Features

- **Single-Supply Operation from +1.4V ~ +5.5V**
- **Rail-to-Rail Input / Output**
- **Gain-Bandwidth Product: 14.5KHz (Typ)**
- **Low Input Bias Current: 1pA (Typ)**
- **Low Offset Voltage: 3mV (Max)**
- **Quiescent Current: 600nA per Amplifier (Typ)**
- **Operating Temperature: -40°C ~ +125°C**
- **Embedded RF Anti-EMI Filter**

Applications

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

Pin Configuration

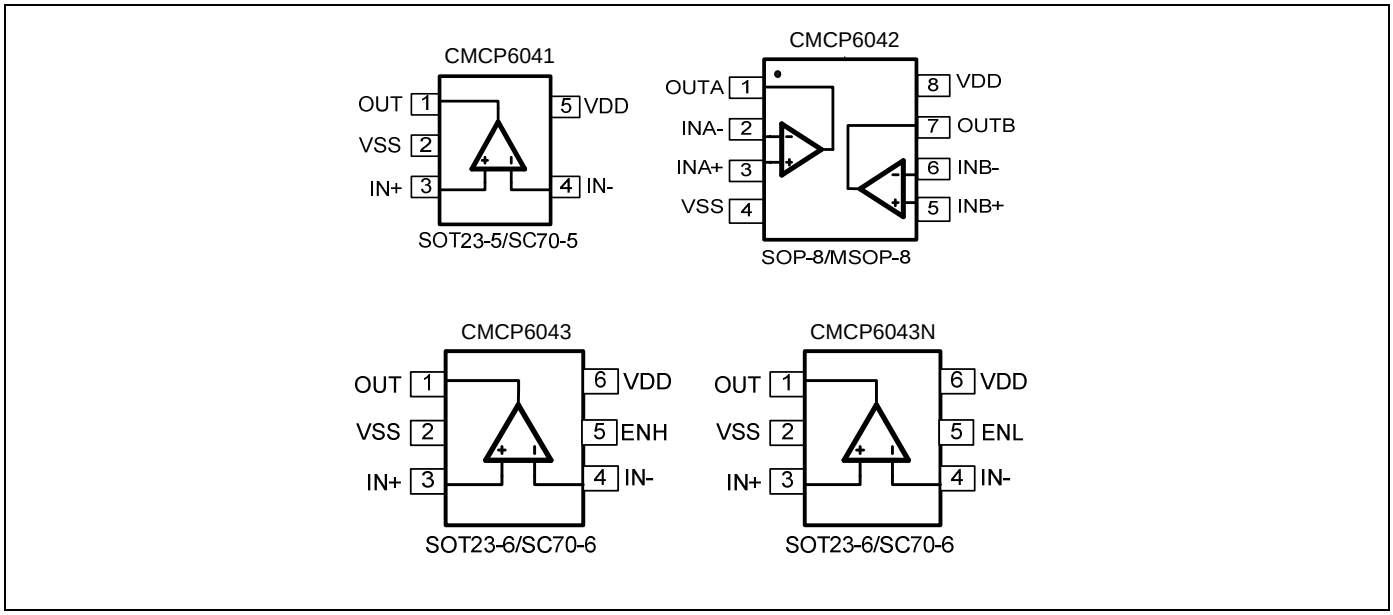


Figure 1. Pin Assignment Diagram

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, θ_{JA}	125°C/W	
MSOP-8, θ_{JA}	216°C/W	
SOT23-5, θ_{JA}	190°C/W	
SOT23-6, θ_{JA}	190°C/W	
SC70-5, θ_{JA}	333°C/W	
SC70-6, θ_{JA}	333°C/W	
ESD Susceptibility		
HBM	6KV	
MM	300V	

