

# ISO776x-Q1 High-speed, Robust EMC, Reinforced Six-channel Digital Isolators

## 1 Features

- Qualified for automotive applications
- AEC-Q100 qualified with the following results:
  - Device temperature grade 1:  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  ambient temperature range
  - Device HBM ESD classification level 3A
  - Device CDM ESD classification level C6
- **Functional Safety-Capable**
  - Documentation available to aid functional safety system design: [ISO7760-Q1](#), [ISO7761-Q1](#), [ISO7762-Q1](#), [ISO7763-Q1](#)
- 100Mbps data rate
- Robust isolation barrier:
  - >30-Year projected lifetime
  - Up to  $5000\text{V}_{\text{RMS}}$  isolation rating
  - Up to 12.8kV surge capability
  - $\pm 100\text{kV}/\mu\text{s}$  Typical CMTI
- Wide supply range: 2.25V to 5.5V
- 2.25V to 5.5V Level translation
- Default output *high* (ISO776x) and *low* (ISO776xF) Options
- Low power consumption, typical 1.4mA per channel at 1Mbps
- Low propagation delay: 11ns typical at 5V
- Robust Electromagnetic Compatibility (EMC):
  - System-level ESD, EFT, and surge immunity
  - $\pm 8\text{kV}$  IEC 61000-4-2 Contact discharge protection across isolation barrier
  - Low emissions
- Wide-SOIC (DW-16) and SSOP (DBQ-16) package options
- Safety-related certifications:
  - Reinforced insulation per DIN EN IEC 60747-17 (VDE 0884-17)
  - UL 1577 component recognition program
  - CSA certification per IEC 62368-1 and IEC 60601-1
  - CQC certification per GB4943.1
  - TUV certification according to EN 62368-1 and EN 61010-1

## 2 Applications

- Hybrid, electric and power train system (EV/HEV)
  - Battery management system (BMS)
  - On-board charger
  - Traction inverter
  - DC/DC converter

– Starter/generator

## 3 Description

The ISO776x-Q1 devices are high-performance, six-channel digital isolators with  $5000\text{V}_{\text{RMS}}$  (DW package) and  $3000\text{V}_{\text{RMS}}$  (DBQ package) isolation ratings per UL 1577. This family of devices is also certified according to VDE, CSA, TUV and CQC.

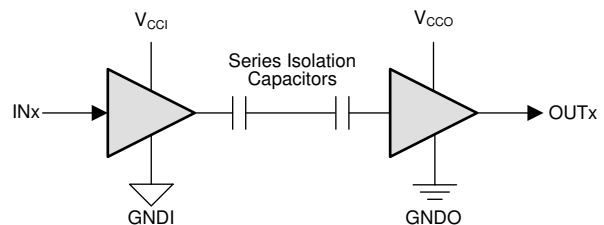
The ISO776x-Q1 family of devices provides high-electromagnetic immunity and low emissions at low-power consumption, while isolating CMOS or LVCMOS digital I/Os. Each isolation channel has a logic-input and logic-output buffer separated by a double capacitive silicon dioxide ( $\text{SiO}_2$ ) insulation barrier. The ISO776x-Q1 family of devices is available in all possible pin configurations such that all six channels are in the same direction, or one, two, or three channels are in reverse direction while the remaining channels are in forward direction. If the input power or signal is lost, the default output is *high* for devices without suffix F and *low* for devices with suffix F. See the [Device Functional Modes](#) section for further details.

### Package Information

PART NUMBER	PACKAGE <sup>(1)</sup>	BODY SIZE (NOM)	PACKAGE SIZE <sup>(2)</sup>
ISO7760-Q1 ISO7761-Q1	SOIC (DW, 16)	10.30mm × 7.50mm	10.3mm × 10.30mm
ISO7762-Q1 ISO7763-Q1	SSOP (DBQ, 16)	4.90mm × 3.90mm	4.90mm × 6.00mm

(1) For more information, see [Section 13](#).

(2) The package size (length × width) is a nominal value and includes pins, where applicable.



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$V_{\text{CCI}}$ =Input  $V_{\text{CC}}$ ,  $V_{\text{CCO}}$ =Output  $V_{\text{CC}}$

GNDI=Input ground, GNDO=Output ground

### Simplified Schematic



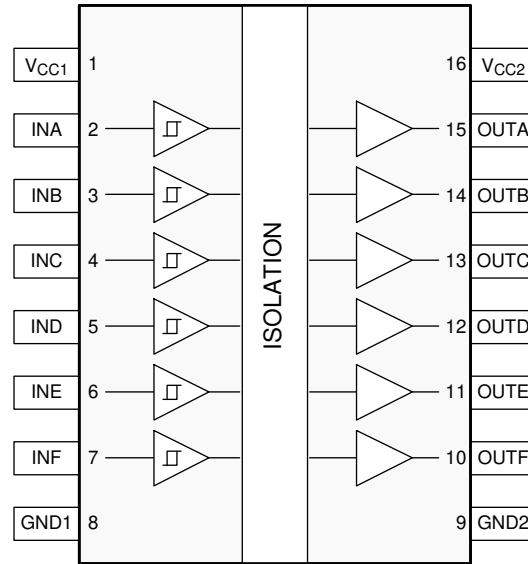
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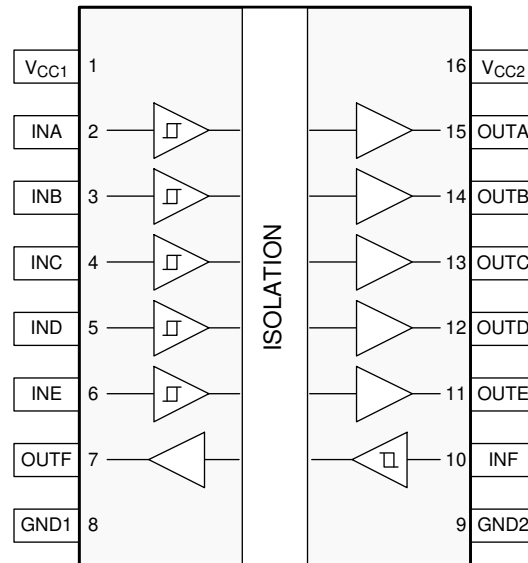
### 4 Description (Continued)

Used in conjunction with isolated power supplies, this family of devices helps prevent noise currents on data buses, such as CAN and LIN, or other circuits from entering the local ground and interfering with or damaging sensitive circuitry. Through innovative chip design and layout techniques, electromagnetic compatibility of the ISO776x-Q1 family of devices has been significantly enhanced to ease system-level ESD, EFT, surge, and emissions compliance. The ISO776x-Q1 family of devices is available in 16-pin SOIC and SSOP packages.

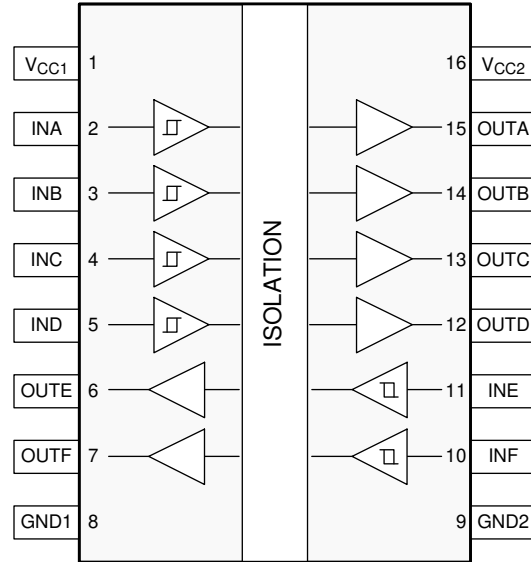
## 5 Pin Configuration and Functions



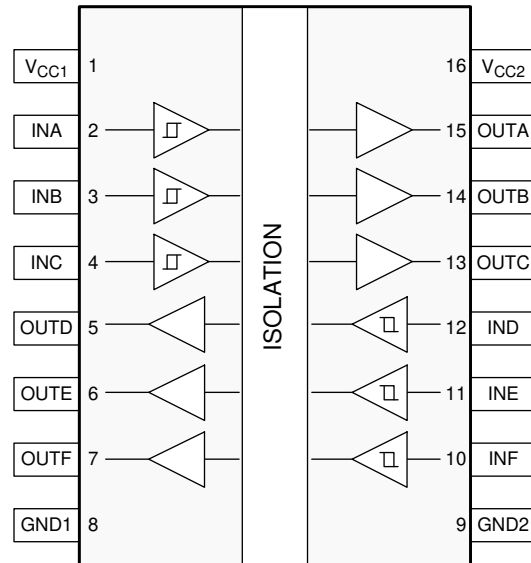
**Figure 5-1. ISO7760-Q1 DW and DBQ Packages 16-Pin SOIC and SSOP Top View**



**Figure 5-2. ISO7761-Q1 DW and DBQ Packages 16-Pin SOIC and SSOP Top View**



**Figure 5-3. ISO7762-Q1 DW and DBQ Packages 16-Pin SOIC and SSOP Top View**



**Figure 5-4. ISO7763-Q1 DW and DBQ Packages 16-Pin SOIC and SSOP Top View**

**Table 5-1. Pin Functions**

NAME	PIN				Type	DESCRIPTION
	NO.					
	ISO7760-Q1	ISO7761-Q1	ISO7762-Q1	ISO7763-Q1		
GND1	8	8	8	8	—	Ground connection for V <sub>CC1</sub>
GND2	9	9	9	9	—	Ground connection for V <sub>CC2</sub>
INA	2	2	2	2	I	Input, channel A
INB	3	3	3	3	I	Input, channel B
INC	4	4	4	4	I	Input, channel C
IND	5	5	5	12	I	Input, channel D
INE	6	6	11	11	I	Input, channel E
INF	7	10	10	10	I	Input, channel F
OUTA	15	15	15	15	O	Output, channel A
OUTB	14	14	14	14	O	Output, channel B
OUTC	13	13	13	13	O	Output, channel C
OUTD	12	12	12	5	O	Output, channel D
OUTE	11	11	6	6	O	Output, channel E
OUTF	10	7	7	7	O	Output, channel F
V <sub>CC1</sub>	1	1	1	1	—	Power supply, side 1
V <sub>CC2</sub>	16	16	16	16	—	Power supply, side 2

## 6 Specifications

### 6.1 Absolute Maximum Ratings

See<sup>(1)</sup>

		MIN	MAX	UNIT
$V_{CC1}, V_{CC2}$	Supply voltage <sup>(2)</sup>	-0.5	6	V
V	Voltage at INx, OUTx	-0.5	$V_{CCX} + 0.5$ <sup>(3)</sup>	V
$I_o$	Output current	-15	15	mA
$T_J$	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, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. 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

(1)

		VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per AEC Q100-002 <sup>(1)</sup>	±6000
		Charged device model (CDM), per AEC Q100-011	±1500
		Contact discharge per IEC 61000-4-2; Isolation barrier withstand test <sup>(2) (3)</sup>	±8000

- (1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.
- (2) IEC ESD strike is applied across the barrier with all pins on each side tied together creating a two-terminal device.
- (3) Testing is carried out in air or oil to determine the intrinsic contact discharge capability of the device.

### 6.3 Recommended Operating Conditions

		MIN	NOM	MAX	UNIT
$V_{CC1}, V_{CC2}$	Supply Voltage	2.25		5.5	V
$V_{cc (UVLO+)}$	UVLO threshold when supply voltage is rising		2	2.25	V
$V_{cc (UVLO-)}$	UVLO threshold when supply voltage is falling	1.7	1.8		V
$V_{HYS (UVLO)}$	Supply voltage UVLO hysteresis	100	200		mV
$I_{OH}$	High level output current	$V_{CCO}^{(1)} = 5\text{ V}$		-4	mA
		$V_{CCO} = 3.3\text{ V}$		-2	
		$V_{CCO} = 2.5\text{ V}$		-1	
$I_{OL}$	Low level output current	$V_{CCO} = 5\text{ V}$		4	mA
		$V_{CCO} = 3.3\text{ V}$		2	
		$V_{CCO} = 2.5\text{ V}$		1	
$V_{IH}$	High level Input voltage	$0.7 \times V_{CCI}^{(1)}$		$V_{CCI}$	V
$V_{IL}$	Low level Input voltage	0		$0.3 \times V_{CCI}$	V
$DR^{(2)}$	Data Rate	0		100	Mbps
$T_A$	Ambient temperature	-55	25	125	°C

(1)  $V_{CCI}$  = Input-side  $V_{CC}$ ;  $V_{CCO}$  = Output-side  $V_{CC}$

(2) 100 Mbps is the maximum specified data rate, although higher data rates are possible.

