and a WRSR instruction is not valid. **uncheck: writable** (factory default)

GPIO

Figure 7 shows the **GPIO** tab. Note that it consists of four sections, each containing 12 checkboxes correlating to the 12 PIO pins of the DS28DG02. The EV board was designed so that the first eight pins are input pins. An 8-switch DIP switch block is provided to allow changing the input states from 0 to 1 or vice versa. If the user toggles a switch, clicking the **Read All** button on the **GPIO** software tab shows the change. Conversely, the last four pins (pins 8–11) of the EV board were designed to be used as outputs. Each output is associated with a green LED that responds to changes of state of the output pin. The last four pins can be switched on through software interaction, specifically by clicking on the checkboxes labeled **8**, **9**, **10**, and **11**. The results show up on the EV board as LEDs being turned on or off. Under **Output Value**, Figure 7 shows the first eight pins in the off or logic 0 state. For the EV board it does not matter that these checkboxes are on or off because the board uses the pins as inputs, so output values are meaningless in this situation. For more information about the DS28DG02's PIO schematic, see Figure 10. Conversely, the last four pins under **Output Value** of the **GPIO** tab are checked and are configured on the EV board as outputs. A green LED lights when the output of one of the last four pins is a logic 0. So, the checkmarks in Figure 7 would indicate the LEDs are not lit. Unchecking them would light the LEDs.

The second section of the **GPIO** tab is labeled **Direction**. Each pin can be either an input pin or an output pin. A checkmark (logic 1) by the pin number indicates the pin is configured as an input. Unchecking the pin configures it as an output. Figure 7 shows the first eight pins configured as input and the rest as output.

The **Inversion Mask** is the third section of the **GPIO** tab. When a pin is checked under this section, the inverse of the state of the pin displays in the **Input Value** section. It does not affect the actual state of the pin, just the read-out.

Finally, the **Input Value** is the fourth section of the **GPIO** tab. It shows the state of the pin with inversion mask (if any) applied. Note that this is read-only and the checkboxes cannot be changed.

Note that all four sections contain checkboxes indicating each PIO pin by number. To write to each section's register, simply click on the checkbox by the pin number. This action toggles the value and write the change to the part immediately. There is also an alternate way to write to the PIO registers. On the **GPIO** tab, three of the four sections corresponding to the appropriate register have

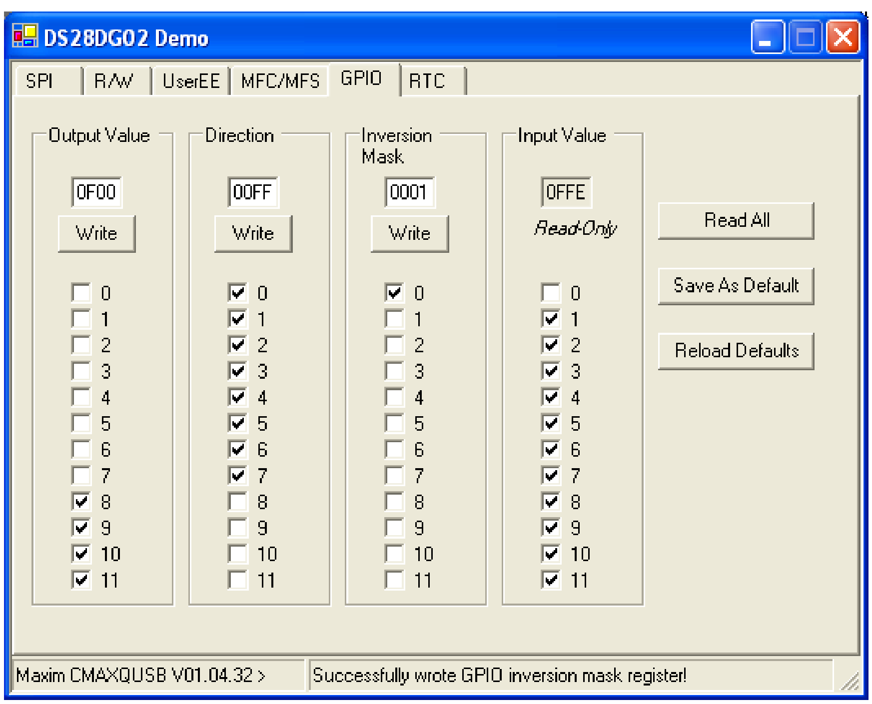

Figure 7. DS28DG02 Evaluation Software: GPIO Tab

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a text box located above the pin checkboxes. The text box is editable with a **Write** button underneath. This allows the user to calculate the desired PIO settings on a bit level, and input the resulting hex number to the text box. Click the **Write** button and the specific PIO register changes accordingly.

