



## HIGH SPEED, TRIPLE DIGITAL ISOLATORS

Check for Samples: [ISO7230C-Q1](#), [ISO7231C-Q1](#)

### FEATURES

- Qualified for Automotive Applications
- 25 and 150-Mbps Signaling Rate Options
  - Low Channel-to-Channel Output Skew
  - Low Pulse-Width Distortion (PWD)
  - Low Jitter Content; 1 ns Typ at 150 Mbps
- Typical 25-Year Life at Rated Working Voltage (See Application Note [SLLA197](#) and [Figure 14](#))
- 4000-V<sub>peak</sub> Isolation, 560-V<sub>peak</sub> V<sub>IORM</sub>
  - UL 1577, IEC 60747-5-2 (VDE 0884, Rev 2), IE 61010-1, IEC 60950-1 and CSA Approved
- 4 kV ESD Protection
- Operate With 3.3-V or 5-V Supplies
- High Electromagnetic Immunity (See Application Note [SLLA181](#))
- –40°C to 125°C Operating Range

### DESCRIPTION

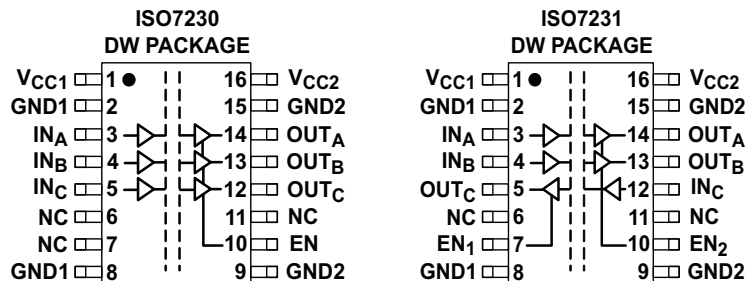
The ISO7230C-Q1 and ISO7231C-Q1 are triple-channel digital isolators each with multiple channel configurations and output enable functions. These devices have logic input and output buffers separated by TI's silicon dioxide (SiO<sub>2</sub>) isolation barrier. Used in conjunction with isolated power supplies, these devices block high voltage, isolate grounds, and prevent noise currents on a data bus or other circuits from entering the local ground and interfering with or damaging sensitive circuitry.

The ISO7230C-Q1 triple-channel device has all three channels in the same direction while the ISO7231C-Q1 has two channels in one direction and one channel in opposition. These devices have an active-high output enable that when driven to a low level, places the output in a high-impedance state.

The ISO7230C-Q1 and ISO7231C-Q1 have TTL input thresholds and a noise-filter at the input that prevents transient pulses of up to 2 ns in duration from being passed to the output of the device.

In each device, a periodic update pulse is sent across the isolation barrier to ensure the proper dc level of the output. If this dc-refresh pulse is not received, the input is assumed to be unpowered or not being actively driven, and the failsafe circuit drives the output to a logic high state. (Contact TI for a logic low failsafe option).

These devices require two supply voltages of 3.3-V, 5-V, or any combination. All inputs are 5-V tolerant when supplied from a 3.3-V supply and all outputs are 4-mA CMOS. These devices are characterized for operation over the ambient temperature range of –40°C to 125°C.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## FUNCTION DIAGRAM

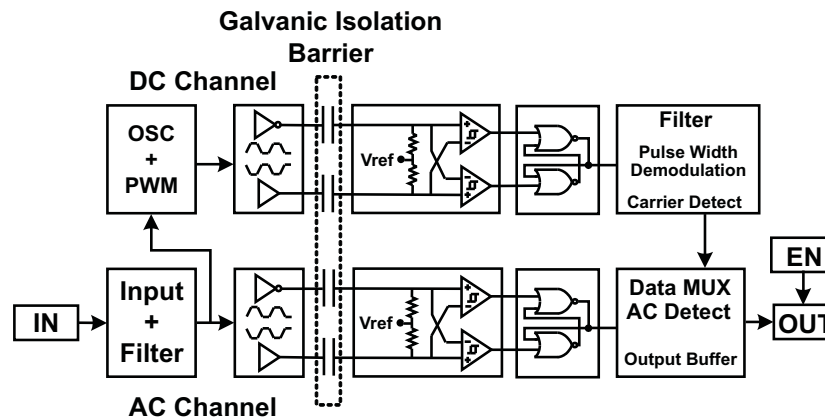


Table 1. Device Function Table ISO723xC-Q1 <sup>(1)</sup>

INPUT $V_{CC}$	OUTPUT $V_{CC}$	INPUT (IN)	OUTPUT ENABLE (EN)	OUTPUT (OUT)
PU	PU	H	H or Open	H
		L	H or Open	L
		X	L	Z
		Open	H or Open	H
PD	PU	X	H or Open	H
PD	PU	X	L	Z

(1) PU = Powered Up; PD = Powered Down ; X = Irrelevant; H = High Level; L = Low Level

## ORDERING INFORMATION<sup>(1)</sup>

$T_A$	PACKAGE		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 125°C	SOIC - DW	Reel of 2000	ISO7230CQDWRQ1	PREVIEW
			ISO7231CQDWRQ1	ISO7231CQ

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at [www.ti.com](http://www.ti.com).

**ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

		VALUE	UNIT		
V <sub>CC</sub>	Supply voltage <sup>(2)</sup> , V <sub>CC1</sub> , V <sub>CC2</sub>	-0.5 to 6	V		
V <sub>I</sub>	Voltage at IN, OUT, EN	-0.5 to 6	V		
I <sub>O</sub>	Output current	±15	mA		
ESD	Electrostatic discharge	Human Body Model	All pins	±4	kV
		Field-Induced-Charged Device Model		±1	
		Machine Model		±200	V
T <sub>J</sub>	Maximum junction temperature	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 are with respect to network ground terminal and are peak voltage values.

