



# FGA90N33AT

## 330V, 90A PDP Trench IGBT

### Features

- High current capability
- Low saturation voltage:  $V_{CE(sat)} = 1.1V @ I_C = 20A$
- High input impedance
- Fast switching
- RoHS compliant

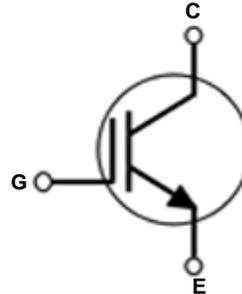
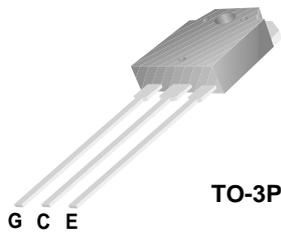
### Applications

- PDP System



### General Description

Using Novel Trench IGBT Technology, Fairchild's new series of trench IGBTs offer the optimum performance for PDP applications where low conduction and switching losses are essential.



### Absolute Maximum Ratings

Symbol	Description	Ratings	Units
$V_{CES}$	Collector to Emitter Voltage	330	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 30$	V
$I_C$	Collector Current @ $T_C = 25^\circ C$	90	A
$I_{C \text{ pulse}(1)}$	Pulsed Collector Current @ $T_C = 25^\circ C$	220	A
$I_{C \text{ pulse}(2)}$	Pulsed Collector Current @ $T_C = 25^\circ C$	330	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ C$	223	W
	Maximum Power Dissipation @ $T_C = 100^\circ C$	89	W
$T_J$	Operating Junction Temperature	-55 to +150	$^\circ C$
$T_{stg}$	Storage Temperature Range	-55 to +150	$^\circ C$
$T_L$	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ C$

### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction to Case	-	0.56	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	$^\circ C/W$

**Notes:**

- (1) Repetitive test, Pulse width=100usec, Duty=0.1  
 (2) Half sine wave, D<0.01, Pulse width<5usec  
 \* $I_C$  pulse limited by max  $T_J$

## Package Marking and Ordering Information

Device Marking	Device	Package	Packaging Type	Qty per Tube	Max Qty per Box
FGA90N33AT	FGA90N33ATTU	TO-3P	Tube	30ea	-

## Electrical Characteristics of the IGBT T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
$V_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	330	-	-	V
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	-	-	250	$\mu A$
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	-	-	$\pm 400$	nA
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 250\mu A, V_{CE} = V_{GE}$	2.5	4.0	5.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 20A, V_{GE} = 15V$	-	1.1	1.4	V
		$I_C = 45A, V_{GE} = 15V,$	-	1.3	-	V
		$I_C = 90A, V_{GE} = 15V,$ $T_C = 25^\circ C$	-	1.6	-	V
		$I_C = 90A, V_{GE} = 15V,$ $T_C = 125^\circ C$	-	1.7	-	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$	-	2200	-	pF
$C_{oes}$	Output Capacitance		-	135	-	pF
$C_{res}$	Reverse Transfer Capacitance		-	100	-	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 200V, I_C = 20A,$ $R_G = 5\Omega, V_{GE} = 15V,$ Resistive Load, $T_C = 25^\circ C$	-	23	-	ns
$t_r$	Rise Time		-	40	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	100	-	ns
$t_f$	Fall Time		-	180	240	ns
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 200V, I_C = 20A,$ $R_G = 5\Omega, V_{GE} = 15V,$ Resistive Load, $T_C = 125^\circ C$	-	20	-	ns
$t_r$	Rise Time		-	40	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	110	-	ns
$t_f$	Fall Time		-	250	300	ns
$Q_g$	Total Gate Charge	$V_{CE} = 200V, I_C = 20A,$ $V_{GE} = 15V$	-	95	-	nC
$Q_{ge}$	Gate to Emitter Charge		-	12	-	nC
$Q_{gc}$	Gate to Collector Charge		-	40	-	nC

