
**Is Now Part of**


**ON Semiconductor®**

**To learn more about ON Semiconductor, please visit our website at**
**www.onsemi.com**

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD SEMICONDUCTOR®

November 2006

# FDFS2P753Z

## Integrated P-Channel PowerTrench® MOSFET and Schottky Diode

### -30V, -3A, 115mΩ

## Features

- Max $r_{DS(on)}$ = 115mΩ at $V_{GS}$ = -10V, $I_D$ = -3.0A
- Max $r_{DS(on)}$ = 180mΩ at $V_{GS}$ = -4.5V, $I_D$ = -1.5A
- $V_F$ < 500mV @ 1A

  $V_F$ < 580mV @ 2A
- Schottky and MOSFET incorporated into single power surface mount SO-8 package
- Electrically independent Schottky and MOSFET pinout for design flexibility
- RoHS Compliant

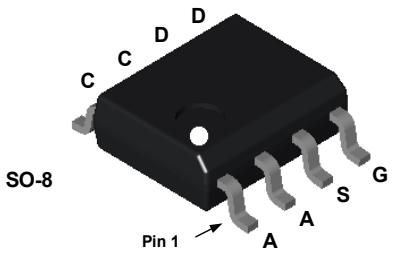
## General Description

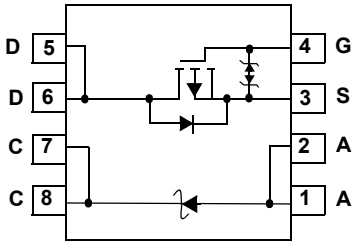
The FDFS2P753Z combines the exceptional performance of Fairchild's PowerTrench MOSFET technology with a very low forward voltage drop Schottky barrier rectifier in an SO-8 package.

This device is designed specifically as a single package solution for DC to DC converters. It features a fast switching, low gate charge MOSFET with very low on-state resistance. The independently connected Schottky diode allows its use in a variety of DC/DC converter topologies.

## Application

- DC - DC Conversion




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

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | | -30 | V |
| $V_{GS}$ | Gate to Source Voltage | | ±25 | V |
| $I_D$ | Drain Current -Continuous | (Note 1a) | -3 | A |
| | -Pulsed | | -16 | |
| $P_D$ | Power Dissipation | (Note 1a) | 1.6 | W |
| $E_{AS}$ | Single Pulse Avalanche Energy | (Note 2) | 6 | mJ |
| $V_{RRM}$ | Schottky Repetitive Peak Reverse Voltage | | -20 | V |
| $I_O$ | Schottky Average Forward Current | (Note 1a) | -2 | A |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | -55 to +150 | °C |

### Thermal Characteristics

| | | | | |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1a) | 78 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | (Note 1) | 40 | |

### Package Marking and Ordering Information

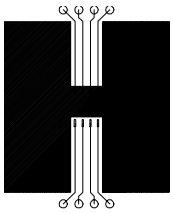
| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDFS2P753Z | FDFS2P753Z | SO-8 | 330mm | 12mm | 2500 units |

