

TPS65030EVM-162

This user's guide describes the characteristics, operation, and use of the TPS65030EVM-162 evaluation module (EVM). This EVM demonstrates the Texas Instruments TPS65030 power management IC for USB On-The-Go (USB-OTG) applications. This user's guide includes setup instructions, a schematic diagram, a bill of materials (BOM), and PCB layout drawings for the evaluation module.

Contents

1	Introduction	1
2	Setup	2
3	Board Layout	4
4	Schematic and Bill of Materials	10

List of Figures

1	Assembly Layer	5
2	Top Layer Routing	6
3	Layer 2 Routing	7
4	Layer 3 Routing	8
5	Bottom Layer Routing	9
6	TPS65030EVM-162 Schematic	10

List of Tables

1	TPS65030EVM-162 Bill of Materials	11
---	---	----

1 Introduction

The Texas Instruments TPS65030EVM-162 evaluation module (EVM) helps designers evaluate the operation and performance of the TPS65030 power management IC for USB-OTG applications. The TPS65030 contains four regulated output voltages and operates from a 3-V to 5-V input supply. The supplied outputs provide all the necessary supply voltages for USB-OTG. The EVM has jumpers for all input pins for easy evaluation of the EN₁, SW₁, SLEEP, and TEST $\overline{\text{SRP}}$ inputs. A power-good output (PGood) is available for easy power supply sequencing applications. The 1-MHz charge pump design as well the 25-ball chip scale package provide a small footprint solution.

1.1 Related Documentation From Texas Instruments

TPS65030 data sheet ([SLVS620](#))

2 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up, and use the TPS65030EVM-162.

2.1 *Input/Output Connector Descriptions*

2.1.1 J1 —VIN

This is the positive input voltage connection to the converter. The EVM operates from any supply voltage between 3 V and 5 V. The leads to the input supply should be twisted together and kept as short as possible to minimize EMI transmission and input voltage droop.

2.1.2 J2 — GND

This is the input return connection for the input power supply.

2.1.3 J3 —VOUT1

This is the positive output voltage connection from the VBUS output. This charge pump regulator output regulates to 5 V and supplies up to 100 mA.

2.1.4 J4 — GND

This is the output ground connection for the VOUT1 charge pump.

2.1.5 J5 —VOUT2

This is the positive output voltage connection from the VOUT2 output. This charge pump regulator output regulates to 3.3 V and supplies up to 22 mA.

2.1.6 J6 — GND

This is the output ground connection for the VOUT2 charge pump and VOUT4 LDO regulators.

2.1.7 J7 —VOUT3

This is the positive output voltage connection from the VOUT3 output. This charge pump regulator output regulates to 1.5 V and supplies up to 200 mA.

2.1.8 J8 —GND

This is the output ground connection for the VOUT3 charge pump.

2.1.9 J9 —VOUT4

This is the positive output voltage connection from the VOUT4 output. This LDO regulator output regulates to 1.8 V and supplies up to 60 mA.

2.1.10 JP1 —VBUS Converter Enable

JP1 is used to enable the VBUS converter (VOUT1). Place a shunt in the ON position to turn the VBUS converter on. When the VBUS converter is enabled, VOUT1 regulates to 5 V and supplies up to 100 mA. Place a shunt in the OFF position to turn the VBUS converter off. VOUT1 is high impedance when the VBUS converter is disabled.

2.1.11 JP2 —VOUT2 and VOUT3 Converter Enable

JP2 is used to enable the VOUT2 and VOUT3 converters. Place a shunt in the ON position to turn the VOUT2 and VOUT3 converters on. When the VOUT2 and VOUT3 converters are enabled, VOUT2 regulates to 3.3 V and supplies up to 22 mA, and VOUT3 regulates to 1.5 V and supplies up to 200 mA. Place a shunt in the OFF position to turn the VOUT2 and VOUT3 converters off. VOUT2 and VOUT3 are high impedance when the converters are disabled.

2.1.12 JP3 —VOUT4 Converter Enable

JP3 is used to enable the VOUT4 LDO. Place a shunt in the ON position to turn the VOUT4 LDO on. When the VOUT4 LDO is enabled, VOUT4 regulates to 1.8 V and supplies up to 60 mA. Place a shunt in the OFF position to turn the VOUT4 LDO off. VOUT4 is high impedance when the LDO is disabled.

