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# NC7NP14

## TinyLogic® ULP Triple Inverter with Schmitt Trigger Input

### Features

- Space saving US8 package
- Ultra small MicroPak™ package
- 0.9V to 3.6V  $V_{CC}$  supply operation
- 3.6V overvoltage tolerant I/O's at  $V_{CC}$  from 0.9V to 3.6V
- Power-Off high impedance inputs and outputs
- Static Drive ( $I_{OH}/I_{OL}$ ):
  - $\pm 2.6\text{mA}$  @ 3.00V  $V_{CC}$
  - $\pm 2.1\text{mA}$  @ 2.30V  $V_{CC}$
  - $\pm 1.5\text{mA}$  @ 1.65V  $V_{CC}$
  - $\pm 1.0\text{mA}$  @ 1.40V  $V_{CC}$
  - $\pm 0.5\text{mA}$  @ 1.10V  $V_{CC}$
  - $\pm 20\mu\text{A}$  @ 0.9V  $V_{CC}$
- Low noise switching using design techniques of Quiet Series™ noise/EMI reduction circuitry
- Ultra low dynamic power

### General Description

The NC7NP14 is a triple inverter with Schmitt trigger input from Fairchild's Ultra Low Power (ULP) Series of TinyLogic®. Ideal for applications where battery life is critical, this product is designed for ultra low power consumption within the  $V_{CC}$  operating range of 0.9V to 3.6V  $V_{CC}$ .


The internal circuit is composed of a minimum of inverter stages, including the output buffer, to enable ultra low static and dynamic power.

The NC7NP14 is designed for optimized power and speed, and is fabricated with an advanced CMOS technology to achieve high speed, low noise operation while maintaining extremely low CMOS power dissipation.

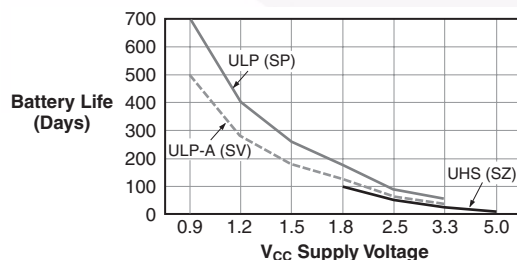
### Ordering Information

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7NP14K8X	MAB08A	NP14	8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide	3k Units on Tape and Reel
NC7NP14L8X	MAC08A	X6	8-Lead MicroPak, 1.6mm Wide	5k Units on Tape and Reel

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.

 All packages are lead free per JEDEC: J-STD-020B standard.

### Battery Life vs. $V_{CC}$ Supply Voltage



TinyLogic ULP and ULP-A with up to 50% less power consumption can extend your battery life significantly.

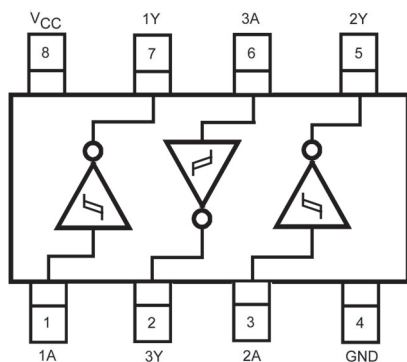
$$\text{Battery Life} = (V_{\text{battery}} \times I_{\text{battery}} \times 0.9) / (P_{\text{device}}) / 24\text{hrs/day}$$

$$\text{Where, } P_{\text{device}} = (I_{CC} \times V_{CC}) + (C_{PD} + C_L) \times V_{CC}^2 \times f$$

Assumes ideal 3.6V Lithium Ion battery with current rating of 900mA and derated 90% and device frequency at 10MHz, with  $C_L = 15\text{pF}$  load.

