FAIRCHILD

SEMICONDUCTOR®

FDD8580/FDU8580
N-Channel PowerTrench® MOSFET
20V, 35A, 9mΩ

Features

■ Max $r_{DS(on)} = 9m\Omega$ at V_{GS} = 10V, I_D = 35A

■ Max $r_{DS(on)} = 13m\Omega$ at V_{GS} = 4.5V, I_D = 33A

■ Low gate charge: $Q_{g(TOT)}$ = 19nC(Typ), V_{GS} = 10V

■ Low gate resistance

■ 100% Avalanche tested

■ RoHS compliant

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.

Application

■ Vcore DC-DC for Desktop Computers and Servers

■ VRM for Intermediate Bus Architecture

**D-PAK
(TO-252)**

**G D S   I-PAK
(TO-251AA)**
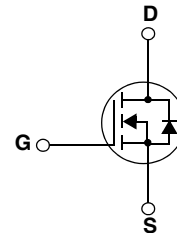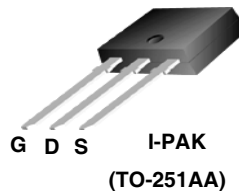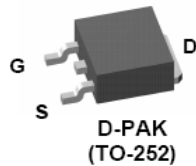
MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DS}	Drain to Source Voltage		20	V
V_{GS}	Gate to Source Voltage		±20	V
I_D	Drain Current -Continuous (Package Limited)		35	A
	-Continuous (Die Limited)		58	
	-Pulsed	(Note 1)	159	
E_{AS}	Single Pulse Avalanche Energy	(Note 2)	66	mJ
P_D	Power Dissipation		49.5	W
T_J, T_{STG}	Operating and Storage Temperature		-55 to 175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case TO-252,TO-251	3.03	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient TO-252,TO-251	100	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient TO-252,1in^2 copper pad area	52	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD8580	FDD8580	TO-252AA	13''	12mm	2500 units
FDU8580	FDU8580	TO-251AA	N/A(Tube)	N/A	75 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		20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250µA, referenced to 25°C			17.3		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 16V, V_{GS} = 0V				1	µA
			T_J = 150°C			250	
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20V				±100	nA
On Characteristics							
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250µA		1.2	1.8	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250µA, referenced to 25°C			-6.3		mV/°C
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 10V, I_D = 35A			6.6	9.0	mΩ
		V_{GS} = 4.5V, I_D = 33A			9.3	13.0	
		V_{GS} = 10V, I_D = 35A T_J = 175°C			10.6	14.5	
g_{FS}	Forward Transcondductance	V_{DS} = 5V,I_D = 35A			61		S
Dynamic Characteristics							
C_{iss}	Input Capacitance	V_{DS} = 10V, V_{GS} = 0V, f = 1MHz			1085	1445	pF
C_{oss}	Output Capacitance				340	450	pF
C_{rss}	Reverse Transfer Capacitance				205	310	pF
R_g	Gate Resistance	f = 1MHz			1.3		Ω
Switching Characteristics							
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 10V, I_D = 35A V_{GS} = 10V, R_{GS} = 27Ω			7	14	ns
t_r	Rise Time				11	20	ns
$t_{d(off)}$	Turn-Off Delay Time				59	94	ns
t_f	Fall Time				34	54	ns
$Q_{g(TOT)}$	Total Gate Charge at 10V	V_{GS} = 0V to 10V	V_{DD} = 10V I_D = 35A I_g = 1.0mA		19	27	nC
$Q_{g(5)}$	Total Gate Charge at 5V	V_{GS} = 0V to 5V			10	14	nC
Q_{gs}	Gate to Source Gate Charge				3.5		nC
Q_{gd}	Gate to Drain "Miller"Charge				3.9		nC
Drain-Source Diode Characteristics							
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = 35A			0.95	1.25	V
		V_{GS} = 0V, I_S = 15A			0.85	1.2	
t_{rr}	Reverse Recovery Time	I_F = 35A, di/dt = 100A/µs			26	39	ns
Q_{rr}	Reverse Recovery Charge	I_F = 35A, di/dt = 100A/µs			19	29	nC

Notes:
1: Pulse time < 300µs, Duty cycle = 2%.
2: Starting T_J = 25ºC, L = 0.3mH, I_{AS} = 21A ,V_{DD} = 18V, V_{GS} = 10V.

