

ISO7810 高性能 8000 V_{PK} 增强型单通道数字隔离器

1 特性

- 信号传输速率：高达 100Mbps
- 宽电源电压范围：2.25V 至 5.5V
- 2.25V 至 5.5V 电平转换
- 宽温度范围：-55°C 至 125°C
- 低功耗，每通道电流典型值为 1.8mA（1Mbps 时）
- 低传播延迟：典型值 11ns（5V 电源供电时）
- 行业领先的 CMTI：±100kV/μs
- 优异的电磁兼容性 (EMC)
- 系统级静电放电 (ESD)、瞬态放电 (EFT) 以及抗浪涌保护
- 低辐射
- 隔离栅寿命：> 25 年
- 宽体 (DW) 小外形尺寸集成电路 (SOIC)-16 封装
- 安全及管理批准：
 - 8000 V_{PK} V_{IOTM} 和 2121 V_{PK} V_{IORM} 增强型隔离，符合 DIN V VDE V 0884-10 (VDE V 0884-10):2006-12 标准
 - 符合 UL 1577 标准且长达 1 分钟的 5.7kV_{RMS} 隔离
 - CSA 组件接受通知 5A, IEC 60950-1、IEC 60601-1 和 IEC 61010-1 终端设备标准
 - 通过 GB4943.1-2011 CQC 认证

2 应用范围

- 工业自动化
- 电机控制
- 电源
- 太阳能逆变器
- 医疗设备
- 混合动力电动汽车

3 说明

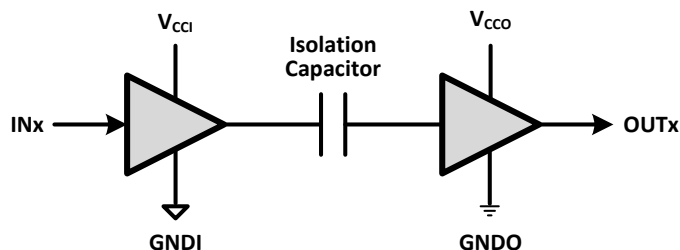
7810ISO 是一款高性能单通道数字隔离器，隔离电压高达 8000 V_{PK}。该器件已通过符合 VDE、CSA 和 CQC 标准的增强型隔离认证。在隔离 CMOS 或者 LVCMOS 数字 I/O 时，该隔离器可提供高电磁抗扰度和低辐射，且具有低功耗特性。每个隔离通道的逻辑输入和输出缓冲器均由二氧化硅 (SiO₂) 绝缘栅栅分离开来。如果出现输入功率或信号丢失，ISO7810 器件默认输出“高”电平，ISO7810F 器件默认输出“低”电平。更多详细信息，请参见 [器件功能模式](#)。与隔离式电源一起使用时，此器件可防止数据总线或者其它电路上的噪音电流进入本地接地，以及干扰或损坏敏感电路。凭借创新的芯片设计和布线技术，ISO7810 的电磁兼容性得到了显著增强，从而可确保提供系统级 ESD、EFT 和浪涌保护并符合辐射标准。ISO7810 采用 16 引脚 SOIC 宽体 (DW) 封装。

器件信息⁽¹⁾

| 部件号 | 封装 | 封装尺寸 (标称值) |
|---------------------|---------------|------------------|
| ISO7810 ISO7810F | SOIC, DW (16) | 10.30mm x 7.50mm |

(1) 要了解所有可用封装，请见数据表末尾的可订购产品附录。

简化电路原理图



(1) V_{CCI} 和 GNDI 分别是输入通道的电源和接地连接。

(2) V_{CCO} 和 GNDO 分别是输出通道的电源和接地连接。



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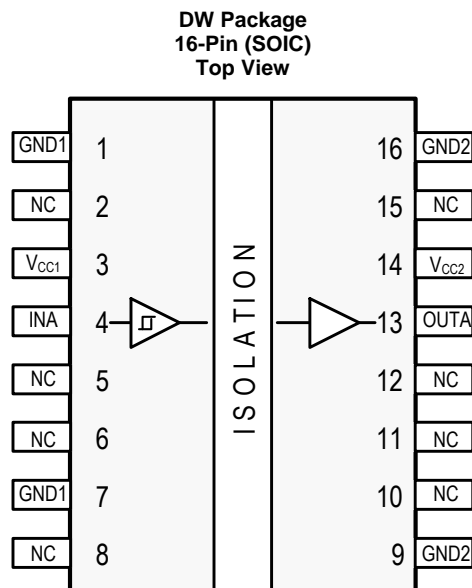
4 修订历史记录

Changes from Original (July 2015) to Revision A

Page

| | |
|------------------------------|----------|
| • 已从“单页产品预览”更改为“量产”数据表 | 1 |
|------------------------------|----------|

5 Pin Configuration and Functions



Pin Functions

| PIN | | I/O | DESCRIPTION |
|-----------|----------------------------|-----|---------------------------------|
| NAME | NO. | | |
| GND1 | 1, 7 | – | Ground connection for V_{CC1} |
| GND2 | 9, 16 | – | Ground connection for V_{CC2} |
| INA | 4 | I | Input, channel A |
| NC | 2, 5, 6, 8, 10, 11, 12, 15 | – | Not connected |
| OUTA | 13 | O | Output, channel A |
| V_{CC1} | 3 | – | Power supply, V_{CC1} |
| V_{CC2} | 14 | – | Power supply, V_{CC2} |

6 Specifications

6.1 Absolute Maximum Ratings⁽¹⁾

| | | MIN | MAX | UNIT |
|--------------------------------|--------------------|------|----------------------|------|
| Supply voltage ⁽²⁾ | V_{CC1}, V_{CC2} | -0.5 | 6 | V |
| Voltage | INx, OUTx | -0.5 | $V_{CC} + 0.5^{(3)}$ | V |
| Output Current | I_O | -15 | 15 | mA |
| Storage temperature, T_{stg} | | -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, all pins ⁽¹⁾ | ±6000 | V |
| | | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins ⁽²⁾ | ±1500 | V |

- (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 | TYP | MAX | UNIT |
|--------------------|-------------------------------------|------------------------------|-----|----------------------|------|
| V_{CC1}, V_{CC2} | Supply voltage | 2.25 | | 5.5 | V |
| I_{OH} | High-level output current | $V_{CCO}^{(1)} = 5\text{ V}$ | | -4 | mA |
| | | $V_{CCO} = 3.3\text{ V}$ | | -2 | |
| | | $V_{CCO} = 2.5\text{ V}$ | | -1 | |
| I_{OL} | Low-level output current | $V_{CCO} = 5\text{ V}$ | | 4 | mA |
| | | $V_{CCO} = 3.3\text{ V}$ | | 2 | |
| | | $V_{CCO} = 2.5\text{ V}$ | | 1 | |
| V_{IH} | High-level input voltage | $0.7 \times V_{CCI}^{(1)}$ | | V_{CCI} | V |
| V_{IL} | Low-level input voltage | 0 | | $0.3 \times V_{CCI}$ | V |
| t_{ui} | Input pulse duration | 7 | | | ns |
| DR | Signaling rate | 0 | | 100 | Mbps |
| T_J | Junction temperature ⁽²⁾ | -55 | | 150 | °C |
| T_A | Ambient temperature | -55 | 25 | 125 | °C |

- (1) V_{CCI} = Input-side V_{CC} ; V_{CCO} = Output-side V_{CC} .
- (2) To maintain the recommended operating conditions for T_J , see the [Thermal Information](#) table.

