

## FDD8444

### N-Channel PowerTrench® MOSFET

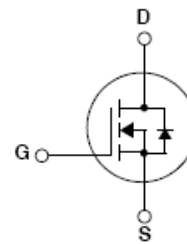
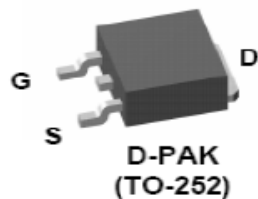
40V, 50A, 5.2mΩ

#### Features

- Typ  $r_{DS(on)} = 4m\Omega$  at  $V_{GS} = 10V$ ,  $I_D = 50A$
- Typ  $Q_{g(10)} = 89nC$  at  $V_{GS} = 10V$
- Low Miller Charge
- Low  $Q_{rr}$  Body Diode
- UIS Capability (Single Pulse/ Repetitive Pulse)
- Qualified to AEC Q101
- RoHS Compliant

#### Applications

- Automotive Engine Control
- Powertrain Management
- Solenoid and Motor Drivers
- Electronic Transmission
- Distributed Power Architecture and VRMs
- Primary Switch for 12V Systems



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

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain to Source Voltage	40	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current Continuous ( $V_{GS} = 10\text{V}$ ) (Note 1)	145	A
	Continuous ( $V_{GS} = 10\text{V}$ , with $R_{\theta JA} = 52^\circ\text{C/W}$ )	20	
	Pulsed	Figure 4	
$E_{AS}$	Single Pulse Avalanche Energy (Note 2)	535	mJ
$P_D$	Power Dissipation	153	W
	Derate above $25^\circ\text{C}$	1.02	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	0.98	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient TO-252, $1\text{in}^2$ copper pad area	52	$^\circ\text{C/W}$

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD8444	FDD8444	TO-252AA	13"	12mm	2500 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	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2	2.5	4	V
$r_{DS(on)}$	Drain to Source On Resistance	$I_D = 50\text{A}, V_{GS} = 10\text{V}$	-	4	5.2	m $\Omega$
		$I_D = 50\text{A}, V_{GS} = 10\text{V},$ $T_J = 175^\circ\text{C}$	-	7.2	9.4	

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}$	-	6195	-	pF	
$C_{oss}$	Output Capacitance		-	585	-	pF	
$C_{rfs}$	Reverse Transfer Capacitance		-	332	-	pF	
$R_G$	Gate Resistance	$f = 1\text{MHz}$	-	1.9	-	$\Omega$	
$Q_{g(TOT)}$	Total Gate Charge at 10V	$V_{GS} = 0$ to 10V	$V_{DD} = 20\text{V}$ $I_D = 50\text{A}$ $I_g = 1.0\text{mA}$	-	89	116	nC
$Q_{g(5)}$	Total Gate Charge at 5V	$V_{GS} = 0$ to 5V		-	43	56	nC
$Q_{g(TH)}$	Threshold Gate Charge	$V_{GS} = 0$ to 2V		-	11	14.3	nC
$Q_{gs}$	Gate to Source Gate Charge			-	23	-	nC
$Q_{gs2}$	Gate Charge Threshold to Plateau			-	11	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge			-	20	-	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	$V_{DD} = 20\text{V}, I_D = 50\text{A}$ $V_{GS} = 10\text{V}, R_{GS} = 2\Omega$	-	-	135	ns
$t_{d(on)}$	Turn-On Delay Time		-	12	-	ns
$t_r$	Turn-On Rise Time		-	78	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	48	-	ns
$t_f$	Turn-Off Fall Time		-	15	-	ns
$t_{off}$	Turn-Off Time		-	-	95	ns

**Drain-Source Diode Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{SD}$	Source to Drain Diode Voltage	$I_{SD} = 50\text{A}$	-	0.9	1.25	V
		$I_{SD} = 25\text{A}$	-	0.8	1.0	
$t_{rr}$	Reverse Recovery Time	$I_F = 50\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$	-	39	51	ns
$Q_{rr}$	Reverse Recovery Charge		-	45	59	nC

**Notes:**

- 1: Package current limitation is 50A.
- 2: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.67\text{mH}$ ,  $I_{AS} = 40\text{A}$

This product has been designed to meet the extreme test conditions and environment demanded by the automotive industry. For a copy of the requirements, see AEC Q101 at: <http://www.aecouncil.com/>  
 All Fairchild Semiconductor products are manufactured, assembled and tested under ISO9000 and QS9000 quality systems certification.