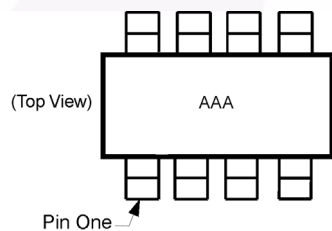
## Connection Diagrams

Pin Assignments for US8



(Top View)

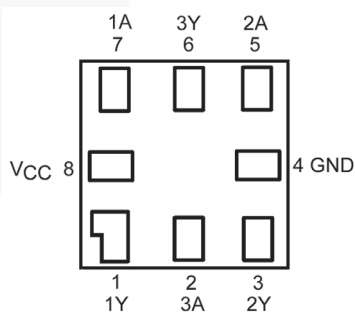
Pin One Orientation Diagram



AAA represents Product Code Top Mark – see ordering code

**Note:** Orientation of Top Mark determines Pin One location. Read the top product code mark left to right, Pin One is the lower left pin (see diagram).

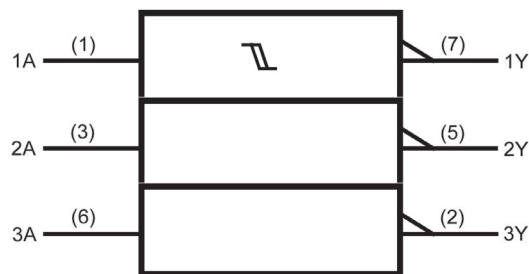
Pad Assignments for MicroPak



(Top Thru View)

## Logic Symbol

IEEE/IEC



## Function Table

$$Y = \bar{A}$$

Input	Output
A	Y
L	H
H	L

H = HIGH Logic Level

L = LOW Logic Level

## Pin Description

Pin Names	Description
A	Input
Y	Output

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	-0.5V to +4.6V
$V_{IN}$	DC Input Voltage	-0.5V to +4.6V
$V_{OUT}$	DC Output Voltage HIGH or LOW State <sup>(1)</sup> $V_{CC} = 0V$	-0.5V to $V_{CC} + 0.5V$ -0.5V to +4.6V
$I_{IK}$	DC Input Diode Current @ $V_{IN} < 0V$	-50mA
$I_{OK}$	DC Output Diode Current $V_{OUT} < 0V$ $V_{OUT} > V_{CC}$	-50mA +50mA
$I_{OH}/I_{OL}$	DC Output Source/Sink Current	±50mA
$I_{CC}$ or Ground	DC $V_{CC}$ or Ground Current per Supply Pin	±50mA
$T_{STG}$	Storage Temperature Range	-65°C to +150°C
$T_J$	Junction Temperature Under Bias	150°C
$T_L$	Junction Lead Temperature (Soldering, 10 seconds)	260°C
$P_D$	Power Dissipation @ +85°C US8 Micropak-8	245mW 165mW

## Recommended Operating Conditions<sup>(2)</sup>

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	0.9V to 3.6V
$V_{IN}$	Input Voltage	0V to 3.6V
$V_{OUT}$	Output Voltage HIGH or LOW State $V_{CC} = 0V$	0V to $V_{CC}$ 0V to 3.6V
$I_{OH}/I_{OL}$	Output Current in $I_{OH}/I_{OL}$ $V_{CC} = 3.0V$ to 3.6V $V_{CC} = 2.3V$ to 2.7V $V_{CC} = 1.65V$ to 1.95V $V_{CC} = 1.40V$ to 1.60V $V_{CC} = 1.10V$ to 1.30V $V_{CC} = 0.9V$	±2.6mA ±2.1mA ±1.5mA ±1.0mA ±0.5mA ±20µA
$T_A$	Free Air Operating Temperature	-40°C to +85°C
$\Delta t/\Delta V$	Minimum Input Edge Rate @ $V_{IN} = 0.8V$ to 2.0V, $V_{CC} = 3.0V$	10ns/V
$\theta_{JA}$	Thermal Resistance US8 Micropak-8	265°C/W 395°C/W

