FAIRCHILD SEMICONDUCTOR®

June 2008

NC7SV02
TinyLogic® ULP-A 2-Input NOR Gate

Features

- 0.9V to 3.6V V_{CC} supply operation
- 3.6V overvoltage tolerant I/O's at V_{CC} from 0.9V to 3.6V
- Extremely High Speed t_{PD}:
  - 1.0ns typ. for 2.7V to 3.6V V_{CC}
  - 1.2ns typ. for 2.3V to 2.7V V_{CC}
  - 1.9ns typ. for 1.65V to 1.95V V_{CC}
  - 3.2ns typ. for 1.4V to 1.6V V_{CC}
  - 6.0ns typ. for 1.1V to 1.3V V_{CC}
  - 13ns typ. for 0.9V V_{CC}
- Power-Off high impedance inputs and outputs
- High Static Drive (I_{OH}/I_{OL}):
  - ±24mA @ 3.00V V_{CC}
  - ±18mA @ 2.30V V_{CC}
  - ±6mA @ 1.65V V_{CC}
  - ±4mA @ 1.4V V_{CC}
  - ±2mA @ 1.1V V_{CC}
  - ±0.1mA @ 0.9V V_{CC}
- Uses patented Quiet Series™ noise/EMI reduction circuitry
- Ultra small MicroPak™ package
- Ultra low dynamic power

General Description

The NC7SV02 is a single 2-Input NOR Gate from Fairchild's Ultra Low Power-A (ULP-A) Series of TinyLogic®. ULP-A is ideal for applications that require extreme high speed, high drive and low power. This product is designed for a wide low voltage operating range (0.9V to 3.6V V_{CC}) and applications that require more drive and speed than the TinyLogic ULP series, but still offer best in class low power operation.

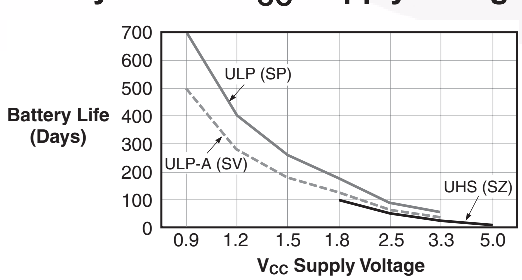
The NC7SV02 is uniquely designed for optimized power and speed, and is fabricated with an advanced CMOS technology to achieve high-speed operation while maintaining low CMOS power dissipation.

Ordering Information

Order Number	Package Number	Package Code Top Mark	Package Description	Supplied As
NC7SV02P5X	MAA05A	V02	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
NC7SV02L6X	MAC06A	F6	6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

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

Battery Life vs. V_{CC} Supply Voltage



TinyLogic ULP and ULP-A with up to 50% less power consumption can extend your battery life significantly.

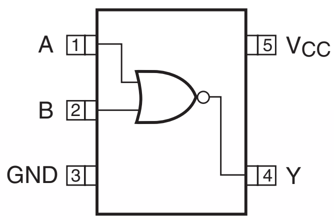
Battery Life = ($V_{battery}$ x $I_{battery}$ x 0.9) / (P_{device}) / 24hrs/day

Where, $P_{device} = (I_{CC} \times V_{CC}) + (C_{PD} + C_L) \times V_{CC}^2 \times f$

Assumes ideal 3.6V Lithium Ion battery with current rating of 900mAH and derated 90% and device frequency at 10MHz, with C_L = 15pF load.

