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May 2014

# FDMS7606

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

**Q1: 30 V, 12 A, 12.0 mΩ Q2: 30 V, 22 A, 11.6 mΩ**

### Features

Q1: N-Channel

■ Max  $r_{DS(on)}$  = 12.0 mΩ at  $V_{GS} = 10$  V,  $I_D = 11.5$  A■ Max  $r_{DS(on)}$  = 16.4 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

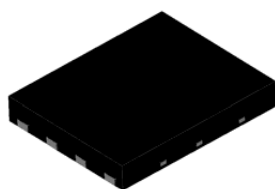
■ RoHS Compliant

### General Description

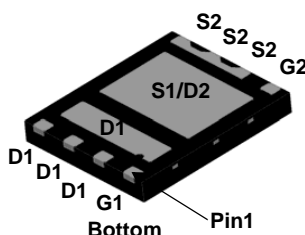
This device includes two specialized N-Channel MOSFETs in a dual MLP package. The switch node has been internally connected to enable easy placement and routing of synchronous buck converters. The control MOSFET (Q1) and synchronous MOSFET (Q2) have been designed to provide optimal power efficiency.

### Applications

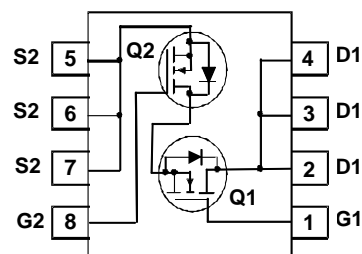
- Computing
- Communications
- General Purpose Point of Load
- Notebook Charger



Top



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 $T_C = 25^\circ\text{C}$	12	22	A
	-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	$V_{GS} = 10\ \text{V}$ , $I_D = 11.5\ \text{A}$	Q1		9.2	12.0	m $\Omega$
		$V_{GS} = 4.5\ \text{V}$ , $I_D = 10\ \text{A}$			12.6	16.4	
		$V_{GS} = 10\ \text{V}$ , $I_D = 11.5\ \text{A}$ , $T_J = 125^\circ\text{C}$	Q2		11.8	14.7	
		$V_{GS} = 10\ \text{V}$ , $I_D = 12\ \text{A}$ , $T_J = 125^\circ\text{C}$			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
$C_{rss}$	Reverse Transfer Capacitance		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 $5\ \text{V}$	Q1 Q2		8 10	11 15	nC
$Q_{gs}$	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 $I_F = 11.5\text{ A}, di/dt = 100\text{ A/s}$	Q1		22	35	ns
		Q2	Q2		18	33	
$Q_{rr}$	Reverse Recovery Charge	$I_F = 12\text{ A}, di/dt = 100\text{ A/s}$	Q1		7	13	nC
			Q2		6	12	

Notes:

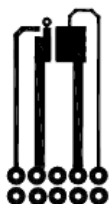
1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



