

# ***TPS65400 4.5- to 18-V Input Flexible Power Management Unit with PMBus/I<sup>2</sup>C Interface Evaluation Module***

This document presents the information required to operate the TPS65400 PMIC as well as the support documentation including schematic, layout, hardware setup and bill of materials.

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## 1 Background

The TPS65400 is an integrated power management unit (PMU) optimized for applications that require small form factor and high-power conversion efficiency, enabling small space-constrained equipment with high-ambient operating temperature without cooling. The TPS65400 provides high-power efficiency at a system level by enabling a single-stage conversion from an intermediate distribution bus with an optimized combination of regulators.

The TPS65400 consists of four high-current buck-switching regulators (SW1, SW2, SW3, and SW4) with integrated FETs. The switching power supplies are intended for powering high-current digital circuits such as the processor, FPGA, ASIC, memory, and digital I/Os. SW1 and SW2 support 4 A each, and SW3 and SW4 support 2 A each. Each regulator's switching frequency is independently adjustable up to 2.2 MHz.

Current limit programmability on each switcher enables optimization of inductor ratings for a particular application configuration not requiring the maximum current capability. The TPS65400 can be powered from a single-input voltage rail between 4.5 and 18 V, making it suitable for applications running off a 5- or 12-V intermediate power distribution bus. Sequencing requirements can be met using the individual enable pins or by programming the sequence through the I<sup>2</sup>C bus into the onboard EEPROM. Output voltages can be set through external resistor networks and VREF can be programmed from 0.6 to 1.87 V in 10-mV steps. All control and status info can be accessed through a PMBus-compatible I<sup>2</sup>C bus.

The TPS65400 provides a high level of flexibility for monitoring and control through the I<sup>2</sup>C bus while providing the option of programmability through the use of external components and voltage levels for systems not using I<sup>2</sup>C. As there are many possible options to set the converters, [Table 1](#) presents the performance specification summary for the EVM.

The evaluation module is designed to provide access to the features of the TPS65400. Some modifications can be made to this module to test performance at different input and output voltages for bucks. Please contact the TI Field Applications group for advice on these matters.

As there are many possible options to set the converters, [Table 1](#) presents the performance specification summary for the EVM.

**Table 1. Summary of Performance**

Test Conditions	Performance
VIN = 4.5 to 18 V fsw = 500 kHz (25°C ambient)	Buck1, 1.8 V, up to 4 A
	Buck2, 3.3 V, up to 4 A
	Buck3, 1.2 V, up to 2 A
	Buck4, 2.5 V, up to 2A

## 2 TPS65400 EVM Schematic

Figure 1 illustrates the TPS65400 EVM schematic.

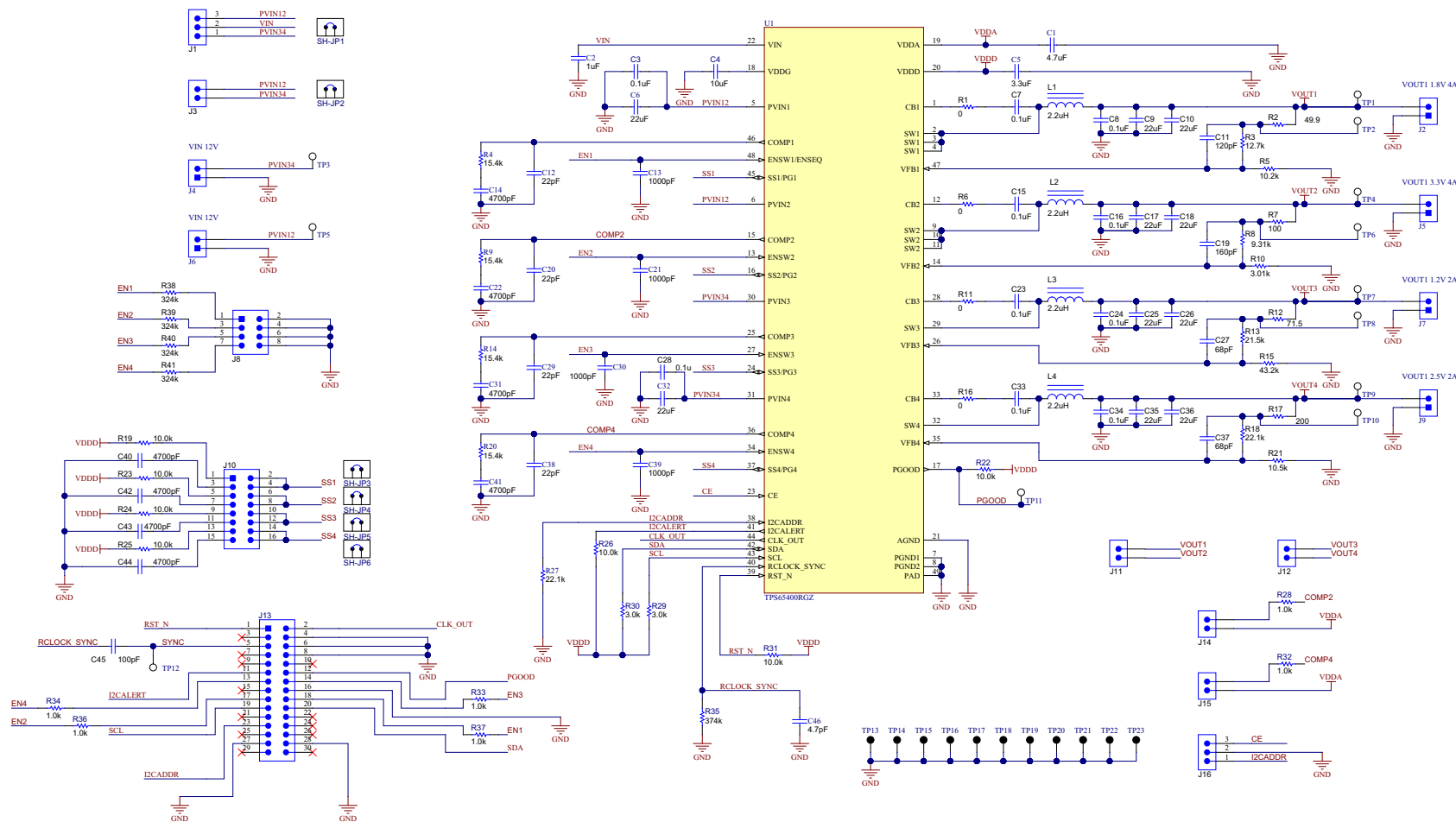
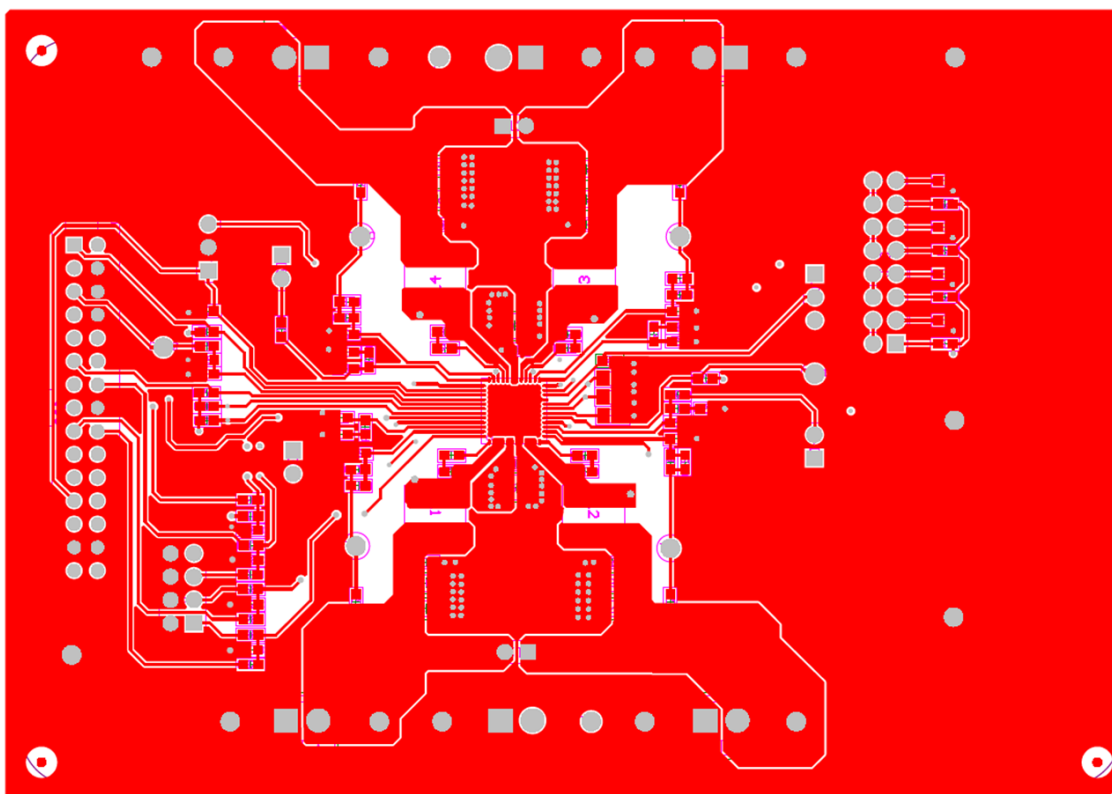