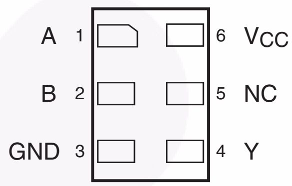
Connection Diagrams

Pin Assignment for SC70



(Top View)

Pad Assignments for MicroPak



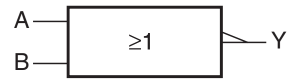
(Top Through View)

Pin Description

Pin Names	Description
A, B	Input
Y	Output
NC	No Connect

Logic Symbol

IEEE/IEC



Function Table

$$Y = \overline{A + B}$$

Inputs		Output
A	**B**	**Y**
L	L	H
L	H	L
H	L	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 +4.6V
V_{IN}	DC Input Voltage	–0.5V to +4.6V
V_{OUT}	DC Output Voltage HIGH or LOW State(1) V_{CC} = 0V	 –0.5V to V_{CC} +0.5V –0.5V to +4.6V
I_{IK}	DC Input Diode Current @ V_{IN} < 0V	–50mA
I_{OK}	DC Output Diode Current V_{OUT} < 0V V_{OUT} > V_{CC}	 –50mA +50mA
I_{OH} / I_{OL}	DC Output Source/Sink Current	±50mA
I_{CC} or Ground	DC V_{CC} or Ground Current per Supply Pin	±50mA
T_{STG}	Storage Temperature Range	–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 SC70-5 Micropak-6	 150mW 130mW

Recommended Operating Conditions(2)

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	0.9V to 3.6V
V_{IN}	Input Voltage	0V to 3.6V
V_{OUT}	Output Voltage HIGH or LOW State V_{CC} = 0V	 0V to V_{CC} 0V to 3.6V
I_{OH} / I_{OL}	Output Current in I_{OH} / I_{OL} V_{CC} = 3.0V to 3.6V V_{CC} = 2.3V to 2.7V V_{CC} = 1.65V to 1.95V V_{CC} = 1.4V to 1.6V V_{CC} = 1.1V to 1.3V V_{CC} = 0.9V	 ±24mA ±18mA ±6mA ±4mA ±2mA ±0.1mA
T_A	Free Air Operating Temperature	–40°C to +85°C
$\Delta t / \Delta V$	Minimum Input Edge Rate @ V_{IN} = 0.8V to 2.0V, V_{CC} = 3.0V	10ns/V
θ_{JA}	Thermal Resistance SC70-5 Micropak-6	 425°C/W 500°C/W

