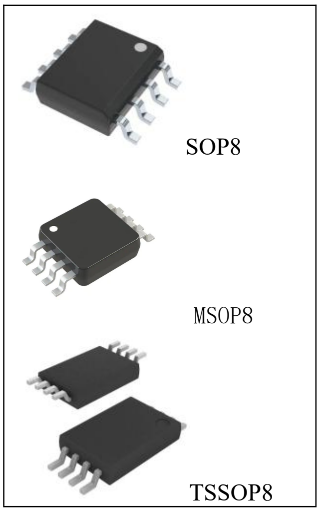
LMV358

General Purpose Low Voltage Rail-to-Rail Output Amplifiers

General Description



The LMV358(dual) is rail-to-rail input and output voltage feedback amplifiers offering low cost. They have a wide input common-mode voltage range and output voltage swing, and take the minimum operating supply voltage down to 2.1V and the maximum recommended supply voltage is 5.5 V. All are specified over the extended – 45°C to +85°C temperature range.

The LMV358 provide 1MHz bandwidth at a low current consumption of 60μA per amplifier. Very low input bias currents of 10pA, enable LMV358 to be used for integrators, photodiode amplifiers, and piezoelectric sensors. Rail-to-rail inputs and outputs are useful to designers buffering ASIC in single-supply systems.

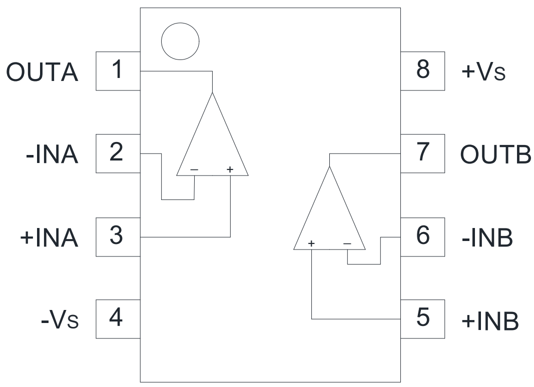
Applications for the series amplifiers include safety monitor, portable equipment, battery and power supply control, and signal conditioning and interfacing for transducers in very low power systems

The LMV358 is available in SOP8、MSOP8 and TSSOP8 package.

Features

- Low Cost
- Rail-to-Rail Input and Output: 0.8mV Typical Vos
- Unity Gain Stable
- Gain Bandwidth Product: 1MHz
- Very Low Input Bias Currents: 10pA
- Operates on 2.1 V to 5.5 V Supplies
- Input Voltage Range: -0.1 V to +5.6 V with $V_S = 5.5$ V
- Low Supply Current: 60μA/Amplifier

Block Diagram and Pin Configuration



LMV358(SOP8/MSOP8/TSSOP8)

Package Information

Part NO.	Package Description	Package Marking	Package Option
LMV358	SOP8	CHMC LMV358 SXXXX	100/Tube 4000/Reel
LMV358M	MSOP8	CHMC LMV358M SXXXX	100/Tube 4000/Reel
LMV358T	TSSOP8	CHMC LMV358T SXXXX	100/Tube 4000/Reel

CHMC:Trademark LMV358/LMV358M/LMV358T:Part NO. SXXXX:Lot NO.

Recommended Operating Conditions

Characteristic	Min.	Max.	Unit
Operating Temperature Rangge	-40	+85	°C
Power Supply Operating Range	2.1	5.5	V

Absolute Maximum Ratings

Characteristic	Min.	Max.	Unit
Power Supply Voltage	0	+7.5	V
Maximum Junction Temperature		+160	°C
Input Voltage Range	-Vs-0.5	+Vs+0.5	V
Operating Temperature Range	-45	+85	°C
Storage Temperature Range	-65	+150	°C
Lead Temperature, 10 seconds		+260	°C

Electrical Characteristics (Vs=+5V, R_L=10kΩ to Vs/2, V_{Out}=Vs/2; unless otherwise noted)

