



# 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

# 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.

ISO7230	ISO7231
DW PACKAGE	DW PACKAGE
$V_{CC1} \blacksquare 1 \bullet 11 16 \blacksquare V_{CC2}$	$V_{CC1} \square 1 \bullet 11 16 \square V_{CC2}$
GND1 $\blacksquare 2 11 15 \blacksquare$ GND2	GND1 $\square 2 11 15 \square$ GND2
IN <sub>B</sub> □ 4 - → i - → 13 □ OUT <sub>B</sub>	IN <sub>B</sub> □ 4 - → + + → 13 □ OUT <sub>B</sub>
IN <sub>C</sub> □ 5 - → - 12 □ OUT <sub>C</sub>	OUT <sub>C</sub> □ 5 - → + → + 12 □ IN <sub>C</sub>
NC	$ \begin{array}{c c} EN_1 \blacksquare 7 \multimap &   \\ GND1 \blacksquare 8 & ! \\ \end{array} \begin{array}{c c} SND2 \blacksquare GND2 \end{array} $



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.

- High Electromagnetic Immunity (See Application Note SLLA181)
- –40°C to 125°C Operating Range





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**

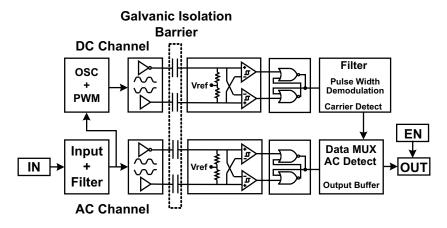


Table 1. Device Function Table ISO723xC-Q1 <sup>(1)</sup>

INPUT V <sub>CC</sub>	OUTPUT V <sub>CC</sub>	INPUT (IN)	OUTPUT ENABLE (EN)	OUTPUT (OUT)
		Н	H or Open	Н
DU	PU	L	H or Open	L
PU		Х	L	Z
		Open	H or Open	Н
PD	PU	Х	X H or Open	
PD	PU	Х	L	Z

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

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

T <sub>A</sub>	PACKAGE		ORDERABLE PART NUMBER	TOP-SIDE MARKING
40°C to 125°C	SOIC - DW	Reel of 2000	ISO7230CQDWRQ1	PREVIEW
–40°C to 125°C	50IC - DW	Reel of 2000	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.

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

				VALUE	UNIT
$V_{CC}$	Supply voltag	e <sup>(2)</sup> , V <sub>CC1</sub> , V <sub>CC2</sub>		–0.5 to 6	V
VI					V
I <sub>O</sub>	Output current				mA
		Human Body Model		±4	kV
ESD	Electrostatic discharge	Field-Induced-Charged Device Model	All pins	±1	ĸv
	uscharge	Machine Model		±200	V
TJ	J 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
VIH	High-level input voltage (IN) (EN on all devices)	2		V <sub>CC</sub>	V
VIL	Low-level input voltage (IN) (EN on all devices)	0		0.8	V
T <sub>A</sub>	Operating free-air temperature	-40		125	°C
Н	External magnetic field-strength immunity per IEC 61000-4-8 and IEC 61000-4-9 certification			1000	A/m

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. Typical sigalling rate under ideal conditions at 25°C. (1)

(2)

