

# FDMC8588

## N-Channel PowerTrench® MOSFET 25 V, 40 A, 5.7 mΩ

### Features

- Max  $r_{DS(on)}$  = 5.7 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 16.5$  A
- State-of-the-art switching performance
- Lower output capacitance, gate resistance, and gate charge boost efficiency
- Shielded gate technology reduces switch node ringing and increases immunity to EMI and cross conduction
- RoHS Compliant

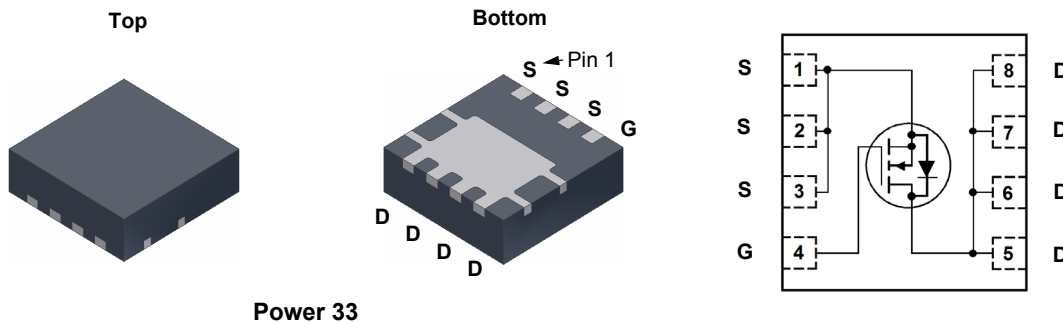


### General Description

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

- High side switching for high end computing
- High power density DC-DC synchronous buck converter



Power 33

### MOSFET Maximum Ratings $T_A = 25$ °C unless otherwise noted

Symbol	Parameter	Notes	Rated	Units
$V_{DS}$	Drain to Source Voltage	(Note 5)	25	V
$V_{GS}$	Gate to Source Voltage	(Note 4)	±12	V
$I_D$	Drain Current - Continuous (Package limited) $T_C = 25$ °C		40	A
	- Continuous (Silicon Limited) $T_C = 25$ °C		59	
	- Continuous	(Note 1a)	16.5	
	- Pulsed		60	
$E_{AS}$	Single Pulse Avalanche Energy	(Note 3)	29	mJ
$P_D$	Power Dissipation	$T_C = 25$ °C	26	W
	Power Dissipation	$T_A = 25$ °C (Note 1a)	2.4	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range		-55 to +150	°C

### Thermal Characteristics

Symbol	Parameter	Notes	Rated	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	$T_C = 25$ °C	4.7	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	$T_A = 25$ °C (Note 1a)	53	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
08OD	FDMC8588	Power 33	13 "	12 mm	3000 units

## Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	25			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		17		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 20\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current, Forward	$V_{GS} = 12\text{ V}$ , $V_{DS} = 0\text{ V}$			100	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	0.8	1.4	1.8	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-4		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 17\text{ A}$		3.5	5.0	m $\Omega$
		$V_{GS} = 4.5\text{ V}$ , $I_D = 16.5\text{ A}$		4.3	5.7	
		$V_{GS} = 10\text{ V}$ , $I_D = 17\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$		4.8	6.9	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5\text{ V}$ , $I_D = 16.5\text{ A}$		85		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 13\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		1228		pF
$C_{oss}$	Output Capacitance			441		pF
$C_{rss}$	Reverse Transfer Capacitance			69		pF
$R_g$	Gate Resistance			0.5		$\Omega$

### Switching Characteristics

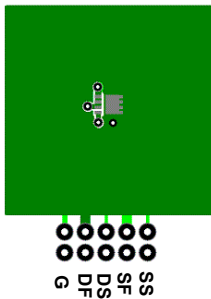
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 13\text{ V}$ , $I_D = 16.5\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		8		ns
$t_r$	Rise Time			3		ns
$t_{d(off)}$	Turn-Off Delay Time			25		ns
$t_f$	Fall Time			2		ns
$Q_{g(TOT)}$	Total Gate Charge at 4.5V	$V_{DD} = 13\text{ V}$ , $I_D = 16.5\text{ A}$		12		nC
$Q_{gs}$	Total Gate Charge			3.0		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			3.3		nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 2\text{ A}$ (Note 2)		0.7	1.2	V
		$V_{GS} = 0\text{ V}$ , $I_S = 16.5\text{ A}$ (Note 2)		0.8	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 16.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		25		ns
$Q_{rr}$	Reverse Recovery Charge			10		nC

