

# FDS9958

## Dual P-Channel PowerTrench® MOSFET -60V, -2.9A, 105mΩ

### Features

- Max  $r_{DS(on)}$  = 105mΩ at  $V_{GS} = -10V$ ,  $I_D = -2.9A$
- Max  $r_{DS(on)}$  = 135mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -2.5A$
- RoHS Compliant



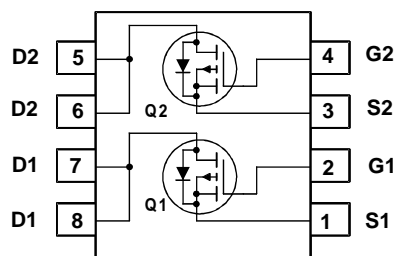
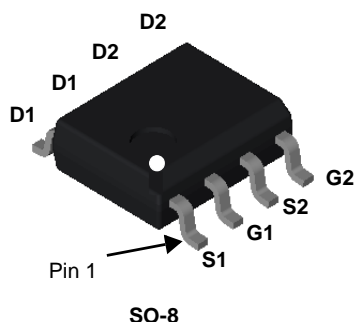
### General Description

These P-channel logic level specified MOSFETs are produced using Fairchild Semiconductor's advanced PowerTrench® process that has been especially tailored to minimize the on-state resistance and yet maintain low gate charge for superior switching performance.

These devices are well suited for portable electronics applications: load switching and power management, battery charging and protection circuits.

### Applications

- Load Switch
- Power Management



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	-60	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current -Continuous	-2.9	A
	-Pulsed	-12	
$E_{AS}$	Single Pulse Avalanche Energy	54	mJ
$P_D$	Power Dissipation for Dual Operation	2	W
	Power Dissipation	1.6	
	Power Dissipation	0.9	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	40	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	78	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDS9958	FDS9958	SO-8	330mm	12mm	2500units

**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	$I_D = -250\mu\text{A}$ , $V_{GS} = 0\text{V}$	-60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-52		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -48\text{V}$ , $V_{GS} = 0\text{V}$ $T_J = 125^\circ\text{C}$			-1 -100	$\mu\text{A}$
$I_{GSS}$	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	-1.6	-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 $25^\circ\text{C}$		4		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -10\text{V}$ , $I_D = -2.9\text{A}$		82	105	m $\Omega$
		$V_{GS} = -4.5\text{V}$ , $I_D = -2.5\text{A}$		103	135	
		$V_{GS} = -10\text{V}$ , $I_D = -2.9\text{A}$ , $T_J = 125^\circ\text{C}$		131	190	
$g_{FS}$	Forward Transconductance	$V_{DD} = -5\text{V}$ , $I_D = -2.9\text{A}$		7.7		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = -30\text{V}$ , $V_{GS} = 0\text{V}$ , $f = 1\text{MHz}$		765	1020	pF
$C_{oss}$	Output Capacitance			90	120	pF
$C_{rss}$	Reverse Transfer Capacitance			40	65	pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -30\text{V}$ , $I_D = -2.9\text{A}$ , $V_{GS} = -10\text{V}$ , $R_{GEN} = 6\Omega$		6	12	ns
$t_r$	Rise Time			3	10	ns
$t_{d(off)}$	Turn-Off Delay Time			27	43	ns
$t_f$	Fall Time			6	12	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{V}$ to $-10\text{V}$	$V_{DD} = -30\text{V}$ , $I_D = -2.9\text{A}$	16	23	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{V}$ to $-4.5\text{V}$		8	12	nC
$Q_{gs}$	Gate to Source Charge			2		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			3		nC

**Drain-Source Diode Characteristics**

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}$ , $I_S = -1.3\text{A}$ (Note 2)		-0.8	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -2.9\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$		26	42	ns
$Q_{rr}$	Reverse Recovery Charge			21	35	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) 78°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b) 135°C/W when mounted on a minimum pad

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

3. UIL condition: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{mH}$ ,  $I_{AS} = 6\text{A}$ ,  $V_{DD} = 60\text{V}$ ,  $V_{GS} = 10\text{V}$ .

