

ISO71xxCC 4242V_{PK} 小封装低功耗三通道和四通道数字隔离器

1 特性

- 最大信号传输速率：50Mbps（5V 电源）
- 具有集成噪声滤波器的稳健耐用设计
- 缺省输出低选项（后缀 F）
- 低功耗，每通道 I_{CC} 典型值（3.3V 电源）：
 - ISO7131：1Mbps 时为 1.5mA，25Mbps 时为 2.6mA
 - ISO7140：1Mbps 时为 1mA，25Mbps 时为 2.3mA
 - ISO7141：1Mbps 时为 1.3mA，25Mbps 时为 2.6mA
- 低传播延迟：典型值 23ns（3.3V 电源）
- 宽温度范围：-40°C 至 125°C
- 50kV/μs 瞬态抗扰度，典型值
- 采用 SiO₂ 隔离格栅，使用寿命长
- 可由 2.7V、3.3V 和 5V 电源及逻辑电平供电
- 小型四分之一英寸小外形封装 (QSOP)-16 封装
- 安全及管理批准
 - 符合 UL 1577 的长达 1 分钟的 2500V_{RMS} 隔离
 - 符合 DIN V VDE V 0884-10 (VDE V 0884-10):2006-12 的 4242V_{PK} 隔离，566V_{PK} 工作电压
 - CSA 组件接受通知 5A，IEC 60950-1 和 IEC 61010-1 终端设备标准
 - 符合 GB 4943.1-2011 的 CQC 认证

2 应用范围

- 通用隔离
 - 工业现场总线 (Fieldbus)
 - Profibus 现场总线
 - Modbus™
 - DeviceNet 数据总线
 - RS-232, RS-485
 - 串行外设接口

3 说明

ISO7131、ISO7140 和 ISO7141 器件提供符合 UL 标准的长达 1 分钟的 2500 V_{RMS} 电流隔离，以及符合 VDE 标准的 4242 V_{PK}。ISO7131 有三个通道，其中两个为正向通道，一个为反向通道。ISO7140 和 ISO7141 均为四通道隔离器；ISO7140 有四个正向通道，而 ISO7141 有三个正向通道和一个反向通道。这些器件在由 5V 电源和 3.3V/2.7V 电源供电时，分别可提供 50Mbps 和 40Mbps 的最大数据传输速率，并且输入上带有集成滤波器，适用于易受噪声干扰的应用。后缀 F 表示缺省输出状态为低电平；否则，缺省输出状态为高电平（请见表 3）。

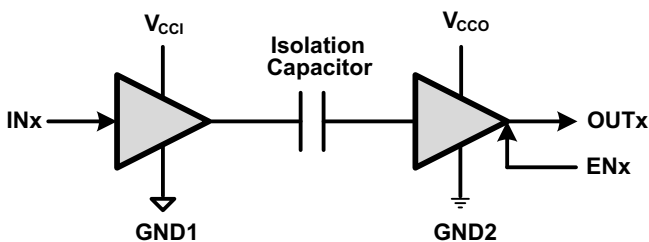
每个隔离通道的逻辑输入和输出缓冲器均由二氧化硅 (SiO₂) 绝缘格栅分离开来。与隔离式电源一起使用时，这些器件可防止数据总线或者其它电路上的噪声电流进入本地接地并且干扰或损坏敏感电路。这些器件具有晶体管晶体管逻辑电路 (TTL) 输入阈值，并且可由 2.7V、3.3V 和 5V 电压供电运行。通过 2.7V 或 3.3V 电源供电时，所有输入均可耐受 5V 电压。

器件信息⁽¹⁾

| 器件型号 | 封装 | 封装尺寸 (标称值) |
|------------|-----------|-----------------|
| ISO7131CC | SSOP (16) | 4.90mm × 3.90mm |
| ISO7140CC | | |
| ISO7140FCC | | |
| ISO7141CC | | |
| ISO7141FCC | | |

(1) 如需了解所有可用封装，请见数据表末尾的可订购产品附录。

简化电路原理图



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4 修订历史记录

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

| Changes from Revision E (September 2013) to Revision F | Page |
|---------------------------------------------------------------------------------------------------|----------|
| • 已添加 引脚配置和功能部分, ESD 额定表, 特性描述部分, 器件功能模式, 应用和实施部分, 电源相关建议部分, 布局部分, 器件和文档支持部分以及机械、封装和可订购信息部分 | 1 |
| • VDE 标准更改为 DIN V VDE V 0884-10 (VDE V 0884-10):2006-12 | 1 |

| Changes from Revision D (August 2013) to Revision E | Page |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| • 将符合 UL 1577 的长达 1 分钟的 2500V _{RMS} 隔离从 (审批正在审理中) 更改为 (已通过审批) | 1 |
| • Added note1 to the AVAILABLE OPTIONS table | 17 |
| • Changed 图 15 | 18 |
| • Changed From: Basic Insulation To: Basic Insulation, Altitude \leq 5000m, Tropical Climate, 250 VRMS maximum working voltage in the Regulatory Information table | 19 |
| • Changed File number: E181974 (approval pending) To: File number: E181974 in the Regulatory Information table | 19 |
| • Changed the title of 图 21, 图 22, and 图 23 to include "PRBS 2 ¹⁶ - 1" | 23 |

| Changes from Revision C (July 2013) to Revision D | Page |
|--------------------------------------------------------------------|-----------|
| • 添加了安全列表项“GB 4943.1-2011 和 GB 8898:2011 CQC 认证 (审批正在审理中)” | 1 |
| • Added 图 2 | 12 |
| • Deleted "Product Preview" From the AVAILABLE OPTIONS table | 17 |
| • Changed the REGULATORY INFORMATION, added column for CQC | 19 |

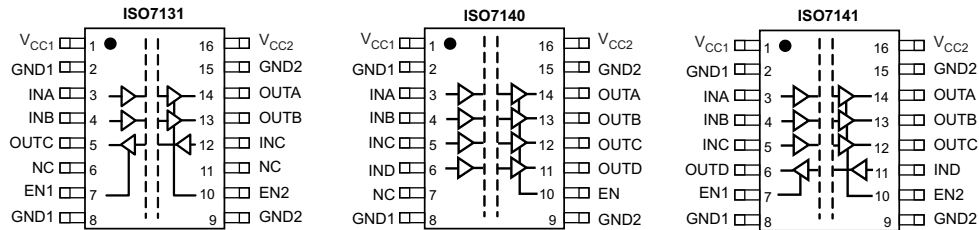
| Changes from Revision B (June 2013) to Revision C | Page |
|-------------------------------------------------------------------------------------------|-------------|
| • 将特性从: ISO7140: 1Mbps 时待定 (TBD), 25Mbps 时 TBD 改为: ISO7140: 1Mbps 时为 1mA, 25Mbps 时为 2.3mA | 1 |
| • 在说明中添加了文本: “当由一个 2.7V 或者 3.3V 电源供电时, 所有输入均可耐受 5V 电压。” | 1 |
| • 删除了产品状态表 | 1 |
| • 更改了安全和管理批准 | 1 |
| • Changed the ABSOLUTE MAXIMUM RATINGS table | 5 |
| • Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. | 7 |
| • Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. | 8 |
| • Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. | 8 |
| • Changed ISO7140 in the SUPPLY CURRENT table From: TBD To: values | 9 |
| • Changed ISO7140 in the SUPPLY CURRENT table From: TBD To: values | 10 |
| • Changed ISO7140 in the SUPPLY CURRENT table From: TBD To: values | 11 |
| • Changed 图 1 X-axis scale | 12 |
| • Changed the AVAILABLE OPTIONS table | 17 |

| Changes from Revision A (June 2013) to Revision B | Page |
|----------------------------------------------------------|-------------|
| • 将器件 ISO7141CC 从: 产品预览改为: 在产品状态表中发布 | 1 |

| Changes from Original (April 2013) to Revision A | Page |
|-----------------------------------------------------------------------------------------------|-------------|
| • 更改了简化电路原理图, 添加了接地符号 | 1 |
| • Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. Values by device. | 7 |
| • Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. Values by device. | 8 |
| • Changed the SWITCHING CHARACTERISTICS table, Input glitch rejection time. Values by device. | 8 |
| • Added 图 3 | 12 |

5 Pin Configuration and Functions

**16-Pin
SSOP Package
Top View**



Pin Functions

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

6 Specifications

6.1 Absolute Maximum Ratings⁽¹⁾

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

- (1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values except differential I/O bus voltages are with respect to the local ground terminal (GND1 or GND2) and are peak voltage values.
- (3) Maximum voltage must not exceed 6 V

