

ISO1176T/35T/3086T Evaluation Module

This document describes the ISO1176T/35T/3086T Evaluation Module (EVM). It is used to evaluate the ISO1176T PROFIBUS™ Transceiver, the ISO35T RS-485 Transceiver, or the ISO3086T RS-485 Transceiver. Because the devices are similar transceivers, and the printed-circuit board is the same for all three EVMs, this manual can be used for all three devices.

The EVM can be used to evaluate device parameters while acting as a guide for board layout. The board allows for the connection of 50-Ω coaxial cables via QuietZone connectors. It also provides easy connection points for oscilloscope probes. Banana jacks are provided for connection of a dc power supply. These features provide the designer with a tool for evaluation and the successful design of an end-product.

Contents

1	Overview	2
2	Recommended Equipment	8

List of Figures

1	ISO1176T Device Pinout and Block Diagram	3
2	ISO35T Device Pinout and Block Diagram	3
3	ISO3086T Device Pinout and Block Diagram	3
4	ISO1176T/35T/3086TEVM Board.....	5
5	Point-to-Point Simplex Circuit	6
6	Parallel Terminated Simplex Circuit	6
7	Five-Node Multipoint Circuit	7
8	Two-Node Multipoint Circuit	7
9	EVM Configuration for Inducing a Ground Potential Difference Voltage Between Nodes	8
10	PCB Top Layer	12
11	Silk Screen – Top Side	13
12	Signal Traces – Bottom Layer	14
13	Silkscreen – Bottom Layer	15

List of Tables

1	EVM Configuration Options for ISO1176T.....	8
2	EVM Configuration Options for ISO35T and ISO3086T	9
3	ISO1176TEVM Bill of Material	10
4	ISO35TEVM Bill of Materials.....	11
5	ISO3086TEVM Bill of Materials.....	11

1 Overview

This EVM allows for evaluation of either the ISO1176T PROFIBUS™ or ISO35T or ISO3086T RS-485 transceivers. The EVM comes with a single transceiver installed on the circuit board (U1), but any of the three devices can be evaluated using this single printed-circuit board (PCB). The PCB also contains a transformer and voltage regulator that is used to provide dc power to the right (bus) side of the device. Because all three devices contain the output oscillator signals used to drive the transformer, any of the three devices can be evaluated using this single PCB. Note that two different transformers and voltage regulators can be installed on the PCB. One set is used to generate +3.3 Vdc for the ISO35T device, which is specified for 3.3-Vdc operation. The other set is installed on the ISO1176TEVM and ISO3086TEVM to generate +5-Vdc power required for those two devices. These three integrated circuits (ISO1176T, ISO35T, and ISO3086T) all contain the integrated transformer driver and are footprint compatible. The major difference is the +5-Vdc or +3.3-Vdc operation.

Care needs to be taken regarding the isolated power and ground, as this is an isolating device. Power and ground for the Data/Control side of the device (pins D, R, DE, RE, D1, and D2) can be completely isolated from power and ground for the Bus side of the device (pins A, B, etc.). Although these devices are designed to operate with an isolation voltage up to 4000 V, this PCB is not. To ensure user safety while using the EVM, the PCB has been designed to support an isolation voltage of approximately 500 V. The user must be careful when using the EVM to test isolation voltage.

Finally, the ISO1176TEVM allows half-duplex operation, whereas the ISO35T and ISO3086T are full-duplex devices. The PCBs are configured for either half- or full-duplex operation in their as-shipped configuration. Changes between configurations can easily be done using the notes provided on the schematic. The EVMs allow the user to evaluate half-duplex point-to-point or multidrop (PROFIBUS) systems, or multipoint (RS-485) applications using multiple EVMs.

The ISO1176T meets or exceeds the requirements of EN50170 and the ISO35T and ISO3086T meet or exceed the requirements of TIA/EIA RS-485 while providing 4000 V of isolation between the Data/Control and Bus sides of the device. Each device has specific features, such as receiver hysteresis, low bus capacitance, and failsafe receiver output for bus open, short, or idle conditions. These devices also support extremely fast data rates or 1 Mbps (ISO35T), 20 Mbps (ISO3086T), or 40 Mbps (ISO1176T). These features all contribute to making the ISO1176T, ISO35T, or ISO3086T an excellent choice for use in industrial and factory environments.

CAUTION

Note that although the device provides galvanic isolation of up to 4000 V, this EVM cannot be used for isolation voltage testing. It is designed for the examination of device operating parameters only and may be damaged if high voltage (>500 V) is applied across the isolation barrier or if a voltage >5.5 V is applied to any device pin.

The data sheet for three devices is available on the TI Web site. A pinout of each device and functional block diagram are in [Figure 1](#) through [Figure 3](#).

