

# User's Guide

## BQ2022A Evaluation Software



### ABSTRACT

The BQ2022A is a 1 K-bit serial EPROM containing a factory-programmed, unique 48-bit identification number, 8-bit CRC generation, and an 8-bit family code. A 64-bit status register controls write protection and page redirection.

The purpose of the evaluation software is to demonstrate the functionality of the BQ2022A. The BQ2022A evaluation board can be used for one or two ICs.

The BQ2022A is ideal for applications such as battery pack configuration parameters, record maintenance, asset tracking, product revision status, and access-code security.

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## 1 Kit Contents

1. BQ2022A, HPA125 revision-B board
2. CD-ROM including Microsoft® Windows® based PC software and support documentation

### Note

An EV2400 board is required to interface this EVM with the PC and can be purchased separately. The EV2400 up through at least version 0.18 does not support this EVM.

## 2 BQ2022A-Based Circuit Module

The BQ2022A-based circuit module is ideal for programming the 1 K-bit EPROM and the STATUS bytes of the BQ2022A IC. The circuit module includes a 3-pin SOT23 dual socket, a BQ2022A IC, a Zener diode for host protection during EPROM programming, and a programming circuit that generates a 12-V pulse when used with a power supply and a control signal. In a typical application, only the BQ2022A IC and a pullup resistor is required.

### 2.1 Test Points

[Table 2-1](#) lists the EVM test points.

**Table 2-1. Test Points**

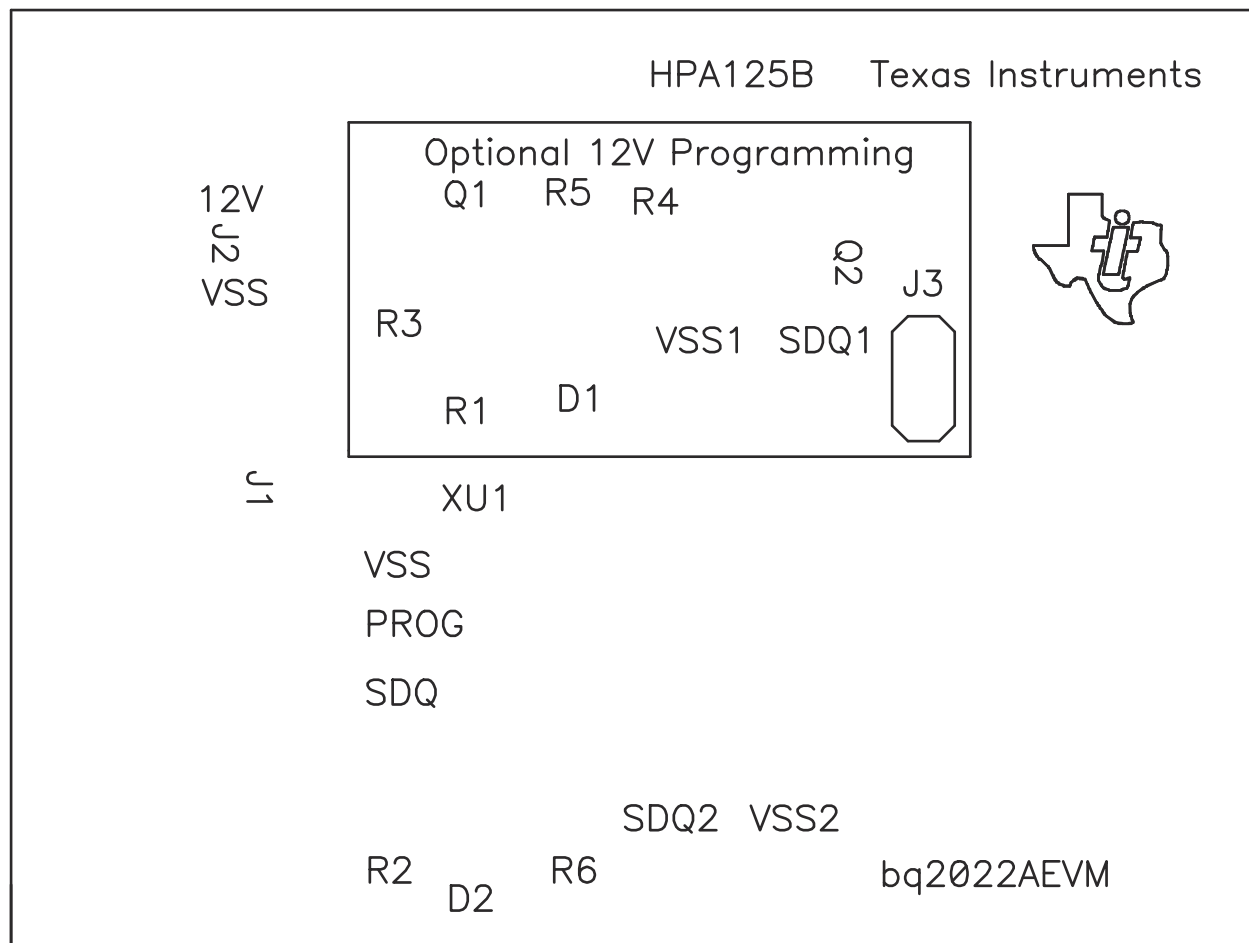
| Test Point | SIGNAL NAME | DESCRIPTION                                 |
|------------|-------------|---|
| J1-1       | VSS         | Device ground                               |
| J1-2       | PROG        | Input for timing of EPROM programming pulse |
| J1-3       | SDQ         | SDQ single-wire communication bus           |
| J2-1       | 12V         | High voltage for EPROM programming          |
| J2-2       | VSS         | Programming ground                          |
| J3         |             | Connect for EPROM programming               |

