TinyLogic ULP-A Dual 2-Input AND Gate

NC7WP08

The NC7WP08 is a dual 2–input AND gate in tiny footprint packages. The device is designed to operate for V_{CC} = 0.9 V to 3.6 V.

Features

- Designed for 0.9 V to 3.6 V V_{CC} Operation
- 2.2 ns t_{PD} at 3.3 V (Typ)
- Inputs/Outputs Over–Voltage Tolerant up to 3.6 V
- I_{OFF} Supports Partial Power Down Protection
- Source/Sink 2.6 mA at 3.3 V
- Available in US8 and MicroPak™ Packages
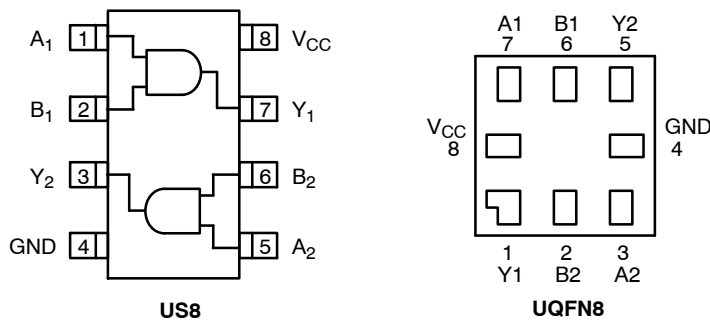- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

MARKING DIAGRAMS

UQFN8
1.6X1.6, 0.5P
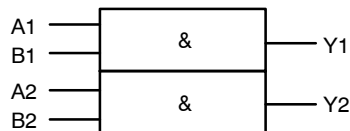CASE 523AY

CCKK
XYZ

US8
CASE 846AN
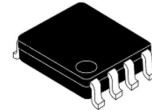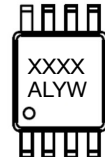
XXXX
ALYW

CC, XXXX	= Specific Device Code
KK	= 2–Digit Lot Run Traceability Code
XY	= 2–Digit Date Code Format
Z	= Assembly Plant Code
A	= Assembly Site
L	= Wafer Lot Number
YW	= Assembly Start Week

ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 6 of this data sheet.

Figure 1. Pinout Diagrams (Top Views)

