Using the LP8580EVM Evaluation Module

User's Guide

Literature Number: SNVU495
March 2016

Contents

Read This First

About this Manual

This user's guide describes the characteristics, operation, and use of the LP8580EVM evaluation module. This user's guide includes a schematic diagram and a bill of materials (BOM).

Related Documentation from Texas Instruments

LP8580 data sheet SNVSA65

FCC Warning

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user, at their own expense, is required to take whatever measures may be required to correct this interference.

If You Need Assistance

Contact your local TI sales representative.

LP8580 Evaluation Board

1 Introduction

The Texas Instruments LP8580EVM evaluation module helps designers evaluate the operation and performance of LP8580 integrated circuit (IC). The LP8580EVM uses the LP8580 high-efficiency boost converter and six LED outputs to drive display backlight with local dimming capability. More information about the LP8580 capabilities can be found in the device data sheet (SNVSA65).

In order to facilitate ease of testing and evaluation of this circuit, the EVM contains power supply connection for the VIN and VDD voltages. Test points are provided for the key signals. The onboard microcontroller can be used to control the digital input signals of the LP8580. A graphical user interface (GUI) is provided for fast and easy evaluation of the device.

For evaluation purposes, the EVM has been tested over a 2.7-V to 27-V input voltage (V_{IN}) range. V_{DD} voltage needs to be within 2.9 V to 5 V. This voltage range is within the absolute maximum input range of the LP8580. Users are cautioned to evaluate their specific operating conditions and choose components with the appropriate voltage ratings before designing this support circuitry into a final product.

Table 1.

PART NUMBER	PACKAGE	BODY SIZE (NOM)
LP8580	QFN (24)	4.00 mm × 4.00 mm

2 Description of the LP8580 Device

The LP8580 IC is a high-efficiency LED driver with an integrated boost converter. It has 6 high–precision current sinks that can be controlled individually through an SPI™ and I2C interface. The LP8580 device includes support for regional backlight control (1D local dimming) with up to 6 independently controlled backlight regions. The LP8580 IC also supports whole screen (0D dimming) content adaptive backlight control such as CABC.

2.1 Features

- High-efficiency asynchronous DC-DC boost converter with integrated power FET
- Six high-precision current sinks with up to 50-mA output current/channel
- Individual LED string brightness control
- Supports both SPI and I2C interfaces for brightness control
- Extensive protection features including open and shorted LED fault detections
- 2.7-V – 27-V V_{IN} input voltage range

2.2 Applications

- Mobile Phones
- Tablet PCs
- Notebooks

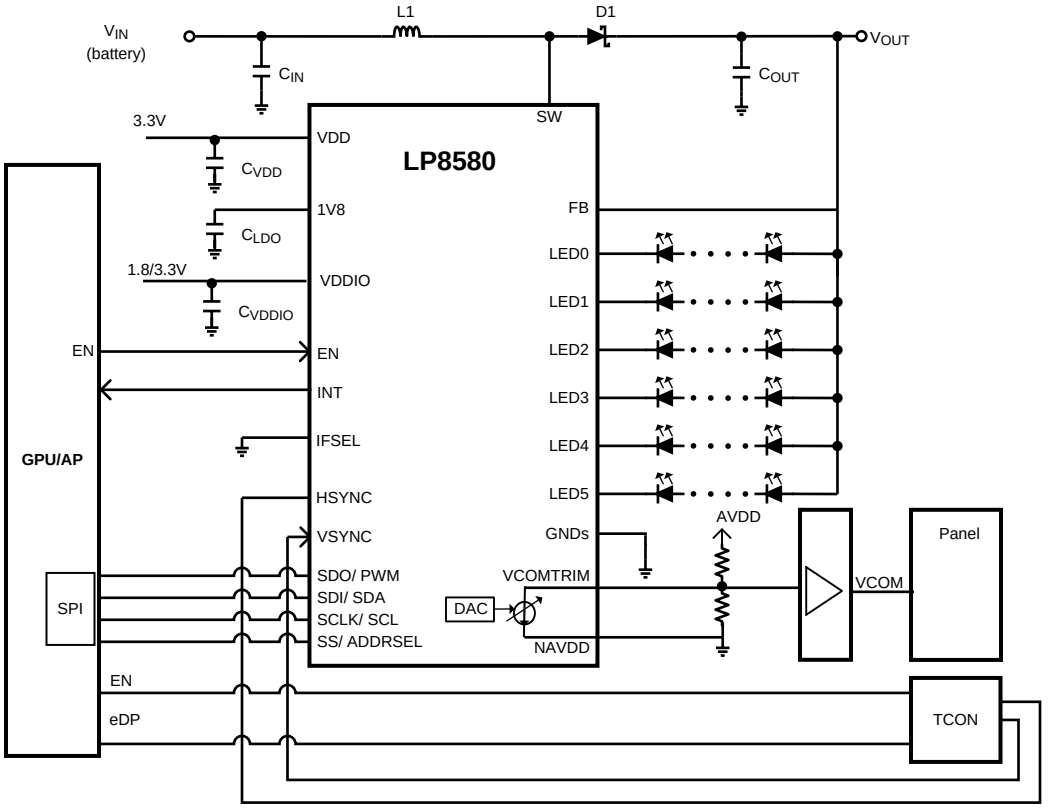

Figure 1. Typical Application

3 Hardware Setup

Figure 2 shows how to set up LP8580EVM. An external 2.9-V to 5-V power source must be connected to VDD input connector, and boost input voltage between 2.7 V to 27 V must be connected to the VIN connector. If an onboard microcontroller is used, the LP8580EVM must be connected to a Windows® PC with a USB cable.

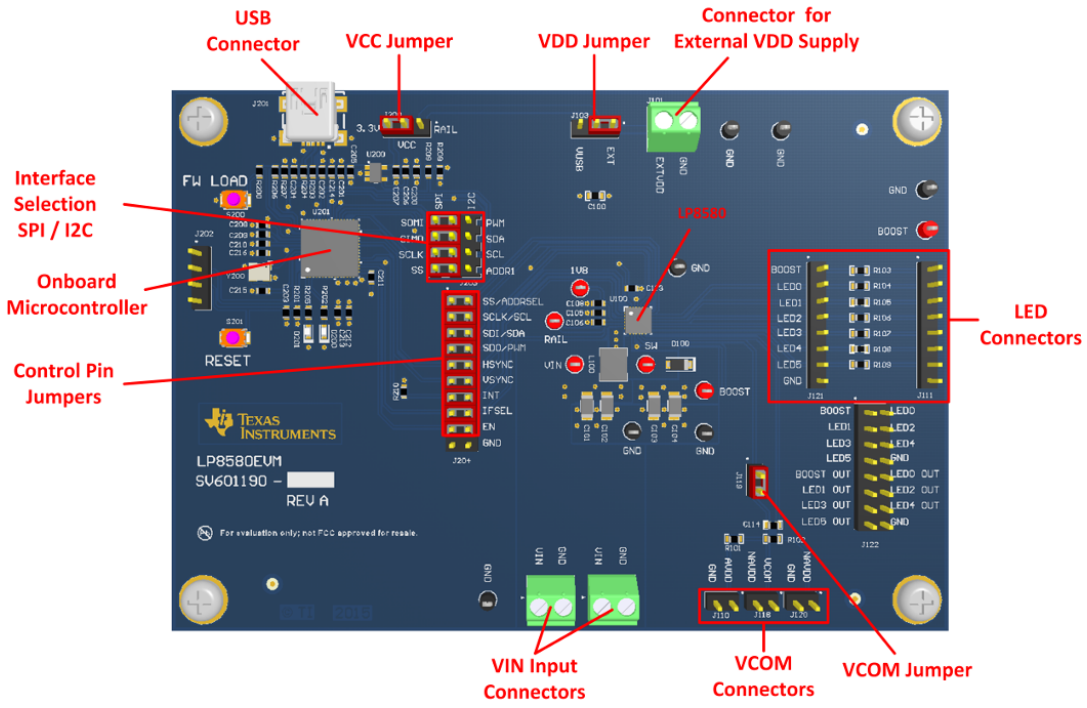

Figure 2. LP8580EVM Hardware Setup

3.1 LED Connectors

An external LED load board must be connected to LED connectors. Use of six strings of white LEDs with 3 to 13 LEDs in each string is recommended. The sum of LED forward voltages of the LED strings must be between 10 V to 40 V. Either connector (J121 or J111) can be used to connect the LEDs. Connector J111 has series resistors on the LED outputs and boost output, while the connector J121 connects straight to LED output pins (see *Section 7* for connection details). LED anodes must be connected to BOOST pin and the cathodes to LEDx pins. The GND pin is provided for measurement purposes only and does not need to be connected to the LEDs.

If LEDs are connected to connector J111, connector J122 can be used to measure the individual LED currents and boost converter output current. LEDx– and LEDx OUT pins connect to the different sides of the current sense resistors and LED current can be measured by connecting a voltage meter on these pins. BOOST and BOOST OUT pins connect to the different sides of the boost output current sense resistor. Boost output has a 1-Ω current sense resistor while LED outputs have 10-Ω current sense resistors.

3.2 VCC and VDD Jumpers

The VDD jumper selects the VDD input voltage source for the LP8580 IC. If the VDD jumper is set to the EXT side the LP8580 is powered from a external voltage source that is connected to the external VDD supply connector (J101). If the VDD jumper is set to the VUSB side, the LP8580 IC is powered from a USB ports 5-V input voltage. Note that boost converter input voltage always comes from the VIN input connectors.

