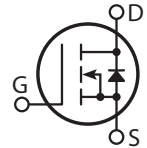
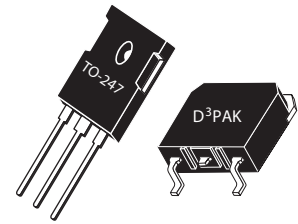




## Super Junction MOSFET

- Ultra low  $R_{DS(ON)}$
- Increased Power Dissipation
- Low Miller Capacitance
- Ultra Low Gate Charge,  $Q_g$
- Avalanche Energy Rated
- TO-247 or Surface Mount D<sup>3</sup>PAK Package



### MAXIMUM RATINGS

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

Symbol	Parameter	APT47N65B_SC3	UNIT
$V_{DSS}$	Drain-Source Voltage	650	Volts
$I_D$	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	47	Amps
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	141	
$V_{GS}$	Gate-Source Voltage Continuous	±20	Volts
$V_{GSM}$	Gate-Source Voltage Transient	±30	
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	417	Watts
	Linear Derating Factor	3.33	W/°C
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 150	°C
$T_L$	Lead Temperature: 0.063" from Case for 10 Sec.	260	
$dv/dt$	Drain-Source Voltage slope ( $V_{DS} = 480\text{V}$ , $I_D = 47\text{A}$ , $T_J = 125^\circ\text{C}$ )	50	V/ns
$I_{AR}$	Repetitive Avalanche Current <sup>7</sup> +++++Repetitive Avalanche Energy <sup>7</sup>	20	Amps
$E_{AR}$	Single Pulse Avalanche Energy <sup>4</sup>	1	mJ
$E_{AS}$	Single Pulse Avalanche Energy <sup>4</sup>	1800	

### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$BV_{DSS}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{V}$ , $I_D = 250\mu\text{A}$ )	650			Volts
$R_{DS(on)}$	Drain-Source On-State Resistance <sup>2</sup> ( $V_{GS} = 10\text{V}$ , $I_D = 30\text{A}$ )		0.06	0.07	Ohms
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{DS} = 650\text{V}$ , $V_{GS} = 0\text{V}$ )		0.5	25	$\mu\text{A}$
	Zero Gate Voltage Drain Current ( $V_{DS} = 650\text{V}$ , $V_{GS} = 0\text{V}$ , $T_J = 150^\circ\text{C}$ )			250	
$I_{GSS}$	Gate-Source Leakage Current ( $V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$ )			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage ( $V_{DS} = V_{GS}$ , $I_D = 2.7\text{mA}$ )	2.10	3	3.9	Volts

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

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**DYNAMIC CHARACTERISTICS**

**APT47N65BC3**

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0V V <sub>DS</sub> = 25V f = 1 MHz		6965	8355	pF
C <sub>oss</sub>	Output Capacitance			2100	2940	
C <sub>rss</sub>	Reverse Transfer Capacitance			85	127	
Q <sub>g</sub>	Total Gate Charge <sup>3</sup>	V <sub>GS</sub> = 10V V <sub>DD</sub> = 300V I <sub>D</sub> = 47A @ 25°C		250	375	nC
Q <sub>gs</sub>	Gate-Source Charge			30	45	
Q <sub>gd</sub>	Gate-Drain ("Miller") Charge			105	157	
t <sub>d(on)</sub>	Turn-on Delay Time	<b>INDUCTIVE SWITCHING</b> V <sub>GS</sub> = 13V V <sub>DD</sub> = 380V I <sub>D</sub> = 47A @ 125°C R <sub>G</sub> = 5Ω		18	36	ns
t <sub>r</sub>	Rise Time			28	56	
t <sub>d(off)</sub>	Turn-off Delay Time			295	442	
t <sub>f</sub>	Fall Time			84	168	
E <sub>on</sub>	Turn-on Switching Energy <sup>6</sup>	<b>INDUCTIVE SWITCHING @ 25°C</b> V <sub>DD</sub> = 400V, V <sub>GS</sub> = 15V I <sub>D</sub> = 47A, R <sub>G</sub> = 5Ω		810	1620	μJ
E <sub>off</sub>	Turn-off Switching Energy			840	1680	
E <sub>on</sub>	Turn-on Switching Energy <sup>6</sup>	<b>INDUCTIVE SWITCHING @ 125°C</b> V <sub>DD</sub> = 400V V <sub>GS</sub> = 15V I <sub>D</sub> = 47A, R <sub>G</sub> = 5Ω		1172	1758	
E <sub>off</sub>	Turn-off Switching Energy			985	1970	

