

## Features

- Supply Voltage: 2.5V to 5.5V
- Low Supply Current: 80µA per channel
- Positive Offset Voltage: +1mV to +4mV
- Offset Voltage Temperature Drift: 2 µV/°C
- High Output Capability: 100mA
- Rail to Rail Input and Output
- Bandwidth: 1 MHz
- Slew Rate: 0.7V/µs
- Excellent EMI Suppress Performance
- Low Noise: 35 nV/√Hz at 1kHz
- -40°C to 125°C Operation Temperature Range

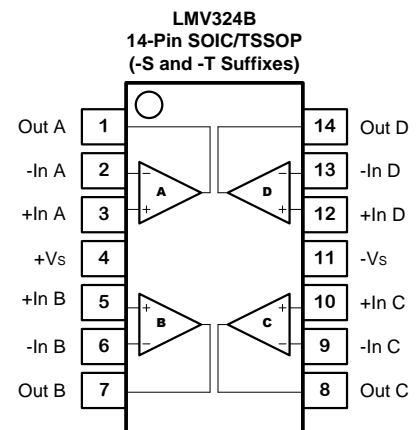
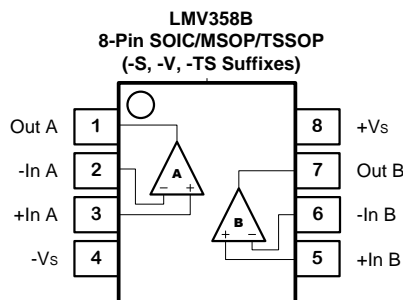
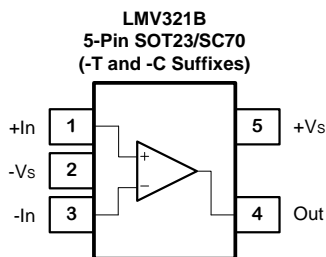
## Applications

- Active Filters, ASIC Input or Output Amplifier
- Sensor Interface
- Smoke/Gas/Environment Sensors
- Portable Instruments and Mobile Device

## Description

The LMV321B/358B/324B series are CMOS dual, and quad RRIO op-amps with low offset, low power and stable high frequency response. They incorporate 3PEAK's proprietary and patented design techniques to achieve very good AC performance with 1MHz bandwidth, 0.7V/µs slew rate and low distortion while drawing only 80µA of quiescent current per amplifier. The input common-mode voltage range extends 100mV beyond V<sub>-</sub> and V<sub>+</sub>, and the outputs swing rail-to-rail. The LMV321B/358B/324B family can be used as plug-in replacements for many commercially available op-amps to reduce power and improve input/output range and performance. The combination of features makes the LMV321B/358B/324B ideal choices for motor control and portable audio amplification, sound ports, and other consumer Audio. The LMV321B/358B/324B Op-amp is very stable, and it is capable of driving heavy capacitive loads such as those found in LCDs. The ability to swing rail-to-rail at the inputs and outputs enables designers to buffer CMOS DACs, ASICs, or other wide output swing devices in single-supply systems.

## Pin Configuration



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## Revision History

Date	Revision	Notes
2018/3/30	Rev.Pre	Pre-Release Version
2018/5/30	Rev.0	First Release to Market Version

## Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity
LMV321B-TR	-40 to 125°C	5-Pin SOT23	21BXX <sup>Note 2</sup>	3	Tape and Reel, 3000
LMV321B-CR	-40 to 125°C	5-Pin SC70	21BXX <sup>Note 2</sup>	1	Tape and Reel, 3000
LMV358B-SR	-40 to 125°C	8-Pin SOIC	V358B XXXX <sup>Note 3</sup>	3	Tape and Reel, 4000
LMV358B-TSR	-40 to 125°C	8-Pin TSSOP	V358B XXXX <sup>Note 3</sup>	3	Tape and Reel, 3000
LMV358B-VR	-40 to 125°C	8-Pin MSOP	V358B XXXX <sup>Note 3</sup>	3	Tape and Reel, 3000
LMV324B-SR	-40 to 125°C	14-Pin SOIC	V324B XXXX <sup>Note 3</sup>	3	Tape and Reel, 2500
LMV324B-TR	-40 to 125°C	14-Pin TSSOP	V324B XXXX <sup>Note 3</sup>	3	Tape and Reel, 3000

Note 1: The sample will be ready in 1 month.

Note 2: XX is the date code.

Note 3: XXXX is date code.

## Absolute Maximum Ratings <sup>Note 1</sup>

Parameters	Rating
Supply Voltage, (+V <sub>S</sub> )– (-V <sub>S</sub> )	6 V
Input Voltage	(-V <sub>S</sub> ) – 0.3 to (+V <sub>S</sub> ) + 0.3
Differential Input Voltage	±6V
Input Current: +IN, –IN <sup>Note 2</sup>	±10mA
Output Short-Circuit Duration <sup>Note 3</sup>	Infinite
Maximum Junction Temperature	150°C
Operating Temperature Range	–40 to 125°C
Storage Temperature Range	–65 to 150°C
Lead Temperature (Soldering, 10 sec)	260°C

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: The inputs are protected by ESD protection diodes to each power supply. If the input extends more than 300mV beyond the power supply, the input current should be limited to less than 10mA.

Note 3: A heat sink may be required to keep the junction temperature below the absolute maximum. This depends on the power supply voltage and how many amplifiers are shorted. Thermal resistance varies with the amount of PC board metal connected to the package. The specified values are for short traces connected to the leads.

