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# FDMD8540L

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

Q1: 40 V, 156 A, 1.5 mΩ Q2: 40 V, 156 A, 1.5 mΩ

### Features

Q1: N-Channel

- Max  $r_{DS(on)}$  = 1.5 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 33\text{ A}$
- Max  $r_{DS(on)}$  = 2.2 mΩ at  $V_{GS} = 4.5\text{ V}$ ,  $I_D = 26\text{ A}$

Q2: N-Channel

- Max  $r_{DS(on)}$  = 1.5 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 33\text{ A}$
- Max  $r_{DS(on)}$  = 2.2 mΩ at  $V_{GS} = 4.5\text{ V}$ ,  $I_D = 26\text{ A}$
- Ideal for Flexible Layout in Primary Side of Bridge Topology
- 100% UIL Tested
- Kelvin High Side MOSFET Drive Pin-out Capability
- RoHS Compliant

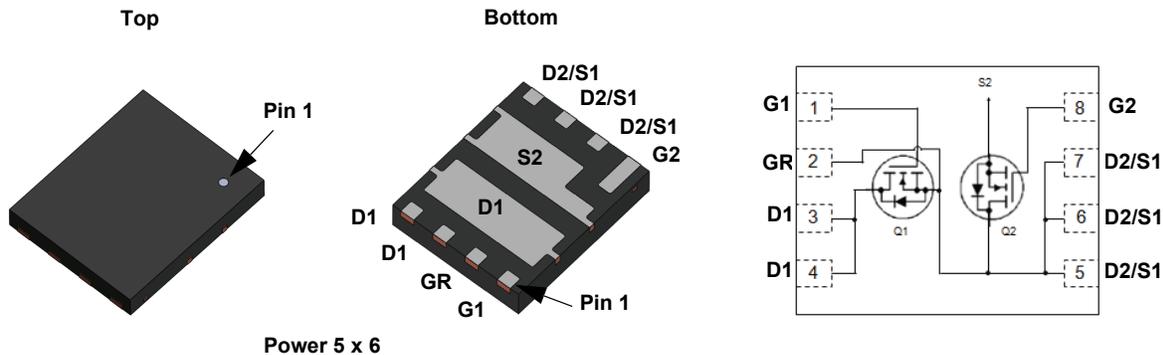


### General Description

This device includes two 40V N-Channel MOSFETs in a dual Power (5 mm X 6 mm) package. HS source and LS drain internally connected for half/full bridge, low source inductance package, low  $r_{DS(on)}$ /Qg FOM silicon.

### Applications

- POL Synchronous Dual
- One Phase Motor Half Bridge
- Half/Full Bridge Secondary Synchronous Rectification



Power 5 x 6

### MOSFET Maximum Ratings $T_A = 25\text{ °C}$ unless otherwise noted.

Symbol	Parameter	Q1	Q2	Units
$V_{DS}$	Drain to Source Voltage	40	40	V
$V_{GS}$	Gate to Source Voltage	±20	±20	V
$I_D$	Drain Current -Continuous $T_C = 25\text{ °C}$ (Note 5)	156	156	A
	-Continuous $T_C = 100\text{ °C}$ (Note 5)	99	99	
	-Continuous $T_A = 25\text{ °C}$	33 <sup>1a</sup>	33 <sup>1b</sup>	
	-Pulsed (Note 4)	886	886	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	541	541	mJ
$P_D$	Power Dissipation $T_C = 25\text{ °C}$	62	62	W
	Power Dissipation $T_A = 25\text{ °C}$	2.3 <sup>1a</sup>	2.3 <sup>1b</sup>	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150		°C

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	2.0	2.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	55 <sup>1a</sup>	55 <sup>1b</sup>	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMD8540L	FDMD8540L	Power 5 x 6	13 "	12 mm	3000 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	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	Q1 Q2	40 40			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$	Q1 Q2		20 20		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 32\text{ V}$ , $V_{GS} = 0\text{ V}$	Q1 Q2			1 1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$	Q1 Q2			$\pm 100$ $\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	Q1 Q2	1.0 1.0	1.8 1.8	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 $25\text{ }^\circ\text{C}$	Q1 Q2		-6 -6		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 33\text{ A}$	Q1		1.25	1.5	m $\Omega$
		$V_{GS} = 4.5\text{ V}$ , $I_D = 26\text{ A}$			1.65	2.2	
		$V_{GS} = 10\text{ V}$ , $I_D = 33\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$			1.7	2.1	
		$V_{GS} = 10\text{ V}$ , $I_D = 33\text{ A}$	Q2		1.25	1.5	
		$V_{GS} = 4.5\text{ V}$ , $I_D = 26\text{ A}$			1.65	2.2	
		$V_{GS} = 10\text{ V}$ , $I_D = 33\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$			1.7	2.1	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5\text{ V}$ , $I_D = 33\text{ A}$	Q1 Q2		178 178		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 20\text{ V}$ , $V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$	Q1 Q2		5670 5670	7940 7940	pF
$C_{oss}$	Output Capacitance		Q1 Q2		1668 1668	2335 2335	pF
$C_{rss}$	Reverse Transfer Capacitance		Q1 Q2		75 75	135 135	pF
$R_g$	Gate Resistance		Q1	0.1	1.6	3.2	$\Omega$
			Q2	0.1	1.6	3.2	