1 Optional 12V Programming

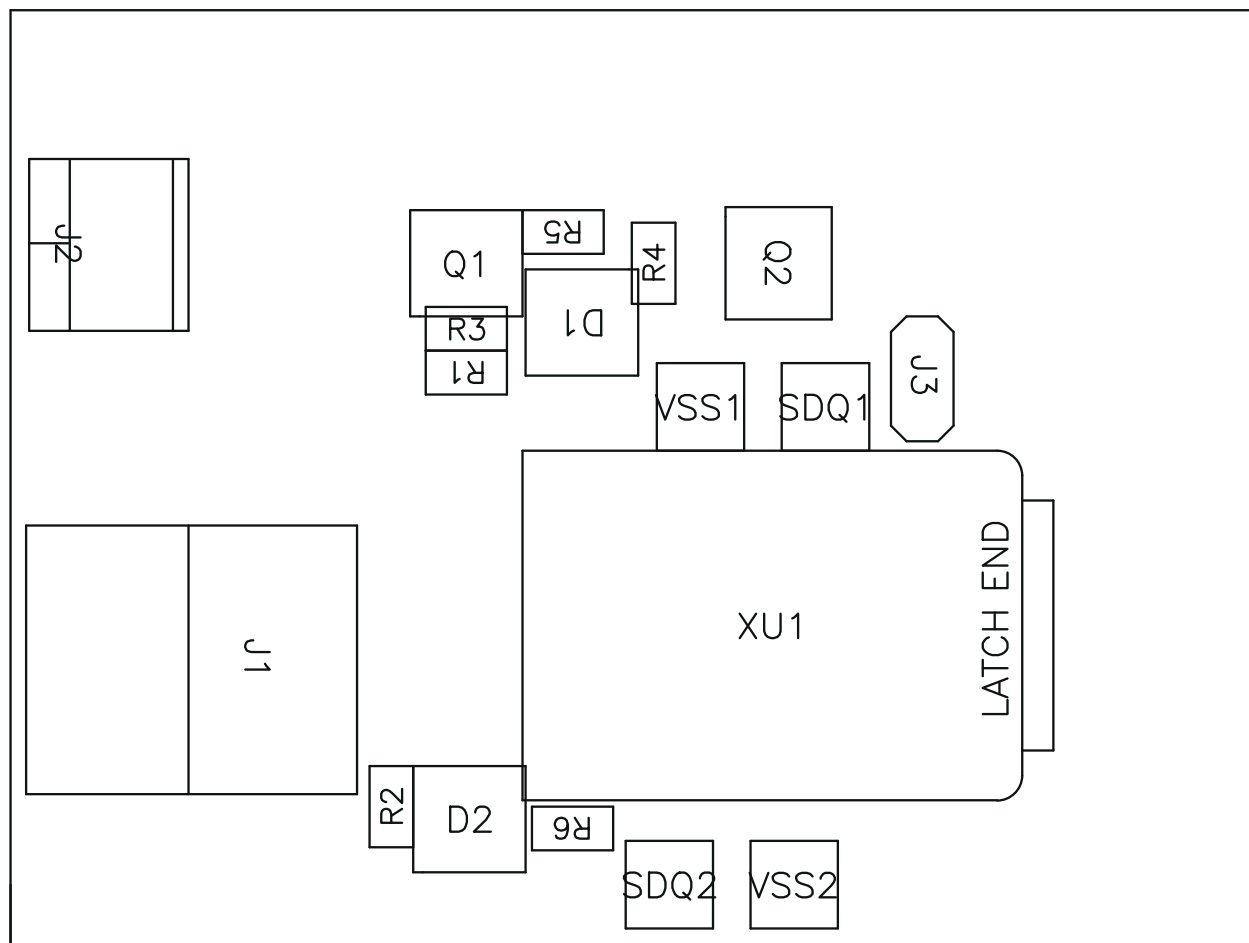
### Figure 3-1. EVM Schematic

## 4 Circuit Module Physical Layouts

This section contains the board layout and assembly drawings for the BQ2022AEVM circuit module.



