ISOLATED 5-V FULL AND HALF-DUPLEX RS-485 TRANSCEIVERS

Check for Samples: ISO3080, ISO3086, ISO3082, ISO3088

FEATURES

- **4000-V_{PEAK} Isolation, 560-V_{peak} V_{IORM}**
  - **UL 1577, IEC 60747-5-2 (VDE 0884, Rev. 2), IEC 61010-1, IEC 60950-1 and CSA Approved**
- **Bus-Pin ESD Protection**
  - **12 kV HBM Between Bus Pins and GND2**
  - **6 kV HBM Between Bus Pins and GND1**
- **1/8 Unit Load – Up to 256 Nodes on a Bus**
- **Meets or Exceeds TIA/EIA RS-485 Requirements**
- **Signaling Rates up to 20 Mbps**
- **Thermal Shutdown Protection**
- **Low Bus Capacitance – 16 pF (Typ)**
- **50 kV/μs Typical Transient Immunity**
- **Fail-safe Receiver for Bus Open, Short, Idle**
- **3.3-V Inputs are 5-V Tolerant**

APPLICATIONS

- **Security Systems**
- **Chemical Production**
- **Factory Automation**
- **Motor/Motion Control**
- **HVAC and Building Automation Networks**
- **Networked Security Stations**

ISO3080	Full-Duplex	200 kbps
ISO3086	Full-Duplex	20 Mbps
ISO3082	Half-Duplex	200 kbps
ISO3088	Half-Duplex	20 Mbps

DESCRIPTION

The ISO3080, and ISO3086 are isolated full-duplex differential line drivers and receivers while the ISO3082, and ISO3088 are isolated half-duplex differential line transceivers for TIA/EIA 485/422 applications.

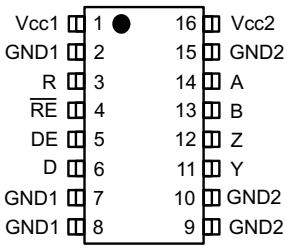
These devices are ideal for long transmission lines since the ground loop is broken to allow for a much larger common-mode voltage range. The symmetrical isolation barrier of the device is tested to provide 2500 Vrms of isolation for 60s between the bus-line transceiver and the logic-level interface.

Any cabled I/O can be subjected to electrical noise transients from various sources. These noise transients can cause damage to the transceiver and/or near-by sensitive circuitry if they are of sufficient magnitude and duration. These isolated devices can significantly increase protection and reduce the risk of damage to expensive control circuits.

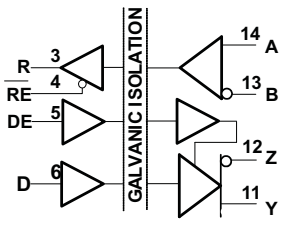
The ISO3080, SO3082, ISO3086 and ISO3088 are qualified for use from –40°C to 85°C.

ISO3080, ISO3086

DW PACKAGE

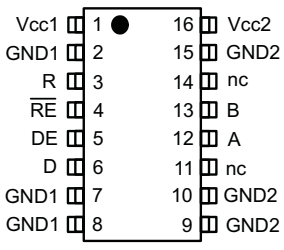


function diagram

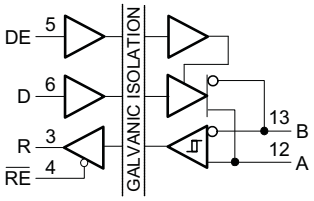


ISO3082, ISO3088

DW PACKAGE



function diagram



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

ABSOLUTE MAXIMUM RATINGS(1)

					VALUE	UNIT
V_{CC}	Input supply voltage, (2) V_{CC1}, V_{CC2}				–0.3 to 6	V
V_O	Voltage at any bus I/O terminal				–9 to 14	V
V_{IT}	Voltage input, transient pulse, A, B, Y, and Z (through 100Ω, see Figure 11)				–50 to 50	V
V_I	Voltage input at any D, DE or $\overline{RE}$ terminal				–0.5 to 7	V
I_O	Receiver output current				±10	mA
ESD	Electrostatic discharge	Human Body Model	JEDEC Standard 22, Test Method A114-C.01	Bus pins and GND1	±6	kV
				Bus pins and GND2	±12	
				All pins	±4	
		Charged Device Model	JEDEC Standard 22, Test Method C101	All pins	±1	kV
		Machine Model	ANSI/ESDS5.2-1996		±200	V
T_J	Maximum junction temperature				150	°C
T_{STG}	Operating junction temperature				–65 to 150	°C

(1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) All voltage values except differential I/O bus voltages are with respect to network ground terminal and are peak voltage values

RECOMMENDED OPERATING CONDITIONS

			MIN	TYP	MAX	UNIT
V_{CC1}	Logic-side supply voltage (1)		3.15		5.5	V
V_{CC2}	Bus-side supply voltage(1)		4.5	5	5.5	V
V_{OC}	Voltage at either bus I/O terminal	A, B	–7		12	V
V_{IH}	High-level input voltage	D, DE, $\overline{RE}$	2		VCC	V
V_{IL}	Low-level input voltage		0		0.8	
V_{ID}	Differential input voltage	A with respect to B	–12		12	V
		Dynamic (ISO3086)	see Figure 14			
R_L	Differential input resistance		54	60		Ω
I_O	Output current	Driver	–60		60	mA
		Receiver	–8		8	
T_J	Operating junction temperature		–40		85	°C

(1) For 5-V operation, V_{CC1} or V_{CC2} is specified from 4.5 V to 5.5 V. For 3.3-V operation, V_{CC1} is specified from 3.15 V to 3.6V.

SUPPLY CURRENT

over recommended operating condition (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
I_{CC1}	Logic-side supply current	$\overline{RE}$ at 0 V or V_{CC}, DE at 0 V or V_{CC1}	3.3-V V_{CC1}			8	mA
		$\overline{RE}$ at 0 V or V_{CC}, DE at 0 V or V_{CC1}	5-V V_{CC1}			10	
I_{CC2}	Bus-side supply current	$\overline{RE}$ at 0 V or V_{CC}, DE at 0 V, No load				15	mA

DRIVER ELECTRICAL CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
$\lvert V_{OD} \rvert$	Differential output voltage magnitude	I_O = 0 mA, no load			3	4.3	V_{CC}	V
		R_L = 54 Ω, See Figure 1			1.5	2.3		
		R_L = 100 Ω (RS-422), See Figure 1			2	2.3		
		V_{test} from –7 V to +12 V, See Figure 2			1.5			
$\Delta\lvert V_{OD} \rvert$	Change in magnitude of the differential output voltage	See Figure 1 and Figure 2			–0.2	0	0.2	V
$V_{OC(SS)}$	Steady-state common-mode output voltage	See Figure 3			1	2.6	3	V
$\Delta V_{OC(SS)}$	Change in steady-state common-mode output voltage				–0.1		0.1	
$V_{OC(pp)}$	Peak-to-peak common-mode output voltage	See Figure 3				0.5		V
I_I	Input current	D, DE, V_I at 0 V or V_{CC1}			–10		10	µA
I_{OZ}	High-impedance state output current	ISO3082 ISO3088	See receiver input current					
		ISO3080 ISO3086	V_Y or V_Z = 12 V, V_{CC} = 0 V or 5 V, DE = 0 V	Other input at 0 V			1	µA
			V_Y or V_Z = –7 V. V_{CC} = 0 V or 5 V, DE = 0 V		–1			
I_{OS}	Short-circuit output current	V_A or V_B at –7 V		Other input at 0 V	–200		200	mA
		V_A or V_B at 12 V						
CMTI	Common-mode transient immunity	See Figure 12 and Figure 13			25	50		kV/µs