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
I <sub>S</sub>	Continuous Source Current (Body Diode)			47	Amps
I <sub>SM</sub>	Pulsed Source Current <sup>1</sup> (Body Diode)			141	Amps
V <sub>SD</sub>	Diode Forward Voltage <sup>2</sup> (V <sub>GS</sub> = 0V, I <sub>S</sub> = -47A)			1.2	Volts
t <sub>rr</sub>	Reverse Recovery Time (I <sub>S</sub> = -47A, di <sub>S</sub> /dt = 100A/μs, V <sub>R</sub> = 350V)		580	650	ns
Q <sub>rr</sub>	Reverse Recovery Charge (I <sub>S</sub> = -47A, di <sub>S</sub> /dt = 100A/μs, V <sub>R</sub> = 350V)		23	16.5	μC
dv <sub>dt</sub>	Peak Diode Recovery dv <sub>dt</sub> <sup>5</sup>			6	V/ns

**THERMAL CHARACTERISTICS**

Symbol	Characteristic	MIN	TYP	MAX	UNIT
R <sub>θJC</sub>	Junction to Case			0.30	°C/W
R <sub>θJA</sub>	Junction to Ambient			62	

① Repetitive Rating: Pulse width limited by maximum junction temperature

② Pulse Test: Pulse width < 380 μs, Duty Cycle < 2%

③ See MIL-STD-750 Method 3471

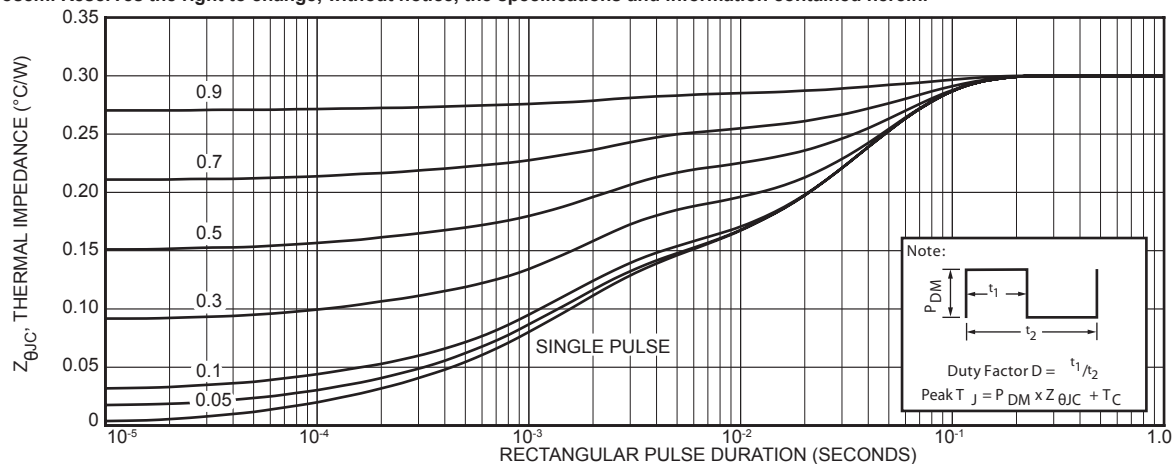
④ Starting T<sub>J</sub> = +25°C, L = 36.0mH, R<sub>G</sub> = 25Ω, Peak I<sub>L</sub> = 10A

⑤ dv<sub>dt</sub> numbers reflect the limitations of the test circuit rather than the device itself. I<sub>S</sub> = -I<sub>D</sub> 47A, di<sub>S</sub>/dt = 700A/μs V<sub>R</sub> = V<sub>DSS</sub>, T<sub>J</sub> = 150°C

⑥ Eon includes diode reverse recovery. See figures 18, 20.

