MP8104

Ultra Low Power 1.8V, 400KHz Op Amp With Industry Standard Pin-Out

The Future of Analog IC Technology®

DESCRIPTION

The MP8104 is a rail-to-rail output, operational amplifier in a TSOT-23 package with Industry standard pin-out. This amplifier provides 400KHz bandwidth while consuming an incredibly low 11µA of supply current. The MP8104 can operate with a single supply voltage as low as 1.8V.

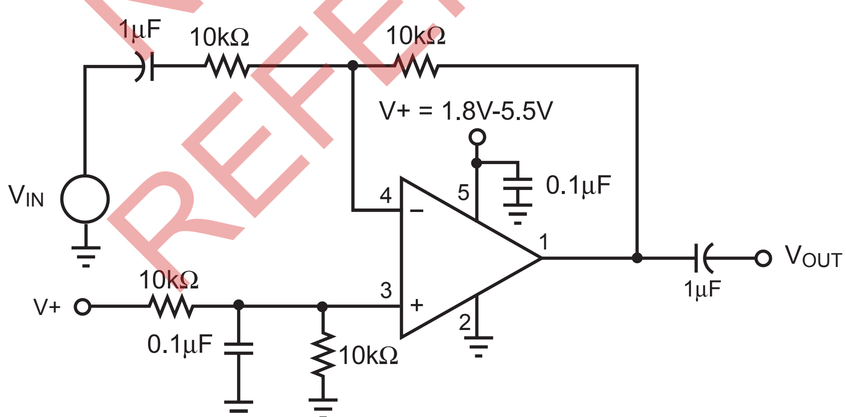
FEATURES

- Single Supply Operation: 1.8V to 5.5V
- TSOT23-5 Package
- 400KHz Gain Bandwidth
- 11µA Supply Current
- Rail-to-Rail Output
- Unity-Gain Stable
- Input Common Mode to Ground
- Drives Up to 1000pF of Capacitive Loads

APPLICATIONS

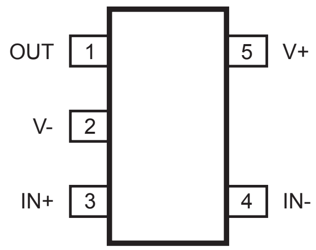
- Portable Equipment
- PDAs
- Pagers
- Cordless Phones
- Handheld GPS
- Consumer Electronics

TYPICAL APPLICATION



PACKAGE REFERENCE

TOP VIEW



Part Number*	Package	Temperature
MP8104DJ	TSOT23-5	–40°C to +85°C

* For Tape & Reel, add suffix –Z (eg. MP8104DJ–Z)
For Lead Free, add suffix –LF (eg. MP8104DJ–LF–Z)

ABSOLUTE MAXIMUM RATINGS [(1)]

Supply Voltage (V+ to V-) .... +6.0V
Differential Input Voltage (V_{IN+} – $V_{IN–}$) .... +6.0V
Input Voltage (V_{IN+} – $V_{IN–}$).. V_{IN+} + 0.3V, $V_{IN–}$ – 0.3V

Recommended Operating Conditions [(2)]

Supply Voltage .... +1.8V to +5.5V
Operating Temperature ....–40°C to +85°C

Thermal Resistance [(3)] θ_{JA} θ_{JC}

TSOT23-5 .... 220 .... 110.. °C/W

Notes:
1) Exceeding these ratings may damage the device.
2) The device is not guaranteed to function outside of its operating conditions.
3) Measured on approximately 1" square of 1 oz copper.

ELECTRICAL CHARACTERISTICS

V+ = +5V, V- = 0V, V_{CM} = V+/2, R_L = 10kΩ, T_A = +25°C, unless otherwise noted.

