

# FDS8958B

## Dual N & P-Channel PowerTrench® MOSFET

Q1-N-Channel: 30 V, 6.4 A, 26 mΩ Q2-P-Channel: -30 V, -4.5 A, 51 mΩ

### Features

Q1: N-Channel

- Max  $r_{DS(on)}$  = 26 mΩ at  $V_{GS} = 10$  V,  $I_D = 6.4$  A
- Max  $r_{DS(on)}$  = 39 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 5.2$  A

Q2: P-Channel

- Max  $r_{DS(on)}$  = 51 mΩ at  $V_{GS} = -10$  V,  $I_D = -4.5$  A
- Max  $r_{DS(on)}$  = 80 mΩ at  $V_{GS} = -4.5$  V,  $I_D = -3.3$  A
- HBM ESD protection level > 3.5 kV (Note 3)

- RoHS Compliant



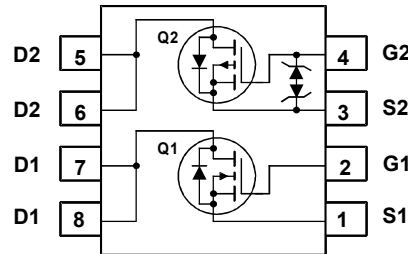
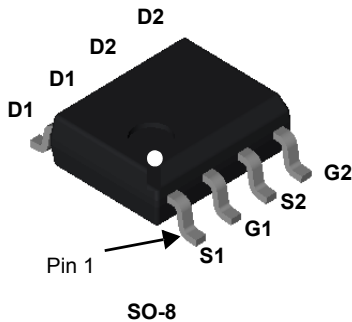
### General Description

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.

### Application

- DC-DC Conversion
- BLU and motor drive inverter



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

Symbol	Parameter	Q1	Q2	Units
$V_{DS}$	Drain to Source Voltage	30	-30	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	$\pm 25$	V
$I_D$	Drain Current - Continuous $T_A = 25^\circ\text{C}$	6.4	-4.5	A
	- Pulsed	30	-30	
$P_D$	Power Dissipation for Dual Operation	2.0		W
	Power Dissipation for Single Operation $T_A = 25^\circ\text{C}$ (Note 1a)	1.6		
	$T_A = 25^\circ\text{C}$ (Note 1b)	0.9		
$E_{AS}$	Single Pulse Avalanche Energy (Note 4)	18	5	mJ
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150		$^\circ\text{C}$

### Thermal Characteristics

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

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDS8958B	FDS8958B	SO-8	13"	12 mm	2500 units

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

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$ $I_D = -250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$	Q1 Q2	30 -30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$ $I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$	Q1 Q2		24 -21		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$ $V_{DS} = -24\text{ V}, V_{GS} = 0\text{ V}$	Q1 Q2			1 -1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$ $V_{GS} = \pm 25\text{ V}, V_{DS} = 0\text{ V}$	Q1 Q2			$\pm 100$ $\pm 10$	nA $\mu\text{A}$

#### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$ $V_{GS} = V_{DS}, I_D = -250\text{ }\mu\text{A}$	Q1 Q2	1.0 -1.0	2.0 -1.9	3.0 -3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$ $I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$	Q1 Q2		-6 5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 6.4\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 5.2\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 6.4\text{ A}, T_J = 125\text{ }^\circ\text{C}$	Q1		21 29 31	26 39 39	m $\Omega$
		$V_{GS} = -10\text{ V}, I_D = -4.5\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -3.3\text{ A}$ $V_{GS} = -10\text{ V}, I_D = -4.5\text{ A}, T_J = 125\text{ }^\circ\text{C}$	Q2		38 60 53	51 80 72	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5\text{ V}, I_D = 6.4\text{ A}$ $V_{DD} = -5\text{ V}, I_D = -4.5\text{ A}$	Q1 Q2		20 10		S

#### Dynamic Characteristics

$C_{iss}$	Input Capacitance	Q1 $V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	Q1 Q2		405 570	540 760	pF
$C_{oss}$	Output Capacitance	Q2	Q1 Q2		75 115	100 155	pF
$C_{riss}$	Reverse Transfer Capacitance	$V_{DS} = -15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	Q1 Q2		55 100	80 150	pF
$R_g$	Gate Resistance		Q1 Q2		2.4 4.4		$\Omega$

#### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	Q1	Q1 Q2		4.3 6.0	10 12	ns
$t_r$	Rise Time	$V_{DD} = 15\text{ V}, I_D = 6.4\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$	Q1		2.0	10	ns
			Q2		6.0	12	
$t_{d(off)}$	Turn-Off Delay Time	Q2 $V_{DD} = -15\text{ V}, I_D = -4.5\text{ A},$ $V_{GS} = -10\text{ V}, R_{GEN} = 6\text{ }\Omega$	Q1		12	22	ns
			Q2		17	30	
$t_f$	Fall Time	$V_{DD} = -15\text{ V}, I_D = -4.5\text{ A},$ $V_{GS} = -10\text{ V}, R_{GEN} = 6\text{ }\Omega$	Q1		2.0	10	ns
			Q2		7.0	14	
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 10\text{ V}$ $V_{GS} = -10\text{ V}$	Q1		8.3	12	nC
			Q2		14	19	
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 4.5\text{ V}$ $V_{GS} = -4.5\text{ V}$	Q1	$V_{DD} = 15\text{ V},$ $I_D = 6.4\text{ A}$	4.1	5.8	nC
			Q2		7.0	9.6	
$Q_{gs}$	Gate to Source Charge		Q1		1.3		nC
			Q2		1.9		
$Q_{gd}$	Gate to Drain "Miller" Charge		Q1		1.7		nC
			Q2		3.6		

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

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
<b>Drain-Source Diode Characteristics</b>							
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 1.3\text{ A}$ (Note 2)	Q1		0.8	1.2	V
		$V_{GS} = 0\text{ V}, I_S = -1.3\text{ A}$ (Note 2)	Q2		-0.8	-1.2	
$t_{rr}$	Reverse Recovery Time	Q1 $I_F = 6.4\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	Q1		17	30	ns
			Q2		20	36	
$Q_{rr}$	Reverse Recovery Charge	Q2 $I_F = -4.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	Q1		6	12	nC
			Q2		8	16	

**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. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.
4. UIL condition: Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 1\text{ mH}$ ,  $I_{AS} = 6\text{ A}$ ,  $V_{DD} = 27\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . (Q1)  
Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 1\text{ mH}$ ,  $I_{AS} = -4\text{ A}$ ,  $V_{DD} = -27\text{ V}$ ,  $V_{GS} = -10\text{ V}$ . (Q2)

**Typical Characteristics (Q1 N-Channel)**  $T_J = 25^\circ\text{C}$  unless otherwise noted

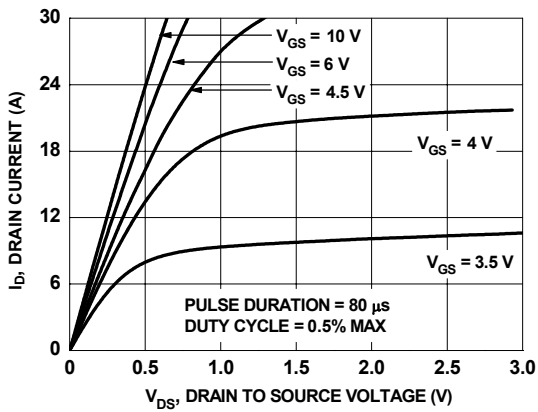


Figure 1. On Region Characteristics

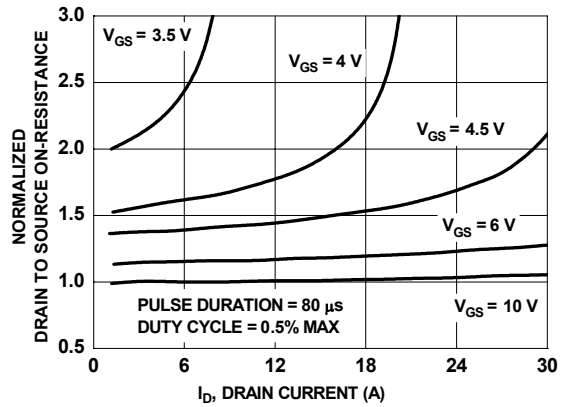


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

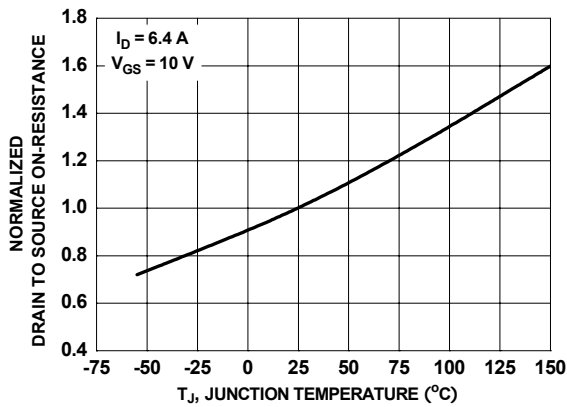


Figure 3. Normalized On Resistance vs Junction Temperature

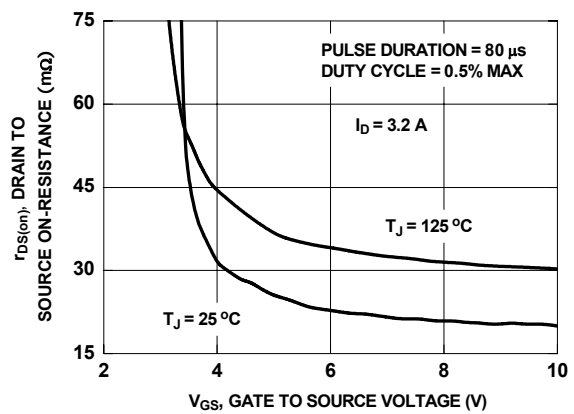


Figure 4. On-Resistance vs Gate to Source Voltage

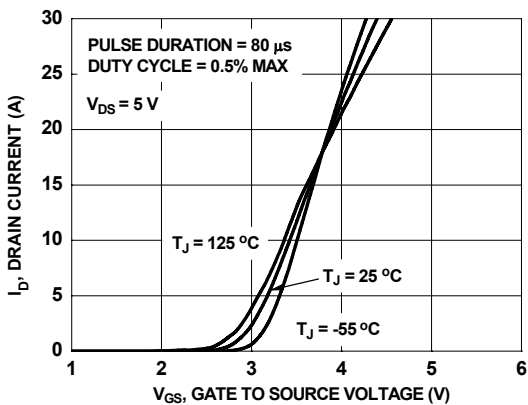


Figure 5. Transfer Characteristics

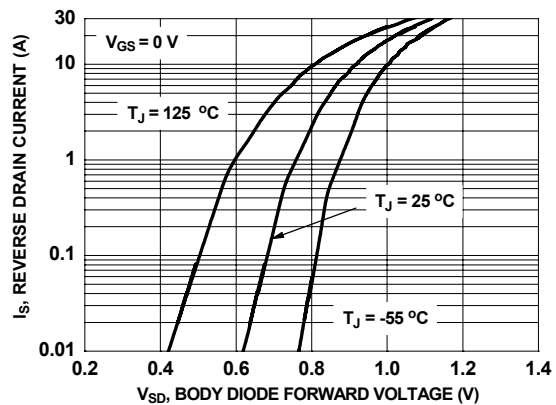
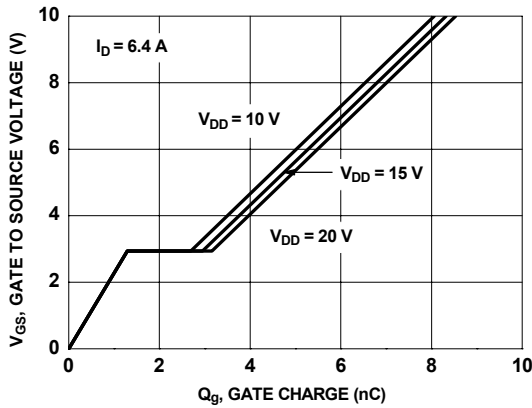
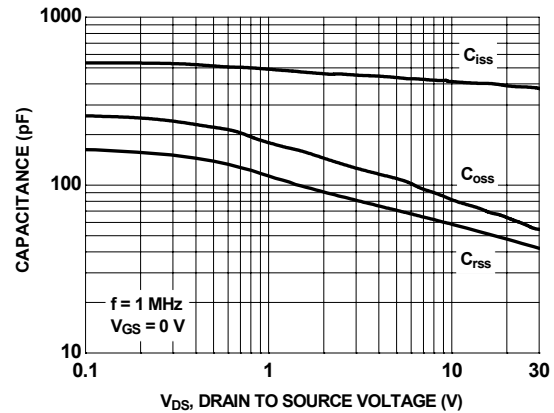


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

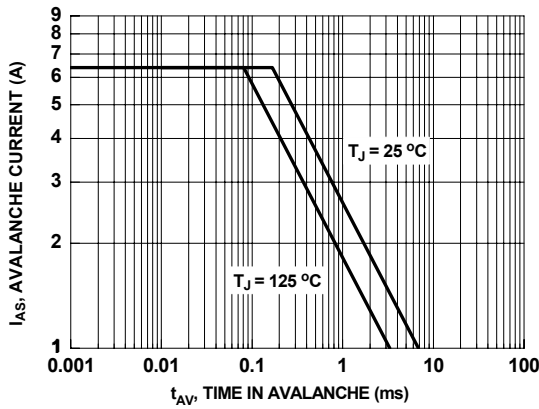
**Typical Characteristics (Q1 N-Channel)**  $T_J = 25^\circ\text{C}$  unless otherwise noted



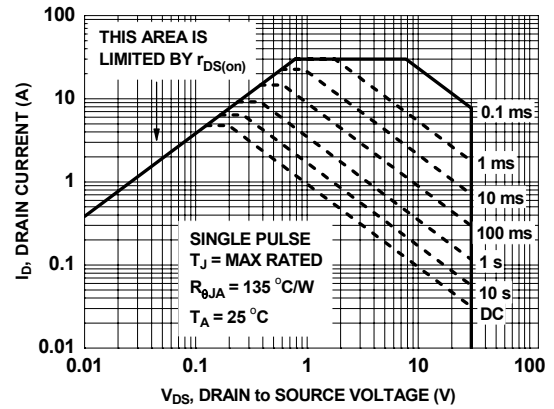
**Figure 7. Gate Charge Characteristics**



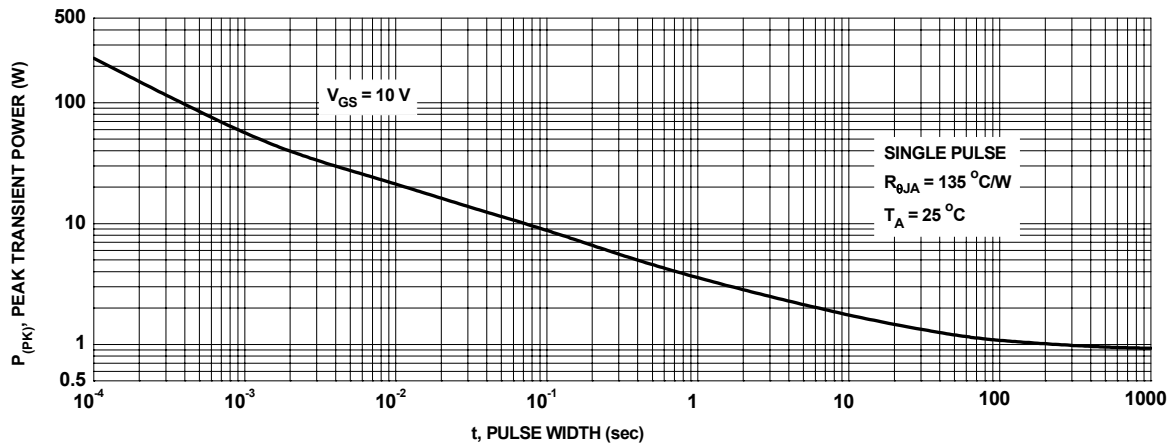
**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Unclamped Inductive Switching Capability**

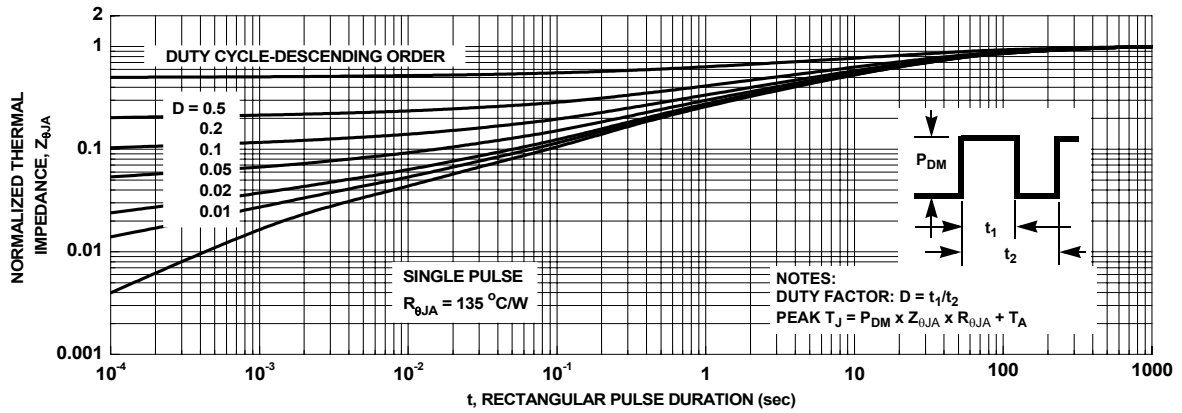


**Figure 10. Forward Bias Safe Operating Area**



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

**Typical Characteristics (Q1 N-Channel)**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



**Figure 12. Junction-to-Ambient Transient Thermal Response Curve**

**Typical Characteristics (Q2 P-Channel)**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted

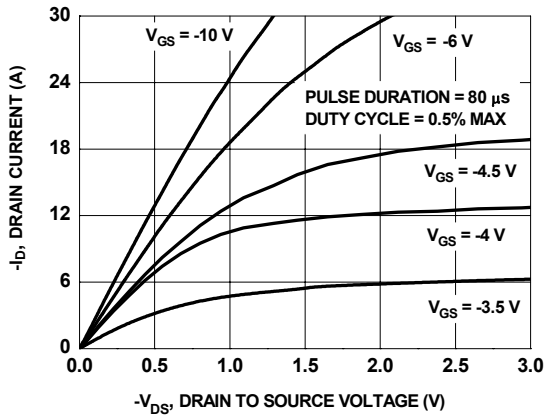


Figure 15. On-Region Characteristics

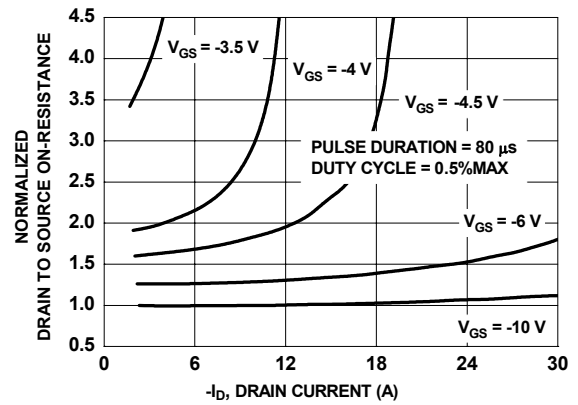


Figure 16. Normalized on-Resistance vs Drain Current and Gate Voltage

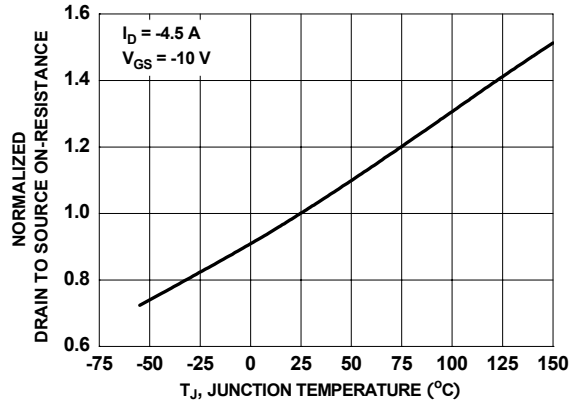


Figure 17. Normalized On-Resistance vs Junction Temperature

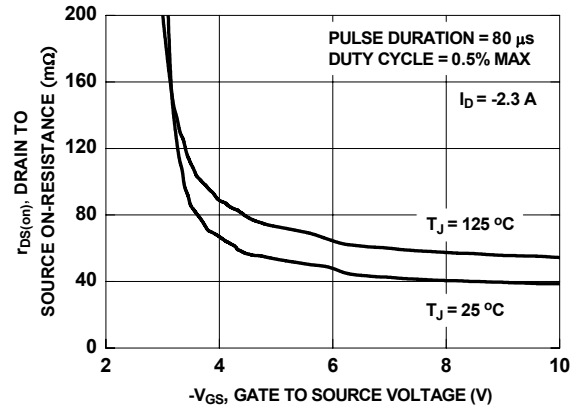


Figure 18. On-Resistance vs Gate to Source Voltage

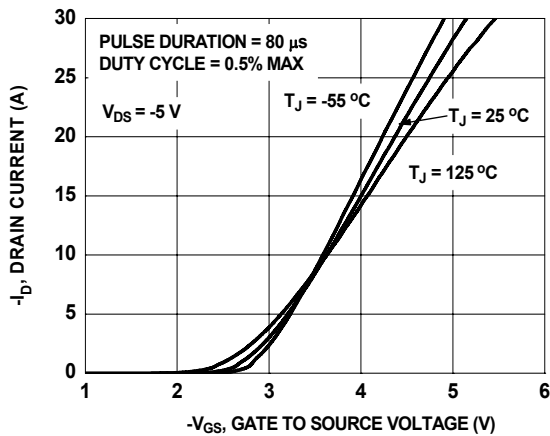


Figure 19. Transfer Characteristics

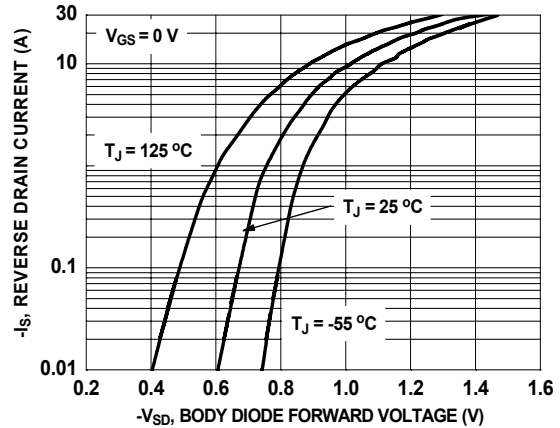
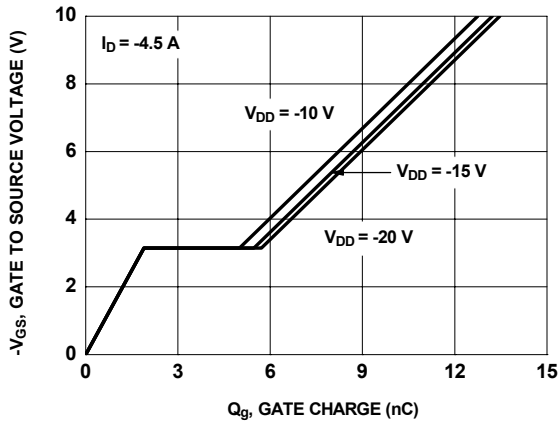
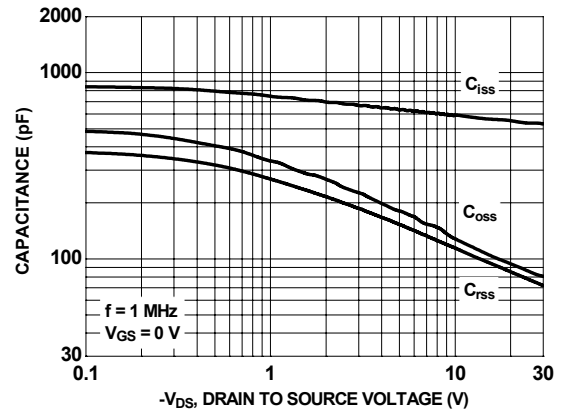


Figure 20. Source to Drain Diode Forward Voltage vs Source Current

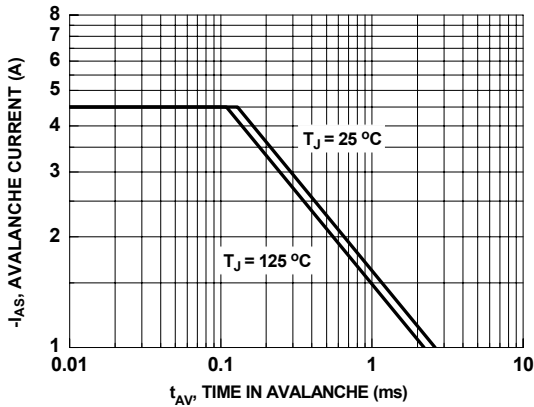
**Typical Characteristics (Q2 P-Channel)  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted**



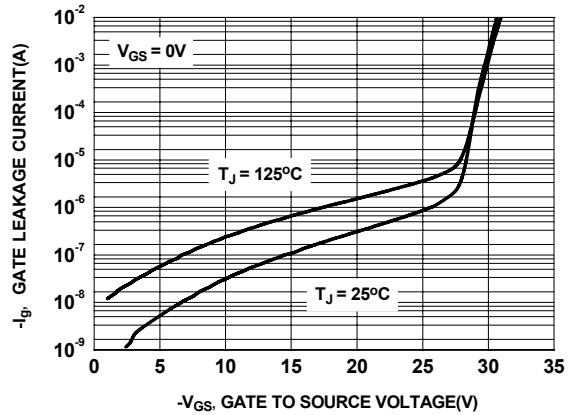
**Figure 21. Gate Charge Characteristics**



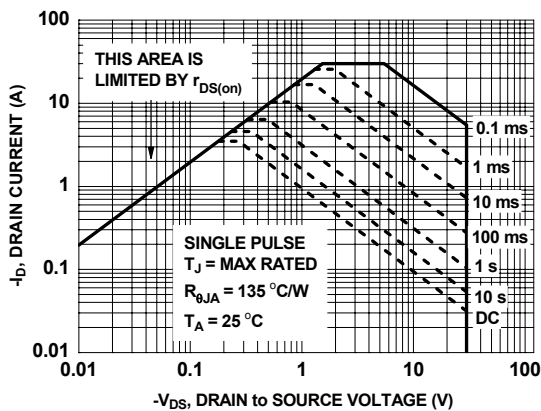
**Figure 22. Capacitance vs Drain to Source Voltage**



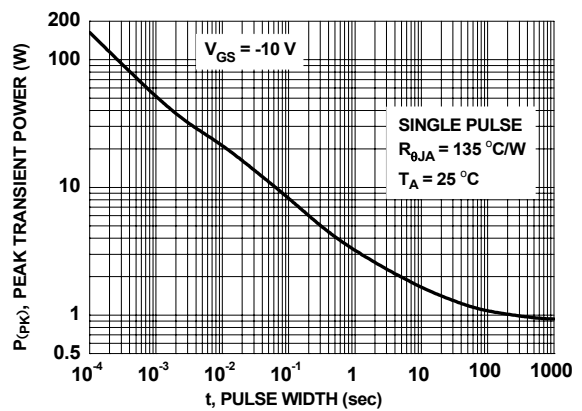
**Figure 23. Unclamped Inductive Switching Capability**



**Figure 24.  $I_g$  vs  $V_{GS}$**



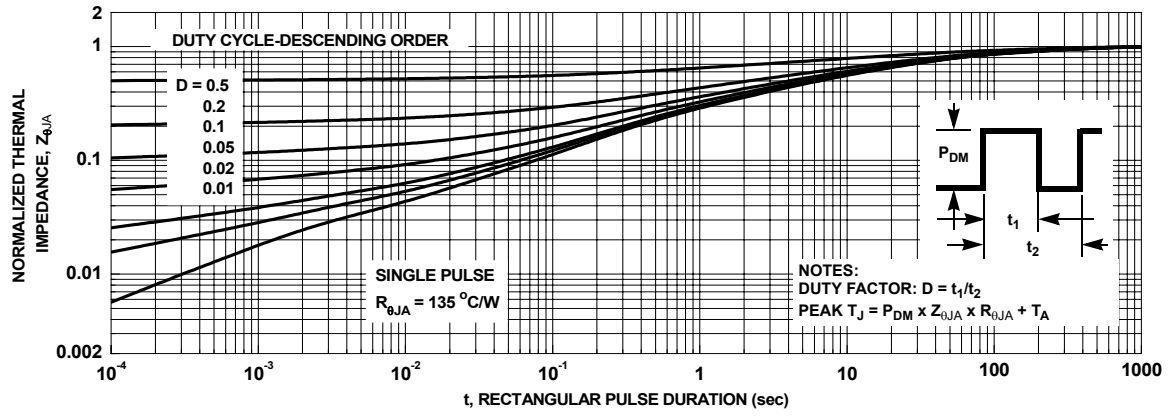
**Figure 25. Forward Bias Safe Operating Area**



**Figure 26. Single Pulse Maximum Power Dissipation**

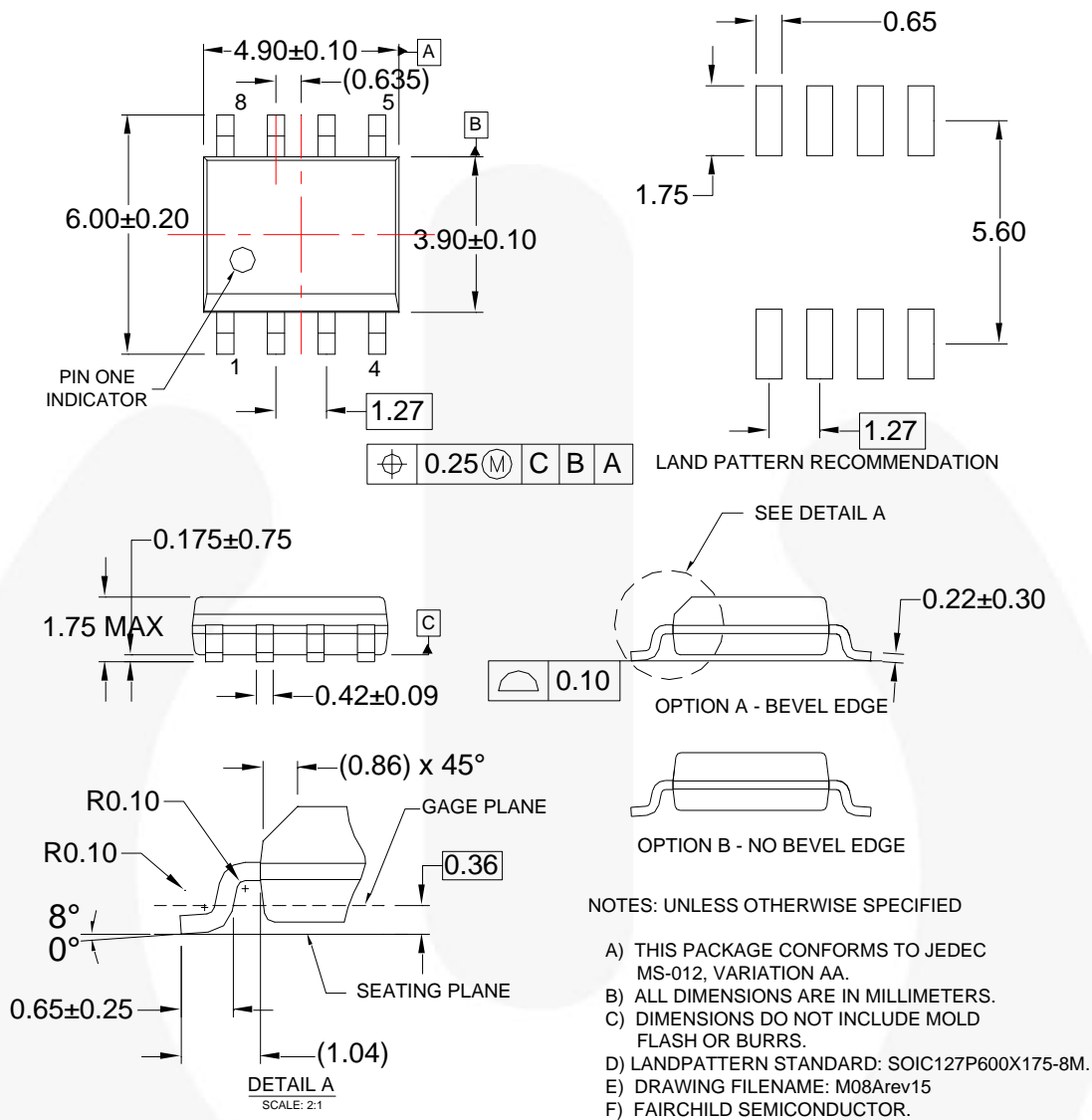


**Typical Characteristics (Q2 P-Channel)  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted**



**Figure 27. Junction-to-Ambient Transient Thermal Response Curve**

## Physical Dimensions



**Figure 16. 8-Lead, SOIC, JEDEC MS-012, .150-inch Narrow Body**



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No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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