Electrical Characteristics

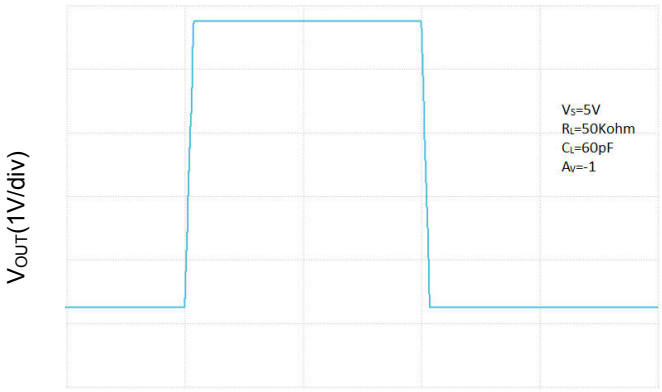
(At V_S = +5V, R_L = 1MΩ connected to V_S/2, and V_{OUT} = V_S/2, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	CMCP6041/6042/6043			
			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	78	66		dB
		V_S = 5V, V_{CM} = -0.1V to 5.1V	84	67		
Open-Loop Voltage Gain	A_{OL}	Vs=1.4V, R_L = 50kΩ, V_O = Vs-0.1V	86	75		dB
		Vs=5V, R_L = 50kΩ, V_O = Vs-0.1V	93	84		
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta_T$		2.5			μV/℃
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	77		dB
Quiescent Current / Amplifier	I_Q		600			nA
Shutdown Current / Amplifier	I_{Q_off}	CMCP6043 CMCP6043N	54			nA
DYNAMIC PERFORMANCE (CL = 100pF)						
Gain-Bandwidth Product	GBP		14.5			KHz
Slew Rate	SR	G = +1, 2V Output Step	6			V/ms

Typical Performance characteristics

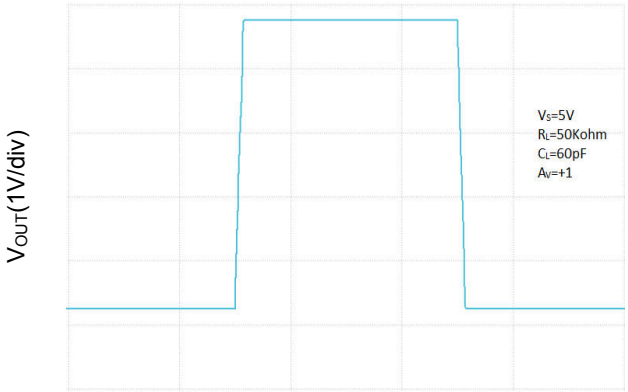
At T_A=+25°C, V_S=+5V, and R_L=100KΩ connected to V_S/2, unless otherwise noted.

Large Signal Inverting Pulse Response



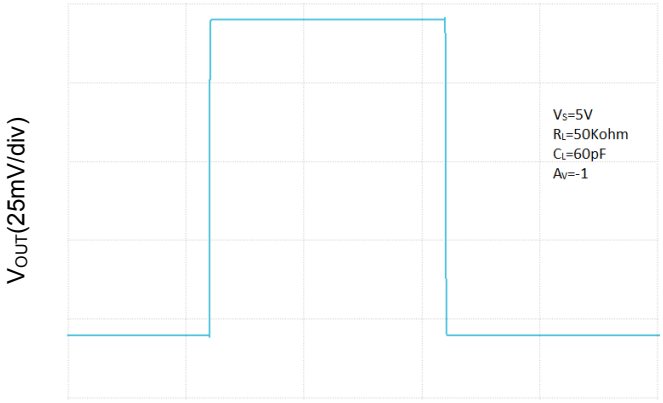
Time(10ms/div)