## 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		ISO776x		UNIT
		DW (SOIC)	DBQ (SSOP)	
		16 PINS	16 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	60.3	86.5	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	24.0	26.9	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	29.3	36.6	°C/W
$\Psi_{JT}$	Junction-to-top characterization parameter	3.3	1.7	°C/W
$\Psi_{JB}$	Junction-to-board characterization parameter	28.7	36.1	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	n/a	n/a	°C/W

(1) For more information about traditional and new thermal metrics, see the [no.](#)

## 6.5 Power Ratings

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>ISO7760</b>						
$P_D$	Maximum power dissipation (both sides)	$V_{CC1} = V_{CC2} = 5.5\text{ V}$ , $T_J = 150^\circ\text{C}$ , $C_L = 15\text{ pF}$ , Input a 50-MHz 50% duty cycle square wave			314	mW
$P_{D1}$	Maximum power dissipation (side-1)				55	mW
$P_{D2}$	Maximum power dissipation (side-2)				259	mW
<b>ISO7761</b>						
$P_D$	Maximum power dissipation (both sides)	$V_{CC1} = V_{CC2} = 5.5\text{ V}$ , $T_J = 150^\circ\text{C}$ , $C_L = 15\text{ pF}$ , Input a 50-MHz 50% duty cycle square wave			314	mW
$P_{D1}$	Maximum power dissipation (side-1)				88	mW
$P_{D2}$	Maximum power dissipation (side-2)				226	mW
<b>ISO7762</b>						
$P_D$	Maximum power dissipation (both sides)	$V_{CC1} = V_{CC2} = 5.5\text{ V}$ , $T_J = 150^\circ\text{C}$ , $C_L = 15\text{ pF}$ , Input a 50-MHz 50% duty cycle square wave			314	mW
$P_{D1}$	Maximum power dissipation (side-1)				122	mW
$P_{D2}$	Maximum power dissipation (side-2)				192	mW
<b>ISO7763</b>						
$P_D$	Maximum power dissipation (both sides)	$V_{CC1} = V_{CC2} = 5.5\text{ V}$ , $T_J = 150^\circ\text{C}$ , $C_L = 15\text{ pF}$ , Input a 50-MHz 50% duty cycle square wave			314	mW
$P_{D1}$	Maximum power dissipation (side-1)				157	mW
$P_{D2}$	Maximum power dissipation (side-2)				157	mW



## 6.6 Insulation Specifications

PARAMETER		TEST CONDITIONS	VALUE		UNIT
			DW-16	DBQ-16	
CLR	External clearance <sup>(1)</sup>	Shortest terminal-to-terminal distance through air	>8	>3.7	mm
CPG	External creepage <sup>(1)</sup>	Shortest terminal-to-terminal distance across the package surface	>8	>3.7	mm
DTI	Distance through the insulation	Minimum internal gap (internal clearance)	>17	>17	μm
CTI	Comparative tracking index	DIN EN 60112 (VDE 0303-11); IEC 60112; UL 746A	>600	>600	V
	Material group	According to IEC 60664-1	I	I	
	Overvoltage category per IEC 60664-1	Rated mains voltage ≤ 150 V <sub>RMS</sub>	I-IV	I-IV	
		Rated mains voltage ≤ 300 V <sub>RMS</sub>	I-IV	I-III	
		Rated mains voltage ≤ 600 V <sub>RMS</sub>	I-IV	n/a	
		Rated mains voltage ≤ 1000 V <sub>RMS</sub>	I-III	n/a	
<b>DIN EN IEC 60747-17 (VDE 0884-17)<sup>(2)</sup></b>					
V <sub>IORM</sub>	Maximum repetitive peak isolation voltage	AC voltage (bipolar)	2121	566	V <sub>PK</sub>
V <sub>IOWM</sub>	Maximum working isolation voltage	AC voltage; Time dependent dielectric breakdown (TDDB) test; See <a href="#">Figure 8-7</a>	1500	400	V <sub>RMS</sub>
		DC voltage	2121	566	V <sub>DC</sub>
V <sub>IOTM</sub>	Maximum transient isolation voltage	V <sub>TEST</sub> = V <sub>IOTM</sub> , t = 60 s (qualification); V <sub>TEST</sub> = 1.2 x V <sub>IOTM</sub> , t = 1 s (100% production)	8000	4242	V <sub>PK</sub>
V <sub>IMP</sub>	Maximum impulse voltage <sup>(3)</sup>	Tested in air, 1.2/50-μs waveform per IEC 62368-1	8000	4000	V <sub>PK</sub>
V <sub>IOSM</sub>	Maximum surge isolation voltage <sup>(4)</sup>	V <sub>IOSM</sub> ≥ 1.3 x V <sub>IMP</sub> ; Tested in oil (qualification test), 1.2/50-μs waveform per IEC 62368-1	12800	10000	V <sub>PK</sub>
q <sub>pd</sub>	Apparent charge <sup>(5)</sup>	Method a, After Input-output safety test subgroup 2/3, V <sub>ini</sub> = V <sub>IOTM</sub> , t <sub>ini</sub> = 60 s; V <sub>pd(m)</sub> = 1.2 x V <sub>IORM</sub> , t <sub>m</sub> = 10 s	≤5	≤5	pC
		Method a, After environmental tests subgroup 1, V <sub>ini</sub> = V <sub>IOTM</sub> , t <sub>ini</sub> = 60 s; V <sub>pd(m)</sub> = 1.6 x V <sub>IORM</sub> , t <sub>m</sub> = 10 s	≤5	≤5	
		Method b: At routine test (100% production) and preconditioning (type test); V <sub>ini</sub> = 1.2 x V <sub>IOTM</sub> , t <sub>ini</sub> = 1 s; V <sub>pd(m)</sub> = 1.875 x V <sub>IORM</sub> , t <sub>m</sub> = 1 s (method b1) or V <sub>pd(m)</sub> = V <sub>ini</sub> , t <sub>m</sub> = t <sub>ini</sub> (method b2)	≤5	≤5	
C <sub>IO</sub>	Barrier capacitance, input to output <sup>(6)</sup>	V <sub>IO</sub> = 0.4 x sin(2πft), f = 1 MHz	~1.1	~0.9	pF
R <sub>IO</sub>	Isolation resistance <sup>(6)</sup>	V <sub>IO</sub> = 500 V, T <sub>A</sub> = 25°C	>10 <sup>12</sup>	>10 <sup>12</sup>	Ω
		V <sub>IO</sub> = 500 V, 100°C ≤ T <sub>A</sub> ≤ 125°C	>10 <sup>11</sup>	>10 <sup>11</sup>	
		V <sub>IO</sub> = 500 V, T <sub>S</sub> = 150°C	>10 <sup>9</sup>	>10 <sup>9</sup>	
	Pollution degree		2	2	
	Climatic category		55/125/ 21	55/125/ 21	
<b>UL 1577</b>					
V <sub>ISO</sub>	Maximum withstanding isolation voltage	V <sub>TEST</sub> = V <sub>ISO</sub> , t = 60 s (qualification), V <sub>TEST</sub> = 1.2 x V <sub>ISO</sub> , t = 1 s (100% production)	5000	3000	V <sub>RMS</sub>

- (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 *safe electrical insulation* only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

**ISO7760-Q1, ISO7761-Q1, ISO7762-Q1, ISO7763-Q1**SLLSEU7E – NOVEMBER 2018 – REVISED JULY 2024

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- (3) Testing is carried out in air to determine the surge immunity of the package
- (4) Testing is carried out in oil to determine the intrinsic surge immunity of the isolation barrier.
- (5) Apparent charge is electrical discharge caused by a partial discharge (pd).
- (6) All pins on each side of the barrier tied together creating a two-terminal device.

## 6.7 Safety-Related Certifications

VDE	CSA	UL	CQC	TUV
Certified according to DIN EN IEC 60747-17 (VDE 0884-17)	Certified according to IEC 62368-1 and IEC 60601-1	Recognized under UL 1577 Component Recognition Program	Certified according to GB 4943.1	Certified according to EN 61010-1 and EN 62368-1
Reinforced Insulation; Maximum transient isolation voltage, 8000 V <sub>PK</sub> (ISO7760 in DW-16), 7071 V <sub>PK</sub> (ISO7761, ISO7762, ISO7763 in DW-16) and 4242 V <sub>PK</sub> (DBQ-16); Maximum repetitive peak isolation voltage, 2121 V <sub>PK</sub> (DW-16) and 566 V <sub>PK</sub> (DBQ-16); Maximum surge isolation voltage, 12800 V <sub>PK</sub> (DW-16) and 10000 V <sub>PK</sub> (DBQ-16)	Reinforced insulation per CSA 62368-1 and IEC 62368-1 800 V <sub>RMS</sub> (DW-16) and 370 V <sub>RMS</sub> (DBQ-16) maximum working voltage (pollution degree 2, material group I); DW-16: 2 MOPP (Means of Patient Protection) per CSA 60601-1 and IEC 60601-1, 250 V <sub>RMS</sub> maximum working voltage	DW-16: Single protection, 5000 V <sub>RMS</sub> ; DBQ-16: Single protection, 3000 V <sub>RMS</sub>	DW-16: Reinforced Insulation, Altitude ≤ 5000 m, Tropical Climate, 700 V <sub>RMS</sub> maximum working voltage; DBQ-16: Basic Insulation, Altitude ≤ 5000 m, Tropical Climate, 400 V <sub>RMS</sub> maximum working voltage	5000 V <sub>RMS</sub> Reinforced insulation per EN 61010-1 up to working voltage of 600 V <sub>RMS</sub> (DW-16) and 300 V <sub>RMS</sub> (DBQ-16) 5000 V <sub>RMS</sub> Reinforced insulation per EN 62368-1 up to working voltage of 600 V <sub>RMS</sub> (DW-16) and 370 V <sub>RMS</sub> (DBQ-16)
Certificate number: 40040142	Master contract number: 220991	File number: E181974	Certificate numbers: CQC15001121716 (DW) CQC18001199097 (DBQ)	Client ID number: 77311

## 6.8 Safety Limiting Values

Safety limiting<sup>(1)</sup> intends to minimize potential damage to the isolation barrier upon failure of input or output circuitry.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>DW-16 PACKAGE</b>						
I <sub>S</sub>	Safety input, output, or supply current <sup>(1)</sup>	R <sub>θJA</sub> = 60.3°C/W, V <sub>I</sub> = 5.5 V, T <sub>J</sub> = 150°C, T <sub>A</sub> = 25°C, see <a href="#">Figure 6-1</a>			377	mA
		R <sub>θJA</sub> = 60.3°C/W, V <sub>I</sub> = 3.6 V, T <sub>J</sub> = 150°C, T <sub>A</sub> = 25°C, see <a href="#">Figure 6-1</a>			576	
		R <sub>θJA</sub> = 60.3°C/W, V <sub>I</sub> = 2.75 V, T <sub>J</sub> = 150°C, T <sub>A</sub> = 25°C, see <a href="#">Figure 6-1</a>			754	
P <sub>S</sub>	Safety input, output, or total power <sup>(1)</sup>	R <sub>θJA</sub> = 60.3°C/W, T <sub>J</sub> = 150°C, T <sub>A</sub> = 25°C, see <a href="#">Figure 6-1</a>			2073	mW
T <sub>S</sub>	Maximum safety temperature <sup>(1)</sup>				150	°C
<b>DBQ-16 PACKAGE</b>						
I <sub>S</sub>	Safety input, output, or supply current <sup>(1)</sup>	R <sub>θJA</sub> = 86.5°C/W, V <sub>I</sub> = 5.5 V, T <sub>J</sub> = 150°C, T <sub>A</sub> = 25°C, see <a href="#">Figure 6-2</a>			263	mA
		R <sub>θJA</sub> = 86.5°C/W, V <sub>I</sub> = 3.6 V, T <sub>J</sub> = 150°C, T <sub>A</sub> = 25°C, see <a href="#">Figure 6-2</a>			401	
		R <sub>θJA</sub> = 86.5°C/W, V <sub>I</sub> = 2.75 V, T <sub>J</sub> = 150°C, T <sub>A</sub> = 25°C, see <a href="#">Figure 6-2</a>			525	
P <sub>S</sub>	Safety input, output, or total power <sup>(1)</sup>	R <sub>θJA</sub> = 86.5°C/W, T <sub>J</sub> = 150°C, T <sub>A</sub> = 25°C, see <a href="#">Figure 6-2</a>			1445	mW
T <sub>S</sub>	Maximum safety temperature <sup>(1)</sup>				150	°C

(1) The maximum safety temperature, T<sub>S</sub>, has the same value as the maximum junction temperature, T<sub>J</sub>, specified for the device. The I<sub>S</sub> and P<sub>S</sub> parameters represent the safety current and safety power respectively. The maximum limits of I<sub>S</sub> and P<sub>S</sub> should not be exceeded. These limits vary with the ambient temperature, T<sub>A</sub>.

The junction-to-air thermal resistance, R<sub>θJA</sub>, in the table is that of a device installed on a high-K test board for leaded surface-mount packages. Use these equations to calculate the value for each parameter:

T<sub>J</sub> = T<sub>A</sub> + R<sub>θJA</sub> × P, where P is the power dissipated in the device.

T<sub>J(max)</sub> = T<sub>S</sub> = T<sub>A</sub> + R<sub>θJA</sub> × P<sub>S</sub>, where T<sub>J(max)</sub> is the maximum allowed junction temperature.

$P_S = I_S \times V_I$ , where  $V_I$  is the maximum input voltage.

## 6.9 Electrical Characteristics—5-V Supply

VCC1 = VCC2 = 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 7-1</a>	V <sub>CCO</sub> <sup>(1)</sup> - 0.4	4.8		V
V <sub>OL</sub>	Low-level output voltage	I <sub>OL</sub> = 4 mA; See <a href="#">Figure 7-1</a>		0.2	0.4	V
V <sub>IT+(IN)</sub>	Rising input switching threshold			0.6 x V <sub>CC1</sub>	0.7 x V <sub>CC1</sub>	V
V <sub>IT-(IN)</sub>	Falling input switching threshold		0.3 x V <sub>CC1</sub>	0.4 x V <sub>CC1</sub>		V
V <sub>I(HYS)</sub>	Input threshold voltage hysteresis		0.1 x V <sub>CC1</sub>	0.2 x V <sub>CC1</sub>		V
I <sub>IH</sub>	High-level input current	V <sub>IH</sub> = V <sub>CC1</sub> <sup>(1)</sup> at INx			10	μA
I <sub>IL</sub>	Low-level input current	V <sub>IL</sub> = 0 V at INx	-10			μA
CMTI	Common mode transient immunity	V <sub>I</sub> = V <sub>CC1</sub> or 0 V, V <sub>CM</sub> = 1200 V; See <a href="#">Figure 7-3</a>	85	100		kV/μs
C <sub>I</sub>	Input Capacitance <sup>(2)</sup>	V <sub>I</sub> = V <sub>CC1</sub> / 2 + 0.4 × sin(2πft), f = 1 MHz, V <sub>CC</sub> = 5 V		2		pF

(1) V<sub>CC1</sub> = Input-side V<sub>CC</sub>; V<sub>CCO</sub> = Output-side V<sub>CC</sub>

(2) Measured from input pin to same side ground.

## 6.10 Supply Current Characteristics—5-V Supply

VCC1 = VCC2 = 5 V ± 10% (over recommended operating conditions unless otherwise noted).

PARAMETER	TEST CONDITIONS		SUPPLY CURRENT	MIN	TYP	MAX	UNIT
<b>ISO7760-Q1</b>							
Supply current - DC signal	V <sub>I</sub> = V <sub>CC1</sub> (ISO7760-Q1); V <sub>I</sub> = 0 V (ISO7760-Q1 with F suffix)		I <sub>CC1</sub>		1.6	2.9	mA
			I <sub>CC2</sub>		3	5.3	
	V <sub>I</sub> = 0 V (ISO7760-Q1); V <sub>I</sub> = V <sub>CC1</sub> (ISO7760-Q1 with F suffix)		I <sub>CC1</sub>		8	11.3	
			I <sub>CC2</sub>		3.3	5.7	
Supply current - AC signal	All channels switching with square wave clock input; C <sub>L</sub> = 15 pF	1 Mbps	I <sub>CC1</sub>		5	6.5	
			I <sub>CC2</sub>		3.5	5.9	
		10 Mbps	I <sub>CC1</sub>		5.2	6.7	
			I <sub>CC2</sub>		6.4	9.7	
		100 Mbps	I <sub>CC1</sub>		7	9.2	
			I <sub>CC2</sub>		35	47	
<b>ISO7761-Q1</b>							
Supply current - DC signal	V <sub>I</sub> = V <sub>CC1</sub> <sup>(1)</sup> (ISO7761-Q1); V <sub>I</sub> = 0 V (ISO7761-Q1 with F suffix)		I <sub>CC1</sub>		1.9	3.5	mA
			I <sub>CC2</sub>		2.9	5.4	
	V <sub>I</sub> = 0 V (ISO7761-Q1); V <sub>I</sub> = V <sub>CC1</sub> (ISO7761-Q1 with F suffix)	I <sub>CC1</sub>		7.3	10.6		
		I <sub>CC2</sub>		4.2	6.9		
Supply current - AC signal	All channels switching with square wave clock input; C <sub>L</sub> = 15 pF	1 Mbps	I <sub>CC1</sub>		4.7	6.6	
			I <sub>CC2</sub>		3.8	6.5	
		10 Mbps	I <sub>CC1</sub>		5.3	8	
			I <sub>CC2</sub>		6.3	9.6	
		100 Mbps	I <sub>CC1</sub>		11.5	15.6	
			I <sub>CC2</sub>		30.5	40.3	
<b>ISO7762-Q1</b>							

**ISO7760-Q1, ISO7761-Q1, ISO7762-Q1, ISO7763-Q1**

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

PARAMETER	TEST CONDITIONS	SUPPLY CURRENT	MIN	TYP	MAX	UNIT	
Supply current - DC signal	$V_I = V_{CCI}$ (ISO7762-Q1); $V_I = 0\text{ V}$ (ISO7762-Q1 with F suffix)	$I_{CC1}$		2.1	4.1	mA	
		$I_{CC2}$		2.6	4.9		
	$V_I = 0\text{ V}$ (ISO7762-Q1); $V_I = V_{CCI}$ (ISO7762-Q1 with F suffix)	$I_{CC1}$		6.5	9.3		
		$I_{CC2}$		5	7.6		
Supply current - AC signal	All channels switching with square wave clock input; $C_L = 15\text{ pF}$	1 Mbps	$I_{CC1}$		4.5		6.7
			$I_{CC2}$		4		6.5
		10 Mbps	$I_{CC1}$		5.6		8
			$I_{CC2}$		6		8.9
		100 Mbps	$I_{CC1}$		16.5	21.3	
			$I_{CC2}$		25.7	34	
<b>ISO7763-Q1</b>							
Supply current - DC signal	$V_I = V_{CCI}$ (ISO7763-Q1); $V_I = 0\text{ V}$ (ISO7763-Q1 with F suffix)	$I_{CC1}, I_{CC2}$		2.4	4.7	mA	
		$I_{CC1}, I_{CC2}$		5.7	8.6		
Supply current - AC signal	All channels switching with square wave clock input; $C_L = 15\text{ pF}$	1 Mbps	$I_{CC1}, I_{CC2}$		4.2		6.8
			$I_{CC1}, I_{CC2}$		5.8		8.7
		10 Mbps	$I_{CC1}, I_{CC2}$		21		28.4
			$I_{CC1}, I_{CC2}$				

 (1)  $V_{CCI} = \text{Input-side } V_{CC}$

### 6.11 Electrical Characteristics—3.3-V Supply

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{OH}$	High-level output voltage	$I_{OH} = -2\text{mA}$ ; See <a href="#">Figure 7-1</a>	$V_{CCO}^{(1)} - 0.3$	3.2		V
$V_{OL}$	Low-level output voltage	$I_{OL} = 2\text{mA}$ ; See <a href="#">Figure 7-1</a>		0.1	0.3	V
$V_{IT+(IN)}$	Rising input switching threshold			$0.6 \times V_{CCI}$	$0.7 \times V_{CCI}^{(1)}$	V
$V_{IT-(IN)}$	Falling input switching threshold		$0.3 \times V_{CCI}$	$0.4 \times V_{CCI}$		V
$V_{I(HYS)}$	Input threshold voltage hysteresis		$0.1 \times V_{CCI}$	$0.2 \times V_{CCI}$		V
$I_{IH}$	High-level input current	$V_{IH} = V_{CCI}^{(1)}$ at INx			10	$\mu\text{A}$
$I_{IL}$	Low-level input current	$V_{IL} = 0\text{ V}$ at INx	-10			$\mu\text{A}$
CMTI	Common mode transient immunity	$V_I = V_{CC}$ or $0\text{ V}$ , $V_{CM} = 1200\text{ V}$ ; See <a href="#">Figure 7-3</a>	85	100		kV/us

(1)  $V_{CCI}$  = Input-side  $V_{CC}$ ;  $V_{CCO}$  = Output-side  $V_{CC}$

### 6.12 Supply Current Characteristics—3.3-V Supply

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

PARAMETER	TEST CONDITIONS		SUPPLY CURRENT	MIN	TYP	MAX	UNIT
<b>ISO7760-Q1</b>							
Supply current - DC signal	$V_I = V_{CC1}$ (ISO7760-Q1); $V_I = 0\text{ V}$ (ISO7760-Q1 with F suffix)		$I_{CC1}$		1.6	2.9	mA
			$I_{CC2}$		3	5.3	
	$V_I = 0\text{ V}$ (ISO7760-Q1); $V_I = V_{CC1}$ (ISO7760-Q1 with F suffix)		$I_{CC1}$		8	11.4	
			$I_{CC2}$		3.3	5.7	
Supply current - AC signal	All channels switching with square wave clock input; $C_L = 15\text{ pF}$	1 Mbps	$I_{CC1}$		4.9	6.4	
			$I_{CC2}$		3.4	5.7	
		10 Mbps	$I_{CC1}$		5	6.6	
			$I_{CC2}$		5.5	8.5	
		100 Mbps	$I_{CC1}$		6.3	8.1	
			$I_{CC2}$		26	35	
<b>ISO7761-Q1</b>							
Supply current - DC signal	$V_I = V_{CC1}^{(1)}$ (ISO7761-Q1); $V_I = 0\text{ V}$ (ISO7761-Q1 with F suffix)		$I_{CC1}$		1.8	3.5	mA
			$I_{CC2}$		2.9	5.3	
	$V_I = 0\text{ V}$ (ISO7761-Q1); $V_I = V_{CC1}$ (ISO7761-Q1 with F suffix)		$I_{CC1}$		7.2	10.3	
			$I_{CC2}$		4.2	6.9	
Supply current - AC signal	All channels switching with square wave clock input; $C_L = 15\text{ pF}$	1 Mbps	$I_{CC1}$		4.6	6.5	
			$I_{CC2}$		3.7	6.3	
		10 Mbps	$I_{CC1}$		5.1	7.5	
			$I_{CC2}$		5.5	8.6	
		100 Mbps	$I_{CC1}$		9.4	12.7	
			$I_{CC2}$		22.8	30.5	
<b>ISO7762-Q1</b>							

**ISO7760-Q1, ISO7761-Q1, ISO7762-Q1, ISO7763-Q1**

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

PARAMETER	TEST CONDITIONS	SUPPLY CURRENT	MIN	TYP	MAX	UNIT
Supply current - DC signal	$V_I = V_{CCI}$ (ISO7762-Q1); $V_I = 0\text{ V}$ (ISO7762-Q1 with F suffix)	$I_{CC1}$		2.1	4	mA
		$I_{CC2}$		2.5	4.8	
	$V_I = 0\text{ V}$ (ISO7762-Q1); $V_I = V_{CCI}$ (ISO7762-Q1 with F suffix)	$I_{CC1}$		6.5	9.4	
		$I_{CC2}$		5	7.5	
Supply current - AC signal	All channels switching with square wave clock input; $C_L = 15\text{ pF}$	1 Mbps	$I_{CC1}$	4.4	6.6	
			$I_{CC2}$	3.9	6.3	
		10 Mbps	$I_{CC1}$	5.2	7.5	
			$I_{CC2}$	5.4	8.1	
		100 Mbps	$I_{CC1}$	12.9	16.9	
			$I_{CC2}$	19.5	26	
<b>ISO7763-Q1</b>						
Supply current - DC signal	$V_I = V_{CCI}$ (ISO7763-Q1); $V_I = 0\text{ V}$ (ISO7763-Q1 with F suffix)	$I_{CC1}, I_{CC2}$		2.4	4.6	mA
		$I_{CC1}, I_{CC2}$		5.7	8.4	
Supply current - AC signal	All channels switching with square wave clock input; $C_L = 15\text{ pF}$	1 Mbps	$I_{CC1}, I_{CC2}$	4.2	6.6	
			$I_{CC1}, I_{CC2}$	5.2	8.1	
		10 Mbps	$I_{CC1}, I_{CC2}$	5.2	8.1	
			$I_{CC1}, I_{CC2}$	16	21.9	

 (1)  $V_{CCI} = \text{Input-side } V_{CC}$



### 6.13 Electrical Characteristics—2.5-V Supply

$V_{CC1} = V_{CC2} = 2.5\text{ V} \pm 10\%$  (over recommended operating conditions unless otherwise noted).

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{OH}$	High-level output voltage	$I_{OH} = -1\text{mA}$ ; See <a href="#">Figure 7-1</a>	$V_{CCO}^{(1)} - 0.2$	2.45		V
$V_{OL}$	Low-level output voltage	$I_{OL} = 1\text{mA}$ ; See <a href="#">Figure 7-1</a>		0.05	0.2	V
$V_{IT+(IN)}$	Rising input switching threshold			$0.6 \times V_{CCI}$	$0.7 \times V_{CCI}^{(1)}$	V
$V_{IT-(IN)}$	Falling input switching threshold		$0.3 \times V_{CCI}$	$0.4 \times V_{CCI}$		V
$V_{I(HYS)}$	Input threshold voltage hysteresis		$0.1 \times V_{CCI}$	$0.2 \times V_{CCI}$		V
$I_{IH}$	High-level input current	$V_{IH} = V_{CCI}^{(1)}$ at INx			10	$\mu\text{A}$
$I_{IL}$	Low-level input current	$V_{IL} = 0\text{ V}$ at INx	-10			$\mu\text{A}$
CMTI	Common mode transient immunity	$V_I = V_{CC}$ or $0\text{ V}$ , $V_{CM} = 1200\text{ V}$ ; See <a href="#">Figure 7-3</a>	85	100		kV/us

(1)  $V_{CCI}$  = Input-side  $V_{CC}$ ;  $V_{CCO}$  = Output-side  $V_{CC}$

### 6.14 Supply Current Characteristics—2.5-V Supply

$V_{CC1} = V_{CC2} = 2.5\text{ V} \pm 10\%$  (over recommended operating conditions unless otherwise noted).

PARAMETER	TEST CONDITIONS		SUPPLY CURRENT	MIN	TYP	MAX	UNIT
<b>ISO7760-Q1</b>							
Supply current - DC signal	$V_I = V_{CC1}$ (ISO7760-Q1); $V_I = 0\text{ V}$ (ISO7760-Q1 with F suffix)		$I_{CC1}$		1.6	2.9	mA
			$I_{CC2}$		3	5.2	
	$V_I = 0\text{ V}$ (ISO7760-Q1); $V_I = V_{CC1}$ (ISO7760-Q1 with F suffix)		$I_{CC1}$		8	11.6	
			$I_{CC2}$		3.3	5.7	
Supply current - AC signal	All channels switching with square wave clock input; $C_L = 15\text{ pF}$	1 Mbps	$I_{CC1}$		4.9	6.4	
			$I_{CC2}$		3.4	5.7	
		10 Mbps	$I_{CC1}$		5	6.5	
			$I_{CC2}$		4.9	7.7	
		100 Mbps	$I_{CC1}$		6	7.7	
			$I_{CC2}$		20.3	27.9	
<b>ISO7761-Q1</b>							
Supply current - DC signal	$V_I = V_{CC1}^{(1)}$ (ISO7761-Q1); $V_I = 0\text{ V}$ (ISO7761-Q1 with F suffix)		$I_{CC1}$		1.8	3.4	mA
			$I_{CC2}$		2.9	5.3	
	$V_I = 0\text{ V}$ (ISO7761-Q1); $V_I = V_{CC1}$ (ISO7761-Q1 with F suffix)		$I_{CC1}$		7.2	10.3	
			$I_{CC2}$		4.2	6.8	
Supply current - AC signal	All channels switching with square wave clock input; $C_L = 15\text{ pF}$	1 Mbps	$I_{CC1}$		4.6	6.5	
			$I_{CC2}$		3.7	6.3	
		10 Mbps	$I_{CC1}$		4.9	7.2	
			$I_{CC2}$		5	7.9	
		100 Mbps	$I_{CC1}$		8.3	11.2	
			$I_{CC2}$		18.1	24.6	
<b>ISO7762-Q1</b>							

$V_{CC1} = V_{CC2} = 2.5\text{ V} \pm 10\%$  (over recommended operating conditions unless otherwise noted).

PARAMETER	TEST CONDITIONS	SUPPLY CURRENT	MIN	TYP	MAX	UNIT	
Supply current - DC signal	$V_I = V_{CCI}$ (ISO7762-Q1); $V_I = 0\text{ V}$ (ISO7762-Q1 with F suffix)	$I_{CC1}$		2.1	4	mA	
		$I_{CC2}$		2.6	4.8		
	$V_I = 0\text{ V}$ (ISO7762-Q1); $V_I = V_{CCI}$ (ISO7762-Q1 with F suffix)	$I_{CC1}$		6.5	9.6		
		$I_{CC2}$		4.9	7.4		
Supply current - AC signal	All channels switching with square wave clock input; $C_L = 15\text{ pF}$	1 Mbps	$I_{CC1}$		4.4		6.5
			$I_{CC2}$		3.9		6.3
		10 Mbps	$I_{CC1}$		5		7.2
			$I_{CC2}$		5		7.6
		100 Mbps	$I_{CC1}$		10.9	14.4	
			$I_{CC2}$		15.6	21.3	
<b>ISO7763-Q1</b>							
Supply current - DC signal	$V_I = V_{CCI}$ (ISO7763-Q1); $V_I = 0\text{ V}$ (ISO7763-Q1 with F suffix)	$I_{CC1}, I_{CC2}$		2.3	4.6	mA	
		$I_{CC1}, I_{CC2}$		5.7	8.4		
Supply current - AC signal	All channels switching with square wave clock input; $C_L = 15\text{ pF}$	1 Mbps	$I_{CC1}, I_{CC2}$		4.1		6.6
		10 Mbps	$I_{CC1}, I_{CC2}$		4.9		7.6
		100 Mbps	$I_{CC1}, I_{CC2}$		13		18.1

(1)  $V_{CCI} = \text{Input-side } V_{CC}$

## 6.15 Switching Characteristics—5-V Supply

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>ISO776x-Q1</b>						
$t_{PLH}, t_{PHL}$	Propagation delay time	See <a href="#">Figure 7-1</a>	6	11	17	ns
PWD	Pulse width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $		0.4	5.9	ns	
$t_{sk(o)}$	Channel-to-channel output skew time <sup>(2)</sup>	Same-direction channels			4	ns
$t_{sk(pp)}$	Part-to-part skew time <sup>(3)</sup>				4.5	ns
$t_r$	Output signal rise time	See <a href="#">Figure 7-1</a>		1.1	3.9	ns
$t_f$	Output signal fall time			1.4	3.9	ns
$t_{DO}$	Default output delay time from input power loss	Measured from the time $V_{CC}$ goes below 1.7V. See <a href="#">Figure 7-2</a>		0.2	0.3	$\mu\text{s}$
$t_{ie}$	Time interval error	$2^{16} - 1$ PRBS data at 100 Mbps		1.3		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.

## 6.16 Switching Characteristics—3.3-V Supply

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>ISO776x-Q1</b>						
$t_{PLH}, t_{PHL}$	Propagation delay time	See <a href="#">Figure 7-1</a>	6	12	18.5	ns
PWD	Pulse width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $		0.5	5.9	ns	
$t_{sk(o)}$	Channel-to-channel output skew time <sup>(2)</sup>	Same-direction channels			4.4	ns
$t_{sk(pp)}$	Part-to-part skew time <sup>(3)</sup>				5	ns
$t_r$	Output signal rise time	See <a href="#">Figure 7-1</a>		1	3	ns
$t_f$	Output signal fall time			1	3	ns
$t_{DO}$	Default output delay time from input power loss	Measured from the time $V_{CC}$ goes below 1.7V. See <a href="#">Figure 7-2</a>		0.2	0.3	$\mu$ s
$t_{ie}$	Time interval error	$2^{16} - 1$ PRBS data at 100 Mbps		1.3		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.

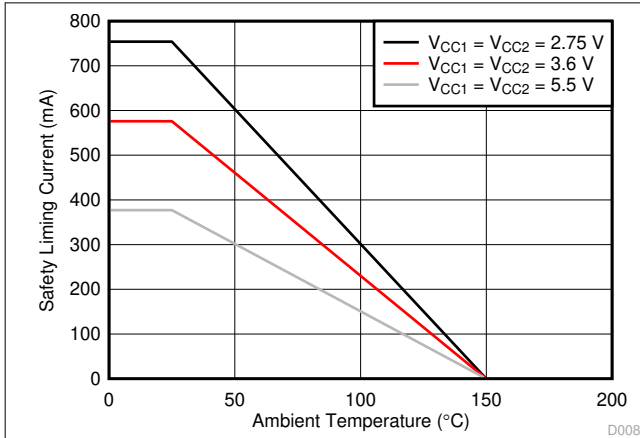
## 6.17 Switching Characteristics—2.5-V Supply

$V_{CC1} = V_{CC2} = 2.5\text{ V} \pm 10\%$  (over recommended operating conditions unless otherwise noted)

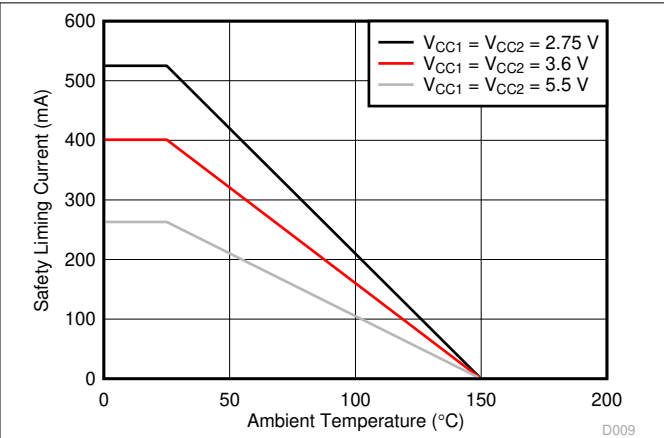
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>ISO776x-Q1</b>						
$t_{PLH}, t_{PHL}$	Propagation delay time	See <a href="#">Figure 7-1</a>	7.5	13	21	ns
PWD	Pulse width distortion <sup>(1)</sup> $ t_{PHL} - t_{PLH} $		0.6	5.9	ns	
$t_{sk(o)}$	Channel-to-channel output skew time <sup>(2)</sup>	Same-direction channels			4.4	ns
$t_{sk(pp)}$	Part-to-part skew time <sup>(3)</sup>				5.3	ns
$t_r$	Output signal rise time	See <a href="#">Figure 7-1</a>		1	3.5	ns
$t_f$	Output signal fall time		1	3.5	ns	
$t_{DO}$	Default output delay time from input power loss	Measured from the time $V_{CC}$ goes below 1.7V. See <a href="#">Figure 7-2</a>		0.1	0.3	$\mu$ s
$t_{ie}$	Time interval error	$2^{16} - 1$ PRBS data at 100 Mbps		1.3		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.

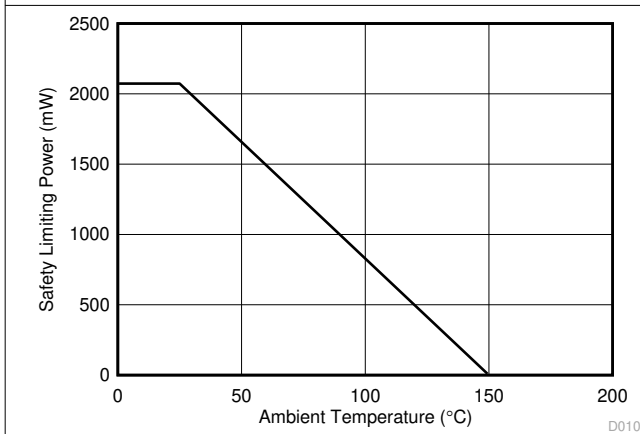
## 6.18 Insulation Characteristics Curves



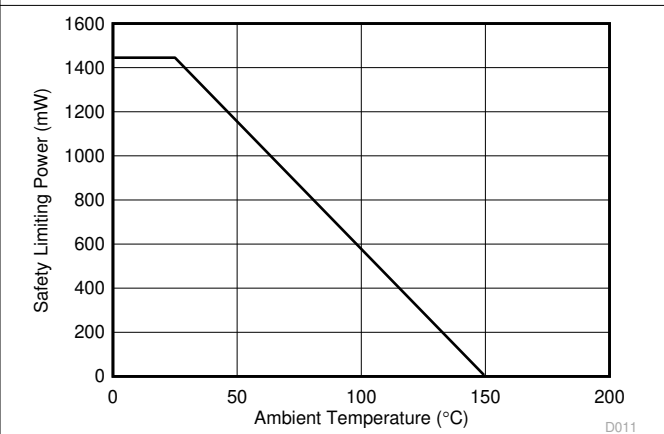
**Figure 6-1. Thermal Derating Curve for Limiting Current per VDE for DW-16 Package**



**Figure 6-2. Thermal Derating Curve for Limiting Current per VDE for DBQ-16 Package**

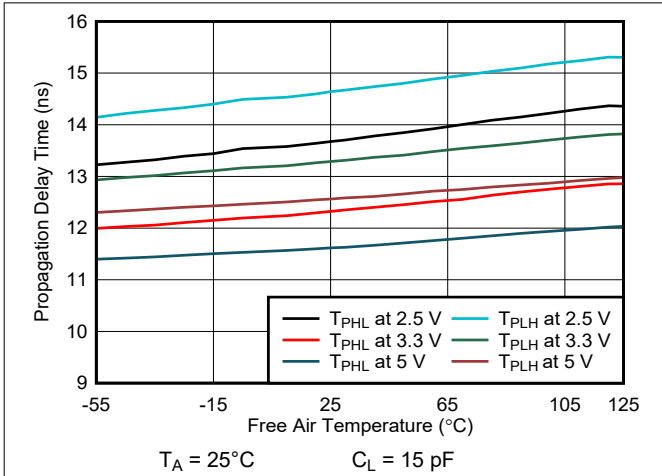


**Figure 6-3. Thermal Derating Curve for Limiting Power per VDE for DW-16 Package**

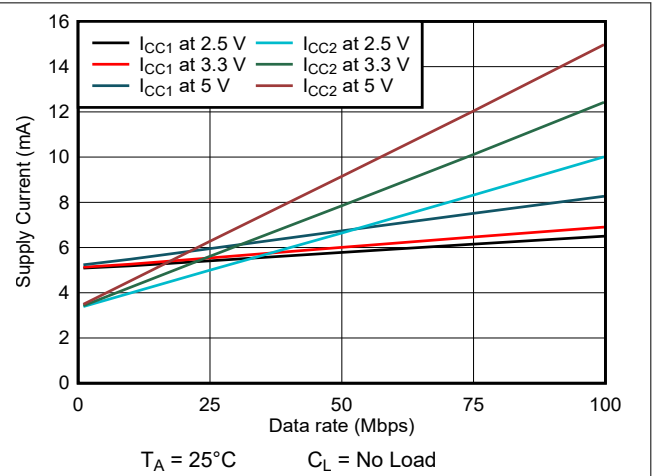


**Figure 6-4. Thermal Derating Curve for Limiting Power per VDE for DBQ-16 Package**

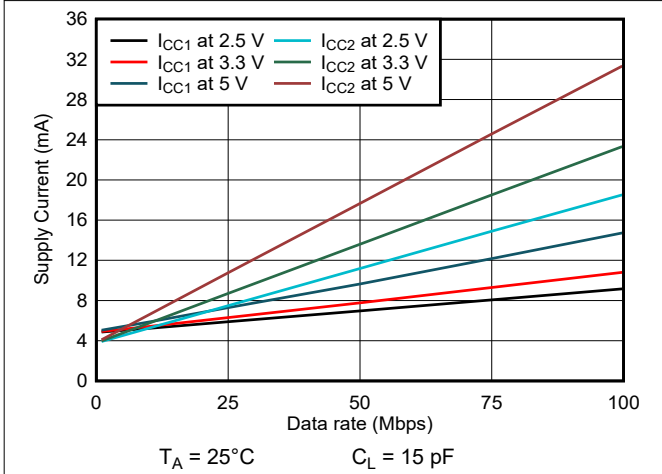
## 6.19 Typical Characteristics



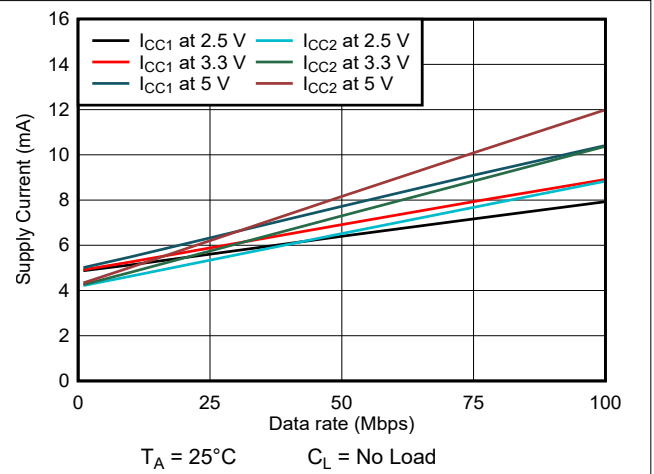
**Figure 6-5. ISO7760-Q1 Supply Current vs Data Rate (With 15-pF Load)**



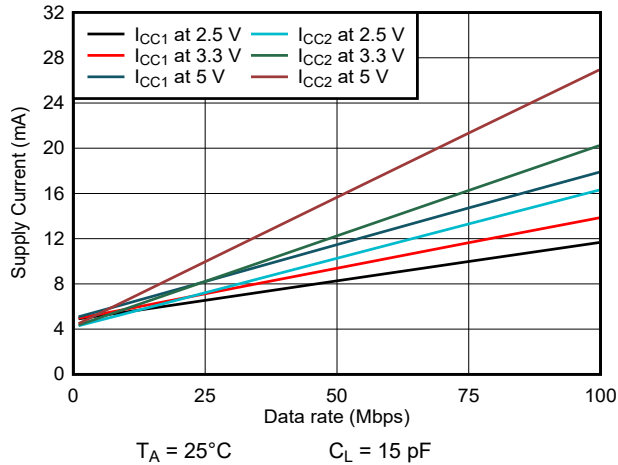
**Figure 6-6. ISO7760-Q1 Supply Current vs Data Rate (With No Load)**



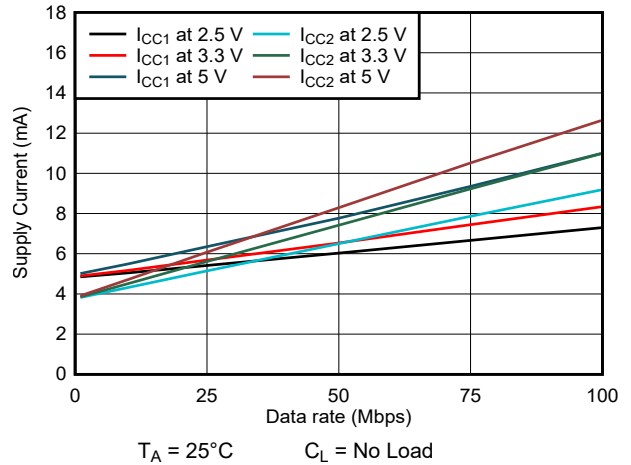
**Figure 6-7. ISO7761-Q1 Supply Current vs Data Rate (With 15-pF Load)**



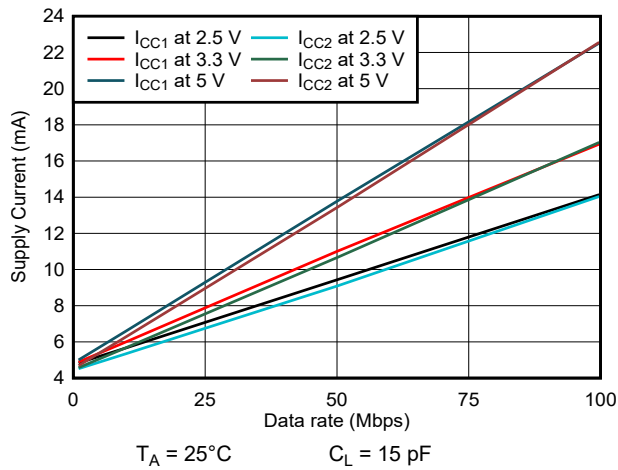
**Figure 6-8. ISO7761-Q1 Supply Current vs Data Rate (With No Load)**



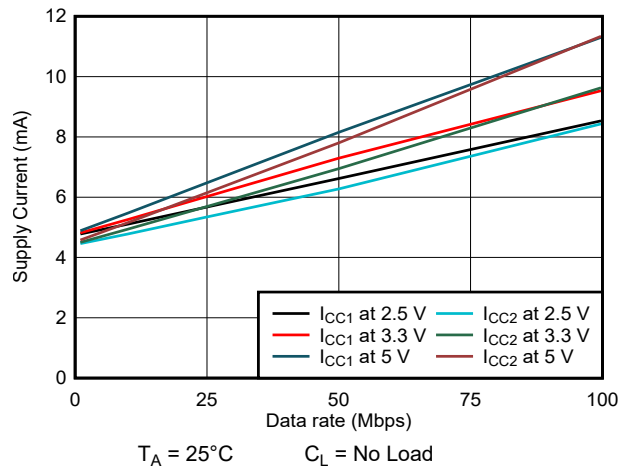
**Figure 6-9. ISO7762-Q1 Supply Current vs Data Rate (With 15-pF Load)**



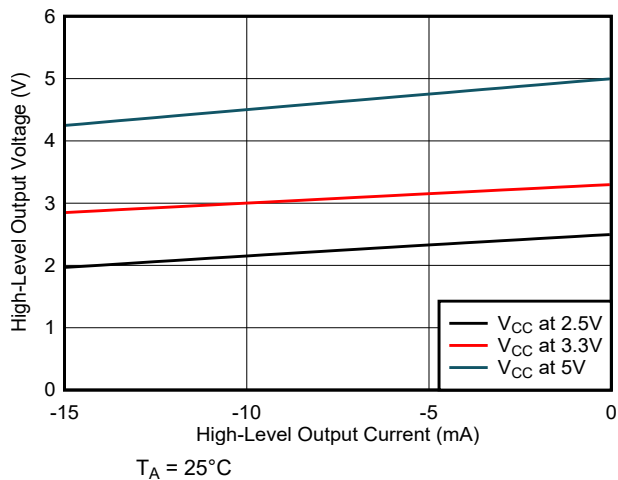
**Figure 6-10. ISO7762-Q1 Supply Current vs Data Rate (With No Load)**



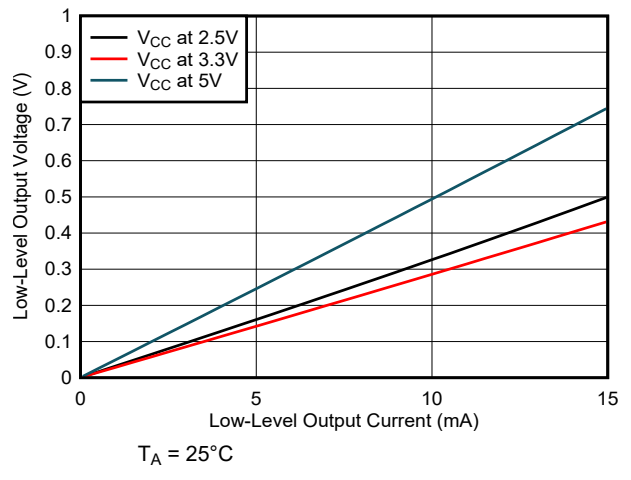
**Figure 6-11. ISO7763-Q1 Supply Current vs Data Rate (With 15-pF Load)**



**Figure 6-12. ISO7763-Q1 Supply Current vs Data Rate (With No Load)**

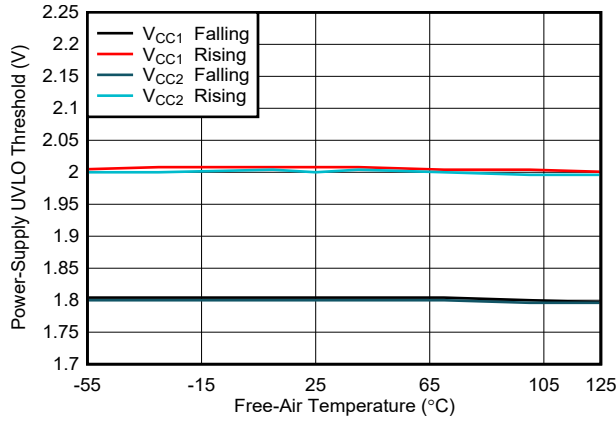


**Figure 6-13. High-Level Output Voltage vs High-Level Output Current**

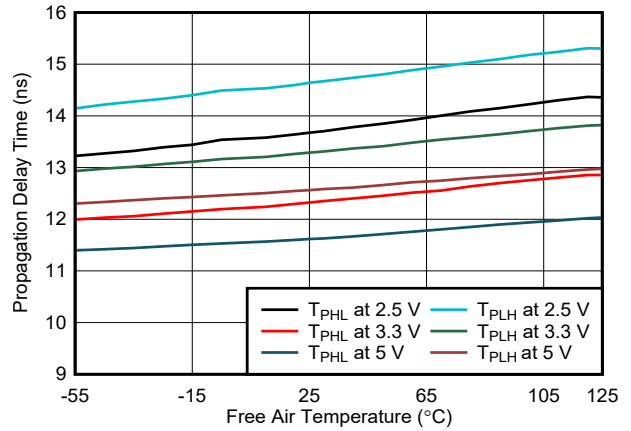


**Figure 6-14. Low-Level Output Voltage vs Low-Level Output Current**

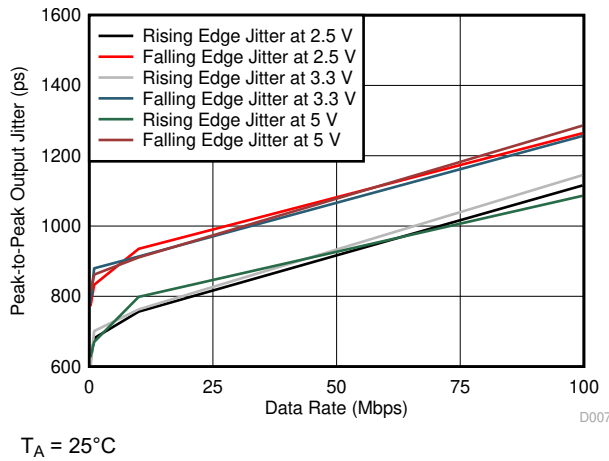




**Figure 6-15. Power Supply Undervoltage Threshold vs Free-Air Temperature**

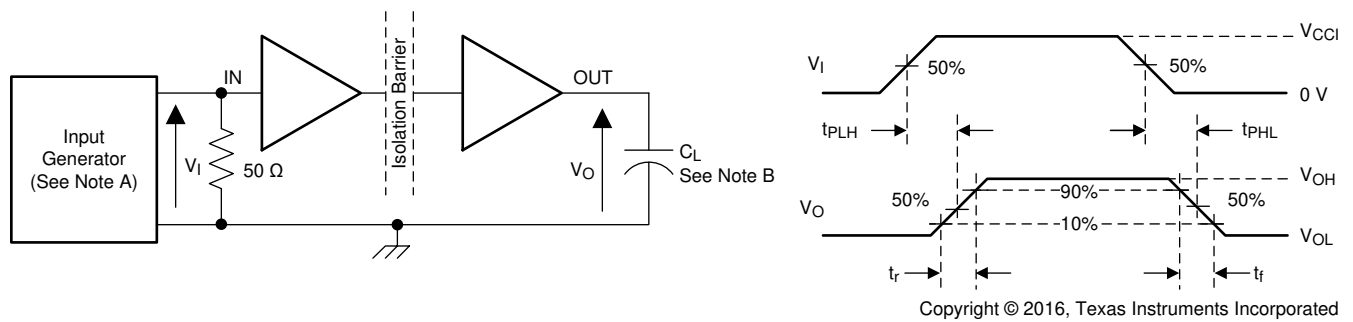


**Figure 6-16. Propagation Delay Time vs Free-Air Temperature**



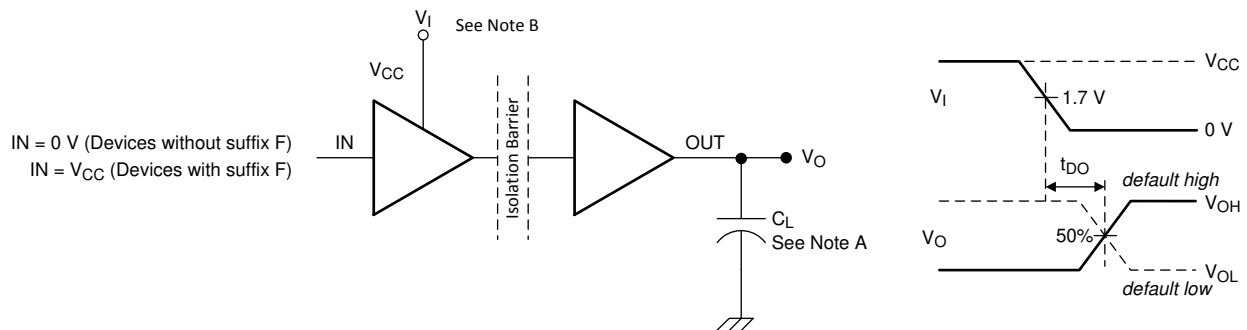
**Figure 6-17. Peak-to-Peak Output Jitter vs Data Rate**

## Parameter Measurement Information



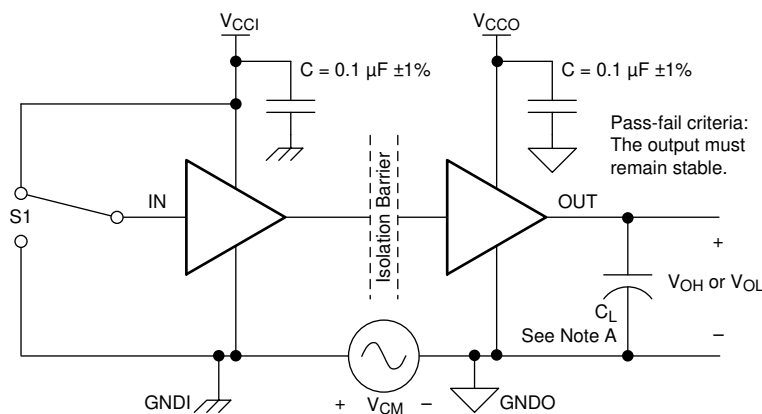
- A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 50 kHz, 50% duty cycle,  $t_r \leq 3$  ns,  $t_f \leq 3$  ns,  $Z_O = 50 \Omega$ . At the input, a 50- $\Omega$  resistor is required to terminate Input Generator signal. It is not needed in actual application.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

**Figure 7-1. Switching Characteristics Test Circuit and Voltage Waveforms**



- A.  $C_L = 15$  pF and includes instrumentation and fixture capacitance within  $\pm 20\%$ .
- B. Power-supply ramp rate = 10 mV/ns

**Figure 7-2. Default Output Delay Time Test Circuit and Voltage Waveforms**



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

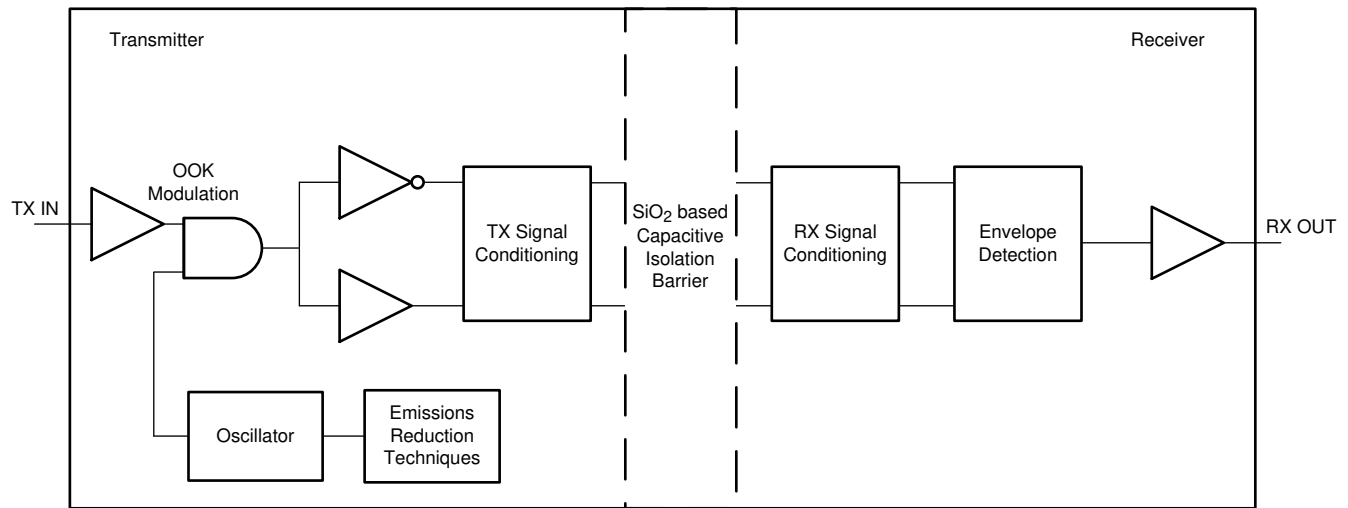
**Figure 7-3. Common-Mode Transient Immunity Test Circuit**

## 7 Detailed Description

### 7.1 Overview

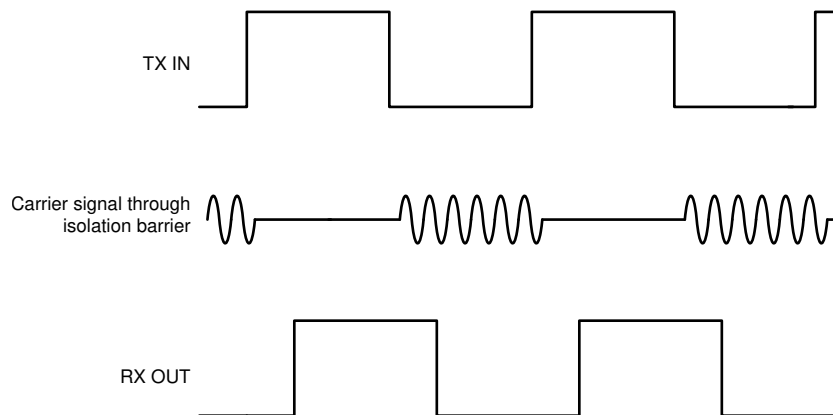
The ISO776x-Q1 family of devices uses an ON-OFF keying (OOK) modulation scheme to transmit the digital data across a silicon-dioxide based isolation barrier. The transmitter sends a high-frequency carrier across the barrier to represent one digital state and sends no signal to represent the other digital state. The receiver demodulates the signal after advanced signal conditioning and produces the output through a buffer stage. The ISO776x-Q1 family of devices also incorporates advanced circuit techniques to maximize the CMTI performance and minimize the radiated emissions because of the high-frequency carrier and IO buffer switching. The conceptual block diagram of a digital capacitive isolator, [Figure 7-1](#), shows a functional block diagram of a typical channel. [Figure 7-2](#) shows a conceptual detail of how the ON-OFF keying scheme works.

