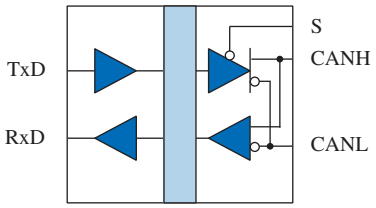
Isolated High-Speed CAN Transceiver

Functional Diagram



IL41050

V_{DD2} (V)	TxD[1]	S	CANH	CANL	Bus State	RxD
4.75 to 5.25	↓	Low[2]	High	Low	Dominant	Low
4.75 to 5.25	X	High	$V_{DD2}/2$	$V_{DD2}/2$	Recessive	High
4.75 to 5.25	↑	X	$V_{DD2}/2$	$V_{DD2}/2$	Recessive	High
<2V (no pwr)	X	X	0<V<2.5	0<V<2.5	Recessive	High
2>V_{DD2}<4.75	>2V	X	0<V<2.5	0<V<2.5	Recessive	High

Table 1. Function table.

Notes:
1. TxD input is edge triggered: ↑ = Logic Lo to Hi, ↓ = Hi to Lo
2. Valid for logic state as described or open circuit

X = don't care

Features

- Single-chip isolated CAN/DeviceNet transceiver
- Fully compliant with the ISO 11898 CAN standard
- Best-in-class loop delay (180 ns typ.)
- 3.0 V to 5.5 V input power supplies
- >110-node fan-out
- High speed (up to 1 Mbps)
- 2,500 V_{RMS} isolation (1 minute)
- Very low Electromagnetic Emission (EME)
- Differential signaling for excellent Electromagnetic Immunity (EMI)
- 30 kV/µs transient immunity
- Silent mode to disable transmitter
- Unpowered nodes do not disturb the bus
- Transmit data (TxD) dominant time-out function
- Edge triggered, non-volatile input improves noise performance
- Bus pin transient protection for automotive environment
- Thermal shutdown protection
- Short-circuit protection for ground and bus power
- −55°C to +125°C operating temperature
- 0.15" and 0.3" and 16-pin JEDEC-standard SOIC packages
- UL1577 and IEC 61010-2001 approved

Applications

- Noise-critical CAN
- Partially-powered CAN
- DeviceNet
- Factory automation

Description

The IL41050 is a galvanically isolated, high-speed CAN (Controller Area Network) transceiver, designed as the interface between the CAN protocol controller and the physical bus. The IL41050 provides isolated differential transmit capability to the bus and isolated differential receive capability to the CAN controller via NVE's patented* IsoLoop spintronic Giant Magnetoresistance (GMR) technology.

Advanced features facilitate reliable bus operation. Unpowered nodes do not disturb the bus, and a unique non-volatile programmable power-up feature prevents unstable nodes. The devices also have a hardware-selectable silent mode that disables the transmitter.

Designed for harsh CAN and DeviceNet environments, IL41050T transceivers have transmit data dominant time-out, bus pin transient protection, thermal shutdown protection, and short-circuit protection, Unique edge-triggered inputs improve noise performance. Unlike optocouplers or other isolation technologies, IsoLoop isolators have indefinite life at high voltage.

NVE Corporation 11409 Valley View Road, Eden Prairie, MN 55344-3617 Phone: (952) 829-9217 Fax: (952) 829-9189 www.IsoLoop.com

Absolute Maximum Ratings[1] [2]

Parameters	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Storage temperature	T_S	−55		150	°C	
Ambient operating temperature	T_A	−55		135	°C	
DC voltage at CANH and CANL pins	V_{CANH} V_{CANL}	−27		40	V	0 V< V_{DD2} < 5.25 V; indefinite duration
Supply voltage	V_{DD1} , V_{DD2}	−0.5		6	V	
Digital input voltage	V_{TxD} , V_S	−0.3		V_{DD} + 0.3	V	
Digital output voltage	V_{RxD}	−0.3		V_{DD} + 0.3	V	
DC voltage at V_{REF}	V_{REF}	−0.3		V_{DD} + 0.3	V	
Transient Voltage at CANH or CANL	$V_{trt(CAN)}$	−200		200	V	
Electrostatic discharge at all pins	V_{esd}	−4,000		4,000	V	Human body model
Electrostatic discharge at all pins	V_{esd}	−200		200	V	Machine model

