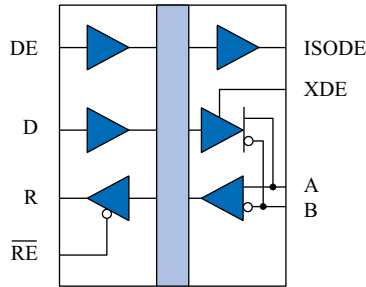
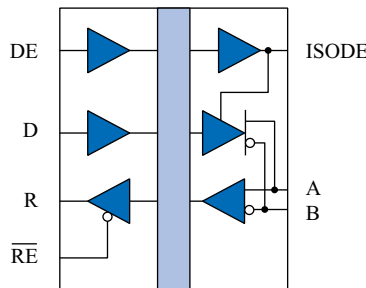


PROFIBUS-Compatible Isolated RS-485 Transceivers

Functional Diagram



IL3685-3
(narrow-body)



IL3685
(wide-body)

| V_{ID} (A-B) | DE | \overline{RE} | R | D | Mode |
|----------------|----|-----------------|---|---|---------|
| ≥ 200 mV | L | L | H | X | Receive |
| ≤ -200 mV | L | L | L | X | Receive |
| ≥ 1.5 V | H | L | H | H | Drive |
| ≤ -1.5 V | H | L | L | L | Drive |
| X | X | H | Z | X | Hi-Z R |
| Open | L | L | H | X | Receive |

Features

- 40 Mbps data rate
- 6 kV_{RMS} isolation / 12.8 kV surge / 1 kV_{RMS} working voltage (V-Series)
- 3 V to 5 V power supplies
- 20 ns propagation delay
- 5 ns pulse skew
- 50 kV/ μ s typ.; 30 kV/ μ s min. common mode transient immunity
- 44000 year barrier life
- 15 kV bus ESD protection
- Low EMC footprint
- Thermal shutdown protection
- -40°C to $+85^{\circ}\text{C}$ temperature range
- Meets or exceeds ANSI RS-485 and ISO 8482:1987(E)
- PROFIBUS compliant
- VDE V 0884-10 certified; UL 1577 recognized
- 0.15" or 0.3" True 8™ 16-pin SOIC packages

Applications

- PROFIBUS, PROFIBUS DP, and FMS networks
- Factory automation
- Industrial control networks
- Building environmental controls
- Equipment covered under IEC 61010-1 Edition 3

Description

The IL3685 is a galvanically isolated, high-speed differential bus transceiver, designed for bidirectional data communication on balanced transmission lines. The device uses NVE's patented* IsoLoop spintronic Giant Magnetoresistance (GMR) technology.

The part is available in an ultraminiature 0.15" 16-pin SOIC package, a JEDEC-standard 0.3"-wide package, or NVE's exclusive True 8™ 16-pin SOIC package for true 8 millimeter creepage.

The IL3685 is fully PROFIBUS compliant, including the rigorous PROFIBUS differential output voltage specifications.

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

The device is compatible with 3 V as well as 5 V input supplies, allowing interface to standard microcontrollers without additional level shifting.

Current limiting and thermal shutdown features protect against output short circuits and bus contention that may cause excessive power dissipation. Receiver inputs feature a "fail-safe if open" design, ensuring a logic high R-output if A/B are floating.



IsoLoop® is a registered trademark of NVE Corporation.

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

REV. R

Absolute Maximum Ratings⁽¹⁾

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|----------------------------------|--------------------|------|------|----------------|-------|-----------------|
| Storage Temperature | T_S | -55 | | 150 | °C | |
| Junction Temperature | T_J | -55 | | 150 | °C | |
| Ambient Operating Temperature | T_A | -40 | | 85 | °C | |
| Voltage Range at A or B Bus Pins | | -7 | | 12 | V | |
| Supply Voltage ⁽¹⁾ | V_{DD1}, V_{DD2} | -0.5 | | 7 | V | |
| Digital Input Voltage | | -0.5 | | $V_{DD} + 0.5$ | V | |
| Digital Output Voltage | | -0.5 | | $V_{DD} + 1$ | V | |
| ESD (all bus nodes) | | 15 | | | kV | HBM |

Recommended Operating Conditions

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|--|------------------------|------------|------|------------|-------|--|
| Supply Voltage | V_{DD1} V_{DD2} | 3.0 4.5 | | 5.5 5.5 | V | |
| Junction Temperature | T_J | -40 | | 110 | °C | |
| High-Level Digital Input Voltage | V_{IH} | 2.4 3.0 | | V_{DD1} | V | $V_{DD1} = 3.3\text{ V}$ $V_{DD1} = 5.0\text{ V}$ |
| Low-Level Digital Input Voltage | V_{IL} | 0 | | 0.8 | V | |
| Differential Input Voltage ⁽²⁾ | V_{ID} | | | +12 / -7 | V | |
| High-Level Output Current (Driver) | I_{OH} | | | 60 | mA | |
| High-Level Digital Output Current (Receiver) | I_{OH} | | | 8 | mA | |
| Low-Level Output Current (Driver) | I_{OL} | -60 | | | mA | |
| Low-Level Digital Output Current (Receiver) | I_{OL} | -8 | | | mA | |
| Ambient Operating Temperature | T_A | -40 | | 85 | °C | |
| Digital Input Signal Rise and Fall Times | t_{IR}, t_{IF} | | | | | DC Stable |

