FAIRCHILD SEMICONDUCTOR®

March 2008

NC7SZ57, NC7SZ58
TinyLogic® UHS Universal Configurable 2-Input Logic Gates

Features

- Space saving SC70-6 lead surface mount package
- Ultra small MicroPak™ leadless package
- Ultra High Speed
- Capable of implementing any 2-input logic function
- Typical usage replaces 2 TinyLogic® gate devices
- Reduces part counts in inventory
- Broad V_{CC} operating range: 1.65V to 5.5V
- Power down high impedance input/output
- Overvoltage tolerant inputs facilitate 5V to 3V translation
- Patented noise/EMI reduction circuitry implemented

General Description

The NC7SZ57 and the NC7SZ58 are Universal Configurable 2-Input Logic Gates. Each device is capable of being configured for 1 of 5 unique 2-input logic functions. Any possible 2-input combinatorial logic function can be implemented as shown in the Function Selection Table. Device functionality is selected by how the device is wired at the board level. Figure 1 through Figure 10 illustrate how to connect the NC7SZ57 and NC7SZ58 respectively for the desired logic function. All inputs have been implemented with hysteresis.

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 broad V_{CC} operating range. The device is specified to operate over the 1.65V to 5.5V V_{CC} operating range. The input and output are high impedance when V_{CC} is 0V. Inputs tolerate voltages up to 5.5V independent of V_{CC} operating range.

Ordering Information

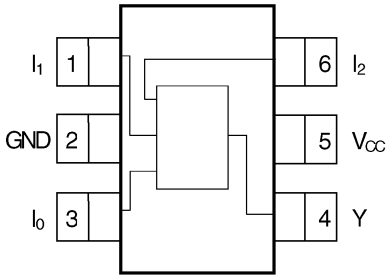
Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7SZ57P6X	MAA06A	Z57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
NC7SZ57L6X	MAC06A	KK	6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel
NC7SZ58P6X	MAA06A	Z58	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
NC7SZ58L6X	MAC06A	LL	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.

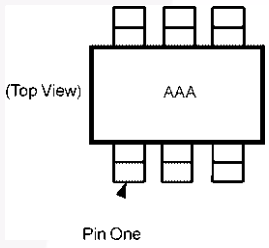
Connection Diagrams

Pin Assignments for SC70



(Top View)
NC7SZ57 and NC7SZ58

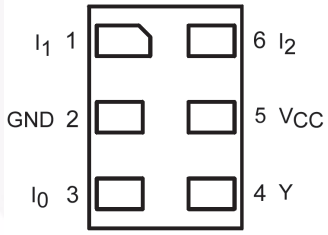
Pin One Orientation Diagram



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 Assignment for MicroPak



(Top Thru View)

Function Table

Inputs			NC7SZ57	NC7SZ58
I_2	I_1	I_0	$Y = (\bar{I}_0) \cdot (\bar{I}_2)\ (I_1) \cdot (I_2)$	$Y = (I_0) \cdot (\bar{I}_2) + (\bar{I}_1) \cdot (I_2)$
L	L	L	H	L
L	L	H	L	H
L	H	L	H	L
L	H	H	L	H
H	L	L	L	H
H	L	H	L	H
H	H	L	H	L
H	H	H	H	L

Pin Description

Pin Name	Description
I_0, I_1, I_2	Data Inputs
Y	Output

H = HIGH Logic Level

L = LOW Logic Level

Function Selection Table

2-Input Logic Function	Device Selection	Connection Configuration
2-Input AND	NC7SZ57	Figure 1
2-Input AND with inverted input	NC7SZ58	Figure 7, Figure 8
2-Input AND with both inputs inverted	NC7SZ57	Figure 4
2-Input NAND	NC7SZ58	Figure 6
2-Input NAND with inverted input	NC7SZ57	Figure 2, Figure 3
2-Input NAND with both inputs inverted	NC7SZ58	Figure 9
2-Input OR	NC7SZ58	Figure 9
2-Input OR with inverted input	NC7SZ57	Figure 2, Figure 3
2-Input OR with both inputs inverted	NC7SZ58	Figure 6
2-Input NOR	NC7SZ57	Figure 4
2-Input NOR with inverted input	NC7SZ58	Figure 7, Figure 8
2-Input NOR with both inputs inverted	NC7SZ57	Figure 1
2-Input XOR	NC7SZ58	Figure 10
2-Input XNOR	NC7SZ57	Figure 5

Logic Configurations NC7SZ57

Figure 1 through Figure 5 show the logical functions that can be implemented using the NC7SZ57. The diagrams show the DeMorgan's equivalent logic duals for a given 2-input function. Next to the logical implementation is the board level physical implementation of how the pins of the function should be connected.