**RECOMMENDED OPERATING CONDITIONS**

		MIN	TYP	MAX	UNIT
V <sub>CC</sub>	Supply voltage <sup>(1)</sup> , V <sub>CC1</sub> , V <sub>CC2</sub>	3.15		5.5	V
I <sub>OH</sub>	High-level output current	-4			mA
I <sub>OL</sub>	Low-level output current			4	mA
t <sub>ui</sub>	Input pulse width	40			ns
1/t <sub>ui</sub>	Signaling rate	0	30 <sup>(2)</sup>	25	Mbps
V <sub>IH</sub>	High-level input voltage (IN) (EN on all devices)	2		V <sub>CC</sub>	V
V <sub>IL</sub>	Low-level input voltage (IN) (EN on all devices)	0		0.8	
T <sub>A</sub>	Operating free-air temperature	-40		125	°C
H	External magnetic field-strength immunity per IEC 61000-4-8 and IEC 61000-4-9 certification			1000	A/m

- (1) For the 5-V operation, V<sub>CC1</sub> or V<sub>CC2</sub> is specified from 4.5 V to 5.5 V.  
For the 3-V operation, V<sub>CC1</sub> or V<sub>CC2</sub> is specified from 3.15 V to 3.6 V.
- (2) Typical signalling rate under ideal conditions at 25°C.

**ELECTRICAL CHARACTERISTICS:  $V_{CC1}$  and  $V_{CC2}$  at 5-V<sup>(1)</sup> OPERATION**

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
<b>SUPPLY CURRENT</b>							
$I_{CC1}$	ISO7230C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, $EN_2$ at 3 V		1	3	mA
		25 Mbps			7	9.5	
	ISO7231C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, $EN_1$ at 3 V, $EN_2$ at 3 V		6.5	11	mA
		25 Mbps			11	17	
$I_{CC2}$	ISO7230C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, $EN_2$ at 3 V		15	22	mA
		25 Mbps			17	24	
	ISO7231C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, $EN_1$ at 3 V, $EN_2$ at 3 V		13	20	mA
		25 Mbps			17.5	27	
<b>ELECTRICAL CHARACTERISTICS</b>							
$I_{OFF}$	Sleep mode output current	EN at 0 V, Single channel		0			$\mu$ A
$V_{OH}$	High-level output voltage	$I_{OH} = -4$ mA, See <a href="#">Figure 1</a>		$V_{CC} - 0.8$			V
		$I_{OH} = -20$ $\mu$ A, See <a href="#">Figure 1</a>		$V_{CC} - 0.1$			
$V_{OL}$	Low-level output voltage	$I_{OL} = 4$ mA, See <a href="#">Figure 1</a>				0.4	V
		$I_{OL} = 20$ $\mu$ A, See <a href="#">Figure 1</a>				0.1	
$V_{I(HYS)}$	Input voltage hysteresis			150			mV
$I_{IH}$	High-level input current	IN from 0 V to $V_{CC}$				10	$\mu$ A
$I_{IL}$	Low-level input current			-10			
$C_I$	Input capacitance to ground	IN at $V_{CC}$ , $V_I = 0.4 \sin(4E6\pi t)$		2			pF
CMTI	Common-mode transient immunity	$V_I = V_{CC}$ or 0 V, See <a href="#">Figure 4</a>		25	50		kV/ $\mu$ s

- (1) For the 5-V operation,  $V_{CC1}$  or  $V_{CC2}$  is specified from 4.5 V to 5.5 V.  
For the 3-V operation,  $V_{CC1}$  or  $V_{CC2}$  is specified from 3.15 V to 3.6 V.

**SWITCHING CHARACTERISTICS:  $V_{CC1}$  and  $V_{CC2}$  at 5-V OPERATION**

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$	Propagation delay	See <a href="#">Figure 1</a>	18		45	ns
PWD	Pulse-width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $				5	
$t_{sk(pp)}$	Part-to-part skew <sup>(2)</sup>				8	ns
$t_{sk(o)}$	Channel-to-channel output skew <sup>(3)</sup>		0		4	ns
$t_r$	Output signal rise time	See <a href="#">Figure 1</a>		2		ns
$t_f$	Output signal fall time			2		
$t_{PHZ}$	Propagation delay, high-level-to-high-impedance output	See <a href="#">Figure 2</a>		15	25	ns
$t_{PZH}$	Propagation delay, high-impedance-to-high-level output			15	25	
$t_{PLZ}$	Propagation delay, low-level-to-high-impedance output			15	25	
$t_{PZL}$	Propagation delay, high-impedance-to-low-level output			15	25	
$t_{fs}$	Failsafe output delay time from input power loss	See <a href="#">Figure 3</a>		12		$\mu$ s

- (1) Also referred to as pulse skew.
- (2)  $t_{sk(pp)}$  is the magnitude of the difference in propagation delay times between any specified terminals of two devices when both devices operate with the same supply voltages, at the same temperature, and have identical packages and test circuits.
- (3)  $t_{sk(o)}$  is the skew between specified outputs of a single device with all driving inputs connected together and the outputs switching in the same direction while driving identical specified loads.

