ON Semiconductor®

FDD8444L-F085

N-Channel PowerTrench® MOSFET

40V, 50A, 6.0mΩ

Features

- Typ $r_{DS(on)}$ = 3.8mΩ at V_{GS} = 5V, I_D = 50A
- Typ $Q_{g(tot)}$ = 46nC at V_{GS} = 5V
- Low Miller Charge
- Low Q_{rr} Body Diode
- UIS Capability (Single Pulse/ Repetitive Pulse)
- Qualified to AEC Q101
- RoHS Compliant

LEAD-FREE IMPLEMENTATION

Applications

- Automotive Engine Control
- Powertrain Management
- Solenoid and Motor Drivers
- Electronic Transmission
- Distributed Power Architecture and VRMs
- Primary Switch for 12V and 24V systems

D-PAK
(TO-252)
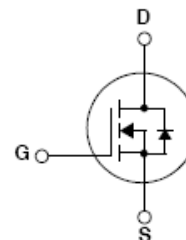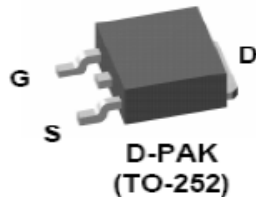
MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain to Source Voltage		40	V
V_{GS}	Gate to Source Voltage		±20	V
I_D	Drain Current Continuous (T_C < 150°C, V_{GS} = 10V) (Note 1)		50	A
	Continuous (T_{amb} = 25°C, V_{GS} = 10V, with $R_{\theta JA}$ = 52°C/W)		16	
	Pulsed		See Figure 4	
E_{AS}	Single Pulse Avalanche Energy (Note 2)		295	mJ
P_D	Power Dissipation		153	W
	Derate above 25°C		1.02	W/°C
T_J, T_{STG}	Operating and Storage Temperature		-55 to +175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case		0.98	°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
FDD8444L	FDD8444L-F085	TO-252AA	13"	12mm	2500 units

Electrical Characteristics T_J = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units

Off Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
B_{VDSS}	Drain to Source Breakdown Voltage	I_D = 250µA, V_{GS} = 0V		40	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 32V, V_{GS} = 0V		-	-	1	µA
			T_J = 150°C	-	-	250	
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20V		-	-	±100	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250µA	1	1.8	3	V
$r_{DS(on)}$	Drain to Source On Resistance	I_D = 50A, V_{GS}= 10V	-	3.5	5.2	mΩ
		I_D = 50A, V_{GS}= 5V	-	3.8	6.0	
		I_D = 50A, V_{GS}= 4.5V	-	4.0	6.5	
		I_D = 50A, V_{GS}= 5V, T_J = 175°C	-	6.8	10.7	

Dynamic Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz		-	5530	-	pF
C_{oss}	Output Capacitance			-	605	-	pF
C_{rss}	Reverse Transfer Capacitance			-	400	-	pF
R_G	Gate Resistance	f = 1MHz		-	1.7	-	Ω
$Q_{g(TOT)}$	Total Gate Charge at 5V	V_{GS} = 0 to 5V	V_{DD} = 20V, I_D = 50A, I_g = 1.0mA	-	46	60	nC
$Q_{g(TH)}$	Threshold Gate Charge	V_{GS} = 0 to 2V		-	5.4	7	nC
Q_{gs}	Gate to Source Gate Charge			-	16.3	-	nC
Q_{gs2}	Gate Charge Threshold to Plateau			-	10.9	-	nC
Q_{gd}	Gate to Drain "Miller" Charge			-	21	-	nC

Electrical Characteristics $T_J = 25^oC$ 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} = 20V, I_D = 50A V_{GS} = 5V, R_{GS} = 2Ω	-	-	104	ns
$t_{d(on)}$	Turn-On Delay Time		-	18.7	-	ns
t_r	Turn-On Rise Time		-	46	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	42	-	ns
t_f	Turn-Off Fall Time		-	19.2	-	ns
t_{off}	Turn-Off Time		-	-	96	ns

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Voltage	I_{SD} = 50A	-	0.9	1.25	V
		I_{SD} = 25A	-	0.8	1.0	
t_{rr}	Reverse Recovery Time	I_F = 50A, dI_F/dt = 100A/μs	-	34	44	ns
Q_{rr}	Reverse Recovery Charge		-	29	38	nC

Notes:
1: Package current limitation is 50A.
2: Starting $T_J = 25^oC$, L = 0.37mH, I_{AS} = 40A.

