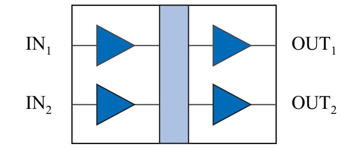
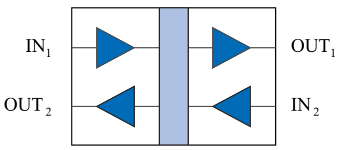
# Low-Power Digital Isolators

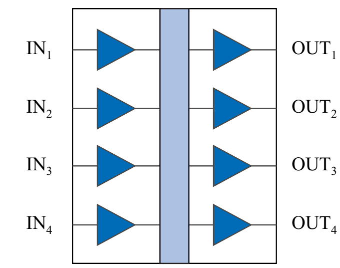
## Functional Diagrams



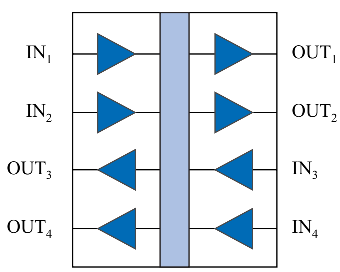

**IL011**



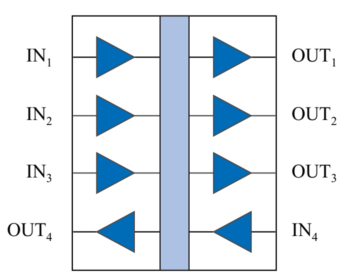

**IL012**




**IL015**




**IL016**




**IL017**

## Features

- 0.3 mA/channel total typical quiescent current
- 10 Mbps guaranteed maximum data rate
- Extended 2.5 to 5.5 volt supply range
- –40 °C to +100 °C
- No carriers or clocks for low EMI emissions
- 44000 year barrier life
- 50 kV/µs typical common mode transient immunity
- Excellent magnetic immunity
- VDE V 0884-11 / IEC 60747-17 certified; UL 1577 listed
- SOIC8 and wide-body 16-pin SOIC packages

## Applications

- 4-to-20 mA loop-powered controls
- Battery-powered instruments
- SPI
- Multiplexed data transmission
- Ground loop elimination
- Logic level shifting

## Description

NVE's IL01x low-power digital isolators use NVE's patented* spintronic Tunneling Magnetoresistance (TMR) technology for a remarkable combination of power efficiency and speed.

A unique ceramic/polymer composite barrier provides excellent isolation and virtually unlimited barrier life.

Their unique design sensitive has no carriers or clocks, providing virtually undetectable EMI emissions.

Parts are available in various two-channel and four-channel configurations.


*U.S. Patent numbers 5,831,426; 6,300,617 and others.

**REV. B**

## Absolute Maximum Ratings

| Parameters | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Storage Temperature | $T_S$ | –55 | | 150 | °C | |
| Junction Temperature | $T_J$ | –55 | | 150 | °C | |
| Ambient Operating Temperature[1] | $T_A$ | –40 | | 100 | °C | |
| Supply Voltage | $V_{DD1}$, $V_{DD2}$ | –0.5 | | 7 | V | |
| Input Voltage | $V_I$ | –0.5 | | $V_{DD}$+0.5 | V | |
| Output Voltage | $V_O$ | –0.5 | | $V_{DD}$+0.5 | V | |
| Output Current Drive | $I_O$ | | | 10 | mA | |
| Lead Solder Temperature | | | | 260 | °C | 10 sec. |
| ESD | | | 2 | | kV | HBM |

## Recommended Operating Conditions

| Parameters | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Ambient Operating Temperature | $T_A$ | –40 | | 100 | °C | |
| Junction Temperature | $T_J$ | –40 | | 110 | °C | |
| Supply Voltage | $V_{DD1}$, $V_{DD2}$ | 2.5 | | 5.5 | V | |
| Logic High Input Voltage | $V_{IH}$ | 2.4 | | $V_{DD}$ | V | |
| Logic Low Input Voltage | $V_{IL}$ | 0 | | 0.8 | V | |
| Input Signal Rise and Fall Times | $t_{IR}$, $t_{IF}$ | | | 1 | μs | |



REV. B

## Safety and Approvals

***VDE V 0884-11 / IEC 60747-17*** (Basic Isolation; VDE File Number 5016933-4880-0001)

- Isolation voltage ($V_{ISO}$) 2500 $V_{RMS}$.
- Transient overvoltage ($V_{IOTM}$) 4000 $V_{PK}$.
- Surge rating 4000 V.
- Each part tested at 1590 $V_{PK}$ for 1 second, 5 pC partial discharge limit.
- Samples tested at 4000 $V_{PK}$ for 60 sec.; then 1358 $V_{PK}$ for 10 sec. with 5 pC partial discharge limit.