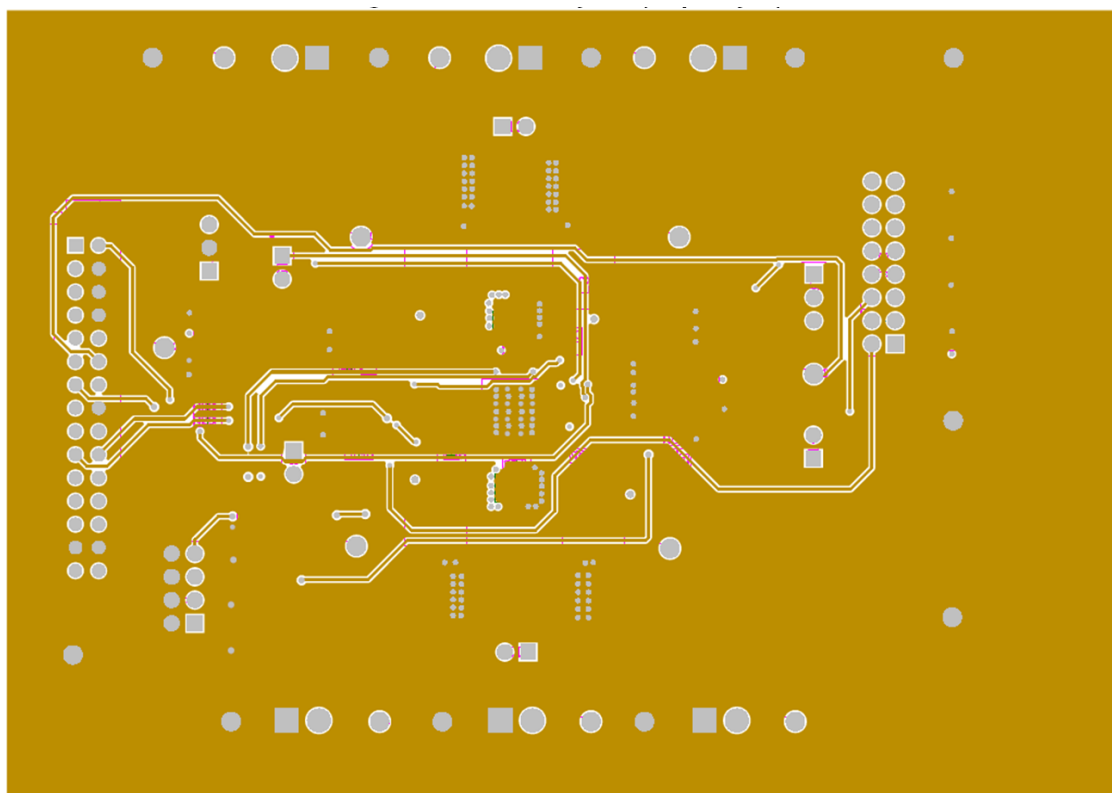
Figure 1. TPS65400 EVM Schematic

Figure 2 through Figure 6 illustrate the printed-circuit board (PCB) layouts.