Insulation Specifications

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|--|----------------------|--------------|------------|------|-----------------------|--|
| Creepage Distance (external) | IL3685-3E IL3685E | 4.0 8.03 | 8.3 | | mm | Per IEC 60601 |
| Total Barrier Thickness (internal) | | 0.013 | 0.016 | | mm | |
| Barrier Resistance | R_{IO} | | $>10^{14}$ | | Ω | 500 V |
| Barrier Capacitance | C_{IO} | | 7 | | pF | f = 1 MHz |
| Leakage Current | | | 0.2 | | μA_{RMS} | 240 V_{RMS} , 60 Hz |
| Comparative Tracking Index | CTI | ≥ 600 | | | V_{RMS} | Per IEC 60112 |
| High Voltage Endurance (Maximum Barrier Voltage for Indefinite Life) | AC DC V_{IO} | 1000 1500 | | | V_{RMS} V_{DC} | At maximum operating temperature |
| Surge Immunity ("V" Versions) | V_{IOSM} | 12.8 | | | kV _{PK} | Per IEC 61000-4-5 |
| 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 | IL3685-3E IL3685E θ_{JA} | | 100 60 | | °C/W | Soldered to double-sided board; free air |
| Junction-Case Thermal Resistance | IL3685-3E IL3685E Ψ_{JT} | | 25 12 | | °C/W | |
| Power Dissipation | IL3685-3E IL3685E P_D | | | 625 800 | mW | |

Safety and Approvals

VDE V 0884-10

Standard isolation grade; File Number 5016933-4880-0001

- Working Voltage (V_{IORM}) 600 V_{RMS} (848 V_{PK}); basic insulation; pollution degree 2
- 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

V-Series isolation grade; certification pending

- Working Voltage (V_{IORM}) 1000 V_{RMS} (1415 V_{PK}); reinforced insulation; pollution degree 2
- Isolation voltage (V_{ISO}) 6000 V_{RMS}
- Surge immunity (V_{IOSM}) 12.8 k V_{PK}
- Surge rating 8 kV
- Transient overvoltage (V_{IOTM}) 6000 V_{PK}
- Each part tested at 2387 V_{PK} for 1 second, 5 pC partial discharge limit
- Samples tested at 6000 V_{PK} for 60 sec.; then 2122 V_{PK} for 10 sec. with 5 pC partial discharge limit

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

IEC 61010-1 (Edition 2; TUV Certificate Numbers N1502812; N1502812-101)

Reinforced Insulation; Pollution Degree II; Material Group III

| Part No. Suffix | Package | Working Voltage |
|-----------------|-------------------------------------|-----------------|
| -3 | SOIC | 150 V_{RMS} |
| None | Wide-body SOIC/True 8 TM | 300 V_{RMS} |

UL 1577 (Component Recognition Program File Number E207481)

Standard isolation grade

Each part tested at 3000 V_{RMS} (4243 V_{PK}) for 1 second; each lot sample tested at 2500 V_{RMS} (3536 V_{PK}) for 1 minute

V-Series isolation grade (recognition pending)

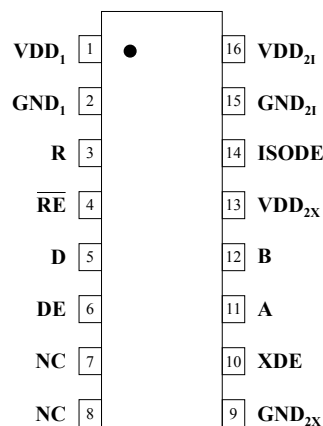
6 kV rating; tested at 7.2 k V_{RMS} (10.2 k V_{PK}) for 1 second; each lot sample tested at 6 k V_{RMS} (8485 V_{PK}) for 1 minute

Soldering Profile

Per JEDEC J-STD-020C, MSL 1

IL3685-3 (0.15" SOIC Package) Pin Connections

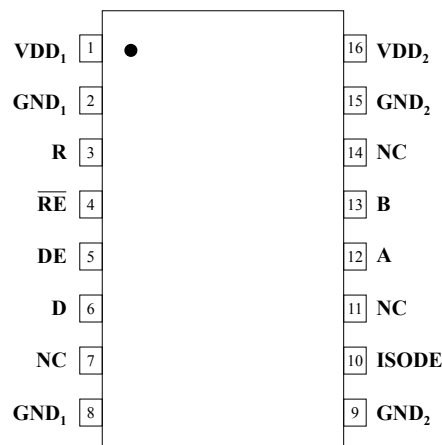
| | | |
|------|------------------------|---|
| 1 | V _{DD1} | Input power supply |
| 2 | GND ₁ | Input power supply ground return |
| 3 | R | Output data from bus |
| 4 | $\overline{\text{RE}}$ | Read data enable (if RE is high, R= high impedance) |
| 5 | D | Data input to bus |
| 6 | DE | Drive enable |
| 7, 8 | NC | No internal connection |
| 9 | GND _{2X} | Output transceiver ground return. (normally connected to pin 15) |
| 10 | XDE | Transceiver Device Enable input enables the transceiver from the bus side, or is connected to ISODE to enable the transceiver from the controller-side DE input. (this input should not be left unterminated) |
| 11 | A | Non-inverting bus line |
| 12 | B | Inverting bus line |
| 13 | V _{DD2X} | Output transceiver power supply (normally connected to pin 16) |
| 14 | ISODE | Isolated DE output (normally connected to pin 10) |
| 15 | GND ₂₁ | Output isolation power supply ground return. (normally connected to pin 9) |
| 16 | V _{DD21} | Output isolation power supply (normally connected to pin 13) |



IL3685-3

IL3685 (0.3" SOIC Package) Pin Connections

| | | |
|----|------------------------|--|
| 1 | V _{DD1} | Input power supply |
| 2 | GND ₁ | Input power supply ground return (pin 2 is internally connected to pin 8) |
| 3 | R | Output data from bus |
| 4 | $\overline{\text{RE}}$ | Read data enable (if RE is high, R= high impedance) |
| 5 | DE | Drive enable |
| 6 | D | Data input to bus |
| 7 | NC | No internal connection |
| 8 | GND ₁ | Input power supply ground return (pin 8 is internally connected to pin 2) |
| 9 | GND ₂ | Output power supply ground return (pin 9 is internally connected to pin 15) |
| 10 | ISODE | Isolated DE output for use in PROFIBUS applications where the state of the isolated drive enable node needs to be monitored. |
| 11 | NC | No internal connection |
| 12 | A | Non-inverting bus line |
| 13 | B | Inverting bus line |
| 14 | NC | No internal connection |
| 15 | GND ₂ | Output power supply ground return (pin 15 is internally connected to pin 9) |
| 16 | V _{DD2} | Output power supply |



IL3685

Driver Section

| Electrical Specifications (T_{\min} to T_{\max} and $V_{DD} = 4.5$ V to 5.5 V unless otherwise stated) | | | | | | |
|---|-------------------|-----------|---------------------|-----------|---------|---|
| Parameter | Symbol | Min. | Typ. ⁽⁵⁾ | Max. | Units | Test Conditions |
| Output voltage | V_O | | | V_{DD} | V | $I_O = 0$ |
| Differential Output Voltage ⁽²⁾ | $ V_{OD1} $ | | | V_{DD} | V | $I_O = 0$ |
| Differential Output Voltage ⁽²⁾ | $ V_{OD2} $ | 2.1 | 3 | 3.5 | V | $R_L = 54 \Omega$ |
| Differential Output Voltage ⁽²⁾⁽⁶⁾ | V_{OD3} | 1.9 | | 3.5 | V | $R_L = 60 \Omega$ |
| Change in Magnitude of Differential Output Voltage ⁽⁷⁾ | $\Delta V_{OD} $ | | | ± 0.2 | V | $R_L = 54 \Omega$ or 100Ω |
| Common Mode Output Voltage | V_{OC} | | | 3 | V | $R_L = 54 \Omega$ or 100Ω |
| Change in Magnitude of Common Mode Output Voltage ⁽⁷⁾ | $\Delta V_{OC} $ | | | ± 0.2 | V | $R_L = 54 \Omega$ or 100Ω |
| Output Current ⁽⁴⁾ | I_O | | | 1 -0.8 | mA | Output Disabled, $V_O = 12$ $V_O = -7$ |
| High Level Input Current | I_{IH} | | | 10 | μ A | $V_I = 3.5$ V |
| Low Level Input Current | I_{IL} | | | -10 | μ A | $V_I = 0.4$ V |
| Absolute Short-circuit Output Current | I_{OS} | | | 250 | mA | -7 V < V_O < 12 V |
| Supply Current | $V_{DD1} = 5$ V | I_{DD1} | 4 | 6 | mA | No load (Outputs Enabled) |
| | $V_{DD1} = 3.3$ V | I_{DD1} | 3 | 4 | | |

Notes (apply to both driver and receiver sections):

- All voltages are with respect to network ground except differential I/O bus voltages.
- Differential input/output voltage is measured at the noninverting terminal A with respect to the inverting terminal B.
- Skew limit is the maximum propagation delay difference between any two devices at 25°C .
- The power-off measurement in ANSI Standard EIA/TIA-422-B applies to disabled outputs only and is not applied to combined inputs and outputs.
- All typical values are at $V_{DD1}, V_{DD2} = 5$ V or $V_{DD1} = 3.3$ V and $T_A = 25^\circ\text{C}$.
- -7 V < $V_{CM} < 12$ V; 4.5 V < $V_{DD} < 5.5$ V.
- $\Delta|V_{OD}|$ and $\Delta|V_{OC}|$ are the changes in magnitude of V_{OD} and V_{OC} , respectively, that occur when the input is changed from one logic state to the other.
- This applies for both power on and power off, refer to ANSI standard RS-485 for exact condition. The EIA/TIA-422-B limit does not apply for a combined driver and receiver terminal.
- Includes 10 ns read enable time. Maximum propagation delay is 25 ns after read assertion.
- Pulse skew is defined as $|t_{PLH} - t_{PHL}|$ of each channel.
- Absolute Maximum specifications mean the device will not be damaged if operated under these conditions. It does not guarantee performance.
- The relevant test and measurement methods are given in the Electromagnetic Compatibility section on p. 6.
- 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. 6).

Receiver Section

| Electrical Specifications (T_{min} to T_{max} and $V_{DD} = 4.5$ V to 5.5 V unless otherwise stated) | | | | | | |
|---|-----------|----------------|---------------------|---------|------------|--|
| Parameter | Symbol | Min. | Typ. ⁽⁵⁾ | Max. | Units | Test Conditions |
| Positive-going Input Threshold Voltage | V_{IT+} | | | 0.2 | V | -7 V < V_{CM} < 12 V |
| Negative-going Input Threshold Voltage | V_{IT-} | -0.2 | | | V | -7 V < V_{CM} < 12 V |
| Hysteresis Voltage ($V_{IT+} - V_{IT-}$) | V_{HYS} | | 28 | | mV | $V_{CM} = 0$ V, $T = 25^{\circ}$ C |
| Differential Bus Input Capacitance | C_D | | 9 | 12 | pF | |
| High Level Digital Output Voltage | V_{OH} | $V_{DD} - 0.2$ | V_{DD} | | V | $V_{ID} = 200$ mV $I_{OH} = -20$ μ A |
| Low Level Digital Output Voltage | V_{OL} | | | 0.2 | V | $V_{ID} = -200$ mV $I_{OH} = 20$ μ A |
| High-impedance-state output current | I_{OZ} | | | ± 1 | μ A | $V_O = 0.4$ to $(V_{DD2} - 0.5)$ V |
| Line Input Current ⁽⁸⁾ | I_I | | | 1 | mA | $V_I = 12$ V |
| | | | | -0.8 | mA | $V_I = -7$ V |
| Input Resistance | R_I | 20 | | | k Ω | |
| Supply Current | I_{DD2} | | 5 | 16 | mA | No load; Outputs Enabled; V_{DD2X} connected to V_{DD21} if applicable |

Switching Characteristics

| $V_{DD1} = 5$ V, $V_{DD2} = 5$ V | | | | | | |
|---|----------------|------|---------------------|------|-------------|--|
| Parameter | Symbol | Min. | Typ. ⁽⁵⁾ | Max. | Units | Test Conditions |
| Data Rate | | 40 | | | Mbps | $R_I = 54$ Ω , $C_L = 50$ pF |
| Propagation Delay ^(2, 9) | t_{PD} | | 20 | 30 | ns | $V_O = -1.5$ to 1.5 V, $C_L = 15$ pF |
| Pulse Skew ^(2, 10) | $t_{SK}(P)$ | | 1 | 5 | ns | $V_O = -1.5$ to 1.5 V, $C_L = 15$ pF |
| Skew Limit ⁽³⁾ | $t_{SK}(LIM)$ | | 2 | 10 | ns | $R_I = 54$ Ω , $C_L = 50$ pF |
| Output Enable Time To High Level | t_{PZH} | | 15 | 30 | ns | $C_L = 15$ pF |
| Output Enable Time To Low Level | t_{PZL} | | 15 | 30 | ns | $C_L = 15$ pF |
| Output Disable Time From High Level | t_{PHZ} | | 15 | 30 | ns | $C_L = 15$ pF |
| Output Disable Time From Low Level | t_{PLZ} | | 15 | 30 | ns | $C_L = 15$ pF |
| Common Mode Transient Immunity (Output Logic High to Logic Low) | $ CM_H , CM_L$ | 30 | 50 | | kV/ μ s | $V_{CM} = 1500$ V _{DC} $t_{TRANSIENT} = 25$ ns |
| $V_{DD1} = 3.3$ V, $V_{DD2} = 5$ V | | | | | | |
| Parameter | Symbol | Min. | Typ. ⁽⁵⁾ | Max. | Units | Test Conditions |
| Data Rate | | 40 | | | Mbps | $R_I = 54$ Ω , $C_L = 50$ pF |
| Propagation Delay ^(2, 9) | t_{PD} | | 25 | 35 | ns | $V_O = -1.5$ to 1.5 V, $C_L = 15$ pF |
| Pulse Skew ^(2, 10) | $t_{SK}(P)$ | | 2 | 5 | ns | $V_O = -1.5$ to 1.5 V, $C_L = 15$ pF |
| Skew Limit ⁽³⁾ | $t_{SK}(LIM)$ | | 4 | 10 | ns | $R_I = 54$ Ω , $C_L = 50$ pF |
| Output Enable Time To High Level | t_{PZH} | | 17 | 30 | ns | $C_L = 15$ pF |
| Output Enable Time To Low Level | t_{PZL} | | 17 | 30 | ns | $C_L = 15$ pF |
| Output Disable Time From High Level | t_{PHZ} | | 17 | 30 | ns | $C_L = 15$ pF |
| Output Disable Time From Low Level | t_{PLZ} | | 17 | 30 | ns | $C_L = 15$ pF |
| Common Mode Transient Immunity (Output Logic High to Logic Low) | $ CM_H , CM_L$ | 30 | 50 | | kV/ μ s | $V_{CM} = 1500$ V _{DC} $t_{TRANSIENT} = 25$ ns |

Magnetic Field Immunity⁽¹²⁾

| V _{DD1} = 5 V, V _{DD2} = 5 V | | | | | | |
|--|------------------|------|------|--|-----|----------------------|
| Power Frequency Magnetic Immunity | H _{PF} | 2800 | 3500 | | A/m | 50Hz/60Hz |
| Pulse Magnetic Field Immunity | H _{PM} | 4000 | 4500 | | A/m | t _p = 8μs |
| Damped Oscillatory Magnetic Field | H _{OSC} | 4000 | 4500 | | A/m | 0.1Hz – 1MHz |
| Cross-axis Immunity Multiplier ⁽¹³⁾ | K _X | | 2.5 | | | |
| V _{DD1} = 3.3 V, V _{DD2} = 5 V | | | | | | |
| Power Frequency Magnetic Immunity | H _{PF} | 1000 | 1500 | | A/m | 50Hz/60Hz |
| Pulse Magnetic Field Immunity | H _{PM} | 1800 | 2000 | | A/m | t _p = 8μs |
| Damped Oscillatory Magnetic Field | H _{OSC} | 1800 | 2000 | | A/m | 0.1Hz – 1MHz |
| Cross-axis Immunity Multiplier ⁽¹³⁾ | K _X | | 2.5 | | | |

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.

Narrow- and Wide-Body Pinout Differences

The narrow-body version (IL3685-3E) is designed for application flexibility and minimum board area in densely-populated PCAs. The wide-body version (IL3685E) has redundant ground pins for layout flexibility.

The narrow-body version provides a separate isolated DE output (ISODE) and Transceiver Device Enable (XDE) input. ISODE follows the Device Enable input (DE). XDE can be used to enable and disable the transceiver from the bus side, or connected to ISODE to enable and disable the transceiver from the DE controller-side input. The narrow-body version also provides separate bus-side power supply and ground pins—V_{DD2X} and GND_{2X} for the transceiver module and V_{DD21} and GND₂₁ for the isolation module. The supplies and grounds should be externally connected for normal operation, but they can be used separately for testing or troubleshooting.

The wide-body version has internal connections between the isolated DE output and the Transceiver Device Enable input, and well as between the two bus-side power supplies. The ISODE output can be used in PROFIBUS applications where the state of the isolated drive enable node needs to be monitored, or for testing or troubleshooting.

Dynamic Power Consumption

IsoLoop Isolators achieve their low power consumption from the way they transmit data across the isolation barrier. By detecting the edge transitions of the input logic signal and converting these to narrow current pulses, a magnetic field is created around the GMR Wheatstone bridge. Depending on the direction of the magnetic field, the bridge causes the output comparator to switch following the input logic signal. Since the current pulses are narrow, about 2.5 ns, the power consumption is independent of mark-to-space ratio and solely dependent on frequency. This has obvious advantages over optocouplers, which have power consumption heavily dependent on frequency and time.

| Data Rate (Mbps) | I _{DD1} | I _{DD2} |
|------------------|------------------|------------------|
| 1 | 150 μA | 150 μA |
| 10 | 1.5 mA | 1.5 mA |
| 20 | 3 mA | 3 mA |
| 40 | 6 mA | 6 mA |

Table 2. Typical Dynamic Supply Currents.

Power Supply Decoupling

Both V_{DD1} and V_{DD2} must be bypassed with 47 nF ceramic capacitors. These should be placed as close as possible to V_{DD} pins for proper operation. Additionally, V_{DD2} should be bypassed with a 10 μF tantalum capacitor.

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.

DC Correctness

The IL3685 incorporates a patented refresh circuit to maintain the correct output state with respect to data input. At power up, the bus outputs will follow the Function Table shown on Page 1. The DE input should be held low during power-up to eliminate false drive data pulses from the bus. An external power supply monitor to minimize glitches caused by slow power-up and power-down transients is not required.

Electromagnetic Compatibility

The IL3685 is fully compliant with generic EMC standards EN50081, EN50082-1 and the umbrella line-voltage standard for Information Technology Equipment (ITE) EN61000. The IsoLoop Isolator's Wheatstone bridge configuration and differential magnetic field signaling ensure excellent EMC performance against all relevant standards. NVE conducted compliance tests in the categories below:

EN50081-1

Residential, Commercial & Light Industrial

Methods EN55022, EN55014

EN50082-2: Industrial Environment

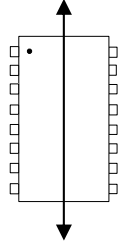
Methods EN61000-4-2 (ESD), EN61000-4-3 (Electromagnetic Field Immunity), EN61000-4-4 (Electrical Transient Immunity),

EN61000-4-6 (RFI Immunity), EN61000-4-8 (Power Frequency Magnetic Field Immunity), EN61000-4-9 (Pulsed Magnetic

Field), EN61000-4-10 (Damped Oscillatory Magnetic Field)

ENV50204

Radiated Field from Digital Telephones (Immunity Test)



Immunity to external magnetic fields is even higher if the field direction is “end-to-end” (rather than to “pin-to-pin”) as shown in the diagram above.

Termination and Fail-Safe Biasing

Internal Biasing Resistors

“Fail-safe biasing” forces a logic high state on “R” in response to an open-circuit condition between the bus “A” and “B” lines, or when no drivers are active on the bus. IL3000-Series Isolated Transceivers include internal pull-up and pull-down resistors of approximately 30 kΩ in the receiver section (RFS-INT in Figure 2 below):

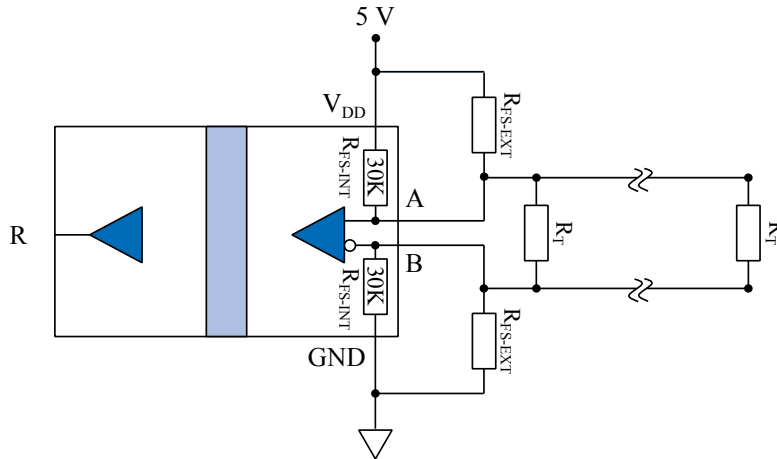


Figure 2. Termination and internal and external fail-safe biasing resistors.

These internal resistors ensure fail-safe operation if there are no termination resistors and up to four RS-485 worst-case Unit Loads of 12 kΩ.

Termination Resistors

Termination resistors should be on both ends of the network to minimize reflections. Values should be selected to match cable impedance; 220 Ω resistors are typical for PROFIBUS.

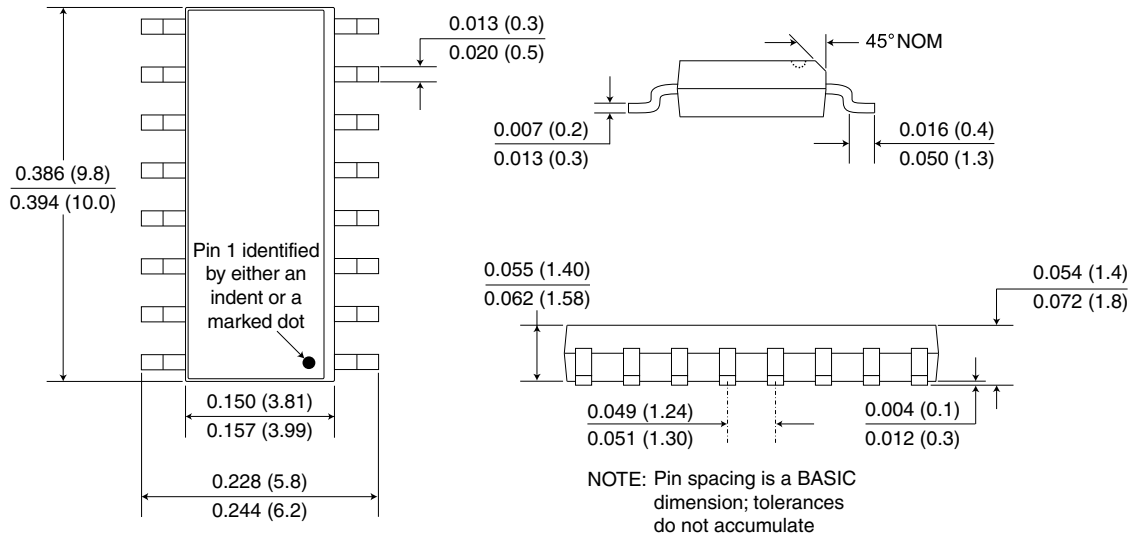
External Fail-Safe Biasing Resistors

Termination resistors bring the differential voltage across the conductor pair close to zero with no active drivers. In this case, the idle bus is indeterminate and susceptible to noise. External fail-safe biasing resistors (labeled RFS-EXT in Figure 2) at one end of the bus ensure fail-safe operation with a terminated bus. Biasing should provide at least 200 mV across the conductor pair to meet the RS-485 input sensitivity specification. Fail-safe resistors of 390 Ω are common for PROFIBUS. They should be on only one node of the network. Using the same value for pull-up and pull-down biasing resistors maintains balance for positive- and negative going transitions.

