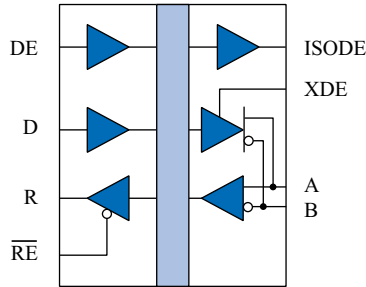
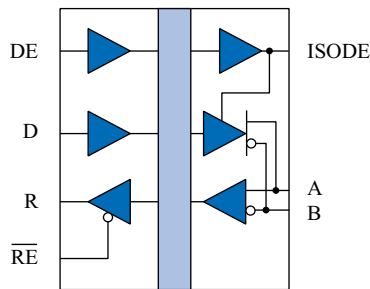


High Speed Isolated RS-485 Transceivers

Functional Diagrams



IL3585-3
(narrow-body)



IL3585
(wide-body)

| V _{ID} (A-B) | DE | \overline{RE} | R | D | Mode | Notes |
|-----------------------|----|-----------------|---|---|----------|----------------------------|
| ≥ 200 mV | L | L | H | X | Receive | |
| ≤ -200 mV | L | L | L | X | | |
| Open | L | L | H | X | | |
| ≥ 1.5 V | H | L | H | H | Drive | R reads back D information |
| ≤ -1.5 V | H | L | L | L | | |
| ≥ 1.5 V | H | H | Z | H | | R tri-state (no output) |
| ≤ -1.5 V | H | H | Z | L | | |
| X | L | H | Z | X | Disabled | R tri-state; A/B failsafe |

Features

- 40 Mbps data rate
- 6 kV_{RMS} Reinforced Isolation / 12.8 kV surge / 1.2 kV_{RMS} WV (IL3585VE)
- 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 °C temperature range
- Meets or exceeds ANSI RS-485 and ISO 8482:1987(E)
- IEC 60747-17 (VDE 0884-17):2021-10 certified; UL 1577 recognized
- 0.15" or 0.3" True 8TM 16-pin SOIC packages

Applications

- Factory automation
- Industrial control networks
- Building environmental controls
- Equipment covered under IEC 61010-1 Edition 3
- 5 kV_{RMS} rated IEC 60601-1 medical applications

Description

The IL3585 is a galvanically isolated, high-speed differential bus transceiver, designed for bidirectional data communication on balanced transmission lines. The device uses NVE's patented* spintronic Giant Magnetoresistance (GMR) technology.

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

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 8TM 16-pin SOIC package for true 8 millimeter creepage.

The IL3585 delivers an exceptional 2.3 V differential output into a 54 Ω load over the supply range of 4.5 V to 5.5 V. This provides better data integrity over longer cable lengths, even at data rates as high as 40 Mbps. The device is also compatible with 3 V 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.

Absolute Maximum Ratings⁽¹¹⁾

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|----------------------------------|--------------------|------|------|----------------|-------|-----------------|
| Storage Temperature | T_S | -55 | | 150 | °C | |
| Junction Temperature | T_J | -55 | | 150 | °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 | |
| Ambient Operating Temperature | T_A | -40 | | 85 | °C | |
| Junction Temperature | T_J | -40 | | 100 | °C | |
| Input Voltage at any Bus Terminal (separately or common mode) | V_I V_{IC} | | | 12 -7 | V | |
| 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 | |
| Digital Input Signal Rise and Fall Times | t_{IR}, t_{IF} | | | | | DC Stable |

Safety and Approvals

IEC 60747-17 (VDE 0884-17):2021-10:

IL3585VE version (Reinforced Isolation; VDE File Number 5016933-4880-0002)

- Working Voltage (V_{IORM}): 1200 V_{RMS} (1700 V_{PK}) with 20% Safety Factor; pollution degree 2
- Isolation voltage (V_{ISO}): 6000 V_{RMS}
- Surge immunity (V_{IOSM}): 12.8 kV_{PK}
- Surge rating: 8000 V
- 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

Standard IL3585E versions (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 |
|---------------------------------------|-----------------|-----------------|
| QSOP16 | -1 | 600 V_{RMS} |
| Narrow-body SOIC16 | -3 | 700 V_{RMS} |
| Wide-body SOIC16/True 8 TM | None | 600 V_{RMS} |

| 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 |

UL 1577 (Component Recognition Program File Number E207481)