**ELECTRICAL CHARACTERISTICS:  $V_{CC1}$  at 5-V,  $V_{CC2}$  at 3.3-V<sup>(1)</sup> OPERATION**

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
<b>SUPPLY CURRENT</b>							
$I_{CC1}$	ISO7230C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, EN <sub>2</sub> at 3 V		1	3	mA
		25 Mbps			7	9.5	
	ISO7231C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, EN <sub>1</sub> at 3 V, EN <sub>2</sub> at 3 V		6.5	11	mA
		25 Mbps			11	17	
$I_{CC2}$	ISO7230C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, EN <sub>2</sub> at 3 V		9	15	mA
		25 Mbps			10	17	
	ISO7231C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, EN <sub>1</sub> at 3 V, EN <sub>2</sub> at 3 V		8	12	mA
		25 Mbps			10.5	16	
<b>ELECTRICAL CHARACTERISTICS</b>							
$I_{OFF}$	Sleep mode output current	EN at 0 V, Single channel			0		μA
$V_{OH}$	High-level output voltage	$I_{OH} = -4$ mA, See <a href="#">Figure 1</a>	ISO7230C-Q1	$V_{CC} - 0.4$		V	
			ISO7231C-Q1 (5-V side)	$V_{CC} - 0.8$			
		$I_{OH} = -20$ μA, See <a href="#">Figure 1</a>		$V_{CC} - 0.1$			
$V_{OL}$	Low-level output voltage	$I_{OL} = 4$ mA, See <a href="#">Figure 1</a>		0.4		V	
		$I_{OL} = 20$ μA, See <a href="#">Figure 1</a>		0.1			
$V_{I(HYS)}$	Input voltage hysteresis			150		mV	
$I_{IH}$	High-level input current	IN from 0 V to $V_{CC}$		10		μA	
$I_{IL}$	Low-level input current			-10			
$C_I$	Input capacitance to ground	IN at $V_{CC}$ , $V_I = 0.4 \sin(4E6\pi t)$		2		pF	
CMTI	Common-mode transient immunity	$V_I = V_{CC}$ or 0 V, See <a href="#">Figure 4</a>		25	50	kV/μs	

(1) For the 5-V operation,  $V_{CC1}$  or  $V_{CC2}$  is specified from 4.5 V to 5.5 V.  
For the 3-V operation,  $V_{CC1}$  or  $V_{CC2}$  is specified from 3.15 V to 3.6 V.

**SWITCHING CHARACTERISTICS:  $V_{CC1}$  at 5-V,  $V_{CC2}$  at 3.3-V OPERATION**

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$	Propagation delay, low-to-high-level output	See <a href="#">Figure 1</a>	20		50	ns
PWD	Pulse-width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $				4	
$t_{sk(pp)}$	Part-to-part skew <sup>(2)</sup>				10	ns
$t_{sk(o)}$	Channel-to-channel output skew <sup>(3)</sup>			0	4	ns
$t_r$	Output signal rise time	See <a href="#">Figure 1</a>		2		ns
$t_f$	Output signal fall time			2		
$t_{PHZ}$	Propagation delay, high-level-to-high-impedance output	See <a href="#">Figure 2</a>		15	25	ns
$t_{PZH}$	Propagation delay, high-impedance-to-high-level output			15	25	
$t_{PLZ}$	Propagation delay, low-level-to-high-impedance output			15	25	
$t_{PZL}$	Propagation delay, high-impedance-to-low-level output			15	25	
$t_{fs}$	Failsafe output delay time from input power loss	See <a href="#">Figure 3</a>		18		$\mu$ s

(1) Also known as pulse skew

 (2)  $t_{sk(pp)}$  is the magnitude of the difference in propagation delay times between any specified terminals of two devices when both devices operate with the same supply voltages, at the same temperature, and have identical packages and test circuits.

 (3)  $t_{sk(o)}$  is the skew between specified outputs of a single device with all driving inputs connected together and the outputs switching in the same direction while driving identical specified loads.

**ELECTRICAL CHARACTERISTICS:  $V_{CC1}$  at 3.3-V,  $V_{CC2}$  at 5-V<sup>(1)</sup> OPERATION**

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
<b>SUPPLY CURRENT</b>							
$I_{CC1}$	ISO7230C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, $EN_2$ at 3 V	0.5		1	mA
		25 Mbps		3		5	
	ISO7231C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, $EN_1$ at 3 V, $EN_2$ at 3 V	4.5		7	mA
		25 Mbps		6.5		11	
$I_{CC2}$	ISO7230C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, $EN_2$ at 3 V	15		22	mA
		25 Mbps		17		24	
	ISO7231C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, $EN_1$ at 3 V, $EN_2$ at 3 V	13		20	mA
		25 Mbps		17.5		27	
<b>ELECTRICAL CHARACTERISTICS</b>							
$I_{OFF}$	Sleep mode output current	EN at 0 V, Single channel		0			$\mu$ A
$V_{OH}$	High-level output voltage	$I_{OH} = -4$ mA, See <a href="#">Figure 1</a>	ISO7230C-Q1	$V_{CC} - 0.4$			V
			ISO7231C-Q1 (5-V side)	$V_{CC} - 0.8$			
		$I_{OH} = -20$ $\mu$ A, See <a href="#">Figure 1</a>	$V_{CC} - 0.1$				
$V_{OL}$	Low-level output voltage	$I_{OL} = 4$ mA, See <a href="#">Figure 1</a>		0.4			V
		$I_{OL} = 20$ $\mu$ A, See <a href="#">Figure 1</a>		0.1			
$V_{I(HYS)}$	Input voltage hysteresis			150			mV
$I_{IH}$	High-level input current	IN from 0 V to $V_{CC}$		10			$\mu$ A
$I_{IL}$	Low-level input current			-10			
$C_I$	Input capacitance to ground	IN at $V_{CC}$ , $V_I = 0.4 \sin(4E6\pi t)$		2			pF
CMTI	Common-mode transient immunity	$V_I = V_{CC}$ or 0 V, See <a href="#">Figure 4</a>		25	50		kV/ $\mu$ s

(1) For the 5-V operation,  $V_{CC1}$  or  $V_{CC2}$  is specified from 4.5 V to 5.5 V.  
For the 3-V operation,  $V_{CC1}$  or  $V_{CC2}$  is specified from 3.15 V to 3.6 V.