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

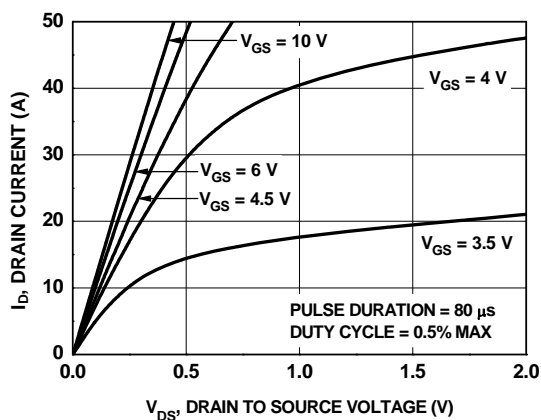


Figure 1. On Region Characteristics

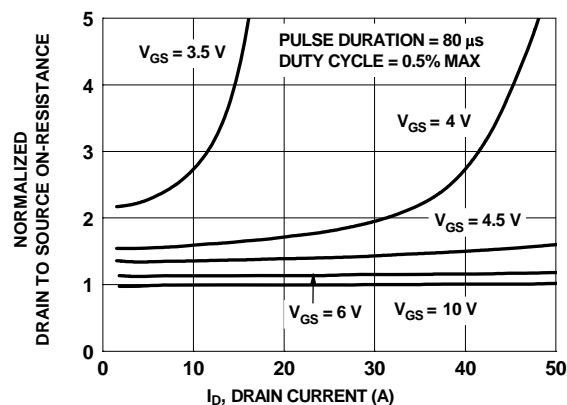


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

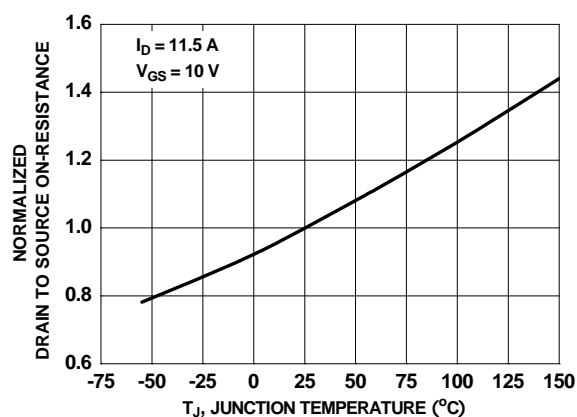


Figure 3. Normalized On Resistance vs Junction Temperature

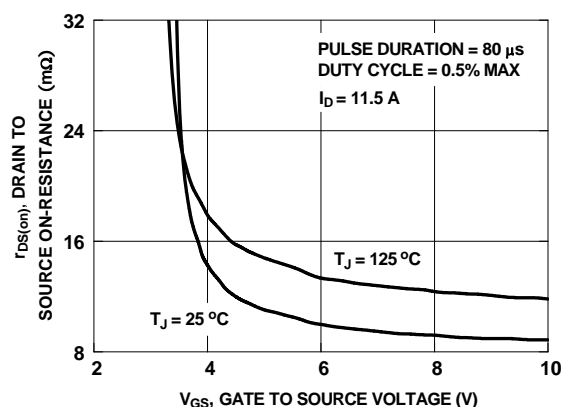


Figure 4. On-Resistance vs Gate to Source Voltage

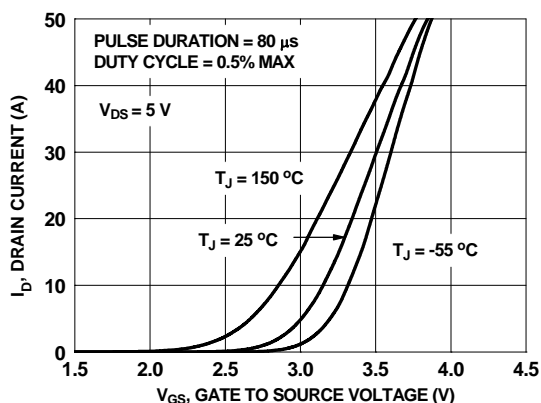


Figure 5. Transfer Characteristics

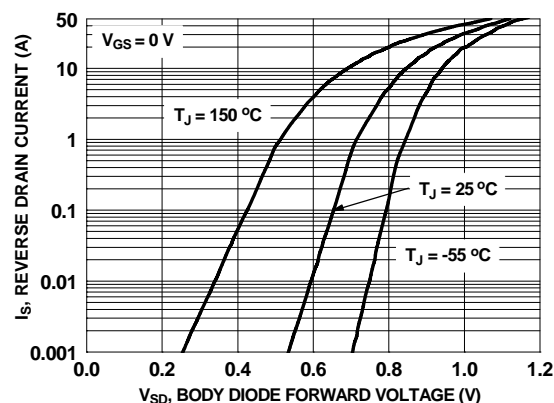


