

TPS2041B/51B EVM Power-Distribution Switch

This User's Guide describes the characteristics, operation, and use of TPS2041B/51B evaluation modules (EVM) featuring the Texas Instruments TPS2041/51B in the SOT-23 package.

Contents

1	Introduction	1
2	Setup	1
3	Board Layout	4
4	Bill of Materials and Schematics.....	6

List of Figures

1	Disabled Device at Power Up.....	3
2	Enabling the Device	3
3	Overcurrent Mode	4
4	Top-Side Layout of TPS2041B EVM.....	4
5	Bottom-Side Layout of TPS2041B EVM.....	5
6	Top-Side Layout of TPS2051B EVM.....	5
7	Bottom-Side Layout of TPS2051B EVM.....	6
8	TPS2041B EVM Schematic	7
9	TPS2051B EVM Schematic	8

List of Tables

1	TPS2041B EVM BOM	6
2	TPS2051B EVM BOM	7

1 Introduction

These EVMs provide a means for the user to evaluate quickly the functionality and electrical performance of the TPS2041B/51B. All inputs and outputs are brought out to test points for control and monitoring. All passive components are included on the EVM for device operation. The input pin should be connected to an external supply; the output should be connected to a load. The device can be enabled/disabled through the enable pin. Faults can be monitored by observing the OC_– pin.

1.1 Related Documentation From Texas Instruments

TPS204xB/TPS205xB Current-Limited, Power-Distribution Switches data sheet ([SLVS514](#))

2 Setup

2.1 Input/Output Connector Descriptions

This chapter describes each test point and how to properly connect, set up, and use the TPS2041B/51B EVM.

Setup

2.1.1 TP1 – Output Power

This is the output of the DC/DC power supply. Connect a load between the two terminals of this test point with reference to one of the ground points.

2.1.2 TP2, TP7, TP8, TP9 – Ground

Any of these test points can be used as references to the input, output, and oscilloscope probes.

2.1.3 TP3 – Overcurrent

When the output load exceeds the current-limit threshold or a short is present, the device limits the output current to a safe level by switching into a constant-current mode, pulling the overcurrent logic output low.

2.1.4 TP4 – Input Power

Apply the input voltage here. Recommended range is 2.7 V to 5.5 V. Note that 6 V is the absolute maximum and –0.3 V is the absolute minimum, so it is extremely important not to exceed these limits.

2.1.5 TP5 – Enable

The enable input is active-low for the TPS2041B and active-high for the TPS2051B. To turn the TPS2041B on, this point must be tied to a low potential. To turn the TPS2051B on, this point must be tied to a high potential. The negative terminal (active-low) and the positive terminal (active-high) of the power supply are recommended points.

2.2 Electrical Specifications

Parameters		Test Conditions	Min	Typ	Max	Unit
V _{in}	Input voltage		2.7		5.5	V
I _{o(out)}	Continuous output current		0		500	mA
R _{dson}		V _{I(IN)} = 5 V or 3.3 V, I _O = 0.5 A, –40°C ≤ T _J ≤ 125°C		95	140	mΩ

2.3 Test Results

The figures in this section come from testing the TPS2041B EVM, which has an active-low enable.

2.3.1 Apply Power to EVM While Disabled

Figure 1 shows the input (Ch. 1, 5 V/div), output (Ch. 2, 5 V/div), overcurrent (Ch. 3, 5 V/div), and the enable input (Ch. 4, 5 V/div). Because enable is in a logic-high state, 0 volts is observed at the output.

