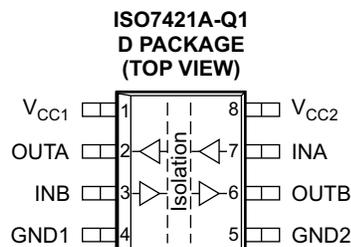


LOW-POWER DUAL DIGITAL ISOLATORS

FEATURES

- Qualified for Automotive Applications
- AEC-Q100 Qualified With the Following Results:
 - Device Temperature Grade 1: –40°C to 125°C Ambient Operating Temperature Range
 - Device HBM ESD Classification Level H3A
 - Device CDM ESD Classification Level C5
- High Signaling Rate: 50 Mbps
- Low Power Consumption
- Low Propagation Delay – 9 ns (Typical)
- Low Skew – 300 ps (Typical)
- 4-kVpeak Maximum Isolation, 2.5 kVrms per UL 1577, IEC/VDE and CSA Approved, IEC 60950-1, IEC 61010-1 End Equipment Standards Approved. All Approvals Pending.
- 50 kV/μs Transient Immunity (Typical)
- Over 25-Year Isolation Integrity at Rated Voltage
- Operates From 3-V to 5.5-V Supply and Logic Levels



DESCRIPTION

The ISO7421A-Q1 provides galvanic isolation up to 2.5 kVrms for 1 minute per UL. This digital isolator has two isolated channels with bidirectional channel configuration. Each isolation channel has a logic input and output buffer separated by a silicon dioxide (SiO₂) insulation barrier. Used in conjunction with isolated power supplies, these devices prevent noise currents on a data bus or other circuit from entering the local ground and interfering with or damaging sensitive circuitry.

The devices have TTL input thresholds and require two supply voltages from 3 V to 5.5 V, or any combination. All inputs are 5-V tolerant when supplied from a 3-V supply.

ORDERING INFORMATION⁽¹⁾

| T _A | PACKAGE ⁽²⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------------------|--------------|-----------------------|------------------|
| –40°C to 125°C | SOIC – D | Reel of 2500 | ISO7421AQDRQ1 | 7421AQ |

(1) For the most-current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI Web site at www.ti.com.

(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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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.

PIN FUNCTIONS

| PIN | | I/O | DESCRIPTION |
|-----------|-----|-----|---------------------------------|
| NAME | NO. | | |
| GND1 | 4 | – | Ground connection for V_{CC1} |
| GND2 | 5 | – | Ground connection for V_{CC2} |
| INA | 7 | I | Input, channel A |
| INB | 3 | I | Input, channel B |
| OUTA | 2 | O | Output, channel A |
| OUTB | 6 | O | Output, channel B |
| V_{CC1} | 1 | – | Power supply, V_{CC1} |
| V_{CC2} | 8 | – | Power supply, V_{CC2} |

Table 1. FUNCTION TABLE⁽¹⁾

| INPUT SIDE VCC | OUTPUT SIDE VCC | INPUT IN | OUTPUT OUT |
|-------------------|--------------------|-------------|---------------|
| PU | PU | H | H |
| | | L | L |
| | | Open | H |
| PD | PU | X | H |

(1) PU = Powered up ($V_{CC} \geq 3$ V), PD = Powered down ($V_{CC} \leq 2.4$ V),
X = Irrelevant, H = High level, L = Low level

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

| | | | | |
|--------------|---|---|----------|--------|
| V_{CC} | Supply voltage ⁽²⁾ , V_{CC1} , V_{CC2} | –0.5 V to 6 V | | |
| V_I | Voltage at IN, OUT | –0.5 V to 6 V | | |
| I_O | Output current | ±15 mA | | |
| ESD | Electrostatic discharge | Human-body model (HBM) AEC-Q100 Classification Level H3A | All pins | 4 kV |
| | | Charged-device model (CDM) AEC-Q100 Classification Level C5 | | 1.5 kV |
| | | Machine model (MM) | | 200 V |
| $T_{J(Max)}$ | Maximum junction temperature | 150°C | | |

- (1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values except differential I/O bus voltages are with respect to network ground terminal and are peak voltage values.

RECOMMENDED OPERATING CONDITIONS

| | | MIN | TYP | MAX | UNIT |
|-----------------------|---------------------------|-----|----------|-----|------|
| V_{CC1} , V_{CC2} | Supply voltage | 3 | 5.5 | | V |
| I_{OH} | High-level output current | –4 | | | mA |
| I_{OL} | Low-level output current | | | 4 | mA |
| V_{IH} | High-level input voltage | 2 | V_{CC} | | V |
| V_{IL} | Low-level input voltage | 0 | 0.8 | | V |
| T_A | Operating temperature | –40 | | 125 | °C |

ELECTRICAL CHARACTERISTICS
 $V_{CC1} = V_{CC2} = 5\text{ V} \pm 10\%$, $T_A = -40^\circ\text{C}$ to 125°C

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------|------------------------------------|--|----------------|-----|-----|-------------------|
| V_{OH} | High-level output voltage | $I_{OH} = -4\text{ mA}$, see Figure 1 | $V_{CC} - 0.8$ | 4.6 | | V |
| | | $I_{OH} = -20\text{ }\mu\text{A}$, see Figure 1 | $V_{CC} - 0.1$ | 5 | | |
| V_{OL} | Low-level output voltage | $I_{OL} = 4\text{ mA}$, see Figure 1 | | 0.2 | 0.4 | V |
| | | $I_{OL} = 20\text{ }\mu\text{A}$, see Figure 1 | | 0 | 0.1 | |
| $V_{I(HYS)}$ | Input threshold voltage hysteresis | | | 400 | | mV |
| I_{IH} | High-level input current | IN from 0 V or V_{CC} | | | 10 | μA |
| I_{IL} | Low-level input current | | | -10 | | μA |
| C_I | Input capacitance to ground | IN at V_{CC} , $V_I = 0.4\text{ sin}(4E6\pi t)$ | | 1.2 | | pF |
| CMTI | Common-mode transient immunity | $V_I = V_{CC}$ or 0 V, see Figure 3 | 25 | 50 | | kV/ μs |

SUPPLY CURRENT (All inputs switching with square wave clock signal for dynamic I_{CC} measurement)

| I_{CC1} | Supply current for V_{CC1} and V_{CC2} | DC to 1 Mbps | DC Input: $V_I = V_{CC}$ or 0 V AC Input: $C_L = 15\text{ pF}$ | 2.3 | 3.6 | mA |
|-----------|--|--------------|---|-----|-----|----|
| I_{CC2} | | | | | | |
| I_{CC1} | | 10 Mbps | | 2.9 | 4.5 | |
| I_{CC2} | | | | 2.9 | 4.5 | |
| I_{CC1} | | 25 Mbps | $C_L = 15\text{ pF}$ | 4.3 | 6 | |
| I_{CC2} | | | | 4.3 | 6 | |
| I_{CC1} | | 50 Mbps | | 6 | 9.1 | |
| I_{CC2} | | | | 6 | 9.1 | |

