BURR-BROWN®

INA146

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High-Voltage, Programmable Gain DIFFERENCE AMPLIFIER

FEATURES

- HIGH COMMON-MODE VOLTAGE:
  +40V at V_S = +5V
  ±100V at V_S = ±15V
- DIFFERENTIAL GAIN = 0.1V/V TO 100V/V:
  Set with External Resistors
- LOW QUIESCENT CURRENT: 570µA
- WIDE SUPPLY RANGE:
  Single Supply: 4.5V to 36V
  Dual Supplies: ±2.25V to ±18V
- LOW GAIN ERROR: 0.025%
- HIGH CMR: 80dB
- SO-8 PACKAGE

APPLICATIONS

- CURRENT SHUNT MEASUREMENTS
- SENSOR AMPLIFIER
- SYNCHRONOUS DEMODULATOR
- CURRENT AND DIFFERENTIAL LINE RECEIVER
- VOLTAGE-CONTROLLED CURRENT SOURCE
- BATTERY POWERED SYSTEMS
- LOW COST AUTOMOTIVE INSTRUMENTATION

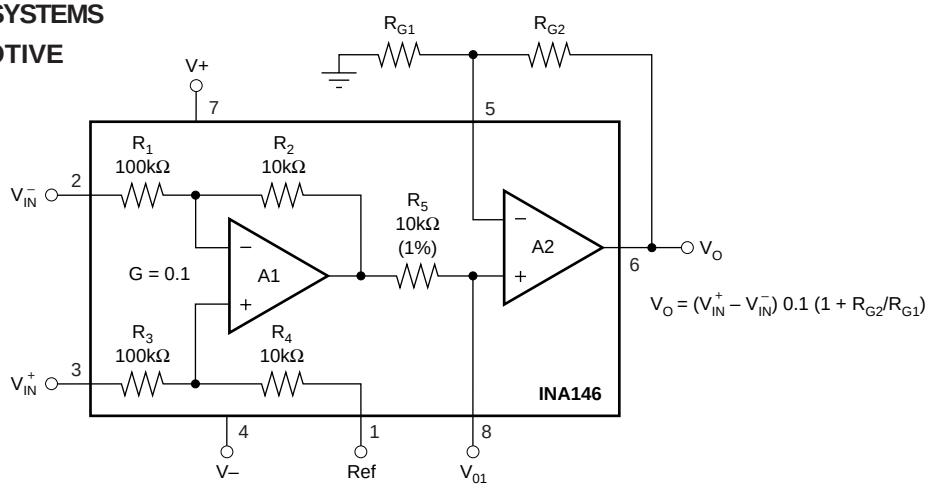
DESCRIPTION

The INA146 is a precision difference amplifier that can be used to accurately attenuate high differential voltages and reject high common-mode voltages for compatibility with common signal processing voltage levels. High-voltage capability also affords inherent input protection. The input common-mode range extends beyond both supply rails, making the INA146 well-suited for both single and dual supply applications.

On-chip precision resistors are laser-trimmed to achieve accurate gain and high common-mode rejection. Excellent TCR tracking of these resistors assures continued high precision over temperature.

A 10:1 difference amplifier provides 0.1V/V gain when the output amplifier is used as a unity-gain buffer. In this configuration, input voltages up to ±100V can be measured. Gains greater than 0.1V/V can be set with an external resistor pair without affecting the common-mode input range.

The INA146 is available in the SO-8 surface-mount package specified for the extended industrial temperature range, –40°C to +85°C.



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SBOS109

SPECIFICATIONS: V_S = ±2.25V to ±18V Dual Supplies

At T_A = +25°C, G = 0.1, R_L = 10kΩ connected to ground and ref pin connected to ground unless otherwise noted.
Boldface limits apply over the specified temperature range, **T_A = –40°C to +85°C.**

PARAMETER		CONDITION	INA146UA MIN	INA146UA TYP	INA146UA MAX	UNITS
OFFSET VOLTAGE, V_O		RTI[1, 2]				
Input Offset Voltage	V_{OS}	V_S = ±15, V_{CM} = V_O = 0V		±1	±5	mV
vs Temperature	**$\Delta V_{OS}/\Delta T$**			**See Typical Curve**		
vs Power Supply	PSRR	V_S = ±1.35V to ±18V		±100	±600	µV/V
vs Time				±3		µV/mo
Offset Voltage, V_{01}		RTI[1, 2]		±1		mV
INPUT VOLTAGE RANGE						
Common-Mode Voltage Range	V_{CM}	(V_{IN}+) – (V_{IN}–) = 0V, V_O = 0V			±100[3]	V
Common-Mode Rejection	CMRR	V_{CM} = 11 (V–) to 11 (V+) = 11, R_S = 0Ω	70	80		dB
Over Temperature			**64**	**74**		dB
INPUT BIAS CURRENT[2]		V_{CM} = V_S/2				
Bias Current	I_B			±50		nA
Offset Current	I_{OS}			±5		nA
INPUT IMPEDANCE						
Differential (non-inverting input)				110		kΩ
Differential (inverting input)				91.7		kΩ
Common-Mode				55		kΩ
NOISE		RTI[1, 4]				
Voltage Noise, f = 0.1Hz to 10Hz				10		µVp-p
Voltage Noise Density, f = 1kHz	e_n			550		nV/√Hz
GAIN				G = 0.1 to 100		
Gain Equation				G = 0.1 • (1 + R_{G2}/R_{G1})		V/V
Initial[1]				0.1		V/V
Gain Error		R_L = 100kΩ, V_O = (V–)+0.15 to (V+)–1, G = 1		±0.025	±0.1	%
vs Temperature		**R_L = 100kΩ, V_O = (V–)+0.25 to (V+)–1, G = 1**		**±1**	**±10**	ppm/°C
		R_L = 10kΩ, V_O = (V–)+0.3 to (V+)–1.25, G = 1		±0.025	±0.1	%
vs Temperature		**R_L = 10kΩ, V_O = (V–)+0.5 to (V+)–1.25, G = 1**		**±1**	**±10**	ppm/°C
Nonlinearity		V_O = (V–)+0.3 to (V+)–1.25, G = 1		±0.001	±0.01	% of FS
FREQUENCY RESPONSE						
Small Signal Bandwidth		G = 0.1		550		kHz
		G = 1		50		kHz
Slew Rate				0.45		V/µs
Settling Time, 0.1%		G = 1, 10V Step		40		µs
0.01%		G = 1, 10V Step		80		µs
Overload Recovery		50% Input Overload		40		µs
OUTPUT, V_O						
Voltage Output		R_L = 100kΩ, G = 1	(V–) + 0.15		(V+) – 1	V
Over Temperature		**R_L = 100kΩ, G = 1**	**(V–) + 0.25**		**(V+) – 1**	V
		R_L = 10kΩ, G = 1	(V–) + 0.3		(V+) – 1.25	V
Over Temperature		**R_L = 10kΩ, G = 1**	**(V–) + 0.5**		**(V+) – 1.25**	V
Short-Circuit Current		Continuous to Common		±15		mA
Capacitive Load		Stable Operation		1000		pF
POWER SUPPLY						
Specified Voltage Range, Dual Supplies			±2.25		±18	V
Operating Voltage Range			±1.35		±18	V
Quiescent Current		V_{IN} = 0, I_O = 0		±570	±700	µA
Over Temperature					**±750**	µA
TEMPERATURE RANGE						
Specified Range			–40		+85	°C
Operating Range			–55		+125	°C
Storage Range			–55		+125	°C
Thermal Resistance	θ_{JA}			150		°C/W

NOTES: (1) Overall difference amplifier configuration. Referred to input pins (V_{IN}+ and V_{IN}–), gain = 0.1V/V. Specified with 10kΩ in feedback of A2. (2) Input offset voltage specification includes effects of amplifier's input bias and offset currents. (3) Common-mode voltage range is 11 (V–) to 11 [(V+) – 1] with a maximum of ±100V. (4) Includes effects of input current noise and thermal noise contribution of resistor network.

