

## **TMP007EVM User's Guide**

This user's guide describes the characteristics, operation, and use of the TMP007 evaluation module. This user's guide discusses how to set up and configure the software and hardware, and reviews various aspects of the program operation. Throughout this document, the terms *evaluation board*, *evaluation module*, *TMP007 test board*, and *EVM* are synonymous with TMP007EVM.

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## 1 Introduction to the TMP007 and TMP007EVM

The [TMP007](#) is an infrared thermopile sensor that measures the temperature of an object without having to be in contact with it. The integrated thermopile absorbs the infrared energy emitted from the object that appears in the sensor's field of view. The thermopile voltage is digitized and input to the integrated math processor, along with the local die temperature. The processor then computes the corresponding object temperature.

Default Seebeck coefficients and thermal transient coefficients are encoded into the processor. System calibration values can be programmed and stored in the built-in, non-volatile memory as user inputs for improved accuracy. An alert function is also available and can be programmed in the comparator or interrupt mode.

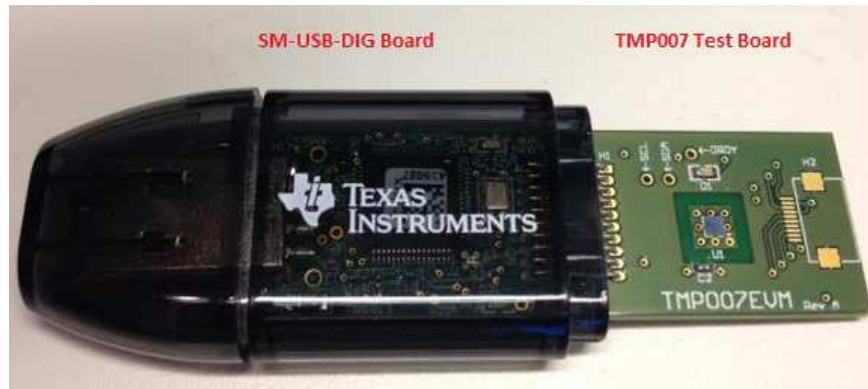
The EVM consists of two printed circuit boards (PCBs): the SM-USB-DIG and the TMP007 test board. The SM-USB-DIG communicates with the computer, provides power, and sends and receives appropriate digital signals. The TMP007 Test Board contains the TMP007 and support circuitry.

### 1.1 TMP007EVM Kit Contents

[Table 1](#) summarizes the contents of the EVM kit. [Figure 1](#) shows the included hardware. Contact the [Texas Instruments Product Information Center](#) nearest you if any component is missing. Verify you have the latest versions of the released software by checking the TMP007 product folder on the TI web site at [www.ti.com](#).

**Table 1. TMP007EVM Kit Contents**

Item	Quantity
TMP007 test board	1
SM-USB-DIG board	1



**Figure 1. Hardware Included with TMP007EVM Kit**

## 1.2 Related Documentation from Texas Instruments

The following documents provide information regarding Texas Instruments' integrated circuits used in the assembly of the TMP007. This user's guide is available from the TI web site under literature number **SBOU137**. Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions may be available from the [TI web site](#), or call the Texas Instruments' Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number.

**Table 2. Related Documentation**

Document	Literature Number
TMP007 product data sheet	<a href="#">SBOS685</a>
SM-USB-DIG platform user guide	<a href="#">SBOU098</a>

## 2 TMP007EVM Hardware Setup

**Figure 2** shows the system setup for the EVM. The computer runs the graphical user interface (GUI) software that communicates with the SM-USB-DIG over a USB connection. The SM-USB-DIG translates USB commands from the computer into power, I<sup>2</sup>C, SPI™, and general-purpose input/output (GPIO) commands for the TMP007 test board. Note that the TMP007EVM does not require any additional components to operate.



**Figure 2. TMP007EVM Hardware Setup**

## EVM Schematic

Figure 3 shows a complete schematic of the TMP007 test board. The SDA, SCK, and ALERT pins are pulled up by the SM-USB-DIG built-in pull-up resistance and 47-k $\Omega$  pull-up resistance combined in parallel. Overall pull-up resistance for these signals remains at approximately 9 k $\Omega$ . Capacitor C2 functions as a bypass capacitor for DVDD or V+. Resistors R1 and R2 are 0- $\Omega$  resistors that ground the ADDR0 and ADDR1 pins, hence the I2C device address for the TMP007EVM is 80h. The TMP007 ALERT signal is connected to an LED light to visually demonstrate functionality.

