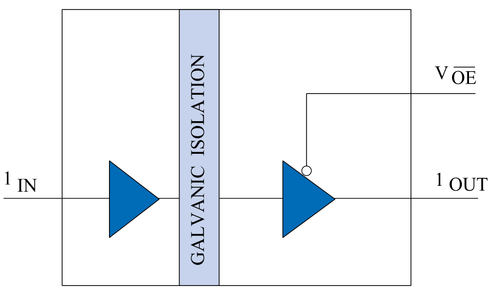
NVE CORPORATION

IL710

IsoLoop®

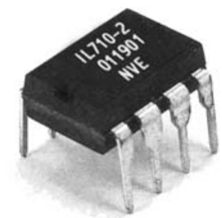
High Speed Digital Isolator

Functional Diagram



Features

- +5V and +3.3V CMOS/TTL Compatible
- 2 ns Typical Pulse Width Distortion
- 4 ns Typical Propagation Delay Skew
- 10 ns Typical Propagation Delay
- High Speed: 110 MBd Typical
- 30 kV/µs Typical Common Mode Rejection
- Tri State Output
- 2500V_{RMS} Isolation (1 min.)
- UL1577 Approved (File # E207481)
- IEC 61010-1 Approved (Report # 607057)



Applications

- Digital Fieldbus Isolation
- Multiplexed Data Transmission
- Computer Peripheral Interface
- Noise Reduction in High Speed Digital Systems
- Isolated Data Interfaces
- Logic Level Shifting

Truth Table

V_I	$V_{\overline{OE}}$	V_O
L	L	L
H	L	H
L	H	Z
H	H	Z

Ordering Information

Model	Package Type	
	8–PDIP	*8–SOIC*
IL710	-2	-3

IL710-2 is an 8–PDIP package

IL710-3 is an 8–SOIC package

If requesting tape and reel, please specify as TR.

Example: **IL710-3TR**

Description

The IL710 is a CMOS digital isolator integrated with NVE's patented* IsoLoop® technology, which gives the IL710 high speed performance and excellent transient immunity specifications. The symmetric magnetic coupling barrier gives this device a typical propagation delay of only 10 ns and a pulse width distortion of 2 ns, giving the IL710 the best specifications of any isolator device. The IL710 also has a 100 Mbaud data rate, making it the world's fastest digital isolator. The IL710 is ideally suited for isolating such applications as PROFIBUS, RS-485, RS422, etc. It is available in 8-pin PDIP and 8-pin SOIC packages, and is specified over the temperature range of -40°C to +100°C without any performance derating.

* US Patent number 5,831,426; 6,300,617 and others

Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Units
Storage Temperature	T_S	-55	175	°C
Ambient Operating Temperature(1)	T_A	-55	125	°C
Supply Voltage	V_{DD1},V_{DD2}	-0.5	7	Volts
Input Voltage	V_I	-0.5	V_{DD1}+0.5	Volts
Input Voltage	$V_{\overline{OE}}$	-0.5	V_{DD2}+0.5	Volts
Output Voltage	V_O	-0.5	V_{DD2}+0.5	Volts
Output Current Drive	I_O		10	mA
Lead Solder Temperature (10s)			260	°C
ESD	2kV Human Body Model			

Recommended Operating Conditions

Parameters	Symbol	Min.	Max.	Units
Ambient Operating Temperature	T_A	-40	100	°C
Supply Voltage	V_{DD1},V_{DD2}	3.0	5.5	Volts
Logic High Input Voltage	V_{IH}	2.4	V_{DD1}	Volts
Logic Low Input Voltage	V_{IL}	0	0.8	Volts
Minimum Signal Rise and Fall Times	t_{IR},t_{IF}		1	μsec

Insulation Specifications

Parameter	Condition	Min.	Typ.	Max.	Units
Barrier Impedance			$>10^{14}$‖3		Ω ‖ pF
Creepage Distance (External)		7.036 (PDIP) 4.026 (SOIC)			mm
Leakage Current	240 V_{RMS} 60Hz		0.2		μA