Large Signal Non-Inverting Pulse Response



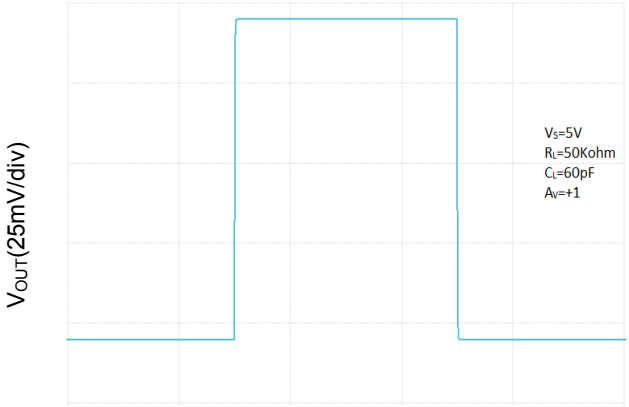
Time(10ms/div)

Small Signal Inverting Pulse Response



Time(10ms/div)

Small Signal Non-Inverting Pulse Response

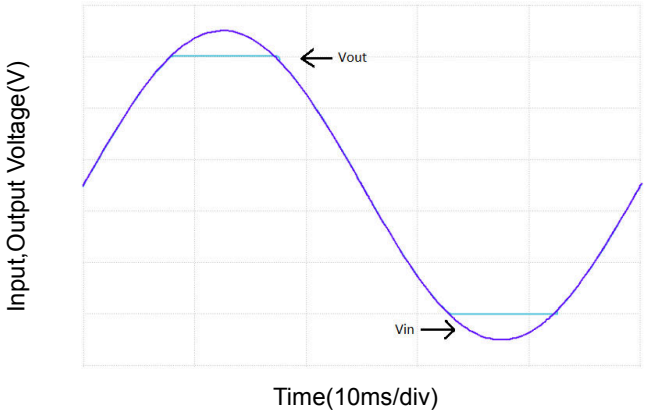


Time(10ms/div)

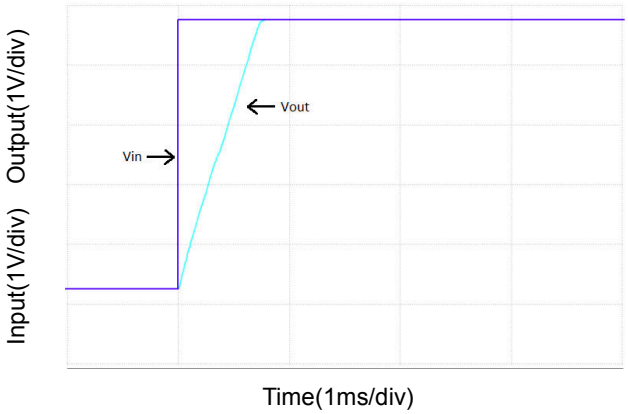
Typical Performance characteristics

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



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.

