



ON Semiconductor®

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

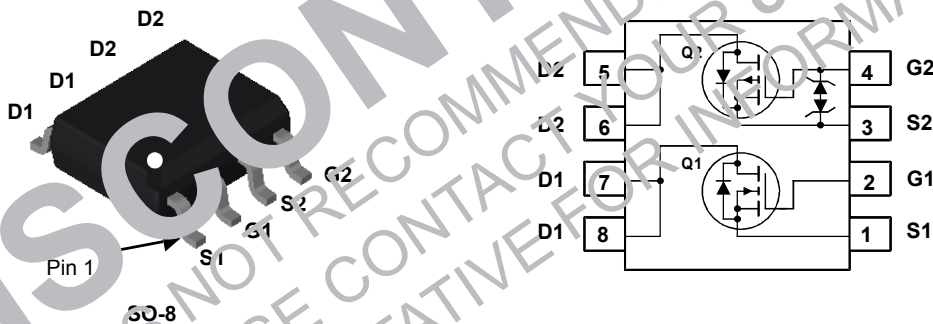
General Description

These dual N- and P-Channel enhancement mode power field effect transistors are produced using ON 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 line power loss and fast switching are required.

Applications

- DC-DC Conversion
- Battery 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	±20	±25	V
I _D	Drain Current - Continuous			

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	μA
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			± 100 ± 10	nA μA

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		5		mV/ $^{\circ}\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$, $I_D = 6.4\text{ A}$ $V_{GS} = 4.5\text{ V}$, $I_D = 5.2\text{ A}$ $V_{GS} = 10\text{ V}$, $I_D = 6.4\text{ A}$, $T_J = 25\text{ }^{\circ}\text{C}$ $V_{GS} = -10\text{ V}$, $I_S = -6.4\text{ A}$ $V_{GS} = -4.5\text{ V}$, $I_S = -5.2\text{ A}$ $V_{GS} = -10\text{ V}$, $I_D = -6.4\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	Q1 Q2		21 29 31 38 60 53	26 39 39 51 80 72	m Ω
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}$, $I_D = 6.4\text{ A}$ $V_{DS} = -5\text{ V}$, $I_S = -4.5\text{ A}$	Q1 Q2		20 10		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$	Q1 Q2		405 570	540 760	pF
C_{oss}	Output Capacitance		Q1 Q2		75 115	100 155	pF
C_{rss}	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		Ω

Switching Characteristics

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

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

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

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in² 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 in² pad of 2 oz copper



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

2. Pulse Test: Pulse Width < 300 μs , Duty cycle < 2.0%.

3. The diode connected between the gate and source serves only as protection against V_{SD} . No gate overvoltage rating is implied.

4. UIL condition: Starting $T_J = 25^\circ\text{C}$, $L = 1\text{ mH}$, $I_{AS} = 6\text{ A}$, $V_{DD} = 27\text{ V}$, $V_{GS} = 0\text{ V}$. (Q1)
Starting $T_J = 25^\circ\text{C}$, $L = 1\text{ mH}$, $I_{AS} = -4\text{ A}$, $V_{DD} = -27\text{ V}$, $V_{GS} = 0\text{ V}$. (Q2)