Notes:
1. I_O Absolute Maximum Rating must be observed.
2. Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C Min.	T_A = +25°C Max.	T_A = –40°C to +85°C Min.	T_A = –40°C to +85°C Max.	Units
V_{IH}	HIGH Level Input Voltage	0.90		0.65 x V_{CC}		0.65 x V_{CC}		V
		$1.10 \le V_{CC} \le 1.30$		0.65 x V_{CC}		0.65 x V_{CC}		
		$1.40 \le V_{CC} \le 1.60$		0.65 x V_{CC}		0.65 x V_{CC}		
		$1.65 \le V_{CC} \le 1.95$		0.65 x V_{CC}		0.65 x V_{CC}		
		$2.30 \le V_{CC} < 2.70$		1.6		1.6		
		$2.70 \le V_{CC} \le 3.60$		2.0		2.0		
V_{IL}	LOW Level Input Voltage	0.90			0.35 x V_{CC}		0.35 x V_{CC}	V
		$1.10 \le V_{CC} \le 1.30$			0.35 x V_{CC}		0.35 x V_{CC}	
		$1.40 \le V_{CC} \le 1.60$			0.35 x V_{CC}		0.35 x V_{CC}	
		$1.65 \le V_{CC} \le 1.95$			0.35 x V_{CC}		0.35 x V_{CC}	
		$2.30 \le V_{CC} < 2.70$			0.7		0.7	
		$2.70 \le V_{CC} \le 3.60$			0.8		0.8	
V_{OH}	HIGH Level Output Voltage	0.90	I_{OH} = –100µA	V_{CC} – 0.1		V_{CC} – 0.1		V
		$1.10 \le V_{CC} \le 1.30$		V_{CC} – 0.1		V_{CC} – 0.1		
		$1.40 \le V_{CC} \le 1.60$		V_{CC} – 0.2		V_{CC} – 0.2		
		$1.65 \le V_{CC} \le 1.95$		V_{CC} – 0.2		V_{CC} – 0.2		
		$2.30 \le V_{CC} < 2.70$		V_{CC} – 0.2		V_{CC} – 0.2		
		$2.70 \le V_{CC} \le 3.60$		V_{CC} – 0.2		V_{CC} – 0.2		
		$1.10 \le V_{CC} \le 1.30$	I_{OH} = –2mA	0.75 x V_{CC}		0.75 x V_{CC}		
		$1.40 \le V_{CC} \le 1.60$	I_{OH} = –4mA	0.75 x V_{CC}		0.75 x V_{CC}		
		$1.65 \le V_{CC} \le 1.95$	I_{OH} = –6mA	1.25		1.25		
		$2.30 \le V_{CC} < 2.70$		2.0		2.0		
		$2.30 \le V_{CC} < 2.70$	I_{OH} = –12mA	1.8		1.8		
		$2.70 \le V_{CC} \le 3.60$		2.2		2.2		
		$2.30 \le V_{CC} < 2.70$	I_{OH} = –18mA	1.7		1.7		
		$2.70 \le V_{CC} \le 3.60$		2.4		2.4		
		$2.70 \le V_{CC} \le 3.60$	I_{OH} = –24mA	2.2		2.2		
V_{OL}	LOW Level Output Voltage	0.90	I_{OL} = 100µA		0.1		0.1	V
