

# AZ100LVEL16VR

## ECL/PECL Oscillator Gain Stage & Buffer with Selectable Enable

### FEATURES

- Green and RoHS Compliant / Lead (Pb) Free Packages Available
- Enhanced Enable Operation
- High Bandwidth for  $\geq 1\text{GHz}$
- Similar Operation as AZ100EL16VO
- -147 dBc/Hz Typical Noise Floor in Oscillator Applications
- Minimizes External Components
- Selectable Enable Polarity and Threshold (CMOS/TTL or PECL)
- Available in a MLP 16 or MLP 8 Package
- S-Parameter (.s2p) and IBIS Model Files Available on Arizona Microtek Website
- >2 kV HBM ESD Protection
- Additional ESD Data Available on Arizona Microtek Website

### PACKAGE AVAILABILITY

PACKAGE	PART NO.	MARKING	NOTES
MLP 16 (3x3) RoHS Compliant / Lead (Pb) Free	AZ100LVEL16VRL+	AZM+ 16R <Date Code>	1,2
MLP 8 (2x2) Green / RoHS Compliant / Lead (Pb) Free	AZ100LVEL16VRNEG	R5G <Date Code>	1,2
DIE	AZ100LVEL16VRXP	N/A	3

- 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" for year followed by "WW" for week.
- 3 Waffle Pack. Die thickness 14 mils.

### DESCRIPTION

The AZ100LVEL16VR is a specialized oscillator gain stage with high gain output buffer including an enable function. The  $Q_{HG}/Q_{HG}$  outputs have voltage gain several times greater than the  $Q/Q$  outputs.

#### MLP 16, 3x3 mm Package (VRL) or DIE (VRX)

The AZ100LVEL16VR provides a selectable  $Q_{HG}/Q_{HG}$  enable that allows continuous oscillator operation via the  $Q/Q$  outputs. The enable truth table on the next page shows the operating modes. Leaving EN-SEL open (NC) selects PECL/ECL operation for the EN pad/pin. In this mode the  $Q_{HG}/Q_{HG}$  outputs are enabled when EN is left open (NC) or set to a PECL/ECL low.

Connecting EN-SEL to  $V_{CC}$ ,  $V_{EE}$  or  $V_{BB}$  selects CMOS operation for the EN pad/pin. When EN-SEL is tied to  $V_{EE}$ , the  $Q_{HG}/Q_{HG}$  outputs are disabled when EN is left open (NC). When EN-SEL is tied to  $V_{CC}$  or  $V_{BB}$ , the  $Q_{HG}/Q_{HG}$  outputs are enabled when EN is left open.<sup>1</sup> This default logic condition can be overridden by a  $\leq 20\text{k}\Omega$  resistor connected to the opposite supply.

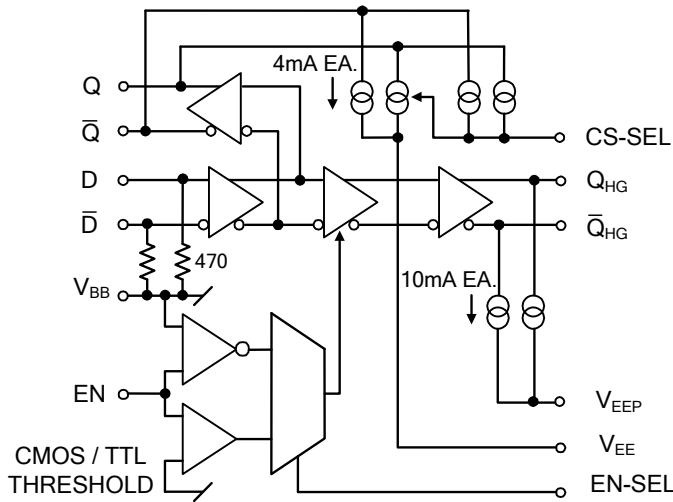
The AZ100LVEL16VR also provides a  $V_{BB}$  and  $470\Omega$  internal bias resistors from D to  $V_{BB}$  and D to  $V_{BB}$ . The  $V_{BB}$  pin supports 1.5mA sink/source current.  $V_{BB}$  should be bypassed to ground or  $V_{CC}$  with a  $0.01\ \mu\text{F}$  capacitor.

Outputs  $Q/Q$  each have a selectable on-chip pull-down current source. See the current source truth table on the next page for the supported values. External resistors may also be used to increase pull-down current to a maximum total of 25mA for the  $Q/Q$  outputs.

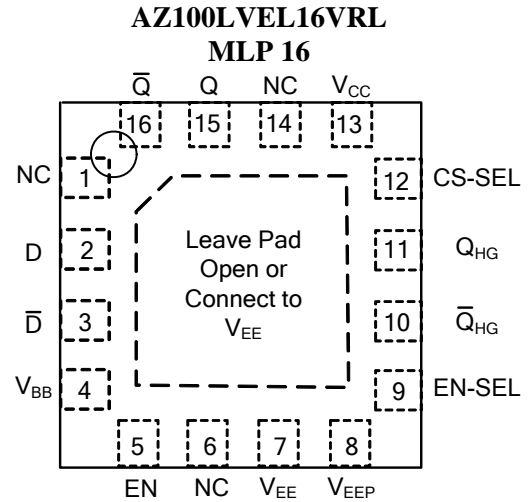
## AZ100LVEL16VR

Each of the  $Q_{HG}/\bar{Q}_{HG}$  outputs has an optional on-chip pull-down current source of 10 mA. When pad/pin  $V_{EEP}$  is left open (NC), the output current sources are disabled and the  $Q_{HG}/\bar{Q}_{HG}$  operate as standard PECL/ECL. When  $V_{EEP}$  is connected to  $V_{EE}$ , the current sources are activated. The  $Q_{HG}/\bar{Q}_{HG}$  pull-down current can be decreased by using a resistor between  $V_{EEP}$  and  $V_{EE}$ .

