



November 2014

# MOC223M, MOCD223M 8-pin SOIC Darlington Output Optocouplers

## Features

- High Current Transfer Ratio of 500% Minimum at  $I_F = 1 \text{ mA}$
- Minimum  $BV_{CEO}$  of 30 V Guaranteed
- Convenient Plastic SOIC-8 Surface Mountable Package Style, with 0.050" Lead Spacing
- Safety and Regulatory Approvals:
  - UL1577, 2,500  $VAC_{RMS}$  for 1 Minute
  - DIN-EN/IEC60747-5-5, 565 V Peak Working Insulation Voltage

## Applications

- Low Power Logic Circuits
- Interfacing and Coupling Systems of Different Potentials and Impedances
- Telecommunications Equipment
- Portable Electronics
- Solid State Relays

## Description

The MOC223M consists of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon photodarlington detector, in a surface mountable, small outline, plastic package. The MOCD223M is a dual-channel version of the MOC223M. They are ideally suited for high density applications, and eliminates the need for through the board mounting.

## Package Outline

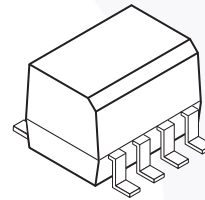


Figure 1. Package Outline

## Schematics

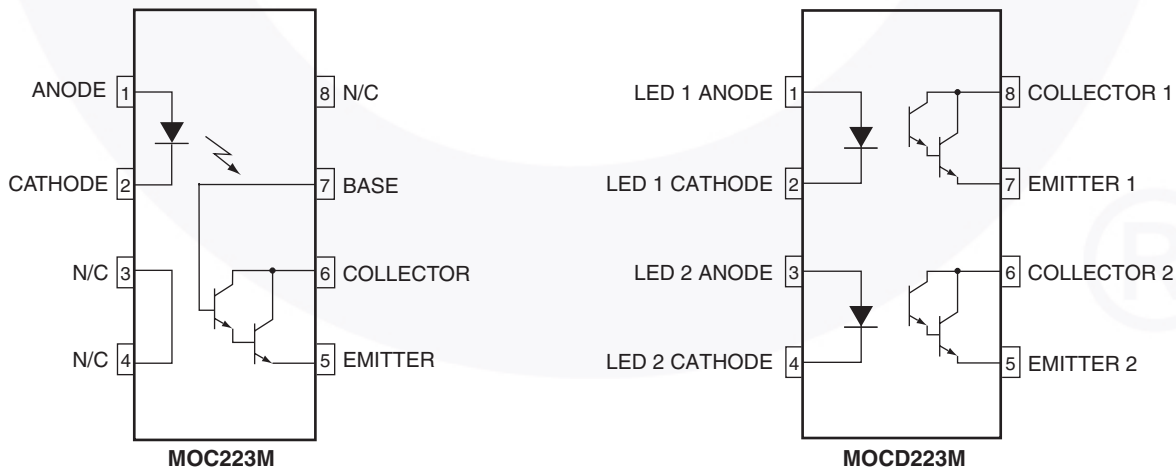


Figure 2. Schematics

## Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V <sub>RMS</sub>	I–IV
	< 300 V <sub>RMS</sub>	I–III
Climatic Classification		55/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V <sub>PR</sub>	Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC	904	V <sub>peak</sub>
	Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC	1060	V <sub>peak</sub>
V <sub>IORM</sub>	Maximum Working Insulation Voltage	565	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over-Voltage	4000	V <sub>peak</sub>
	External Creepage	≥ 4	mm
	External Clearance	≥ 4	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.4	mm
T <sub>S</sub>	Case Temperature <sup>(1)</sup>	150	°C
I <sub>S,INPUT</sub>	Input Current <sup>(1)</sup>	200	mA
P <sub>S,OUTPUT</sub>	Output Power <sup>(1)</sup>	300	mW
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V <sup>(1)</sup>	> 10 <sup>9</sup>	Ω

