



## HIGH SPEED, TRIPLE DIGITAL ISOLATORS

Check for Samples: [ISO7230C](#), [ISO7230M](#), [ISO7231C](#), [ISO7231M](#)

### FEATURES

- 25 and 150-Mbps Signaling Rate Options
  - Low Channel-to-Channel Output Skew; 1 ns max
  - Low Pulse-Width Distortion (PWD); 2 ns max
  - 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- $V_{\text{peak}}$  Isolation, 560- $V_{\text{peak}}$   $V_{\text{IORM}}$ 
  - 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](#))
- $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  Operating Range

### APPLICATIONS

- Industrial Fieldbus
- Computer Peripheral Interface
- Servo Control Interface
- Data Acquisition

### DESCRIPTION

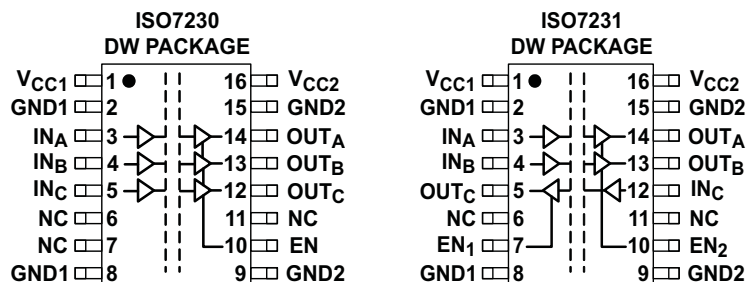
The ISO7230 and ISO7231 are triple-channel digital isolators each with multiple channel configurations and output enable functions. These devices have logic input and output buffers separated by TI's silicon dioxide ( $\text{SiO}_2$ ) isolation barrier. Used in conjunction with isolated power supplies, 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 ISO7230 triple-channel device has all three channels in the same direction while the ISO7231 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 and ISO7231C 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, while the ISO7230M and ISO7231M have CMOS  $V_{\text{CC}}/2$  input thresholds and do not have the input noise-filter or the additional propagation delay.

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  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ .



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

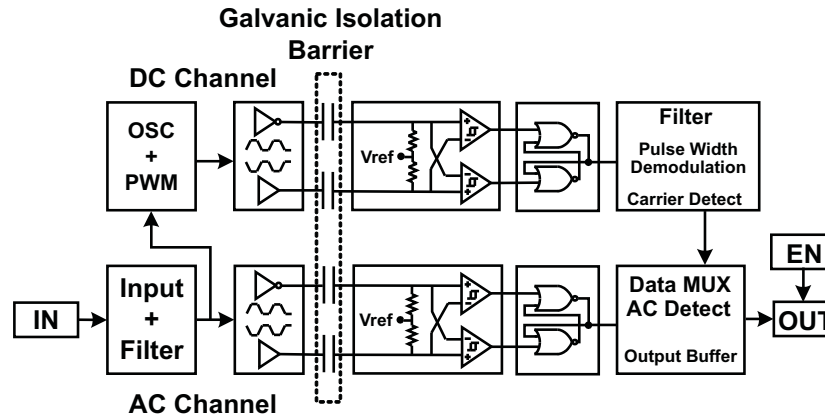


Table 1. Device Function Table ISO723x <sup>(1)</sup>

INPUT V <sub>CC</sub>	OUTPUT V <sub>CC</sub>	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

## AVAILABLE OPTIONS

PRODUCT	SIGNALING RATE	INPUT THRESHOLD	CHANNEL CONFIGURATION	MARKED AS	ORDERING NUMBER <sup>(1)</sup>
ISO7230CDW	25 Mbps	~1.5 V (TTL) (CMOS compatible)	3/0	ISO7230C	ISO7230CDW (rail)
					ISO7230CDWR (reel)
ISO7230MDW	150 Mbps	V <sub>CC</sub> /2 (CMOS)		ISO7230M	ISO7230MDW (rail)
					ISO7230MDWR (reel)
ISO7231CDW	25 Mbps	~1.5 V (TTL) (CMOS compatible)	2/1	ISO7231C	ISO7231CDW (rail)
					ISO7231CDWR (reel)
ISO7231MDW	150 Mbps	V <sub>CC</sub> /2 (CMOS)		ISO7231M	ISO7231MDW (rail)
					ISO7231MDWR (reel)

