

NC7SZ86

TinyLogic® UHS 2-Input Exclusive-OR Gate

General Description

The NC7SZ86 is a single 2-Input Exclusive-OR Gate from Fairchild's Ultra High Speed Series of TinyLogic®. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a very broad V_{CC} operating range. The device is specified to operate over the 1.65V to 5.5V V_{CC} range. The inputs and output are high impedance when V_{CC} is 0V. Inputs tolerate voltages up to 6V independent of V_{CC} operating voltage.

Features

- Space saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ Pb-Free leadless package
- Ultra High Speed; t_{PD} 2.9 ns typ into 50 pF at 5V V_{CC}
- High Output Drive; ± 24 mA at 3V V_{CC}
- Broad V_{CC} Operating Range; 1.65V to 5.5V
- Matches the performance of LCX when operated at 3.3V
- Power down high impedance inputs/output
- Overvoltage tolerant inputs facilitate 5V to 3V translation
- Patented noise/EMI reduction circuitry implemented

Ordering Code:

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7SZ86M5X	MA05B	7Z86	5-Lead SOT23, JEDEC MO-178, 1.6mm	3k Units on Tape and Reel
NC7SZ86M5X_NL	MA05B	7Z86	Pb-Free 5-Lead SOT23, JEDEC MO-178, 1.6mm	3k Units on Tape and Reel
NC7SZ86P5X	MAA05A	Z86	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
NC7SZ86P5_NL (Note 1)	MAA05A	Z86	Pb-Free 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
NC7SZ86P5X_NL (Note 2)	MAA05A	Z86	Pb-Free 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
NC7SZ86L6X	MAC06A	B3	Pb-Free 6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

Pb-Free package per JEDEC J-STD-020B.

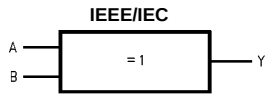
Note 1: "_NL" indicates lead-free product (per JEDEC J-STD-020B).

Note 2: "_NL" indicates lead-free product (per JEDEC J-STD-020B). Device is available in Tape and Reel only.

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NC7SZ86 TinyLogic® UHS 2-Input Exclusive-OR Gate

Logic Symbol



Pin Descriptions

Pin Names	Description
A, B	Input
Y	Output
NC	No Connect

Function Table

$Y = A \oplus B$

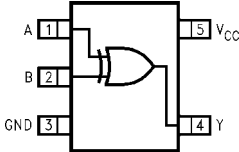
Inputs		Output
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

H = HIGH Logic Level

L = LOW Logic Level

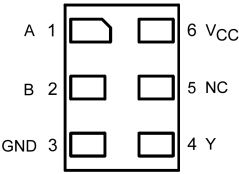
Connection Diagrams

Pin Assignments for SC70 and SOT23



(Top View)

Pad Assignments for MicroPak



(Top Thru View)

Absolute Maximum Ratings(Note 3)

Supply Voltage (V_{CC})	-0.5V to +6V
DC Input Voltage (V_{IN})	-0.5V to +6V
DC Output Voltage (V_{OUT})	-0.5V to +6V
DC Input Diode Current (I_{IK})	
@ $V_{IN} < -0.5V$	-50 mA
@ $V_{IN} > 6V$	+20 mA
DC Output Diode Current (I_{OK})	
@ $V_{OUT} < -0.5V$	-50 mA
@ $V_{OUT} > 6V$, $V_{CC} = GND$	+20 mA
DC Output Current (I_{OUT})	± 50 mA
DC V_{CC}/GND Current (I_{CC}/I_{GND})	± 50 mA
Storage Temperature (T_{STG})	-65°C to +150°C
Junction Temperature under Bias (T_J)	150°C
Junction Lead Temperature (T_L); (Soldering, 10 seconds)	260°C
Power Dissipation (P_D) @ +85°C	
SOT23-5	200 mW
SC70-5	150 mW

Recommended Operating Conditions (Note 4)