### MLP 16 (VRL) AND DIE (VRX)



AZ100LVEL16VRL, VRX



TOP VIEW

#### ENABLE TRUTH TABLE

EN-SEL	EN	Q/Q	$Q_{HG}$	$\bar{Q}_{HG}$
NC	PECL Low, $V_{EE}$ or NC	Data	Data	Data
NC	PECL High or $V_{CC}$	Data	Low	High
$V_{EE}^1$	CMOS Low, $V_{EE}$ or NC	Data	Low	High
$V_{EE}^1$	CMOS High or $V_{CC}$	Data	Data	Data
$V_{CC}$ or $V_{BB}^{1,2}$	CMOS Low or $V_{EE}$	Data	Low	High
$V_{CC}$ or $V_{BB}^{1,2}$	CMOS High, $V_{CC}$ or NC	Data	Data	Data

<sup>1</sup> EN-SEL connections must be  $\leq 1\Omega$ .

<sup>2</sup> Date codes prior to 0428 do not support this operating mode.

#### PIN DESCRIPTION

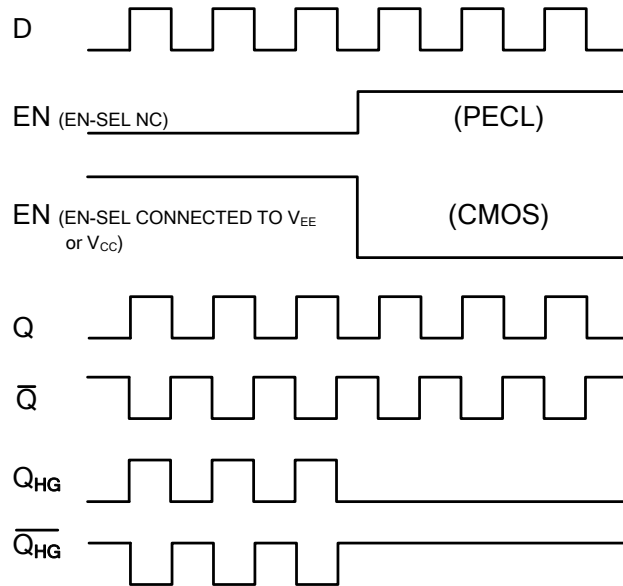
PIN	FUNCTION
D/D	Data Inputs
Q/Q	Data Outputs
$Q_{HG}/\bar{Q}_{HG}$	Data Outputs w/High Gain
$V_{BB}$	Reference Voltage Output
EN-SEL	Enable Logic Select
EN	Enable Input
CS-SEL	Selects Q and $\bar{Q}$ Current Source Magnitude
$V_{EEP}$	Optional $Q_{HG}$ and $\bar{Q}_{HG}$ Current Sources
$V_{EE}$	Negative Supply
$V_{CC}$	Positive Supply

#### CURRENT SOURCE TRUTH TABLE

CS-SEL	Q	$\bar{Q}$
NC	4mA typ.	4mA typ.
$V_{EE}^1$	8mA typ.	8mA typ.
$V_{CC}^1$	0	4mA typ.

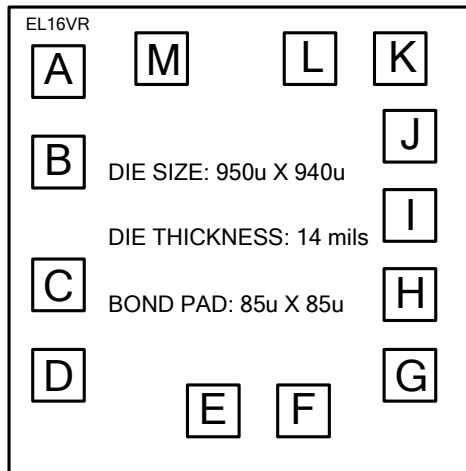
<sup>1</sup>Connections to  $V_{CC}$  or  $V_{EE}$  must be  $\leq 1\Omega$ .

**MLP 16 (VRL) AND DIE (VRX)**



**TIMING DIAGRAM**

**DIE PAD COORDINATES**



NAME	SIGNAL	X (Microns)	Y (Microns)
A	D	-342.5	312.5
B	D	-342.5	144.5
C	V <sub>BB</sub>	-342.5	-87.0
D	EN	-342.5	-255.0
E	V <sub>EE</sub>	-33.5	-312.5
F	V <sub>EEP</sub>	126.5	-312.5
G	EN-SEL	312.5	-248.5
H	Q <sub>HG</sub>	312.5	-98.5
I	Q <sub>HG</sub>	312.5	51.5
J	CS-SEL	312.5	201.5
K	V <sub>CC</sub>	302.5	342.5
L	Q	142.5	342.5
M	Q	-140.5	342.5

- Notes:
1. Other die thicknesses available. Contact factory for further information.
  2. The die backside may be left open or connected to V<sub>EE</sub>.