⑦ Repetitive avalanche causes additional power losses that can be calculated as P<sub>AV</sub> = E<sub>AR</sub> \* f

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**FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION**

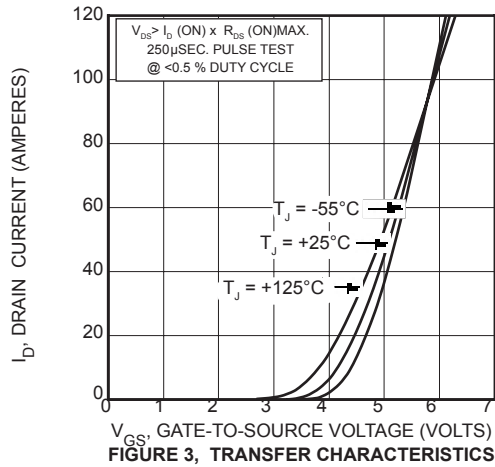


FIGURE 3, TRANSFER CHARACTERISTICS

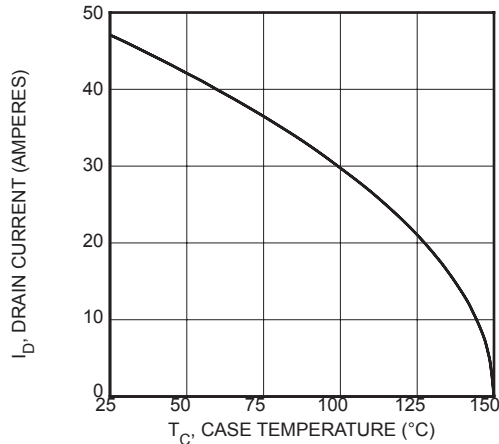


FIGURE 5, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

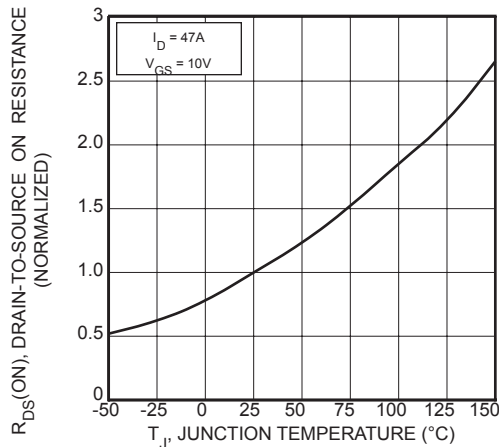


FIGURE 7, ON-RESISTANCE vs. TEMPERATURE

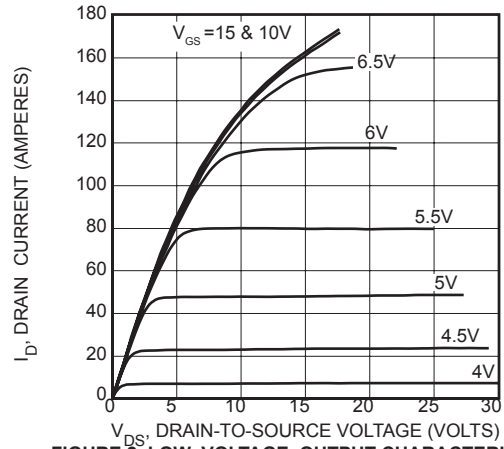