The VCC jumper can be used to select the input voltage for the onboard microcontroller. If the VCC jumper is set to the 3.3-V side, the microcontroller is powered from the USB bus. A 3.3-V voltage regulator is used to lower the 5-V input voltage from the USB port to 3.3 V. If the VCC jumper is set to RAIL side, the microcontroller is powered from the same source as the LP8580 IC. This jumper also selects the VDDIO voltage for the LP8580 IC.

3.3 Buttons

There are two push buttons on the EVM. Button S200 (FW LOAD) is used for microcontroller firmware programming during LP8580EVM manufacturing and does require input from the user. Button S201 (RESET) can be used to reset the onboard microcontroller if firmware gets stuck for any reason.

3.4 Indicator LED

When LP8580EVM is connected to the USB port LED D201 should be blinking indicating that the firmware of the onboard microcontroller is running. If LED D201 is not blinking, check that the VCC jumper is set to the 3.3-V position or that the external power supply is connected.

3.5 Interface Setup

The LP8580 supports SPI and I2C interfaces. Interface selection of LP8580EVM shunts must be set correctly for each interface. Figure 3 and Figure 4 show how to set up the shunts for each interface.

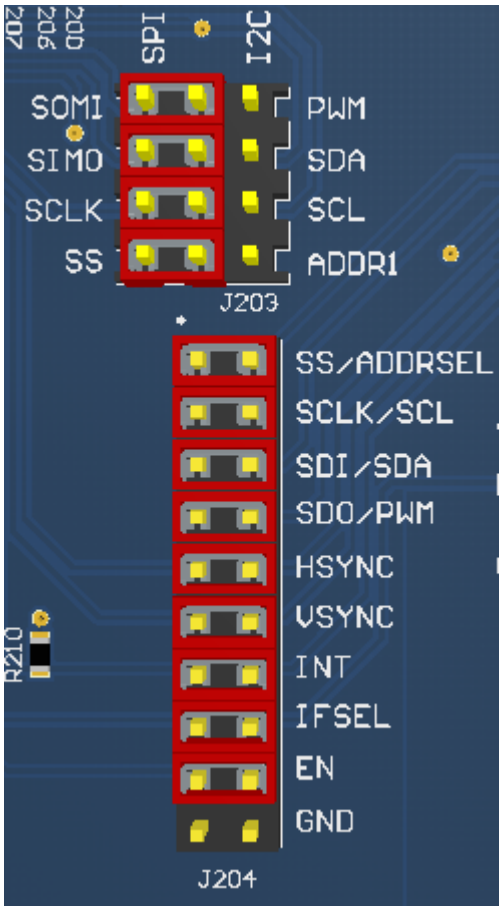

Figure 3. SPI Settings

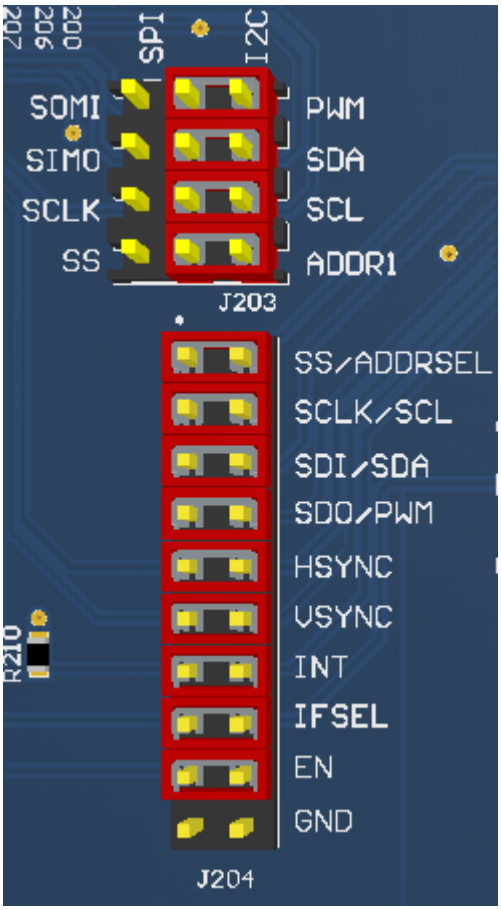

Figure 4. I2C Settings

4 LP8580EVM Evaluation Software

The LP8580EVM is connected to the computer via USB. The EVM is controlled with special evaluation software. The onboard MSP430 microcontroller is used to provide easy I2C/SPI communication, as well as to control the digital inputs of the LP8580 IC. The microcontroller is powered by default from USB. The LP8580 IC is powered from external power supply.

4.1 LP8580EVM Evaluation Software Installation

Before LP8580 evaluation software can be used it must be installed. Open the folder containing the installation package and double click the “LP8580_setup.exe”. If Windows prompts you to verify the installation click “Yes”. The license agreement window opens. Click “I Agree” for the license agreement. Next choose to include the start-up menu and desktop shortcuts. Select the ones you like and click “Next”. The installer then prompts for installation folder. Installing the program to its default location is recommended. Click “Install”. Once installation is complete, close the installer by clicking “Close” button.

4.2 Driver Installation

When the LP8580EVM is connected to a computer for the first time, Windows should recognize it automatically and start to install the driver. A “Found New Hardware” dialog box prompts user to locate the missing driver. Select “No, not this time” and continue with “Next”. Select “Install from a list or specific location (Advanced)” to install the driver. Select the directory where the TI_CDC_Virtual_Port driver is located. If LP8580 evaluation software was installed to its default location, the driver can be found at C:\Program Files (x86)\Texas Instruments\LP8580\Driver. Windows should now install the driver. The driver generates a virtual COM port which is used to communicate with the evaluation board.

4.3 Evaluation Software Removal

The LP8580 evaluation software can be uninstalled through Windows Control Panel. Open *Control Panel → Programs and Features*. Find LP8580 from the list, right click it, then select "Uninstall".

5 Using the LP8580EVM Evaluation Software

When LP8580 evaluation software is run it looks like Figure 5. This is the main view where all the controls are located. A short description of the main GUI areas follows, explaining how they can be used to control the LP8580EVM.

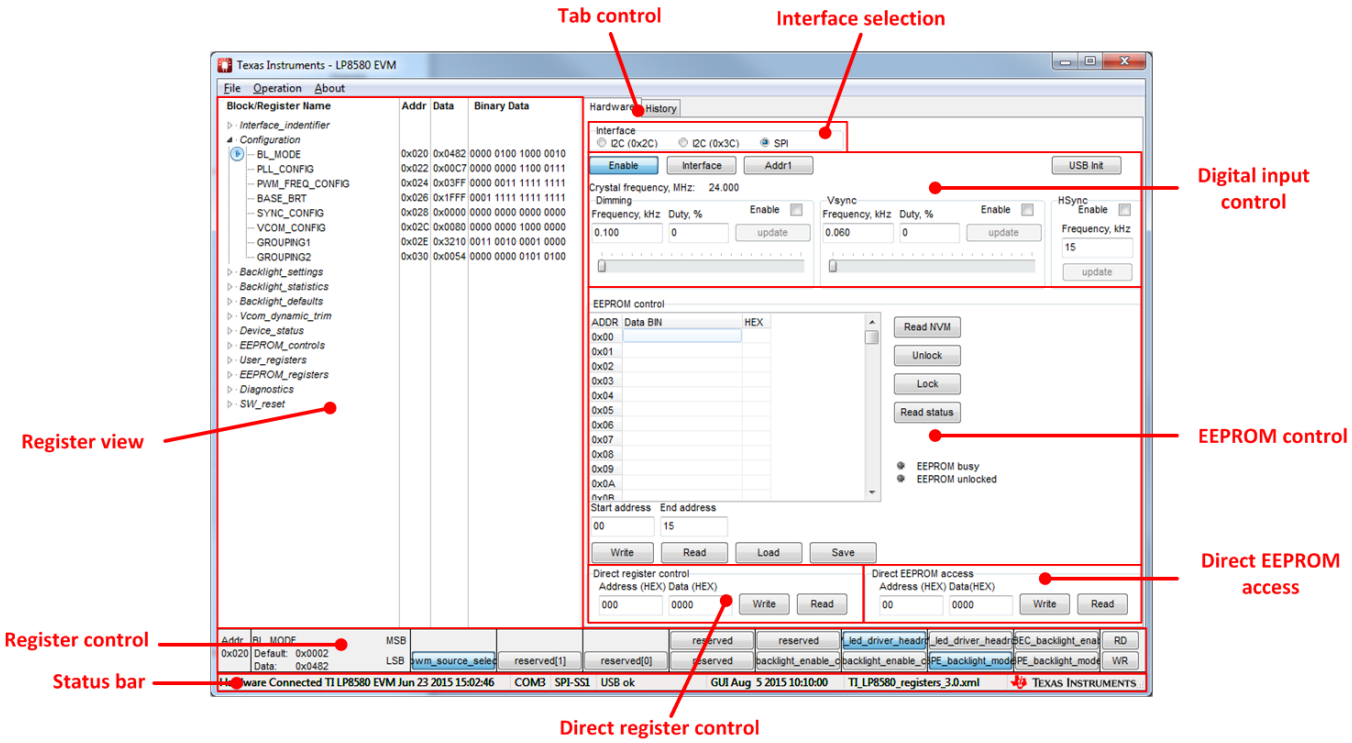

Figure 5. Evaluation Software

5.1 Digital Input Control

Controls in the digital input control area are used to control the digital input pins of the LP8580 IC. The **Enable** button controls the state of the EN pin. The **Interface** button controls the state of the IFSEL pin. The **Addr1** button controls the state of the SS/ADDRSEL pin when LP8580EVM is set up for I2C mode.

