

## **ISO5500EVM**

This document describes the ISO5500 Evaluation Module (EVM) and allows designers to analyze and evaluate the Texas Instruments ISO5500 Isolated Gate Driver.

The ISO5500EVM can be used to evaluate device parameters while acting as a guide for board layout. The board allows the user to evaluate device performance using a simulated (10-nF) IGBT load installed on the board, or to install an IGBT or MOSFET (TO-247 package) onto the board and drive it with the ISO5500.

### **Contents**

1	Introduction .....	1
	1.1 Overview .....	1
	1.2 ISO5500EVM Kit Contents .....	2
2	Printed-Circuit Board .....	2
	2.1 ISO5500 Operation .....	2
	2.2 Schematic and Bill of Materials .....	5

### **List of Figures**

1	ISO5500 Pinout and Functional Block Diagram .....	2
2	High-Side Interconnection Diagram .....	4
3	Low-Side Interconnection Diagram .....	4
4	Component Changes to Change Turnon/Turnoff .....	5

### **List of Tables**

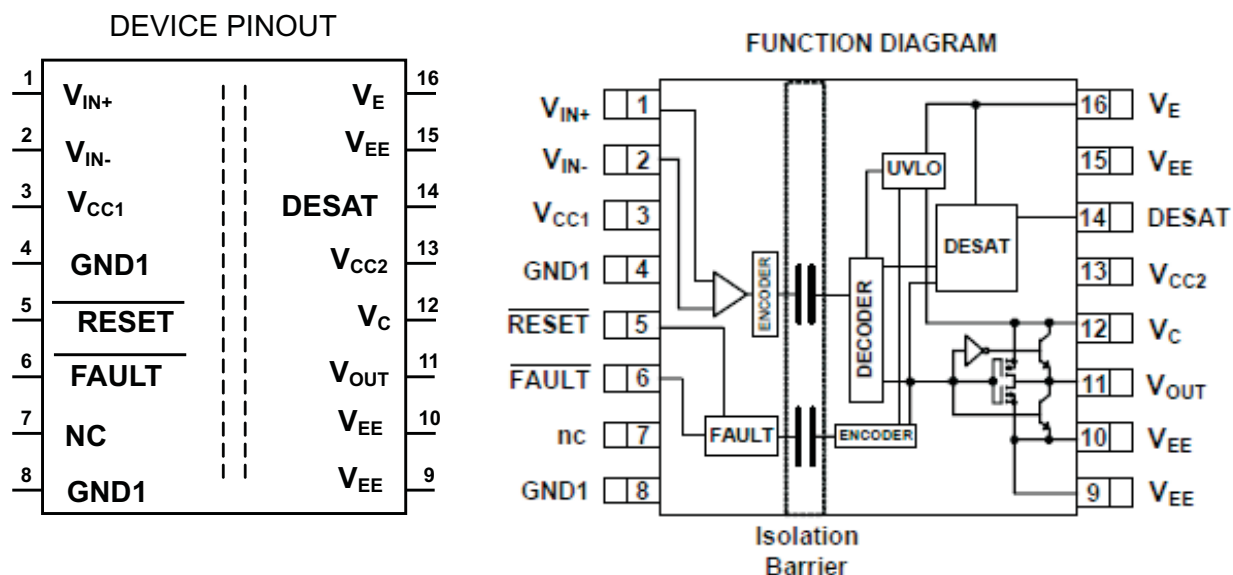
1	Test Points .....	5
2	Bill of Materials .....	6

## **1 Introduction**

### **1.1 Overview**

This ISO5500EVM was designed to allow the user to evaluate the performance and features of the ISO5500. This includes the IGBT desaturation protection (DESAT) and the UVLO circuit that ensures a sufficient gate voltage is available to drive the IGBT or MOSFET. The printed-circuit board (PCB) also includes provisions to adjust the turnon/turnoff characteristics by changing the loading between the ISO5500 output and the IGBT (or MOSFET) gate.

