

November 2008

# FDS9958 F085

# Dual P-Channel PowerTrench<sup>®</sup> MOSFET -60V, -2.9A, $105m\Omega$

#### **Features**

- Max  $r_{DS(on)}$  =105m $\Omega$  at  $V_{GS}$  = -10V,  $I_D$  = -2.9A
- Max  $r_{DS(on)}$  =135m $\Omega$  at  $V_{GS}$  = -4.5V,  $I_D$  = -2.5A
- Qualified to AEC Q101
- RoHS Compliant



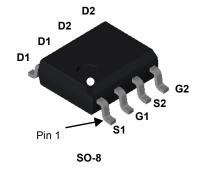
### **General Description**

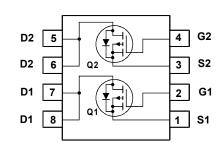
These P-channel logic level specified MOSFETs are produced using Fairchild Semiconductor's advanced PowerTrench® process that has been especially tailored to minimize the on-state resistance and yet maintain low gate charge for superior switching performance.

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<sub>A</sub> = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V <sub>DS</sub>	Drain to Source Voltage		-60	V
V <sub>GS</sub>	Gate to Source Voltage		±20	V
	Drain Current -Continuous	(Note 1a)	-2.9	Δ.
ID	-Pulsed		-12	Α
E <sub>AS</sub>	Single Pulse Avalanche Energy	(Note 3)	54	mJ
	Power Dissipation for Dual Operation		2	
$P_{D}$	Power Dissipation	(Note 1a)	1.6	W
	Power Dissipation	(Note 1b)	0.9	
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Range		-55 to +150	°C

#### **Thermal Characteristics**

$R_{\theta JC}$	Thermal Resistance, Junction to Case	40	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	78	C/VV

#### **Package Marking and Ordering Information**

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDS9958	FDS9958_F085	SO-8	330mm	12mm	2500units

# **Electrical Characteristics** T<sub>J</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Тур	Max	Units
Off Chara	octeristics					
BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	$I_D = -250 \mu A, V_{GS} = 0 V$	-60			V
$\Delta BV_{DSS} \over \Delta T_J$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = -250μA, referenced to 25°C		-52		mV/°C
	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -48V,			-1	μА
DSS	Zero Gate Voltage Drain Current	$V_{GS} = 0V$ $T_J = 125^{\circ}C$			-100	μΑ
I <sub>GSS</sub>	Gate to Source Leakage Current	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V			±100	nA

#### **On Characteristics**

V <sub>GS(th)</sub>	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250 \mu A$	-1.0	-1.6	-3.0	V
$\Delta V_{GS(th)} \over \Delta T_J$	Gate to Source Threshold Voltage Temperature Coefficient	I <sub>D</sub> = -250μA, referenced to 25°C		4		mV/°C
r <sub>DS(on)</sub>	Static Drain to Source On Resistance	$V_{GS} = -10V, I_D = -2.9A$		82	105	
		$V_{GS} = -4.5V, I_D = -2.5A$		103	135	mΩ
		$V_{GS} = -10V$ , $I_D = -2.9A$ , $T_J = 125$ °C		131	190	
9 <sub>FS</sub>	Forward Transconductance	$V_{DD} = -5V, I_{D} = -2.9A$		7.7		S

## **Dynamic Characteristics**

$C_{i}$	iss	Input Capacitance	V = 30V V = 0V	765	1020	pF
C	oss	Output Capacitance	$V_{DS} = -30V, V_{GS} = 0V,$ f = 1MHz	90	120	pF
C	rss	Reverse Transfer Capacitance	1141112	40	65	pF

## **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time	.,	6	12	ns
t <sub>r</sub>	Rise Time	$V_{DD}$ = -30V, $I_{D}$ = -2.9A, $V_{GS}$ = -10V, $R_{GEN}$ = 6 $\Omega$	3	10	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	V <sub>GS</sub> = -10V, K <sub>GEN</sub> = 052	27	43	ns
t <sub>f</sub>	Fall Time		6	12	ns
$Q_g$	Total Gate Charge	V <sub>GS</sub> = 0V to -10V	16	23	nC
Qg	Total Gate Charge	$V_{GS} = 0V \text{ to } -4.5V$ $V_{DD} = -30V,$ $I_{D} = -2.9A$	8	12	nC
Q <sub>gs</sub>	Gate to Source Charge	I <sub>D</sub> = -2.9A	2		nC
Q <sub>gd</sub>	Gate to Drain "Miller" Charge		3		nC