6.4 Thermal Information

| THERMAL METRIC | | SOIC | UNIT |
|--------------------------|----------------------------------------------|--------------|------|
| | | 16 Pins (DW) | |
| R _{θJA} | Junction-to-ambient thermal resistance | 84.7 | °C/W |
| R _{θJC(top)} | Junction-to-case(top) thermal resistance | 47.3 | |
| R _{θJB} | Junction-to-board thermal resistance | 49.4 | |
| Ψ _{JT} | Junction-to-top characterization parameter | 19.1 | |
| Ψ _{JB} | Junction-to-board characterization parameter | 48.8 | |
| R _{θJC(bottom)} | Junction-to-case(bottom) thermal resistance | n/a | |

6.5 Power Rating

| | | VALUE | UNIT |
|-----------------|------------------------------------------------|-------|------|
| P _D | Maximum power dissipation by ISO7810 | 100 | mW |
| P _{D1} | Maximum power dissipation by side-1 of ISO7810 | 40 | |
| P _{D2} | Maximum power dissipation by side-2 of ISO7810 | 60 | |

V_{CC1} = V_{CC2} = 5.5 V, T_J = 150°C, C_L = 15 pF, input a 50 MHz 50% duty cycle square wave

6.6 Electrical Characteristics, 5 V

V_{CC1} = V_{CC2} = 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 Figure 7 | V _{CCX} ⁽¹⁾ - 0.4 | V _{CCX} ⁽¹⁾ - 0.2 | | V |
| V _{OL} | Low-level output voltage | I _{OL} = 4 mA; see Figure 7 | | 0.2 | 0.4 | V |
| V _{I(HYS)} | Input threshold voltage hysteresis | | 0.1 x V _{CCX} ⁽¹⁾ | | | V |
| I _{IH} | High-level input current | V _{IH} = V _{CCX} ⁽¹⁾ at INx or ENx | | | 10 | μA |
| I _{IL} | Low-level input current | V _{IL} = 0 V at INx or ENx | -10 | | | |
| CMTI | Common-mode transient immunity | V _I = V _{CCX} ⁽¹⁾ or 0 V; see Figure 9 | 50 | 100 | | kV/μs |
| I _{CC1} | Supply current | DC Signal | DC signal: V _I = 0 V (Devices with suffix F), V _I = V _{CCX} (Devices without suffix F) | 0.6 | 1.1 | mA |
| I _{CC2} | | | | 0.6 | 1.1 | |
| I _{CC1} | | | | 1.8 | 2.7 | |
| I _{CC2} | | | | 0.7 | 1.1 | |
| I _{CC1} | Supply current | 1 Mbps | AC Signal: All channels switching with square wave clock input; C _L = 15 pF | 1.2 | 1.9 | mA |
| I _{CC2} | | | | 0.6 | 1.1 | |
| I _{CC1} | | 10 Mbps | | 1.2 | 1.9 | |
| I _{CC2} | | | | 1.1 | 1.6 | |
| I _{CC1} | | 100 Mbps | | 1.3 | 2 | |
| I _{CC2} | | | | 5.7 | 6.7 | |

(1) V_{CC1} = Input-side V_{CC}; V_{CC0} = Output-side V_{CC}.

6.7 Electrical Characteristics, 3.3 V

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

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------|------------------------------------|---------------------------------------------------------|----------------------------------------------------------------------------------------------------|-----------------------|-----|-------------------|
| V_{OH} | High-level output voltage | $I_{OH} = -2 \text{ mA}$; see Figure 7 | $V_{CCX}^{(1)} - 0.4$ | $V_{CCX}^{(1)} - 0.2$ | | V |
| V_{OL} | Low-level output voltage | $I_{OL} = 2 \text{ mA}$; see Figure 7 | | 0.2 | 0.4 | V |
| $V_{I(HYS)}$ | Input threshold voltage hysteresis | | $0.1 \times V_{CCX}^{(1)}$ | | | V |
| I_{IH} | High-level input current | $V_{IH} = V_{CCX}^{(1)}$ at INx or ENx | | | 10 | μA |
| I_{IL} | Low-level input current | $V_{IL} = 0 \text{ V}$ at INx or ENx | -10 | | | |
| CMTI | Common-mode transient immunity | $V_I = V_{CCX}$ or 0 V; see Figure 9 | 50 | 100 | | kV/ μs |
| I_{CC1} | Supply current | DC Signal | DC signal: $V_I = 0 \text{ V}$ (Devices with suffix F), $V_I = V_{CCX}$ (Devices without suffix F) | 0.6 | 1.1 | mA |
| I_{CC2} | | | | 0.6 | 1 | |
| I_{CC1} | | | | 1.8 | 2.7 | |
| I_{CC2} | | | | 0.6 | 1.1 | |
| I_{CC1} | Supply current | 1 Mbps | AC Signal: All channels switching with square wave clock input; $C_L = 15 \text{ pF}$ | 1.2 | 1.9 | mA |
| I_{CC2} | | | | 0.6 | 1.1 | |
| I_{CC1} | | 10 Mbps | | 1.2 | 1.9 | |
| I_{CC2} | | | | 0.9 | 1.4 | |
| I_{CC1} | | 100 Mbps | | 1.3 | 2 | |
| I_{CC2} | | | | 4.1 | 4.9 | |

 (1) V_{CC1} = Input-side V_{CC} ; V_{CC0} = Output-side V_{CC} .

6.8 Electrical Characteristics, 2.5 V

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

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------|------------------------------------|---------------------------------------------------------|----------------------------------------------------------------------------------------------------|-----------------------|-----|-------------------|
| V_{OH} | High-level output voltage | $I_{OH} = -1 \text{ mA}$; see Figure 7 | $V_{CCX}^{(1)} - 0.4$ | $V_{CCX}^{(1)} - 0.2$ | | V |
| V_{OL} | Low-level output voltage | $I_{OL} = 1 \text{ mA}$; see Figure 7 | | 0.2 | 0.4 | V |
| $V_{I(HYS)}$ | Input threshold voltage hysteresis | | $0.1 \times V_{CCX}^{(1)}$ | | | V |
| I_{IH} | High-level input current | $V_{IH} = V_{CCX}^{(1)}$ at INx or ENx | | | 10 | μA |
| I_{IL} | Low-level input current | $V_{IL} = 0 \text{ V}$ at INx or ENx | -10 | | | |
| CMTI | Common-mode transient immunity | $V_I = V_{CCX}$ or 0 V; see Figure 9 | 70 | 100 | | kV/ μs |
| I_{CC1} | Supply current | DC Signal | DC signal: $V_I = 0 \text{ V}$ (Devices with suffix F), $V_I = V_{CCX}$ (Devices without suffix F) | 0.6 | 1.1 | mA |
| I_{CC2} | | | | 0.6 | 1 | |
| I_{CC1} | | | | 1.8 | 2.7 | |
| I_{CC2} | | | | 0.6 | 1.1 | |
| I_{CC1} | Supply current | 1 Mbps | AC Signal: All channels switching with square wave clock input; $C_L = 15 \text{ pF}$ | 1.2 | 1.9 | mA |
| I_{CC2} | | | | 0.6 | 1.1 | |
| I_{CC1} | | 10 Mbps | | 1.2 | 1.9 | |
| I_{CC2} | | | | 0.9 | 1.3 | |
| I_{CC1} | | 100 Mbps | | 1.3 | 2 | |
| I_{CC2} | | | | 3.3 | 4.1 | |

 (1) V_{CC1} = Input-side V_{CC} ; V_{CC0} = Output-side V_{CC} .

