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ON Semiconductor®

FDB8445-F085

N-Channel PowerTrench® MOSFET

40V, 70A, 9mΩ

Features

- Typ $r_{DS(on)}$ = 6.8mΩ at V_{GS} = 10V, I_D = 70A

- Typ $Q_{g(10)}$ = 44nC 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

LEAD-FREE IMPLEMENTATION

GATE

SOURCE

DRAIN
(FLANGE)

TO-263AB
FDB SERIES

D

G

S
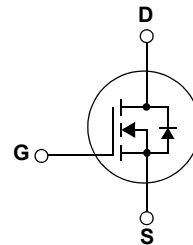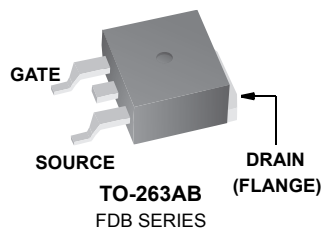
Absolute Maximum Ratings $T_C = 25°C$ unless otherwise noted

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 ($V_{GS} = 10V$) (Note 1)		70	A
	Pulsed		Figure 4	
E_{AS}	Single Pulse Avalanche Energy (Note 2)		102	mJ
P_D	Power Dissipation		92	W
	Derate above 25°C		0.6	W/°C
T_J, T_{STG}	Operating and Storage Temperature		-55 to +175	°C

Thermal Characteristics

Symbol	Parameter	Ratings	Units
$R_{\theta JC}$	Maximum Thermal Resistance, Junction to Case	1.63	°C/W
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient TO-263, lin^2 copper pad area	43	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDB8445	FDB8445-F085	TO-263AB	330mm	24mm	800 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	$I_D = 250\mu A$, $V_{GS} = 0V$		40	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 32V$ $V_{GS} = 0V$		-	-	1	μA
			$T_J = 150°C$	-	-	250	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20V$		-	-	±100	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\mu A$	2	2.5	4	V
$r_{DS(on)}$	Drain to Source On Resistance	$I_D = 70A$, $V_{GS} = 10V$	-	6.8	9	mΩ
		$I_D = 70A$, $V_{GS} = 10V$, $T_J = 175°C$	-	13	17.2	

Dynamic Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
C_{iss}	Input Capacitance	$V_{DS} = 25V$, $V_{GS} = 0V$, f = 1MHz		-	2860	3805	pF
C_{oss}	Output Capacitance			-	295	395	pF
C_{rss}	Reverse Transfer Capacitance			-	180	270	pF
R_G	Gate Resistance	f = 1MHz		-	1.95	-	Ω
$Q_{g(TOT)}$	Total Gate Charge at 10V	$V_{GS} = 0$ to 10V	$V_{DD} = 20V$, $I_D = 70A$,	-	44	62	nC
$Q_{g(TH)}$	Threshold Gate Charge	$V_{GS} = 0$ to 2V		-	2.9	4.1	nC
Q_{gs}	Gate to Source Gate Charge			-	11	-	nC
Q_{gs2}	Gate Charge Threshold to Plateau			-	8.2	-	nC
Q_{gd}	Gate to Drain "Miller" Charge			-	11	-	nC

Electrical Characteristics T_J = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Switching Characteristics						
$t_{(on)}$	Turn-On Time	V_{DD} = 20V, I_D = 70A V_{GS} = 10V, R_{GS} = 5Ω	-	-	45	ns
$t_{d(on)}$	Turn-On Delay Time		-	10	-	ns
t_r	Turn-On Rise Time		-	19	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	36	-	ns
t_f	Turn-Off Fall Time		-	16	-	ns
t_{off}	Turn-Off Time		-	-	81	ns
Drain-Source Diode Characteristics						
V_{SD}	Source to Drain Diode Voltage	I_{SD} = 70A	-	-	1.25	V
		I_{SD} = 35A	-	-	1.0	V
t_{rr}	Reverse Recovery Time	I_F = 70A, di/dt = 100A/μs	-	-	59	ns
Q_{rr}	Reverse Recovery Charge	I_F = 70A, di/dt = 100A/μs	-	-	77	nC

Notes:
1: Maximum wire current carrying capacity is 70A.
2: Starting T_J = 25°C, L = 65uH, I_{AS} = 56A.