(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	JEDEC Standard 22, Test Method A114-C.01	All pins	±4	kV
		Field-Induced-Charged Device Model	JEDEC Standard 22, Test Method C101		±1	
		Machine Model	ANSI/ESDS5.2-1996		±200	
T <sub>J</sub>	Maximum junction temperature		170	°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	ISO723xC	40			ns
		ISO723xM	6.67	5		
1/t <sub>ui</sub>	Signaling rate	ISO723xC	0	30 <sup>(2)</sup>	25	Mbps
		ISO723xM	0	200 <sup>(2)</sup>	150	
V <sub>IH</sub>	High-level input voltage (IN)	ISO723xM	0.7 V <sub>CC</sub>		V <sub>CC</sub>	V
V <sub>IL</sub>	Low-level input voltage (IN)		0		0.3 V <sub>CC</sub>	
V <sub>IH</sub>	High-level input voltage (IN) (EN on all devices)	ISO723xC	2		V <sub>CC</sub>	V
V <sub>IL</sub>	Low-level input voltage (IN) (EN on all devices)		0		0.8	
T <sub>J</sub>	Junction temperature				150	°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/M	Quiescent	$V_1 = V_{CC}$ or 0 V, All channels, no load, $EN_2$ at 3 V		1	3	mA
		25 Mbps			7	9.5	
	ISO7231C/M	Quiescent	$V_1 = V_{CC}$ 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/M	Quiescent	$V_1 = V_{CC}$ or 0 V, All channels, no load, $EN_2$ at 3 V		15	22	mA
		25 Mbps			17	24	
	ISO7231C/M	Quiescent	$V_1 = V_{CC}$ 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	
$C_1$	Input capacitance to ground	IN at $V_{CC}$ , $V_1 = 0.4 \sin(4E6\pi t)$			2		pF
CMTI	Common-mode transient immunity	$V_1 = V_{CC}$ 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	ISO723xC	See <a href="#">Figure 1</a>	18		42	ns
PWD	Pulse-width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $				2.5		
$t_{PLH}$ , $t_{PHL}$	Propagation delay	ISO723xM		10		23	ns
PWD	Pulse-width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $				1	2	
$t_{sk(pp)}$	Part-to-part skew <sup>(2)</sup>	ISO723xC				8	ns
		ISO723xM			0	3	
$t_{sk(o)}$	Channel-to-channel output skew <sup>(3)</sup>	ISO723xC			0	2	ns
		ISO723xM			0	1	
$t_r$	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	20	ns
$t_{PZH}$	Propagation delay, high-impedance-to-high-level output				15	20	
$t_{PLZ}$	Propagation delay, low-level-to-high-impedance output				15	20	
$t_{PZL}$	Propagation delay, high-impedance-to-low-level output				15	20	
$t_{fs}$	Failsafe output delay time from input power loss		See <a href="#">Figure 3</a>		12		$\mu$ s
$t_{jit(pp)}$	Peak-to-peak eye-pattern jitter	ISO723xM	150 Mbps PRBS NRZ data input, Same polarity input on all channels, See <a href="#">Figure 5</a>		1		ns

- (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/M	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/M	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/M	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/M	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>	ISO7230	$V_{CC} - 0.4$			V
			ISO7231 (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} $					
$t_{PLH}$ , $t_{PHL}$	Propagation delay, low-to-high-level output		12		29	ns
PWD	Pulse-width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $					
$t_{sk(pp)}$	Part-to-part skew <sup>(2)</sup>	ISO723xC			10	ns
		ISO723xM			0	
$t_{sk(o)}$	Channel-to-channel output skew <sup>(3)</sup>	ISO723xC		0	2.5	ns
		ISO723xM		0	1	
$t_r$	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	20	ns
$t_{PZH}$	Propagation delay, high-impedance-to-high-level output			15	20	
$t_{PLZ}$	Propagation delay, low-level-to-high-impedance output			15	20	
$t_{PZL}$	Propagation delay, high-impedance-to-low-level output			15	20	
$t_{fs}$	Failsafe output delay time from input power loss	See <a href="#">Figure 3</a>		18		$\mu$ s
$t_{jit(pp)}$	Peak-to-peak eye-pattern jitter	ISO723xM		1		ns

(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/M	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, EN <sub>2</sub> at 3 V	0.5		1	mA
		25 Mbps		3		5	
	ISO7231C/M	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	4.5		7	mA
		25 Mbps		6.5		11	
$I_{CC2}$	ISO7230C/M	Quiescent	$V_I = V_{CC}$ or 0 V, All channels, no load, EN <sub>2</sub> at 3 V	15		22	mA
		25 Mbps		17		24	
	ISO7231C/M	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	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			μA
$V_{OH}$	High-level output voltage	$I_{OH} = -4$ mA, See <a href="#">Figure 1</a>	ISO7230	$V_{CC} - 0.4$			V
			ISO7231 (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 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			ISO723xC	See <a href="#">Figure 1</a>	22		51
PWD	Pulse-width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $					3		
$t_{PLH}$ , $t_{PHL}$	Propagation delay	ISO723xM	12			30		
PWD	Pulse-width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $					1	2	
$t_{sk(pp)}$	Part-to-part skew <sup>(2)</sup>	ISO723xC				10	ns	
		ISO723xM				0		5
$t_{sk(o)}$	Channel-to-channel output skew <sup>(3)</sup>	ISO723xC				0	2.5	ns
		ISO723xM				0	1	
$t_r$	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	20	ns
$t_{PZH}$	Propagation delay, high-impedance-to-high-level output					15	20	
$t_{PLZ}$	Propagation delay, low-level-to-high-impedance output					15	20	
$t_{PZL}$	Propagation delay, high-impedance-to-low-level output					15	20	
$t_{fs}$	Failsafe output delay time from input power loss		See <a href="#">Figure 3</a>			12	$\mu$ s	
$t_{jit(pp)}$	Peak-to-peak eye-pattern jitter	ISO723xM	150 Mbps PRBS NRZ data input, Same polarity input on all channels, See <a href="#">Figure 5</a>			1	ns	

