# GS8141/8142/8143

## 350nA 7KHZ CMOS Rail-to-Rail IO Opamp with RF Filter

## Features

- **Single-Supply Operation from +1.4V ~ +5.5V**
- **Rail-to-Rail Input / Output**
- **Gain-Bandwidth Product: 7KHz (Typ)**
- **Low Input Bias Current: 1pA (Typ)**
- **Low Offset Voltage: 3mV (Max)**
- **Quiescent Current: 350nA per Amplifier (Typ)**
- **Chip Select with GS8143NH( active High ) and GS8143NL(active Low )**
- **Operating Temperature: -40°C ~ +125°C**
- **Embedded RF Anti-EMI Filter**
- **Small Package:**

**GS8141 Available in SOT23-5 and SC70-5 Packages**
**GS8142 Available in SOP-8 and MSOP-8 Packages**
**GS8143NH Available in SOT23-6 and SC70-6 Packages**
**GS8143NL Available in SOT23-6 and SC70-6 Packages**

## General Description

The GS814X family has a high gain-bandwidth product of 7KHz, a slew rate of 3V/ms, and a quiescent current of 350nA/amplifier at 5V. The GS814X family is designed to provide optimal performance in low voltage and low noise systems. They provide rail-to-rail output swing into heavy loads. The input common mode voltage range includes ground, and the maximum input offset voltage is 3mV for GS814X family. They are specified over the extended industrial temperature range (-40℃ to +125℃). The operating range is from 1.4V to 5.5V. The GS8141 single is available in Green SC70-5 and SOT23-5 packages. The GS8142 Dual is available in Green SOP-8 and MSOP-8 packages. The GS8143 single is available in Green SC70-6 and SOT23-6 packages.

## Applications

- ASIC Input or Output Amplifier
- Sensor Interface
- Medical Communication
- Smoke Detectors
- Audio Output
- Piezoelectric Transducer Amplifier
- Medical Instrumentation
- Portable Systems

## Pin Configuration

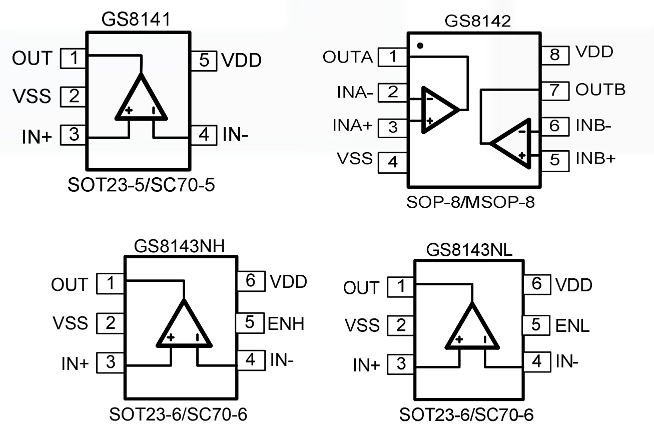



Figure 1. Pin Assignment Diagram

## Absolute Maximum Ratings

| Condition | Min | Max |
|---|---|---|
| Power Supply Voltage ($V_{DD}$ to Vss) | -0.5V | +7.5V |
| Analog Input Voltage (IN+ or IN-) | Vss-0.5V | $V_{DD}$+0.5V |
| PDB Input Voltage | Vss-0.5V | +7V |
| Operating Temperature Range | -40°C | +125°C |
| Junction Temperature | +160°C | |
| Storage Temperature Range | -55°C | +150°C |
| Lead Temperature (soldering, 10sec) | +260°C | |
| **Package Thermal Resistance ($T_A$=+25℃)** | | |
| SOP-8, $\theta_{JA}$ | 125°C/W | |
| MSOP-8, $\theta_{JA}$ | 216°C/W | |
| SOT23-5, $\theta_{JA}$ | 190°C/W | |
| SOT23-6, $\theta_{JA}$ | 190°C/W | |
| SC70-5, $\theta_{JA}$ | 333°C/W | |
| SC70-6, $\theta_{JA}$ | 333°C/W | |
| **ESD Susceptibility** | | |
| HBM | 6KV | |
| MM | 300V | |

