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January 2015

# FDMS86350ET80

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

80 V, 198 A, 2.4 mΩ

### Features

- Extended  $T_J$  rating to 175°C
- Max  $r_{DS(on)}$  = 2.4 mΩ at  $V_{GS} = 10$  V,  $I_D = 25$  A
- Max  $r_{DS(on)}$  = 3.2 mΩ at  $V_{GS} = 8$  V,  $I_D = 22$  A
- Advanced Package and Silicon combination for low  $r_{DS(on)}$  and high efficiency
- MSL1 robust package design
- 100% UIL tested
- RoHS Compliant

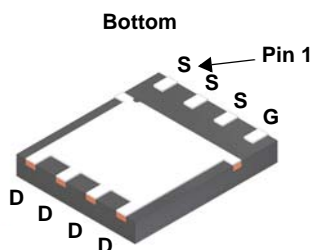
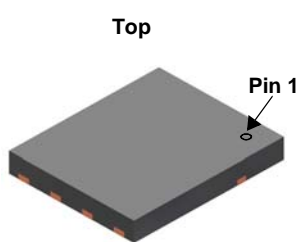


### General Description

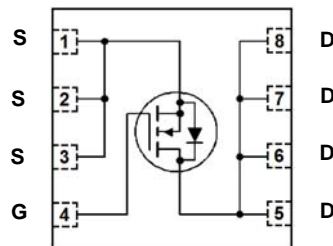
This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced Power Trench<sup>®</sup> process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

### Applications

- Primary MOSFET
- Synchronous Rectifier
- Load Switch
- Motor Control Switch



Power 56



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	80	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current -Continuous $T_C = 25^\circ\text{C}$ (Note 5)	198	A
	-Continuous $T_C = 100^\circ\text{C}$ (Note 5)	140	
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	25	
	-Pulsed (Note 4)	693	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	864	mJ
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	187	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	3.3	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +175	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.8	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	45	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS86350ET	FDMS86350ET80	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	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	80			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^{\circ}\text{C}$		45		mV/ $^{\circ}\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 64\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	2.5	3.8	4.5	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 $25\text{ }^{\circ}\text{C}$		-12		mV/ $^{\circ}\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 25\text{ A}$		2.0	2.4	m $\Omega$
		$V_{GS} = 8\text{ V}$ , $I_D = 22\text{ A}$		2.5	3.2	
		$V_{GS} = 10\text{ V}$ , $I_D = 25\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$		3.1	3.8	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}$ , $I_D = 25\text{ A}$		70		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 40\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		8030		pF
$C_{oss}$	Output Capacitance			1370		pF
$C_{rss}$	Reverse Transfer Capacitance			31		pF
$R_g$	Gate Resistance		0.1	1.1	3	$\Omega$

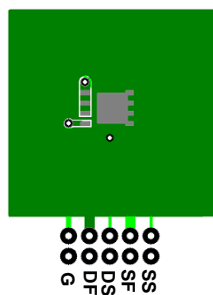
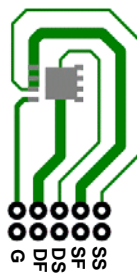
**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 40\text{ V}$ , $I_D = 25\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		50	80	ns
$t_r$	Rise Time			34	55	ns
$t_{d(off)}$	Turn-Off Delay Time			40	65	ns
$t_f$	Fall Time			11	20	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to } 10\text{ V}$	$V_{DD} = 40\text{ V}$ , $I_D = 25\text{ A}$	110	155	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to } 8\text{ V}$		90	127	nC
$Q_{gs}$	Gate to Source Charge			46		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			23		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)		0.71	1.2	V
		$V_{GS} = 0\text{ V}$ , $I_S = 25\text{ A}$ (Note 2)		0.79	1.3	
$t_{rr}$	Reverse Recovery Time	$I_F = 25\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		63	101	ns
$Q_{rr}$	Reverse Recovery Charge			62	100	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.  $R_{\theta CA}$  is determined by the user's board design.a. 45  $^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.b. 115  $^{\circ}\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.3.  $E_{AS}$  of 864 mJ is based on starting  $T_J = 25\text{ }^{\circ}\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 24\text{ A}$ ,  $V_{DD} = 80\text{ V}$ ,  $V_{GS} = 10\text{ V}$ , 100% test at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 74\text{ A}$ .4. Pulse  $I_d$  please refer to Fig.11 SOA curve for more details.

