

# FDS86540

## N-Channel PowerTrench® MOSFET 60 V, 18 A, 4.5 mΩ

### Features

- Max  $r_{DS(on)}$  = 4.5 mΩ at  $V_{GS} = 10$  V,  $I_D = 18$  A
- Max  $r_{DS(on)}$  = 5.4 mΩ at  $V_{GS} = 8$  V,  $I_D = 16.5$  A
- High performance trench technology for extremely low  $r_{DS(on)}$
- High power and current handling capability in a widely used surface mount package
- 100% UIL Tested
- RoHS Compliant

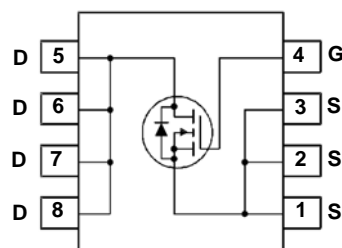
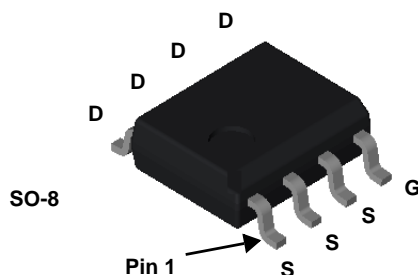


### General Description

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



### MOSFET Maximum Ratings $T_A = 25$ °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	18	A
	-Pulsed	120	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	194	mJ
$P_D$	Power Dissipation $T_C = 25$ °C (Note 1)	5.0	W
	Power Dissipation $T_A = 25$ °C (Note 1a)	2.5	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case (Note 1)	25	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDS86540	FDS86540	SO-8	13"	12 mm	2500 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	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^{\circ}\text{C}$		28		mV/ $^{\circ}\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}$ , $V_{GS} = 0\text{ V}$			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	3.1	4	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	$V_{GS} = 10\text{ V}$ , $I_D = 18\text{ A}$		3.7	4.5	m $\Omega$
		$V_{GS} = 8\text{ V}$ , $I_D = 16.5\text{ A}$		4.2	5.4	
		$V_{GS} = 10\text{ V}$ , $I_D = 18\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$		5.9	7	
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}$ , $I_D = 18\text{ A}$		69		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 30\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		4820	6410	pF
$C_{oss}$	Output Capacitance			1610	2145	pF
$C_{rss}$	Reverse Transfer Capacitance			67	130	pF
$R_g$	Gate Resistance			0.6		$\Omega$

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}$ , $I_D = 18\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		28	45	ns
$t_r$	Rise Time			15	27	ns
$t_{d(off)}$	Turn-Off Delay Time			33	53	ns
$t_f$	Fall Time			7.1	15	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V}$ to $10\text{ V}$	$V_{DD} = 30\text{ V}$ , $I_D = 18\text{ A}$	65	90	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V}$ to $8\text{ V}$		53	75	nC
$Q_{gs}$	Gate to Source Charge			22		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			13		nC

**Drain-Source Diode Characteristics**

$V_{SD}$	Source-Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 18\text{ A}$ (Note 2)		0.8	1.3	V
		$V_{GS} = 0\text{ V}$ , $I_S = 2\text{ A}$ (Note 2)		0.7	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 18\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		57	92	ns
$Q_{rr}$	Reverse Recovery Charge			44	71	nC

## NOTES:

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<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) 50  $^{\circ}\text{C}/\text{W}$  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.

2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.  
3. Starting  $T_J = 25\text{ }^{\circ}\text{C}$ ,  $L = 0.3\text{ mH}$ ,  $I_{AS} = 36\text{ A}$ ,  $V_{DD} = 54\text{ V}$ ,  $V_{GS} = 10\text{ V}$ .