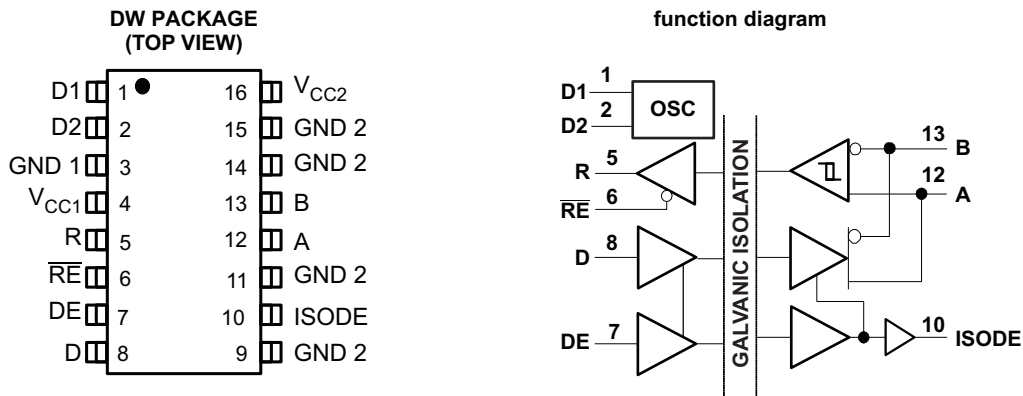


Figure 1. ISO1176T Device Pinout and Block Diagram

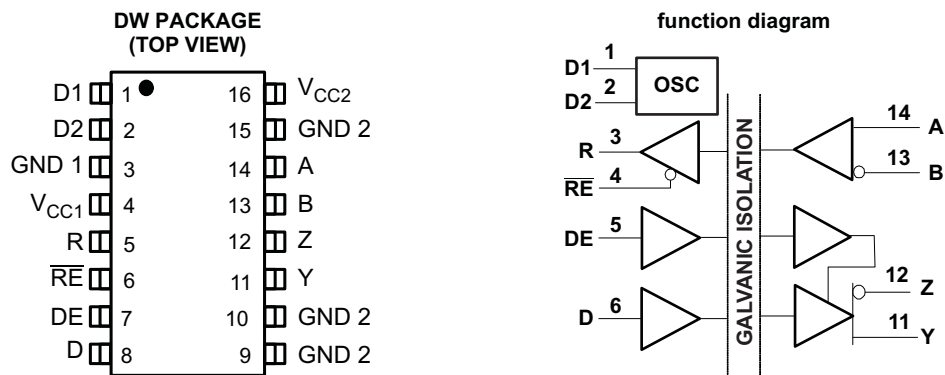


Figure 2. ISO35T Device Pinout and Block Diagram

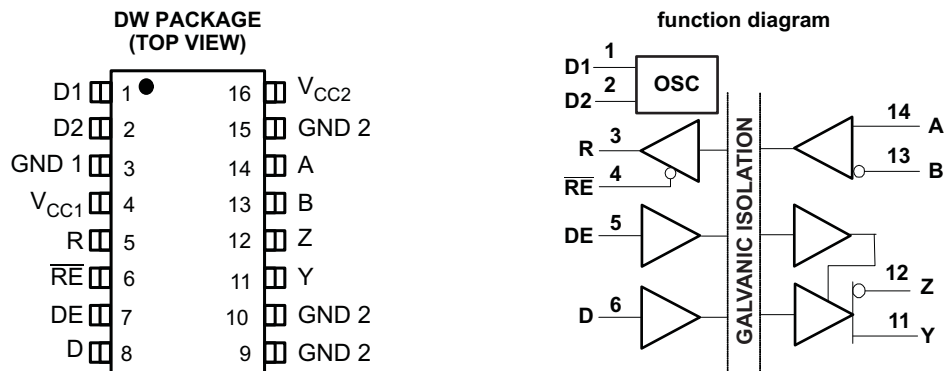


Figure 3. ISO3086T Device Pinout and Block Diagram

1.1 PROFIBUS/RS-485

The TIA/EIA-485 (also known as RS-485) standard was created in response to a demand from the data communications community for a general-purpose, high-speed balanced interface standard for multipoint applications. The standard, *Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems*, specifies differential signaling drivers and receivers for data interchange across half-duplex or multipoint data bus structures. Although TIA/EIA-485 specifies requirements for drivers and receivers operating at a signaling rate up to 10 Mbps, the standard also states that devices meeting the electrical characteristics of the standard:

...."need not operate over the entire data signaling rate range specified nor be limited to 10Mbps. They may be specified to operate at data rates to satisfy specific applications. The upper bound is application dependent and beyond the scope of this standard. Maximum signaling rate is typically limited by the following: ratio of signal transition time to the unit interval, maximum allowable stub length, and the bandwidth of the interconnecting media."

PROFIBUS (Process Field Bus), developed subsequently, had several impacts on the electrical (physical) layer including an increase in the receiver noise margin, to allow the bus to be used in an extremely noisy (i.e., EMI-rich) environment. This was accomplished by increasing the minimum differential voltage on the bus. The ISO1176T has been designed specifically for these types of environments. The two standards are indeed very similar.

1.2 EVM Kit Contents

1.2.1 ISO1176TEVM Kit Contents

ISO1176TEVM circuit board with ISO1176TDW installed - (6510416-1)

This PCB is configured with a DA2304-AL transformer and LP2985A-50DBVR LDO for 3-V to 5-V operation on the logic side of the device and 5-V operation on the bus side.

1.2.2 ISO35TEVM Kit Contents

ISO35TEVM circuit board with ISO35TDW installed – (6510416-2)

This PCB is configured with a DA2303-AL transformer and LP2985A-33DBVR for 3-V operation on the logic and bus sides of the device.

1.2.3 ISO3086TEVM Kit Contents

ISO3086TEVM circuit board with ISO3086TDW installed - (6510416-3)

This PCB is configured with a DA2304-AL transformer and LP2985A-50DBVR LDO for 3-V to 5-V operation on the logic side of the device and 5-V operation on the bus side.

The ISO1176T/35T/3086TEVM is shown in [Figure 4](#).