(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/M	Quiescent	$V_1 = V_{CC}$ or 0 V, all channels, no load, EN <sub>2</sub> at 3 V	0.5	1		mA
		25 Mbps		3	5		
	ISO7231C/M	Quiescent	$V_1 = V_{CC}$ or 0 V, all channels, no load, EN <sub>1</sub> at 3 V, EN <sub>2</sub> at 3 V	4.5	7		mA
		25 Mbps		6.5	11		
$I_{CC2}$	ISO7230C/M	Quiescent	$V_1 = V_{CC}$ or 0 V, all channels, no load, EN <sub>2</sub> at 3 V	9	15		mA
		25 Mbps		10	17		
	ISO7231C/M	Quiescent	$V_1 = V_{CC}$ 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>		$V_{CC} - 0.4$			V
		$I_{OH} = -20$ 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 or $V_{CC}$				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	$V_1 = V_{CC}$ 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:  $V_{CC1}$  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	ISO723xC	See <a href="#">Figure 1</a>	25		56	ns	
PWD	Pulse-width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $				4			
$t_{pLH}$ , $t_{pHL}$	Propagation delay	ISO723xM		12		34	ns	
PWD	Pulse-width distortion <sup>(1)</sup> $ t_{pHL} - t_{pLH} $				1	2		
$t_{sk(pp)}$	Part-to-part skew <sup>(2)</sup>	ISO723xC				10	ns	
		ISO723xM				0		5
$t_{sk(o)}$	Channel-to-channel output skew <sup>(3)</sup>	ISO723xC				0	3	ns
		ISO723xM				0	1	
$t_r$	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	20	ns	
$t_{PZH}$	Propagation delay, high-impedance-to-high-level output				15	20		
$t_{PLZ}$	Propagation delay, low-level-to-high-impedance output				15	20		
$t_{PZL}$	Propagation delay, high-impedance-to-low-level output				15	20		
$t_{fs}$	Failsafe output delay time from input power loss		See <a href="#">Figure 3</a>		18		$\mu$ s	
$t_{jit(pp)}$	Peak-to-peak eye-pattern jitter	ISO723xM	150 Mbps PRBS NRZ data input, same polarity input on all channels, See <a href="#">Figure 5</a>		1		ns	

- (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.

PARAMETER MEASUREMENT INFORMATION

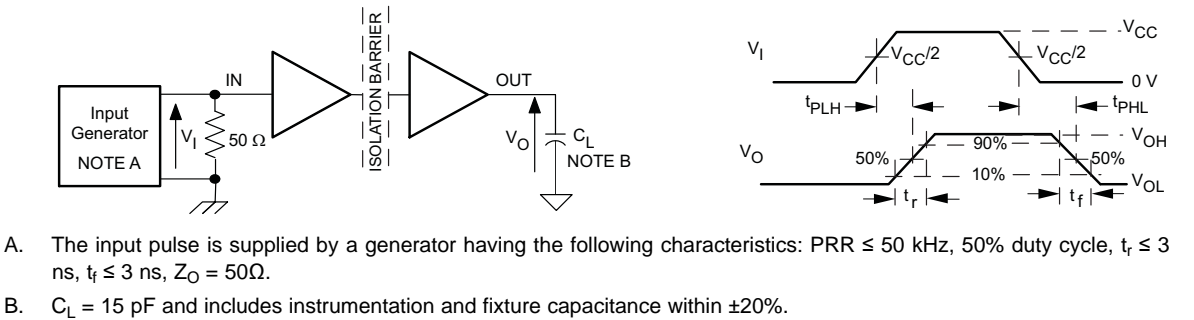


Figure 1. Switching Characteristic Test Circuit and Voltage Waveforms

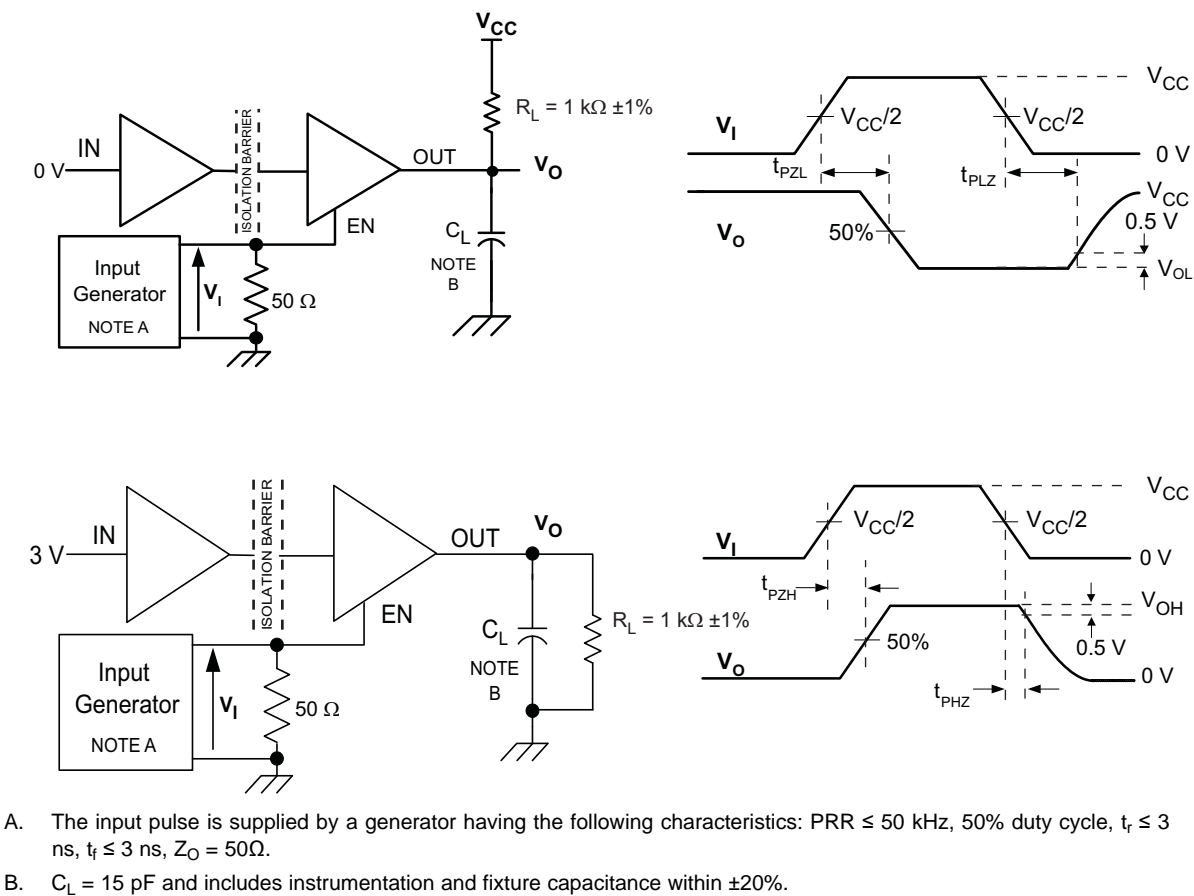
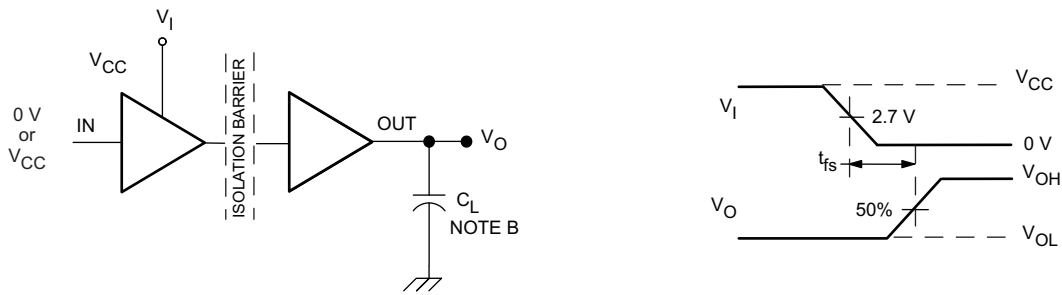


