

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- and V+, 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

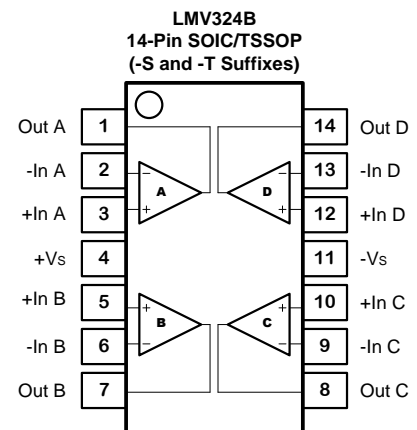
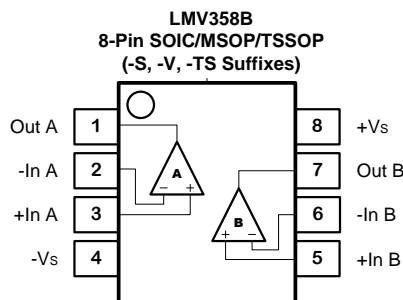
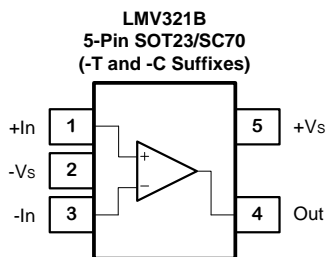


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Revision History

| 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 ^{Note 2} | 3 | Tape and Reel, 3000 |
| LMV321B-CR | -40 to 125°C | 5-Pin SC70 | 21BXX ^{Note 2} | 1 | Tape and Reel, 3000 |
| LMV358B-SR | -40 to 125°C | 8-Pin SOIC | V358B XXXX ^{Note 3} | 3 | Tape and Reel, 4000 |
| LMV358B-TSR | -40 to 125°C | 8-Pin TSSOP | V358B XXXX ^{Note 3} | 3 | Tape and Reel, 3000 |
| LMV358B-VR | -40 to 125°C | 8-Pin MSOP | V358B XXXX ^{Note 3} | 3 | Tape and Reel, 3000 |
| LMV324B-SR | -40 to 125°C | 14-Pin SOIC | V324B XXXX ^{Note 3} | 3 | Tape and Reel, 2500 |
| LMV324B-TR | -40 to 125°C | 14-Pin TSSOP | V324B XXXX ^{Note 3} | 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 ^{Note 1}

| Parameters | Rating |
|--|--|
| Supply Voltage, (+V _S)– (-V _S) | 6 V |
| Input Voltage | (-V _S) – 0.3 to (+V _S) + 0.3 |
| Differential Input Voltage | ±6V |
| Input Current: +IN, –IN ^{Note 2} | ±10mA |
| Output Short-Circuit Duration ^{Note 3} | 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 _{JA} | θ _{JC} | 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 |

