

# 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
MSOP 8 Green / RoHS Compliant / Lead(Pb) Free	AZ10EP16VSTG	AZTP EP16VS	1,2,3
MSOP 8 Green / RoHS Compliant / Lead(Pb) Free	AZ100EP16VSTG	AZHPG EP16VS	1,2,3
MLP 16 (3x3) Green / RoHS Compliant / Lead(Pb) Free	AZ10/100EP16VSLG	AZMG 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 MSOP 8 package, 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 $\mu$ 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.

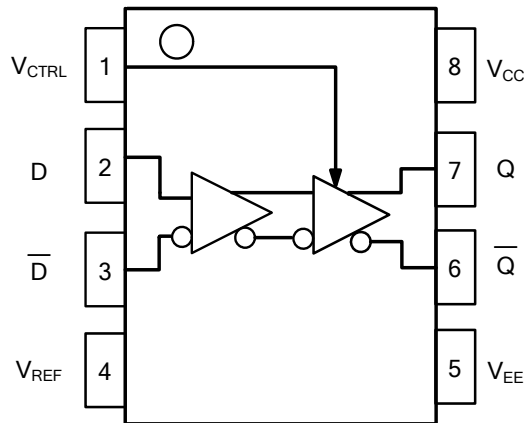
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**PIN DESCRIPTION**

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

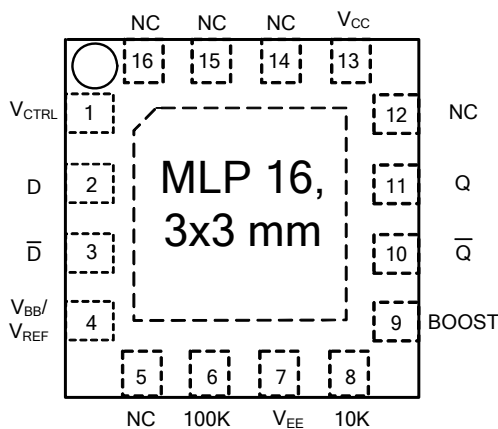
\*BOOST should be tied to  $V_{EE}$  for best performance when using the variable swing feature.

**LOGIC DIAGRAM AND PINOUT ASSIGNMENT**



MSOP 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  $1\Omega$ .

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

Symbol	Characteristic	Rating	Unit
V <sub>CC</sub>	PECL Power Supply (V <sub>EE</sub> = 0V)	0 to +4.5	Vdc
V <sub>I</sub>	PECL Input Voltage (V <sub>EE</sub> = 0V)	0 to +4.5	Vdc
V <sub>EE</sub>	ECL Power Supply (V <sub>CC</sub> = 0V)	-4.5 to 0	Vdc
V <sub>I</sub>	ECL Input Voltage (V <sub>CC</sub> = 0V)	-4.5 to 0	Vdc
I <sub>OUT</sub>	Output Current --- Continuous --- Surge	50 100	mA
T <sub>A</sub>	Operating Temperature Range	-40 to +85	°C
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C

**10K ECL DC Characteristics (V<sub>EE</sub> = -3.0V to -3.6V, V<sub>CC</sub> = 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 <sub>OH</sub>	Output HIGH Voltage <sup>1</sup>	-1095		-845	-1055		-805	-1030		-780	-970		-720	mV
V <sub>OL</sub>	Output LOW Voltage <sup>1,2</sup> V <sub>CTRL</sub> = V <sub>REF</sub> BOOST = V <sub>EE</sub>	-2000		-1700	-2000		-1690	-2000		-1690	-2000		-1655	mV
V <sub>OL</sub>	Output LOW Voltage <sup>1,2</sup> V <sub>CTRL</sub> = V <sub>CC</sub> BOOST = V <sub>EE</sub>	-1285		-1035	-1270		-1020	-1265		-1015	-1255		-1005	mV
V <sub>OL</sub>	Output LOW Voltage <sup>1,3</sup> V <sub>CTRL</sub> = NC BOOST = NC	-1950		-1650	-1950		-1630	-1950		-1630	-1950		-1595	mV
V <sub>REF</sub> V <sub>BB</sub> /V <sub>REF</sub>	Reference Voltage <sup>2</sup> BOOST = V <sub>EE</sub>	-1700		-1500	-1670		-1470	-1650		-1450	-1600		-1400	mV
V <sub>BB</sub> /V <sub>REF</sub>	Reference Voltage <sup>3</sup> BOOST = NC	-1430		-1300	-1380		-1270	-1350		-1250	-1310		-1190	mV
I <sub>IH</sub>	Input HIGH Current D,D V <sub>CTRL</sub>			80 400			80 400			80 400			80 400	μA
I <sub>IL</sub>	Input LOW Current	0.5			0.5			0.5			0.5			μA
I <sub>EE</sub>	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<sub>CC</sub> - 2V.
- BOOST is internally bonded to V<sub>EE</sub> for the MSOP 8 packages.
- Supported in MLP 16 package only.

