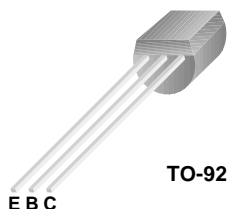
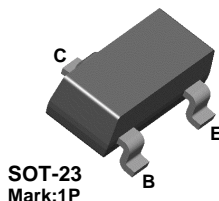


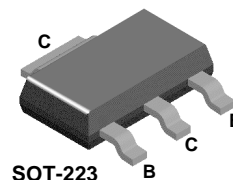
## PN2222A



## MMBT2222A



## PZT2222A



### NPN General Purpose Amplifier

- This device is for use as a medium power amplifier and switch requiring collector currents up to 500mA.
- Sourced from process 19.

### Absolute Maximum Ratings \* $T_a=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Value	Units
$V_{CEO}$	Collector-Emitter Voltage	40	V
$V_{CBO}$	Collector-Base Voltage	75	V
$V_{EBO}$	Emitter-Base Voltage	6.0	V
$I_C$	Collector Current	1.0	A
$T_{STG}$	Operating and Storage Junction Temperature Range	- 55 ~ 150	$^\circ\text{C}$

\* These ratings are limiting values above which the serviceability of any semiconductor device may be impaired

#### NOTES:

- These ratings are based on a maximum junction temperature of 150 degrees C.
- These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations

### Electrical Characteristics $T_a=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Max.	Units
<b>Off Characteristics</b>					
$BV_{(BR)CEO}$	Collector-Emitter Breakdown Voltage *	$I_C = 10\text{mA}$ , $I_B = 0$	40		V
$BV_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C = 10\mu\text{A}$ , $I_E = 0$	75		V
$BV_{(BR)EBO}$	Emitter-Base Breakdown Voltage	$I_E = 10\mu\text{A}$ , $I_C = 0$	6.0		V
$I_{CEX}$	Collector Cutoff Current	$V_{CE} = 60\text{V}$ , $V_{EB(off)} = 3.0\text{V}$		10	nA
$I_{CBO}$	Collector Cutoff Current	$V_{CB} = 60\text{V}$ , $I_E = 0$ $V_{CB} = 60\text{V}$ , $I_E = 0$ , $T_a = 125^\circ\text{C}$		0.01 10	$\mu\text{A}$ $\mu\text{A}$
$I_{EBO}$	Emitter Cutoff Current	$V_{EB} = 3.0\text{V}$ , $I_C = 0$		10	$\mu\text{A}$
$I_{BL}$	Base Cutoff Current	$V_{CE} = 60\text{V}$ , $V_{EB(off)} = 3.0\text{V}$		20	$\mu\text{A}$
<b>On Characteristics</b>					
$h_{FE}$	DC Current Gain	$I_C = 0.1\text{mA}$ , $V_{CE} = 10\text{V}$ $I_C = 1.0\text{mA}$ , $V_{CE} = 10\text{V}$ $I_C = 10\text{mA}$ , $V_{CE} = 10\text{V}$ $I_C = 10\text{mA}$ , $V_{CE} = 10\text{V}$ , $T_a = -55^\circ\text{C}$ $I_C = 150\text{mA}$ , $V_{CE} = 10\text{V}$ * $I_C = 150\text{mA}$ , $V_{CE} = 10\text{V}$ * $I_C = 500\text{mA}$ , $V_{CE} = 10\text{V}$ *	35 50 75 35 100 50 40	300	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage *	$I_C = 150\text{mA}$ , $V_{CE} = 10\text{V}$ $I_C = 500\text{mA}$ , $V_{CE} = 10\text{V}$		0.3 1.0	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage *	$I_C = 150\text{mA}$ , $V_{CE} = 10\text{V}$ $I_C = 500\text{mA}$ , $V_{CE} = 10\text{V}$	0.6	1.2 2.0	V V

\* Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

## Electrical Characteristics $T_a=25^{\circ}\text{C}$ unless otherwise noted (Continued)

Symbol	Parameter	Test Condition	Min.	Max.	Units
<b>Small Signal Characteristics</b>					
$f_T$	Current Gain Bandwidth Product	$I_C = 20\text{mA}$ , $V_{CE} = 20\text{V}$ , $f = 100\text{MHz}$	300		MHz
$C_{obo}$	Output Capacitance	$V_{CB} = 10\text{V}$ , $I_E = 0$ , $f = 1\text{MHz}$		8.0	pF
$C_{ibo}$	Input Capacitance	$V_{EB} = 0.5\text{V}$ , $I_C = 0$ , $f = 1\text{MHz}$		25	pF
$r_b'C_C$	Collector Base Time Constant	$I_C = 20\text{mA}$ , $V_{CB} = 20\text{V}$ , $f = 31.8\text{MHz}$		150	pS
NF	Noise Figure	$I_C = 100\mu\text{A}$ , $V_{CE} = 10\text{V}$ , $R_S = 1.0\text{K}\Omega$ , $f = 1.0\text{KHz}$		4.0	dB
$\text{Re}(h_{ie})$	Real Part of Common-Emitter High Frequency Input Impedance	$I_C = 20\text{mA}$ , $V_{CE} = 20\text{V}$ , $f = 300\text{MHz}$		60	$\Omega$
<b>Switching Characteristics</b>					
$t_d$	Delay Time	$V_{CC} = 30\text{V}$ , $V_{EB(\text{off})} = 0.5\text{V}$ , $I_C = 150\text{mA}$ , $I_{B1} = 15\text{mA}$		10	ns
$t_r$	Rise Time			25	ns
$t_s$	Storage Time	$V_{CC} = 30\text{V}$ , $I_C = 150\text{mA}$ , $I_{B1} = I_{B2} = 15\text{mA}$		225	ns
$t_f$	Fall Time			60	ns

## Thermal Characteristics $T_a=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Max.			Units
		PN2222A	*MMBT2222A	**PZT2222A	
$P_D$	Total Device Dissipation Derate above $25^{\circ}\text{C}$	625 5.0	350 2.8	1,000 8.0	mW mW/ $^{\circ}\text{C}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3			$^{\circ}\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	357	125	$^{\circ}\text{C/W}$

\* Device mounted on FR-4 PCB  $1.6" \times 1.6" \times 0.06"$ .

\*\* Device mounted on FR-4 PCB  $36\text{mm} \times 18\text{mm} \times 1.5\text{mm}$ ; mounting pad for the collector lead min.  $6\text{cm}^2$ .

## Spice Model

NPN (Is = 14.34f Xti = 3 Eg = 1.11 Vaf = 74.03 Bf = 255.9 Ne = 1.307 Ise = 14.34 Ikf = .2847 Xtb = 1.5 Br = 6.092 Isc = 0  
Ikr = 0 Rc = 1 Cjc = 7.306p Mjc = .3416 Vjc = .75 Fc = .5 Cje = 22.01p Mje = .377 Vje = .75 Tr = 46.91n Tf = 411.1p Itf = .6  
Vtf = 1.7 Xtf = 3 Rb = 10)

