Features

- Single-Supply Operation from +1.8V ~ +5.5V
- Low Offset Voltage: 30μV (Max@25°C)
- Zero Drift: 0.01μV/ºC (Typ)
- Gain-Bandwidth Product: 1.8MHz (Typ@25°C)
- Low Input Bias Current: 20pA (Typ@25°C)
- Quiescent Current: 180μA per Amplifier (Typ)
- Operating Temperature: -45°C ~ +125°C
- Embedded RF Anti-EMI Filter
- Rail-to-Rail Input / Output
- Small Package:
  BL3891 Available in SOT23-5 and SOP-8 Packages
  BL3892 Available in MSOP-8 and SOP-8 Packages
  BL3894 Available in SOP-14 and TSSOP-14 Packages

General Description

BL389X series operates from a single 1.8V to 5.5V supply or dual ±0.9V to ±2.75V supplies，the amplifiers offer bandwidth of 1.8MHz, rail-to-rail inputs and outputs.The BL389X amplifier is micro-power, zero-drift CMOS operational amplifiers, BL389X uses chopper stabilized technique to provide very low offset voltage (less than 30μV maximum) and near zero drift over temperature. The BL389X offers excellent CMRR without the crossover associated with traditional complementary input stages. The BL3891 is available in SOT23-5 and SOP-8 packages. And the BL3892 is available in MSOP-8 and SOP-8 packages. The BL3894 Quad is available in Green SOP-14 and TSSOP-14 packages.

Applications

- Automatic control
- ECG equipment
- Medical equipment
- Internet of Things

Package/Ordering Information

MODEL	CHANNEL	ORDER NUMBER	PACKAGE DESCRIPTION	PACKAGE OPTION
BL3891	Single	BL3891FR	SOT23-5	Tape and Reel,3000
BL3892	Dual	BL3892SR	SOP-8	Tape and Reel,4000
		BL3892MR	MSOP-8	Tape and Reel,3000
BL3894	Quad	BL3894TR	TSSOP-14	Tape and Reel,3000
		BL3894SR	SOP-14	Tape and Reel,2500

Pin Configuration

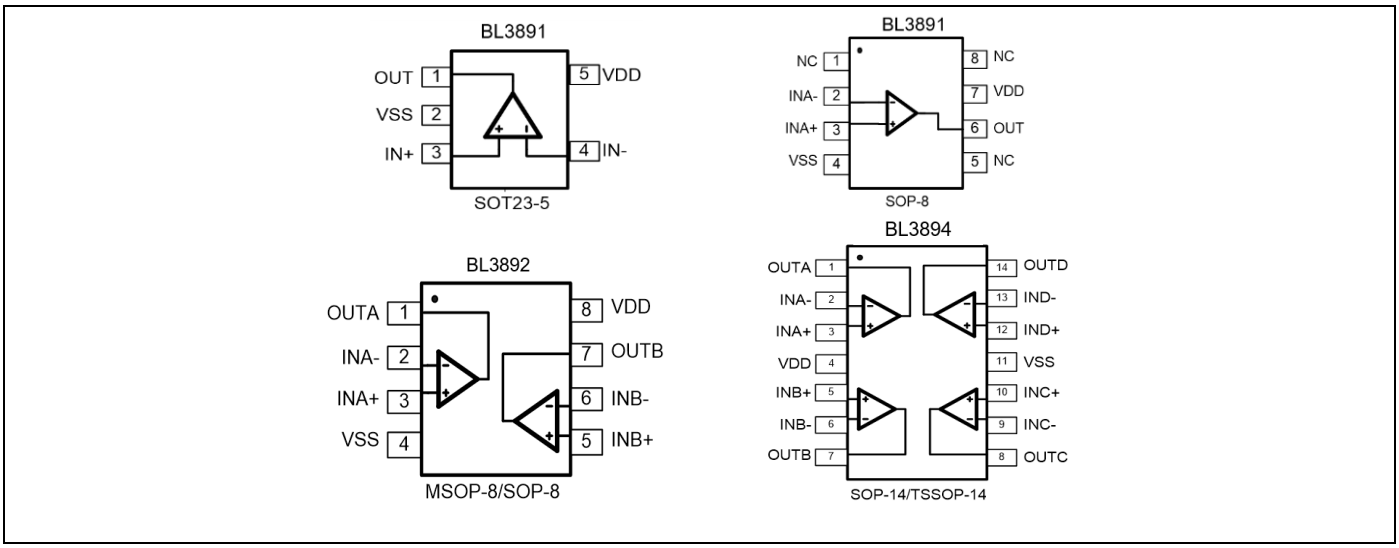


Figure 1. Pin Assignment Diagram

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	-45°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	
ESD Susceptibility		
HBM	6KV	
MM	400V	

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.