**Note:** Stress greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions outside those indicated in the operational sections of this specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## Package/Ordering Information

| MODEL | CHANNEL | ORDER NUMBER | PACKAGE DESCRIPTION | PACKAGE OPTION | MARKING INFORMATION |
|---|---|---|---|---|---|
| GS8141 | Single | GS8141-CR | SC70-5 | Tape and Reel,3000 | 8141 |
| | | GS8141-TR | SOT23-5 | Tape and Reel,3000 | 8141 |
| GS8142 | Dual | GS8142-SR | SOP-8 | Tape and Reel,4000 | GS8142 |
| | | GS8142-MR | MSOP-8 | Tape and Reel,3000 | GS8142 |
| GS8143NH | Single | GS8143NH-CR | SC70-6 | Tape and Reel,4000 | 143H |
| | | GS8143NH-TR | SOT23-6 | Tape and Reel,3000 | GS8143NH |
| GS8143NL | Single | GS8143NL-CR | SC70-6 | Tape and Reel,4000 | 143L |
| | | GS8143NL-TR | SOT23-6 | Tape and Reel,3000 | GS8143NL |

## Electrical Characteristics

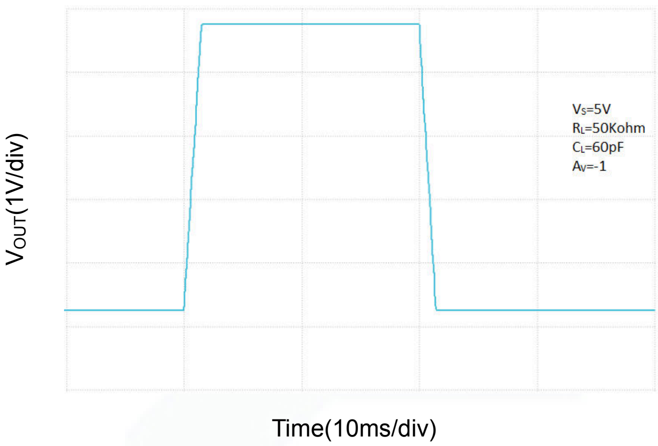
(At $V_S$ = +5V, $R_L$ = 1MΩ connected to $V_S/2$, and $V_{OUT}$ = $V_S/2$, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | GS8141/8142/8143 | | | |
|---|---|---|---|---|---|---|
| | | | TYP | MIN | MAX | UNITS |
| **INPUT CHARACTERISTICS** | | | | | | |
| Input Offset Voltage | $V_{OS}$ | $V_{CM} = V_S/2$ | 0.4 | | 3 | mV |
| Input Bias Current | $I_B$ | | 1 | | | pA |
| Input Offset Current | $I_{OS}$ | | 1 | | | pA |
| Common-Mode Voltage Range | $V_{CM}$ | $V_S$ = 5.5V | -0.1 to +5.6 | | | V |
| Common-Mode Rejection Ratio | CMRR | $V_S$ = 5V, $V_{CM}$ = -0.1V to 2.5V | 77 | 63 | | dB |
| | | $V_S$ = 5V, $V_{CM}$ = -0.1V to 5.1V | 83 | 68 | | |
| Open-Loop Voltage Gain | $A_{OL}$ | Vs=1.4V, $R_L$ = 50kΩ, $V_O$ = Vs-0.1V | 84 | 75 | | dB |
| | | Vs=5V, $R_L$ = 50kΩ, $V_O$ = Vs-0.1V | 93 | 87 | | |
| Input Offset Voltage Drift | $\Delta V_{OS}/\Delta_T$ | | 2.5 | | | μV/°C |
| **OUTPUT CHARACTERISTICS** | | | | | | |
| Output Voltage Swing from Rail | $V_{OH}$ | Vs=1.4V, $R_L$ = 50kΩ | 1.395 | 1.390 | | V |
| | $V_{OL}$ | | 4.5 | | 10 | mV |
| | $V_{OH}$ | Vs=5V, $R_L$ = 50kΩ | 4.997 | 4.990 | | V |
| | $V_{OL}$ | | 3.5 | | 10 | mV |
| Output Current | $I_{SOURCE}$ | $R_L$ = 10Ω to $V_S/2$ | 20 | | | mA |
| | $I_{SINK}$ | | 20 | | | |
| **POWER SUPPLY** | | | | | | |
| Operating Voltage Range | | | 1.4 | | | V |
| | | | 5.5 | | | V |
| Power Supply Rejection Ratio | PSRR | $V_S$ = +1.4V to +5.5V, $V_{CM}$ = +0.5V | 80 | 69 | | dB |
| Quiescent Current / Amplifier | $I_Q$ | | 600 | | | nA |
| Shutdown Current / Amplifier | $I_{Q\_off}$ | GS8143NH / GS8143NL | 54 | | | nA |
| **DYNAMIC PERFORMANCE (CL = 100pF)** | | | | | | |
| Gain-Bandwidth Product | GBP | | 7 | | | KHz |
| Slew Rate | SR | G = +1, 2V Output Step | 3 | | | V/ms |

