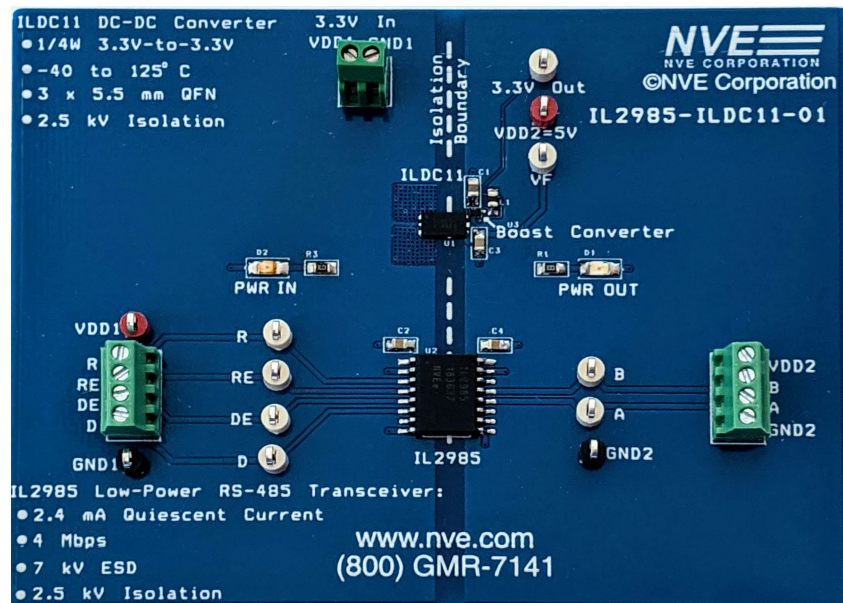


# IL2985-ILDC11-01 Isolated 5V RS-485 Transceiver / DC-DC Converter Evaluation Board



Board No.: IL2985-ILDC11-01

# About This Evaluation Board

This Evaluation Board provides a complete isolated 5-volt RS-485 node using an IL2985E low-power transceiver and an ILDC11-15E ultraminiature isolated DC-DC convertor. The 4 by 3 inch (100 by 75 mm) board provides screw terminal and test point connections.

The IL2985E is a low-power, fully-isolated, differential 5-volt bus transceiver. The ILDC11-15E isolates the 3.3-volt controller supply, and a boost regulator provides a five-volt fully-isolated bus supply.

The IL2985E transceiver has current limiting and thermal shutdown features protect against RS-485 short circuits and bus contention that may cause excessive power dissipation. RS-485 inputs feature a “fail-safe if open” design, ensuring a logic high R-output if A/B are floating. The ILDC11-15E DC-DC convertor has frequency hopping and shielding to minimize EMI.

Both devices use NVE’s unique ceramic/polymer composite barrier to provide full isolation and virtually unlimited barrier life.

## IL2985E Specification Highlights

- Very low quiescent current (2.4 mA typ.  $IDD1Q + IDD2Q$ )
- 3 V to 5 V controller; 5 V bus voltages
- 4 Mbps
- 2500 V<sub>RMS</sub> isolation voltage
- 7 kV bus ESD protection
- Thermal shutdown protection
- -40 °C to +85 °C temperature range

