November 2014

# NC7SZ11
# TinyLogic® UHS Three-Input AND Gate

## Features

- Ultra-High Speed: $t_{PD}$ 2.7 ns (Typical) into 50 pF at 5V $V_{CC}$
- High Output Drive: ±24 mA at 3 V $V_{CC}$
- Broad $V_{CC}$ Operating Range: 1.65 V to 5.5 V
- Power Down High Impedance Inputs/Outputs
- Over-Voltage Tolerance inputs facilitate 5 V to 3 V Translation
- Proprietary Noise/EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Space-Saving SC70 Package

## Description

The NC7SZ11 is a single three-input AND Gate from Fairchild's Ultra-High Speed Series of TinyLogic®. 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 1.65 V to 5.5 V $V_{CC}$ operating range. The inputs and output are high impedance when $V_{CC}$ is 0 V. Inputs tolerate voltages up to 7 V, independent of $V_{CC}$ operating voltage.

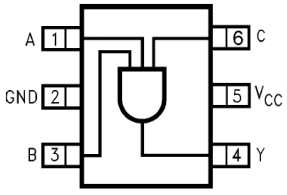
## Ordering Information

| Part Number | Top Mark | Package | Packing Method |
|---|---|---|---|
| NC7SZ11P6X | Z11 | 6-Lead SC70, EIAJ SC-88a, 1.25 mm Wide | 3000 Units on Tape & Reel |
| NC7SZ11L6X | E7 | 6-Lead MicroPak™, 1.00 mm Wide | 5000 Units on Tape & Reel |

## Connection Diagrams

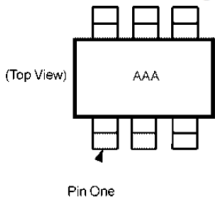

**Figure 1. Logic Symbol**

## Pin Configurations



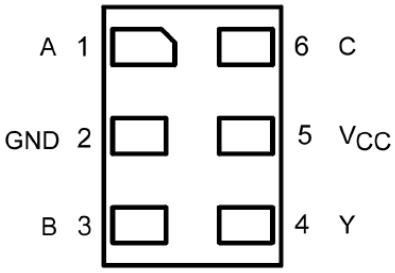

**(Top View)**

**Pin One Orientation Diagram**




AAA represents 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)

**Figure 2. SC70 (Top View)**




**(Top Thru View)**

**Figure 3. MicroPak (Top Through View)**

## Pin Definitions

| Pin # SC70 | Pin # MicroPak | Name | Description |
|---|---|---|---|
| 1 | 1 | A | Input |
| 2 | 2 | GND | Ground |
| 3 | 3 | B | Input |
| 4 | 4 | Y | Output |
| 5 | 5 | $V_{CC}$ | Supply Voltage |
| 6 | 6 | C | Input |

## Function Table

Y=ABC

| Inputs | | | Output |
|---|---|---|---|
| **A** | **B** | **C** | **Y** |
| X | X | L | L |
| X | L | X | L |
| L | X | X | L |
| H | H | H | H |

H = HIGH Logic Level

L = LOW Logic Level

X = Either LOW or HIGH 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 | | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | | -0.5 | 7.0 | V |
| $V_{IN}$ | DC Input Voltage | | -0.5 | 7.0 | V |
| $V_{OUT}$ | DC Output Voltage | | -0.5 | 7.0 | V |
| $I_{IK}$ | DC Input Diode Current | $V_{IN}$ < -0.5 V | | -50 | mA |
| $I_{OK}$ | DC Output Diode Current | $V_{OUT}$ < -0.5 V | | -50 | mA |
| | | $V_{OUT}$ > 6 V, $V_{CC}$=GND | | +20 | |
| $I_{OUT}$ | DC Output Current | | | ±50 | mA |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current | | | ±50 | mA |
| $T_{STG}$ | Storage Temperature Range | | -65 | +150 | °C |
| $T_J$ | Junction Temperature Under Bias | | | +150 | °C |
| $T_L$ | Junction Lead Temperature (Soldering, 10 Seconds) | | | +260 | °C |
| $P_D$ | Power Dissipation at +85°C | SC70-6 | | 150 | mW |
| | | MicroPak-6 | | 130 | |
| ESD | Human Body Model, JESD22-A114 | | | 4000 | V |
| | Charged Device Model, JESD22-C101 | | | 2000 | |