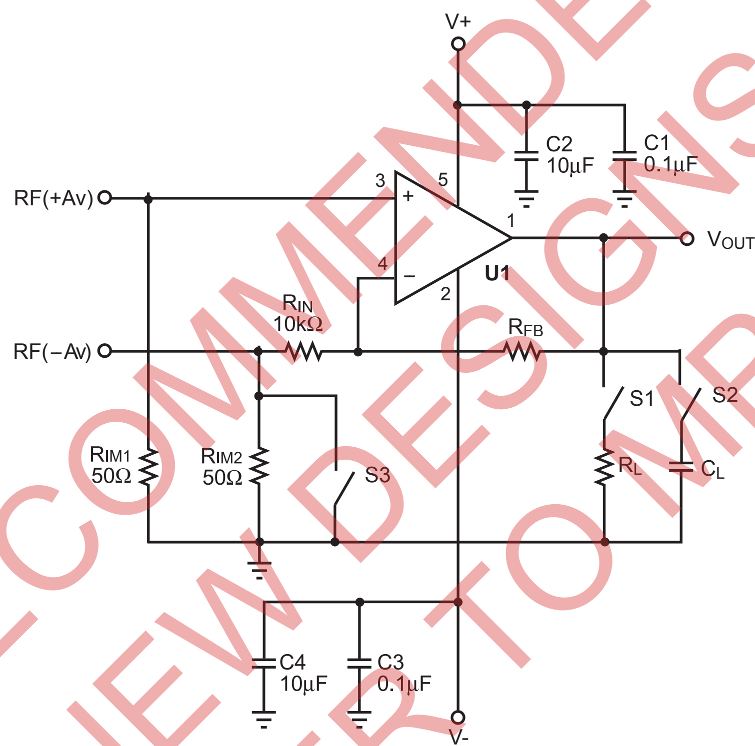
Parameter	Symbol	Condition	Min	Typ	Max	Units
Input Offset Voltage	V_{OS}		–5	1	+5	mV
Input Offset Voltage Temp Coefficient				15		µV/°C
Input Bias Current [(4)]	I_B			2		pA
Input Offset Current [(4)]	I_{OS}			0.2		pA
Input Voltage Range	V_{CM}	CMRR > 60dB	0		3.8	V
Common-Mode Rejection Ratio	CMRR	0 < V_{CM} < 3.5V		82		dB
Power Supply Rejection Ratio	PSRR	Supply Voltage change of 1.0V		80		dB
Large Signal Voltage Gain	A_{VOL}	R_L = 100kΩ, V_{OUT} = 5.0 Peak to Peak	60	88		dB
Maximum Output Voltage Swing	V_{OUT}	R_L = 10kΩ		(V+) – 23mV		V
Minimum Output Voltage Swing	V_{OUT}	R_L = 10kΩ		(V–) + 19mV		V
Gain-Bandwidth Product [(4)]	GBW	R_L = 200kΩ,C_L = 2pF, V_{OUT} = 0		400		KHz
–3dB Bandwidth [(4)]	BW	A_V = 1, C_L = 2pF, R_L = 1MΩ		1		MHz
Slew Rate [(4)]	SR	A_V = 1, C_L = 2pF, R_L = 1MΩ		0.2		V/µs
Short Circuit Current	I_{SC}	Source		20		mA
		Sink		20		mA
Supply Current		No Load		11	20	µA

Note:
4) Guaranteed by design.

PIN FUNCTIONS

Pin #	Name	Description
1	OUT	Output.
2	V-	Ground or Supply Return Pin.
3	IN+	Non-Inverting Input.
4	IN-	Inverting Input.
5	V+	Supply Voltage.

TEST CIRCUITS



Notes: Close S3 for positive gain. Input signal to RF(+Av) connector.
The gain $Av = 1 + R_{FB}/R_{IN}$.
For unity gain, remove R_{IN} and short R_{FB}.
Open S3 for negative gain. Input signal to RF(-Av) connector.
The gain $Av = -R_{FB}/R_{IN}$.
S1 and S2 are switches for possible resistor and capacitor load connections.