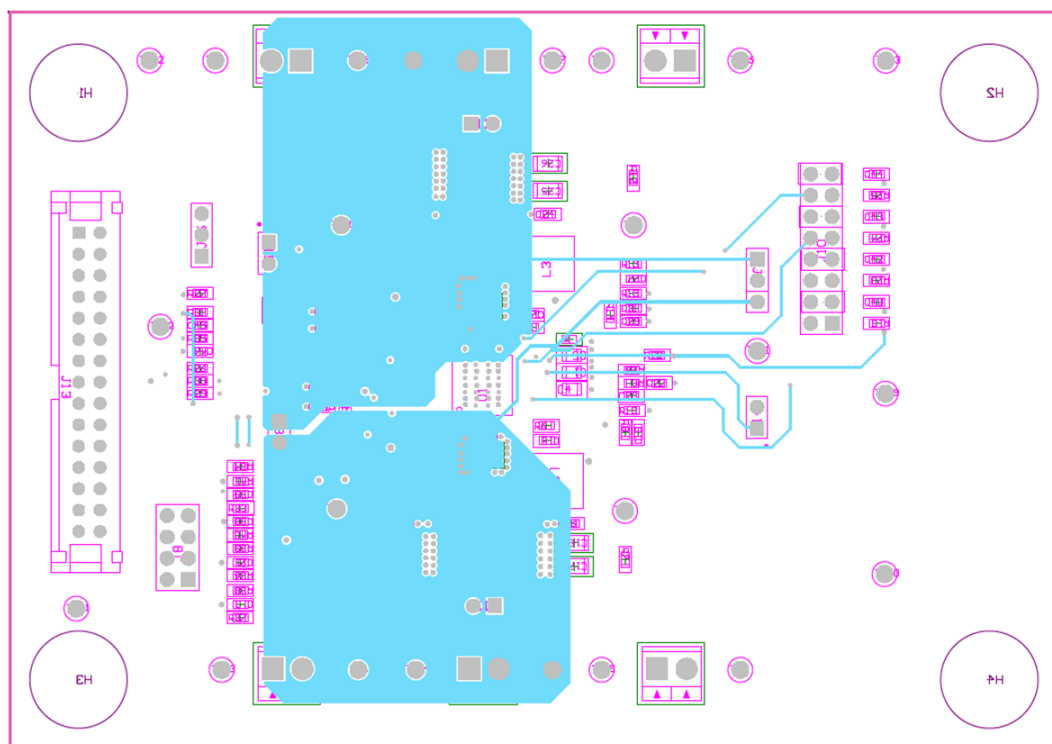




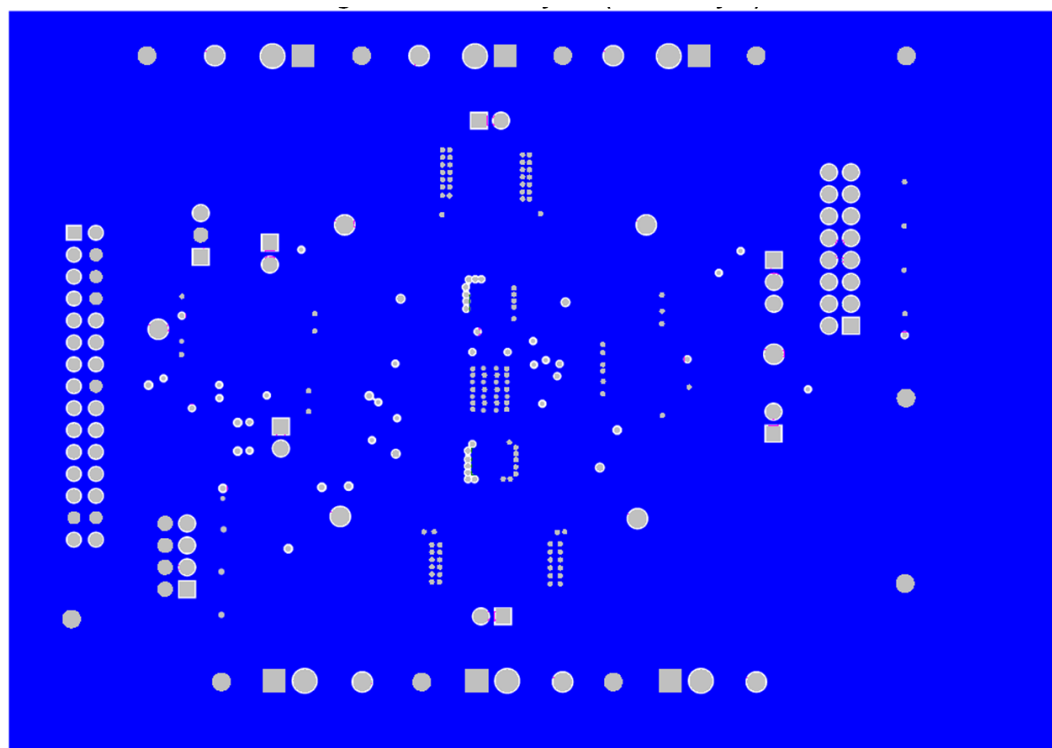
**Figure 3. Board Layout (Top Layer)**



**Figure 4. Board Layout (Second Layer)**



**Figure 5. Board Layout (Third Layer)**



**Figure 6. Board Layout (Bottom Layer)**

## 4 Bench Test Setup Conditions

### 4.1 Headers Description and Jumper Placement

Figure 7 illustrates the header descriptions and jumper placement on the EVM.