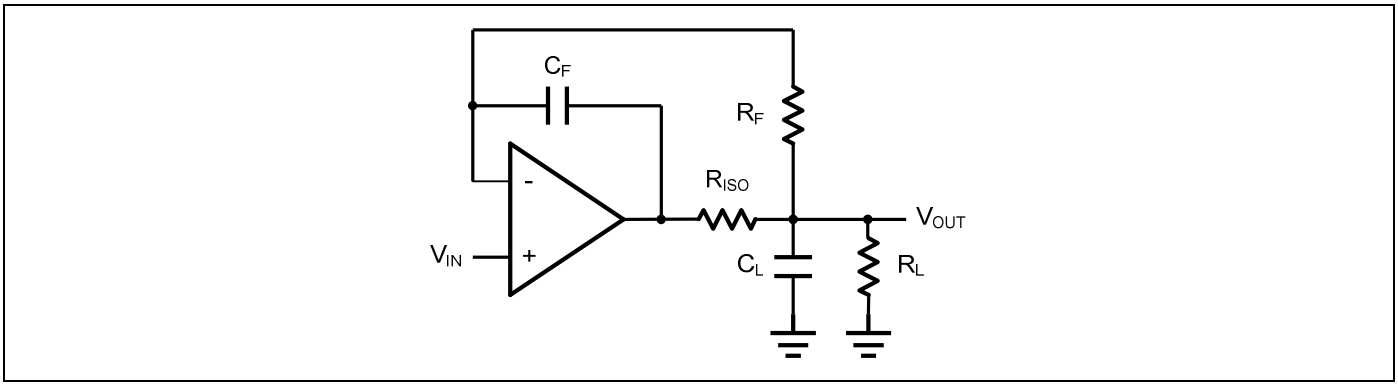


Figure 3. Indirectly Driving a Capacitive Load with DC Accuracy

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 CMCP604X famlly

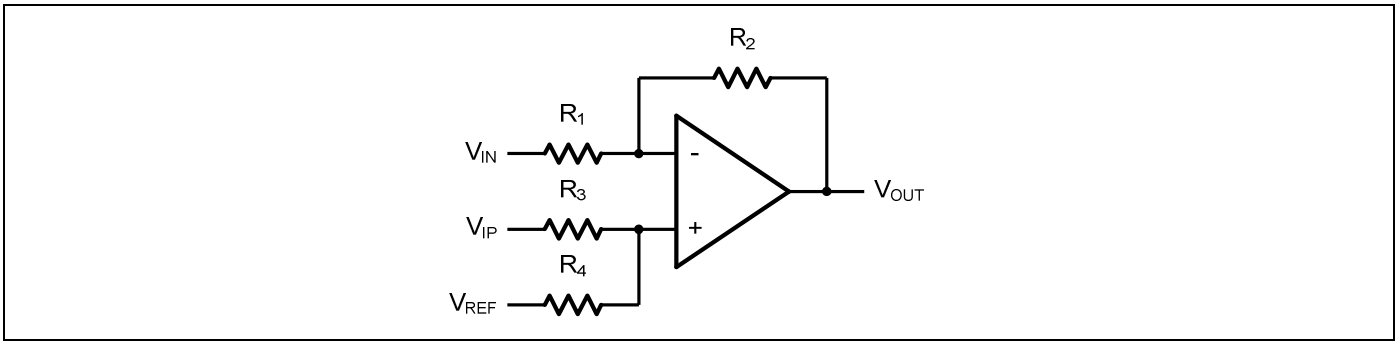


Figure 4. Differential Amplifier

$$V_{OUT}=(\frac{R1+R2}{R3+R4})\frac{R4}{R1}V_{IN}-\frac{R2}{R1}V_{IP}+(\frac{R1+R2}{R3+R4})\frac{R3}{R1}V_{REF}$$

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 $f_C=1/(2\pi R_3C_1)$.