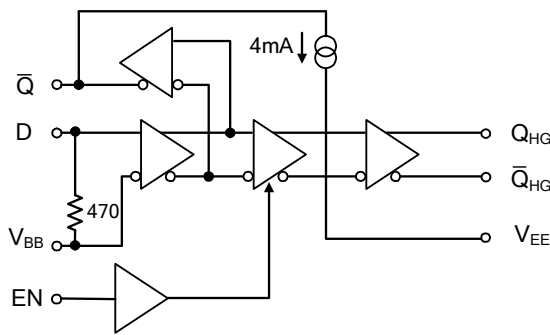
# AZ100LVEL16VR

## MLP 8, 2x2 mm Package (VRNE)

A CMOS enable input (EN) allows continuous oscillator operation. When the EN input is HIGH or left open (NC), the Q and Q<sub>HG</sub>/Q<sub>HG</sub> outputs follow the data input. When EN is LOW, the Q<sub>HG</sub> output is forced high and the Q<sub>HG</sub> output is forced low while Q continues to follow the data input. The Q output has an internal 4 mA current source to V<sub>EE</sub>, in most cases eliminating the need for an external pull-down resistor.

The data input D is tied to the V<sub>BB</sub> pin through a 470 Ω internal bias resistor while the inverting input D is connected directly to V<sub>BB</sub>. Bypassing V<sub>BB</sub> to ground with a 0.01 μF capacitor is recommended.

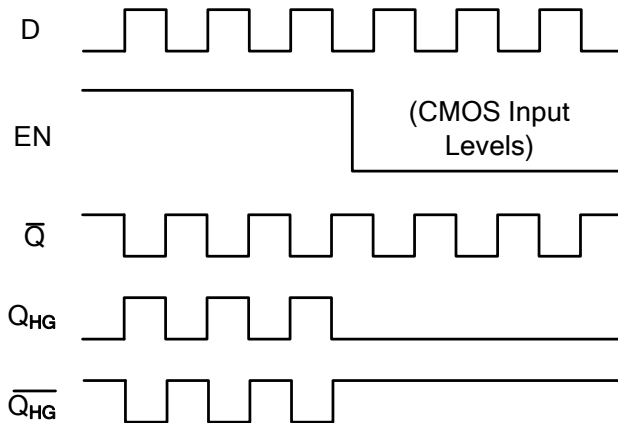
NOTE: The specifications in the ECL/PECL tables are valid when thermal equilibrium has been established.



AZ100LVEL16VRNE

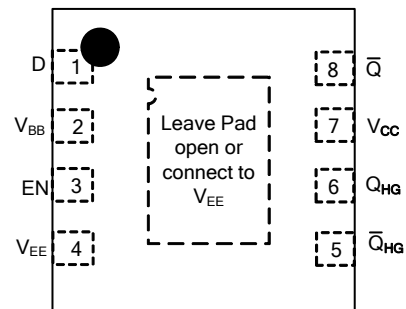
### PIN DESCRIPTION

PIN	FUNCTION
D	Data Input
Q	Data Output
Q <sub>HG</sub> /Q <sub>HG</sub>	Data Outputs w/High Gain
V <sub>BB</sub>	Reference Voltage Output
EN	Enable Input
V <sub>EE</sub>	Negative Supply
V <sub>CC</sub>	Positive Supply



TIMING DIAGRAM

AZ100LVEL16VRNE  
MLP 8, 2x2 mm



TOP VIEW

# AZ100LVEL16VR

**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 +6.0	Vdc
V <sub>D/D</sub>	PECL D/D Input Voltage (V <sub>EE</sub> = 0V)	±0.75 with respect to V <sub>BB</sub>	Vdc
V <sub>EN</sub>	PECL EN Input Voltage (V <sub>EE</sub> = 0V)	0 to +6.0	Vdc
V <sub>EE</sub>	ECL Power Supply (V <sub>CC</sub> = 0V)	-6.0 to 0	Vdc
V <sub>D/D</sub>	ECL D/D Input Voltage (V <sub>CC</sub> = 0V)	±0.75 with respect to V <sub>BB</sub>	Vdc
V <sub>EN</sub>	ECL EN Input Voltage (V <sub>CC</sub> = 0V)	-6.0 to 0	Vdc
I <sub>OUT</sub>	Output Current, Q/Q — Continuous — Surge	25 50	mA
I <sub>HGOUT</sub>	Output Current, Q <sub>HG</sub> /Q <sub>HG</sub> — 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

## ECL DC Characteristics (V<sub>EE</sub> = -3.0V to -5.5V, V<sub>CC</sub> = GND)

Symbol	Characteristic	-40°C		0°C		25°C		85°C		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	
V <sub>OH</sub>	Output HIGH Voltage <sup>1</sup>	-1045	-835	-1025	-835	-1025	-835	-1025	-835	mV
V <sub>OL</sub>	Output LOW Voltage <sup>1</sup>	-1925	-1555	-1900	-1620	-1900	-1620	-1900	-1620	mV
V <sub>IH</sub>	Input HIGH Voltage									
	D/D, EN (ECL) <sup>2</sup> EN (CMOS) <sup>3</sup>	-1165 V <sub>EE</sub> +2000	-740 V <sub>CC</sub>	-1165 V <sub>EE</sub> +2000	-740 V <sub>CC</sub>	-1165 V <sub>EE</sub> +2000	-740 V <sub>CC</sub>	-1165 V <sub>EE</sub> +2000	-740 V <sub>CC</sub>	mV
V <sub>IL</sub>	Input LOW Voltage									
	D/D, EN (ECL) <sup>2</sup> EN (CMOS) <sup>3</sup>	-1900 V <sub>EE</sub>	-1475 V <sub>EE</sub> + 800	-1900 V <sub>EE</sub>	-1475 V <sub>EE</sub> + 800	-1900 V <sub>EE</sub>	-1475 V <sub>EE</sub> + 800	-1900 V <sub>EE</sub>	-1475 V <sub>EE</sub> + 800	mV
V <sub>BB</sub>	Reference Voltage	-1390	-1250	-1390	-1250	-1390	-1250	-1390	-1250	mV
I <sub>IH</sub>	Input HIGH Current EN		150		150		150		150	µA
I <sub>IL</sub>	Input LOW Current									
	EN (ECL) <sup>2</sup> EN (CMOS) <sup>3</sup>	0.5 -150		0.5 -150		0.5 -150		0.5 -150		µA
I <sub>EE</sub>	Power Supply Current <sup>1</sup>		48		48		48		54	mA

