

AMP02

FEATURES

- Low Offset Voltage 100 μ V Max
- Low Drift 2 μ V/ $^{\circ}$ C Max
- Wide Gain Range 1 to 10,000
- High Common-Mode Rejection 115dB Min
- High Bandwidth (G = 1000) 200kHz Typ
- Gain Equation Accuracy 0.5% Max
- Single Resistor Gain Set
- Input Overvoltage Protection
- Low Cost
- Available in Die Form

APPLICATIONS

- Differential Amplifier
- Strain Gauge Amplifier
- Thermocouple Amplifier
- RTD Amplifier
- Programmable Gain Instrumentation Amplifier
- Medical Instrumentation
- Data Acquisition Systems

ORDERING INFORMATION †

$T_A = +25^{\circ}$ C		PLASTIC 8-PIN	OPERATING TEMPERATURE RANGE
V_{ios} MAX (μ V)	V_{Oos} MAX (mV)		
100	4	AMP02EP	XIND
200	8	AMP02FP	XIND

† Burn-in is available on commercial and industrial temperature range parts in CerDIP, plastic DIP, and TO-can packages.

GENERAL DESCRIPTION

The AMP-02 is the first precision instrumentation amplifier available in an 8-pin package. Gain of the AMP-02 is set by a single external resistor, and can range from 1 to 10,000. No gain set resistor is required for unity gain. The AMP-02 includes an input protection network that allows the inputs to be taken 60V beyond either supply rail without damaging the device.

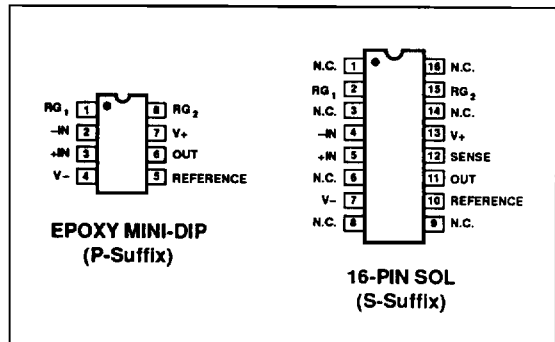
Laser trimming reduces the input offset voltage to under 100 μ V. Output offset voltage is below 4mV and gain accuracy is better than 0.5% for gain of 1000. PMI's proprietary thin-film resistor process keeps the gain temperature coefficient under 50 ppm/ $^{\circ}$ C.

Due to the AMP-02's design, its bandwidth remains very high over a wide range of gain. Slew rate is over 4V/ μ s making the AMP-02 ideal for fast data acquisition systems.

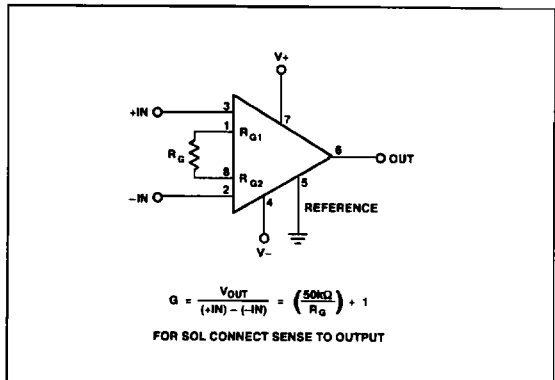
A reference pin is provided to allow the output to be referenced to an external DC level. This pin may be used for offset correction or level shifting as required. In the 8-pin package, sense is internally connected to the output.

For an instrumentation amplifier with the highest precision, consult the AMP-01 data sheet. For the highest input impedance and speed, consult the AMP-05 data sheet.

PIN CONNECTIONS



BASIC CIRCUIT CONNECTIONS



This is an abridged data sheet. To obtain the most recent version or complete data sheet, call our fax retrieval system at 1-800-446-6212.

