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# FDMC5614P P-Channel PowerTrench<sup>®</sup> MOSFET

-60V, -13.5A, 100mΩ

## Features

- Max  $r_{DS(on)}$  = 100mΩ at  $V_{GS} = -10V$ ,  $I_D = -5.7A$
- Max  $r_{DS(on)}$  = 135mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -4.4A$
- Low gate charge
- Fast switching speed
- High performance trench technology for extremely low  $r_{DS(on)}$
- High power and current handling capability
- RoHS Compliant

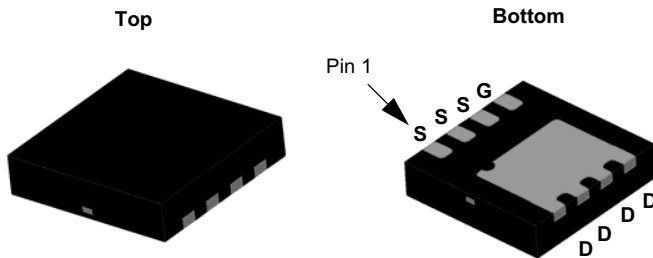


## General Description

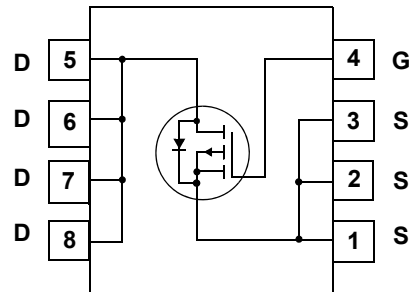
This P-Channel MOSFET is a rugged gate version of Fairchild Semiconductor's advanced PowerTrench<sup>®</sup> process. It has been optimized for power management applications requiring a wide range of gate drive voltage ratings (4.5V-20V).

## Application

- Power management
- Load switch
- Battery protection



MLP 3.3x3.3



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

Symbol	Parameter	Rated	Units
$V_{DS}$	Drain to Source Voltage	-60	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current -Continuous (Package limited) $T_C = 25^\circ\text{C}$	-13.5	A
	-Continuous (Silicon limited) $T_C = 25^\circ\text{C}$	-14	
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	-5.7	
	-Pulsed	-23	
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	42	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.1	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

## Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.0	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	60	

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
5614P	FDMC5614P	Power 33	7"	8mm	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	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-54		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -48\text{V}, V_{GS} = 0\text{V}$			-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	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	-1	-1.95	-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 $25^\circ\text{C}$		4.7		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -10\text{V}, I_D = -5.7\text{A}$		84	100	m $\Omega$
		$V_{GS} = -4.5\text{V}, I_D = -4.4\text{A}$		108	135	
		$V_{GS} = -10\text{V}, I_D = -5.7\text{A}, T_J = 125^\circ\text{C}$		140	168	
$g_{FS}$	Forward Transconductance	$V_{DS} = -15\text{V}, I_D = -5.7\text{A}$		11		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -30\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		795	1055	pF
$C_{oss}$	Output Capacitance			140	185	pF
$C_{rss}$	Reverse Transfer Capacitance			60	90	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -30\text{V}, I_D = -1\text{A}$ $V_{GS} = -10\text{V}, R_{GEN} = 6\Omega$		10	21	ns
$t_r$	Rise Time			11	23	ns
$t_{d(off)}$	Turn-Off Delay Time			32	65	ns
$t_f$	Fall Time			11	22	ns
$Q_{g(TOT)}$	Total Gate Charge at 10V		$V_{GS} = -10\text{V}$		15	20
$Q_{gs}$	Gate to Source Gate Charge	$V_{DD} = -30\text{V}$ $I_D = -5.7\text{A}$		1.6	2.1	nC
$Q_{gd}$	Gate to Drain "Miller" Charge			2.7	3.5	nC

### Drain-Source Diode Characteristics

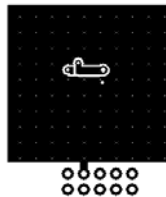
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = -3.2\text{A}$		-0.8	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -3.2\text{A}, di/dt = 100\text{A}/\mu\text{s}$			36	ns
$Q_{rr}$	Reverse Recovery Charge				29	nC

#### Notes:

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

(a)  $R_{\theta JA} = 60^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper, 1.5"x1.5"x0.062" thick PCB.

