Tifomy Technologies
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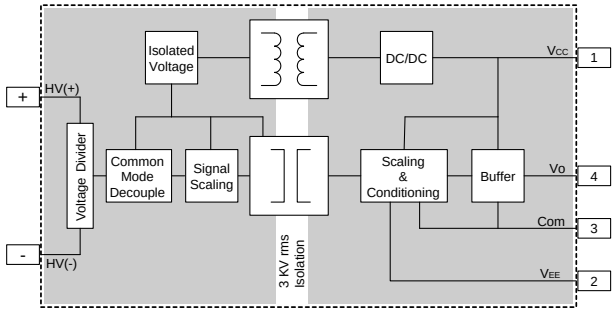
± 50V PRECISION HIGH BANDWIDTH ISOLATED VOLTAGE TRANSDUCER

V50-ISO

FEATURES

- Voltage Measuring Range: 0 to ± 50V
- Output Voltage Range: 0 to ± 5V
- Both AC and DC Voltage Measurement
- Galvanic Isolated Voltage Rating: 3000 Vrms
- Very Low Leakage Current:60uA @ 3KVrms 60Hz
- Large Signal Bandwidth: 28 KHz
- Fast Response Time: < 25 μS
- Overall Accuracy: Better than ± 1% of Full-Scale
- Low Nonlinearity: ± 0.02% Max
- High Common Mode Voltage Rejection: 120 dB
- High Input Resistance: 6 KΩ
- Operating Temperature Range: - 40 °C to 85 °C
- Low Output Voltage Offset Drift: ± 0.33 mV/°C
- Very Low Voltage Gain Drift: ± 0.022% /°C
- Operating Power Supply Range: ± 11V to ± 13V
- Low Quiescent Current: < 48mA/0.8mA
- Built-in Isolated Power Supply
- Small Footprint: 1.5" x 1" x 0.5" (38.1x25.4x12.7mm)
- Weight: 0.741 oz (21 g)
- RoHS Compliant
- MTBF 1815×10^3 Hrs (25°C) 846×10^3Hrs (85°C)
- Excellent Water and Thermal Shock Resistance
- Flame Retardant (UL 94 V-O)



Functional Block Diagram

V50-ISO Picture (1.5"x 1"x 0.5" Excluding Pins)

DESCRIPTION

The V50-ISO is a precision high bandwidth voltage transducer that is capable of measuring AC and DC voltages up to ± 50V with ± 1% accuracy. The device is rated 3KV rms galvanic isolation with advanced voltage sensing, common mode decoupling, and isolation technology built-in to ensure safe and accurate high voltage measurement. Excellent dynamic characteristics provide large signal bandwidth of 28 KHz and high common mode rejection of 120 dB @ 60Hz. The V50-ISO is ideal for high voltage sensing that requires high accuracy, fast response, high common mode rejection, wide operating temperatures (- 40 °C to 85 °C), and a small footprint.

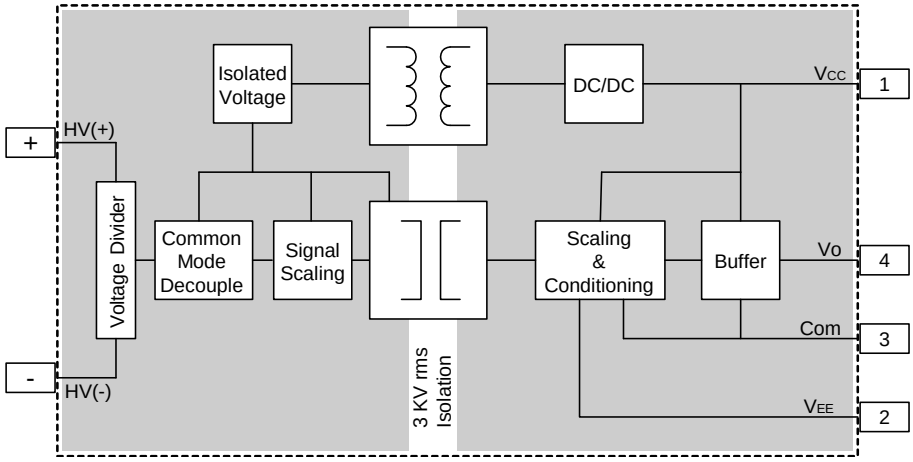
The V50-ISO is easy to use and does not require additional components. The device has an internal integrated isolation power supply and circuitry for direct high voltage sensing. Just apply nominal ± 12Vdc power and high voltage to be sensed, the device will output a galvanic isolated voltage signal with voltage attenuation gain of 10. High voltage input pins are "+" and "-" with maximum differential voltage of ± 50V and voltage rated 3KV rms with respect to ground. Operating power supply requirement is ± 12Vdc nominal (range: ± 11V to ± 13V). Pin 1 is +12V input, Pin 2 is -12V input, and pin 3 is ± 12V return. Pin 4 is the output with full scale output voltage of ± 5V. Pins "+", "-" and Pins 1, 2, 3, 4 are isolated with reinforced insulation of 3KVrms isolation rating.

Typical output to input voltage gain is 1:10. The V50-ISO has excellent gain linearity with maximum ± 0.02% nonlinearity. Gain deviation as a function of temperature is typically ± 0.022% /°C. Typical output voltage offset drift is 0.33 mV /°C.

