

GENERAL DESCRIPTION

The SGM8194 series is a low power, high DC and AC CMRR, voltage output current-sense amplifier. This device is designed to provide optimal performance in battery management systems requiring over-current protection and precision current measurement. The SGM8194 can sense voltage drops across current-sense resistor with common mode voltage from -0.1V to 40V. The common mode voltage is independent with the power supply voltage due to its AC coupling and related signal sampling structure.

The SGM8194 features low input bias current, low offset voltage and zero-drift. The dynamic range is extended due to the latter two features when measuring current. Larger current-sense resistor can be used in mA level measurement application and it provides accurate current measurements. Small current-sense resistor is always used to reduce power loss in power efficiency sensitive systems. The SGM8194 can provide accurate current measurements in system where small current-sense resistor is used.

The SGM8194 series provides two fixed gains: 100V/V and 200V/V. It operates with a single power supply from 2.1V to 5.5V. When this device is enabled, it draws a 60µA typical power supply current, and it consumes only 10nA when disabled.

The SGM8194 is available in Green UTQFN-1.8×1.4-10L and SC70-6 packages. It is rated over the -40°C to +125°C temperature range.

FEATURES

- **Operating Power Supply Range:** 2.1V to 5.5V
- **Common Mode Voltage Range:** -0.1V to 40V
- **CMRR:** 150dB (TYP)
- **Low Offset Voltage:** ±50µV (MAX)
- **Low Bias Current:** 0.5nA (TYP)
- **Supply Current:** 60µA (TYP)
- **Shutdown Current:** 10nA (TYP)
- **Choice of Gains:**
 - ◆ SGM8194C3 Gain: 100V/V
 - ◆ SGM8194A3 Gain: 100V/V
 - ◆ SGM8194A4 Gain: 200V/V
- **Gain Error:**
 - ◆ ±0.4% (MAX) for SC70-6 Package
 - ◆ ±0.45% (MAX) for UTQFN-1.8×1.4-10L Package
- **Supports Bidirectional Current Sense**
- **-40°C to +125°C Operating Temperature Range**
- **Available in Green UTQFN-1.8×1.4-10L and SC70-6 Packages**

APPLICATIONS

Battery Fuel Gauge
 Notebook PC
 Tablet PC

TYPICAL APPLICATION

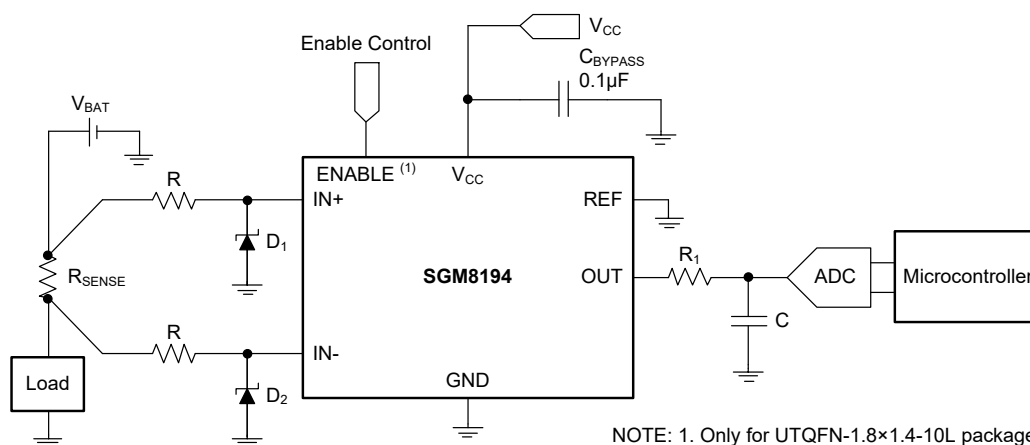


Figure 1. Typical Application Circuit for Battery-Powered System

PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|------------------------------|---------------------|-----------------------------|---------------------|-----------------|---------------------|
| SGM8194C3 (Gain = 100V/V) | UTQFN-1.8×1.4-10L | -40°C to +125°C | SGM8194C3XUWQ10G/TR | SXJ XXX | Tape and Reel, 3000 |
| SGM8194A3 (Gain = 100V/V) | SC70-6 | -40°C to +125°C | SGM8194A3XC6G/TR | 07VXX | Tape and Reel, 3000 |
| SGM8194A4 (Gain = 200V/V) | UTQFN-1.8×1.4-10L | -40°C to +125°C | SGM8194A4XUWQ10G/TR | SXK XXX | Tape and Reel, 3000 |
| | SC70-6 | -40°C to +125°C | SGM8194A4XC6G/TR | 07WXX | Tape and Reel, 3000 |

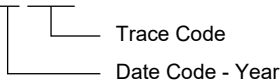
MARKING INFORMATION

NOTE: XX = Date Code. XXX = Date Code and Trace Code.

UTQFN-1.8×1.4-10L

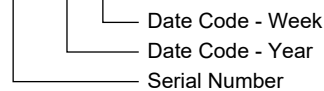
YYY — Serial Number

XXX



SC70-6

YYY X X



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_{CC} 6V
- $(V_{IN+}) - (V_{IN-})$ Differential ⁽¹⁾ -42V to 42V
- V_{IN+} , V_{IN-} , Relative to GND GND - 0.3V to 42V
- ENABLE, V_{ENABLE} GND - 0.3V to 6V
- REF, OUT GND - 0.3V to $V_{CC} + 0.3V$
- Junction Temperature +150°C
- Storage Temperature Range -65°C to +150°C
- Lead Temperature (Soldering, 10s) +260°C
- ESD Susceptibility
- HBM (for UTQFN-1.8×1.4-10L Package) 4000V
- HBM (for SC70-6 Package) 5000V
- CDM 1000V

RECOMMENDED OPERATING CONDITIONS

- Operating Supply Voltage, V_{CC} 2.1V to 5.5V
- Input Common Mode Range, V_{CM} GND - 0.1V to 40V
- Input Pin Voltage Range, V_{IN+} , V_{IN-} GND - 0.1V to 40V
- Differential Input Voltage, $V_{SENSE} = V_{IN+} - V_{IN-}$
..... $-(V_{CC} - 0.2V)/Gain$ to $(V_{CC} - 0.2V)/Gain$
- Reference Pin Voltage Range, V_{REF} GND to V_{CC}
- Operating Temperature Range -40°C to +125°C

NOTE: 1. V_{IN+} and V_{IN-} indicates the voltage at the two input pins $IN+$ and $IN-$ of the current-sense amplifier.

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.

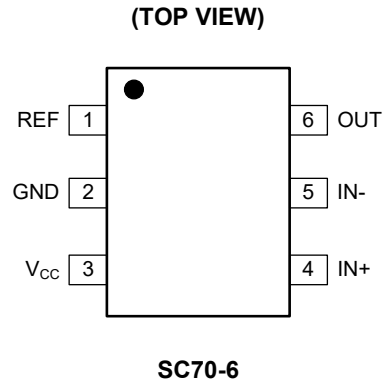
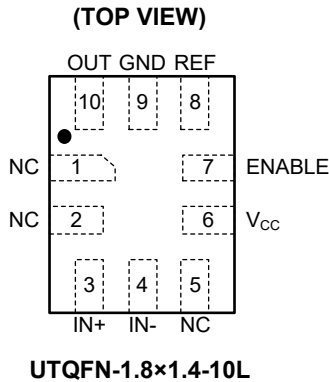
ESD SENSITIVITY CAUTION

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

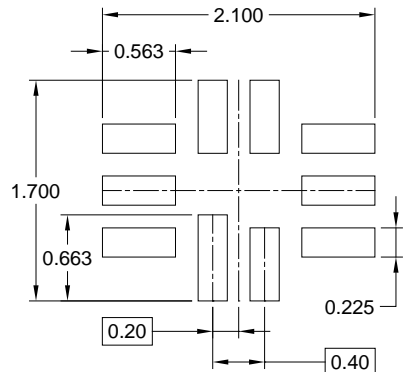
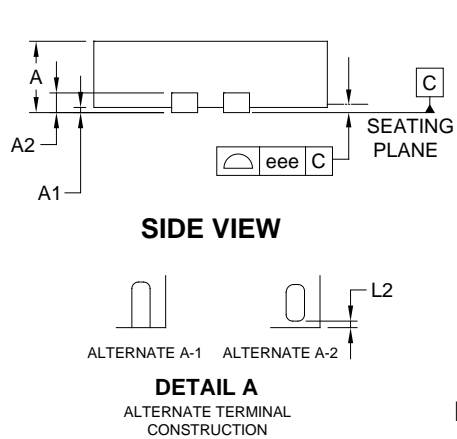
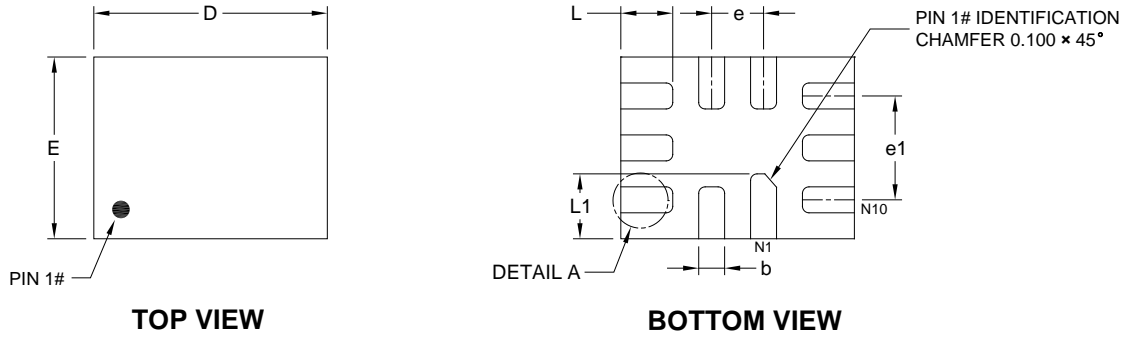


PIN DESCRIPTION

| PIN | | NAME | TYPE | FUNCTION |
|-------------------|--------|-----------------|---------------|--|
| UTQFN-1.8×1.4-10L | SC70-6 | | | |
| 1, 2, 5 | — | NC | — | No Connection. |
| 3 | 4 | IN+ | Analog Input | Non-Inverting Input of the Current-Sense Amplifier. To measure the current with high-side mode, please put this pin at the bus side of the sense resistor. To measure the current with low-side mode, please put this pin at the load side of the sense resistor. |
| 4 | 5 | IN- | Analog Input | Inverting Input of the Current-Sense Amplifier. To measure the current with high-side mode, please put this pin at the load side of the sense resistor. To measure the current with low-side mode, please put this pin at the ground side of the sense resistor. |
| 6 | 3 | V _{CC} | — | Power Supply. Voltage range is from 2.1V to 5.5V. |
| 7 | — | ENABLE | Digital Input | Enable Function. UTQFN-1.8×1.4-10L package only. Pull this pin to V _{CC} to enable the device by a pull-up resistor, and the device operates as a current-sense amplifier. Pull this pin to GND to disable the device, and the device turns into shutdown mode. Also, the shutdown current is extremely low and the high-impedance property is shown at the output. Connect this pin to V _{CC} if not used, and do not leave it floating, which means that this pin should be driven externally. |
| 8 | 1 | REF | Analog Input | Reference Input. Bidirectional current-sense can be realized if an external voltage is applied to this pin. |
| 9 | 2 | GND | — | Ground. |
| 10 | 6 | OUT | Analog Output | Output Pin. This pin is an analog voltage output pin, where $V_{OUT} = G \times (V_{IN+} - V_{IN-}) + V_{REF}$. |

