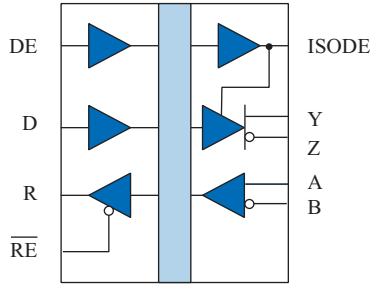


High Speed Isolated RS485/RS422 Transceiver

Functional Diagram



IL3522

IL3522 Receiver

RE	R	V _(A-B)
H	Z	X
L	H	≥ 200 mV
L	L	≤ -200 mV
L	H	Open

IL3522 Driver

DE	D	V _(Y-Z)
L	X	Z
H	H	≥ 2 V
H	L	≤ -2 V

H = High Level, L = Low Level
X = Irrelevant, Z = High Impedance

Features

- 40 Mbps data rate
- 20 ns propagation delay
- 1 ns pulse skew
- 6 kV_{RMS} Reinforced Isolation / 12.8 kV surge / 1.2 kV_{RMS} WV (IL3522VE)
- 50 kV/μs typ.; 30 kV/μs min. common mode transient immunity
- 3 V to 5 V power supplies
- 44000 year barrier life
- 15 kV bus ESD protection
- Low EMC footprint
- Thermal shutdown protection
- -40 °C to +85 °C temperature range
- IEC 60747-17 (VDE 0884-17):2021-10 certified; UL 1577 recognized
- 16-pin JEDEC-standard True 8™ mm 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 IL3522 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 IL3522 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⁽⁷⁾

Parameters	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Storage Temperature	T_S	-55		150	°C	
Junction Temperature	T_J	-55		150	°C	
Voltage Range at any Bus Pin		-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

Parameters	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	
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:

IL3522VE 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 IL3522E version (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	°C
Safety rating power (180 °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

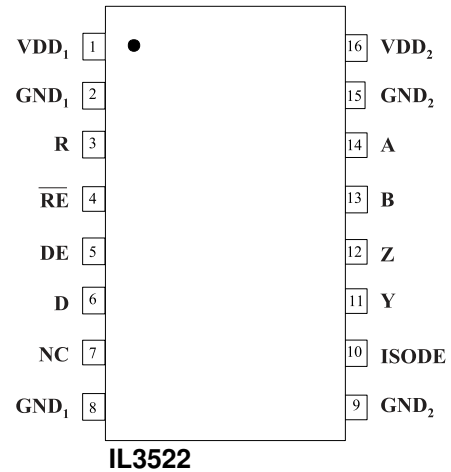
6 kV rating; each part tested at 7.2 kV_{RMS} (10.2 kV_{PK}) for 1 second; each lot sample tested at 6 kV_{RMS} (8485 V_{PK}) for 1 minute.

Soldering Profile

Per JEDEC J-STD-020C, MSL 1

IL3522 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	Y	Y Bus (Drive – True)
12	Z	Z Bus (Drive – Inverse)
13	B	B Bus (Receive – Inverse)
14	A	A Bus (Receive – True)
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 are T_{min} to T_{max} and $V_{DD} = 4.5$ V to 5.5 V, unless otherwise stated.

Parameters	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 ⁽⁸⁾	$ V_{OD1} $			V_{DD}	V	$I_O = 0$
Differential Output Voltage ⁽⁸⁾	$ V_{OD2} $	2.5	3	5	V	$R_L = 54 \Omega$, $V_{DD} = 5$ V
Differential Output Voltage ⁽⁸⁾	V_{OD3}	2.3		5	V	-7 V $> V_{CM} < 12$ V; $R_L = 54 \Omega$, $V_{DD} = 4.5$ V
Change in Magnitude of Differential Output Voltage ⁽⁴⁾	$\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 ⁽⁴⁾	$\Delta V_{OC} $			± 0.2	V	$R_L = 54 \Omega$ or 100Ω
Output Current	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 ¹	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)