#### Notes:

1.  $R_{\theta JA}$  is determined with the device mounted on a 1in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a. 53  $^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 125  $^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.

3.  $E_{AS}$  of 29 mJ is based on starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 1.2\text{ mH}$ ,  $I_{AS} = 7\text{ A}$ ,  $V_{DD} = 23\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% tested at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 16\text{ A}$ .

4. As an N-ch device, the negative  $V_{GS}$  rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

5. The continuous  $V_{ds}$  rating is 25V; however, a pulse of 28 V peak voltage for no longer than 3ns duration at 500KHz frequency can be applied.

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

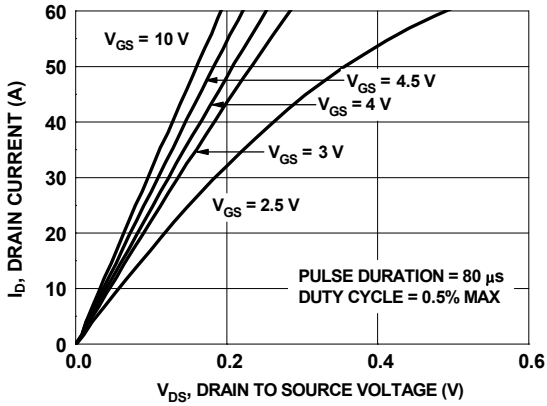


Figure 1. On Region Characteristics

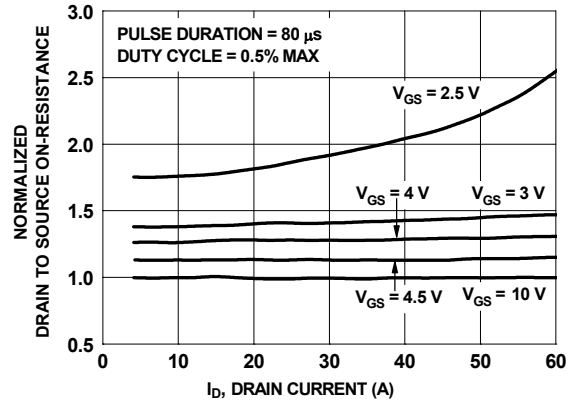


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

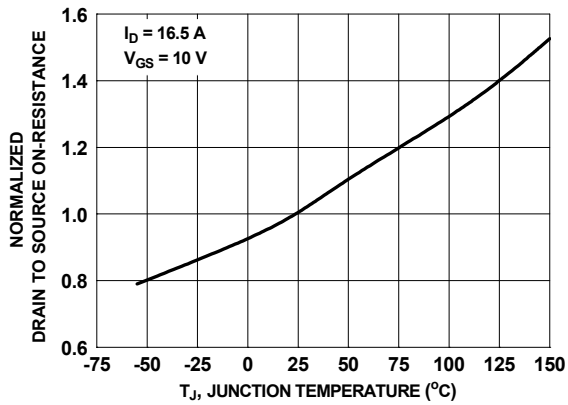


Figure 3. Normalized On Resistance vs. Junction Temperature

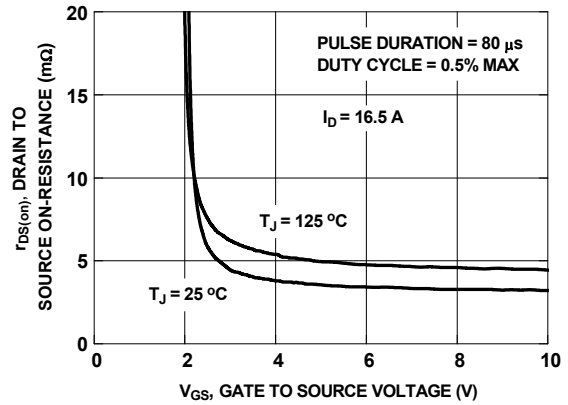


Figure 4. On-Resistance vs. Gate to Source Voltage

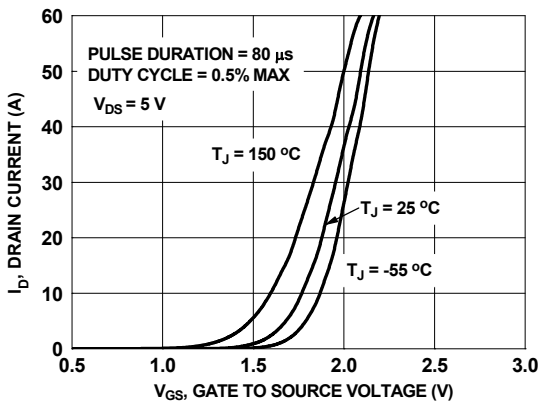


Figure 5. Transfer Characteristics

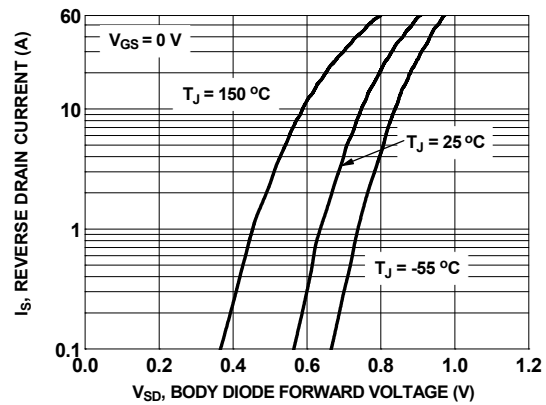
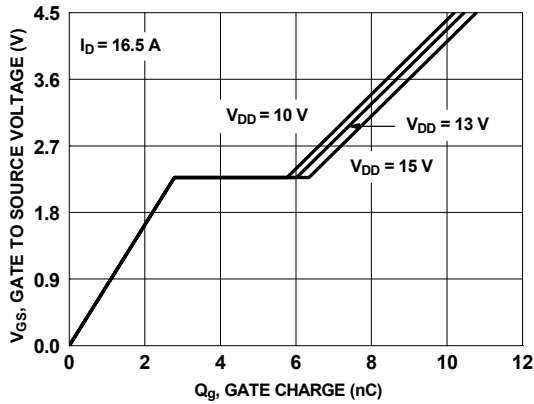
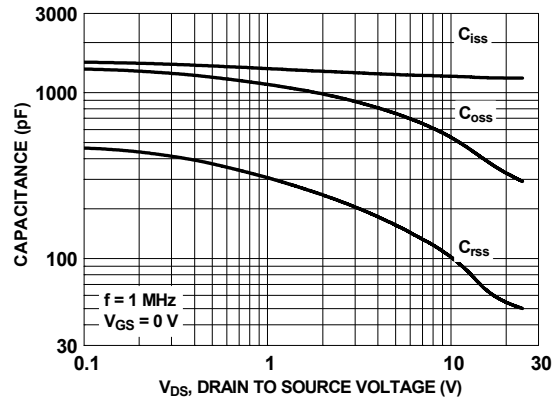


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

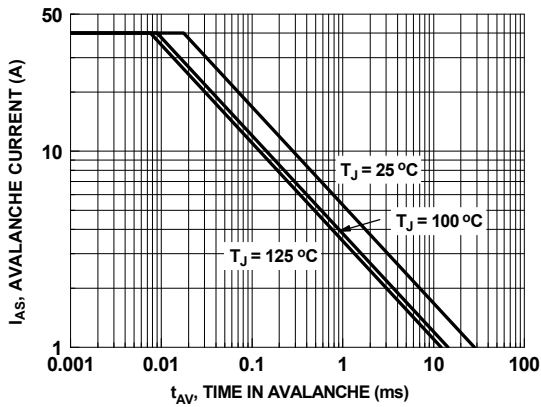
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



