

TPS65185 Evaluation Module

The hardware and software described in this document may slightly vary from the content of the EVM package. However, operating and installation procedures remain the same.

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Trademarks

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1 EVM Package Contents

The EVM package contains the following components:

- EVM (TPS65185 installed)
- User's guide
- USB interface adapter
- USB interface cable
- Ribbon cable
- Software

2 Hardware

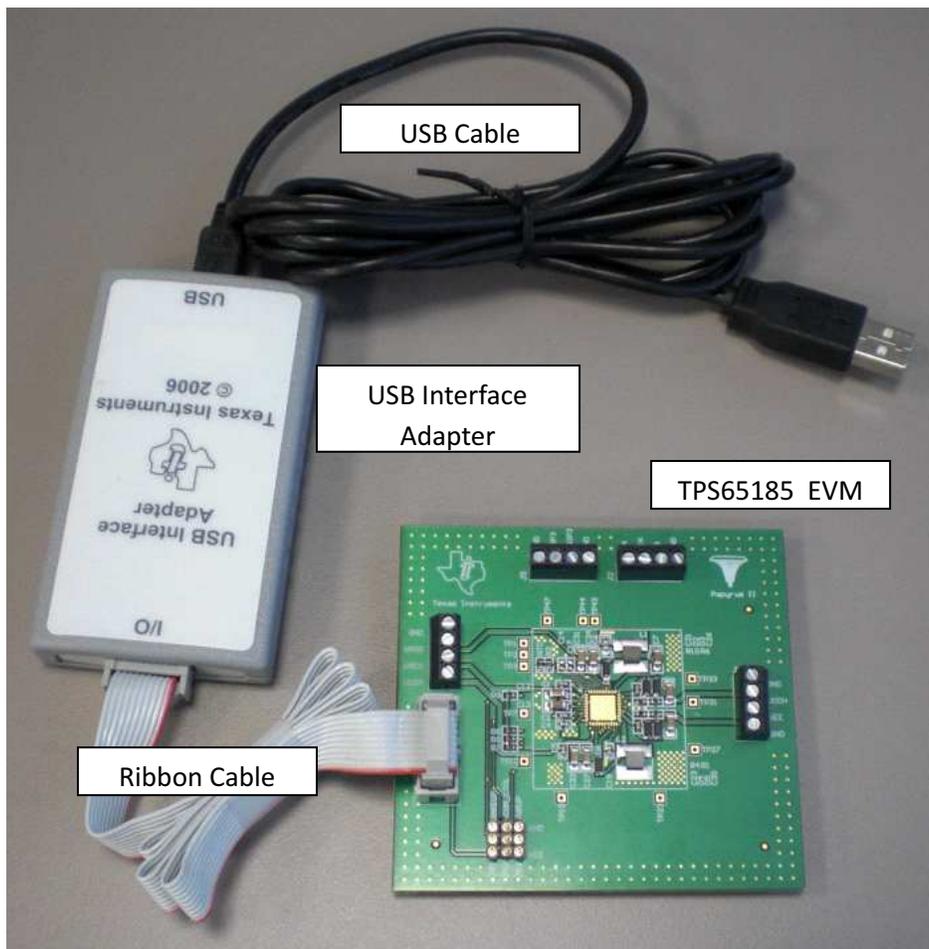


Figure 1. Included Hardware

3 Software

- TPS65185 GUI setup file: setup.exe

4 EVM Overview

Figure 2 identifies the main components of the EVM. The exact configuration of the EVM may vary from the image below.