Dimming control can be used to control the SDO/PWM pin when LP8580EVM is set up for I2C mode. This can be used for PWM brightness control. The PWM frequency and duty cycle can be set, and the PWM generator can be turned on and off. The **Update** button needs to be pressed to update new frequency or duty cycle to the PWM generator.

V_{SYNC} control can be used to control the VSYNC pin. The V_{SYNC} frequency and duty cycle can be set and the V_{SYNC} generator can be turned on and off. The **Update** button needs to be pressed to update new frequency or duty cycle to the V_{SYNC} generator.

H_{SYNC} control can be used to control the HSYNC pin. The H_{SYNC} frequency can be set, and H_{SYNC} generator can be turned on and off. **Update** button needs to be pressed to update new frequency to the V_{SYNC} generator.

5.2 Interface Selection

The LP8580 supports both SPI and I2C interfaces. The interface is selected with the IFSEL pin of the LP8580. In I2C mode the LP8580 supports two I2C slave addresses (0x2C and 0x3C). The LP8580 I2C address is selected with the SS/ADDRSEL pin. Before LP8580 registers can be read or written, hardware settings and evaluation software interface selection must be set correctly. The **Interface** and the **Addr1** buttons control the digital input pins of the LP8580, and Interface selection controls how the onboard microcontroller communicates with the LP8580 IC.

To use the SPI interface, shunts of the IC must be set as shown in Figure 6. The **Interface** button in the digital control area of the evaluation software must be in OFF state, and SPI must be selected in the interface selection area.

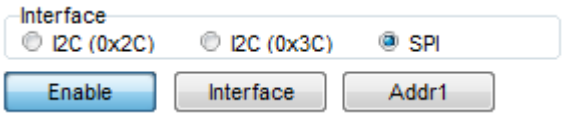

Figure 6. SW SPI Settings

To use the I2C interface shunts of the LP8580 must be set as shown in Figure 6 and the **Interface** button in the Digital control area of the evaluation software must be in an ON state. To use I2C interface with 0x2C address **Addr1** button must be in OFF state.

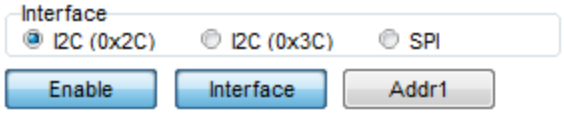

Figure 7. I2C Settings With 0x2C Address

To use the I2C interface with 0x3C address the **Interface** and **Addr1** buttons must be in an ON state. Interface selection must be made with I2C (0x3C).

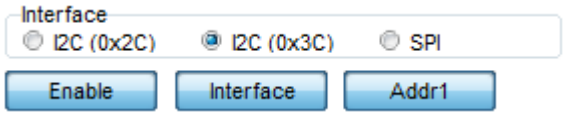

Figure 8. I2C Settings With 0x3C Address

5.3 Register View

The register view shows the content of all the registers in the LP8580 IC. Registers are grouped into logical register blocks. Each block can be opened or closed by clicking the arrow on the left side of the block name. Register view is not automatically updated. When evaluation software is started up all register values are shown as zeros. To read the content of the LP8580 registers into register view, click *Operation → Read All Registers*.

5.4 Register Control Area

When any of the registers is selected it appears in the register control area. All registers of the LP8580 are 16 bits long, but the unused bits are hidden in the register control. Changing the register bit settings does not automatically update the register value. Once all the register bits are set the **WR** button must be pressed to write the new value into the register. Register values can be read by clicking the **RD** button on the right side of the register control area.

5.5 Direct Register Control

Single register values can be written or read with the direct register control area. To read a register value, set the register address in an address field in a 16-bit hexadecimal value, and click the **Read** button. The register value appears in the Data field. To write a new value to a register, write the new data into the data field and click the **Write** button.

5.6 EEPROM Control Area

The EEPROM control area can be used to read and write the whole content or a specific area of the EEPROM. Clicking the **Read** button reads the content of the LP8580 EEPROM to the EEPROM content window where start and end addresses can be defined. This is useful if only part of the EEPROM must be updated.

When LP8580 is started up, EEPROM content is locked from editing. To be able to write new values in the EEPROM, first it must be unlocked. This can be done by clicking the **Unlock** button. The status of the EEPROM lock can be checked by pressing the **Read status** button. If EEPROM is unlocked the **EEPROM unlocked** status indicator turns red. EEPROM can be locked again by pressing the **Lock** button. The **Read NVM** button reads the content of the LP8580 EEPROM to LP8580 control registers.

The **Save** button can be used to save the EEPROM settings in the EEPROM content window to a text file for future use. To save the content of the LP8580 EEPROM to a text file, first press the **Read** button to read the content of the LP8580 EEPROM into the EEPROM content window.

The **Load** button can be used to load EEPROM values form a text file into EEPROM content window. EEPROM content of the LP8580 IC is not updated until the **Write** button is pressed.

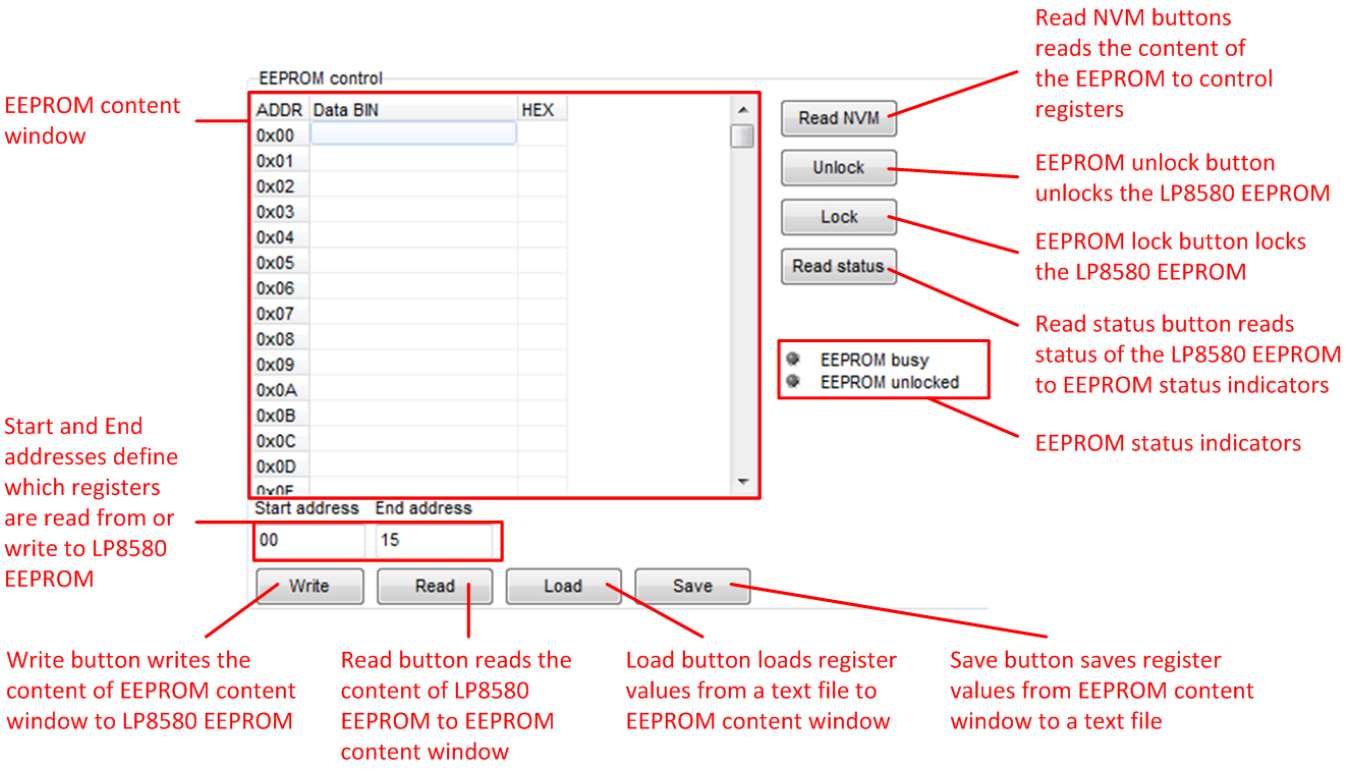

Figure 9. EEPROM Control Area

5.7 Direct EEPROM Access

Direct EEPROM access can be used to read and write a single EEPROM register. To read a register value, set the register address into the address field in a 16-bit hexadecimal value, and click the **Read** button. Registers value appear in the data field. To write a new value to a register, write new data into the data field, and click the **Write** button. EEPROM must be unlocked before new values can be written into EEPROM.

5.8 Status Bar

The status bar shows if the LP8580EVM is successfully connected to a PC. It also shows the virtual COM port number, GUI build date, and other information.

5.9 History Tab

The LP8580 evaluation software history tab shows all the register reads and writes that have been done. The history can be cleared by clicking the **Clear** button.

