MIC863

Dual Ultra Low Power Op Amp in SOT23-8

Final Information

General Description

The MIC863 is a dual low power operational amplifier in 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 MIC863 provides 450kHz gain-bandwidth product while consuming only a 4.2μA supply current.

With low supply voltage and SOT23-8 packaging, MIC863 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.

Features

- SOT23-8 packaging
- 450kHz gain-bandwidth product
- 800kHz, –3dB bandwidth
- 4.2μA supply current/channel
- Rail-to-rail output
- Ground sensing at input (common mode to GND)
- Drives large capactive loads (0.02μF)
- Unity gain stable

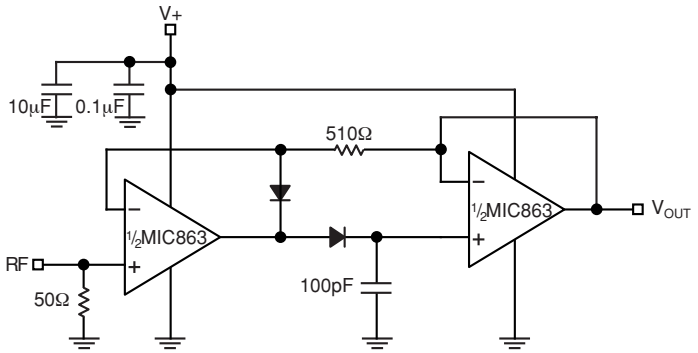
Applications

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

Ordering Information

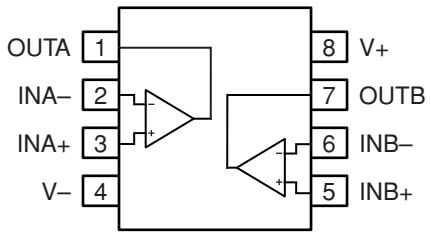
Part Number					
Standard	**Marking**	**Pb-Free**	**Marking**	**Ambient Temp. Range**	**Package**
MIC863BM8	A35	MIC863YM8	A35	–40°C to +85°C	SOT23-8

Typical Application



Peak Detector Circuit for AM Radio

Pin Configuration



SOT23-8 (M8)

Pin Description

Pin Number	Pin Name	Pin Function
1	OUTA	Output: 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	Output: Amplifier B Output
8	V+	Positive Supply

Absolute Maximum Ratings (Note 1)

Supply Voltage (V_{V+} – V–) ..... +6.0V
Differential Input Voltage ($|V_{IN+} – V_{IN–}|$), Note 4 ..... +6.0V
Input Voltage ($V_{IN+} – V_{IN–}$) ..... V_+ + 0.3V, V_- –0.3V
Lead Temperature (soldering, 5 sec.) ..... 260°C
Output Short Circuit Current Duration ..... Indefinite
Storage Temperature (T_S) ..... 150°C
ESD Rating, **Note 3**

Operating Ratings (Note 2)

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

Electrical Characteristics

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

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{OS}	Input Offset Voltage		**–6** –5	0.1	**6** 5	mV
	Differential Offset Voltage			0.5		mV
	Input Offset Voltage Temp Coefficient			6		μV/°C
I_B	Input Bias Current			10		pA
I_{OS}	Input Offset Current			5		pA
V_{CM}	Input Voltage Range	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**	85		dB
A_{VOL}	Large-Signal Voltage Gain	R_L = 100kΩ, V_{OUT} 1.4V_{PP}	**66**	81		dB
		R_L = 500kΩ, V_{OUT} 1.4V_{PP}	**73**	90		dB
V_{OUT}	Maximum Output Voltage Swing	R_L = 500kΩ	**V+–3mV**	V+–1.4mV		V
V_{OUT}	Minimum Output Voltage Swing	R_L = 500kΩ		V–+0.5mV	**V–+ 3mV**	V
GBW	Gain-Bandwidth Product	R_L = 200kΩ, C_L = 2pF, Av = 11		320		kHz
PM	Phase Margin	R_L = 200kΩ, C_L = 2pF, Av = 11		69		°
BW	–3dB Bandwidth	A_V = 1, C_L = 2pF, R_L = 1MΩ		600		kHz
SR	Slew Rate	A_V = 1, C_L = 2pF, R_L = 1MΩ, Positive Slew Rate = 0.17V/μs		0.33		V/μs
I_{SC}	Short-Circuit Output Current	Source	**1.8**	2.6		mA
		Sink	**1.5**	2.2		mA
I_S	Supply Current (per Op Amp)	No Load		3.5	**7**	μA
	Channel to Channel Crosstalk	**Note 5**		-100		dB

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

V_{OS}	Input Offset Voltage		**–6** –5	0.1	**6** 5	mV
	Differential Offset Voltage			0.5		mV
	Input Offset Voltage Temp Coefficient			6		μV/°C
I_B	Input Bias Current			10		pA
I_{OS}	Input Offset Current			5		pA
V_{CM}	Input Voltage Range	CMRR > 60dB	**1**	1.8		V
CMRR	Common-Mode Rejection Ratio	0 < V_{CM} < 1.35V	**60**	83		dB
PSRR	Power Supply Rejection Ratio	Supply voltage change from 2.7V to 3V	**55**	85		dB
A_{VOL}	Large-Signal Voltage Gain	R_L = 100k, V_{OUT} 2V_{PP}	**70**	83		dB
		R_L = 500k, V_{OUT} 2V_{PP}	**78**	91		dB