### Figure 4-1. Silk Screen



**Figure 4-2. EVM Top Assembly**

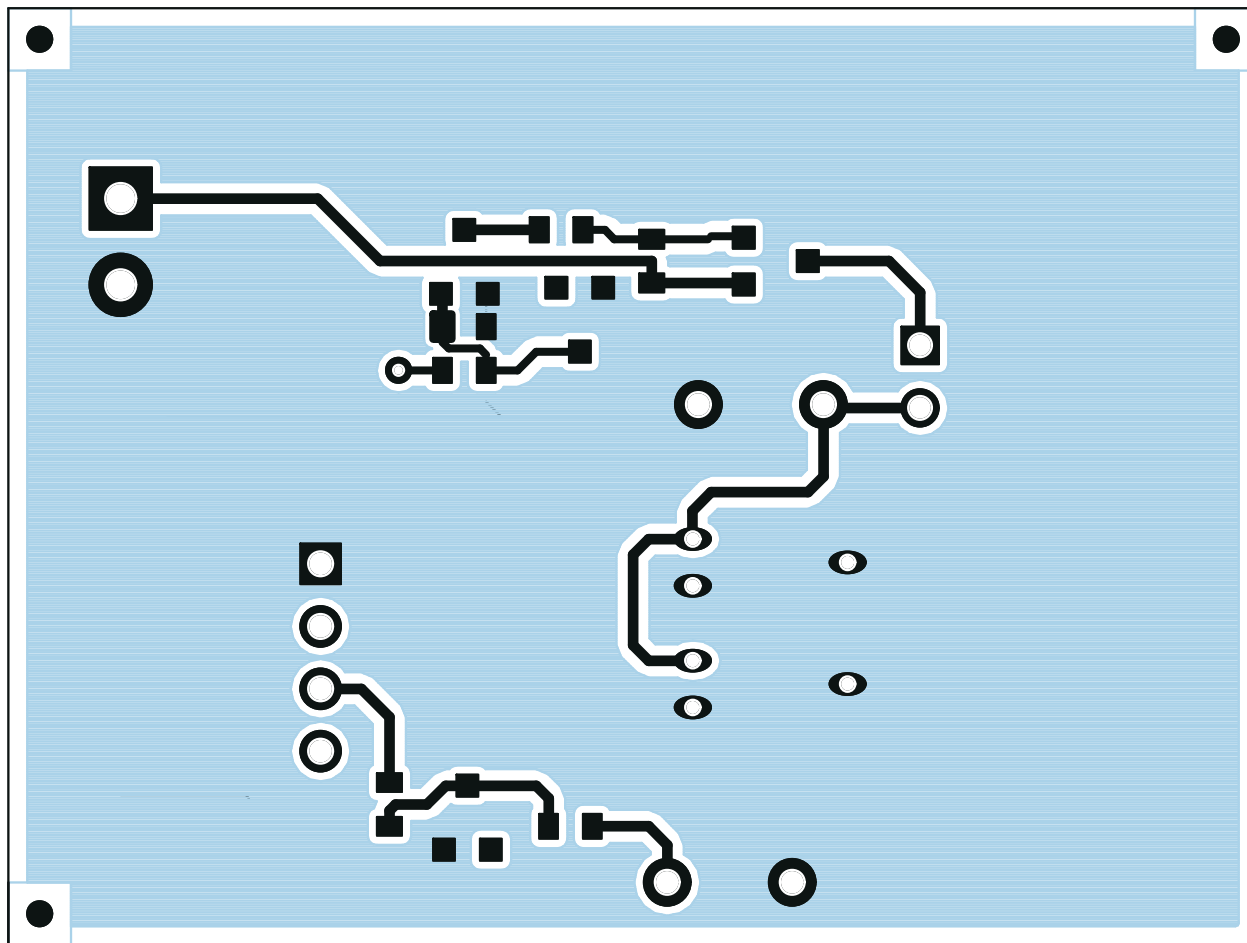
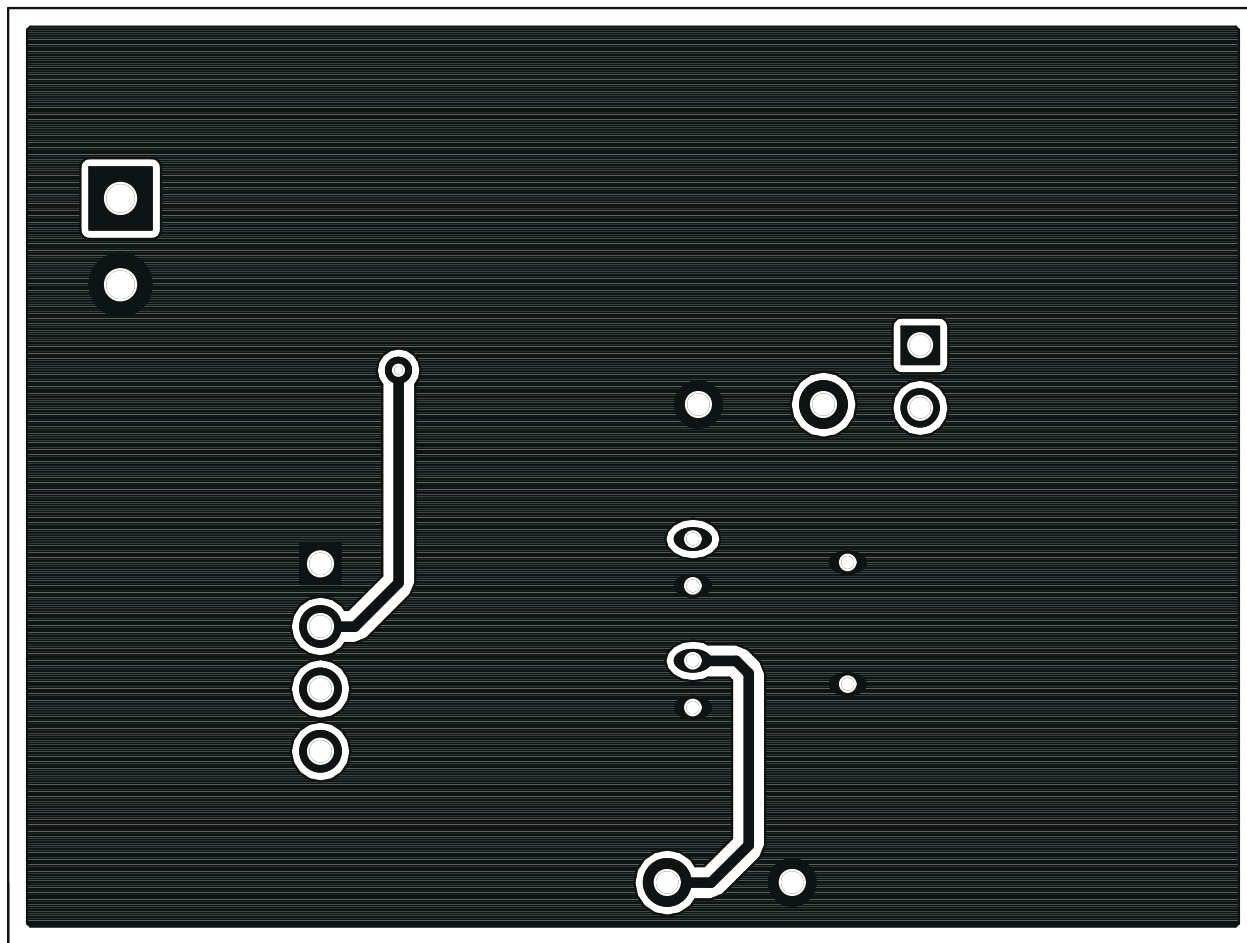


Figure 4-3. EVM Layer One



**Figure 4-4. EVM Layer Two**

## 5 BQ2022A Circuit Module List of Materials

Table 5-1 presents the list of materials required for the BQ2022AEVM circuit module.

