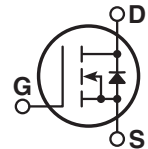
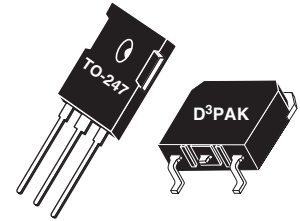




## Super Junction MOSFET

- Ultra Low  $R_{DS(ON)}$
- Low Miller Capacitance
- Ultra Low Gate Charge,  $Q_g$
- Avalanche Energy Rated
- Extreme  $dv/dt$  Rated
- Popular TO-247 or Surface Mount D<sup>3</sup> package.




### MAXIMUM RATINGS

 All Ratings per die:  $T_C = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	APT53N60B_SC6	UNIT
$V_{DSS}$	Drain-Source Voltage	600	Volts
$I_D$	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	53	Amps
	Continuous Drain Current @ $T_C = 100^\circ\text{C}$	34	
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	159	
$V_{GS}$	Gate-Source Voltage Continuous	$\pm 20$	Volts
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	417	Watts
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	- 55 to 150	$^\circ\text{C}$
$T_L$	Lead Temperature: 0.063" from Case for 10 Sec.	260	
$I_{AR}$	Avalanche Current <sup>2</sup>	9.3	Amps
$E_{AR}$	Repetitive Avalanche Energy <sup>2</sup> ( $I_D = 9.3\text{A}, V_{DD} = 50\text{V}$ )	1.72	mJ
$E_{AS}$	Single Pulse Avalanche Energy ( $I_D = 9.3\text{A}, V_{DD} = 50\text{V}$ )	1135	

### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$BV_{(DSS)}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$ )	600			Volts
$R_{DS(on)}$	Drain-Source On-State Resistance <sup>3</sup> ( $V_{GS} = 10\text{V}, I_D = 25.8\text{A}$ )			0.070	Ohms
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$ )			25	$\mu\text{A}$
	Zero Gate Voltage Drain Current ( $V_{DS} = 600\text{V}, V_{GS} = 0\text{V}, T_C = 150^\circ\text{C}$ )			250	
$I_{GSS}$	Gate-Source Leakage Current ( $V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$ )			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 1.72\text{mA}$ )	2.5	3	3.5	Volts


 CAUTION: These Devices are Sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

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## DYNAMIC CHARACTERISTICS

APT53N60B\_SC6

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
$C_{iss}$	Input Capacitance	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1\text{ MHz}$		4020		pF
$C_{oss}$	Output Capacitance			3545		
$C_{rss}$	Reverse Transfer Capacitance			330		
$Q_g$	Total Gate Charge <sup>4</sup>	$V_{GS} = 10V$ $V_{DD} = 300V$ $I_D = 53A @ 25^\circ C$		154		nC
$Q_{gs}$	Gate-Source Charge			26		
$Q_{gd}$	Gate-Drain ("Miller") Charge			82		
$t_{d(on)}$	Turn-on Delay Time	<b>INDUCTIVE SWITCHING</b> $V_{GS} = 15V$ $V_{DD} = 400V$ $I_D = 53A @ 125^\circ C$ $R_G = 4.3\Omega$		14		ns
$t_r$	Rise Time			36		
$t_{d(off)}$	Turn-off Delay Time			151		
$t_f$	Fall Time			74		
$E_{on}$	Turn-on Switching Energy <sup>5</sup>	<b>INDUCTIVE SWITCHING @ 25°C</b> $V_{DD} = 400V, V_{GS} = 15V$ $I_D = 53A, R_G = 4.3\Omega$		960		$\mu J$
$E_{off}$	Turn-off Switching Energy			873		
$E_{on}$	Turn-on Switching Energy <sup>5</sup>	<b>INDUCTIVE SWITCHING @ 125°C</b> $V_{DD} = 400V, V_{GS} = 15V$ $I_D = 53A, R_G = 4.3\Omega$		1478		
$E_{off}$	Turn-off Switching Energy			995		

