Features

- **Fast, 91ns Propagation Delay**
- **22uA (Typ.) Low Power Consumption**
- **Single-Supply Operation from +2.7V ~ +5.5V**
- **Low Offset Voltage: 5mV (Max.)**
- **Rail-to-Rail Input and open drain Output**
- **CMOS/TTL-Compatible Output**
- **Internal Hysteresis for Clean Switching**
- **No Phase Reversal for Overdriven Inputs**
- **Operating Temperature: -40°C ~ +85°C**
- **Small Package:**

GS8749 Available in SOT23-5 and SC70-5 Packages

GS8750 Available in SOP-8 and MSOP-8 Packages

General Description

The GS8749 family are low-power, high-speed comparators with internal hysteresis, optimized for systems powered from a 3V or 5V supply. The device features high-speed response, low-power consumption, low offset voltage, rail-to-rail input range and open drain output. Propagation delay is 91ns (100mV overdrive), while supply current is 22uA per comparator. The internal input hysteresis eliminates output switching due to internal input noise voltage. The maximum input offset voltage is 5mV, and the operating range is from 2.7V to 5.5V.

All devices are specified for the temperature range of -40℃ to +85℃. The GS8749 single is available in Green SC70-5 and SOT23-5 packages. The GS8750 Dual is available in Green SOP-8 and MSOP-8 packages.

Applications

- Line Receivers
- Battery-Powered Systems
- Threshold Detectors/Discriminators
- 3V/5V Systems
- Zero-Crossing Detectors
- Sampling Circuits

Pin Configuration

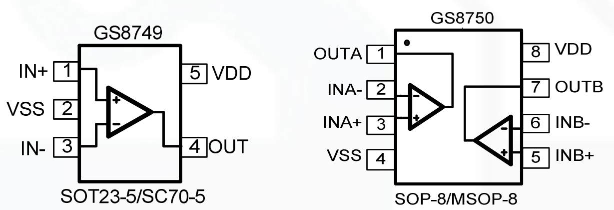


Figure 1. Pin Assignment Diagram

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	+85°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, θ_{JA}	125°C/W	
MSOP-8, θ_{JA}	216°C/W	
SOT23-5, θ_{JA}	190°C/W	
SC70-5, θ_{JA}	333°C/W	
ESD Susceptibility		
HBM	4KV	
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
GS8749	Single	GS8749-CR	SC70-5	Tape and Reel,3000	8749
		GS8749-TR	SOT23-5	Tape and Reel,3000	8749
GS8750	Dual	GS8750-SR	SOP-8	Tape and Reel,4000	GS8750
		GS8750-MR	MSOP-8	Tape and Reel,3000	GS8750

Electrical Characteristics

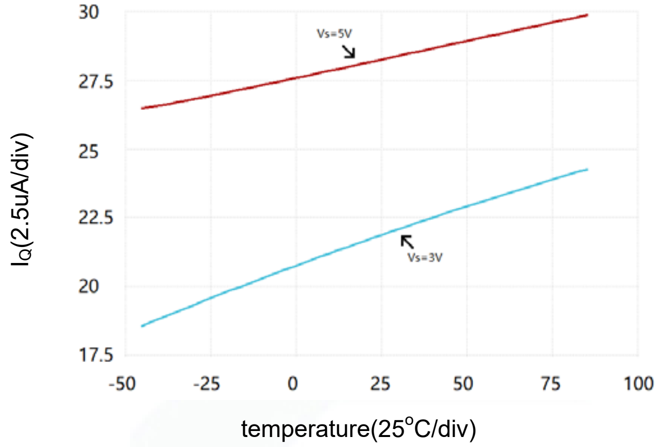
(At V_S = +5V, V_{CM} = 0V, C_L = 15pF, and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	GS8743/8744/8745			
			TYP	MIN	MAX	UNITS
INPUT CHARACTERISTICS						
Input Offset Voltage	V_{OS}	V_{CM} = 0V	0.4		5	mV
Input Bias Current	I_B		6			pA
Input Offset Current	I_{OS}		4			pA
Input Hysteresis	V_{hys}		2.6			mV
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} = 0V to 5V	77	60		dB
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail	V_{OH}	Vs=5V, I_O = 4mA	Vs – 0.200		Vs - 0.275	V
	V_{OL}		159		222	mV
Output Short-Circuit Current	I_{SOURCE}	V_S = 5V, Out to V_S/2	35	22.5		mA
	I_{SINK}		36	25.5		
POWER SUPPLY						
Operating Voltage Range			2.7			V
			5.5			V
Power Supply Rejection Ratio	PSRR	V_S = +2.7V to +5.5V, V_{CM} = 0V	71	58		dB
Quiescent Current / Comparator	I_Q	V_S = +3V	22			uA
DYNAMIC PERFORMANCE (CL = 15pF)						
Propagation Delay (Low to High)	T_{dLH}	V_S = 3V, Overdrive = 10mV	173			ns
		V_S = 3V, Overdrive = 100mV	91			ns
Propagation Delay (High to Low)	T_{dHL}	V_S = 3V, Overdrive = 10mV	206			ns
		V_S = 3V, Overdrive = 100mV	64			ns
Rise Time	T_r	V_S = 3V, Overdrive = 10mV	7.6			ns
		V_S = 3V, Overdrive = 100mV	7.5			ns
Fall Time	T_f	V_S = 3V, Overdrive = 10mV	6.5			ns
		V_S = 3V, Overdrive = 100mV	6.4			ns

