FAIRCHILD SEMICONDUCTOR™

December 1997

NC7S14
TinyLogic™ HS Inverter with Schmitt Trigger Input

General Description

The NC7S14 is a single high performance CMOS Inverter with Schmitt Trigger input. The circuit design provides hysteresis between the positive-going and negative going input thresholds thereby improving noise margins.

Advanced Silicon Gate CMOS fabrication assures high speed and low power circuit operation over a broad V_{CC} range. ESD protection diodes inherently guard both input and output with respect to the V_{CC} and GND rails.

Features

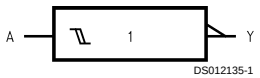
- Space saving SOT23 or SC70 5-lead surface mount package
- Schmitt input hysteresis: > 1V typ
- High speed: T_{PD} 4.5 ns typ
- Low quiescent power: I_{CC} < 1 µA
- Balanced output drive: 2 mA I_{OL}, −2 mA I_{OH}
- Broad V_{CC} operating range: 2V – 6V
- Balanced propagation delays
- Specified for 3V operation

Ordering Code:

Product	Package	Package Drawing	Package Top Mark	Supplied As
NC7S14M5	SOT23-5	MA05B	7S14	250 Units on Tape and Reel
NC7S14M5X	SOT23-5	MA05B	7S14	3k Units on Tape and Reel
NC7S14P5	SC70-5	MAA05A	S14	250 Units on Tape and Reel
NC7S14P5X	SC70-5	MAA05A	S14	3k Units on Tape and Reel

Logic Symbol

IEEE/IEC



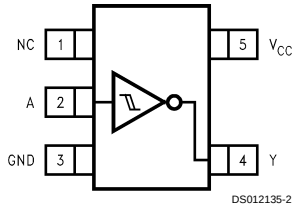
DS012135-1

Pin Descriptions

Pin Names	Description
A	Input
Y	Output
NC	No Connect

Connection Diagram

Pin Assignment for 5-lead Packages



DS012135-2

(Top View)

Function Table

$Y = \overline{A}$

Input	Output
A	**Y**
L	H
H	L

H = HIGH Logic Level
L = LOW Logic Level

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Absolute Maximum Ratings (Note 1)

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Input Diode Current (I_{IK})	
@$V_{IN} \le -0.5V$	−20 mA
@$V_{IN} \ge V_{CC}$ +0.5V	+20 mA
DC Input Voltage (V_{IN})	−0.5V to V_{CC} +0.5V
DC Output Diode Current (I_{OK})	
@$V_{OUT} < -0.5V$	−20 mA
@$V_{OUT} > V_{CC}$ +0.5V	+20 mA
DC Output Voltage (V_{OUT})	−0.5V to V_{CC} +0.5V
DC Output Source or Sink Current (I_{OUT})	±12.5 mA
DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND})	±25 mA
Storage Temperature (T_{STG})	−65˚C to +150˚C
Junction Temperature (T_J)	150˚C
Lead Temperature (T_L) (Soldering, 10 seconds)	260˚C
Power Dissipation (P_D) @ +85˚C	
SOT23-5	200 mW
SC70-5	150 mW
ESD Tolerance (Human Body Model)	
MIL-STD-883D Method 3015.7	2000V
DC Latchup Tolerance Source Current (JEDEC Method 17)	±500 mA

Recommended Operating Conditions

Supply Voltage (V_{CC})	2.0V to 6.0V
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
Thermal Resistance (θ_{JA})	
SOT23-5	300˚C/W
SC70-5	425˚C/W

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook 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 of circuits outside the databook specifications.

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	NC7S14 T_A = +25˚C			NC7S14 T_A = −40˚C to +85˚C		Units	Conditions
			Min	Typ	Max	Min	Max		
V_P	Positive Threshold Voltage	2.0	1.0	1.29	1.5	1.0	1.6	V	
		3.0	1.5	1.90	2.2	1.5	2.2		
		4.5	2.3	2.73	3.15	2.3	3.15		
		6.0	3.0	3.56	4.2	3.0	4.2		
V_N	Negative Threshold Voltage	2.0	0.3	0.70	0.9	0.3	0.9	V	
		3.0	0.6	1.05	1.35	0.6	1.35		
		4.5	1.13	1.66	2.0	1.13	2.0		
		6.0	1.5	2.24	2.6	1.5	2.6		
V_H	Hysteresis Voltage	2.0	0.3	0.59	1.0	0.3	1.0	V	
		3.0	0.4	0.85	1.3	0.4	1.3		
		4.5	0.6	1.08	1.4	0.6	1.4		
		6.0	0.8	1.31	1.7	0.8	1.7		
V_{OH}	High Level Output Voltage	2.0	1.90	2.0		1.90		V	I_{OH} = −20 µA V_{IN} = V_{IL}
		3.0	2.90	3.0		2.90			
		4.5	4.40	4.5		4.40			
		6.0	5.90	6.0		5.90			
								V	V_{IN} = V_{IL}
		3.0	2.68	2.87		2.63			I_{OH} = −1.3 mA
		4.5	4.18	4.37		4.13			I_{OH} = −2 mA
		6.0	5.68	5.86		5.63			I_{OH} = −2.6 mA

DC Electrical Characteristics (Continued)

Symbol	Parameter	V_{CC} (V)	NC7S14 T_A = +25˚C			NC7S14 T_A = −40˚C to +85˚C		Units	Conditions
			Min	Typ	Max	Min	Max		
V_{OL}	Low Level Output Voltage	2.0		0.0	0.10		0.10	V	I_{OH} = 20 µA V_{IN} = V_{IH}
		3.0		0.0	0.10		0.10		
		4.5		0.0	0.10		0.10		
		6.0		0.0	0.10		0.10		
								V	V_{IN} = V_{IH}
		3.0		0.1	0.26		0.33		I_{OL} = 1.3 mA
		4.5		0.1	0.26		0.33		I_{OL} = 2 mA
		6.0		0.1	0.26		0.33		I_{OL} = 2.6 mA
I_{IN}	Input Leakage Current	6.0			±0.1		±1.0	µA	V_{IN} = V_{CC}, GND
I_{CC}	Quiescent Supply Current	6.0			1.0		10.0	µA	V_{IN} = V_{CC}, GND

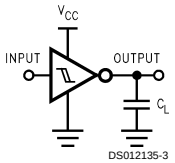
AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	NC7S14 T_A = +25˚C			NC7S14 T_A = −40˚C to +85˚C		Units	Conditions
			Min	Typ	Max	Min	Max		
t_{PLH}, t_{PHL}	Propagation Delay	5.0		4.5	21			ns	C_L = 15 pF
		2.0		20	100		125	ns	C_L = 50 pF
		3.0		12	27		35		
		4.5		8.5	20		25		
		6.0		7.5	17		21		
t_{TLH}, t_{THL}	Output Transition Time	5.0		3	8			ns	C_L = 15 pF
		2.0		25	125		145	ns	C_L = 50 pF
		3.0		16	35		45		
		4.5		11	25		30		
		6.0		9	21		24		
C_{IN}	Input Capacitance (Note 2)	Open		2	10		10	pF	
C_{PD}	Power Dissipation Capacitance	5.0		7				pF	(Note 3)

Note 2: Parameter guaranteed by design. Not tested.

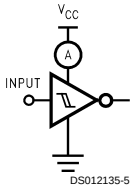
Note 3: C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See *Figure 2*.) C_{PD} is related to I_{CCD} dynamic operating current by the expression: I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CC}static).

AC Electrical Characteristics (Continued)