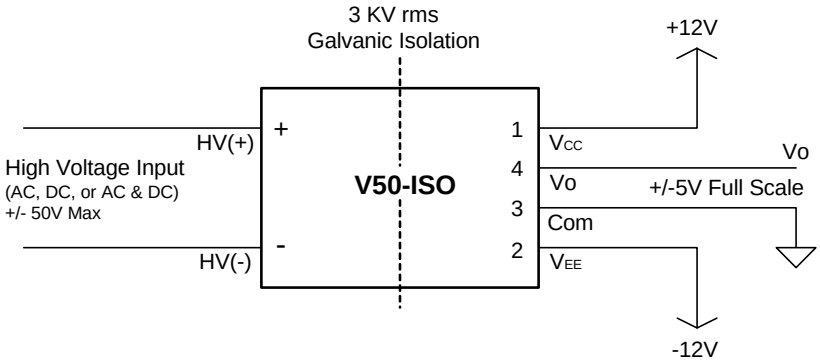
High voltage input resistance is typical 6 KΩ and it requires very small power from high voltage bus circuit being sensed. For example, power drawn from a 50Vdc high voltage bus is 0.42 watts. The input resistance is optimized with dynamic characteristics, DC characteristics, and thermal performance of the device.

The V50-ISO requires small quiescent current (48 mA max) from its +12Vdc input power supply and 0.8 mA max from -12V. The internal integrated isolation power supply is derived from the +12Vdc input to power up high voltage side circuitry.

FUNCTIONAL BLOCK DIAGRAM



TYPICAL APPLICATION WIRING DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Minimum	Maximum	Units
Storage Temperature		T_S	-45	+ 95	°C
Ambient Operating Temperature		T_A	-40	+ 85	°C
Supply Voltages		V_{CC} [Pin 1]	+ 10.8	+ 13.2	V
		V_{EE} [Pin 2]	- 13.2	- 10.8	V
		Com [Pin 3]	0	0	V
Steady State Input Voltage		[Pin +] - [Pin -]	-55	+ 55	V
Transient Input Voltage (2 Seconds)		[Pin +] - [Pin -]	-65	+ 65	V
Output Voltage		V_o [Pin 4]	- 6	+ 6	V
Pins Soldering	Temperature			260	°C
	Time Duration			15	S

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Minimum	Maximum	Units
Ambient Operating Temperature	T_A	- 40	+ 85	°C
Supply Voltages	V_{CC} [Pin 1]	+ 11	+ 13	V
	V_{EE} [Pin 2]	- 13	- 11	V
Input Voltage Range	[Pin +] - [Pin -]	-50	+ 50	V

ELECTRICAL CHARACTERISTICS

At T_A = +25°C , V_{cc} = +12V V_{ee} =-12V, and R_L = 10kΩ, unless otherwise noted.

PARAMETER	CONDITIONS	Fig	Note	V100-ISO			UNITS
				MIN	TYP	MAX	
ISOLATION							
Isolation Voltage Rating	Input to Output, 60Hz AC, 60sec 100% Tested	21	1	3000			V rms
Leakage Current	Input to Output, 3000 Vrms @ 60Hz				49	60	μA rms
GAIN							
Nominal Gain	Output to Input Voltage Ratio	1-2	2		1/10		V/V
Overall Accuracy		3	3		± 0.6	± 1	%
Gain Vs Temperature	-40 °C to 85 °C	6	4		± 0.02	± 0.035	% / °C
Nonlinearity		4	5		± 0.01	± 0.02	%
COMMON MODE REJECTION							
Frequency Response	60Hz	20,23	6	120			dB
	500KHz			70			dB
Transient Immunity	500V Step Excitation (>10KV/μs)	19,24	7			0.2	V
INPUT VOLTAGE							
Voltage Range	Continuous Operation	22	8	± 50			V
Resistance	Between Pin "+" and Pin "-"				6		KΩ
OUTPUT VOLTAGE							
Voltage Range					± 5		V
Offset Voltage					± 20	± 32	mV
Voltage Offset Drift	Deviation from offset at 25 °C	22	9			± 0.33	mV / °C
Current Drive						± 5	mA
Capacitive Load	In parallel with 1KΩ				1000 pF		
Ripple Voltage	Vin=0V, Scope Bandwidth 100 MHz				± 25	± 40	mV
Dynamic Response							
Full Signal Bandwidth	Input Voltage Amplitude: 50V	7-15	10	28			KHz
Propagation Delay	Pulse Transient Test	16-18	11		2.8	4.4	μS
Slew Rate		22			1.2	2.5	V / μS
Power Supply							
Supply Voltage				± 11	± 12	± 13	Vdc
Quiescent Current (V_{CC})	Over Rated Input Voltage Range			31	37	48	mA
Quiescent Current (V_{EE})					0.3	0.8	mA
Temperature Range							
Operating	Continuous Full Input Voltage			-40		85	°C
Storage	Non-Power			-45		95	°C

PERFORMANCE CHARACTERISTICS

At T_A = +25°C , V_{cc} = +12V V_{ee} =-12V, and R_L = 10kΩ, unless otherwise noted.