2.1.13 JP4 —Sleep Mode Enable

JP4 is used to enable the sleep mode feature for VOUT2, VOUT3, and VOUT4. Place a shunt in the ON position to enable sleep mode. During sleep mode, VOUT2, VOUT3, and VOUT4 are regulated using low-power LDOs. VOUT2 regulates to 3 V, VOUT3 regulates to 1.5 V and VOUT4 regulates to 1.8 V. All three outputs supply up to 100 μ A. Place a shunt in the OFF position to turn the sleep mode off and return to normal operation.

2.1.14 JP5 —VOUT3 Switchover Enable

JP5 is used to enable the VOUT3 switchover function. Place a shunt in the ON position to enable the switchover function. When the switchover function is enabled, VOUT3 is powered from VBUS unless VBUS is below 4.3 V. When VBUS is less than 4.3V, VOUT3 is powered from VIN. If sleep mode is enabled, VOUT3 is powered from VIN regardless of this jumper location. Place a shunt in the OFF position to disable the VOUT3 switchover function. VOUT3 is always powered from VIN when the switchover mode is disabled.

2.1.15 JP6 – VOUT2 Switchover Enable

JP6 is used to enable the VOUT2 switchover function. Place a shunt in the ON position to enable the switchover function. When the switchover function is enabled, VOUT2 is powered from VBUS unless VBUS is below 4.3 V. In this case, VOUT2 is powered from VIN. If sleep mode is enabled, VOUT2 is powered from VIN regardless of this jumper location. Place a shunt in the OFF position to disable the VOUT2 switchover function. VOUT2 is always powered from VIN when the switchover mode is disabled.

2.1.16 JP7 — Current-Limit Selection and TEST Mode Indicator

JP7 is used for two functions. The first is to select the current-limit during start-up. Place a shunt across the jumper to select a 1-mA current limit during start-up. Remove the shunt to select a 100-mA current limit during start-up.

The second function for JP7 is signal output during test mode. If test mode is enabled, pin 1 of JP7 goes either high or low to indicate connectivity status. See the “TEST Input SRP Enable” section of the TPS65030 data sheet ([SLVS620](#)) or details on entering test mode and connectivity status indicator.

2.1.17 TP1 — Power Good Output

TP1 is used to monitor the PGood signal. TP1 goes high a minimum 3.1 ms after VOUT2, VOUT3, and VOUT4 exceed the PGood thresholds. The thresholds are 85% of the regulation voltage for VOUT2, and 90% of the regulation voltage for VOUT3 and VOUT4. The PGOOD pin goes low if one of these outputs falls below its threshold. Outputs that are disabled are ignored by the PGood circuitry.

2.2 Setup

1. Configure JP1 to enable or disable VBUS as desired
2. Configure JP2 to enable or disable VOUT2 and VOUT3 as desired
3. Configure JP3 to enable or disable VOUT4 as desired
4. Configure JP4 to enable or disable sleep mode as desired
5. Configure JP5 to enable or disable VOUT3 switchover mode as desired
6. Configure JP6 to enable or disable VOUT2 switchover mode as desired
7. Configure JP7 to set the start-up current-limit as desired
8. Connect the input voltage return to J2.
9. Connect the positive input voltage to J1.
10. Turn on input voltage.
11. The output voltages that were enabled by JP1, JP2, and JP3 are available.

3 Board Layout

This section provides the TPS65030EVM-162 board layout and illustrations.

3.1 Layout

Figure 1 through Figure 5 show the board layout for the TPS65030EVM-162 PCB.

