FAIRCHILD

SEMICONDUCTOR ™

NC7SB3157
TinyLogic™ Low Voltage UHS SPDT Analog Switch or 2:1 Multiplexer/Demultiplexer Bus Switch

General Description

The NC7SB3157 is a high performance, single-pole/double-throw (SPDT) Analog Switch or 2:1 Multiplexer/Demultiplexer Bus Switch from Fairchild's Ultra High Speed Series of TinyLogic™. The device is fabricated with advanced sub-micron CMOS technology to achieve high speed enable and disable times and low On Resistance. The break before make select circuitry prevents disruption of signals on the B Port due to both switches temporarily being enabled during select pin switching. The device is specified to operate over the 1.65 to 5.5V V_{CC} operating range. The control input tolerates voltages up to 5.5V independent of the V_{CC} operating range.

Features

■ Useful in both analog and digital applications
■ Space saving SC70 6-lead surface mount package
■ Ultra small MicroPak™ leadless package
■ Low On Resistance; $< 10\Omega$ on typ @ 3.3V V_{CC}
■ Broad V_{CC} operating range; 1.65V to 5.5V
■ Rail-to-rail signal handling
■ Power down high impedance control input
■ Overvoltage tolerance of control input to 7.0V
■ Break before make enable circuitry
■ 250 MHz - 3dB bandwidth

Ordering Code:

| Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7SB3157P6X	MAA06A	B7A	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
NC7SB3157L6X	MAC06A	BB	6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

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Logic Symbol

Analog Symbol
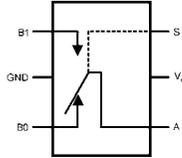
Function Table

Input (S)	Function
L	B_0 Connected to A
H	B_1 Connected to A

H = HIGH Logic Level   L = LOW Logic Level

Pin Descriptions

Pin Names	Description
A, B_0, B_1	Data Ports
S	Control Input

Connection Diagrams

Pin Assignments for SC70

| B_1 | 1 | | 6 | S |
| GND | 2 | | 5 | V_{CC} |
| B_0 | 3 | | 4 | A |

(Top View)
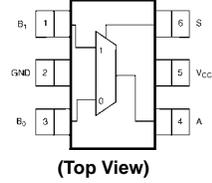
Pin One Orientation Diagram
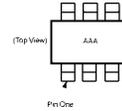
AAA = Product Code Top Mark - see ordering code.

Note: Orientation of Top Mark determines Pin One location. Read the top product code mark left to right, Pin One is the lower left pin (see diagram).

Pad Assignments for MicroPak

B_1	1		6	S
GND	2		5	V_{CC}
B_0	3		4	A

(Top Thru View)

NC7SB3157

Absolute Maximum Ratings (Note 1)

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Switch Voltage (V_S) (Note 2)	−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})	
@ (I_{IK}) $V_{IN} < 0V$	−50 mA
DC Output Current (I_{OUT})	128 mA
DC V_{CC} or Ground Current (I_{CC}/I_{GND})	±100 mA
Storage Temperature Range (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	180 mW

Recommended Operating Conditions (Note 3)

Supply Voltage Operating (V_{CC})	1.65V to 5.5V
Control Input Voltage (V_{IN})	0V to V_{CC}
Switch Input Voltage (V_{IN})	0V to V_{CC}
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)	
Control Input V_{CC} = 2.3V - 3.6V	0 ns/V to 10 ns/V
Control Input V_{CC} = 4.5V - 5.5V	0 ns/V to 5 ns/V
Thermal Resistance (θ_{JA})	350°C/W

Note 1: 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 2: The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

Note 3: Control input must be held HIGH or LOW, it must not float.