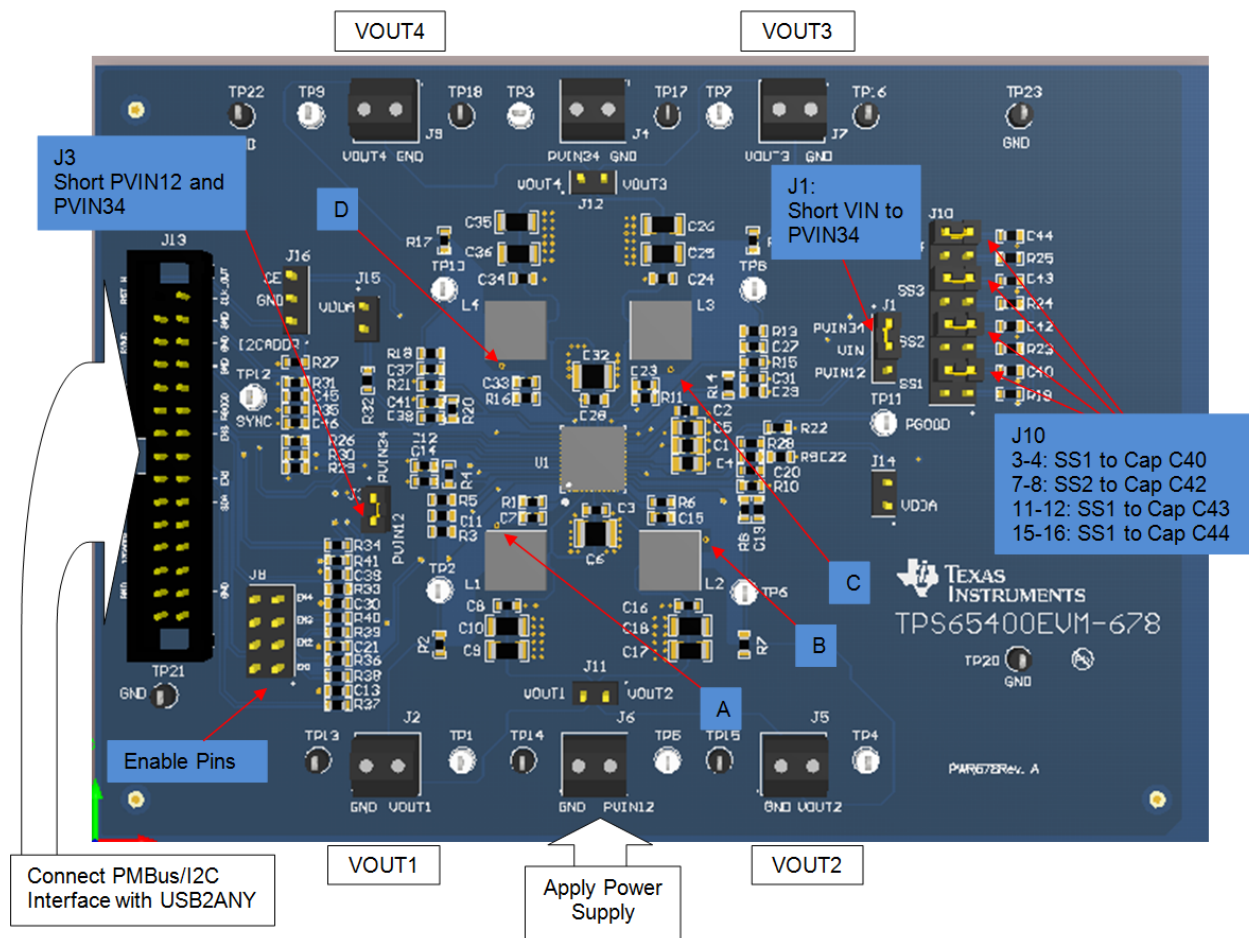


Figure 7. Headers Description and Jumper Placement

Test points:

- (A) LX of VOUT1
- (B) LX of VOUT2
- (C) LX of VOUT3
- (D) LX of VOUT4

VOUT1, VOUT2, VOUT3, VOUT4

**Table 2. Input/Output Connection**

No.	Function	Description
J2	Buck1 Connector	Output of Buck1
J5	Buck2 Connector	Output of Buck2
J7	Buck3 Connector	Output of Buck3
J9	Buck4 Connector	Output of Buck4
J6	Buck1/2/3/4 VIN Connector	Apply power supply to this connector
J13	PMBus/I <sup>2</sup> C Interface connector	Communication via PMBus/I <sup>2</sup> C Interface

**Table 3. Jumpers**

No.	Functions	Description
JP1-PVIN34-Vin-PVIN12	Short VIN to PVIN34	Vin tied to PVIN34
JP3-PVIN12-PVIN34	Short PVIN12 with PVIN34	PVIN34 tied to PVIN12
JP10-3-4	Connect Cap to SS1	tied SS1 to C40
JP10-7-8	Connect Cap to SS2	tied SS2 to C42
JP10-11-12	Connect Cap to SS3	tied SS3 to C43
JP10-15-16	Connect Cap to SS4	tied SS4 to C44

## 4.2 Hardware Requirement

This EVM requires an external power supply capable of providing 4.5 V to 18 V at 6 A.

The EVM kit includes USB2ANY interface box which, when installed on a PC and connected to the EVM, permits communication with the EVM via a GUI interface. The minimum PC requirements are:

- Microsoft® Windows® 2000, Windows XP, or Windows 7 operating system
- USB port
- Minimum of 30MB of free hard disk space (100MB recommended)
- Minimum of 256MB of RAM

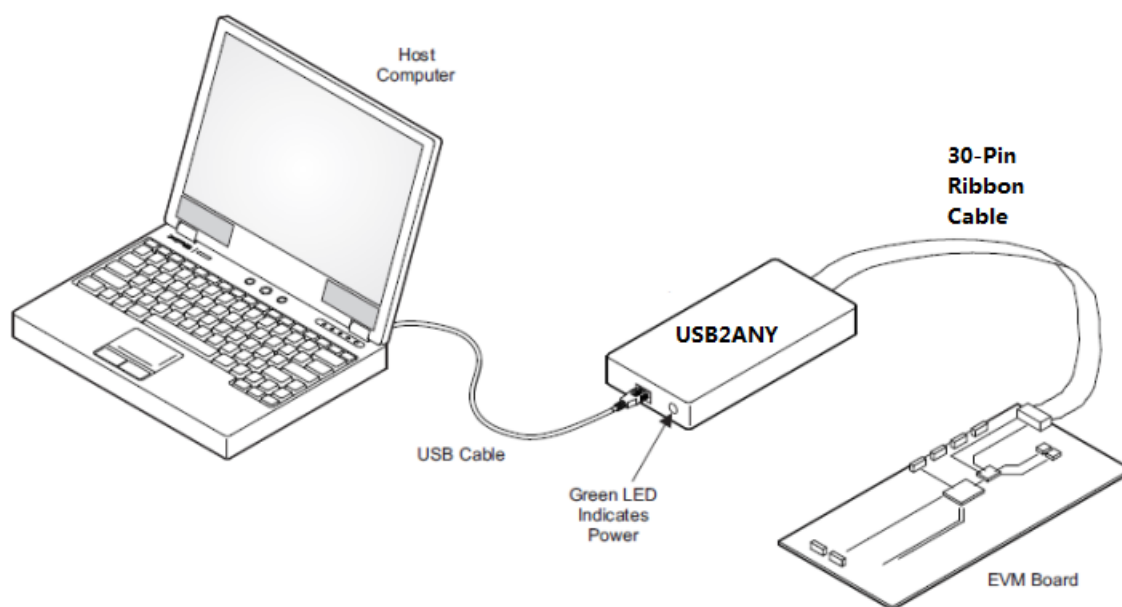
## 4.3 Hardware Setup

After connecting the power supply to J6 and turning on the power supply, the EVM regulates the output voltages to the value listed in [Table 1](#). Additional input capacitance may be required in order to mitigate the inductive voltage droop that may occur during a load transient event.

In order to change the output voltage by sending the digital control signal via a PC running the TPS65400 controller software and USB2ANY interface box, perform the following steps:

- Step 1. Connect the USB port of USB2ANY to the PC using the USB cable and the other end to J13 of the TPS65400 using the supplied 30-pin ribbon cable ([Figure 8](#)). The connectors on the ribbon cable are keyed to prevent incorrect installation.
- Step 2. Connect the power supply on J6 and turn on the power supply.
- Step 3. Run the software as explained in [Section 4.4](#).





**Figure 8. USB Interface Adapter Quick Connection Diagram**

#### 4.4 Software Install

If installing from the TI Web site, go to the URL, [www.ti.com](http://www.ti.com)

**NOTE:** This installation page is best viewed with the Microsoft® Internet Explorer® browser and may not work correctly with other browsers.

Click on the install button; the PC should give a security warning asking if you want to install this application. Select *Install* to proceed. If a pre-release or Beta version is currently installed on the PC, uninstall this version of the software before installing the final version.