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

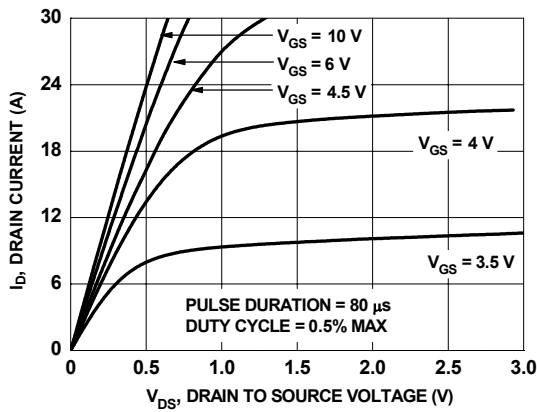


Figure 1. On Region Characteristics

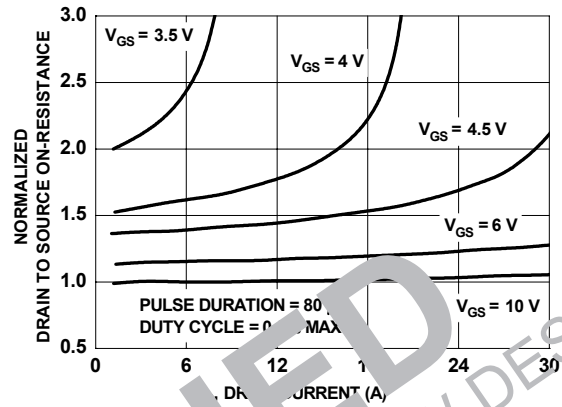


Figure 2. Normalized On-Resistance Drain Current and Gate Voltage

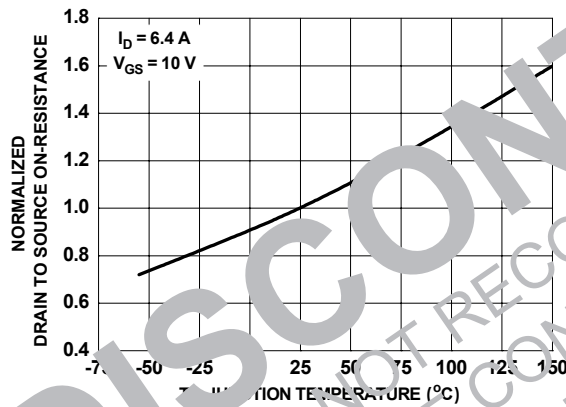


Figure 3. Normalized On-Resistance vs Junction Temperature

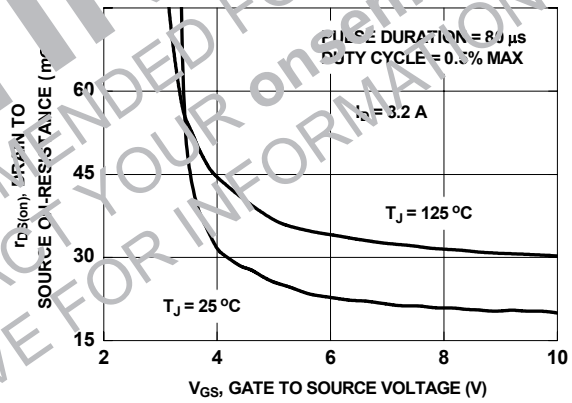


Figure 4. On-Resistance vs Gate to Source Voltage

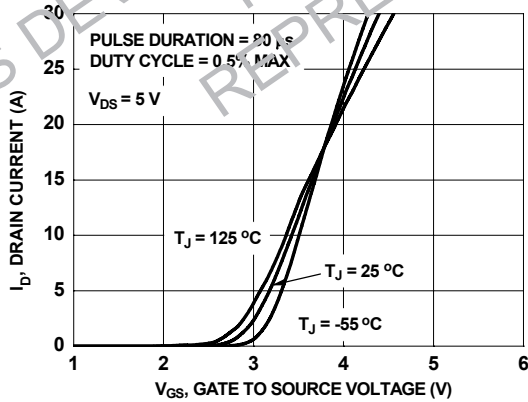