Supply Voltage Operating (V_{CC})	1.65V to 5.5V
Supply Voltage Data Retention (V_{CC})	1.5V to 5.5V
Input Voltage (V_{IN})	0V to 5.5V
Output Voltage (V_{OUT})	0V to V_{CC}
Operating Temperature (T_A)	-40°C to +85°C
Input Rise and Fall Time (t_r , t_f)	
$V_{CC} = 1.8V$, $2.5V \pm 0.2V$	0 ns/V to 20 ns/V
$V_{CC} = 3.3V \pm 0.3V$	0 ns/V to 10 ns/V
$V_{CC} = 5.0V \pm 0.5V$	0 ns/V to 5 ns/V
Thermal Resistance (θ_{JA})	
SOT23-5	300°C/W
SC70-5	425°C/W

Note 3: Absolute maximum ratings are DC values beyond which the device may be damaged or have its useful life impaired. The datasheet specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside datasheet specifications.

Note 4: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	V _{CC} (V)	T _A = +25°C			T _A = -40°C to +85°C		Units	Conditions	
			Min	Typ	Max	Min	Max			
V _{IH}	HIGH Level Input Voltage	1.65 to 1.95 2.3 to 5.5	0.75 V _{CC} 0.7 V _{CC}			0.75 V _{CC} 0.7 V _{CC}		V		
V _{IL}	LOW Level Input Voltage	1.65 to 1.95 2.3 to 5.5	0.25 V _{CC} 0.3 V _{CC}			0.25 V _{CC} 0.3 V _{CC}		V		
V _{OH}	HIGH Level Output Voltage	1.65	1.55	1.65	1.55		V	V _{IN} = V _{IH} , V _{IL}	I _{OH} = -100 μA	
		1.8	1.7	1.8	1.7					
		2.3	2.2	2.3	2.2					
		3.0	2.9	3.0	2.9					
		4.5	4.4	4.5	4.4					
		1.65	1.29	1.52	1.29		V		I _{OH} = -4 mA I _{OH} = -8 mA I _{OH} = -16 mA I _{OH} = -24 mA I _{OH} = -32 mA	
		2.3	1.9	2.15	1.9					
		3.0	2.4	2.80	2.4					
		3.0	2.3	2.68	2.3					
		4.5	3.8	4.20	3.8					
V _{OL}	LOW Level Output Voltage	1.65	0.0		0.1	0.1		V	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 100 μA
		1.8	0.0		0.1	0.1				
		2.3	0.0		0.1	0.1				
		3.0	0.0		0.1	0.1				
		4.5	0.0		0.1	0.1				
		1.65	0.08		0.24	0.24		V		I _{OL} = 4 mA I _{OL} = 8 mA I _{OL} = 16 mA I _{OL} = 24 mA I _{OL} = 32 mA
		2.3	0.10		0.3	0.3				
		3.0	0.15		0.4	0.4				
		3.0	0.22		0.55	0.55				
		4.5	0.22		0.55	0.55				
I _{IN}	Input Leakage Current	0 to 5.5	±1			±10		μA	V _{IN} = 5.5V, GND	
I _{OFF}	Power Off Leakage Current	0.0	1			10		μA	V _{IN} or V _{OUT} = 5.5V	
I _{CC}	Quiescent Supply Current	1.65 to 5.5	2.0			20		μA	V _{IN} = 5.5V, GND	

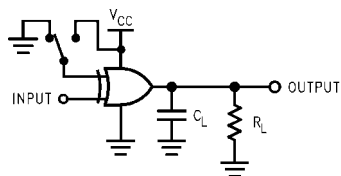
AC Electrical Characteristics

Symbol	Parameter	V _{CC} (V)	T _A = +25°C			T _A = -40°C to +85°C		Units	Conditions	Figure Number
			Min	Typ	Max	Min	Max			
t _{PLH} , t _{PHL}	Propagation Delay	1.65	2.0	6.9	13.8	2.0	14.5	ns	C _L = 15 pF, R _L = 1 MΩ	Figures 1, 3
		1.8	2.0	5.7	11.5	2.0	12			
		2.5 ± 0.2	0.8	3.8	8.0	0.8	8.5			
		3.3 ± 0.3	0.5	3.0	5.7	0.5	6.0			
		5.0 ± 0.5	0.5	2.4	5.0	0.5	5.4			
t _{PLH} , t _{PHL}	Propagation Delay	3.3 ± 0.3	1.5	3.5	6.2	1.5	6.5	ns	C _L = 50 pF, R _L = 500Ω	Figures 1, 3
C _{IN}	Input Capacitance	0		4				pF		
C _{PD}	Power Dissipation Capacitance	3.3		25				pF	(Note 5)	Figure 2
		5.0		31						