## Typical Characteristics

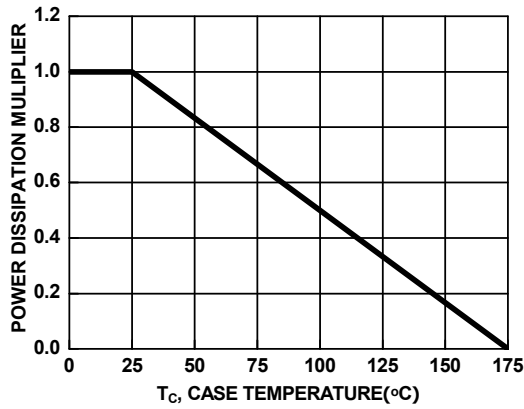


Figure 1. Normalized Power Dissipation vs Case Temperature

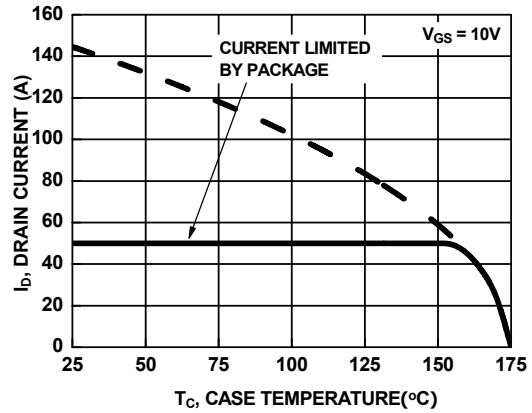


Figure 2. Maximum Continuous Drain Current vs Case Temperature

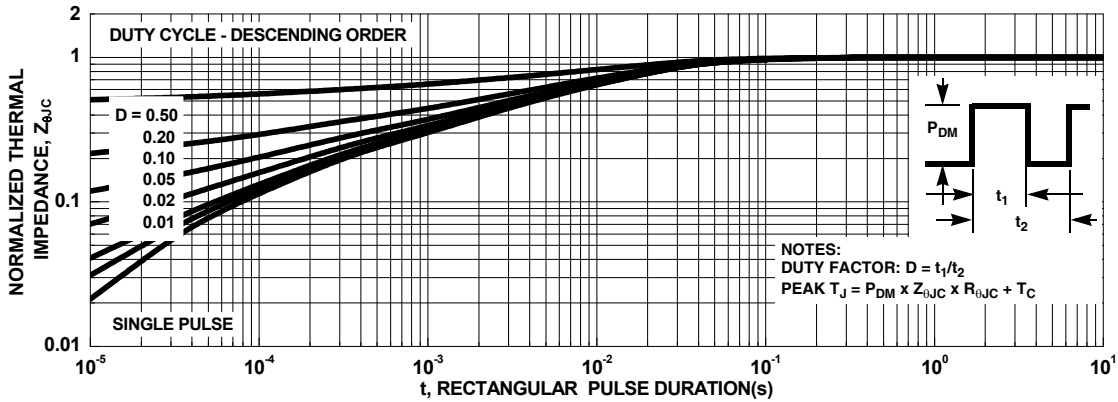