### Note:

1. Safety limit values – maximum values allowed in the event of a failure.

## 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.  $T_A = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Rating	Value	Unit
<b>TOTAL DEVICE</b>			
$T_{STG}$	Storage Temperature	-40 to +125	$^\circ\text{C}$
$T_A$	Ambient Operating Temperature	-40 to +100	$^\circ\text{C}$
$T_J$	Junction Temperature	-40 to +125	$^\circ\text{C}$
$T_{SOL}$	Lead Solder Temperature	260 for 10 seconds	$^\circ\text{C}$
$P_D$	Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$	240	mW
	Derate Above $25^\circ\text{C}$	2.94	mW/ $^\circ\text{C}$
<b>EMITTER</b>			
$I_F$	Continuous Forward Current	60	mA
$I_F$ (pk)	Forward Current – Peak (PW = 100 $\mu\text{s}$ , 120 pps)	1.0	A
$V_R$	Reverse Voltage	6.0	V
$P_D$	LED Power Dissipation @ $T_A = 25^\circ\text{C}$	90	mW
	Derate Above $25^\circ\text{C}$	0.8	mW/ $^\circ\text{C}$
<b>DETECTOR</b>			
$I_C$	Continuous Collector Current	150	mA
$V_{CEO}$	Collector-Emitter Voltage	30	V
$V_{CBO}$	Collector-Base Voltage, MOC223M	70	V
$V_{ECO}$	Emitter-Collector Voltage	7	V
$P_D$	Detector Power Dissipation @ $T_A = 25^\circ\text{C}$	150	mW
	Derate Above $25^\circ\text{C}$	1.76	mW/ $^\circ\text{C}$

## Electrical Characteristics

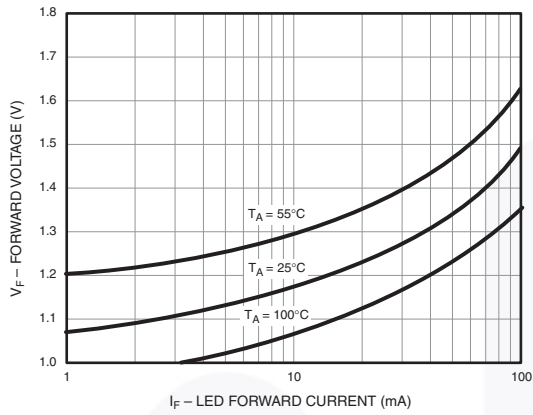
$T_A = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>EMITTER</b>						
$V_F$	Input Forward Voltage	$I_F = 1.0\text{ mA}$		1.08	1.3	V
$I_R$	Reverse Leakage Current	$V_R = 6.0\text{ V}$		0.001	100	$\mu\text{A}$
$C_{IN}$	Input Capacitance			18		pF
<b>DETECTOR</b>						
$I_{CEO1}$	Collector-Emitter Dark Current	$V_{CE} = 5.0\text{ V}, T_A = 25^\circ\text{C}$		1.0	50	nA
$I_{CEO2}$		$V_{CE} = 5.0\text{ V}, T_A = 100^\circ\text{C}$		1.0		$\mu\text{A}$
$BV_{CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 100\ \mu\text{A}$	30	100		V
$BV_{CBO}$	Collector-Base Breakdown Voltage	$I_C = 100\ \mu\text{A}$	70	120		V
$BV_{ECO}$	Emitter-Collector Breakdown Voltage	$I_E = 100\ \mu\text{A}$	7	10		V
$C_{CE}$	Collector-Emitter Capacitance	$f = 1.0\text{ MHz}, V_{CE} = 0$		5.5		pF
<b>COUPLED</b>						
CTR	Current Transfer Ratio	$I_F = 1.0\text{ mA}, V_{CE} = 5.0\text{ V}$	500	1000		%
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 500\ \mu\text{A}, I_F = 1.0\text{ mA}$			1.0	V
$t_{on}$	Turn-On Time	$I_F = 5.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$ (Figure 8)		10		$\mu\text{s}$
$t_{off}$	Turn-Off Time	$I_F = 5.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$ (Figure 8)		125		ns
$t_r$	Rise Time	$I_F = 5.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$ (Figure 8)		8		$\mu\text{s}$
$t_f$	Fall Time	$I_F = 5.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$ (Figure 8)		110		$\mu\text{s}$

