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# FDMC013P030Z

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

-30 V, -54 A, 7.0 mΩ

### Features

- Max  $r_{DS(on)}$  = 7.0 mΩ at  $V_{GS} = -10$  V,  $I_D = -14$  A
- Max  $r_{DS(on)}$  = 12.0 mΩ at  $V_{GS} = -4.5$  V,  $I_D = -10$  A
- High Performance Trench Technology for Extremely Low  $r_{DS(on)}$
- High Power and Current Handling Capability in a Widely Used Surface Mount Package
- Termination is Lead-free and RoHS Compliant
- HBM ESD Capability Level > 4 kV Typical (Note 4)

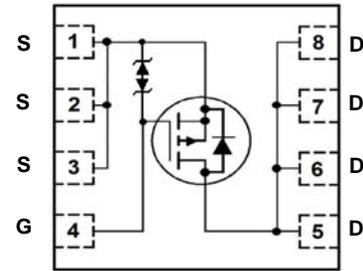
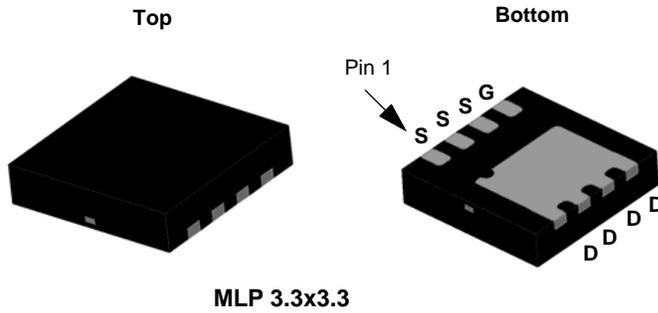


### General Description

This P-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been optimized for  $r_{DS(on)}$ , switching performance and ruggedness.

### Applications

- Battery Management
- Load Switch



### 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	$\pm 25$	V
$I_D$	Drain Current -Continuous $T_C = 25^\circ\text{C}$ (Note 5)	-54	A
	Drain Current -Continuous $T_C = 100^\circ\text{C}$ (Note 5)	-35	
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	-14	
	-Pulsed (Note 4)	-309	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	54	mJ
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	30	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.4	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	4.2	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC013P030Z	FDMC013P030Z	MLP 3.3x3.3	13"	12 mm	3000 units

FDMC013P030Z P-Channel PowerTrench<sup>®</sup> MOSFET

## 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	$I_D = -250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$	-30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-13		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	$V_{GS} = V_{DS}, I_D = -250\text{ }\mu\text{A}$	-1	-1.6	-3	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 $25\text{ }^\circ\text{C}$		5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -10\text{ V}, I_D = -14\text{ A}$		5.0	7.0	m $\Omega$
		$V_{GS} = -4.5\text{ V}, I_D = -10\text{ A}$		8.0	12.0	
		$V_{GS} = -10\text{ V}, I_D = -14\text{ A}, T_J = 125\text{ }^\circ\text{C}$		6.2	10.4	
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -14\text{ A}$		60		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$		4130	5785	pF
$C_{oss}$	Output Capacitance			1355	1895	pF
$C_{rss}$	Reverse Transfer Capacitance			1335	1870	pF

### Switching Characteristics

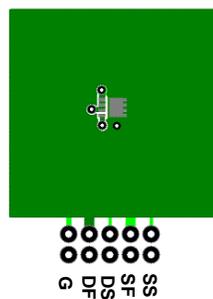
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -15\text{ V}, I_D = -14\text{ A},$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\text{ }\Omega$		34	55	ns	
$t_r$	Rise Time			157	251	ns	
$t_{d(off)}$	Turn-Off Delay Time			55	88	ns	
$t_f$	Fall Time			94	150	ns	
$Q_g$	Total Gate Charge		$V_{GS} = 0\text{ V to } -10\text{ V}$		96	135	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to } -4.5\text{ V}$	$V_{DD} = -15\text{ V},$ $I_D = -14\text{ A}$		58	81	nC
$Q_{gs}$	Gate to Source Charge				11		nC
$Q_{gd}$	Gate to Drain "Miller" Charge				36		nC

### Drain-Source Diode Characteristics

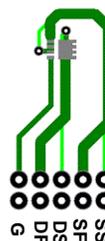
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -14\text{ A}$ (Note 2)		-0.8	-1.3	V
		$V_{GS} = 0\text{ V}, I_S = -2\text{ A}$ (Note 2)		-0.7	-1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = -14\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		44	77	ns
$Q_{rr}$	Reverse Recovery Charge			23	37	nC

#### NOTES:

1.  $R_{\theta JA}$  is determined with the device mounted on a  $1\text{ in}^2$  pad 2 oz copper pad on a  $1.5 \times 1.5\text{ in.}$  board of FR-4 material.  $R_{\theta CA}$  is determined by the user's board design.



a)  $53\text{ }^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



b)  $125\text{ }^\circ\text{C/W}$  when mounted on a minimum pad

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

3.  $E_{AS}$  of  $54\text{ mJ}$  is based on starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 6\text{ A}$ ,  $V_{DD} = 30\text{ V}$ ,  $V_{GS} = 10\text{ V}$ .