FDD8444L-F085 N-Channel PowerTrench® MOSFET

Typical Characteristics
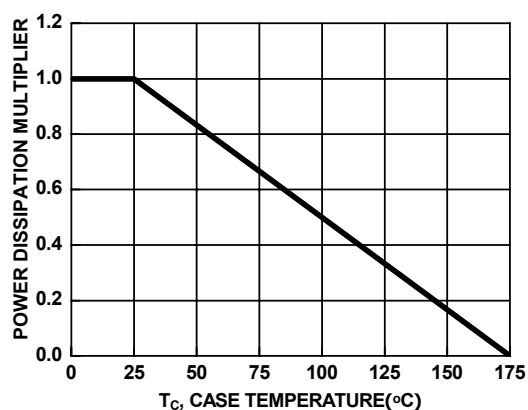
Figure 1. Normalized Power Dissipation vs Case Temperature
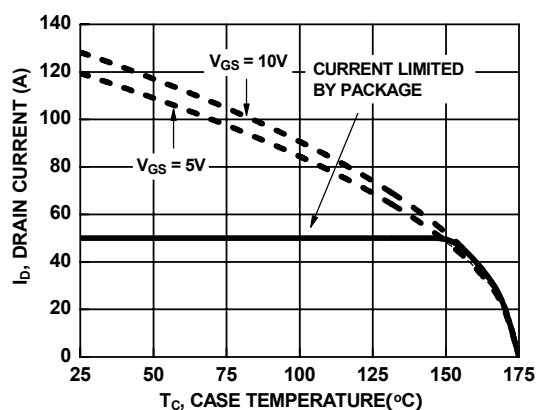
Figure 2. Maximum Continuous Drain Current vs Case Temperature

NOTES:
DUTY FACTOR: $D = t_1/t_2$
PEAK $T_J = P_{DM} \times Z_{\theta JC} \times R_{\theta JC} + T_C$
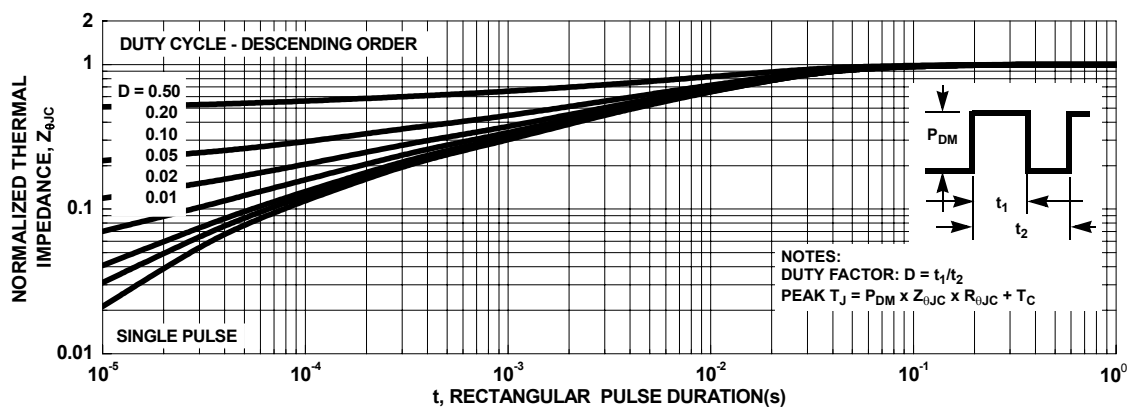
Figure 3. Normalized Maximum Transient Thermal Impedance

$T_C = 25^oC$
FOR TEMPERATURES ABOVE 25°C DERATE PEAK CURRENT AS FOLLOWS:

$$I = I_{25} \left[\sqrt{\frac{175 - T_C}{150}} \right]$$
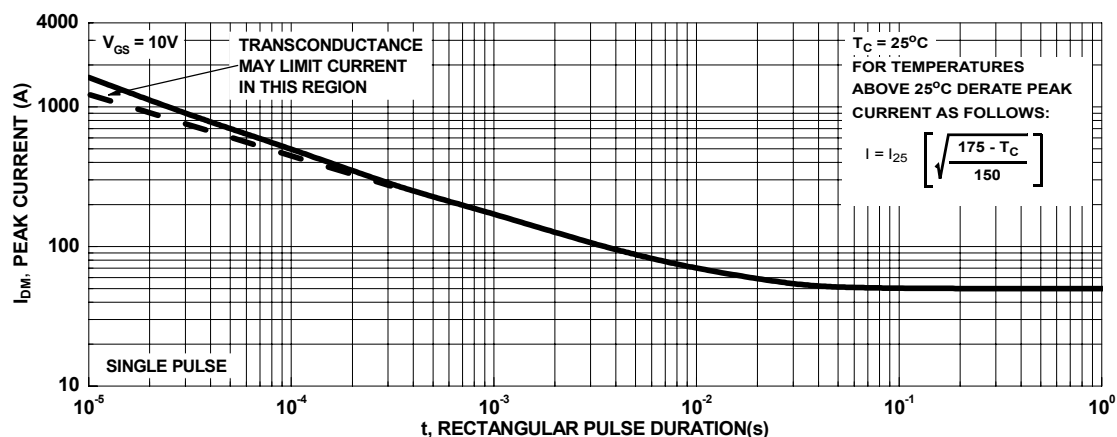
Figure 4. Peak Current Capability

Typical Characteristics
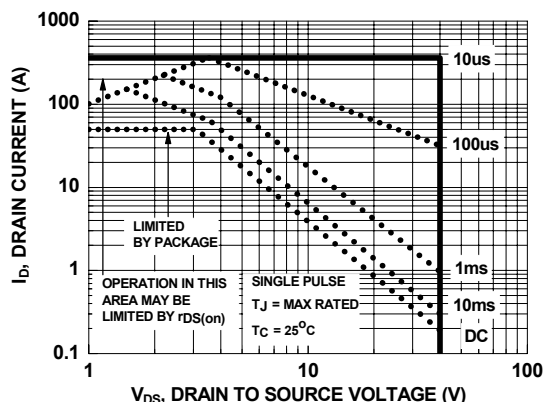
Figure 5. Forward Bias Safe Operating Area
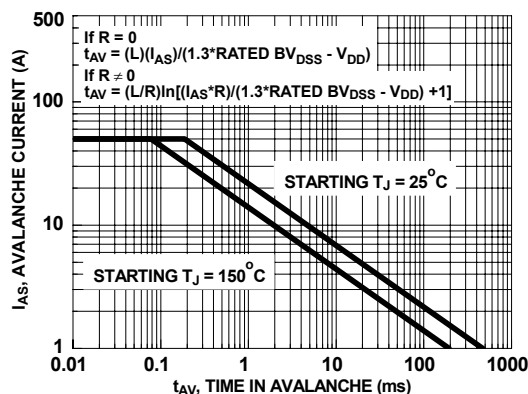
Figure 6. Unclamped Inductive Switching Capability
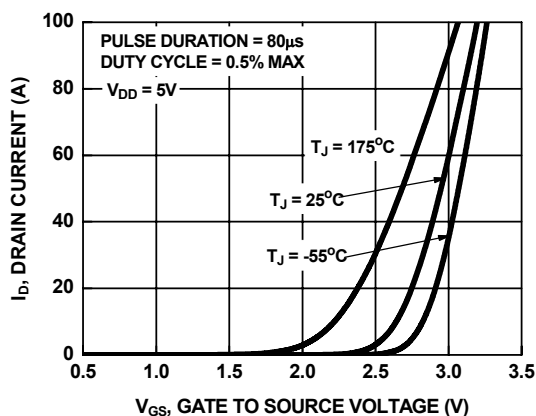
Figure 7. Transfer Characteristics
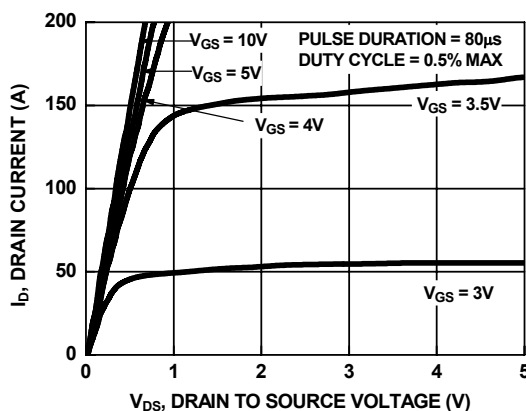
Figure 8. Saturation Characteristics
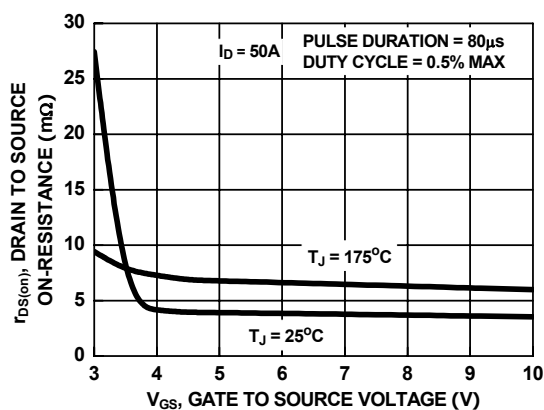
Figure 9. Drain to Source On-Resistance Variation vs Gate to Source Voltage
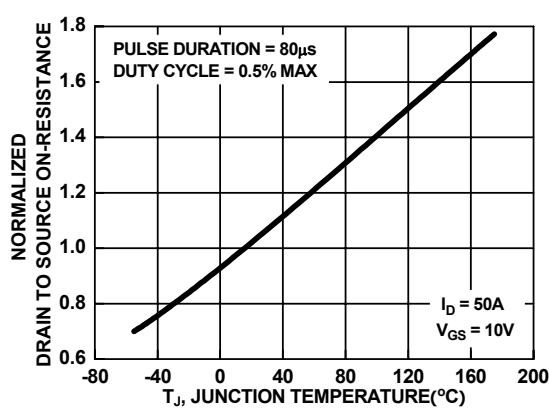
Figure 10. Normalized Drain to Source On Resistance vs Junction Temperature