## **Drain-Source Diode Characteristics**

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0V, I_S = -1.3A$ (Note 2)		-0.8	-1.2	V
t <sub>rr</sub>	Reverse Recovery Time	- I <sub>E</sub> = -2.9A. di/dt = 100A/μs		26	42	ns
Q <sub>rr</sub>	Reverse Recovery Charge	1F = -2.9A, αι/αι = 100A/μs		21	35	nC

#### NOTES

<sup>1.</sup> R<sub>0,JA</sub> is determined with the device mounted on a 1in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. R<sub>0,JC</sub> is guaranteed by design while R<sub>0,CA</sub> 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 minimun pad

- 2. Pulse Test: Pulse Width < 300 $\mu$ s, Duty cycle < 2.0%.
- 3. UIL condition: Starting  $T_J$  = 25°C, L = 3mH,  $I_{AS}$  = 6A,  $V_{DD}$  = 60V,  $V_{GS}$  = 10V.

## Typical Characteristics T<sub>J</sub> = 25°C unless otherwise noted

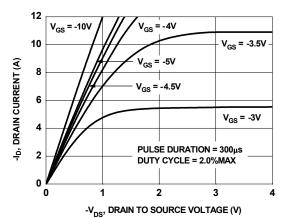


Figure 1. On-Region Characteristics

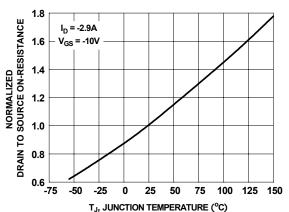


Figure 3. Normalized On-Resistance vs Junction Temperature

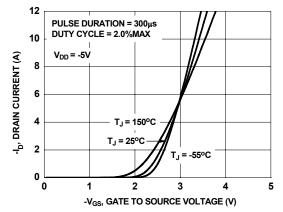


Figure 5. Transfer Characteristics

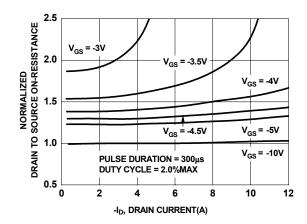


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

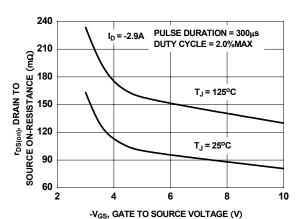


Figure 4. On-Resistance vs Gate to Source Voltage

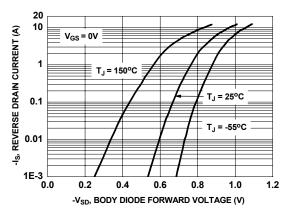


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

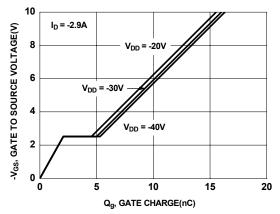


Figure 7. Gate Charge Characteristics

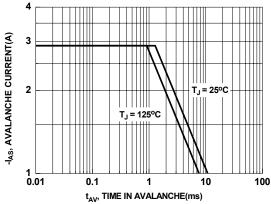


Figure 9. Unclamped Inductive Switching Capability

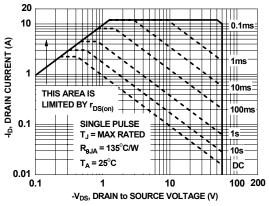


Figure 11. Forward Bias Safe Operating Area

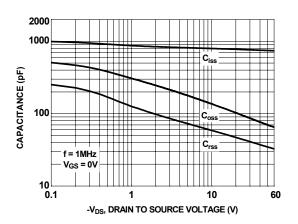


Figure 8. Capacitance vs Drain to Source Voltage

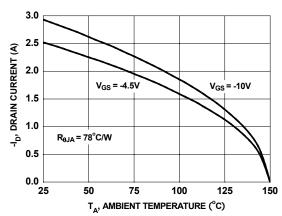


Figure 10. Maximum Continuous Drain Current vs Ambient Temperature

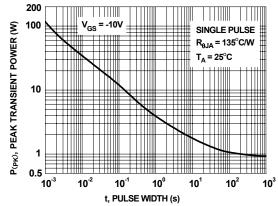


Figure 12. Single Pulse Maximum Power Dissipation

# Typical Characteristics T<sub>J</sub> = 25°C unless otherwise noted

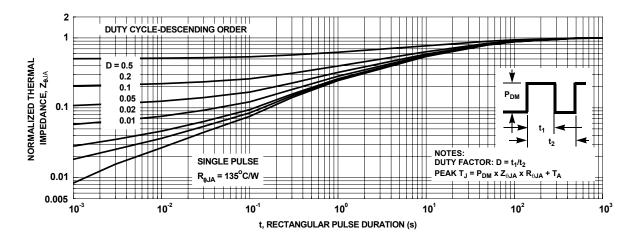


Figure 13. Transient Thermal Response Curve





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