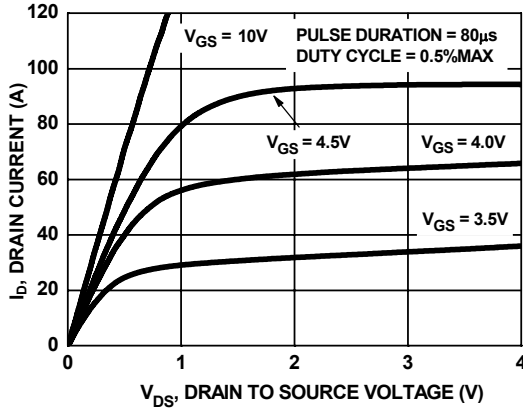**Typical Characteristics** T_J = 25°C unless otherwise noted
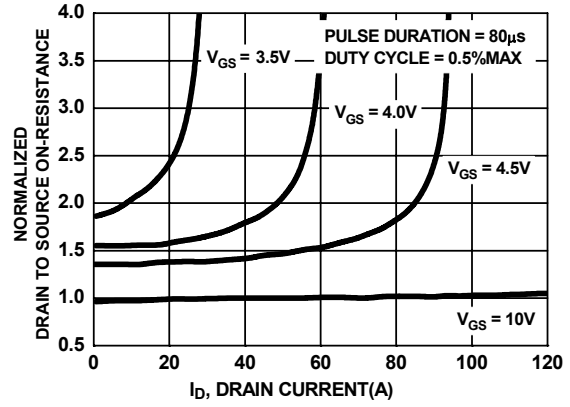
Figure 1. On Region Characteristics

Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage
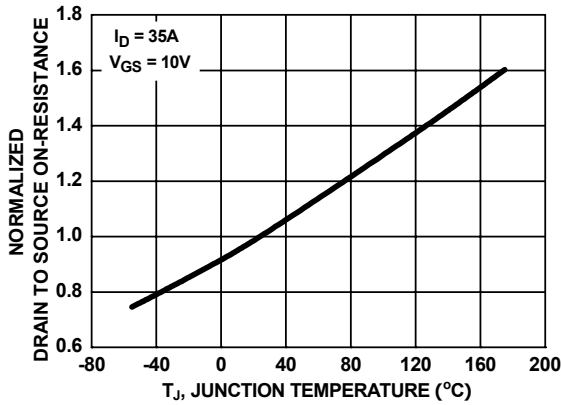
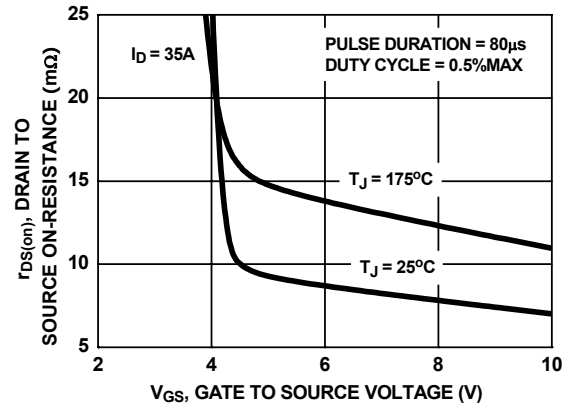Figure 3. Normalized On Resistance vs Junction Temperature
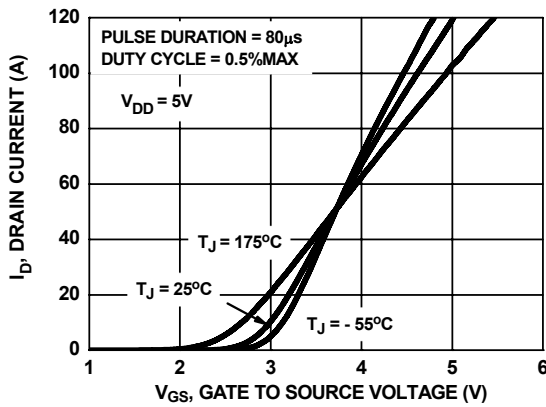
Figure 4. On-Resistance vs Gate to Source Voltage

Figure 5. Transfer Characteristics

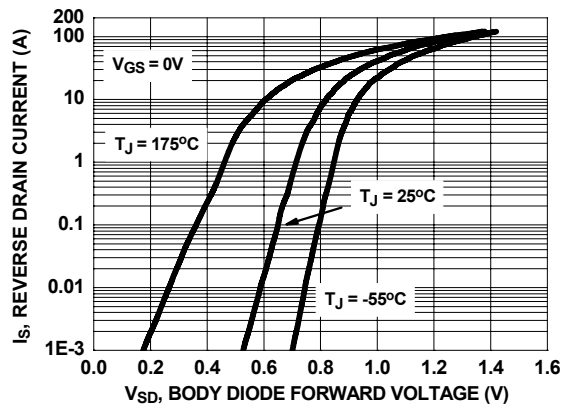Figure 6. Source to Drain Diode Forward Voltage vs Source Current