C_L includes load and stray capacitance
Input PRR = 1.0 MHz, t_w = 500 ns

FIGURE 1. AC Test Circuit



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

FIGURE 2. I_{CCD} Test Circuit

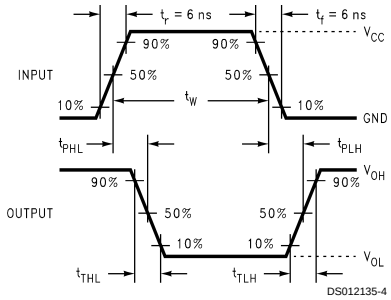
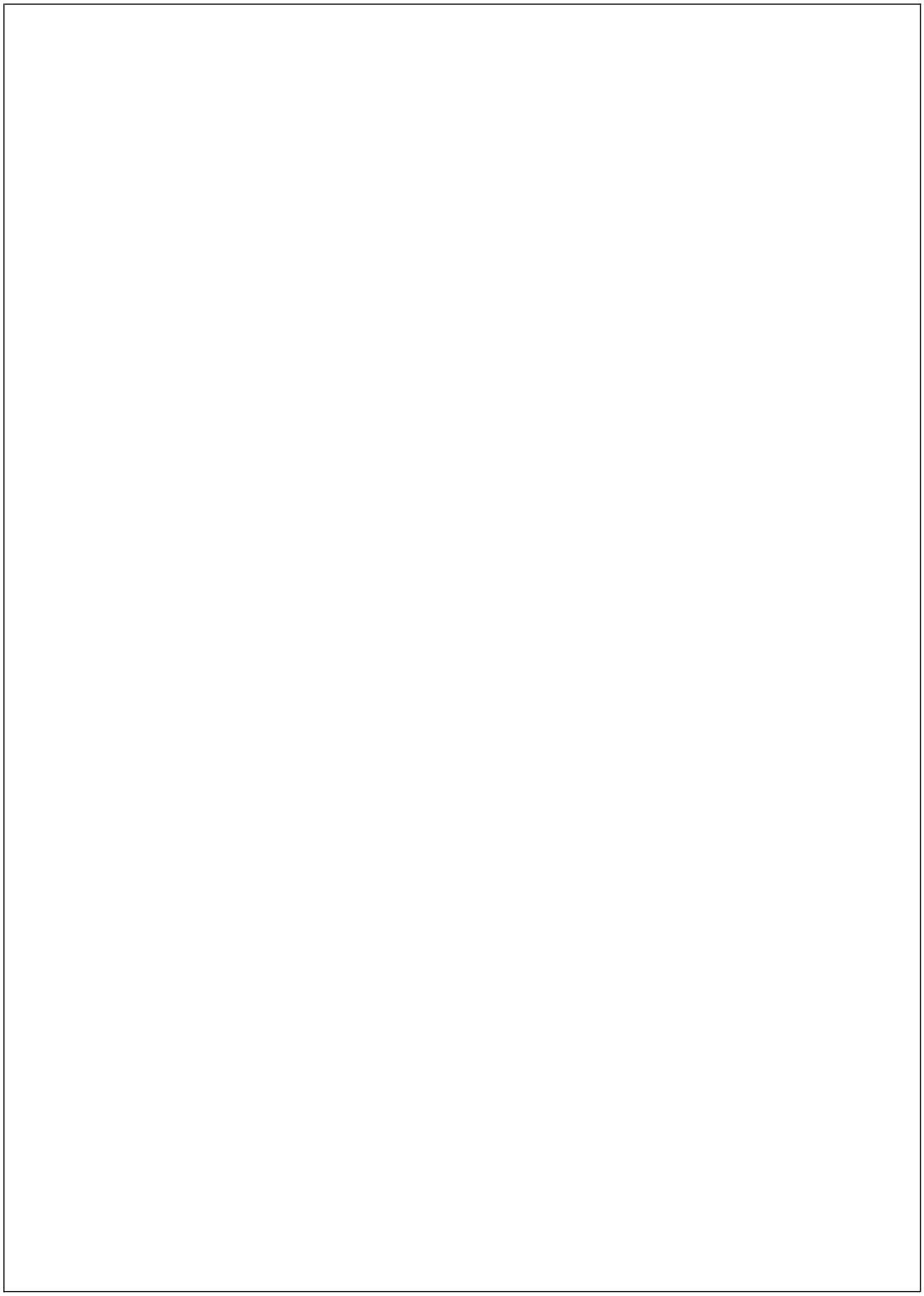
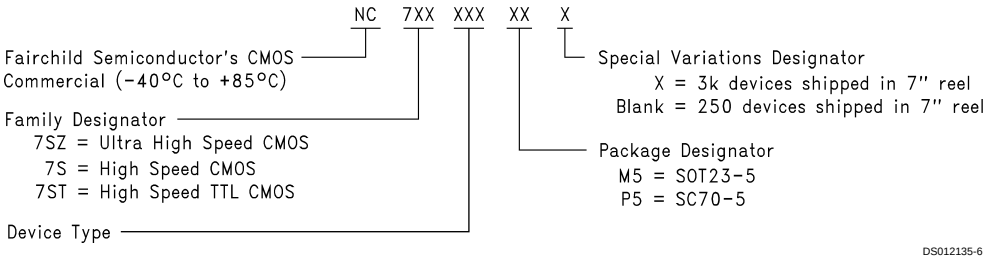