The **GPIO** software tab contains two buttons to save and restore default PIO settings. One way to experiment with this is to set the DS28DG02's PIO pins to the desired states and/or settings and click the **Save As Default** button. This saves the settings to the DS28DG02. Next, change the settings and click the **Reload Defaults** button. This restores the previous PIO settings.

RTC

See Figure 8 for a screenshot of the **RTC** tab. This tab allows for exercising and configuring the DS28DG02's RTC. It presents two sections. The top section is labeled **Real-Time Clock** and contains text boxes to input the time, date, and 24-hour time settings. Three buttons are also located in this section. The **Read RTC** and **Write RTC** buttons read the RTC, displaying the time/date in the appropriate text boxes, or write what has been entered into the text boxes to the DS28DG02's RTC. The third button is labeled **Sync RTC to PC**, and when clicked, reads the PC's clock and writes the resulting time/date info to the DS28DG02's time registers.

The bottom section of the **RTC** tab is labeled **RTC Alarm**. This section contains two buttons, one for reading the alarm and one for writing the alarm. The alarm settings can either be input or read into the text boxes located in this section. The text boxes include the alarm occurrence frequency (every second, minute, hour, day, week, or month). They also allow the user to input the time, date, or day associated with the alarm. When the clock alarms, the red ALMZ LED lights on the EV board.

Note that the RTC and the RTC alarm must be enabled prior to experimenting with the **RTC** tab. Enabling and disabling the RTC and RTC alarm and clearing any resulting alarm conditions are done on the **MFC/MFS** software tab. To enable the RTC, check the box labeled **OSCE** (oscillator enable). To enable the RTC alarm, check the box labeled **CAE** (clock alarm enable). To clear any resulting alarm condition that lights the red ALMZ LED, click the **Clear MFS** button. The red ALMZ LED then turns off.

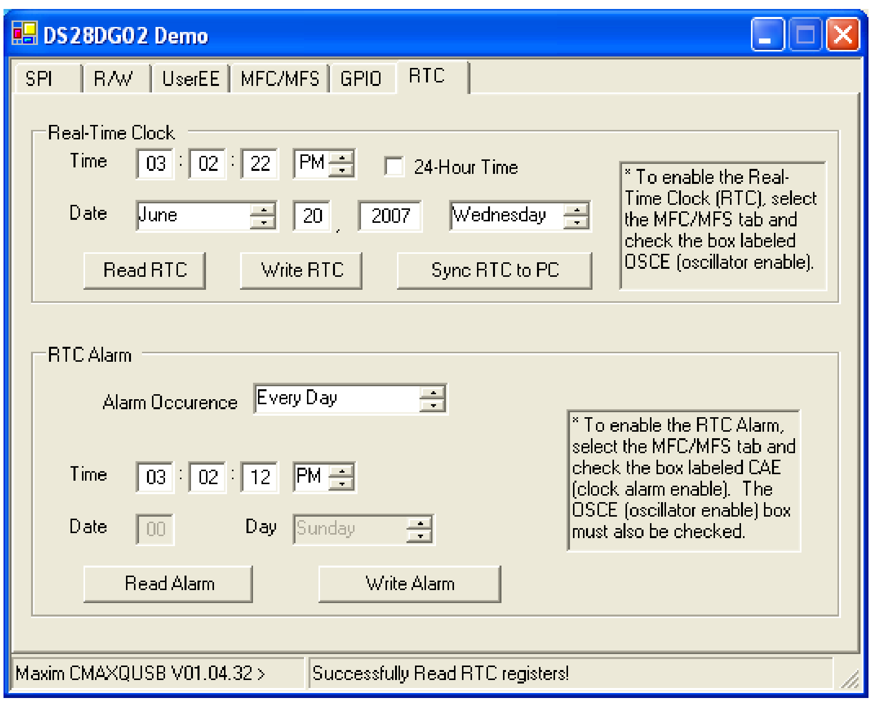

Figure 8. DS28DG02 Evaluation Software: RTC Tab

WatchDog

The **WatchDog** tab of the EV software provides a way to exercise the DS28DG02's watchdog. This tab simply provides the option to select the watchdog input (WDI) pin's input frequency. The software provides the watchdog signal's frequency to the WDI pin based upon the user input on this tab. At least one input is outside any of the watchdog timeout settings.