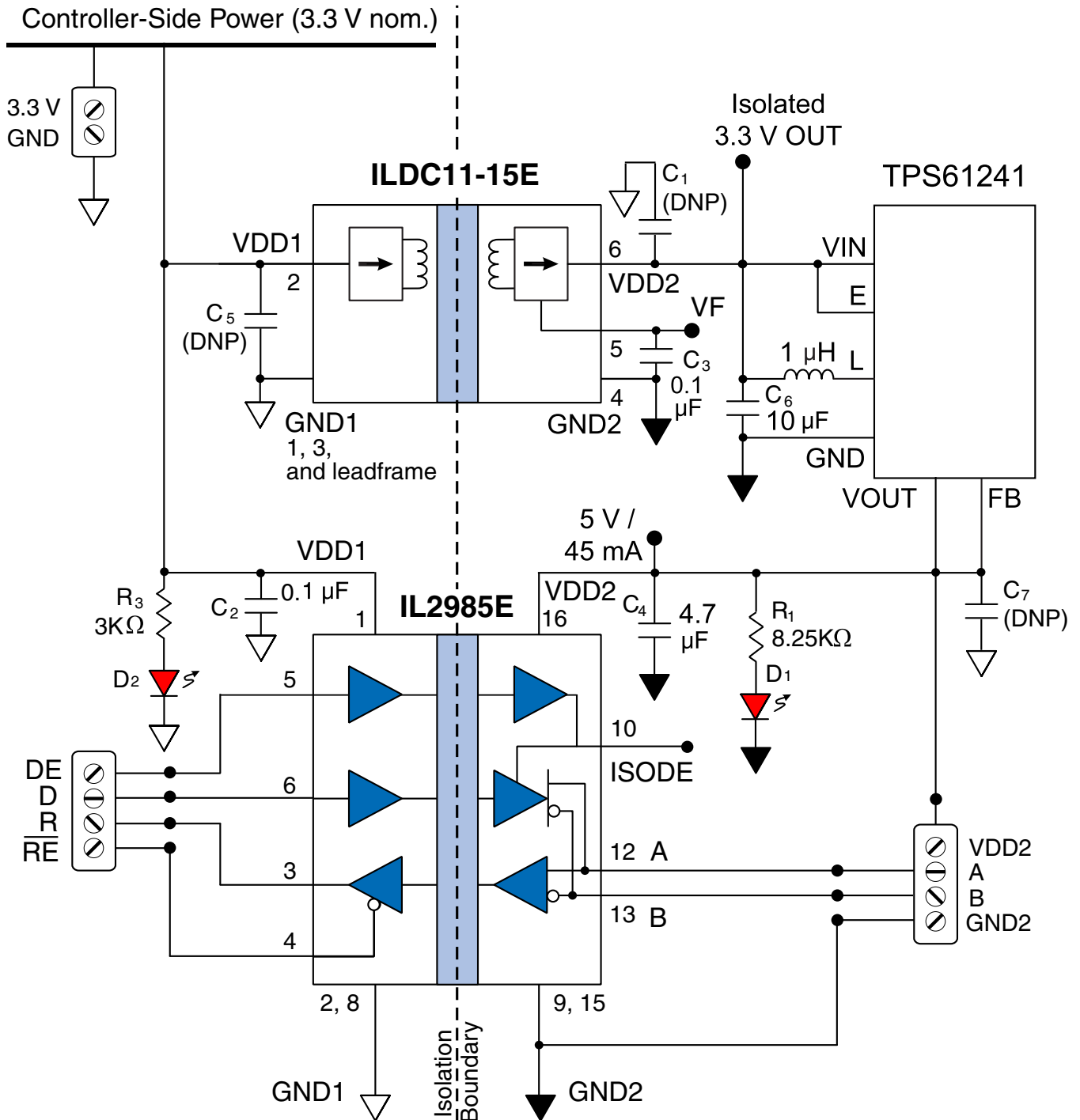
## ILDC11-15E Specification Highlights

- Ultraminiature 3 mm x 5.5 mm DFN package
- 3.3 V input to 3.3 V output
- Quarter watt output power
- Fully-regulated output
- Short-circuit protection
- No minimum load
- 2500 V<sub>RMS</sub> isolation voltage
- Low EMI without ferrite beads
- -40 °C to 125 °C temperature range