- Working Voltage ($V_{IORM}$; pollution degree 2):

| Package | Part No. Suffix | Working Voltage |
|---|---|---|
| SOIC8 | -3 | 400 $V_{RMS}$ |
| Wide-body SOIC16/ True 8™ | None | 500 $V_{RMS}$ |

| Safety-Limiting Values | Symbol | Value | Units |
|---|---|---|---|
| Safety rating ambient temperature | $T_S$ | 180 | °C |
| Safety rating power (180°C) | $P_S$ | 270 | mW |
| Supply current safety rating (total of supplies) | $I_S$ | 54 | mA |

***UL 1577*** (pending under Component Recognition Program File Number E207481)

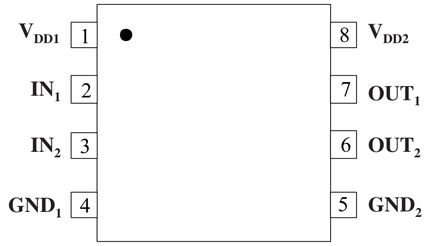
Tested at 3000 $V_{RMS}$ (4240 $V_{PK}$) for 1 second; each lot sample tested at 2500 $V_{RMS}$ (3530 $V_{PK}$) for 1 minute

## Soldering Profile

Per JEDEC J-STD-020C, MSL 1

### IL011-3 Pin Connections

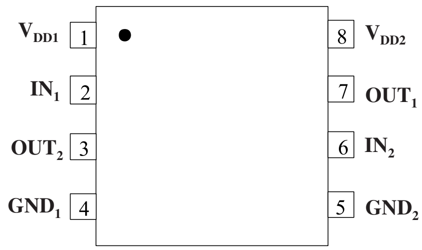
| | | |
|---|---|---|
| 1 | $V_{DD1}$ | Supply voltage |
| 2 | $IN_1$ | Data in, channel 1 |
| 3 | $IN_2$ | Data in, channel 2 |
| 4 | $GND_1$ | Ground return for $V_{DD1}$ |
| 5 | $GND_2$ | Ground return for $V_{DD2}$ |
| 6 | $OUT_2$ | Data out, channe2 |
| 7 | $OUT_1$ | Data out, channel 1 |
| 8 | $V_{DD2}$ | Supply voltage |



IL011-3

### IL012-3 Pin Connections

| | | |
|---|---|---|
| 1 | $V_{DD1}$ | Supply voltage |
| 2 | $IN_1$ | Data in, channel 1 |
| 3 | $OUT_2$ | Data out, channel 2 |
| 4 | $GND_1$ | Ground return for $V_{DD1}$ |
| 5 | $GND_2$ | Ground return for $V_{DD2}$ |
| 6 | $IN_2$ | Data in, channel 2 |
| 7 | $OUT_1$ | Data out, channel 1 |
| 8 | $V_{DD2}$ | Supply voltage |



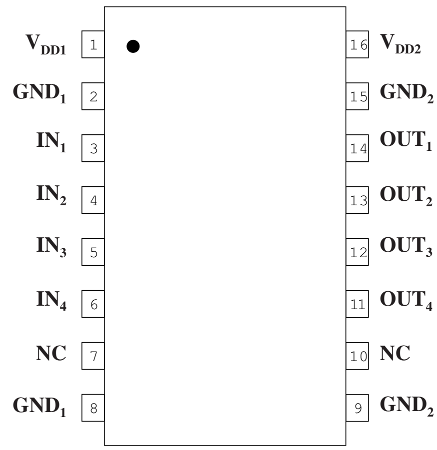
IL012-3



NVE Corporation 11409 Valley View Road, Eden Prairie, MN 55344 (952) 829-9217 www.nve.com YouTube.com/NveCorporation iso-apps@nve.com

## IL015 Pin Connections

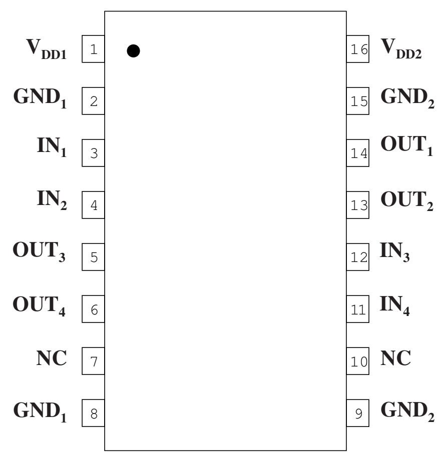
| | | |
|---|---|---|
| 1 | $V_{DD1}$ | Supply voltage |
| 2 | $GND_1$ | Ground return for $V_{DD1}$* |
| 3 | $IN_1$ | Data in, channel 1 |
| 4 | $IN_2$ | Data in, channel 2 |
| 5 | $IN_3$ | Data in, channel 3 |
| 6 | $IN_4$ | Data in, channel 4 |
| 7 | NC | No connection |
| 8 | $GND_1$ | Ground return for $V_{DD1}$* |
| 9 | $GND_2$ | Ground return for $V_{DD2}$* |
| 10 | NC | No connection |
| 11 | $OUT_4$ | Data out, channel 4 |
| 12 | $OUT_3$ | Data out, channel 3 |
| 13 | $OUT_2$ | Data out, channel 2 |
| 14 | $OUT_1$ | Data out, channel 1 |
| 15 | $GND_2$ | Ground return for $V_{DD2}$* |
| 16 | $V_{DD2}$ | Supply voltage |