1. Specified with V<sub>EEP</sub> and CS-SEL NC, Q<sub>HG</sub>/Q<sub>HG</sub> terminated through 50Ω resistors to V<sub>CC</sub> - 2V.
2. EN-SEL = NC.
3. EN-SEL = V<sub>CC</sub> or V<sub>EE</sub>.

## 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	Max	Min	Max	Min	Max	Min	Max	
V <sub>OH</sub>	Output HIGH Voltage <sup>1,2</sup>	2255	2465	2275	2465	2275	2465	2275	2465	mV
V <sub>OL</sub>	Output LOW Voltage <sup>1,2</sup>	1375	1745	1400	1680	1400	1680	1400	1680	mV
V <sub>IH</sub>	Input HIGH Voltage <sup>1</sup>									
	D/D, EN (PECL) <sup>3</sup> EN (CMOS) <sup>4</sup>	2135 2000	2560 V <sub>CC</sub>	2135 2000	2560 V <sub>CC</sub>	2135 2000	2560 V <sub>CC</sub>	2135 2000	2560 V <sub>CC</sub>	mV
V <sub>IL</sub>	Input LOW Voltage <sup>1</sup>									
	D/D, EN (PECL) <sup>3</sup> EN (CMOS) <sup>4</sup>	1400 GND	1825 800	1400 GND	1825 800	1400 GND	1825 800	1400 GND	1825 800	mV
V <sub>BB</sub>	Reference Voltage <sup>1</sup>	1910	2050	1910	2050	1910	2050	1910	2050	mV
I <sub>IH</sub>	Input HIGH Current EN		150		150		150		150	µA
I <sub>IL</sub>	Input LOW Current									
	EN (PECL) <sup>3</sup> EN (CMOS) <sup>4</sup>	0.5 -150		0.5 -150		0.5 -150		0.5 -150		µA
I <sub>EE</sub>	Power Supply Current <sup>2</sup>		48		48		48		54	mA

1. For supply voltages other than 3.3V, use the ECL table values and ADD supply voltage value.
2. Specified with V<sub>EEP</sub> and CS-SEL NC, Q<sub>HG</sub>/Q<sub>HG</sub> terminated through 50Ω resistors to V<sub>CC</sub> - 2V.
3. EN-SEL = NC.
4. EN-SEL = V<sub>CC</sub> or V<sub>EE</sub>.

# AZ100LVEL16VR

## PECL DC Characteristics ( $V_{EE} = \text{GND}$ , $V_{CC} = +5.0\text{V}$ )

Symbol	Characteristic	-40°C		0°C		25°C		85°C		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	
$V_{OH}$	Output HIGH Voltage <sup>1,2</sup>	3955	4165	3975	4165	3975	4165	3975	4165	mV
$V_{OL}$	Output LOW Voltage <sup>1,2</sup>	3075	3445	3100	3380	3100	3380	3100	3380	mV
$V_{IH}$	Input HIGH Voltage <sup>1</sup>	3835	4260	3835	4260	3835	4260	3835	4260	mV
	D/D, EN (PECL) <sup>3</sup> EN (CMOS) <sup>4</sup>	2000	$V_{CC}$	2000	$V_{CC}$	2000	$V_{CC}$	2000	$V_{CC}$	
$V_{IL}$	Input LOW Voltage <sup>1</sup>	3100	3525	3100	3525	3100	3525	3100	3525	mV
	D/D, EN (PECL) <sup>3</sup> EN (CMOS) <sup>4</sup>	GND	800	GND	800	GND	800	GND	800	
$V_{BB}$	Reference Voltage <sup>1</sup>	3610	3750	3610	3750	3610	3750	3610	3750	mV
$I_{IH}$	Input HIGH Current EN		150		150		150		150	$\mu\text{A}$
$I_{IL}$	Input LOW Current									$\mu\text{A}$
	EN (PECL) <sup>3</sup> EN (CMOS) <sup>4</sup>	0.5 -150		0.5 -150		0.5 -150		0.5 -150		
$I_{EE}$	Power Supply Current <sup>2</sup>		48		48		48		54	mA

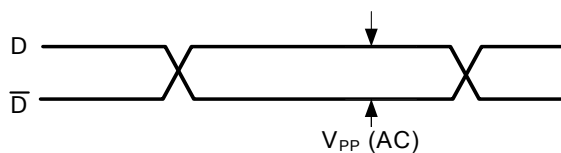
1. For supply voltages other than 5.0V, use the ECL table values and ADD supply voltage value.
2. Specified with  $V_{EEP}$  and CS-SEL NC,  $Q_{HG}/Q_{HG}$  terminated through 50 $\Omega$  resistors to  $V_{CC} - 2\text{V}$ .
3. EN-SEL = NC.
4. EN-SEL =  $V_{CC}$  or  $V_{EE}$ .