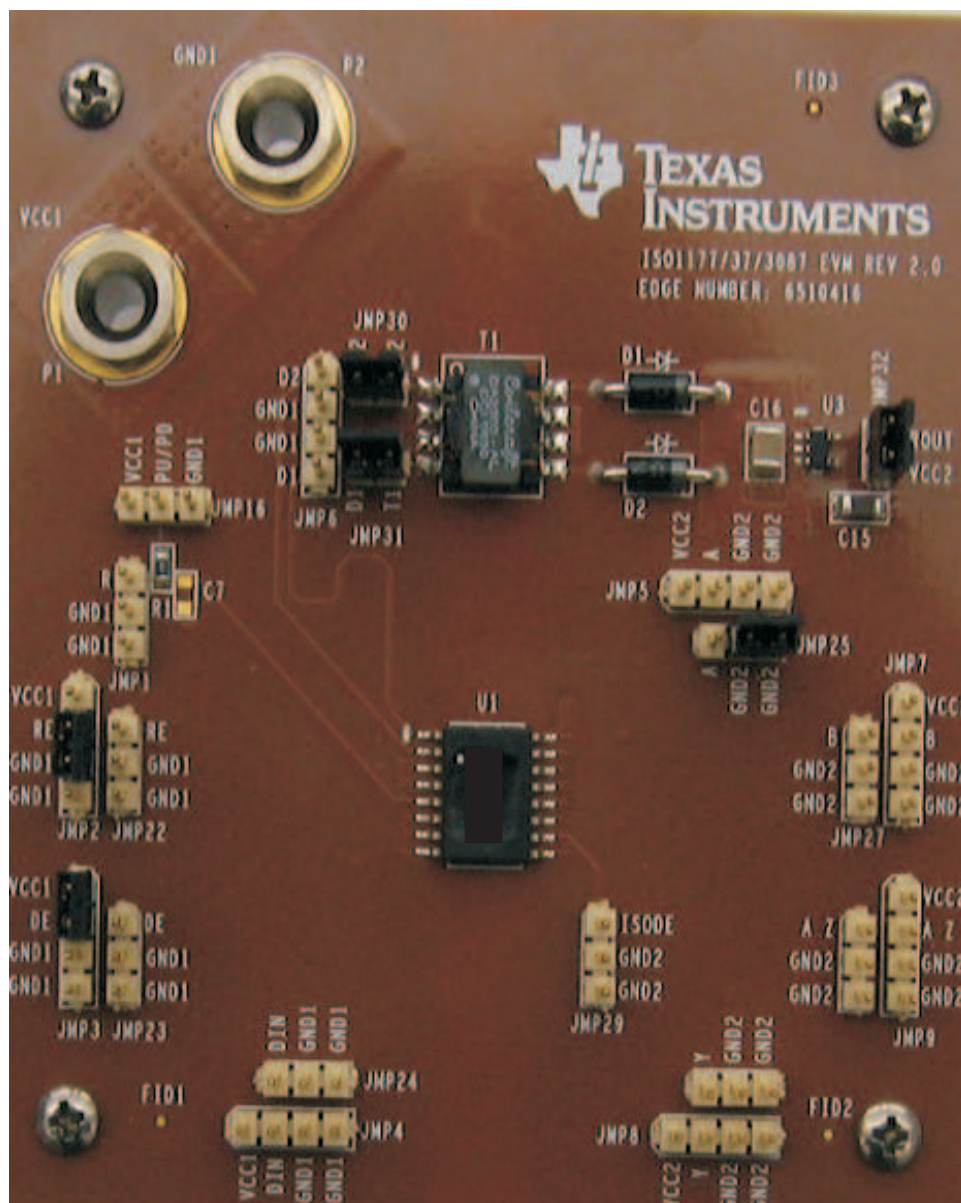


Figure 4. ISO1176T/35T/3086TEVM Board

1.3 Configurations

The ISO1176T/35T/3086TEVM board allows the user to evaluate performance of any of the three devices, or to connect easily to an existing PROFIBUS or RS-485 bus to evaluate system performance in an existing system. Also, multiple EVMs can be obtained to allow the user to construct various bus configurations. With just two EVMs, the user may evaluate performance of a point-to-point simplex, parallel-terminated point-to-point simplex, and two-node multipoint operation. When using multiple EVMs, all of these modes of operation can be configured through onboard jumpers, external cabling, and the R7–R10 resistors.

1.3.1 Point-to-Point

The point-to-point configuration is shown in Figure 5. This configuration requires two EVMs, and although this is not the intended mode of operation for PROFIBUS/RS-485 devices, it is used for high noise or longer (higher loss) transmission lines. Due to the increased drive current, a single 100-Ω termination resistor on the EVM results in a differential bus voltage (V_{od}) twice as large as the normally doubled terminated line. This practice is acceptable as long as the combination of input voltage and common-mode voltage does not exceed absolute maximum ratings of the line circuits.

This configuration is shown in Figure 5. It consists of a single driver on the left, and a single receiver on the right. Note that the termination resistors (R9 and R10) have been removed from the driver EVM.

This configuration shows the receiver disabled on the driver (JUMP2 connected to Vcc) EVM and the driver disabled on the receiver EVM (JMP4 tied to GND1). Note that with only a single termination, the differential bus voltage is higher than normal.



Figure 5. Point-to-Point Simplex Circuit

This configuration also can have a termination at the source and load (parallel terminated as shown Figure 6) thereby, keeping nominal PROFIBUS/RS-485 signal levels.

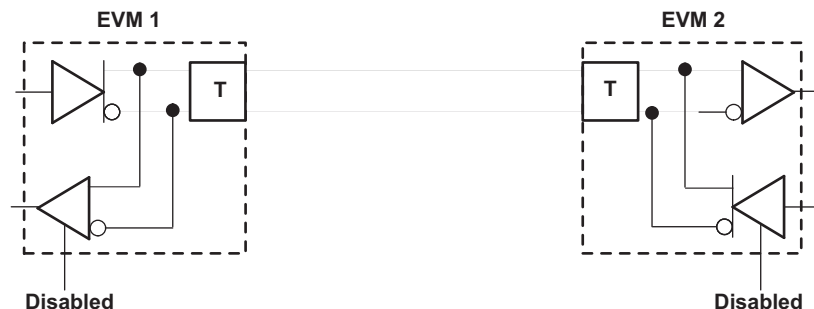


Figure 6. Parallel Terminated Simplex Circuit

1.3.2 Multipoint

The multipoint configuration is the primary application of PROFIBUS/RS-485. The RS-485 standard allows for any combination of drivers, receivers, or transceivers up to a total of 32 unit loads on the line. The ISO1176T device allows the total number of nodes to be increased because ISO1176T represents just 1/5 of a unit load. This allows up to 160 nodes to be connected onto a single bus. Figure 7 shows a representation of a five-node multipoint configuration using five ISO1176T transceivers. Increased drive current in addition to the wide common-mode input, allows this ISO1176T PROFIBUS transceiver to drive multiple receivers over longer line lengths. Notice that the termination resistors (R9 and R10) are only installed on the EVMs at each end of the bus.