6.9 Switching Characteristics, 5 V

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

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------------------------------------------------|----------------------------------------------------------------|-----|------|-----|---------------|
| t_{PLH} , t_{PHL} Propagation delay time | See Figure 7 | 6 | 10.7 | 16 | ns |
| PWD ⁽¹⁾ Pulse width distortion $ t_{PHL} - t_{PLH} $ | | | 0.6 | 4.6 | |
| $t_{sk(pp)}$ ⁽²⁾ Part-to-part skew time | | | | 4.5 | ns |
| t_r Output signal rise time | See Figure 7 | | 2.4 | 3.9 | ns |
| t_f Output signal fall time | | | | 2.4 | |
| t_{is} Default output delay time from input power loss | Measured from the time V_{CC} goes below 1.7 V. See Figure 8 | | 0.2 | 9 | μs |
| t_{ie} Time interval error | 2^{16} - 1 PRBS data at 100 Mbps | | 1 | | ns |

- (1) Also known as Pulse Skew.
(2) $t_{sk(pp)}$ 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, 3.3 V

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

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------------------------------------------------|----------------------------------------------------------------|-----|------|-----|---------------|
| t_{PLH} , t_{PHL} Propagation delay time | See Figure 7 | 6 | 10.8 | 16 | ns |
| PWD ⁽¹⁾ Pulse width distortion $ t_{PHL} - t_{PLH} $ | | | | 0.7 | |
| $t_{sk(pp)}$ ⁽²⁾ Part-to-part skew time | | | | 4.5 | ns |
| t_r Output signal rise time | See Figure 7 | | 1.3 | 3 | |
| t_f Output signal fall time | | | | 1.3 | 3 |
| t_{is} Default output delay time from input power loss | Measured from the time V_{CC} goes below 1.7 V. See Figure 8 | | 0.2 | 9 | μs |
| t_{ie} Time interval error | 2^{16} - 1 PRBS data at 100 Mbps | | 1 | | ns |

- (1) Also known as Pulse Skew.
(2) $t_{sk(pp)}$ 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, 2.5 V

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

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------------------------------------------------|----------------------------------------------------------------|-----|------|------|---------------|
| t_{PLH} , t_{PHL} Propagation delay time | See Figure 7 | 7.5 | 11.7 | 17.5 | ns |
| PWD ⁽¹⁾ Pulse width distortion $ t_{PHL} - t_{PLH} $ | | | | 0.7 | |
| $t_{sk(pp)}$ ⁽²⁾ Part-to-part skew time | | | | 4.5 | ns |
| t_r Output signal rise time | See Figure 7 | | 1.8 | 3.5 | |
| t_f Output signal fall time | | | | 1.8 | 3.5 |
| t_{is} Default output delay time from input power loss | Measured from the time V_{CC} goes below 1.7 V. See Figure 8 | | 0.2 | 9 | μs |
| t_{ie} Time interval error | 2^{16} - 1 PRBS data at 100 Mbps | | 1 | | ns |

- (1) Also known as Pulse Skew.
(2) $t_{sk(pp)}$ 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 Typical Characteristics

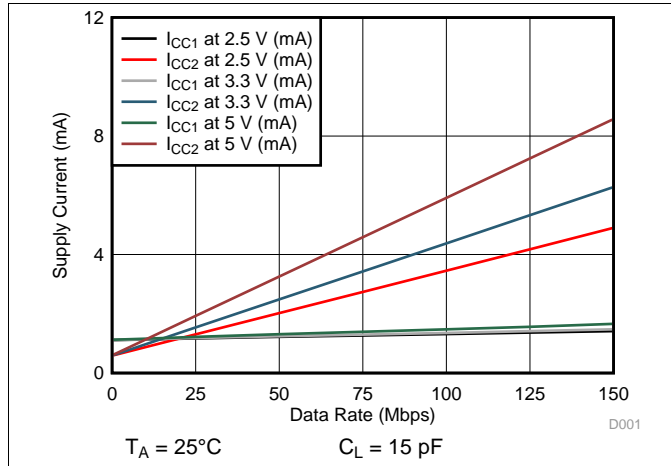


Figure 1. Supply Current vs Data Rate (with 15 pF Load)

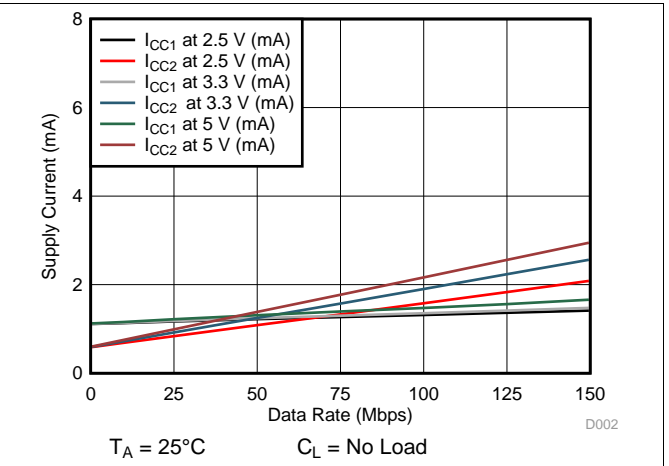


Figure 2. Supply Current vs Data Rate (with No Load)