**Table 5-1. List of Materials**

| REF DES    | QTY | DESCRIPTION                                    | MFR           | PART NUMBER         |
|------------|-----|--|---------------|---------------------|
| D1, D2     | 1   | Diode, Zener, 5.6-V, 350-mW                    | Diodes, Inc.  | BZX84C5V6           |
| J3         | 1   | Header, 2-pin, 100-mil spacing, (36-pin strip) | Sullins       | PTC36SAAN           |
| R1, R2, R6 | 3   | Resistor, Chip, 100-Ω, 1/16-W                  | Std           | Std                 |
| R3         | 1   | Resistor, Chip, 100-kΩ, 1/16-W                 | Std           | Std                 |
| R4         | 1   | Resistor, Chip, 10-kΩ, 1/16-W                  | Std           | Std                 |
| XU1        | 1   | Socket, Double 3P SOT-23                       | Loranger      | 13293 121 X218A     |
| J1         | 1   | Header, Friction Lock Ass'y, 4-pin Right Angle | Molex         | 22-05-3041          |
| J2         | 1   | Terminal Block, 2-pin, 6-A, 3.5-mm             | OST           | ED1514              |
| VSS1, VSS2 | 2   | Test Point, Black, 1-mm                        | Keystone      | 5001                |
| SDQ1, SDQ2 | 2   | Test Point, Red, 1-mm                          | Keystone      | 5000                |
| Q1         | 1   | MOSFET, N-ch, 60-V, 115-mA, 1.2-Ω              | Vishay-Liteon | 2N7002DICT          |
| Q2         | 1   | MOSFET, Pch, -20V, 3.7A, 65 mΩ                 | IR            | IRLML6402           |
| U1         | 1   | IC, 1 K Serial EPROM With SDQ Interface        | TI            | BQ2022ADBZR         |
| –          | 1   | PCB, 2 In x 1.25 In x .125 In                  | Any           | HPA125 Rev. B Board |
| N/A        | 1   | Shunt, 100-mil, Black                          | 3M            | 929950-00           |

## 6 BQ2022AEVM Circuit Module Performance Specification Summary

Table 6-1 provides the performance specification summary.

**Table 6-1. Performance Specification Summary**

| SPECIFICATION                   | MIN  | TYP | MAX | UNITS |
|---------------------------------|------|-----|-----|-------|
| Voltage Pullup ( $V_{UP}$ )     | 2.65 |     | 5.5 | V     |
| Programming Voltage( $V_{PP}$ ) | 11.5 |     | 12  | V     |

## 7 EVM Hardware and Software Setup

### 7.1 Drivers and Software Installation

This section describes how to install the BQ2022AEVM PC software, and how to connect the different components of the EVM.

Use the following steps to install the BQ2022A evaluation software:

1. Insert the CD ROM into a CD ROM drive.
2. Select the CD ROM drive using *My Computer* or *File Manager*.
3. Select the ReadMeFirst.txt file.
4. Select the Software/EV2400 Drivers directory of CD and run SETUP.EXE.
5. Plug the EV2400 into a USB port.
6. Wait until system prompt new hardware found appears. Choose select location manually, and use the browse button to point to subdirectory TIUSBWin2K-XP-1.
7. Answer continue to the warning that drivers are not certified with Microsoft.
8. After installation finishes, another system prompt new hardware found appears. Repeat procedure above, but point to subdirectory TIUSBWin2K-XP-2.
9. Answer continue to the warning that drivers are not certified with Microsoft. Installation of drivers is now finished.
10. For Microsoft® Windows® 98, point to directory TIUSBWin98.
11. After installing the USB drivers for EV2400, double-click on the Setup.exe icon that is under the Software/bq2022A Evaluation Software folder.
12. Follow the instructions on screen during the installation of evaluation software.
13. The setup program installs a Windows application group.



## 7.2 Hardware Connection

The BQ2022AEVM has three hardware components. :

1. The BQ2022AEVM circuit module
2. The PC interface board, (EV2400 – purchased separately)
3. The PC

Use the following steps to configure the hardware for interface to the PC:

1. Connect the HPA125 board with the EV2400 PC interface board using [Table 7-1](#) as a pin connection guide.
2. Connect the USB cable to the EV2400 and the PC USB port.

The BQ2022AEVM is now set up for normal operation.

**Table 7-1. Wire Connection**

| BQ2022AEVM (HPA125 Rev. B) | EV2400 |
|----------------------------|--------|
| SDQ                        | HDQ    |
| VSS                        | GND    |
| PROG                       | VOUT   |

To program the EPROM of BQ2022AEVM, a 12-V pulse must be generated on the SDQ line. The HPA125 board has an additional circuit included that permits generating this pulse when using a power supply set to 12 V and the VOUT output of the EV2400. The evaluation software controls this pulse for EPROM programming.