SPECIFICATIONS: V_S = +5V Single Supply

At T_A = +25°C, G = 1, R_L = 10kΩ connected to V_S/2 and Ref pin connected to V_S/2 unless otherwise noted.
Boldface limits apply over the specified temperature range, **T_A = –40°C to +85°C.**

PARAMETER	CONDITION	INA146UA MIN	INA146UA TYP	INA146UA MAX	UNITS
OFFSET VOLTAGE, V_O	RTI[1, 2]				
Input Offset Voltage V_{OS}	V_{CM} = V_O = 0V		±3	±10	mV
vs Temperature $\Delta V_{OS}/\Delta T$			**See Typical Curve**		
vs Power Supply Rejection Ratio PSRR	V_S = ±1.35V to ±18V		±100	±600	µV/°C
vs Time			±3		µV/mo
INPUT VOLTAGE RANGE					
Common-Mode Voltage Range V_{CM}	V_{IN}+ – V_{IN}– = 0V, V_O = 0V	–25		19	V
Common-Mode Rejection Ratio CMRR	V_{CM} = –25V to +19V, R_S = 0Ω	70	80		dB
Over Temperature		**64**	**74**		dB
INPUT BIAS CURRENT[2]					
Bias Current I_B			±50		nA
Offset Current I_{OS}			±5		nA
INPUT IMPEDANCE					
Differential (non-inverting input)			110		kΩ
Differential (inverting input)			91.7		kΩ
Common-Mode			55		kΩ
NOISE	RTI[1, 3, 4]				
Voltage Noise, f = 0.1Hz to 10Hz			10		µVp-p
Voltage Noise Density, f = 1kHz e_n			550		nV/√Hz
GAIN			G = 0.1 to 100		V/V
Gain Equation			G = 0.1 • (1 + R_{G2}/R_{G1})		V/V
Initial[1]			0.1		V/V
Gain Error	R_L = 100kΩ, V_O = 0.15V to 4V, G = 1		±0.025	±0.1	%
vs Temperature	**R_L = 100kΩ, V_O = 0.25V to 4V, G = 1**		**±1**	**±10**	ppm/°C
	R_L = 10kΩ, V_O = 0.3V to 3.75V, G = 1		±0.025	±0.1	%
vs Temperature	**R_L = 10kΩ, V_O = 0.5V to 3.75V, G = 1**		**±1**	**±10**	ppm/°C
Nonlinearity	V_O = +0.3 to +3.75, G = 1		±0.001	±0.01	% of FS
FREQUENCY RESPONSE					
Small Signal Bandwidth	G = 0.1		550		kHz
	G = 1		50		kHz
Slew Rate			0.45		V/µs
Settling Time, 0.1%	G = 1, 10V Step		40		µs
0.01%	G = 1, 10V Step		80		µs
Overload Recovery	50% Input Overload		40		µs
OUTPUT, V_O					
Voltage Output	R_L = 100kΩ, G = 1	0.15		4	V
Over Temperature	**R_L = 100kΩ, G = 1**	**0.25**		**4**	V
	R_L = 10kΩ, G = 1	0.3		3.75	V
Over Temperature	**R_L = 10kΩ, G = 1**	**0.5**		**3.75**	V
Short-Circuit Current	Continuous to Common		±15		mA
Capacitive Load	Stable Operation		1000		pF
POWER SUPPLY					
Voltage Range, Dual Supplies		±2.25		±18	V
Voltage Range, Single Supply		±4.5		±36	V
Quiescent Current	V_{IN} = 0, I_O = 0		±570	±700	µA
Over Temperature				**±750**	µA
TEMPERATURE RANGE					
Specified Range		–40		+85	°C
Operating Range		–55		+125	°C
Storage Range		–55		+125	°C
Thermal Resistance θ_{JA}			150		°C/W

NOTES: (1) Overall difference amplifier configuration. Referred to input pins (V_{IN}+ and V_{IN}–), gain = 0.1V/V. Specified with 10kΩ in feedback of A2. (2) Input offset voltage specification includes effects of amplifier's input bias and offset currents. (3) Includes effects of input current noise and thermal noise contribution of resistor network. (4) Common-mode voltage range is 11 (V–) to 11 [(V+) – 1] with a maximum of ±100V.

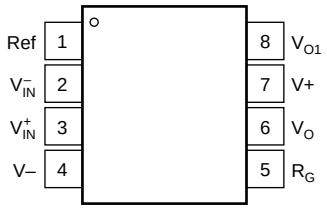
AMPLIFIER A1, A2 PERFORMANCE

At T_A = +25°C, G = 0.1, R_L = 10kΩ connected to ground and Ref pin, unless otherwise noted.
Boldface limits apply over the specified temperature range, **T_A = –40°C to +85°C.**

PARAMETER		CONDITION	INA146UA MIN	INA146UA TYP	INA146UA MAX	UNITS
OFFSET VOLTAGE, V_O		RTI(1, 2)				
Input Offset Voltage	V_{OS}	V_S = ±15V, V_{CM} = V_O = 0V		±0.5		mV
vs Temperature	**$\Delta V_{OS}/\Delta T$**	**T_A = –40°C to +85°C**		**±1**		µV/°C
INPUT VOLTAGE RANGE						
Common-Mode Voltage Range	V_{CM}	V_{IN}+ – V_{IN}– = 0V, V_O = 0V		(V–) to (V+) –1		V
Common-Mode Rejection Ratio	CMRR	V_{CM} = (V–) to (V+) –1		90		dB
OPEN-LOOP GAIN						
Open Loop Gain	A_{OL}			110		dB
INPUT BIAS CURRENT(2)						
Bias Current	I_B			±50		nA
Offset Current	I_{OS}			±5		nA
RESISTOR AT A1 OUTPUT, V_{O1}						
Initial				10		kΩ
Error				±1		%
Temperature Drift Coefficient				±100		ppm/°C

PIN CONFIGURATION

Top View **SO-8**



ABSOLUTE MAXIMUM RATINGS(1)

Supply Voltage, V+ to V–	36V
Signal Input Terminals, Voltage	±100V
Current	±1mA
Output Short Circuit (to ground)	Continuous
Operating Temperature	–55°C to +125°C
Storage Temperature	–55°C to +150°C
Junction Temperature	+150°C
Lead Temperature (soldering, 10s)	+240°C

NOTE: (1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability.

ELECTROSTATIC DISCHARGE SENSITIVITY

This integrated circuit can be damaged by ESD. Burr-Brown recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PACKAGE/ORDERING INFORMATION

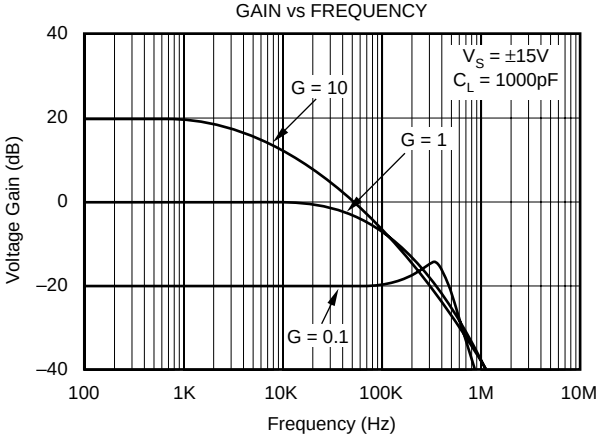
PRODUCT	PACKAGE	PACKAGE DRAWING NUMBER(1)	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	ORDERING NUMBER(2)	TRANSPORT MEDIA
INA146UA	SO-8	182	–40°C to +85°C	INA146UA	INA146UA	Rails
"	"	"	"	"	INA146UA/2K5	Tape and Reel

NOTES: (1) For detailed drawing and dimension table, please see end of data sheet, or Appendix C of Burr-Brown IC Data Book, or visit the Burr-Brown web site at www.burr-brown.com. (2) Models with a slash (/) are available only in Tape and Reel in the quantities indicated (e.g., /2K5 indicates 2500 devices per reel). Ordering 2500 pieces of "INA146UA/2K5" will get a single 2500-piece Tape and Reel. For detailed Tape and Reel mechanical information, refer to Appendix B of Burr-Brown IC Data Book.

