



October 1996
Revised February 2005

NC7SZ04 TinyLogic® UHS Inverter

General Description

The NC7SZ04 is a single inverter 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} 2.4 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 V_{CC}
- 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
NC7SZ04M5X	MA05B	7Z04	5-Lead SOT23, JEDEC MO-178, 1.6mm	3k Units on Tape and Reel
NC7SZ04M5X_NL (Note 1)	MA05B	7Z04	Pb-Free 5-Lead SOT23, JEDEC MO-178, 1.6mm	3k Units on Tape and Reel
NC7SZ04P5X	MAA05A	Z04	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
NC7SZ04P5_NL (Note 2)	MAA05A	Z04	Pb-Free 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
NC7SZ04P5X_NL (Note 1)	MAA05A	Z04	Pb-Free 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
NC7SZ04L6X	MAC06A	CC	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 Pb-Free product (per JEDEC J-STD-020B). Device is available in Tape and Reel only.

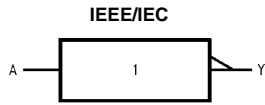
Note 2: "_NL" indicates Pb-Free product (per JEDEC J-STD-020B).

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MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

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Logic Symbol



Pin Descriptions

Pin Names	Description
A	Input
Y	Output
NC	No Connect

Function Table

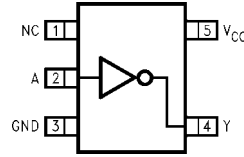
$$Y = \bar{A}$$

Input	Output
A	Y
L	H
H	L

H = HIGH Logic Level
L = LOW Logic Level

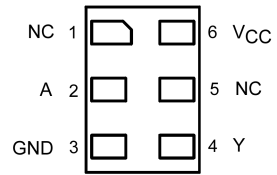
Connection Diagrams

Pin Assignments for SC70



(Top View)

Pad Assignments for MircoPak



(Top Thru View)

Absolute Maximum Ratings (Note 3)		Recommended Operating Conditions (Note 4)	
Supply Voltage (V_{CC})	-0.5V to +6V	Supply Voltage Operating (V_{CC})	1.65V to 5.5V
DC Input Voltage (V_{IN})	-0.5V to +6V	Supply Voltage Data Retention (V_{CC})	1.5V to 5.5V
DC Output Voltage (V_{OUT})	-0.5V to +6V	Input Voltage (V_{IN})	0V to 5.5V
DC Input Diode Current (I_{IK})		Output Voltage (V_{OUT})	0V to V_{CC}
@ $V_{IN} < -0.5V$	-50 mA	Operating Temperature (T_A)	-40°C to +85°C
@ $V_{IN} > 6V$	+20 mA	Input Rise and Fall Time (t_r, t_f)	
DC Output Diode Current (I_{OK})		$V_{CC} = 1.8V, 2.5V \pm 0.2V$	0 ns/V to 20 ns/V
@ $V_{OUT} < -0.5V$	-50 mA	$V_{CC} = 3.3V \pm 0.3V$	0 ns/V to 10 ns/V
@ $V_{OUT} > 6V, V_{CC} = GND$	+20 mA	$V_{CC} = 5.0V \pm 0.5V$	0 ns/V to 5 ns/V
DC Output Current (I_{OUT})	± 50 mA	Thermal Resistance (θ_{JA})	
DC V_{CC}/GND Current (I_{CC}/I_{GND})	± 50 mA	SOT23-5	300°C/W
Storage Temperature (T_{STG})	-65°C to +150°C	SC70-5	425°C/W
Junction Temperature under Bias (T_J)	150°C	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.	
Junction Lead Temperature (T_L)		Note 4: Unused inputs must be held HIGH or LOW. They may not float.	
(Soldering, 10 seconds)	260°C		
Power Dissipation (P_D) @ +85°C			
SOT23-5	200 mW		
SOT70-5	150 mW		