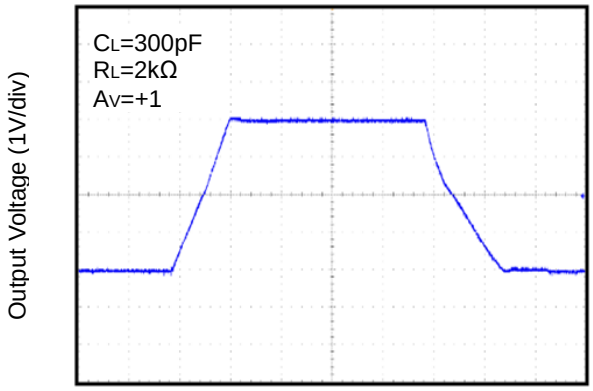
Electrical Characteristics

(V_S = +5V, V_{CM} = +2.5V, V_O = +2.5V, T_A = +25℃, unless otherwise noted.)

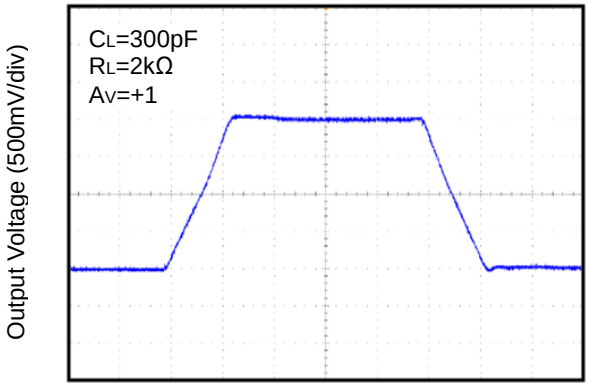
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS					
Input Offset Voltage (V_{OS})			1	30	μV
Input Bias Current (I_B)			20		pA
Input Offset Current (I_{OS})			10		pA
Common-Mode Rejection Ratio (CMRR)	V_{CM} = 0V to 5V		110		dB
Large Signal Voltage Gain (A_{VO})	R_L = 10kΩ, V_O = 0.3V to 4.7V		145		dB
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta_T$)			10	50	nV/℃
OUTPUT CHARACTERISTICS					
Output Voltage High (V_{OH})	R_L = 100kΩ to - V_S		4.998		V
	R_L = 10kΩ to - V_S		4.994		V
Output Voltage Low (V_{OL})	R_L = 100kΩ to + V_S		2		mV
	R_L = 10kΩ to + V_S		5		mV
Short Circuit Limit (I_{SC})	R_L =10Ω to - V_S		60		mA
Output Current (I_O)			65		mA
POWER SUPPLY					
Power Supply Rejection Ratio (PSRR)	V_S = 2.5V to 5.5V		115		dB
Quiescent Current (I_Q)	V_O = 0V, R_L = 0Ω		180		μA
DYNAMIC PERFORMANCE					
Gain-Bandwidth Product (GBP)	G = +100		1.8		MHz
Slew Rate (SR)	R_L = 10kΩ		0.95		V/μs
Overload Recovery Time			0.10		ms
NOISE PERFORMANCE					
Voltage Noise (e_n p-p)	0Hz to 10Hz		0.3		μV_{P-P}
Voltage Noise Density (e_n)	f = 1kHz		38		$nV/\sqrt{Hz}$

