# SGM8608-2
# 11MHz, Rail-to-Rail I/O CMOS Operational Amplifier

## GENERAL DESCRIPTION

The SGM8608-2 is a low noise, low power operational amplifier optimized for low voltage operation. The device can operate from 2.1V to 5.5V single supply, and consumes only 1.1mA quiescent current per amplifier at 5V.

The SGM8608-2 features a 1.7mV maximum input offset voltage. The minimum input common mode voltage is within 0.1V below the negative rail, and the output swing is rail-to-rail with heavy loads. It exhibits a high gain-bandwidth product of 11MHz and a slew rate of 6.6V/μs. These specifications make the operational amplifier appropriate for a wide range of applications.

The SGM8608-2 is available in Green SOIC-8, MSOP-8, TSSOP-8 and UTDFN-2×2-8BL packages. It is specified over the extended industrial temperature range (-40℃ to +125℃).

## FEATURES

- **Input Offset Voltage: 1.7mV (MAX)**
- **High Gain-Bandwidth Product: 11MHz**
- **High Slew Rate: 6.6V/μs**
- **Settling Time to 0.1% with 2V Step: 500ns**
- **Overload Recovery Time: 0.16μs**
- **Low Noise: 12nV/$\sqrt{Hz}$ at 10kHz**
- **Rail-to-Rail Input and Output**
- **Supply Voltage Range: 2.1V to 5.5V**
- **Input Voltage Range: -0.1V to 5.6V with $V_S$ = 5.5V**
- **Low Power: 1.1mA/Amplifier (TYP)**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green SOIC-8, MSOP-8, TSSOP-8 and UTDFN-2×2-8BL Packages**

## APPLICATIONS

Sensors
Audio
Active Filters
A/D Converters
Communications
Test Equipment
Cellular and Cordless Phones
Laptops and PDAs
Photodiode Amplification
Battery-Powered Instrumentation

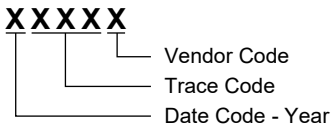
# PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---|---|---|---|---|---|
| SGM8608-2 | SOIC-8 | -40℃ to +125℃ | SGM8608-2XS8G/TR | SGM<br>86082XS8<br>XXXXX | Tape and Reel, 4000 |
| | MSOP-8 | -40℃ to +125℃ | SGM8608-2XMS8G/TR | SGMG3K<br>XMS8<br>XXXXX | Tape and Reel, 4000 |
| | TSSOP-8 | -40℃ to +125℃ | SGM8608-2XTS8G/TR | SGMG3J<br>XTS8<br>XXXXX | Tape and Reel, 4000 |
| | UTDFN-2×2-8BL | -40℃ to +125℃ | SGM8608-2XUGD8G/TR | MDP<br>XXXX | Tape and Reel, 3000 |

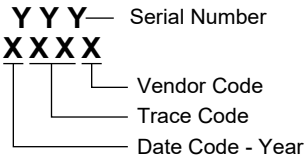
## MARKING INFORMATION

NOTE: XXXX = Date Code, Trace Code and Vendor Code.

**SOIC-8/MSOP-8/TSSOP-8**




**UTDFN-2×2-8BL**




Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage, $+V_S$ to $-V_S$ ..... 6V
Input Common Mode Voltage Range
..... $(-V_S)$ - 0.3V to $(+V_S)$ + 0.3V
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM ..... 8000V
CDM ..... 1000V

## RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range ..... -40℃ to +125℃

## OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

## ESD SENSITIVITY CAUTION

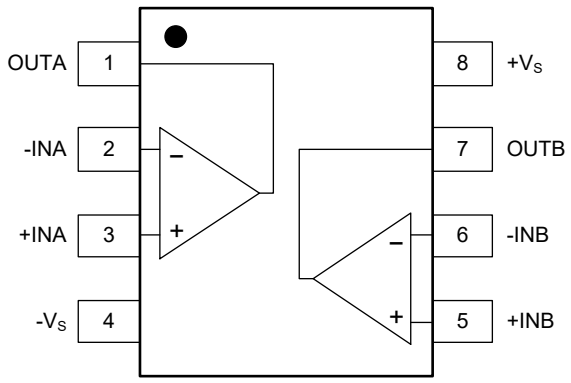
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

## DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

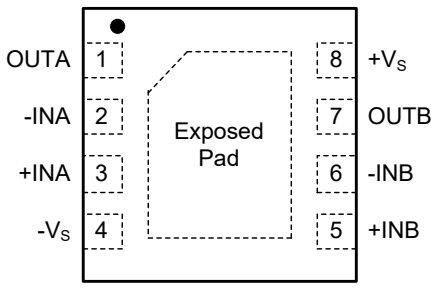
## PIN CONFIGURATIONS

(TOP VIEW)




SOIC-8/MSOP-8/TSSOP-8

(TOP VIEW)




UTDFN-2×2-8BL

NOTE: For the UTDFN-2×2-8BL package, the exposed pad is not internally connected and can be set to ground or left floating.

## ELECTRICAL CHARACTERISTICS

(For $V_S$ (Total Supply Voltage) = (+$V_S$) - (-$V_S$) = 2.1V to 5.5V, $V_{CM}$ = $V_S$/2, $V_{OUT}$ = $V_S$/2, and $R_L$ = 600Ω connected to $V_S$/2, Full = -40℃ to +125℃, typical values are at $T_A$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| **Input Characteristics** | | | | | | | |
| Input Offset Voltage | $V_{OS}$ | $V_S$ = 5V | +25℃ | | ±0.4 | ±1.7 | mV |
| | | | Full | | | ±1.9 | |
| Input Offset Voltage Drift | $\Delta V_{OS}/\Delta T$ | $V_S$ = 5V | Full | | 0.9 | | μV/℃ |
| Input Bias Current | $I_B$ | | +25℃ | | 10 | 150 | pA |
| | | | Full | | | 5000 | |
| Input Offset Current | $I_{OS}$ | | +25℃ | | 10 | 150 | pA |
| | | | Full | | | 1500 | |
| Input Common Mode Voltage Range | $V_{CM}$ | | Full | (-$V_S$) - 0.1 | | (+$V_S$) + 0.1 | V |
| Common Mode Rejection Ratio | CMRR | $V_S$ = 2.1V, (-$V_S$) - 0.1V < $V_{CM}$ < (+$V_S$) - 1.7V | +25℃ | 74 | 91 | | dB |
| | | | Full | 71 | | | |
| | | $V_S$ = 2.1V, (-$V_S$) - 0.1V < $V_{CM}$ < (+$V_S$) + 0.1V | +25℃ | 60 | 74 | | |
| | | | Full | 57 | | | |
| | | $V_S$ = 5.5V, (-$V_S$) - 0.1V < $V_{CM}$ < (+$V_S$) - 1.7V | +25℃ | 80 | 96 | | |
| | | | Full | 77 | | | |
| | | $V_S$ = 5.5V, (-$V_S$) - 0.1V < $V_{CM}$ < (+$V_S$) + 0.1V | +25℃ | 68 | 82 | | |
| | | | Full | 65 | | | |
| Input Common Mode Capacitance | $C_{IC}$ | | +25℃ | | 26 | | pF |
| Input Differential Capacitance | $C_{ID}$ | | +25℃ | | 2 | | pF |
| Open-Loop Voltage Gain | $A_{OL}$ | $V_S$ = 2.1V, $R_L$ = 600Ω, (-$V_S$) + 0.4V < $V_{OUT}$ < (+$V_S$) - 0.4V | +25℃ | 89 | 112 | | dB |
| | | | Full | 86 | | | |
| | | $V_S$ = 2.1V, $R_L$ = 10kΩ, (-$V_S$) + 0.2V < $V_{OUT}$ < (+$V_S$) - 0.2V | +25℃ | 90 | 115 | | |
| | | | Full | 87 | | | |
| | | $V_S$ = 5.5V, $R_L$ = 600Ω, (-$V_S$) + 0.4V < $V_{OUT}$ < (+$V_S$) - 0.4V | +25℃ | 95 | 120 | | |
| | | | Full | 86 | | | |
| | | $V_S$ = 5.5V, $R_L$ = 10kΩ, (-$V_S$) + 0.2V < $V_{OUT}$ < (+$V_S$) - 0.2V | +25℃ | 98 | 140 | | |
| | | | Full | 86 | | | |
| **Output Characteristics** | | | | | | | |
| Output Voltage Swing from Rail | $V_{OUT}$ | $V_S$ = 5.5V, $R_L$ = 10kΩ | +25℃ | | 4 | 10 | mV |
| | | | Full | | | 20 | |
| | | $V_S$ = 5.5V, $R_L$ = 600Ω | +25℃ | | 55 | 75 | |
| | | | Full | | | 90 | |
| Output Short-Circuit Current | $I_{SC}$ | $V_S$ = 5V | +25℃ | 50 | 62 | | mA |
| | | | Full | 35 | | | |
| Open-Loop Output Impedance | $Z_{OUT}$ | $V_S$ = 5V, f = 10MHz | +25℃ | | 95 | | Ω |

