

ISO723xx 高速三通道数字隔离器

1 特性

- 25Mbps 和 150Mbps 信令速率选项
 - 低通道间输出偏斜；
最大值为 1ns
 - 低脉宽失真度 (PWD)；
最大值为 2ns
 - 低抖动内容；速率为 150Mbps 时的典型值为 1ns
- 额定工作电压下的使用寿命典型值为 25 年
(请参阅 [隔离寿命预测](#))
- 4kV ESD 保护
- 由 3.3V 和 5V 电源供电
- 3.3V 和 5V 电平转换
- 高电磁场抗扰度
(请参阅应用手册 [ISO72x 数字隔离器磁场抗扰度](#))
- - 40°C 至 125°C 工作温度范围
- 安全相关认证
 - DIN EN IEC 60747-17 (VDE 0884-17)
 - UL 1577 组件认证计划
 - IEC 61010-1、IEC 62368-1 认证

2 应用

- 工厂自动化
 - Modbus
 - Profibus™
 - DeviceNet™ 数据总线
- 计算机外设接口
- 伺服器控制接口
- 数据采集

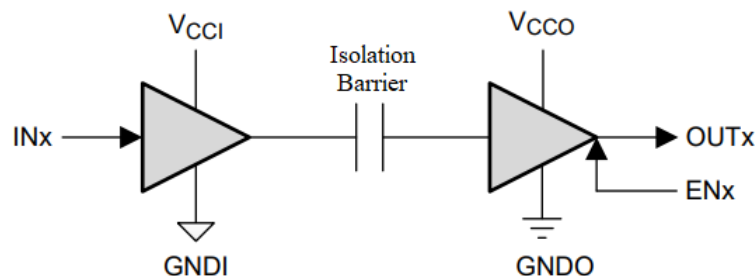
3 说明

ISO7230 和 ISO7231 是三通道数字隔离器，每个隔离器都具有多个通道配置和输出使能功能。这些器件具有由 TI 的二氧化硅 (SiO₂) 隔离栅进行隔离的逻辑输入和输出缓冲器。当与隔离电源结合使用时，这些器件可阻止高电压和隔离接地，并可防止数据总线或其他电路上的噪声电流进入本地接地或对敏感电路造成干扰或损坏。

封装信息

器件型号	封装 (1)	本体尺寸 (标称值)	封装尺寸(2)
ISO7230C ISO7231C ISO7231M	DW (SOIC , 16)	10.30mm × 7.50mm	10.30mm × 10.30mm

- (1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。
(2) 封装尺寸 (长 × 宽) 为标称值，并包括引脚 (如适用)。



- A. VCCI 和 GNDI 分别是输入通道的电源和接地连接引脚。
B. VCCO 和 GNDO 分别是输出通道的电源和接地连接引脚。

简化版原理图



Table of Contents

1 特性	1	6.16 Switching Characteristics: V_{CC1} at 5-V, V_{CC2} at 3.3-V.....	10
2 应用	1	6.17 Typical Characteristics.....	11
3 说明	1	7 Parameter Measurement Information	13
4 Device Comparison Table	3	8 Detailed Description	15
5 Pin Configuration and Functions	3	8.1 Overview.....	15
6 Specifications	4	8.2 Functional Block Diagram.....	15
6.1 Absolute Maximum Ratings.....	4	8.3 Feature Description.....	16
6.2 ESD Ratings.....	4	8.4 Device Functional Modes.....	16
6.3 Thermal Information.....	4	9 Application and Implementation	17
6.4 Recommended Operating Conditions.....	4	9.1 Application Information.....	17
6.5 Power Ratings.....	5	9.2 Typical Application.....	17
6.6 Insulation Specifications.....	5	9.3 Power Supply Recommendations.....	19
6.7 Safety-Related Certifications.....	6	9.4 Layout.....	20
6.8 Safety Limiting Values.....	6	10 Device and Documentation Support	21
6.9 Electrical Characteristics: V_{CC1} and V_{CC2} at 3.3 V.....	6	10.1 Documentation Support.....	21
6.10 Electrical Characteristics: V_{CC1} and V_{CC2} at 5-V.....	7	10.2 接收文档更新通知.....	21
6.11 Electrical Characteristics: V_{CC1} at 3.3-V, V_{CC2} at 5-V.....	7	10.3 支持资源.....	21
6.12 Electrical Characteristics: V_{CC1} at 5-V, V_{CC2} at 3.3-V.....	8	10.4 Trademarks.....	21
6.13 Switching Characteristics: V_{CC1} and V_{CC2} at 3.3-V.....	8	10.5 静电放电警告.....	21
6.14 Switching Characteristics: V_{CC1} and V_{CC2} at 5-V.....	9	10.6 术语表.....	21
6.15 Switching Characteristics: V_{CC1} at 3.3-V and V_{CC2} at 5-V.....	9	11 Revision History	21
		12 Mechanical, Packaging, and Orderable Information	22

4 Device Comparison Table

PRODUCT	SIGNALING RATE	INPUT THRESHOLD	CHANNEL CONFIGURATION	ISOLATION RATING
ISO7230C	25 Mbps	≈ 1.5 V (TTL) (CMOS compatible)	3/0	4000 V _{PK} , 2500 V _{RMS}
ISO7231C	25 Mbps	≈ 1.5 V (TTL) (CMOS compatible)	2/1	
ISO7231M	150 Mbps	V _{CC} /2 (CMOS)		

5 Pin Configuration and Functions

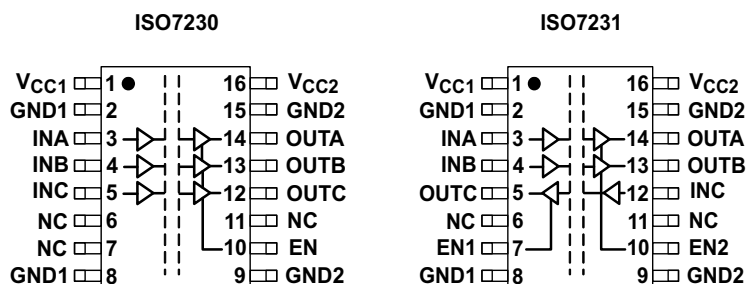


图 5-1. DW Package 16-Pin SOIC Top View

表 5-1. Pin Functions

NAME	PIN		TYPE ⁽¹⁾	DESCRIPTION
	ISO7230	ISO7231		
EN	10	—	I	Enable, channel A, B, and C
EN1	—	7	I	Enable, channel C
EN2	—	10	I	Enable, channel A and B
GND1	2, 8	2, 8	—	Ground connection for V _{CC1}
GND2	9, 15	9, 15	—	Ground connection for V _{CC2}
INA	3	3	I	Input, channel A
INB	4	4	I	Input, channel B
INC	5	12	I	Input, channel C
NC	6, 7, 11	6, 11	—	Not connected
OUTA	14	14	O	Output, channel A
OUTB	13	13	O	Output, channel B
OUTC	12	5	O	Output, channel C
V _{CC1}	1	1	—	Power supply, V _{CC1}
V _{CC2}	16	16	—	Power supply, V _{CC2}

(1) I = Input; O = Output

6 Specifications

6.1 Absolute Maximum Ratings

See⁽¹⁾

		MIN	MAX	UNIT
V _{CC}	Supply voltage ⁽²⁾ , V _{CC1} , V _{CC2}	- 0.5	6	V
V _I	Voltage at INx, OUTx, ENx	- 0.5	V _{CC} + 0.5 ⁽³⁾	V
I _O	Output current	- 15	15	mA
T _J	Maximum junction temperature		170	°C
T _{stg}	Storage temperature	- 65	150	°C

- Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.
- All voltage values are with respect to network ground terminal and are peak voltage values.
- Maximum voltage must not exceed 6 V.

6.2 ESD Ratings

			VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±4000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±1000	

- JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Thermal Information

THERMAL METRIC ⁽¹⁾		ISO7230C, ISO7231C, ISO7231M	UNIT
		DW (SOIC)	
		16 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	168	°C/W
		68.6	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	33.9	°C/W
R _{θJB}	Junction-to-board thermal resistance	33.5	°C/W
ψ _{JT}	Junction-to-top characterization parameter	14.8	°C/W
ψ _{JB}	Junction-to-board characterization parameter	32.9	°C/W
R _{θJC(bot)}	Junction-to-case (bottom) thermal resistance	n/a	°C/W

- For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application note.