DC 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
V_{IH}	HIGH Level	1.65 – 1.95	0.75 V_{CC}			0.75 V_{CC}		V	
	Input Voltage	2.3 – 5.5	0.7 V_{CC}			0.7 V_{CC}			
V_{IL}	LOW Level	1.65 – 1.95			0.25 V_{CC}		0.25 V_{CC}	V	
	Input Voltage	2.3 – 5.5			0.3 V_{CC}		0.3 V_{CC}		
I_{IN}	Input Leakage Current	0 – 5.5		±0.05	±0.1		±1	μA	$0 \leq V_{IN} \leq 5.5V$
I_{OFF}	OFF State Leakage Current	1.65 – 5.5		±0.05	±0.1		±1	μA	$0 \leq A, B \leq V_{CC}$
R_{ON}	Switch On Resistance (Note 4)	4.5		3	7		7	Ω	$V_{IN} = 0V, I_O = 30$ mA
				5	12		12	Ω	$V_{IN} = 2.4V, I_O = −30$ mA
				7	15		15	Ω	$V_{IN} = 4.5V, I_O = −30$ mA
		3.0		4	9		9	Ω	$V_{IN} = 0V, I_O = 24$ mA
				10	20		20	Ω	$V_{IN} = 3V, I_O = −24$ mA
		2.3		5	12		12	Ω	$V_{IN} = 0V, I_O = 8$ mA
				13	30		30	Ω	$V_{IN} = 2.3V, I_O = −8$ mA
		1.65		6.5	20		20	Ω	$V_{IN} = 0V, I_O = 4$ mA
				17	50		50	Ω	$V_{IN} = 1.65V, I_O = −4$ mA
I_{CC}	Quiescent Supply Current All Channels ON or OFF	5.5			1		10	μA	$V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0$
	Analog Signal Range	V_{CC}	0		V_{CC}	0	V_{CC}	V	
R_{RANGE}	On Resistance Over Signal Range (Note 4)(Note 8)	4.5					25	Ω	$I_A = −30$ mA, $0 \leq V_{Bn} \leq V_{CC}$
		3.0					50		$I_A = −24$ mA, $0 \leq V_{Bn} \leq V_{CC}$
		2.3					100		$I_A = −8$ mA, $0 \leq V_{Bn} \leq V_{CC}$
		1.65					300		$I_A = −4$ mA, $0 \leq V_{Bn} \leq V_{CC}$
ΔR_{ON}	On Resistance Match Between Channels (Note 4)(Note 5)(Note 6)	4.5		0.15				Ω	$I_A = −30$ mA, $V_{Bn} = 3.15$
		3.0		0.2					$I_A = −24$ mA, V_{Bn} 2.1
		2.3		0.5					$I_A = −8$ mA, $V_{Bn} = 1.6$
		1.65		0.5					$I_A = −4$ mA, $V_{Bn} = 1.15$

DC Electrical Characteristics (Continued)

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
R$_{flat}$	On Resistance Flatness (Note 4)(Note 5)(Note 7)	5.0		6				Ω	I$_A$ = −30 mA, 0 ≤ V$_{Bn}$ ≤ V$_{CC}$
		3.3		12					I$_A$ = −24 mA, 0 ≤ V$_{Bn}$ ≤ V$_{CC}$
		2.5		28					I$_A$ = −8 mA, 0 ≤ V$_{Bn}$ ≤ V$_{CC}$
		1.8		125					I$_A$ = −4 mA, 0 ≤ V$_{Bn}$ ≤ V$_{CC}$

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 Ports).

Note 5: Parameter is characterized but not tested in production.

Note 6: ΔR$_{ON}$ = R$_{ON}$ max − R$_{ON}$ min measured at identical V$_{CC}$, temperature and voltage levels.

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

Note 8: Guaranteed by Design.