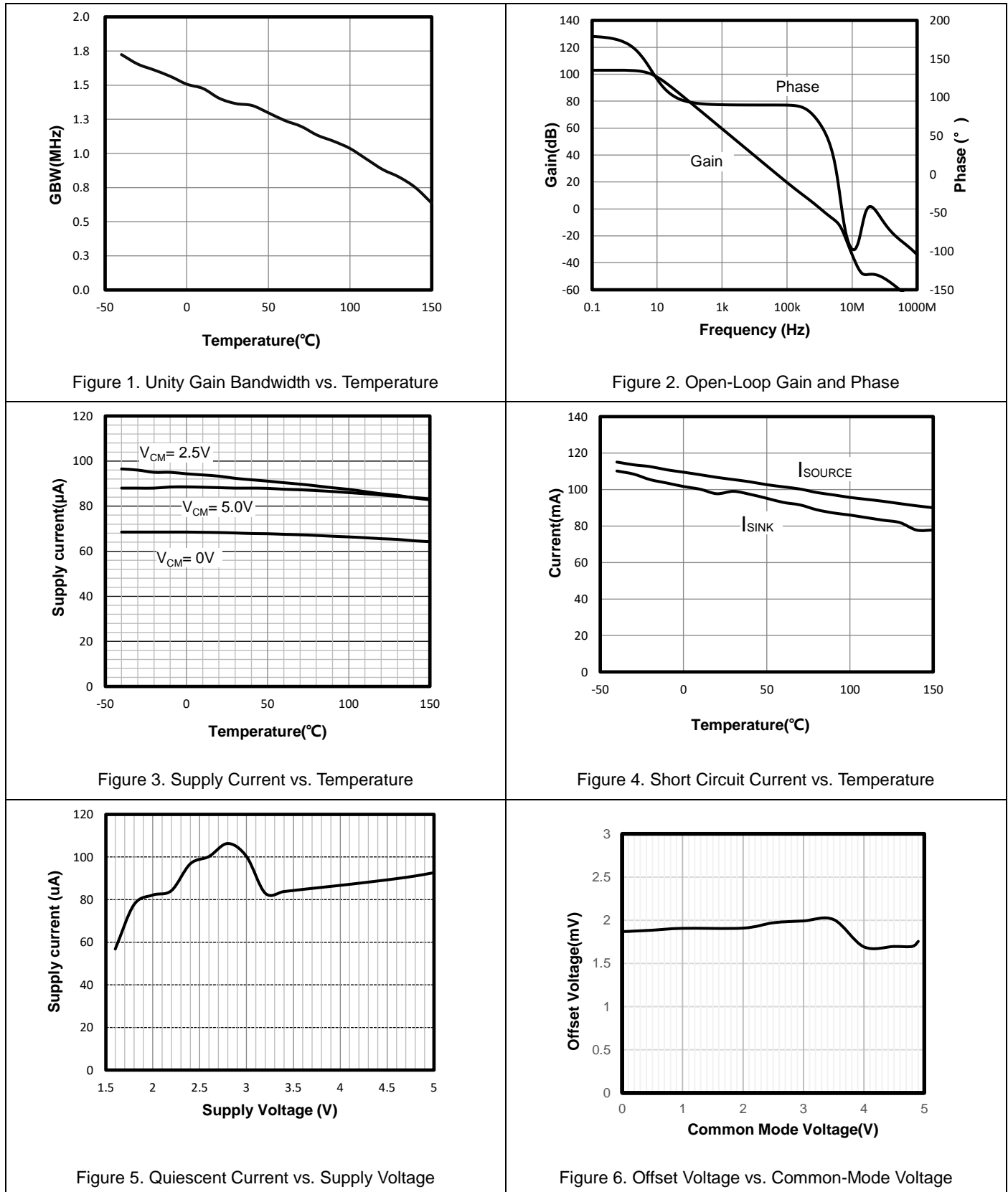
Electrical Characteristics

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 |
|-------------------------------|-------------------------------------|--|------------|-------|------------|------------------|
| Power Supply | | | | | | |
| V_S | Supply Voltage Range | | 2.5 | | 5.5 | V |
| I_Q | Quiescent Current per Amplifier | | | 80 | 130 | μA |
| PSRR | Power Supply Rejection Ratio | | 70 | 75 | | dB |
| Input Characteristics | | | | | | |
| 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 | | μA |
| | | $T_A = 85^\circ C$ | | 25 | | μA |
| I_{OS} | Input Offset Current | | | 1 | | μA |
| 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 |
| Output Characteristics | | | | | | |
| V_{OH}, V_{OL} | Maximum Output Voltage Swing | $R_{LOAD} = 10k\Omega$ | | 3 | 15 | mV |
| I_{SC} | Output Short-Circuit Current | | 90 | 100 | | mA |
| AC Specifications | | | | | | |
| 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/ μs |
| t_s | Settling Time, 0.1% | $A_V = 1$, 2V Step, $C_{LOAD} = 60pF$, $R_{LOAD} = 1k\Omega$ | | 3.5 | | μs |
| | Settling Time, 0.01% | | | 4.8 | | μs |
| PM | Phase Margin | $R_{LOAD} = 1k\Omega$, $C_{LOAD} = 60pF$ | | 60 | | $^\circ$ |
| GM | Gain Margin | $R_{LOAD} = 1k\Omega$, $C_{LOAD} = 60pF$ | | 15 | | dB |
| Noise Performance | | | | | | |
| E_N | Input Voltage Noise | $f = 0.1Hz$ to $10Hz$ | | 3 | | μV_{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 | $f = 1kHz$, $A_V = 1$, $R_L = 2k\Omega$, $V_{OUT} = 1V_{p-p}$ | | 0.003 | | % |

