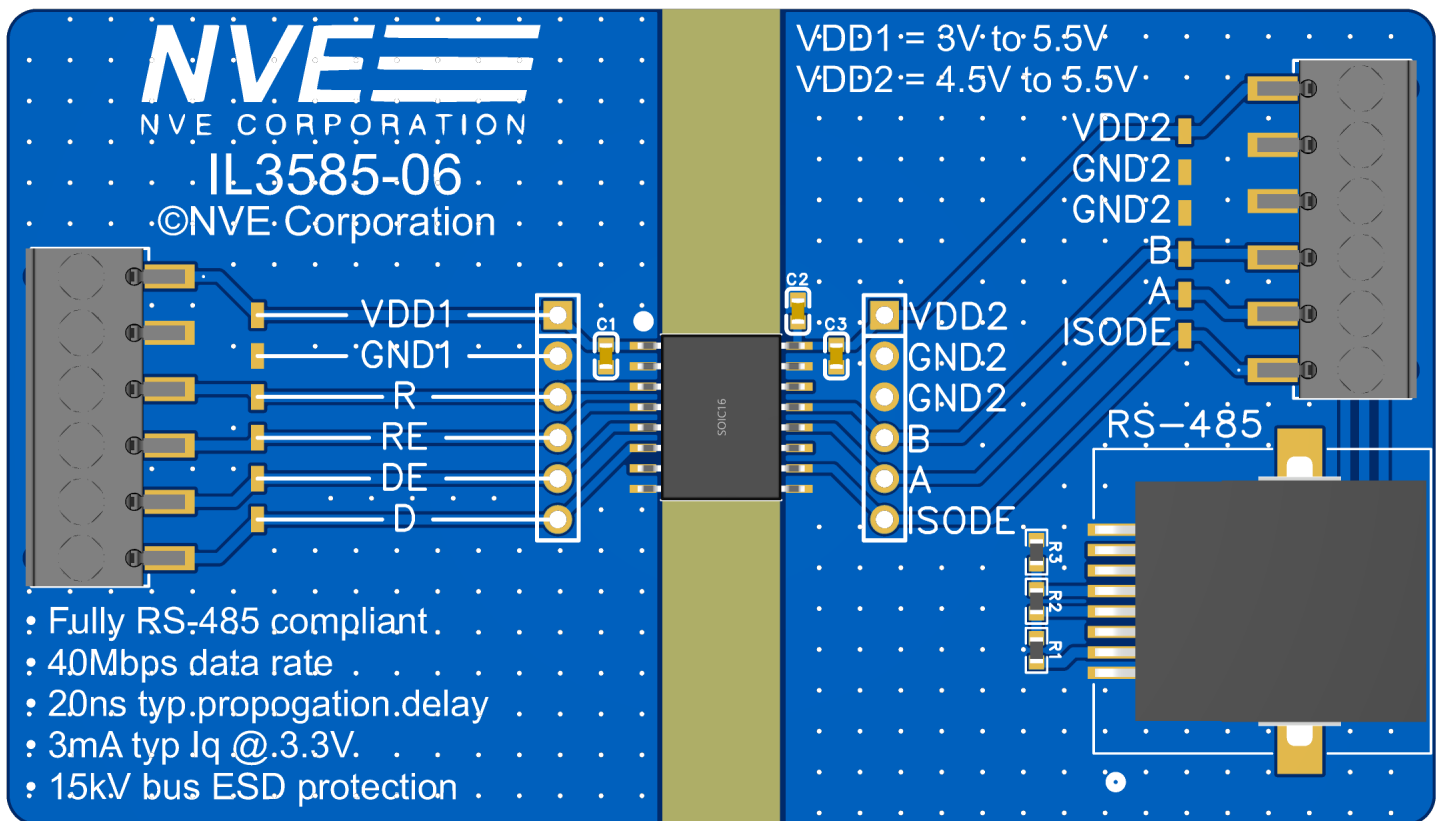


RS-485 Isolated Transceiver Evaluation Boards



About These Evaluation Boards

Isolation reduces noise, eliminates ground loops, and improves safety in RS-485 applications.

These 2 x 3.5-inch (50 x 90 mm) boards contain your choice of an isolated RS-485 transceiver, termination and fail-safe resistors, power-supply bypass capacitors as recommended, as well as screw connections, test pads, provisions for header pins and either an RJ45 or a DB9 bus connector. The RJ45 connector is common for RS-485 and the DB9 is used for PROFIBUS.

