

# NC7SZ04

## TinyLogic® UHS Inverter

### Features

- Space saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ leadless package
- Ultra High Speed;  $t_{PD}$  2.4ns typ. into 50pF at 5V  $V_{CC}$
- High Output Drive;  $\pm 24mA$  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


### 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.

### Ordering Information

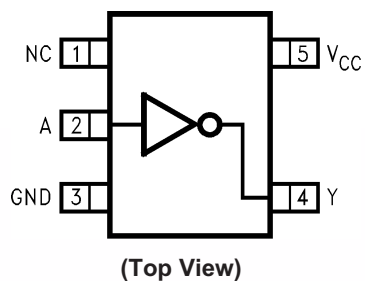
Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7SZ04M5X	MA05B	7Z04	5-Lead SOT23, JEDEC MO-178, 1.6mm	3k Units on Tape and Reel
NC7SZ04P5X	MAA05A	Z04	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
NC7SZ04L6X	MAC06A	CC	6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

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

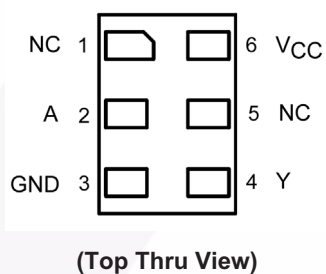
 All packages are lead free per JEDEC: J-STD-020B standard.

## Connection Diagram

Pin Assignments for SC70 and SOT23



Pad Assignments for MicroPak



## Pin Description

Pin Names	Description
A	Input
Y	Output
NC	No Connect

## Logic Symbol



## Function Table

$$Y = \bar{A}$$

Input	Output
A	Y
L	H
H	L

H = HIGH Logic Level

L = LOW Logic Level

## 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 +6V
$V_{IN}$	DC Input Voltage	-0.5V to +6V
$V_{OUT}$	DC Output Voltage	-0.5V to +6V
$I_{IK}$	DC Input Diode Current @ $V_{IN} < -0.5V$ @ $V_{IN} > 6V$	-50mA +20mA
$I_{OK}$	DC Output Diode Current @ $V_{OUT} < -0.5V$ @ $V_{OUT} > 6V, V_{CC} = GND$	-50mA +20mA
$I_{OUT}$	DC Output Current	±50mA
$I_{CC}/I_{GND}$	DC $V_{CC}/GND$ Current	±50mA
$T_{STG}$	Storage Temperature	-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 SOT23-5 SC70-5	200mW 150mW

## Recommended Operating Conditions<sup>(1)</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 Operation	1.65V to 5.5V
$V_{CC}$	Supply Voltage Data Retention	1.5V to 5.5V
$V_{IN}$	Input Voltage	0V to 5.5V
$V_{OUT}$	Output Voltage	0V to $V_{CC}$
$T_A$	Operating Temperature	-40°C to +85°C
$t_r, t_f$	Input Rise and Fall Time $V_{CC}$ @ 1.8V, 2.5V ± 0.2V $V_{CC}$ @ 3.3V ± 0.3V $V_{CC}$ @ 5.0V ± 0.5V	0ns/V to 20ns/V 0ns/V to 10ns/V 0ns/V to 5ns/V
$\theta_{JA}$	Thermal Resistance SOT23-5 SC70-5	300°C/W 425°C/W