Typical Performance characteristics

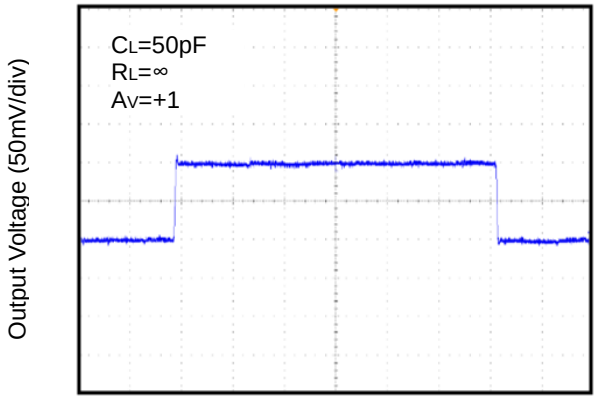
Large Signal Transient Response at +5V



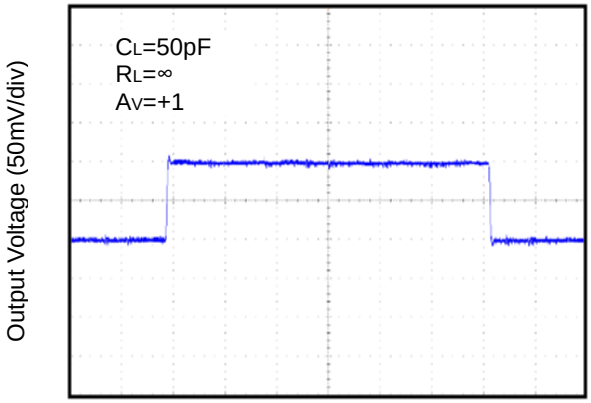
Large Signal Transient Response at +2.5V



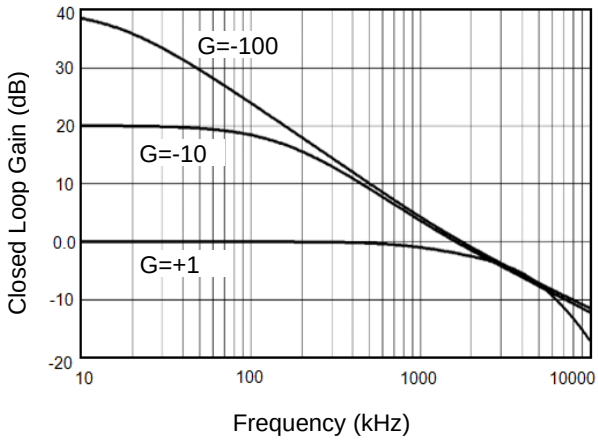
Small Signal Transient Response at +5V



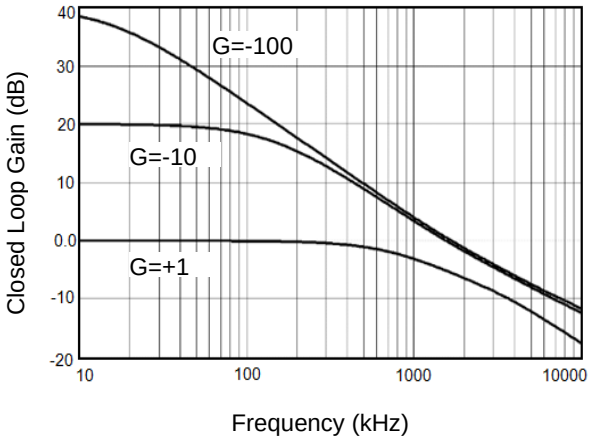
Small Signal Transient Response at +2.5V