Standard isolation grade

2500 V rating; 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

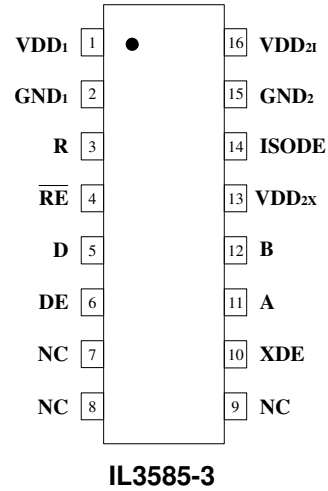
6 kV rating; each part tested at 7.2 kV_{RMS} (10.2 kV_{PK}) for 1 second; each lot sample tested at 6 kV_{RMS} (8485 V_{PK}) for 1 minute

Soldering Profile

Per JEDEC J-STD-020C, MSL 1

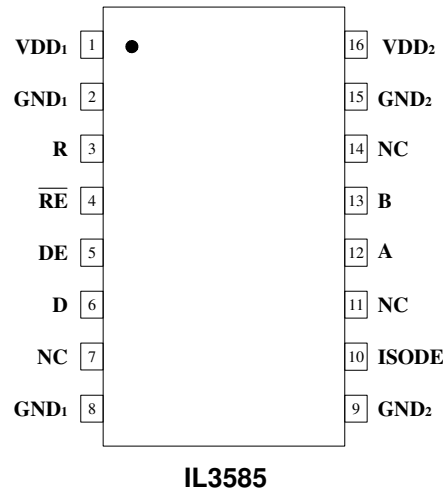
IL3585-3 (0.15" SOIC Package) Pin Connections

| | | |
|---------|-------------------|---|
| 1 | V _{DD1} | Input power supply |
| 2 | GND ₁ | Input power supply ground return |
| 3 | R | Output data from bus |
| 4 | \overline{RE} | Read data enable (if \overline{RE} is high, R= high impedance) |
| 5 | D | Data input to bus |
| 6 | DE | Drive enable |
| 7, 8, 9 | NC | No internal connection |
| 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 ₂ | Output power supply ground return. |
| 16 | V _{DD2I} | Output isolation power supply (normally connected to pin 13) |



IL3585 (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{RE} | Read data enable (if \overline{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 |



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. | Max. | Units | Test Conditions |
| Input Clamp Voltage | V _{IK} | | | -1.5 | V | I _L = -18 mA |
| 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} | 2.5 | 3 | 5 | V | R _L = 54 Ω, V _{DD} = 5 V |
| Differential Output Voltage ⁽²⁾ | V _{OD3} | 2.3 | | 5 | V | R _L = 54 Ω, V _{DD} = 4.5 V |
| Change in Magnitude of Differential Output Voltage ⁽⁴⁾ | Δ V _{OD} | | | ±0.2 | V | R _L = 54 Ω or 100 Ω |
| Common Mode Output Voltage | V _{OC} | | | 3 | V | R _L = 54 Ω or 100 Ω |
| Change in Magnitude of Common Mode Output Voltage ⁽⁴⁾ | Δ V _{OC} | | | ±0.2 | V | R _L = 54 Ω or 100 Ω |
| Output Current | I _O | | | 1 -0.8 | mA | Output Disabled, V _O = 12 V _O = -7 |
| High Level Input Current | I _{IH} | | | 10 | μA | V _I = 3.5 V |
| Low Level Input Current | I _{IL} | | | -10 | μA | V _I = 0.4 V |
| Absolute Short-circuit Output Current | I _{OS} | | | 250 | mA | -7 V < V _O < 12 V |

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. | 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} | | 40 | | mV | V _{CM} = 0 V, T = 25°C |
| High Level Digital Output Voltage | V _{OH} | V _{DD} - 0.2 | V _{DD} | | V | V _{ID} = 200 mV I _{OH} = -20 μA |
| Low Level Digital Output Voltage | V _{OL} | | | 0.2 | V | V _{ID} = -200 mV I _{OH} = 20 μA |
| High-impedance-state output current | I _{OZ} | | | ±1 | μA | V _O = 0.4 to (V _{DD2} -0.5) V |
| Line Input Current | I _I | | | 1 | mA | V _I = 12 V |
| | | | | -0.8 | mA | V _I = -7 V |
| Input Resistance | R _I | 20 | | | kΩ | |

