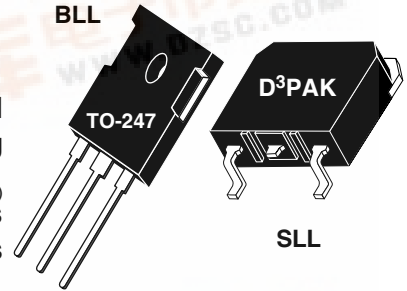




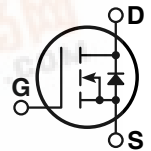
**APT5024BLL**  
**APT5024SLL**  
**500V 22A 0.240Ω**

**POWER MOS 7<sup>®</sup> MOSFET**

Power MOS 7<sup>®</sup> is a new generation of low loss, high voltage, N-Channel enhancement mode power MOSFETS. Both conduction and switching losses are addressed with Power MOS 7<sup>®</sup> by significantly lowering  $R_{DS(ON)}$  and  $Q_g$ . Power MOS 7<sup>®</sup> combines lower conduction and switching losses along with exceptionally fast switching speeds inherent with APT's patented metal gate structure.



- Lower Input Capacitance
- Lower Miller Capacitance
- Lower Gate Charge,  $Q_g$
- Increased Power Dissipation
- Easier To Drive
- TO-247 or Surface Mount D<sup>3</sup>PAK Package



**MAXIMUM RATINGS**

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

Symbol	Parameter	APT5024BLL_SLL	UNIT
$V_{DSS}$	Drain-Source Voltage	500	Volts
$I_D$	Continuous Drain Current @ $T_C = 25^\circ C$	22	Amps
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	88	
$V_{GS}$	Gate-Source Voltage Continuous	±30	Volts
$V_{GSM}$	Gate-Source Voltage Transient	±40	
$P_D$	Total Power Dissipation @ $T_C = 25^\circ C$	265	Watts
	Linear Derating Factor	2.12	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.	300	
$I_{AR}$	Avalanche Current <sup>(1)</sup> (Repetitive and Non-Repetitive)	22	Amps
$E_{AR}$	Repetitive Avalanche Energy <sup>(1)</sup>	30	mJ
$E_{AS}$	Single Pulse Avalanche Energy <sup>(4)</sup>	960	

**STATIC ELECTRICAL CHARACTERISTICS**

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$BV_{DSS}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0V, I_D = 250\mu A$ )	500			Volts
$I_{D(on)}$	On State Drain Current <sup>(2)</sup> ( $V_{DS} > I_{D(on)} \times R_{DS(on)}$ Max, $V_{GS} = 10V$ )	22			Amps
$R_{DS(on)}$	Drain-Source On-State Resistance <sup>(2)</sup> ( $V_{GS} = 10V, 11A$ )			0.24	Ohms
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{DS} = 500V, V_{GS} = 0V$ )			100	μA
	Zero Gate Voltage Drain Current ( $V_{DS} = 400V, V_{GS} = 0V, T_C = 125^\circ C$ )			500	
$I_{GSS}$	Gate-Source Leakage Current ( $V_{GS} = \pm 30V, V_{DS} = 0V$ )			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 1mA$ )	3		5	Volts

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

## DYNAMIC CHARACTERISTICS

APT5024BLL\_SLL

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
$C_{iss}$	Input Capacitance	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1 \text{ MHz}$		1900		pF
$C_{oss}$	Output Capacitance			417		
$C_{rss}$	Reverse Transfer Capacitance			27		
$Q_g$	Total Gate Charge ③	$V_{GS} = 10V$ $V_{DD} = 250V$ $I_D = 22A @ 25^\circ C$		43		nC
$Q_{gs}$	Gate-Source Charge			12		
$Q_{gd}$	Gate-Drain ("Miller") Charge			24		
$t_{d(on)}$	Turn-on Delay Time	<b>RESISTIVE SWITCHING</b> $V_{GS} = 15V$ $V_{DD} = 250V$ $I_D = 22A @ 25^\circ C$ $R_G = 1.6\Omega$		8		ns
$t_r$	Rise Time			6		
$t_{d(off)}$	Turn-off Delay Time			18		
$t_f$	Fall Time			2		
$E_{on}$	Turn-on Switching Energy ⑥	<b>INDUCTIVE SWITCHING @ 25°C</b> $V_{DD} = 333V, V_{GS} = 15V$ $I_D = 22A, R_G = 5\Omega$		167		$\mu J$
$E_{off}$	Turn-off Switching Energy			86		
$E_{on}$	Turn-on Switching Energy ⑥	<b>INDUCTIVE SWITCHING @ 125°C</b> $V_{DD} = 333V, V_{GS} = 15V$ $I_D = 22A, R_G = 5\Omega$		262		
$E_{off}$	Turn-off Switching Energy			99		