STRUMENTS

**EXAS** 

# 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
SUPPLY	CURRENT						
	10070000 04	Quiescent	$V_{I} = V_{CC}$ or 0 V, All channels, no load,		1	3	
	ISO7230C-Q1	25 Mbps	EN <sub>2</sub> at 3 V		7	9.5	mA
I <sub>CC1</sub>	10070040 04	Quiescent	$V_{I} = V_{CC}$ or 0 V, All channels, no load,		6.5	11	~ ^
	ISO7231C-Q1	25 Mbps	EN <sub>1</sub> at 3 V, EN <sub>2</sub> at 3 V		11	17	mA
	ISO7230C-Q1	Quiescent	$V_{I} = V_{CC}$ or 0 V, All channels, no load,		15	22	~ ^
	15072300-Q1	25 Mbps	EN <sub>2</sub> at 3 V		17	24	mA
I <sub>CC2</sub>	10070040 04	Quiescent	$V_{I} = V_{CC}$ or 0 V, All channels, no load,		13	20	~ ^
	ISO7231C-Q1	25 Mbps	$EN_1$ at 3 V, $EN_2$ at 3 V		17.5	27	mA
ELECTR	RICAL CHARACTERISTIC	CS					
I <sub>OFF</sub>	Sleep mode output cur	rent	EN at 0 V, Single channel		0		μA
V	High-level output volta	20	I <sub>OH</sub> = –4 mA, See Figure 1	$V_{CC} - 0.8$			V
V <sub>OH</sub>		ye	$I_{OH} = -20 \ \mu A$ , See Figure 1	$V_{CC} - 0.1$			v
V			I <sub>OL</sub> = 4 mA, See Figure 1			0.4	V
V <sub>OL</sub>	Low-level output voltag	Je	$I_{OL} = 20 \ \mu A$ , See Figure 1			0.1	v
V <sub>I(HYS)</sub>	Input voltage hysteresi	S			150		mV
I <sub>IH</sub>	High-level input curren	t	IN from 0 V to V <sub>CC</sub>			10	
I <sub>IL</sub>	Low-level input current			-10			μA
CI	Input capacitance to g	round	IN at $V_{CC}$ , $V_I = 0.4 \sin (4E6\pi t)$		2		pF
CMTI	Common-mode transie	ent immunity	$V_{I} = V_{CC}$ or 0 V, See Figure 4	25	50		kV/μs

(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.

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# SWITCHING CHARACTERISTICS: $V_{\text{CC1}}$ and $V_{\text{CC2}}$ at 5-V OPERATION

over recommended operating conditions (unless otherwise noted)

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation delay		18		45	
PWD	Pulse-width distortion <sup>(1)</sup>  t <sub>PHL</sub> – t <sub>PLH</sub>	- See Figure 1			5	ns
t <sub>sk(pp)</sub>	Part-to-part skew <sup>(2)</sup>				8	ns
t <sub>sk(o)</sub>	Channel-to-channel output skew (3)			0	4	ns
t <sub>r</sub>	Output signal rise time			2		
t <sub>f</sub>	Output signal fall time	- See Figure 1		2		ns
t <sub>PHZ</sub>	Propagation delay, high-level-to-high-impedance output			15	25	
t <sub>PZH</sub>	Propagation delay, high-impedance-to-high-level output			15	25	
t <sub>PLZ</sub>	Propagation delay, low-level-to-high-impedance output	- See Figure 2		15	25	ns
t <sub>PZL</sub>	Propagation delay, high-impedance-to-low-level output			15	25	
t <sub>fs</sub>	Failsafe output delay time from input power loss	See Figure 3		12		μs

(1) Also referred to as pulse skew.

(2) t<sub>sk(pp)</sub> 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)  $t_{sk(0)}$  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.

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

over recommended operating conditions (unless otherwise noted)

