FAIRCHILD SEMICONDUCTOR®

September 2009

# NC7SZ08
# TinyLogic® UHS Two-Input AND Gate

## Features

- Ultra-High Speed: $t_{PD}$ 2.7ns (Typical) into 50pF at 5V $V_{CC}$
- High Output Drive: ±24mA at 3V $V_{CC}$
- Broad $V_{CC}$ Operating Range: 1.65V to 5.5V
- Matches Performance of LCX Operated at 3.3V $V_{CC}$
- Power Down High Impedance Inputs/Outputs
- Over-Voltage Tolerance inputs facilitate 5V to 3V Translation
- Proprietary Noise/EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Space-Saving SOT23 and SC70 Packages

## Description

The NC7SZ08 is a single two-input AND gate from Fairchild's Ultra-High Speed (UHS) 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 devise is specified to operate over the 1.65V to 5.5V $V_{CC}$ operating range. The inputs and output are high impedance when $V_{CC}$ is 0V. Inputs tolerate voltages up to 6V, independent of $V_{CC}$ operating voltage.

## Ordering Information

| Part Number | Top Mark | Eco Status | Package | Packing Method |
|---|---|---|---|---|
| NC7SZ08M5X | 7Z08 | RoHS | 5-Lead SOT23, JEDEC MO-178 1.6mm | 3000 Units on Tape & Reel |
| NC7SZ08P5X | Z08 | RoHS | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 3000 Units on Tape & Reel |
| NC7SZ08L6X | GG | RoHS | 6-Lead MicroPak™, 1.00mm Wide | 5000 Units on Tape & Reel |
| NC7SZ08FHX | GG | Green | 6-Lead, MicroPak2, 1x1mm Body, .35mm Pitch | 5000 Units on Tape & Reel |

*For Fairchild's definition of Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.*

© 1996 Fairchild Semiconductor Corporation

## Connection Diagrams




**Figure 1. Logic Symbol**

## Pin Configurations

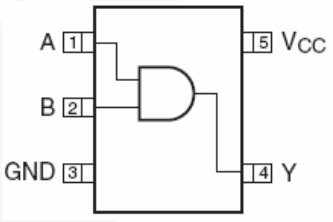



**Figure 2. SC70 and SOT23 (Top View)**

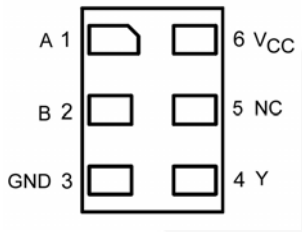



**Figure 3. MicroPak (Top Through View)**

## Pin Definitions

| Pin # SC70 / SOT23 | Pin # MicroPak | Name | Description |
|---|---|---|---|
| 1 | 1 | A | Input |
| 2 | 2 | B | Input |
| 3 | 3 | GND | Ground |
| 4 | 4 | Y | Output |
| 5 | 6 | $V_{CC}$ | Supply Voltage |
| | 5 | NC | No Connect |

## Function Table

Y=AB

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

H = HIGH Logic Level

L = LOW Logic Level

© 1996 Fairchild Semiconductor Corporation

## 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 | 6.0 | V |
| $V_{IN}$ | DC Input Voltage | | -0.5 | 6.0 | V |
| $V_{OUT}$ | DC Output Voltage | | -0.5 | 6.0 | V |
| $I_{IK}$ | DC Input Diode Current | $V_{IN}$ < -0.5V | | -50 | mA |
| | | $V_{IN}$ > 6.0V | | +20 | |
| $I_{OK}$ | DC Output Diode Current | $V_{OUT}$ < -0.5V | | -50 | mA |
| | | $V_{OUT}$ > 6V, $V_{CC}$=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 | SOT-23 | | 200 | mW |
| | | SC70-5 | | 150 | |
| | | MicroPak-6 | | 130 | |
| | | MicroPak2-6 | | 120 | |
| 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 1.8V, 2.5V ± 0.2V | 0 | 20 | ns/V |
| | | $V_{CC}$ at 3.3V ± 0.3V | 0 | 10 | |
| | | $V_{CC}$ at 5.0V ± 0.5V | 0 | 5 | |
| $\theta_{JA}$ | Thermal Resistance | SOT-23 | | 300 | °C/W |
| | | SC70-5 | | 425 | |
| | | MicroPak-6 | | 500 | |
| | | MicroPak2-6 | | 560 | |

