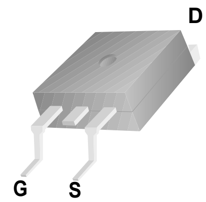
FAIRCHILD

May 2014

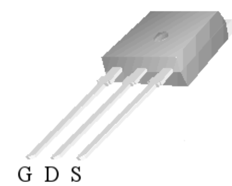
# FQB27N25TM_F085/FQI27N25TU_F085

## N-Channel MOSFET

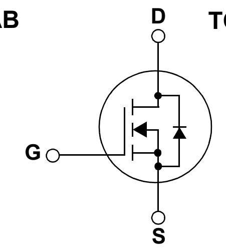
### 250 V, 25.5 A, 131 m$\Omega$




TO-263AB




TO-262AB




For current package drawing, please refer to the Fairchild website at www.fairchildsemi.com/packaging

### Features

- Typ $R_{DS(on)}$ = 108m$\Omega$ at $V_{GS}$ = 10V, $I_D$ = 25.5A
- Typ $Q_{g(tot)}$ = 45nC at $V_{GS}$ = 10V, $I_D$ = 27A
- UIS Capability
- RoHS Compliant
- Qualified to AEC Q101

### Applications

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

100% RoHS COMPLIANT

### MOSFET Maximum Ratings $T_J$ = 25°C unless otherwise noted

| Symbol | Parameter | Ratings | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | 250 | V |
| $V_{GS}$ | Gate to Source Voltage | ±30 | V |
| $I_D$ | Drain Current - Continuous ($V_{GS}$=10) (Note 1) $T_C$ = 25°C | 25.5 | A |
| | Pulsed Drain Current $T_C$ = 25°C | See Figure 4 | |
| $E_{AS}$ | Single Pulse Avalanche Energy (Note 2) | 972 | mJ |
| $P_D$ | Power Dissipation | 417 | W |
| | Derate above 25$^o$C | 3.3 | W/$^o$C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature | -55 to + 150 | $^o$C |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 0.3 | $^o$C/W |
| $R_{\theta JA}$ | Maximum Thermal Resistance, Junction to Ambient (Note 3) | 43 | $^o$C/W |

### Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FQB27N25TM | FQB27N25TM_F085 | TO-263AB | 330mm | 24mm | 800 units |
| FQI27N25TU | FQI27N25TU_F085 | TO-262AB | Tube | N/A | 50 units |

Notes:
1: Current is limited by bondwire configuration.
2: Starting $T_J$ = 25°C, L = 4.67mH, $I_{AS}$ = 20.4A, $V_{DD}$ = 100V during inductor charging and $V_{DD}$ = 0V during time in avalanche.
3: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$is determined by the user's board design. The maximum rating presented here is based on mounting on a 1 in$^2$ pad of 2oz copper.

## Electrical Characteristics $T_J$ = 25°C unless otherwise noted.

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | | |
| $B_{VDSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250μA, $V_{GS}$ = 0V | | 250 | - | - | V |
| $I_{DSS}$ | Drain to Source Leakage Current | $V_{DS}$=250V, $V_{GS}$ = 0V | $T_J$ = 25°C | - | - | 1 | μA |
| | | | $T_J$ = 150°C(Note 4) | - | - | 250 | uA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±30V | | - | - | ±100 | nA |
| **On Characteristics** | | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA | | 3.0 | 4.1 | 5.0 | V |
| $R_{DS(on)}$ | Drain to Source On Resistance | $I_D$ = 25.5A, $V_{GS}$= 10V | $T_J$ = 25°C | - | 108 | 131 | mΩ |
| | | | $T_J$ = 150°C(Note 4) | - | 265 | 310 | mΩ |
| **Dynamic Characteristics** | | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1MHz | | - | 1800 | - | pF |
| $C_{oss}$ | Output Capacitance | | | - | 350 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | - | 45 | - | pF |
| $R_g$ | Gate Resistance | f = 1MHz | | - | 0.82 | - | Ω |
| $Q_{g(ToT)}$ | Total Gate Charge at 10V | $V_{GS}$ = 0 to 10V | $V_{DD}$ = 125V, $I_D$ = 27A | - | 45 | 49 | nC |
| $Q_{g(th)}$ | Threshold Gate Charge | $V_{GS}$ = 0 to 2V | | - | 3.3 | 4 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | | - | 12 | - | nC |
| $Q_{gd}$ | Gate to Drain “Miller“ Charge | | | - | 23 | - | nC |

