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FAIRCHILD SEMICONDUCTOR®

September 2008

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}):
  - ±2.6mA @ 3.00V V_{CC}
  - ±2.1mA @ 2.30V V_{CC}
  - ±1.5mA @ 1.65V V_{CC}
  - ±1.0mA @ 1.40V V_{CC}
  - ±0.5mA @ 1.10V V_{CC}
  - ±20µA @ 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.

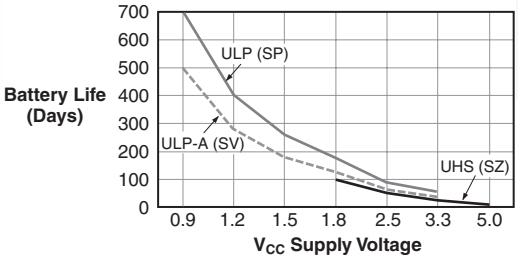
Ordering Information

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.

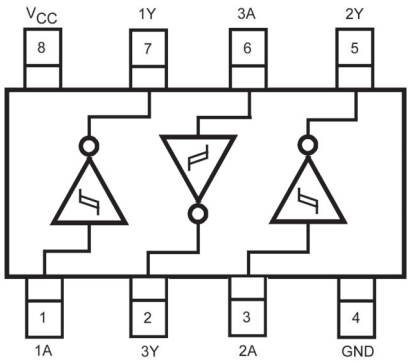
Battery Life = $(V_{battery} \times I_{battery} \times 0.9) / (P_{device}) / 24hrs/day$

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

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

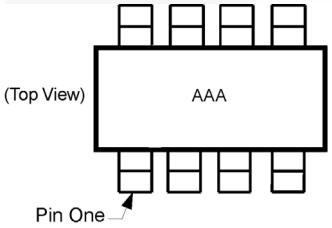
Connection Diagrams

Pin Assignments for US8



(**Top View**)

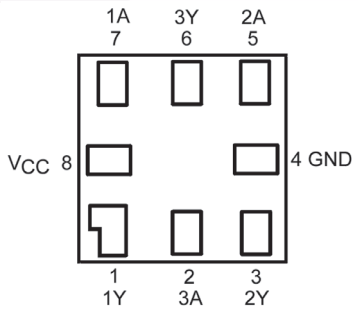
Pin One Orientation Diagram



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).

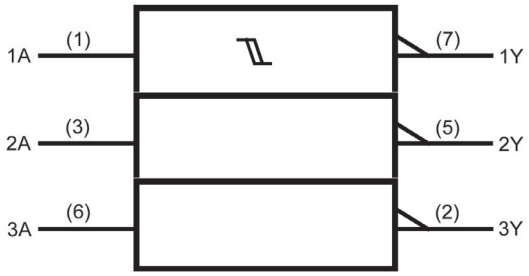
Pad Assignments for MicroPak



(Top Thru View)

Logic Symbol

IEEE/IEC



Function Table

$Y = \overline{A}$

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(1) 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(2)

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
θ_{JA}	Thermal Resistance US8 Micropak-8	 265°C/W 395°C/W

Notes:

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

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C		T_A = –40°C to +85°C		Units
				Min.	Max.	Min.	Max.	
V_P	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_N	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_H	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_{OH}	HIGH Level Output Voltage	0.90	I_{OH} = –20µA	V_{CC} – 0.1		V_{CC} – 0.1		V
		1.10 ≤ V_{CC} ≤ 1.30		V_{CC} – 0.1		V_{CC} – 0.1		
		1.40 ≤ V_{CC} ≤ 1.60		V_{CC} – 0.1		V_{CC} – 0.1		
		1.65 ≤ V_{CC} ≤ 1.95		V_{CC} – 0.1		V_{CC} – 0.1		
		2.30 ≤ V_{CC} < 2.70		V_{CC} – 0.1		V_{CC} – 0.1		
		3.00 ≤ V_{CC} ≤ 3.60		V_{CC} – 0.1		V_{CC} – 0.1		
		1.10 ≤ V_{CC} ≤ 1.30	I_{OH} = –0.5mA	0.75 x V_{CC}		0.70 x V_{CC}		
		1.40 ≤ V_{CC} ≤ 1.60	I_{OH} = –1.0mA	1.07		0.99		
		1.65 ≤ V_{CC} ≤ 1.95	I_{OH} = –1.5mA	1.24		1.22		
		2.30 ≤ V_{CC} < 2.70	I_{OH} = –2.1mA	1.95		1.87		
		3.00 ≤ V_{CC} < 3.60	I_{OH} = –2.6mA	2.61		2.55		
V_{OL}	LOW Level Output Voltage	0.90	I_{OL} = 20µA		0.1		0.1	V
		1.10 ≤ V_{CC} ≤ 1.30			0.1		0.1	
		1.40 ≤ V_{CC} ≤ 1.60			0.1		0.1	
		1.65 ≤ V_{CC} ≤ 1.95			0.1		0.1	
		2.30 ≤ V_{CC} < 2.70			0.1		0.1	
		3.00 ≤ V_{CC} ≤ 3.60			0.1		0.1	
		1.10 ≤ V_{CC} ≤ 1.30	I_{OL} = 0.5mA		0.30 x V_{CC}		0.30 x V_{CC}	
		1.40 ≤ V_{CC} ≤ 1.60	I_{OL} = 1.0mA		0.31		0.37	
		1.65 ≤ V_{CC} ≤ 1.95	I_{OL} = 1.5mA		0.31		0.35	
		2.30 ≤ V_{CC} < 2.70	I_{OL} = 2.1mA		0.31		0.33	
		3.00 ≤ V_{CC} < 3.60	I_{OL} = 2.6mA		0.31		0.33	
I_{IN}	Input Leakage Current	0.90 to 3.60	0 ≤ V_I ≤ 3.6V		±0.1		±0.5	µA
I_{OFF}	Power Off Leakage Current	0	0 ≤ (V_I, V_O) ≤ 3.6V		0.5		0.5	µA
I_{CC}	Quiescent Supply Current	0.90 to 3.60	V_I = V_{CC} or GND		0.9		0.9	µA