## 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 | Conditions | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage Operating | | 1.65 | 5.50 | V |
| | Supply Voltage Data Retention | | 1.50 | 5.50 | |
| $V_{IN}$ | Input Voltage | | 0 | 5.5 | V |
| $V_{OUT}$ | Output Voltage | | 0 | $V_{CC}$ | V |
| $T_A$ | Operating Temperature | | -40 | +85 | °C |
| $t_r$, $t_f$ | Input Rise and Fall Times | $V_{CC}$ at 1.8 V, 2.5 V ± 0.2 V | 0 | 20 | ns/V |
| | | $V_{CC}$ at 3.3 V ± 0.3 V | 0 | 10 | |
| | | $V_{CC}$ at 5.0 V ± 0.5 V | 0 | 5 | |
| $\theta_{JA}$ | Thermal Resistance | SC70-6 | | 425 | °C/W |
| | | MicroPak-6 | | 500 | |

**Note:**

1. Unused inputs must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

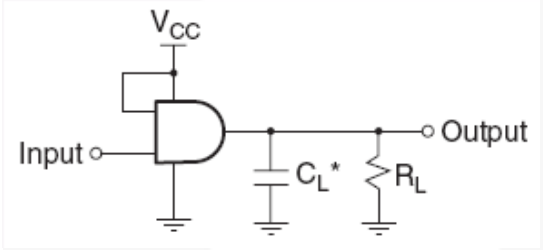
| Symbol | Parameter | $V_{CC}$ | Conditions | $T_A$=25°C | | | $T_A$=-40 to +85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | Min. | Max. | |
| $V_{IH}$ | HIGH Level Input Voltage | 1.8 ± 0.15 | | 0.75 $V_{CC}$ | | | 0.75 $V_{CC}$ | | V |
| | | 2.30 to 5.50 | | 0.70 $V_{CC}$ | | | 0.70 $V_{CC}$ | | |
| $V_{IL}$ | LOW Level Input Voltage | 1.8 ± 0.15 | | | | 0.25 $V_{CC}$ | | 0.25 $V_{CC}$ | V |
| | | 2.30 to 5.50 | | | | 0.30 $V_{CC}$ | | 0.30 $V_{CC}$ | |
| $V_{OH}$ | HIGH Level Output Voltage | 1.65 | $V_{IN}$=$V_{IH}$, $I_{OH}$=-100 µA | 1.55 | 1.65 | | 1.55 | | V |
| | | 2.30 | | 2.20 | 2.30 | | 2.20 | | |
| | | 3.00 | | 2.90 | 3.00 | | 2.90 | | |
| | | 4.50 | | 4.40 | 4.50 | | 4.40 | | |
| | | 1.65 | $I_{OH}$=-4 mA | 1.29 | 1.52 | | 1.29 | | |
| | | 2.30 | $I_{OH}$=-8 mA | 1.90 | 2.15 | | 1.90 | | |
| | | 3.00 | $I_{OH}$=-16 mA | 2.50 | 2.80 | | 2.40 | | |
| | | 3.00 | $I_{OH}$=-24 mA | 2.40 | 2.68 | | 2.30 | | |
| | | 4.50 | $I_{OH}$=-32 mA | 3.90 | 4.20 | | 3.80 | | |
| $V_{OL}$ | LOW Level Output Voltage | 1.65 | $V_{IN}$=$V_{IL}$, $I_{OL}$=100 µA | | 0.00 | 0.10 | | 0.10 | V |
| | | 2.30 | | | 0.00 | 0.10 | | 0.10 | |
| | | 3.00 | | | 0.00 | 0.10 | | 0.10 | |
| | | 4.50 | | | 0.00 | 0.10 | | 0.10 | |
| | | 1.65 | $I_{OL}$=4 mA | | 0.80 | 0.24 | | 0.24 | |
| | | 2.30 | $I_{OL}$=8 mA | | 0.10 | 0.30 | | 0.30 | |
| | | 3.00 | $I_{OL}$=16 mA | | 0.15 | 0.40 | | 0.40 | |
| | | 3.00 | $I_{OL}$=24 mA | | 0.22 | 0.55 | | 0.55 | |
| | | 4.50 | $I_{OL}$=32 mA | | 0.22 | 0.55 | | 0.55 | |
| $I_{IN}$ | Input Leakage Current | 0 to 5.5 | $V_{IN}$=5.5 V, GND | | | ±1 | | ±10 | µA |
| $I_{OFF}$ | Power Off Leakage Current | 0 | $V_{IN}$ or $V_{OUT}$=5.5 V | | | 1 | | 10 | µA |
| $I_{CC}$ | Quiescent Supply Current | 1.65 to 5.50 | $V_{IN}$=5.5 V, GND | | | 2 | | 20 | µA |

