

# AZ100EP16FE

## ECL/PECL High Speed VCSEL Driver with Variable Output Swing or Limiting Amplifier

### FEATURES

- Silicon-Germanium for High Speed Operation
- <100ps Typical Rise/Fall Times
- Optimized for 0.622 to 2.5Gbps Fiber Applications
- Available in a 3x3mm MLP Package

### PACKAGE AVAILABILITY

PACKAGE	PART NO.	MARKING
MLP 8	AZ100EP16FEL	AZM16D
MLP 8 T&R	AZ100EP16FELR1	AZM16D
MLP 8 T&R	AZ100EP16FELR2	AZM16D
TSSOP 8	AZ100EP16FET	AZHP16FE
TSSOP 8 T&R	AZ100EP16FETR1	AZHP16FE
TSSOP 8 T&R	AZ100EP16FETR2	AZHP16FE

### DESCRIPTION

The AZ100EP16FE is a Silicon-Germanium (SiGe) differential VCSEL driver with variable output swing or limiting post amplifier. The 100EP16FE is optimized for OC-12, OC-24, OC-48, Ethernet, Sonnet, Fiber Channel or related applications at data rates up to 2.5Gbps. An input controls the amplitude of the Q/Q outputs, which allows compensation for differing VCSEL characteristics.

The operational range of the 100EP16FE control input,  $V_{CTRL}$ , is from  $V_{REF}$  (full swing) to  $V_{CC}$  (small swing). For post amplifier applications, maximum swing is achieved by leaving the  $V_{CTRL}$  pin open or by tying it to the negative supply pin ( $V_{EE}$ ). 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  $V_{CTRL}$ . A typical application circuit is described in this Data Sheet.

The 100EP16FE also provides a  $V_{REF}$  output which functions as a DC bias for input AC coupling to the device. The  $V_{REF}$  pin should be used only as a bias for the 100EP16FE as its current sink/source capability is limited. When used, the  $V_{REF}$  pin should be bypassed to ground via a 0.01 $\mu$ F capacitor.

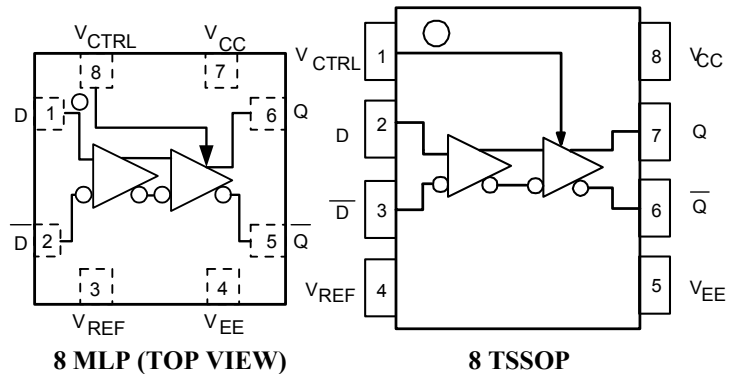
The maximum DC output current should be kept below 16mA. Connecting each output (Q/Q) to  $V_{EE}$  with a 180 $\Omega$  resistor is typically used. The load is then AC coupled from the output. DC and AC symmetrical loading of the Q/Q outputs will provide the best output wave shape.

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.

### PIN DESCRIPTION

PIN	FUNCTION
D, $\bar{D}$	Data Inputs
$V_{CTRL}$	Output Swing Control
Q, $\bar{Q}$	Data Outputs
$V_{REF}$	Reference Voltage Output
$V_{CC}$	Positive Supply
$V_{EE}$	Negative Supply



# AZ100EP16FE

**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	22 44	mA
T <sub>A</sub>	Operating Temperature Range	-40 to +85	°C
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C

