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ON Semiconductor®

# FDD3860

## N-Channel PowerTrench® MOSFET 100 V, 29 A, 36 mΩ

### Features

- Max  $r_{DS(on)}$  = 36 mΩ at  $V_{GS} = 10$  V,  $I_D = 5.9$  A
- High Performance Trench Technology for Extremely Low  $r_{DS(on)}$
- 100% UIL Tested
- RoHS Compliant

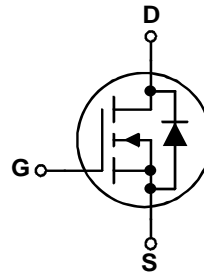
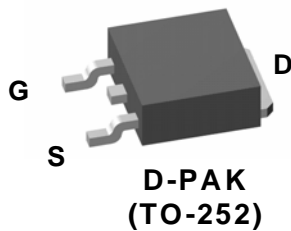


### General Description

This N-Channel MOSFET is rugged gate version of ON Semiconductor's advanced Power Trench® process. This part is tailored for low  $r_{DS(on)}$  and low Qg figure of merit, with avalanche ruggedness for a wide range of switching applications.

### Applications

- DC-AC Conversion
- Synchronous Rectifier



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Rated Value	Units
$V_{DS}$	Drain to Source Voltage	100	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current -Continuous	$T_C = 25^\circ\text{C}$	A
	-Continuous	$T_A = 25^\circ\text{C}$ (Note 1a)	
	-Pulsed		
$E_{AS}$	Single Pulse Avalanche Energy	(Note 3)	mJ
$P_D$	Power Dissipation	$T_C = 25^\circ\text{C}$	W
	Power Dissipation	$T_A = 25^\circ\text{C}$ (Note 1a)	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +175	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.8	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD3860	FDD3860	D-PAK (TO-252)	13"	16 mm	2500 units

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

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	100			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		98		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 80\text{V}, V_{GS} = 0\text{V}$			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	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2.5	3.8	4.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-11.4		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 5.9\text{A}$		29	36	m $\Omega$
		$V_{GS} = 10\text{V}, I_D = 5.9\text{A}, T_J = 125^\circ\text{C}$		51	64	
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{V}, I_D = 5.9\text{A}$		20		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 50\text{V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}$		1310	1740	pF
$C_{oss}$	Output Capacitance			100	130	pF
$C_{riss}$	Reverse Transfer Capacitance			45	70	pF
$R_g$	Gate Resistance	$f = 1\text{MHz}$		1.6		$\Omega$

### Switching Characteristics

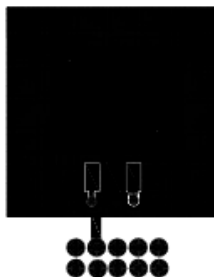
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\text{V}, I_D = 5.9\text{A},$ $V_{GS} = 10\text{V}, R_{GEN} = 6\Omega$		16	29	ns
$t_r$	Rise Time			10	21	ns
$t_{d(off)}$	Turn-Off Delay Time			24	39	ns
$t_f$	Fall Time			7	15	ns
$Q_g$	Total Gate Charge at 10V	$V_{DD} = 50\text{V}, I_D = 5.9\text{A}$		22	31	nC
$Q_{gs}$	Gate to Source Charge			7.1		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			6.3		nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 2.0\text{A}$ (Note 2)		0.7	1.2	V
		$V_{GS} = 0\text{V}, I_S = 5.9\text{A}$ (Note 2)		0.8	1.3	
$t_{rr}$	Reverse Recovery Time	$I_F = 5.9\text{A}, di/dt = 100\text{A}/\mu\text{s}$		34	55	ns
$Q_{rr}$	Reverse Recovery Charge			40	64	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.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.



a)  $40^\circ\text{C}/\text{W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz. copper



b)  $96^\circ\text{C}/\text{W}$  when mounted on a minimum pad.

