



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China





March 2015



FDD8876 / FDU8876

FDD8876 / FDU8876

N-Channel PowerTrench[®] MOSFET 30V, 73A, 8.2mΩ

General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(ON)}$ and fast switching speed.

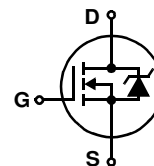
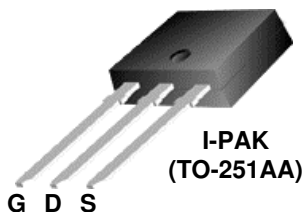
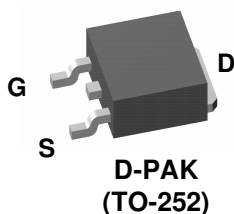
Applications

- DC/DC converters



Features

- $r_{DS(ON)} = 8.2m\Omega$, $V_{GS} = 10V$, $I_D = 35A$
- $r_{DS(ON)} = 10m\Omega$, $V_{GS} = 4.5V$, $I_D = 35A$
- High performance trench technology for extremely low $r_{DS(ON)}$
- Low gate charge
- High power and current handling capability
- RoHS Compliant



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

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain to Source Voltage	30	V
V_{GS}	Gate to Source Voltage	± 20	V
I_D	Drain Current		
	Continuous ($T_C = 25^\circ\text{C}$, $V_{GS} = 10V$) (Note 1)	73	A
	Continuous ($T_C = 25^\circ\text{C}$, $V_{GS} = 4.5V$) (Note 1)	66	A
	Continuous ($T_{amb} = 25^\circ\text{C}$, $V_{GS} = 10V$, with $R_{\theta JA} = 52^\circ\text{C/W}$)	15	A
	Pulsed	Figure 4	A
E_{AS}	Single Pulse Avalanche Energy (Note 2)	95	mJ
P_D	Power dissipation	70	W
	Derate above 25°C	0.47	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case TO-252, TO-251	2.14	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient TO-252, TO-251	100	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient TO-252, 1in ² copper pad area	52	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD8876	FDD8876	TO-252AA	13"	16mm	2500 units
FDU8876	FDU8876	TO-251AA	Tube	N/A	75 units

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

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

Off Characteristics

B_{VDSS}	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$	30	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{V}$ $V_{GS} = 0\text{V}$ $T_C = 150^\circ\text{C}$	-	-	1 250	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}$	-	-	± 100	nA

On Characteristics

$V_{GS(TH)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\mu\text{A}$	1.2	-	2.5	V
$r_{DS(ON)}$	Drain to Source On Resistance	$I_D = 35\text{A}$, $V_{GS} = 10\text{V}$	-	0.0066	0.0082	Ω
		$I_D = 35\text{A}$, $V_{GS} = 4.5\text{V}$	-	0.008	0.010	
		$I_D = 35\text{A}$, $V_{GS} = 10\text{V}$, $T_J = 175^\circ\text{C}$	-	0.011	0.013	

Dynamic Characteristics

C_{ISS}	Input Capacitance	$V_{DS} = 15\text{V}$, $V_{GS} = 0\text{V}$, $f = 1\text{MHz}$	-	1700	-	pF
C_{OSS}	Output Capacitance		-	330	-	pF
C_{RSS}	Reverse Transfer Capacitance		-	200	-	pF
R_G	Gate Resistance	$V_{GS} = 0.5\text{V}$, $f = 1\text{MHz}$	-	2.2	-	Ω
$Q_{g(TOT)}$	Total Gate Charge at 10V	$V_{GS} = 0\text{V}$ to 10V	-	34	47	nC
$Q_{g(5)}$	Total Gate Charge at 5V	$V_{GS} = 0\text{V}$ to 5V	-	18	26	nC
$Q_{g(TH)}$	Threshold Gate Charge	$V_{GS} = 0\text{V}$ to 1V	-	1.4	1.9	nC
Q_{gs}	Gate to Source Gate Charge	$V_{DD} = 15\text{V}$ $I_D = 35\text{A}$ $I_g = 1.0\text{mA}$	-	4.2	-	nC
Q_{gs2}	Gate Charge Threshold to Plateau		-	2.8	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	8.0	-	nC
			-			

Switching Characteristics ($V_{GS} = 10\text{V}$)

t_{ON}	Turn-On Time	$V_{DD} = 15\text{V}$, $I_D = 35\text{A}$ $V_{GS} = 10\text{V}$, $R_{GS} = 10\Omega$	-	-	149	ns
$t_{d(ON)}$	Turn-On Delay Time		-	8	-	ns
t_r	Rise Time		-	91	-	ns
$t_{d(OFF)}$	Turn-Off Delay Time		-	44	-	ns
t_f	Fall Time		-	37	-	ns
t_{OFF}	Turn-Off Time		-	-	122	ns

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Voltage	$I_{SD} = 35\text{A}$	-	-	1.25	V
		$I_{SD} = 15\text{A}$	-	-	1.0	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 35\text{A}$, $dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	26	ns
Q_{RR}	Reverse Recovered Charge	$I_{SD} = 35\text{A}$, $dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	12	nC

Notes:

- 1: Package current limitation is 35A.
- 2: Starting $T_J = 25^\circ\text{C}$, $L = 0.24\text{mH}$, $I_{AS} = 28\text{A}$, $V_{DD} = 27\text{V}$, $V_{GS} = 10\text{V}$.