**Note:**

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

© 1996 Fairchild Semiconductor Corporation

## DC Electrical Characteristics

| Symbol | Parameter | $V_{CC}$ | Conditions | $T_A$=25°C | | | $T_A$=-40 to +85°C | | Units |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | Min. | Max. | |
| $V_{IH}$ | HIGH Level Input Voltage | 1.65 to 1.95 | | $0.75V_{CC}$ | | | $0.75V_{CC}$ | | V |
| | | 2.30 to 5.50 | | $0.70V_{CC}$ | | | $0.70V_{CC}$ | | |
| $V_{IL}$ | LOW Level Input Voltage | 1.65 to 1.95 | | | | $0.25V_{CC}$ | | $0.25V_{CC}$ | V |
| | | 2.30 to 5.50 | | | | $0.30V_{CC}$ | | $0.30V_{CC}$ | |
| $V_{OH}$ | HIGH Level Output Voltage | 1.65 | $V_{IN}=V_{IH}$, $I_{OH}$=-100µA | 1.55 | 1.65 | | 1.55 | | V |
| | | 1.80 | | 1.70 | 1.80 | | 1.70 | | |
| | | 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 | $I_{OH}$=-4mA | 1.29 | 1.52 | | 1.29 | | |
| | | 2.30 | $I_{OH}$=-8mA | 1.90 | 2.15 | | 1.90 | | |
| | | 3.00 | $I_{OH}$=-16mA | 2.50 | 2.80 | | 2.40 | | |
| | | 3.00 | $I_{OH}$=-24mA | 2.40 | 2.68 | | 2.30 | | |
| | | 4.50 | $I_{OH}$=-32mA | 3.90 | 4.20 | | 3.80 | | |
| $V_{OL}$ | LOW Level Output Voltage | 1.65 | $V_{IN}=V_{IL}$, $I_{OL}$=100µA | | 0.00 | 0.10 | | 0.10 | V |
| | | 1.80 | | | 0.00 | 0.10 | | 0.10 | |
| | | 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 | $I_{OL}$=4mA | | 0.80 | 0.24 | | 0.24 | |
| | | 2.30 | $I_{OL}$=8mA | | 0.10 | 0.30 | | 0.30 | |
| | | 3.00 | $I_{OL}$=16mA | | 0.15 | 0.40 | | 0.40 | |
| | | 3.00 | $I_{OL}$=24mA | | 0.22 | 0.55 | | 0.55 | |
| | | 4.50 | $I_{OL}$=32mA | | 0.22 | 0.55 | | 0.55 | |
| $I_{IN}$ | Input Leakage Current | 0 to 5.5 | $V_{IN}$=5.5V, GND | | | ±1 | | ±10 | µA |
| $I_{OFF}$ | Power Off Leakage Current | 0 | $V_{IN}$ or $V_{OUT}$=5.5V | | | 1 | | 10 | µA |
| $I_{CC}$ | Quiescent Supply Current | 1.65 to 5.50 | $V_{IN}$=5.5V, GND | | | 2 | | 20 | µA |

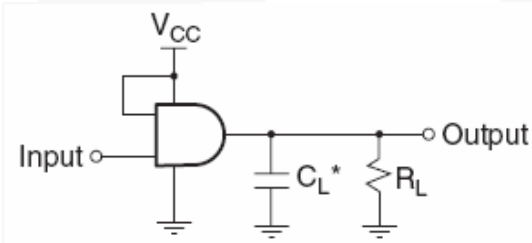
© 1996 Fairchild Semiconductor Corporation