## ESD Rating

Symbol	Parameter	Condition	Minimum Level	Unit
HBM	Human Body Model ESD	ANSI/ESDA/JEDEC JS-001	8	kV
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002	2	kV

## Thermal Information

Package Type	θ <sub>JA</sub>	θ <sub>JC</sub>	Unit
5-Pin SC70	400		°C/W
5-Pin SOT23	250	81	°C/W
8-Pin SOIC	158	43	°C/W
8-Pin TSSOP	191	44	°C/W
8-Pin MSOP	210	45	°C/W
14-Pin SOIC	120	36	°C/W
14-Pin TSSOP	180	35	°C/W

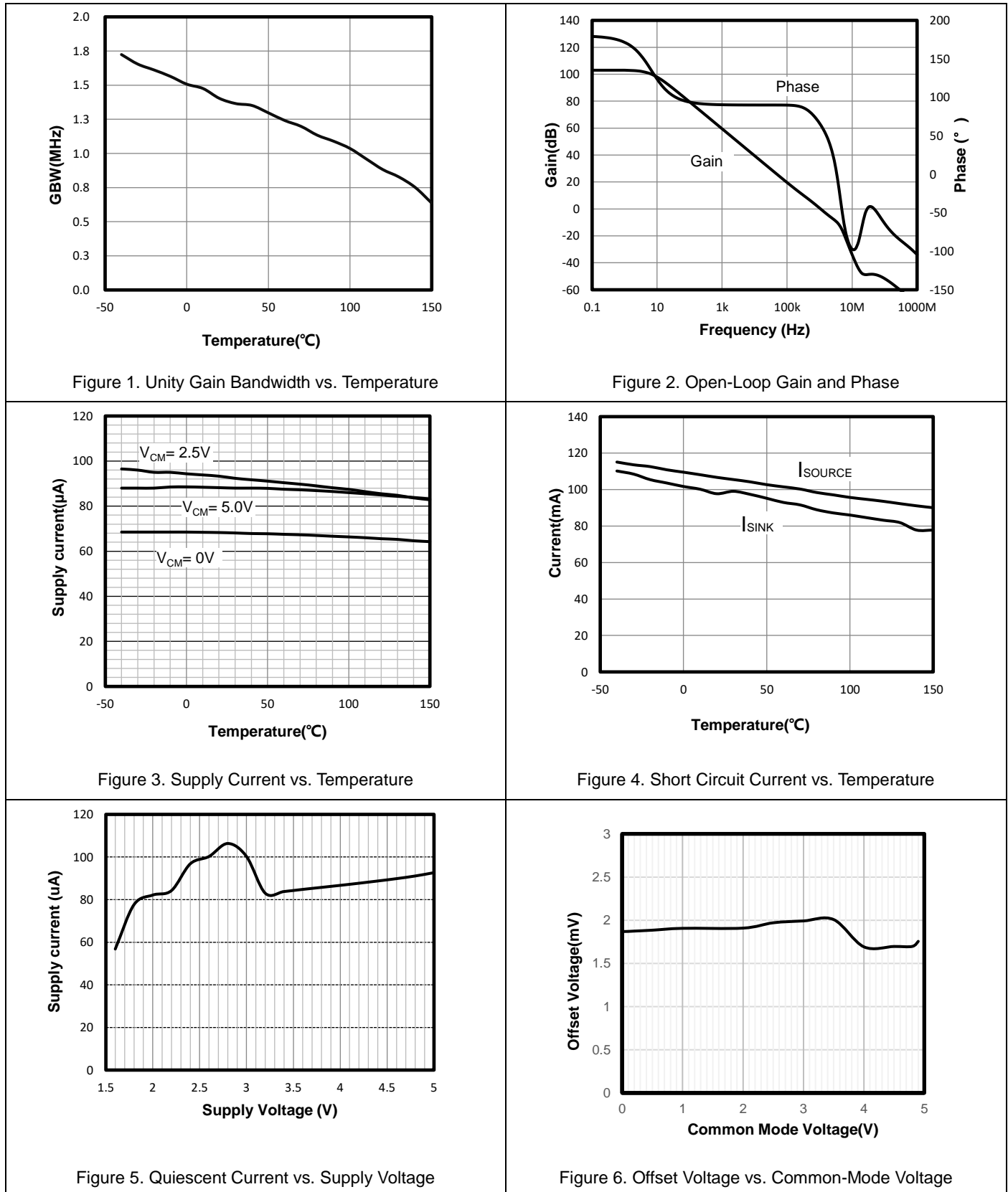
## Electrical Characteristics

All test condition is  $V_S = 5V$ ,  $T_A = 25^\circ C$ ,  $R_L = 2k\Omega$ ,  $C_L = 100pF$ , unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Power Supply</b>						
$V_S$	Supply Voltage Range		2.5		5.5	V
$I_Q$	Quiescent Current per Amplifier			80	130	$\mu A$
PSRR	Power Supply Rejection Ratio		70	75		dB
<b>Input Characteristics</b>						
$V_{OS}$	Input Offset Voltage	$V_{CM} = 0V$ to $3V$	+1	+2	+4	mV
$V_{OS\ TC}$	Input Offset Voltage Drift	$T_A = -40^\circ C$ to $125^\circ C$		2		$\mu V/^\circ C$
$I_B$	Input Bias Current	$T_A = 25^\circ C$		1		$\mu A$
		$T_A = 85^\circ C$		25		$\mu A$
$I_{OS}$	Input Offset Current			1		$\mu A$
$C_{IN}$	Input Capacitance	Differential Mode		8		pF
		Common Mode		7		pF
$A_V$	Open-loop Voltage Gain	$R_{LOAD} = 10k\Omega$	85	110		dB
$V_{CMR}$	Common-mode Input Voltage Range		(V-) - 0.1		(V+) + 0.1	V
CMRR	Common Mode Rejection Ratio	$V_{CM} = 0V$ to $3V$	65	85		dB
Xtalk	Channel Separation	$f = 1kHz$ , $R_L = 2k\Omega$		110		dB
<b>Output Characteristics</b>						
$V_{OH}, V_{OL}$	Maximum Output Voltage Swing	$R_{LOAD} = 10k\Omega$		3	15	mV
$I_{SC}$	Output Short-Circuit Current		90	100		mA
<b>AC Specifications</b>						
GBW	Gain-Bandwidth Product			1		MHz
SR	Slew Rate	$A_V = 1$ , $V_{OUT} = 1.5V$ to $3.5V$ , $C_{LOAD} = 60pF$ , $R_{LOAD} = 1k\Omega$		0.7		V/ $\mu s$
$t_s$	Settling Time, 0.1%	$A_V = 1$ , 2V Step, $C_{LOAD} = 60pF$ , $R_{LOAD} = 1k\Omega$		3.5		$\mu s$
	Settling Time, 0.01%			4.8		$\mu s$
PM	Phase Margin	$R_{LOAD} = 1k\Omega$ , $C_{LOAD} = 60pF$		60		$^\circ$
GM	Gain Margin	$R_{LOAD} = 1k\Omega$ , $C_{LOAD} = 60pF$		15		dB
<b>Noise Performance</b>						
$E_N$	Input Voltage Noise	$f = 0.1Hz$ to $10Hz$		3		$\mu V_{RMS}$
$e_N$	Input Voltage Noise Density	$f = 1kHz$		35		nV/ $\sqrt{Hz}$
$i_N$	Input Current Noise	$f = 1kHz$		2		fA/ $\sqrt{Hz}$
THD+N	Total Harmonic Distortion and Noise	$f = 1kHz$ , $A_V = 1$ , $R_L = 2k\Omega$ , $V_{OUT} = 1Vp-p$		0.003		%