## Typical Performance Characteristics

Figure 1. Typical Output Characteristics

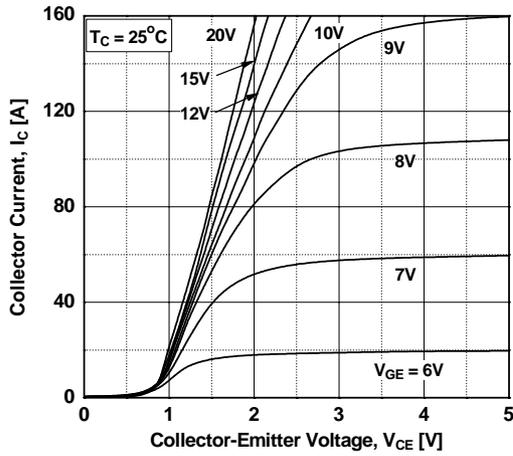


Figure 2. Typical Output Characteristics

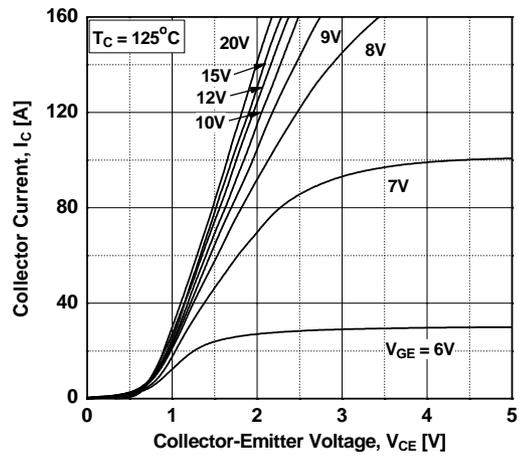


Figure 3. Typical Saturation Voltage Characteristics

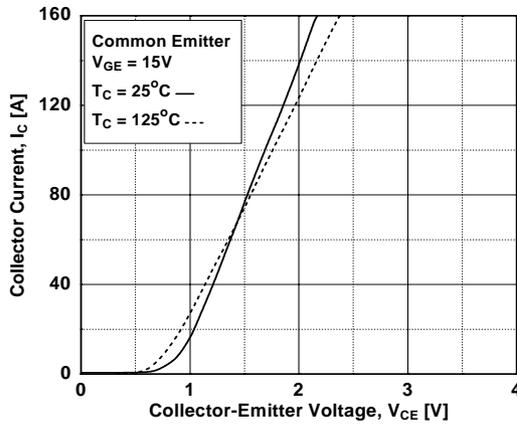


Figure 4. Transfer Characteristics

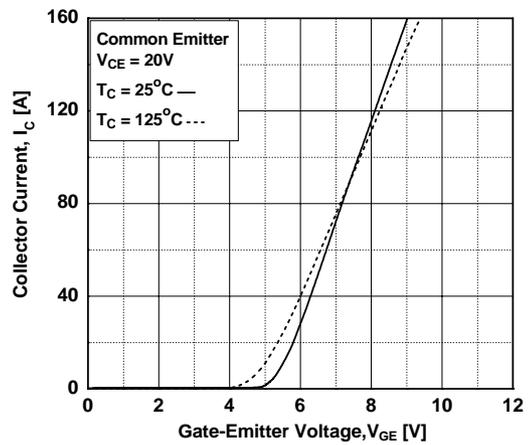


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

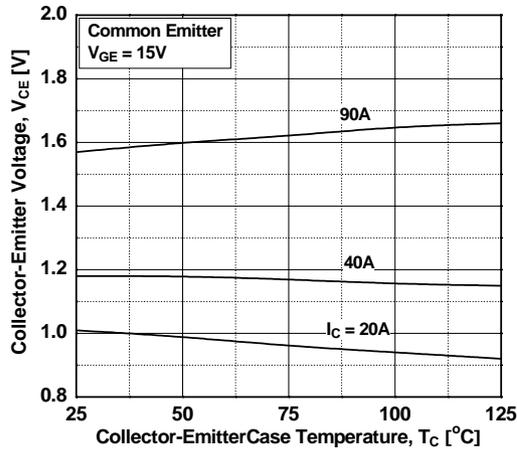
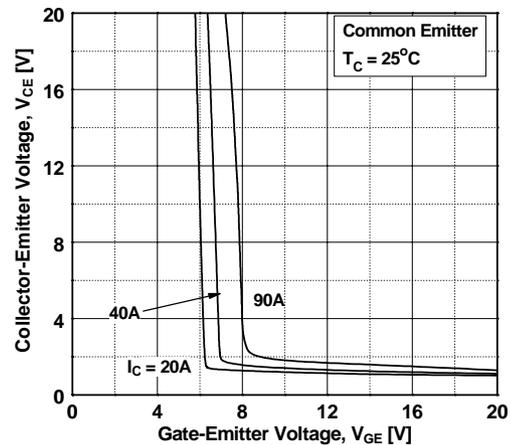