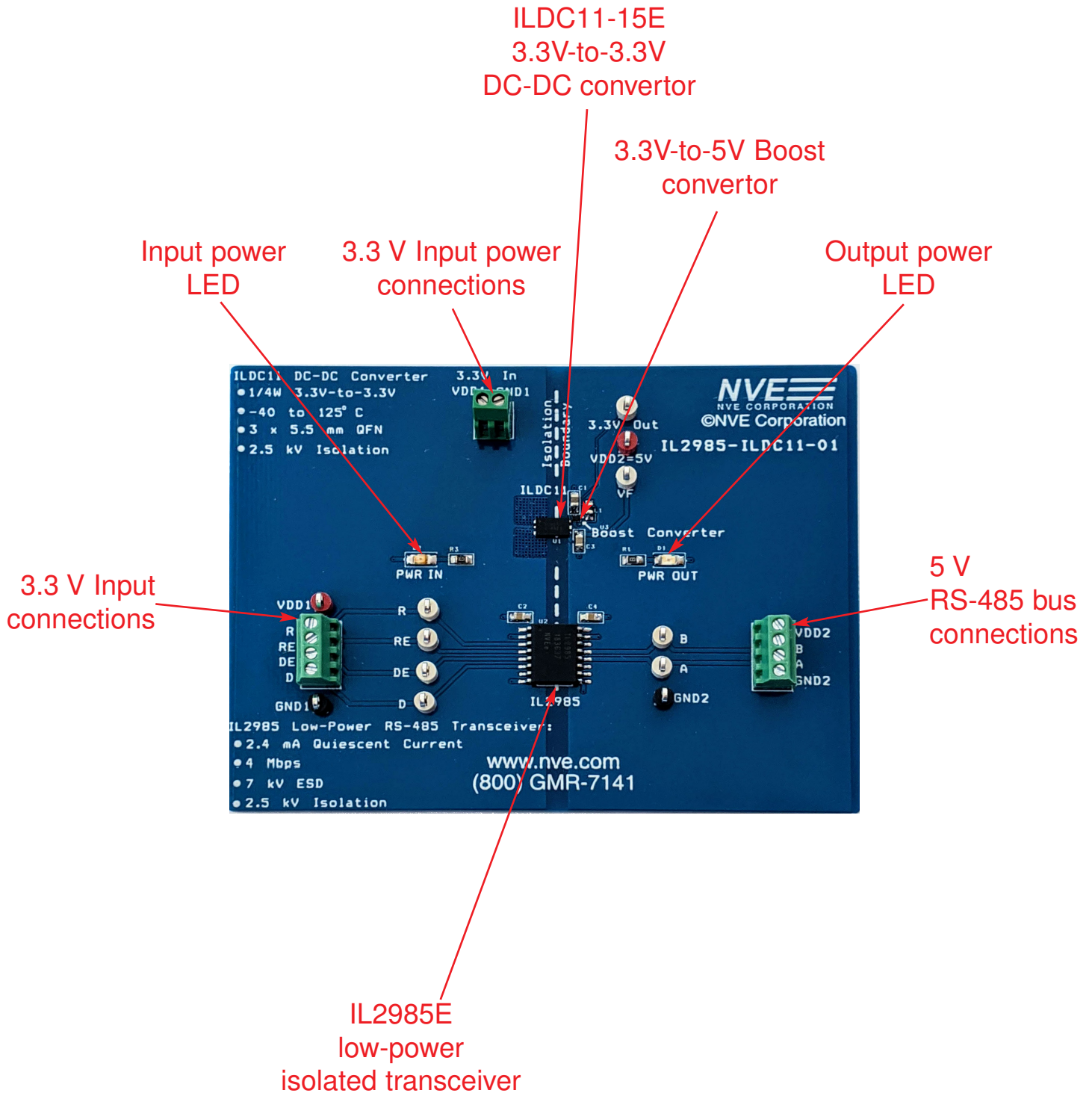
# Quick Start

- Connect  $V_{DD1}$  to a 3.3 V power supply.
- The two LEDs should indicate input power and output power from the DC-DC convertor.
- 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.