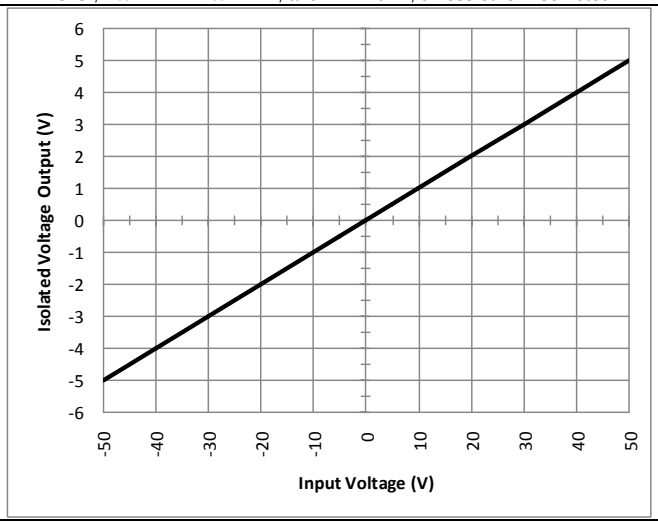


Figure 1: Input to Output Voltage

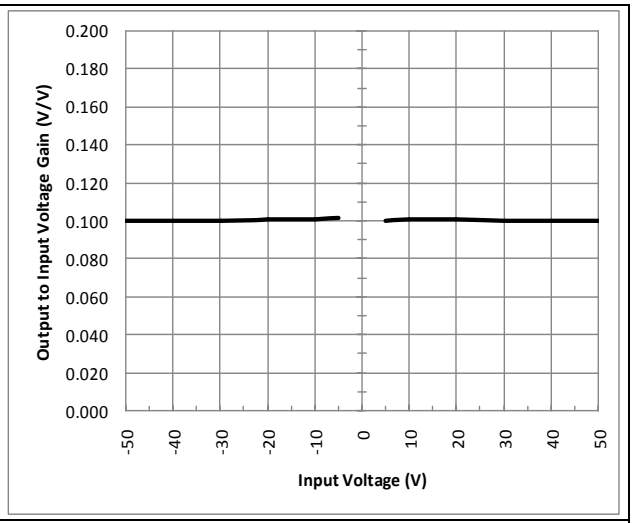


Figure 2: Output to Input voltage Gain

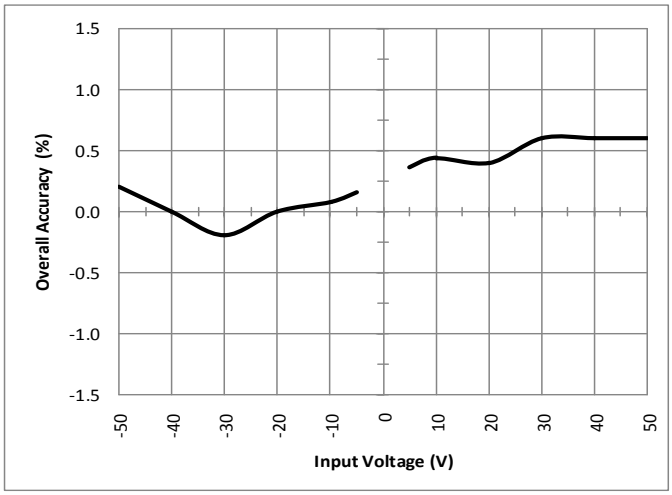


Figure 3: Voltage Sensing Overall Accuracy

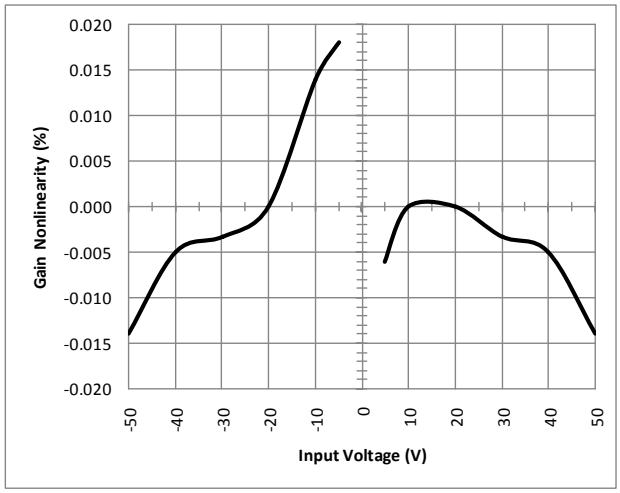


Figure 4: Gain Nonlinearity

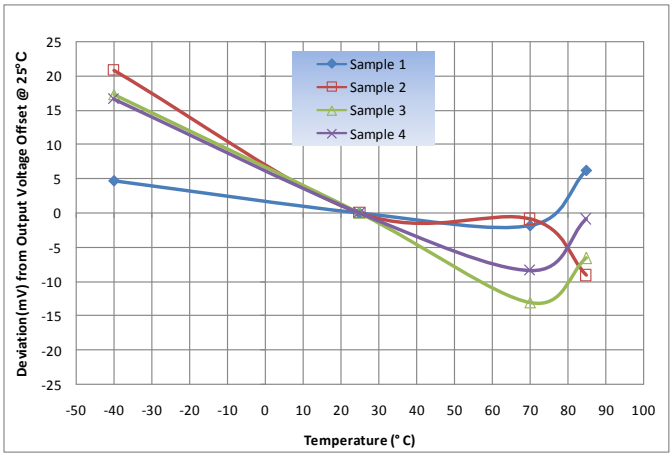


Figure 5: Output Voltage Drift Vs. Temperature

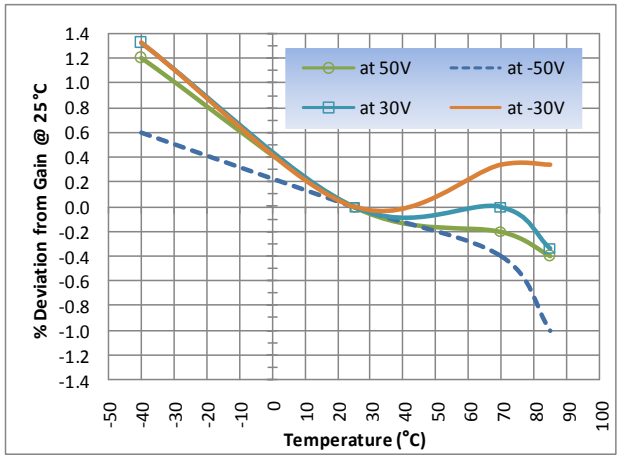


Figure 6: Gain Percentage Deviation Vs. Temperature

PERFORMANCE CHARACTERISTICS (-Continue)

At T_A = +25°C , V_{cc} = +12V V_{ee} =-12V, and R_L = 10kΩ, unless otherwise noted.

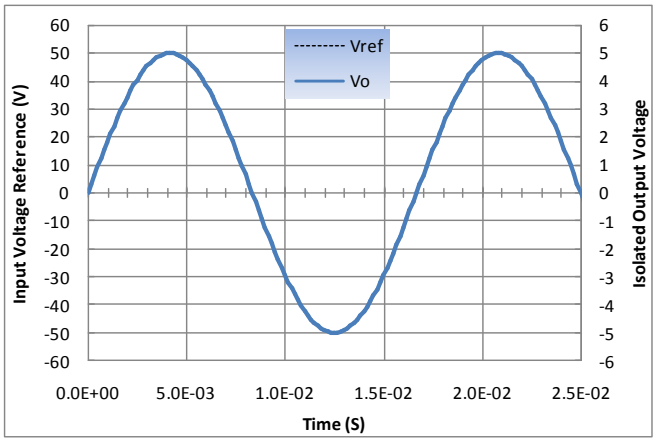


Figure 7: 60Hz Response (Two signals are overlap)

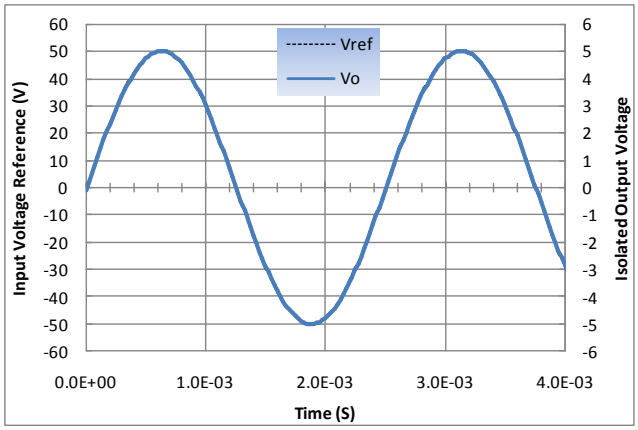


Figure 8 400Hz: Response (Two signals are overlap)

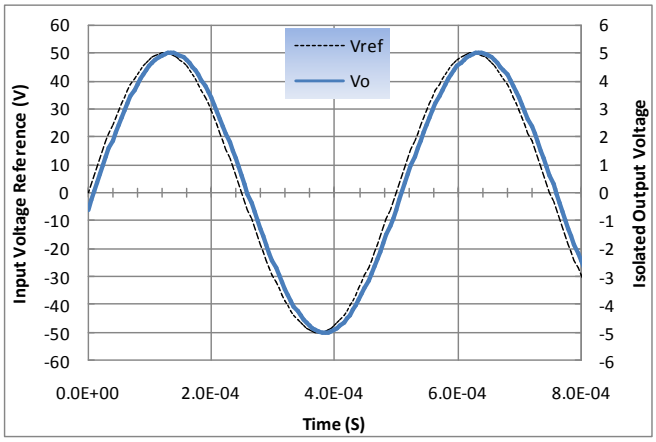


Figure 9: 2 KHz Response

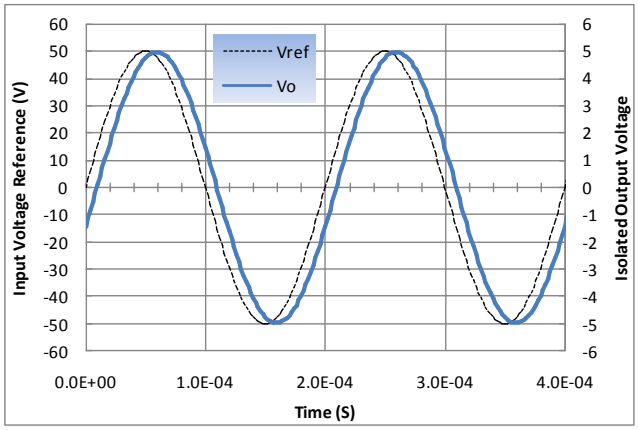


Figure 10: 5 KHz Response

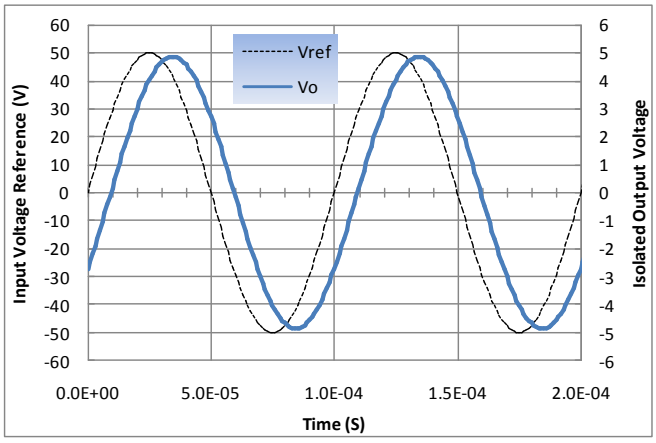


Figure 11: 10 KHz Response

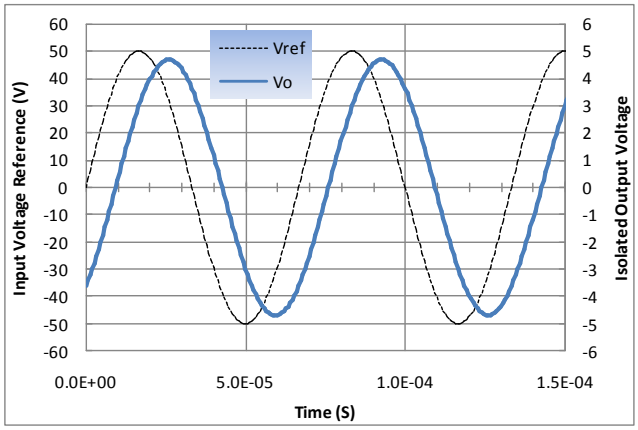


Figure 12: 15 KHz Response

PERFORMANCE CHARACTERISTICS (Continue)

At T_A = +25°C , V_{cc} = +12V V_{ee} =-12V, and R_L = 10kΩ, unless otherwise noted.