Symbol	Parameter	Condition	Min	Typ	Max	Units
GBW	Gain-Bandwidth Product	R_L = 200kΩ, C_L = 2pF, Av = 11		350		kHz
PM	Phase Margin	R_L = 200kΩ, C_L = 2pF, Av = 11		65		°
BW	–3dB Bandwidth	A_V = 1, C_L = 2pF, R_L = 1MΩ		600		kHz
SR	Slew Rate	A_V = 1, C_L = 2pF, R_L = 1MΩ Positive Slew Rate = 0.17V/μs		0.35		V/μs
I_{SC}	Short-Circuit Output Current	Source	**4.5**	6.3		mA
		Sink	**4.5**	6.2		mA
I_S	Supply Current (per Op Amp)	No Load		3.6	**7**	μA
	Channel to Channel Crosstalk	**Note 5**		–120		dB

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

V_{OS}	Input Offset Voltage		**–6** –5	0.1	**6** 5	mV
	Differential Offset Voltage			0.5		mV
	Input Offset Voltage Temp 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**	85		dB
PSRR	Power Supply Rejection Ratio	Supply voltage change from 3V to 5V	**60**	86		dB
A_{VOL}	Large-Signal Voltage Gain	R_L = 100kΩ, V_{OUT} 4.0V_{PP}	**73**	81		dB
		R_L = 500kΩ, V_{OUT} 4.0V_{PP}	**78**	88		dB
V_{OUT}	Maximum Output Voltage Swing	R_L = 500kΩ	**V+–3mV**	V+–1.3mV		V
V_{OUT}	Minimum Output Voltage Swing	R_L = 500kΩ		V–+0.7mV	**V–+3mV**	V
GBW	Gain-Bandwidth Product	R_L = 200kΩ, C_L = 2pF, Av = 11		450		kHz
PM	Phase Margin			63		°
BW	–3dB Bandwidth	A_V = 1, C_L = 2pF, R_L = 1MΩ		800		kHz
SR	Slew Rate	A_V = 1, C_L = 2pF, R_L = 1MΩ Positive Slew Rate = 0.2V/μs		0.35		V/μs
I_{SC}	Short-Circuit Output Current	Source	**17**	23		mA
		Sink	**18**	27		mA
I_S	Supply Current (per Op Amp)	No Load		4.2	**8**	μA
	Channel to Channel Crosstalk	**Note 5**		–120		dB

Note 1. Exceeding the absolute maximum rating may damage the device.

Note 2. The device is not guaranteed to function outside its operating rating.

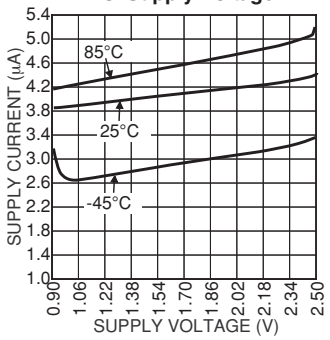
Note 3. Devices are ESD sensitive. Handling precautions recommended. Human body model, 1.5k in series with 100pF. Pin 4 is ESD sensitive

Note 4. Exceeding the maximum differential input voltage will damage the input stage and degrade performance (in particular, input bias current is likely to increase.

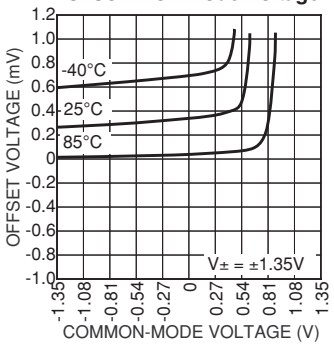
Note 5. DC signal referenced to input. Refer to Typical Characteristics graphs for AC performance.

DC Performance Characteristics

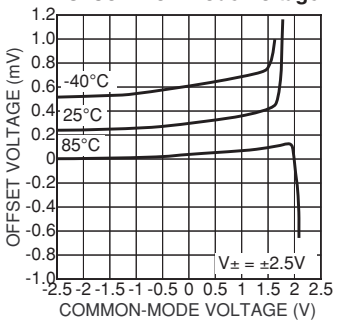
Supply Current vs. Supply Voltage



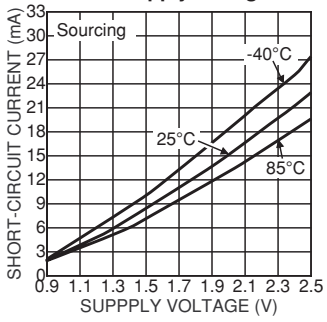
Offset Voltage vs. Common-Mode Voltage



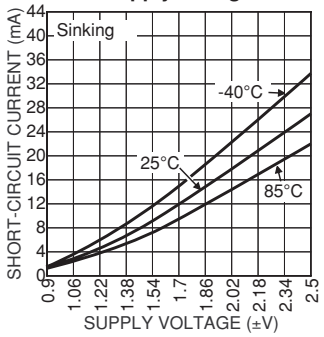
Offset Voltage vs. Common-Mode Voltage



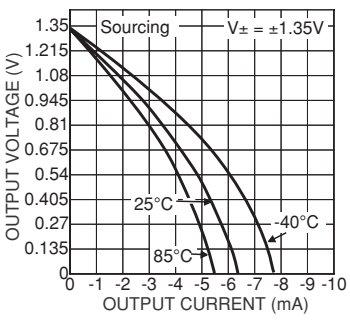
Short Circuit Current vs. Supply Voltage



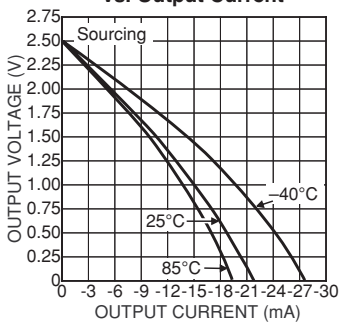
Short Circuit Current vs. Supply Voltage