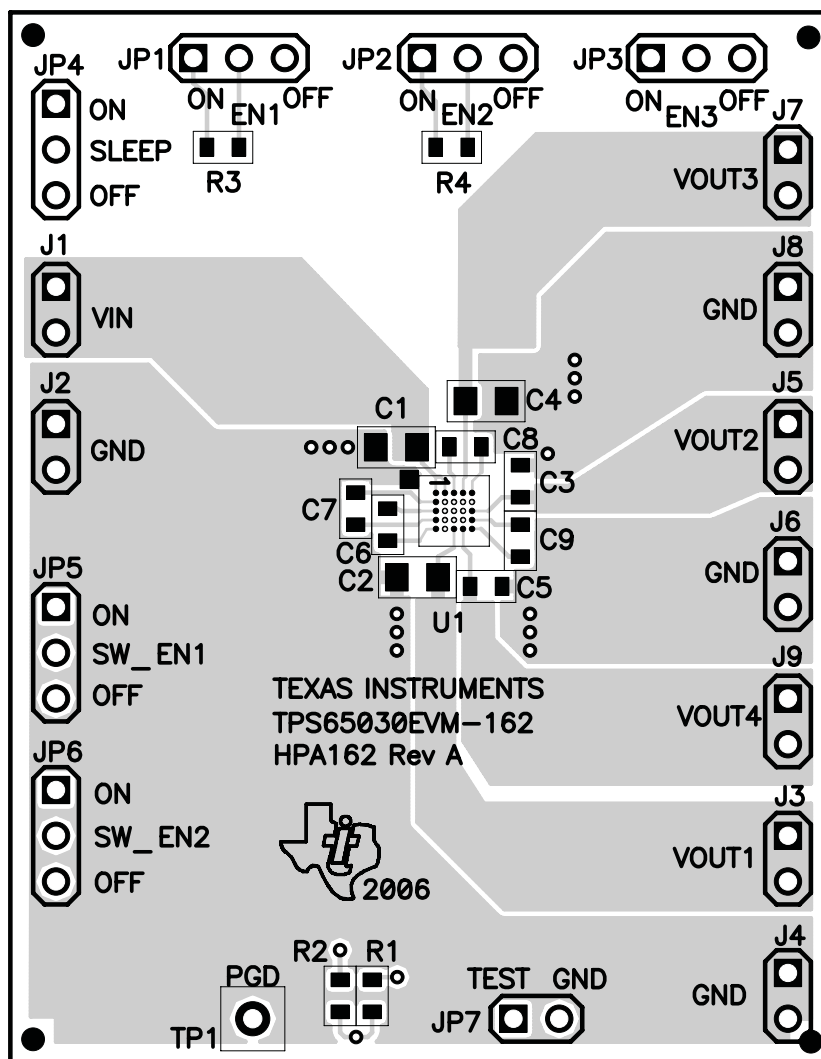


Figure 1. Assembly Layer

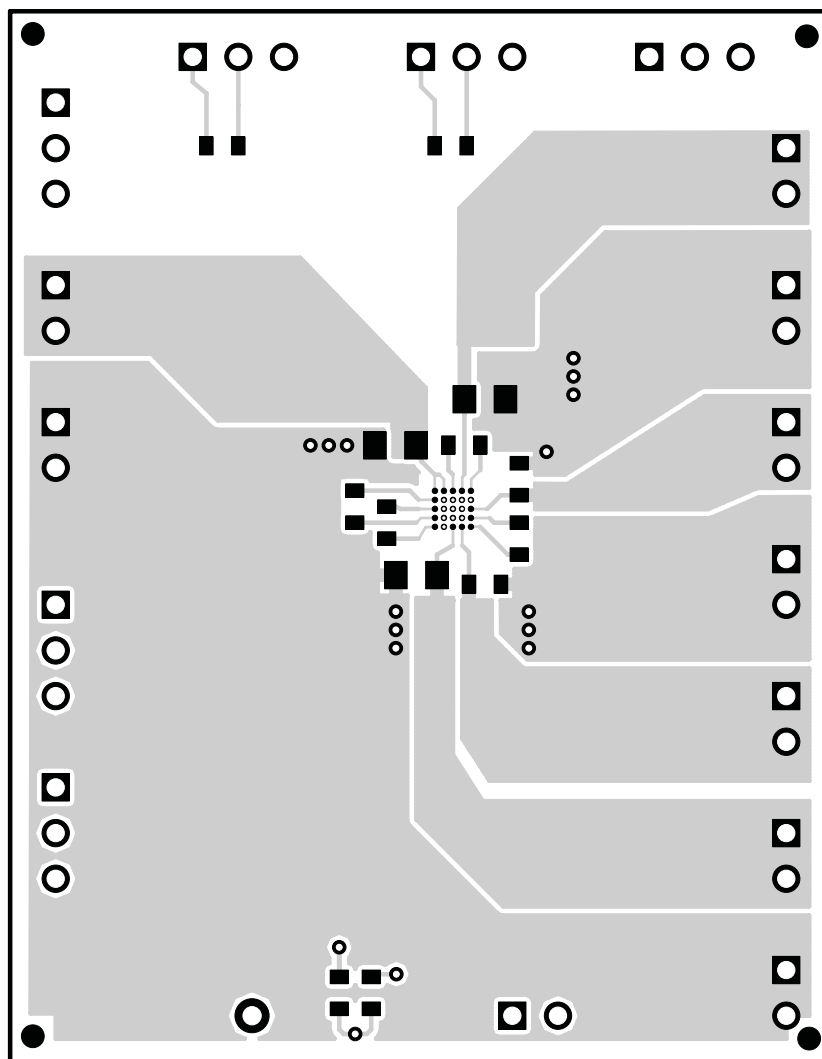


Figure 2. Top Layer Routing