### Notes:

- $I_O$  Absolute Maximum Rating must be observed.
- Unused inputs must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C		T <sub>A</sub> = -40°C to +85°C		Units
				Min.	Max.	Min.	Max.	
V <sub>P</sub>	Positive Threshold Voltage	0.90		0.3	0.6	0.3	0.6	V
		1.10		0.4	1.0	0.4	1.0	
		1.40		0.5	1.2	0.5	1.2	
		1.65		0.7	1.5	0.7	1.5	
		2.30		1.0	1.9	1.0	1.9	
		3.00		1.5	2.6	1.5	2.6	
V <sub>N</sub>	Negative Threshold Voltage	0.90		0.1	0.6	0.1	0.6	V
		1.10		0.15	0.7	0.15	0.7	
		1.40		0.2	0.8	0.2	0.8	
		1.65		0.25	0.9	0.25	0.9	
		2.30		0.4	1.15	0.4	1.15	
		3.00		0.6	1.5	0.6	1.5	
V <sub>H</sub>	Hysteresis Voltage	0.90		0.07	0.5	0.07	0.5	V
		1.10		0.08	0.6	0.08	0.6	
		1.40		0.09	0.8	0.09	0.8	
		1.65		0.10	1.0	0.10	1.0	
		2.30		0.25	1.1	0.25	1.1	
		3.00		0.60	1.8	0.60	1.8	
V <sub>OH</sub>	HIGH Level Output Voltage	0.90	I <sub>OH</sub> = -20μA	V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1		V
		1.10 ≤ V <sub>CC</sub> ≤ 1.30		V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1		
		1.40 ≤ V <sub>CC</sub> ≤ 1.60		V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1		
		1.65 ≤ V <sub>CC</sub> ≤ 1.95		V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1		
		2.30 ≤ V <sub>CC</sub> < 2.70		V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1		
		3.00 ≤ V <sub>CC</sub> ≤ 3.60		V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1		
		1.10 ≤ V <sub>CC</sub> ≤ 1.30	I <sub>OH</sub> = -0.5mA	0.75 x V <sub>CC</sub>		0.70 x V <sub>CC</sub>		
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	I <sub>OH</sub> = -1.0mA	1.07		0.99		
		1.65 ≤ V <sub>CC</sub> ≤ 1.95	I <sub>OH</sub> = -1.5mA	1.24		1.22		
		2.30 ≤ V <sub>CC</sub> < 2.70	I <sub>OH</sub> = -2.1mA	1.95		1.87		
		3.00 ≤ V <sub>CC</sub> < 3.60	I <sub>OH</sub> = -2.6mA	2.61		2.55		
V <sub>OL</sub>	LOW Level Output Voltage	0.90	I <sub>OL</sub> = 20μA			0.1		V
		1.10 ≤ V <sub>CC</sub> ≤ 1.30				0.1		
		1.40 ≤ V <sub>CC</sub> ≤ 1.60				0.1		
		1.65 ≤ V <sub>CC</sub> ≤ 1.95				0.1		
		2.30 ≤ V <sub>CC</sub> < 2.70				0.1		
		3.00 ≤ V <sub>CC</sub> ≤ 3.60				0.1		
		1.10 ≤ V <sub>CC</sub> ≤ 1.30	I <sub>OL</sub> = 0.5mA	0.30 x V <sub>CC</sub>		0.30 x V <sub>CC</sub>		
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	I <sub>OL</sub> = 1.0mA	0.31		0.37		
		1.65 ≤ V <sub>CC</sub> ≤ 1.95	I <sub>OL</sub> = 1.5mA	0.31		0.35		
		2.30 ≤ V <sub>CC</sub> < 2.70	I <sub>OL</sub> = 2.1mA	0.31		0.33		
		3.00 ≤ V <sub>CC</sub> < 3.60	I <sub>OL</sub> = 2.6mA	0.31		0.33		
I <sub>IN</sub>	Input Leakage Current	0.90 to 3.60	0 ≤ V <sub>I</sub> ≤ 3.6V	±0.1		±0.5		μA
I <sub>OFF</sub>	Power Off Leakage Current	0	0 ≤ (V <sub>I</sub> , V <sub>O</sub> ) ≤ 3.6V	0.5		0.5		μA
I <sub>CC</sub>	Quiescent Supply Current	0.90 to 3.60	V <sub>I</sub> = V <sub>CC</sub> or GND	0.9		0.9		μA

## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40°C to +85°C		Units	Figure Number
				Min.	Typ.	Max.	Min.	Max.		
t <sub>PHL</sub> , t <sub>PLH</sub>	Propagation Delay	0.90	C <sub>L</sub> = 10pF, R <sub>L</sub> = 1MΩ		66.0				ns	Figure 1 Figure 2
		1.10 ≤ V <sub>CC</sub> ≤ 1.30		3.5	24.0	34.5	3.0	41.6		
		1.40 ≤ V <sub>CC</sub> ≤ 1.60		2.5	7.0	14.8	2.0	15.0		
		1.65 ≤ V <sub>CC</sub> ≤ 1.95		2.0	6.0	12.0	1.5	12.2		
		2.30 ≤ V <sub>CC</sub> < 2.70		1.5	5.0	9.4	1.0	9.9		
		3.00 ≤ V <sub>CC</sub> ≤ 3.60		1.0	4.0	8.3	1.0	9.0		
		0.90	C <sub>L</sub> = 15pF, R <sub>L</sub> = 1MΩ		71.0				ns	Figure 1 Figure 2
		1.10 ≤ V <sub>CC</sub> ≤ 1.30		4.0	28.0	37.3	3.5	46.3		
		1.40 ≤ V <sub>CC</sub> ≤ 1.60		3.0	8.0	15.5	2.5	16.5		
		1.65 ≤ V <sub>CC</sub> ≤ 1.95		2.5	6.0	12.6	2.0	13.6		
		2.30 ≤ V <sub>CC</sub> < 2.70		2.0	5.0	9.9	1.5	10.8		
		3.00 ≤ V <sub>CC</sub> ≤ 3.60		1.5	4.0	8.7	1.0	9.5		
		0.90	C <sub>L</sub> = 30pF, R <sub>L</sub> = 1MΩ		76.0				ns	Figure 1 Figure 2
		1.10 ≤ V <sub>CC</sub> ≤ 1.30		5.0	31.0	39.3	4.0	49.7		
		1.40 ≤ V <sub>CC</sub> ≤ 1.60		4.0	9.0	17.8	3.5	18.2		
		1.65 ≤ V <sub>CC</sub> ≤ 1.95		3.0	7.0	14.4	2.0	15.9		
		2.30 ≤ V <sub>CC</sub> < 2.70		2.0	6.0	11.3	1.5	12.8		
		3.00 ≤ V <sub>CC</sub> ≤ 3.60		1.5	5.0	9.2	1.0	10.7		
C <sub>IN</sub>	Input Capacitance	0			2.0			pF		
C <sub>PD</sub>	Power Dissipation Capacitance	0.90 to 3.60	V <sub>I</sub> = 0V or V <sub>CC</sub> , f = 10MHz		8.0			pF		