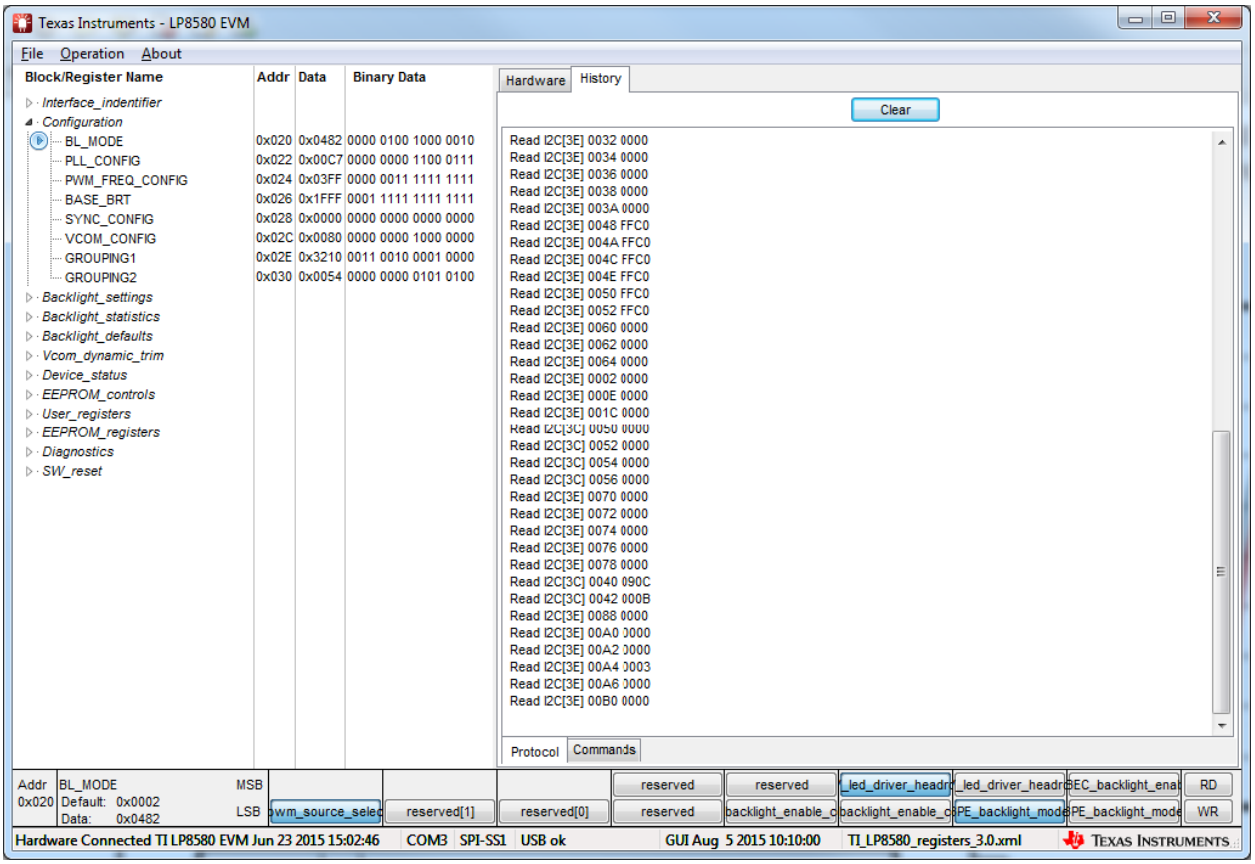

Figure 10. History Tab

The *Commands* view of the history tab shows the commands that the evaluation software sends to the virtual COM port. This can be useful if one wants to automate some tests with automated test sequencers. The same command can be sent from any program that interfaces with the virtual COM port. The *Commands* view also shows commands that are used to control the digital input pins.

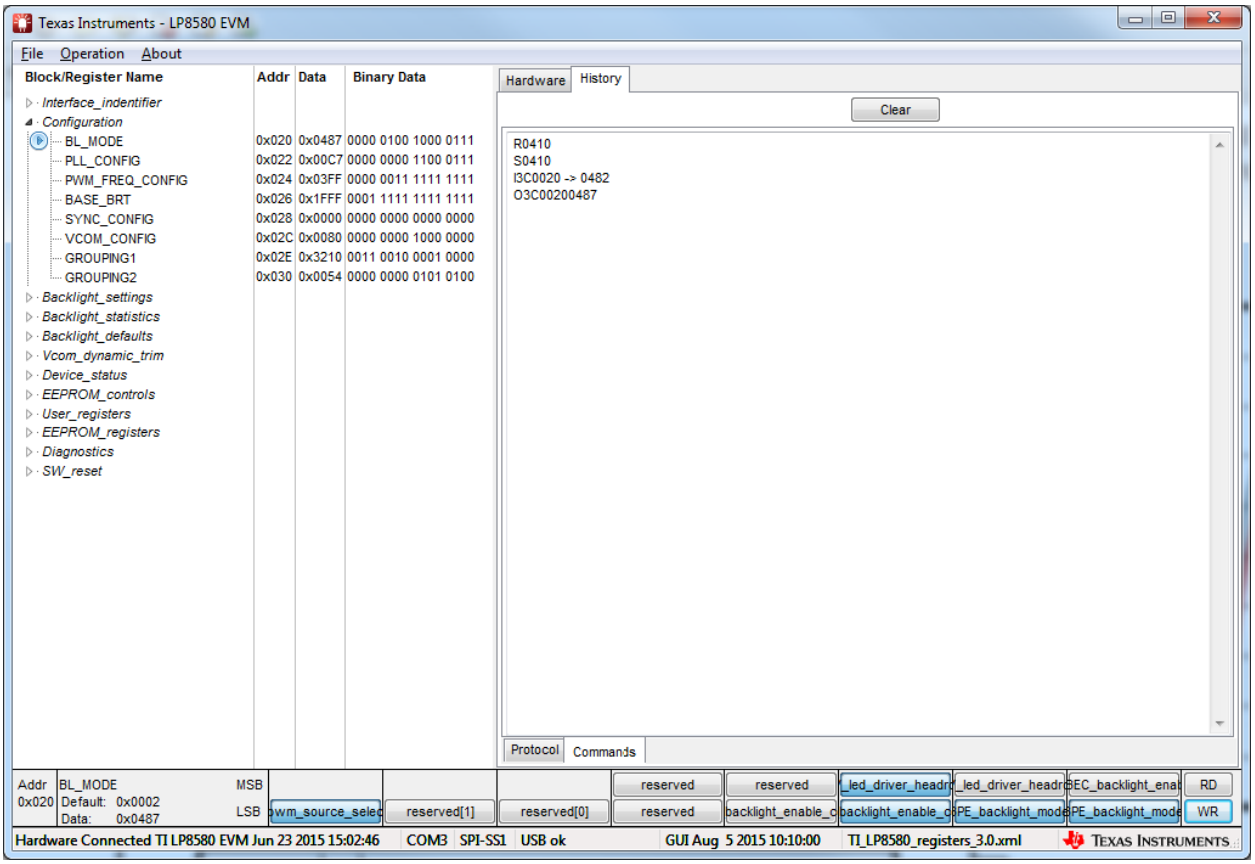

Figure 11. Commands View

5.10 Menu Bar

The LP8580 evaluation software has three items in its menu bar:*File, Operations*, and *About*.

5.10.1 File Menu

The file menu has 6 menu items:*Save Register Block, Load Register Block, Save All Registers, Load All Registers, Options,* and *Exit*.

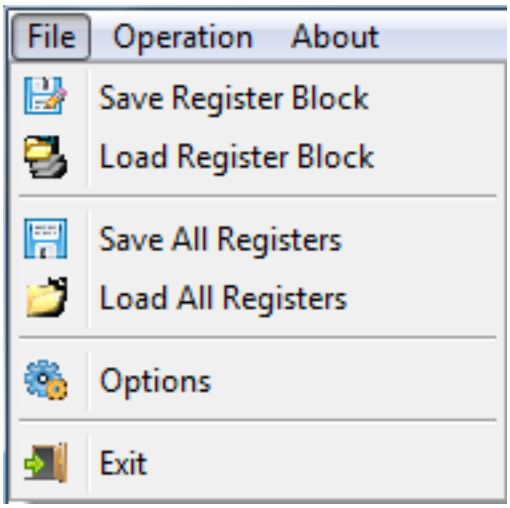

Figure 12. File Menu

The *Save Register Block* option saves the register block that is selected in the register view to a text file. Selecting *Save Register Block* opens a Save As window which allows user to give the text file a descriptive name. The *Load Register Block* option loads new values from a text file into a register block that is selected in the register view. Selecting *Load Register Block* opens Open dialog which allows user to select the file that is loaded into register block. A register file that is loaded into the register block must have same number of data lines as the register block, and register values are read in the same order they are written in the text file.

The *Save All Registers* option saves the all registers to a text file. Selecting *Save All Registers* opens a Save As window which allows user to give the text file a descriptive name. *Load All Registers* loads new values from a text file into all registers. Selecting *Load All Registers* opens *Open Dialog* , which allows the user to select the file that is loaded into the registers. The register file that is loaded into the registers must have same number of data lines as the register.