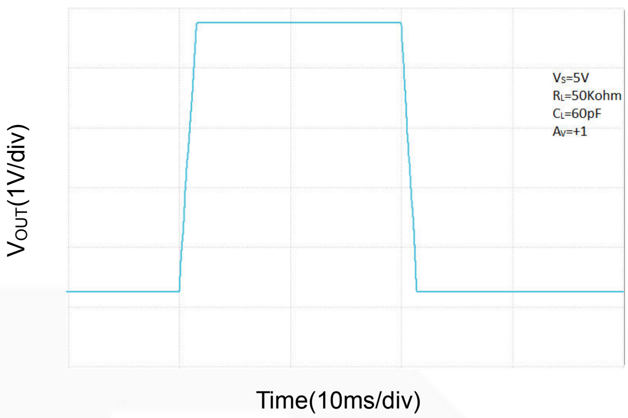
## Typical Performance characteristics

At $T_A$=+25°C, $V_S$=+5V, and $R_L$=100KΩ connected to $V_S$/2, unless otherwise noted.

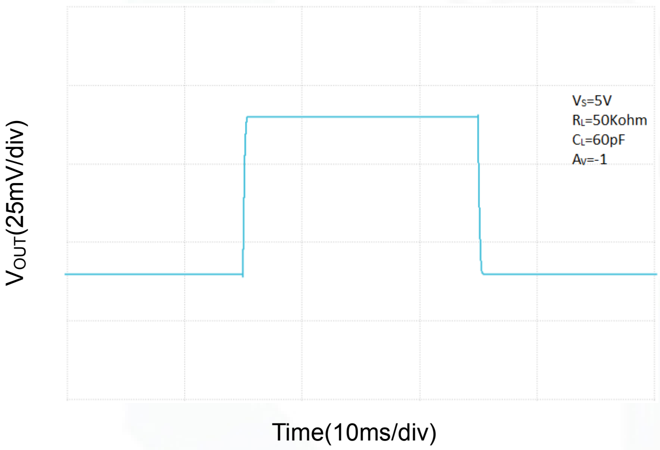
Large Signal Inverting Pulse Response



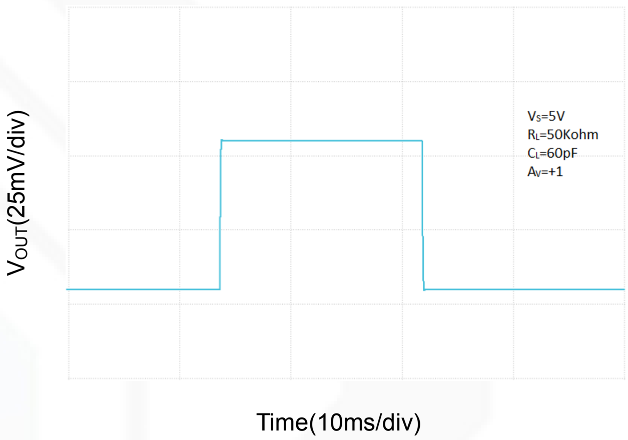

Large Signal Non-Inverting Pulse Response




Small Signal Inverting Pulse Response



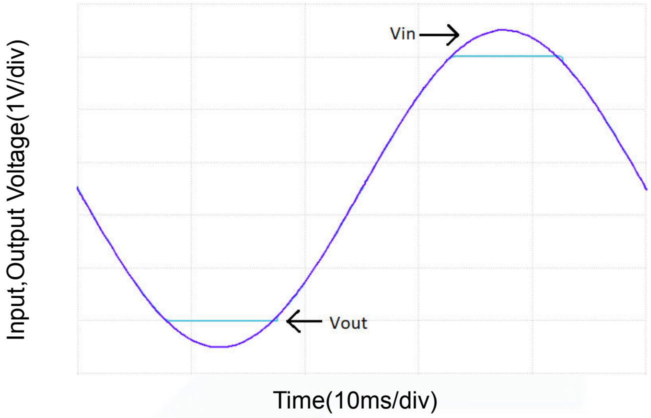

Small Signal Non-Inverting Pulse Response



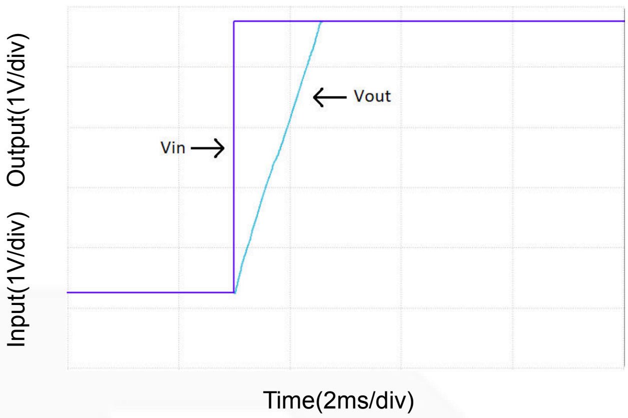
## Typical Performance characteristics

At $T_A$=+25°C, $V_S$=+5V, and $R_L$=100KΩ connected to $V_S$/2, unless otherwise noted.

No Phase Reversal




Output Settling Time



# Application Note

## Size

GS814X family series op amps are unity-gain stable and suitable for a wide range of general-purpose applications. The small footprints of the GS814X family packages save space on printed circuit boards and enable the design of smaller electronic products.

## Power Supply Bypassing and Board Layout

GS814X family series operates from a single 1.4V to 5.5V supply or dual ±0.7V to ±2.75V supplies. For best performance, a 0.1μF ceramic capacitor should be placed close to the $V_{DD}$ pin in single supply operation. For dual supply operation, both $V_{DD}$ and $V_{SS}$ supplies should be bypassed to ground with separate 0.1μF ceramic capacitors.

## Low Supply Current

The low supply current (typical 350nA per channel) of GS814X family will help to maximize battery life. They are ideal for battery powered systems.