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

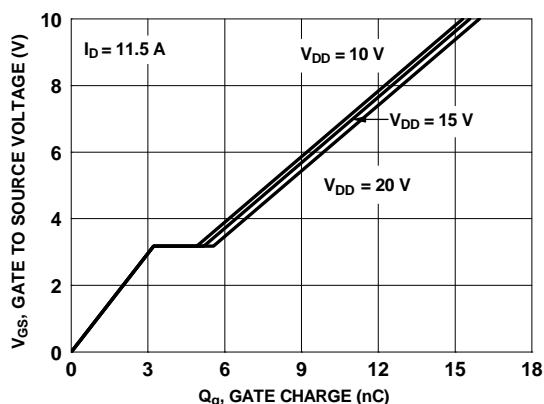


Figure 7. Gate Charge Characteristics

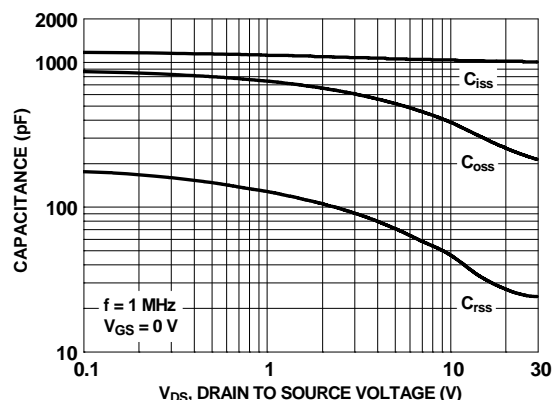


Figure 8. Capacitance vs Drain to Source Voltage

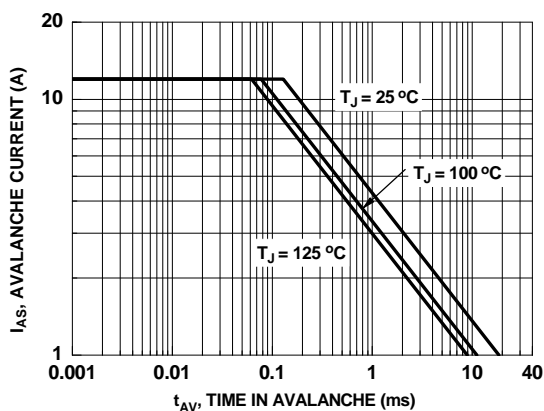


Figure 9. Unclamped Inductive Switching Capability

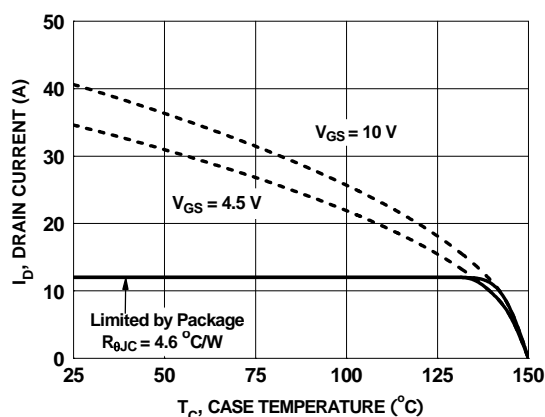


Figure 10. Maximum Continuous Drain Current vs Case Temperature

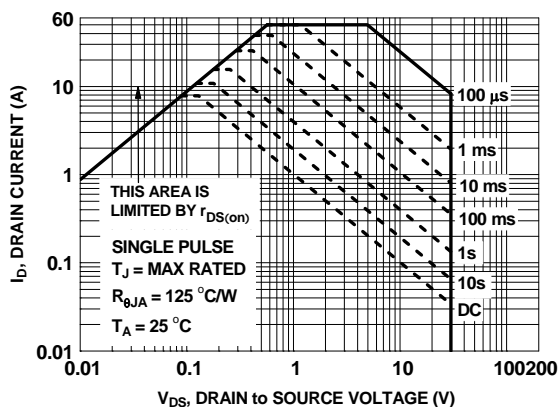


Figure 11. Forward Bias Safe Operating Area

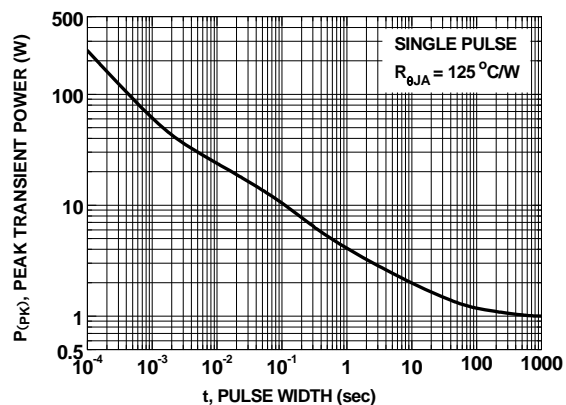
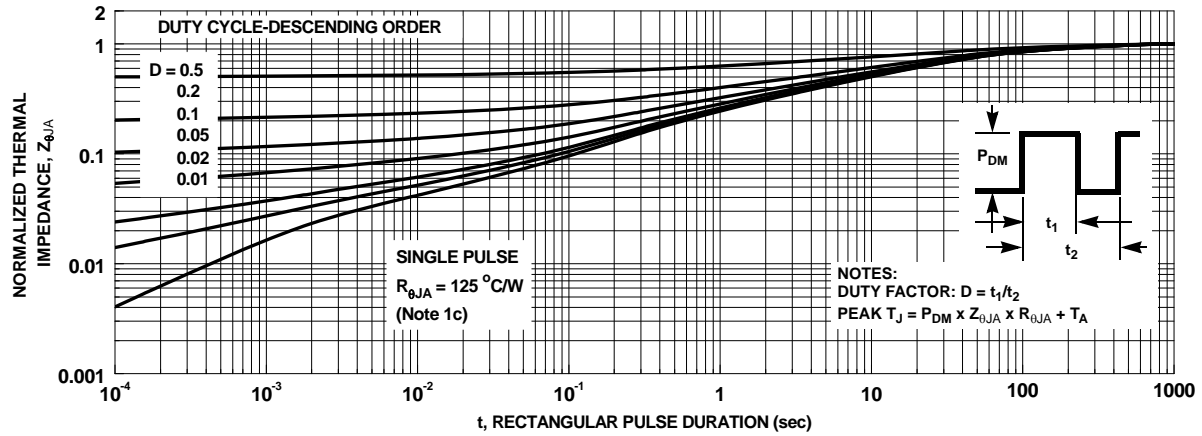


