



ON Semiconductor®

# FDMS6681Z

## P-Channel PowerTrench® MOSFET

-30 V, -122 A, 3.2 mΩ

### Features

- Max  $r_{DS(on)}$  = 3.2 mΩ at  $V_{GS} = -10$  V,  $I_D = -21.1$  A
- Max  $r_{DS(on)}$  = 5.0 mΩ at  $V_{GS} = -4.5$  V,  $I_D = -15.7$  A
- Advanced Package and Silicon combination for low  $r_{DS(on)}$
- HBM ESD Protection Level of 8kV Typical(Note 3)
- MSL1 Robust Package Design
- RoHS Compliant

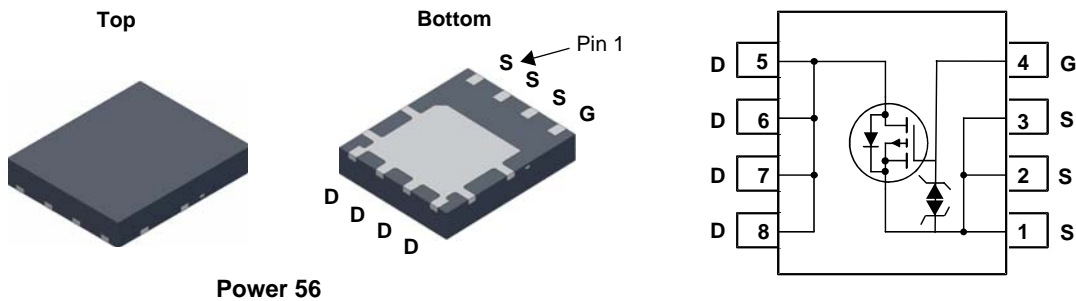


### General Description

The FDMS6681Z has been designed to minimize losses in load switch applications. Advancements in both silicon and package technologies have been combined to offer the lowest  $r_{DS(on)}$  and ESD protection.

### Applications

- Load Switch in Notebook and Server
- Notebook Battery Pack Power Management



### MOSFET Maximum Ratings $T_A = 25$ °C unless otherwise noted.

Symbol	Parameter	Conditions	Rated Value	Units
$V_{DS}$	Drain to Source Voltage		-30	V
$V_{GS}$	Gate to Source Voltage		±25	V
$I_D$	Drain Current	-Continuous $T_C = 25$ °C (Note5)	-122	A
		-Continuous $T_C = 100$ °C (Note5)	-77	
		-Continuous $T_A = 25$ °C (Note 1a)	-21.1	
		-Pulsed (Note4)	-600	
$P_D$	Power Dissipation	$T_C = 25$ °C	73	W
		$T_A = 25$ °C (Note 1a)	2.5	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range		-55 to +150	°C

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.7	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS6681Z	FDMS6681Z	Power 56	13 "	12 mm	3000 units

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = -250\ \mu\text{A}, V_{GS} = 0\ \text{V}$	-30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		20		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -24\ \text{V}, V_{GS} = 0\ \text{V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 25\ \text{V}, V_{DS} = 0\ \text{V}$			$\pm 10$	$\mu\text{A}$