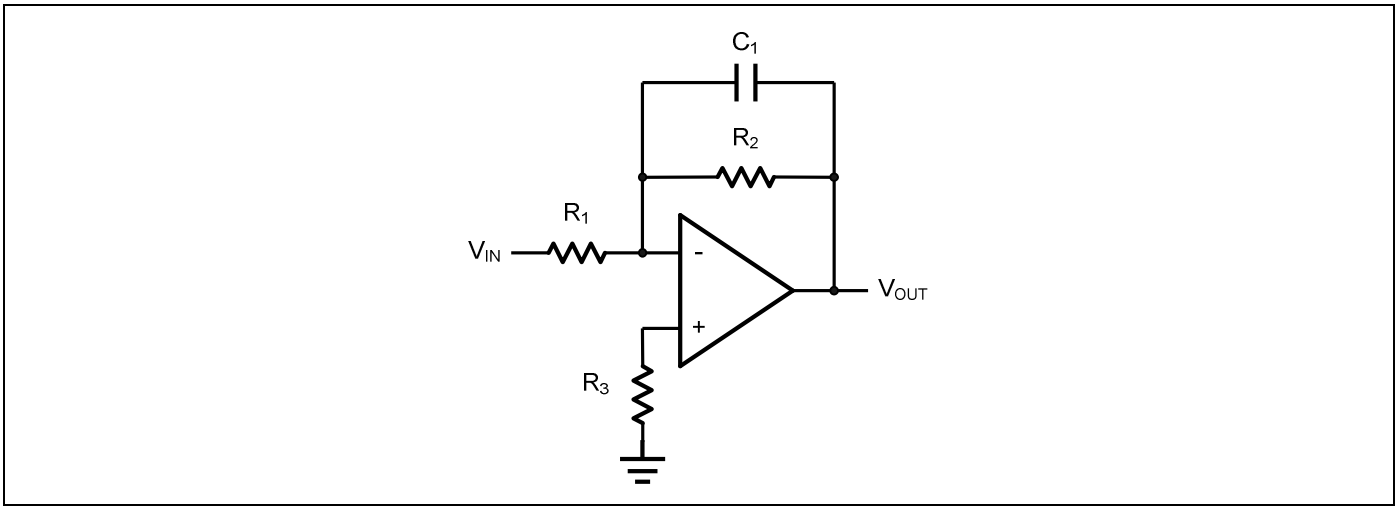


Figure 5. Low Pass Active Filter

Instrumentation Amplifier

The triple CP604X 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.

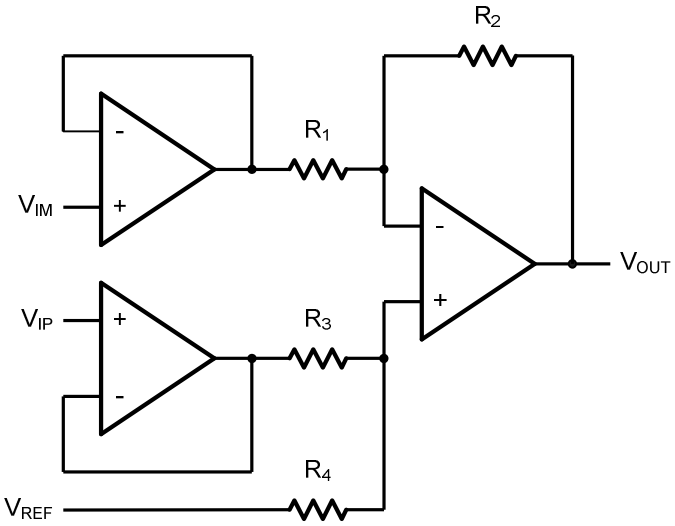


Figure 6. Instrument Amplifier

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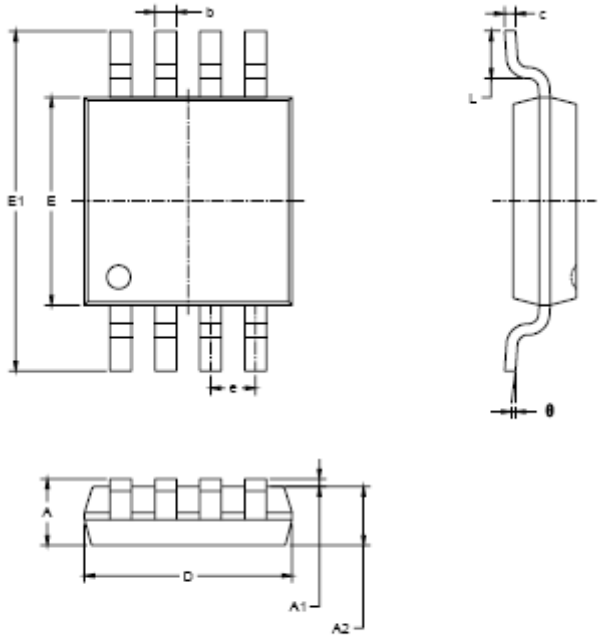
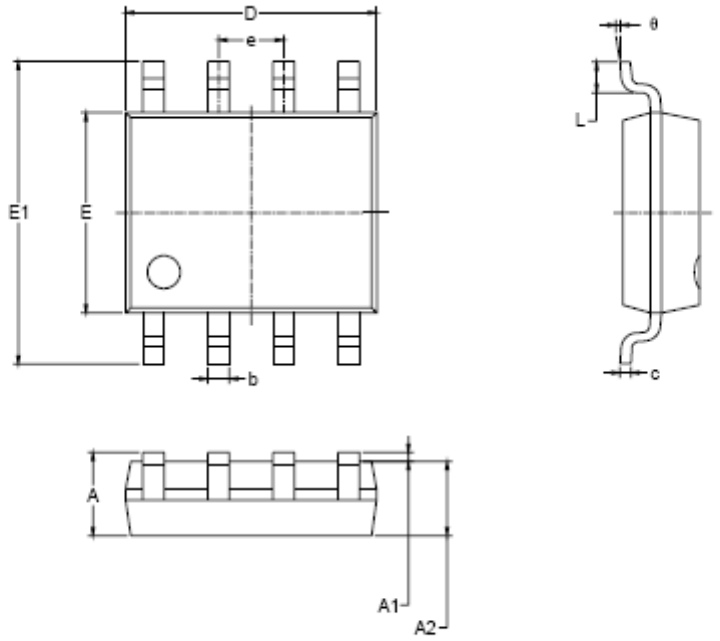
Package Information