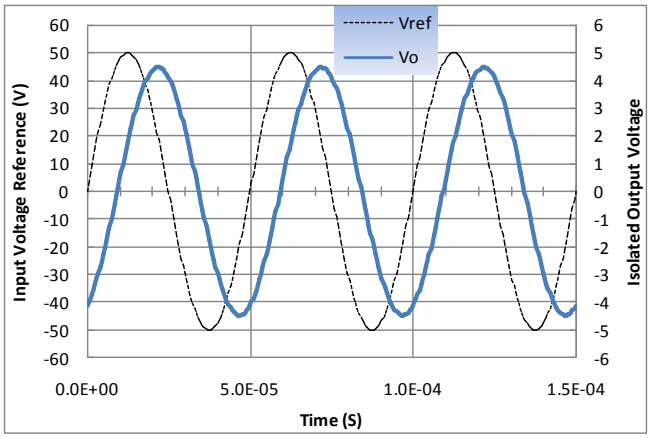


Figure 13: 20 KHz Response

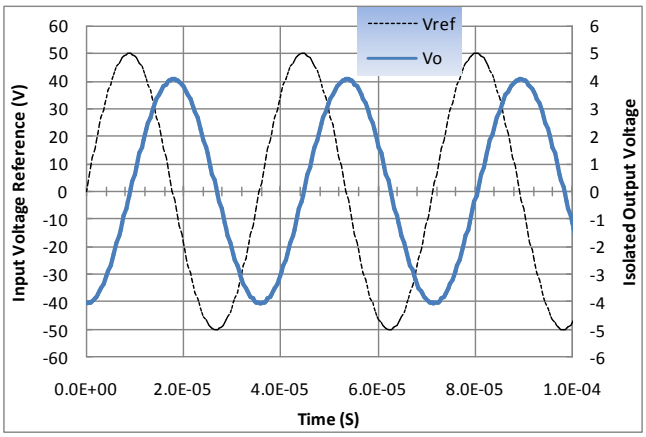


Figure 14: 28 KHz Response

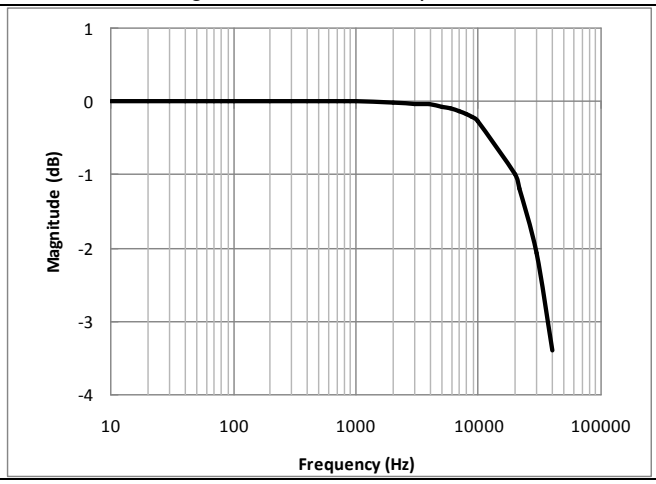


Figure 15: Voltage Sensing Frequency Response

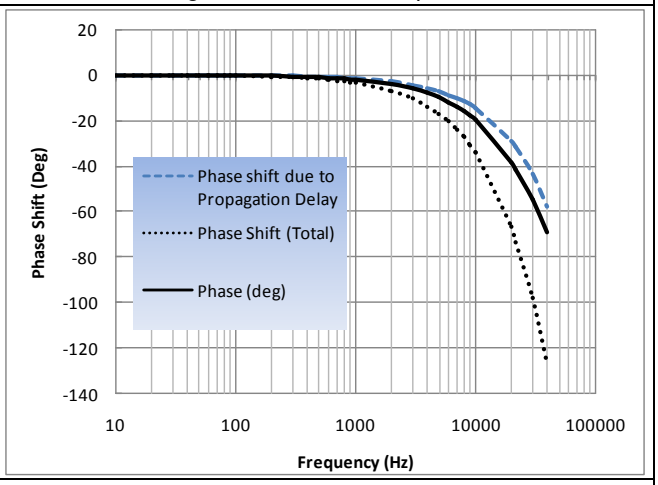


Figure 16: Phase Shift vs. Frequency

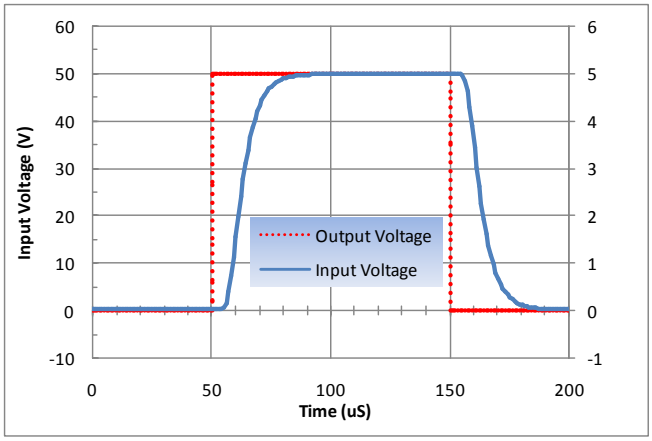


Figure 17: +50V Input Step Response

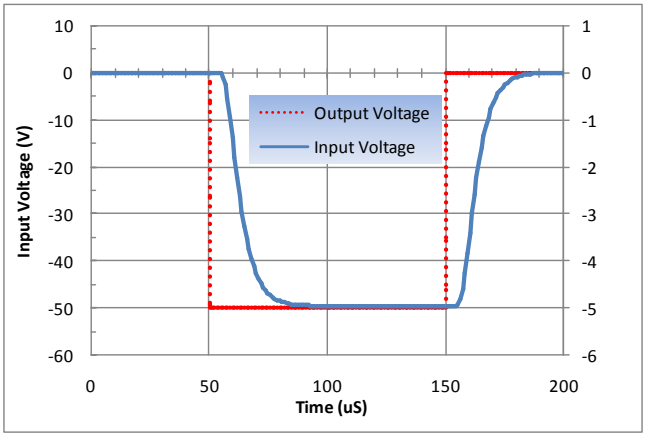


Figure 18: -50V Input Step Response

PERFORMANCE CHARACTERISTICS (Continue)

At T_A = +25°C , V_{cc} = +12V V_{ee} =-12V, and R_L = 10kΩ, unless otherwise noted.