The software attempts to install the Microsoft® .NET Framework 2.0 (if it is not already installed). This framework is required for the software to run.

To run the software after installation, go to  
Start → All programs → Texas Instruments → PI-Commander-0.8.4-672M → PI-Commander-PMU.

At start-up, the software first checks the firmware version of the USB2ANY adapter box. If an incorrect firmware version is installed, the software automatically searches on the Internet (if connected) for updates. If a new update is available, the software notifies the user of the update, and downloads and installs the software. Note that after the firmware is updated, the USB cable between the adapter and PC must be disconnected and then reconnected, as instructed during the install process. The host PC software also automatically searches on the Internet (if connected) for updates. If a new update is available, the software notifies the user of the update and downloads and installs it. During future use of the software, it may prompt you to install a new version if one becomes available on the Web.

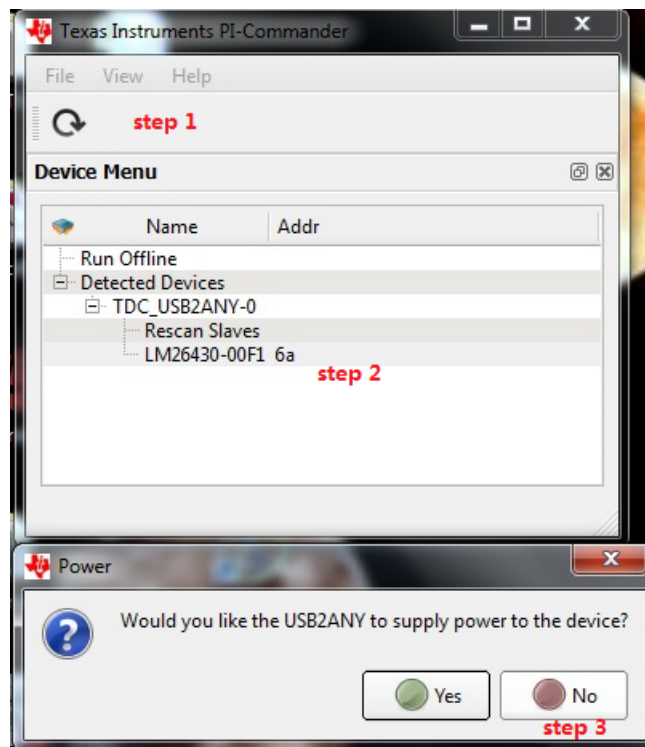
**NOTE:** VeriSign® Code Signing is used to prevent any malicious code from changing this application. If at any time in the future the binaries are modified, the code will no longer attempt to run.

## 4.5 Software Operation

This section provides descriptions of the EVM software.

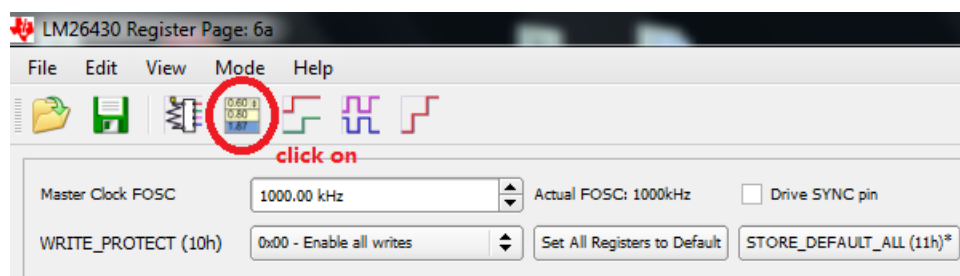
The supplied software is used to communicate with the TPS65400 EVM. Click on the icon on the host computer to start the software. The software displays the main control panel to connect with the EVM board.

- Step 1. Click on *Rescan Slaves*
- Step 2. Click on *LM26430-00F1 6a*
- Step 3. Click the *No* button on the popup dialog



**Figure 9. Connect to TPS65400 EVM with EVM GUI**

- Step 4. Click on *PMBus Register Page*



**Figure 10. Go to Main Setting Panel**

Then, a detail setting panel is presented as shown in Figure 11.