Parameters	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Positive-going Input Threshold Voltage ⁽²⁾	V_{IT+}			0.2	V	-7 V $> V_{CM} < 12$ V
Negative-going Input Threshold Voltage ⁽²⁾	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, $T = 25^\circ$ C
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	I_I			1	mA	$V_I = 12$ V
				-0.8	mA	$V_I = -7$ V
Input Resistance	R_I	20			k Ω	

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	I_{DD1}		3 4	4 6	mA	$f_{IN} = 0$ Hz $V_{DD1} = 3.3$ V $V_{DD1} = 5$ V
Bus-Side Quiescent Supply Current	I_{DD2}		5	16	mA	Outputs Enabled; $R_T = \infty$; $f_{IN} = 0$ Hz
Controller-Side Dynamic Supply Current	I_{DD1}		0.22		mA/Mbps	$V_{DD1} = 3.3$ V
Bus-Side Dynamic Supply Current	$\Delta I_{DD2}/\Delta f_{IN}$		1			$R_T = \infty$
			0.8			$R_T = 60 \Omega$

Switching Characteristics

V _{DD1} = 5 V, V _{DD2} = 5 V						
Parameters	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						
Parameters	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⁽¹³⁾

V _{DD1} = 5 V, V _{DD2} = 5 V						
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 ⁽¹⁴⁾	K _X		2.5			
V _{DD1} = 3.3 V, V _{DD2} = 5 V						
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 ⁽¹⁴⁾	K _X		2.5			

Insulation Specifications

Parameters	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Creepage Distance (external)		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	1000			V _{RMS}	At maximum operating temperature
	DC	1500			V _{DC}	
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	θ_{JA}		67		°C/W	Double-sided PCB in free air
Junction–Case (Top) Thermal Resistance	θ_{JC}		12			
Junction–Ambient Thermal Resistance	θ_{JA}		46			2s2p PCB in free air per JESD51
Junction–Case (Top) Thermal Resistance	θ_{JC}		9			
Power Dissipation	P_D			1500	mW	

Notes:

1. All voltages are with respect to network ground except differential I/O bus voltages.
2. Differential input voltage is measured at the noninverting terminal A with respect to the inverting terminal B.
3. Skew limit is the maximum propagation delay difference between any two devices at 25°C.
4. $\Delta|V_{OD}|$ 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.
5. Includes 10 ns read enable time. Maximum propagation delay is 25 ns after read assertion.
6. Pulse skew is defined as $|t_{PLH} - t_{PHL}|$ of each channel.
7. Absolute Maximum specifications mean the device will not be damaged if operated under these conditions. It does not guarantee performance.
8. Differential output voltage is measured at terminal Y with respect to Z.
9. The relevant test and measurement methods are given in the Electromagnetic Compatibility section.
10. 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.

Power Supply Decoupling

V_{DD1} and V_{DD2} should be bypassed with 0.1 μF typical (0.047 μF minimum) capacitors as close as possible to 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.

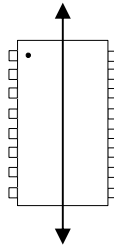
DC Correctness

The IL3522 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

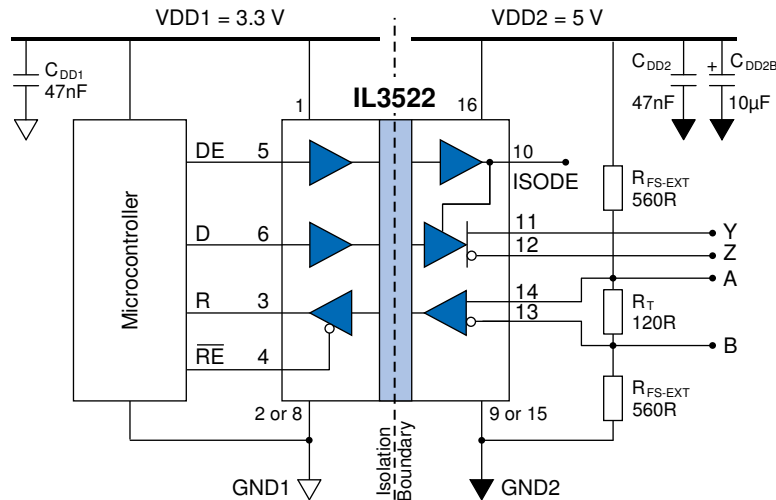
The IL3522 is fully compliant with IEC 61000-6-1 and IEC 61000-6-2 standards for immunity, and IEC 61000-6-3, IEC 61000-6-4, CISPR, and FCC Class A standards for emissions.