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$I_S$	Continuous Source Current (Body Diode)			22	Amps
$I_{SM}$	Pulsed Source Current ① (Body Diode)			88	
$V_{SD}$	Diode Forward Voltage ② ( $V_{GS} = 0V, I_S = -I_D 22A$ )			1.3	Volts
$t_{rr}$	Reverse Recovery Time ( $I_S = -I_D 22A, di_S/dt = 100A/\mu s$ )		516		ns
$Q_{rr}$	Reverse Recovery Charge ( $I_S = -I_D 22A, di_S/dt = 100A/\mu s$ )		7		$\mu C$
$dv/dt$	Peak Diode Recovery $dv/dt$ ⑤			8	V/ns

## THERMAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.47	$^\circ C/W$
$R_{\theta JA}$	Junction to Ambient			40	

① Repetitive Rating: Pulse width limited by maximum junction temperature

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

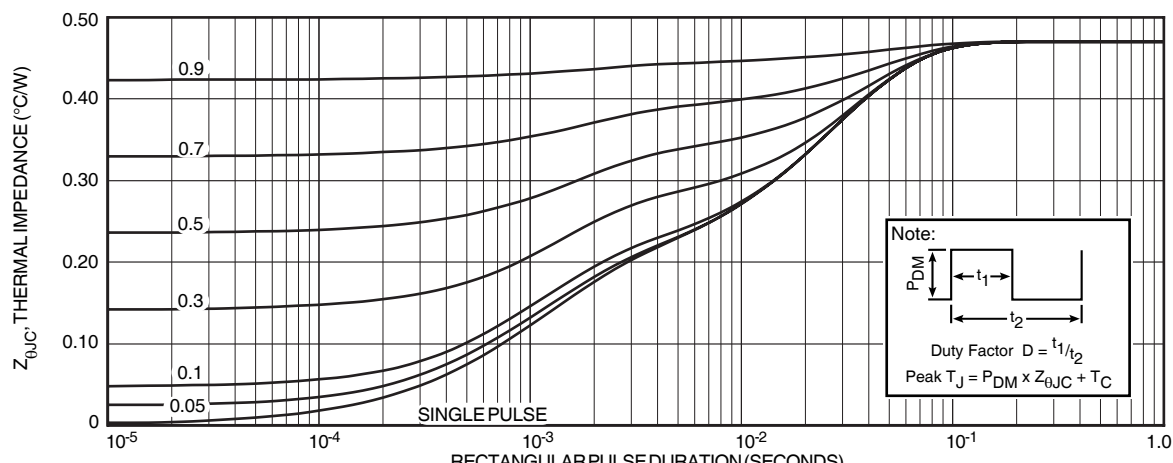
③ See MIL-STD-750 Method 3471

APT Reserves the right to change, without notice, the specifications and information contained herein.

④ Starting  $T_J = +25^\circ C$ ,  $L = 3.97mH$ ,  $R_G = 25\Omega$ , Peak  $I_L = 22A$

⑤  $dv/dt$  numbers reflect the limitations of the test circuit rather than the device itself.  $I_S \leq -I_D 22A$   $di/dt \leq 700A/\mu s$   $V_R \leq V_{DSS}$   $T_J \leq 150^\circ C$