**SWITCHING CHARACTERISTICS:  $V_{CC1}$  at 3.3-V and  $V_{CC2}$  at 5-V OPERATION**

, over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT	
$t_{PLH}$ , $t_{PHL}$	Propagation delay	See Figure 1	20		51	ns	
PWD	Pulse-width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $				4		
$t_{sk(pp)}$	Part-to-part skew <sup>(2)</sup>				10	ns	
$t_{sk(o)}$	Channel-to-channel output skew <sup>(3)</sup>			0	4	ns	
$t_r$	Output signal rise time	See Figure 1			2	ns	
$t_f$	Output signal fall time				2		
$t_{PHZ}$	Propagation delay, high-level-to-high-impedance output	See Figure 2			15	ns	
$t_{PZH}$	Propagation delay, high-impedance-to-high-level output				15		25
$t_{PLZ}$	Propagation delay, low-level-to-high-impedance output				15		25
$t_{PZL}$	Propagation delay, high-impedance-to-low-level output				15		25
$t_{fs}$	Failsafe output delay time from input power loss	See Figure 3			12	$\mu$ s	

(1) Also known as pulse skew

 (2)  $t_{sk(pp)}$  is the magnitude of the difference in propagation delay times between any specified terminals of two devices when both devices operate with the same supply voltages, at the same temperature, and have identical packages and test circuits.

 (3)  $t_{sk(o)}$  is the skew between specified outputs of a single device with all driving inputs connected together and the outputs switching in the same direction while driving identical specified loads.

**ELECTRICAL CHARACTERISTICS:  $V_{CC1}$  and  $V_{CC2}$  at 3.3 V<sup>(1)</sup> OPERATION**

, over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
<b>SUPPLY CURRENT</b>							
$I_{CC1}$	ISO7230C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, all channels, no load, $EN_2$ at 3 V	0.5	1		mA
		25 Mbps		3	5		
	ISO7231C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, all channels, no load, $EN_1$ at 3 V, $EN_2$ at 3 V	4.5	7		mA
		25 Mbps		6.5	11		
$I_{CC2}$	ISO7230C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, all channels, no load, $EN_2$ at 3 V	9	15		mA
		25 Mbps		10	17		
	ISO7231C-Q1	Quiescent	$V_I = V_{CC}$ or 0 V, all channels, no load, $EN_1$ at 3 V, $EN_2$ at 3 V	8	12		mA
		25 Mbps		10.5	16		
<b>ELECTRICAL CHARACTERISTICS</b>							
$I_{OFF}$	Sleep mode output current	EN at 0 V, single channel		0			$\mu$ A
$V_{OH}$	High-level output voltage	$I_{OH} = -4$ mA, See <a href="#">Figure 1</a>		$V_{CC} - 0.4$			V
		$I_{OH} = -20$ $\mu$ A, See <a href="#">Figure 1</a>		$V_{CC} - 0.1$			
$V_{OL}$	Low-level output voltage	$I_{OL} = 4$ mA, See <a href="#">Figure 1</a>		0.4			V
		$I_{OL} = 20$ $\mu$ A, See <a href="#">Figure 1</a>		0.1			
$V_{I(HYS)}$	Input voltage hysteresis			150			mV
$I_{IH}$	High-level input current	IN from 0 V or $V_{CC}$		10			$\mu$ A
$I_{IL}$	Low-level input current			-10			
$C_I$	Input capacitance to ground	IN at $V_{CC}$ , $V_I = 0.4 \sin(4E6\pi t)$		2			pF
CMTI	Common-mode transient immunity	$V_I = V_{CC}$ or 0 V, See <a href="#">Figure 4</a>		25	50		kV/ $\mu$ s

- (1) For the 5-V operation,  $V_{CC1}$  or  $V_{CC2}$  is specified from 4.5 V to 5.5 V.  
For the 3-V operation,  $V_{CC1}$  or  $V_{CC2}$  is specified from 3.15 V to 3.6 V.

**SWITCHING CHARACTERISTICS:  $V_{CC1}$  and  $V_{CC2}$  at 3.3-V OPERATION**

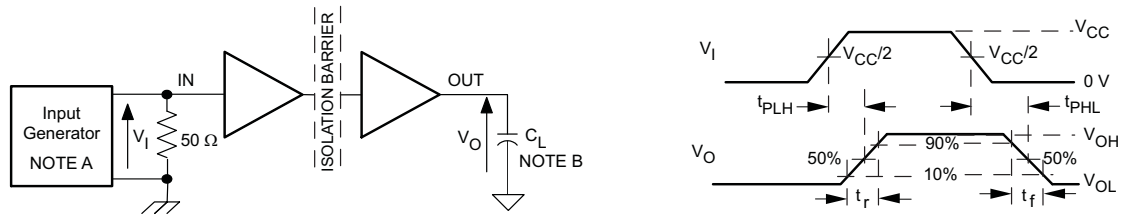
over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$	Propagation delay	See <a href="#">Figure 1</a>	25		56	ns
PWD	Pulse-width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $				4	
$t_{sk(pp)}$	Part-to-part skew <sup>(2)</sup>				10	ns
$t_{sk(o)}$	Channel-to-channel output skew			0	4	ns
$t_r$	Output signal rise time	See <a href="#">Figure 1</a>		2		ns
$t_f$	Output signal fall time			2		
$t_{PHZ}$	Propagation delay, high-level-to-high-impedance output	See <a href="#">Figure 2</a>		15	25	ns
$t_{PZH}$	Propagation delay, high-impedance-to-high-level output			15	25	
$t_{PLZ}$	Propagation delay, low-level-to-high-impedance output			15	25	
$t_{PZL}$	Propagation delay, high-impedance-to-low-level output			15	25	
$t_{fs}$	Failsafe output delay time from input power loss	See <a href="#">Figure 3</a>		18		$\mu$ s

(1) Also referred to as pulse skew.