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$_{PHL}$ t$_{PLH}$	Propagation Delay Bus to Bus (Note 10)	1.65 – 1.95						ns	V$_I$ = OPEN	Figures 1, 2
		2.3 – 2.7			1.2		1.2			
		3.0 – 3.6			0.8		0.8			
		4.5 – 5.5			0.3		0.3			
t$_{PZL}$ t$_{PZH}$	Output Enable Time Turn on Time (A to B$_n$)	1.65 – 1.95	7		23	7	24	ns	V$_I$ = 2 x V$_{CC}$ for t$_{PZL}$ V$_I$ = 0V for t$_{PZH}$	Figures 1, 2
		2.3 – 2.7	3.5		13	3.5	14			
		3.0 – 3.6	2.5		6.9	2.5	7.6			
		4.5 – 5.5	1.7		5.2	1.7	5.7			
t$_{PLZ}$ t$_{PHZ}$	Output Disable Time Turn Off Time (A Port to B Port)	1.65 – 1.95	3		12.5	3	13	ns	V$_I$ = 2 x V$_{CC}$ for t$_{PLZ}$ V$_I$ = 0V for t$_{PHZ}$	Figures 1, 2
		2.3 – 2.7	2		7	2	7.5			
		3.0 – 3.6	1.5		5	1.5	5.3			
		4.5 – 5.5	0.8		3.5	0.8	3.8			
t$_{B-M}$	Break Before Make Time (Note 9)	1.65 – 1.95	0.5			0.5		ns		Figure 3
		2.3 – 2.7	0.5			0.5				
		3.0 – 3.6	0.5			0.5				
		4.5 – 5.5	0.5			0.5				
Q	Charge Injection (Note 9)	5.0		7				pC	C$_L$ = 0.1 nF, V$_{GEN}$ = 0V R$_{GEN}$ = 0Ω	Figure 4
		3.3		3						
OIRR	Off Isolation (Note 11)	1.65 – 5.5		−57				dB	R$_L$ = 50Ω f = 10MHz	Figure 5
Xtalk	Crosstalk	1.65 – 5.5		−54				dB	R$_L$ = 50Ω f = 10MHz	Figure 6
BW	−3dB Bandwidth	1.65 – 5.5		250				MHz	R$_L$ = 50Ω	Figure 9
THD	Total Harmonic Distortion (Note 9)	5		.011				%	R$_L$ = 600Ω 0.5 V$_{P-P}$ f = 600 Hz to 20 KHz	

Note 9: Guaranteed by Design.

Note 10: This parameter is guaranteed by design but not tested. The bus switch contributes no propagation delay other than the RC delay of the On Resistance of the switch and the 50 pF load capacitance, when driven by an ideal voltage source (zero output impedance).

Note 11: Off Isolation = 20 log$_{10}$ [V$_A$ / V$_{Bn}$]

Capacitance (Note 12)

Symbol	Parameter	Typ	Max	Units	Conditions	Figure Number
C_{IN}	Control Pin Input Capacitance	2.3		pF	$V_{CC} = 0V$	
C_{IO-B}	B Port Off Capacitance	6.5		pF	$V_{CC} = 5.0V$	Figure 7
C_{IOA-ON}	A Port Capacitance When Switch Is Enabled	18.5		pF	$V_{CC} = 5.0V$	Figure 8

Note 12: $T_A = +25°C$, f = 1 MHz, Capacitance is characterized but not tested in production.

AC Loading and Waveforms
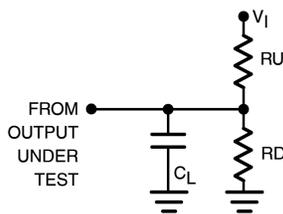
Note: Input driven by 50Ω source terminated in 50Ω

