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May 2014

FDMS7608S

Dual N-Channel PowerTrench[®] MOSFET

Q1: 30 V, 22 A, 10.0 mΩ Q2: 30 V, 30 A, 6.3 mΩ

Features

Q1: N-Channel

- Max $r_{DS(on)}$ = 10.0 mΩ at $V_{GS} = 10$ V, $I_D = 12$ A
- Max $r_{DS(on)}$ = 13.6 mΩ at $V_{GS} = 4.5$ V, $I_D = 10$ A

Q2: N-Channel

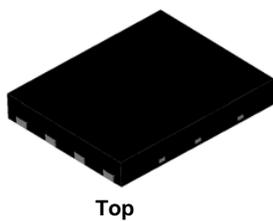
- Max $r_{DS(on)}$ = 6.3 mΩ at $V_{GS} = 10$ V, $I_D = 15$ A
- Max $r_{DS(on)}$ = 7.2 mΩ at $V_{GS} = 4.5$ V, $I_D = 13$ A
- RoHS Compliant

General Description

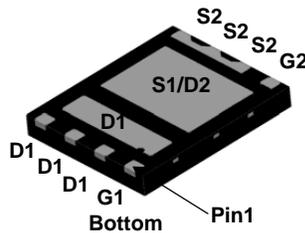
This device includes two specialized N-Channel MOSFETs in a dual MLP package. The switch node has been internally connected to enable easy placement and routing of synchronous buck converters. The control MOSFET (Q1) and synchronous SyncFET[™] (Q2) have been designed to provide optimal power efficiency.

Applications

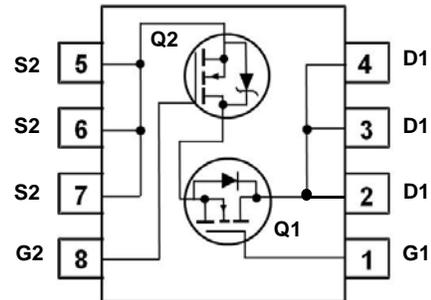
- Computing
- Communications
- General Purpose Point of Load
- Notebook VCore



Top



Power 56



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

Symbol	Parameter	Q1	Q2	Units
V_{DS}	Drain to Source Voltage	30	30	V
V_{GS}	Gate to Source Voltage (Note 3)	± 20	± 20	V
I_D	Drain Current -Continuous (Package limited) $T_C = 25^\circ\text{C}$	22	30	A
	-Continuous $T_A = 25^\circ\text{C}$	12 ^{1a}	15 ^{1b}	
	-Pulsed	50	60	
E_{AS}	Single Pulse Avalanche Energy (Note 4)	29	33	mJ
P_D	Power Dissipation for Single Operation $T_A = 25^\circ\text{C}$	2.2 ^{1a}	2.5 ^{1b}	W
	Power Dissipation for Single Operation $T_A = 25^\circ\text{C}$	1.0 ^{1c}	1.0 ^{1d}	
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	57 ^{1a}	50 ^{1b}	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	125 ^{1c}	120 ^{1d}	
$R_{\theta JC}$	Thermal Resistance, Junction to Case	4.0	3.2	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS7608S	FDMS7608S	Power 56	13 "	12 mm	3000 units

Electrical Characteristics $T_J = 25^\circ\text{C}$ 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	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$ $I_D = 1 \text{ mA}, V_{GS} = 0 \text{ V}$	Q1 Q2	30 30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, referenced to 25°C $I_D = 10 \text{ mA}$, referenced to 25°C	Q1 Q2		13 19		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24 \text{ V}, V_{GS} = 0 \text{ V}$	Q1 Q2			1 500	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$	Q1 Q2			100 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$ $V_{GS} = V_{DS}, I_D = 1 \text{ mA}$	Q1 Q2	1.2 1.2	1.9 1.7	3.0 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°C $I_D = 10 \text{ mA}$, referenced to 25°C	Q1 Q2		-6 -4		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 12 \text{ A}$ $V_{GS} = 4.5 \text{ V}, I_D = 10 \text{ A}$ $V_{GS} = 10 \text{ V}, I_D = 12 \text{ A}, T_J = 125^\circ\text{C}$	Q1		7.4 10.0 10.3	10.0 13.6 13.9	m Ω
		$V_{GS} = 10 \text{ V}, I_D = 15 \text{ A}$ $V_{GS} = 4.5 \text{ V}, I_D = 13 \text{ A}$ $V_{GS} = 10 \text{ V}, I_D = 15 \text{ A}, T_J = 125^\circ\text{C}$	Q2		4.8 6.0 6.6	6.3 7.2 8.6	
g_{FS}	Forward Transconductance	$V_{DD} = 5 \text{ V}, I_D = 12 \text{ A}$ $V_{DD} = 5 \text{ V}, I_D = 15 \text{ A}$	Q1 Q2		54 76		S

Dynamic Characteristics

C_{iss}	Input Capacitance	Q1: $V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	Q1 Q2		1135 1380	1510 1835	pF
C_{oss}	Output Capacitance	Q2: $V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	Q1 Q2		390 478	520 635	pF
C_{riss}	Reverse Transfer Capacitance	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	Q1 Q2		42 60	65 90	pF
R_g	Gate Resistance		Q1 Q2	0.2 0.2	1.6 0.5	3.2 2.0	Ω