DC Electrical Characteristics

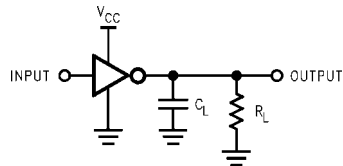
Symbol	Parameter	V_{CC} (V)	$T_A = +25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		Units	Conditions
			Min	Typ	Max	Min	Max		
V_{IH}	HIGH Level Input Voltage	1.65 to 1.95 2.3 to 5.5	0.75 V_{CC} 0.7 V_{CC}			0.75 V_{CC} 0.7 V_{CC}		V	
V_{IL}	LOW Level Input Voltage	1.65 to 1.95 2.3 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	1.7		V	$V_{IN} = V_{IL}$ $I_{OH} = -100 \mu\text{A}$	
		1.8	1.7	1.8	1.7				
V_{OH}	HIGH Level Output Voltage	2.3	2.2	2.3	2.2		V	$I_{OH} = -4 \text{ mA}$ $I_{OH} = -8 \text{ mA}$ $I_{OH} = -16 \text{ mA}$ $I_{OH} = -24 \text{ mA}$ $I_{OH} = -32 \text{ mA}$	
		3.0	2.9	3.0	2.9				
		4.5	4.4	4.5	4.4				
		1.65	1.29	1.52	1.29				
		2.3	1.9	2.15	1.9				
		3.0	2.4	2.80	2.4				
V_{OL}	LOW Level Output Voltage	3.0	2.3	2.68	2.3		V	$V_{IN} = V_{IH}$ $I_{OL} = 100 \mu\text{A}$	
		4.5	3.8	4.20	3.8				
		1.65	0.0		0.1				
		1.8	0.0		0.1				
		2.3	0.0		0.1				
		3.0	0.0		0.1				
V_{OL}	LOW Level Output Voltage	4.5	0.0		0.1		V	$I_{OL} = 4 \text{ mA}$ $I_{OL} = 8 \text{ mA}$ $I_{OL} = 16 \text{ mA}$ $I_{OL} = 24 \text{ mA}$ $I_{OL} = 32 \text{ mA}$	
		1.65	0.08		0.24				
		2.3	0.10		0.3				
		3.0	0.15		0.4				
		3.0	0.22		0.55				
		4.5	0.22		0.55				
I_{IN}	Input Leakage Current	0 to 5.5	± 1			± 10		μA	$0 \leq V_{IN} \leq 5.5V$
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	$V_{IN} = 5.5V, GND$

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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}	Propagation Delay	1.65	2.0	5.3	11.4	2.0	12.0	ns	C _L = 15 pF R _L = 1 MΩ	Figures 1, 3
t _{PHL}		1.8	2.0	4.4	9.5	2.0	10			
		2.5 ± 0.2	0.8	2.9	6.5	0.8	7.0			
		3.3 ± 0.3	0.5	2.1	4.5	0.5	4.7			
		5.0 ± 0.5	0.5	1.8	3.9	0.5	4.1			
t _{PLH}	Propagation Delay	3.3 ± 0.3	1.5	2.9	5.0	1.5	5.2	ns	C _L = 50 pF R _L = 500Ω	Figures 1, 3
t _{PHL}		5.0 ± 0.5	0.8	2.4	4.3	0.8	4.5			
C _{IN}	Input Capacitance	0	4					pF		
C _{PD}	Power Dissipation Capacitance	3.3	20					pF	(Note 5)	Figure 2
		5.0	26							

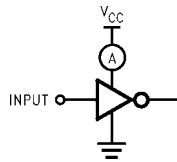
Note 5: C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 2.) C_{PD} is related to I_{CCD} dynamic operating current by the expression:
I_{CCD} =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

