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March 2015

FDD86540

N-Channel PowerTrench® MOSFET
60 V, 136 A, 4.1 mΩ

Features

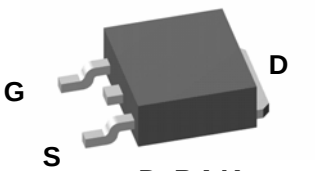
- Max $r_{DS(on)}$ = 4.1 mΩ at V_{GS} = 10 V, I_D = 21.5 A
- Max $r_{DS(on)}$ = 5 mΩ at V_{GS} = 8 V, I_D = 19.5 A
- 100% UIL tested
- RoHS Compliant

General Description

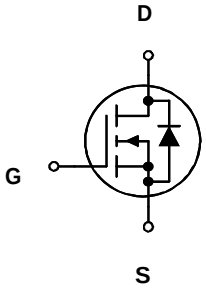
This N-Channel MOSFET has been designed specifically to improve the overall efficiency and to minimize switch node ringing of DC/DC converters using either synchronous or conventional switching PWM controllers.It has been optimized for low gate charge, low $r_{DS(on)}$, fast switching speed and body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

Applications

- Primary Switch in isolated DC-DC
- Synchronous Rectifier
- Load Switch



D-PAK
(TO-252)



MOSFET Maximum Ratings T_C = 25 °C unless otherwise noted

Symbol	Parameter			Ratings	Units
V_{DS}	Drain to Source Voltage			60	V
V_{GS}	Gate to Source Voltage			±20	V
I_D	Drain Current -Continuous	T_C = 25 °C	(Note 5)	136	A
	-Continuous	T_C = 100 °C	(Note 5)	86	
	-Continuous	T_A = 25 °C	(Note 1a)	21.5	
	-Pulsed		(Note 4)	240	
E_{AS}	Single Pulse Avalanche Energy		(Note 3)	228	mJ
P_D	Power Dissipation	T_C = 25 °C		127	W
	Power Dissipation	T_A = 25 °C	(Note 1a)	3.1	
T_J, T_{STG}	Operating and Storage Junction Temperature Range			-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.98	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	40	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD86540	FDD86540	D-PAK(TO-252)	13 ”	16 mm	2500 units

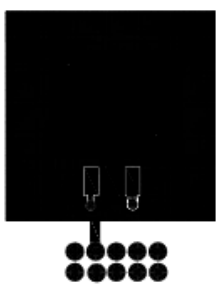
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Electrical Characteristics T_J = 25 °C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		28		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 48 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V			±100	nA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	2	3.1	4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		-11		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 21.5 A		3.4	4.1	mΩ
		V_{GS} = 8 V, I_D = 19.5 A		4.1	5	
		V_{GS} = 10 V, I_D = 21.5 A, T_J = 125 °C		5.2	6.3	
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 21.5 A		75		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 30 V, V_{GS} = 0 V, f = 1 MHz		4767	6340	pF
C_{oss}	Output Capacitance			1409	1880	pF
C_{rss}	Reverse Transfer Capacitance			48	90	pF
R_g	Gate Resistance			0.6		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 30 V, I_D = 21.5 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		26	42	ns
t_r	Rise Time			15	28	ns
$t_{d(off)}$	Turn-Off Delay Time			31	49	ns
t_f	Fall Time			6.9	14	ns
Q_g	Total Gate Charge	V_{GS} = 0 V to 10 V; V_{DD} = 30 V, I_D = 21.5 A		65	90	nC
Q_g	Total Gate Charge	V_{GS} = 0 V to 8 V; V_{DD} = 30 V, I_D = 21.5 A		54	75	nC
Q_{gs}	Gate to Source Charge	V_{DD} = 30 V, I_D = 21.5 A		23		nC
Q_{gd}	Gate to Drain “Miller” Charge	V_{DD} = 30 V, I_D = 21.5 A		12		nC
Drain-Source Diode Characteristics						
V_{SD}	Source-Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 21.5 A (Note 2)		0.8	1.3	V
		V_{GS} = 0 V, I_S = 2.6 A (Note 2)		0.7	1.2	V
t_{rr}	Reverse Recovery Time	I_F = 21.5 A, di/dt = 100 A/μs		56	90	ns
Q_{rr}	Reverse Recovery Charge			43	69	nC

Notes:

1: $R_{\theta JA}$ 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. $R_{\theta JA}$ is determined by the user’s board design.



a) 40 °C/W when mounted on a 1 in^2 pad of 2 oz copper



b) 96 °C/W when mounted on a minimum pad

2: Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
3: Starting T_J = 25 °C, L = 0.3 mH, I_{AS} = 39 A, V_{DD} = 54 V, V_{GS} = 10 V.
4: Pulsed Id please refer to Fig 11 SOA graph for more details.
5: Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

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Typical Characteristics T_J = 25 °C unless otherwise noted

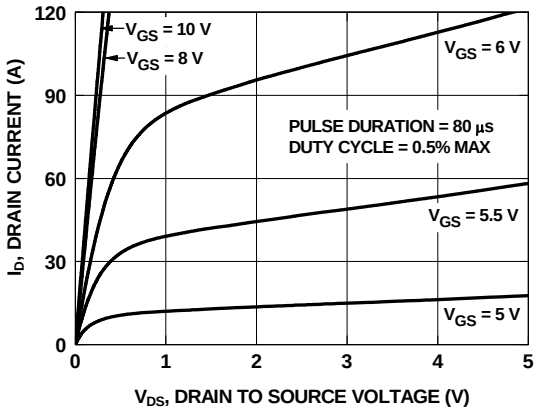


Figure 1. On-Region Characteristics

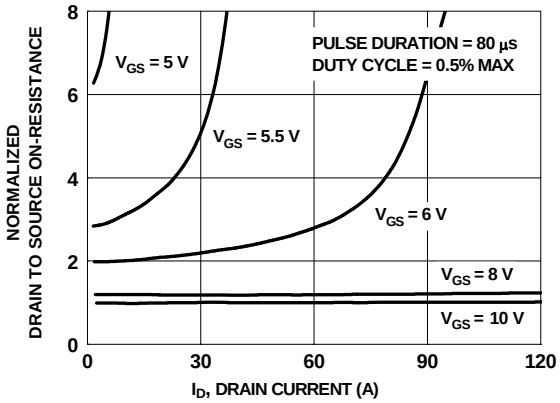


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

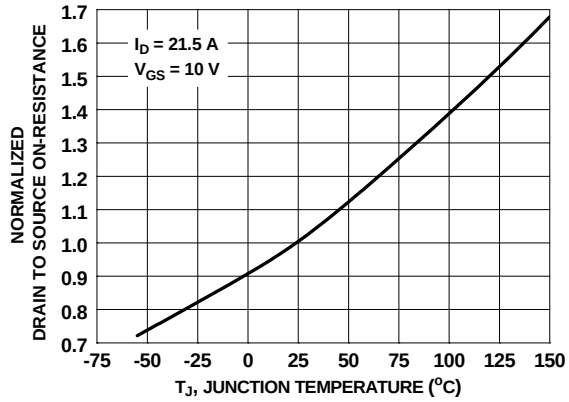


Figure 3. Normalized On-Resistance vs Junction Temperature

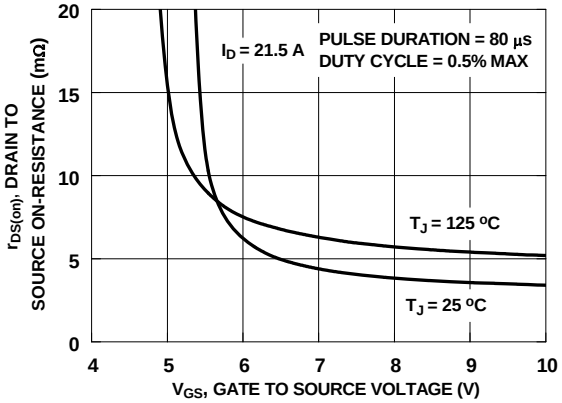


Figure 4. On-Resistance vs Gate to Source Voltage

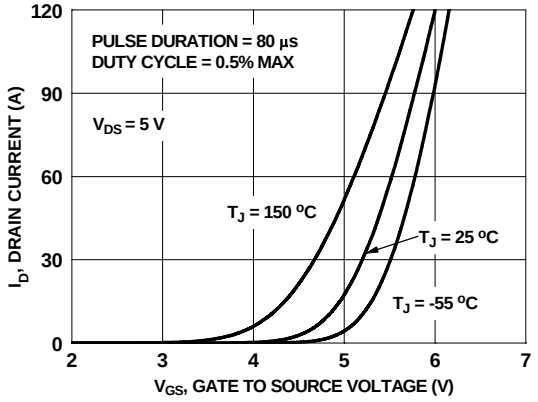


Figure 5. Transfer Characteristics

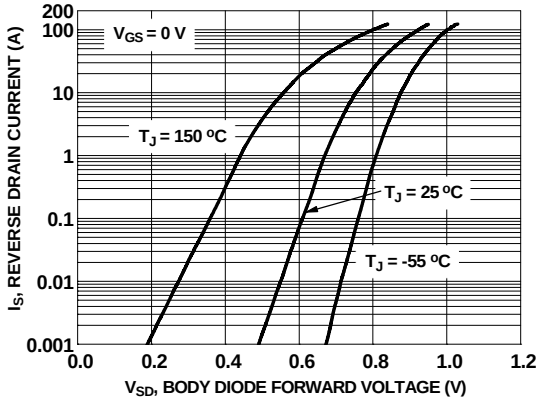


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25 °C unless otherwise noted

