



SGM8754-2/SGM8754-4 General-Purpose, Low Voltage, Open-Drain Comparators

GENERAL DESCRIPTION

The dual SGM8754-2 and quad SGM8754-4 are rail-to-rail input, low voltage power supply comparators that can operate in the range of 2.7V to 5.5V. The two devices both have an open-drain output structure. They can be a good choice for applications with low power, low voltage operation and limited space sizes in PCB design.

The SGM8754-2 is available in Green SOIC-8 and MSOP-8 packages. The SGM8754-4 is available in Green SOIC-14 and UTQFN-2×2-14BL packages. They are rated over the -40°C to +125°C temperature range.

FEATURES

- **Single-Supply Voltage Range: 2.7V to 5.5V**
- **Low Supply Current:**
 - ◆ 80µA (TYP) for SGM8754-2 at $V_{CC} = 5V$
 - ◆ 160µA (TYP) for SGM8754-4 at $V_{CC} = 5V$
- **Rail to Rail Input**
- **Input Common Mode Voltage Range:**
 $GND - 0.1V$ to $V_{CC} + 0.1V$
- **Open-Drain Output Structure**
- **Low Output Saturation Voltage:**
55mV (TYP) at $V_{CC} = 5V$
- **-40°C to +125°C Operating Temperature Range**
- **Small Packaging:**
SGM8754-2 Available in Green SOIC-8 and MSOP-8 Packages
SGM8754-4 Available in Green SOIC-14 and UTQFN-2×2-14BL Packages

APPLICATIONS

- Window Comparators
- Hysteresis Comparators
- Oscillators
- Test Equipment
- Industrial Applications
- Measurements

TYPICAL APPLICATION

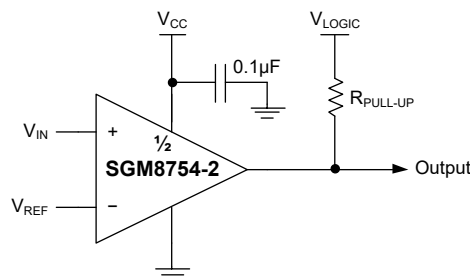


Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

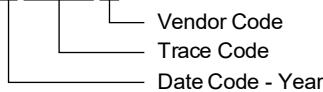
| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|-----------|---------------------|-----------------------------|---------------------|-----------------------|---------------------|
| SGM8754-2 | SOIC-8 | -40°C to +125°C | SGM8754-2XS8G/TR | 0C6XS8 XXXXX | Tape and Reel, 4000 |
| | MSOP-8 | -40°C to +125°C | SGM8754-2XMS8G/TR | 0C7XMS8 XXXXX | Tape and Reel, 4000 |
| SGM8754-4 | SOIC-14 | -40°C to +125°C | SGM8754-4XS14G/TR | SGM87544XS14 XXXXX | Tape and Reel, 2500 |
| | UTQFN-2×2-14BL | -40°C to +125°C | SGM8754-4XUUG14G/TR | 0C9 XXXX | Tape and Reel, 3000 |

MARKING INFORMATION

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

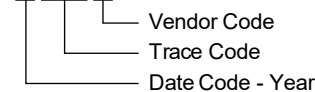
SOIC-8/MSOP-8/SOIC-14

XXXXX



UTQFN-2×2-14BL

YYY — Serial Number
XXXX



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, $V_{CC}^{(1)}$ | 6V |
| Differential Input Voltage, $V_{ID}^{(2)}$ | $\pm V_{CC}$ |
| Input Voltage Range (Either Input), $V_{IN} \dots$ | -0.3V to $V_{CC} + 0.3V$ |
| Output Short-Circuit to GND Duration (One Amplifier) ⁽³⁾ | |
| At or below $T_A = +25^\circ C$, $V_{CC} \leq 5.5V$ | Unlimited |
| Package Thermal Resistance | |
| SOIC-8, θ_{JA} | 162.1°C/W |
| MSOP-8, θ_{JA} | 180.6°C/W |
| SOIC-14, θ_{JA} | 98.6°C/W |
| UTQFN-2×2-14BL, θ_{JA} | 125.1°C/W |
| Junction Temperature | +150°C |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature (Soldering, 10s) | +260°C |
| ESD Susceptibility | |
| HBM | 4000V |
| CDM | 1000V |

RECOMMENDED OPERATING CONDITIONS

| | |
|---|-----------------|
| Single Supply Voltage Range, V_{CC} | 2.7V to 5.5V |
| Operating Temperature Range | -40°C to +125°C |

NOTES:

1. All voltage values are related to the GND network, except for the differential voltages.
2. Differential voltage is between +IN and -IN.
3. When the output is short-circuited to power supply, the device can overheat and eventually be damaged.

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.