## Switching Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $t_{on}$ | Turn-On Time | $V_{DD}$ = 125V, $I_D$ = 27A, $V_{GS}$ = 10V, $R_{GEN}$ = 25Ω | - | - | 196 | ns |
| $t_{d(on)}$ | Turn-On Delay | | - | 36 | - | ns |
| $t_r$ | Rise Time | | - | 122 | - | ns |
| $t_{d(off)}$ | Turn-Off Delay | | - | 81 | - | ns |
| $t_f$ | Fall Time | | - | 60 | - | ns |
| $t_{off}$ | Turn-Off Time | | - | - | 164 | ns |

### Drain-Source Diode Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Source to Drain Diode Voltage | $I_{SD}$ = 25.5A, $V_{GS}$ = 0V | - | - | 1.5 | V |
| | | $I_{SD}$ = 12.75A, $V_{GS}$ = 0V | - | - | 1.25 | V |
| $t_{rr}$ | Reverse--Recovery Time | $I_F$ = 27A, $dI_{SD}/dt$ = 100A/μs, $V_{DD}$=200V | - | 205 | 238 | ns |
| $Q_{rr}$ | Reverse--Recovery Charge | | - | 1.8 | 2.3 | nC |

**Notes:**

4: The maximum value is specified by design at $T_J$ = 150°C. Product is not tested to this condition in production.