The boards use best layout practices including separate ground planes. The galvanically-isolated transceivers use NVE's patented spintronic Giant Magnetoresistance (GMR) technology.

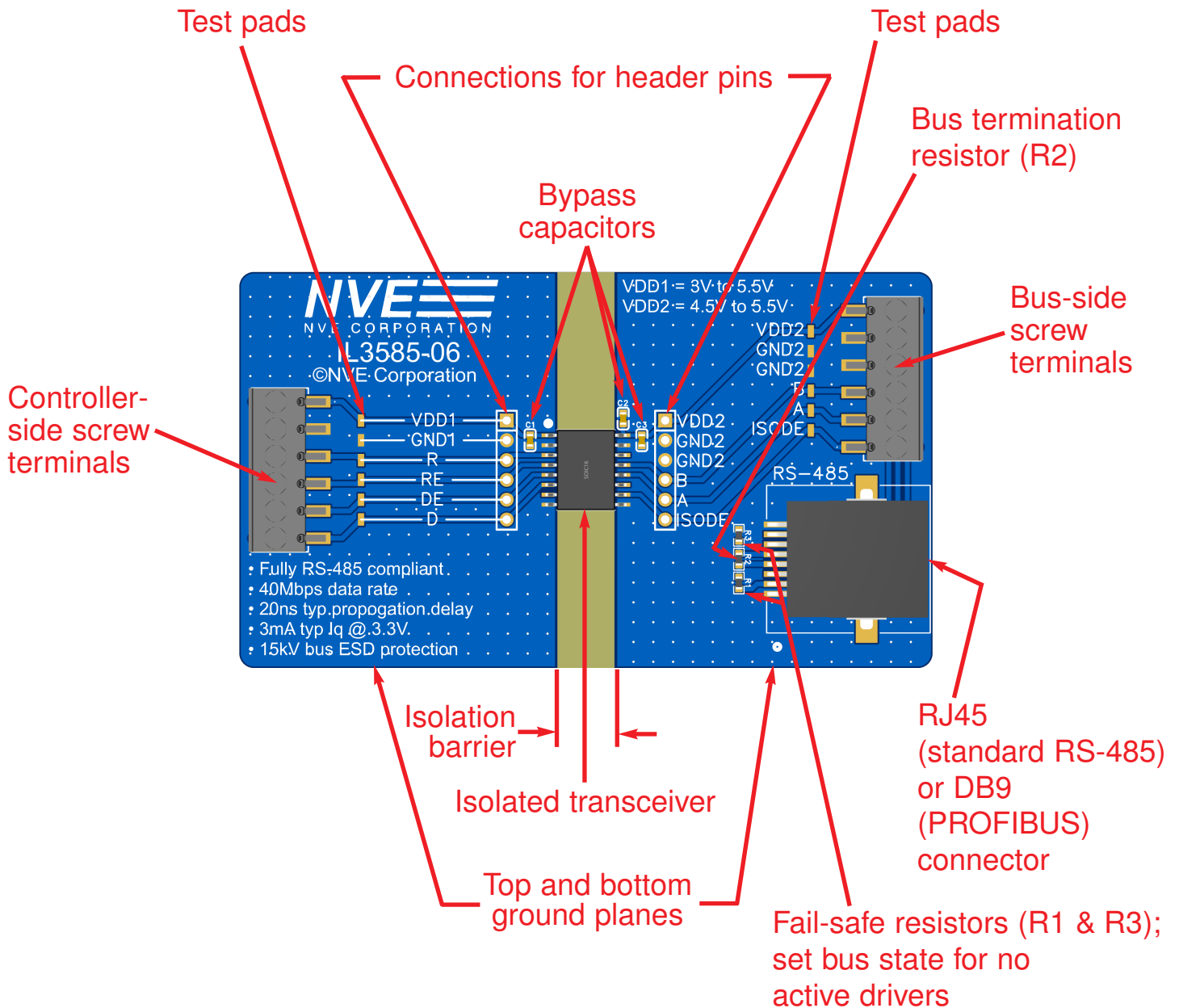
Current limiting and thermal shutdown features protect against output short circuits and bus contention that may cause excessive power dissipation. Receiver inputs feature a "fail-safe if open" design, ensuring a logic high R-output if A/B are floating.