## AC Electrical Characteristics

| Symbol | Parameter | $V_{CC}$ | Conditions | $T_A$=25°C | | | $T_A$=-40 to +85°C | | Unit | Figure |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay | 1.80 ± 0.15 | $C_L$=15 pF, $R_L$=1M Ω | 2.0 | 9.0 | 18.5 | 2.0 | 19.0 | ns | Figure 4 Figure 5 |
| | | 2.50 ± 0.20 | | 0.8 | 4.9 | 10.5 | 0.8 | 11.0 | | |
| | | 3.30 ± 0.30 | | 0.5 | 3.5 | 8.5 | 0.5 | 9.0 | | |
| | | 5.00 ± 0.50 | | 0.5 | 2.5 | 6.5 | 0.5 | 7.0 | | |
| | | 3.30 ± 0.30 | $C_L$=50 pF, $R_L$=500 Ω | 1.5 | 4.1 | 8.5 | 1.5 | 9.0 | | |
| | | 5.00 ± 0.50 | | 0.8 | 2.9 | 7.5 | 0.8 | 8.0 | | |
| $C_{IN}$ | Input Capacitance | 0.00 | | | 4 | | | | pF | |
| $C_{PD}$ | Power Dissipation Capacitance(2) | 3.30 | | | 20 | | | | pF | Figure 6 |
| | | 5.00 | | | 25 | | | | | |

**Note:**

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




**Notes:**

3. $C_L$ includes load and stray capacitance.
4. Input PRR=1.0 MHz; $t_W$500 ns.

**Figure 4. AC Test Circuit**

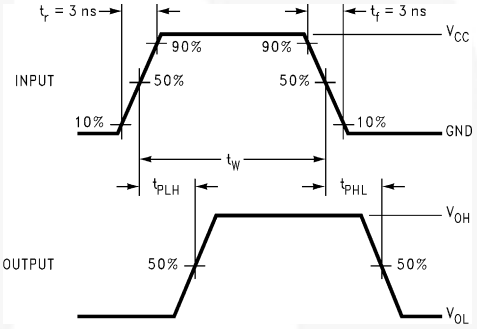
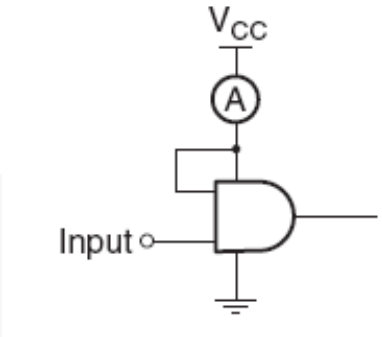



