

## FDB8441

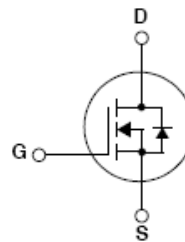
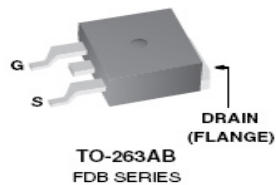
### N-Channel PowerTrench® MOSFET 40V, 120A, 2.5mΩ

#### Features

- Typ  $r_{DS(on)}$  = 1.9mΩ at  $V_{GS} = 10V$ ,  $I_D = 80A$
- Typ  $Q_{g(10)}$  = 215nC at  $V_{GS} = 10V$
- Low Miller Charge
- Low  $Q_{rr}$  Body Diode
- UIS Capability (Single Pulse and Repetitive Pulse)
- RoHS Compliant

#### Applications

- Powertrain Management
- Solenoid and Motor Drivers
- Electronic Steering
- Integrated Starter / Alternator
- Distributed Power Architectures and VRMs
- Primary Switch for 12V Systems



## MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

| Symbol         | Parameter  | Ratings      | Units                     |
|----------------|--|--------------|---------------------------|
| $V_{DS}$       | Drain to Source Voltage  | 40           | V                         |
| $V_{GS}$       | Gate to Source Voltage   | $\pm 20$     | V                         |
| $I_D$          | Drain Current Continuous ( $T_C = 25^\circ\text{C}$ , Silicon limited)                       | 262*         | A                         |
|                | Drain Current Continuous ( $T_C = 100^\circ\text{C}$ , Silicon limited)                      | 185*         |                           |
|                | Drain Current Continuous ( $T_C = 25^\circ\text{C}$ , Package limited)                       | 120          |                           |
|                | Drain Current Continuous ( $T_A = 25^\circ\text{C}$ , $R_{\theta JA} = 43^\circ\text{C/W}$ ) | 28           |                           |
|                | Pulsed   | See Figure 4 |                           |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 1)   | 947          | mJ                        |
| $P_D$          | Power dissipation  | 300          | W                         |
|                | Derate above $25^\circ\text{C}$  | 2            | $\text{W}/^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Temperature  | -55 to 175   | $^\circ\text{C}$          |

\*Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 120A.

## Thermal Characteristics

|                 |  |     |                    |
|-----------------|--|-----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance Junction to Case                                    | 0.5 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient (Note 2)                        | 62  | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient, $1\text{in}^2$ copper pad area | 43  | $^\circ\text{C/W}$ |

## Package Marking and Ordering Information

| Device Marking | Device  | Package  | Reel Size | Tape Width | Quantity  |
|----------------|---------|----------|-----------|------------|-----------|
| FDB8441        | FDB8441 | TO-263AB | 330mm     | 24mm       | 800 units |

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

### Off Characteristics

|            |                                   |  |    |   |           |               |
|------------|-----------------------------------|--|----|---|-----------|---------------|
| $B_{VDSS}$ | Drain to Source Breakdown Voltage | $I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$ | 40 | - | -         | V             |
| $I_{DSS}$  | Zero Gate Voltage Drain Current   | $V_{DS} = 32\text{V}, V_{GS} = 0\text{V}$  | -  | - | 1         | $\mu\text{A}$ |
|            |                                   | $T_J = 150^\circ\text{C}$                  | -  | - | 250       |               |
| $I_{GSS}$  | Gate to Source Leakage Current    | $V_{GS} = \pm 20\text{V}$                  | -  | - | $\pm 100$ | nA            |

### On Characteristics

|              |                                  |  |   |     |     |            |
|--------------|----------------------------------|--|---|-----|-----|------------|
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$                          | 2 | 2.8 | 4   | V          |
| $r_{DS(on)}$ | Drain to Source On Resistance    | $I_D = 80\text{A}, V_{GS} = 10\text{V}$                          | - | 1.9 | 2.5 | m $\Omega$ |
|              |                                  | $I_D = 80\text{A}, V_{GS} = 10\text{V}, T_J = 175^\circ\text{C}$ | - | 3.3 | 4.3 |            |