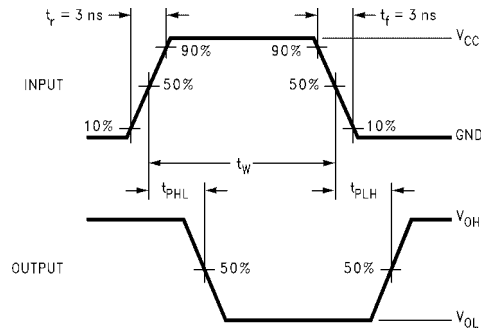
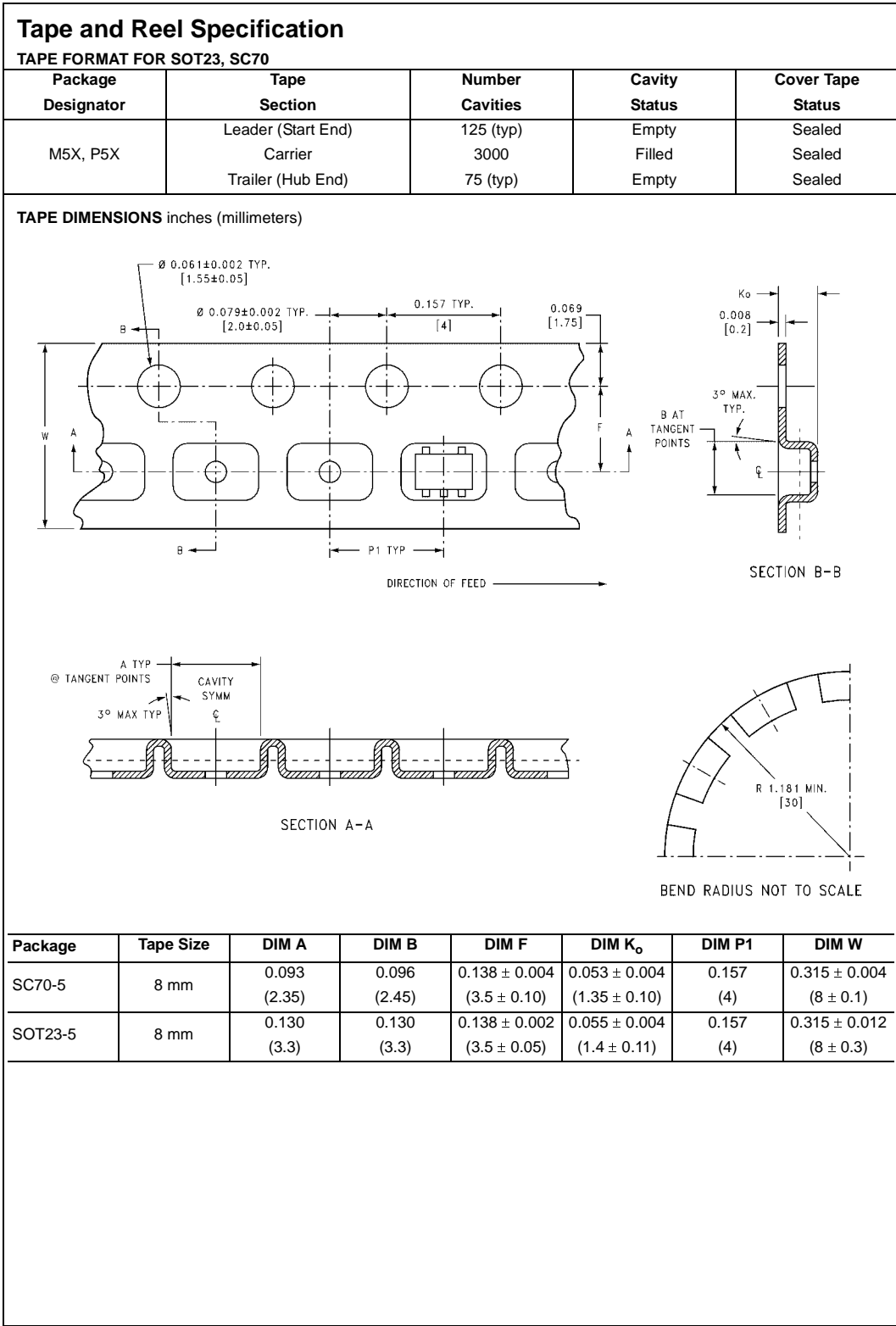