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



Application Information

The following figure shows typical connections to a microcontroller. The schematic includes typical termination and fail-safe resistors, and power supply decoupling capacitors:



Typical IL3522 connections.

Receiver Features

The receiver includes a “fail-safe if open” function that guarantees a high level output if the receiver inputs are unconnected (floating). The receiver output “R” has tri-state capability via the active low RE input.

Driver Features

The RS-422 driver is differential output and delivers at least 1.5 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 IL3522 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 receivers.

Fail-Safe Operation

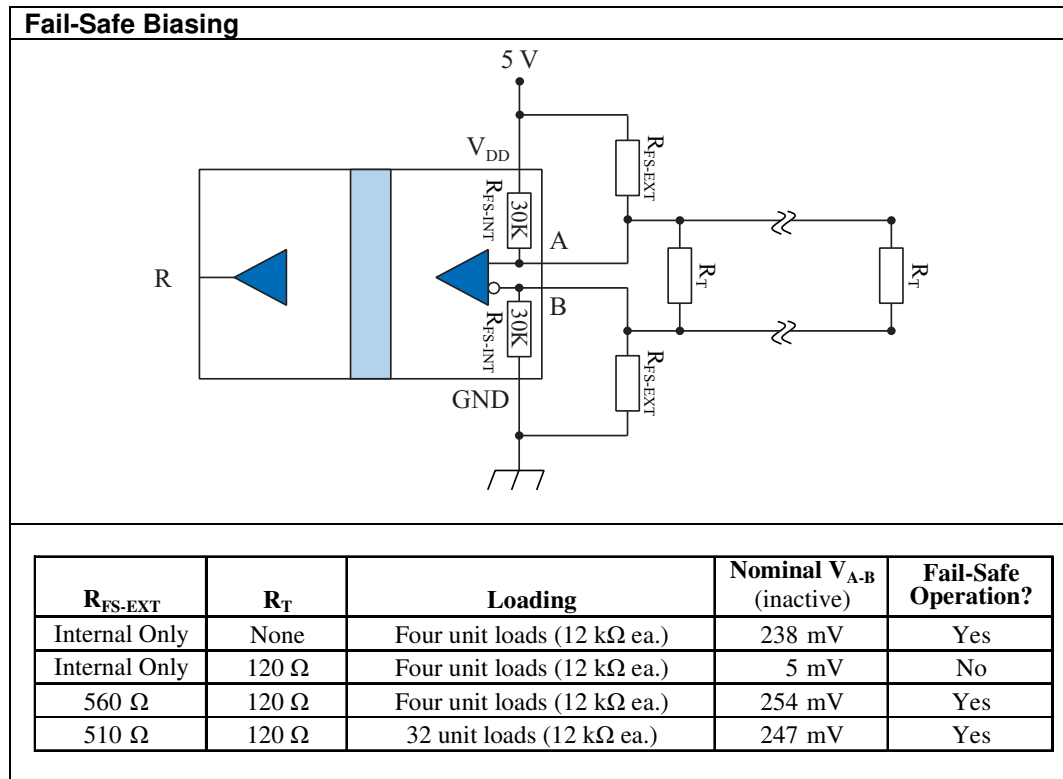
“Fail-safe operation” is defined here as the forcing of a logic high state on the “R” output in response to an open-circuit condition between the “A” and “B” lines of the bus, or when no drivers are active on the bus.