Figure 1—AC Test Circuit

TEST CIRCUITS *(continued)*

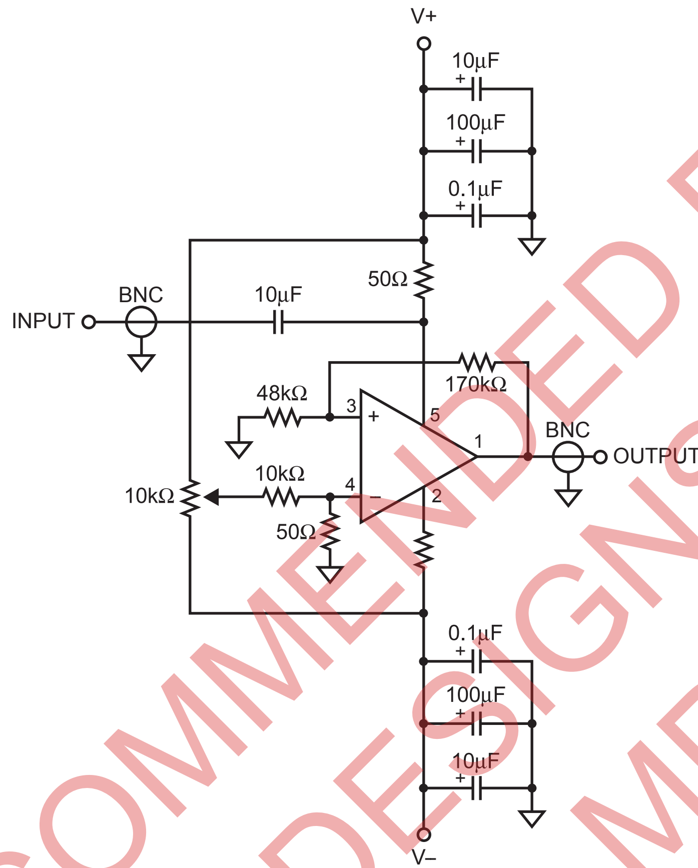
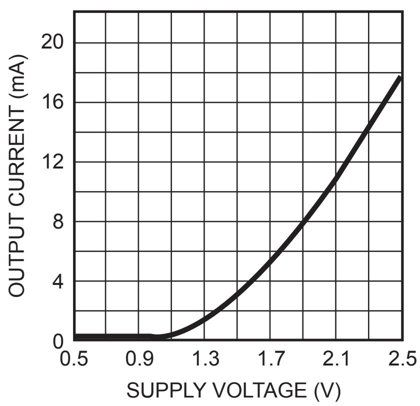


Figure 2—Positive Power Supply Rejection Ratio Measurement

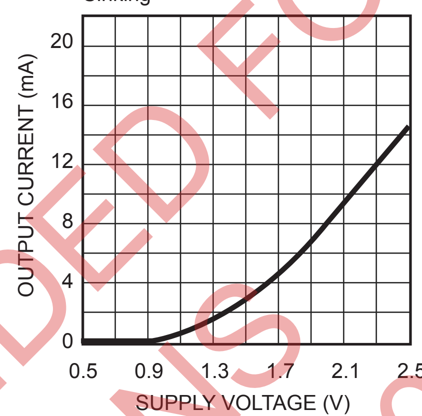
TYPICAL PERFORMANCE CHARACTERISTICS

T_A = +25°C, unless otherwise noted.

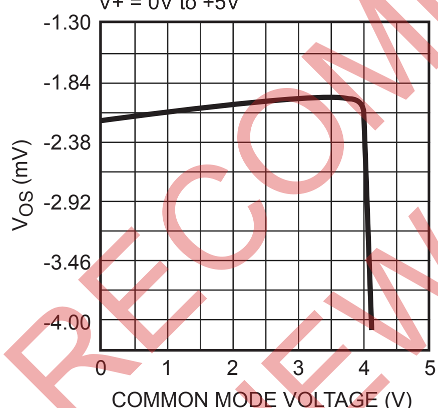
Short Circuit Current vs Supply Voltage
Sourcing



