

# FDS8638

## N-Channel PowerTrench® MOSFET 40 V, 18 A, 4.3 mΩ

### Features

- Max  $r_{DS(on)}$  = 4.3 mΩ at  $V_{GS}$  = 10 V,  $I_D$  = 18 A
- Max  $r_{DS(on)}$  = 5.4 mΩ at  $V_{GS}$  = 4.5 V,  $I_D$  = 16 A
- High performance trench technology for extremely low  $r_{DS(on)}$
- 100% UIL Tested
- RoHS Compliant

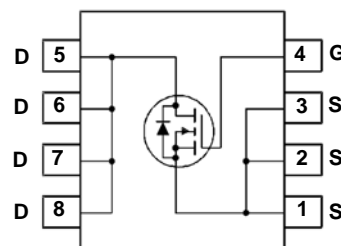
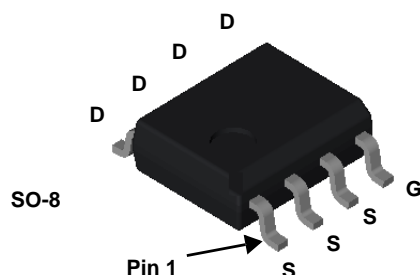


### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advance Power Trench® process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

### Applications

- Synchronous Rectifier
- Load Switch



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	40	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current -Continuous	18	A
	-Pulsed	100	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	541	mJ
$P_D$	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.5	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1b)	1	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

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

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDS8638	FDS8638	SO-8	13 "	12 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	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$	40			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$		32		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 32\ \text{V}$ , $V_{GS} = 0\ \text{V}$			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	$V_{GS} = V_{DS}$ , $I_D = 250\ \mu\text{A}$	1.0	1.9	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$		-7		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}$ , $I_D = 18\ \text{A}$		3.3	4.3	m $\Omega$
		$V_{GS} = 4.5\ \text{V}$ , $I_D = 16\ \text{A}$		4.0	5.4	
		$V_{GS} = 10\ \text{V}$ , $I_D = 18\ \text{A}$ , $T_J = 125^\circ\text{C}$		4.8	6.3	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\ \text{V}$ , $I_D = 18\ \text{A}$		88		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 15\ \text{V}$ , $V_{GS} = 0\ \text{V}$ , $f = 1\ \text{MHz}$		4270	5680	pF
$C_{oss}$	Output Capacitance			1175	1560	pF
$C_{rss}$	Reverse Transfer Capacitance			120	180	pF
$R_g$	Gate Resistance			0.9		$\Omega$

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 20\ \text{V}$ , $I_D = 18\ \text{A}$ , $V_{GS} = 10\ \text{V}$ , $R_{GEN} = 6\ \Omega$		16	30	ns
$t_r$	Rise Time			6	13	ns
$t_{d(off)}$	Turn-Off Delay Time			39	63	ns
$t_f$	Fall Time			5	10	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $10\ \text{V}$	$V_{DD} = 20\ \text{V}$ , $I_D = 18\ \text{A}$	61	86	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $4.5\ \text{V}$		27	39	nC
$Q_{gs}$	Gate to Source Charge			12		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			7.2		nC

**Drain-Source Diode Characteristics**

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}$ , $I_S = 18\ \text{A}$ (Note 2)		0.81	1.3	V
		$V_{GS} = 0\ \text{V}$ , $I_S = 2.1\ \text{A}$ (Note 2)		0.71	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 18\ \text{A}$ , $di/dt = 100\ \text{A}/\mu\text{s}$		51	82	ns
$Q_{rr}$	Reverse Recovery Charge			30	49	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  $T_J = 25^\circ\text{C}$ ,  $L = 3\ \text{mH}$ ,  $I_{AS} = 19\ \text{A}$ ,  $V_{DD} = 40\ \text{V}$ ,  $V_{GS} = 10\ \text{V}$ .