Typical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

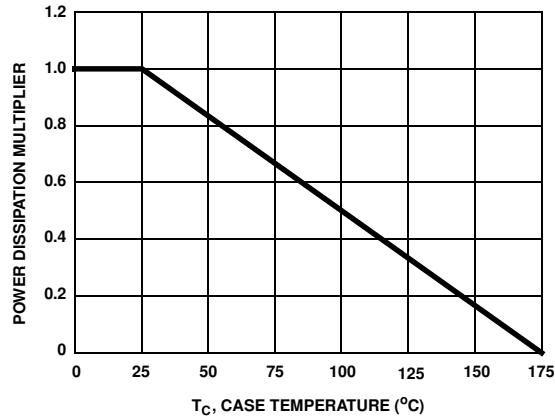


Figure 1. Normalized Power Dissipation vs Case Temperature

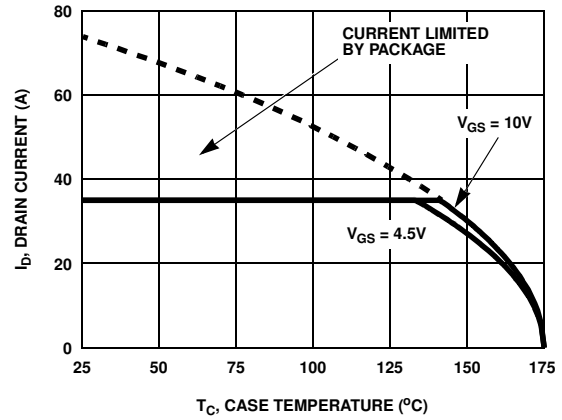


Figure 2. Maximum Continuous Drain Current vs Case Temperature

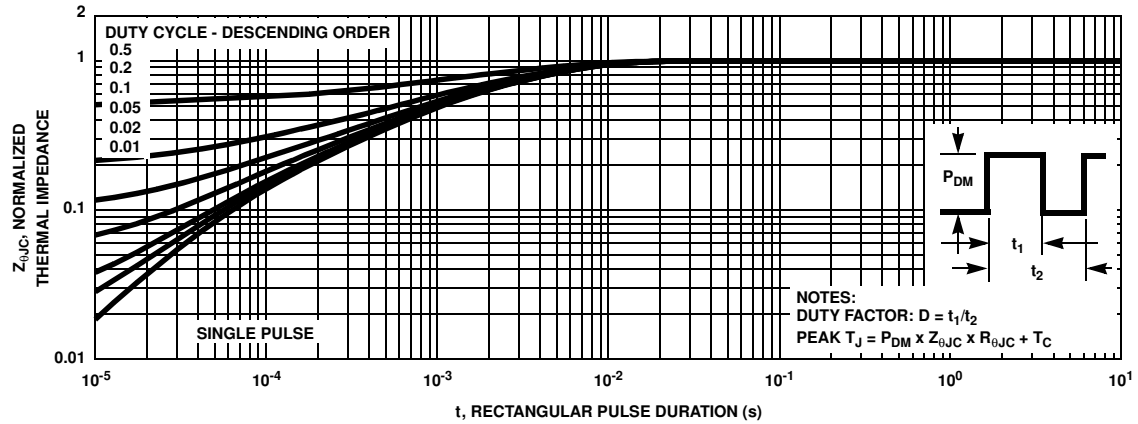


Figure 3. Normalized Maximum Transient Thermal Impedance

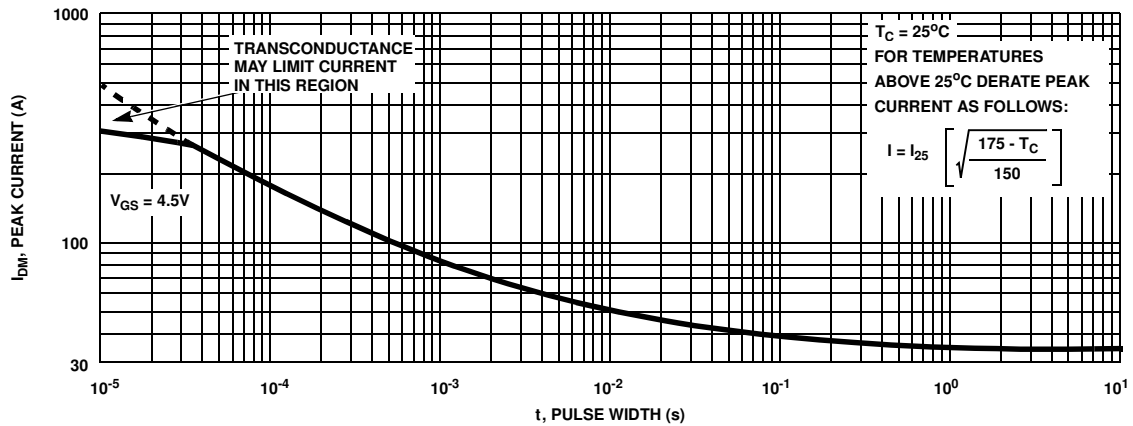


Figure 4. Peak Current Capability

Typical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

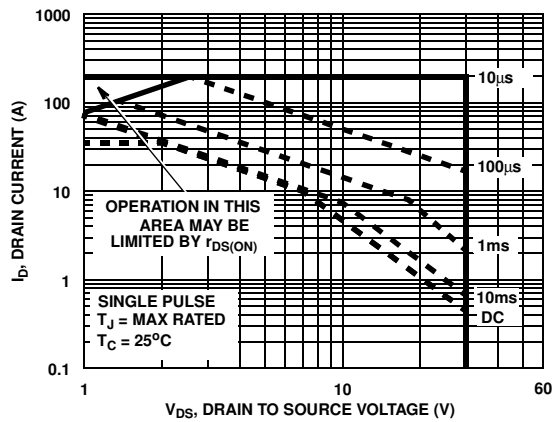
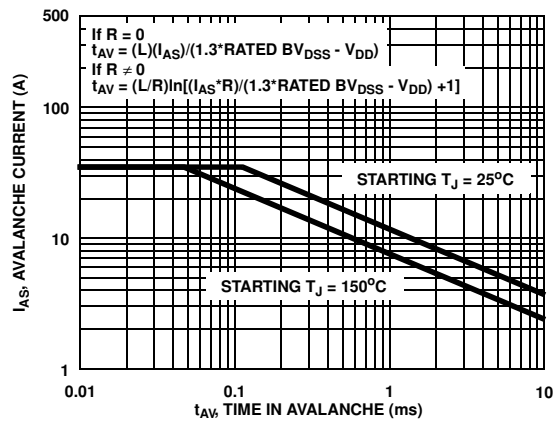


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to Fairchild Application Notes AN7514 and AN7515
Figure 6. Unclamped Inductive Switching Capability