AC Electrical Characteristics

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

AC Loading and Waveforms

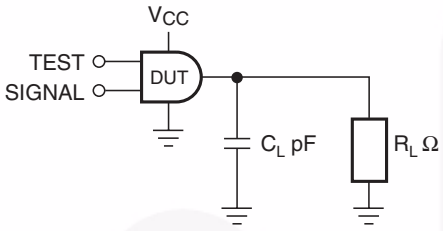


Figure 1. AC Test Circuit

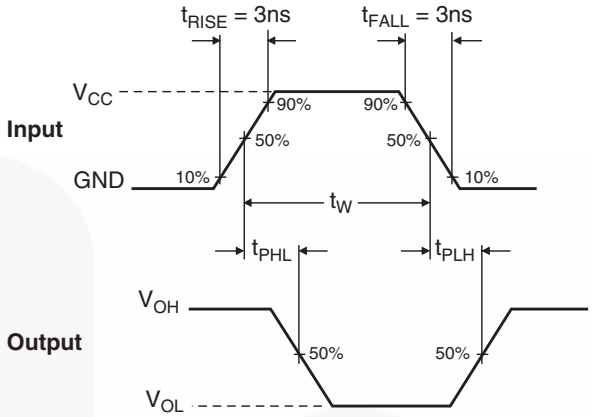


Figure 2. AC Waveforms

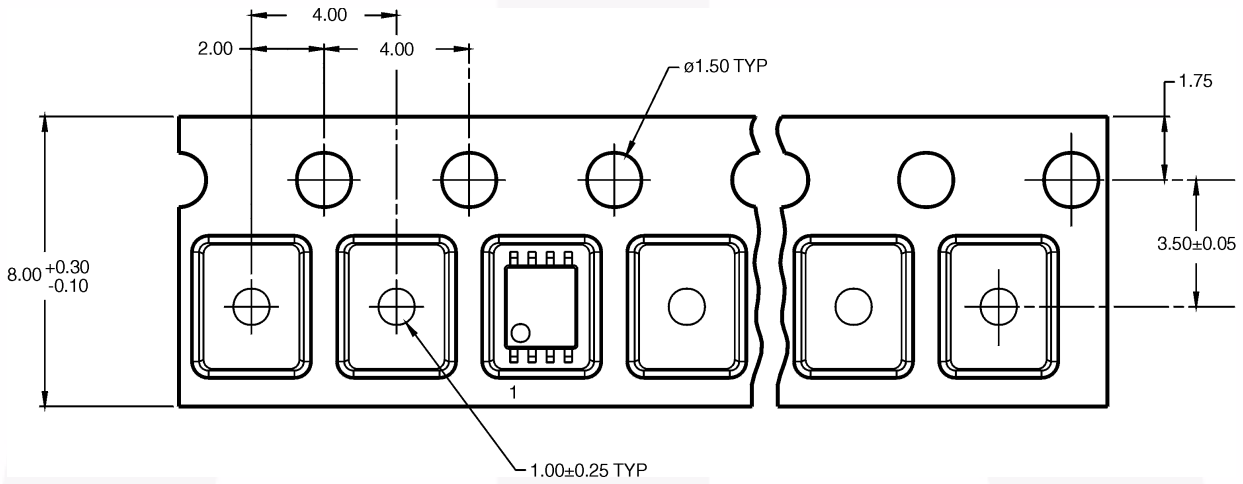
Symbol	V_{CC}					
	3.3V ± 0.3V	**2.5V ± 0.2V**	**1.8V ± 0.15V**	**1.5V ± 0.1V**	**1.2V ± 0.1V**	**0.9V**
V_{mi}	1.5V	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$
V_{mo}	1.5V	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$

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

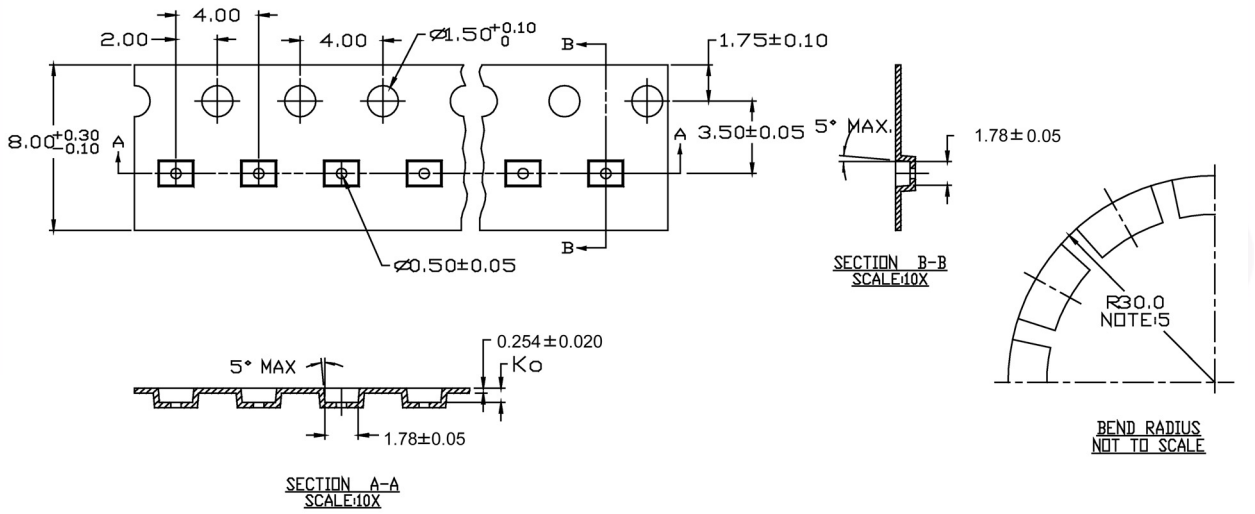
Tape Dimensions inches (millimeters)