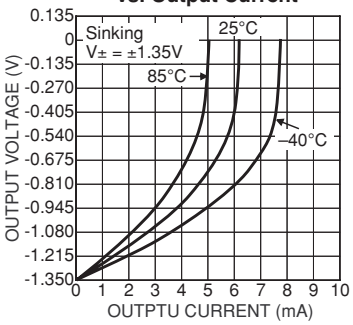
Output Voltage vs. Output Current



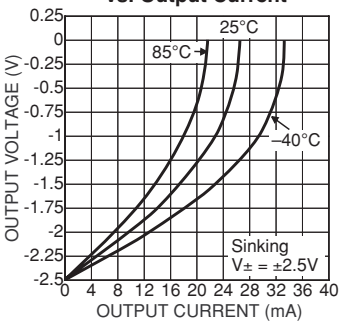
Output Voltage vs. Output Current



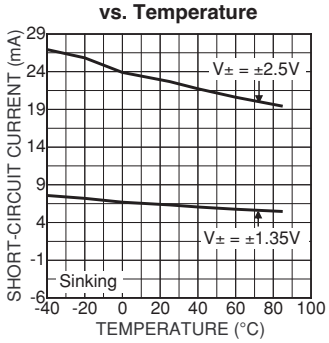
Output Voltage vs. Output Current



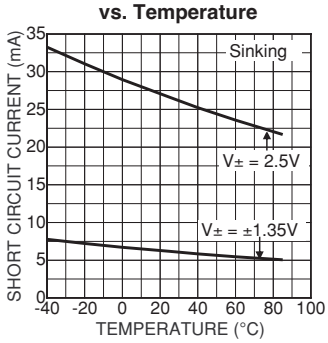
Output Voltage vs. Output Current



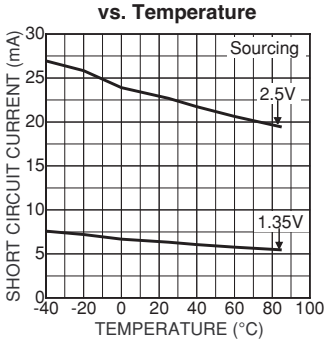
Short Circuit Current vs. Temperature



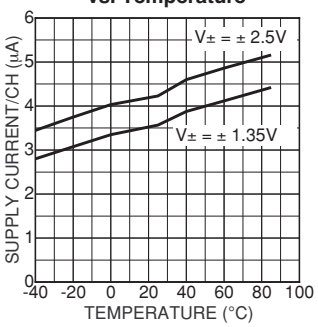
Short Circuit Current vs. Temperature



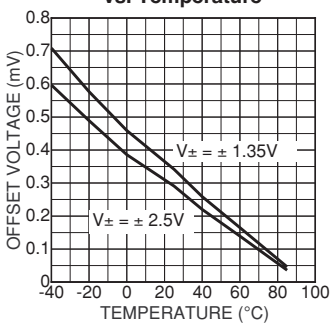
Short Circuit Current vs. Temperature



Supply Current per Channel vs. Temperature

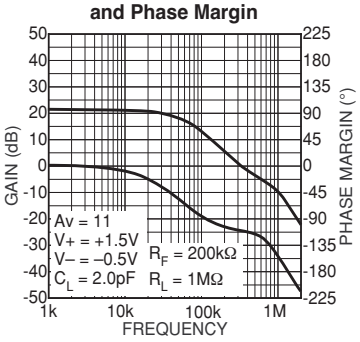


Offset Voltage vs. Temperature

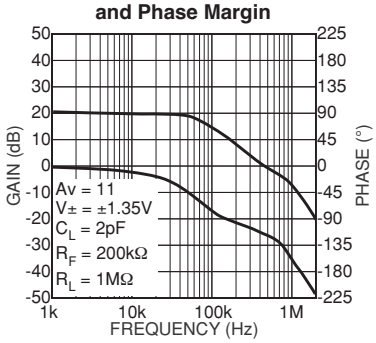


AC Perfomance Characteristics

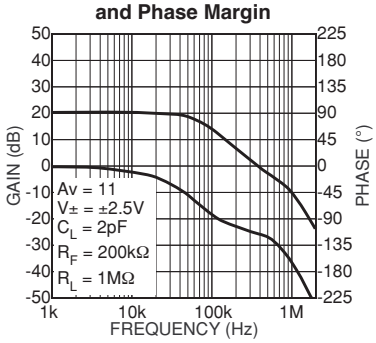
Gain Bandwidth and Phase Margin



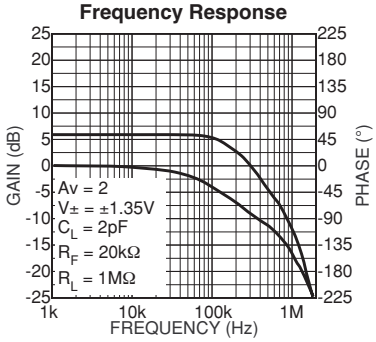
Gain Bandwidth and Phase Margin



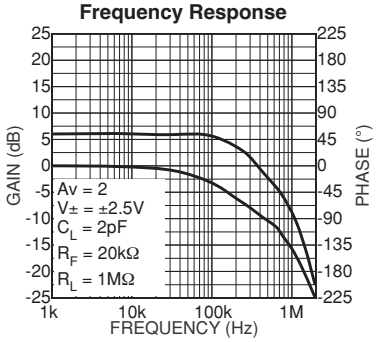
Gain Bandwidth and Phase Margin



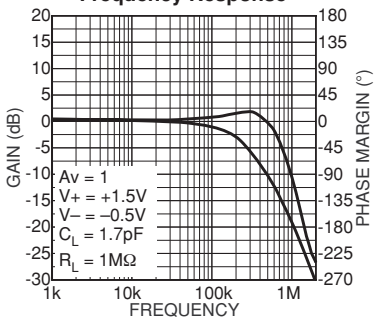
