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FAIRCHILD
SEMICONDUCTOR ™

July 2002
Rev. 2, May 2004

NC7SVU04
TinyLogic® ULP-A Unbuffered Inverter

General Description

The NC7SVU04 is a single unbuffered inverter from Fairchild's Ultra Low Power-A (ULP-A) series of TinyLogic®. ULP-A is ideal for applications that require extreme high speed, high drive and low power. This product is designed for a wide low voltage operating range (0.9V to 3.6V V_{CC}) and applications that require more drive and speed than the TinyLogic ULP series, but still offer best in class low power operation.

The NC7SVU04 is uniquely designed for optimized power and speed, and is fabricated with an advanced CMOS technology to achieve high-speed operation while maintaining low CMOS power dissipation.

Features

■ 0.9V to 3.6V V_{CC} supply operation

■ 3.6V overvoltage tolerant I/O's at V_{CC} from .9V to 3.6

■ Extremely High Speed t_{PD}

  1.5 ns typ for 2.7V to 3.6V V_{CC}

  1.8 ns typ for 2.3V to 2.7V V_{CC}

  1.9 ns typ for 1.65 to 1.95V V_{CC}

  3.2 ns typ for 4V to 6V V_{CC}

  5.9 ns typ for 1. to 1. V

  1 0 ns V_{CC}

■ Power-On high impedance inputs and outputs

■ High tic ve (I_{OH}/I_{OL})

  ±24 mA @ 3.00V V_{CC}

  18 mA @ 2 30V V_{CC}

  ±6 mA @ 1.65V V_{CC}

  ±4 mA @ 1.4V V_{CC}

  ±2 mA @ 1.1 V V_{CC}

  ±20 µA @ 0.9V V_{CC}

■ Uses patented Quiet Series™ noise/EMI reduction circuitry

■ Ultra small MicroPak™ leadfree package

■ Ultra low dynamic power

Ordering Code:

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7SVU04P5X	MAA05A	VU4	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
NC7SVU04L6X	MAC06A	N4	6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

Battery Life vs. V_{CC} Supply Voltage
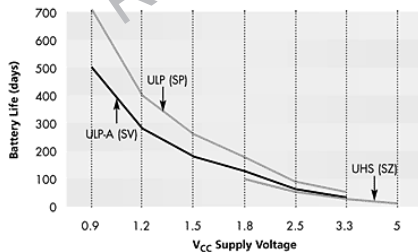
TinyLogic ULP and ULP-A with up to 50% less power consumption can extend your battery life significantly.

Battery Life = $(V_{battery} * I_{battery} * .9)/(P_{device})/24hrs/day$

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

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

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NC7SVU04

Logic Symbol

IEEE/IEC

A ──────[1]────▷── Y
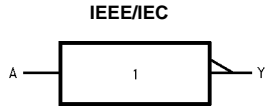
Pin Descriptions

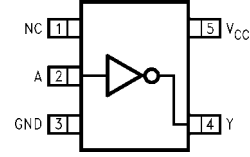| Pin Names	Description
A	Input
Y	Output
NC	No Connect

Function Table

$$Y = \overline{A}$$

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

H = HIGH Logic Level
L = LOW Logic Level

Connection Diagrams

Pin Assignment for SC70

NC [1]   [5] V$_{CC}$
A [2]   [4] Y
GND [3]

(Top View)

Pad Assignments for MicroPak

NC 1   V$_{CC}$
A 2   NC
GND   4 Y

(Top Thru View)

Absolute Maximum Ratings(Note 1)

Supply Voltage (V_{CC})	−0.5V to +4.6V
DC Input Voltage (V_{IN})	−0.5V to +4.6V
DC Output Voltage (V_{OUT})	
HIGH or LOW State (Note 2)	−0.5V to V_{CC} +0.5V
V_{CC} = 0V	−0.5V to +4.6V
DC Input Diode Current (I_{IK}) V_{IN} < 0V	±50 mA
DC Output Diode Current (I_{OK})	
V_{OUT} < 0V	−50 mA
V_{OUT} > V_{CC}	+50 mA
DC Output Source/Sink Current (I_{OH}/I_{OL})	± 50 mA
DC V_{CC} or Ground Current per	
Supply Pin (I_{CC} or Ground)	± 50 mA
Storage Temperature Range (T_{STG})	−65°C to +150°C