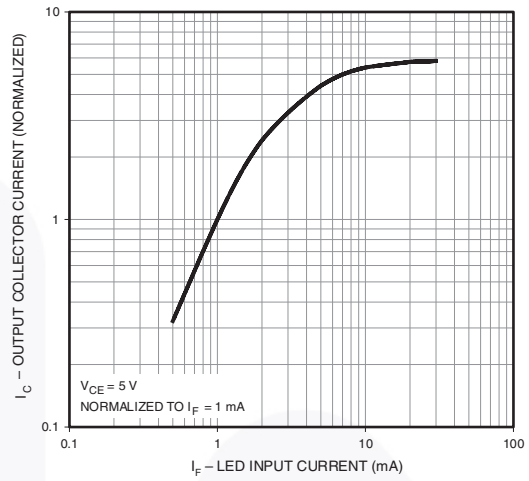
## Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$V_{ISO}$	Input-Output Isolation Voltage	$t = 1\text{ Minute}$	2500			$V_{AC_{RMS}}$
$C_{ISO}$	Isolation Capacitance	$V_{I-O} = 0\text{ V}, f = 1\text{ MHz}$		0.2		pF
$R_{ISO}$	Isolation Resistance	$V_{I-O} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$	$10^{11}$			$\Omega$

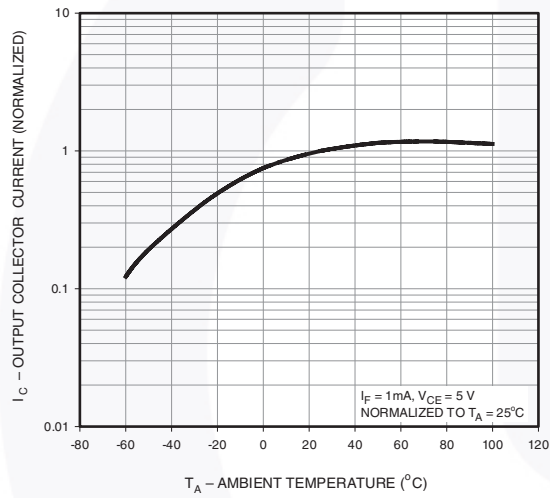
## Typical Performance Curves



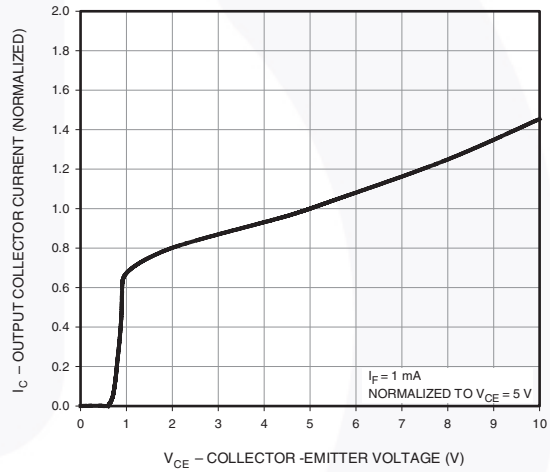
**Figure 3. LED Forward Voltage vs. Forward Current**



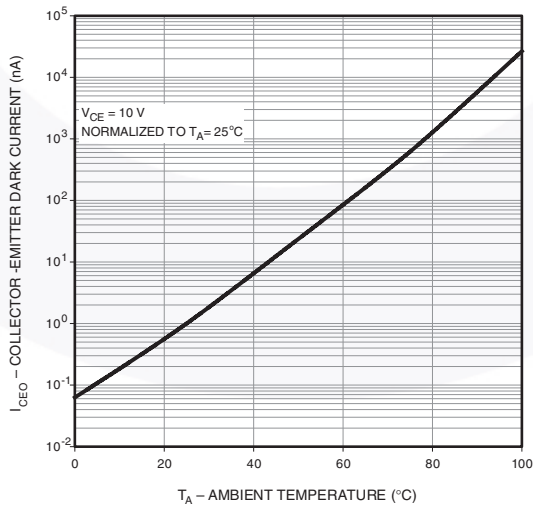
**Figure 4. Output Current vs. Input Current**



