

# FDMS7606

## Dual N-Channel PowerTrench® MOSFET

Q1: 30 V, 12 A, 11.4 mΩ Q2: 30 V, 22 A, 11.6 mΩ

### Features

Q1: N-Channel

- Max  $r_{DS(on)}$  = 11.4 mΩ at  $V_{GS} = 10$  V,  $I_D = 11.5$  A
- Max  $r_{DS(on)}$  = 15.7 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 10$  A

Q2: N-Channel

- Max  $r_{DS(on)}$  = 11.6 mΩ at  $V_{GS} = 10$  V,  $I_D = 12$  A
- Max  $r_{DS(on)}$  = 17.2 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 9.5$  A
- RoHS Compliant

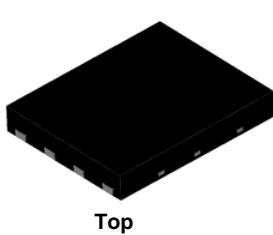


### General Description

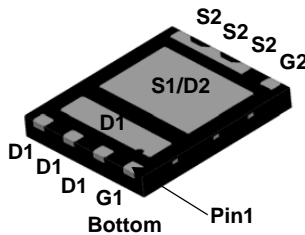
This device includes two specialized N-Channel MOSFETs in a dual MLP package. The switch node has been internally connected to enable easy placement and routing of synchronous buck converters. The control MOSFET (Q1) and synchronous MOSFET (Q2) have been designed to provide optimal power efficiency.

### Applications

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

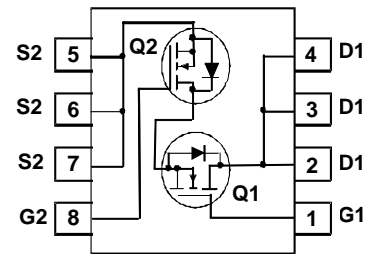


Top



Bottom

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 (Package limited) $T_C = 25^\circ\text{C}$	12	22	A
	-Continuous (Silicon limited) $T_C = 25^\circ\text{C}$	41	39	
	-Continuous $T_A = 25^\circ\text{C}$	11.5 <sup>1a</sup>	12 <sup>1b</sup>	
	-Pulsed	50	60	
$E_{AS}$	Single Pulse Avalanche Energy (Note 4)	25	33	mJ
$P_D$	Power Dissipation for Single Operation $T_A = 25^\circ\text{C}$	2.2 <sup>1a</sup>	2.5 <sup>1b</sup>	W
	Power Dissipation for Single Operation $T_A = 25^\circ\text{C}$	1.0 <sup>1c</sup>	1.0 <sup>1d</sup>	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150		$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	57 <sup>1a</sup>	50 <sup>1b</sup>	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	125 <sup>1c</sup>	120 <sup>1d</sup>	
$R_{\theta JC}$	Thermal Resistance, Junction to Case	4.6	4.7	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS7606	FDMS7606	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	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$	Q1 Q2	30 30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$	Q1 Q2		16 20		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24 \text{ V}, V_{GS} = 0 \text{ V}$	Q1 Q2			1 1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$ $V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	Q1 Q2			100 $\pm 100$	nA

#### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	Q1 Q2	1.0 1.0	2.1 1.9	3.0 3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$	Q1 Q2		-6 -5.5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 11.5 \text{ A}$ $V_{GS} = 4.5 \text{ V}, I_D = 10 \text{ A}$ $V_{GS} = 10 \text{ V}, I_D = 11.5 \text{ A}, T_J = 125^\circ\text{C}$	Q1		9.2 12.6 11.8	11.4 15.7 14.7	m $\Omega$
		$V_{GS} = 10 \text{ V}, I_D = 12 \text{ A}$ $V_{GS} = 4.5 \text{ V}, I_D = 9.5 \text{ A}$ $V_{GS} = 10 \text{ V}, I_D = 12 \text{ A}, T_J = 125^\circ\text{C}$	Q2		9.7 12.8 12.3	11.6 17.2 15.4	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5 \text{ V}, I_D = 11.5 \text{ A}$ $V_{DD} = 5 \text{ V}, I_D = 12 \text{ A}$	Q1 Q2		53 47		S

#### Dynamic Characteristics

$C_{iss}$	Input Capacitance	Q1: $V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	Q1 Q2		1050 947	1400 1260	pF
$C_{oss}$	Output Capacitance	Q2: $V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	Q1 Q2		295 191	395 255	pF
$C_{riss}$	Reverse Transfer Capacitance	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	Q1 Q2		32 131	50 200	pF
$R_g$	Gate Resistance		Q1 Q2	0.2 0.2	1.6 1.0	4.0 2.5	$\Omega$

#### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	Q1 $V_{DD} = 15 \text{ V}, I_D = 11.5 \text{ A}, R_{GEN} = 6 \Omega$	Q1 Q2		7 6	14 12	ns
$t_r$	Rise Time		Q1 Q2		3 3	10 10	ns
$t_{d(off)}$	Turn-Off Delay Time	Q2 $V_{DD} = 15 \text{ V}, I_D = 12 \text{ A}, R_{GEN} = 6 \Omega$	Q1 Q2		18 19	33 34	ns
$t_f$	Fall Time		Q1 Q2		3 3	10 10	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\text{V to } 10 \text{ V}$	Q1 Q2		16 19	22 27	nC
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\text{V to } 5 \text{ V}$			8 10	11 15	
$Q_{gs}$	Gate to Source Charge	Q2 $V_{DD} = 15 \text{ V}, I_D = 12 \text{ A}$	Q1 Q2		3.2 2.6		nC
$Q_{gd}$	Gate to Drain "Miller" Charge		Q1 Q2		2.0 4.2		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

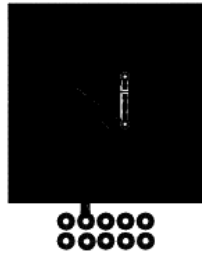
$V_{SD}$	Source-Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2)	Q1		0.76	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 11.5\text{ A}$ (Note 2)	Q1		0.87	1.2	
		$V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2)	Q2		0.75	1.2	
		$V_{GS} = 0\text{ V}, I_S = 12\text{ A}$ (Note 2)	Q2		0.85	1.2	
$t_{rr}$	Reverse Recovery Time	Q1	Q1		22	35	ns
		$I_F = 11.5\text{ A}, di/dt = 100\text{ A/s}$	Q2		18	33	
$Q_{rr}$	Reverse Recovery Charge	Q1	Q1		7	13	nC
		$I_F = 12\text{ A}, di/dt = 100\text{ A/s}$	Q2		6	12	

**Notes:**

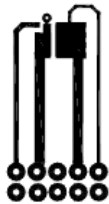
1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



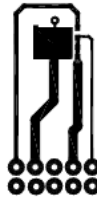
a. 57 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



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

2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , 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 25 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.3\text{ mH}$ ,  $I_{AS} = 13\text{ A}$ ,  $V_{DD} = 27\text{ V}$ ,  $V_{GS} = 10\text{ V}$ .

Q2:  $E_{AS}$  of 33 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.3\text{ mH}$ ,  $I_{AS} = 15\text{ A}$ ,  $V_{DD} = 27\text{ V}$ ,  $V_{GS} = 10\text{ V}$ .