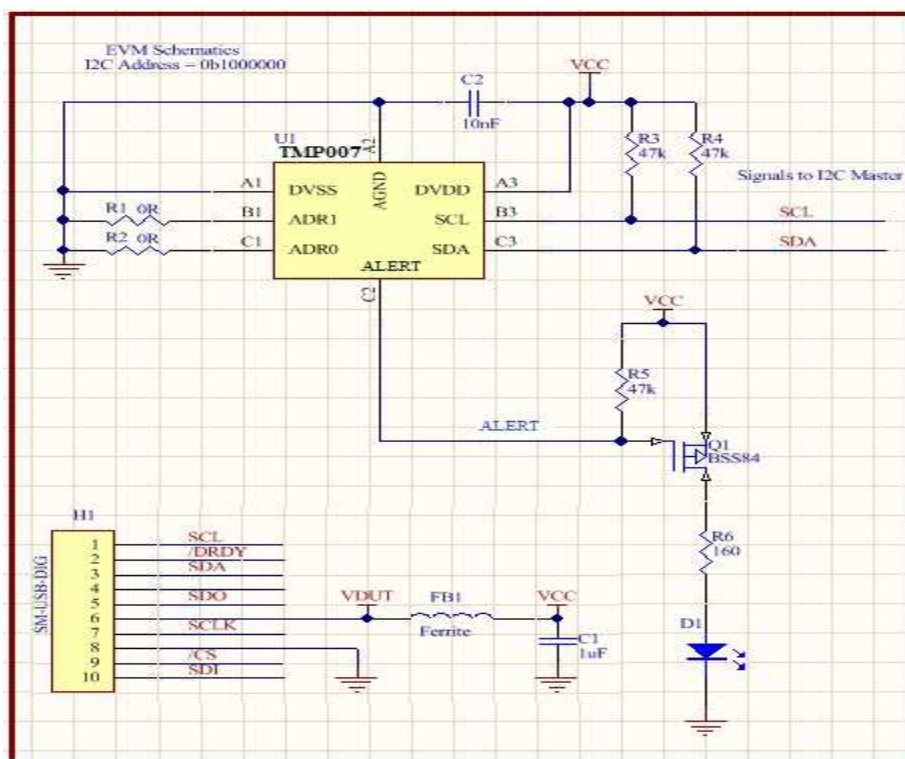


Figure 3. TMP007 Test Board Schematic

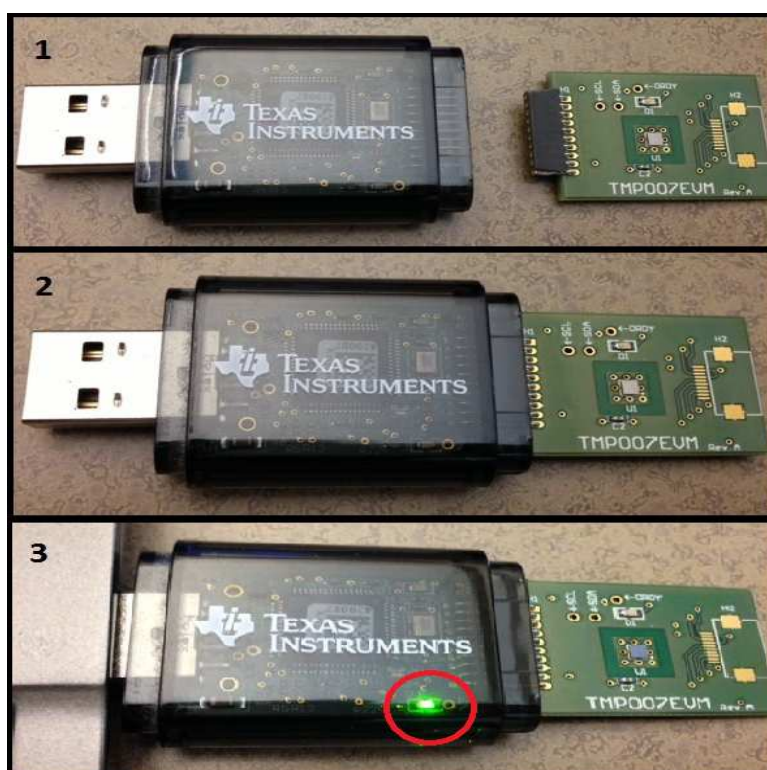
### 3 Hardware Overview

If not already assembled, the basic hardware setup for the TMP007EVM involves connecting the TMP007 test board to the SM-USB-DIG and then connecting the SM-USB-DIG to the computer. This section describes the details of this procedure.

#### 3.1 Typical Hardware Connections

Connect the right-angle female socket on the TMP007 test board to the right angle male header on the SM-USB-DIG. Take special care to ensure that the two 10-pin sockets directly align with each other. Make sure that all connectors are properly aligned and pushed together firmly. Loose connections may cause intermittent operation.

Afterwards, plug the SM-USB-DIG to the computer. A green LED light indicates that the SM-USB-DIG is powered up, as shown in [Figure 4](#). Always connect the two boards together before connecting the USB cable to avoid any issues if the connectors are misaligned. The device is not operational if the connectors are misaligned.



**Figure 4. Typical Hardware Connection**



Figure 5 shows the typical response when the SM-USB-DIG is plugged into the USB port of a computer for the first time. Typically, the computer responds with a *Found New Hardware, USB Device* pop-up dialog. The pop-up window then changes to *Found New Hardware, USB Human Interface Device*. This pop-up indicates that the device is ready to be used. The SM-USB-DIG uses the human interface device drivers that are part of the Microsoft® Windows® operating system.



**Figure 5. Typical PC Behavior After Connecting TMP007EVM**

## 4 TMP007EVM Software

This section discusses how to install the TMP007EVM software.

### 4.1 Hardware Requirements

The TMP007EVM software is tested on Microsoft Windows 7 operating systems (OS) with United States regional settings. The software should also function on other Windows OS platforms.

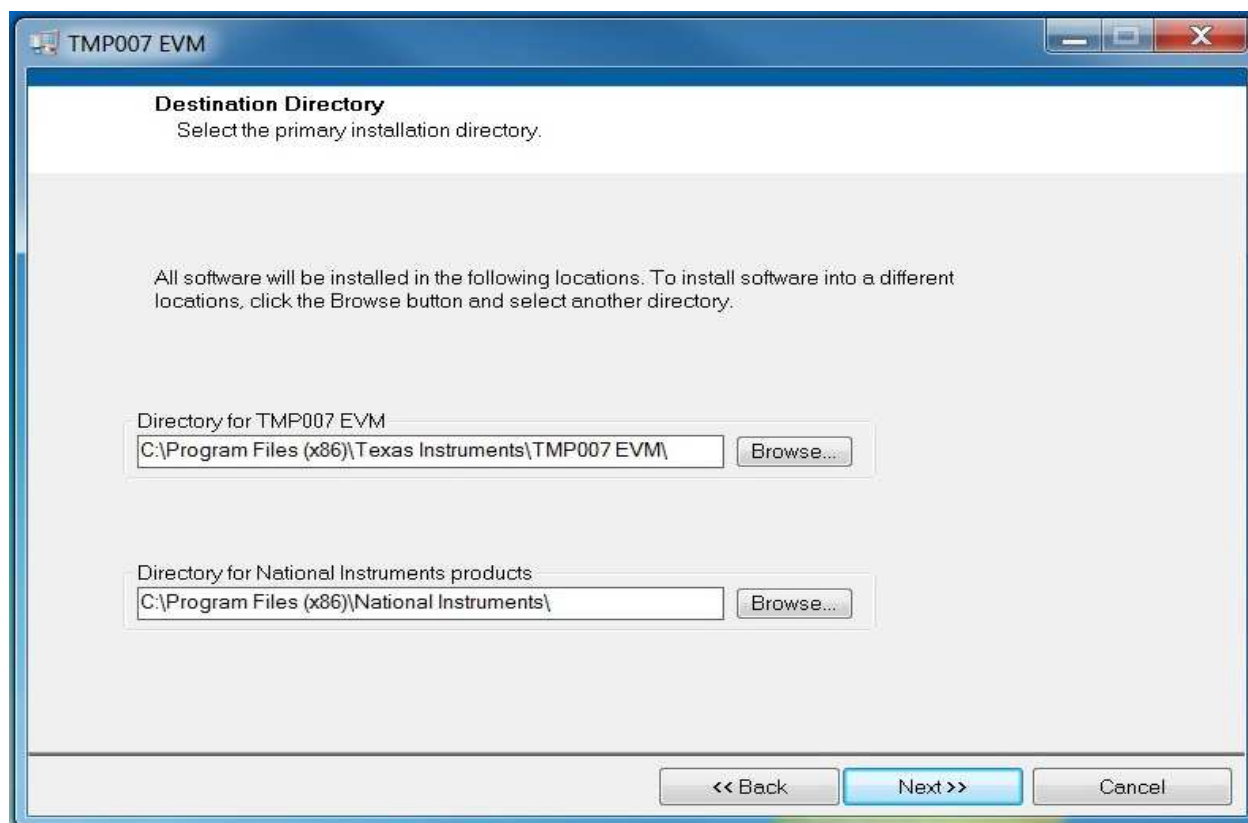
### 4.2 GUI Software Installation

The software is available through the TMP007EVM product folder on [www.ti.com](http://www.ti.com). To install the software to a computer, download the *SBOC441.zip* file from [www.ti.com](http://www.ti.com), unzip the file, and open the TMP007EVM software folder. Locate and launch the TMP007EVM installation file (*setup.exe*), as shown in Figure 6. This file is located in the *Installer* directory.