Figure 2. Logic Symbol

PIN ASSIGNMENT

Pin	US8	UQFN8
1	A1	Y1
2	B1	B2
3	Y2	A2
4	GND	GND
5	A2	Y2
6	B2	B1
7	Y1	A1
8	V_{CC}	V_{CC}

FUNCTION TABLE

Inputs		Output
A	**B**	**Y**
L	L	L
L	H	L
H	L	L
H	H	H

NOTE:　H = HIGH Logic Level
　　　　L = LOW Logic Level

NC7WP08

MAXIMUM RATINGS

Symbol	Characteristics		Value	Unit
V_{CC}	DC Supply Voltage		−0.5 to +4.3	V
V_{IN}	DC Input Voltage		−0.5 to +4.3	V
V_{OUT}	DC Output Voltage	Active−Mode (High or Low State) Tri−State Mode (Note 1) Power−Down Mode (V_{CC} = 0 V)	−0.5 to V_{CC} + 0.5 −0.5 to +4.3 −0.5 to +4.3	V
I_{IK}	DC Input Diode Current	V_{IN} < GND	−50	mA
I_{OK}	DC Output Diode Current	V_{OUT} < GND	−50	mA
I_{OUT}	DC Output Source/Sink Current		±50	mA
I_{CC} or I_{GND}	DC Supply Current per Supply Pin or Ground Pin		±50	mA
T_{STG}	Storage Temperature Range		−65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
T_J	Junction Temperature Under Bias		+150	°C
θ_{JA}	Thermal Resistance (Note 2)	US8 MicroPak	250 210	°C/W
P_D	Power Dissipation in Still Air	US8 MicroPak	500 595	mW
MSL	Moisture Sensitivity		Level 1	−
F_R	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V−0 @ 0.125 in	−
V_{ESD}	ESD Withstand Voltage (Note 3)	Human Body Model Charged Device Model	2000 1000	V
$I_{Latchup}$	Latchup Performance (Note 4)		±100	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.
1. Applicable to devices with outputs that may be tri−stated.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm−by−1 inch, 2 ounce copper trace no air flow per JESD51−7.
3. HBM tested to EIA / JESD22−A114−A. CDM tested to JESD22−C101−A. JEDEC recommends that ESD qualification to EIA/JESD22−A115A (Machine Model) be discontinued.
4. Tested to EIA/JESD78 Class II.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	Positive DC Supply Voltage		0.9	3.6	V
V_{IN}	DC Input Voltage		0	3.6	V
V_{OUT}	DC Output Voltage	Active−Mode (High or Low State) Tri−State Mode (Note 1) Power−Down Mode (V_{CC} = 0 V)	0 0 0	V_{CC} 3.6 3.6	
T_A	Operating Temperature Range		−40	+85	°C
t_r , t_f	Input Transition Rise and Fall Time	V_{CC} = 3.3 V ± 0.3 V	0	10	ns/V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V_{CC} (V)	$T_A = 25°C$			$T_A = -40°C$ to $+85°C$		Unit
				Min	Typ	Max	Min	Max	
V_{IH}	High–Level Input Voltage		0.9	–	0.5	–	–	–	V
			1.1 to 1.3	0.65 x V_{CC}	–	–	0.65 x V_{CC}	–	
			1.4 to 1.6	0.65 x V_{CC}	–	–	0.65 x V_{CC}	–	
			1.65 to 1.95	0.65 x V_{CC}	–	–	0.65 x V_{CC}	–	
			2.3 to 2.7	1.6	–	–	1.6	–	
			3.0 to 3.6	2.1	–	–	2.1	–	
V_{IL}	Low–Level Input Voltage		0.9	–	0.5	–	–	–	V
			1.1 to 1.3	–	–	0.35 x V_{CC}	–	0.35 x V_{CC}	
			1.4 to 1.6	–	–	0.35 x V_{CC}	–	0.35 x V_{CC}	
			1.65 to 1.95	–	–	0.35 x V_{CC}	–	0.35 x V_{CC}	
			2.3 to 2.7	–	–	0.7	–	0.7	
			3.0 to 3.6	–	–	0.9	–	0.9	
V_{OH}	High–Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL}							V
		$I_{OH} = -20$ μA	0.9	–	$V_{CC} - 0.1$	–	–	–	
			1.1 to 1.3	$V_{CC} - 0.1$	–	–	$V_{CC} - 0.1$	–	
			1.4 to 1.6	$V_{CC} - 0.1$	–	–	$V_{CC} - 0.1$	–	
			1.65 to 1.95	$V_{CC} - 0.1$	–	–	$V_{CC} - 0.1$	–	
			2.3 to 2.7	$V_{CC} - 0.1$	–	–	$V_{CC} - 0.1$	–	
			3.0 to 3.6	$V_{CC} - 0.1$	–	–	$V_{CC} - 0.1$	–	
		$I_{OH} = -0.5$ mA	1.1 to 1.3	0.75 x V_{CC}	–	–	0.70 x V_{CC}	–	
		$I_{OH} = -1$ mA	1.4 to 1.6	1.07	–	–	0.99	–	
		$I_{OH} = -1.5$ mA	1.65 to 1.95	1.24	–	–	1.22	–	
		$I_{OH} = -2.1$ mA	2.3 to 2.7	1.95	–	–	1.87	–	
		$I_{OH} = -2.6$ mA	3.0 to 3.6	2.61	–	–	2.55	–	
V_{OL}	Low–Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL}							V
		$I_{OL} = 20$ μA	0.9	–	0.1	–	–	–	
			1.1 to 1.3	–	–	0.1	–	0.1	
			1.4 to 1.6	–	–	0.1	–	0.1	
			1.65 to 1.95	–	–	0.1	–	0.1	
			2.3 to 2.7	–	–	0.1	–	0.1	
			3.0 to 3.6	–	–	0.1	–	0.1	
		$I_{OL} = 0.5$ mA	1.1 to 1.3	–	–	0.3 x V_{CC}	–	0.3 x V_{CC}	
		$I_{OL} = 1$ mA	1.4 to 1.6	–	–	0.31	–	0.37	
		$I_{OL} = 1.5$ mA	1.65 to 1.95	–	–	0.31	–	0.35	
		$I_{OL} = 2.1$ mA	2.3 to 2.7	–	–	0.31	–	0.33	
		$I_{OL} = 2.6$ mA	3.0 to 3.6	–	–	0.31	–	0.33	
I_{IN}	Input Leakage Current	$V_{IN} = 0$ V to 3.6 V	0.9 to 3.6	–	–	±0.1	–	±0.5	μA
I_{OFF}	Power Off Leakage Current	$V_{IN} = 0$ V to 3.6 V or $V_{OUT} = 0$ V to 3.6 V	0	–	–	0.5	–	0.5	μA
I_{CC}	Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	0.9 to 3.6	–	–	0.9	–	0.9	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.
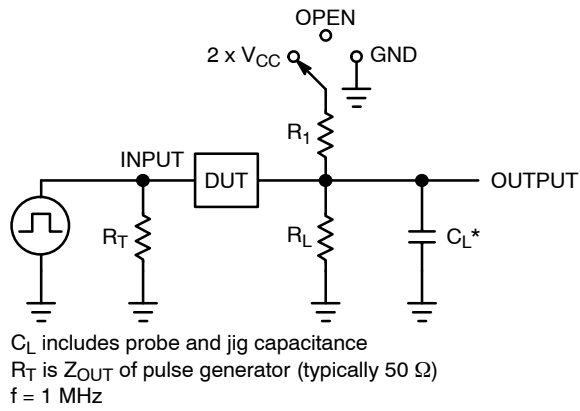
NC7WP08