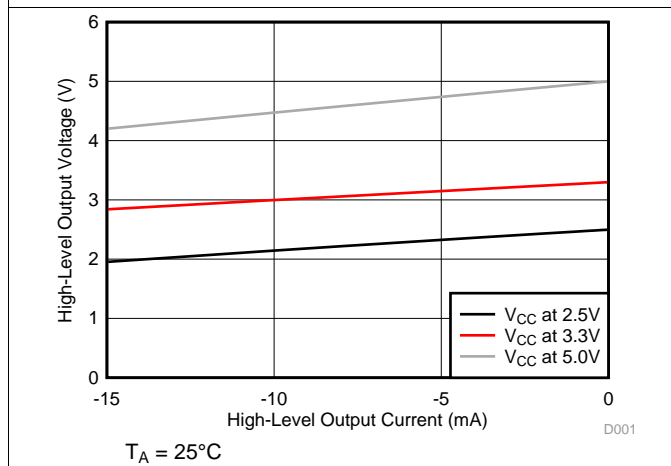


Figure 3. High-Level Output Voltage vs High-level Output Current

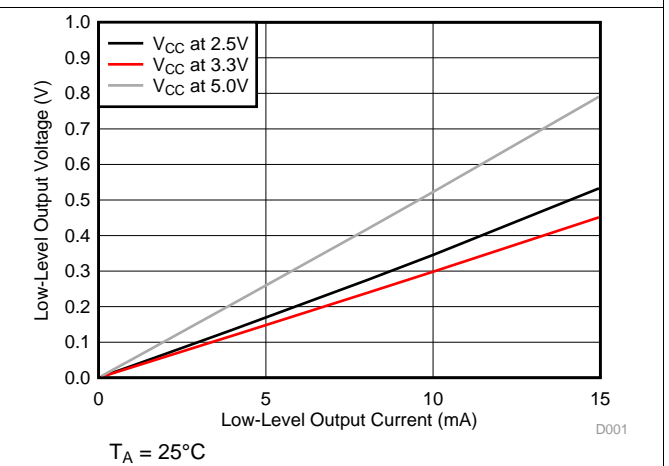


Figure 4. Low-Level Output Voltage vs Low-Level Output Current

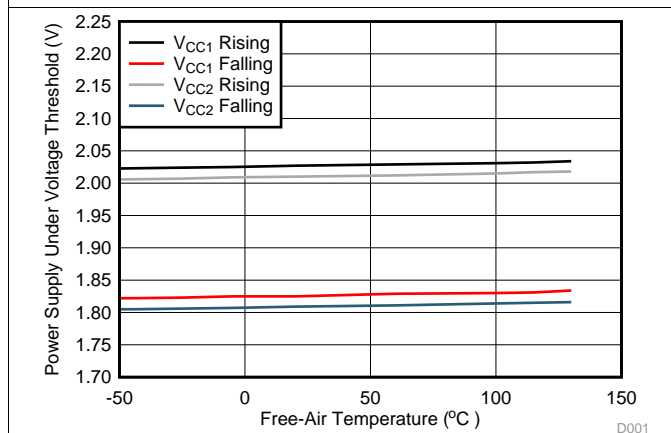


Figure 5. Power Supply Undervoltage Threshold vs Free-Air Temperature

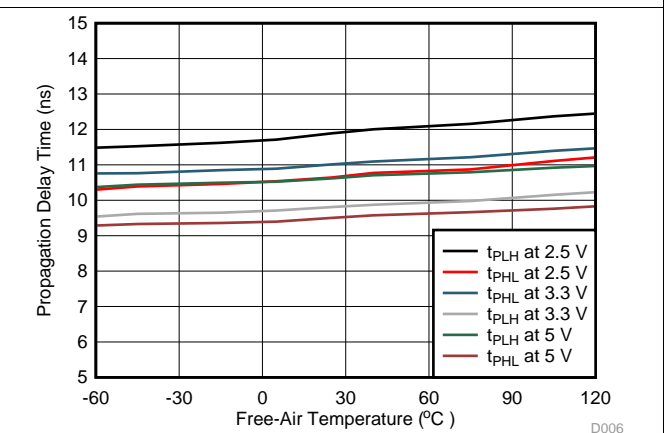
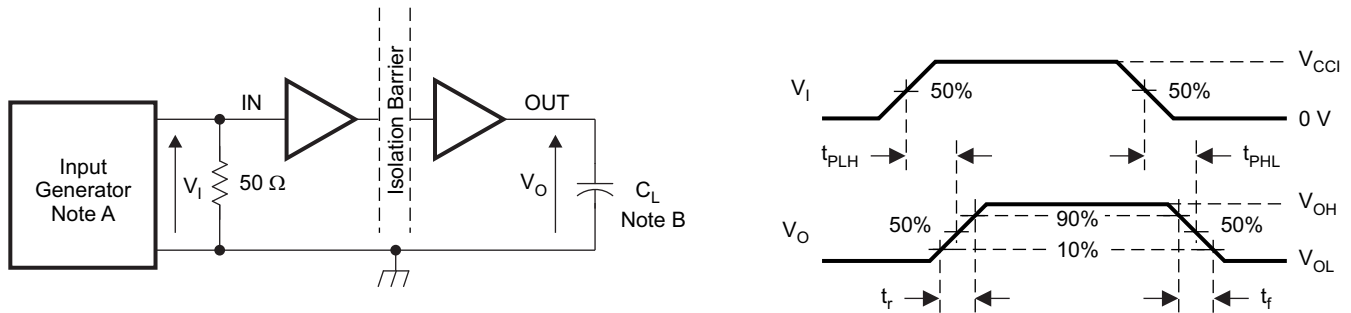


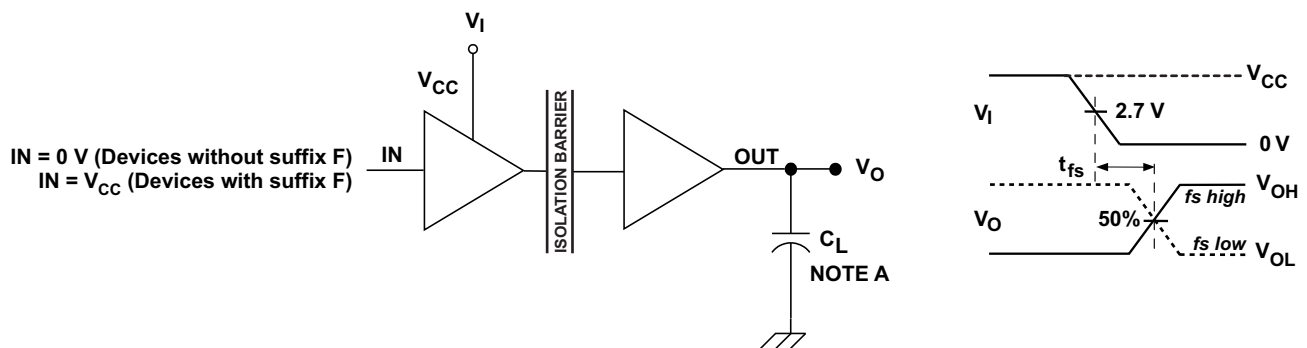
Figure 6. Propagation Delay Time vs Free-Air Temperature

7 Parameter Measurement Information



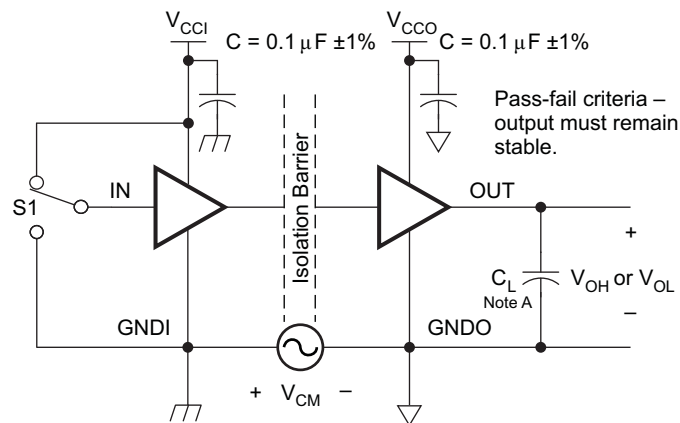
- A. The input pulse is supplied by a generator having the following characteristics: PRR \leq 50 kHz, 50% duty cycle, $t_r \leq$ 3 ns, $t_f \leq$ 3ns, $Z_O = 50 \Omega$. At the input, 50Ω resistor is required to terminate Input Generator signal. It is not needed in actual application.
- B. $C_L = 15$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

Figure 7. Switching Characteristics Test Circuit and Voltage Waveforms



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

Figure 8. Default Output Delay Time Test Circuit and Voltage Waveforms



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

Figure 9. Common-Mode Transient Immunity Test Circuit

8 Detailed Description

8.1 Overview

ISO7810 employs an ON-OFF Keying (OOK) modulation scheme to transmit the digital data across a silicon dioxide based isolation barrier. The transmitter sends a high frequency carrier across the barrier to represent one digital state and sends no signal to represent the other digital state. The receiver demodulates the signal after advanced signal conditioning and produces the output through a buffer stage. These devices also incorporate advanced circuit techniques to maximize the CMTI performance and minimize the radiated emissions due to the high frequency carrier and IO buffer switching. The conceptual block diagram of a digital capacitive isolator, [Figure 10](#), shows a functional block diagram of a typical channel.