## ELECTRICAL CHARACTERISTICS (continued)

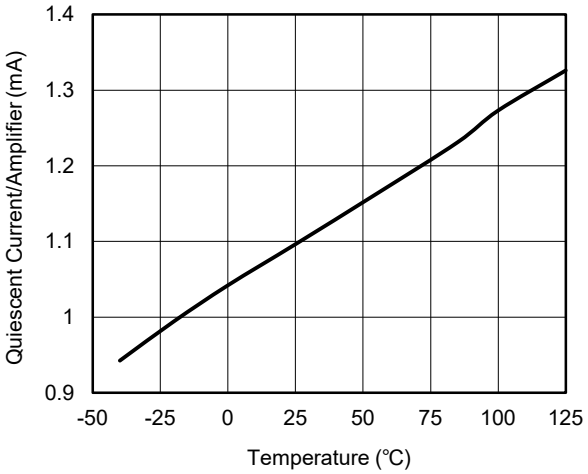
(For $V_S$ (Total Supply Voltage) = (+$V_S$) - (-$V_S$) = 2.1V to 5.5V, $V_{CM}$ = $V_S$/2, $V_{OUT}$ = $V_S$/2, and $R_L$ = 600Ω connected to $V_S$/2, Full = -40℃ to +125℃, typical values are at $T_A$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| **Power Supply** | | | | | | | |
| Operating Voltage Range | $V_S$ | | Full | 2.1 | | 5.5 | V |
| Power Supply Rejection Ratio | PSRR | $V_{CM}$ = (-$V_S$) + 0.4V | +25℃ | | 2 | 25 | μV/V |
| | | | Full | | | 28 | |
| Quiescent Current/Amplifier | $I_Q$ | $V_S$ = 5V | +25℃ | | 1.1 | 1.45 | mA |
| | | | Full | | | 1.8 | |
| **Dynamic Performance** | | | | | | | |
| Gain-Bandwidth Product | GBP | $V_S$ = 5V, G = +1, $R_L$ = 600Ω, $C_L$ = 100pF | +25℃ | | 11 | | MHz |
| Phase Margin | PM | $V_S$ = 5V, G = +1, $R_L$ = 600Ω, $C_L$ = 100pF | +25℃ | | 45 | | ° |
| Slew Rate | SR | $V_S$ = 5V, G = +1, $R_L$ = 600Ω, $V_{OUT}$ = 2$V_{P-P}$, $V_{CM}$ = 1/2$V_S$ (10%~90%) | +25℃ | | 6.6 | | V/μs |
| Settling Time to 0.1% | $t_S$ | $V_S$ = 5V, G = +1, 2V step, $R_L$ = 600Ω, $C_L$ = 100pF | +25℃ | | 500 | | ns |
| Overload Recovery Time | ORT | $V_S$ = 5V, $V_{IN}$ × G > $V_S$, $R_L$ = 600Ω | +25℃ | | 0.16 | | μs |
| Total Harmonic Distortion + Noise | THD+N | $V_S$ = 5.5V, $V_{CM}$ = 2.5V, $V_{OUT}$ = 0.5$V_{RMS}$, G = +1, f = 1kHz, BW = 10Hz to 90kHz | +25℃ | | 0.0008 | | % |
| Full-Power Bandwidth | BWP | < 1% distortion | +25℃ | | 120 | | kHz |
| **Noise** | | | | | | | |
| Input Voltage Noise | | f = 0.1Hz to 10Hz | +25℃ | | 8 | | $\mu V_{P-P}$ |
| Input Voltage Noise Density | $e_n$ | f = 1kHz | +25℃ | | 30 | | $nV/\sqrt{Hz}$ |
| | | f = 10kHz | +25℃ | | 12 | | |
| Input Current Noise Density | $i_n$ | f = 1kHz | +25℃ | | 31 | | $fA/\sqrt{Hz}$ |

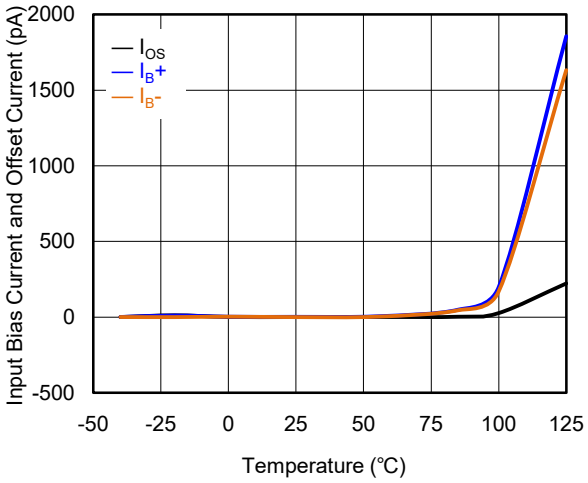
## TYPICAL PERFORMANCE CHARACTERISTICS

At $T_A$ = +25℃, $V_S$ = 5.5V, unless otherwise noted.

