MIC862

Dual Ultra-Low-Power Op Amp in SOT23-8

General Description

The MIC862 is a dual low-power operational amplifier in an SOT23-8 package. It is designed to operate in the 2V to 5V range, rail-to-rail output, with input common-mode to ground. The MIC862 provides 3MHz gain-bandwidth product while consuming only a 31µA/channel supply current.

With low supply voltage and SOT23-8 packaging, MIC862 provides two channels as general-purpose amplifiers for portable and battery-powered applications. Its package provides the maximum performance available while maintaining an extremely slim form factor. The minimal power consumption of this IC maximizes the battery life potential.

Datasheets and support documentation are available on Micrel's website at: www.micrel.com.

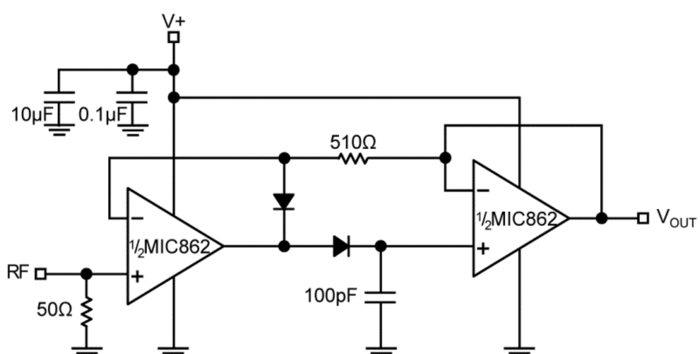
Features

- SOT23-8 package
- 3MHz gain-bandwidth product
- 5MHz, –3dB bandwidth
- 31µA supply current
- Rail-to-rail output
- Ground sensing at input (common mode to GND)
- Drive large capacitive loads
- Unity gain stable

Applications

- Portable equipment
- Medical instruments
- PDAs
- Pagers
- Cordless phones
- Consumer electronics

Typical Application

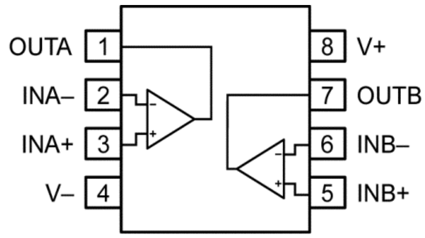


Peak Detector Circuit for AM Radio

Ordering Information

Part Number	Marking	Ambient Temperature Range	Package
MIC862TYM8	A34	–40° to +85°C	SOT23-8

Pin Configuration



SOT23-8 (M8)
(Top View)

Pin Description

Pin Number	Pin Name	Pin Function
1	OUTA	Amplifier A output
2	INA-	Amplifier A inverting input
3	INA+	Amplifier A non-inverting input
4	V-	Negative supply
5	INB+	Amplifier B non-inverting input
6	INB-	Amplifier B inverting input
7	OUTB	Amplifier B output
8	V+	Positive supply

Absolute Maximum Ratings[1]

Supply Voltage (V_{V+} to V_{V-})..+6.0V
Differential Input Voltage (V_{IN+} to V_{IN-})[3]......................+6.0V
Input Voltage (V_{IN+} to V_{IN-})..................V_{V+} + 0.3V, V_{V-} - 0.3V
Lead Temperature (soldering, 10s)............................260°C
Output Short-Circuit Current Duration....................Indefinite
Operating Temperature.............................–40°C to +125°C
Storage Temperature (Ts)..150°C
ESD Rating[4]...ESD Sensitive

Operating Ratings[2]

Supply Voltage (V+ to V-) .... +2.0V to +5.25V
Ambient Temperature (T_A)..........................–40°C to +85°C
Package Thermal Resistance
θ_{JA} (Using 4 Layer PCB) ....100°C/W
θ_{JC} (Using 4 Layer PCB) ....70°C/W

Electrical Characteristics[5]

V+ = +2V, V- = 0V, V_{CM} = V+/2; R_L = 500kΩ to V+/2; T_A = 25°C, **bold** values indicate –40°C ≤ T_A ≤ +85°C, unless noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
V_{OS}	Input Offset Voltage		**-6**	0.1	**6**	mV
			-5	0.1	5	mV
	Differential Offset Voltage			0.5		mV
	Input Offset Voltage Temperature Coefficient			6		µV/°C
I_B	Input Bias Current			10		pA
I_{OS}	Input Offset Current			5		pA
V_{CM}	Input Voltage Range (from V-)	CMRR > 50dB	**0.5**	1		V
CMRR	Common-Mode Rejection Ratio	0 < V_{CM} < 1V	**45**	75		dB
PSRR	Power Supply Rejection Ratio	Supply voltage change of 2V to 2.7V	**50**	78		dB
A_{VOL}	Large-Signal Voltage Gain	R_L = 5kΩ, V_{OUT} = 1.4V_{PP}	**66**	74		dB
		R_L = 100kΩ, V_{OUT} = 1.4V_{PP}	**75**	89		dB
		R_L = 500kΩ, V_{OUT} = 1.4V_{PP}	**85**	100		dB
V_{OUT}	Maximum Output Voltage Swing	R_L = 5kΩ	**V+ -80mV**	V+ -55mV		V
		R_L = 500kΩ	**V+ -3mV**	V+ -1.4mV		V
V_{OUT}	Minimum Output Voltage Swing	R_L = 5kΩ		V- +14mV	**V- +20mV**	V
		R_L = 500kΩ		V- +0.85mV	**V- +3mV**	V
GBW	Gain-Bandwidth Product	R_L = 20kΩ, C_L = 2pF, A_V = 11		2.1		MHz
PM	Phase Margin	R_L = 20kΩ, C_L = 2pF, A_V = 11		57		°
BW	–3dB Bandwidth	R_L = 1MΩ, C_L = 2pF, A_V = 1		4.2		MHz
SR	Slew Rate	R_L = 1MΩ, C_L = 2pF, A_V = 1 Positive Slew Rate = 1.5V/µs		2		V/µs
I_{SC}	Short-Circuit Ouptut Current	Source	**1.8**	2.6		mA
		Sink	**1.5**	2.2		mA
I_S	Supply Current (per Op Amp)	No Load		27	**43**	µA
	Channel-to-Channel Crosstalk	Note 6		-100		dB