6.4 Recommended Operating Conditions

			MIN	NOM	MAX	UNIT
V _{CC}	Supply voltage ⁽²⁾ , V _{CC1} , V _{CC2}		3.15		5.5	V
I _{OH}	High-level output current		- 4			mA
I _{OL}	Low-level output current				4	mA
t _{ui}	Input pulse width ⁽¹⁾	ISO723xC	40			ns
t _{ui}	Input pulse width ⁽¹⁾	ISO723xM	6.67	5		ns
1/t _{ui}	Signaling rate ⁽¹⁾	ISO723xC	0	30	25	Mbps
1/t _{ui}	Signaling rate ⁽¹⁾	ISO723xM	0	200	150	Mbps
V _{IH}	High-level input voltage	ISO723xM	0.7 × V _{CC}		V _{CC}	V
V _{IL}	Low-level input voltage	ISO723xM	0		0.3 × V _{CC}	V
V _{IH}	High-level input voltage	ISO723xC	2		5.5	V
V _{IL}	Low-level input voltage	ISO723xC	0		0.8	V
T _A	Ambient temperature		-40	25	125	

		MIN	NOM	MAX	UNIT
T _J	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) Typical signaling rate and Input pulse width are measured at ideal conditions at 25°C.
- (2) For the 5-V operation, V_{CC1} or V_{CC2} is specified from 4.5 V to 5.5 V.
For the 3.3-V operation, V_{CC1} or V_{CC2} is specified from 3 V to 3.6 V.
For the 2.8-V operation, V_{CC1} or V_{CC2} is specified at 2.8 V.

6.5 Power Ratings

over operating free-air temperature range (unless otherwise noted)

PARAMETER		ISO7230C, ISO7231C, ISO7231M		UNIT
		DW (SOIC)		
		16 PINS		
P _D	Device power dissipation, V _{CC1} = V _{CC2} = 5.5 V, T _J = 150°C, C _L = 15 pF, D Input a 50% duty cycle, 25-Mbps square wave	220		mW

6.6 Insulation Specifications

PARAMETER	TEST CONDITIONS	VALUE	UNIT
GENERAL			
CLR	External clearance ⁽¹⁾	Shortest terminal-to-terminal distance through air	8 mm
CPG	External creepage ⁽¹⁾	Shortest terminal-to-terminal distance across the package surface	8 mm
DTI	Distance through the insulation	Minimum internal gap (internal clearance)	0.008 mm
CTI	Comparative tracking index	DIN EN 60112 (VDE 0303-11); IEC 60112	400 V
	Material group		II
	Overvoltage category	Rated mains voltage ≤ 150 V _{RMS}	I-IV
		Rated mains voltage ≤ 300 V _{RMS}	I-III
		Rated mains voltage ≤ 400 V _{RMS}	I-II
DIN EN IEC 60747-17 (VDE 0884-17):⁽²⁾			
V _{IORM}	Maximum repetitive peak isolation voltage	AC voltage (bipolar)	560 V _{PK}
V _{IOTM}	Maximum transient isolation voltage	V _{TEST} = V _{IOTM} , t = 60 s (qualification); V _{TEST} = 1.2 × V _{IOTM} , t = 1 s (100% production)	4000 V _{PK}
q _{pd}	Apparent charge ⁽³⁾	Method a: After I/O safety test subgroup 2/3, V _{ini} = V _{IOTM} , t _{ini} = 60 s; V _{pd(m)} = 1.2 × V _{IORM} , t _m = 10 s	≤ 5 pC
		Method a: After environmental tests subgroup 1, V _{ini} = V _{IOTM} , t _{ini} = 60 s; V _{pd(m)} = 1.3 × V _{IORM} , t _m = 10 s	≤ 5 pC
		Method b: At routine test (100% production); V _{ini} = 1.2 × V _{IOTM} , t _{ini} = 1 s; V _{pd(m)} = 1.5 × V _{IORM} , t _m = 1 s (method b1) or V _{pd(m)} = V _{ini} , t _m = t _{ini} (method b2)	≤ 5 pC
C _{IO}	Barrier capacitance, input to output ⁽⁴⁾	V _{IO} = 0.4 × sin(2π ft), f = 1 MHz	1 pF
R _{IO}	Isolation resistance, input to output ⁽⁴⁾	V _{IO} = 500 V, T _A = 25°C	> 10 ¹² Ω
		V _{IO} = 500 V, 100°C ≤ T _A ≤ 125°C	> 10 ¹¹ Ω
		V _{IO} = 500 V at T _S = 150°C	> 10 ⁹ Ω
	Pollution degree		2
	Climatic category		40/125/21
UL 1577			
V _{ISO}	Withstand isolation voltage	V _{TEST} = V _{ISO} = 2500 V _{RMS} , t = 60 s (qualification); V _{TEST} = 1.2 × V _{ISO} = 3000 V _{RMS} , t = 1 s (100% production)	2500 V _{RMS}

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

- (2) This coupler is suitable for *basic electrical insulation* only within the maximum operating ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.
- (3) Apparent charge is electrical discharge caused by a partial discharge (pd).
- (4) All pins on each side of the barrier tied together creating a two-terminal device

6.7 Safety-Related Certifications

VDE	CSA	UL
Plan to certify according to DIN EN IEC 60747-17 (VDE 0884-17)	Plan to certify according to IEC 62368-1	Plan to certify according to UL 1577 Component Recognition Program
Certificate planned	Certificate planned	Certificate planned

6.8 Safety Limiting Values

Safety limiting⁽¹⁾ intends to minimize potential damage to the isolation barrier upon failure of input or output circuitry. A failure of the I/O can allow low resistance to ground or the supply and, without current limiting, dissipate sufficient power to overheat the die and damage the isolation barrier, potentially leading to secondary system failures.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I _S	Safety input, output, or supply current	R _{θJA} = 212°C/W, V _I = 5.5 V, T _J = 170°C, T _A = 25°C, see 节 6.3			124	mA
		R _{θJA} = 212°C/W, V _I = 3.6 V, T _J = 170°C, T _A = 25°C, see 节 6.3			190	
T _S	Safety temperature				150	°C

- (1) The safety-limiting constraint is the maximum junction temperature specified in the data sheet. The power dissipation and junction-to-air thermal impedance of the device installed in the application hardware determines the junction temperature. The assumed junction-to-air [thermal resistance](#) in the table is that of a device installed on a high-K test board for leaded surface-mount packages. The power is the recommended maximum input voltage times the current. The junction temperature is then the ambient temperature plus the power times the junction-to-air thermal resistance.

6.9 Electrical Characteristics: V_{CC1} and V_{CC2} at 3.3 V

over recommended operating conditions (unless otherwise noted)⁽¹⁾

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
SUPPLY CURRENT						
I _{CC1}	ISO7230C/M	Quiescent	V _I = V _{CC1} or 0 V, all channels, no load, EN at 3 V	0.5	1.2	mA
		25 Mbps		3	5	
	ISO7231C/M	Quiescent	V _I = V _{CC1} or 0 V, all channels, no load, EN1 at 3 V, EN2 at 3 V	4.5	7	mA
		25 Mbps		6.5	11	
I _{CC2}	ISO7230C/M	Quiescent	V _I = V _{CC1} or 0 V, all channels, no load, EN at 3 V	9	15	mA
		25 Mbps		10	17	
	ISO7231C/M	Quiescent	V _I = V _{CC1} or 0 V, all channels, no load, EN1 at 3 V, EN2 at 3 V	8	12	mA
		25 Mbps		10.5	16	
ELECTRICAL CHARACTERISTICS						
I _{OFF}	Sleep mode output current	ENx at 0 V, single channel		0		μA
V _{OH}	High-level output voltage	I _{OH} = - 4 mA, See 图 7-1		V _{CC0} - 0.4		V
		I _{OH} = - 20 μA, See 图 7-1		V _{CC0} - 0.1		
V _{OL}	Low-level output voltage	I _{OL} = 4 mA, See 图 7-1			0.4	V
		I _{OL} = 20 μA, See 图 7-1			0.1	
V _{I(HYS)}	Input voltage hysteresis			150		mV
I _{IH}	High-level input current	INx at V _{CC1}			10	μA
I _{IL}	Low-level input current	INx at 0 V		- 10		
C _I	Input capacitance to ground	IN at V _{CC} , V _I = 0.4 sin(2πft), f=2MHz		2		pF
CMTI	Common-mode transient immunity	V _I = V _{CC1} or 0 V, See 图 7-4	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 3.3-V operation, V_{CC1} or V_{CC2} is specified from 3.15 V to 3.6 V.