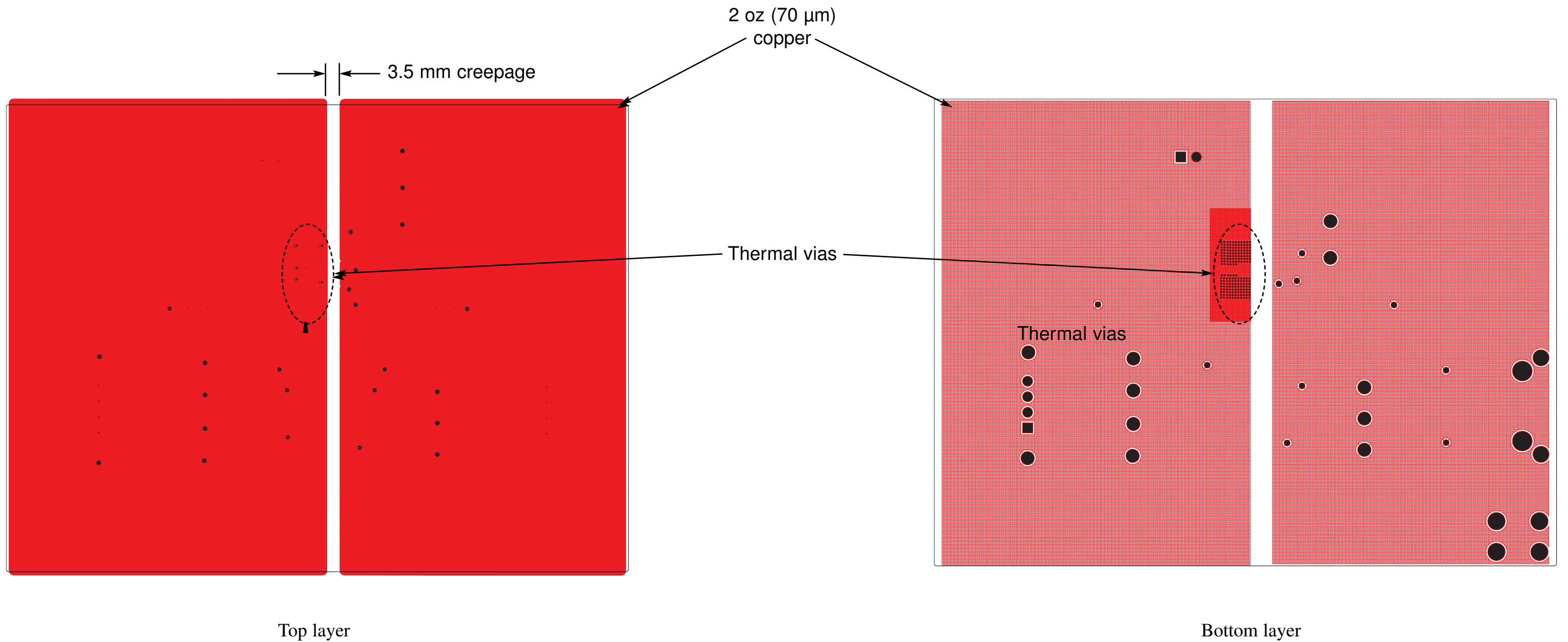
# Circuit Diagram



# Evaluation Board Layout



# Evaluation Board Layers



# Bill of Materials

Reference	Manufacturer	Part Number	Description
U1	NVE Corporation	ILDC11-15E	3.3V-to-3.3V Ultramini DC-DC Con
U2	NVE Corporation	IL2985E	Low-Power Isolated RS485 Transcei
U3	Texas Instruments	TPS61241YFFR	IC REG BOOST 5V 600MA 6DSBG
D1, D2	Kingbright	APT3216LSECK/J3-PRV	LED CLEAR CHIP 2SMD
L1	Taiyo Yuden	LBR2012T1R0M	FIXED IND 1UH 400MA 91 MOHM
R1	TE Connectivity Passive	CRG0805F8K25	RES SMD 8.25K OHM 1% 1/8W 08
R2	TE Connectivity Passive	CRG0805F3K0	RES SMD 3K OHM 1% 1/8W 0805
C2, C3	Samsung Electro-Mech	CL21B104MBCNNNC	CAP CER 0.1UF 50V X7R 0805
C4	Samsung Electro-Mech	CL21A475KPFNNNE	CAP CER 4.7UF 10V X5R 0805
C6	Taiyo Yuden	LMK212AB7106MG-T	CAP CER 10UF 10V X7R 0805
C1, C5, C7	Samsung Electro-Mech	DNP	Alternate capacitor locations
	Keystone Electronics	500x	PC TEST POINT COMPACT
2x	TE Connectivity	282834-4	TERM BLK 4P SIDE ENT 2.54MM
	TE Connectivity	282834-2	TERM BLK 2P SIDE ENT 2.54MM