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.

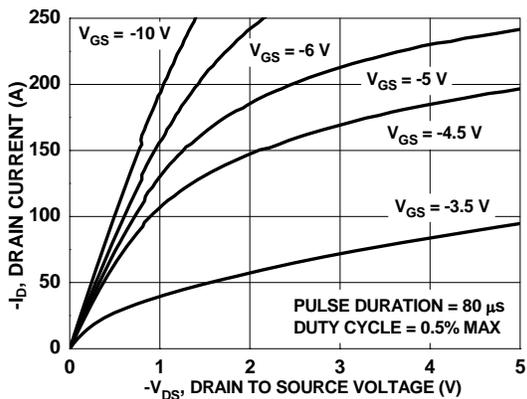


Figure 1. On Region Characteristics

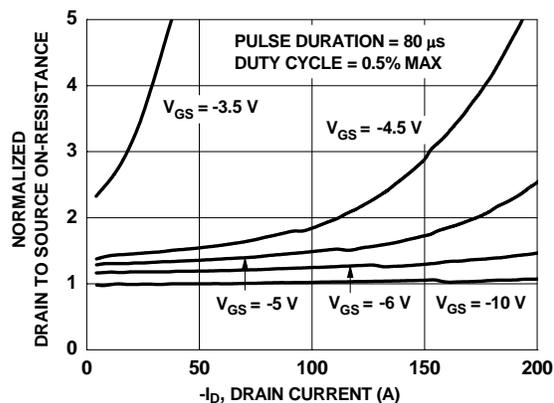


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

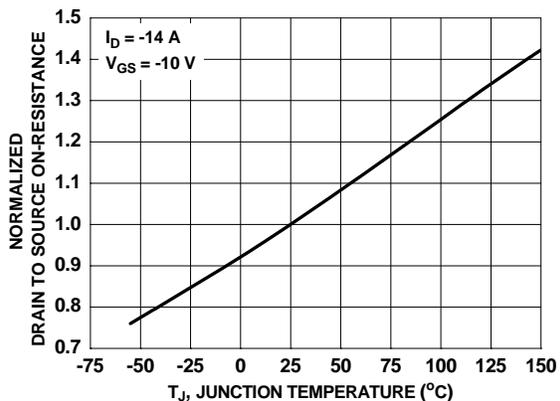


Figure 3. Normalized On Resistance vs. Junction Temperature

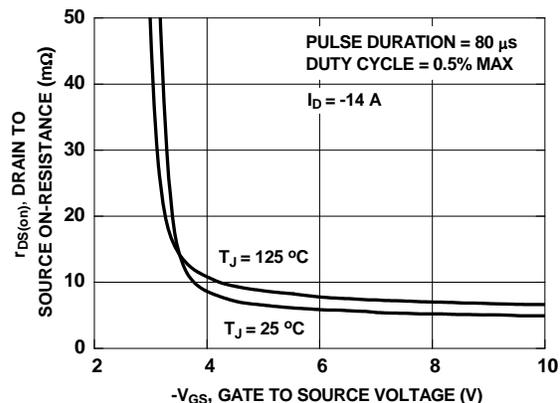


Figure 4. On-Resistance vs. Gate to Source Voltage

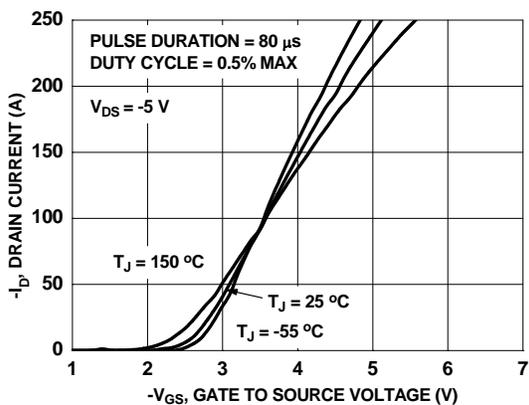