FIGURE 2, LOW VOLTAGE OUTPUT CHARACTERISTICS

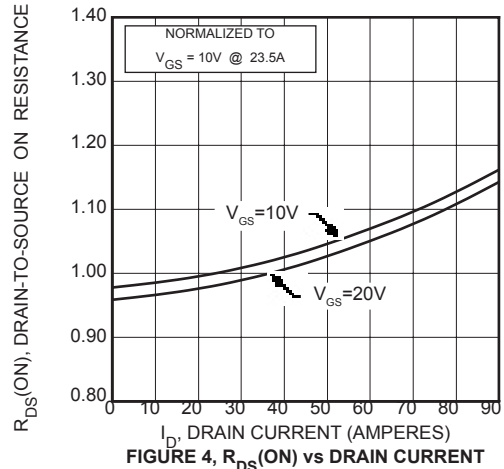


FIGURE 4,  $R_{DS(ON)}$  vs DRAIN CURRENT

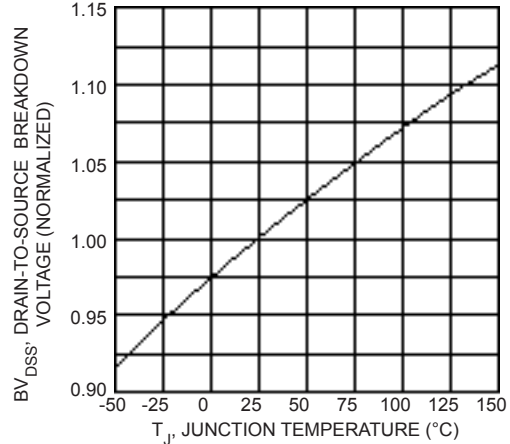


FIGURE 6, BREAKDOWN VOLTAGE vs TEMPERATURE

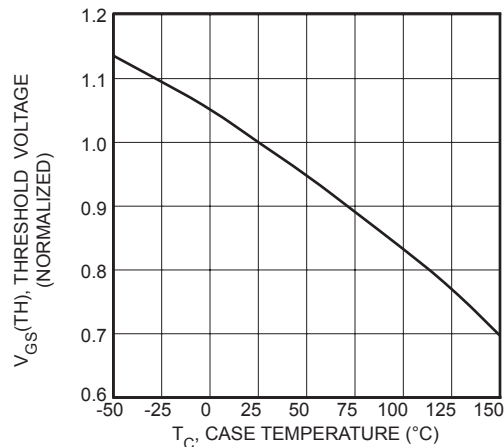


FIGURE 8, THRESHOLD VOLTAGE vs TEMPERATURE

# Typical Performance Curves

APT47N65B\_SC3

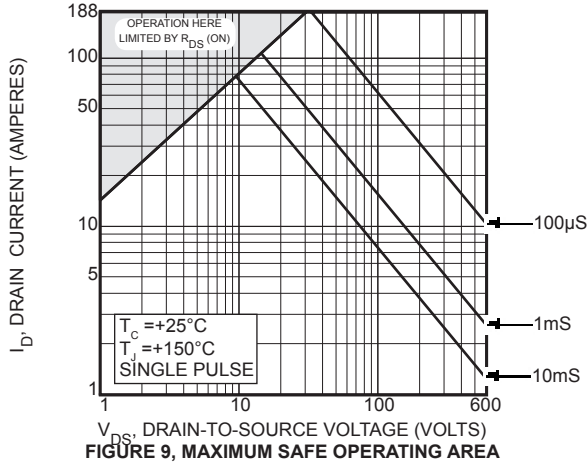


FIGURE 9, MAXIMUM SAFE OPERATING AREA

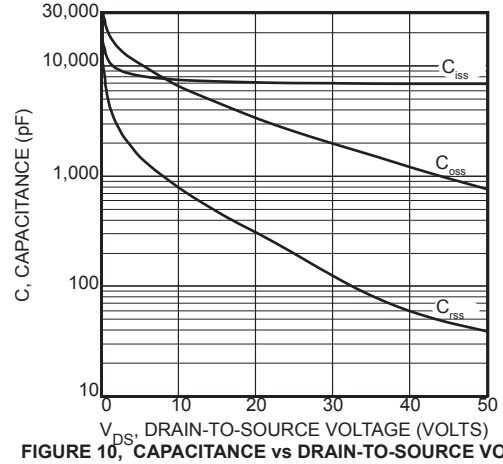


FIGURE 10, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