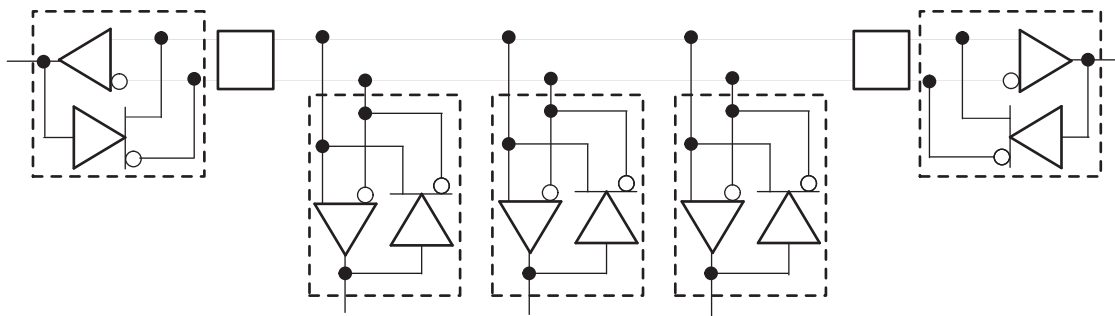


Figure 7. Five-Node Multipoint Circuit

Notice that the bus configuration shown in [Figure 7](#) can be redrawn as shown in [Figure 8](#). Additional EVMs can be obtained and connected to the bus, but the termination resistors on those EVMs need to be removed so that the bus is terminated only at each end.

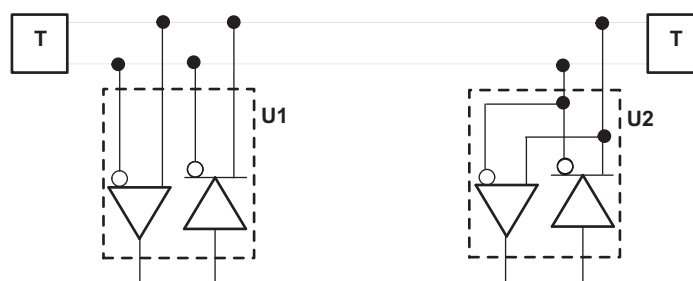


Figure 8. Two-Node Multipoint Circuit

1.4 Operation Over Extended Common-Mode Voltage Range

One of the features of the three ISO devices is their operation over an extremely wide common-mode voltage range or -7 Vdc to $+12$ Vdc. This can be evaluated using two EVMs, each powered from a separate independent power supply. This extended common-mode range is important because communications between equipment located hundreds of meters apart usually means a voltage offset exists between the grounds of each node. The EVMs can be configured with three power supplies with isolated outputs in such a way as to input a fixed offset between the grounds (see [Figure 7](#)). This induces a ground potential difference voltage (VGPD) between EVM#1 and EVM#2. To demonstrate this capability, the following steps are presented.

1. Adjust PS1 and PS2 to the supply voltage (+5 V) and current limit to 200 mA.
2. Set PS3 to 0 V.
3. Induce a ground offset by varying the output of PS3.

WARNING

PS3 output must not exceed +12 V to -7 V to remain within the device ratings.

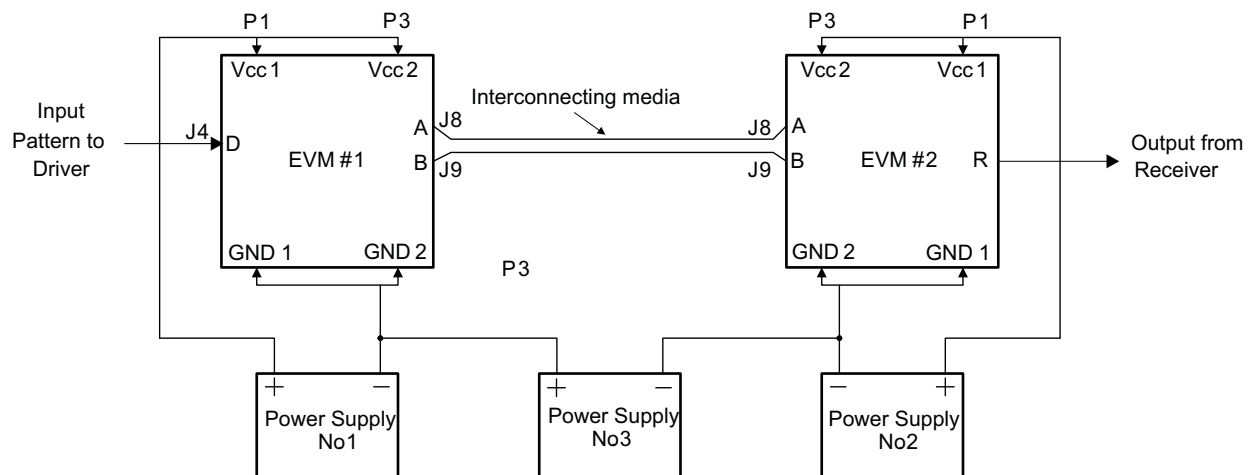


Figure 9. EVM Configuration for Inducing a Ground Potential Difference Voltage Between Nodes

2 Recommended Equipment

- 5-Vdc at 0.5 A power supply
- A pattern generator capable of supplying single-ended signals at the desired signaling rate and input levels
- A multiple-channel, high-bandwidth oscilloscope, preferably above the 100-MHz range. Differential and single-ended oscilloscope probes
- When using two or more EVMs, a 100-Ω transmission medium between transceivers (twisted-pair cable recommended, CAT5 cable for example) made be used using JMP7 and JMP9 (half duplex) between EVMs. Full-duplex connections can be made using JMP5/JMP7 and JMP8/JMP9. The termination resistors need to be configured for each case.