Options opens an Options dialog which has two tabs: *Interface* and *General*. Settings in the *Interface* tab can be used to set the options for the digital input controls. The Interface settings affect how the onboard microcontroller reacts when digital input controls are used. These controls include settings for the PWM generators and the output pins for the digital input controls; they are set correctly by default and do not require adjusting.

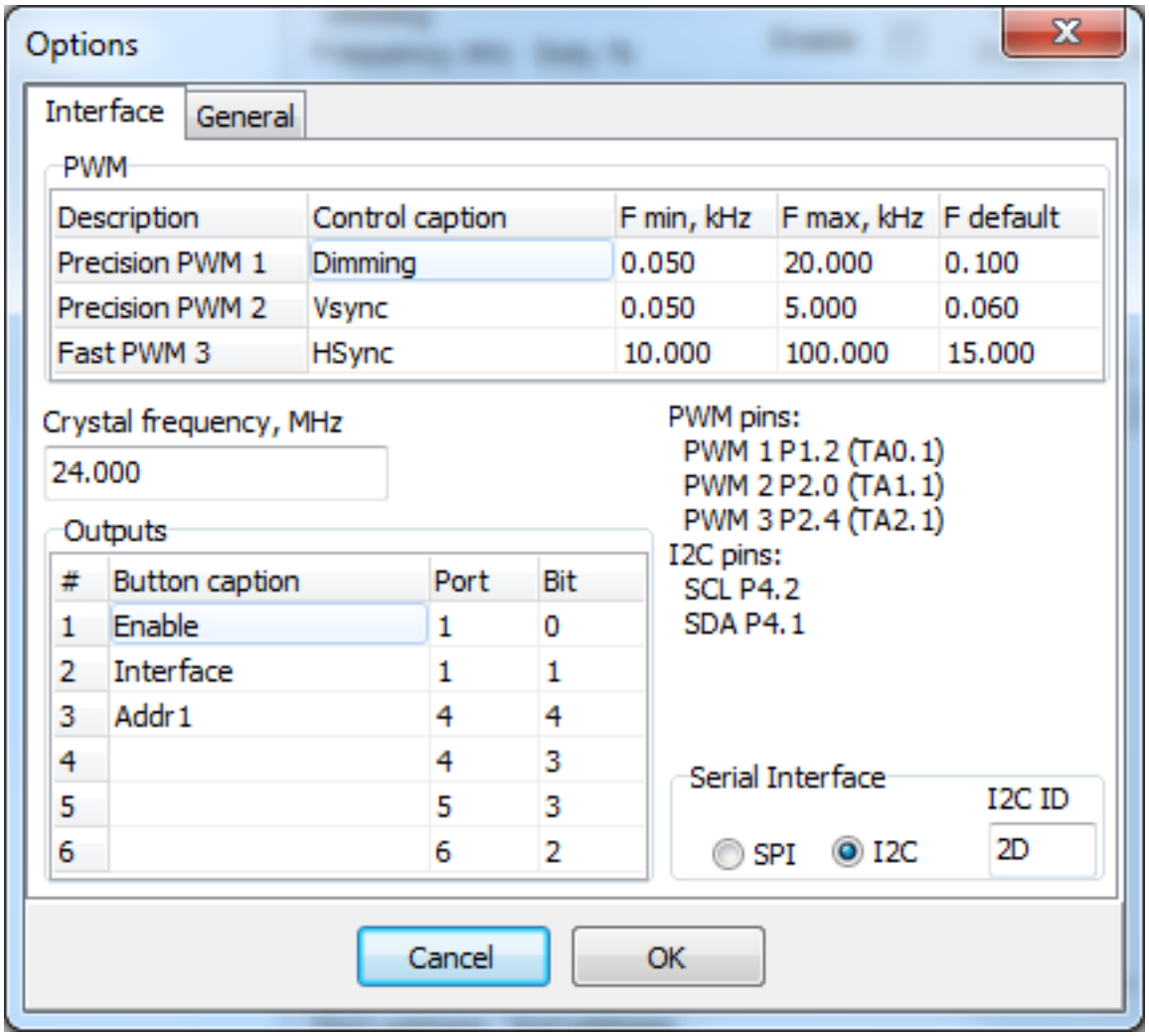

Figure 13. Interface Options

The *General* options tab sets general settings for the evaluation software; these settings are set correctly by default and do not require adjusting.

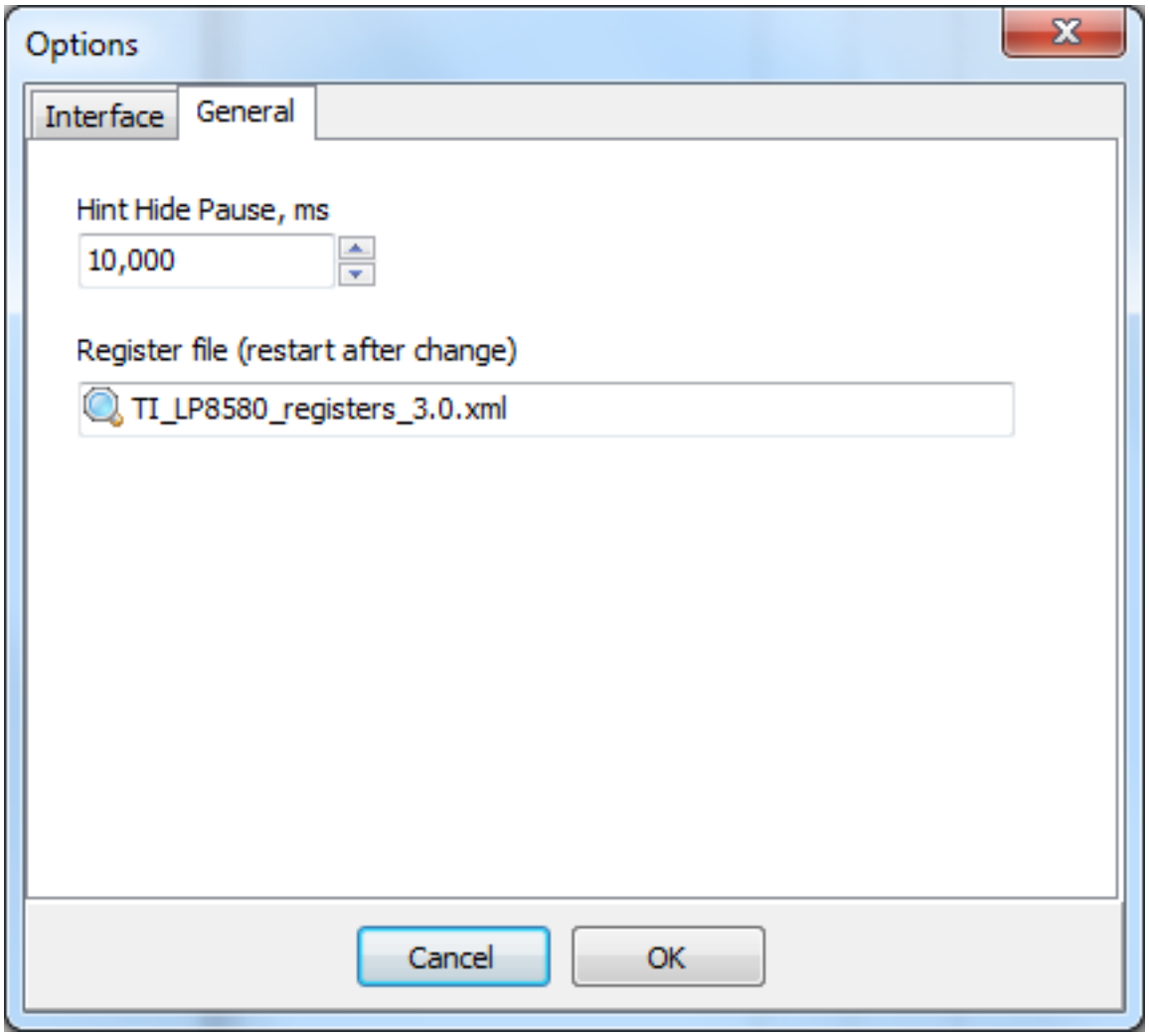

Figure 14. General Options

Exit closes the evaluation software. Evaluation software can also be closed by clicking the red cross button in the upper-left corner of the evaluation software.

5.10.2 Operations Menu

The Operations menu has four items: *SPI Slave Select, Read Register Block, Read All Registers*, and *Execute Macro*:

- *SPI Slave Select* selects the output pin for the SPI slave select signal. SS1 is selected by default, and this should not be changed. When evaluation software is started, all the register in the register view are zeros.
- *Read Register Block* reads the content of the register block that is selected in the register view from the LP8580 IC to the register view.
- *Read All Registers* reads the content of whole LP8580 memory into the register view.
- The *Execute* macro is described in Section 6.9.

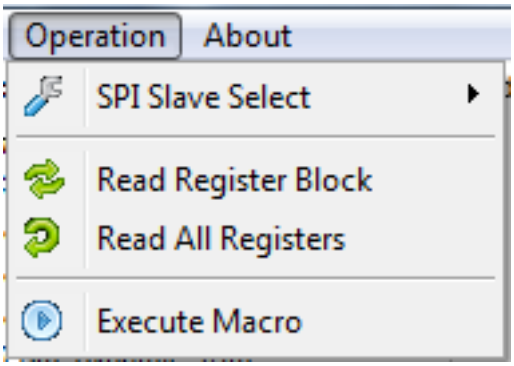

Figure 15. Operation Menu

6 Examples

This section describes how to do some basic operations with the LP8580 evaluation software. Note that the EEPROM settings affect how the LP8580 starts up; some of the following steps can be skipped if correct settings are already set in the EEPROM.

