FAIRCHILD

SEMICONDUCTOR®

FDI8442

## N-Channel PowerTrench® MOSFET

40V, 80A, 2.9mΩ

Features

- Typ $r_{DS(on)}$ = 2.3mΩ at V_{GS} = 10V, I_D = 80A

- Typ $Q_{g(10)}$ = 181nC at V_{GS} = 10V

- Low Miller Charge

- Low Q_{rr} Body Diode

- UIS Capability (Single Pulse and Repetitive Pulse)

- Qualified to AEC Q101

- RoHS Compliant

Applications

- Automotive Engine Control

- Powertrain Management

- Solenoid and Motor Drivers

- Electronic Steering

- Integrated Starter / Alternator

- Distributed Power Architectures and VRMs

- Primary Switch for 12V Systems

SOURCE DRAIN GATE
DRAIN (FLANGE)   TO-262AB FDI SERIES
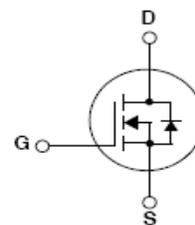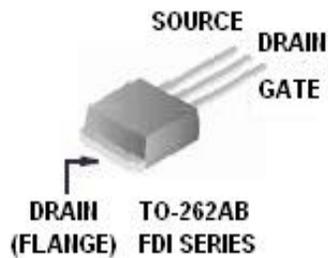
MOSFET Maximum Ratings $T_C = 25°C$ unless otherwise noted

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<158°C, V_{GS} = 10V)	80	A
	Drain Current Continuous (T_{amb} = 25°C, V_{GS} = 10V, with $R_{\theta JA}$ = 62°C/W)	23	
	Pulsed	See Figure 4	
E_{AS}	Single Pulse Avalanche Energy (Note 1)	720	mJ
P_D	Power Dissipation	254	W
	Derate above 25°C	1.7	W/°C
T_J, T_{STG}	Operating and Storage Temperature	-55 to +175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case	0.59	°C/W
$R_{\theta JA}$	Thermal Resistance Junction to Ambient (Note 2)	62	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDI8442	FDI8442	TO-262	Tube	N/A	50 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_{DS} = V_{GS}, I_D = 250µA	2	2.9	4	V
$r_{DS(on)}$	Drain to Source On Resistance	I_D = 80A, V_{GS} = 10V	-	2.3	2.9	mΩ
		I_D = 80A, V_{GS} = 10V, T_J = 175°C	-	3.9	5.0	

Dynamic Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz		-	12200	-	pF
C_{oss}	Output Capacitance			-	1040	-	pF
C_{rss}	Reverse Transfer Capacitance			-	640	-	pF
R_G	Gate Resistance	V_{GS} = 0.5V, f = 1MHz		-	1.0	-	Ω
$Q_{g(TOT)}$	Total Gate Charge at 10V	V_{GS} = 0 to 10V	V_{DD} = 20V I_D = 80A I_g = 1mA	-	181	235	nC
$Q_{g(TH)}$	Threshold Gate Charge	V_{GS} = 0 to 2V		-	23	30	nC
Q_{gs}	Gate to Source Gate Charge			-	49	-	nC
Q_{gs2}	Gate Charge Threshold to Plateau			-	26	-	nC
Q_{gd}	Gate to Drain "Miller" Charge			-	41	-	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		-	-	62	ns
$t_{d(on)}$	Turn-On Delay Time		-	19.5	-	ns
t_r	Turn-On Rise Time	V_{DD} = 20V, I_D = 80A	-	19.3	-	ns
$t_{d(off)}$	Turn-Off Delay Time	V_{GS} = 10V, R_{GS} = 2Ω	-	57	-	ns
t_f	Turn-Off Fall Time		-	17.2	-	ns
t_{off}	Turn-Off Time		-	-	118	ns
Drain-Source Diode Characteristics						
V_{SD}	Source to Drain Diode Voltage	I_{SD} = 80A	-	0.9	1.25	V
		I_{SD} = 40A	-	0.8	1.0	V
t_{rr}	Reverse Recovery Time	I_F = 75A, di/dt = 100A/μs	-	49	64	ns
Q_{rr}	Reverse Recovery Charge	I_F = 75A, di/dt = 100A/μs	-	70	91	nC

Notes:
1: Starting T_J = 25°C, L = 0.35mH, I_{AS} = 64A
2: Pulse width = 100s.