- 2: Pulse Test: Pulse Width <  $300\mu\text{s}$ , Duty cycle < 2.0%.  
 3: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{mH}$ ,  $I_{AS} = 9\text{A}$ ,  $V_{DD} = 100\text{V}$ ,  $V_{GS} = 10\text{V}$ .

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

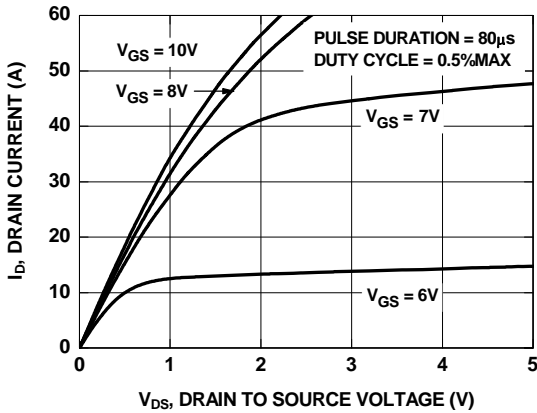


Figure 1. On-Region Characteristics

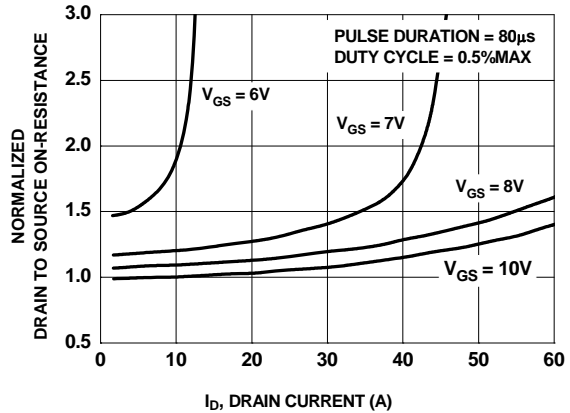


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

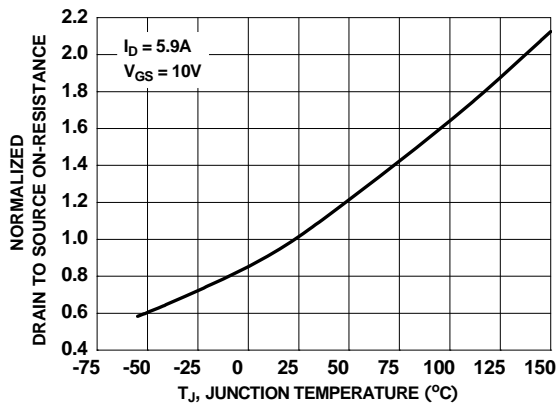