## AC Loading and Waveforms

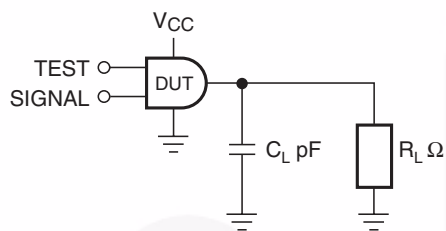


Figure 1. AC Test Circuit

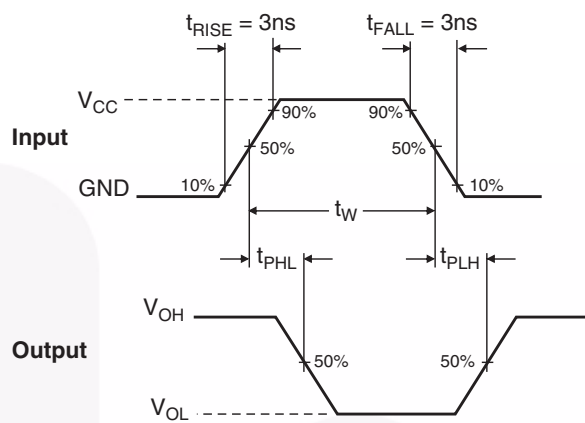


Figure 2. AC Waveforms

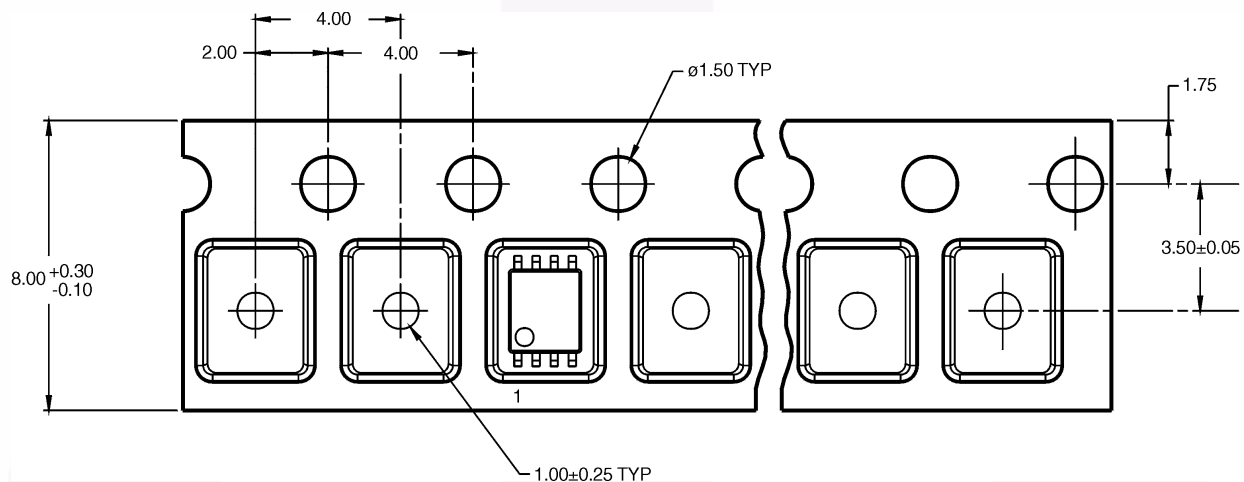
Symbol	$V_{CC}$					
	$3.3V \pm 0.3V$	$2.5V \pm 0.2V$	$1.8V \pm 0.15V$	$1.5V \pm 0.1V$	$1.2V \pm 0.1V$	$0.9V$
$V_{mi}$	1.5V	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$
$V_{mo}$	1.5V	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$

## Tape and Reel Specifications

### Tape Format for US8

Package Designator	Tape Section	Number of Cavities	Cavity Status	Cover Tape Status
K8X	Leader (Start End)	125 (typ.)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ.)	Empty	Sealed