When programming the EPROM, it is expected that a 12-V supply must be connected to the HPA125 board at the 12-V input terminal of the HPA125 board. Ensure that the ground of the power supply is connected to VSS of the board.

A jumper (J3) must be connected when using the EPROM programming circuit.

### 7.2.1 Normal Operation

Normal operation includes performing any of the ROM commands, reading the 1 K-bit EPROM and reading the EPROM Status Memory.

### 7.2.2 EPROM Programming

To program EPROM registers, a 12-V pulse must be sent across the SDQ line after sending the code 0x5A during a write command. See the BQ2022A data sheet ([SLUS724](#)) for a specific description of EPROM programming requirements. When programming EPROM registers, the following must be ensured:

- J3 jumper is connected.
- VOUT output of EV2400 is connected to PROG input of HPA125 board.
- Power supply set to 12 V is connected across the 12 V and VSS inputs of HPA125 board.

## 8 Software Operation

Run the program from the Start|Programs|Texas Instruments|bq2022A Evaluation Software menu sequence.

### 8.1 Evaluation Software Pages

This section describes the function of each page of the EVSW.

#### 8.2 ROM CMD

This page provides all the ROM commands for BQ2022A (see [Figure 8-1](#)).

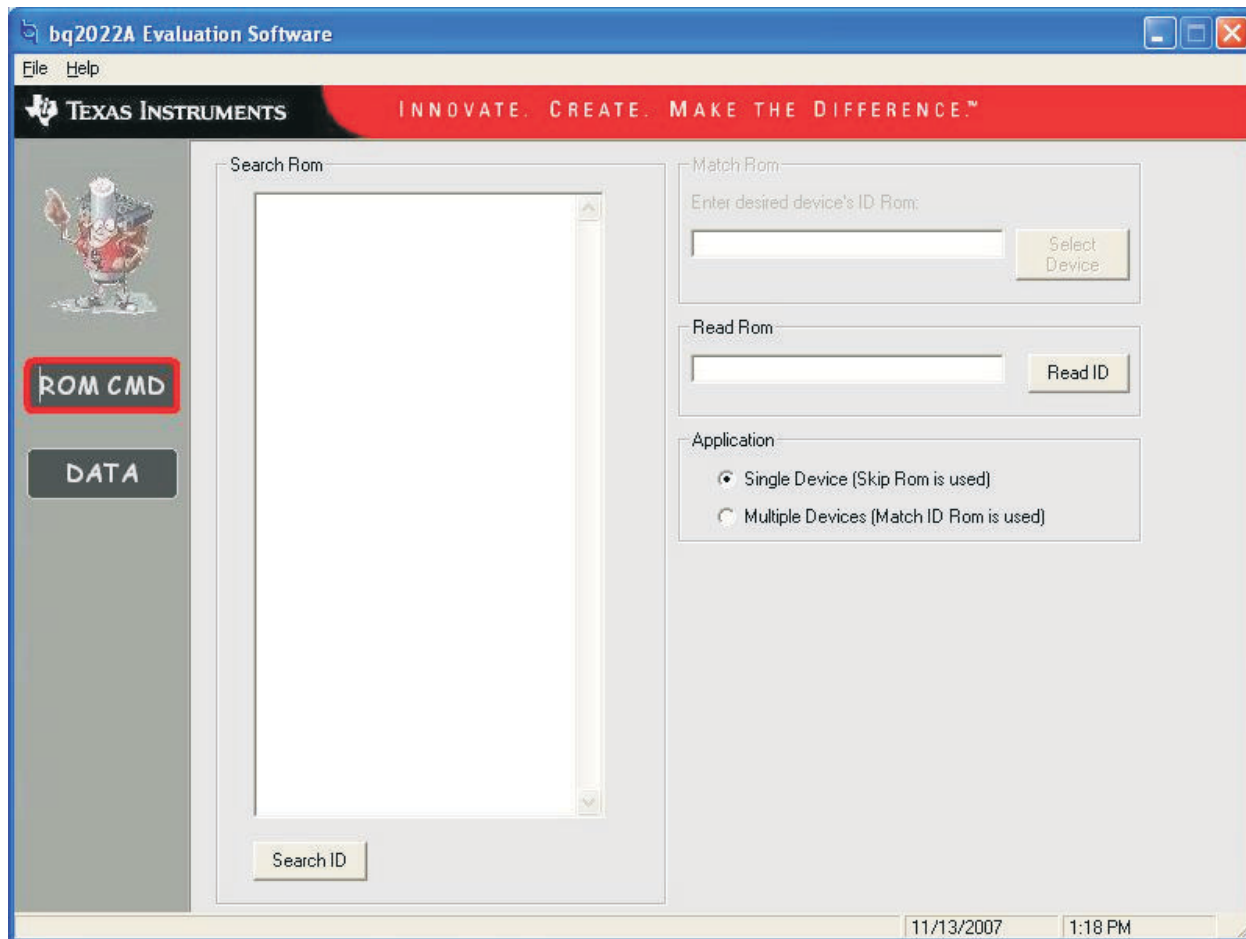
##### 8.2.1 Sections Within the ROM CMD Page

