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# FDMT80040DC

## N-Channel Dual Cool™ 88 PowerTrench® MOSFET

40 V, 420 A, 0.56 mΩ

### Features

- Max  $r_{DS(on)}$  = 0.56 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 64\text{ A}$
- Max  $r_{DS(on)}$  = 0.9 mΩ at  $V_{GS} = 6\text{ V}$ ,  $I_D = 47\text{ A}$
- Advanced Package and Silicon Combination for Low  $r_{DS(on)}$  and High Efficiency
- Next Generation Enhanced Body Diode Technology, Engineered for Soft Recovery
- Low Profile 8x8mm MLP Package
- MSL1 Robust Package Design
- 100% UIL Tested
- RoHS Compliant

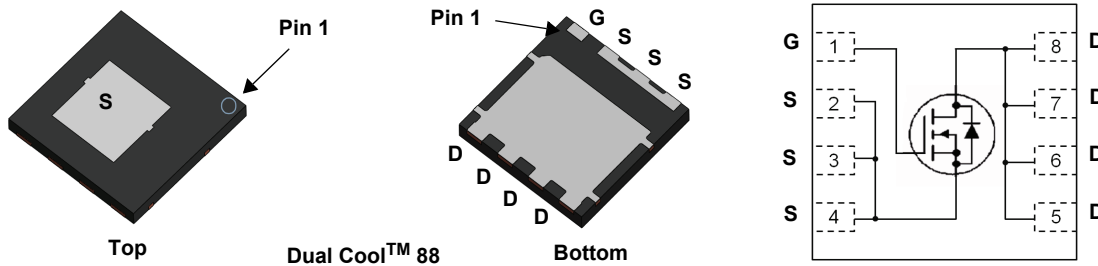


### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process. Advancements in both silicon and Dual Cool™ package technologies have been combined to offer the lowest  $r_{DS(on)}$  while maintaining excellent switching performance by extremely low Junction-to-Ambient thermal resistance.

### Applications

- OringFET / Load Switching
- Synchronous Rectification
- DC-DC Conversion



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

Symbol	Parameter	Rated	Units
$V_{DS}$	Drain to Source Voltage	40	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current -Continuous $T_C = 25\text{ °C}$ (Note 5)	420	A
	-Continuous $T_C = 100\text{ °C}$ (Note 5)	265	
	-Continuous $T_A = 25\text{ °C}$ (Note 1a)	64	
	-Pulsed (Note 4)	2644	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	2773	mJ
$P_D$	Power Dissipation $T_C = 25\text{ °C}$	156	W
	Power Dissipation $T_A = 25\text{ °C}$ (Note 1a)	3.2	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

Symbol	Parameter	Rated	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Top Source)	1.6	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Bottom Drain)	0.8	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	38	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1b)	81	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1i)	15	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1j)	21	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1k)	9	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
80040DC	FDMT80040DC	Dual Cool™ 88	13"	13.3 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	$I_D = 250\ \mu\text{A}, V_{GS} = 0\ \text{V}$	40			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		21		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 32\ \text{V}, V_{GS} = 0\ \text{V}$			10	$\mu\text{A}$
$I_{GSS}$	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	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	2.0	2.7	4.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-9		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}, I_D = 64\ \text{A}$		0.44	0.56	m $\Omega$
		$V_{GS} = 6\ \text{V}, I_D = 47\ \text{A}$		0.63	0.9	
		$V_{GS} = 10\ \text{V}, I_D = 64\ \text{A}, T_J = 125\text{ }^\circ\text{C}$		0.66	0.84	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\ \text{V}, I_D = 64\ \text{A}$		278		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 20\ \text{V}, V_{GS} = 0\ \text{V},$ $f = 1\ \text{MHz}$		18650	26110	pF
$C_{oss}$	Output Capacitance			5540	7760	pF
$C_{rss}$	Reverse Transfer Capacitance			304	1210	pF
$R_g$	Gate Resistance		0.1	1.8	3.6	$\Omega$