Figure 5. Transfer Characteristics

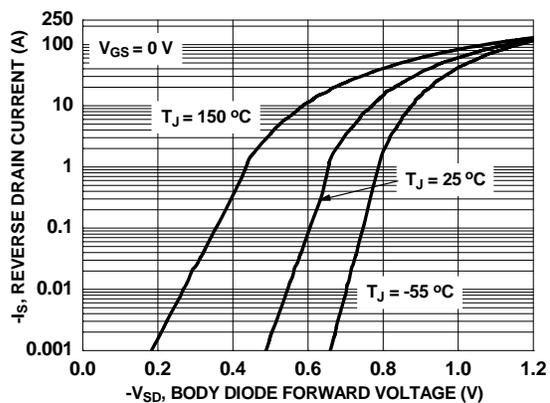
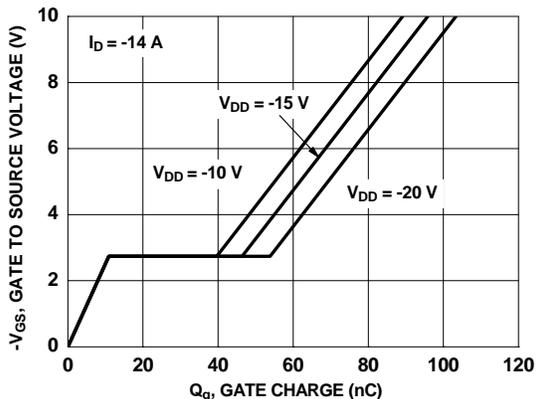
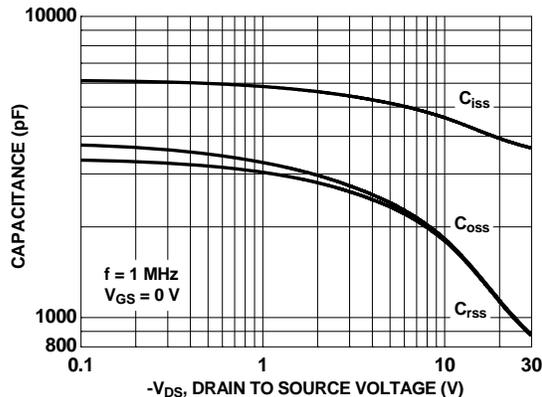


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

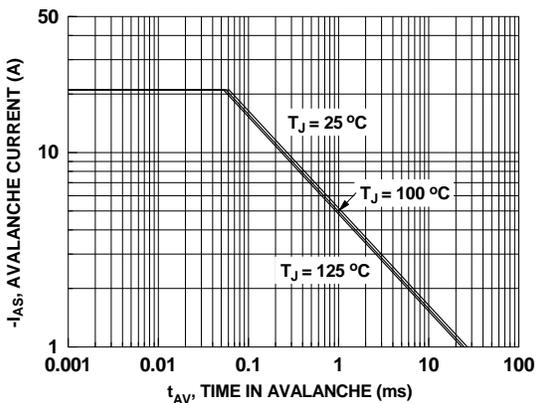
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted.



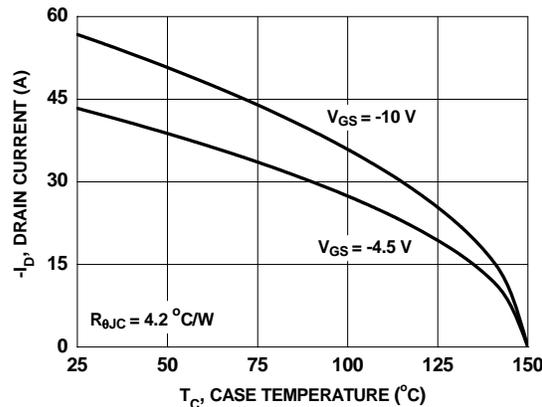
**Figure 7. Gate Charge Characteristics**



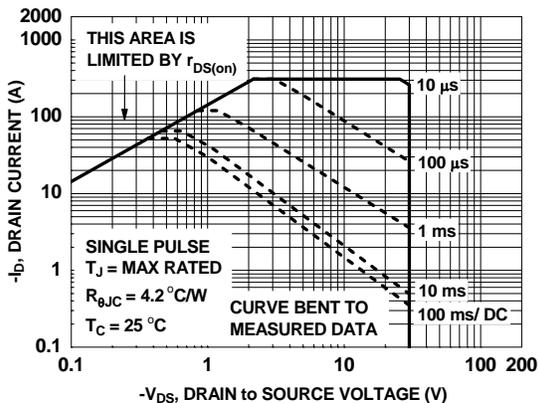
**Figure 8. Capacitance vs. Drain to Source Voltage**