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$	-1	-1.7	-3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-7		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -10\ \text{V}, I_D = -22.1\ \text{A}$		2.7	3.2	m $\Omega$
		$V_{GS} = -4.5\ \text{V}, I_D = -15.7\ \text{A}$		4.0	5.0	
		$V_{GS} = -10\ \text{V}, I_D = -22.1\ \text{A}, T_J = 125\text{ }^\circ\text{C}$		3.9	5.0	
$g_{FS}$	Forward Transconductance	$V_{DD} = -10\ \text{V}, I_D = -22.1\ \text{A}$		143		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -15\ \text{V}, V_{GS} = 0\ \text{V},$ $f = 1\ \text{MHz}$		7803	10380	pF
$C_{oss}$	Output Capacitance			1540	2050	pF
$C_{rss}$	Reverse Transfer Capacitance			1345	2020	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -15\ \text{V}, I_D = -22.1\ \text{A},$ $V_{GS} = -10\ \text{V}, R_{GEN} = 6\ \Omega$		15	24	ns	
$t_r$	Rise Time			38	61	ns	
$t_{d(off)}$	Turn-Off Delay Time			260	416	ns	
$t_f$	Fall Time			197	316	ns	
$Q_g$	Total Gate Charge		$V_{GS} = 0\ \text{V}$ to $-10\ \text{V}$		172	241	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $-5\ \text{V}$	$V_{DD} = -15\ \text{V},$ $I_D = -22.1\ \text{A}$		97	136	nC
$Q_{gs}$	Gate to Source Charge				22		nC
$Q_{gd}$	Gate to Drain "Miller" Charge				46		nC

### Drain-Source Diode Characteristics

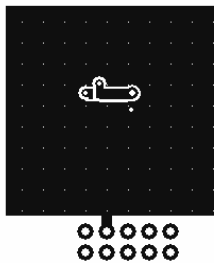
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}, I_S = -2.1\ \text{A}$ (Note 2)		0.68	1.2	V
		$V_{GS} = 0\ \text{V}, I_S = -22.1\ \text{A}$ (Note 2)		0.79	1.25	V
$t_{rr}$	Reverse Recovery Time	$I_F = -22.1\ \text{A}, di/dt = 100\ \text{A}/\mu\text{s}$		44	71	ns
$Q_{rr}$	Reverse Recovery Charge			39	63	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. 50  $^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.

b. 125  $^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.



2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.

3. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

4. Pulsed  $I_d$  please refer to Fig 12 SOA graph for more details.

5. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal electro-mechanical application board design.