Additional setup of the DS28DG02 is required prior to experimenting with the watchdog feature of the DS28DG02. First, the user must enable some options located on the **MFC/MFS** software tab. Specifically, the user must check the oscillator enable (**OSCE**) and watchdog enable (**WDE**) checkboxes. These settings are part of the control register. Optionally, select the desired output pin for the watchdog alarm. It can alarm on either the WDOZ pin or the ALMZ pin. When alarming, either pin lights up the appropriate LED on the EV board. The last items to set up for watchdog functionality are the **WD1** and **WD0** checkboxes under the **SPI Status Byte** section of the **MFC/MFS** software tab. These specify the duration of the watchdog timeout. See Table 4 for the watchdog timeout settings. Note that the WDI pin of the DS28DG02 can be floating when the EV board is first connected to the CMAXQUSB command module. Either grounding this pin or selecting the **WatchDog** tab of the software and starting the watchdog signal on this pin defines the state of the pin and allows further experimentation.

Table 4. Watchdog Timeout Settings

WD1	WD0	TIMEOUT (ms)
Unchecked	Unchecked	1600
Unchecked	Checked	800
Checked	Unchecked	400
Checked	Checked	200

Note: *These are nominal timeout values. Check the DS28DG02 data sheet's Electrical Characteristics table for complete ranges.*

Detailed Description of Hardware

Figure 9 is a visual overview of the hardware sections of the DS28DG02 EV board. Many of the components and their use are described in previous sections of this document, so this section describes the components not previously mentioned.

VBAT Monitoring

A battery can be connected to the DS28DG02 that supplies power to the RTC and associated registers if VCC is switched off. Because of this, the DS28DG02 was designed with a built-in battery monitor. If the battery voltage falls below a user-selected trip point monitored on the V_{BAT} pin, the DS28DG02 outputs an alarm. On the EV board, the alarm lights up the red ALMZ LED.

To exercise the battery monitor on the EV board, first place a jumper on the correct pins of J3. Jumper J3 allows the user to choose how the V_{BAT} pin of the DS28DG02 receives power, either through the onboard battery or through V_{CC} (powered by the PC's USB port). Place the jumper on the side of J3 labeled **VCC** (leaving the jumper on **BATT** would prematurely deplete the battery). Once that has been done, use the software described in the *Detailed Description of Software* section to enable the clock oscillator. Click on the **MFC/MFS** tab and check the oscillator enable (**OSCE**) checkbox. The battery monitor enable (**BME**) checkbox should be checked along with selecting a battery trip point (**BTRP**). See Figure 6 for the **BTRP** selections, which are **1.75V**, **2.00V**, **2.25V**, and **2.50V**. Just select the desired setting by clicking on it. Finally, adjust the potentiometer R5 to a low value and rewind the RTC to a few seconds before hour rollover as the battery monitor tests the VBAT voltage every hour on the hour. The RTC can be set on the EV board through the **RTC** software tab. See Figure 8 for a screenshot. The alarm shows on the EV board by lighting the red ALMZ LED. It shows on the **MFC/MFS** software tab as well. Click the **Read MFC/MFS** button, and the battery alarm (**BATA**) checkbox is checked. To clear the alarm, click the **Clear MFS** button. This switches off the ALMZ LED.

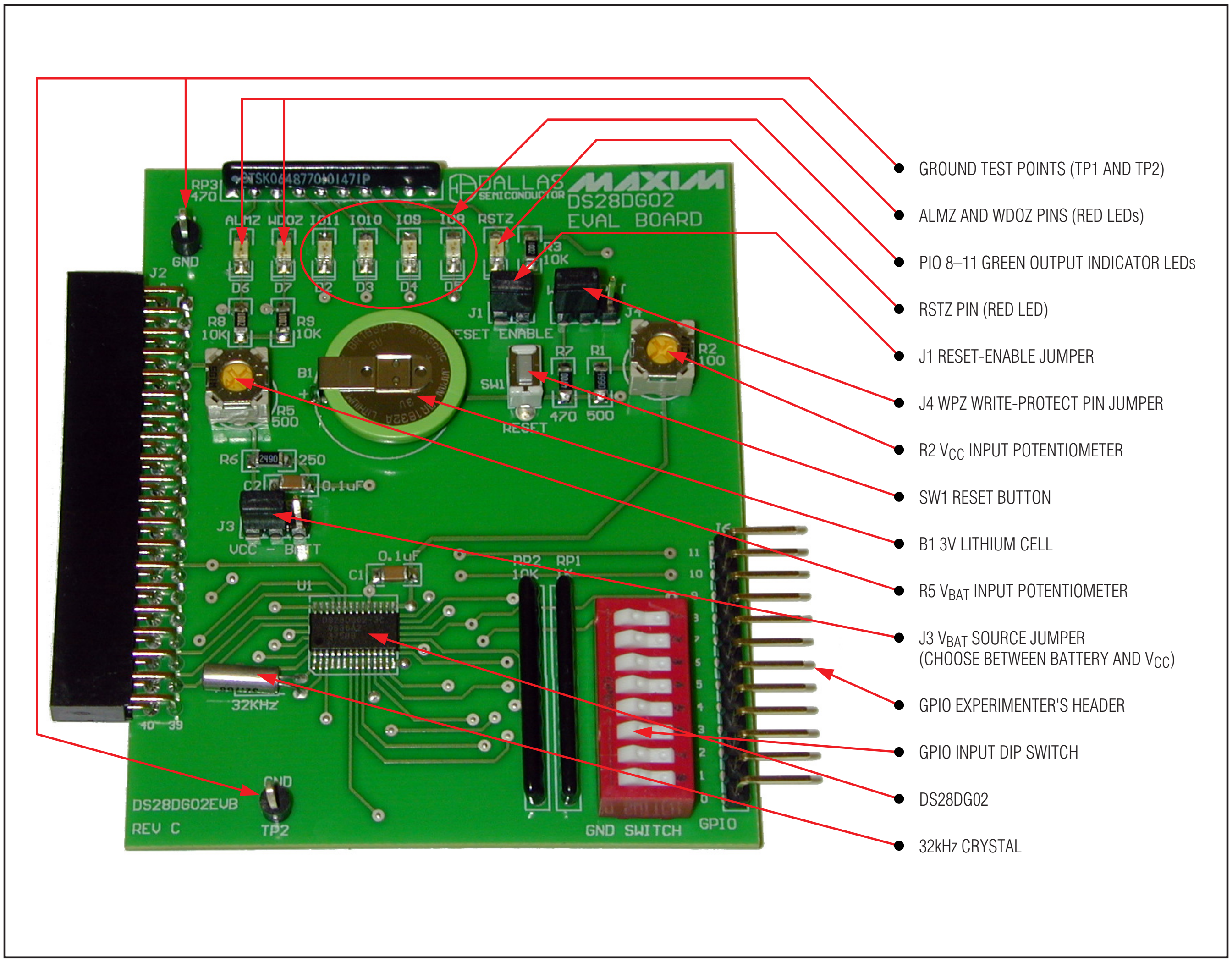

Figure 9. DS28DG02 EV Board Component Map

Reset Monitoring (VCC Monitoring and Pushbutton Reset)

The reset monitor of the DS28DG02 generates a reset to the CPU if the voltage at the V_{CC} pin falls below the factory-set limit, which is between 2.97V and 3.14V with the typical trip point falling at 3.05V. The reset output includes a debounce circuit for manual pushbutton reset.

There are two methods to test reset monitoring of the DS28DG02. The first is to simply push the reset pushbutton switch labeled as SW1 on the EV board. Doing so briefly lights the EV board's red RSTZ LED; this is also indicated on the **MFC/MFS** software tab of the EV software by a checkmark in the reset flag (**RSTF**) checkbox. To see the flag, the **MFC/MFS** screen must be refreshed by clicking on the **Read MFC/MFS** button. To clear the flag, click on the **Clear MFS** button.

The second method is by adjusting the R2 potentiometer on the EV board until the red RSTZ LED lights up. To do this, use a Phillips-head screwdriver and turn the potentiometer counterclockwise. Next, refresh the **MFC/MFS** software tab by clicking on the **Read MFC/MFS** button. A check should appear in the **RSTF** checkbox showing that the low voltage condition occurred. To clear the flag, turn the potentiometer clockwise until the light turns off and click on the **Clear MFS** button on the **MFC/MFS** software tab.

Write Protection

The DS28DG02 provides robust write protection for different sections of on-board memory. The first section of memory that has a write-protection scheme is the user EEPROM area. This area consists of four separate memory blocks of 64 bytes each. These can be write protected through the EV software's **MFC/MFS** tab specifically by clicking on the **BP0** and **BP1** checkboxes under the **SPI Status Byte** section. See Table 5 for the possible combinations of write protection available for user EEPROM block write protection.