**Figure 5. AC Waveforms**




**Note:**

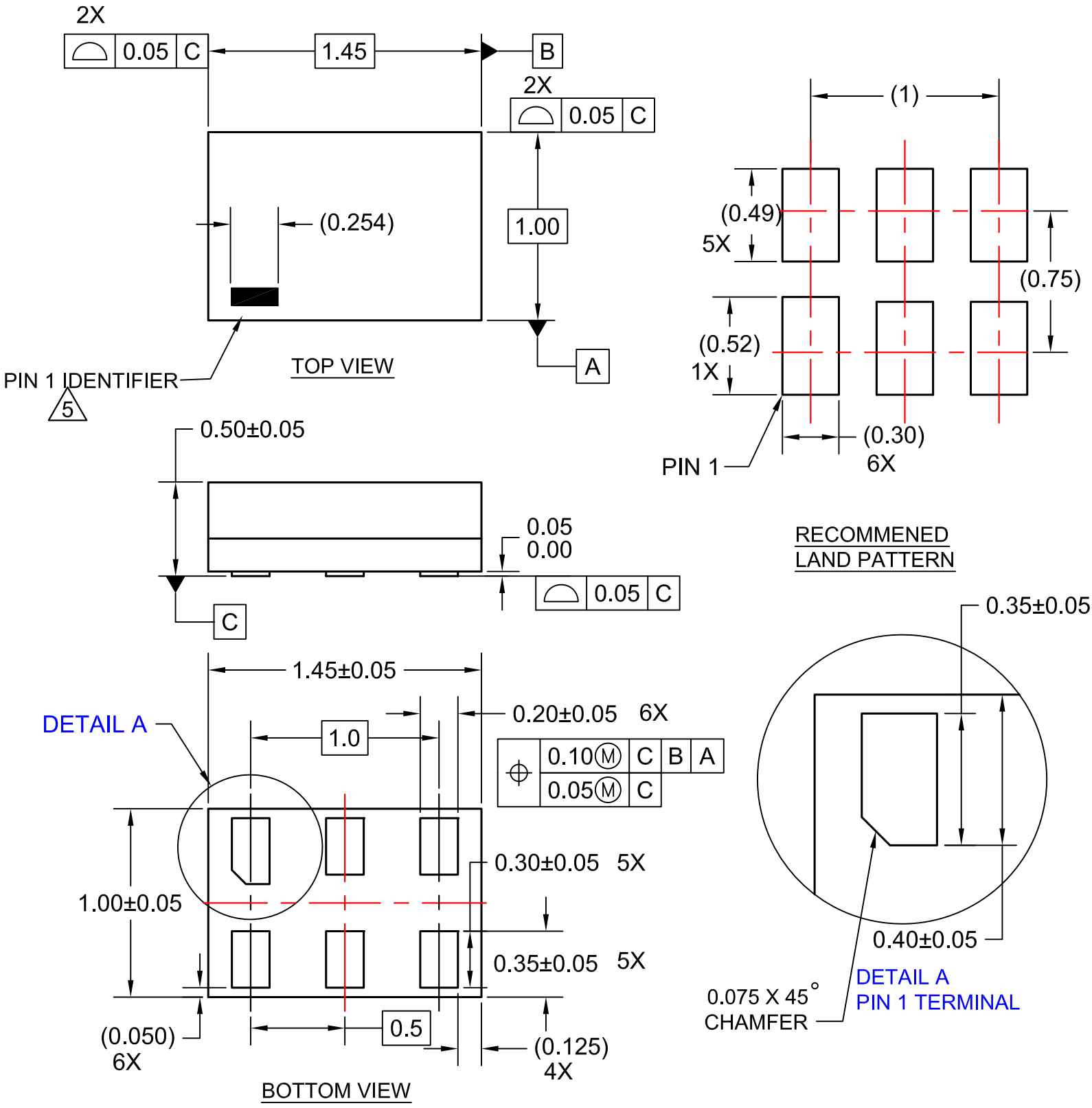
5. Input=AC Waveform; $t_r$=$t_f$=1.8 ns; PRR=10 MHz; Duty Cycle=50%.