SWITCHING CHARACTERISTICS
 $V_{CC1} = V_{CC2} = 5\text{ V} \pm 10\%$, $T_A = -40^\circ\text{C}$ to 125°C

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------|---|------------------------------|-----|-----|-----|---------------|
| t_{PLH} , t_{PHL} | Propagation delay time | See Figure 1 | | 9 | 14 | ns |
| PWD ⁽¹⁾ | Pulse duration distortion $ t_{PHL} - t_{PLH} $ | | | 0.3 | 3.7 | ns |
| $t_{sk(pp)}$ | Part-to-part skew time | | | | 4.9 | ns |
| $t_{sk(o)}$ | Channel-to-channel output skew time | | | | 3.6 | ns |
| t_r | Output signal rise time | See Figure 1 | | 1 | | ns |
| t_f | Output signal fall time | | | 1 | | ns |
| t_{fs} | Fail-safe output delay time from input power loss | See Figure 2 | | 6 | | μs |
| t_{ui} | Input pulse duration | | 7 | | | ns |
| $1 / t_{ui}$ | Signaling rate | | 0 | | 50 | Mbps |

(1) Also known as pulse skew

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ELECTRICAL CHARACTERISTICS

 $V_{CC1} = 5\text{ V} \pm 10\%$, $V_{CC2} = 3.3\text{ V} \pm 10\%$, $T_A = -40^\circ\text{C}$ to 125°C

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------|------------------------------------|---|----------------|-----|-----|-------------------|
| V_{OH} | High-level output voltage | $I_{OH} = -4\text{ mA}$, see Figure 1 , 5-V side | $V_{CC} - 0.8$ | | | V |
| | | $I_{OH} = -20\text{ }\mu\text{A}$, see Figure 1 | $V_{CC} - 0.1$ | | | |
| V_{OL} | Low-level output voltage | $I_{OL} = 4\text{ mA}$, see Figure 1 | 0.4 | | | V |
| | | $I_{OL} = 20\text{ }\mu\text{A}$, see Figure 1 | 0.1 | | | |
| $V_{I(HYS)}$ | Input threshold voltage hysteresis | | 400 | | | mV |
| I_{IH} | High-level input current | IN from 0 V or V_{CC} | 10 | | | μA |
| I_{IL} | Low-level input current | | -10 | | | μA |
| C_I | Input capacitance to ground | IN at V_{CC} , $V_I = 0.4\text{ sin}(4E6\pi t)$ | 1.2 | | | pF |
| CMTI | Common-mode transient immunity | $V_I = V_{CC}$ or 0 V, see Figure 3 | 25 | 40 | | kV/ μs |

SUPPLY CURRENT (All inputs switching with square wave clock signal for dynamic I_{CC} measurement)

| I_{CC1} | Supply current for V_{CC1} and V_{CC2} | DC to 1 Mbps | DC Input: $V_I = V_{CC}$ or 0 V AC Input: $C_L = 15\text{ pF}$ | 2.3 | 3.6 | mA |
|-----------|--|--------------|---|-----|-----|----|
| I_{CC2} | | | | | | |
| I_{CC1} | | 10 Mbps | $C_L = 15\text{ pF}$ | 2.9 | 4.5 | |
| I_{CC2} | | | | 2.2 | 3.2 | |
| I_{CC1} | | 25 Mbps | | 4.3 | 6 | |
| I_{CC2} | | | | 2.8 | 4.1 | |
| I_{CC1} | | 50 Mbps | | 6 | 9.1 | |
| I_{CC2} | | | | 3.8 | 5.8 | |

SWITCHING CHARACTERISTICS

 $V_{CC1} = 5\text{ V} \pm 10\%$, $V_{CC2} = 3.3\text{ V} \pm 10\%$, $T_A = -40^\circ\text{C}$ to 125°C

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------|---|------------------------------|-----|-----|-----|---------------|
| t_{PLH} , t_{PHL} | Propagation delay time | See Figure 1 | | 10 | 17 | ns |
| PWD ⁽¹⁾ | Pulse duration distortion $ t_{PHL} - t_{PLH} $ | | | 0.5 | 5.6 | ns |
| $t_{sk(pp)}$ | Part-to-part skew time | | | | 6.3 | ns |
| $t_{sk(o)}$ | Channel-to-channel output skew time | | | | 4 | ns |
| t_r | Output signal rise time | See Figure 1 | | 2 | | ns |
| t_f | Output signal fall time | | | 2 | | ns |
| t_{fs} | Fail-safe output delay time from input power loss | See Figure 2 | | 6 | | μs |
| t_{ui} | Input pulse duration | | 7 | | | ns |
| $1 / t_{ui}$ | Signaling rate | | 0 | | 50 | Mbps |

(1) Also known as pulse skew

ELECTRICAL CHARACTERISTICS

 $V_{CC1} = 3.3\text{ V} \pm 10\%$, $V_{CC2} = 5\text{ V} \pm 10\%$, $T_A = -40^\circ\text{C}$ to 125°C

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|--|---|---|-----|-----|-------------------|
| V_{OH} | High-level output voltage | $I_{OH} = -4\text{ mA}$, see Figure 1 , 3.3-V side | $V_{CC} - 0.4$ | | | V |
| | | $I_{OH} = -20\text{ }\mu\text{A}$, see Figure 1 | $V_{CC} - 0.1$ | | | |
| V_{OL} | Low-level output voltage | $I_{OL} = 4\text{ mA}$, see Figure 1 | 0.4 | | | V |
| | | $I_{OL} = 20\text{ }\mu\text{A}$, see Figure 1 | 0 0.1 | | | |
| $V_{I(HYS)}$ | Input threshold voltage hysteresis | | 400 | | | mV |
| I_{IH} | High-level input current | IN from 0 V or V_{CC} | 10 | | | μA |
| I_{IL} | Low-level input current | | -10 | | | μA |
| C_I | Input capacitance to ground | IN at V_{CC} , $V_I = 0.4\text{ sin}(4E6\pi t)$ | 1 | | | pF |
| CMTI | Common-mode transient immunity | $V_I = V_{CC}$ or 0 V, see Figure 3 | 25 | 40 | | kV/ μs |
| SUPPLY CURRENT (All inputs switching with square wave clock signal for dynamic I_{CC} measurement) | | | | | | |
| I_{CC1} | Supply current for V_{CC1} and V_{CC2} | DC to 1 Mbps | DC Input: $V_I = V_{CC}$ or 0 V AC Input: $C_L = 15\text{ pF}$ | 1.8 | 2.8 | mA |
| I_{CC2} | | | | 2.3 | 3.6 | |
| I_{CC1} | | 10 Mbps | $C_L = 15\text{ pF}$ | 2.2 | 3.2 | |
| I_{CC2} | | | | 2.9 | 4.5 | |
| I_{CC1} | | 25 Mbps | $C_L = 15\text{ pF}$ | 2.8 | 4.1 | |
| I_{CC2} | | | | 4.3 | 6 | |
| I_{CC1} | | 50 Mbps | $C_L = 15\text{ pF}$ | 3.8 | 5.8 | |
| I_{CC2} | | | | 6 | 9.1 | |