## Typical Performance Characteristics

$V_S = 5V$ ,  $V_{CM} = 2.5V$ ,  $R_L = \text{Open}$ , unless otherwise specified.



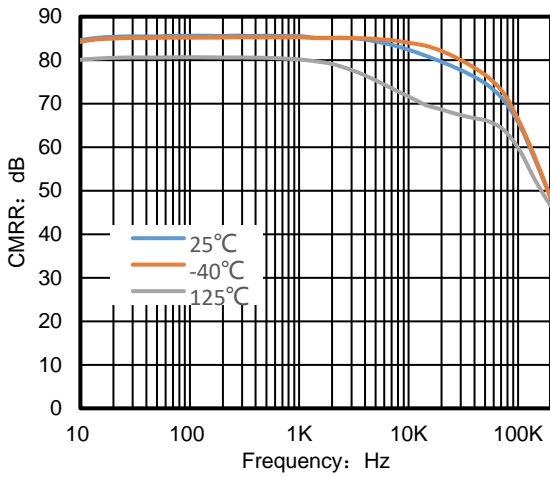


Figure 7. CMRR vs. Frequency

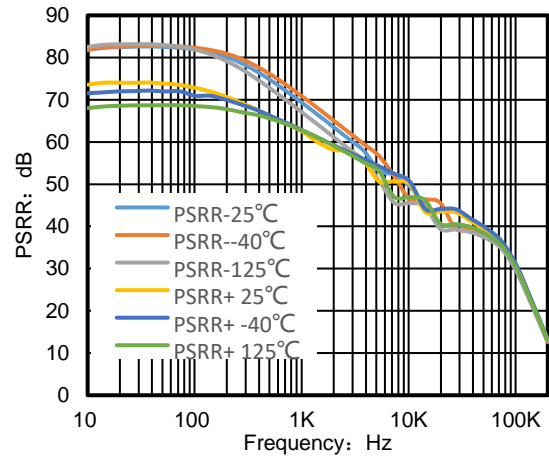


Figure 8. PSRR vs. Frequency

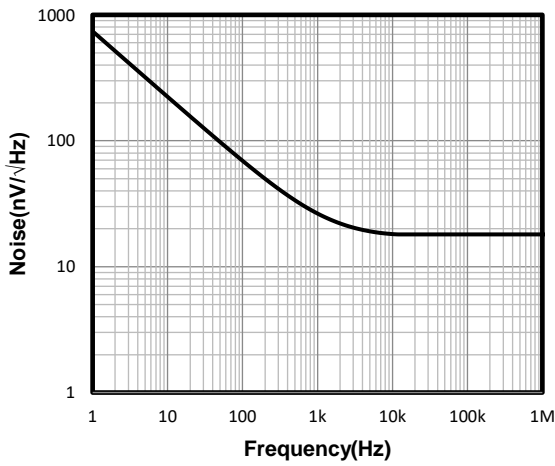


Figure 9. Input Voltage Noise Spectral Density

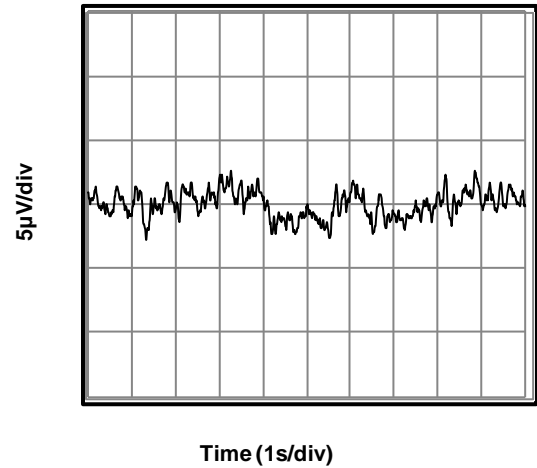


Figure 10. 0.1 Hz to 10 Hz Input Voltage Noise

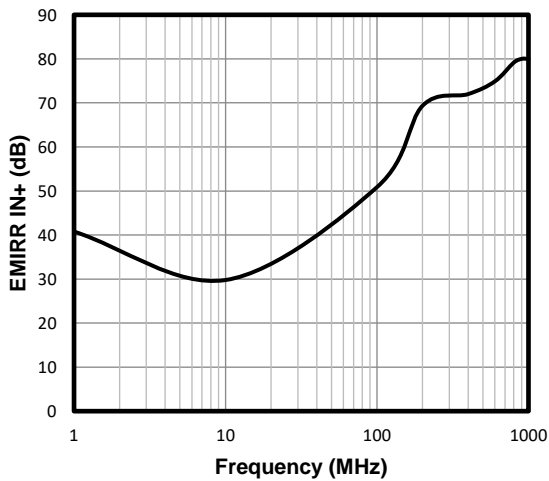