PACKAGE OUTLINE DIMENSIONS

UTQFN-1.8x1.4-10L



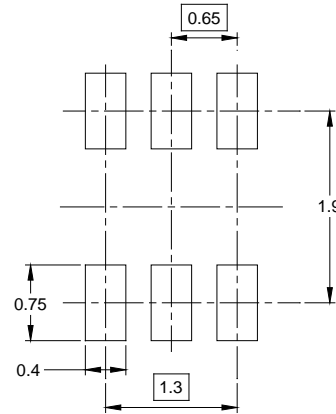
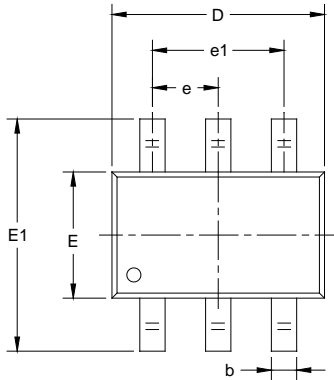
RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|-------|-------|
| | MIN | MOD | MAX |
| A | 0.450 | - | 0.600 |
| A1 | 0.000 | - | 0.050 |
| A2 | 0.152 REF | | |
| b | 0.150 | 0.200 | 0.250 |
| D | 1.750 | 1.800 | 1.850 |
| E | 1.350 | 1.400 | 1.450 |
| e | 0.400 TYP | | |
| e1 | 0.800 REF | | |
| L | 0.350 | 0.400 | 0.450 |
| L1 | 0.450 | 0.500 | 0.550 |
| L2 | 0.000 | - | 0.100 |
| eee | - | 0.080 | - |

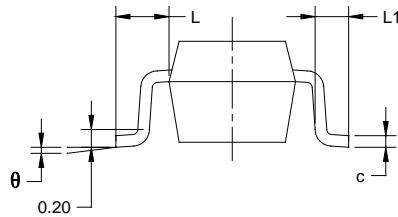
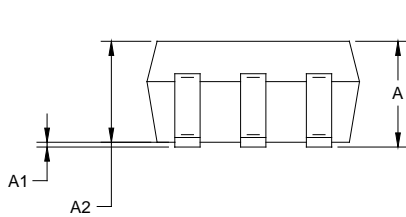
NOTE: This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

SC70-6



RECOMMENDED LAND PATTERN (Unit: mm)



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|----------|------------------------------|-------|-------------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.800 | 1.100 | 0.031 | 0.043 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.800 | 1.000 | 0.031 | 0.039 |
| b | 0.150 | 0.350 | 0.006 | 0.014 |
| c | 0.080 | 0.220 | 0.003 | 0.009 |
| D | 2.000 | 2.200 | 0.079 | 0.087 |
| E | 1.150 | 1.350 | 0.045 | 0.053 |
| E1 | 2.150 | 2.450 | 0.085 | 0.096 |
| e | 0.65 TYP | | 0.026 TYP | |
| e1 | 1.300 BSC | | 0.051 BSC | |
| L | 0.525 REF | | 0.021 REF | |
| L1 | 0.260 | 0.460 | 0.010 | 0.018 |
| 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.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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 |
|-------------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| UTQFN-1.8×1.4-10L | 7" | 9.0 | 1.75 | 2.10 | 0.70 | 4.0 | 4.0 | 2.0 | 8.0 | Q1 |
| SC70-6 | 7" | 9.5 | 2.40 | 2.50 | 1.20 | 4.0 | 4.0 | 2.0 | 8.0 | Q3 |

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PACKAGE INFORMATION

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 |

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