6.10 Electrical Characteristics: V_{CC1} and V_{CC2} at 5-V

over recommended operating conditions (unless otherwise noted)⁽¹⁾

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
SUPPLY CURRENT							
I_{CC1}	ISO7230C/M	Quiescent	$V_I = V_{CC1}$ or 0 V, all channels, no load, EN at 3 V	1	3		mA
		25 Mbps		7	9.5		
	ISO7231C/M	Quiescent	$V_I = V_{CC1}$ or 0 V, all channels, no load, EN1 at 3 V, EN2 at 3 V	6.5	11		mA
		25 Mbps		11	17		
I_{CC2}	ISO7230C/M	Quiescent	$V_I = V_{CC1}$ or 0 V, all channels, no load, EN at 3 V	15	22		mA
		25 Mbps		17	24		
	ISO7231C/M	Quiescent	$V_I = V_{CC1}$ or 0 V, all channels, no load, EN1 at 3 V, EN2 at 3 V	13	20		mA
		25 Mbps		17.5	27		
ELECTRICAL CHARACTERISTICS							
I_{OFF}	Sleep mode output current	ENx at 0 V, single channel		0			μ A
V_{OH}	High-level output voltage	$I_{OH} = -4$ mA, See 图 7-1		$V_{CCO} - 0.8$			V
		$I_{OH} = -20$ μ A, See 图 7-1		$V_{CCO} - 0.1$			
V_{OL}	Low-level output voltage	$I_{OL} = 4$ mA, See 图 7-1				0.4	V
		$I_{OL} = 20$ μ A, See 图 7-1				0.1	
$V_{I(HYS)}$	Input voltage hysteresis			150			mV
I_{IH}	High-level input current	INx at V_{CC1}				10	μ A
I_{IL}	Low-level input current	INx at 0 V		-10			
C_I	Input capacitance to ground	IN at V_{CC} , $V_I = 0.4 \sin(2\pi ft)$, $f=2$ MHz		2			pF
CMTI	Common-mode transient immunity	$V_I = V_{CC1}$ or 0 V, See 图 7-4		25	50		kV/ μ s

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

6.11 Electrical Characteristics: V_{CC1} at 3.3-V, V_{CC2} at 5-V

over recommended operating conditions (unless otherwise noted)⁽¹⁾

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
SUPPLY CURRENT							
I_{CC1}	ISO7230C/M	Quiescent	$V_I = V_{CC1}$ or 0 V, all channels, no load, EN at 3 V	0.5	1.2		mA
		25 Mbps		3	5		
	ISO7231C/M	Quiescent	$V_I = V_{CC1}$ or 0 V, all channels, no load, EN1 at 3 V, EN2 at 3 V	4.5	7		mA
		25 Mbps		6.5	11		
I_{CC2}	ISO7230C/M	Quiescent	$V_I = V_{CC1}$ or 0 V, all channels, no load, EN at 3 V	15	22		mA
		25 Mbps		17	24		
	ISO7231C/M	Quiescent	$V_I = V_{CC1}$ or 0 V, all channels, no load, EN1 at 3 V, EN2 at 3 V	13	20		mA
		25 Mbps		17.5	27		
ELECTRICAL CHARACTERISTICS							
I_{OFF}	Sleep mode output current	ENx at 0 V, Single channel		0			μ A
V_{OH}	High-level output voltage	$I_{OH} = -4$ mA, See 图 7-1	ISO7230	$V_{CCO} - 0.4$			V
			ISO7231 (5-V side)	$V_{CCO} - 0.8$			
		$I_{OH} = -20$ μ A, See 图 7-1	$V_{CCO} - 0.1$				
V_{OL}	Low-level output voltage	$I_{OL} = 4$ mA, See 图 7-1				0.4	V
		$I_{OL} = 20$ μ A, See 图 7-1				0.1	
$V_{I(HYS)}$	Input voltage hysteresis			150			mV
I_{IH}	High-level input current	INx at V_{CC1}				10	μ A
I_{IL}	Low-level input current	INx at 0 V		-10			

over recommended operating conditions (unless otherwise noted)⁽¹⁾

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
C _I	Input capacitance to ground	IN at V _{CC} , V _I = 0.4 sin(2πft), f=2MHz		2		pF
CMTI	Common-mode transient immunity	V _I = V _{CC1} or 0 V, See 图 7-4	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 3.3-V operation, V_{CC1} or V_{CC2} is specified from 3.15 V to 3.6 V.

6.12 Electrical Characteristics: V_{CC1} at 5-V, V_{CC2} at 3.3-V

over recommended operating conditions (unless otherwise noted)⁽¹⁾

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT	
SUPPLY CURRENT							
I _{CC1}	ISO7230C/M	Quiescent	V _I = V _{CC1} or 0 V, all channels, no load, EN at 3 V	1	3	mA	
		25 Mbps		7	9.5		
	ISO7231C/M	Quiescent		V _I = V _{CC1} or 0 V, all channels, no load, EN1 at 3 V, EN2 at 3 V	6.5	11	mA
		25 Mbps			11	17	
I _{CC2}	ISO7230C/M	Quiescent	V _I = V _{CC1} or 0 V, all channels, no load, EN at 3 V		9	15	mA
		25 Mbps			10	17	
	ISO7231C/M	Quiescent		V _I = V _{CC1} or 0 V, all channels, no load, EN1 at 3 V, EN2 at 3 V	8	12	mA
		25 Mbps			10.5	16	
ELECTRICAL CHARACTERISTICS							
I _{OFF}	Sleep mode output current	ENx at 0 V, Single channel			0		μA
V _{OH}	High-level output voltage	I _{OH} = -4 mA, See 图 7-1	ISO7230	V _{CCO} - 0.4		V	
			ISO7231 (5-V side)	V _{CCO} - 0.8			
		I _{OH} = -20 μA, See 图 7-1		V _{CCO} - 0.1			
V _{OL}	Low-level output voltage	I _{OL} = 4 mA, See 图 7-1			0.4	V	
		I _{OL} = 20 μA, See 图 7-1			0.1		
V _{I(HYS)}	Input voltage hysteresis			150		mV	
I _{IH}	High-level input current	INx at V _{CC1}			10	μA	
I _{IL}	Low-level input current	INx at 0 V	-10				
C _I	Input capacitance to ground	IN at V _{CC} , V _I = 0.4 sin(2πft), f=2MHz		2		pF	
CMTI	Common-mode transient immunity	V _I = V _{CC1} or 0 V, See 图 7-4	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 3.3-V operation, V_{CC1} or V_{CC2} is specified from 3.15 V to 3.6 V.

6.13 Switching Characteristics: V_{CC1} and V_{CC2} at 3.3-V

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT	
t _{PLH} , t _{PHL}	Propagation delay	ISO723xC	See 图 7-1	25	56	ns	
PWD	Pulse-width distortion ⁽¹⁾ t _{PHL} - t _{PLH}			4			
t _{PLH} , t _{PHL}	Propagation delay	ISO723xM	See 图 7-1	8	34	ns	
PWD	Pulse-width distortion ⁽¹⁾ t _{PHL} - t _{PLH}			1	2		
t _{sk(pp)}	Part-to-part skew ⁽²⁾	ISO723xC			10	ns	
		ISO723xM			0		5
t _{sk(o)}	Channel-to-channel output skew ⁽³⁾	ISO723xC			0	3	ns
		ISO723xM			0	1	
t _r	Output signal rise time	See 图 7-1			2.4	ns	
t _f	Output signal fall time				2.3		

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{PHZ}	Propagation delay, high-level-to-high-impedance output	See 图 7-2			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 图 7-3			18		μ s
$t_{jit(pp)}$	Peak-to-peak eye-pattern jitter	ISO723xM	150 Mbps PRBS NRZ data input, same polarity input on all channels, See 图 7-5		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.

6.14 Switching Characteristics: V_{CC1} and V_{CC2} at 5-V

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{PLH} , t_{PHL}	Propagation delay	ISO723xC	See 图 7-1	18		42	ns
PWD	Pulse-width distortion ⁽¹⁾ $ t_{PHL} - t_{PLH} $					2.5	
t_{PLH} , t_{PHL}	Propagation delay	ISO723xM		8		23	ns
PWD	Pulse-width distortion ⁽¹⁾ $ t_{PHL} - t_{PLH} $					1	
$t_{sk(pp)}$	Part-to-part skew ⁽²⁾	ISO723xC				8	ns
		ISO723xM				0	
$t_{sk(o)}$	Channel-to-channel output skew ⁽³⁾	ISO723xC			0	2	ns
		ISO723xM				0	
t_r	Output signal rise time	See 图 7-1			2.4		ns
t_f	Output signal fall time				2.3		
t_{PHZ}	Propagation delay, high-level-to-high-impedance output	See 图 7-2			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 图 7-3			12		μ s
$t_{jit(pp)}$	Peak-to-peak eye-pattern jitter	ISO723xM	150 Mbps PRBS NRZ data input, Same polarity input on all channels, See 图 7-5		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.

6.15 Switching Characteristics: V_{CC1} at 3.3-V and V_{CC2} at 5-V

, over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{PLH} , t_{PHL}	Propagation delay	ISO723xC	See 图 7-1	22		51	ns
PWD	Pulse-width distortion ⁽¹⁾ $ t_{PHL} - t_{PLH} $						
t_{PLH} , t_{PHL}	Propagation delay	ISO723xM		8		30	ns
PWD	Pulse-width distortion ⁽¹⁾ $ t_{PHL} - t_{PLH} $						
$t_{sk(pp)}$	Part-to-part skew ⁽²⁾	ISO723xC				10	ns
		ISO723xM				0	

, over recommended operating conditions (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _{sk(o)}	Channel-to-channel output skew ⁽³⁾	ISO723xC		0	2.5	1	ns
		ISO723xM		0			
t _r	Output signal rise time		See 图 7-1	2.4			ns
t _f	Output signal fall time			2.3			
t _{PHZ}	Propagation delay, high-level-to-high-impedance output		See 图 7-2	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 图 7-3	12			μs
t _{jit(pp)}	Peak-to-peak eye-pattern jitter	ISO723xM	150 Mbps PRBS NRZ data input, Same polarity input on all channels, See 图 7-5	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.

6.16 Switching Characteristics: V_{CC1} at 5-V, V_{CC2} at 3.3-V

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	ISO723xC	See 图 7-1	20		50	ns
PWD	Pulse-width distortion ⁽¹⁾ t _{PHL} - t _{PLH}				3		
t _{PLH} , t _{PHL}	Propagation delay, low-to-high-level output	ISO723xM		8		29	ns
PWD	Pulse-width distortion ⁽¹⁾ t _{PHL} - t _{PLH}				1	2	
t _{sk(pp)}	Part-to-part skew ⁽²⁾	ISO723xC				10	ns
		ISO723xM				0	
t _{sk(o)}	Channel-to-channel output skew ⁽³⁾	ISO723xC		0	2.5	1	ns
		ISO723xM		0	1		
t _r	Output signal rise time		See 图 7-1	2.4			ns
t _f	Output signal fall time			2.3			
t _{PHZ}	Propagation delay, high-level-to-high-impedance output		See 图 7-2	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 图 7-3	18			μs
t _{jit(pp)}	Peak-to-peak eye-pattern jitter	ISO723xM	150 Mbps PRBS NRZ data input, Same polarity input on all channels, See 图 7-5	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.