**Application** This section determines the number of BQ2022A devices that are on the SDQ bus. If only one device is used, then select *Single Device*. This option sends the *SKIP ROM* command before any communication attempt is made with the device. If more than one device is used, then select *Multiple Devices*. This option sends the *MATCH ROM* command before any communication attempt is made with the desired device

**Search ROM** This section demonstrates the *SEARCH ROM* command. When multiple devices are on the SDQ bus, the ROM ID of the devices that share the bus is listed.

**Match ROM** This section is only available when the *Multiple Devices* option is selected in the Application section. To use the *MATCH ROM*, enter the ROM ID of the device of interest in the text box, and then click on the *Select Device* button. This causes the *MATCH ROM* commands with the desired ROM ID to be sent whenever communication is attempted with the desired device. If *SEARCH ROM* is used, the desired ID can be copied from the *SEARCH ROM* list, and then pasted into the *MATCH ROM* text box. Ensure that only the ID numbers are pasted into the text box and not the whole line referring to the device.

**Read ROM** This section is only available when the *Single Device* option is selected in the Application section. The ID ROM of the device on the SDQ communication line is displayed.



**Figure 8-1. ROM CMD Page**

## 8.3 DATA

This page (see [Figure 8-2](#)) allows the user to program the 1 K-bit EPROM with desired values and to program the STATUS bytes. It requires that the hardware is set up as described in the EPROM programming of this user's guide.

### 8.3.1 1 K-Bit EPROM

The EPROM memory map is organized in four pages of 32 bytes each. All registers can be read by clicking on the *Read Memory* button. As the registers of a specific page are being read, the page number is highlighted in red.

The two methods of programming the EPROM using the EVSW follow.

1. Click on a specific grid that corresponds to the register that needs to be written. Write the hexadecimal value of the data that needs to be written, and then press ENTER.
2. The other method of programming the EPROM is by importing a data file that contains all the values to be programmed. The data file has the file extension **.epr**. An example of a data file is included with the EVSW. To create additional data files, modify the example file so that the values on the right side of the file represent the desired values. Save the file with a different name ensuring that the extension **.epr** is used. To import a file into the grid, go to *File|Open Data File*, and select the appropriate file. Once the file is opened, the grid is filled in with the values contained in the data file. Click on the *Write Memory* button so that the values are programmed into the EPROM.

A data file can also be saved by going to *File|Save Data File*. The data that is saved in the file is the data displayed on the grids representing the EPROM memory map.

### 8.3.2 Status Bytes

This section allows the user to read or write the EPROM Status bytes of the BQ2022A. The registers are programmed by clicking on the appropriate grid, entering the desired value, and pressing ENTER.

Buttons are provided for the user to select specific pages for write protection. By selecting any of the *Write Protection Bits* button, register 0x00 of status registers is written automatically so that the corresponding bit is cleared.

Note that the status registers are EPROM. Once a bit has been cleared, it cannot be set.