Notes:

1. Exceeding the absolute maximum ratings may damage the device.
2. The device is not guaranteed to function outside its operating ratings.
3. Exceeding the maximum differential input voltage will damage the input stage and degrade performance. In particular, input bias current is likely to increase.
4. Devices are ESD sensitive. Handling precautions are recommended. Human body model, 1.5kΩ in series with 100pF.
5. Specification for packaged product only.
6. DC signal referenced to input. Refer to Typical Characteristics graphs for AC performance.

Electrical Characteristics[(5)] (Continued)

V+ = +2.7V, V- = 0V, V_{CM} = V+/2; R_L = 500kΩ to V+/2; T_A = 25°C, **bold** values indicate –40°C ≤ T_A ≤ +85°C, unless noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
V_{OS}	Input Offset Voltage		**-6**	0.1	**6**	mV
			-5	0.1	5	mV
	Differential Offset Voltage			0.5		mV
	Input Offset Voltage Temperature Coefficient			6		µV/°C
I_B	Input Bias Current			10		pA
I_{OS}	Input Offset Current			5		pA
V_{CM}	Input Voltage Range (from V-)	CMRR > 60dB	**1**	1.8		V
CMRR	Common-Mode Rejection Ratio	0 < V_{CM} < 1.35V	**65**	83		dB
PSRR	Power Supply Rejection Ratio	Supply voltage change of 2.7V to 3V	**60**	85		dB
A_{VOL}	Large-Signal Voltage Gain	R_L = 5kΩ, V_{OUT} = 2V_{PP}	**65**	77		dB
		R_L = 100kΩ, V_{OUT} = 2V_{PP}	**80**	90		dB
		R_L = 500kΩ, V_{OUT} = 2V_{PP}	**90**	101		dB
GBW	Gain-Bandwidth Product	R_L = 20kΩ, C_L = 2pF, A_V = 11		2.3		MHz
PM	Phase Margin	R_L = 20kΩ, C_L = 2pF, A_V = 11		50		°
BW	–3dB Bandwidth	R_L = 1MΩ, C_L = 2pF, A_V = 1		4.2		MHz
SR	Slew Rate	R_L = 1MΩ, C_L = 2pF, A_V = 1 Positive Slew Rate = 1.5V/µs		3		V/µs
I_{SC}	Short-Circuit Ouptut Current	Source	**4.5**	6.3		mA
		Sink	**4.5**	6.2		mA
I_S	Supply Current (per Op Amp)	No Load		28	**45**	µA
	Channel-to-Channel Crosstalk	Note 6		-120		dB

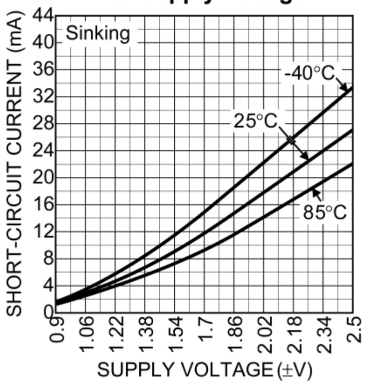
Electrical Characteristics[5] (Continued)

V+ = +5V, V- = 0V, V_{CM} = V+/2; R_L = 500kΩ to V+/2; T_A = 25°C, **bold** values indicate –40°C ≤ T_A ≤ +85°C, unless noted.

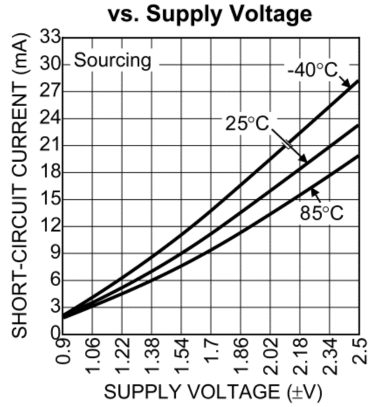
Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
V_{OS}	Input Offset Voltage		**-6**	0.1	**6**	mV
			-5	0.1	5	mV
	Differential Offset Voltage			0.5		mV
	Input Offset Voltage Temperature Coefficient			6		µV/°C
I_B	Input Bias Current			10		pA
I_{OS}	Input Offset Current			5		pA
V_{CM}	Input Voltage Range (from V-)	CMRR > 60dB	**3.5**	4.1		V
CMRR	Common-Mode Rejection Ratio	0 < V_{CM} < 3.5V	**60**	87		dB
PSRR	Power Supply Rejection Ratio	Supply voltage change of 3V to 5V	**60**	92		dB
A_{VOL}	Large-Signal Voltage Gain	R_L = 5kΩ, V_{OUT} = 4.8V_{PP}	**65**	73		dB
		R_L = 100kΩ, V_{OUT} = 4.8V_{PP}	**80**	86		dB
		R_L = 500kΩ, V_{OUT} = 4.8V_{PP}	**89**	96		dB
V_{OUT}	Maximum Output Voltage Swing	R_L = 5kΩ	**V+ -50mV**	V+ -37mV		V
		R_L = 500kΩ	**V+ -3mV**	V+ -1.3mV		V
V_{OUT}	Minimum Output Voltage Swing	R_L = 5kΩ		V- +24mV	**V- +40mV**	V
		R_L = 500kΩ		V- +0.7mV	**V- +3mV**	V
GBW	Gain-Bandwidth Product	R_L = 20kΩ, C_L = 2pF, A_V = 11		3		MHz
PM	Phase Margin			45		°
BW	–3dB Bandwidth	R_L = 1MΩ, C_L = 2pF, A_V = 1		5		MHz
SR	Slew Rate	R_L = 1MΩ, C_L = 2pF, A_V = 1 Positive Slew Rate = 1.5V/µs		4		V/µs
I_{SC}	Short-Circuit Ouptut Current	Source	**17**	23		mA
		Sink	**18**	27		mA
I_S	Supply Current (per Op Amp)	No Load		31	**47**	µA
	Channel-to-Channel Crosstalk	Note 6		-120		dB

