

AZ10EP16VS AZ100EP16VS

ECL/PECL Differential Receiver with Variable Output Swing

FEATURES

- Silicon-Germanium for High Speed Operation
- 150ps Typical Propagation Delay
- AZ100EP16VS Functionally Equivalent to ON Semiconductor MC100EP16VS at 3.3V
- Available in a 3x3mm MLP Package
- S-Parameter (.s2p) and IBIS Model Files available on Arizona Microtek Website

PACKAGE AVAILABILITY

| PACKAGE | PART NUMBER | MARKING | NOTES |
|---|------------------|----------------------------|-------|
| SOIC 8 | AZ10EP16VSD | AZM10 EP16VS | 1,2,3 |
| SOIC 8 | AZ100EP16VSD | AZM100 EP16VS | 1,2,3 |
| TSSOP 8 | AZ10EP16VST | AZTP EP16VS | 1,2,3 |
| TSSOP 8 | AZ100EP16VST | AZHP EP16VS | 1,2,3 |
| MLP 16 (3x3) | AZ10/100EP16VSL | AZM 16S <Date Code> | 1,2 |
| MLP 16 (3x3) RoHS Compliant / Lead(Pb) Free | AZ10/100EP16VSL+ | AZM+ 16S <Date Code> | 1,2 |

- 1 Add R1 at end of part number for 7 inch (1K parts), R2 for 13 inch (2.5K parts) Tape & Reel.
- 2 Date code format: "Y" or "YY" for year followed by "WW" for week.
- 3 Date code "YWW" or "YYWW" on underside of part.

DESCRIPTION

The AZ10/100EP16VS is a Silicon-Germanium (SiGe) differential receiver with variable output swing. The EP16VS has functionality and output transition times similar to the EP16, with an input that controls the amplitude of the Q/Q outputs.

Connecting the BOOST pin to V_{EE} increases the output swing by about 15% above standard ECL/PECL levels. The BOOST pin is internally tied to V_{EE} for the SOIC 8 and TSSOP 8 packages, and is under external user control for the MLP 16 package. When both the BOOST pin and the V_{CTRL} pin are not connected, the part operates with the standard ECL/PECL output and V_{BB} levels of the AZ10/100EP16 device. To ensure best performance, the BOOST pin should be tied to V_{EE} when the variable swing feature is used.

The operational range of the EP16VS control input, V_{CTRL} , is from V_{REF} (full swing) to V_{CC} (min. swing). Maximum swing is achieved by leaving the V_{CTRL} pin open or tied to V_{EE} . Simple control of the output swing can be obtained by a variable resistor between the V_{REF} and V_{CC} pins, with the wiper driving V_{CTRL} . Typical application circuits and results are described in this Data Sheet.

The EP16VS provides a V_{REF} (V_{BB}/V_{REF}) output for a DC bias when AC coupling to the device. The V_{REF} pin should be used only as a bias for the EP16VS as its current sink/source capability is limited. Whenever used, the V_{REF} pin should be bypassed to ground via a 0.01 μ F capacitor.

Under open input conditions for D/D, the Q/Q outputs are not guaranteed.

NOTE: Specifications in ECL/PECL tables are valid when thermal equilibrium is established.

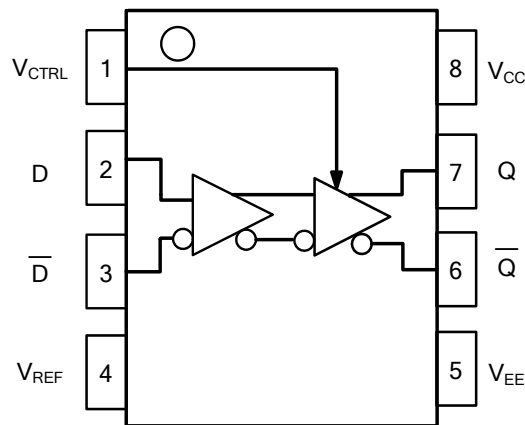
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PIN DESCRIPTION

| PIN | FUNCTION |
|---------------------------------|---|
| D, \bar{D} | Data Inputs |
| V_{CTRL} | Output Swing Control |
| Q, \bar{Q} | Data Outputs |
| V_{REF} , V_{BB}/V_{REF} | Reference Voltage Output |
| BOOST | Increases Output Swing when tied to V_{EE} * |
| V_{CC} | Positive Supply |
| V_{EE} | Negative Supply |
| NC | No Connect |

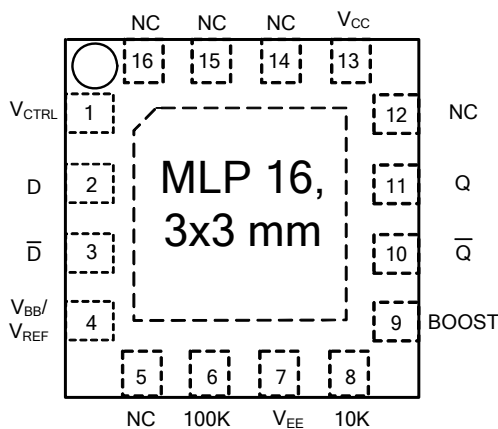
*BOOST should be tied to V_{EE} for best performance when using the variable swing feature.