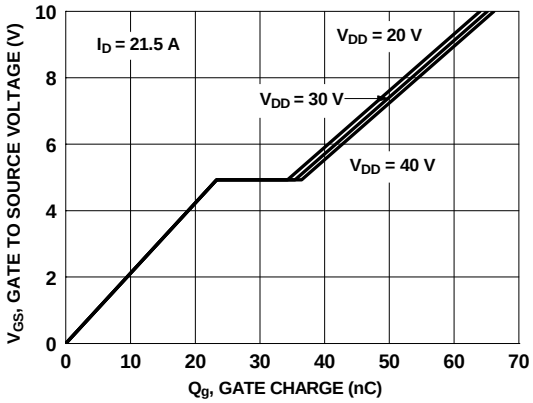


Figure 7. Gate Charge Characteristics

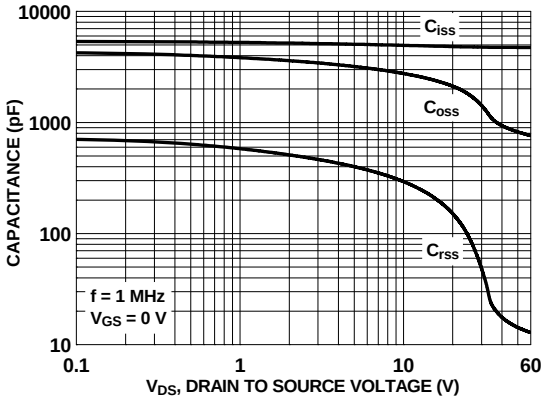


Figure 8. Capacitance vs Drain to Source Voltage

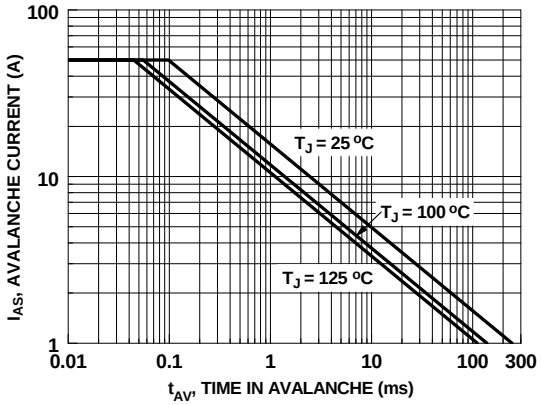


Figure 9. Unclamped Inductive Switching Capability

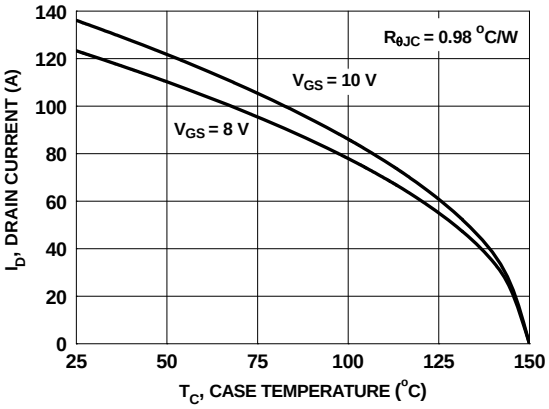


Figure 10. Maximum Continuous Drain Current vs Case Temperature