Note 5: C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 2.) C_{PD} is related to I_{CCD} dynamic operating current by the expression:

$$I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC} \text{ static})$$

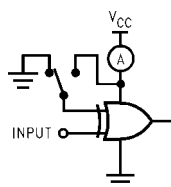
AC Loading and Waveforms



C_L includes load and stray capacitance

Input PRR = 1.0 MHz; t_w = 500 ns

FIGURE 1. AC Test Circuit



Input = AC Waveform; t_r = t_f = 1.8 ns;

PRR = 10 MHz; Duty Cycle = 50%

FIGURE 2. I_{CCD} Test Circuit

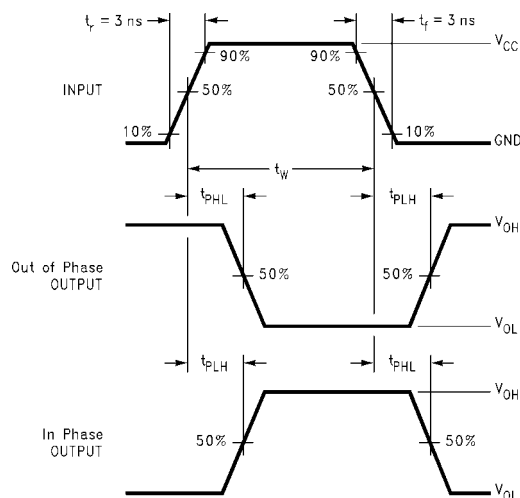


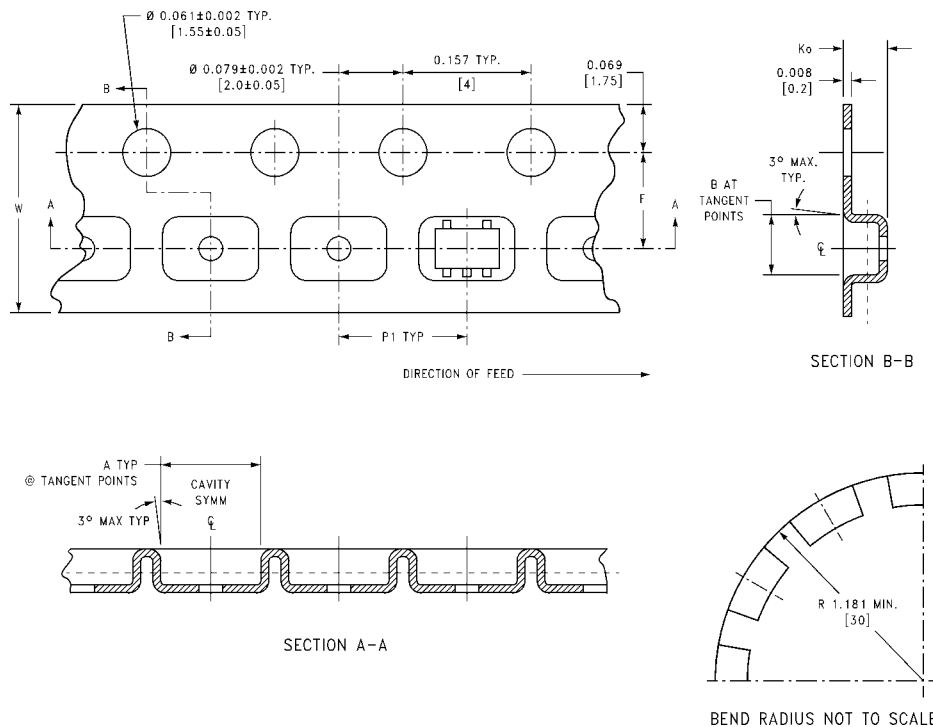
FIGURE 3. AC Waveforms

Tape and Reel Specification

TAPE FORMAT for SC70 and SOT23

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
M5X, P5X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