Typical Performance Characteristics

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



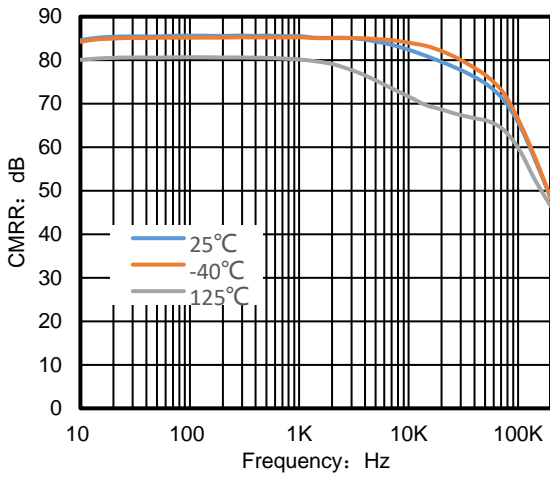


Figure 7. CMRR vs. Frequency

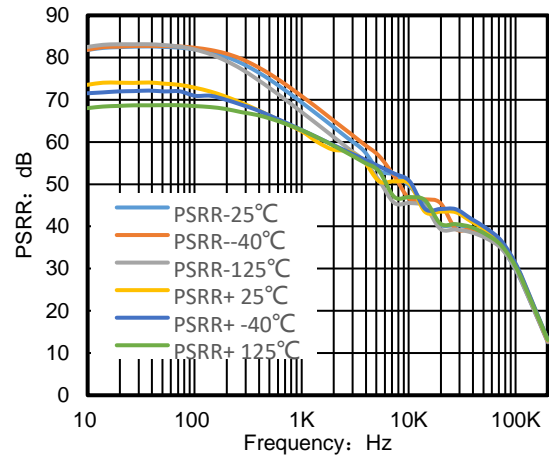


Figure 8. PSRR vs. Frequency

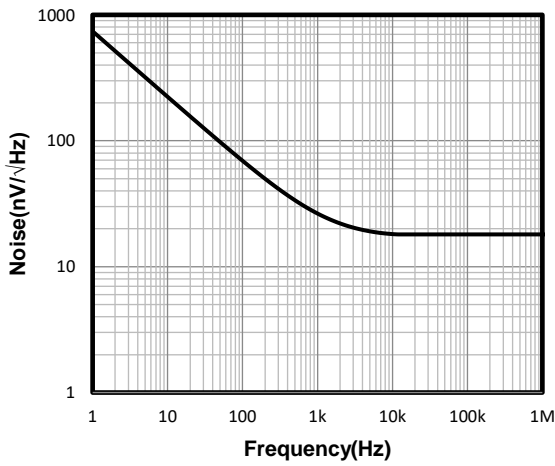


Figure 9. Input Voltage Noise Spectral Density

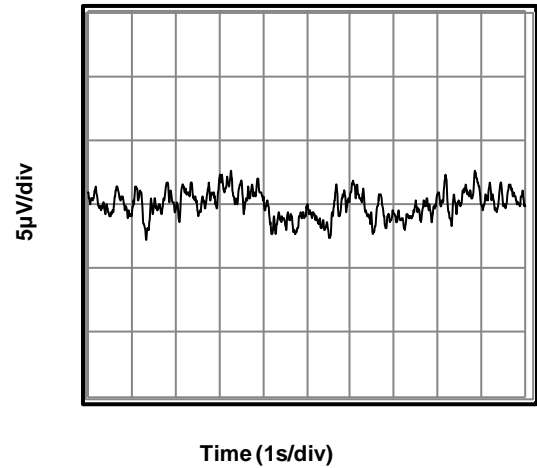


Figure 10. 0.1 Hz to 10 Hz Input Voltage Noise

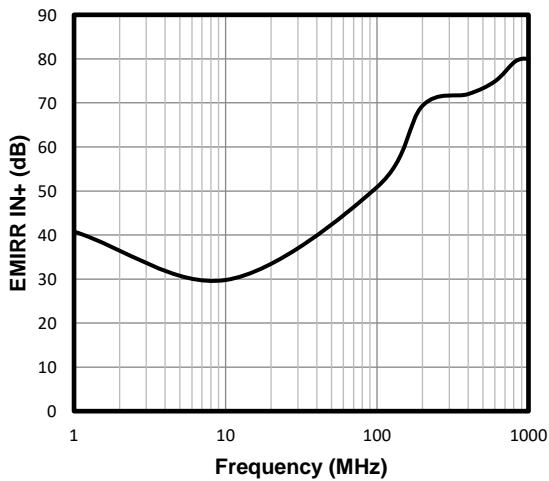


Figure 11. EMIRR IN+ vs. Frequency

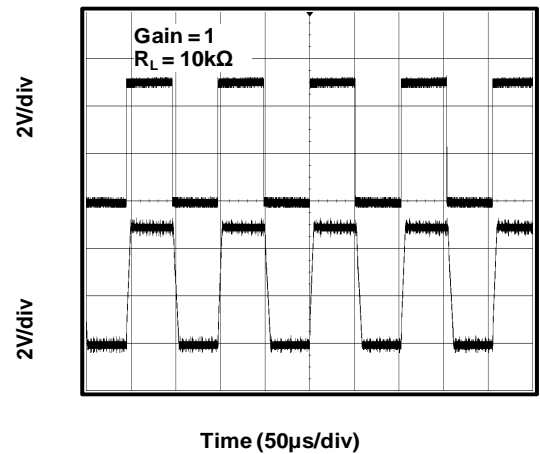
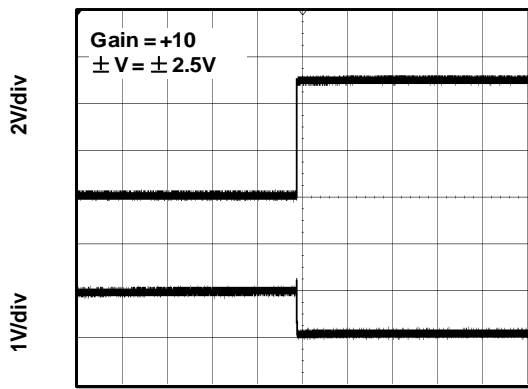
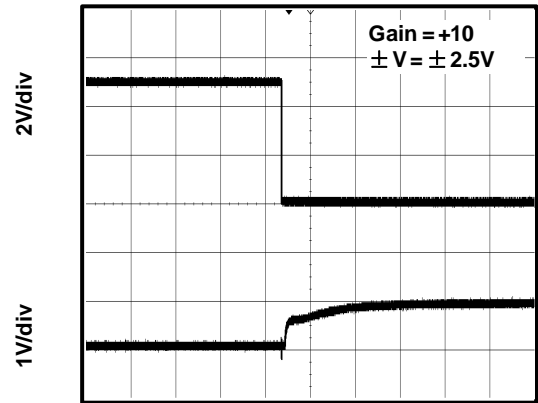