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 20\text{ V}$ , $I_D = 33\text{ A}$ $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$	Q1 Q2		15 15	28 28	ns	
$t_r$	Rise Time		Q1 Q2		13 13	24 24	ns	
$t_{d(off)}$	Turn-Off Delay Time		Q1 Q2		51 51	81 81	ns	
$t_f$	Fall Time		Q1 Q2		14 14	25 25	ns	
$Q_{g(TOT)}$	Total Gate Charge		$V_{GS} = 0\text{ V to }10\text{ V}$	Q1 Q2		81 81	113 113	nC
$Q_{g(TOT)}$	Total Gate Charge		$V_{GS} = 0\text{ V to }4.5\text{ V}$	Q1 Q2		38 38	54 54	nC
$Q_{gs}$	Gate to Source Charge		$V_{DD} = 20\text{ V}$ , $I_D = 33\text{ A}$	Q1 Q2		15 15		nC
$Q_{gd}$	Gate to Drain "Miller" Charge	Q1 Q2			11 11		nC	

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

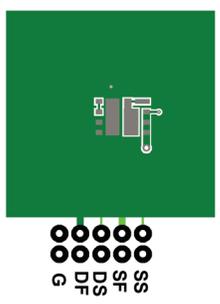
Symbol	Parameter	Test Conditions	Type	Min.	Typ.	Max.	Units
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**Drain-Source Diode Characteristics**

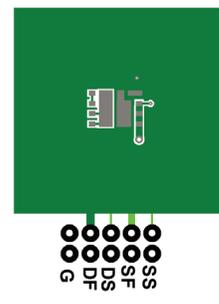
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 33\text{ A}$ (Note 2)	Q1 Q2		0.8 0.8	1.3 1.3	V
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2)	Q1 Q2		0.7 0.7	1.2 1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 33\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	Q1 Q2		54 54	86 86	ns
$Q_{rr}$	Reverse Recovery Charge		Q1 Q2		38 38	60 60	nC

NOTES:

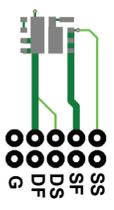
1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



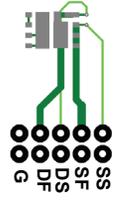
a. 55 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 55 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



c. 155 °C/W when mounted on a minimum pad of 2 oz copper



d. 155 °C/W when mounted on a minimum pad of 2 oz copper

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0 %.
- Q1:  $E_{AS}$  of 541 mJ is based on starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 19\text{ A}$ ,  $V_{DD} = 40\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% tested at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 59\text{ A}$ .
- Q2:  $E_{AS}$  of 541 mJ is based on starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 19\text{ A}$ ,  $V_{DD} = 40\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% tested at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 59\text{ A}$ .
- Pulsed Id please refer to Fig 11 and Fig 24 SOA graph for more details.
- Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