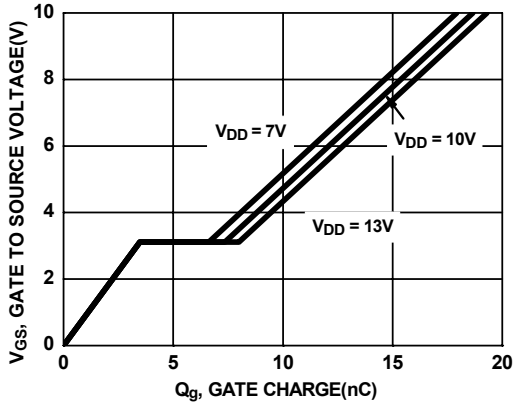## Typical Characteristics T_J = 25°C unless otherwise noted

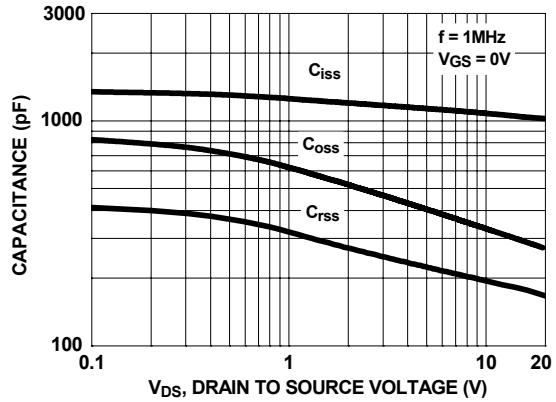**Figure 7. Gate Charge Characteristics**

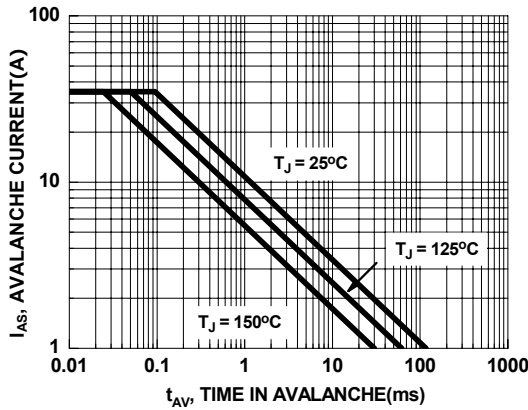**Figure 8. Capacitance vs Drain to Source Voltage**

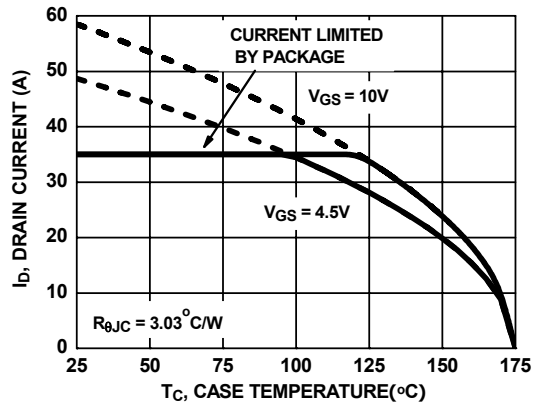**Figure 9. Unclamped Inductive Switching Capability**