SWITCHING CHARACTERISTICS

 $V_{CC1} = 3.3\text{ V} \pm 10\%$, $V_{CC2} = 5\text{ V} \pm 10\%$, $T_A = -40^\circ\text{C}$ to 125°C

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------|---|------------------------------|-----|-----|-----|---------------|
| t_{PLH} , t_{PHL} | Propagation delay time | See Figure 1 | | 10 | 17 | ns |
| PWD ⁽¹⁾ | Pulse duration distortion $ t_{PHL} - t_{PLH} $ | | | 0.5 | 4 | ns |
| $t_{sk(pp)}$ | Part-to-part skew time | | | | 8.5 | ns |
| $t_{sk(o)}$ | Channel-to-channel output skew time | | | | 4 | ns |
| t_r | Output signal rise time | See Figure 1 | | 2 | | ns |
| t_f | Output signal fall time | | | 2 | | ns |
| t_{fs} | Fail-safe output delay time from input power loss | See Figure 2 | | 6 | | μs |
| t_{ui} | Input pulse duration | | 7 | | | ns |
| $1 / t_{ui}$ | Signaling rate | | 0 | | 50 | Mbps |

(1) Also known as pulse skew

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ELECTRICAL CHARACTERISTICS

 $V_{CC1} = V_{CC2} = 3.3\text{ V} \pm 5\%$, $T_A = -40^\circ\text{C}$ to 125°C

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------|------------------------------------|--|----------------|-----|-----|-------------------|
| V_{OH} | High-level output voltage | $I_{OH} = -4\text{ mA}$, see Figure 1 | $V_{CC} - 0.4$ | 3 | | V |
| | | $I_{OH} = -20\ \mu\text{A}$, see Figure 1 | $V_{CC} - 0.1$ | 3.3 | | |
| V_{OL} | Low-level output voltage | $I_{OL} = 4\text{ mA}$, see Figure 1 | | 0.2 | 0.4 | V |
| | | $I_{OL} = 20\ \mu\text{A}$, see Figure 1 | | 0 | 0.1 | |
| $V_{I(HYS)}$ | Input threshold voltage hysteresis | | | 400 | | mV |
| I_{IH} | High-level input current | IN from 0 V or V_{CC} | | | 10 | μA |
| I_{IL} | Low-level input current | | | -10 | | μA |
| C_I | Input capacitance to ground | IN at V_{CC} , $V_I = 0.4\text{ sin}(4E6\pi t)$ | | 1 | | pF |
| CMTI | Common-mode transient immunity | $V_I = V_{CC}$ or 0 V, see Figure 3 . | 25 | 40 | | kV/ μs |

SUPPLY CURRENT (All inputs switching with square wave clock signal for dynamic I_{CC} measurement)

| I_{CC1} | Supply current for V_{CC1} and V_{CC2} | DC to 1 Mbps | DC Input: $V_I = V_{CC}$ or 0 V AC Input: $C_L = 15\text{ pF}$ | MIN | TYP | MAX | mA | |
|-----------|--|--------------|---|-----|-----|-----|----|-----|
| I_{CC2} | | | | | | 1.8 | | 2.8 |
| I_{CC1} | | 10 Mbps | | 2.2 | 3.2 | | | |
| I_{CC2} | | | | 2.2 | 3.2 | | | |
| I_{CC1} | | 25 Mbps | $C_L = 15\text{ pF}$ | | 2.8 | 4.1 | | |
| I_{CC2} | | | | | 2.8 | 4.1 | | |
| I_{CC1} | | 50 Mbps | | 3.8 | 5.8 | | | |
| I_{CC2} | | | | 3.8 | 5.8 | | | |

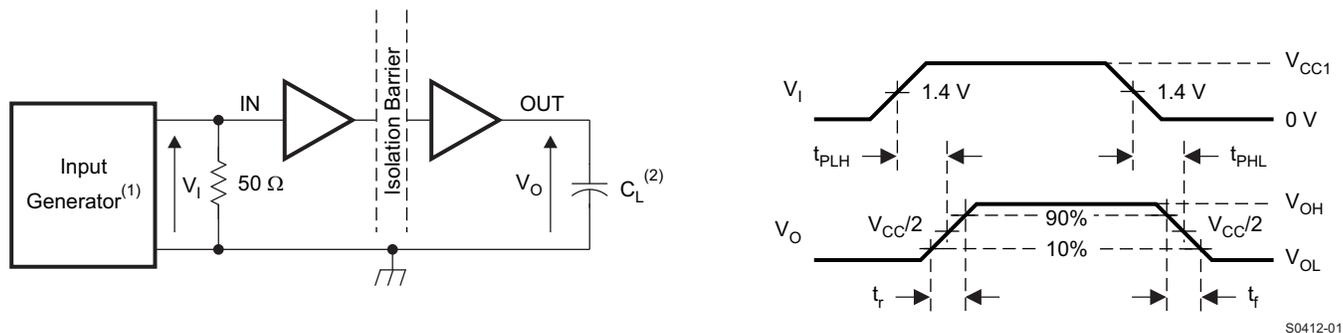
SWITCHING CHARACTERISTICS

 $V_{CC1} = V_{CC2} = 3.3\text{ V} \pm 5\%$, $T_A = -40^\circ\text{C}$ to 125°C

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------|---|------------------------------|-----|-----|-----|---------------|
| t_{PLH} , t_{PHL} | Propagation delay time | See Figure 1 | | 12 | 20 | ns |
| PWD ⁽¹⁾ | Pulse duration distortion $ t_{PHL} - t_{PLH} $ | | | 1 | 5 | ns |
| $t_{sk(pp)}$ | Part-to-part skew time | | | | 6.8 | ns |
| $t_{sk(o)}$ | Channel-to-channel output skew time | | | | 5.5 | ns |
| t_r | Output signal rise time | See Figure 1 | | 2 | | ns |
| t_f | Output signal fall time | | | 2 | | ns |
| t_{fs} | Fail-safe output delay time from input power loss | See Figure 2 | | 6 | | μs |
| t_{ui} | Input pulse duration | | 7 | | | ns |
| $1 / t_{ui}$ | Signaling rate | | 0 | | 50 | Mbps |