Characteristics	Test Conditions	Min.	Typ.	Max.	Unit
AC Performance					
Gain bandwidth product	C_L=100pF		1.0		MHz
Phase margin			52		Deg
Gain margin			17		dB
Slew rate	Vo=1Vpp		0.52		V/μs
Input voltage noise	>50kHz		36		$nV/\sqrt{Hz}$
DC Performance					
Input offset voltage			±0.8	±5	mV
Input bias current			10		pA
Input offset current			10		pA
Power supply rejection ratio	Vs=+2.5V～+5.5V	60	82		dB
Supply current			120	240	μA
Input characteristics					
Input common mode voltage range	Vs=5.5V	-0.1		5.6	V
Common mode rejection ratio	Vs=5.5V Vo=0.1～4.9V	56	68		dB
Output characteristics					
Output voltage Swing from Rail	R_L=100kΩ		0.008		V
Output current	R_L=100kΩ	20	23		mA

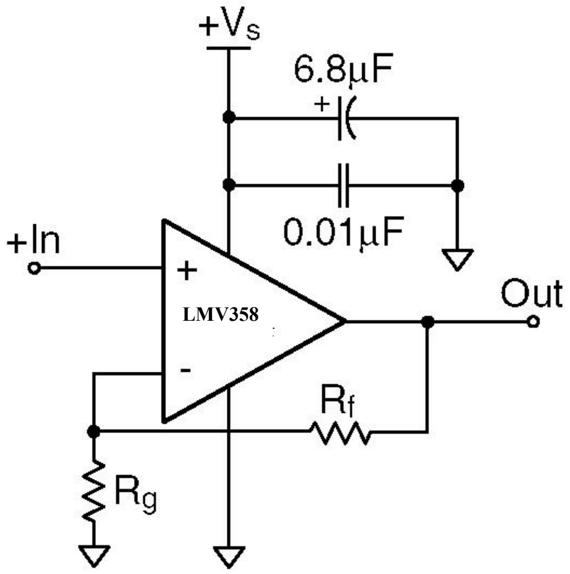
Application Summary

Data Sheet

The LMV358 family are single supply, general purpose, voltage-feedback amplifiers that are pin-for-pin compatible and drop in replacements with other industry standard

LMV358 amplifier. The LMV358 is fabricated on a CMOS process, features a rail-to-rail output, and is unity gain stable.

The typical non-inverting circuit schematic is shown in Figure below:



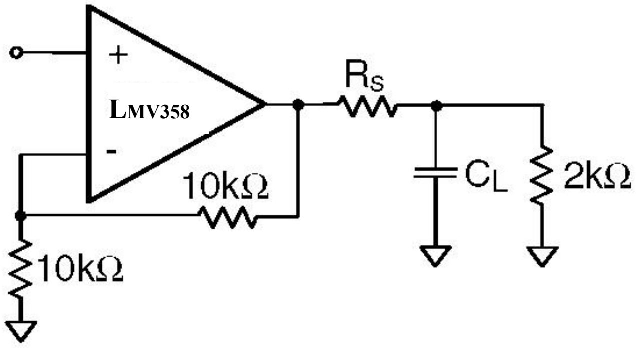
Typical Non-inverting configuration

Power Dissipation

The maximum internal power dissipation allowed is directly related to the maximum junction temperature. If the maximum junction temperature exceeds 150°C, some performance degradation will occur. If the maximum junction temperature exceeds 175°C for an extended time, device failure may occur.