FIGURE 3. AC Waveforms



Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



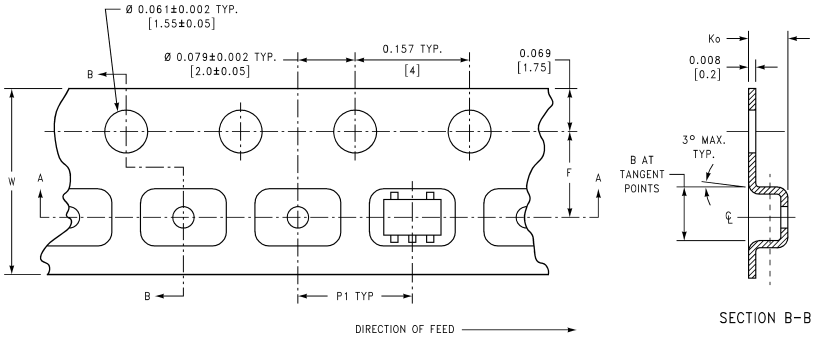
DS012135-6

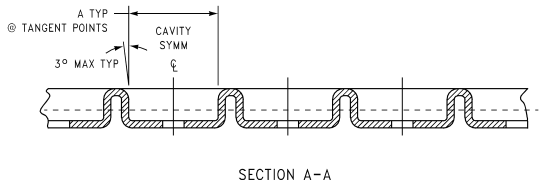
Tape and Reel Specification

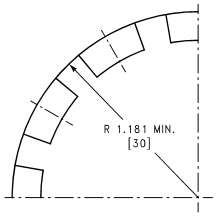
TAPE FORMAT

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
M5, P5	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	250	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed
M5X, P5X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

TAPE DIMENSIONS inches (millimeters)







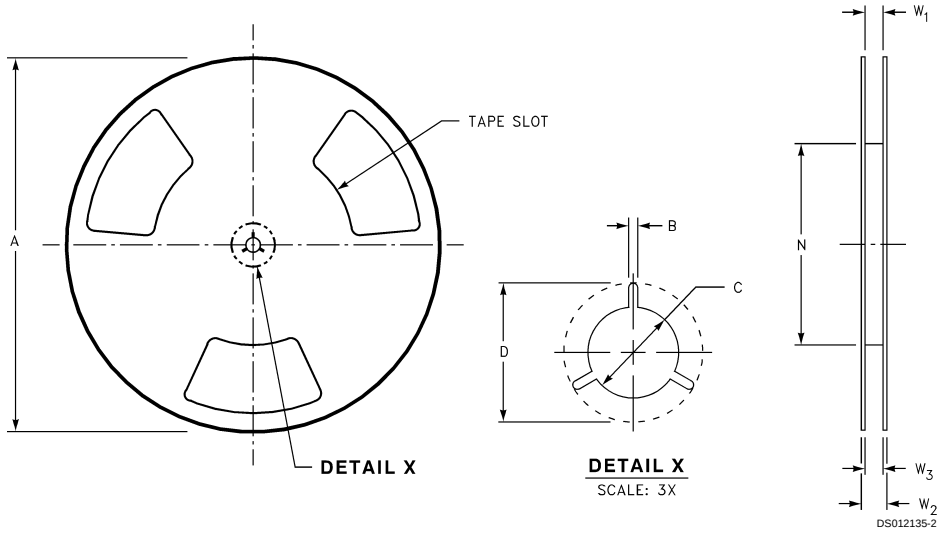
DS012135-1

Pkg	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

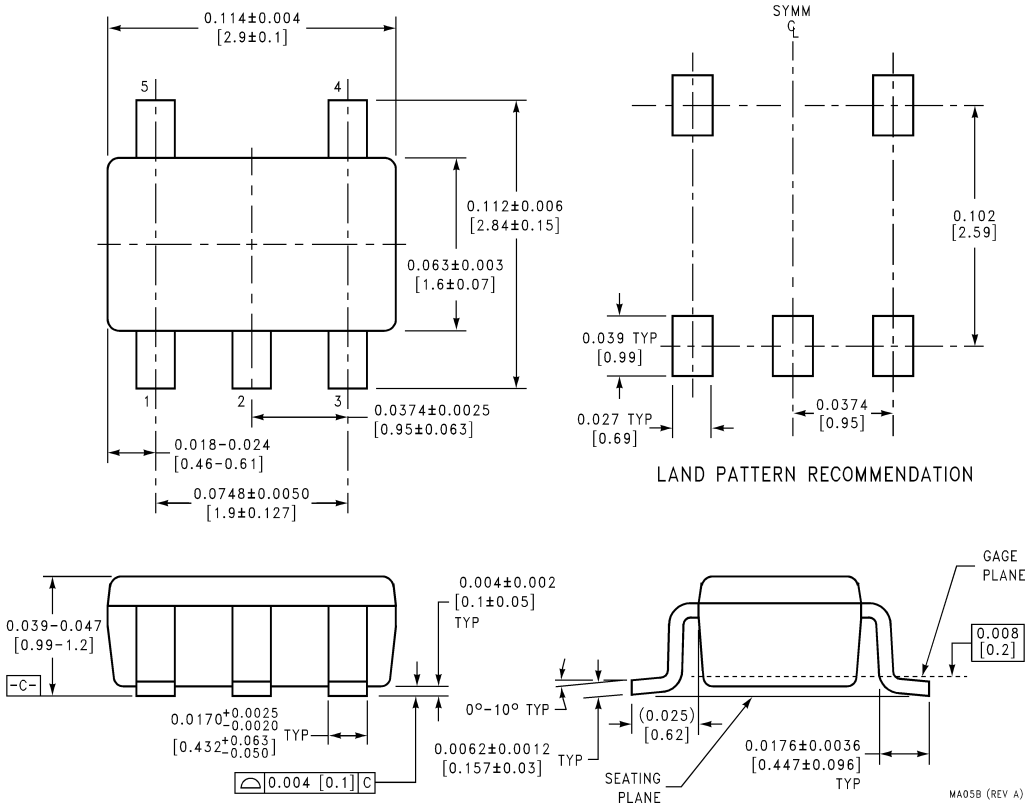
(Continued)