Typical Characteristics
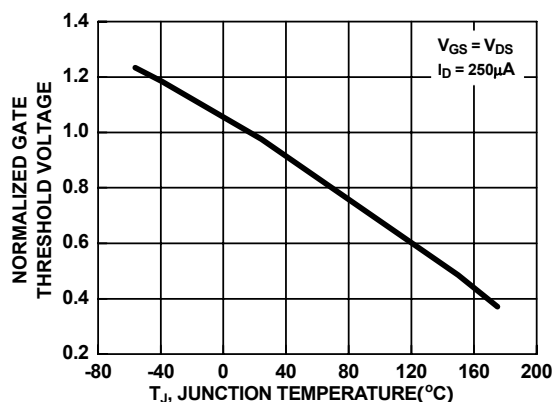
Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature
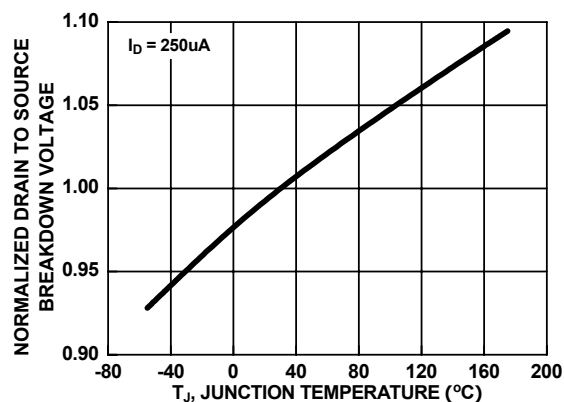
Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature
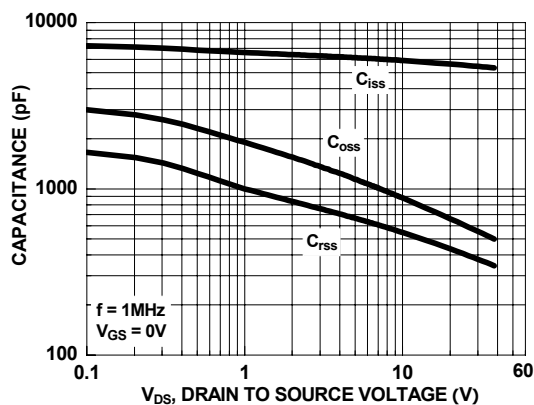
Figure 13. Capacitance vs Drain to Source Voltage
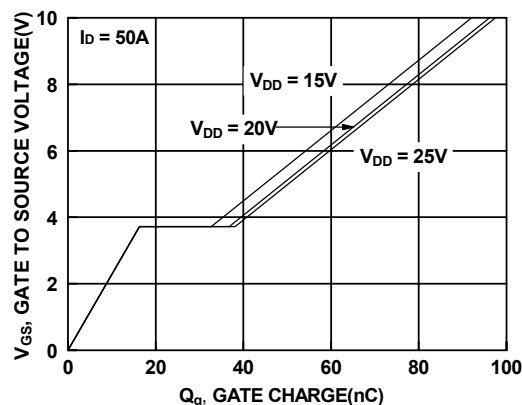
Figure 14. Gate Charge vs Gate to Source Voltage

PUBLICATION ORDERING INFORMATION

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