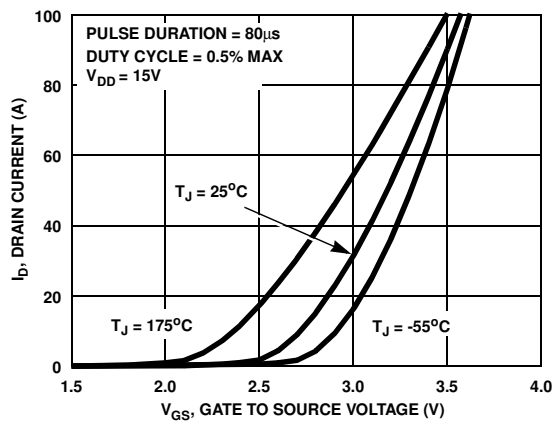


Figure 7. Transfer Characteristics

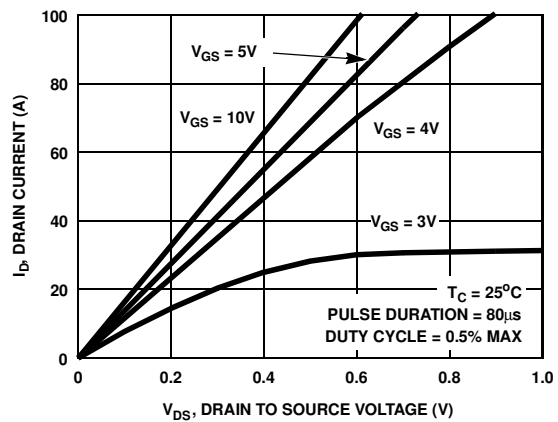


Figure 8. Saturation Characteristics

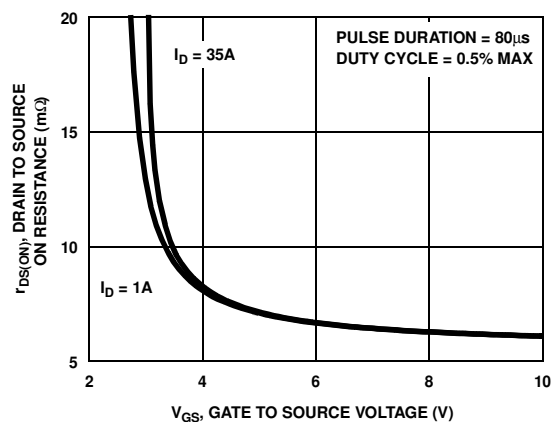


Figure 9. Drain to Source On Resistance vs Gate Voltage and Drain Current

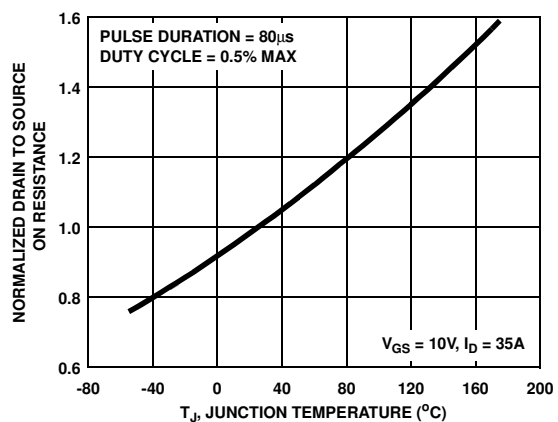


Figure 10. Normalized Drain to Source On Resistance vs Junction Temperature

Typical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

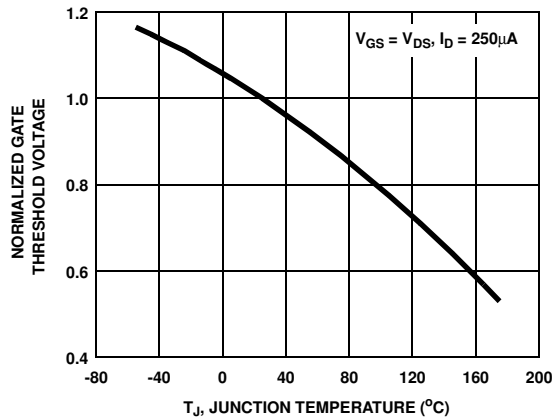


Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature

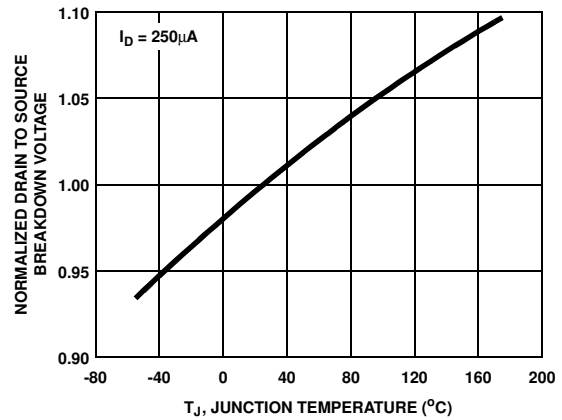


Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature

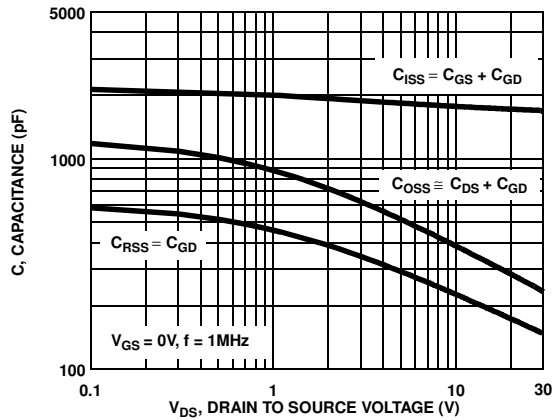


Figure 13. Capacitance vs Drain to Source Voltage

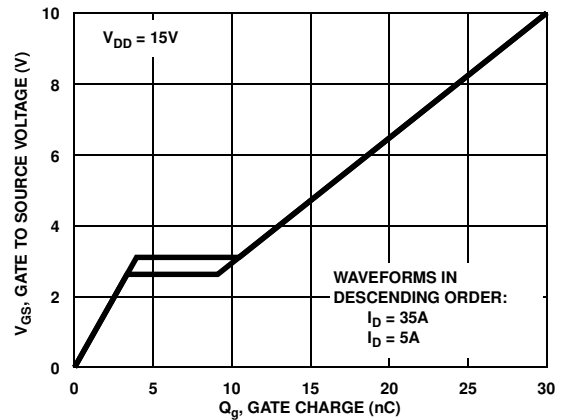


Figure 14. Gate Charge Waveforms for Constant Gate Current

Test Circuits and Waveforms

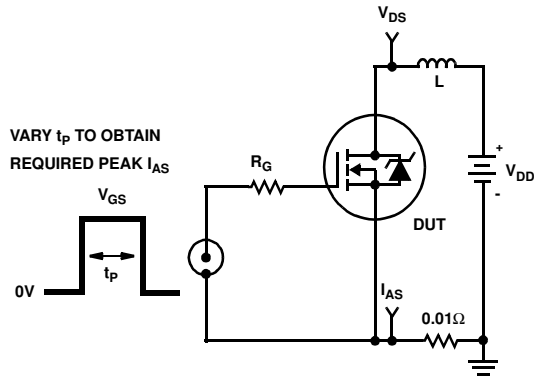


Figure 15. Unclamped Energy Test Circuit

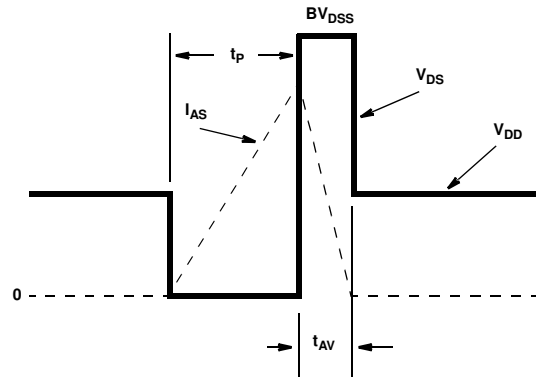


Figure 16. Unclamped Energy Waveforms

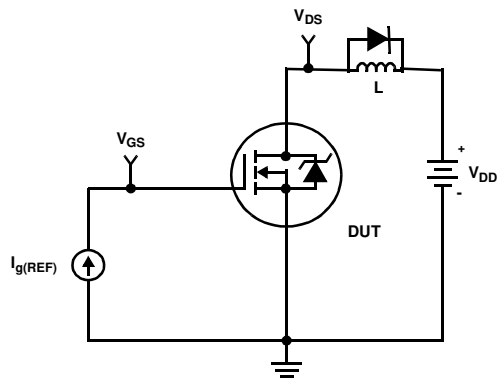


Figure 17. Gate Charge Test Circuit

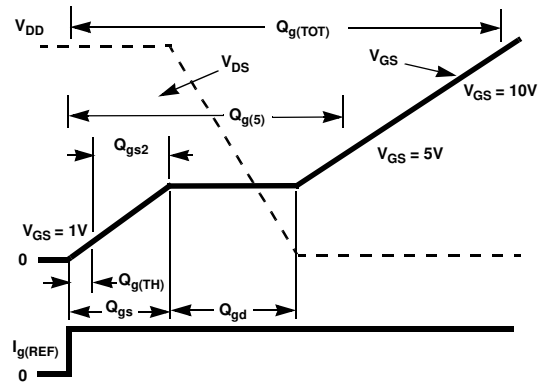


Figure 18. Gate Charge Waveforms

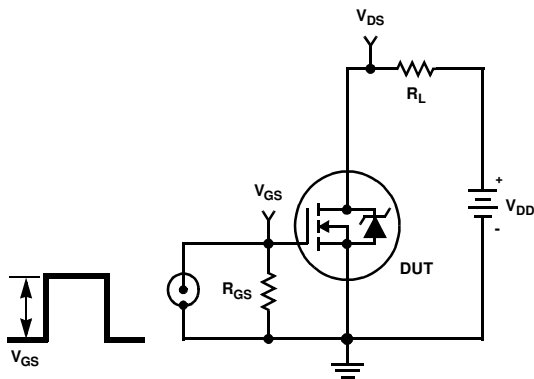


Figure 19. Switching Time Test Circuit