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

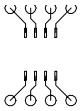
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = -250μA, $V_{GS}$ = 0V | -30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = -250μA, referenced to 25°C | | -21 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = -24V, $V_{GS}$ = 0V | | | -1 | μA |
| | | $V_{DS}$ = -24V, $V_{GS}$ = 0V, $T_J$ = 125°C | | | -100 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±25V, $V_{DS}$ = 0V | | | ±10 | μA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = -250μA | -1 | -2.1 | -3 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = -250μA, referenced to 25°C | | 5 | | mV/°C |
| $r_{DS(on)}$ | Drain to Source On-Resistance | $V_{GS}$ = -10V, $I_D$ = -3.0A | | 69 | 115 | mΩ |
| | | $V_{GS}$ = -4.5V, $I_D$ = -1.5A | | 115 | 180 | mΩ |
| | | $V_{GS}$ = -10V, $I_D$ = -3.0A, $T_J$ = 125°C | | 97 | 162 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = -5V, $I_D$ = -3.0A | | 6 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = -10V, $V_{GS}$ = 0V, f = 1MHz | | 340 | 455 | pF |
| $C_{oss}$ | Output Capacitance | | | 80 | 110 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 65 | 100 | pF |
| $R_g$ | Gate Resistance | f = 1MHz | | 18 | | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = -10V, $I_D$ = -3.0A, $V_{GS}$ = -10V, $R_{GEN}$ = 6Ω | | 7 | 14 | ns |
| $t_r$ | Rise Time | | | 31 | 50 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 18 | 33 | ns |
| $t_f$ | Fall Time | | | 20 | 35 | ns |
| $Q_{g(TOT)}$ | Total Gate Charge at -10V | $V_{GS}$ = 0V to -10V, $V_{DD}$ = -10V, $I_D$ = -3.0A | | 6.6 | 9.3 | nC |
| $Q_{g(4.5)}$ | Total Gate Charge at -4.5V | $V_{GS}$ = 0V to -4.5V, $V_{DD}$ = -10V, $I_D$ = -3.0A | | 3.3 | 4.6 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | $V_{DD}$ = -10V, $I_D$ = -3.0A | | 1.3 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | $V_{DD}$ = -10V, $I_D$ = -3.0A | | 1.6 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = -2.0A (Note 3) | | -0.9 | -1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = -3.0A, di/dt = 100A/μs | | 20 | 30 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | $I_F$ = -3.0A, di/dt = 100A/μs | | 14 | 21 | nC |
| **Schottky Diode Characteristics** | | | | | | |
| $I_R$ | Reverse Leakage | $V_R$ = -20V, $T_J$ = 25°C | | | -190 | μA |
| | | $V_R$ = -20V, $T_J$ = 125°C | | | -66 | mA |
| $V_F$ | Forward Voltage | $I_F$ = 1A, $T_J$ = 25°C | | | 0.5 | V |
| | | $I_F$ = 1A, $T_J$ = 125°C | | | 0.39 | V |
| | | $I_F$ = 2A, $T_J$ = 25°C | | | 0.58 | V |
| | | $I_F$ = 2A, $T_J$ = 125°C | | | 0.53 | V |

**Notes:**

**1:** $R_{\theta JA}$ 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 $R_{\theta CA}$ is determined by the user's board design.