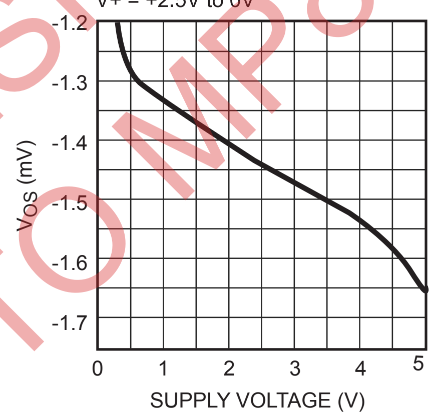
Short Circuit Current vs Supply Voltage
Sinking



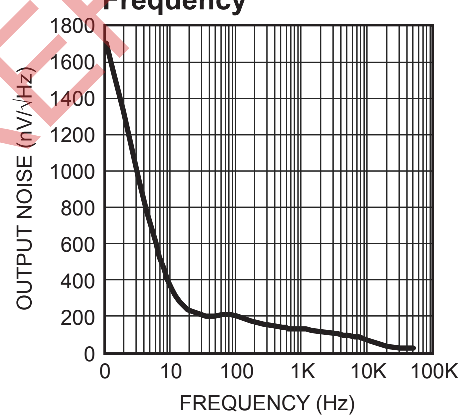
Offset Voltage vs. Common Mode Voltage
R_{FB} = 50kΩ, V- = -5V to 0V,
V+ = 0V to +5V



Offset Voltage vs. Supply Voltage
R_{FB} = 50kΩ, V- = -2.5V to 0V,
V+ = +2.5V to 0V



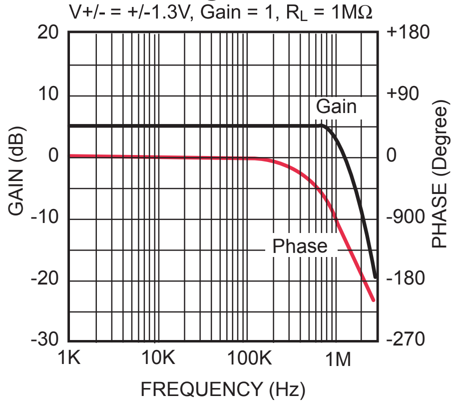
Output Noise vs. Frequency



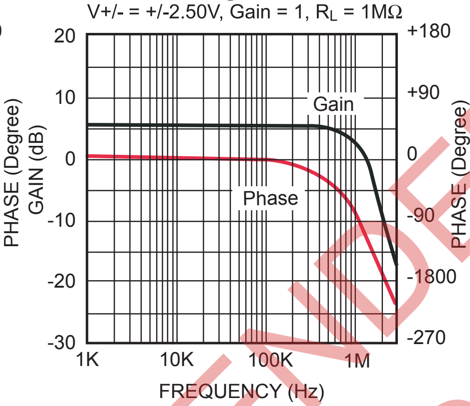
TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

T_A = +25°C, unless otherwise noted.

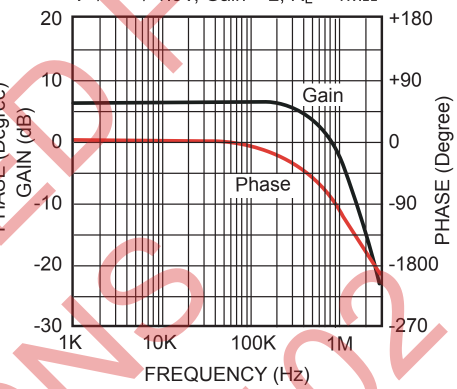
Gain Bandwidth and Phase Margin
V+/- = +/-1.3V, Gain = 1, R_L = 1MΩ