Power Consumption

| T _{min} to T _{max} and V _{DD2} = 5 V unless otherwise stated | | | | | | |
|---|-------------------------------------|------|----------|--------|---------|---|
| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
| Controller-Side Quiescent Current V _{DD1} = 3.3 V V _{DD1} = 5 V | I _{DD1} | | 3 4 | 4 6 | mA | f _{IN} = 0 Hz |
| Bus-Side Quiescent Supply Current | I _{DD2} | | 5 | 16 | mA | Outputs Enabled; R _T = ∞; f _{IN} = 0 Hz ; V _{DD2X} connected to V _{DD21} if applicable |
| Controller-Side Dynamic Supply Current | I _{DD1} | | 0.22 | | mA/Mbps | V _{DD1} = 3.3 V |
| Bus-Side Dynamic Supply Current | ΔI _{DD2} /Δf _{IN} | | 1 0.8 | | | R _T = ∞ R _T = 60 Ω |

Switching Characteristics

| V _{DD1} = 5 V, V _{DD2} = 5 V | | | | | | |
|---|-------------------------------------|------|------|------|-------|--|
| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
| Data Rate | | 40 | | | Mbps | R _L = 54 Ω, C _L = 50 pF |
| Propagation Delay ⁽⁵⁾ | t _{PD} | | 27 | 35 | ns | V _O = -1.5 to 1.5 V, C _L = 15 pF |
| Pulse Skew ⁽⁶⁾ | t _{SK(P)} | | 1 | 6 | ns | V _O = -1.5 to 1.5 V, C _L = 15 pF |
| Skew Limit ⁽³⁾ | t _{SK(LIM)} | | 2 | 12 | ns | R _L = 54 Ω, C _L = 50 pF |
| Output Enable Time To High Level | t _{PZH} | | 15 | 25 | ns | C _L = 15 pF |
| Output Enable Time To Low Level | t _{PZL} | | 15 | 25 | ns | C _L = 15 pF |
| Output Disable Time From High Level | t _{PHZ} | | 15 | 25 | ns | C _L = 15 pF |
| Output Disable Time From Low Level | t _{PLZ} | | 15 | 25 | ns | C _L = 15 pF |
| Common Mode Transient Immunity (Output Logic High to Logic Low) | CM _H , CM _L | 30 | 50 | | kV/μs | V _{CM} = 1500 V _{DC} t _{TRANSIENT} = 25 ns |
| V _{DD1} = 3.3 V, V _{DD2} = 5 V | | | | | | |
| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
| Data Rate | | 40 | | | Mbps | R _L = 54 Ω, C _L = 50 pF |
| Propagation Delay ⁽⁵⁾ | t _{PD} | | 30 | 38 | ns | V _O = -1.5 to 1.5 V, C _L = 15 pF |
| Pulse Skew ⁽⁶⁾ | t _{SK(P)} | | 1 | 6 | ns | V _O = -1.5 to 1.5 V, C _L = 15 pF |
| Skew Limit ⁽³⁾ | t _{SK(LIM)} | | 4 | 12 | ns | R _L = 54 Ω, C _L = 50 pF |
| Output Enable Time To High Level | t _{PZH} | | 17 | 27 | ns | C _L = 15 pF |
| Output Enable Time To Low Level | t _{PZL} | | 17 | 27 | ns | C _L = 15 pF |
| Output Disable Time From High Level | t _{PHZ} | | 17 | 27 | ns | C _L = 15 pF |
| Output Disable Time From Low Level | t _{PLZ} | | 17 | 27 | ns | C _L = 15 pF |
| Common Mode Transient Immunity (Output Logic High to Logic Low) | CM _H , CM _L | 30 | 50 | | kV/μs | V _{CM} = 1500 V _{DC} t _{TRANSIENT} = 25 ns |

Magnetic Field Immunity⁽⁸⁾

| V _{DD1} = 5 V, V _{DD2} = 5 V | | | | | | |
|--|------------------|------|------|------|-------|----------------------|
| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
| Power Frequency Magnetic Immunity | H _{PF} | | 3500 | | A/m | 50Hz/60Hz |
| Pulse Magnetic Field Immunity | H _{PM} | | 4500 | | A/m | t _p = 8μs |
| Damped Oscillatory Magnetic Field | H _{OSC} | | 4500 | | A/m | 0.1Hz – 1MHz |
| Cross-axis Immunity Multiplier ⁽⁹⁾ | K _X | | 2.5 | | | |
| V _{DD1} = 3.3 V, V _{DD2} = 5 V | | | | | | |
| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
| Power Frequency Magnetic Immunity | H _{PF} | | 1500 | | A/m | 50Hz/60Hz |
| Pulse Magnetic Field Immunity | H _{PM} | | 2000 | | A/m | t _p = 8μs |
| Damped Oscillatory Magnetic Field | H _{OSC} | | 2000 | | A/m | 0.1Hz – 1MHz |
| Cross-axis Immunity Multiplier ⁽⁹⁾ | K _X | | 2.5 | | | |