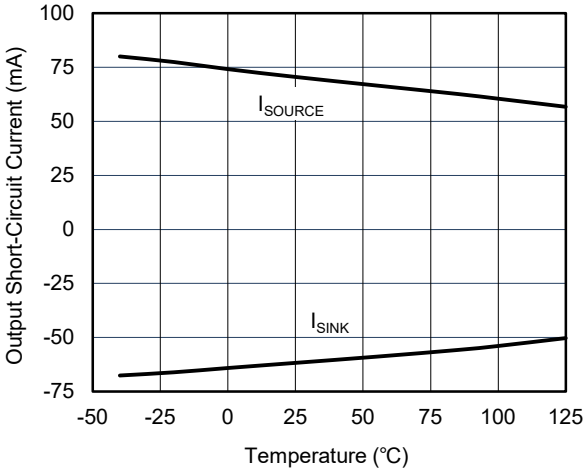
Quiescent Current vs. Temperature



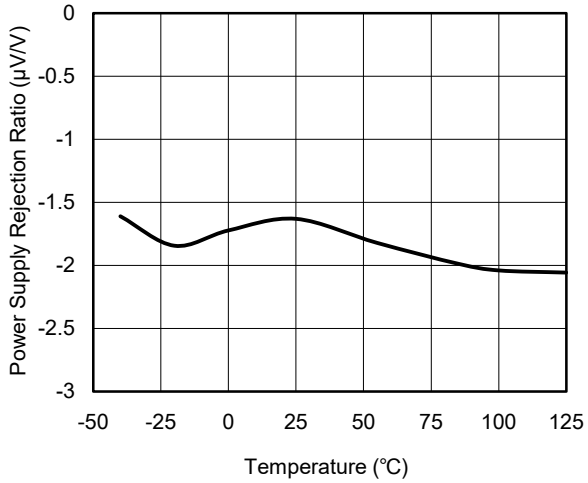

$I_B$ and $I_{OS}$ vs. Temperature



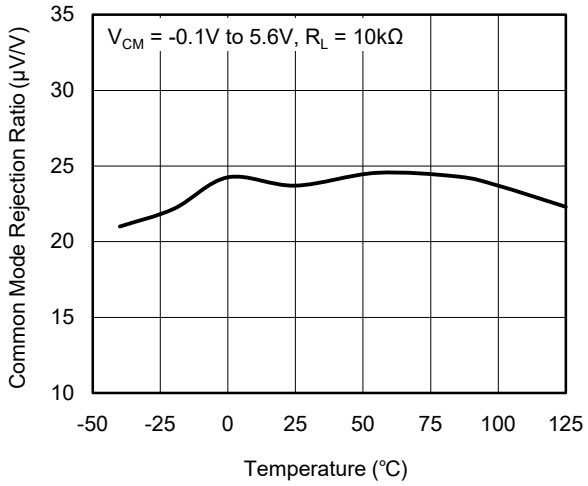

Output Short-Circuit Current vs. Temperature



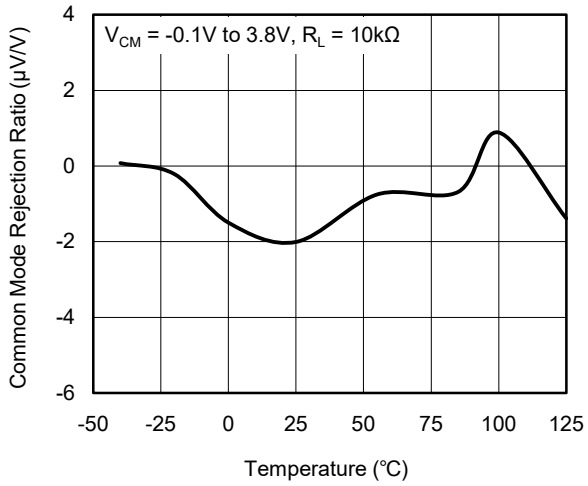

PSRR vs. Temperature




CMRR vs. Temperature



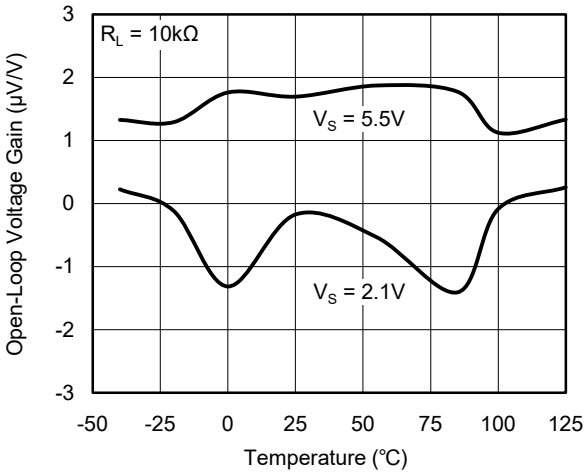

CMRR vs. Temperature



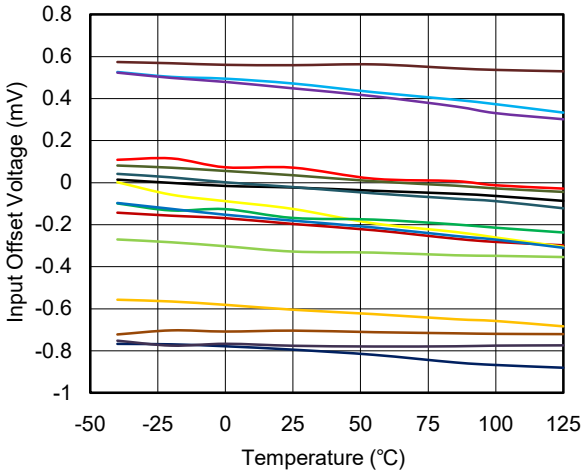
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A$ = +25℃, $V_S$ = 5.5V, unless otherwise noted.

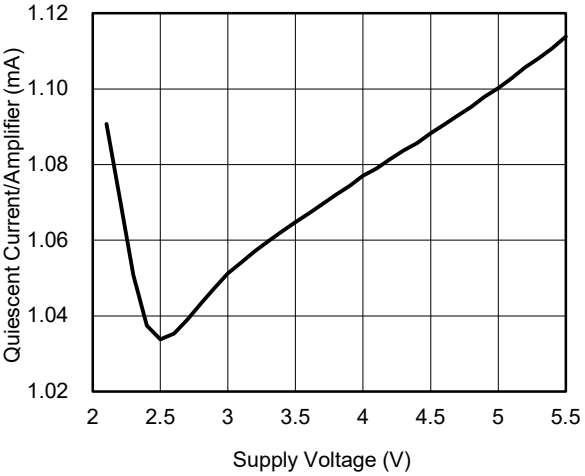
Open-Loop Voltage Gain vs. Temperature



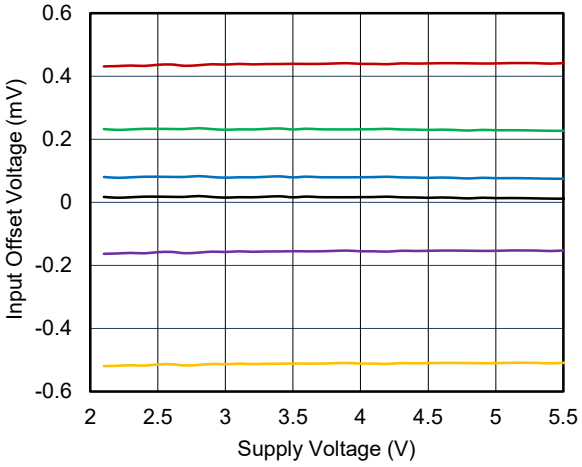

Input Offset Voltage vs. Temperature



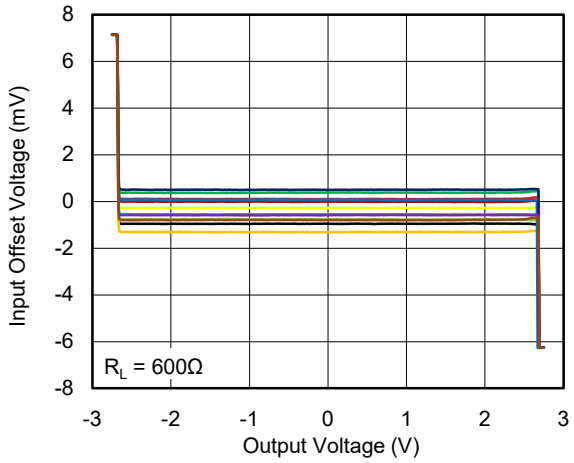

Quiescent Current vs. Supply Voltage



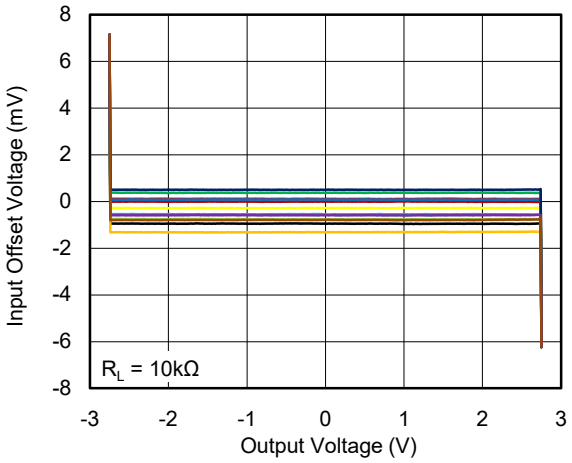

Input Offset Voltage vs. Supply Voltage




Input Offset Voltage vs. Output Voltage



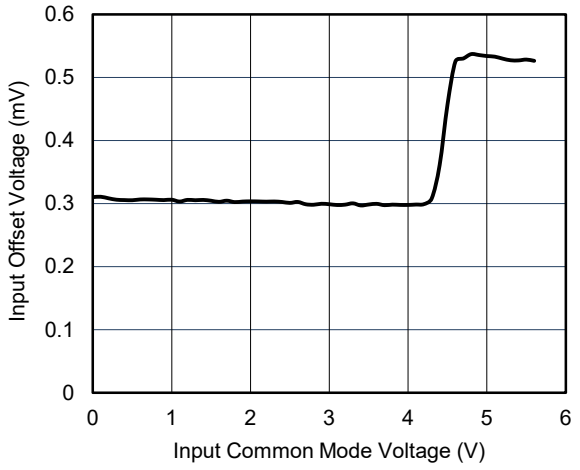

Input Offset Voltage vs. Output Voltage



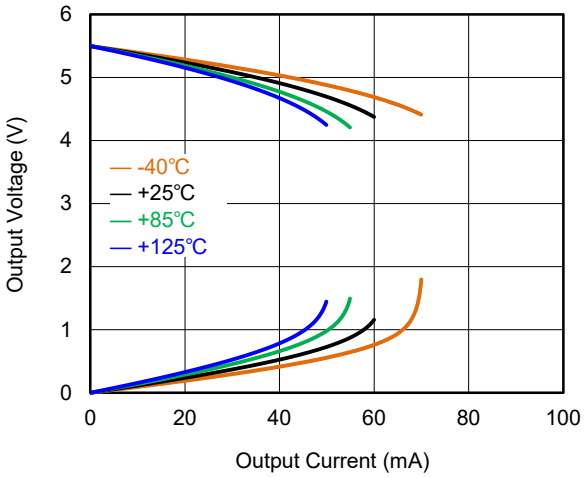
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A$ = +25℃, $V_S$ = 5.5V, unless otherwise noted.