### Dynamic Characteristics

|              |                                  |  |   |       |     |          |
|--------------|----------------------------------|--|---|-------|-----|----------|
| $C_{iss}$    | Input Capacitance                | $V_{DS} = 25\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$ | - | 15000 | -   | pF       |
| $C_{oss}$    | Output Capacitance               |  | - | 1250  | -   | pF       |
| $C_{rss}$    | Reverse Transfer Capacitance     |  | - | 685   | -   | pF       |
| $R_G$        | Gate Resistance                  | $V_{GS} = 0.5\text{V}, f = 1\text{MHz}$                    | - | 1.1   | -   | $\Omega$ |
| $Q_{g(TOT)}$ | Total Gate Charge at 10V         | $V_{GS} = 0$ to 10V  | - | 215   | 280 | nC       |
| $Q_{g(TH)}$  | Threshold Gate Charge            | $V_{GS} = 0$ to 2V   | - | 29    | 38  | nC       |
| $Q_{gs}$     | Gate to Source Gate Charge       | $V_{DD} = 20\text{V}, I_D = 35\text{A}, I_g = 1\text{mA}$  | - | 60    | -   | nC       |
| $Q_{gs2}$    | Gate Charge Threshold to Plateau |  | - | 32    | -   | nC       |
| $Q_{gd}$     | Gate to Drain "Miller" Charge    |  | - | 49    | -   | nC       |

**Electrical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

**Switching Characteristics**

| Symbol       | Parameter           | Test Conditions  | Min | Typ  | Max | Units |
|--------------|---------------------|--|-----|------|-----|-------|
| $t_{(on)}$   | Turn-On Time        | $V_{DD} = 20\text{V}, I_D = 35\text{A}$<br>$V_{GS} = 10\text{V}, R_{GS} = 1.5\Omega$ | -   | -    | 77  | ns    |
| $t_{d(on)}$  | Turn-On Delay Time  |  | -   | 23   | -   | ns    |
| $t_r$        | Turn-On Rise Time   |  | -   | 24   | -   | ns    |
| $t_{d(off)}$ | Turn-Off Delay Time |  | -   | 75   | -   | ns    |
| $t_f$        | Turn-Off Fall Time  |  | -   | 17.9 | -   | ns    |
| $t_{off}$    | Turn-Off Time       |  | -   | -    | 147 | ns    |

**Drain-Source Diode Characteristics**

| Symbol   | Parameter                     | Test Conditions                                     | Min | Typ | Max  | Units |
|----------|-------------------------------|---|-----|-----|------|-------|
| $V_{SD}$ | Source to Drain Diode Voltage | $I_{SD} = 35\text{A}$                               | -   | 0.8 | 1.25 | V     |
|          |                               | $I_{SD} = 15\text{A}$                               | -   | 0.8 | 1.0  | V     |
| $t_{rr}$ | Reverse Recovery Time         | $I_F = 35\text{A}, di/dt = 100\text{A}/\mu\text{s}$ | -   | 52  | 68   | ns    |
| $Q_{rr}$ | Reverse Recovery Charge       | $I_F = 35\text{A}, di/dt = 100\text{A}/\mu\text{s}$ | -   | 76  | 99   | nC    |

**Notes:**

- 1: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.46\text{mH}$ ,  $I_{AS} = 64\text{A}$ .
- 2: Pulse width = 100 $\mu\text{s}$ .