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

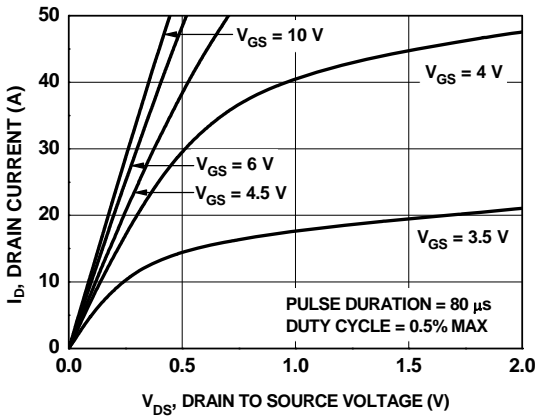


Figure 1. On Region Characteristics

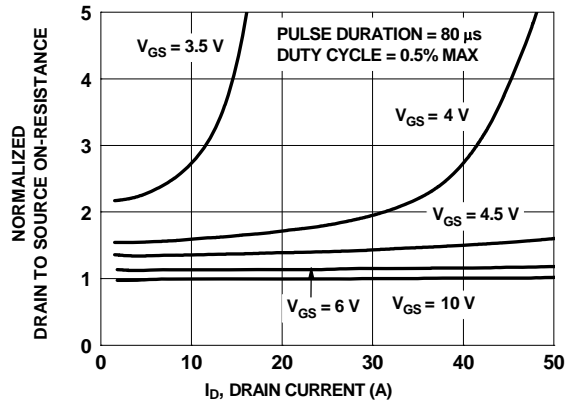


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

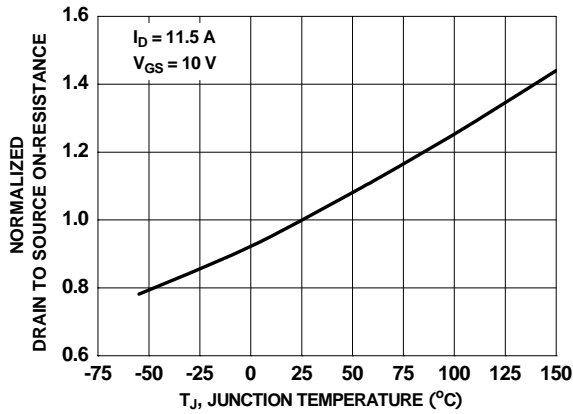


Figure 3. Normalized On Resistance vs Junction Temperature

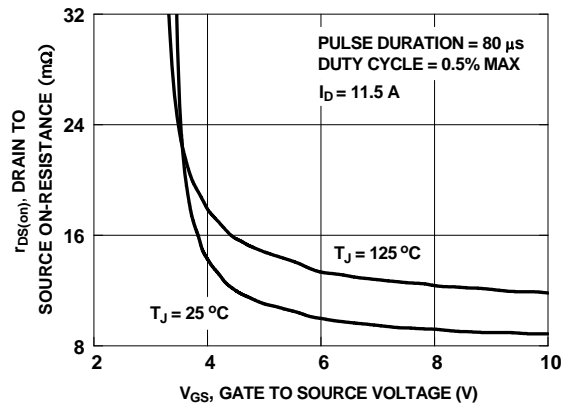


Figure 4. On-Resistance vs Gate to Source Voltage

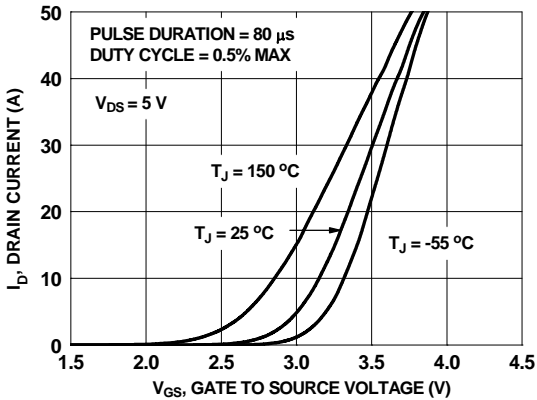


Figure 5. Transfer Characteristics

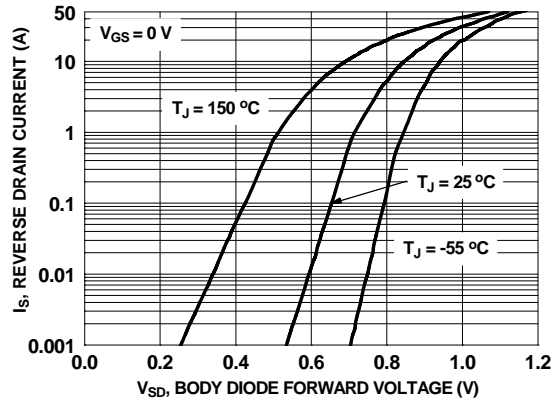
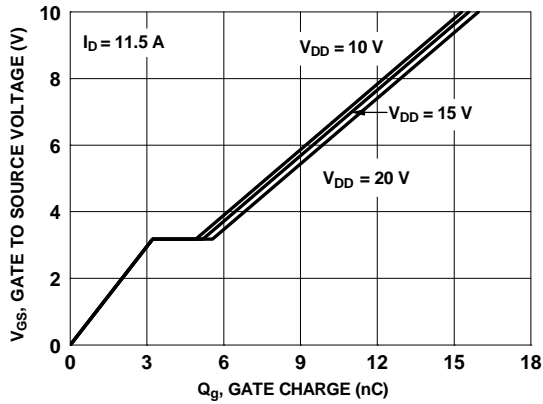
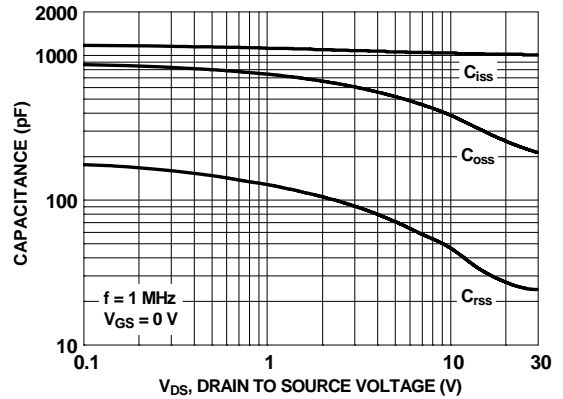