Package Drawings

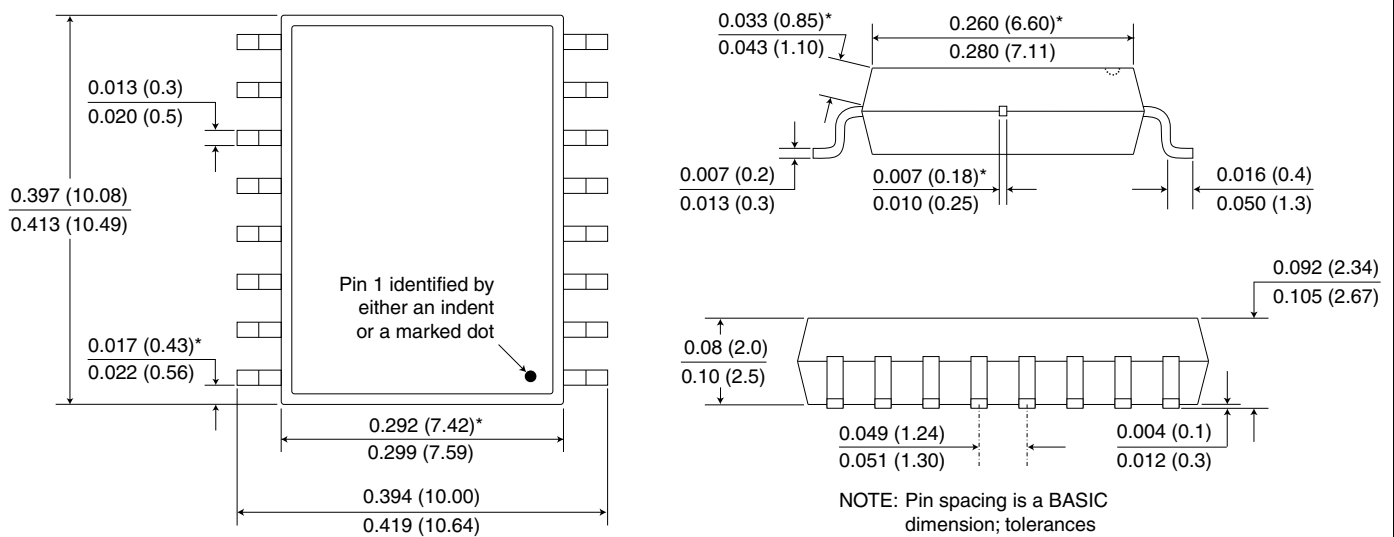
0.15" 16-pin SOIC Package (-3 suffix)

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



0.3" 16-pin SOIC Package (no suffix)

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

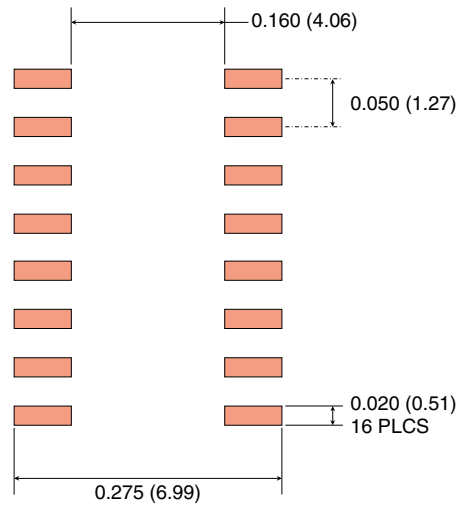


*Specified for True 8™ package to guarantee 8 mm creepage per IEC 60601.