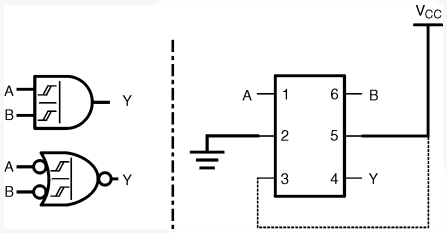


Figure 1. 2-Input AND Gate

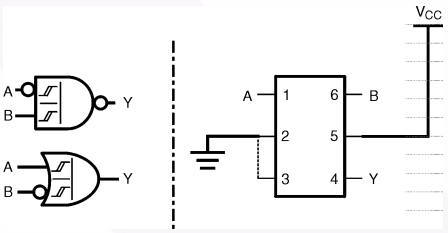


Figure 2. 2-Input NAND with Inverted A Input

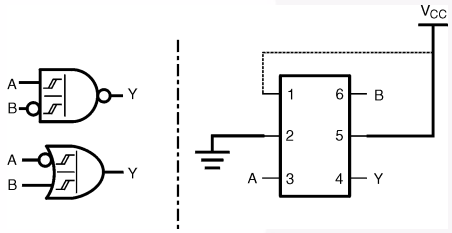


Figure 3. 2-Input NAND with Inverted B Input

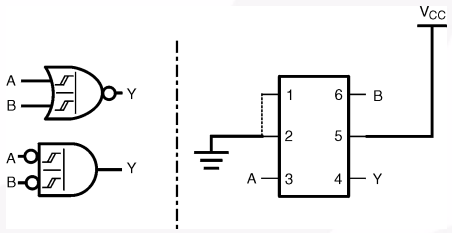


Figure 4. 2-Input NOR Gate

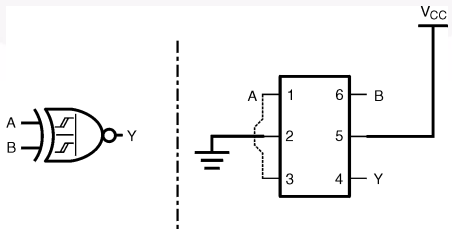


Figure 5. 2-Input XNOR Gate

Logic Configurations NC7SZ58

Figure 6 through Figure 10 show the logical functions that can be implemented using the NC7SZ58. The diagrams show the DeMorgan's equivalent logic duals for a given 2-input function. Next to the logical implementation is the board level physical implementation of how the pins of the function should be connected.