LOGIC DIAGRAM AND PINOUT ASSIGNMENT



SOIC 8 & TSSOP 8

TOP VIEW



Bottom Center Pad may be left open or tied to V_{EE}

MLP 16 Package:
10K/100K Selection

Connect pin 10K to V_{EE} and float (NC) pin 100K to select 10K operation. Connect pin 100K to V_{EE} and float (NC) pin 10K to select 100K operation.

Variable Swing Selection

Connect pin BOOST to V_{EE} to support variable swing operation. Float (NC) pins BOOST and V_{CTRL} to disable variable swing operation.

All V_{EE} connections must be less than 1Ω .

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Absolute Maximum Ratings are those values beyond which device life may be impaired.

| Symbol | Characteristic | Rating | Unit |
|------------------|---|-------------|------|
| V _{CC} | PECL Power Supply (V _{EE} = 0V) | 0 to +4.5 | Vdc |
| V _I | PECL Input Voltage (V _{EE} = 0V) | 0 to +4.5 | Vdc |
| V _{EE} | ECL Power Supply (V _{CC} = 0V) | -4.5 to 0 | Vdc |
| V _I | ECL Input Voltage (V _{CC} = 0V) | -4.5 to 0 | Vdc |
| I _{OUT} | Output Current --- Continuous --- Surge | 50 100 | mA |
| T _A | Operating Temperature Range | -40 to +85 | °C |
| T _{STG} | Storage Temperature Range | -65 to +150 | °C |

10K ECL DC Characteristics (V_{EE} = -3.0V to -3.6V, V_{CC} = GND)

| Symbol | Characteristic | -40°C | | | 0°C | | | 25°C | | | 85°C | | | Unit |
|---|--|-------|-----|-----------|-------|-----|-----------|-------|-----|-----------|-------|-----|-----------|------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| V _{OH} | Output HIGH Voltage ¹ | -1095 | | -845 | -1055 | | -805 | -1030 | | -780 | -970 | | -720 | mV |
| V _{OL} | Output LOW Voltage ^{1,2} V _{CTRL} = V _{REF} BOOST = V _{EE} | -2000 | | -1700 | -2000 | | -1690 | -2000 | | -1690 | -2000 | | -1655 | mV |
| V _{OL} | Output LOW Voltage ^{1,2} V _{CTRL} = V _{CC} BOOST = V _{EE} | -1285 | | -1035 | -1270 | | -1020 | -1265 | | -1015 | -1255 | | -1005 | mV |
| V _{OL} | Output LOW Voltage ^{1,3} V _{CTRL} = NC BOOST = NC | -1950 | | -1650 | -1950 | | -1630 | -1950 | | -1630 | -1950 | | -1595 | mV |
| V _{REF} V _{BB} /V _{REF} | Reference Voltage ² BOOST = V _{EE} | -1700 | | -1500 | -1670 | | -1470 | -1650 | | -1450 | -1600 | | -1400 | mV |
| V _{BB} /V _{REF} | Reference Voltage ³ BOOST = NC | -1430 | | -1300 | -1380 | | -1270 | -1350 | | -1250 | -1310 | | -1190 | mV |
| I _{IH} | Input HIGH Current D,D V _{CTRL} | | | 80 400 | | | 80 400 | | | 80 400 | | | 80 400 | μA |
| I _{IL} | Input LOW Current | 0.5 | | | 0.5 | | | 0.5 | | | 0.5 | | | μA |
| I _{EE} | Power Supply Current | 21 | 27 | 36 | 22 | 28 | 37 | 22 | 29 | 38 | 24 | 30 | 40 | mA |

- Each output is terminated through a 50Ω resistor to V_{CC} - 2V.
- BOOST is internally bonded to V_{EE} for both the SOIC 8 and TSSOP 8 packages.
- Supported in MLP 16 package only.