### Typical Characteristics

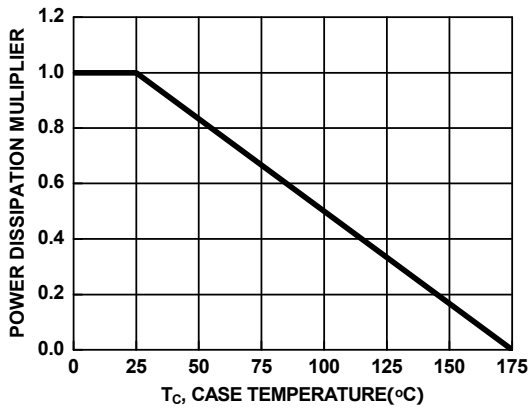


Figure 1. Normalized Power Dissipation vs Case Temperature

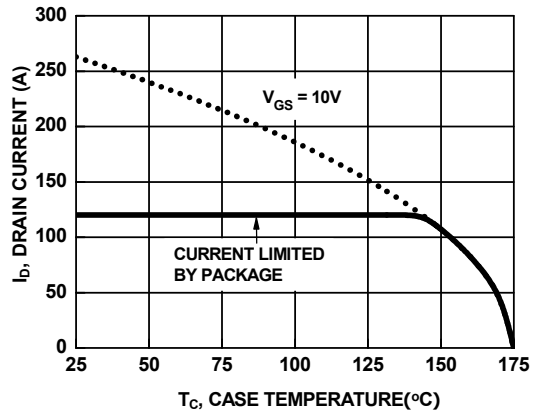


Figure 2. Maximum Continuous Drain Current vs Case Temperature

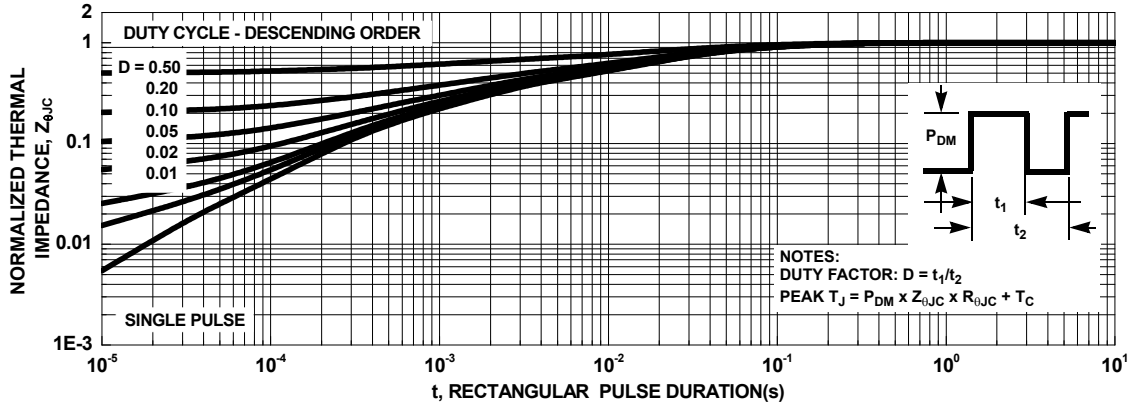


Figure 3. Normalized Maximum Transient Thermal Impedance

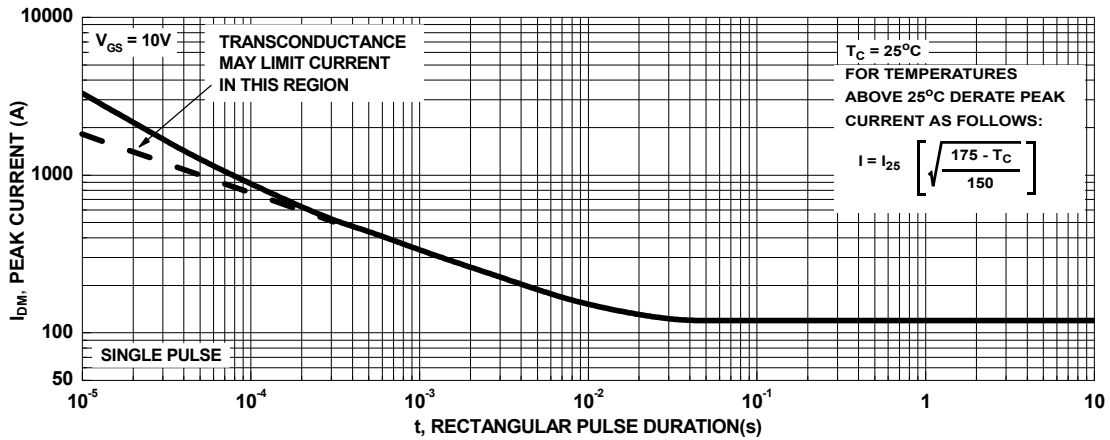


Figure 4. Peak Current Capability

### Typical Characteristics

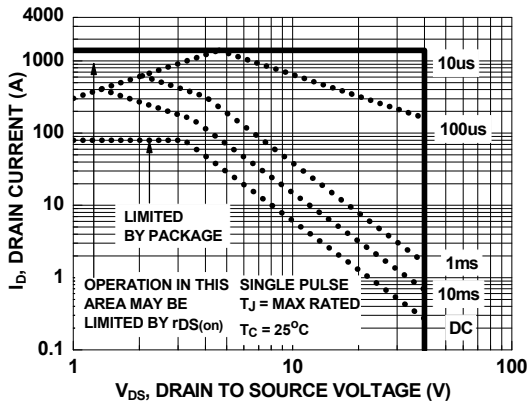
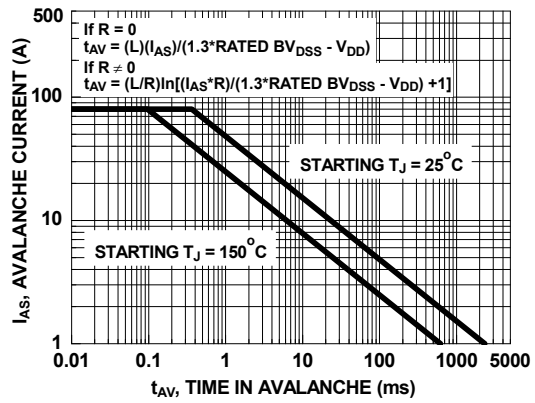