## Operating Voltage

GS814X family operates under wide input supply voltage (1.4V to 5.5V) In addition, all temperature specifications apply from -40 °C to +125 °C. Most behavior remains unchanged throughout the full operating voltage range. These guarantees ensure operation throughout the single Li-Ion battery lifetime.

## Rail-to-Rail Input

The input common-mode range of GS814X family extends 100mV beyond the supply rails ($V_{SS}$-0.1V to $V_{DD}$+0.1V). This is achieved by using complementary input stage. For normal operation, inputs should be limited to this range.

## Rail-to-Rail Output

Rail-to-Rail output swing provides maximum possible dynamic range at the output. This is particularly important when operating in low supply voltages. The output voltage of GS814X family can typically swing to less than 50mV from supply rail in light resistive loads (>50kΩ).

## Capacitive Load Tolerance

The GS814X family is optimized for bandwidth and speed, not for driving capacitive loads. Output capacitance will create a pole in the amplifier's feedback path, leading to excessive peaking and potential oscillation. If dealing with load capacitance is a requirement of the application, the two strategies to consider are (1) using a small resistor in series with the amplifier's output and the load capacitance and (2) reducing the bandwidth of the amplifier's feedback loop by increasing the overall noise gain. Figure 2. shows a unity gain follower using the series resistor strategy. The resistor isolates the output from the capacitance and, more importantly, creates a zero in the feedback path that compensates for the pole created by the output capacitance.