Table 5. User EEPROM Write Protection with BP1 and BP0

BP1	BP0	PROTECTED MEMORY
0	0	Not protected (factory default)
0	1	Block 3 (0C0h to 0FFh) protected
1	0	Blocks 2 and 3 (080h to 0FFh) protected
1	1	Blocks 0 to 3 (000h to 0FFh) protected

The second section of memory with a write-protection scheme is the block of memory addresses at 120h and higher. This block is protected through the register protection (**RPROT**) bit of the SPI Status Byte. This bit can be changed through software by clicking the **RPROT** checkbox on the EV software's **MFC/MFS** tab. A checkmark indicates that the addresses are write protected; no checkmark means that the addresses are writable. The **RPROT** checkbox write protects the MFS, MFC, and PIO registers. A valid experiment would be to place a checkmark in the **RPROT** checkbox, and try to read or write any of the registers that RPROT write protects. The attempts should be unsuccessful.

Finally, the previously mentioned SPI Status Byte can be write protected. This is slightly more difficult to do since the bit to write protect the SPI Status Byte is actually a part of the SPI Status Byte. This was intentionally designed this way, as the SPI Status Byte is where all write-protection settings are located. The bit to set is the write-protect enable (**WPEN**) bit. On the **MFC/MFS** software tab, click the checkbox labeled **WPEN** to turn on write protection of the SPI Status Byte. Turning off write protection of the SPI Status Byte requires the WPZ pin of the DS28DG02 to be at a logic 1 state. When the WPZ pin is at the logic 1 state, the SPI Status Byte is writable even if **WPEN** is checked. Placing a jumper on the rightmost two pins of J4 of the EV board can set the WPZ pin to a logic 1, making an otherwise write-protected SPI Status Byte writable.