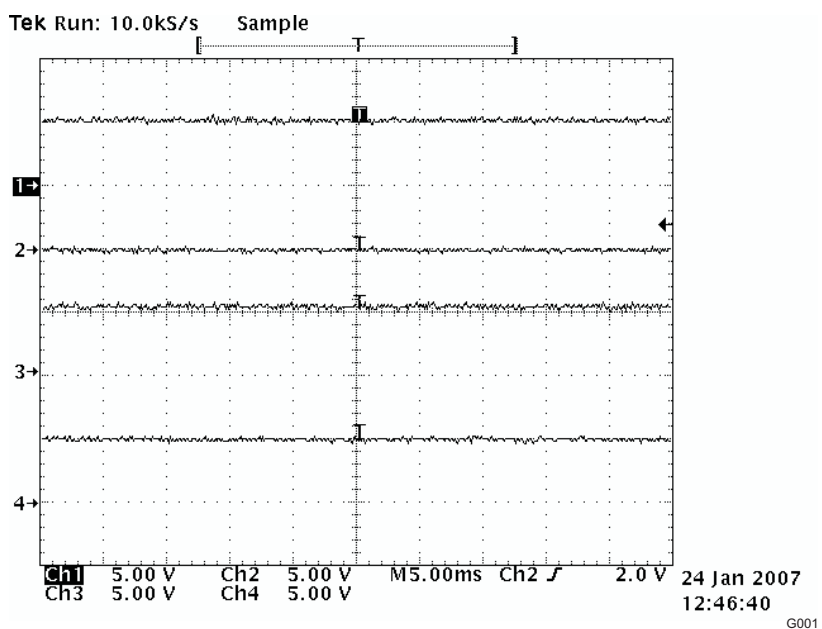


Figure 1. Disabled Device at Power Up

2.3.2 EVM Is Enabled

Figure 2 shows the enable input toggled from a logic-high (Ch. 4) to a logic-low state. When this occurs, the output shoots up to 5 V (Ch. 2).

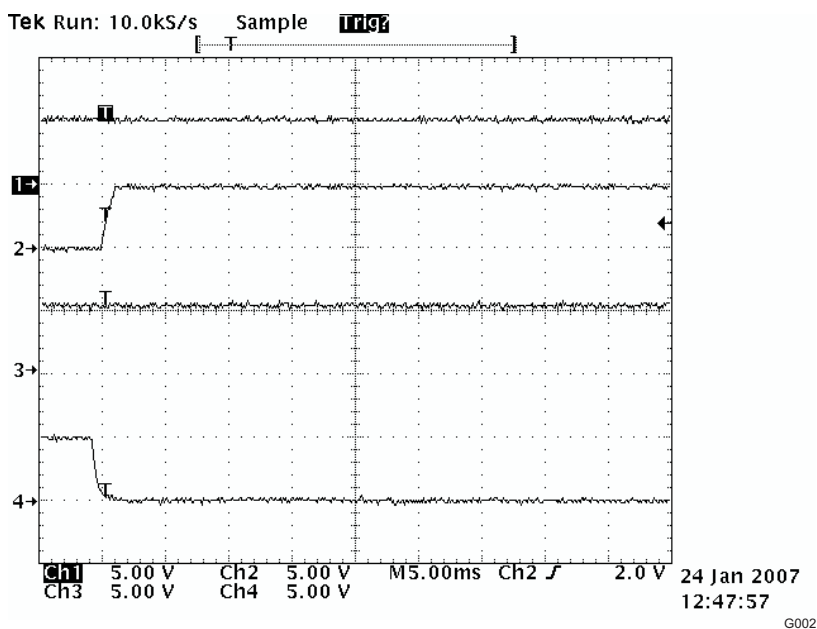


Figure 2. Enabling the Device

Figure 3 shows the overcurrent signal (Ch. 3) pulling low due to a short circuit on the output. The device switches into a constant-current mode and shuts off the switch, so 0 V is seen on the output (Ch 2).

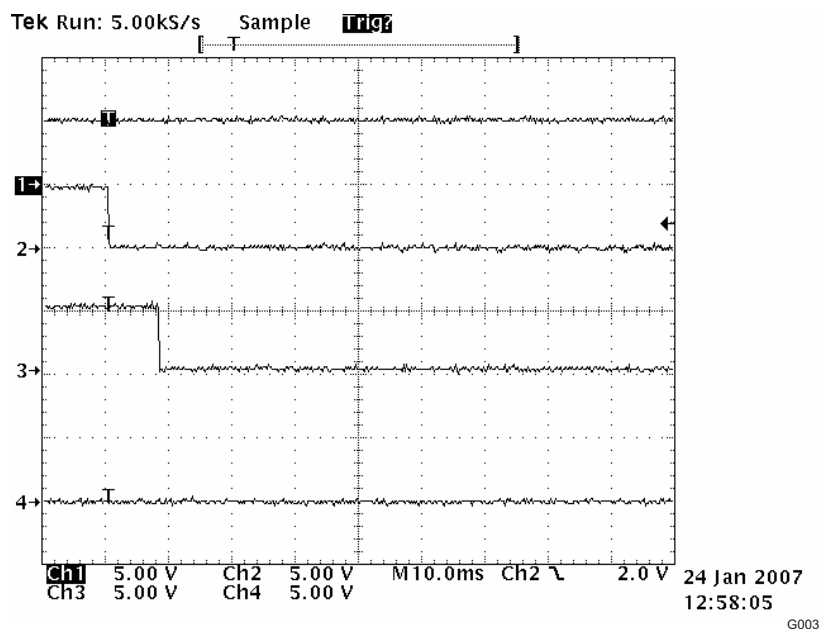


Figure 3. Overcurrent Mode

3 Board Layout

This chapter provides the TPS2041B EVM and TPS2051B EVM board layouts and illustrations.