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

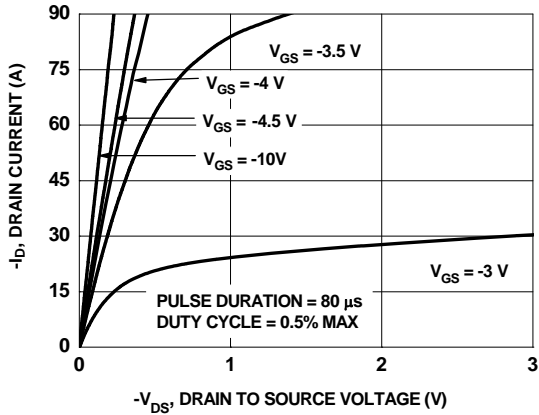


Figure 1. On Region Characteristics

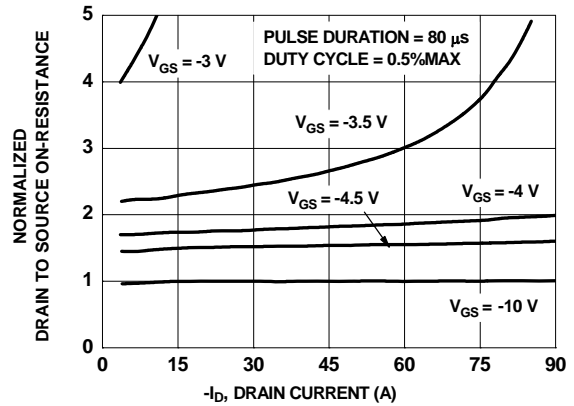


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

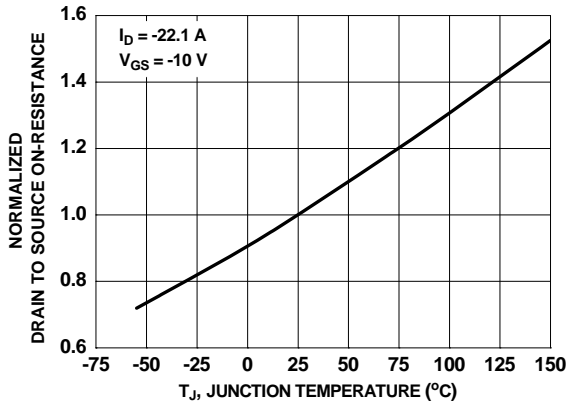


Figure 3. Normalized On Resistance vs Junction Temperature

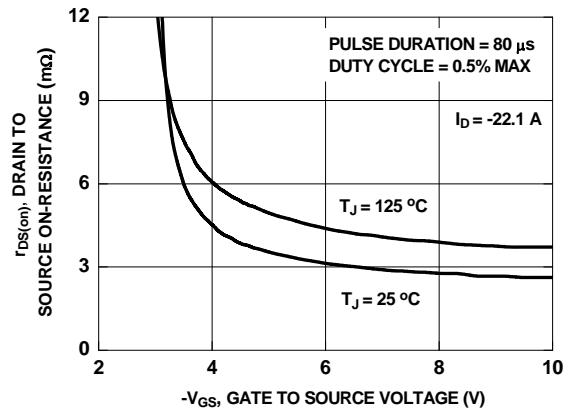


Figure 4. On-Resistance vs Gate to Source Voltage

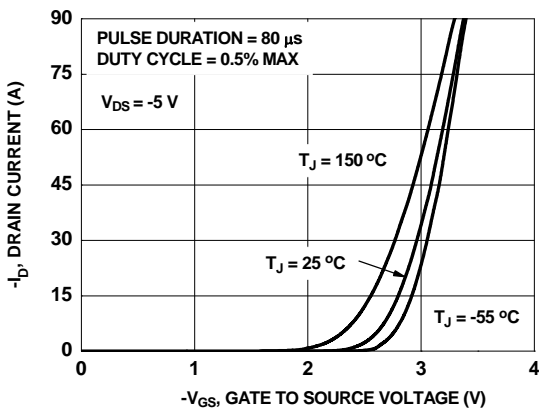


Figure 5. Transfer Characteristics

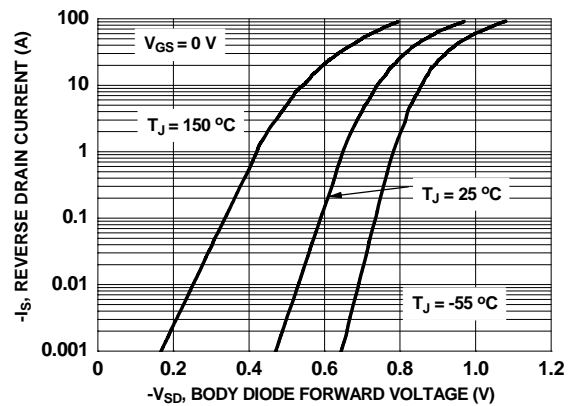
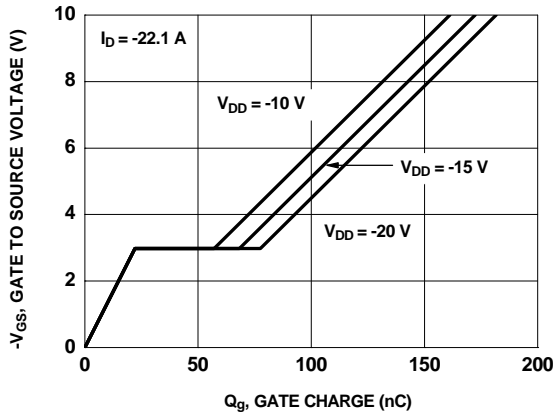
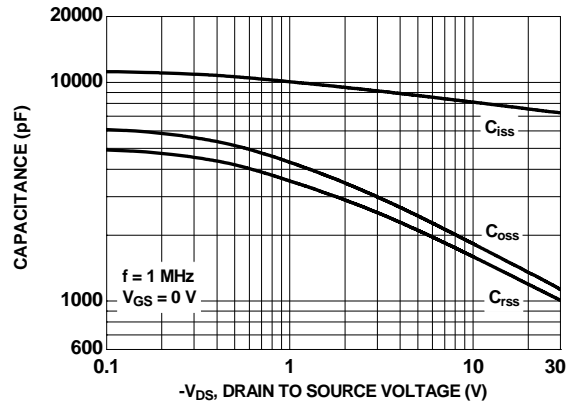