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

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

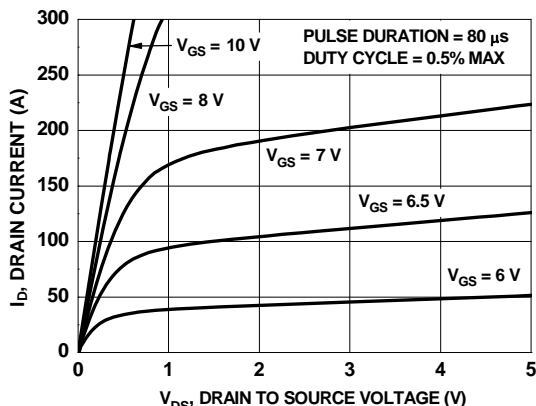


Figure 1. On-Region Characteristics

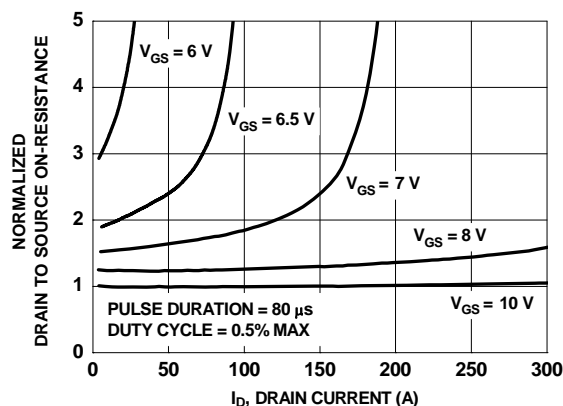


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

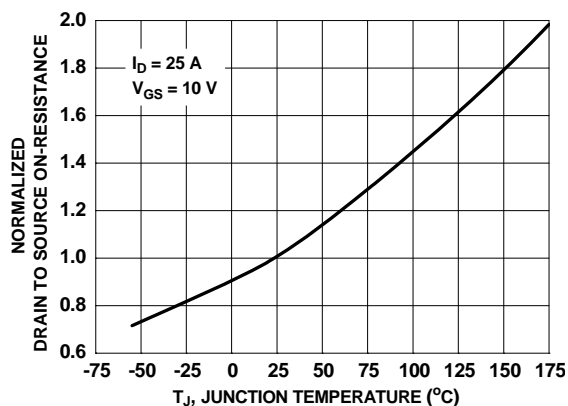


Figure 3. Normalized On-Resistance vs Junction Temperature

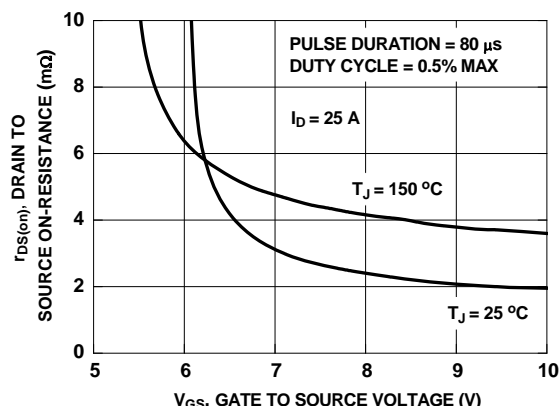