Typical Characteristics

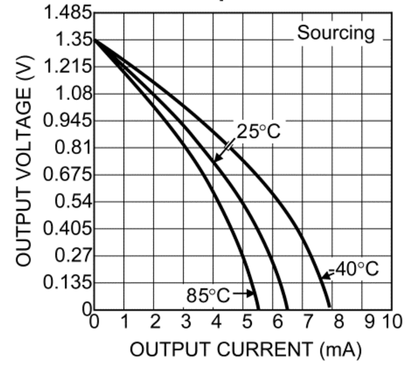
Short Circuit Current vs. Supply Voltage



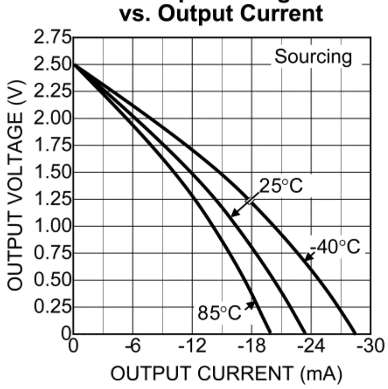
Short Circuit Current vs. Supply Voltage



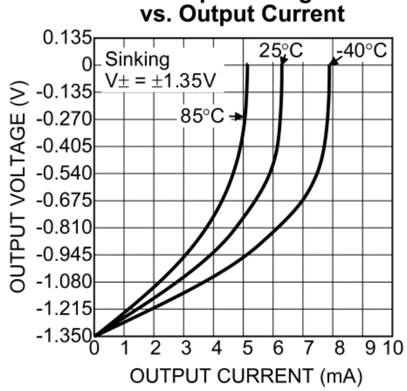
Output Voltage vs. Output Current



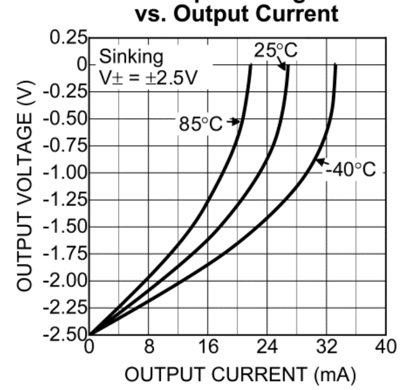
Output Voltage vs. Output Current



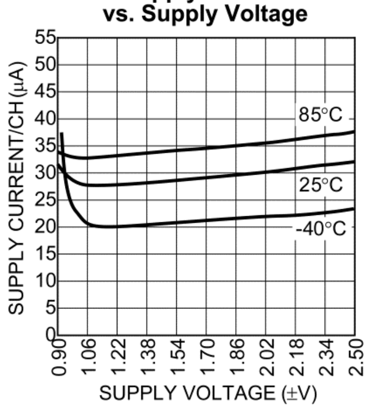
Output Voltage vs. Output Current



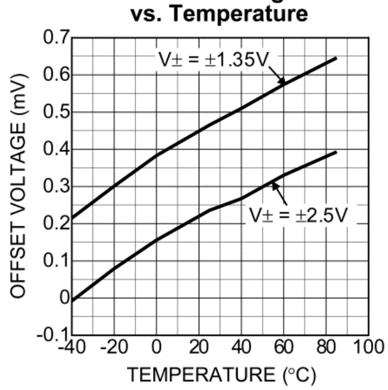
Output Voltage vs. Output Current



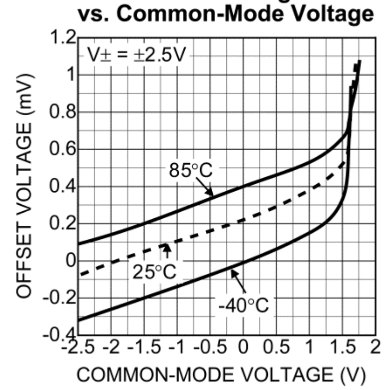
Supply Current vs. Supply Voltage



Offset Voltage vs. Temperature

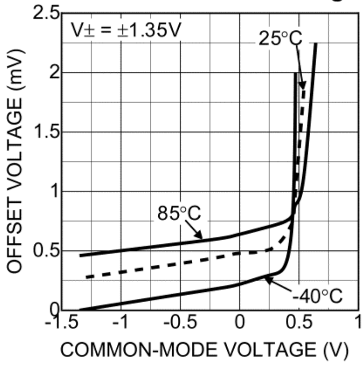


Offset Voltage vs. Common-Mode Voltage

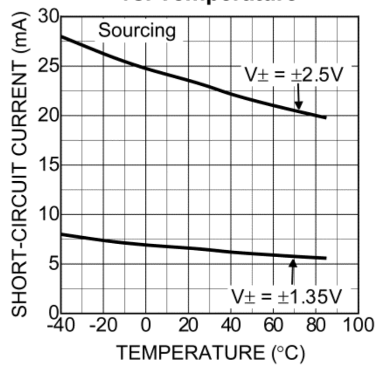


Typical Characteristics (Continued)