The EVM kit includes the ISO5500 data sheet. [Figure 1](#) shows the device pinout and the functional block diagram.



**Figure 1. ISO5500 Pinout and Functional Block Diagram**

## 1.2 ISO5500EVM Kit Contents

- ISO5500EVM printed-circuit board with ISO5500DW installed (P/N 6512405)
- ISO5500EVM User's Guide (This document)
- ISO5500 data sheet

## 2 Printed-Circuit Board

The ISO5500 is an isolated gate driver with several important features. The printed-circuit board (PCB) has been designed to support this device and to allow the user to evaluate its basic operation and features. The left side of the PCB contains the interface to the input, control, and status functions of the integrated circuit (IC). The right side of the PCB has been designed to interface to an IGBT (or MOSFET). No electrical connections exist between the right and left sides of the PCB.

Refer to the ISO5500EVM schematic and bill of materials to become familiar with the PCB components and layout. The PCB files (Gerber/ODB) are available from Texas Instruments on request.

## 2.1 ISO5500 Operation

### 2.1.1 Left-Side Operation: DC Power, Control, and Status

#### 2.1.1.1 DC Power

The left side of the ISO5500 (and therefore the PCB) can be operated using either a +3.3-V ( $\pm 10\%$ ) or +5-V ( $\pm 10\%$ ) dc power supply. The small amount of dc current required ( $< 20$  mA) means that the device can also be battery operated. The dc power supply must be connected to TP10 (+5 Vdc) and TP9 (+5-Vdc return). Also, a user can solder wires directly to the PCB from the dc power supply by means of the plated through-holes located next to the test points.

#### 2.1.1.2 Control and Status

The interface to the device is via the JMP1 header. It contains the V<sub>IN+</sub> and V<sub>IN-</sub> inputs, the device RESET, and FAULT indicator output. The JMP1 header allows easy connections to test equipment using standard clip leads or QuietZone™ connectors. Each of the four signals also has a test point for additional connections. These are TP1 through TP4.

## 2.1.2 Right-Side Operation

### 2.1.2.1 DC Power

Power is provided to Vcc2 on the right side of the device at TP12 (+Vdc) and TP11 (–Vdc). The dc supply must be able to provide a bias voltage over the range of +15 Vdc to +30 Vdc. As the current requirement is extremely low, the user may choose to operate the ISO5500 by battery. Solder holes are provided next to the test points if the user chooses to hardwire these connections. If a negative gate drive is required, a dc supply (or battery) must be connected across VE (P5 or MFG1) to VEE (MGF11 or TP11). The voltage range must be between 0 V and 15 Vdc.

### 2.1.2.2 DESAT – JMP2

One of the features of the ISO5500 is the IGBT desaturation protection. JMP2 provides access to the DESAT pin. It is a 2-pin male header, and installing a shorting jumper onto JMP2 disables the DESAT function.

### 2.1.2.3 IGBT (or MOSFET)

As shipped, the ISO5500EVM does not have an IGBT installed. The user can evaluate device operation using a simulated IGBT load or they can remove the simulated load and install an IGBT onto the board. Most IGBTs are available in the standard TO-247 package. The PCB has provisions to solder an IGBT directly onto the board.

#### 2.1.2.3.1 No IGBT (or MOSFET) Installed – JMP3

When using the simulated load, the user must install a jumper short onto JMP3. This connects a 10-nF capacitor (C9) to the Vout pin. The simulated IGBT consists of the 10-Ω gate resistor (R4) and this 10-nF capacitor (C9).

#### 2.1.2.3.2 IGBT (or MOSFET) Installed – REMOVE JMP3

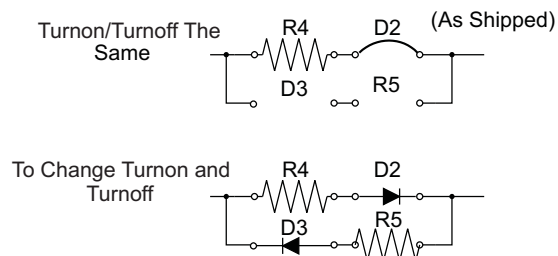
If the user chooses to install an IGBT, JMP must be left open with no shorting jumper installed. The PCB has been designed with several large plated-through holes (or vias) to support both high-side and low-side drive configurations. (Note: Plated-through holes are designated as MFGx on the schematic.) The connections for these modes are described next.