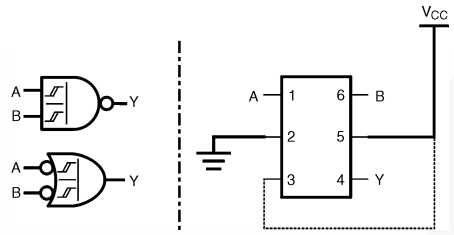


Figure 6. 2-Input NAND Gate

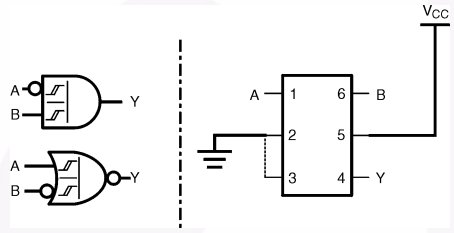


Figure 7. 2-Input AND with Inverted A Input

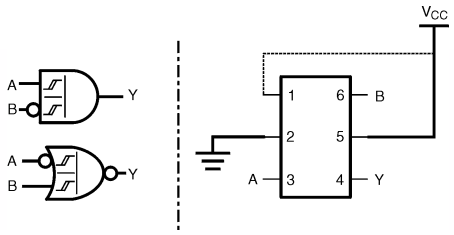


Figure 8. 2-Input AND with Inverted B Input

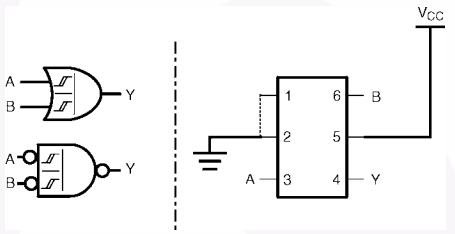


Figure 9. 2-Input OR Gate

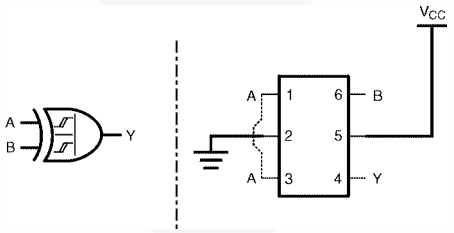


Figure 10. 2-Input XOR Gate

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 +7V
V_{IN}	DC Input Voltage	–0.5V to +7V
V_{OUT}	DC Output Voltage	–0.5V to +7V
I_{IK}	DC Input Diode Current @ $V_{IN} \leq 0.5V$	–50mA
I_{OK}	DC Output Diode Current @ $V_{IN} \leq –0.5V$	–50mA
I_{OUT}	DC Output Current Source/Sink Current	±50mA
I_{CC}/I_{GND}	DC V_{CC} or Ground Current	±50mA
T_{STG}	Storage Temperature Range	–65°C to +150°C
T_J	Max. Junction Temperature Under Bias	150°C
T_L	Lead Temperature (Soldering, 10 seconds)	260°C
P_D	Power Dissipation @ +85°C, SC70-6	180mW

Recommended Operating Conditions

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 Operating	1.65V to 5.5V
	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
θ_{JA}	Thermal Resistance, SC70-6	350°C/W

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	Conditions		T_A = +25°C			T_A = –40°C to +85°C		Units
					Min.	Typ.	Max.	Min.	Max.	
V_P	Positive Threshold Voltage	1.65			0.6	0.99	1.4	0.6	1.4	V
		2.3			1.0	1.39	1.8	1.0	1.8	
		3.0			1.3	1.77	2.2	1.3	2.2	
		4.5			1.9	2.49	3.1	1.9	3.1	
		5.5			2.2	2.95	3.6	2.2	3.6	
V_N	Negative Threshold Voltage	1.65			0.2	0.50	0.9	0.2	0.9	V
		2.3			0.4	0.75	1.15	0.4	1.15	
		3.0			0.6	0.99	1.5	0.6	1.5	
		4.5			1.0	1.43	2.0	1.0	2.0	
		5.5			1.2	1.70	2.3	1.2	2.3	
V_H	Hysteresis Voltage	1.65			0.15	0.48	0.9	0.15	0.9	V
		2.3			0.25	0.64	1.1	0.25	1.1	
		3.0			0.4	0.78	1.2	0.4	1.2	
		4.5			0.6	1.06	1.5	0.6	1.5	
		5.5			0.7	1.25	1.7	0.7	1.7	
V_{OH}	HIGH Level Output Voltage	1.65	$V_{IN} = V_{IH}$ or V_{IL}	I_{OH} = –100µA	1.55	1.65		1.55		V
		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	$V_{IN} = V_{IH}$ or V_{IL}	I_{OH} = –4mA	1.29	1.52		1.29		
		2.3		I_{OH} = –8mA	1.9	2.15		1.9		
		3.0		I_{OH} = –16mA	2.4	2.80		2.4		
		3.0		I_{OH} = –24mA	2.3	3.68		2.3		
		4.5		I_{OH} = –32mA	3.8	4.20		3.8		
V_{OL}	LOW Level Output Voltage	1.65	$V_{IN} = V_{IH}$ or V_{IL}	I_{OL} = 100µA		0.0	0.10		0.10	V
		2.3				0.0	0.10		0.10	
		3.0				0.0	0.10		0.10	
		4.5				0.0	0.10		0.10	
		1.65	$V_{IN} = V_{IH}$ or V_{IL}	I_{OL} = 4mA		0.08	0.24		0.24	
		2.3		I_{OL} = 8mA		0.10	0.3		0.3	
		3.0		I_{OL} = 16mA		0.15	0.4		0.4	
		3.0		I_{OL} = 24mA		0.22	0.55		0.55	
		4.5		I_{OL} = 32mA		0.22	0.55		0.55	
I_{IN}	Input Leakage Current	0–5.5	V_{IN} = 5.5V, GND				±0.1		±1	µA
I_{OFF}	Power Off Leakage Current	0.0	V_{IN} or V_{OUT} = 5.5V				1		10	µA
I_{CC}	Quiescent Supply Current	1.65–5.5	V_{IN} = 5.5V, GND				1		10	µA