## AC Electrical Characteristics

| Symbol | Parameter | $V_{CC}$ | Conditions | $T_A$=25°C | | | $T_A$=-40 to +85°C | | Units | Figure |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay | 1.65 | $C_L$=15pF, $R_L$=1MΩ | 2.0 | 6.3 | 12.0 | 2.0 | 12.7 | ns | Figure 4 Figure 5 |
| | | 1.80 | | 2.0 | 5.2 | 10.0 | 2.0 | 10.5 | | |
| | | 2.50 ± 0.20 | | 0.8 | 3.4 | 7.0 | 0.8 | 7.5 | | |
| | | 3.30 ± 0.30 | | 0.5 | 2.6 | 4.7 | 0.5 | 5.0 | | |
| | | 5.00 ± 0.50 | | 0.5 | 2.2 | 4.1 | 0.5 | 4.4 | | |
| | | 3.30 ± 0.30 | $C_L$=50pF, $R_L$=500Ω | 1.5 | 3.3 | 5.2 | 1.5 | 5.5 | | |
| | | 5.00 ± 0.50 | | 0.8 | 2.7 | 4.5 | 0.8 | 4.8 | | |
| $C_{IN}$ | 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=1.0MHz; $t_W$500ns.

**Figure 4. AC Test Circuit**

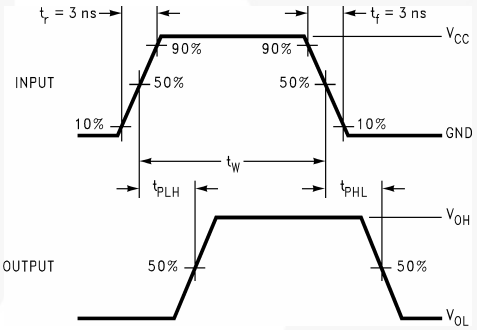
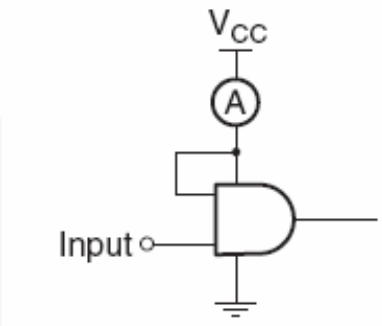