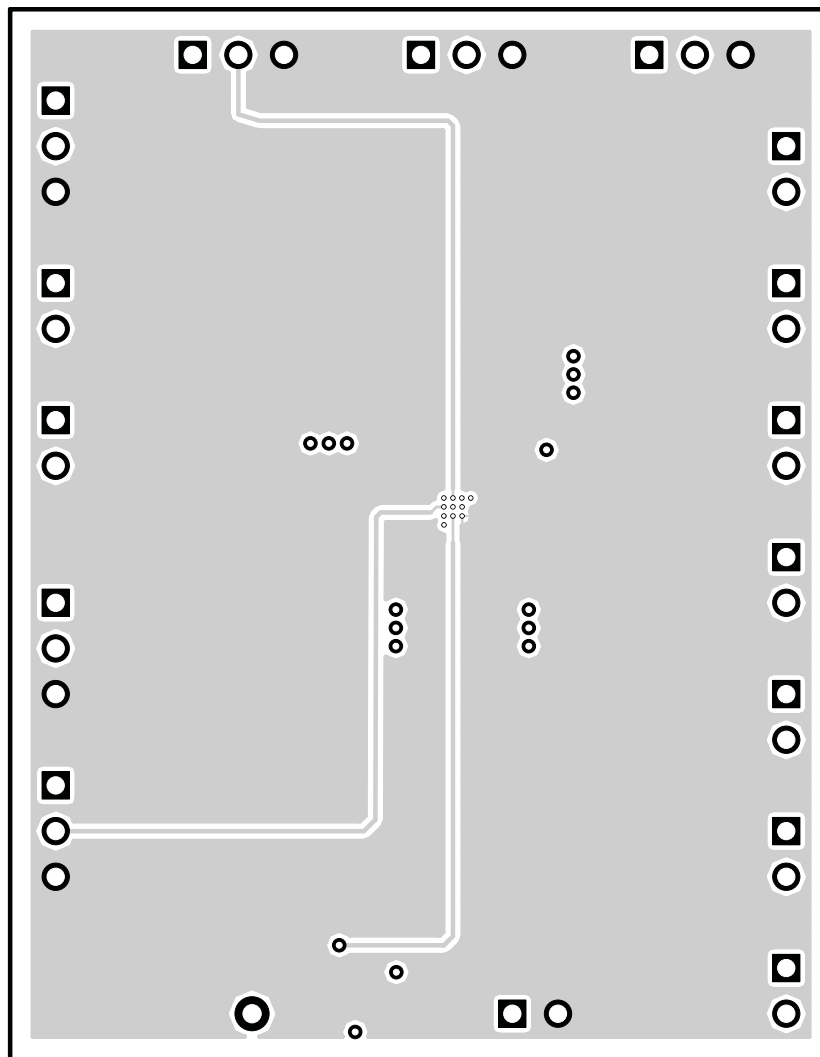


Figure 3. Layer 2 Routing

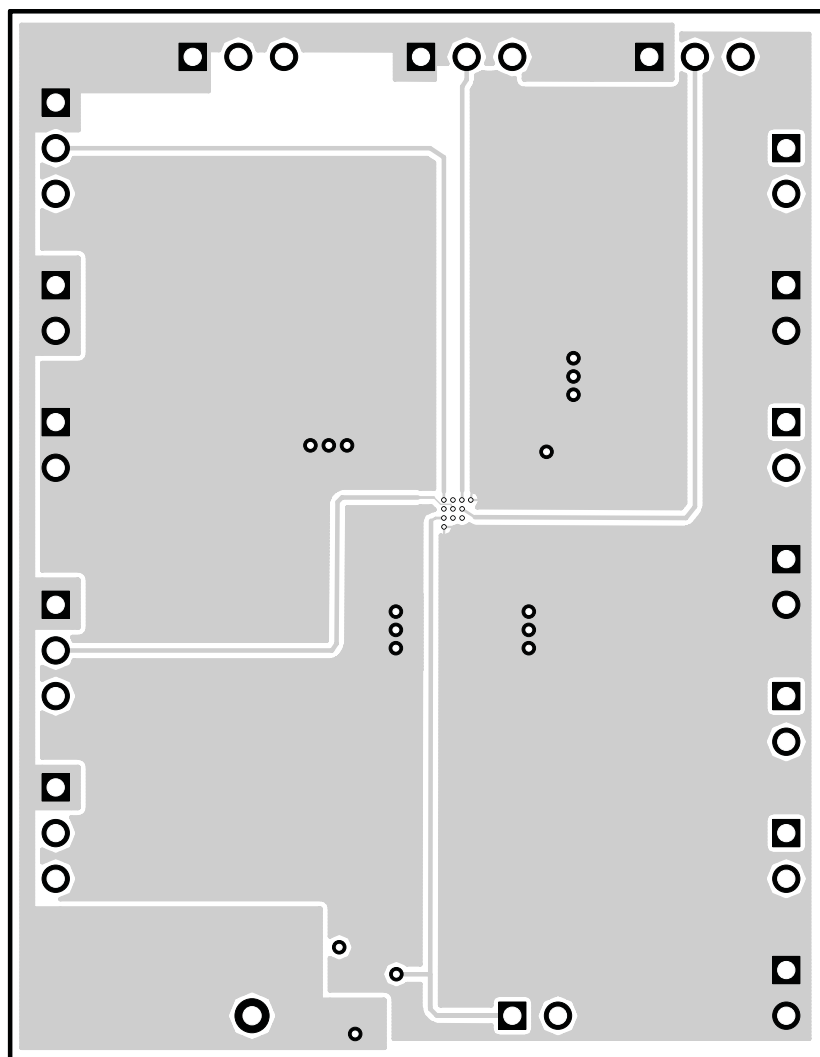


Figure 4. Layer 3 Routing

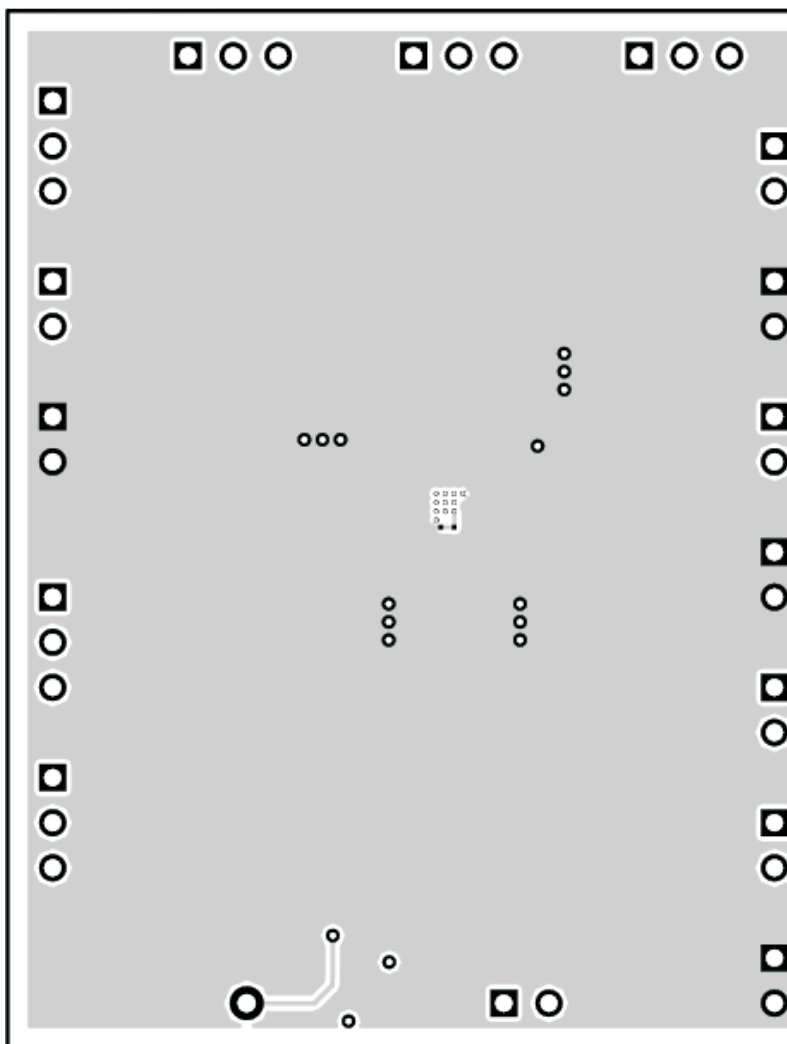


Figure 5. Bottom Layer Routing

4 Schematic and Bill of Materials

This section provides the TPS65030EVM-162 schematic and bill of materials.