Name	Date modified	Type	Size
bin	8/29/2013 10:23 PM	File folder	
license	8/29/2013 10:23 PM	File folder	
supportfiles	8/29/2013 10:23 PM	File folder	
nidist.id	8/22/2013 6:27 PM	ID File	1 KB
setup.exe	5/6/2013 5:01 PM	Application	1,394 KB
setup.ini	8/22/2013 6:27 PM	Configuration sett...	12 KB

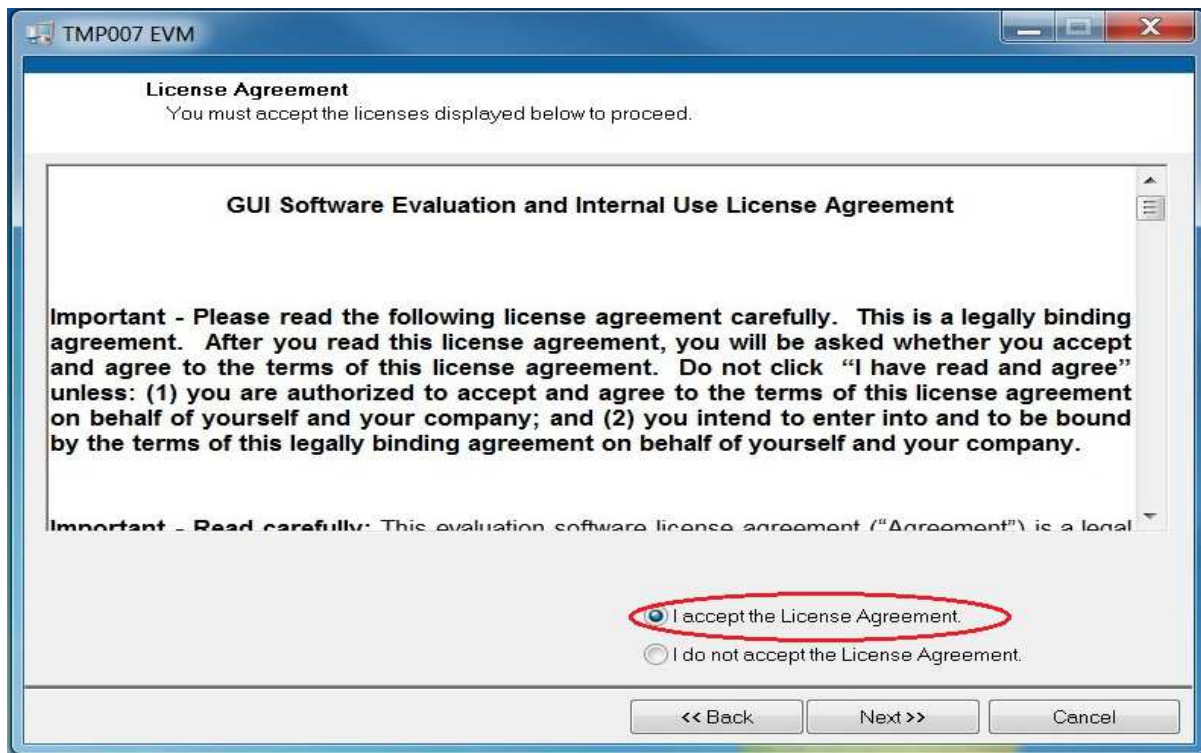
**Figure 6. TMP007EVM Software Installation Files**

The TMP007EVM software installer file then begins the installation process, as shown in [Figure 7](#).

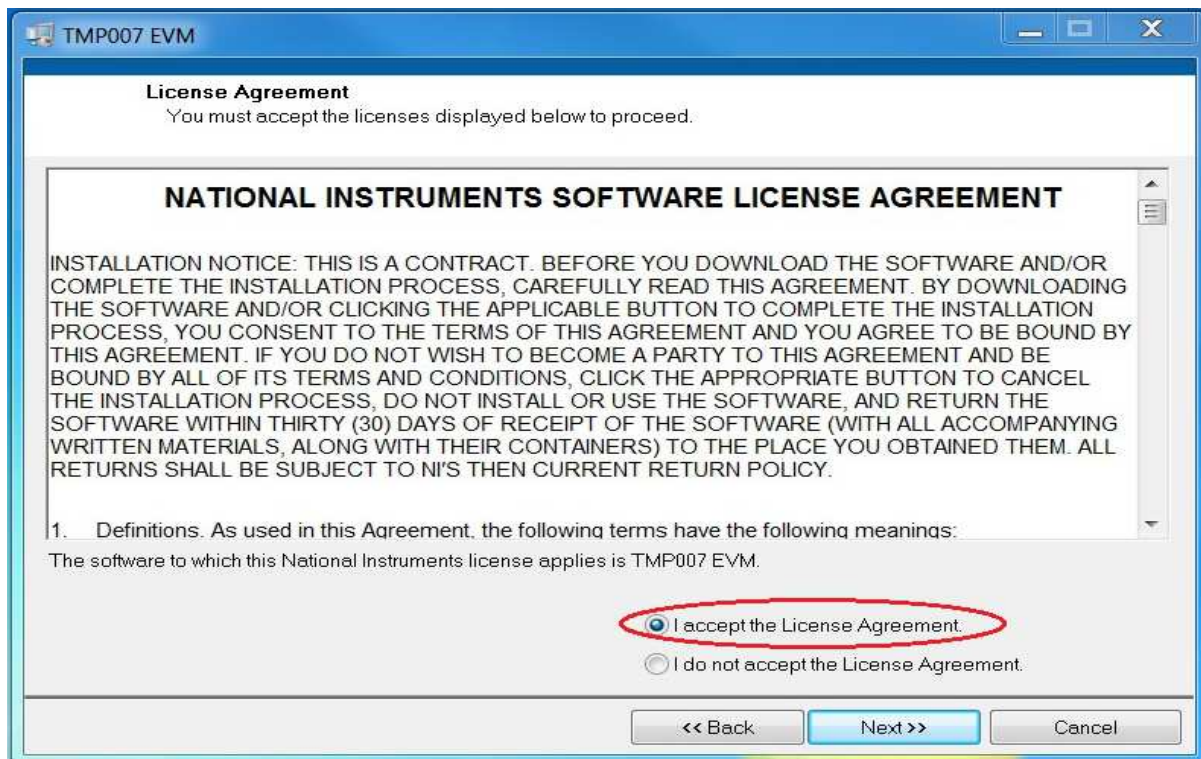


**Figure 7. TMP007EVM Software Installation Launch**

Follow the prompts shown in [Figure 8](#) to [Figure 12](#) to install the TMP007EVM GUI software.