RS-485 Isolated Transceiver Specification Highlights

- Up to 40 Mbps data rate (IL3585 / IL3685)
- Up to 7 kV_{RMS} isolation (IL3x85VE)
- Up to 125 °C (IL3x85TE)
- Meet or exceeds ANSI RS-485 and ISO 8482:1987(E)
- PROFIBUS compliant (IL3685)
- 3 V to 5.5 V power supplies
- Low quiescent supply current
- Minimal EMC footprint
- Thermal shutdown protection
- Reinforced isolation (IL3x85VE)
- IEC 60747-17 (VDE 0884-17):2021-10 certified; UL 1577 recognized
- ATEX and IECEx certified for IS-to-IS Intrinsically Safe applications
- 16-pin wide-body, narrow-body and QSOP packages

Visit www.nve.com for datasheets and illustrative applications.

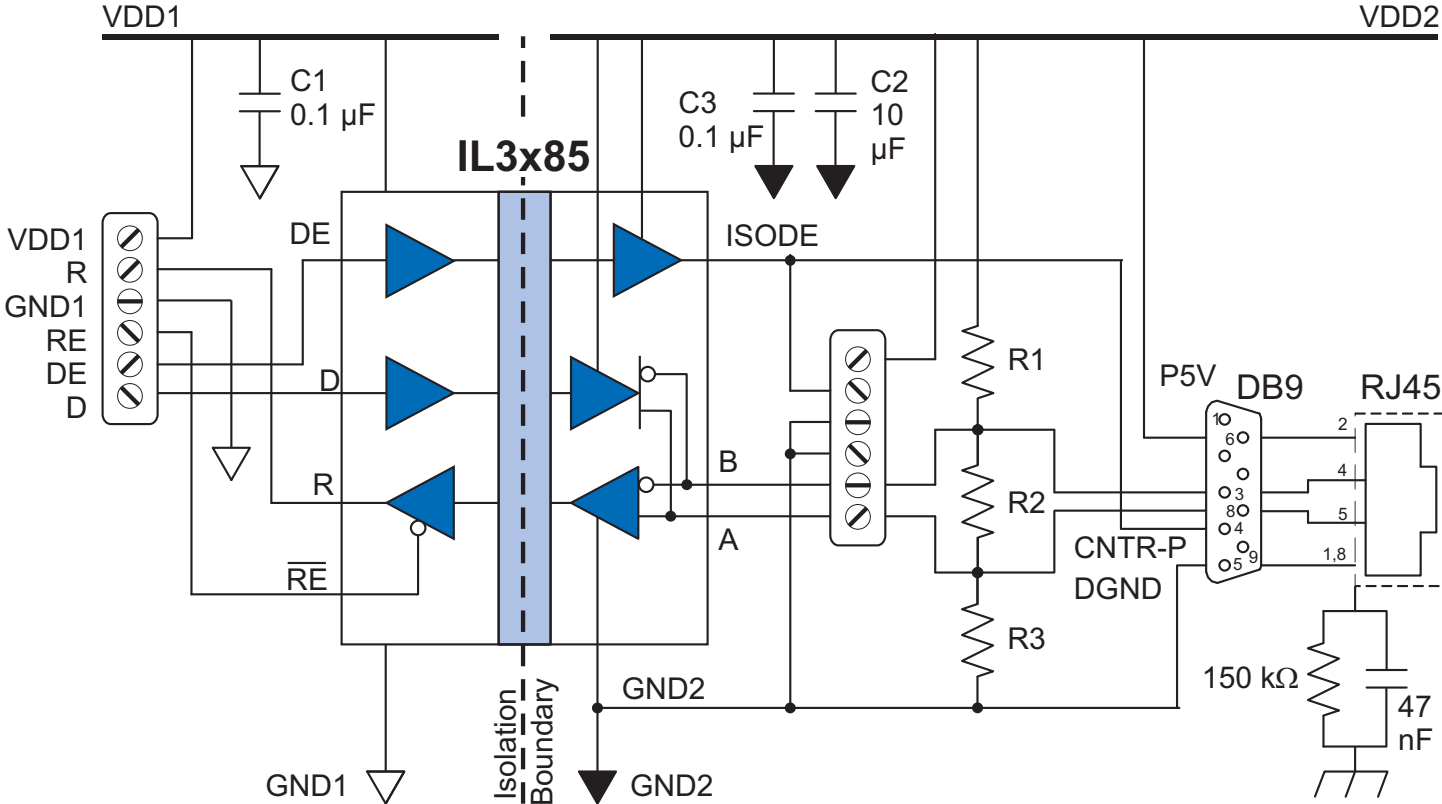
Evaluation Board Layout



Quick Start (typical operation)

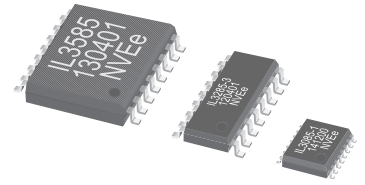
- Connect V_{DD1} to a 3.3 V power supply and V_{DD2} to a 5 V supply.
- Tie “DE” high and “ \overline{RE} ” low to enable the input and output data.
- Connect a square-wave signal to the “D” input with an amplitude of 2.4 to 3.3 V.
- Look for the complementary “A” and “B” outputs on an oscilloscope.