Figure 11. EMIRR IN+ vs. Frequency

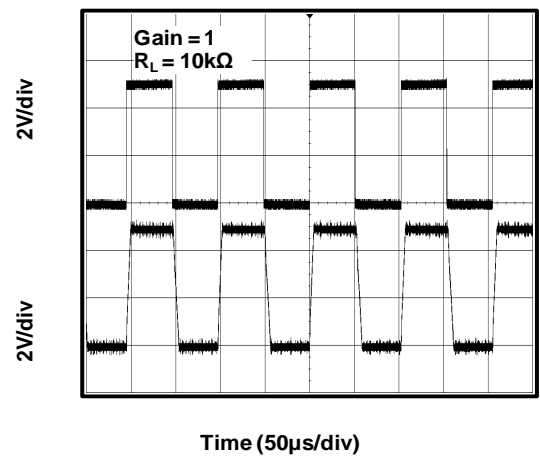


Figure 12. Large-Scale Step Response

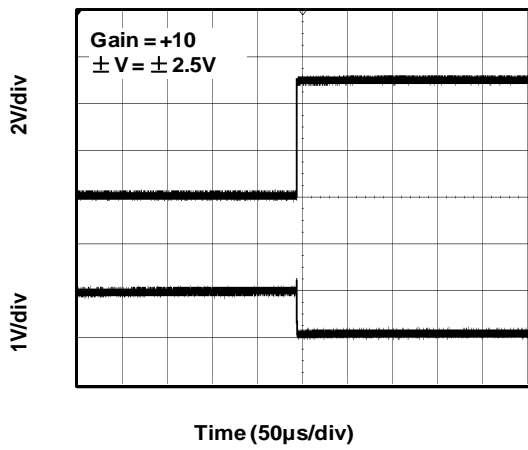


Figure 13. Negative Over-Voltage Recovery

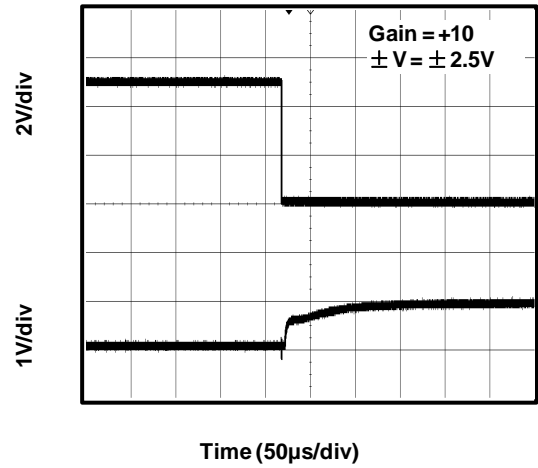


Figure 14. Positive Over-Voltage Recovery

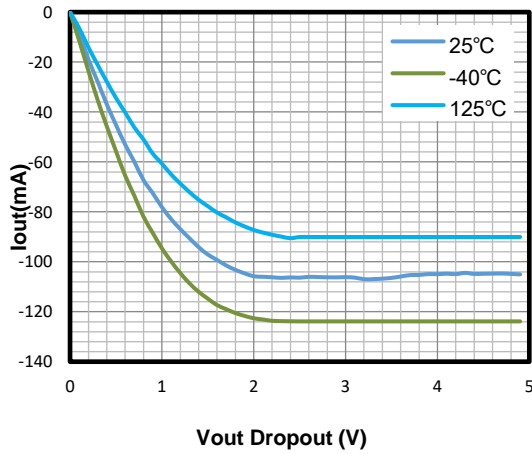


Figure 15. Negative Output Swing vs. Load Current

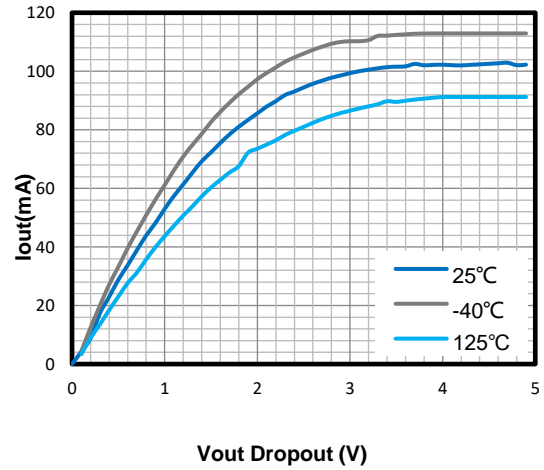
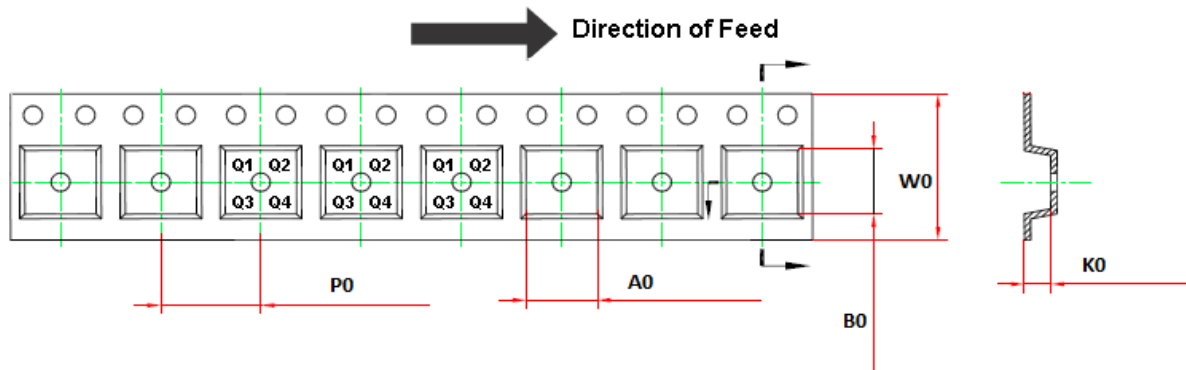
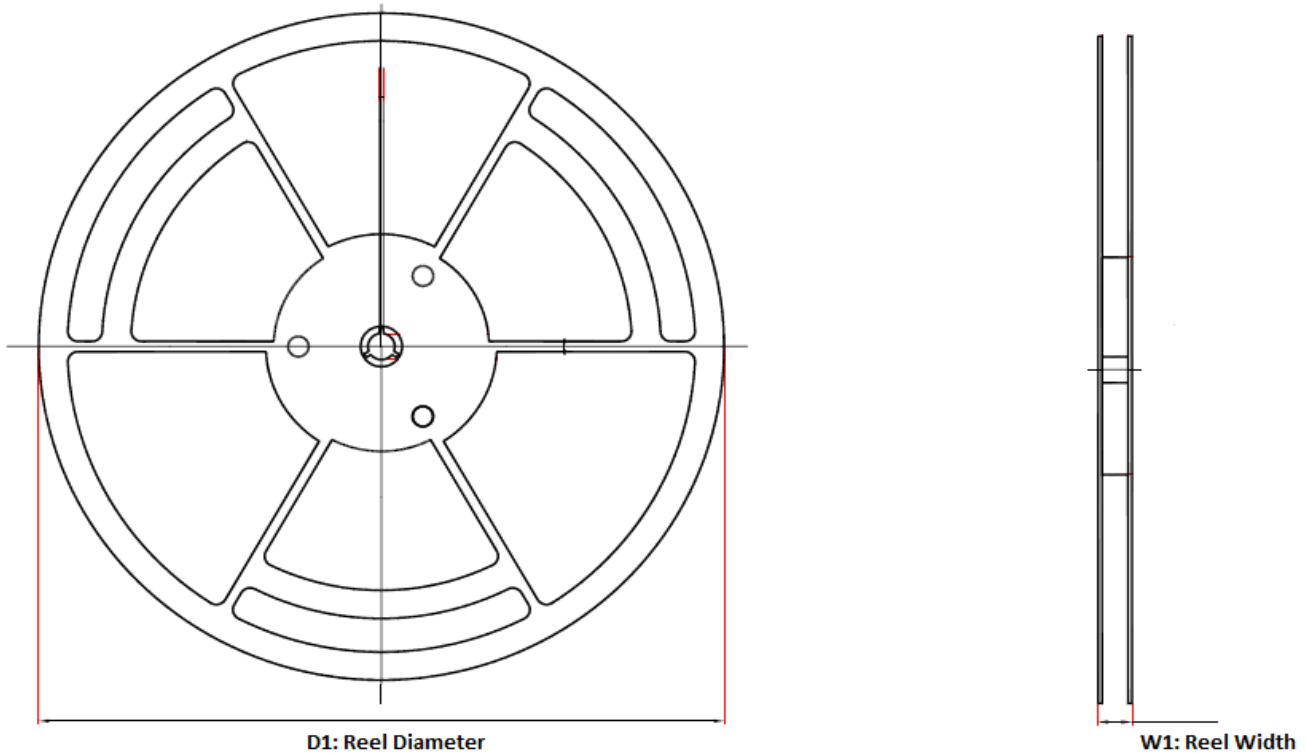