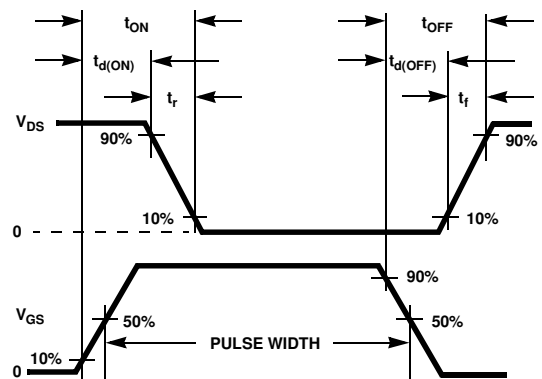


Figure 20. Switching Time Waveforms

Thermal Resistance vs. Mounting Pad Area

The maximum rated junction temperature, T_{JM} , and the thermal resistance of the heat dissipating path determines the maximum allowable device power dissipation, P_{DM} , in an application. Therefore the application's ambient temperature, T_A ($^{\circ}\text{C}$), and thermal resistance $R_{\theta JA}$ ($^{\circ}\text{C}/\text{W}$) must be reviewed to ensure that T_{JM} is never exceeded. Equation 1 mathematically represents the relationship and serves as the basis for establishing the rating of the part.

$$P_{DM} = \frac{(T_{JM} - T_A)}{R_{\theta JA}} \quad (\text{EQ. 1})$$

In using surface mount devices such as the TO-252 package, the environment in which it is applied will have a significant influence on the part's current and maximum power dissipation ratings. Precise determination of P_{DM} is complex and influenced by many factors:

1. Mounting pad area onto which the device is attached and whether there is copper on one side or both sides of the board.
2. The number of copper layers and the thickness of the board.
3. The use of external heat sinks.
4. The use of thermal vias.
5. Air flow and board orientation.
6. For non steady state applications, the pulse width, the duty cycle and the transient thermal response of the part, the board and the environment they are in.

Fairchild provides thermal information to assist the designer's preliminary application evaluation. Figure 21 defines the $R_{\theta JA}$ for the device as a function of the top copper (component side) area. This is for a horizontally positioned FR-4 board with 1oz copper after 1000 seconds of steady state power with no air flow. This graph provides the necessary information for calculation of the steady state junction temperature or power dissipation. Pulse applications can be evaluated using the Fairchild device Spice thermal model or manually utilizing the normalized maximum transient thermal impedance curve.

Thermal resistances corresponding to other copper areas can be obtained from Figure 21 or by calculation using Equation 2 or 3. Equation 2 is used for copper area defined in inches square and equation 3 is for area in centimeters square. The area, in square inches or square centimeters is the top copper area including the gate and source pads.

$$R_{\theta JA} = 33.32 + \frac{23.84}{(0.268 + \text{Area})} \quad (\text{EQ. 2})$$

Area in Inches Squared

$$R_{\theta JA} = 33.32 + \frac{154}{(1.73 + \text{Area})} \quad (\text{EQ. 3})$$