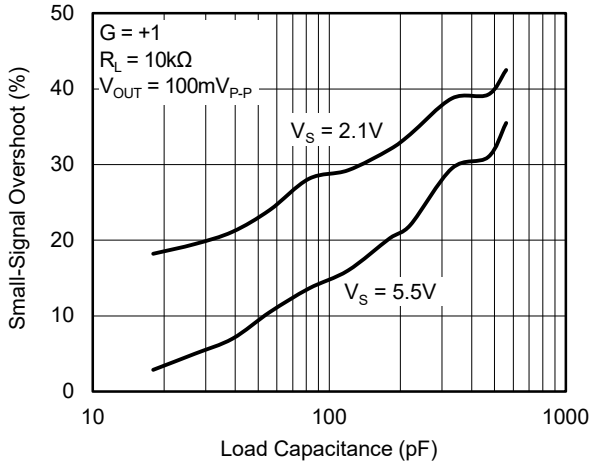
Input Offset Voltage vs. Input Common Mode Voltage



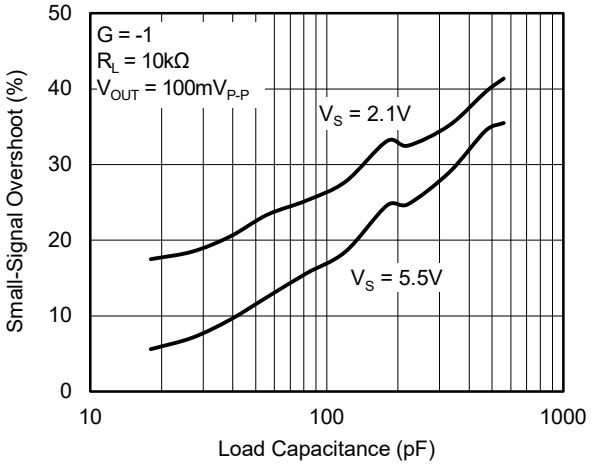

Output Voltage Swing vs. Output Current



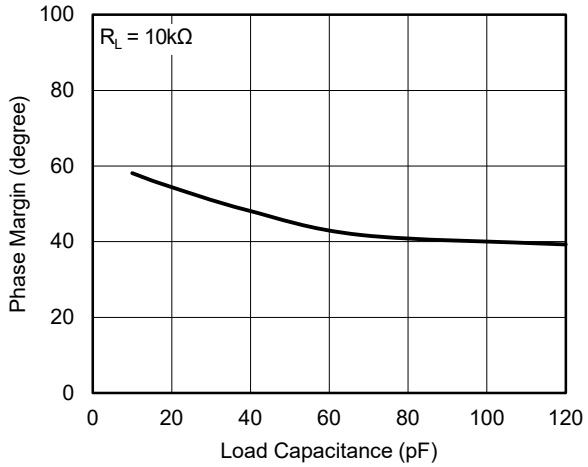

Small-Signal Overshoot vs. Capacitive Load



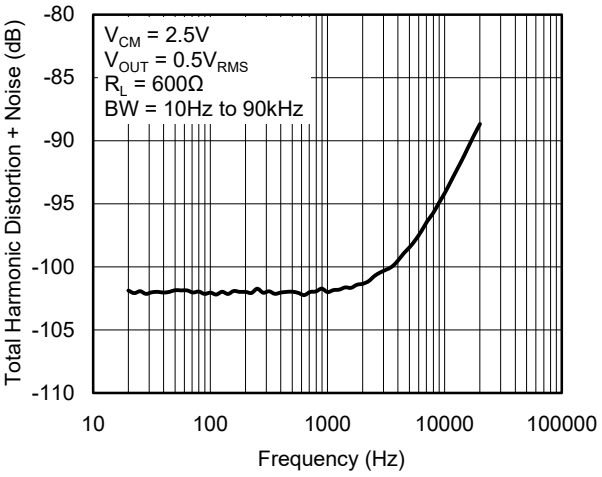

Small-Signal Overshoot vs. Capacitive Load




Phase Margin vs. Capacitive Load



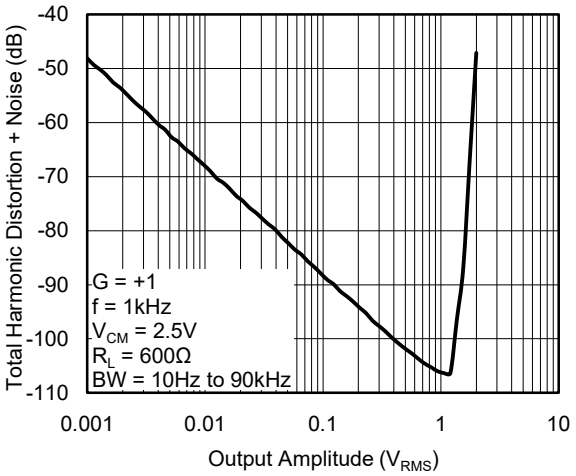

THD+N vs. Frequency



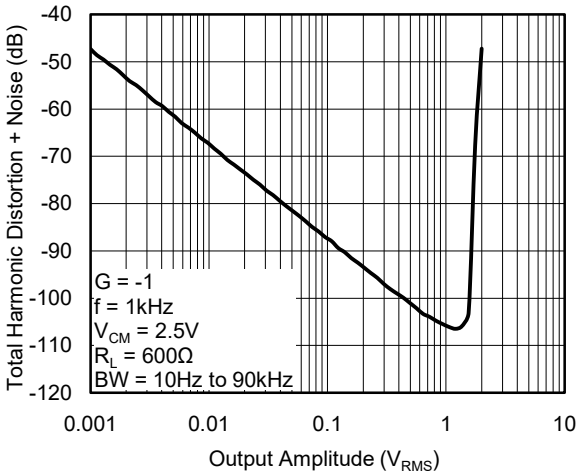
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A$ = +25℃, $V_S$ = 5.5V, unless otherwise noted.