Figure 12. Large-Scale Step Response



Time (50μs/div)

Figure 13. Negative Over-Voltage Recovery



Time (50μs/div)

Figure 14. Positive Over-Voltage Recovery

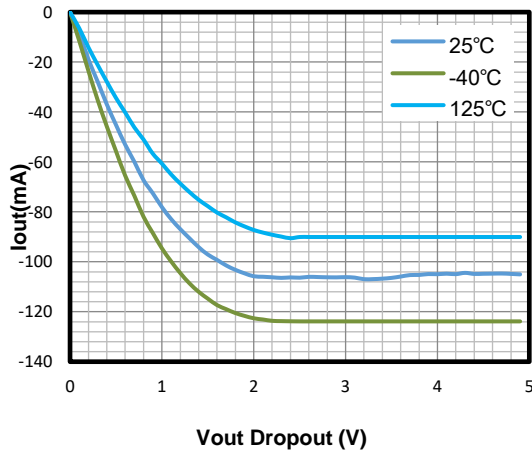


Figure 15. Negative Output Swing vs. Load Current

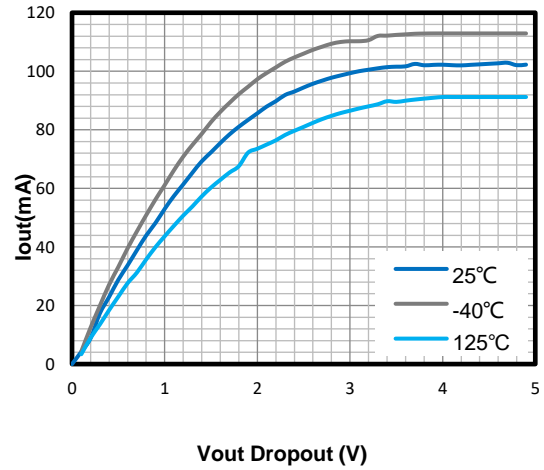
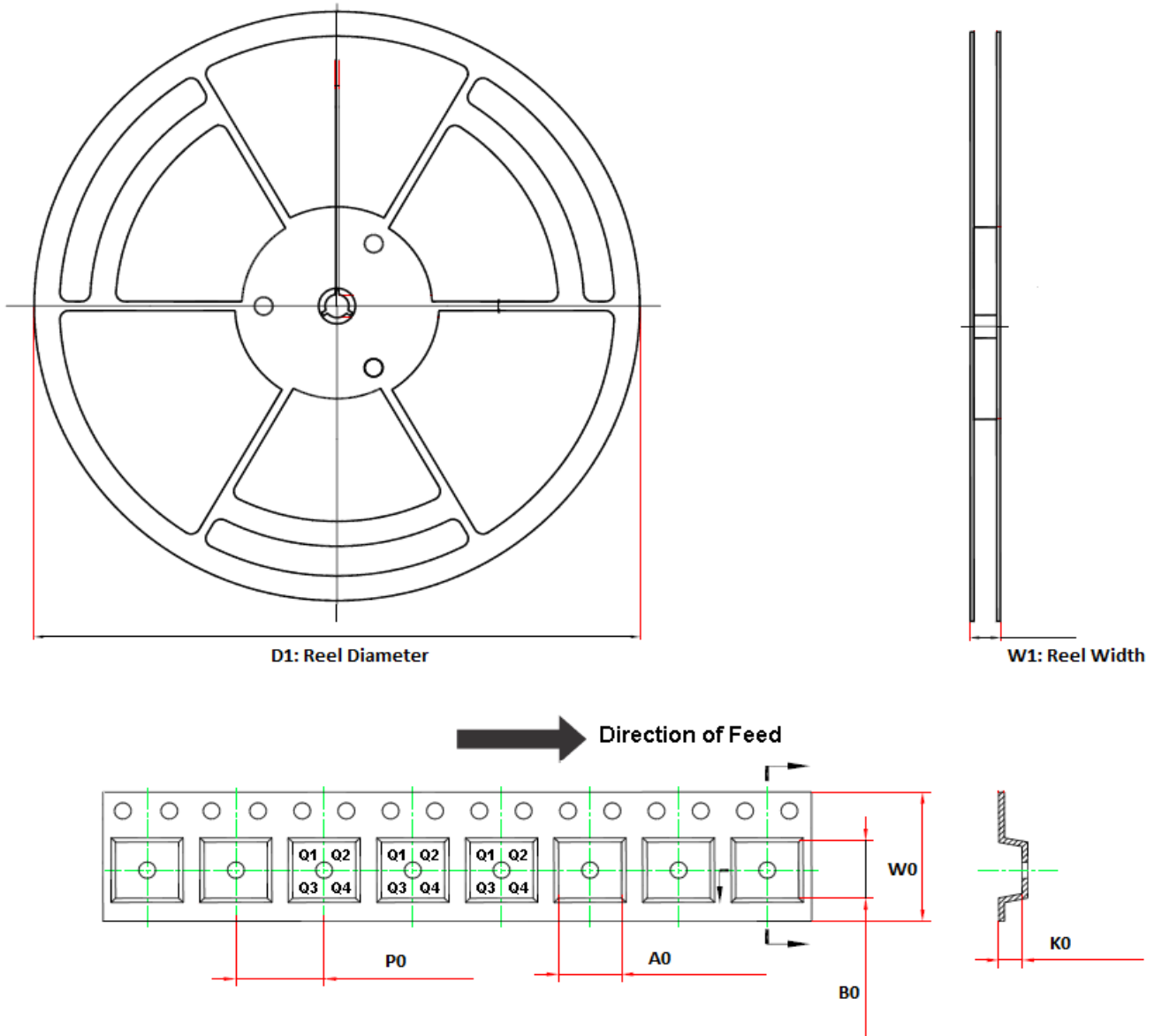