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

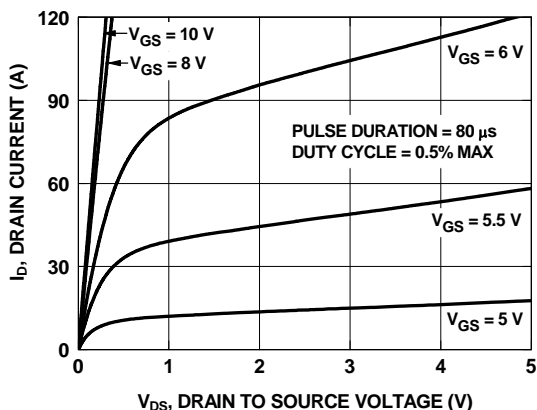


Figure 1. On-Region Characteristics

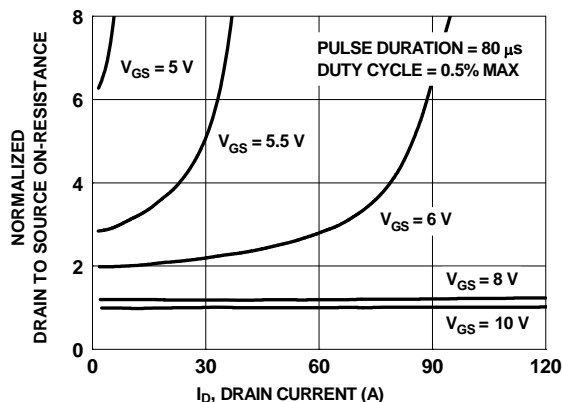


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

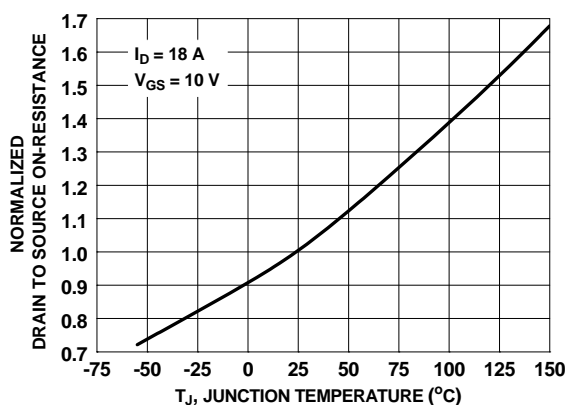


Figure 3. Normalized On-Resistance vs Junction Temperature

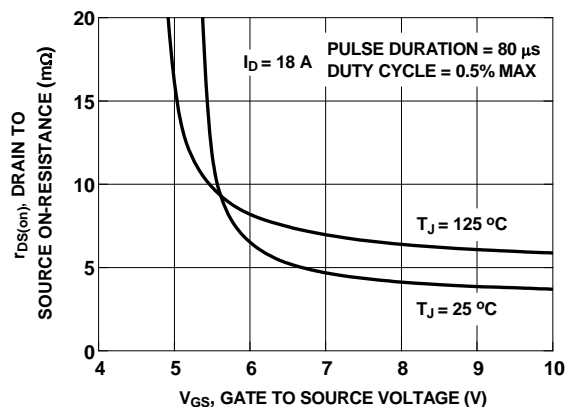


Figure 4. On-Resistance vs Gate to Source Voltage

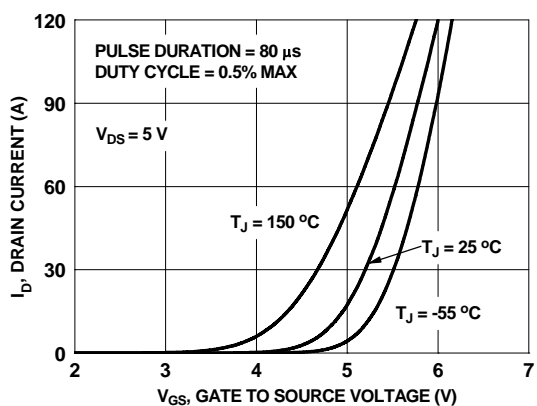


Figure 5. Transfer Characteristics

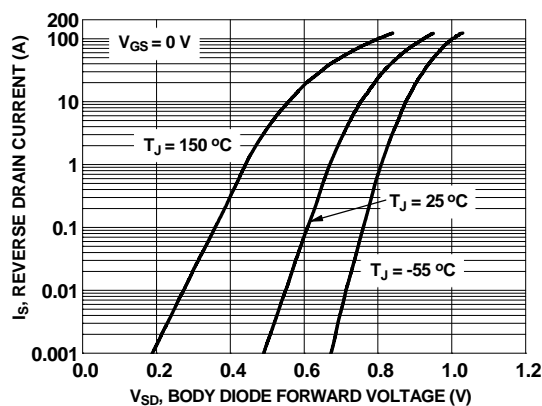


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

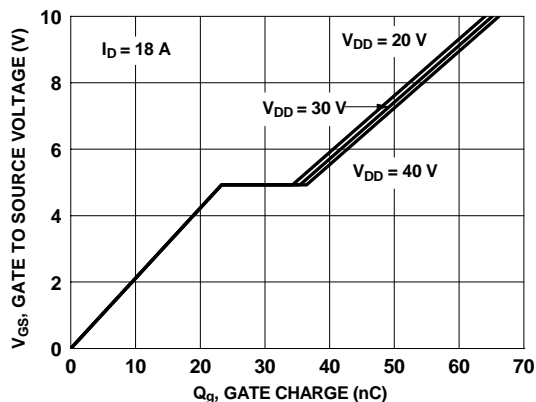