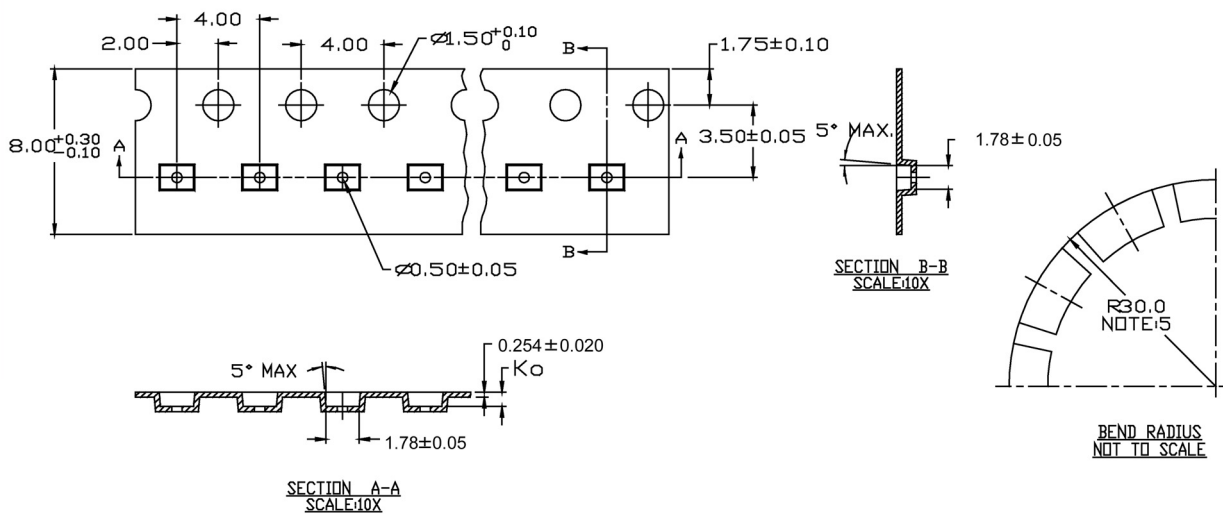
### Tape Dimensions inches (millimeters)



### Tape Format for MicroPak

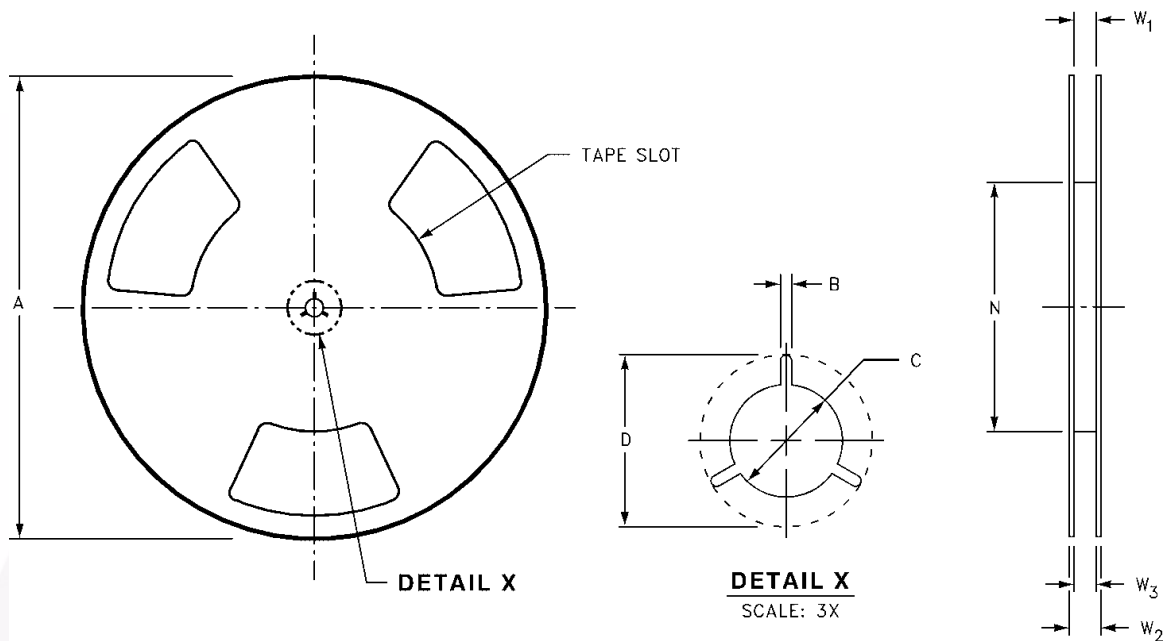
Package Designator	Tape Section	Number of Cavities	Cavity Status	Cover Tape Status
L8X	Leader (Start End)	125 (typ.)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ.)	Empty	Sealed