Recommended Operating Conditions

Parameters	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Supply voltage	V_{DD1} V_{DD2}	3.0 4.75		5.5 5.25	V	
Input voltage at any bus terminal (separately or common mode)	V_{CANH} V_{CANL}	−12		12	V	
High-level digital input voltage [3] [4]	V_{IH}	2.0 2.4 2.0		V_{DD1} V_{DD1} V_{DD2}	V	V_{DD1} = 3.3 V V_{DD1} = 5.0 V V_{DD2} = 5.0 V
Low-level digital input voltage [3] [4]	V_{IL}	0		0.8	V	
Digital output current (RxD)	I_{OH}	−8		8	mA	V_{DD1} = 3.3V to 5V
Ambient operating temperature	T_A	−55		125	°C	
Digital input signal rise and fall times	t_{IR}, t_{IF}			1	µs	

Insulation Specifications

Parameters	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Creepage distance (external)		8.08			mm	
Barrier impedance			> 10^{14} ‖ 7		Ω ‖ pF	
Leakage current			0.2		μA_{RMS}	240 V_{RMS}, 60 Hz

Safety and Approvals

IEC61010-2001

TUV Certificate Numbers: N1502812 (pending)

Classification: Reinforced Insulation

Model	Package	Pollution Degree	Material Group	Max. Working Voltage
IL41050	SOIC (0.15" and 0.3")	II	III	300 V_{RMS}

UL 1577

Component Recognition Program File Number: E207481
Rated 2,500V_{RMS} for 1 minute

Soldering Profile

Per JEDEC J-STD-020C
Moisture Sensitivity Level: MSL=2

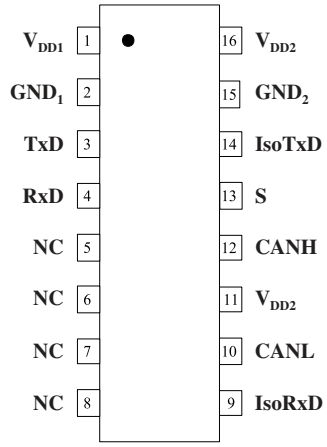
Notes:

1. Absolute Maximum specifications mean the device will not be damaged if operated under these conditions. It does not guarantee performance.
2. All voltages are with respect to network ground except differential I/O bus voltages.
3. The TxD input is edge sensitive. Voltage magnitude of the input signal is specified, but edge rate specifications must also be met.
4. The maximum time allowed for a logic transition at the TxD input is 1 µs.

NVE Corporation 11409 Valley View Road, Eden Prairie, MN 55344-3617 Phone: (952) 829-9217 Fax: (952) 829-9189 www.IsoLoop.com

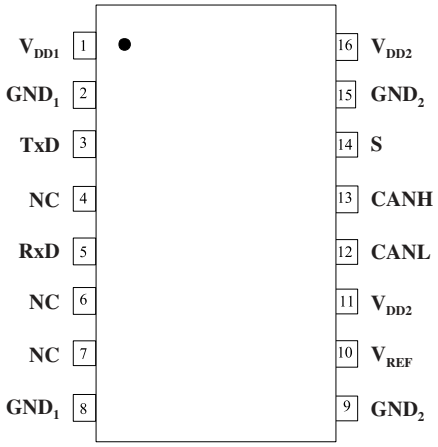
IL41050-3 Pin Connections (0.15" SOIC Package)

1	V_{DD1}	V_{DD1} power supply input
2	GND_1	V_{DD1} power supply ground return
3	T D	Transmit Data input
4	RxD	Receive Data output
5	NC	No internal connection
6	NC	No internal connection
7	NC	No internal connection
8	NC	No internal connection
9	IsoRxD	Isolated RxD output. No connection should be made to this pin.
10	CANL	Low level CANbus line
11	V_{DD2}	V_{DD2} CAN I/O bus circuitry power supply input*
12	CANH	High level CANbus line
13	S	Mode select input. Leave open or set low for normal operation; set high for silent mode.
14	IsoTxD	Isolated TxD output. No connection should be made to this pin.
15	GND_2	V_{DD2} power supply ground return
16	V_{DD2}	V_{DD2} isolation power supply input*