## Typical Characteristics

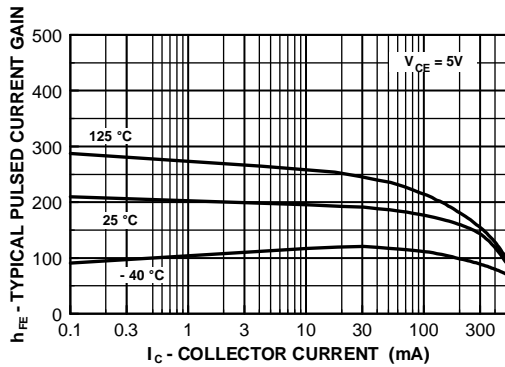


Figure 1. Typical Pulsed Current Gain vs Collector Current

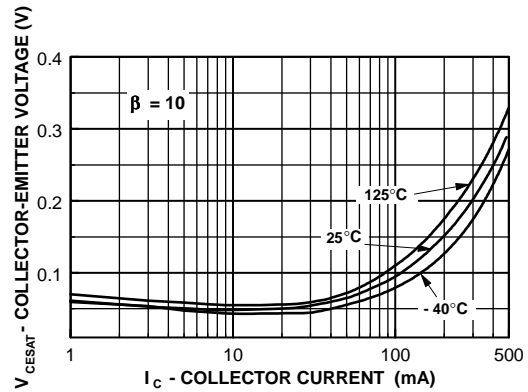


Figure 2. Collector-Emitter Saturation Voltage vs Collector Current

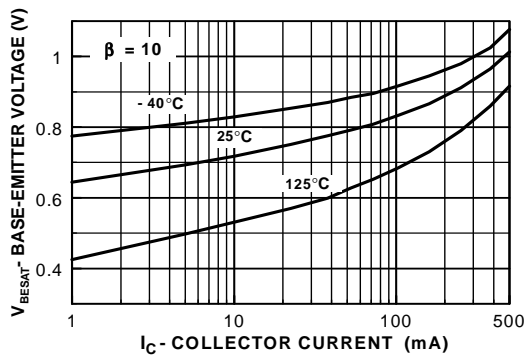


Figure 3. Base-Emitter Saturation Voltage vs Collector Current

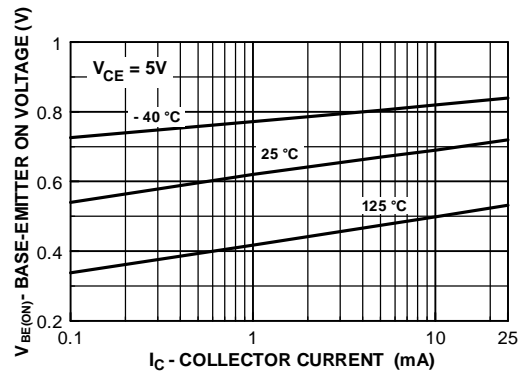


Figure 4. Base-Emitter On Voltage vs Collector Current

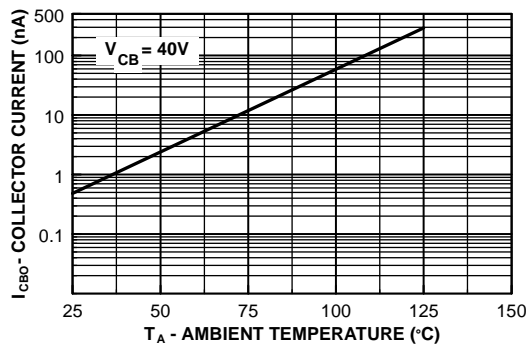


Figure 5. Collector Cutoff Current vs Ambient Temperature

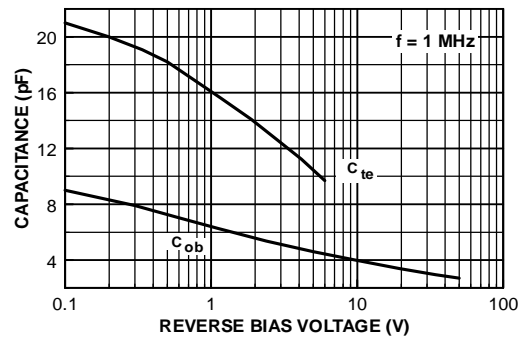


Figure 6. Emitter Transition and Output Capacitance vs Reverse Bias Voltage

## Typical Characteristics

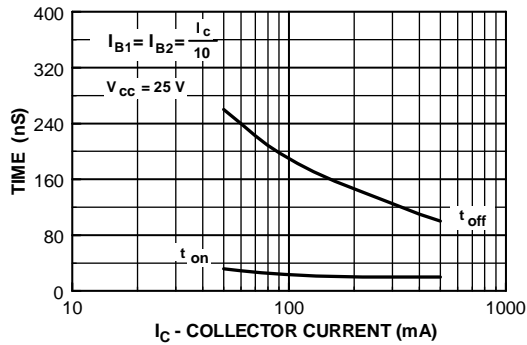


Figure 7. Turn On and Turn Off Times vs Collector Current

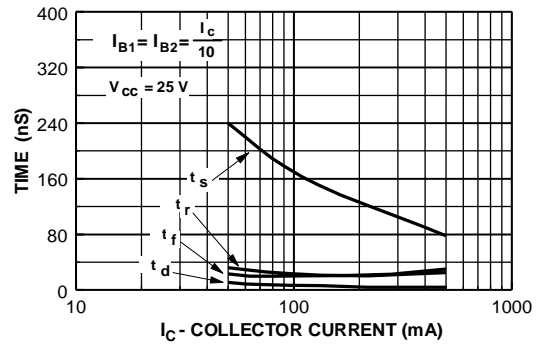


Figure 8. Switching Times vs Collector Current

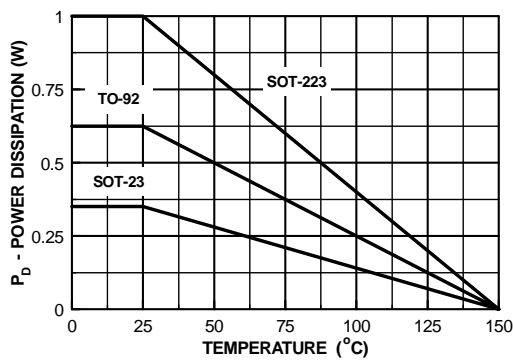


Figure 9. Power Dissipation vs Ambient Temperature

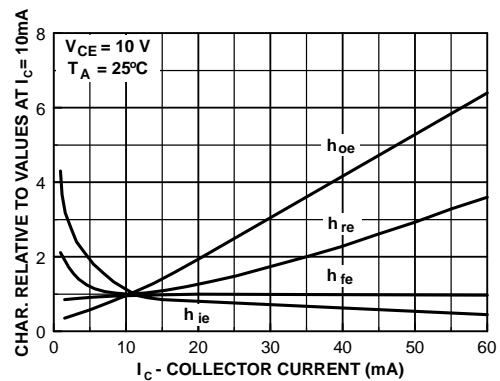


Figure 10. Common Emitter Characteristics

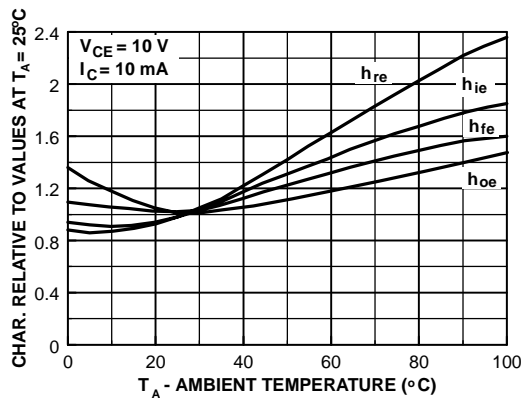


Figure 11. Common Emitter Characteristics

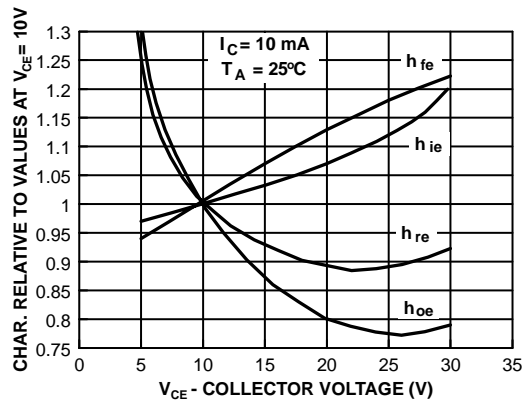
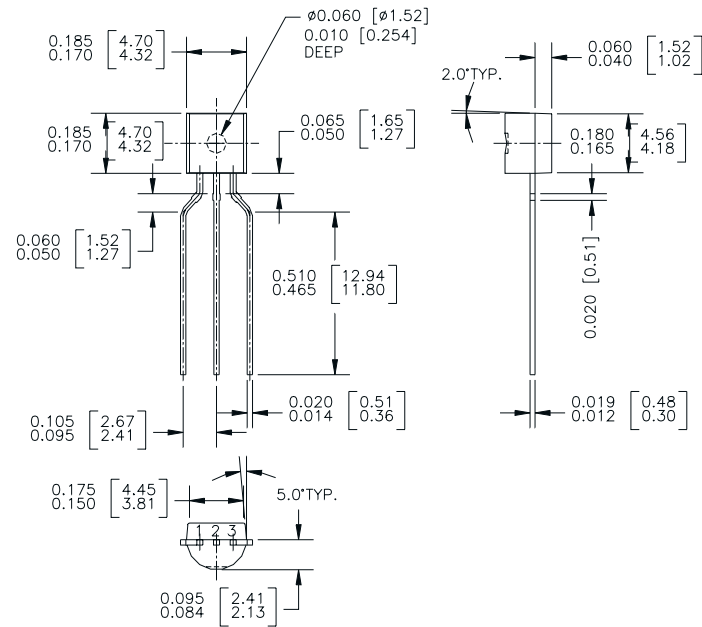