Figure 12. Single Pulse Maximum Power Dissipation

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

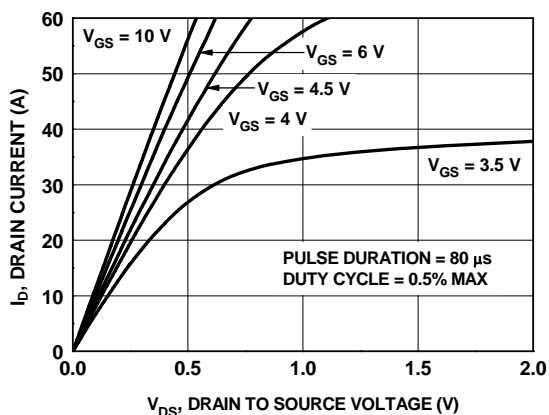


Figure 14. On-Region Characteristics

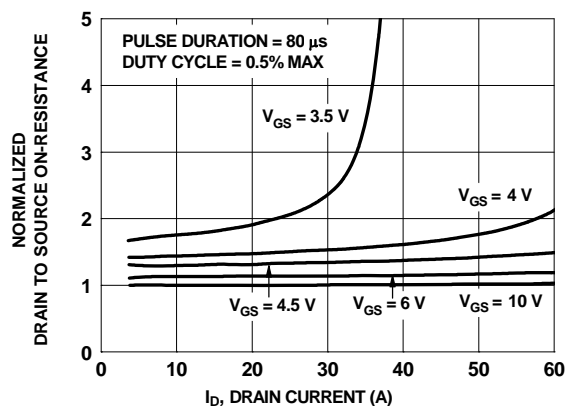


Figure 15. Normalized on-Resistance vs Drain Current and Gate Voltage

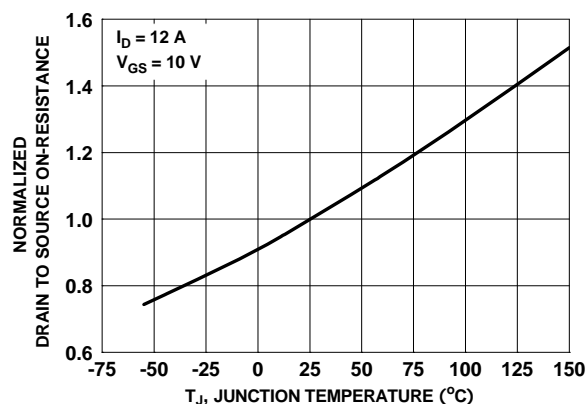


Figure 16. Normalized On-Resistance vs Junction Temperature

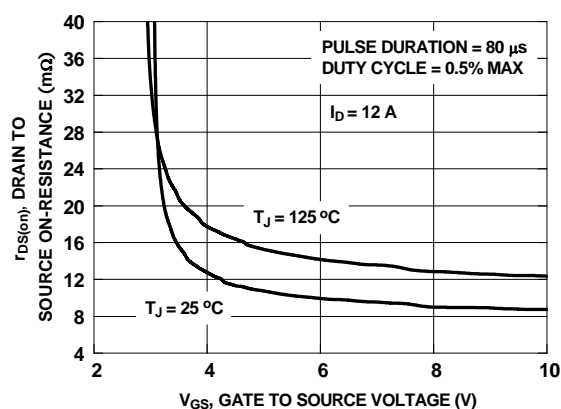


Figure 17. On-Resistance vs Gate to Source Voltage