IL41050 Pin Connections (0.3" SOIC Package)

1	V_{DD1}	V_{DD1} power supply input
2	GND_1	V_{DD1} power supply ground return (pin 2 is internally connected to pin 8)
3	TxD	Transmit Data input
4	NC	No internal connection
5	RxD	Receive Data output
6	NC	No internal connection
7	NC	No internal connection
8	GND_1	V_{DD1} power supply ground return (pin 8 is internally connected to pin 2)
9	GND_2	V_{DD2} power supply ground return (pin 9 is internally connected to pin 15)
10	V_{REF}	Reference voltage output (nominally 50% of V_{DD2})
11	V_{DD2}	V_{DD2} CAN I/O bus circuitry power supply input*
12	CANL	Low level CANbus line
13	CANH	High level CANbus line
14	S	Mode select input. Leave open or set low for normal operation; set high for silent mode.
15	GND_2	V_{DD2} power supply ground return (pin 15 is internally connected to pin 9)
16	V_{DD2}	V_{DD2} isolation power supply input*



***NOTE:** Pin 11 is not internally connected to pin 16; both should be connected to the V_{DD2} power supply for normal operation.

NVE Corporation 11409 Valley View Road, Eden Prairie, MN 55344-3617 Phone: (952) 829-9217 Fax: (952) 829-9189 www.IsoLoop.com

Specifications

Electrical Specifications are T_{min} to T_{max} and V_{DD1}, V_{DD2}= 4.75 V to 5.25 V unless otherwise stated.