## AC Characteristics ( $V_{EE} = -3.0\text{V}$ to $-5.5\text{V}$ ; $V_{CC} = \text{GND}$ or $V_{EE} = \text{GND}$ ; $V_{CC} = +3.0\text{V}$ to $+5.5\text{V}$ )

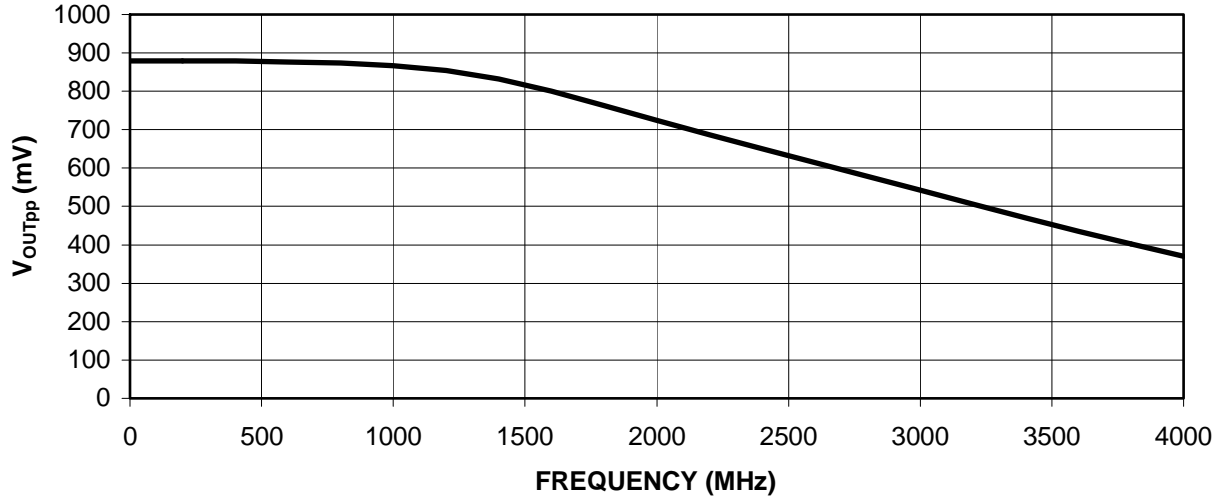
Symbol	Characteristic	-40°C			0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$t_{PLH} / t_{PHL}$	Propagation Delay													ps
	D to Q/Q Outputs <sup>1</sup> (SE) D to $Q_{HG}/Q_{HG}$ Outputs <sup>2</sup> (SE)			400 450			400 450			400 450			400 450	
$t_{SKEW}$	Duty Cycle Skew <sup>4</sup> (SE)		5	20		5	20		5	20		5	20	ps
$V_{PP}(\text{AC})$	Differential Input Swing <sup>5</sup>	80		1000	80		1000	80		1000	80		1000	mV
$t_r / t_f$	Output Rise/Fall <sup>1,2</sup> (20% - 80%)	100		240	100		240	100		240	100		240	ps

1. Specified with CS-SEL connected to  $V_{EE}$ , Q/Q terminated with an AC coupled 50 $\Omega$  load.
2. Specified with  $V_{EEP}$  NC,  $Q_{HG}/Q_{HG}$  terminated through 50 $\Omega$  resistors to  $V_{CC} - 2\text{V}$ .
3. Duty cycle skew is the difference between a  $t_{PLH}$  and  $t_{PHL}$  propagation delay through a device.
4. The peak-to-peak differential input swing is the range for which AC parameters are guaranteed.  $V_D$  and  $V_{\bar{D}}$  must remain within the range of  $\pm 750$  mV with respect to  $V_{BB}$ . The device has a voltage gain of  $\approx 20$  to the Q/Q outputs and a voltage gain of  $\approx 100$  to the  $Q_{HG}/Q_{HG}$  outputs.