6.1 Starting up the LP8580EVM

To start up the LP8580 and to communicate with the device, follow these steps:

1. Connect and set up the EVM hardware as described in Section 3, and turn on the power supplies. Either an I2C or SPI interface can be selected as described in Section 3.5 and Section 5.2.
2. Set the EN pin high by setting **Enable** button to ON state.
3. Select *Operation → Read All Registers*. All register values should now be available on the register view.

NOTE: The LP8580 EEPROM has an AUTOSTART bit. If AUTOSTART bit is set to 1, the I2C and SPI interfaces are available once VDD voltage is applied, even if the EN pin is low.

6.2 Turn Backlight ON and Control the Brightness

This example assumes that AUTOSTART bit is set to 0.

1. Start up the device as described in Section 6.1.
2. Set the desired LED output current into the LEDx_CURRENT registers. These registers can be found under the Backlight_settings memory block.
3. Set the desired PWM value for each LED output into the LEDx_B0 registers. These registers can be found under the Backlight_settings register block.
4. Write 0x0001 into register BRT_DB_CONTROL register under the Backlight_settings register block. This simultaneously latches the regional PWM values to the LED outputs.
5. Write 0x0586 into BL_MODE register under the Configuration memory block. This enables the backlight and sets the brightness control to register control. More information about the different brightness control methods can be found in the LP8580 data sheet (SNVSA65).
6. The brightness of the whole backlight can now be controlled with the BASE_BRT register. Brightness of the individual LED strings can be controlled with the LEDx_B0 registers. After changing the LEDx_B0 registers, 0x0001 must be written to the BRT_DB_CONTROL register before the change takes effect.

6.3 Using PWM Brightness Control

This example requires that the I2C interface is selected, and the backlight is turned ON, as described in Section 6.2:

1. Turn on the Dimming PWM generator by checking the **Enable** checkbox. Set the frequency to 0.1 kHZ and the duty cycle to 20%, then click the **update** button.
2. Write 0x0504 to the BL_MODE register under the Configuration memory block. This sets the brightness control to PWM input.
3. The brightness of the whole backlight can now be controlled by changing the duty cycle in the dimming control. The brightness of the individual LED strings can still be controlled with LEDx_B0 registers.

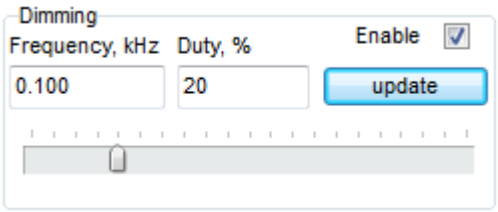

Figure 16. PWM Settings

6.4 Turning ON the VCOMTRIM Output

To turn on the VCOMTRIM current source, follow the next steps. Note that an external voltage source must be connected to the NAVDD and AVDD pins of the LP8580EVM. The LP8580 supports both unipolar and bipolar voltages. More information on the VCOMTRIM can be found in the LP8580 data sheet.

1. Write 0x0001 into the VCOM_CONFIG register under the Configuration memory block. This enables the VCOMTRIM output.
2. VCOMTRIM output current can be controlled with the VCOM_TRIM_ADJ0 register under the VCOM_DYNAMIC_TRIM register block. Set desired output current to the VCOM_TRIM_ADJ0 register.
3. The new VCOM_TRIM_ADJ0 value must be latched to the VCOMTRIM current output before it takes effect. This is done by writing 0x0001 to the VCOM_DB_CONTROL register under the VCOM_DYNAMIC_TRIM register block.

6.5 Saving the EEPROM Content to a Text File

EEPROM content can be saved to a text file for future use.

1. Read EEPROM values into the EEPROM content window by clicking the **Read** button under the EEPROM content window. It is not necessary to unlock EEPROM to read the values.
2. Click the **Save** button, give the text a file name, and click *Save*. This saves the EEPROM settings to a text file.

The text file can be opened with any text editor and modified as needed. Each row in the text file has a register address followed by the register data in a hexadecimal format.

6.6 EEPROM Reprogramming

EEPROM content can be reprogrammed easily from a text file containing the new EEPROM values. To reprogram the EERPOM, follow the steps below:

1. Start up the device as described in Section 6.1.
2. Unlock the EEPROM by clicking the **Unlock** button on the EEPROM Control area.
3. Verify that EEPROM was unlocked successfully by clicking the **Read status** button. The EEPROM unlocked indicator should turn red indicating that EEPROM is unlocked.
4. Click the **Load** button and browse to the location where the EEPROM text file is located. Select the text file and click *Open*. New values are loaded to the EEPROM content window; however, the new values are not written into the EEPROM of the LP8580 IC.
5. To write the new values into the EEPROM, click the **Write** button. This writes the EEPROM values in the EEPROM content window to the LP8580 EEPROM.
6. To read the newly programmed values from the LP8580 EEPROM to the control registers, click the

Read NVM button. If the **Read NVM** button is not clicked, the new EEPROM values are not read to the control registers until the next time the IC is started up.

6.7 Saving Register Settings to a File

Control register values can also be saved to a text file for future use. This can be done for the whole memory or for a single register block.

To save the contents of the whole memory, go to *File → Save All Registers* — a *Save As* window pops up. Give the register file name, and click the **Save** button.

To save the contents of a register block into a text file, activate any register inside that block by selecting it from the register view. Go to *Go to File → Save Register Block* — a *Save As* window pops up. Give the register a file name and click the **Save** button.

6.8 Reading Control Register Values from a Text File

Control register values can also be set from a text file. This can be done for the whole memory or for a single register block.

To set the contents of the whole memory, go to *File → Load All Registers*, and an *Open File* window pops up. Browse to the folder containing the register file, select it, then click the **Open** button.

To set the content of a register block activate any register inside that block by selecting it from the register view. Go to *File → Load Registers*, and an *Open File* window pops up. Browse to the folder containing the register file, select it, then click the **Open** button.

NOTE: The register file must have same number of lines containing register settings as the register block that is being set up. The settings are read line by line, and the register address in the file is ignored.

6.9 Using Macros

Macros have a structure similar to the register settings files, but they have one advantage. In register files data must be in same order as the registers, and they are read into the registers line by line. Additionally, register files can only be used to set up a whole register block or to the whole memory. A macro file, on the other hand, can have any number of register settings in any order. It can also have multiple writes to the same register. Macro file settings are saved in an address-data format. Macro files also allow comments after register data. Comments must be separated with at least one space after the register data.

Section 6.9.1 shows an example of a simply macro. The macro first sets the BASE_BRT setting to maximum (register 026h, data 1FFFh). Next, the macro sets up the LED current of each output to 0071hex (registers 1C2h to 1CCh); the macro then enables the VCOMTRIM output (register 02Ch, data 0081h) and sets the VCOM_TRIM_ADJ0 setting to 00FFhex (register 202h data 00FFh). Finally, the macro turns on the backlight (register 020h, data 0582h).

Macro files are executed by selecting *Operations → Execute Macro*; an *Open File* window pops up. Browse to the folder containing the macro file, select it, then click the **Open** button.

6.9.1 Macro File Format

```
026 1FFF ;BASE_BRT to max
1C2 0071 ;set LED0 current to 0071hex
1C4 0071 ;set LED1 current to 0071hex
1C6 0071 ;set LED2 current to 0071hex
1C8 0071 ;set LED3 current to 0071hex
1CA 0071 ;set LED4 current to 0071hex
1CC 0071 ;set LED5 current to 0071hex
```

02C 0081 ;enable VCOMTRIM

202 00FF ;set VCOM_TRIM_ADJ0 to 00FFhex

020 0582 ;enable backlight

6.9.2 Evaluation Software Example Macros

A few example macros are supplied in the evaluation software package. After the evaluation software is installed, the example macros can be found in the *Macro* folder in the installation path.

The 4_String_Config.txt macro file shows an example of how to reprogram the LP8580 EEPROM settings. This macro configures a backlight for 4 strings. Because the evaluation software of the LP8580 does not have delay command, dummy writes are used to generate enough delay for EEPROM programming. This macro does not turn on the backlight.

6_String_Config.txt macro file shows an example how to reprogram LP8580 EEPROM settings. This macro configures backlight for 6 strings. Because the evaluation software of the LP8580 does not have delay command, dummy writes are used to generate enough delay for EERPROM programming. This macro does not turn on the backlight.

PWM_BrightnessControl.txt macro file configures uniform values for LED currents and regional brightness. It turns on the backlight with PWM brightness control. Overall brightness can be controlled with the dimming control of the evaluation software. This macro requires that the LP8580EVM and software are set for I2C interface.

RegisterBrightnessControl.txt macro file configures different regional brightness value for each output. LED output 0 has the lowest brightness. Brightness of the other strings increases towards output 5. The backlight is turned on with the register brightness control. Overall brightness can be controlled with BASE_BRT register (register 0x0026). Both the SPI interface and the I2C interface can be used with this macro.

RegisterBrightnessControl.txt macro file configures uniform values for LED currents and regional brightness. It turns on the backlight with register brightness control. Overall brightness can be controlled with BASE_BRT register (register 0x0026). Both the SPI interface and the I2C interface can be used with this macro.