Gain Bandwidth Frequency Response



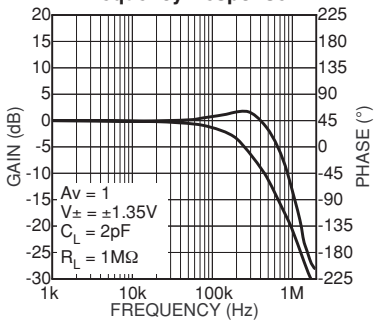
Gain Bandwidth Frequency Response



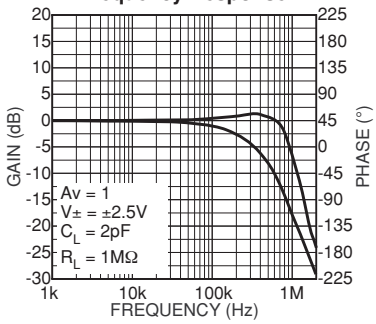
Unity Bandwidth Frequency Response

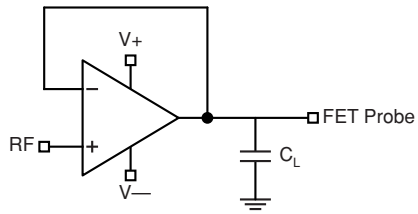


Unity Gain Frequency Response

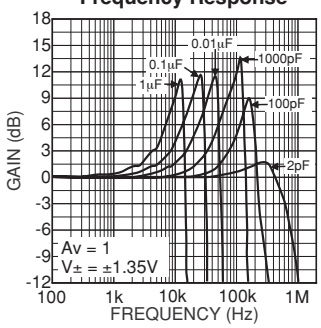


Unity Gain Frequency Response

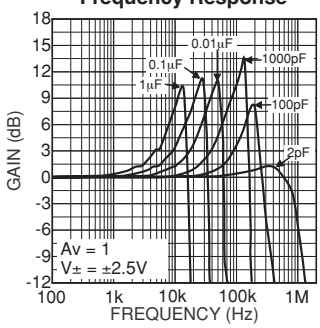




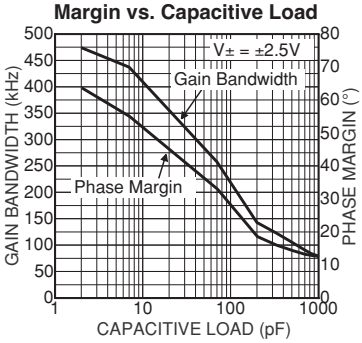
Close Loop Unity Gain Frequency Response



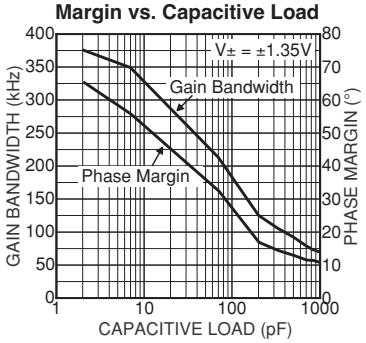
Close Loop Unity Gain Frequency Response

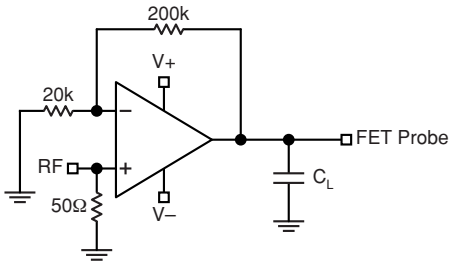


Gain Bandwidth and Phase Margin vs. Capacitive Load

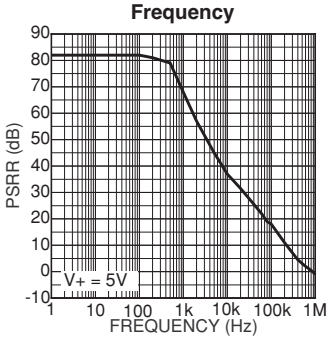


Gain Bandwidth and Phase Margin vs. Capacitive Load

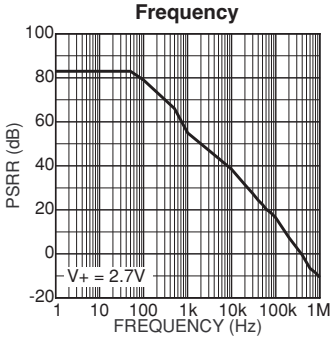




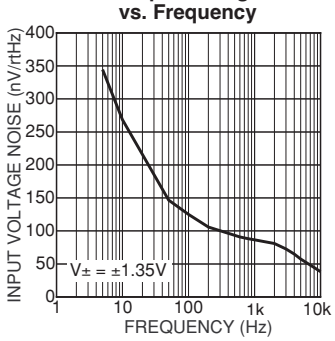
PSRR vs. Frequency



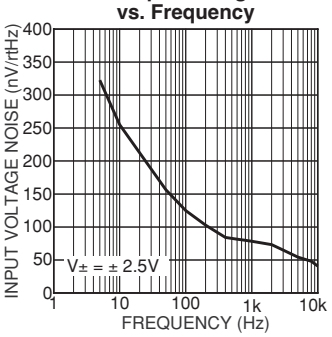
PSRR vs. Frequency



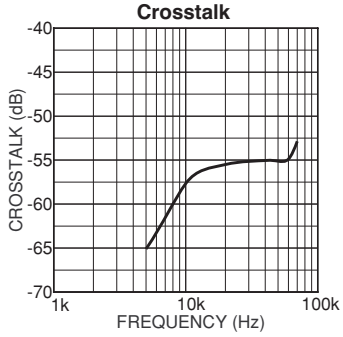
MIC863 Input Voltage Noise vs. Frequency