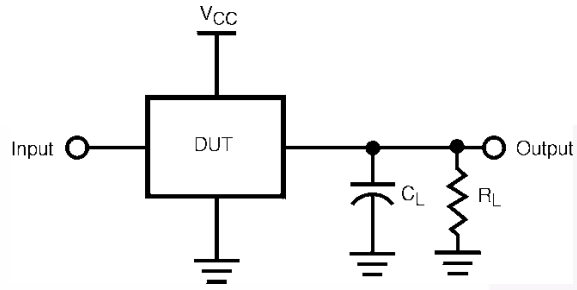
AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C			T_A = –40°C to +85°C		Units	Fig. No.
				Min.	Typ.	Max.	Min.	Max.		
t_{PLH}, t_{PHL}	Propagation Delay I_n to Y	1.8 ± 0.15	C_L = 15pF, R_L = 1MΩ	3.0	8	14.0	3.0	14.5	ns	Figure 11 Figure 13
		2.5 ± 0.2		1.5	4.9	8.0	1.5	8.5		
		3.3 ± 0.3		1.2	3.7	5.3	1.2	5.7		
		5.0 ± 0.5		0.8	2.8	4.3	0.8	4.6		
t_{PLH}, t_{PHL}	Propagation Delay I_n to Y	3.3 ± 0.3	C_L = 50pF, R_L = 500Ω	1.5	4.2	6.0	1.5	6.5	ns	Figure 11 Figure 13
		5.0 ± 0.5		1.0	3.4	4.9	1.0	5.3		
C_{IN}	Input Capacitance	0			2				pF	
C_{PD}	Power Dissipation	3.3	(1)		14				pF	Figure 12
	Capacitance	5.0			17					

Note:

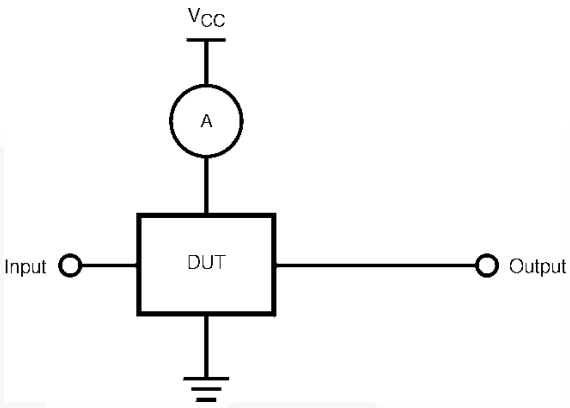
1. C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 12) C_{PD} is related to I_{CCD} dynamic operatic current by the expression:
   $I_{CCD} = (C_{PD})(V_{CC})(f_{in}) + (I_{CC}static)$.