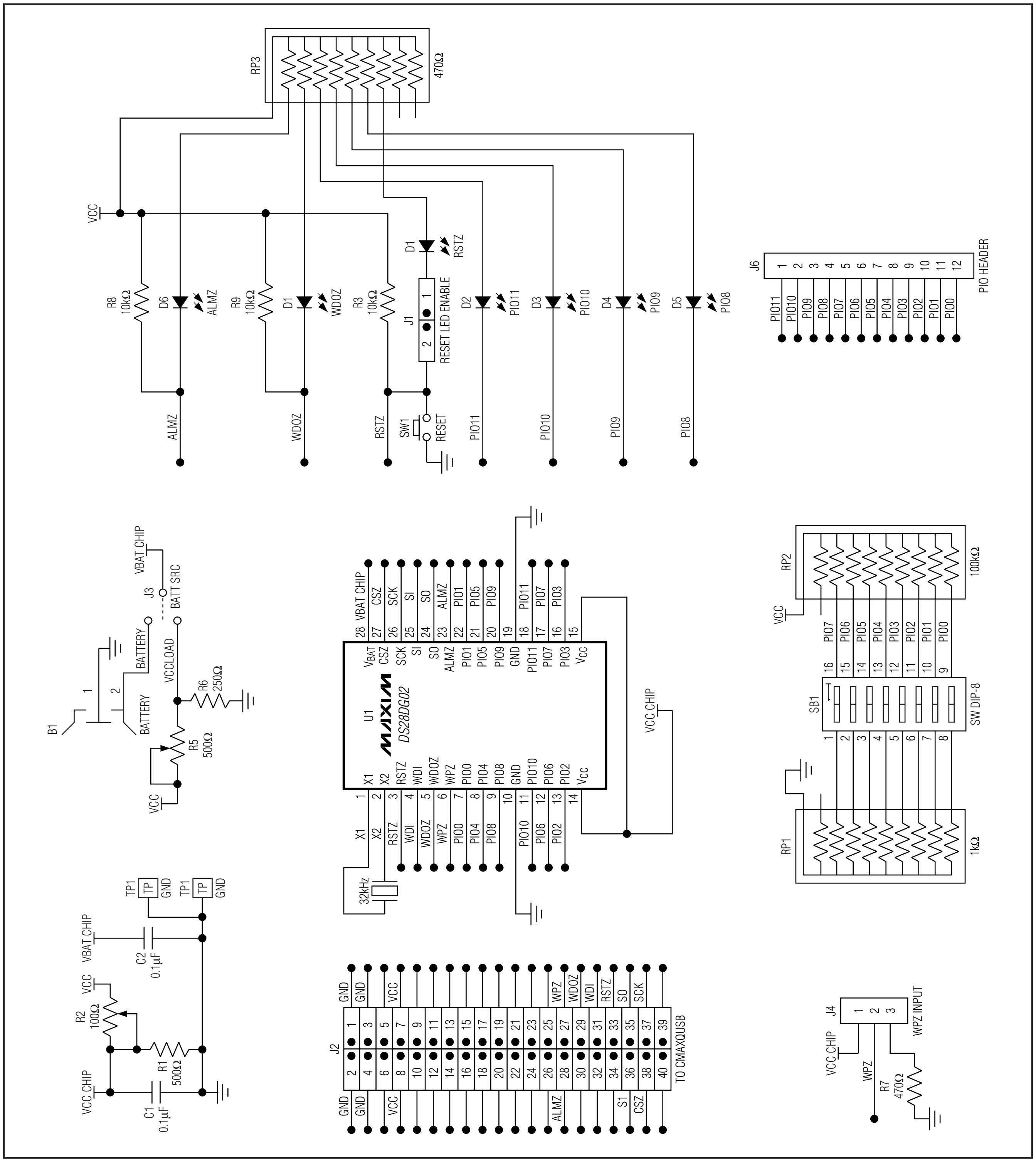

Figure 10. DS28DG02 EV Board Schematics

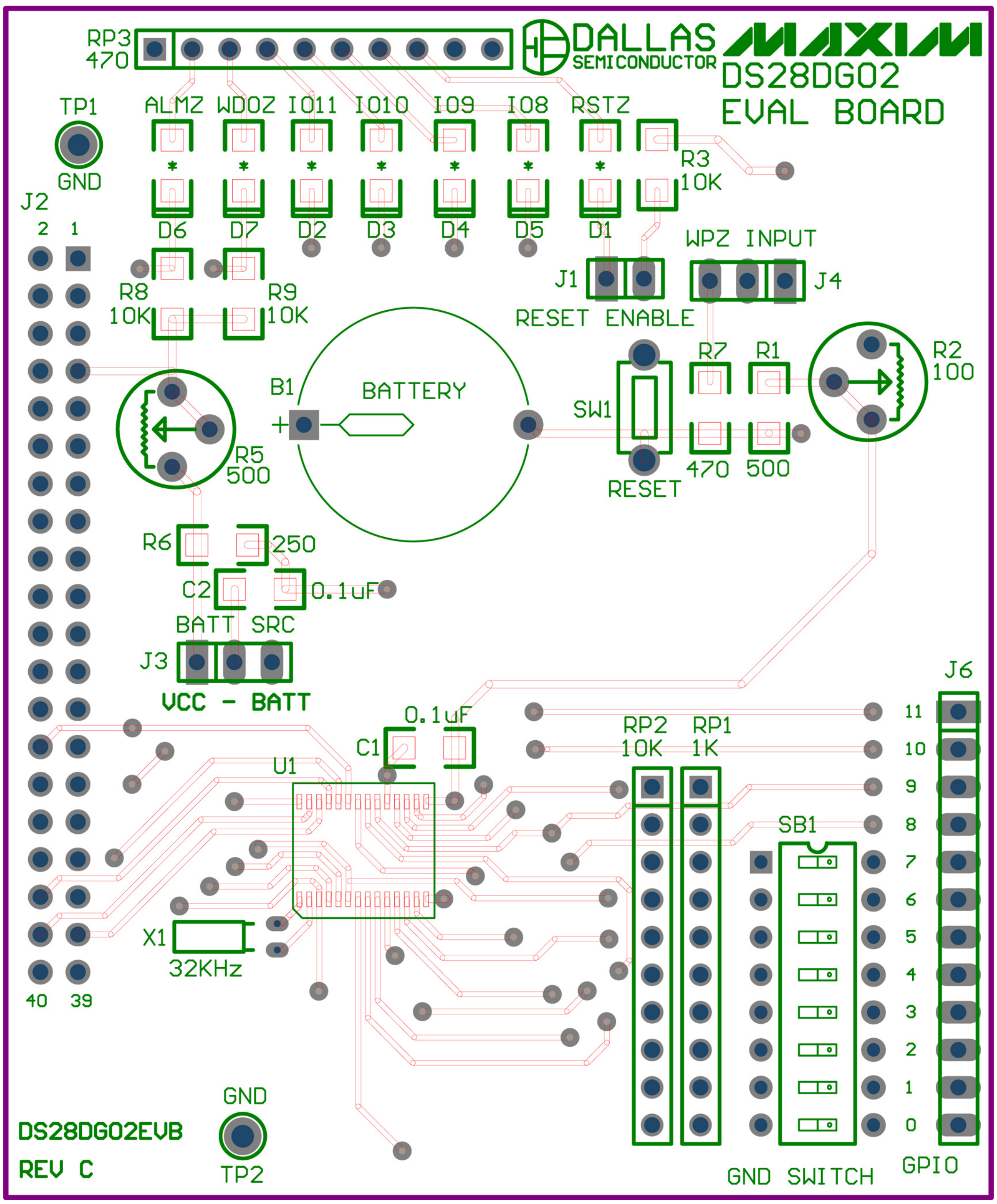

Figure 11. DS28DG02 EV Board Layout Top

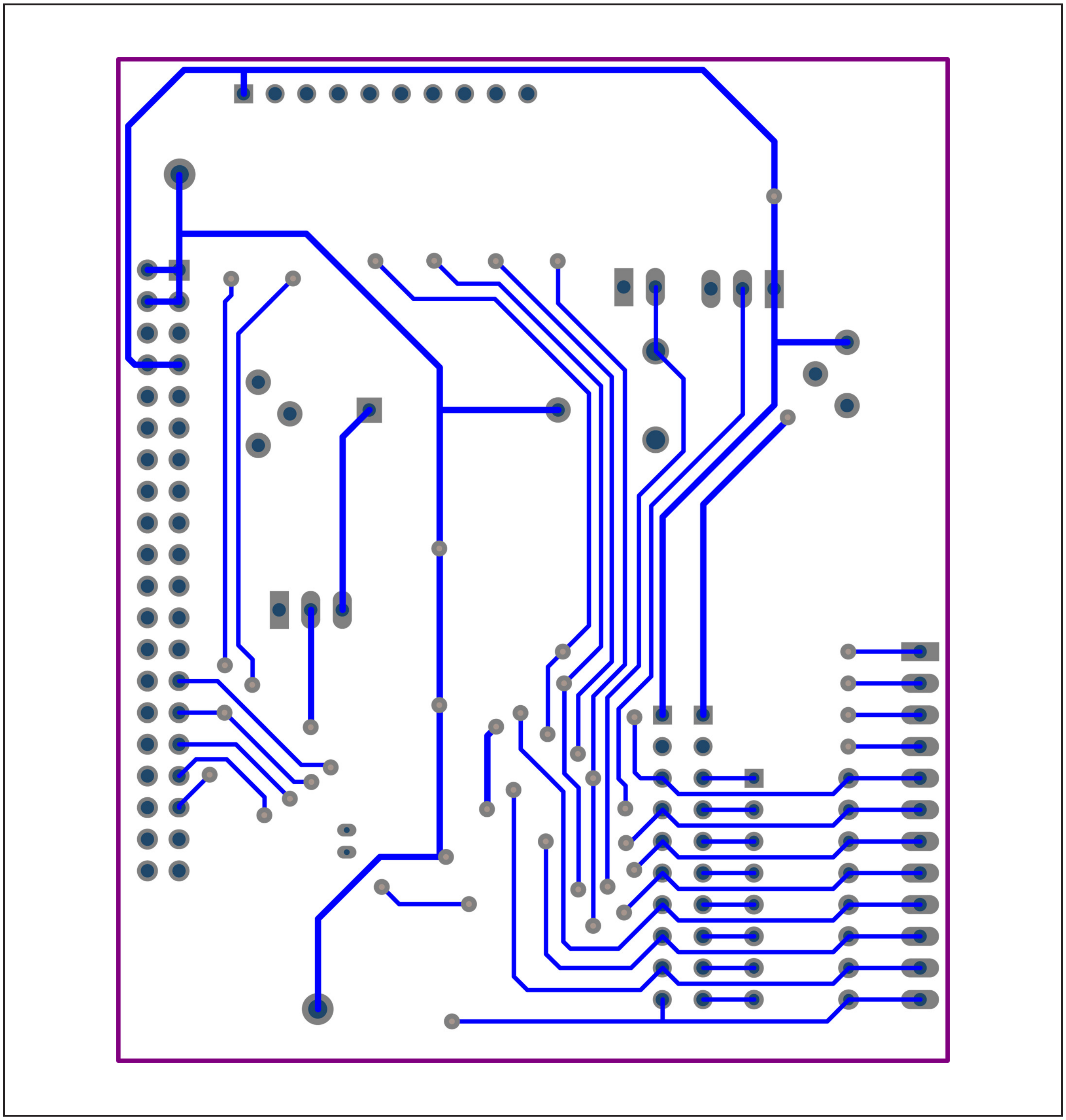

