

# FDS8958A\_F085

## Dual N & P-Channel PowerTrench® MOSFET

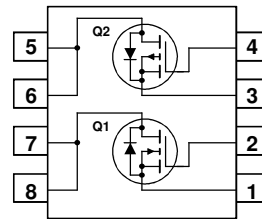
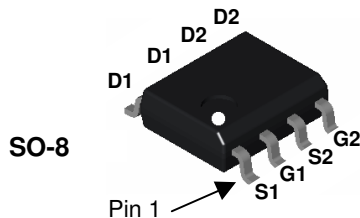
### General Description

These dual N- and P-Channel enhancement mode power field effect transistors are produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

These devices are well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

### Features

- **Q1:** N-Channel  
7.0A, 30V  $R_{DS(on)} = 0.028\Omega @ V_{GS} = 10V$   
 $R_{DS(on)} = 0.040\Omega @ V_{GS} = 4.5V$
- **Q2:** P-Channel  
-5A, -30V  $R_{DS(on)} = 0.052\Omega @ V_{GS} = -10V$   
 $R_{DS(on)} = 0.080\Omega @ V_{GS} = -4.5V$
- Fast switching speed
- High power and handling capability in a widely used surface mount package
- Qualified to AEC Q101
- RoHS Compliant



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

Symbol	Parameter	Q1	Q2	Units
$V_{DS}$	Drain-Source Voltage	30	30	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D$	Drain Current - Continuous (Note 1a)	7	-5	A
	- Pulsed	20	-20	
$P_D$	Power Dissipation for Dual Operation	2	2	W
	Power Dissipation for Single Operation (Note 1a)	1.6	1.6	
	(Note 1c)	0.9	0.9	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	54	13	mJ
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150		$^\circ\text{C}$

### Thermal Characteristics

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

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS8958A	FDS8958A_F085	13"	12mm	2500 units

**Electrical Characteristics**

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

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
<b>Off Characteristics</b>							
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA	Q1 Q2	30 -30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C I <sub>D</sub> = -250 μA, Referenced to 25°C	Q1 Q2		25 -23		mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V V <sub>DS</sub> = -24 V, V <sub>GS</sub> = 0 V	Q1 Q2			1 -1	μA
I <sub>GSSF</sub>	Gate-Body Leakage, Forward	V <sub>GS</sub> = 20 V, V <sub>DS</sub> = 0 V	All			100	nA
I <sub>GSSR</sub>	Gate-Body Leakage, Reverse	V <sub>GS</sub> = -20 V, V <sub>DS</sub> = 0 V	All			-100	nA
<b>On Characteristics (Note 2)</b>							
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA	Q1 Q2	1 -1	1.9 -1.7	3 -3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C I <sub>D</sub> = -250 μA, Referenced to 25°C	Q1 Q2		-4.5 4.5		mV/°C
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7 A V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7 A, T <sub>J</sub> = 125°C V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 6 A V <sub>GS</sub> = -10 V, I <sub>D</sub> = -5 A V <sub>GS</sub> = -10 V, I <sub>D</sub> = -5 A, T <sub>J</sub> = 125°C V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -4 A	Q1   Q2		19 27 24 42 57 65	28 42 40 52 78 80	mΩ
I <sub>D(on)</sub>	On-State Drain Current	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 5 V V <sub>GS</sub> = -10 V, V <sub>DS</sub> = -5 V	Q1 Q2	20 -20			A
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 7 A V <sub>DS</sub> = -5 V, I <sub>D</sub> = -5 A	Q1 Q2		25 10		S
<b>Dynamic Characteristics</b>							
C <sub>iss</sub>	Input Capacitance	Q1 V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	Q1 Q2		575 528		pF
C <sub>oss</sub>	Output Capacitance	Q2	Q1 Q2		145 132		pF
C <sub>rss</sub>	Reverse Transfer Capacitance	V <sub>DS</sub> = -15 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	Q1 Q2		65 70		pF
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> = 15 mV, f = 1.0 MHz	Q1 Q2		2.1 6.0		Ω