a) 78°C/W when mounted on a 0.5in2 pad of 2 oz copper



b) 135°C/W when mounted on a minimun pad

**2:** Starting $T_J$ = 25°C, L = 3mH, $I_{AS}$ = 2A, $V_{DD}$ = 27V, $V_{GS}$ = 10V

**3:** Pulse Test: Pulse Width < 300μs, Duty cycle < 2.0%.

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

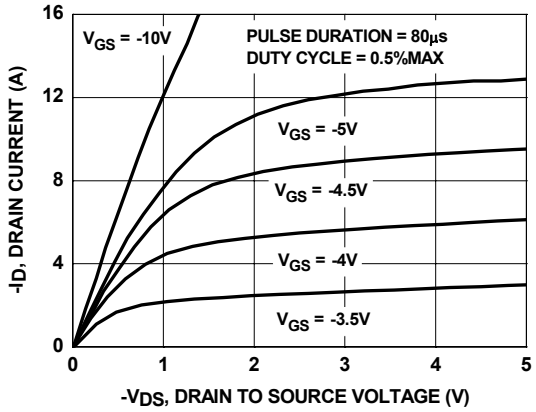



Figure 1. On Region Characteristics

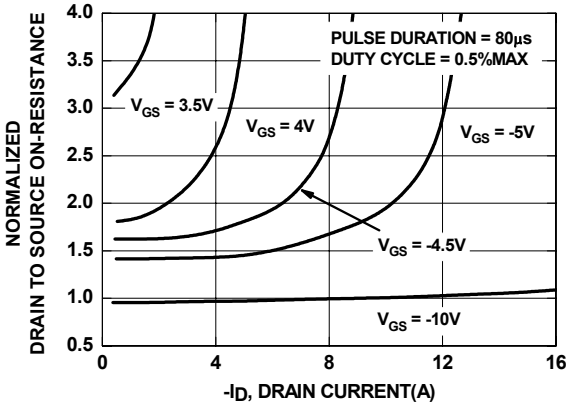



Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

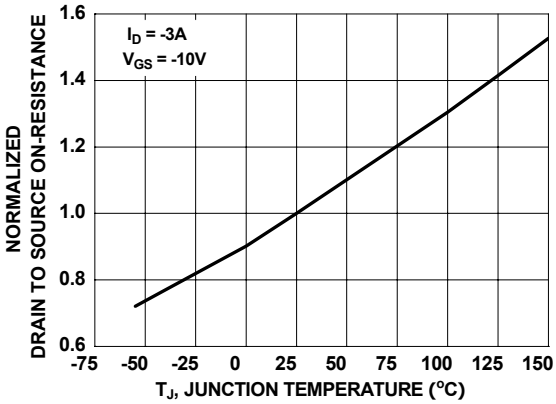



Figure 3. Normalized On-Resistance vs Junction Temperature

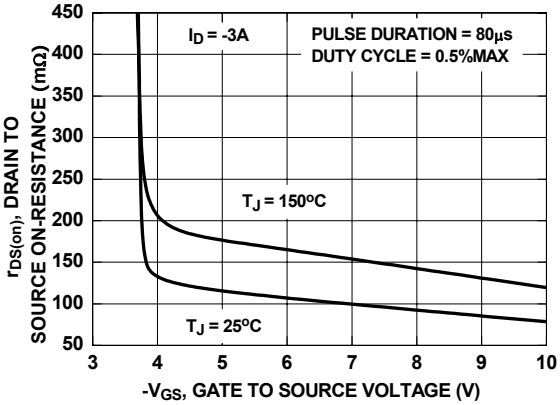



Figure 4. On-Resistance vs Gate to Source Voltage

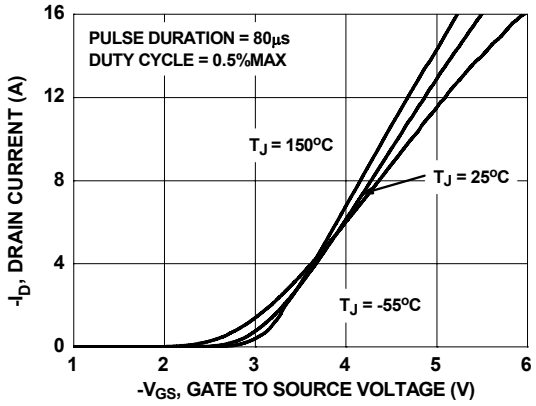



Figure 5. Transfer Characteristics

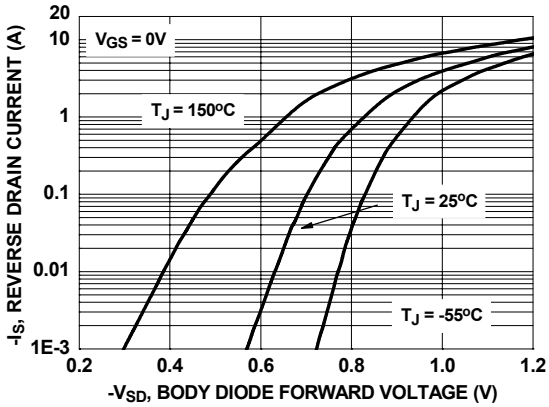



Figure 6. Source to Drain Diode Forward Voltage vs Source Current

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

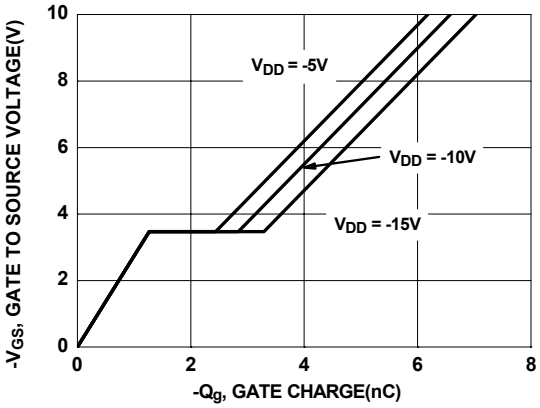



Figure 7. Gate Charge Characteristics

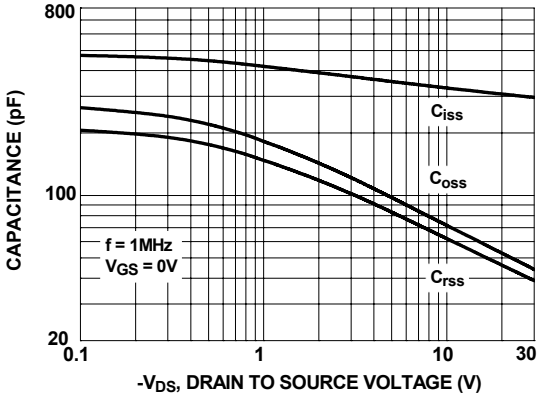



Figure 8. Capacitance vs Drain to Source Voltage

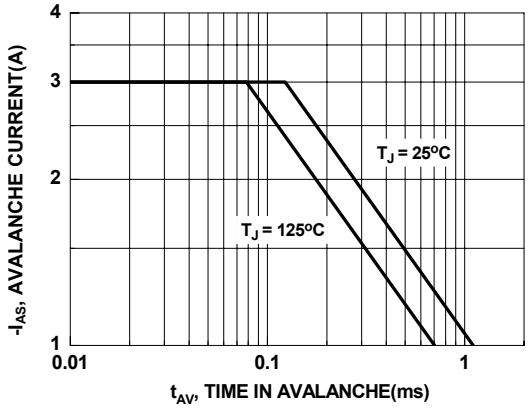



