FAIRCHILD SEMICONDUCTOR™

October 2001
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NC7SB121

TinyLogic™ Low Voltage UHS Single SPST Wide Bandwidth Normally Open Analog Switch

General Description

The NC7SB121 is a ultra high-speed (UHS) CMOS compatible single-pole/single-throw (SPST) analog switch or 1-bit bus switch. The LOW on resistance of the switch allows inputs to be connected to outputs with minimal propagation delay and without generating additional ground bounce noise. The device is organized as a 1-bit switch with a switch enable (OE) signal. When OE is HIGH, the switch is on and Port A is connected to Port B. When OE is LOW, the switch is open and a high-impedance state exists between the two ports.

Features

- Space saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ leadless package
- Broad V_{CC} Operating Range 2V–5.5V
- Rail-to-rail signal handling
- 7.2Ω switch connection between two ports
- Minimal propagation delay through the switch
- Low I_{CC}
- Zero bounce in flow-through mode
- Control input compatible with CMOS input levels
- >326 MHz –3dB bandwidth
- Improved package replacement for the P15A121

Ordering Code:

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7SB121M5X	MA05B	7B21	5-Lead SOT23, JEDEC MO-178, 1.6mm	3k Units on Tape and Reel
NC7SB121P5X	MAA05A	B21	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
NC7SB121L6X	MAC06 (Preliminary)	21	6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

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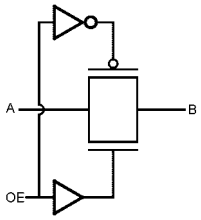
Logic Symbol



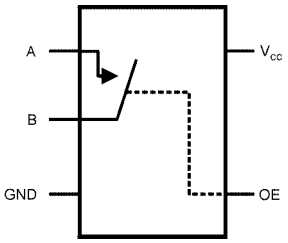
Pin Descriptions

Pin Names	Description
OE	Switch Enable Input
A	Bus A I/O
B	Bus B I/O
NC	No Connect

Function Table

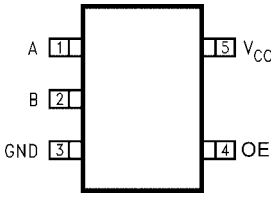
OE	B_0	Function
L	HIGH-Z State	Disconnect
H	A_0	Connect

Analog Symbol



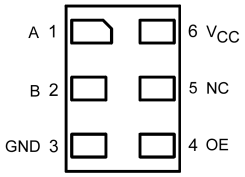
Connection Diagrams

Pin Assignments for SC70



(Top View)

Pad Assignment for MicroPak



(Top Thru View)

Absolute Maximum Ratings (Note 1)

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Switch Voltage (V_S)	−0.5V to V_{CC} +0.5V
DC Input Voltage (V_{IN}) (Note 2)	−0.5V to +7.0V
DC Input Diode Current (I_{IK}) V_{IN} < 0V	−50 mA
DC Output (I_{OUT}) Sink Current	128 mA
DC V_{CC}/GND Current (I_{CC}/I_{GND})	±100 mA
Storage Temperature Range (T_{STG})	−65°C to +150°C
Junction Lead 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 3)

Power Supply Operating (V_{CC})	2V to 5.5V
Control Input Voltage (V_{IN})	0V to 5.5V
Switch Input Voltage (V_{IN})	0V to V_{CC}
Switch Output Voltage (V_{OUT})	0V to V_{CC}
Input Rise and Fall Time (t_r, t_f)	
Control Input; V_{CC} = 2.3V–3.6V	0 ns/V to 10 ns
Control Input; V_{CC} = 4.5–5.5V	0 ns/V to 5 ns
Switch I/O	0 ns/V to DC
Operating Temperature (T_A)	−40°C to +85°C
Thermal Resistance (θ_{JA})	
SOT23-5	300°C/Watt
SC70-5	425°C/Watt

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be 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: The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are 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	Typ	Max	Min	Typ (Note 5)	Max		
V_{IH}	HIGH Level Input Voltage	2 to 5.5				0.7 V_{CC}			V	
V_{IL}	LOW Level Input Voltage	2 to 5.5						0.3 V_{CC}	V	
I_{IN}	Control Input Leakage Current	0 to 5.5					±0.05	±1.0	µA	0 ≤ V_{IN} ≤ 5.5V
I_{OFF}	OFF Leakage Current	2 to 5.5					±0.05	±10.0	µA	0 ≤ A, B ≤ V_{CC}
R_{ON}	Switch On Resistance	4.5		7.2	10			12	Ω	V_{IN} = 2.5V, I_{IN} = 30 mA
	(Note 4)	3.0		12	18		12	22		V_{IN} = 1.5V, I_{IN} = 24 mA
R_{flat}	On Resistance Flatness	5.0		3.2	3.5			4	Ω	I_A = −30 mA, V_{IN} = 1, 2.5, 4V
	(Note 4)(Note 6)(Note 7)	3.3		4.5	5			5		I_A = −24 mA, V_{IN} = 0.8, 2.5V
I_{CC}	Quiescent Supply Current	2 to 5.5			1		0.05	10	µA	V_{IN} = V_{CC} or GND I_{OUT} = 0

Note 4: Measured by the voltage drop between A and B pins at the indicated current through the switch. On Resistance is determined by the lower of the voltages on the two (A or B) pins.

Note 5: All typical values are at the specified V_{CC}, and T_A = 25°C.

Note 6: Parameter is characterized but not tested in production.

Note 7: Flatness is defined as the difference between the maximum and minimum value of On Resistance over the specified range of conditions.

AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	$T_A = -40°C$ to $+85°C$, $C_L = 50$ pF, $R_U = R_D = 500\Omega$			Units	Conditions	Figure Number
			Min	Typ (Note 8)	Max			
t_{PZL}, t_{PZH}	Output Enable Time	3.0 - 3.6			25	ns	V_{IN} = 2 x V_{CC} for t_{PZL}	Figures 1, 2
		4.5 - 5.5			15	ns	V_{IN} = 0V for t_{PZH}	
t_{PLZ}, t_{PHZ}	Output Disable Time	3.0 - 3.6			12	ns	V_{IN}= 2 x V_{CC} for t_{PLZ}	Figures 1, 2
		4.5 - 5.5			7	ns	V_{IN} = 0V for t_{PHZ}	
Q	Charge Injection (Note 9)	2 - 5.5			10	pC	C_L = 1 nF, V_{GEN} = 0V, R_{GEN} = 0Ω, f = 1 MHz	Figure 3
OIRR	Off Isolation (Note 10)	2 - 5.5		–43		dB	R_L = 50 Ω, C_L = 5 pF, f = 10 MHz	Figure 4
BW	–3dB Bandwidth	2 - 5.5		326		MHz	R_L = 50 Ω	Figure 5

Note 8: All typical values are at the specified V_{CC}, and $T_A = 25°C$.

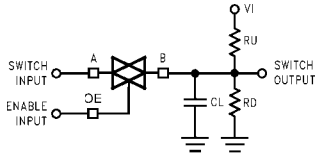
Note 9: Guaranteed by design.

Note 10: Off Isolation = 20 $\log_{10}$ [V_A/V_{BN}].

Capacitance

Symbol	Parameter	Typ	Max	Units	Conditions
C_{IN}	Control Pin Input Capacitance	2		pF	V_{CC} = 0V
$C_{I/O}$	Input/Output Capacitance	5.5		pF	V_{CC} = 5.0V

AC Loading and Waveforms



Input driven by 50Ω source terminated in 50Ω

C_L includes load and stray capacitance.

Input PRR = 1.0 MHz; t_w = 500 ns

FIGURE 1. AC Test Circuit

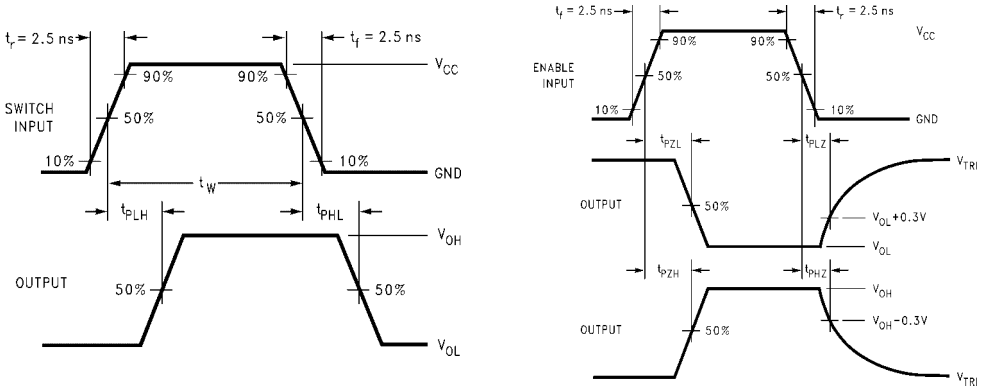


FIGURE 2. AC Waveforms

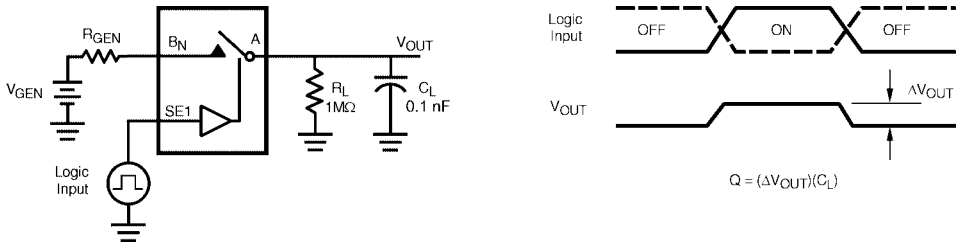


FIGURE 3. Charge Injection Test

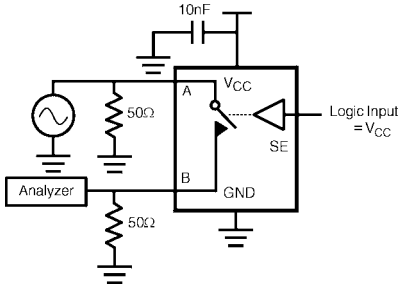


FIGURE 4. Off Isolation

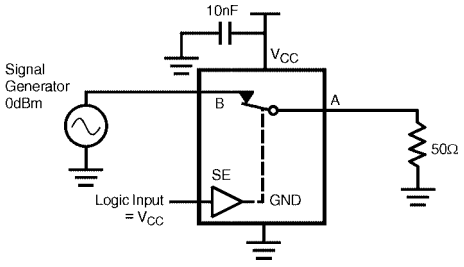


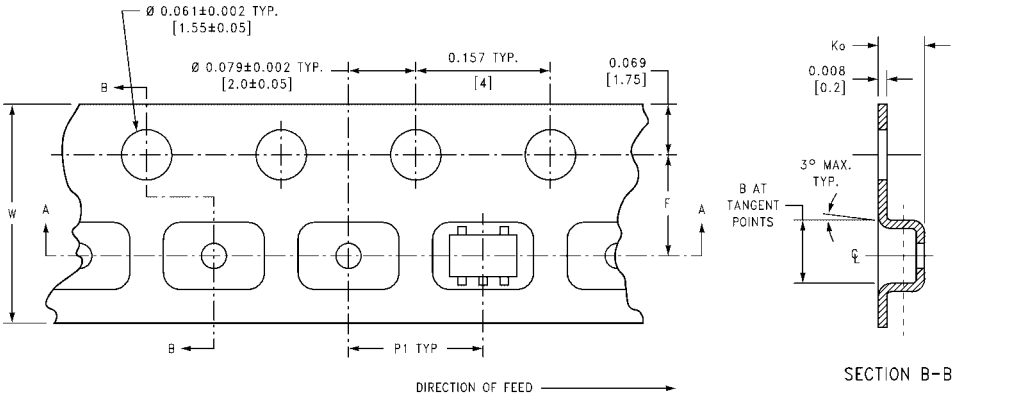
FIGURE 5. Bandwidth

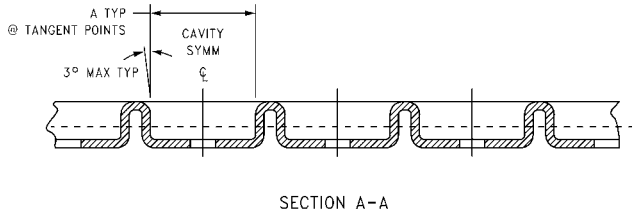
Tape and Reel Specification

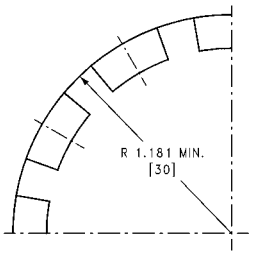
TAPE FORMAT FOR SOT23, SC70

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)







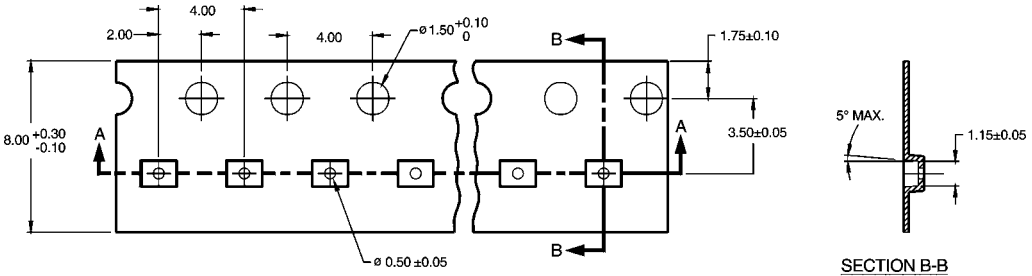
Package	Tape Size	DIM A	DIM B	DIM F	DIM K_o	DIM P1	DIM W
SC70-5	8 mm	0.093 (2.35)	0.096 (2.45)	0.138 ± 0.004 (3.5 ± 0.10)	0.053 ± 0.004 (1.35 ± 0.10)	0.157 (4)	0.315 ± 0.004 (8 ± 0.1)
SOT23-5	8 mm	0.130 (3.3)	0.130 (3.3)	0.138 ± 0.002 (3.5 ± 0.05)	0.055 ± 0.004 (1.4 ± 0.11)	0.157 (4)	0.315 ± 0.012 (8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

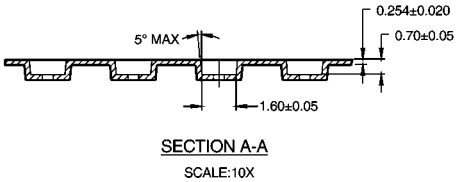
Tape and Reel Specification (Continued)

TAPE FORMAT FOR MicroPak

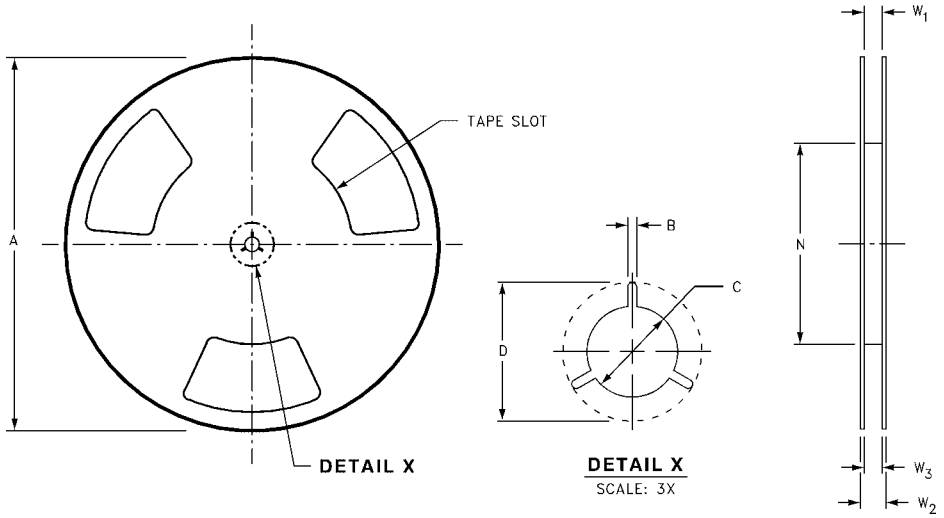
Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
L6X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

TAPE DIMENSIONS inches (millimeters)



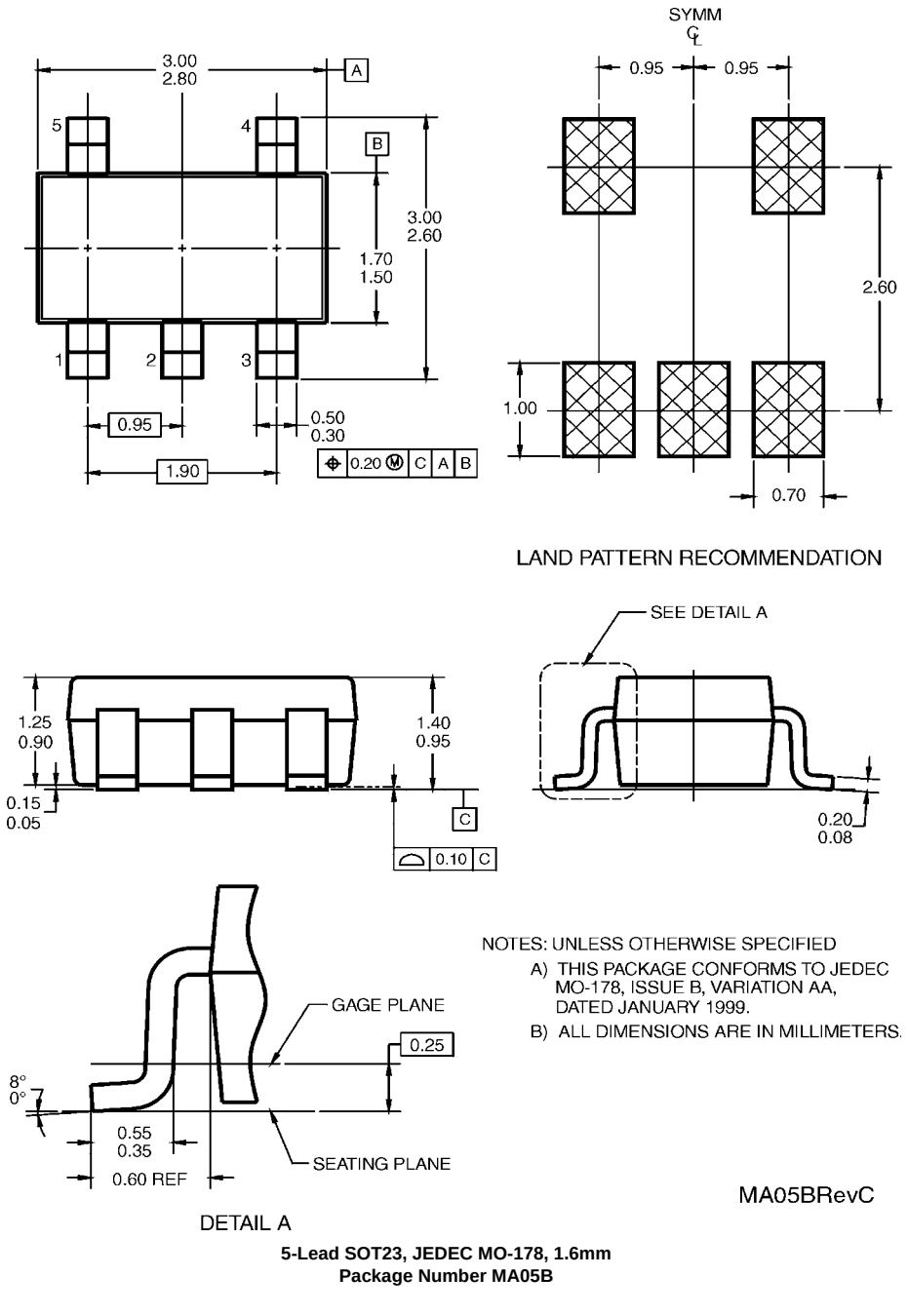


REEL DIMENSIONS inches (millimeters)



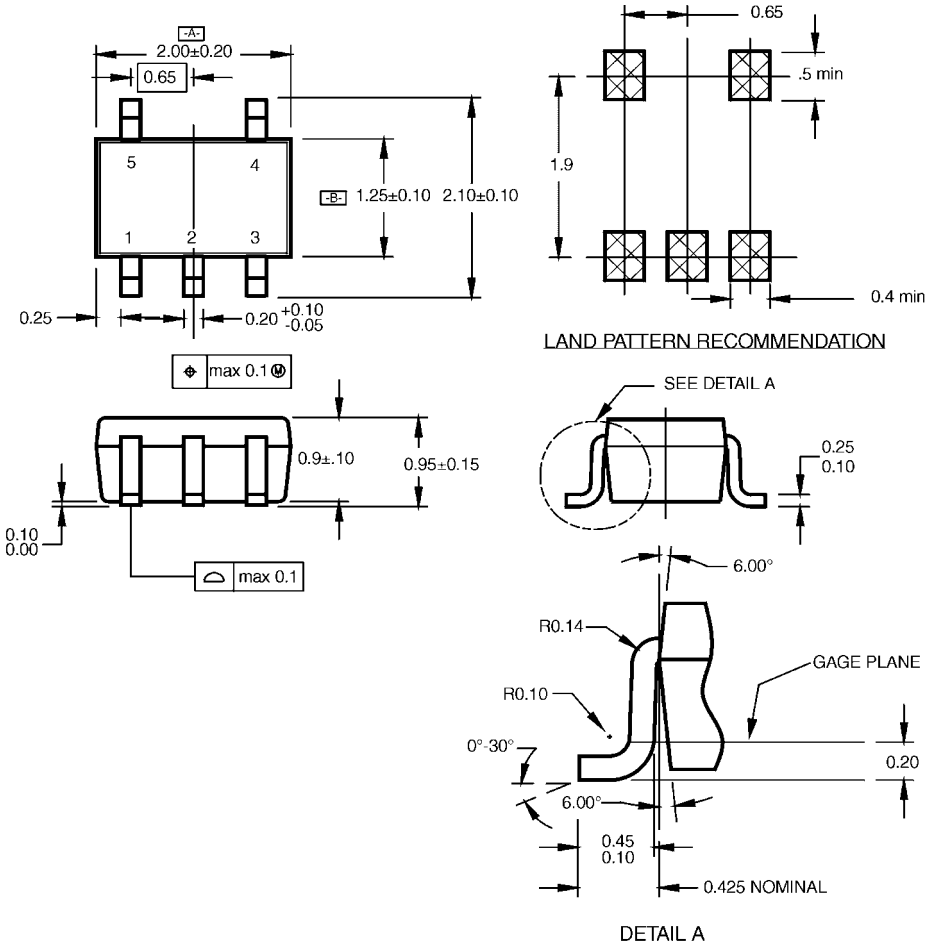
Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 + 0.059/–0.000 (8.40 + 1.50/–0.00)	0.567 (14.40)	W1 + 0.078/–0.039 (W1 + 2.00/–1.00)

Physical Dimensions inches (millimeters) unless otherwise noted



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

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



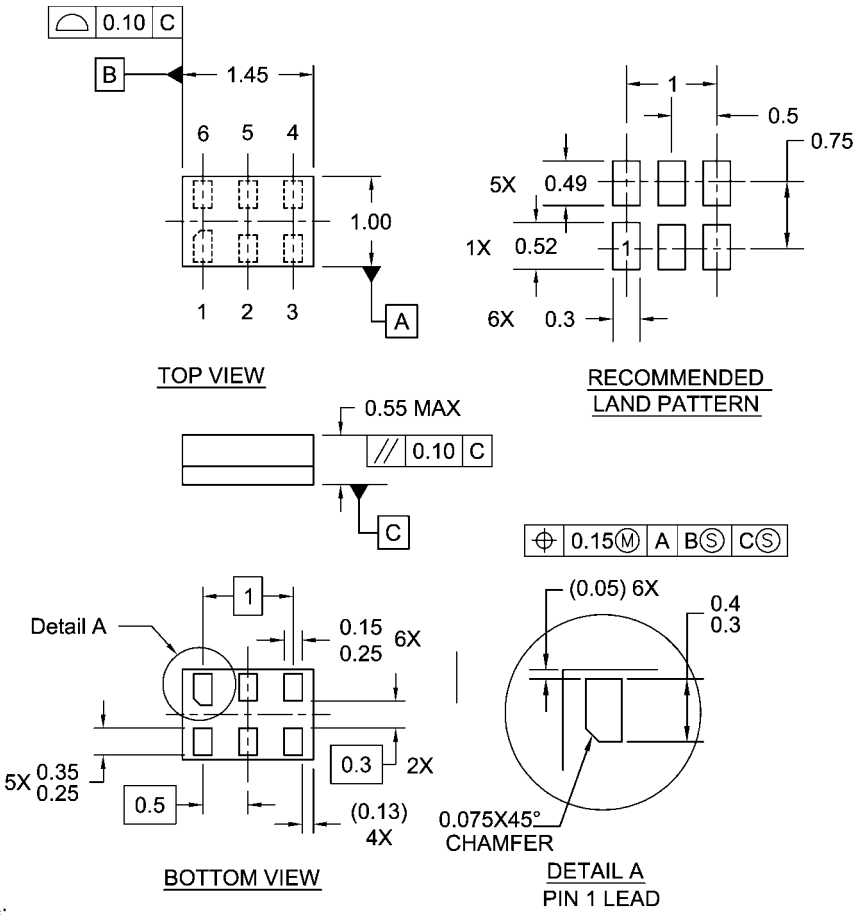
NOTES:

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. DIMENTIONS ARE IN MILLIMETERS
3. THIS DRAWING IS PRELIMINARY AND SUBJECT TO CHANGE
4. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06ARevB

6-Lead MicroPak, 1.0mm Wide
Package Number MAC06A
Preliminary