Package Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Capacitance (Input-Output)(5)	C_{I-O}		1.1		pF	f= 1MHz
Thermal Resistance (PDIP)	θ_{JCT}		150		°C/W	Thermocouple located at center underside of package
(SOIC)	θ_{JCT}		240		°C/W	
Package Power Dissipation	P_{PD}			150	mW	

IEC61010-1

TUV Certificate Numbers: B 01 07 44230 001 (PDIP)
B 01 07 44230 002 (SOIC)

Classification as Table 1.

Model	Pollution Degree	Material Group	Max Working Voltage	Package Type	
				8–PDIP	*8–SOIC*
IL710-2	II	III	300 VRMS	✓	
IL710-3	II	III	150 VRMS		✓

UL 1577

Component Recognition program. File # E207481
Rated 2500Vrms for 1min.

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

Electrical Specifications

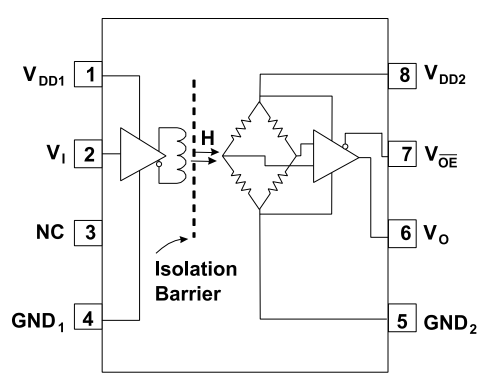
Electrical Specifications are T_{min} to T_{max} unless otherwise stated.

Parameter	Symbol	3.3 Volt Specifications Min.	Typ.	Max.	5Volt Specifications Min.	Typ.	Max.	Units	Test Conditions
DC Specifications									
Input Quiescent Supply Current	I_{DD1}		8	10		10	15	µA	
Output Quiescent Supply Current	I_{DD2}		3.3	4		5	6	mA	
Logic Input Current	I_I	-10		10	-10		10	µA	
Logic High Output Voltage	V_{OH}	V_{DD2}-0.1 0.8*V_{DD2}	V_{DD2} V_{DD2}-0.5		V_{DD2}-0.1 0.8*V_{DD2}	V_{DD2} V_{DD2}-0.5		V	I_O =-20 µA, V_I =V_{IH} I_O = -4 mA, V_I =V_{IH}
Logic Low Output Voltage	V_{OL}		0 0.5	0.1 0.8		0 0.5	0.1 0.8	V	I_O = 20 µA, V_I =V_{IL} I_O = 4 mA, V_I =V_{IL}
Switching Specifications									
Maximum Data Rate		100	110		100	110		MBd	C_L = 15 pF
Pulse Width	PW	10			10			ns	
Propagation Delay Input to Output (High to Low)	t_{PHL}		12	18		10	15	ns	C_L = 15 pF
Propagation Delay Input to Output (Low to High)	t_{PLH}		12	18		10	15	ns	C_L = 15 pF
Propagation Delay Enable to Output (High to High Impedance)	t_{PHZ}		3	5		3	5	ns	C_L = 15 pF
Propagation Delay Enable to Output (Low to High Impedance)	t_{PLZ}		3	5		3	5	ns	C_L = 15 pF
Propagation Delay Enable to Output (High Impedance to High)	t_{PZH}		3	5		3	5	ns	C_L = 15 pF
Propagation Delay Enable to Output (High Impedance to Low)	t_{PZL}		3	5		3	5	ns	C_L = 15 pF
Pulse Width Distortion(2)			2	3		2	3		
Propagation Delay Skew(3)	t_{PSK}		4	6		4	6	ns	C_L = 15 pF
Output Rise Time (10-90%)	t_R		2	4		1	3	ns	C_L = 15 pF
Output Fall Time (10-90%)	t_F		2	4		1	3	ns	C_L = 15 pF
Common Mode Transient Immunity (Output Logic High or Logic Low) (4)	|CMH| |CML|	20	30		20	30		kV/µs	Vcm = 300V

Pin Connections

1	V_{DD1}	Input Power Supply
2	V_I	Logic Input Signal
3	NC	No Internal Connection
4	GND_1	Input Power Supply Ground
5	GND_2	Output Power Supply Ground
6	V_O	Output Logic Signal
7	$V_{\overline{OE}}$	Logic Output Enable*
8	V_{DD2}	Output Power Supply

*Held Low Internally



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Notes:

1. Absolute Maximum ambient operating temperature means the device will not be damaged if operated under these conditions. It does not guarantee performance.
2. PWD is defined as $| t_{PHL} - t_{PLH} |$. %PWD is equal to the PWD divided by the pulse width.
3. t_{PSK} is equal to the magnitude of the worst case difference in t_{PHL} and/or t_{PLH} that will be seen between units at 25°C.
4. CM_H is the maximum common mode voltage slew rate that can be sustained while maintaining $V_O > 0.8\ V_{DD2}$. CM_L is the maximum common mode input voltage that can be sustained while maintaining $V_O < 0.8$ V. The common mode voltage slew rates apply to both rising and falling common mode voltage edges.
5. Device is considered a two terminal device: pins 1-4 shorted and pins 5-8 shorted.

Application Notes:

Power Consumption

Isoloop® devices achieve their low power consumption from the manner by which 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 2.5ns wide, the power consumption is independent of mark-to-space ratio and solely dependent on frequency. This has obvious advantages over optocouplers whose power consumption is heavily dependent on its on-state and frequency.

The approximate power supply current per channel for Isoloop® is: $I(\text{input}) = 40 \left(\frac{f}{f_{max}}\right)\left(\frac{1}{4}\right)$ mA

where f = operating frequency
fmax = 50 MHz

Power Supplies

It is recommended that low ESR ceramic capacitors be used to decouple the supplies. 10nF capacitors should be placed as close to the device as possible between V_{DD1} and GND_1, as well as between V_{DD2} and GND_2.

Signal Status on Start-up and Shut Down

To minimize power dissipation, the input signal to the IL710 is differentiated and then latched on the output side of the isolation barrier to reconstruct the signal. This could result in an ambiguous output state depending on power up, shutdown and power loss sequencing. Therefore, the designer should consider the inclusion of an initialization signal in his start-up circuit.

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.