Figure 6. Saturation Voltage vs. Vge



## Typical Performance Characteristics

Figure 7. Saturation Voltage vs.  $V_{GE}$

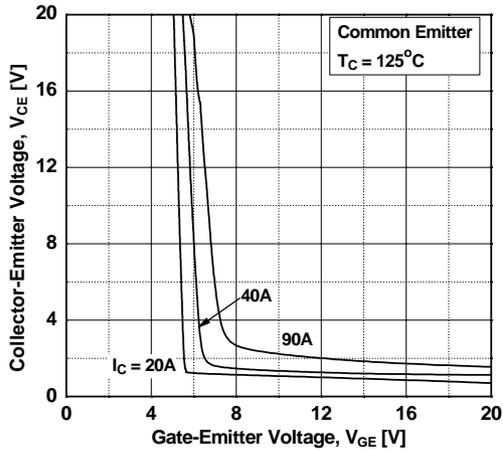


Figure 8. Capacitance Characteristics

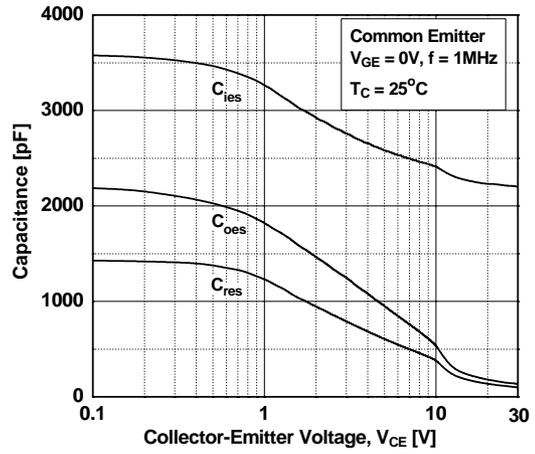


Figure 9. Gate charge Characteristics

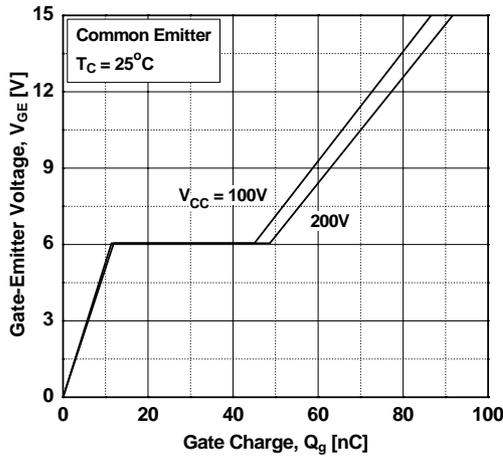


Figure 10. SOA Characteristics

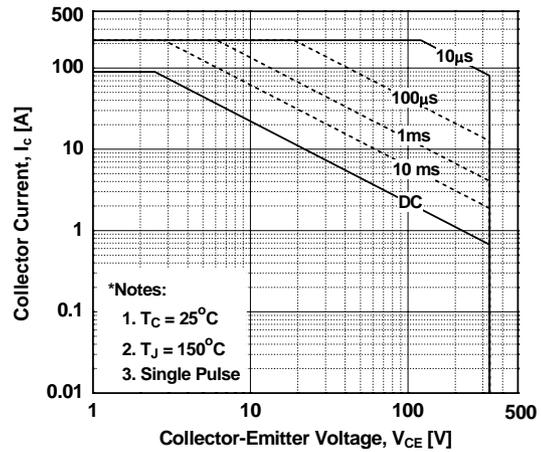


Figure 11. Turn-on Characteristics vs. Gate Resistance

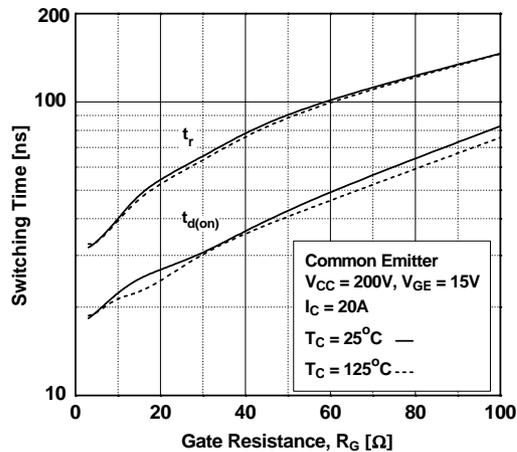
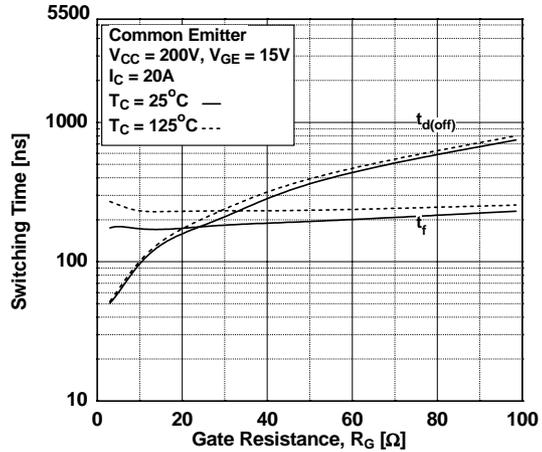
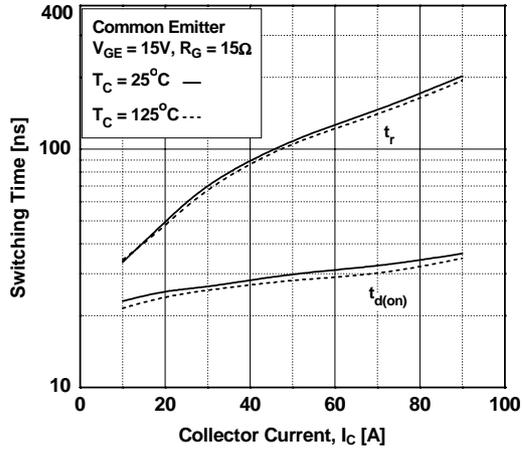