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 20\ \text{V}, I_D = 64\ \text{A},$ $V_{GS} = 10\ \text{V}, R_{GEN} = 6\ \Omega$		63	101	ns	
$t_r$	Rise Time			62	100	ns	
$t_{d(off)}$	Turn-Off Delay Time			101	162	ns	
$t_f$	Fall Time			43	69	ns	
$Q_{g(TOT)}$	Total Gate Charge		$V_{GS} = 0\ \text{V to } 10\ \text{V}$		241	338	nC
$Q_{g(TOT)}$	Total Gate Charge		$V_{GS} = 0\ \text{V to } 6\ \text{V}$	$V_{DD} = 20\ \text{V},$ $I_D = 64\ \text{A}$	149	209	nC
$Q_{gs}$	Gate to Source Charge			76		nC	
$Q_{gd}$	Gate to Drain "Miller" Charge			35		nC	

**Drain-Source Diode Characteristics**

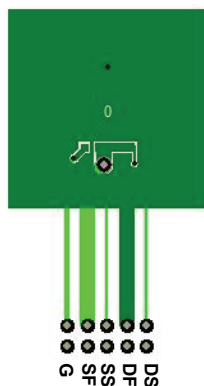
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}, I_S = 2.6\ \text{A}$ (Note 2)		0.67	1.1	V
		$V_{GS} = 0\ \text{V}, I_S = 64\ \text{A}$ (Note 2)		0.77	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 64\ \text{A}, di/dt = 100\ \text{A}/\mu\text{s}$		94	151	ns
$Q_{rr}$	Reverse Recovery Charge			219	351	nC

## Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Top Source)	1.6	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Bottom Drain)	0.8	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	38	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1b)	81	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1c)	26	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1d)	34	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1e)	14	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1f)	16	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1g)	26	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1h)	60	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1i)	15	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1j)	21	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1k)	9	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1l)	11	

### NOTES:

1.  $R_{\theta JA}$  is determined with the device mounted on a FR-4 board using a specified pad of 2 oz copper as shown below.  $R_{\theta CA}$  is determined by the user's board design.



a. 38  $^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 81  $^{\circ}\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

- c. Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
  - d. Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
  - e. Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
  - f. Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
  - g. 200FPM Airflow, No Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
  - h. 200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper
  - i. 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
  - j. 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
  - k. 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
  - l. 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.
  3.  $E_{AS}$  of 2773mJ is based on starting  $T_J = 25^{\circ}\text{C}$ ; N-ch: L = 3 mH,  $I_{AS} = 43\text{ A}$ ,  $V_{DD} = 40\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at L = 0.3 mH,  $I_{AS} = 93\text{ A}$ .
  4. Pulsed Id please refer to Fig 11 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**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted.