**10K LVPECL DC Characteristics (V<sub>EE</sub> = GND, V<sub>CC</sub> = +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 <sub>OH</sub>	Output HIGH Voltage <sup>1,2</sup>	2205		2455	2245		2495	2270		2520	2330		2580	mV
V <sub>OL</sub>	Output LOW Voltage <sup>1,2,3</sup> V <sub>CTRL</sub> = V <sub>REF</sub> BOOST = V <sub>EE</sub>	1300		1600	1300		1610	1300		1610	1300		1645	mV
V <sub>OL</sub>	Output LOW Voltage <sup>1,2,3</sup> V <sub>CTRL</sub> = V <sub>CC</sub> BOOST = V <sub>EE</sub>	2015		2265	2030		2280	2035		2285	2045		2295	mV
V <sub>OL</sub>	Output LOW Voltage <sup>1,3,4</sup> V <sub>CTRL</sub> = NC BOOST = NC	1350		1650	1350		1670	1350		1670	1350		1670	mV
V <sub>REF</sub> V <sub>BB</sub> /V <sub>REF</sub>	Reference Voltage <sup>3</sup> BOOST = V <sub>EE</sub>	1600		1800	1630		1830	1650		1850	1700		1900	mV
V <sub>BB</sub> /V <sub>REF</sub>	Reference Voltage <sup>4</sup> BOOST = NC	1870		2000	1920		2030	1950		2050	1990		2110	mV
I <sub>IH</sub>	Input HIGH Current D,D V <sub>CTRL</sub>			80 400			80 400			80 400			80 400	μA
I <sub>IL</sub>	Input LOW Current	0.5			0.5			0.5			0.5			μA
I <sub>EE</sub>	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<sub>CC</sub> - 2V.
- BOOST is internally bonded to V<sub>EE</sub> for the MSOP 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 <sup>1</sup>	-1130		-840	-1090		-840	-1090		-840	-1090		-840	mV
$V_{OL}$	Output LOW Voltage <sup>1,2</sup> $V_{CTRL} = V_{REF}$ BOOST = $V_{EE}$	-1950		-1700	-1950		-1700	-1950		-1700	-1950		-1700	mV
$V_{OL}$	Output LOW Voltage <sup>1,2</sup> $V_{CTRL} = V_{CC}$ BOOST = $V_{EE}$	-1200		-940	-1190		-940	-1190		-940	-1190		-940	mV
$V_{OL}$	Output LOW Voltage <sup>1,3</sup> $V_{CTRL} = NC$ BOOST = NC	-1900		-1640	-1890		-1640	-1890		-1640	-1890		-1640	mV
$V_{REF}$ $V_{BB}/V_{REF}$	Reference Voltage <sup>2</sup> BOOST = $V_{EE}$	-1650		-1450	-1650		-1450	-1650	-1550	-1450	-1650		-1450	mV
$V_{BB}/V_{REF}$	Reference Voltage <sup>3</sup> 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	$\mu A$
$I_{IL}$	Input LOW Current	0.5			0.5			0.5			0.5			$\mu A$
$I_{EE}$	Power Supply Current	20	26	35	21	27	36	22	28	38	25	31	41	mA