Figure 16. Positive Output Swing vs. Load Current



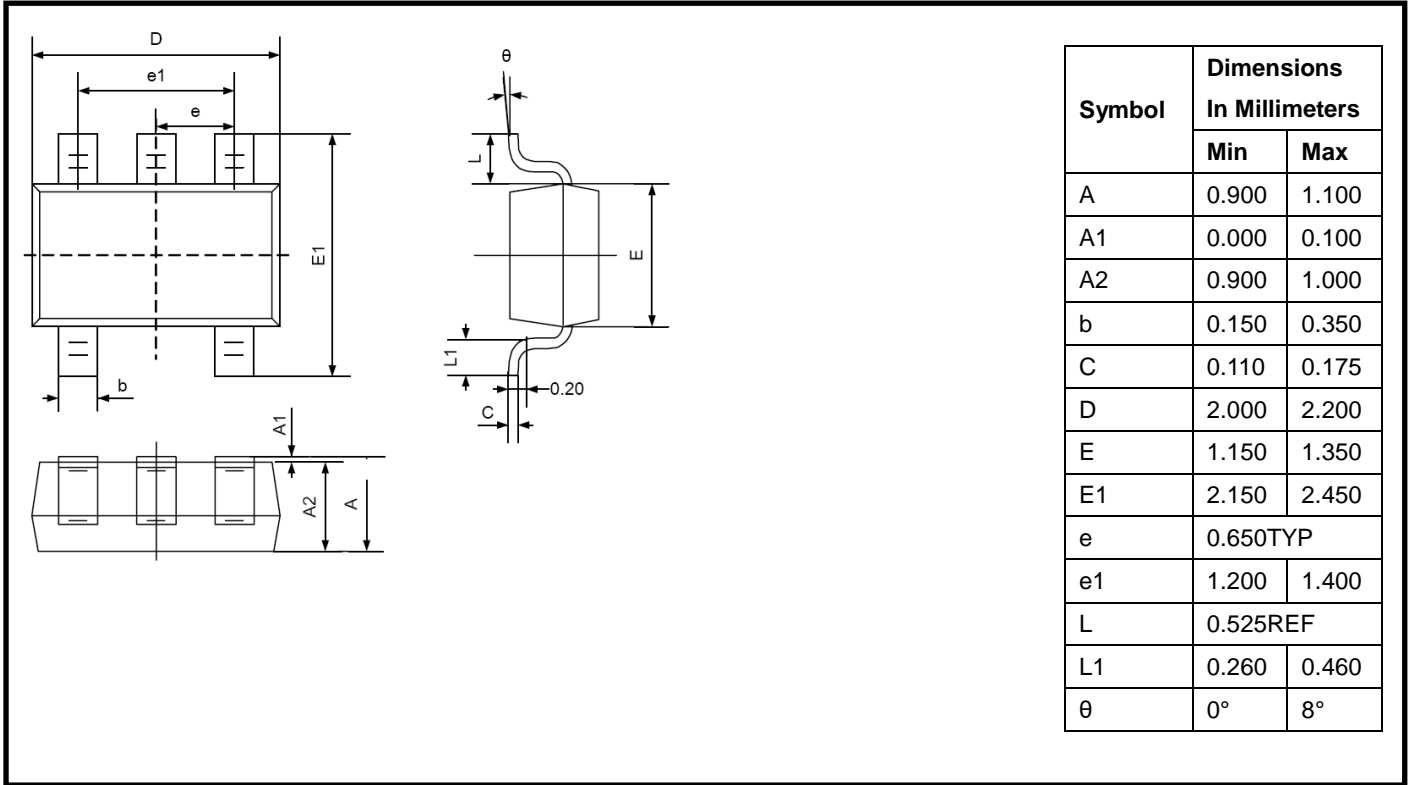
## Tape and Reel Information



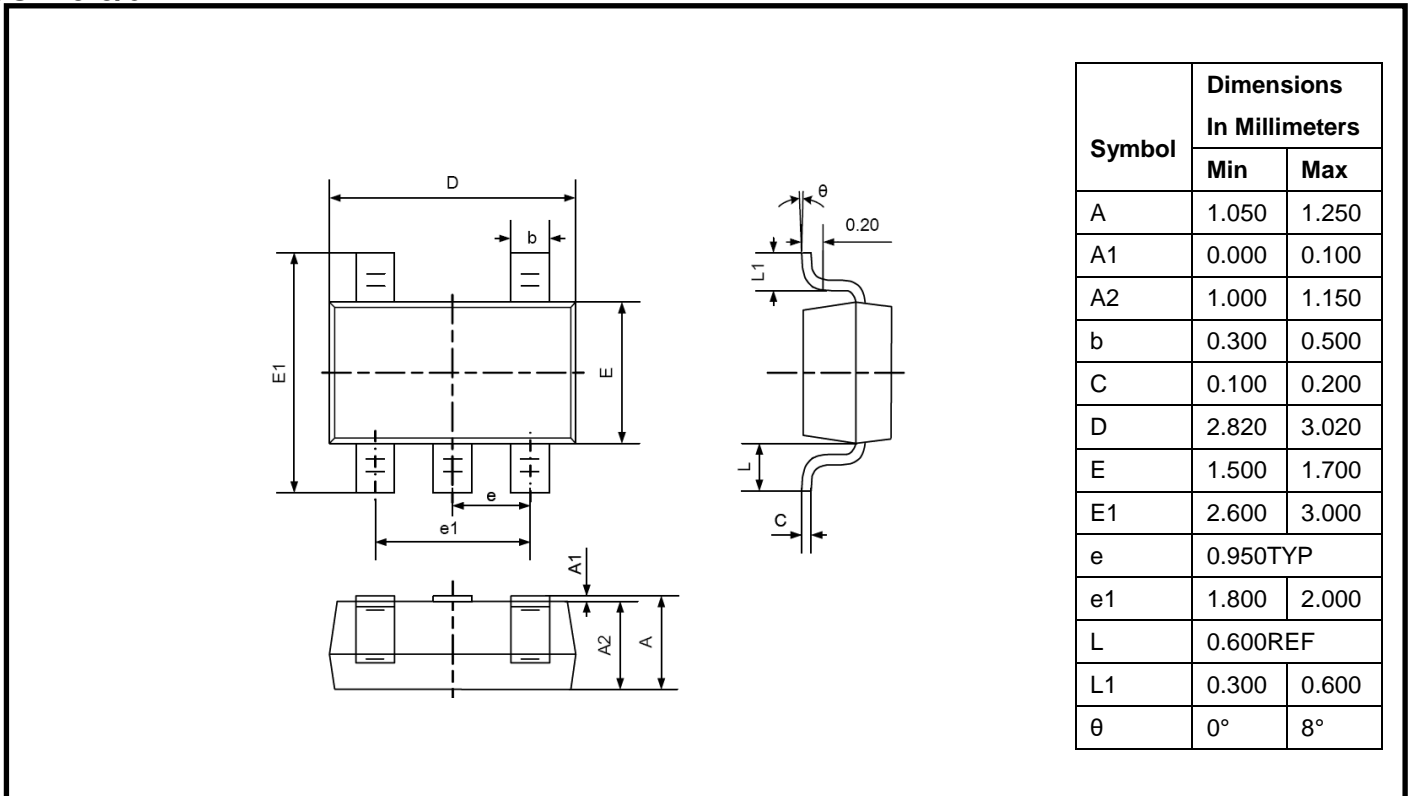
Order Number	Package	D1	W1	A0	B0	K0	P0	W0	Pin1 Quadrant
LMV321B-CR	5-Pin SC70	178.0	9.5	2.4	2.5	1.2	4.0	8.0	Q3
LMV321B-TR	5-Pin SOT23	180.0	13.1	3.2	3.2	1.4	4.0	8.0	Q3
LMV358B-SR	8-Pin SOIC	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
LMV358B-VR	8-Pin MSOP	330.0	17.6	5.2	3.3	1.5	8.0	12.0	Q1
LMV358B-TSR	8-Pin TSSOP	330.0	17.6	6.8	3.3	1.2	8.0	12.0	Q1
LMV324B-SR	14-Pin SOIC	330.0	21.6	6.5	9.0	2.1	8.0	16.0	Q1
LMV324B-TR	14-Pin TSSOP	330.0	17.6	6.8	5.4	1.2	8.0	12.0	Q1