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

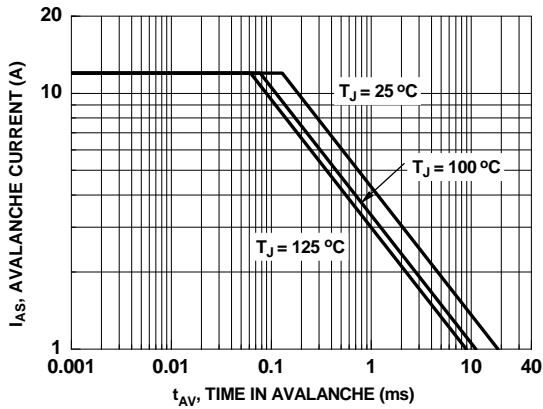
**Typical Characteristics (Q1 N-Channel)**  $T_J = 25^\circ\text{C}$  unless otherwise noted



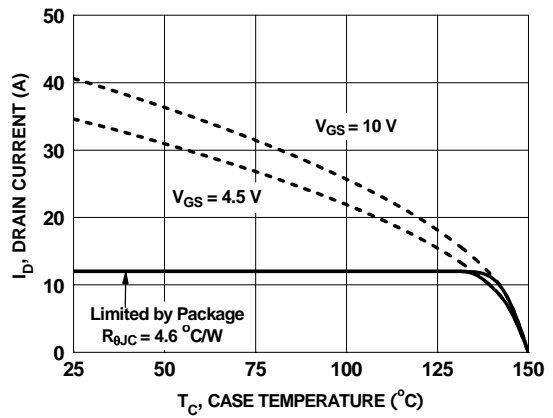
**Figure 7. Gate Charge Characteristics**



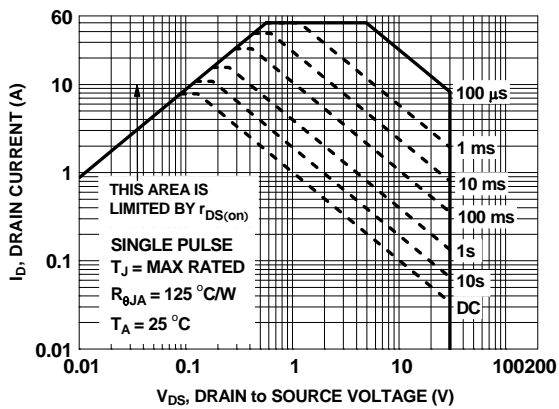
**Figure 8. Capacitance vs Drain to Source Voltage**



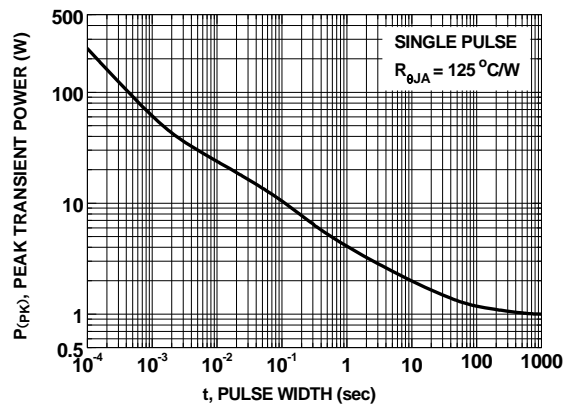
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs Case Temperature**