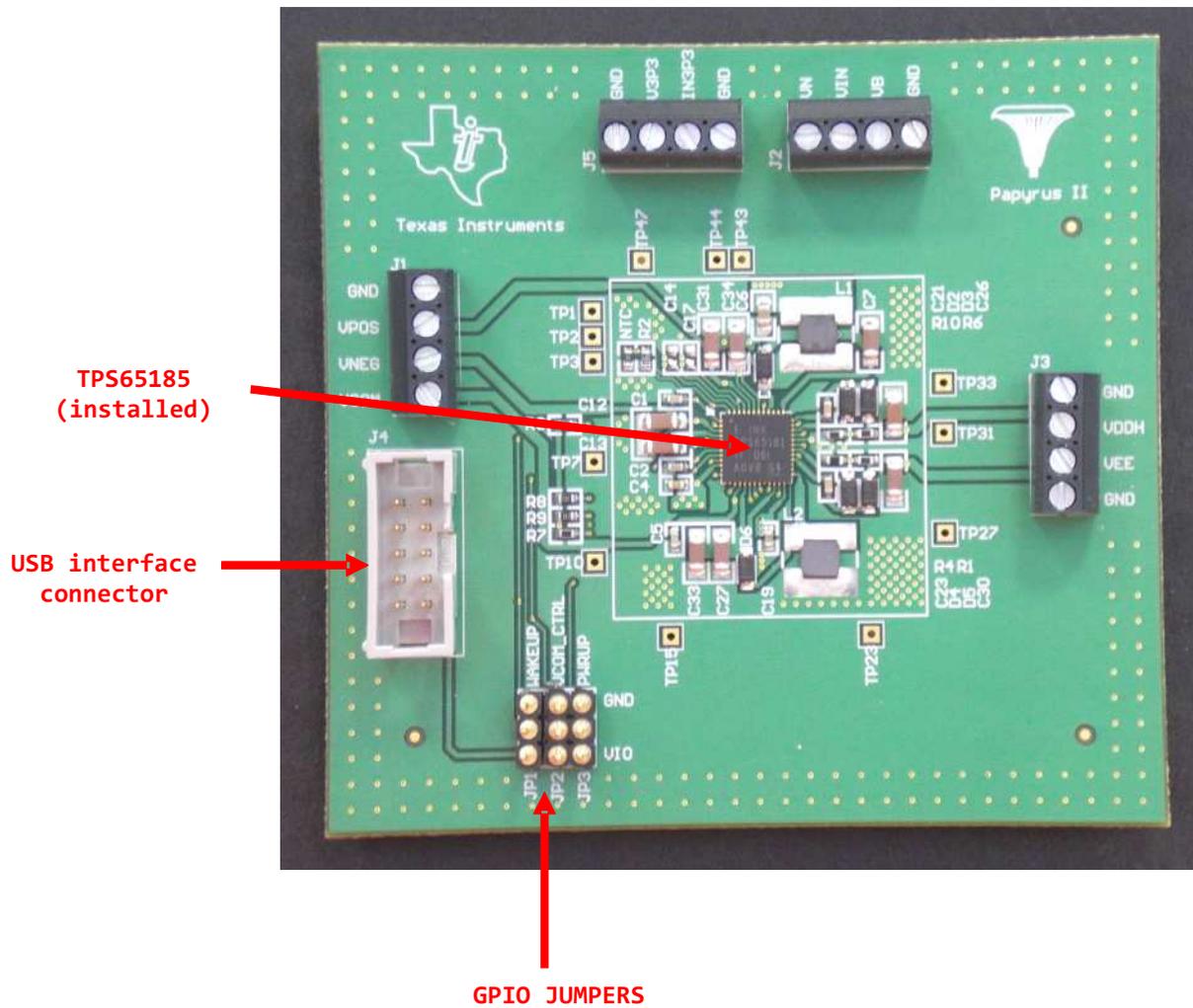


Figure 2. TPS65185 EVM

4.1 Powering Up the EVM - GPIO Control

To power up the EVM follow the steps outlined below:

- Install WAKEUP jumper in the GND position.
- Install VCOM_CTRL jumper in the GND position.
- Install PWRUP jumper in the VIO position.
- Connect the EVM to the USB interface adapter using the 10-lead ribbon cable.
- Connect the USB interface connector to the computer USB port using a standard USB cable.
- Connect a 3-V - 6-V supply from the VIN terminal to GND.
- Move the WAKEUP jumper from the GND position to VIO position.

The TPS65185 should start immediately with the predefined power-up sequence and voltage settings.

NOTE: Please note that although in this example no software control and therefore no I²C communication is required, the USB interface still needs to be connected. This is because the interface board also provides the 3.3-V VIO rail. To operate the EVM without the interface, connect a 3.3-V supply from VIO to GND.