Figure 4. On-Resistance vs Gate to Source Voltage

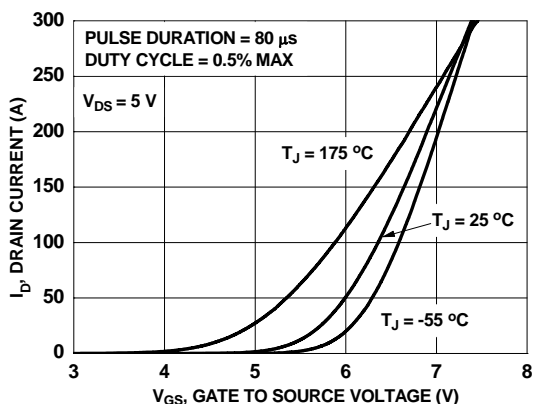


Figure 5. Transfer Characteristics

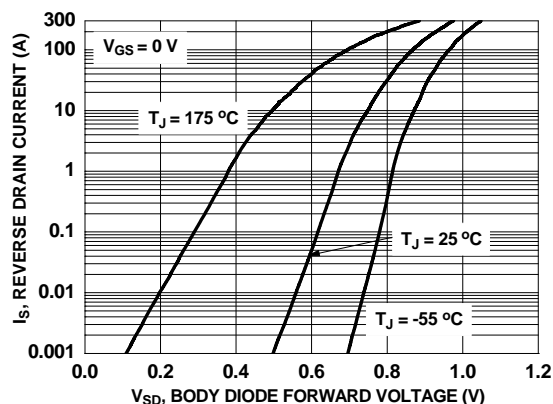


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

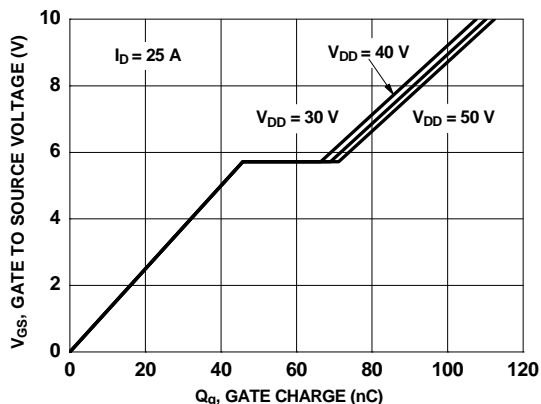


Figure 7. Gate Charge Characteristics

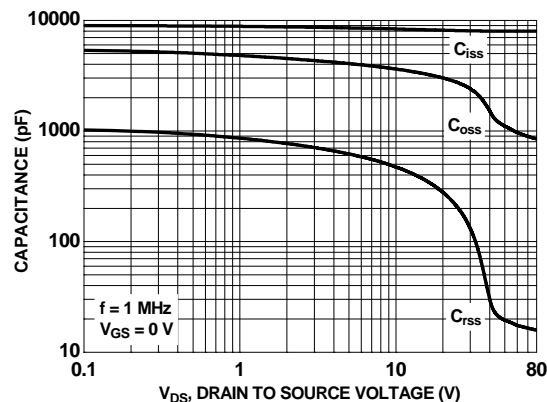


Figure 8. Capacitance vs Drain to Source Voltage

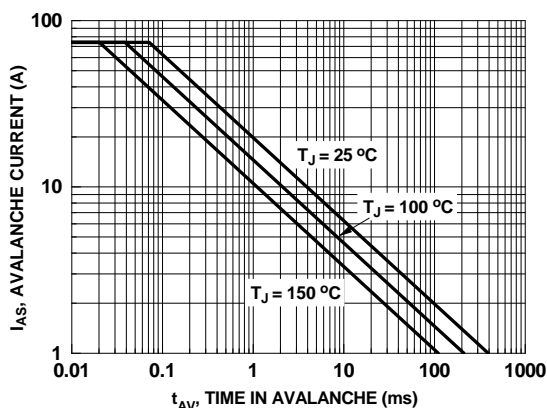