**Figure 8. GUI Software and Internal Use License**



**Figure 9. National Instruments Software License**



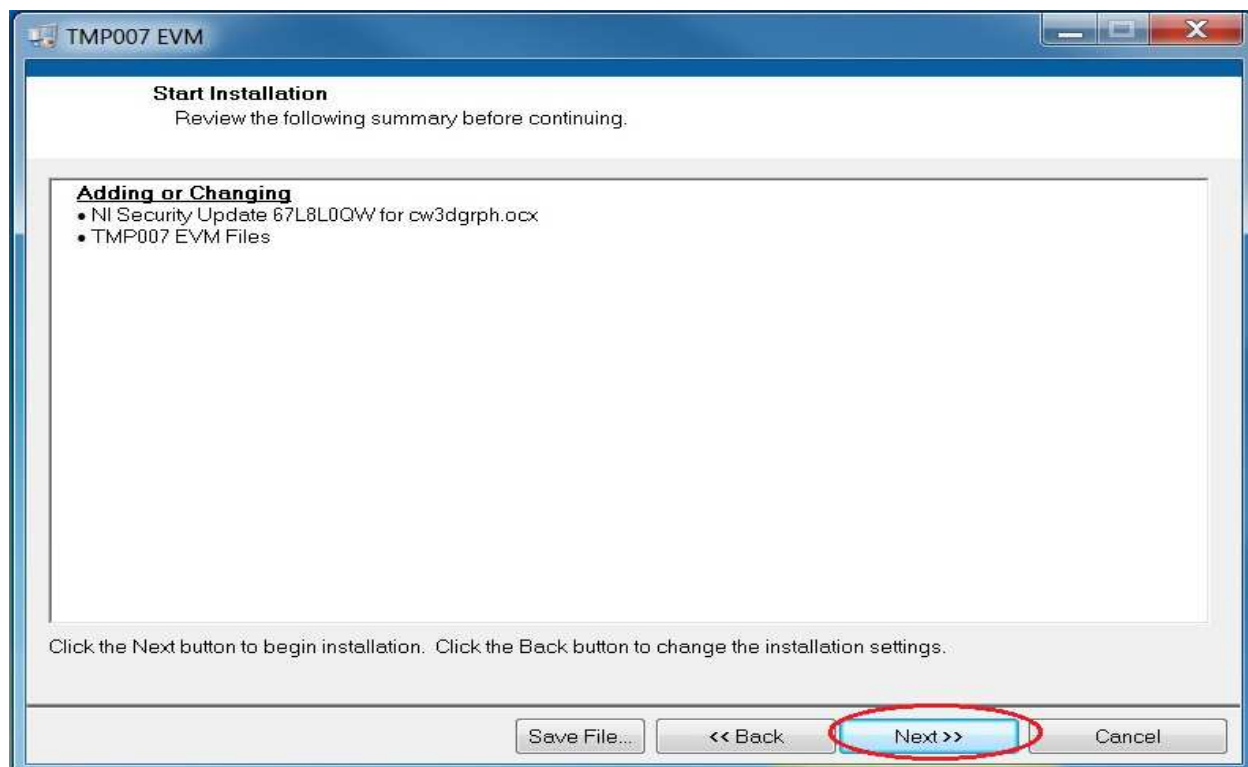


Figure 10. Start Installation Prompts

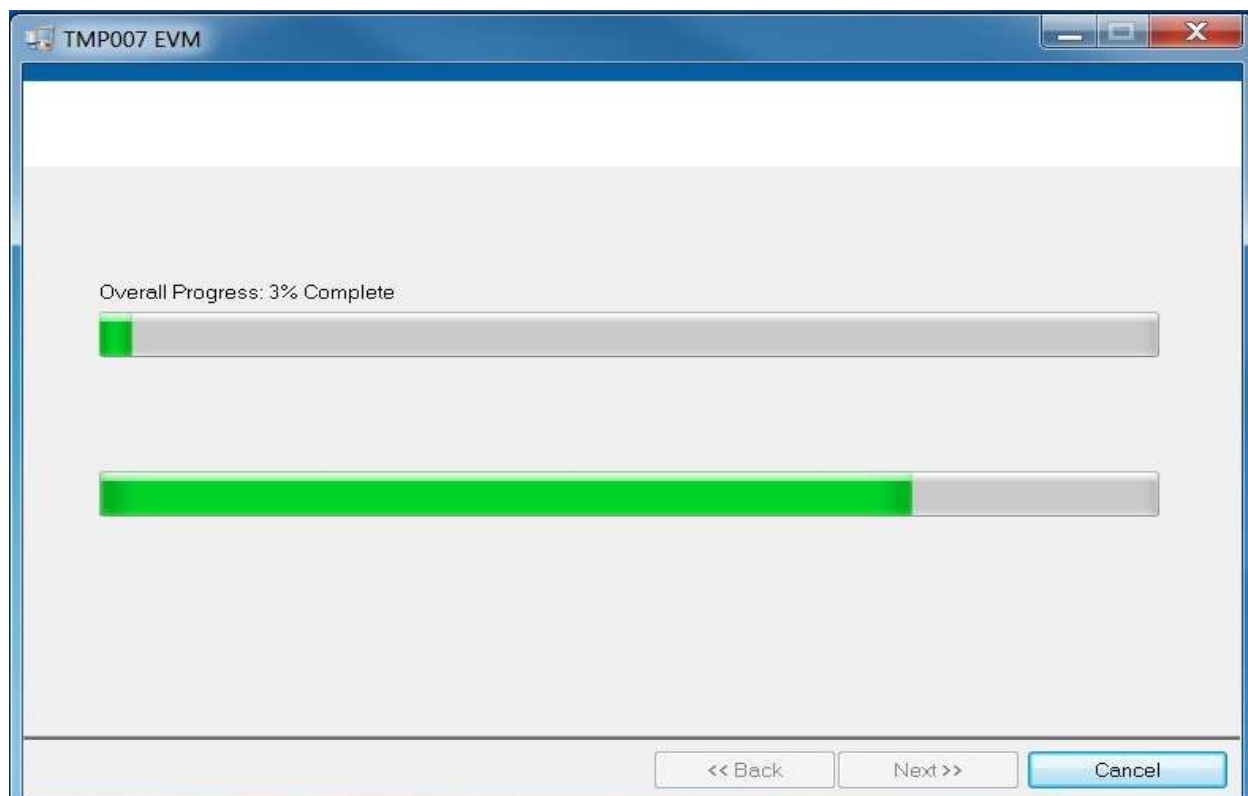
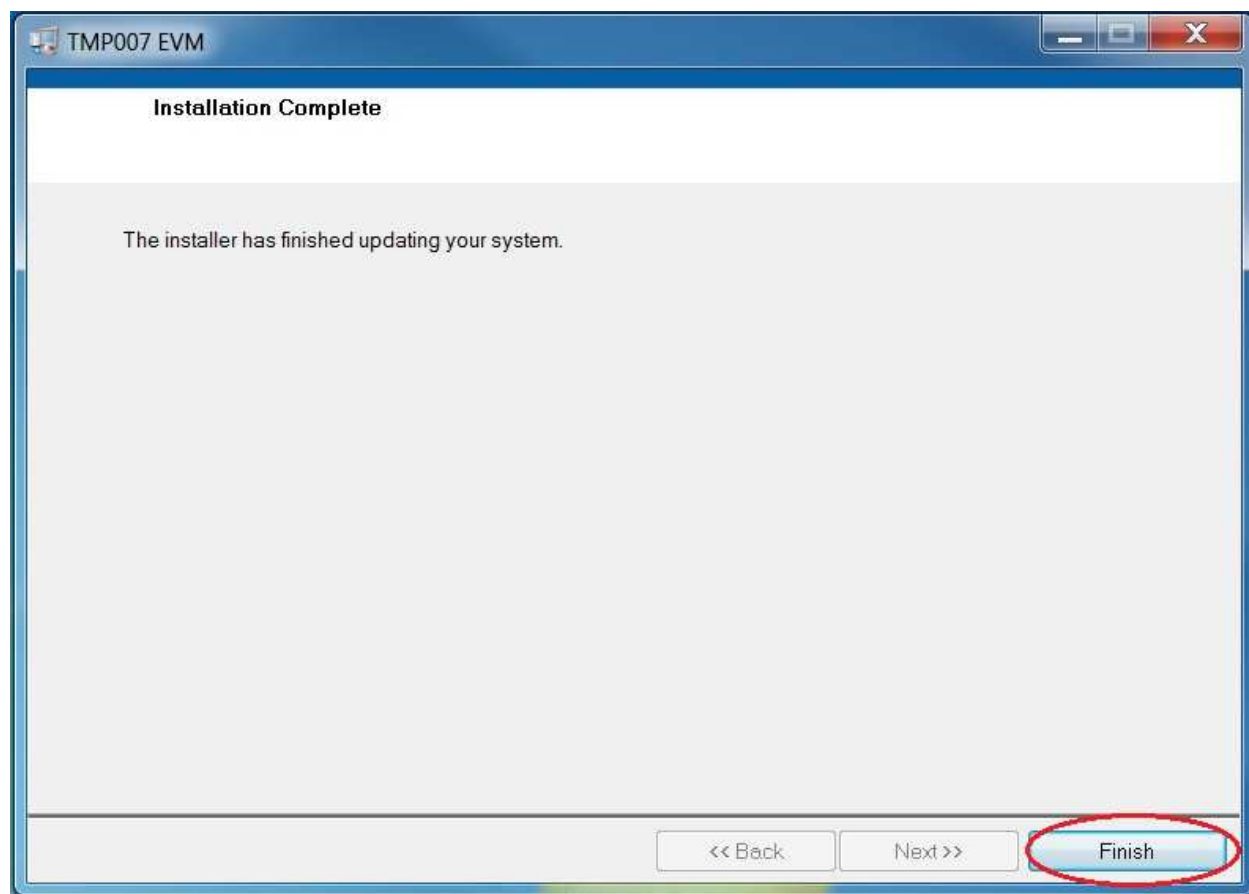