**Figure 5. AC Waveforms**




**Note:**

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

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

© 1996 Fairchild Semiconductor Corporation

## Physical Dimensions

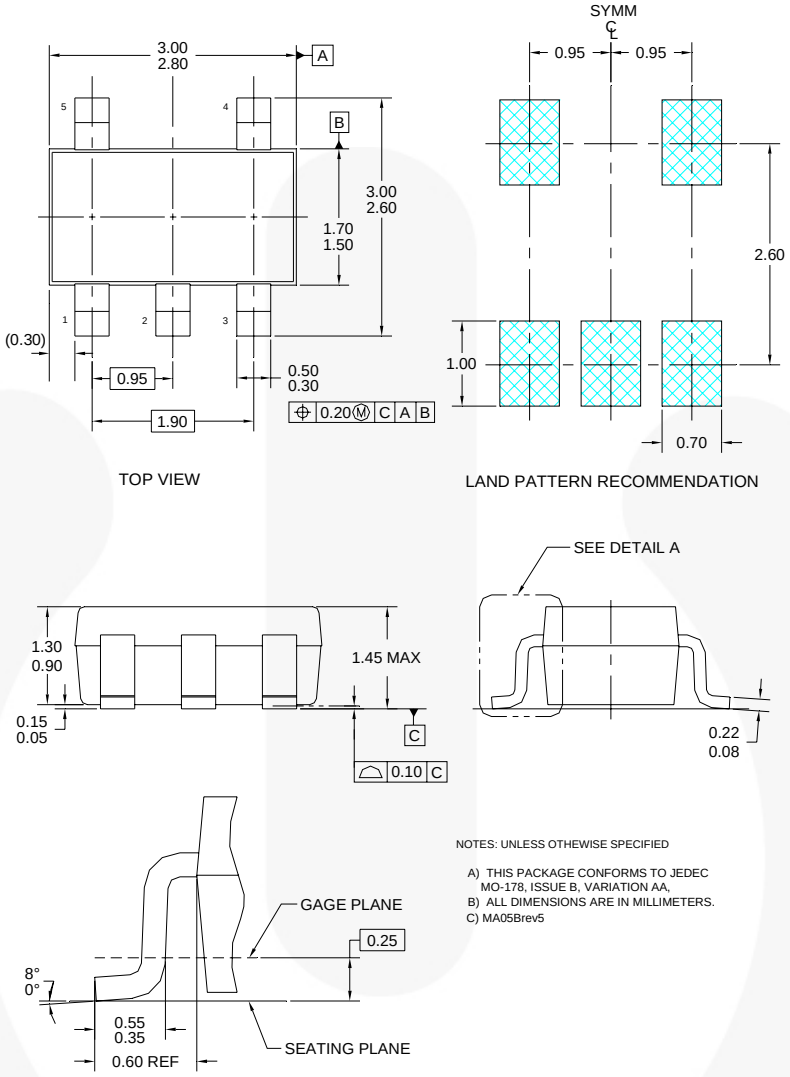



**Figure 7. 5-Lead SOT23, JEDEC MO-178 1.6mm**

*Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.*

*Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:*
*http://www.fairchildsemi.com/packaging/.*

## Tape and Reel Specifications

*Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:*
*http://www.fairchildsemi.com/packaging/SOT23-5L_tr.pdf.*

| Package Designator | Tape Section | Cavity Number | Cavity Status | Cover Type Status |
|---|---|---|---|---|
| M5X | Leader (Start End) | 125 (Typical) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (Typical) | Empty | Sealed |

© 1996 Fairchild Semiconductor Corporation

## Physical Dimensions

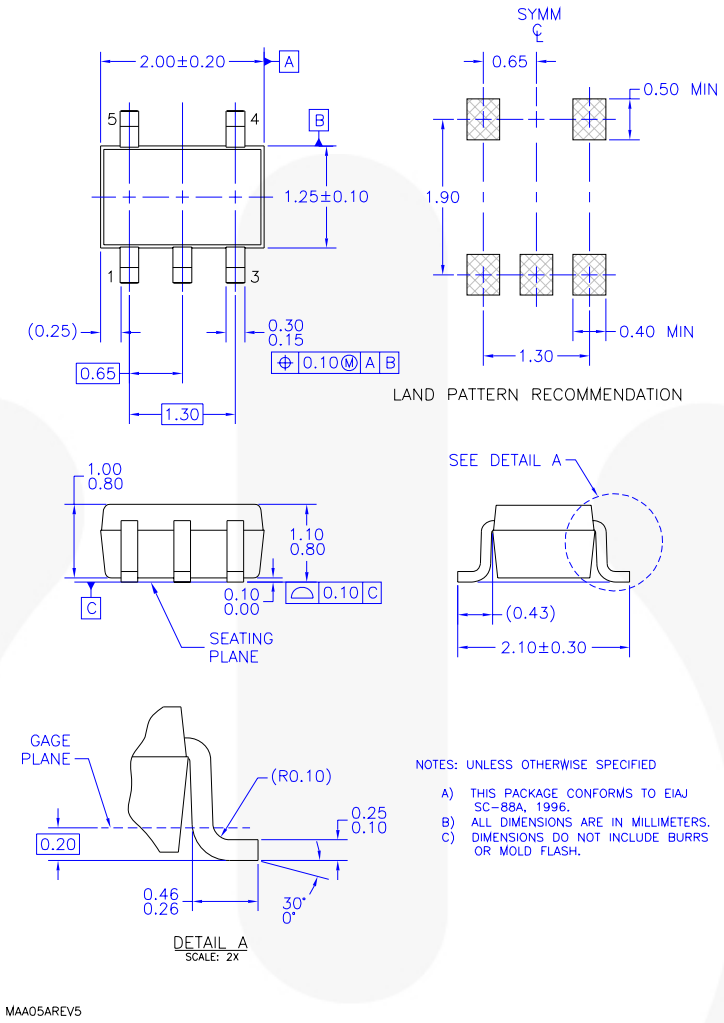



**Figure 8. 5-Lead, SC70, EIAJ SC-88a, 1.25mm Wide**

*Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.*

*Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:*
*http://www.fairchildsemi.com/packaging/.*