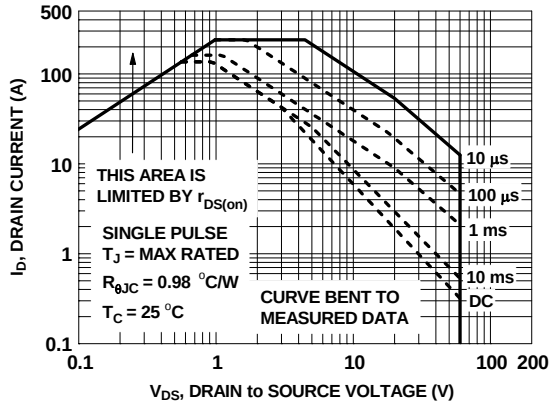


Figure 11. Forward Bias Safe Operating Area

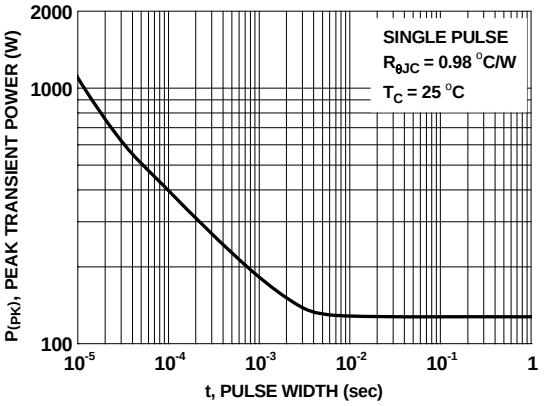


Figure 12. Single Pulse Maximum Power Dissipation

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Typical Characteristics T_J = 25 °C unless otherwise noted

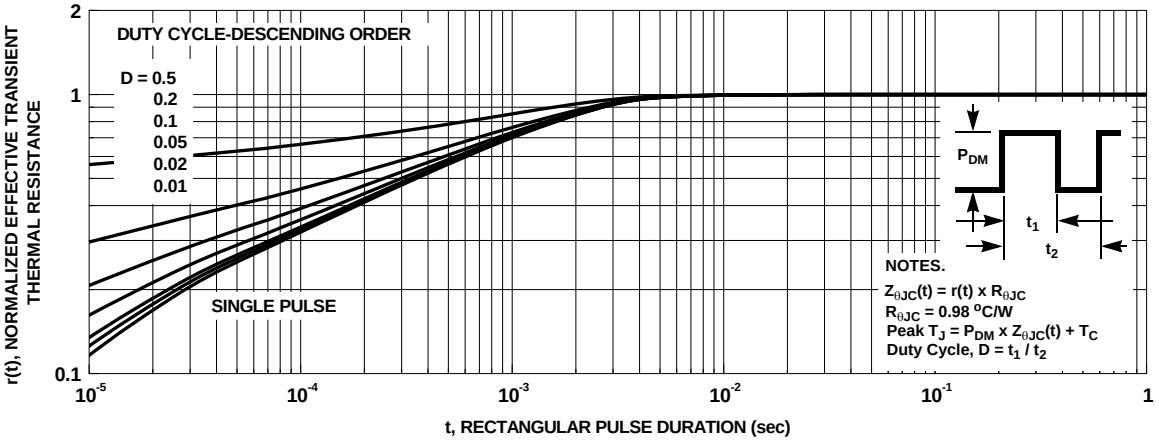
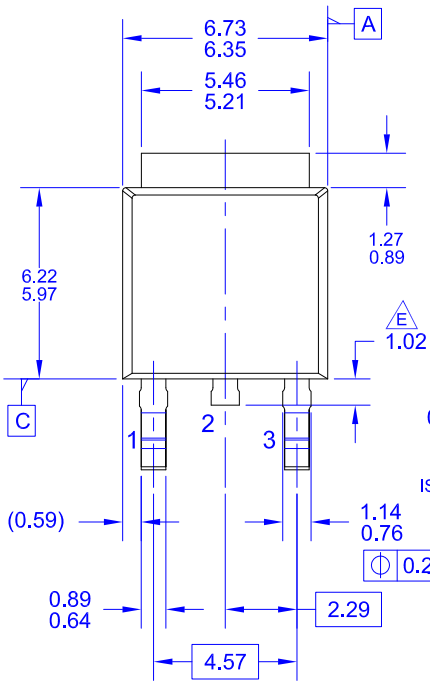
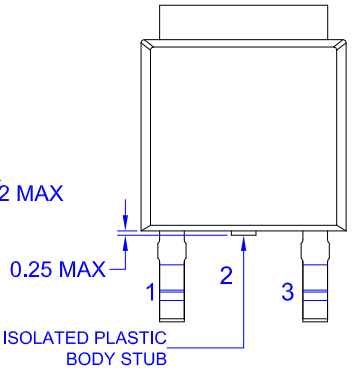