Switching Characteristics

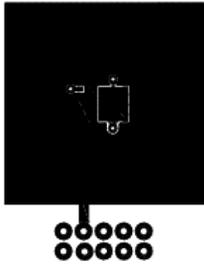
$t_{d(on)}$	Turn-On Delay Time	Q1 $V_{DD} = 15 \text{ V}, I_D = 12 \text{ A}, R_{GEN} = 6 \Omega$	Q1		7	14	ns	
			Q2		7	14		
t_r	Rise Time	Q1 $V_{DD} = 15 \text{ V}, I_D = 12 \text{ A}, R_{GEN} = 6 \Omega$	Q1		3	10	ns	
			Q2		3	10		
$t_{d(off)}$	Turn-Off Delay Time	Q2 $V_{DD} = 15 \text{ V}, I_D = 15 \text{ A}, R_{GEN} = 6 \Omega$	Q1		19	35	ns	
			Q2		20	36		
t_f	Fall Time	Q1 $V_{DD} = 15 \text{ V}, I_D = 15 \text{ A}, R_{GEN} = 6 \Omega$	Q1		3	10	ns	
			Q2		2	10		
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\text{V to } 10 \text{ V}$	Q1 $V_{DD} = 15 \text{ V}, I_D = 12 \text{ A}$	Q1		18	24	nC
				Q2		21	30	
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\text{V to } 5 \text{ V}$	Q1 $V_{DD} = 15 \text{ V}, I_D = 12 \text{ A}$	Q1		9	14	nC
				Q2		12	16	
Q_{gs}	Gate to Source Charge	Q2 $V_{DD} = 15 \text{ V}, I_D = 15 \text{ A}$	Q1		3.6		nC	
			Q2		3.5			
Q_{gd}	Gate to Drain "Miller" Charge	Q2 $V_{DD} = 15 \text{ V}, I_D = 15 \text{ A}$	Q1		2.5		nC	
			Q2		3.0			

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

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
Drain-Source Diode Characteristics							
V_{SD}	Source-Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2)	Q1		0.75	1.1	V
		$V_{GS} = 0\text{ V}, I_S = 12\text{ A}$ (Note 2)	Q1		0.84	1.2	
		$V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2)	Q2		0.63	0.8	
		$V_{GS} = 0\text{ V}, I_S = 15\text{ A}$ (Note 2)	Q2		0.80	1.2	
t_{rr}	Reverse Recovery Time	Q1 $I_F = 12\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	Q1		25	40	ns
			Q2		21	34	
Q_{rr}	Reverse Recovery Charge	Q2 $I_F = 15\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$	Q1		9	18	nC
			Q2		19	33	

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. 57 °C/W when mounted on a 1 in² pad of 2 oz copper



b. 50 °C/W when mounted on a 1 in² pad of 2 oz copper



c. 125 °C/W when mounted on a minimum pad of 2 oz copper



d. 120 °C/W when mounted on a minimum pad of 2 oz copper

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

3. As an N-ch device, the negative V_{GS} rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

4. Q1: E_{AS} of 29 mJ is based on starting $T_J = 25^\circ\text{C}$; N-ch: $L = 0.3\text{ mH}$, $I_{AS} = 14\text{ A}$, $V_{DD} = 27\text{ V}$, $V_{GS} = 10\text{ V}$. 100% tested at $L = 3\text{ mH}$, $I_{AS} = 3.75\text{ A}$.

Q2: E_{AS} of 33 mJ is based on starting $T_J = 25^\circ\text{C}$; N-ch: $L = 0.3\text{ mH}$, $I_{AS} = 15\text{ A}$, $V_{DD} = 27\text{ V}$, $V_{GS} = 10\text{ V}$. 100% tested at $L = 3\text{ mH}$, $I_{AS} = 3.9\text{ A}$.