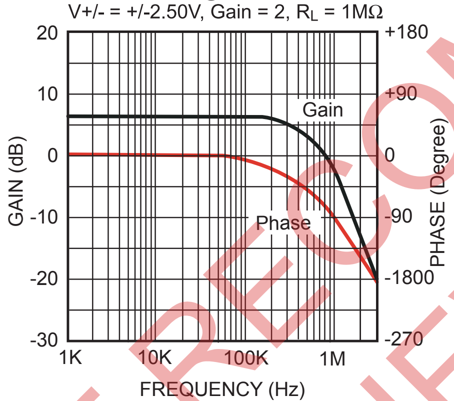
Gain Bandwidth and Phase Margin
V+/- = +/-2.50V, Gain = 1, R_L = 1MΩ



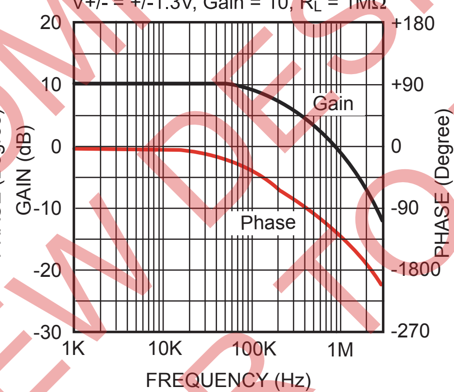
Gain Bandwidth and Phase Margin
V+/- = +/-1.3V, Gain = 2, R_L = 1MΩ



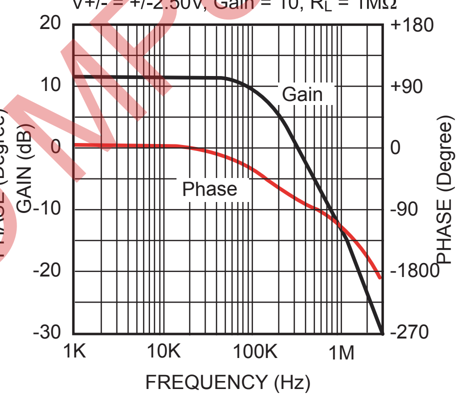
Gain Bandwidth and Phase Margin
V+/- = +/-2.50V, Gain = 2, R_L = 1MΩ



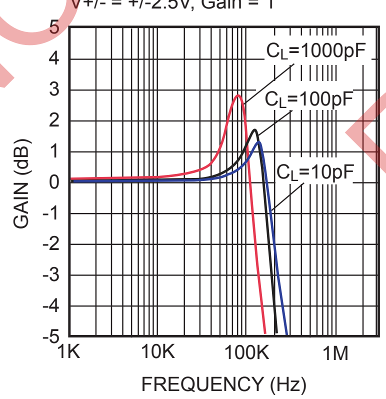
Gain Bandwidth and Phase Margin
V+/- = +/-1.3V, Gain = 10, R_L = 1MΩ



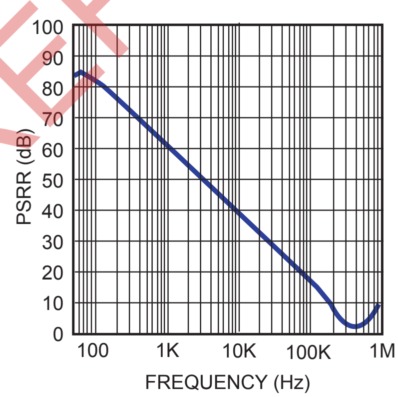
Gain Bandwidth and Phase Margin
V+/- = +/-2.50V, Gain = 10, R_L = 1MΩ



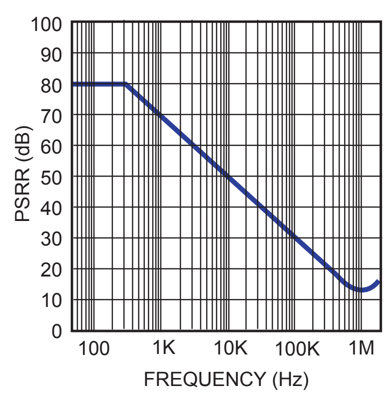
Close-Loop Unity Gain Frequency Response
V+/- = +/-2.5V, Gain = 1