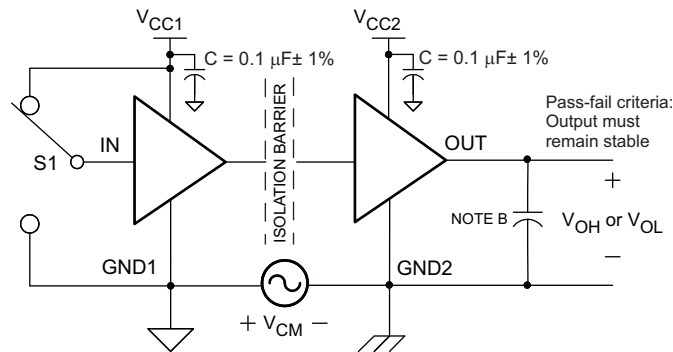
Figure 2. Enable/Disable Propagation Delay Time Test Circuit and Waveform

PARAMETER MEASUREMENT INFORMATION (continued)



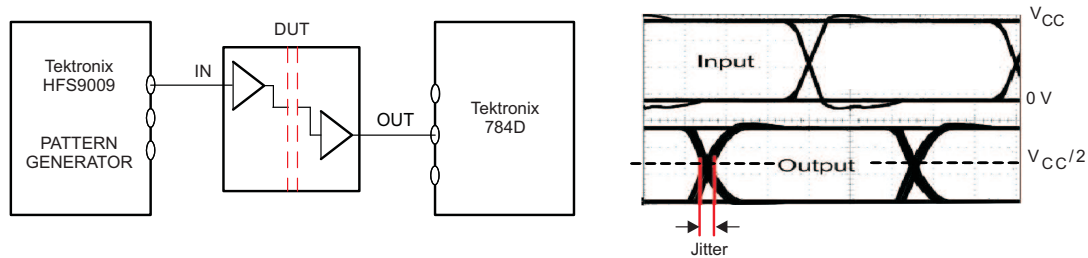
- A. The input pulse is supplied by a generator having the following characteristics: PRR  $\leq$  50 kHz, 50% duty cycle,  $t_r \leq$  3 ns,  $t_f \leq$  3 ns,  $Z_O = 50\Omega$ .
- B.  $C_L = 15$  pF and includes instrumentation and fixture capacitance within  $\pm 20\%$ .

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-Peak Eye-Pattern Jitter Test Circuit and Voltage Waveform

## DEVICE INFORMATION

### PACKAGE CHARACTERISTICS

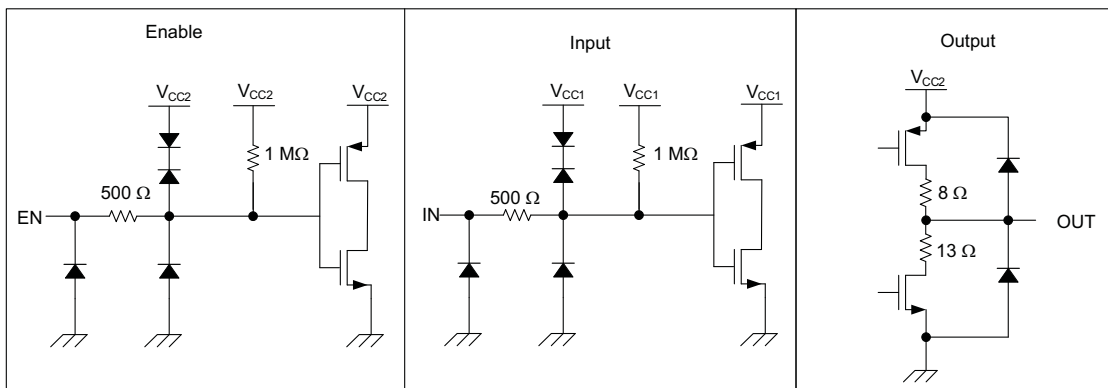
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
L(I01) Minimum air gap (Clearance)	Shortest terminal-to-terminal distance through air	8.34			mm
L(I02) Minimum external tracking (Creepage)	Shortest terminal-to-terminal distance across the package surface	8.1			mm
Minimum Internal Gap (Internal Clearance)	Distance through the insulation	0.008			mm
R <sub>IO</sub> Isolation resistance	Input to output, V <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  
SIGNALLING RATE