Recommended Operating Conditions (Note 3)

Supply Voltage	0.9V to 3.6V
Input Voltage (V_{IN})	0V to 3.6V
Output Voltage (V_{OUT})	
V_{CC} = 0.0V	0V to 3.6V
HIGH or LOW State	0V to V_{CC}
Output Current in I_{OH}/I_{OL}	
V_{CC} = 3.0V to 3.6V	+24 mA
V_{CC} = 2.3V to 2.7V	± mA
V_{CC} = 1.65V to 1.95V	±6
V_{CC} = 1.4V to 1.6V	±4
V_{CC} = 1.1V to 1.3V	mA
V_{CC} = 0.9V	±20 μA
Free Air Operating Temperature (T_A)	°C to 85°C
Minimum Input Edge Rate ($\Delta t/\Delta$	
V_{IN} = 0.8V to V, V_{C} = 3.0	10 ns/V

Note 1: Absolute Maximum Ratings are those values beyond which the safety of the device is not guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: I_O Absolute Maximum Rating must be observed.

Note 3: 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	Max	Min	Max			
V_{IH}	HIGH Level Input Voltage	0.90	0.8 x V_{CC}		0.8 x V_{CC}		V		
		1.10 ≤ V_{CC} ≤ 1.30	0.8 x V_{CC}		0.8 x V_{CC}				
		1.40 ≤ V_{CC} ≤ 1.60	0.8 x V_{CC}		0.8 x V_{CC}				
		1.65 ≤ V_{CC} ≤ 1.95	0.8 x V_{CC}		0.8 x V_{CC}				
		2.30 ≤ V_{CC} < 2.70	0.8 x V_{CC}		0.8 x V_{CC}				
		2.70 ≤ V_{CC} ≤ 3.60	0.8 x V_{CC}		0.8 x V_{CC}				
V_{IL}	LOW Level Input Voltage	0.90		0.2 x V_{CC}		0.2 x V_{CC}	V		
		1.10 ≤ V_{CC} ≤ 1.30		0.2 x V_{CC}		0.2 x V_{CC}			
		1.40 ≤ V_{CC} ≤ 1.60		0.2 x V_{CC}		0.2 x V_{CC}			
		1.65 ≤ V_{CC} ≤ 1.95		0.2 x V_{CC}		0.2 x V_{CC}			
		2.30 ≤ V_{CC} < 2.70		0.2 x V_{CC}		0.2 x V_{CC}			
		2.70 ≤ V_{CC} ≤ 3.60		0.2 x V_{CC}		0.2 x V_{CC}			
V_{OH}	HIGH Level Output Voltage	0.90	V_{CC} − 0.2		V_{CC} − 0.2		V	I_{OH} = −20 μA	
		1.10 ≤ V_{CC} ≤ 1.30	V_{CC} − 0.2		V_{CC} − 0.2				V_{IN} = V_{IH}
		1.40 ≤ V_{CC} ≤ 1.60	V_{CC} − 0.3		V_{CC} − 0.3			I_{OH} = −100 μA	
		1.65 ≤ V_{CC} ≤ 1.95	V_{CC} − 0.3		V_{CC} − 0.3				
		2.30 ≤ V_{CC} < 2.70	V_{CC} − 0.3		V_{CC} − 0.3				
		2.70 ≤ V_{CC} ≤ 3.60	V_{CC} − 0.3		V_{CC} − 0.3				
		1.10 ≤ V_{CC} ≤ 1.30	0.75 x V_{CC}		0.75 x V_{CC}		V	I_{OH} = −2 mA	V_{IN} = GND
		1.40 ≤ V_{CC} ≤ 1.60	0.75 x V_{CC}		0.75 x V_{CC}			I_{OH} = −4 mA	
		1.65 ≤ V_{CC} ≤ 1.95	1.25		1.25			I_{OH} = −6 mA	
		2.30 ≤ V_{CC} < 2.70	2.0		2.0				
		2.30 ≤ V_{CC} < 2.70	1.8		1.8			I_{OH} = −12 mA	
		2.70 ≤ V_{CC} ≤ 3.60	2.2		2.2				
		2.30 ≤ V_{CC} < 2.70	1.7		1.7			I_{OH} = −18 mA	
		2.70 ≤ V_{CC} ≤ 3.60	2.4		2.4				
		2.70 ≤ V_{CC} ≤ 3.60	2.2		2.2			I_{OH} = −24 mA	