Package Outline Dimensions

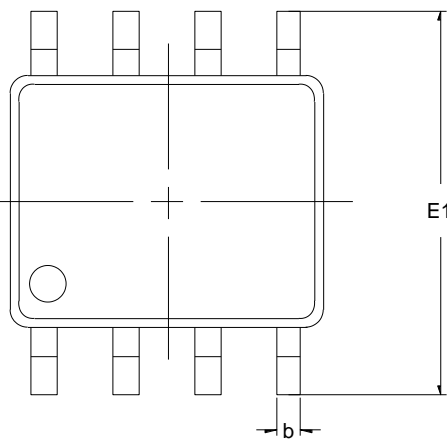
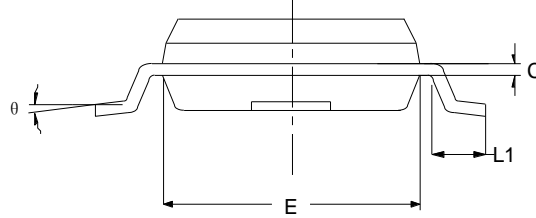
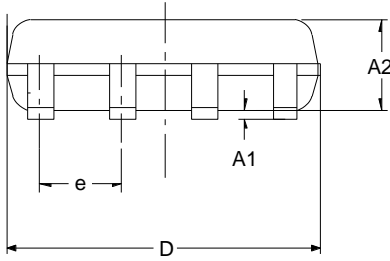
SC70-5/SC70-6 /SOT-353/SOT-363