8.2 Functional Block Diagram

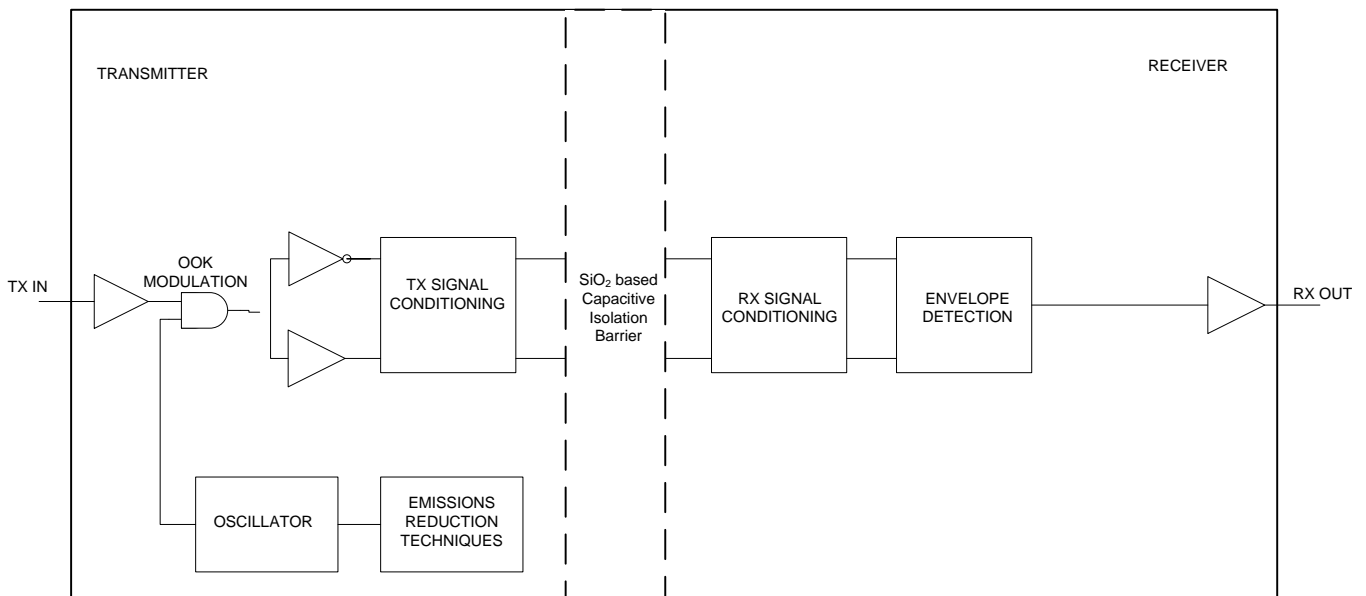


Figure 10. Conceptual Block Diagram of a Digital Capacitive Isolator

Also a conceptual detail of how the ON/OFF Keying scheme works is shown in [Figure 11](#).

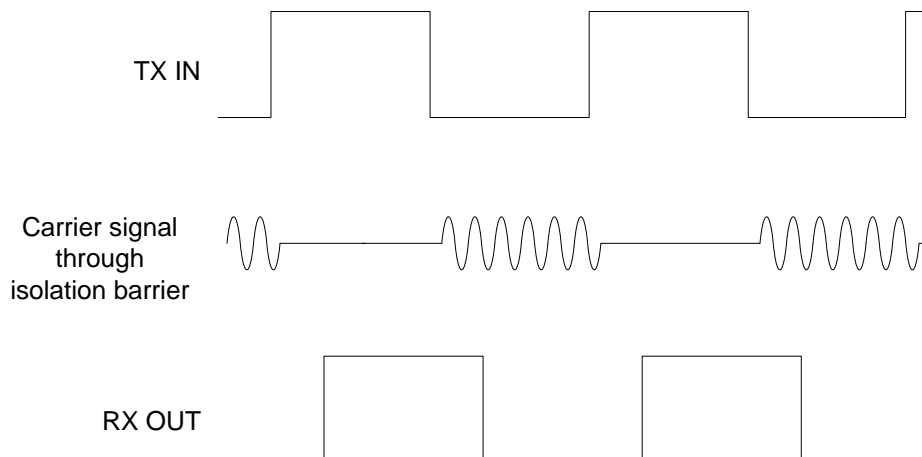


Figure 11. On-Off Keying (OOK) Based Modulation Scheme

8.3 Feature Description

ISO7810 is available in two channel configurations and default output state options to enable a variety of application uses.

| PRODUCT | CHANNEL DIRECTION | RATED ISOLATION | MAX DATA RATE | DEFAULT OUTPUT |
|----------|-------------------|-------------------------------------------------------------|---------------|----------------|
| ISO7810 | 1 Forward | 5700 V _{RMS} / 8000 V _{PK} ⁽¹⁾ | 100 Mbps | High |
| ISO7810F | 1 Forward | 5700 V _{RMS} / 8000 V _{PK} ⁽¹⁾ | 100 Mbps | Low |

(1) See the [Regulatory Information](#) section for detailed isolation ratings.

8.3.1 High Voltage Feature Description

8.3.1.1 Package Insulation and Safety-Related Specifications

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 | DW-16 | 8 | | mm |
| L(I02) ⁽¹⁾ | Minimum external tracking (creepage) | Shortest terminal-to-terminal distance across the package surface | DW-16 | 8 | | mm |
| CTI | Tracking resistance (comparative tracking index) | DIN EN 60112 (VDE 0303-11); IEC 60112; UL 746A | | 600 | | V |
| R _{IO} | Isolation resistance, input to output ⁽²⁾ | V _{IO} = 500 V, T _A = 25°C | | 10 ¹² | | Ω |
| | | V _{IO} = 500 V, 100°C ≤ T _A ≤ max | | 10 ¹¹ | | Ω |
| C _{IO} | Barrier capacitance, input to output ⁽²⁾ | V _{IO} = 0.4 x sin (2πft), f = 1 MHz | | 2 | | pF |
| C _I | Input capacitance ⁽³⁾ | V _I = V _{CC} /2 + 0.4 x sin (2πft), f = 1 MHz, V _{CC} = 5 V | | 2 | | pF |

(1) Per JEDEC package dimensions.

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

(3) Measured from input pin to ground.

NOTE

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

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

8.3.1.2 Insulation Characteristics

| PARAMETER ⁽¹⁾ | | TEST CONDITIONS | SPECIFICATION | UNIT |
|----------------------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|
| DTI | Distance through the insulation | Minimum internal gap (internal clearance) | 21 | μm |
| V _{IOWM} | Maximum isolation working voltage | Time dependent dielectric breakdown (TDDB) test | 1500 | V _{RMS} |
| | | | 2121 | V _{DC} |
| DIN V VDE V 0884-10 (VDE V 0884-10):2006-12 | | | | |
| V _{IOTM} | Maximum transient isolation voltage | V _{TEST} = V _{IOTM} t = 60 sec (qualification) t = 1 sec (100% production) | 8000 | V _{PK} |
| V _{IOSM} | Maximum surge isolation voltage | Test method per IEC 60065, 1.2/50 μs waveform, V _{TEST} = 1.6 x V _{IOSM} = 12800 V _{PK} (qualification) | 8000 | V _{PK} |
| V _{IORM} | Maximum repetitive peak isolation voltage | | 2121 | V _{PK} |
| V _{PR} | Input-to-output test voltage | Method a, After Input/Output safety test subgroup 2/3, V _{PR} = V _{IORM} x 1.2, t = 10 s, Partial discharge < 5 pC | 2545 | V _{PK} |
| | | Method a, After environmental tests subgroup 1, V _{PR} = V _{IORM} x 1.6, t = 10 s, Partial Discharge < 5 pC | 3394 | |
| | | Method b1, After environmental tests subgroup 1, V _{PR} = V _{IORM} x 1.875, t = 1 s (100% Production test) Partial discharge < 5 pC | 3977 | |
| R _S | Isolation resistance | V _{IO} = 500 V at T _S | >10 ⁹ | Ω |
| | Pollution degree | | 2 | |
| UL 1577 | | | | |
| V _{ISO} | Withstanding isolation voltage | V _{TEST} = V _{ISO} = 5700 V _{RMS} , t = 60 sec (qualification); V _{TEST} = 1.2 x V _{ISO} = 6840 V _{RMS} , t = 1 sec (100% production) | 5700 | V _{RMS} |