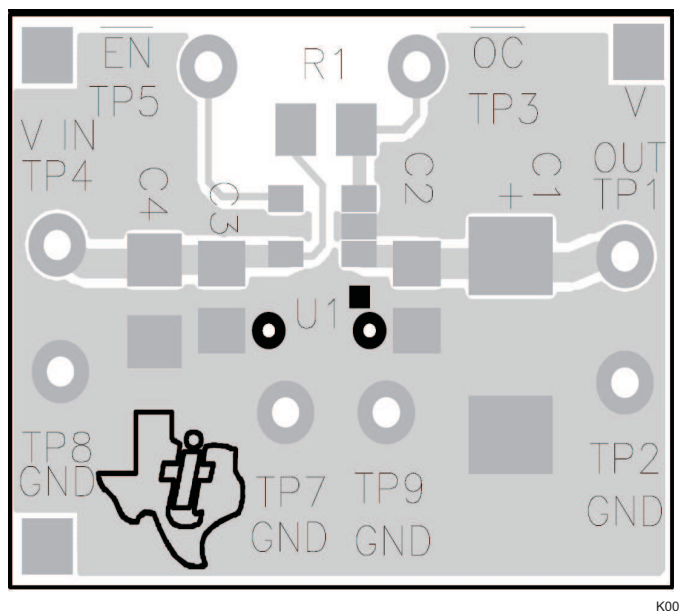
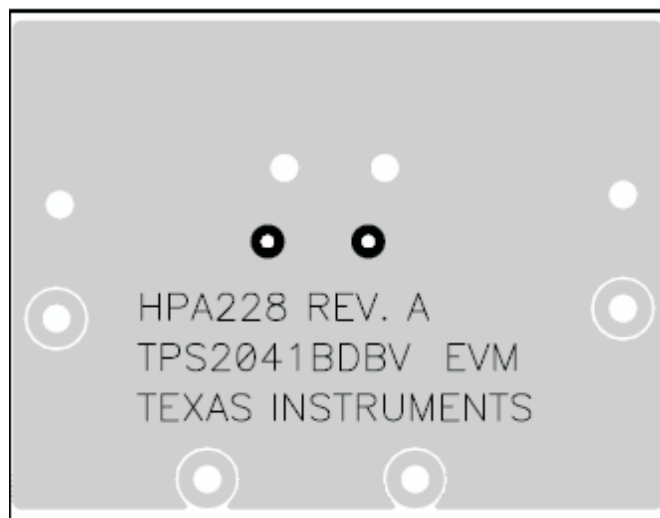
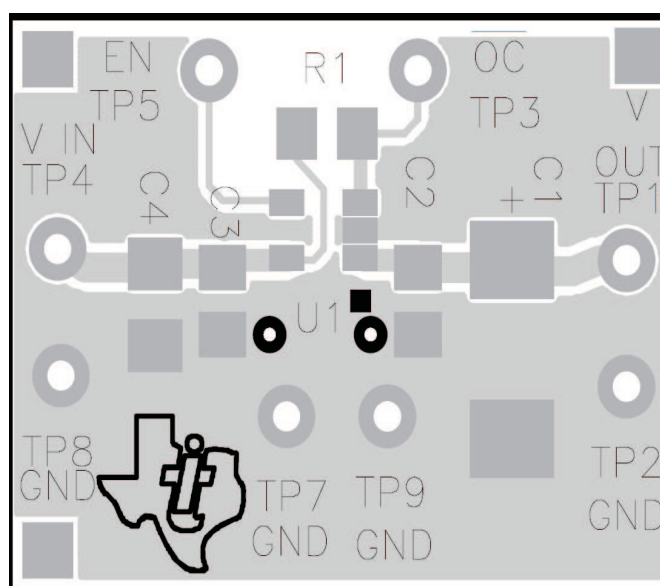