Insulation Specifications

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|--|----------------------|-------------|-------------------|------|-------------------|---|
| Creepage Distance (external) | IL3585-3E IL3585E | 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} | | 3 | | 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 | 1000 | | | V _{RMS} | At maximum operating temperature |
| | DC | 1500 | | | V _{DC} | |
| Surge Immunity (“V” Versions) | V _{IOSM} | 12.8 kV | | | V _{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 | QSOP | θ_{JA} | | 100 | | $^{\circ}\text{C}/\text{W}$ | Double-sided PCB in free air |
| | 0.15" SOIC | | | 82 | | | |
| 0.3" SOIC | 67 | | | | | | |
| | 9 | | | | | | |
| Junction–Case (Top) Thermal Resistance | QSOP | θ_{JC} | | 8 | | | |
| | 0.15" SOIC | | | 12 | | | |
| | 0.3" SOIC | | 46 | | | | |
| Junction–Ambient Thermal Resistance | 0.3" SOIC | θ_{JA} | 9 | | | | |
| Junction–Case (Top) Thermal Resistance | | θ_{JC} | | | | | |
| Power Dissipation | QSOP | P_D | | 675 | mW | | |
| | 0.15" SOIC | | 700 | | | | |
| | 0.3" SOIC | | 1500 | | | | |

Notes:

- 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.
- ΔV_{OD} and ΔV_{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.
- 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.
- External magnetic field immunity is improved by this factor if the field direction is “end-to-end” rather than to “pin-to-pin.”

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 (IL3585-3E) is designed for application flexibility and minimum board area in densely-populated PCAs. The wide-body version (IL3585E) 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 pins— V_{DD2X} for the transceiver module and V_{DD2I} for the isolation module. These pins 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 V_{DD2} bus-side power supply pins. The two internally GND pins for each supply side provide layout flexibility. 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 μ A | 150 μ A |
| 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

V_{DD1} and V_{DD2} should be bypassed with 0.1 μ F typical (47 nF 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.

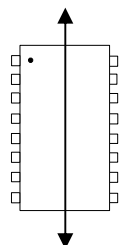
DC Correctness

The IL3585 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 IL3585 is fully compliant with 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 “pin-to-pin”) as shown in the diagram at right:



Application Information

Figures 1a and 1b show typical connections to a microcontroller for the narrow-body and wide-body versions. The schematics include typical termination and fail-safe resistors, and power supply decoupling capacitors:

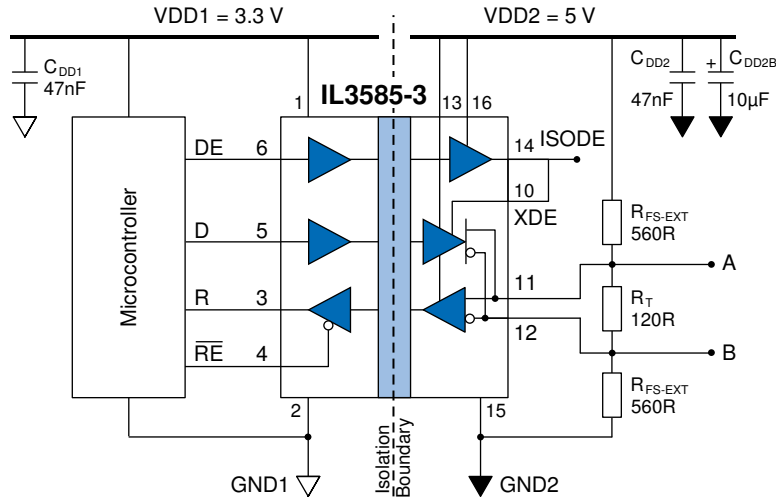


Figure 1a. Typical narrow-body connections.