Recommended Pad Layouts

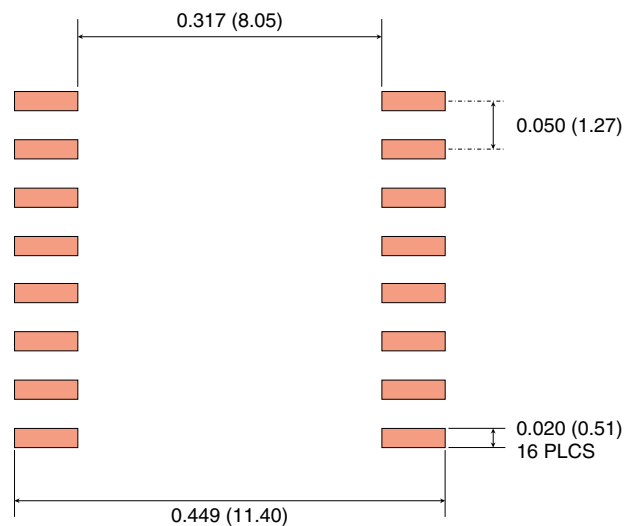
0.15" 16-pin SOIC Pad Layout

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



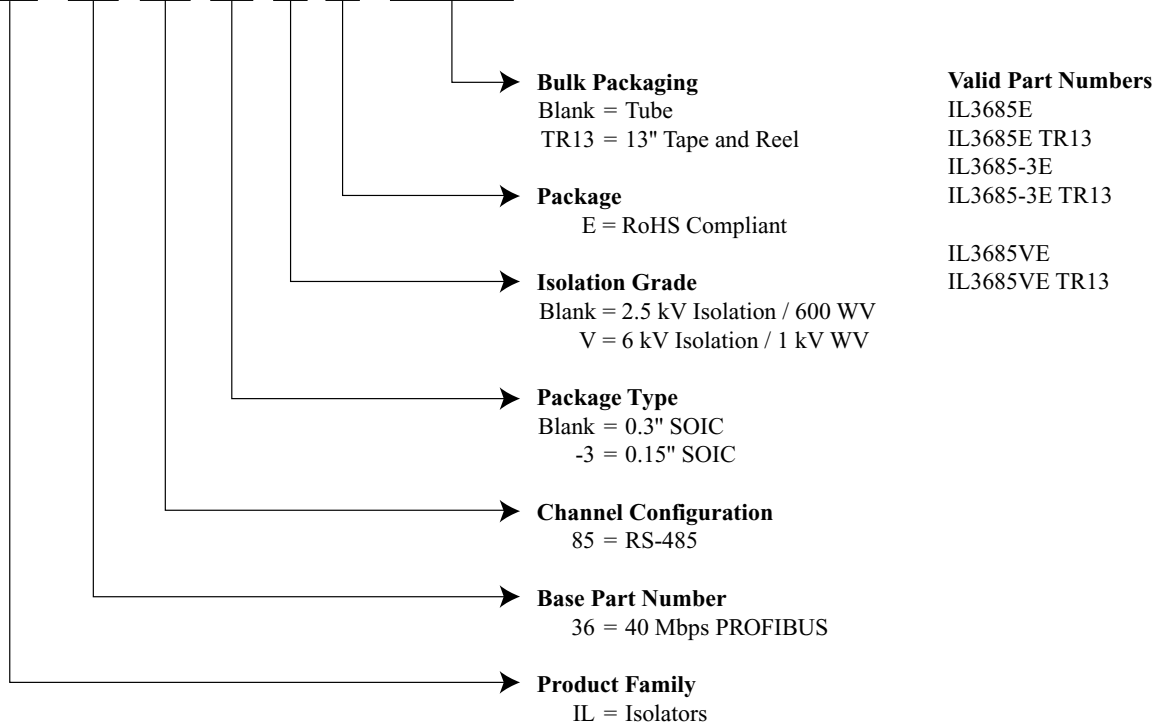
0.3" 16-pin SOIC Pad Layout

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



Ordering Information and Valid Part Numbers

IL 36 85 -3 V E TR13



Revision History

ISB-DS-001-IL3685-R
August 2015

Change

- Updated VDE certification standard to VDE V 0884-10.
- Upgraded “V” Version Surge Immunity specification to 12.8 kV.
- Upgraded “V” Version VDE 0884-10 rating to reinforced insulation.

ISB-DS-001-IL3685-Q

Change

- Increased V-Series isolation voltage to 6 kVrms.
- Increased typ. Total Barrier Thickness specification to 0.016 mm.
- Increased CTI min. specification to $\geq 600 V_{RMS}$.

ISB-DS-001-IL3685-P

Change

- Increase V-Series surge voltage specification to 10 kV.
- Upgraded V-Series safety and approval from IEC 60747-5-5 (VDE 0884) to VDE 0884-10.

ISB-DS-001-IL3685-O

Change

- Added V-Series versions (5 kVrms isolation / 1000 Vrms working voltage)

ISB-DS-001-IL3685-N

Change

- Added Differential Bus Input Capacitance specification (p. 6).

ISB-DS-001-IL3685-M

Change

- IEC 60747-5-5 (VDE 0884) certification.
- Upgraded from MSL 2 to MSL 1.

ISB-DS-001-IL3685-L

Change

- Increased transient immunity specifications based on additional data.
- Added VDE 0884 pending.
- Added transient immunity specifications.
- Added high voltage endurance specification.
- Increased magnetic immunity specifications.
- Updated package drawings.
- Added recommended solder pad layouts.

ISB-DS-001-IL3685-K

Change

- Added thermal characteristics (p. 2).
- Cosmetic changes.

ISB-DS-001-IL3685-J

Change

- Added narrow-body version (IL3685-3E).
- UL 1577 recognition and IEC 61010-1 approval.
- Added application schematics (p. 7).
- Revised biasing and termination section (p. 8).

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.

An ISO 9001 Certified Company

NVE Corporation
11409 Valley View Road
Eden Prairie, MN 55344-3617 USA
Telephone: (952) 829-9217
Fax: (952) 829-9189
www.nve.com
e-mail: iso-info@nve.com

©NVE Corporation
All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

ISB-DS-001-IL3685-R

August 2015