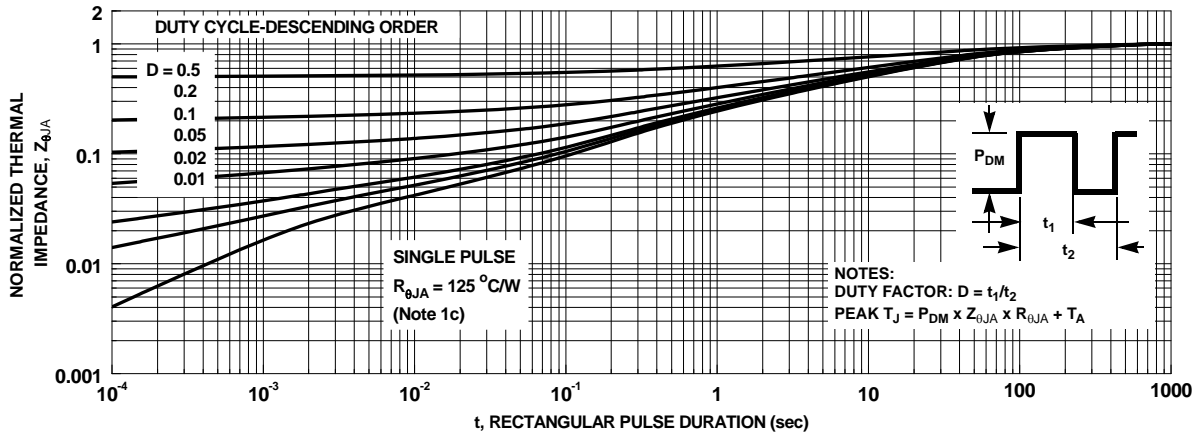


**Figure 11. Forward Bias Safe Operating Area**



**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

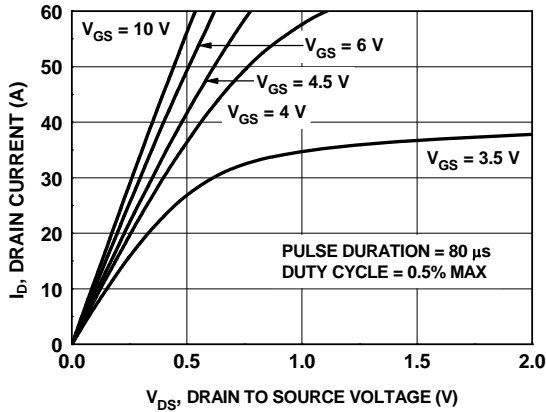


Figure 14. On-Region Characteristics

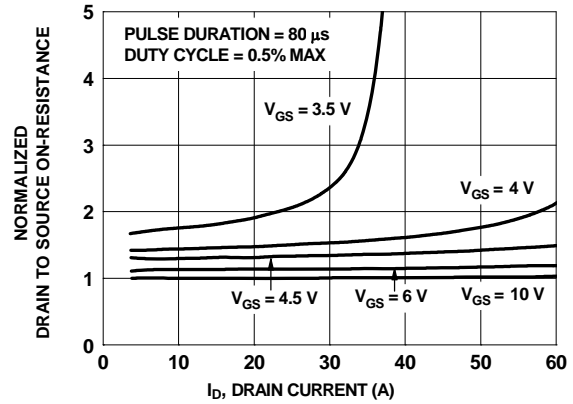


Figure 15. Normalized on-Resistance vs Drain Current and Gate Voltage

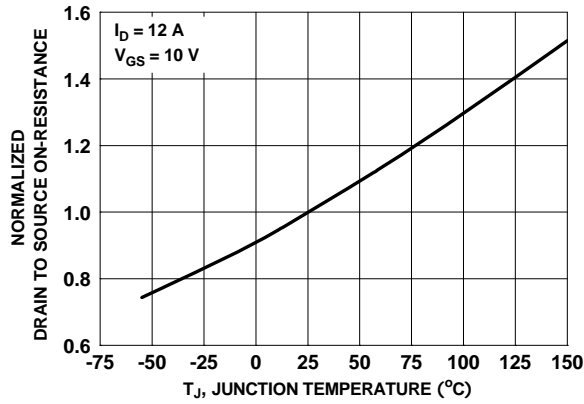


Figure 16. Normalized On-Resistance vs Junction Temperature

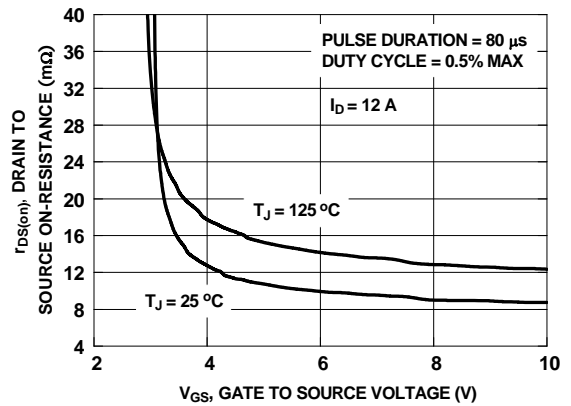


Figure 17. On-Resistance vs Gate to Source Voltage