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$I_S$	Continuous Source Current (Body Diode)			46	Amps
$I_{SM}$	Pulsed Source Current <sup>1</sup> (Body Diode)			159	
$V_{SD}$	Diode Forward Voltage <sup>3</sup> ( $V_{GS} = 0V, I_S = -53A$ )		0.9	1.2	Volts
$dv/dt$	Peak Diode Recovery $dv/dt$ <sup>6</sup>			15	V/ns
$t_{rr}$	Reverse Recovery Time ( $I_S = -53A, di/dt = 100A/\mu s$ )	$T_J = 25^\circ C$		795	ns
$Q_{rr}$	Reverse Recovery Charge ( $I_S = -53A, di/dt = 100A/\mu s$ )	$T_J = 25^\circ C$		25	$\mu C$
$I_{RRM}$	Peak Recovery Current ( $I_S = -53A, di/dt = 100A/\mu s$ )	$T_J = 25^\circ C$		58	Amps

## THERMAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.30	$^\circ C/W$
$R_{\theta JA}$	Junction to Ambient			40	

1 Repetitive Rating: Pulse width limited by maximum junction temperature

2 Repetitive avalanche causes additional power losses that can be calculated as

$$P_{AV} = E_{AR} \cdot f \cdot \text{Pulse width tp limited by } T_J \text{ max.}$$

3 Pulse Test: Pulse width < 380  $\mu s$ , Duty Cycle < 2%

Microsemi reserves the right to change, without notice, the specifications and information contained herein.