FDB8445-F085 N-Channel PowerTrench® MOSFET
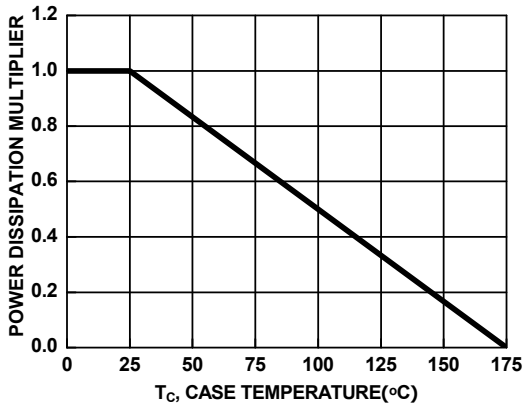
Typical Characteristics
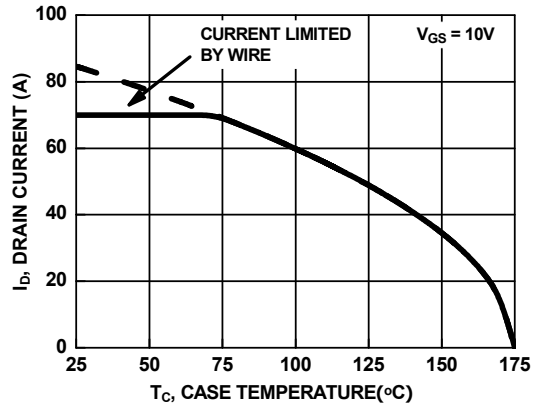
Figure 1. Normalized Power Dissipation vs Case Temperature

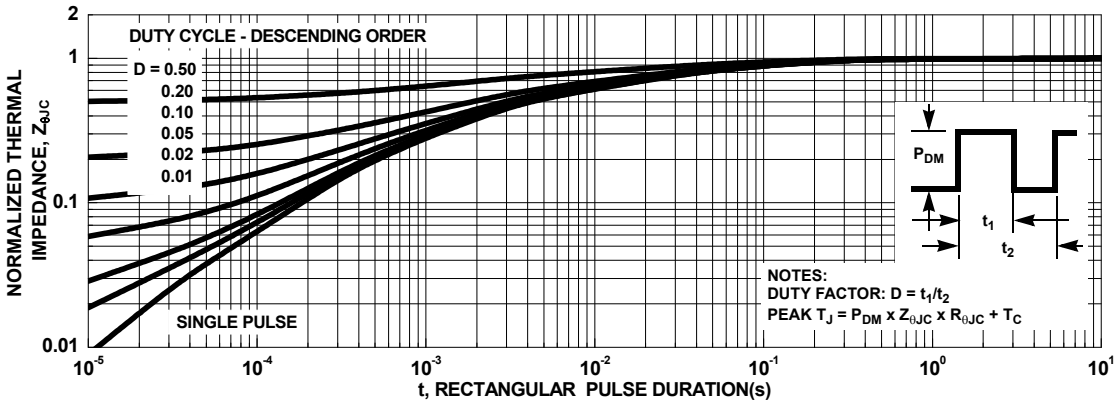**Figure 2. Maximum Continuous Drain Current vs Case Temperature**

