19-2279; Rev 4; 3/06

MAXIM

SOT23, 3V/5V, Single-Supply, Rail-to-Rail Instrumentation Amplifiers

General Description

The MAX4460/MAX4461/MAX4462 are instrumentation amplifiers with precision specifications, low-power consumption, and excellent gain-bandwidth product. Proprietary design techniques allow ground-sensing capability combined with ultra-low input current and increased common-mode rejection performance. These rail-to-rail output instrumentation amplifiers are offered in fixed or adjustable gains and the option for either a shutdown mode or a pin to set the output voltage relative to an external reference (see the *Ordering Information* and *Selector Guide*).

The MAX4460 has an adjustable gain and uses ground as its reference voltage. The MAX4461 is offered in fixed gains of 1, 10, and 100, uses ground as its reference voltage, and has a logic-controlled shutdown input. The MAX4462 is offered in fixed gains of 1, 10, and 100 and has a reference input pin (REF). REF sets the output voltage for zero differential input to allow bipolar signals in single-supply applications.

The MAX4460/MAX4461/MAX4462 have high-impedance inputs optimized for small-signal differential voltages. The MAX4461/MAX4462 are factory trimmed to gains of 1, 10, or 100 (suffixed U, T, and H) with ±0.1% accuracy. The typical offset of the MAX4460/MAX4461/MAX4462 is 100µV. All devices have a gain-bandwidth product of 2.5MHz.

These amplifiers operate with a single-supply voltage from 2.85V to 5.25V and with a quiescent current of only 700µA (less than 1µA in shutdown for the MAX4461). The MAX4462 can also be operated with dual supplies. Smaller than most competitors, the MAX4460/MAX4461/MAX4462 are available in space-saving 6-pin SOT23 and TDFN packages.

Applications

Industrial Process Control

Strain-Gauge Amplifiers

Transducer Interface

Precision Low-Side Current Sense

Low-Noise Microphone Preamplifier

Differential Voltage Amplification

Battery-Powered Medical Equipment

Selector Guide appears at end of data sheet.

Pin Configurations appear at end of data sheet.

Features

- ♦ **Tiny 6-Pin SOT23 and TDFN Packages**
- ♦ **Input Negative Rail Sensing**
- ♦ **1pA (typ) Input Bias Current**
- ♦ **100µV Input Offset Voltage**
- ♦ **Rail-to-Rail Output**
- ♦ **2.85V to 5.25V Single Supply**
- ♦ **700µA Supply Current**
- ♦ **±0.1% Gain Error**
- ♦ **2.5MHz Gain-Bandwidth Product**
- ♦ **18nV/√Hz Input-Referred Noise**

Ordering Information

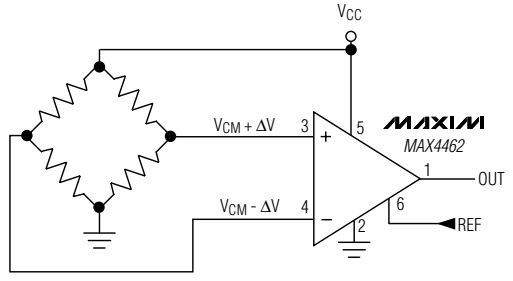
PART	TEMP RANGE	PIN-PACKAGE	TOP MARK
MAX4460ETT+T	-40°C to +85°C	6 TDFN-EP*	+ANI
MAX4460EUT-T	-40°C to +85°C	6 SOT23-6	AASS
MAX4460ESA	-40°C to +85°C	8 SO	—
MAX4461UETT+T	-40°C to +85°C	6 TDFN-EP*	+ANJ
MAX4461UEUT-T	-40°C to +85°C	6 SOT23-6	AAST
MAX4461UESA	-40°C to +85°C	8 SO	—
MAX4461TETT+T	-40°C to +85°C	6 TDFN-EP*	+ANK
MAX4461TEUT-T	-40°C to +85°C	6 SOT23-6	AASU
MAX4461TESA	-40°C to +85°C	8 SO	—
MAX4461HETT+T	-40°C to +85°C	6 TDFN-EP*	+ANL
MAX4461HEUT-T	-40°C to +85°C	6 SOT23-6	AASV
MAX4461HESA	-40°C to +85°C	8 SO	—

+Denotes lead-free package.

**EP = Exposed paddle.*

Ordering Information continued at end of data sheet.

Typical Application Circuits



Typical Application Circuits continued at end of data sheet.