Tape Format for MicroPak

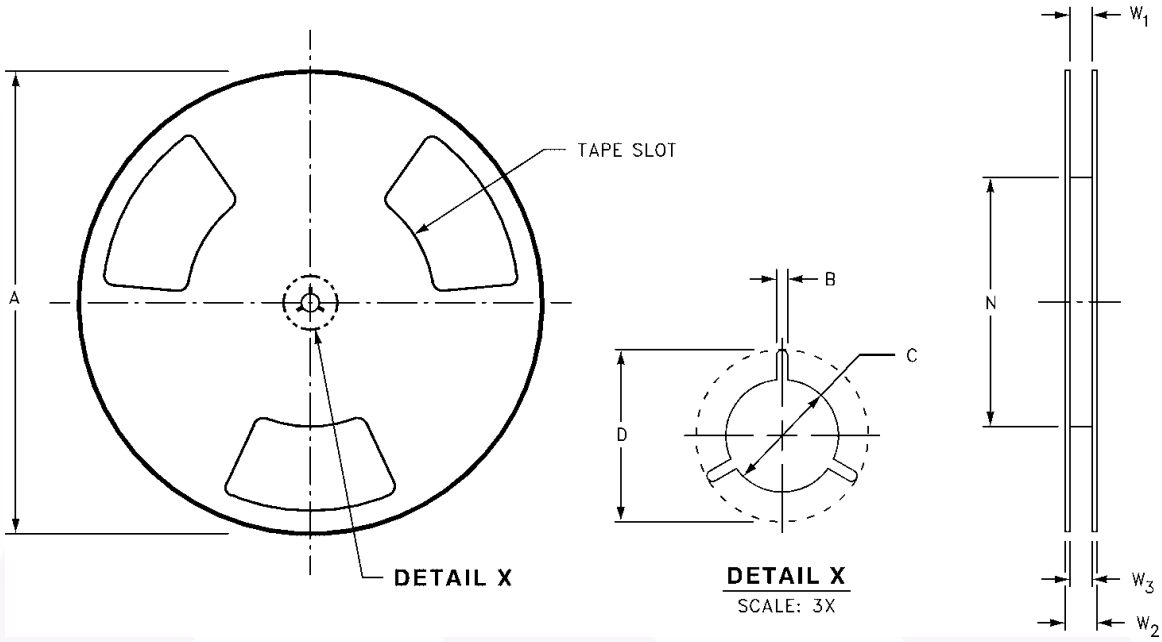
Package Designator	Tape Section	Number of Cavities	Cavity Status	Cover Tape Status
L8X	Leader (Start End)	125 (typ.)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ.)	Empty	Sealed

Tape Dimensions inches (millimeters)



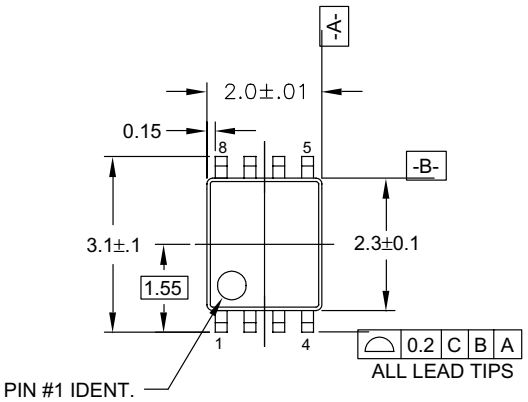
Tape and Reel Specifications (Continued)

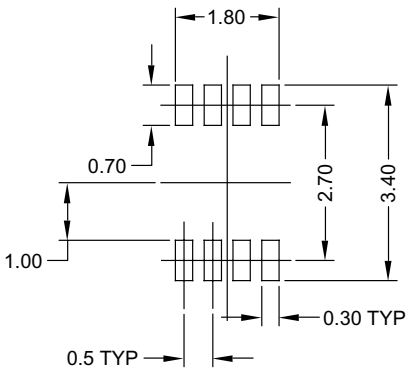
Reel Dimensions inches (millimeters)



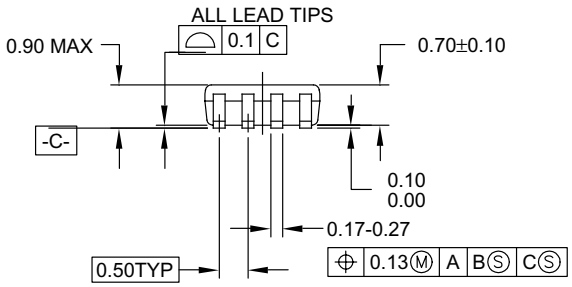
Tape Size	A	B	C	D	N	W1	W2	W3
8mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 +0.059/–0.000 (8.40 +1.50/–0.00)	0.567 (14.40)	W1 +0.078/–0.039 (W1 +2.00/–1.00)