	PARAMETE	R	TEST CONDITI	ONS	MIN	TYP	MAX	UNIT
SUPPL	YCURRENT							
	ISO7230C-Q1	Quiescent		and ENL at 2 \/		1	3	
	1507230C-Q1	25 Mbps	$-V_{I} = V_{CC}$ or 0 V, All channels, no I	$0a0, EN_2 at 3 V$		7	9.5	mA
I <sub>CC1</sub>	ISO7231C-Q1	Quiescent	$V_{I} = V_{CC}$ or 0 V, All channels, no I	oad, EN <sub>1</sub> at 3 V,		6.5	11	<b>س</b> ۸
	1507231C-Q1	25 Mbps	EN <sub>2</sub> at 3 V			11	17	mA
	ISO7230C-Q1	Quiescent	$- \frac{1}{2} \sqrt{- \frac{1}{2}} - \frac{$	$V_1 = V_{CC}$ or 0 V, All channels, no load, EN <sub>2</sub> at 3 V		9	15	mA
	1507250C-Q1	25 Mbps	$v_1 = v_{CC}$ or 0 v, All charmens, nor	0a0, EN <sub>2</sub> at 5 V		10	17	IIIA
I <sub>CC2</sub>	ISO7231C-Q1	Quiescent	$V_{I} = V_{CC}$ or 0 V, All channels, no I	$V_{\rm I} = V_{\rm CC}$ or 0 V, All channels, no load, EN <sub>1</sub> at 3 V,		8	12	12 16 mA
	1507251C-Q1	25 Mbps	EN <sub>2</sub> at 3 V			10.5	16	
ELECT	RICAL CHARACTER	RISTICS						
I <sub>OFF</sub>	Sleep mode outp	out current	EN at 0 V, Single channel	EN at 0 V, Single channel		0		μA
				ISO7230C-Q1	$V_{CC} - 0.4$			l
V <sub>OH</sub>	High-level output	voltage	I <sub>OH</sub> = –4 mA, See Figure 1	ISO7231C-Q1 (5-V side)	V <sub>CC</sub> – 0.8			V
			$I_{OH} = -20 \ \mu A$ , See Figure 1		$V_{CC} - 0.1$			
V <sub>OL</sub>	Low-level output	voltago	I <sub>OL</sub> = 4 mA, See Figure 1				0.4	v
VOL		voltage	I <sub>OL</sub> = 20 μA, See Figure 1				0.1	v
V <sub>I(HYS)</sub>	Input voltage hys	teresis				150		mV
I <sub>IH</sub>	High-level input of	current	IN from 0.V/ to V/				10	
IIL	Low-level input c	urrent	- IN from 0 V to V <sub>CC</sub>		-10			μA
CI	Input capacitance	e to ground	IN at $V_{CC}$ , $V_I = 0.4 \sin (4E6\pi t)$	IN at $V_{CC}$ , $V_{I} = 0.4 \sin (4E6\pi t)$		2		pF
CMTI	Common-mode t immunity	ransient	$V_1 = V_{CC}$ or 0 V, See Figure 4		25	50		kV/µs

(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.

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### 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 <sub>PLH</sub> , t <sub>PHL</sub>	Propagation delay, low-to-high-level output		20		50	
PWD	Pulse-width distortion <sup>(1)</sup>  t <sub>PHL</sub> – t <sub>PLH</sub>	See Figure 1			4	ns
t <sub>sk(pp)</sub>	Part-to-part skew <sup>(2)</sup>				10	ns
t <sub>sk(o)</sub>	Channel-to-channel output skew <sup>(3)</sup>			0	4	ns
t <sub>r</sub>	Output signal rise time	See Figure 1		2		20
t <sub>f</sub>	Output signal fall time	- See Figure 1		2		ns
t <sub>PHZ</sub>	Propagation delay, high-level-to-high-impedance output			15	25	
t <sub>PZH</sub>	Propagation delay, high-impedance-to-high-level output			15	25	
t <sub>PLZ</sub>	Propagation delay, low-level-to-high-impedance output	- See Figure 2		15	25	ns
t <sub>PZL</sub>	Propagation delay, high-impedance-to-low-level output			15	25	
t <sub>fs</sub>	Failsafe output delay time from input power loss	See Figure 3		18		μs

(1) Also known as pulse skew

(2) t<sub>sk(pp)</sub> 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)  $t_{sk(0)}$  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.

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# ELECTRICAL CHARACTERISTICS: V<sub>CC1</sub> at 3.3-V, V<sub>CC2</sub> at 5-V<sup>(1)</sup> OPERATION

over recommended operating conditions (unless otherwise noted)