Figure 16. Positive Output Swing vs. Load Current

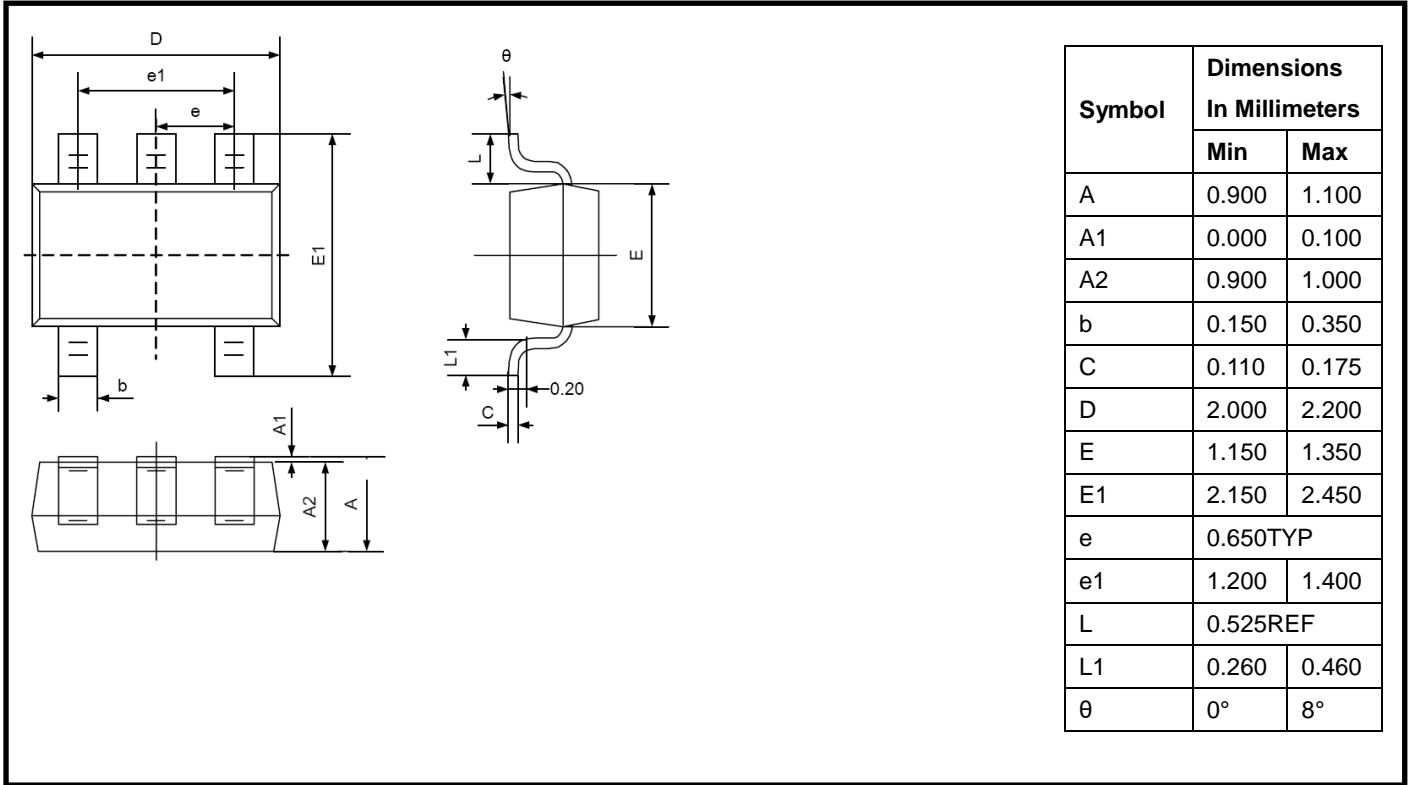
Tape and Reel Information



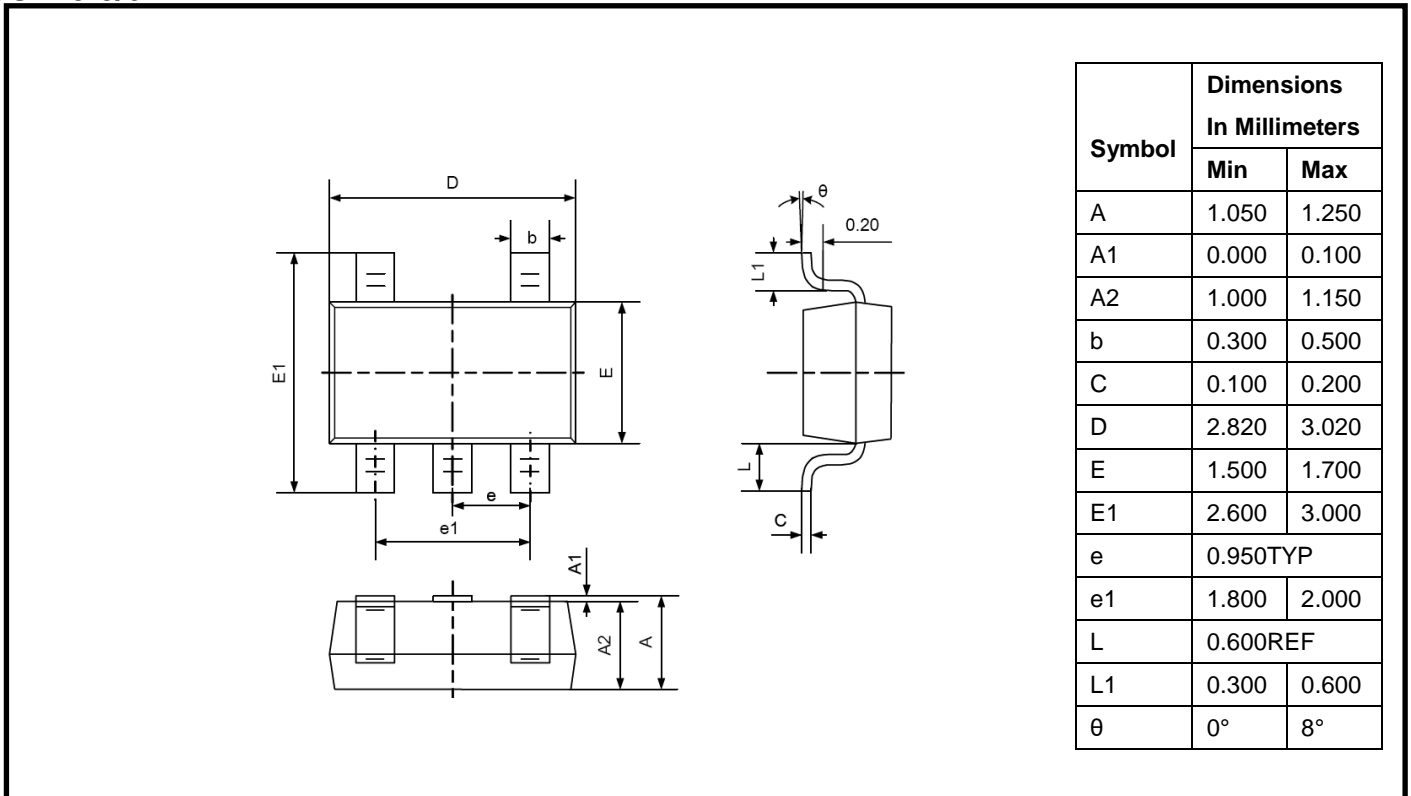
| Order Number | Package | D1 | W1 | A0 | B0 | K0 | P0 | W0 | Pin1 Quadrant |
|--------------|--------------|-------|------|-----|-----|-----|-----|------|---------------|