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

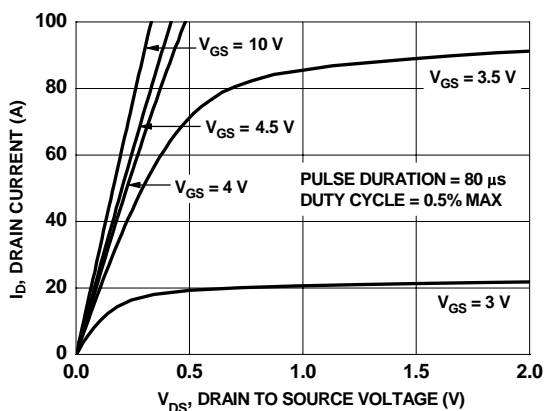


Figure 1. On Region Characteristics

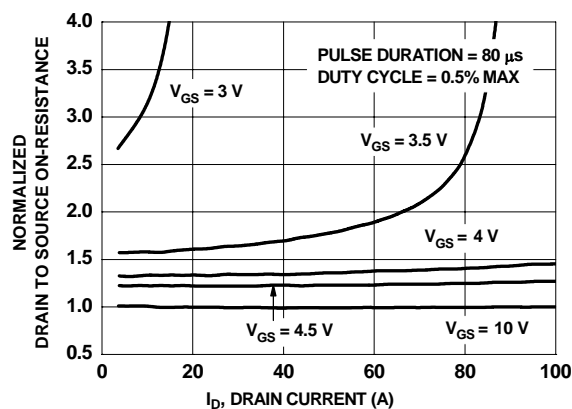


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

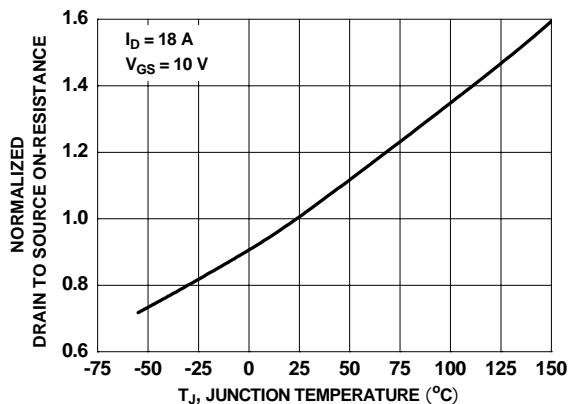


Figure 3. Normalized On Resistance vs Junction Temperature

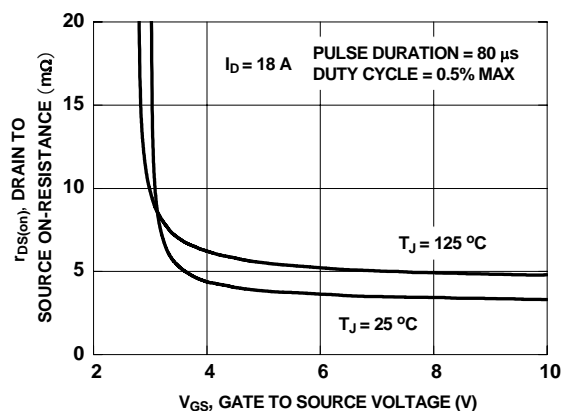


Figure 4. On-Resistance vs Gate to Source Voltage

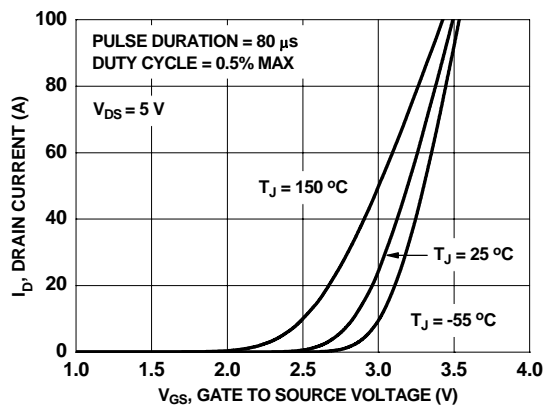


Figure 5. Transfer Characteristics

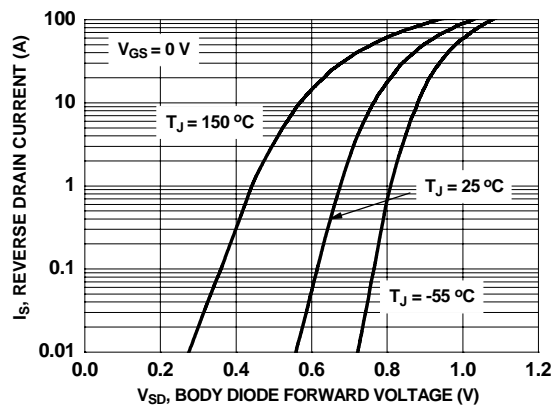


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

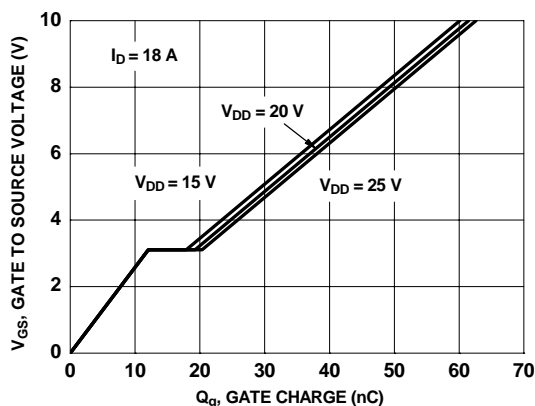


Figure 7. Gate Charge Characteristics

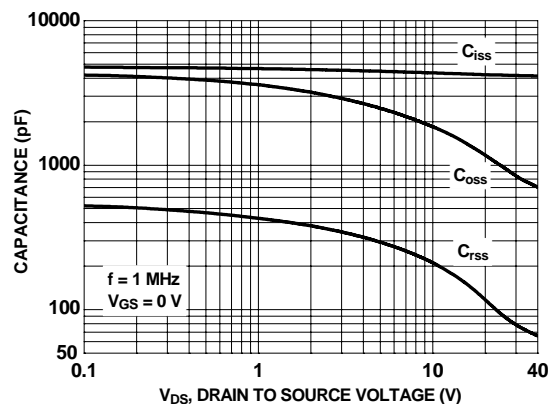


Figure 8. Capacitance vs Drain to Source Voltage

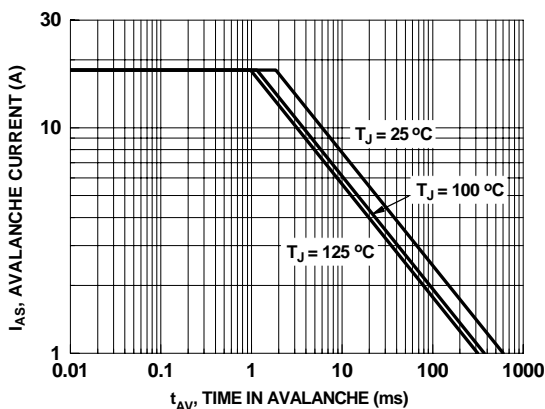


Figure 9. Unclamped Inductive Switching Capability

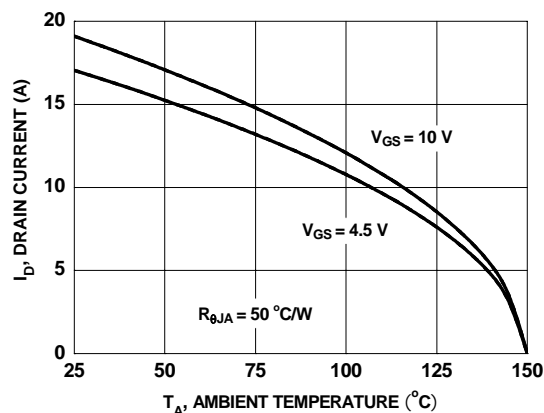