Figure 4. Top-Side Layout of TPS2041B EVM



K002

Figure 5. Bottom-Side Layout of TPS2041B EVM



K003

Figure 6. Top-Side Layout of TPS2051B EVM

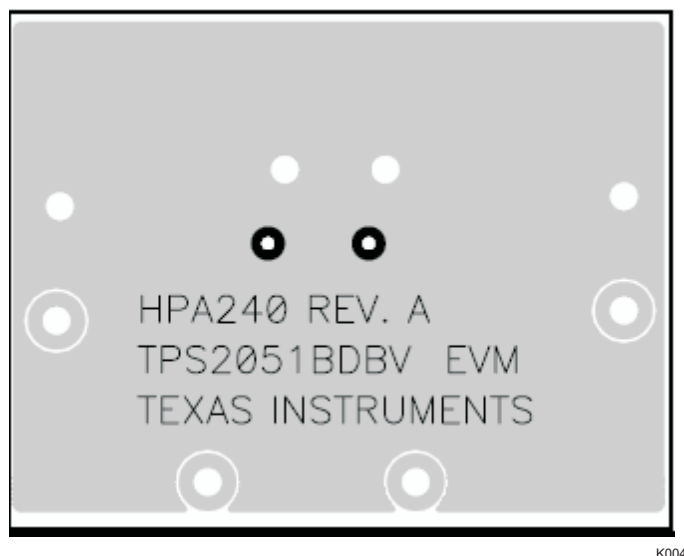


Figure 7. Bottom-Side Layout of TPS2051B EVM

3.1 Layout Considerations

1. All leads should be as short as possible with wide traces.
2. Pair signals to reduce emissions and noise, especially the paths that carry high-current pulses; these include paths to power semiconductors and magnetics.
3. Reduce the length of all the traces in described step 2.
4. Where possible, use vertical pairing.

4 Bill of Materials and Schematics

This chapter provides the Bill of Materials and Schematics for the TPS2041B/51B EVMs.

4.1 Bill of Materials

4.1.1 TPS2041B EVM BOM

[Table 1](#) is the Bill of Materials for the TPS2041B EVM.

Table 1. TPS2041B EVM BOM

RefDes	Count	Size	Mfr	Part Number	Description
C1	1	SMD	STD	STD	Capacitor, tantalum, 150-μF, 10-V, 100-mΩ, 20%
C2, C3	2	0805	STD	STD	Capacitor, ceramic, 0.1-μF, 10-V, 20%
C4	1	1206	STD	STD	Capacitor, ceramic, 10-μF, 10-V, 20%
R1	1	0805	STD	STD	Resistor, chip, 10-kΩ, 1/10W, 5%
TP1, TP3, TP4, TP5	4	TH	Keystone	5000	Test point, red, thru hole, color keyed
TP2, TP7, TP8, TP9	4	TH	Keystone	5001	Test point, black, thru hole, color keyed
U1	1	SOT-23-5	TI	TPS2041BDBV	IC, 80-mΩ, 500-mA power-distribution single switch
–	1		Any	HPA228	PCB, 1 in. × 0.8 in. × 0.062 in. (2,54 cm × 2,03 cm × 1,58 mm)

- NOTES:
1. These assemblies are ESD sensitive; ESD precautions must be observed.
 2. These assemblies must be clean and free from flux and all contaminants. Use of no-clean flux is not acceptable.
 3. These assemblies must comply with workmanship standards IPC-A-610 Class 2.

4.1.2 TPS2051B EVM BOM

Table 2 is the Bill of Materials for the TPS2051B EVM.

Table 2. TPS2051B EVM BOM

RefDes	Count	Size	Mfr	Part Number	Description
C1	1	SMD	STD	STD	Capacitor, tantalum, 150- μ F, 10-V, 100-m Ω , 20%
C2, C3	2	0805	STD	STD	Capacitor, ceramic, 0.1- μ F, 10-V, 20%
C4	1	1206	STD	STD	Capacitor, ceramic, 10- μ F, 10-V, 20%
R1	1	0805	STD	STD	Resistor, chip, 10-k Ω , 1/10W, 5%
TP1, TP3, TP4, TP5	4	TH	Keystone	5000	Test point, red, thru hole, color keyed
TP2, TP7, TP8, TP9	4	TH	Keystone	5001	Test point, black, thru hole, color keyed
U1	1	SOT-23-5	TI	TPS2051BDBV	IC, 80-m Ω , 500-mA power-distribution single switch
–	1		Any	HPA240	PCB, 1 in. $\times$ 0.8 in. $\times$ 0.062 in. (2,54 cm $\times$ 2,03 cm $\times$ 1,58 mm)

- NOTES: 1. These assemblies are ESD sensitive; ESD precautions must be observed.
 2. These assemblies must be clean and free from flux and all contaminants. Use of no-clean flux is not acceptable.
 3. These assemblies must comply with workmanship standards IPC-A-610 Class 2.