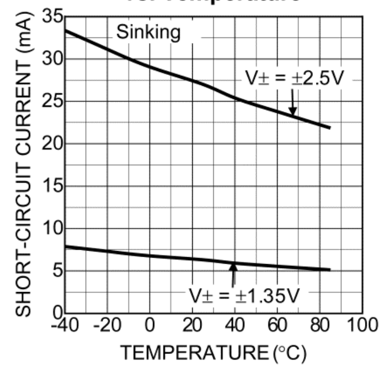
Offset Voltage vs. Common-Mode Voltage



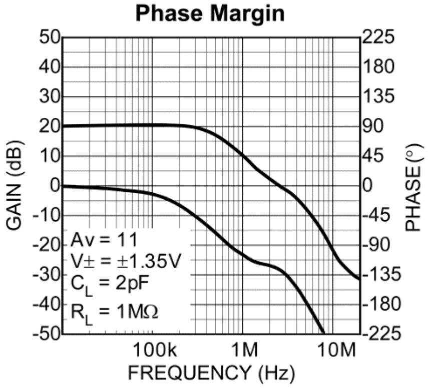
Short Circuit Current vs. Temperature



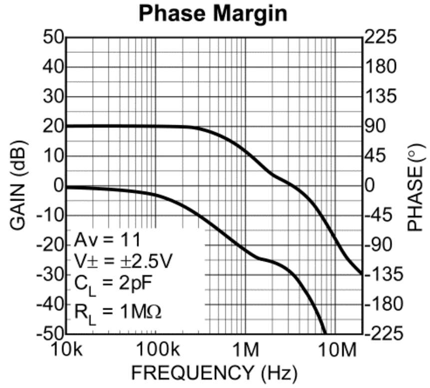
Short Circuit Current vs. Temperature



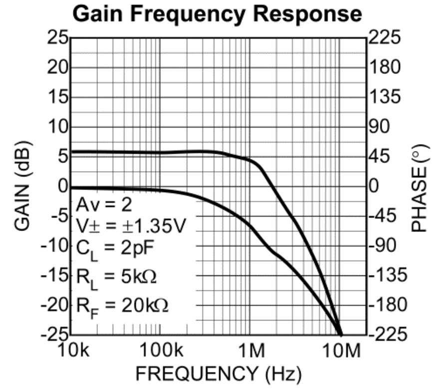
Gain Bandwidth and Phase Margin



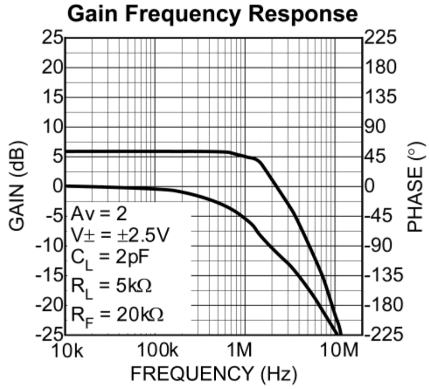
Gain Bandwidth and Phase Margin



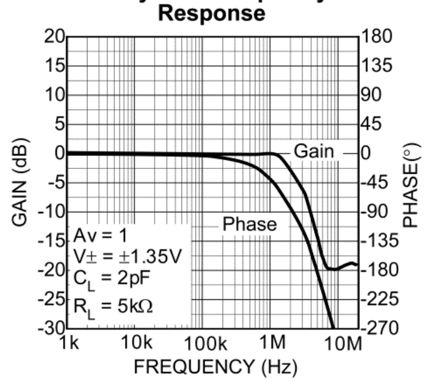
Gain Frequency Response



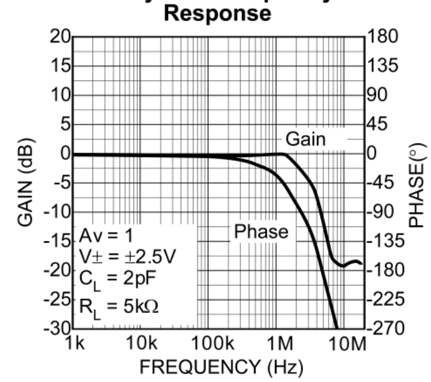
Gain Frequency Response



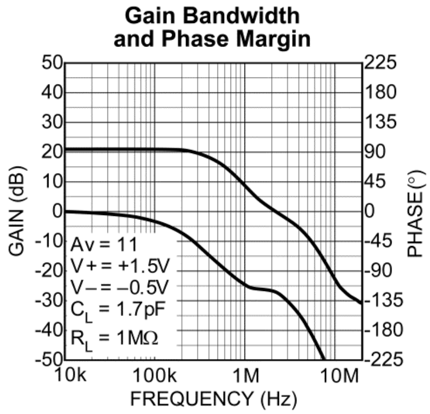
Unity Gain Frequency Response

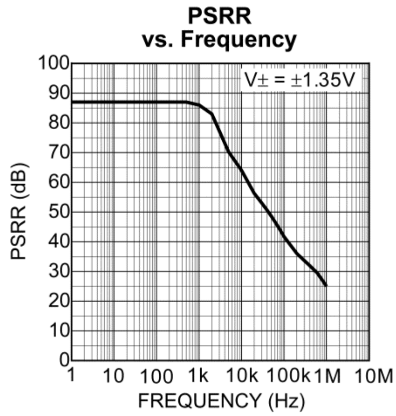


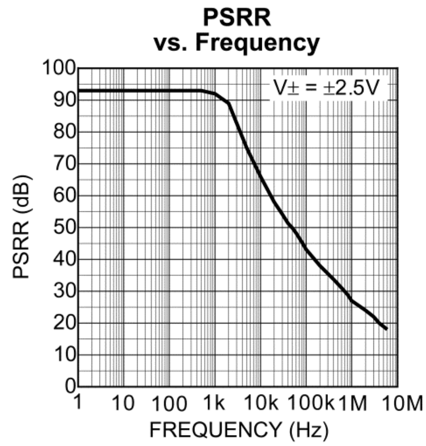
Unity Gain Frequency Response

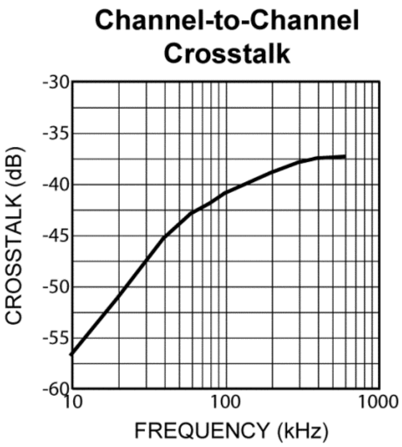


Typical Characteristics (Continued)