#### 2.1.2.3.3 High-Side/Low-Side Operation and Interconnection

The connections required for high-side and low-side operation are shown in [Figure 2](#) and [Figure 3](#), respectively. The user can select the load and install it directly on the PCB.



The PCB contains a single, 10- $\Omega$  gate resistor (R4) and a short bus wire in place of diode D2. This simple configuration sets the peak current at approximately 3 A, with turnon/turnoff characteristics the same. The PCB has provisions for the user to install the D2 and D3 diodes and R4 and R5 resistors. This allows the user to evaluate device operation with different on/off characteristics. This is shown in [Figure 4](#). The turnon characteristics can also be adjusted with the value of R2, which connects VC to VCC2. As shipped, R2 is set to 0  $\Omega$ , but the user can change this and examine the effects on turnon characteristics.



**Figure 4. Component Changes to Change Turnon/Turnoff**

### 2.1.2.5 The Interchange Jumper – JMP8

The ISO5500 device is similar to other devices currently available from other manufacturers. One of the similar devices uses pin 15 as an output driver for an LED. The TI ISO5500 uses pin 15 as a VEE (GND) connection. If the user wishes to install a different device onto the PCB, and that device does not use pin 15 as a VEE connection, the user can simply use the jumper short from JMP8. This opens the pin 15 connection to VEE. JMP8 can then be used as a test point for the output signal on pin 15.

### 2.1.3 Test Points

Test points have been provided for ready access to signal monitoring. They are listed in [Table 1](#).

**Table 1. Test Points**

TEST POINT	I/O	FUNCTION
TP1	Output	FAULT PIN (Left side)
TP2	Input	RESET (Left side)
TP3	Input	VIN– (Left side)
TP4	Input	VIN+ (Left side)
TP5	Output	VOUT (Right Side)
TP6	Output	GATE VOLTAGE (Right Side)
TP7	Input	DRAIN VOLTAGE (Right Side)
TP8	Input	DESAT VOLTAGE (Right Side)
TP9	Output	GND1 (Left side)
TP10	Input	VCC1 (Left side)
TP11	Output	VEE (Right Side)
TP12	Input	VCC2 (Right Side)
TP13	Input	VE (Right Side)

