FAIRCHILD SEMICONDUCTOR®

December 2012

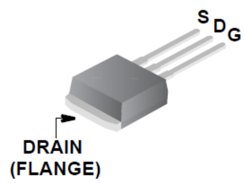
FDI9406_F085

N-Channel Power Trench® MOSFET

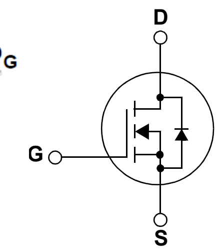
40V, 110A, 2.2mΩ

Features

- Typ $r_{DS(on)}$ = 1.73mΩ at V_{GS} = 10V, I_D = 80A
- Typ $Q_{g(tot)}$ = 107nC at V_{GS} = 10V, I_D = 80A
- UIS Capability
- RoHS Compliant
- Qualified to AEC Q101



TO-262AB
FDI SERIES



Applications

- Automotive Engine Control
- Powertrain Management
- Solenoid and Motor Drivers
- Electronic Steering
- Integrated Starter/alternator
- Distributed Power Architectures and VRM
- Primary Switch for 12V Systems

MOSFET Maximum Ratings T_J = 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}=10) (Note 1)	T_C = 25°C	110	A
	Pulsed Drain Current	T_C = 25°C	See Figure4	
E_{AS}	Single Pulse Avalanche Energy	(Note 2)	172	mJ
P_D	Power Dissipation		176	W
	Derate above 25°C		1.18	W/°C
T_J, T_{STG}	Operating and Storage Temperature		-55 to + 175	°C
$R_{\theta JC}$	Thermal Resistance Junction to Case		0.85	°C/W
$R_{\theta JA}$	Maximum Thermal Resistance Junction to Ambient	(Note 3)	43	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDI9406	FDI9406_F085	TO-262AB	Tube	N/A	50 units

Notes:
1: Current is limited by bondwire configuration.
2: Starting T_J = 25°C, L = 0.04mH, I_{AS} = 88A, V_{DD} = 40V during inductor charging and V_{DD} = 0V during time in avalanche
3: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$is determined by the user's board design. The maximum rating presented here is based on mounting on a 1 in^2 pad of 2oz copper.

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}	Drain to Source Leakage Current	V_{DS}=40V, V_{GS} = 0V	T_J = 25°C	-	-	1	μA
			T_J = 175°C(Note 4)	-	-	1	mA
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		2.0	2.83	4.0	V
$r_{DS(on)}$	Drain to Source On Resistance	I_D = 80A, V_{GS}= 10V	T_J = 25°C	-	1.73	2.2	mΩ
			T_J = 175°C(Note 4)	-	2.86	3.2	mΩ

Dynamic Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz		-	7710	-	pF
C_{oss}	Output Capacitance			-	2015	-	pF
C_{rss}	Reverse Transfer Capacitance			-	102	-	pF
R_g	Gate Resistance	f = 1MHz		-	2.1	-	Ω
$Q_{g(ToT)}$	Total Gate Charge at 10V	V_{GS} = 0 to 10V	V_{DD} = 32V I_D = 80A	-	107	138	nC
$Q_{g(th)}$	Total Gate Charge at 5V	V_{GS} = 0 to 2V		-	14	19	nC
Q_{gs}	Gate to Source Gate Charge			-	33	-	nC
Q_{gd}	Gate to Drain "Miller" Charge			-	18	-	nC

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
t_{on}	Turn-On Time	V_{DD} = 20V, I_D = 80A, V_{GS} = 10V, R_{GEN} = 6Ω	-	-	107	ns
$t_{d(on)}$	Turn-On Delay Time		-	28	-	ns
t_r	Rise Time		-	48	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	50	-	ns
t_f	Fall Time		-	20	-	ns
t_{off}	Turn-Off Time		-	-	100	ns

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Voltage	I_{SD} = 80A, V_{GS} = 0V	-	-	1.25	V
T_{rr}	Reverse Recovery Time	I_F = 80A, dI_{SD}/dt = 100A/μs, V_{DD}=32V	-	81	92	ns
Q_{rr}	Reverse Recovery Charge		-	109	140	nC

Notes:

4: The maximum value is specified by design at TJ = 175°C. Product is not tested to this condition in production.