## Typical Characteristics

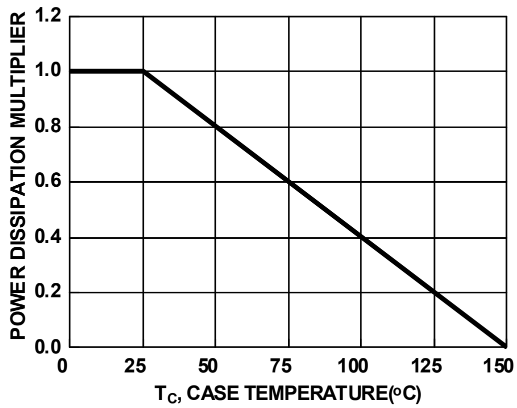



**Figure 1. Normalized Power Dissipation vs. Case Temperature**

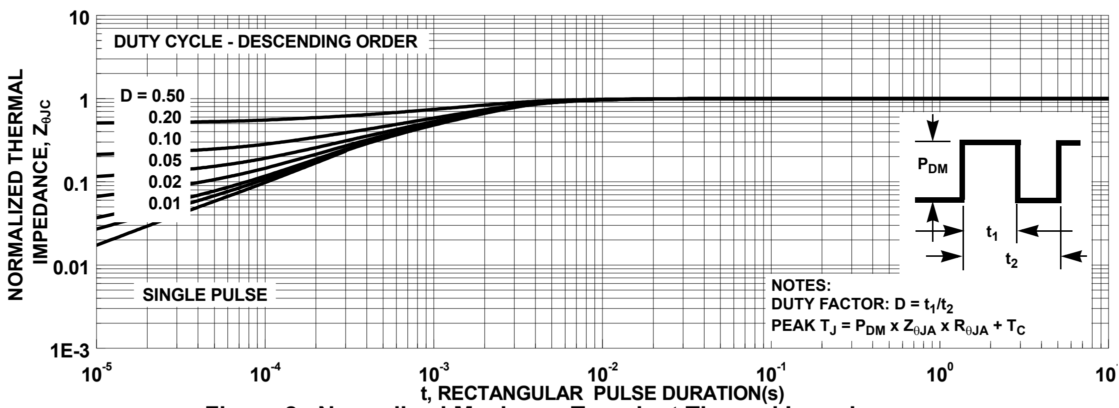



**Figure 2. Normalized Maximum Transient Thermal Impedance**

## Typical Characteristics

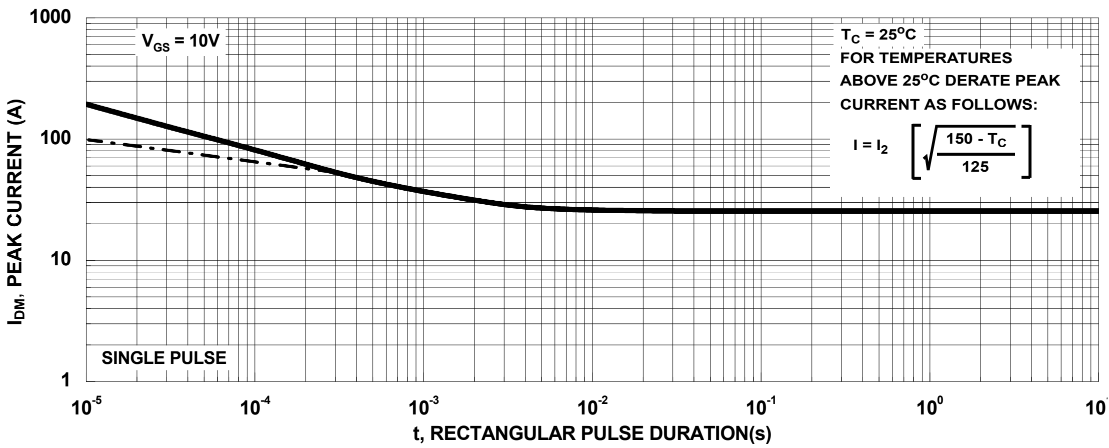



**Figure 3. Peak Current Capability**

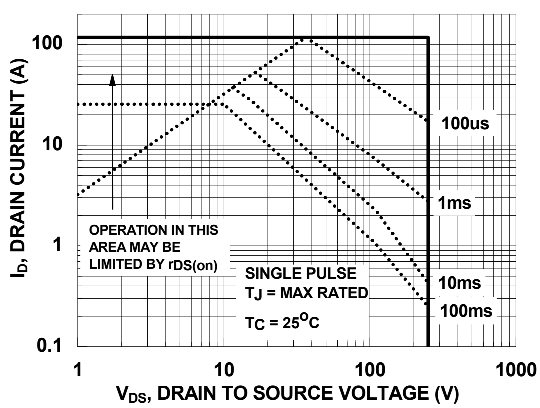
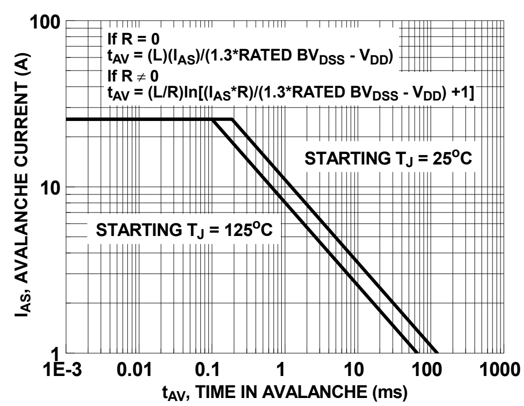