Figure 3. Normalized Maximum Transient Thermal Impedance

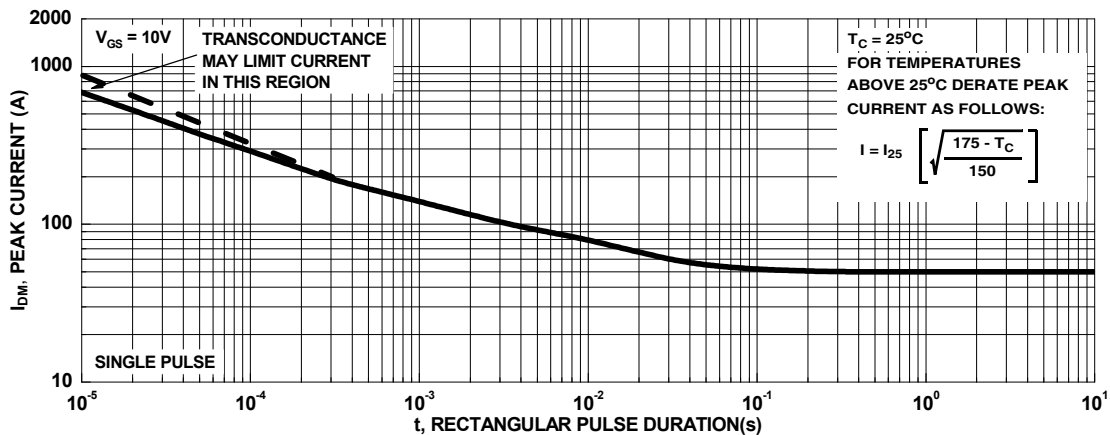


Figure 4. Peak Current Capability

## Typical Characteristics

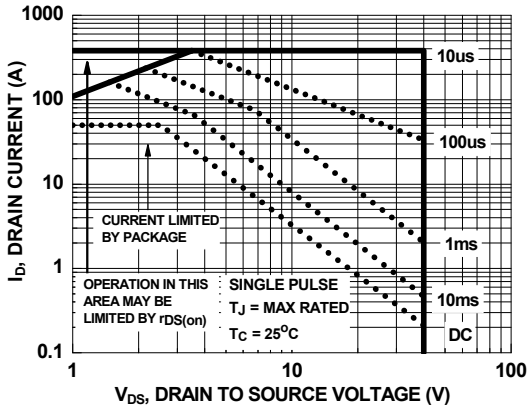
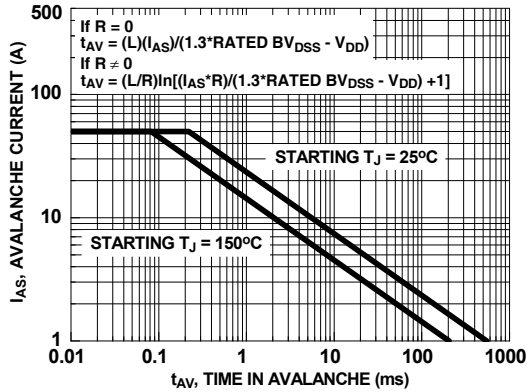