6.2 ESD Ratings

| | | VALUE | UNIT |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------|-------|------|
| $V_{(ESD)}$ | Electrostatic discharge | | |
| | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾ | ±4000 | V |
| Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾ | ±1500 | | |

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

6.3 Recommended Operating Conditions

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

6.4 Thermal Information

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

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

6.5 Power Dissipation Ratings

| | | TEST CONDITIONS | VALUE | UNIT |
|----------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------|------|
| P _D | Device power dissipation | V _{CC1} = V _{CC2} = 5.5 V, T _J = 150°C, C _L = 15 pF Input a 25-MHz, 50% duty cycle square wave | 150 | mW |

6.6 Electrical Characteristics: V_{CC1} and V_{CC2} at 5 V ±10%

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

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

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

6.7 Electrical Characteristics: V_{CC1} and V_{CC2} at 3.3 V ±10%

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

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

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

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

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

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

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

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

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

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

(1) Also known as pulse skew

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

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

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

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

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

(1) Also known as pulse skew

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

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

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

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

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

(1) Also known as pulse skew

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

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

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

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

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

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

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

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

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

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

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

6.15 Typical Characteristics

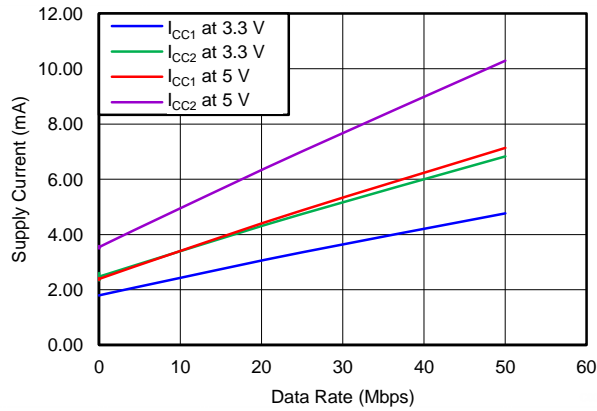


图 1. ISO7131 Supply Current for All Channels vs Data Rate

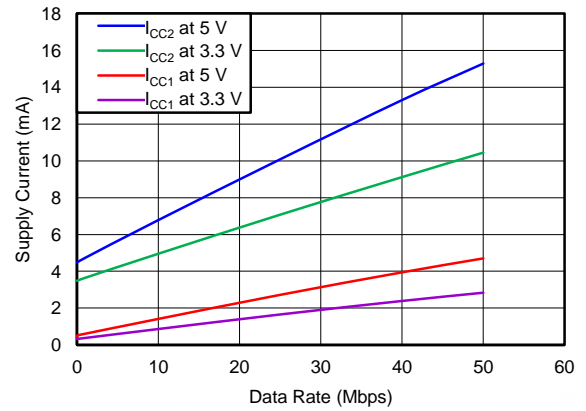


图 2. ISO7140 Supply Current for All Channels vs Data Rate

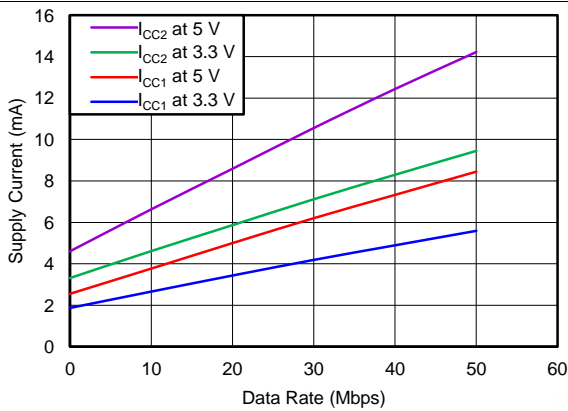


图 3. ISO7141 Supply Current for All Channels vs Data Rate

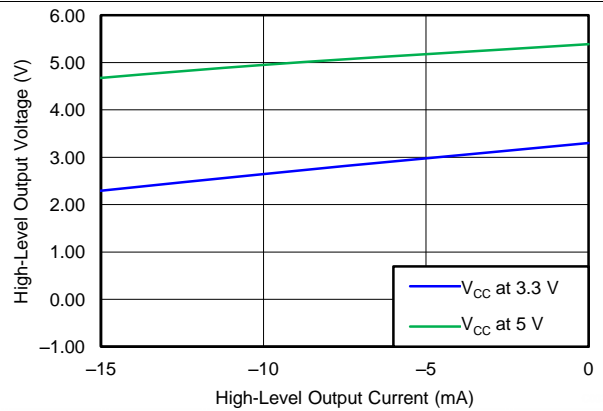


图 4. High-Level Output Voltage vs High-Level Output Current

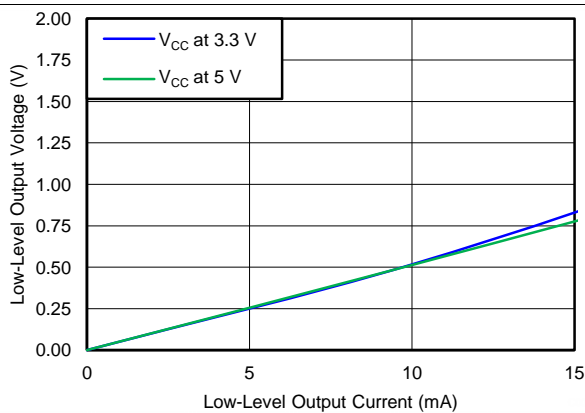


图 5. Low-Level Output Voltage vs Low-Level Output Current

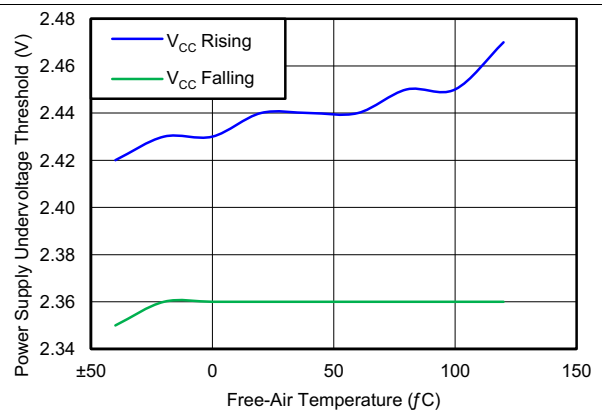
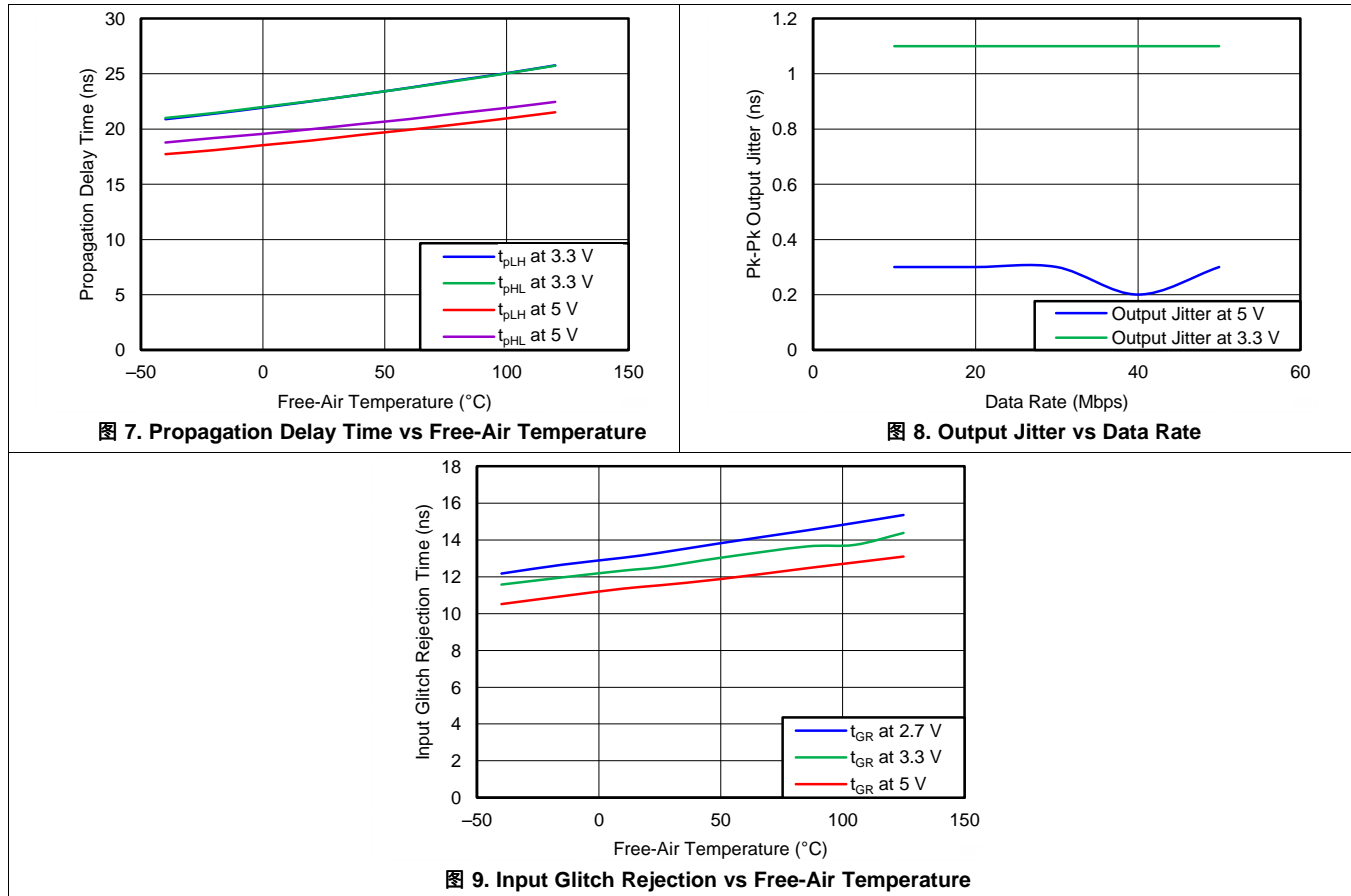
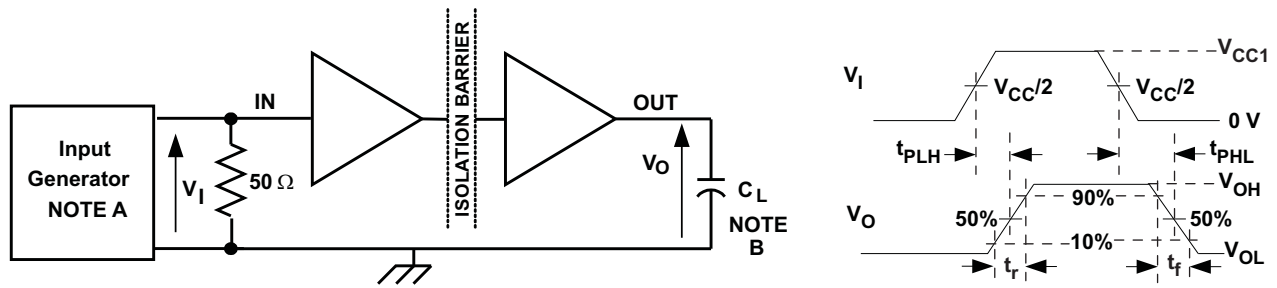