- Each output is terminated through a 50 $\Omega$  resistor to  $V_{CC} - 2V$ .
- BOOST is internally bonded to  $V_{EE}$  for the MSOP 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 <sup>1,2</sup>	2170		2460	2210		2460	2210		2460	2210		2460	mV
$V_{OL}$	Output LOW Voltage <sup>1,2,3</sup> $V_{CTRL} = V_{REF}$ BOOST = $V_{EE}$	1350		1600	1350		1600	1350		1600	1350		1600	mV
$V_{OL}$	Output LOW Voltage <sup>1,2,3</sup> $V_{CTRL} = V_{CC}$ BOOST = $V_{EE}$	2100		2360	2110		2360	2110		2360	2110		2360	mV
$V_{OL}$	Output LOW Voltage <sup>1,3,4</sup> $V_{CTRL} = NC$ BOOST = NC	1410		1660	1410		1660	1410		1660	1410		1660	mV
$V_{REF}$ $V_{BB}/V_{REF}$	Reference Voltage <sup>3</sup> BOOST = $V_{EE}$	1650		1850	1650		1850	1650		1850	1650		1850	mV
$V_{BB}/V_{REF}$	Reference Voltage <sup>4</sup> 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	$\mu A$
$I_{IL}$	Input LOW Current	0.5			0.5			0.5			0.5			$\mu A$
$I_{EE}$	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 $\Omega$  resistor to  $V_{CC} - 2V$ .
- BOOST is internally bonded to  $V_{EE}$  for the MSOP 8 packages.
- Supported in MLP 16 package only.

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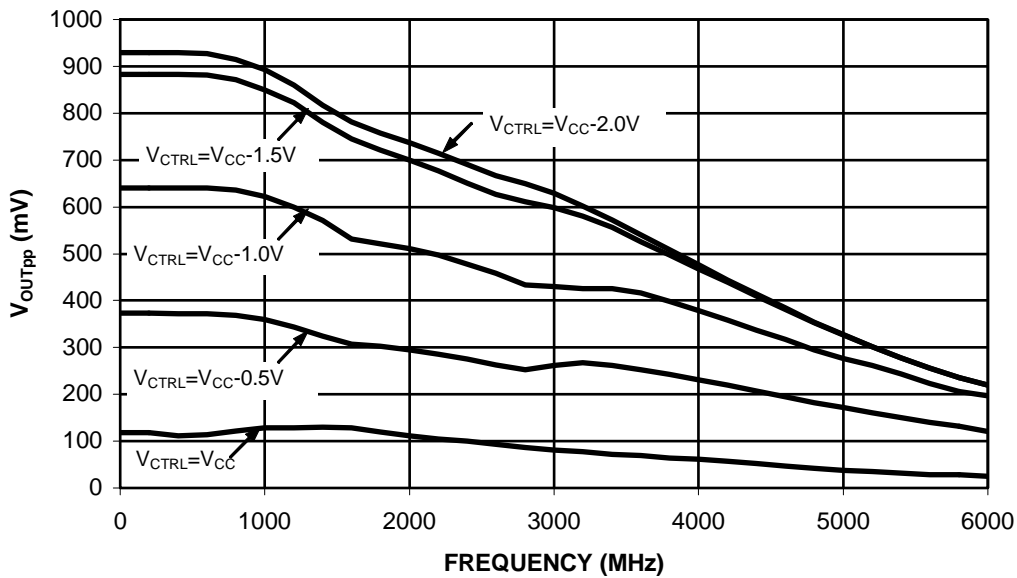
## AZ100EP16VS

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 <sup>5</sup>		>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 <sup>1</sup> (Diff)		4	20		4	15		4	15		4	15	ps
$V_{DP}$	Minimum Input Swing <sup>2</sup>	150			150			150			150			mV
$V_{CMR}$	Common Mode Range <sup>3</sup>	$V_{EE} + 2.0$		$V_{CC}$	$V_{EE} + 2.0$		$V_{CC}$	$V_{EE} + 2.0$		$V_{CC}$	$V_{EE} + 2.0$		$V_{CC}$	V
$A_v$	Small Signal Gain <sup>4</sup>							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.  $240\Omega$  to  $V_{EE}$  on Q/Q outputs,  $V_{CTRL} = NC$  and  $BOOST = V_{EE}$  (for MLP 16 package).
- See graph below.