### Notes:

1. 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		Unit			
					Min.	Typ.	Max.	Min.	Max.				
V <sub>IH</sub>	HIGH Level Input Voltage	1.65–1.95			0.75 x V <sub>CC</sub>			0.75 x V <sub>CC</sub>		V			
		2.3–5.5			0.7 x V <sub>CC</sub>			0.7 x V <sub>CC</sub>					
V <sub>IL</sub>	LOW Level Input Voltage	1.65–1.95					0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>	V			
		2.3–5.5					0.3 x V <sub>CC</sub>		0.3 x V <sub>CC</sub>				
V <sub>OH</sub>	HIGH Level Output Voltage	1.65	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -100µA	1.55	1.65				V			
		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		I <sub>OH</sub> = -4mA	1.29	1.52		1.29					
		2.3			I <sub>OH</sub> = -8mA	1.9	2.15		1.9				
		3.0				I <sub>OH</sub> = -16mA	2.4	2.80			2.4		
		3.0					I <sub>OH</sub> = -24mA	2.3	2.68			2.3	
		4.5						I <sub>OH</sub> = -32mA	3.8		4.20		3.8
V <sub>OL</sub>	LOW Level Output Voltage	1.65	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 100µA			0.0	0.1		0.1	V		
		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		I <sub>OL</sub> = 4mA		0.08	0.24		0.24				
		2.3			I <sub>OL</sub> = 8mA		0.10	0.3		0.3			
		3.0				I <sub>OL</sub> = 16mA		0.15	0.4			0.4	
		3.0					I <sub>OL</sub> = 24mA		0.22	0.55			0.55
		4.5			I <sub>OL</sub> = 32mA			0.22	0.55			0.55	
I <sub>IN</sub>	Input Leakage Current	0–5.5	0 ≤ V <sub>IN</sub> ≤ 5.5V				±1		±10	µA			
I <sub>OFF</sub>	Power Off Leakage Current	0.0	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5V				1		10	µA			
I <sub>CC</sub>	Quiescent Supply Current	1.65–5.5	V <sub>IN</sub> = 5.5V, GND				2.0		20	µA			

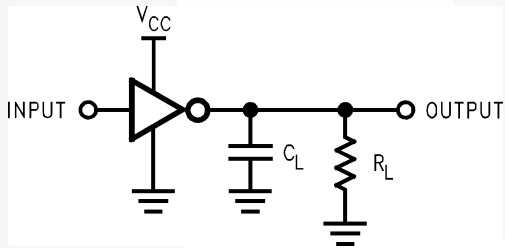
## AC Electrical Characteristics

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>PLH</sub> , t <sub>PHL</sub>	Propagation Delay	1.65	C <sub>L</sub> = 15pF, R <sub>L</sub> = 1MΩ	2.0	5.3	11.4	2.0	12.0	ns	Figure 1 Figure 3
		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 <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay	3.3 ± 0.3	C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω	1.5	2.9	5.0	1.5	5.2	ns	Figure 1 Figure 3
		5.0 ± 0.5		0.8	2.4	4.3	0.8	4.5		
C <sub>IN</sub>	Input Capacitance	0			4				pF	
C <sub>PD</sub>	Power Dissipation Capacitance	3.3	(2)		20				pF	Figure 2
		5.0			26					

**Note:**

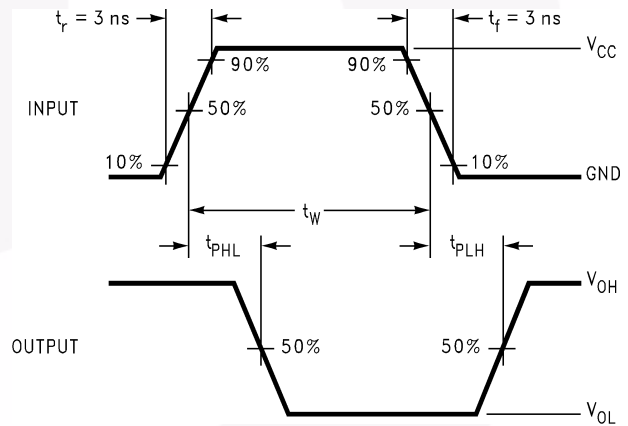
2. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. (See Figure 2.) C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression: I<sub>CCD</sub> = (C<sub>PD</sub>) (V<sub>CC</sub>) (f<sub>IN</sub>) + (I<sub>CC</sub> static)

## AC Loading and Waveforms

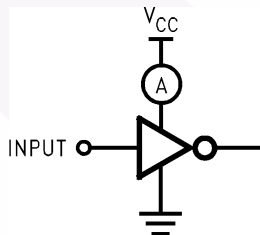


C<sub>L</sub> includes load and stray capacitance  
Input PRR = 1.0MHz, t<sub>W</sub> = 500ns

**Figure 1. AC Test Circuit**



**Figure 3. AC Waveforms**



Input = AC Waveform; t<sub>r</sub> = t<sub>f</sub> = 1.8ns;  
PRR = 10 MHz; Duty Cycle = 50%