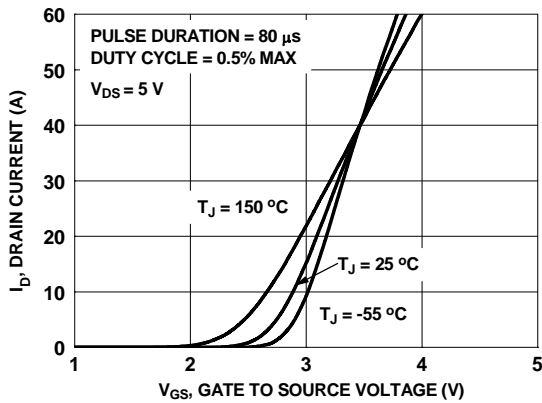


Figure 18. Transfer Characteristics

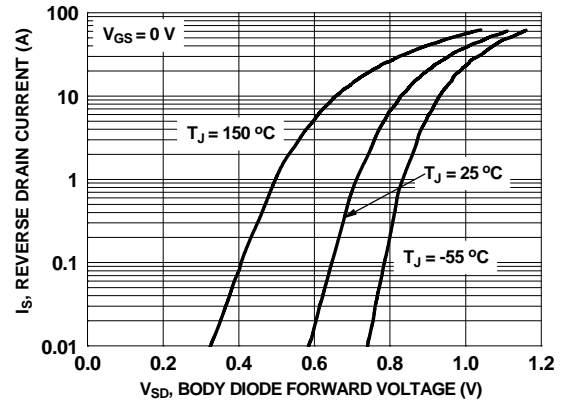
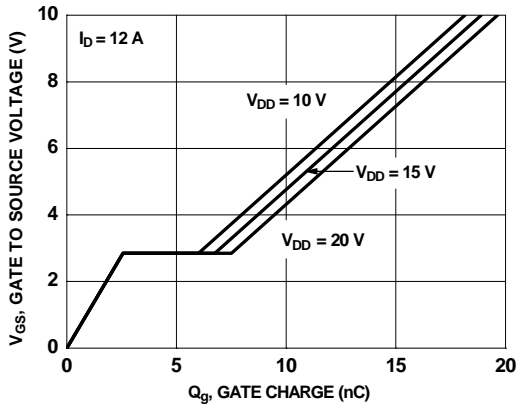
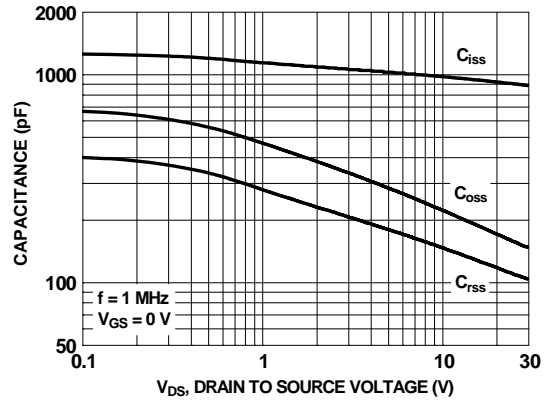


Figure 19. Source to Drain Diode Forward Voltage vs Source Current

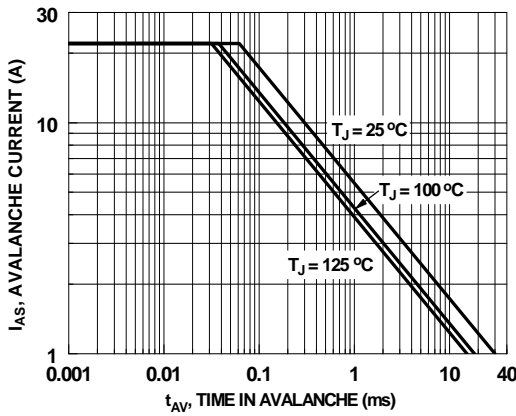
**Typical Characteristics (Q2 N-Channel)**  $T_J = 25^\circ\text{C}$  unless otherwise noted



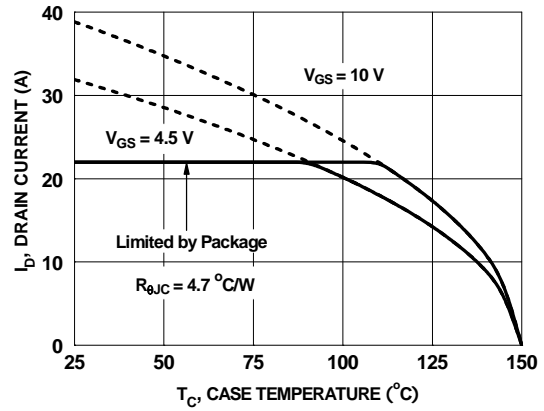
**Figure 20. Gate Charge Characteristics**



