

# ISO71xxCC 4242-V<sub>PK</sub> Small-Footprint Low-Power Triple and Quad Channels Digital Isolators

## 1 Features

- Maximum Signaling Rate: 50 Mbps (With 5-V Supplies)
- Robust Design With Integrated Noise Filter
- Default Output Low Option (Suffix F)
- Low Power Consumption, Typical I<sub>CC</sub> per Channel (With 3.3-V Supplies):
  - ISO7131: 1.5 mA at 1 Mbps, 2.6 mA at 25 Mbps
  - ISO7140: 1 mA at 1 Mbps, 2.3 mA at 25 Mbps
  - ISO7141: 1.3 mA at 1 Mbps, 2.6 mA at 25 Mbps
- Low Propagation Delay: 23-ns Typical (3.3-V Supplies)
- Wide Temperature Range: –40°C to 125°C
- 50-kV/μs Transient Immunity, Typical
- Long Life With SiO<sub>2</sub> Isolation Barrier
- Operates from 2.7-V, 3.3-V, and 5-V Supply and Logic Levels
- Small QSOP-16 Package
- Safety and Regulatory Approvals
  - 2500-V<sub>RMS</sub> Isolation for 1 minute per UL 1577
  - 4242-V<sub>PK</sub> Isolation per DIN V VDE V 0884-10 (VDE V 0884-10):2006-12, 566 V<sub>PK</sub> Working Voltage
  - CSA Component Acceptance Notice 5A, IEC 60950-1 and IEC 61010-1 End Equipment Standards
  - CQC Certification per GB 4943.1-2011

## 2 Applications

- General-Purpose Isolation
  - Industrial Fieldbus
    - Profibus
    - Modbus™
    - DeviceNet Data Buses
  - RS-232, RS-485
  - Serial Peripheral Interface

## 3 Description

ISO7131, ISO7140, and ISO7141 devices provide galvanic isolation up to 2500 V<sub>RMS</sub> for 1 minute per UL and 4242 V<sub>PK</sub> per VDE. ISO7131 has three channels with two forward and one reverse-direction channels. ISO7140 and ISO7141 are quad-channel isolators; ISO7140 has four forward channels, ISO7141 has three forward and one reverse-direction channels. These devices are capable of 50-Mbps maximum data rate with 5-V supplies and 40-Mbps maximum data rate with 3.3-V or 2.7-V supplies, with integrated filters on the inputs for noise-prone applications. The suffix F indicates that default output state is low; otherwise, the default output state is high (see [Table 3](#)).

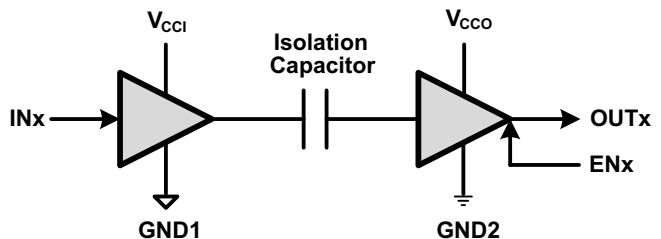
Each isolation channel has a logic input and output buffer separated by a silicon dioxide (SiO<sub>2</sub>) insulation barrier. Used with isolated power supplies, these devices prevent noise currents on a data bus or other circuits from entering the local ground and interfering with or damaging sensitive circuitry. The devices have TTL input thresholds and can operate from 2.7-V, 3.3-V, and 5-V supplies. All inputs are 5-V tolerant when supplied from a 2.7-V or 3.3-V supply.

### Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
ISO7131CC	SSOP (16)	4.90 mm x 3.90 mm
ISO7140CC		
ISO7140FCC		
ISO7141CC		
ISO7141FCC		

(1) For all available packages, see the orderable addendum at the end of the datasheet.

### Simplified Schematic



## Table of Contents

<b>1 Features</b> .....	<b>1</b>	6.14 Supply Current: $V_{CC1}$ and $V_{CC2}$ at 2.7 V.....	<b>11</b>
<b>2 Applications</b> .....	<b>1</b>	6.15 Typical Characteristics .....	<b>12</b>
<b>3 Description</b> .....	<b>1</b>	<b>7 Parameter Measurement Information</b> .....	<b>14</b>
<b>4 Revision History</b> .....	<b>2</b>	<b>8 Detailed Description</b> .....	<b>16</b>
<b>5 Pin Configuration and Functions</b> .....	<b>4</b>	8.1 Overview .....	<b>16</b>
<b>6 Specifications</b> .....	<b>5</b>	8.2 Functional Block Diagram .....	<b>16</b>
6.1 Absolute Maximum Ratings .....	<b>5</b>	8.3 Feature Description.....	<b>17</b>
6.2 ESD Ratings.....	<b>5</b>	8.4 Device Functional Modes.....	<b>19</b>
6.3 Recommended Operating Conditions.....	<b>5</b>	<b>9 Application and Implementation</b> .....	<b>21</b>
6.4 Thermal Information .....	<b>6</b>	9.1 Application Information.....	<b>21</b>
6.5 Power Dissipation Ratings .....	<b>6</b>	9.2 Typical Applications .....	<b>21</b>
6.6 Electrical Characteristics: $V_{CC1}$ and $V_{CC2}$ at 5 V $\pm 10\%$ .....	<b>6</b>	<b>10 Power Supply Recommendations</b> .....	<b>25</b>
6.7 Electrical Characteristics: $V_{CC1}$ and $V_{CC2}$ at 3.3 V $\pm 10\%$ .....	<b>6</b>	<b>11 Layout</b> .....	<b>25</b>
6.8 Electrical Characteristics: $V_{CC1}$ and $V_{CC2}$ at 2.7 V ...	<b>7</b>	11.1 Layout Guidelines .....	<b>25</b>
6.9 Switching Characteristics: $V_{CC1}$ and $V_{CC2}$ at 5 V $\pm 10\%$ .....	<b>7</b>	11.2 Layout Example .....	<b>25</b>
6.10 Switching Characteristics: $V_{CC1}$ and $V_{CC2}$ at 3.3 V $\pm 10\%$ .....	<b>8</b>	<b>12 Device and Documentation Support</b> .....	<b>26</b>
6.11 Switching Characteristics: $V_{CC1}$ and $V_{CC2}$ at 2.7 V.	<b>8</b>	12.1 Documentation Support .....	<b>26</b>
6.12 Supply Current: $V_{CC1}$ and $V_{CC2}$ at 5 V $\pm 10\%$ .....	<b>9</b>	12.2 Related Links .....	<b>26</b>
6.13 Supply Current: $V_{CC1}$ and $V_{CC2}$ at 3.3 V $\pm 10\%$ ....	<b>10</b>	12.3 Trademarks .....	<b>26</b>
		12.4 Electrostatic Discharge Caution.....	<b>26</b>
		12.5 Glossary .....	<b>26</b>
		<b>13 Mechanical, Packaging, and Orderable Information</b> .....	<b>26</b>

## 4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

### Changes from Revision E (September 2013) to Revision F

Page

• Added <i>Pin Configuration and Functions</i> section, <i>ESD Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section .....	<b>1</b>
• VDE Standard changed to DIN V VDE V 0884-10 (VDE V 0884-10):2006-12 .....	<b>1</b>

### Changes from Revision D (August 2013) to Revision E

Page

• Changed From: 2500 $V_{RMS}$ Isolation for 1 minute per UL 1577 (Approval Pending) To: (Approved) .....	<b>1</b>
• Added note1 to the AVAILABLE OPTIONS table.....	<b>17</b>
• Changed <a href="#">Figure 15</a> .....	<b>18</b>
• Changed From: Basic Insulation To: Basic Insulation, Altitude $\leq$ 5000m, Tropical Climate, 250 VRMS maximum working voltage in the Regulatory Information table .....	<b>19</b>
• Changed File number: E181974 (approval pending) To: File number: E181974 in the Regulatory Information table .....	<b>19</b>
• Changed the title of <a href="#">Figure 21</a> , <a href="#">Figure 22</a> , and <a href="#">Figure 23</a> to include "PRBS 2 <sup>16</sup> - 1" .....	<b>23</b>

### Changes from Revision C (July 2013) to Revision D

Page

• Added Safety List item "GB 4943.1-2011 and GB 8898:2011 CQC Certification (Approval Pending)" .....	<b>1</b>
• Added <a href="#">Figure 2</a> .....	<b>12</b>
• Deleted "Product Preview" From the AVAILABLE OPTIONS table .....	<b>17</b>
• Changed the REGULATORY INFORMATION, added column for CQC .....	<b>19</b>

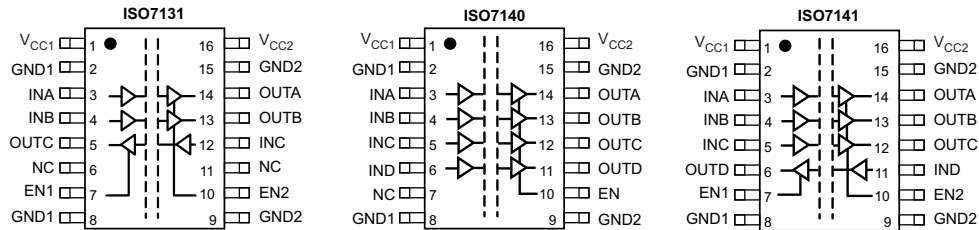
<b>Changes from Revision B (June 2013) to Revision C</b>	<b>Page</b>
• Changed Feature From: ISO7140: TBD at 1 Mbps, TBD at 25 Mbps To: ISO7140: 1 mA at 1 Mbps, 2.3 mA at 25 Mbps..	1
• Added text to the Description: "All inputs are 5V tolerant when supplied from a 2.7V or 3.3V supply."	1
• Deleted the Product Status table.....	1
• Changed the SAFETY and REGULATORY APPROVALS .....	1
• Changed the ABSOLUTE MAXIMUM RATINGS table .....	5
• Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. ....	7
• Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. ....	8
• Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. ....	8
• Changed ISO7140 in the SUPPLY CURRENT table From: TBD To: values.....	9
• Changed ISO7140 in the SUPPLY CURRENT table From: TBD To: values.....	10
• Changed ISO7140 in the SUPPLY CURRENT table From: TBD To: values.....	11
• Changed <a href="#">Figure 1</a> X-axis scale .....	12
• Changed the AVAILABLE OPTIONS table.....	17

<b>Changes from Revision A (June 2013) to Revision B</b>	<b>Page</b>
• Changed device ISO7141CC From: Product Preview To: Released in the Product Status table .....	1

<b>Changes from Original (April 2013) to Revision A</b>	<b>Page</b>
• Changed the Simplified Schematic, added ground symbols .....	1
• Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. Values by device. ....	7
• Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. Values by device. ....	8
• Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. Values by device. ....	8
• Added <a href="#">Figure 3</a> .....	12

## 5 Pin Configuration and Functions

16-Pin  
SSOP Package  
Top View



Pin Functions

NAME	PIN			I/O	DESCRIPTION
	ISO7131	ISO7140	ISO7141		
EN	—	10	—	I	Output enable. All output pins are enabled when EN is high or disconnected and disabled when EN is low.
EN1	7	—	7	I	Output enable 1. Output pins on side-1 are enabled when EN1 is high or disconnected and disabled when EN1 is low.
EN2	10	—	10	I	Output enable 2. Output pins on side-2 are enabled when EN2 is high or disconnected and disabled when EN2 is low.
GND1	2,8	2,8	2,8	—	Ground connection for $V_{CC1}$
GND2	9,15	9,15	9,15	—	Ground connection for $V_{CC2}$
INA	3	3	3	I	Input, channel A
INB	4	4	4	I	Input, channel B
INC	12	5	5	I	Input, channel C
IND	—	6	11	I	Input, channel D
NC	6,11	7	—	—	No Connect pins are floating with no internal connection
OUTA	14	14	14	O	Output, channel A
OUTB	13	13	13	O	Output, channel B
OUTC	5	12	12	O	Output, channel C
OUTD	—	11	6	O	Output, channel D
$V_{CC1}$	1	1	1	—	Power supply, $V_{CC1}$
$V_{CC2}$	16	16	16	—	Power supply, $V_{CC2}$