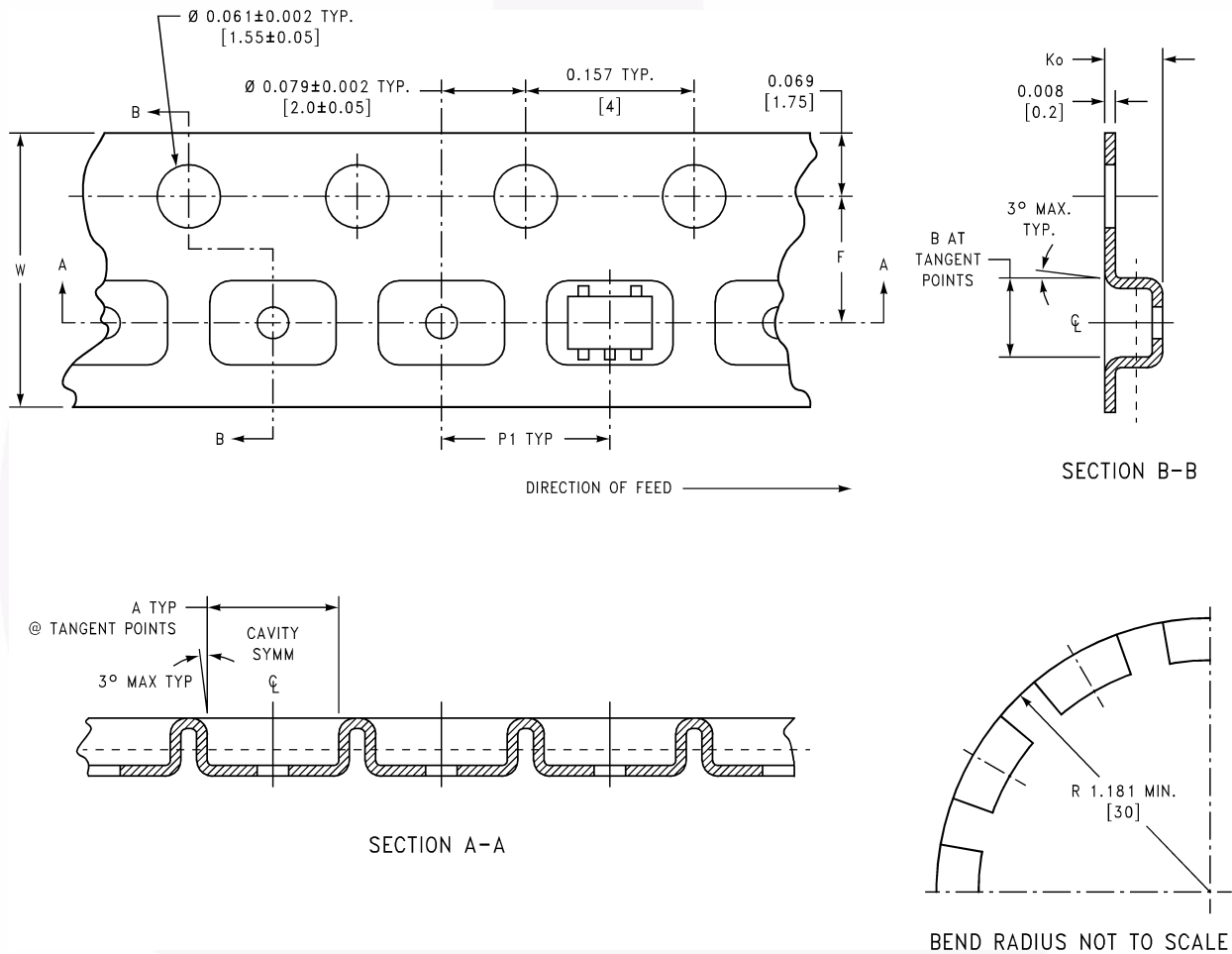
**Figure 2. I<sub>CCD</sub> Test Circuit**