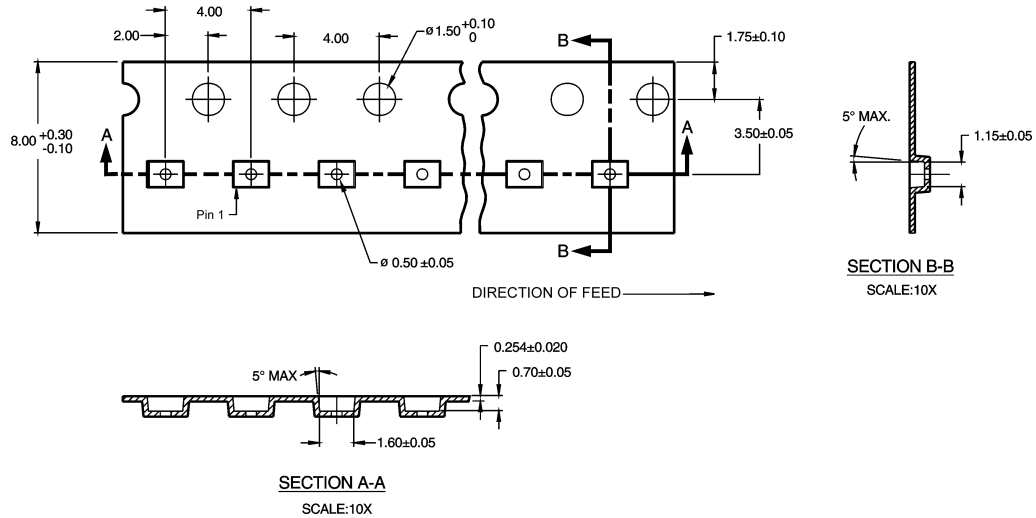
FIGURE 3. AC Waveforms



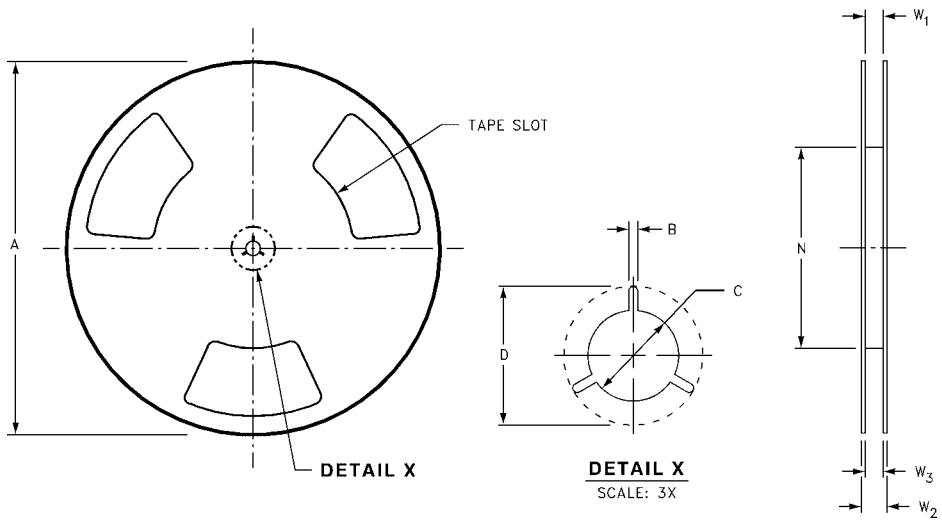
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Tape and Reel Specification (Continued)				
TAPE FORMAT FOR MicroPak				
Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
L6X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

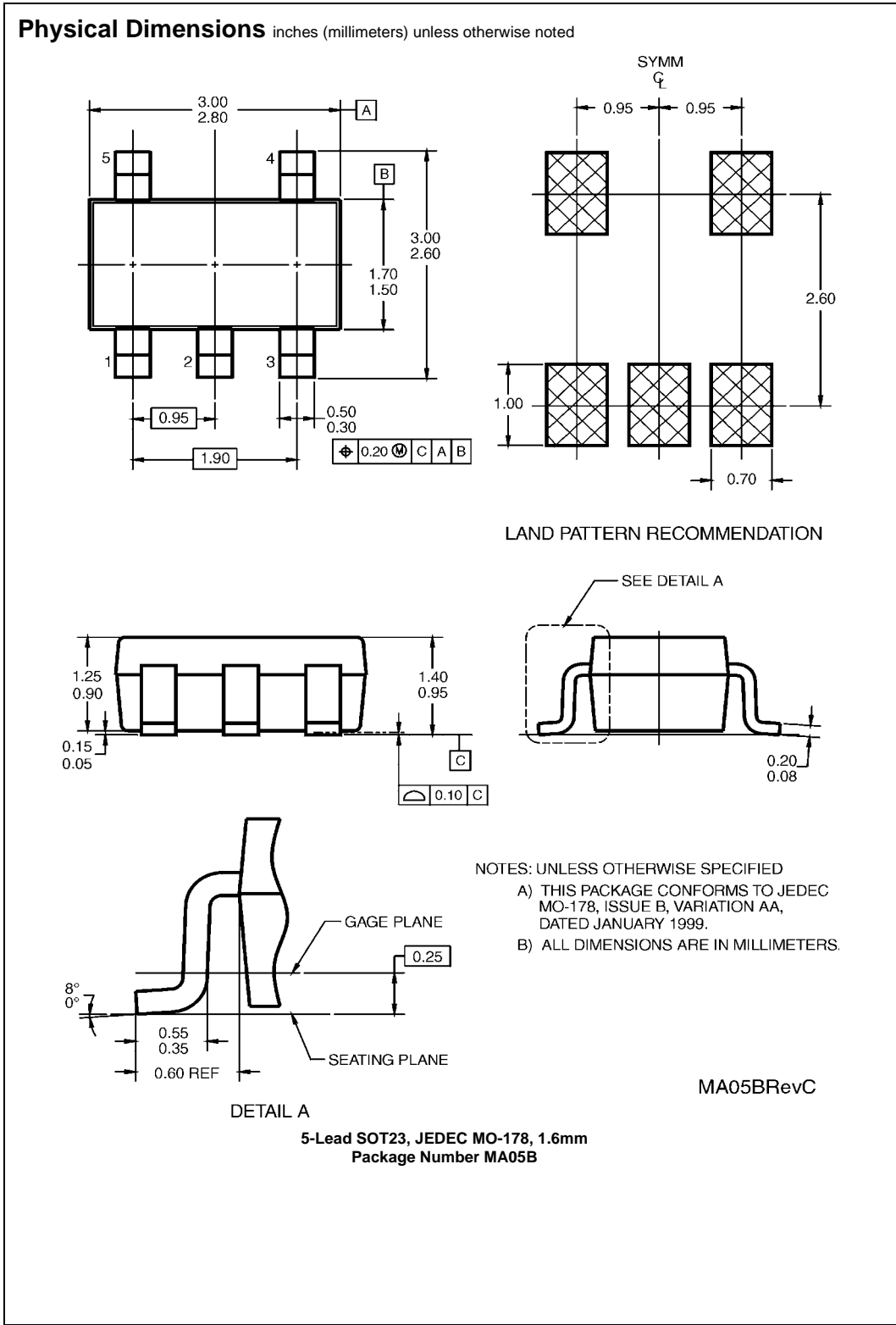
TAPE DIMENSIONS inches (millimeters)



REEL DIMENSIONS inches (millimeters)