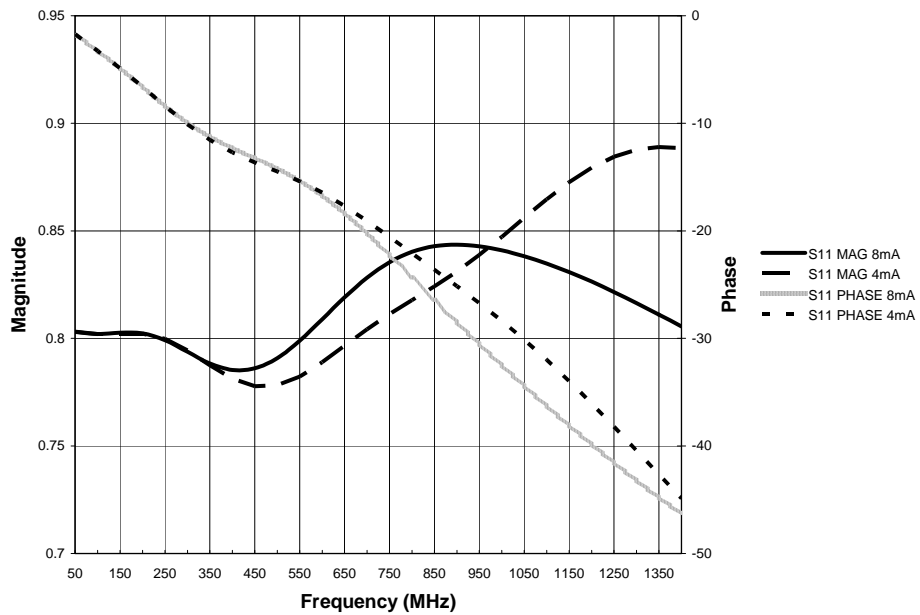
### AC PP INPUT



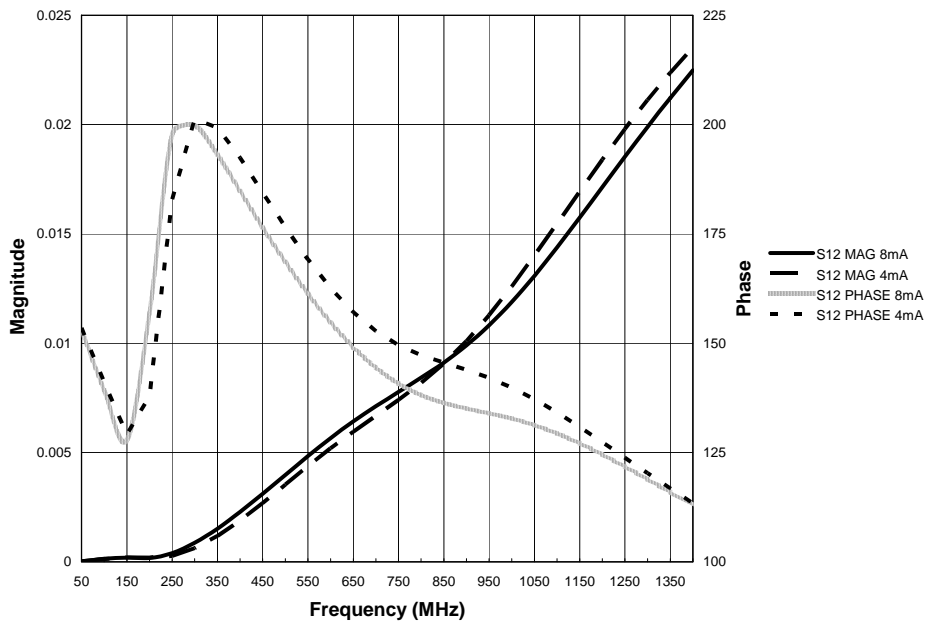
Typical Large Signal Outputs,  $Q_{HG}/Q_{HG}$



Measured with 750mv differential input,  $V_{EEP}$  NC,  $Q_{HG}/Q_{HG}$  each terminated to  $V_{CC}-2V$  via  $50 \Omega$  resistors.