### Tape Dimensions inches (millimeters)



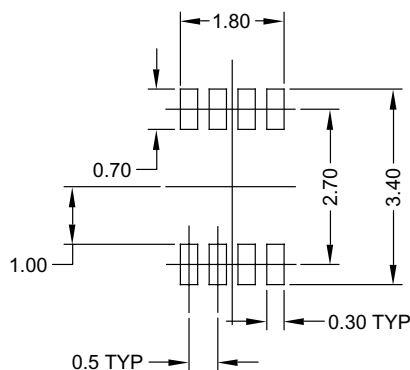
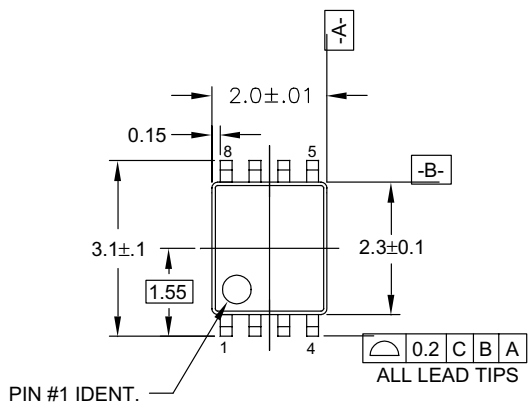
## Tape and Reel Specifications (Continued)

Reel Dimensions inches (millimeters)

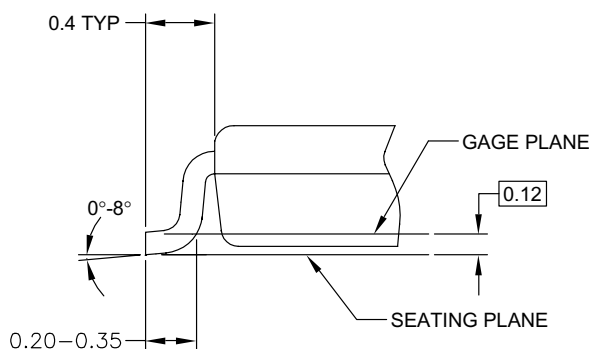
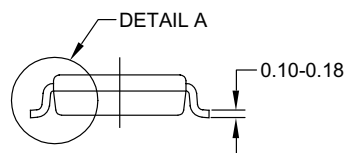
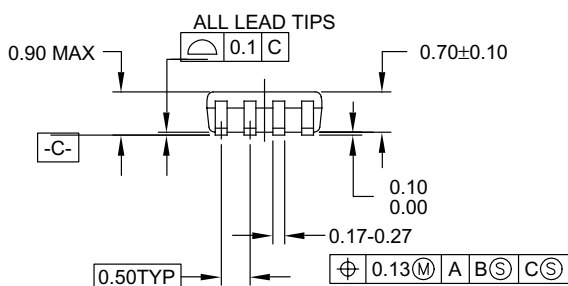


Tape Size	A	B	C	D	N	W1	W2	W3
8mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 +0.059/-0.000 (8.40 +1.50/-0.00)	0.567 (14.40)	W1 +0.078/-0.039 (W1 +2.00/-1.00)