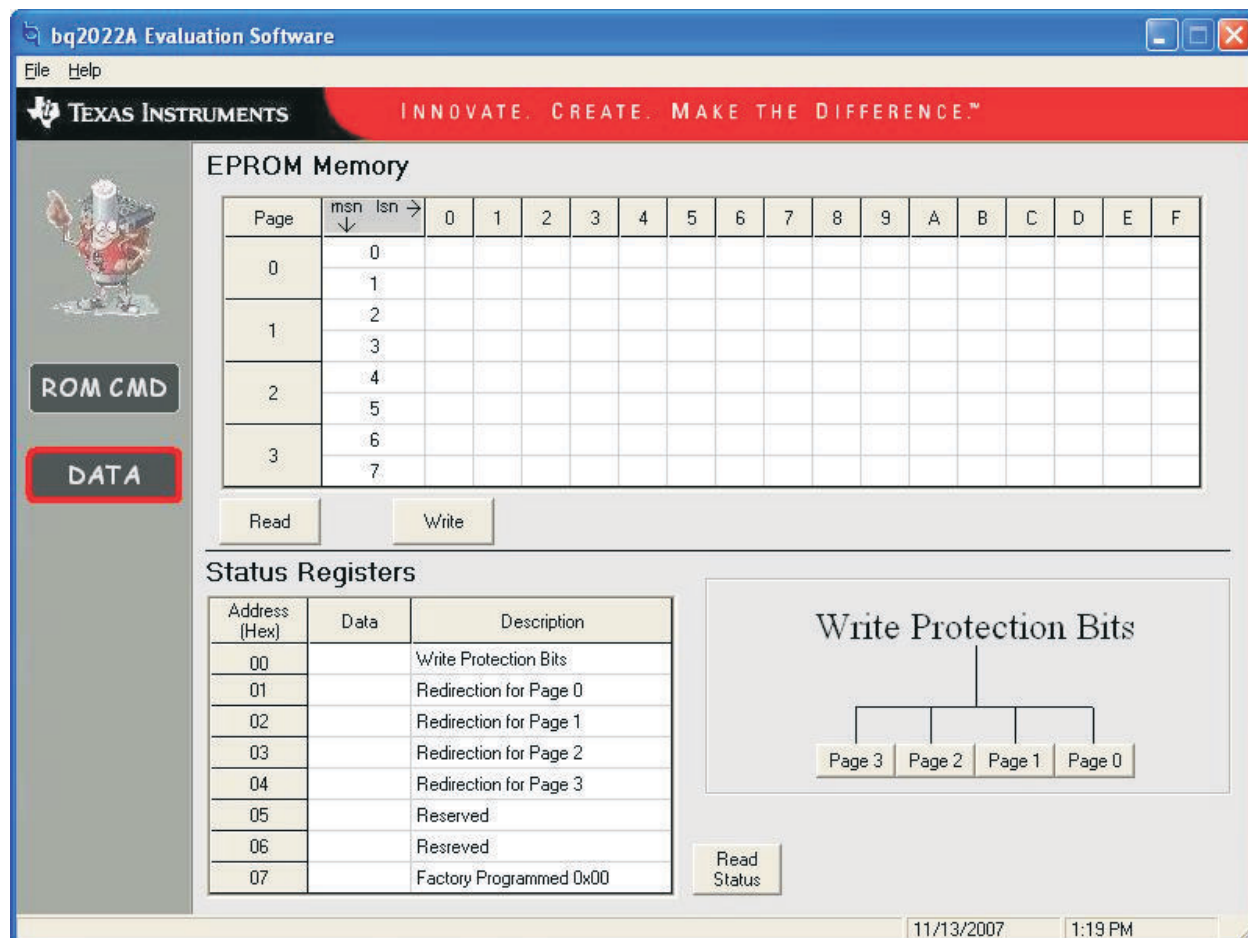


Figure 8-2. DATA Page

## 9 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision B (July 2017) to Revision C (February 2021)                                     | Page |
|---|------|
| • Updated the numbering format for tables, figures, and cross-references throughout the document..... | 2    |
| • Updated user guide to use EV2400 instead of EV2300 (NRND).....                                      | 2    |
| Changes from Revision A (October 2013) to Revision B (July 2017)                                      | Page |
| • Added note regarding EV2400 board versions.....   | 2    |

## STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
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  - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
  - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

### **WARNING**

**Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.**

**User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.**

**NOTE:**

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

### 3 Regulatory Notices:

#### 3.1 United States

##### 3.1.1 Notice applicable to EVMs not FCC-Approved:

**FCC NOTICE:** This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

##### 3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

#### **CAUTION**

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

#### **FCC Interference Statement for Class A EVM devices**

*NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*

#### **FCC Interference Statement for Class B EVM devices**

*NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:*

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

#### 3.2 Canada

##### 3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

#### **Concerning EVMs Including Radio Transmitters:**

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

#### **Concernant les EVMs avec appareils radio:**

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

#### **Concerning EVMs Including Detachable Antennas:**

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

### Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

#### 3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see [http://www.tij.co.jp/sds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/sds/ti_ja/general/eStore/notice_01.page) 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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#### 3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

---

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

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