### 7.2 Functional Block Diagram



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**Figure 7-1. Conceptual Block Diagram of a Digital Capacitive Isolator**



**Figure 7-2. ON-OFF Keying (OOK) Based Modulation Scheme**

## 7.3 Feature Description

Table 7-1 lists the device features.

**Table 7-1. Device Features**

PART NUMBER	CHANNEL DIRECTION	MAXIMUM DATA RATE	DEFAULT OUTPUT	PACKAGE	RATED ISOLATION <sup>(1)</sup>
ISO7760-Q1	6 Forward, 0 Reverse	100 Mbps	High	DW-16	5000 V <sub>RMS</sub> / 8000 V <sub>PK</sub>
				DBQ-16	3000 V <sub>RMS</sub> / 4242 V <sub>PK</sub>
ISO7760-Q1 with F suffix	6 Forward, 0 Reverse	100 Mbps	Low	DW-16	5000 V <sub>RMS</sub> / 8000 V <sub>PK</sub>
				DBQ-16	3000 V <sub>RMS</sub> / 4242 V <sub>PK</sub>
ISO7761-Q1	5 Forward, 1 Reverse	100 Mbps	High	DW-16	5000 V <sub>RMS</sub> / 8000V <sub>PK</sub>
				DBQ-16	3000 V <sub>RMS</sub> / 4242 V <sub>PK</sub>
ISO7761-Q1 with F suffix	5 Forward, 1 Reverse	100 Mbps	Low	DW-16	5000 V <sub>RMS</sub> / 8000 V <sub>PK</sub>
				DBQ-16	3000 V <sub>RMS</sub> / 4242 V <sub>PK</sub>
ISO7762-Q1	4 Forward, 2 Reverse	100 Mbps	High	DW-16	5000 V <sub>RMS</sub> / 8000V <sub>PK</sub>
				DBQ-16	3000 V <sub>RMS</sub> / 4242 V <sub>PK</sub>
ISO7762-Q1 with F suffix	4 Forward, 2 Reverse	100 Mbps	Low	DW-16	5000 V <sub>RMS</sub> / 8000V <sub>PK</sub>
				DBQ-16	3000 V <sub>RMS</sub> / 4242 V <sub>PK</sub>
ISO7763-Q1	3 Forward, 3 Reverse	100 Mbps	High	DW-16	5000 V <sub>RMS</sub> / 8000V <sub>PK</sub>
				DBQ-16	3000 V <sub>RMS</sub> / 4242 V <sub>PK</sub>
ISO7763-Q1 with F suffix	3 Forward, 3 Reverse	100 Mbps	Low	DW-16	5000 V <sub>RMS</sub> / 8000 V <sub>PK</sub>
				DBQ-16	3000 V <sub>RMS</sub> / 4242 V <sub>PK</sub>

(1) See [Section 6.7](#) for detailed isolation ratings.

### 7.3.1 Electromagnetic Compatibility (EMC) Considerations

Many applications in harsh industrial environment are sensitive to disturbances such as electrostatic discharge (ESD), electrical fast transient (EFT), surge and electromagnetic emissions. These electromagnetic disturbances are regulated by international standards such as IEC 61000-4-x and CISPR 22. Although system-level performance and reliability depends, to a large extent, on the application board design and layout, the ISO776x-Q1 family of devices incorporates many chip-level design improvements for overall system robustness. Some of these improvements include:

- Robust ESD protection for input and output signal pins and inter-chip bond pads.
- Low-resistance connectivity of ESD cells to supply and ground pins.
- Enhanced performance of high voltage isolation capacitor for better tolerance of ESD, EFT and surge events.
- Bigger on-chip decoupling capacitors to bypass undesirable high energy signals through a low impedance path.
- PMOS and NMOS devices isolated from each other by using guard rings to avoid triggering of parasitic SCRs.
- Reduced common mode currents across the isolation barrier by ensuring purely differential internal operation.

## 7.4 Device Functional Modes

Table 7-2 lists the functional modes for the ISO776x-Q1.

**Table 7-2. Function Table**

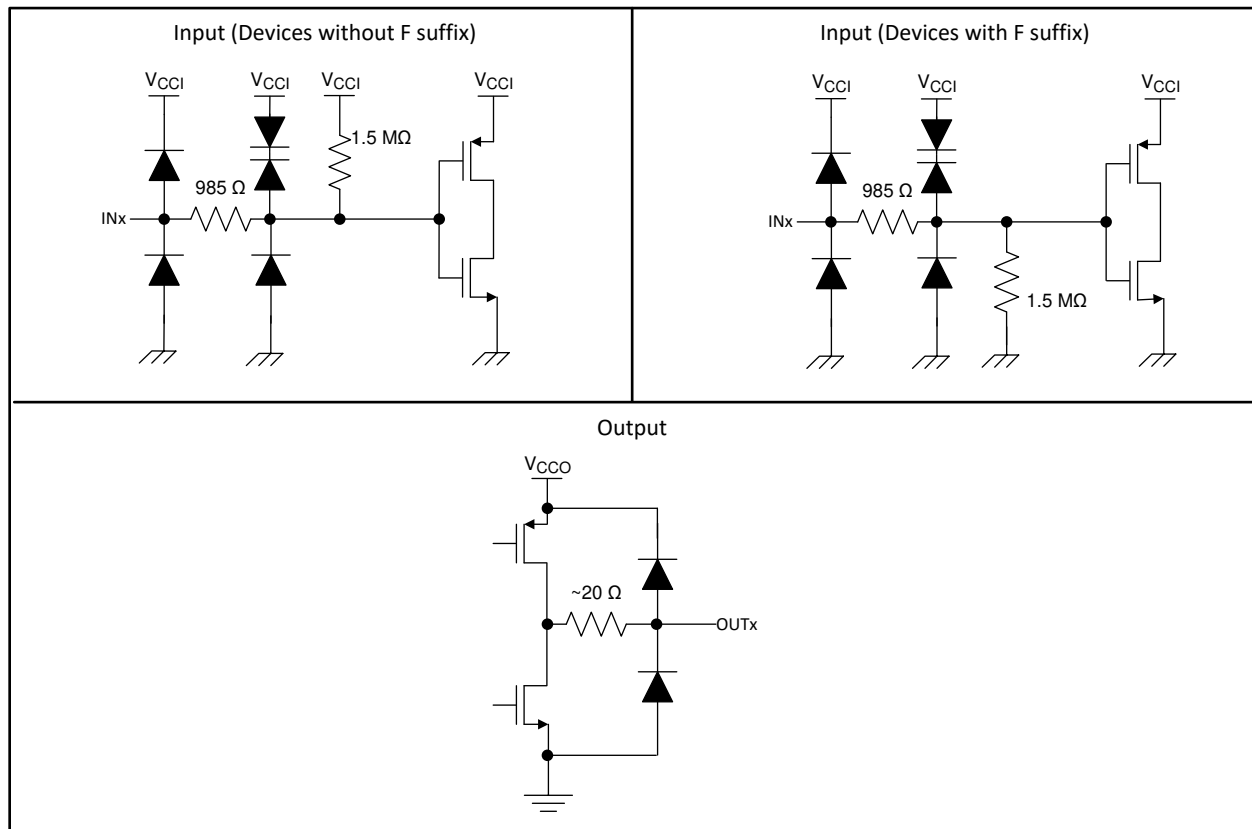
$V_{CCI}^{(1)}$	$V_{CCO}$	INPUT (INx) <sup>(3)</sup>	OUTPUT (OUTx)	COMMENTS
PU	PU	H	H	Normal Operation: A channel output assumes the logic state of the input.
		L	L	
		Open	Default	Default mode: When INx is open, the corresponding channel output goes to its default logic state. Default is <i>High</i> for ISO776x-Q1 and <i>Low</i> for ISO776x-Q1 with F suffix.
PD	PU	X	Default	Default mode: When $V_{CCI}$ is unpowered, a channel output assumes the logic state based on the selected default option. Default is <i>High</i> for ISO776x-Q1 and <i>Low</i> for ISO776x-Q1 with F suffix. When $V_{CCI}$ transitions from unpowered to powered-up, a channel output assumes the logic state of its input. When $V_{CCI}$ transitions from powered-up to unpowered, channel output assumes the selected default state.
X	PD	X	Undetermined	When $V_{CCO}$ is unpowered, a channel output is undetermined <sup>(2)</sup> . When $V_{CCO}$ transitions from unpowered to powered-up, a channel output assumes the logic state of the input

(1)  $V_{CCI}$  = Input-side  $V_{CC}$ ;  $V_{CCO}$  = Output-side  $V_{CC}$ ; PU = Powered up ( $V_{CC} \geq 2.25$  V); PD = Powered down ( $V_{CC} \leq 1.7$  V); X = Irrelevant; H = High level; L = Low level

(2) The outputs are in undetermined state when  $1.7$  V <  $V_{CCI}$ ,  $V_{CCO} < 2.25$  V.

(3) A strongly driven input signal can weakly power the floating  $V_{CC}$  via an internal protection diode and cause undetermined output.

### 7.4.1 Device I/O Schematics



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**Figure 7-3. Device I/O Schematics**

## 8 Application and Implementation

### Note

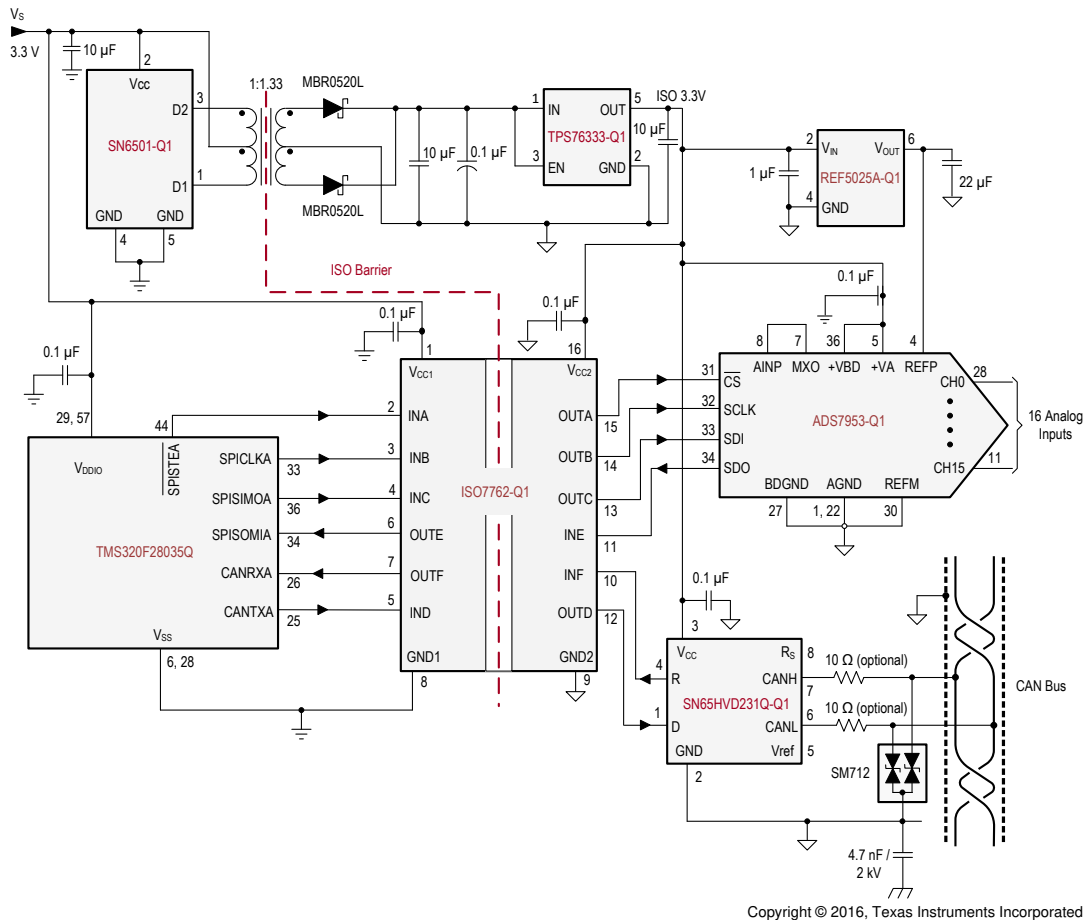
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation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

### 8.1 Application Information

The ISO776x-Q1 family of devices is a high-performance, six-channel digital isolators. The ISO776x-Q1 family of devices uses single-ended CMOS-logic switching technology. The voltage range is from 2.25 V to 5.5 V for both supplies,  $V_{CC1}$  and  $V_{CC2}$ . When designing with digital isolators, keep in mind that because of 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.

### 8.2 Typical Application

Figure 8-1 shows the isolated serial-peripheral interface (SPI) and controller-area network (CAN) interface implementation.



Multiple pins and discrete components omitted for clarity purpose.