2.1 EVM Configurations

The schematic for the ISO1176TEVM appears on the last page of this manual.

[Table 1](#) contains a list of the onboard jumpers and their function as well as the input and output loading installed on the board for the half-duplex ISO1176TEVM. [Table 2](#) contains the same information for the full-duplex ISO35TEVM and ISO3086TEVM.

Table 1. EVM Configuration Options for ISO1176T

Jumper Function	Configuration	I/O Load
DATA/CONTROL		
SIDE JUMPERS		
JMP1 – Receiver Output		R1 (see JMP16)
JMP2 – Receiver Enable		R2 – 50 Ω ⁽¹⁾
JMP3 – Driver Enable		R3 – 50 Ω ⁽¹⁾
JMP4 – Driver Input		R4 – 50 Ω ⁽¹⁾
		R7 – Uninstalled
JMP6 – D1/D2 Test Point		R8 – Uninstalled
JMP16 – Rout Load	Jumper short allows Rout to be pulled up to Vcc or to GND through a 1-kΩ resistor.	R10 – Uninstalled

⁽¹⁾ These resistors are provided as impedance-matching terminations to be used when driving these signals with 50-Ω source impedance test/measurement equipment. When not driving these signals with a 50-Ω source, the components must be removed.

Table 1. EVM Configuration Options for ISO1176T (continued)

Jumper Function	Configuration	I/O Load
JMP22 – RE Test Point		R11 – Uninstalled
JMP23 – DE Test Point		
JMP24 – D Test Point		
JMP30 – D2	Connects D2 output to transformer pin 1	Jumper short installed
JMP31 – D1	Connects D1 output to transformer pin 4	Jumper short installed
BUS SIDE JUMPERS		
JMP5 – GND2	Jumper installed from pin 2 to pin 3	Ground U1-14
JMP7 – Bus Pin B		R8,R10 – Uninstalled
JMP8 – GND2	Jumper installed from pin 2 to pin 3	Ground U1-11
JMP9 – Bus Pin A	Bus termination A to B	Install R9 – 54 Ω
JMP25	Not used on half-duplex device	
JMP26 – A Test Point		
JMP27 – B Test Point		
JMP28	Not used on half-duplex device	
JMP29 – ISODE Test Point	ISO1176T only	
JMP32 – Regulator Output	Jumper installed from pin 1 to pin 2	Connects regulator output to Vcc2. Remove this jumper when connecting power externally (regulator not in use)
NOTE: For half-duplex operation R9 (54 Ω) only; R7, R8, AND R10 are uninstalled.	R9 for half-duplex ISO1176T device; R7, R8, and R10 for full-duplex device.	

Table 2. EVM Configuration Options for ISO35T and ISO3086T

Jumper Function	Configuration	I/O Load
DATA/CONTROL		
SIDE JUMPERS		
JMP1 – Receiver Output		R1 (see JMP16)
JMP2 – Receiver Enable		R2 – 50 Ω ⁽¹⁾
JMP3 – Driver Enable		R3 – 50 Ω ⁽¹⁾
JMP4 – Driver Input		R4 – 50 Ω ⁽¹⁾
		R7 – Uninstalled
JMP6 – D1/D2 Test Point		
JMP16 – Rout Load	Jumper short allows Rout to be pulled up to Vcc or to GND through a 1-k Ω resistor.	
JMP22 – RE Test Point		
JMP23 – DE Test Point		
JMP24 – D Test Point		
JMP30– D2	Connects D2 output to transformer pin 1	Jumper Short Installed
JMP31 – D1	Connects D1 output to transformer pin 4	Jumper Short Installed
BUS SIDE JUMPERS		
JMP5 – A Input	R7 and R8 for bus termination	R7 – 50 Ω
JMP7 – B Input	Across A and B inputs	R8 – 50 Ω

⁽¹⁾ These resistors are provided as impedance-matching terminations to be used when driving these signals with 50- Ω source impedance test/measurement equipment. When not driving these signals with a 50- Ω source, the components must be removed.

Table 2. EVM Configuration Options for ISO35T and ISO3086T (continued)

Jumper Function	Configuration	I/O Load
JMP8 – Y Output JMP9 – Z Output JMP25 – A Test Point JMP26 – Z Test Point JMP27 – B Test Point JMP28 – Y Test Point JMP29 – GND2 JMP32 – Regulator Output	R10 set source termination across Driver pins Y and Z Jumper installed from pin 1 to pin 2	R10 – 54 Ω R10 – 54 Ω Jumper short installed to short U1-10 to GND2 Connects regulator output to Vcc2. Remove this jumper when connecting power externally (regulator not in use)

2.2 Bill of Materials

The items used in the ISO1176T/35T/3086TEVM are listed in the bill of materials in [Table 3](#), [Table 4](#), and [Table 5](#).

Table 3. ISO1176TEVM Bill of Material

Item	Qty	Reference	Value	Footprint	Manufacturer	Part Number
1	1	C2	68 μ F	cc7260	SPRAGUE	592D68X0010R2T
2	1	C3	10 μ F	cc7343	SPRAGUE	293D106X0035D2W
3	1	C4	1 μ F	cc1206	AVX	12063G105ZATRA
4	1	C5	0.1 μ F	cc1206	AVX	12065C104JATMA
5	1	C6	0.01 μ F	cc0805	AVX	06033G102JATMA
6	1	C7	DNI	cc0805		
7	2	C15, C17	10 μ F	cc1206		
8	1	C16	22 μ F	cc1210		
9	2	D1,D2	1N5817			
10	10	JMP1, JMP16, JMP22–JMP29	Header 3x1			
11	8	JMP2–JMP9	Header 4x1			
12	3	JMP30–JMP32	Header 2x1			
13	2	P1, P2	Banana-Jack	bjack	ITT-POMONA	3267
14	1	R1	1K	r0805		
15	5	R2, R3, R4	49.9	r0805		
16	2	R7, R8, R10, R11	DNI	r0805		
17	1	R9	54	r0805		
18	1	T1	DA2304-AL		Coil Craft	DA2304-AL
19	1	U1	ISO1176T	16 pin DW	TI	ISO1176T
20	1	U3	LP2985A-50DBVR	SOT23-5	TI	LP2985A-50DBVR

Table 4. ISO35TEVM Bill of Materials

Item	QTY	Reference	Value	Footprint	Manufacturer	Part Number
1	1	C2	68 μ F	cc7260	SPRAGUE	592D68X0010R2T
2	1	C3	10 μ F	cc7343	SPRAGUE	293D106X0035D2W
3	1	C4	1 μ F	cc1206	AVX	12063G105ZATRA
4	1	C5	0.1 μ F	cc1206	AVX	12065C104JATMA
5	1	C6	0.01 μ F	cc0805	AVX	06033G102JATMA
6	1	C7	DNI	cc0805		
7	2	C15, C17	10 μ F	cc1206		
8	1	C16	22 μ F	cc1210		
9	2	D1, D2	1N5817			
10	10	JMP1, JMP16, JMP22–JMP29	Header 3x1			
11	8	JMP2–JMP9	Header 4x1			
12	3	JMP30–JMP32	Header 2x1			
13	2	P1, P2	Banana-Jack	bjack	ITT-POMONA	3267
14	1	R1	1K	r0805		
15	3	R2, R3, R4, R7, R8	49.9	r0805		
16	1	R10	54	r0805		
17	4	R9, R11	DN!	r0805		
18	1	T1	DA2303-AL		Coil Craft	DA2303-AL
19	1	U1	ISO35T	16 pin DW	TI	ISO35T
20	1	U3	LP2985A-33DBVR	SOT23-5	TI	LP2985A-33DBVR

Table 5. ISO3086TEVM Bill of Materials

Item	QTY	Reference	Value	Footprint	Manufacturer	Part Number
1	1	C2	68 μ F	cc7260	SPRAGUE	592D68X0010R2T
2	1	C3	10 μ F	cc7343	SPRAGUE	293D106X0035D2W
3	1	C4	1 μ F	cc1206	AVX	12063G105ZATRA
4	1	C5	0.1 μ F	cc1206	AVX	12065C104JATMA
5	1	C6	0.01 μ F	cc0805	AVX	06033G102JATMA
6	1	C7	DNI	cc0805		
7	2	C15, C17	10 μ F	cc1206		
8	1	C16	22 μ F	cc1210		
9	2	D1, D2	1N5817			
10	10	JMP1, JMP16, JMP22–JMP29	Header 3x1			
11	8	JMP2–JMP9	Header 4x1			
12	3	JMP30–JMP32	Header 2x1			
13	2	P1, P2	Banana-Jack	bjack	ITT-POMONA	3267
14	1	R1	1K	r0805		
15	3	R2, R3, R4, R7, R8	49.9	r0805		
16	1	R10	54	r0805		
17	4	R9, R11	DN!	r0805		
18	1	T1	DA2304_AL		Coil Craft	DA2304-AL
19	1	U1	ISO3086T	16 pin DW	TI	ISO3086T
20	1	U3	LP2985A-50DBVR	SOT23-5	TI	LP2985A-50DBVR

2.3 PCB Layout and Construction

The ISO1176/35T/3086TEVM PCB is a 4-layer board. The top and bottom layers (Figure 10 and Figure 12) contain signal routing. The remaining layers (Figure 11 and Figure 13) are power and ground planes. These are split planes to keep the Vcc1/GND1 separate from Vcc2/GND2. The I/O traces are designed to have a characteristic impedance of 50 Ω .