AC Loading and Waveforms



C_L includes load and stray Capacitance
Input PRR = 1.0 MHz, t_W = 500 ns

Figure 11. AC Test Circuit



Input = AC Waveforms
PRR = Variable; Duty Cycle = 50%

Figure 12. I_{CCD} Test Circuit

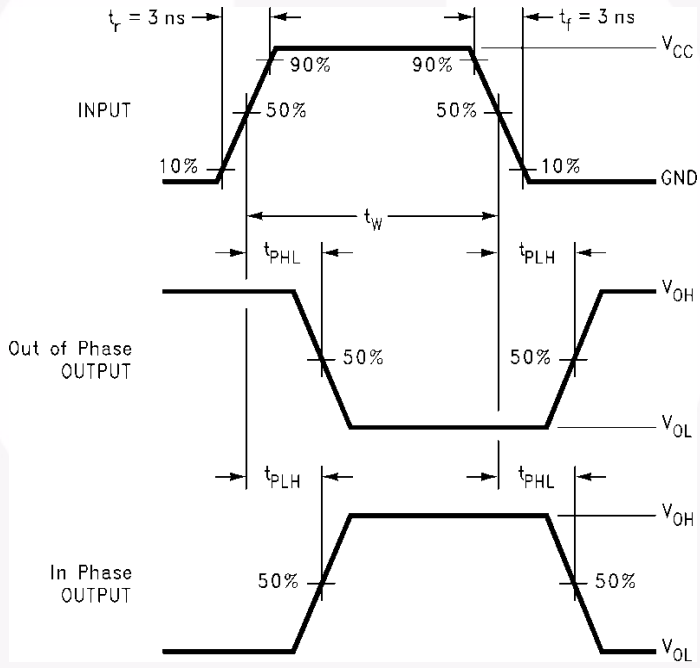


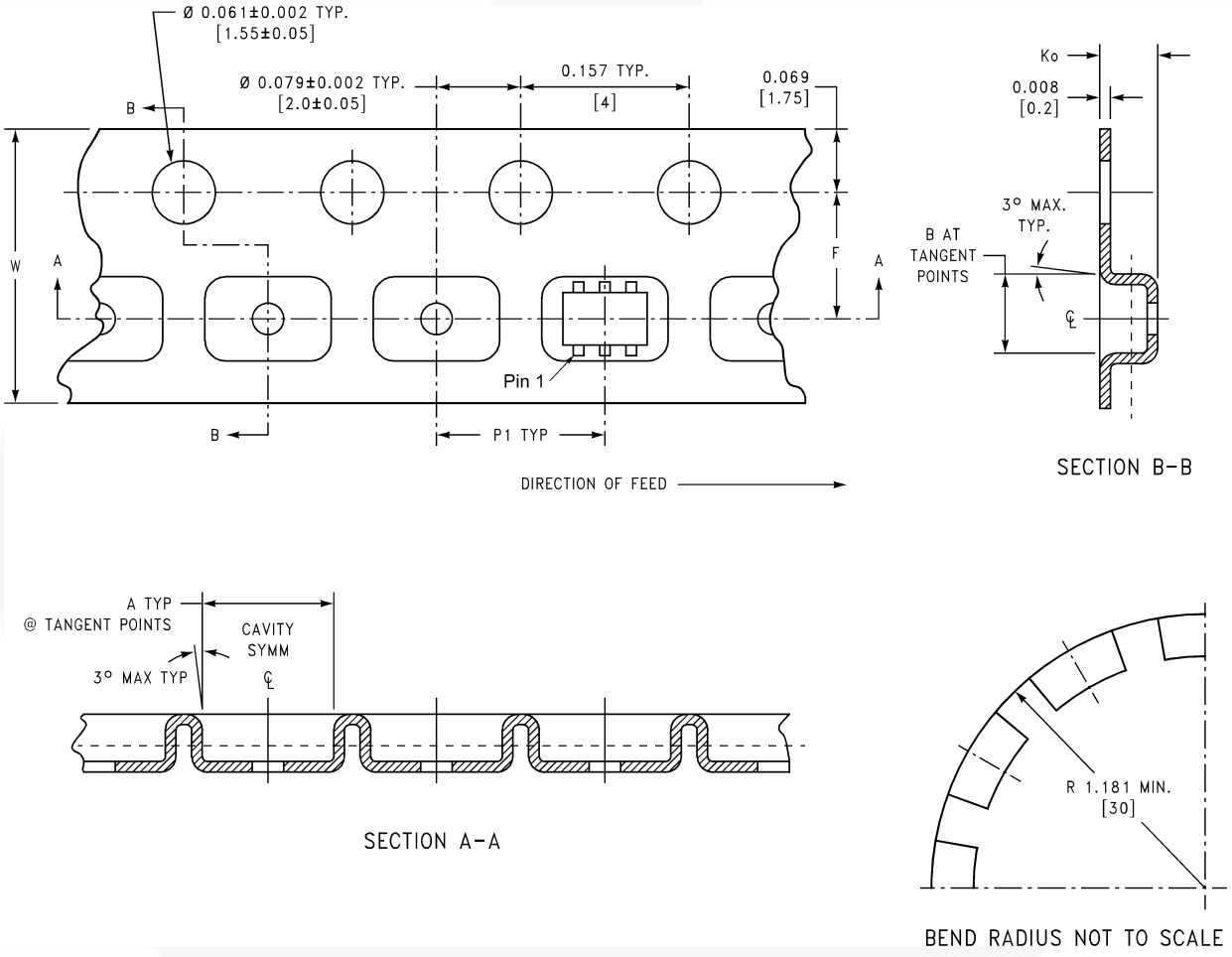
Figure 13. AC Waveforms

Tape and Reel Specification

Tape Format for SC70

Package Designator	Tape Section	Number of 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)