## Tape and Reel Specifications

### 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)

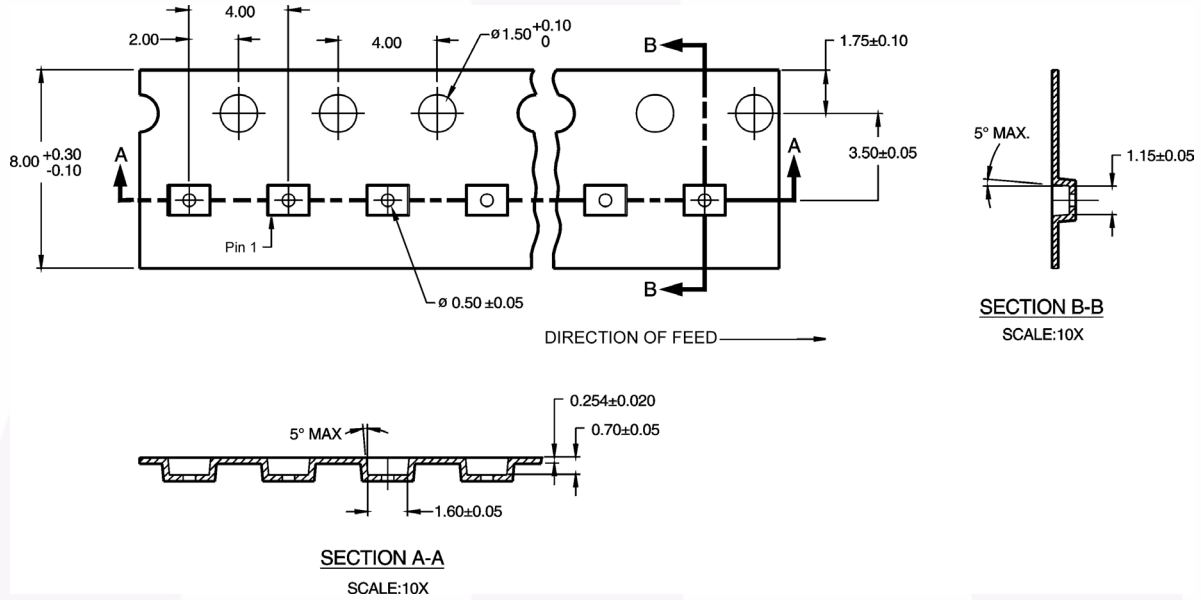


Package	Tape Size	Dim A	Dim B	Dim F	Dim $K_o$	Dim P1	Dim W
SC70-5	8mm	0.093 (2.35)	0.096 (2.45)	0.138 ± 0.004 (3.5 ± 0.10)	0.053 ± 0.004 (1.35 ± 0.10)	0.157 (4)	0.315 ± 0.004 (8 ± 0.1)
SOT23-5	8mm	0.130 (3.3)	0.130 (3.3)	0.138 ± 0.002 (3.5 ± 0.05)	0.055 ± 0.004 (1.4 ± 0.11)	0.157 (4)	0.315 ± 0.012 (8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

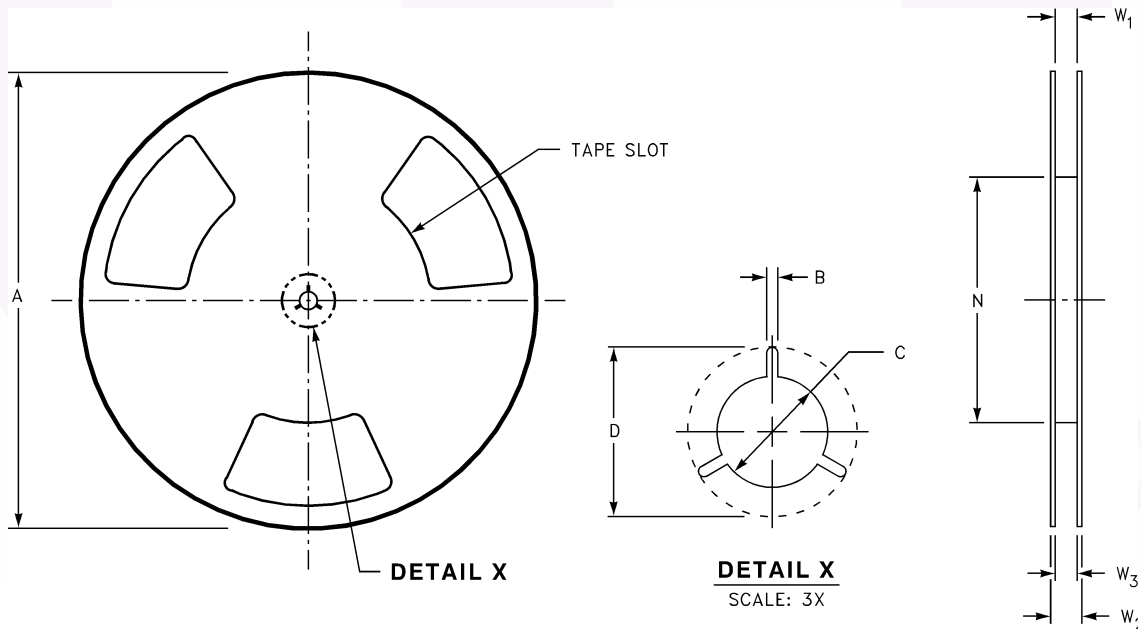
## Tape and Reel Specifications (Continued)