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

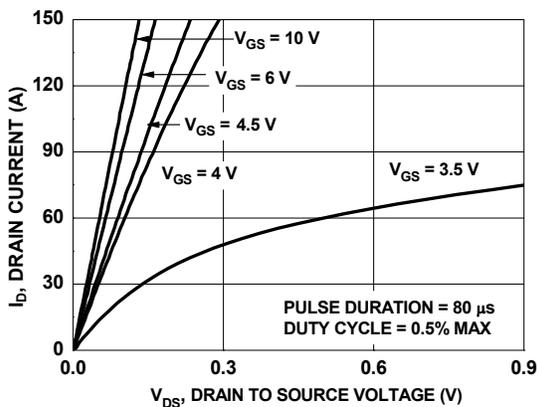


Figure 1. On Region Characteristics

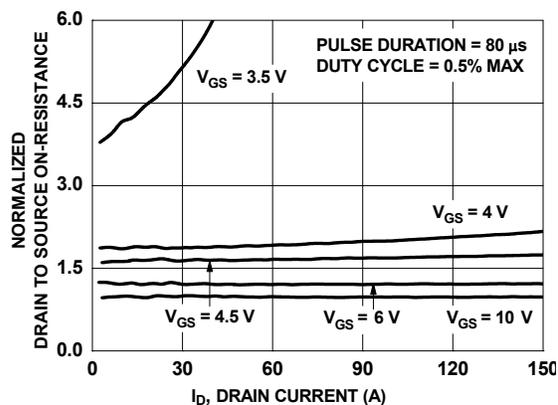


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

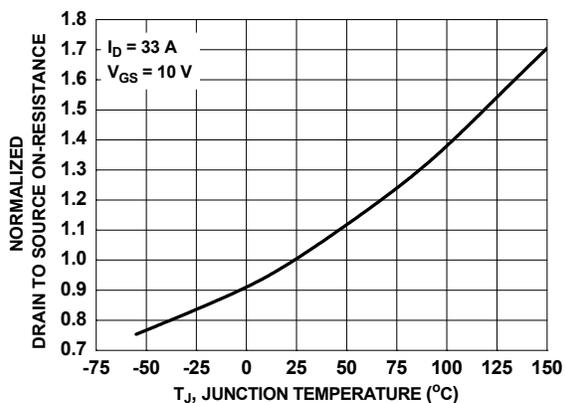


Figure 3. Normalized On Resistance vs. Junction Temperature

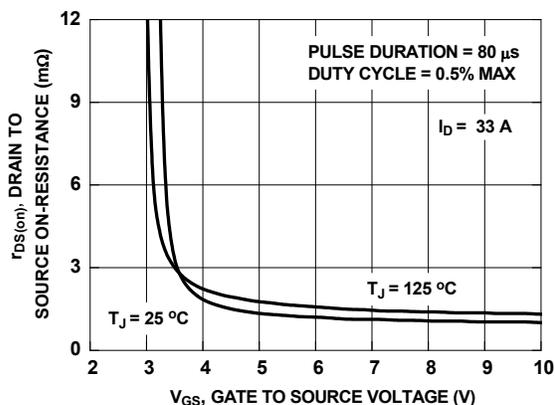


Figure 4. On-Resistance vs. Gate to Source Voltage

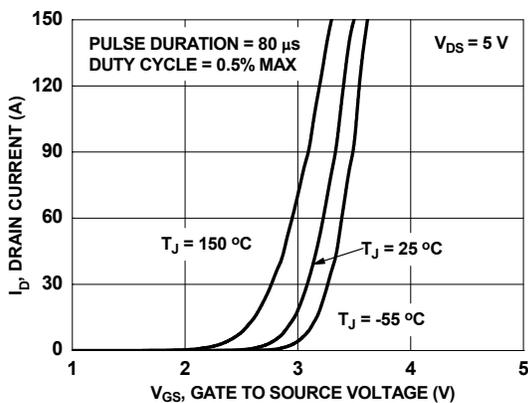


Figure 5. Transfer Characteristics

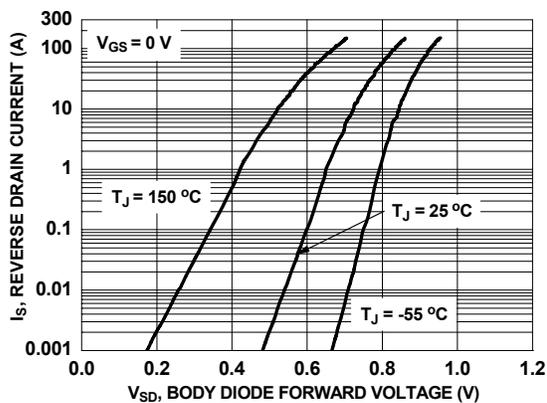
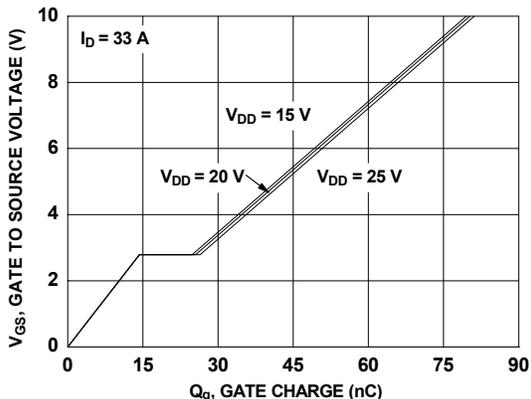
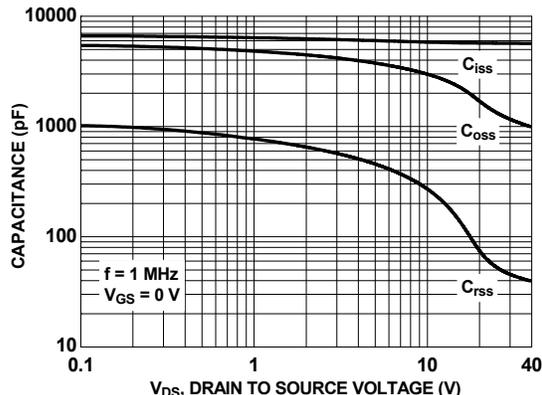