DRIVER SWITCHING CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER				TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}, t_{PHL}	Propagation delay	ISO3080/82		See Figure 4		0.7	1.3	µs
		ISO3086/88				25	45	ns
PWD(1)	Pulse skew ($\lvert t_{PHL} - t_{PLH} \rvert$)	ISO3080/82				20	200	ns
		ISO3086/88				3	7.5	
t_r, t_f	Differential output signal rise and fall time	ISO3080/82			0.5	0.9	1.5	µs
		ISO3086/88				7	15	ns
t_{PZH}, t_{PZL}	Propagation delay, high-impedance-to-high-level output	ISO3080/82	50% Vo	See Figure 5 and Figure 6, DE at 0 V		2.5	7	µs
			90% Vo			1.8		
	Propagation delay, high-impedance-to-low-level output	ISO3086/88				25	55	ns
t_{PHZ}, t_{PLZ}	Propagation delay, high-level-to-high-impedance output	ISO3080/82				95	225	ns
	Propagation delay, low-level to high-impedance output	ISO3086/88				25	55	

(1) Also known as pulse skew

RECEIVER ELECTRICAL CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$V_{IT(+)}$	Positive-going input threshold voltage	I_O = –8 mA			–85	–10	mV
$V_{IT(–)}$	Negative-going input threshold voltage	I_O = 8 mA		–200	–115		mV
V_{hys}	Hysteresis voltage ($V_{IT+} – V_{IT–}$)				30		mV
V_{OH}	High-level output voltage	V_{ID} = 200 mV, I_O = –8 mA, See Figure 7	3.3-V V_{CC1}	V_{CC1}-0.4	3.1		V
			5-V V_{CC1}	4	4.8		
V_{OL}	Low-level output voltage	V_{ID} = –200 mV, I_O = 8 mA, See Figure 7	3.3-V V_{CC1}		0.15	0.4	V
			5-V V_{CC1}		0.15	0.4	
$I_{O(Z)}$	High-impedance state output current	V_I = –7 to 12 V, Other input = 0 V		–1		1	µA
I_I	Bus input current	V_A or V_B = 12 V	Other input at 0 V		0.04	0.1	mA
		V_A or V_B = 12 V, V_{CC} = 0			0.06	0.13	
		V_A or V_B = –7 V		–0.1	–0.04		
		V_A or V_B = –7 V, V_{CC} = 0		–0.05	–0.03		
I_{IH}	High-level input current, $\overline{RE}$	V_{IH} = 2 V		–10		10	µA
I_{IL}	Low-level input current, $\overline{RE}$	V_{IL} = 0.8 V		–10		10	µA
R_{ID}	Differential input resistance	A, B		48			kΩ
C_D	Differential input capacitance	Test input signal is a 1.5 MHz sine wave with 1Vpp amplitude. CD is measured across A and B.			7		pF

RECEIVER SWITCHING CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}, t_{PHL}	Propagation delay	See Figure 8		90	125	ns
PWD(1)	Pulse width distortion $\lvert t_{PHL} – t_{PLH} \rvert$			4	12	
t_r, t_f	Output signal rise and fall time			1		ns
t_{PHZ}, t_{PZH}	Propagation delay, high-level-to-high-impedance output Propagation delay, high-impedance-to-high-level output	See Figure 9, DE at 0 V			22	ns
t_{PZL}, t_{PLZ}	Propagation delay, high-impedance-to-low-level output Propagation delay, low-level-to-high-impedance output	See Figure 10, DE at 0 V			22	ns

(1) Also known as pulse skew.

PARAMETER MEASUREMENT INFORMATION

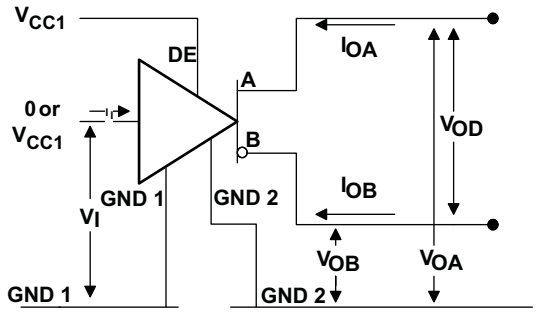


Figure 1. Driver V_{OD} Test and Current Definitions

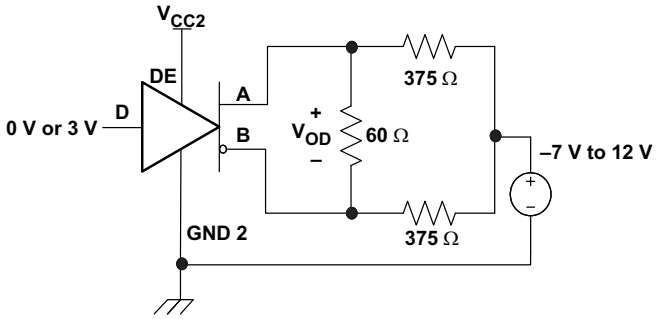


Figure 2. Driver V_{OD} With Common-Mode Loading Test Circuit

Note: Unless otherwise stated, test circuits are shown for half-duplex devices, ISO3082 & ISO3088. For full-duplex devices, driver output pins are Y and Z.

PARAMETER MEASUREMENT INFORMATION (continued)

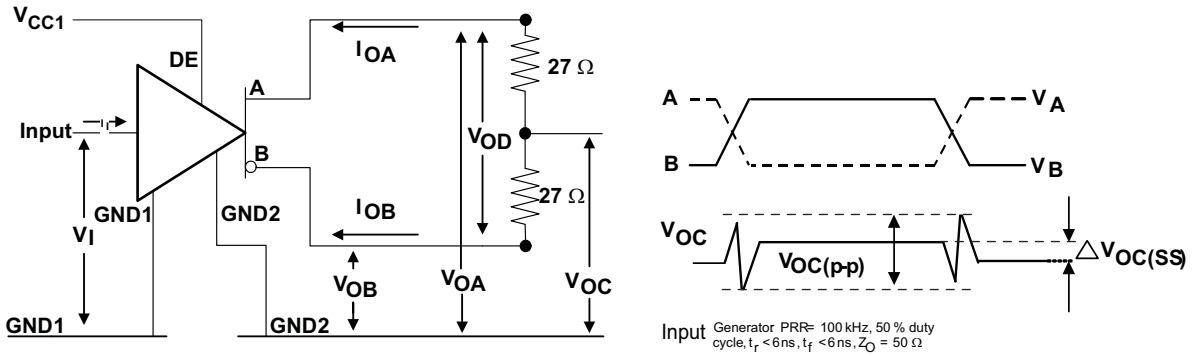


Figure 3. Test Circuit and Waveform Definitions For The Driver Common-Mode Output Voltage

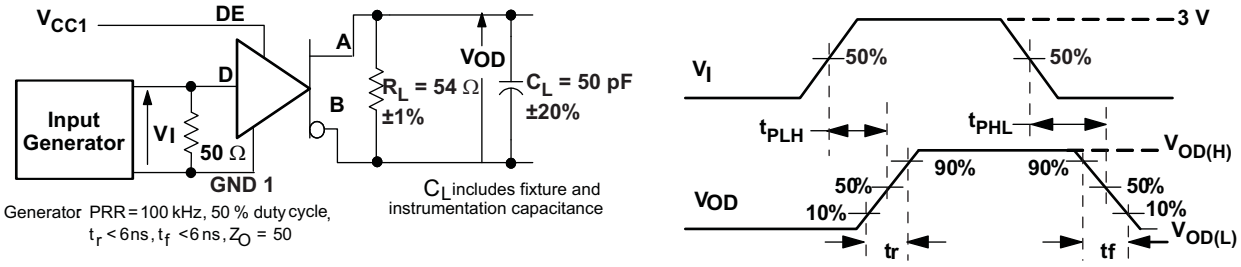


Figure 4. Driver Switching Test Circuit and Voltage Waveforms

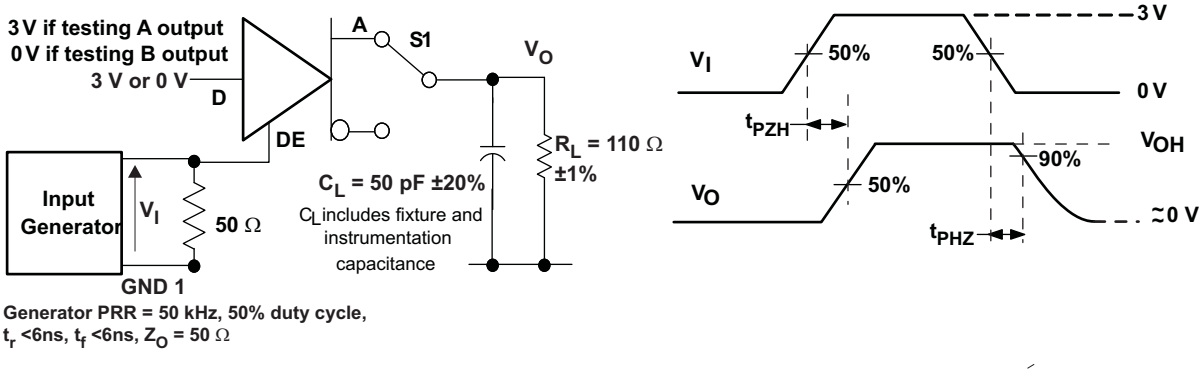


Figure 5. Driver High-Level Output Enable and Disable Time Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION (continued)

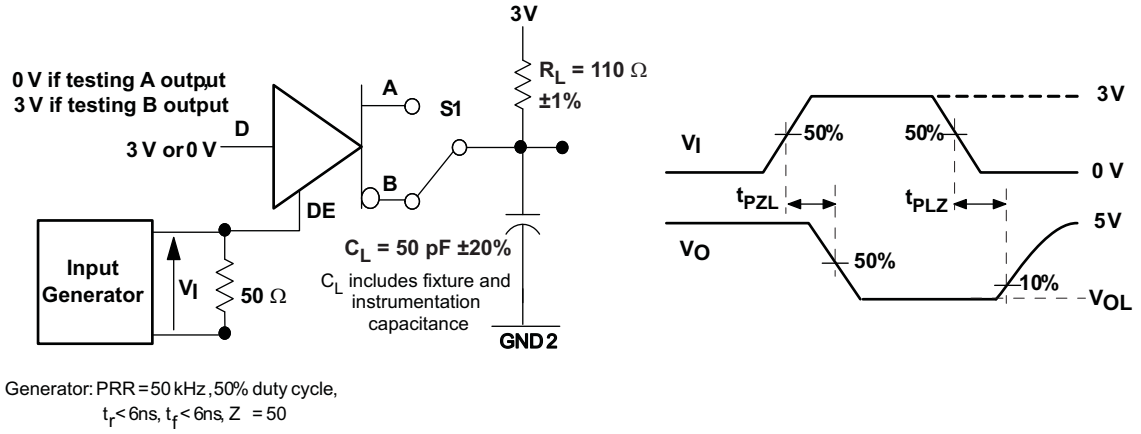


Figure 6. Driver Low-Level Output Enable and Disable Time Test Circuit and Voltage Waveform

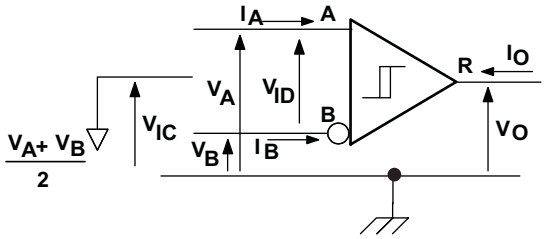


Figure 7. Receiver Voltage and Current Definitions

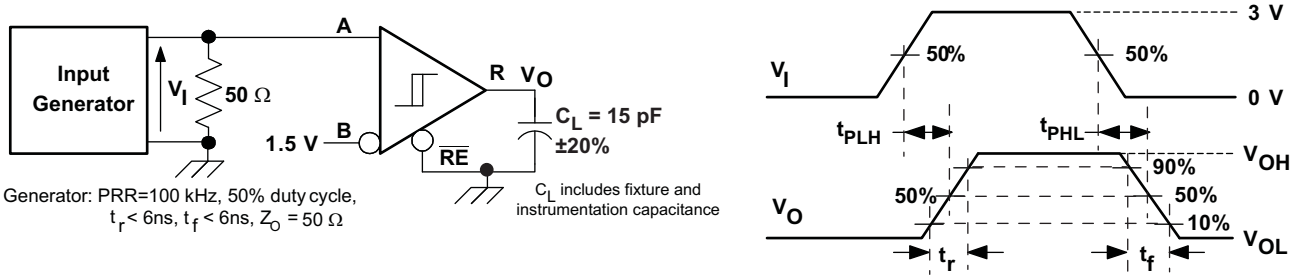


Figure 8. Receiver Switching Test Circuit and Waveforms

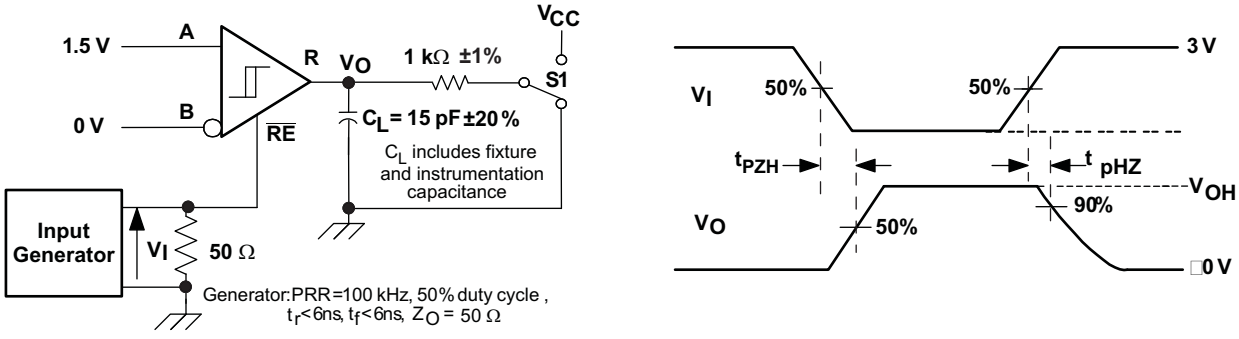


Figure 9. Receiver Enable Test Circuit and Waveforms, Data Output High

PARAMETER MEASUREMENT INFORMATION (continued)

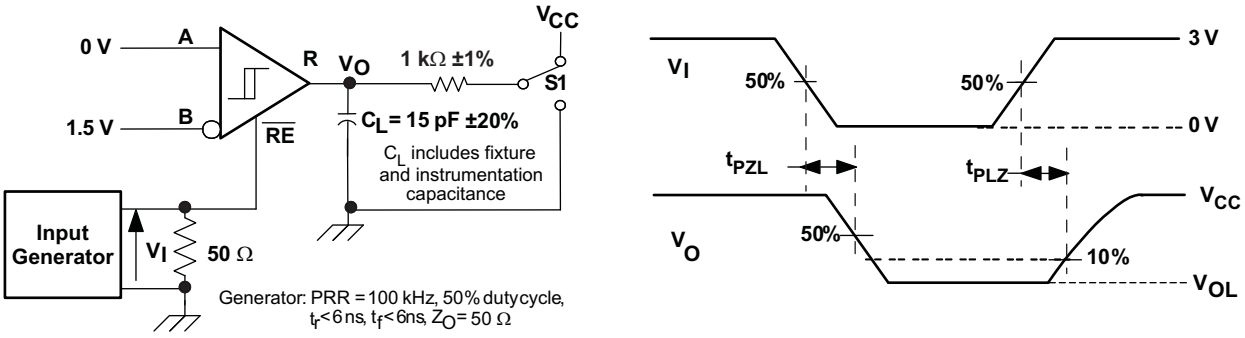
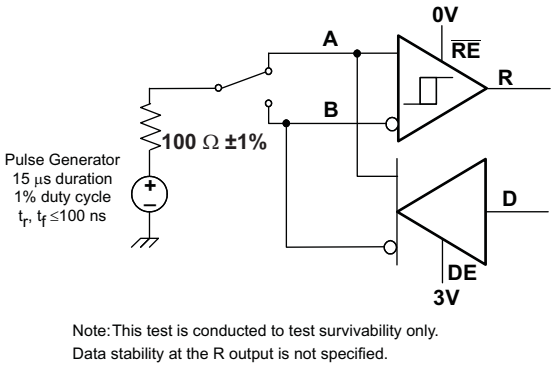


Figure 10. Receiver Enable Test Circuit and Waveforms, Data Output Low



Note: This test is conducted to test survivability only.
Data stability at the R output is not specified.

Figure 11. Transient Over-Voltage Test Circuit

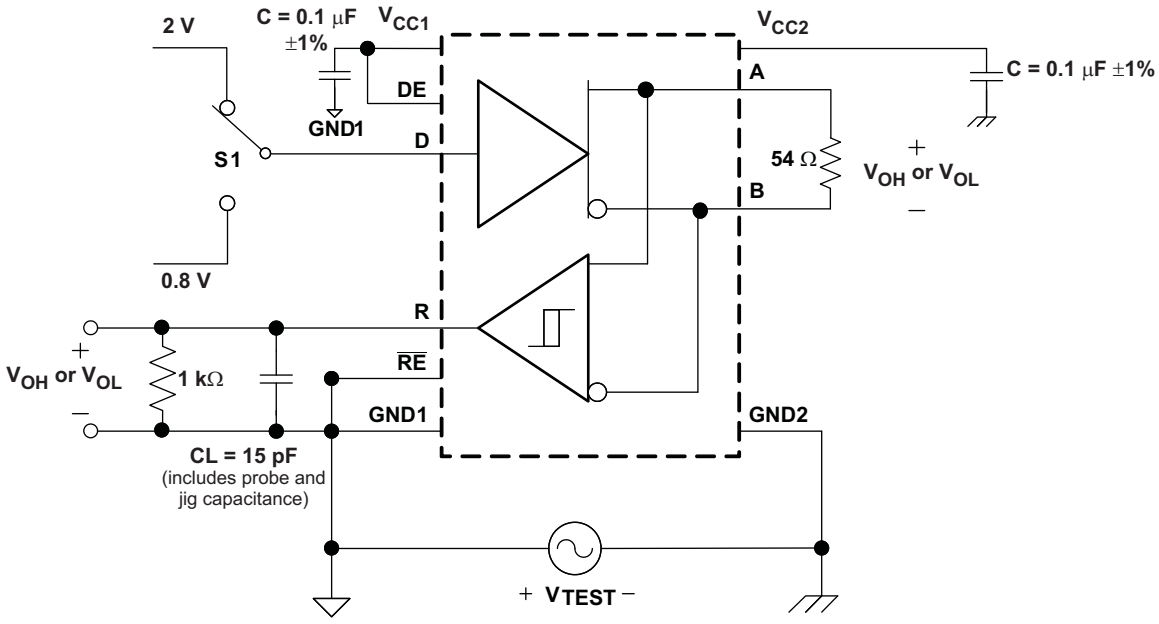


Figure 12. Half-Duplex Common-Mode Transient Immunity Test Circuit

PARAMETER MEASUREMENT INFORMATION (continued)