### 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

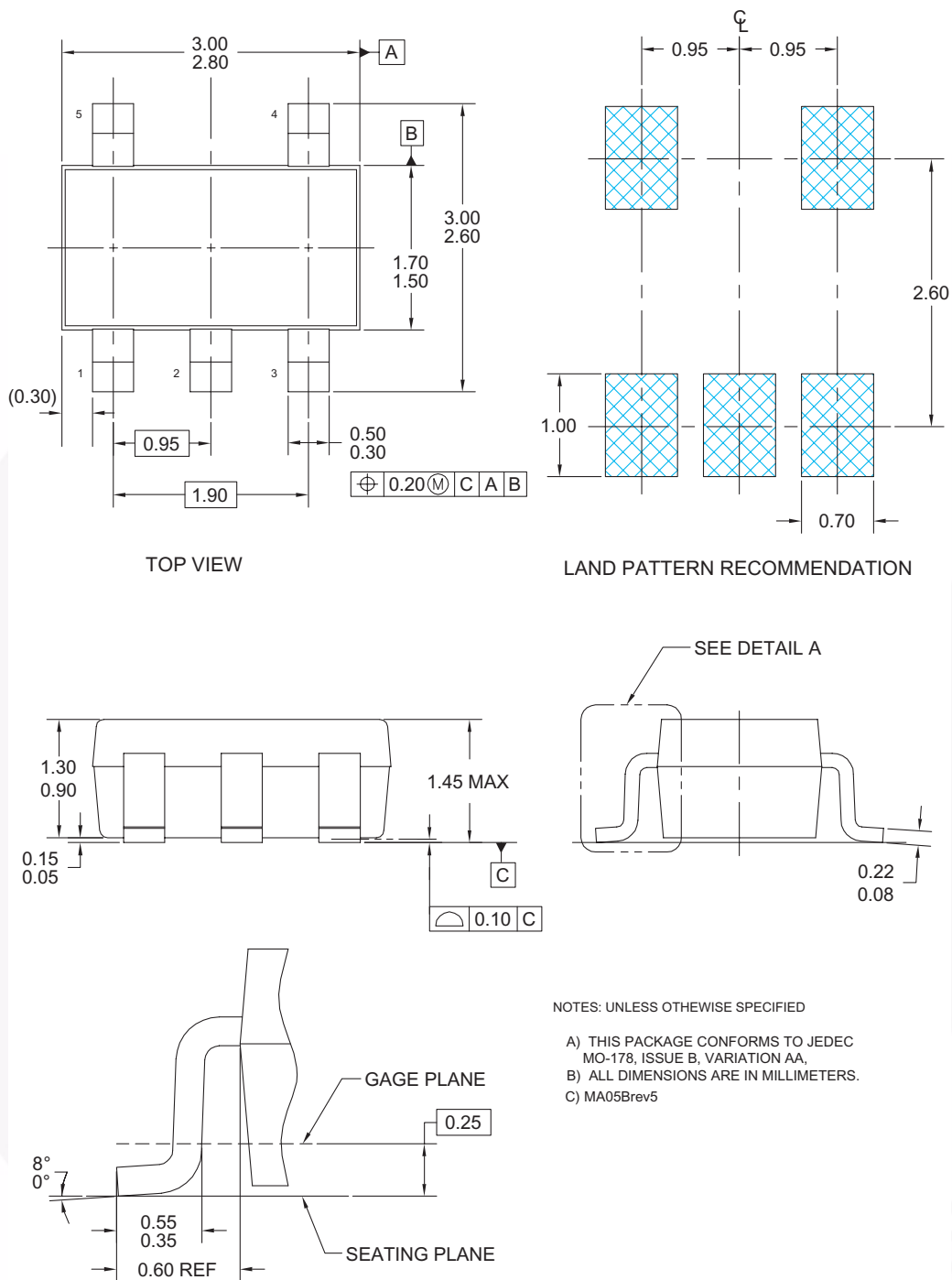


### Reel Dimensions inches (millimeters)