Figure 5. Forward Bias Safe Operating Area



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

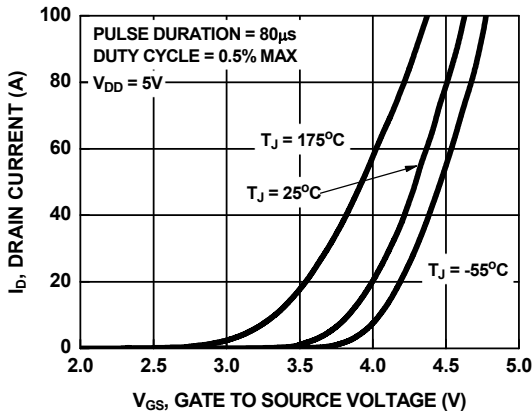


Figure 7. Transfer Characteristics

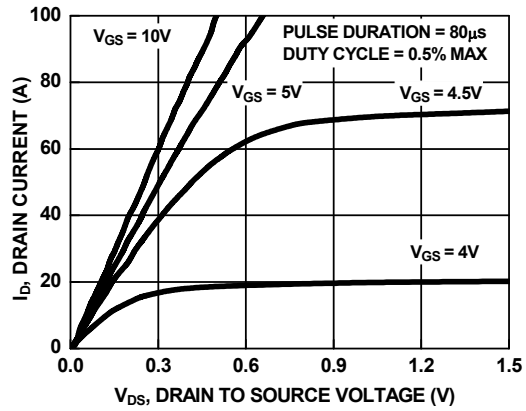


Figure 8. Saturation Characteristics

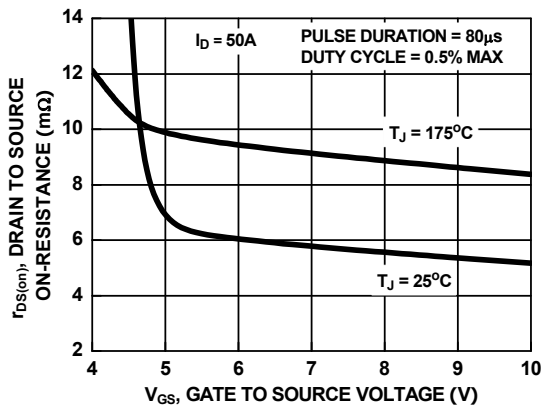


Figure 9. Drain to Source On-Resistance Variation vs Gate to Source Voltage

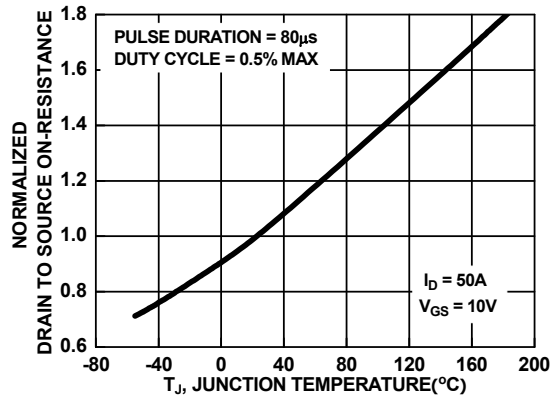


Figure 10. Normalized Drain to Source On-Resistance vs Junction Temperature

## Typical Characteristics

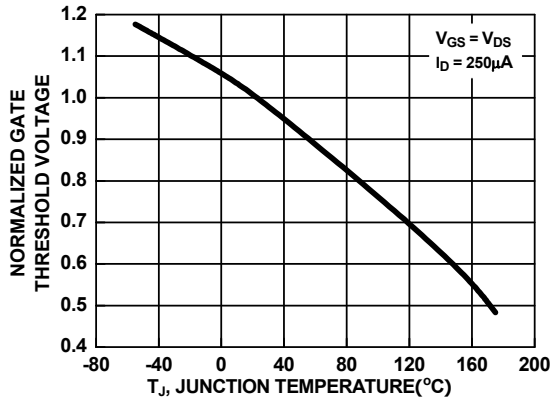


Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature

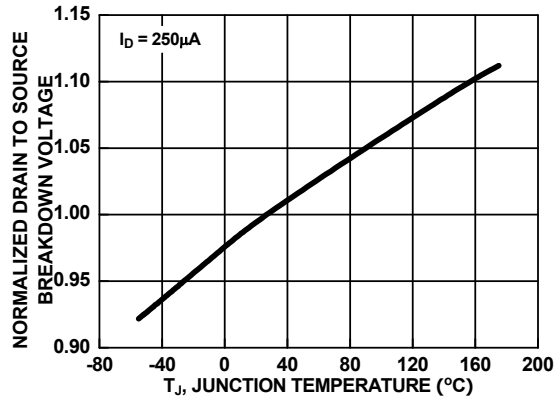


Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature

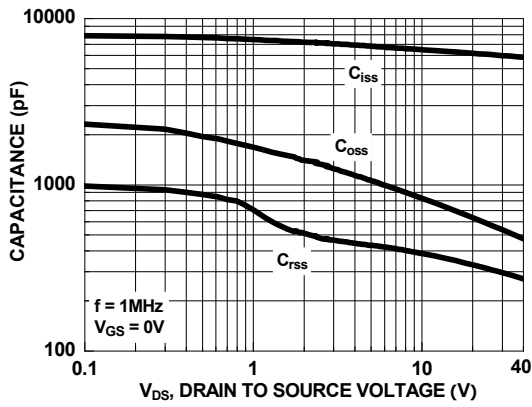


Figure 13. Capacitance vs Drain to Source Voltage

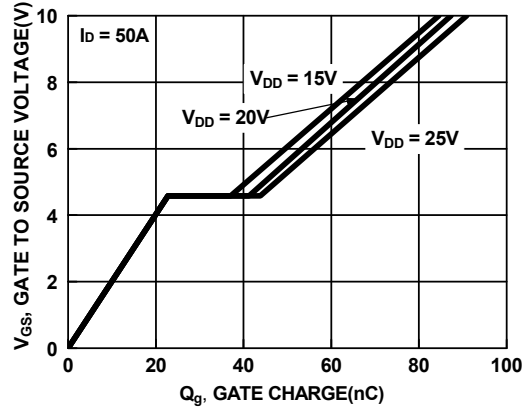



Figure 14. Gate Charge vs Gate to Source Voltage



## TRADEMARKS

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

ACE <sup>®</sup>	Green FPS <sup>™</sup> e-Series <sup>™</sup>	POWEREDGE <sup>®</sup>	SuperSOT <sup>™</sup> -8
Build it Now <sup>™</sup>	GTO <sup>™</sup>	Power-SPM <sup>™</sup>	SyncFET <sup>™</sup>
CorePLUS <sup>™</sup>	<i>i-Lo</i> <sup>™</sup>	PowerTrench <sup>®</sup>	The Power Franchise <sup>®</sup>