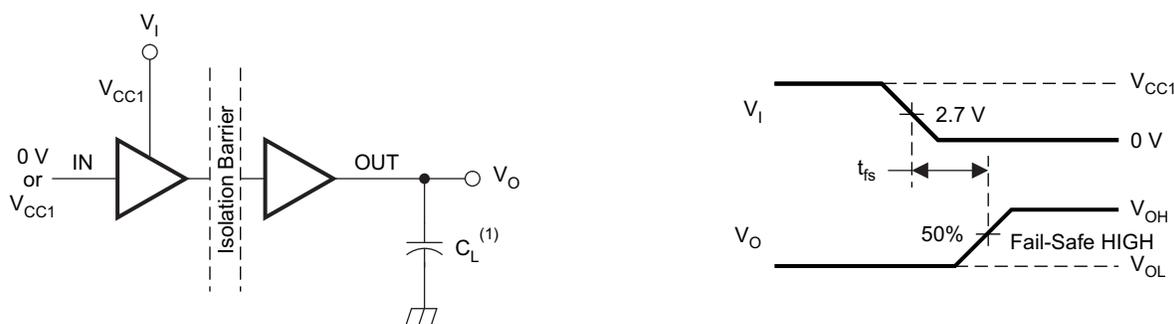
(1) Also known as pulse skew

PARAMETER MEASUREMENT INFORMATION



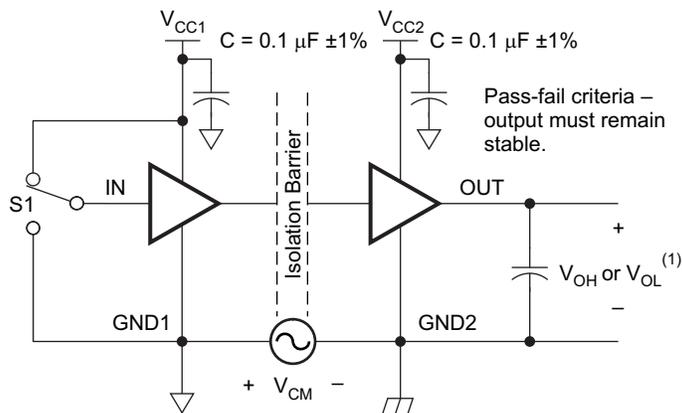
- (1) The input pulse is supplied by a generator having the following characteristics: PRR ≤ 50 kHz, 50% duty cycle, $t_r \leq 3$ ns, $t_f \leq 3$ ns, $Z_O = 50 \Omega$.
- (2) $C_L = 15$ pF and includes instrumentation and fixture capacitance within ±20%.

Figure 1. Switching Characteristic Test Circuit and Voltage Waveforms



- (1) $C_L = 15$ pF and includes instrumentation and fixture capacitance within ±20%.

Figure 2. Fail-Safe Output Delay-Time Test Circuit and Voltage Waveforms



- (1) $C_L = 15$ pF and includes instrumentation and fixture capacitance within ±20%.

Figure 3. Common-Mode Transient Immunity Test Circuit

DEVICE INFORMATION

PACKAGE CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------|--|---|-------------------|-----|-----|------|
| L(I01) | Minimum air gap (clearance) | Shortest terminal-to-terminal distance through air | 4.8 | | | mm |
| L(I02) | Minimum external tracking (creepage) | Shortest terminal-to-terminal distance across the package surface | 4.3 | | | mm |
| CTI | Tracking resistance (comparative tracking index) | DIN IEC 60112 / VDE 0303 Part 1 | >175 | | | V |
| | Minimum internal gap (internal clearance) | Distance through the insulation | 0.008 | | | mm |
| R _{IO} | Isolation resistance | Input to output, V _{IO} = 500 V, all pins on each side of the barrier tied together creating a two-terminal device, T _A < 100°C | >10 ¹² | | | Ω |
| | | Input to output | >10 ¹¹ | | | Ω |
| C _{IO} | Barrier capacitance, input to output | V _I = 0.4 sin (4E6πt) | | 1 | | pF |

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 do not reduce this distance.

Creepage and clearance on a printed-circuit board become equal according to the measurement techniques shown in the Isolation Glossary. Techniques such as inserting grooves and/or ribs on a printed circuit board are used to help increase these specifications.

INSULATION CHARACTERISTICS⁽¹⁾

over recommended operating conditions (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | SPECIFICATION | UNIT |
|-------------------|------------------------------------|---|------------------|------------------|
| V _{IORM} | Maximum working insulation voltage | | 560 | V |
| V _{PR} | Input-to-output test voltage | t = 1 s (100% production), partial discharge 5 pC | 1050 | V |
| V _{IOTM} | Transient overvoltage | t = 60 s (qualification) | 4000 | V |
| | | t = 1 s (100% production) | | |
| V _{ISO} | Isolation voltage per UL | t = 60 s (qualification) | 2500 | V _{rms} |
| | | t = 1 s (100% production) | 3000 | |
| R _S | Insulation resistance | V _{IO} = 500 V at T _S | >10 ⁹ | Ω |
| | Pollution degree | | 2 | |

(1) Climatic Classification 40/125/21

Table 2. IEC 60664-1 RATINGS TABLE

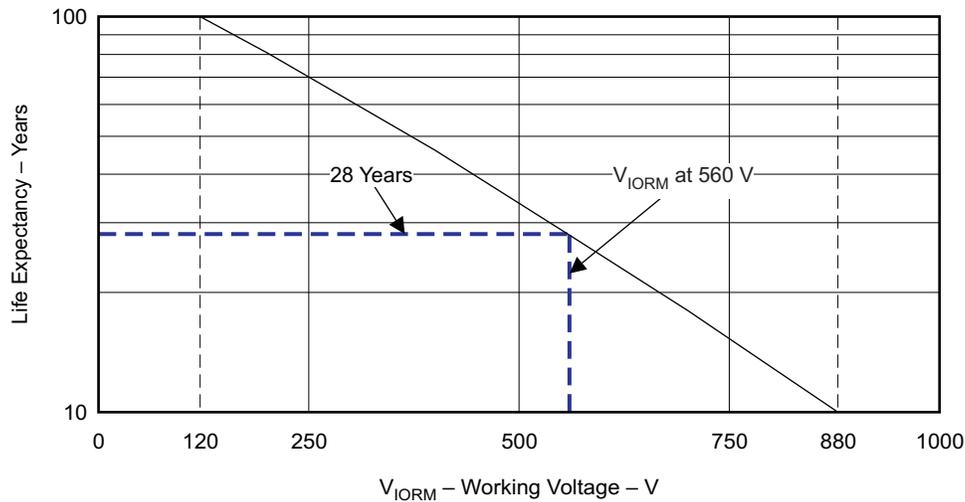
| PARAMETER | TEST CONDITIONS | SPECIFICATION |
|-----------------------------|--|---------------|
| Basic isolation group | Material group | III-a |
| Installation classification | Rated mains voltage ≤ 150 V _{rms} | I–IV |
| | Rated mains voltage ≤ 300 V _{rms} | I–III |
| | Rated mains voltage ≤ 400 V _{rms} | I–II |

REGULATORY INFORMATION

| VDE | CSA | UL |
|--------------------------------------|--|--|
| Certified according to IEC 60747-5-2 | Approved under CSA Component Acceptance Notice | Recognized under 1577 Component Recognition Program ⁽¹⁾ |
| File number: pending (40016131) | File number: pending (1698195) | File number: pending (E181974) |

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

LIFE EXPECTANCY versus WORKING VOLTAGE



G001

Figure 4. Life Expectancy versus Working Voltage

IEC 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 I/O can allow low resistance to ground or the supply and, without current limiting, dissipate sufficient power to overheat the die and damage the isolation barrier, potentially leading to secondary system failures.

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|-----|-----|-----|------------------|
| I_S Safety input, output, or supply current | $\theta_{JA} = 212^\circ\text{C}/\text{W}$, $V_I = 5.5 \text{ V}$, $T_J = 170^\circ\text{C}$, $T_A = 25^\circ\text{C}$ | | | 112 | mA |
| | $\theta_{JA} = 212^\circ\text{C}/\text{W}$, $V_I = 3.6 \text{ V}$, $T_J = 170^\circ\text{C}$, $T_A = 25^\circ\text{C}$ | | | 171 | |
| T_S Maximum case temperature | | | | 150 | $^\circ\text{C}$ |

The safety-limiting constraint is the absolute-maximum junction temperature specified in the *Absolute Maximum Ratings* 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 Characteristics* table is that of a device installed in the JESD51-3, Low-Effective-Thermal-Conductivity Test Board for Leaded Surface-Mount Packages and is conservative. 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.

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PACKAGE THERMAL CHARACTERISTICS

(over recommended operating conditions unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---------------|--------------------------------------|--|-----|------|-----|------|
| θ_{JA} | Junction-to-air thermal resistance | Low-K thermal resistance ⁽¹⁾ | | 212 | | °C/W |
| | | High-K thermal resistance ⁽¹⁾ | | 122 | | |
| θ_{JB} | Junction-to-board thermal resistance | | | 37 | | °C/W |
| θ_{JC} | Junction-to-case thermal resistance | | | 69.1 | | °C/W |
| P_D | Device power dissipation | $V_{CC1} = V_{CC2} = 5.5\text{ V}$, $T_J = 150^\circ\text{C}$, $C_L = 15\text{ pF}$, Input a 150-Mbps 50% duty-cycle square wave | | | 390 | mW |

(1) Tested in accordance with the low-K or high-K thermal metric definitions of EIA/JESD51-3 for leaded surface mount packages

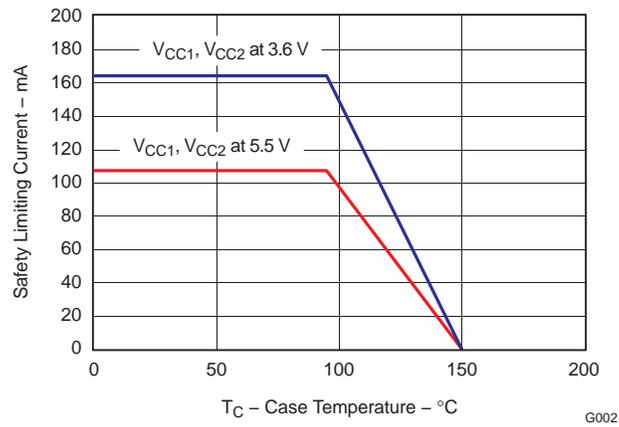


Figure 5. θ_{JC} Thermal Derating Curve per IEC 60747-5-2

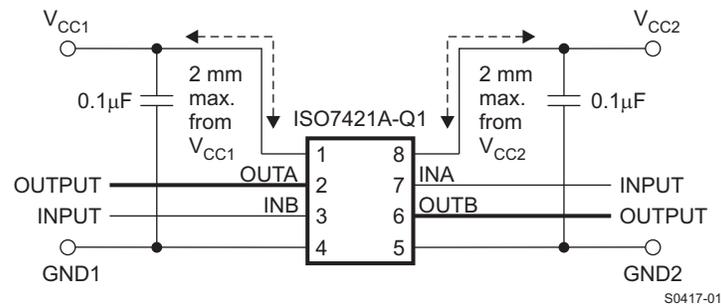
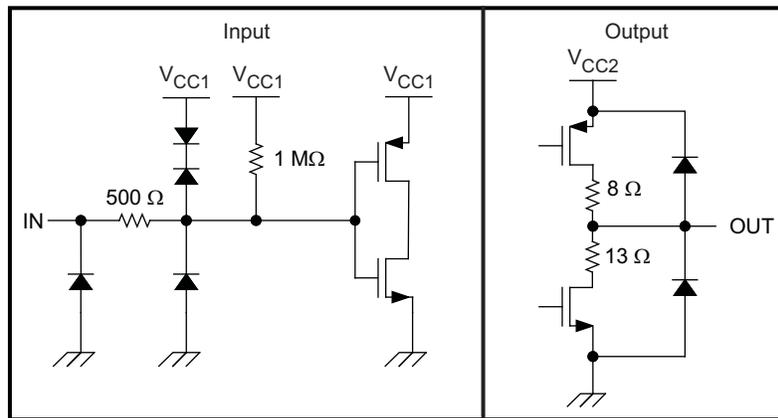


Figure 6. Typical ISO7421A-Q1 Application Circuit



S0422-01

Figure 7. Device I/O Schematics

TYPICAL CHARACTERISTICS

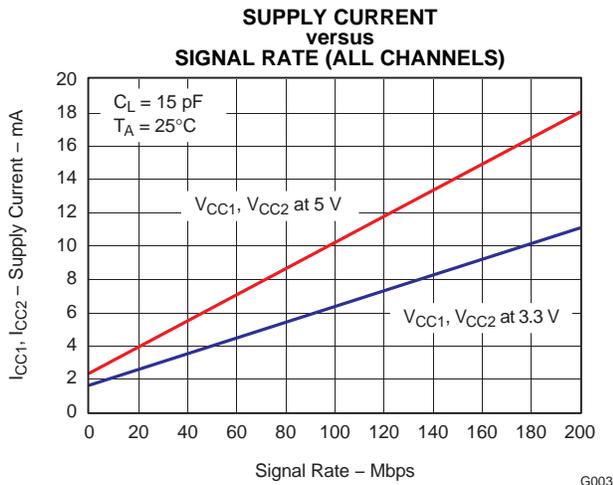


Figure 8.

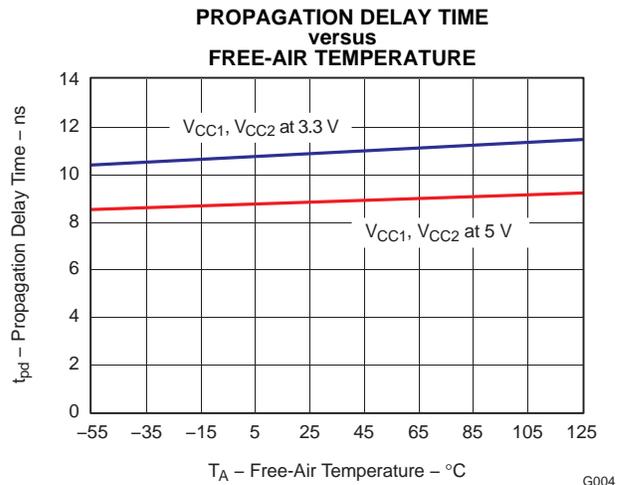


Figure 9.

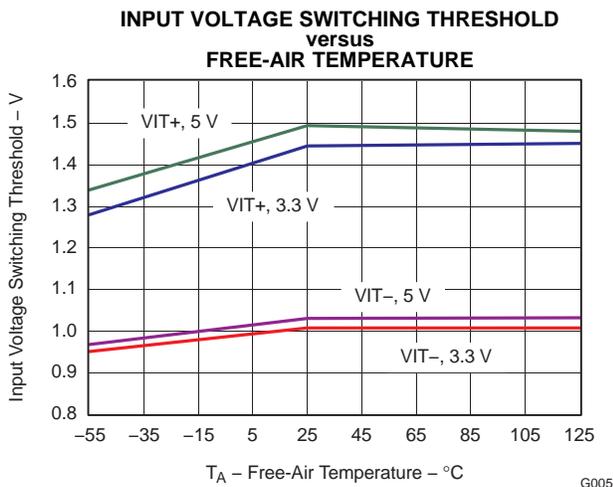


Figure 10.

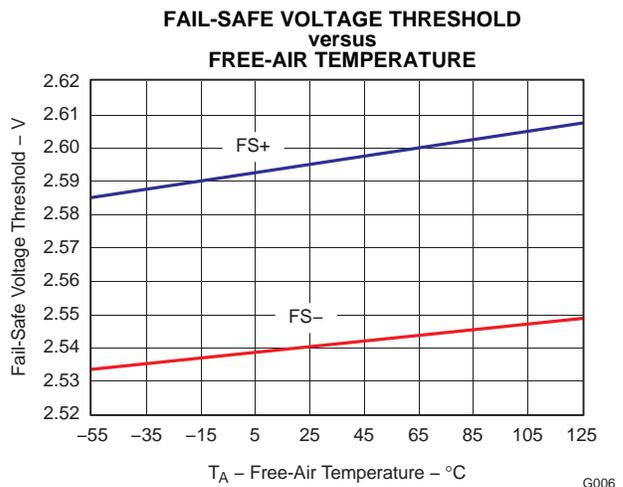


Figure 11.

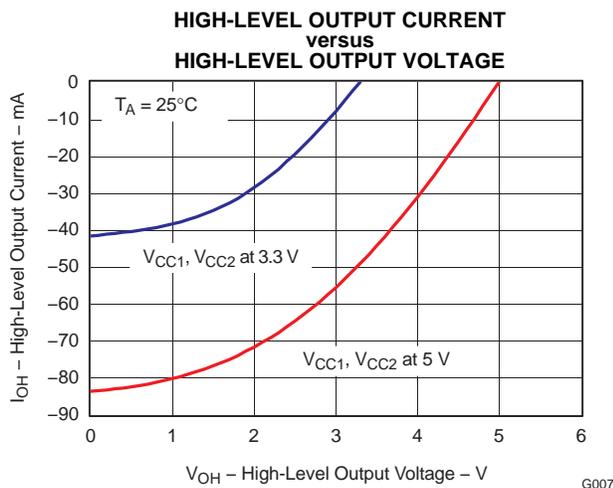


Figure 12.

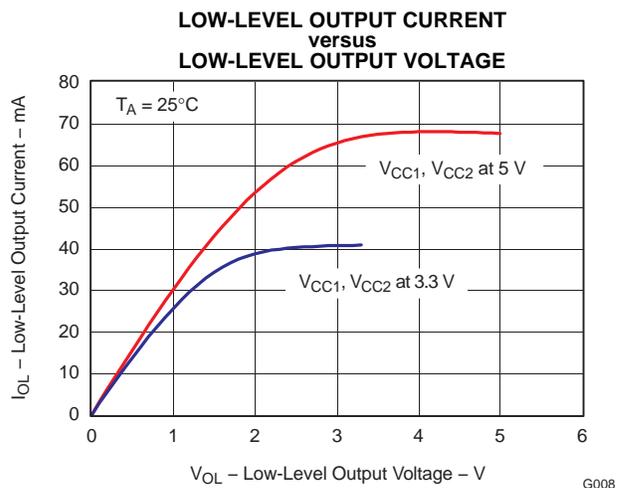


Figure 13.

TYPICAL CHARACTERISTICS (continued)