10K LVPECL DC Characteristics (V_{EE} = GND, V_{CC} = +3.3V)

| Symbol | Characteristic | -40°C | | | 0°C | | | 25°C | | | 85°C | | | Unit |
|---|--|-------|-----|-----------|------|-----|-----------|------|-----|-----------|------|-----|-----------|------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| V _{OH} | Output HIGH Voltage ^{1,2} | 2205 | | 2455 | 2245 | | 2495 | 2270 | | 2520 | 2330 | | 2580 | mV |
| V _{OL} | Output LOW Voltage ^{1,2,3} V _{CTRL} = V _{REF} BOOST = V _{EE} | 1300 | | 1600 | 1300 | | 1610 | 1300 | | 1610 | 1300 | | 1645 | mV |
| V _{OL} | Output LOW Voltage ^{1,2,3} V _{CTRL} = V _{CC} BOOST = V _{EE} | 2015 | | 2265 | 2030 | | 2280 | 2035 | | 2285 | 2045 | | 2295 | mV |
| V _{OL} | Output LOW Voltage ^{1,3,4} V _{CTRL} = NC BOOST = NC | 1350 | | 1650 | 1350 | | 1670 | 1350 | | 1670 | 1350 | | 1670 | mV |
| V _{REF} V _{BB} /V _{REF} | Reference Voltage ³ BOOST = V _{EE} | 1600 | | 1800 | 1630 | | 1830 | 1650 | | 1850 | 1700 | | 1900 | mV |
| V _{BB} /V _{REF} | Reference Voltage ⁴ BOOST = NC | 1870 | | 2000 | 1920 | | 2030 | 1950 | | 2050 | 1990 | | 2110 | mV |
| I _{IH} | Input HIGH Current D,D V _{CTRL} | | | 80 400 | | | 80 400 | | | 80 400 | | | 80 400 | μA |
| I _{IL} | Input LOW Current | 0.5 | | | 0.5 | | | 0.5 | | | 0.5 | | | μA |
| I _{EE} | Power Supply Current | 21 | 27 | 36 | 22 | 28 | 37 | 22 | 29 | 38 | 24 | 30 | 40 | mA |

- For supply voltages other than 3.3V, use the ECL table values and ADD supply voltage value.
- Each output is terminated through a 50Ω resistor to V_{CC} - 2V.
- BOOST is internally bonded to V_{EE} for both the SOIC 8 and TSSOP 8 packages.
- Supported in MLP 16 package only.

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100K ECL DC Characteristics ($V_{EE} = -3.0V$ to $-3.6V$, $V_{CC} = GND$)

| Symbol | Characteristic | -40°C | | | 0°C | | | 25°C | | | 85°C | | | Unit |
|-------------------------------|---|-------|-----|-----------|-------|-----|-----------|-------|-------|-----------|-------|-----|-----------|---------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| V_{OH} | Output HIGH Voltage ¹ | -1130 | | -840 | -1090 | | -840 | -1090 | | -840 | -1090 | | -840 | mV |
| V_{OL} | Output LOW Voltage ^{1,2} $V_{CTRL} = V_{REF}$ BOOST = V_{EE} | -1950 | | -1700 | -1950 | | -1700 | -1950 | | -1700 | -1950 | | -1700 | mV |
| V_{OL} | Output LOW Voltage ^{1,2} $V_{CTRL} = V_{CC}$ BOOST = V_{EE} | -1200 | | -940 | -1190 | | -940 | -1190 | | -940 | -1190 | | -940 | mV |
| V_{OL} | Output LOW Voltage ^{1,3} $V_{CTRL} = NC$ BOOST = NC | -1900 | | -1640 | -1890 | | -1640 | -1890 | | -1640 | -1890 | | -1640 | mV |
| V_{REF} V_{BB}/V_{REF} | Reference Voltage ² BOOST = V_{EE} | -1650 | | -1450 | -1650 | | -1450 | -1650 | -1550 | -1450 | -1650 | | -1450 | mV |
| V_{BB}/V_{REF} | Reference Voltage ³ BOOST = NC | -1440 | | -1320 | -1380 | | -1260 | -1380 | | -1260 | -1380 | | -1260 | mV |
| I_{IH} | Input HIGH Current D,D V_{CTRL} | | | 80 400 | | | 80 400 | | | 80 400 | | | 80 400 | μA |
| I_{IL} | Input LOW Current | 0.5 | | | 0.5 | | | 0.5 | | | 0.5 | | | μA |
| I_{EE} | Power Supply Current | 20 | 26 | 35 | 21 | 27 | 36 | 22 | 28 | 38 | 25 | 31 | 41 | mA |

- Each output is terminated through a 50 Ω resistor to $V_{CC} - 2V$.
- BOOST is internally bonded to V_{EE} for both the SOIC 8 and TSSOP 8 packages.
- Supported in MLP 16 package only.