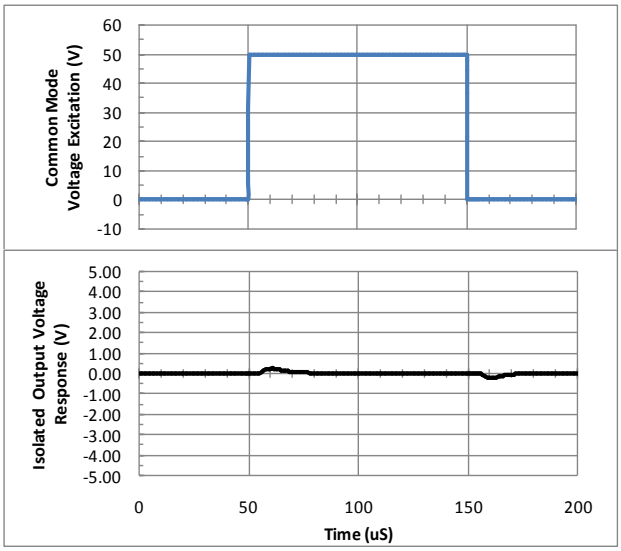


Figure 19: 500V Common Mode Voltage Transient Response

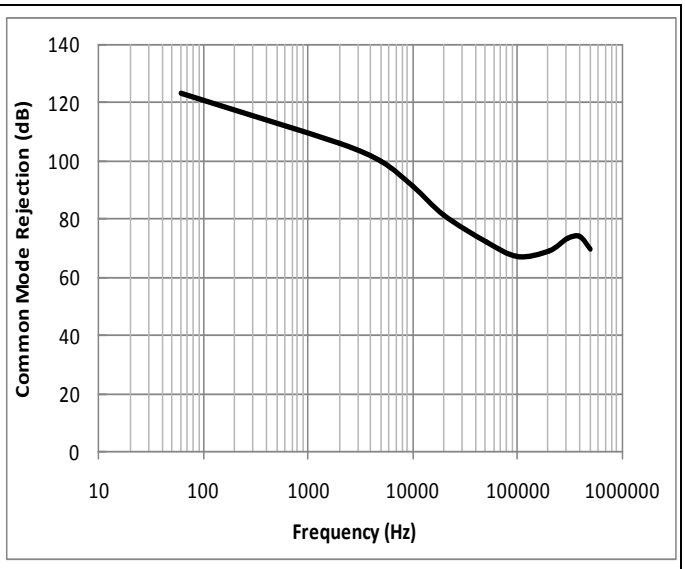


Figure 20: Common Mode Rejection vs. Frequency

NOTES:

1. The 3000Vrms 60Hz is applied between shorted high voltage pins ("+" and "-") and shorted low voltage pins (1, 2, 3, and 4) for a duration of 60 seconds at room temperature. Passing criteria is less than 70 µA. Each device is 100% tested by this test.

2. Isolated output voltage (pin 4 - pin 3) is plotted as a function of high voltage input (pin "+"- pin "-"). Gain is defined as the ratio of output voltage (pin 4 – pin 3) and input voltage (pin "+" - pin "-").

3. Overall accuracy is defined as voltage error between measured output voltage and actual input voltage divided by 10, expressed as a percentage of the full-scale differential output voltage.

4. Gain vs. temperature is defined as gain deviation from the gain at 25°C, expressed as a percentage per degree C over the operating temperature range of -40°C to 85°C.

5. Nonlinearity is defined as gain deviation from the best-fit gain line, expressed as a percentage of the full-scale differential output voltage.

6. See figure 23 for common mode rejection frequency response test setup.

7. See figure 24 for common mode rejection transient immunity test setup.

8. This is continuous voltage operation range. Maximum DC voltage operation is ± 50V. Maximum AC voltage operation is 35.4 Vrms. The amplitude of the AC voltage is 1.414*35.4=50V for 35.4 Vrms.

9. The output voltage offset drift is defined as voltage deviation from the offset measured at 25 °C with zero input voltage, expressed as per degree C over the operating temperature range of -40°C to 85°C.

10. This is the output voltage response for a sinusoidal input voltage with fixed amplitude of 50V and frequency from 60Hz to 28 KHz.

11. The propagation delay in terms of phase shift for sinusoidal voltage response is plotted in figure 16. The delay adds additional phase shift to the bandwidth of filtering network.

12. Calculation of MTBF (Mean Time Between Failure) is based on Mil-HDBK-217F Notice 2.

TEST SETUP:

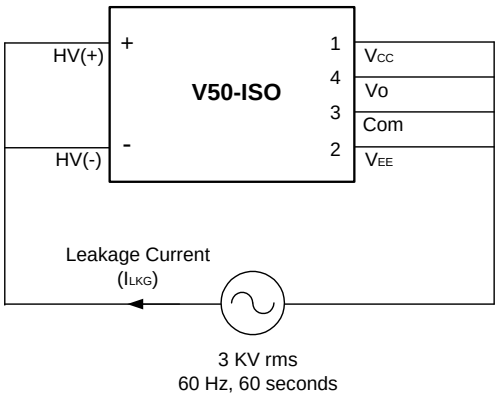


Fig 21 Isolation (Hi-pot) Test Setup

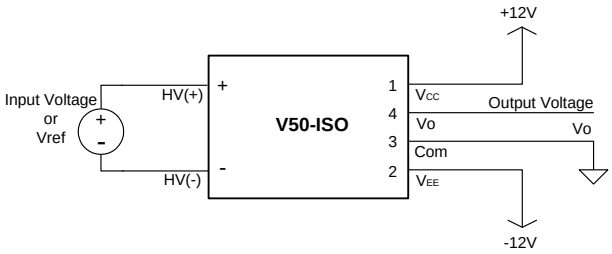


Fig 22 Input Output Voltage Test Setup

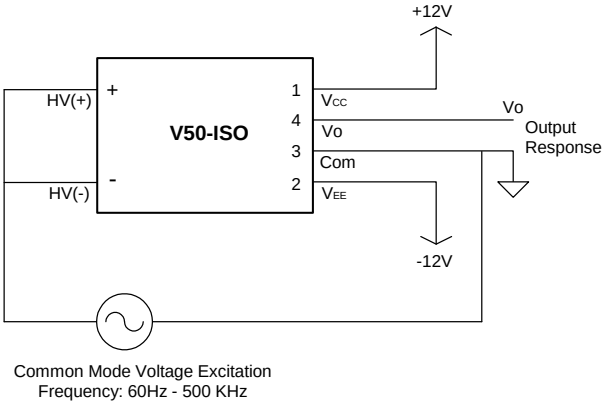


Fig 23 Common Mode Rejection Frequency Response Test Setup

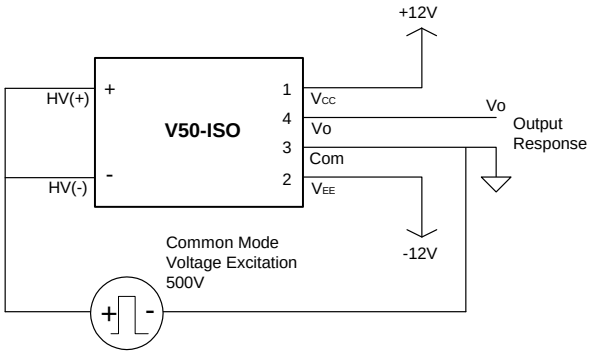
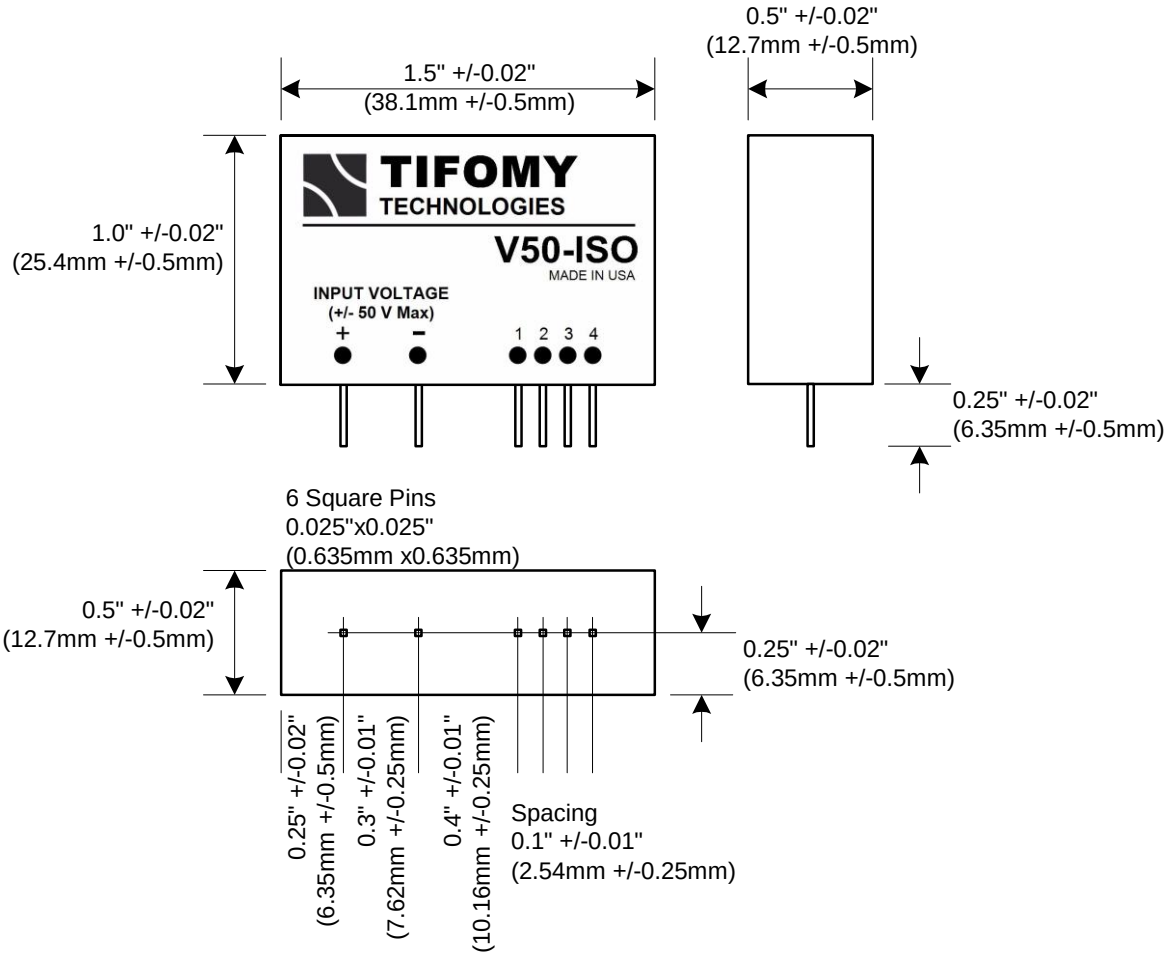


Fig 24 Common Mode Rejection Transient Immunity Test Setup

PACKAGE OUTLINE:



PACKAGE WEIGHT:

0.741 oz (21 g)

WARNING

 Danger! Electrical Shock Risk	The exposed pins of the voltage transducer can carry hazardous voltage. The device must be used in a protective housing and the conducting parts must be inaccessible after installation. Ignoring this warning can lead to injury and/or serious damage.

IMPORTANT NOTICE

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