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-422 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-422 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.

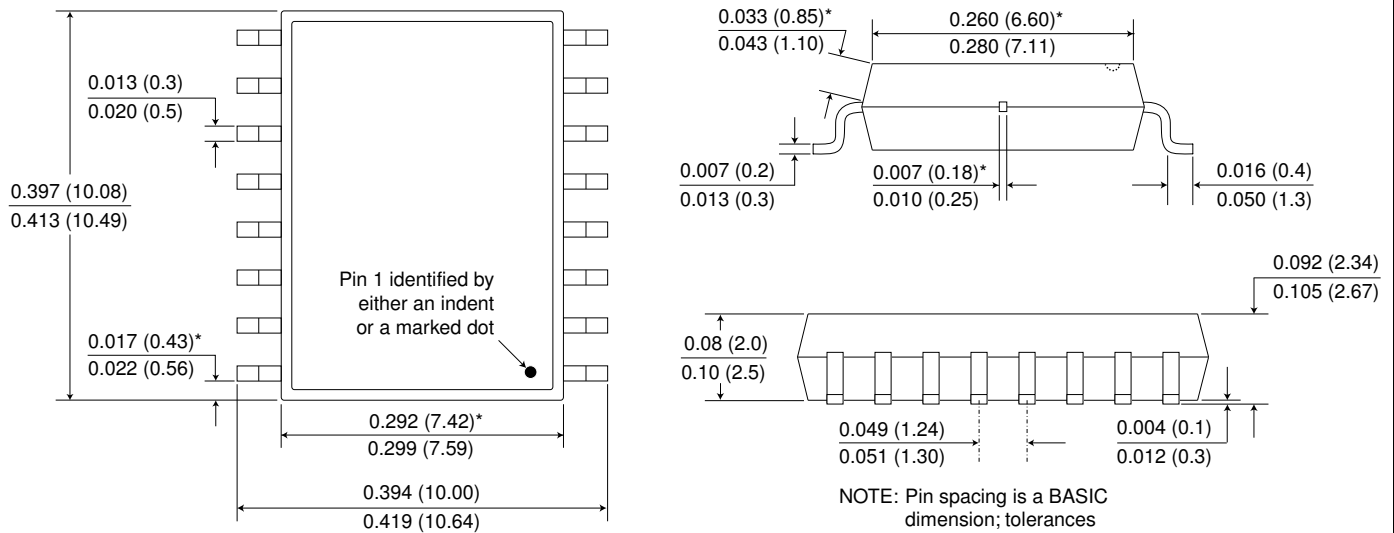
In the example with two 120 Ω termination resistors and four Unit Loads, 560 Ω external biasing resistors provide more than 200 mV between “A” and “B” with adequate margin for power supply variations and resistor tolerances. This ensures a known state when there are no active drivers. Other illustrative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



Package Drawing

0.3" 16-pin SOIC Package

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

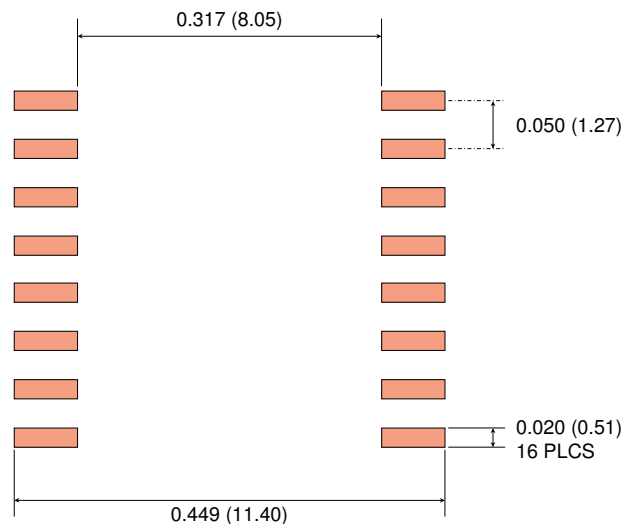


*Specified for True 8™ package to guarantee 8 mm creepage per IEC 60601.