AMP02

ABSOLUTE MAXIMUM RATINGS

Supply Voltage	±18V
Common-Mode Input Voltage	[(V-) - 60V] to [(V+) + 60V]
Differential Input Voltage	[(V-) - 60V] to [(V+) + 60V]
Output Short-Circuit Duration	Continuous
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 sec)	+300°C

PACKAGE TYPE	θ_{JA} (Note 2)	θ_{JC}	UNITS
8-Pin Plastic DIP (P)	96	37	°C/W
18-Pin SOL (S)	92	27	°C/W

NOTE:

1. Absolute maximum ratings apply to both DICE and packaged parts, unless otherwise noted.
2. θ_{JA} is specified for worst case mounting conditions, i.e., θ_{JA} is specified for device in socket for P-DIP package; θ_{JA} is specified for device soldered to printed circuit board for SOL package.

ELECTRICAL CHARACTERISTICS at $V_S = \pm 15V$, $V_{CM} = 0V$, $T_A = +25^\circ C$, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	AMP-02E			AMP-02F			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
OFFSET VOLTAGE									
Input Offset Voltage	V_{IOS}	$T_A = +25^\circ C$ $-40^\circ C \leq T_A \leq +85^\circ C$	-	20	100	-	40	200	μV
Input Offset Voltage Drift	TCV_{IOS}	$-40^\circ C \leq T_A \leq +85^\circ C$	-	0.5	2	-	1	4	$\mu V/^\circ C$
Output Offset Voltage	V_{OOS}	$T_A = +25^\circ C$ $-40^\circ C \leq T_A \leq +85^\circ C$	-	1	4	-	2	8	mV
Output Offset Voltage Drift	TCV_{OOS}	$-40^\circ C \leq T_A \leq +85^\circ C$	-	50	100	-	100	200	$\mu V/^\circ C$
Power Supply Rejection	PSR	$V_S = \pm 4.8V$ to $\pm 18V$ $G = 1000$	115	128	-	110	115	-	dB
		$G = 100$	115	125	-	110	115	-	
		$G = 10$	100	110	-	95	100	-	
		$G = 1$	80	90	-	75	80	-	
		$V_S = \pm 4.8V$ to $\pm 18V$ $-40^\circ C \leq T_A \leq +85^\circ C$ $G = 1000$	110	120	-	105	110	-	dB
		$G = 100$	110	120	-	105	110	-	
$G = 10$	95	110	-	90	95	-			
$G = 1$	75	90	-	70	75	-			
INPUT CURRENT									
Input Bias Current	I_B	$T_A = +25^\circ C$ $-40^\circ C \leq T_A \leq +85^\circ C$	-	2	10	-	4	20	nA
Input Bias Current Drift	TCI_B	$-40^\circ C \leq T_A \leq +85^\circ C$	-	150	-	-	250	-	$\mu A/^\circ C$
Input Offset Current	I_{OS}	$T_A = +25^\circ C$ $-40^\circ C \leq T_A \leq +85^\circ C$	-	1.2	5	-	2	10	nA
Input Offset Current Drift	TCI_{OS}	$-40^\circ C \leq T_A \leq +85^\circ C$	-	9	-	-	15	-	$\mu A/^\circ C$
INPUT									
Input Resistance	R_{IN}	Differential, $G \leq 1000$ Common-Mode, $G = 1000$	-	10	-	-	10	-	$G\Omega$
Input Voltage Range	IVR	$T_A = +25^\circ C$ (Note 3) $-40^\circ C \leq T_A \leq +85^\circ C$	± 11	-	-	± 11	-	-	V
Common-Mode Rejection	CMR	$V_{CM} = \pm 11V$ $G = 1000$	115	120	-	110	115	-	dB
		$G = 100$	115	120	-	110	115	-	
		$G = 10$	100	115	-	95	110	-	
		$G = 1$	80	95	-	75	90	-	
		$V_{CM} = \pm 11V$ $-40^\circ C \leq T_A \leq +85^\circ C$ $G = 1000$	110	120	-	105	115	-	dB
		$G = 100$	110	120	-	105	115	-	
$G = 10$	95	110	-	90	105	-			
$G = 1$	75	90	-	70	85	-			