100K LVPECL DC Characteristics ($V_{EE} = GND$, $V_{CC} = +3.3V$)

| Symbol | Characteristic | -40°C | | | 0°C | | | 25°C | | | 85°C | | | Unit |
|-------------------------------|---|-------|-----|-----------|------|-----|-----------|------|-----|-----------|------|-----|-----------|---------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| V_{OH} | Output HIGH Voltage ^{1,2} | 2170 | | 2460 | 2210 | | 2460 | 2210 | | 2460 | 2210 | | 2460 | mV |
| V_{OL} | Output LOW Voltage ^{1,2,3} $V_{CTRL} = V_{REF}$ BOOST = V_{EE} | 1350 | | 1600 | 1350 | | 1600 | 1350 | | 1600 | 1350 | | 1600 | mV |
| V_{OL} | Output LOW Voltage ^{1,2,3} $V_{CTRL} = V_{CC}$ BOOST = V_{EE} | 2100 | | 2360 | 2110 | | 2360 | 2110 | | 2360 | 2110 | | 2360 | mV |
| V_{OL} | Output LOW Voltage ^{1,3,4} $V_{CTRL} = NC$ BOOST = NC | 1410 | | 1660 | 1410 | | 1660 | 1410 | | 1660 | 1410 | | 1660 | mV |
| V_{REF} V_{BB}/V_{REF} | Reference Voltage ³ BOOST = V_{EE} | 1650 | | 1850 | 1650 | | 1850 | 1650 | | 1850 | 1650 | | 1850 | mV |
| V_{BB}/V_{REF} | Reference Voltage ⁴ BOOST = NC | 1860 | | 1980 | 1920 | | 2040 | 1920 | | 2040 | 1920 | | 2040 | mV |
| I_{IH} | Input HIGH Current D,D V_{CTRL} | | | 80 400 | | | 80 400 | | | 80 400 | | | 80 400 | μA |
| I_{IL} | Input LOW Current | 0.5 | | | 0.5 | | | 0.5 | | | 0.5 | | | μA |
| I_{EE} | Power Supply Current | 20 | 26 | 35 | 21 | 27 | 36 | 22 | 28 | 38 | 25 | 31 | 41 | mA |

- For supply voltages other than 3.3V, use the ECL table values and ADD supply voltage value.
- Each output is terminated through a 50 Ω resistor to $V_{CC} - 2V$.
- BOOST is internally bonded to V_{EE} for both the SOIC 8 and TSSOP 8 packages.
- Supported in MLP 16 package only.

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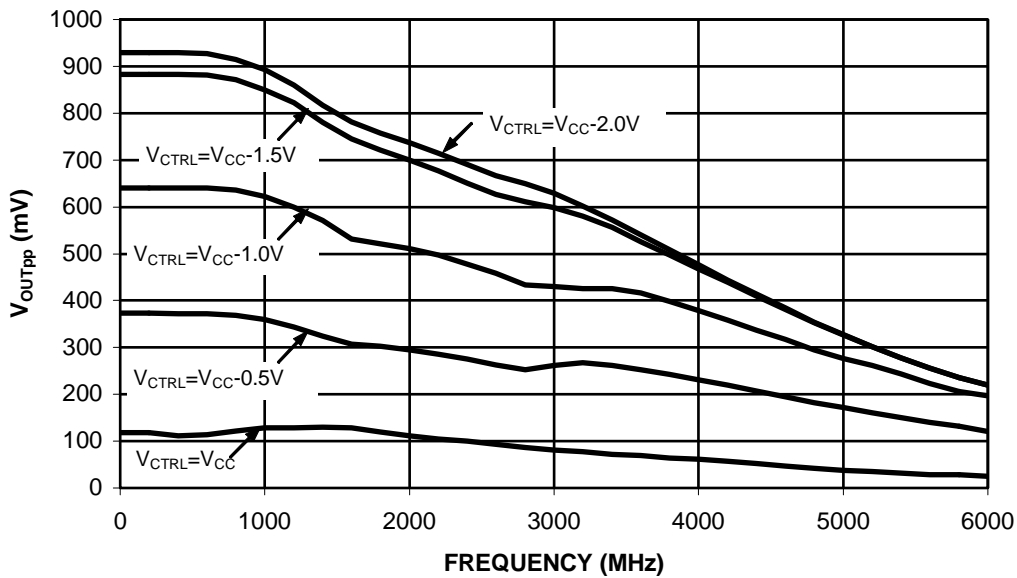
AZ100EP16VS