## 100K 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		-890	-1035		-870	-1000	-920	-840	-940		-760	mV
V <sub>OL</sub>	Output LOW Voltage <sup>1</sup> V <sub>CTRL</sub> = V <sub>REF</sub>	-1935		-1745	-1905		-1715	-1885	-1790	-1695	-1830		-1640	mV
V <sub>OL</sub>	Output LOW Voltage <sup>1</sup> V <sub>CTRL</sub> = V <sub>CC</sub>	-1140		-950	-1120		-930	-1100	-1005	-910	-1055		-865	mV
V <sub>REF</sub>	Reference Voltage	-1700		-1500	-1700		-1500	-1700		-1500	-1700		-1500	mV
I <sub>IH</sub>	Input HIGH Current D, $\bar{D}$ 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	20	26	35	21	27	36	21	28	36	22	31	38	mA

1. Each output is terminated through a 180Ω resistor to V<sub>EE</sub>.

## 100K 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		2410	2265		2430	2300	2380	2460	2360		2540	mV
V <sub>OL</sub>	Output LOW Voltage <sup>2</sup> V <sub>CTRL</sub> = V <sub>REF</sub>	1365		1555	1395		1585	1415	1510	1605	1470		1660	mV
V <sub>OL</sub>	Output LOW Voltage <sup>2</sup> V <sub>CTRL</sub> = V <sub>CC</sub>	2160		2350	2180		2370	2200	2295	2390	2245		2435	mV
V <sub>REF</sub>	Reference Voltage	1600		1800	1600		1800	1600		1800	1600		1800	mV
I <sub>IH</sub>	Input HIGH Current D, $\bar{D}$ 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	20	26	35	21	27	36	21	28	36	22	31	38	mA

1. For supply voltages other than 3.3V, use the ECL table values and ADD supply voltage value.

2. Each output is terminated through a 180Ω resistor to V<sub>EE</sub>.

## AC Characteristics (V<sub>EE</sub> = -3.0 to -3.6V, V<sub>CC</sub> = GND, V<sub>CTRL</sub> = V<sub>REF</sub> or V<sub>EE</sub> = GND, V<sub>CC</sub> = +3.0V to +3.6V, V<sub>CTRL</sub> = V<sub>REF</sub>)

Symbol	Characteristic	-40°C			0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
f <sub>max</sub>	Maximum Toggle Frequency <sup>5</sup>		>6			>6			>6			>6		GHz
t <sub>PLH</sub> / t <sub>PHL</sub>	Input to Output (Diff) Delay (SE)	100	150 155	240	100	150 155	240	100	150 155	240	120	170 175	280	ps
t <sub>SKEW</sub>	Duty Cycle Skew <sup>1</sup> (Diff)		4	20		4	15		4	15		4	15	ps
V <sub>pp</sub>	Minimum Input Swing <sup>2</sup>	150			150			150			150			mV
V <sub>CMR</sub>	Common Mode Range <sup>3</sup>	V <sub>EE</sub> + 2.0		V <sub>CC</sub>	V <sub>EE</sub> + 2.0		V <sub>CC</sub>	V <sub>EE</sub> + 2.0		V <sub>CC</sub>	V <sub>EE</sub> + 2.0		V <sub>CC</sub>	V
A <sub>v</sub>	Small Signal Gain <sup>4</sup>							28						dB
t <sub>r</sub> / t <sub>f</sub>	Output Rise/Fall Times Q (20% - 80%)			130			130			130			130	ps

1. Duty cycle skew is the difference between a t<sub>PLH</sub> and t<sub>PHL</sub> propagation delay through a device.

2. V<sub>pp</sub> is the minimum peak-to-peak differential input swing for which AC parameters are guaranteed.

3. The V<sub>CMR</sub> 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<sub>pp</sub>(min) and 1V. The lower end of the V<sub>CMR</sub> range varies 1:1 with V<sub>EE</sub> and is equal to V<sub>EE</sub> + 2V.