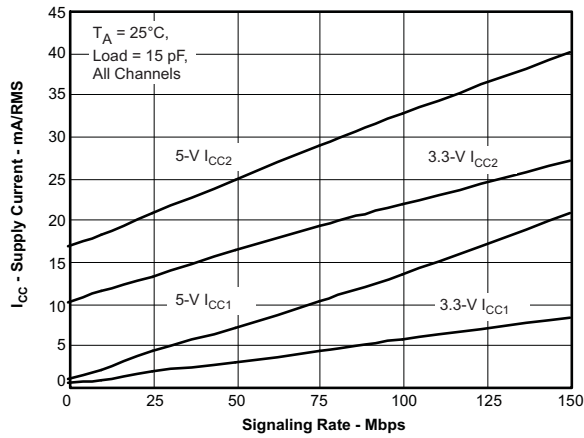


Figure 6.

ISO7231 C/M RMS SUPPLY CURRENT  
vs  
SIGNALLING RATE

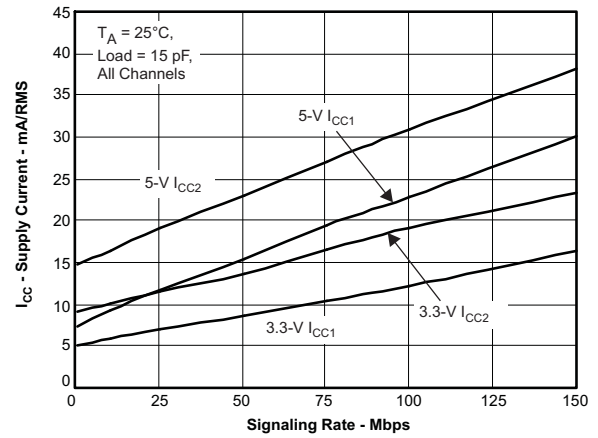


Figure 7.

PROPAGATION DELAY  
vs  
FREE-AIR TEMPERATURE

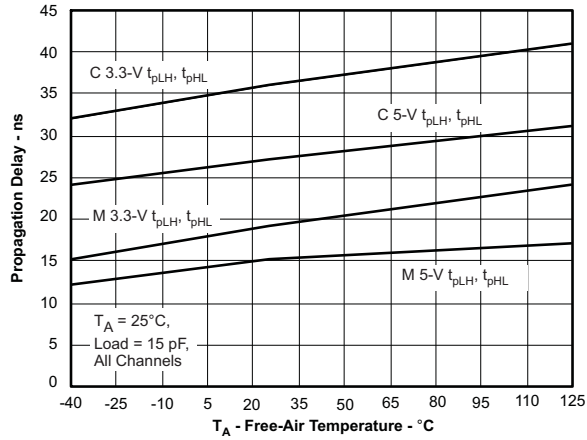


Figure 8.

INPUT THRESHOLD VOLTAGE  
vs  
FREE-AIR TEMPERATURE

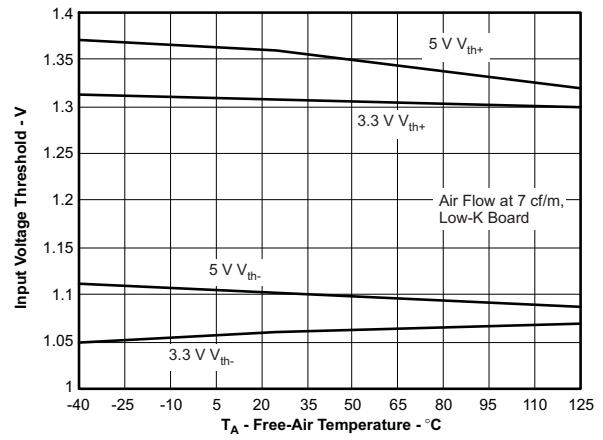


Figure 9.

**TYPICAL CHARACTERISTIC CURVES (continued)**

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

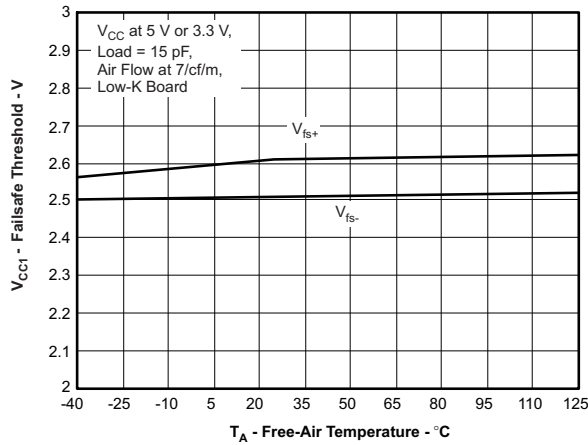


Figure 10.