Note: C_L includes load and stray capacitance

Note: Input PRR = 1.0 MHz; t_W = 500 ns

FIGURE 1. AC Test Circuit
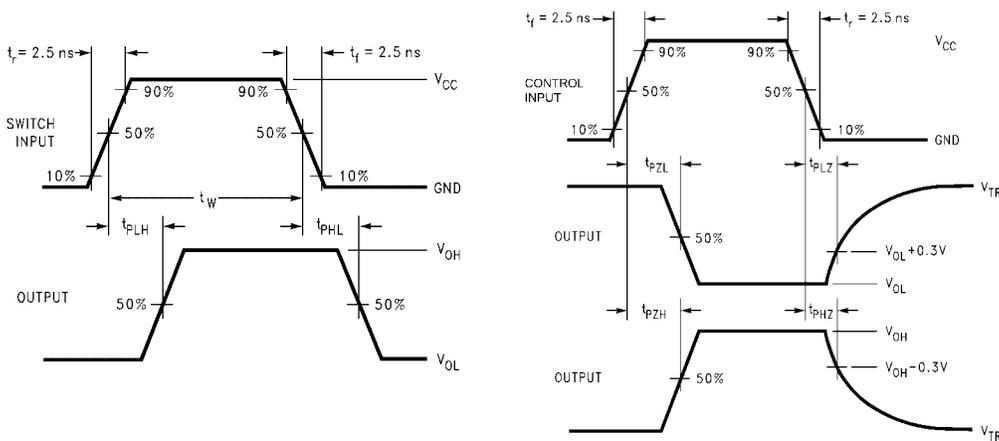
FIGURE 2. AC Waveforms
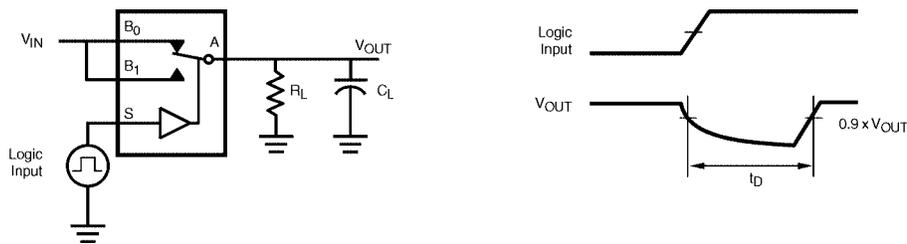
FIGURE 3. Break Before Make Interval Timing

AC Loading and Waveforms (Continued)
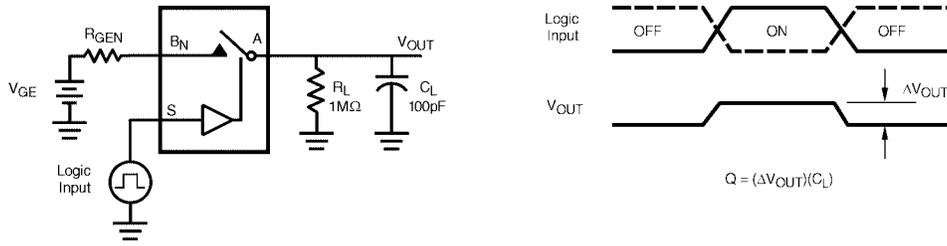
FIGURE 4. Charge Injection Test

$$Q = (\Delta V_{OUT})(C_L)$$
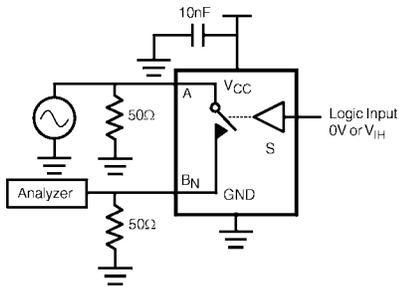

FIGURE 5. Off Isolation
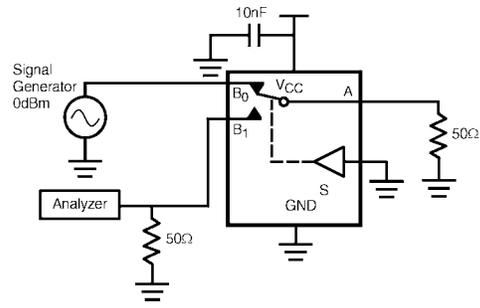
FIGURE 6. Crosstalk
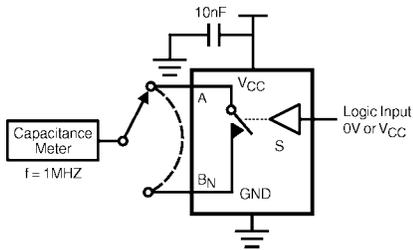
**FIGURE 7. Channel Off Capacitance**
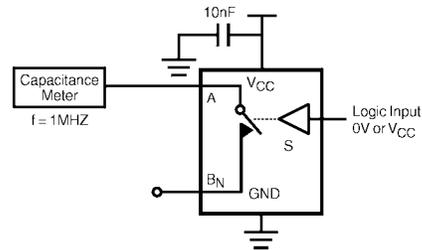