	PARAMETE	R	TEST CONDITION	S	MIN	TYP	MAX	UNIT
SUPPL	Y CURRENT		-					
	ISO7230C-Q1	Quiescent				0.5	1	mA
	15072300-01	25 Mbps	$V_1 = V_{CC}$ or 0 V, All channels, no load, EN <sub>2</sub> at 3 V			3	5	ШA
I <sub>CC1</sub>	ISO7231C-Q1	Quiescent	$V_{I} = V_{CC}$ or 0 V, All channels, no load	l, EN <sub>1</sub> at 3 V,		4.5	7	mA
	15072310-Q1	25 Mbps	EN <sub>2</sub> at 3 V	•		6.5	11	mA
	ISO7230C-Q1	Quiescent	$- \sqrt{-1}$ or $0 \sqrt{-11}$ channels no loss			15	22	mA
	13072300-Q1	25 Mbps	$v_{\rm I} = v_{\rm CC}$ or $v_{\rm V}$ , All charmens, no load	$V_{I} = V_{CC}$ or 0 V, All channels, no load, EN <sub>2</sub> at 3 V		17	24	ma
I <sub>CC2</sub>	ISO7231C-Q1 Quiescent		$V_{I} = V_{CC}$ or 0 V, All channels, no load, EN <sub>1</sub> at 3 V,			13	20	mA
	1307231C-Q1	25 Mbps	EN <sub>2</sub> at 3 V	EN <sub>2</sub> at 3 V		17.5	27	mA
ELECT	RICAL CHARACTEI	RISTICS						
I <sub>OFF</sub>	Sleep mode outp	out current	EN at 0 V, Single channel	EN at 0 V, Single channel		0		μA
			I <sub>OH</sub> = -4 mA, See Figure 1	ISO7230C-Q1	$V_{CC} - 0.4$			
V <sub>OH</sub>	High-level output	voltage		ISO7231C-Q1 (5-V side)	$V_{CC} - 0.8$			V
			$I_{OH} = -20 \ \mu A$ , See Figure 1		V <sub>CC</sub> – 0.1			
V	Low-level output	voltago	$I_{OL} = 4$ mA, See Figure 1 $I_{OL} = 20$ µA, See Figure 1				0.4	V
V <sub>OL</sub>	Low-level output	voltage					0.1	v
V <sub>I(HYS)</sub>	Input voltage hys	steresis				150		mV
I <sub>IH</sub>	High-level input of	current	IN from 0 1/ to 1/				10	
IIL	Low-level input c	urrent	IN from 0 V to V <sub>CC</sub>		-10			μA
CI	Input capacitance	e to ground	IN at $V_{CC}$ , $V_I = 0.4 \sin (4E6\pi t)$			2		pF
CMTI	Common-mode t immunity	ransient	$V_I = V_{CC}$ or 0 V, See Figure 4		25	50		kV/µs

(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.

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

, over recommended operating conditions (unless otherwise noted)

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

(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.  $t_{sk(0)}$  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. (3)

STRUMENTS

**EXAS** 

# ELECTRICAL CHARACTERISTICS: $V_{cc1}$ and $V_{cc2}$ at 3.3 $V^{(1)}$ OPERATION

, over recommended operating conditions (unless otherwise noted)

	PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
SUPPLY	CURRENT					·	
	ISO7230C-Q1	Quiescent	$V_{I} = V_{CC}$ or 0 V, all channels, no load,		0.5	1	
	15072300-Q1	25 Mbps	EN <sub>2</sub> at 3 V		3	5	mA
I <sub>CC1</sub>	10070040 04	Quiescent	$V_{I} = V_{CC}$ or 0 V, all channels, no load,		4.5	7	
	ISO7231C-Q1	25 Mbps	EN <sub>1</sub> at 3 V, EN <sub>2</sub> at 3 V		6.5	11	mA
	ISO7230C-Q1	Quiescent $V_{I} = V_{CC}$ or 0 V, all channels, no load,		9	15		
		25 Mbps	EN <sub>2</sub> at 3 V		10	17	mA
I <sub>CC2</sub>	ISO7231C-Q1	Quiescent	$V_{I} = V_{CC}$ or 0 V, all channels, no load,		8	12	mA
	15072310-Q1	25 Mbps	EN <sub>1</sub> at 3 V, EN <sub>2</sub> at 3 V		10.5	16	ШA
ELECTR	RICAL CHARACTERISTICS	ł				·	
I <sub>OFF</sub>	Sleep mode output current		EN at 0 V, single channel		0		μA
V	High lovel output veltage		I <sub>OH</sub> = -4 mA, See Figure 1	$V_{CC} - 0.4$			V
V <sub>OH</sub>	High-level output voltage		$I_{OH} = -20 \ \mu A$ , See Figure 1	V <sub>CC</sub> - 0.1			v
V			I <sub>OL</sub> = 4 mA, See Figure 1			0.4	V
V <sub>OL</sub>	Low-level output voltage		I <sub>OL</sub> = 20 μA, See Figure 1			0.1	v
V <sub>I(HYS)</sub>	Input voltage hysteresis				150		mV
I <sub>IH</sub>	High-level input current					10	
IIL	Low-level input current		IN from 0 V or V <sub>CC</sub>	-10	-10		μA
CI	Input capacitance to ground	I	IN at $V_{CC}$ , $V_{I} = 0.4 \sin (4E6\pi t)$		2		pF
CMTI	Common-mode transient im	munity	$V_1 = V_{CC}$ or 0 V, See Figure 4	25	50		kV/µs

(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.