Figure 10. Maximum Continuous Drain Current vs Case Temperature
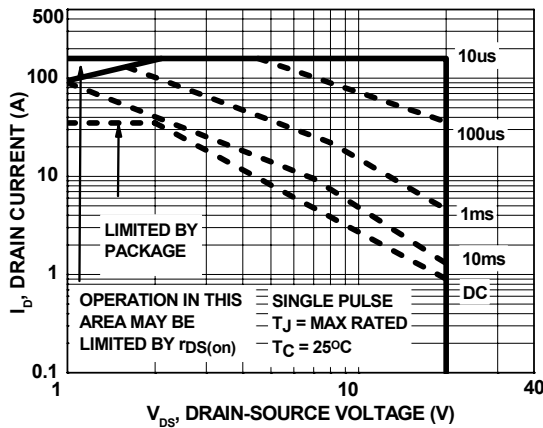
Figure 11. Forward Bias Safe Operating Area
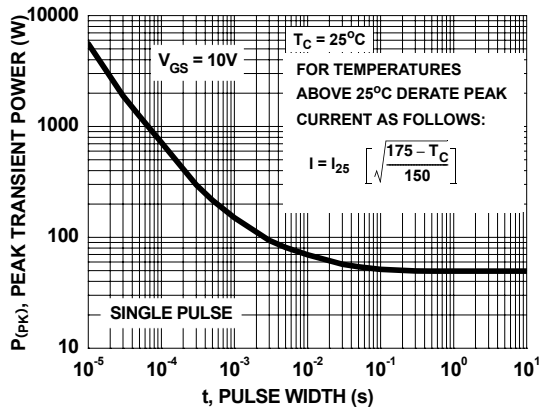
Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25°C unless otherwise noted
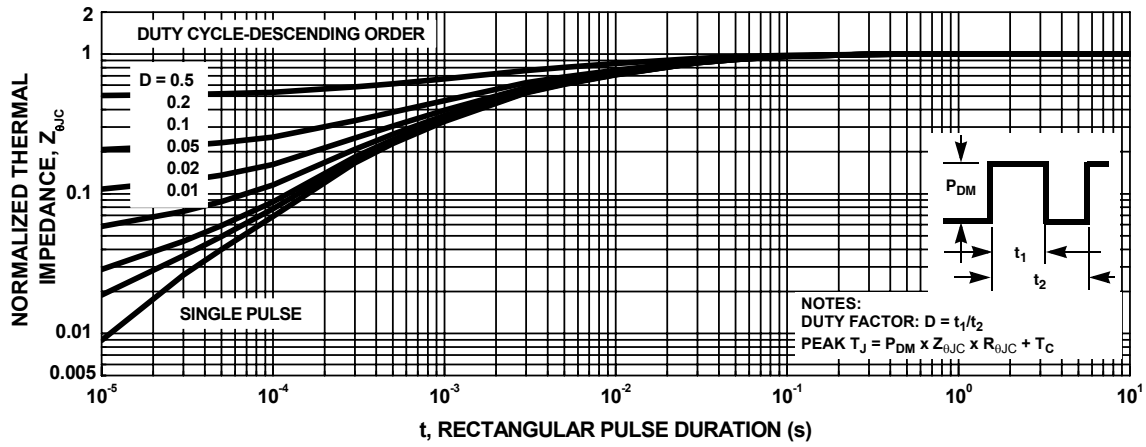
Figure 13. Transient Thermal Response Curve

DUTY CYCLE-DESCENDING ORDER

D = 0.5
0.2
0.1
0.05
0.02
0.01

SINGLE PULSE

NORMALIZED THERMAL IMPEDANCE, $Z_{\theta JC}$

t, RECTANGULAR PULSE DURATION (s)

P_{DM}

t_1

t_2

NOTES:
DUTY FACTOR: $D = t_1/t_2$
PEAK $T_J = P_{DM} \times Z_{\theta JC} \times R_{\theta JC} + T_C$

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACEx™	FACT Quiet Series™	OCX™	SILENT SWITCHER®	UniFET™
ActiveArray™	GlobalOptoisolator™	OCXPro™	SMART START™	UltraFET®
Bottomless™	GTO™	OPTOLOGIC®	SPM™	VCX™
Build it Now™	HiSeC™	OPTOPLANAR™	Stealth™	Wire™
CoolFET™	I²C™	PACMAN™	SuperFET™	
CROSSVOLT™	i-Lo™	POP™	SuperSOT™-3	
DOME™	ImpliedDisconnect™	Power247™	SuperSOT™-6	
EcoSPARK™	IntelliMAX™	PowerEdge™	SuperSOT™-8	
E²CMOS™	ISOPLANAR™	PowerSaver™	SyncFET™	
EnSigna™	LittleFET™	PowerTrench®	TCM™	
FACT™	MICROCOUPLER™	QFET®	TinyBoost™	
FAST®	MicroFET™	QS™	TinyBuck™	
FASTr™	MicroPak™	QT Optoelectronics™	TinyPWM™	
FPS™	MICROWIRE™	Quiet Series™	TinyPower™	
FRFET™	MSX™	RapidConfigure™	TinyLogic®	
	MSXPro™	RapidConnect™	TINYOPTO™	
Across the board. Around the world.™		μSerDes™	TruTranslation™	
The Power Franchise®		ScalarPump™	UHC™	
Programmable Active Droop™				

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, or (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 significant injury to the user.

2. A critical component is 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, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order 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 in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

Rev. I20