图 6. V_{CC} Undervoltage Threshold vs Free-Air Temperature

Typical Characteristics (接下页)

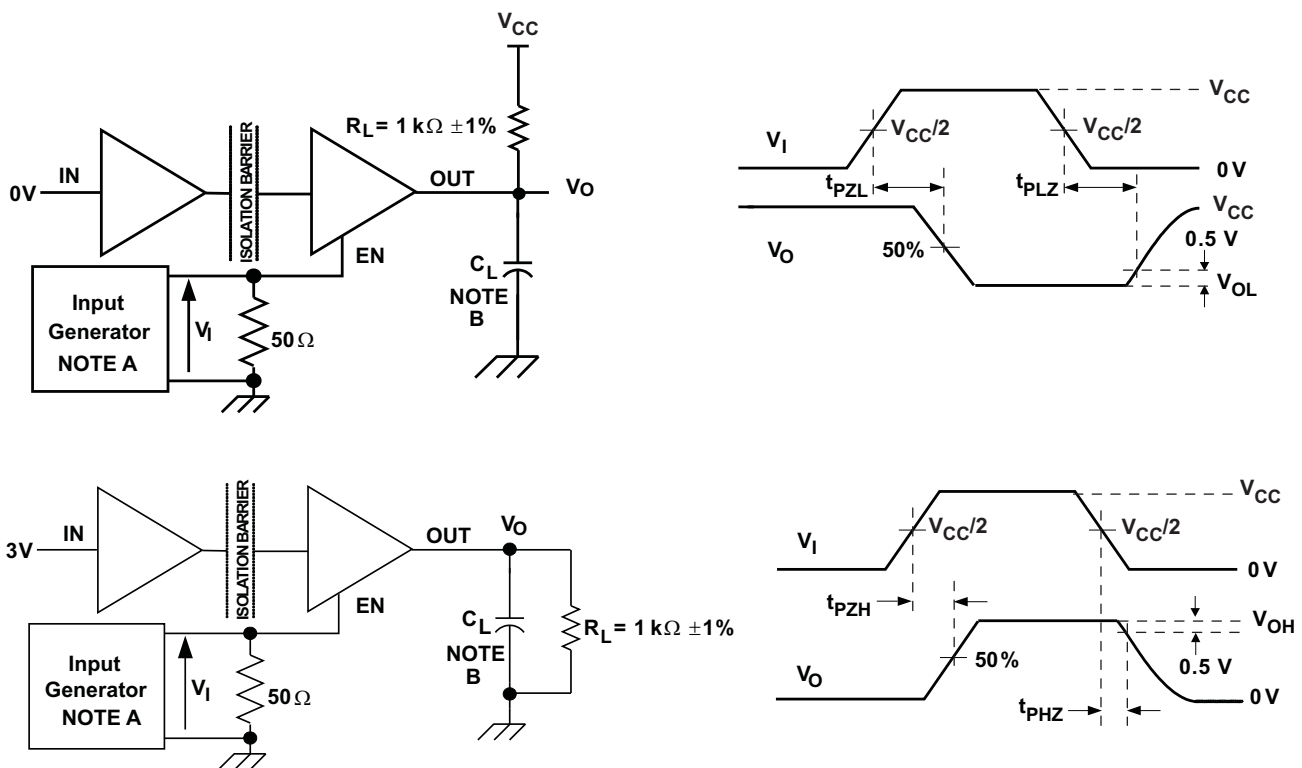


7 Parameter Measurement Information



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

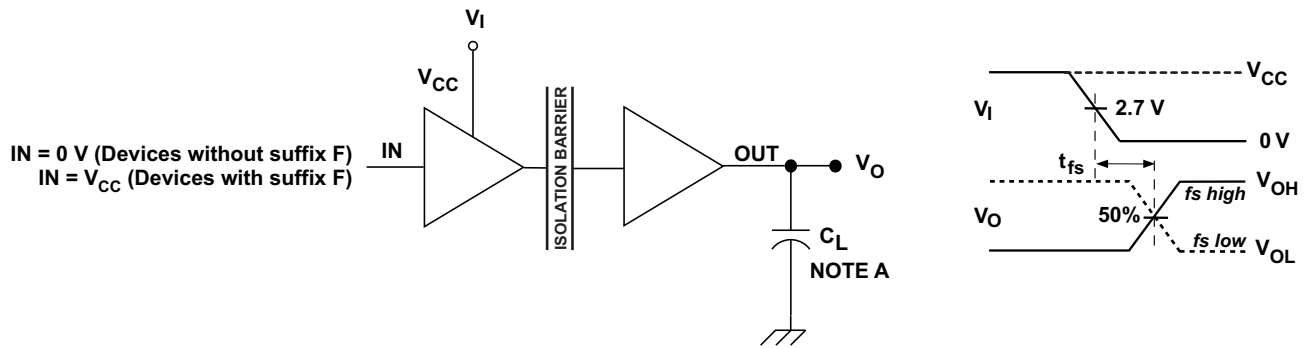
图 10. Switching-Characteristics Test Circuit and Voltage Waveforms



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

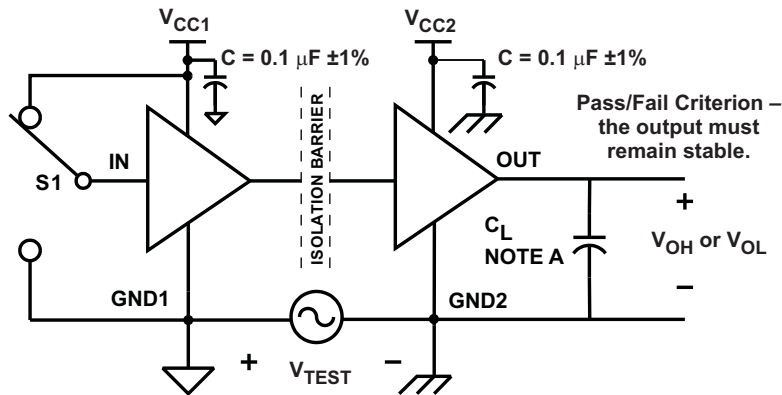
图 11. Enable/Disable Propagation Delay-Time Test Circuit and Waveform