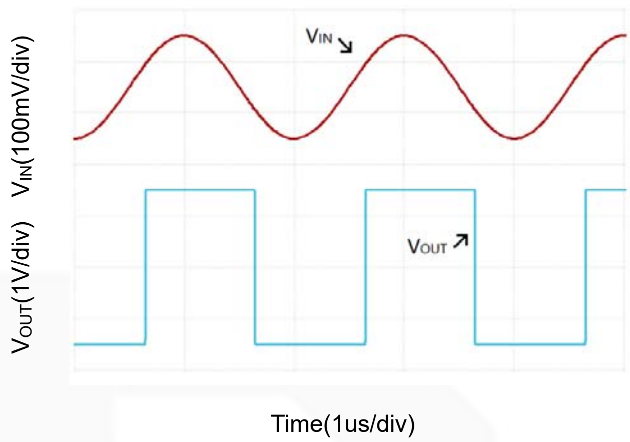
Typical Performance characteristics

At T_A=+25°C, V_S=+3V, and C_L=15pF, unless otherwise noted.

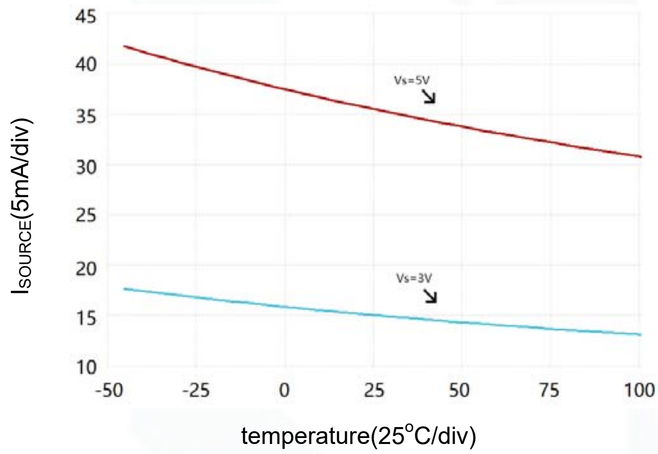
Supply Current vs. Temperature



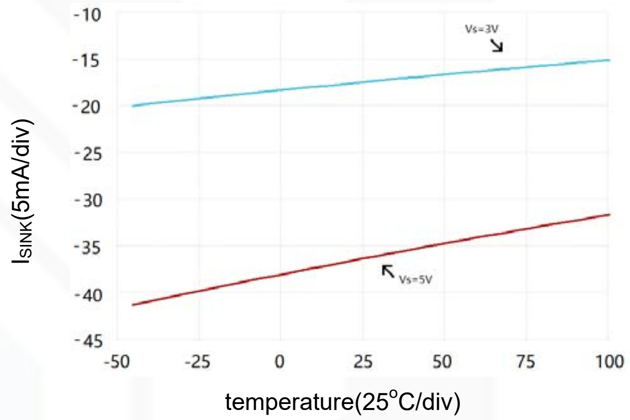
Sinusoid Response at 0.5MHz



Output Short-Circuit (Source) Current vs. Temperature



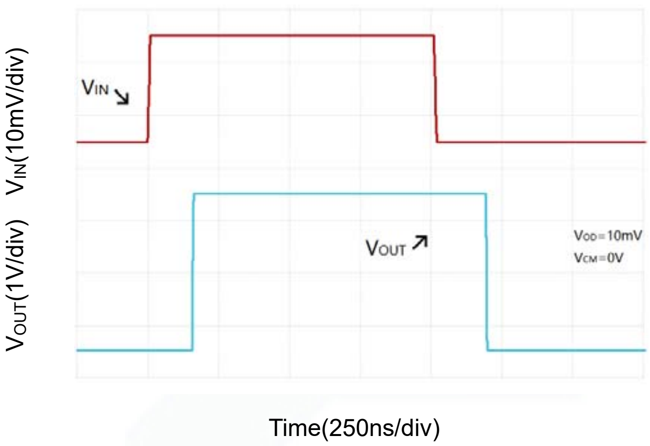
Output Short-Circuit (Sink) Current vs. Temperature



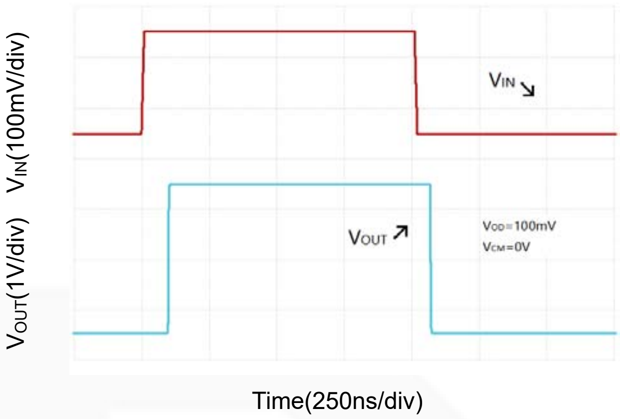
Typical Performance characteristics

At T_A=+25°C, V_S=+3V, and C_L=15pF, unless otherwise noted.

Progation Delay (L-H&H-L)



Progation Delay (L-H&H-L)



Application Note

Size

GS8749 family series comparators are low-power, high-speed and suitable for a wide range of general-purpose applications. The small footprints of the GS8749 family packages save space on printed circuit boards and enable the design of smaller electronic products. The GS8749 family interfaces directly to CMOS and TTL logics.

Power Supply Bypassing and Board Layout

GS8749 family series operates from a single 2.7V to 5.5V supply or dual ±1.35V 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 22uA per channel) of GS8749 family will help to maximize battery life. They are ideal for battery powered systems.

Operating Voltage

GS8749 family operates under wide input supply voltage (2.7V to 5.5V). In addition, all temperature specifications apply from -40 °C to +85 °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 GS8749 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.

Internal Hysteresis

Because of noise or undesired parasitic feedback, high-speed comparators oscillate in the linear region. Oscillation tends to occur when the voltage on one input is at or equal to the voltage on the other input. The GS8749 family eliminates this undesired oscillation by integrating an internal hysteresis of 2.6mV.

The hysteresis in a comparator creates two trip points: one for the rising input voltage and one for the falling input voltage (Figure 1). The difference between two trip points is the hysteresis, while the average of two trip points is the offset voltage. When the comparator's input voltages are equal, the hysteresis effectively causes one comparator input voltage to move quickly past the other, thus taking the input out of the region where oscillation occurs.