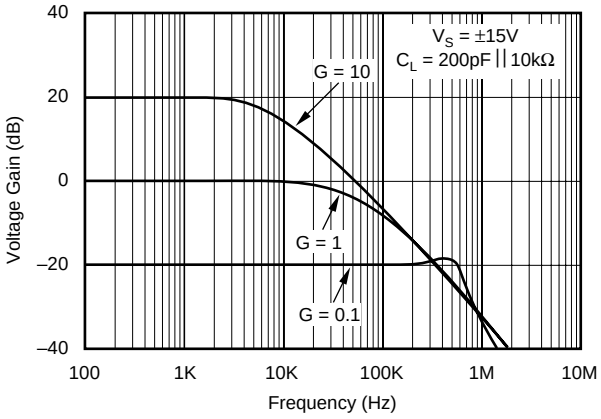
TYPICAL PERFORMANCE CURVES

At T_A = +25°C, V_S = ±15V, G = 0.1, R_L = 10kΩ connected to ground and Ref pin connected to ground, unless otherwise noted.

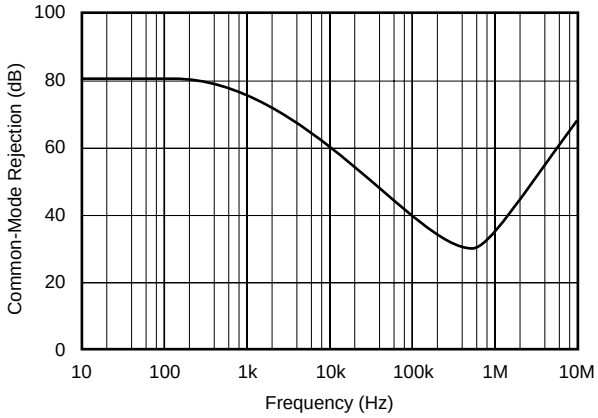
GAIN vs FREQUENCY



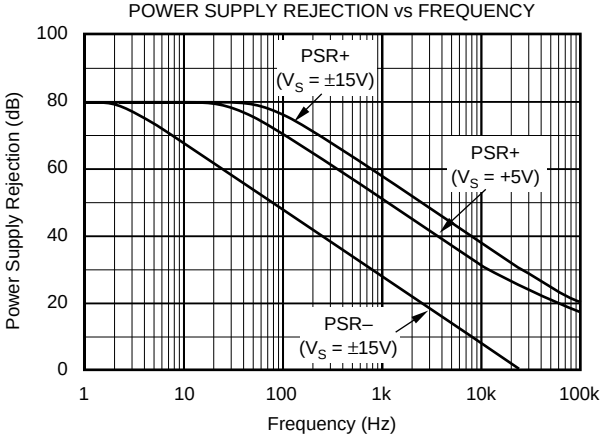
GAIN vs FREQUENCY



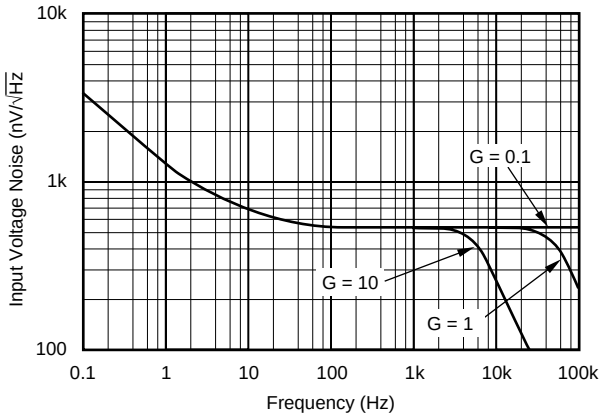
COMMON-MODE REJECTION vs FREQUENCY



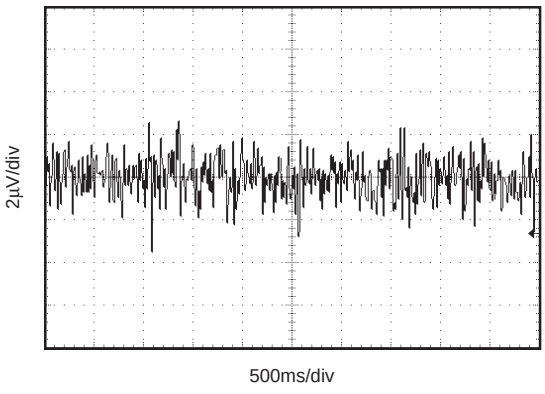
POWER SUPPLY REJECTION vs FREQUENCY



INPUT VOLTAGE NOISE DENSITY



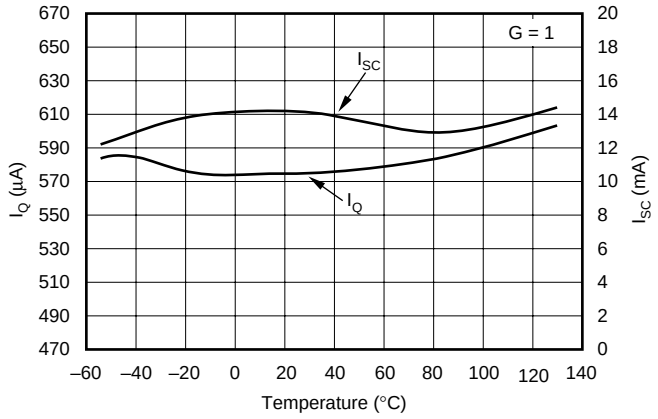
0.1Hz to 10Hz VOLTAGE NOISE (RTI)



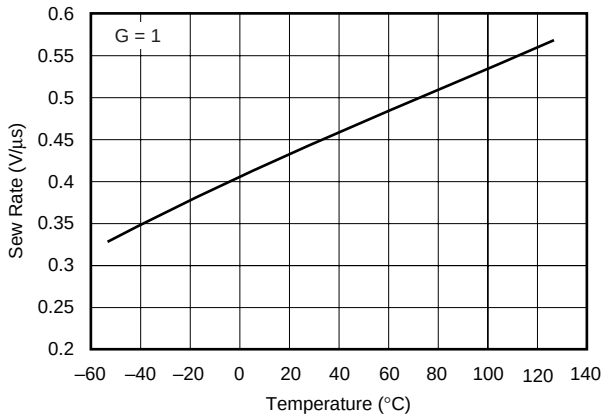
TYPICAL PERFORMANCE CURVES (Cont.)

At T_A = +25°C, V_S = ±15V, G = 0.1, R_L = 10kΩ connected to ground and Ref pin connected to ground, unless otherwise noted.