		$1.10 \le V_{CC} \le 1.30$			0.1		0.1	
		$1.40 \le V_{CC} \le 1.60$			0.2		0.2	
		$1.65 \le V_{CC} \le 1.95$			0.2		0.2	
		$2.30 \le V_{CC} < 2.70$			0.2		0.2	
		$2.70 \le V_{CC} \le 3.60$			0.2		0.2	
		$1.10 \le V_{CC} \le 1.30$	I_{OL} = 2mA		0.25 x V_{CC}		0.25 x V_{CC}	
		$1.40 \le V_{CC} \le 1.60$	I_{OL} = 4mA		0.25 x V_{CC}		0.25 x V_{CC}	
		$1.65 \le V_{CC} \le 1.95$	I_{OL} = 6mA		0.3		0.3	
		$2.30 \le V_{CC} < 2.70$	I_{OL} = 12mA		0.4		0.4	
		$2.70 \le V_{CC} \le 3.60$			0.4		0.4	
		$2.30 \le V_{CC} < 2.70$	I_{OL} = 18mA		0.6		0.6	
		$2.70 \le V_{CC} \le 3.60$			0.4		0.4	
		$2.70 \le V_{CC} \le 3.60$	I_{OL} = 24mA		0.55		0.55	

DC Electrical Characteristics (Continued)

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C Min.	T_A = +25°C Max.	T_A = –40°C to +85°C Min.	T_A = –40°C to +85°C Max.	Units
I_{IN}	Input Leakage Current	0.90 to 3.60	$0 \leq V_I \leq 3.6V$		±0.1		±0.5	µA
I_{OFF}	Power Off Leakage Current	0	$0 \leq (V_I, V_O) \leq 3.6V$		0.5		0.5	µA
I_{CC}	Quiescent Supply Current	0.90 to 3.60	$V_I = V_{CC}$ or GND,		0.9		0.9	µA
			$V_{CC} \leq V_I \leq 3.6V$				±0.9	

AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	Conditions	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	Figure Number
t_{PHL}, t_{PLH}	Propagation Delay	0.90	C_L = 15pF, R_L = 1MΩ		13				ns	Figure 1 Figure 2
		$1.10 \leq V_{CC} \leq 1.30$	C_L = 15 pF, R_L = 2kΩ	3.0	6.0	15.0	1.0	18.6		
		$1.40 \leq V_{CC} \leq 1.60$		1.0	3.2	8.7	1.0	9.7		
		$1.65 \leq V_{CC} \leq 1.95$	C_L = 30pF, R_L = 500Ω	1.0	1.9	6.0	1.0	6.8		
		$2.30 \leq V_{CC} < 2.70$		0.8	1.2	4.1	0.7	4.7		
		$2.70 \leq V_{CC} \leq 3.60$		0.7	1.0	3.3	0.6	4.0		
C_{IN}	Input Capacitance	0			2.0				pF	
C_{PD}	Power Dissipation Capacitance	0.90 to 3.60	V_I = 0V or V_{CC}, f = 10MHz		8				pF	