Figure 9. Unclamped Inductive Switching Capability

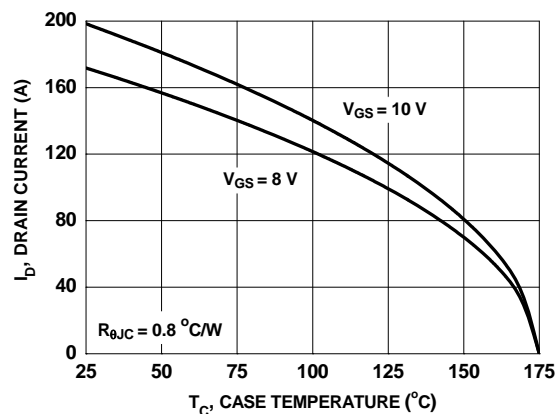


Figure 10. Maximum Continuous Drain Current vs Case Temperature

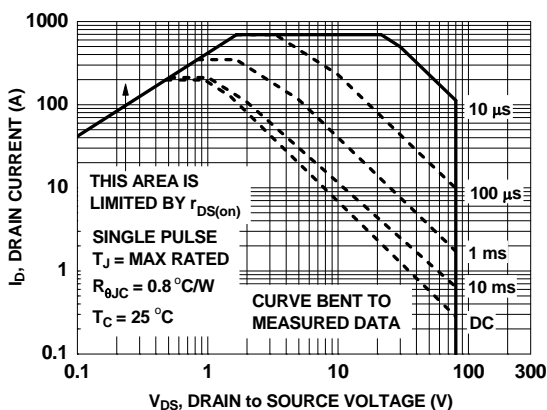


Figure 11. Forward Bias Safe Operating Area

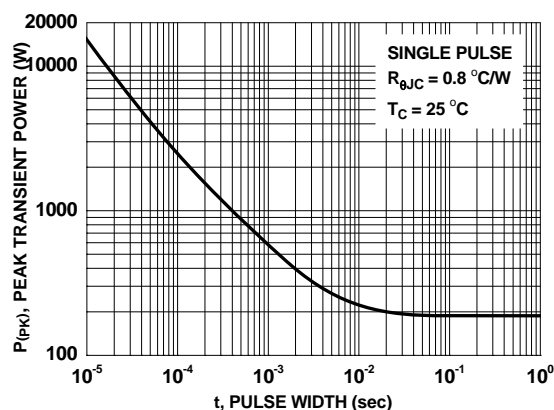
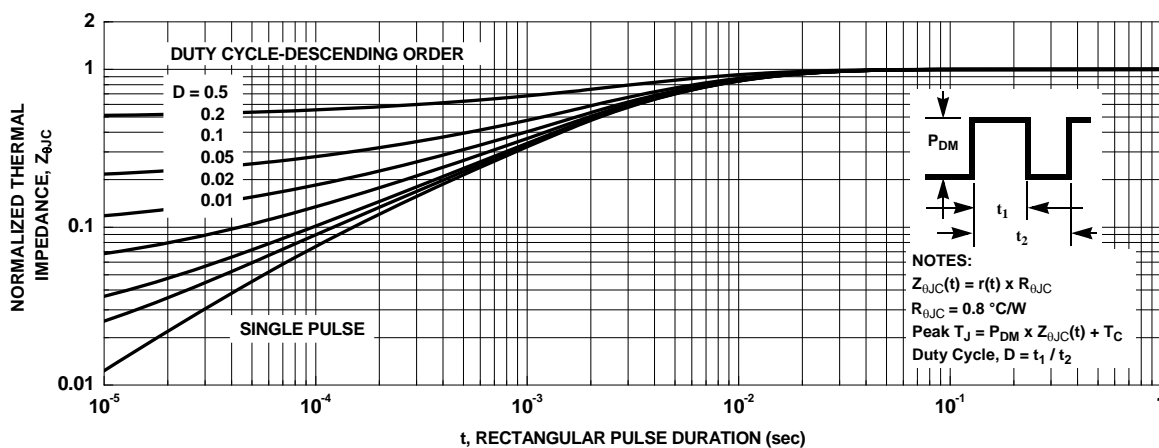
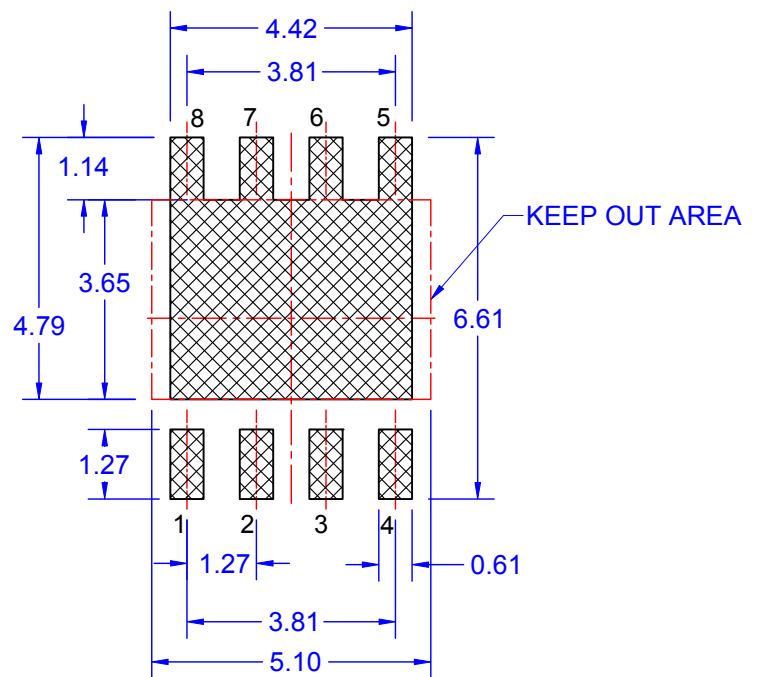
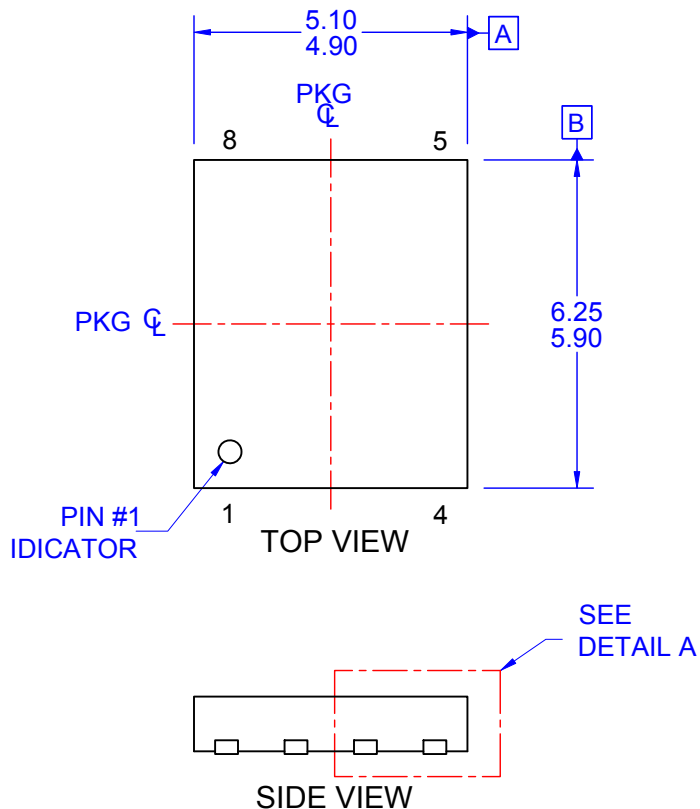