(1) Climatic Classification 55/125/21

8.3.1.3 IEC 60664-1 Ratings Table

| PARAMETER | | TEST CONDITIONS | SPECIFICATION |
|-----------------------------|------------|---------------------------------------------|---------------|
| Basic isolation group | | Material group | I |
| Installation classification | DW package | Rated mains voltage ≤ 600 V _{RMS} | I–IV |
| | | Rated mains voltage ≤ 1000 V _{RMS} | I–III |

8.3.1.4 Regulatory Information

DW package certifications are complete.

| VDE | CSA | UL | CQC |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Certified according to DIN V VDE V 0884-10 (VDE V 0884-10):2006-12 and DIN EN 60950-1 (VDE 0805 Teil 1):2011-01 | Approved under CSA Component Acceptance Notice 5A, IEC 60950-1, IEC 61010-1, and IEC 60601-1 | Recognized under UL 1577 Component Recognition Program | Certified according to GB 4943.1-2011 |
| Reinforced insulation Maximum transient isolation voltage, 8000 V _{PK} ; Maximum repetitive peak isolation voltage, 2121 V _{PK} ; Maximum surge isolation voltage, 8000 V _{PK} | Reinforced insulation per CSA 61010-1-12 and IEC 61010-1 3rd Ed., 300 V _{RMS} max working voltage; Reinforced insulation per CSA 60950-1-07+A1+A2 and IEC 60950-1 2nd Ed., 800 V _{RMS} max working voltage (pollution degree 2, material group I); 2 MOPP (Means of Patient Protection) per CSA 60601-1:14 and IEC 60601-1 Ed. 3.1, 250 V _{RMS} (354 V _{PK}) max working voltage | Single protection, 5700 V _{RMS} ⁽¹⁾ | Reinforced Insulation, Altitude ≤ 5000 m, Tropical Climate, 250 V _{RMS} maximum working voltage |
| Certificate number: 40040142 | Master contract number: 220991 | File number: E181974 | Certificate number: CQC15001121716 |

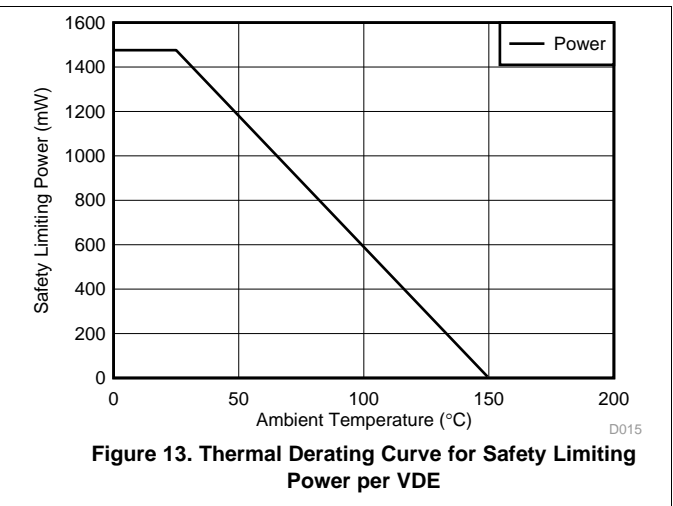
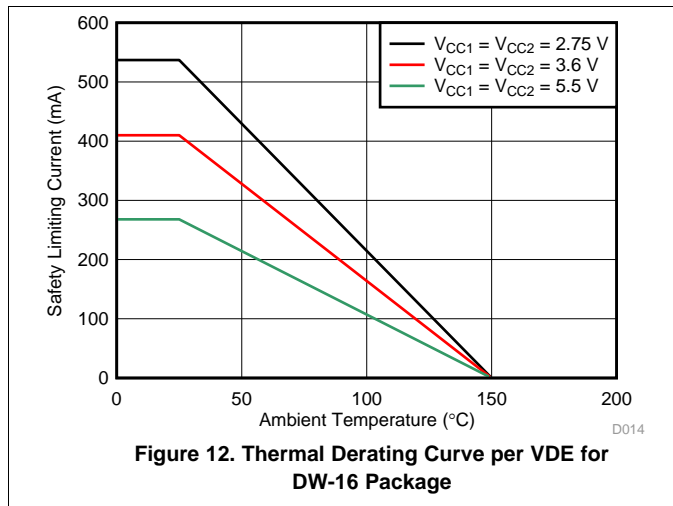
(1) Production tested ≥ 6840 V_{RMS} for 1 second in accordance with UL 1577.

8.3.1.5 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 (DW-16) | Safety input, output, or supply current for DW-16 package | R _{θJA} = 84.7°C/W, V _I = 5.5 V, T _J = 150°C, T _A = 25°C | | | 268 | mA |
| | | R _{θJA} = 84.7°C/W, V _I = 3.6 V, T _J = 150°C, T _A = 25°C | | | 410 | |
| | | R _{θJA} = 84.7°C/W, V _I = 2.75 V, T _J = 150°C, T _A = 25°C | | | 537 | |
| P _S | Safety input, output, or total power | R _{θJA} = 84.7°C/W, T _J = 150°C, T _A = 25°C | | | 1476 | mW |
| T _S | Maximum case temperature | | | | 150 | °C |

The maximum safety temperature is the maximum junction temperature specified for the device. 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](#) 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.



8.4 Device Functional Modes

ISO7810DW functional modes are shown in Table 1.

Table 1. ISO7810DW Function Table⁽¹⁾

| V _{CCI} | V _{CCO} | INPUT (IN _x) ⁽²⁾ | OUTPUT (OUT _x) | COMMENTS |
|------------------|------------------|-----------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PU | PU | H | H | Normal Operation: A channel output assumes the logic state of its input. |
| | | L | L | |
| | | Open | Default | Default mode: When IN _x is open, the corresponding channel output goes to its default high logic state. Default= High for ISO7810 and Low for ISO7810F. |
| PD | PU | X | Default | Default mode: When V _{CCI} is unpowered, a channel output assumes the logic state based on the selected default option. Default= High for ISO7810 and Low for ISO7810F. When V _{CCI} transitions from unpowered to powered-up, a channel output assumes the logic state of its input. When V _{CCI} transitions from powered-up to unpowered, channel output assumes the selected default state. |
| X | PD | X | Undetermined | When V _{CCO} is unpowered, a channel output is undetermined ⁽³⁾ . When V _{CCO} transitions from unpowered to powered-up, a channel output assumes the logic state of its input |

- (1) V_{CCI} = Input-side V_{CC}; V_{CCO} = Output-side V_{CC}; PU = Powered up (V_{CC} ≥ 2.25 V); PD = Powered down (V_{CC} ≤ 1.7 V); X = Irrelevant; H = High level; L = Low level
- (2) A strongly driven input signal can weakly power the floating V_{CC} via an internal protection diode and cause undetermined output.
- (3) The outputs are in undetermined state when 1.7 V < V_{CCI}, V_{CCO} < 2.25 V.