Figure 3. Normalized On-Resistance vs. Junction Temperature

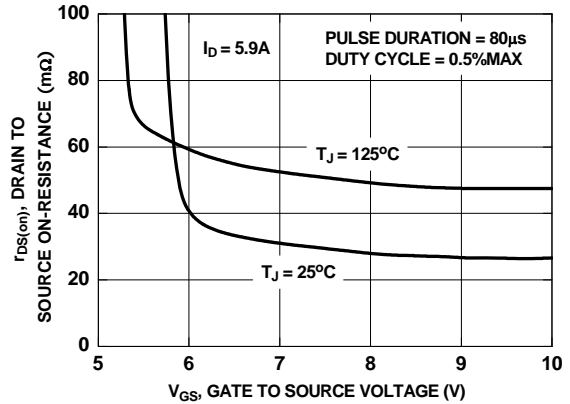


Figure 4. On-Resistance vs. Gate to Source Voltage

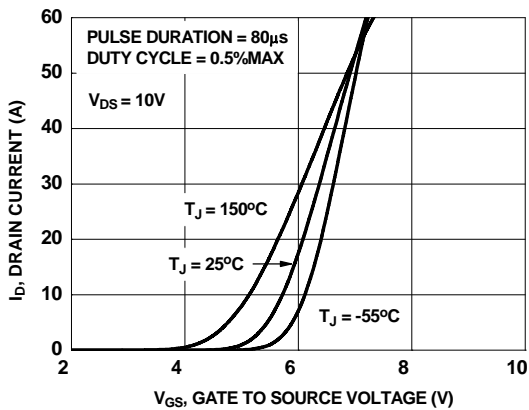


Figure 5. Transfer Characteristics

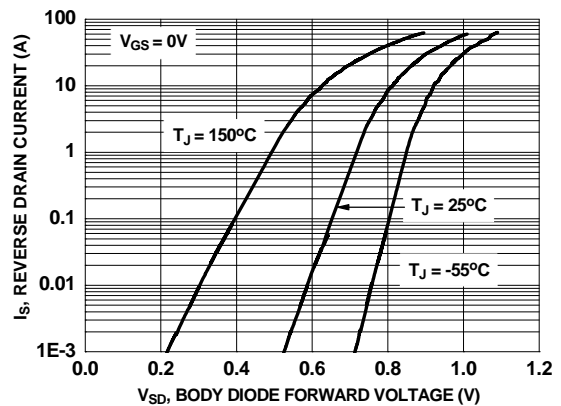
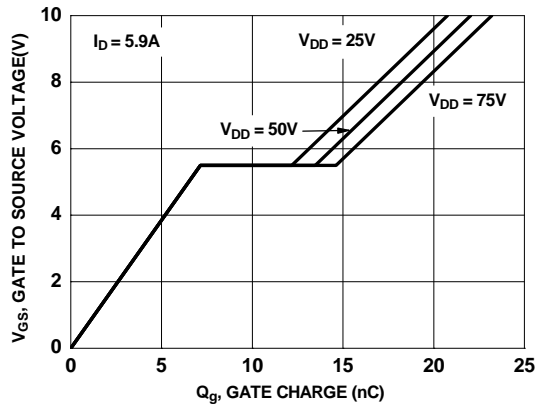
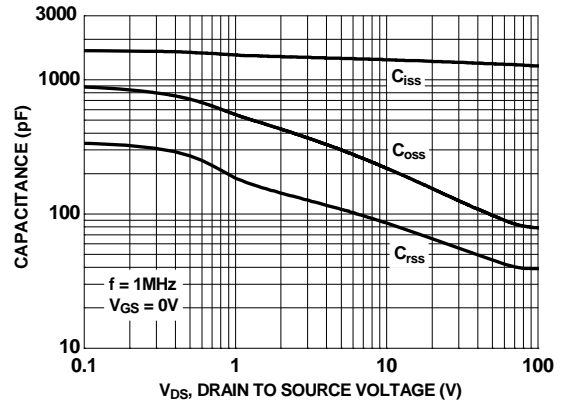


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

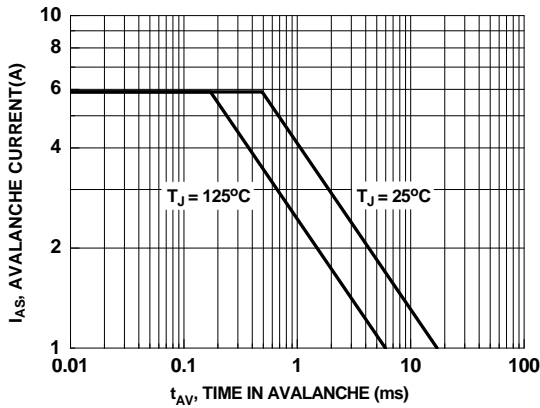
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted.