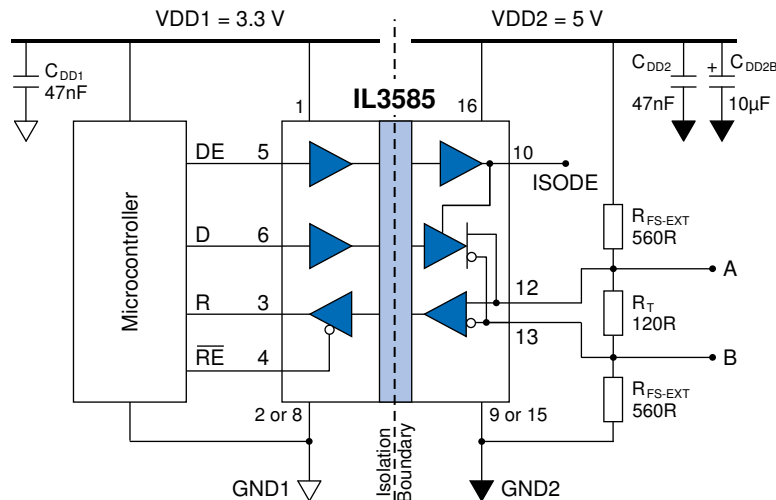


Figure 1b. Typical wide-body connections.

Receiver Features

The receiver output “R” has tri-state capability via the active low \overline{RE} input.

Driver Features

The RS-485 driver has a differential output and delivers at least 2.1 V across a 54 Ω load. Drivers feature low propagation delay skew to maximize bit width and minimize EMI. Drivers have tri-state capability via the active-high DE input.

Receiver Data Rate, Cables and Terminations

The IL3585 is intended for networks up to 4,000 feet (1,200 m), but the maximum data rate decreases as cable length increases. Twisted pair cable should be used in all networks since they tend to pick up noise and other electromagnetically induced voltages as common mode signals, which are effectively rejected by the differential receiver.

Fail-Safe Operation

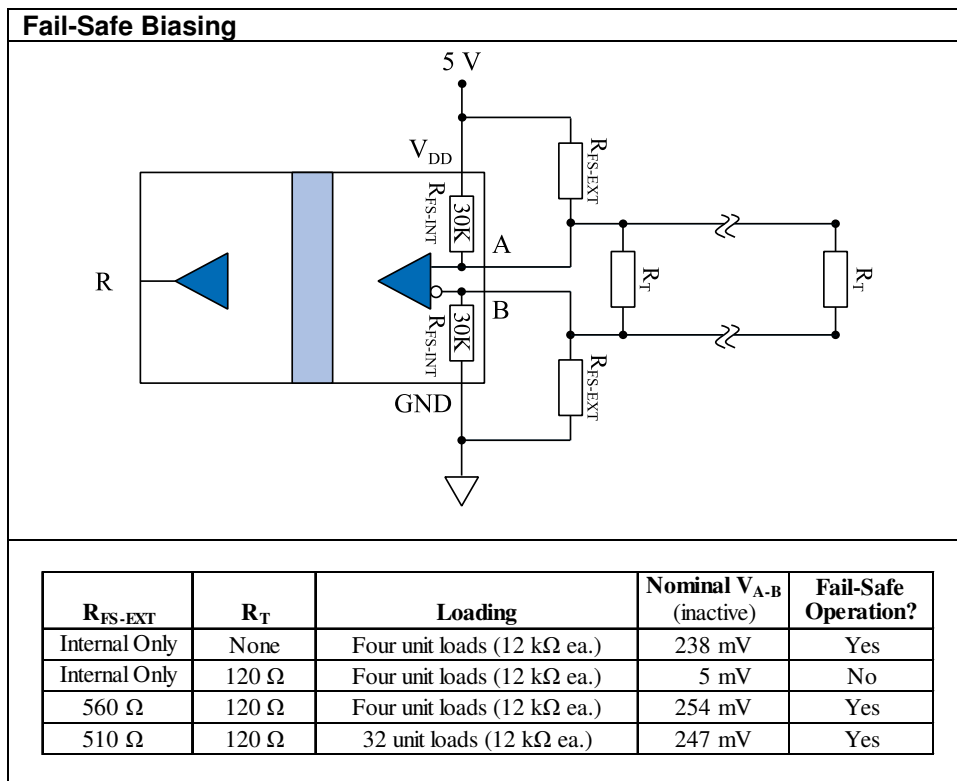
“Fail-safe operation” is defined here as the forcing of a logic high state on the “R” output in response to an open-circuit condition between the “A” and “B” lines of the bus, or when no drivers are active on the bus.

Proper biasing can ensure fail-safe operation, that is a known state when there are no active drivers on the bus. IL3000-Series Isolated Transceivers include internal pull-up and pull-down resistors of approximately 30 kΩ in the receiver section (R_{FS-INT}; see figure below). These internal resistors are designed to ensure failsafe operation but only if there are no termination resistors. The entire V_{DD} will appear between inputs “A” and “B” if there is no loading and no termination resistors, and there will be more than the required 200 mV with up to four RS-485 worst-case Unit Loads of 12 kΩ. Many designs operating below 1 Mbps or less than 1,000 feet are unterminated. Termination resistors may not be necessary for very low data rates and very short cable runs because reflections have time to settle before data sampling, which occurs at the middle of the bit interval.