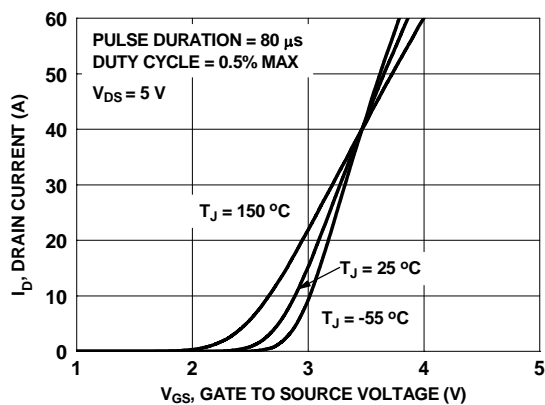


Figure 18. Transfer Characteristics

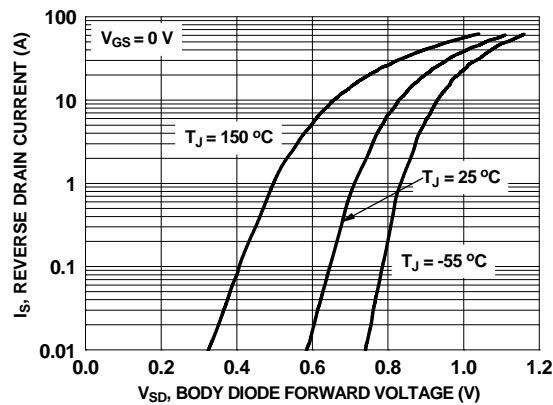


Figure 19. Source to Drain Diode Forward Voltage vs Source Current



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

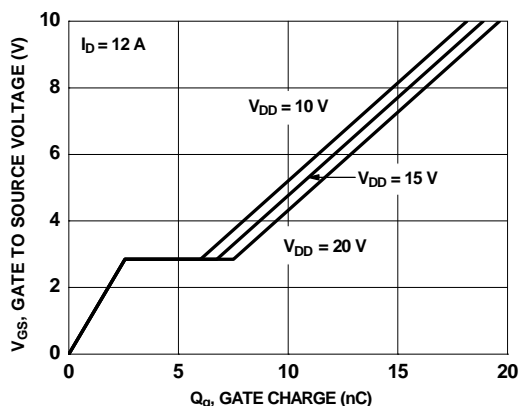


Figure 20. Gate Charge Characteristics

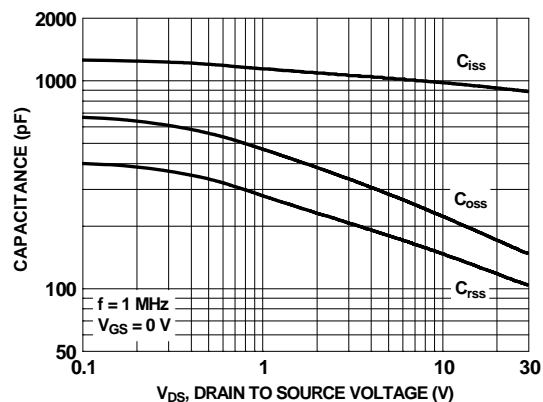


Figure 21. Capacitance vs Drain to Source Voltage

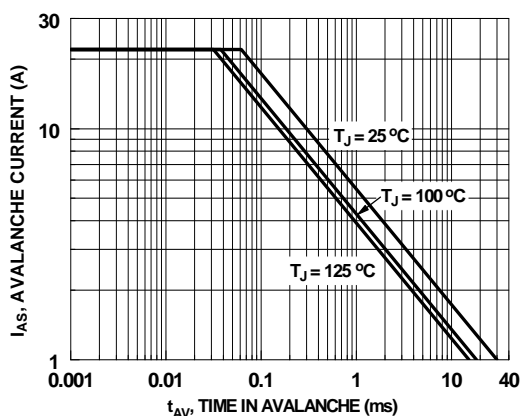