Figure 5. Transfer Characteristics

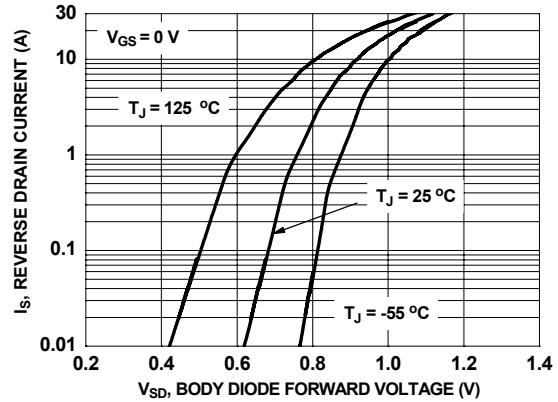


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

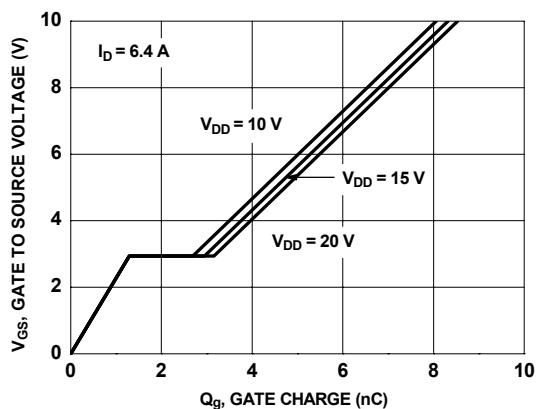


Figure 7. Gate Charge Characteristics

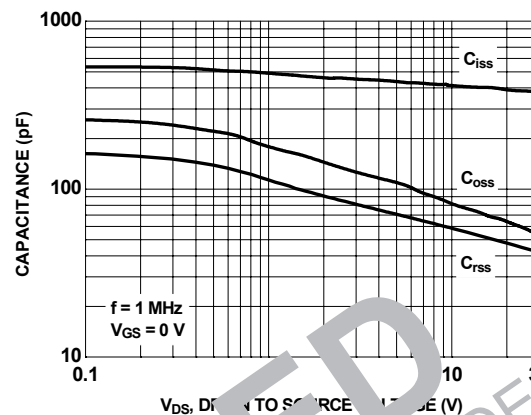


Figure 8. Capacitance vs Drain to Source Voltage

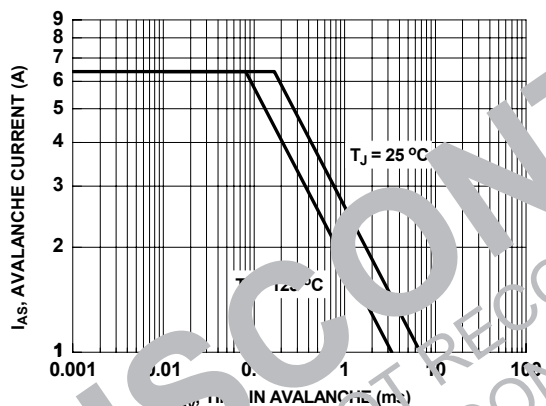


Figure 9. Unclamped Inductive Switching Capability

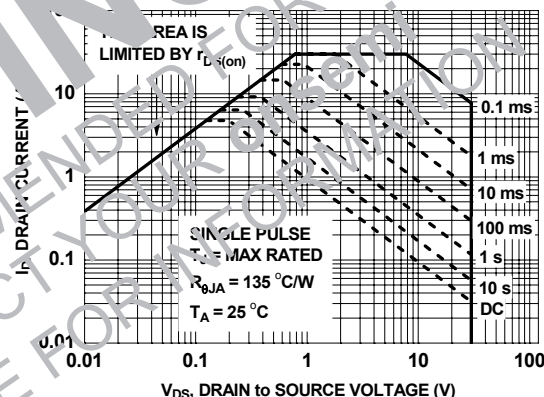


Figure 10. Forward Bias Safe Operating Area

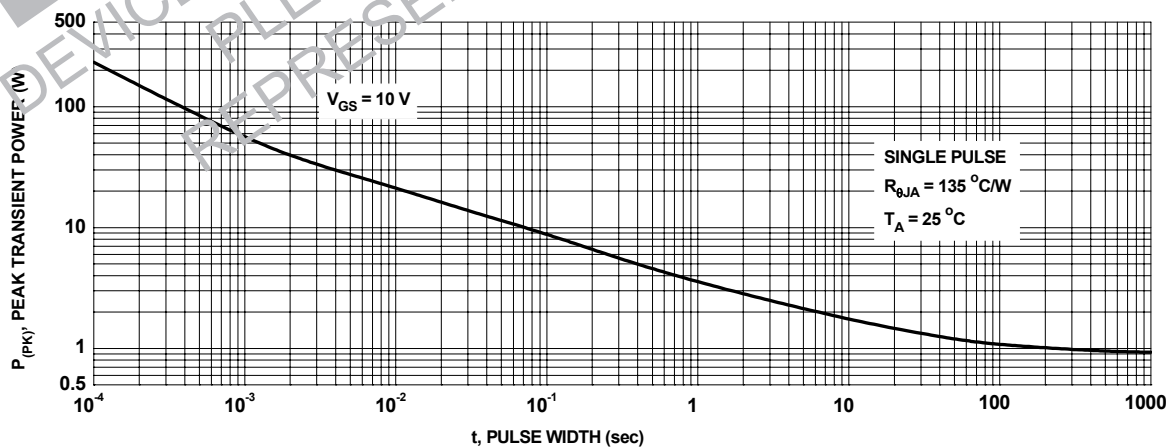


Figure 11. Single Pulse Maximum Power Dissipation

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

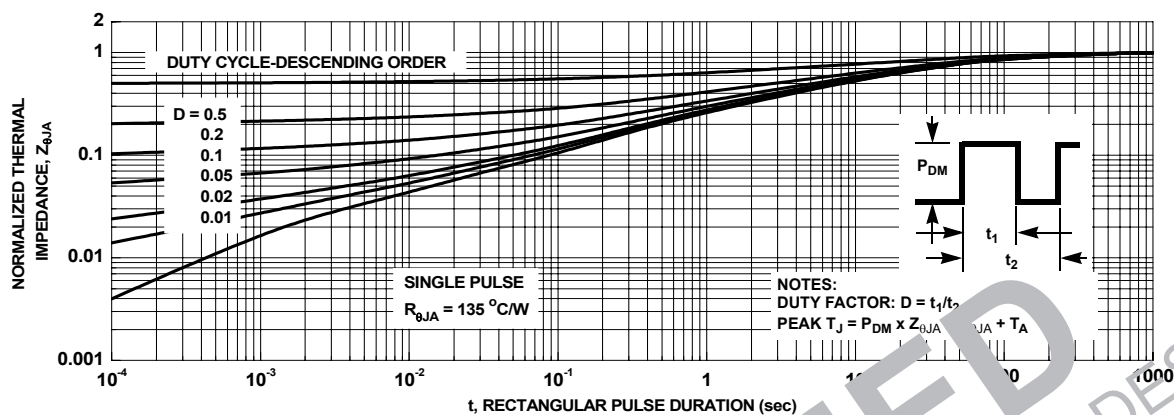


Figure 12. Junction-to-Ambient Transient Thermal Response Curves

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

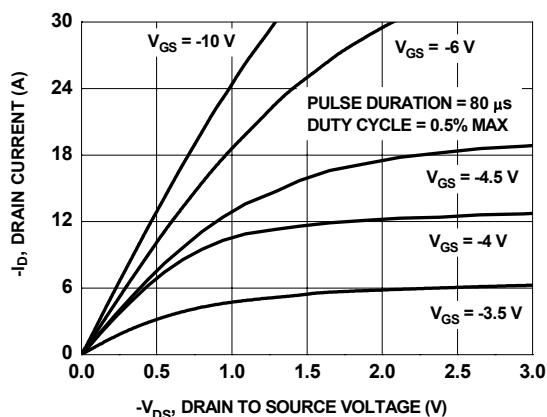


Figure 15. On-Region Characteristics

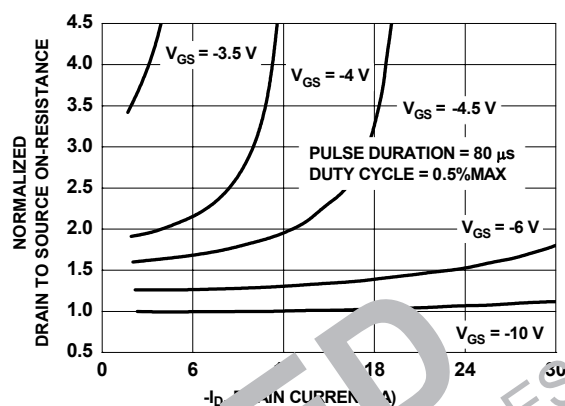


Figure 16. Normalized on-resistance vs Drain Current and Gate Voltage

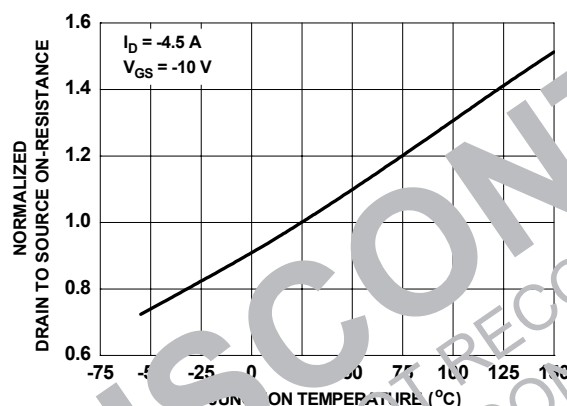


Figure 17. Normalized On-Resistance vs Junction Temperature

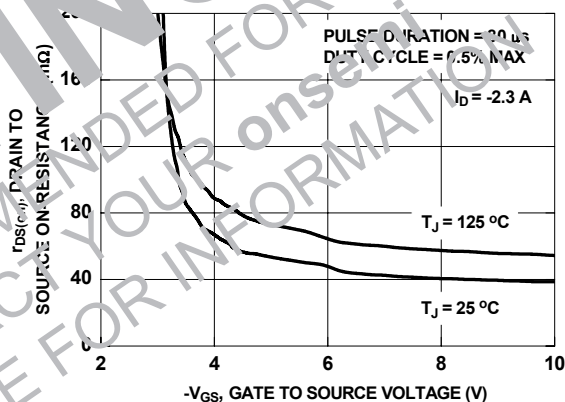


Figure 18. On-Resistance vs Gate to Source Voltage

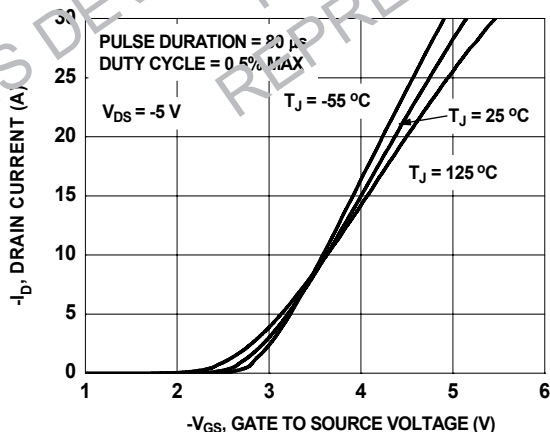


Figure 19. Transfer Characteristics

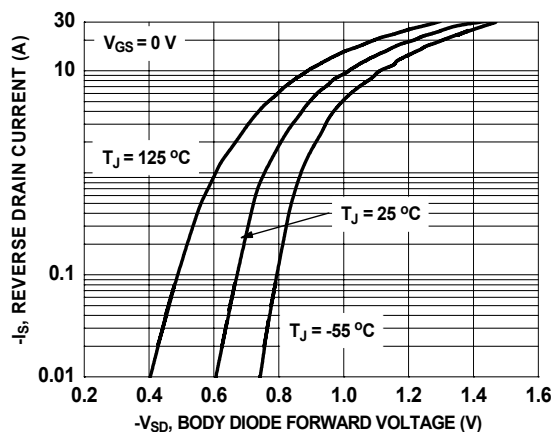


Figure 20. Source to Drain Diode Forward Voltage vs Source Current