Figure 10. Maximum Continuous Drain Current vs Ambient Temperature

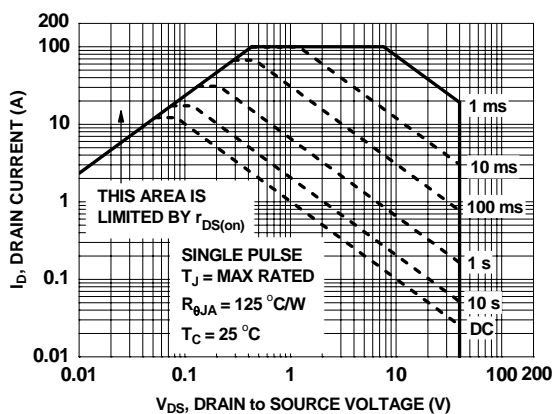


Figure 11. Forward Bias Safe Operating Area

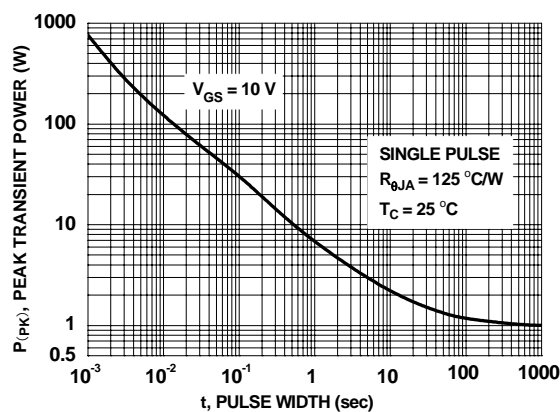


Figure 12. Single Pulse Maximum Power Dissipation

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

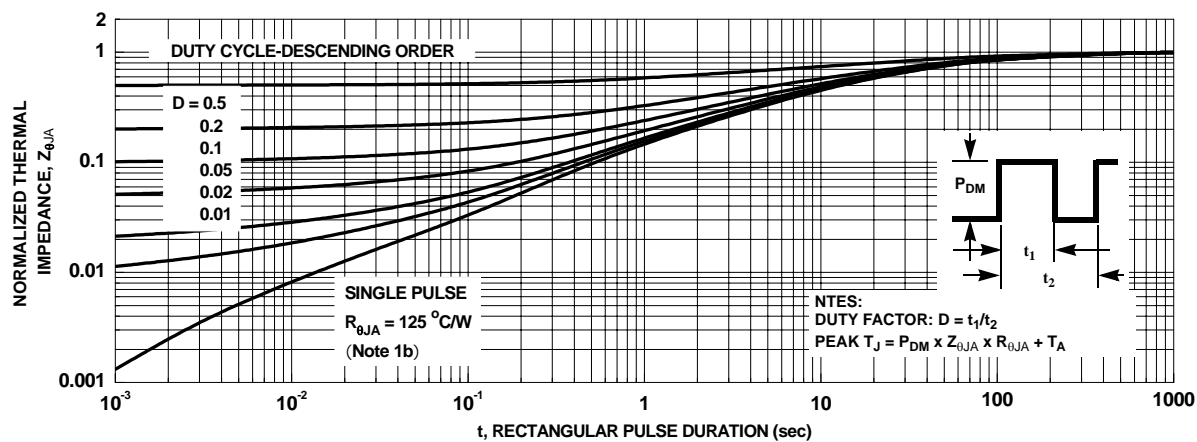



Figure 13. Junction-to-Ambient Transient Thermal Response Curve





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