UnlockEEPROM.txt macro opens the LP8580 EEPROM lock. EEPROM can be re-locked by writing any value to the EEPROM_UNLOCK register (register 0x0278).

7 Evaluation Board Schematic

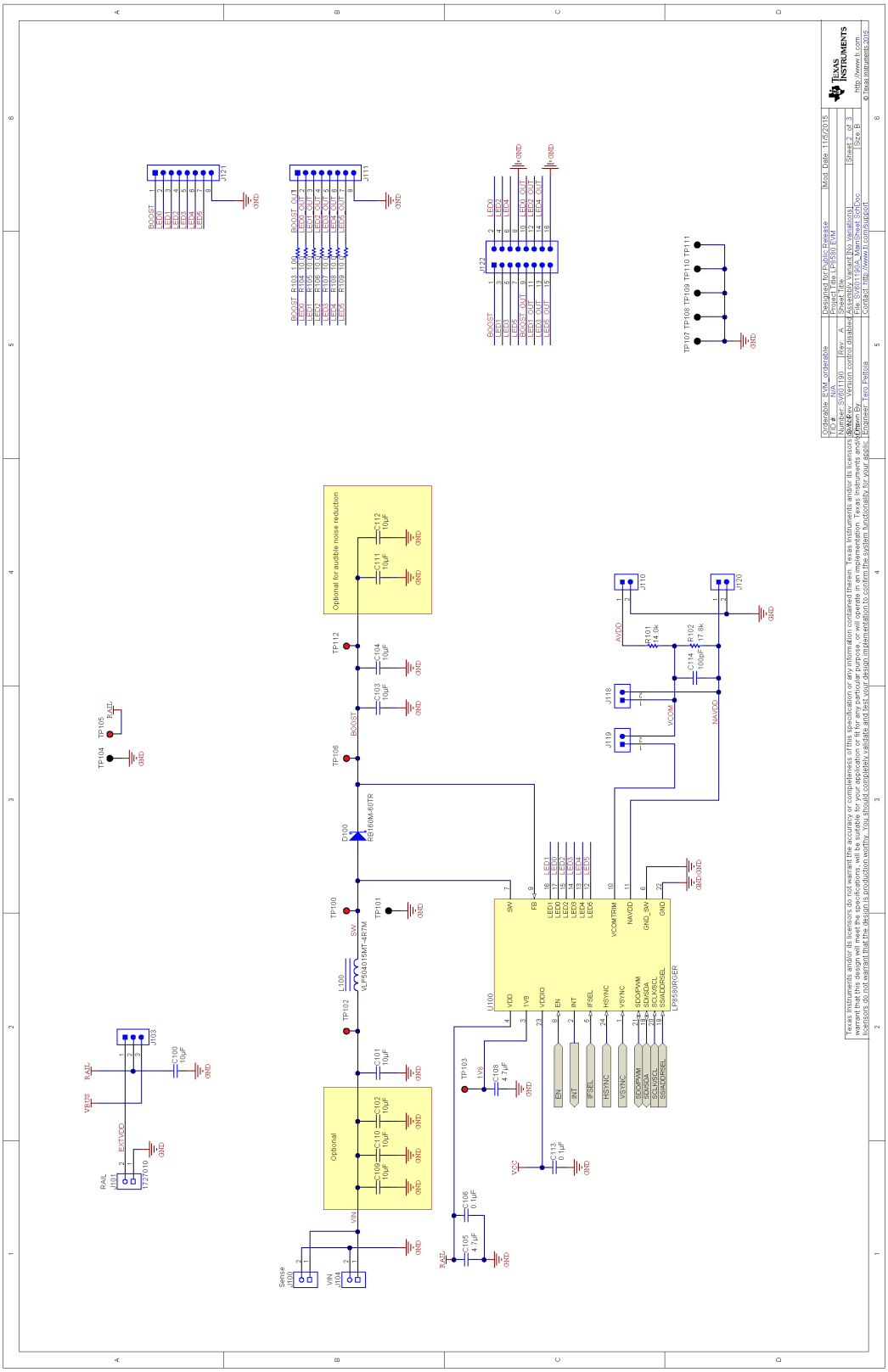

Figure 17. LP8580 Main Schematic

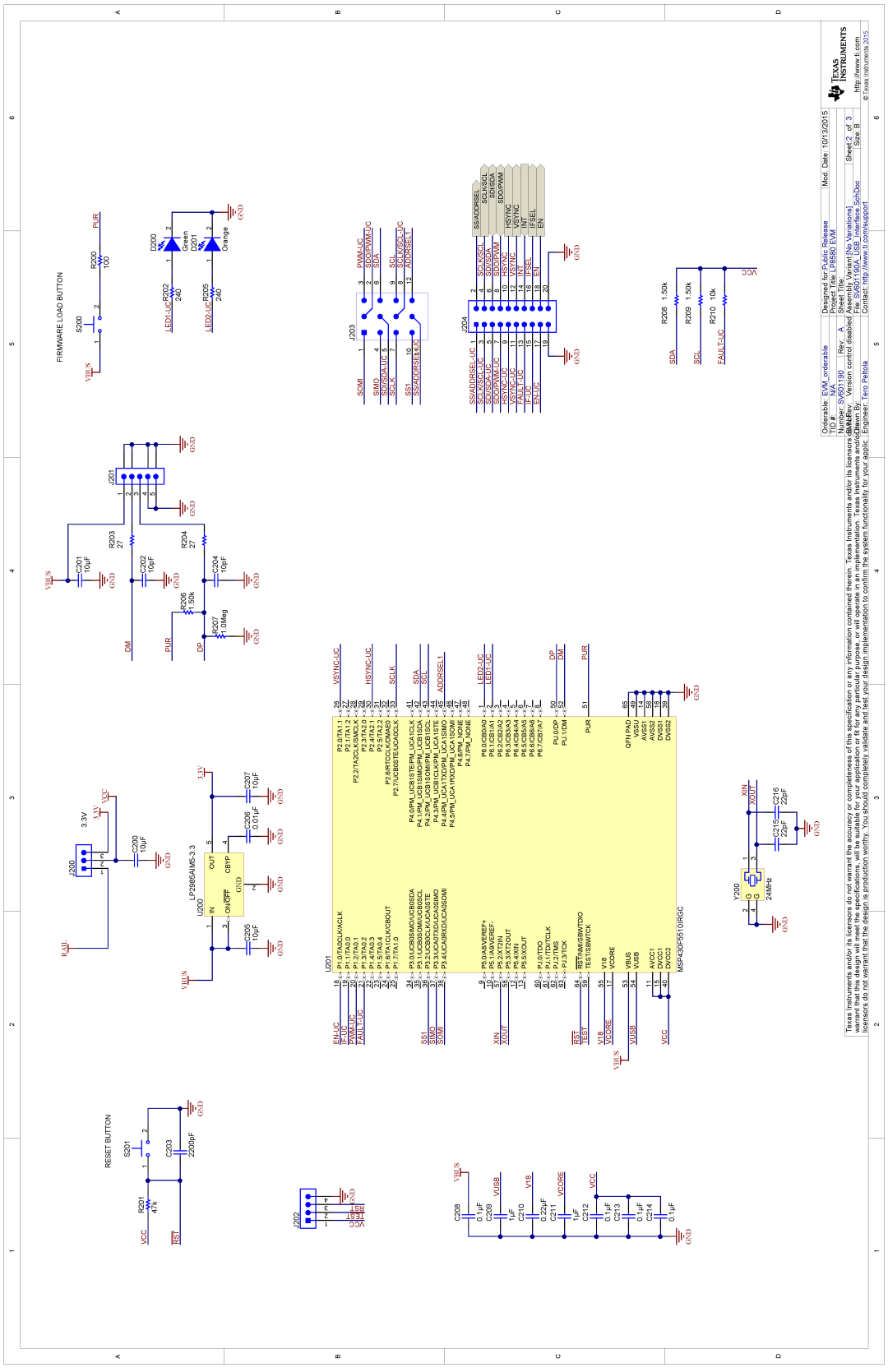

Figure 18. Microcontroller Schematic

7.1 Bill of Materials for LP8580EVM

DESIGNATOR	QTY	VALUE	PART NUMBER
C100, C200, C201, C205, C207	5	10 µF	EMK107BBJ106MA-T
C101, C103, C104	3	10 µF	CGA5L3X5R1H106K160AB
C105, C108	2	4.7 µF	C0603C475K8PACTU
C107, C208, C212, C213, C214	5	0.1 µF	C0603C104M4RACTU
C114	1	100 pF	C1608C0G1H101J
C202, C204	2	10 pF	06035A100JAT2A
C203	1	2200 pF	C0603C222K5RACTU
C206	1	0.01 µF	C0603C103J5RACTU
C209, C211	2	1 µF	C0603C105K8PACTU
C210	1	0.22 µF	C0603C224K4RACTU
C215, C216	2	22 pF	C0603C220J5GACTU
D100	1	60 V	RB160M-60TR
D200	1	Green	LTST-C190GKT
D201	1	Orange	LTST-C190KFKT
L100	1	4.7 uH	VLF504015MT-4R7M
R100	1	1 kΩ	CRCW06031K00FKEA
R101	1	14 kΩ	CRCW060314K0FKEA
R102	1	17.8 kΩ	CRCW060317K8FKEA
R103	1	1 Ω	CRCW06031R00FKEA
R104, R105, R106, R107, R108, R109	6	10 Ω	RT0603BRD0710RL
R200	1	100 Ω	CRCW0603100RJNEA
R201	1	47 kΩ	RC0603JR-0747KL
R202, R205	2	240	CRCW0603240RJNEA
R203, R204	2	27	CRCW060327R0JNEA
R206, R208, R209	3	1.5 kΩ	RC0603FR-071K5L
R207	1	1 MΩ	CRCW06031M00JNEA
R210	1	10 kΩ	CRCW060310K0JNEA
R211, R212, R213	3	0 Ω	CRCW06030000Z0EA
S200, S201	2		SKRKAEE010
U100	1		LP8580RGER
U200	1		LP2985AIM5-3.3
U201	1		MSP430F5510IRGC
Y200	1		ABM8-24.000MHZ-B2-T
C102, C109, C110, C111, C112	0	10 µF	CGA5L3X5R1H106K160AB
C106, C113	0	0.1 µF	C0603C104M4RACTU