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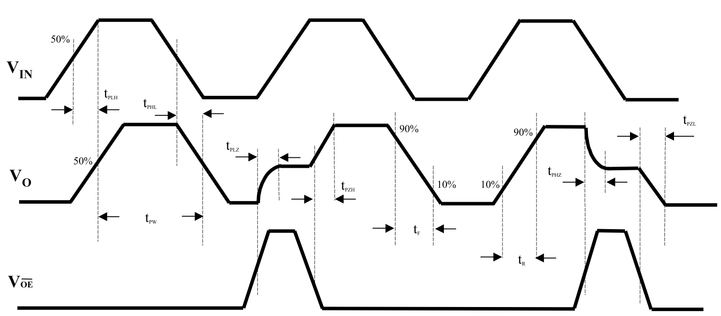
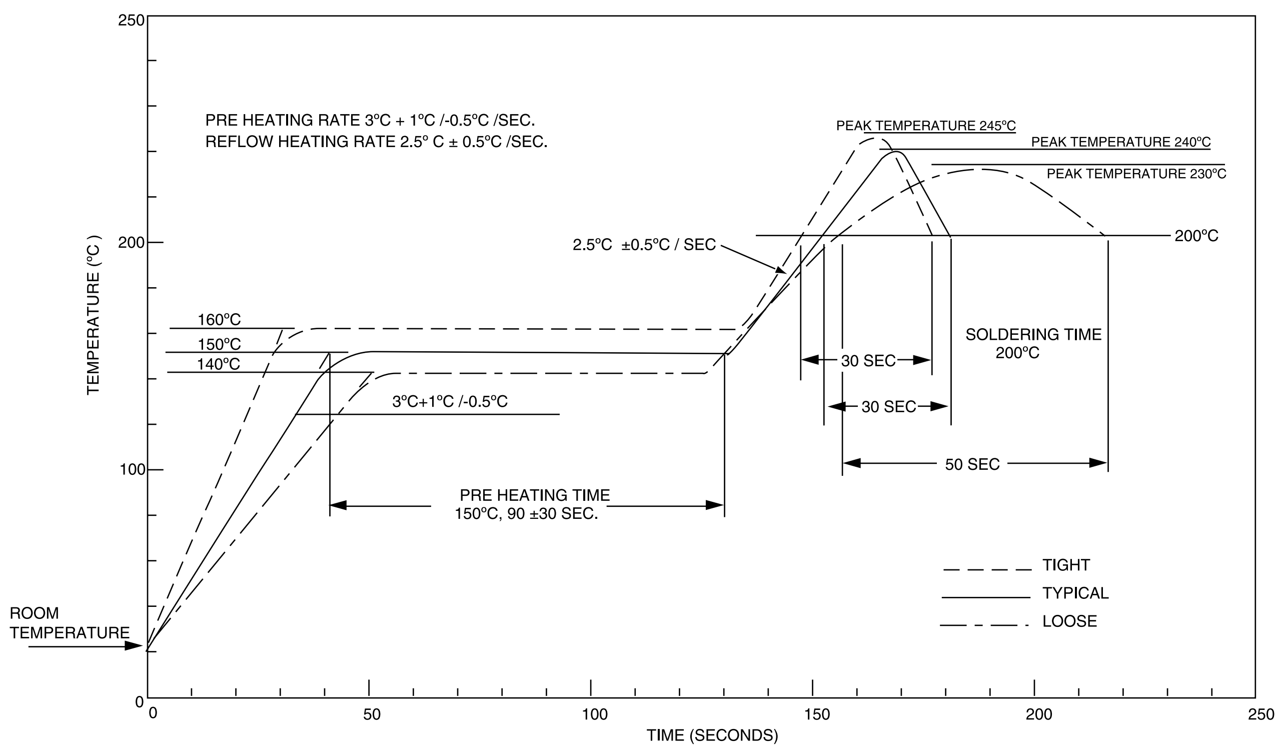
Timing Diagram



Legend

t_{PLH}	Propagation Delay, Low to High
t_{PHL}	Propagation Delay, High to Low
t_{PW}	Minimum Pulse Width
t_{PLZ}	Propagation Delay, Low to High Impedance
t_{PZH}	Propagation Delay, High Impedance to High
t_{PHZ}	Propagation Delay, High to High Impedance
t_{PZL}	Propagation Delay, High Impedance to Low
t_R	Rise Time
t_F	Fall Time