PSRR vs. Frequency
V- = -2.5V, V+ = 2.5V



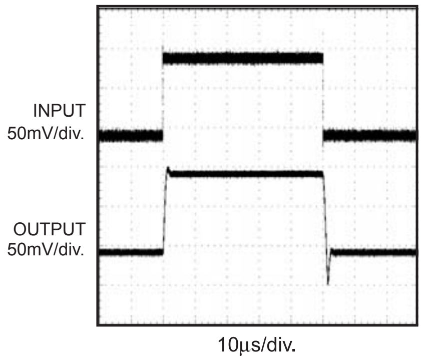
CMRR vs. Frequency
V- = -2.5V, V+ = 2.5V



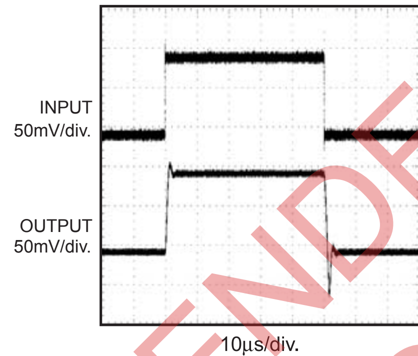
TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

T_A = +25°C, unless otherwise noted.

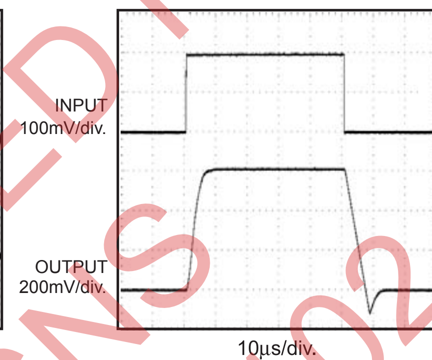
Small Signal Pulse Response
A_V = 1, V+ = 2.5V, V- = -2.5V
R_L = 1MΩ, C_L = 8pF



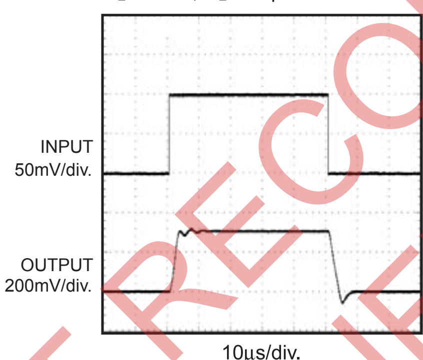
Small Signal Pulse Response
A_V = 1, V+ = 1.3V, V- = -1.3V
R_L = 1MΩ, C_L = 8pF



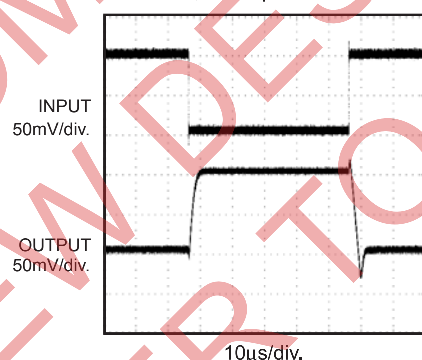
Small Signal Pulse Response
A_V = 1, V+ = 2.5V, V- = -2.5V
R_L = 1MΩ, C_L = 47pF



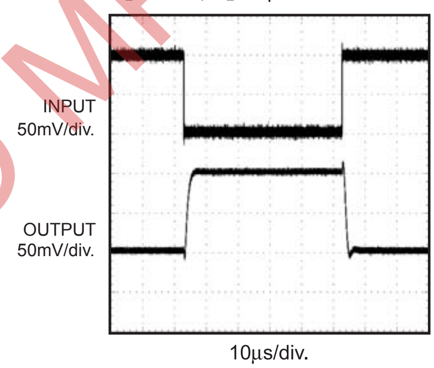
Small Signal Pulse Response
A_V = 1, V+ = 1.3V, V- = -1.3V
R_L = 1MΩ, C_L = 47pF