AC Characteristics ($V_{EE} = -3.0$ to $-3.6V$, $V_{CC} = GND$, $V_{CTRL} = V_{REF}$ or $V_{EE} = GND$, $V_{CC} = +3.0V$ to $3.6V$, $V_{CTRL} = V_{REF}$)

| Symbol | Characteristic | -40°C | | | 0°C | | | 25°C | | | 85°C | | | Unit |
|---------------------|---------------------------------------|----------------|------------|----------|----------------|------------|----------|----------------|------------|----------|----------------|------------|----------|------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| f_{max} | Maximum Toggle Frequency ⁵ | | >4 | | | >4 | | | >4 | | | >4 | | GHz |
| t_{PLH} / t_{PHL} | Input to Output (Diff) Delay (SE) | 100 | 150 155 | 240 | 100 | 150 155 | 240 | 100 | 150 155 | 240 | 120 | 170 175 | 280 | ps |
| t_{SKEW} | Duty Cycle Skew ¹ (Diff) | | 4 | 20 | | 4 | 15 | | 4 | 15 | | 4 | 15 | ps |
| V_{DP} | Minimum Input Swing ² | 150 | | | 150 | | | 150 | | | 150 | | | mV |
| V_{CMR} | Common Mode Range ³ | $V_{EE} + 2.0$ | | V_{CC} | $V_{EE} + 2.0$ | | V_{CC} | $V_{EE} + 2.0$ | | V_{CC} | $V_{EE} + 2.0$ | | V_{CC} | V |
| A_v | Small Signal Gain ⁴ | | | | | | | 28 | | | | | | dB |
| t_r / t_f | Output Rise/Fall Times Q (20% - 80%) | | 120 | 170 | | 120 | 180 | | 120 | 180 | | 120 | 200 | ps |

- Duty cycle skew is the difference between a t_{PLH} and t_{PHL} propagation delay through a device.
- V_{PP} is the minimum peak-to-peak differential input swing for which AC parameters are guaranteed.
- The V_{CMR} range is referenced to the most positive side of the differential input signal. Normal operation is obtained if the HIGH level falls within the specified range and the peak-to-peak voltage lies between $V_{PP}(\min)$ and $1V$.
- Differential input, differential output. 240Ω to V_{EE} on Q/Q outputs, $V_{CTRL} = NC$ and $BOOST = V_{EE}$ (for MLP 16 package).
- See graph below.

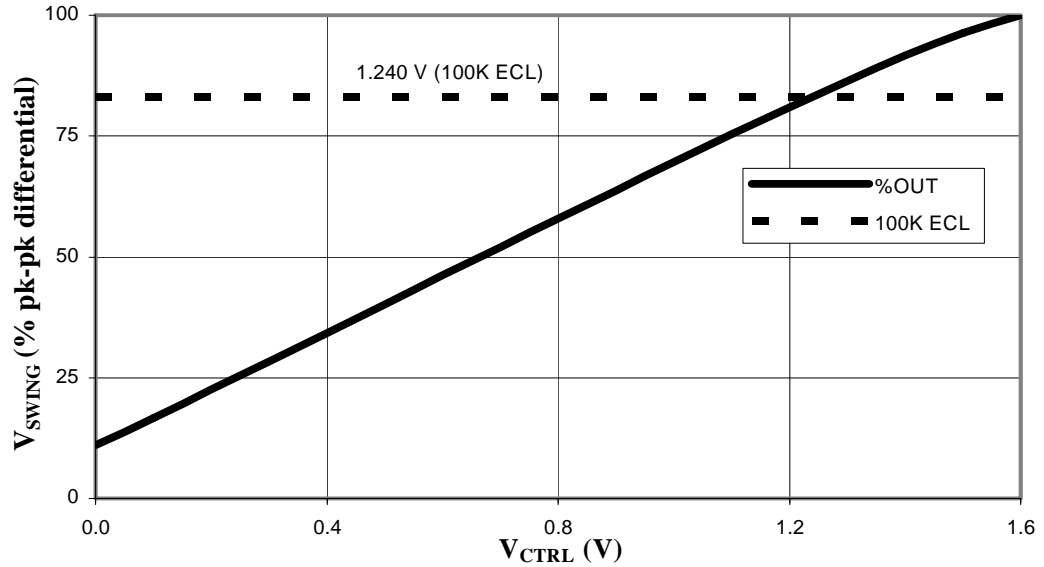
Typical Large Signal Performance, AZ100EP16VS*



*Measured using a 750mV differential input source at 50% duty cycle. Valid for SOIC 8, TSSOP 8, or MLP 16 with $BOOST = V_{EE}$.