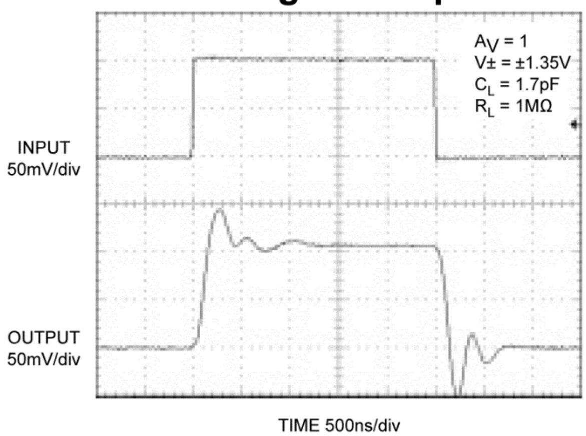




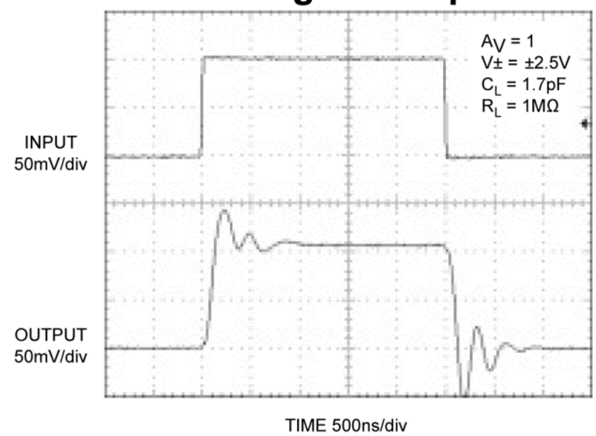


Functional Characteristics

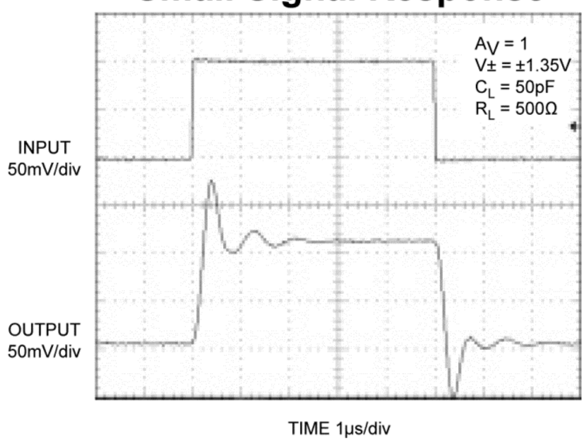
Small Signal Response



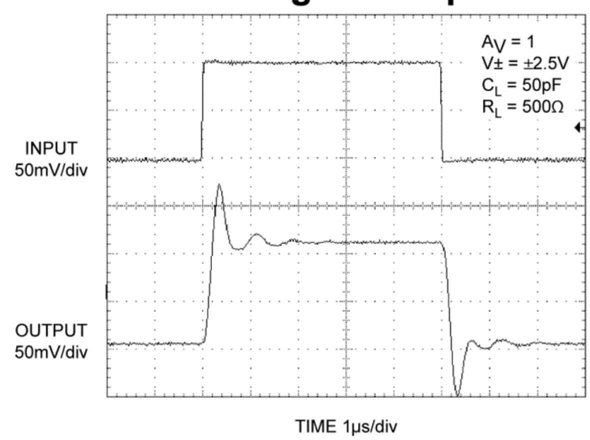
Small Signal Response



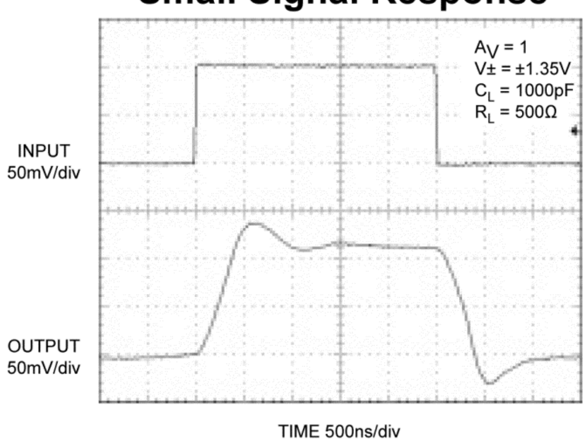
Small Signal Response



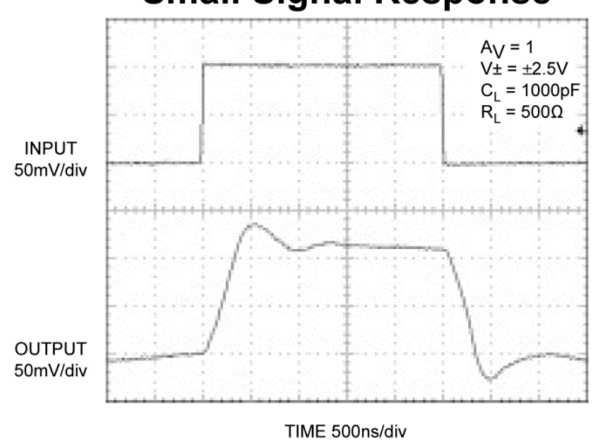
Small Signal Response



Small Signal Response

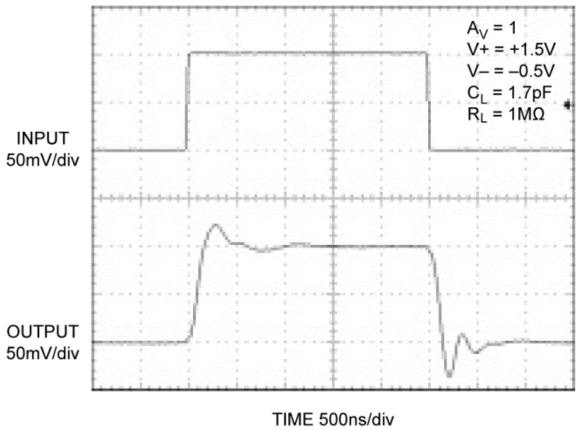


Small Signal Response

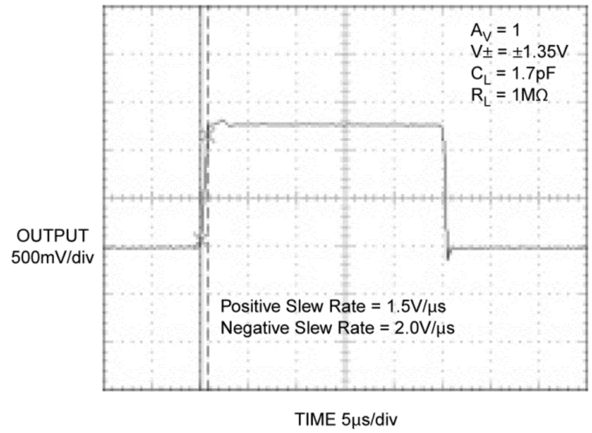


Functional Characteristics (Continued)

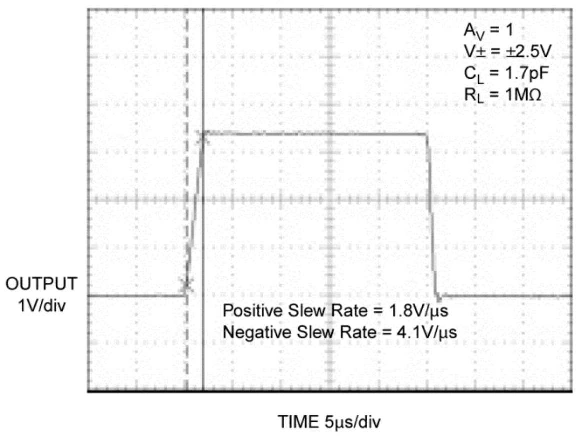
Small Signal Pulse Response



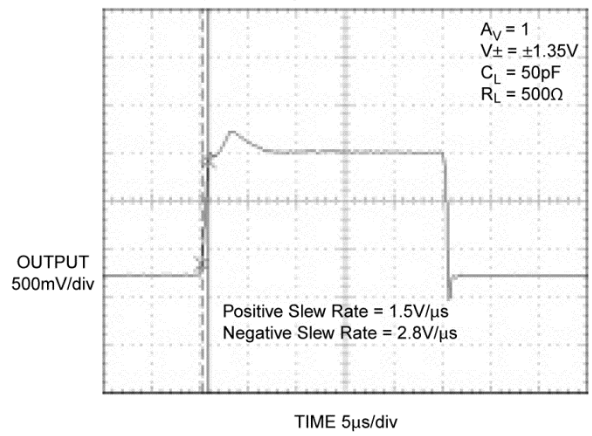
Large Signal Response



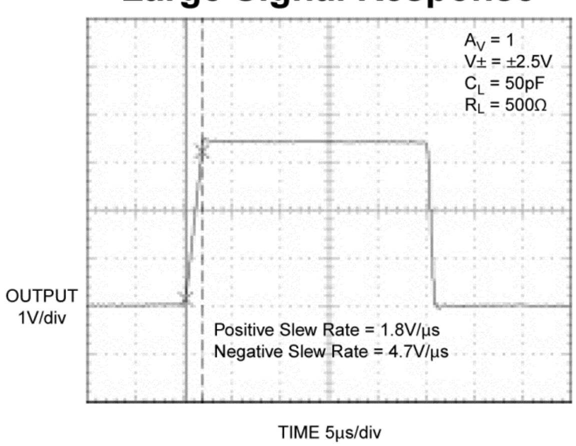
Large Signal Response



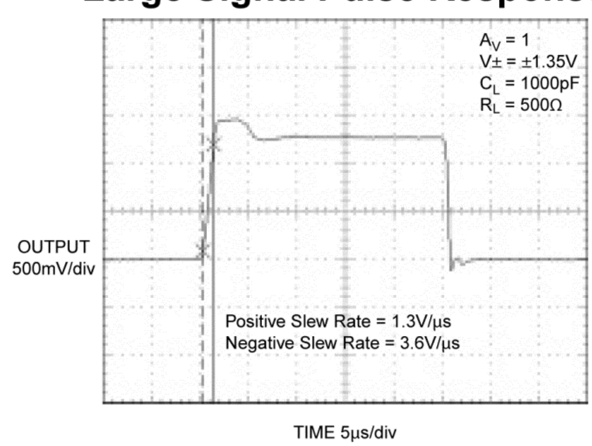
Large Signal Response



Large Signal Response

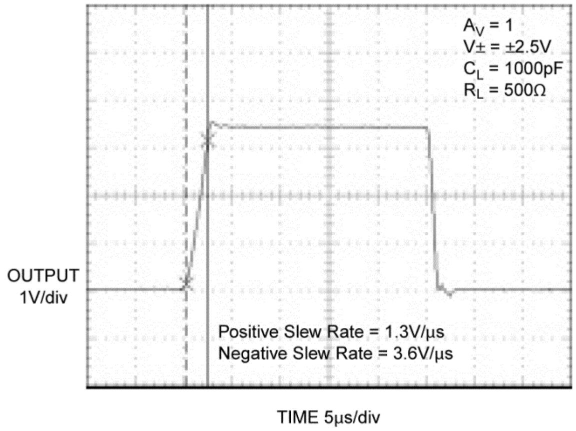


Large Signal Pulse Response

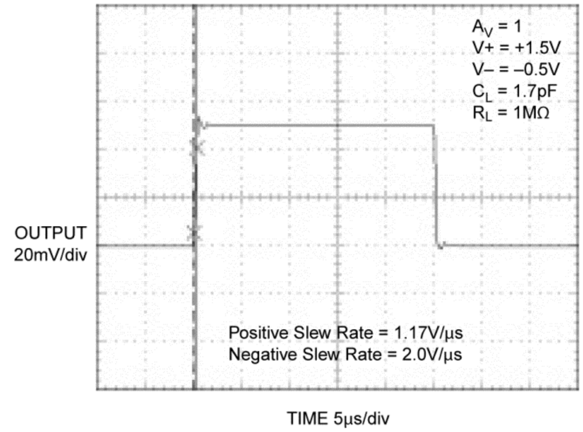


Functional Characteristics (Continued)

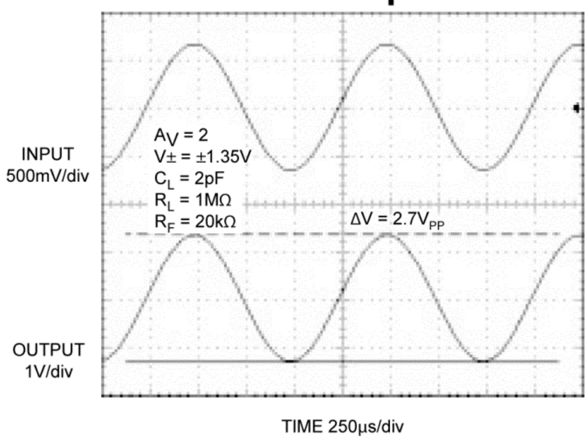
Large Signal Pulse Response



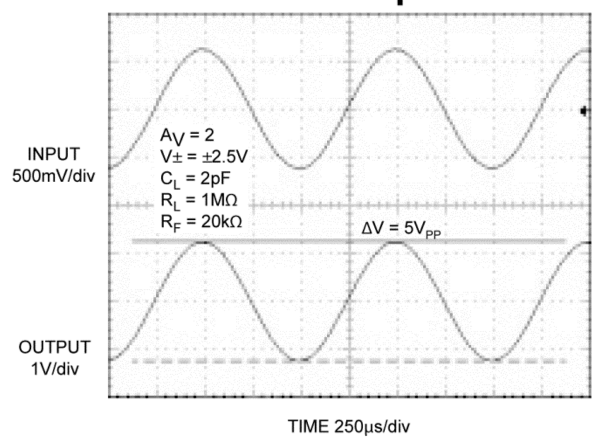
Large Signal Pulse Response



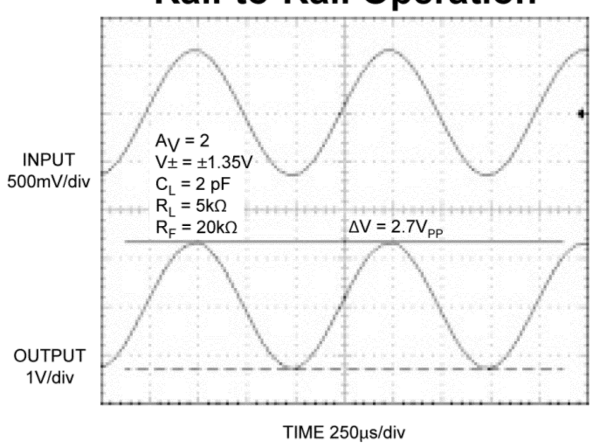