Parameters	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Power Supply Current						
Quiescent supply current (recessive)	IQ_{VDD1}	1 0.7	1.75 1.4	3.0 2.0	mA	dr = 0 bps; V_{DD1} = 5 V dr = 0 bps; V_{DD1} = 3.3 V
Dynamic supply current (dominant)	I_{VDD1}	1.2 0.9	2.0 1.6	3.2 2.2	mA	dr = 1 Mbps, R_L= 60Ω; V_{DD1} = 5 V dr = 1 Mbps, R_L= 60Ω; V_{DD1} = 3.3 V
Quiescent supply current (recessive) Dynamic supply current (dominant)	IQ_{VDD2} I_{VDD2}	3.5 26	6.75 52	13 78	mA	0 bps 1 Mbps, R_L = 60Ω
Transmitter Data input (TxD)[1]						
High level input voltage ↑	V_{IH}	2.4		5.25	V	V_{DD1} = 5 V; recessive
High level input voltage ↑	V_{IH}	2.0		3.6	V	V_{DD1} = 3.3 V; recessive
Low level input voltage ↓	V_{IL}	−0.3		0.8	V	Output dominant
TxD input rise and fall time[2]	tr			1	µs	10% to 90% 
High level input current	I_{IH}	−10		10	µA	V_{TxD} = V_{DD1}
Low level input current	I_{IL}	10		10	µA	V_{TxD} = 0 V
Mode select input (S)						
High level input voltage	V_{IH}	2.0		V_{DD2} + 0.3	V	Silent mode
Low level input voltage	V_{IL}	−0.3		0.8	V	High-speed mode
High level input current	I_{IH}	20	30	45	µA	V_S = 2 V
Low level input current	I_{IL}	15	30	10	µA	V_S = 0 V
Receiver Data output (RxD)						
High level output current	I_{OH}	−2	−8.5	−20	mA	V_{RxD} = 0.8 V_{DD1}
Low level output current	I_{OL}	2	8.5	20	mA	V_{RxD} = 0.45 V
Failsafe supply voltage[4]	V_{DD2}	3.6		3.9	V	
Reference Voltage output (V_{REF})						
Reference Voltage output	V_{REF}	0.45 V_{DD2}	0.5 V_{DD2}	0.55 V_{DD2}	V	−50 µA<I_{VREF}< +50 µA
Bus lines (CANH and CANL)						
Recessive voltage at CANH pin	$V_{O(reces)}$ CANH	2.0	2.5	3.0	V	V_{TxD} = V_{DD1}, no load
Recessive voltage at CANL pin	$V_{O(reces)}$ CANL	2.0	2.5	3.0	V	V_{TxD} = V_{DD1}, no load
Recessive current at CANH pin	$I_{O(reces)}$ CANH	−2.0		+2.5	mA	−27 V < V_{CANH}< +32V; 0V < V_{DD2}<5.25V
Recessive current at CANL pin	$I_{O(reces)}$ CANL	−2.0		+2.5	mA	−27 V < V_{CANL} < +32V; 0 V <V_{DD2} < 5.25 V
Dominant voltage at CANH pin	$V_{O(dom)}$ CANH	3.0	3.6	4.25	V	V_{TxD} = 0 V
Dominant voltage at CANL pin	$V_{O(dom)}$ CANL	0.5	1.4	1.75	V	V_{TxD} = 0 V
Differential bus input voltage (V_{CANH} − V_{CANL})	$V_{i(dif)(bus)}$	1.5	2.25	3.0	V	V_{TxD} = 0 V; dominant 42.5 Ω < R_L < 60 Ω
		−50	0	+50	mV	V_{TxD} = V_{DD1}; recessive; no load
Short-circuit output current at CANH	$I_{O(sc)}$ CANH	−45	−70	−95	mA	V_{CANH} = 0 V, V_{TxD} = 0
Short-circuit output current at CANL	$I_{O(sc)}$ CANL	45	70	100	mA	V_{CANL} = 36 V, V_{TxD} = 0
Differential receiver threshold voltage	$V_{i(dif)(th)}$	0.5	0.7	0.9	V	−12 V <V_{CANL}< +12V; −12 V <V_{CANH}< +12 V
Differential receiver input voltage hysteresis	$V_{i(dif)(hys)}$	50	70	100	mV	−12 V <V_{CANL}< +12 V; −12 V <V_{CANH}< +12 V
Common Mode input resistance at CANH	$R_{i(CM)(CANH)}$	15	25	35	kΩ	
Common Mode input resistance at CANL	$R_{i(CM)(CANL)}$	15	25	35	kΩ	
Matching between Common Mode input resistance at CANH, CANL	$R_{i(CM)(m)}$	−3	0	+3	%	V_{CANL} = V_{CANH}
Differential input resistance	$R_{i(diff)}$	25	50	75	kΩ	
Input capacitance, CANH	$C_{i(CANH)}$		7.5	20	pF	V_{TxD} = V_{DD1}
Input capacitance, CANL	$C_{i(CANL)}$		7.5	20	pF	V_{TxD} = V_{DD1}

NVE Corporation 11409 Valley View Road, Eden Prairie, MN 55344-3617 Phone: (952) 829-9217 Fax: (952) 829-9189 www.IsoLoop.com

Specifications (...cont.)

Electrical Specifications are T_{min} to T_{max} and V_{DD1}, V_{DD2}= 4.5 V to 5.5 V unless otherwise stated.

Differential input capacitance	$C_{i(dif)}$		3.75	10	pF	$V_{TxD} = V_{DD1}$
Input leakage current at CANH	$I_{LI(CANH)}$	100	170	250	µA	V_{CANH}= 5 V, V_{DD2}= 0 V
Input leakage current at CANL	$I_{LI(CANL)}$	100	170	250	µA	V_{CANL}= 5 V, V_{DD2}= 0 V
Thermal Shutdown						
Shutdown junction temperature	$T_{j(SD)}$	155	165	180	°C	
Timing Characteristics						
TxD to bus active delay	$t_{d(TxD-BUSon)}$	29 32	63 66	125 128	ns	V_S= 0 V; V_{DD1} = 5 V V_S = 0 V; V_{DD1} = 3.3 V
TxD to bus inactive delay	$t_{d(TxD-BUSoff)}$	29 32	68 71	110 113	ns	V_S = 0 V; V_{DD1} = 5 V V_S = 0 V; V_{DD1} = 3.3 V
Bus active to RxD delay	$t_{d(BUSon-RxD)}$	24 27	58 61	125 128	ns	V_S = 0 V; V_{DD1} = 5 V V_S = 0 V; V_{DD1} = 3.3 V
Bus inactive to RxD delay	$t_{d(BUSoff-RxD)}$	49 52	103 106	170 173	ns	V_S = 0 V; V_{DD1} = 5 V V_S = 0 V; V_{DD1} = 3.3 V
Loop delay low-to-high or high-to-low	T_{LOOP}	53	180	210	ns	V_S = 0 V
TxD dominant time for timeout	$T_{dom(TxD)}$	250	457	765	µs	V_{TxD} = 0 V 3.0 V > V_{DD1} < 5.5 V