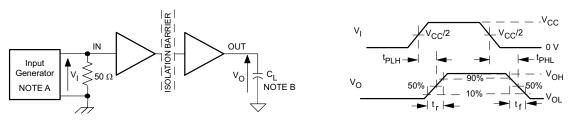
# SWITCHING CHARACTERISTICS: $V_{CC1}$ and $V_{CC2}$ at 3.3-V OPERATION

over recommended operating conditions (unless otherwise noted)

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation delay	One Firmer 4	25		56	
PWD	Pulse-width distortion <sup>(1)</sup>  t <sub>PHL</sub> – t <sub>PLH</sub>	See Figure 1			4	ns
t <sub>sk(pp)</sub>	Part-to-part skew <sup>(2)</sup>				10	ns
t <sub>sk(o)</sub>	Channel-to-channel output skew			0	4	ns
t <sub>r</sub>	Output signal rise time	See Figure 1		2		
t <sub>f</sub>	Output signal fall time	See Figure 1		2		ns
t <sub>PHZ</sub>	Propagation delay, high-level-to-high-impedance output			15	25	
t <sub>PZH</sub>	Propagation delay, high-impedance-to-high-level output			15	25	
t <sub>PLZ</sub>	Propagation delay, low-level-to-high-impedance output	- See Figure 2		15	25	ns
t <sub>PZL</sub>	Propagation delay, high-impedance-to-low-level output			15	25	
t <sub>fs</sub>	Failsafe output delay time from input power loss	See Figure 3		18		μs

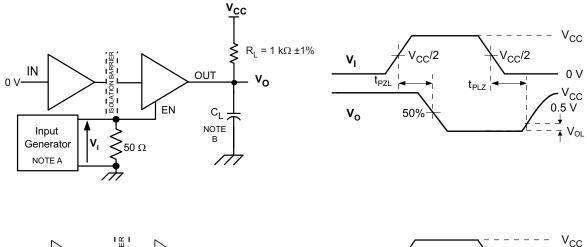
Also referred to as pulse skew.
t<sub>sk(pp)</sub> is the magnitude of the difference in propagation delay times between any specified terminals of two devices when both devices operate with the same supply voltages, at the same temperature, and have identical packages and test circuits.

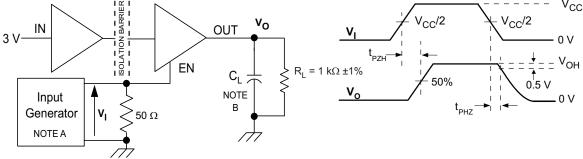
### PARAMETER MEASUREMENT INFORMATION



- A. The input pulse is supplied by a generator having the following characteristics: PRR  $\leq$  50 kHz, 50% duty cycle, t<sub>r</sub>  $\leq$  3 ns, t<sub>f</sub>  $\leq$  3 ns, Z<sub>0</sub> = 50 $\Omega$ .
- B.  $C_L = 15 \text{ pF}$  and includes instrumentation and fixture capacitance within ±20%.

### Figure 1. Switching Characteristic Test Circuit and Voltage Waveforms



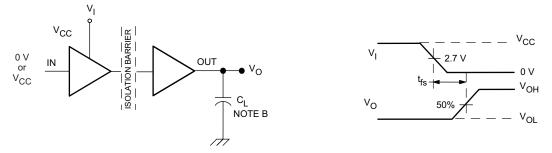


- A. The input pulse is supplied by a generator having the following characteristics: PRR  $\leq$  50 kHz, 50% duty cycle, t<sub>r</sub>  $\leq$  3 ns, t<sub>f</sub>  $\leq$  3 ns, Z<sub>O</sub> = 50 $\Omega$ .
- B.  $C_L = 15 \text{ pF}$  and includes instrumentation and fixture capacitance within ±20%.