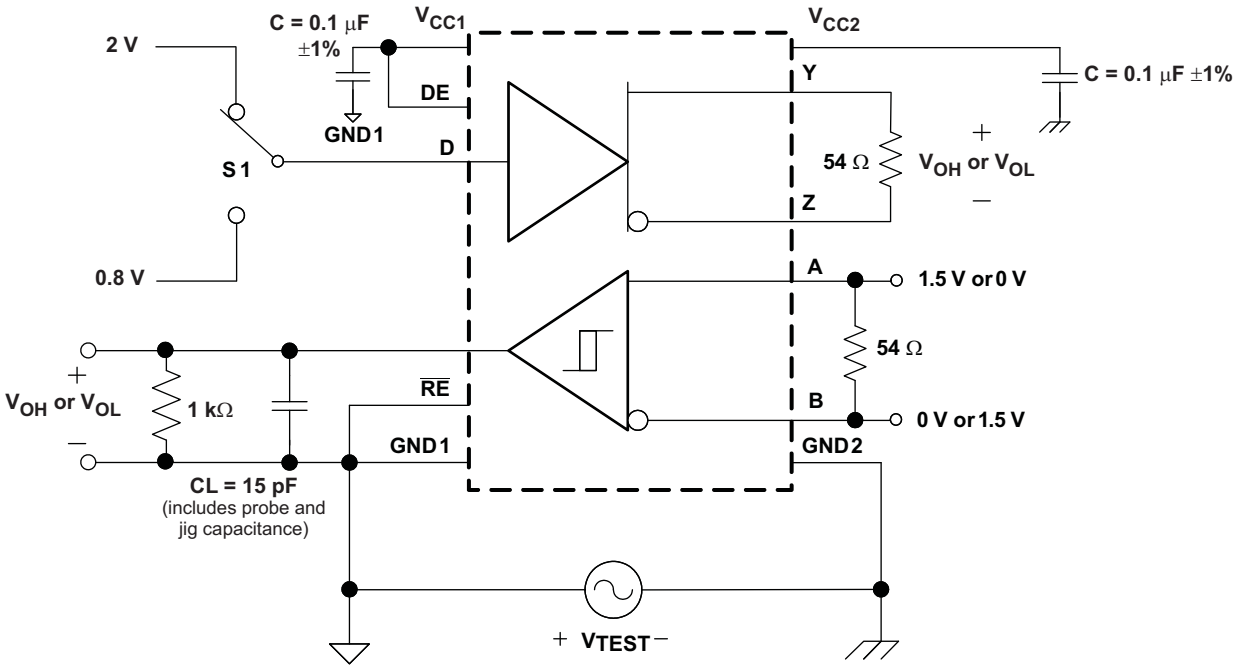


Figure 13. Full-Duplex Common-Mode Transient Immunity Test Circuit

DEVICE INFORMATION

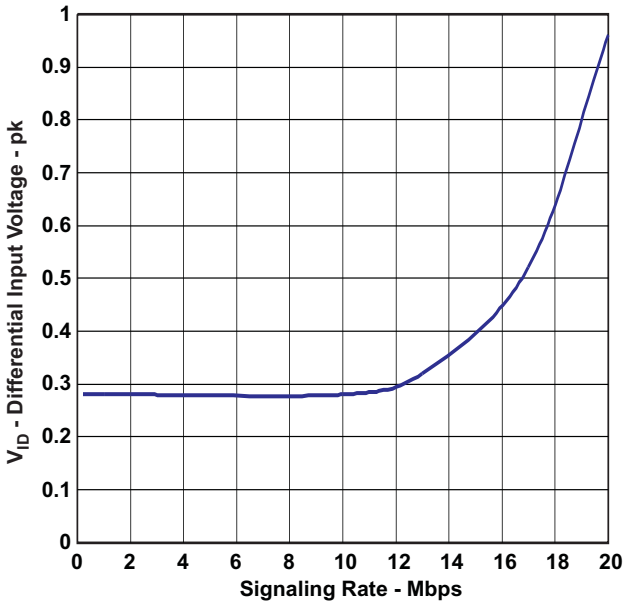


Figure 14. ISO3086 Recommended Minimum Differential Input Voltage vs Signaling Rate

Table 1. Driver Function Table(1)

V_{CC1}	V_{CC2}	INPUT (D)	ENABLE INPUT (DE)	OUTPUTS(1)	
				Y / A	Z / B
PU	PU	H	H	H	L
PU	PU	L	H	L	H
PU	PU	X	L	hi-Z	hi-Z
PU	PU	X	OPEN	hi-Z	hi-Z
PU	PU	OPEN	H	H	L
PD	PU	X	X	hi-Z	hi-Z
PU	PD	X	X	hi-Z	hi-Z
PD	PD	X	X	hi-Z	hi-Z

(1) Driver output pins are Y & Z for full-duplex devices and A & B for half-duplex devices.

Table 2. Receiver Function Table(1)

V_{CC1}	V_{CC2}	DIFFERENTIAL INPUT $V_{ID} = (V_A - V_B)$	ENABLE ($\overline{RE}$)	OUTPUT (R)
PU	PU	$-0.01\ V \le V_{ID}$	L	H
PU	PU	$-0.2\ V < V_{ID} < -0.01\ V$	L	?
PU	PU	$V_{ID} \le -0.2\ V$	L	L
PU	PU	X	H	hi-Z
PU	PU	X	OPEN	hi-Z
PU	PU	Open circuit	L	H
PU	PU	Short Circuit	L	H
PU	PU	Idle (terminated) bus	L	H
PD	PU	X	X	hi-Z
PU	PD	X	L	H

(1) PU = Powered Up; PD = Powered Down; H = Logic High; L= Logic Low; X = Irrelevant, hi-Z = High Impedance (off), ? = Indeterminate

PACKAGE CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER(1)		TEST CONDITIONS	MIN	TYP	MAX	UNIT
L(I01)	Minimum air gap (Clearance)	Shortest terminal to terminal distance through air	8.34			mm
L(I02)	Minimum external tracking (Creepage)	Shortest terminal to terminal distance across the package surface	8.1			mm
CTI	Tracking resistance (Comparative Tracking Index)	DIN IEC 60112 / VDE 0303 Part 1	≥175			V
	Minimum Internal Gap (Internal Clearance)	Distance through the insulation	0.008			mm
R_{IO}	Isolation resistance	Input to output, V_{IO} = 500 V, all pins on each side of the barrier tied together creating a two-terminal device		$>10^{12}$		Ω
C_{IO}	Barrier capacitance Input to output	VI = 0.4 sin (4E6πt)		2		pF
C_I	Input capacitance to ground	VI = 0.4 sin (4E6πt)		2		pF

(1) Creepage and clearance requirements should be applied according to the specific equipment isolation standards of an application. Care should be taken to maintain the creepage and clearance distance of a board design to ensure that the mounting pads of the isolator on the printed circuit board do not reduce this distance.
Creepage and clearance on a printed circuit board become equal according to the measurement techniques shown in the Isolation Glossary. Techniques such as inserting grooves and/or ribs on a printed circuit board are used to help increase these specifications.

IEC 60664-1 RATINGS TABLE

PARAMETER	TEST CONDITIONS	SPECIFICATION
Basic isolation group	Material group	IIIa
Installation classification	Rated mains voltage ≤ 150 V_{RMS}	I-IV
	Rated mains voltage ≤ 300 V_{RMS}	I-III
	Rated mains voltage ≤ 400 V_{RMS}	I-II

IEC 60747-5-2 INSULATION CHARACTERISTICS (1)

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	SPECIFICATION	UNIT
V_{IORM}	Maximum working insulation voltage		560	V
V_{PR}	Input to output test voltage	Method b1, $V_{PR} = V_{IORM} \times 1.875$, 100% Production test with t = 1 s, Partial discharge < 5 pC	1050	V
V_{IOTM}	Transient overvoltage	t = 60 s	4000	V
R_S	Insulation resistance	V_{IO} = 500 V at T_S	$>10^9$	Ω
	Pollution degree		2	

(1) Climatic Classification 40/125/21

REGULATORY INFORMATION

VDE	CSA	UL
Certified according to IEC 60747-5-2	Approved under CSA Component Acceptance Notice	Recognized under 1577 Component Recognition Program(1)
File Number: 40016131	File Number: 220991	File Number: E181974

(1) Production tested ≥3000 VRMS for 1 second in accordance with UL 1577.

IEC SAFETY LIMITING VALUES

Safety limiting intends to prevent potential damage to the isolation barrier upon failure of input or output circuitry. A failure of the IO can allow low resistance to ground or the supply and, without current limiting, dissipate sufficient power to overheat the die and damage the isolation barrier potentially leading to secondary system failures.