IL015

## IL016 Pin Connections

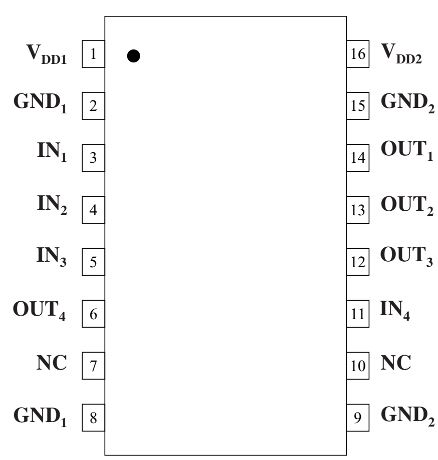
| | | |
|---|---|---|
| 1 | $V_{DD1}$ | Supply voltage |
| 2 | $GND_1$ | Ground Return for $V_{DD1}$* |
| 3 | $IN_1$ | Data in, channel 1 |
| 4 | $IN_2$ | Data in, channel 2 |
| 5 | $OUT_3$ | Data out, channel 3 |
| 6 | $OUT_4$ | Data out, channel 4 |
| 7 | NC | No connection |
| 8 | $GND_1$ | Ground Return for $V_{DD1}$* |
| 9 | $GND_2$ | Ground Return for $V_{DD2}$* |
| 10 | NC | No connection |
| 11 | $IN_4$ | Data in, channel 4 |
| 12 | $IN_3$ | Data in, channel 3 |
| 13 | $OUT_2$ | Data out, channel 2 |
| 14 | $OUT_1$ | Data out, channel 1 |
| 15 | $GND_2$ | Ground Return for $V_{DD2}$* |
| 16 | $V_{DD2}$ | Supply voltage |




IL016

## IL017 Pin Connections

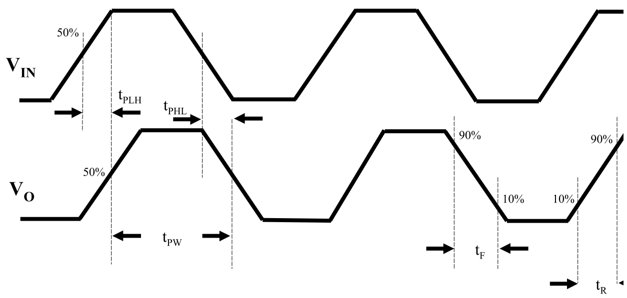
| | | |
|---|---|---|
| 1 | $V_{DD1}$ | Supply voltage |
| 2 | $GND_1$ | Ground return for $V_{DD1}$* |
| 3 | $IN_1$ | Data in, channel 1 |
| 4 | $IN_2$ | Data in, channel 2 |
| 5 | $IN_3$ | Data in, channel 3 |
| 6 | $OUT_4$ | Data out, channel 4 |
| 7 | NC | No connection |
| 8 | $GND_1$ | Ground return for $V_{DD1}$* |
| 9 | $GND_2$ | Ground return for $V_{DD2}$* |
| 10 | NC | No connection |
| 11 | $IN_4$ | Data in, channel 4 |
| 12 | $OUT_3$ | Data out, channel 3 |
| 13 | $OUT_2$ | Data out, channel 2 |
| 14 | $OUT_1$ | Data out, channel 1 |
| 15 | $GND_2$ | Ground return for $V_{DD2}$* |
| 16 | $V_{DD2}$ | Supply voltage |




IL017

***NOTE:** Pins 2 and 8 are internally connected, as are pins 9 and 15.

## Timing Diagram




**Legend**

| | |
|---|---|
| $t_{PLH}$ | Propagation Delay, Low to High |
| $t_{PHL}$ | Propagation Delay, High to Low |
| $t_{PW}$ | Minimum Pulse Width |
| $t_R$ | Rise Time |
| $t_F$ | Fall Time |



