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# FDMC7660DC

## N-Channel Dual Cool™ 33 PowerTrench® MOSFET 30 V, 40 A, 2.2 mΩ

### Features

- Dual Cool™ Top Side Cooling PQFN package
- Max  $r_{DS(on)}$  = 2.2 mΩ at  $V_{GS} = 10$  V,  $I_D = 22$  A
- Max  $r_{DS(on)}$  = 3.3 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 18$  A
- High performance technology for extremely low  $r_{DS(on)}$
- SyncFET Schottky Body Diode
- RoHS Compliant

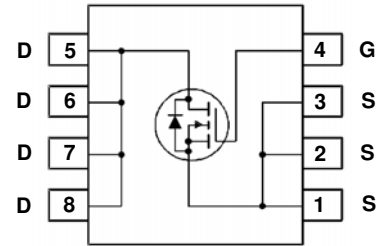
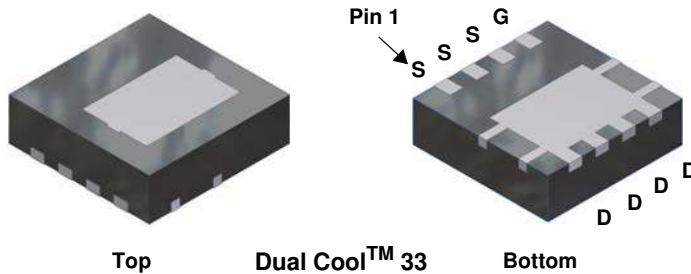


### General Description

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

- Synchronous Rectifier for DC/DC Converters
- Telecom Secondary Side Rectification
- High End Server/Workstation



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	30	V
$V_{GS}$	Gate to Source Voltage (Note 4)	$\pm 20$	V
$I_D$	Drain Current -Continuous (Package limited) $T_C = 25^\circ\text{C}$	40	A
	-Continuous (Silicon limited) $T_C = 25^\circ\text{C}$	150	
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	30	
	-Pulsed	200	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	220	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 5)	1.0	V/ns
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	78	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	3.0	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to + 150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case (Top Source)	4.3	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Bottom Drain)	1.6	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	42	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	105	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1i)	17	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1j)	26	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1k)	12	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
7660	FDMC7660DC	Dual Cool™ 33	13"	12 mm	3000 units

**Electrical Characteristics**  $T_J = 25^\circ\text{C}$  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 $25^\circ\text{C}$		15		mV/°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, Forward	$V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$			100	nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	1.2	2	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$		-7		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 22 \text{ A}$		1.6	2.2	m $\Omega$
		$V_{GS} = 4.5 \text{ V}, I_D = 18 \text{ A}$		2.5	3.3	
		$V_{GS} = 10 \text{ V}, I_D = 22 \text{ A}, T_J = 125^\circ\text{C}$		2.2	3.3	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5 \text{ V}, I_D = 22 \text{ A}$		147		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1\text{MHz}$		3885	5170	pF
$C_{oss}$	Output Capacitance			1215	1620	pF
$C_{rss}$	Reverse Transfer Capacitance			100	150	pF
$R_g$	Gate Resistance			0.7	1.5	$\Omega$

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15 \text{ V}, I_D = 22 \text{ A},$ $V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$		17	31	ns	
$t_r$	Rise Time			6.6	13	ns	
$t_{d(off)}$	Turn-Off Delay Time			36	58	ns	
$t_f$	Fall Time			5	10	ns	
$Q_g$	Total Gate Charge		$V_{GS} = 0 \text{ V to } 10 \text{ V}$		54	76	nC
$Q_g$	Total Gate Charge		$V_{GS} = 0 \text{ V to } 4.5 \text{ V}$		24	34	nC
$Q_{gs}$	Gate to Source Charge	$V_{DD} = 15 \text{ V},$ $I_D = 22 \text{ A}$		13		nC	
$Q_{gd}$	Gate to Drain "Miller" Charge			5.5		nC	

**Drain-Source Diode Characteristics**

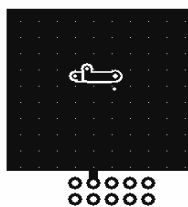
$V_{SD}$	Source-Drain Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_S = 22 \text{ A}$ (Note 2)		0.8	1.2	V
		$V_{GS} = 0 \text{ V}, I_S = 1.9 \text{ A}$ (Note 2)		0.7	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 22 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$		43	69	ns
$Q_{rr}$	Reverse Recovery Charge			24	38	nC