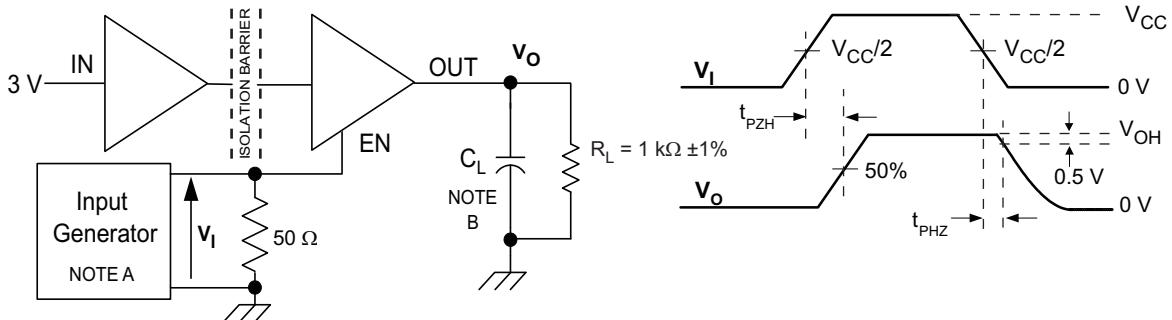
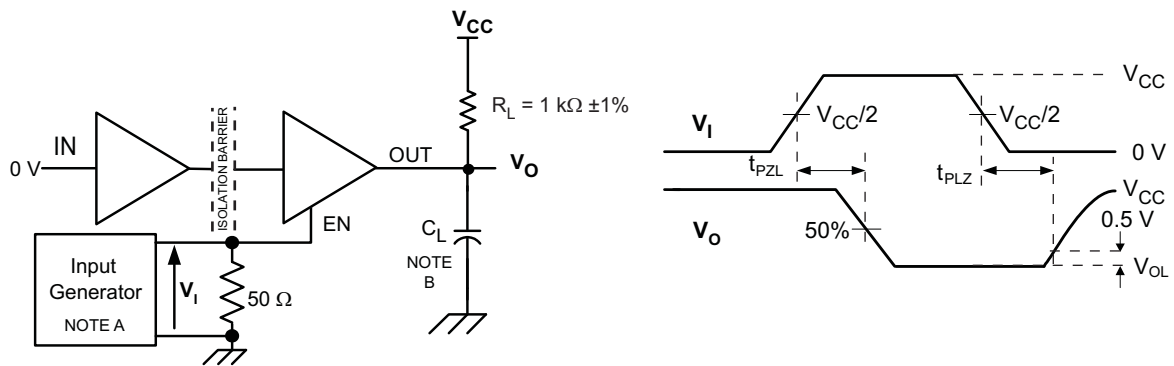
 (2)  $t_{sk(pp)}$  is the magnitude of the difference in propagation delay times between any specified terminals of two devices when both devices operate with the same supply voltages, at the same temperature, and have identical packages and test circuits.

PARAMETER MEASUREMENT INFORMATION



- A. The input pulse is supplied by a generator having the following characteristics: PRR  $\leq$  50 kHz, 50% duty cycle,  $t_r \leq$  3 ns,  $t_f \leq$  3 ns,  $Z_O = 50\Omega$ .
- B.  $C_L = 15$  pF and includes instrumentation and fixture capacitance within  $\pm 20\%$ .

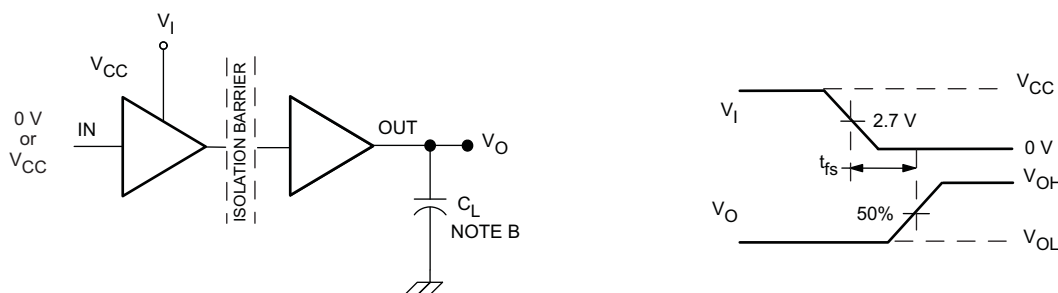
Figure 1. Switching Characteristic Test Circuit and Voltage Waveforms



- A. The input pulse is supplied by a generator having the following characteristics: PRR  $\leq$  50 kHz, 50% duty cycle,  $t_r \leq$  3 ns,  $t_f \leq$  3 ns,  $Z_O = 50\Omega$ .
- B.  $C_L = 15$  pF and includes instrumentation and fixture capacitance within  $\pm 20\%$ .