DC Electrical Characteristics (Continued)

Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$ Min	$T_A = +25°C$ Max	$T_A = -40°C$ to $+85°C$ Min	$T_A = -40°C$ to $+85°C$ Max	Units	Conditions	
V_{OL}	LOW Level	0.90		0.1		0.1		$I_{OL} = 20$ μA	
	Output Voltage	$1.10 \le V_{CC} \le 1.30$		0.1		0.1			
		$1.40 \le V_{CC} \le 1.60$		0.2		0.2			$V_{IN} = V_{IL}$
		$1.65 \le V_{CC} \le 1.95$		0.2		0.2		$I_{OL} = 100$ μA	
		$2.30 \le V_{CC} < 2.70$		0.2		0.2			
		$2.70 \le V_{CC} \le 3.60$		0.2		0.2			
		$1.10 \le V_{CC} \le 1.30$		$0.25 \times V_{CC}$		$0.25 \times V_{CC}$	V	$I_{OL} = $	
		$1.40 \le V_{CC} \le 1.60$		$0.25 \times V_{CC}$		$0.25 \times V_{CC}$		$I_{OL} = $ mA	
		$1.65 \le V_{CC} \le 1.95$		0.3		0.3		$I_{OL} = 6$	
		$2.30 \le V_{CC} < 2.70$		0.4		0.4		$= 12$ mA	
		$2.70 \le V_{CC} \le 3.60$		0.4		0.4			
		$2.30 \le V_{CC} < 2.70$		0.6		0.6		$= 8$ mA	$V_{IN} = V_{CC}$
		$2.70 \le V_{CC} \le 3.60$		0.4		0.4			
		$2.70 \le V_{CC} \le 3.60$		0.55		55		$I_{OL} = 24$ mA	
I_{IN}	Input Leakage Current	0.90 to 3.60		±0.1			μA	$0 \le V_I \le 3.6V$	
I_{CC}	Quiescent Supply Current	0.90 to 3.60		0.9		0.9	μA	$V_I = V_{CC}$ or GND	
		0.90 to 3.60				±0.9		$V_{CC} \le V_I \le 3.6V$	

AC Electrical Characteristics

| Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$ Min	$T_A = +25°C$ Typ	$T_A = +25°C$ Max	$T_A = -40°C$ to $+85°C$ Min	$T_A = -40°C$ to $+85°C$ Max	Units	Conditions	Figure Number
t_{PHL}	Propagation Delay	0.90			12				$C_L = 15$ pF, $R_L = 1$ MΩ	
t_{PLH}		$1.10 \le V_{CC} \le 1.30$	2.0	5.9	10.0	1.0	14.7	ns	$C_L = 15$ pF, $R_L = 2$ kΩ	
		$1.40 \le V_{CC} \le 1.60$		3.2	6.7	0.9	7.0			Figures 1, 2
		$1.65 \le V_{CC} \le 1.95$	1.0	2.9	5.2	0.7	6.2		$C_L = 30$ pF	
		$2.30 \le V_{CC} < 2.70$	0.8	2.8	3.7	0.6	4.4		$R_L = 1$ kΩ	
		$2.70 \le V_{CC} \le 3.60$	0.7	1.5	3.3	0.5	3.8			
C_{IN}	Input Capacitance	0		2.0				pF		
C_{OUT}	Output Capacitance	0		5				pF		
C_{PD}	Power Dissipation Capacitance	0.90 to 3.60		10				pF	$V_I = 0V$ or V_{CC} $f = 10$ MHz	