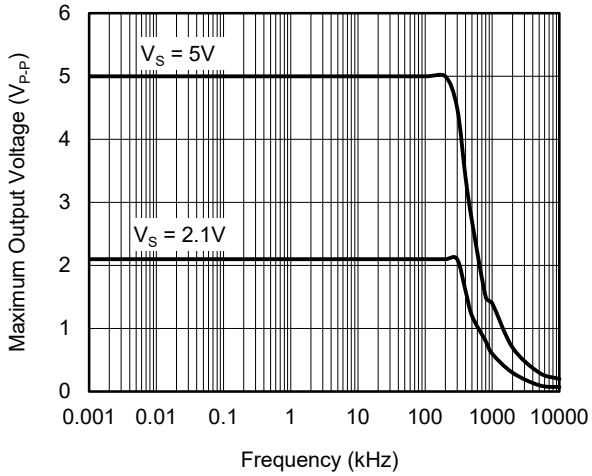
THD+N vs. Output Amplitude



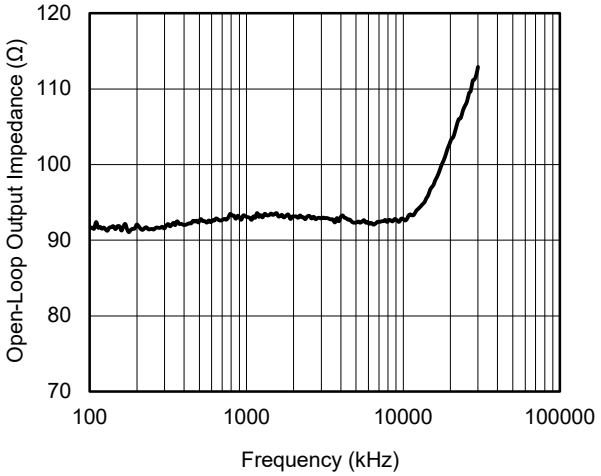

THD+N vs. Output Amplitude



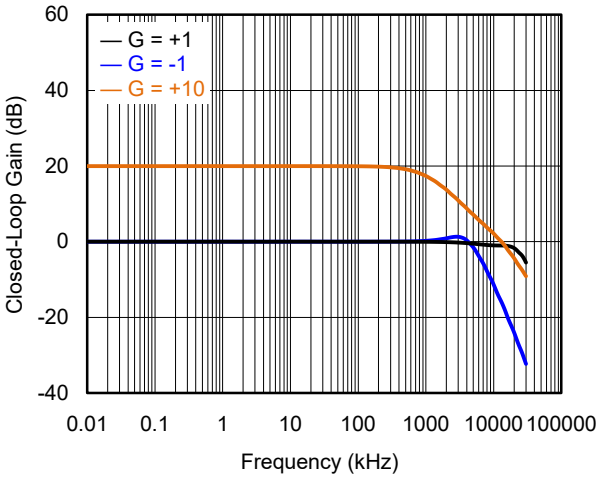

Maximum Output Voltage vs. Frequency



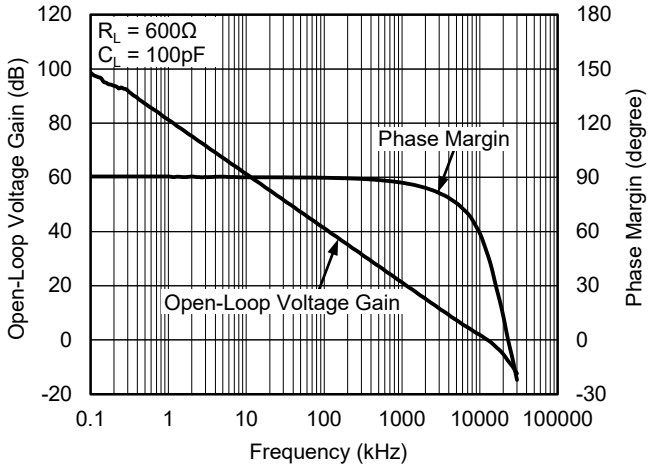

Open-Loop Output Impedance vs. Frequency




Closed-Loop Gain vs. Frequency



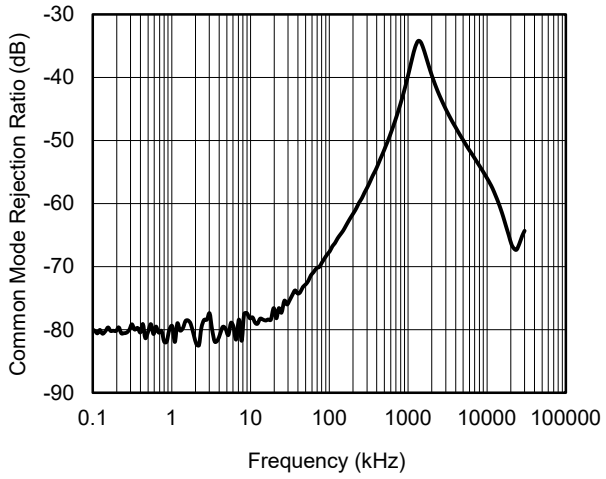

Open-Loop Voltage Gain and Phase Margin vs. Frequency



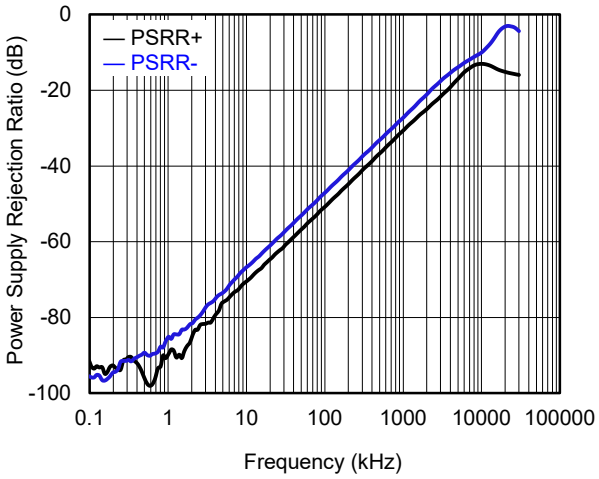
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A$ = +25℃, $V_S$ = 5.5V, unless otherwise noted.

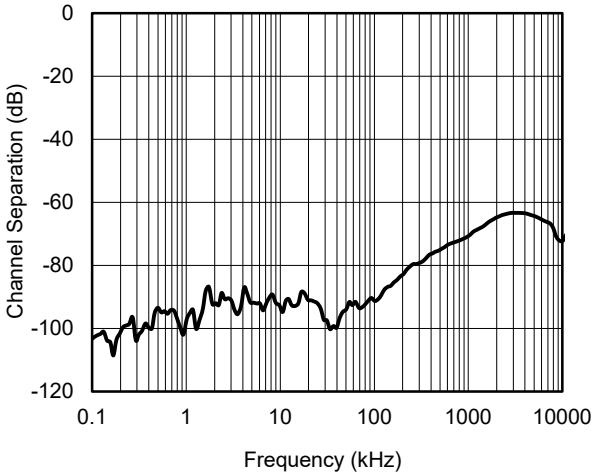
CMRR vs. Frequency (Referred-to-Input)



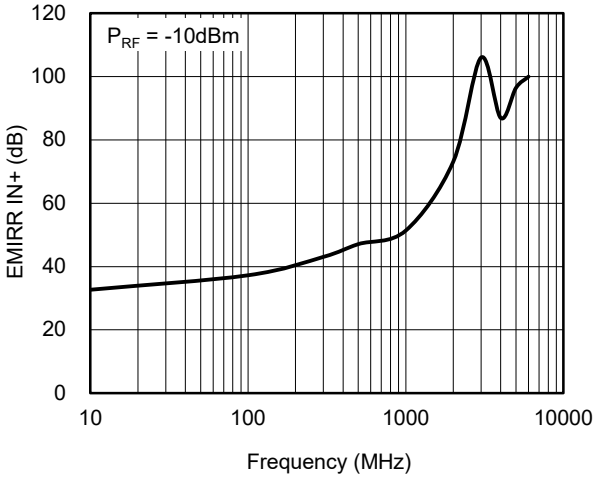

PSRR vs. Frequency (Referred-to-Input)



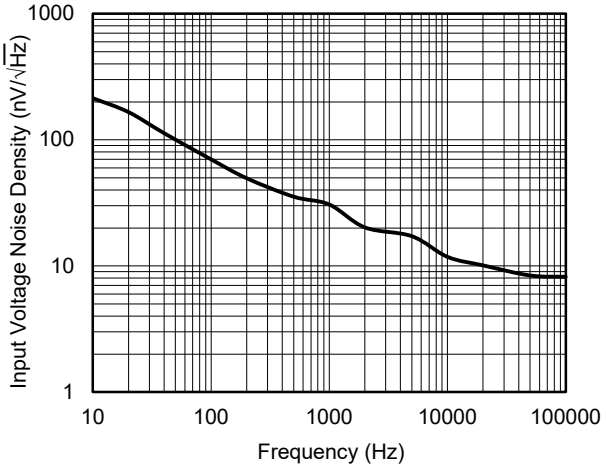

Channel Separation vs. Frequency



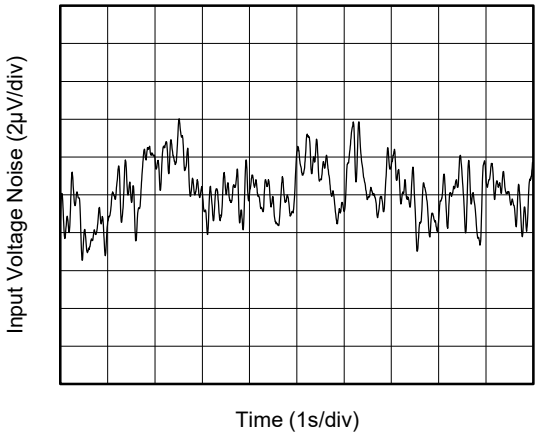

EMIRR IN+ vs. Frequency




Input Voltage Noise Density vs. Frequency




0.1Hz to 10Hz Input Voltage Noise



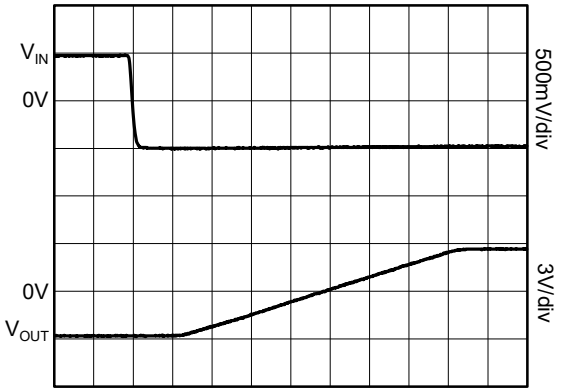
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A$ = +25℃, $V_S$ = 5.5V, unless otherwise noted.