4.2 Schematics

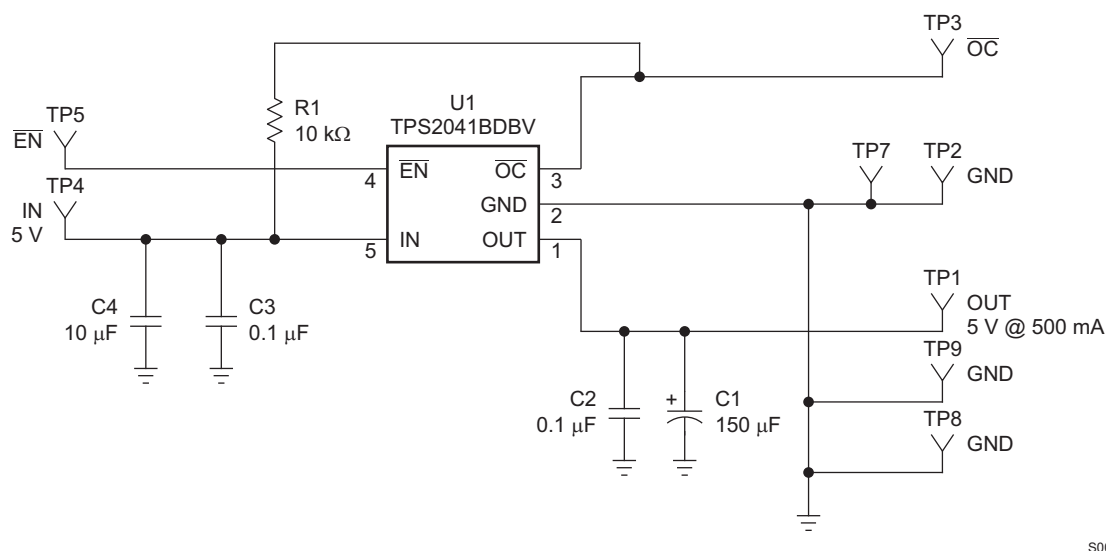


Figure 8. TPS2041B EVM Schematic

S001

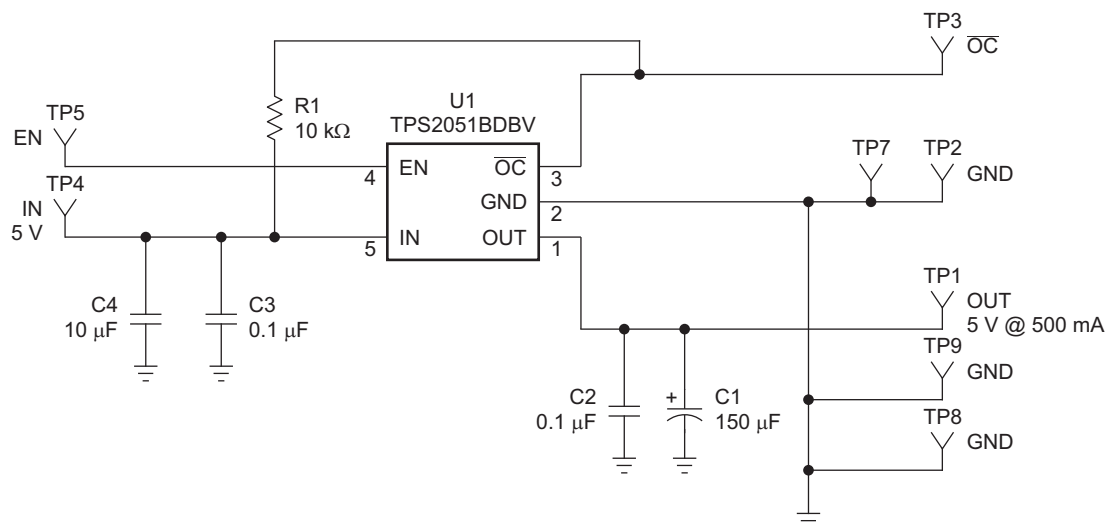


Figure 9. TPS2051B EVM Schematic

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 -0.3 V to 6.0 V, and the output voltage range of -0.3 V to 6.0 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 85°C. The EVM is designed to operate properly with certain components above -40°C as long as the input and output ranges are maintained. These components include but are not limited to, switching transistors, inductor, and IC. 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 © 2007, 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 TI 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. Information of third parties may be subject to additional restrictions.

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		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
Low Power Wireless	www.ti.com/lpw	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