AC Loading and Waveforms

FIGURE 1. AC Test Circuit
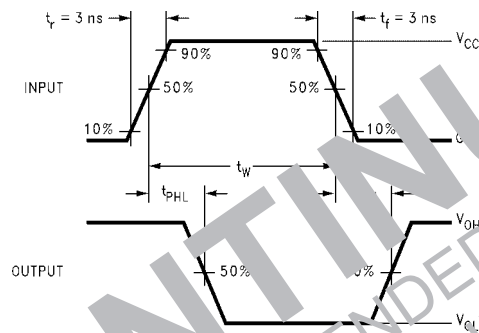
FIGURE 2. Waveform for Inverting and Non-Inverting Functions

| Symbol	V_CC					
	± 0.	2.5V ± 0.2V	1.8V ± 0.15V	1.5V ± 0.10V	1.2V ± 0.10V	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 Specification

TAPE FORMAT for SC70

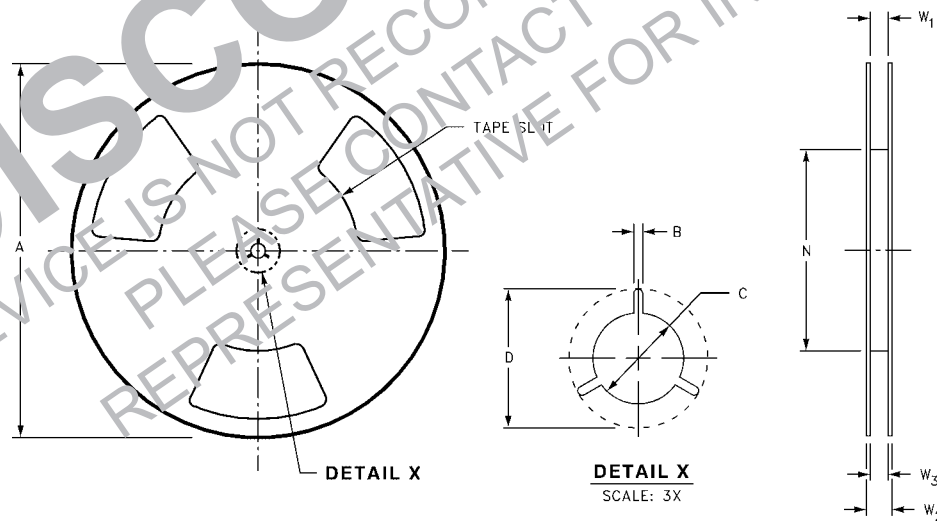| Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
	Leader (Start End)	125 (typ)	Empty	Sealed
P5X	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

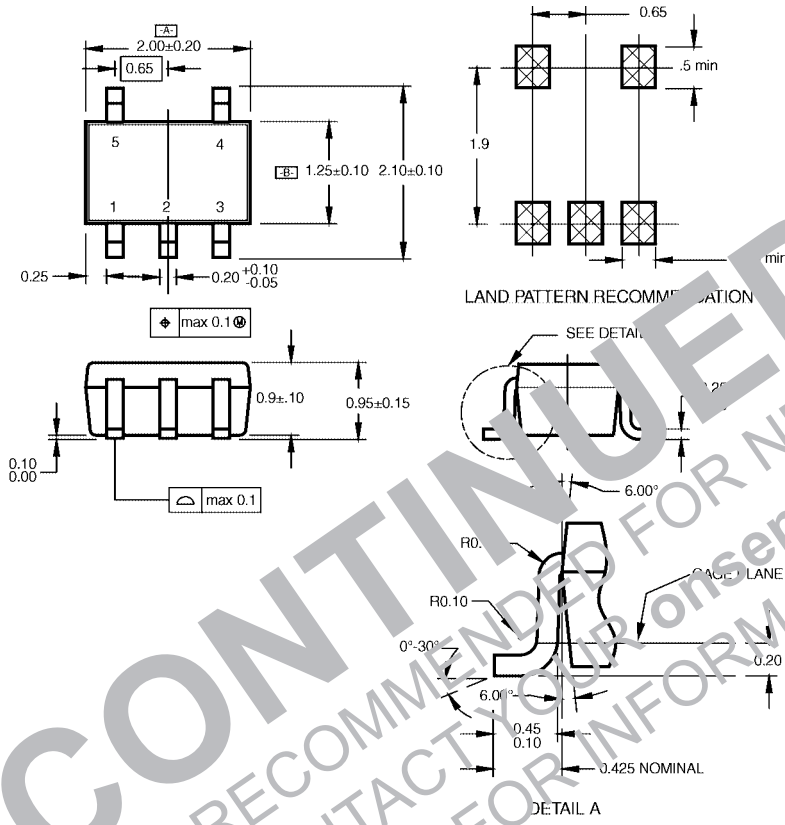**TAPE DIMENSIONS** inches (millimeters)

DIRECTION OF FEED

SECTION B-B

SECTION A-A

R 1.181 MIN.
[30]

BEND RADIUS NOT TO SCALE
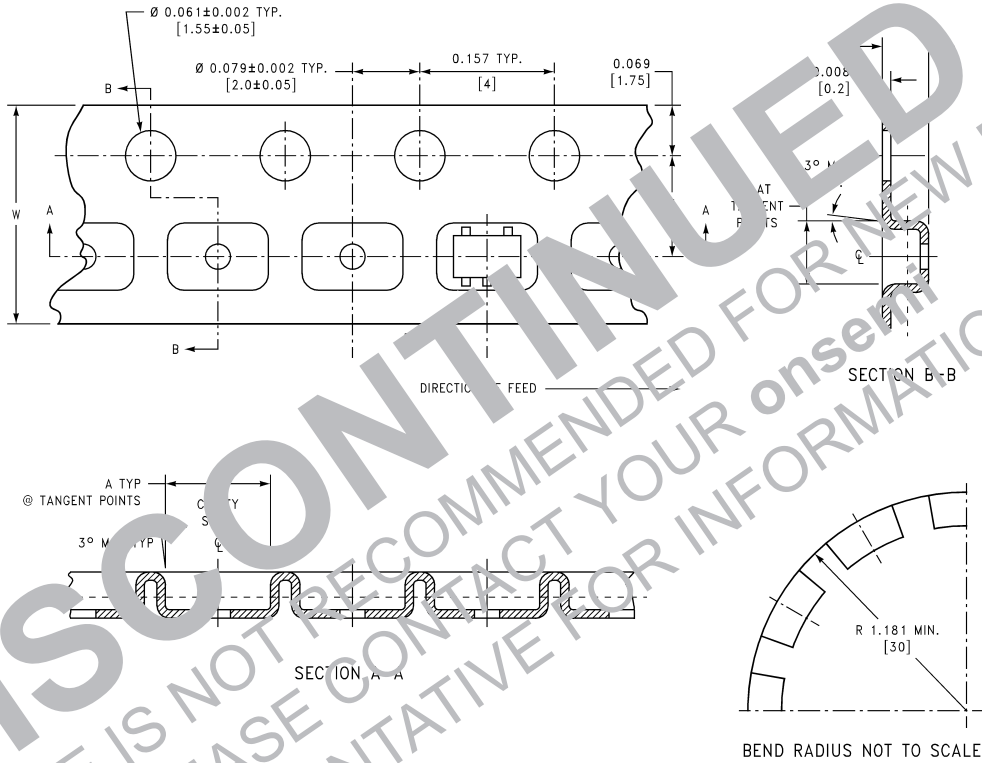
Tape and Reel Specification (Continued)

TAPE FORMAT for MicroPak

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
	Leader (Start End)	125 (typ)	Empty	Sealed
L6X	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

TAPE DIMENSIONS inches (millimeters)

DIRECTION OF FEED

SECTION B-B
SCALE 40X

SECTION A-A
SCALE 40X
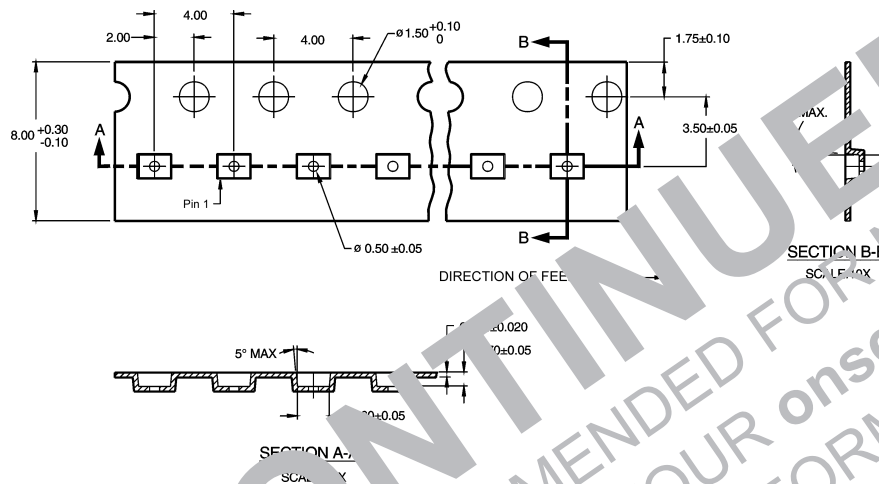
REEL DIMENSIONS inches (millimeters)

TAPE SLOT

DETAIL X

DETAIL X
SCALE: 3X

Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	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)

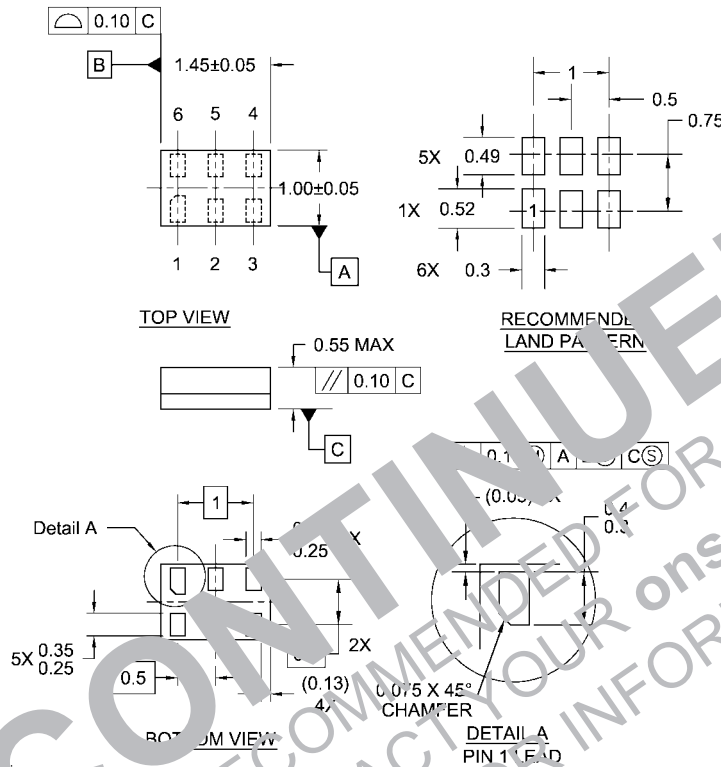**Physical Dimensions** inches (millimeters) unless otherwise noted

2.00±0.20

0.65

5   4

1.25±0.10   2.10±0.10

1   2   3

0.25

0.20 +0.10 −0.05

⊕ max 0.1 Ⓜ

0.65

.5 min

1.9

min

LAND PATTERN RECOMMENDATION

0.9±.10   0.95±0.15

0.10
0.00

△ max 0.1

SEE DETAIL

6.00°

R0.

GAUGE PLANE

R0.10

0°-30°

0.20

6.00°

0.45
0.10

0.425 NOMINAL

DETAIL A

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)

TOP VIEW

1.45±0.05

6 5 4

1.00±0.05

1 2 3

RECOMMENDED
LAND PATTERN

5X 0.49

1X 0.52

6X 0.3

0.55 MAX

Detail A

5X 0.35/0.25

0.5

BOTTOM VIEW

0.075 X 45°
CHAMFER

DETAIL A
PIN 1 LEAD

Notes:

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

MAC06ARevB

6-Lead MicroPak, 1.0mm Wide
Package Number MAC06A

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PUBLICATION ORDERING INFORMATION

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