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

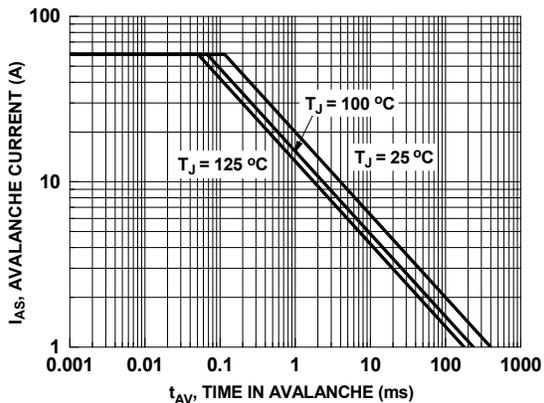
**Typical Characteristics (Q1 N-Channel)**  $T_J = 25^\circ\text{C}$  unless otherwise noted.



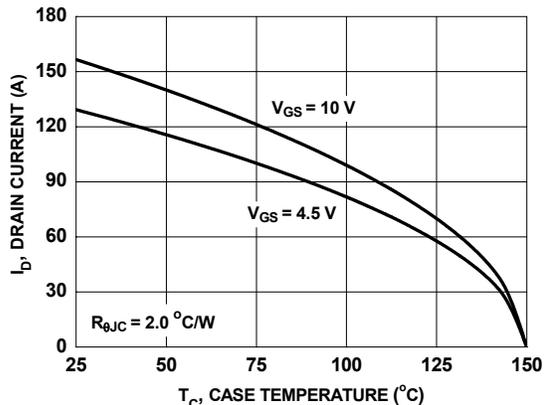
**Figure 7. Gate Charge Characteristics**



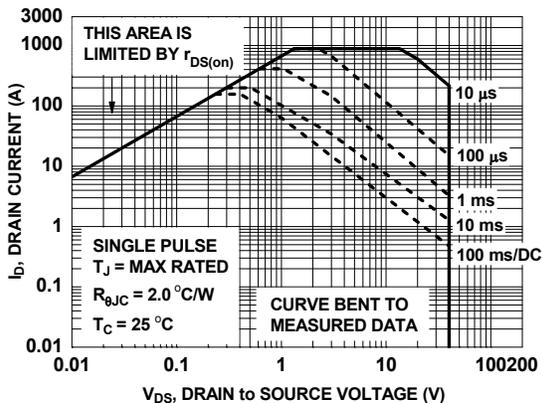
**Figure 8. Capacitance vs. Drain to Source Voltage**



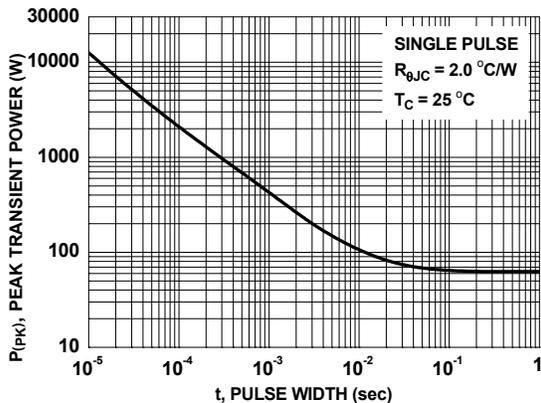
**Figure 9. Unclamped Inductive Switching Capability**