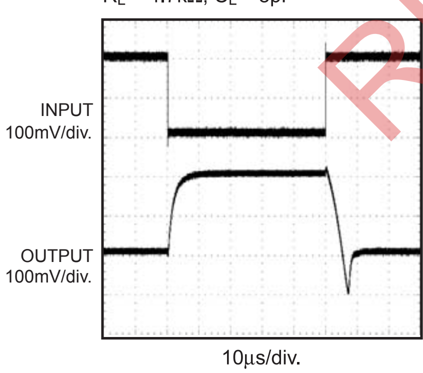
Small Signal Pulse Response
A_V = -1, V+ = 2.5V, V- = -2.5V
R_L = 1MΩ, C_L = 8pF



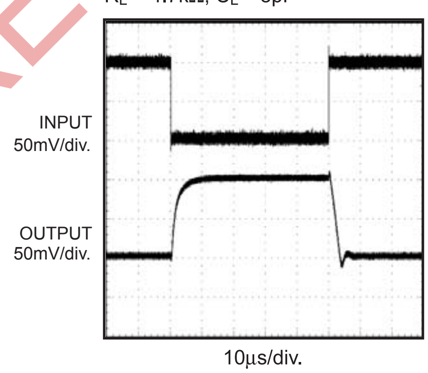
Small Signal Pulse Response
A_V = -1, V+ = 1.3V, V- = -1.3V
R_L = 1MΩ, C_L = 8pF



Small Signal Pulse Response
A_V = -1, V+ = 2.5V, V- = -2.5V
R_L = 4.7kΩ, C_L = 8pF



Small Signal Pulse Response
A_V = -1, V+ = 1.3V, V- = -1.3V
R_L = 4.7kΩ, C_L = 8pF

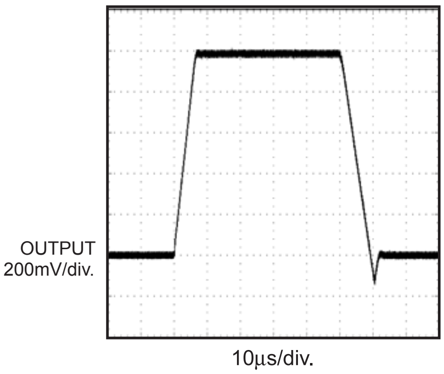


TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

T_A = +25°C, unless otherwise noted.