CROSSVOLT <sup>™</sup>	IntelliMAX <sup>™</sup>	Programmable Active Droop <sup>™</sup>	 ™
CTL <sup>™</sup>	ISOPLANAR <sup>™</sup>	QFET <sup>®</sup>	TinyBoost <sup>™</sup>
Current Transfer Logic <sup>™</sup>	MegaBuck <sup>™</sup>	QS <sup>™</sup>	TinyBuck <sup>™</sup>
EcoSPARK <sup>®</sup>	MICROCOUPLER <sup>™</sup>	QT Optoelectronics <sup>™</sup>	TinyLogic <sup>®</sup>
FACT Quiet Series <sup>™</sup>	MicroFET <sup>™</sup>	Quiet Series <sup>™</sup>	TINYOPTO <sup>™</sup>
FACT <sup>®</sup>	MicroPak <sup>™</sup>	RapidConfigure <sup>™</sup>	TinyPower <sup>™</sup>
FAST <sup>®</sup>	Motion-SPM <sup>™</sup>	SMART START <sup>™</sup>	TinyPWM <sup>™</sup>
FastvCore <sup>™</sup>	OPTOLOGIC <sup>®</sup>	SPM <sup>®</sup>	TinyWire <sup>™</sup>
FPS <sup>™</sup>	OPTOPLANAR <sup>®</sup>	STEALTH <sup>™</sup>	μSerDes <sup>™</sup>
FRFET <sup>®</sup>	PDP-SPM <sup>™</sup>	SuperFET <sup>™</sup>	UHC <sup>®</sup>
Global Power Resource <sup>SM</sup>	Power220 <sup>®</sup>	SuperSOT <sup>™</sup> -3	UniFET <sup>™</sup>
Green FPS <sup>™</sup>	Power247 <sup>®</sup>	SuperSOT <sup>™</sup> -6	VCX <sup>™</sup>

## 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.

## 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; 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	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice 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. I29