## Thermal Characteristics

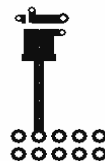
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Top Source)	4.3	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Bottom Drain)	1.6	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	42	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	105	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1c)	29	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1d)	40	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1e)	19	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1f)	23	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1g)	30	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1h)	79	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1i)	17	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1j)	26	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1k)	12	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1l)	16	

### 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.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a. 42  $^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 105  $^{\circ}\text{C}/\text{W}$  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

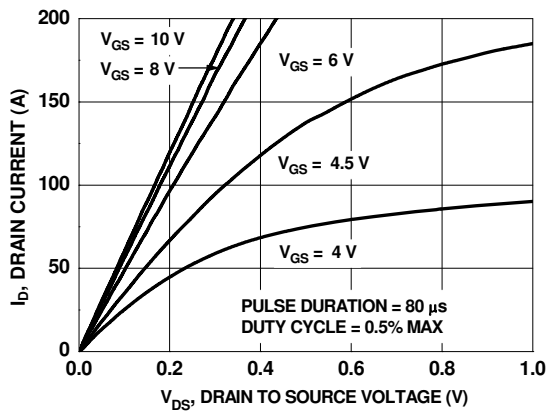
2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.

3.  $E_{AS}$  of 220 mJ is based on starting  $T_J = 25^{\circ}\text{C}$ ; N-ch:  $L = 1$  mH,  $I_{AS} = 21$  A,  $V_{DD} = 27$  V,  $V_{GS} = 10$  V. 100% test at  $L = 0.3$  mH,  $I_{AS} = 33.5$  A.

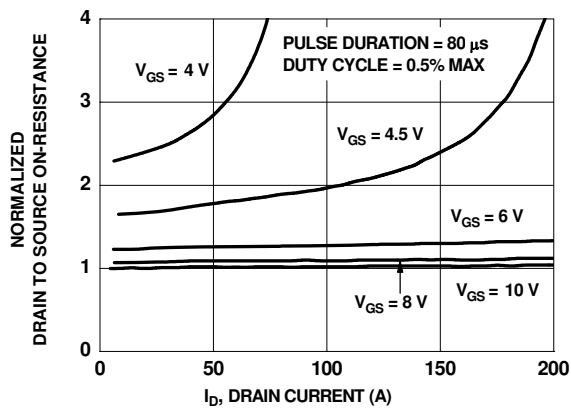
4. As an N-ch device, the negative  $V_{GS}$  rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

5.  $I_{SD} \leq 22$  A,  $di/dt \leq 100$  A/ $\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^{\circ}\text{C}$ .

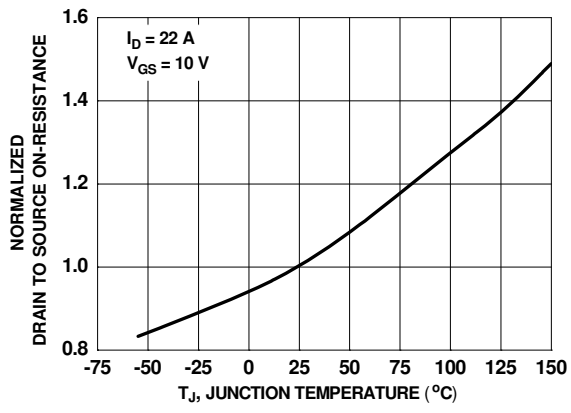
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



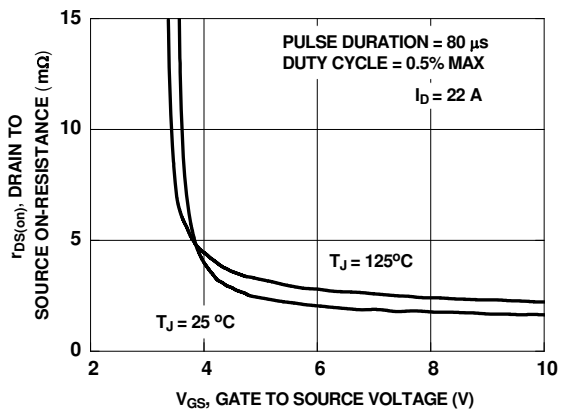
**Figure 1. On Region Characteristics**



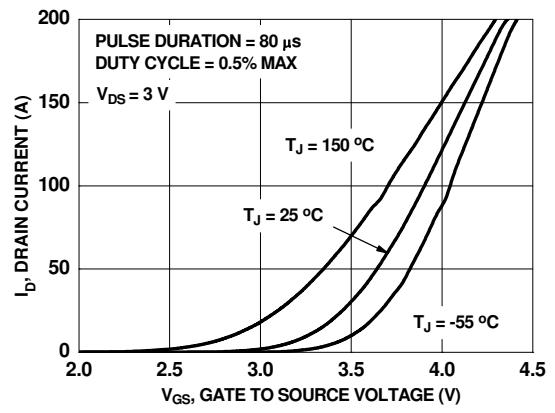
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