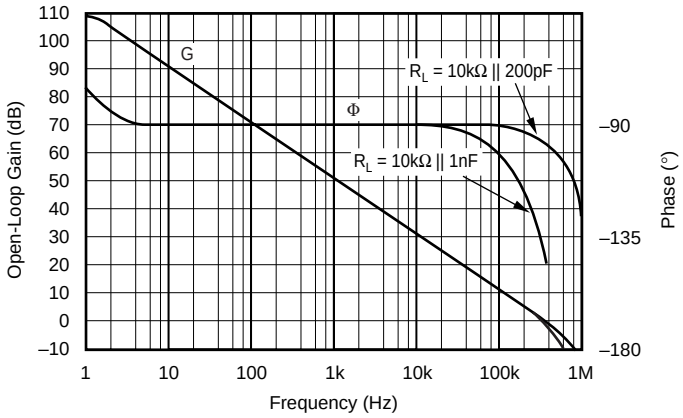
QUIESCENT CURRENT AND
SHORT-CIRCUIT CURRENT vs TEMPERATURE



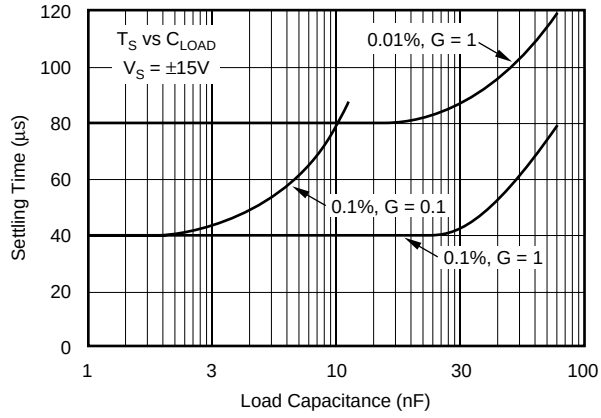
SLEW RATE vs TEMPERATURE



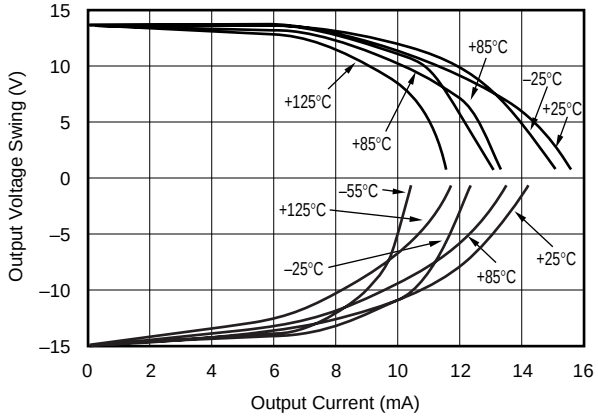
GAIN AND PHASE vs FREQUENCY
Op Amp A1 and A2



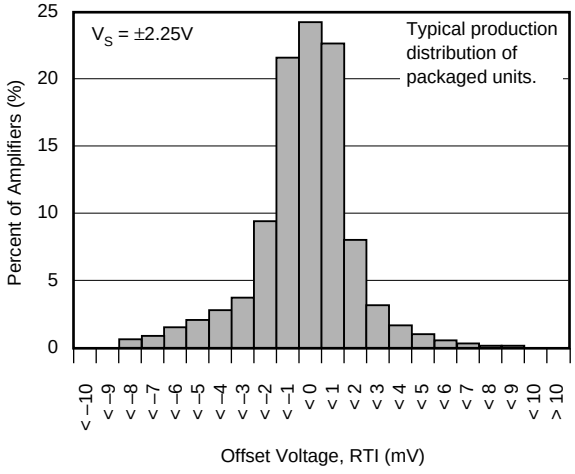
SETTLING TIME vs LOAD CAPACITANCE



MAXIMUM OUTPUT VOLTAGE SWING
vs OUTPUT CURRENT



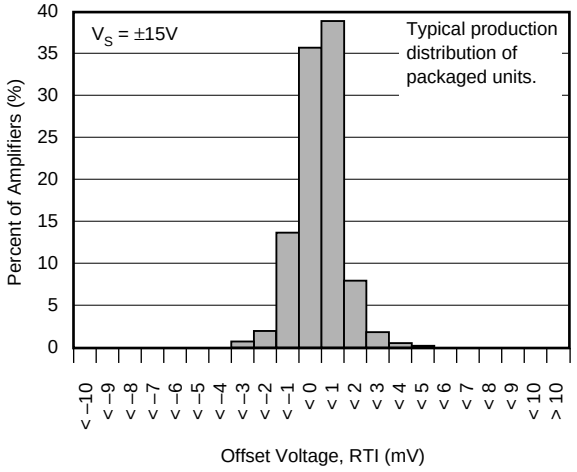
OFFSET VOLTAGE
PRODUCTION DISTRIBUTION



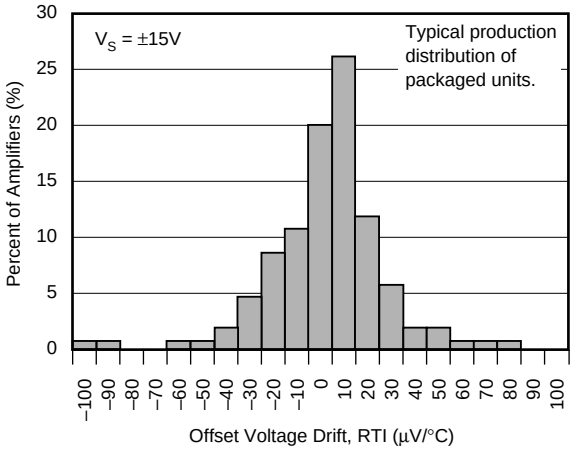
TYPICAL PERFORMANCE CURVES (Cont.)

At T_A = +25°C, V_S = ±15V, G = 0.1, R_L = 10kΩ connected to ground and Ref pin connected to ground, unless otherwise noted.

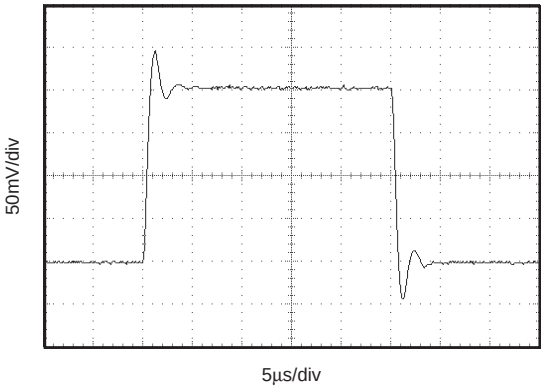
OFFSET VOLTAGE
PRODUCTION DISTRIBUTION



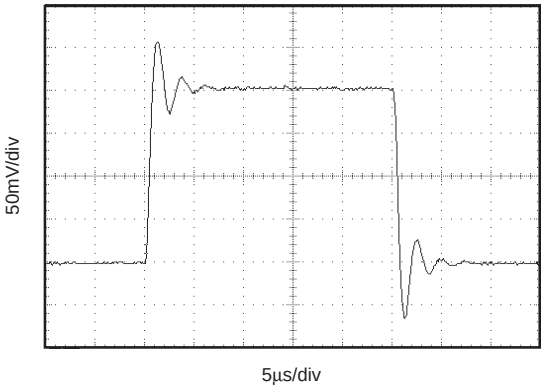
OFFSET VOLTAGE DRIFT
PRODUCTION DISTRIBUTION



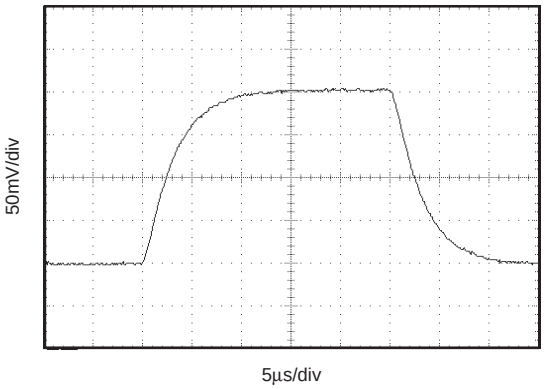
SMALL-SIGNAL STEP RESPONSE
(G = 0.1, R_L = 10kΩ, C_L = 200pF)



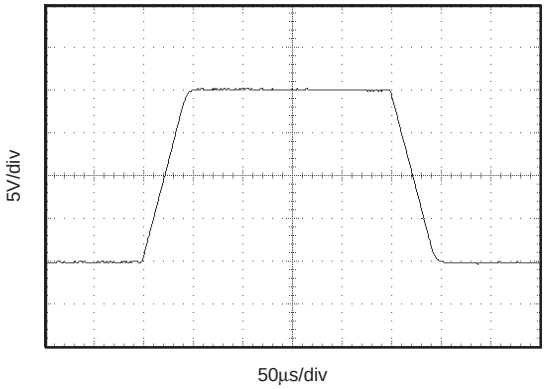
SMALL-SIGNAL STEP RESPONSE
(G = 0.1, C_L = 1000pF)



SMALL-SIGNAL STEP RESPONSE
(G = 1, C_L = 1000pF)



LARGE-SIGNAL STEP RESPONSE
(G = 1, R_L = 10kΩ, C_L = 200pF)



APPLICATION INFORMATION

The INA146 is a programmable gain difference amplifier consisting of a gain of 0.1 difference amplifier and a programmable-gain output buffer stage. Basic circuit connections are shown in Figure 1. Power supply bypass capacitors should be connected close to pins 4 and 7 as shown. The amplifier is programmable in the range of G = 0.1 to G = 50 with two external resistors.