4 See MIL-STD-750 Method 3471

5 Eon includes diode reverse recovery.

6 Maximum 125°C diode commutation speed =  $di/dt$  600A/ $\mu s$

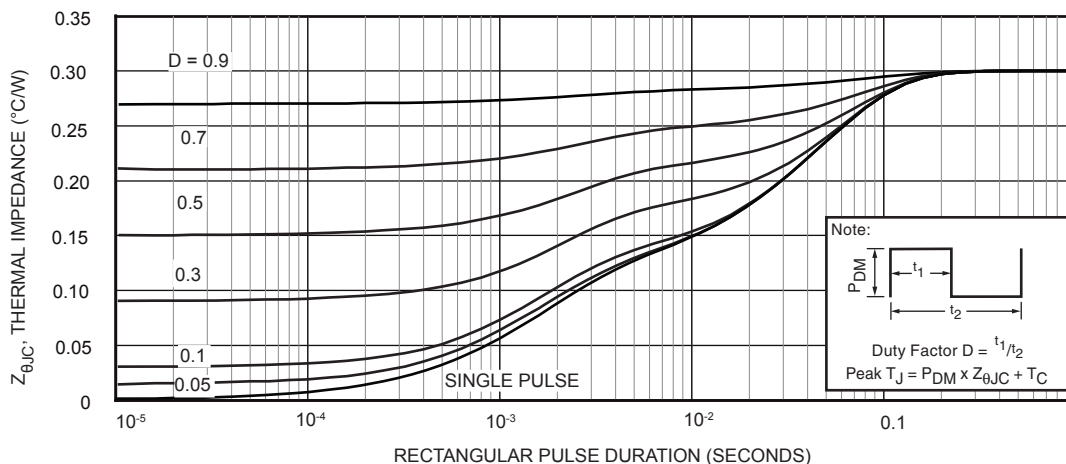


Figure 1, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

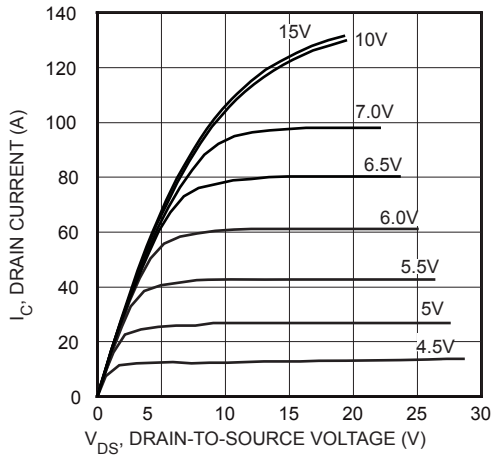


FIGURE 2, Low Voltage Output Characteristics

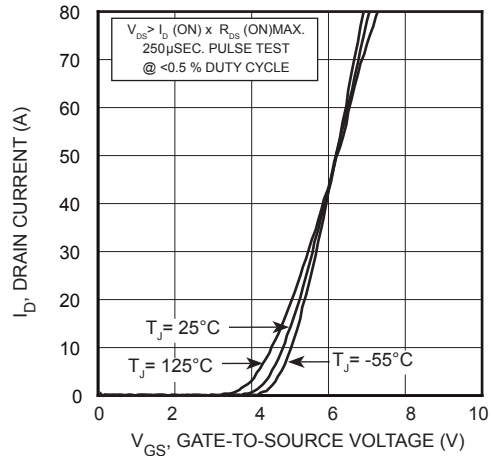


FIGURE 3, Transfer Characteristics

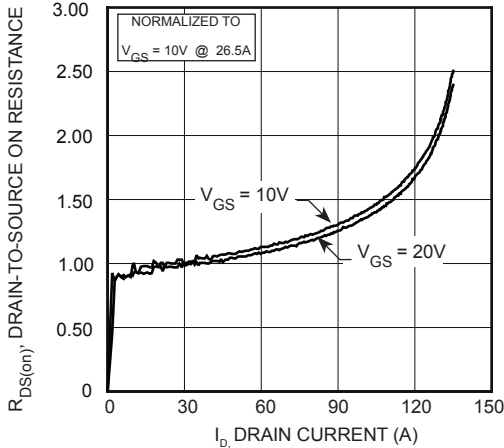


FIGURE 4,  $R_{DS(ON)}$  vs Drain Current

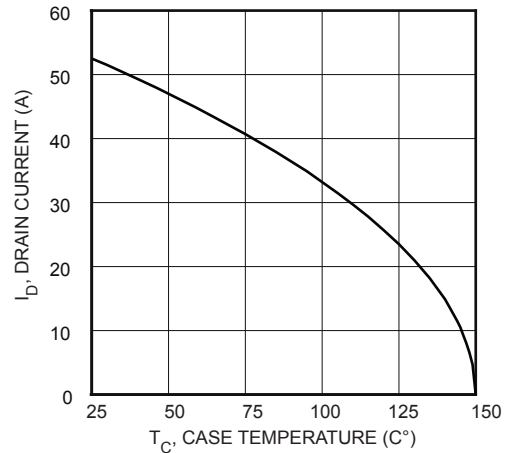