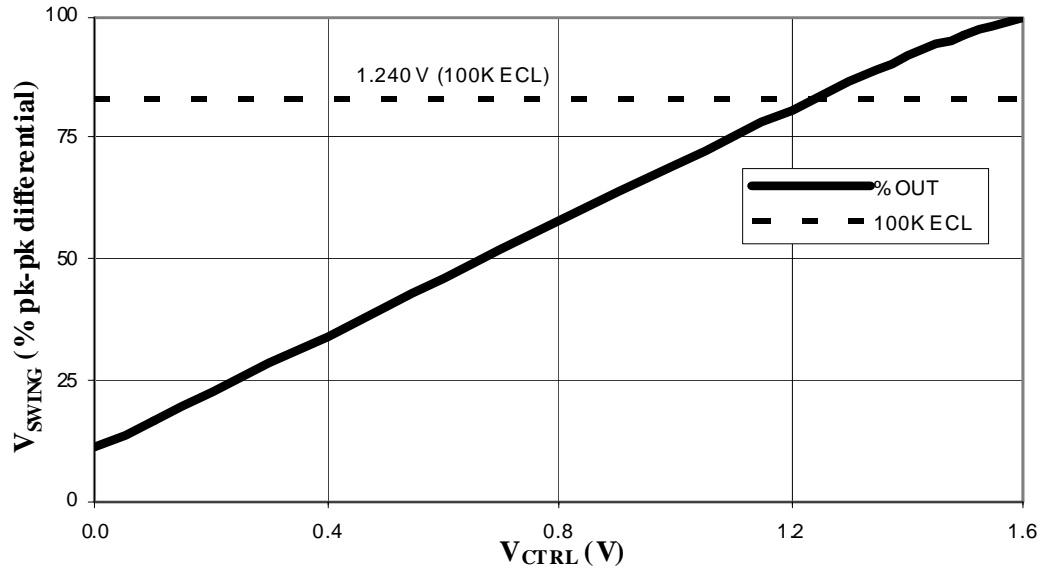
### Typical Large Signal Performance, AZ100EP16VS\*