Figure 12. Turn-off Characteristics vs. Gate Resistance

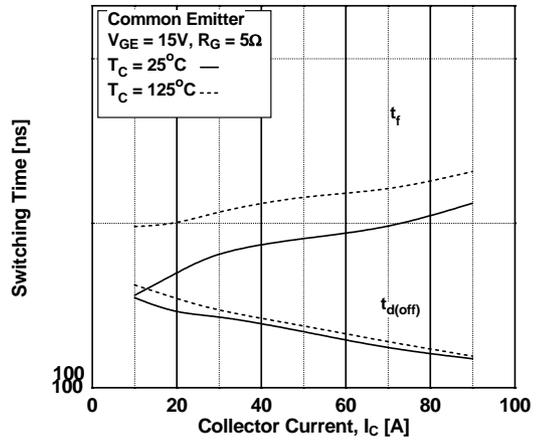


## Typical Performance Characteristics

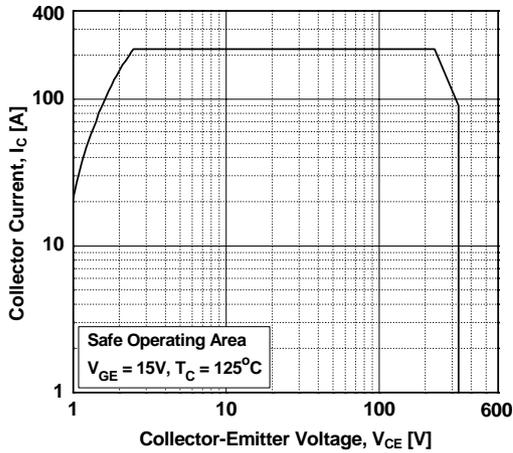
**Figure 13. Turn-on Characteristics vs. Collector Current**