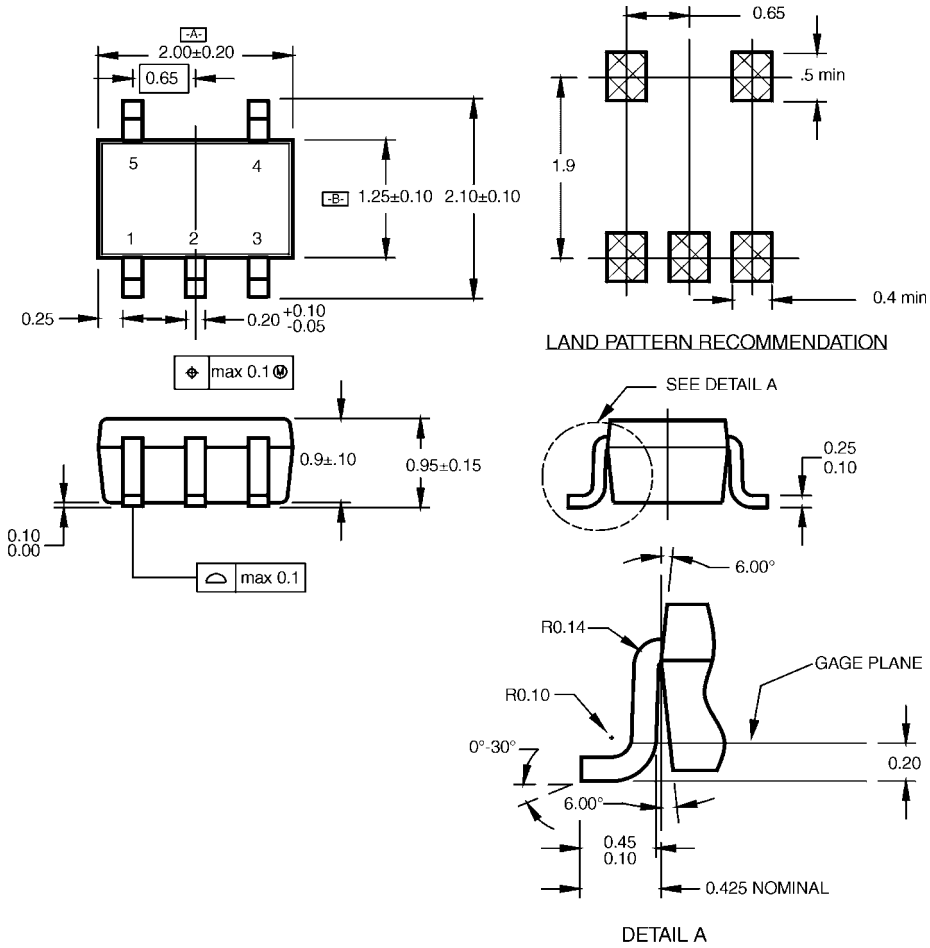


Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 + 0.059/-0.000 (8.40 + 1.50/-0.00)	0.567 (14.40)	W1 + 0.078/-0.039 (W1 + 2.00/-1.00)



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



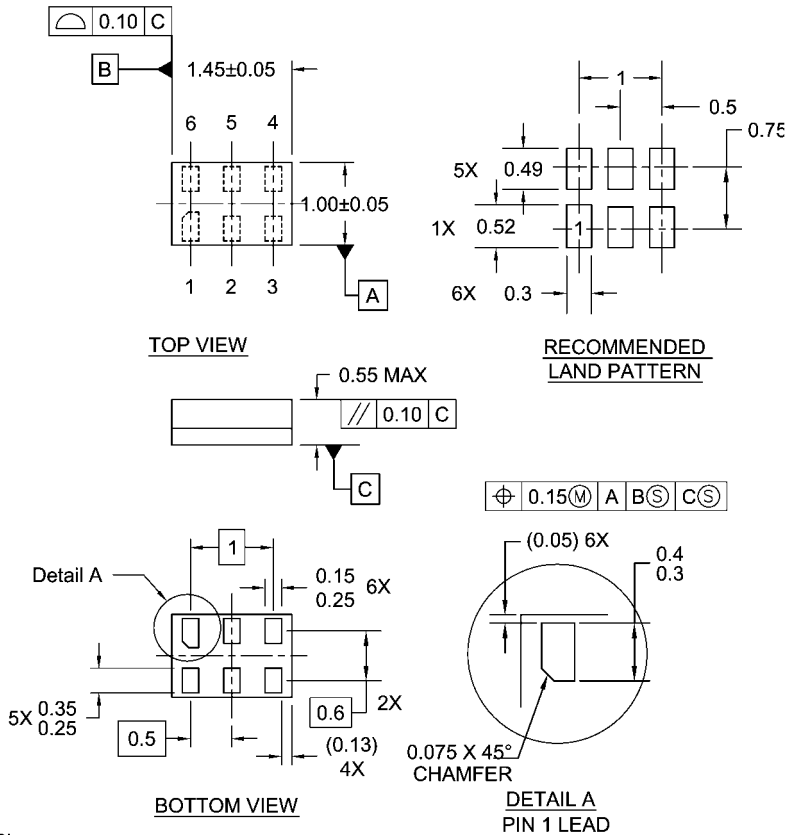
NOTES:

- 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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