**Figure 4. Forward Bias Safe Operating Area**




NOTE: Refer to Fairchild Application Notes AN7514 and AN7515

**Figure 5. Unclamped Inductive Switching Capability**

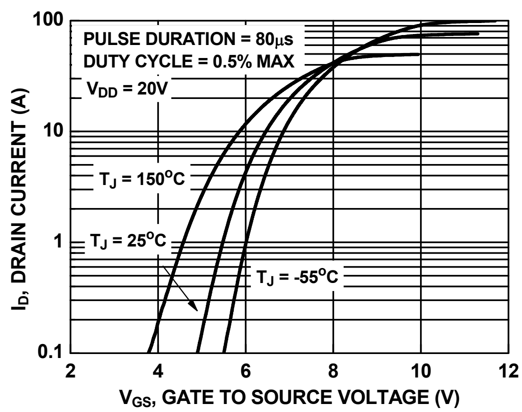



**Figure 6. Transfer Characteristics**

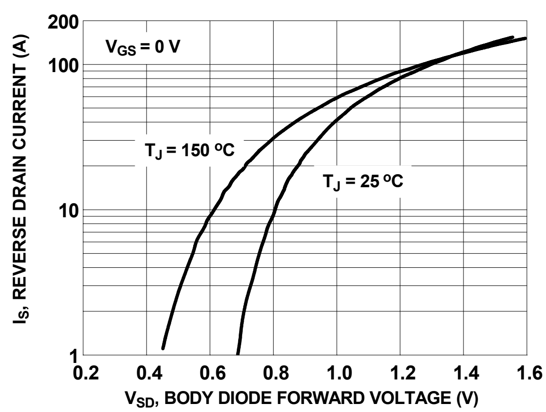



**Figure 7. Forward Diode Characteristics**

## Typical Characteristics

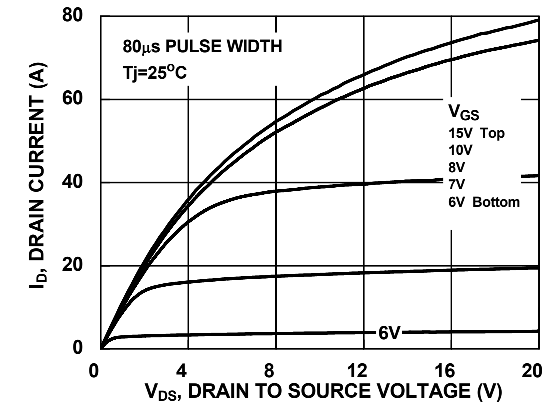



Figure 8. Saturation Characteristics

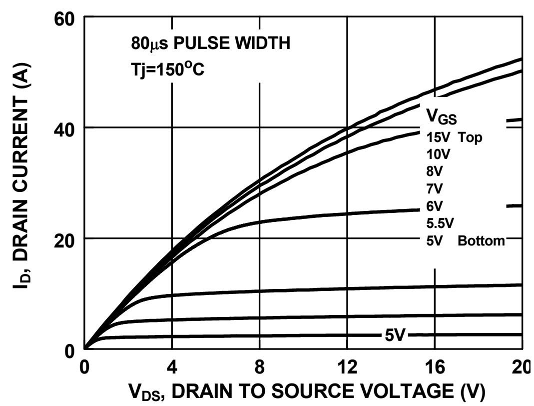



Figure 9. Saturation Characteristics

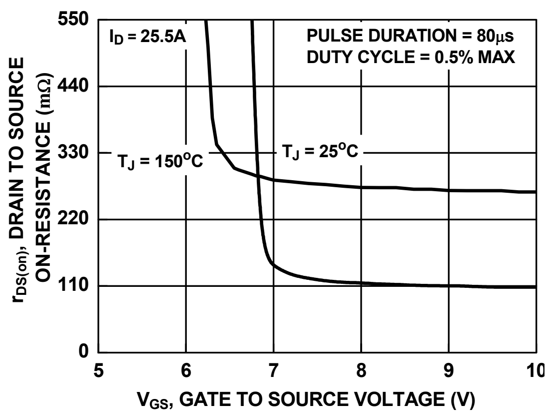



Figure 10. $R_{DSON}$ vs. Gate Voltage

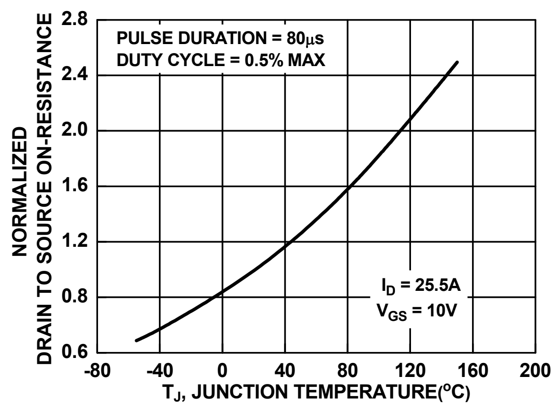



Figure 11. Normalized $R_{DSON}$ vs. Junction Temperature

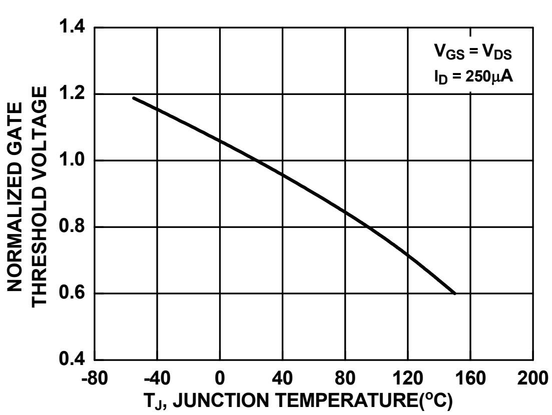



Figure 12. Normalized Gate Threshold Voltage vs. Temperature

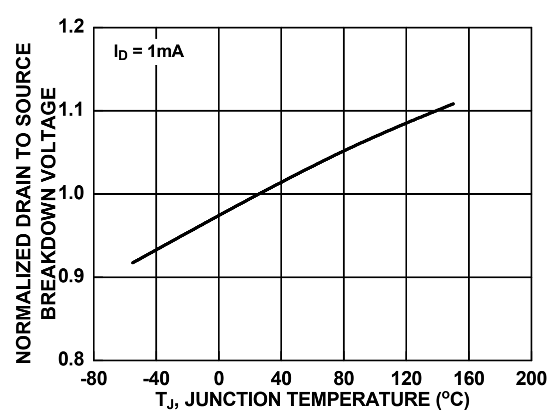



Figure 13. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

## Typical Characteristics

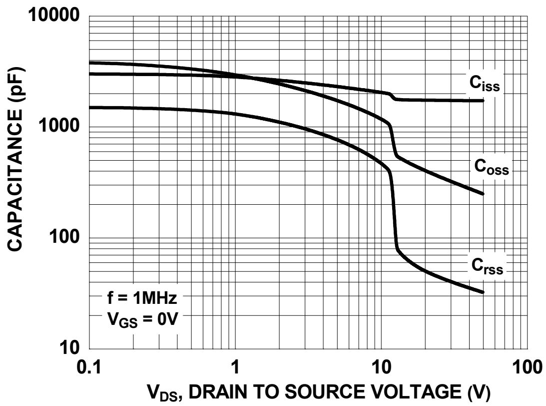



**Figure 14. Capacitance vs. Drain to Source Voltage**

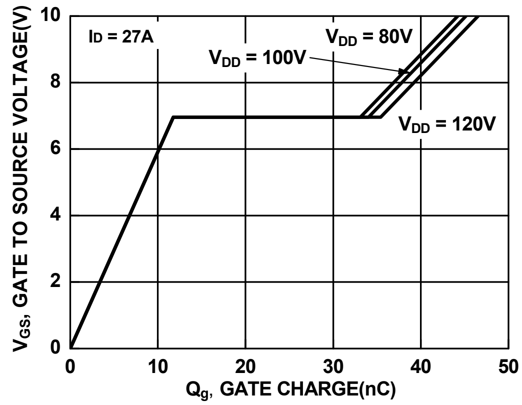



**Figure 15. Gate Charge vs. Gate to Source Voltage**

## 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.

AccuPower™
AX-CAP®*
BitSiC™
Build it Now™
CorePLUS™
CorePOWER™
*CROSSVOLT*™
CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficentMax™
ESBC™
®
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FPS™

F-PFS™
FRFET®
Global Power Resource℠
GreenBridge™
Green FPS™
Green FPS™ e-Series™
G*max*™
GTO™
IntelliMAX™
ISOPLANAR™
Marking Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
mWSaver®
OptoHiT™
OPTOLOGIC®
OPTOPLANAR®

®
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
™
Saving our world, 1mW/W/kW at a time™
SignalWise™
SmartMax™
SMART START™
Solutions for Your Success™
SPM®
STEALTH™
SuperFET®
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS®
SyncFET™
Sync-Lock™

SYSTEM GENERAL®*
TinyBoost®
TinyBuck®
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TranSiC™
TriFault Detect™
TRUECURRENT®*
μSerDes™
μSerDes
UHC®
Ultra FRFET™
UniFET™
VCX™
VisualMax™
VoltagePlus™
XS™
仙童 ™

*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:

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 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 handing 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. |

Rev. I68