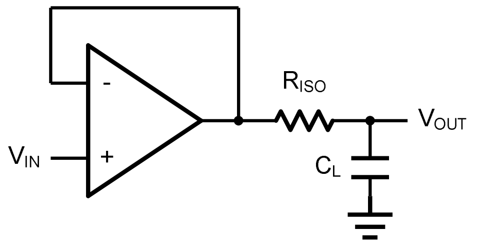



Figure 2. Indirectly Driving a Capacitive Load Using Isolation Resistor

The bigger the $R_{ISO}$ resistor value, the more stable $V_{OUT}$ will be. However, if there is a resistive load $R_L$ in parallel with the capacitive load, a voltage divider (proportional to $R_{ISO}/R_L$) is formed, this will result in a gain error.

The circuit in Figure 3 is an improvement to the one in Figure 2. $R_F$ provides the DC accuracy by feed-forward the $V_{IN}$ to $R_L$. $C_F$ and $R_{ISO}$ serve to counteract the loss of phase margin by feeding the high frequency component of the output signal back to the amplifier's inverting input, thereby preserving the phase margin in the overall feedback loop. Capacitive drive can be increased by increasing the value of $C_F$. This in turn will slow down the pulse response.

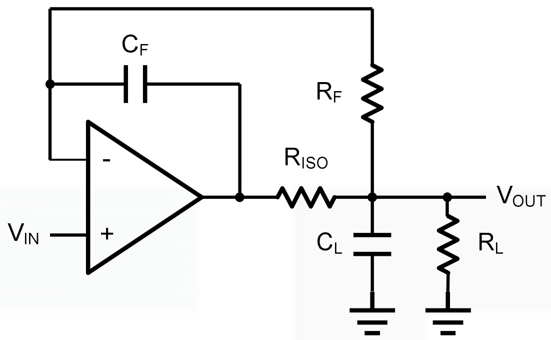



Figure 3. Indirectly Driving a Capacitive Load with DC Accuracy

# Typical Application Circuits

## Differential amplifier

The differential amplifier allows the subtraction of two input voltages or cancellation of a signal common the two inputs. It is useful as a computational amplifier in making a differential to single-end conversion or in rejecting a common mode signal. Figure 4. shown the differential amplifier using GS814X family.

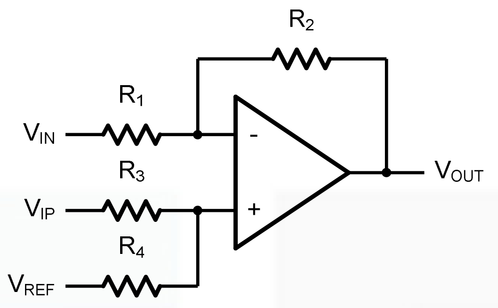



Figure 4. Differential Amplifier

$$V_{OUT}=\left(\frac{R_1+R_2}{R_3+R_4}\right)\frac{R_4}{R_1}V_{IN}-\frac{R_2}{R_1}V_{IP}+\left(\frac{R_1+R_2}{R_3+R_4}\right)\frac{R_3}{R_1}V_{REF}$$

If the resistor ratios are equal (i.e. $R_1=R_3$ and $R_2=R_4$), then

$$V_{OUT}=\frac{R_2}{R_1}(V_{IP}-V_{IN})+V_{REF}$$

## Low Pass Active Filter

The low pass active filter is shown in Figure 5. The DC gain is defined by $-R_2/R_1$. The filter has a -20dB/decade roll-off after its corner frequency $f_C=1/(2\pi R_3C_1)$.

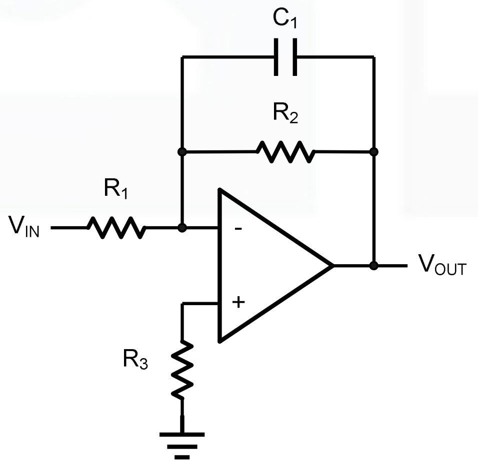



Figure 5. Low Pass Active Filter

## Instrumentation Amplifier

The triple GS814X family can be used to build a three-op-amp instrumentation amplifier as shown in Figure 6. The amplifier in Figure 6 is a high input impedance differential amplifier with gain of R2/R1. The two differential voltage followers assure the high input impedance of the amplifier.