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

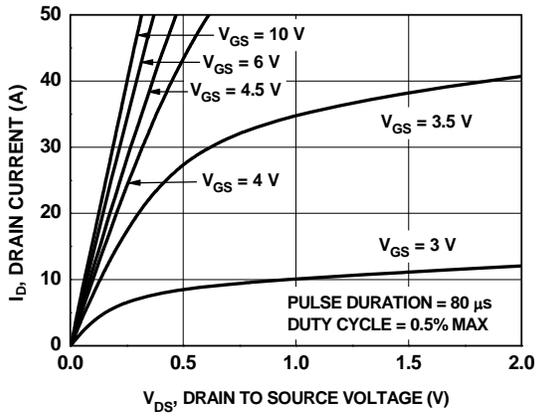


Figure 1. On Region Characteristics

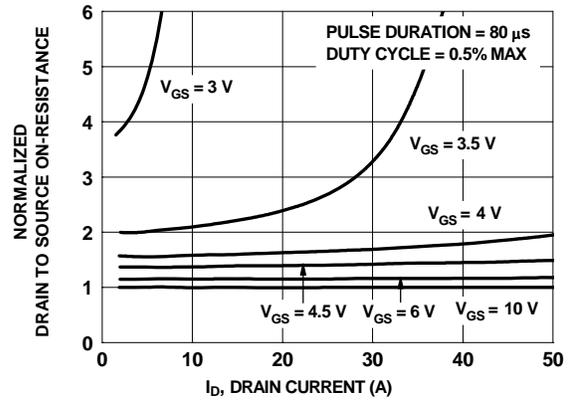


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

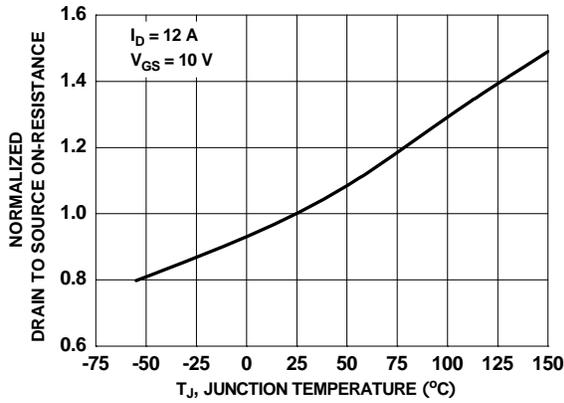


Figure 3. Normalized On Resistance vs Junction Temperature

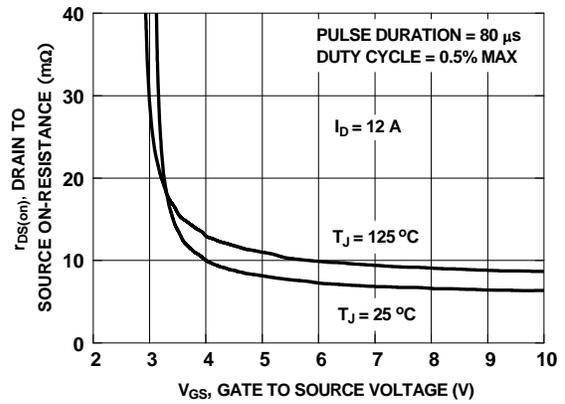


Figure 4. On-Resistance vs Gate to Source Voltage

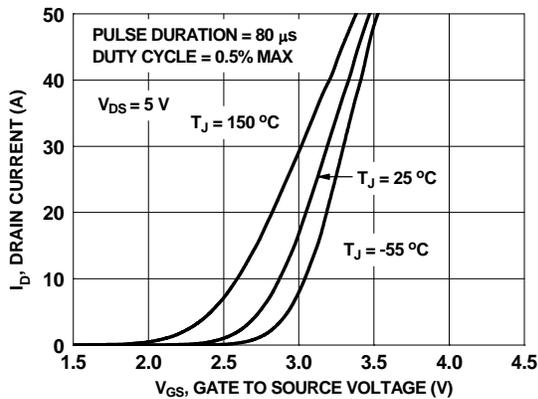


Figure 5. Transfer Characteristics

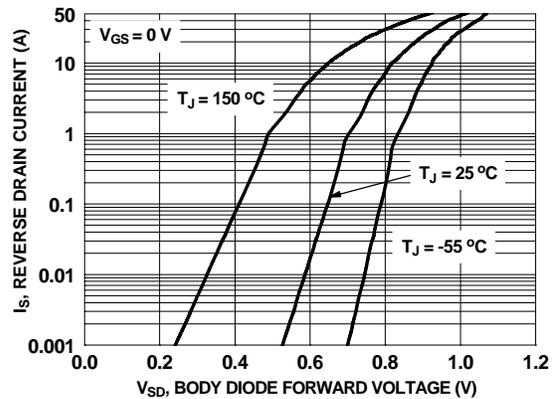


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

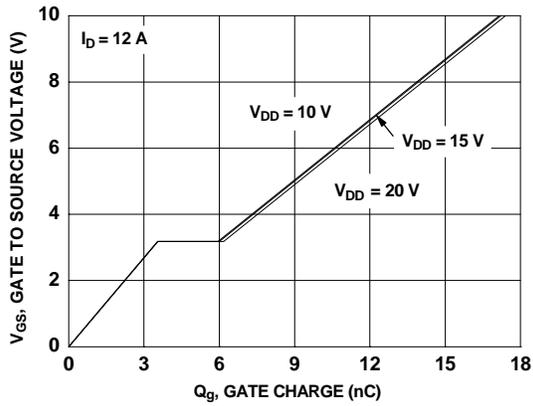


Figure 7. Gate Charge Characteristics