In busses with low-impedance termination resistors however, the differential voltage across the conductor pair will be close to zero with no active drivers. In this case the state of the bus is indeterminate, and the idle bus will be susceptible to noise. For example, with 120 Ω termination resistors (R_T) on each end of the cable, and four Unit Loads (12 kΩ each), without external fail-safe biasing resistors the internal pull-up and pull-down resistors will produce a voltage between inputs “A” and “B” of only about 5 mV. This is not nearly enough to ensure a known state. External fail-safe biasing resistors (R_{FS-EXT}) at one end of the bus can ensure fail-safe operation with a terminated bus. Resistors should be selected so that under worst-case power supply and resistor tolerances there is at least 200 mV across the conductor pair with no active drivers to meet the input sensitivity specification of the RS-485 standard.

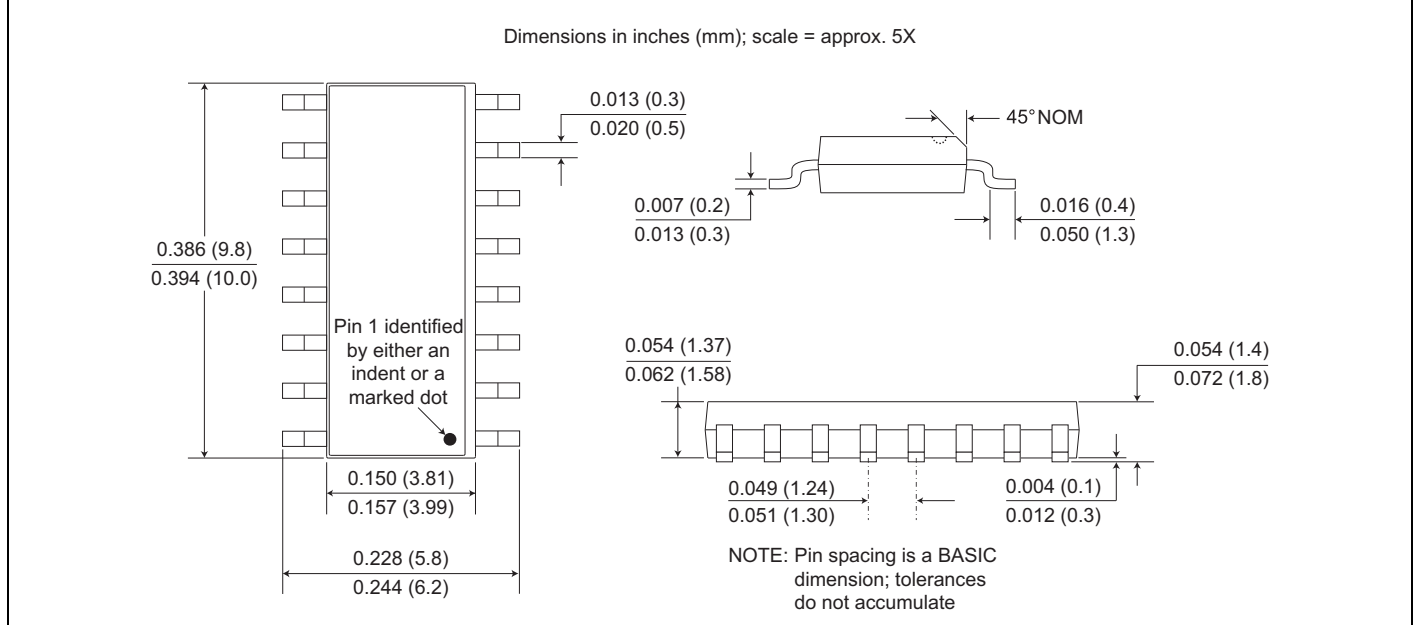
Using the same value for pull-up and pull-down biasing resistors maintains balance for positive- and negative going transitions. Lower-value resistors increase inactive noise immunity at the expense of quiescent power consumption. Note that each Unit Load on the bus adds a worst-case loading of 12 kΩ across the conductor pair, and 32 Unit Loads add 375 Ω worst-case loading. The more loads on the bus, the lower the required values of the biasing resistors.