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to Fairchild Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

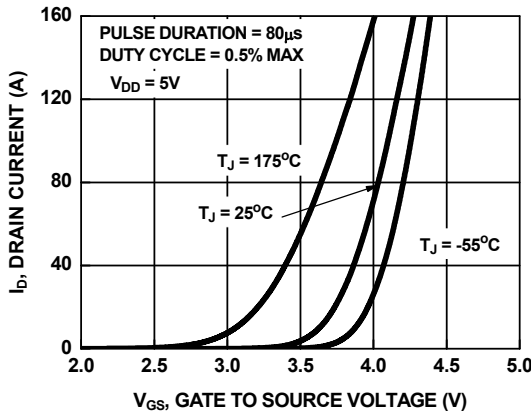


Figure 7. Transfer Characteristics

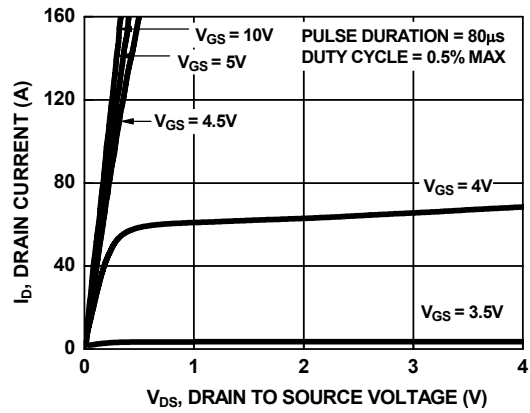


Figure 8. Saturation Characteristics

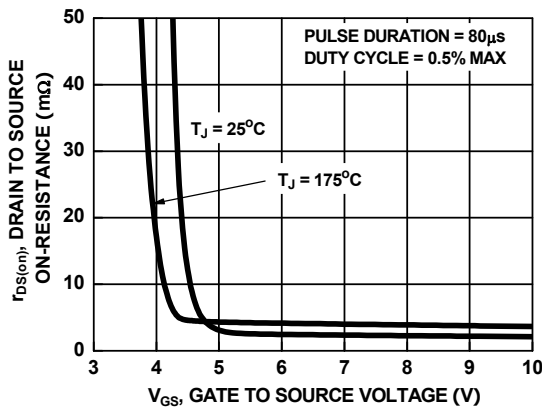


Figure 9. Drain to Source On-Resistance Variation vs Gate to Source Voltage

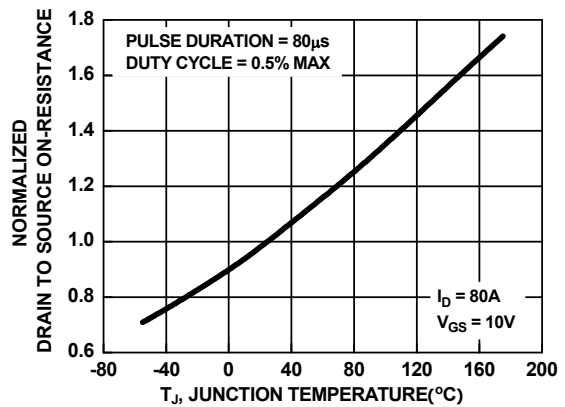


Figure 10. Normalized Drain to Source On-Resistance vs Junction Temperature

### Typical Characteristics

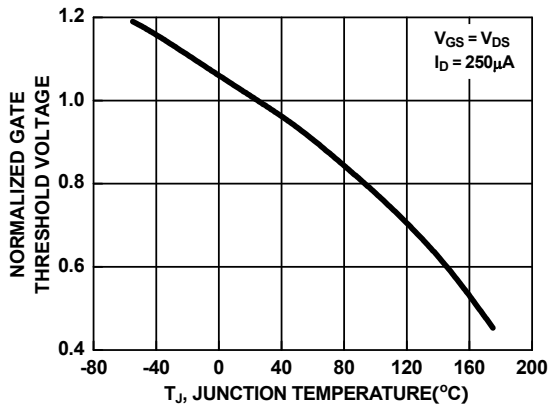


Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature

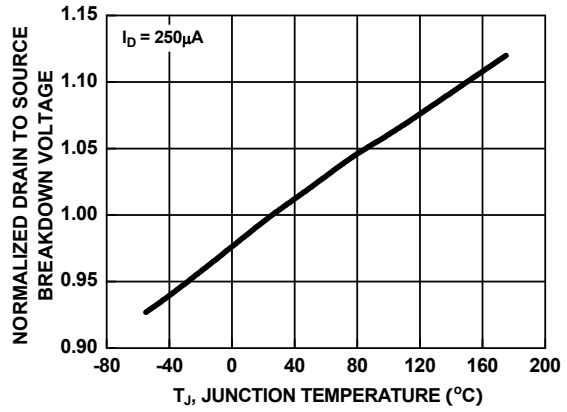


Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature

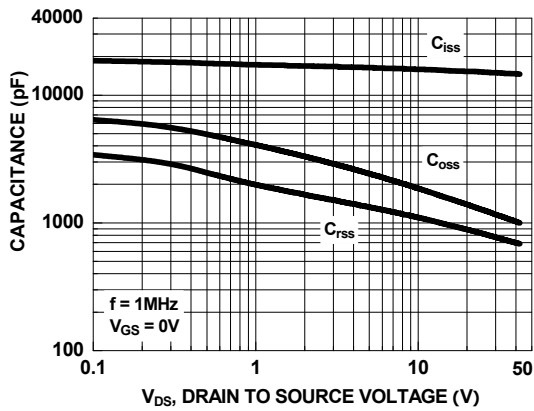


Figure 13. Capacitance vs Drain to Source Voltage

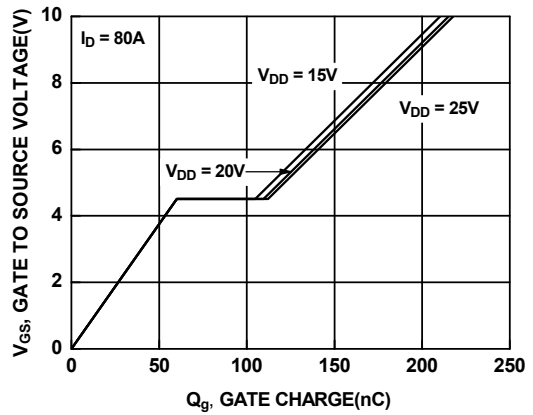


Figure 14. Gate Charge vs Gate to Source Voltage



**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.

- |   |   |   |   |
|---|---|---|---|
| 2Cool™  | FPS™  | PDP SPM™  | The Power Franchise®  |
| AccuPower™  | F-PFS™  | Power-SPM™  | the Power®  |
| Auto-SPM™   | FRFET®  | PowerTrench®  | franchise   |
| AX-CAP™*  | Global Power Resource <sup>SM</sup>             | PowerXS™  | TinyBoost™  |
| BitSiC®   | Green FPS™                                      | Programmable Active Droop™  | TinyBuck™   |
| Build it Now™   | Green FPS™ e-Series™                            | QFET®   | TinyCalc™   |
| CorePLUS™   | Gmax™   | QS™   | TinyLogic®  |
| CorePOWER™  | GTO™  | Quiet Series™   | TINYOPTO™   |
| CROSSVOLT™  | IntelliMAX™                                     | RapidConfigure™   | TinyPower™  |