SOT23, 3V/5V, Single-Supply, Rail-to-Rail Instrumentation Amplifiers

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{DD} to V_{SS}) .....-0.3V to +6V
All Other Pins .....(V_{SS} - 0.3V) to (V_{DD} + 0.3V)
Output Short-Circuit Duration to Either Supply.....1s
Continuous Power Dissipation (T_A = +70°C)
6-Pin SOT23 (derate 8.7mW/°C above +70°C).....695mW
6-Pin TDFN-EP (derate 18.2mW/°C above +70°C)....1454mW
8-Pin SO (derate 5.9mW/°C above +70°C).....470mW
Operating Temperature Range .....-40°C to +85°C
Junction Temperature.....+150°C
Storage Temperature Range .....-65°C to +150°C
Lead Temperature (soldering, 10s).....300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS—MAX4460/MAX4461

(V_{DD} = 5V, V_{CM} = 0V, V_{DIFF} = V_{IN+} - V_{IN-} = 50mV to 100mV for G = 1, 20mV to 100mV for G = 10, 2mV to 48mV for G =100, MAX4460 is configured for G = 10, R_L = 200kΩ to GND, **T_A = +25°C**, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Voltage	V_{DD}	Guaranteed by PSRR test		2.85		5.25	V
Supply Current		V_{DD} = 5V, V_{DIFF} = 0V			0.80	1.1	mA
		V_{DD} = 3V, V_{DIFF} = 0V			0.68	0.9	
Shutdown Supply Current		MAX4461, $\overline{SHDN}$ = GND	V_{DD} = 5V		0.1	1	µA
Input Offset Voltage (Note 1)	V_{OS}	MAX4460ESA			±50	±425	µV
		MAX4461ESA			±50	±300	
		MAX446_EUT/MAX446_ETT			±100	±600	
Input Resistance	R_{IN}	V_{CM} = V_{DD}/2	Differential mode		2		GΩ
			Common mode		2		
Input Common-Mode Range	V_{CM}	Guaranteed by CMRR test		-0.1		V_{DD} - 1.7	V
Input Common-Mode Rejection Ratio	CMRR	V_{CM} = -0.1V to (V_{DD} - 1.7V)		90	120		dB
Power-Supply Rejection Ratio	PSRR	V_{DD} = 2.85V to 5.25V		80	100		dB
Input Bias Current	I_B	(Note 2)			1	100	pA
FB Input Current		MAX4460 (Note 2)			1	100	pA
$\overline{SHDN}$ Logic Levels	V_{IH}	MAX4461		0.7 X V_{DD}			V
	V_{IL}	MAX4461				0.3 X V_{DD}	
$\overline{SHDN}$ Input Current		MAX4461, $V_{\overline{SHDN}}$ = 0V or V_{DD} (Note 2)			1	100	pA
Input Voltage Noise	e_n	f = 10kHz			18		nV/√Hz
		f = 1kHz			38		
Output Voltage Swing	V_{OH}	V_{DD} - V_{OH} (Note 3)	R_L = 200kΩ		1	2.5	mV
			R_L = 20kΩ		3	5	
	V_{OL}	R_L = 200kΩ			0	0.2	
		R_L = 20kΩ			0	0.2	
Short-Circuit Current	I_{SC}	(Note 4)			±150		mA

ELECTRICAL CHARACTERISTICS—MAX4460/MAX4461 (continued)

(V_{DD} = 5V, V_{CM} = 0V, V_{DIFF} = V_{IN+} - V_{IN-} = 50mV to 100mV for G = 1, 20mV to 100mV for G = 10, 2mV to 48mV for G =100, MAX4460 is configured for G = 10, R_L = 200kΩ to GND, **T_A = +25°C**, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Gain Error		R_L = 20kΩ	G = 1V/V, MAX4461UESA		0.1	0.3	%
			G = 10V/V, MAX4461TESA		0.12	0.35	
			G = 100V/V, MAX4461HESA		0.15	0.6	
			G = 10V/V, MAX4460ESA		0.15	0.35	
			MAX446_EUT/MAX446_ETT		0.15	0.6	
Nonlinearity (Note 1)		R_L = 20kΩ			0.05	0.15	%
Maximum Capacitive Load	C_L	No sustained oscillations			100		pF
-3dB Bandwidth	BW_{-3dB}	C_L = 100pF	G = 1V/V, MAX4461U		2500		kHz
			G = 10V/V, MAX4461T		250		
			G = 100V/V, MAX4461H		25		
Gain-Bandwidth Product	GBWP	C_L = 100pF			2.5		MHz
Slew Rate	SR	C_L = 100pF	G = 1V/V		0.5		V/µs
			G = 10V/V		0.5		
			G = 100V/V		0.25		
Settling Time	t_S	C_L = 100pF, within 0.1% of final value	G = 1V/V		15		µs
			G = 10V/V		75		
			G = 100V/V		250		

ELECTRICAL CHARACTERISTICS—MAX4460/MAX4461

(V_{DD} = 5V, V_{CM} = 0V, V_{DIFF} = V_{IN+} - V_{IN-} = 50mV to 100mV for G = 1, 20mV to 100mV for G = 10, 2mV to 48mV for G = 100, MAX4460 is configured for G = 10, R_L = 200kΩ to GND, **T_A = T_{MIN} to T_{MAX}**, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Supply Voltage	V_{DD}	Guaranteed by PSRR test			2.85		5.25	V
Supply Current		V_{DD} = 5V, V_{DIFF} = 0V					1.4	mA
		V_{DD} = 3V, V_{DIFF} = 0V					1.15	
Shutdown Supply Current		MAX4461, $\overline{SHDN}$ = GND	V_{DD} = 5V				1	µA
Input Offset Voltage (Note 1)	V_{OS}	MAX4460ESA	T_A = 0°C to +85°C				±750	µV
			T_A = -40°C to +85°C				±950	
		MAX4461ESA	T_A = 0°C to +85°C	G = 1			±750	
				G = 10			±500	
				G = 100			±500	
			T_A = -40°C to +85°C	G = 1			±950	
				G = 10			±750	
				G = 100			±750	
		MAX446_EUT/ MAX446_ETT	T_A = 0°C to +85°C				±1400	
			T_A = -40°C to +85°C				±1900	
Input Offset-Voltage Drift	TC_{VOS}	(Note 1)				1.5		µV/°C

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ELECTRICAL CHARACTERISTICS—MAX4460/MAX4461 (continued)

(V_{DD} = 5V, V_{CM} = 0V, V_{DIFF} = V_{IN+} - V_{IN-} = 50mV to 100mV for G = 1, 20mV to 100mV for G = 10, 2mV to 48mV for G = 100, MAX4460 is configured for G = 10, R_L = 200kΩ to GND, **T_A = T_{MIN} to T_{MAX}**, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Common-Mode Range	V_{CM}	Guaranteed by CMRR test		-0.1		V_{DD} - 1.85	V
Input Common-Mode Rejection Ratio	CMRR	V_{CM} = -0.1V to (V_{DD} - 1.85V)		80			dB
Power-Supply Rejection Ratio	PSRR	V_{DD} = 2.85V to 5.25V		75			dB
Input Bias Current	I_B	(Note 2)				100	pA
FB Input Current		MAX4460 (Note 2)				100	pA
$\overline{SHDN}$ Logic Levels	V_{IH}	MAX4461		0.7 X V_{DD}			V
	V_{IL}	MAX4461				0.3 X V_{DD}	
$\overline{SHDN}$ Input Current		MAX4461, $V_{\overline{SHDN}}$ = 0V or V_{DD} (Note 2)				100	pA
Output Voltage Swing	V_{OH}	V_{DD} - V_{OH} (Note 3)	R_L = 200kΩ			4	mV
			R_L = 20kΩ			8	
	V_{OL}	R_L = 200kΩ				0.25	
		R_L = 20kΩ				0.25	
Gain Error		MAX4461UESA, R_L = 20kΩ	T_A = 0°C to +85°C			0.8	%
			T_A = -40°C to +85°C			1.6	
		MAX4461TESA, R_L = 20kΩ	T_A = 0°C to +85°C			0.8	
			T_A = -40°C to +85°C			1.7	
		MAX4461HESA, R_L = 20kΩ	T_A = 0°C to +85°C			1.0	
			T_A = -40°C to +85°C			2.0	
		MAX4460ESA, R_L = 20kΩ	T_A = 0°C to +85°C			0.8	
			T_A = -40°C to +85°C			2.0	
		MAX446_EUT/ MAX446_ETT, R_L = 20kΩ	T_A = 0°C to +85°C			1.8	
			T_A = -40°C to +85°C			3.0	
Nonlinearity		R_L = 20kΩ (Note 1)	T_A = 0°C to +85°C			0.20	%
			T_A = -40°C to +85°C			0.25	

ELECTRICAL CHARACTERISTICS—MAX4462

(V_{DD} = 5V, V_{SS} = 0V, V_{CM} = V_{REF} = V_{DD}/2, R_L = 100kΩ to V_{DD}/2, **T_A = +25°C**, unless otherwise noted. V_{DIFF} = V_{IN+} - V_{IN-} = -100mV to +100mV for G = 1 and G = 10, -20mV to +20mV for G = 100.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Voltage	V_{DD}	Guaranteed by PSRR test		2.85		5.25	V
Supply Current		V_{DD} = 5V, V_{DIFF} = 0V			0.8	1.1	mA
		V_{DD} = 3V, V_{DIFF} = 0V			0.68	0.9	
Input Offset Voltage (Note 1)	V_{OS}	MAX4462_ESA			±50	±250	µV
		MAX4462_EUT/MAX4462_ETT			±100	±500	
Input Resistance	R_{IN}	V_{CM} = V_{DD}/2	Differential mode		2		GΩ
			Common mode		2		
Input Common-Mode Range	V_{CM}	Guaranteed by Input CMRR test		V_{SS} - 0.1		V_{DD} - 1.7	V
REF Input Range		Guaranteed by REF rejection test		V_{SS} + 0.1		V_{DD} - 1.7	V
Input Common-Mode Rejection Ratio	CMRR	V_{CM} = (V_{SS} - 0.1V) to (V_{DD} - 1.7V)		90	120		dB
REF Input Rejection Ratio		V_{CM} = (V_{SS} + 0.1V) to (V_{DD} - 1.7V)		85	100		dB
Power-Supply Rejection Ratio	PSRR	V_{DD} = 2.85V to 5.25V		80	100		dB
Input Bias Current	I_B	(Note 2)			1	100	pA
Input Voltage Noise	e_N	f = 10kHz			18		nV/√Hz
		f = 1kHz			38		
Output Voltage Swing	V_{OH}	V_{DD} - V_{OH} (Note 3)	R_L = 100kΩ		1	2.5	mV
			R_L = 10kΩ		3	5	
	V_{OL}	V_{OL} - V_{SS} (Note 3)	R_L = 100kΩ		2	4	
			R_L = 10kΩ		6	12	
Short-Circuit Current	I_{SC}	(Note 4)			±150		mA
Gain Error		R_L = 10kΩ	G = 1V/V, MAX4462UESA		0.1	0.30	%
			G = 10V/V, MAX4462TESA		0.12	0.35	
			G = 100V/V, MAX4462HESA		0.15	0.5	
			MAX4462_EUT/MAX4462_ETT		0.15	0.5	
Nonlinearity		R_L = 10kΩ			0.05	0.15	%

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ELECTRICAL CHARACTERISTICS—MAX4462 (continued)

(V_{DD} = 5V, V_{SS} = 0V, V_{CM} = V_{REF} = V_{DD}/2, R_L = 100kΩ to V_{DD}/2, **T_A = +25°C**, unless otherwise noted. V_{DIFF} = V_{IN+} - V_{IN-} = -100mV to +100mV for G = 1 and G = 10, -20mV to +20mV for G = 100.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Maximum Capacitive Load	C_L	No sustained oscillations			100		pF
-3dB Bandwidth	BW_{-3dB}	C_L = 100pF	G = 1V/V, MAX4462U		2500		kHz
			G = 10V/V, MAX4462T		250		
			G = 100V/V, MAX4462H		25		
Gain-Bandwidth Product	GBWP	C_L = 100pF			2.5		MHz
Slew Rate	SR	C_L = 100pF	G = 1V/V, MAX4462U		0.5		V/µs
			G = 10V/V, MAX4462T		0.5		
			G = 100V/V, MAX4462H		0.25		
Settling Time	t_S	C_L = 100pF, within 0.1% of final value	G = 1V/V, MAX4462U		15		µs
			G = 10V/V, MAX4462T		75		
			G = 100V/V, MAX4462H		250		

ELECTRICAL CHARACTERISTICS—MAX4462

(V_{DD} = 5V, V_{SS} = 0V, V_{CM} = V_{REF} = V_{DD}/2, R_L = 100kΩ to V_{DD}/2, **T_A = T_{MIN} to T_{MAX}**, unless otherwise noted. V_{DIFF} = V_{IN+} - V_{IN-} = -100mV to +100mV for G = 1 and G = 10, -20mV to +20mV for G = 100.) (Note 5)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Voltage	V_{DD}	Guaranteed by PSRR test		2.85		5.25	V
Supply Current		V_{DD} = 5V, V_{DIFF} = 0V				1.4	mA
		V_{DD} = 3V, V_{DIFF} = 0V				1.15	
Input Offset Voltage (Note 1)	V_{OS}	MAX4462_ESA	T_A = 0°C to +85°C			±500	µV
			T_A = -40°C to +85°C			±750	
		MAX4462_EUT/ MAX4462_ETT	T_A = 0°C to +85°C			±1100	
			T_A = -40°C to +85°C			±1300	
Input Offset Voltage Drift	TCV_{OS}	(Note 1)			1.5		µV/°C
Input Common-Mode Range	V_{CM}	Guaranteed by input CMRR test		V_{SS} - 0.1		V_{DD} - 1.85	V
REF Input Range		Guaranteed by REF rejection test		V_{SS} + 0.1		V_{DD} - 1.85	V
Input Common-Mode Rejection Ratio	CMRR	V_{CM} = (V_{SS} – 0.1V) to (V_{DD} - 1.85V)		80			dB
REF Input Rejection Ratio		V_{CM} = (V_{SS} + 0.1V) to (V_{DD} - 1.85V)		75			dB
Power-Supply Rejection Ratio	PSRR	V_{DD} = 2.85V to 5.25V		75			dB
Input Bias Current	I_B	(Note 2)				100	pA

ELECTRICAL CHARACTERISTICS—MAX4462 (continued)

(V_{DD} = 5V, V_{SS} = 0V, V_{CM} = V_{REF} = V_{DD}/2, R_L = 100kΩ to V_{DD}/2, **T_A = T_{MIN} to T_{MAX}**, unless otherwise noted. V_{DIFF} = V_{IN+} - V_{IN-} = -100mV to +100mV for G = 1 and G = 10, -20mV to +20mV for G = 100.) (Note 5)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Output Voltage Swing	V_{OH}	V_{DD} - V_{OH} (Note 3)	R_L = 100kΩ			4	mV
			R_L = 10kΩ			8	
	V_{OL}	V_{OL} - V_{SS} (Note 3)	R_L = 100kΩ			8	
			R_L = 10kΩ			16	
Gain Error	GE	R_L = 10kΩ, MAX4462UESA	T_A = 0°C to +85°C			0.8	%
			T_A = -40°C to +85°C			1.6	
		R_L = 10kΩ, MAX4462TESA	T_A = 0°C to +85°C			0.8	
			T_A = -40°C to +85°C			1.7	
		R_L = 10kΩ, MAX4462HESA	T_A = 0°C to +85°C			0.8	
			T_A = -40°C to +85°C			1.7	
		R_L = 10kΩ, MAX4462_EUT/ MAX4462_ETT	T_A = 0°C to +85°C			1.8	
			T_A = -40°C to +85°C			3.0	
Nonlinearity	NL	R_L = 10kΩ	T_A = 0°C to +85°C			0.2	%
			T_A = -40°C to +85°C			0.25	

Note 1: Offset Voltage is measured with a best straight-line (BSL) method (see *A User Guide to Instrumentation Amplifier Accuracy Specifications* section).

Note 2: IN+ and IN- are gates to CMOS transistors with typical input bias current of 1pA. CMOS leakage is so small that it is impractical to test and guarantee in production. Limits shown are guaranteed by design. However, devices are functionally screened during production testing to eliminate defective units.

Note 3: Output swing high is measured only on G = 100 devices. Devices with G = 1 and G = 10 have output swing high limited by the range of V_{REF}, V_{CM}, and V_{DIFF} (see *Output Swing* section).

Note 4: Short-circuit duration limited to 1s (see *Absolute Maximum Ratings).*

Note 5: SOT23 and TDFN units are 100% production tested at +25°C. Limits over temperature are guaranteed by design.

SOT23, 3V/5V, Single-Supply, Rail-to-Rail Instrumentation Amplifiers

Functional Diagrams

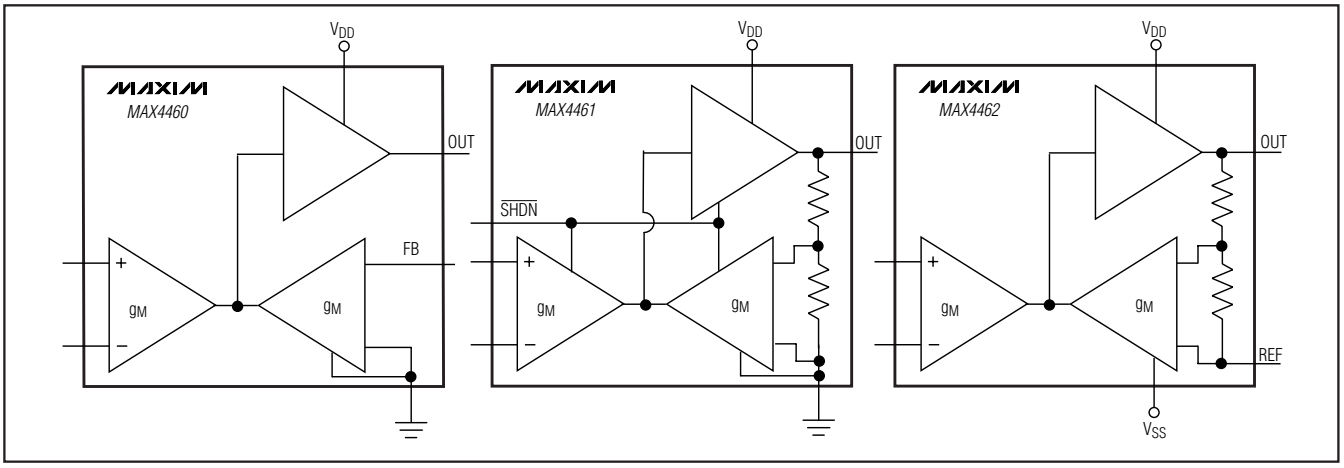


Figure 1. Functional Diagrams

Detailed Description

The MAX4460/MAX4461/MAX4462 family of instrumentation amplifiers implements Maxim's proprietary indirect current-feedback design to achieve a precision specification and excellent gain-bandwidth product. These new techniques allow ground-sensing capability combined with an ultra-low input current and an increased common-mode rejection.

The differential input signal is converted to a current by an input transconductance stage. An output transconductance stage converts a portion of the output voltage (equal to the output voltage divided by the gain) into another precision current. These two currents are subtracted and the result is fed to a loop amplifier with a class AB output stage with sufficient gain to minimize errors (Figure 1).

The MAX4461U/T/H and MAX4462U/T/H have factory-trimmed gains of 1, 10, and 100, respectively. The MAX4460 has an adjustable gain, set with an external pair of resistors between pins OUT, FB, and GND (Figure 2).

The MAX4462U/T/H has a reference input (REF) which is connected to an external reference for bipolar operation of the device. The range for V_{REF} is 0.1V to (V_{DD} - 1.7V). For full output-swing capability, optimal performance is usually obtained with $V_{REF} = V_{DD}/2$.

The MAX4460/MAX4461/MAX4462 operate with single-supply voltages of 2.85V to 5.25V. It is possible to use the MAX4462U/T/H in a dual-supply configuration with up to ±2.6V at V_{DD} and V_{SS}, with REF connected to ground.

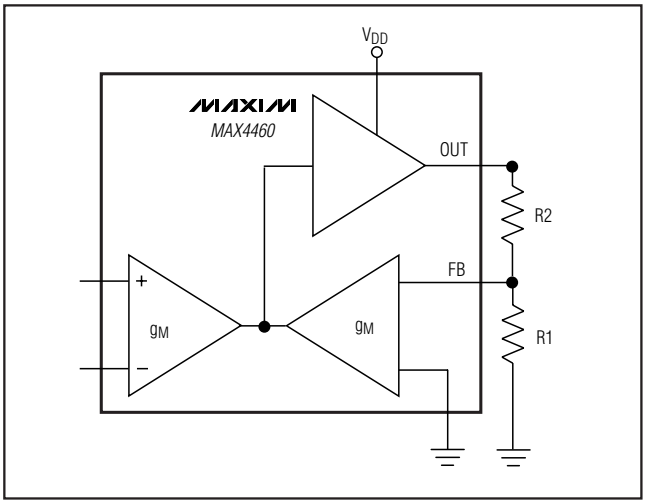


Figure 2. MAX4460 External Resistor Configuration

The MAX4461U/T/H has a shutdown feature to reduce the supply current to less than 1µA. The MAX4461U/T/H output is internally referenced to ground, making the part suitable for unipolar operations.

The MAX4460 has an FB pin that can be used to externally set the gain through a pair of resistors (see *Setting the Gain* (MAX4460) section). The MAX4460 output is internally referenced to ground, making the part suitable for unipolar operations.

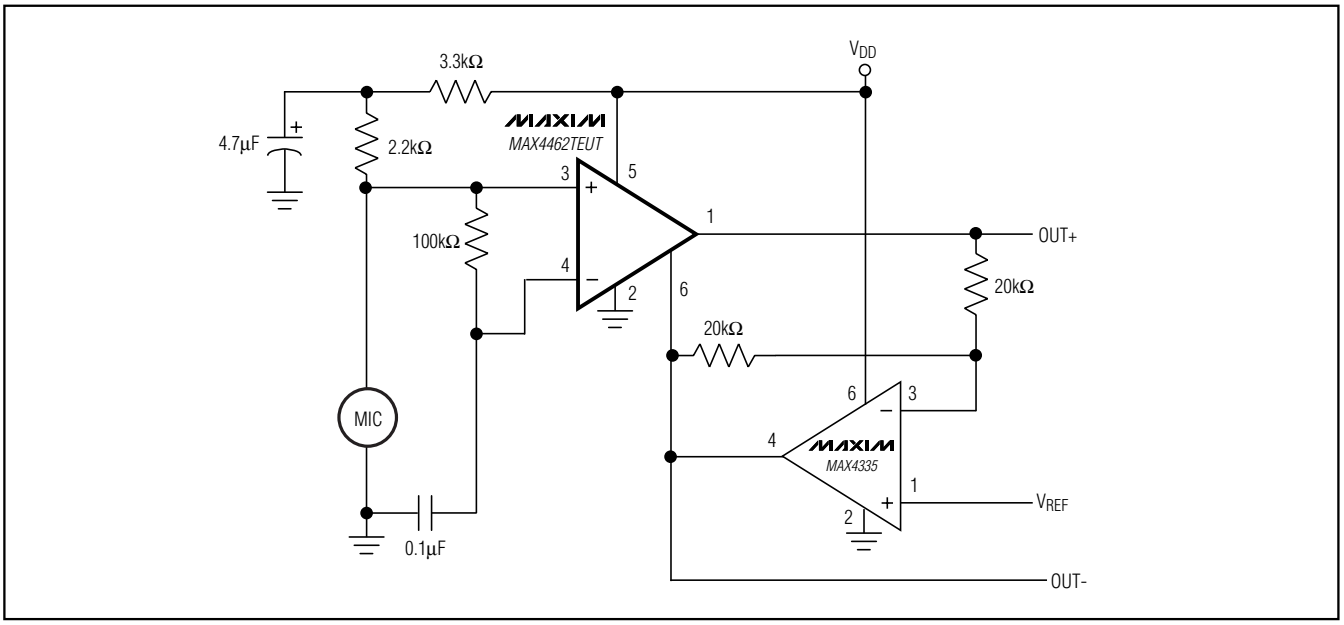
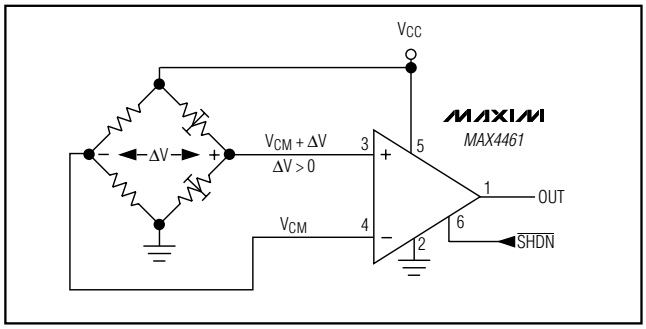


Figure 7. Differential I/O Microphone Amplifier

Typical Application Circuits (continued)



Selector Guide

PART	GAIN	REF	SHUTDOWN
MAX4460	Adjustable	GND	NO
MAX4461U	1	GND	YES
MAX4461T	10	GND	YES
MAX4461H	100	GND	YES
MAX4462U	1	EXT	NO
MAX4462T	10	EXT	NO
MAX4462H	100	EXT	NO

Ordering Information (continued)

PART	TEMP RANGE	PIN-PACKAGE	TOP MARK
MAX4462UETT+T	-40°C to +85°C	6 TDFN-EP*	+ANM
MAX4462UEUT-T	-40°C to +85°C	6 SOT23-6	AASW
MAX4462UESA	-40°C to +85°C	8 SO	—
MAX4462TETT+T	-40°C to +85°C	6 TDFN-EP*	+ANN
MAX4462TEUT-T	-40°C to +85°C	6 SOT23-6	AASX
MAX4462TESA	-40°C to +85°C	8 SO	—
MAX4462HETT+T	-40°C to +85°C	6 TDFN-EP*	+ANO
MAX4462HEUT-T	-40°C to +85°C	6 SOT23-6	AASY
MAX4462HESA	-40°C to +85°C	8 SO	—

+Denotes lead-free package.