MSOP-8



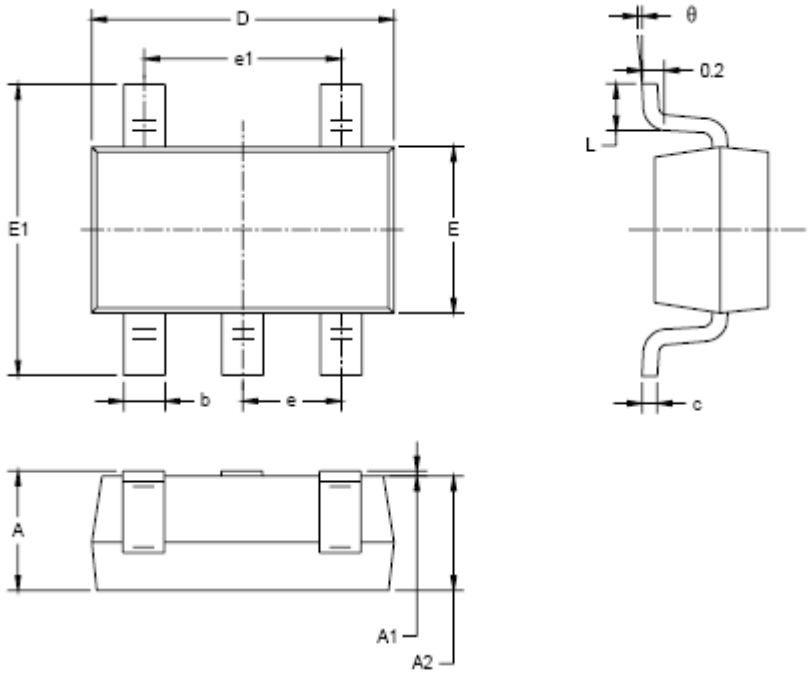
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

SOP-8



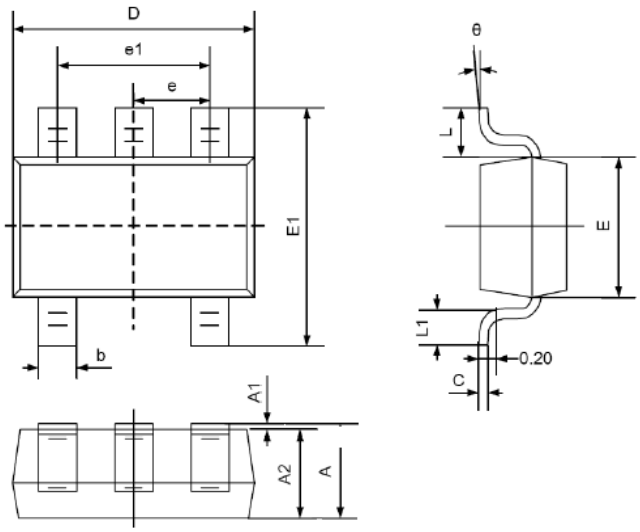
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