Figure 11. Software Installation Process

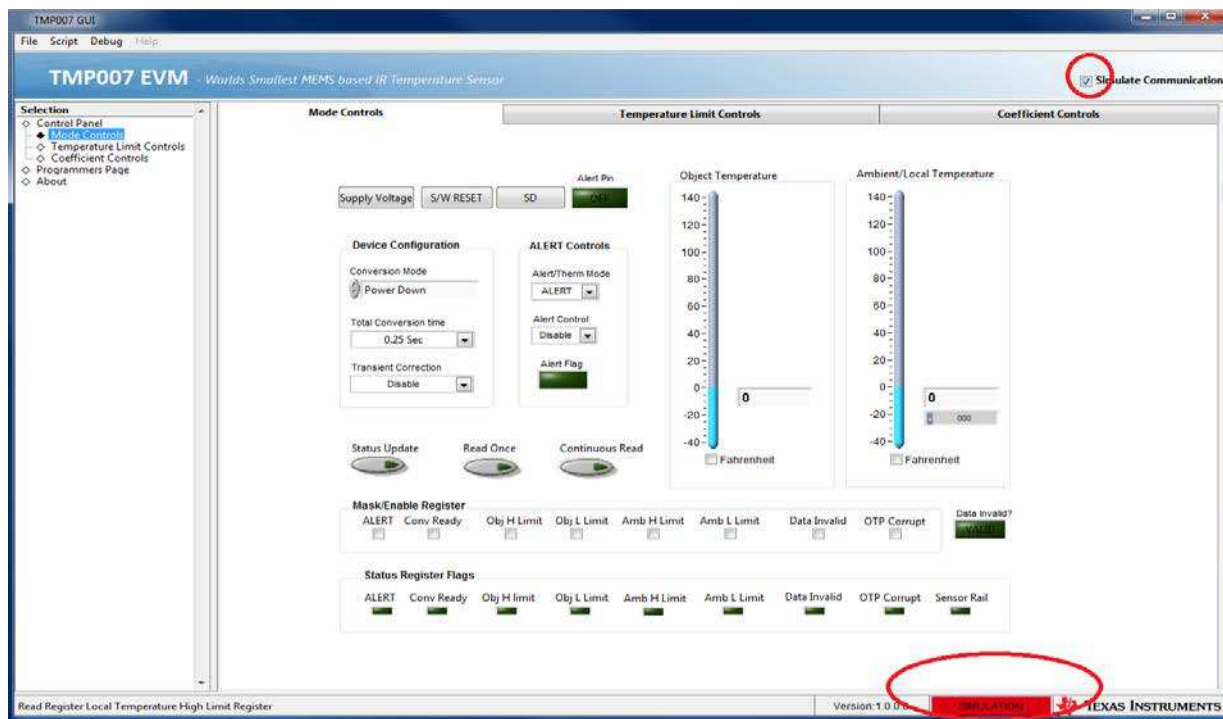


**Figure 12. Installation Complete**

The TMP007EVM GUI software is now installed.

## Launching the GUI Software

With the TMP007EVM properly connected (see [Figure 5](#)), launch the EVM GUI software from the *Start* menu. This menu is located in a folder titled *TMP007EVM* under Program Files. The software launches with a screen similar to that shown in [Figure 13](#).



**Figure 13. GUI Software Default Configuration**

If an error message appears when the TMP007EVM GUI software is launched, disconnect all TMP007EVM kit components and repeat the hardware assembly and connection instructions. Next, insert the TMP007EVM hardware into the USB port (if not already done), as explained in the [Typical Hardware Connections](#) section. Uncheck the *Simulate Communication* checkbox, as shown in [Figure 14](#). Notice that the *SIMULATION* shown in the bottom right corner turns green (this field displays *CONNECTED* in [Figure 14](#)). The simulation communication is a feature used to become familiarized with the TMP007 features without the use of a TMP007 test board. The purpose of this function is to get accustomed to the device features; this function does not simulate TMP007 behavior.



Figure 14. GUI Uncheck Simulate Configuration

When the *Simulate Communication* checkbox is unchecked, notice that the green LED circled in [Figure 15](#) turns on. This light indicates that all connections are correct and the TMP007 device is powered on. Communication with the TMP007 test board can now be initiated.

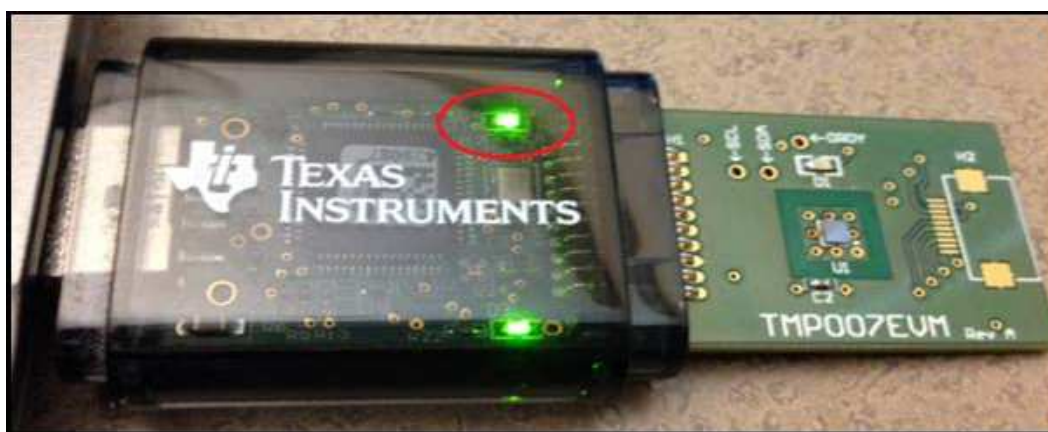


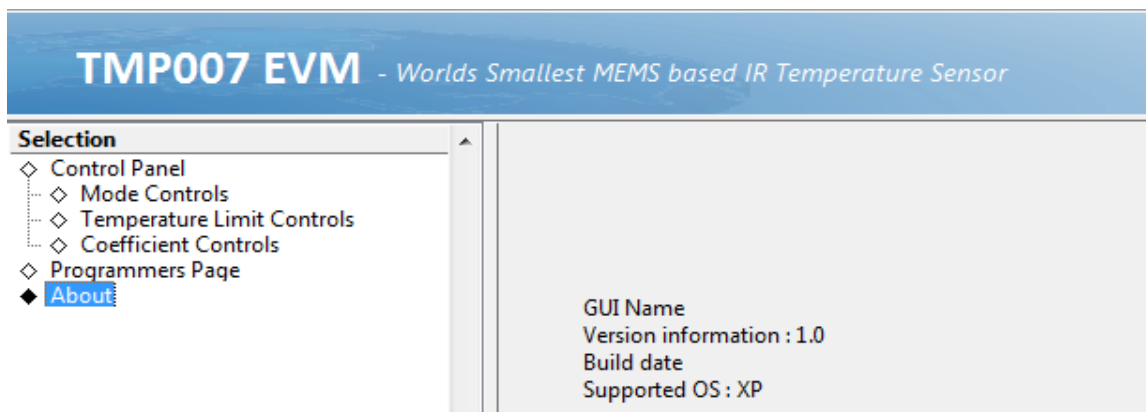
Figure 15. Indication for Correct Hardware Connection

## GUI Software Overview

This section discusses how to use the TMP007 GUI software.