SOT23-5/6

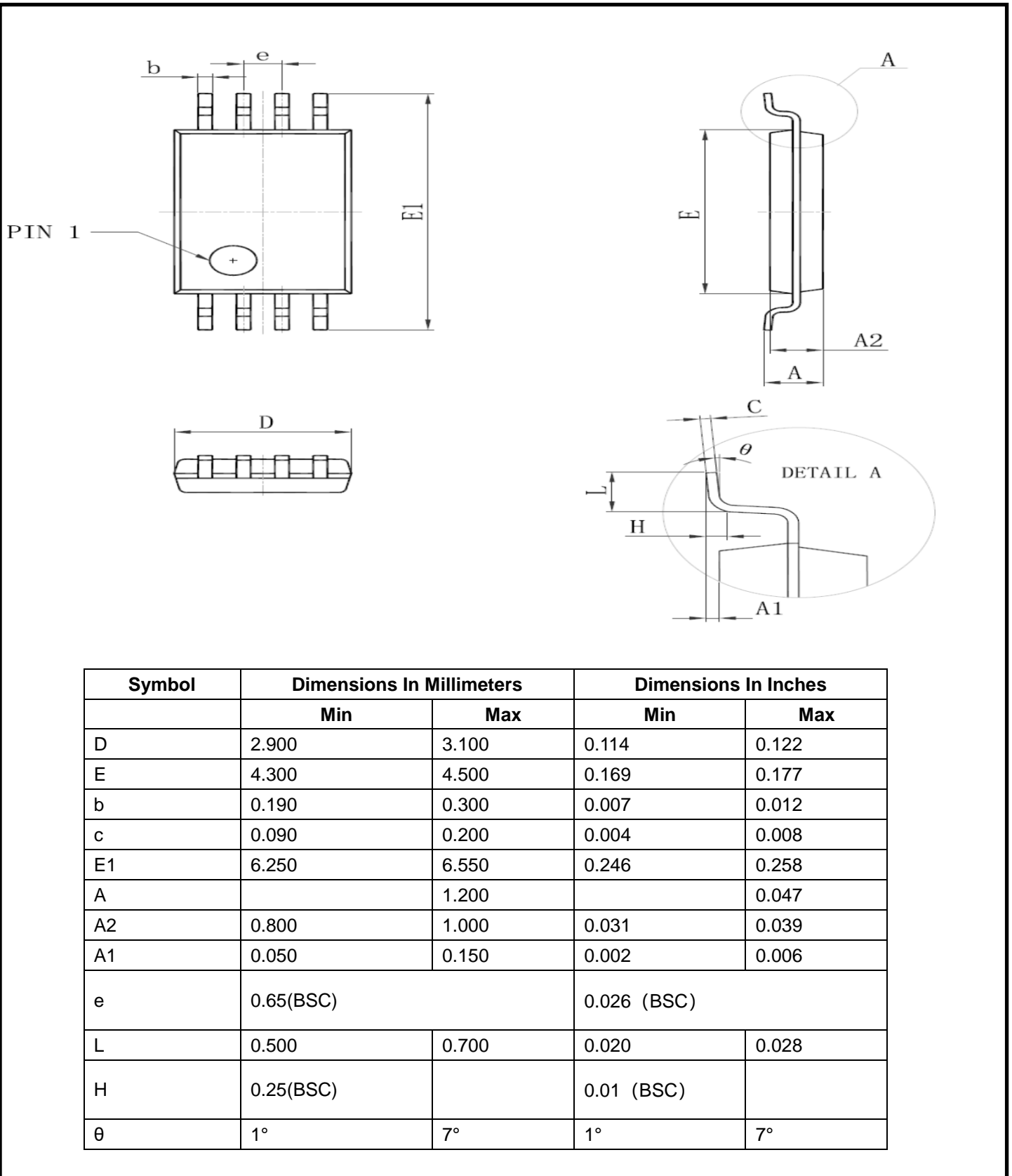


## SOP-8/ SOIC-8

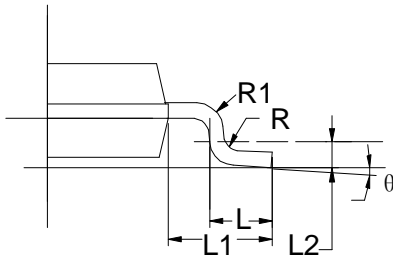
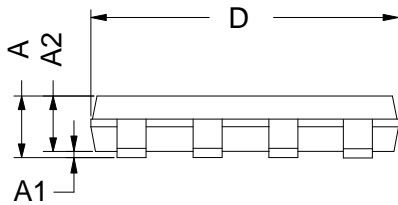
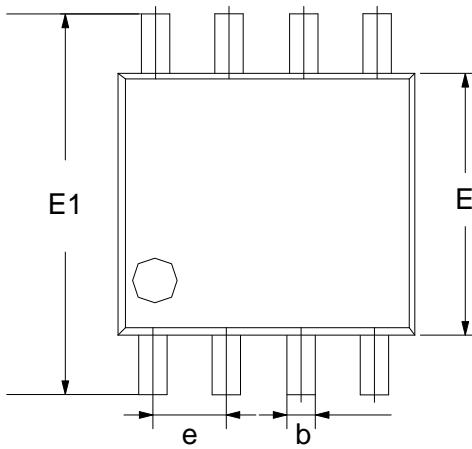


Symbol	Dimensions	
	In Millimeters	
	Min	Max
A1	0.100	0.250
A2	1.300	1.550
b	0.330	0.510
C	0.170	0.250
D	4.780	5.000
E	3.800	4.000
E1	5.800	6.300
e	1.270TYP	
L1	0.400	0.900
$\theta$	0°	8°

TSSOP-8

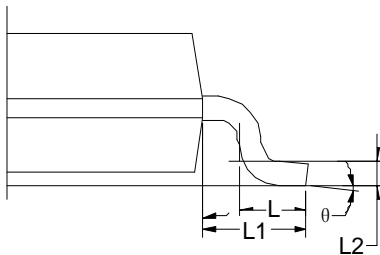
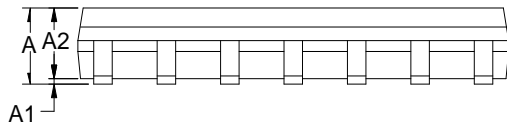
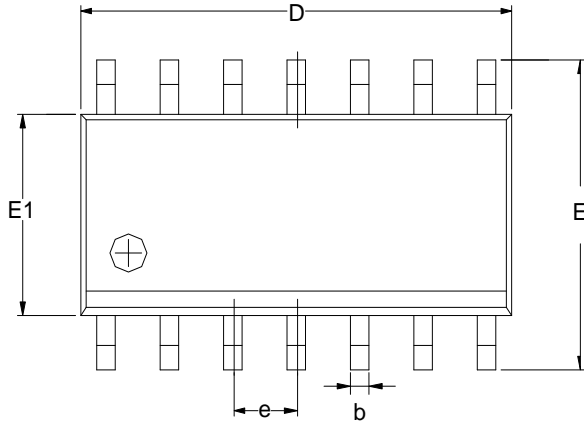


## MSOP-8



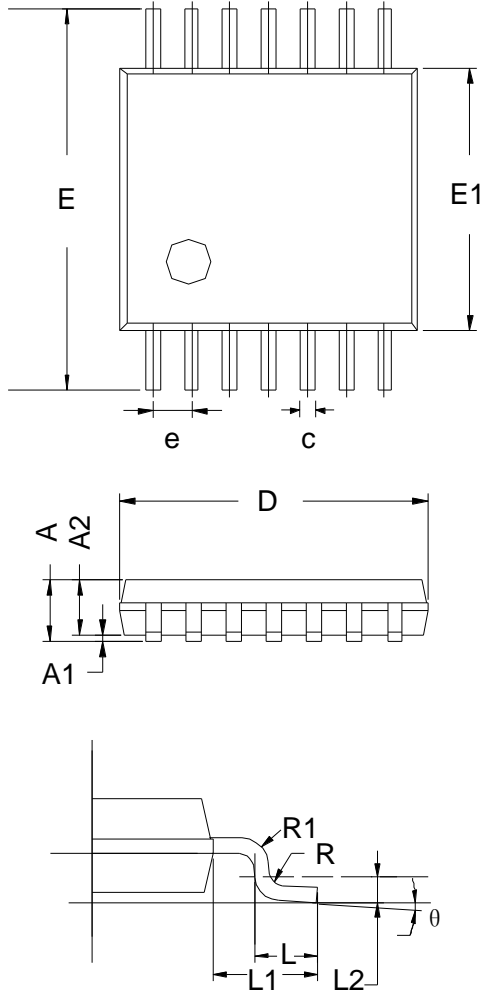
Symbol	Dimensions In Millimeters	
	Min	Max
A	0.800	1.200
A1	0.000	0.200
A2	0.750	0.950
b	0.30 TYP	
C	0.15 TYP	
D	2.900	3.100
e	0.65 TYP	
E	2.900	3.100
E1	4.700	5.100
L1	0.400	0.800
θ	0°	6°

## SOP-14 /SOIC-14



Symbol	Dimensions In Millimeters		
	MIN	TYP	MAX
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
b	0.31		0.51
D	8.45	8.63	8.85
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
L	0.40	0.60	0.80
L1	1.05 REF		
L2	0.25 BSC		
$\theta$	0°		8°

## TSSOP-14



Symbol	Dimensions In Millimeters		
	MIN	TYP	MAX
A	-	-	1.20
A1	0.05	-	0.15
A2	0.80	-	1.05
c	0.19	-	0.30
D	4.86	5.00	5.10
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	-	-
θ	0°	-	8°

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