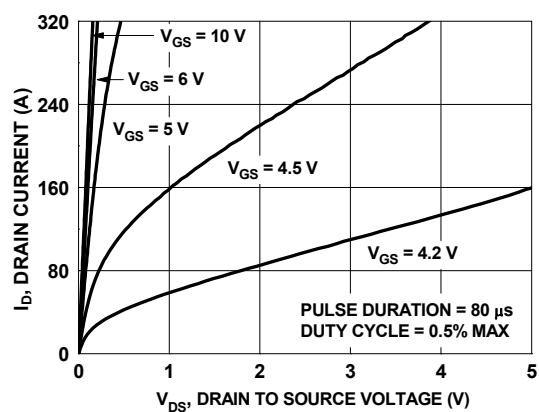


Figure 1. On Region Characteristics

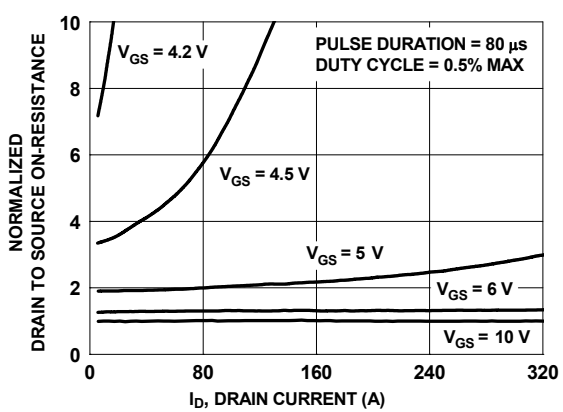


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

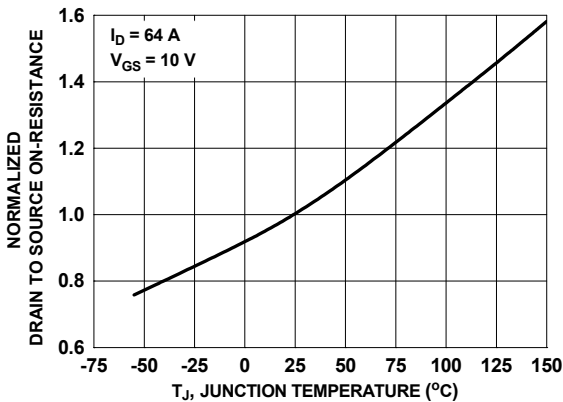


Figure 3. Normalized On Resistance vs. Junction Temperature

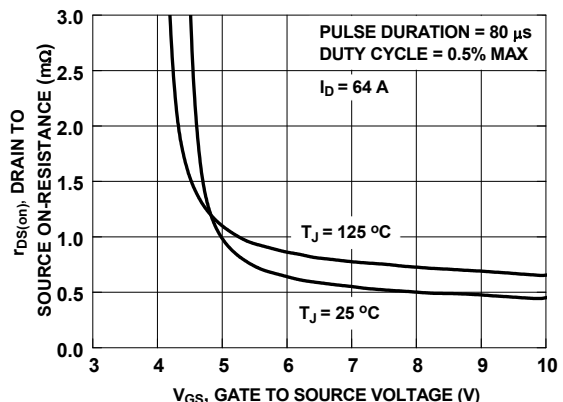


Figure 4. On-Resistance vs. Gate to Source Voltage

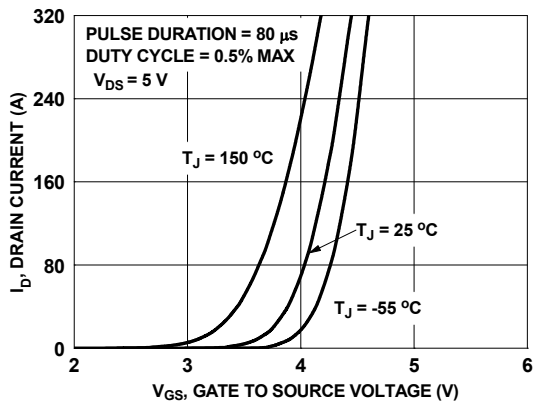


Figure 5. Transfer Characteristics

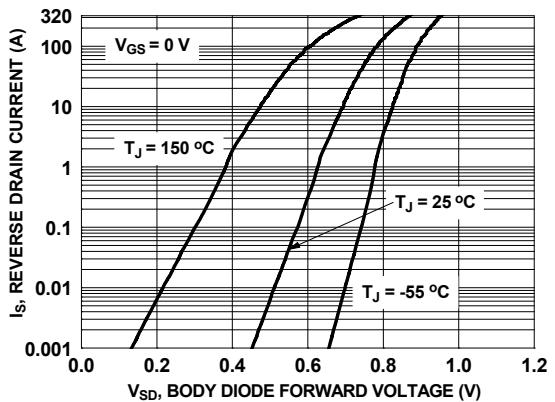
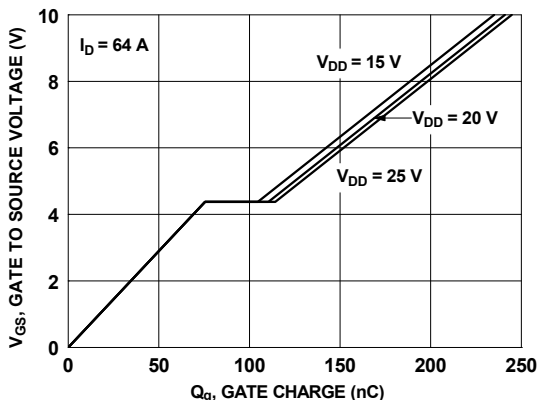
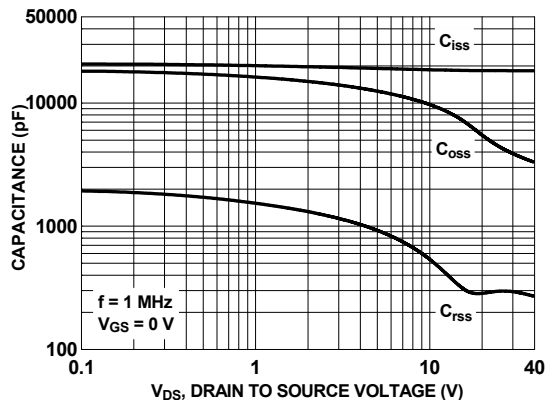


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

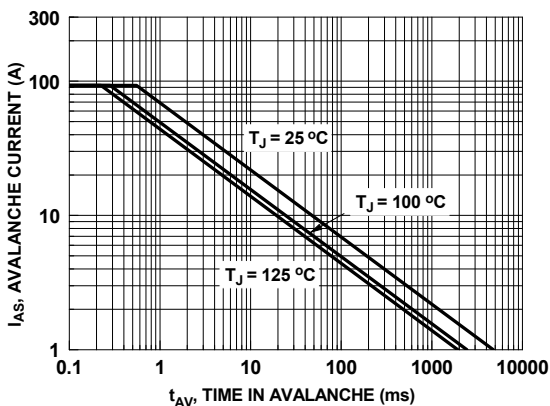
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted.



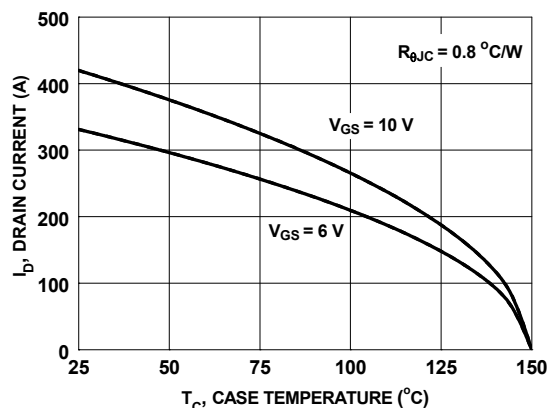
**Figure 7. Gate Charge Characteristics**



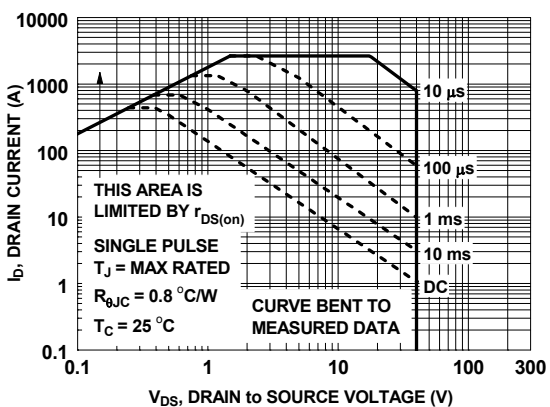
**Figure 8. Capacitance vs Drain to Source Voltage**



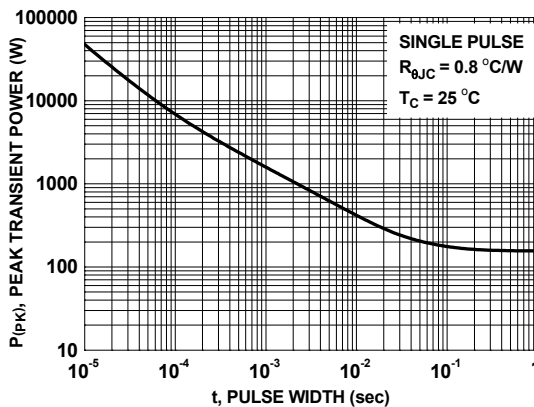
**Figure 9. Unclamped Inductive Switching Capability**



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

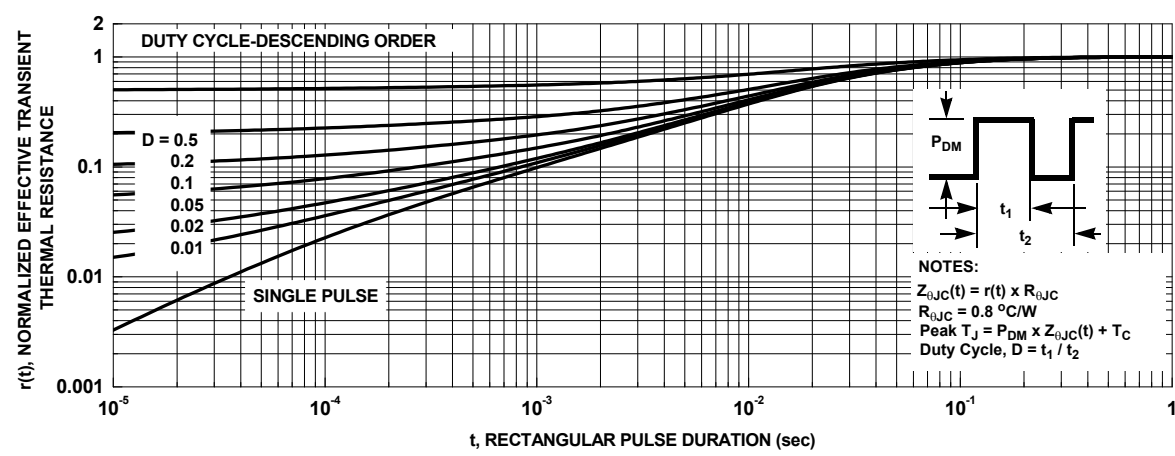


**Figure 11. Forward Bias Safe Operating Area**

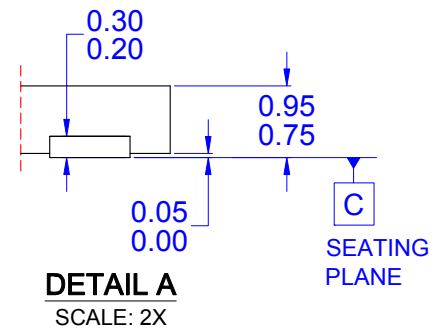
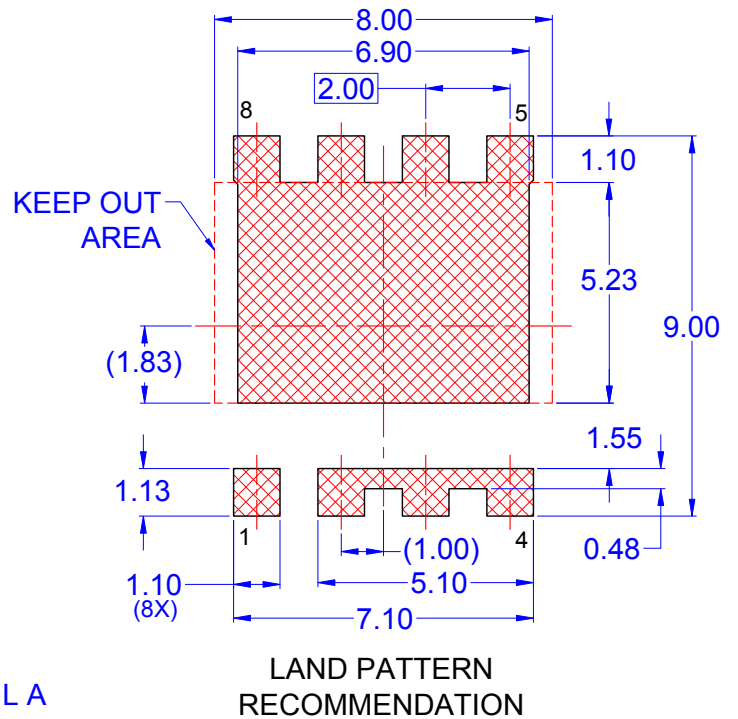
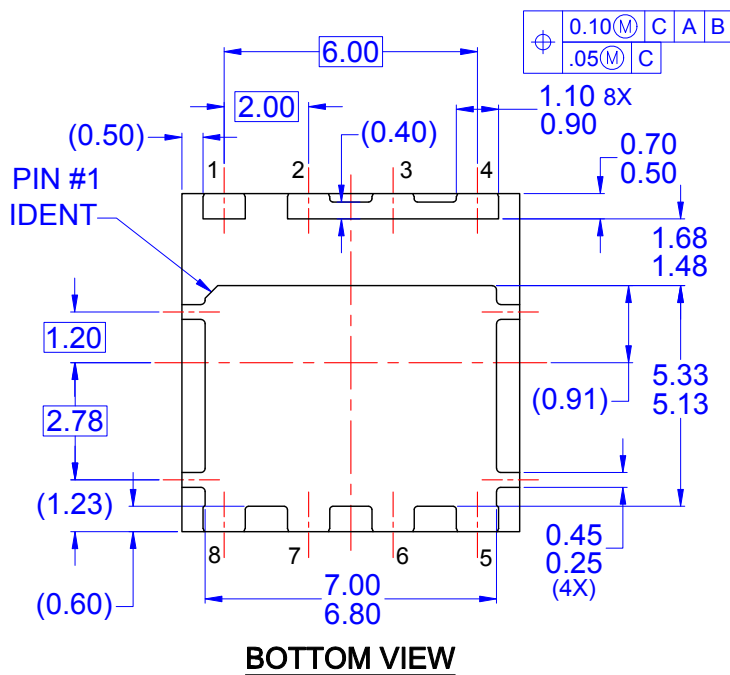
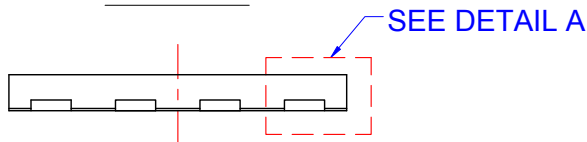
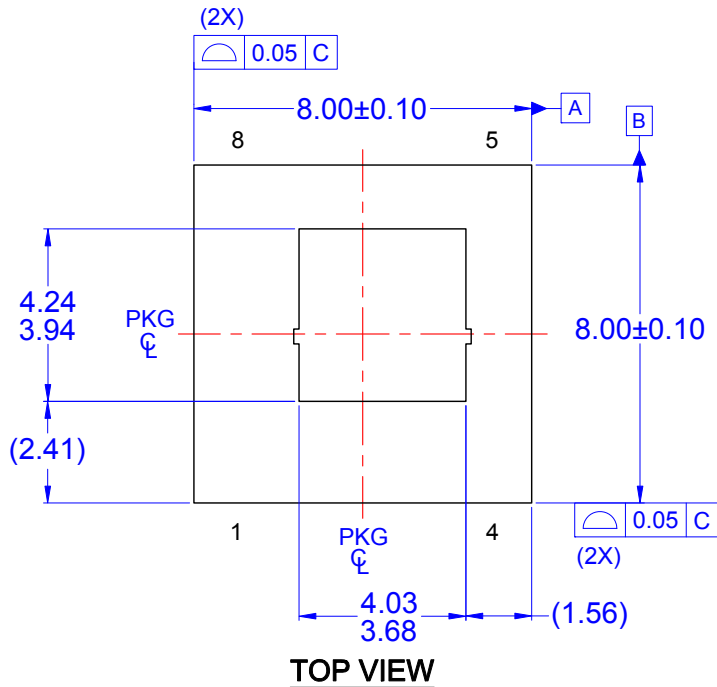


**Figure 12. Single Pulse Maximum Power Dissipation**

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



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



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