chanhvinh.com



FAIRCHILD SEMICONDUCTOR®

August 2010

# NC7NZ04
# TinyLogic® UHS Inverter

## Features

- Ultra-High Speed: $t_{PD}$ 2.4ns (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
- Power-Down, High-Impedance Inputs / Outputs
- Over-Voltage Tolerance Inputs Facilitate 5V to 3V Translation
- Proprietary Noise / EMI Reduction Circuitry
- Space-Saving MicroPak™ and US8 Surface Mount Packages

## Description

The NC7NZ04 is a triple inverter 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 device 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 7V, independent of $V_{CC}$ operating voltage.

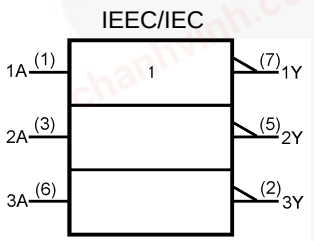



**Figure 1. Logic Symbol**

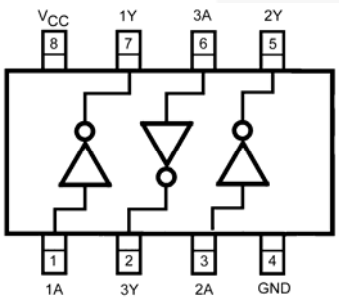



**Figure 2. Connection Diagram**

## Ordering Information

| Part Number | Top Mark | Package | Packing Method |
|---|---|---|---|
| NC7NZ04K8X | NZ04 | 8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide | 3000 Units on Tape & Reel |
| NC7NZ04L8X | T3 | 8-Lead MicroPak™, 1.6mm Wide | 5000 Units on Tape & Reel |

MicroPak™ is a trademarks of Fairchild Semiconductor Corporation.

© 2001 Fairchild Semiconductor Corporation

chanhvinh.com



## Pin Configurations

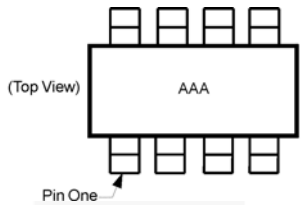



**Figure 3. US8**

**Notes:**
1. AAA represents product code top mark (see ordering table).
2. Orientation of top mark determines pin one location. Reading the top product code mark left to right, pin one is the lower left pin.

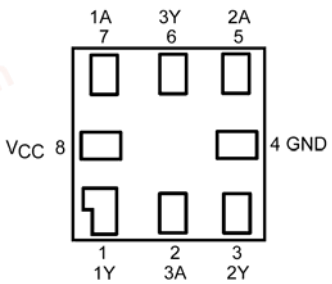



**Figure 4. MicroPak™ (Top Through View)**

## Pin Definitions

| Pin # US8 | Pin # MicroPak™ | Name | Description |
|---|---|---|---|
| 1 | 7 | 1A | Input |
| 2 | 6 | 3Y | Output |
| 3 | 5 | 2A | Input |
| 4 | 4 | GND | Ground |
| 5 | 3 | 2Y | Output |
| 6 | 2 | 3A | Input |
| 7 | 1 | 1Y | Output |
| 8 | 8 | $V_{CC}$ | Supply Voltage |

## Function Table

Y= /A

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

© 2001 Fairchild Semiconductor Corporation

chanhvinh.com



## 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 | $V_{IN}$ < -0.5V | | -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 | | | 250 | mW |
| ESD | Human Body Model, JEDEC:JESD22-A114 | | | 4000 | V |
| | Charge Device Model, JEDEC: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 | | 1.5 | 5.5 | |
| $V_{IN}$ | 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 | US8 | | 250 | °C/W |
| | | MicroPak™ | | 287 | |