**Figure 5. Output Current vs. Ambient Temperature**



**Figure 6. Output Current vs. Collector - Emitter Voltage**



**Figure 7. Dark Current vs. Ambient Temperature**

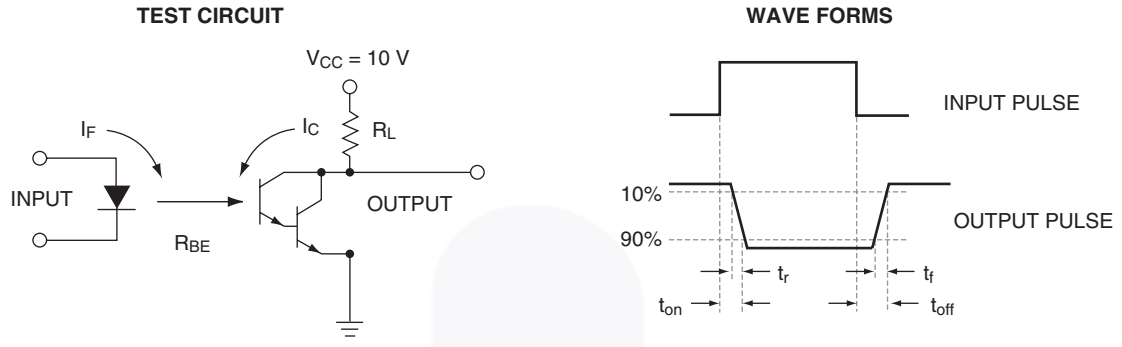


Figure 8. Switching Time Test Circuit and Waveform



## Reflow Profile

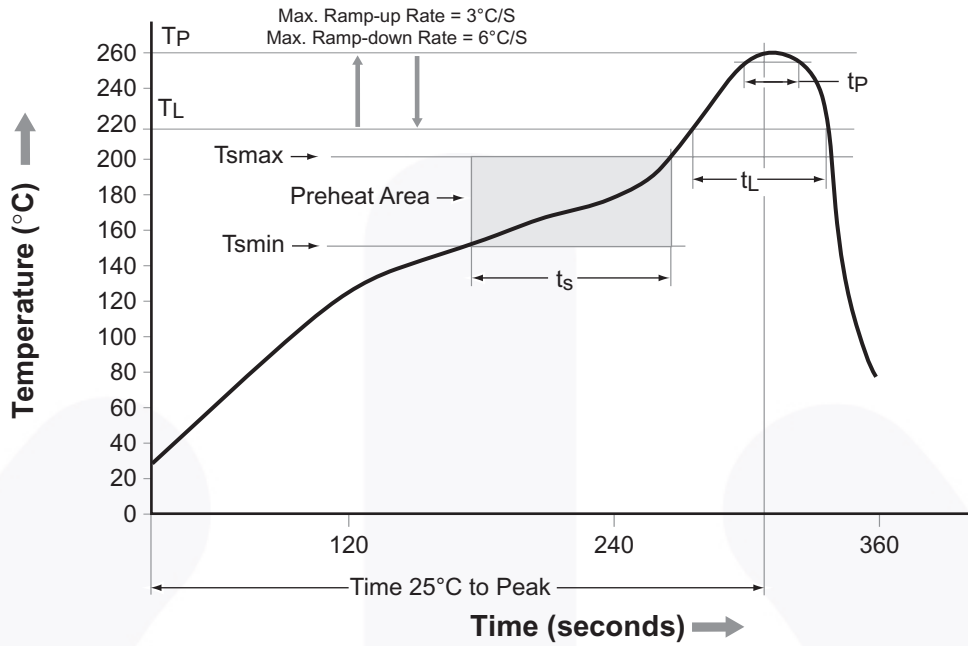


Figure 9. Reflow Profile

Profile Feature	Pb-Free Assembly Profile
Temperature Minimum (Tsmín)	150°C
Temperature Maximum (Tsmáx)	200°C
Time (ts) from (Tsmín to Tsmáx)	60–120 seconds
Ramp-up Rate (tL to tp)	3°C/second maximum
Liquidous Temperature (TL)	217°C
Time (tL) Maintained Above (TL)	60–150 seconds
Peak Body Package Temperature	260°C +0°C / -5°C
Time (tp) within 5°C of 260°C	30 seconds
Ramp-down Rate (TP to TL)	6°C/second maximum
Time 25°C to Peak Temperature	8 minutes maximum

## Ordering Information

Part Number	Package	Packing Method
MOC223M	Small Outline 8-Pin	Tube (100 Units)
MOC223R2M	Small Outline 8-Pin	Tape and Reel (1000 Units)
MOC223VM	Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 Units)
MOC223R2VM	Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
MOCD223M	Small Outline 8-Pin	Tube (100 Units)
MOCD223R2M	Small Outline 8-Pin	Tape and Reel (1000 Units)
MOCD223VM	Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 Units)
MOCD223R2VM	Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)