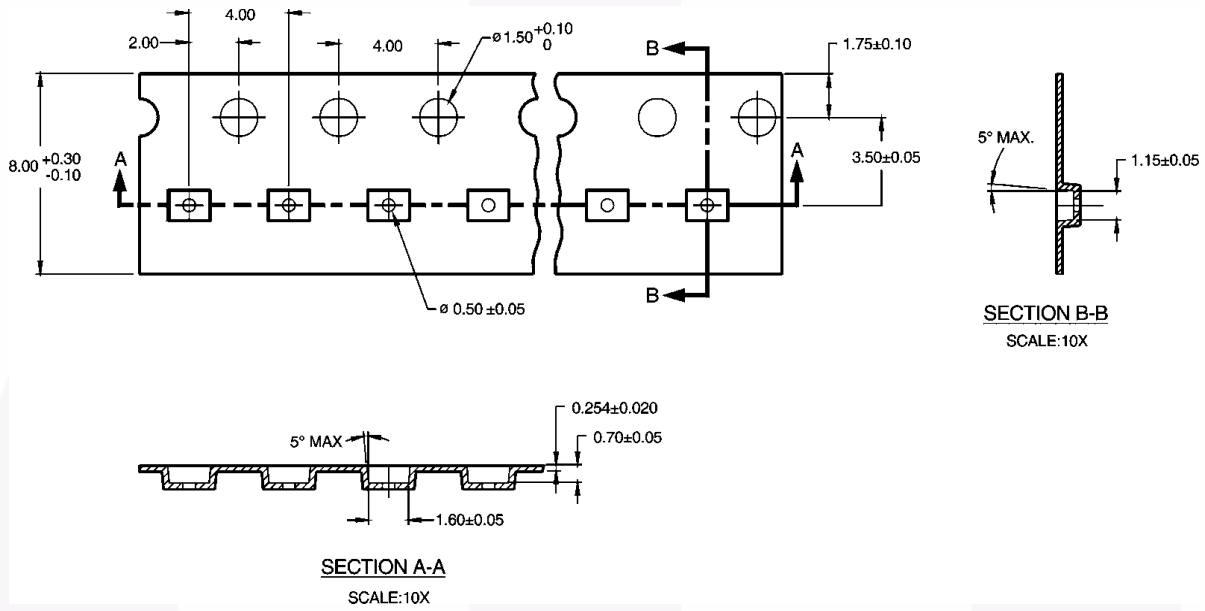


Package	Tape Size	Dim A	Dim B	Dim F	Dim K_o	Dim P1	Dim W
SC70-6	8mm	0.093 (2.35)	0.096 (2.45)	0.138 ± 0.004 (3.5 ± 0.10)	0.053 ± 0.004 (1.35 ± 0.10)	0.157 (4)	0.315 ± 0.004 (8 ± 0.1)