4. Differential input, differential output. 180Ω to V<sub>EE</sub> on Q/Q outputs with 50Ω AC coupled load.

5. See Figure 2.

# AZ100EP16FE

Typical AZ100EP16FE Voltage Output Swing at +25C, V<sub>EE</sub> Nom  
(see Figure 1)

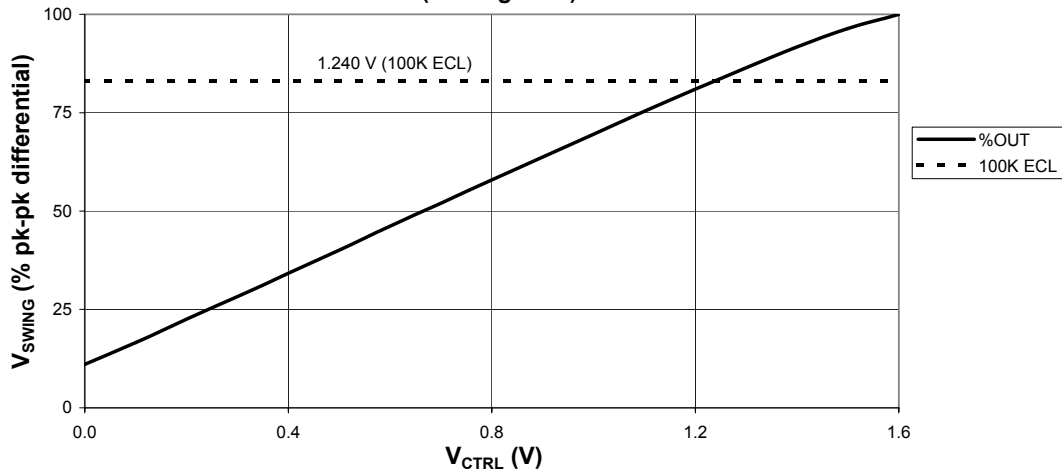


Figure 1: Typical Application

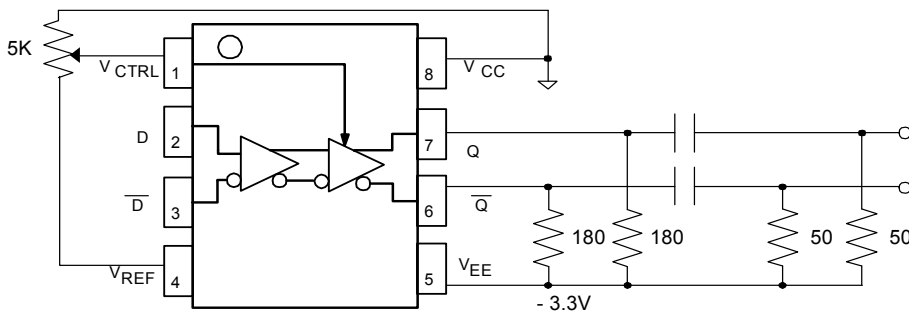