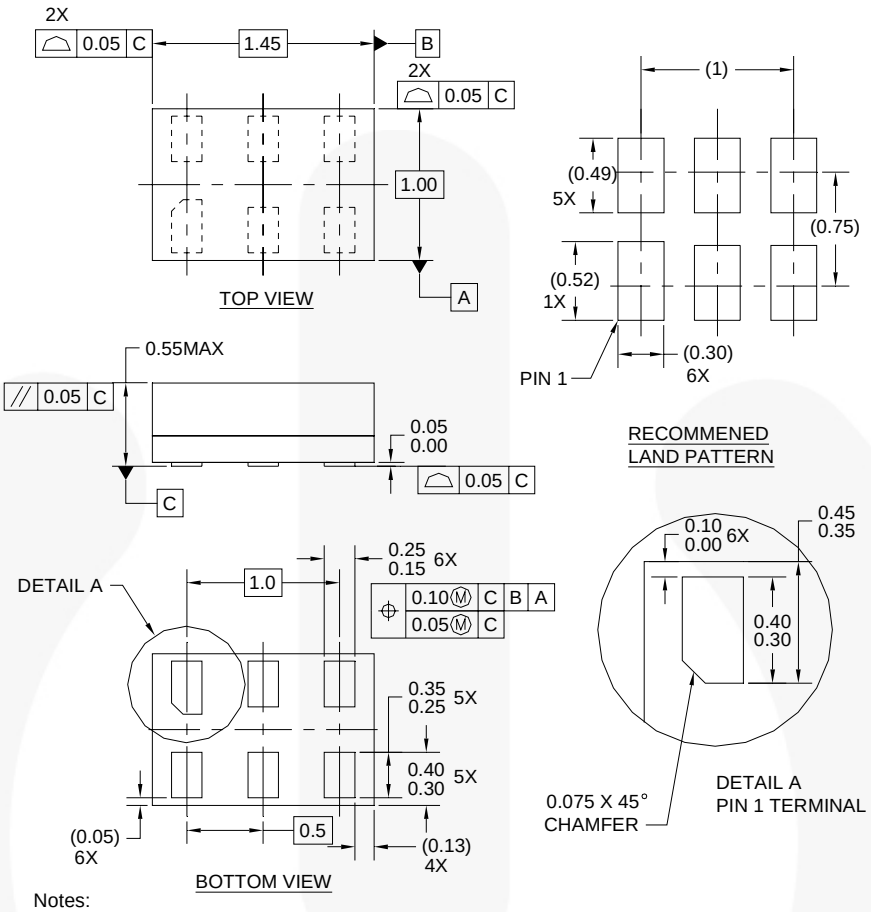
## Tape and Reel Specifications

*Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:*
*http://www.fairchildsemi.com/products/analog/pdf/sc70-5_tr.pdf.*

| Package Designator | Tape Section | Cavity Number | Cavity Status | Cover Type Status |
|---|---|---|---|---|
| P5X | Leader (Start End) | 125 (Typical) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (Typical) | Empty | Sealed |

© 1996 Fairchild Semiconductor Corporation

## Physical Dimensions




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 9. 6-Lead, MicroPak™, 1.0mm Wide**

*Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.*

*Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:*
*http://www.fairchildsemi.com/packaging/.*

