FAIRCHILD

March 2015

FDD8778/FDU8778
N-Channel PowerTrench® MOSFET
25V, 35A, 14mΩ

Features

- Max $r_{DS(on)}$ = 14.0mΩ at V_{GS} = 10V, I_D = 35A
- Max $r_{DS(on)}$ = 21.0mΩ at V_{GS} = 4.5V, I_D = 33A
- Low gate charge: $Q_{g(TOT)}$ = 12.6nC(Typ), V_{GS} = 10V
- Low gate resistance
- RoHS compliant

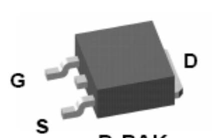
LEAD-FREE IMPLEMENTATION

General Description

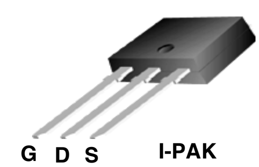
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(on)}$ and fast switching speed.

Application

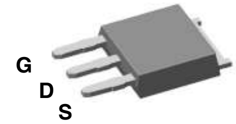
- DC-DC for Desktop Computers and Servers
- VRM for Intermediate Bus Architecture



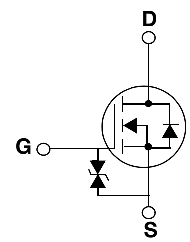
D-PAK
(TO-252)



I-PAK
(TO-251AA)



Short Lead I-PAK



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DS}	Drain to Source Voltage		25	V
V_{GS}	Gate to Source Voltage		±20	V
I_D	Drain Current -Continuous (Package Limited)		35	A
	-Continuous (Die Limited)		40	
	-Pulsed	(Note 1)	145	
E_{AS}	Single Pulse Avalanche Energy	(Note 2)	24	mJ
P_D	Power Dissipation		39	W
T_J, T_{STG}	Operating and Storage Temperature		-55 to 175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case TO-252,TO-251	3.8	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient TO-252,TO-251	100	°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
FDD8778	FDD8778	TO-252AA	13”	16mm	2500 units
FDU8778	FDU8778	TO-251AA	N/A(Tube)	N/A	75 units
FDU8778	FDU8778_F071	TO-251AA	N/A(Tube)	N/A	75 units

Electrical Characteristics T_J = 25°C unless otherwise noted

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V	25			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C		17.2		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 20V, V_{GS} = 0V			1	μA
		V_{DS} = 20V, V_{GS} = 0V, T_J = 150°C			250	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20V			±10	μA

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	1.2	1.5	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C		-5.3		mV/°C
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 10V, I_D = 35A		11.6	14.0	mΩ
		V_{GS} = 4.5V, I_D = 33A		15.7	21.0	mΩ
		V_{GS} = 10V, I_D = 35A, T_J = 175°C		18.2	23.8	mΩ

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 13V, V_{GS} = 0V, f = 1MHz		635	845	pF
C_{oss}	Output Capacitance			160	215	pF
C_{rss}	Reverse Transfer Capacitance			108	162	pF
R_g	Gate Resistance	f = 1MHz		1.3		Ω

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 13V, I_D = 35A, V_{GS} = 10V, R_{GS} = 27Ω		6	12	ns
t_r	Rise Time			22	35	ns
$t_{d(off)}$	Turn-Off Delay Time			43	69	ns
t_f	Fall Time			32	51	ns
$Q_{g(TOT)}$	Total Gate Charge at 10V	V_{GS} = 0V to 10V; V_{DD} = 13V, I_D = 35A, I_g = 1.0mA		12.6	18	nC
$Q_{g(5)}$	Total Gate Charge at 5V	V_{GS} = 0V to 5V		6.7	9.4	nC
Q_{gs}	Gate to Source Gate Charge			2.1		nC
Q_{gd}	Gate to Drain "Miller"Charge			3.2		nC

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = 35A		1.03	1.25	V
		V_{GS} = 0V, I_S = 15A		0.89	1.2	V
t_{rr}	Reverse Recovery Time	I_F = 35A, di/dt = 100A/μs		25	38	ns
Q_{rr}	Reverse Recovery Charge	I_F = 35A, di/dt = 100A/μs		17	26	nC

Notes:
1: Pulse time < 300μs, Duty cycle = 2%.
2: Starting T_J = 25°C, L = 0.1mH, I_{AS} = 22A, V_{DD} = 23V, V_{GS} = 10V.