## 6 Specifications

### 6.1 Absolute Maximum Ratings<sup>(1)</sup>

		MIN	MAX	UNIT
$V_{CC1}, V_{CC2}$	Supply voltage <sup>(2)</sup>	-0.5	6	V
$IN_x, EN_x,$ $OUT_x$	Voltage	-0.5	$V_{CC} + 0.5$ <sup>(3)</sup>	V
$I_O$	Output current	-15	15	mA
$T_J$	Maximum junction temperature		150	°C
$T_{stg}$	Storage temperature	-65	150	°C

- (1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values except differential I/O bus voltages are with respect to the local ground terminal (GND1 or GND2) and are peak voltage values.
- (3) 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 <sup>(1)</sup>	±4000	V
Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup>	±1500		

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

### 6.3 Recommended Operating Conditions

		MIN	NOM	MAX	UNIT
$V_{CC1}, V_{CC2}$	Supply voltage	2.7		5.5	V
$I_{OH}$	High-level output current ( $V_{CC} \geq 3.0$ V)	-4			mA
	High-level output current ( $V_{CC} < 3.0$ V)	-2			
$I_{OL}$	Low-level output current			4	mA
$V_{IH}$	High-level input voltage	2		5.5	V
$V_{IL}$	Low-level input voltage	0		0.8	
$t_{ui}$	Input pulse duration ( $V_{CC} \geq 4.5$ V)	20			ns
$t_{ui}$	Input pulse duration ( $V_{CC} < 4.5$ V)	25			
$1 / t_{ui}$	Signaling rate ( $V_{CC} \geq 4.5$ V)	0		50	Mbps
$1 / t_{ui}$	Signaling rate ( $V_{CC} < 4.5$ V)	0		40	
$T_A$	Ambient temperature	-40	25	125	°C
$T_J$	Junction temperature	-40		136	

## 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		ISO7131, ISO714x	UNIT
		DBQ	
		16 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	104.5	°C/W
R <sub>θJC(top)</sub>	Junction-to-case(top) thermal resistance	57.8	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	46.8	°C/W
ψ <sub>JT</sub>	Junction-to-top characterization parameter	18.3	°C/W
ψ <sub>JB</sub>	Junction-to-board characterization parameter	46.4	°C/W

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](http://SPRA953).

## 6.5 Power Dissipation Ratings

		TEST CONDITIONS	VALUE	UNIT
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 25-MHz, 50% duty cycle square wave	150	mW

## 6.6 Electrical Characteristics: V<sub>CC1</sub> and V<sub>CC2</sub> at 5 V ±10%

V<sub>CC1</sub> and V<sub>CC2</sub> at 5 V ± 10% (over recommended operating conditions unless otherwise noted.)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V <sub>OH</sub>	High-level output voltage	I <sub>OH</sub> = -4 mA; see <a href="#">Figure 10</a>	V <sub>CCO</sub> <sup>(1)</sup> - 0.5	4.8		V
		I <sub>OH</sub> = -20 μA; see <a href="#">Figure 10</a>	V <sub>CCO</sub> <sup>(1)</sup> - 0.1	5		
V <sub>OL</sub>	Low-level output voltage	I <sub>OL</sub> = 4 mA; see <a href="#">Figure 10</a>		0.2	0.4	V
		I <sub>OL</sub> = 20 μA; see <a href="#">Figure 10</a>		0	0.1	
V <sub>I(HYS)</sub>	Input threshold voltage hysteresis			450		mV
I <sub>IH</sub>	High-level input current	V <sub>IH</sub> = V <sub>CC</sub> at INx or ENx			10	μA
I <sub>IL</sub>	Low-level input current	V <sub>IL</sub> = 0 V at INx or ENx	-10			μA
CMTI	Common-mode transient immunity	V <sub>I</sub> = V <sub>CC</sub> or 0 V; see <a href="#">Figure 13</a>	25	75		kV/μs

(1) V<sub>CCO</sub> is the supply voltage, V<sub>CC1</sub> or V<sub>CC2</sub>, for the output channel that is being measured.

## 6.7 Electrical Characteristics: V<sub>CC1</sub> and V<sub>CC2</sub> at 3.3 V ±10%

V<sub>CC1</sub> and V<sub>CC2</sub> at 3.3 V ±10% (over recommended operating conditions unless otherwise noted.)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V <sub>OH</sub>	High-level output voltage	I <sub>OH</sub> = -4 mA; see <a href="#">Figure 10</a>	V <sub>CCO</sub> <sup>(1)</sup> - 0.5	3		V
		I <sub>OH</sub> = -20 μA; see <a href="#">Figure 10</a>	V <sub>CCO</sub> <sup>(1)</sup> - 0.1	3.3		
V <sub>OL</sub>	Low-level output voltage	I <sub>OL</sub> = 4 mA; see <a href="#">Figure 10</a>		0.2	0.4	V
		I <sub>OL</sub> = 20 μA; see <a href="#">Figure 10</a>		0	0.1	
V <sub>I(HYS)</sub>	Input threshold voltage hysteresis			425		mV
I <sub>IH</sub>	High-level input current	V <sub>IH</sub> = V <sub>CC</sub> at INx or ENx			10	μA
I <sub>IL</sub>	Low-level input current	V <sub>IL</sub> = 0 V at INx or ENx	-10			μA
CMTI	Common-mode transient immunity	V <sub>I</sub> = V <sub>CC</sub> or 0 V; see <a href="#">Figure 13</a>	25	50		kV/μs

(1) V<sub>CCO</sub> is the supply voltage, V<sub>CC1</sub> or V<sub>CC2</sub>, for the output channel that is being measured.

## 6.8 Electrical Characteristics: $V_{CC1}$ and $V_{CC2}$ at 2.7 V

$V_{CC1}$  and  $V_{CC2}$  at 2.7 V (over recommended operating conditions unless otherwise noted.)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{OH}$	High-level output voltage	$I_{OH} = -2$ mA; see <a href="#">Figure 10</a>	$V_{CCO}^{(1)} - 0.3$	2.5		V
		$I_{OH} = -20$ $\mu$ A; see <a href="#">Figure 10</a>	$V_{CCO}^{(1)} - 0.1$	2.7		
$V_{OL}$	Low-level output voltage	$I_{OL} = 4$ mA; see <a href="#">Figure 10</a>		0.2	0.4	V
		$I_{OL} = 20$ $\mu$ A; see <a href="#">Figure 10</a>		0	0.1	
$V_{I(HYS)}$	Input threshold voltage hysteresis			350		mV
$I_{IH}$	High-level input current	$V_{IH} = V_{CC}$ at INx or ENx			10	$\mu$ A
$I_{IL}$	Low-level input current	$V_{IL} = 0$ V at INx or ENx	-10			$\mu$ A
CMTI	Common-mode transient immunity	$V_I = V_{CC}$ or 0 V; see <a href="#">Figure 13</a>	25	50		kV/ $\mu$ s

(1)  $V_{CCO}$  is the supply voltage,  $V_{CC1}$  or  $V_{CC2}$ , for the output channel that is being measured.

## 6.9 Switching Characteristics: $V_{CC1}$ and $V_{CC2}$ at 5 V $\pm$ 10%

$V_{CC1}$  and  $V_{CC2}$  at 5 V  $\pm$ 10% (over recommended operating conditions unless otherwise noted.)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$	Propagation delay time	See <a href="#">Figure 10</a>	12	19	35	ns
PWD <sup>(1)</sup>	Pulse width distortion $ t_{PHL} - t_{PLH} $		3			
$t_{sk(o)}$ <sup>(2)</sup>	Channel-to-channel output skew time	Same-direction channels			2	ns
		Opposite-direction channels			4	
$t_{sk(pp)}$ <sup>(3)</sup>	Part-to-part skew time			12	ns	
$t_r$	Output signal rise time	See <a href="#">Figure 10</a>		2		ns
$t_f$	Output signal fall time			2		ns
$t_{PHZ}$ , $t_{PLZ}$	Disable propagation delay, high/low-to-high impedance output	See <a href="#">Figure 11</a>		6	10	ns
$t_{PZH}$ , $t_{PZL}$	Enable propagation delay, high impedance-to-high/low output			5	10	ns
$t_{fs}$	Fail-safe output delay time from input data or power loss	See <a href="#">Figure 12</a>		9.5		$\mu$ s
$t_{GR}$	Input glitch rejection time			11		ns

(1) Also known as pulse skew

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

(3)  $t_{sk(pp)}$  is the magnitude of the difference in propagation delay times between any terminals of different devices switching in the same direction while operating at identical supply voltages, temperature, input signals, and loads.

## 6.10 Switching Characteristics: $V_{CC1}$ and $V_{CC2}$ at 3.3 V $\pm$ 10%

$V_{CC1}$  and  $V_{CC2}$  at 3.3 V  $\pm$ 10% (over recommended operating conditions unless otherwise noted.)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$	Propagation delay time	See Figure 10	15	23	45	ns
PWD <sup>(1)</sup>	Pulse width distortion $ t_{PHL} - t_{PLH} $					
$t_{sk(o)}$ <sup>(2)</sup>	Channel-to-channel output skew time	Same-direction Channels			2	ns
		Opposite-direction Channels			4	
$t_{sk(pp)}$ <sup>(3)</sup>	Part-to-part skew time				19	ns
$t_r$	Output signal rise time	See Figure 10		2.5		ns
$t_f$	Output signal fall time			2.5		ns
$t_{PHZ}$ , $t_{PLZ}$	Disable propagation delay, from high/low to high-impedance output	See Figure 11		6.5	15	ns
$t_{PZH}$ , $t_{PZL}$	Enable propagation delay, from high-impedance to high/low output			6.5	15	ns
$t_{fs}$	Fail-safe output delay time from input data or power loss	See Figure 12		8		$\mu$ s
$t_{GR}$	Input glitch rejection time			12.5		ns

(1) Also known as pulse skew

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

(3)  $t_{sk(pp)}$  is the magnitude of the difference in propagation delay times between any terminals of different devices switching in the same direction while operating at identical supply voltages, temperature, input signals and loads.

## 6.11 Switching Characteristics: $V_{CC1}$ and $V_{CC2}$ at 2.7 V

$V_{CC1}$  and  $V_{CC2}$  at 2.7 V (over recommended operating conditions unless otherwise noted.)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$	Propagation delay time	See Figure 10	15	27	50	ns
PWD <sup>(1)</sup>	Pulse width distortion $ t_{PHL} - t_{PLH} $					
$t_{sk(o)}$ <sup>(2)</sup>	Channel-to-channel output skew time	Same-direction Channels			2	ns
		Opposite-direction Channels			4	
$t_{sk(pp)}$ <sup>(3)</sup>	Part-to-part skew time				22	ns
$t_r$	Output signal rise time	See Figure 10		3		ns
$t_f$	Output signal fall time			3		ns
$t_{PHZ}$ , $t_{PLZ}$	Disable propagation delay, from high/low to high-impedance output	See Figure 11		9	15	ns
$t_{PZH}$ , $t_{PZL}$	Enable propagation delay, from high-impedance to high/low output			9	15	ns
$t_{fs}$	Fail-safe output delay time from input data or power loss	See Figure 12		8.5		$\mu$ s
$t_{GR}$	Input glitch rejection time			14		ns

(1) Also known as pulse skew

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

(3)  $t_{sk(pp)}$  is the magnitude of the difference in propagation delay times between any terminals of different devices switching in the same direction while operating at identical supply voltages, temperature, input signals, and loads.