## 2.2 Schematic and Bill of Materials

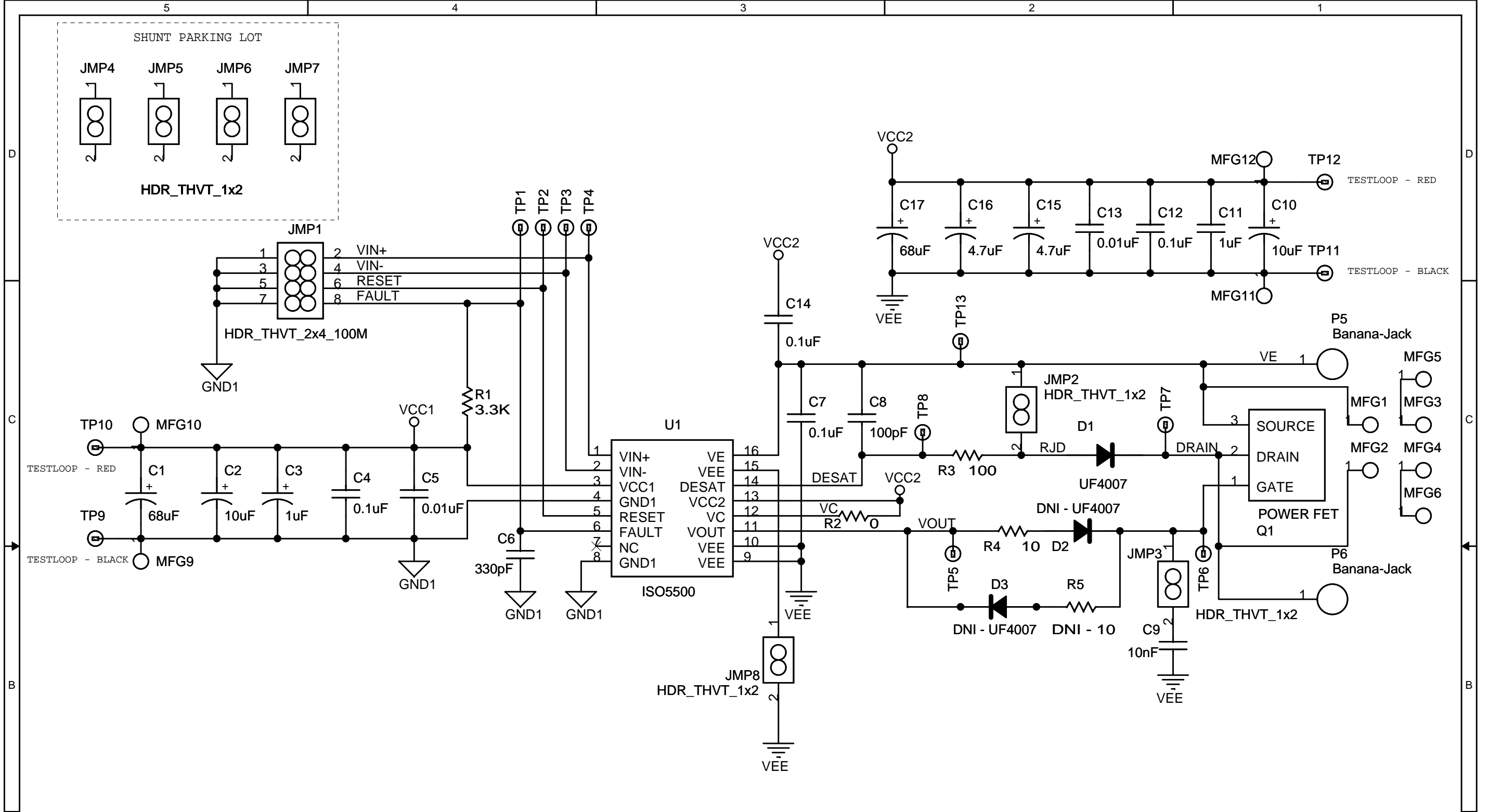
The ISO5500EVM schematic follows the bill of materials.