### Getting Started

The TMP007 GUI is divided into various pages, as shown in [Figure 16](#). The GUI primarily consists of the control panel, the programmers page, and the about page.



**Figure 16. Main Pages in the TMP007 GUI**

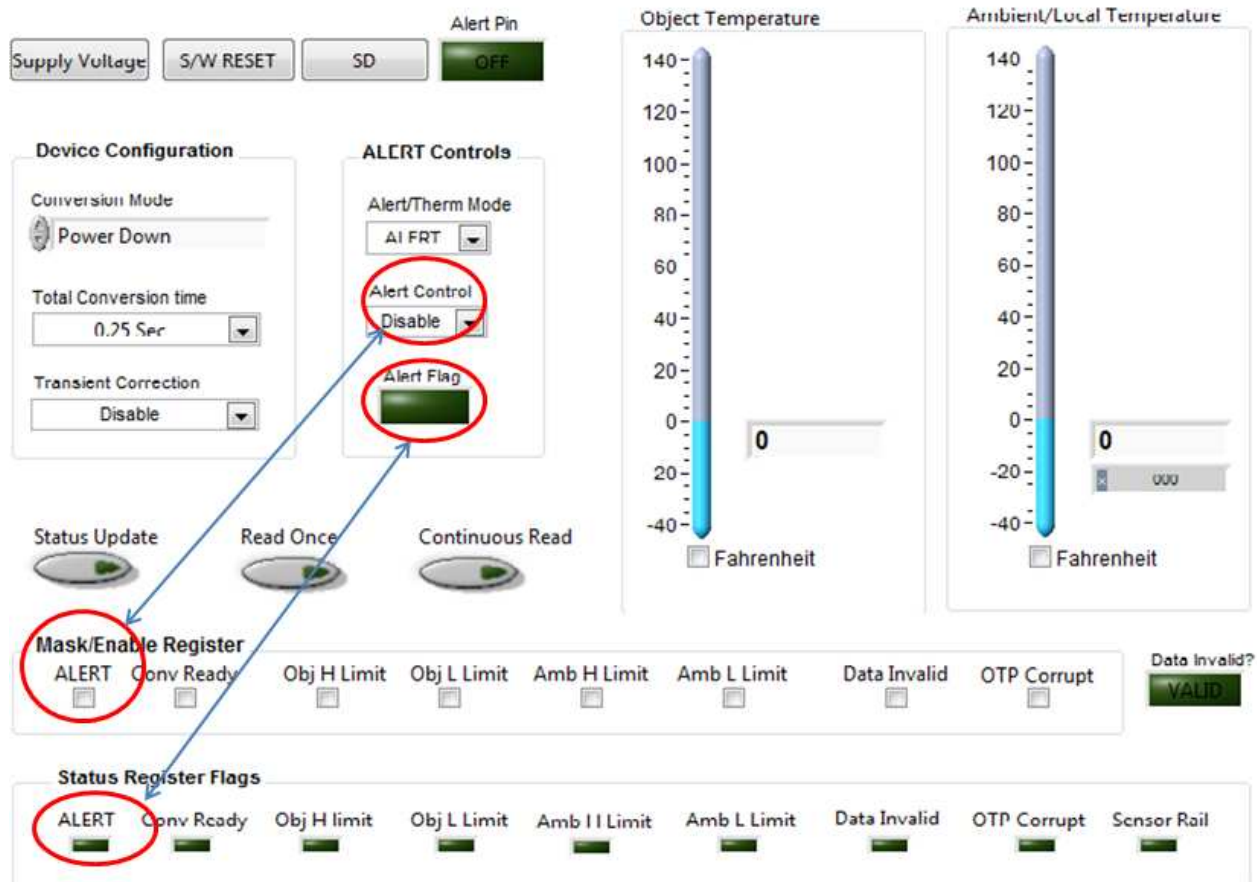
### Control Panel

The control panel includes the mode control page, temperature limit controls page, and coefficient controls page. This section describes each page in detail.



### 4.2.0.1 Mode Control Page

Figure 17 shows the mode control page. Refer to the [TMP007 data sheet](#) for further information regarding device controls and functionality.



**Figure 17. Control Page: Mode Controls**

The **Supply Voltage** button controls the 3.3-V power supply to the TMP007 test board. This control is on by default.

The **S/W Reset** button provides a software or firmware reset to the TMP007. This control resets all register values to their default states.

The **SD** button is a non-operational control.

The **Alert Pin** button is similar in functionality to the on-board LED. The on or off status of the LED may not be synchronized with the external LED in the TMP007 test board.

The *Object Temperature* and *Ambient/Local Temperature* control boxes provide the temperature of the object that the TMP007 is pointing to and the ambient temperature of the local temperature sensor, respectively. The user can convert the displayed temperatures from the default Celsius to Fahrenheit by checking the *Fahrenheit* checkbox under the thermometer displays.

The *Device Configuration* control box located at the left of the mode Controls page configures the TMP007 conversion mode, conversion time, and transient correction functions.

The *ALERT Controls* control box is located next to the *Device Configuration* control box. This box provides mode selection and configures the alert control and alert flag functions. The *Alert/Therm Mode* control allows the user to select Alert or Therm mode. The *Alert Control* drop-down enables and disables the ALERT functionality. This control is similar in function to the ALERT control located in the *Mask/Enable Register* control box, as shown in [Figure 17](#). The effect of enabling this control is seen on the alert pin indicator and external LED on the TMP007 test board, provided at least one of the features in the *Mask/Enable Register* control box is enabled. Refer to the [TMP007 data sheet](#) for further information on ALERT functionality.

Three buttons are found below the *Device Configuration* and *Alert/Therm Mode* control boxes. These buttons are: **Status Update**, **Read Once**, and **Continuous Read**. The **Status Update** control reads and updates the status register flags. The **Read Once** and **Continuous Read** controls read and update the object and ambient temperatures accordingly.

Two control boxes are located at the bottom of the mode controls page. These boxes are: *Mask/Enable Register* and *Status Register Flags*. The *Mask/Enable Register* box provides flexibility to enable individual features based on the users need. The *Status Register Flags* box indicates the status of these functions when activated. Note that the *Status Register Flags* box is only updated when the **Status Update** control is activated. In order to obtain the current status of the flags, the **Status Update** control must be enabled every time a change is made (continuous monitoring is not possible).

A **Data Invalid?** button is located at the right of the *Mask/Enable Register* control box. This button indicates if the calculated object temperature is invalid because of invalid operations in the math processor.

## Temperature Limit Controls

The temperature limit controls are divided into object and local temperature limits and controls, as shown in Figure 18.