SOT23-5



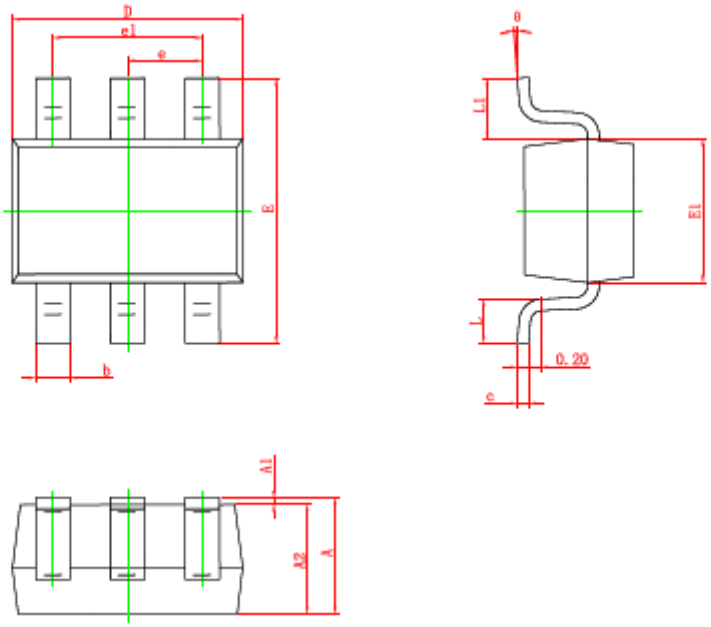
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 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



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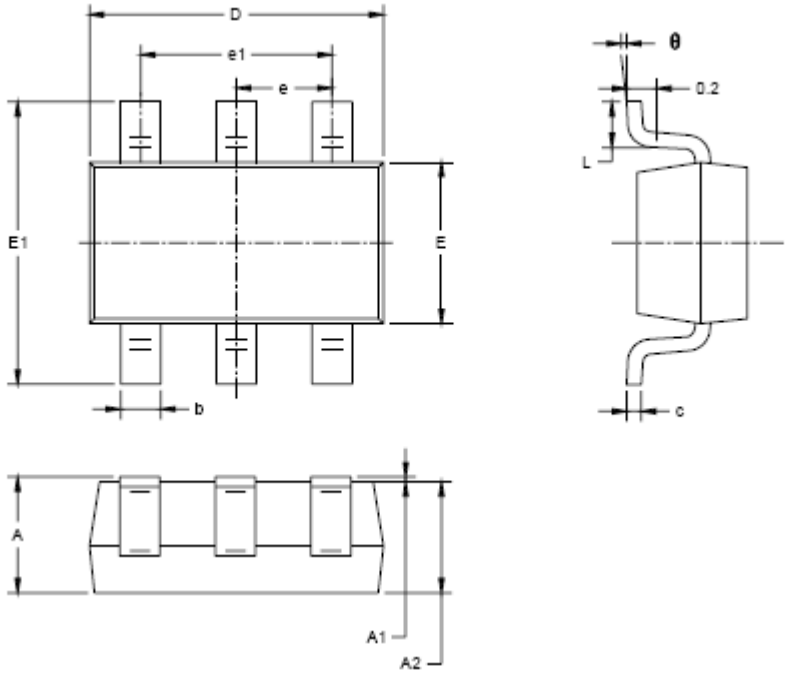
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	2.150	2.450	0.085	0.096
E1	1.150	1.350	0.045	0.053
e	0.650 TYP.		0.026 TYP.	
e1	1.200	1.400	0.047	0.055
L	0.260	0.460	0.010	0.018
L1	0.525 REF.		0.021 REF.	
θ	0°	8°	0°	8°

SOT23-6



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e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°