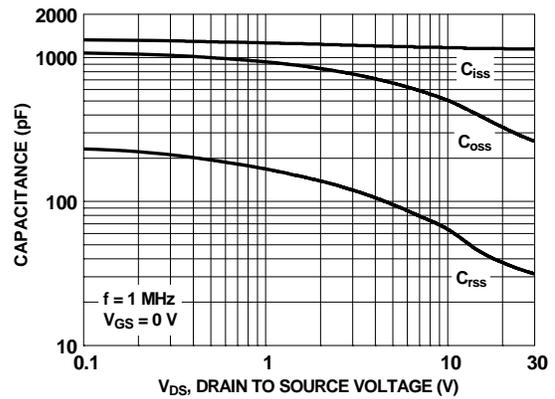


Figure 8. Capacitance vs Drain to Source Voltage

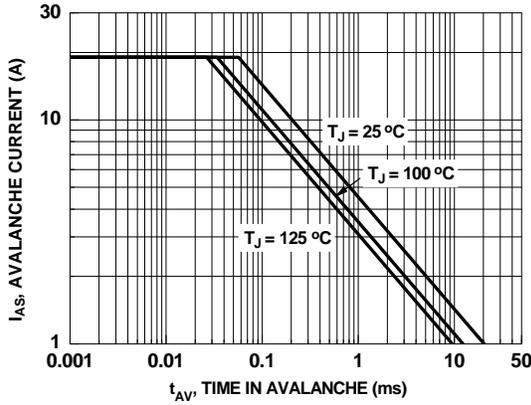


Figure 9. Unclamped Inductive Switching Capability

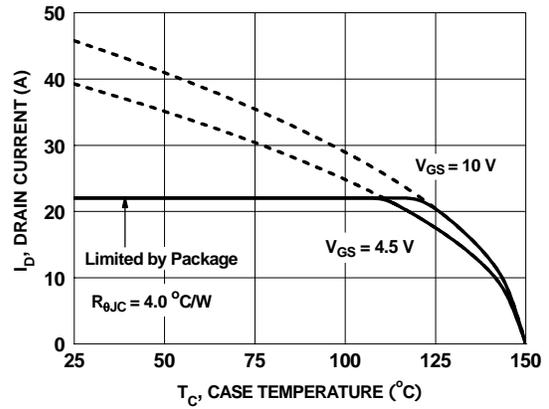


Figure 10. Maximum Continuous Drain Current vs Case Temperature

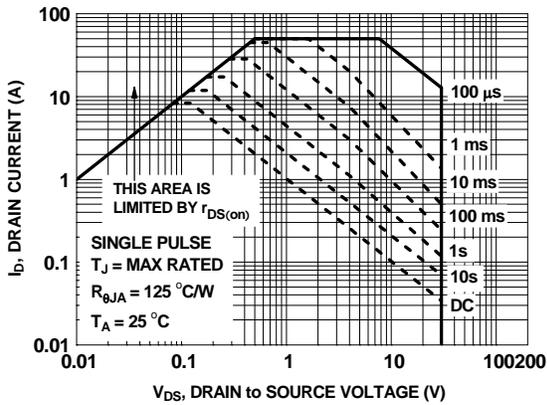


Figure 11. Forward Bias Safe Operating Area

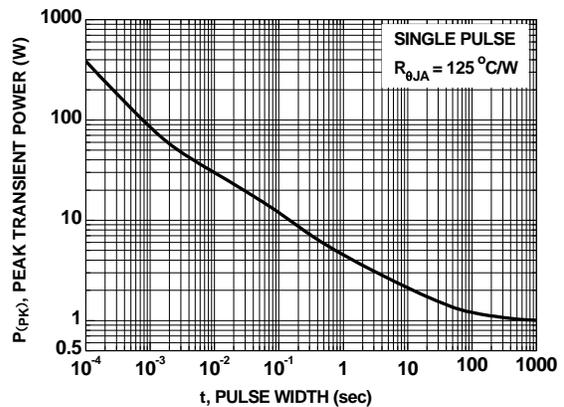


Figure 12. Single Pulse Maximum Power Dissipation

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

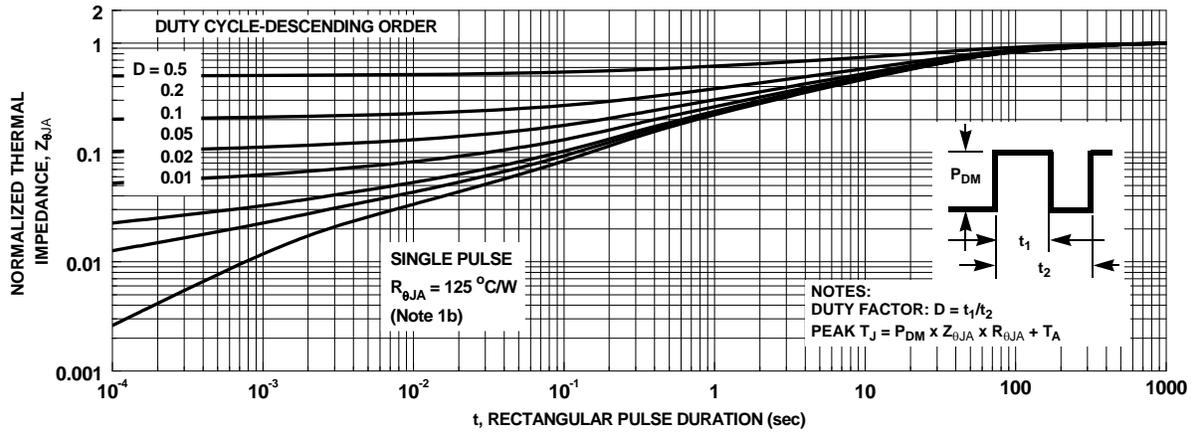


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

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