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V_{CC} (V)	$T_A = 25°C$			$T_A = -40°C$ to $+85°C$		Unit
				Min	Typ	Max	Min	Max	
t_{PLH}, t_{PHL}	Propagation Delay, (A or B) to Y (Figures 3 and 4)	$R_L = 1\ M\Omega$, $C_L = 10\ pF$	0.9	–	40.4	–	–	–	ns
			1.10 to 1.30	–	11.7	24.3	–	34.3	
			1.40 to 1.60	–	6.1	14.8	–	15.0	
			1.65 to 1.95	–	4.0	12.0	–	12.2	
			2.3 to 2.7	–	3.0	9.4	–	9.9	
			3.0 to 3.6	–	2.2	8.3	–	9.0	
t_{PLH}, t_{PHL}	Propagation Delay, (A or B) to Y (Figures 3 and 4)	$R_L = 1\ M\Omega$, $C_L = 15\ pF$	0.9	–	42.2	–	–	–	ns
			1.10 to 1.30	–	12.2	25.7	–	37.3	
			1.40 to 1.60	–	6.4	15.5	–	16.5	
			1.65 to 1.95	–	4.3	12.6	–	13.6	
			2.3 to 2.7	–	3.2	9.9	–	10.8	
			3.0 to 3.6	–	2.4	8.7	–	9.5	
t_{PLH}, t_{PHL}	Propagation Delay, (A or B) to Y (Figures 3 and 4)	$R_L = 1\ M\Omega$, $C_L = 30\ pF$	0.9	–	48.5	–	–	–	ns
			1.10 to 1.30	–	13.5	29.7	–	46.3	
			1.40 to 1.60	–	7.5	17.8	–	18.2	
			1.65 to 1.95	–	5.2	14.4	–	15.9	
			2.3 to 2.7	–	3.8	11.3	–	12.8	
			3.0 to 3.6	–	2.9	9.2	–	10.7	

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition	Typical ($T_A = 25°C$)	Unit
C_{IN}	Input Capacitance	$V_{CC} = 0\ V$	2.0	pF
C_{OUT}	Output Capacitance	$V_{CC} = 0\ V$	4.0	pF
C_{PD}	Power Dissipation Capacitance (Note 5)	f = 10 MHz, $V_{CC} = 0.9$ to 3.6 V, $V_{IN} = 0\ V$ or V_{CC}	6.0	pF

5. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$. C_{PD} is used to determine the no−load dynamic power consumption: $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.