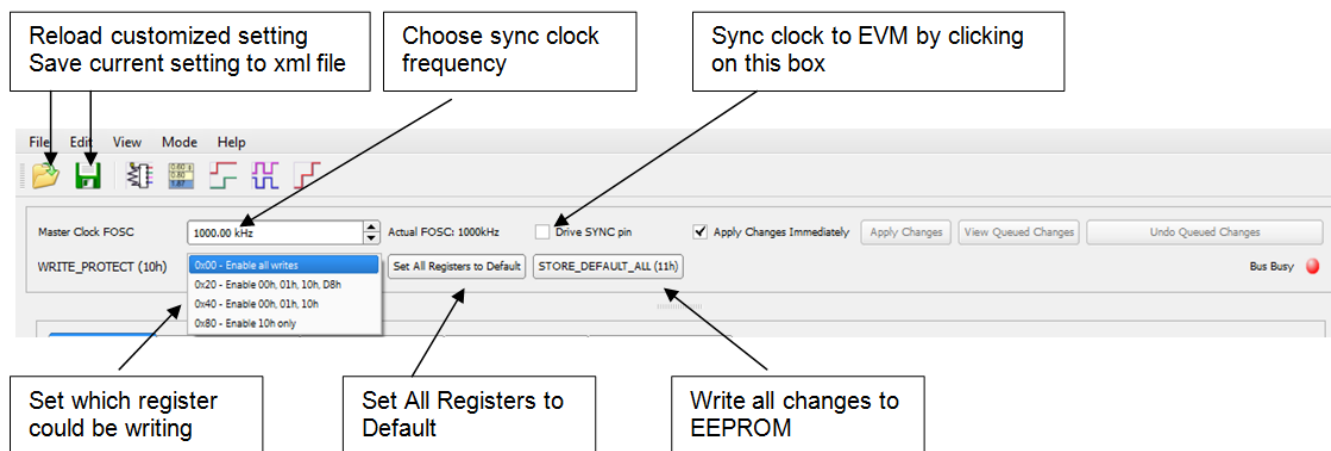


Figure 11. Global Commands

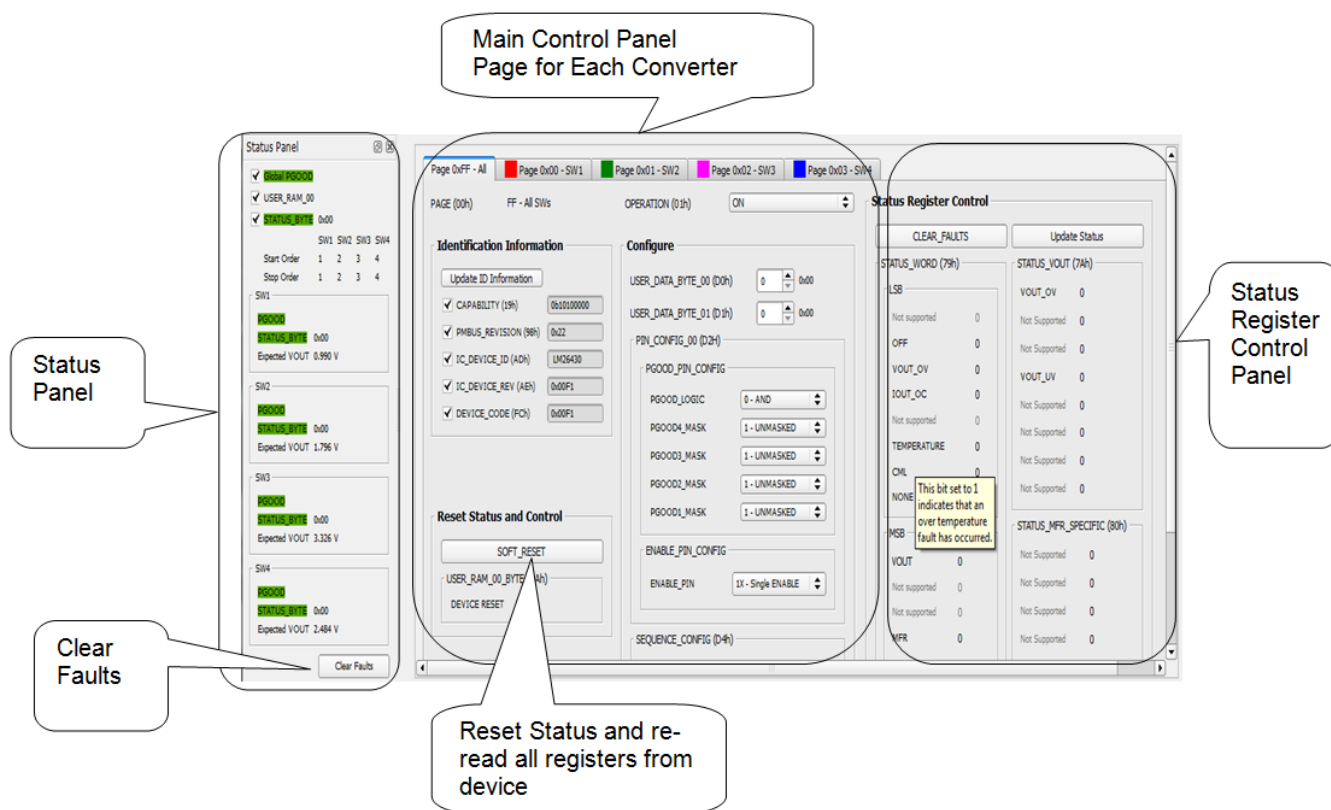


Figure 12. Status and Main Setting Panel

Figure 10 to Figure 15 show the control GUI interface. Vout voltage, phase shift, and power sequence are programmed with this GUI. Detailed information for each option is in the datasheet. Reference the datasheet and select the right option for your application (<http://www.ti.com/products/tps65400>).

One option is to *Apply Changes Immediately*; if this checkbox is selected, any change is immediately sent to the EVM. *STORE\_DEFAULT\_ALL* must be clicked to write all settings to EEPROM. EEPROM values can be read back from the EVM by clicking *SOFT\_RESET* on *Page 0xFF – ALL*.