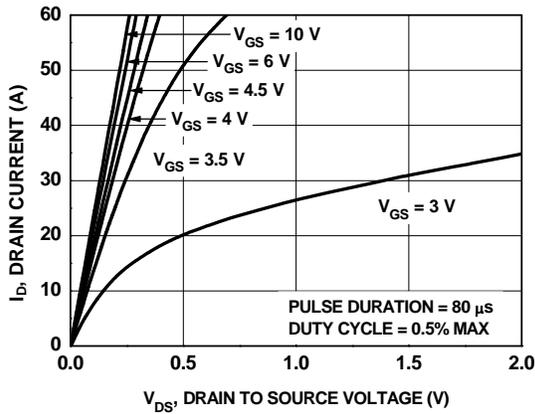


Figure 14. On-Region Characteristics

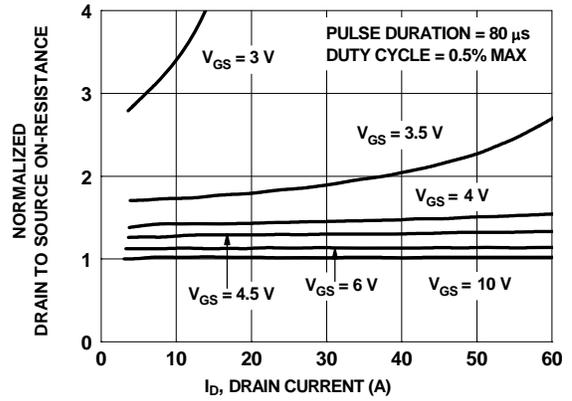


Figure 15. Normalized on-Resistance vs Drain Current and Gate Voltage

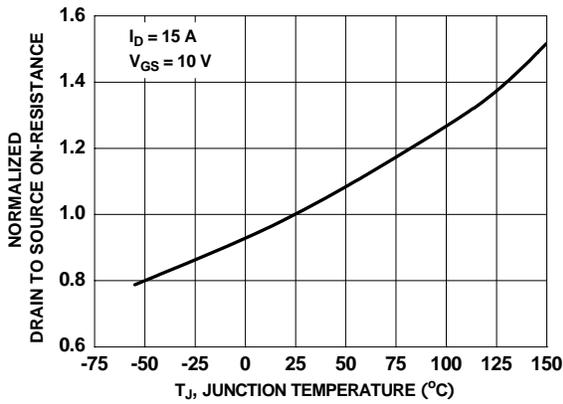


Figure 16. Normalized On-Resistance vs Junction Temperature

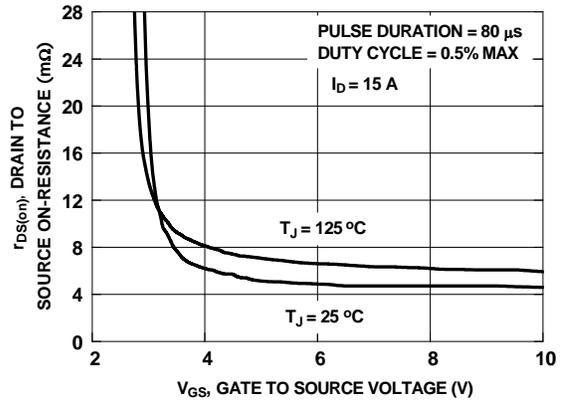


Figure 17. On-Resistance vs Gate to Source Voltage

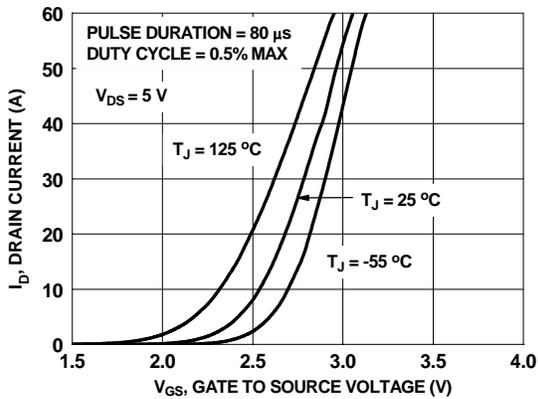


Figure 18. Transfer Characteristics

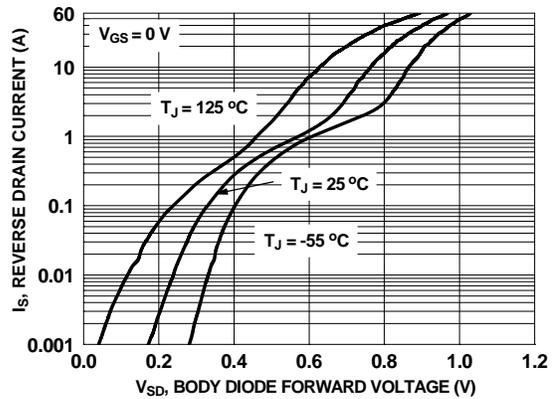


Figure 19. Source to Drain Diode Forward Voltage vs Source Current

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

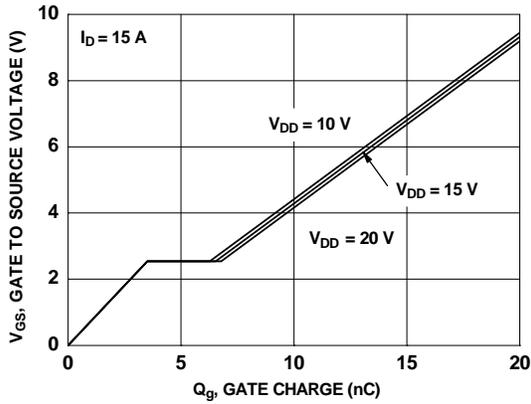