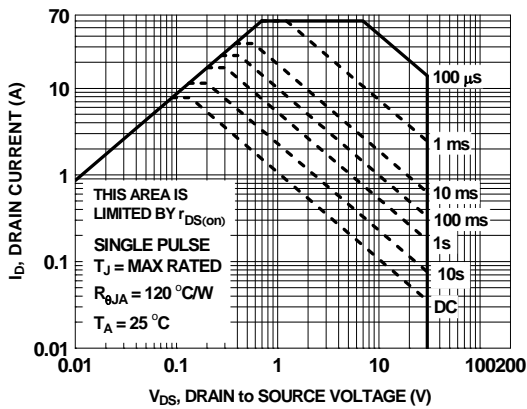
**Figure 21. Capacitance vs Drain to Source Voltage**



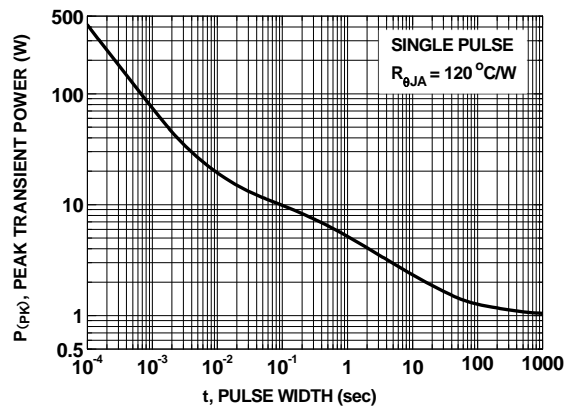
**Figure 22. Unclamped Inductive Switching Capability**



**Figure 23. Maximum Continuous Drain Current vs Case Temperature**



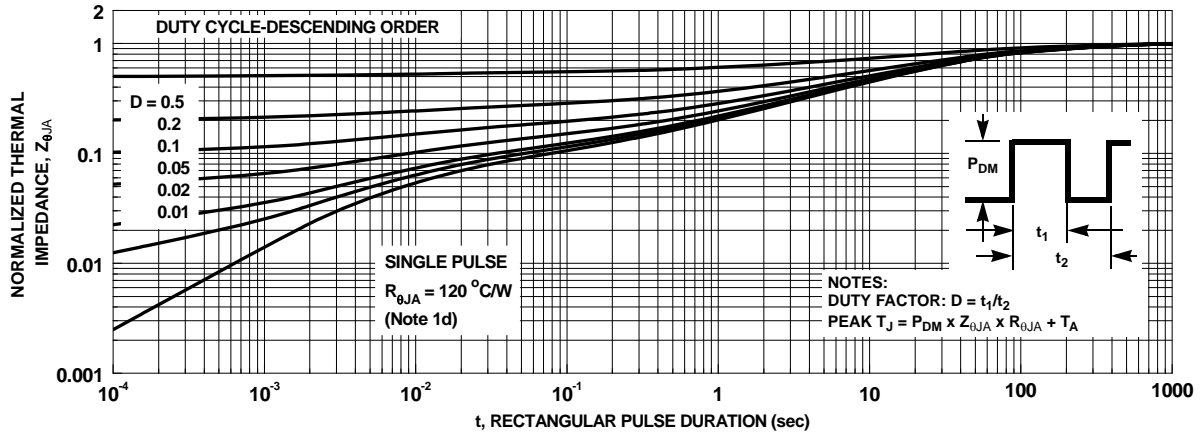
**Figure 24. Forward Bias Safe Operating Area**