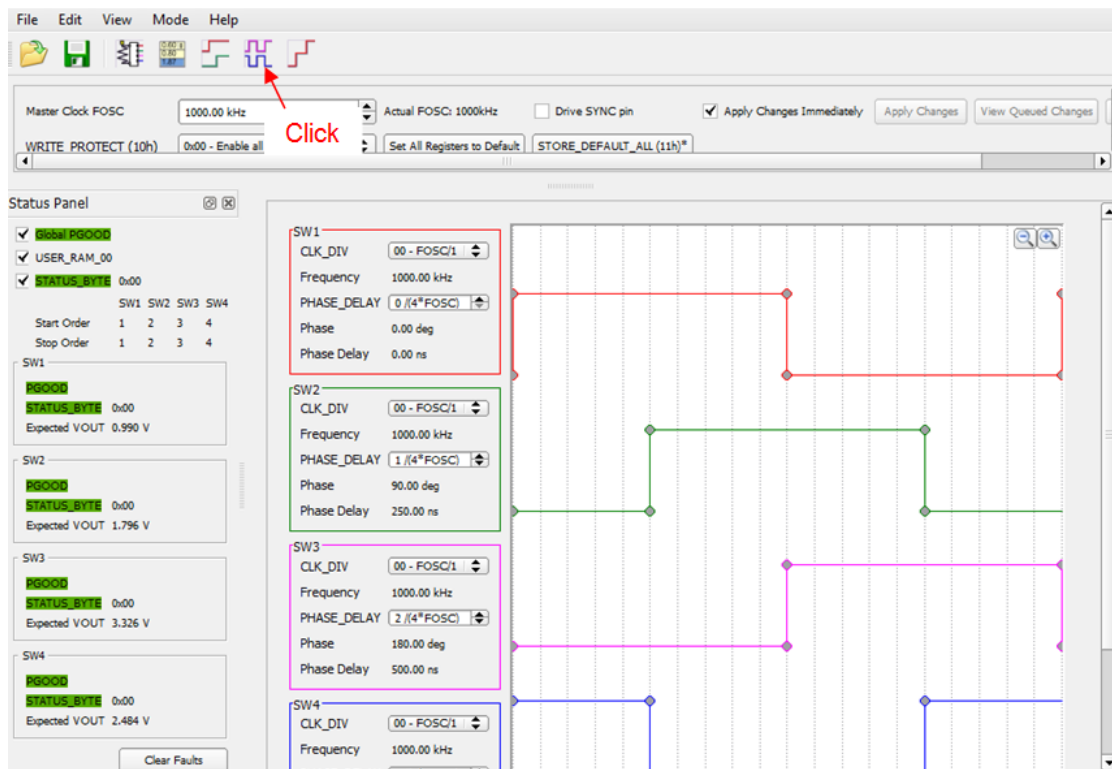


Figure 13. Phase Shift Panel

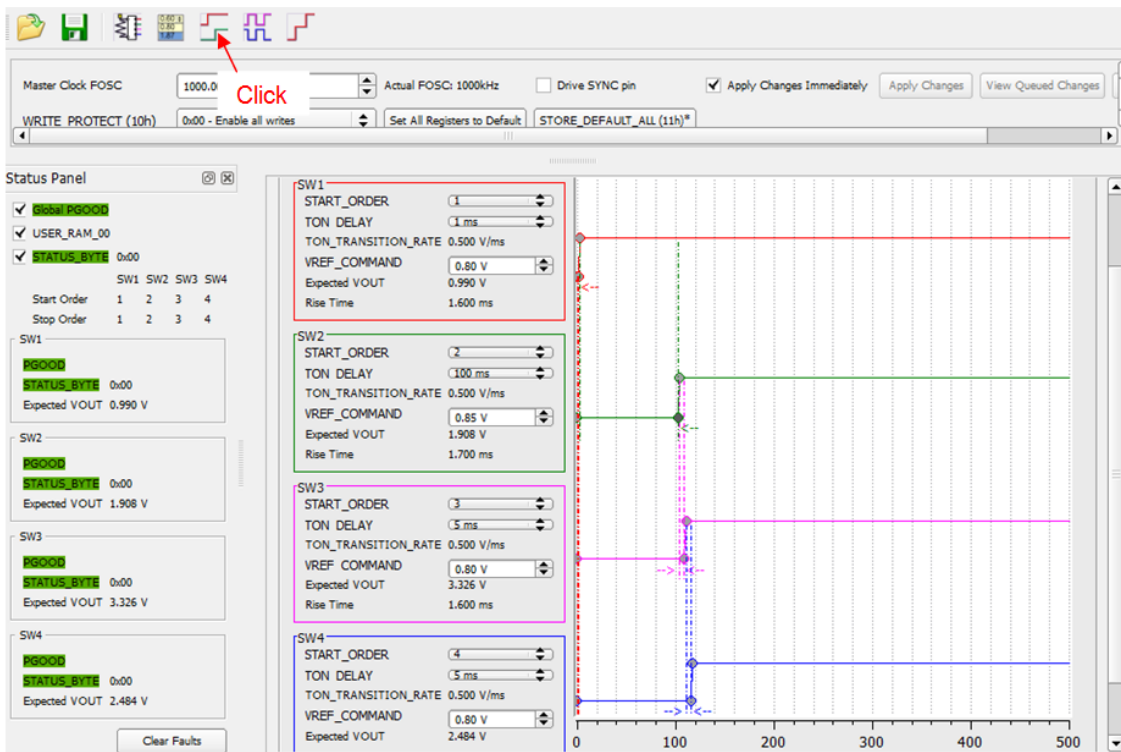
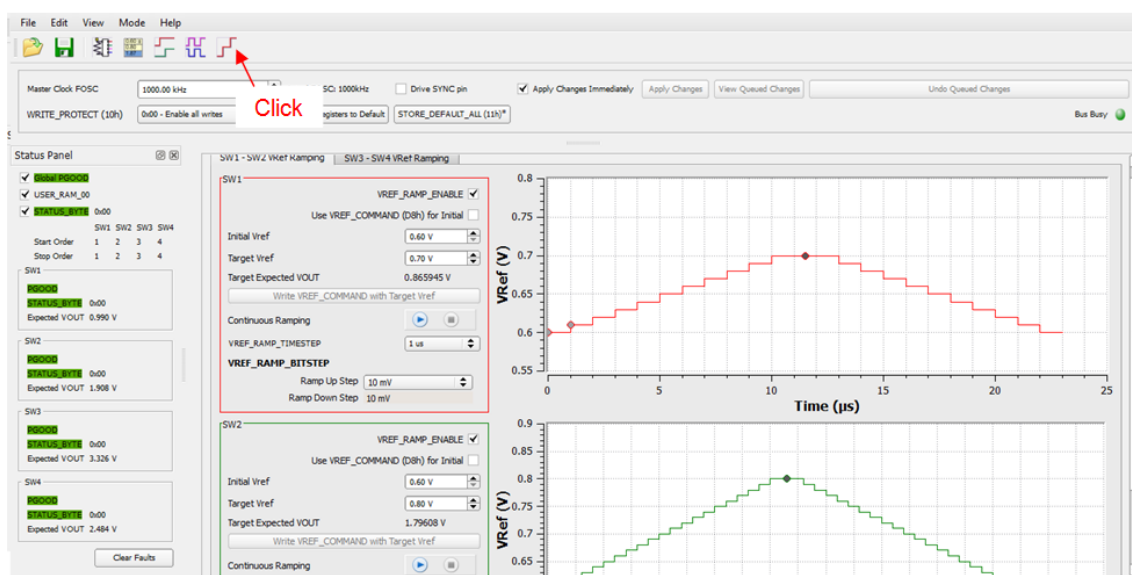


Figure 14. Power Sequence Panel



**Figure 15. Vref Ramping Up and Down Panel**

## 5 Power-Up Procedure

1. Connect the USB2ANY adaptor to J13 on the EVM board and connect the other port from USB2ANY to the USB port on the host computer
2. Apply 12 V to J6
3. Open the GUI on computer

## 6 Power-Down Procedure

1. Close the GUI on computer
2. Remove or shutdown 12 V on J6
3. Remove USB2ANY

## 7 Bill of Materials

Table 4 lists the bill of materials (BOM) for this EVM.