REEL DIMENSIONS inches (millimeters)



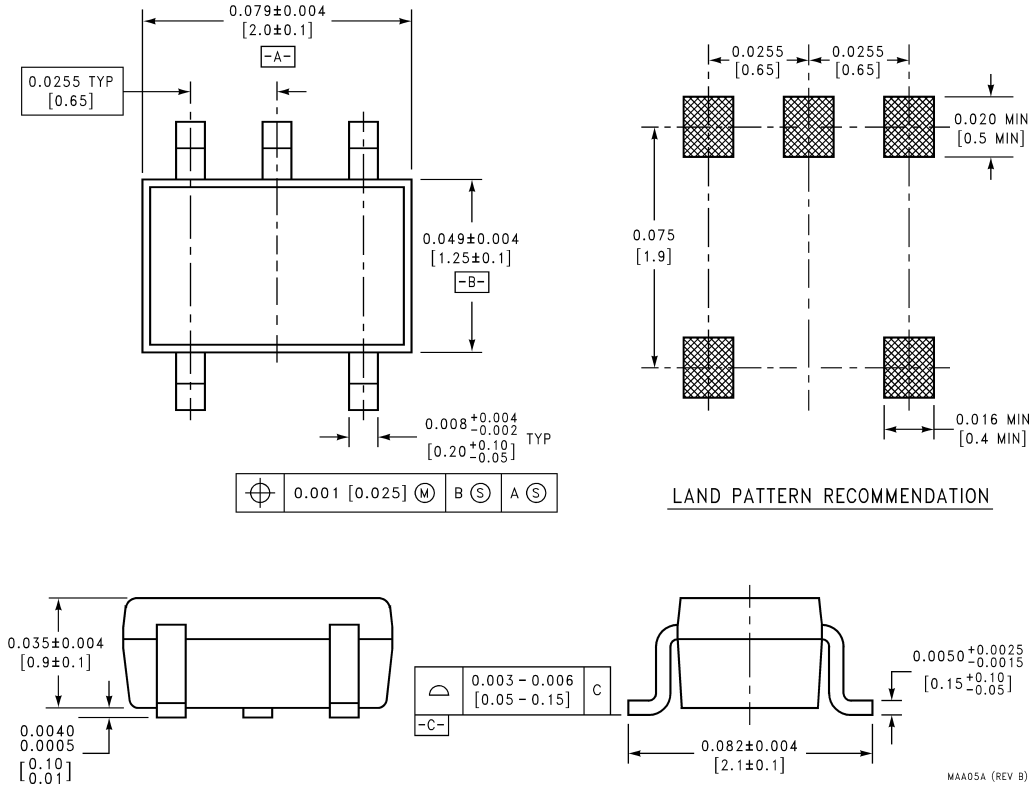
Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 +0.059/−0.000 (8.40 +1.50/−0.00)	0.567 (14.40)	W1 +0.078/−0.039 (W1 +2.00/−1.00)

Physical Dimensions inches (millimeters) unless otherwise noted



5-Lead Molded SOT23, Enhanced Thermal
Package Number MA05B

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



5-Lead Molded SC70, Enhanced Thermal
Package Number MAA05A

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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.

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