Typical Characteristics T_J = 25°C unless otherwise noted

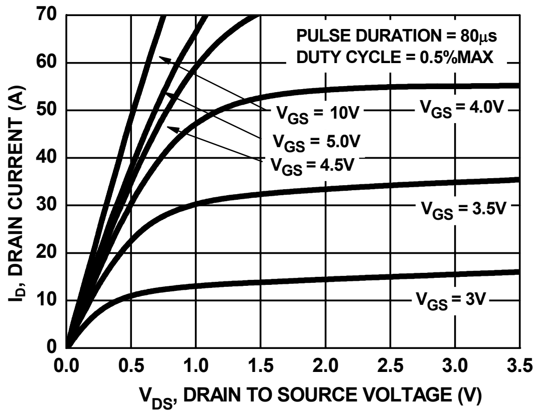


Figure 1. On Region Characteristics

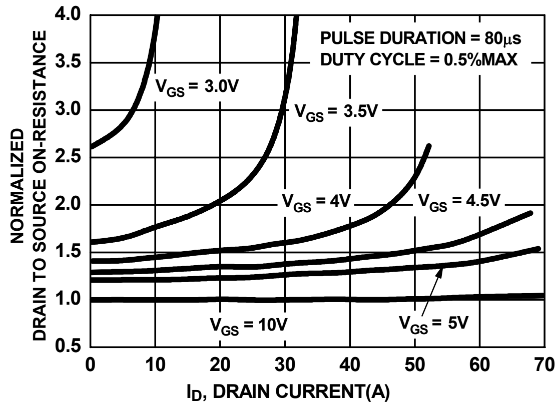


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

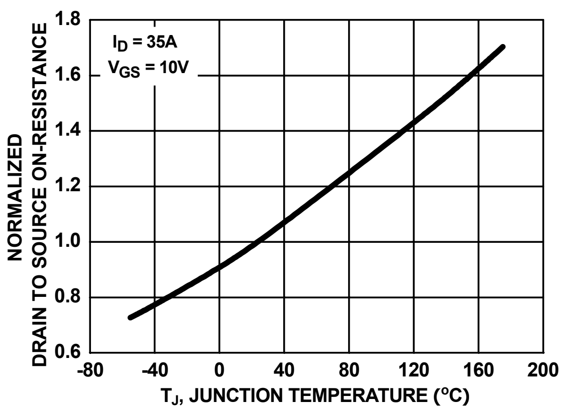


Figure 3. Normalized On Resistance vs Junction Temperature

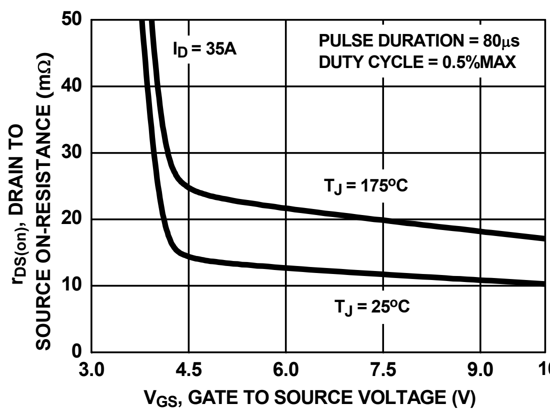


Figure 4. On-Resistance vs Gate to Source Voltage

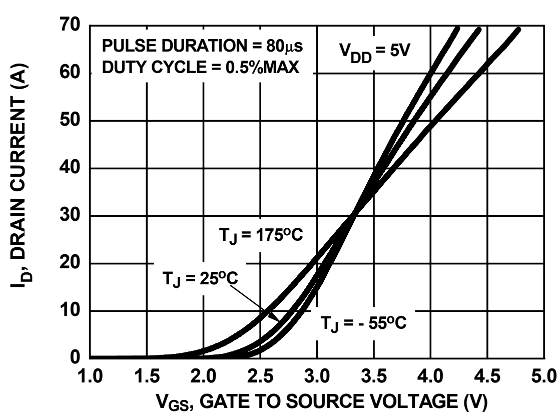


Figure 5. Transfer Characteristics

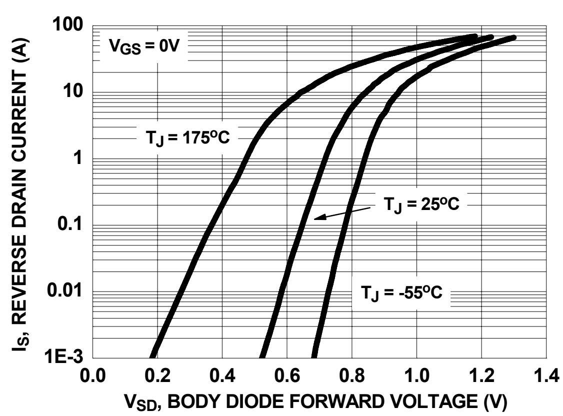


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25°C$ unless otherwise noted