FIGURE 8. Channel On Capacitance
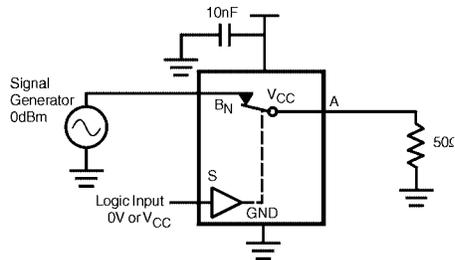
FIGURE 9. Bandwidth

Tape and Reel Specification

TAPE FORMAT for SC70

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
P6X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

TAPE DIMENSIONS inches (millimeters)
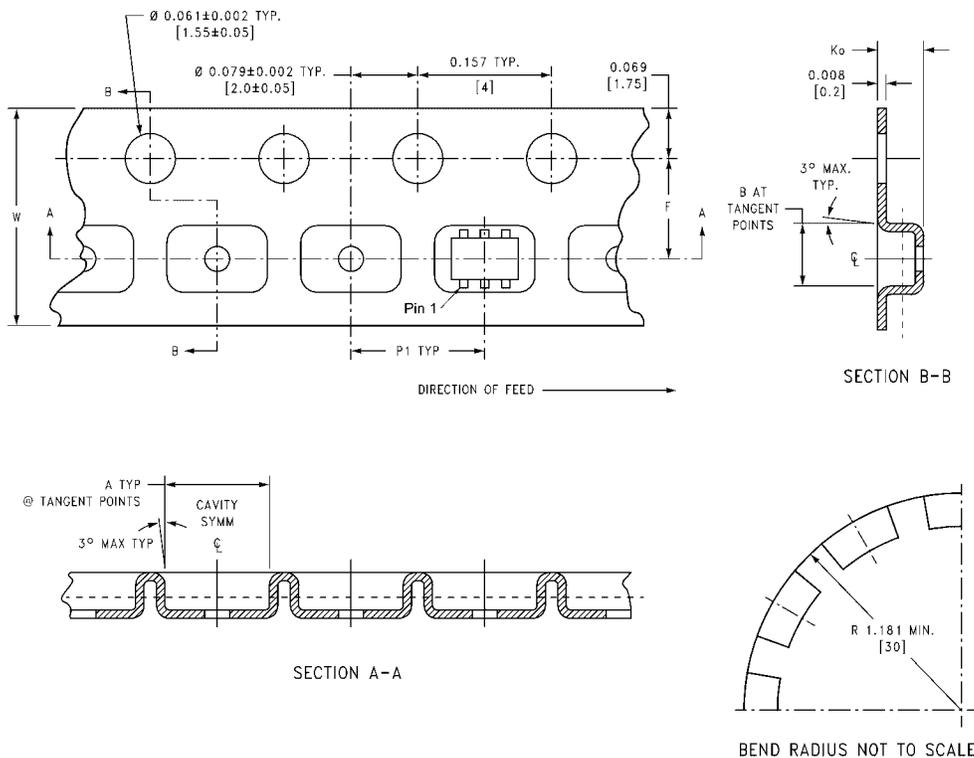
| Package	Tape Size	DIM A	DIM B	DIM F	DIM K$_o$	DIM P1	DIM W
SC70-6	8 mm	0.093 (2.35)	0.096 (2.45)	0.138 ± 0.004 (3.5 ± 0.10)	0.053 ± 0.004 (1.35 ± 0.10)	0.157 (4)	0.315 ± 0.004 (8 ± 0.1)

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)

SECTION B-B
SCALE:10X

SECTION A-A
SCALE:10X

REEL DIMENSIONS inches (millimeters)