Magnetic Field Immunity[3]

V_{DD1} = 5 V, V_{DD2} = 5 V						
Power frequency magnetic immunity	H_{PF}	2,500	3,000		A/m	50 Hz/60 Hz
Pulse magnetic field immunity	H_{PM}	3,000	3,500		A/m	t_p = 8 µs
Cross-axis immunity multiplier	K_X		1.8			Figure 1
V_{DD1} = 3.3 V, V_{DD2} = 5 V						
Power frequency magnetic immunity	H_{PF}	1,000	1,500		A/m	50 Hz/60 Hz
Pulse magnetic field immunity	H_{PM}	1,800	2,000		A/m	t_p = 8 µs
Cross-axis immunity multiplier	K_X		1.5			Figure 1

Notes:

1. The TxD input is edge sensitive. Voltage magnitude of the input signal is specified, but edge rate specifications must also be met.
2. The maximum time allowed for a logic transition at the TxD input is 1 µs.
3. Uniform magnetic field applied across the pins of the device. Cross-axis multiplier effective when field is applied perpendicular to the pins.
4. If V_{DD2} falls below the specified failsafe supply voltage, RxD will go High.

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

The IL41050 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 higher if the field direction is "end-to-end" (rather than to "pin-to-pin") as shown in the diagram at right.

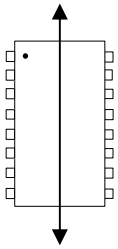


Fig. 1

NVE Corporation 11409 Valley View Road, Eden Prairie, MN 55344-3617 Phone: (952) 829-9217 Fax: (952) 829-9189 www.IsoLoop.com

Application Information

V_{DD2} Power Supply Pins

Both V_{DD2} power supply inputs (pins 11 and 16) must be connected to the bus-side power supply. Pin 11 powers the bus side of the CAN I/O circuitry, while pin 16 powers the bus-side isolation circuitry. For testing purposes, they are not internally connected, but the part will not operate without both pins powered, and operation without both pins powered can cause damage.

Power Supply Decoupling

Both V_{DD1} and V_{DD2} must be bypassed with 100 nF ceramic capacitors. These supply the dynamic current required for the isolator switching and should be placed as close as possible to V_{DD} and their respective ground return pins.

Input Configurations

The TxD input should not be left open as the state will be indeterminate. If connected to an open-drain or open collector output, a pull-up resistor (typically 16 kΩ) should be connected from the input to V_{DD1}.

The Mode Select ("S") input has a nominal 150 kΩ internal pull-down resistor. It can be left open or set low for normal operation.

Dominant Mode Time-out and Failsafe Receiver Functions

CAN bus latch up is prevented by an integrated Dominant mode timeout function. If the TxD pin is forced permanently low by hardware or software application failure, the time-out returns the RxD output to the high state no more than 765 µs after TxD is asserted dominant. The timer is triggered by a negative edge on TxD. If the duration of the low is longer than the internal timer value, the transmitter is disabled, driving the bus to the recessive state. The timer is reset by a positive edge on pin TxD.

If power is lost on Vdd2, the IL41050 asserts the RxD output high when the supply voltage falls below 3.8 V. RxD will return to normal operation as soon as Vdd2 rises above approximately 4.2 V.