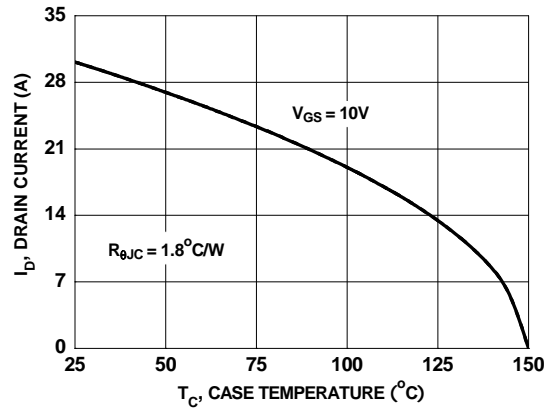
**Figure 7. Gate Charge Characteristics**



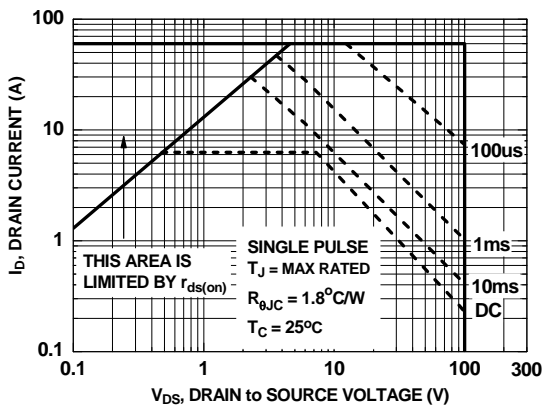
**Figure 8. Capacitance vs. Drain to Source Voltage**



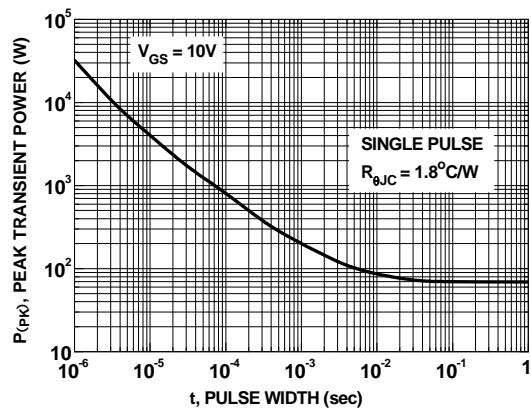
**Figure 9. Unclamped Inductive Switching Capability**