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

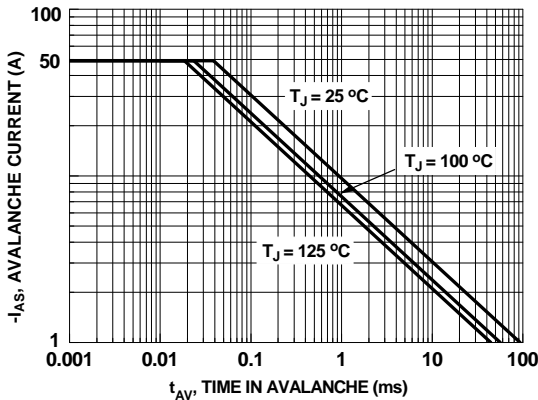
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted.



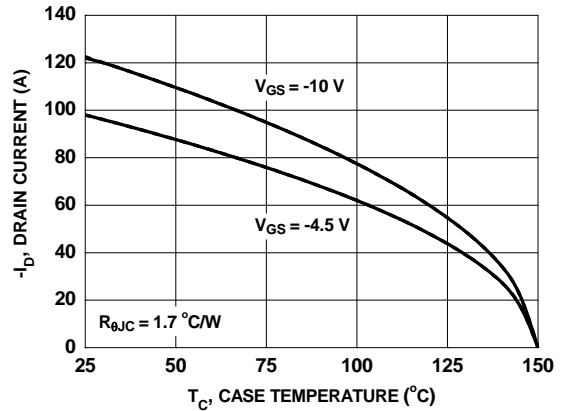
**Figure 7. Gate Charge Characteristics**



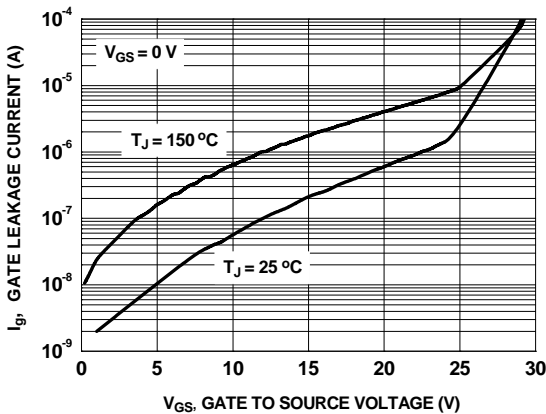
**Figure 8. Capacitance vs Drain to Source Voltage**



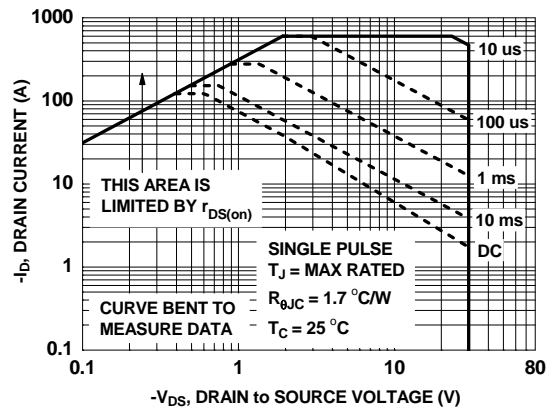
**Figure 9. Unclamped Inductive Switching Capability**