6.17 Typical Characteristics

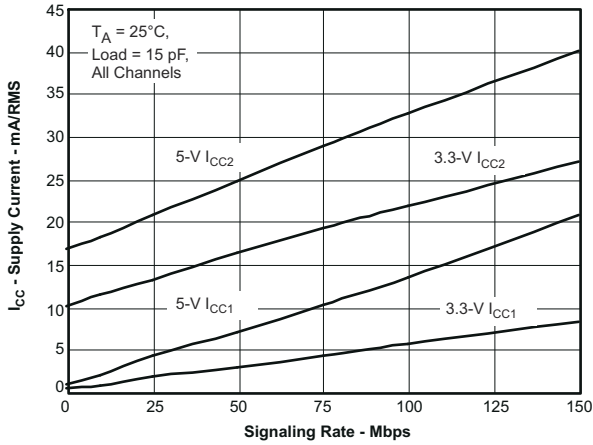


图 6-1. ISO7230C/M RMS Supply Current vs Signaling Rate

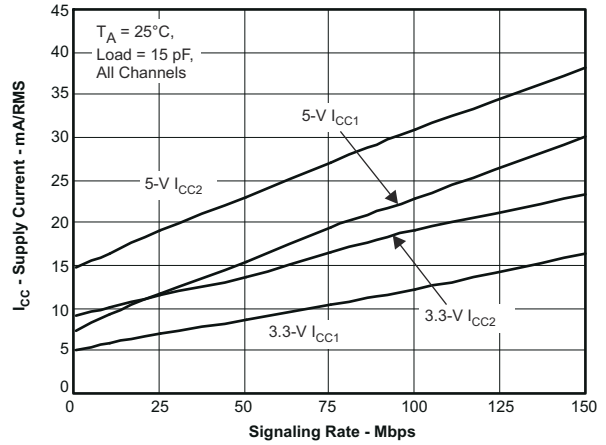


图 6-2. ISO7231C/M RMS Supply Current vs Signaling Rate

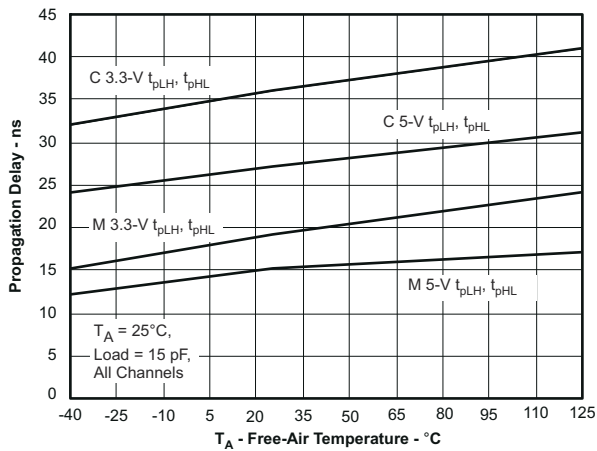


图 6-3. Propagation Delay vs Free-Air Temperature

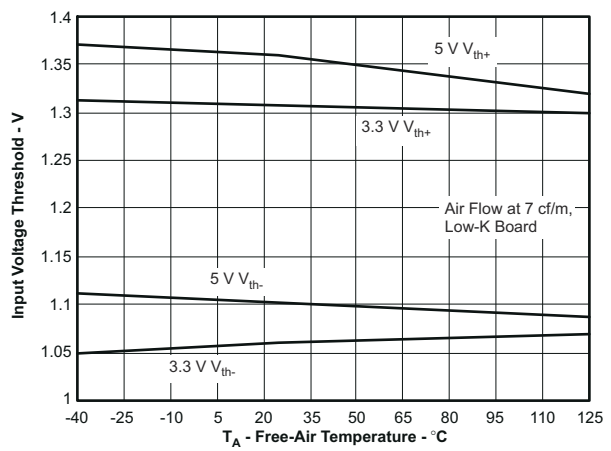


图 6-4. Input Threshold Voltage vs Free-Air Temperature

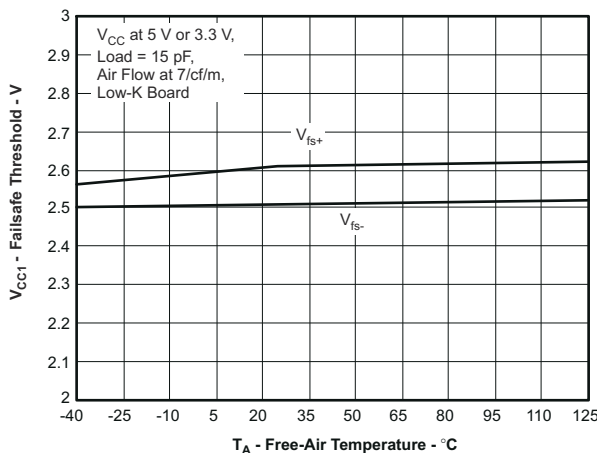


图 6-5. VCC1 Fail-Safe Threshold vs Free-Air Temperature

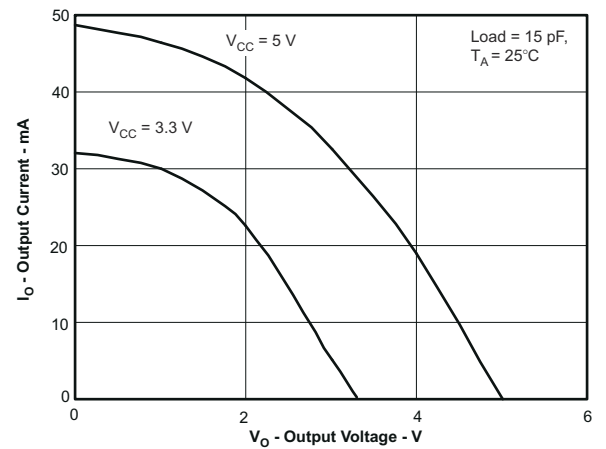


图 6-6. High-Level Output Current vs High-Level Output Voltage

6.17 Typical Characteristics (continued)

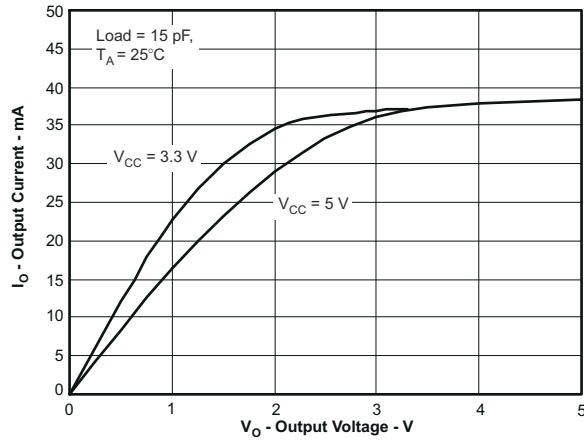
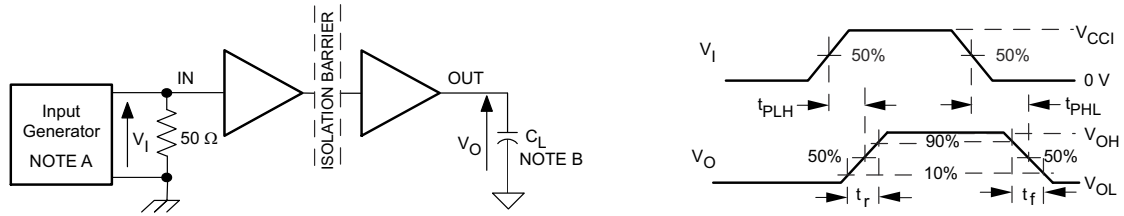


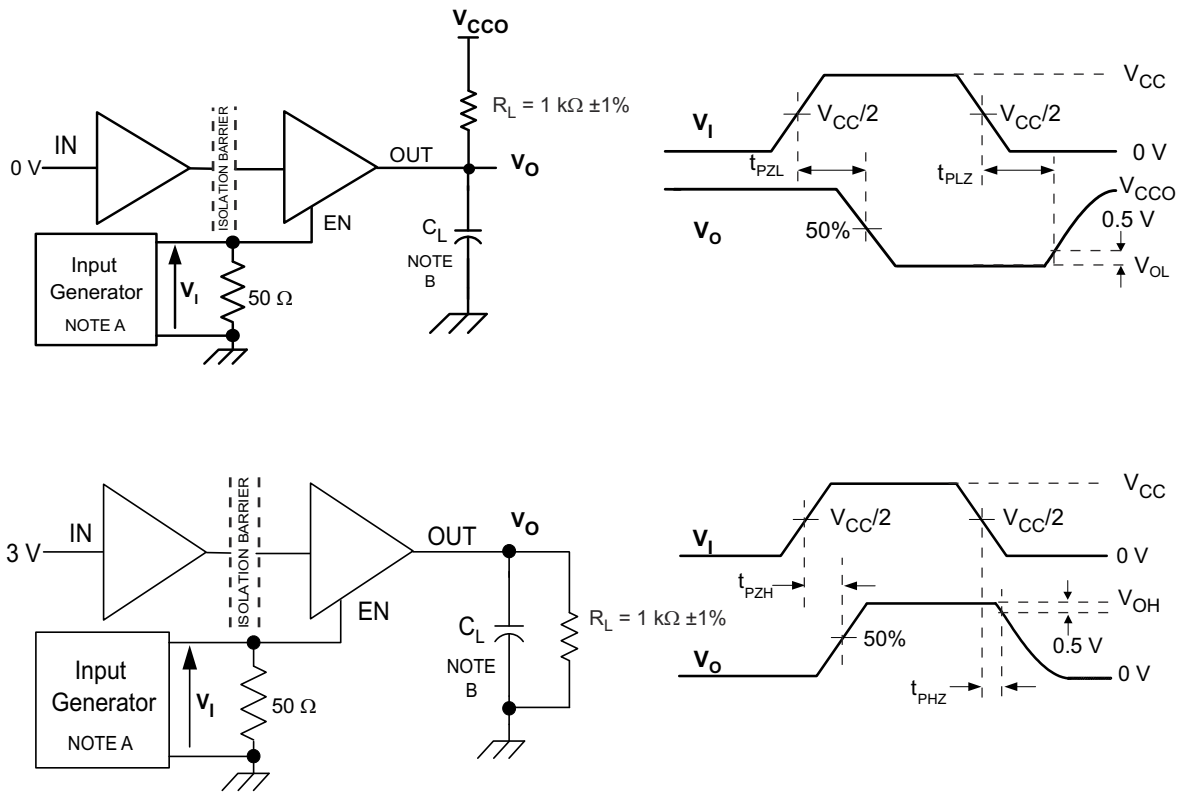
图 6-7. Low-Level Output Current vs Low-Level Output Voltage

7 Parameter Measurement Information



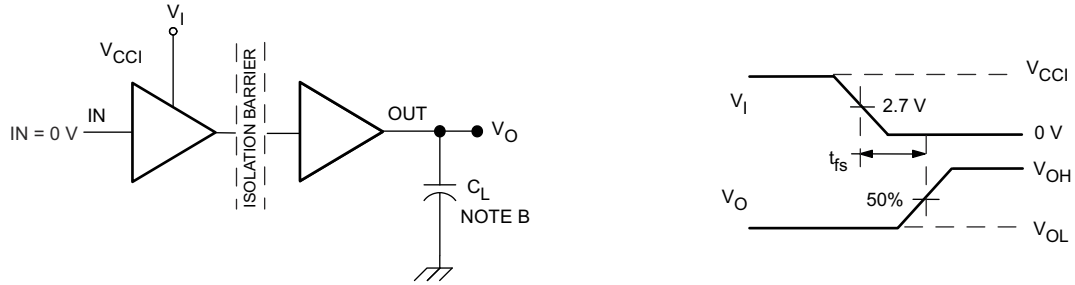
- A. The input pulse is supplied by a generator having the following characteristics: $PRR \leq 50$ kHz, 50% duty cycle, $t_r \leq 3$ ns, $t_f \leq 3$ ns, $Z_O = 50 \Omega$. At the input, a $50\text{-}\Omega$ resistor is required to terminate the Input Generator signal. The $50\text{-}\Omega$ is not needed in actual application.
- B. $C_L = 15$ pF and includes instrumentation and fixture capacitance within $\pm 20\%$.

图 7-1. Switching Characteristic Test Circuit and Voltage Waveforms



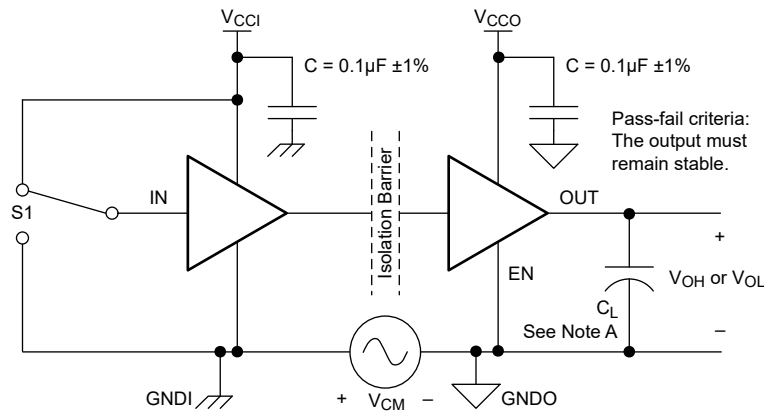
- A. The input pulse is supplied by a generator having the following characteristics: $PRR \leq 50$ kHz, 50% duty cycle, $t_r \leq 3$ ns, $t_f \leq 3$ ns, $Z_O = 50\Omega$.
- B. $C_L = 15$ pF and includes instrumentation and fixture capacitance within $\pm 20\%$.

图 7-2. Enable/Disable Propagation Delay Time Test Circuit and Waveform



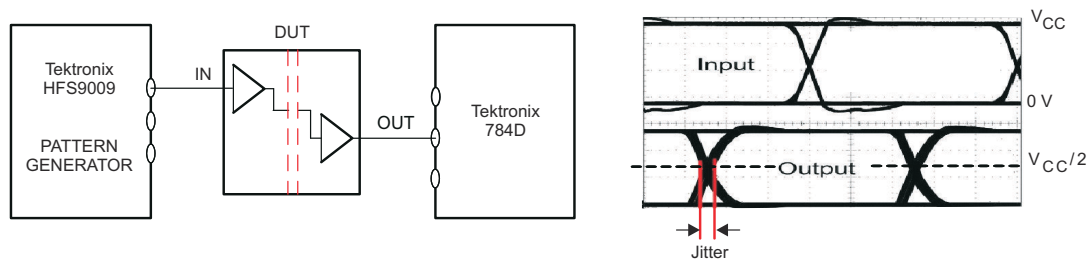
- A. The input pulse is supplied by a generator having the following characteristics: PRR \leq 50 kHz, 50% duty cycle, $t_r \leq$ 3 ns, $t_f \leq$ 3 ns, $Z_0 = 50 \Omega$.
- B. $C_L = 15$ pF and includes instrumentation and fixture capacitance within $\pm 20\%$.