PARAMETER				MIN	TYP	MAX	UNIT
I_S	Safety input, output, or supply current	DW-16	θ_{JA} = 168°C/W, V_I = 5.5 V, T_J = 170°C, T_A = 25°C			157	mA
T_S	Maximum case temperature	DW-16				150	°C

The safety-limiting constraint is the absolute maximum junction temperature specified in the absolute maximum ratings table. The power dissipation and junction-to-air thermal impedance of the device installed in the application hardware determines the junction temperature. The assumed junction-to-air thermal resistance in the Thermal Characteristics table is that of a device installed in the JESD51-3, Low Effective Thermal Conductivity Test Board for Leaded Surface Mount Packages and is conservative. The power is the recommended maximum input voltage times the current. The junction temperature is then the ambient temperature plus the power times the junction-to-air thermal resistance.

THERMAL CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
θ_{JA}	Junction-to-Air	Low-K Thermal Resistance(1)		168		°C/W
		High-K Thermal Resistance		96.1		
θ_{JB}	Junction-to-Board Thermal Resistance			61		°C/W
θ_{JC}	Junction-to-Case Thermal Resistance			48		°C/W
P_D	Device Power Dissipation	$V_{CC1} = V_{CC2} = 5.25$ V, $T_J = 150°C$, $C_L = 15$ pF, Input a 20 MHz 50% duty cycle square wave			220	mW

(1) Tested in accordance with the Low-K or High-K thermal metric definitions of EIA/JESD51-3 for leaded surface mount packages.

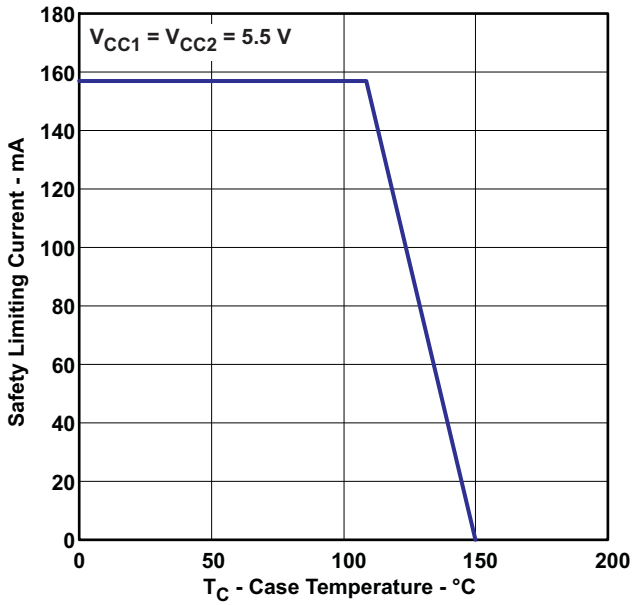
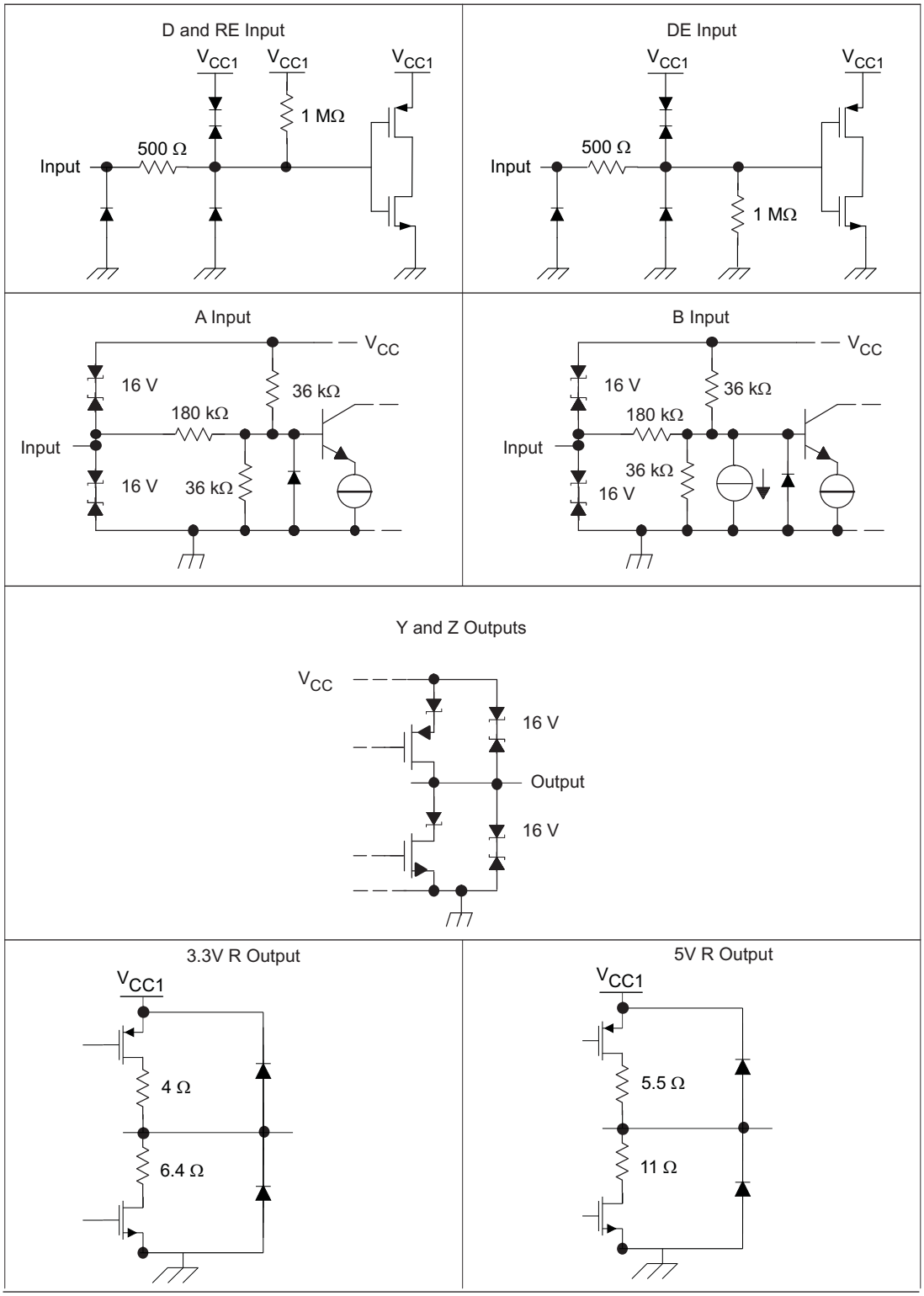


Figure 15. DW-16 θ_{JC} Thermal Derating Curve per IEC 60747-5-2

EQUIVALENT CIRCUIT SCHEMATICS



REVISION HISTORY

Changes from Original (May 2008) to Revision A **Page**

- Changed the Package Characteristics table - L(101) Minimum air gap (Clearance) From 7.7mm To 8.34mm 9
- Deleted the CSA column from the Regulatory Information Table. 10
- Changed the file number in the VDE column of the Regulatory Information table From: 40014131 To: 40016131 10