(b)  $R_{\theta JA} = 135^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.



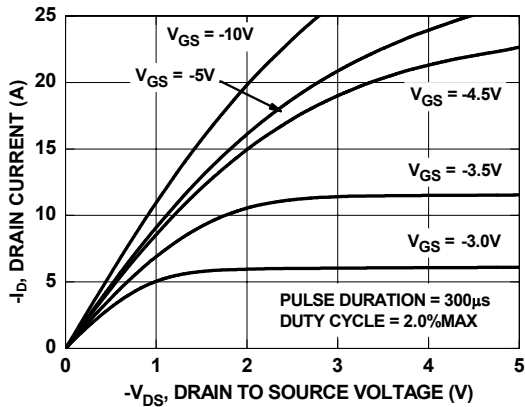
a.  $60^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



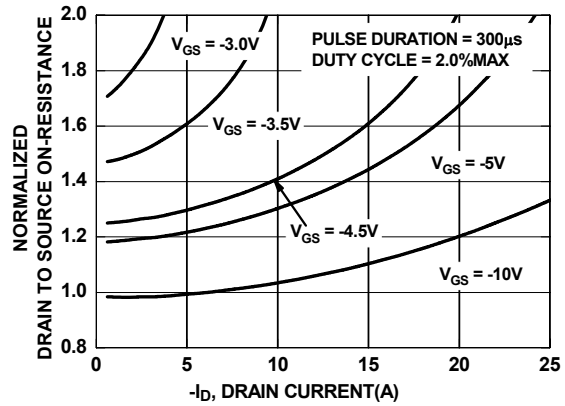
b.  $135^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

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

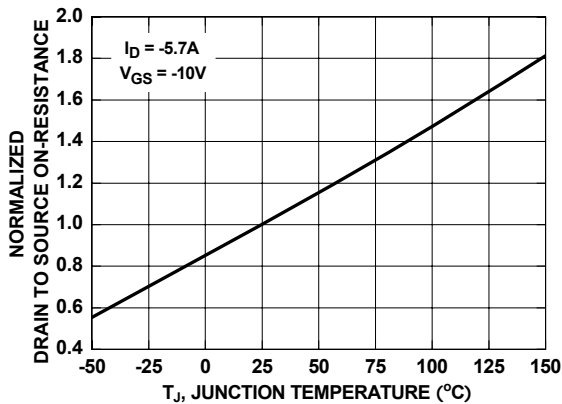
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



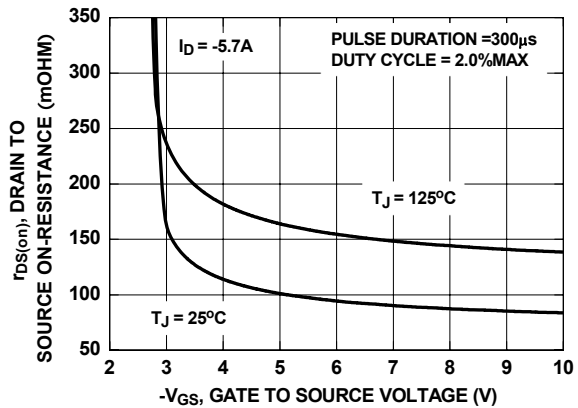
**Figure 1. On-Region Characteristics**



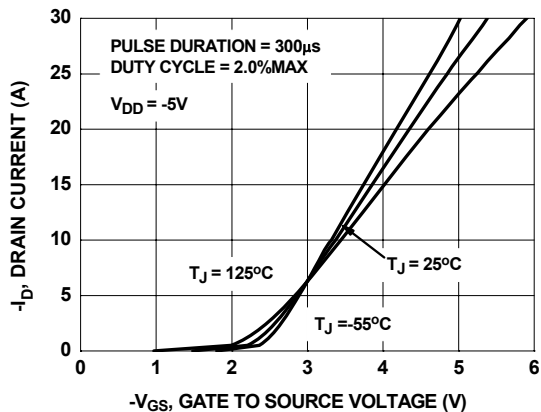
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