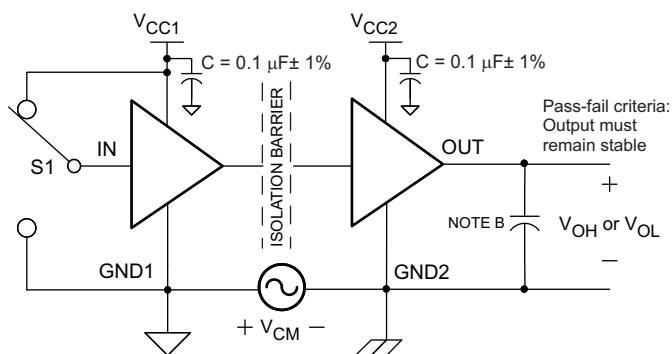
Figure 2. Enable/Disable Propagation Delay Time Test Circuit and Waveform

PARAMETER MEASUREMENT INFORMATION (continued)



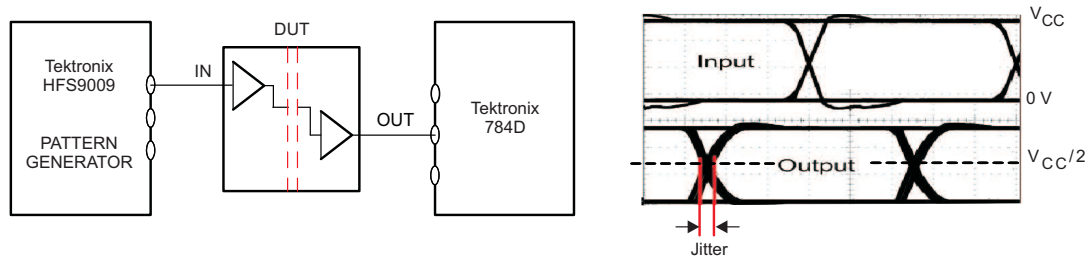
- A. The input pulse is supplied by a generator having the following characteristics: PRR  $\leq$  50 kHz, 50% duty cycle,  $t_r \leq$  3 ns,  $t_f \leq$  3 ns,  $Z_O = 50\Omega$ .
- B.  $C_L = 15$  pF and includes instrumentation and fixture capacitance within  $\pm 20\%$ .

Figure 3. Failsafe Delay Time Test Circuit and Voltage Waveforms



- A. The input pulse is supplied by a generator having the following characteristics: PRR  $\leq$  50 kHz, 50% duty cycle,  $t_r \leq$  3 ns,  $t_f \leq$  3 ns,  $Z_O = 50\Omega$ .
- B.  $C_L = 15$  pF and includes instrumentation and fixture capacitance within  $\pm 20\%$ .

Figure 4. Common-Mode Transient Immunity Test Circuit and Voltage Waveform



NOTE: PRBS bit pattern run length is  $2^{16} - 1$ . Transition time is 800 ps. NRZ data input has no more than five consecutive 1s or 0s.

Figure 5. Peak-to-Pek Eye-Pattern Jitter Test Circuit and Voltage Waveform

## DEVICE INFORMATION

### PACKAGE CHARACTERISTICS

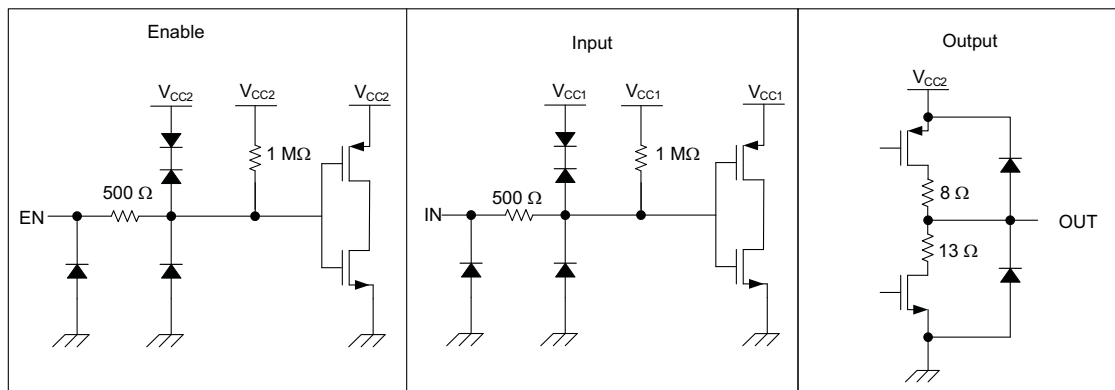
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
L(I01) Minimum air gap (Clearance)	Shortest terminal-to-terminal distance through air	8.34			mm
L(I02) Minimum external tracking (Creepage)	Shortest terminal-to-terminal distance across the package surface	8.1			mm
Minimum Internal Gap (Internal Clearance)	Distance through the insulation	0.008			mm
R <sub>IO</sub> Isolation resistance	Input to output, V <sub>IO</sub> = 500 V, all pins on each side of the barrier tied together creating a two-terminal device, T <sub>A</sub> < 100°C		>10 <sup>12</sup>		Ω
	Input to output, V <sub>IO</sub> = 500 V, 100°C ≤ T <sub>A</sub> ≤ T <sub>A</sub> max		>10 <sup>11</sup>		Ω
C <sub>IO</sub> Barrier capacitance Input to output	V <sub>I</sub> = 0.4 sin (4E6πt)		2		pF
C <sub>I</sub> Input capacitance to ground	V <sub>I</sub> = 0.4 sin (4E6πt)		2		pF

### REGULATORY INFORMATION

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

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

### DEVICE I/O SCHEMATICS



NOTE: Input is assumed to be on V<sub>CC1</sub> side and Output on V<sub>CC2</sub> side.

### THERMAL CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
θ <sub>JA</sub> Junction-to-air	Low-K Thermal Resistance <sup>(1)</sup>		168		°C/W
	High-K Thermal Resistance		96.1		
θ <sub>JB</sub> Junction-to-Board Thermal Resistance			61		°C/W
θ <sub>JC</sub> Junction-to-Case Thermal Resistance			48		°C/W
P <sub>D</sub> Device Power Dissipation	V <sub>CC1</sub> = V <sub>CC2</sub> = 5.5 V, T <sub>J</sub> = 150°C, C <sub>L</sub> = 15 pF, Input a 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.