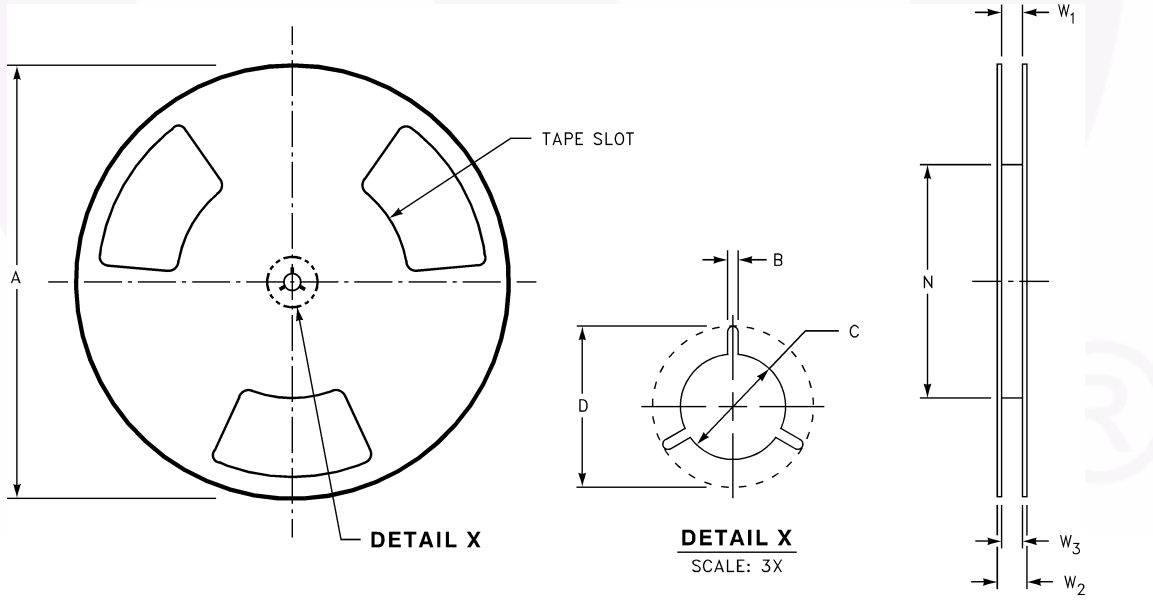
Tape and Reel Specifications

Tape Format for MicroPak

Package Designator	Tape Section	Number of 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