Figure 7. Gate Charge Characteristics

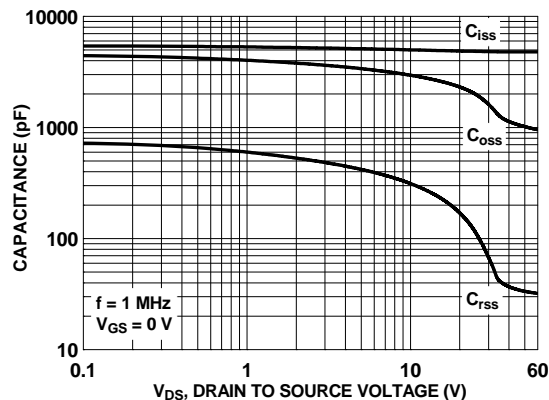


Figure 8. Capacitance vs Drain to Source Voltage

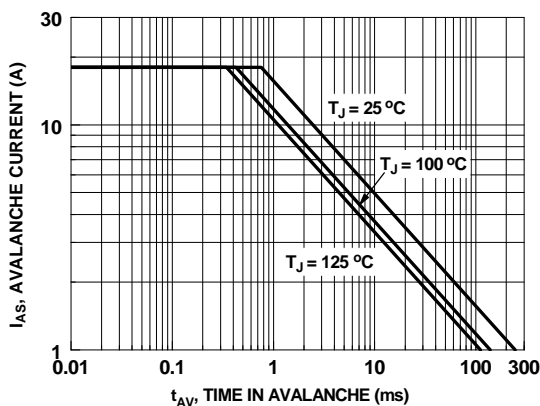


Figure 9. Unclamped Inductive Switching Capability

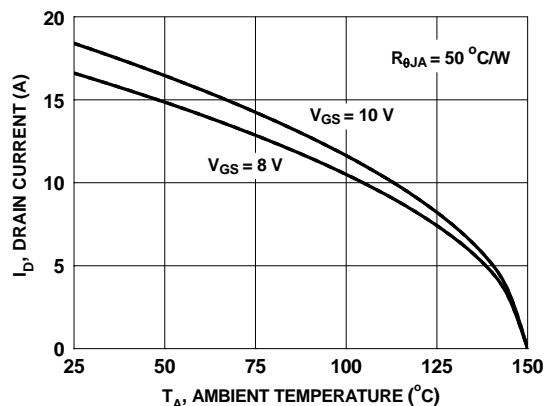


Figure 10. Maximum Continuous Drain Current vs Ambient Temperature

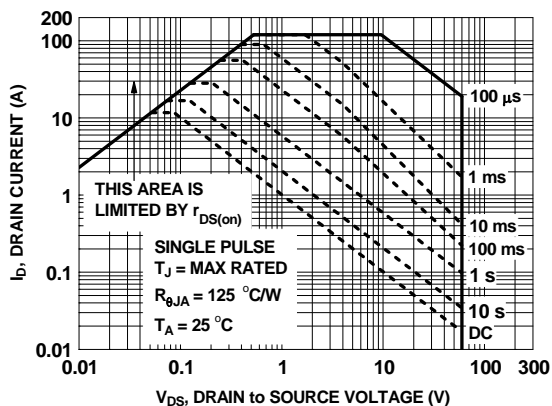


Figure 11. Forward Bias Safe Operating Area

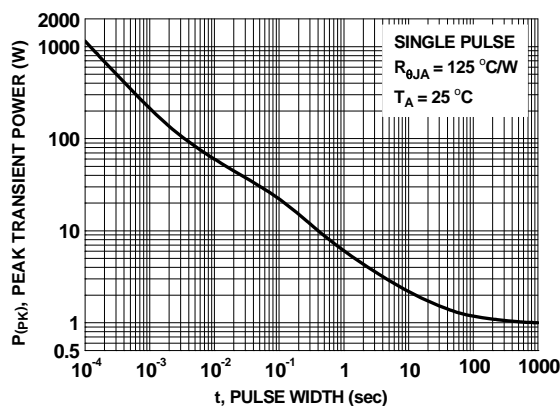
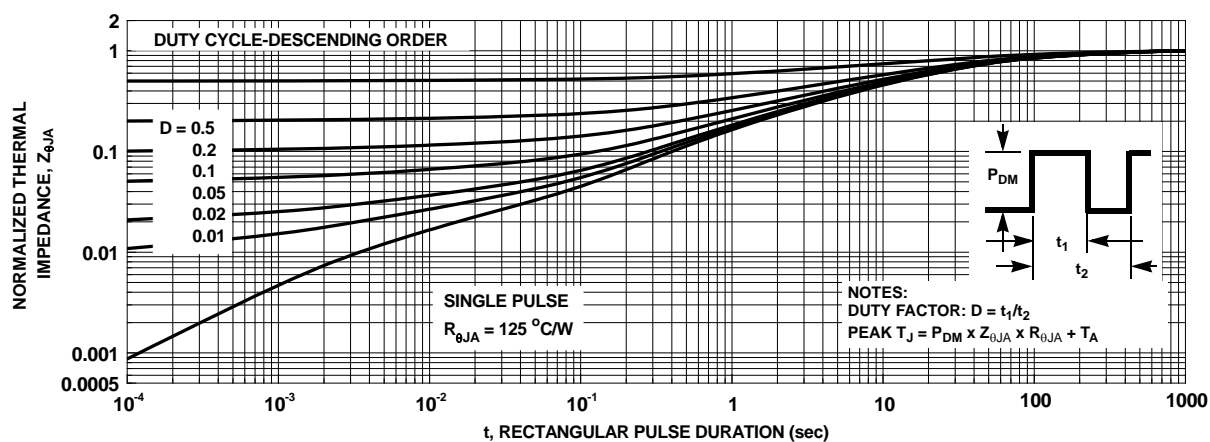


Figure 12. Single Pulse Maximum Power Dissipation



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





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