| LMV321B-CR | 5-Pin SC70 | 178.0 | 9.5 | 2.4 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| LMV321B-TR | 5-Pin SOT23 | 180.0 | 13.1 | 3.2 | 3.2 | 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

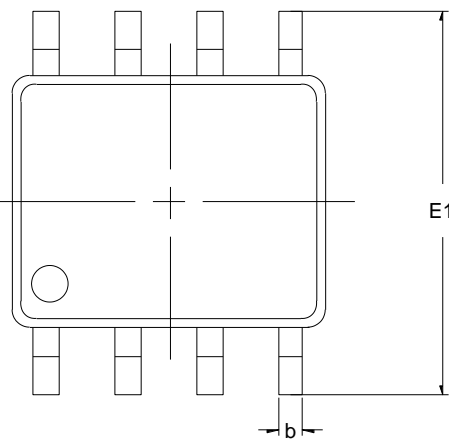
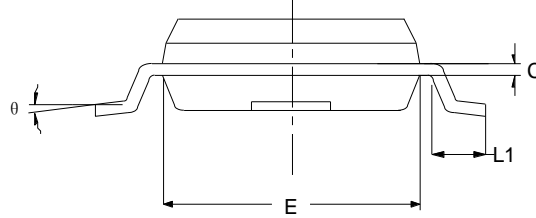
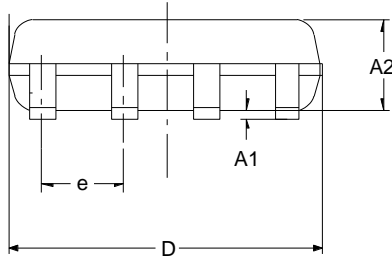
SC70-5/SC70-6 /SOT-353/SOT-363