**Figure 8-1. Isolated SPI and CAN Interface**

### 8.2.1 Design Requirements

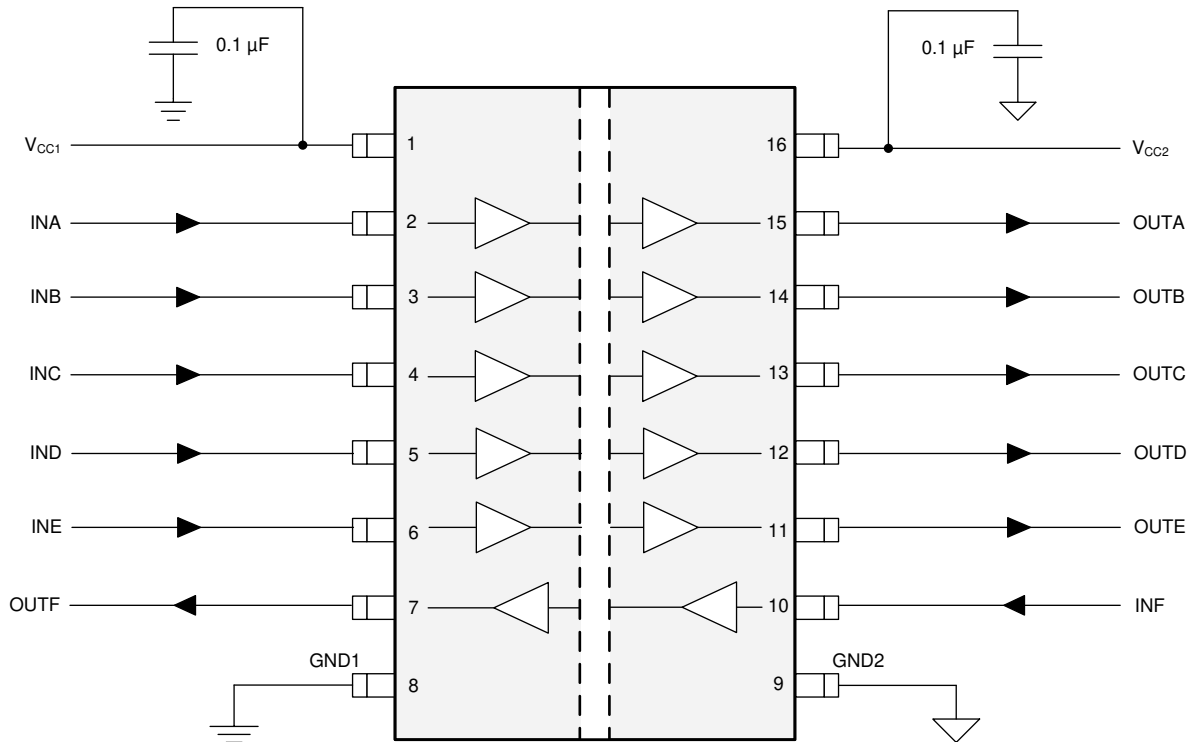
For this design example, use the parameters listed in [Table 8-1](#).

**Table 8-1. Design Parameters**

PARAMETER	VALUE
Supply voltage, $V_{CC1}$ and $V_{CC2}$	2.25 to 5.5 V
Decoupling capacitor between $V_{CC1}$ and GND1	0.1 $\mu$ F
Decoupling capacitor from $V_{CC2}$ and GND2	0.1 $\mu$ F

### 8.2.2 Detailed Design Procedure

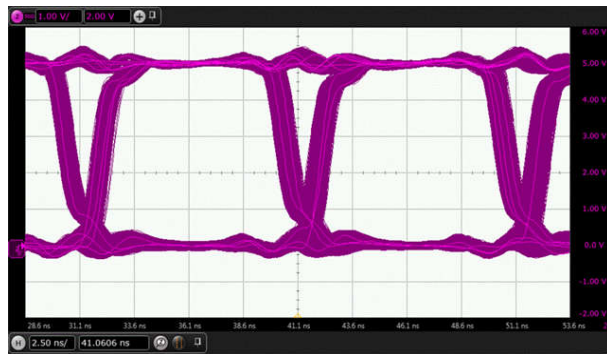
Unlike optocouplers, which require external components to improve performance, provide bias, or limit current, the ISO776x-Q1 family of devices only requires two external bypass capacitors to operate.



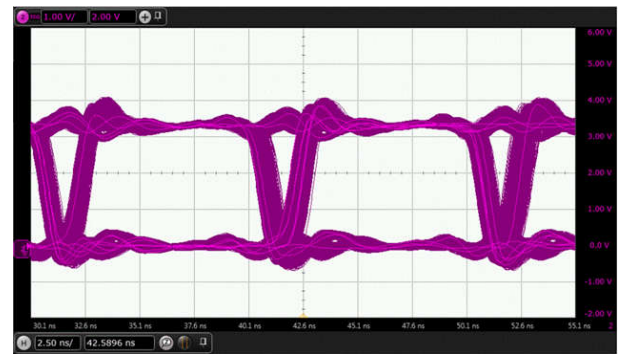
**Figure 8-2. Typical ISO7761-Q1 Circuit Hook-up**

### 8.2.3 Application Curves

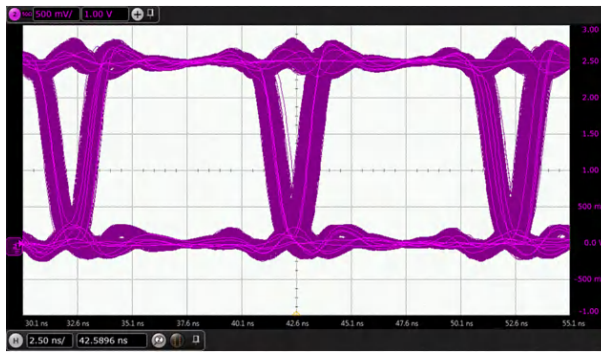
The typical eye diagram of the ISO776x-Q1 family of devices indicates low jitter and a wide open eye at the maximum data rate of 100 Mbps.



**Figure 8-3. Eye Diagram at 100 Mbps PRBS  $2^{16} - 1$  Data, 5 V and 25°C**



**Figure 8-4. Eye Diagram at 100 Mbps PRBS  $2^{16} - 1$  Data, 3.3 V and 25°C**



**Figure 8-5. Eye Diagram at 100 Mbps PRBS  $2^{16} - 1$  Data, 2.5 V and 25°C**

#### 8.2.3.1 Insulation Lifetime

Insulation lifetime projection data is collected by using industry-standard Time Dependent Dielectric Breakdown (TDDB) test method. In this test, all pins on each side of the barrier are tied together creating a two-terminal device and high voltage applied between the two sides; See [Figure 8-6](#) for TDDB test setup. The insulation breakdown data is collected at various high voltages switching at 60 Hz over temperature. For reinforced insulation, VDE standard requires the use of TDDB projection line with failure rate of less than 1 part per million (ppm). Even though the expected minimum insulation lifetime is 20 years at the specified working isolation voltage, VDE reinforced certification requires additional safety margin of 20% for working voltage and 50% for lifetime which translates into minimum required insulation lifetime of 30 years at a working voltage that's 20% higher than the specified value.

[Figure 8-7](#) shows the intrinsic capability of the isolation barrier to withstand high voltage stress over its lifetime. Based on the TDDB data, the intrinsic capability of the insulation is 1500  $V_{RMS}$  with a lifetime of 36 years. Other factors, such as package size, pollution degree, material group, etc. can further limit the working voltage of the component. The working voltage of DW-16 package is specified upto 1500  $V_{RMS}$  and DBQ-16 package up to 400  $V_{RMS}$ . At the lower working voltages, the corresponding insulation lifetime is much longer than 36 years.



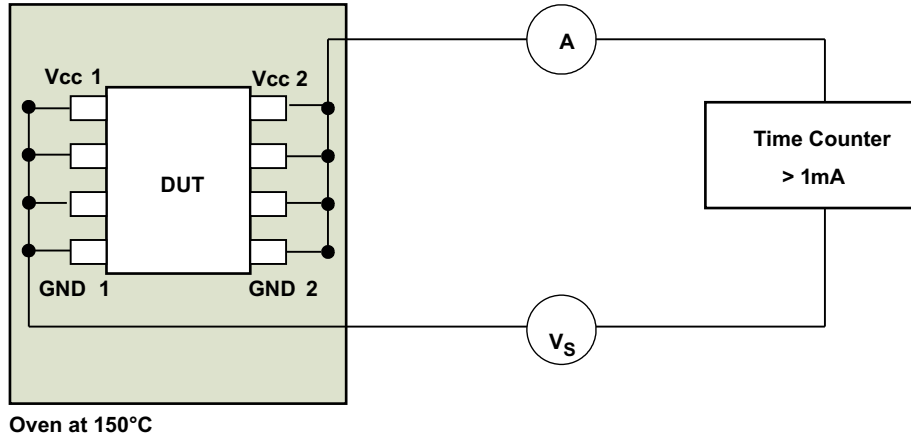


Figure 8-6. Test Setup for Insulation Lifetime Measurement

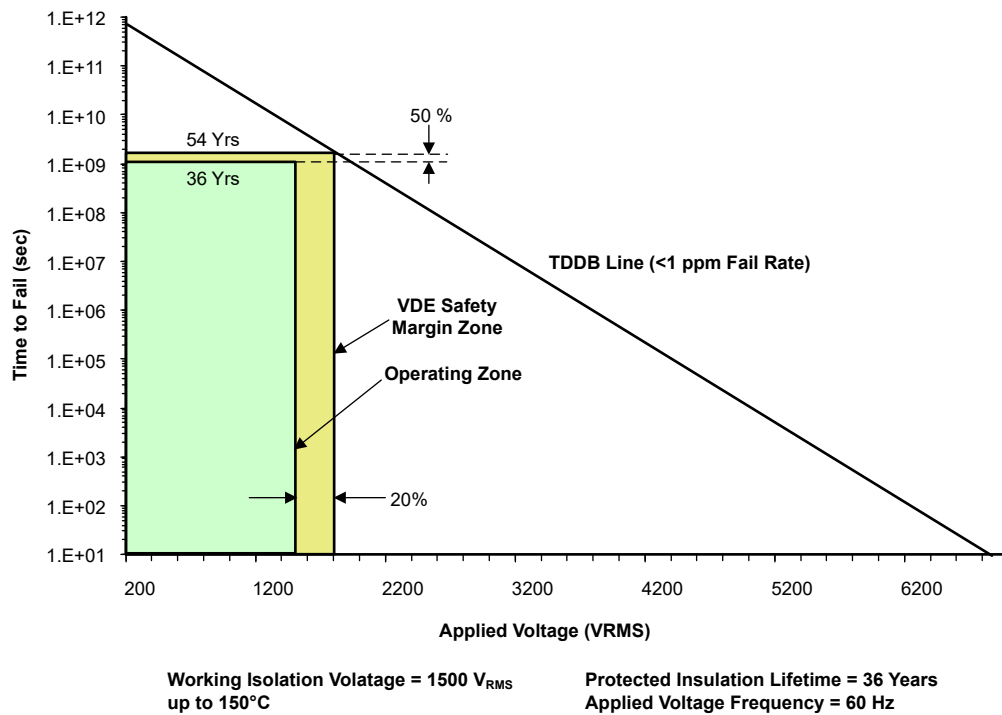


Figure 8-7. Insulation Lifetime Projection Data

## 9 Power Supply Recommendations

To help ensure reliable operation at data rates and supply voltages, a 0.1- $\mu$ 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 Texas Instruments' [SN6501](#) or [SN6505](#). For such applications, detailed power supply design and transformer selection recommendations are available in the [SN6501 Transformer Driver for Isolated Power Supplies data sheet](#) or the [SN6505 Low-Noise 1-A Transformer Drivers for Isolated Power Supplies data sheet](#).

## 10 Layout

### 10.1 Layout Guidelines

A minimum of four layers is required to accomplish a low EMI PCB design (see [Figure 10-1](#)). 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 100 pF/inch<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 or 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 the [Digital Isolator Design Guide application report](#).

#### 10.1.1 PCB Material

For digital circuit boards operating at less than 150 Mbps, (or rise and fall times greater than 1 ns), and trace lengths of up to 10 inches, use standard FR-4 UL94V-0 printed circuit board. This PCB is preferred over cheaper alternatives because of lower dielectric losses at high frequencies, less moisture absorption, greater strength and stiffness, and the self-extinguishing flammability-characteristics.

### 10.2 Layout Example

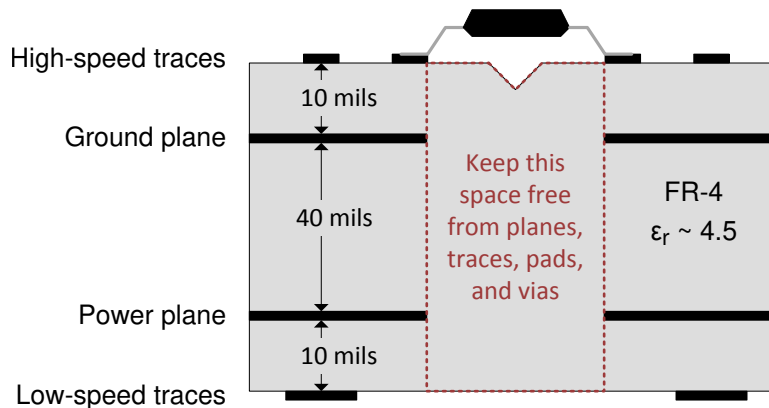


Figure 10-1. Layout Example Schematic

## 11 Device and Documentation Support

### 11.1 Documentation Support

#### 11.1.1 Related Documentation

For related documentation see the following:

- Texas Instruments, [Digital Isolator Design Guide application report](#)
- Texas Instruments, [How to use isolation to improve ESD, EFT and Surge immunity in industrial systems application report](#)
- Texas Instruments, [Isolation Glossary](#)
- Texas Instruments, [TMS320F2803xPiccolo™ Microcontrollers data sheet](#)
- Texas Instruments, [ADS7953-Q1 Automotive 12-Bit, 1MSPS, 16-Channel Single-Ended Micropower, Serial Interface ADC data sheet](#)
- Texas Instruments, [REF50xxA-Q1 Low-Noise, Very Low Drift, Precision Voltage Reference data sheet](#)
- Texas Instruments, [SN6501-Q1 Transformer Driver for Isolated Power Supplies data sheet](#)
- Texas Instruments, [SN65HVD231Q-Q1 3.3-V CAN Transceiver data sheet](#)
- Texas Instruments, [TPS76333-Q1 Low-Power 150-mA Low-Dropout Linear Regulators data sheet](#)

### 11.2 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 11-1. Related Links**

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
ISO7760-Q1	<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>
ISO7761-Q1	<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>
ISO7762-Q1	<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>
ISO7763-Q1	<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>

### 11.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 11.4 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

### 11.5 Trademarks

Piccolo™ is a trademark of Texas Instruments.