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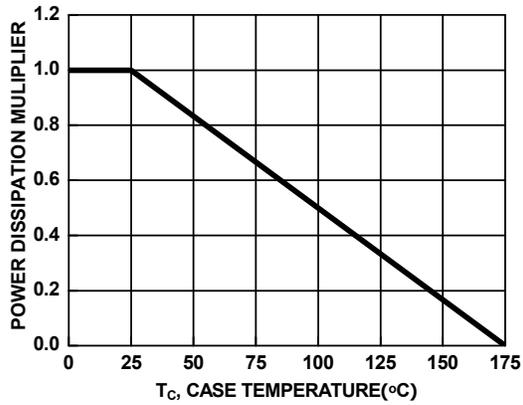
Figure 1. Normalized Power Dissipation vs Case Temperature
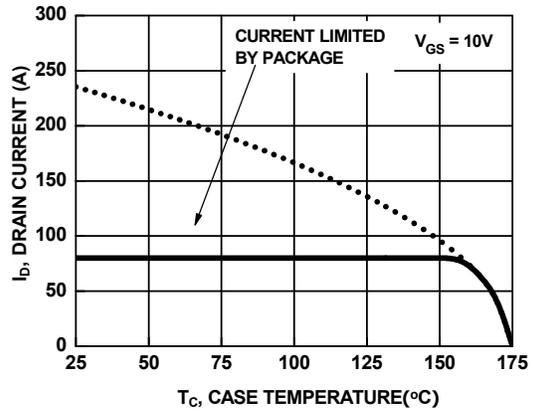
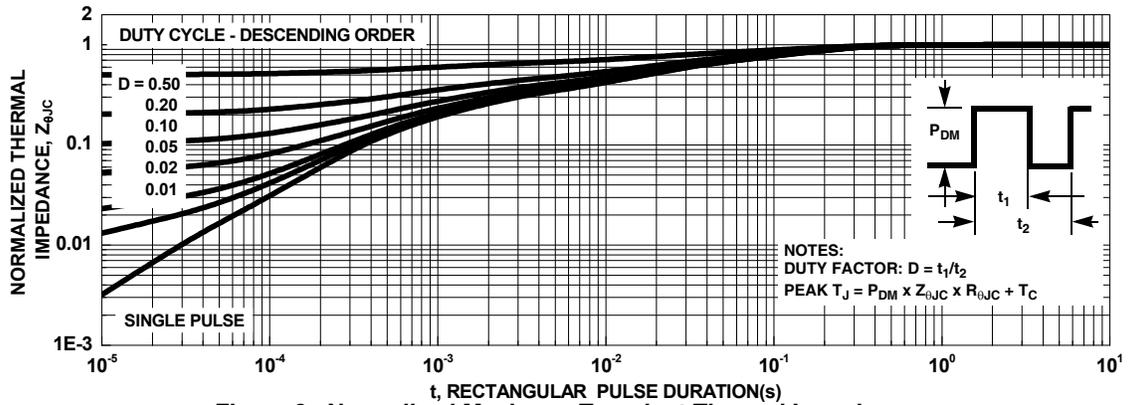**Figure 2. Maximum Continuous Drain Current vs Case Temperature**

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

$V_{GS} = 10V$ TRANSCONDUCTANCE MAY LIMIT CURRENT IN THIS REGION

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

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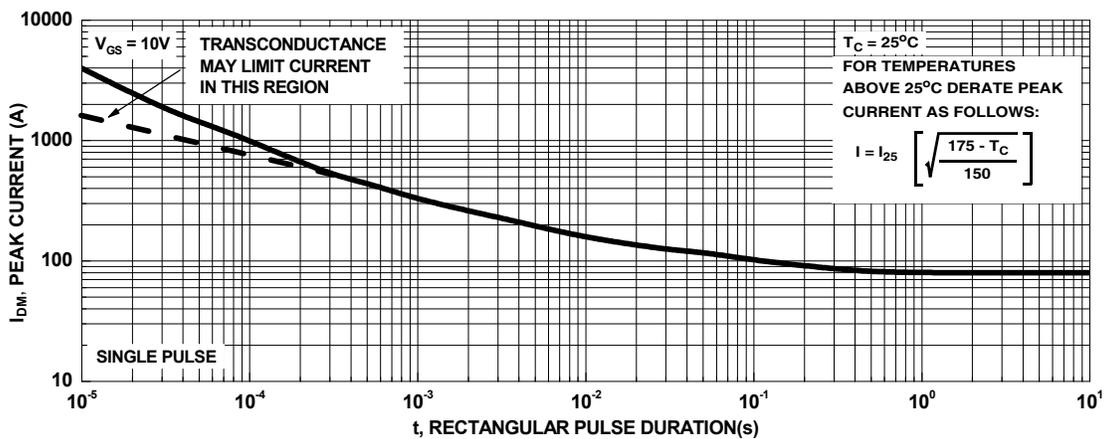
Figure 4. Peak Current Capability