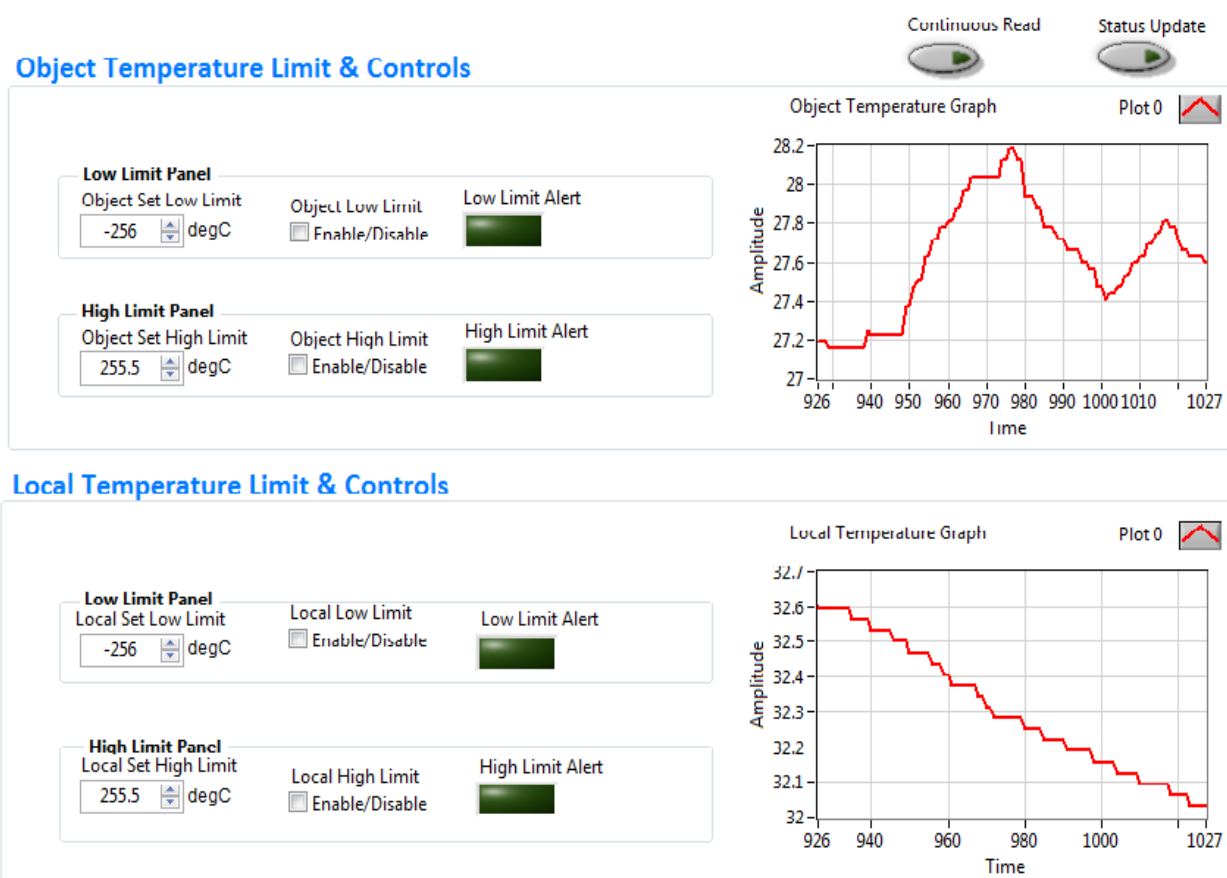


Figure 18. Control Page: Temperature Limit Controls

Figure 18 is broken into two panels: object and local limit controls. Two buttons (**Continuous Read** and **Status Update**) are located in the top left corner of Figure 18, above these two panels. The **Continuous Read** and **Status Update** controls function the same as the controls on the mode controls page. The **Continuous Read** control continuously updates both the object and ambient or local temperature graphs while the **Status Update** control updates the low and high limit alert flags present in the limit panels of the object and local temperature limits and controls panels shown in Figure 18.

The transient correction effect (see the [Mode Control Page](#)) is displayed on the object temperature graph, which is within the object temperature limit and controls panel of Figure 18. The object set low and high limit values reflect the default device values at power up or at software reset.

The **Enable/Disable** checkboxes enable and disable the limits for the object and local temperature sensor. These checkboxes only cause an alert when indicating any events of temperature going over or under the limits. The limits of the **Enable/Disable** controls function the same as the temperature limit controls present in the **Mask/Enable Register** control box of the [Mode Control Page](#). The low and high limit alert indicators shown in Figure 18 function the same as the limit indicators present in the **Status Register Flag** control box of the [Mode Control Page](#). Therefore, the **Status Update** control (top left corner of Figure 18) is functionally the same as the **Status Update** control in the [Mode Control Page](#).

#### 4.2.0.2 Coefficient Controls

All coefficients for the TMP007 are represented as either *intended values* or *actual values*, as shown in Figure 19. The intended value is the value that the user intends to program; this value may not be in resolution multiples of the value that must be programmed into the registers. Thus, the actual value represents the real value (in resolution multiples) that is actually programmed into the register. At power-up or at software reset, the actual values reflect the device default values. Refer to the [TMP007 device data sheet](#) for more information on coefficients.

**S0 Coefficient**

S0 Intended Value: 0.000E+0

S0 Actual Value: 6.000E-14

**A Coefficients**

A1 Intended Value: 0.000E+0

A2 Intended Value: 0.000E+0

A1 Actual Value: 3.815E-6

A2 Actual Value: -1.681E-5

**B Coefficients**

B0 Intended Value: 0.000E+0

B1 Intended Value: 2.000E-5

B2 Intended Value: 3.120E-7

B0 Actual Value: 0.000E+0

B1 Actual Value: 4.883E-9

B2 Actual Value: 2.480E-10

**C2 Coefficient**

C2 Intended Value: 0.000E+0

C2 Actual Value: 3.815E-1

**TC Coefficients**

TC0 Intended Value: 0.000E+0

TC1 Intended Value: 0.000E+0

TC0 Actual Value: 2.600E-4

TC1 Actual Value: 0.000E+0

When you program the intended value of the coefficients beyond specified range, the actual value programmed into the register will be the limit value. Refer Datasheet for more information on the programmable range for coefficients.

**Non Volatile Memory Operations**

Memory Address: 0

Memory Store

Single Load

Register Memory Bank: 0

General Load

Overall Memory Bank: 0

Figure 19. Control Page: Coefficient Controls Page

Nonvolatile memory operations facilitate storage of coefficients other than the register default values based upon the user's physical setup. TI highly recommends that the user determines the coefficients first, based on the application before writing the coefficients to the nonvolatile memory. Coefficients vary resulting from any changes in distance, field of view (FoV), and emissivity of the target object so the user should make sure the calibrated coefficients are written into the nonvolatile memory. The user can write to the nonvolatile memory up to **eight** times only. Further writes do not take effect.

Input the coefficient value in the **Intended Value** field (step 1 in Figure 19) and make sure the value is actually written into the coefficient register space by checking the **Actual value** field. Fill the register address of the appropriate coefficient in hexadecimal format at the **Memory Address** field (shown in step 2 of Figure 19) and click on **Memory Store**. To check if the value is written in a particular address field, click **Single Load** to read the status in the **Register Memory Bank** field (shown in step 3 of Figure 19). For checking the status of overall memory bank, click on **General Load** to read the status in the **Overall Memory Bank** field. Note that the increments for each memory bank write are as follows: 0, 0, 2, 3, 4, 5, 6, and 7 (note that 1 is missing because of the internal digital design configurations).

## Programmers Page

The programmers page is one level below the control page (see [Figure 16](#)) and directly deals with the basic register map read and write functionality.