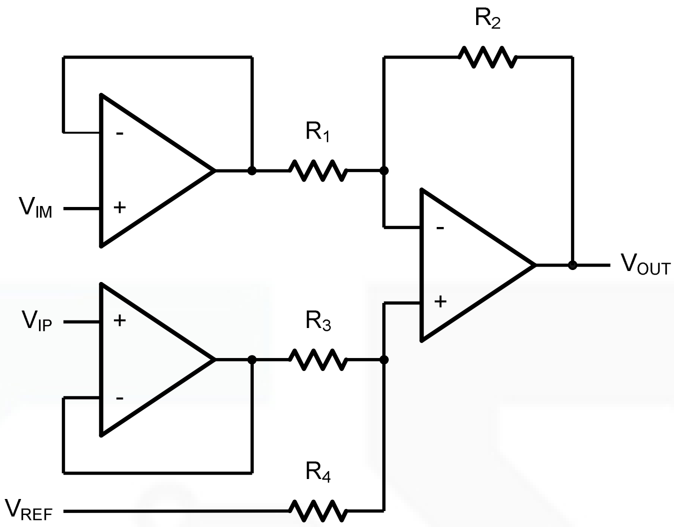



Figure 6. Instrument Amplifier

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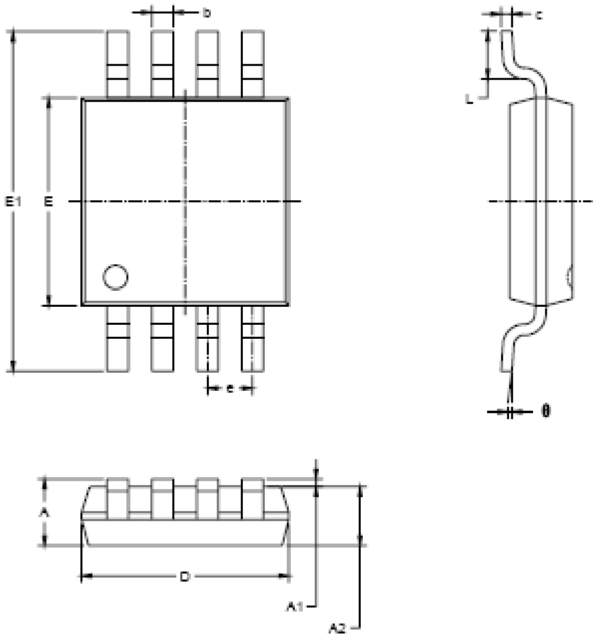
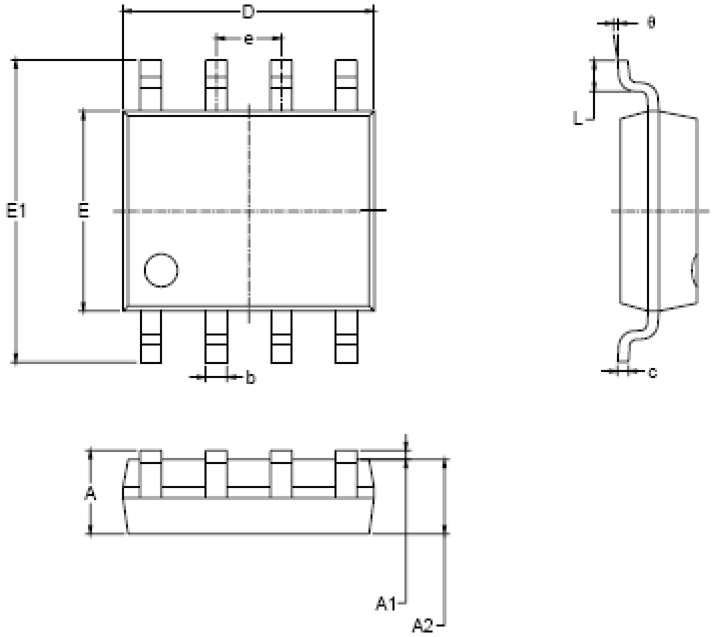
## Package Information