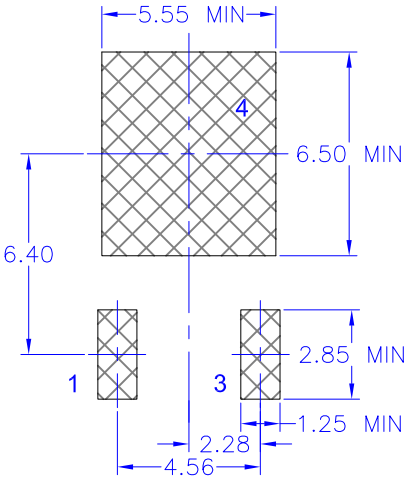
Figure 13. Junction-to-Case Transient Thermal Response Curve



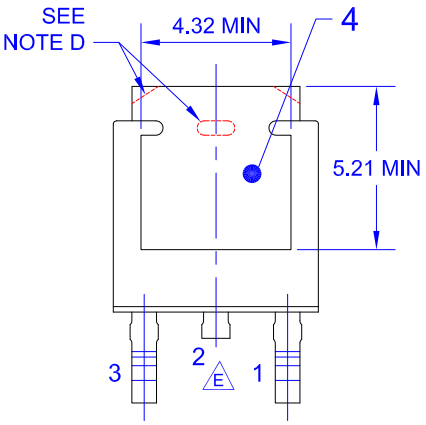
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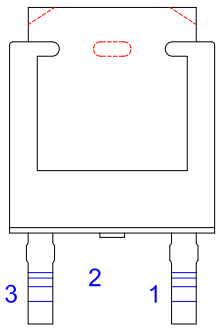
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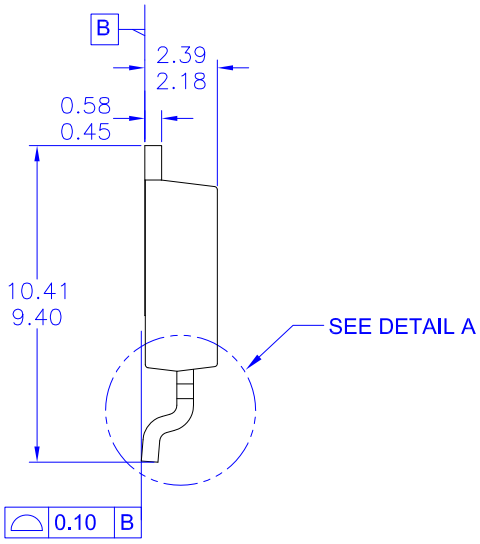
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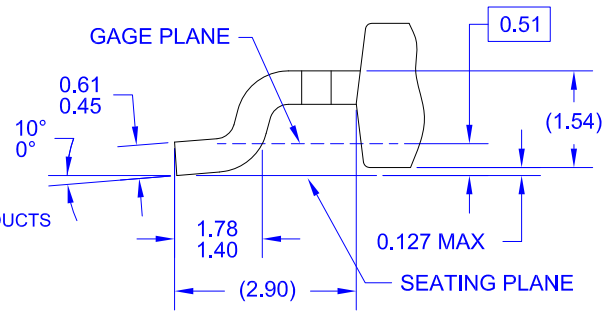


DIODE PRODUCTS VERSION



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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 METAL CENTER LEAD IS PRESENT ON FOR NON-DIODE PRODUCTS
F) DIMENSIONS ARE EXCLUSIVE OF BURS, MOLD FLASH AND TIE BAR EXTRUSIONS.
G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.
H) DRAWING NUMBER AND REVISION: MKT-TO252A03REV11



DETAIL A
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