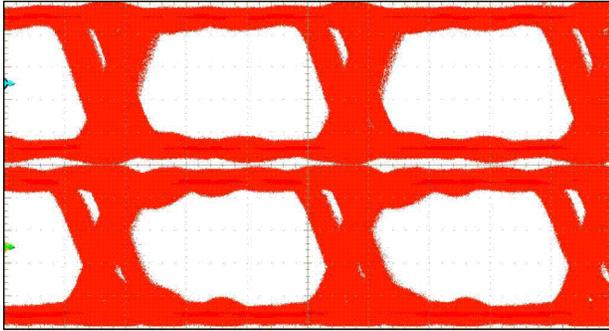


Figure 14. Eye Diagram at 250 MBPS, 5-V V_{CC} , Typical ^{G009}

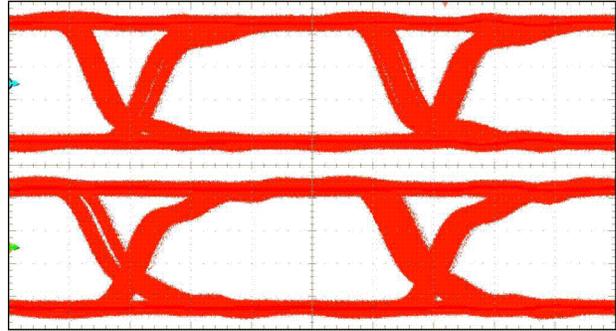


Figure 15. Eye Diagram at 200 MBPS, 5-V V_{CC} , 125°C ^{G010}

REVISION HISTORY

| Changes from Revision A (September 2012) to Revision B | Page |
|---|-------------|
| • Deleted ISO7420-Q1 part number from header of every page | 1 |
| • Deleted ISO7420-Q1 package from pinout drawing | 1 |
| • Deleted ISO7420-Q1 part number from Description section | 1 |
| • Deleted ISO7420-Q1 from Ordering Information table | 1 |
| • Deleted ISO7420-Q1 from Pin Functions table | 2 |
| • Deleted ISO7420-Q1 from Supply Current section of 5-V, 5-V Electrical Characteristics table | 3 |
| • Deleted ISO7420-Q1 from Supply Current section of 5-V, 3.3-V Electrical Characteristics table | 4 |
| • | 5 |
| • Deleted ISO7420-Q1 from Supply Current section of 3.3-V, 5-V Electrical Characteristics table | 5 |
| • Deleted ISO7420-Q1 from Supply Current section of 3.3-V, 5-V Electrical Characteristics table | 6 |
| • Corrected part number in Typical Application Circuit diagram | 10 |

| Changes from Original (March, 2012) to Revision A | Page |
|---|-------------|
| • Changed High Signaling Rate from 1 to 50 Mbps. | 1 |
| • Replaced Supply Current section with marked up table from commercial datasheet SLLSE45, 8.5 max value changed to 9.1. | 3 |
| • Changed Signaling rate max value from 1 to 50. | 3 |
| • Replaced Supply Current section with marked up table from commercial datasheet SLLSE45, 8.5 max value changed to 9.1 and 5.5 changed to 5.8. | 4 |
| • Changed Signaling rate from 1 to 50 Mbps. | 4 |
| • Replaced Supply Current section with marked up table from commercial datasheet SLLSE45, 5.5 max value changed to 5.8 and 8.5 changed to 9.1. | 5 |
| • Changed Signaling rate from 1 to 50 Mbps. | 5 |
| • Replaced Supply Current section with marked up table from commercial datasheet SLLSE45, 5.5 max value changed to 5.8. | 6 |
| • Changed Signaling rate from 1 to 50 Mbps. | 6 |

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) |
|-------------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| ISO7421AQDRQ1 | Active | Production | SOIC (D) 8 | 2500 LARGE T&R | Yes | NIPDAU | Level-3-260C-168 HR | -40 to 125 | 7421AQ |
| ISO7421AQDRQ1.A | Active | Production | SOIC (D) 8 | 2500 LARGE T&R | Yes | NIPDAU | Level-3-260C-168 HR | -40 to 125 | 7421AQ |
| ISO7421AQDRQ1.B | Active | Production | SOIC (D) 8 | 2500 LARGE T&R | - | Call TI | Call TI | -40 to 125 | |

(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.

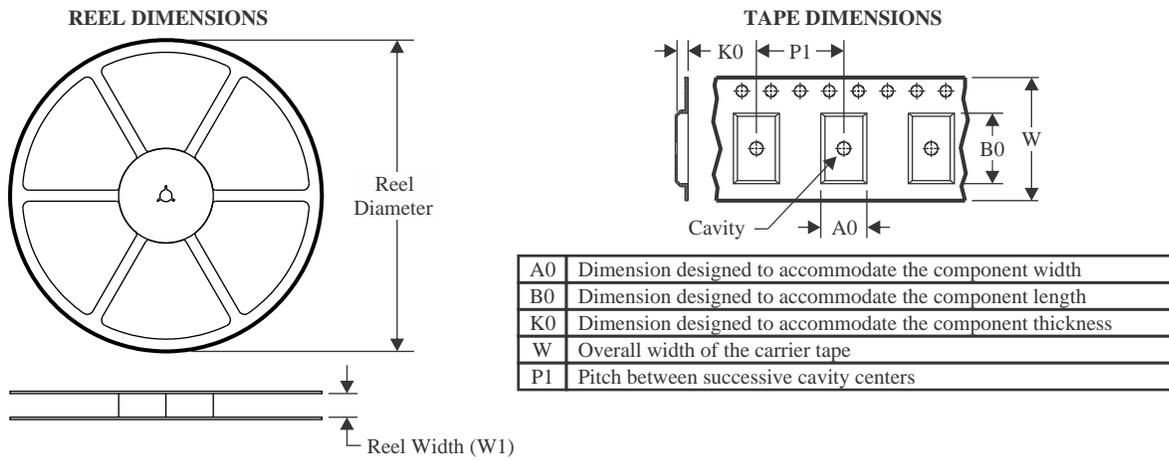
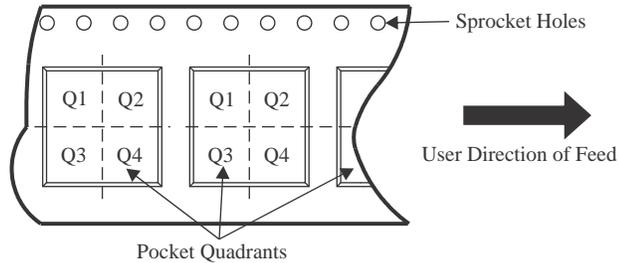
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will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

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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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| ISO7421AQDRQ1 | SOIC | D | 8 | 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) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| ISO7421AQDRQ1 | SOIC | D | 8 | 2500 | 350.0 | 350.0 | 43.0 |