### MSOP-8



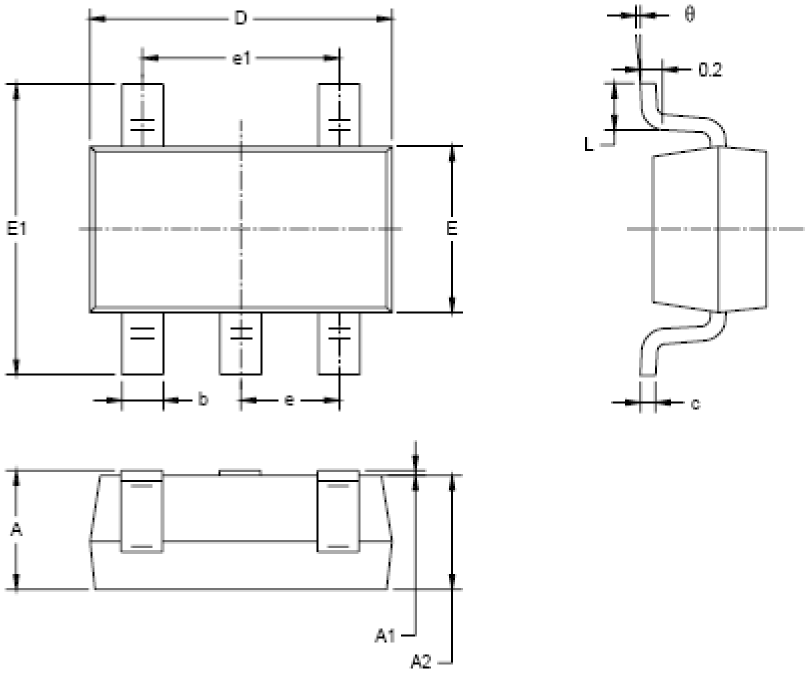

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.820 | 1.100 | 0.032 | 0.043 |
| A1 | 0.020 | 0.150 | 0.001 | 0.006 |
| A2 | 0.750 | 0.950 | 0.030 | 0.037 |
| b | 0.250 | 0.380 | 0.010 | 0.015 |
| c | 0.090 | 0.230 | 0.004 | 0.009 |
| 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° |

**SOP-8**



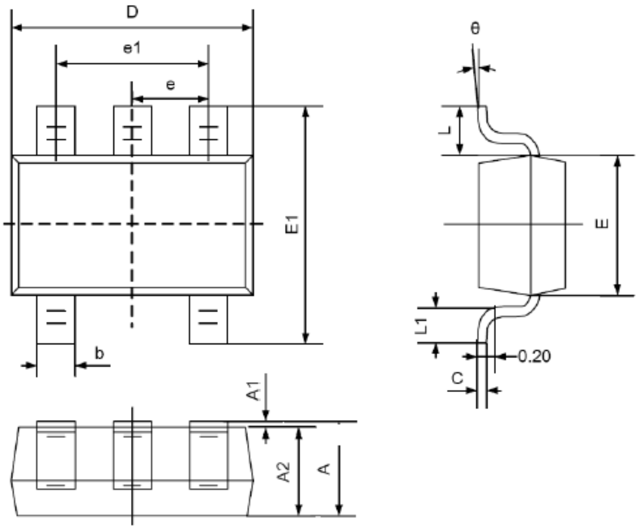

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.010 |
| 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° |