Positive Overload Recovery

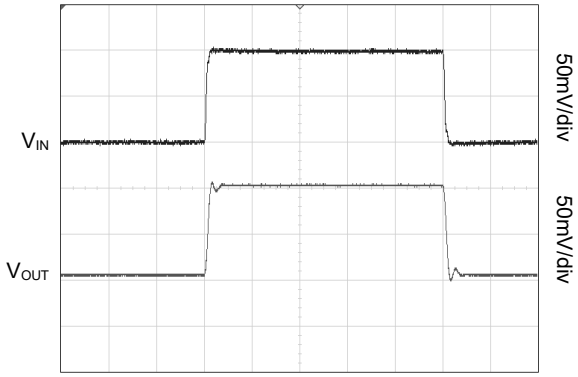

Time (100ns/div)

Negative Overload Recovery



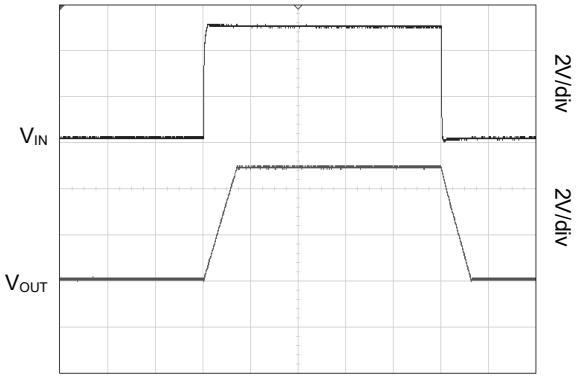

Time (100ns/div)

Small-Signal Step Response



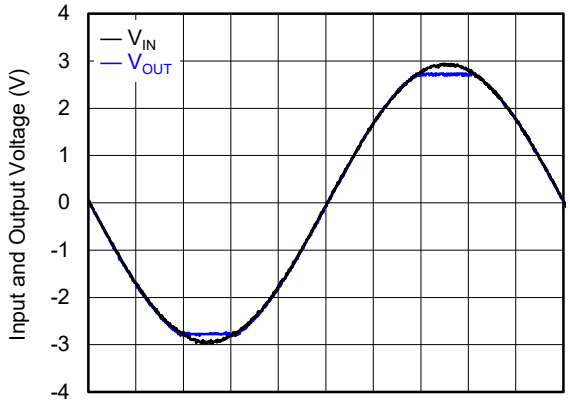

Time (200ns/div)

Large-Signal Step Response



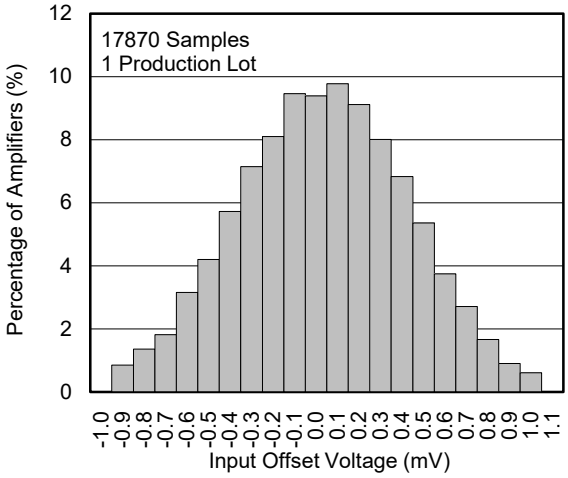

Time (1μs/div)

No Phase Reversal



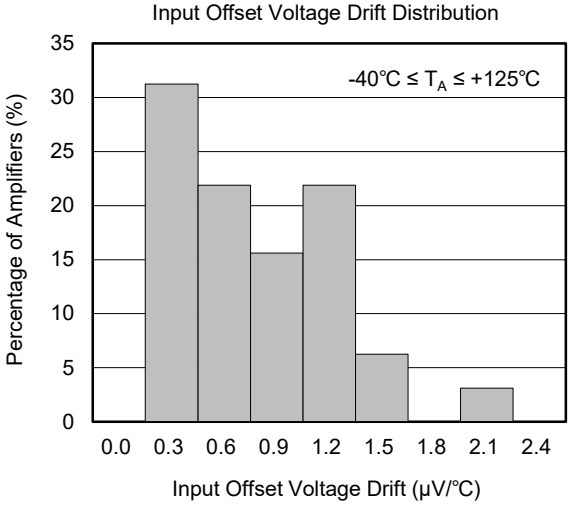

Time (100μs/div)

Input Offset Voltage Production Distribution



## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A$ = +25℃, $V_S$ = 5.5V, unless otherwise noted.



# APPLICATION INFORMATION

## Rail-to-Rail Output

The SGM8608-2 supports rail-to-rail output operation. In single power supply application, for example, when $+V_S$ = 5.5V, $-V_S$ = GND, 10kΩ load resistor is tied from OUT pin to $V_S$/2, the typical output swing range is from 0.004V to 5.496V.

## Driving Capacitive Loads

The SGM8608-2 is designed for unity-gain stable for capacitive load up to 2200pF. If greater capacitive load must be driven in application, the circuit in Figure 1 can be used. In this circuit, the IR drop voltage generated by $R_{ISO}$ is compensated by feedback loop.

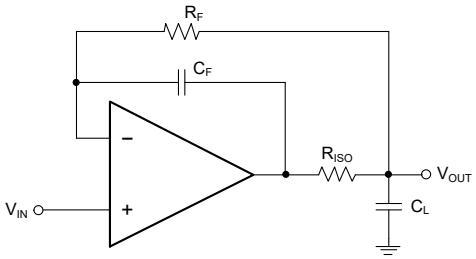



**Figure 1. Circuit to Drive Heavy Capacitive Load**

## Power Supply Decoupling and Layout

A clean and low noise power supply is very important in amplifier circuit design, besides of input signal noise, the power supply is one of important source of noise to the amplifier through $+V_S$ and $-V_S$ pins. Power supply bypassing is an effective method to clear up the noise at power supply, and the low impedance path to ground of decoupling capacitor will bypass the noise to GND. In application, 10μF ceramic capacitor paralleled with 0.1μF or 0.01μF ceramic capacitor is used in Figure 2. The ceramic capacitors should be placed as close as possible to $+V_S$ and $-V_S$ power supply pins.

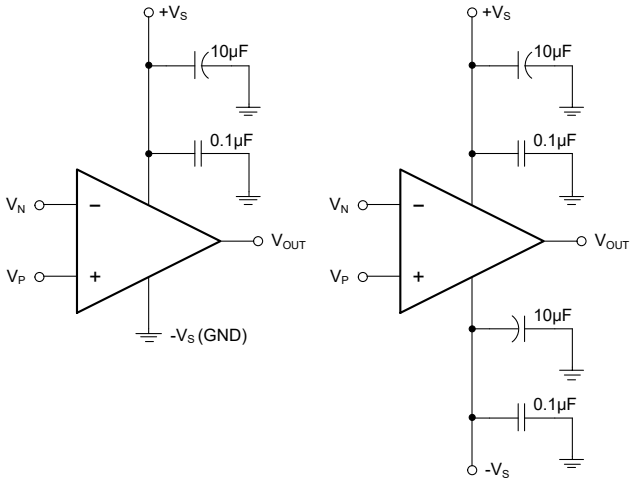



**Figure 2. Amplifier Power Supply Bypassing**

## Grounding

In low speed application, one node grounding technique is the simplest and most effective method to eliminate the noise generated by grounding. In high speed application, the general method to eliminate noise is to use a complete ground plane technique, and the whole ground plane will help distribute heat and reduce EMI noise pickup.

## Reduce Input-to-Output Coupling

To reduce the input-to-output coupling, the input traces must be placed as far away from the power supply or output traces as possible. The sensitive trace must not be placed in parallel with the noisy trace in same layer. They must be placed perpendicularly in different layers to reduce the crosstalk. These PCB layout techniques will help to reduce unwanted positive feedback and noise.

# APPLICATION INFORMATION (continued)

## Typical Application Circuits

### Difference Amplifier

The circuit in Figure 3 is a design example of classical difference amplifier. If $R_4/R_3 = R_2/R_1$, then $V_{OUT} = (V_P - V_N) \times R_2/R_1 + V_{REF}$.