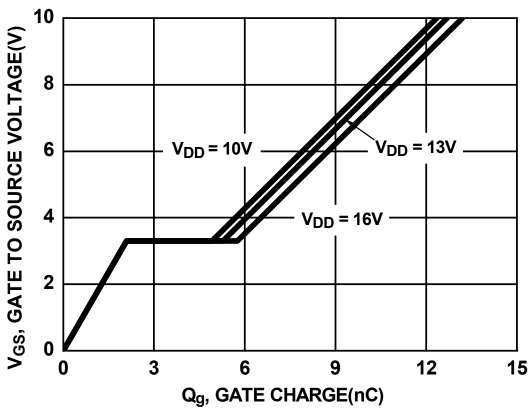


Figure 7. Gate Charge Characteristics

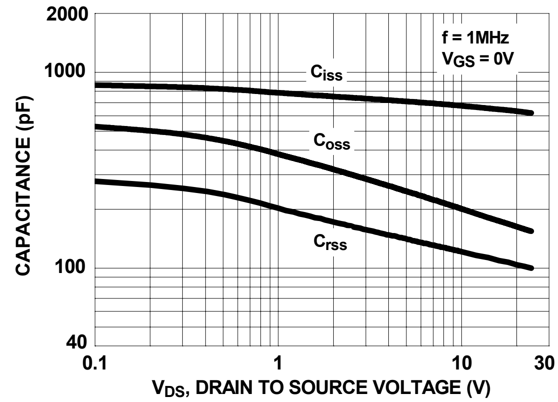


Figure 8. Capacitance vs Drain to Source Voltage

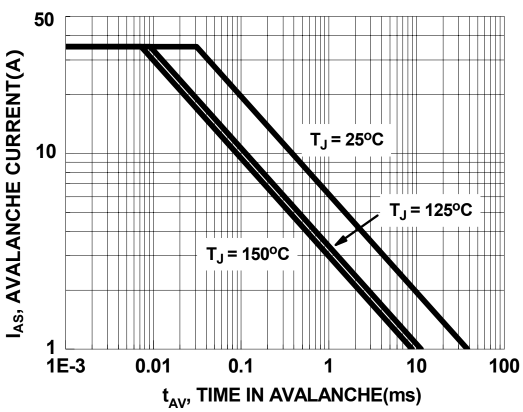


Figure 9. Unclamped Inductive Switching Capability

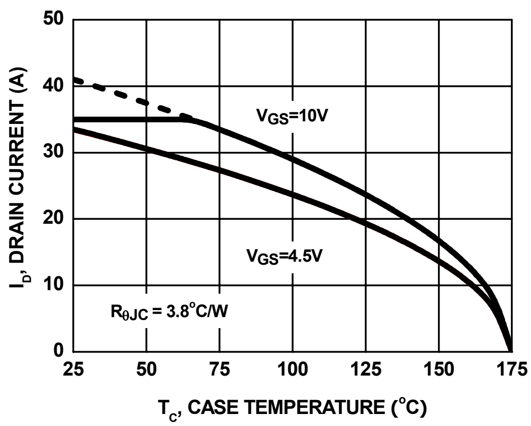


Figure 10. Maximum Continuous Drain Current vs Case Temperature