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

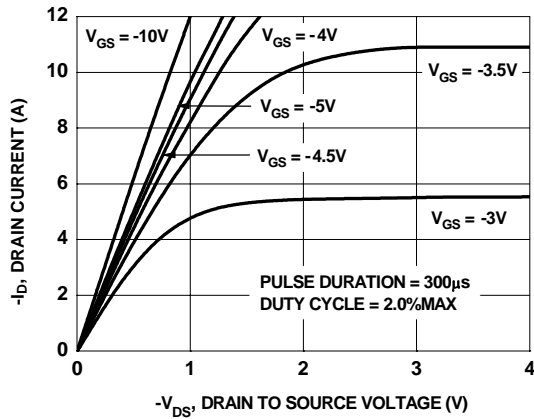


Figure 1. On-Region Characteristics

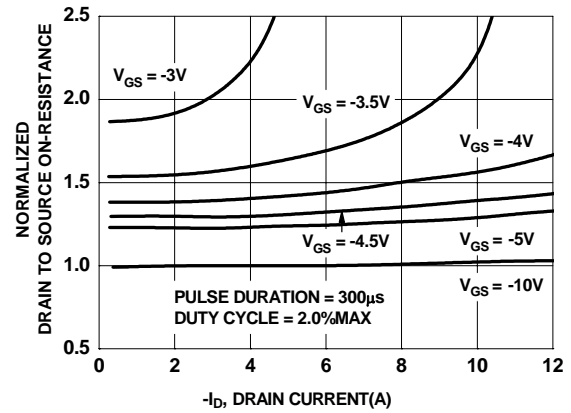


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

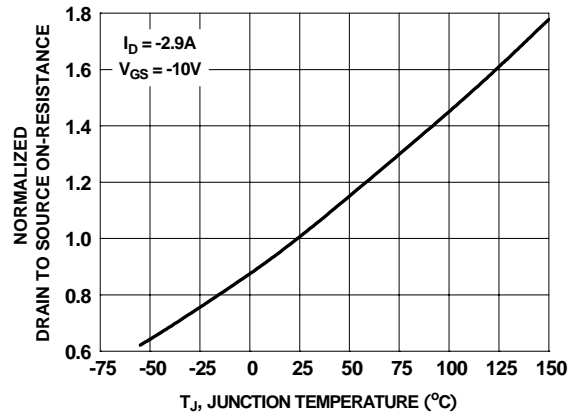


Figure 3. Normalized On-Resistance vs Junction Temperature

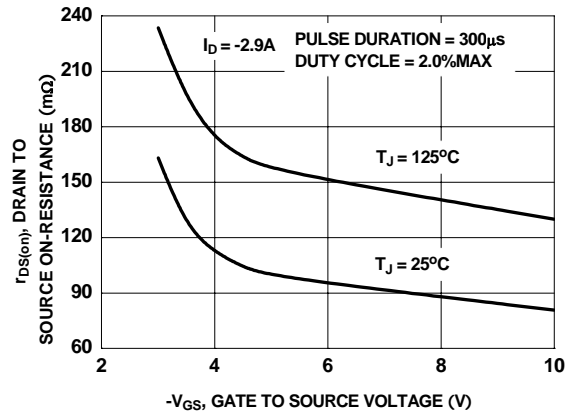


Figure 4. On-Resistance vs Gate to Source Voltage

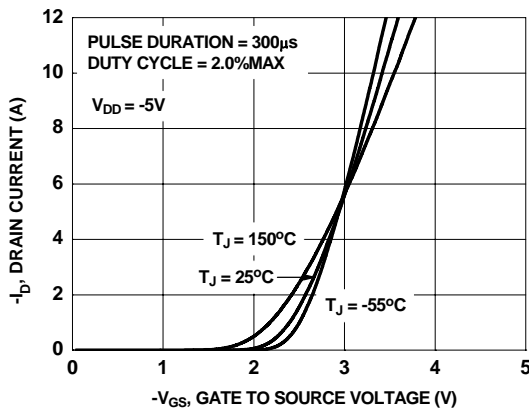