图 7-3. Failsafe Delay Time Test Circuit and Voltage Waveforms



- A. $C_L = 15$ pF and includes instrumentation and fixture capacitance within $\pm 20\%$.

图 7-4. Common-Mode Transient Immunity Test Circuit



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.

图 7-5. Peak-to-Pek Eye-Pattern Jitter Test Circuit and Voltage Waveform

8 Detailed Description

8.1 Overview

The ISO723x family of devices transmit digital data across a silicon dioxide based isolation barrier. The digital input signal (IN) of the device is sampled by a transmitter and at every data edge the transmitter sends a corresponding differential signal across the isolation barrier. When the input signal is static, the refresh logic periodically sends the necessary differential signal from the transmitter. On the other side of the isolation barrier, the receiver converts the differential signal into a single-ended signal which is output on the OUT pin through a buffer. If the receiver does not receive a data or refresh signal, the timeout logic detects the loss of signal or power from the input side and drives the output to the default level.

8.2 Functional Block Diagram

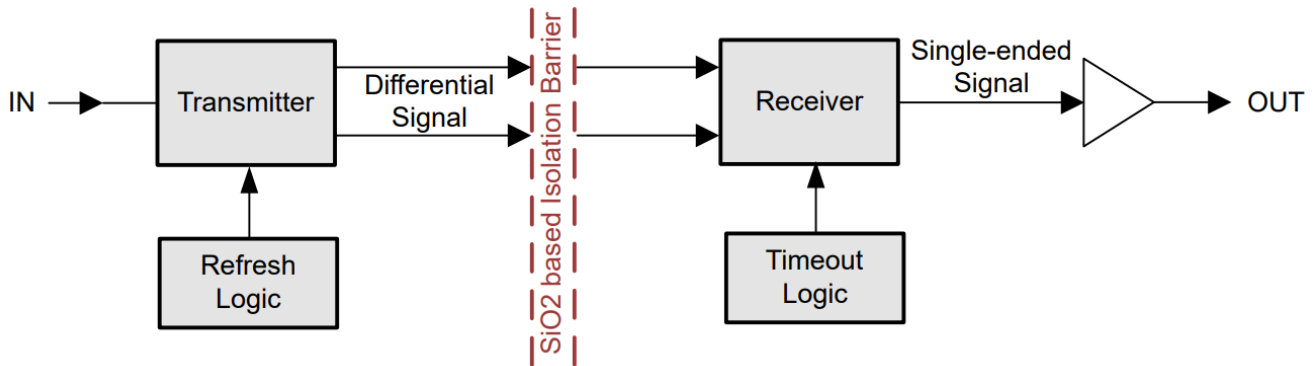


图 8-1. Conceptual Block Diagram of a Digital Isolator

8.3 Feature Description

The ISO723xx family of devices is available in multiple channel configurations and default output-state options to enable wide variety of application uses. 表 8-1 lists these device features.

表 8-1. Device Features

PRODUCT ⁽¹⁾	SIGNALING RATE	INPUT THRESHOLD	CHANNEL CONFIGURATION
ISO7230C	25 Mbps	≈1.5 V (TTL)	3/0
ISO7231C	25 Mbps	≈1.5 V (TTL)	2/1
ISO7231M	150 Mbps	V _{CC} / 2 (CMOS)	

(1) For the most current package and ordering information, see the 节 12 section, or see the TI website at www.ti.com.

8.4 Device Functional Modes

List of ISO723xx functional modes.

表 8-2. Device Function Table ISO723x

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
X	PD	X	X	Undetermined

8.4.1 Device I/O Schematics

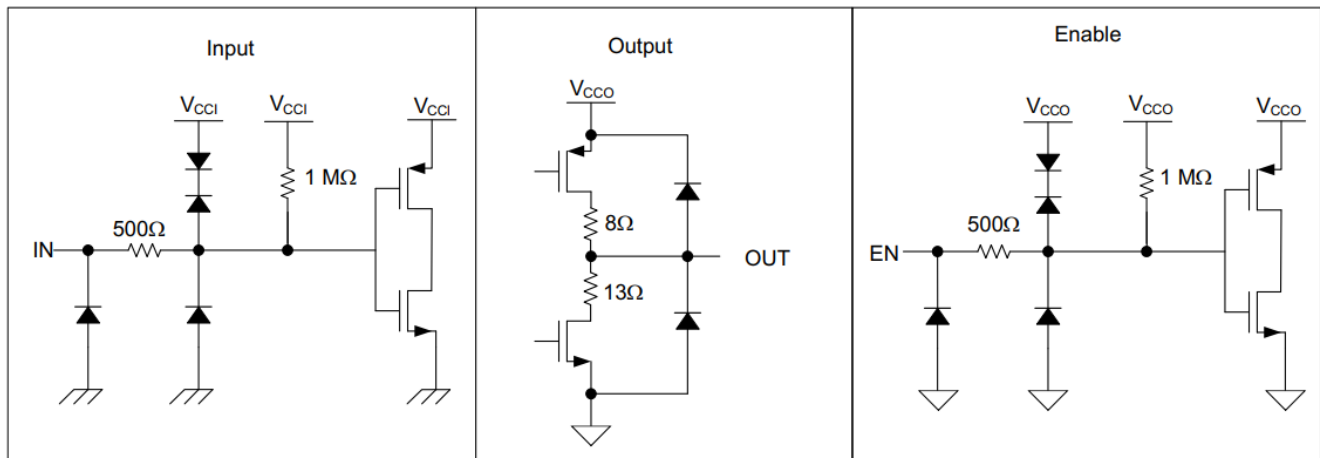


图 8-2. Device I/O Schematics

9 Application and Implementation

备注

以下应用部分中的信息不属于 TI 器件规格的范围，TI 不担保其准确性和完整性。TI 的客户应负责确定器件是否适用于其应用。客户应验证并测试其设计，以确保系统功能。

9.1 Application Information

ISO723x utilize single-ended TTL or CMOS-logic switching technologies. The supply voltage range is from 3.15 V to 5.5 V for both supplies, V_{CC1} and V_{CC2} . When designing with digital isolators keep in mind that due to the single-ended design structure, digital isolators do not conform to any specific interface standard and are only intended for isolating single-ended CMOS or TTL digital signal lines. The isolator is typically placed between the data controller (that is, μC or UART), and a data converter or a line transceiver, regardless of the interface type or standard.

9.2 Typical Application

ISO7231 combined with Texas Instruments' mixed signal micro-controller, RS-485 transceiver, transformer driver, and voltage regulator can create an isolated RS-485 system as shown in 图 9-1.