Rail-to-Rail Operation



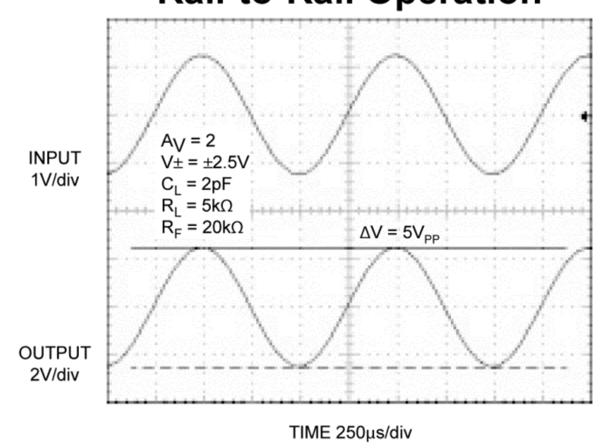
Rail-to-Rail Operation



Rail-to-Rail Operation



Rail-to-Rail Operation



Application Information

Power Supply Bypassing

Regular supply bypassing techniques are recommended. A 10µF capacitor in parallel with a 0.1µF capacitor on both the positive and negative supplies are ideal. For best performance all bypassing capacitors should be located as close to the op amp as possible and all capacitors should be low ESL (equivalent series inductance), ESR (equivalent series resistance). Surface-mount ceramic capacitors are ideal.