The programmers' page allows the user to manually control register read and write programmability as compared to the [Mode Control Page](#). Register address, their default values, and the allowable read and write modes are displayed in the programmers page, as shown in [Figure 20](#). The LW\* and LR\* columns display the last value written and the last value read, respectively, from each register. The **Read Register** and **Write Register** buttons provide control to perform operations to the values entered in the *Read Data* and *Write Data* fields. A specific configuration can be loaded from or saved to a .csv file using the **Load Config** and **Save Config** control buttons.

### Register Map

Block / Register Name	Address	Default	Mode	Size	LW*	LR*
<b>User Registers</b>						
Sensor Voltage Result Register	0x00	0x0000	R	16	0x0000	0x00
Ambient Temperature Result Register	0x01	0x0000	R	16	0x0000	0x1004
Configuration Register	0x02	0x7400	R/W	16	0x7460	0x7400
Object Temperature Result Register	0x03	0x0000	R	16	0x0000	0x0DC
Status Register	0x04	0x0000	R	16	0x0000	0x0000
Mask/En Register	0x05	0x0000	R/W	16	0x0000	0x0000
Object Temperature High Limit Register	0x06	0x0000	R/W	16	0x0000	0x7FC0
Object Temperature Low Limit Register	0x07	0x0000	R/W	16	0x0000	0x8000
Local Temperature High Limit Register	0x08	0x0000	R/W	16	0x0000	0x7FC0
Local Temperature Low Limit Register	0x09	0x0000	R/W	16	0x0000	0x8000
S0 Coefficient Register	0x0A	0x3A69	R/W	16	0x3A69	0x3A69
A1 Coefficient Register	0x0B	0x01CB	R/W	16	0x01CB	0x01CB
A2 Coefficient Register	0x0C	0xFEE6	R/W	16	0xFEE6	0xFEE6
B0 Coefficient Register	0x0D	0xFF40	R/W	16	0xFF40	0xFF40
B1 Coefficient Register	0x0E	0xFC29	R/W	16	0xFC29	0xFC29
B2 Coefficient Register	0x0F	0x001A	R/W	16	0x001A	0x001A
C2 Coefficient Register	0x10	0x1190	R/W	16	0x1190	0x1190
TC0 Coefficient Register	0x11	0x0034	R/W	16	0x0034	0x0034
TC1 Coefficient Register	0x12	0xFFC0	R/W	16	0xFFC0	0xFFC0
OTP Access Register	0x2A	0x0000	R/W	16	0x0000	0x00
Manufacturer ID Register	0x1E	0x5449	R	16	0x5449	0x00
Device ID Register	0x1F	0x0070	R	16	0x0070	0x00

### Register Data

Write Data  
x 0  
Write Register  
Write All

Read Data  
x 0  
Read Register  
Read All

Current Address  
x 0  
Note: Load Config will Overwrite all Registers.  
Load Config  
Save Config

R W  
0 ☐ Sensor Voltage[0]  
1 ☐ Sensor Voltage[1]  
2 ☐ Sensor Voltage[2]  
3 ☐ Sensor Voltage[3]  
4 ☐ Sensor Voltage[4]  
5 ☐ Sensor Voltage[5]  
6 ☐ Sensor Voltage[6]  
7 ☐ Sensor Voltage[7]  
8 ☐ Sensor Voltage[8]  
9 ☐ Sensor Voltage[9]  
10 ☐ Sensor Voltage[10]  
11 ☐ Sensor Voltage[11]  
12 ☐ Sensor Voltage[12]  
13 ☐ Sensor Voltage[13]  
14 ☐ Sensor Voltage[14]  
15 ☐ Sensor Voltage[15]

### Register Description

Sensor Voltage[15:0]  
This is the converted sensor voltage output of the sensor

\*LW---> Last Write ; \*LR---> Last Read

Figure 20. Programmers Page



### 4.3 Bill of Materials

Table 3 lists the bill of materials for the TMP007EVM.

**Table 3. TMP007 Test Board Bill of Materials**

Item No.	Qty	Value	Ref Des	Description	Vendor/Mfr	Part Number
1	1	—	N/A	Printed Circuit Board	Texas Instruments	EDGE#: 6499073
2	1	1uF	C1	CAP CER 1.0UF 16V X7R 10% 0603	TDK	C1608X7R1C105K
3	1	0.01uF	C2	CAP CER 10000PF 25V X7R 10% 0402	TDK	C1005X7R1E103K
4	1	—	D1	LED ALINGAP GRN WHT DIFF 0603SMD	Lumex	SML-LX0603SUGW-TR
5	1	—	FB1	FERRITE BEAD 300 OHM .2A 0402	Würth	74279272
6	1	—	H1	CONN SOCKET 10PIN .050 R/A SNGL	Mill-Max	851-43-010-20-001000
7	—	—	H2	CONN FPC/FFC 10POS .5MM HORZ SMD	Hirose	FH12-10S-0.5SH(55)
8	1	—	Q1	MOSFET P-CH 50V 130MA SC70-3	Diodes Inc	BSS84W-7-F
9	2	0R	R1,R2	RES 0.0 OHM 1/16W 0402 SMD	Rohm	MCR01MZPJ000
10	3	47k	R3-R5	RES 47.0K OHM 1/16W 1% 0402 SMD	Rohm	MCR01MZPF4702
11	1	160R	R6	RES 160 OHM 1/16W 1% 0402 SMD	Rohm	MCR01MZPF1600
12	1	—	U1	Infra-Red Sensor with Digital Interface	Texas Instruments	TMP007AIYZFT

## Revision History

Changes from Original (May 2014) to A Revision	Page
• Changed title to show EVM .....	1
• Deleted row regarding USB drive in <a href="#">Table 1</a> ; software available on <a href="#">www.ti.com</a> .....	2
• Deleted USB drive from <a href="#">Figure 1</a> ; software available on <a href="#">www.ti.com</a> .....	2
• Changed first sentence in <a href="#">Section 3</a> to clarify hardware connection .....	5
• Changed <a href="#">Figure 5</a> .....	6
• Deleted text and figure regarding hardware driver installation .....	6
• Changed text in first sentence of <a href="#">Section 4.2</a> to clarify that software is now available at <a href="#">www.ti.com</a> .....	6

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

## STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.

- 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms and conditions that accompany such Software
- 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

- 2 *Limited Warranty and Related Remedies/Disclaimers:*

- 2.1 These terms and conditions do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
- 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 any defects that are 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. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.
- 2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, 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.

- 3 *Regulatory Notices:*

- 3.1 *United States*

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

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

#### Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). 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/llds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/llds/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。  
[http://www.tij.co.jp/llds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/llds/ti_ja/general/eStore/notice_01.page)

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

If User uses EVMs in Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

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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本開発キットは技術基準適合証明を受けておりません。

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2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

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上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。

日本テキサス・インスツルメンツ株式会社

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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:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMS 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 assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMS, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.



6. *Disclaimers:*

- 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY WRITTEN DESIGN MATERIALS PROVIDED WITH THE EVM (AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
- 6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS AND CONDITIONS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT MADE, CONCEIVED OR ACQUIRED PRIOR TO OR AFTER DELIVERY OF THE EVM.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS AND CONDITIONS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

- 8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS AND CONDITIONS OR THE USE OF THE EVMS PROVIDED HEREUNDER, REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS OCCURRED.
- 8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY WARRANTY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS AND CONDITIONS, OR ANY USE OF ANY TI EVM PROVIDED HEREUNDER, EXCEED THE TOTAL AMOUNT PAID TO TI FOR THE PARTICULAR UNITS SOLD UNDER THESE TERMS AND CONDITIONS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM AGAINST THE PARTICULAR UNITS SOLD TO USER UNDER THESE TERMS AND CONDITIONS SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

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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Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
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Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
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