## 6.12 Supply Current: $V_{CC1}$ and $V_{CC2}$ at 5 V $\pm 10\%$

$V_{CC1}$  and  $V_{CC2}$  at 5 V  $\pm 10\%$  (over recommended operating conditions unless otherwise noted.)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT		
<b>ISO7131</b>								
$I_{CC1}$	Disable	EN1 = EN2 = 0 V		2.2	3.7	mA		
$I_{CC2}$				3.7	5			
$I_{CC1}$	DC to 1 Mbps	DC signal: $V_I = V_{CC}$ or 0 V AC signal: All channels switching with square-wave clock input; $C_L = 15$ pF		2.2	3.7	mA		
$I_{CC2}$				3.7	5			
$I_{CC1}$	10 Mbps			3.4	4.8			
$I_{CC2}$				4.9	6.6			
$I_{CC1}$	25 Mbps			4.9	6.6			
$I_{CC2}$				6.8	9			
$I_{CC1}$	50 Mbps			7.1	10			
$I_{CC2}$				10.5	13			
<b>ISO7140</b>								
$I_{CC1}$	Disable		EN = 0 V		0.6		1.2	mA
$I_{CC2}$				4.6	7			
$I_{CC1}$	DC to 1 Mbps	DC Signal: $V_I = V_{CC}$ or 0 V, AC Signal: All channels switching with square wave clock input; $C_L = 15$ pF		0.6	1.3	mA		
$I_{CC2}$				4.8	7			
$I_{CC1}$	10 Mbps			1.4	2.2			
$I_{CC2}$				6.9	9.2			
$I_{CC1}$	25 Mbps			2.7	3.9			
$I_{CC2}$				10.3	13.5			
$I_{CC1}$	50 Mbps			4.7	6.5			
$I_{CC2}$				15.6	21			
<b>ISO7141</b>								
$I_{CC1}$	Disable		EN1 = EN2 = 0V		2.5		4.2	mA
$I_{CC2}$				4.2	7			
$I_{CC1}$	DC to 1 Mbps	DC signal: $V_I = V_{CC}$ or 0 V, AC signal: All channels switching with square wave clock input; $C_L = 15$ pF		2.5	4.2	mA		
$I_{CC2}$				4.2	7			
$I_{CC1}$	10 Mbps			3.8	5.3			
$I_{CC2}$				6.2	9.6			
$I_{CC1}$	25 Mbps			5.6	7.5			
$I_{CC2}$				9.2	13			
$I_{CC1}$	50 Mbps			8.4	11.2			
$I_{CC2}$				14	18.5			

### 6.13 Supply Current: $V_{CC1}$ and $V_{CC2}$ at 3.3 V $\pm$ 10%

 $V_{CC1}$  and  $V_{CC2}$  at 3.3 V  $\pm$ 10% (over recommended operating conditions unless otherwise noted.)

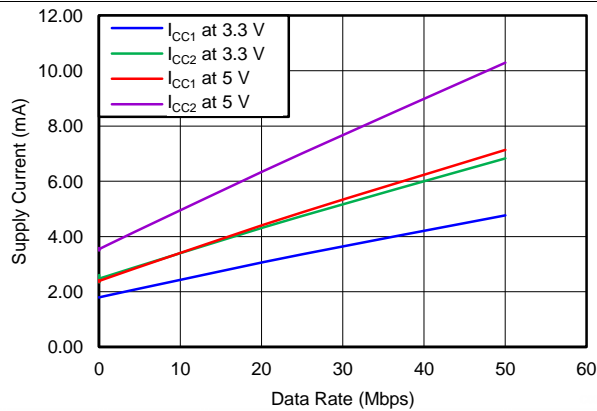
PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT		
<b>ISO7131</b>								
$I_{CC1}$	Disable	EN1 = EN2 = 0 V		1.9	2.7	mA		
$I_{CC2}$				2.6	3.8			
$I_{CC1}$	DC to 1 Mbps	DC signal: $V_I = V_{CC}$ or 0 V AC signal: All channels switching with square-wave clock input; $C_L = 15$ pF		1.9	2.7	mA		
$I_{CC2}$				2.6	3.8			
$I_{CC1}$	10 Mbps			2.4	3.5			
$I_{CC2}$				3.5	4.7			
$I_{CC1}$	25 Mbps			3.2	4.6			
$I_{CC2}$				4.7	6.2			
$I_{CC1}$	40 Mbps			5	7			
$I_{CC2}$				7	9			
<b>ISO7140</b>								
$I_{CC1}$	Disable		EN = 0 V		0.3		0.7	mA
$I_{CC2}$				3.6	5.2			
$I_{CC1}$	DC to 1 Mbps	DC signal: $V_I = V_{CC}$ or 0 V, AC signal: All channels switching with square-wave clock input; $C_L = 15$ pF		0.4	0.8	mA		
$I_{CC2}$				3.7	5.3			
$I_{CC1}$	10 Mbps			0.9	1.4			
$I_{CC2}$				5.1	6.8			
$I_{CC1}$	25 Mbps			1.7	2.4			
$I_{CC2}$				7.3	10			
$I_{CC1}$	40 Mbps			2.4	3.7			
$I_{CC2}$				9.4	13			
<b>ISO7141</b>								
$I_{CC1}$	Disable		EN1 = EN2 = 0 V		2		3.1	mA
$I_{CC2}$				3.2	4.9			
$I_{CC1}$	DC to 1 Mbps	DC signal: $V_I = V_{CC}$ or 0 V, AC signal: All channels switching with square-wave clock input; $C_L = 15$ pF		2	3.1	mA		
$I_{CC2}$				3.2	4.9			
$I_{CC1}$	10 Mbps			2.8	3.8			
$I_{CC2}$				4.5	6.1			
$I_{CC1}$	25 Mbps			4	5.2			
$I_{CC2}$				6.4	8.3			
$I_{CC1}$	40 Mbps			5	8			
$I_{CC2}$				8.2	11.6			

## 6.14 Supply Current: $V_{CC1}$ and $V_{CC2}$ at 2.7 V

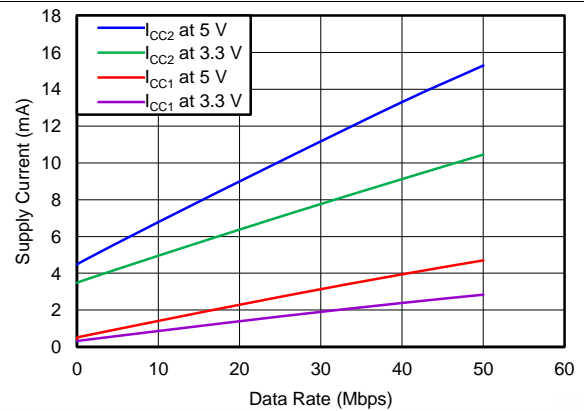
$V_{CC1}$  and  $V_{CC2}$  at 2.7 V (over recommended operating conditions unless otherwise noted.)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT		
<b>ISO7131</b>								
$I_{CC1}$	Disable	EN1 = EN2 = 0 V		1.2	2.4	mA		
$I_{CC2}$				2.3	3.3			
$I_{CC1}$	DC to 1 Mbps	DC signal: $V_I = V_{CC}$ or 0 V AC signal: All channels switching with square-wave clock input; $C_L = 15$ pF		1.2	2.4	mA		
$I_{CC2}$				2.3	3.3			
$I_{CC1}$	10 Mbps			2.1	3			
$I_{CC2}$				2.9	4			
$I_{CC1}$	25 Mbps			3	3.8			
$I_{CC2}$				4	5.2			
$I_{CC1}$	40 Mbps			4.2	5.3			
$I_{CC2}$				5.8	7			
<b>ISO7140</b>								
$I_{CC1}$	Disable		EN = 0 V		0.2		0.4	mA
$I_{CC2}$				3.2	4.7			
$I_{CC1}$	DC to 1 Mbps	DC signal: $V_I = V_{CC}$ or 0 V, AC signal: All channels switching with square-wave clock input; $C_L = 15$ pF		0.2	0.5	mA		
$I_{CC2}$				3.4	4.8			
$I_{CC1}$	10 Mbps			0.6	1			
$I_{CC2}$				4.5	6.3			
$I_{CC1}$	25 Mbps			1.2	1.8			
$I_{CC2}$				6.2	8			
$I_{CC1}$	40 Mbps			1.8	2.6			
$I_{CC2}$				8	11			
<b>ISO7141</b>								
$I_{CC1}$	Disable		EN1 = EN2 = 0 V		1.6		2.6	mA
$I_{CC2}$				2.8	4.1			
$I_{CC1}$	DC to 1 Mbps	DC signal: $V_I = V_{CC}$ or 0 V, AC signal: All channels switching with square-wave clock input; $C_L = 15$ pF		1.6	2.6	mA		
$I_{CC2}$				2.8	4.1			
$I_{CC1}$	10 Mbps			2.3	3.2			
$I_{CC2}$				3.8	5			
$I_{CC1}$	25 Mbps			3.3	4.2			
$I_{CC2}$				5.4	6.8			
$I_{CC1}$	40 Mbps			4.3	5.8			
$I_{CC2}$				6.9	9.2			

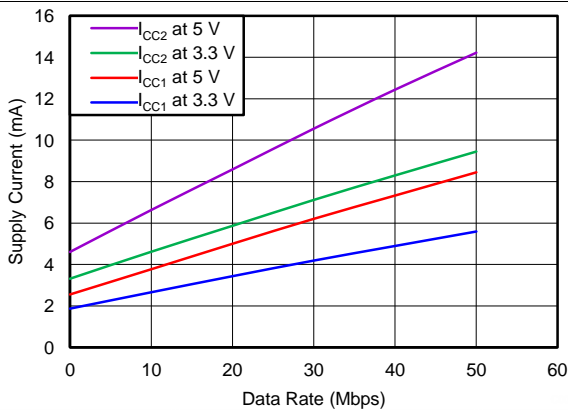
## 6.15 Typical Characteristics



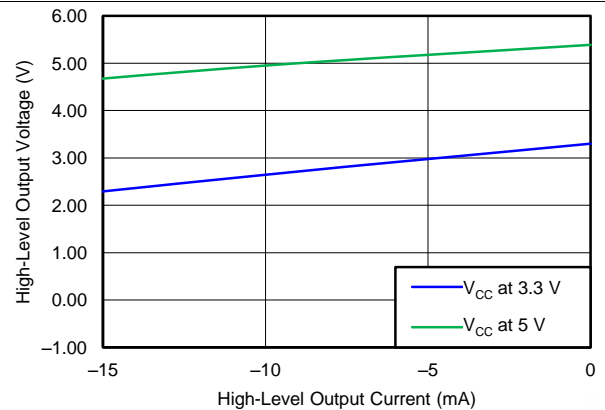
**Figure 1. ISO7131 Supply Current for All Channels vs Data Rate**



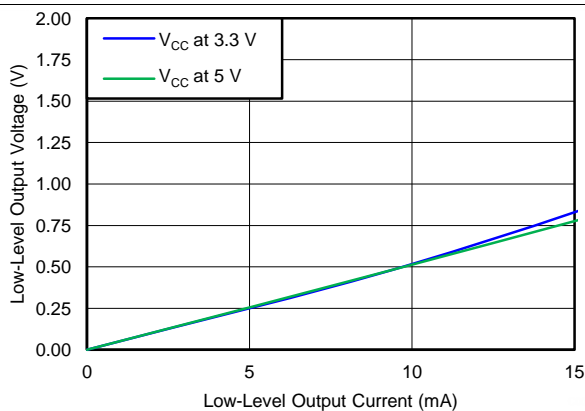
**Figure 2. ISO7140 Supply Current for All Channels vs Data Rate**