Area in Centimeters Squared

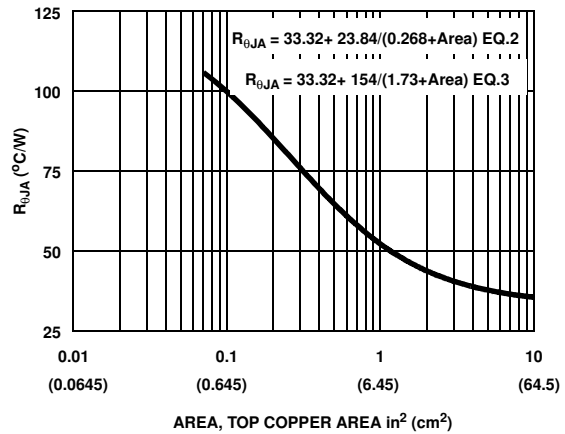


Figure 21. Thermal Resistance vs Mounting Pad Area

PSPICE Electrical Model

.SUBCKT FDD8876 2 1 3 ; rev January 2004

Ca 12 8 1.9e-9

Cb 15 14 1.6e-9

Cin 6 8 1.55e-9

Dbody 7 5 DbodyMOD

Dbreak 5 11 DbreakMOD

Dplcap 10 5 DplcapMOD

Ebreak 11 7 17 18 33.15

Eds 14 8 5 8 1

Egs 13 8 6 8 1

Esg 6 10 6 8 1

Evthres 6 21 19 8 1

Etemp 20 6 18 22 1

It 8 17 1

Lgate 1 9 4.7e-9

Ldrain 2 5 1.0e-9

Lsource 3 7 1.7e-9

RLgate 1 9 47

RLdrain 2 5 10

RLsource 3 7 17

Mmed 16 6 8 8 MmedMOD

Mstro 16 6 8 8 MstroMOD

Mweak 16 21 8 8 MweakMOD

Rbreak 17 18 RbreakMOD 1

Rdrain 50 16 RdrainMOD 2.9e-3

Rgate 9 20 2.2

RSLC1 5 51 RSLCMOD 1e-6

RSLC2 5 50 1e3

Rsource 8 7 RsourceMOD 2.7e-3

Rvthres 22 8 RvthresMOD 1

Rvtemp 18 19 RvtempMOD 1

S1a 6 12 13 8 S1AMOD

S1b 13 12 13 8 S1BMOD

S2a 6 15 14 13 S2AMOD

S2b 13 15 14 13 S2BMOD

Vbat 22 19 DC 1

ESLC 51 50 VALUE={{(V(5,51)/ABS(V(5,51)))*(PWR(V(5,51)/(1e-6*300),10))}}

.MODEL DbodyMOD D (IS=3E-12 IKF=10 N=1.01 RS=3.4e-3 TRS1=8e-4 TRS2=2e-7
+ CJO=6.3e-10 M=0.57 TT=1e-17 XTI=2)

.MODEL DbreakMOD D (RS=1 TRS1=1e-3 TRS2=-8.9e-6)

.MODEL DplcapMOD D (CJO=6.1e-10 IS=1e-30 N=10 M=0.41)

.MODEL MmedMOD NMOS (VTO=1.95 KP=10 IS=1e-30 N=10 TOX=1 L=1u W=1u RG=2.2 T_ABS=25)

.MODEL MstroMOD NMOS (VTO=2.45 KP=250 IS=1e-30 N=10 TOX=1 L=1u W=1u T_ABS=25)

.MODEL MweakMOD NMOS (VTO=1.65 KP=0.05 IS=1e-30 N=10 TOX=1 L=1u W=1u RG=22 RS=0.1 T_ABS=25)

.MODEL RbreakMOD RES (TC1=8.3e-4 TC2=-8e-7)

.MODEL RdrainMOD RES (TC1=1e-4 TC2=8e-6)

.MODEL RSLCMOD RES (TC1=9e-4 TC2=1e-6)

.MODEL RsourceMOD RES (TC1=7.5e-3 TC2=1e-6)

.MODEL RvthresMOD RES (TC1=-1.7e-3 TC2=-8.2e-6)

.MODEL RvtempMOD RES (TC1=-2.6e-3 TC2=2e-7)

.MODEL S1AMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-4 VOFF=-3.5)

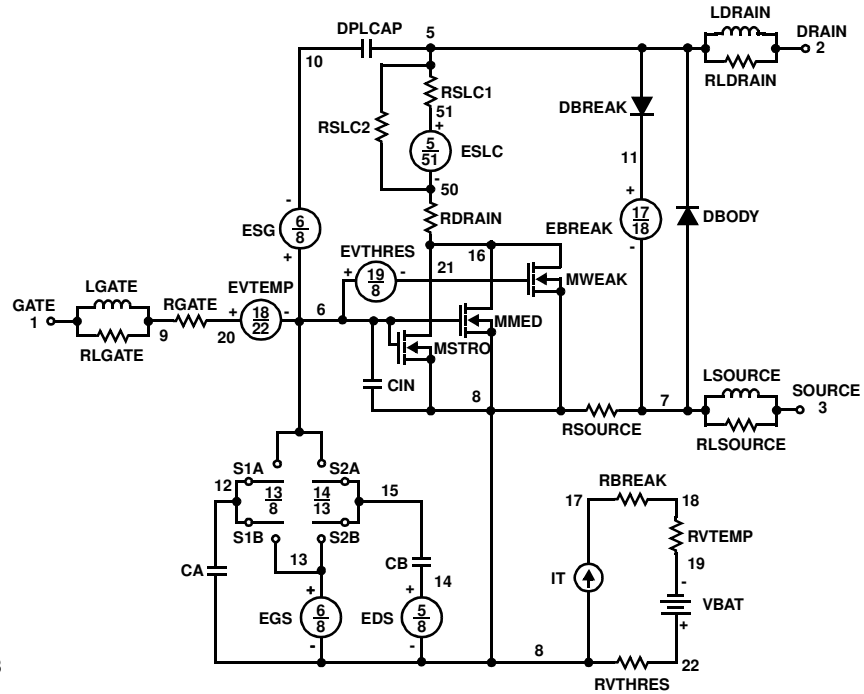
.MODEL S1BMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-3.5 VOFF=-4)

.MODEL S2AMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-2 VOFF=-1.5)

.MODEL S2BMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-1.5 VOFF=-2)

.ENDS

Note: For further discussion of the PSPICE model, consult **A New PSPICE Sub-Circuit for the Power MOSFET Featuring Global Temperature Options**; IEEE Power Electronics Specialist Conference Records, 1991, written by William J. Hepp and C. Frank Wheatley.