Figure 12. Common Emitter Characteristics

# Package Dimensions

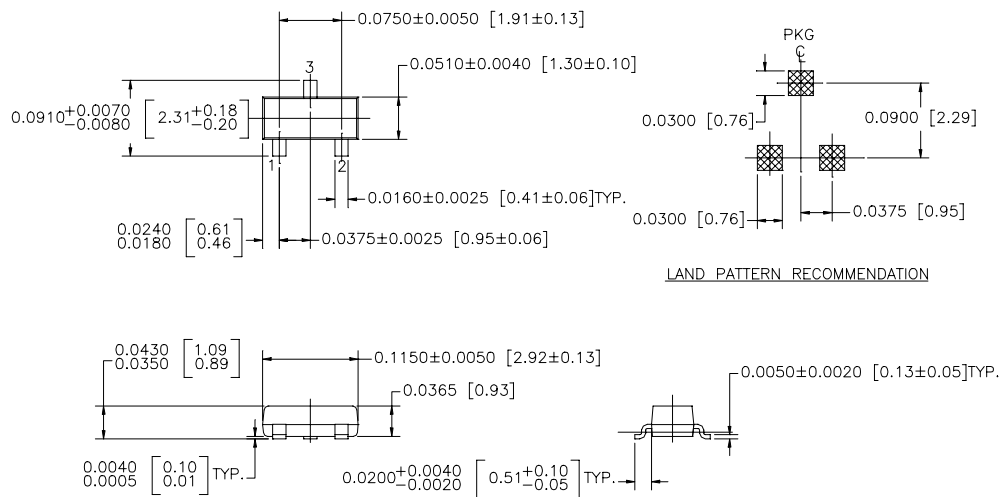
## TO-92



Dimensions in Millimeters

## Package Dimensions (Continued)

### SOT-23



CONTROLLING DIMENSION IS INCH  
VALUES IN [ ] ARE MILLIMETERS

SOT 23, 3 LEADS LOW PROFILE

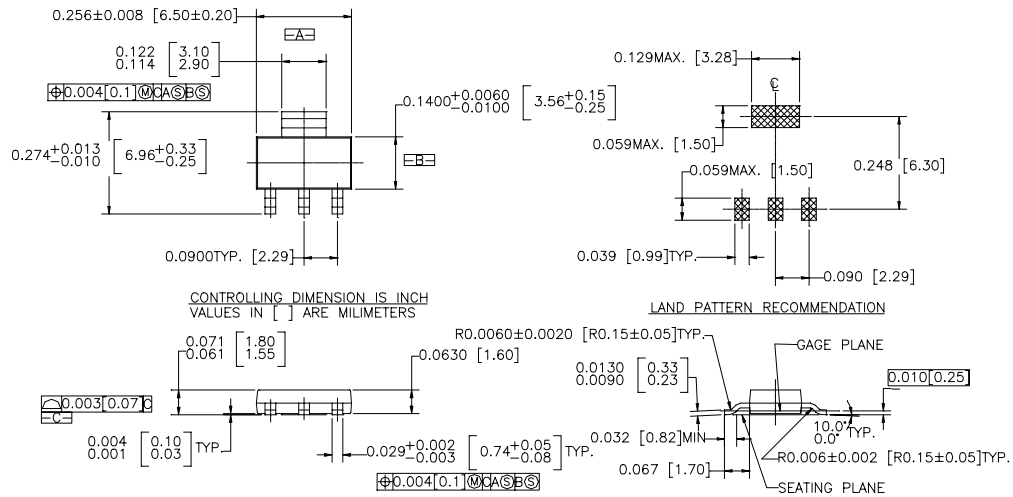
NOTE : UNLESS OTHERWISE SPECIFIED

1. STANDARD LEAD FINISH 150 MICROINCHES / 3.81 MICROMETERS  
MINIMUM TIN / LEAD (SOLDER) ON ALLOY 42
2. REFERENCE JEDEC REGISTRATION TO-236, VARIATION AB, ISSUE G, DATED JUL 1993

Dimensions in Millimeters

## Package Dimensions (Continued)

### SOT-223



- NOTES : UNLESS OTHERWISE SPECIFIED
1. STANDARD LEAD FINISH TO BE 150 MICROINCHES/ 3.81 MICROMETERS MINIMUM TIN/LEAD (SOLDER) ON COPPER.
  2. REFERENCE JEDEC REGISTRATION TO-261, VARIATION AA, ISSUE A, DATED JAN 1990

SOT223, 4 LEADS

Dimensions in Millimeters

## TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACE <sup>™</sup>	FAST <sup>®</sup>	ISOPLANAR <sup>™</sup>	Power247 <sup>™</sup>	SuperFET <sup>™</sup>
ActiveArray <sup>™</sup>	FASTr <sup>™</sup>	LittleFET <sup>™</sup>	PowerSaver <sup>™</sup>	SuperSOT <sup>™</sup> -3
Bottomless <sup>™</sup>	FPS <sup>™</sup>	MICROCOUPLER <sup>™</sup>	PowerTrench <sup>®</sup>	SuperSOT <sup>™</sup> -6
CoolFET <sup>™</sup>	FRFET <sup>™</sup>	MicroFET <sup>™</sup>	QFET <sup>®</sup>	SuperSOT <sup>™</sup> -8
CROSSVOLT <sup>™</sup>	GlobalOptoisolator <sup>™</sup>	MicroPak <sup>™</sup>	QS <sup>™</sup>	SyncFET <sup>™</sup>
DOME <sup>™</sup>	GTO <sup>™</sup>	MICROWIRE <sup>™</sup>	QT Optoelectronics <sup>™</sup>	TinyLogic <sup>®</sup>
EcoSPARK <sup>™</sup>	HiSeC <sup>™</sup>	MSX <sup>™</sup>	Quiet Series <sup>™</sup>	TINYOPTO <sup>™</sup>
E <sup>2</sup> C <sup>™</sup>	I <sup>2</sup> C <sup>™</sup>	MSXPro <sup>™</sup>	RapidConfigure <sup>™</sup>	TruTranslation <sup>™</sup>
EnSigna <sup>™</sup>	i-Lo <sup>™</sup>	OCX <sup>™</sup>	RapidConnect <sup>™</sup>	UHC <sup>™</sup>
FACT <sup>™</sup>	ImpliedDisconnect <sup>™</sup>	OCXPro <sup>™</sup>	μSerDes <sup>™</sup>	UltraFET <sup>®</sup>
FACT Quiet Series <sup>™</sup>		OPTOLOGIC <sup>®</sup>	SILENT SWITCHER <sup>®</sup>	VCX <sup>™</sup>
Across the board. Around the world. <sup>™</sup>		OPTOPLANAR <sup>™</sup>	SMART START <sup>™</sup>	
The Power Franchise <sup>®</sup>		PACMAN <sup>™</sup>	SPM <sup>™</sup>	
Programmable Active Droop <sup>™</sup>		POP <sup>™</sup>	Stealth <sup>™</sup>	

## 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.

## 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, or (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 significant injury to the user.
2. A critical component is 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.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.