DETAIL X

DETAIL X
SCALE: 3X
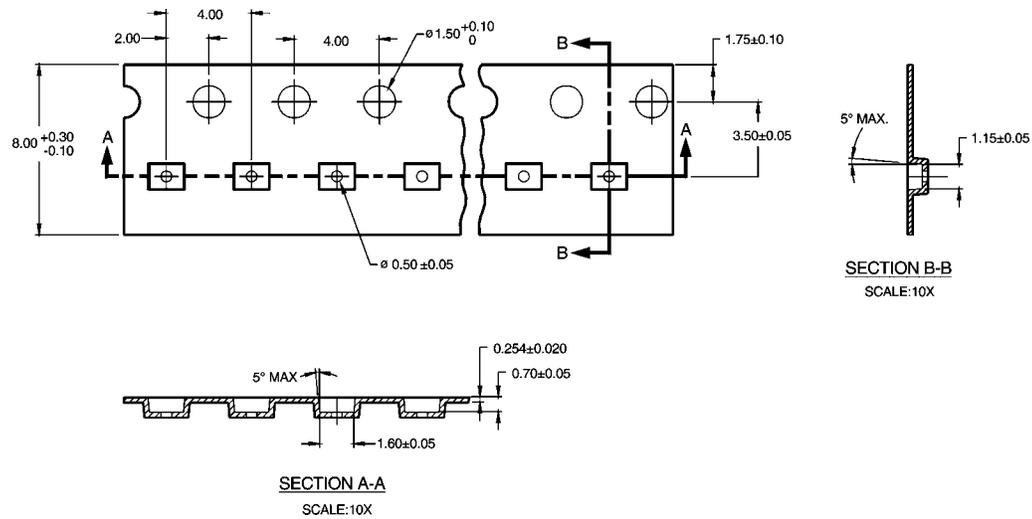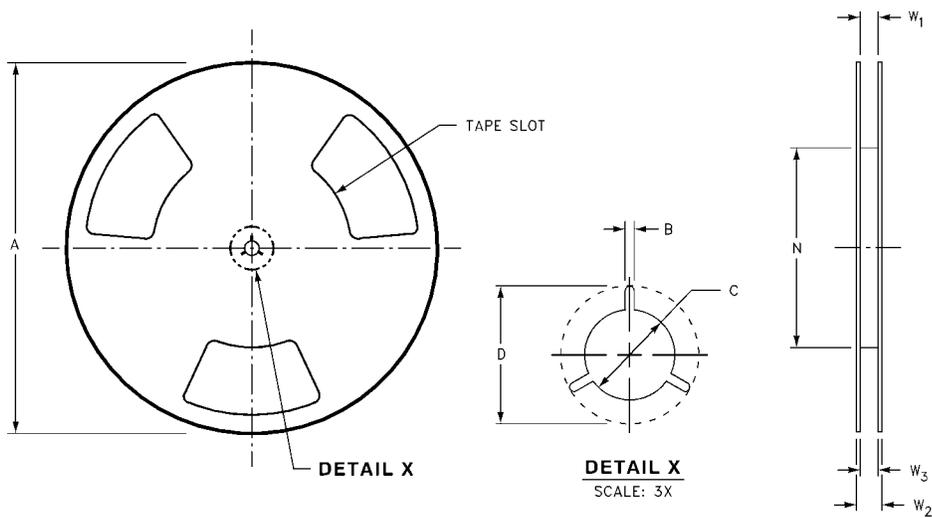
Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 + 0.059/−0.000 (8.40 + 1.50/−0.00)	0.567 (14.40)	W1 + 0.078/−0.039 (W1 + 2.00/−1.00)