8 LP8580EVM PCB Layout and Layers

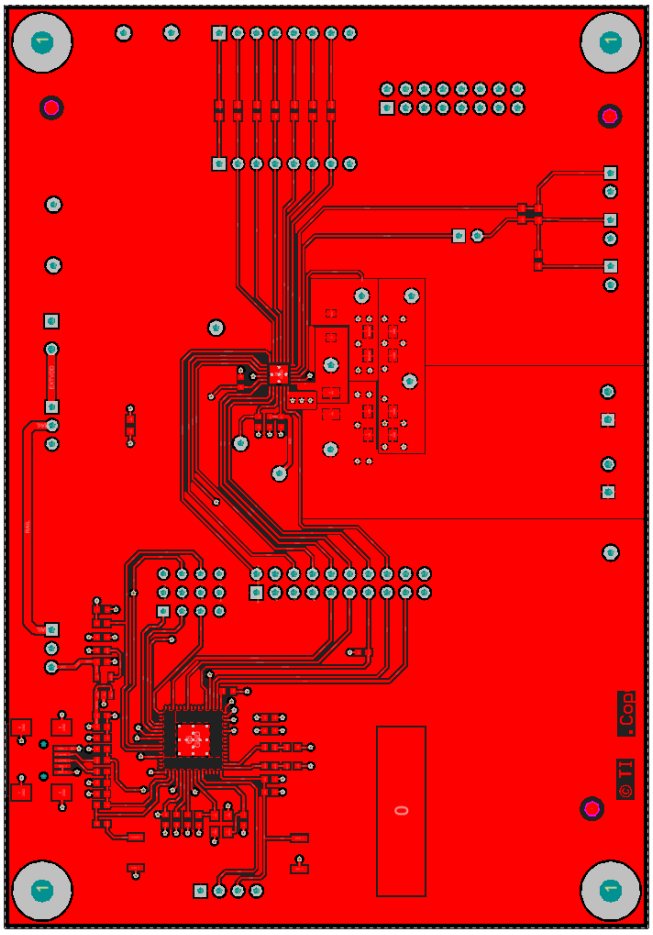

Figure 19. Top Layer

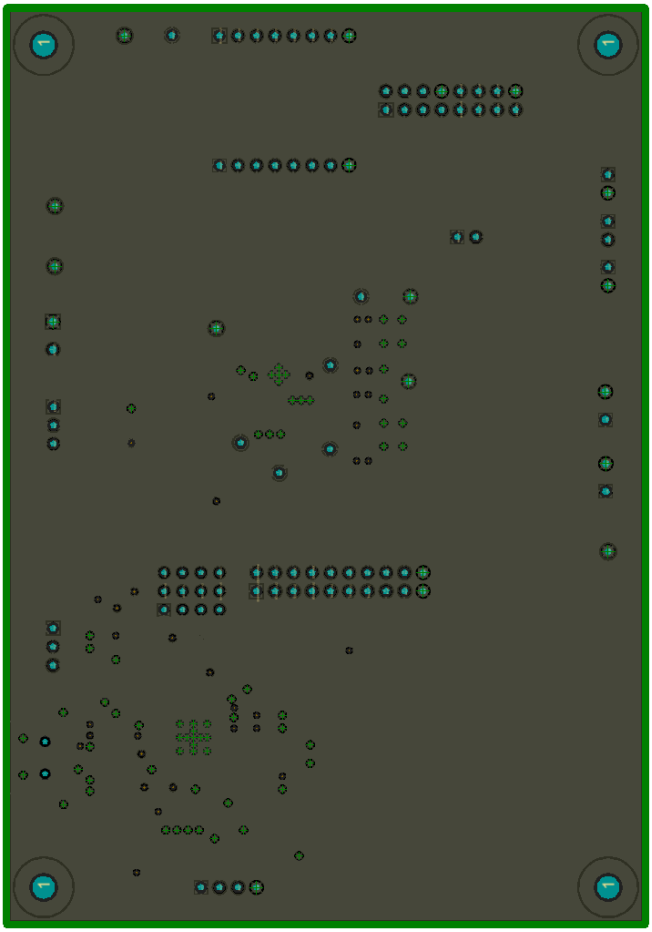

Figure 20. Mid-Layer 1 (GND Plane)

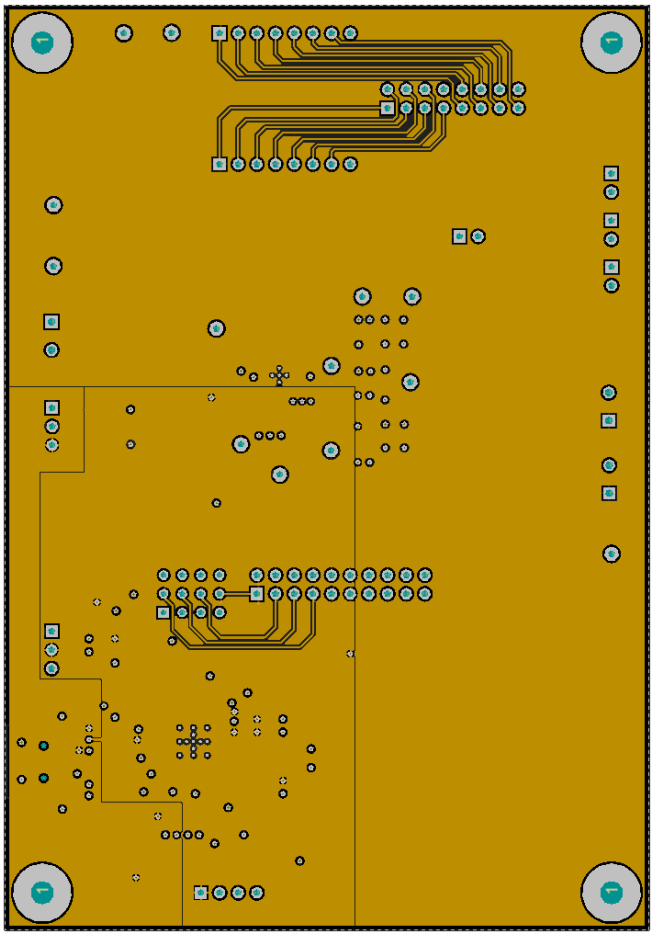

Figure 21. Mid-Layer 2

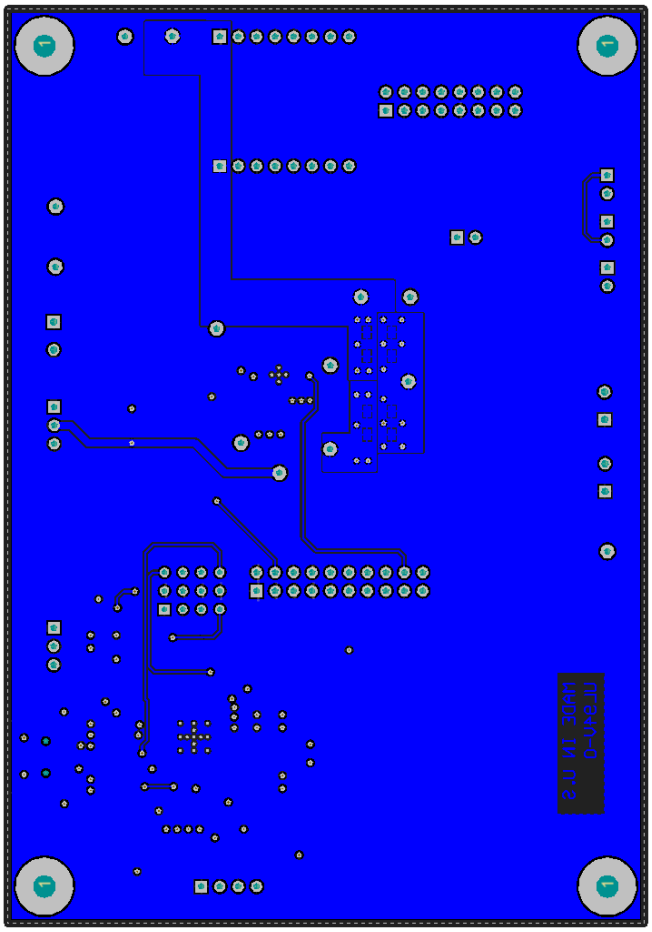

Figure 22. Bottom Layer

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

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      CAUTION

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- *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.*

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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

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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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Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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