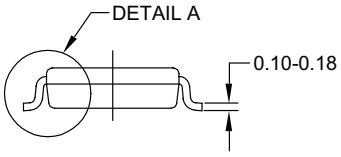
Physical Dimensions

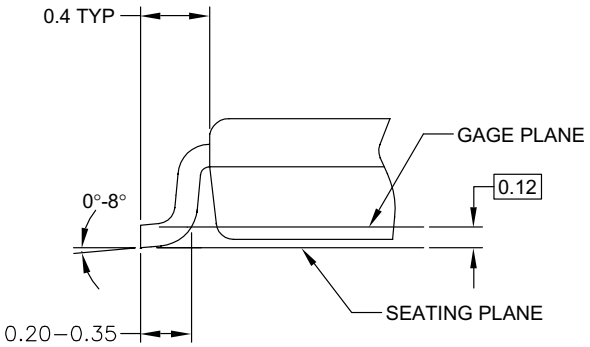




LAND PATTERN RECOMMENDATION







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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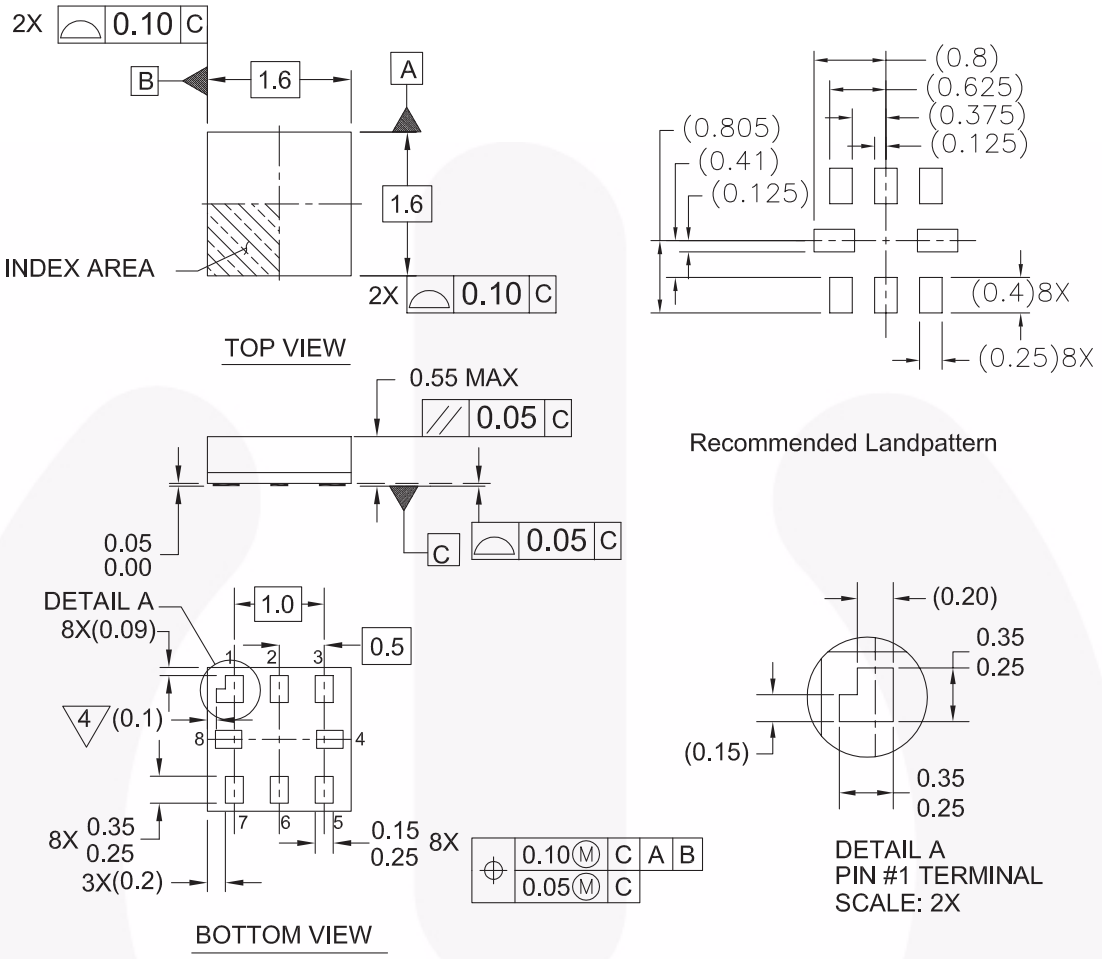
Physical Dimensions (Continued)



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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SuperSOT™-6
SuperSOT™-8
SupreMOS™
SyncFET™
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TinyBuck™
TinyLogic®
TINYOPTO™
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1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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