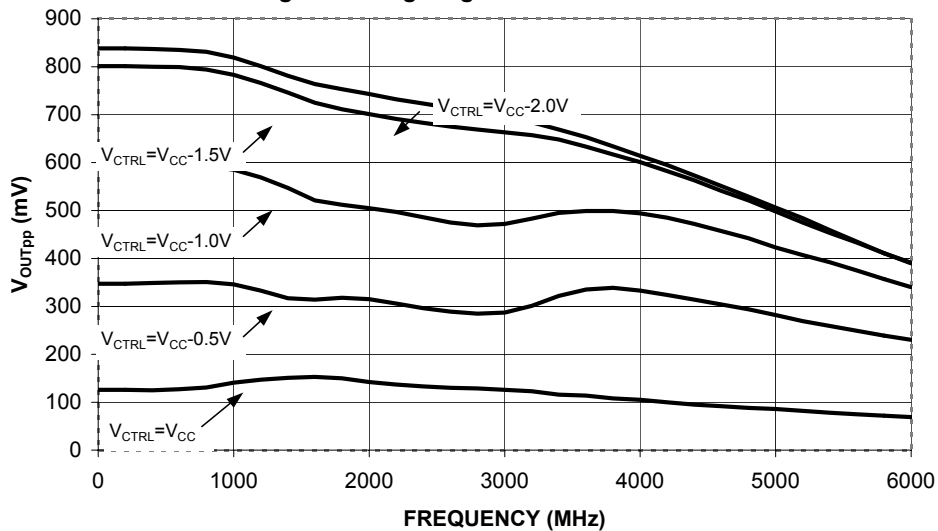
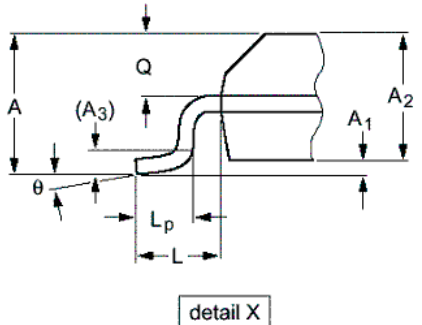
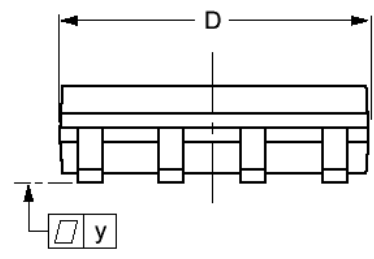
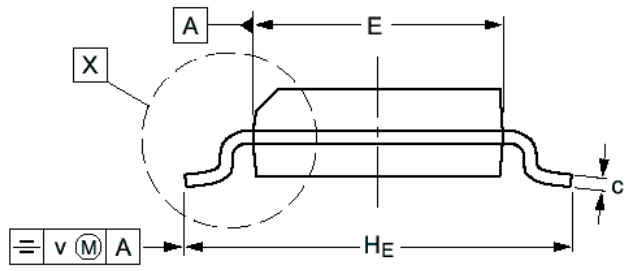
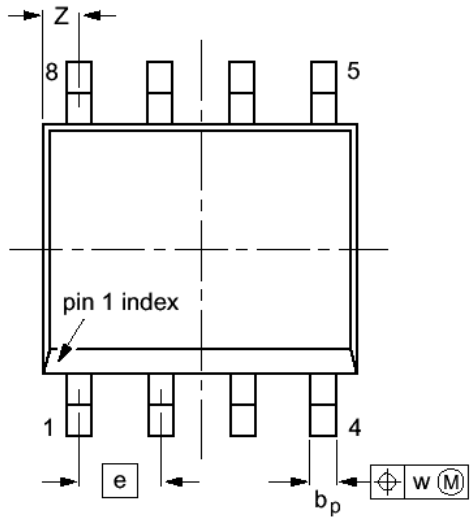


Figure 2: Large Signal Performance\*



\*Measured using a 750mV differential input source at 50% duty cycle.

**PACKAGE DIAGRAM  
SOIC 8**

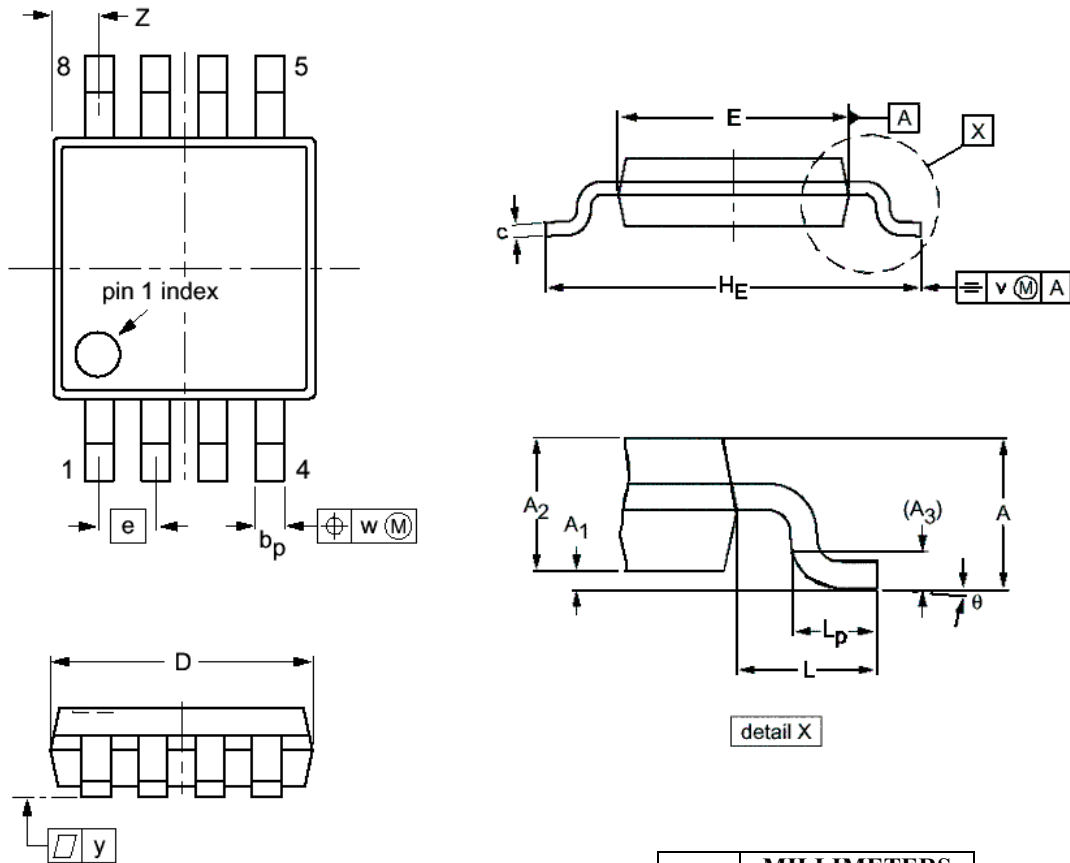


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A <sub>1</sub>	0.10	0.25	0.004	0.010
A <sub>2</sub>	1.28	1.57	0.050	0.062
A <sub>3</sub>	0.25		0.01	
b <sub>p</sub>	0.36	0.49	0.014	0.019
c	0.19	0.25	0.0075	0.0100
D	4.80	5.0	0.19	0.20
E	3.80	4.0	0.15	0.16
e	1.27		0.050	
H <sub>E</sub>	5.80	6.20	0.228	0.244
L	1.05		0.041	
L <sub>p</sub>	0.40	1.27	0.016	0.050
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**

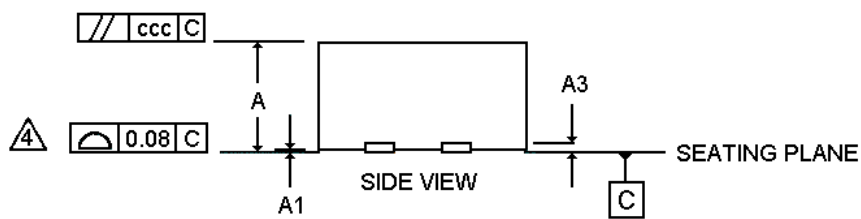
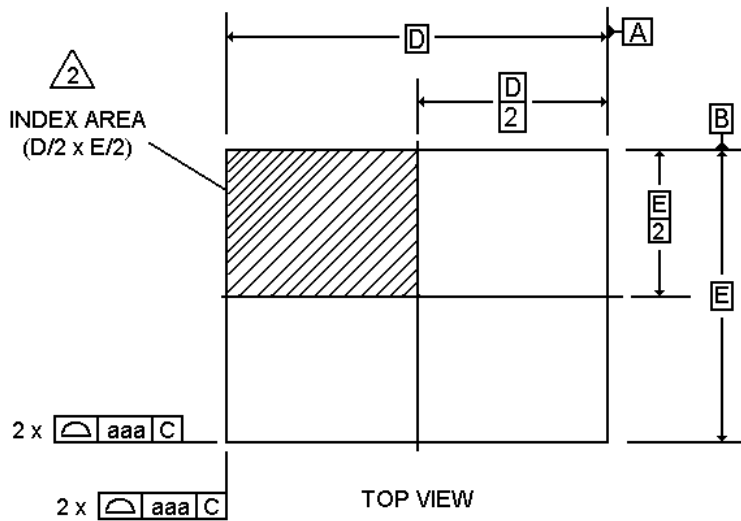


NOTES:

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 <sub>1</sub>	0.05	0.15
A <sub>2</sub>	0.75	0.95
A <sub>3</sub>	0.25	
b <sub>p</sub>	0.22	0.40
c	0.13	0.23
D	2.90	3.10
E	2.90	3.10
e	0.65	
H <sub>E</sub>	4.75	5.05
L	0.95	
L <sub>p</sub>	0.40	0.70
v	0.10	
w	0.08	
y	0.10	
Z	0.38	0.64
$\theta$	0°	6°

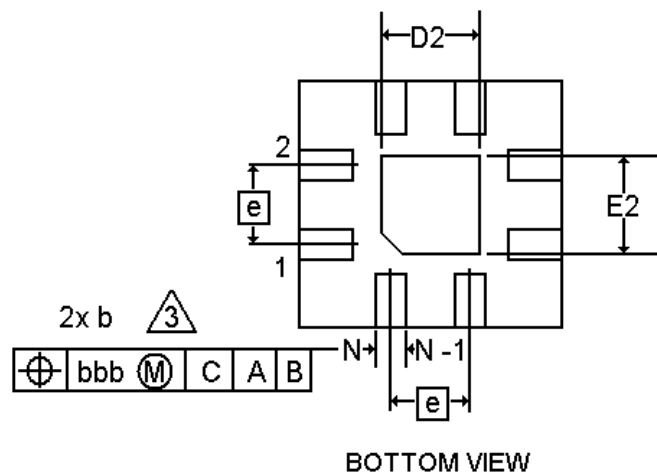
**PACKAGE DIAGRAM  
MLP 8**



NOTES

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME T14-1994.
2. THE TERMINAL #1 AND PAD NUMBERING CONVENTION SHALL CONFORM TO JESD 95-1 SPP-012.
3. DIMENSION *b* APPLIES TO METALLIZED PAD AND IS MEASURED BETWEEN 0.25 AND 0.30mm FROM PAD TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.08	1.00
A1	0.00	0.05
A3	0.25 REF	
<i>b</i>	0.23	0.38
D	2.90	3.10
D2	0.25	1.95
E	2.90	3.10
E2	0.25	1.95
<i>e</i>	0.65 BSC	
L	0.30	0.50
aaa	0.25	
bbb	0.10	
ccc	0.10	



## AZ100EP16FE

Arizona Microtek, Inc. reserves the right to change circuitry and specifications at any time without prior notice. Arizona Microtek, Inc. makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Arizona Microtek, Inc. assume any liability arising out of the application or use of any product or circuit and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Arizona Microtek, Inc. does not convey any license rights nor the rights of others. Arizona Microtek, Inc. products are not designed, intended or authorized for use as components in systems intended to support or sustain life, or for any other application in which the failure of the Arizona Microtek, Inc. product could create a situation where personal injury or death may occur. Should Buyer purchase or use Arizona Microtek, Inc. products for any such unintended or unauthorized application, Buyer shall indemnify and hold Arizona Microtek, Inc. and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Arizona Microtek, Inc. was negligent regarding the design or manufacture of the part.