# Board Layout

## **Bypass Capacitors**

As shown on this board, bypass capacitors should be placed close to the transceiver VDD pins and to the DC-DC convertor VDD and VF pins.

## **Maintaining Creepage**

The ILDC11 has 3.5 mm clearance between isolated pads. Creepage distances are often critical in isolated circuits. Therefore power planes should be spaced to avoid compromising creepage, and board pads should not extend past the part pads to avoid compromising creepage.

## **Thermal Management**

The ILDC11 is rated to 125 °C operating temperature with a 175 °C maximum junction temperature. Since this evaluation board is limited to the IL2985E's 85 °C maximum operating temperature, a simple, double-sided PCB can be used. Two-ounce (70 µm) copper and thermal vias were used to improve thermal performance. The thermal vias are shown on the "Evaluation Board Layers" page.

For high-temperature applications a double-sided, double buried power plane ("2s2p") board with thermal vias minimize the ILDC11 temperature rise. Even if not necessary to avoid the maximum junction temperature, a 2s2p board will reduce temperature rise and therefore improve the thermal stability of the DC-DC convertor output voltage in critical applications.



# Application Information

## **Inherently Low EMI**

IL4685E Transceivers are fully compliant with generic EMC standards EN50081, EN50082-1 and the umbrella line-voltage standard for Information Technology Equipment (ITE) EN61000.

The DC-DC convertor oscillator operates above 88 MHz, where emission limits are higher since there is less risk of interference with common commercial radio and television broadcasting.

Frequency-hopping technology dramatically reduces peak EMI, and synchronous rectification and PWM control are avoided, resulting in inherently low EMI. Ferrite beads are generally not required for EMI mitigation.

## **High Magnetic Immunity**

The IL2985E's Wheatstone bridge configuration and differential magnetic field signaling ensure excellent EMC performance against all relevant standards.

## **Power Management**

Here are some tips to avoid overtaxing the DC-DC convertor:

### ***Use a low-power transceiver***

Transceivers such as the NVE IL2985E use less bus power than other transceivers.

### ***Eliminate termination resistors***

Termination resistors minimize reflections, which can be important for long cable lengths. However, these resistors dramatically increase output drive current and may be unnecessary for short cables and low speeds.

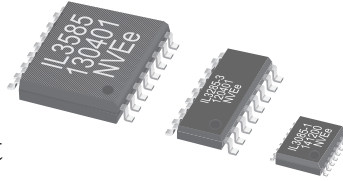
### ***Avoid “fail-safe” resistors***

Because the IL2985E has internal “fail-safe” resistors, external “fail-safe” pull-up and pull-down bias resistors are unnecessary and use power.

# Isolated RS485 / RS422 Transceivers

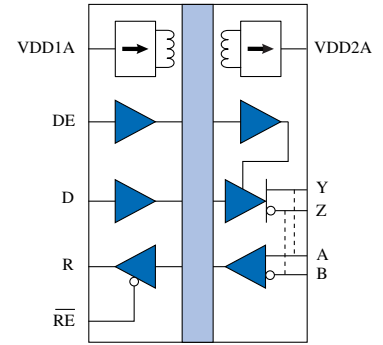
NVE offers a wide choice of isolated RS-485 and RS-422 network transceivers.

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 solutions in the world.