FIGURE 5, Maximum Drain Current vs Case Temperature

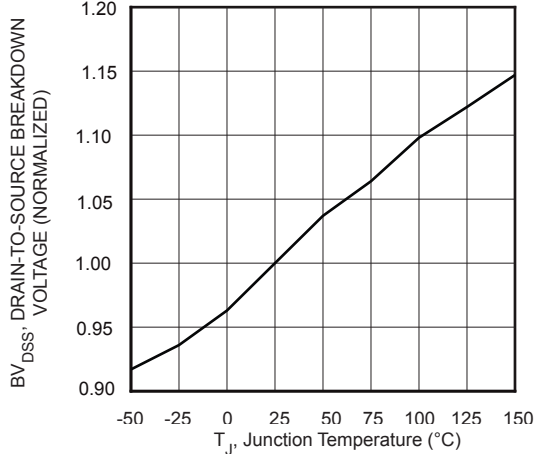


FIGURE 6, Breakdown Voltage vs Temperature

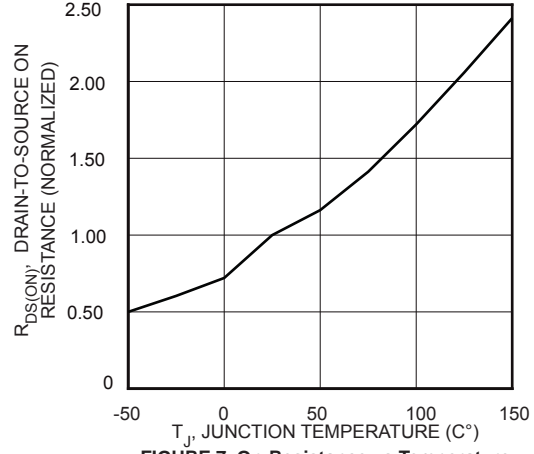


FIGURE 7, On-Resistance vs Temperature

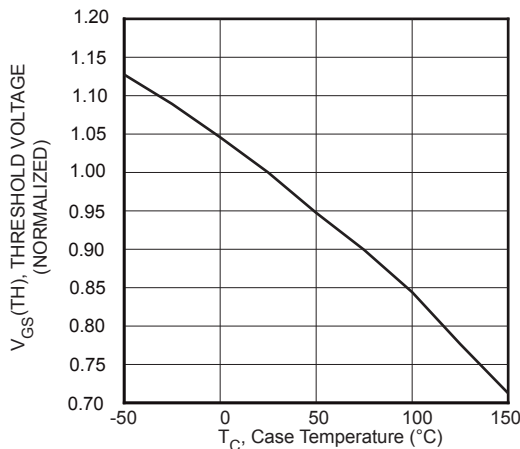


FIGURE 8, Threshold Voltage vs Temperature

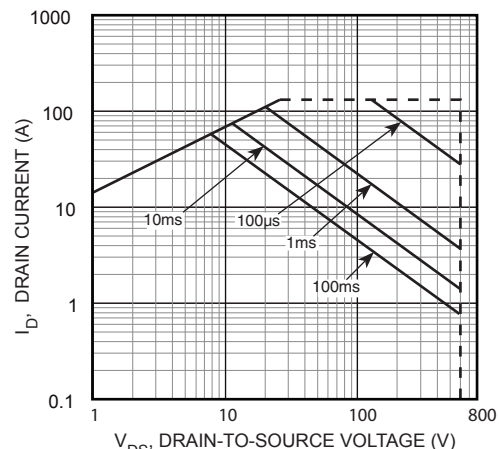


FIGURE 9, Maximum Safe Operating Area

# Typical Performance Curves

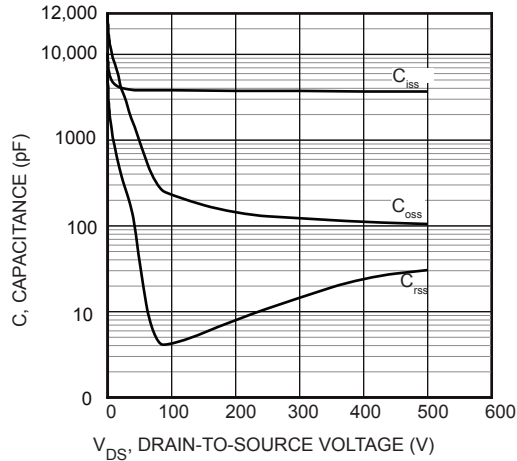


FIGURE 10, Capacitance vs Drain-To-Source Voltage