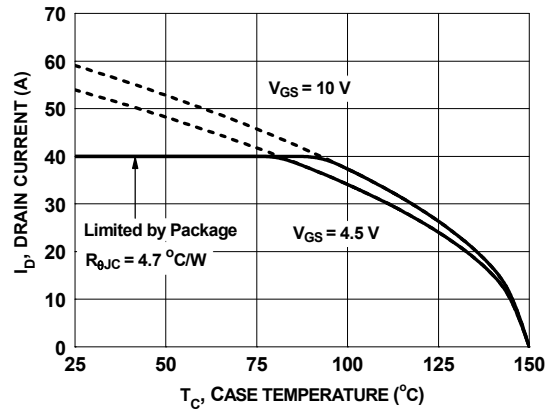
**Figure 7. Gate Charge Characteristics**



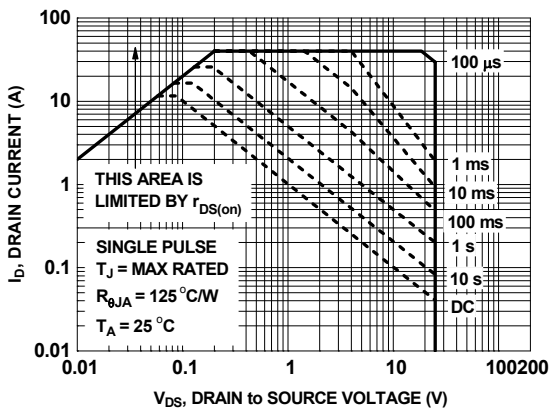
**Figure 8. Capacitance vs. Drain to Source Voltage**



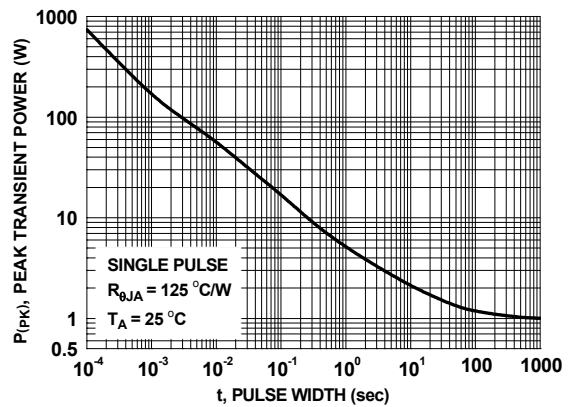
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs. Case Temperature**