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Test	Switch Position
t_{PLH} / t_{PHL}	Open
t_{PLZ} / t_{PZL}	2 x V_{CC}
t_{PHZ} / t_{PZH}	GND

C_L includes probe and jig capacitance
R_T is Z_{OUT} of pulse generator (typically 50 Ω)
f = 1 MHz

Figure 3. Test Circuit
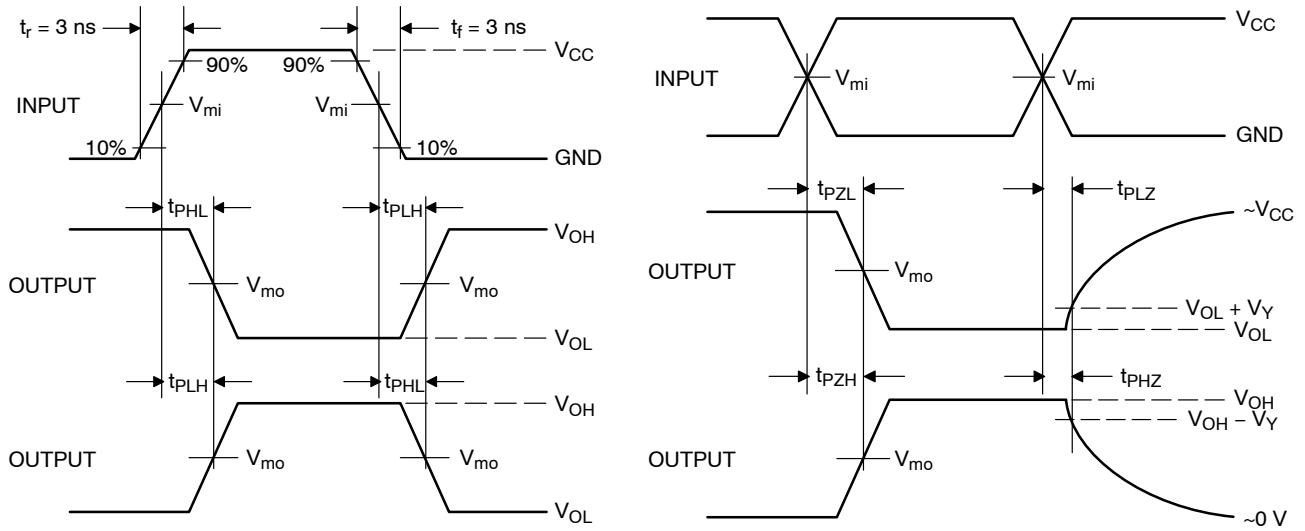
V_{CC}, V	V_{mi}, V	V_{mo}, V	V_Y, V
0.9	V_{CC} / 2	V_{CC} / 2	0.1
1.1 to 1.3	V_{CC} / 2	V_{CC} / 2	0.1
1.4 to 1.6	V_{CC} / 2	V_{CC} / 2	0.1
1.65 to 1.95	V_{CC} / 2	V_{CC} / 2	0.15
2.3 to 2.7	V_{CC} / 2	V_{CC} / 2	0.15
3.0 to 3.6	1.5	1.5	0.3

Figure 4. Switching Waveforms

NC7WP08

ORDERING INFORMATION

Device	Package	Marking	Pin 1 Orientation (See below)	Shipping†
NC7WP08K8X	US8	WP08	Q4	3000 / Tape & Reel
NC7WP08L8X	MicroPak, UQFN8	Y5	Q4	5000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Pin 1 Orientation in Tape and Reel