5 Software Installation Instruction

The following section explains the procedure for installing the Graphical User Interface (GUI) onto a Windows based PC. A USB interface adapter is required to connect the EVM to a PC and should have been provided with the EVM.

Additional interfaces can be ordered through www.ti.com/tool/usb-to-gpio.

If the software has been installed already, skip the following section and continue at Operating Instructions.

To install the EVM software follow the steps outlined below:

- Copy the TPS65185 folder to your computer.
- Double-click on the setup.exe file in the TPS65185\Volume directory.
- Follow the prompts to finish the installation.
- At the end of the installation you may be asked to reboot your computer.

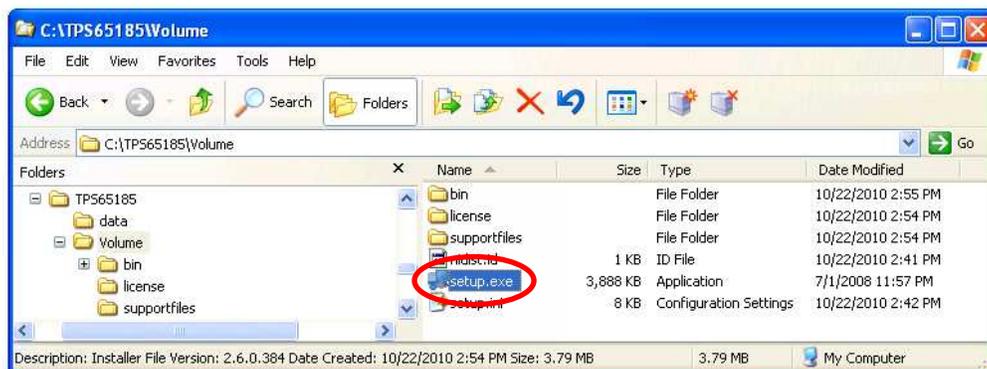


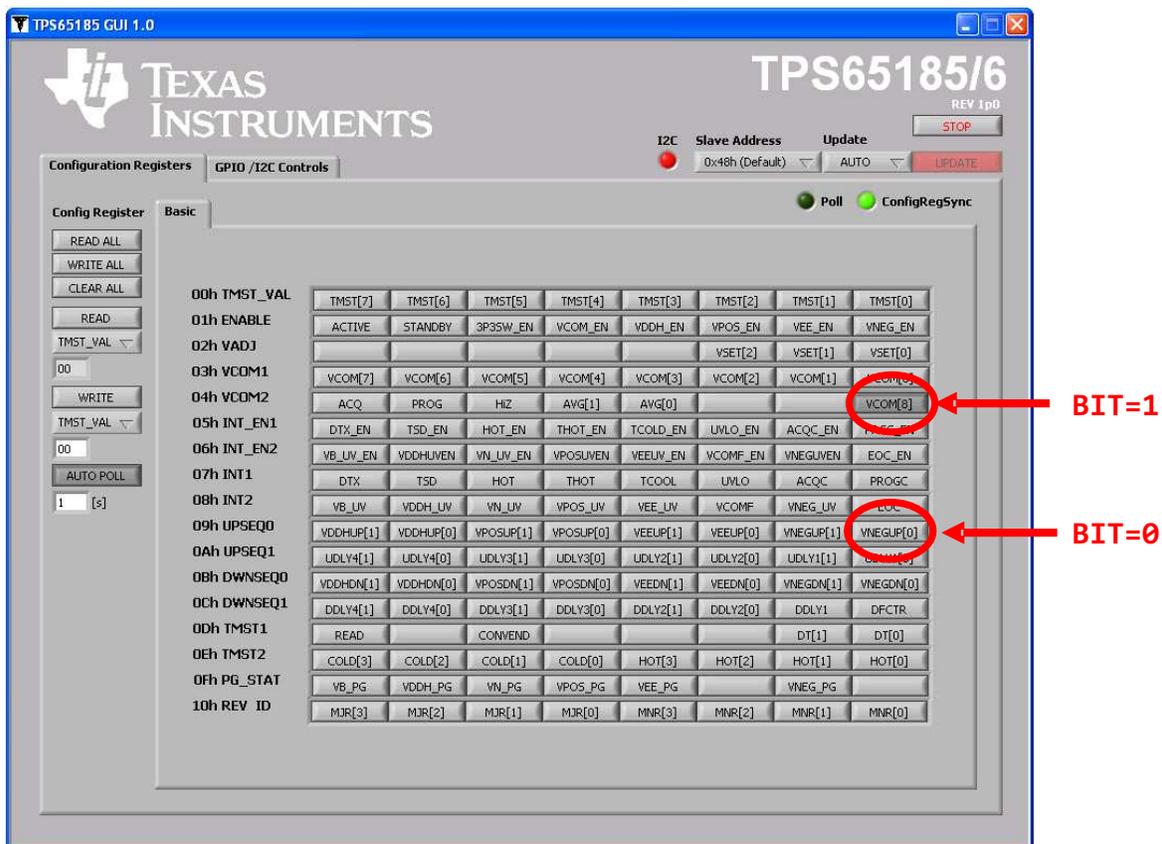
Figure 3. setup.exe File Location

6 Powering Up the EVM - Software Control

To power up the EVM follow the steps outlined below:

- Install WAKEUP jumper in the GND position.
- Install VCOM_CTRL jumper in the GND position.
- Install PWRUP jumper in the GND position.
- Connect the USB interface connector to the computer USB port using a standard USB cable.
- Connect a 3-V - 6-V supply from the VIN terminal to GND.
- Move the WAKEUP jumper from the GND position to VIO position.
- Run the TPS65185.exe software:
 - Click on “start”.
 - Click on “All Programs”.
 - Select TPS65185 program group.
 - Click on TPS65185.

The following window should appear:



This image is for illustration only and does not represent the default register settings.

Figure 4. Startup Panel TPS65185 Control Software

Update the Slave Address to 0x68h and click on the ACTIVE bit in the ENABLE register. All regulators should power up.

6.1 Configuration Registers/BASIC Tab

The BASIC panel represents the register map and contains a button for each bit. A depressed button represents a bit set to '1' and a released button represents a '0'.

6.2 GPIO/I²C Controls Tab

Use this page to change the I²C interface data rate and SDA/SCL pullup resistors which are built into the USB interface adapter.

This tab also provides controls for the VCOM_CTRL, PWRUP, and WAKEUP pins. Please note that the jumpers JP1, JP2, and JP3 must be removed to control the pins through the GUI.