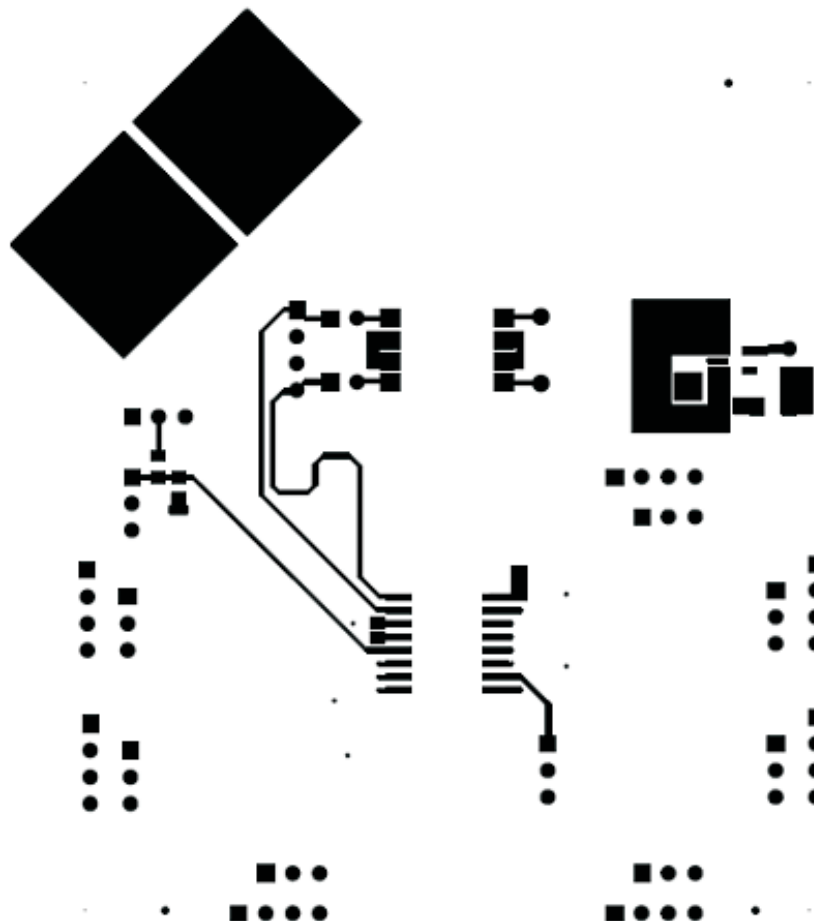


Figure 10. PCB Top Layer

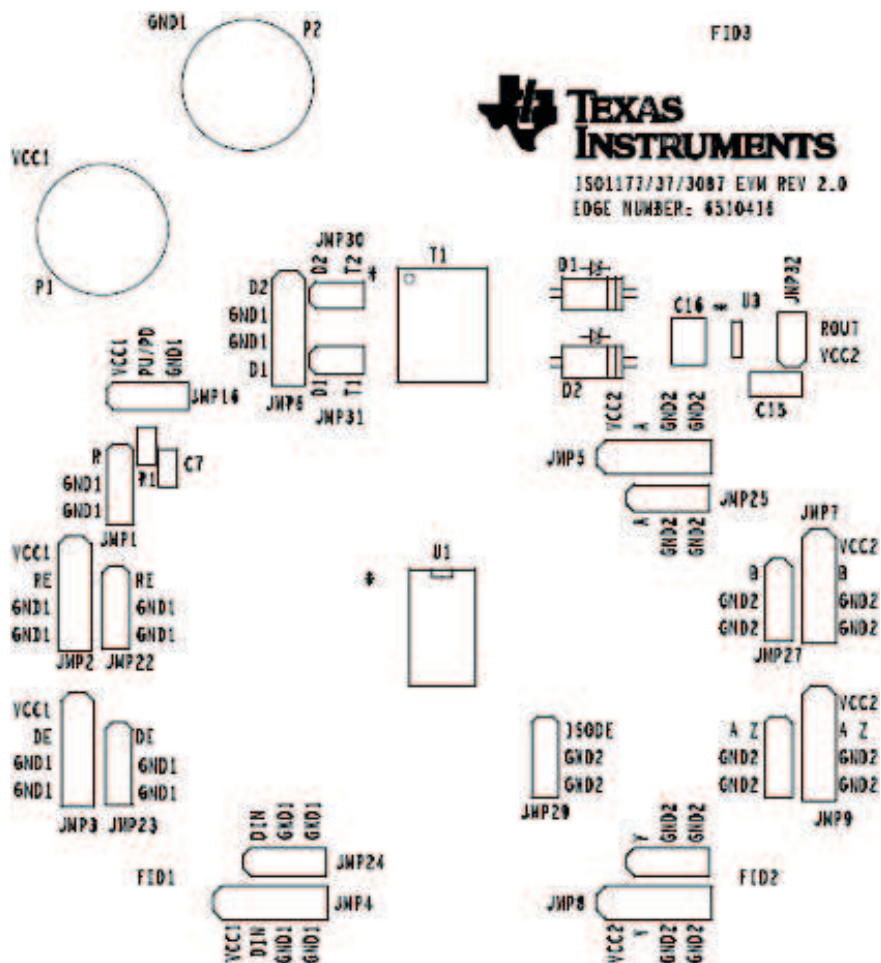


Figure 11. Silk Screen – Top Side

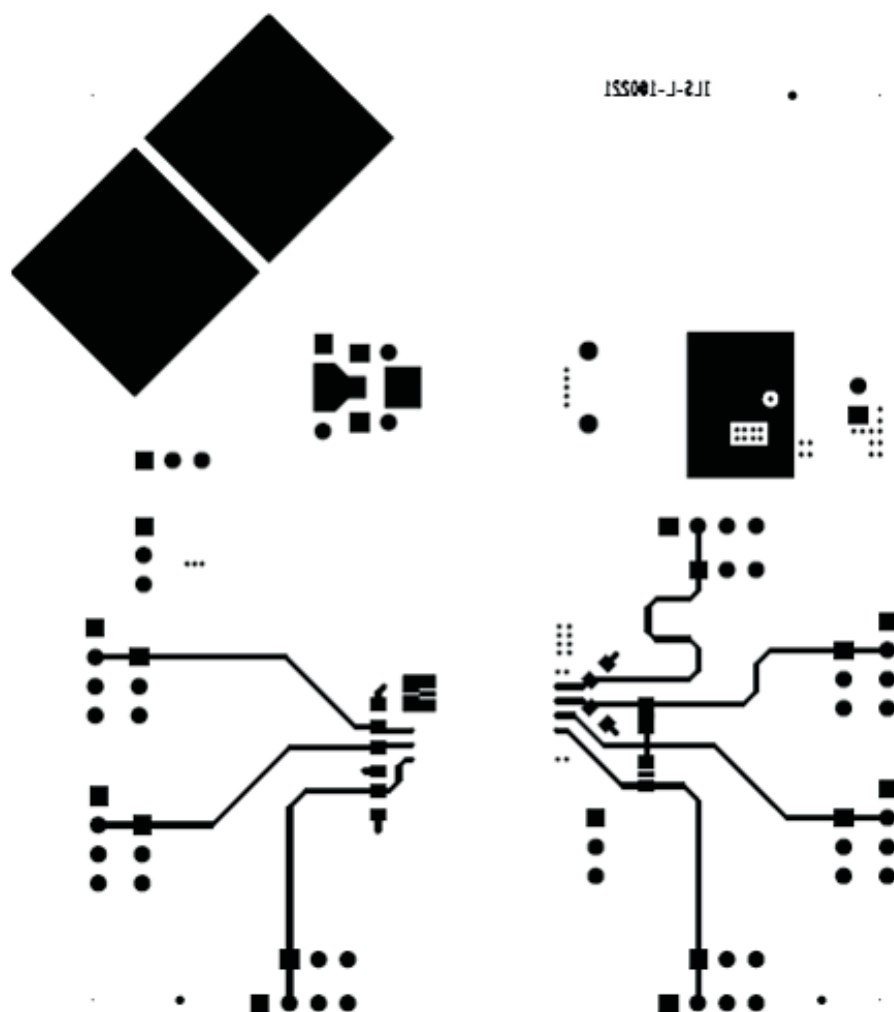
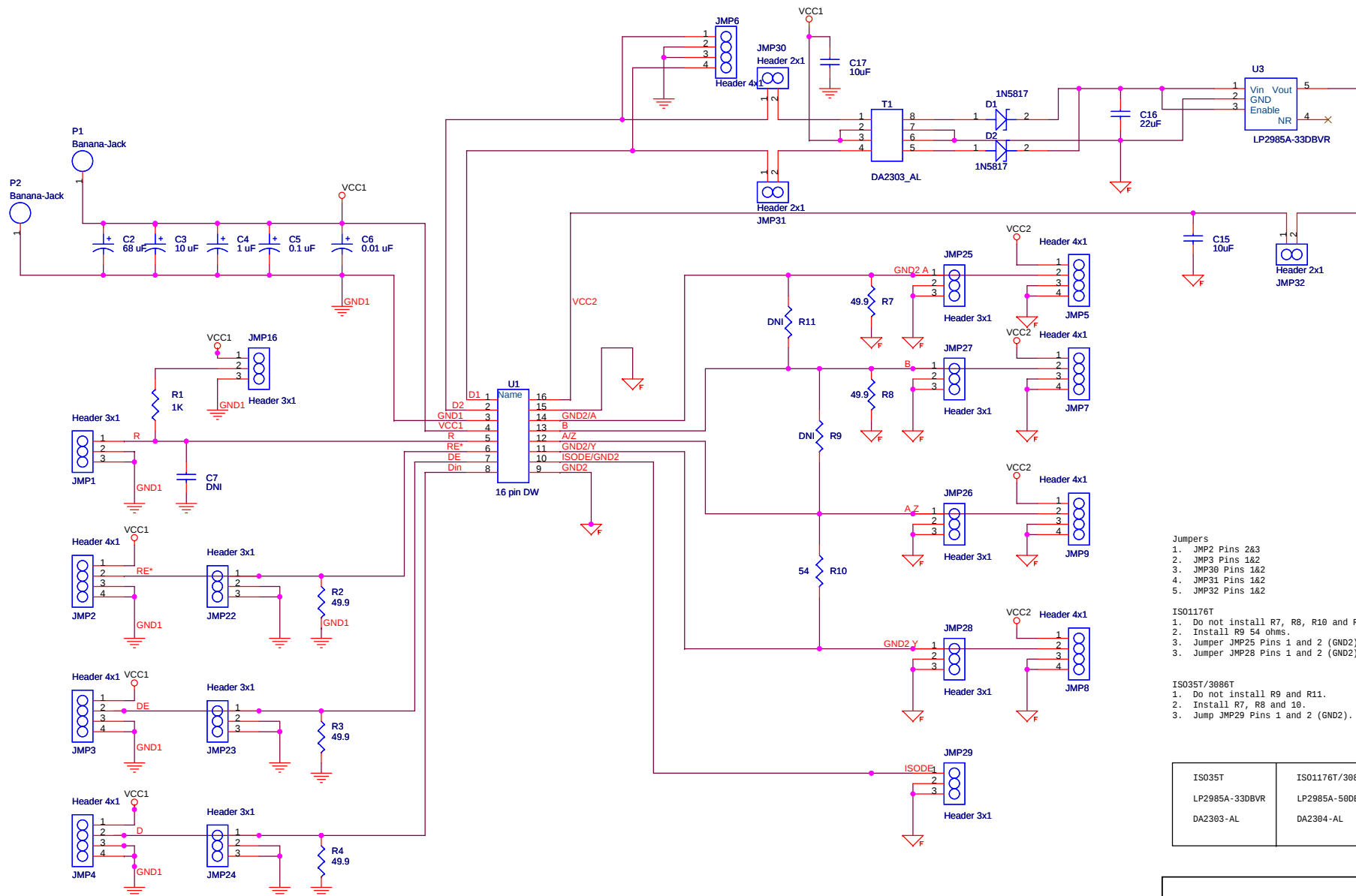


Figure 12. Signal Traces – Bottom Layer





- Jumpers
1. JMP2 Pins 2&3
 2. JMP3 Pins 1&2
 3. JMP30 Pins 1&2
 4. JMP31 Pins 1&2
 5. JMP32 Pins 1&2
- ISO1176T
1. Do not install R7, R8, R10 and R11.
 2. Install R9 54 ohms.
 3. Jumper JMP25 Pins 1 and 2 (GND2).
 3. Jumper JMP28 Pins 1 and 2 (GND2).
- ISO35T/3086T
1. Do not install R9 and R11.
 2. Install R7, R8 and R10.
 3. Jump JMP29 Pins 1 and 2 (GND2).

ISO35T	ISO1176T/3086T
LP2985A-33DBVR	LP2985A-50DBVR
DA2303-AL	DA2304-AL

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 V to 5.5 V and the output voltage range of 0 V to 6 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 85° 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 © 2010, 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

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics & Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video
Wireless	www.ti.com/wireless-apps