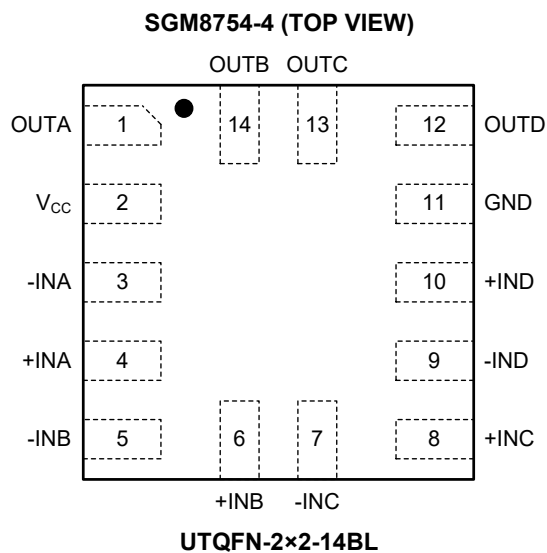
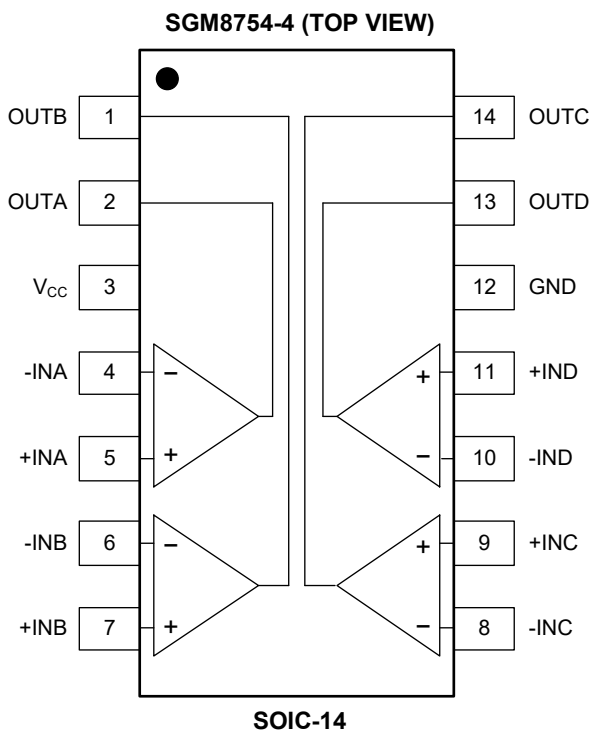
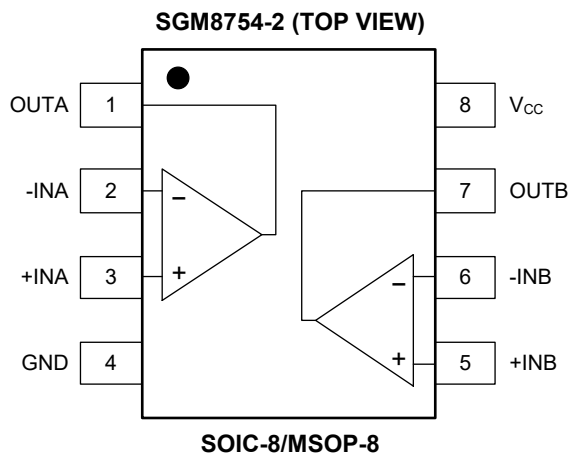
ESD SENSITIVITY CAUTION

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

Table 1. SGM8754-2 Pin Description

| PIN | | NAME | TYPE | FUNCTION |
|---------------|--|-----------------|------|-------------------------------------|
| SOIC-8/MSOP-8 | | | | |
| 1, 7 | | OUTA, OUTB | O | Output. |
| 2, 6 | | -INA, -INB | I | Inverting Input of Comparators. |
| 3, 5 | | +INA, +INB | I | Non-Inverting Input of Comparators. |
| 4 | | GND | — | Ground. |
| 8 | | V _{CC} | — | Power Supply. |

Table 2. SGM8754-4 Pin Description

| PIN | | NAME | TYPE | FUNCTION |
|--------------|---------------|------------------------|------|-------------------------------------|
| SOIC-14 | TQFN-2x2-14L | | | |
| 1, 2, 13, 14 | 14, 1, 12, 13 | OUTB, OUTA, OUTD, OUTC | O | Output. |
| 3 | 2 | V _{CC} | — | Power Supply. |
| 4, 6, 8, 10 | 3, 5, 7, 9 | -INA, -INB, -INC, -IND | I | Inverting Input of Comparators. |
| 5, 7, 9, 11 | 4, 6, 8, 10 | +INA, +INB, +INC, +IND | I | Non-Inverting Input of Comparators. |
| 12 | 11 | GND | — | Ground. |

ELECTRICAL CHARACTERISTICS

($V_{CC} = 2.7V$, $GND = 0V$, $R_L = 5.1k\Omega$, Full = $-40^{\circ}C$ to $+125^{\circ}C$, typical values are at $T_A = +25^{\circ}C$, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---------------------------------|--------------------------|--|-------|-----------|-------|----------------|-------------------|
| Input Offset Voltage | V_{OS} | $V_{CM} = V_{CC}/2$ | +25°C | | ±0.6 | ±3.4 | mV |
| | | | Full | | | ±3.6 | |
| Input Offset Voltage Drift | $\Delta V_{OS}/\Delta T$ | | Full | | 1 | | $\mu V/^{\circ}C$ |
| Input Bias Current | I_B | $V_{CM} = V_{CC}/2$ | +25°C | | ±0.05 | ±0.45 | nA |
| | | | Full | | | ±5 | |
| Input Offset Current | I_{OS} | $V_{CM} = V_{CC}/2$ | +25°C | | ±0.05 | ±0.45 | nA |
| | | | Full | | | ±1 | |
| Input Common Mode Voltage Range | V_{CM} | | +25°C | GND - 0.1 | | $V_{CC} + 0.1$ | V |
| Common Mode Rejection Ratio | CMRR | $V_{CM} = GND - 0.1V$ to $V_{CC} + 0.1V$ | +25°C | 56 | 73 | | dB |
| | | | Full | 52 | | | |
| Output Current (Sinking) | I_{OUT} | $V_{OUT} \leq 1.5V$ | +25°C | 33 | 48 | | mA |
| | | | Full | 20 | | | |
| Output Leakage Current | | | Full | | 0.01 | 1 | μA |
| Saturation Voltage | V_{SAT} | $I_{OUT} \leq 1.5mA$ | Full | | 28 | 55 | mV |
| Supply Current | I_{CC} | For SGM8754-2 | Full | | 70 | 100 | μA |
| | | For SGM8754-4 | Full | | 145 | 200 | |