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



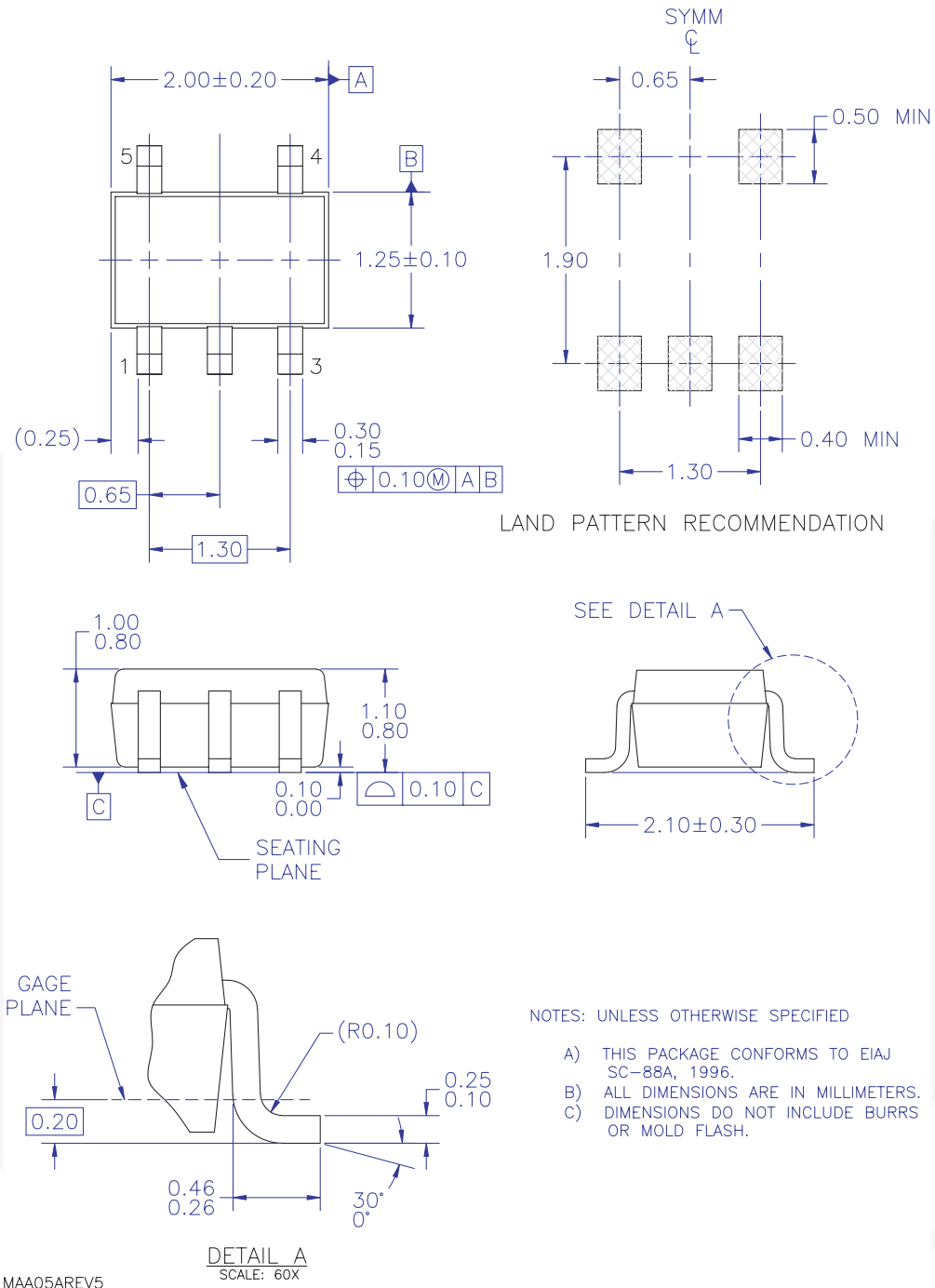
**Figure 4. 5-Lead SOT23, JEDEC MO-178, 1.6mm**