8.4.1 Device I/O Schematics

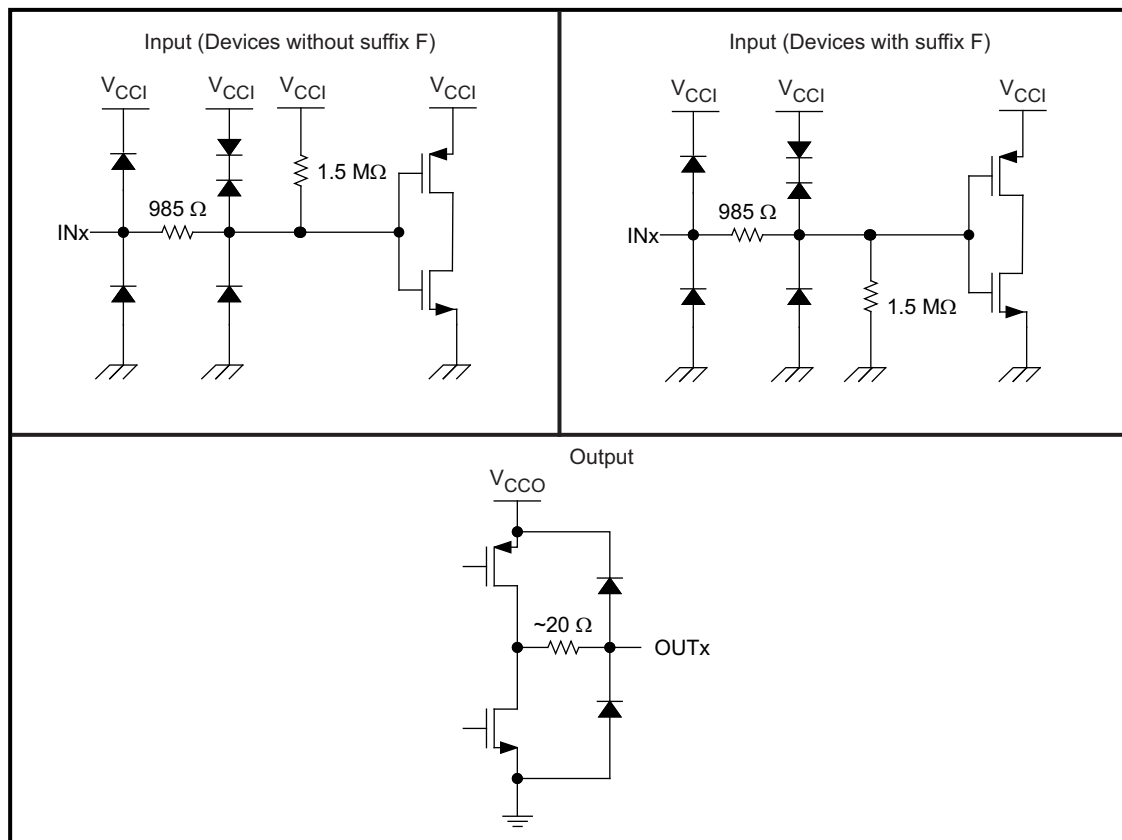


Figure 14. Device I/O Schematics

9 Applications and Implementation

NOTE

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

9.1 Application Information

The ISO7810 is a high-performance, dual-channel digital isolator with 5.7 kV_{RMS} isolation voltage. It utilizes single-ended CMOS-logic switching technology. Its supply voltage range is from 2.25 V to 5.5 V for both supplies, V_{CC1} and V_{CC2}. When designing with digital isolators, it is important to keep in mind that due to the single-ended design structure, digital isolators do not conform to any specific interface standard and are only intended for isolating single-ended CMOS or TTL digital signal lines. The isolator is typically placed between the data controller (that is, μ C or UART), and a data converter or a line transceiver, regardless of the interface type or standard.

9.2 Typical Application

ISO7810DW can be used with Texas Instruments' mixed signal micro-controller, gatedrivers, transformer driver, and voltage regulator to create an isolated MOSFET/IGBT drive circuit.

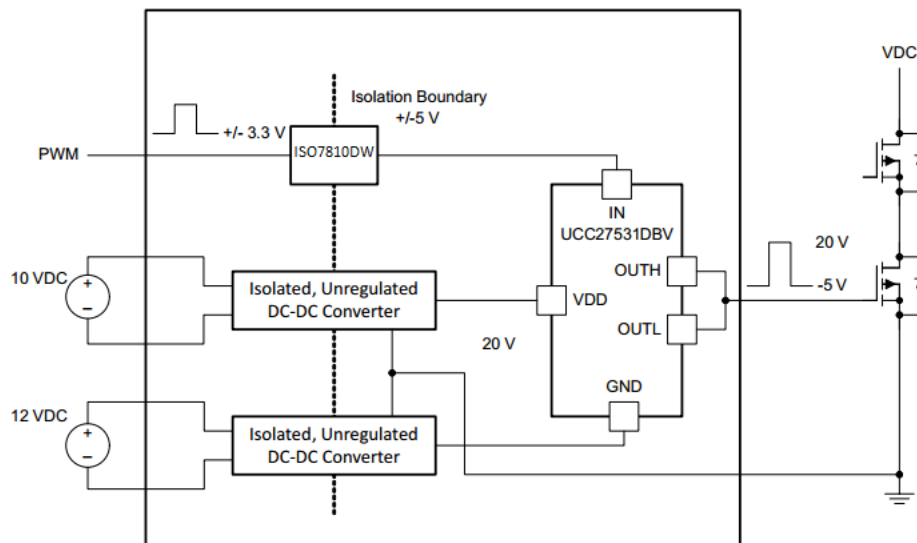


Figure 15. Low Side Gate Driver Hookup

9.2.1 Design Requirements

For the ISO7810, use the parameters shown in [Table 2](#).

Table 2. Design Parameters

| PARAMETER | VALUE |
|--------------------------------------------------------|-----------------|
| Supply voltage | 2.25 V to 5.5 V |
| Decoupling capacitor between V _{CC1} and GND1 | 0.1 μ F |
| Decoupling capacitor from V _{CC2} and GND2 | 0.1 μ F |

9.2.2 Detailed Design Procedure

Unlike optocouplers, which need external components to improve performance, provide bias, or limit current, ISO7810 only needs two external bypass capacitors to operate.

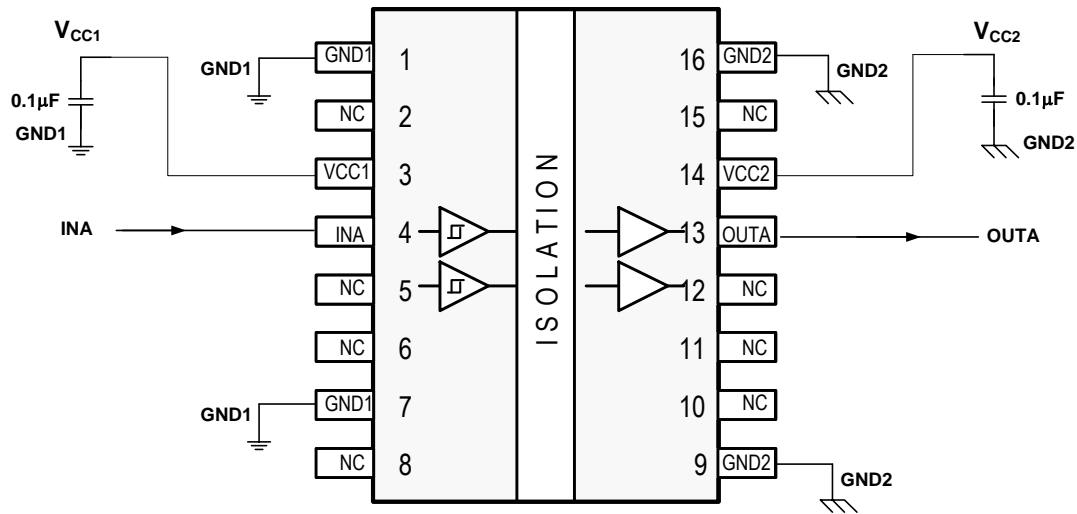


Figure 16. Typical ISO7810DW Circuit Hook-up

9.2.2.1 Electromagnetic Compatibility (EMC) Considerations

Many applications in harsh industrial environment are sensitive to disturbances such as electrostatic discharge (ESD), electrical fast transient (EFT), surge and electromagnetic emissions. These electromagnetic disturbances are regulated by international standards such as IEC 61000-4-x and CISPR 22. Although system-level performance and reliability depends, to a large extent, on the application board design and layout, the ISO7810 incorporate many chip-level design improvements for overall system robustness. Some of these improvements include:

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

9.2.3 Application Performance Curve

Typical eye diagram of ISO7810 indicate low jitter and wide open eye at the maximum data rate of 100 Mbps.

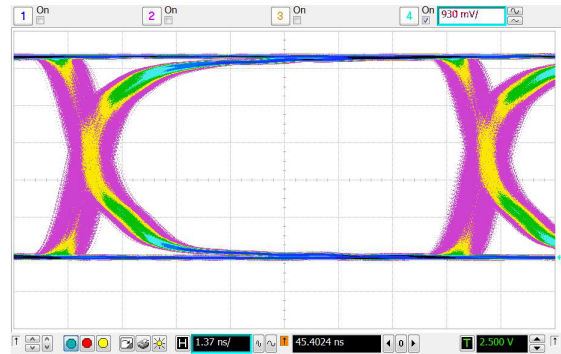


Figure 17. Eye Diagram at 100 Mbps PRBS, 5 V and 25°C

10 Power Supply Recommendations

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

11 Layout

11.1 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 Guidelines

A minimum of four layers is required to accomplish a low EMI PCB design (see [Figure 18](#)). Layer stacking should be in the following order (top-to-bottom): high-speed signal layer, ground plane, power plane and low-frequency signal layer.

- Routing the high-speed traces on the top layer avoids the use of vias (and the introduction of their inductances) and allows for clean interconnects between the isolator and the transmitter and receiver circuits of the data link.
- Placing a solid ground plane next to the high-speed signal layer establishes controlled impedance for transmission line interconnects and provides an excellent low-inductance path for the return current flow.
- Placing the power plane next to the ground plane creates additional high-frequency bypass capacitance of approximately 100 pF/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*.

11.3 Layout Example

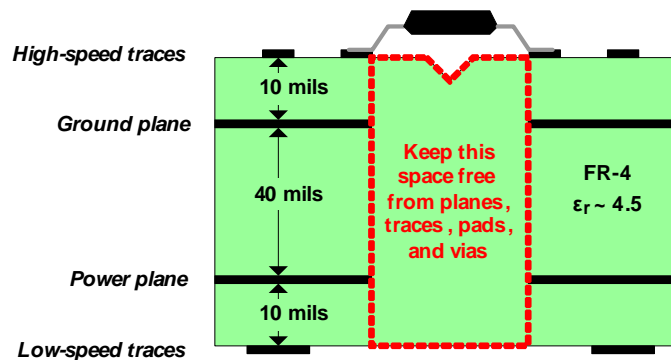


Figure 18. Layout Example

12 器件和文档支持

12.1 文档支持

12.1.1 相关文档

请参见 [隔离术语表 \(SLLA353\)](#)

12.2 相关链接

下面的表格列出了快速访问链接。 范围包括技术文档、支持和社区资源、工具和软件，以及样片或购买的快速访问。

表 3. 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 |
|----------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| ISO7810 | 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 |
| ISO7810F | 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 社区资源

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

TI E2E™ Online Community *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At [e2e.ti.com](#), you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

12.4 商标

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12.5 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。

12.6 Glossary

[SLYZ022](#) — *TI Glossary*.

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

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 Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| ISO7810DW | ACTIVE | SOIC | DW | 16 | 40 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -55 to 125 | ISO7810 | Samples |
| ISO7810DWR | ACTIVE | SOIC | DW | 16 | 2000 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -55 to 125 | ISO7810 | Samples |
| ISO7810DWW | ACTIVE | SOIC | DWW | 16 | 45 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | -55 to 125 | ISO7810 | Samples |
| ISO7810DWWR | ACTIVE | SOIC | DWW | 16 | 1000 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | -55 to 125 | ISO7810 | Samples |
| ISO7810FDW | ACTIVE | SOIC | DW | 16 | 40 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -55 to 125 | ISO7810F | Samples |
| ISO7810FDWR | ACTIVE | SOIC | DW | 16 | 2000 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -55 to 125 | ISO7810F | Samples |
| ISO7810FDWW | ACTIVE | SOIC | DWW | 16 | 45 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | -55 to 125 | ISO7810F | Samples |
| ISO7810FDWWR | ACTIVE | SOIC | DWW | 16 | 1000 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | -55 to 125 | ISO7810F | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSELETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

⁽⁶⁾ Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

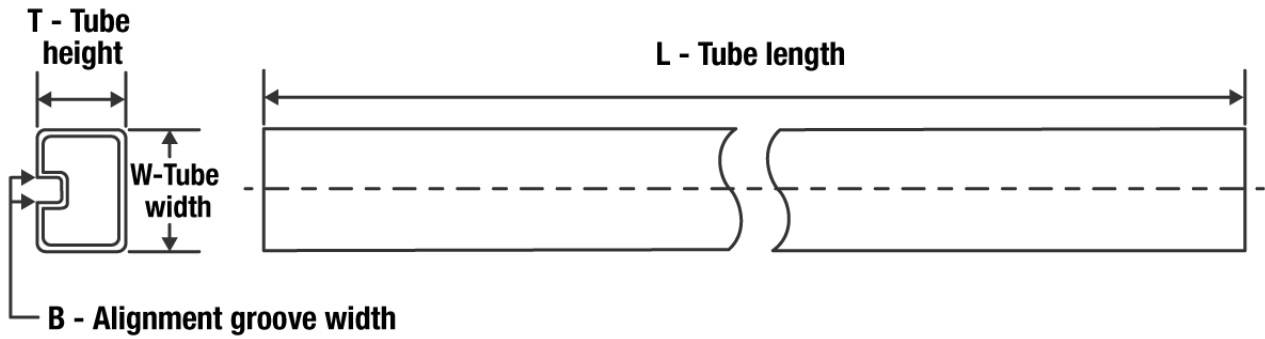

*All dimensions are nominal

| 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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| ISO7810DWR | SOIC | DW | 16 | 2000 | 330.0 | 16.4 | 10.75 | 10.7 | 2.7 | 12.0 | 16.0 | Q1 |
| ISO7810DWWR | SOIC | DWW | 16 | 1000 | 330.0 | 24.4 | 18.0 | 10.0 | 3.0 | 20.0 | 24.0 | Q1 |
| ISO7810FDWR | SOIC | DW | 16 | 2000 | 330.0 | 16.4 | 10.75 | 10.7 | 2.7 | 12.0 | 16.0 | Q1 |
| ISO7810FDWWR | SOIC | DWW | 16 | 1000 | 330.0 | 24.4 | 18.0 | 10.0 | 3.0 | 20.0 | 24.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| ISO7810DWR | SOIC | DW | 16 | 2000 | 350.0 | 350.0 | 43.0 |
| ISO7810DWWR | SOIC | DWW | 16 | 1000 | 350.0 | 350.0 | 43.0 |
| ISO7810FDWR | SOIC | DW | 16 | 2000 | 350.0 | 350.0 | 43.0 |
| ISO7810FDWWR | SOIC | DWW | 16 | 1000 | 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) |
|-------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| ISO7810DW | DW | SOIC | 16 | 40 | 506.98 | 12.7 | 4826 | 6.6 |
| ISO7810DWW | DWW | SOIC | 16 | 45 | 507 | 20 | 5000 | 9 |
| ISO7810FDW | DW | SOIC | 16 | 40 | 506.98 | 12.7 | 4826 | 6.6 |
| ISO7810FDWW | DWW | SOIC | 16 | 45 | 507 | 20 | 5000 | 9 |

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