Figure 20. Gate Charge Characteristics

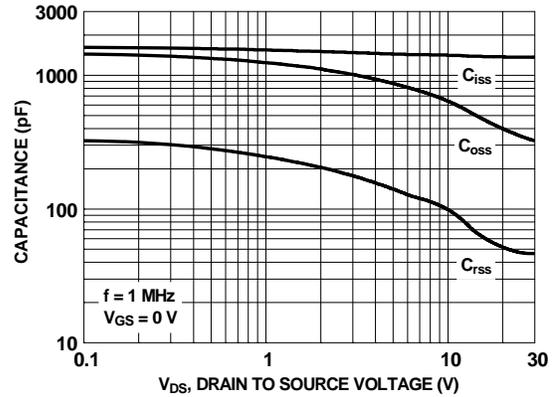


Figure 21. Capacitance vs Drain to Source Voltage

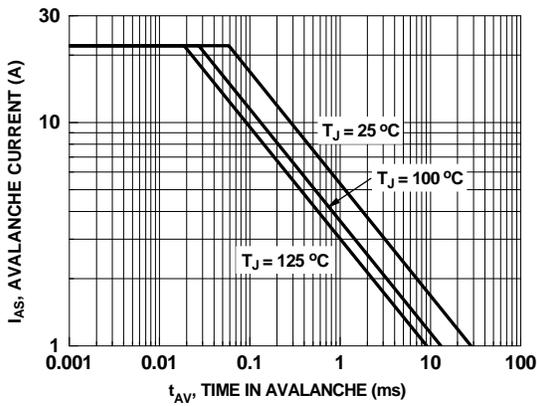


Figure 22. Unclamped Inductive Switching Capability

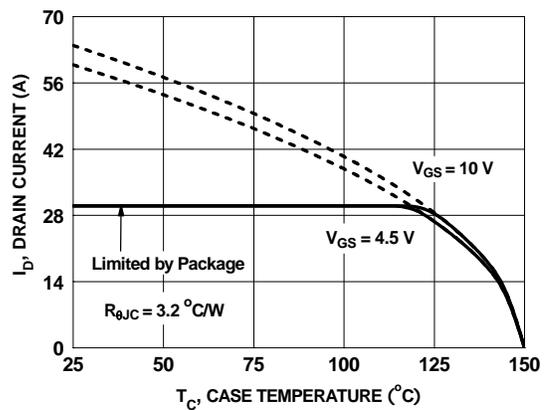


Figure 23. Maximum Continuous Drain Current vs Case Temperature

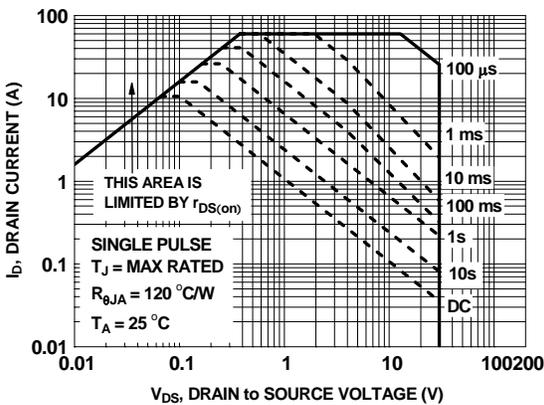


Figure 24. Forward Bias Safe Operating Area

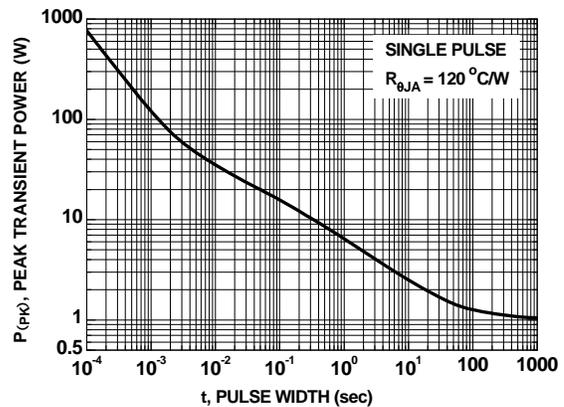


Figure 25. Single Pulse Maximum Power Dissipation

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

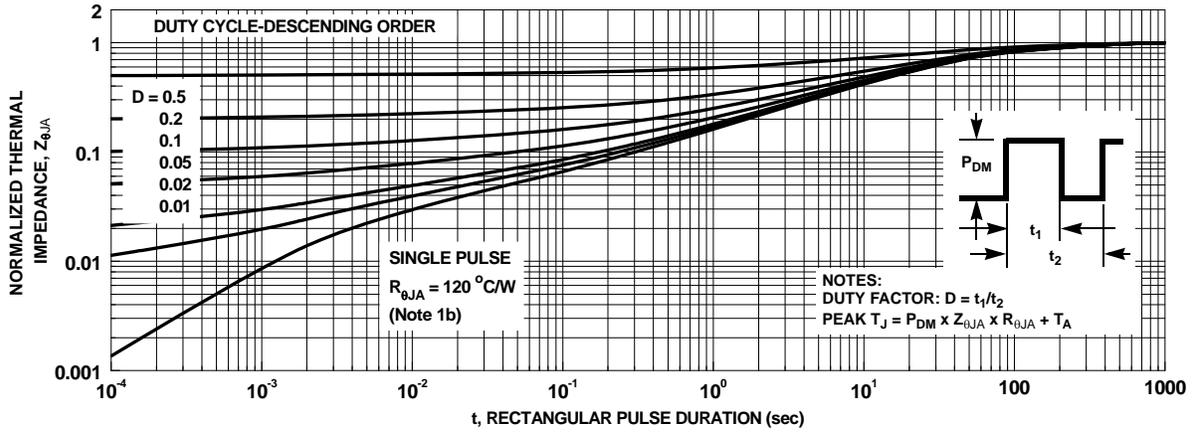


Figure 26. Junction-to-Ambient Transient Thermal Response Curve