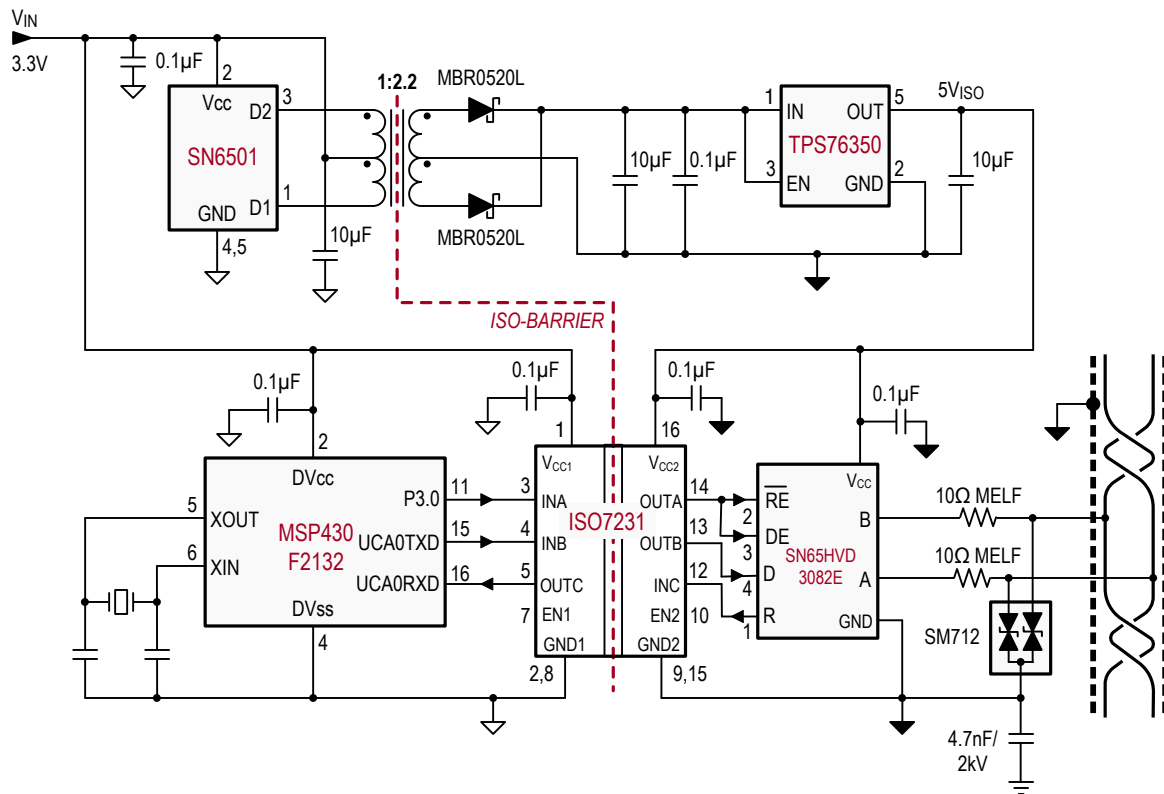


图 9-1. Isolated RS-485 Application Circuit

9.2.1 Design Requirements

Unlike optocouplers, which need external components to improve performance, provide bias, or limit current, ISO723x only needs two external bypass capacitors to operate.