The output of A1 is connected to the noninverting input of A2 through a 10kΩ resistor which is trimmed to ±1% absolute accuracy. The A2 input is available for applications such as a filter or a precision current source. See application figures for examples.

OPERATING VOLTAGE

The INA146 is fully specified for supply voltages from ±2.25V to ±18V with key parameters guaranteed over the temperature range –40°C to +85°C. The INA146 can be operated with single or dual supplies with excellent performance. Parameters that vary significantly with operating voltage, load conditions or temperature are shown in the typical performance curves.

SETTING THE GAIN

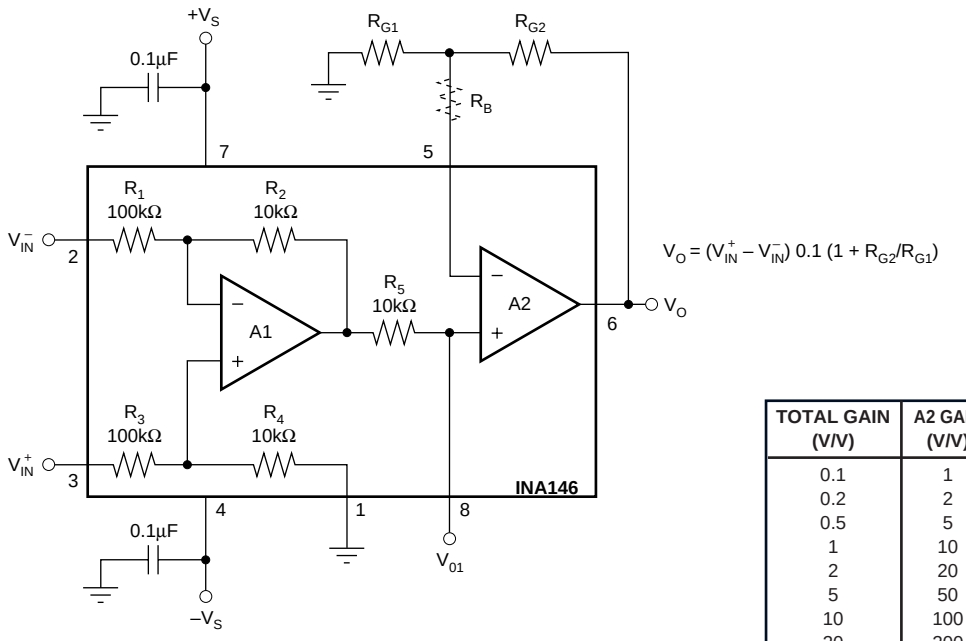
The gain of the INA146 is set by using two external resistors, R_{G1} and R_{G2}, according to the equation:

$$G = 0.1 \bullet (1 + R_{G2}/R_{G1})$$

For a total gain of 0.1, A2 is connected as a buffer amplifier with no R_{G1}. A feedback resistor, R_{G2} = 10kΩ, should be used in the buffer connection. This provides bias current cancellation (in combination with internal R_5) to assure specified offset voltage performance. Commonly used values are shown in the table of Figure 1. Resistor values for other gains should be chosen to provide a 10kΩ parallel resistance.

COMMON-MODE RANGE

The 10:1 input resistor ratio of the INA146 provides an input common-mode range that can extend well beyond the power supply rails. Exact range depends on the power supply voltage and the voltage applied to the Ref terminal (pin 1). To assure proper operation, the voltage at the non-inverting input of A1 (an internal node) must be within its linear operating range. Its voltage is determined by the simple 10:1 voltage divider between pin 3 and pin 1. This voltage must be between V– and (V+) – 1V.



		STANDARD 1% RESISTORS		
TOTAL GAIN (V/V)	A2 GAIN (V/V)	R_{G1} (Ω)	R_{G2} (Ω)	R_B (Ω)
0.1	1	(None)	10k	—
0.2	2	20k	20k	—
0.5	5	12.4k	49.9k	—
1	10	11.0k	100k	—
2	20	10.5k	200k	—
5	50	10.2k	499k	—
10	100	10.2k	1M	—
20	200	499	100k	9.53k
50	500	100	49.9k	10k
100	1000	100	100k	10k

FIGURE 1. Basic Circuit Connections.

OFFSET TRIM

The INA146 is laser-trimmed for low offset voltage and drift. Most applications require no external offset adjustment. Figure 2 shows an optional circuit for trimming the offset voltage. A voltage applied to the Ref terminal will be summed with the output signal. This can be used to null offset voltage. To maintain good common-mode rejection, the source impedance of a signal applied to the Ref terminal should be less than 10Ω and a resistor added to the positive input terminal should be 10 times that, or 100Ω. Alternatively, the trim voltage can be buffered with an op amp such as the OPA277.

INPUT IMPEDANCE

The input impedance of the INA146 is determined by the input resistor network and is approximately 100kΩ. The source impedance at the two input terminals must be nearly equal to maintain good common-mode rejection. A 12Ω mismatch in impedance between the two inputs will cause the typical common-mode rejection to be degraded to approximately 72dB. Figure 7 shows a common application measuring power supply current through a shunt resistor. The source impedance of the shunt resistor, R_S, is balanced by an equal compensation resistor, R_C.

Source impedances greater than 800Ω are not recommended, even if they are perfectly matched. Internal resistors are laser trimmed for accurate ratios, not to absolute values. Adding equal resistors greater than 800Ω can cause a mismatch in the total resistor ratios, degrading CMR.

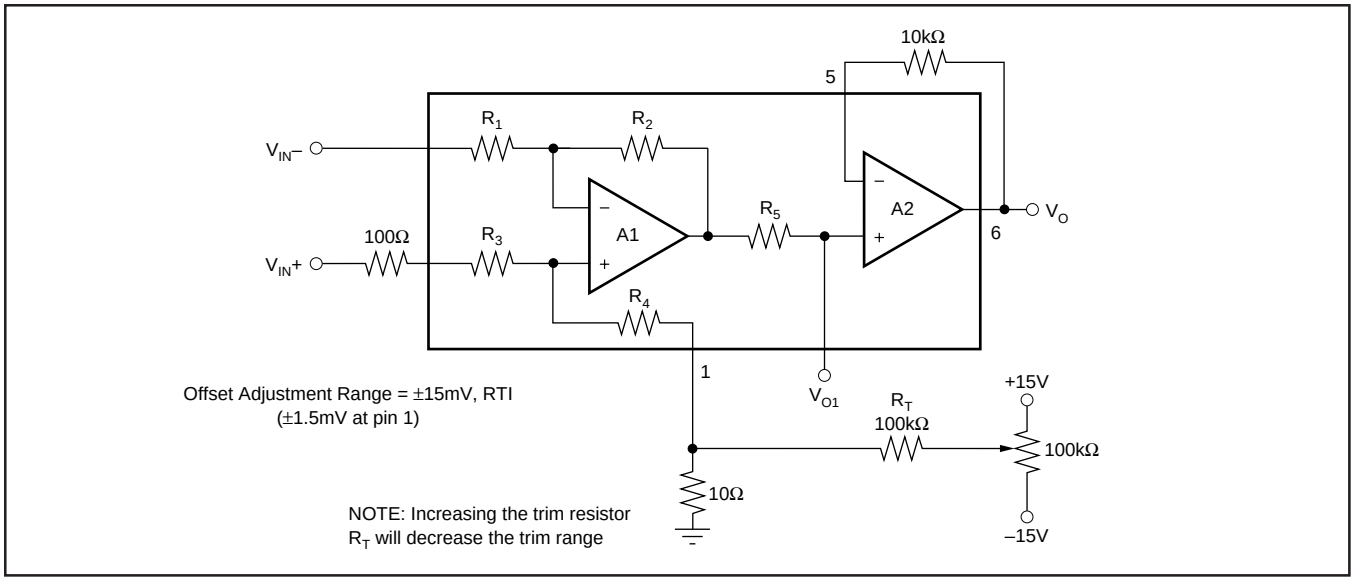


FIGURE 2. Optional Offset Trim Circuit.