Typical Characteristics (continued)

SyncFET[™] Schottky body diode Characteristics

Fairchild's SyncFET[™] process embeds a Schottky diode in parallel with PowerTrench[®] MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 27 shows the reverse recovery characteristic of the FDMS7608S.

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.

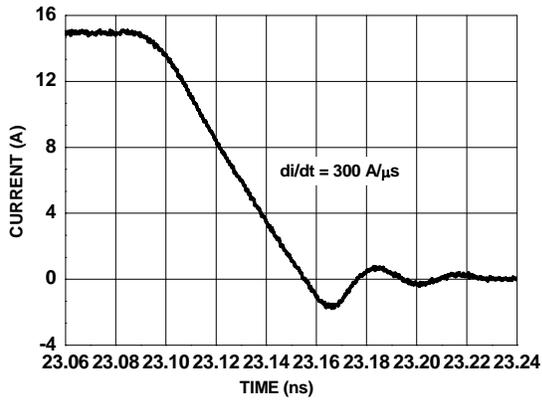


Figure 27. FDMS7608S SyncFET[™] Body Diode Reverse Recovery Characteristic

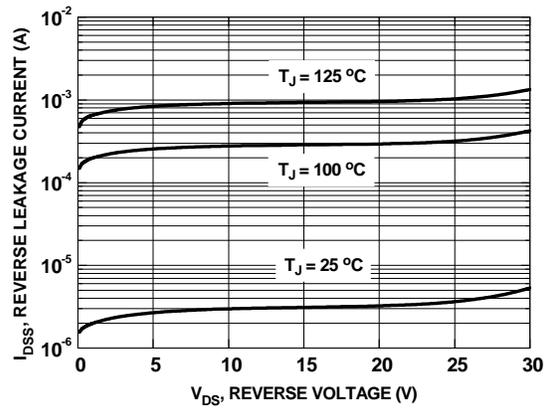
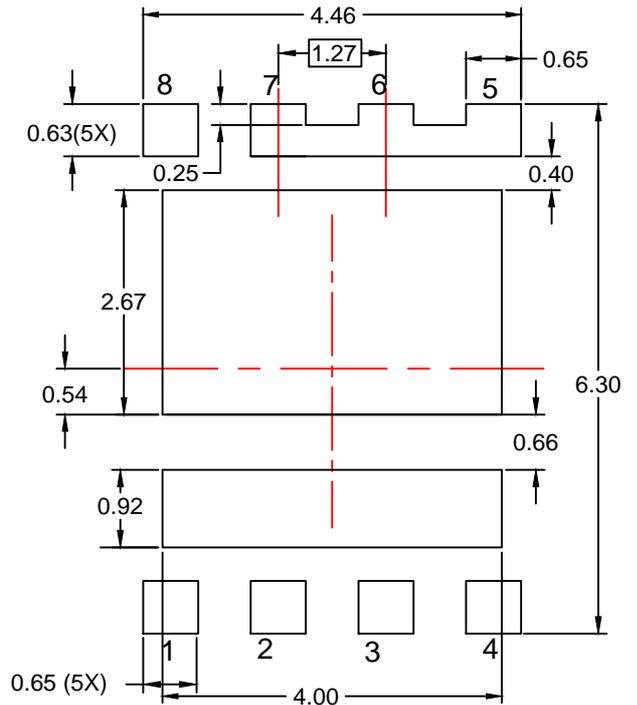
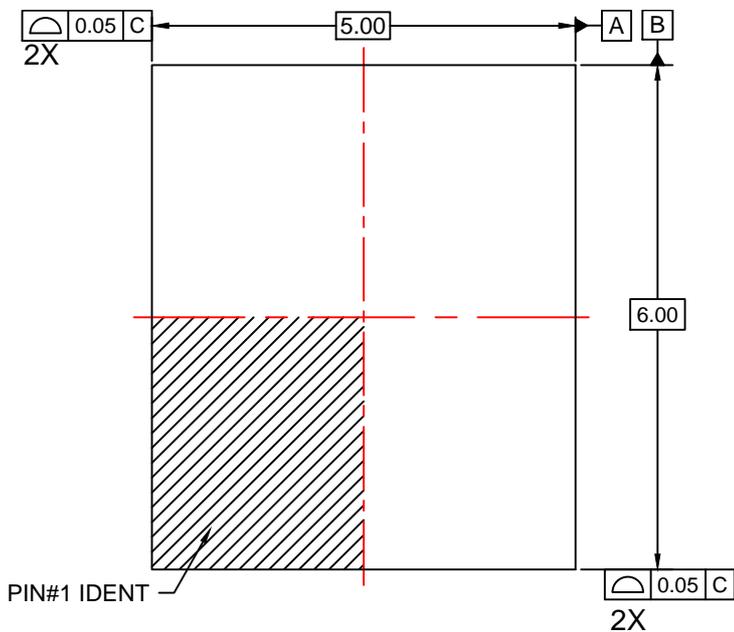
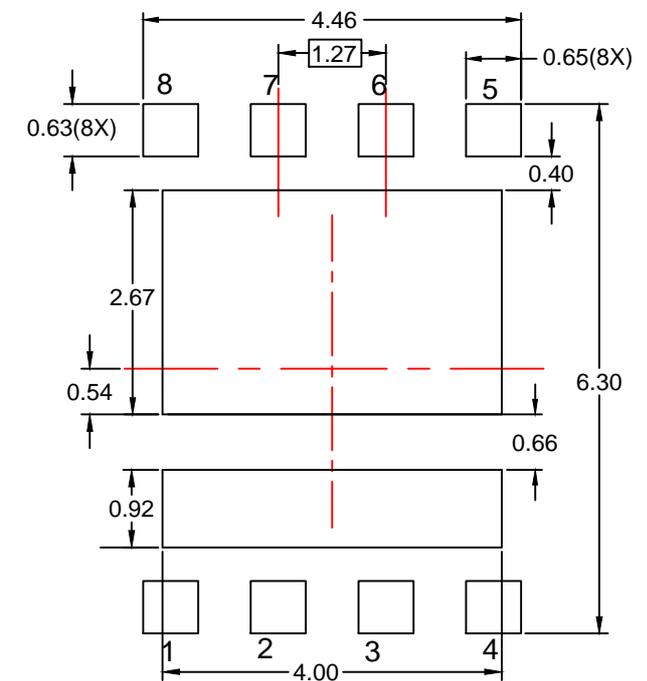
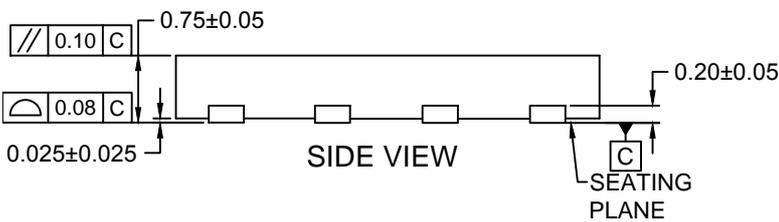


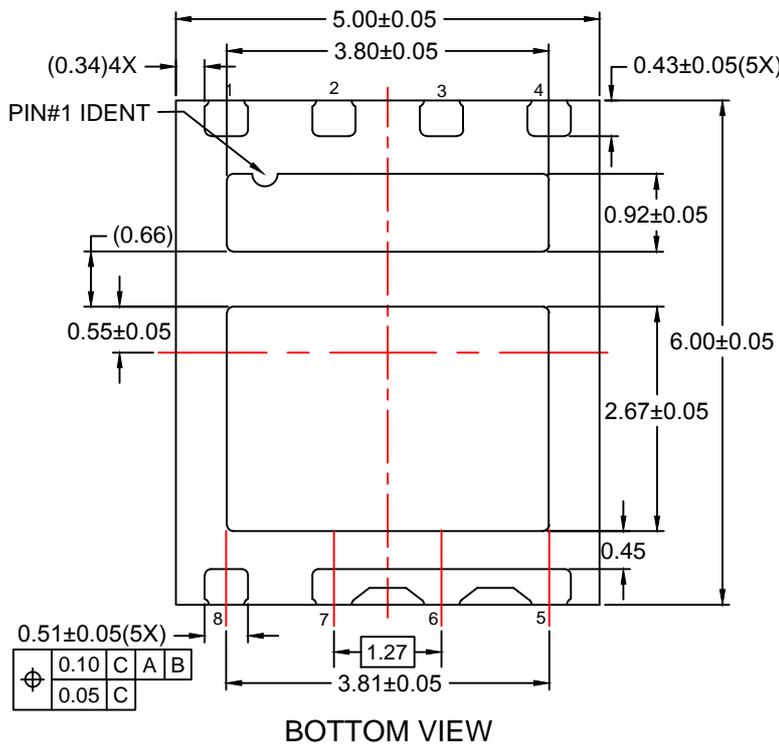
Figure 28. SyncFET[™] Body Diode Reverse Leakage vs. Drain-Source Voltage



RECOMMENDED LAND PATTERN (OPTION 1 - FUSED LEADS 5,6,7)



RECOMMENDED LAND PATTERN (OPTION 2 - ISOLATED LEADS)



BOTTOM VIEW

NOTES:

- A. PACKAGE DOES NOT FULLY CONFORM TO JEDEC STANDARD.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
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