Figure 5. Transfer Characteristics

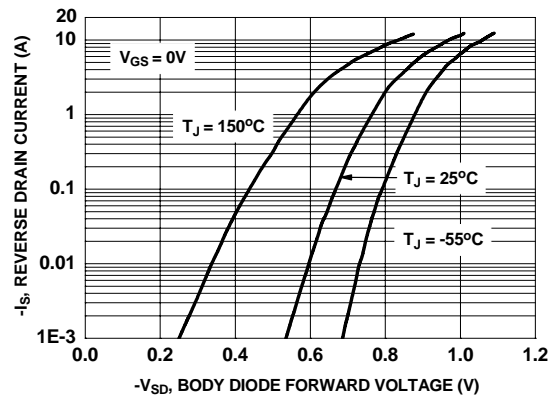


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

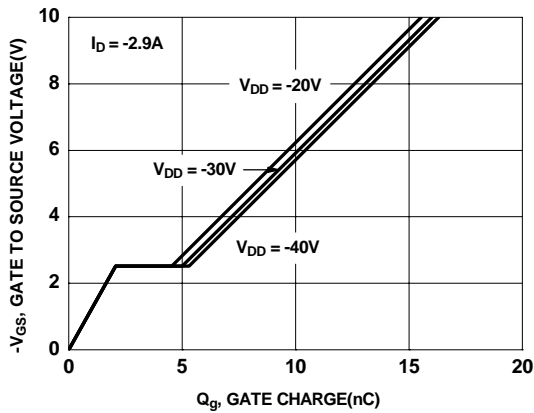


Figure 7. Gate Charge Characteristics

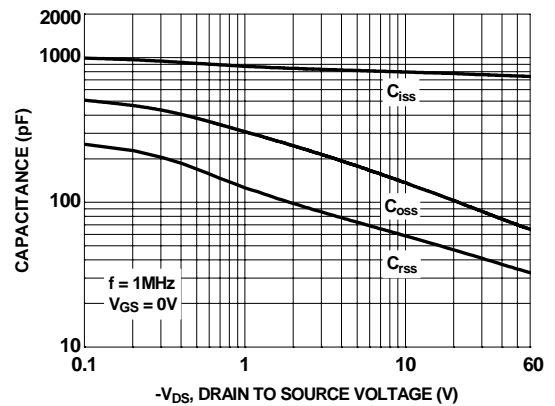


Figure 8. Capacitance vs Drain to Source Voltage

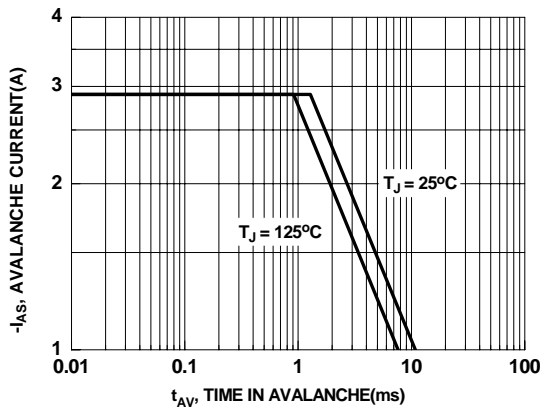


Figure 9. Unclamped Inductive Switching Capability

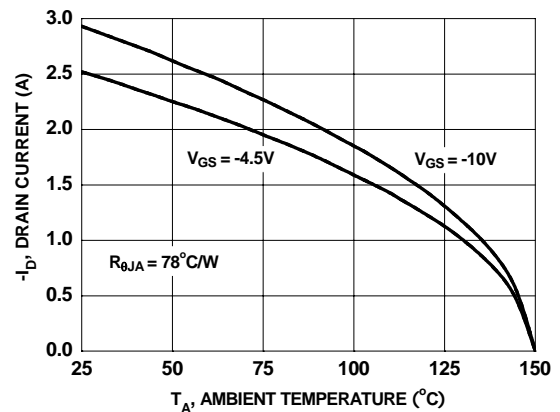