## Physical Dimensions



## LAND PATTERN RECOMMENDATION



## DETAIL A

### 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, 1982.

MAB08AREVC

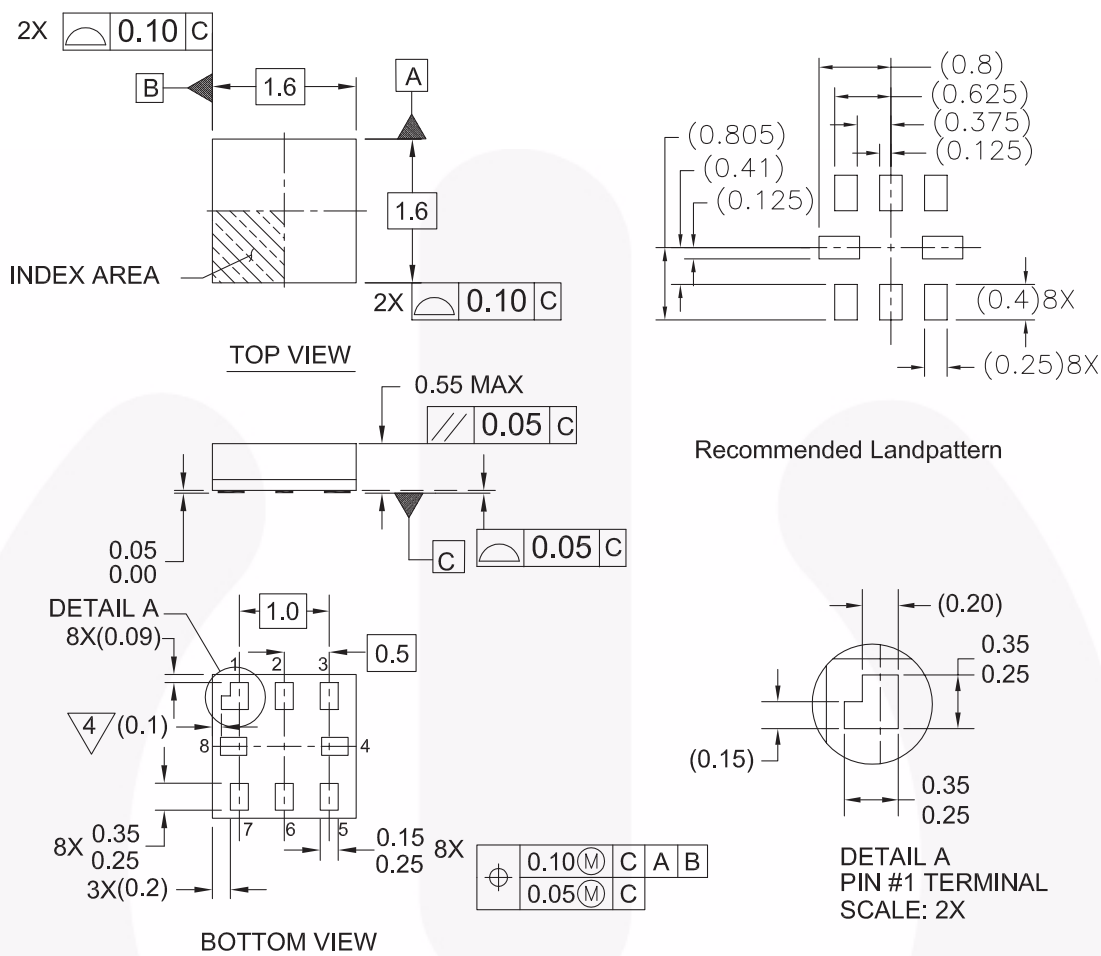
**Figure 3. 8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide**

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### Physical Dimensions (Continued)



**Notes:**

1. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y.14M-1994
4. PIN 1 FLAG, END OF PACKAGE OFFSET
5. DRAWING FILE NAME: MKT-MAC08AREV4

MAC08AREV4

**Figure 4. 8-Lead MicroPak, 1.6mm Wide**

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| CorePLUS™   | FRFET®  | Programmable Active Droop™  | the power franchise   |
| CorePOWER™  | Global Power Resource <sup>SM</sup>   | QFET®   | TinyBoost™  |
| CROSSVOLT™  | Green FPS™  | QS™   | TinyBuck™   |
| CTL™  | Green FPS™ e-Series™  | Quiet Series™   | TinyLogic®  |
| Current Transfer Logic™   | GTO™  | RapidConfigure™   | TINYOPTO™   |
| EcoSPARK®   | IntelliMAX™   |  ™ | TinyPower™  |
| EfficientMax™   | ISOPLANAR™  | Saving our world, 1mW/W/kW at a time™   | TinyPWM™  |
| EZSWITCH™ *   | MegaBuck™   | SmartMax™   | TinyWire™   |
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