AC Loading and Waveforms

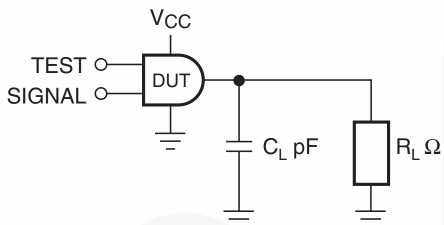


Figure 1. AC Test Circuit

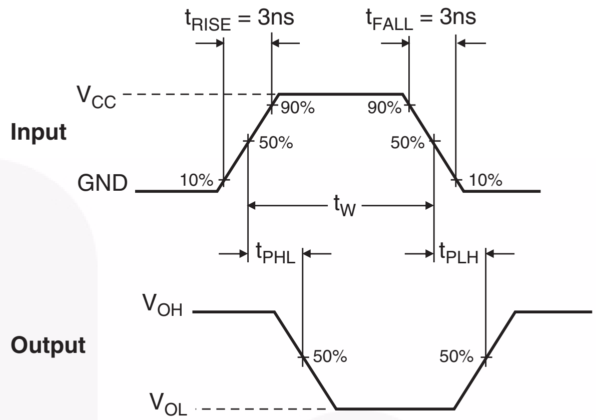


Figure 2. AC Waveforms

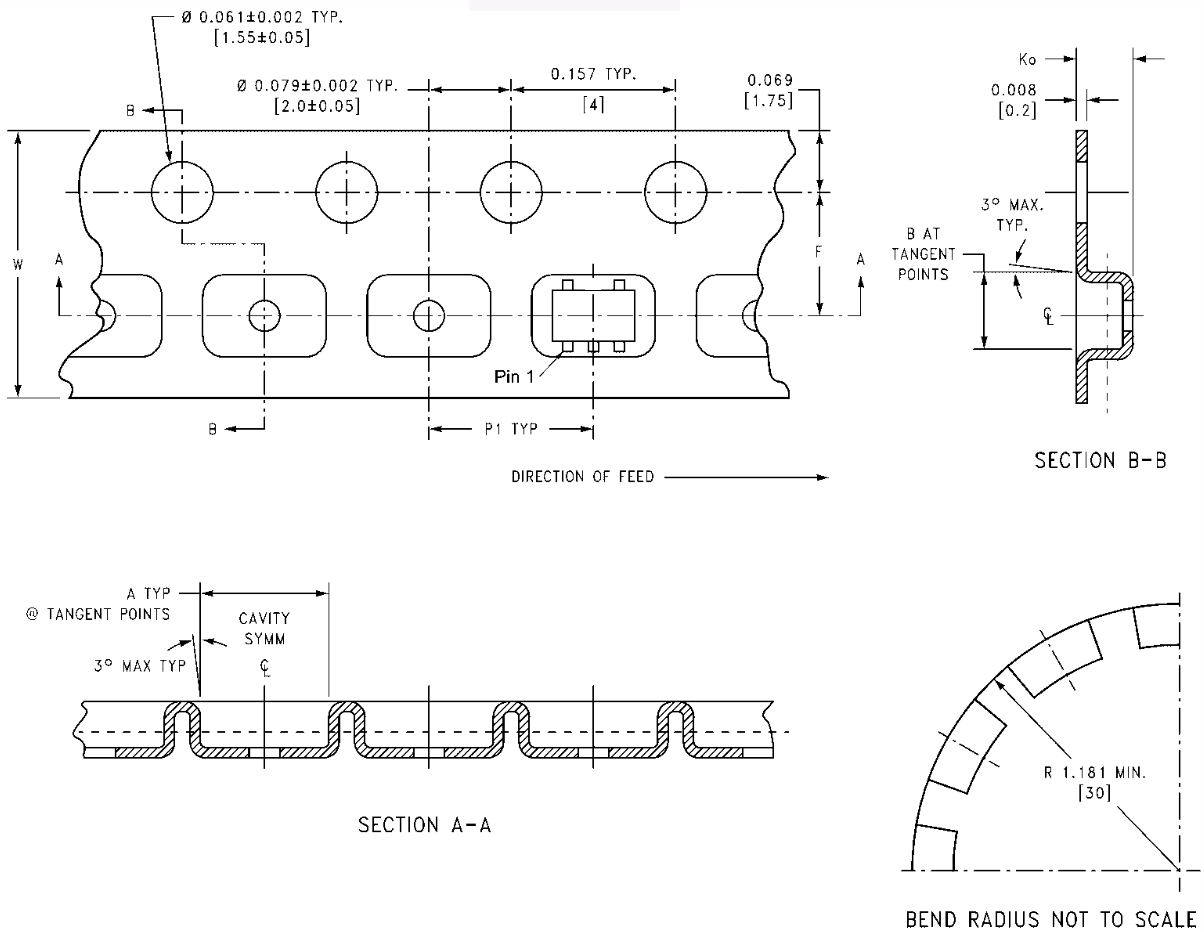
Symbol	V_{CC}					
	3.3V ± 0.3V	**2.5V ± 0.2V**	**1.8V ± 0.15V**	**1.5V ± 0.1V**	**1.2V ± 0.1V**	**0.9V**
V_{mi}	1.5V	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$
V_{mo}	1.5V	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$