9.2.2 Detailed Design Procedure

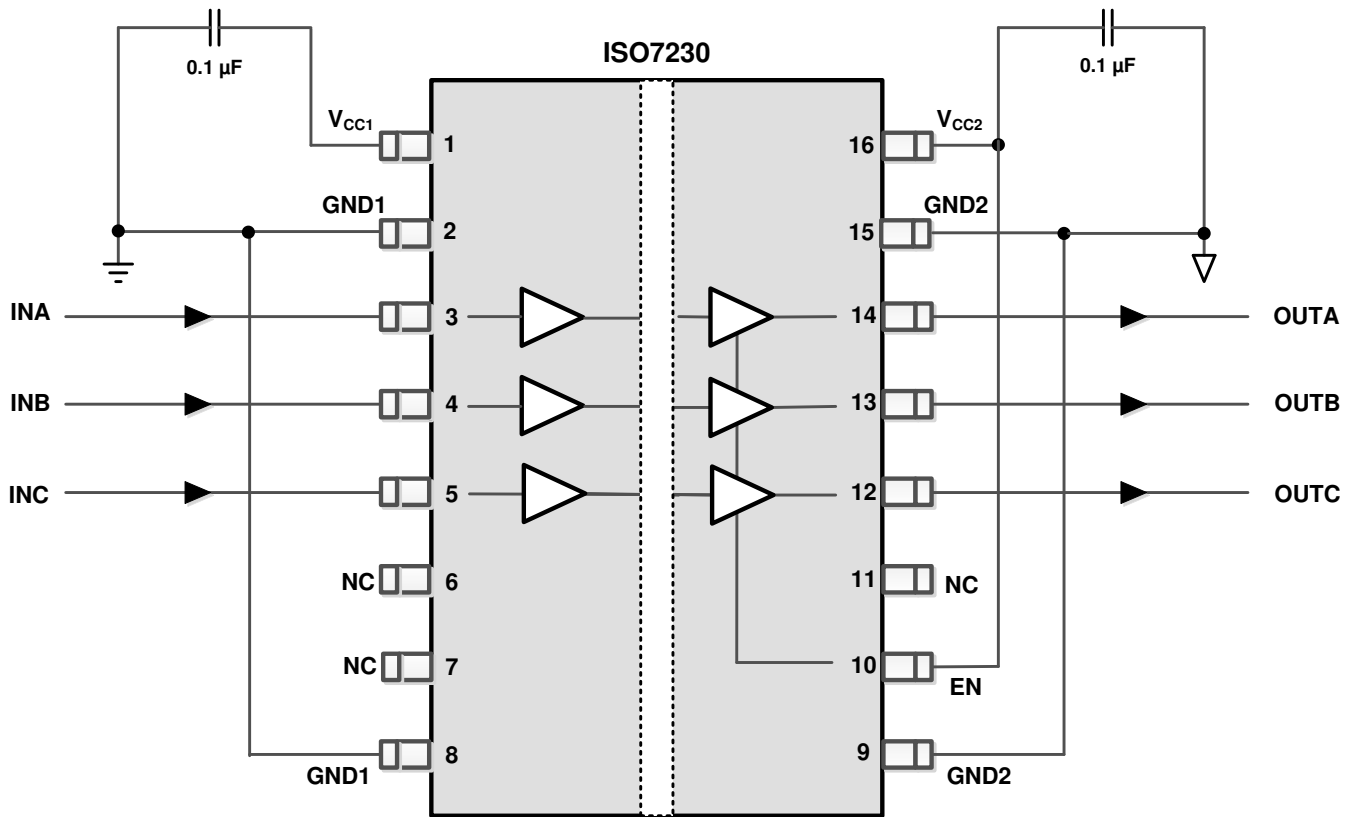


图 9-2. Typical ISO7230 Circuit Hook-up

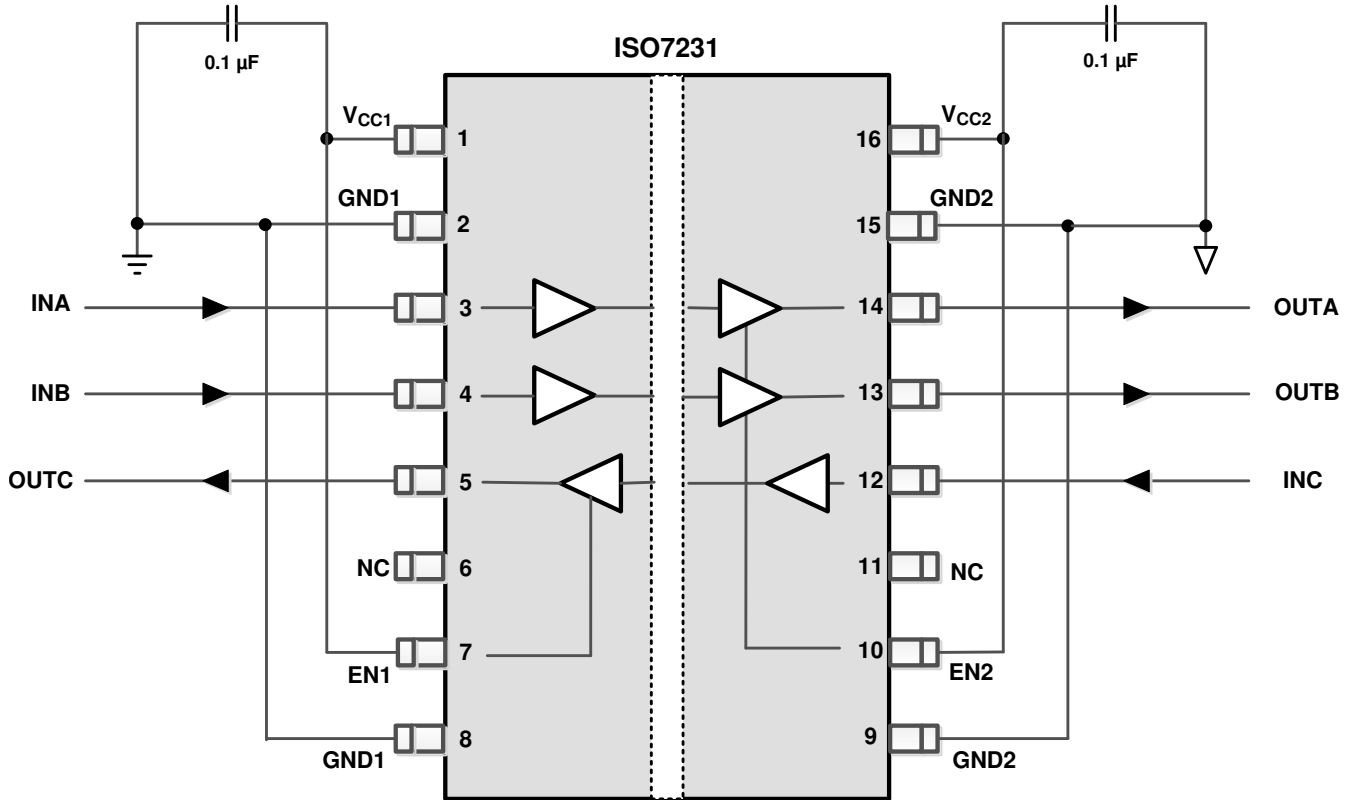


图 9-3. Typical ISO7231 Circuit Hook-up

9.2.3 Application Performance Plots

9.2.3.1 Insulation Characteristics Curves

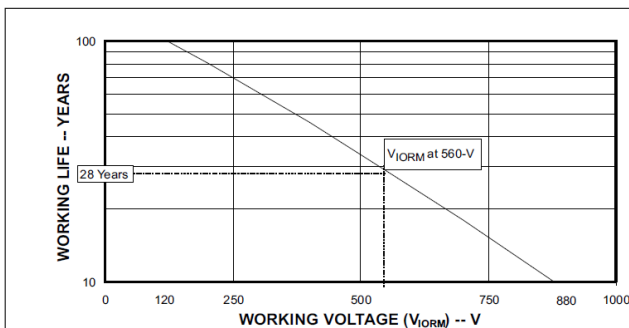


图 9-4. Isolation Lifetime Projection

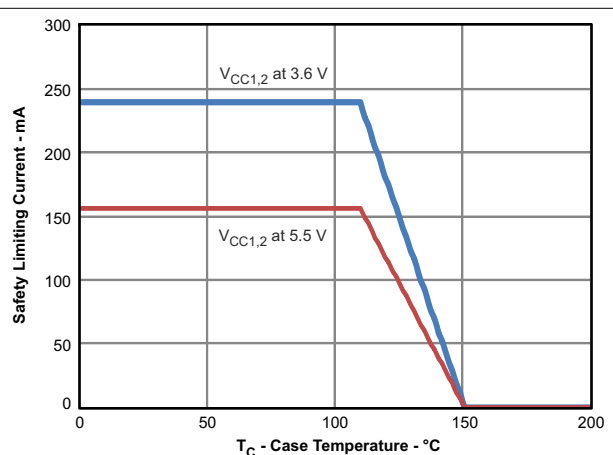


图 9-5. Thermal Derating Curve for Limiting Current per VDE

9.3 Power Supply Recommendations

To provide reliable operation at all data rates and supply voltages, a 0.1 μF bypass capacitor is recommended at input and output supply pins (V_{CC1} and V_{CC2}). The capacitors must be placed as close to the supply pins as possible. If only a single primary-side power supply is available in an application, isolated power can be

generated for the secondary-side with the help of a transformer driver such as Texas Instruments SN6501 data sheet. For such applications, detailed power supply design and transformer selection recommendations are available in the [SN6501 data sheet](#).

9.4 Layout

9.4.1 Layout Guidelines

A minimum of four layers is required to accomplish a low EMI PCB design (see [图 9-6](#)). Layer stacking must be in the following order (top-to-bottom): high-speed signal layer, ground plane, power plane and low-frequency signal layer.

- Routing the high-speed traces on the top layer avoids the use of vias (and the introduction of the inductances) and allows for clean interconnects between the isolator and the transmitter and receiver circuits of the data link.
- Placing a solid ground plane next to the high-speed signal layer establishes controlled impedance for transmission line interconnects and provides an excellent low-inductance path for the return current flow.
- Placing the power plane next to the ground plane creates additional high-frequency bypass capacitance of approximately 100pF/in².
- Routing the slower speed control signals on the bottom layer allows for greater flexibility as these signal links usually have margin to tolerate discontinuities such as vias.

If an additional supply voltage plane or signal layer is needed, add a second power/ground plane system to the stack to keep the planes symmetrical. This makes the stack mechanically stable and prevents warping. Also the power and ground plane of each power system can be placed closer together, thus increasing the high-frequency bypass capacitance significantly. For detailed layout recommendations, see Application Note [SLLA284](#), *Digital Isolator Design Guide*.

9.4.1.1 PCB Material

For digital circuit boards operating below 150 Mbps, (or rise and fall times higher than 1 ns), and trace lengths of up to 10 inches, use standard FR-4 epoxy-glass as PCB material. FR-4 (Flame Retardant 4) meets the requirements of Underwriters Laboratories UL94-V0, and is preferred over cheaper alternatives due to the lower dielectric losses at high frequencies, less moisture absorption, greater strength and stiffness, and the self-extinguishing flammability-characteristics.

9.4.2 Layout Example

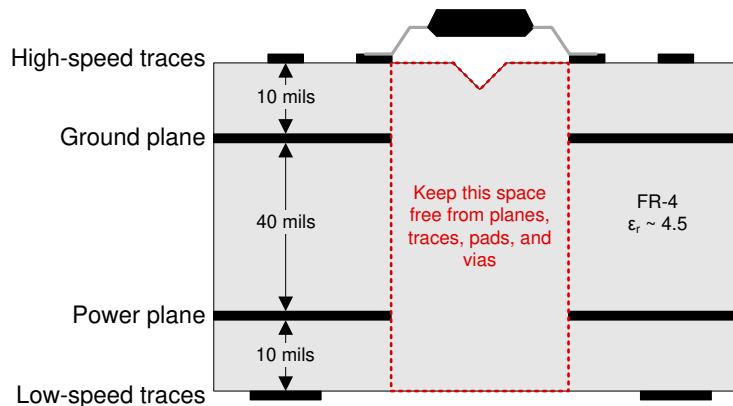


图 9-6. Recommended Layer Stack

10 Device and Documentation Support

10.1 Documentation Support

10.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, [High-Voltage Lifetime of the ISO72x Family of Digital Isolators application report](#)
- Texas Instruments, [ISO72x Digital Isolator Magnetic-Field Immunity application report](#)
- Texas Instruments, [SN6501 Transformer Driver for Isolated Power Supplies data sheet](#)
- Texas Instruments, [Digital Isolator Design Guide application report](#)
- Texas Instruments, [Isolation Glossary application report](#)

10.2 接收文档更新通知

要接收文档更新通知，请导航至 ti.com 上的器件产品文件夹。点击 [通知](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

10.3 支持资源

[TI E2E™ 中文支持论坛](#) 是工程师的重要参考资料，可直接从专家处获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题，获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 [使用条款](#)。

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DeviceNet™ is a trademark of Open DeviceNet Vendors Association.

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10.5 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

10.6 术语表

[TI 术语表](#) 本术语表列出并解释了术语、首字母缩略词和定义。

11 Revision History

注：以前版本的页码可能与当前版本的页码不同

Changes from Revision K (October 2015) to Revision L (October 2024)	Page
• 更新了整个文档中的表格、图和交叉参考的编号格式.....	1
• 通篇将“VDE V 0884-11”更新为“DIN VDE 0884-17”.....	1
• 通篇将引用内容从电容隔离更新为隔离栅.....	1
• Updated Thermal Characteristics, Safety Limiting Values, and Thermal Derating Curves to provide more accurate system-level thermal calculations.....	4
• Updated the <i>Regulatory Information</i> table.....	6
• Updated electrical and switching characteristics to match device performance.....	6
• Moved the <i>Insulation Characteristics Curves</i> to the <i>Application Curves</i> section.....	19

Changes from Revision J (May 2015) to Revision K (October 2015)	Page
• Added Note 1 to L(I01) and changed the MIN value From: 8.34 To 8 mm in the <i>Insulation Specifications</i> table.....	5
• Added Note 1 to LI02) and changed the MIN value From: 8.1 To 8 mm in the <i>Insulation Specifications</i> table..	5
• Deleted Note 1 From the <i>Safety-Related Certifications</i> table.....	6
• Changed The ground symbols on the Enable circuit in the Device I/O Schematics images.....	16

12 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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
ISO7230CDW	OBSOLETE	SOIC	DW	16		TBD	Call TI	Call TI	-40 to 125	ISO7230C	
ISO7230CDWR	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	ISO7230C	Samples
ISO7230MDW	OBSOLETE	SOIC	DW	16		TBD	Call TI	Call TI	-40 to 125	ISO7230M	
ISO7230MDWR	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	ISO7230M	Samples
ISO7231CDW	OBSOLETE	SOIC	DW	16		TBD	Call TI	Call TI	-40 to 125	ISO7231C	
ISO7231CDWR	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	ISO7231C	Samples
ISO7231CDWRG4	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	ISO7231C	Samples
ISO7231MDW	OBSOLETE	SOIC	DW	16		TBD	Call TI	Call TI	-40 to 125	ISO7231M	
ISO7231MDWR	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	ISO7231M	Samples
ISO7231MDWRG4	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	ISO7231M	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 :

- 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	350.0	350.0	43.0
ISO7230MDWR	SOIC	DW	16	2000	350.0	350.0	43.0
ISO7231CDWR	SOIC	DW	16	2000	350.0	350.0	43.0
ISO7231MDWR	SOIC	DW	16	2000	350.0	350.0	43.0

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