**Electrical Characteristics (continued)**  $T_A = 25^\circ\text{C}$  unless otherwise noted

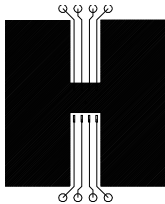
Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
<b>Switching Characteristics (Note 2)</b>							
$t_{d(on)}$	Turn-On Delay Time	Q1 $V_{DD} = 15\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$	Q1 Q2		8 7	16 14	ns
$t_r$	Turn-On Rise Time		Q1 Q2		5 13	10 24	ns
$t_{d(off)}$	Turn-Off Delay Time	Q2 $V_{DD} = -15\text{ V}, I_D = -1\text{ A},$ $V_{GS} = -10\text{ V}, R_{GEN} = 6\ \Omega$	Q1 Q2		23 14	37 25	ns
$t_f$	Turn-Off Fall Time		Q1 Q2		3 9	6 17	ns
$Q_g$	Total Gate Charge	Q1 $V_{DS} = 15\text{ V}, I_D = 7\text{ A}, V_{GS} = 10\text{ V}$	Q1 Q2		11.4 9.6	16 13	nC
$Q_{gs}$	Gate-Source Charge	Q2	Q1 Q2		1.7 2.2		nC
$Q_{gd}$	Gate-Drain Charge	$V_{DS} = -15\text{ V}, I_D = -5\text{ A}, V_{GS} = -10\text{ V}$	Q1 Q2		2.1 1.7		nC

**Drain-Source Diode Characteristics and Maximum Ratings**

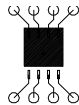
$I_S$	Maximum Continuous Drain-Source Diode Forward Current		Q1 Q2			1.3 -1.3	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current (Note 2)		Q1 Q2			20 -20	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 1.3\text{ A}$ (Note 2) $V_{GS} = 0\text{ V}, I_S = -1.3\text{ A}$ (Note 2)	Q1 Q2		0.75 -0.88	1.2 -1.2	V
$t_{rr}$	Diode Reverse Recovery Time	Q1 $I_F = 7\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$	Q1 Q2		19 19		nS
$Q_{rr}$	Diode Reverse Recovery Charge	Q2 $I_F = -5\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$	Q1 Q2		9 6		nC

**Notes:**

- $R_{\theta JA}$  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  $R_{\theta CA}$  is determined by the user's board design.



a) 78°/W when mounted on a 0.5 in<sup>2</sup> pad of 2 oz copper



b) 125°/W when mounted on a .02 in<sup>2</sup> pad of 2 oz copper

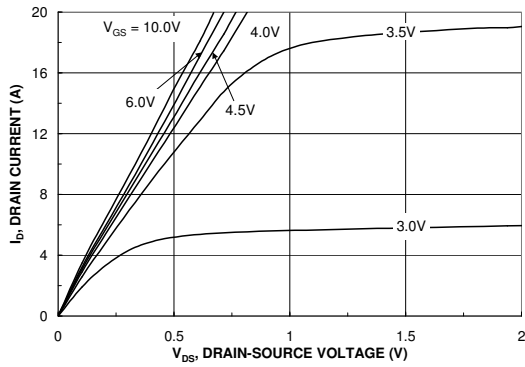


c) 135°/W when mounted on a minimum pad.

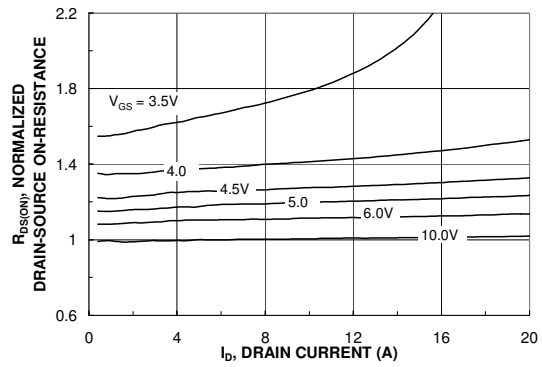
Scale 1 : 1 on letter size paper

- Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty Cycle < 2.0%
- Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 6\text{ A}$ ,  $V_{DD} = 30\text{ V}$ ,  $V_{GS} = 10\text{ V}$  (Q1).  
Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 3\text{ A}$ ,  $V_{DD} = 30\text{ V}$ ,  $V_{GS} = 10\text{ V}$  (Q2).

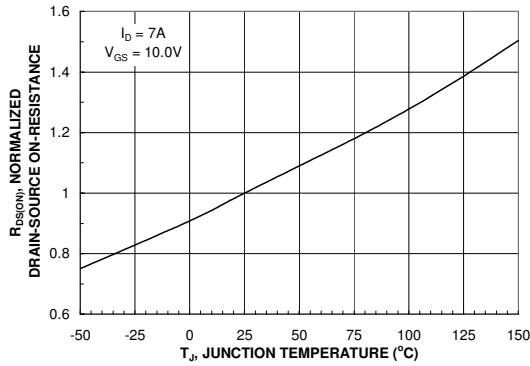
**Typical Characteristics: Q1 (N-Channel)**



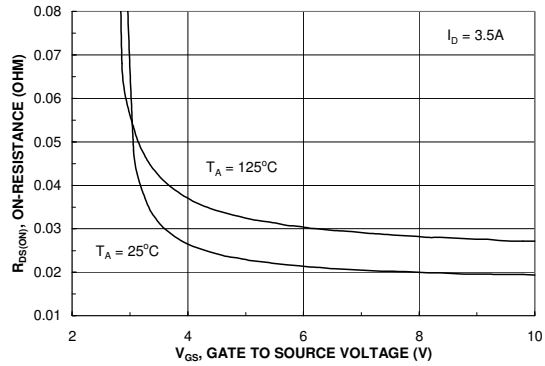
**Figure 1. On-Region Characteristics.**



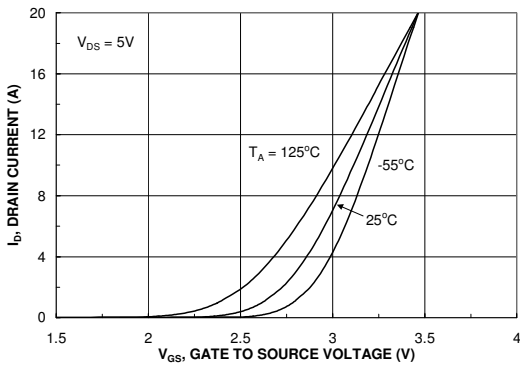
**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**



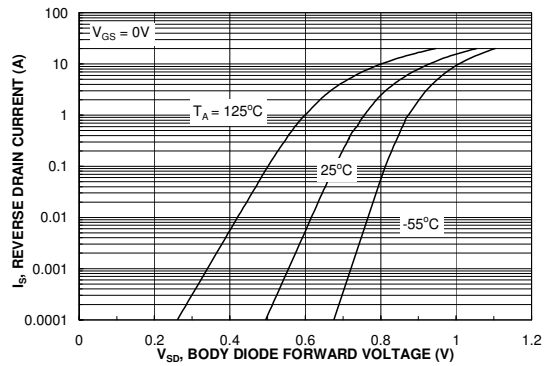
**Figure 3. On-Resistance Variation with Temperature.**



**Figure 4. On-Resistance Variation with Gate-to-Source Voltage.**

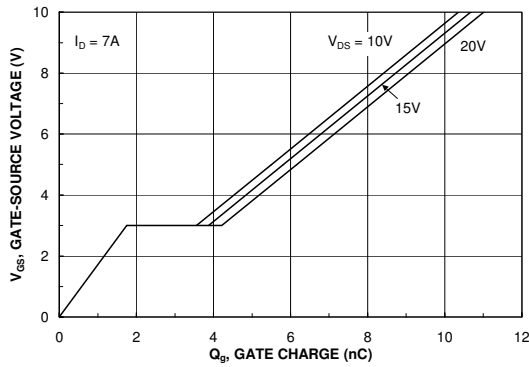


**Figure 5. Transfer Characteristics.**

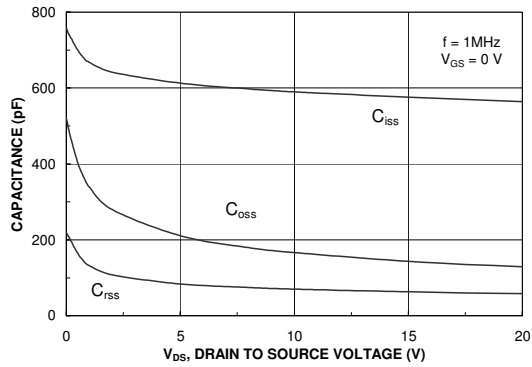


**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.**

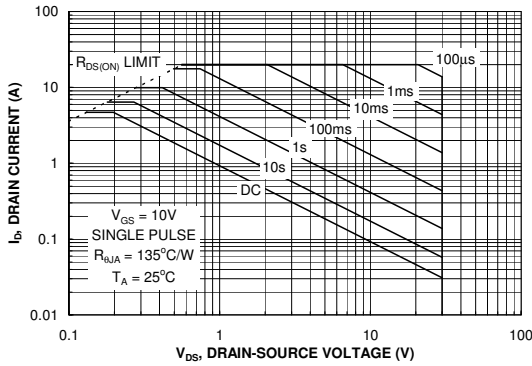
**Typical Characteristics: Q1 (N-Channel)**



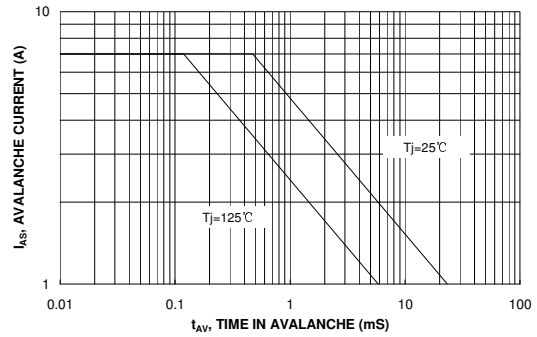
**Figure 7. Gate Charge Characteristics.**



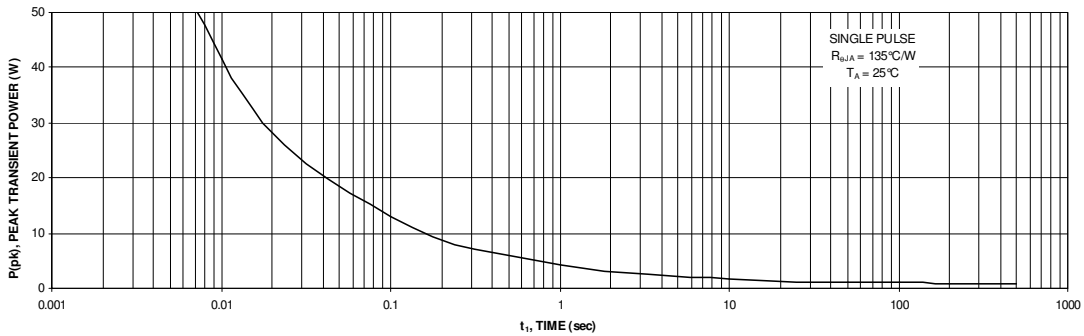
**Figure 8. Capacitance Characteristics.**



**Figure 9. Maximum Safe Operating Area.**



**Figure 10. Unclamped Inductive Switching Capability Figure**



**Figure 11. Single Pulse Maximum Power Dissipation.**

Typical Characteristics: Q2 (P-Channel)

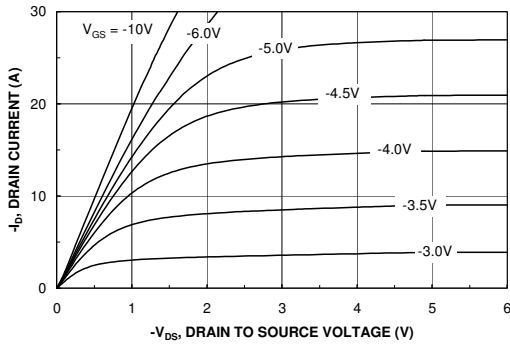


Figure 12. On-Region Characteristics.

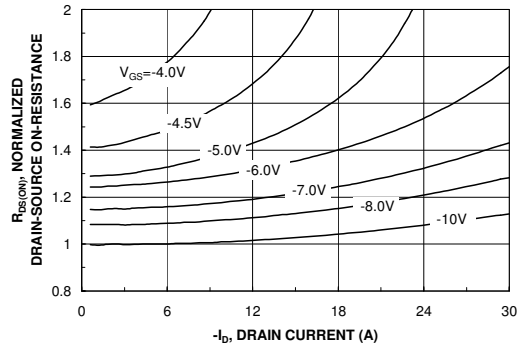


Figure 13. On-Resistance Variation with Drain Current and Gate Voltage.

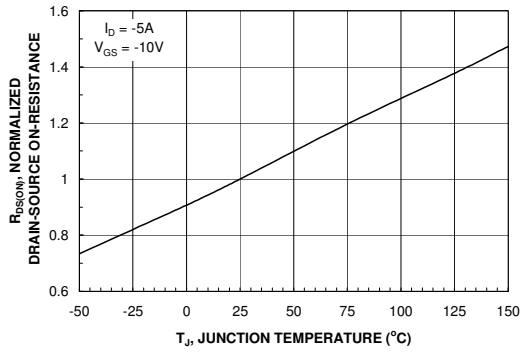


Figure 14. On-Resistance Variation with Temperature.

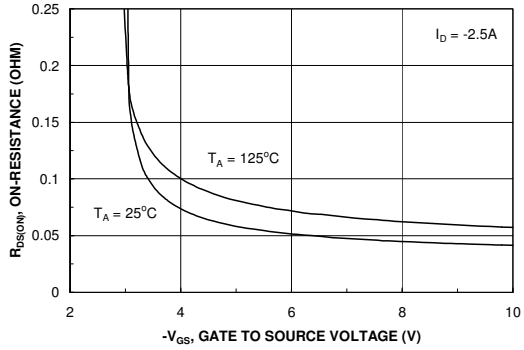


Figure 15. On-Resistance Variation with Gate-to-Source Voltage.

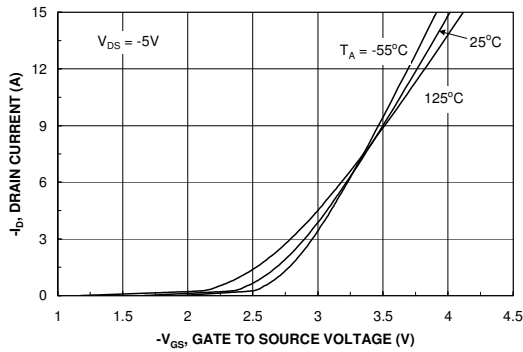


Figure 16. Transfer Characteristics.

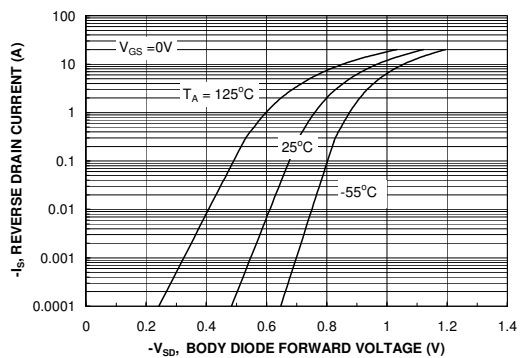
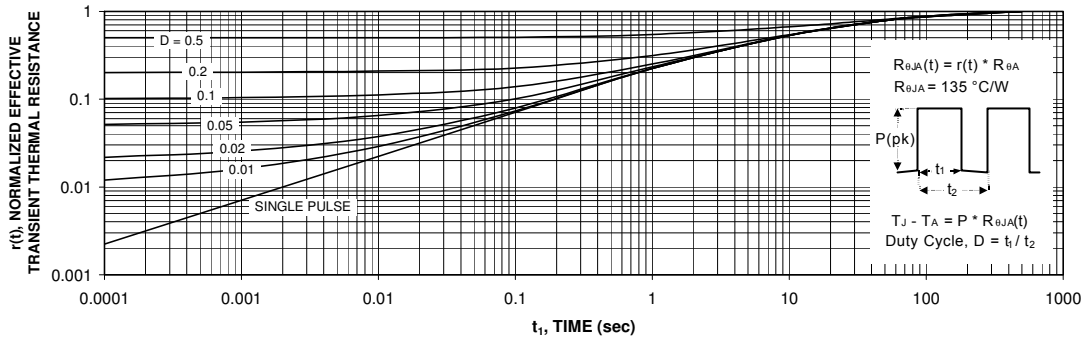


Figure 17. Body Diode Forward Voltage Variation with Source Current and Temperature.

### Typical Characteristics: Q2 (P-Channel)



**Figure 23. Transient Thermal Response Curve.**






Thermal characterization performed using the conditions described in Note 1c.  
Transient thermal response will change depending on the circuit board design.

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