**Figure 14. Turn-off Characteristics vs. Collector Current**

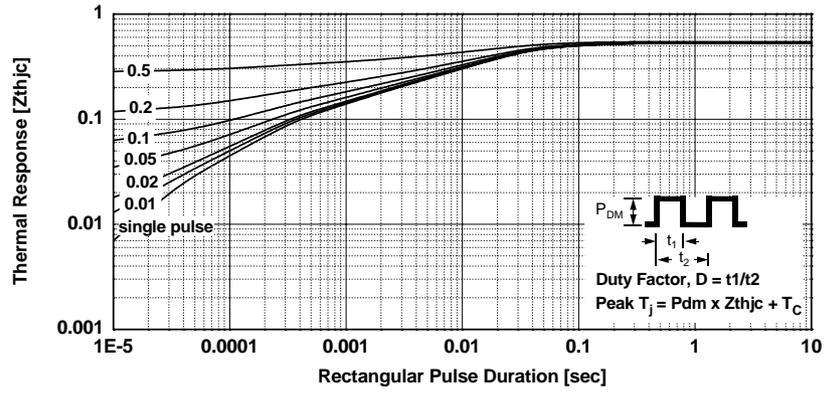


**Figure 15. Turn off Switching SOA Characteristics**



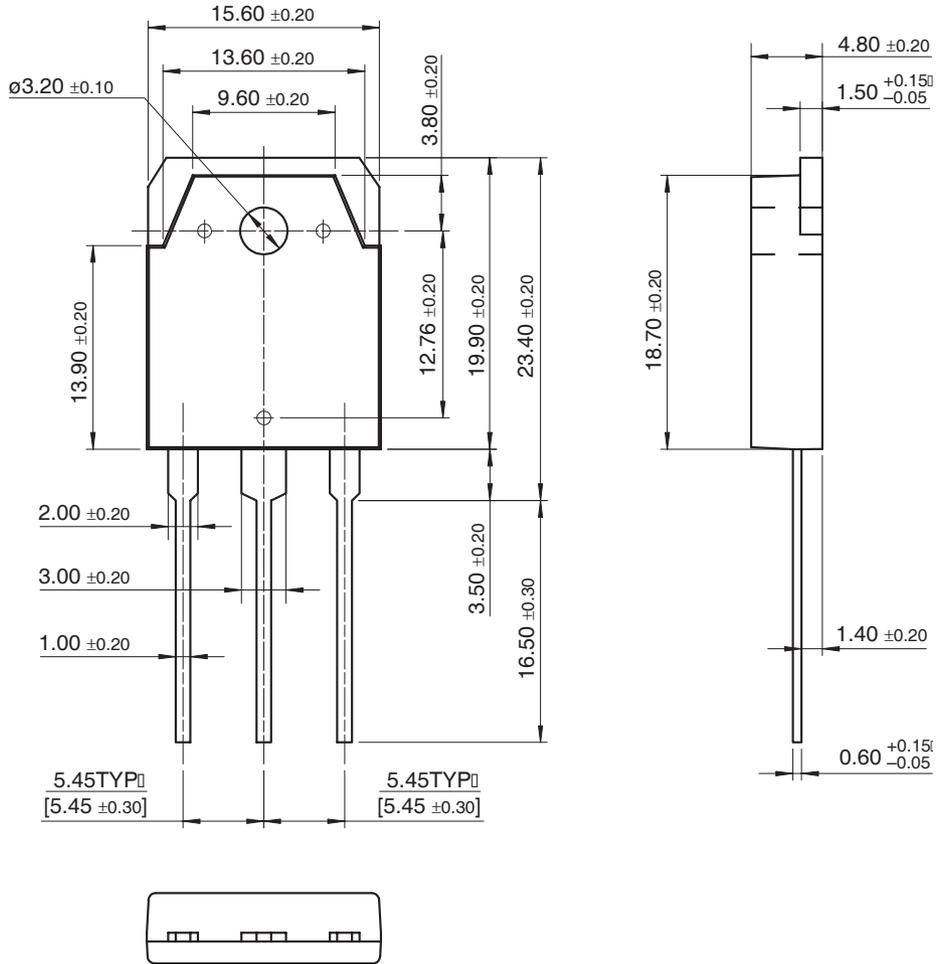
Typical Performance Characteristics

Figure 16. Transient Thermal Impedance of IGBT



Mechanical Dimensions

TO-3P



Dimensions in Millimeters



**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.

- |                          |                         |                                 |                      |
|--------------------------|-------------------------|---------------------------------|----------------------|
| ACEx®                    | FPS™                    | PDP-SPM™                        | The Power Franchise® |
| Build it Now™            | F-PFS™                  | Power-SPM™                      | the power franchise  |
| CorePLUS™                | FRFET®                  | PowerTrench®                    | TinyBoost™           |
| CorePOWER™               | Global Power ResourceSM | Programmable Active Droop™      | TinyBuck™            |
| CROSSVOLT™               | Green FPS™              | QFET®                           | TinyLogic®           |
| CTL™                     | Green FPS™ e-Series™    | QST™                            | TINYOPTO™            |
| Current Transfer Logic™  | GTO™                    | Quiet Series™                   | TinyPower™           |
| EcoSPARK®                | IntelliMAX™             | RapidConfigure™                 | TinyPWM™             |
| EfficientMax™            | ISOPLANAR™              | Saving our world 1mW at a time™ | TinyWire™            |
| EZSWITCH™ *              | MegaBuck™               | SmartMax™                       | μSerDes™             |
| EZ™                      | MICROCOUPLER™           | SMART START™                    | SerDes™              |
| F™                       | MicroFET™               | SPM®                            | UHC®                 |
| Fairchild®               | MicroPak™               | STEALTH™                        | Ultra FRFET™         |
| Fairchild Semiconductor® | MillerDrive™            | SuperFET™                       | UniFET™              |
| FACT Quiet Series™       | MotionMax™              | SuperSOT™-3                     | VCX™                 |
| FACT®                    | Motion-SPM™             | SuperSOT™-6                     | VisualMax™           |
| FAST®                    | OPTOLOGIC®              | SuperSOT™-8                     |                      |
| FastvCore™               | OPTOPLANAR®             | SuperMOS™                       |                      |
| FlashWriter® *           | power®                  | SYSTEM GENERAL®                 |                      |

\* EZSWITCH™ and FlashWriter® are 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:

- 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.
- 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.

**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; 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	This 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	This datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. 134