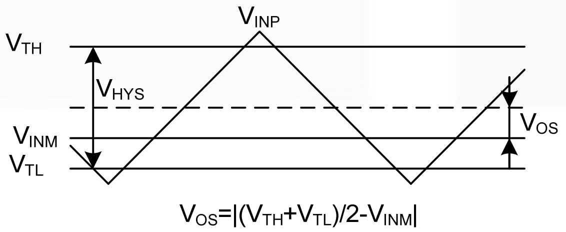


Figure 1. Comparator's hysteresis and offset

External Hysteresis

Greater flexibility in selecting hysteresis is achieved by using external resistors. Hysteresis reduces output chattering when one input is slowly moving past the other.

Non-Inverting Comparator with Hysteresis

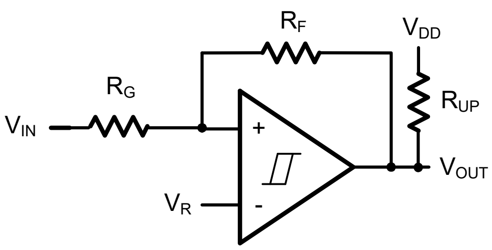


Figure 2. Non-Inverting Comparator with Hysteresis

A non-inverting comparator with hysteresis requires a two-resistor network, as shown in Figure 2 and a voltage reference (V_R) at the inverting input.

$$V_{TH} = \frac{R_G + R_F}{R_F} \times V_R$$

$$V_{TL} = \frac{R_G + R_F}{R_F} \times V_R - \frac{R_G}{R_F} \times V_{DD}$$

$$V_{HYS} = \frac{R_G}{R_F} \times V_{DD}$$

R_{UP} is the open drain pull-up resistor , R_{UP} should be much smaller than R_G and R_F.

Inverting Comparator with Hysteresis

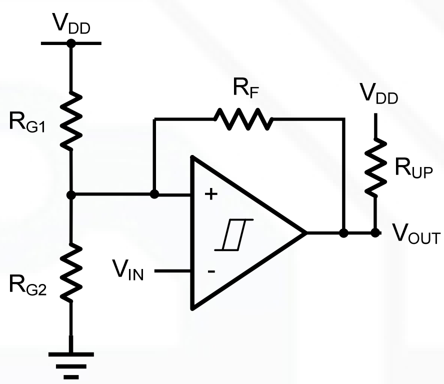


Figure 3. Inverting Comparator with Hysteresis

The inverting comparator with hysteresis requires a three-resistor network that is referenced to the comparator supply voltage (V_{DD}), as shown in Figure 3.

$$V_{TH} = \frac{R_{G2}}{R_{G1} \parallel R_F + R_{G2}} \times V_{DD}$$

$$V_{TL} = \frac{R_{G2} \parallel R_F}{R_{G2} \parallel R_F + R_{G1}} \times V_{DD}$$

$$V_{HYS} = \frac{R_{G1} \parallel R_{G2}}{R_{G1} \parallel R_{G2} + R_F} \times V_{DD}$$

R_{UP} is the open drain pull-up resistor, R_{UP} should be much smaller than R_{G1},R_{G2} and R_F.

Typical Application Circuits

Line Receiver

A Line Receiver using GS8749 family is shown in Figure 4. Resistors R_{G1} and R_{G2} set the bias point at the comparator's inverting input. R_{IN} should be same as $R_{G1}||R_{G2}$ to get a better match. GS8749 family detects the voltage of the Coax Line, and outputs logic high or logic low quickly with no glitch.

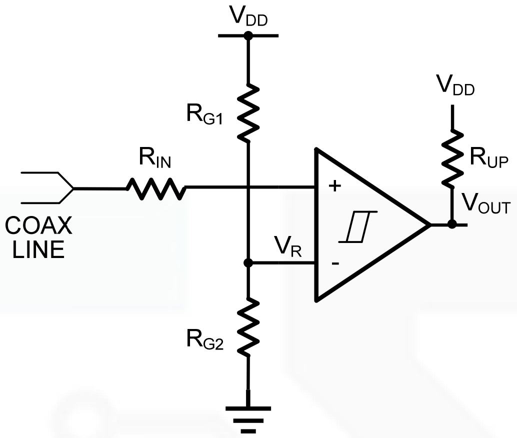


Figure 4. Line Receiver

IR Receiver

GS8749 family is an ideal candidate to be used as an infrared receiver shown in Figure 5. The infrared photo diode creates a current relative to the amount of infrared light present. The current creates a voltage across R_{IN}. When this voltage level cross the voltage applied by the voltage divider to the inverting input, the output transitions. Optional R_F provides additional hysteresis for noise immunity.