**Figure 6. $I_{CCD}$ Test Circuit**

## Tape and Reel Specifications

| Package Designator | Tape Section | Cavity Number | Cavity Status | Cover Type Status |
|---|---|---|---|---|
| P6X | Leader (Start End) | 125 (Typical) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (Typical) | Empty | Sealed |

| Package Designator | Tape Section | Cavity Number | Cavity Status | Cover Type Status |
|---|---|---|---|---|
| L6X | Leader (Start End) | 125 (Typical) | Empty | Sealed |
| | Carrier | 5000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (Typical) | Empty | Sealed |



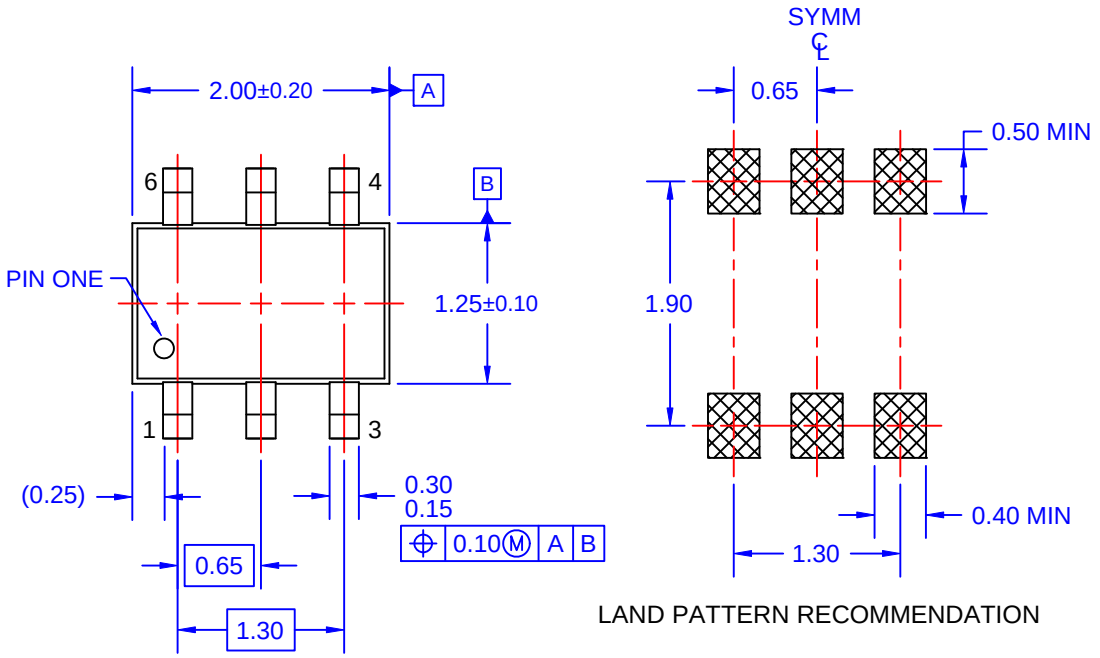

NOTES:

1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. LANDPATTERN RECOMMENDATION PER FSC
5. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.
6. FILENAME AND REVISION: MAC06AREV6