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Typical AZ100EP16VS Voltage Output Swing at +25C, Nominal Supply
 (see Figure 1 and Figure 2)



(BOOST tied to V_{EE} for MLP 16, or SOIC 8/TSSOP 8 Package)

Figure 1: Voltage Source Implementation

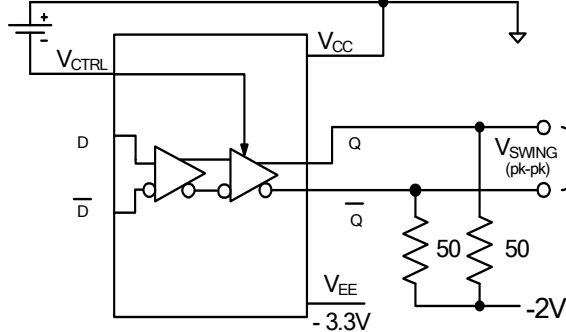
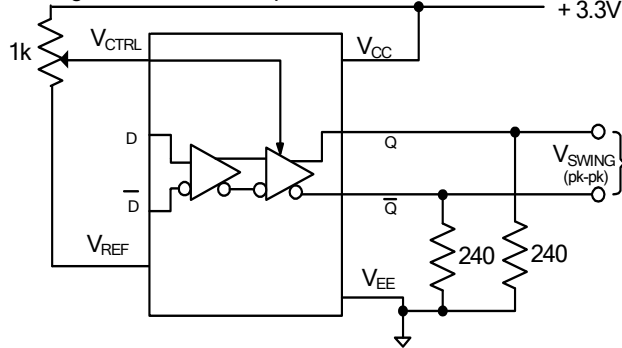
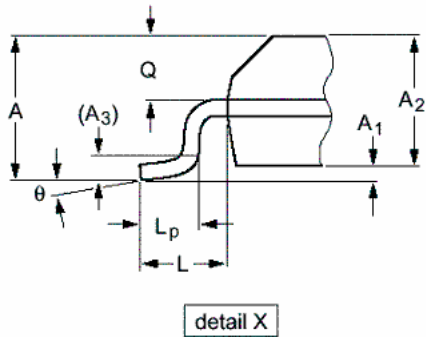
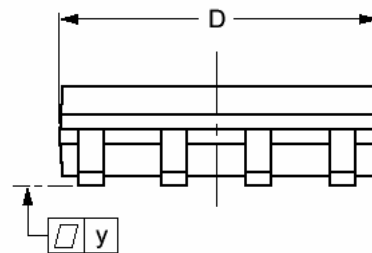
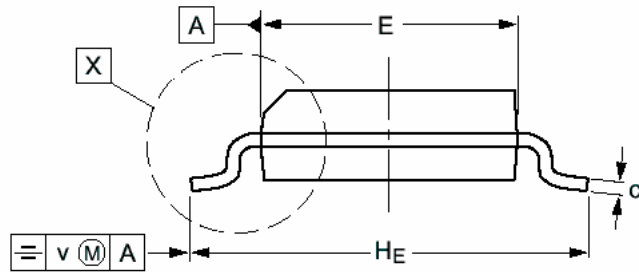
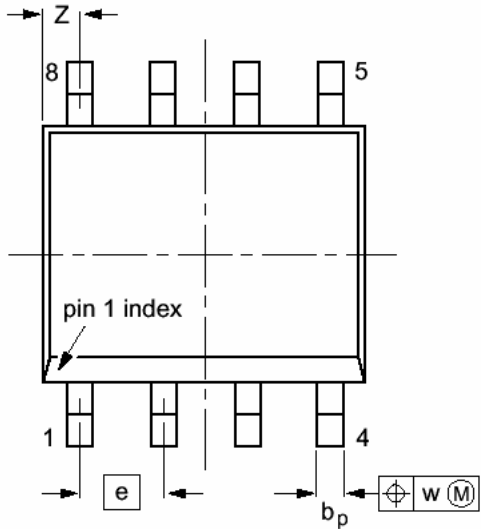