Closed Loop Gain vs. Frequency at +5V

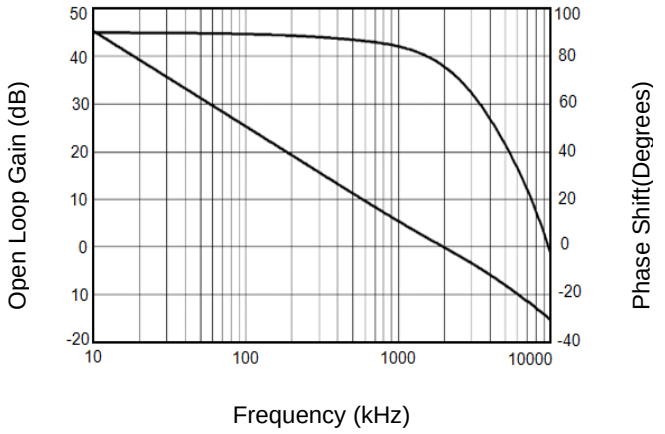


Closed Loop Gain vs. Frequency at +2.5V

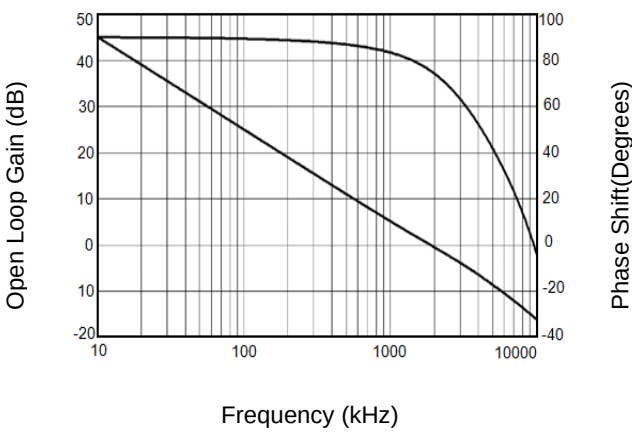


Typical Performance characteristics

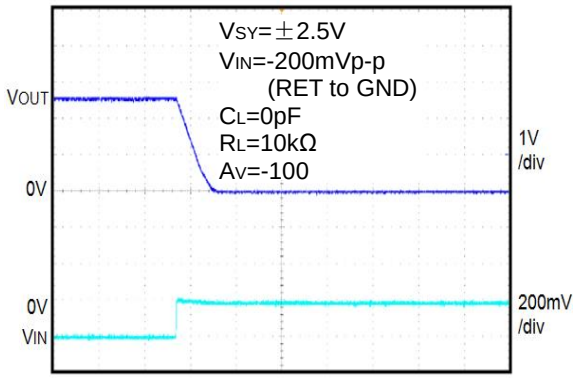
Open Loop Gain, Phase Shift vs. Frequency at +5V



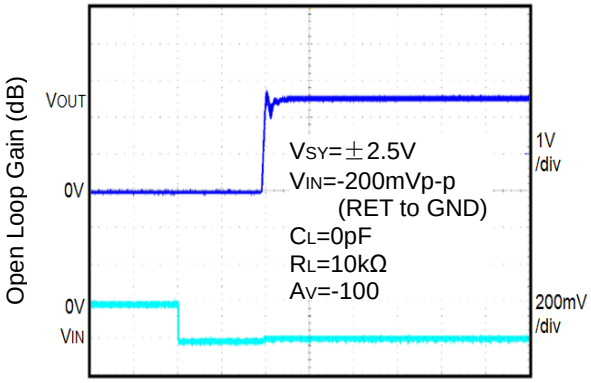
Open Loop Gain, Phase Shift vs. Frequency at +2.5V



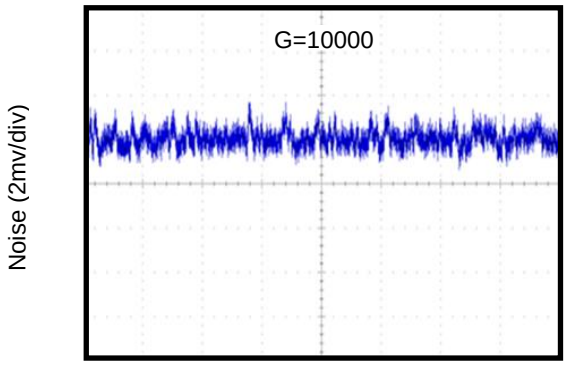
Positive Overvoltage Recovery



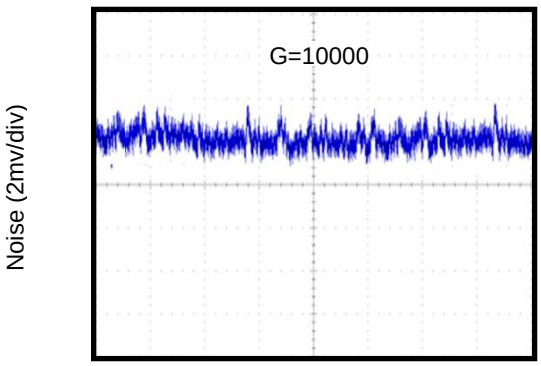
Negative Overvoltage Recovery



0.1Hz to 10Hz Noise at +5V



0.1Hz to 10Hz Noise at +2.5V



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 1. shown the differential amplifier using BL389X.