# Physical Dimensions inches (millimeters) unless otherwise noted

-A-

2.00±0.20

0.65

6 5 4

-B- 1.25±0.10 2.10±0.10

1 2 3

0.25

0.20 +0.10 -0.05

⊕ max 0.1 ⊛

0.9±.10

0.95±0.15

0.10 0.00

⌒ max 0.1

0.65

.5 min

1.9

0.4 min

LAND PATTERN RECOMMENDATION

SEE DETAIL A

0.25 0.10

6.00°

R0.14

R0.10

GAGE PLANE

0°-30°

0.20

6.00°

0.45 0.10

0.425 NOMINAL

DETAIL A
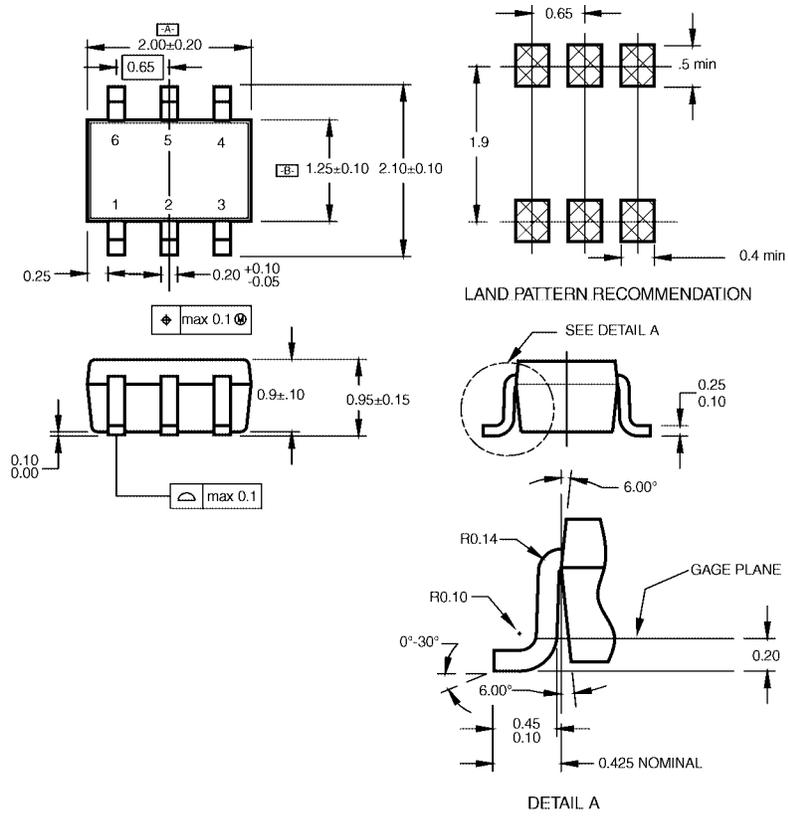
NOTES:
   A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88.
   B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
   C. DIMENSIONS ARE IN MILLIMETERS.

MAA06ARevC

6-Lead SC70, EIAJ SC88, 1.25mm Wide
Package Number MAA06A

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

TOP VIEW

RECOMMENDED
LAND PATTERN

BOTTOM VIEW

DETAIL A
PIN 1 LEAD
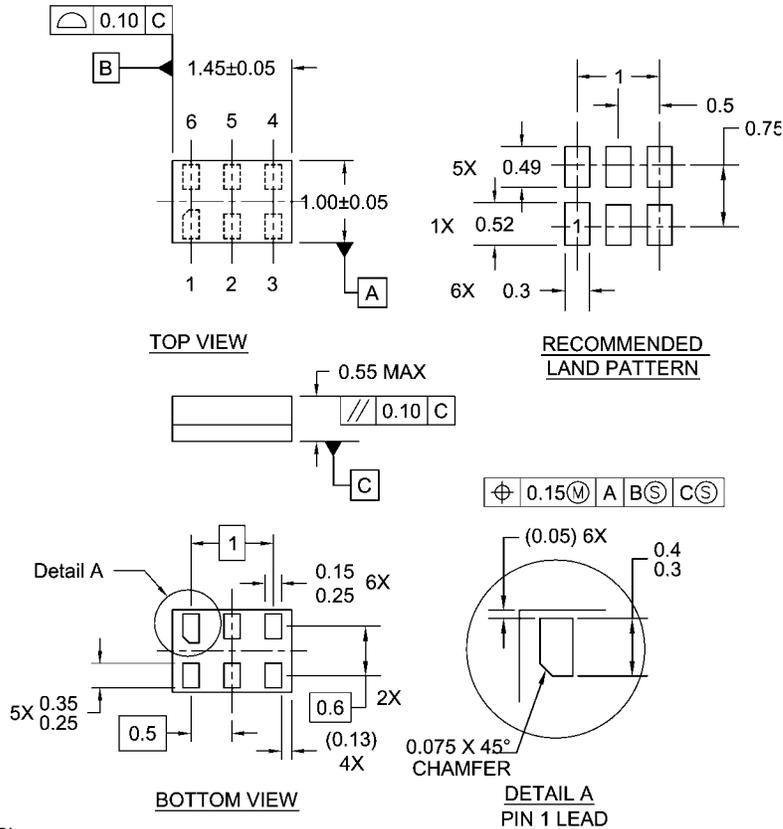
Notes:

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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