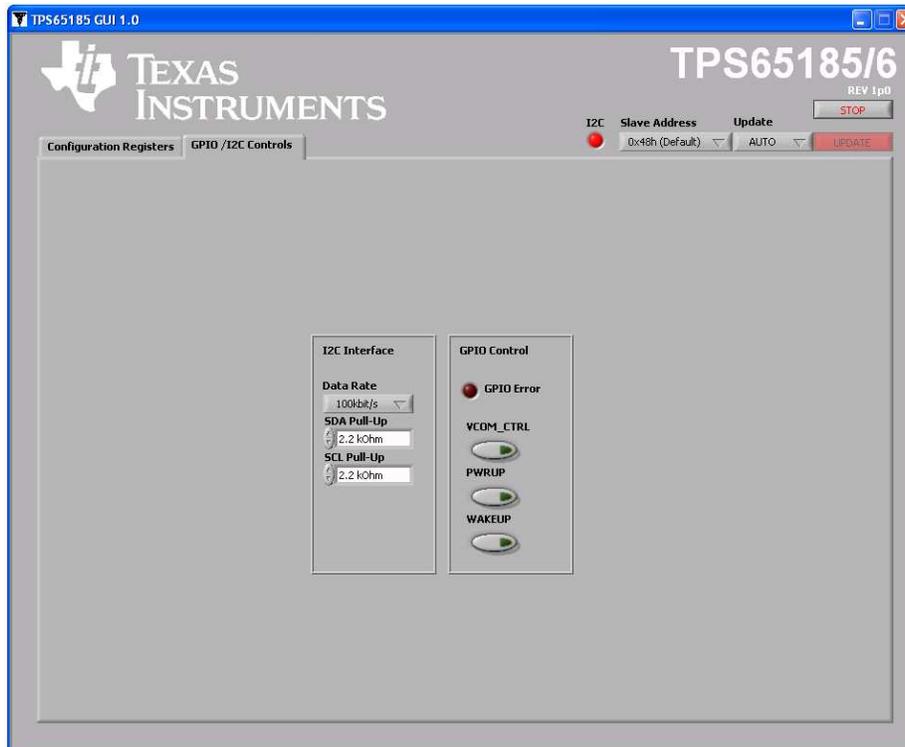


Figure 5. GPIO/I²C Control Tab

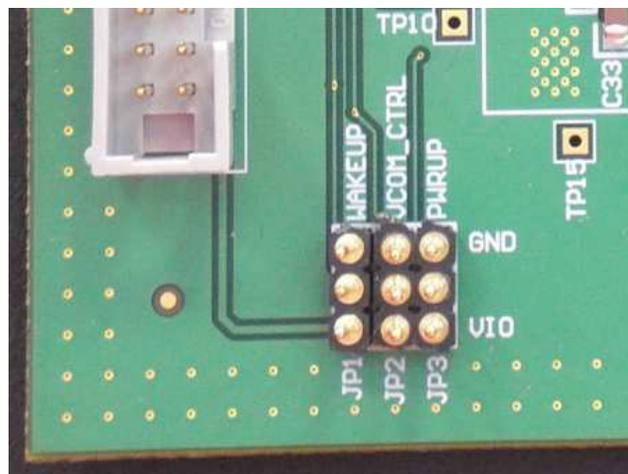


Figure 6. JP1, JP2, and JP3 Must Be Removed Before Using the GUI GPIO Control

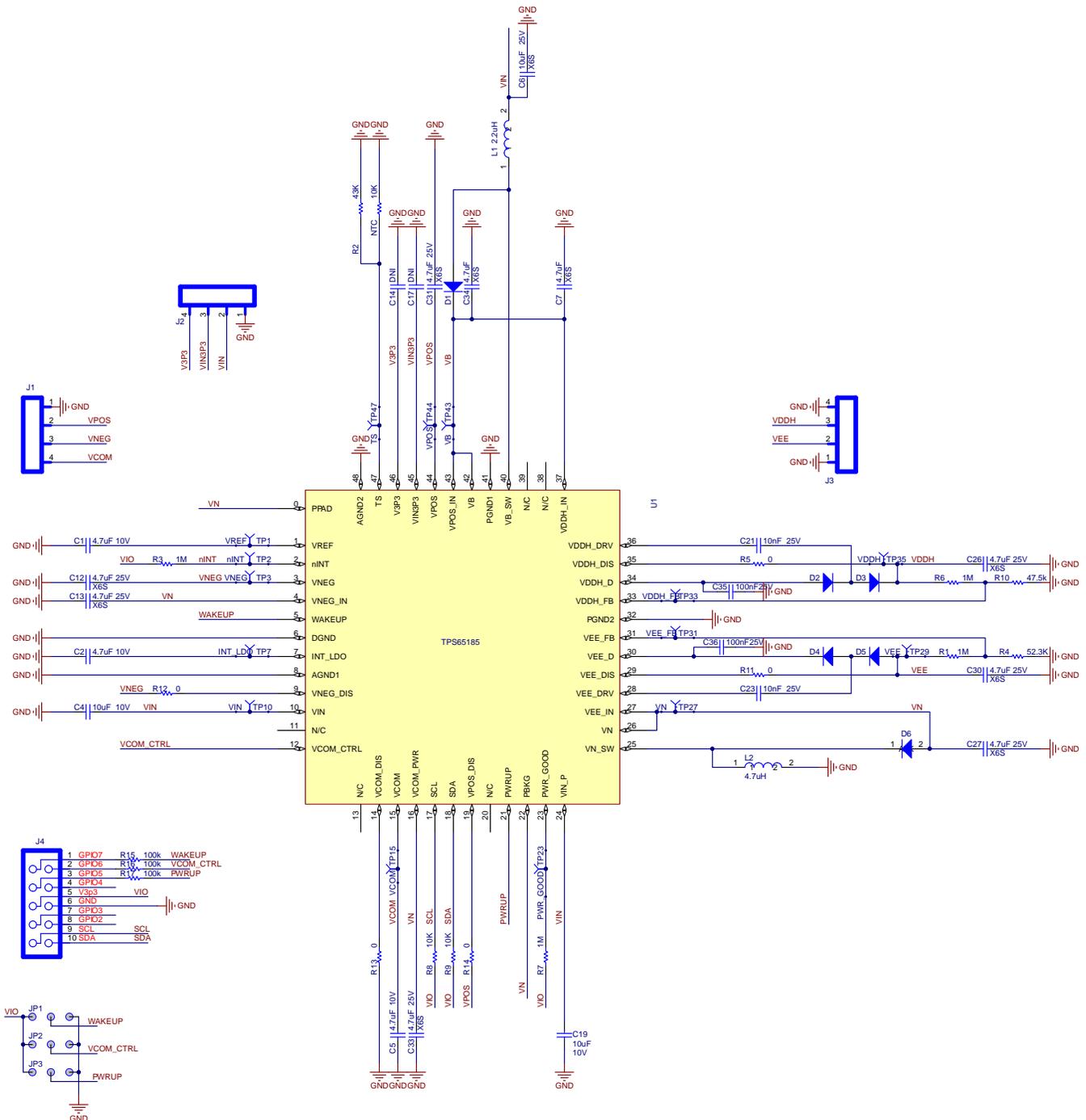
7 Other Functions

- To clear the GUI panel, press the “CLEAR ALL” button. Note that this function has no effect on the TPS65185. This function is useful to verify that “READ ALL” function is working properly.
- Individual registers can be read and written to using the READ and WRITE buttons. The data is displayed in HEX format.
- The default setting for the GUI is to update the register settings immediately after the user changes values. Select “MANUAL” update control if you wish to change multiple values before writing to the TPS65185.
- The GUI periodically polls the TMST_VAL, ENABLE, INT1, INT2, and PG_STAT registers to reflect the current status of the device. The polling interval can be adjusted by the user by entering a number below the "AUTO POLL" button. Release the "AUTO POLL" button to disable automatic polling.

8 Application Considerations

For production systems, VDDH_D and VEE_D should have dedicated 100-nF capacitors to GND. This evaluation module demonstrates the various features of the TPS65185x, but does not necessarily constitute a robust production design.

9 EVM Schematic



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10 Bill of Materials

Table 1 lists the bill of materials for the TPS65185EVM.