Direction of Feed
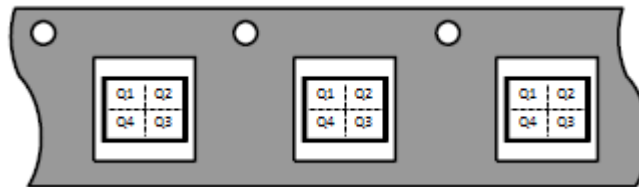
UQFN8 1.6X1.6, 0.5P
CASE 523AY
ISSUE O

DATE 31 AUG 2016

TOP VIEW

PIN#1 IDENT

2X

SIDE VIEW

SEATING PLANE

RECOMMENDED
LAND PATTERN
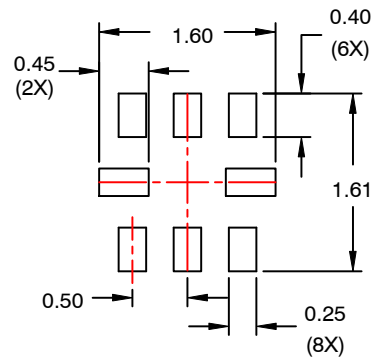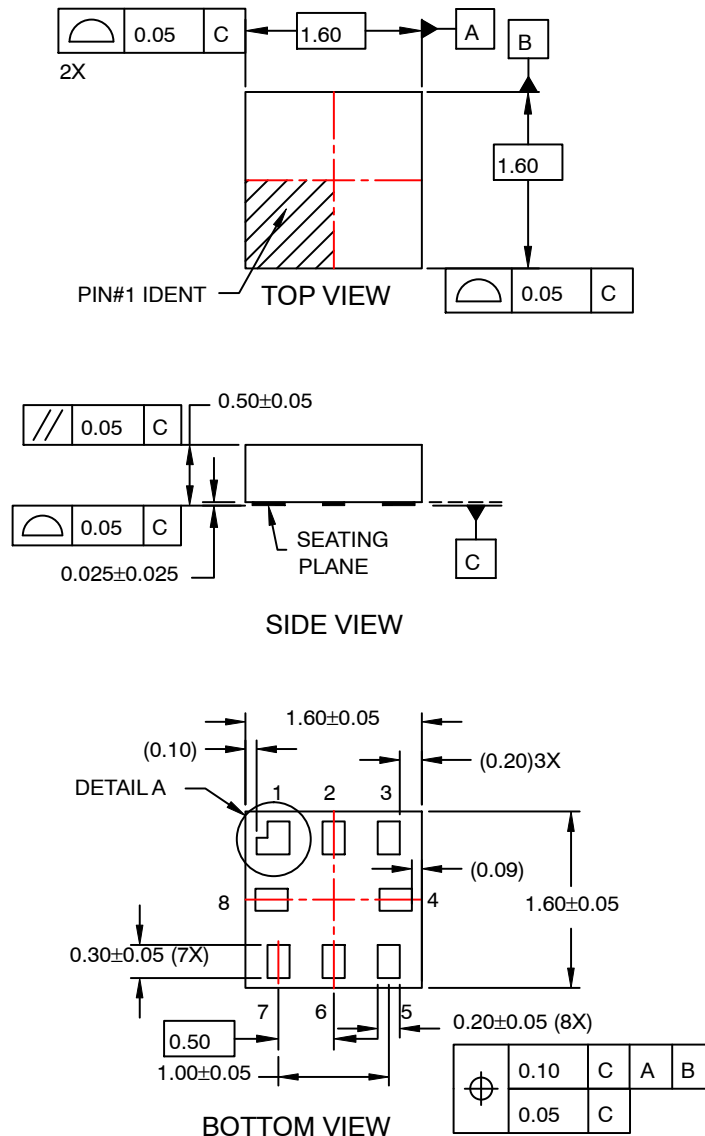
NOTES:

A. PACKAGE CONFORMS TO JEDEC MO−255 VARIATION UAAD.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.

D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.