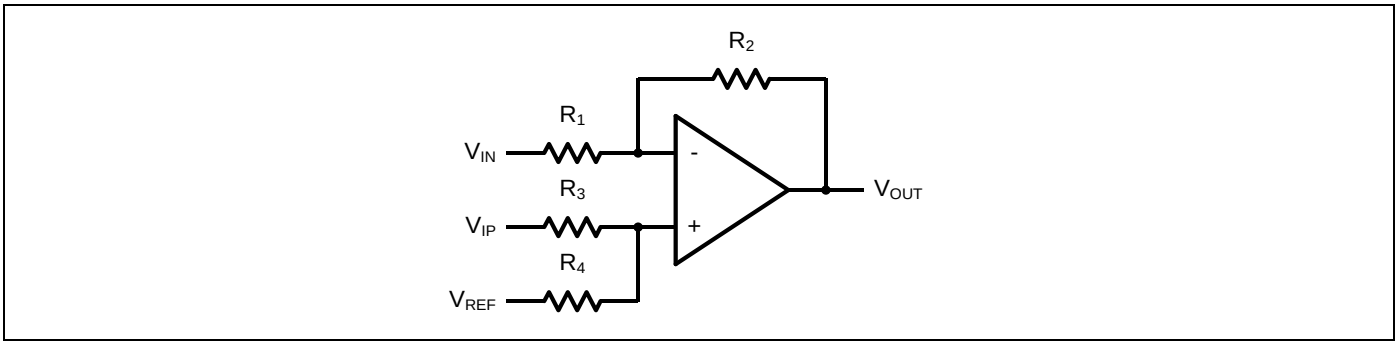


Figure 1. Differential Amplifier

$$V_{OUT}=(\frac{R_1+R_2}{R_3+R_4})\frac{R_4}{R_1}V_{IN}-\frac{R2}{R1}V_{IP}+(\frac{R_1+R_2}{R_3+R_4})\frac{R_3}{R_1}V_{REF}$$

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

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

Instrumentation Amplifier

The triple BL389X can be used to build a three-op-amp instrumentation amplifier as shown in Figure 2. The amplifier in Figure 2 is a high input impedance differential amplifier with gain of R_2/R_1. The two differential voltage followers assure the high input impedance of the amplifier.

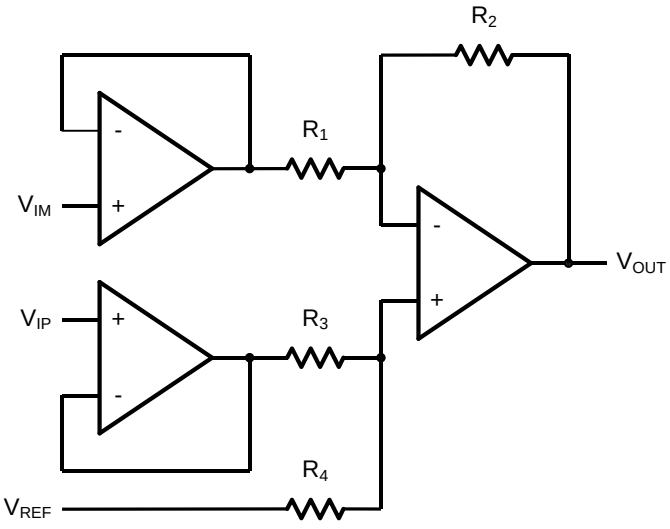
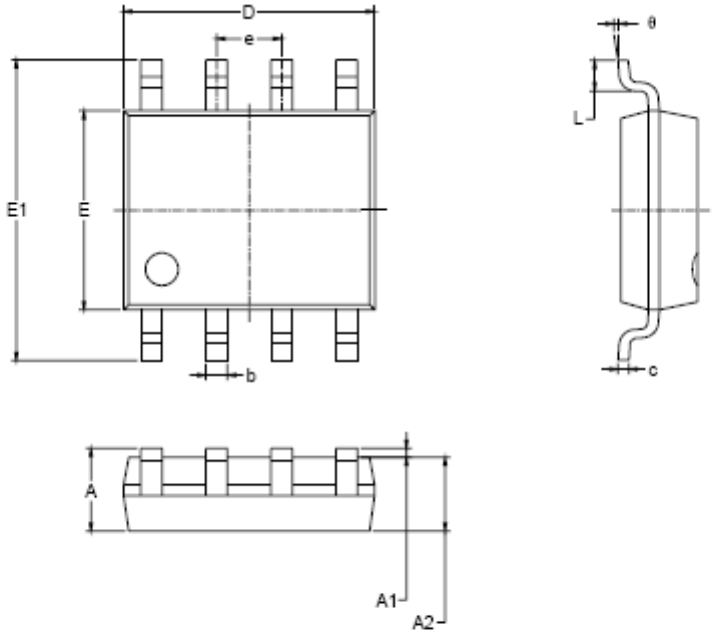