PSPICE Thermal Model

REV 23 January 2004

FDD8876T

CTHERM1 TH 6 7e-4
 CTHERM2 6 5 9e-4
 CTHERM3 5 4 2e-3
 CTHERM4 4 3 2.5e-3
 CTHERM5 3 2 6e-3
 CTHERM6 2 TL 1.1e-2

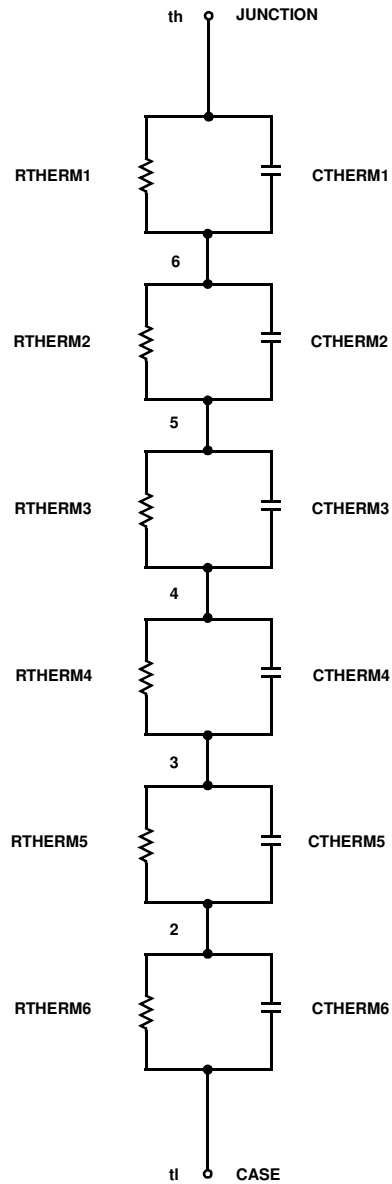
RTHERM1 TH 6 7.0e-2
 RTHERM2 6 5 1.1e-1
 RTHERM3 5 4 2.2e-1
 RTHERM4 4 3 3.2e-1
 RTHERM5 3 2 4.9e-1
 RTHERM6 2 TL 5e-1

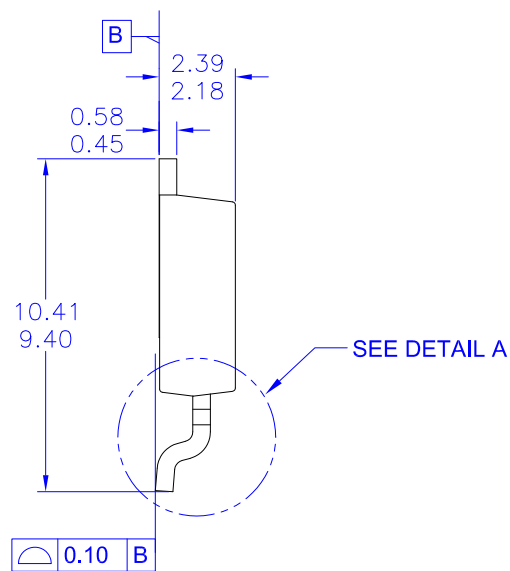
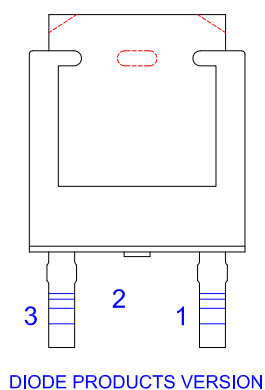
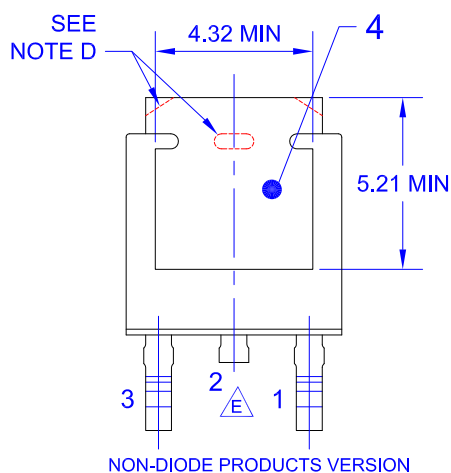
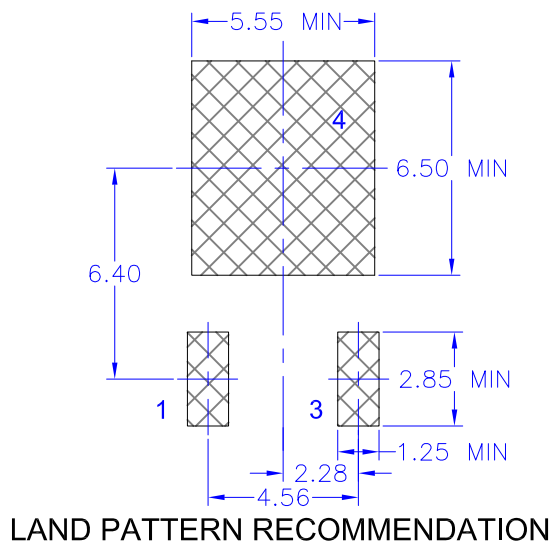
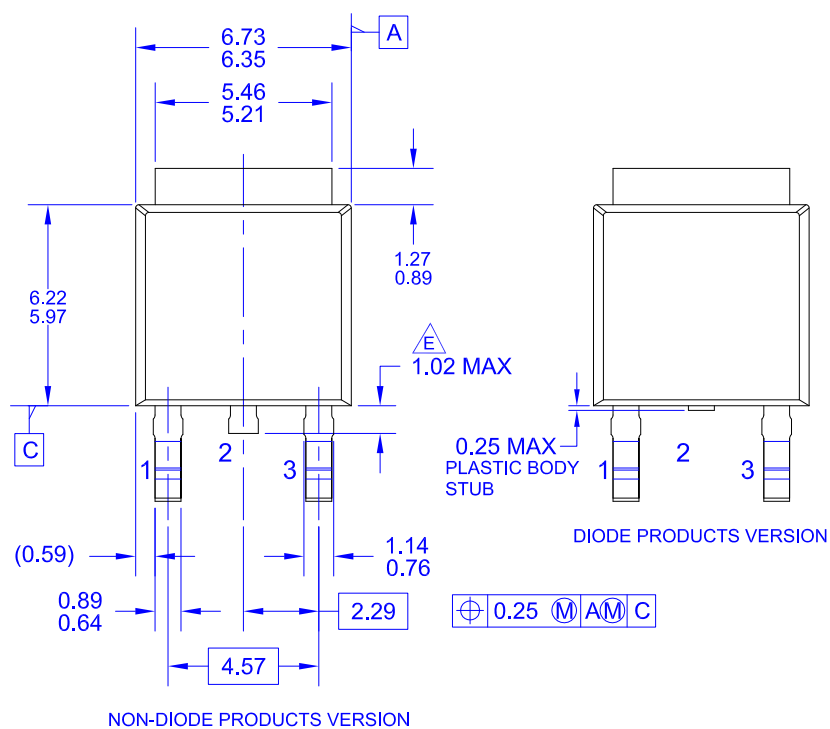
SABER Thermal Model