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

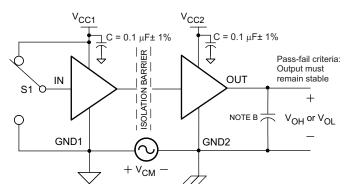


### PARAMETER MEASUREMENT INFORMATION (continued)



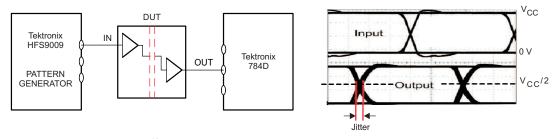
- A. The input pulse is supplied by a generator having the following characteristics: PRR  $\leq$  50 kHz, 50% duty cycle, t<sub>r</sub>  $\leq$  3 ns, t<sub>f</sub>  $\leq$  3 ns, t<sub>f</sub>  $\leq$  3 ns, Z<sub>O</sub> = 50 $\Omega$ .
- B.  $C_L = 15 \text{ pF}$  and includes instrumentation and fixture capacitance within ±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<sub>r</sub>  $\leq$  3 ns, t<sub>f</sub>  $\leq$  3 ns, t<sub>f</sub>  $\leq$  3 ns, Z<sub>D</sub> = 50 $\Omega$ .
- B.  $C_L = 15 \text{ pF}$  and includes instrumentation and fixture capacitance within ±20%.

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



NOTE: PRBS bit pattern run length is 2<sup>16</sup> – 1. Transition time is 800 ps. NRZ data input has no more than five consecutive 1s or 0s.

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

# **DEVICE INFORMATION**

## PACKAGE CHARACTERISTICS

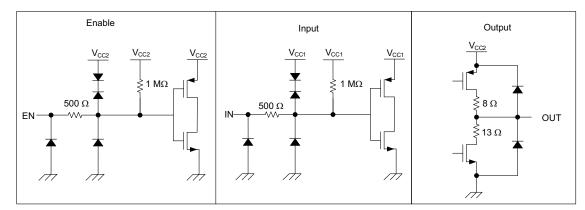
	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
L(I01)	Minimum air gap (Clearance)	Shortest terminal-to-terminal distance through air	8.34			mm
L(I02) Minimum external tracking (Creepage)		Shortest terminal-to-terminal distance across the package surface	8.1			mm
	Minimum Internal Gap (Internal Clearance)	Distance through the insulation	0.008			mm
R <sub>IO</sub>	Isolation resistance	Input to output, $V_{IO}$ = 500 V, all pins on each side of the barrier tied together creating a two-terminal device, $T_A < 100^{\circ}C$		>10 <sup>12</sup>		Ω
		Input to output, $V_{IO} = 500 \text{ V}$ , $100^{\circ}\text{C} \le \text{T}_{A} \le \text{T}_{A} \text{ max}$		>10 <sup>11</sup>		Ω
CIO	Barrier capacitance Input to output	V <sub>I</sub> = 0.4 sin (4E6πt)		2		pF
CI	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  $\ge$  3000 VRMS for 1 second in accordance with UL 1577.

# **DEVICE I/O SCHEMATICS**



NOTE: Input is assumed to be on  $V_{\text{CC1}}$  side and Output on  $V_{\text{CC2}}$  side.

### THERMAL CHARACTERISTICS

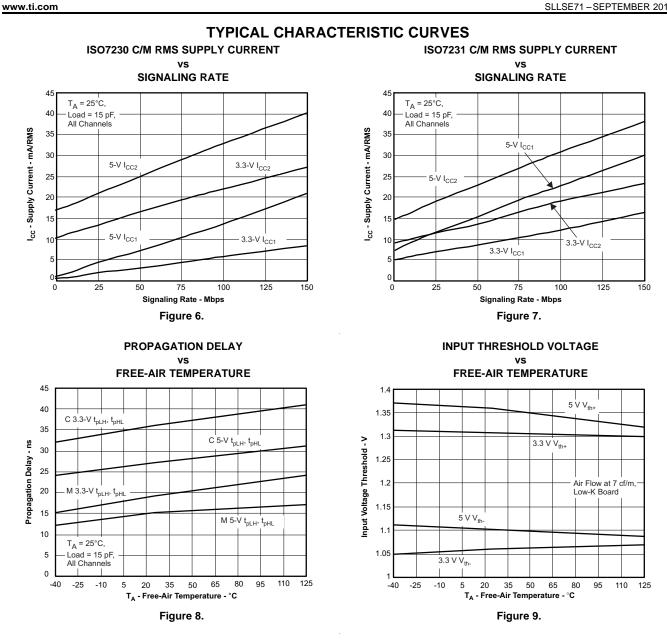
over recommended operating conditions (unless otherwise noted)