IR Soldering Profile



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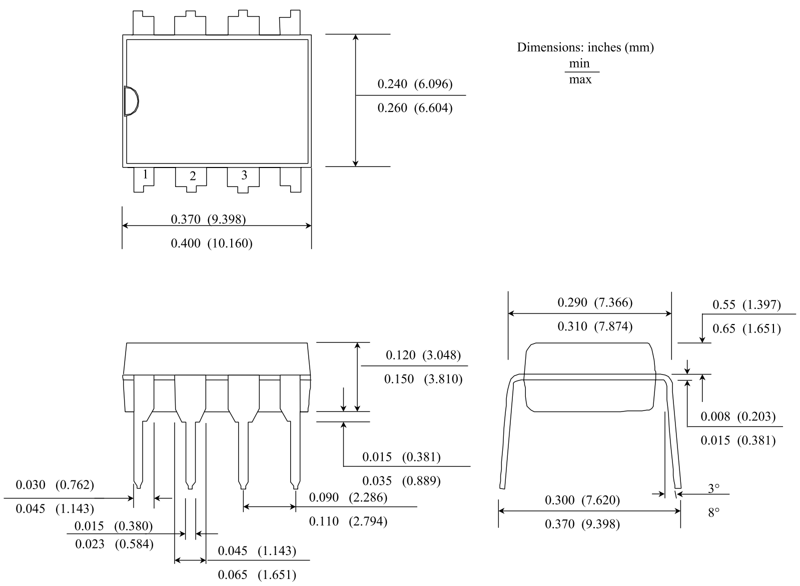
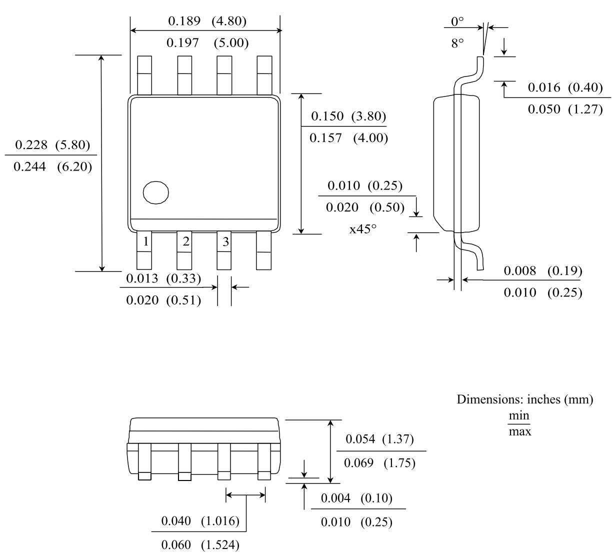
IL710-2 (8-Pin PDIP Package)

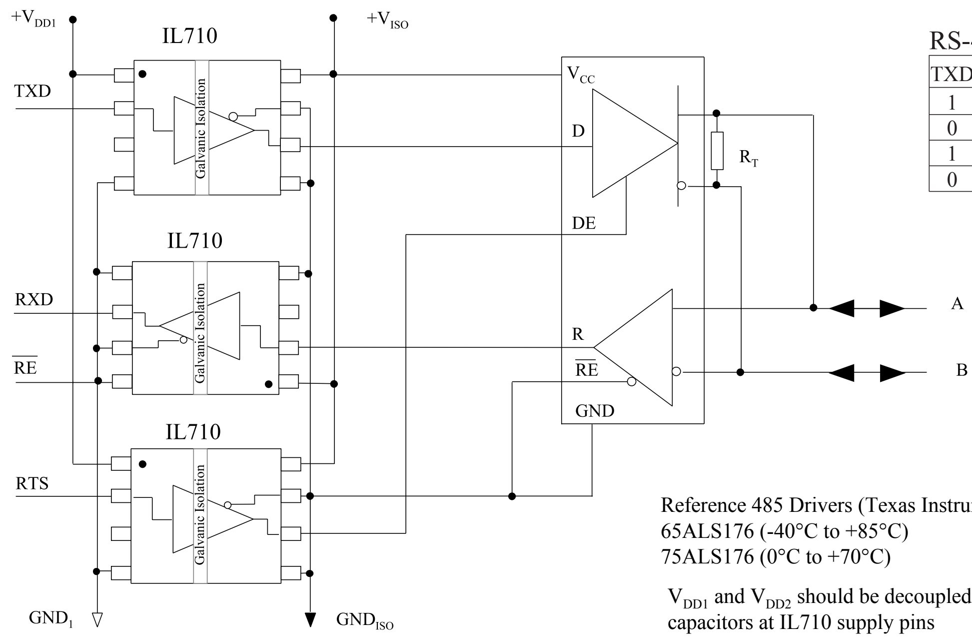


IL710-3 (Small Outline SOIC-8 package)