Parameter Measurement Information (接下页)



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

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



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

图 13. Common-Mode Transient Immunity Test Circuit

8 Detailed Description

8.1 Overview

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

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

8.2 Functional Block Diagram

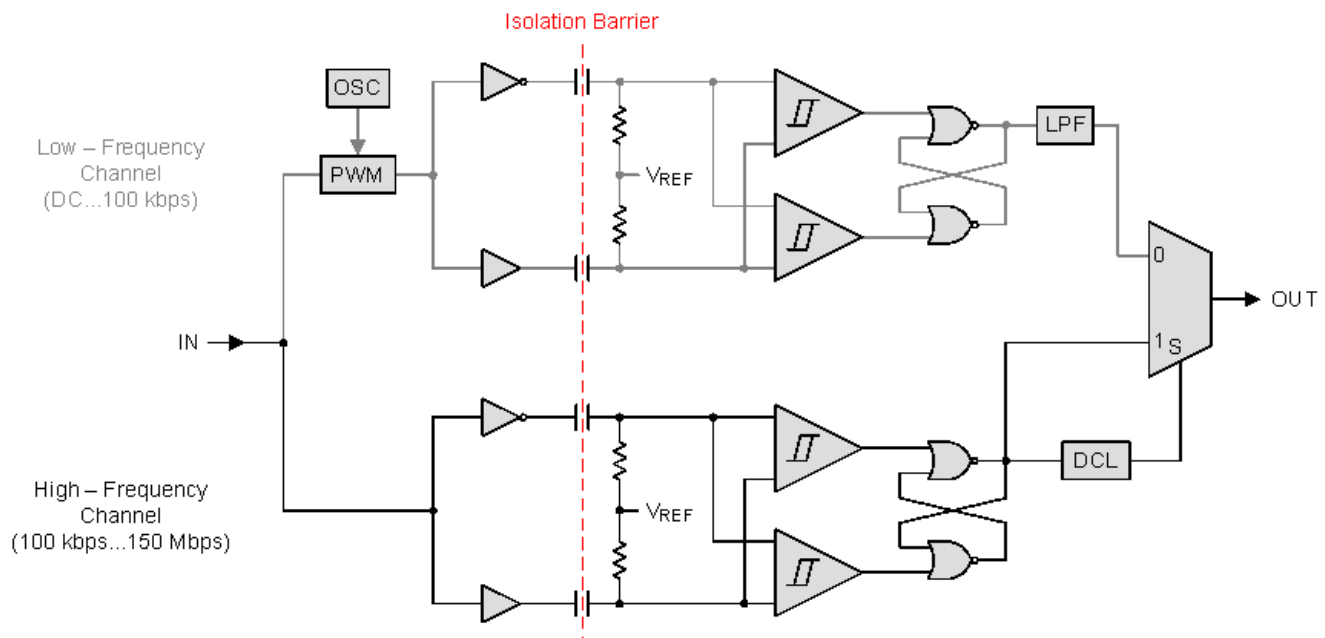


图 14. Conceptual Block Diagram of a Digital Capacitive Isolator

8.3 Feature Description

表 1. Product Features

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

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

8.3.1 Insulation and Safety-Related Specifications

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

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

(2) Measured from input pin to ground.

注

Creepage and clearance requirements should be applied according to the specific equipment isolation standards of an application. Care should be taken to maintain the creepage and clearance distance of a board design to ensure that the mounting pads of the isolator on the printed-circuit-board (PCB) do not reduce this distance.

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

表 2. IEC 60664-1 Ratings Table

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

8.3.1.1 Safety Limiting Values

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

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT | |
|-----------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----|-----|------|------------|
| I_S Safety input, output, or supply current | DBQ-16 $R_{\theta JA} = 104.5^\circ C/W, V_I = 5.5V, T_J = 150^\circ C, T_A = 25^\circ C$ | $R_{\theta JA} = 104.5^\circ C/W, V_I = 5.5V, T_J = 150^\circ C, T_A = 25^\circ C$ | | | 217 | mA |
| | | $R_{\theta JA} = 104.5^\circ C/W, V_I = 3.6V, T_J = 150^\circ C, T_A = 25^\circ C$ | | | 332 | |
| | | $R_{\theta JA} = 104.5^\circ C/W, V_I = 2.7V, T_J = 150^\circ C, T_A = 25^\circ C$ | | | 443 | |
| T_S Maximum case temperature | | | | | 150 | $^\circ C$ |

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

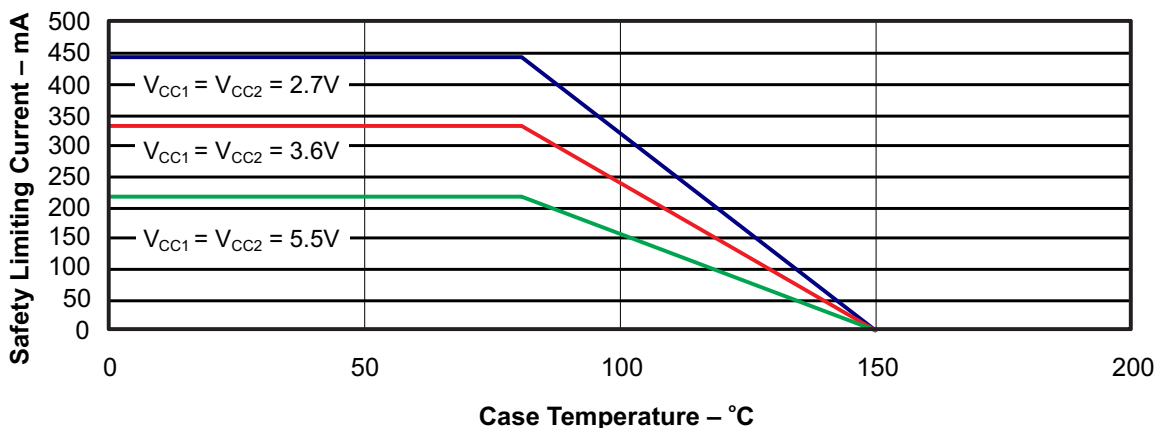


图 15. DBQ-16 θ_{JC} Thermal Derating Curve

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under [Recommended Operating Conditions](#) is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

8.3.1.2 Regulatory Information

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

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

8.4 Device Functional Modes

表 3. Function Table⁽¹⁾

| V _{CCI} | V _{CCO} | INPUT (INx) | OUTPUT ENABLE (ENx) | OUTPUT (OUTx) | |
|------------------|------------------|-------------|---------------------|---------------|--------------|
| | | | | ISO71xxCC | ISO71xxFCC |
| PU | PU | H | H or open | H | H |
| | | L | H or open | L | L |
| | | X | L | Z | Z |
| | | Open | H or open | H | L |
| PD | PU | X | H or open | H | L |
| PD | PU | X | L | Z | Z |
| PU | PD | X | X | Undetermined | Undetermined |

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

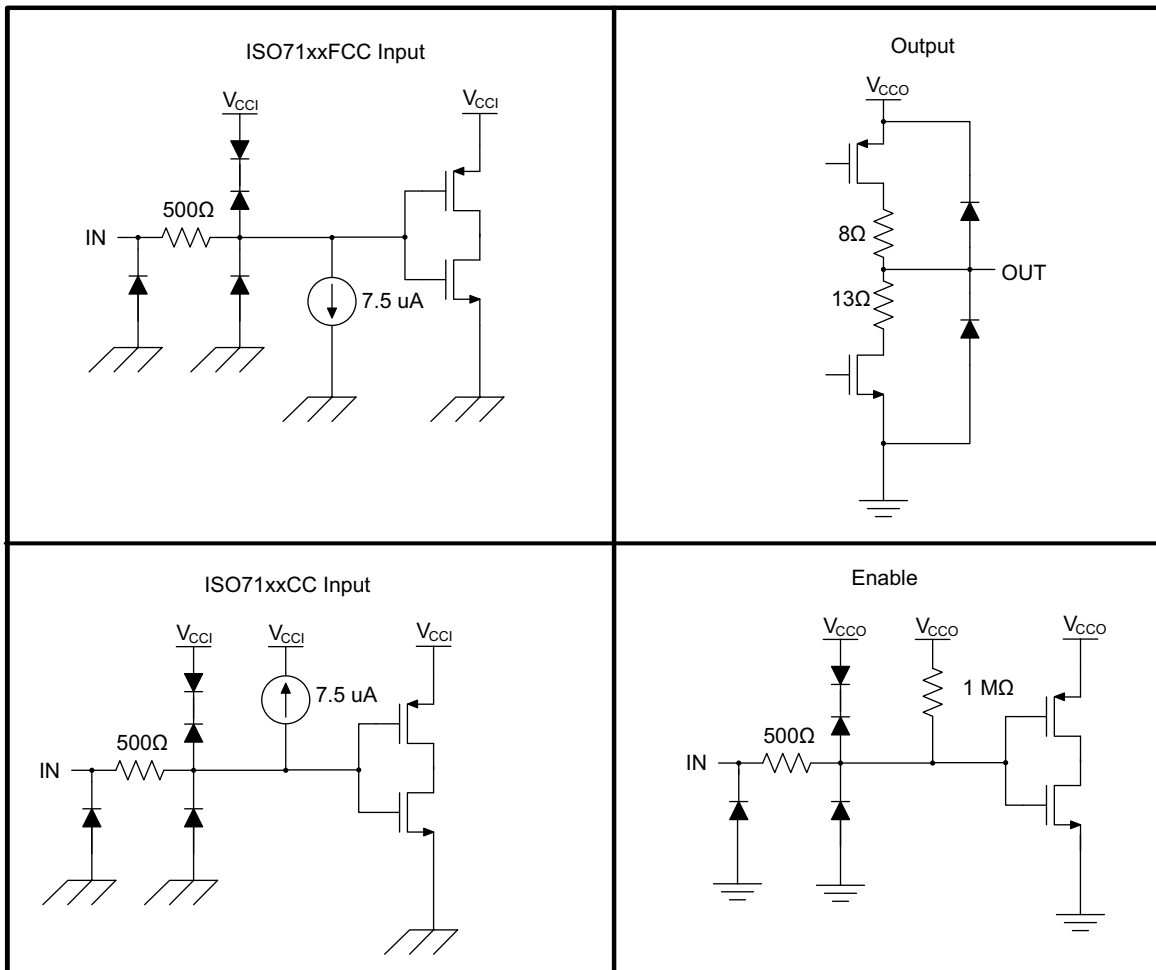


图 16. Device I/O Schematics

9 Application and Implementation

注

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

9.1 Application Information

ISO71xx use single-ended TTL-logic switching technology. Its supply voltage range is from 3 V to 5.5 V for both supplies, V_{CC1} and V_{CC2} . When designing with digital isolators, it is important to note that due to the single-ended design structure, digital isolators do not conform to any specific interface standard and are only intended for isolating single-ended CMOS or TTL digital signal lines. The isolator is typically placed between the data controller (that is, μC or UART), and a data converter or a line transceiver, regardless of the interface type or standard.

9.2 Typical Applications

9.2.1 Isolated Data Acquisition System for Process Control

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

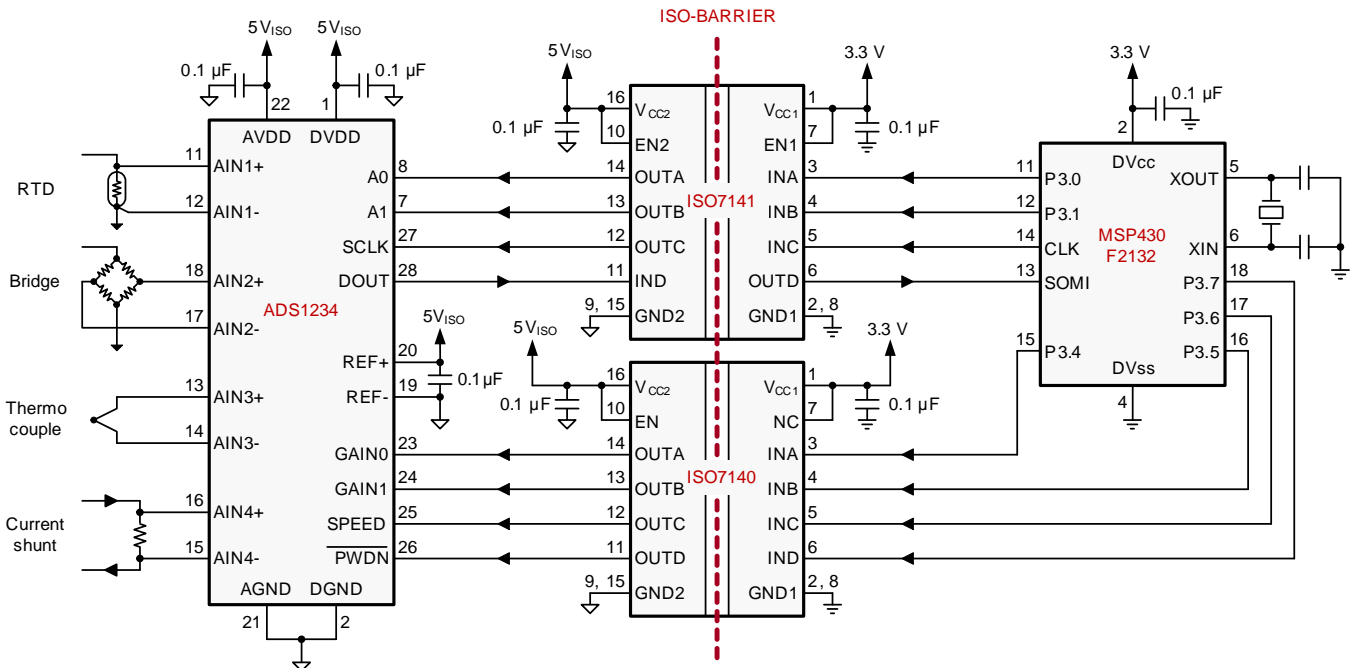


图 17. Isolated Data Acquisition System for Process Control

Typical Applications (接下页)

9.2.1.1 Design Requirements

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

9.2.1.2 Detailed Design Procedure

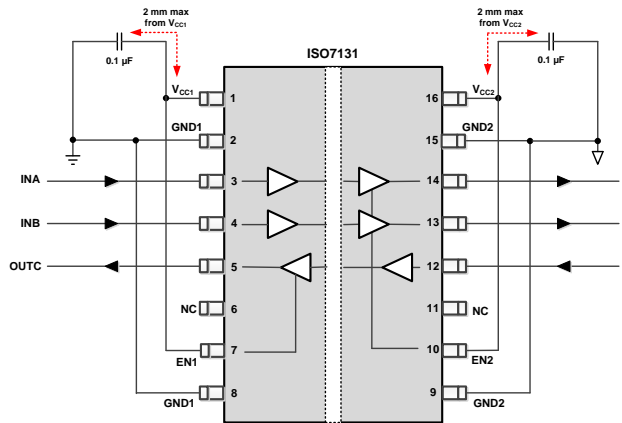


图 18. Typical ISO7131 Circuit Hook-up

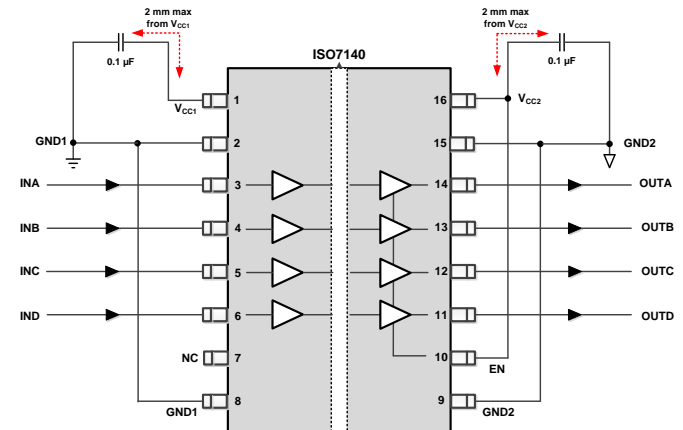


图 19. Typical ISO7140 Circuit Hook-up

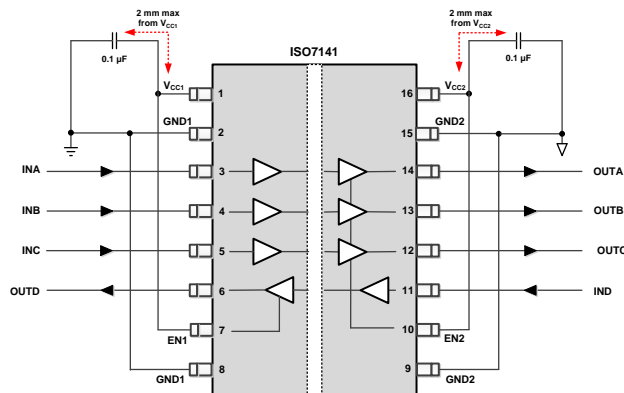


图 20. Typical ISO7141 Circuit Hook-up

Typical Applications (接下页)

9.2.1.3 Application Curves

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

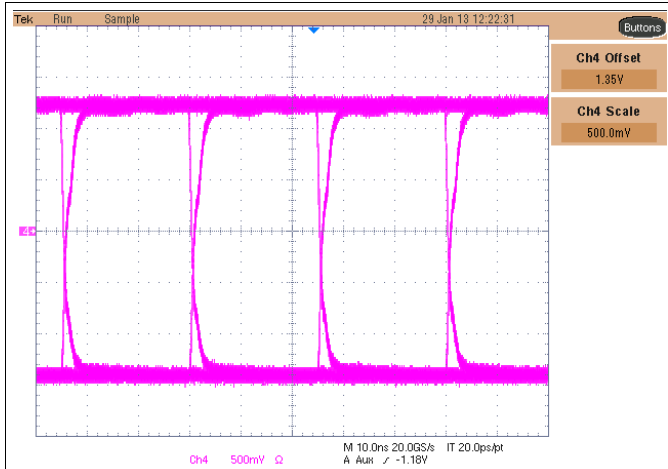


图 21. Typical Eye Diagram at 40 MBPS, PRBS $2^{16} - 1$, 2.7-V Operation

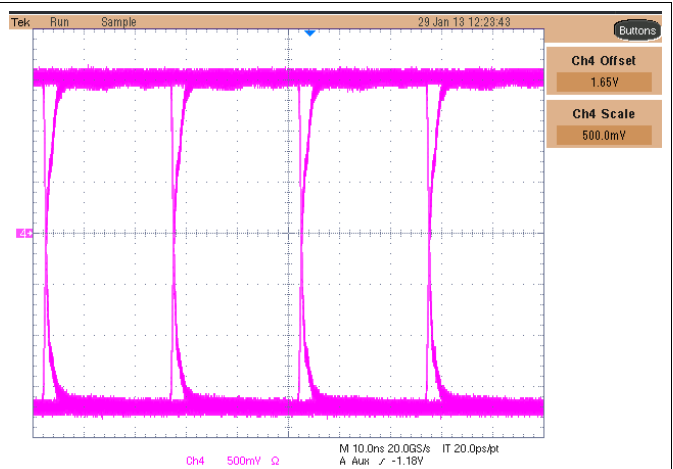


图 22. Typical Eye Diagram at 40 MBPS, PRBS $2^{16} - 1$, 3.3-V Operation

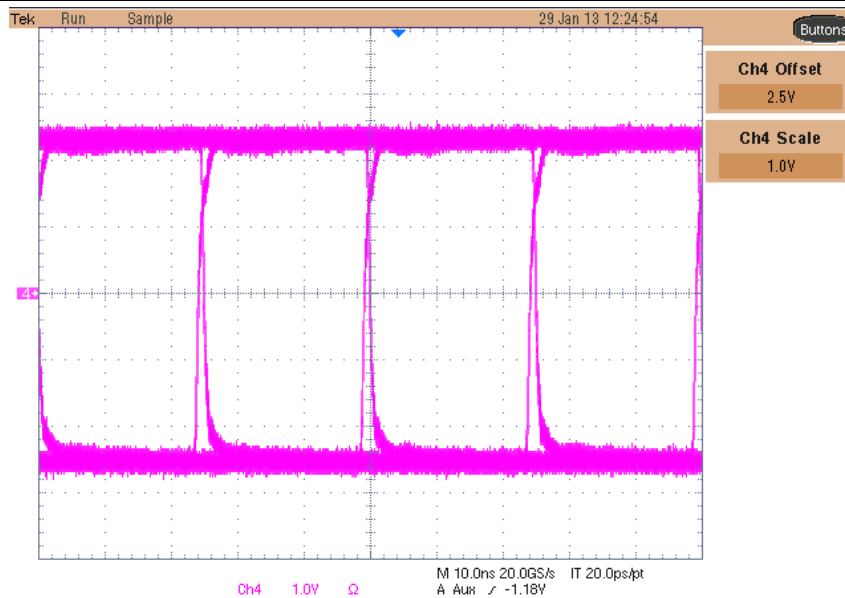
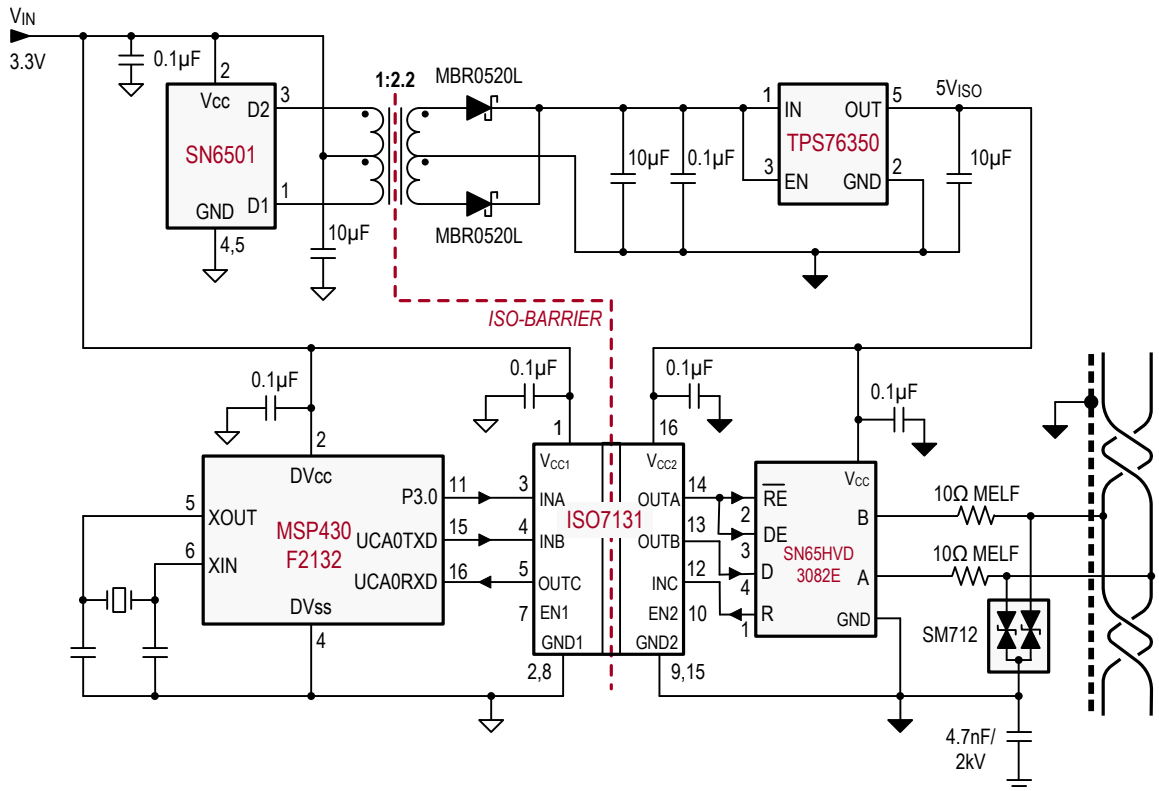


图 23. Typical Eye Diagram at 50 MBPS, PRBS $2^{16} - 1$, 5-V Operation

Typical Applications (接下页)
9.2.2 Isolated RS-485 Interface

图 24. Isolated RS-485 Interface
9.2.2.1 Design Requirements

 See previous [Design Requirements](#).

9.2.2.2 Detailed Design Procedure

 See previous [Detailed Design Procedure](#).

9.2.2.3 Application Curves

 See previous [Application Curves](#).

10 Power Supply Recommendations

To ensure reliable operation at all data rates and supply voltages, a 0.1- μ F bypass capacitor is recommended at input and output supply pins (V_{CC1} and V_{CC2}). The capacitors should be placed as close to the supply pins as possible. If only a single primary-side power supply is available in an application, isolated power can be generated for the secondary-side with the help of a transformer driver such as TI's [SN6501](#). For such applications, detailed power supply design and transformer selection recommendations are available in [SN6501](#) data sheet ([SLLSEA0](#)).

11 Layout

11.1 Layout Guidelines

A minimum of four layers is required to accomplish a low EMI PCB design (see [图 25](#)). Layer stacking should be in the following order (top-to-bottom): high-speed signal layer, ground plane, power plane and low-frequency signal layer.

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

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

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

11.1.1 PCB Material

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

11.2 Layout Example

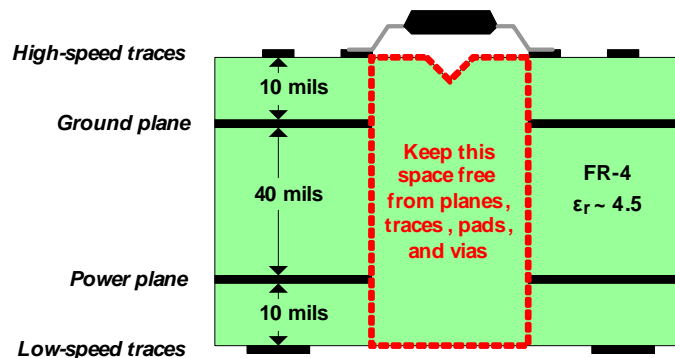


图 25. Recommended Layer Stack

12 器件和文档支持

12.1 文档支持

12.1.1 相关文档

- [SLLA284](#), 《数字隔离器设计指南》
- [SLLSEA0](#), 《用于隔离电源的变压器驱动器》

12.2 相关链接

以下表格列出了快速访问链接。范围包括技术文档、支持与社区资源、工具和软件，并且可以快速访问样片或购买链接。

表 4. 相关链接

| 器件 | 产品文件夹 | 样片与购买 | 技术文档 | 工具与软件 | 支持与社区 |
|------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| ISO7131CC | 请单击此处 | 请单击此处 | 请单击此处 | 请单击此处 | 请单击此处 |
| ISO7140CC | 请单击此处 | 请单击此处 | 请单击此处 | 请单击此处 | 请单击此处 |
| ISO7140FCC | 请单击此处 | 请单击此处 | 请单击此处 | 请单击此处 | 请单击此处 |
| ISO7141CC | 请单击此处 | 请单击此处 | 请单击此处 | 请单击此处 | 请单击此处 |
| ISO7141FCC | 请单击此处 | 请单击此处 | 请单击此处 | 请单击此处 | 请单击此处 |

12.3 商标

Modbus is a trademark of Gould Inc.

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12.4 静电放电警告



这些装置包含有限的内置 ESD 保护。存储或装卸时，应将导线一起截短或将装置放置于导电泡棉中，以防止 MOS 门极遭受静电损伤。

12.5 术语表

[SLYZ022](#) — TI 术语表。

这份术语表列出并解释术语、首字母缩略词和定义。

[SLLA353](#) - 《隔离相关术语》。

13 机械封装和可订购信息

以下页中包括机械封装和可订购信息。 这些信息是针对指定器件可提供的最新数据。 这些数据会在无通知且不对本文档进行修订的情况下发生改变。 欲获得该数据表的浏览器版本，请查阅左侧的导航栏。

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) |
|--------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| ISO7131CCDBQ | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7131CC |
| ISO7131CCDBQ.A | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7131CC |
| ISO7131CCDBQR | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7131CC |
| ISO7131CCDBQR.A | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7131CC |
| ISO7131CCDBQRG4 | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7131CC |
| ISO7131CCDBQRG4.A | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7131CC |
| ISO7140CCDBQ | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140CC |
| ISO7140CCDBQ.A | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140CC |
| ISO7140CCDBQR | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140CC |
| ISO7140CCDBQR.A | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140CC |
| ISO7140CCDBQRG4 | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140CC |
| ISO7140CCDBQRG4.A | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140CC |
| ISO7140FCCDBQ | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140FC |
| ISO7140FCCDBQ.A | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140FC |
| ISO7140FCCDBQG4 | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140FC |
| ISO7140FCCDBQG4.A | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140FC |
| ISO7140FCCDBQR | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140FC |
| ISO7140FCCDBQR.A | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7140FC |
| ISO7141CCDBQ | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7141CC |
| ISO7141CCDBQ.A | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7141CC |
| ISO7141CCDBQR | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7141CC |
| ISO7141CCDBQR.A | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7141CC |
| ISO7141CCDBQRG4 | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7141CC |
| ISO7141CCDBQRG4.A | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7141CC |
| ISO7141FCCDBQ | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7141FC |
| ISO7141FCCDBQ.A | Active | Production | SSOP (DBQ) 16 | 75 TUBE | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7141FC |
| ISO7141FCCDBQR | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7141FC |
| ISO7141FCCDBQR.A | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7141FC |
| ISO7141FCCDBQRG4 | Active | Production | SSOP (DBQ) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | 7141FC |

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

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

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

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

(4) Lead finish/Ball material: Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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

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

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

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

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

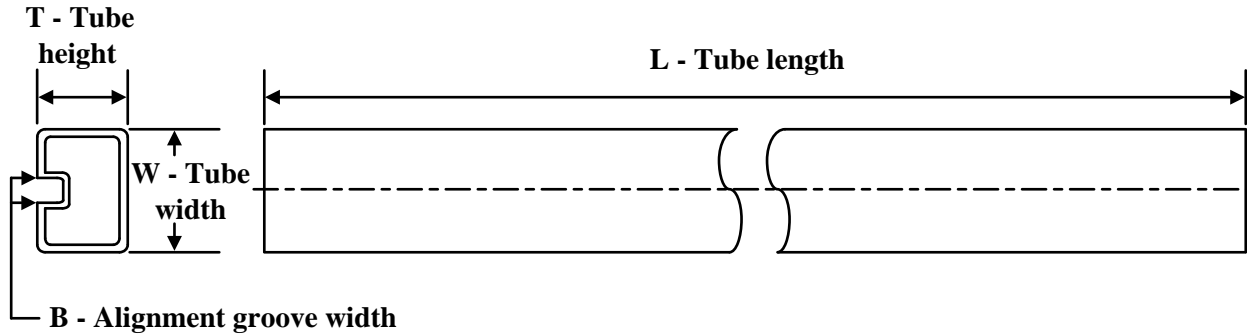

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| ISO7131CCDBQR | SSOP | DBQ | 16 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| ISO7131CCDBQRG4 | SSOP | DBQ | 16 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| ISO7140CCDBQR | SSOP | DBQ | 16 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| ISO7140CCDBQRG4 | SSOP | DBQ | 16 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| ISO7140FCCDBQR | SSOP | DBQ | 16 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| ISO7141CCDBQR | SSOP | DBQ | 16 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| ISO7141CCDBQRG4 | SSOP | DBQ | 16 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| ISO7141FCCDBQR | SSOP | DBQ | 16 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| ISO7141FCCDBQRG4 | SSOP | DBQ | 16 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

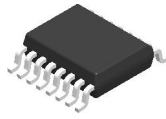
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| ISO7131CCDBQR | SSOP | DBQ | 16 | 2500 | 350.0 | 350.0 | 43.0 |
| ISO7131CCDBQRG4 | SSOP | DBQ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

TUBE


*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------------|--------------|--------------|------|------|--------|--------|--------|--------|
| ISO7131CCDBQ | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |
| ISO7131CCDBQ | DBQ | SSOP | 16 | 75 | 506.6 | 8 | 3940 | 4.32 |
| ISO7131CCDBQ.A | DBQ | SSOP | 16 | 75 | 506.6 | 8 | 3940 | 4.32 |
| ISO7131CCDBQ.A | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |
| ISO7131CCDBQR | DBQ | SSOP | 16 | 2500 | 506.6 | 8 | 3940 | 4.32 |
| ISO7131CCDBQR.A | DBQ | SSOP | 16 | 2500 | 506.6 | 8 | 3940 | 4.32 |
| ISO7140CCDBQ | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |
| ISO7140CCDBQ | DBQ | SSOP | 16 | 75 | 506.6 | 8 | 3940 | 4.32 |
| ISO7140CCDBQ.A | DBQ | SSOP | 16 | 75 | 506.6 | 8 | 3940 | 4.32 |
| ISO7140CCDBQ.A | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |
| ISO7140CCDBQR | DBQ | SSOP | 16 | 2500 | 506.6 | 8 | 3940 | 4.32 |
| ISO7140CCDBQR.A | DBQ | SSOP | 16 | 2500 | 506.6 | 8 | 3940 | 4.32 |
| ISO7140FCCDBQ | DBQ | SSOP | 16 | 75 | 506.6 | 8 | 3940 | 4.32 |
| ISO7140FCCDBQ | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |
| ISO7140FCCDBQ.A | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |
| ISO7140FCCDBQ.A | DBQ | SSOP | 16 | 75 | 506.6 | 8 | 3940 | 4.32 |
| ISO7140FCCDBQG4 | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |
| ISO7140FCCDBQG4.A | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |
| ISO7140FCCDBQR | DBQ | SSOP | 16 | 2500 | 506.6 | 8 | 3940 | 4.32 |
| ISO7140FCCDBQR.A | DBQ | SSOP | 16 | 2500 | 506.6 | 8 | 3940 | 4.32 |
| ISO7141CCDBQ | DBQ | SSOP | 16 | 75 | 506.6 | 8 | 3940 | 4.32 |
| ISO7141CCDBQ | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |
| ISO7141CCDBQ.A | DBQ | SSOP | 16 | 75 | 506.6 | 8 | 3940 | 4.32 |
| ISO7141CCDBQ.A | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |
| ISO7141CCDBQR | DBQ | SSOP | 16 | 2500 | 506.6 | 8 | 3940 | 4.32 |
| ISO7141CCDBQR.A | DBQ | SSOP | 16 | 2500 | 506.6 | 8 | 3940 | 4.32 |
| ISO7141FCCDBQ | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |
| ISO7141FCCDBQ | DBQ | SSOP | 16 | 75 | 506.6 | 8 | 3940 | 4.32 |
| ISO7141FCCDBQ.A | DBQ | SSOP | 16 | 75 | 505.46 | 6.76 | 3810 | 4 |