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

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AZ100EP16VS**

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



**(BOOST tied to V<sub>EE</sub> for MLP 16, or MSSOP 8 Package)**

Figure 1: Voltage Source Implementation

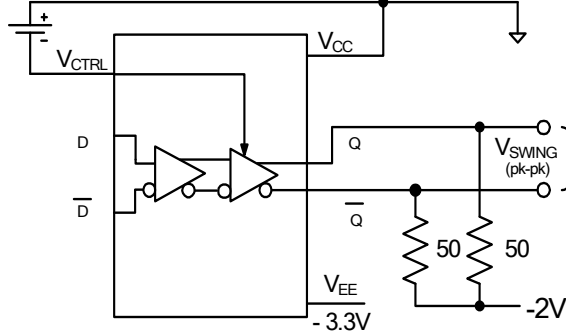
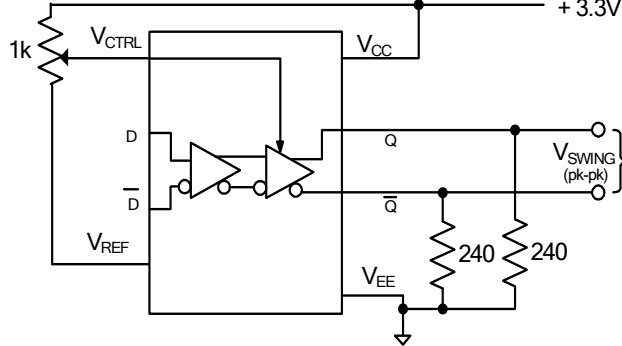
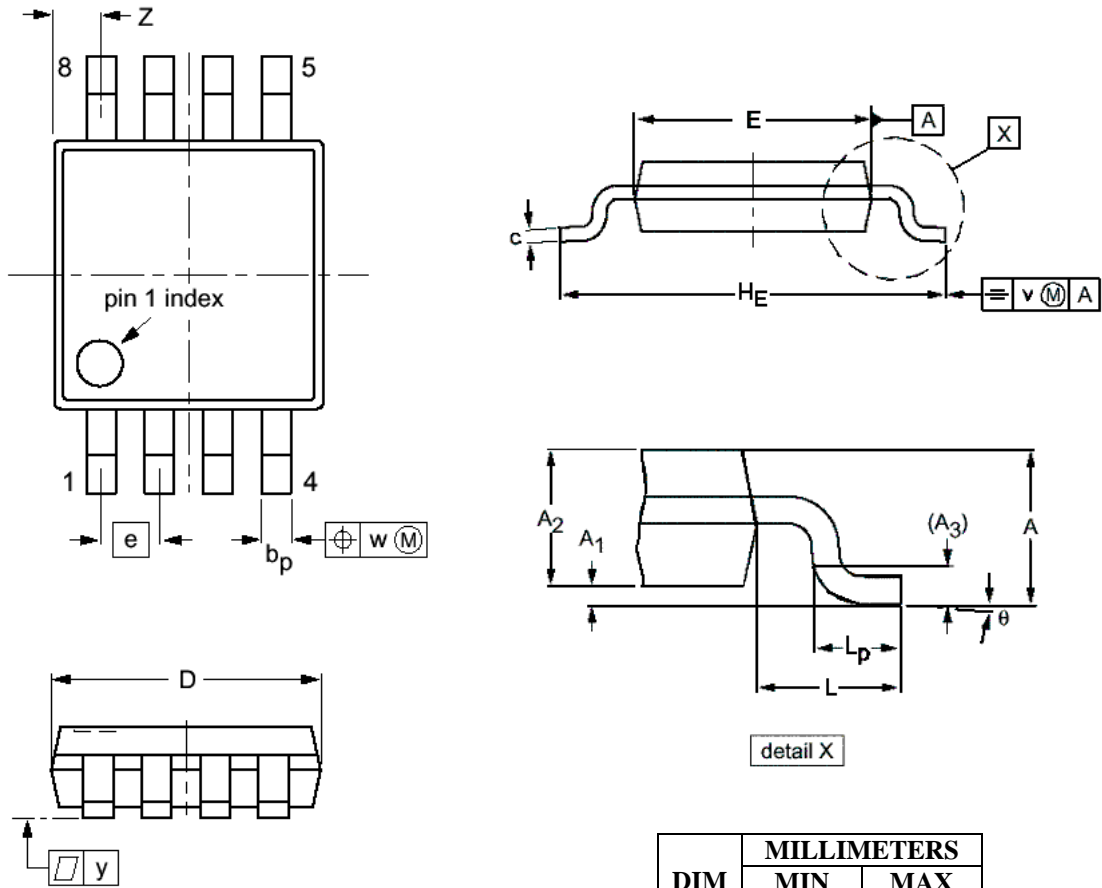


Figure 2: Alternative Implementation



**AZ10EP16VS**  
**AZ100EP16VS**

**PACKAGE DIAGRAM**  
**MSOP 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 <sub>1</sub>	0.05	0.15
A <sub>2</sub>	0.80	0.95
A <sub>3</sub>	0.25	
b <sub>p</sub>	0.25	0.45
c	0.15	0.28
D	2.90	3.10
E	2.90	3.10
e	0.65	
H <sub>E</sub>	4.70	5.10
L	0.94	
L <sub>p</sub>	0.40	0.70
v	0.10	
w	0.10	
y	0.10	
Z	0.35	0.70
θ	0°	6°



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