Recommended Pad Layout

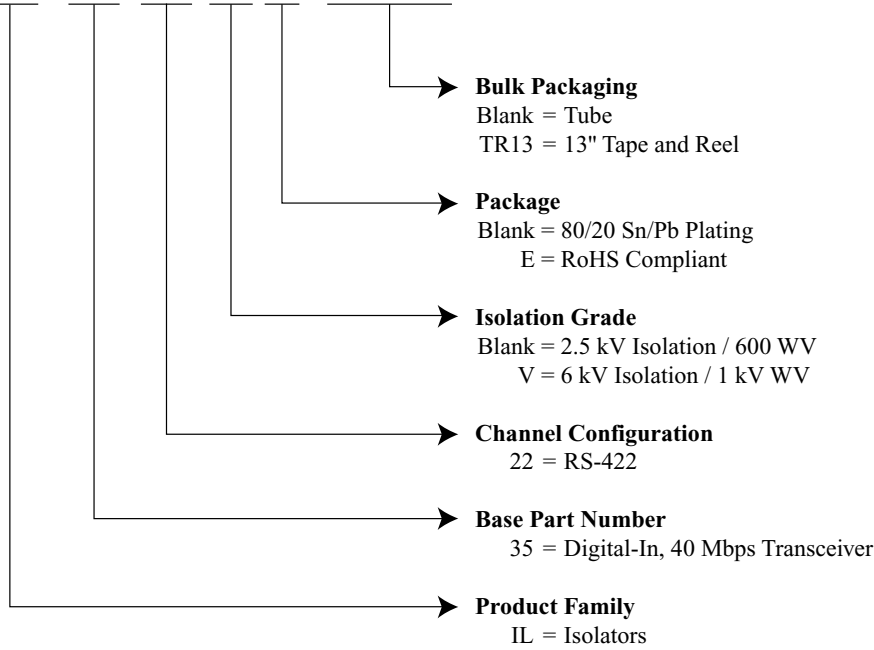
0.15" 16-pin SOIC Pad Layout

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



Ordering Information and Valid part Numbers

IL 35 22 V E TR13



Valid Part Numbers

- IL3522
- IL3522E
- IL3522TR13
- IL3522E TR13

- IL3522VE
- IL3522VE TR13



Revision History

ISB-DS-001-IL3522-T August 2022	<ul style="list-style-type: none"> • Upgraded to IEC 60747-17 (VDE 0884-17):2021-10 certification (p. 3). • Increased Working Voltage ratings based on latest VDE testing (p. 3). • Separate power consumption specifications section; added dynamic power consumption (p. 5). • Updated EMC standards. • Deleted minimum magnetic field immunity specifications (p. 6) since it is not 100% tested. • Added thermal characteristics (p. 7).
ISB-DS-001-IL3522-S	<ul style="list-style-type: none"> • Updated VDE Reinforced Isolation file number and description.
ISB-DS-001-IL3522-R	<ul style="list-style-type: none"> • 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-IL3522-Q	<ul style="list-style-type: none"> • 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-IL3522-P	<ul style="list-style-type: none"> • 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-IL3522-O	<ul style="list-style-type: none"> • Added V-Series versions (5 kVrms isolation / 1000 Vrms working voltage).
ISB-DS-001-IL3522-N	<ul style="list-style-type: none"> • IEC 60747-5-5 (VDE 0884) certification. • Upgraded from MSL 2 to MSL 1.
ISB-DS-001-IL3522-M	<ul style="list-style-type: none"> • 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-IL3522-L	<ul style="list-style-type: none"> • Changed title to “Very High Speed Isolated RS485/RS422 Transceiver.” • Detailed isolation and barrier specifications. • Cosmetic changes.
ISB-DS-001-IL3522-J	<ul style="list-style-type: none"> • Added clarification of internal ground connections (p. 3).

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.

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