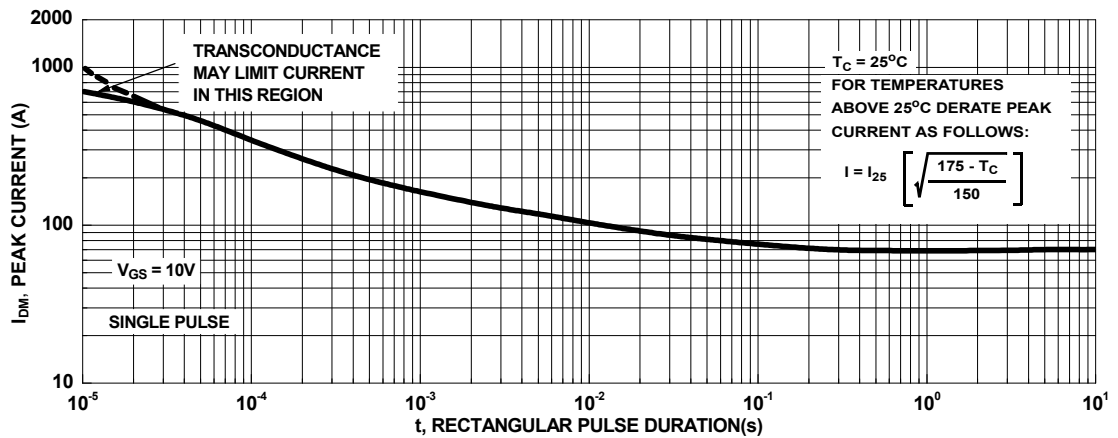**Figure 3. Normalized Maximum Transient Thermal Impedance**

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

Figure 4. Peak Current Capability

$T_C = 25^oC$

FOR TEMPERATURES ABOVE 25°C DERATE PEAK CURRENT AS FOLLOWS:

$$I = I_{25} \left[\sqrt{\frac{175 - T_C}{150}} \right]$$

Typical Characteristics
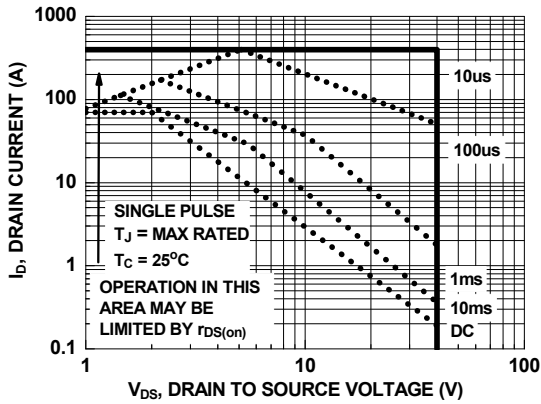
Figure 5. Forward Bias Safe Operating Area

I_D, DRAIN CURRENT (A) vs V_DS, DRAIN TO SOURCE VOLTAGE (V)

SINGLE PULSE
T_J = MAX RATED
T_C = 25°C

OPERATION IN THIS AREA MAY BE LIMITED BY $r_{DS(on)}$

10us, 100us, 1ms, 10ms, DC

If R = 0
$t_{AV} = (L)(I_{AS})/(1.3*RATED\ BV_{DSS} - V_{DD})$
If R ≠ 0
$t_{AV} = (L/R)ln[(I_{AS}*R)/(1.3*RATED\ BV_{DSS} - V_{DD}) +1]$

STARTING T_J = 25°C
STARTING T_J = 150°C

I_AS, AVALANCHE CURRENT (A) vs t_AV, TIME IN AVALANCHE (ms)
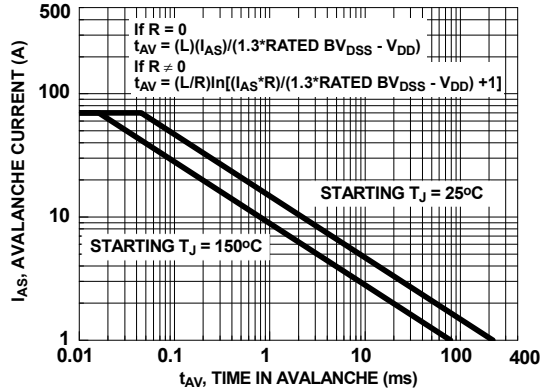
NOTE: Refer to ON Semiconductor Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