Figure 2: Alternative Implementation



**PACKAGE DIAGRAM
SOIC 8**

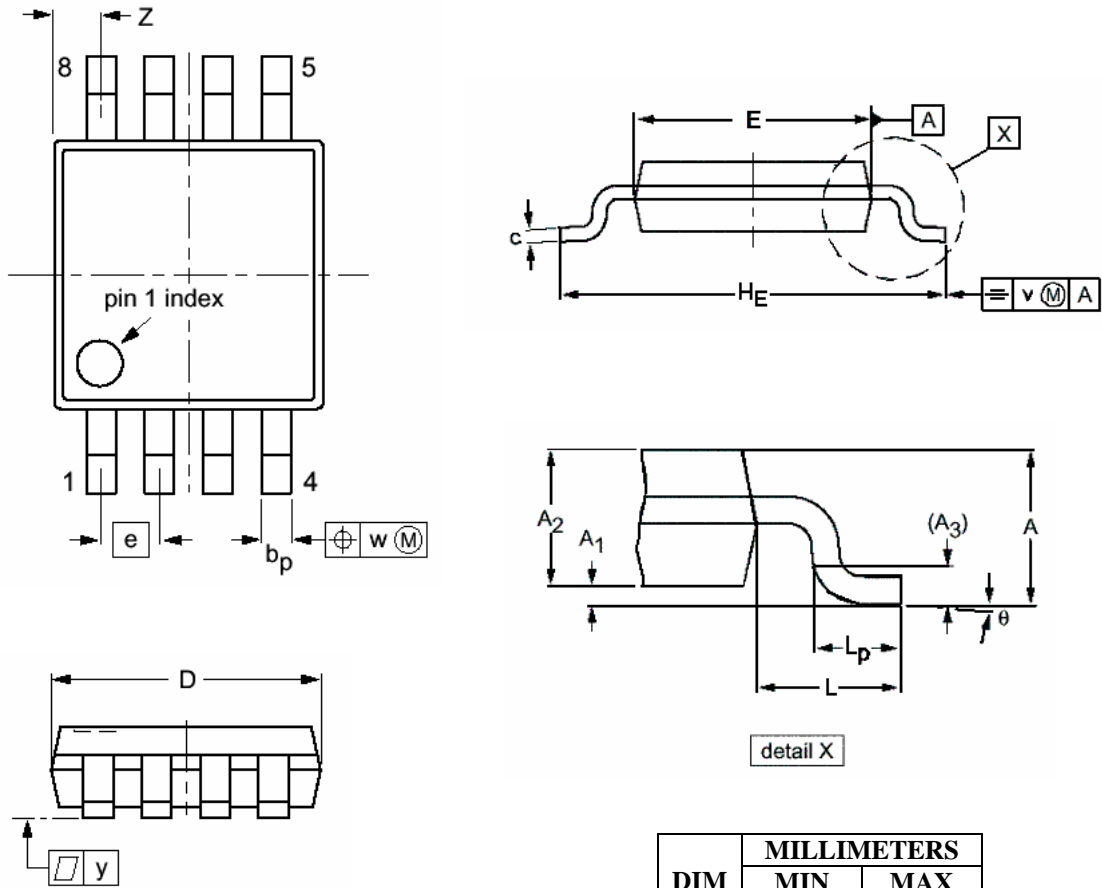


| DIM | MILLIMETERS | | INCHES | |
|----------------|-------------|------|--------|--------|
| | MIN | MAX | MIN | MAX |
| A | | 1.75 | | 0.069 |
| A ₁ | 0.10 | 0.25 | 0.004 | 0.010 |
| A ₂ | 1.25 | 1.45 | 0.049 | 0.057 |
| A ₃ | 0.25 | | 0.01 | |
| b _p | 0.36 | 0.49 | 0.014 | 0.019 |
| c | 0.19 | 0.25 | 0.0075 | 0.0100 |
| D | 4.8 | 5.0 | 0.19 | 0.20 |
| E | 3.8 | 4.0 | 0.15 | 0.16 |
| e | 1.27 | | 0.050 | |
| H _E | 5.80 | 6.20 | 0.228 | 0.244 |
| L | 1.05 | | 0.041 | |
| L _p | 0.40 | 1.00 | 0.016 | 0.039 |
| Q | 0.60 | 0.70 | 0.024 | 0.028 |
| v | 0.25 | | 0.01 | |
| w | 0.25 | | 0.01 | |
| y | 0.10 | | 0.004 | |
| Z | 0.30 | 0.70 | 0.012 | 0.028 |
| θ | 0° | 8° | 0° | 8° |

NOTES:

1. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
2. MAXIMUM MOLD PROTRUSION FOR D IS 0.15mm.
3. MAXIMUM MOLD PROTRUSION FOR E IS 0.25mm.