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

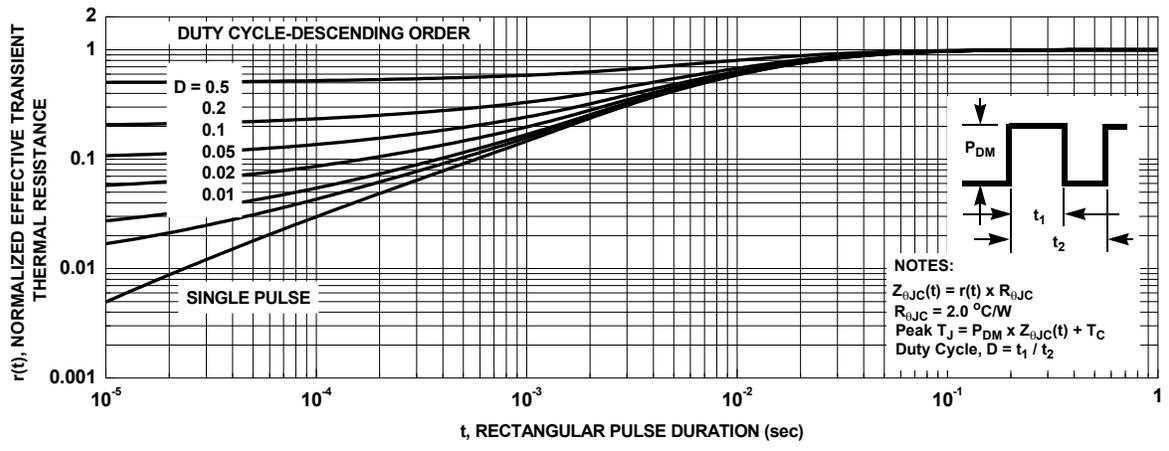


**Figure 11. Forward Bias Safe Operating Area**



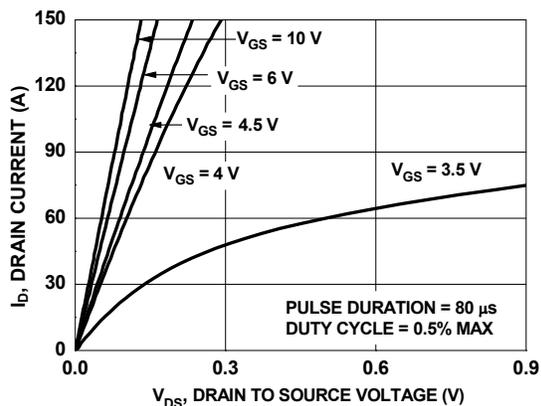
**Figure 12. Single Pulse Maximum Power Dissipation**

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

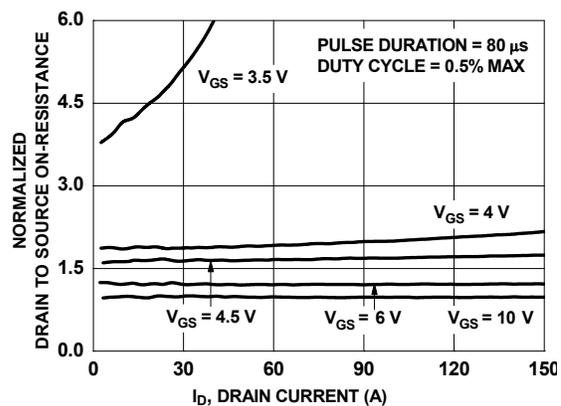


**Figure 13. Junction-to-Case Transient Thermal Response Curve**

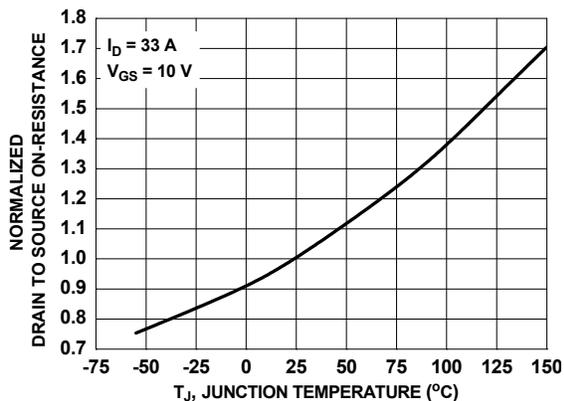
**Typical Characteristics (Q2 N-Channel)**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted.



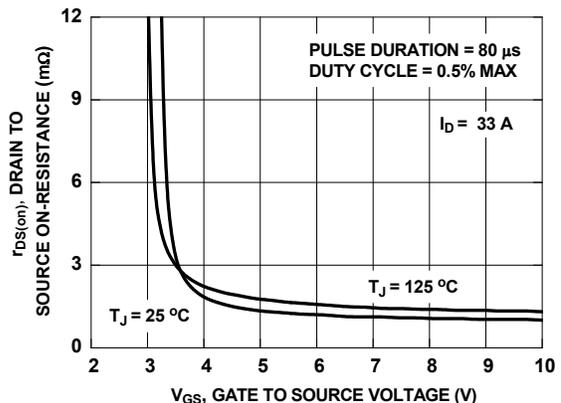
**Figure 14. On-Region Characteristics**