In the example with two 120 Ω termination resistors and four Unit Loads, 560 Ω external biasing resistors provide more than 200 mV between “A” and “B” with adequate margin for power supply variations and resistor tolerances. This ensures a known state when there are no active drivers. Other illustrative examples are shown in the table below:

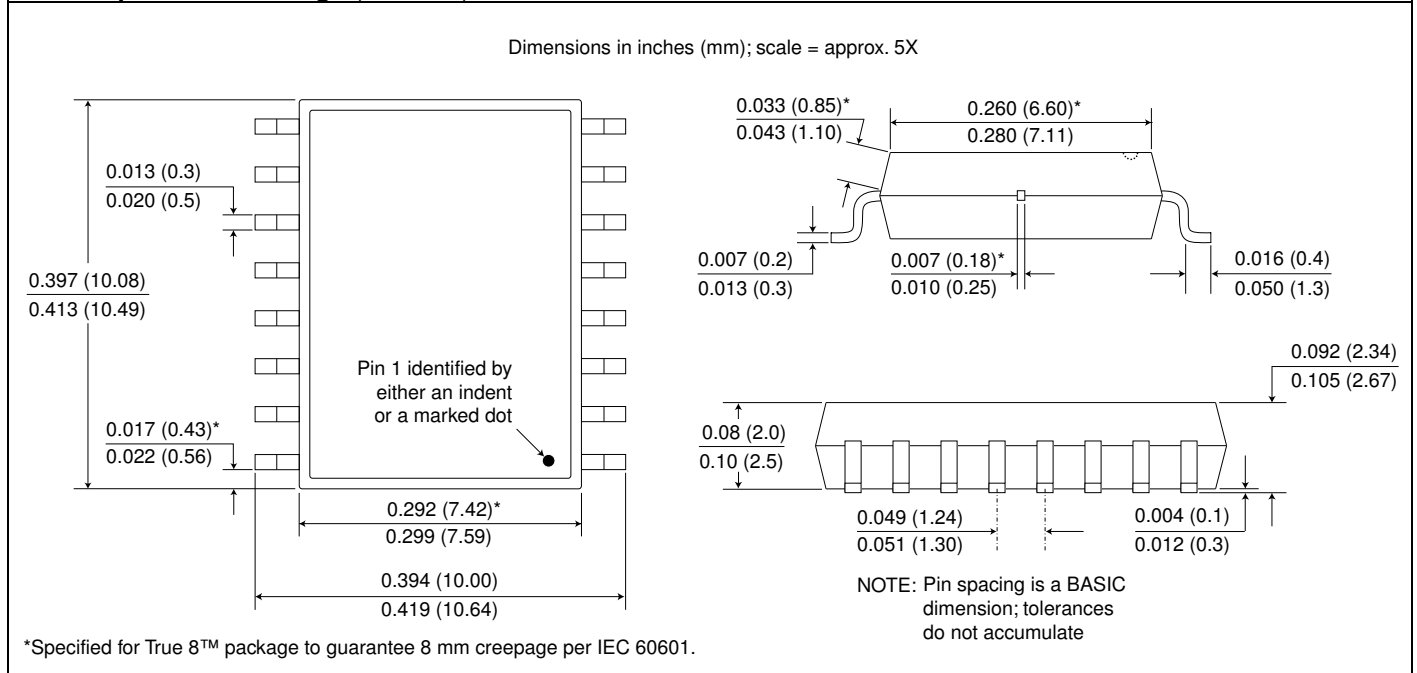


Package Drawings

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



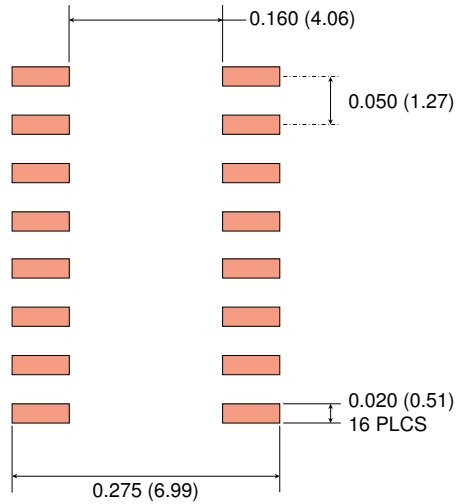
0.3" 16-pin SOIC Package (no suffix)