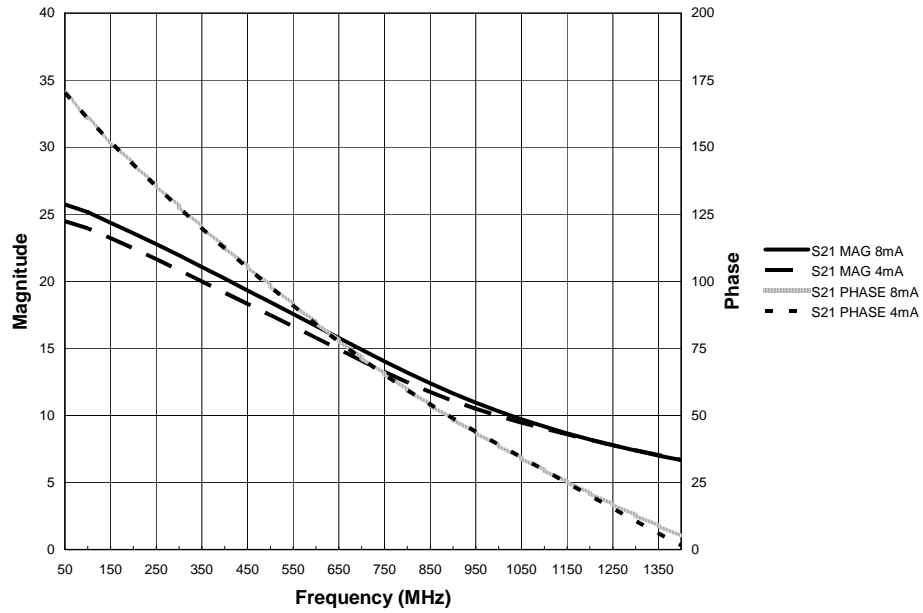


**S11, D to Q**  
(50 Ω external AC, 4 & 8mA internal DC Load on Q)

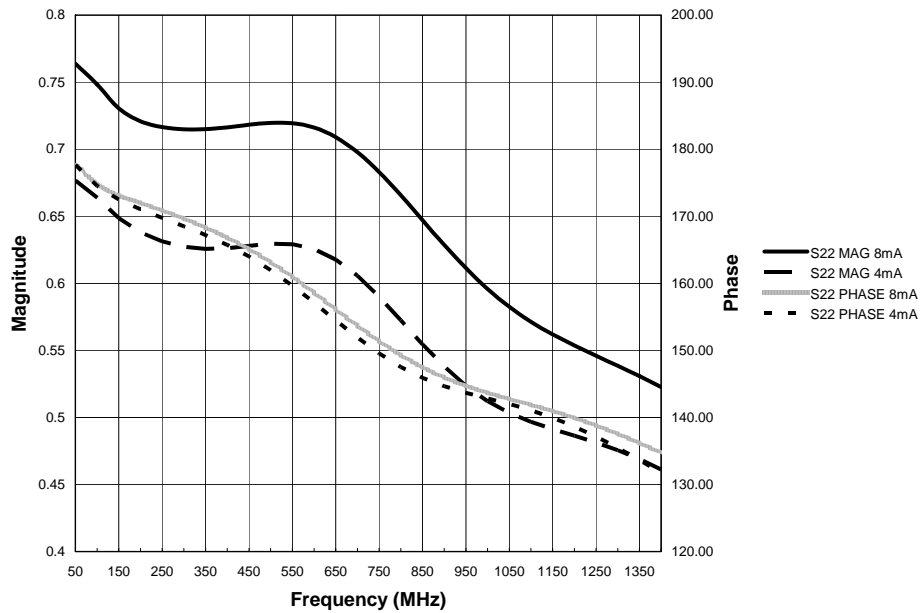


**S12, D to Q**  
(50 Ω external AC, 4 & 8mA internal DC Load on Q)

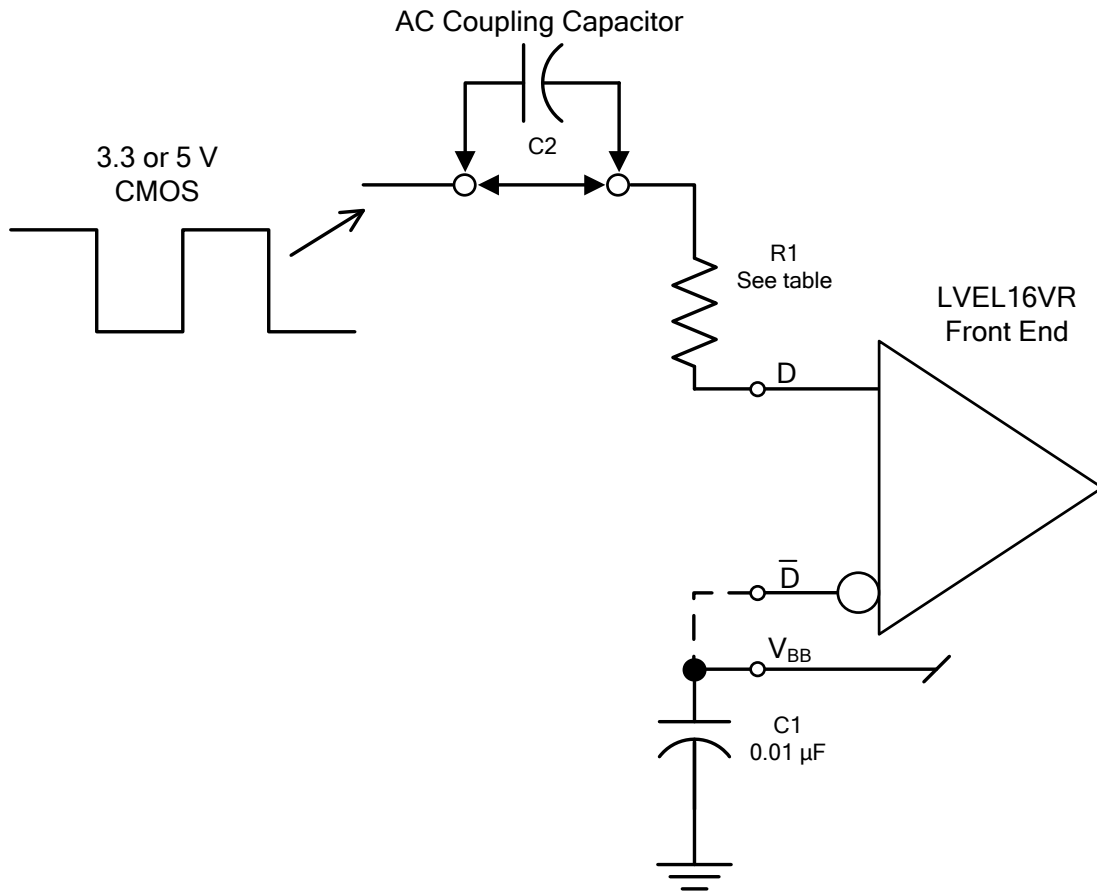
# AZ100LVEL16VR



**S21, D to Q**  
(50  $\Omega$  external AC, 4 & 8mA internal DC Load on Q)



**S22, D to Q**  
(50  $\Omega$  external AC, 4 & 8mA internal DC Load on Q)



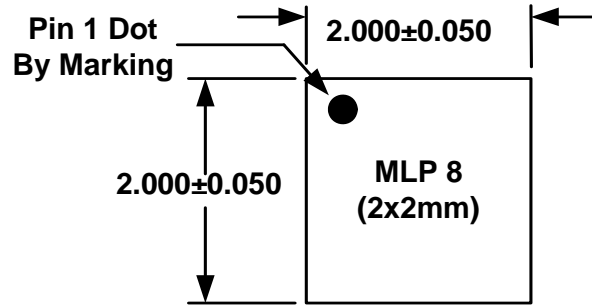
### Application Circuit for CMOS Inputs

Input Type	R1 <sup>1</sup>	
	AC Coupled (C2 in circuit)	DC Coupled (C2 shorted)
3.3 V CMOS	1.1 kΩ	2.0 kΩ
5 V CMOS	1.6 kΩ	3.3 kΩ