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

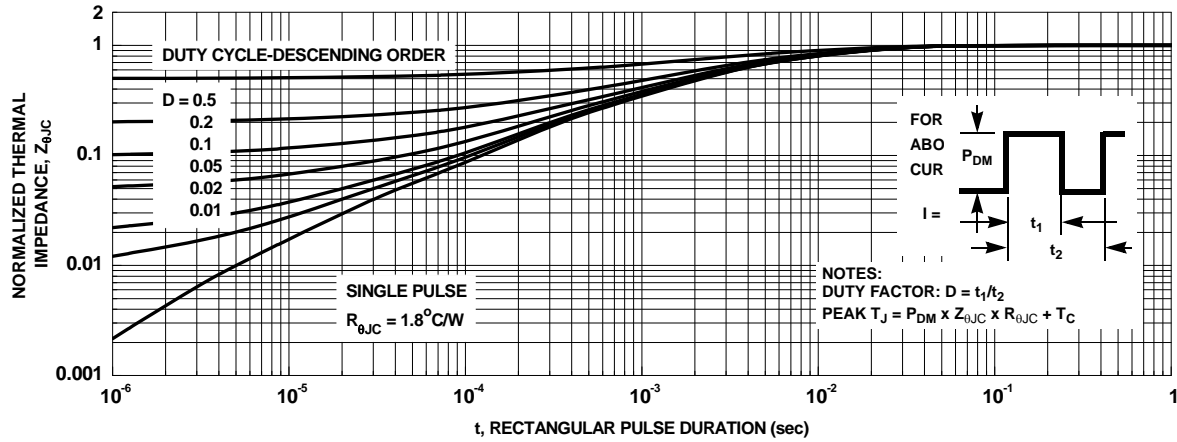


**Figure 11. Forward Bias Safe Operating Area**

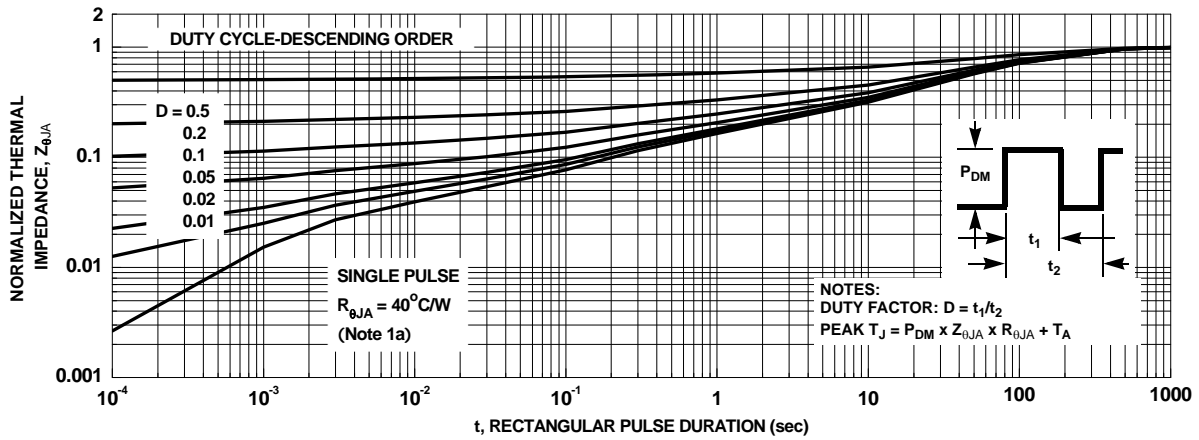


**Figure 12. Single Pulse Maximum Power Dissipation**

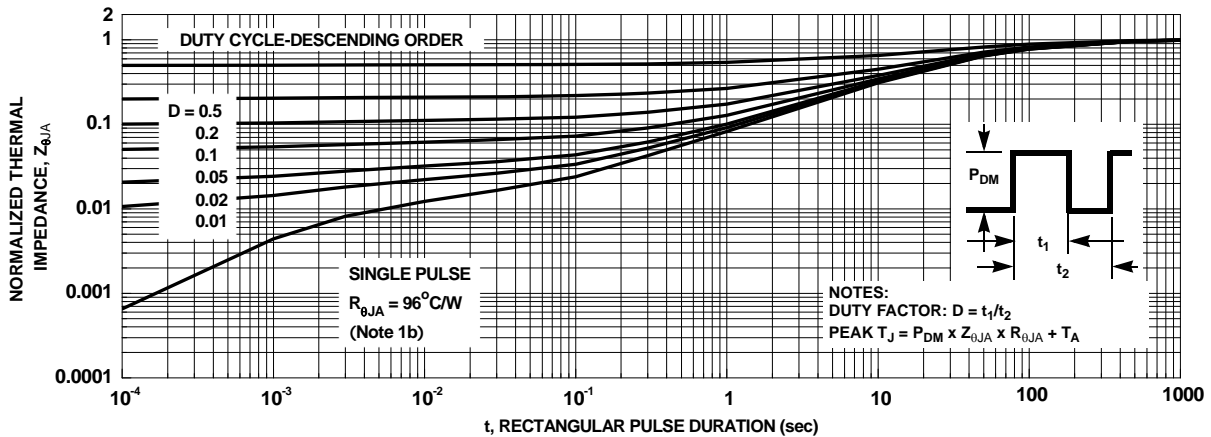
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted.



**Figure 13. Transient Thermal Response Curve**



**Figure 14. Transient Thermal Response Curve**



**Figure 15. Transient Thermal Response Curve**

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