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### 11.6 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## 11.7 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 12 Revision History

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

### Changes from Revision D (January 2024) to Revision E (July 2024) Page

• Updated the numbering format for tables, figures, and cross-references throughout the document.....	1
• Updated Thermal Characteristics, Safety Limiting Values, and Thermal Derating Curves to provide more accurate system-level thermal calculations.....	8
• Changed CPG parameter description from "External clearance" to "External creepage".....	9
• Updated electrical and switching characteristics to match device performance.....	13

### Changes from Revision C (October 2022) to Revision D (January 2024) Page

• Added table note to Data rate specification.....	7
• Changed $V_{IORM}$ value for DW-16 package from "1414 $V_{PK}$ " to "2121 $V_{PK}$ ".....	9
• Changed $V_{IOWM}$ values for DW-16 package from "1000 $V_{RMS}$ " and "1414 $V_{DC}$ " to "1500 $V_{RMS}$ " and "2121 $V_{DC}$ ".....	9
• Updated certification information.....	11

### Changes from Revision B (October 2020) to Revision C (October 2022) Page

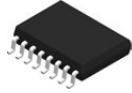
• Updated the numbering format for tables, figures, and cross-references throughout the document.....	1
• Changed standard name from: "DIN V VDE V 0884-11:2017-01" To: "DIN EN IEC 60747-17 (VDE 0884-17)" throughout the document.....	1
• Removed references to standard IEC/EN/CSA 60950-1 throughout the document.....	1
• Updated Thermal characteristics, Safety Limiting Values, and Thermal derating Curves to provide more accurate system-level thermal calculations.....	6
• Updated electrical and switching characteristics to match device performance.....	6
• Changed the $C_{IO}$ value for the DBQ package from 1.1 to 0.9 pF.....	9
• Changed working voltage lifetime margin From: 87.5% To: 50%, minimum required insulation lifetime From: 37.5 years To: 30 years and insulation lifetime per TDDb From: 135 years To: 169 years in Insulation Lifetime per DIN EN IEC 60747-17 (VDE 0884-17).....	32
• Changed Figure 9-7 per DIN EN IEC 60747-17 (VDE 0884-17).....	32

### Changes from Revision A (February 2019) to Revision B (October 2020) Page

• Added Functional Safety Bullets.....	1
• Added the maximum transient isolation voltage for the DW-16 package of the ISO7761, ISO7762, and ISO7763 devices and changed the maximum value for the DBQ-16 package from 3600 to 4242 for all devices.....	9
• Changed table note and table condition of safety limiting values.....	11

## 13 Mechanical, Packaging, and Orderable Information

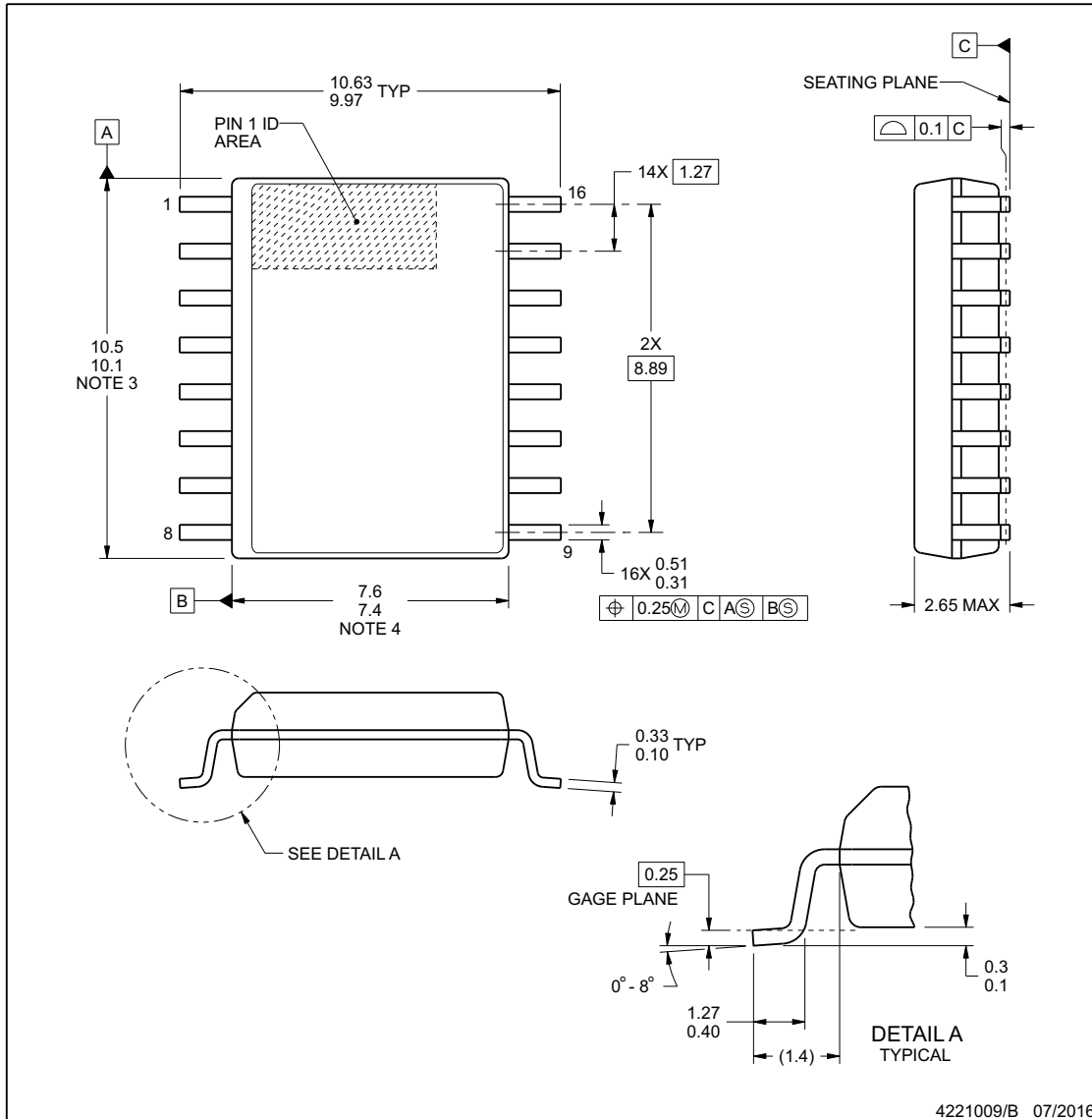
The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand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



**DW0016B**

**PACKAGE OUTLINE**  
**SOIC - 2.65 mm max height**

SOIC



NOTES:

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

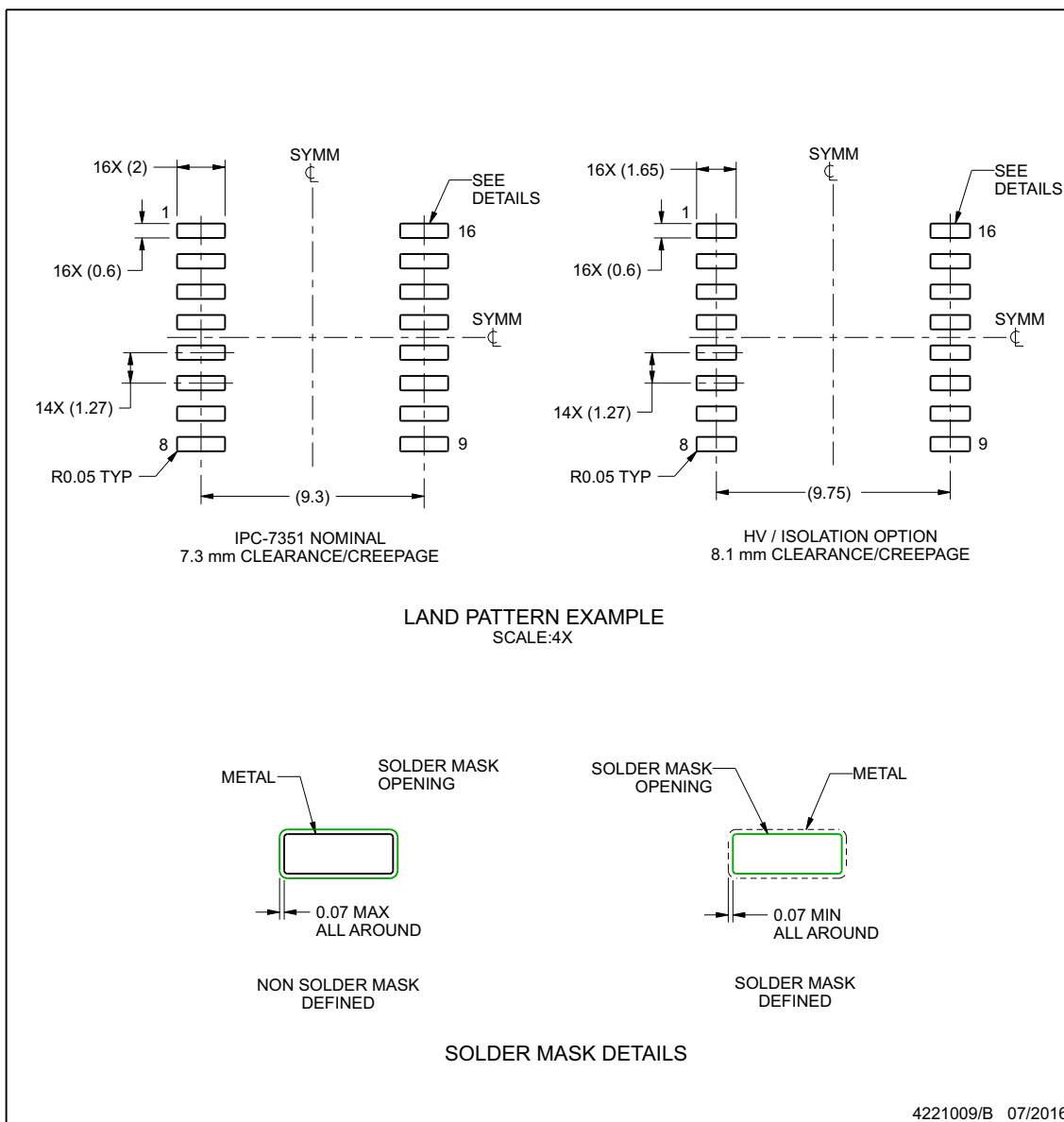
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## EXAMPLE BOARD LAYOUT

**DW0016B**

**SOIC - 2.65 mm max height**

SOIC



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.

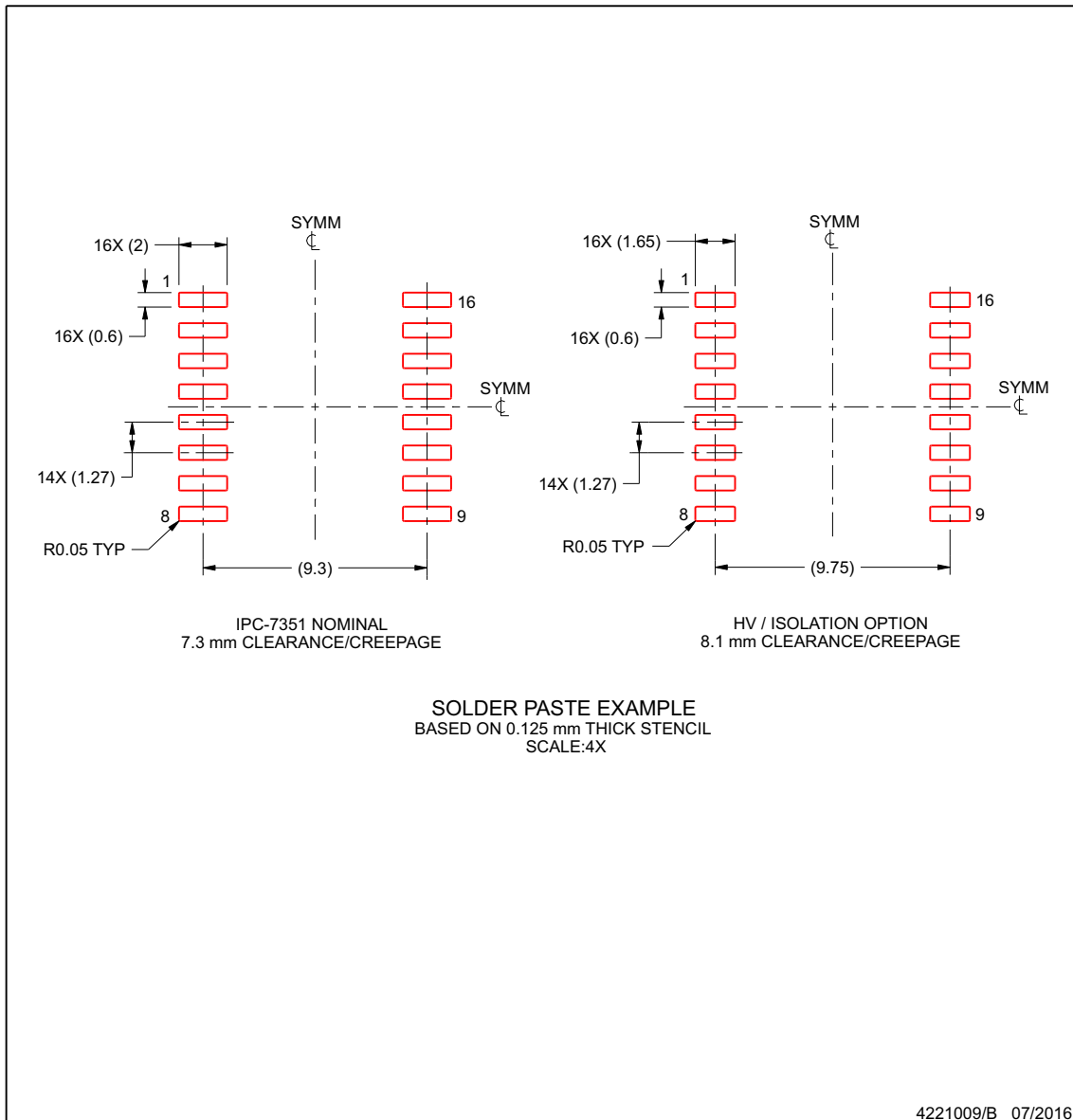
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## EXAMPLE STENCIL DESIGN

**DW0016B**

**SOIC - 2.65 mm max height**

SOIC



NOTES: (continued)

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

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