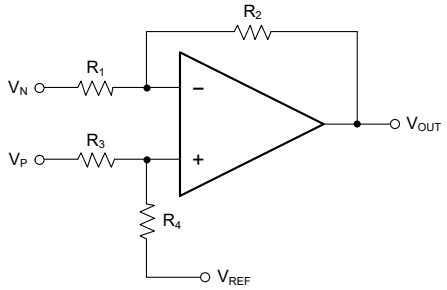



**Figure 3. Difference Amplifier**

### High Input Impedance Difference Amplifier

The circuit in Figure 4 is a design example of high input impedance difference amplifier, the added amplifiers at the input are used to increase the input impedance and eliminate drawback of low input impedance in Figure 3.

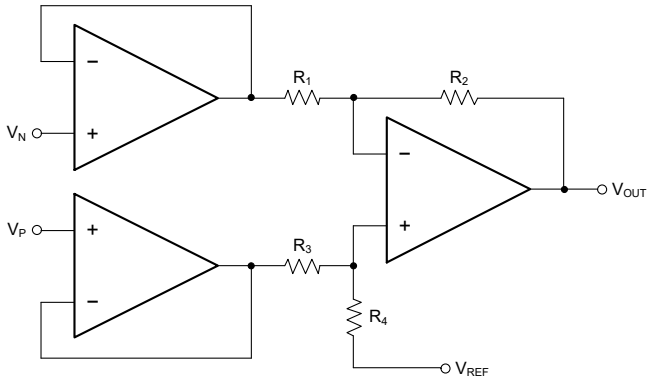



**Figure 4. High Input Impedance Difference Amplifier**

### Active Low-Pass Filter

The circuit in Figure 5 is a design example of active low-pass filter, the DC gain is equal to $-R_2/R_1$ and the -3dB corner frequency is equal to $1/2\pi R_2C$. In this design, the filter bandwidth must be less than the bandwidth of the amplifier, the resistor values must be selected as low as possible to reduce ringing or oscillation generated by the parasitic parameters in PCB layout.

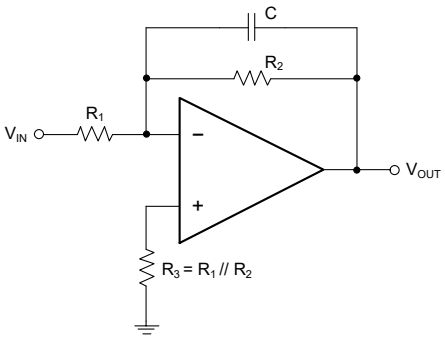



**Figure 5. Active Low-Pass Filter**

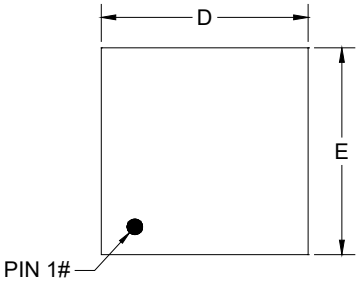
# REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

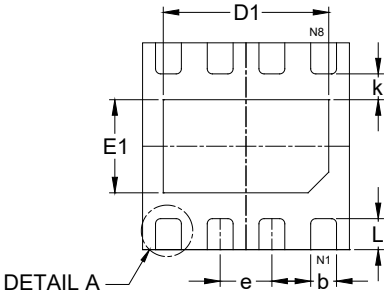
| Changes from Original (NOVEMBER 2022) to REV.A | Page |
|---|---|
| Changed from product preview to production data | All |

# PACKAGE OUTLINE DIMENSIONS

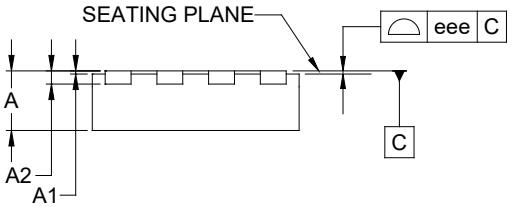
## UTDFN-2×2-8BL



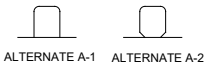

**TOP VIEW**



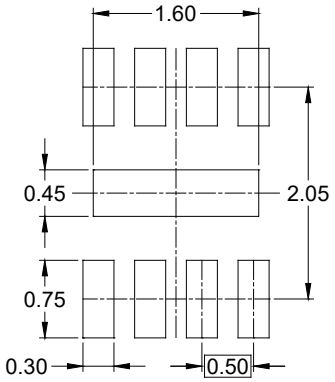

**BOTTOM VIEW**




**SIDE VIEW**




**DETAIL A**
ALTERNATE TERMINAL CONSTRUCTION



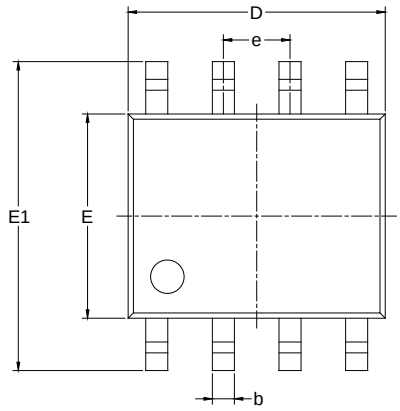

**RECOMMENDED LAND PATTERN** (Unit: mm)

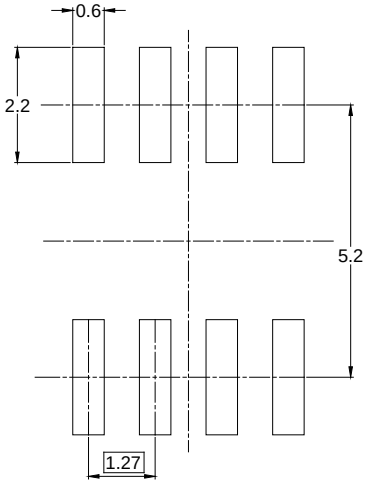
| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | MOD | MAX |
| A | 0.500 | - | 0.600 |
| A1 | 0.000 | - | 0.050 |
| A2 | 0.127 REF | | |
| b | 0.200 | - | 0.300 |
| D | 1.900 | - | 2.100 |
| E | 1.900 | - | 2.100 |
| D1 | 1.500 | 1.600 | 1.700 |
| E1 | 0.800 | 0.900 | 1.000 |
| e | 0.500 BSC | | |
| k | 0.250 REF | | |
| L | 0.200 | - | 0.400 |
| eee | 0.050 | | |

NOTE: This drawing is subject to change without notice.

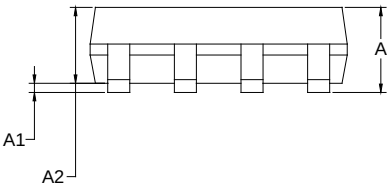
# PACKAGE OUTLINE DIMENSIONS

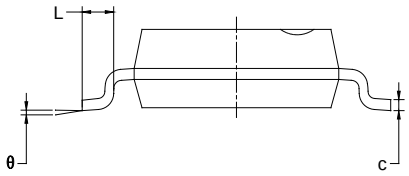
## SOIC-8




**RECOMMENDED LAND PATTERN** (Unit: mm)



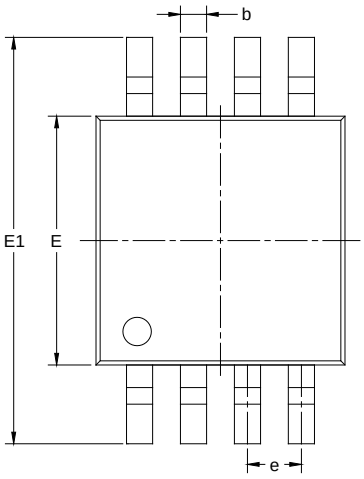



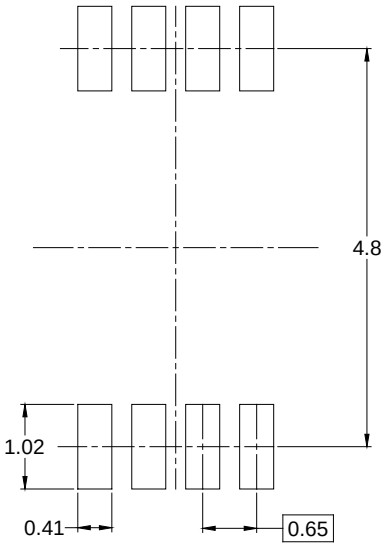

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.200 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| e | 1.27 BSC | | 0.050 BSC | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