Typical Characteristics
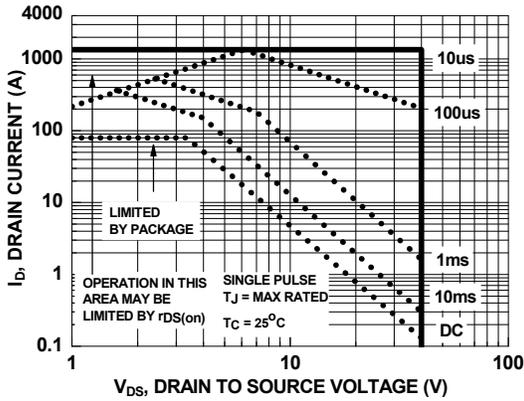
Figure 5. Forward Bias Safe Operating Area

$$\text{If R} = 0$$
$$t_{AV} = (L)(I_{AS})/(1.3 \cdot \text{RATED BV}_{DSS} - V_{DD})$$
$$\text{If R} \neq 0$$
$$t_{AV} = (L/R)\ln[(I_{AS} \cdot R)/(1.3 \cdot \text{RATED BV}_{DSS} - V_{DD}) +1]$$

STARTING $T_J = 25^o$C

STARTING $T_J = 150^o$C
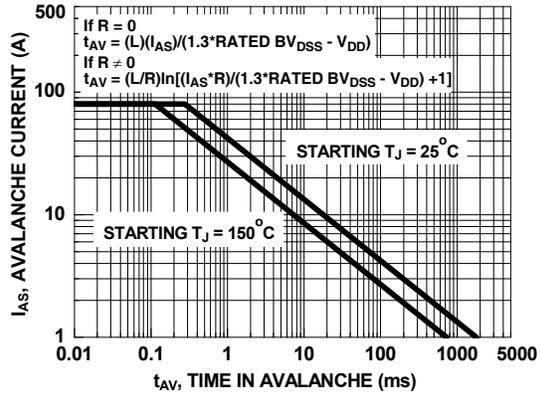
NOTE: Refer to Fairchild Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

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

$T_J = 175^o$C

$T_J = 25^o$C

$T_J = -55^o$C
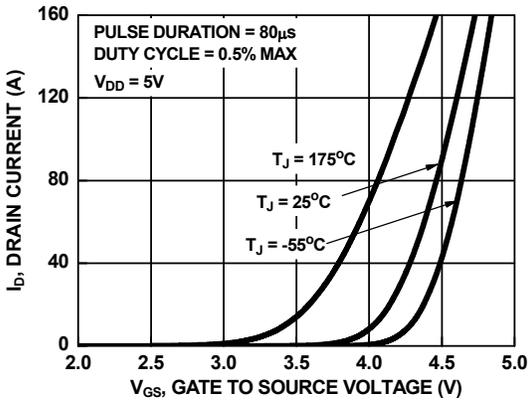
Figure 7. Transfer Characteristics

V_{GS} = 10V
V_{GS} = 5V

PULSE DURATION = 80µs
DUTY CYCLE = 0.5% MAX

V_{GS} = 4.5V

V_{GS} = 4V
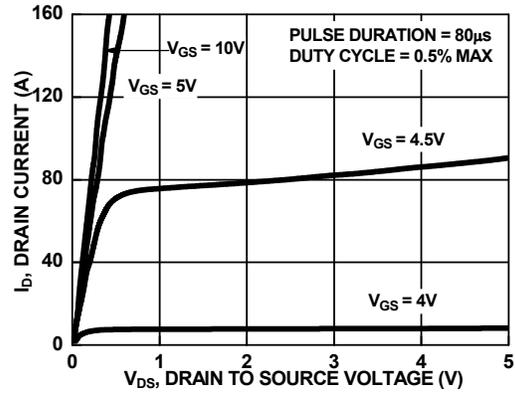
Figure 8. Saturation Characteristics

PULSE DURATION = 80µs
DUTY CYCLE = 0.5% MAX

$T_J = 175^o$C

$T_J = 25^o$C
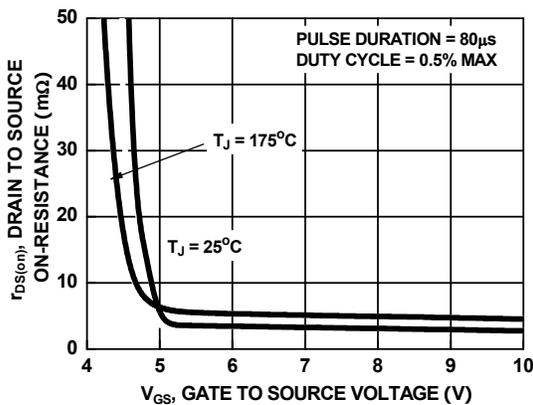
Figure 9. Drain to Source On-Resistance Variation vs Gate to Source Voltage

PULSE DURATION = 80µs
DUTY CYCLE = 0.5% MAX

I_D = 80A
V_{GS} = 10V
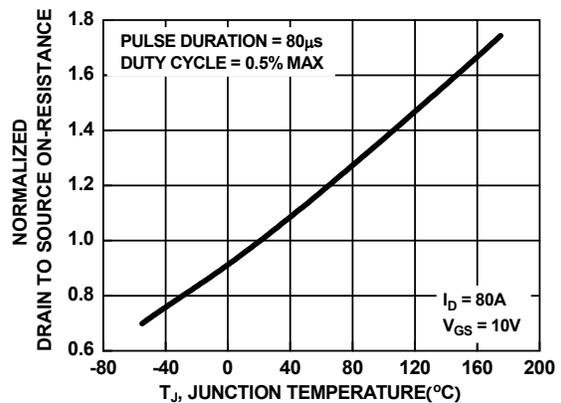
Figure 10. Normalized Drain to Source On Resistance vs Junction Temperature

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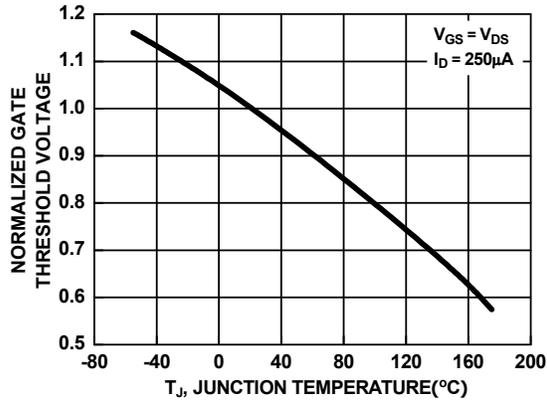
Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature
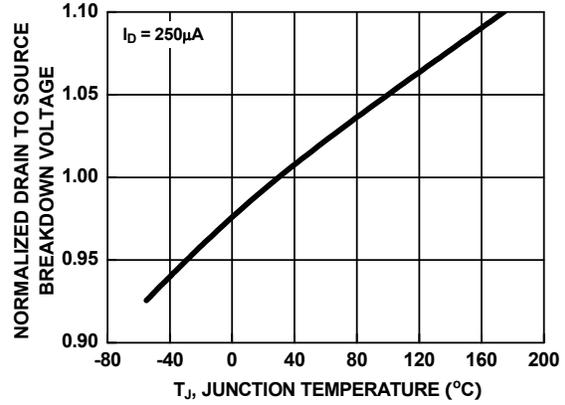
Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature
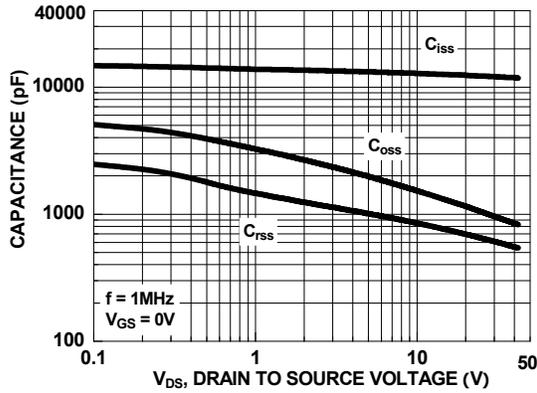
Figure 13. Capacitance vs Drain to Source Voltage
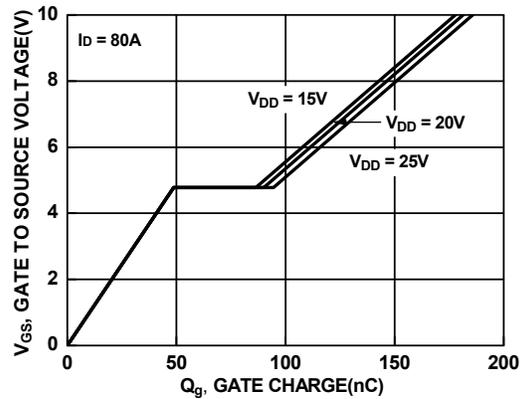
Figure 14. Gate Charge vs Gate to Source Voltage

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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.

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