Typical Characteristics

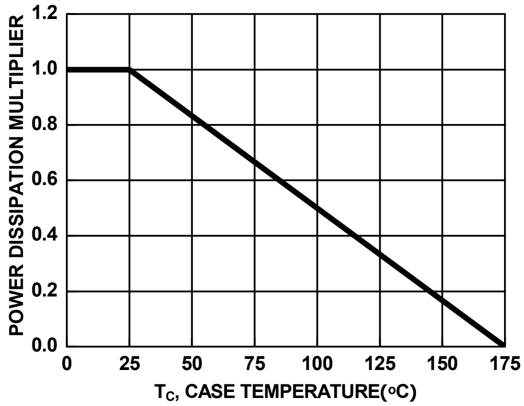


Figure 1. Normalized Power Dissipation vs Case Temperature

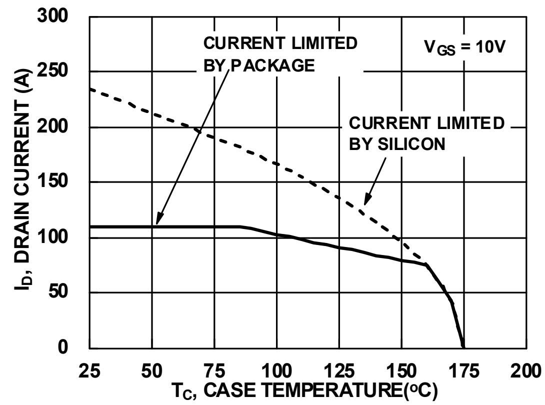


Figure 2. Maximum Continuous Drain Current vs Case Temperature

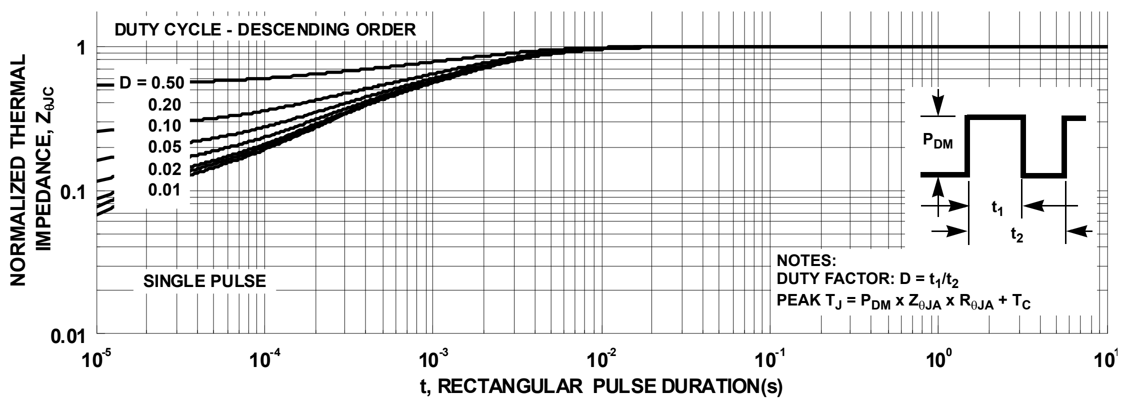


Figure 3. Normalized Maximum Transient Thermal Impedance

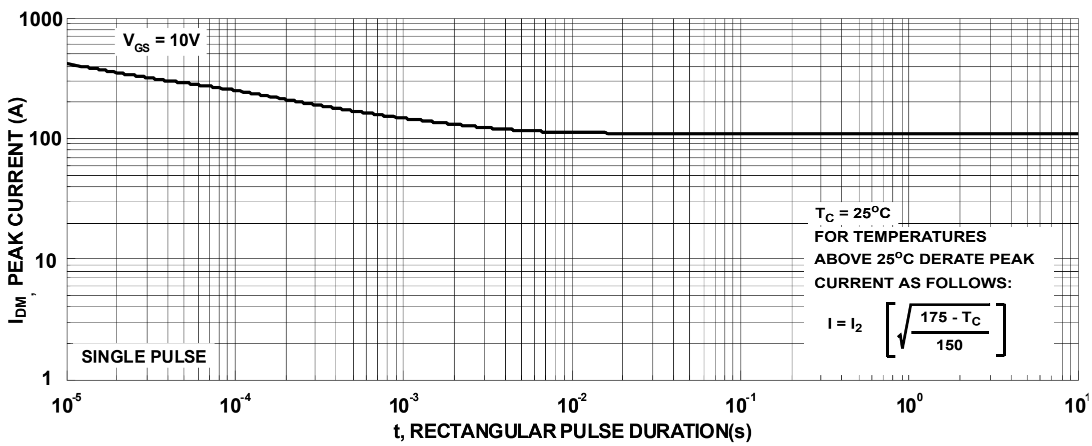


Figure 4. Peak Current Capability

Typical Characteristics

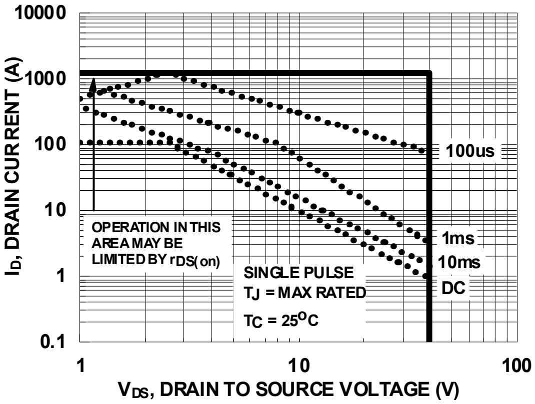
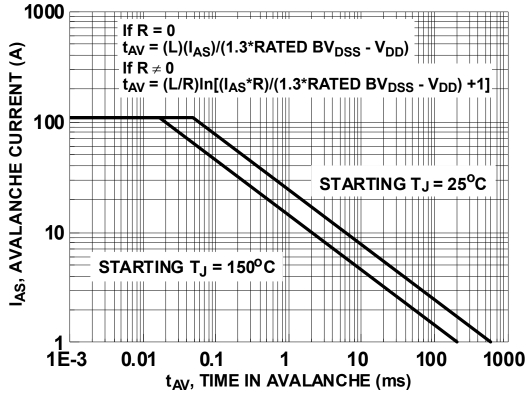


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to Fairchild Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