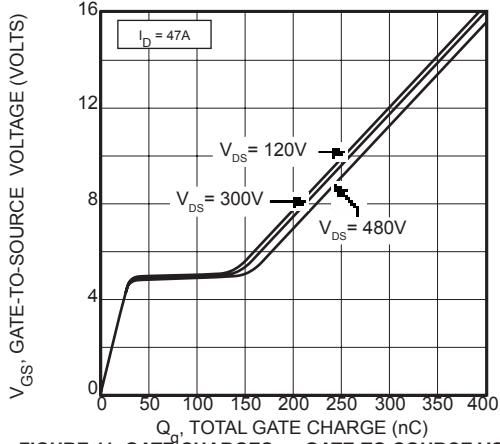


FIGURE 11, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

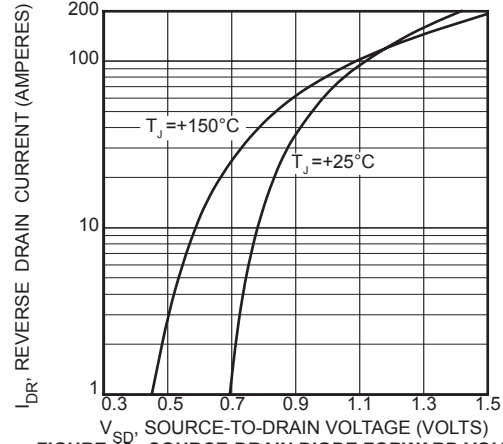


FIGURE 12, SOURCE-DRAIN DIODE FORWARD VOLTAGE

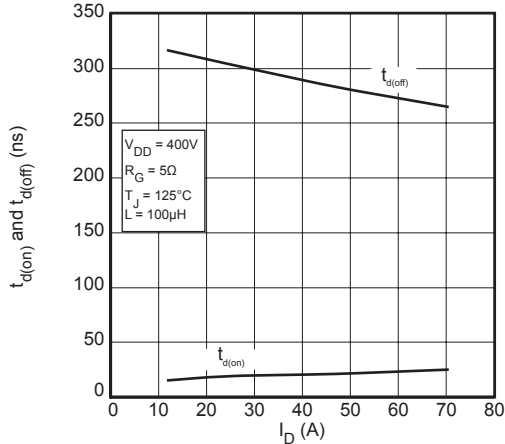


FIGURE 13, DELAY TIMES vs CURRENT

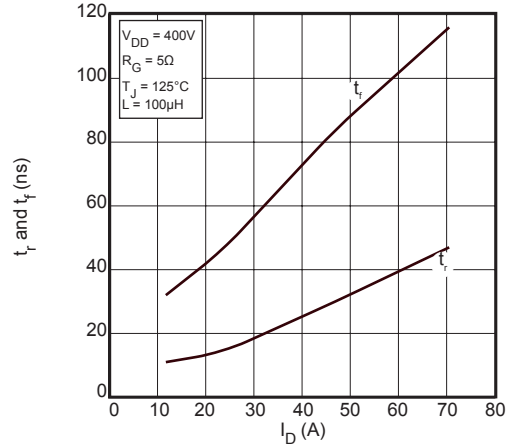


FIGURE 14, RISE AND FALL TIMES vs CURRENT

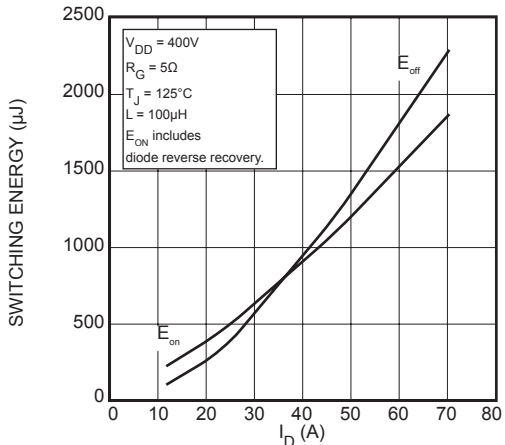


FIGURE 15, SWITCHING ENERGY vs CURRENT

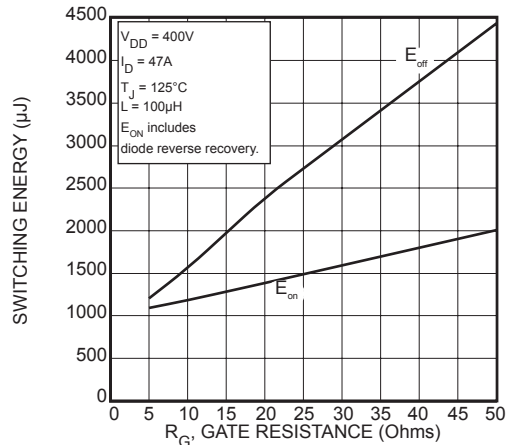