MIC863 Input Voltage Noise vs. Frequency

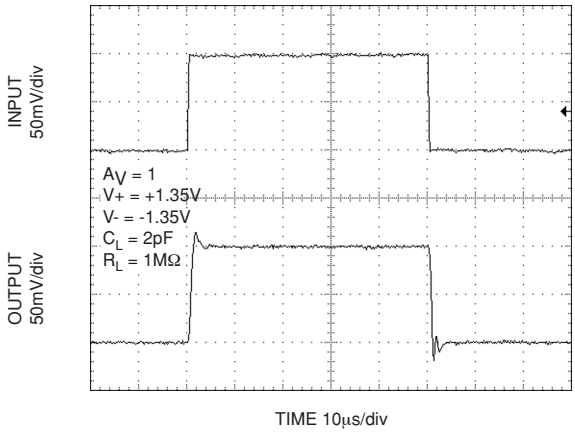


Channel-to-Channel Crosstalk



Functional Characteristics

Small Signal Pulse Response
Test Circuit 3: $A_V = 1$



Small Signal Pulse Response
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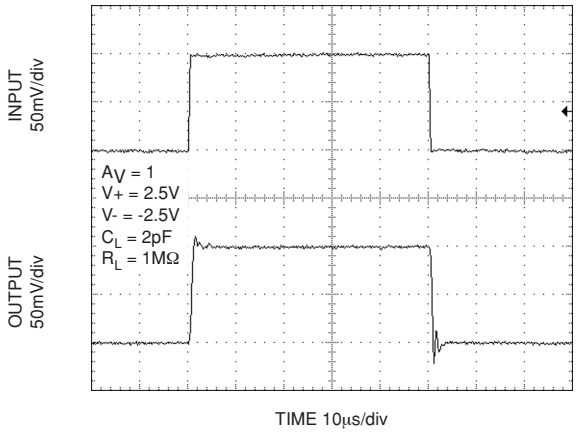
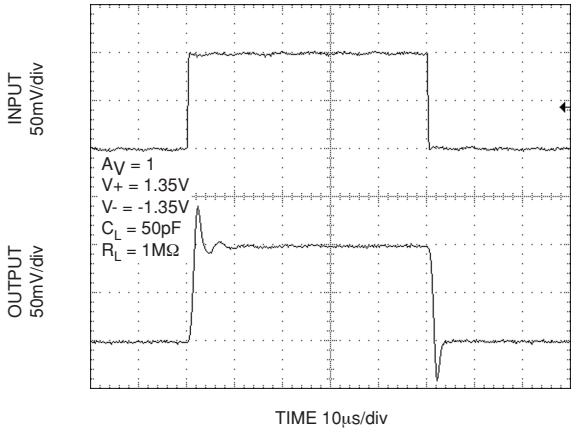
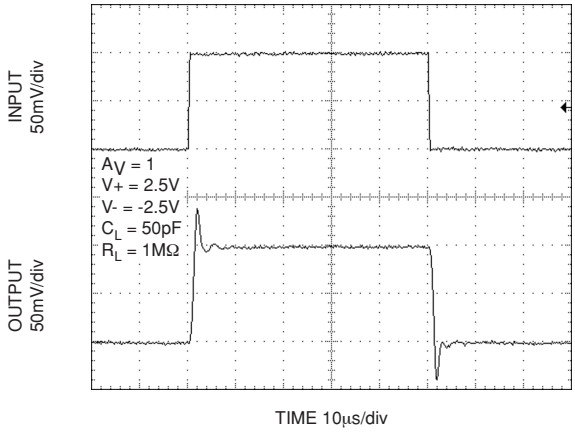


Small Signal Pulse Response
Test Circuit 3: $A_V = 1$



Small Signal Pulse Response
Test Circuit 3: $A_V = 1$



Small Signal Pulse Response
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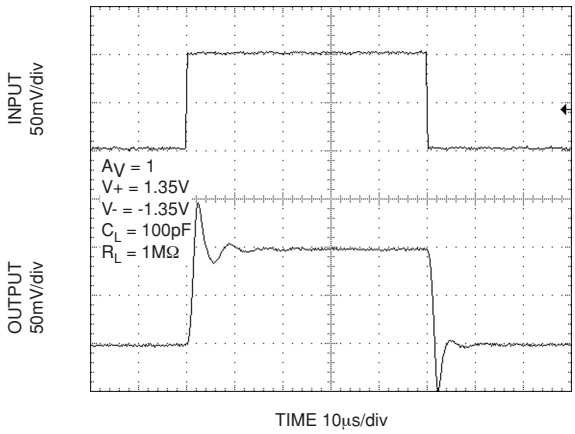