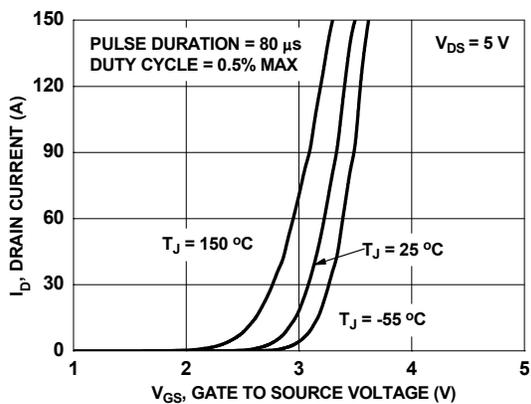
**Figure 15. Normalized on-Resistance vs. Drain Current and Gate Voltage**



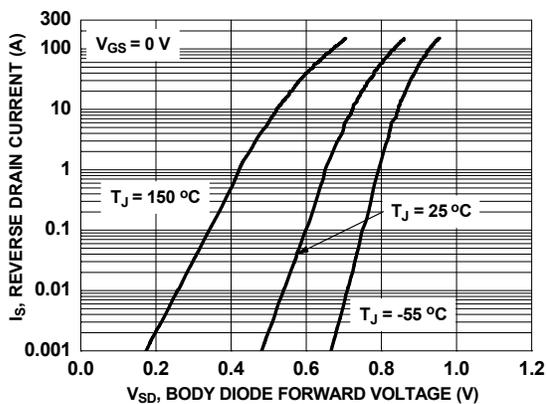
**Figure 16. Normalized On-Resistance vs. Junction Temperature**