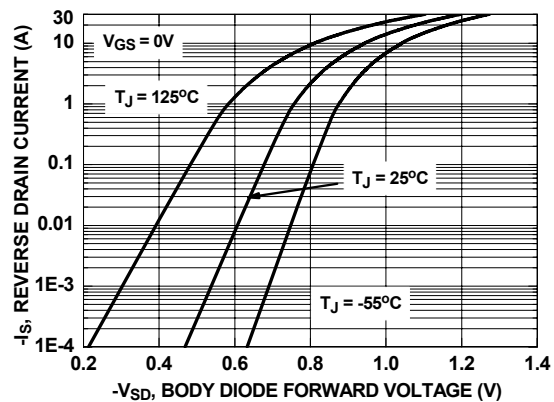
**Figure 3. Normalized On-Resistance vs Junction Temperature**



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

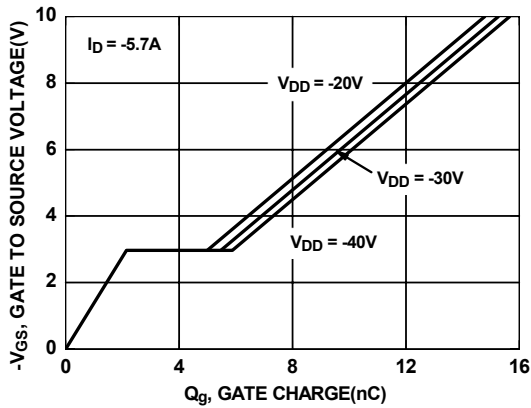


**Figure 5. Transfer Characteristics**

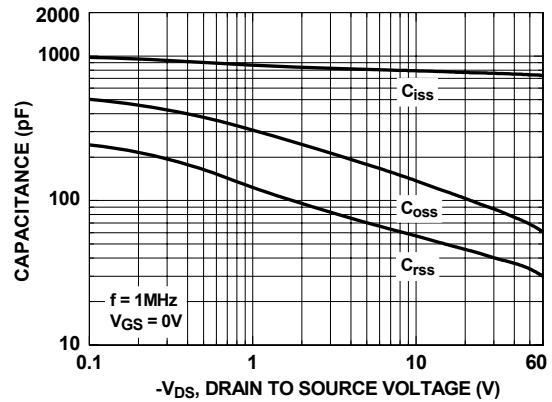


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

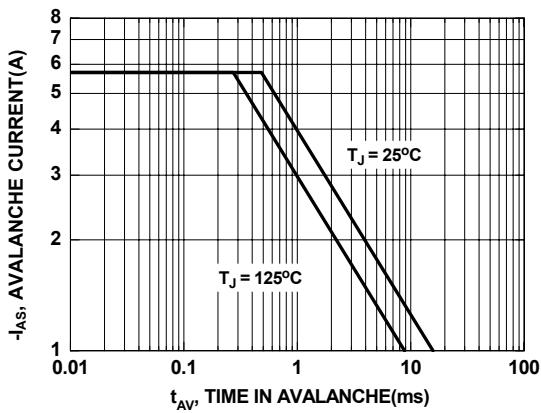
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



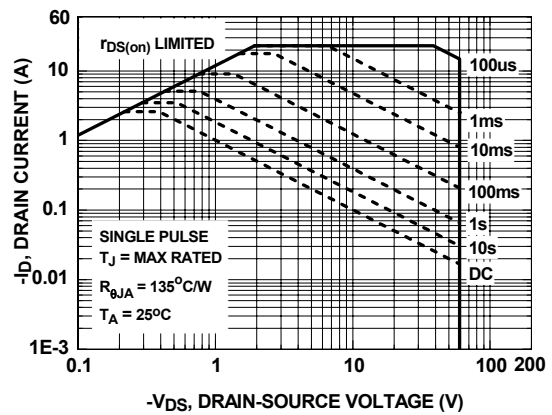
**Figure 7. Gate Charge Characteristics**



