



# FDMC86320

## N-Channel Power Trench<sup>®</sup> MOSFET

80 V, 22 A, 11.7 mΩ

### Features

- Max  $r_{DS(on)}$  = 11.7 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 10.7\text{ A}$
- Max  $r_{DS(on)}$  = 16 mΩ at  $V_{GS} = 8\text{ V}$ ,  $I_D = 8.5\text{ A}$
- MSL1 robust package design
- 100% UIL Tested
- RoHS Compliant

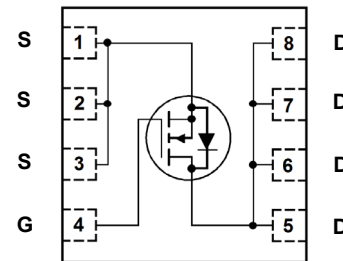
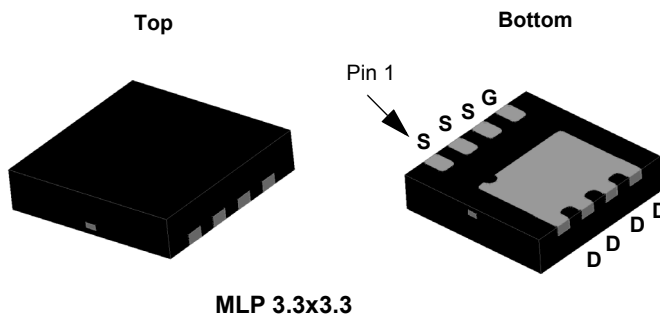


### General Description

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 DC-DC Switch
- Motor Bridge Switch
- Synchronous Rectifier



### MOSFET Maximum Ratings $T_A = 25\text{ °C}$ unless otherwise noted

Symbol	Parameter	Rated	Units
$V_{DS}$	Drain to Source Voltage	80	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current -Continuous	$T_C = 25\text{ °C}$	A
	-Continuous	$T_A = 25\text{ °C}$ (Note 1a)	
	-Pulsed		
$E_{AS}$	Single Pulse Avalanche Energy	(Note 3)	mJ
$P_D$	Power Dissipation	$T_C = 25\text{ °C}$	W
	Power Dissipation	$T_A = 25\text{ °C}$ (Note 1a)	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.1	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a) 53	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC86320	FDMC86320	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	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	80			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		56		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 64\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 100$	nA

#### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	2.4	3.5	4.5	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 $25\text{ }^\circ\text{C}$		-11		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 10.7\text{ A}$		9.7	11.7	m $\Omega$
		$V_{GS} = 8\text{ V}$ , $I_D = 8.5\text{ A}$		11.4	16	
		$V_{GS} = 10\text{ V}$ , $I_D = 10.7\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$		15	18	
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}$ , $I_D = 10.7\text{ A}$		20		S

#### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 40\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		1985	2640	pF
$C_{oss}$	Output Capacitance			353	469	pF
$C_{rss}$	Reverse Transfer Capacitance			12	30	pF
$R_g$	Gate Resistance			0.5		$\Omega$

#### Switching Characteristics

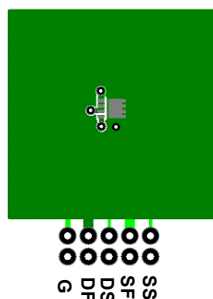
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 40\text{ V}$ , $I_D = 10.7\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		15	28	ns
$t_r$	Rise Time			8	16	ns
$t_{d(off)}$	Turn-Off Delay Time			20	35	ns
$t_f$	Fall Time			5	10	ns
$Q_{g(TOT)}$	Total Gate Charge		$V_{GS} = 0\text{ V to }10\text{ V}$	$V_{DD} = 40\text{ V}$ , $I_D = 10.7\text{ A}$	29	41
$Q_{g(TOT)}$		$V_{GS} = 0\text{ V to }8\text{ V}$	24		34	nC
$Q_{gs}$	Total Gate Charge		10			nC
$Q_{gd}$	Gate to Drain "Miller" Charge		6.9			nC

#### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 10.7\text{ A}$ (Note 2)		0.84	1.3	V
		$V_{GS} = 0\text{ V}$ , $I_S = 2\text{ A}$ (Note 2)		0.75	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 10.7\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		38	61	ns
$Q_{rr}$	Reverse Recovery Charge			27	43	nC

#### NOTES:

- $R_{\theta JA}$  is determined with the device mounted on a  $1\text{ in}^2$  pad of 2 oz copper pad on a  $1.5 \times 1.5\text{ in.}$  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.  $53\text{ }^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



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

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

- Starting  $T_J = 25\text{ }^\circ\text{C}$ ; N-ch:  $L = 0.3\text{ mH}$ ,  $I_{AS} = 20\text{ A}$ ,  $V_{DD} = 72\text{ V}$ ,  $V_{GS} = 10\text{ V}$ .

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

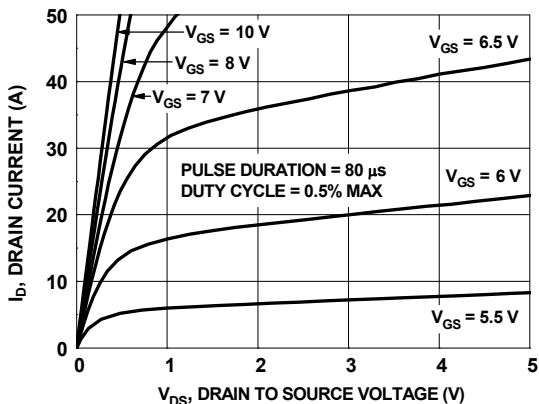


Figure 1. On Region Characteristics

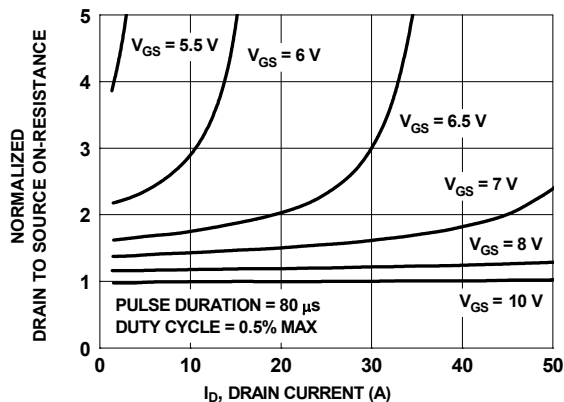


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

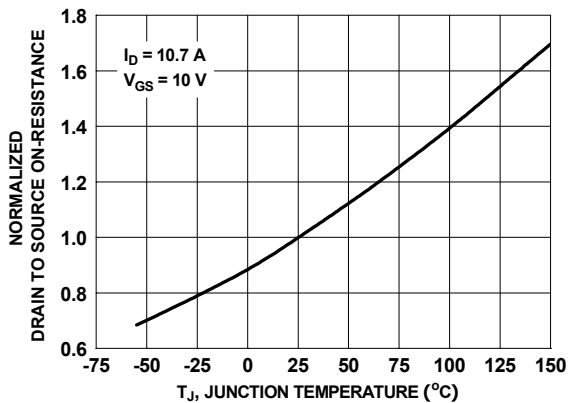


Figure 3. Normalized On Resistance vs. Junction Temperature

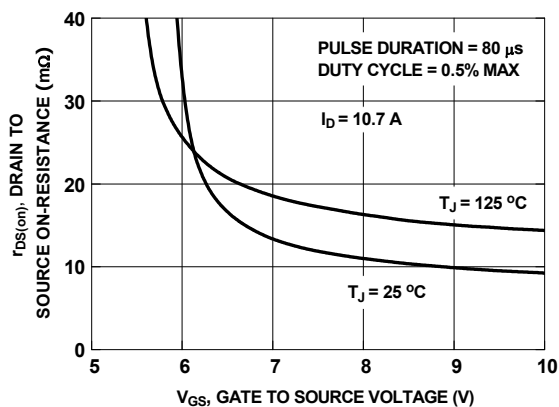


Figure 4. On-Resistance vs. Gate to Source Voltage

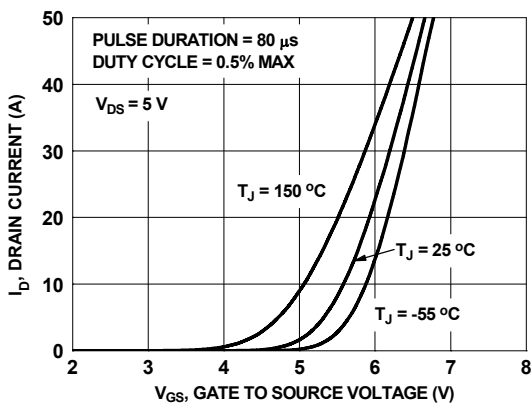


Figure 5. Transfer Characteristics

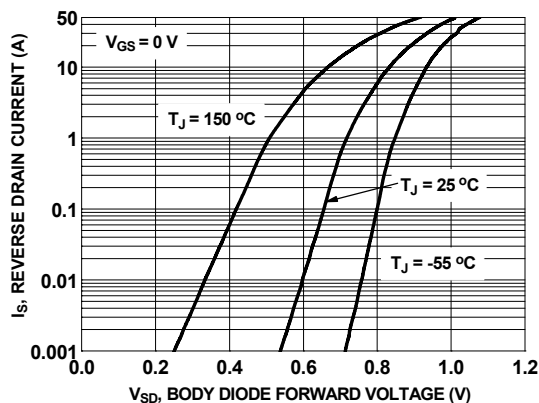
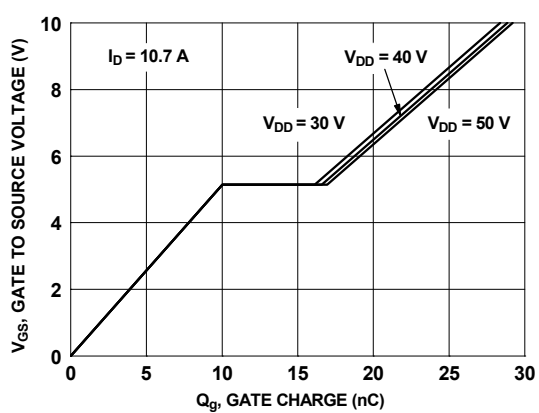
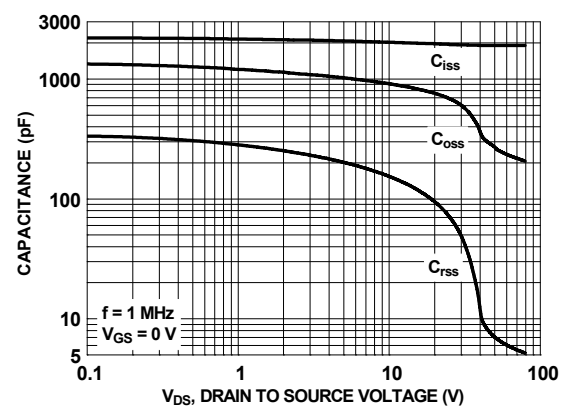


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

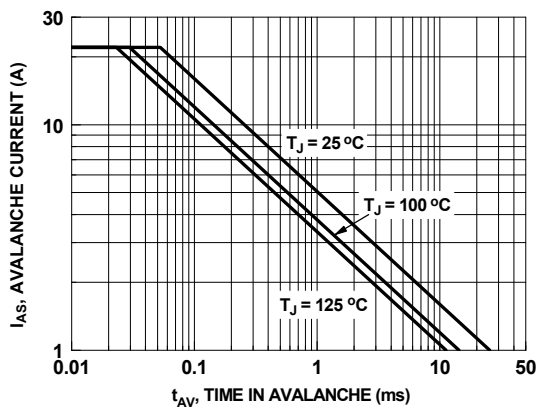
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



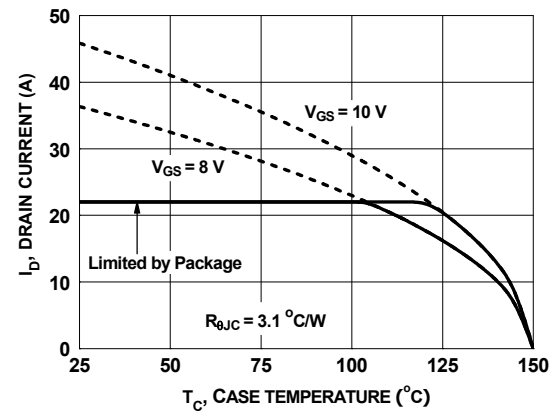
**Figure 7. Gate Charge Characteristics**