PULSE DURATION = 80µs
DUTY CYCLE = 0.5% MAX
V_{DD} = 5V

T_J = 175°C
T_J = 25°C
T_J = -55°C

I_D, DRAIN CURRENT (A) vs V_GS, GATE TO SOURCE VOLTAGE (V)
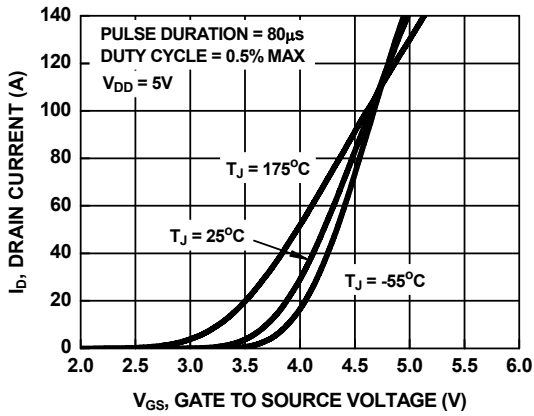
Figure 7. Transfer Characteristics

V_{GS} = 10V
PULSE DURATION = 80µs
DUTY CYCLE = 0.5% MAX
V_{GS} = 5V
V_{GS} = 4.5V
V_{GS} = 4V
V_{GS} = 3.5V

I_D, DRAIN CURRENT (A) vs V_DS, DRAIN TO SOURCE VOLTAGE (V)
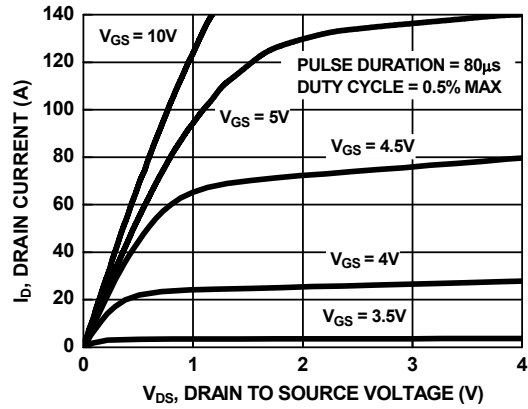
Figure 8. Saturation Characteristics

I_D = 70A   PULSE DURATION = 80µs
DUTY CYCLE = 0.5% MAX
T_J = 175°C
T_J = 25°C

$r_{DS(on)}$, DRAIN TO SOURCE ON-RESISTANCE (mΩ) vs V_GS, GATE TO SOURCE VOLTAGE (V)
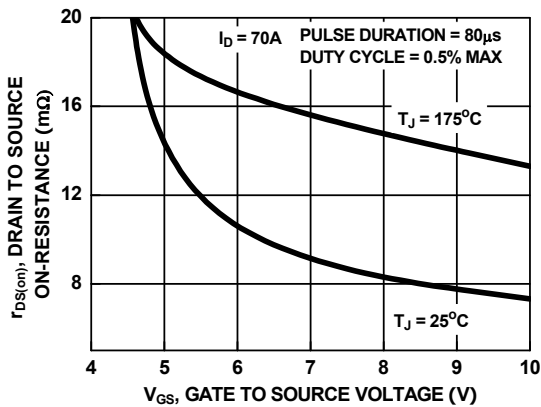
Figure 9. Drain to Source On-Resistance Variation vs Gate to Source Voltage

PULSE DURATION = 80µs
DUTY CYCLE = 0.5% MAX

I_D = 70A
V_{GS} = 10V

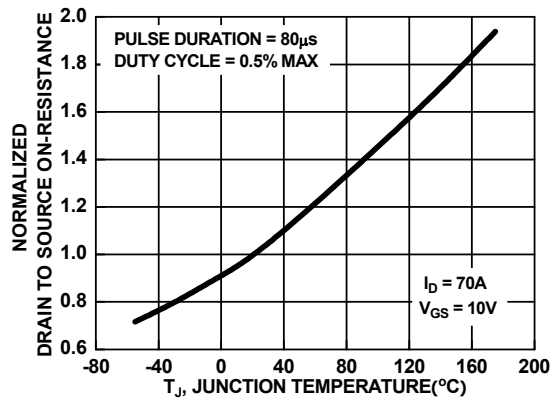NORMALIZED DRAIN TO SOURCE ON-RESISTANCE vs T_J, JUNCTION TEMPERATURE(°C)

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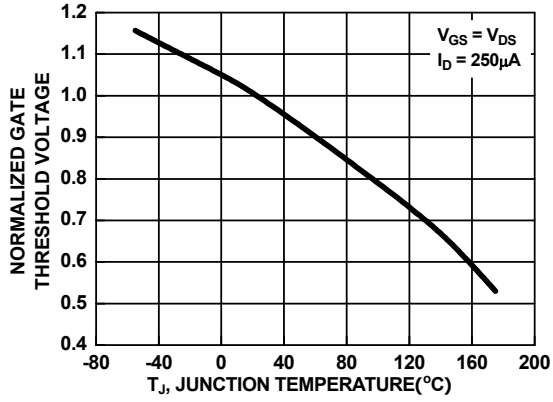
Typical Characteristics

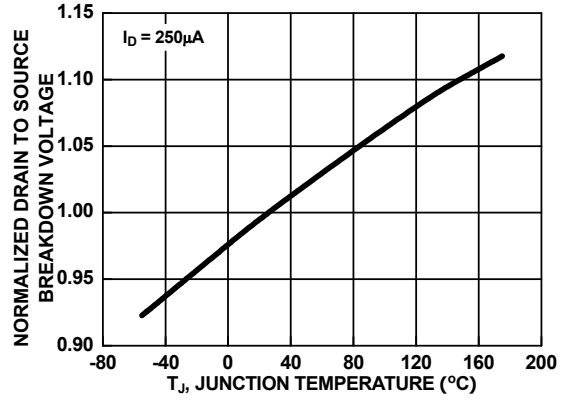**Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature**

Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature
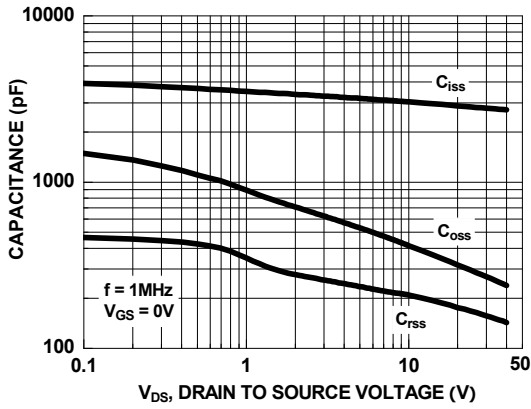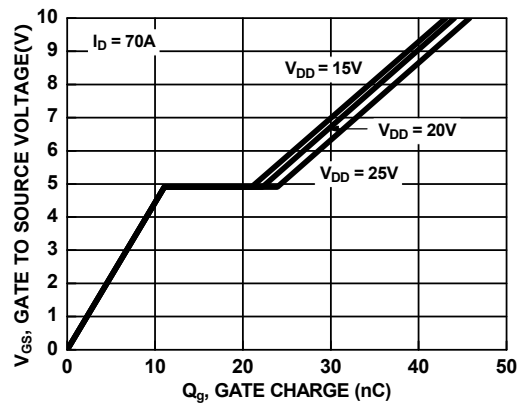
Figure 13. Capacitance vs Drain to Source Voltage

Figure 14. Gate Charge vs Gate to Source Voltage

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