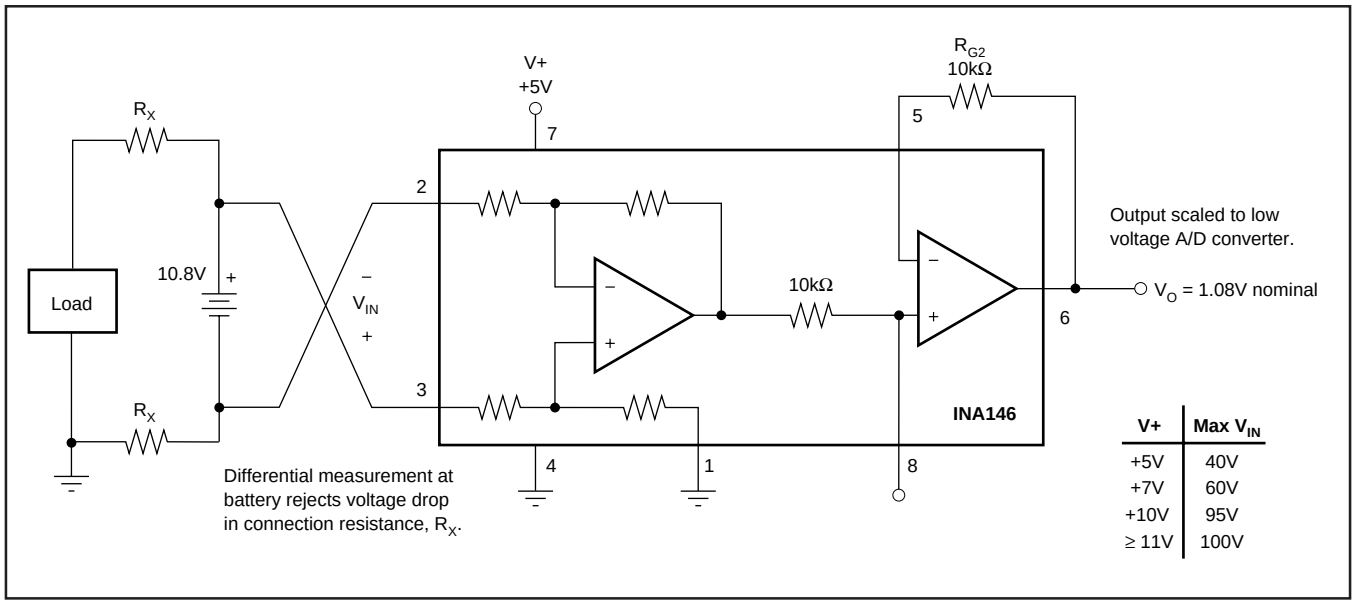


FIGURE 3. Measuring Voltages Greater than Supply Voltage.

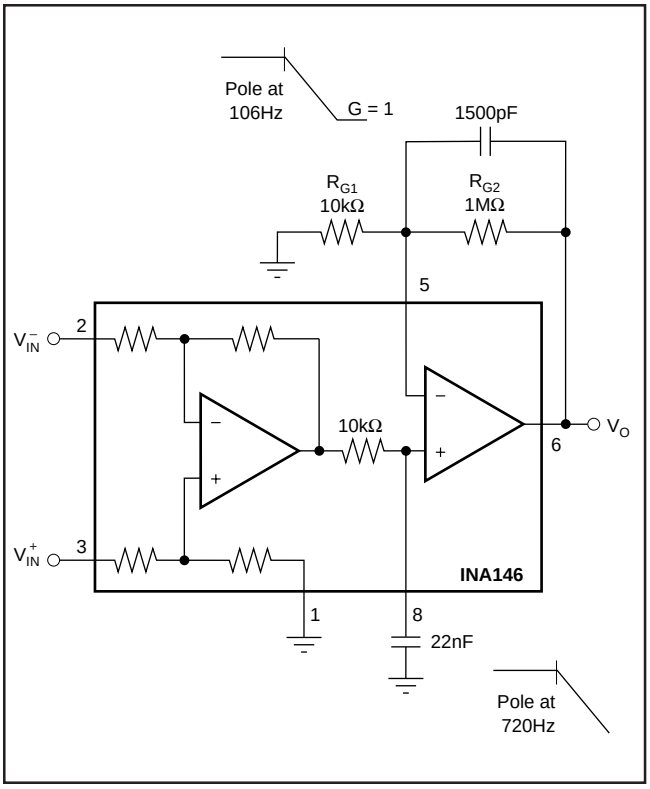


FIGURE 4. Noise Filtering.

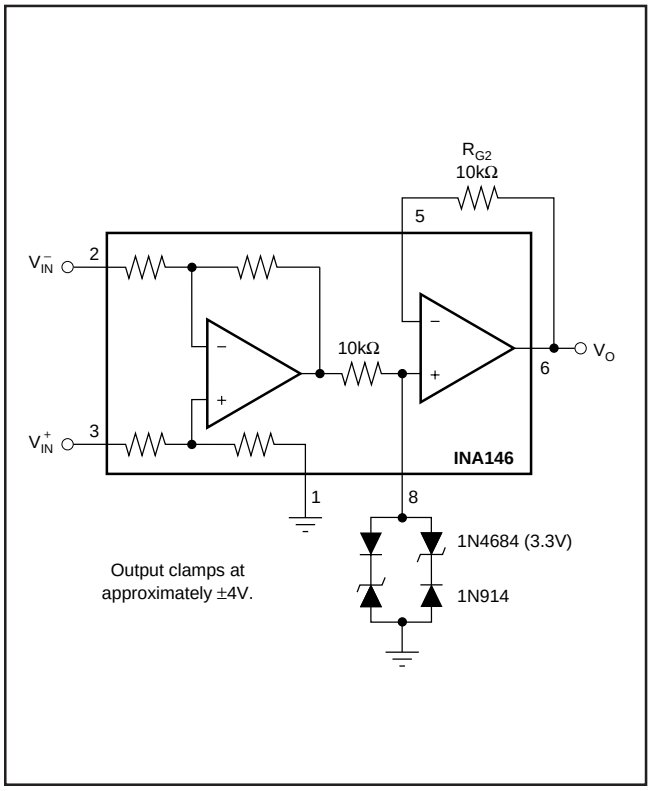


FIGURE 5. Output Clamp.

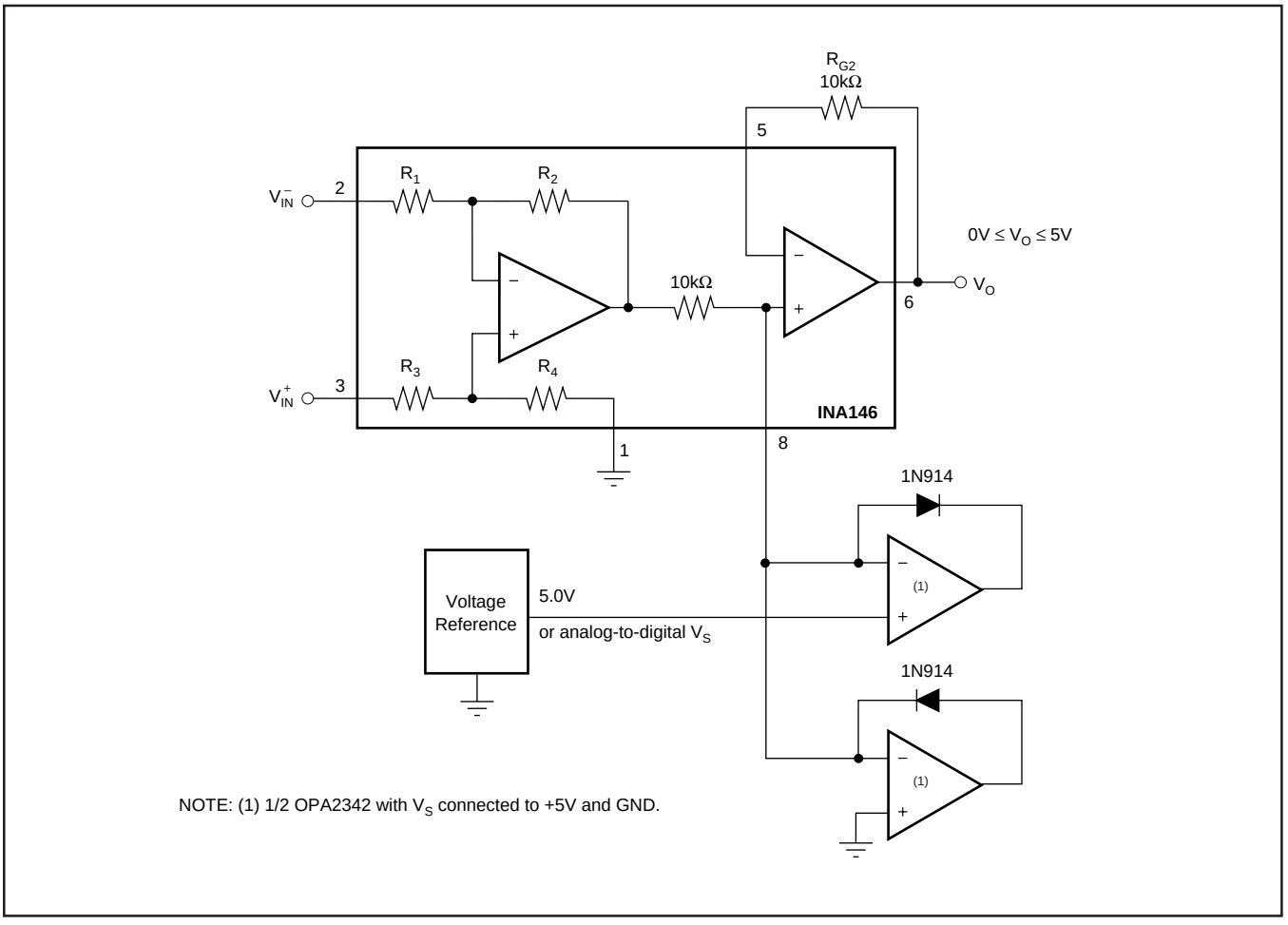


FIGURE 6. Precision Clamp.

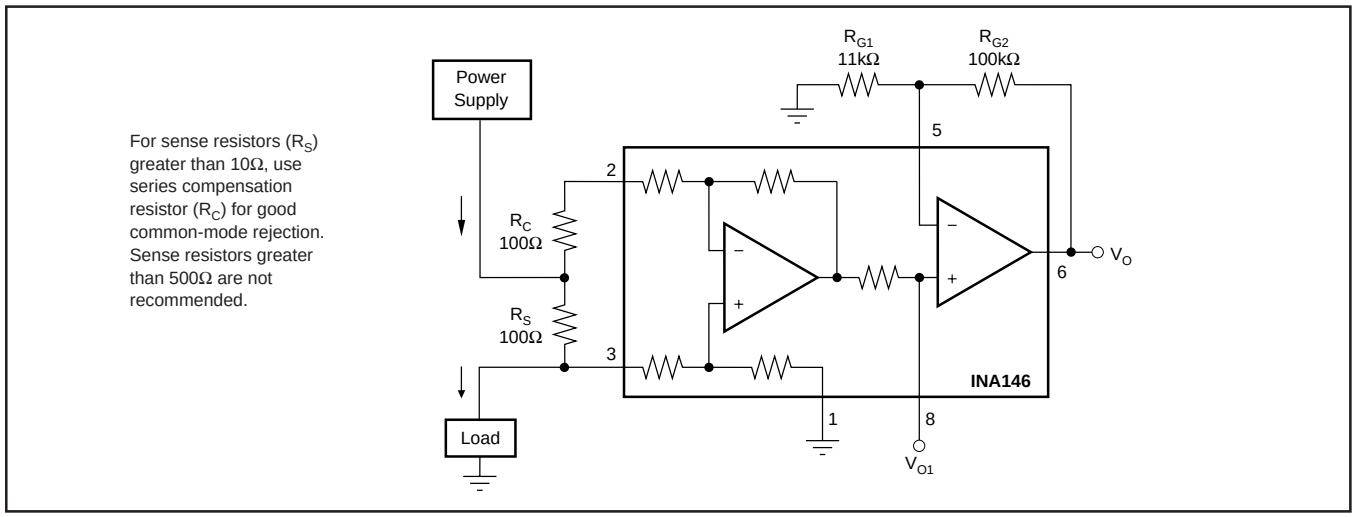


FIGURE 7. Current Monitor, G = 1.

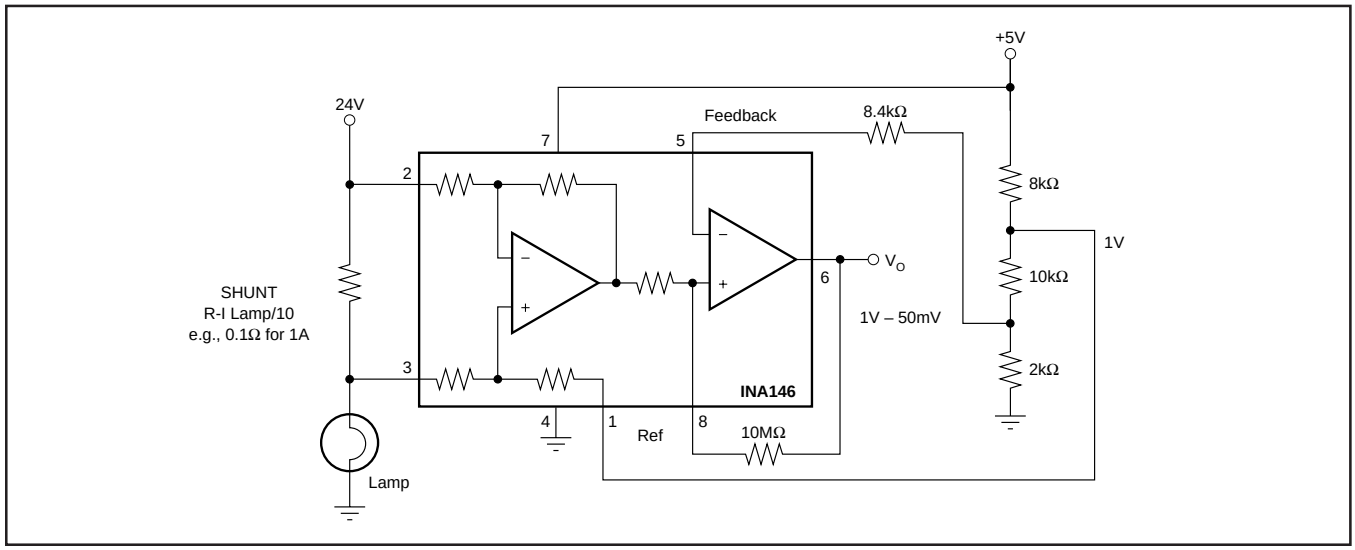


FIGURE 8. Comparator Output with Optional Hysteresis Application to Sense Lamp Burn-Out.

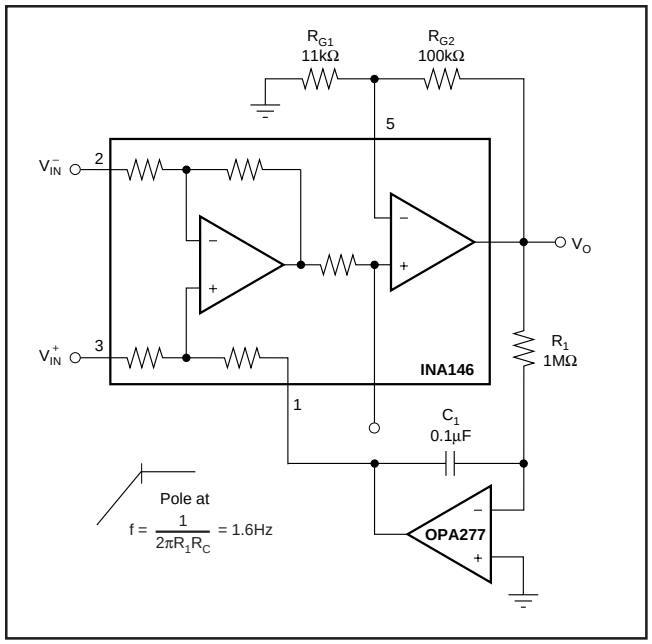


FIGURE 9. AC Coupling (DC Restoration).

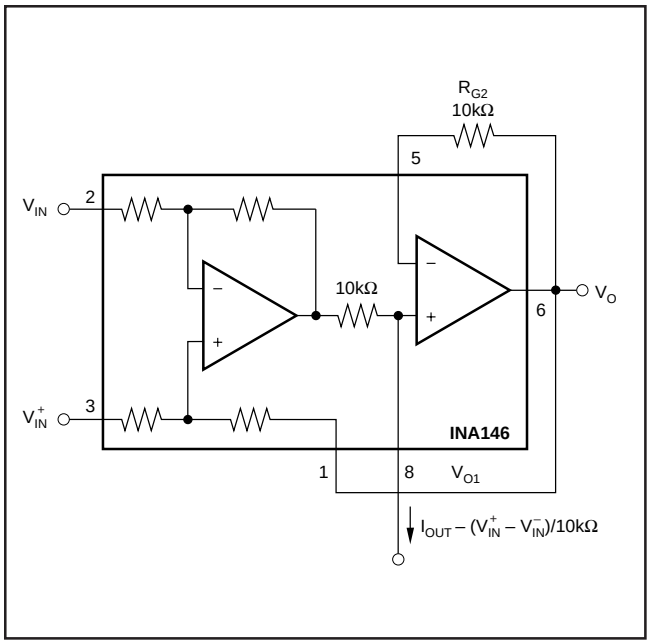


FIGURE 10. Precision Current Source.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
INA146UA	LIFEBUY	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 85	INA 146UA	
INA146UA/2K5	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 85	INA 146UA	Samples
INA146UAE4	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 85	INA 146UA	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

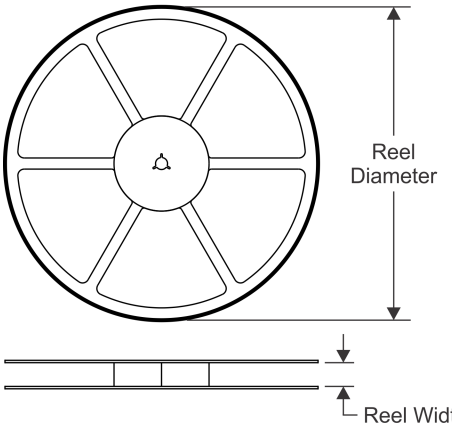
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

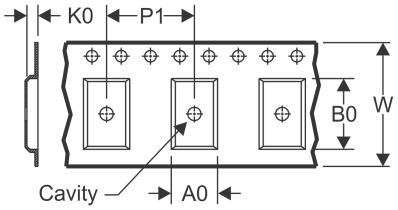
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

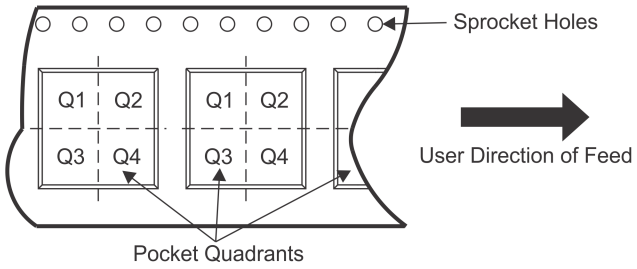


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

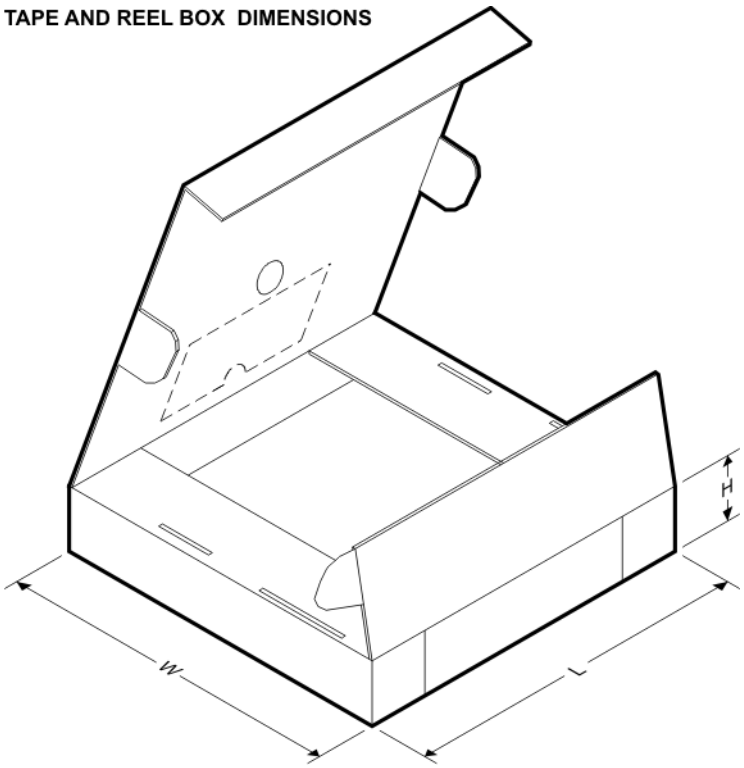
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
INA146UA/2K5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

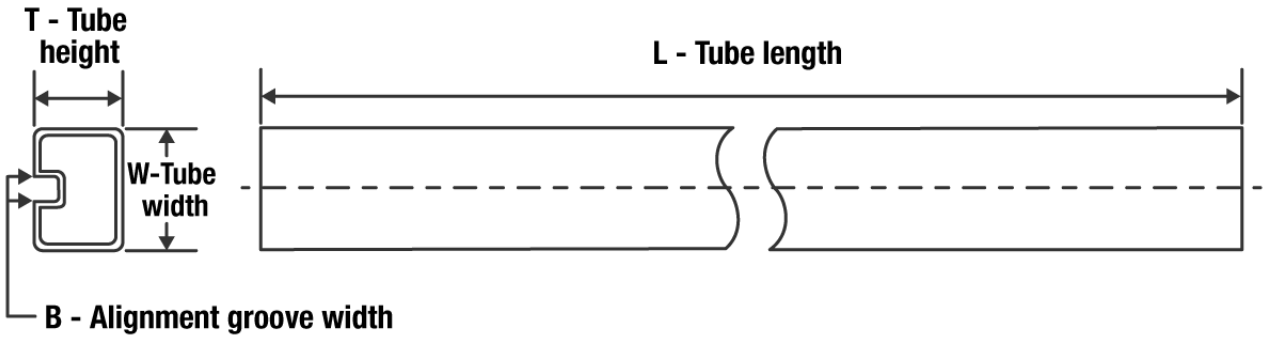
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
INA146UA/2K5	SOIC	D	8	2500	367.0	367.0	35.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
INA146UA	D	SOIC	8	75	506.6	8	3940	4.32
INA146UAE4	D	SOIC	8	75	506.6	8	3940	4.32

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