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

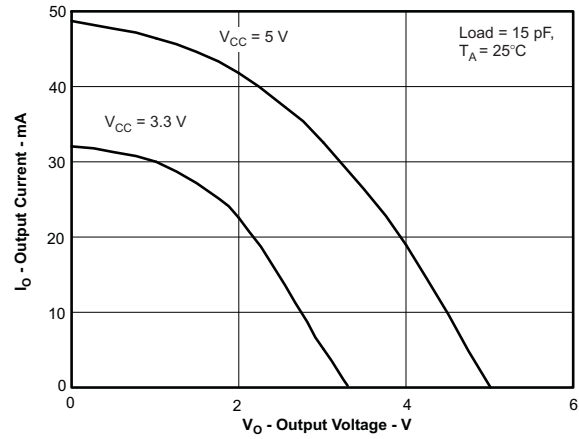


Figure 11.

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

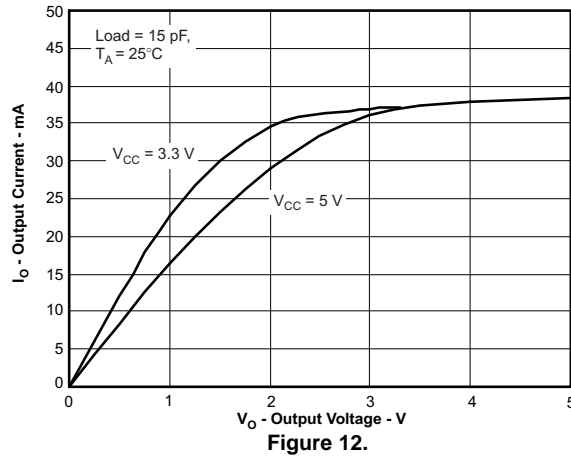


Figure 12.