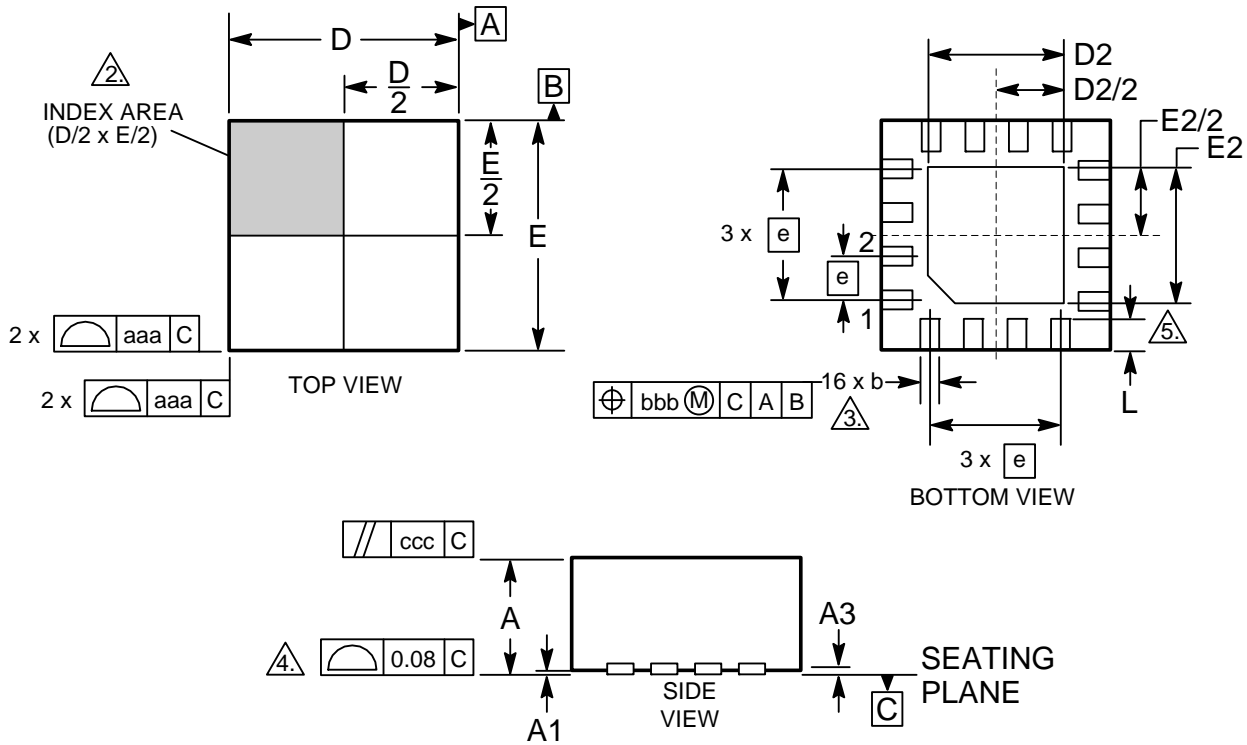
PACKAGE DIAGRAM
TSSOP 8



- NOTES:
1. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
 2. MAXIMUM MOLD PROTRUSION FOR D IS 0.15mm.
 3. MAXIMUM MOLD PROTRUSION FOR E IS 0.25mm.

| DIM | MILLIMETERS | |
|----------------|-------------|------|
| | MIN | MAX |
| A | | 1.10 |
| A ₁ | 0.05 | 0.15 |
| A ₂ | 0.80 | 0.95 |
| A ₃ | 0.25 | |
| b _p | 0.25 | 0.45 |
| c | 0.15 | 0.28 |
| D | 2.90 | 3.10 |
| E | 2.90 | 3.10 |
| e | 0.65 | |
| H _E | 4.70 | 5.10 |
| L | 0.94 | |
| L _p | 0.40 | 0.70 |
| v | 0.10 | |
| w | 0.10 | |
| y | 0.10 | |
| Z | 0.35 | 0.70 |
| θ | 0° | 6° |

PACKAGE DIAGRAM
MLP 16 3x3mm



NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME T14-1994.
- $\triangle 2$ THE TERMINAL #1 AND PAD NUMBERING CONVENTION SHALL CONFORM TO JESD 95-1 SPP-012.
- $\triangle 3$ DIMENSION b APPLIES TO METALLIZED PAD AND IS MEASURED BETWEEN 0.25 AND 0.30 mm FROM PAD TIP.
- $\triangle 4$ COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
- $\triangle 5$ INSIDE CORNERS OF METALLIZED PAD MAY BE SQUARE OR ROUNDED

| DIM | MILLIMETERS | |
|-----|-------------|------|
| | MIN | MAX |
| A | 0.80 | 1.00 |
| A1 | 0.00 | 0.05 |
| A3 | 0.25 REF | |
| b | 0.18 | 0.30 |
| D | 2.90 | 3.10 |
| D2 | 0.25 | 1.95 |
| E | 2.90 | 3.10 |
| E2 | 0.25 | 1.95 |
| e | 0.50 BSC | |
| L | 0.30 | 0.50 |
| aaa | 0.25 | |
| bbb | 0.10 | |
| ccc | 0.10 | |

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