Small Signal Pulse Response
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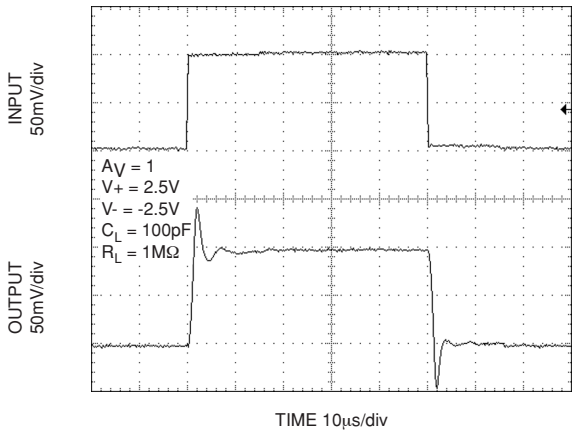
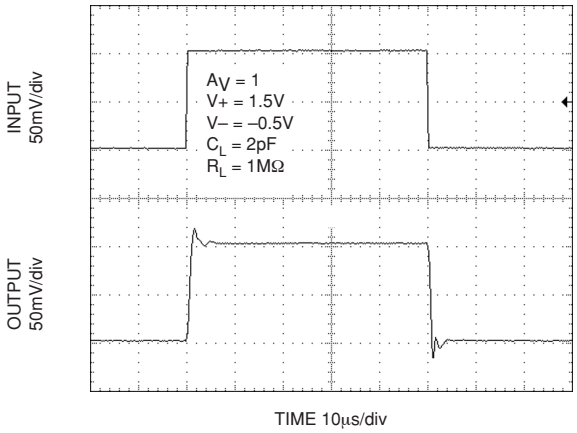
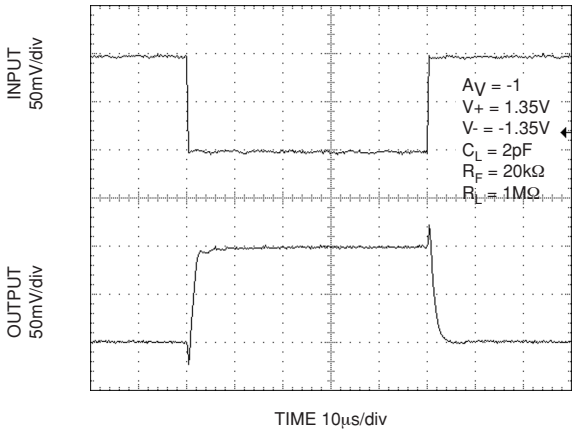


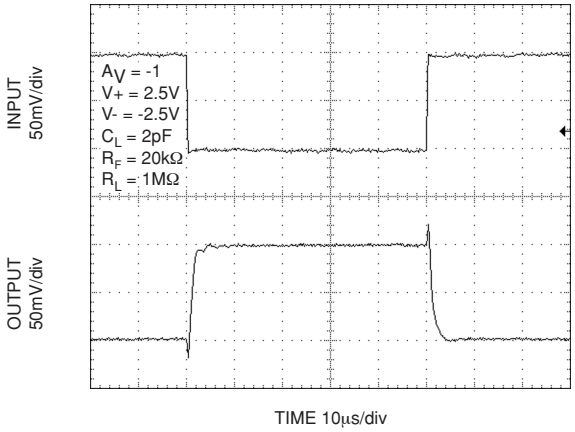
Small Signal Pulse Response
Test Circuit 3: Av = 1



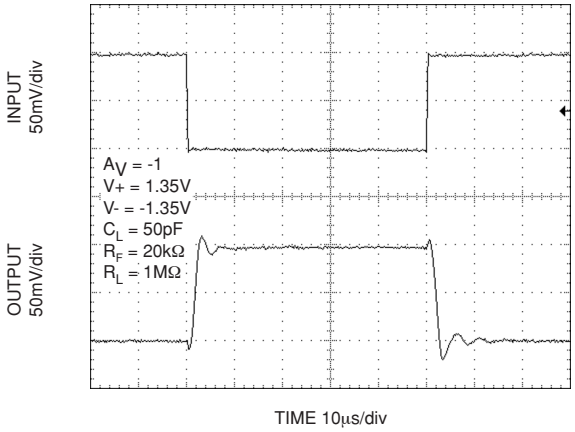
Small Signal Pulse Response
Test Circuit 4: A_V = -1



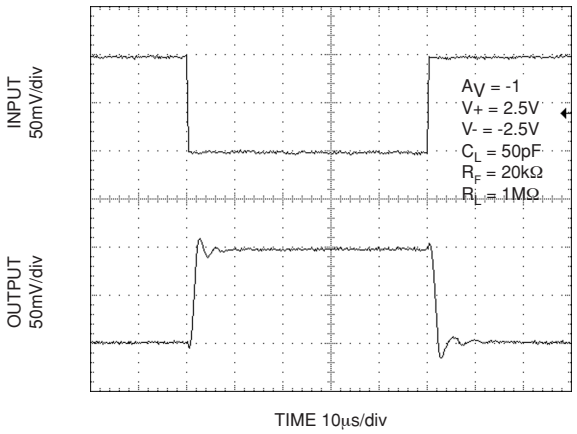
Small Signal Pulse Response
Test Circuit 4: A_V = -1



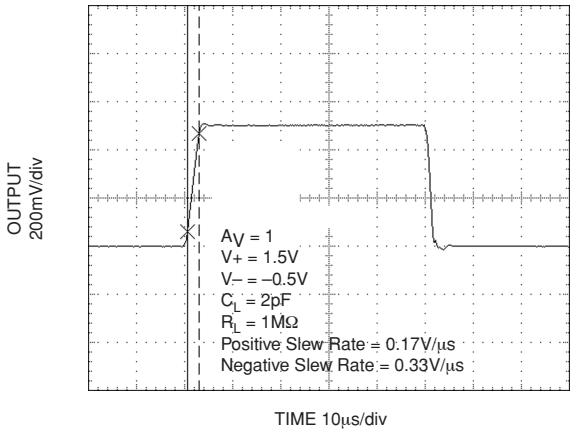
Small Signal Pulse Response
Test Circuit 4: A_V = -1