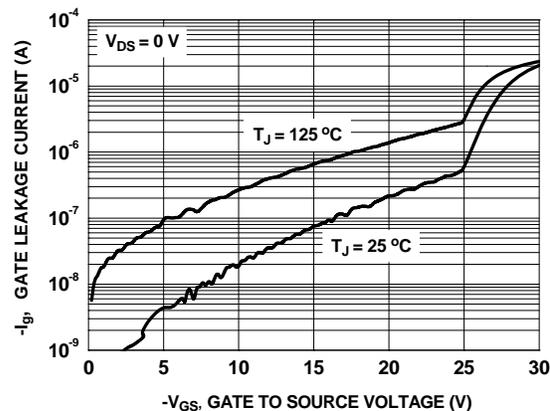
**Figure 9. Unclamped Inductive Switching Capability**



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



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



**Figure 12.  $I_{gss}$  vs.  $V_{gss}$**

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

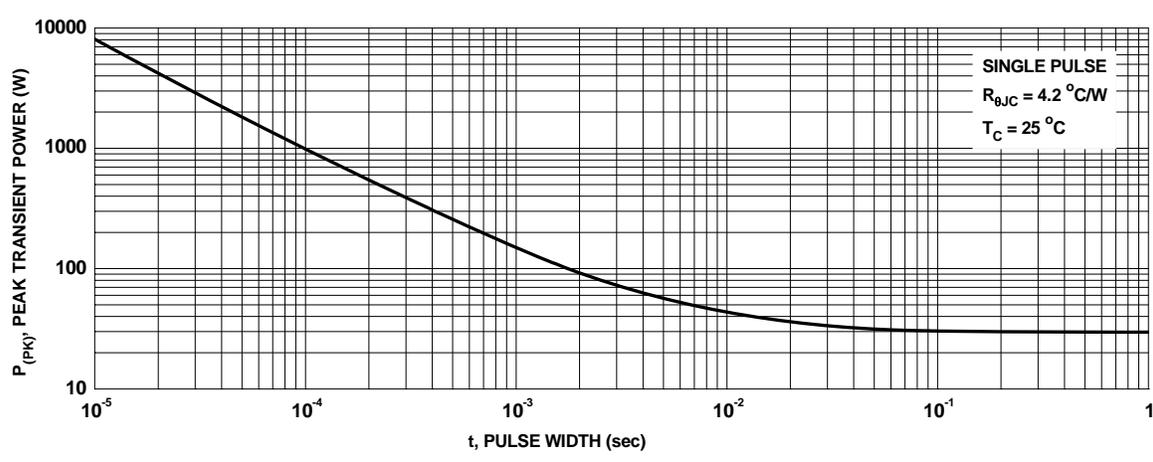


Figure 13. Single Pulse Maximum Power Dissipation