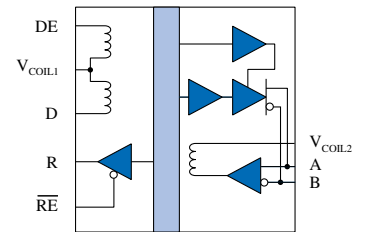


Standard isolation voltage is 2.5 kV<sub>RMS</sub>, and ultrahigh-voltage V-Series versions have 6 kV<sub>RMS</sub> isolation voltage.

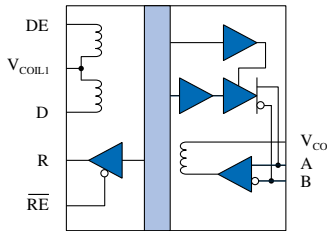
The IL4685 and IL4622 combine isolated transceivers with integrated DC-DC convertors.



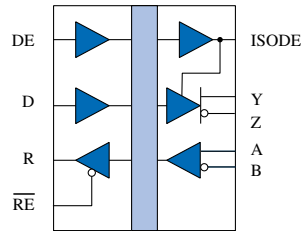
IL4685 / IL4622



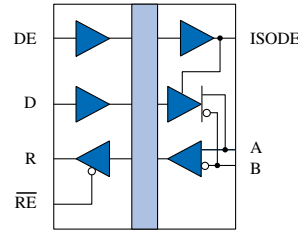
IL3185 / IL3285 / IL3485



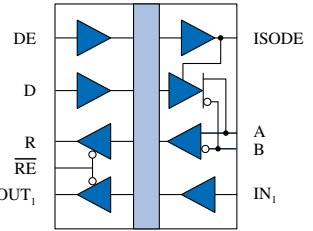
IL3122 / IL3222 / IL3422



IL422 / IL3022 / IL3522



IL485 / IL3085 /  
IL3585 / IL3685 / IL3685P



IL485W

Model	Bus	Inputs	Mbps	Nodes	Bus ESD	Key Features	Available Packages
IL3122	RS-422	Passive	5	32	15 kV	Low Cost	0.15" SOIC16; 0.3" SOIC16
IL3185	RS-485	Passive	5	32	15 kV	Low Cost	0.15" SOIC16; 0.3" SOIC16
IL3222	RS-422	Passive	5	256	15 kV	1/8 Unit Load	0.15" SOIC16; 0.3" SOIC16
IL3285	RS-485	Passive	5	256	15 kV	1/8 Unit Load	0.15" SOIC16; 0.3" SOIC16
IL3422	RS-422	Passive	20	32	15 kV	High Speed	0.15" SOIC16; 0.3" SOIC16
IL3485	RS-485	Passive	20	32	15 kV	High Speed	0.15" SOIC16; 0.3" SOIC16
IL422	RS-422	Digital	25	32	15 kV	Legacy Standard	0.3" SOIC16
IL485	RS-485	Digital	35	32	2 kV	Legacy Standard	0.3" SOIC16
IL485W	RS-485	Digital	35	32	2 kV	Handshake Line	0.3" SOIC16
IL3022	RS-422	Digital	4	32	7.5 kV	Low Cost	0.3" SOIC16
IL2985	RS-485	Digital	4	32	15 kV	Low Power	0.3" SOIC16
IL3085	RS-485	Digital	4	32	15 kV	Low Cost	QSOP16; 0.15" SOIC16; 0.3" SOIC16
IL3522	RS-422	Digital	40	50	15 kV	Very High Speed	0.3" SOIC16
IL3585	RS-485	Digital	40	50	15 kV	Very High Speed	0.15" SOIC16; 0.3" SOIC16
IL3685	RS-485	Digital	40	50	15 kV	PROFIBUS	QSOP16; 0.15" SOIC16; 0.3" SOIC16
IL3685P	RS-485	Digital	40	160	16.5 kV	3.3 V bus; 1/5 U.L.	QSOP16; 0.3" SOIC16
IL4622	RS-422	Digital	40	160	12 kV	DC-DC Convertor	0.3" SOIC16
IL4685	RS-485	Digital	40	160	16.5 kV	DC-DC Convertor	0.3" SOIC16

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