Figure 12. DS28DG02 EV Board Layout Bottom

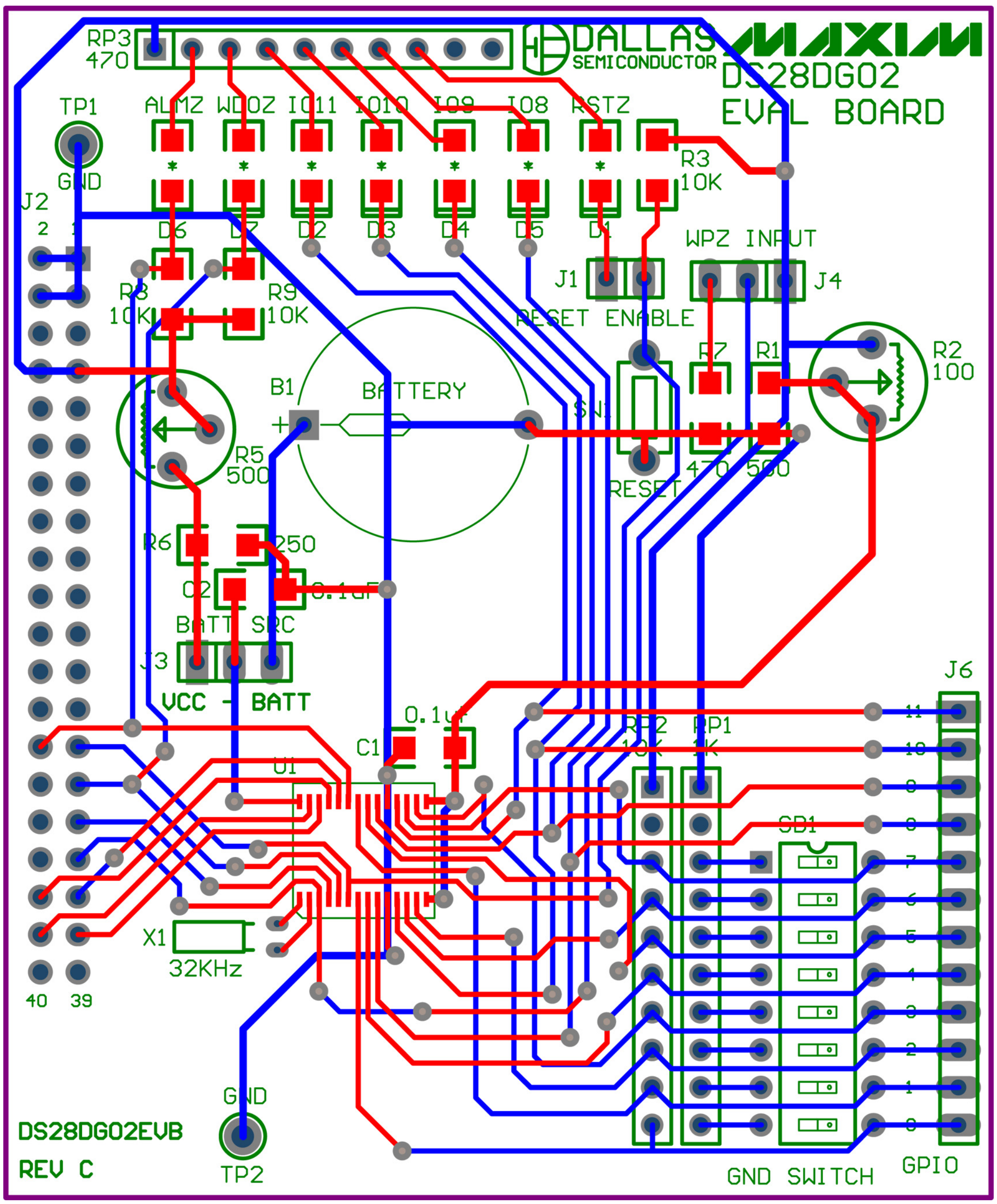

Figure 13. DS28DG02 EV Board Layout Composite

DS28DG02 Evaluation Board/Evaluation System

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	7/07	Initial release.	—
1	5/08	Removed technical support ticketing system link from the *Support Resources* section and replaced with the company technical support web address.	1