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

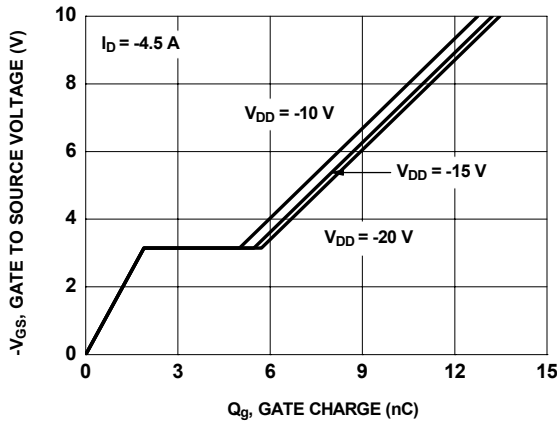


Figure 21. Gate Charge Characteristics

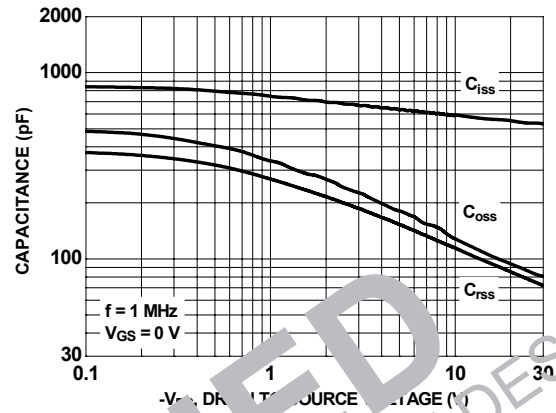


Figure 22. Capacitance vs Drain to Source Voltage

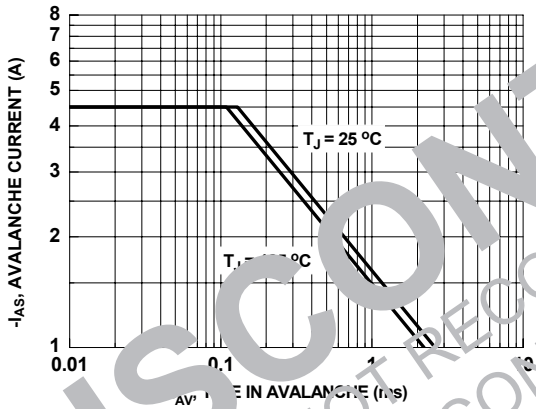


Figure 23. Unclamped Inductive Switching Capability

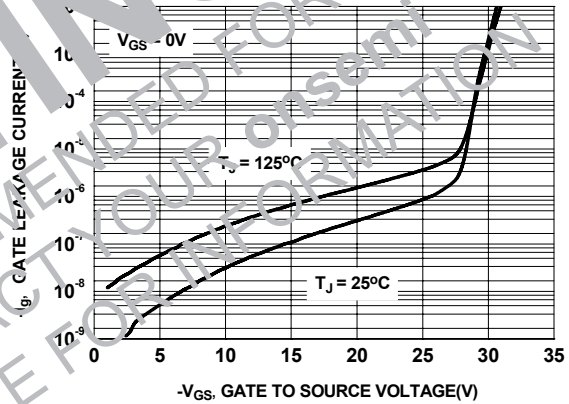


Figure 24. I_g vs V_{gs}

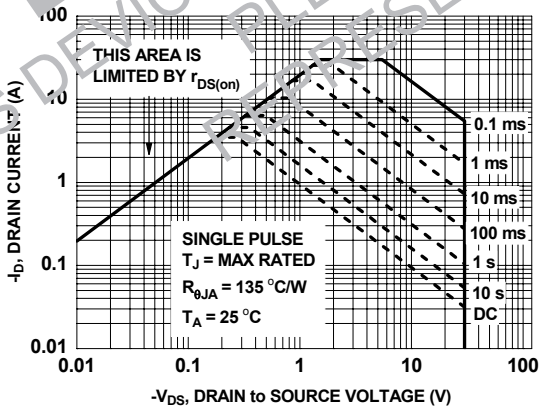