Circuit Diagram



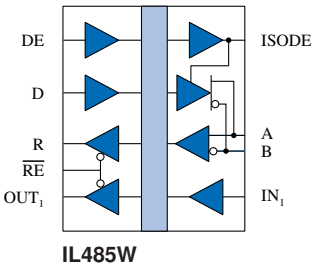
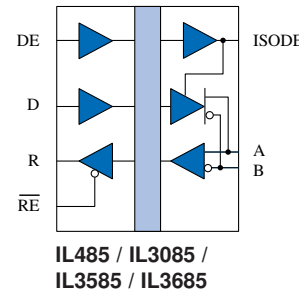
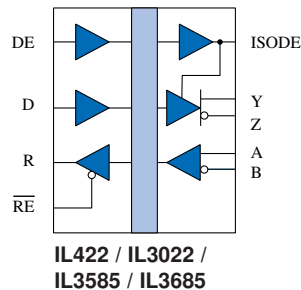
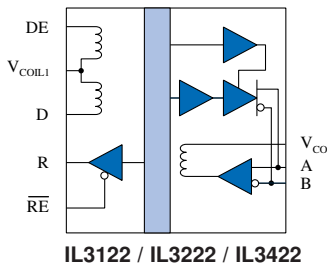
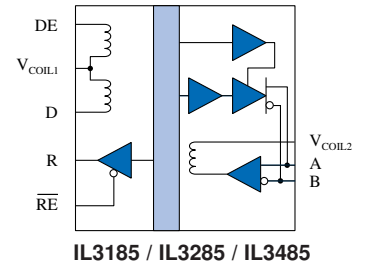
Available Isolated Network Transceivers

NVE offers a wide range of isolated RS-422 and RS-485 transceivers. Versions are available in 0.15-inch and 0.3-inch SOIC packages, as well as ultraminiature QSOP packages. QSOP and 0.15-inch SOIC package are the most compact isolated transceivers in the world, and the 0.3-inch SOIC package offers True 8 mm creepage in accordance with IEC60601.



Standard-grade parts are rated at 85 °C and 2.5 kV_{RMS} isolation; “T” versions are rated at 125 °C, and “V” versions have a 7 kV_{RMS} isolation rating.

NVE parts comply with rigorous industry standards. The IL3685 is strictly PROFIBUS compliant. All models are IEC 60747-17 (VDE 0884-17) and UL 1577 certified. “V” versions are ATEX and IECEx certified for IS-to-IS intrinsically safe applications.



Model	Bus	Inputs	Mbps	Nodes	Bus ESD	Key Features	Available Packages
IL3122	RS-422	Passive	5	32	15 kV	Low Cost	0.15" SOIC-16; 0.3" SOIC-16
IL3185	RS-485	Passive	5	32	15 kV	Low Cost	0.15" SOIC-16; 0.3" SOIC-16
IL3222	RS-422	Passive	5	256	15 kV	Fractional Load	0.15" SOIC-16; 0.3" SOIC-16
IL3285	RS-485	Passive	5	256	15 kV	Fractional Load	0.15" SOIC-16; 0.3" SOIC-16
IL3422	RS-422	Passive	20	32	15 kV	High Speed	0.15" SOIC-16; 0.3" SOIC-16
IL3485	RS-485	Passive	20	32	15 kV	High Speed	0.15" SOIC-16; 0.3" SOIC-16
IL422	RS-422	Digital	25	32	15 kV	Legacy Standard	0.3" SOIC-16
IL485	RS-485	Digital	35	32	2 kV	Legacy Standard	0.3" SOIC-16
IL485W	RS-485	Digital	35	32	2 kV	Handshake Line	0.3" SOIC-16
IL3022	RS-422	Digital	4	32	7.5 kV	Low Cost	0.3" SOIC-16
IL3085	RS-485	Digital	4	32	15 kV	Low Cost	QSOP16; 0.15" SOIC-16; 0.3" SOIC-16
IL3522	RS-422	Digital	40	50	15 kV	Very High Speed	0.3" SOIC-16
IL3585	RS-485	Digital	40	50	15 kV	Very High Speed	0.15" SOIC-16; 0.3" SOIC-16
IL3685	RS-485	Digital	40	50	15 kV	PROFIBUS	QSOP16; 0.15" SOIC-16; 0.3" SOIC-16

For a selector guide, see: <https://www.nve.com/il400>

Board Layout and Cabling

Board Layout Best Practices

Although not always necessary, the following connector layout precautions are best practices:

- The connector, termination resistor, and transceiver should be as close together as possible.
- Use 0.1 μF decoupling capacitors as close as possible to the transceiver V_{DD} pins.
- Provide ground planes for both power supplies.