**Figure 25. Single Pulse Maximum Power Dissipation**

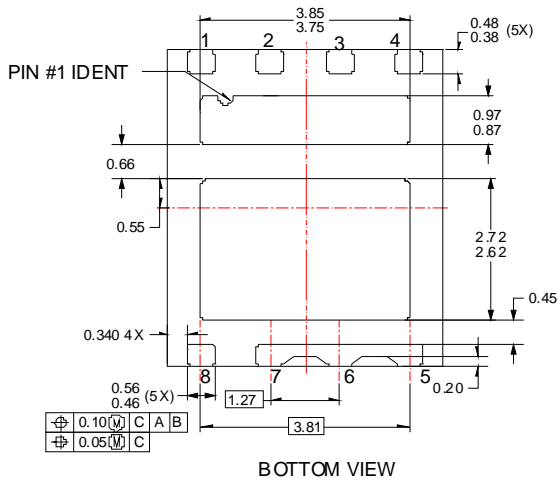
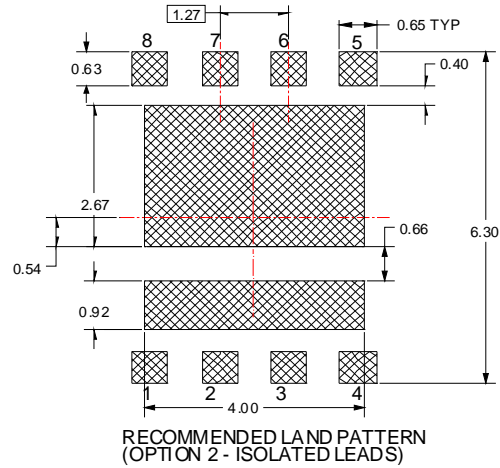
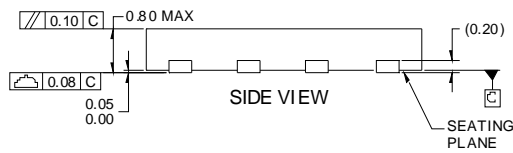
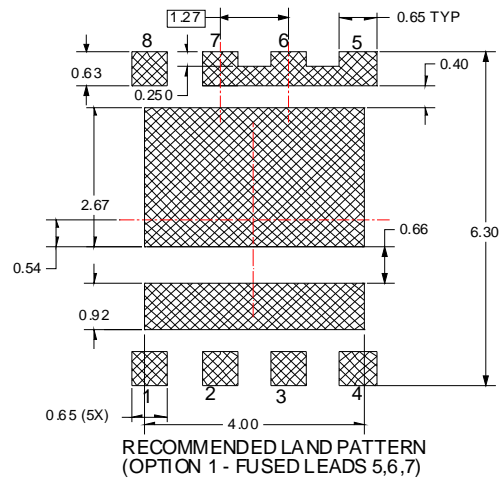
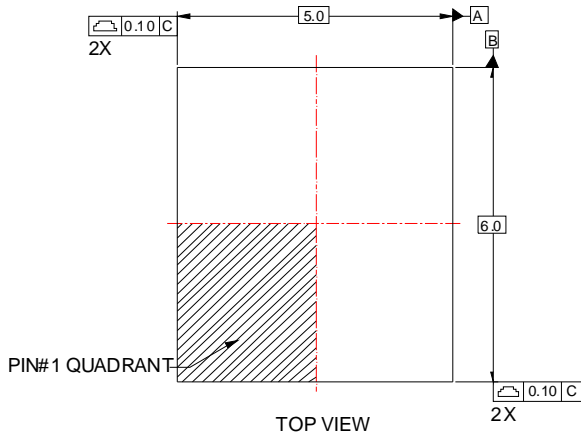


**Typical Characteristics (Q2 N-Channel)  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted**



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

## Dimensional Outline and Pad Layout



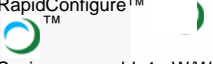
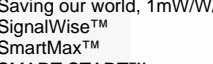




**NOTES:**

- A. DOES NOT FULLY CONFORM TO JEDEC REGISTRATION, MO-229.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
- D. LAND PATTERN RECOMMENDATION IS BASED ON FSC DESIGN ONLY



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| CTL™  | IntelliMAX™   |  | TINYOPTO™   |
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| ESBC™   | MicroPak2™  | SPM®  | TRUECURRENT®*   |
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| Fairchild®  | MotionMax™  | SuperFET®   |  |
| Fairchild Semiconductor®  | Motion-SPM™   | SuperSOT™-3   | UHC®  |
| FACT Quiet Series™  | mWSaver™  | SuperSOT™-6   | Ultra FRFET™  |
| FACT®   | OptiHiT™  | SuperSOT™-8   | UniFET™   |
| FAST®   | OPTOLOGIC®  | SupreMOS®   | VCX™  |
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| FETBench™   |  | Sync-Lock™  | XS™   |
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- Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
- A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

**ANTI-COUNTERFEITING POLICY**

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, [www.fairchildsemi.com](http://www.fairchildsemi.com), under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufactures of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

**PRODUCT STATUS DEFINITIONS**

**Definition of Terms**

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
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.