Recommended Pad Layouts

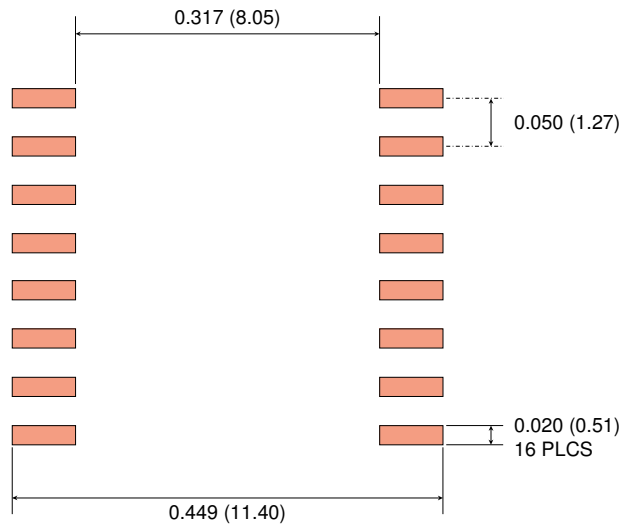
0.15" 16-pin SOIC Pad Layout

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



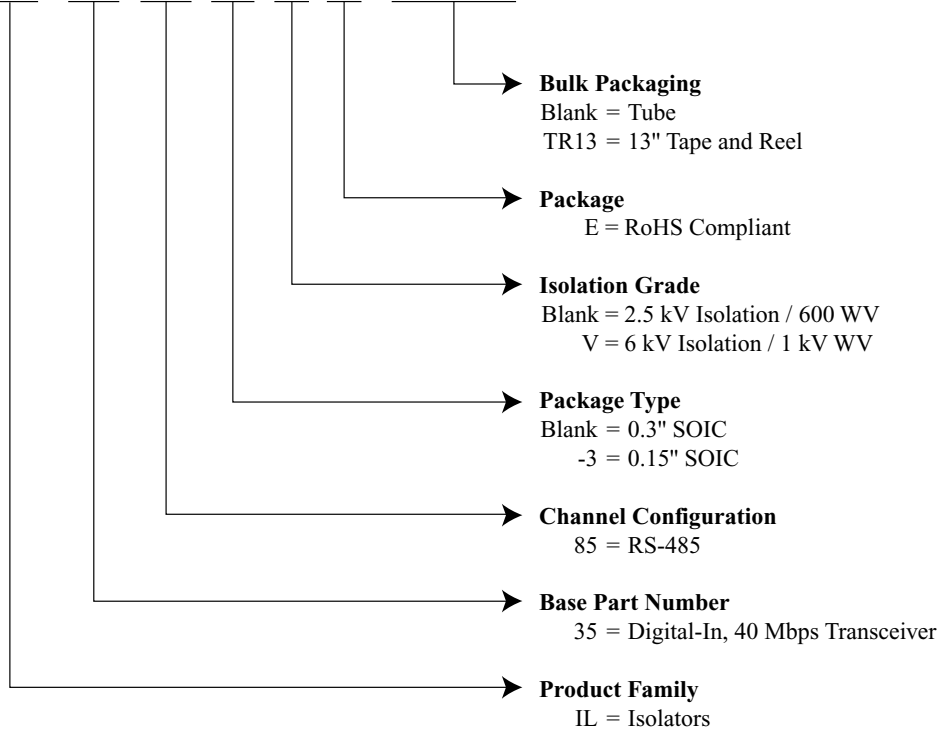
0.3" 16-pin SOIC Pad Layout

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



Ordering Information and Valid Part Numbers

IL 35 85 -3 V E TR13



Valid Part Numbers

- IL3585E
- IL3585E TR13
- IL3585-3E
- IL3585-3E TR13

- IL3585VE
- IL3585VE TR13



Revision History

ISB-DS-001-IL3585-W
August 2022

Changes

- Clarified truth table (p. 1).
- Upgraded to IEC 60747-17 (VDE 0884-17):2021-10 (p. 3).
- Increased Working Voltage ratings based on latest VDE testing (p. 3).
- Separate power consumption specifications section; added dynamic power consumption (p. 5).
- Revised thermal characteristics (p. 7).
- Updated EMC standards.
- Deleted minimum magnetic field immunity specifications (p. 6) since it is not 100% tested.

ISB-DS-001-IL3585-V

Change

- Updated VDE Reinforced Isolation file number and description.

ISB-DS-001-IL3585-U

Changes

- 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-IL3585-T

Changes

- Increased V-Series isolation voltage to 6 kV_{RMS}.
- Increased typ. Total Barrier Thickness specification to 0.016 mm.
- Increased CTI min. specification to ≥ 600 V_{RMS}.

ISB-DS-001-IL3585-S

Changes

- 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-IL3585-R

Change

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

ISB-DS-001-IL3585-Q

Changes

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

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ISB-DS-001-IL3585-W

August 2022