Tape and Reel Specification

Tape Format for SC70

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
P5X	Leader (Start End)	125 (typ.)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ.)	Empty	Sealed

Tape Dimension inches (millimeters)

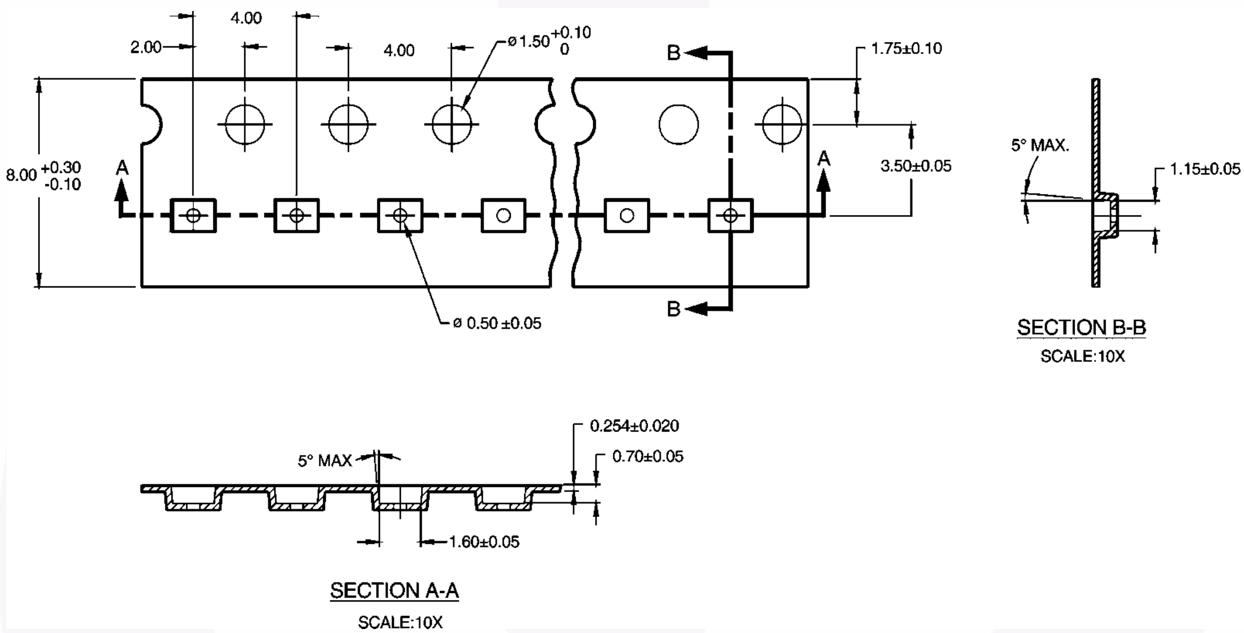


Tape and Reel Specification (Continued)

Tape Format for MicroPak

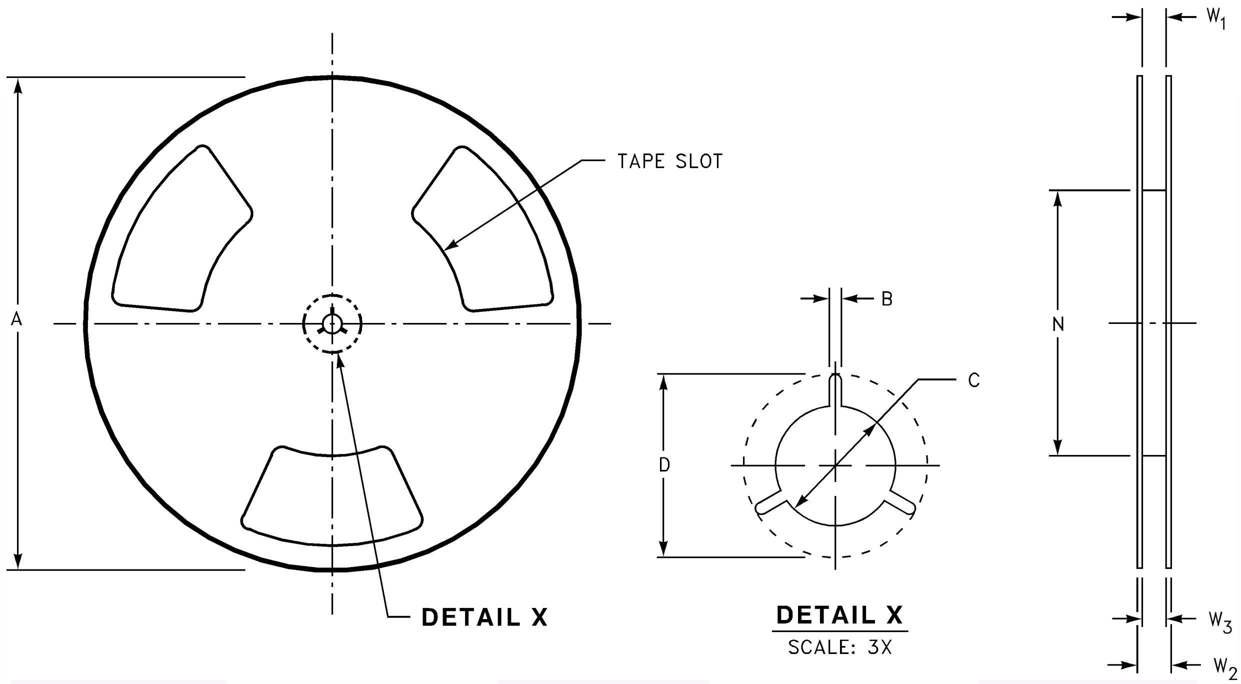
Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
L6X	Leader (Start End)	125 (typ.)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (typ.)	Empty	Sealed

Tape Dimension millimeters



Tape and Reel Specification (Continued)

Reel Dimension for MicroPak inches (millimeters)