ELECTRICAL CHARACTERISTICS at $V_S = \pm 15V$, $V_{CM} = 0V$, $T_A = +25^\circ C$, unless otherwise noted. *Continued*

PARAMETER	SYMBOL	CONDITIONS	AMP-02E			AMP-02F			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
GAIN									
Gain Equation Accuracy	$G = \frac{50k\Omega}{R_G} + 1$	$G = 1000$	-	-	0.50	-	-	0.70	%
		$G = 100$	-	-	0.30	-	-	0.50	
		$G = 10$	-	-	0.25	-	-	0.40	
		$G = 1$	-	-	0.02	-	-	0.05	
Gain Range	G		1	-	10k	1	-	10k	V/V
Nonlinearity		$G = 1$ to 1000	-	0.006	-	-	0.006	-	%
Temperature Coefficient	G_{TC}	$1 \leq G \leq 1000$ (Notes 1, 2)	-	20	50	-	20	50	ppm/°C
OUTPUT RATING									
Output Voltage Swing	V_{OUT}	$T_A = +25^\circ C$, $R_L = 1k\Omega$	± 12	± 13	-	± 12	± 13	-	V
		$R_L = 1k\Omega$, $-40^\circ C \leq T_A \leq +85^\circ C$	± 11	± 12	-	± 11	± 12	-	
Positive Current Limit		Output-to-Ground Short	-	22	-	-	22	-	mA
Negative Current Limit		Output-to-Ground Short	-	32	-	-	32	-	mA
NOISE									
Voltage Density, RTI	e_n	$f_O = 1kHz$	-	9	-	-	9	-	nV/√Hz
		$G = 1000$	-	10	-	-	10	-	
		$G = 100$	-	18	-	-	18	-	
		$G = 1$	-	120	-	-	120	-	
Noise Current Density, RTI	i_n	$f_O = 1kHz$, $G = 1000$	-	0.4	-	-	0.4	-	pA/√Hz
Input Noise Voltage	$e_{n\ p-p}$	0.1Hz to 10Hz	-	0.4	-	-	0.4	-	μV _{p-p}
		$G = 1000$	-	0.5	-	-	0.5	-	
		$G = 100$	-	1.2	-	-	1.2	-	
		$G = 1$	-	10	-	-	10	-	
DYNAMIC RESPONSE									
Small-Signal Bandwidth (-3dB)	BW	$G = 1$	-	1200	-	-	1200	-	kHz
		$G = 10$	-	300	-	-	300	-	
		$G = 100$	-	200	-	-	200	-	
		$G = 1000$	-	200	-	-	200	-	
Slew Rate	SR	$G = 10$, $R_L = 1k\Omega$	4	6	-	4	6	-	V/μs
Settling Time	t_S	To 0.01% ±10V Step $G = 1$ to 1000	-	10	-	-	10	-	μs

NOTES:

- Guaranteed by design.
- Gain tempco does not include the effects of external component drift.
- Input voltage range guaranteed by common-mode rejection test.

AMP02

ELECTRICAL CHARACTERISTICS at $V_S = \pm 15V$, $V_{CM} = 0V$, $T_A = +25^\circ C$, unless otherwise noted. *Continued*

PARAMETER	SYMBOL	CONDITIONS	AMP-02E			AMP-02F			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
SENSE INPUT									
Input Resistance	R_{IN}		-	25	-	-	25	-	k Ω
Voltage Range			-	± 11	-	-	± 11	-	V
REFERENCE INPUT									
Input Resistance	R_{IN}		-	50	-	-	50	-	k Ω
Voltage Range			-	± 11	-	-	± 11	-	V
Gain to Output			-	1	-	-	1	-	V/V
POWER SUPPLY									
Supply Voltage Range	V_S		± 4.5	-	± 18	± 4.5	-	± 18	V
Supply Current	I_{SV}	$T_A = +25^\circ C$ $-40^\circ C \leq T_A \leq +85^\circ C$	-	5	6	-	5	6	mA

SIMPLIFIED SCHEMATIC