## Marking Information

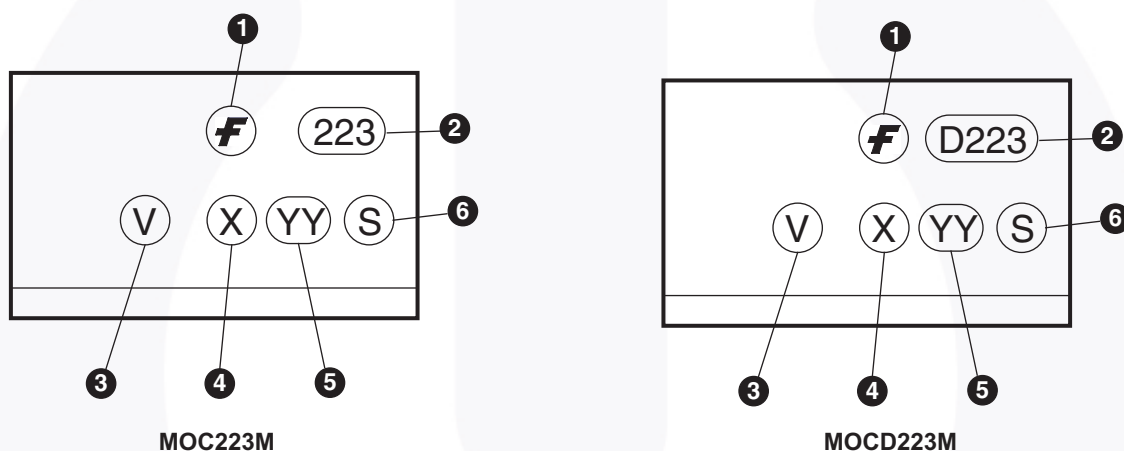


Figure 10. Top Marks

Table 1. Top Mark Definitions

1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., "4"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code





NOTES:






- A) NO STANDARD APPLIES TO THIS PACKAGE
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M.
- E) DRAWING FILENAME: MKT-M08Erev5





### 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™  | F-PFS™   | OPTOPLANAR®   |  SYSTEM GENERAL® |
| AttitudeEngine™   | FRFET®   |  ® | TinyBoost®  |
| Awinda®   | Global Power Resource <sup>SM</sup>            | Power Supply WebDesigner™   | TinyBuck®   |
| AX-CAP®*  | GreenBridge™                                   | PowerTrench®  | TinyCalc™   |
| BitSiC™   | Green FPS™                                     | PowerXS™  | TinyLogic®  |
| Build it Now™   | Green FPS™ e-Series™                           | Programmable Active Droop™  | TINYOPTO™   |
| CorePLUS™   | Gmax™  | QFET®   | TinyPower™  |
| CorePOWER™  | GTO™   | QS™   | TinyPWM™  |
| CROSSVOL™   | IntelliMAX™                                    | Quiet Series™   | TinyWire™   |
| CTL™  | ISOPLANAR™                                     | RapidConfigure™   | TranSiC™  |
| Current Transfer Logic™   | Making Small Speakers Sound Louder and Better™ |  ™ | TriFault Detect™  |
| DEUXPEED®   | MegaBuck™                                      | Saving our world, 1mW/W/kW at a time™   | TRUECURRENT®*   |
| Dual Cool™  | MICROCOUPLER™                                  | SignalWise™   | μSerDes™  |
| EcoSPARK®   | MicroFET™                                      | SmartMax™   |  SerDes®         |
| EfficientMax™   | MicroPak™                                      | SMART START™  | UHC®  |
| ESBC™   | MicroPak2™                                     | Solutions for Your Success™   | Ultra FRFET™  |
|  ® | MillerDrive™                                   | SPM®  | UniFET™   |
| Fairchild®  | MotionMax™                                     | STEALTH™  | VCX™  |
| Fairchild Semiconductor®  | MotionGrid®                                    | SuperFET®   | VisualMax™  |
| FACT Quiet Series™  | MTI®   | SuperSOT™-3   | VoltagePlus™  |
| FACT®   | MTX®   | SuperSOT™-6   | XS™   |
| FAST®   | MVN®   | SuperSOT™-8   | Xsens™  |
| FastvCore™  | mWSaver®                                       | SupreMOS®   | 仙童™   |
| FETBench™   | OptoHiT™                                       | SyncFET™  |   |
| FPS™  | OPTOLOGIC®                                     | Sync-Lock™  |   |

\* 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. TO OBTAIN THE LATEST, MOST UP-TO-DATE DATASHEET AND PRODUCT INFORMATION, VISIT OUR WEBSITE AT [HTTP://WWW.FAIRCHILDSEMI.COM](http://www.fairchildsemi.com). 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](http://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.