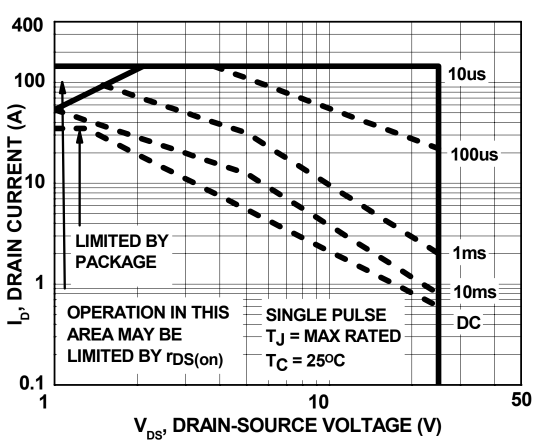


Figure 11. Forward Bias Safe Operating Area

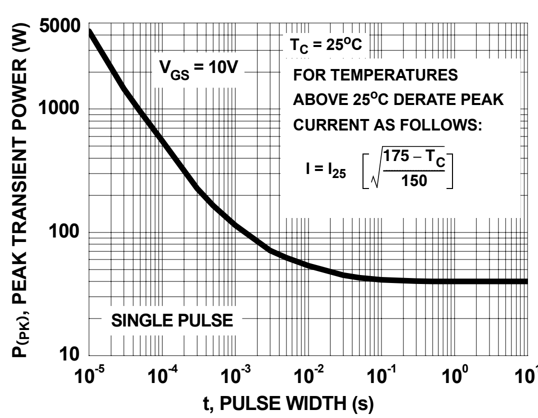


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25°C unless otherwise noted

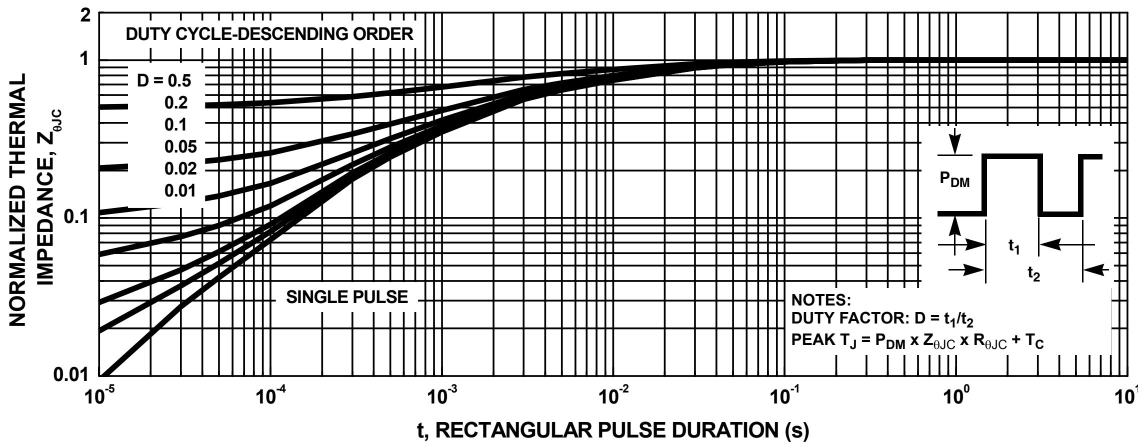
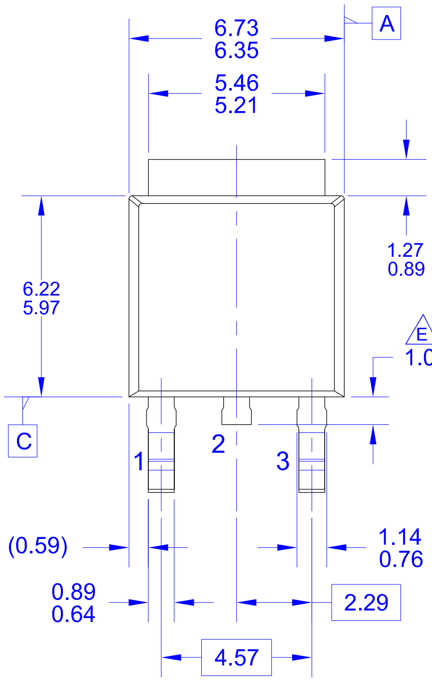
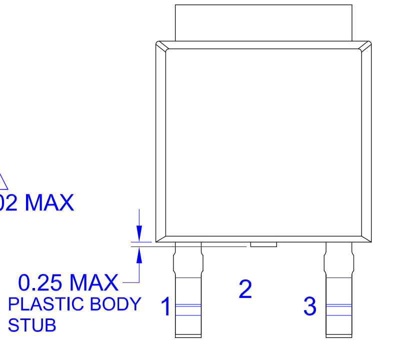