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
0	Junction-to-air	Low-K Thermal Resistance <sup>(1)</sup>	168			°C ///
$\theta_{JA}$	Junction-to-all	High-K Thermal Resistance		96.1		°C/W
$\theta_{JB}$	Junction-to-Board Thermal Resistance			61		°C/W
$\theta_{\text{JC}}$	Junction-to-Case Thermal Resistance			48		°C/W
$P_D$	Device Power Dissipation	$V_{CC1} = V_{CC2} = 5.5 \text{ V}, T_J = 150^{\circ}\text{C}, C_L = 15 \text{ pF},$ 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.



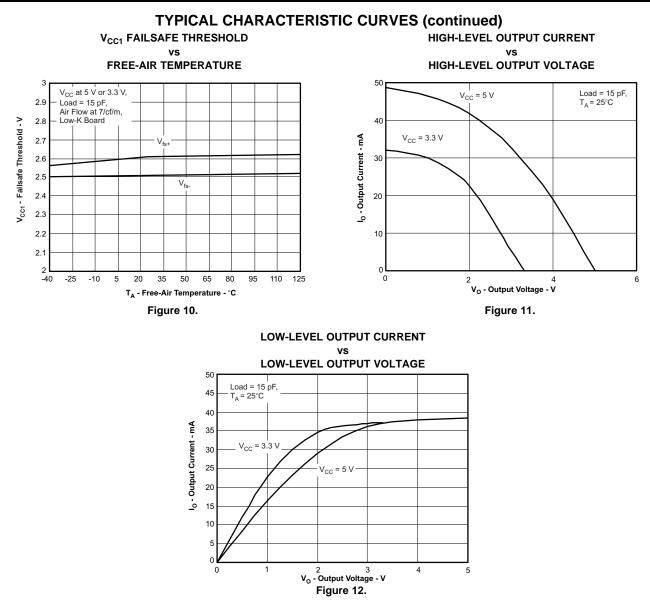
ISO7230C-Q1 ISO7231C-Q1 SLLSE71 – SEPTEMBER 2011



### ISO7230C-Q1 ISO7231C-Q1 SLLSE71-SEPTEMBER 2011



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### **APPLICATION INFORMATION**

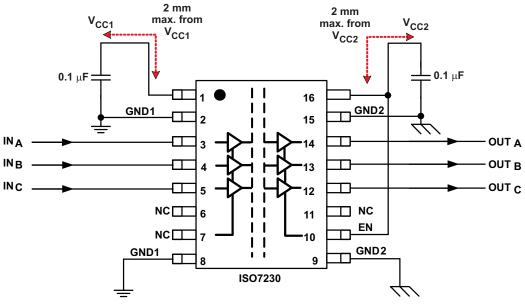


Figure 13. Typical ISO7230 Application Circuit

# LIFE EXPECTANCY vs WORKING VOLTAGE

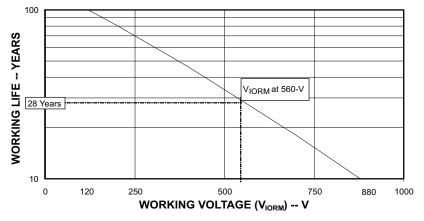


Figure 14. Time Dependant Dielectric Breakdown Testing Results



### PACKAGING INFORMATION

Orderable Device	Status <sup>(1)</sup>	Package Type	e Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
ISO7231CQDWRQ1	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	

<sup>(1)</sup> 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)

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

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

Catalog: ISO7231C

NOTE: Qualified Version Definitions:

• Catalog - TI's standard catalog product

# PACKAGE MATERIALS INFORMATION

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### TAPE AND REEL INFORMATION

### REEL DIMENSIONS

TEXAS INSTRUMENTS





#### 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

# TAPE AND REEL INFORMATION

\*All dimensions are nominal

Device	Package Type	Package Drawing		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

TEXAS INSTRUMENTS

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# PACKAGE MATERIALS INFORMATION

1-Oct-2011



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
ISO7231CQDWRQ1	SOIC	DW	16	2000	346.0	346.0	33.0

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.



# LAND PATTERN DATA



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. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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