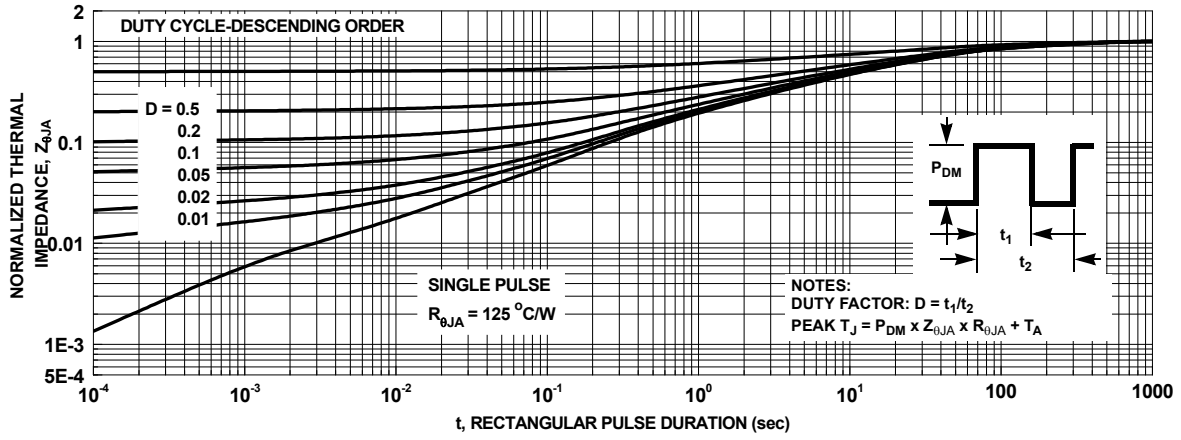


**Figure 11. Forward Bias Safe Operating Area**



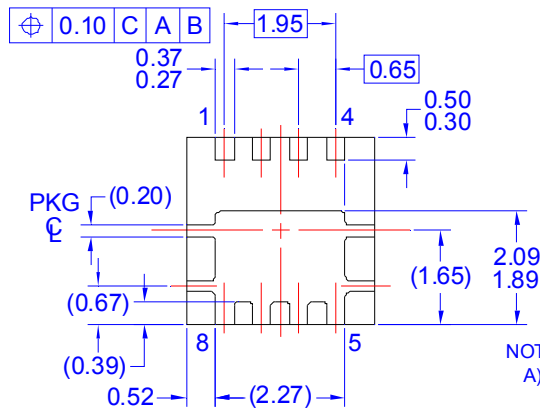
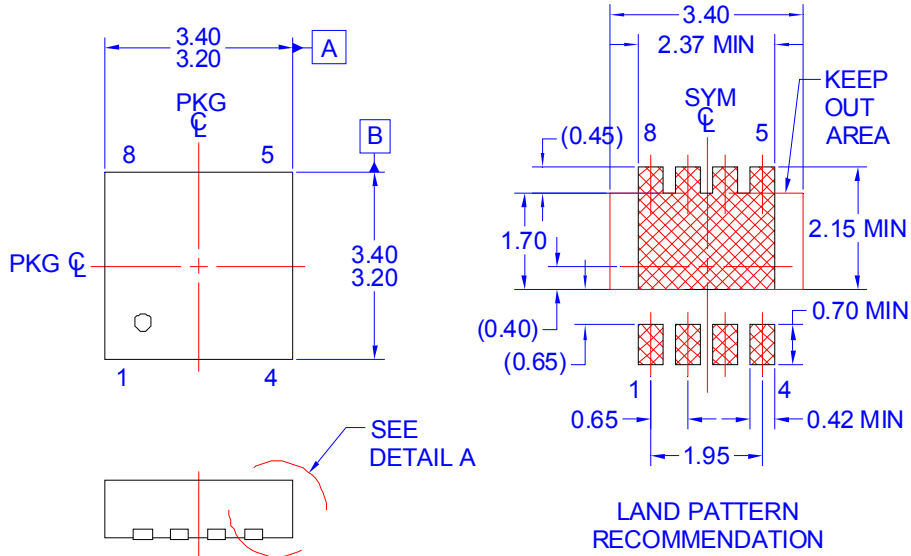
**Figure 12. Single Pulse Maximum Power Dissipation**

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

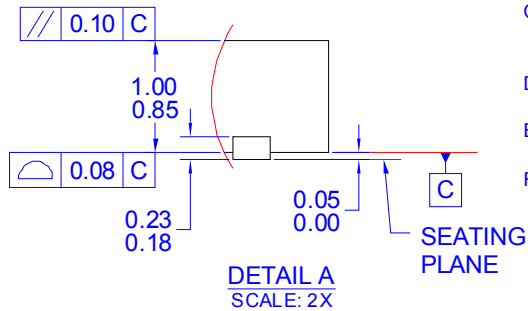


**Figure 13. Junction-to-Ambient Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout







- NOTES: UNLESS OTHERWISE SPECIFIED
- A) PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. BA, DATED OCTOBER 2002.
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
  - D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
  - E) IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.
  - F) DRAWING FILE NAME:





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| Build it Now™   | Green FPS™                                      | QS™   | TinyBuck™   |
| CorePLUS™   | Green FPS™ e-Series™                            | Quiet Series™   | TinyCalc™   |
| CorePOWER™  | Gmax™   | RapidConfigure™   | TinyLogic®  |
| CROSSVOLT™  | GTO™  | ™   | TINYOPTO™   |
| CTL™  | IntelliMAX™                                     |  | TinyPower™  |
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