4.1 Schematic

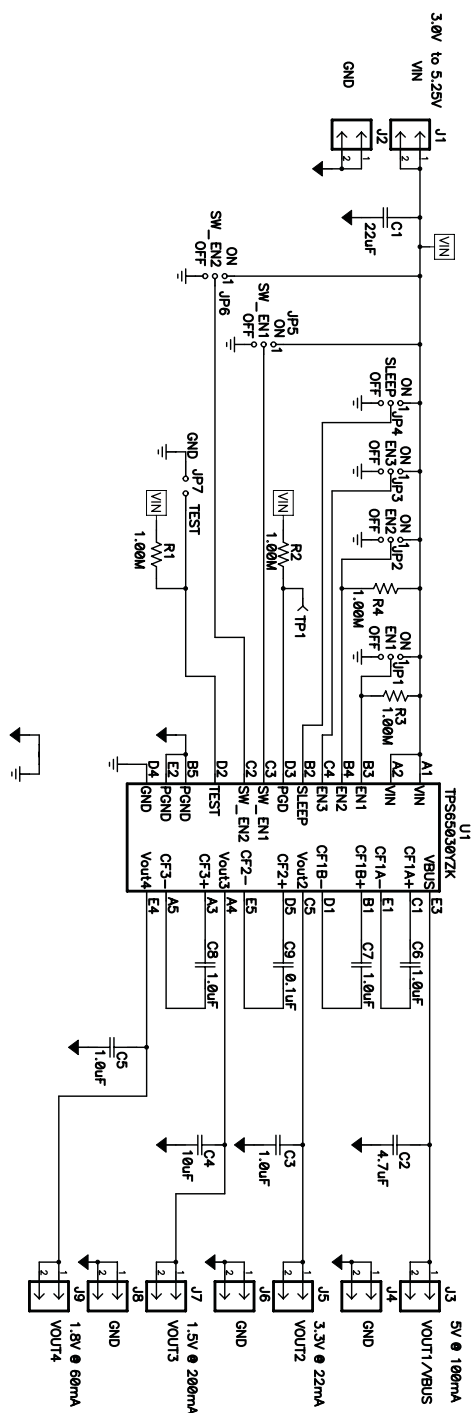


Figure 6. TPS65030EVM-162 Schematic

4.2 Bill of Materials

Table 1. TPS65030EVM-162 Bill of Materials

COUNT	Ref Des	Value	Description	Size	Part Number	MFR
1	C1	22µF	Capacitor, Ceramic, 6.3V, X5R, 20%	0805	C2012X5R0J226M	TDK
1	C2	4.7µF	Capacitor, Ceramic, 6.3V, X5R, 10%	0805	C2012X5R0J475K	TDK
5	C3, C5–C8	1.0µF	Capacitor, Ceramic, 16V, X7R, 10%	0603	C1608X7R1C105K	TDK
1	C4	10µF	Capacitor, Ceramic, 6.3V, X5R, 20%	0805	C2012X5R0J106M	TDK
1	C9	0.1µF	Capacitor, Ceramic, 50V, X7R, 10%	0603	C1608X7R1H104K	TDK
9	J1–J9		Header, 2 pin, 100mil spacing, (36-pin strip)	0.100 × 2	PTC36SAAN	Sullins
6	JP1–JP6		Header, 3 pin, 100mil spacing, (36-pin strip)	0.100 × 3	PTC36SAAN	Sullins
1	JP7		Header, 2 pin, 100mil spacing, (36-pin strip)	0.100 × 2	PTC36SAAN	Sullins
4	R1–R4	1.00M	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	TP1		Test Point, Red, Thru Hole Color Keyed	0.100 × 0.100	5000	Keystone
1	U1		IC, Power Management for USB-OTG	BGA-25	TPS65030YZK	TI
1	—		PCB, 2.3 In × 1.8 In × 0.062 In		HPA162	Any
7	—		Shunt, 100mil, Black	0.100	929950-00	3M

EVALUATION BOARD/KIT IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein**.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 3 V to 5 V and the maximum output voltage of 5 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 50°C. The EVM is designed to operate properly with certain components above 50°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2006, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
Low Power Wireless	www.ti.com/lpw

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2007, Texas Instruments Incorporated