Figure 2. Instrument Amplifier

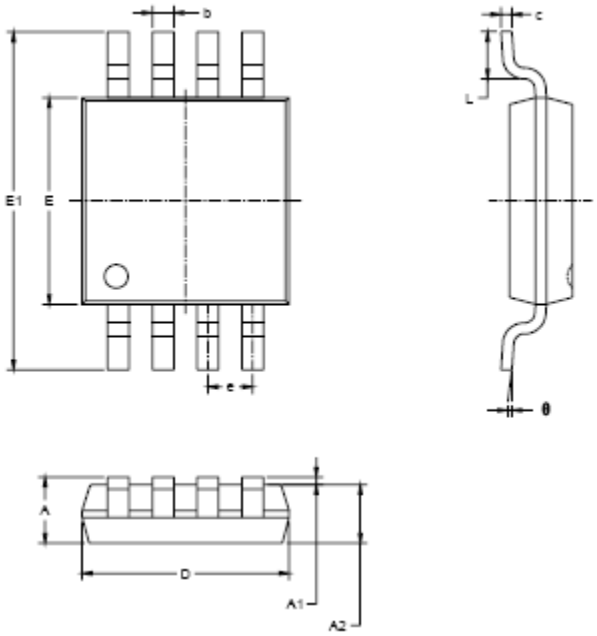
Package Information

SOP-8



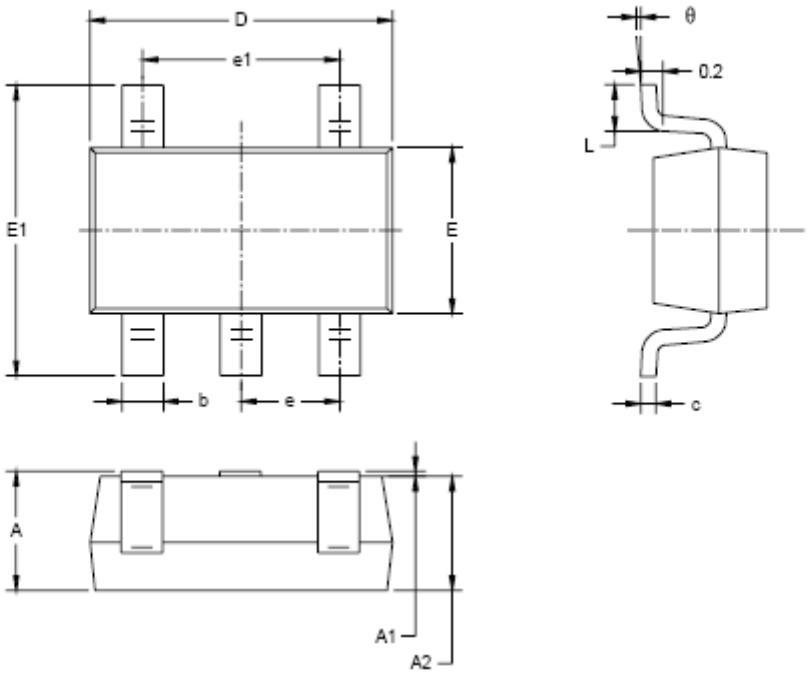
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

MSOP-8



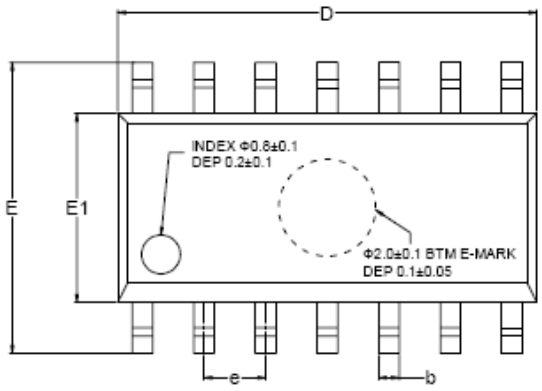
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