Figure 22. Unclamped Inductive Switching Capability

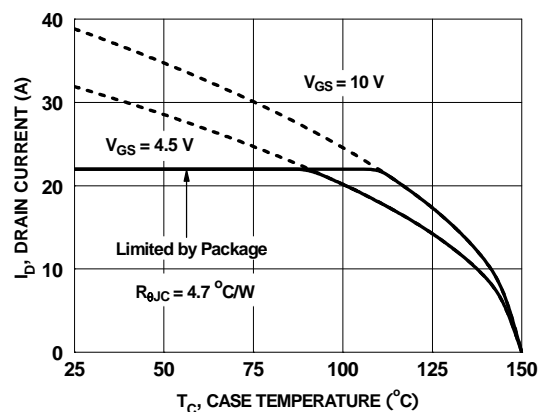


Figure 23. Maximum Continuous Drain Current vs Case Temperature

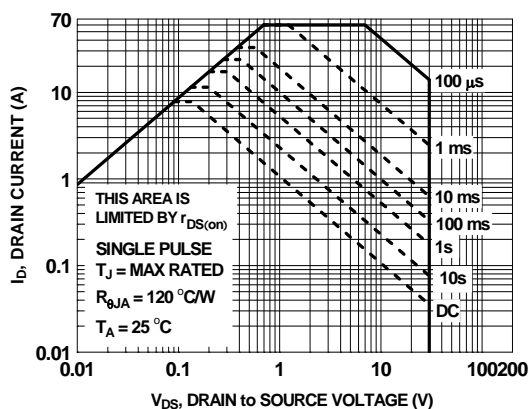


Figure 24. Forward Bias Safe Operating Area

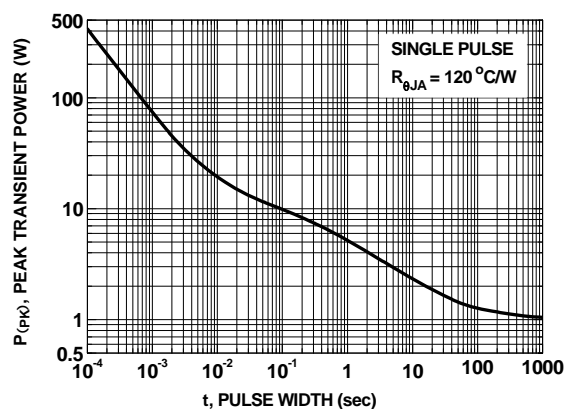
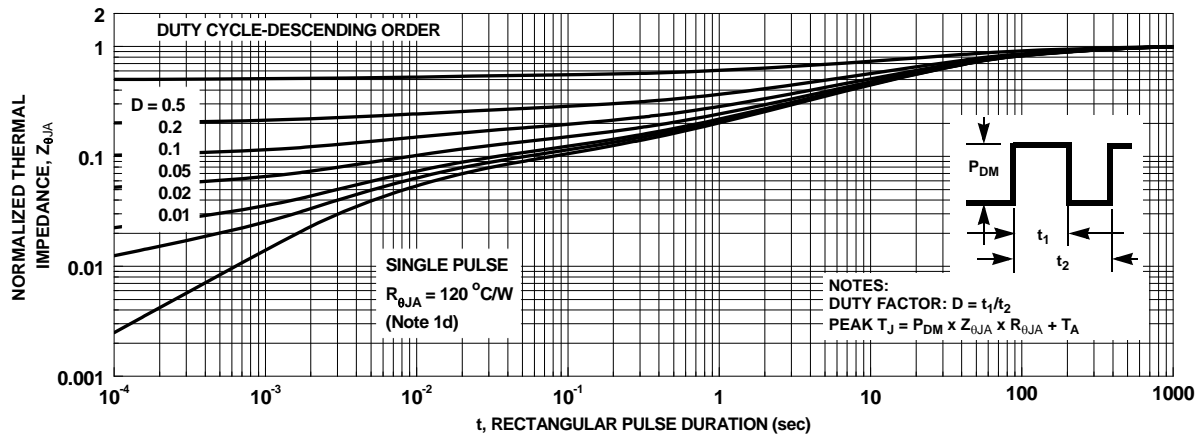


Figure 25. Single Pulse Maximum Power Dissipation

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



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