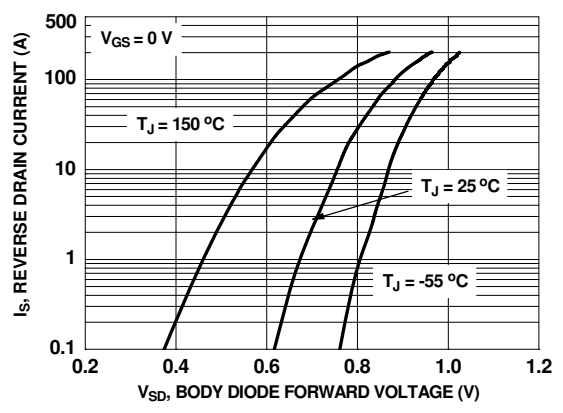
**Figure 3. Normalized On Resistance vs Junction Temperature**



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

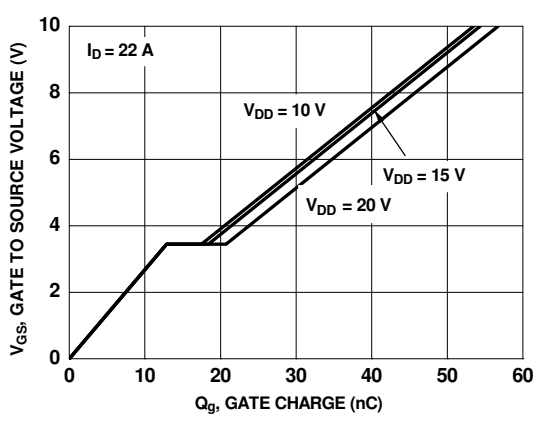


**Figure 5. Transfer Characteristics**

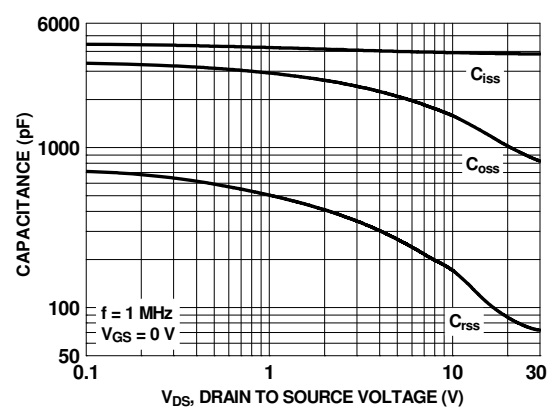


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

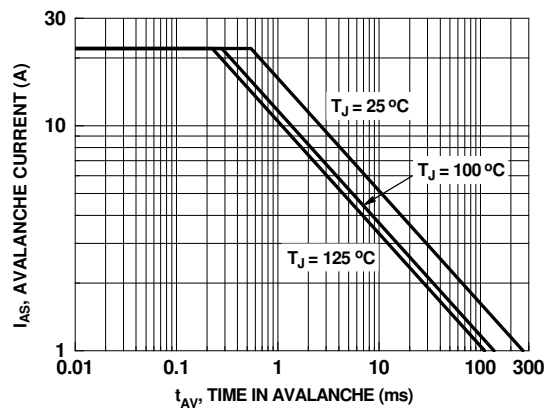
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



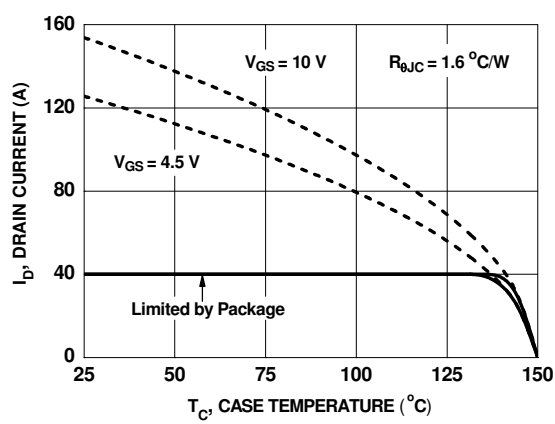
**Figure 7. Gate Charge Characteristics**