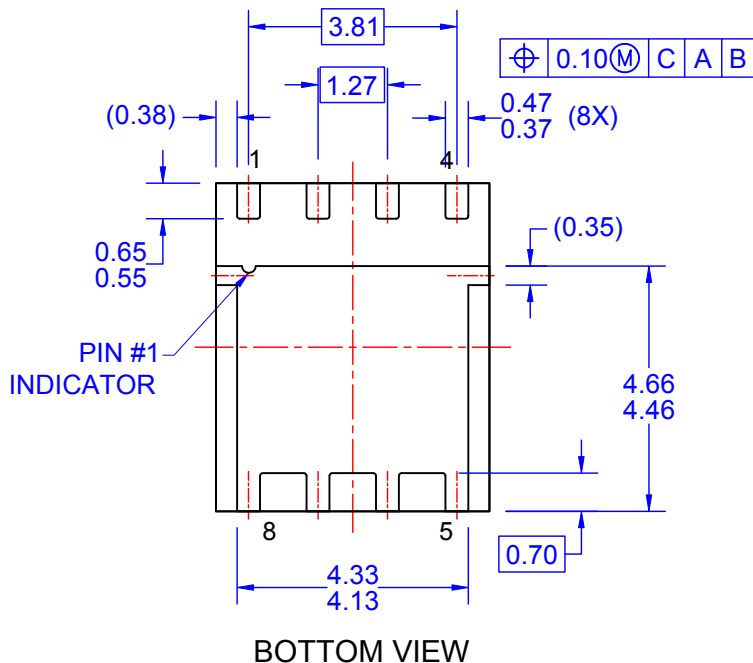
Figure 12. Single Pulse Maximum Power Dissipation

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

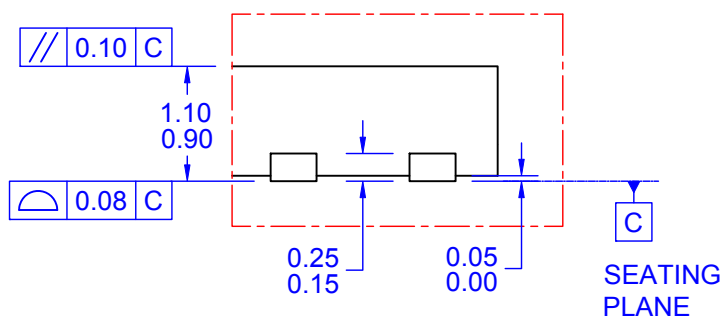




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DETAIL A

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