($V_{CC} = 5V$, $GND = 0V$, $R_L = 5.1k\Omega$, Full = $-40^{\circ}C$ to $+125^{\circ}C$, typical values are at $T_A = +25^{\circ}C$, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|--|--------------------------|--|-------|-----------|-------|----------------|-------------------|
| Input Offset Voltage | V_{OS} | $V_{CM} = V_{CC}/2$ | +25°C | | ±0.6 | ±3.4 | mV |
| | | | Full | | | ±3.6 | |
| Input Offset Voltage Drift | $\Delta V_{OS}/\Delta T$ | | Full | | 1 | | $\mu V/^{\circ}C$ |
| Input Bias Current | I_B | $V_{CM} = V_{CC}/2$ | +25°C | | ±0.05 | ±0.45 | nA |
| | | | Full | | | ±5 | |
| Input Offset Current | I_{OS} | $V_{CM} = V_{CC}/2$ | +25°C | | ±0.05 | ±0.45 | nA |
| | | | Full | | | ±1 | |
| Input Common Mode Voltage Range | V_{CM} | | +25°C | GND - 0.1 | | $V_{CC} + 0.1$ | V |
| Common Mode Rejection Ratio | CMRR | $V_{CM} = GND - 0.1V$ to $V_{CC} + 0.1V$ | +25°C | 60 | 78 | | dB |
| | | | Full | 56 | | | |
| Output Current (Sinking) | I_{OUT} | $V_{OUT} \leq 1.5V$ | +25°C | 67 | 95 | | mA |
| | | | Full | 40 | | | |
| Output Leakage Current | | | Full | | 0.01 | 1 | μA |
| Large-Signal Differential Voltage Gain | A_{VD} | | +25°C | 28 | 100 | | V/mV |
| Saturation Voltage | V_{SAT} | $I_{OUT} \leq 4mA$ | Full | | 55 | 120 | mV |
| Supply Current | I_{CC} | For SGM8754-2 | Full | | 80 | 115 | μA |
| | | For SGM8754-4 | Full | | 160 | 230 | |

SWITCHING CHARACTERISTICS

(V_{CC} = 2.7V, GND = 0V, R_L = 5.1kΩ, Full = -40°C to +125°C, typical values are at T_A = +25°C, unless otherwise noted.)