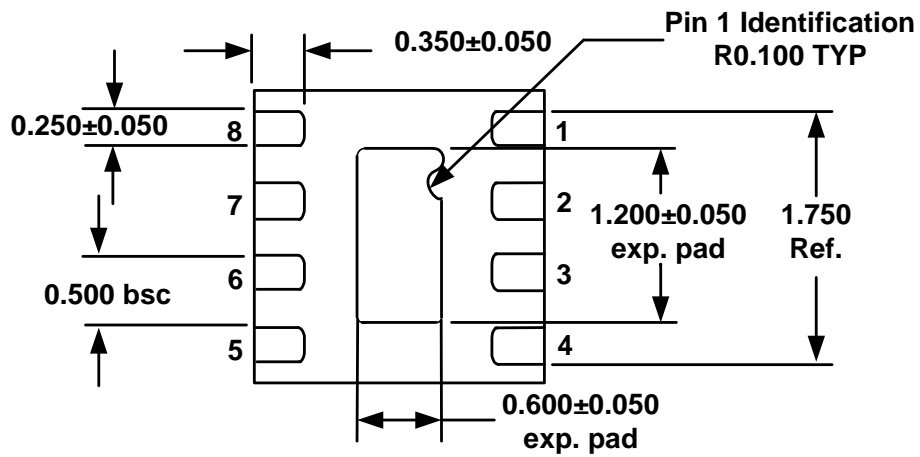
<sup>1</sup> R1 should be chosen so that the input swing on the D input with respect to D is in the range of ±80 to ±1000 mV, per the AC Characteristics table and the D input is < ±750 mV with respect to V<sub>BB</sub>.

### Recommended Component Values for CMOS Single Ended Inputs

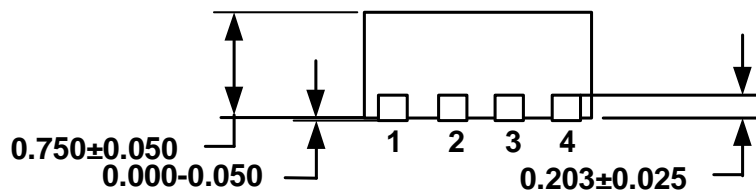
**PACKAGE DIAGRAM**  
**MLP 8 2x2mm**



TOP VIEW



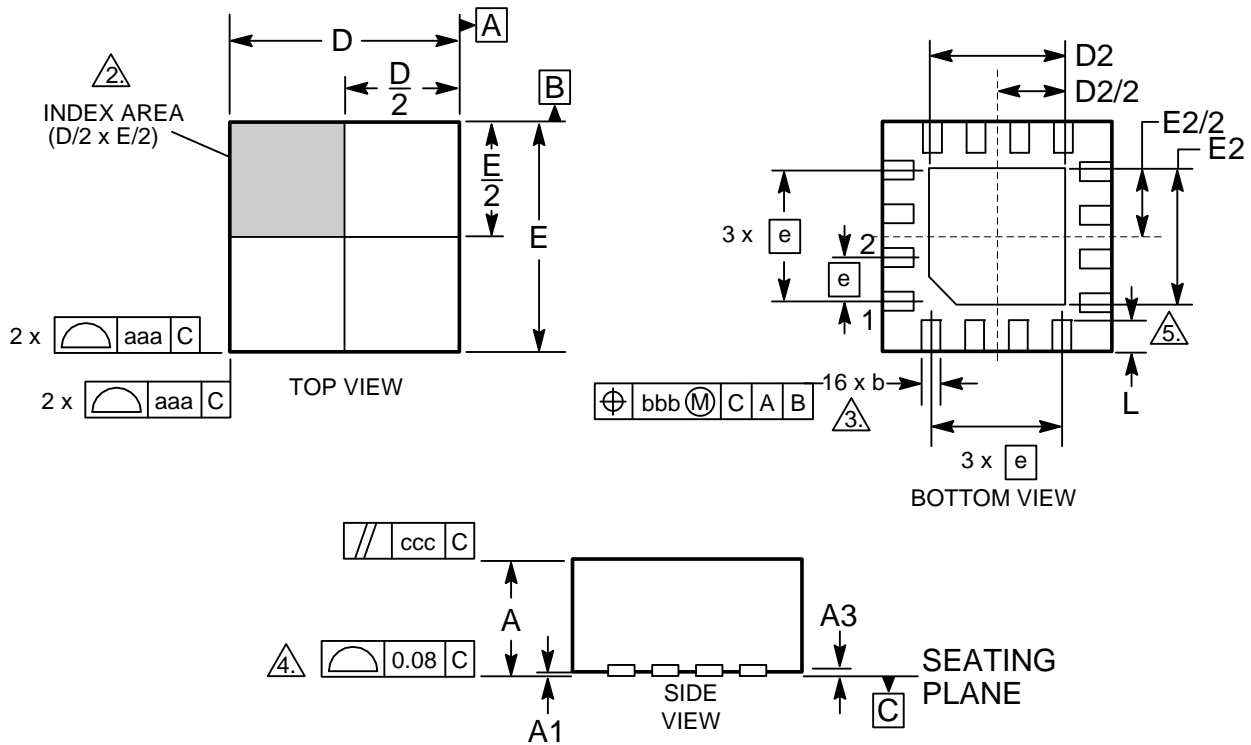
BOTTOM VIEW



SIDE VIEW

**Note: All dimensions are in mm**

**PACKAGE DIAGRAM  
MLP 16**



**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 0.30 mm FROM PAD TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
5. INSIDE CORNERS OF METALLIZED PAD MAY BE SQUARE OR ROUNDED

MILLIMETERS		
DIM	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	

## AZ100LEVEL16VR

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