Changes from Revision A (June 2008) to Revision B **Page**

- Changed Features bullet From: 4000-V_{PEAK} Isolation, To: 4000-V_{PEAK} Isolation,, 560-V_{PEAK} V_{IORM} 1
- Added Features sub bullet: UL 1577, IEC 60747-5-2 (VDE 0884, Rev. 2), IEC 61010-1, IEC 60950-1 and CSA Approved 1
- Added the CSA column to the Regulatory Information table 10

Changes from Revision B (December 2008) to Revision C **Page**

- Changed Recommended Operatings Condition table note From: For 3-V operation, V_{CC1} or V_{CC2} is specified from 3.15 V to 3.6V. To: For 3-V operation, V_{CC1} is specified from 3.15 V to 3.6V. 2

Changes from Revision C (October 2009) to Revision D **Page**

- Added T_{STG} row to the abs max table 2
- Added "Dynamic" conditions to Recommended Operating Conditions V_{ID} spec with reference to Figure 14 2
- Changed for 3 V to 3.3 V in note 1 of the recommended operating table 2
- Deleted V_I = $V_{CC!}$ or 0 V from CMTI spec. Conditions statement. Added "Figure 13" 3
- Changed top row, UNIT column, split into 2 rows, top row µs and second row ns 3
- Added note to bottom of first page of the Parameter Measurement information 4
- Added Figure 14 8
- Added Footnotes to Driver Function Table and Receiver Function Table 9
- Changed File Number from '1698195' to '220991 in Regulatory Information table 10
- Changed $\theta_{JA}$from 212°C/W to 168°C/W in conditions statement for I_S spec.; and MAX current from 210 mA to 157 mA 10
- Changed graph for "DW-16 θ_{JC} Thermal Derating Curve per IEC 60747-5-2", Figure 15 11

Changes from Revision D (January 2011) to Revision E **Page**

- Changed the second list item in FEATURES from 16 kV to 12 kV 1
- Changed ESD HBM spec in the ABS MAX TABLE, value from +/-16 to +/-12 2

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
ISO3080DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3080	Samples
ISO3080DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3080	Samples
ISO3080DWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3080	Samples
ISO3080DWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3080	Samples
ISO3082DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3082	Samples
ISO3082DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3082	Samples
ISO3082DWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3082	Samples
ISO3082DWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3082	Samples
ISO3086DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3086	Samples
ISO3086DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3086	Samples
ISO3086DWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3086	Samples
ISO3088DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3088	Samples
ISO3088DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3088	Samples
ISO3088DWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3088	Samples
ISO3088DWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ISO3088	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

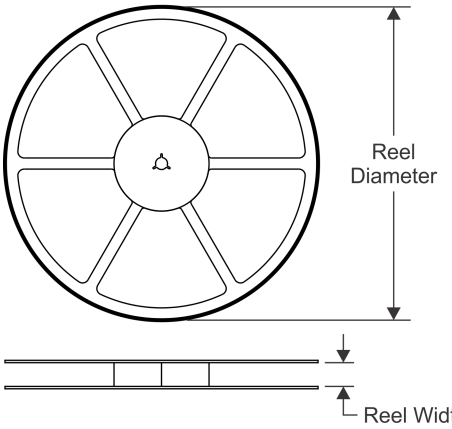
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

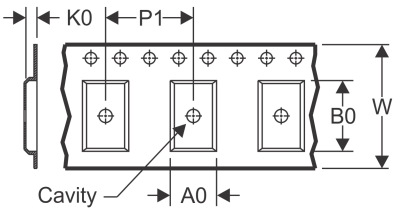
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

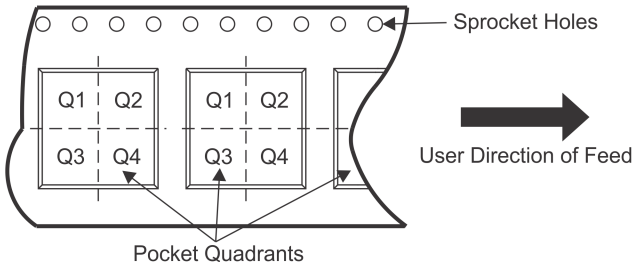


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

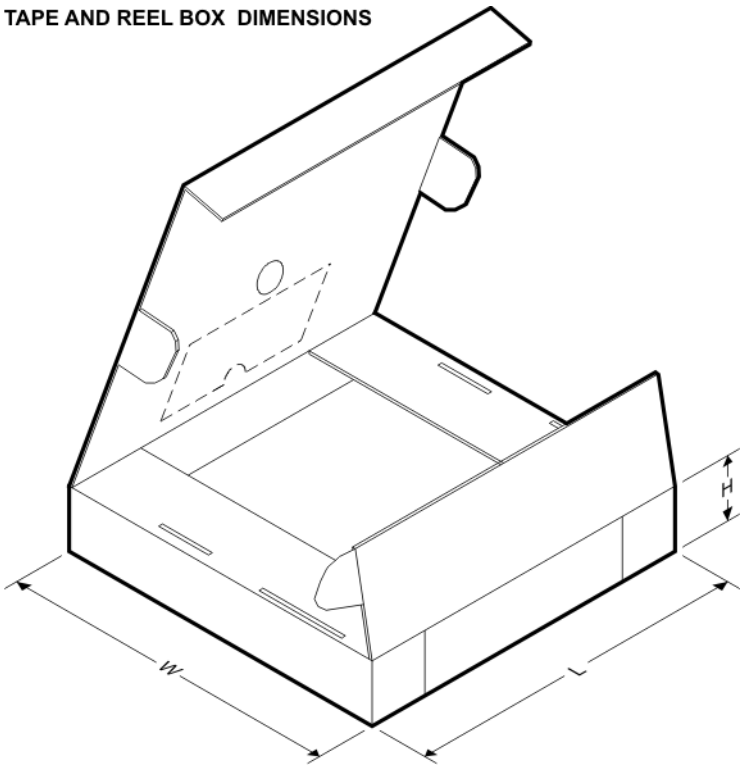
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ISO3080DWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
ISO3082DWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
ISO3086DWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
ISO3088DWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1