Programmable Power-Up

A unique non-volatile programmable power-up feature prevents unstable nodes. A state that needs to be present at node power up can be programmed at the last power down. For example if a CAN node is required to "pulse" dominant at power up, TxD can be sent low by the controller immediately prior to power down. When power is resumed, the node will immediately go dominant allowing self-check code in the microcontroller to verify node operation. If desired, the node can also power up silently by presetting the TxD line high at power down. At the next power on, the IL41050 will remain silent, awaiting a dominant state from the bus.

The microcontroller can check that the CAN node powered down correctly before applying power at the next "power on" request. If the node powered down as intended, RxD will be set high and stored in IL41050's non-volatile memory. The level stored in the RxD bit can be read before isolated node power is enabled, avoiding possible CAN bus disruption due to an unstable node.

Replacing Non-Isolated Transceivers

The IL41050 is designed to replace common non-isolated CAN transceivers such as the Philips/NXP TJA1050 with minimal circuit changes. Some notable differences:

- Some non-isolated CAN transceivers have internal TxD pull-up resistors, but the IL41050 TxD input should not be left open. If connected to an open-drain or open collector output, a pull-up resistor (typically 16 kΩ) should be connected from the input to V_{DD1}.

- Initialization behavior varies between CAN transceivers. To ensure the desired power-up state, the IL41050 should be initialized with a TxD pulse (low-to-high for recessive initialization), or shut down the transceiver in the desired power-up state (the "programmable power-up feature").

- Many non-isolated CAN transceivers have a V_{REF} output. Such a reference is available on the IL41050 wide-body version.

The VREF Output

V_{REF} is a reference voltage output used to drive bus threshold comparators in some legacy systems and is provided on the IL41050 wide-body version. The output is half of the bus supply ±10% (*i.e.,* 0.45 V_{DD2} < V_{REF} < 0.55 V_{DD2}), and can drive up to 50 µA.

IsoRxD / IsoTxD Outputs

The IsoRxD and IsoTxD outputs are isolated versions of the RxD and TxD signals. These outputs are provided on the narrow-body version for troubleshooting, but normally no connections should be made to the pins.

NVE Corporation 11409 Valley View Road Eden Prairie, MN 55344-3617 USA Telephone: (952) 829-9217 Fax (952) 829-9189 Internet: www.isoloop.com

The Isolation Advantage

Battery fire caused by over or under charging of individual lithium ion cells is a major concern in multi-cell high voltage electric and hybrid vehicle batteries. To combat this, each cell is monitored for current flow, cell voltage, and in some advanced batteries, magnetic susceptibility. The IL41050 allows seamless connection of the monitoring electronics of every cell to a common CAN bus by electrically isolating inputs from outputs, effectively isolating each cell from all other cells. Cell status is then monitored via the CAN controller in the Battery Management System (BMS).

Another major advantage of isolation is the tremendous increase in noise immunity it affords the CAN node, even if the power source is a battery. Inductive drives and inverters can produce transient swings in excess of 20 kV/µs. The traditional, non-isolated CAN node provides some protection due to differential signaling and symmetrical driver/receiver pairs, but the IL41050 typically provides more than twice the dV/dt protection of a traditional CAN node.