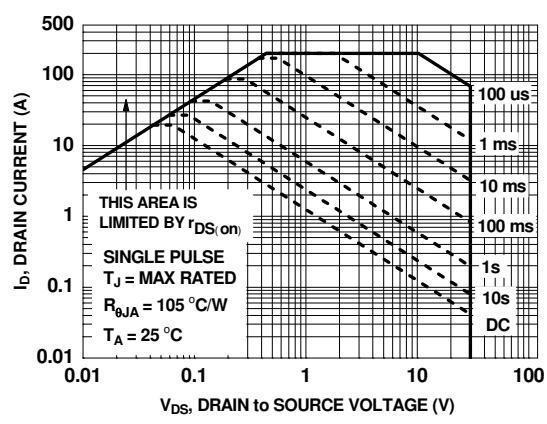
**Figure 8. Capacitance vs Drain to Source Voltage**



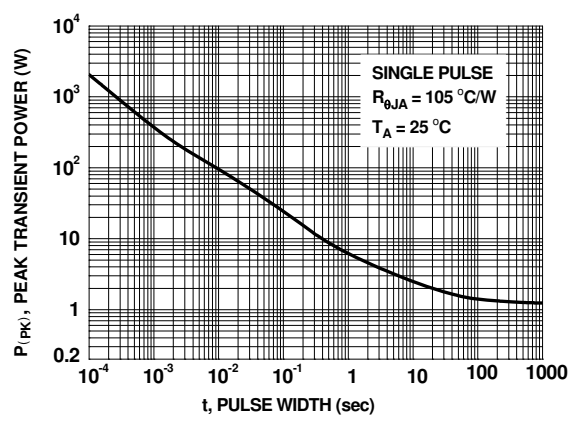
**Figure 9. Unclamped Inductive Switching Capability**