TYPICAL CHARACTERISTIC CURVES

ISO7230 C/M RMS SUPPLY CURRENT  
vs  
SIGNALING RATE

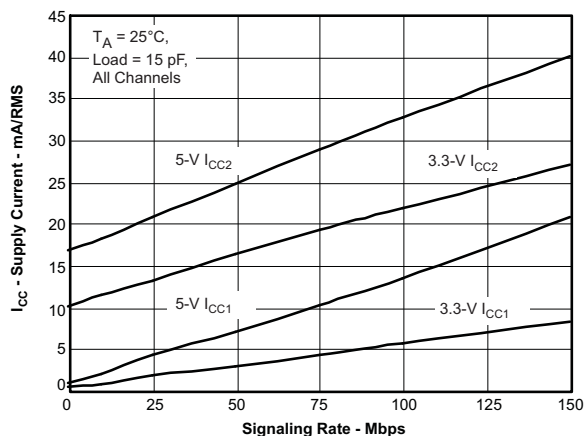


Figure 6.

ISO7231 C/M RMS SUPPLY CURRENT  
vs  
SIGNALING RATE

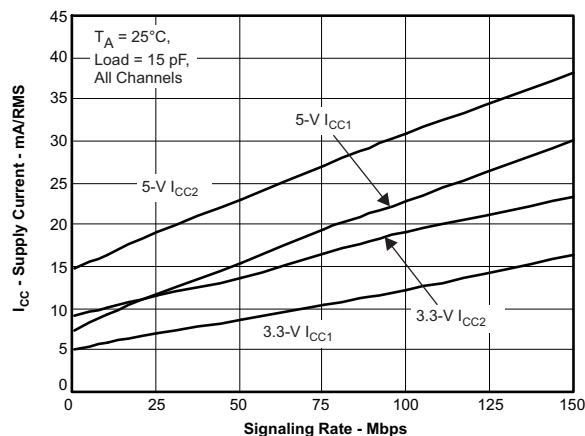


Figure 7.

PROPAGATION DELAY  
vs  
FREE-AIR TEMPERATURE

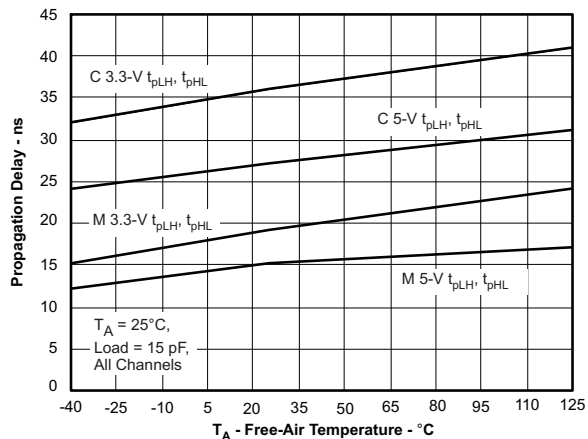


Figure 8.

INPUT THRESHOLD VOLTAGE  
vs  
FREE-AIR TEMPERATURE

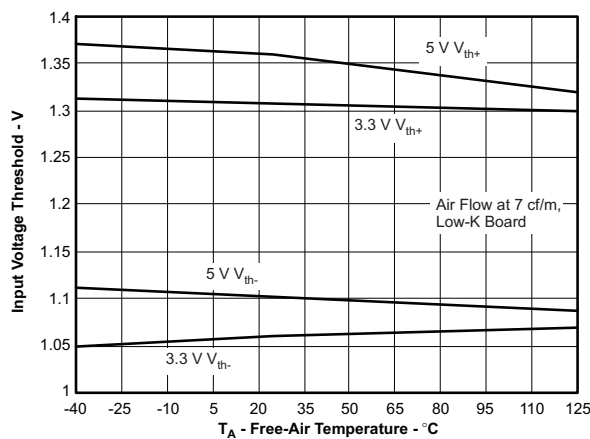


Figure 9.

**TYPICAL CHARACTERISTIC CURVES (continued)**

**V<sub>CC1</sub> FAILSAFE THRESHOLD  
vs  
FREE-AIR TEMPERATURE**

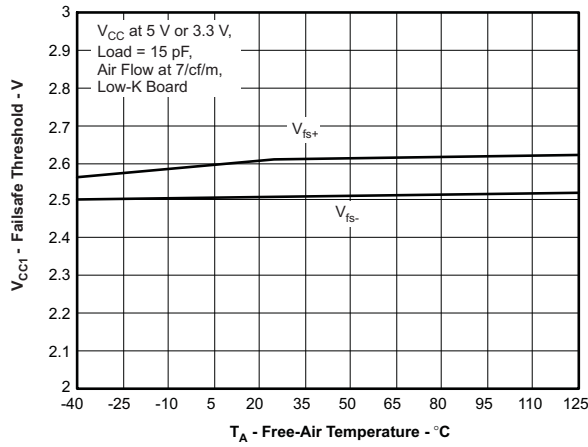


Figure 10.

**HIGH-LEVEL OUTPUT CURRENT  
vs  
HIGH-LEVEL OUTPUT VOLTAGE**

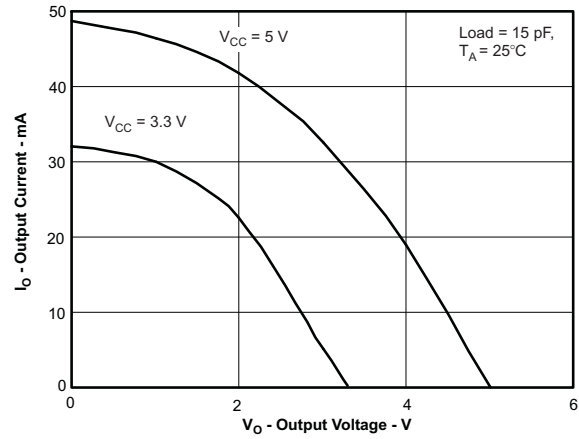


Figure 11.