SOT23-5/6

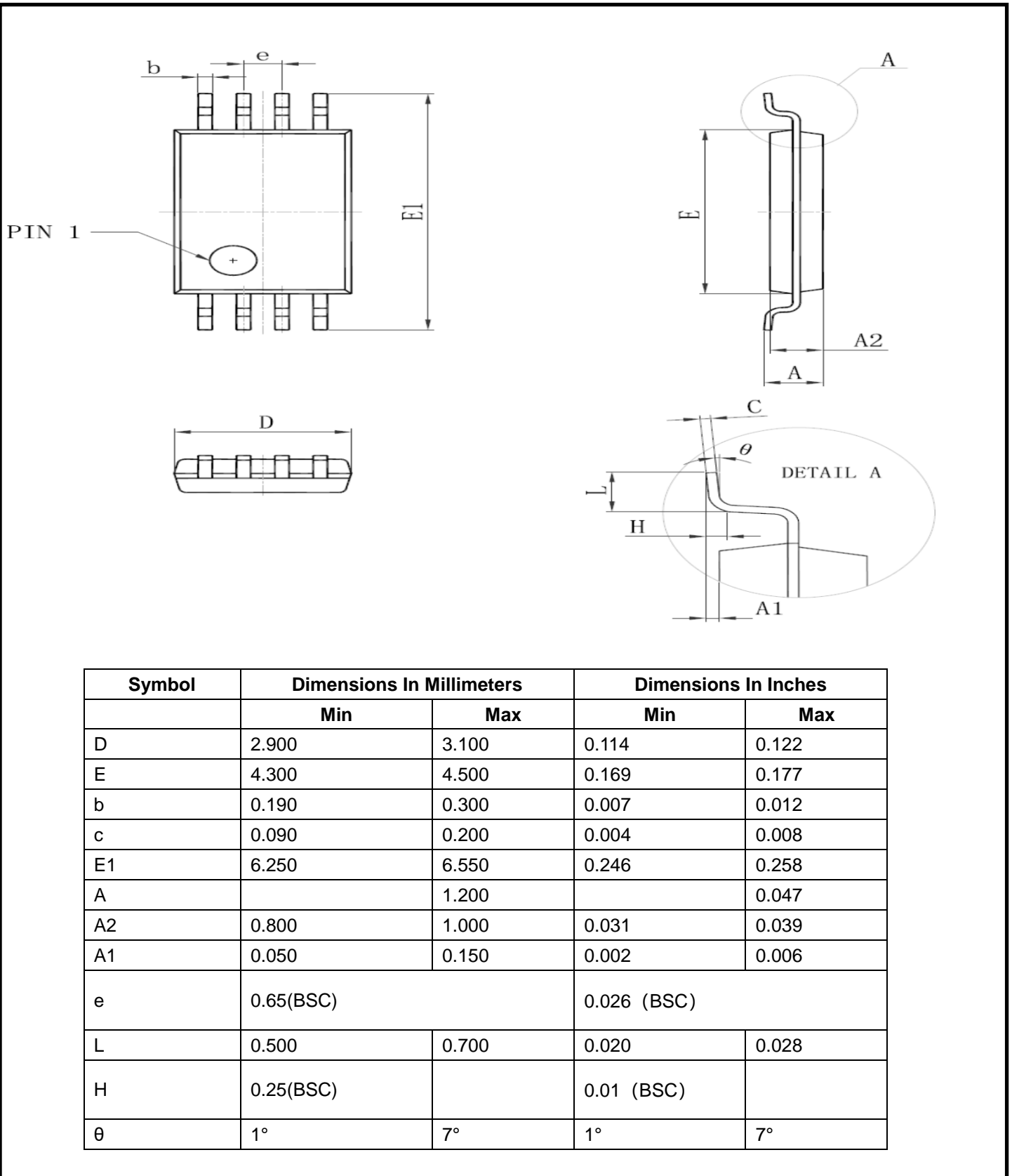


SOP-8/ SOIC-8

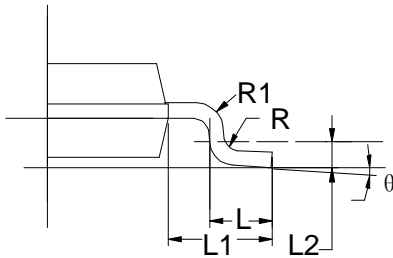
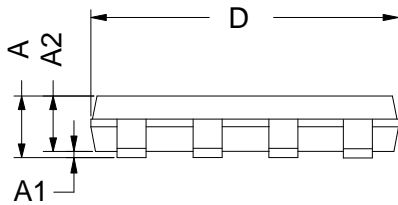
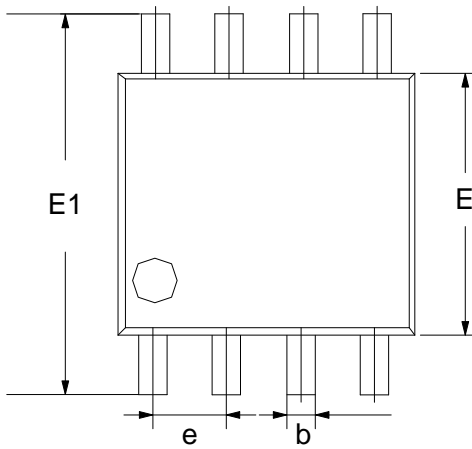


| Symbol | Dimensions | |
|----------|----------------|-------|
| | In Millimeters | |
| | Min | Max |
| A1 | 0.100 | 0.250 |
| A2 | 1.300 | 1.550 |
| b | 0.330 | 0.510 |
| C | 0.170 | 0.250 |
| D | 4.780 | 5.000 |
| E | 3.800 | 4.000 |
| E1 | 5.800 | 6.300 |
| e | 1.270TYP | |
| L1 | 0.400 | 0.900 |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