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

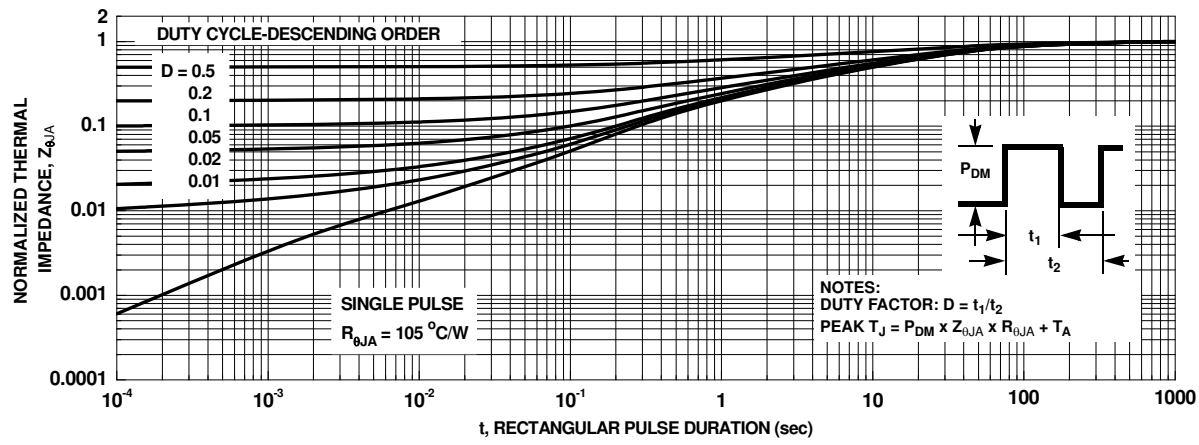


**Figure 11. Forward Bias Safe Operating Area**

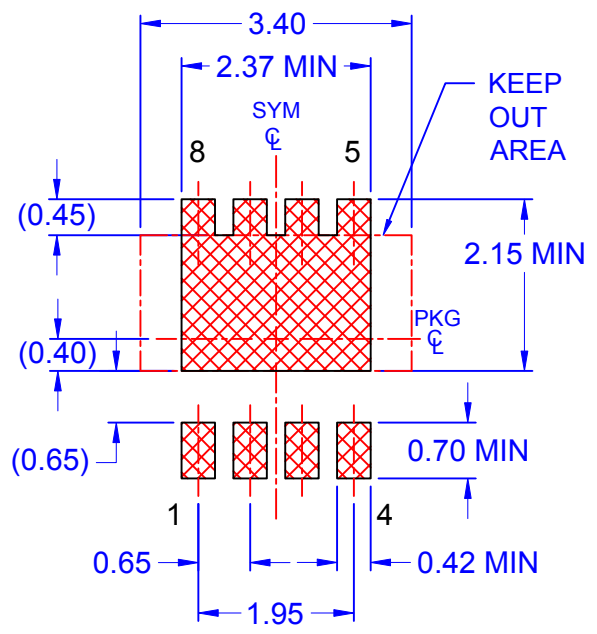
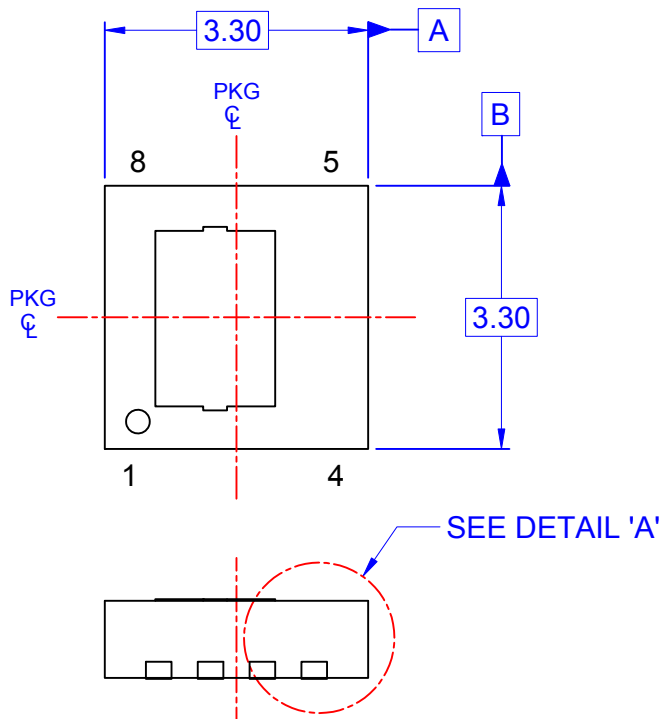


**Figure 12. Single Pulse Maximum Power Dissipation**

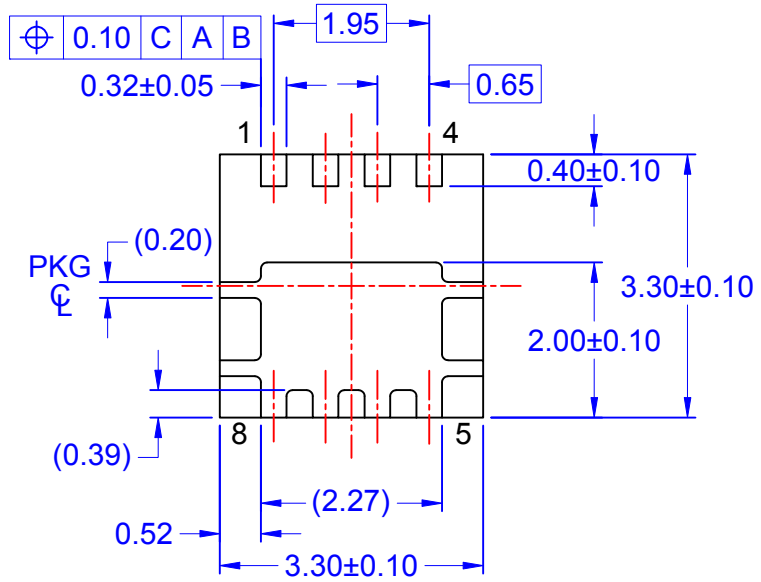
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



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

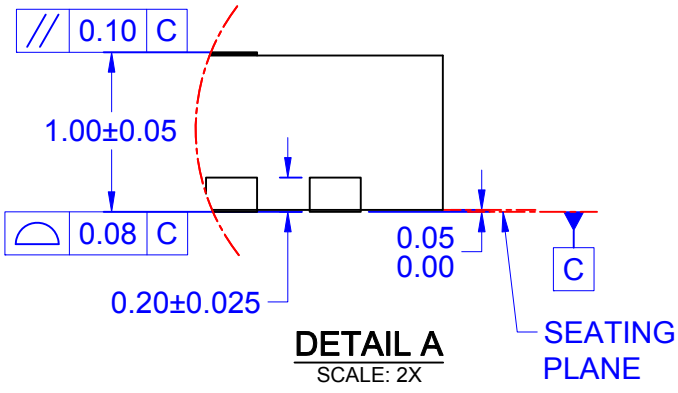


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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
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