**LOW-LEVEL OUTPUT CURRENT  
vs  
LOW-LEVEL OUTPUT VOLTAGE**

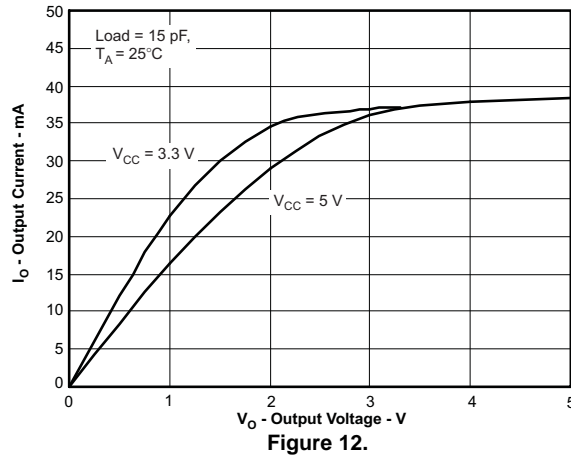


Figure 12.



APPLICATION INFORMATION

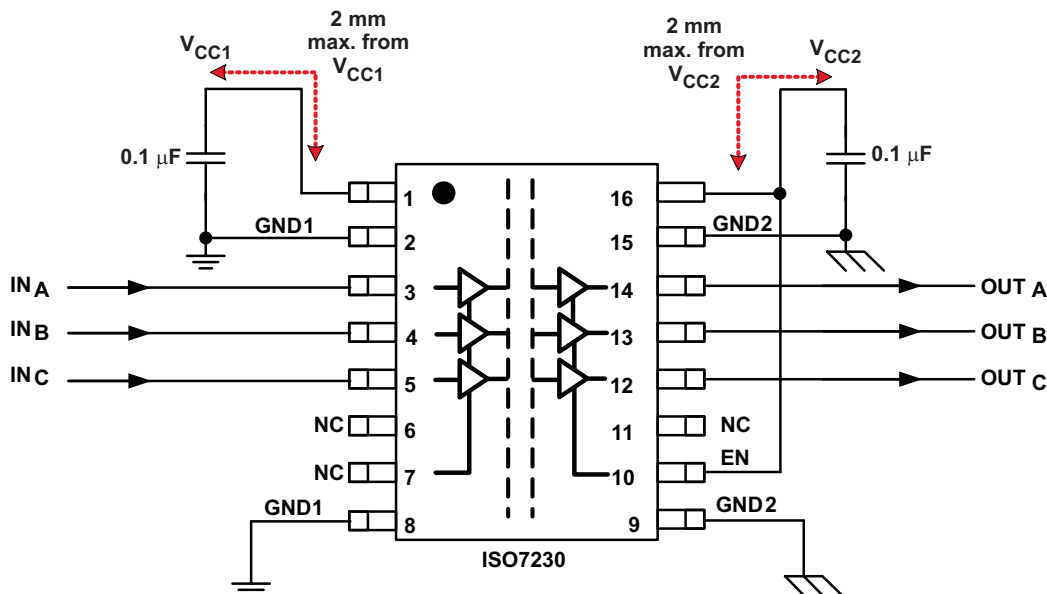


Figure 13. Typical ISO7230 Application Circuit

LIFE EXPECTANCY vs WORKING VOLTAGE

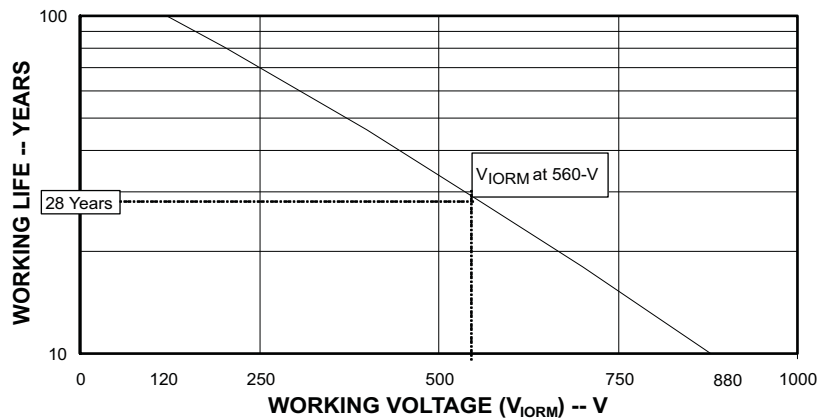


Figure 14. Time Dependant Dielectric Breakdown Testing Results

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
ISO7231CQDWRQ1	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7231CQ	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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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**OTHER QUALIFIED VERSIONS OF ISO7231C-Q1 :**

- Catalog: [ISO7231C](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

## TAPE AND REEL INFORMATION



### 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
ISO7231CQDWRQ1	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)
ISO7231CQDWRQ1	SOIC	DW	16	2000	350.0	350.0	43.0

## GENERIC PACKAGE VIEW

**DW 16**

**SOIC - 2.65 mm max height**

7.5 x 10.3, 1.27 mm pitch

SMALL OUTLINE INTEGRATED CIRCUIT

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



4224780/A



DW0016B

PACKAGE OUTLINE  
SOIC - 2.65 mm max height

SOIC



NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

DW0016B

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:4X



SOLDER MASK DETAILS

4221009/B 07/2016

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



# EXAMPLE STENCIL DESIGN

DW0016B

SOIC - 2.65 mm max height

SOIC



NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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