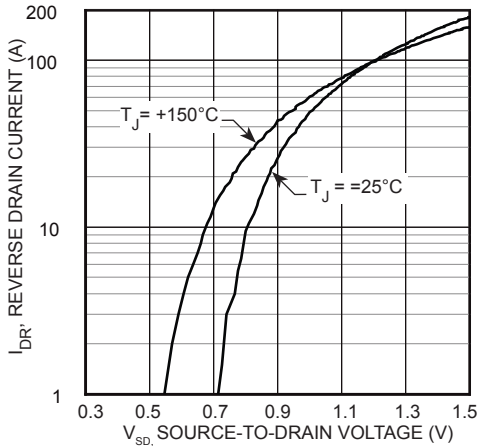


FIGURE 12, Source-Drain Diode Forward Voltage

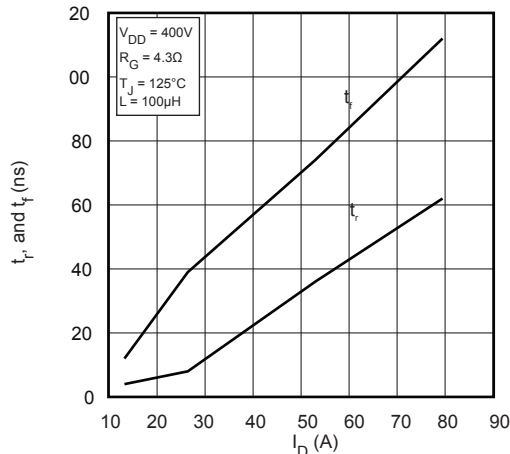


FIGURE 14, Rise and Fall Times vs Current

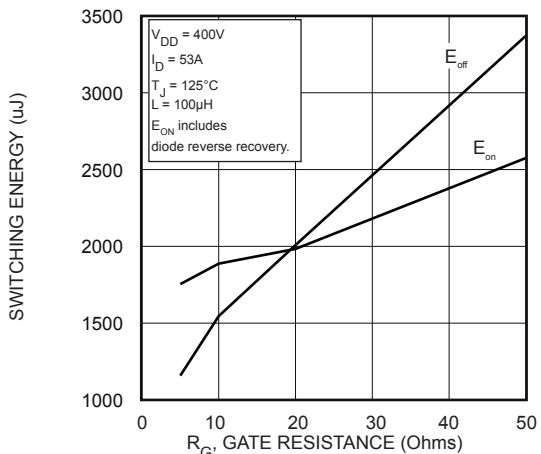


FIGURE 16, Switching Energy vs Gate Resistance

# APT53N60B\_SC6

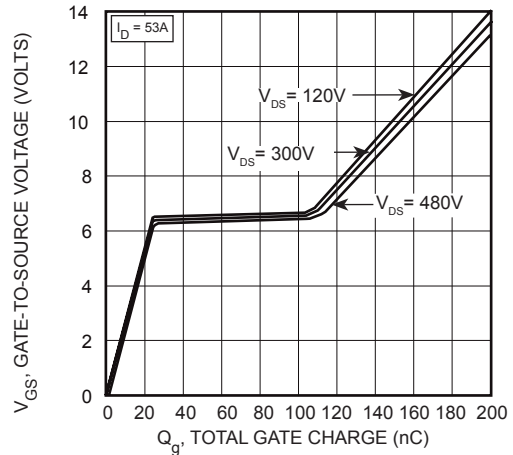


FIGURE 11, Gate Charges vs Gate-To-Source Voltage

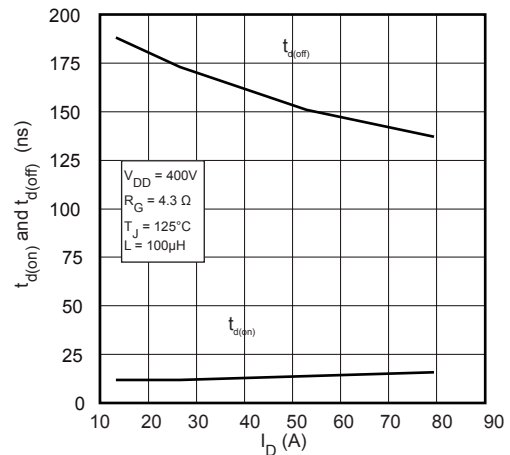


FIGURE 13, Delay Times vs Current

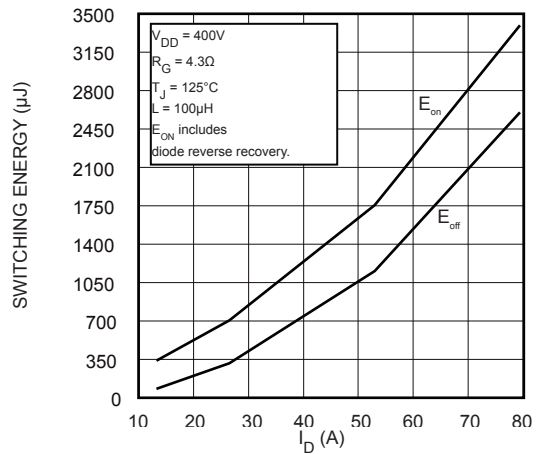