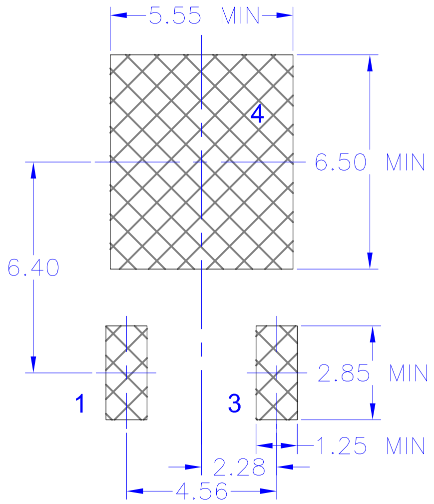
Figure 13. Transient Thermal Response Curve



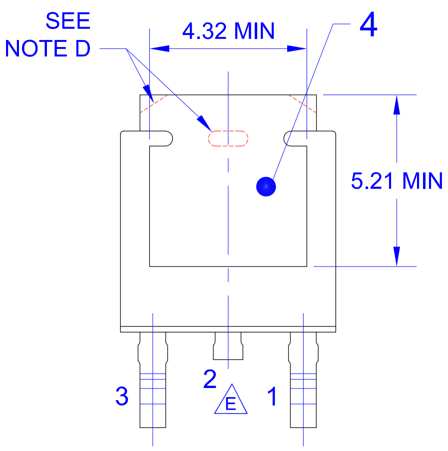
NON-DIODE PRODUCTS VERSION



DIODE PRODUCTS VERSION



LAND PATTERN RECOMMENDATION



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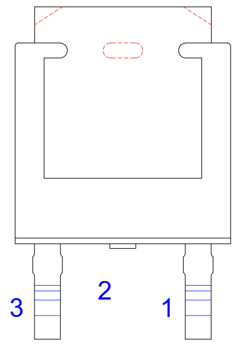
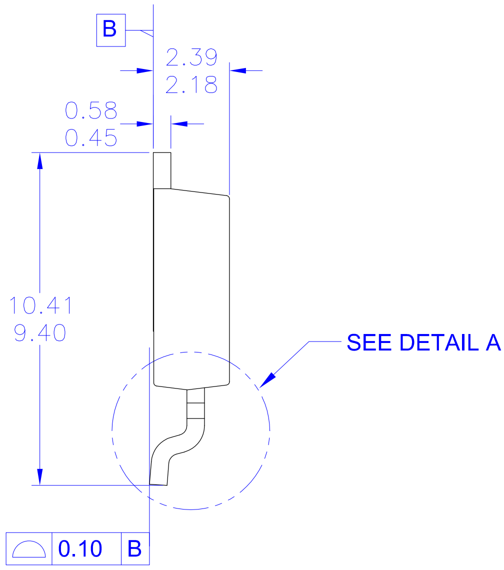


DIODE PRODUCTS VERSION



NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.

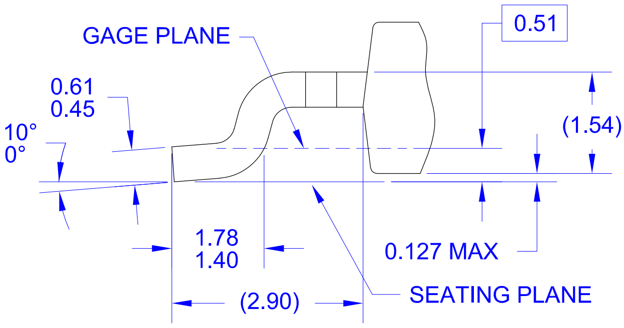
D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.

E) TRIMMED CENTER LEAD IS PRESENT ONLY FOR DIODE PRODUCTS

F) DIMENSIONS ARE EXCLUSSIVE OF BURSS, MOLD FLASH AND TIE BAR EXTRUSIONS.

G) LAND PATTERN RECOMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.

H) DRAWING NUMBER AND REVISION: MKT-TO252A03REV10



DETAIL A
(ROTATED -90°)
SCALE: 12X

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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	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	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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