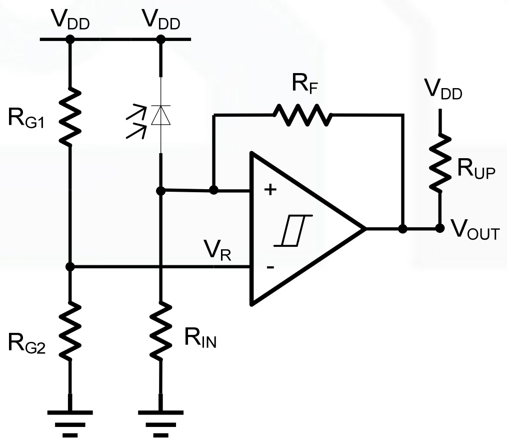


Figure 5. IR Receiver

Oscillator

A oscillator using GS8749 family is shown in Figure 6. Resistors R_{G1} and R_{G2} set the bias point at the comparator's inverting input. The period of oscillator is set by the time constant of R_C and C_{IN}. The maximum frequency is limited by the large signal propagation delay of the comparator. GS8749 family's low propagation delay guarantees the high frequency oscillation.

If $R_{G1}=R_{G2}= R_F$, then the frequency of the oscillator is:

$$f_{OSC} = \frac{1}{2 \times \ln 2 \times R_C \times C_{IN}}$$

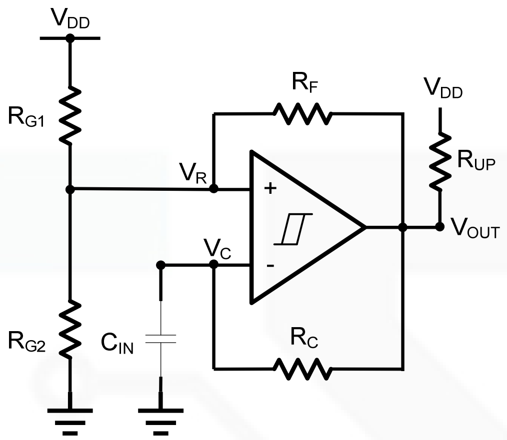
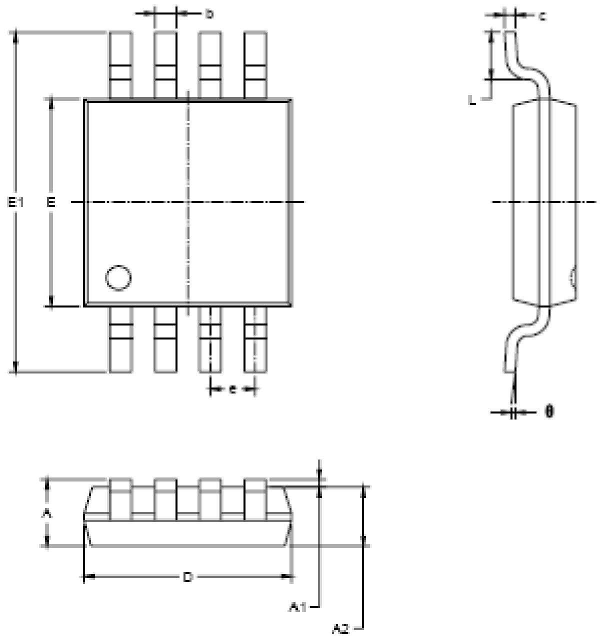