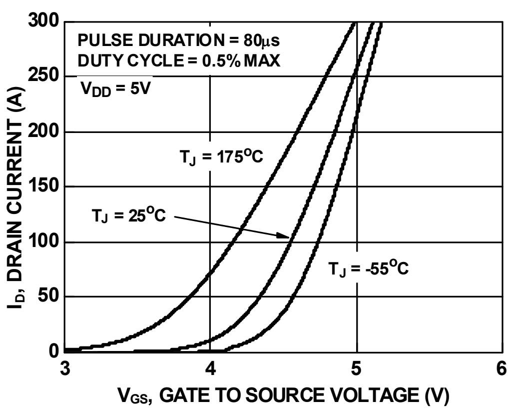


Figure 7. Transfer Characteristics

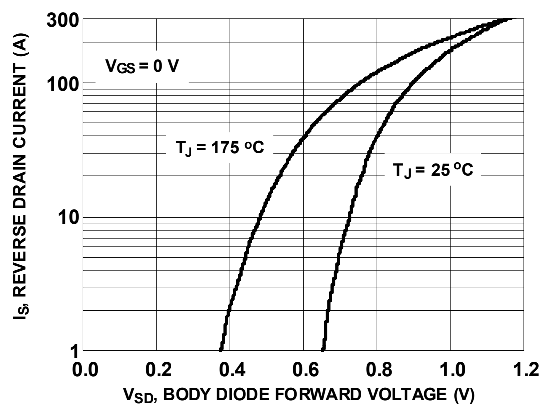


Figure 8. Forward Diode Characteristics

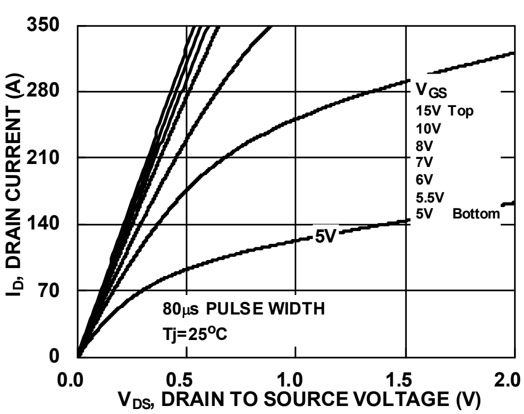


Figure 9. Saturation Characteristics

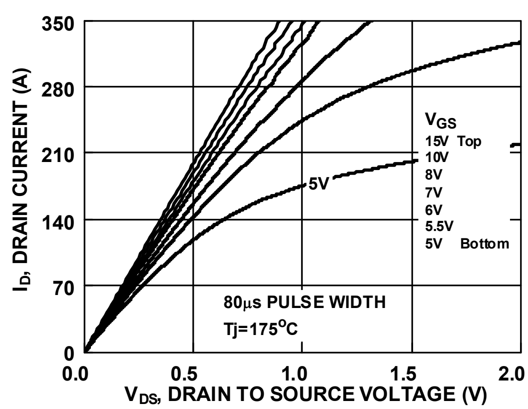


Figure 10. Saturation Characteristics

Typical Characteristics

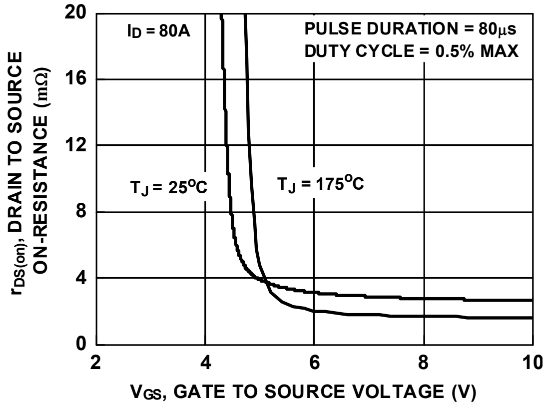


Figure 11. Rdson vs Gate Voltage

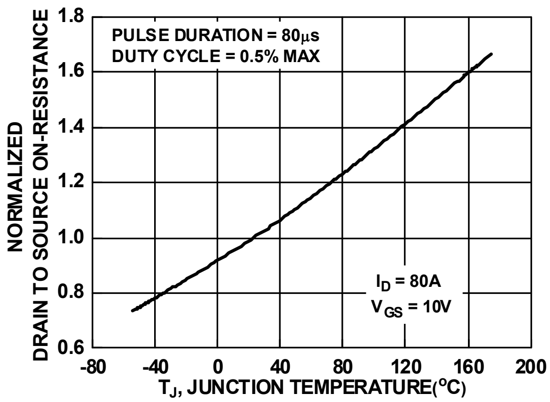