Small Signal Pulse Response
Test Circuit 4: A_V = -1



Large Signal Pulse Response
Test Circuit 3: Av = 1



Large Signal Pulse Response
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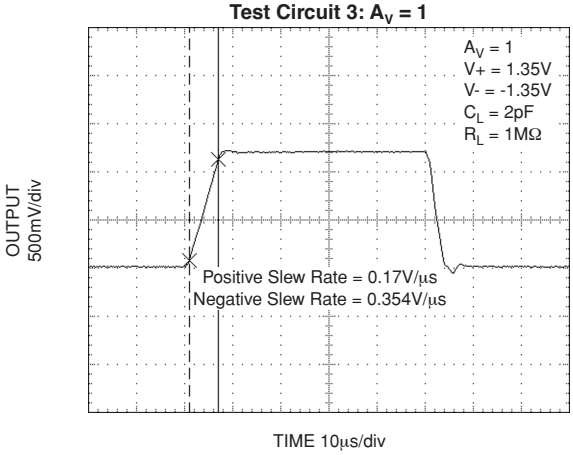

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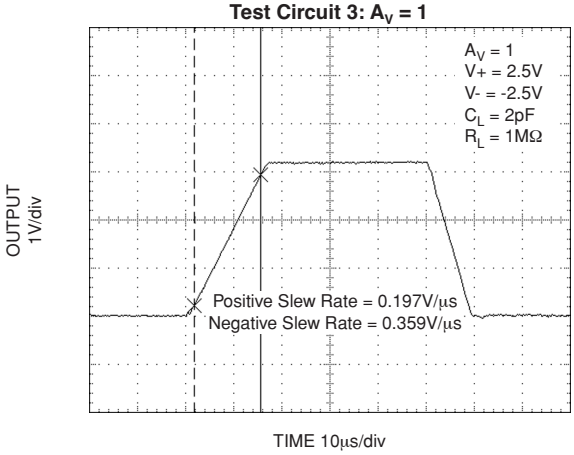

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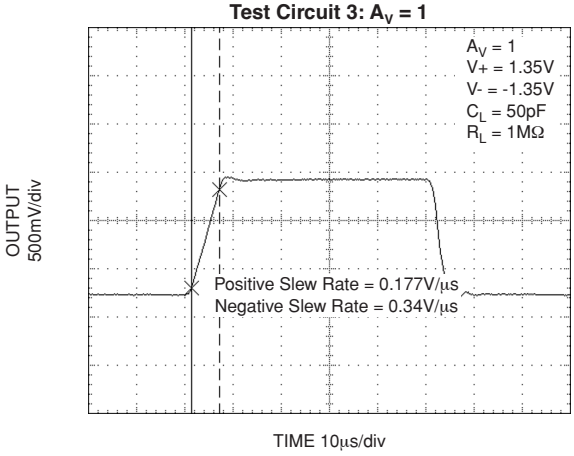

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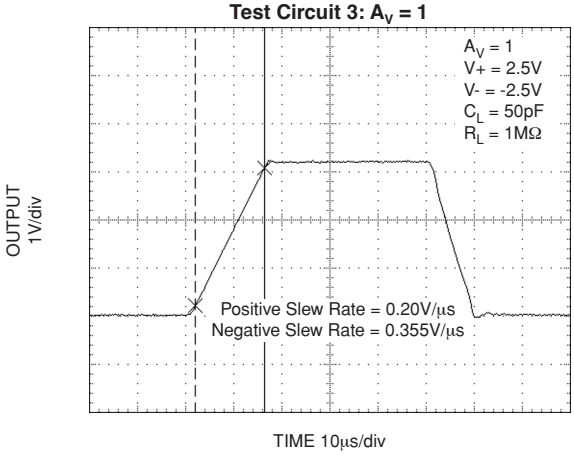

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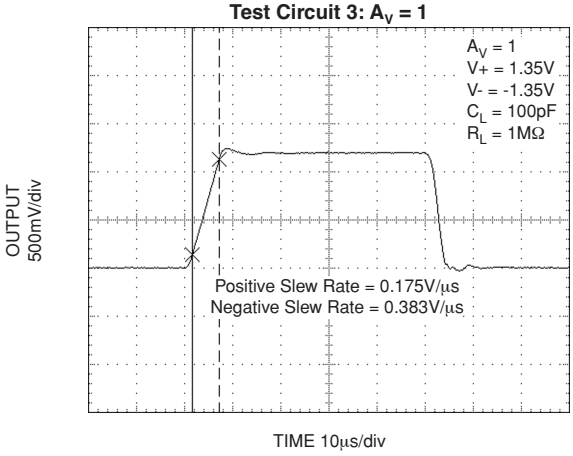