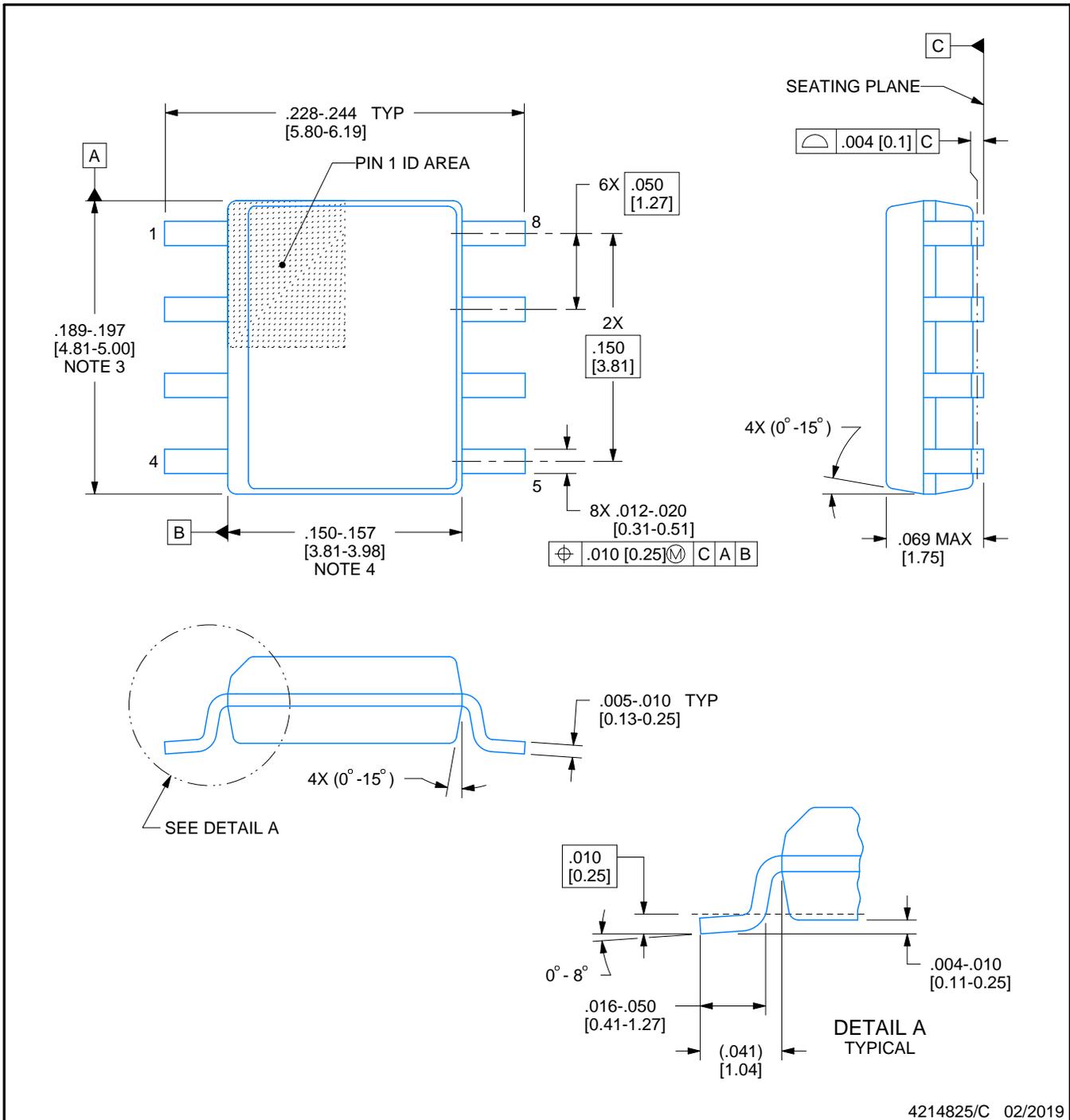


D0008A

PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

NOTES:

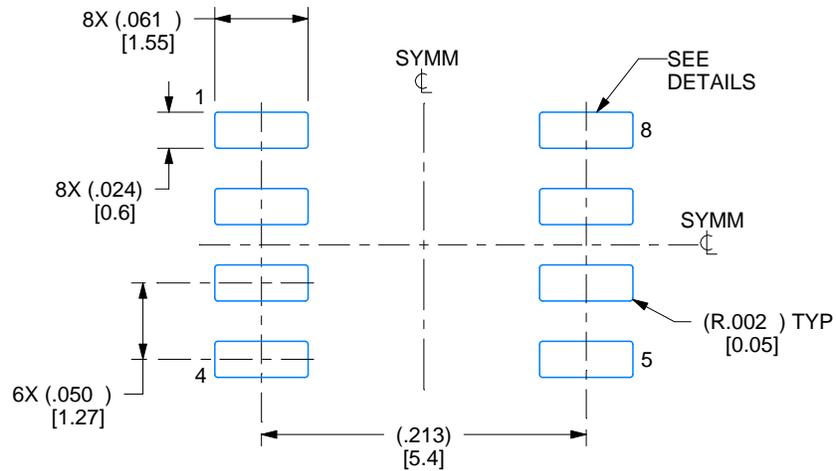
- Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.
- This dimension does not include interlead flash.
- Reference JEDEC registration MS-012, variation AA.

EXAMPLE BOARD LAYOUT

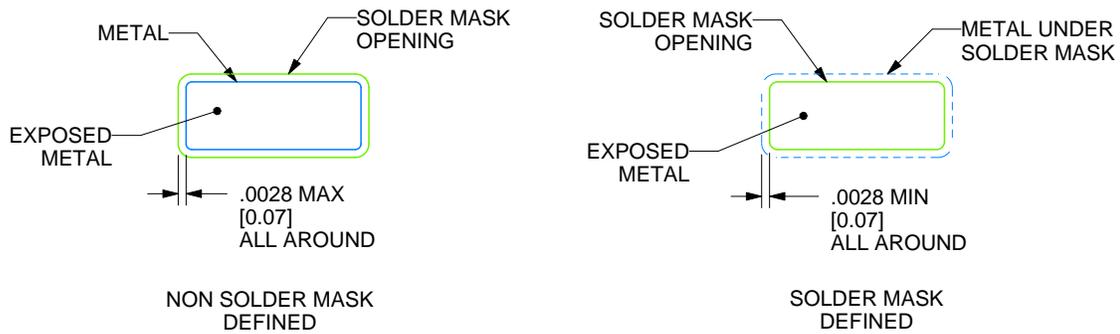
D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

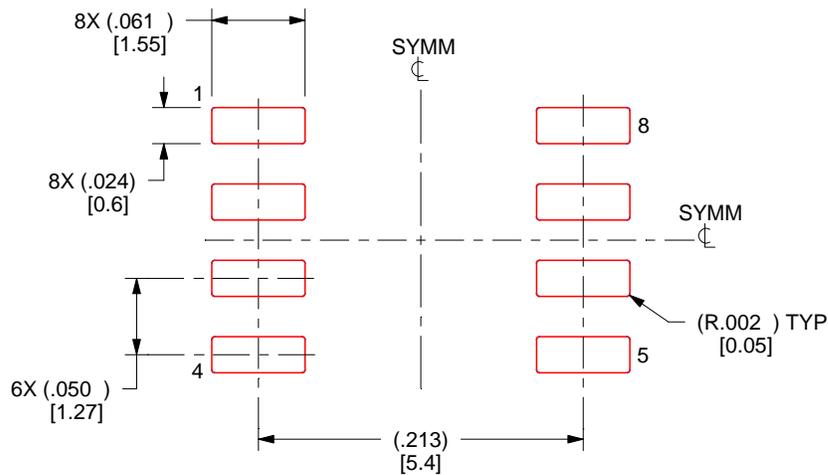
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

4214825/C 02/2019

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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