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**Physical Dimensions (Continued)**

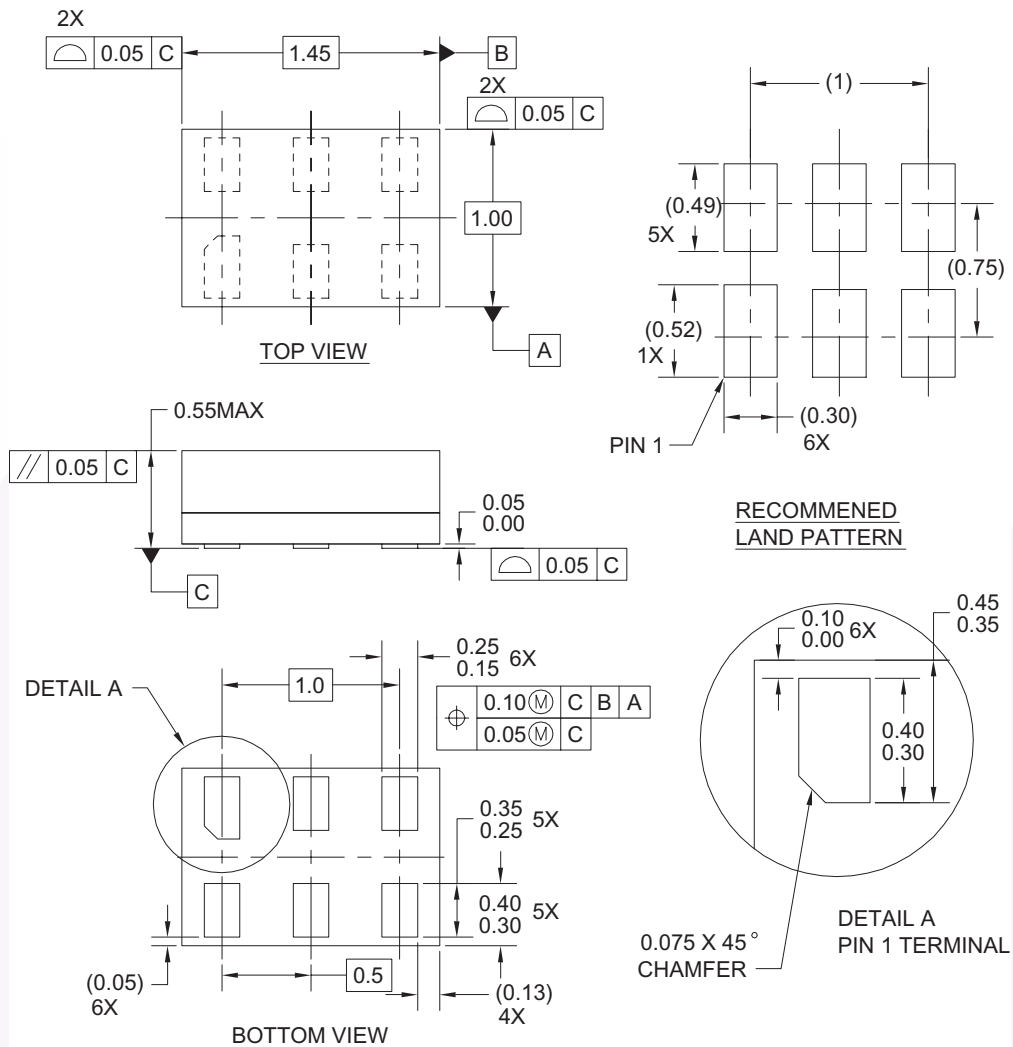


**Figure 5. 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide**

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**Physical Dimensions** (Continued)



**Notes:**

1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994

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**Figure 6. 6-Lead MicroPak, 1.0mm Wide**



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