Figure 25. Forward Bias Safe Operating Area

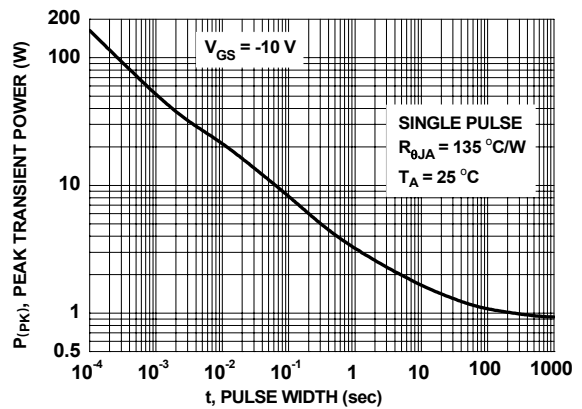


Figure 26. Single Pulse Maximum Power Dissipation

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

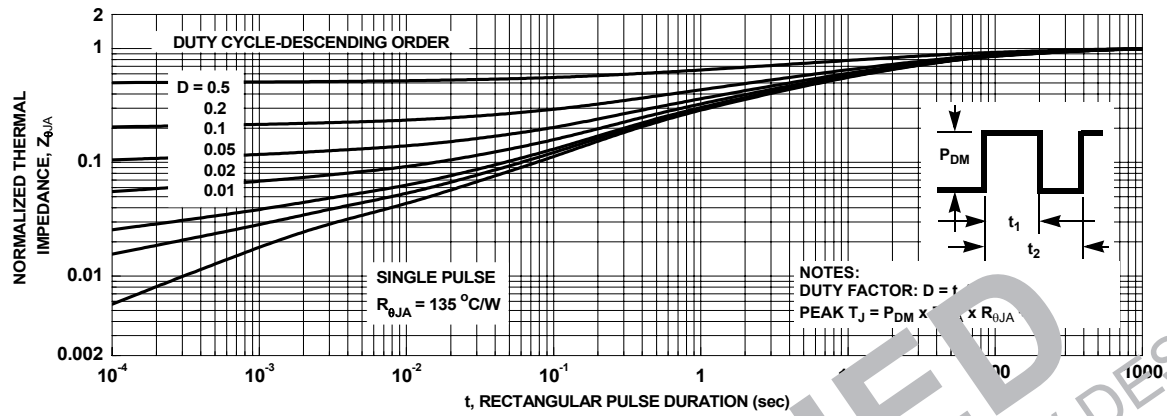


Figure 27. Junction-to-Ambient Transient Thermal Response Curve

Physical Dimensions

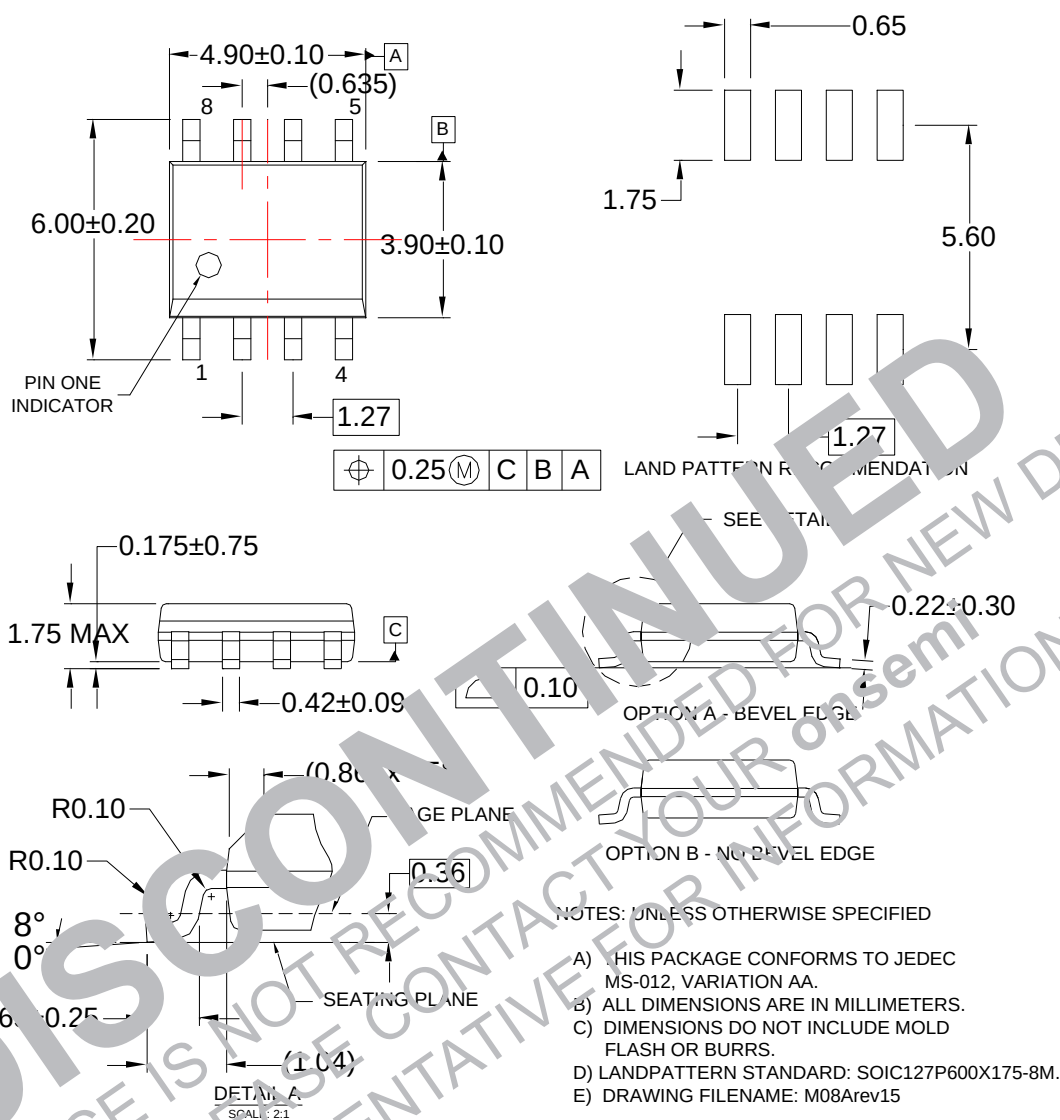


Figure 16 9-Lead, SOIC, JEDEC MS-012, .150-inch Narrow Body

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