| CTL™  | ISOPLANAR™                                      | ™   | TinyPWM™  |
| Current Transfer Logic™   | Marking Small Speakers Sound Louder and Better™ |  Saving our world, 1mW/W/kW at a time™ | TinyWire™   |
| DEUXPEED®   | MegaBuck™                                       | SignalWise™   | TranSiC®  |
| Dual Cool™  | MICROCOUPLER™                                   | SmartMax™   | TriFault Detect™  |
| EcoSPARK®   | MicroFET™                                       | SMART START™  | TRUECURRENT®*   |
| EfficientMax™   | MicroPak™                                       | Solutions for Your Success™   | μSerDes™  |
| ESBC™   | MicroPak2™                                      | SPM®  |  SerDes™ |
|  | MillerDrive™                                    | STEALTH™  | UHC®  |
| Fairchild®  | MotionMax™                                      | SuperFET®   | Ultra FRFET™  |
| Fairchild Semiconductor®  | Motion-SPM™                                     | SuperSOT™_3   | UniFET™   |
| FACT Quiet Series™  | mWSaver™  | SuperSOT™_6   | VCX™  |
| FACT®   | OptoHiT™  | SuperSOT™_8   | VisualMax™  |
| FAST®   | OPTOLOGIC®                                      | SupreMOS®   | VoltagePlus™  |
| FastvCore™  | OPTOPLANAR®                                     | SyncFET™  | XS™   |
| FETBench™   | ®   | Sync-Lock™  |   |
| FlashWriter®*   |   |                                        |   |

\*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 here in:

- 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.

**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 manufactures 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 application, 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 and 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.  |