Figure 12. Normalized Rdson vs Junction Temperature

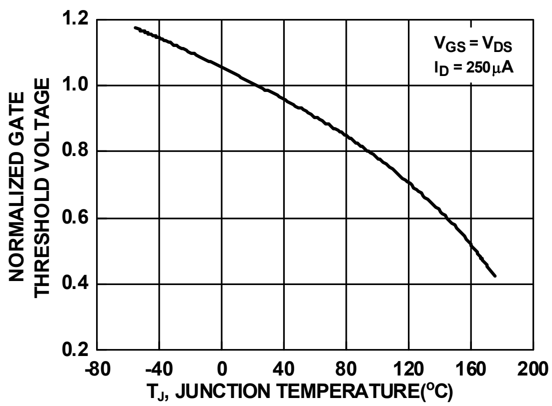


Figure 13. Normalized Gate Threshold Voltage vs Temperature

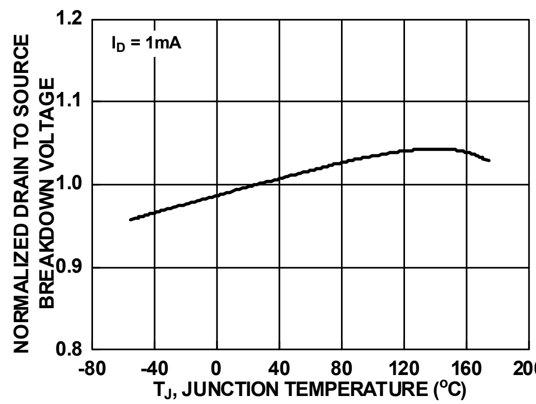


Figure 14. Normalized Drain to Source Breakdown Voltage vs Junction Temperature

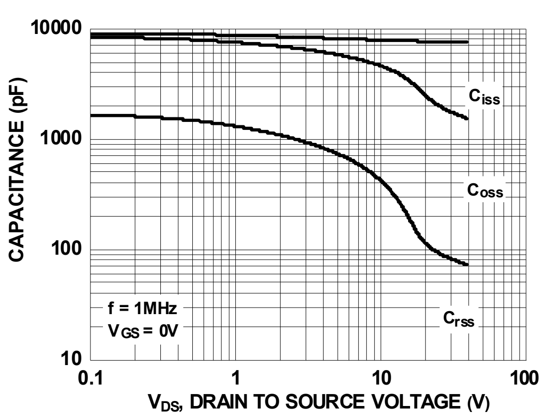


Figure 15. Capacitance vs Drain to Source Voltage

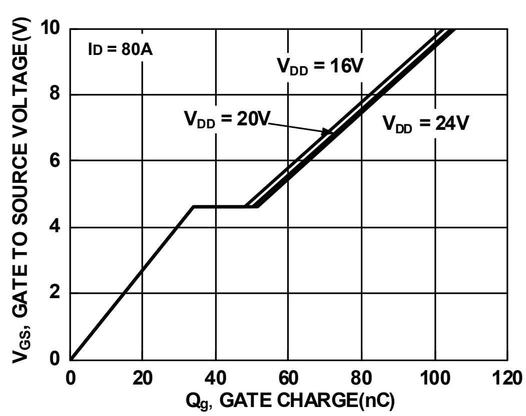


Figure 16. Gate Charge vs Gate to Source Voltage

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