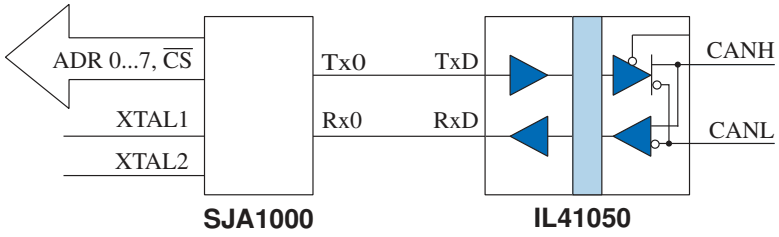
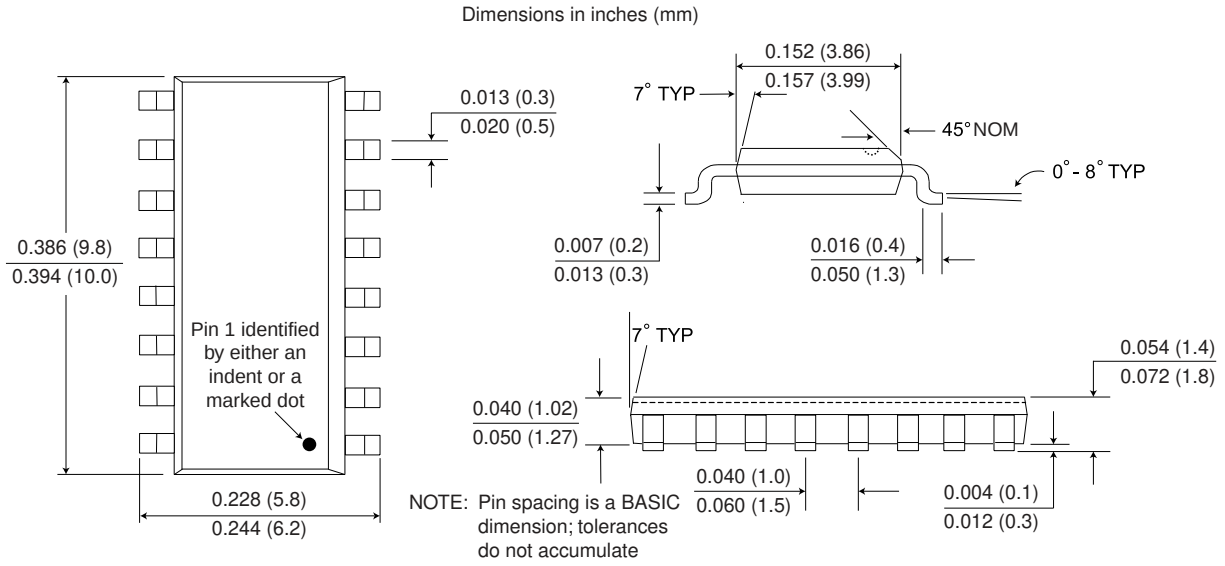


Fig. 2. Isolated CAN node using the IL41050 and an SJA1000 MCU.

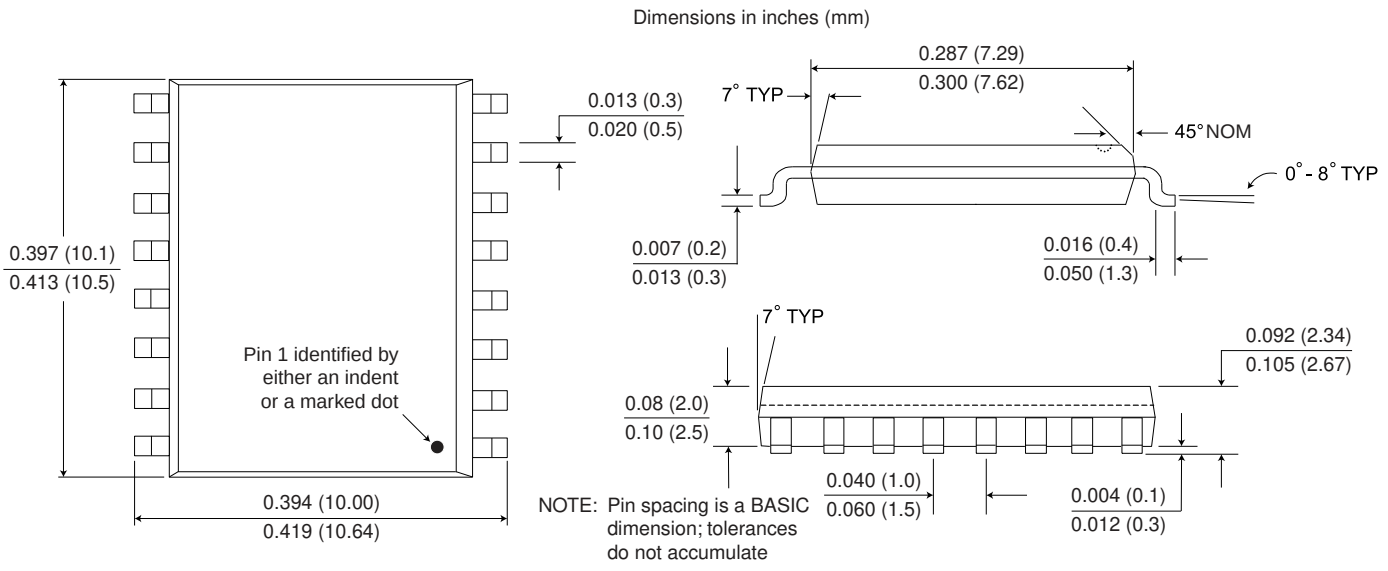
NVE Corporation 11409 Valley View Road Eden Prairie, MN 55344-3617 USA Telephone: (952) 829-9217 Fax (952) 829-9189 Internet: www.isoloop.com