Figure 10. Maximum Continuous Drain Current vs Ambient Temperature

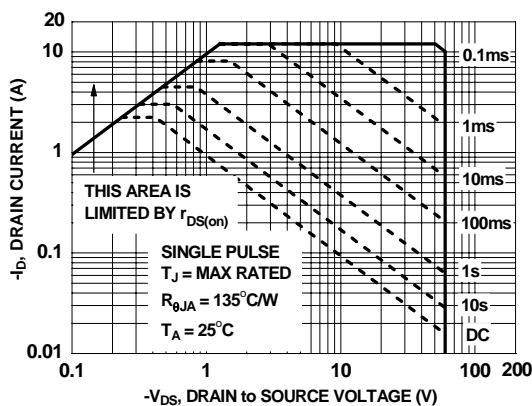


Figure 11. Forward Bias Safe Operating Area

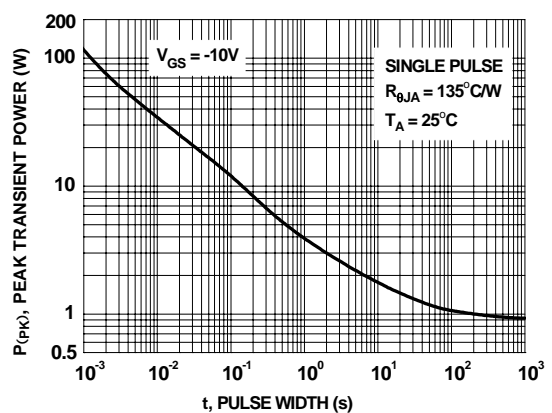


Figure 12. Single Pulse Maximum Power Dissipation

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

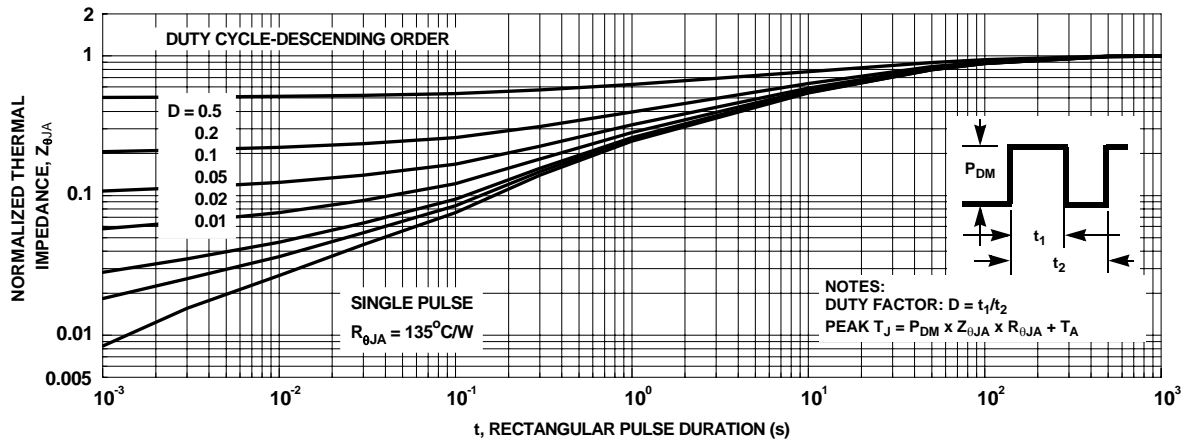



Figure 13. Transient Thermal Response Curve



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