Tape Size	A	B	C	D	N	W_1	W_2	W_3
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

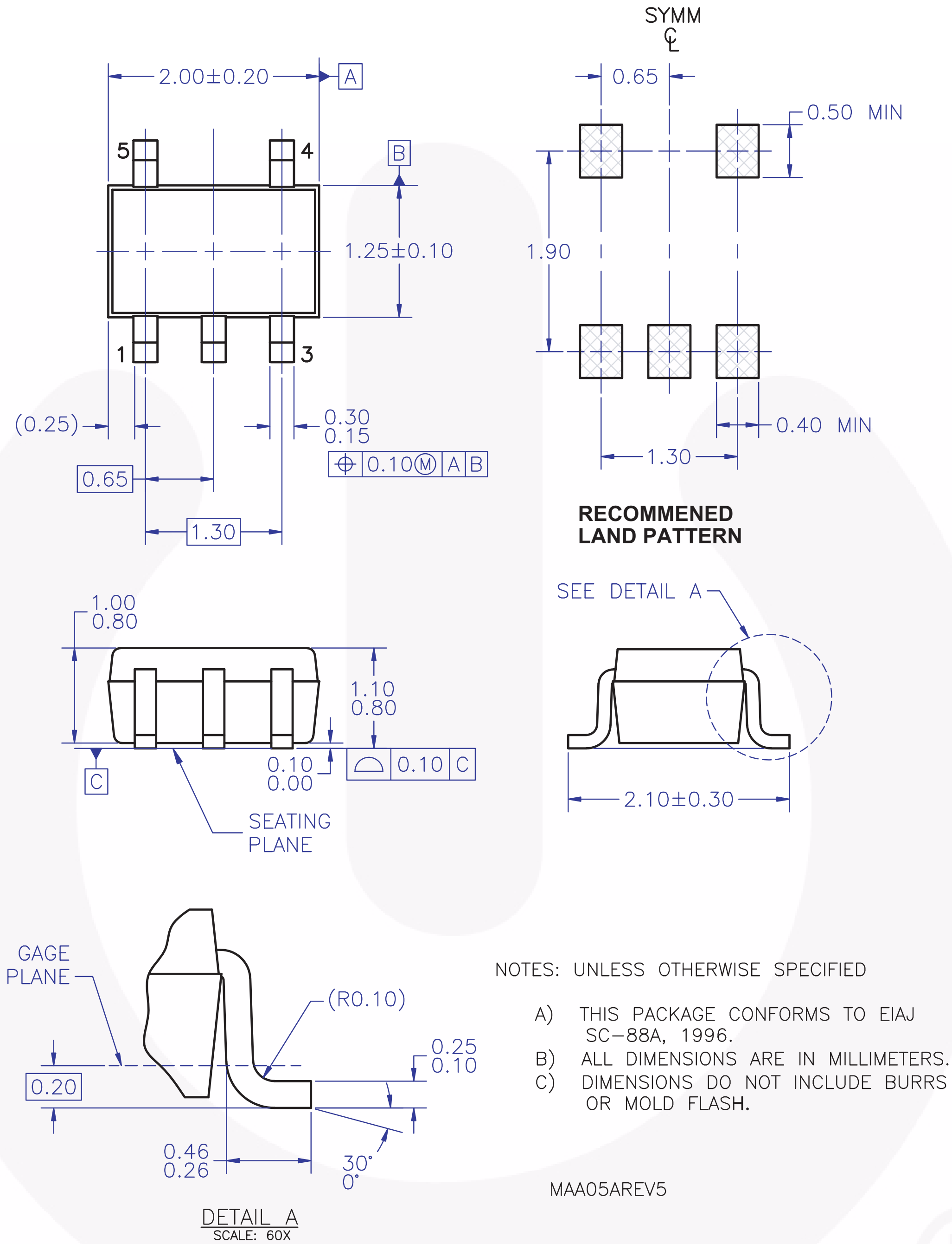


Figure 3. 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide

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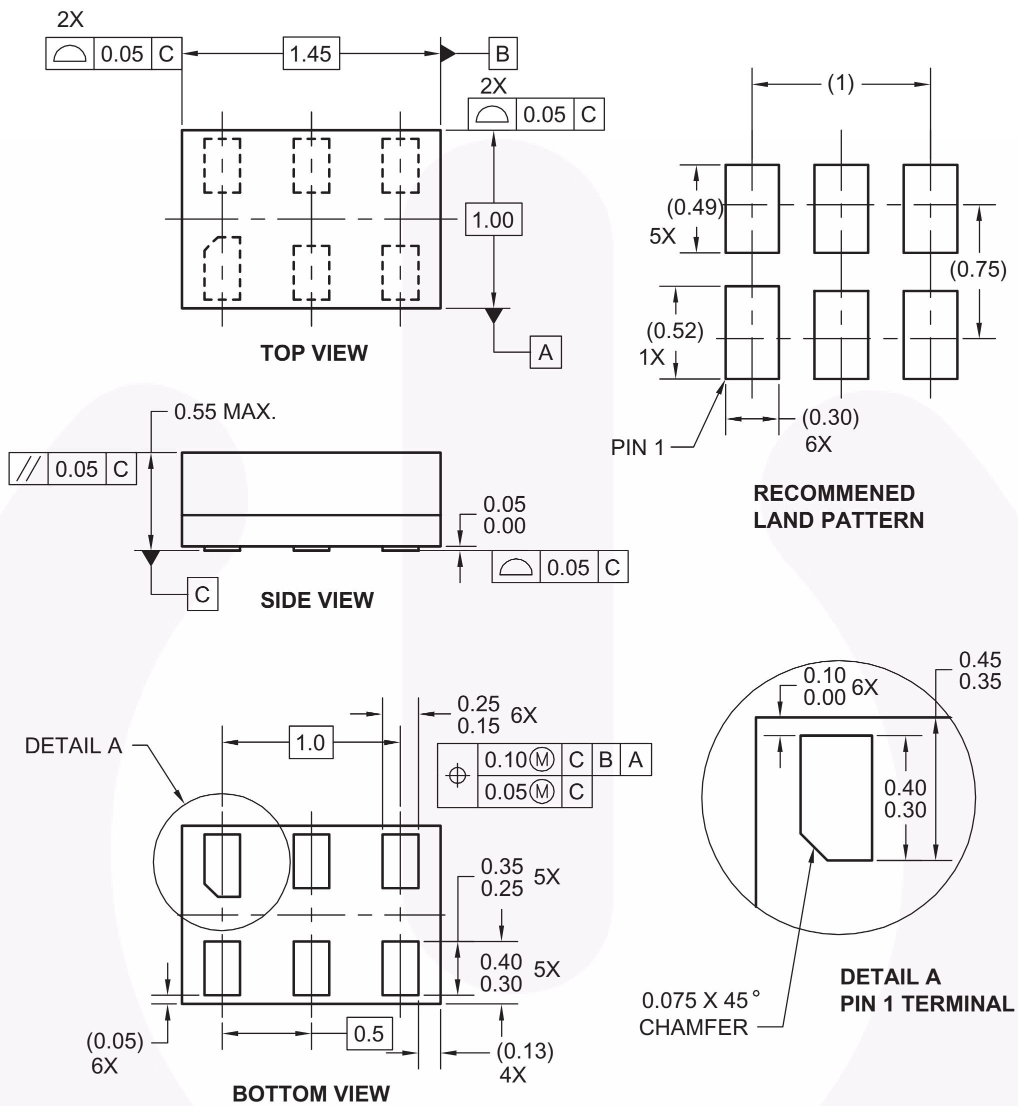
Physical Dimensions (Continued)



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

MAC06AREVC

Figure 4. 6-Lead MicroPak, 1.0mm Wide

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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.
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