**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.

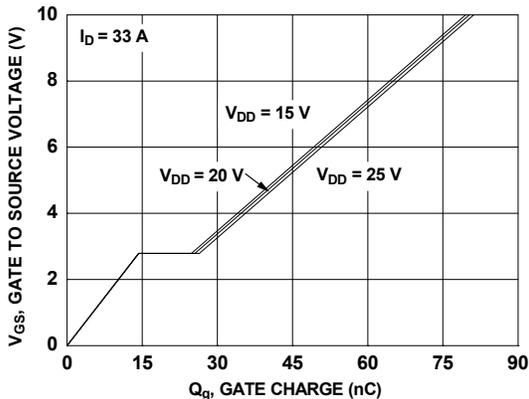


Figure 20. Gate Charge Characteristics

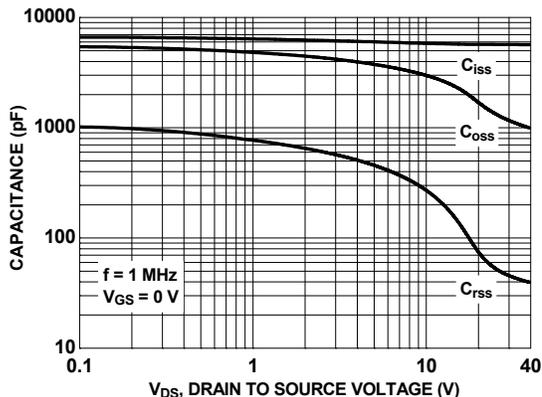


Figure 21. Capacitance vs. Drain to Source Voltage

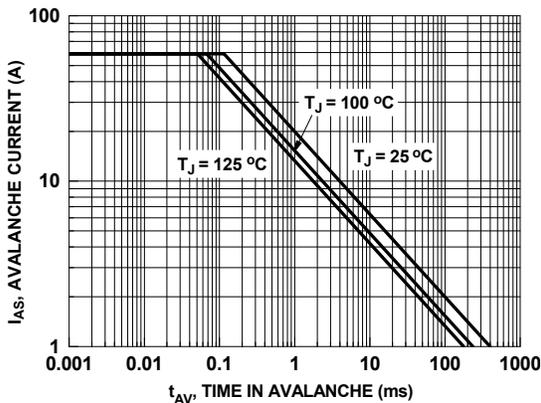


Figure 22. Unclamped Inductive Switching Capability

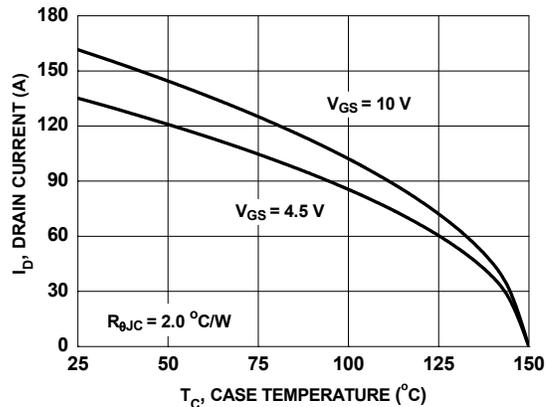


Figure 23. Maximum Continuous Drain Current vs. Case Temperature

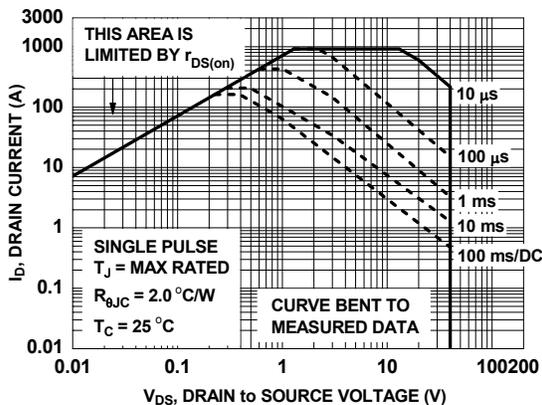


Figure 24. Forward Bias Safe Operating Area

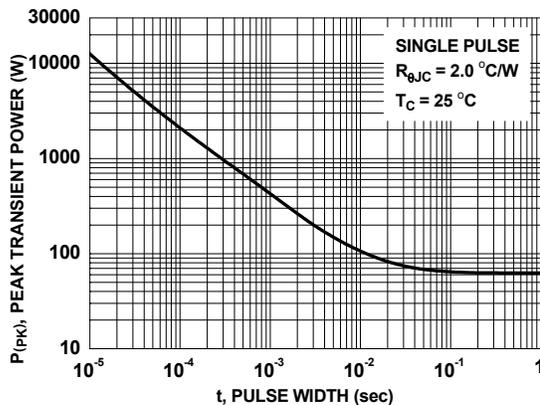
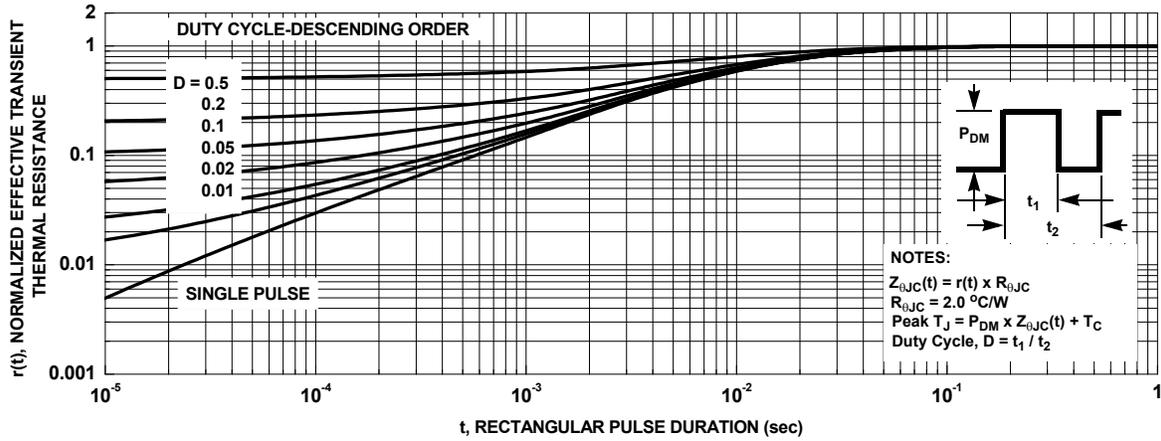
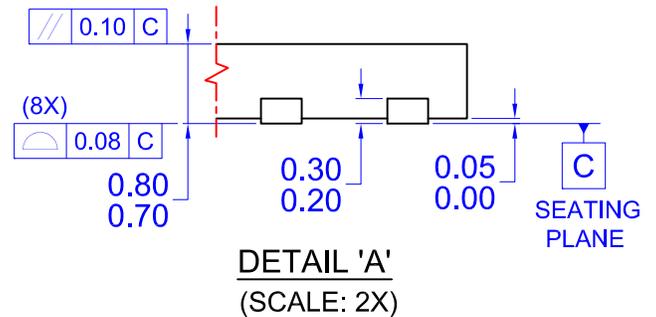