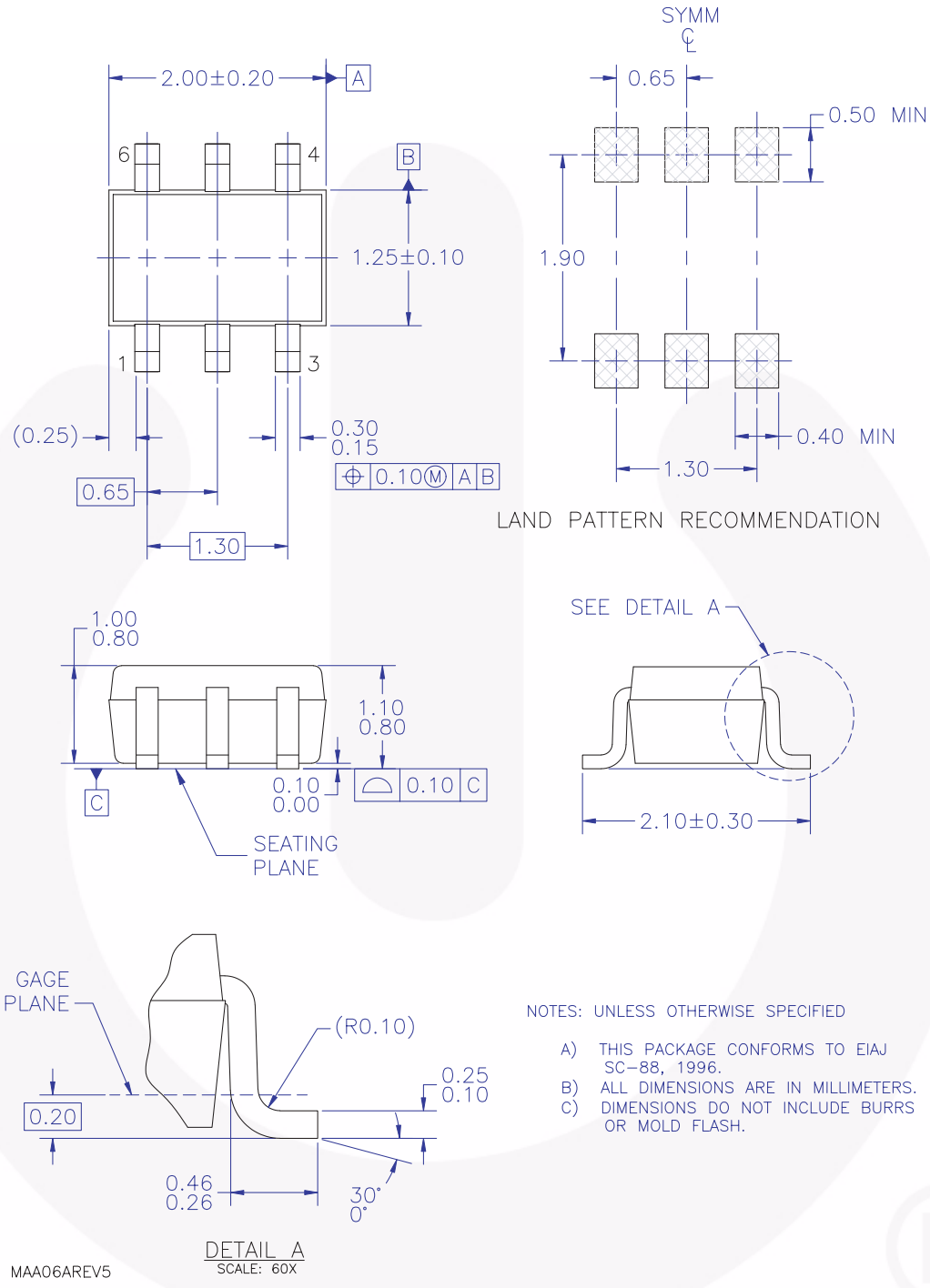


Figure 14. 6-Lead SC70, EIAJ SC88, 1.25mm Wide

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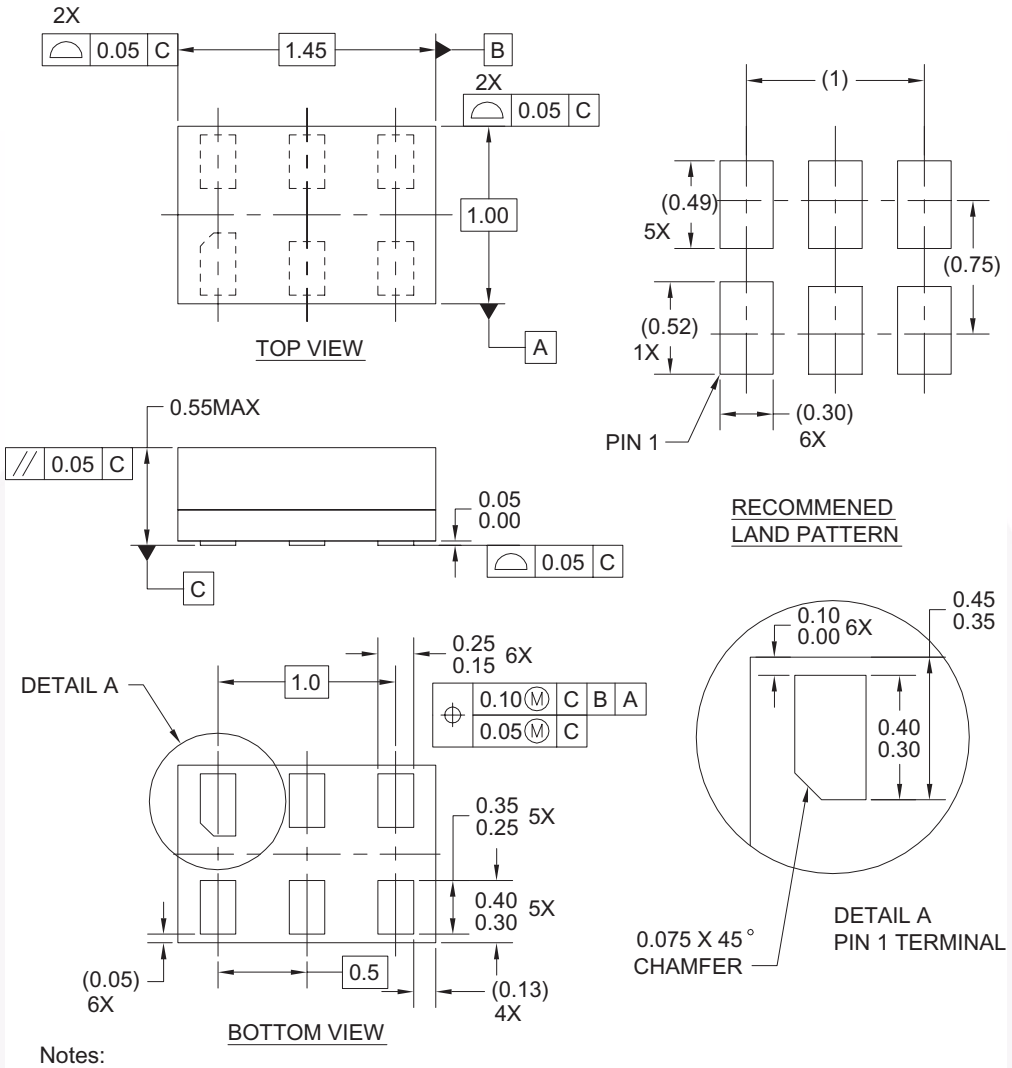
Physical Dimensions (Continued)



Notes:

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

MAC06AREVC

Figure 15. 6-Lead MicroPak, 1.0mm Wide

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MicroPak™
MillerDrive™
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PDP-SPM™
Power220®
POWEREDGE®
Power-SPM™
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1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.

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