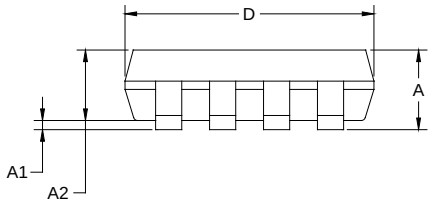
# PACKAGE OUTLINE DIMENSIONS

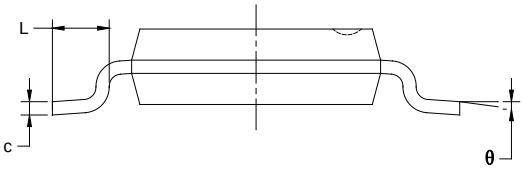
## MSOP-8




**RECOMMENDED LAND PATTERN** (Unit: mm)



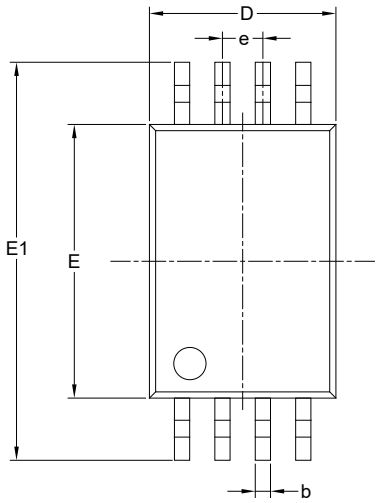



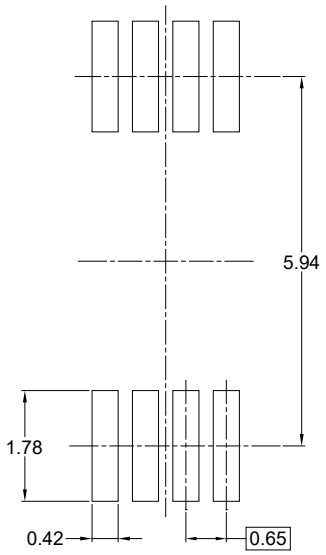

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.820 | 1.100 | 0.032 | 0.043 |
| A1 | 0.020 | 0.150 | 0.001 | 0.006 |
| A2 | 0.750 | 0.950 | 0.030 | 0.037 |
| b | 0.250 | 0.380 | 0.010 | 0.015 |
| c | 0.090 | 0.230 | 0.004 | 0.009 |
| D | 2.900 | 3.100 | 0.114 | 0.122 |
| E | 2.900 | 3.100 | 0.114 | 0.122 |
| E1 | 4.750 | 5.050 | 0.187 | 0.199 |
| e | 0.650 BSC | | 0.026 BSC | |
| L | 0.400 | 0.800 | 0.016 | 0.031 |
| θ | 0° | 6° | 0° | 6° |

NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

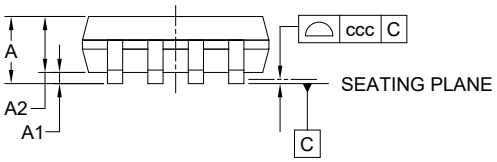
# PACKAGE OUTLINE DIMENSIONS

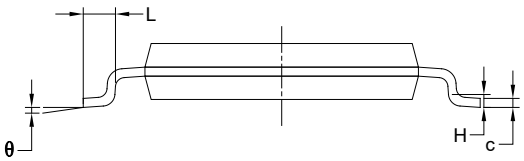
## TSSOP-8




**RECOMMENDED LAND PATTERN** (Unit: mm)



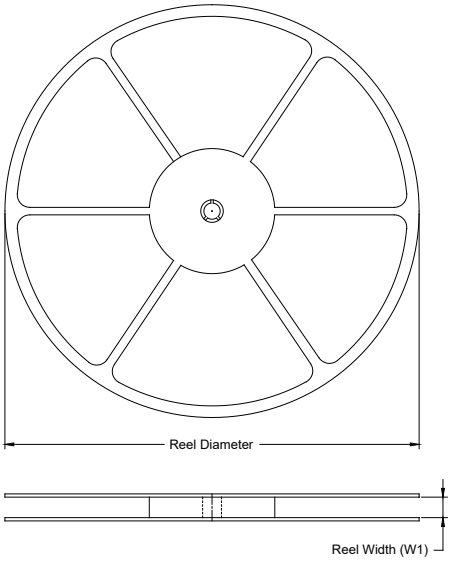




| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | MOD | MAX |
| A | - | - | 1.200 |
| A1 | 0.050 | - | 0.150 |
| A2 | 0.800 | - | 1.050 |
| b | 0.190 | - | 0.300 |
| c | 0.090 | - | 0.200 |
| D | 2.900 | - | 3.100 |
| E | 4.300 | - | 4.500 |
| E1 | 6.200 | - | 6.600 |
| e | 0.650 BSC | | |
| L | 0.450 | - | 0.750 |
| H | 0.250 TYP | | |
| θ | 0° | - | 8° |
| ccc | 0.100 | | |

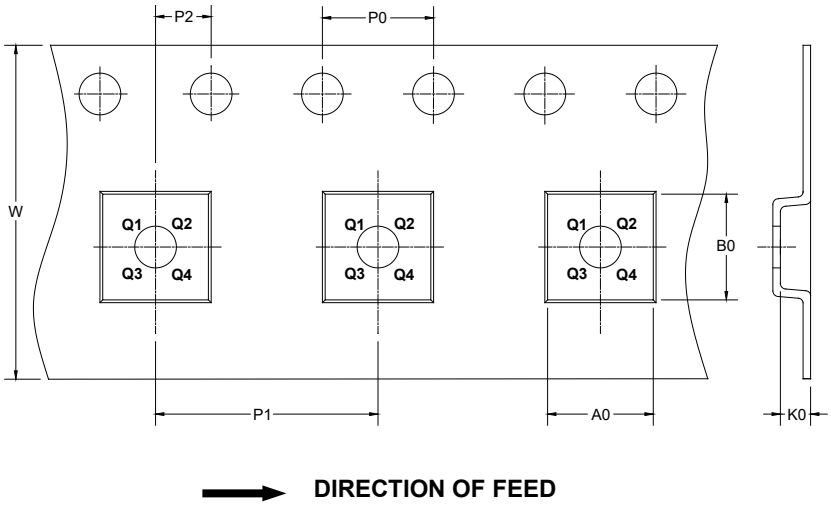
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-153.

# TAPE AND REEL INFORMATION

### REEL DIMENSIONS




### TAPE DIMENSIONS




DIRECTION OF FEED

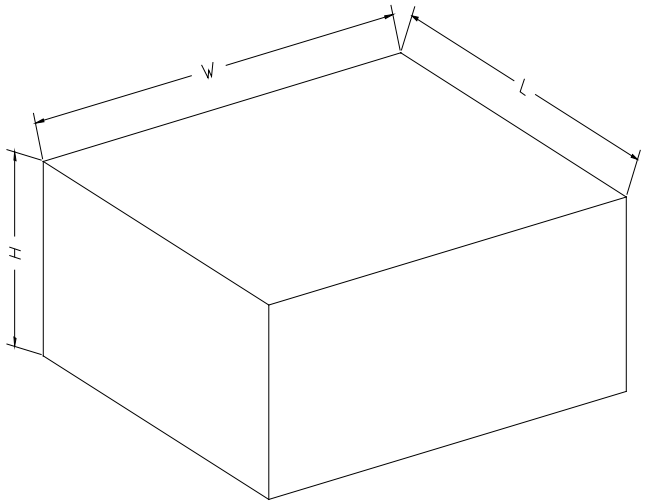
NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|
| UTDFN-2×2-8BL | 7″ | 9.5 | 2.25 | 2.25 | 0.75 | 4.0 | 4.0 | 2.0 | 8.0 | Q1 |
| SOIC-8 | 13″ | 12.4 | 6.40 | 5.40 | 2.10 | 4.0 | 8.0 | 2.0 | 12.0 | Q1 |
| MSOP-8 | 13″ | 12.4 | 5.20 | 3.30 | 1.50 | 4.0 | 8.0 | 2.0 | 12.0 | Q1 |
| TSSOP-8 | 13″ | 12.4 | 6.76 | 3.30 | 1.80 | 4.0 | 8.0 | 2.0 | 12.0 | Q1 |

DD0001

## CARTON BOX DIMENSIONS




NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF CARTON BOX

| Reel Type | Length (mm) | Width (mm) | Height (mm) | Pizza/Carton |
|---|---|---|---|---|
| 7″ (Option) | 368 | 227 | 224 | 8 |
| 7″ | 442 | 410 | 224 | 18 |
| 13″ | 386 | 280 | 370 | 5 |

DD0002