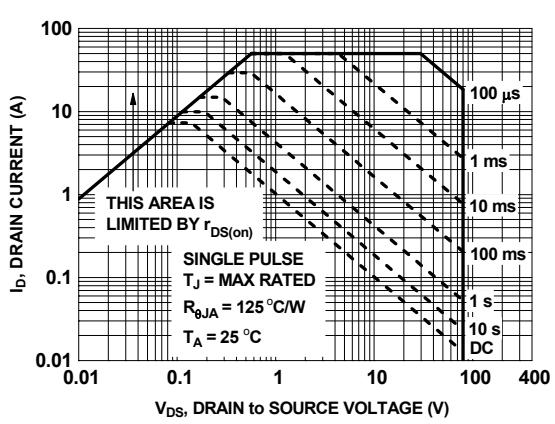
**Figure 8. Capacitance vs. Drain to Source Voltage**



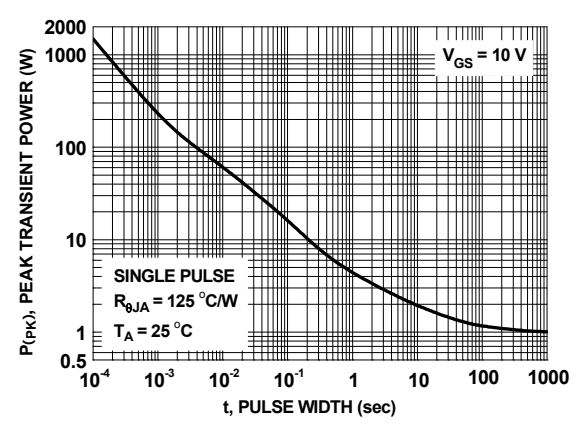
**Figure 9. Unclamped Inductive Switching Capability**



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

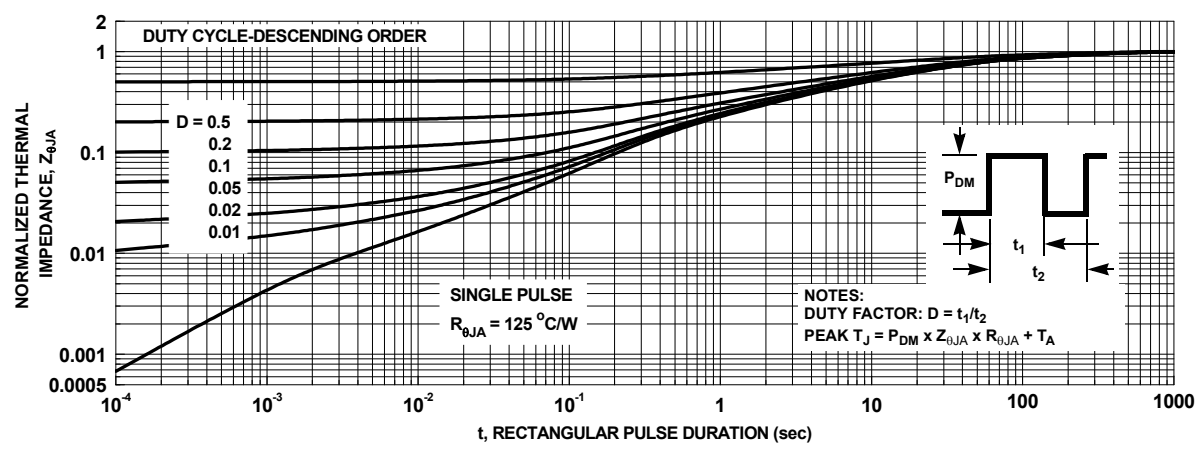


**Figure 11. Forward Bias Safe Operating Area**



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

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



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

## Dimensional Outline and Pad Layout





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