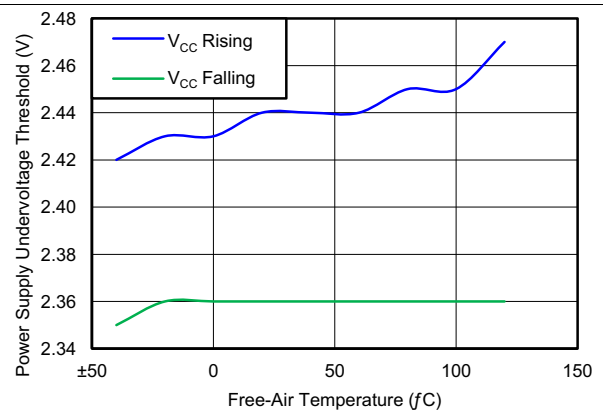
**Figure 3. ISO7141 Supply Current for All Channels vs Data Rate**



**Figure 4. High-Level Output Voltage vs High-Level Output Current**

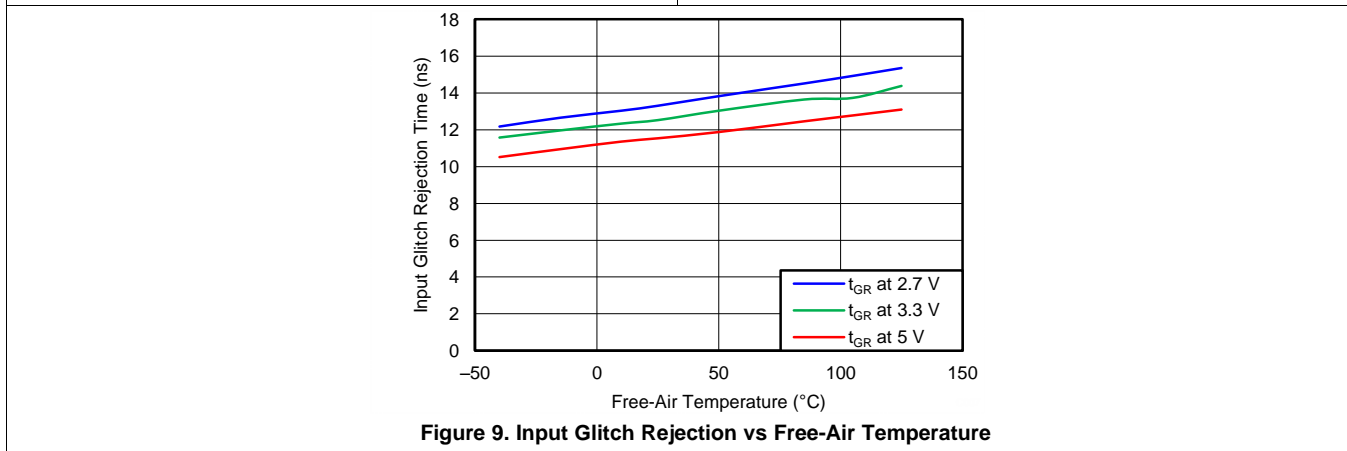
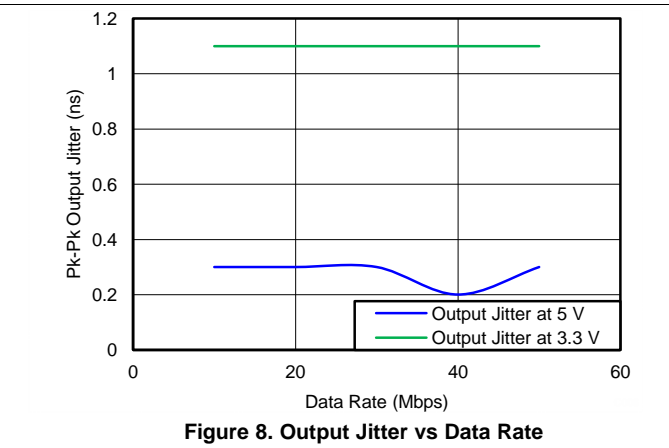
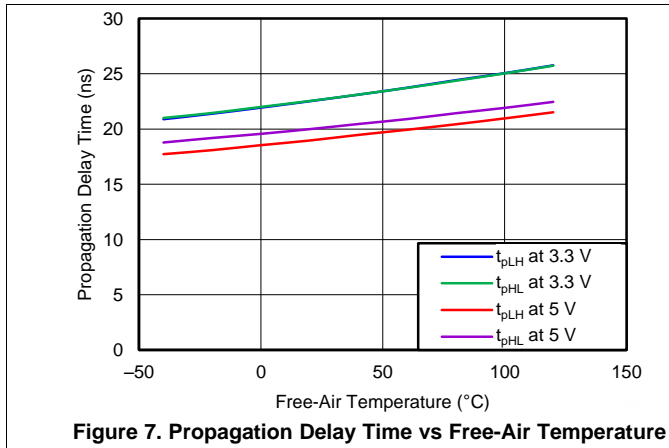


**Figure 5. Low-Level Output Voltage vs Low-Level Output Current**

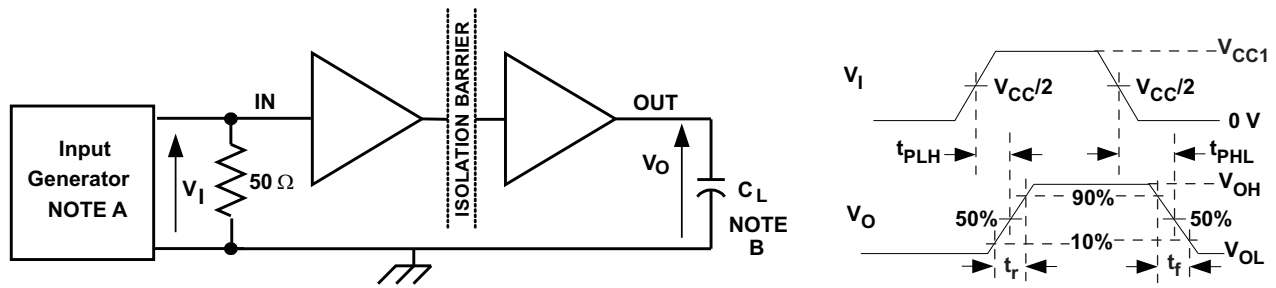


**Figure 6. V<sub>CC</sub> Undervoltage Threshold vs Free-Air Temperature**

Typical Characteristics (continued)

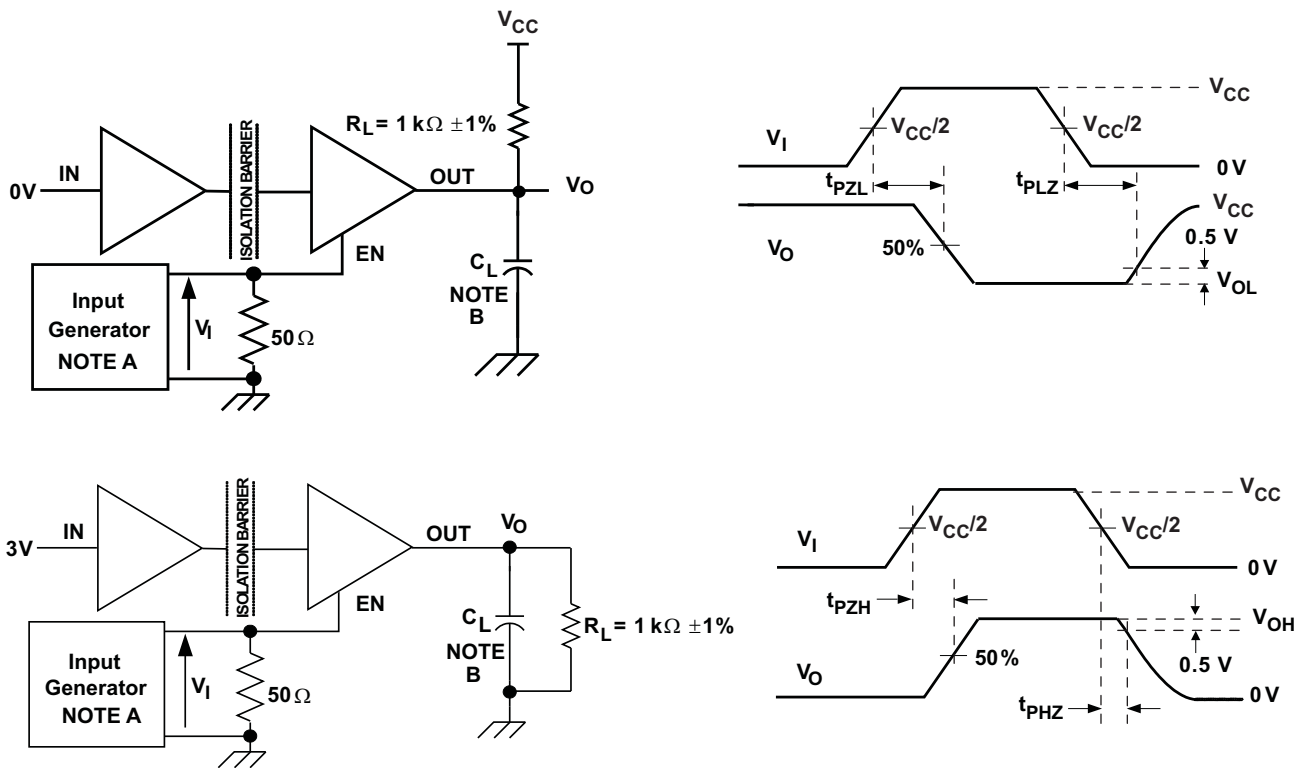


## 7 Parameter Measurement Information



- 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- $\Omega$  resistor is required to terminate the input-generator signal. It is not needed in an actual application.
- B.  $C_L = 15$  pF and includes instrumentation and fixture capacitance within  $\pm 20\%$ .

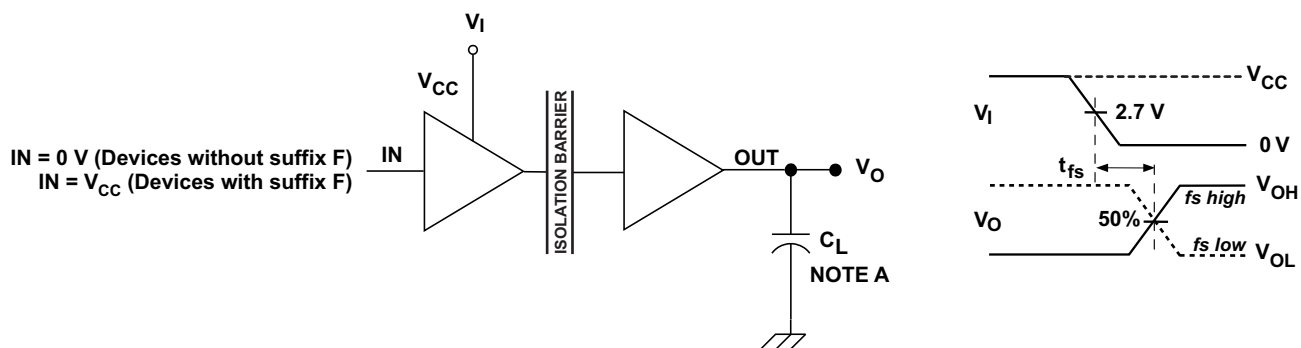
**Figure 10. Switching-Characteristics Test Circuit and Voltage Waveforms**



- 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  $\pm 20\%$ .

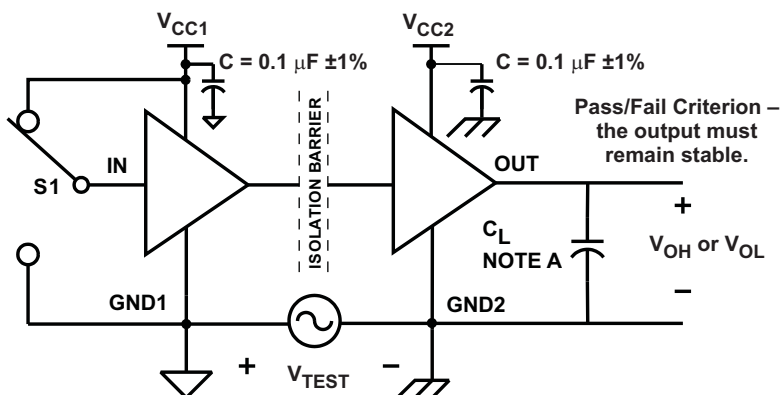
**Figure 11. Enable/Disable Propagation Delay-Time Test Circuit and Waveform**

Parameter Measurement Information (continued)



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

Figure 12. Failsafe Delay-Time Test Circuit and Voltage Waveforms



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

Figure 13. Common-Mode Transient Immunity Test Circuit

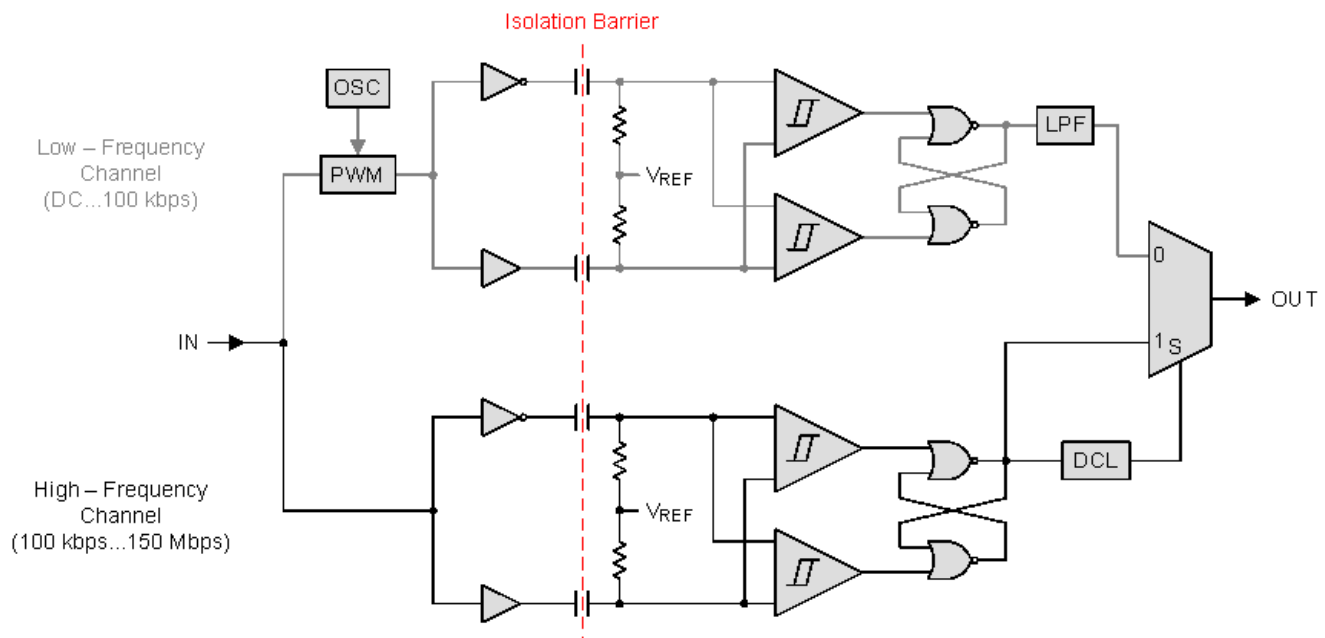
## 8 Detailed Description

### 8.1 Overview

The isolator in Figure 14 is based on a capacitive isolation barrier technique. The I/O channel of the device consists of two internal data channels, a high-frequency channel (HF) with a bandwidth from 100 kbps up to 150 Mbps, and a low-frequency channel (LF) covering the range from 100 kbps down to DC. In principle, a single-ended input signal entering the HF-channel is split into a differential signal through the inverter gate at the input. The following capacitor-resistor networks differentiate the signal into transients, which then are converted into differential pulses by two comparators. The comparator outputs drive a NOR-gate flip-flop whose output feeds an output multiplexer. A decision logic (DCL) at the driving output of the flip-flop measures the durations between signal transients. If the duration between two consecutive transients exceeds a certain time limit, (as in the case of a low-frequency signal), the DCL forces the output-multiplexer to switch from the high- to the low-frequency channel.

Because low-frequency input signals require the internal capacitors to assume prohibitively large values, these signals are pulse-width modulated (PWM) with the carrier frequency of an internal oscillator, thus creating a sufficiently high frequency signal, capable of passing the capacitive barrier. As the input is modulated, a low-pass filter (LPF) is needed to remove the high-frequency carrier from the actual data before passing it on to the output multiplexer.

### 8.2 Functional Block Diagram



**Figure 14. Conceptual Block Diagram of a Digital Capacitive Isolator**



### 8.3 Feature Description

**Table 1. Product Features**

PRODUCT	RATED ISOLATION	INPUT THRESHOLD	DEFAULT OUTPUT	MAX DATA RATE and INPUT FILTER	CHANNEL DIRECTION
ISO7131CC	4242 V <sub>PK</sub> <sup>(1)</sup>	1.5-V TTL (CMOS compatible)	High	50 Mbps, with noise filter integrated	2 forward, 1 reverse
ISO7140CC			Low		4 forward, 0 reverse
ISO7140FCC			High		3 forward, 1 reverse
ISO7141CC			Low		
ISO7141FCC					

(1) See [Regulatory Information](#) for detailed Isolation Ratings.

#### 8.3.1 Insulation and Safety-Related Specifications

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V <sub>IOTM</sub>	Maximum transient overvoltage per DIN V VDE V 0884-10 (VDE V 0884-10):2006-12				4242	V <sub>PK</sub>
V <sub>IORM</sub>	Maximum working voltage per DIN V VDE V 0884-10 (VDE V 0884-10):2006-12				566	V <sub>PK</sub>
V <sub>ISO</sub>	Isolation Voltage per UL 1577	V <sub>TEST</sub> = V <sub>ISO</sub> , t = 60 sec (qualification)			2500	V <sub>RMS</sub>
		V <sub>TEST</sub> = 1.2 * V <sub>ISO</sub> , t = 1 sec (100% production)			3000	
V <sub>PR</sub>	Input-to-output test voltage per DIN V VDE V 0884-10 (VDE V 0884-10):2006-12	After Input/Output safety test subgroup 2/3, V <sub>PR</sub> = V <sub>IORM</sub> × 1.2, t = 10 s, Partial discharge < 5 pC			679	V <sub>PK</sub>
		Method a, After environmental tests subgroup 1, V <sub>PR</sub> = V <sub>IORM</sub> × 1.6, t = 10 s, Partial discharge < 5 pC			906	
		Method b1, 100% production test, V <sub>PR</sub> = V <sub>IORM</sub> × 1.875, t = 1 s, Partial discharge < 5 pC			1061	
L(I01)	Minimum air gap (clearance)	Shortest terminal to terminal distance through air	3.7			mm
L(I02)	Minimum external tracking (creepage)	Shortest terminal to terminal distance across the package surface	3.7			mm
	Minimum internal gap (internal clearance)	Distance through the insulation	0.014			mm
	Pollution degree			2		
CTI	Tracking resistance (comparative tracking index)	DIN IEC 60112 / VDE 0303 Part 1	≥400			V
R <sub>IO</sub> <sup>(1)</sup>	Isolation Resistance, Input to Output	V <sub>IO</sub> = 500 V, T <sub>A</sub> = 25°C		>10 <sup>12</sup>		Ω
		V <sub>IO</sub> = 500 V, 100°C ≤ T <sub>A</sub> ≤ T <sub>A</sub> max		>10 <sup>11</sup>		
C <sub>IO</sub> <sup>(1)</sup>	Barrier capacitance, input to output	V <sub>I</sub> = 0.4 sin (2πft), f = 1 MHz		2.3		pF
C <sub>I</sub> <sup>(2)</sup>	Input capacitance	V <sub>I</sub> = V <sub>CC</sub> /2 + 0.4 sin (2πft), f = 1 MHz, V <sub>CC</sub> = 5 V		2.8		pF

(1) All pins on each side of the barrier tied together creating a two-terminal device.

(2) Measured from input pin to ground.

**NOTE**

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 (PCB) do not reduce this distance.

Creepage and clearance on a PCB become equal in certain cases. Techniques such as inserting grooves and/or ribs on a PCB are used to help increase these specifications.

**Table 2. IEC 60664-1 Ratings Table**

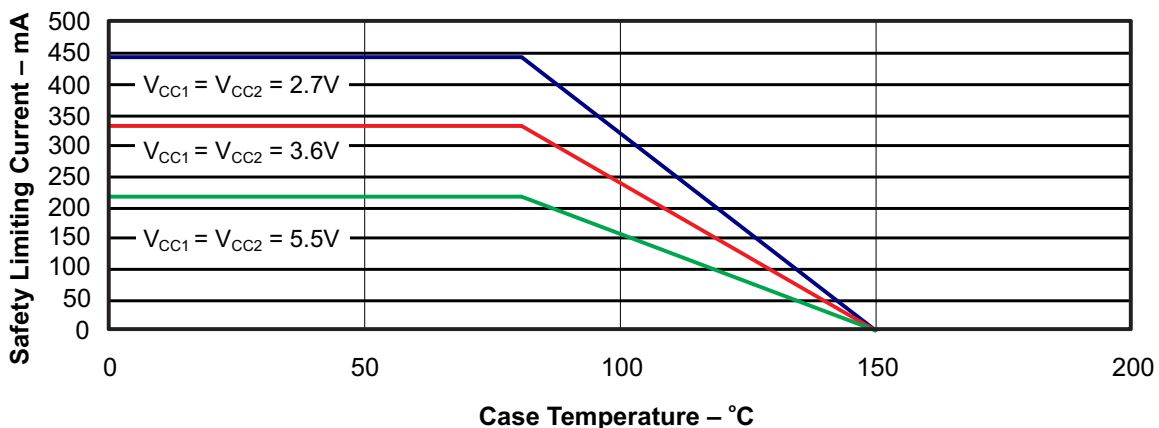
PARAMETER	TEST CONDITIONS	SPECIFICATION
Basic Isolation Group	Material Group	II
Installation classification	Rated mains voltage $\leq 150 V_{RMS}$	I-IV
	Rated mains voltage $\leq 300 V_{RMS}$	I-III
	Rated mains voltage $\leq 400 V_{RMS}$	I-II

**8.3.1.1 Safety Limiting Values**

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
I <sub>S</sub> Safety input, output, or supply current	DBQ-16 R <sub>θJA</sub> = 104.5°C/W, V <sub>I</sub> = 5.5V, T <sub>J</sub> = 150°C, T <sub>A</sub> = 25°C			217	mA
				332	
				443	
T <sub>S</sub> Maximum case temperature				150	°C

The safety-limiting constraint is the absolute-maximum junction temperature specified in the [Absolute Maximum Ratings](#)<sup>(1)</sup> table. The power dissipation and junction-to-air thermal impedance of the device installed in the application hardware determines the junction temperature. The assumed junction-to-air thermal resistance in the [Thermal Information](#) 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.



**Figure 15. DBQ-16  $\theta_{JC}$  Thermal Derating Curve**

(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.

### 8.3.1.2 Regulatory Information

VDE	UL	CSA	CQC
Certified according to DIN V VDE V 0884-10 (VDE V 0884-10):2006-12 and DIN EN 61010-1	Recognized under UL 1577 Component Recognition Program	Approved under CSA Component Acceptance Notice 5A, IEC 60950-1, and IEC 61010-1	Certified according to GB 4943.1-2011
Basic Insulation Maximum Transient Overvoltage, 4242 V <sub>PK</sub> Maximum Working Voltage, 566 V <sub>PK</sub>	Single protection, 2500 V <sub>RMS</sub> <sup>(1)</sup>	Reinforced Insulation per CSA 60950-1-03 and IEC 60950-1 (2nd Ed.), 185 V <sub>RMS</sub> maximum working voltage Basic Insulation per CSA 60950-1-03 and IEC 60950-1 (2nd Ed.), 370 V <sub>RMS</sub> maximum working voltage Reinforced Insulation per CSA 61010-1-12 and IEC 61010-1 (3rd Edition), 150 V <sub>RMS</sub> maximum working voltage Basic Insulation per CSA 61010-1-12 and IEC 61010-1 (3rd Edition), 300 V <sub>RMS</sub> maximum working voltage	Basic Insulation, Altitude ≤ 5000m, Tropical Climate, 250 V <sub>RMS</sub> maximum working voltage
Certificate number: 40016131	File number: E181974	Master contract number: 220991	Certificate number: CQC14001109540

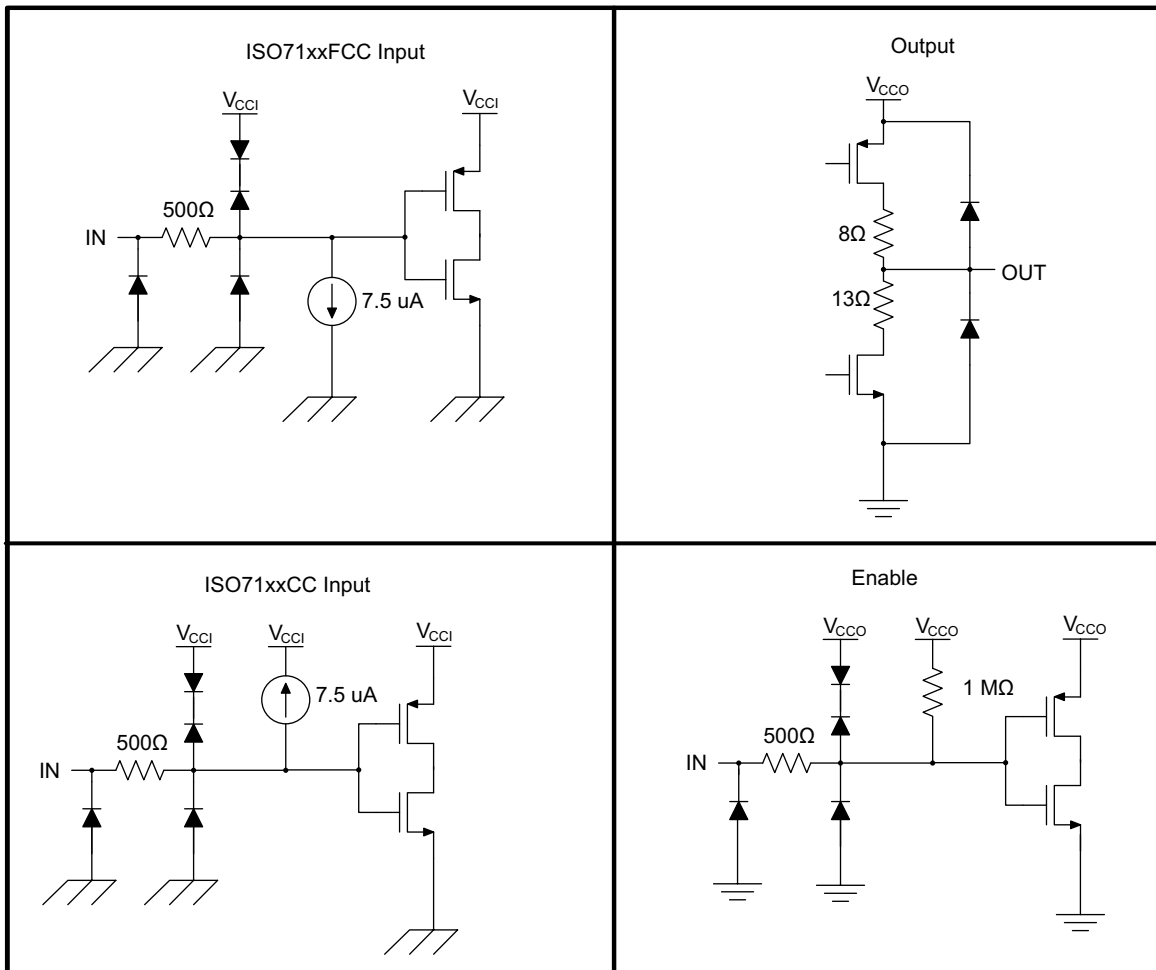
(1) Production tested ≥ 3000 Vrms for 1 second in accordance with UL 1577.

## 8.4 Device Functional Modes

**Table 3. Function Table<sup>(1)</sup>**

V <sub>CCI</sub>	V <sub>CCO</sub>	INPUT (INx)	OUTPUT ENABLE (ENx)	OUTPUT (OUTx)	
				ISO71xxCC	ISO71xxFCC
PU	PU	H	H or open	H	H
		L	H or open	L	L
		X	L	Z	Z
		Open	H or open	H	L
PD	PU	X	H or open	H	L
PD	PU	X	L	Z	Z
PU	PD	X	X	Undetermined	Undetermined

(1) V<sub>CCI</sub> = Input-side V<sub>CC</sub>; V<sub>CCO</sub> = Output-side V<sub>CC</sub>; PU = Powered Up (V<sub>CC</sub> ≥ 2.7 V); PD = Powered Down (V<sub>CC</sub> ≤ 2.1 V); X = Irrelevant; H = High Level; L = Low Level; Z = High Impedance



**Figure 16. Device I/O Schematics**

## 9 Application and Implementation

### NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 9.1 Application Information

ISO71xx use single-ended TTL-logic switching technology. Its supply voltage range is from 3 V to 5.5 V for both supplies,  $V_{CC1}$  and  $V_{CC2}$ . When designing with digital isolators, it is important to note 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,  $\mu C$  or UART), and a data converter or a line transceiver, regardless of the interface type or standard.

### 9.2 Typical Applications

#### 9.2.1 Isolated Data Acquisition System for Process Control

ISO71xx combined with TI's precision analog-to-digital converter and mixed signal micro-controller can create an advanced isolated data acquisition system as shown in Figure 17.

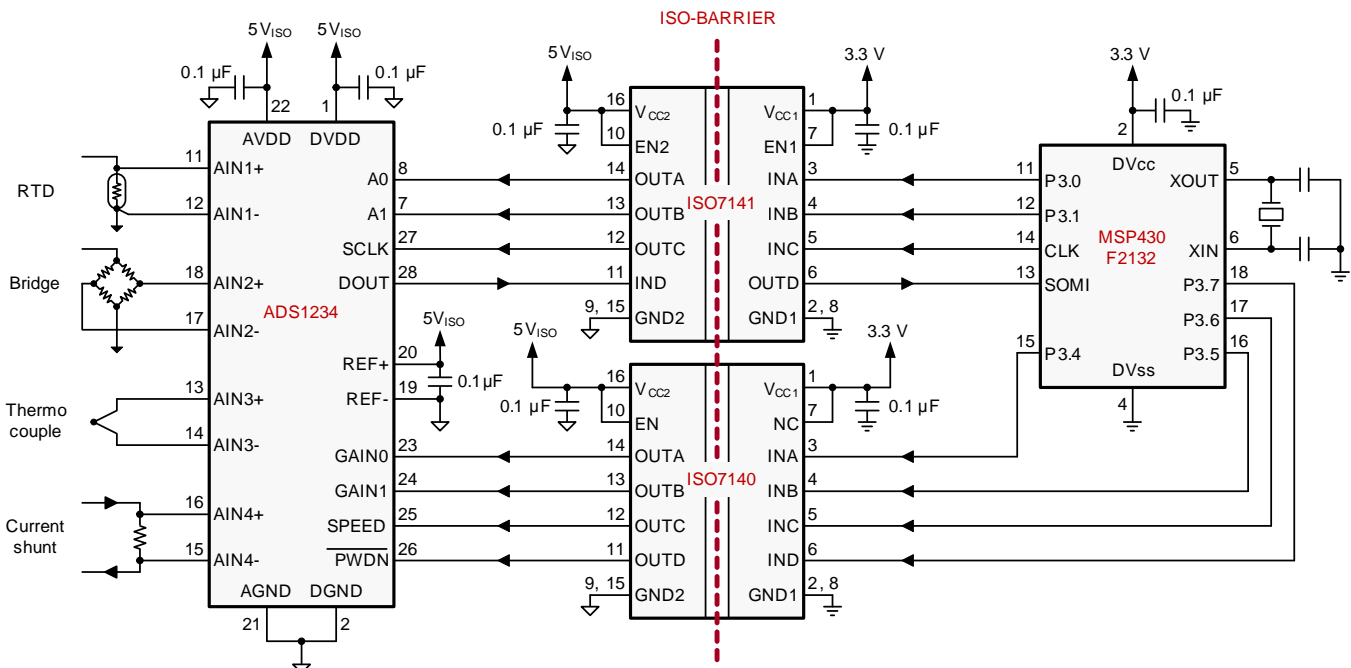


Figure 17. Isolated Data Acquisition System for Process Control

## Typical Applications (continued)

### 9.2.1.1 Design Requirements

Unlike optocouplers, which need external components to improve performance, provide bias, or limit current, ISO71xx only needs two external bypass capacitors to operate.

### 9.2.1.2 Detailed Design Procedure

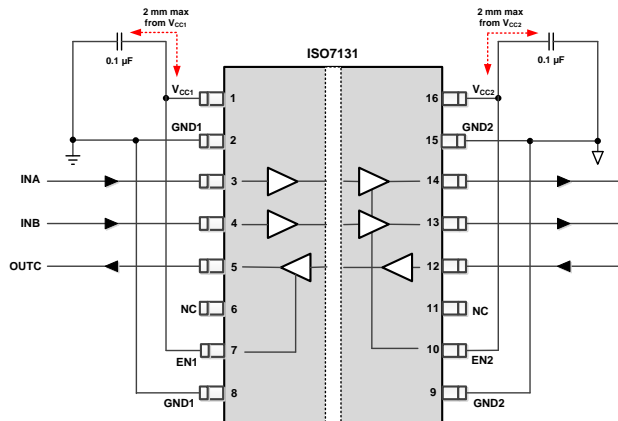


Figure 18. Typical ISO7131 Circuit Hook-up

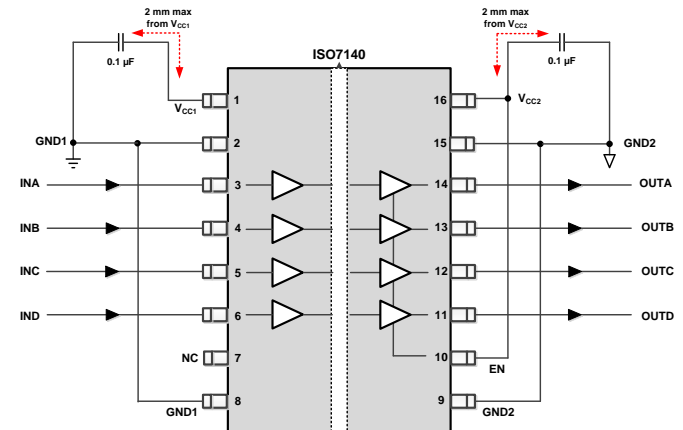


Figure 19. Typical ISO7140 Circuit Hook-up

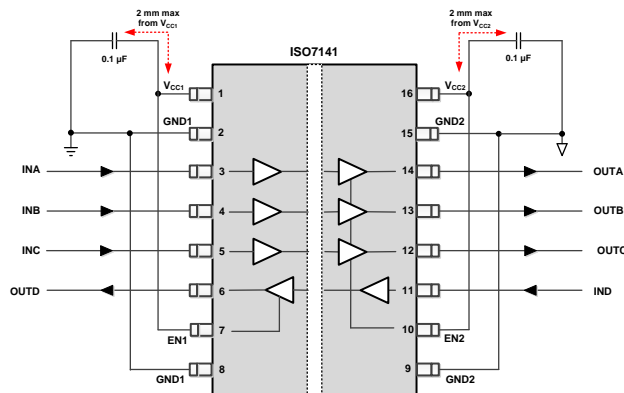


Figure 20. Typical ISO7141 Circuit Hook-up

## Typical Applications (continued)

### 9.2.1.3 Application Curves

Typical eye diagrams of ISO71xx (see [Figure 21](#), [Figure 22](#), and [Figure 23](#)) indicate low jitter and wide open eye at the maximum data rate.

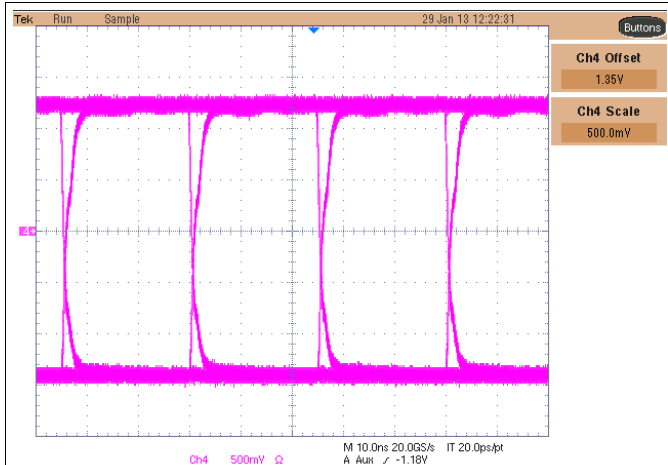


Figure 21. Typical Eye Diagram at 40 MBPS, PRBS 2<sup>16</sup> - 1, 2.7-V Operation

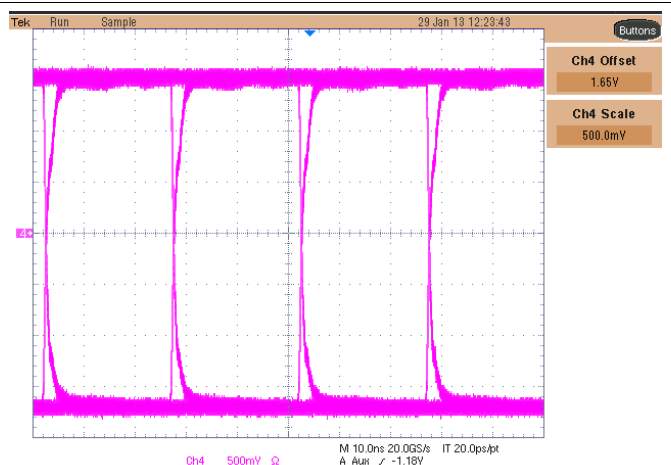


Figure 22. Typical Eye Diagram at 40 MBPS, PRBS 2<sup>16</sup> - 1, 3.3-V Operation

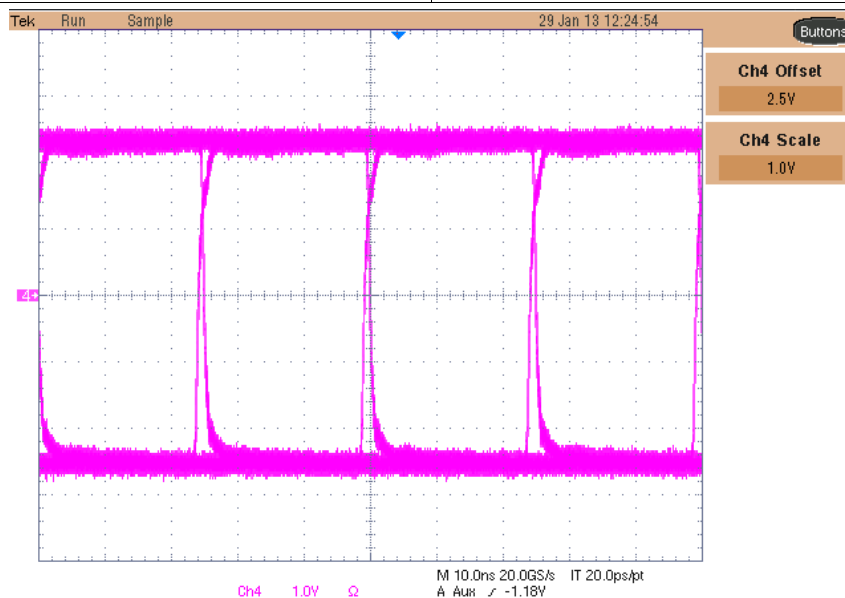
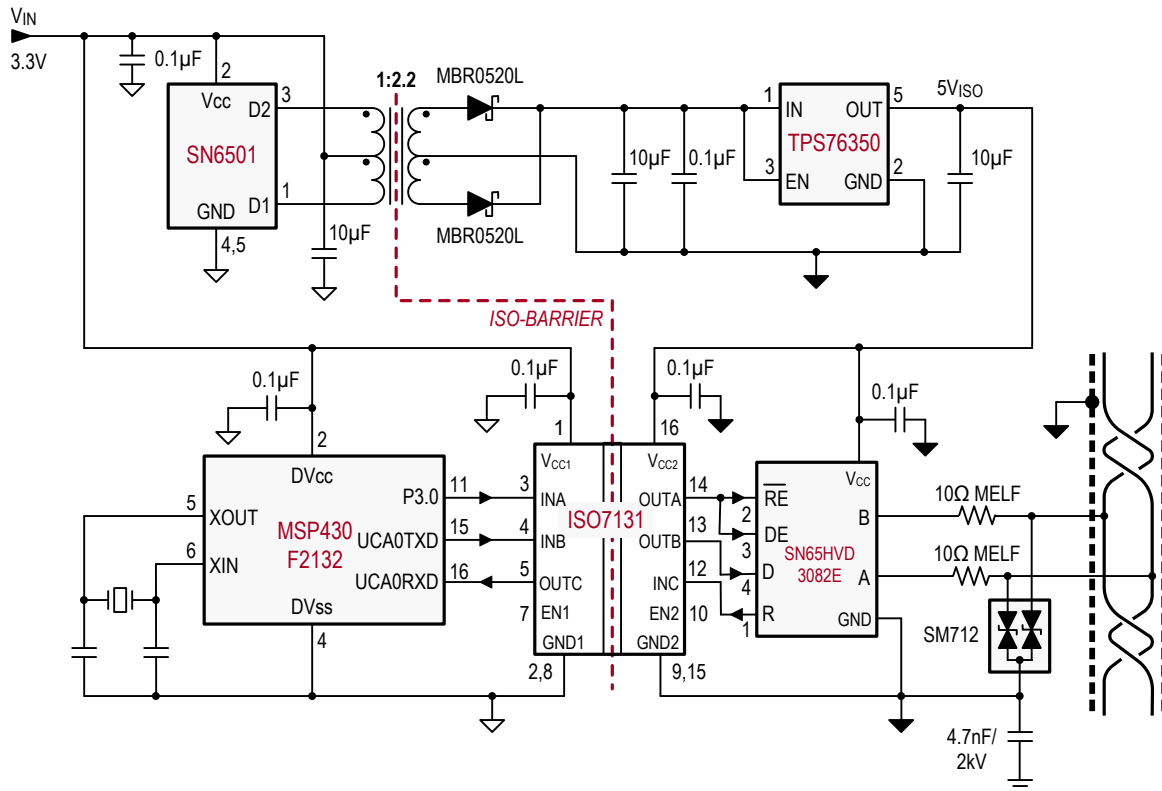


Figure 23. Typical Eye Diagram at 50 MBPS, PRBS 2<sup>16</sup> - 1, 5-V Operation

**Typical Applications (continued)**
**9.2.2 Isolated RS-485 Interface**

**Figure 24. Isolated RS-485 Interface**
**9.2.2.1 Design Requirements**

 See previous [Design Requirements](#).

**9.2.2.2 Detailed Design Procedure**

 See previous [Detailed Design Procedure](#).

**9.2.2.3 Application Curves**

 See previous [Application Curves](#).



## 10 Power Supply Recommendations

To ensure reliable operation at all data rates and supply voltages, a 0.1- $\mu\text{F}$  bypass capacitor is recommended at input and output supply pins ( $V_{CC1}$  and  $V_{CC2}$ ). The capacitors should 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 TI's [SN6501](#). For such applications, detailed power supply design and transformer selection recommendations are available in [SN6501](#) data sheet ([SLLSEA0](#)).

## 11 Layout

### 11.1 Layout Guidelines

A minimum of four layers is required to accomplish a low EMI PCB design (see [Figure 25](#)). Layer stacking should 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 their 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/in<sup>2</sup>.
- 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.

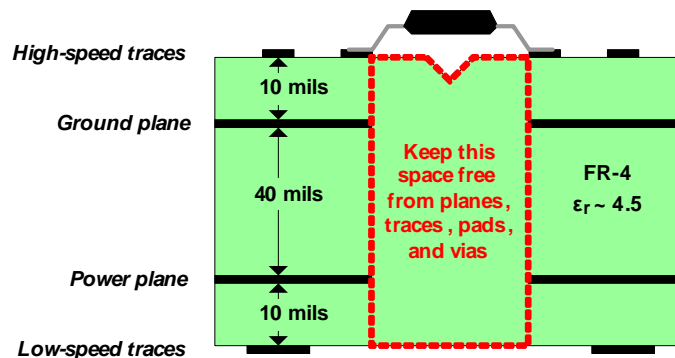
If an additional supply voltage plane or signal layer is needed, add a second power / ground plane system to the stack to keep it symmetrical. This makes the stack mechanically stable and prevents it from warping. Also the power and ground plane of each power system can be placed closer together, thus increasing the high-frequency bypass capacitance significantly.

For detailed layout recommendations, see Application Note [SLLA284](#), *Digital Isolator Design Guide*.

#### 11.1.1 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 its lower dielectric losses at high frequencies, less moisture absorption, greater strength and stiffness, and its self-extinguishing flammability-characteristics.

#### 11.2 Layout Example



**Figure 25. Recommended Layer Stack**

## 12 Device and Documentation Support

### 12.1 Documentation Support

#### 12.1.1 Related Documentation

- [SLLA284](#), *Digital Isolator Design Guide*
- [SLLSEA0](#), *Transformer Driver for Isolated Power Supplies*

### 12.2 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

**Table 4. Related Links**

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
ISO7131CC	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
ISO7140CC	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
ISO7140FCC	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
ISO7141CC	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
ISO7141FCC	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>

### 12.3 Trademarks

Modbus is a trademark of Gould Inc.  
All other trademarks are the property of their respective owners.

### 12.4 Electrostatic Discharge Caution



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.

### 12.5 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

[SLLA353](#) - *Isolation Glossary*.