NVE Corporation 11409 Valley View Road, Eden Prairie, MN 55344 (952) 829-9217 www.nve.com YouTube.com/NveCorporation iso-apps@nve.com

| 3.3 Volt Electrical Specifications ($T_{min}$ to $T_{max}$ unless otherwise stated) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **Symbol** | **Min.** | **Typ.** | **Max.** | **Units** | **Test Conditions** |
| $V_{DD1}$ Quiescent Supply Current | | | | | | |
| IL011 | $I_{DD1}$ | | 8 | 15 | µA | |
| IL012 | | | 0.3 | 0.5 | mA | |
| IL015 | | | 10 | 15 | µA | |
| IL016 | | | 0.4 | 1.0 | mA | |
| IL017 | | | 0.3 | 0.5 | mA | |
| $V_{DD2}$ Quiescent Supply Current | | | | | | |
| IL011 | $I_{DD2}$ | | 0.6 | 1.0 | mA | |
| IL012 | | | 0.3 | 0.5 | mA | |
| IL015 | | | 1.2 | 2.0 | mA | |
| IL016 | | | 0.4 | 1.0 | mA | |
| IL017 | | | 0.9 | 1.5 | mA | |
| Logic Input Current | $I_I$ | −10 | | 10 | µA | |
| Logic High Output Voltage | $V_{OH}$ | $V_{DD}$ – 0.1 | $V_{DD}$ | | V | $I_O$ = −20 µA, $V_I = V_{IH}$ |
| | | 0.8 x $V_{DD}$ | 0.9 x $V_{DD}$ | | | $I_O$ = −4 mA, $V_I = V_{IH}$ |
| Logic Low Output Voltage | $V_{OL}$ | | 0 | 0.1 | V | $I_O$ = 20 µA, $V_I = V_{IL}$ |
| | | | 0.5 | 0.8 | | $I_O$ = 4 mA, $V_I = V_{IL}$ |

| Magnetic Field Immunity[8] ($V_{DD1} = V_{DD2}$ = 3.3V) | | | | | | |
|---|---|---|---|---|---|---|
| Power Frequency Magnetic Immunity | $H_{PF}$ | | 1500 | | A/m | 50 Hz / 60 Hz |
| Pulse Magnetic Field Immunity | $H_{PM}$ | | 2000 | | A/m | $t_p$ = 8 µs |
| Damped Oscillatory Magnetic Field | $H_{OSC}$ | | 2000 | | A/m | 0.1 Hz – 1 MHz |
| Cross-axis Immunity Multiplier[9] | $K_X$ | | 2.5 | | | |

| 5 Volt Electrical Specifications ($T_{min}$ to $T_{max}$ unless otherwise stated) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **Symbol** | **Min.** | **Typ.** | **Max.** | **Units** | **Test Conditions** |
| $V_{DD1}$ Quiescent Supply Current | | | | | | |
| IL011 | $I_{DD1}$ | | 10 | 20 | µA | |
| IL012 | | | 0.5 | 0.75 | mA | |
| IL015 | | | 17 | 25 | µA | |
| IL016 | | | 0.7 | 1.5 | mA | |
| IL017 | | | 0.5 | 0.75 | mA | |
| $V_{DD2}$ Quiescent Supply Current | | | | | | |
| IL011 | $I_{DD2}$ | | 1 | 1.5 | mA | |
| IL012 | | | 0.5 | 0.75 | mA | |
| IL015 | | | 2 | 3 | mA | |
| IL016 | | | 0.7 | 1.5 | mA | |
| IL017 | | | 1.5 | 2.25 | mA | |
| Logic Input Current | $I_I$ | −10 | | 10 | µA | |
| Logic High Output Voltage | $V_{OH}$ | $V_{DD}$ – 0.1 | $V_{DD}$ | | V | $I_O$ = −20 µA, $V_I = V_{IH}$ |
| | | 0.8 x $V_{DD}$ | 0.9 x $V_{DD}$ | | | $I_O$ = −4 mA, $V_I = V_{IH}$ |
| Logic Low Output Voltage | $V_{OL}$ | | 0 | 0.1 | V | $I_O$ = 20 µA, $V_I = V_{IL}$ |
| | | | 0.5 | 0.8 | | $I_O$ = 4 mA, $V_I = V_{IL}$ |

| Magnetic Field Immunity[8] ($V_{DD1} = V_{DD2}$ = 5V) | | | | | | |
|---|---|---|---|---|---|---|
| Power Frequency Magnetic Immunity | $H_{PF}$ | | 3500 | | A/m | 50 Hz / 60 Hz |
| Pulse Magnetic Field Immunity | $H_{PM}$ | | 4500 | | A/m | $t_p$ = 8 µs |
| Damped Oscillatory Magnetic Field | $H_{OSC}$ | | 4500 | | A/m | 0.1 Hz – 1 MHz |
| Cross-axis Immunity Multiplier[9] | $K_X$ | | 2.5 | | | |

| Switching Specifications ($3\text{ V} \le V_{DD} \le 5.5\text{V}$) | | | | | | |
|---|---|---|---|---|---|---|
| Maximum Data Rate | | 10 | | | Mbps | $C_L = 15$ pF |
| Pulse Width(7) | PW | 50 | | | ns | 50% Points, $V_O$ |
| Propagation Delay Input to Output (High to Low) | $t_{PHL}$ | | 50 | 100 | ns | $C_L = 15$ pF |
| Propagation Delay Input to Output (Low to High) | $t_{PLH}$ | | 50 | 100 | ns | $C_L = 15$ pF |
| Pulse Width Distortion(2) | PWD | | 25 | 50 | ns | $C_L = 15$ pF |
| Propagation Delay Skew(3) | $t_{PSK}$ | | 25 | 50 | ns | $C_L = 15$ pF |
| Output Rise Time (10%–90%) | $t_R$ | | 2 | 4 | ns | $C_L = 15$ pF |
| Output Fall Time (10%–90%) | $t_F$ | | 2 | 4 | ns | $C_L = 15$ pF |
| Common Mode Transient Immunity (Output Logic High or Logic Low)(4) | $\|CM_H\|,\|CM_L\|$ | 30 | 50 | | kV/µs | $V_{CM} = 1500\text{ V}_{DC}$ $t_{TRANSIENT} = 25$ ns |
| Channel-to-Channel Skew | $t_{CSK}$ | | 10 | 15 | ns | $C_L = 15$ pF |
| Dynamic Power Consumption(6) | | | 200 | 340 | µA/Mbps | per channel |

| Insulation Specifications | | | | | | | |
|---|---|---|---|---|---|---|---|
| Creepage Distance (external) | | | | | | | |
| SOIC8 | | | 4.03 | | | mm | |
| SOIC16 | | | 8.03 | 8.3 | | mm | Per IEC 60601 |
| Total Barrier Thickness (internal) | | | 0.012 | 0.016 | | mm | |
| Leakage Current(5) | | | | 0.2 | | µA | 240 $V_{RMS}$, 60 Hz |
| Barrier Resistance(5) | | | | $>10^{14}$ | | Ω | 500 V |
| Barrier Capacitance(5) | | | | 4 | | pF | f = 1 MHz |
| Comparative Tracking Index | | CTI | ≥600 | | | $V_{RMS}$ | Per IEC 60112 |
| High Voltage Endurance (Maximum Barrier Voltage for Indefinite Life) | AC | $V_{IO}$ | 1000 | | | $V_{RMS}$ | At maximum operating temperature |
| | DC | | 1500 | | | $V_{DC}$ | |
| Barrier Life | | | | 44000 | | Years | 100°C, 1000 $V_{RMS}$, 60% CL activation energy |

**Thermal Characteristics**

| Parameter | | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| Junction–Ambient Thermal Resistance | SOIC8<br>0.3" SOIC16 | $\theta_{JA}$ | | 134<br>67 | | °C/W | Double-sided PCB in free air |
| Junction–Case (Top) Thermal Resistance | SOIC8<br>0.3" SOIC16 | $\theta_{JC}$ | | 10<br>12 | | °C/W | Double-sided PCB in free air |
| Junction–Ambient Thermal Resistance | 0.3" SOIC | $\theta_{JA}$ | | 46 | | °C/W | 2s2p PCB in free air per JESD51 |
| Junction–Case (Top) Thermal Resistance | 0.3" SOIC | $\theta_{JC}$ | | 9 | | °C/W | 2s2p PCB in free air per JESD51 |
| Power Dissipation | SOIC8<br>0.3" SOIC16 | $P_D$ | | | 675<br>1500 | mW | |

**Notes**:

1. Absolute maximum ambient operating temperature means the device will not be damaged if operated under these conditions. It does not guarantee performance.
2. PWD is defined as $|t_{PHL} - t_{PLH}|$. %PWD is equal to PWD divided by pulse width.
3. $t_{PSK}$ is the magnitude of the worst-case difference in $t_{PHL}$ and/or $t_{PLH}$ between devices at 25°C.
4. $CM_H$ is the maximum common mode voltage slew rate that can be sustained while maintaining $V_O > 0.8\ V_{DD2}$. $CM_L$ is the maximum common mode input voltage that can be sustained while maintaining $V_O < 0.8$ V. The common mode voltage slew rates apply to both rising and falling common mode voltage edges.
5. Device is considered a two terminal device: pins 1–8 shorted and pins 9–16 shorted.
6. Dynamic power consumption is calculated per channel and is supplied by the channel's input-side power supply.
7. Minimum pulse width is the minimum value at which specified PWD is guaranteed.
8. The relevant test and measurement methods are given in the Electromagnetic Compatibility section on p. 9.
9. External magnetic field immunity is improved by this factor if the field direction is "end-to-end" rather than to "pin-to-pin" (see diagram on p. 9).
10. 66,535-bit pseudo-random binary signal (PRBS) NRZ bit pattern with no more than five consecutive 1s or 0s; 800 ps transition time.

## Application Information

### Electrostatic Discharge Sensitivity

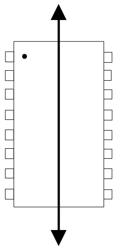
This product has been tested for electrostatic sensitivity to the limits stated in the specifications. However, NVE recommends that all integrated circuits be handled with appropriate care to avoid damage. Damage caused by inappropriate handling or storage could range from performance degradation to complete failure.

### Electromagnetic Compatibility

IsoLoop Isolators have the lowest EMC footprint of any isolation technology. IsoLoop Isolators' Wheatstone bridge configuration and differential magnetic field signaling ensure excellent EMC performance against all relevant standards.

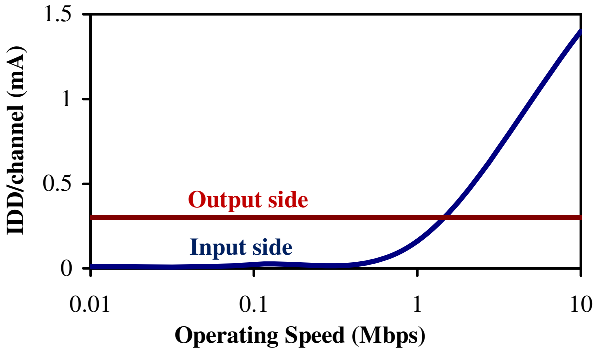
These isolators are fully compliant with generic EMC standards EN50081, EN50082-1 and the umbrella IEC 61000-6-1 and IEC 61000-6-2 standards for immunity, and IEC 61000-6-3, IEC 61000-6-4, CISPR, and FCC Class A standards for emissions.

Immunity to external magnetic fields is even higher if the field direction is "end-to-end" rather than to "pin-to-pin" as shown below:



### Dynamic Power Consumption

IsoLoop Isolators achieve their low EMI emissions and low power consumption from a unique edge-triggered architecture. Most of the power is consumed on the output side, which is not dependant on operating frequency. Input side power consumption is generally lower, but has some dependence on operating frequency. Typical power consumption is shown in the following graph:




**Typical supply current per channel, VDD = 3.3 V; 25°C.**

### Power Supply Decoupling

Both power supplies should be decoupled with 0.1 μF typical (0.047 μF minimum) capacitors as close as possible to the $V_{DD}$ pins.

### Maintaining Creepage

Creepage distances are often critical in isolated circuits. In addition to meeting JEDEC standards, NVE isolator packages have unique creepage specifications. Standard pad libraries often extend under the package, compromising creepage and clearance. Similarly, ground planes, if used, should be spaced to avoid compromising clearance. Package drawings and recommended pad layouts are included in this datasheet.

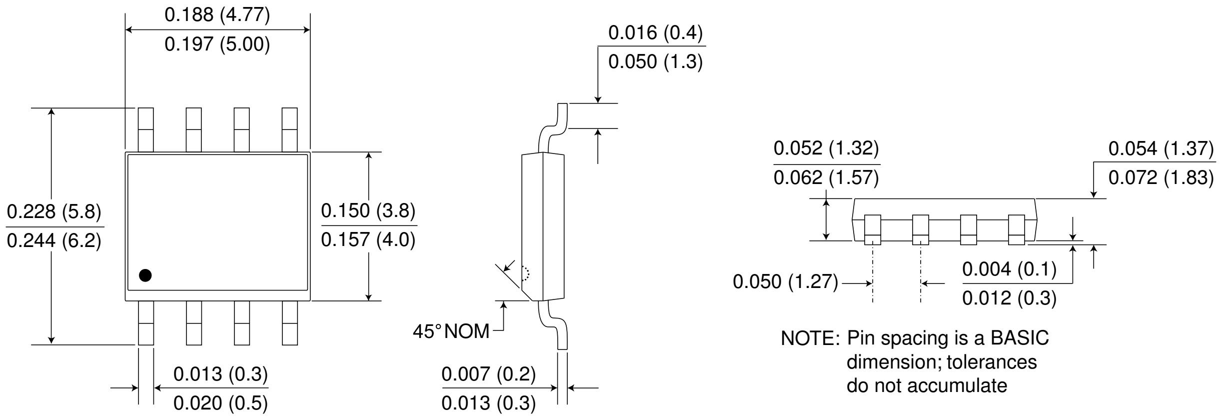
### Signal Status on Start-up and Shut Down

To minimize power dissipation, input signals are differentiated and then latched on the output side of the isolation barrier to reconstruct the signal. This could result in an ambiguous output state depending on power up, shutdown and power loss sequencing. Therefore, the designer should consider including an initialization signal in the start-up circuit. Initialization consists of toggling the input either high then low, or low then high.

## Package Drawings

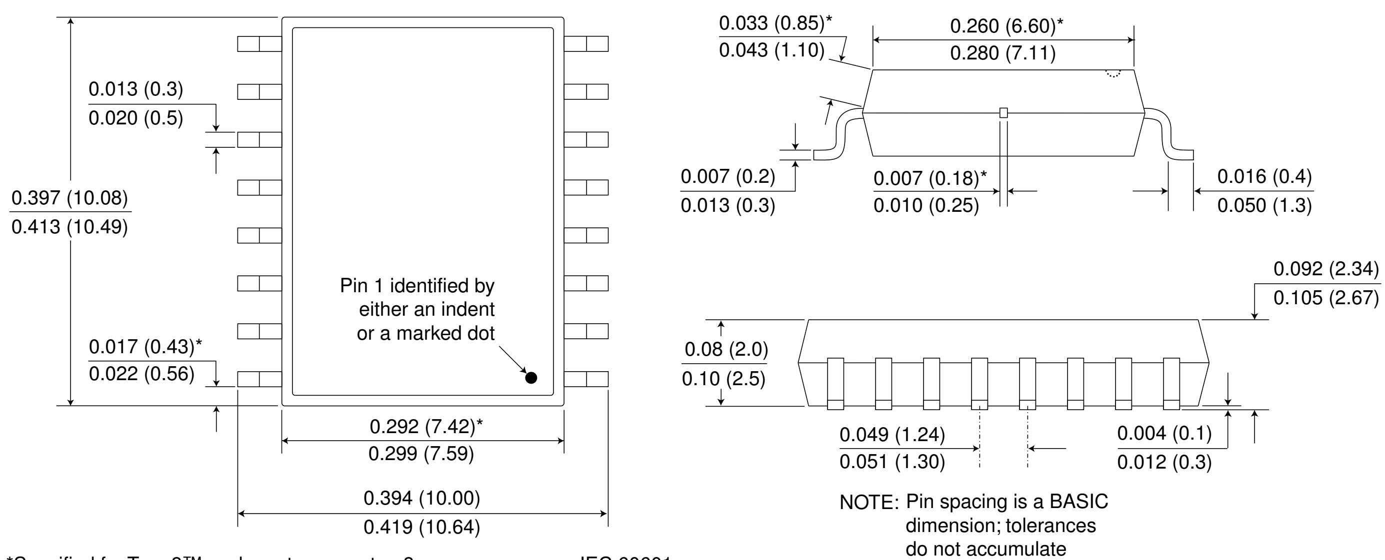
### **8-pin SOIC8 Package** (IL011-3 / IL012-3)

Dimensions in inches (mm); scale = approx. 5X




### **16-pin 0.3" SOIC16 Package** (IL015 / IL016 / IL017)

Dimensions in inches (mm); scale = approx. 5X

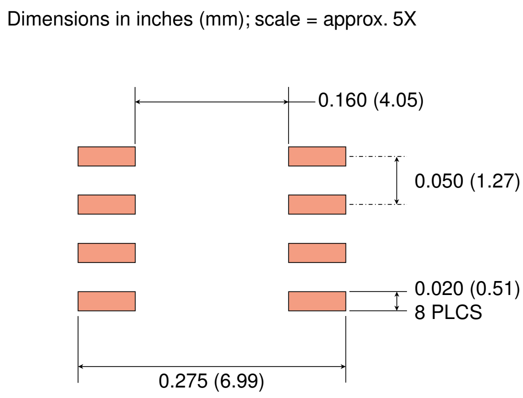



*Specified for True 8™ package to guarantee 8 mm creepage per IEC 60601.

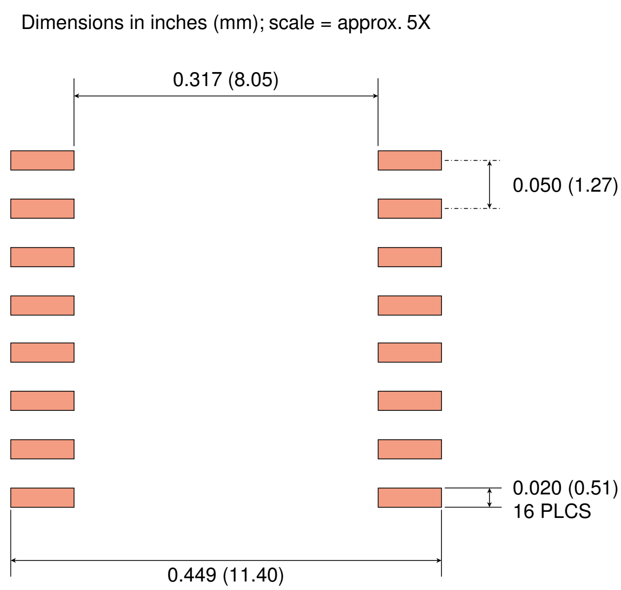
RoHS COMPLIANT

## Recommended Pad Layouts

### SOIC8 Pad Layout




### SOIC16 Pad Layout



## Ordering Information

# IL 0 17 E TR13

**Bulk Packaging**
Blank = Tube
TR7 = 7" Tape and Reel
TR13 = 13" Tape and Reel

**Package**
E = 0.3" SOIC16 (RoHS)
-3E = 0.15" SOIC8 (RoHS)

**Channel Configuration**
11 = 2 Transmit Channels
0.15" SOIC8

12 = 1 Transmit Channel
1 Receive Channel
0.15" SOIC8

15 = 4 Transmit Channels
0.3" SOIC16

16 = 2 Transmit Channels
2 Receive Channels
0.3" SOIC16

17 = 3 Transmit Channels
1 Receive Channel
0.3" SOIC16

**Base Part Number**
0 = Low Power

**Product Family**
IL = Isolators

**ISB-DS-001-IL01x-RevB**
**January 2020**

**Changes**

- Revised thermal characteristics (p. 2).
- Extended power supply range to as low as 2.5 volts.
- Merged 3.3 V and 5 V switching speed specifications and revised specifications (p. 8).
- Upgrade from VDE V 0884-10 to VDE V 0884-11 / IEC 60747-17.
- Updated EMC standards.

**ISB-DS-001-IL01x-RevA**
**June 2018**

**Changes**

- Added IL011 configuration.
- Decrease typ. Pulse Width Distortion Propagation Delay Skew specs.
- Increase worst-case Propagation Delay specs.
- Product launch.

**ISB-DS-001-IL01x-PRELIM**
**December 2017**

**Change**

- Preliminary Release.

**Datasheet Limitations**
The information and data provided in datasheets shall define the specification of the product as agreed between NVE and its customer, unless NVE and customer have explicitly agreed otherwise in writing. All specifications are based on NVE test protocols. In no event however, shall an agreement be valid in which the NVE product is deemed to offer functions and qualities beyond those described in the datasheet.

**Limited Warranty and Liability**
Information in this document is believed to be accurate and reliable. However, NVE does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

In no event shall NVE be liable for any indirect, incidental, punitive, special or consequential damages (including, without limitation, lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

**Right to Make Changes**
NVE reserves the right to make changes to information published in this document including, without limitation, specifications and product descriptions at any time and without notice. This document supersedes and replaces all information supplied prior to its publication.

**Use in Life-Critical or Safety-Critical Applications**
Unless NVE and a customer explicitly agree otherwise in writing, NVE products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical devices or equipment. NVE accepts no liability for inclusion or use of NVE products in such applications and such inclusion or use is at the customer's own risk. Should the customer use NVE products for such application whether authorized by NVE or not, the customer shall indemnify and hold NVE harmless against all claims and damages.

**Applications**
Applications described in this datasheet are illustrative only. NVE makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NVE products, and NVE accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NVE product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customers. Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NVE does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customers. The customer is responsible for all necessary testing for the customer's applications and products using NVE products in order to avoid a default of the applications and the products or of the application or use by customer's third party customers. NVE accepts no liability in this respect.

**Limiting Values**
Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and operation of the device at these or any other conditions above those given in the recommended operating conditions of the datasheet is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

**Terms and Conditions of Sale**
In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NVE hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NVE products by customer.

**No Offer to Sell or License**
Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

**Export Control**
This document as well as the items described herein may be subject to export control regulations. Export might require a prior authorization from national authorities.

**Automotive Qualified Products**
Unless the datasheet expressly states that a specific NVE product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NVE accepts no liability for inclusion or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NVE's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NVE's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NVE for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NVE's standard warranty and NVE's product specifications.

＜お問い合わせ先＞

日本代理店

**株式会社 ロッキー**

ISO9001、ISO14001認証取得
本社：東京都新宿区上落合１−16−7 ＮＫビル ２ Ｆ
TEL ： 03−6804−1411
MAIL：info@kkrocky.com
WEB ：www.kkrocky.com
営業所 ： 大阪 前橋

本仕様の内容は、予告なく変更されることがあります。
最新のカタログはNVE社のホームページ（www.nve.com ）よりダウンロードできます。

An ISO 9001 Certified Company

NVE Corporation
11409 Valley View Road
Eden Prairie, MN 55344-3617 USA
Telephone: (952) 829-9217
www.nve.com
e-mail: iso-info@nve.com



ISB-DS-001-IL01x-RevB

*January 2020*