Figure 6. Oscillator

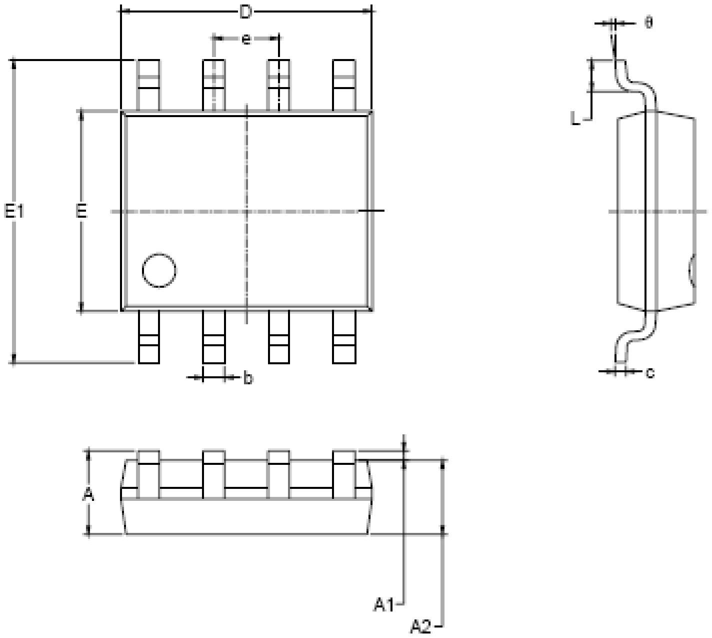
Package Information

MSOP-8



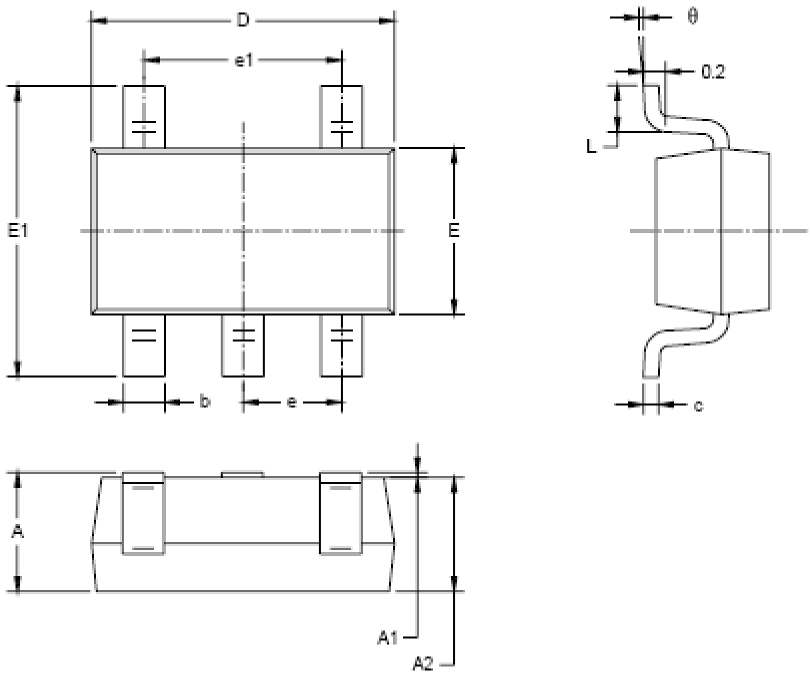
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

SOP-8



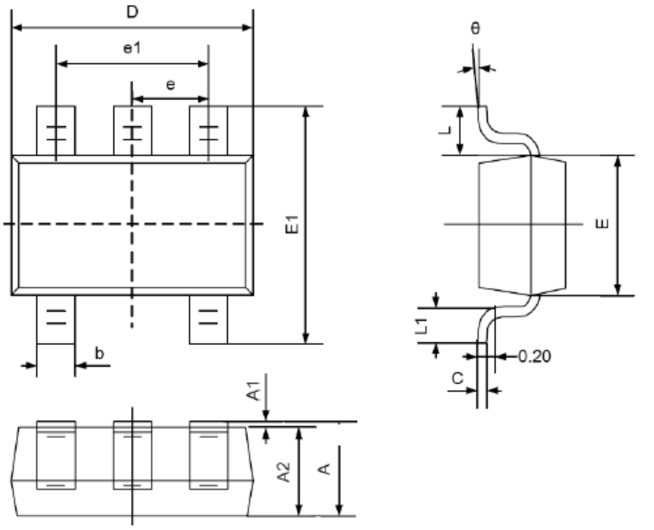
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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