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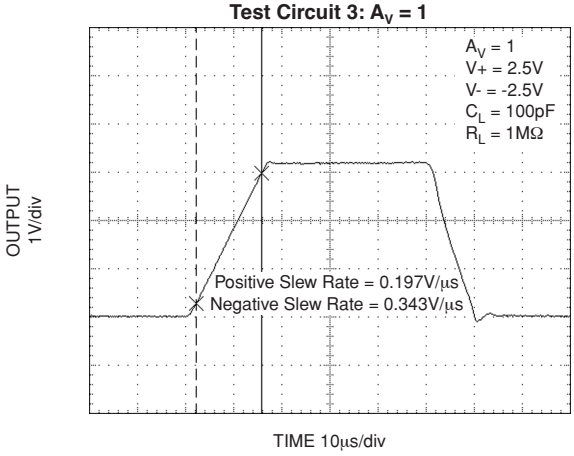
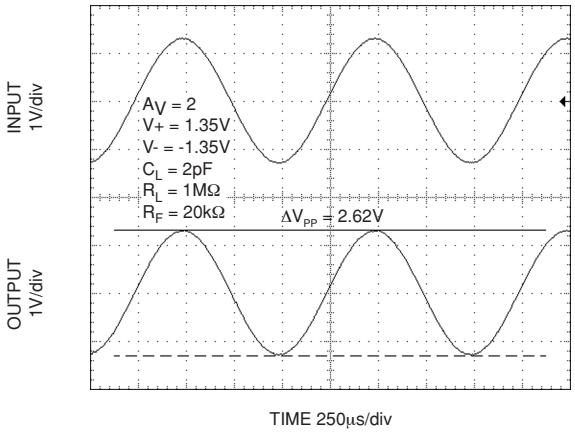
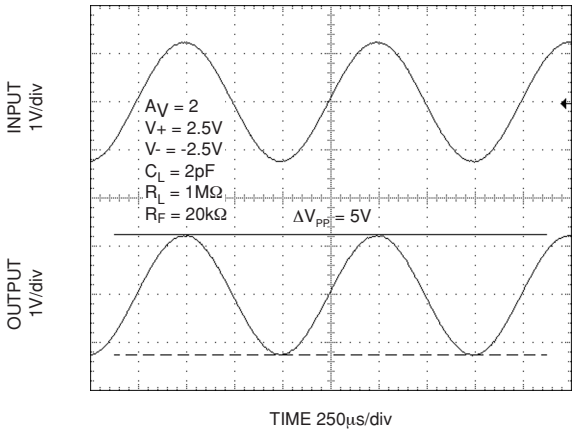


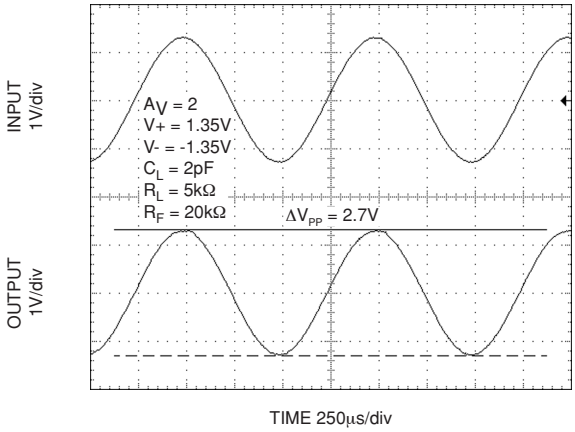
Rail-to-Rail Output Operation



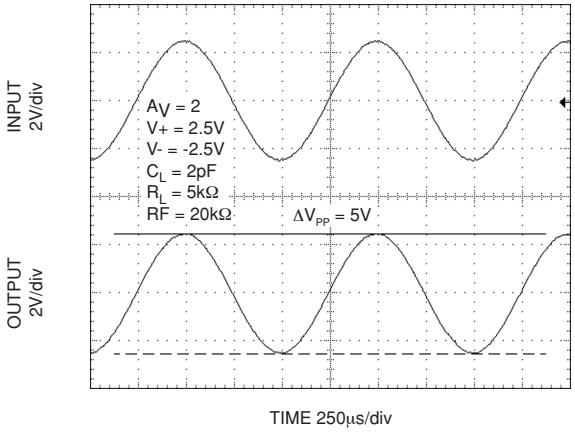
Rail-to-Rail Output Operation



Rail-to-Rail Output Operation



Rail-to-Rail Output Operation



Applications 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

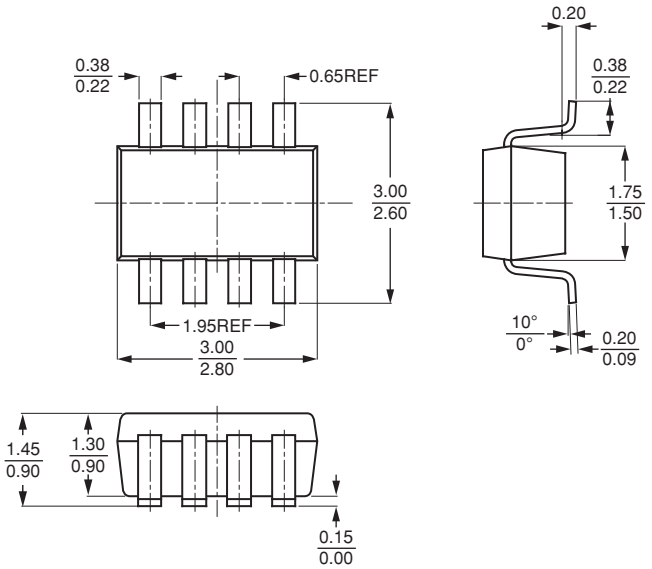
The MIC863 is intended for single supply applications configured with a grounded load. It is not advisable to operate the MIC863 under either of the following conditions when the load is less than 20kΩ and the output swing is greater than 1V(peak-to-peak):

1). A grounded load and split supplies (±V) or

2). A single supply where the load is terminated above ground.

Under the above conditions, there may be some instability when the output is sinking current.

Package Information



SOT23-8 (M8)

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