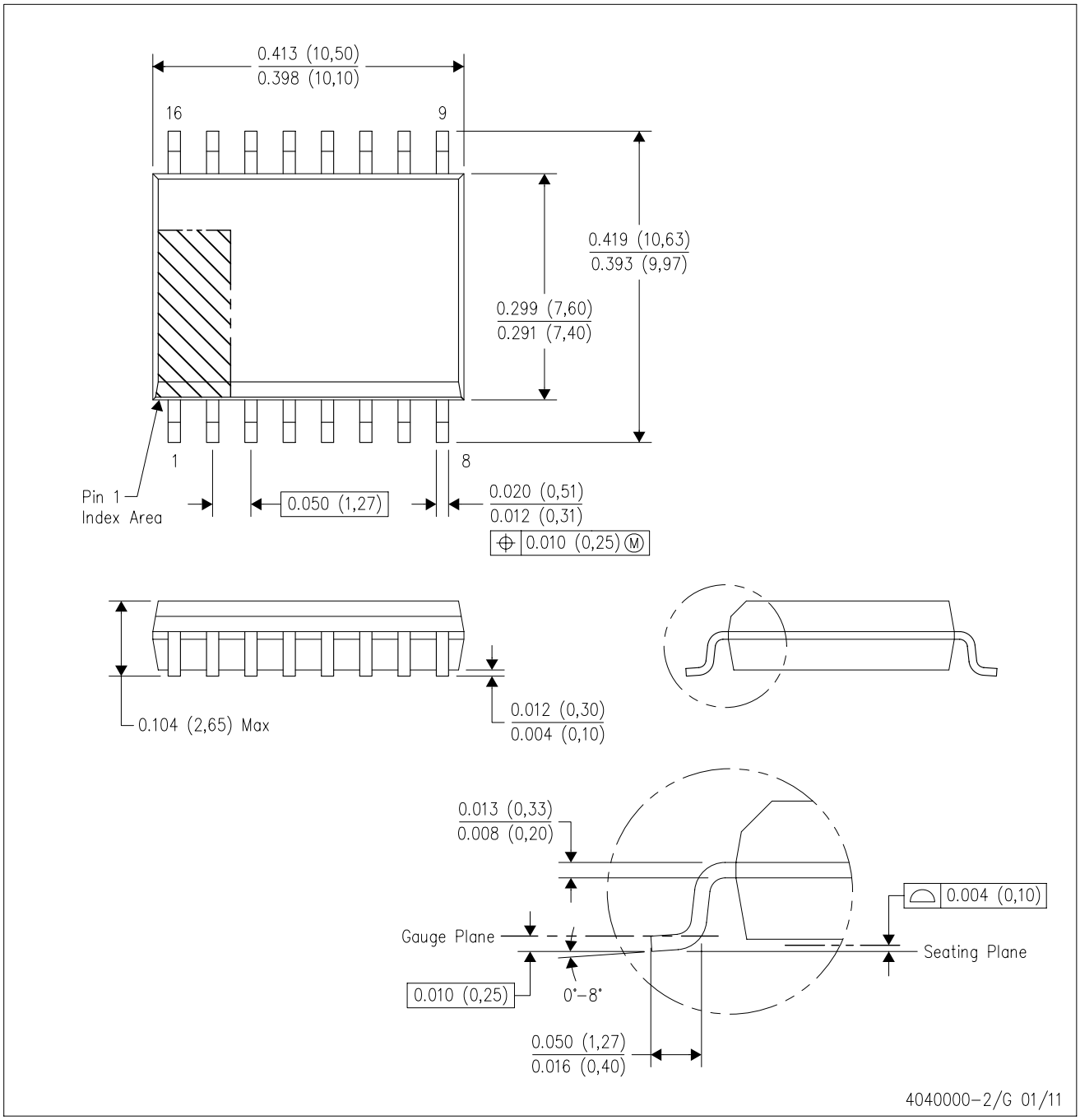
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

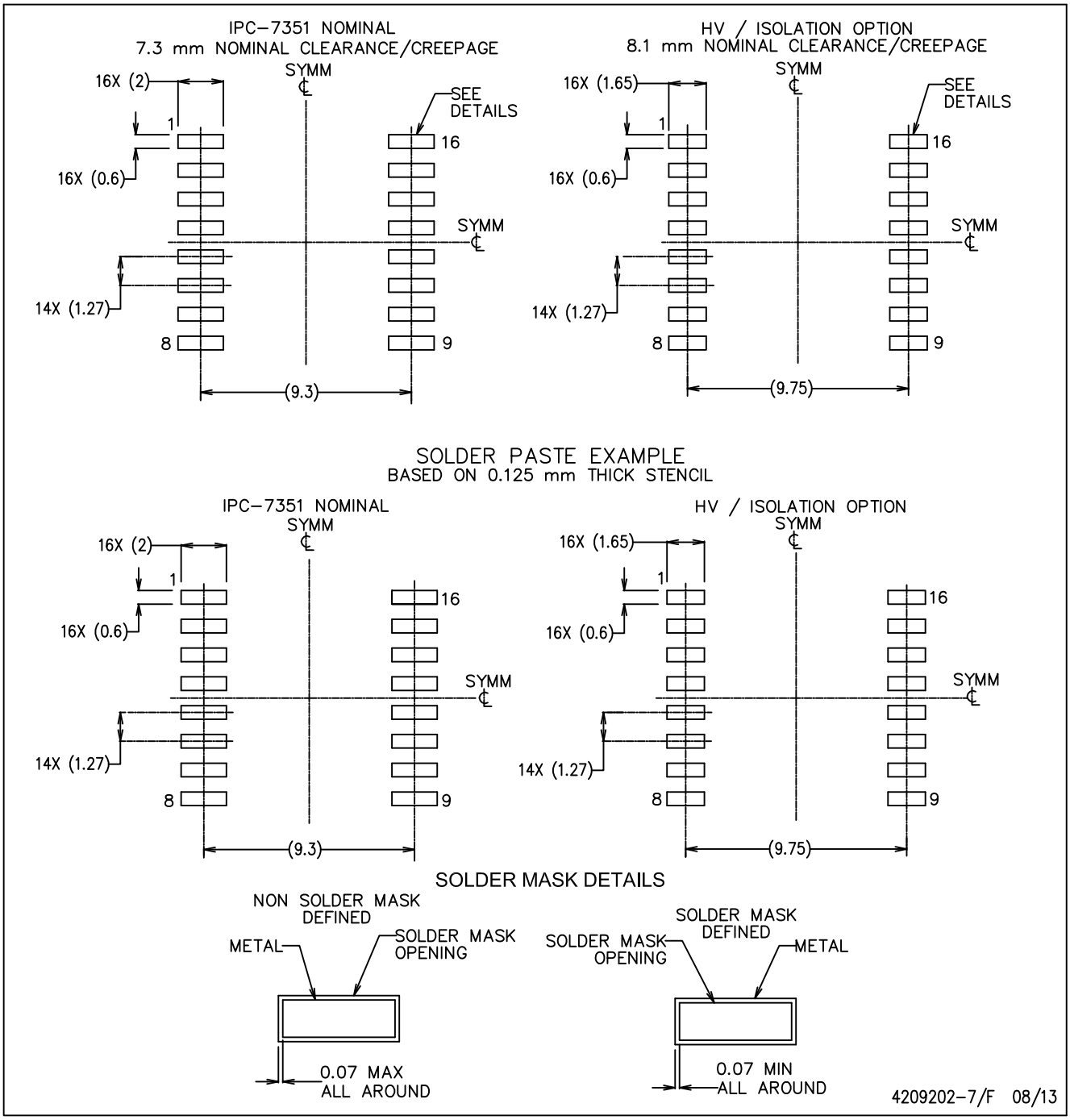
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
ISO3080DWR	SOIC	DW	16	2000	367.0	367.0	38.0
ISO3082DWR	SOIC	DW	16	2000	367.0	367.0	38.0
ISO3086DWR	SOIC	DW	16	2000	367.0	367.0	38.0
ISO3088DWR	SOIC	DW	16	2000	367.0	367.0	38.0

DW (R–PDSO–G16) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS–013 variation AA.

DW (R-PDSO-G16) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Refer to IPC7351 for alternate board design.
D. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
E. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
F. Board assembly site may have different recommendations for stencil design.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

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

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license 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 significant portions 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. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

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

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265