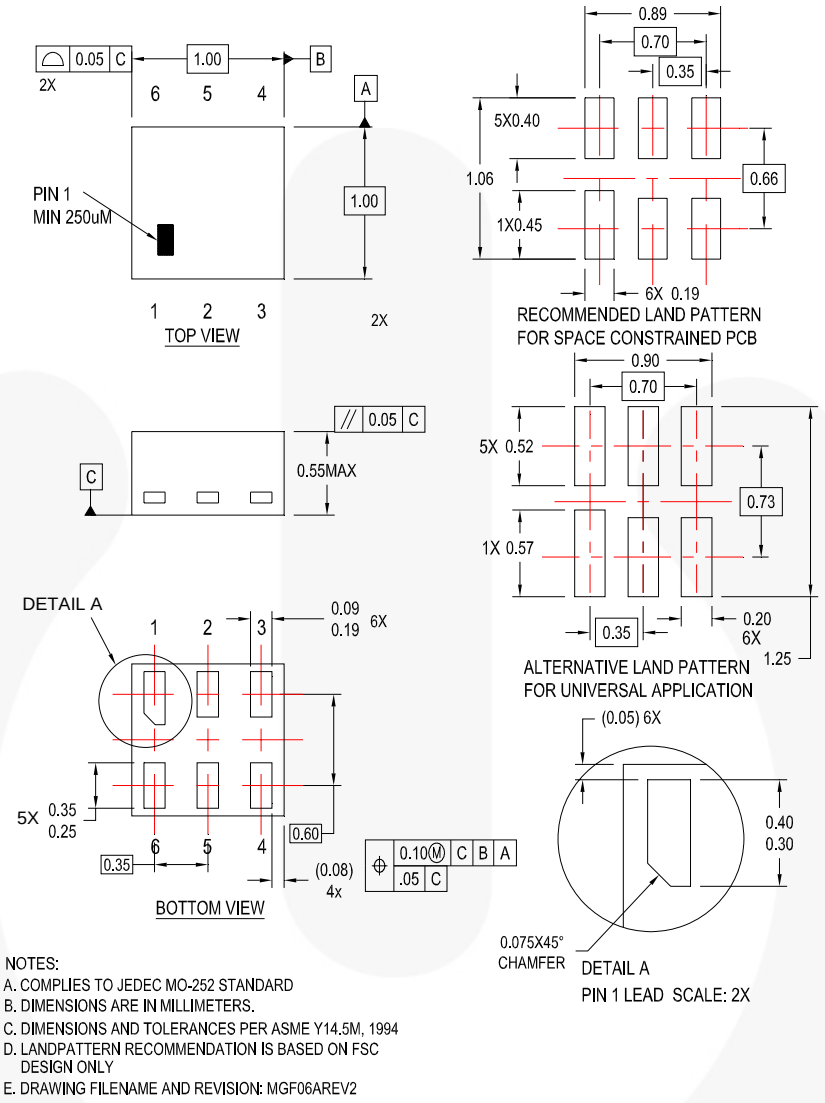
## Tape and Reel Specifications

*Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:*
*http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf.*

| 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 |

© 1996 Fairchild Semiconductor Corporation

## Physical Dimensions




NOTES:
A. COMPLIES TO JEDEC MO-252 STANDARD
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
D. LANDPATTERN RECOMMENDATION IS BASED ON FSC DESIGN ONLY
E. DRAWING FILENAME AND REVISION: MGF06AREV2

**Figure 10. 6-Lead, MicroPak2, 1x1mm Body, .35mm Pitch**

*Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.*

*Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:*
*http://www.fairchildsemi.com/packaging/.*

## Tape and Reel Specification

*Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:*
*http://www.fairchildsemi.com/packaging/MicroPAK2_6L_tr.pdf.*

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

© 1996 Fairchild Semiconductor Corporation

FAIRCHILD SEMICONDUCTOR®

## TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

AccuPower™
Auto-SPM™
Build it Now™
CorePLUS™
CorePOWER™
*CROSSVOLT*™
CTL™
Current Transfer Logic™
EcoSPARK®
EfficientMax™
EZSWITCH™*
EZ™*
F®
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FlashWriter®*
FPS™
F-PFS™
FRFET®
Global Power Resource℠
Green FPS™
Green FPS™ e-Series™
*Gmax*™
GTO™
IntelliMAX™
ISOPLANAR™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MillerDrive™
MotionMax™
Motion-SPM™
OPTOLOGIC®
OPTOPLANAR®
®
PDP SPM™
Power-SPM™
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
™
Saving our world, 1mW/W/kW at a time™
SignalWise™
SmartMax™
SMART START™
SPM®
STEALTH™
SuperFET™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS™
SyncFET™
Sync-Lock™
SYSTEM ®* GENERAL
The Power Franchise®
the power franchise
TinyBoost™
TinyBuck™
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TriFault Detect™
TRUECURRENT™*
µSerDes™
SerDes
UHC®
Ultra FRFET™
UniFET™
VCX™
VisualMax™
XS™

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

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.

## ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

## PRODUCT STATUS DEFINITIONS

**Definition of Terms**

| 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. |
| Preliminary | First Production | 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 | 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. I42

© 1996 Fairchild Semiconductor Corporation