APPLICATION INFORMATION

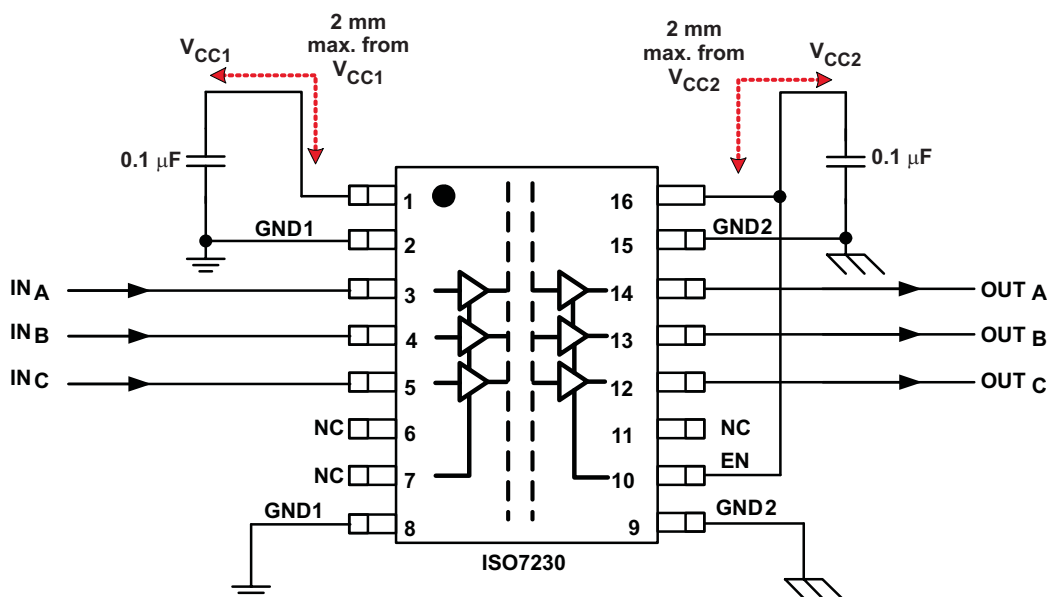


Figure 13. Typical ISO7230 Application Circuit

LIFE EXPECTANCY vs WORKING VOLTAGE

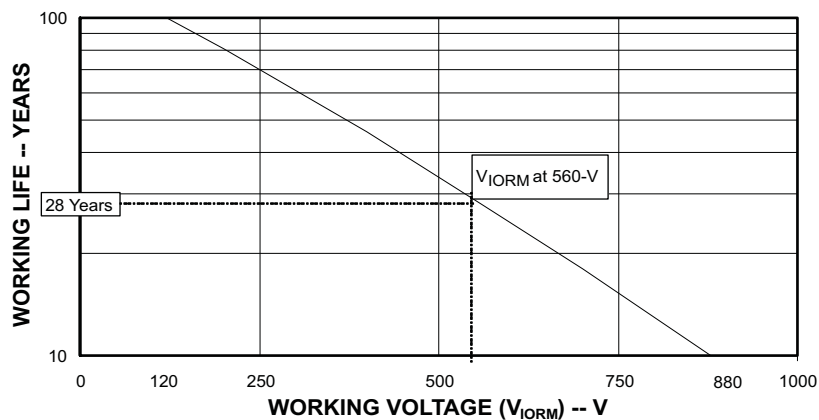


Figure 14. Time Dependant Dielectric Breakdown Testing Results

## REVISION HISTORY

Changes from Original (September 2007) to Revision A	Page
• Deleted Product Preview note .....	2
• Changed $V_{CC}$ Supply Voltage of the ROC Table From: 3 To: 3.15 .....	3
• Changed From: 3.6 To: 3.45 .....	3
• Changed TBD to actual values .....	4
• Changed $V_{CC} - 0.4$ To: $V_{CC} - 0.8$ .....	4
• Changed $C_1$ - Typical value from 1 To: 2 .....	4
• Changed Propagation delay max From: 22 To: 23 .....	5
• Changed $C_1$ - Typical value from 1 To: 2 .....	6
• Changed Propagation delay max From: 46 To: 50 .....	7
• Changed Propagation delay max From: 28 To: 29 .....	7
• Changed $C_1$ - Typical value from 1 To: 2 .....	8
• Changed Propagation delay max From: 26 To: 30 .....	9
• Changed $C_1$ - Typical value from 1 To: 2 .....	10
• Changed Propagation delay max From: 32 To: 34 .....	11
• Changed $C_{IO}$ - Typical value from 1 To: 2 .....	14
• Changed $C_1$ - Typical value from 1 To: 2 .....	14
• Changed the REGULATORY INFORMATION Table .....	14
• Changed <a href="#">Figure 6</a> , <a href="#">Figure 7</a> , and <a href="#">Figure 8</a> .....	15

Changes from Revision A (December 2007) to Revision B	Page
• Changed Supply Voltage of the ROC Table From: 3.45 To: 3.6 .....	3

Changes from Revision B (April 2008) to Revision C	Page
• Deleted Min = 4.5 V and max = 5.5 V for Supply Voltage of the ROC Table. ....	3
• Changed Supply Voltage of the ROC Table From: 3.6 To: 5.5 .....	3

Changes from Revision C (April 2008) to Revision D	Page
• Changed Features bullet 4000- $V_{peak}$ Isolation to the Features list .....	1
• Added $t_{sk(pp)}$ Part-to-part skew .....	5
• Added $t_{sk(pp)}$ Part-to-part skew .....	7
• Added $t_{sk(pp)}$ Part-to-part skew .....	9
• Added $t_{sk(pp)}$ Part-to-part skew .....	11
• Changed Typical ISO723x Application Circuit <a href="#">Figure 13</a> .....	17

<b>Changes from Revision D (May 2008) to Revision E</b>	<b>Page</b>
• Added Note: For the 5-V operation, VCC1 or VCC2 is specified from 4.5 V to 5.5 V. For the 3-V operation, VCC1 or VCC2 is specified from 3.15 V to 3.6 V. ....	3
• Added Note: For the 5-V operation, VCC1 or VCC2 is specified from 4.5 V to 5.5 V. For the 3-V operation, VCC1 or VCC2 is specified from 3.15 V to 3.6 V. ....	4
• Added Note: For the 5-V operation, VCC1 or VCC2 is specified from 4.5 V to 5.5 V. For the 3-V operation, VCC1 or VCC2 is specified from 3.15 V to 3.6 V. ....	6
• Added Note: For the 5-V operation, VCC1 or VCC2 is specified from 4.5 V to 5.5 V. For the 3-V operation, VCC1 or VCC2 is specified from 3.15 V to 3.6 V. ....	8
• Added Note: For the 5-V operation, VCC1 or VCC2 is specified from 4.5 V to 5.5 V. For the 3-V operation, VCC1 or VCC2 is specified from 3.15 V to 3.6 V. ....	10
<hr/>	
<b>Changes from Revision E (June 2008) to Revision F</b>	<b>Page</b>
• Deleted device numbers ISO7230A and ISO7231A from the data sheet. ....	1
• Deleted text from the Description "and turns off internal bias circuitry to conserve power" ....	1
• Added $t_{sk(pp)}$ footnote. ....	5
• Added $t_{sk(o)}$ footnote. ....	5
• Added $t_{sk(pp)}$ footnote. ....	11
• Added $t_{sk(o)}$ footnote. ....	11
• Changed the PACKAGE CHARACTERISTICS table, line 1, $L_{(IO1)}$ MIN from 7.7 to 8.34 ....	14
<hr/>	
<b>Changes from Revision F (December 2008) to Revision G</b>	<b>Page</b>
• Added IEC 60950-1 and CSA Approved to the Features list ....	1
<hr/>	
<b>Changes from Revision G (September 2009) to Revision H</b>	<b>Page</b>
• Changed The Input circuit in the DEVICE I/O SCHEMATICS illustration ....	14
<hr/>	
<b>Changes from Revision H (December 2009) to Revision I</b>	<b>Page</b>
• Changed $I_{OH}$ Min value to -4 and deleted the Max value, in the RECOMMENDED OPERATING CONDITIONS Table ....	3
• Changed $I_{OL}$ Max value to 4 and deleted the Min value, in the RECOMMENDED OPERATING CONDITIONS Table .....	3
• Changed <a href="#">Figure 1</a> , <a href="#">Figure 3</a> , <a href="#">Figure 4</a> , and <a href="#">Figure 5</a> .....	12
• Changed File Number: 1698195 To: 220991 .....	14
• Changed Typical ISO723x Application Circuit <a href="#">Figure 13</a> .....	17

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
ISO7230CDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7230C	<a href="#">Samples</a>
ISO7230CDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7230C	<a href="#">Samples</a>
ISO7230CDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7230C	<a href="#">Samples</a>
ISO7230CDWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7230C	<a href="#">Samples</a>
ISO7230MDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7230M	<a href="#">Samples</a>
ISO7230MDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7230M	<a href="#">Samples</a>
ISO7230MDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7230M	<a href="#">Samples</a>
ISO7230MDWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7230M	<a href="#">Samples</a>
ISO7231CDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7231C	<a href="#">Samples</a>
ISO7231CDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7231C	<a href="#">Samples</a>
ISO7231CDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 125	ISO7231C	<a href="#">Samples</a>
ISO7231CDWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 125	ISO7231C	<a href="#">Samples</a>
ISO7231MDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7231M	<a href="#">Samples</a>
ISO7231MDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7231M	<a href="#">Samples</a>
ISO7231MDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7231M	<a href="#">Samples</a>
ISO7231MDWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 125	ISO7231M	<a href="#">Samples</a>

(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.