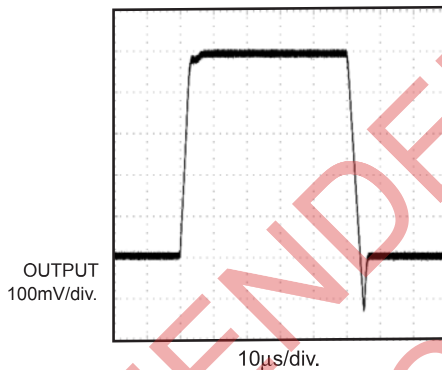
Large Signal Pulse Response

A_V = 1, V+ = 2.5V, V- = -2.5V
R_L = 1MΩ, C_L = 8pF



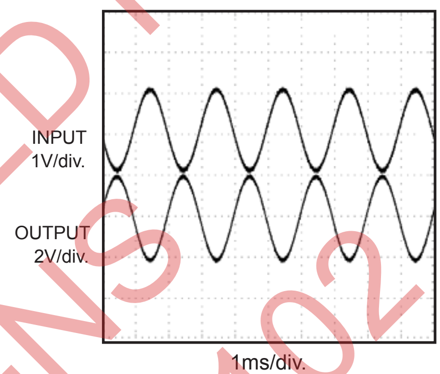
Large Signal Pulse Response

A_V = 1, V+ = 1.3V, V- = -1.3V
R_L = 1MΩ, C_L = 8pF



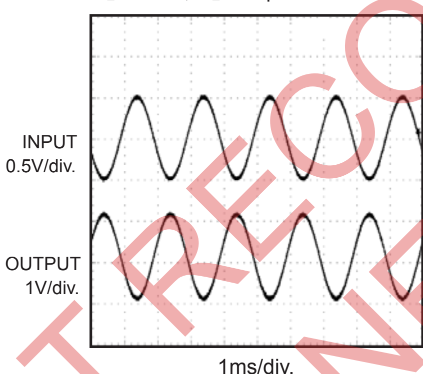
Rail to Rail Output Operation

A_V = -2, V+ = 2.5V, V- = -2.5V
R_L = 1MΩ, C_L = 50pF



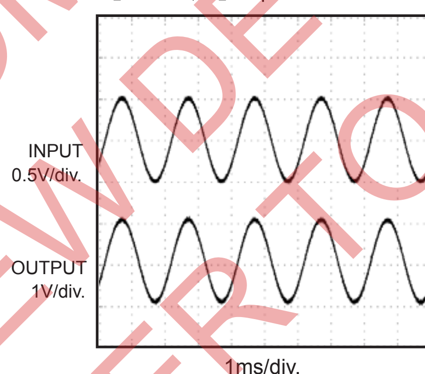
Rail to Rail Output Operation

A_V = -2, V+ = 1.3V, V- = -1.3V
R_L = 1MΩ, C_L = 50pF



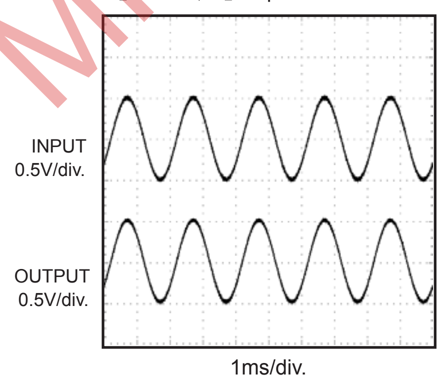
Rail to Rail Output Operation

A_V = 2, V+ = 2.5V, V- = -2.5V
R_L = 1MΩ, C_L = 8pF



Rail to Rail Output Operation

A_V = 2, V+ = 1.3V, V- = -1.3V
R_L = 1MΩ, C_L = 8pF

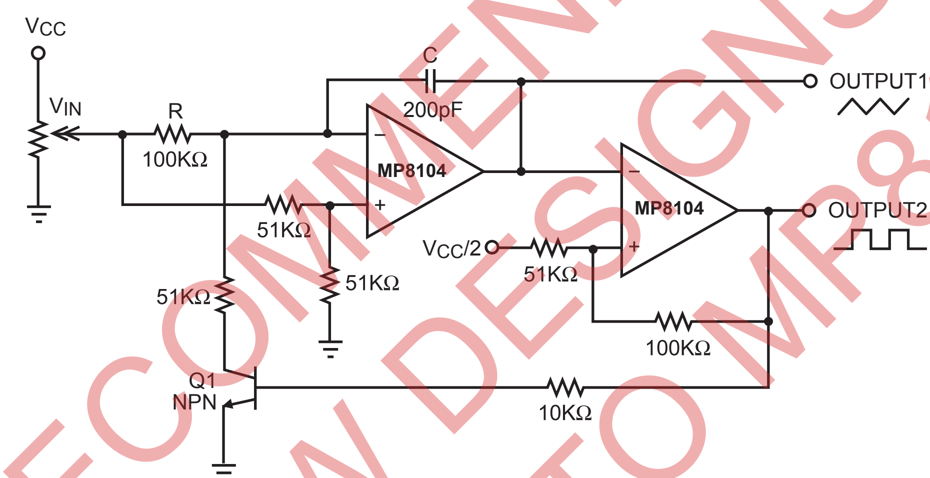


APPLICATION INFORMATION

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 is ideal. For the 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) and low ESR (Equivalent Series Resistance). Surface mount ceramic capacitors are ideal.

TYPICAL APPLICATION CIRCUIT



Notes:
1) The control voltage V_{IN} is wide, $0 < V_{IN} < V_{CC} - 1V$
2) The switch frequency can be changed by adjusting R and C.

Figure 3—Voltage Controlled Frequency Circuit