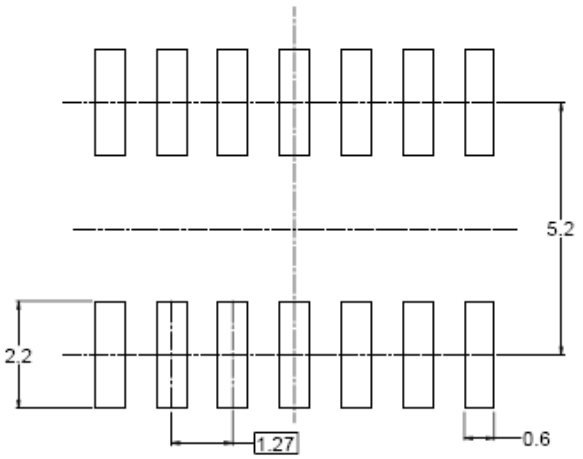
SOT23-5



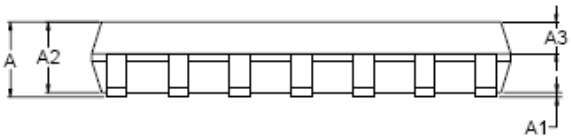
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037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

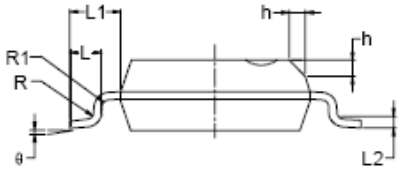
SOP-14





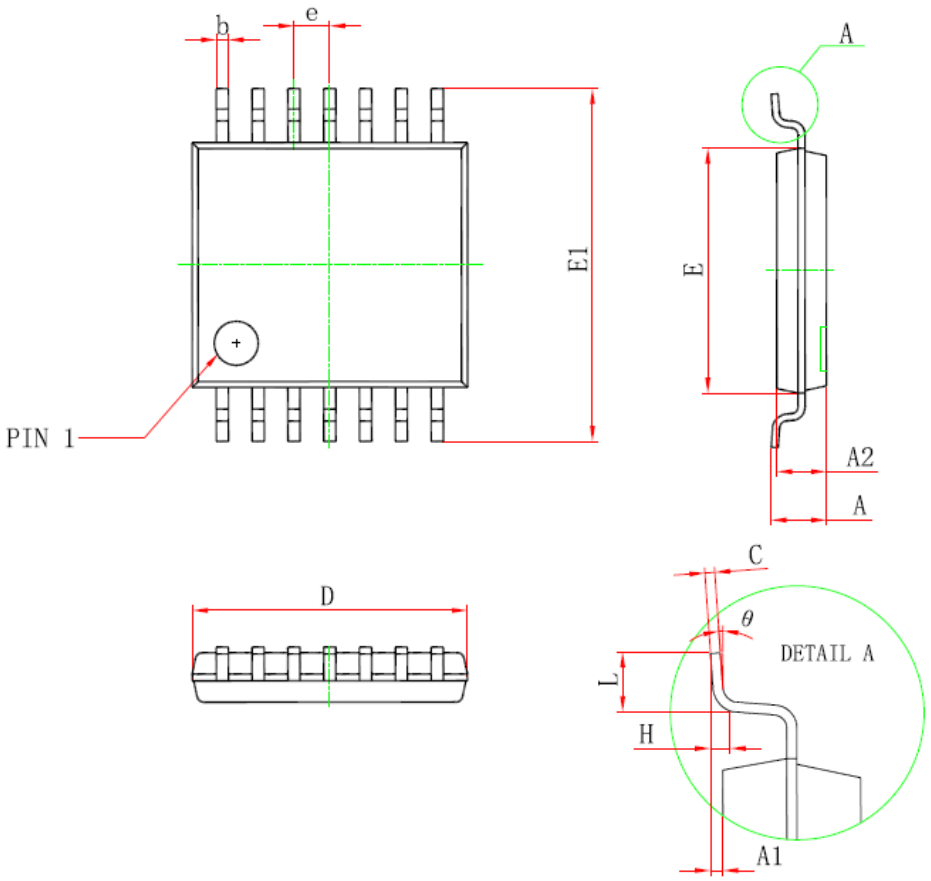
RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters			Dimensions In Inches		
	MIN	MOD	MAX	MIN	MOD	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°

TSSOP-14



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
D	4.900	5.100	0.193	0.201
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A		1.200		0.047
A2	0.800	1.000	0.031	0.039
A1	0.050	0.150	0.002	0.006
e	0.65 (BSC)		0.026(BSC)	
L	0.500	0.700	0.020	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°	7°	1°	7°