<sup>(2)</sup> 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.

<sup>(4)</sup> Multiple Top-Side Markings will be inside parentheses. Only one Top-Side 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 Top-Side Marking for that device.

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#### **OTHER QUALIFIED VERSIONS OF ISO7231C :**

- Automotive: [ISO7231C-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

**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
ISO7230CDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
ISO7230MDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
ISO7231CDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
ISO7231MDWR	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)
ISO7230CDWR	SOIC	DW	16	2000	367.0	367.0	38.0
ISO7230MDWR	SOIC	DW	16	2000	367.0	367.0	38.0
ISO7231CDWR	SOIC	DW	16	2000	367.0	367.0	38.0
ISO7231MDWR	SOIC	DW	16	2000	367.0	367.0	38.0

DW (R-PDSO-G16)

PLASTIC SMALL OUTLINE

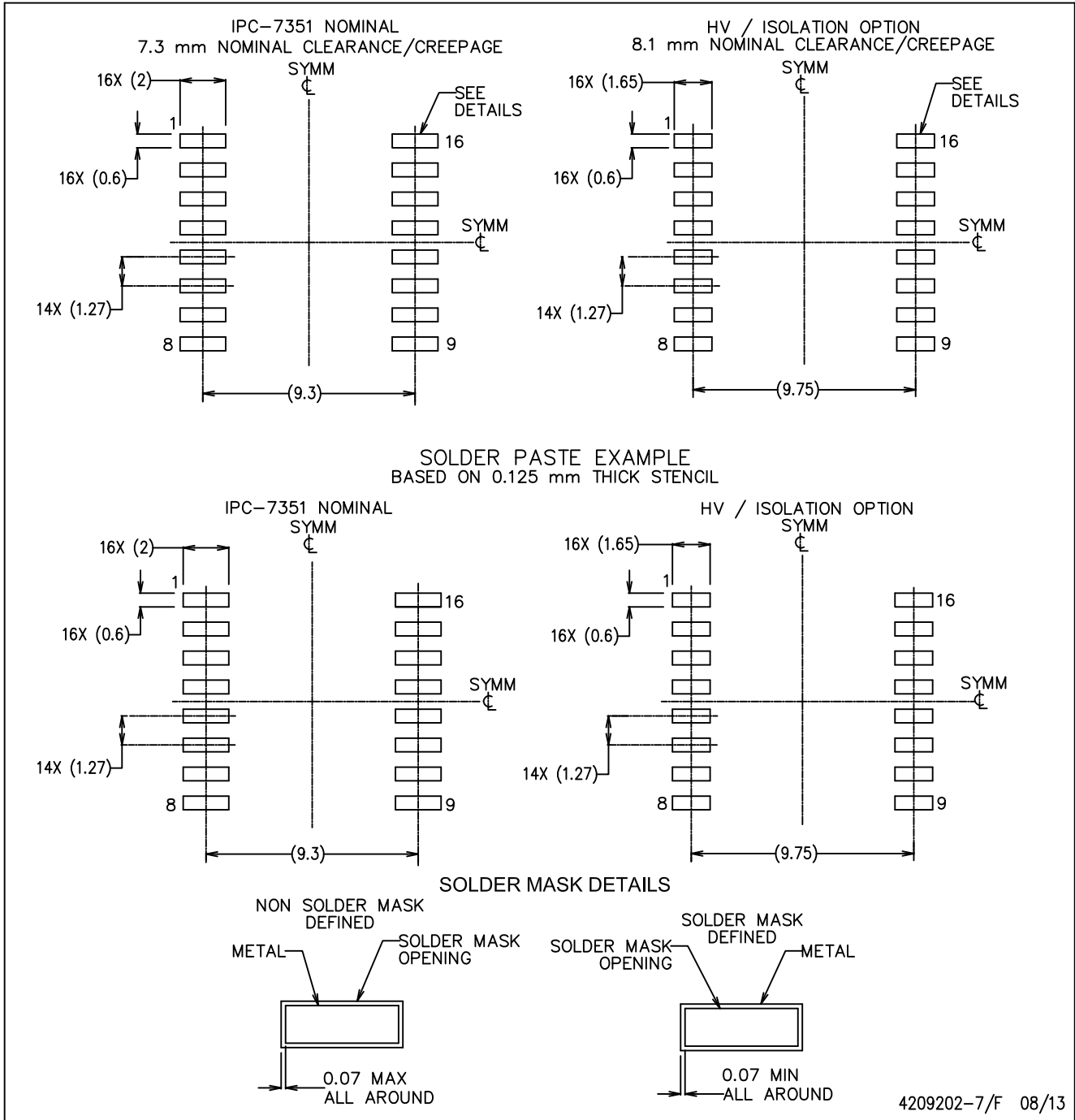


- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation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



DW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4209202-7/F 08/13

- 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.

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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.

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