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

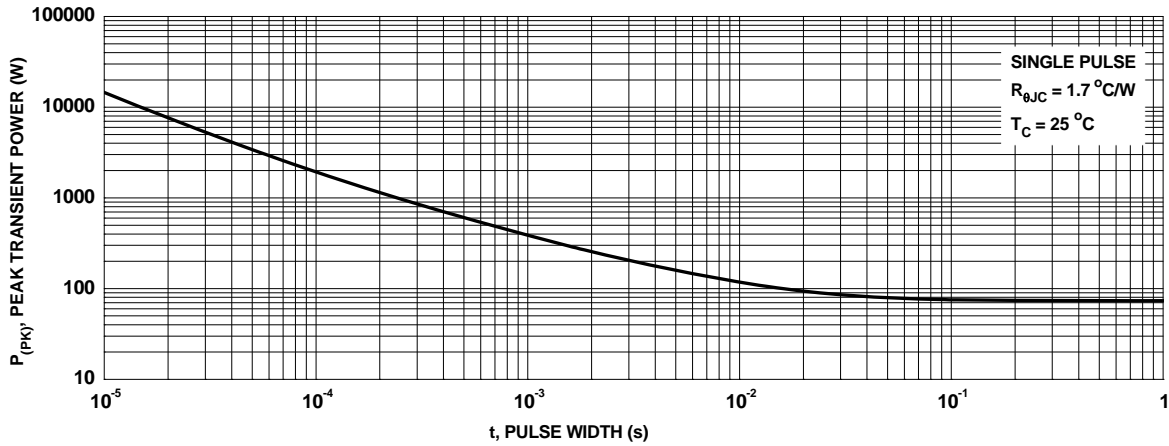


**Figure 11.  $I_{gss}$  vs  $V_{gss}$**

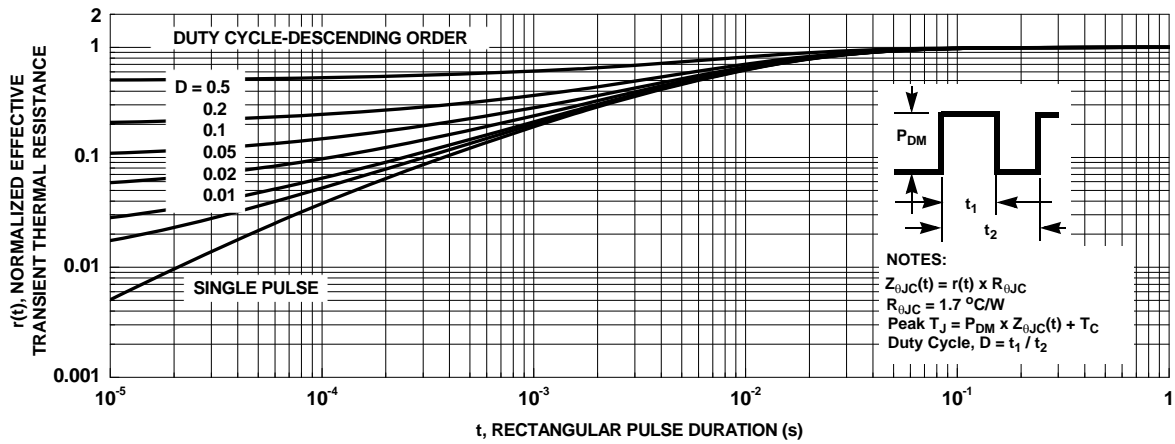


**Figure 12. Forward Bias Safe Operating Area**

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

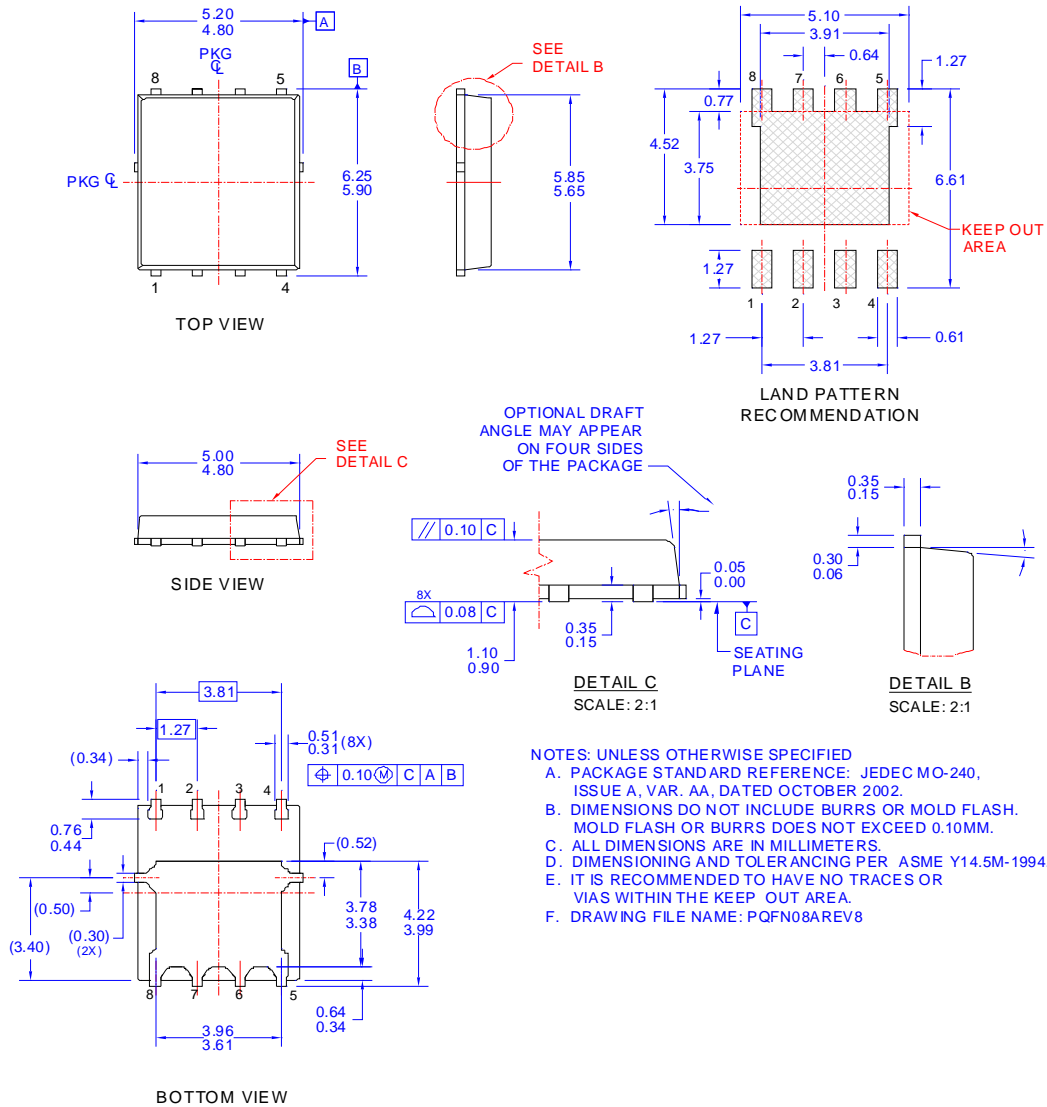


**Figure 13. Single Pulse Maximum Power Dissipation**



**Figure 14. Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout



- NOTES: UNLESS OTHERWISE SPECIFIED
- PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. AA, DATED OCTOBER 2002.
  - DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
  - ALL DIMENSIONS ARE IN MILLIMETERS.
  - DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
  - IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.
  - DRAWING FILE NAME: PQFN08AREV8

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