Package Drawings, Dimensions and Specifications

0.15" 16-pin SOIC Package



0.3" 16-pin SOIC Package



NVE Corporation 11409 Valley View Road Eden Prairie, MN 55344-3617 USA Telephone: (952) 829-9217 Fax (952) 829-9189 Internet: www.isoloop.com

Ordering Information and Valid Part Numbers

IL 4 1050 T -3 E TR13

Bulk Packaging
Blank = Tube (50 pcs)

TR7 = 7" Tape and Reel
(800 pcs; 0.15" SOIC only)

TR13 = 13" Tape and Reel
(3,000 pcs 0.15" SOIC or
1,500 pcs 0.3" SOIC)

Package
E = RoHS Compliant

Package Type
Blank = 0.3" SOIC
-3 = 0.15" SOIC

Temperature Range
T = Extended
(-55˚C to +125˚C)

Channel Configuration
1050 = CAN Transceiver

Base Part Number
4 = Isolated Transceiver

Product Family
IL = Isolators

Valid Part Numbers
IL41050TE
IL41050TE TR13
IL41050T-3E
IL41050T-3E TR7
IL41050T-3E TR13

RoHS COMPLIANT

NVE Corporation 11409 Valley View Road Eden Prairie, MN 55344-3617 USA Telephone: (952) 829-9217 Fax (952) 829-9189 Internet: www.isoloop.com

Revision History

ISB-DS-001-IL41050-J **February 2012**	**Changes** • Update terms and conditions.
ISB-DS-001-IL41050-I **June 2011**	**Changes** • Added loop delay specifications (p. 5).
ISB-DS-001-IL41050-H **June 2011**	**Changes** • UL approval no longer “pending” (p. 2). • Clarified V_{DD2} power supply connections with note on pinouts page (p. 3) and new explanatory “Application Information” paragraph (p. 6).
ISB-DS-001-IL41050-G **February 2011**	**Changes** • Added “Input Configurations,” “Replacing Non-Isolated Transceivers,” “the VREF Output,” and “IsoRxD/IsoTxD Outputs” Application Information (p. 6).
ISB-DS-001-IL41050-F **April 2010**	**Changes** • Added 7-inch tape-and-reel bulk packaging option (TR7) for narrow-body parts (p. 8).
ISB-DS-001-IL41050-E **March 2010**	**Changes** • Changed narrow-body pinouts for pins 9, 10, 12, 13, and 14 (p. 3).
ISB-DS-001-IL41050-D **March 2010**	**Changes** • Added 0.15" narrow-body SOIC package. • Added failsafe supply voltage specification and related Note 4.
ISB-DS-001-IL41050-C **February 2010**	**Changes** • Extended min. operating temperature to −55°C. • Misc. changes and clarifications for final release.
ISB-DS-001-IL41050-B **January 2010**	**Change** • Clarified TxD edge trigger mode. Added information to Applications section. • Tightened timing specifications based on qualification data.
ISB-DS-001-IL41050-A **January 2010**	**Change** • Initial release.

NVE Corporation 11409 Valley View Road Eden Prairie, MN 55344-3617 USA Telephone: (952) 829-9217 Fax (952) 829-9189 Internet: www.isoloop.com

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.

NVE Corporation 11409 Valley View Road Eden Prairie, MN 55344-3617 USA Telephone: (952) 829-9217 Fax (952) 829-9189 Internet: www.isoloop.com

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

ISB-DS-001-IL41050-J

February 2012