FIGURE 16, SWITCHING ENERGY vs. GATE RESISTANCE

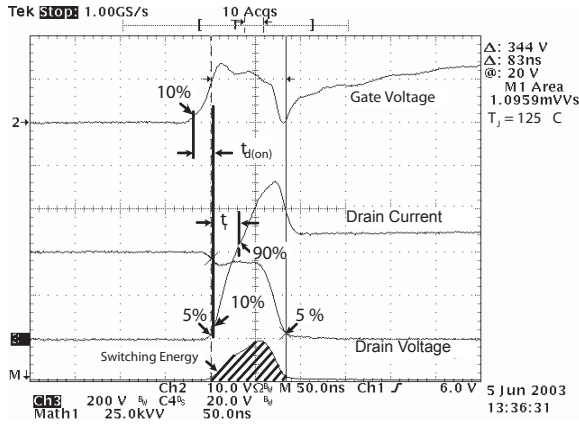


Figure 18, Turn-on Switching Waveforms and Definitions

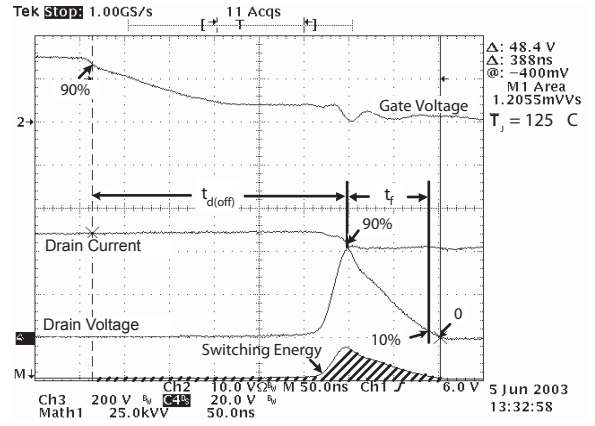


Figure 19, Turn-off Switching Waveforms and Definitions

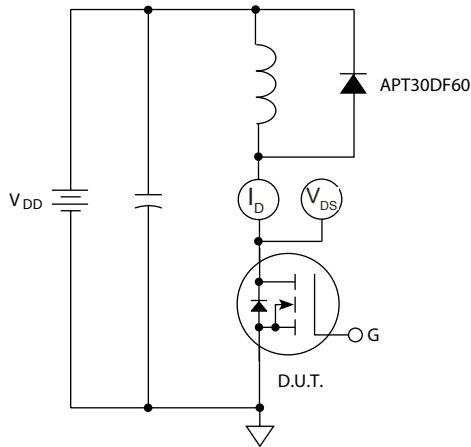
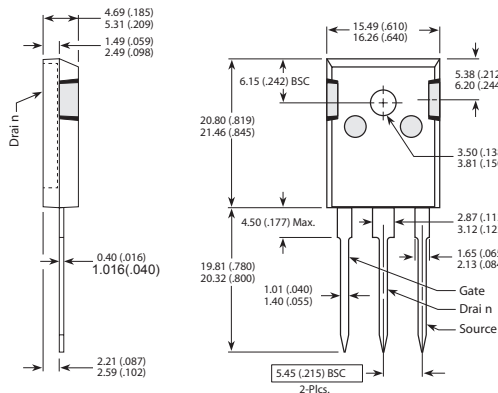


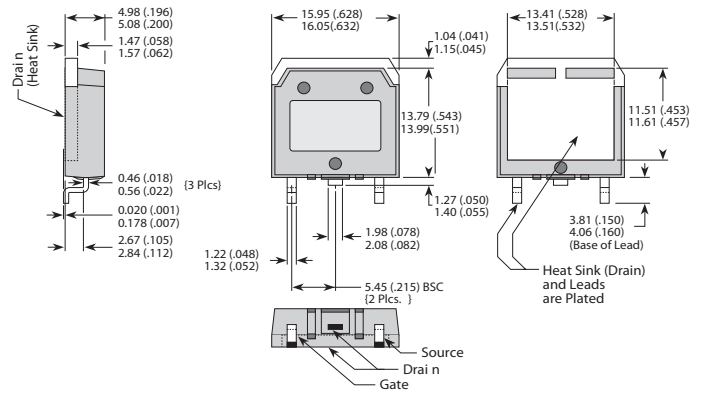
Figure 20, Inductive Switching Test Circuit

TO-247 Package Outline



D<sup>3</sup>PAK (S) Package Outline

③ 100% SN Plated



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