TAPE DIMENSIONS inches (millimeters)



Package	Tape Size	DIM A	DIM B	DIM F	DIM K ₀	DIM P1	DIM W
SC70-5	8 mm	0.093 (2.35)	0.096 (2.45)	0.138 ± 0.004 (3.5 ± 0.10)	0.053 ± 0.004 (1.35 ± 0.10)	0.157 (4)	0.315 ± 0.004 (8 ± 0.1)
SOT23-5	8 mm	0.130 (3.3)	0.130 (3.3)	0.138 ± 0.002 (3.5 ± 0.05)	0.055 ± 0.004 (1.4 ± 0.11)	0.157 (4)	0.315 ± 0.012 (8 ± 0.3)

Tape and Reel Specification (Continued)

TAPE FORMAT for MicroPak

Technical drawing of a mechanical part, showing front, top, and section views with dimensions and tolerances.

Front View: The main view of the part. It is a rectangular component with a central slot. The overall width is 8.00 (+0.30/-0.10). The distance from the left edge to the first hole center is 2.00. The distance between the first and second hole centers is 4.00. The distance between the second and third hole centers is 4.00. The distance from the third hole center to the right edge is 1.75 ± 0.10. The holes have a diameter of $\phi 1.50^{+0.10}_0$. The central slot has a width of $\phi 0.50 \pm 0.05$. The part is symmetrical about a vertical centerline. Section lines A-A and B-B are indicated.

Top View: Shows the part from above. The overall length is 3.50 ± 0.05. The distance from the front edge to the first hole center is 1.15 ± 0.05. The distance between the first and second hole centers is 1.60 ± 0.05. The distance between the second and third hole centers is 1.60 ± 0.05. The distance from the third hole center to the back edge is 0.254 ± 0.020. The part is symmetrical about a horizontal centerline. Section line A-A is indicated.

Section A-A: A cross-section view of the part. It shows a rectangular profile with a width of 1.60 ± 0.05. The top surface is flat. The bottom surface has a central slot with a width of $\phi 0.50 \pm 0.05$. The distance from the front edge to the first hole center is 1.15 ± 0.05. The distance between the first and second hole centers is 1.60 ± 0.05. The distance between the second and third hole centers is 1.60 ± 0.05. The distance from the third hole center to the back edge is 0.254 ± 0.020. The part is symmetrical about a horizontal centerline. Section line A-A is indicated.

Section B-B: A cross-section view of the part. It shows a rectangular profile with a width of 1.75 ± 0.10. The top surface is flat. The bottom surface has a central slot with a width of $\phi 0.50 \pm 0.05$. The distance from the front edge to the first hole center is 1.15 ± 0.05. The distance between the first and second hole centers is 1.60 ± 0.05. The distance between the second and third hole centers is 1.60 ± 0.05. The distance from the third hole center to the back edge is 0.254 ± 0.020. The part is symmetrical about a horizontal centerline. Section line B-B is indicated.

Dimensions and Tolerances:

- Overall width: 8.00 (+0.30/-0.10)
- Distance from left edge to first hole center: 2.00
- Distance between first and second hole centers: 4.00
- Distance between second and third hole centers: 4.00
- Distance from third hole center to right edge: 1.75 ± 0.10
- Hole diameter: $\phi 1.50^{+0.10}_0$
- Central slot width: $\phi 0.50 \pm 0.05$
- Overall length: 3.50 ± 0.05
- Distance from front edge to first hole center: 1.15 ± 0.05
- Distance between first and second hole centers: 1.60 ± 0.05
- Distance between second and third hole centers: 1.60 ± 0.05
- Distance from third hole center to back edge: 0.254 ± 0.020
- Section A-A width: 1.60 ± 0.05
- Section B-B width: 1.75 ± 0.10

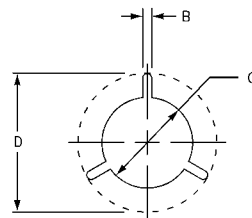
Section A-A
SCALE: 10X

Section B-B
SCALE: 10X

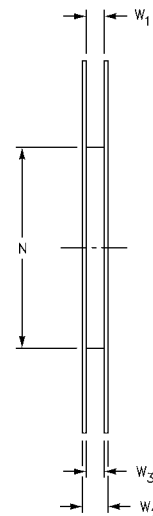
Technical drawing of a circular part. The drawing includes a front view and a detail view.

Front View: A circle with three trapezoidal slots arranged symmetrically. The total height is dimensioned as A . The height of one slot is dimensioned as D . The label "TAPE SLOT" points to one of the slots.

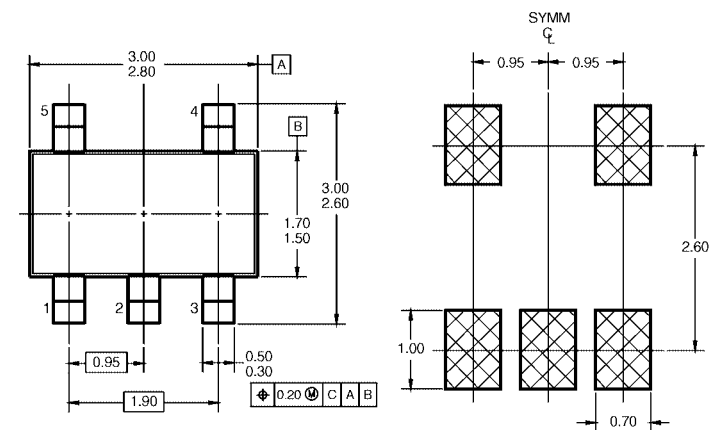
Detail View: A circular detail view of the central hole, labeled "DETAIL X".



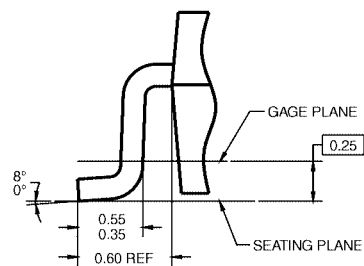
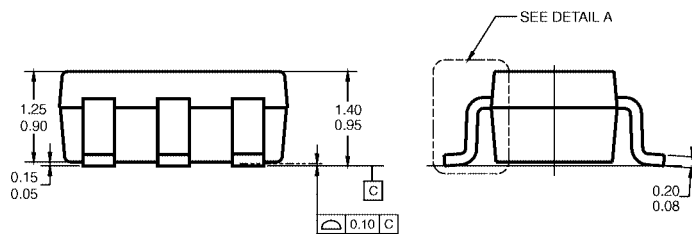
DETAIL X
SCALE: 3X

6

Physical Dimensions inches (millimeters) unless otherwise noted



LAND PATTERN RECOMMENDATION

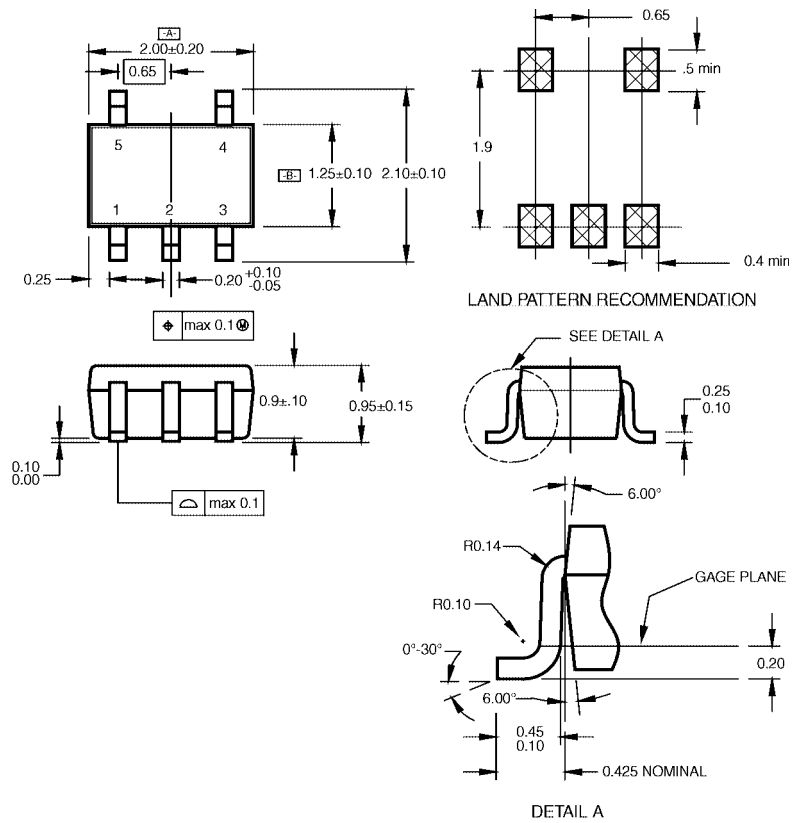


- NOTES: UNLESS OTHERWISE SPECIFIED
 A) THIS PACKAGE CONFORMS TO JEDEC MO-178, ISSUE B, VARIATION AA, DATED JANUARY 1999.
 B) ALL DIMENSIONS ARE IN MILLIMETERS.

MA05BRevC

**5-Lead SOT23, JEDEC MO-178, 1.6mm
 Package Number MA05B**

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



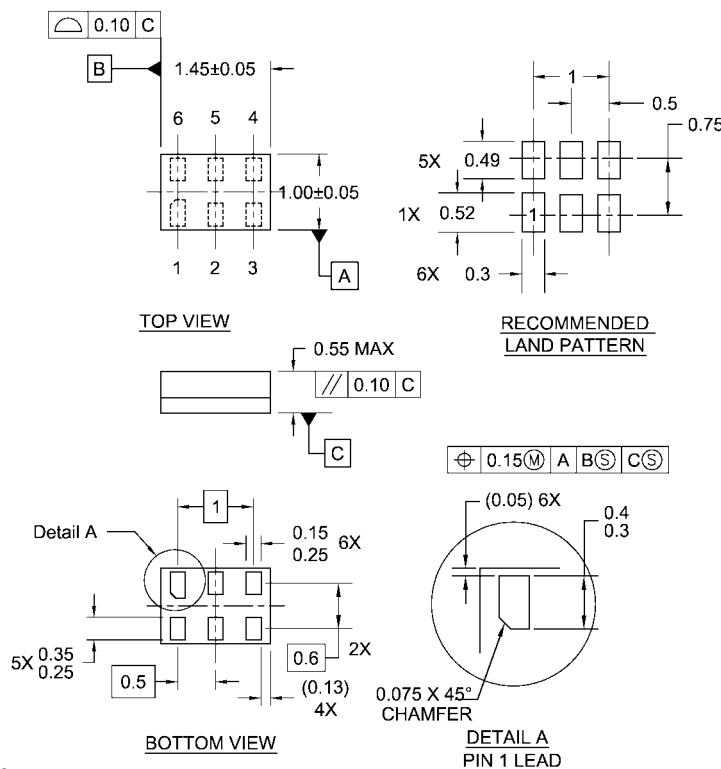
NOTES:

- A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88A.
- B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
- C. DIMENSIONS ARE IN MILLIMETERS.

MAA05ARevC

5-Lead SC70, EIAJ SC-88a, 1.25mm Wide
Package Number MAA05A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



Notes:

1. JEDEC PACKAGE REGISTRATION IS ANTICIPATED
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06ARevB

**Pb-Free 6-Lead MicroPak, 1.0mm Wide
Package Number MAC06A**

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