**Table 2. Bill of Materials**

Item	Qty	Reference	Value	Manufacturer	Manufacturer Part No
1	1	C1	68 $\mu$ F	AVX	TPSE686K020R0150
2	1	C2	10 $\mu$ F	AVX	TPSB106K020R1000
3	1	C3	1 $\mu$ F	AVX	TPSA105K020R3000
4	1	C4	0.1 $\mu$ F	GARRETT	X7R0805HTTD104K
5	2	C5,C13	0.01 $\mu$ F	KEMET	C0805C103M5RACTU
6	1	C6	330 pF	KEMET	C0805C331J5GACTU
7	2	C7,C14	0.1 $\mu$ F	KEMET	C0805C104K5RACTU
8	1	C8	100 pF	KEMET	C0805C101J5GACTU
9	1	C9	10 nF	KEMET	C0805C103K1RAC3123
10	1	C10	10 $\mu$ F	TAIYO-YUDEN	UMK325BJ106MM-T
11	1	C11	1 $\mu$ F	PANASONIC	ECQ-V1J105JM
12	1	C12	0.1 $\mu$ F	KEMET	C0805C104M5RACTU
13	2	C15,C16	4.7 $\mu$ F	VISHAY SPRAGUE	TR3D475K050C0300
14	1	C17	68 $\mu$ F	United Chemicon	EMVY500ADA680MHZ0G
15	1	D1	UF4007	VISHAY	UF4007
16	1	D2	DNI - UF4007	16 AWG Wire Short	16 AWG Wire Short
17	1	D3	DNI - UF4007	VISHAY	UF4007
18	1	JMP1	HDR_THVT_2x4_100M	Sullins	S1032-04-ND
19	7	JMP2,JMP3,JMP4,JMP5,JMP6,JMP7,JMP8	HDR_THVT_1x2	Sullins	S1032-02-ND
20	10	MFG1,MFG2,MFG3,MFG4,MFG5,MFG6,MFG9,MFG10,MFG11,MFG12	MFG060_PTH	Plated Through Holes 0.060" Holes for Customer Use Only	
21	2	P5,P6	Banana-Jack	ITT-POMONA	3267
22	1	Q1	POWER FET	DNI	DNI
23	1	R1	3.3K	VISHAY	CRCW0805332FKEF
24	1	R2	0	Panasonic	ERJ-6GEY0R00V
25	1	R3	100	Panasonic	ERJ-6GEY101V
26	1	R4	10	Panasonic	ERJ-1TYF100U
27	1	R5	DNI - 10	Panasonic	ERJ-1TYF100U
28	9	TP1,TP2,TP3,TP4,TP5,TP6,TP7,TP8,TP13	Test Loop - Black	Component Corporation	TP-105-40-00
29	2	TP9,TP11	Test Loop - Black	KEYSTONE	5011
30	2	TP10,TP12	Test Loop - RED	KEYSTONE	5010
31	1	U1	ISO5500	Texas Instruments	ISO5500
32	4	Bottom Side as shown on Bottom Side Silkscreen	Bumpon Hemisphere - Black	3M	SJ-5003
33	5	To Be Installed on JMP4–JMP7	Jumper Shorts With Handle	TYCO	2-881545-2


**Table 2. Bill of Materials (continued)**

Item	Qty	Reference	Value	Manufacturer	Manufacturer Part No
<b>NOTE ASSEMBLY INSTRUCTIONS BELOW:</b>					
<b>INSTALL JUMPER SHORTS (ITEM 33) ONTO THE FOLLOWING JUMPER LOCATIONS:</b> JMP1-3 TO JMP1-4 JMP1-5 TO JMP1-6 JMP2 JMP8 JMP9 INSTALL #16AWG WIRE IN PLACE OF D2					



NOTES:

- Q1 POWER FET IS POPULATED BY EVM CUSTOMER ONLY.
- SHORTING JUMPER 3 MUST BE REMOVED IF USER INSTALLS FET ONTO THE EVM BOARD.
- QTY 4 JUMPER SHORTS WITH HANDLE: TYCO P/N 881545-2 TO BE INSTALLED ON JMP4 - JMP7.
- DURING EVM ASSEMBLY, A 16 AWG GAUGE WIRE SHORT IS INSTALLED IN PLACE OF D2.



## TEXAS INSTRUMENTS

SCHEMATIC TITLE

ISO5500 Eval Board

PAGE TITLE

ISO5500 Eval Board

ENGINEER	DATE	Size	Document Number	Rev	Sheet
A. Dalrymple	09-15-2009	A	6512405		1 of 1
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RELEASED	DATE				
<OrgAddr3>	<Date2>				



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## EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 3.3 V to 5 V and the output voltage range of 10 V to 30 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 80° C. The EVM is designed to operate properly with certain components above 80° 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.

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### General Statement for EVMs including a radio

*User Power/Frequency Use Obligations:* This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

### 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

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**

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.

### **For EVMs annotated as IC – INDUSTRY CANADA Compliant**

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### **Concerning EVMs including radio transmitters**

This device complies with Industry Canada licence-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.

### **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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

### **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.

### **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.

## **【Important Notice for Users of this Product in Japan】**

**This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan**

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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**For Feasibility Evaluation Only, in Laboratory/Development Environments.** Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

**Certain Instructions.** It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. 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 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

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