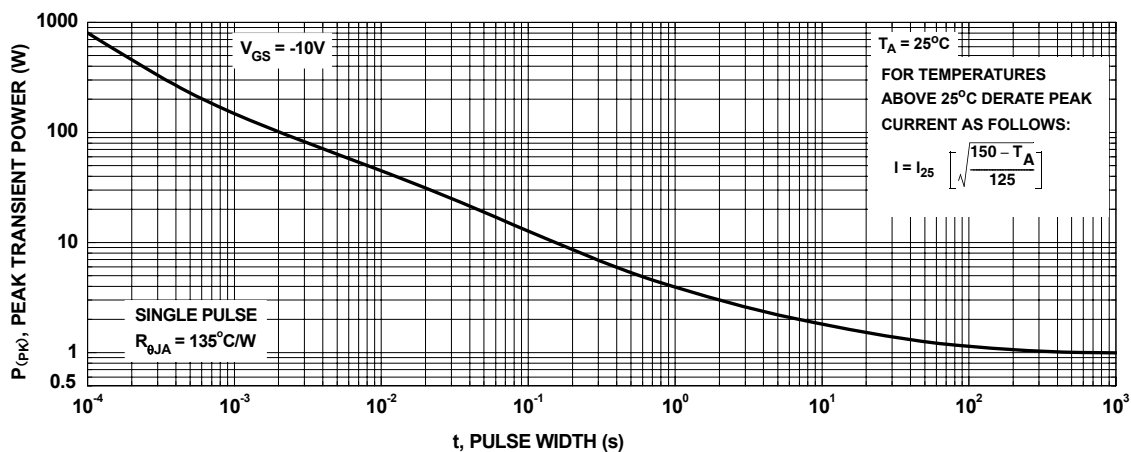
**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Unclamped Inductive Switching Capability**