Figure 9. Unclamped Inductive Switching Capability

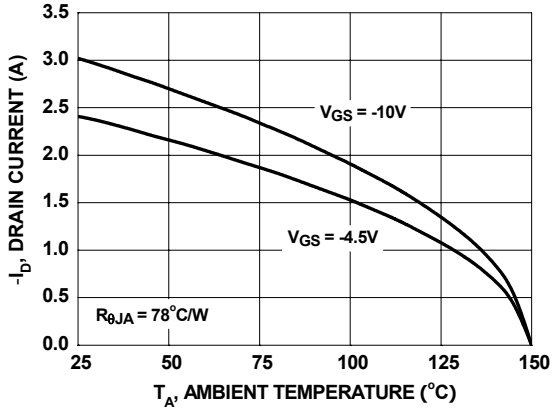



Figure 10. Maximum Continuous Drain Current vs Case Temperature

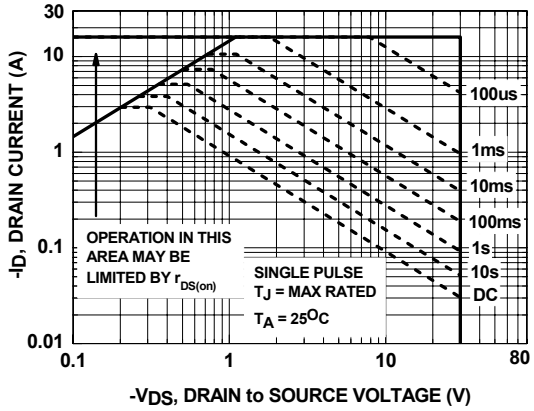



Figure 11. Forward Bias Safe Operating Area

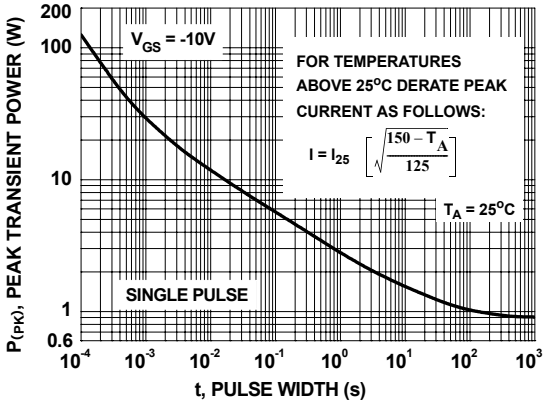



Figure 12. Single Pulse Maximum Power Dissipation

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

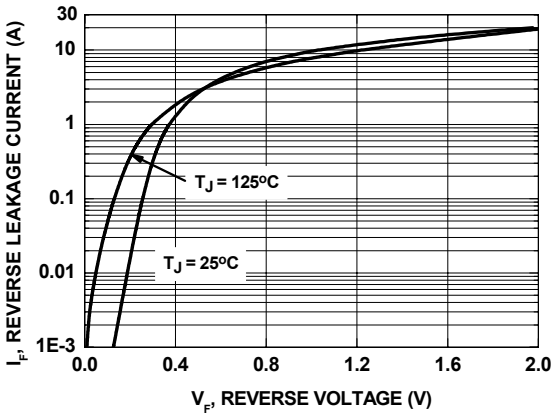



**Figure 13. Schottky Diode Forward Voltage**

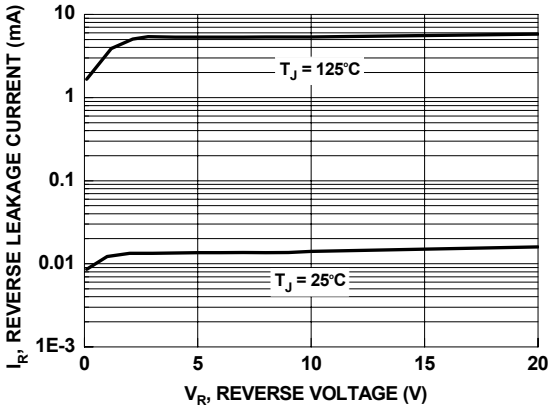



**Figure 14. Schottky Diode Reverse Current**

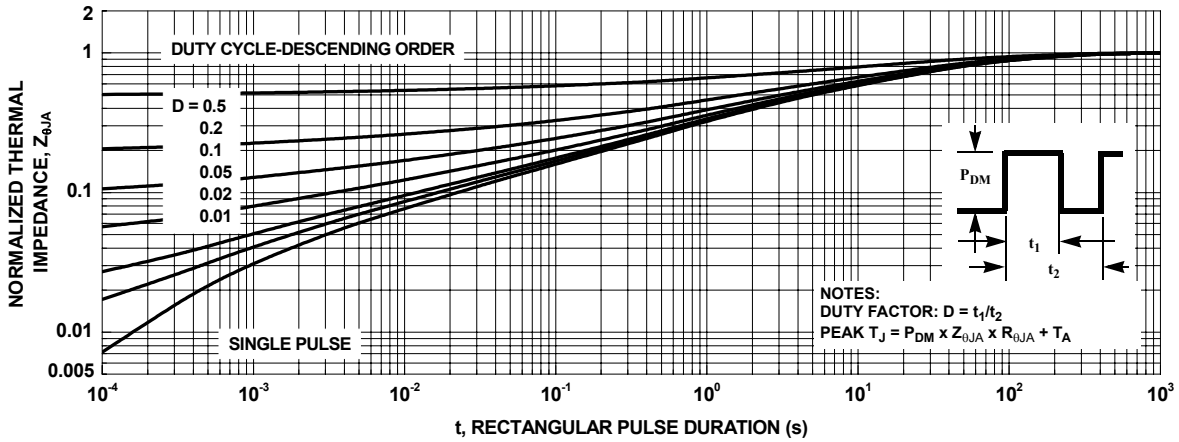



**Figure 15. Transient Thermal Response Curve**

FAIRCHILD SEMICONDUCTOR®

## 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™
AccuPower™
AX-CAP™*
BitSiC™
Build it Now™
CorePLUS™
CorePOWER™
*CROSSVOLT*™
CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficientMax™
ESBC™
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FlashWriter®*
FPS™
F-PFS™
FRFET®
Global Power Resource℠
GreenBridge™
Green FPS™
Green FPS™ e-Series™
G*max*™
GTO™
IntelliMAX™
ISOPLANAR™
Making Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
Motion-SPM™
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®*
The Power Franchise®
the power franchise
TinyBoost™
TinyBuck™
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TranSiC™
TriFault Detect™
TRUECURRENT®*
µSerDes™
SerDes™
UHC®
Ultra FRFET™
UniFET™
VCX™
VisualMax™
VoltagePlus™
XS™

* 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:

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 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. |

Rev. I61

## PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT**:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
**Phone**: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
**Fax**: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
**Email**: orderlit@onsemi.com

**N. American Technical Support**: 800−282−9855 Toll Free USA/Canada
**Europe, Middle East and Africa Technical Support:**
Phone: 421 33 790 2910
**Japan Customer Focus Center**
Phone: 81−3−5817−1050

**ON Semiconductor Website**: **www.onsemi.com**

**Order Literature**: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative