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May 2014

# FDMS7620S

## Dual N-Channel PowerTrench<sup>®</sup> MOSFET

Q1: 30 V, 13 A, 20.0 mΩ Q2: 30 V, 22 A, 11.2 mΩ

### Features

Q1: N-Channel

- Max  $r_{DS(on)}$  = 20.0 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 10.1\text{ A}$
- Max  $r_{DS(on)}$  = 30.0 mΩ at  $V_{GS} = 4.5\text{ V}$ ,  $I_D = 7.5\text{ A}$

Q2: N-Channel

- Max  $r_{DS(on)}$  = 11.2 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 12.4\text{ A}$
- Max  $r_{DS(on)}$  = 14.2 mΩ at  $V_{GS} = 4.5\text{ V}$ ,  $I_D = 10.9\text{ A}$
- Pinout optimized for simple PCB design
- Thermally efficient dual Power 56 Package
- RoHS Compliant



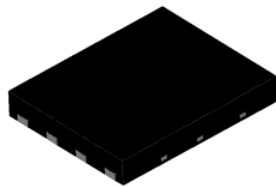
### General Description

This device includes two specialized MOSFETs in a unique dual Power 56 package. It is designed to provide an optimal synchronous buck power stage in terms of efficiency and PCB utilization. The low switching loss “High Side” MOSFET is complementary by a low conduction loss “Low Side” SyncFET.

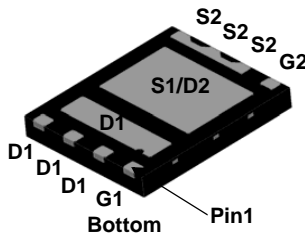
### Applications

Synchronous Buck Converter for:

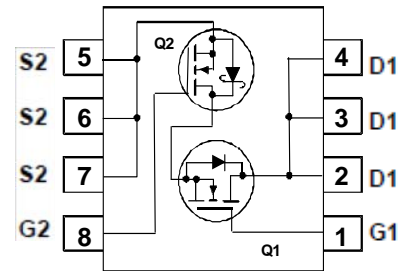
- Notebook System Power
- General Purpose Point of Load



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)	$\pm 20$	$\pm 20$	V
$I_D$	Drain Current -Continuous $T_C = 25^\circ\text{C}$	13	22	A
	-Continuous $T_A = 25^\circ\text{C}$	10.1	12.4	
	-Pulsed	27	45	
$E_{AS}$	Single Pulse Avalanche Energy (Note 4)	9	21	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	$57^{1a}$	$50^{1b}$	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	$125^{1c}$	$120^{1d}$	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS7620S	FDMS7620S	Power 56	13 "	12 mm	3000 units

FDMS7620S Dual N-Channel PowerTrench<sup>®</sup> MOSFET

### 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 $25^\circ\text{C}$ $I_D = 10 \text{ mA}$ , referenced to $25^\circ\text{C}$	Q1 Q2		19 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	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current, Forward	$V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$	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	1.0 1.0	2.2 2.0	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 $25^\circ\text{C}$ $I_D = 10 \text{ mA}$ , referenced to $25^\circ\text{C}$	Q1 Q2		-6 -5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 10.1 \text{ A}$ $V_{GS} = 4.5 \text{ V}, I_D = 7.5 \text{ A}$ $V_{GS} = 10 \text{ V}, I_D = 10 \text{ A}, T_J = 125^\circ\text{C}$	Q1		15.2 22.7 18.7	20.0 30.0 22.5	m $\Omega$
		$V_{GS} = 10 \text{ V}, I_D = 12.4 \text{ A}$ $V_{GS} = 4.5 \text{ V}, I_D = 10.9 \text{ A}$ $V_{GS} = 10 \text{ V}, I_D = 12.4 \text{ A}, T_J = 125^\circ\text{C}$	Q2		8.3 10.5 8.9	11.2 14.2 15.1	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5 \text{ V}, I_D = 10.1 \text{ A}$ $V_{DD} = 5 \text{ V}, I_D = 12.4 \text{ A}$	Q1 Q2		22 53		S

#### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	Q1 Q2		457 1050	608 1400	pF
$C_{oss}$	Output Capacitance		Q1 Q2		167 358	222 477	pF
$C_{rss}$	Reverse Transfer Capacitance		Q1 Q2		22 35	31 49	pF
$R_g$	Gate Resistance		Q1 Q2	0.2 0.2	1.6 1.2	4.4 3.5	$\Omega$

#### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	Q1 $V_{DD} = 15 \text{ V}, I_D = 10.1 \text{ A}, R_{GEN} = 6 \Omega$	Q1 Q2		5.2 6.6	10 14	ns
$t_r$	Rise Time		Q1 Q2		1.2 1.8	10 10	ns
$t_{d(off)}$	Turn-Off Delay Time	Q2 $V_{DD} = 15 \text{ V}, I_D = 12.4 \text{ A}, R_{GEN} = 6 \Omega$	Q1 Q2		11.9 17.4	22 32	ns
$t_f$	Fall Time		Q1 Q2		1.4 1.5	10 10	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\text{V to } 10 \text{ V}$	Q1 $V_{DD} = 15 \text{ V}, I_D = 10.1 \text{ A}$	Q1 Q2	7.2 15.6	11 23	nC
				Q1 Q2	3.8 7.9	6 12	nC
$Q_{gs}$	Gate to Source Charge	Q2 $V_{DD} = 15 \text{ V}, I_D = 12.4 \text{ A}$	Q1 Q2		1.6 3.2		nC
$Q_{gd}$	Gate to Drain "Miller" Charge		Q1 Q2		1.1 1.6		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

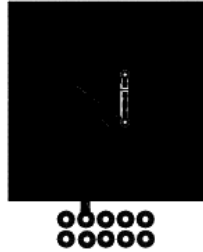
$V_{SD}$	Source-Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 10.1\text{ A}$ (Note 2) $V_{GS} = 0\text{ V}, I_S = 12.4\text{ A}$ (Note 2)	Q1 Q2		0.90 0.83	1.2 1.2	V
$t_{rr}$	Reverse Recovery Time	Q1 $I_F = 10.1\text{ A}, di/dt = 100\text{ A/s}$	Q1 Q2		16 18	28 32	ns
$Q_{rr}$	Reverse Recovery Charge	Q2 $I_F = 12.4\text{ A}, di/dt = 300\text{ A/s}$	Q1 Q2		4 13	10 23	nC

#### Notes:

- $R_{\theta JA}$  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.



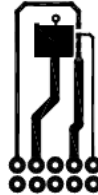
a. 57 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 50 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



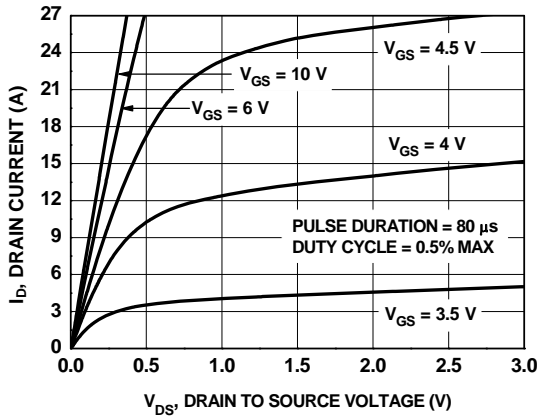
c. 125 °C/W when mounted on a minimum pad of 2 oz copper



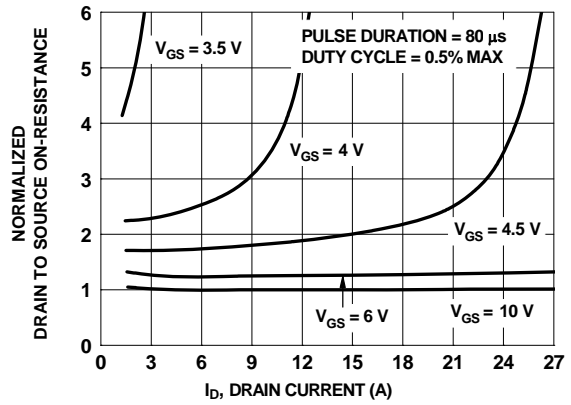
d. 120 °C/W when mounted on a minimum pad of 2 oz copper

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.
- As an N-ch device, the negative  $V_{GS}$  rating is for low duty cycle pulse occurrence only. No continuous rating is implied.
- Q1:  $E_{AS}$  of 9 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.3\text{ mH}$ ,  $I_{AS} = 8\text{ A}$ ,  $V_{DD} = 27\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 12\text{ A}$ .  
Q2:  $E_{AS}$  of 21 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.3\text{ mH}$ ,  $I_{AS} = 12\text{ A}$ ,  $V_{DD} = 27\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 18\text{ A}$ .

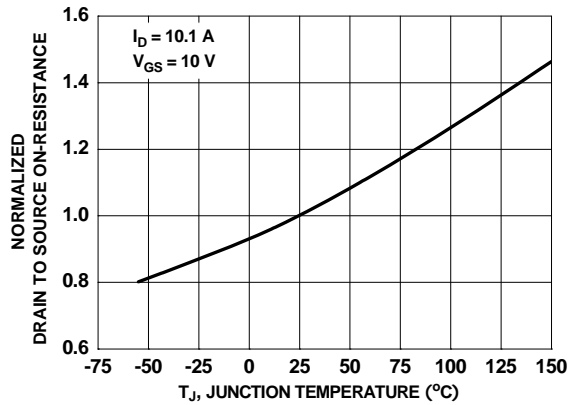
**Typical Characteristics (Q1 N-Channel)**  $T_J = 25^\circ\text{C}$  unless otherwise noted



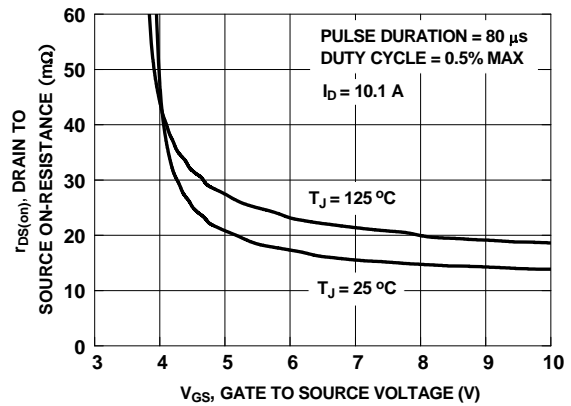
**Figure 1. On Region Characteristics**



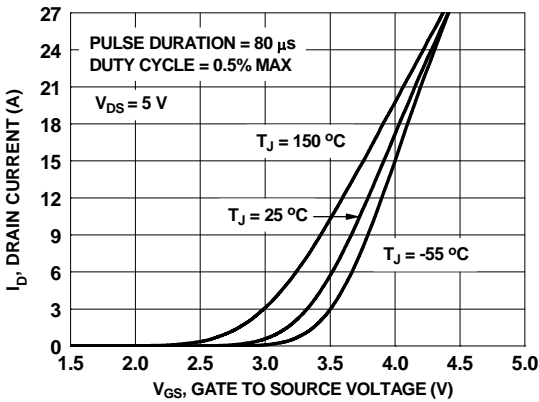
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



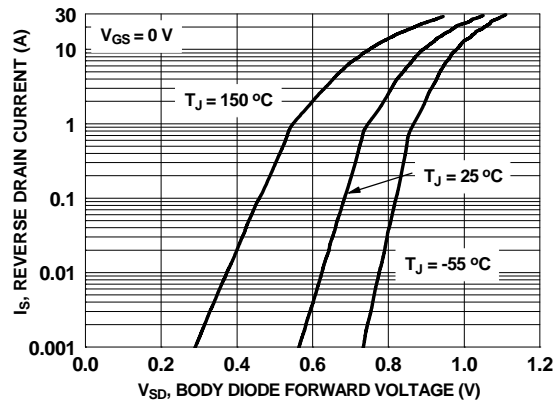
**Figure 3. Normalized On Resistance vs Junction Temperature**



**Figure 4. On-Resistance vs Gate to Source Voltage**

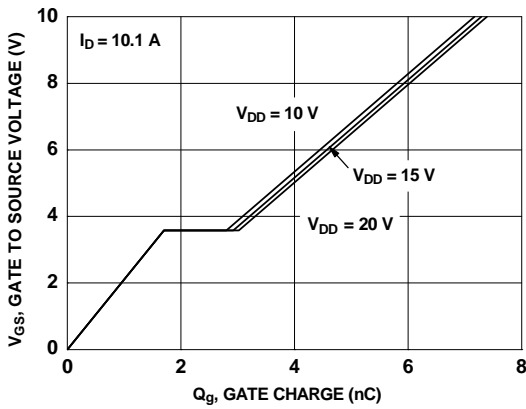


**Figure 5. Transfer Characteristics**

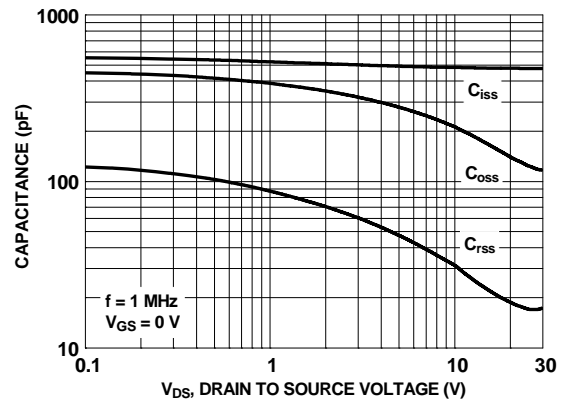


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

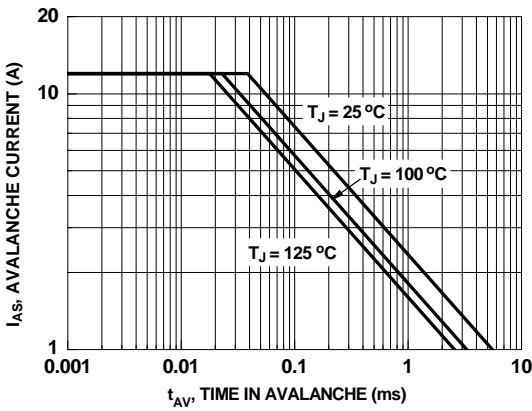
**Typical Characteristics (Q1 N-Channel)**  $T_J = 25^\circ\text{C}$  unless otherwise noted



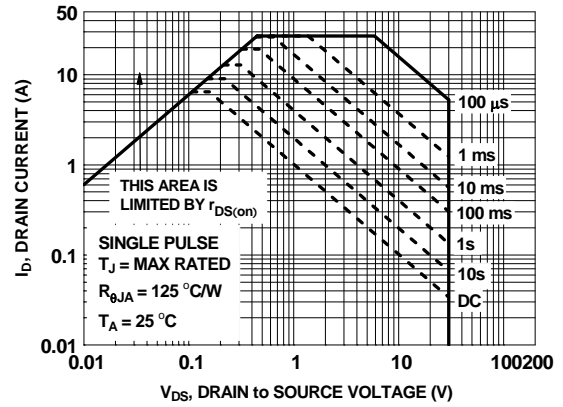
**Figure 7. Gate Charge Characteristics**



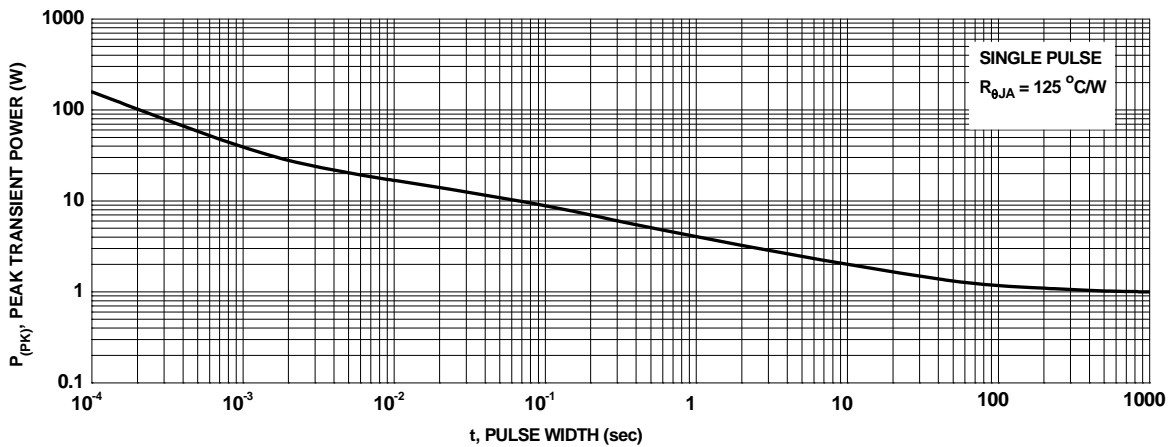
**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Unclamped Inductive Switching Capability**

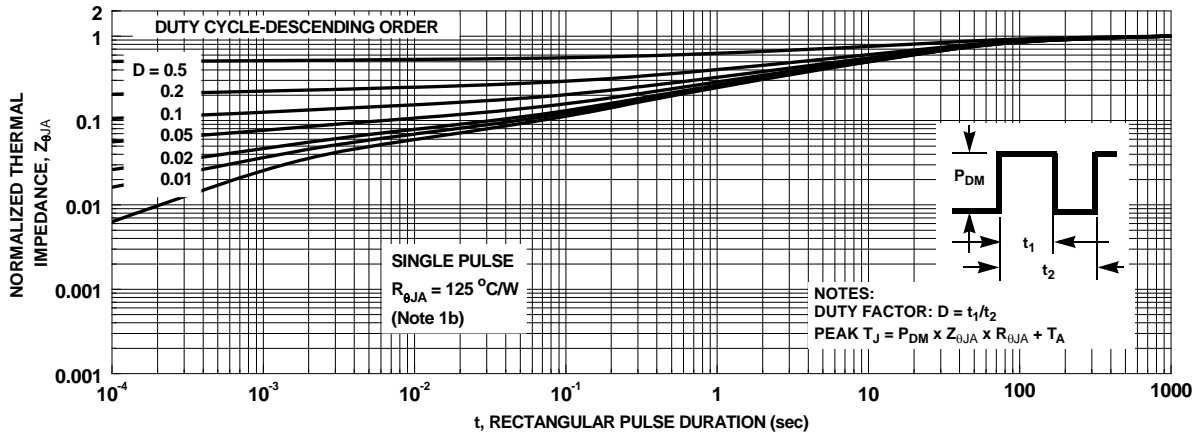


**Figure 10. Forward Bias Safe Operating Area**



**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 Curve**

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

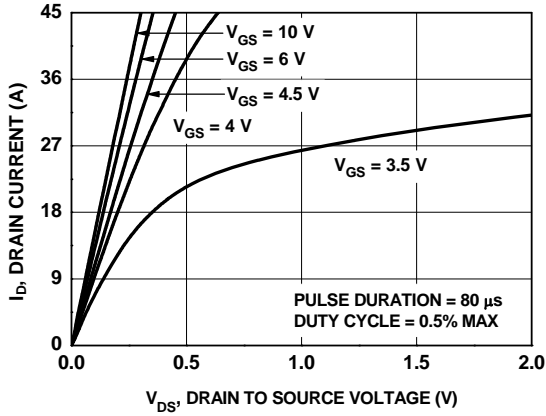


Figure 13. On-Region Characteristics

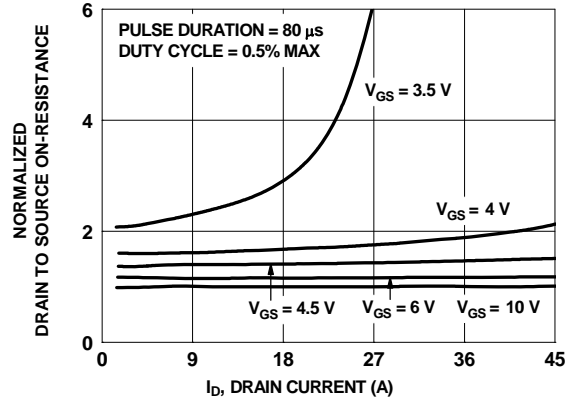


Figure 14. Normalized on-Resistance vs Drain Current and Gate Voltage

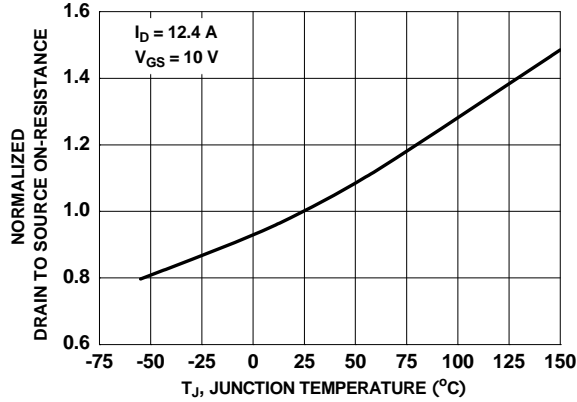


Figure 15. Normalized On-Resistance vs Junction Temperature

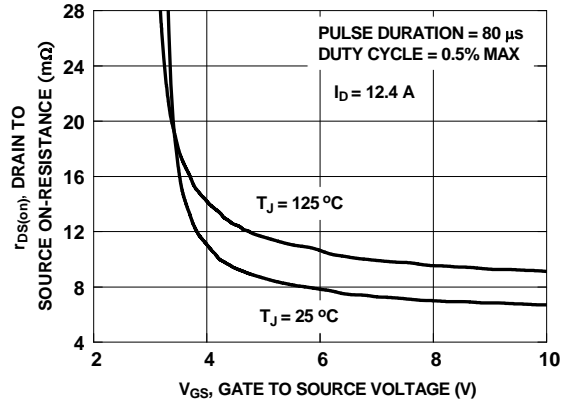


Figure 16. On-Resistance vs Gate to Source Voltage

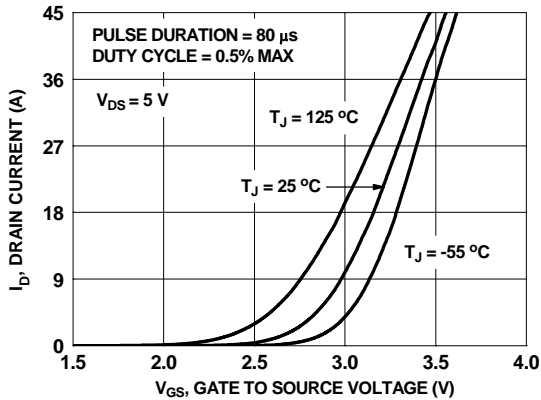


Figure 17. Transfer Characteristics

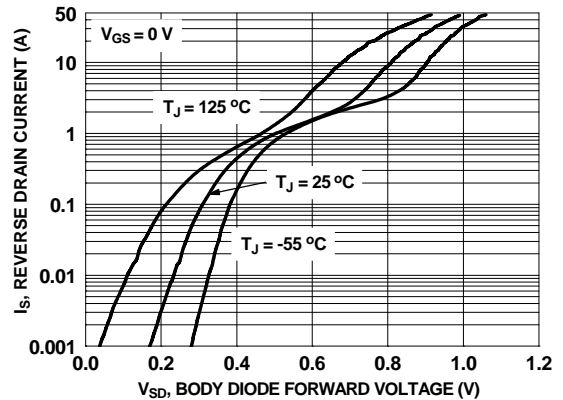
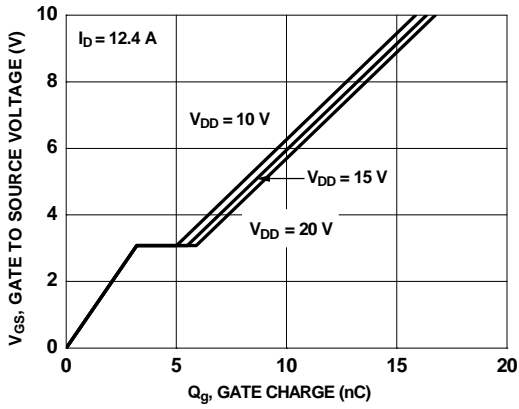


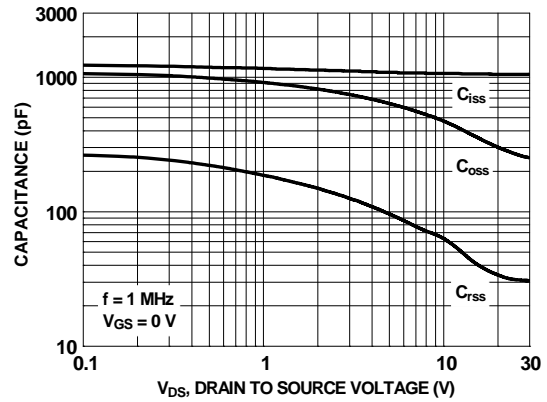
Figure 18. Source to Drain Diode Forward Voltage vs Source Current



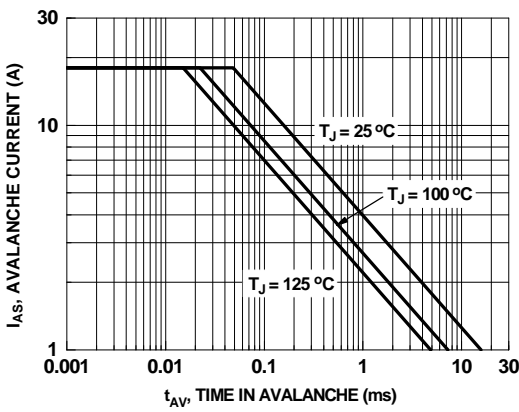
**Typical Characteristics (Q2 N-Channel)**  $T_J = 25^\circ\text{C}$  unless otherwise noted



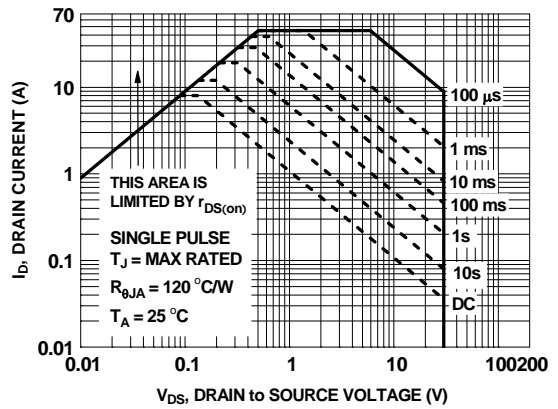
**Figure 19. Gate Charge Characteristics**



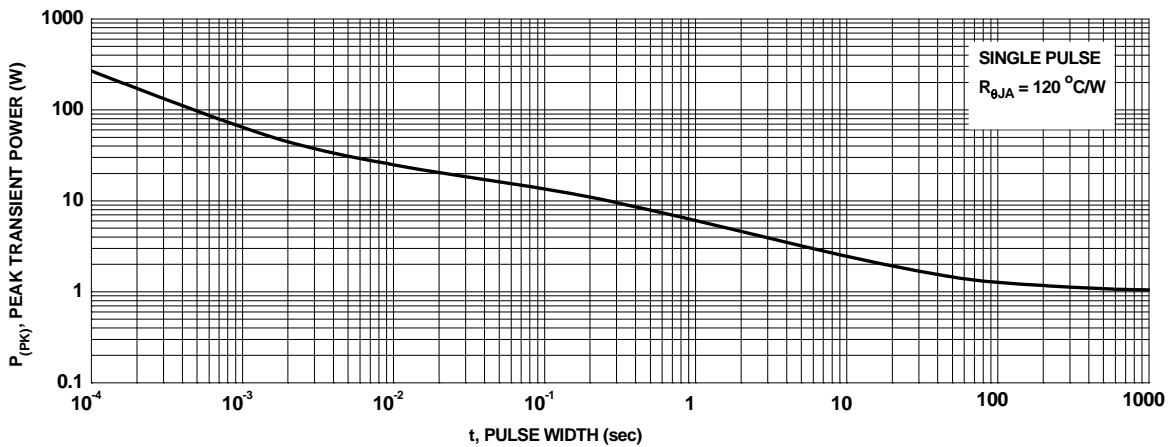
**Figure 20. Capacitance vs Drain to Source Voltage**



**Figure 21. Unclamped Inductive Switching Capability**

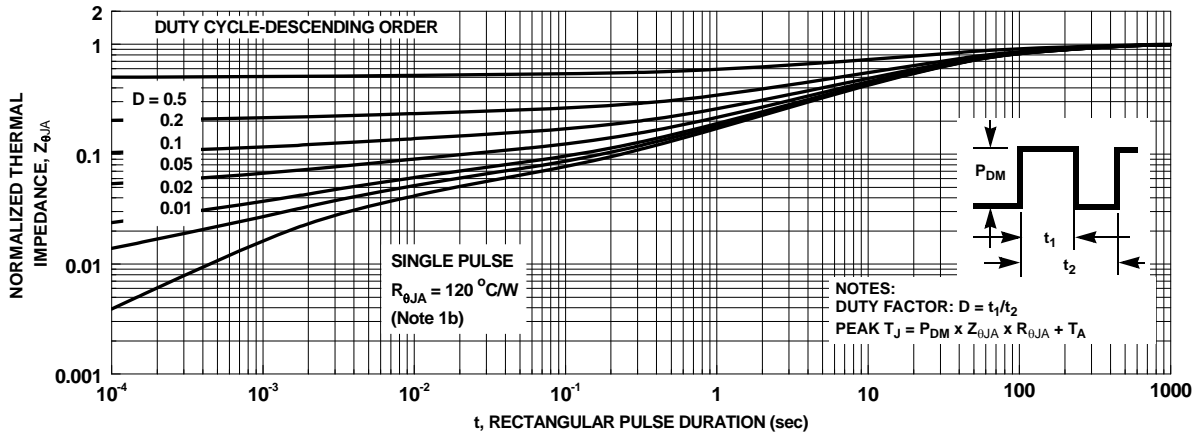


**Figure 22. Forward Bias Safe Operating Area**



**Figure 23. Single Pulse Maximum Power Dissipation**

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



**Figure 24. Junction-to-Ambient Transient Thermal Response Curve**

## Typical Characteristics (continued)

### SyncFET<sup>™</sup> Schottky body diode Characteristics

Fairchild's SyncFET<sup>™</sup> process embeds a Schottky diode in parallel with PowerTrench<sup>®</sup> MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 26 shows the reverse recovery characteristic of the FDMS7620S.

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

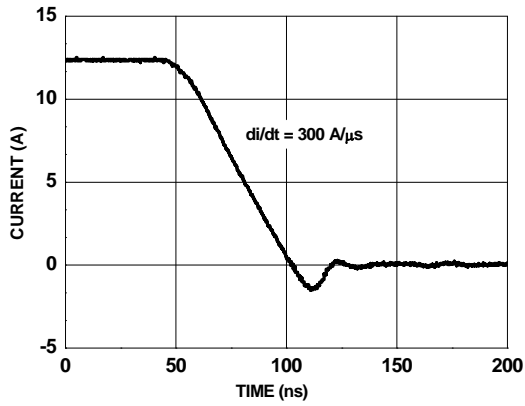


Figure 25. FDMS7620S SyncFET<sup>™</sup> Body Diode Reverse Recovery Characteristic

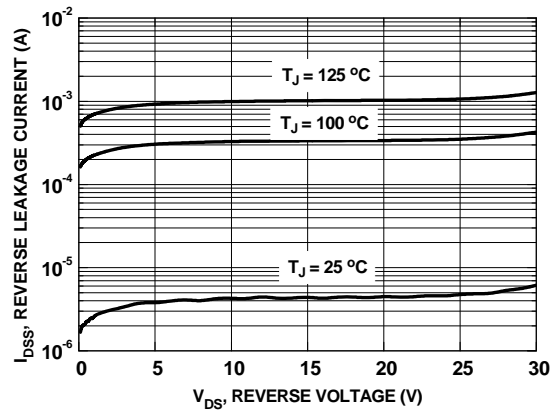
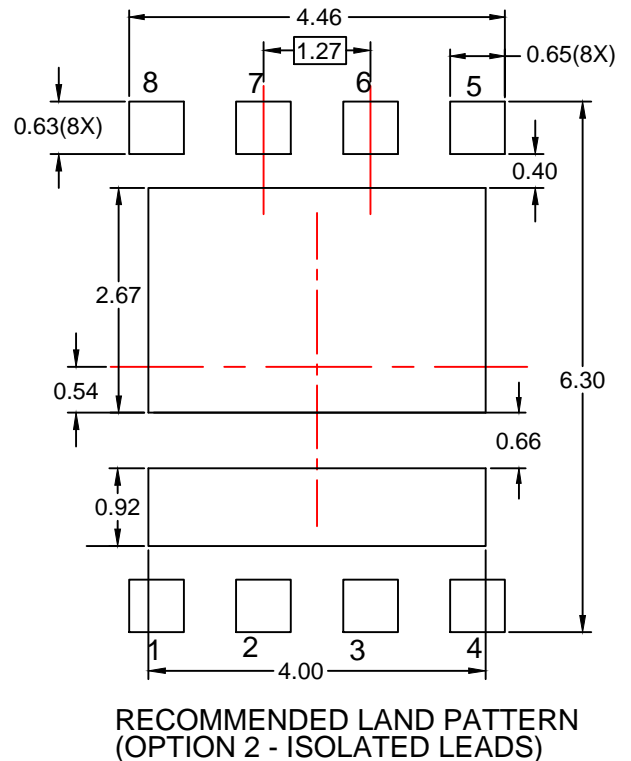
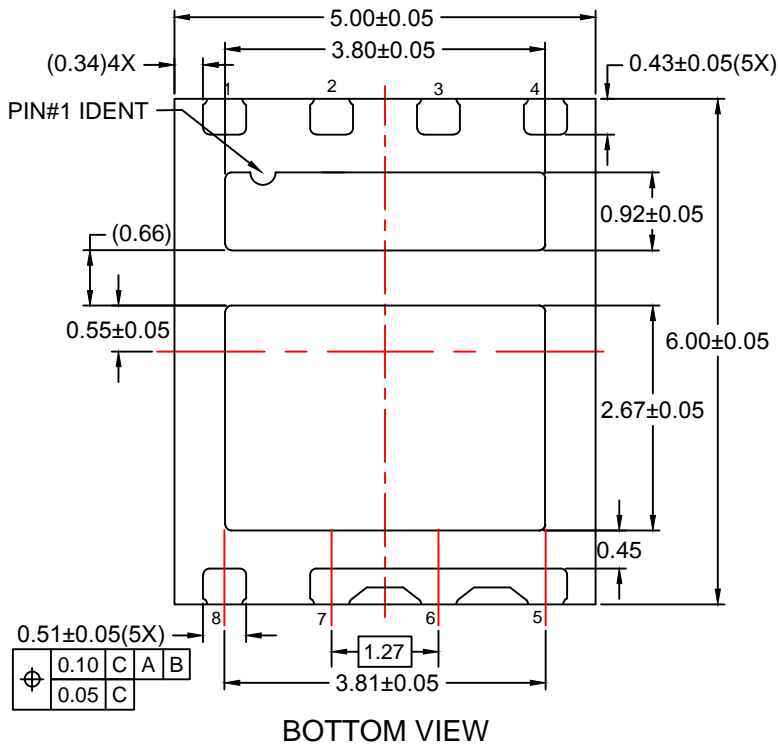
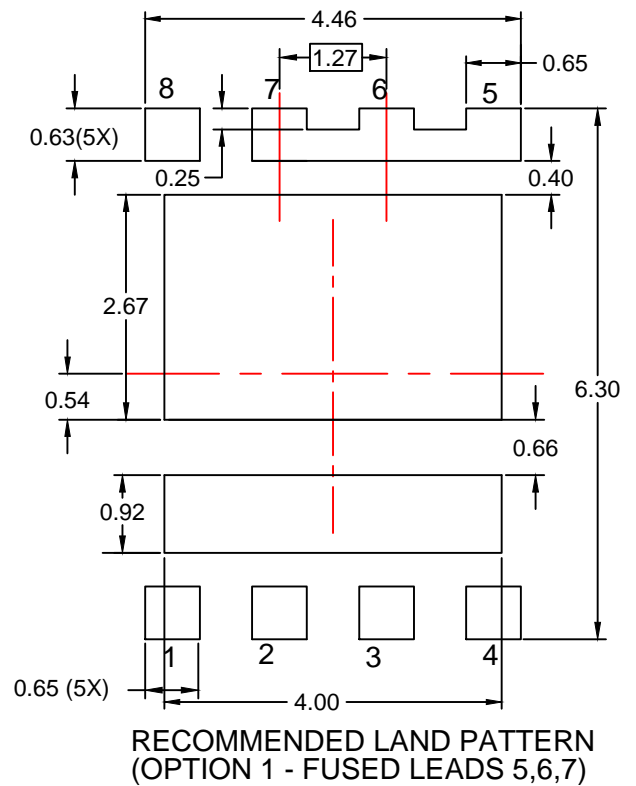
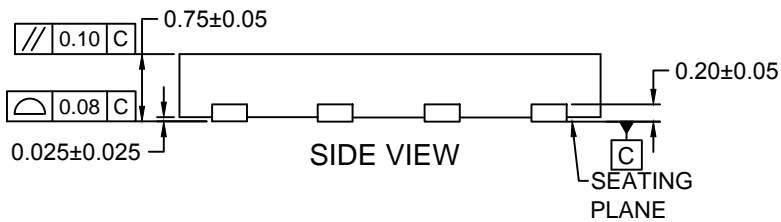
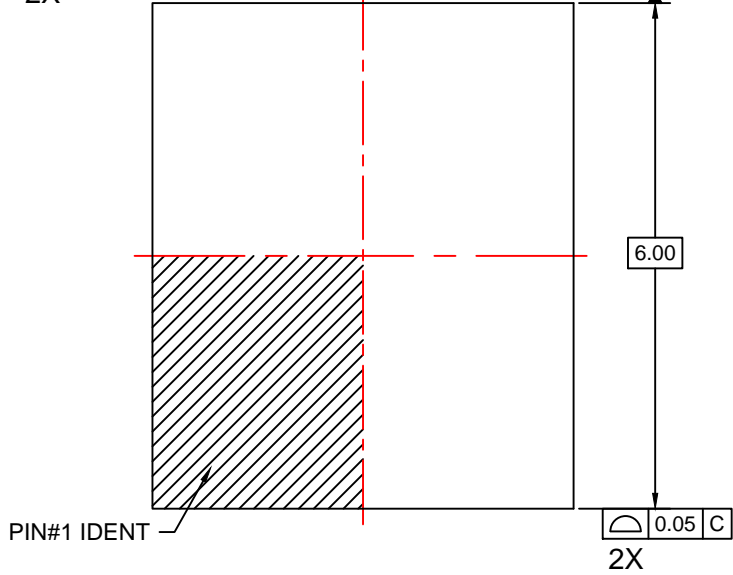


Figure 26. SyncFET<sup>™</sup> Body Diode Reverse Leakage vs. Drain-Source Voltage



**NOTES:**

- A. PACKAGE DOES NOT FULLY CONFORM TO JEDEC STANDARD.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.
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