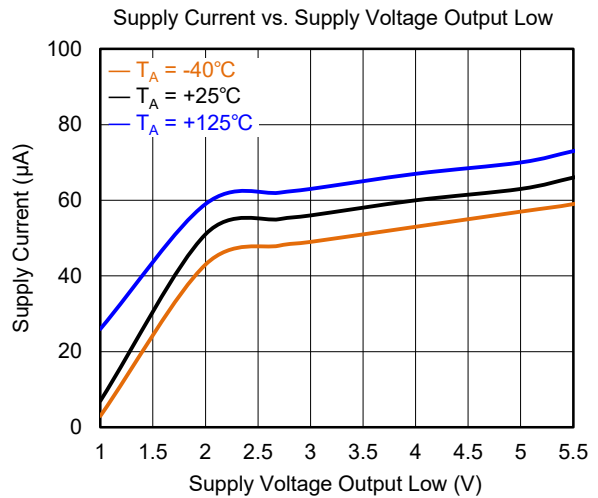
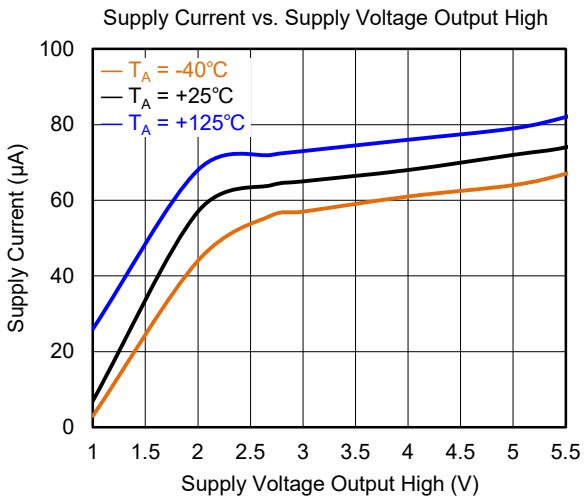
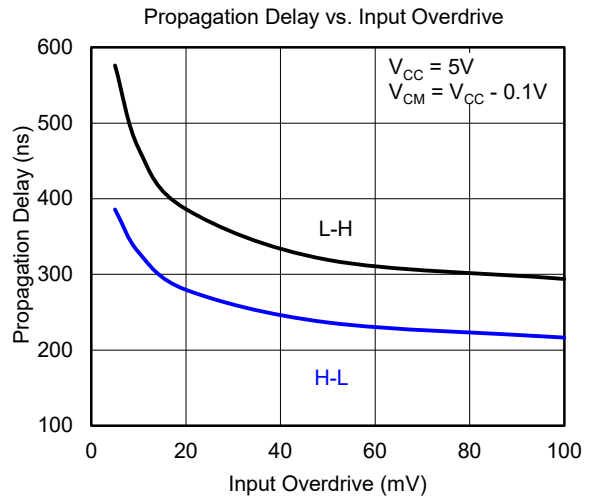
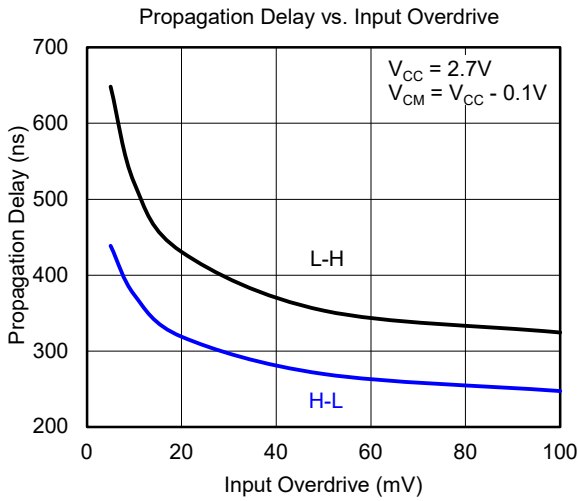
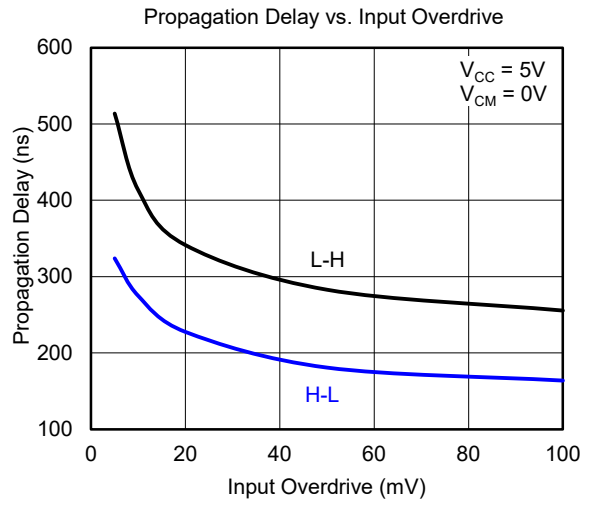
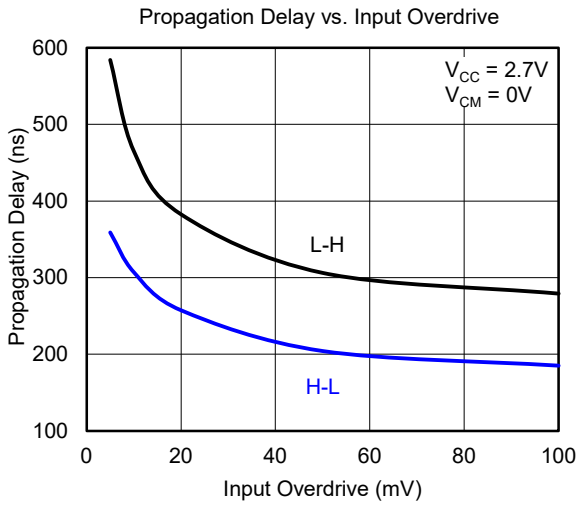
| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---------------------------------|------------------|-------------------------|------|-----|-----|-----|-------|
| Propagation Delay (High to Low) | t _{PHL} | Input overdrive = 10mV | Full | 150 | 400 | 550 | ns |
| | | Input overdrive = 100mV | Full | 75 | 260 | 360 | |
| Propagation Delay (Low to High) | t _{PLH} | Input overdrive = 10mV | Full | 225 | 550 | 750 | ns |
| | | Input overdrive = 100mV | Full | 125 | 350 | 450 | |

(V_{CC} = 5V, GND = 0V, R_L = 5.1kΩ, Full = -40°C to +125°C, typical values are at T_A = +25°C, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---------------------------------|------------------|-------------------------|------|-----|-----|-----|-------|
| Propagation Delay (High to Low) | t _{PHL} | Input overdrive = 10mV | Full | 125 | 350 | 550 | ns |
| | | Input overdrive = 100mV | Full | 60 | 250 | 330 | |
| Propagation Delay (Low to High) | t _{PLH} | Input overdrive = 10mV | Full | 190 | 470 | 700 | ns |
| | | Input overdrive = 100mV | Full | 100 | 320 | 450 | |