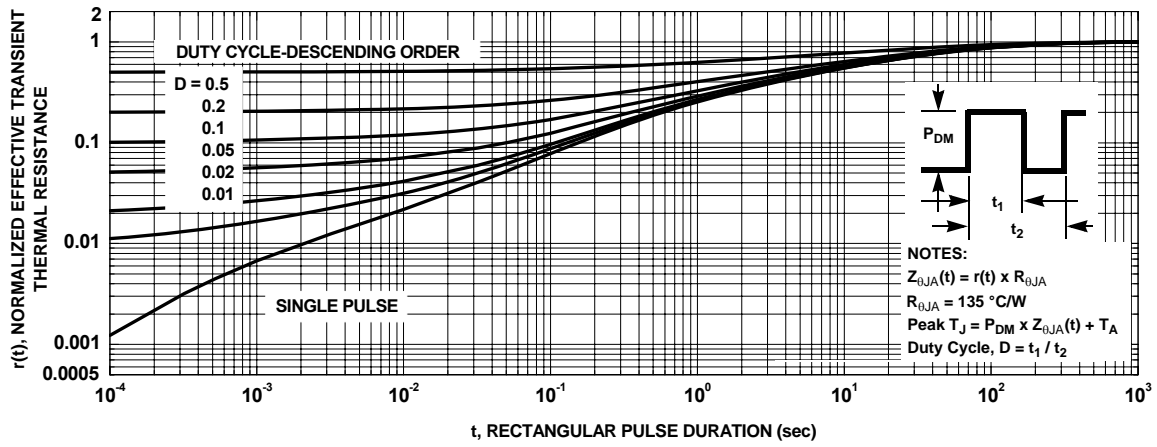


**Figure 10. Forward Bias Safe Operating Area**

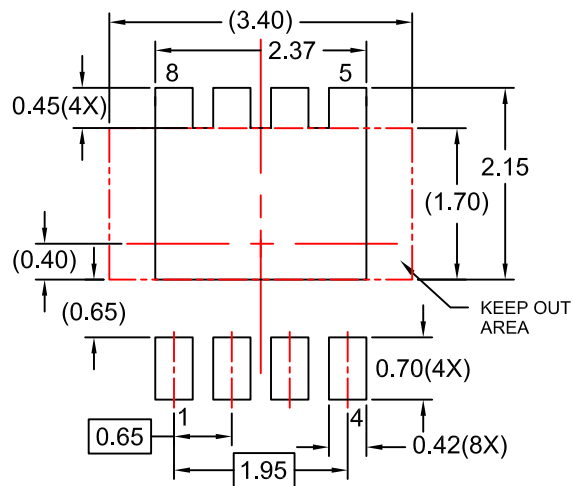
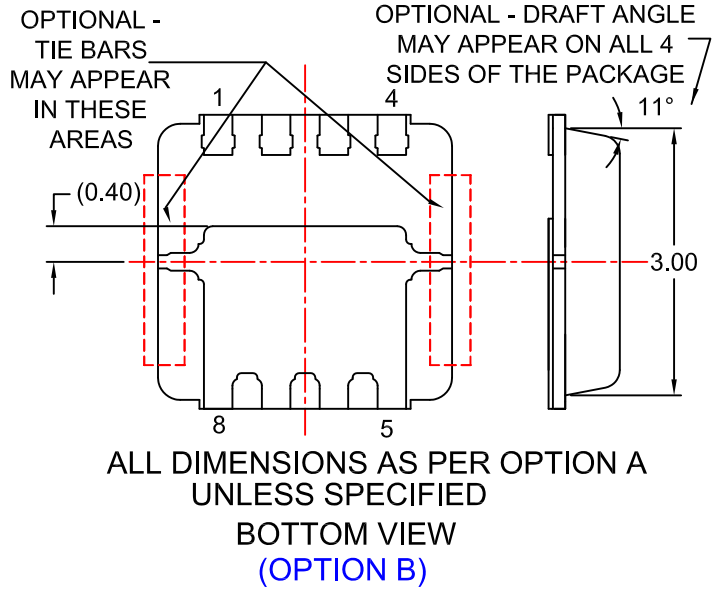
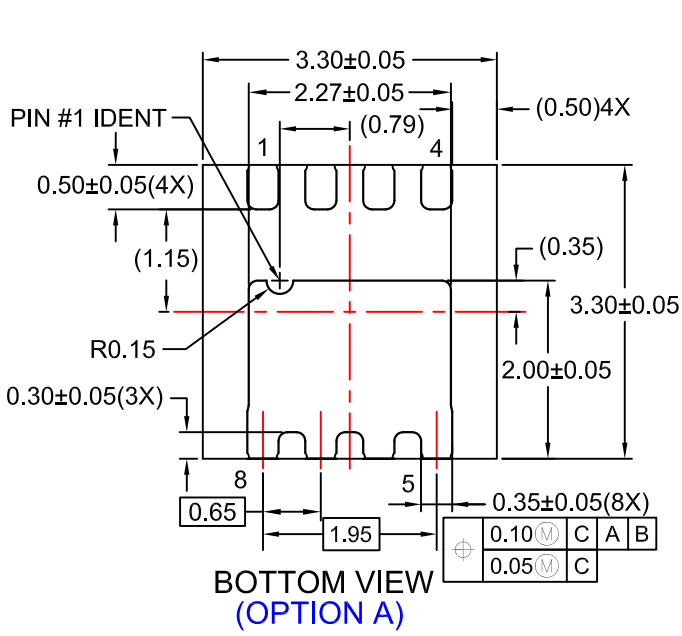
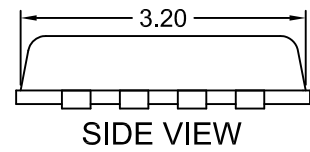
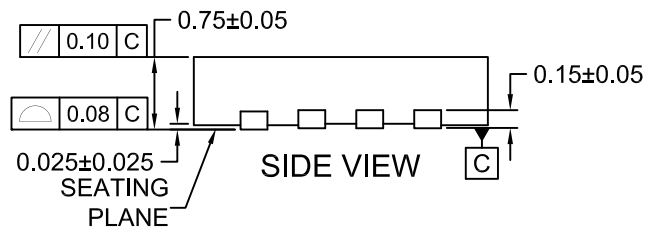
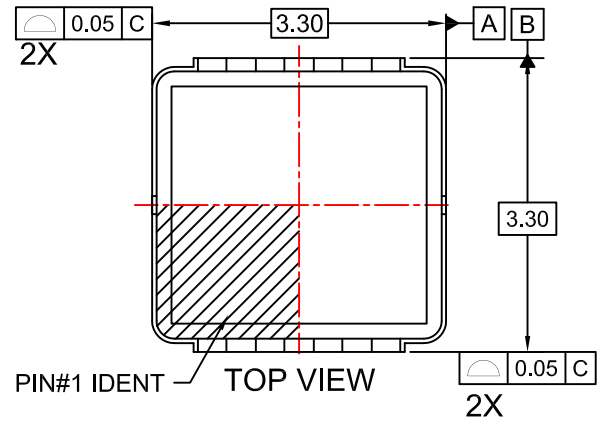
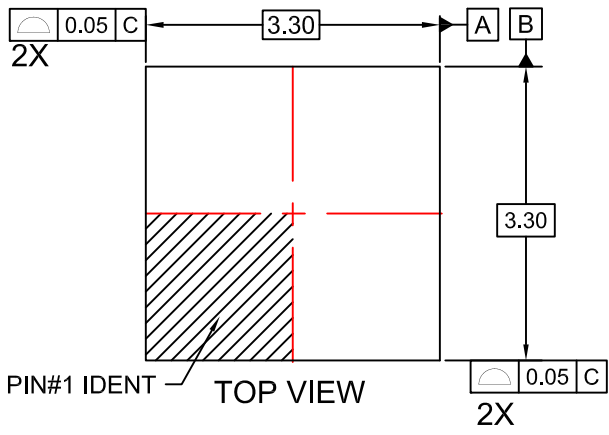