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|------------------|--------------|--------------|------|------|--------|--------|--------|--------|
| ISO7141FCCDBQ.A | DBQ | SSOP | 16 | 75 | 506.6 | 8 | 3940 | 4.32 |
| ISO7141FCCDBQR | DBQ | SSOP | 16 | 2500 | 506.6 | 8 | 3940 | 4.32 |
| ISO7141FCCDBQR.A | DBQ | SSOP | 16 | 2500 | 506.6 | 8 | 3940 | 4.32 |

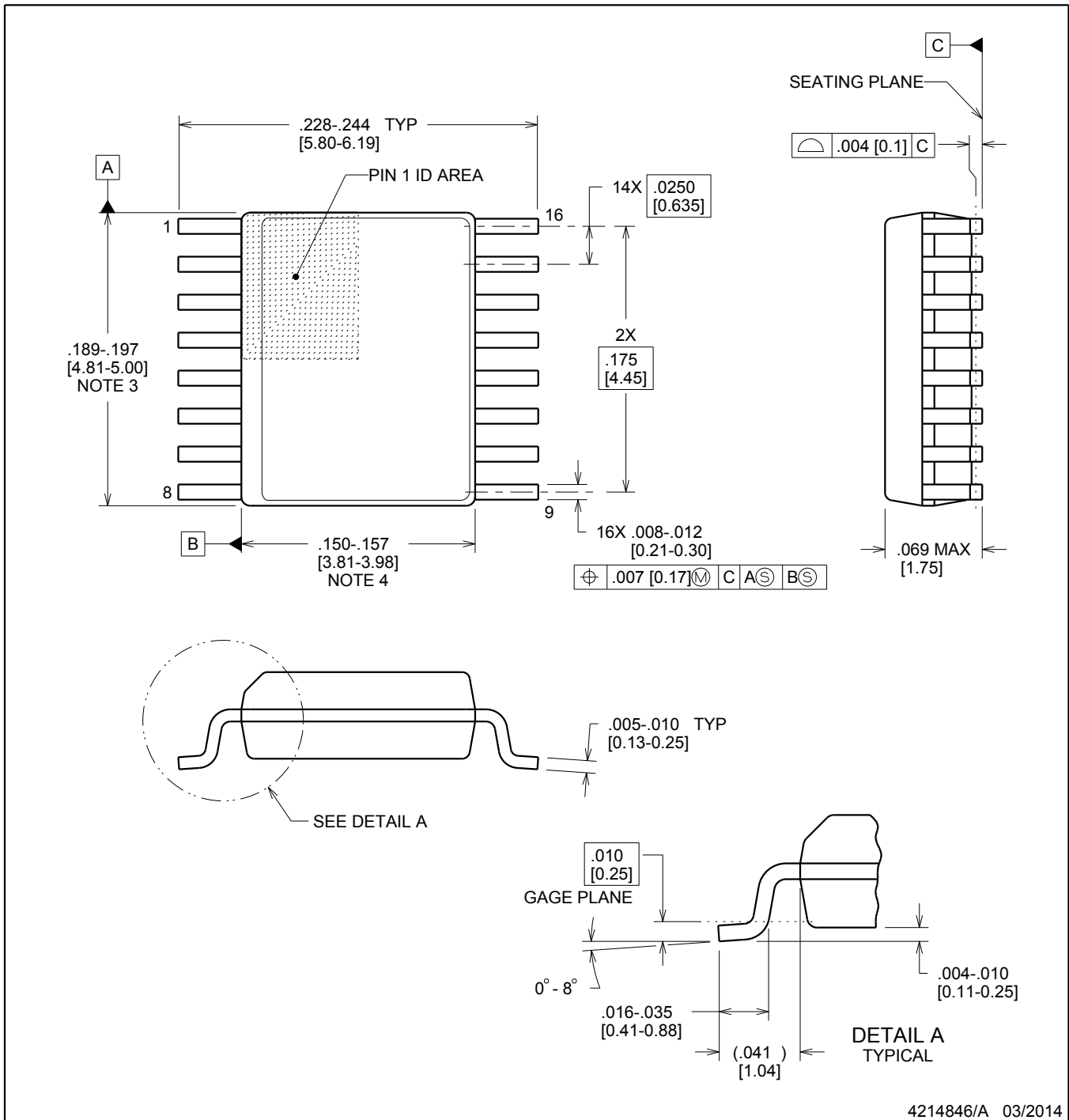


DBQ0016A

PACKAGE OUTLINE

SSOP - 1.75 mm max height

SHRINK SMALL-OUTLINE PACKAGE



NOTES:

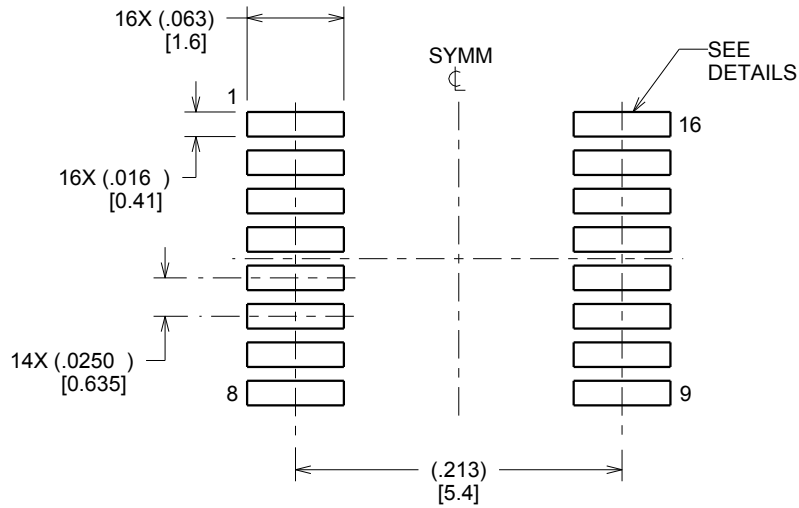
1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate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

EXAMPLE BOARD LAYOUT

DBQ0016A

SSOP - 1.75 mm max height

SHRINK SMALL-OUTLINE PACKAGE



LAND PATTERN EXAMPLE
SCALE:8X



SOLDER MASK DETAILS

4214846/A 03/2014

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

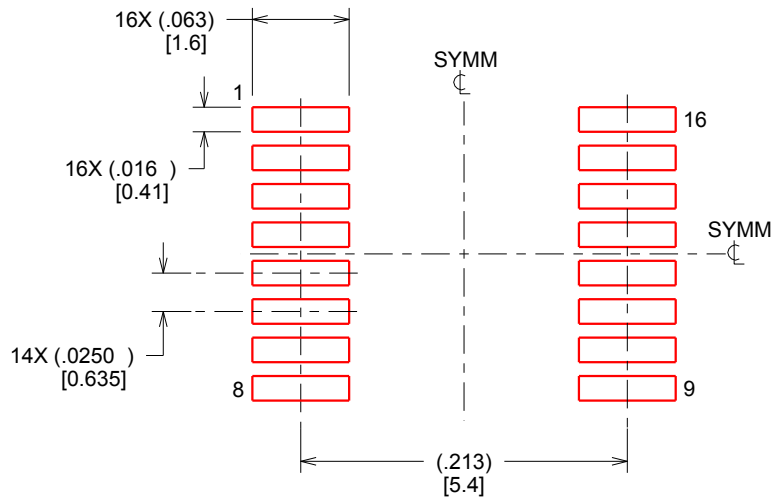
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBQ0016A

SSOP - 1.75 mm max height

SHRINK SMALL-OUTLINE PACKAGE



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

4214846/A 03/2014

NOTES: (continued)

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

重要通知和免责声明

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