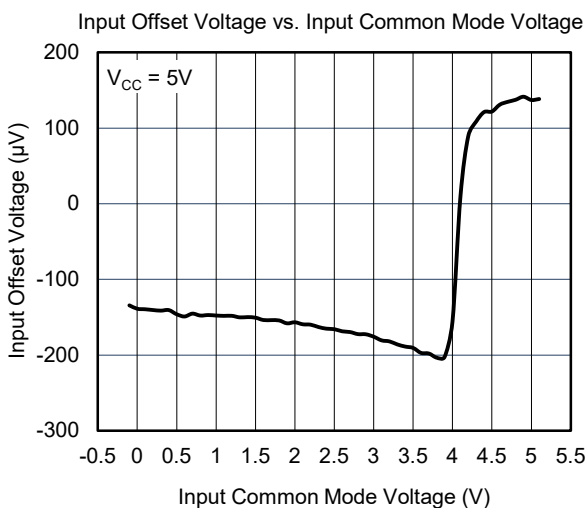
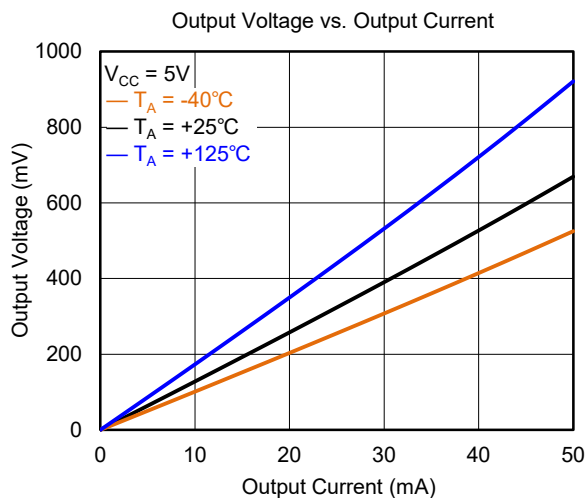
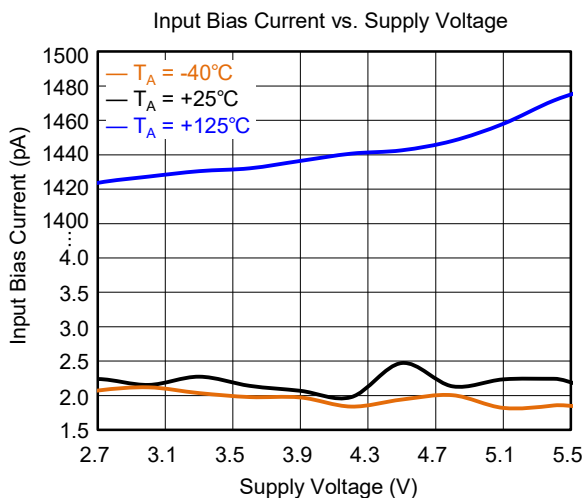
TYPICAL PERFORMANCE CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, unless otherwise noted.



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, unless otherwise noted.



FUNCTIONAL BLOCK DIAGRAM

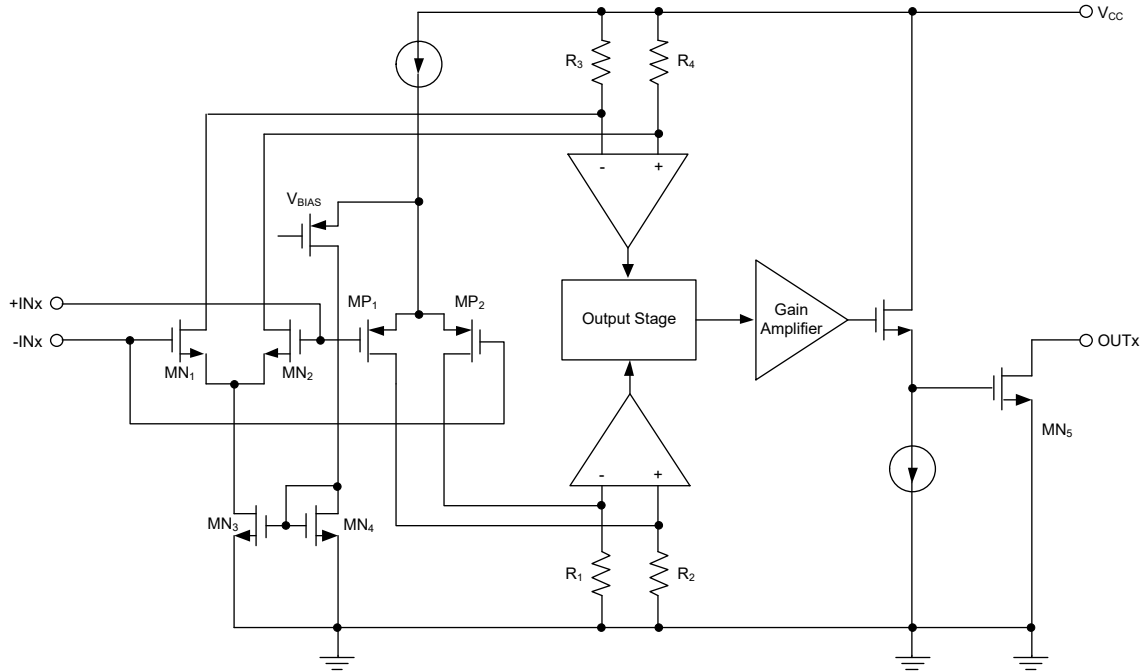


Figure 2. Block Diagram

DETAILED DESCRIPTION

The SGM8754-2 and SGM8754-4 can operate up to 5.5V power supply. Due to the low supply current and fast response, they are widely used in many applications such as industrial or portable applications.

The open-drain output provides the flexibility to configure the output logic, such as wire-AND function which can be realized by connecting the comparator output together.

The SGM8754-2 and SGM8754-4 operate as voltage comparators, which are able to compare the differential voltage between positive and negative input pins. They output a logic low or high (logic high with pull-up) to express the relationship between the two input voltages.

APPLICATION INFORMATION

For comparator applications, comparing between a single signal and a reference or comparing two signals are always encountered. The circuits in Figure 3 can be used to realize these designs. Due to open-drain output structure, it's easy to design the level shifting circuit between comparator's output and I/O of micro-controller, adjusting $R_{PULL-UP}$ and V_{LOGIC} , V_{OH} and V_{OL} of the level shifting circuit and its transient response time will be adjusted.

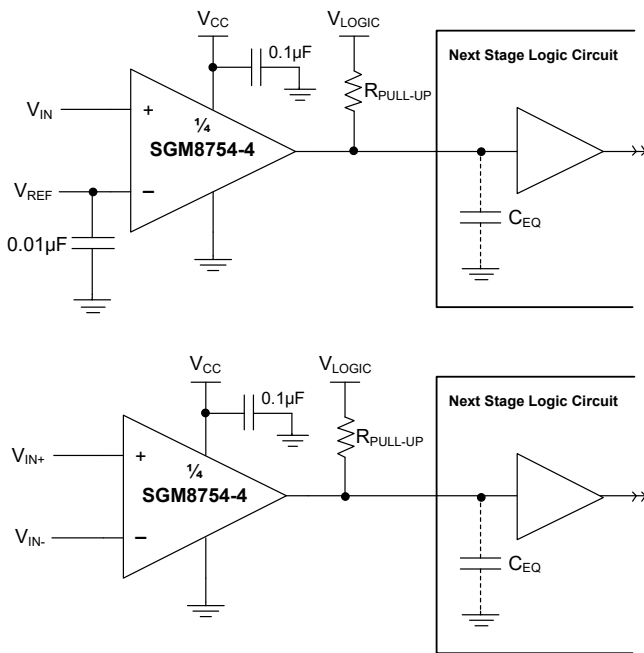


Figure 3. Typical Application Circuits

Input Voltage Range

In Figure 2, using a pair of P-MOSFETs and a pair of N-MOSFETs in a parallel structure at the input stage, the SGM8754-2/4 can support rail-to-rail input, and the input common mode voltage (V_{CM}) is range from (GND - 0.1V) to ($V_{CC} + 0.1V$). In applications, V_{CM} must be considered. If the operating voltage is outside the range of V_{CM} , the SGM8754-2/4 may generate incorrect comparison, so operating voltage must be inside the range of V_{CM} in applications.

Output and Drive Current

In Figure 3, the output and drive current are determined by the pull-up resistance ($R_{PULL-UP}$), V_{LOGIC} and V_{OUT} . Refer to the Equation 1:

$$I_{OUT} = (V_{LOGIC} - V_{OUT})/R_{PULL-UP} \quad (1)$$

The current through $R_{PULL-UP}$ will generate the logic low output voltage (V_{OL}). The output and drive current of comparator will be adjusted by adjusting $R_{PULL-UP}$, at the same time, the transient response time can be adjusted.

Transient Response Time

The transient response time can be determined by the equivalent capacitance (C_{EQ}), $R_{PULL-UP}$ and MN_5 low-side MOSFET's $R_{DS(ON)}$ in Figure 2. The order of magnitude of positive response time (t_p) is about $R_{PULL-UP} \times C_{EQ}$, and the order of magnitude of negative response time (t_n) is about $R_{DS(ON)} \times C_{EQ}$.

Power Supply Bypassing

A clean and stable power supply is very important in comparator circuit design to minimize noise, glitch and temporary fluctuation. The power supply is one of the important sources of noise to the comparator through V_{CC} pin. Power supply bypassing is an effective method to clear up the noise at power supply. The low impedance path to ground of decoupling capacitor will bypass the noise to GND. In applications, 0.1µF ceramic capacitor is always used, and this ceramic capacitor should be placed as close as possible to V_{CC} pin.

REVISION HISTORY

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

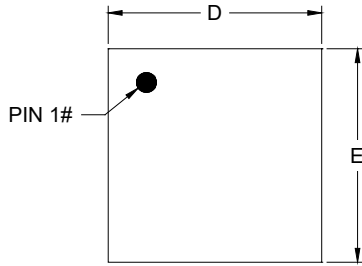
Changes from Original (APRIL 2024) to REV.A

Page

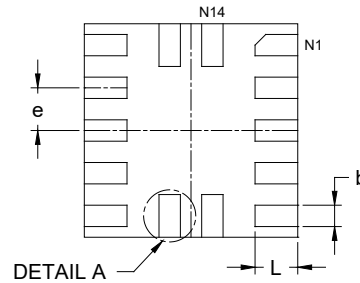
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PACKAGE OUTLINE DIMENSIONS

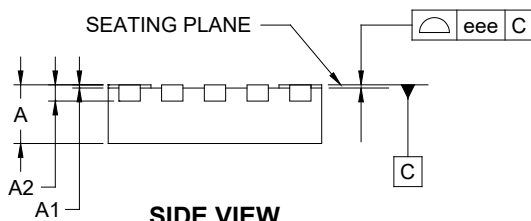
UTQFN-2x2-14BL



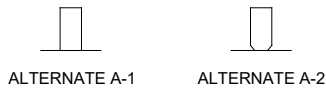
TOP VIEW



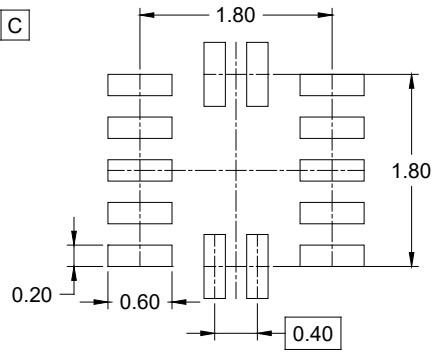
BOTTOM VIEW



SIDE VIEW



DETAIL A
ALTERNATE TERMINAL
CONSTRUCTION



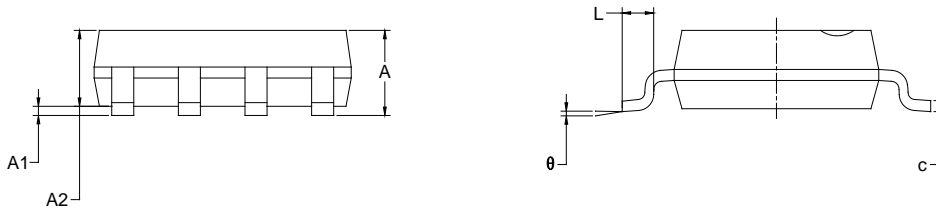
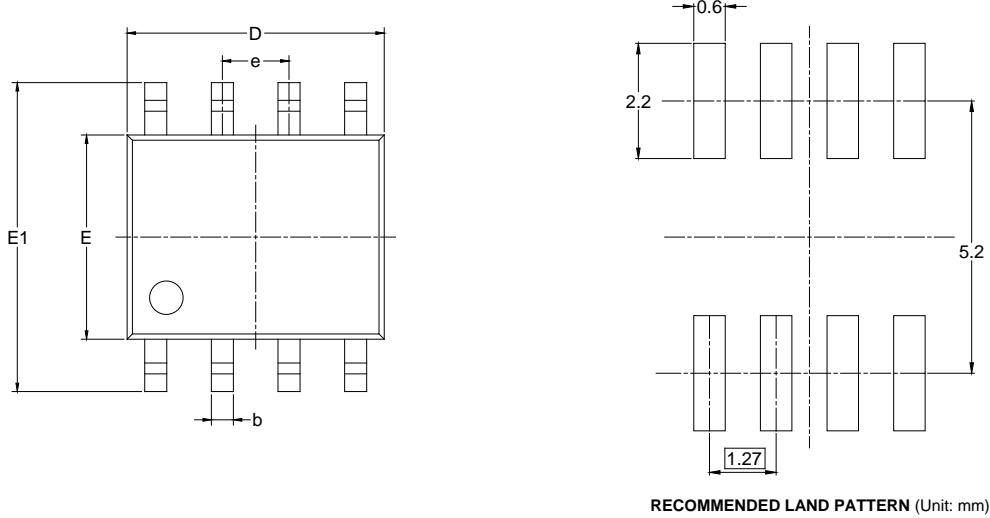
RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|-----|-------|
| | MIN | MOD | MAX |
| A | 0.500 | - | 0.600 |
| A1 | 0.000 | - | 0.050 |
| A2 | 0.152 REF | | |
| b | 0.150 | - | 0.250 |
| D | 1.900 | - | 2.100 |
| E | 1.900 | - | 2.100 |
| e | 0.400 BSC | | |
| L | 0.300 | - | 0.500 |
| eee | 0.050 | | |

NOTE: This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

SOIC-8

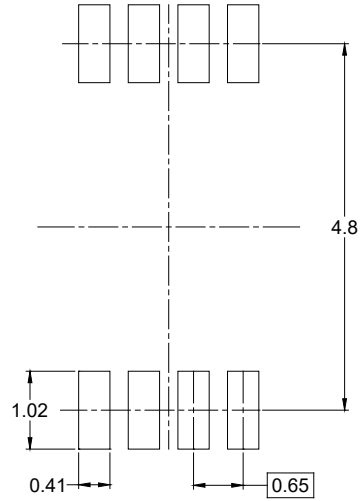
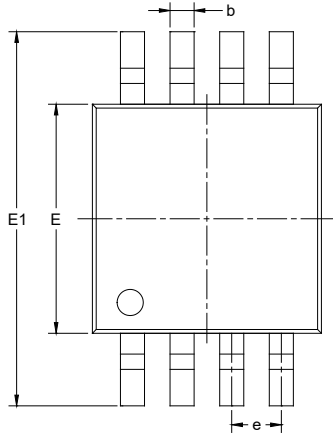


| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------------------------------|-------|-------------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 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° |

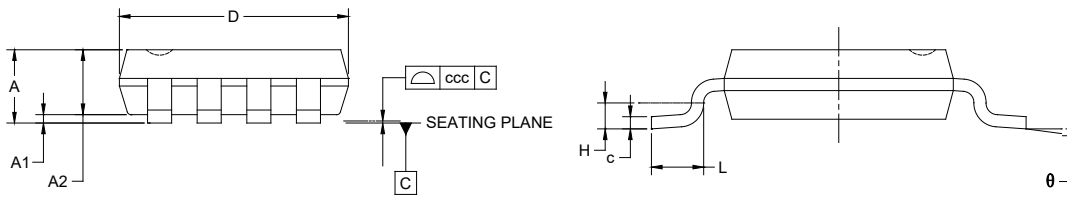
NOTES:
 1. Body dimensions do not include mode flash or protrusion.
 2. This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

MSOP-8



RECOMMENDED LAND PATTERN (Unit: mm)



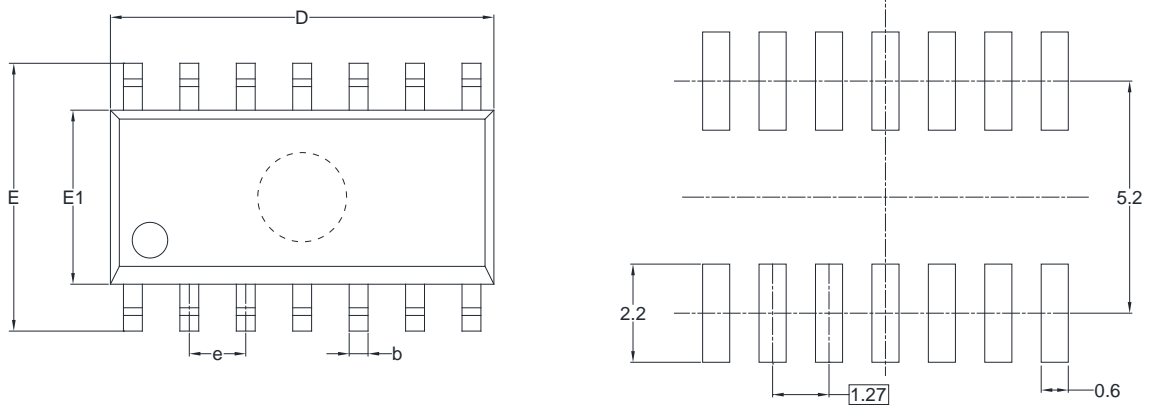
| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|-----|-------|
| | MIN | MOD | MAX |
| A | - | - | 1.100 |
| A1 | 0.000 | - | 0.150 |
| A2 | 0.750 | - | 0.950 |
| b | 0.220 | - | 0.380 |
| c | 0.080 | - | 0.230 |
| D | 2.800 | - | 3.200 |
| E | 2.800 | - | 3.200 |
| E1 | 4.650 | - | 5.150 |
| e | 0.650 BSC | | |
| L | 0.400 | - | 0.800 |
| H | 0.250 TYP | | |
| θ | 0° | - | 8° |
| ccc | 0.100 | | |

NOTES:

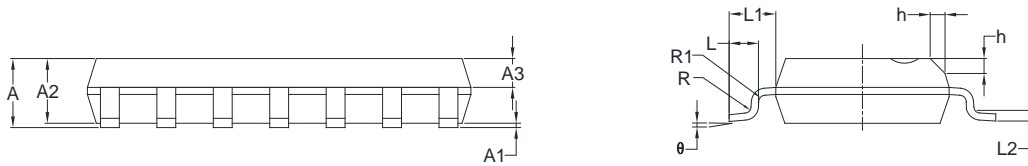
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-187.

PACKAGE OUTLINE DIMENSIONS

SOIC-14



RECOMMENDED LAND PATTERN (Unit: mm)



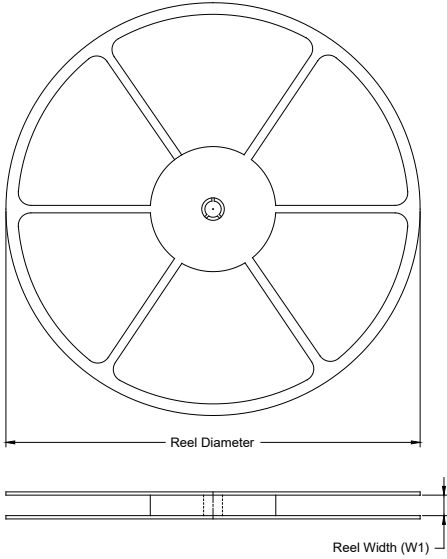
| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------------------------------|------|-------------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.35 | 1.75 | 0.053 | 0.069 |
| A1 | 0.10 | 0.25 | 0.004 | 0.010 |
| A2 | 1.25 | 1.65 | 0.049 | 0.065 |
| A3 | 0.55 | 0.75 | 0.022 | 0.030 |
| b | 0.36 | 0.49 | 0.014 | 0.019 |
| D | 8.53 | 8.73 | 0.336 | 0.344 |
| E | 5.80 | 6.20 | 0.228 | 0.244 |
| E1 | 3.80 | 4.00 | 0.150 | 0.157 |
| e | 1.27 BSC | | 0.050 BSC | |
| L | 0.45 | 0.80 | 0.018 | 0.032 |
| L1 | 1.04 REF | | 0.040 REF | |
| L2 | 0.25 BSC | | 0.01 BSC | |
| R | 0.07 | | 0.003 | |
| R1 | 0.07 | | 0.003 | |
| h | 0.30 | 0.50 | 0.012 | 0.020 |
| 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 INFORMATION

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-2×2-14BL | 7" | 9.5 | 2.25 | 2.25 | 0.75 | 4.0 | 4.0 | 2.0 | 8.0 | Q2 |
| 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 |
| SOIC-14 | 13" | 16.4 | 6.60 | 9.30 | 2.10 | 4.0 | 8.0 | 2.0 | 16.0 | Q1 |

D00001

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 |
| 13" | 386 | 280 | 370 | 5 |

DD0002