Table 1. Bill of Materials

| Quantity | Designator | Value | Footprint | Manufacturer | Manufacturer's Part No. | Description | Comment |
|----------|--|-------------|------------------|----------------------|-------------------------|----------------------------------|------------------|
| 3 | C1, C2, C5 | 4.7uF | 0603 | Murata | GRM188R60J475KE19D | CAP CER 4.7UF 6.3V X5R 0603 | Cap |
| 2 | C4, C19 | 10uF | 0603 | Murata | GRM188R60G106ME47D | CAP CER 10UF 4V X5R 0603 | Cap |
| 1 | C6 | 10uF | 0805 | Murata | GRM21BR70J106KE76L | CAP CER 10UF 6.3V X7R 0805 | Cap |
| 9 | C7, C12, C13, C26, C27, C30, C31, C33, C34 | 4.7uF | 1206 | Taiyo Yuden | UMK316BJ475KL-T | CAP CER 4.7UF 50V X5R 1206 | Cap |
| 1 | C14 | DNI | 0603 | | | | DNI |
| 1 | C17 | DNI | 0603 | | | | Cap |
| 2 | C21, C23 | 10nF | 0603 | Murata | GRM188R71E103KA01D | CAP CER 10000PF 25V 10% X7R 0603 | Cap |
| 2 | C35, C36 | 100nF | 0603 | Murata | GRM188R71E104KA01D | CAP CER .1UF 25V 10% X7R 0603 | Cap |
| 6 | D1, D2, D3, D4, D5, D6 | | SOD-123 | On Semi | MBR130T1G | DIODE SCHOTTKY 30V 1A SOD123 | Diode |
| 3 | J1, J2, J3 | ED1514 | TB_4X3.5MM | On Shore | ED555/4DS | TERMINAL BLOCK 3.5MM 4POS PCB | |
| 1 | J4 | 2510-6002UB | CONN_2510-6002UB | 3M | 2510-6002UB | SHROUDED HEADER 10 POS STRAIGHT | CONN_2510-6002UB |
| 3 | JP1, JP2, JP3 | | JMP0.3 | Samtec Inc | TSW-150-07-T-D | CONN HEADER 100POS .100" DL TIN | JUMPER 3 PIN |
| 1 | L1 | 2.2uH | CDRH6D28 | Murata | LQH55DN2R2M03L | Power Inductors 2.2uH 20% | Inductor |
| 1 | L2 | 4.7uH | CDRH6D28 | Murata | LQH55DN4R7M03L | Power Inductors 4.7uH 20% | Inductor |
| 1 | NTC | 10K | 0603 | Rohm Semi | MCR03EZPFX1002 | RES 10.0K OHM 1/10W 1% 0603 SMD | |
| 4 | R1, R3, R6, R7 | 1M | 0603 | Rohm Semi | MCR03EZPFX1004 | RES 1.00M OHM 1/10W 1% 0603 SMD | Res1 |
| 1 | R2 | 43K | 0603 | Rohm Semi | MCR03EZPFX4302 | RES 43.0K OHM 1/10W 1% 0603 SMD | |
| 1 | R4 | 52.3K | 0603 | Rohm Semi | MCR03EZPFX5232 | RES 52.3K OHM 1/10W 1% 0603 SMD | Res1 |
| 5 | R5, R11, R12, R13, R14 | 0 | 0603 | Rohm Semi | MCR03EZPJ000 | RES 0.0 OHM 1/10W 0603 SMD | Res1 |
| 2 | R8, R9 | 10K | 0603 | Rohm Semi | MCR03EZPFX1002 | RES 10.0K OHM 1/10W 1% 0603 SMD | Res1 |
| 1 | R10 | 47.5k | 0603 | Rohm Semi | MCR03EZPFX4752 | RES 47.5K OHM 1/10W 1% 0603 SMD | Res1 |
| 3 | R15, R16, R17 | 100k | 0603 | Rohm Semi | MCR03EZPFX1003 | RES 100K OHM 1/10W 1% 0603 SMD | Res1 |
| 1 | TP1 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | VREF |
| 1 | TP2 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | nINT |
| 1 | TP3 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | VNEG |
| 1 | TP7 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | INT_LDO |
| 1 | TP10 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | VIN |
| 1 | TP15 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | VCOM |
| 1 | TP23 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | PWR_GOOD |
| 1 | TP27 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | VN |
| 1 | TP29 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | VEE |
| 1 | TP31 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | VEE_FB |
| 1 | TP33 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | VDDH_FB |
| 1 | TP35 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | VDDH |
| 1 | TP43 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | VB |
| 1 | TP44 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | VPOS |
| 1 | TP47 | STD | TP-032 | Keystone Electronics | 5002 | TEST POINT PC MINI .040"D WHITE | TS |
| 1 | U1 | | RGZ (S-PQFP-N48) | | | | TPS65185 |
| 4 | N/A | N/A | N/A | 3M | SJ-5303 (CLEAR) | BUMPON HEMISPHERE .44X.20 CLEAR | |
| 3 | N/A | NA | N/A | Sullins Connector | SPC02SYAN | CONN JUMPER SHORTING GOLD FLASH | |

Revision History

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

| Changes from Original (October 2011) to A Revision | Page |
|---|-------------------|
| • Added slave address update to the <i>Powering Up the EVM - Software Control</i> section | 5 |
| • Added the <i>Application Considerations</i> section | 7 |
| • Changed the <i>EVM Schematic</i> | 8 |
| • Changed the <i>Bill of Materials</i> | 9 |

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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 - 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.
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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.
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.

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3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/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/lstds/ti_ja/general/eStore/notice_01.page

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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3.4.1 *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:*

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.

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