Supply and Loading Resistive Considerations

The MIC862 is intended for single-supply applications configured with a grounded load. It is not advisable to operate the MIC862 under either of the following conditions:

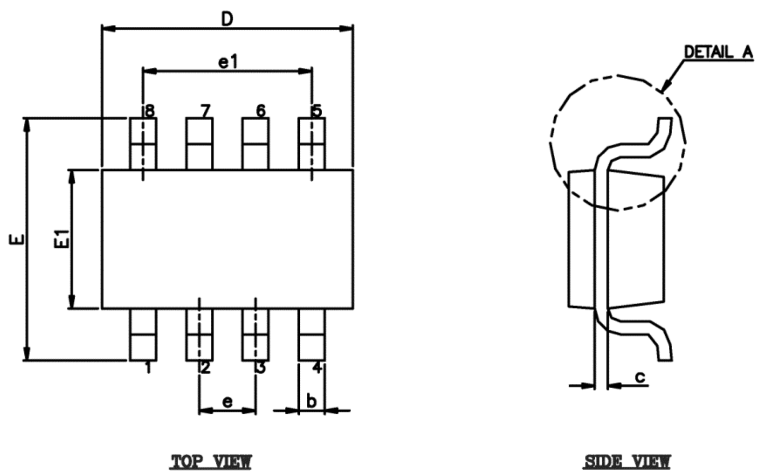
- A grounded load and split supplies (±V)
- A single supply where the load is terminated above ground.

Under the above conditions, if the load is less than 20kΩ and the output swing is greater than 1V (peak), there may be some instability when the output is sinking current.

Capacitive Load

When driving a large capacitive load, a resistor of 500Ω is recommended to be connected between the op amp output and the capacitive load to avoid oscillation.

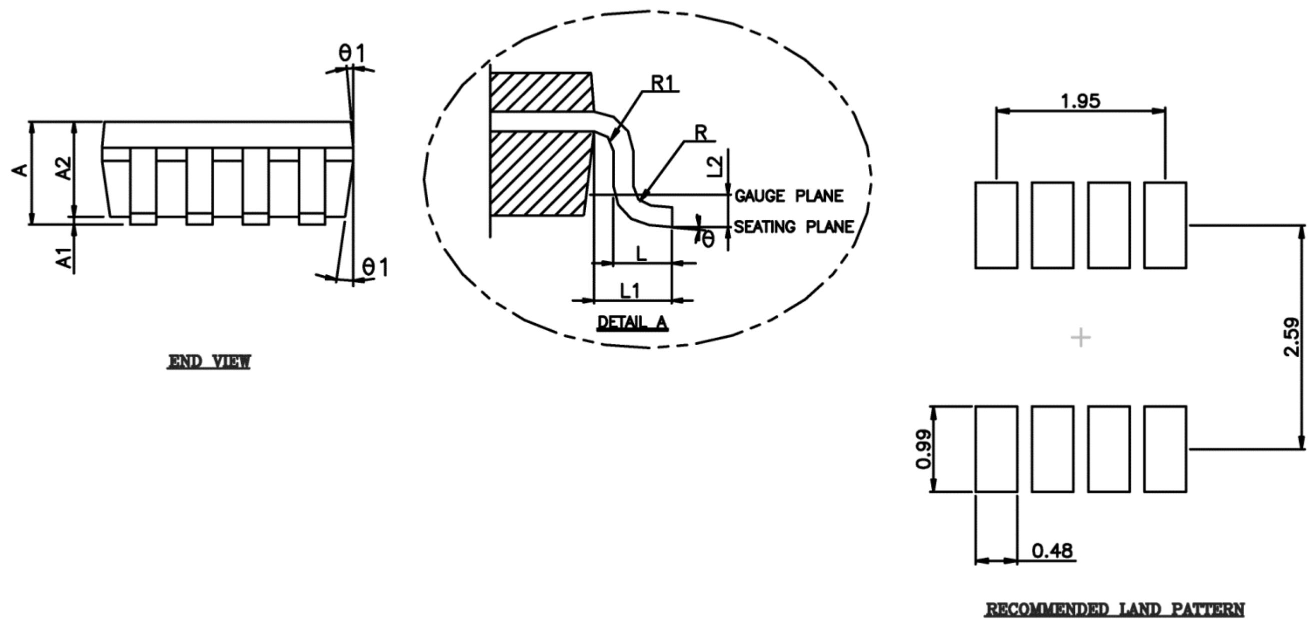
Package Information[7]



VARIATION(ALL DIMENSIONS SHOWN IN MM)

SYMBOL	MIN.	NOM.	MAX.
A	–	–	1.45
A1	0.00	–	0.15
A2	0.90	1.15	1.30
b	0.22	–	0.38
c	0.08	–	0.22
D		2.90 BSC.	
E		2.80 BSC.	
E1		1.60 BSC.	
e		0.65 BSC.	
e1		1.95 BSC.	
L	0.30	0.45	0.60
L1		0.60 REF.	
L2		0.25 BSC.	
R	0.10	–	–
R1	0.10	–	0.25
θ	0°	4°	8°
θ1	5°	10°	15°

NOTE :
1. JEDEC OUTLINE : MO-178 BA.



SOT-23-8 (M8)

Note:

7. Package information is correct as of the publication date. For updates and most current information, go to www.micrel.com.

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