DETAIL A

BOTTOM VIEW

DETAIL A
SCALE : 2X
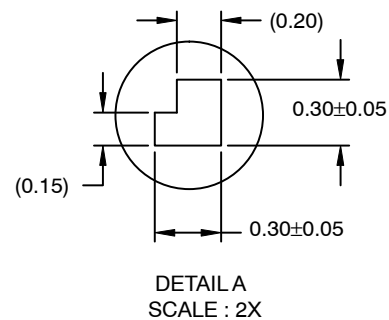
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US8
CASE 846AN
ISSUE O

DATE 31 DEC 2016

TOP VIEW
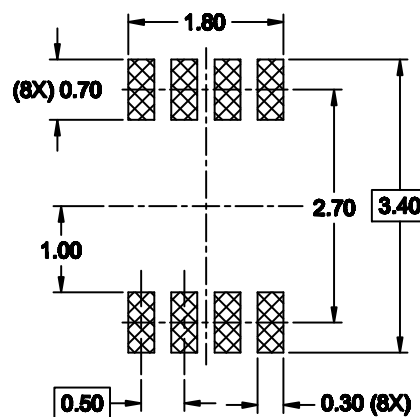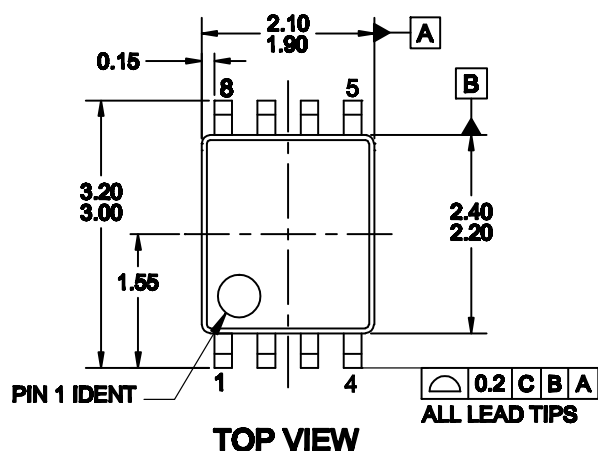
RECOMMENDED LAND PATTERN
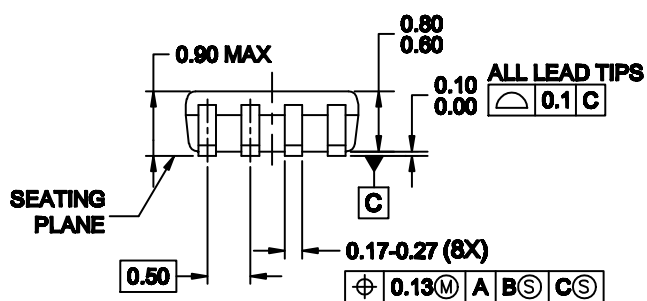
SIDE VIEW
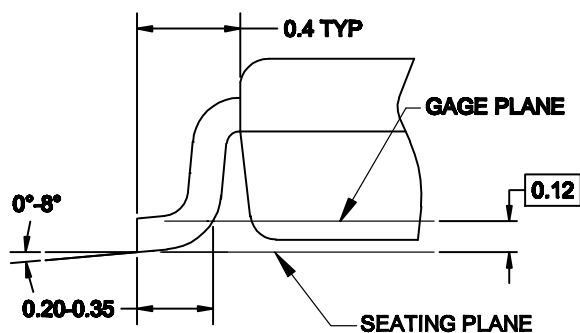
NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-187

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1994.

DETAIL A
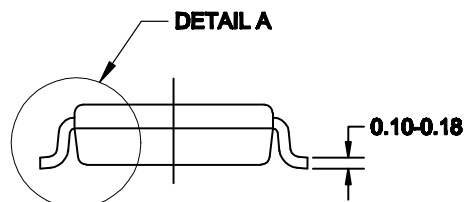
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