Applications

Isolated PROFIBUS / RS-485



RS-485 Truth Table

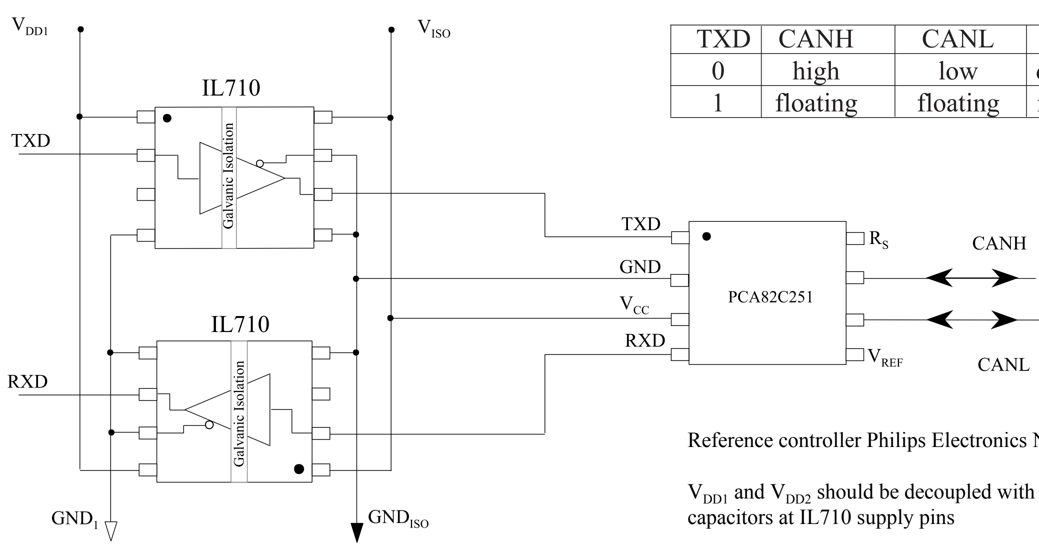
TXD	RTS	A	B	RXD
1	0	Z	Z	X
0	0	Z	Z	X
1	1	1	0	1
0	1	0	1	0

Reference 485 Drivers (Texas Instruments)
65ALS176 (-40°C to +85°C)
75ALS176 (0°C to +70°C)

V_{DD1} and V_{DD2} should be decoupled with 10nF capacitors at IL710 supply pins

Isolated DeviceNet / CAN Transceiver

TXD	CANH	CANL	BUS	RXD
0	high	low	dominant	0
1	floating	floating	recessive	1



Reference controller Philips Electronics N.V.

V_{DD1} and V_{DD2} should be decoupled with 10nF capacitors at IL710 supply pins

About NVE

An ISO 9001 Certified Company

NVE Corporation is a high technology components manufacturer having the unique capability to combine leading edge Giant Magnetoresistive (GMR) materials with integrated circuits to make high performance electronic components. Products include Magnetic Field Sensors, Magnetic Field Gradient Sensors (Gradiometer), Digital Magnetic Field Sensors, Digital Signal Isolators and Isolated Bus Transceivers.

NVE is a leader in GMR research and in 1994 introduced the world's first products using GMR material, a line of GMR magnetic field sensors that can be used for position, magnetic media, wheel speed and current sensing.

NVE is located in Eden Prairie, Minnesota, a suburb of Minneapolis. Please visit our Web site at www.nve.com or call 952-829-9217 for information on products, sales or distribution.

NVE Corporation
11409 Valley View Road
Eden Prairie, Mn 55344-3617 USA
Telephone: (952) 829-9217
Fax: (952) 829-9189
Internet: www.nve.com
e-mail: isoinfo@nve.com

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