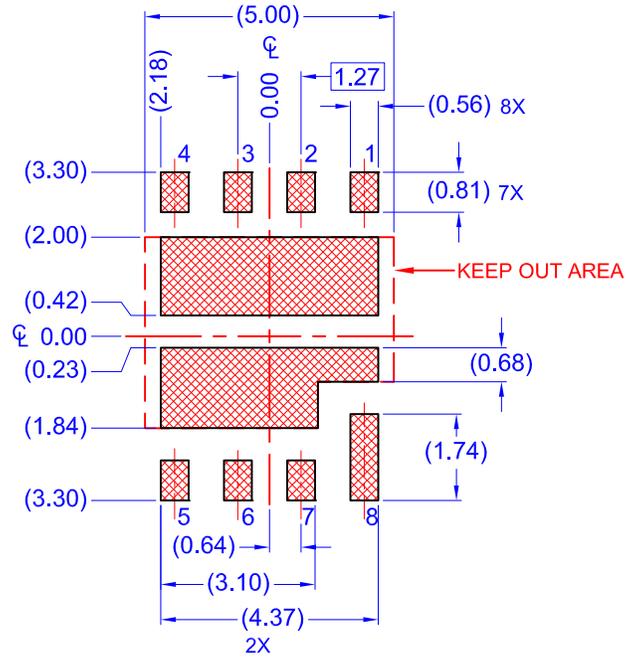
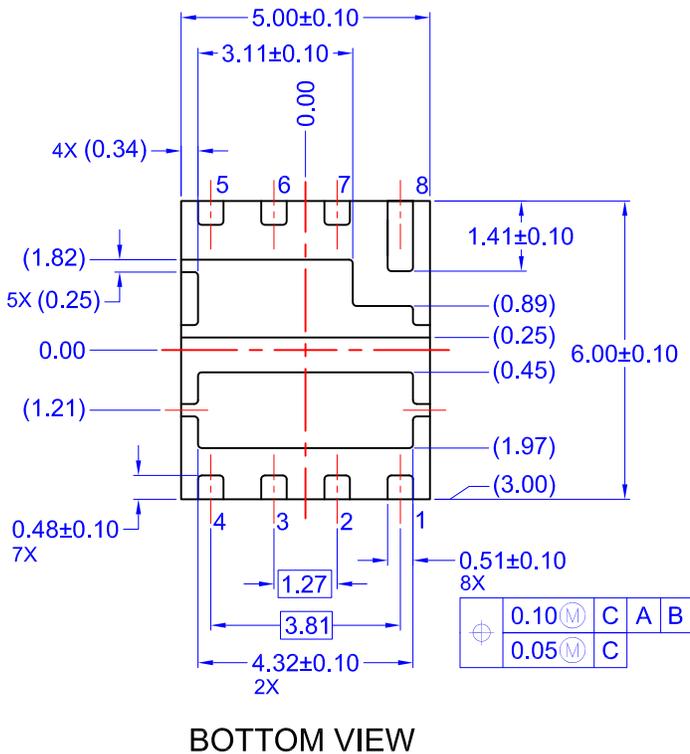
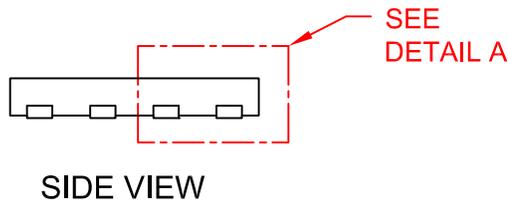
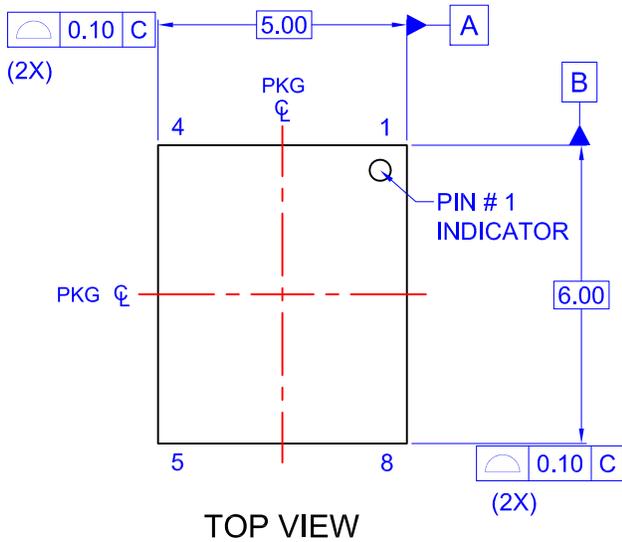


Figure 25. Single Pulse Maximum Power Dissipation

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



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



- NOTES: UNLESS OTHERWISE SPECIFIED
- A) PACKAGE STANDARD REFERENCE: JEDEC REGISTRATION, MO-240, VARIATION AA.
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
  - D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
  - E) IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.
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