**SOT23-5**



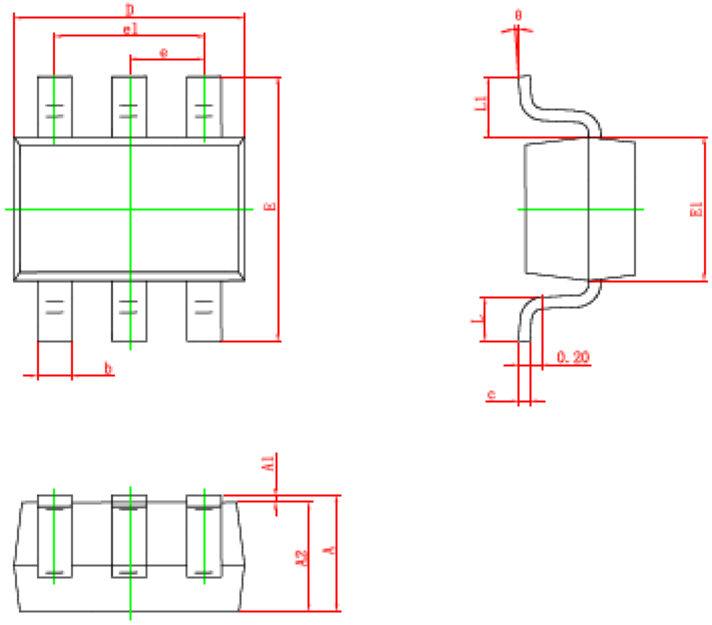

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E | 1.500 | 1.700 | 0.059 | 0.067 |
| E1 | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.950 BSC | | 0.037 BSC | |
| e1 | 1.900 BSC | | 0.075 BSC | |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

**SC70-5**



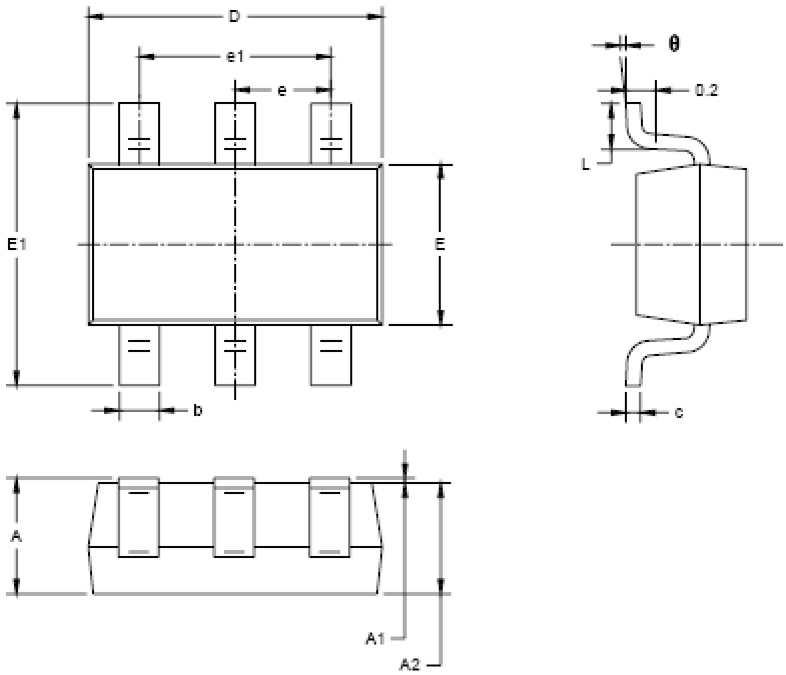

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.900 | 1.100 | 0.035 | 0.043 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.900 | 1.000 | 0.035 | 0.039 |
| b | 0.150 | 0.350 | 0.006 | 0.014 |
| C | 0.080 | 0.150 | 0.003 | 0.006 |
| 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 | 0.650TYP | | 0.026TYP | |
| e1 | 1.200 | 1.400 | 0.047 | 0.055 |
| L | 0.525REF | | 0.021REF | |
| L1 | 0.260 | 0.460 | 0.010 | 0.018 |
| θ | 0° | 8° | 0° | 8° |

**SC70-6**




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 0.900 | 1.100 | 0.035 | 0.043 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.900 | 1.000 | 0.035 | 0.039 |
| b | 0.150 | 0.350 | 0.006 | 0.014 |
| c | 0.080 | 0.150 | 0.003 | 0.006 |
| D | 2.000 | 2.200 | 0.079 | 0.087 |
| E | 2.150 | 2.450 | 0.085 | 0.096 |
| E1 | 1.150 | 1.350 | 0.045 | 0.053 |
| e | 0.650 TYP. | | 0.026 TYP. | |
| e1 | 1.200 | 1.400 | 0.047 | 0.055 |
| L | 0.260 | 0.460 | 0.010 | 0.018 |
| L1 | 0.525 REF. | | 0.021 REF. | |
| θ | 0° | 8° | 0° | 8° |

**SOT23-6**




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E | 1.500 | 1.700 | 0.059 | 0.067 |
| E1 | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.950 BSC | | 0.037 BSC | |
| e1 | 1.900 BSC | | 0.075 BSC | |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

单击下面可查看定价，库存，交付和生命周期等信息

[>>Gainsil(聚洵)]