**Note:**

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

© 2001 Fairchild Semiconductor Corporation

chanhvinh.com



## 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 | 1.80 ± 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 | 1.80 ± 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 | $V_{IN}$=$V_{IL}$, $I_{OH}$=-100µA | 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 | $I_{OH}$=-4mA | 1.29 | 1.52 | | 1.29 | | |
| | | 2.30 | $I_{OH}$=-8mA | 1.90 | 2.15 | | 1.90 | | |
| | | 3.00 | $I_{OH}$=-16mA | 2.40 | 2.80 | | 2.40 | | |
| | | 3.00 | $I_{OH}$=-24mA | 2.30 | 2.68 | | 2.30 | | |
| | | 4.50 | $I_{OH}$=-32mA | 3.80 | 4.20 | | 3.80 | | |
| $V_{OL}$ | LOW Level Output Voltage | 1.65 | $V_{IN}$=$V_{IH}$, $I_{OL}$=100µA | | 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 | $I_{OL}$=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 | 0 ≤ $V_{IN}$ ≤ 5.5V | | | ±1 | | ±1 | 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 | | | 1 | | 10 | µA |

© 2001 Fairchild Semiconductor Corporation

chanhvinh.com



## AC Electrical Characteristics

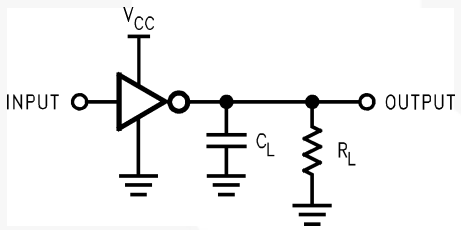
| Symbol | Parameter | $V_{CC}$ | Conditions | $T_A$=25°C | | | $T_A$=-40 to 85°C | | Units | Figure |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay | 1.80 ± 0.15 | $C_L$=15pF, $R_L$=1MΩ | 1.8 | 4.4 | 9.5 | 2.0 | 10.0 | ns | Figure 5 Figure 6 |
| | | 2.50 ± 0.20 | | 0.8 | 2.9 | 5.1 | 0.8 | 5.6 | | |
| | | 3.30 ± 0.30 | | 0.5 | 2.1 | 3.4 | 0.5 | 3.8 | | |
| | | 5.00 ± 0.50 | | 0.5 | 1.8 | 2.8 | 0.5 | 3.1 | | |
| | | 3.30 ± 0.30 | $C_L$=50pF, $R_L$=500Ω | 1.2 | 2.9 | 4.5 | 1.2 | 5.0 | | |
| | | 5.00 ± 0.50 | | 0.8 | 2.4 | 3.6 | 0.8 | 4.0 | | |
| $C_{IN}$ | Input Capacitance | 0 | | | 2.5 | | | | pF | |
| $C_{PD}$ | Power Dissipation Capacitance(4) | 3.30 | | | 9 | | | | pF | Figure 7 |
| | | 5.00 | | | 11 | | | | | |

**Note:**

4. $C_{PD}$ 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: $I_{CCD}=(C_{PD})(V_{CC})(f_{IN})+(I_{CC}static)$.

## Dynamic Switching Characteristics

| Symbol | Parameter | Conditions | $V_{CC}$ | $T_A$=25°c | Unit |
|---|---|---|---|---|---|
| | | | | Typ. | |
| $V_{OLP}$ | Quiet Output Dynamic Peak $V_{OL}$ | $C_L$=50pF, $V_{IH}$=5.0V, $V_{IL}$=0V | 5.0 | 0.8 | V |
| $V_{OLV}$ | Quiet Output Dynamic Valley $V_{OL}$ | | 5.0 | -0.8 | V |




**Note:**

5. $C_L$ includes load and stray capacitance; inputs PRR=1.0MHz, $t_W$=500ns.

**Figure 5. AC Test Circuit**

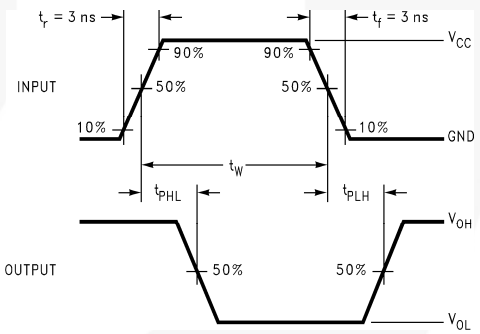
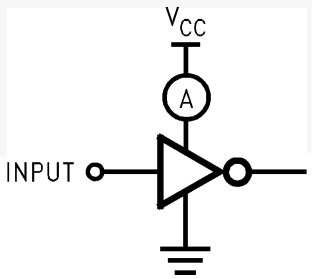



**Figure 6. AC Waveforms**




**Note:**

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

**Figure 7. $I_{CCD}$ Test Circuit**

chanhvinh.com



## Physical Dimensions

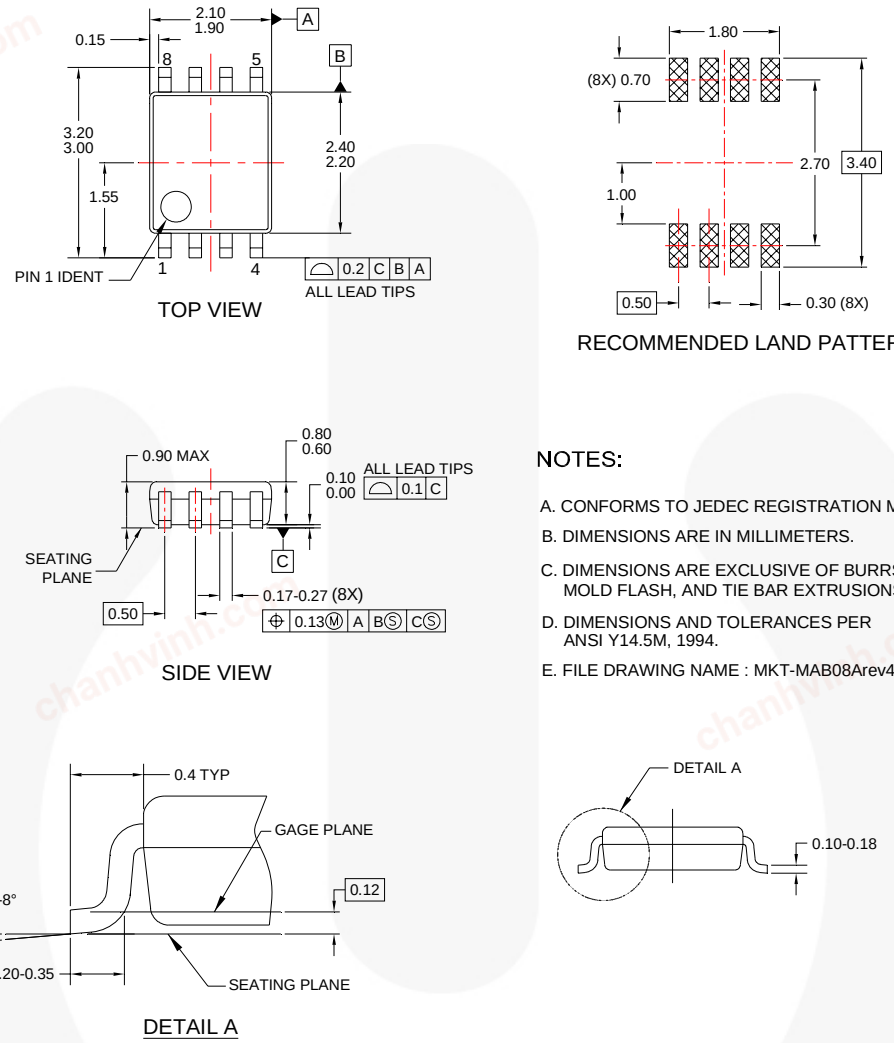



**Figure 8. 8-Lead US8, JEDEC MO-187, Variation CA, 3.1mm Wide**

*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 Specification

*Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:*
*http://www.fairchildsemi.com/packaging/US8_Pack_TNR.pdf*

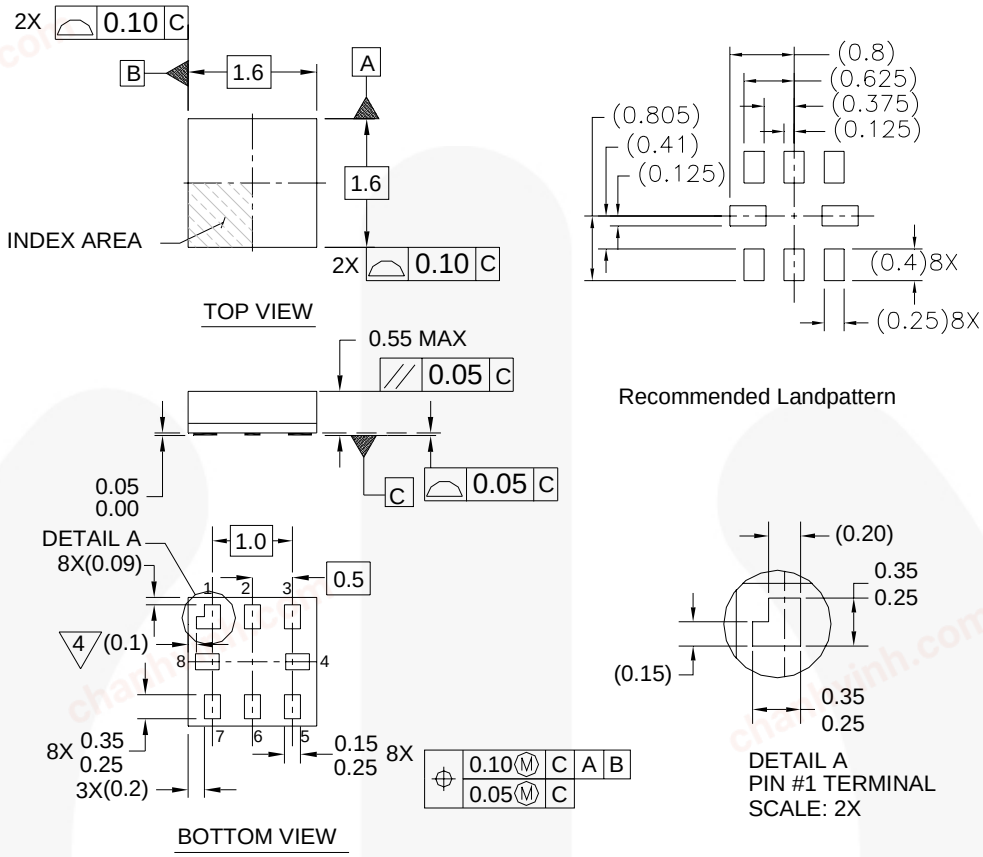
| Package Designator | Tape Section | Cavity Number | Cavity Status | Cover Type Status |
|---|---|---|---|---|
| K8X | Leader (Start End) | 125 (Typical) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (Typical) | Empty | Sealed |

© 2001 Fairchild Semiconductor Corporation

chanhvinh.com



## Physical Dimensions




Notes:

1. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y.14M-1994
4. PIN 1 FLAG, END OF PACKAGE OFFSET
5. DRAWING FILE NAME: MKT-MAC08AREV4

MAC08AREV4

**Figure 9. 8-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 Specification

*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 |
|---|---|---|---|---|
| L8X | Leader (Start End) | 125 (Typical) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (Typical) | Empty | Sealed |

© 2001 Fairchild Semiconductor Corporation

chanhvinh.com



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™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficientMax™
ESBC™
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FlashWriter®*
FPS™
F-PFS™
FRFET®
Global Power Resource℠
Green FPS™
Green FPS™ e-Series™
G*max*™
GTO™
IntelliMAX™
ISOPLANAR™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
Motion-SPM™
OptoHiT™
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™
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. I49

© 2001 Fairchild Semiconductor Corporation