**Table 4. Bill of Materials**

Designator	Qty.	Value	Description	Package Reference	Part Number	Manufacturer
PCB1	1		Printed Circuit Board		PWR678	Any
C1	1	4.7 $\mu$ F	CAP, CERM, 4.7 $\mu$ F, 10 V, $\pm$ 10%, X7R, 0805	805	LMK212B7475KG-T	Taiyo Yuden
C2	1	1 $\mu$ F	CAP, CERM, 1 $\mu$ F, 25 V, $\pm$ 10%, X7R, 0603_950	0603_950	C0603C105K3RACTU	Kemet
C3	1	0.1 $\mu$ F	CAP, CERM, 0.1 $\mu$ F, 25 V, $\pm$ 10%, X5R, 0603	603	06033D104KAT2A	AVX
C4	1	10 $\mu$ F	CAP, CERM, 10 $\mu$ F, 10 V, $\pm$ 10%, X5R, 0805	805	C0805C106K8PACTU	Kemet
C5	1	3.3 $\mu$ F	CAP, CERM, 3.3 $\mu$ F, 10 V, $\pm$ 10%, X7R, 0805	805	GRM21BR71A335KA99L	Murata
C6, C32	2	22 $\mu$ F	CAP, CERM, 22 $\mu$ F, 25 V, $\pm$ 20%, X5R, 1210	1210	12103D226MAT2A	AVX
C7, C8, C15, C16, C23, C24, C33, C34	8	0.1 $\mu$ F	CAP, CERM, 0.1 $\mu$ F, 25V, $\pm$ 10%, X7R, 0603	603	GRM188R71E104KA01D	Murata
C9, C10, C17, C18, C25, C26, C35, C36	8	22 $\mu$ F	CAP, CERM, 22 $\mu$ F, 10V, $\pm$ 10%, X7R, 1206	1206	GRM31CR71A226KE15L	Murata
C11	1	120 pF	CAP, CERM, 120 pF, 50 V, $\pm$ 5%, C0G/NP0, 0603	603	06035A121JAT2A	AVX
C12, C20, C29, C38	4	22 pF	CAP, CERM, 22 pF, 50 V, $\pm$ 5%, C0G/NP0, 0603	603	06035A220JAT2A	AVX
C13, C21, C30, C39	4	1000 pF	CAP, CERM, 1000 pF, 50 V, $\pm$ 10%, C0G/NP0, 0603	603	06035A102KAT2A	AVX
C14, C22, C31, C41	4	4700 pF	CAP, CERM, 4700 pF, 50 V, $\pm$ 10%, X5R, 0603	603	GRM188R61H472KA01D	Murata
C19	1	160 pF	CAP, CERM, 160 pF, 50 V, $\pm$ 5%, C0G/NP0, 0603	603	GRM1885C1H161JA01D	Murata
C27, C37	2	68 pF	CAP, CERM, 68 pF, 50 V, $\pm$ 5%, C0G/NP0, 0603	603	06035A680JAT2A	AVX
C28	1	0.1 $\mu$ F	CAP, CERM, 0.1 $\mu$ F, 50 V, $\pm$ 10%, X7R, 0603	603	06035C104KAT2A	AVX
C40, C42, C43, C44	4	4700 pF	CAP, CERM, 4700 pF, 100 V, $\pm$ 10%, X7R, 0603	603	06031C472KAT2A	AVX
C45	1	100 pF	CAP, CERM, 100 pF, 25 V, $\pm$ 10%, X7R, 0603	603	06033C101KAT2A	AVX
C46	1	4.7 pF	CAP, CERM, 4.7 pF, 50 V, $\pm$ 5%, C0G/NP0, 0603	603	06035A4R7CAT2A	AVX
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M
J1, J16	2		Header, TH, 100mil, 3x1, Gold plated, 230 mil above insulator	TSW-103-07-G-S	TSW-103-07-G-S	Samtec, Inc.
J2, J4, J5, J6, J7, J9	6		Terminal Block, 6A, 3.5mm Pitch, 2-Pos, TH	7.0x8.2x6.5mm	ED555/2DS	On-Shore Technology
J3, J11, J12, J14, J15	5		Header, TH, 100mil, 2x1, Gold plated, 230 mil above insulator	TSW-102-07-G-S	TSW-102-07-G-S	Samtec, Inc.
J8	1		Header, 100mil, 4x2, Gold, TH	4x2 Header	TSW-104-07-G-D	Samtec
J10	1		Header, 100mil, 8x2, Gold, TH	8x2 Header	TSW-108-07-G-D	Samtec
J13	1		Connector, 15x2, 3A 300V STRT DIP, TH	Connector, 15x2, Pitch 2.54mm, TH	XG4C-3031	Omron Electronic Components
L1, L2, L3, L4	4	2.2 $\mu$ H	Inductor, Shielded, Composite, 2.2 $\mu$ H, 12.7A, 0.012 $\Omega$ , SMD	IND_6.4x3.1x6.6	XAL6030-222MEB	Coilcraft
R1, R6, R11, R16	4	0	RES, 0, 5%, 0.1 W, 0603	603	CRCW06030000Z0EA	Vishay-Dale
R2	1	49.9	RES, 49.9, 1%, 0.1 W, 0603	603	CRCW060349R9FKEA	Vishay-Dale
R3	1	12.7k	RES, 12.7 k, 1%, 0.1 W, 0603	603	CRCW060312K7FKEA	Vishay-Dale
R4, R9, R14, R20	4	15.4k	RES, 15.4 k, 1%, 0.1 W, 0603	603	CRCW060315K4FKEA	Vishay-Dale
R5	1	10.2k	RES, 10.2 k, 1%, 0.1 W, 0603	603	CRCW060310K2FKEA	Vishay-Dale

**Table 4. Bill of Materials (continued)**

Designator	Qty.	Value	Description	Package Reference	Part Number	Manufacturer
R7	1	100	RES, 100, 1%, 0.1 W, 0603	603	CRCW0603100RFKEA	Vishay-Dale
R8	1	9.31k	RES, 9.31 k, 1%, 0.1 W, 0603	603	CRCW06039K31FKEA	Vishay-Dale
R10	1	3.01k	RES, 3.01 k, 1%, 0.1 W, 0603	603	CRCW06033K01FKEA	Vishay-Dale
R12	1	71.5	RES, 71.5, 1%, 0.1 W, 0603	603	CRCW060371R5FKEA	Vishay-Dale
R13	1	21.5k	RES, 21.5 k, 1%, 0.1 W, 0603	603	CRCW060321K5FKEA	Vishay-Dale
R15	1	43.2k	RES, 43.2 k, 1%, 0.1 W, 0603	603	CRCW060343K2FKEA	Vishay-Dale
R17	1	200	RES, 200, 1%, 0.1 W, 0603	603	CRCW0603200RFKEA	Vishay-Dale
R18, R27	2	22.1k	RES, 22.1 k, 1%, 0.1 W, 0603	603	CRCW060322K1FKEA	Vishay-Dale
R19, R22, R23, R24, R25, R26, R31	7	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	603	CRCW060310K0FKEA	Vishay-Dale
R21	1	10.5k	RES, 10.5 k, 1%, 0.1 W, 0603	603	CRCW060310K5FKEA	Vishay-Dale
R28, R32, R33, R34, R36, R37	6	1.0k	RES, 1.0 k, 5%, 0.1 W, 0603	603	CRCW06031K00JNEA	Vishay-Dale
R29, R30	2	3.0k	RES, 3.0 k, 5%, 0.1 W, 0603	603	CRCW06033K00JNEA	Vishay-Dale
R35	1	374k	RES, 374 k, 1%, 0.1 W, 0603	603	CRCW0603374KFKEA	Vishay-Dale
R38, R39, R40, R41	4	324k	RES, 324 k, 1%, 0.1 W, 0603	603	CRCW0603324KFKEA	Vishay-Dale
SH-JP1, SH-JP2, SH- JP3, SH-JP4, SH-JP5, SH-JP6	6	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12	12	White	Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone
TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23	11	Black	Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone
U1	1		4.5V to 18V Input Flexible Power Management Unit with PMBus/ I2C and Integrated Sequencing, RGZ0048G	RGZ0048G	TPS65400RGZ or LM26430RGZ	Texas Instruments
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A



## 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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2. 実験局の免許を取得後ご使用いただく。
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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.

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