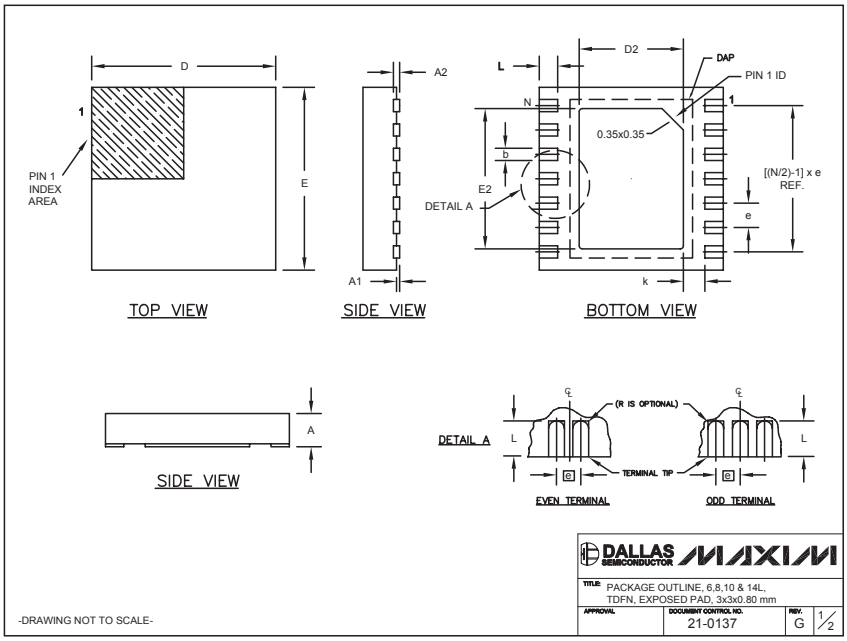
**EP = Exposed paddle.*

Chip Information

TRANSISTOR COUNT: 421

PROCESS: BiCMOS

Package Information



COMMON DIMENSIONS		
SYMBOL	MIN.	MAX.
A	0.70	0.80
D	2.90	3.10
E	2.90	3.10
A1	0.00	0.05
L	0.20	0.40
k	0.25 MIN.	
A2	0.20 REF.	

PACKAGE VARIATIONS								
PKG. CODE	N	D2	E2	e	JEDEC SPEC	b	[(N/2)-1] x e	DOWNBONDS ALLOWED
T633-1	6	1.50±0.10	2.30±0.10	0.95 BSC	MO229 / WEEA	0.40±0.05	1.90 REF	NO
T633-2	6	1.50±0.10	2.30±0.10	0.95 BSC	MO229 / WEEA	0.40±0.05	1.90 REF	NO
T833-1	8	1.50±0.10	2.30±0.10	0.65 BSC	MO229 / WEEC	0.30±0.05	1.95 REF	NO
T833-2	8	1.50±0.10	2.30±0.10	0.65 BSC	MO229 / WEEC	0.30±0.05	1.95 REF	NO
T833-3	8	1.50±0.10	2.30±0.10	0.65 BSC	MO229 / WEEC	0.30±0.05	1.95 REF	YES
T1033-1	10	1.50±0.10	2.30±0.10	0.50 BSC	MO229 / WEED-3	0.25±0.05	2.00 REF	NO
T1433-1	14	1.70±0.10	2.30±0.10	0.40 BSC	----	0.20±0.05	2.40 REF	YES
T1433-2	14	1.70±0.10	2.30±0.10	0.40 BSC	----	0.20±0.05	2.40 REF	NO

NOTES:
1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
2. COPLANARITY SHALL NOT EXCEED 0.08 mm.
3. WARPAGE SHALL NOT EXCEED 0.10 mm.
4. PACKAGE LENGTH/PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC(S).
5. DRAWING CONFORMS TO JEDEC MO229, EXCEPT DIMENSIONS "D2" AND "E2", AND T1433-1 & T1433-2.
6. "N" IS THE TOTAL NUMBER OF LEADS.
7. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.

-DRAWING NOT TO SCALE-

DALLAS SEMICONDUCTOR MAXIM

TITLE: PACKAGE OUTLINE, 6,8,10 & 14L, TDFN, EXPOSED PAD, 3x3x0.80 mm

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Note: MAX446_ _ETT+T uses TDFN package option T633-2.