## 13 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 part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">ISO7131CCDBQ</a>	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7131CC
ISO7131CCDBQ.A	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7131CC
<a href="#">ISO7131CCDBQR</a>	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7131CC
ISO7131CCDBQR.A	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7131CC
ISO7131CCDBQRG4	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7131CC
ISO7131CCDBQRG4.A	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7131CC
<a href="#">ISO7140CCDBQ</a>	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140CC
ISO7140CCDBQ.A	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140CC
<a href="#">ISO7140CCDBQR</a>	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140CC
ISO7140CCDBQR.A	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140CC
ISO7140CCDBQRG4	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140CC
ISO7140CCDBQRG4.A	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140CC
<a href="#">ISO7140FCCDBQ</a>	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140FC
ISO7140FCCDBQ.A	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140FC
ISO7140FCCDBQG4	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140FC
ISO7140FCCDBQG4.A	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140FC
<a href="#">ISO7140FCCDBQR</a>	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140FC
ISO7140FCCDBQR.A	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7140FC
<a href="#">ISO7141CCDBQ</a>	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141CC
ISO7141CCDBQ.A	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141CC
<a href="#">ISO7141CCDBQR</a>	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141CC
ISO7141CCDBQR.A	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141CC
ISO7141CCDBQRG4	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141CC
ISO7141CCDBQRG4.A	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141CC
<a href="#">ISO7141FCCDBQ</a>	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141FC
ISO7141FCCDBQ.A	Active	Production	SSOP (DBQ)   16	75   TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141FC
<a href="#">ISO7141FCCDBQR</a>	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141FC
ISO7141FCCDBQR.A	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141FC
ISO7141FCCDBQRG4	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141FC

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
ISO7141FCCDBQRG4.A	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	7141FC

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**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
ISO7131CCDBQR	SSOP	DBQ	16	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
ISO7131CCDBQRG4	SSOP	DBQ	16	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
ISO7140CCDBQR	SSOP	DBQ	16	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
ISO7140CCDBQRG4	SSOP	DBQ	16	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
ISO7140FCCDBQR	SSOP	DBQ	16	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
ISO7141CCDBQR	SSOP	DBQ	16	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
ISO7141CCDBQRG4	SSOP	DBQ	16	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
ISO7141FCCDBQR	SSOP	DBQ	16	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
ISO7141FCCDBQRG4	SSOP	DBQ	16	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**

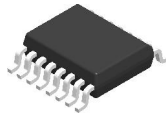

\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
ISO7131CCDBQR	SSOP	DBQ	16	2500	350.0	350.0	43.0
ISO7131CCDBQRG4	SSOP	DBQ	16	2500	350.0	350.0	43.0
ISO7140CCDBQR	SSOP	DBQ	16	2500	350.0	350.0	43.0
ISO7140CCDBQRG4	SSOP	DBQ	16	2500	350.0	350.0	43.0
ISO7140FCCDBQR	SSOP	DBQ	16	2500	350.0	350.0	43.0
ISO7141CCDBQR	SSOP	DBQ	16	2500	350.0	350.0	43.0
ISO7141CCDBQRG4	SSOP	DBQ	16	2500	350.0	350.0	43.0
ISO7141FCCDBQR	SSOP	DBQ	16	2500	350.0	350.0	43.0
ISO7141FCCDBQRG4	SSOP	DBQ	16	2500	350.0	350.0	43.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
ISO7131CCDBQ	DBQ	SSOP	16	75	505.46	6.76	3810	4
ISO7131CCDBQ.A	DBQ	SSOP	16	75	505.46	6.76	3810	4
ISO7140CCDBQ	DBQ	SSOP	16	75	505.46	6.76	3810	4
ISO7140CCDBQ.A	DBQ	SSOP	16	75	505.46	6.76	3810	4
ISO7140FCCDBQ	DBQ	SSOP	16	75	505.46	6.76	3810	4
ISO7140FCCDBQ.A	DBQ	SSOP	16	75	505.46	6.76	3810	4
ISO7140FCCDBQG4	DBQ	SSOP	16	75	505.46	6.76	3810	4
ISO7140FCCDBQG4.A	DBQ	SSOP	16	75	505.46	6.76	3810	4
ISO7141CCDBQ	DBQ	SSOP	16	75	505.46	6.76	3810	4
ISO7141CCDBQ.A	DBQ	SSOP	16	75	505.46	6.76	3810	4
ISO7141FCCDBQ	DBQ	SSOP	16	75	505.46	6.76	3810	4
ISO7141FCCDBQ.A	DBQ	SSOP	16	75	505.46	6.76	3810	4

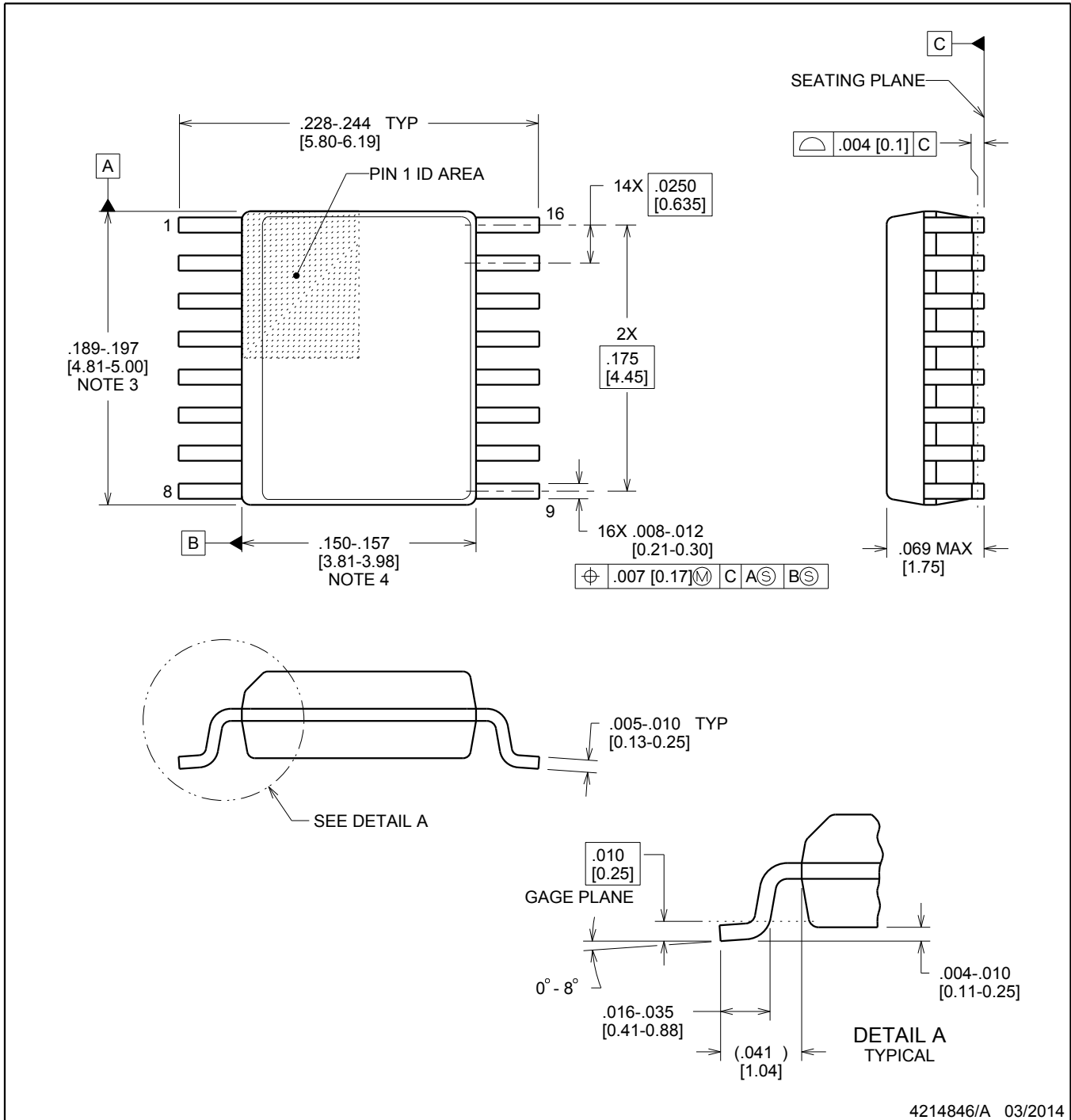


# DBQ0016A

# PACKAGE OUTLINE

## SSOP - 1.75 mm max height

SHRINK SMALL-OUTLINE PACKAGE



4214846/A 03/2014

### NOTES:

- Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 inch, per side.
- This dimension does not include interlead flash.
- Reference JEDEC registration MO-137, variation AB.

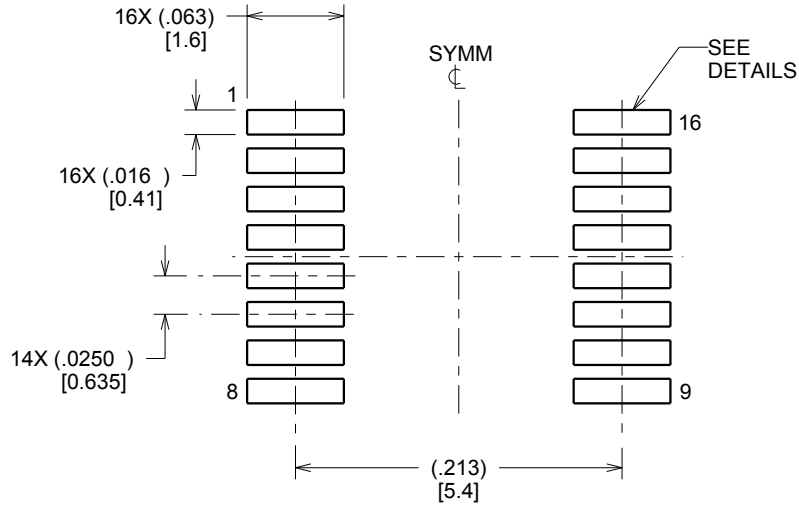


# EXAMPLE BOARD LAYOUT

DBQ0016A

SSOP - 1.75 mm max height

SHRINK SMALL-OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
SCALE:8X



SOLDER MASK DETAILS

4214846/A 03/2014

NOTES: (continued)

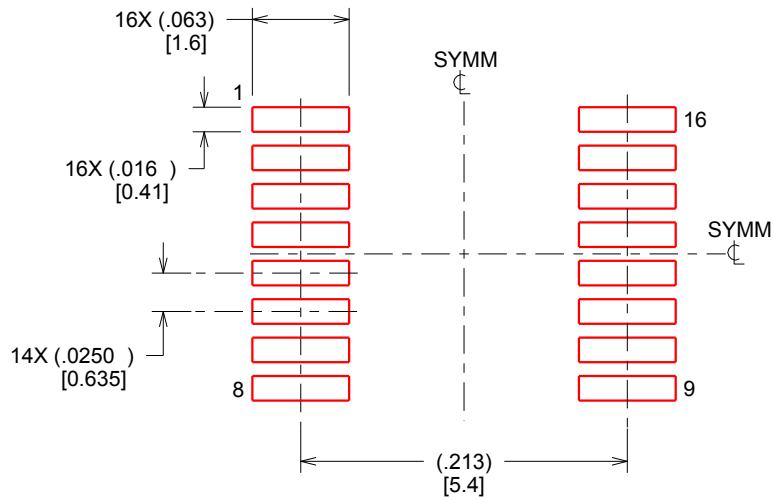
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DBQ0016A

SSOP - 1.75 mm max height

SHRINK SMALL-OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.127 MM] THICK STENCIL  
SCALE:8X

4214846/A 03/2014

NOTES: (continued)

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

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#), [TI's General Quality Guidelines](#), or other applicable terms available either on [ti.com](http://ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2026, Texas Instruments Incorporated

Last updated 10/2025