SABER thermal model FDD8876T
 template thermal_model th tl
 thermal_c th, tl

```
{
  ctherm.ctherm1 th 6 =7e-4
  ctherm.ctherm2 6 5 =9e-4
  ctherm.ctherm3 5 4 =2e-3
  ctherm.ctherm4 4 3 =2.5e-3
  ctherm.ctherm5 3 2 =6e-3
  ctherm.ctherm6 2 tl =1.1e-2
```

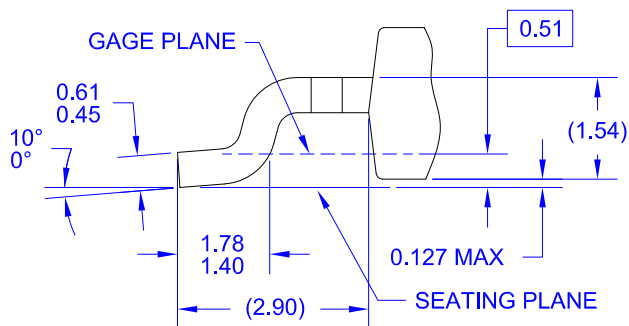
```
  rtherm.rtherm1 th 6 =7.0e-2
  rtherm.rtherm2 6 5 =1.1e-1
  rtherm.rtherm3 5 4 =2.2e-1
  rtherm.rtherm4 4 3 =3.2e-1
  rtherm.rtherm5 3 2 =4.9e-1
  rtherm.rtherm6 2 tl =5e-1
}
```





NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.
- E) TRIMMED CENTER LEAD IS PRESENT ONLY FOR DIODE PRODUCTS
- F) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
- G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.
- H) DRAWING NUMBER AND REVISION: MKT-TO252A03REV10





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™	F-PFS™	OPTOPLANAR®	SYSTEM GENERAL®
AttitudeEngine™	FRFET®	Power Supply WebDesigner™	TinyBoost®
Awinda®	Global Power Resource™	PowerTrench®	TinyBuck™
AX-CAP®*	GreenBridge™	PowerXS™	TinyCalc™
BitSiC™	Green FPS™	Programmable Active Droop™	TinyLogic®
Build it Now™	Green FPS™ e-Series™	QFET®	TINYOPTO™
CorePLUS™	Gmax™	QS™	TinyPower™
CorePOWER™	GTO™	Quiet Series™	TinyPWM™
CROSSVOLT™	IntelliMAX™	RapidConfigure™	TinyWire™
CTL™	ISOPLANAR™	Saving our world, 1mW/W/kW at a time™	TranSiC™
Current Transfer Logic™	Making Small Speakers Sound Louder and Better™	SignalWise™	TriFault Detect™
DEUXPEED®	MegaBuck™	SmartMax™	TRUECURRENT®*
Dual Cool™	MICROCOUPLER™	SMART START™	μSerDes™
EcoSPARK®	MicroFET™	Solutions for Your Success™	SerDes®
EfficientMax™	MicroPak™	SPM®	UHC®
ESBC™	MicroPak2™	STEALTH™	Ultra FRFET™
F®	MillerDrive™	SuperFET®	UniFET™
Fairchild®	MotionMax™	SuperSOT™-3	VCX™
Fairchild Semiconductor®	MotionGrid®	SuperSOT™-6	VisualMax™
FACT Quiet Series™	MTI®	SuperSOT™-8	VoltagePlus™
FACT®	MTx®	SupreMOS®	XS™
FAST®	MVN®	SyncFET™	Xsens™
FastvCore™	mWSaver®	Sync-Lock™	仙童™
FETBench™	OptoHiT™		
FPS™	OPTOLOGIC®		

* 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. TO OBTAIN THE LATEST, MOST UP-TO-DATE DATASHEET AND PRODUCT INFORMATION, VISIT OUR WEBSITE AT [HTTP://WWW.FAIRCHILDSEMI.COM](http://www.fairchildsemi.com). 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.

AUTHORIZED USE

Unless otherwise specified in this data sheet, this product is a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability. This product may not be used in the following applications, unless specifically approved in writing by a Fairchild officer: (1) automotive or other transportation, (2) military/aerospace, (3) any safety critical application – including life critical medical equipment – where the failure of the Fairchild product reasonably would be expected to result in personal injury, death or property damage. Customer's use of this product is subject to agreement of this Authorized Use policy. In the event of an unauthorized use of Fairchild's product, Fairchild accepts no liability in the event of product failure. In other respects, this product shall be subject to Fairchild's Worldwide Terms and Conditions of Sale, unless a separate agreement has been signed by both Parties.

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 Terms of Use

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. I75