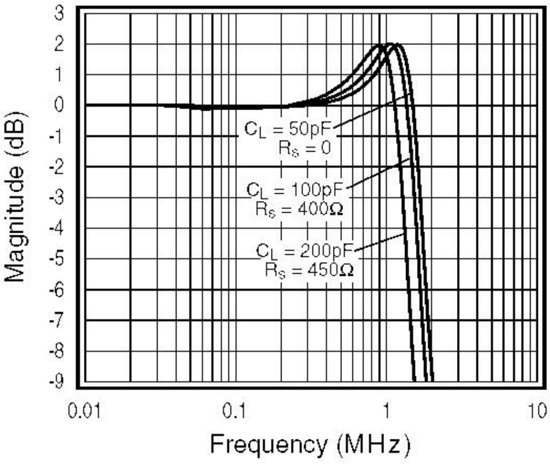
Driving Capacitive Loads

The Frequency Response vs CL plot illustrates the response of the LMV358 . A small series resistance (Rs) at the output of the amplifier, illustrated in Figure below, will improve stability and settling performance. Rs values in the Frequency Response vs CL plot were chosen to achieve maximum bandwidth with less than 1dB of peaking. For maximum flatness, use a larger Rs. As the plot indicates, the LMV358 family can easily drive a 200pF capacitive load without a series resistance.



Driving a capacitive load introduces phase-lag into the output signal, which reduces phase margin in the amplifier. The unity gain follower is the most sensitive configuration.

The response is illustrated in Figure below:



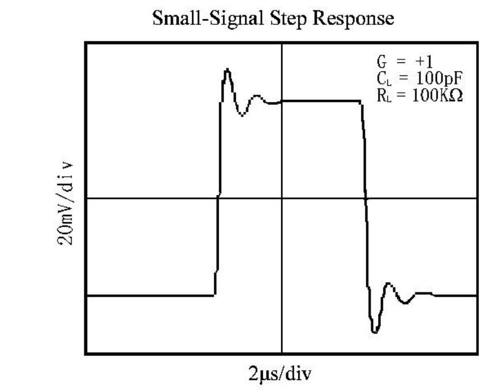
Frequency Response vs C_L for unity gain configuration

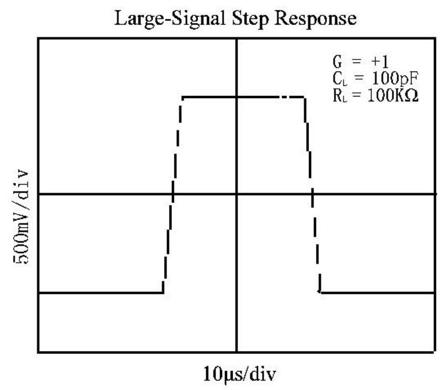
Layout Considerations

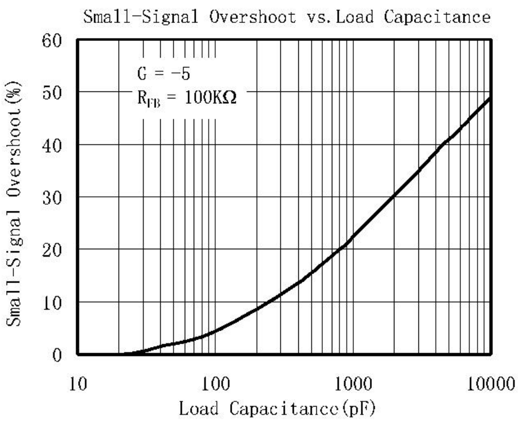
General layout and supply bypassing play major roles in high frequency performance. Follow the steps below as a basis for high frequency layout:

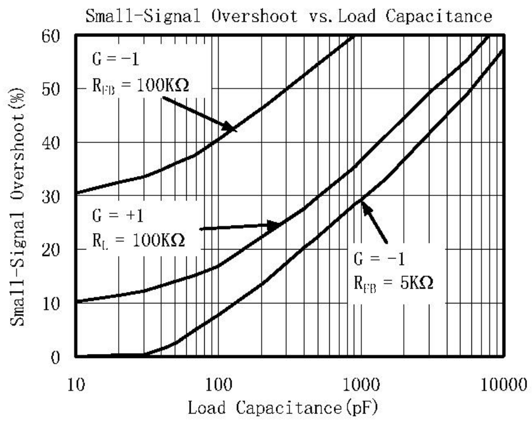
- Include 6.8μF and 0.01μF ceramic capacitors
- Place the 6.8μF capacitor within 0.75 inches of the power pin
- Place the 0.01μF capacitor within 0.1 inches of the power pin
- Remove the ground plane under and around the part, especially near the input and output pins to reduce parasitic capacitance
- Minimize all trace lengths to reduce series inductances

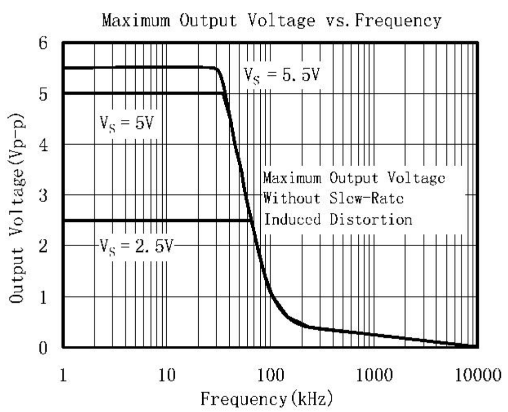
Characteristics Curve (Ta=+25℃, Vs=+5V, RL=100kΩ connected to Vs/2)

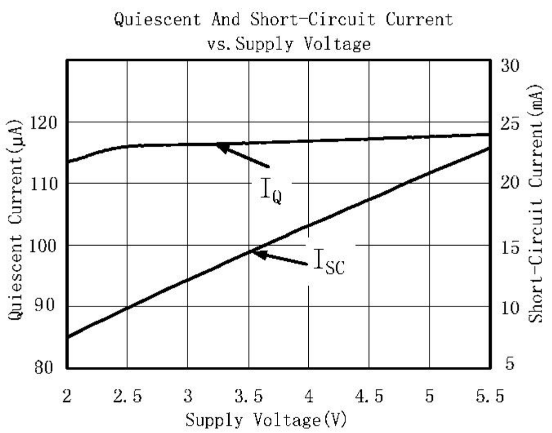


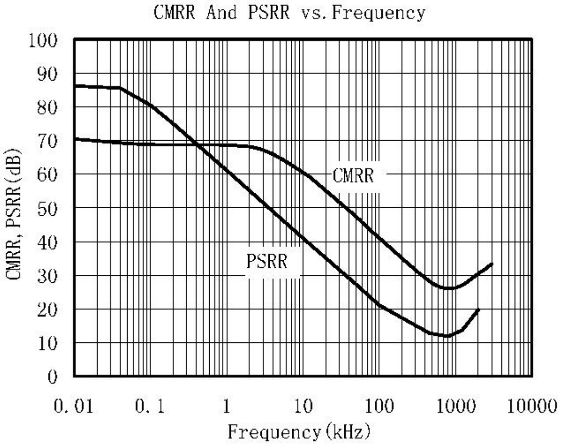


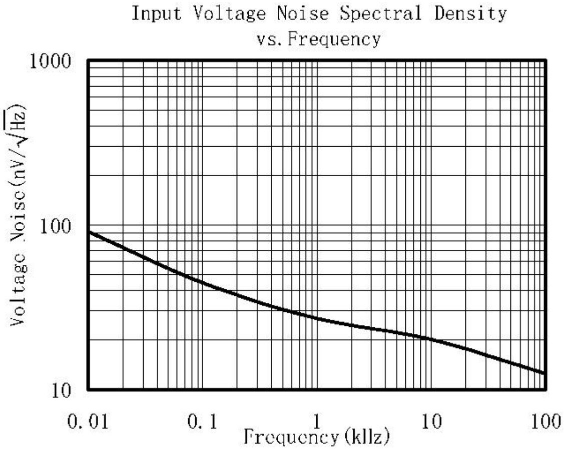


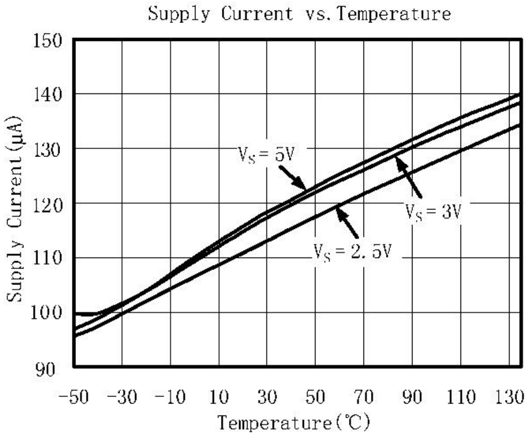


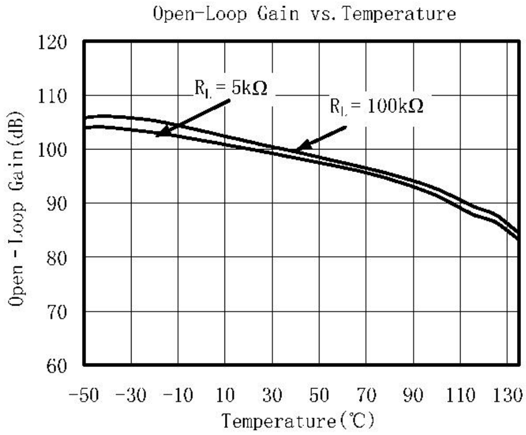


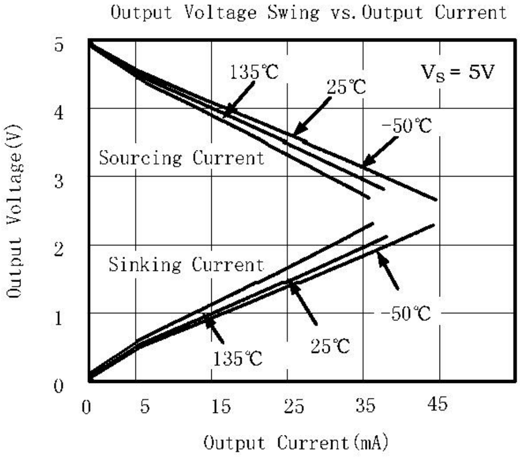


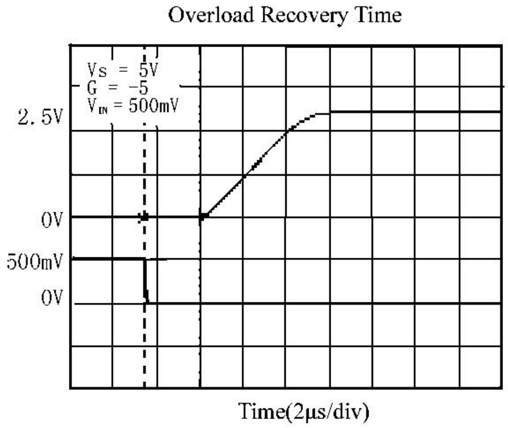

CMRR And PSRR vs. Frequency
CMRR, PSRR (dB)
Frequency (kHz)
CMRR
PSRR
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000

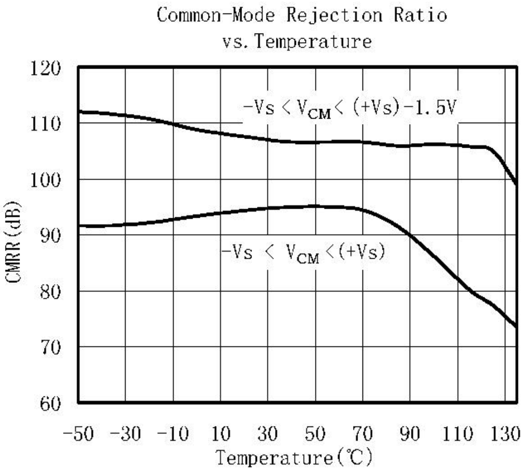

Input Voltage Noise Spectral Density vs. Frequency
Voltage Noise (nV/√Hz)
Frequency (kHz)
1000
100
10
0.01
0.1
1
10
100

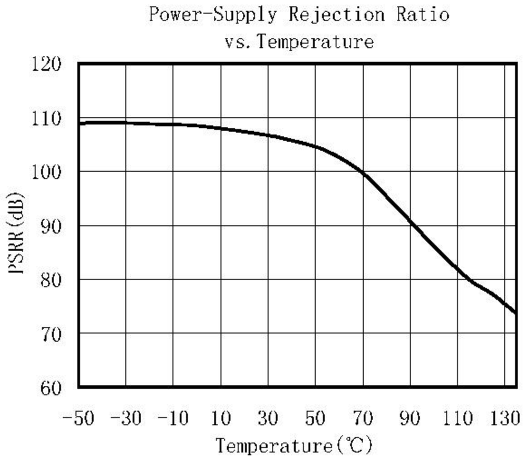

Supply Current vs. Temperature
Supply Current (μA)
Temperature (℃)
VS = 5V
VS = 3V
VS = 2.5V
150
140
130
120
110
100
90
-50
-30
-10
10
30
50
70
90
110
130


Open-Loop Gain vs. Temperature
Open - Loop Gain (dB)
Temperature (℃)
RL = 5kΩ
RL = 100kΩ
120
110
100
90
80
70
60
-50
-30
-10
10
30
50
70
90
110
130


Output Voltage Swing vs. Output Current
Output Voltage (V)
Output Current (mA)
VS = 5V
Sourcing Current
Sinking Current
135℃
25℃
-50℃
135℃
25℃
-50℃
5
4
3
2
1
0
0
5
15
25
35
45

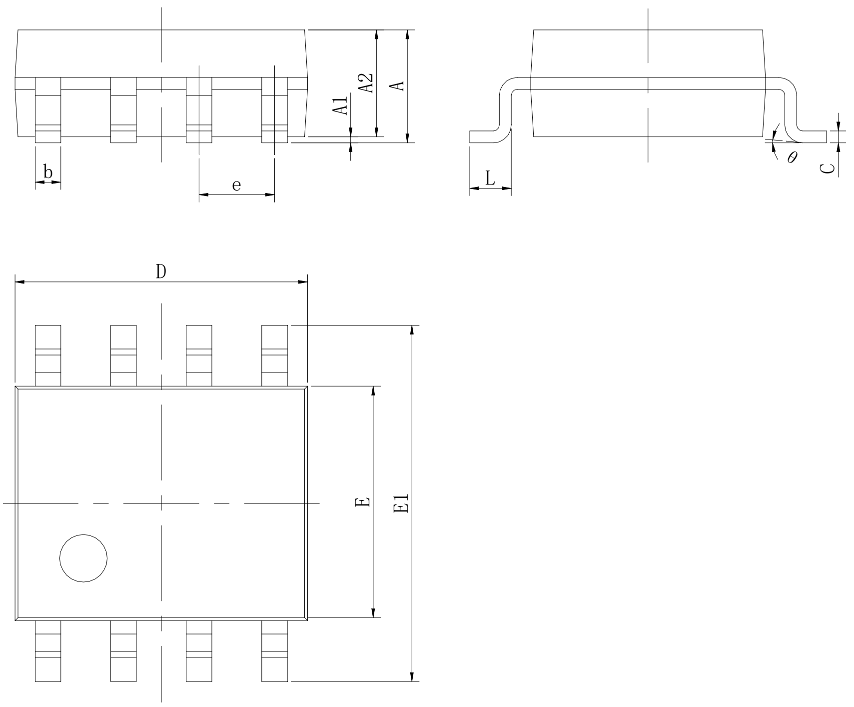

Overload Recovery Time
VS = 5V
G = -5
VIN = 500mV
2.5V
0V
500mV
0V
Time(2μs/div)


Common-Mode Rejection Ratio
vs. Temperature
-Vs < VCM < (+Vs)-1.5V
-Vs < VCM <(+Vs)
CMRR(dB)
120
110
100
90
80
70
60
-50 -30 -10 10 30 50 70 90 110 130
Temperature(℃)


Power-Supply Rejection Ratio
vs. Temperature
PSRR(dB)
120
110
100
90
80
70
60
-50 -30 -10 10 30 50 70 90 110 130
Temperature(℃)

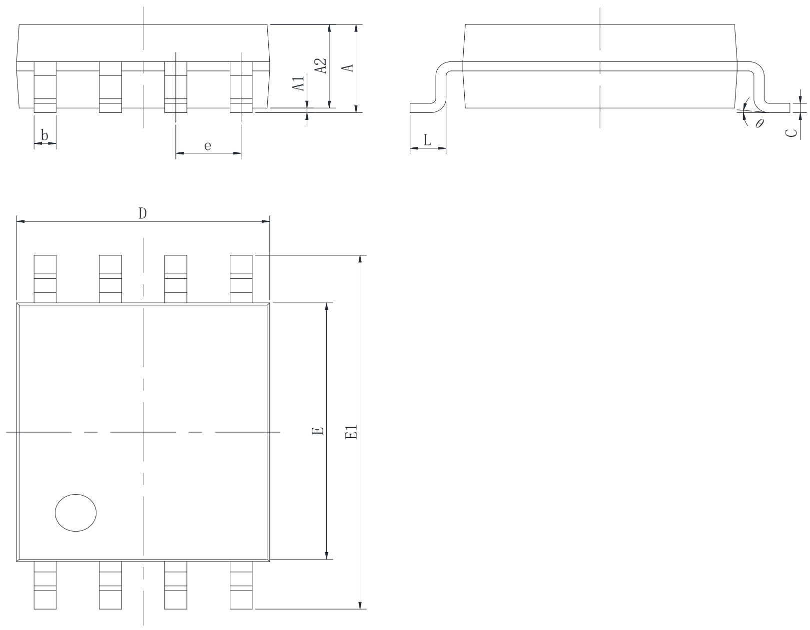
Outline Dimensions

SOP8 Unit: mm



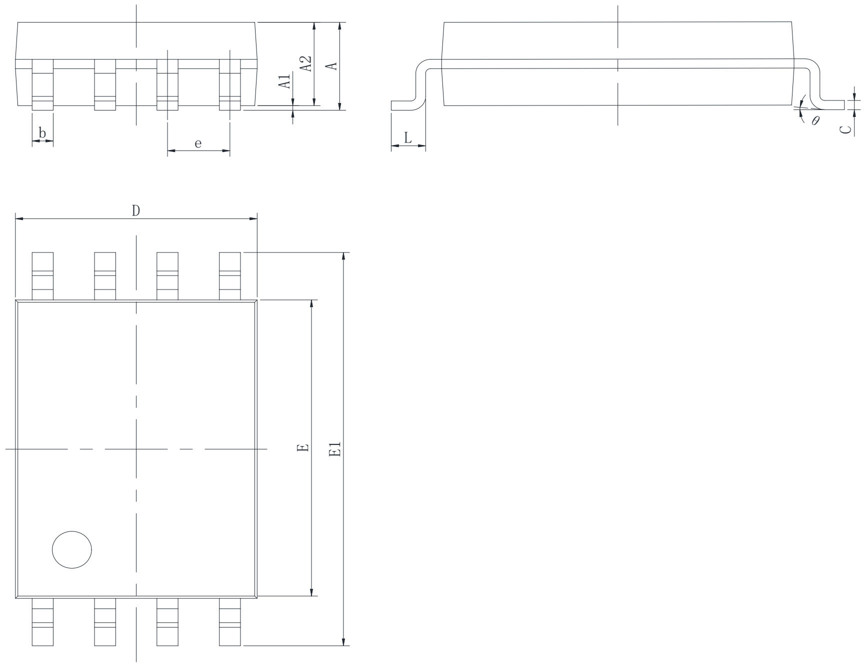
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.800	0.053	0.071
A1	0.000	0.250	0.000	0.010
A2	1.250	1.550	0.053	0.061
b	0.300	0.510	0.011	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.201
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

MSOP8 Unit:mm



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°

TSSOP8 Unit: mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		1.100		0.043
A1	0.020	0.150	0.001	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650(BSC)		0.026(BSC)	
L	0.500	0.700	0.020	0.028
θ	0°	8°	0°	8°

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