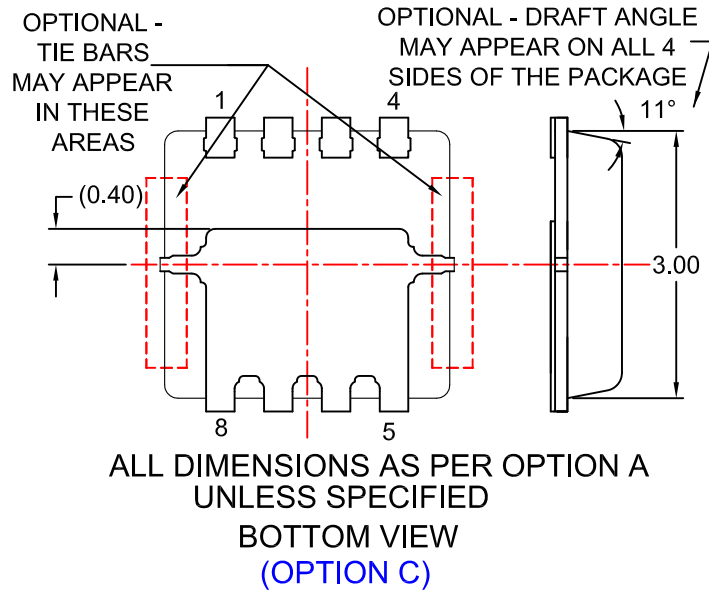
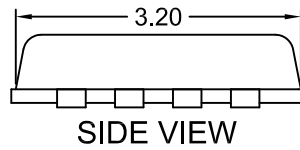
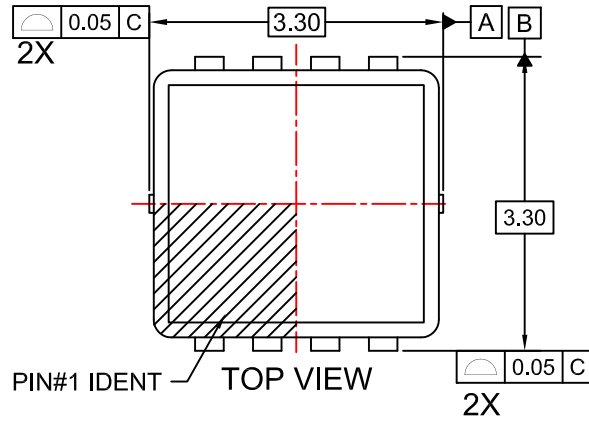
**Figure 11. Single Pulse Maximum Power Dissipation**

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



**Figure 12. Transient Thermal Response Curve**





**NOTES:**

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- B. DIMENSIONS ARE IN MILLIMETERS.
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