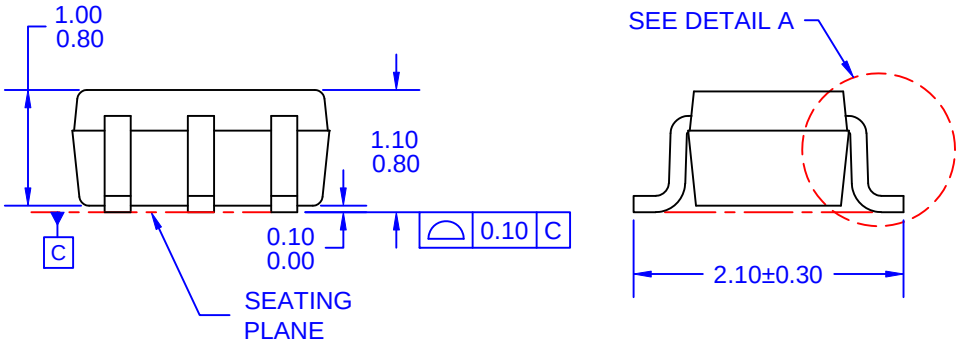
FAIRCHILD

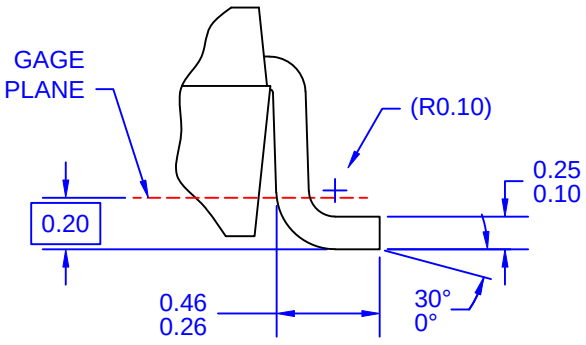
**REVISIONS**

| LTR | DESCRIPTION | DATE | NAME/SITE |
|---|---|---|---|
| A | RELEASE TO DOCUMENT CONTROL | | |
| B | REVISE AS PER EIAJ | JUL.21,1998 | H. ALLEN |
| C | FSC LAND PATTERN REC. | AUG.18,1998 | H. ALLEN |
| D | REDRAW AS PER STD DW TEMPLATE; ADD MIN FOOT LENGHT DIM. CHG DIM STYLE FR DEVIATION TO LIMITS. REARRANGE DWG TITLE. ADD DWG NUMBER &REV. AT LOWER LEFT CORNER OF TEMPLATE. | AUG.04,1999 | MAG |
| 5 | CHG LD WIDTH DIM FR $^{0.50}_{0.15}$ TO $^{0.55}_{0.22}$; LD THICK FR $^{0.25}_{0.10}$ TO $^{0.25}_{0.08}$; LD SPREAD FR 2.10±0.30 TO 2.10$^{+0.35}_{-0.30}$; FT LENGTH FR $^{0.45}_{0.30}$ TO $^{0.46}_{0.26}$; REM LD DIM (0.43) | 17JAN2007 | BMR |
| 6 | ADD PIN ONE INDICATOR; CHG DWG TEMPLATE & FORMAT TO STANDARD. | 14JUL2009 | H. ALLEN |




LAND PATTERN RECOMMENDATION




**DETAIL A**
SCALE: 60X

NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO EIAJ SC-88, 1996.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
D) DRAWING FILENAME: MKT-MAA06AREV6

| APPROVALS | DATE |
|---|---|
| DRAWN: J.U. COMPARATIVO JR. | 14JUL2009 |
| CHECKED: H. ALLEN | |
| APPROVED: M.R. GESTOLE | |
| C.N. TANGPUZ | |

PROJECTION
INCH
[MM]

FAIRCHILD SEMICONDUCTOR TM

6LD, SC-70,
EIAJ SC-88, 1.25MM WIDE

| SCALE | SIZE | DRAWING NUMBER | REV |
|---|---|---|---|
| 1:1 | N/A | MKT-MAA06A | 6 |

FORMERLY: N/A
SHEET : 1 OF 1

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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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| Datasheet Identification | Product Status | Definition |
|---|---|---|
| Advance Information | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice. |
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| No Identification Needed | Full Production | 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 | Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only. |

Rev. I73