TSSOP-8

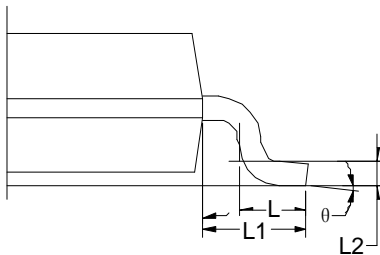
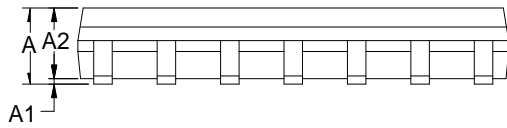
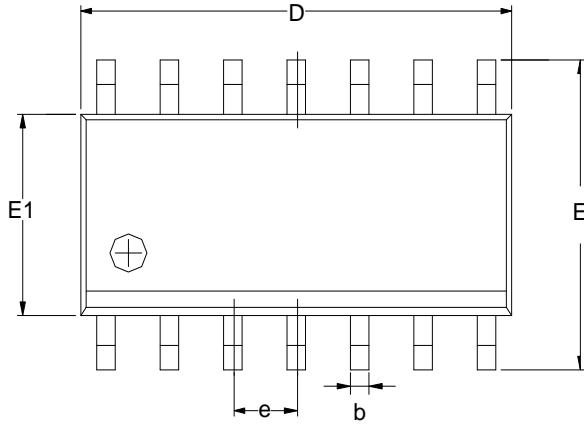


MSOP-8



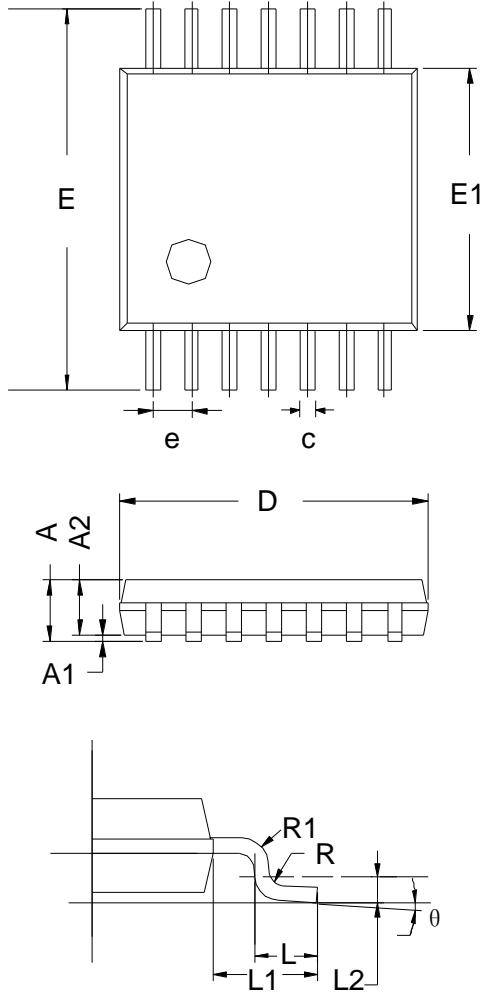
| Symbol | Dimensions In Millimeters | |
|--------|------------------------------|-------|
| | Min | Max |
| A | 0.800 | 1.200 |
| A1 | 0.000 | 0.200 |
| A2 | 0.750 | 0.950 |
| b | 0.30 TYP | |
| C | 0.15 TYP | |
| D | 2.900 | 3.100 |
| e | 0.65 TYP | |
| E | 2.900 | 3.100 |
| E1 | 4.700 | 5.100 |
|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