Cable Length

The transceivers are intended for networks up to 4,000 feet (1,200 m) with proper termination. The maximum data rate decreases as cable length increases.

Cables and Connectors

Twisted pair cable helps cancel common mode noise. In noisy environments, use Shielded Twisted Pair (STP) CAT5 or CAT6 cables and shielded connectors. With shielded cables, one of the connectors should be tied to earth ground (not digital ground). For demanding applications, the other connector shield should be connected via an R-C network (typically 47 nF in parallel with 150 k Ω) to earth ground to damp AC noise induced in the shield.

For PROFIBUS, Type A bus cable is recommended for high transmission speeds (more than 500 Kbps). Type B should only be used at low baud rates and low requirements on the network distances.

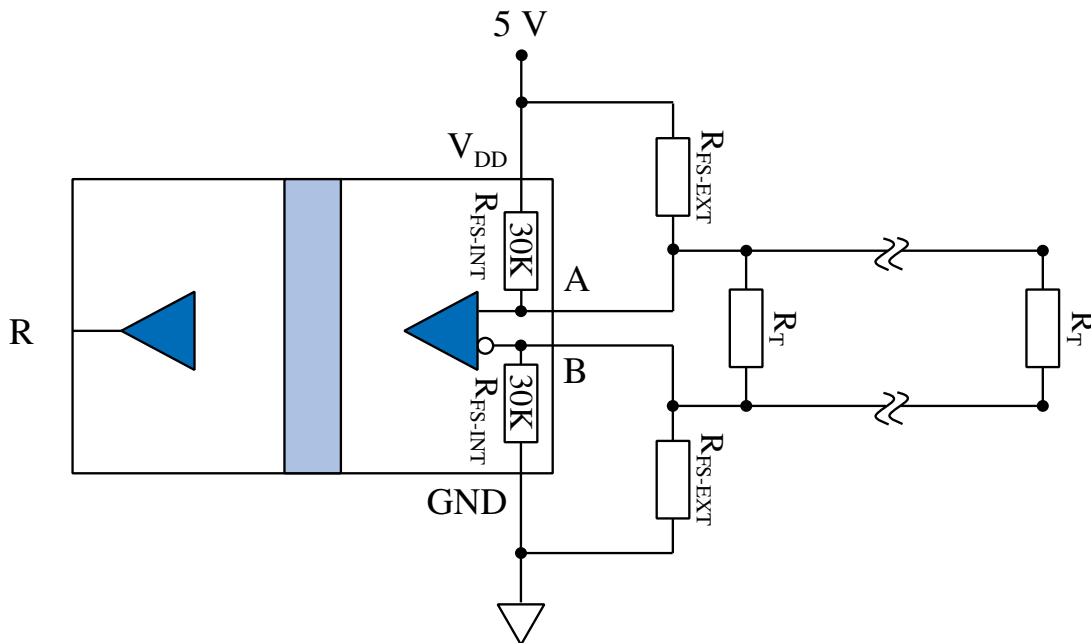
Differential Bus Output Voltage

Unlike many other PROFIBUS transceivers, the IL3685 meets stringent PROFIBUS standards for transceiver differential output voltage. Some transceivers manufacturers erroneously believe maximizing differential output voltage is a good thing. Bus output voltages beyond the PROFIBUS specification can damage transceivers on the bus.

Biasing and Termination

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 k Ω in the receiver section (R_{FS-INT} in the figure below):



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 k Ω .

Termination Resistors

Standard evaluation boards have 120 Ω termination resistors, and PROFIBUS boards have 220 Ω resistors. The termination resistor should be removed if the board is connected to a bus already terminated at both ends.

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 (R_{FS-EXT}) 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.

PROFIBUS-standard 390 Ω fail-safe resistors are included on PROFIBUS evaluation boards. If two or more such boards are connected, remove the resistors from all but one board.

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