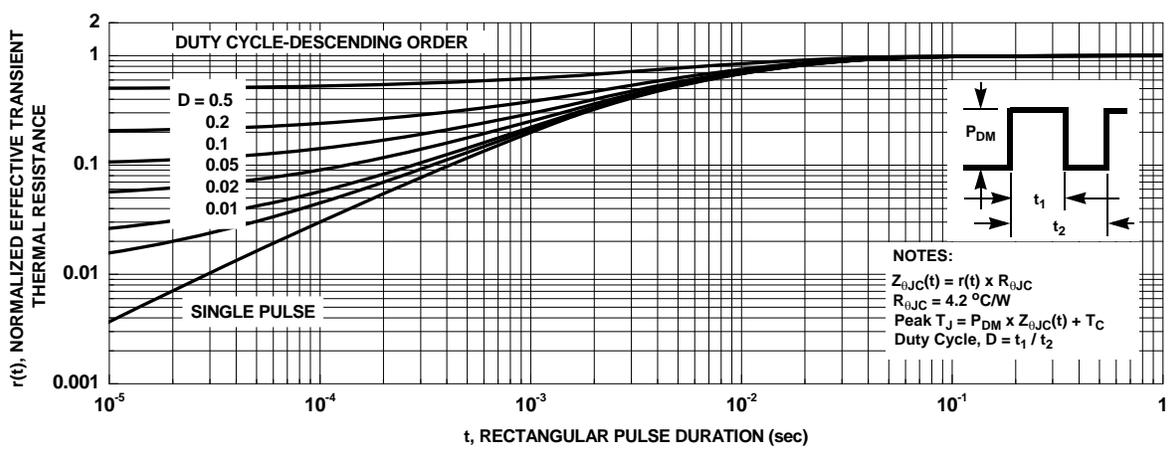
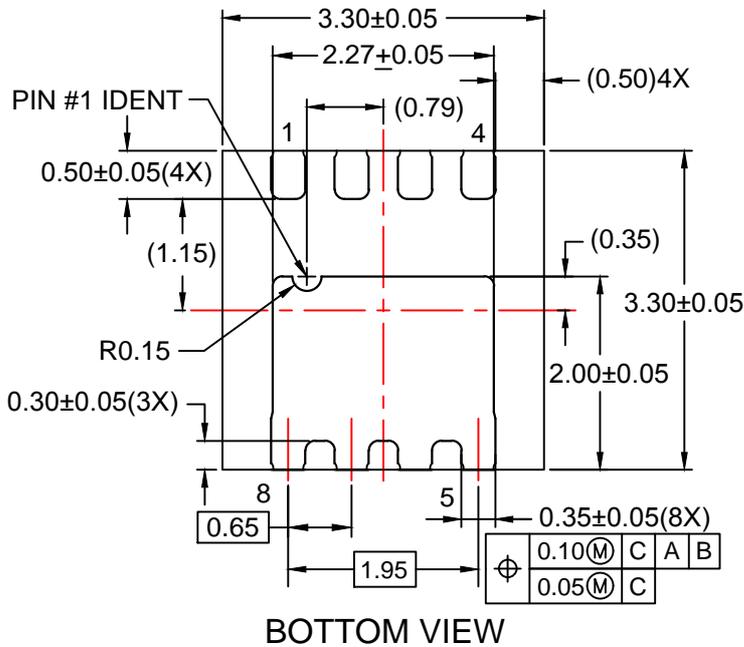
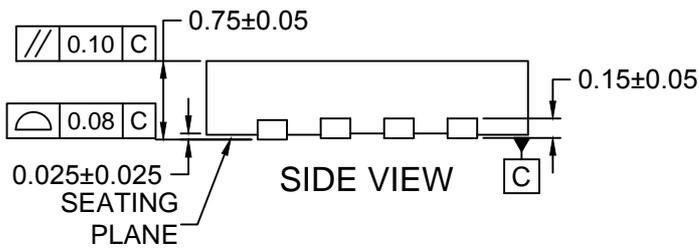
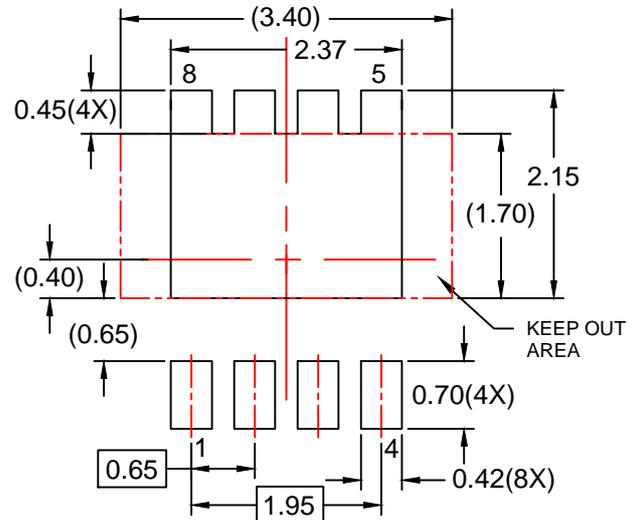
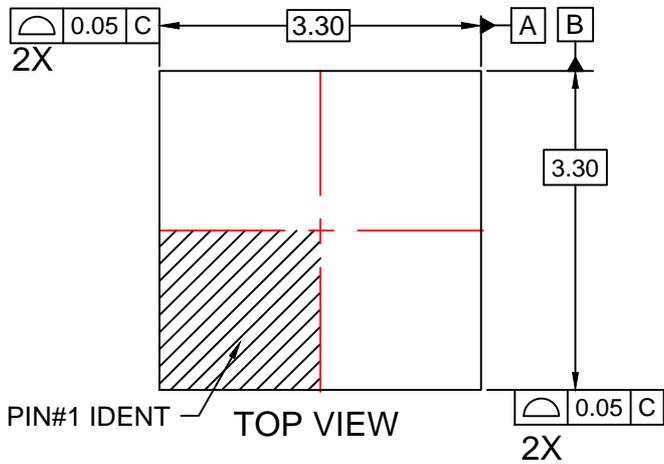


Figure 14. Junction to Case Transient Thermal Response Curve



#### NOTES:

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- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
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