FIGURE 15, Switching Energy vs Current

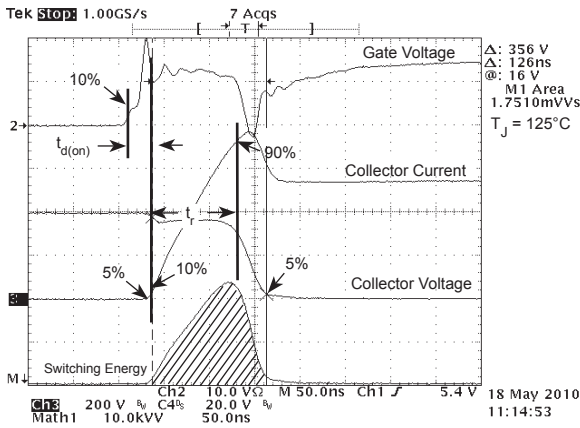


Figure 17, Turn-on Switching Waveforms and Definitions

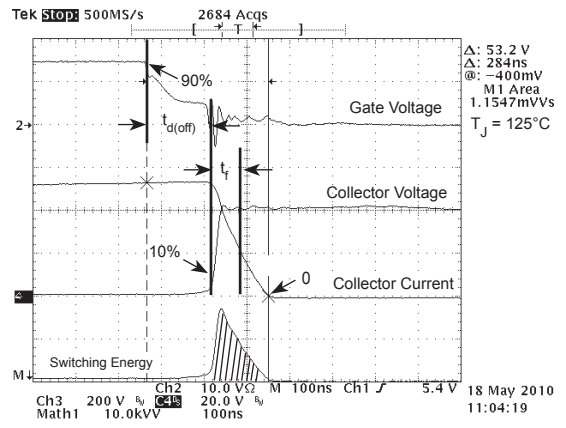


Figure 18, Turn-off Switching Waveforms and Definitions

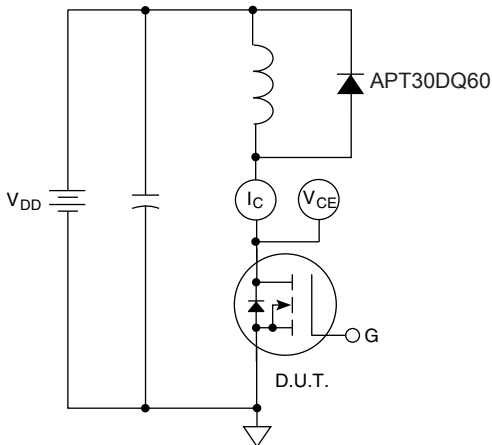
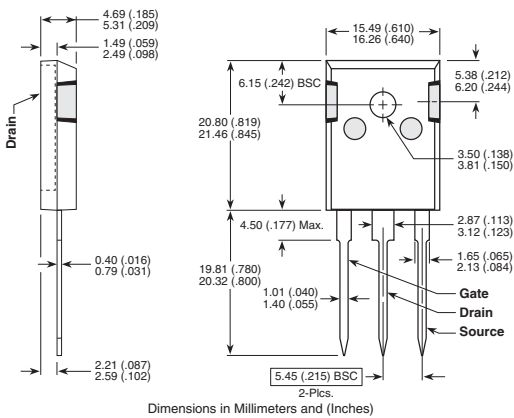
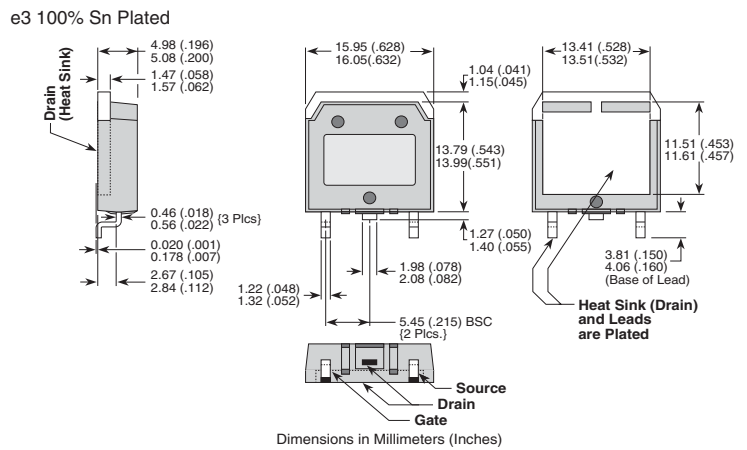


Figure 19, Inductive Switching Test Circuit

TO-247 (B) Package Outline



D<sup>3</sup>PAK Package Outline



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