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



Typical Performance Curves

APT5024BLL\_SLL

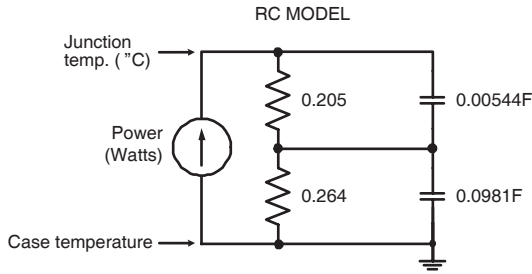


FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL

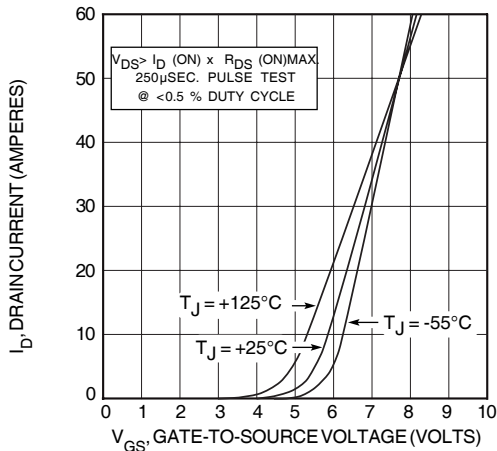


FIGURE 4, TRANSFER CHARACTERISTICS

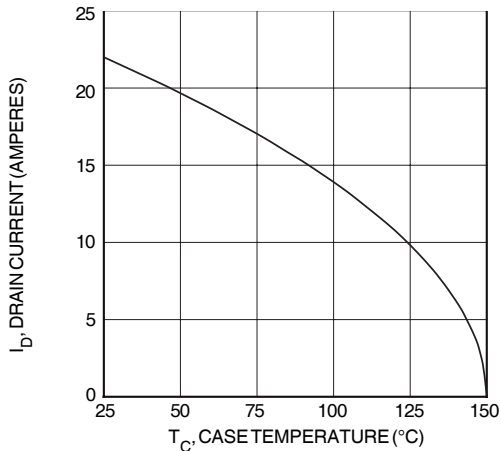


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

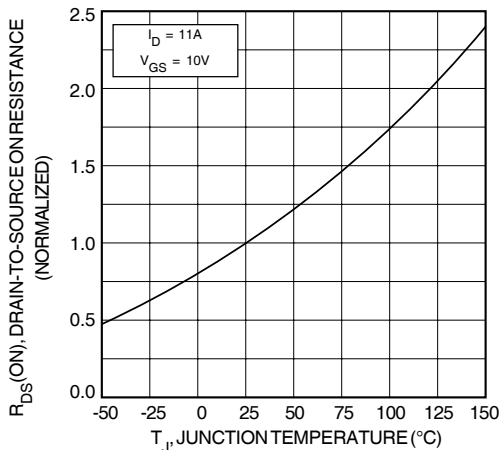


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

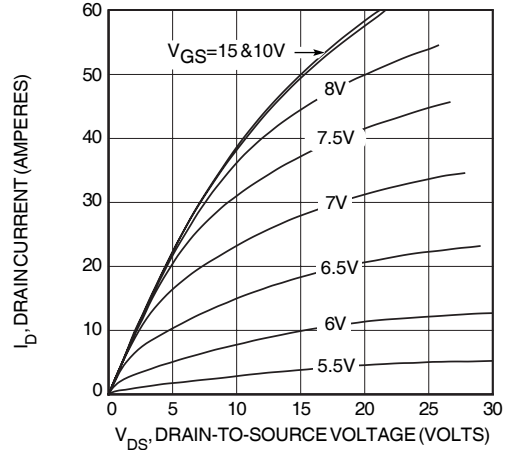


FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

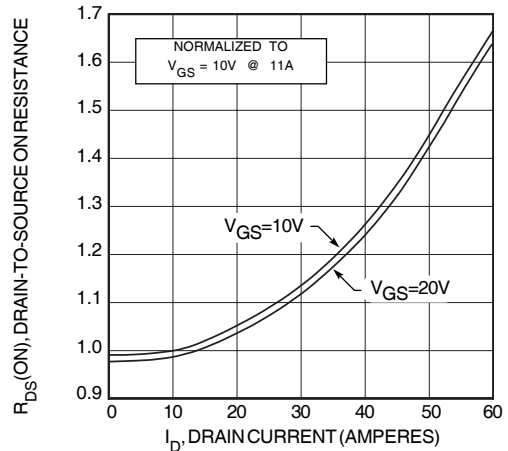


FIGURE 5,  $R_{DS(ON)}$  vs DRAIN CURRENT

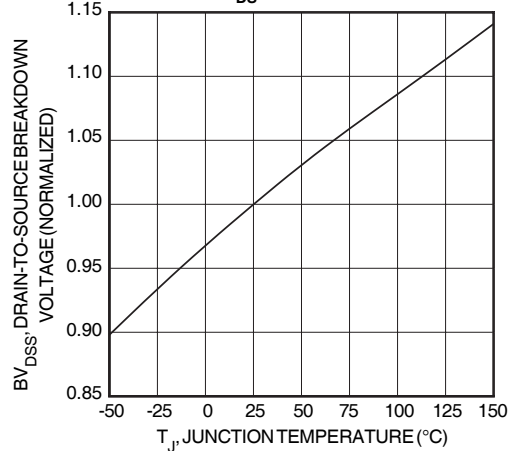


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

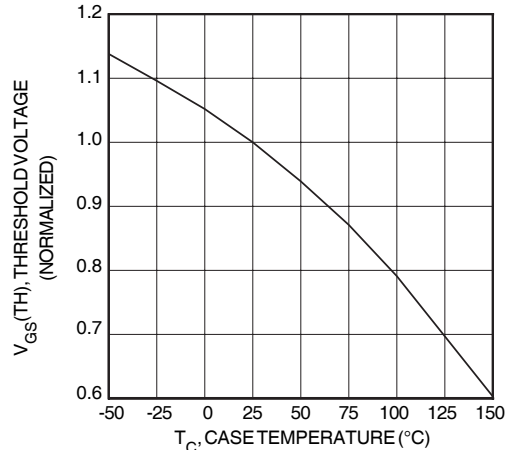


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

Typical Performance Curves

APT5024BLL\_SLL

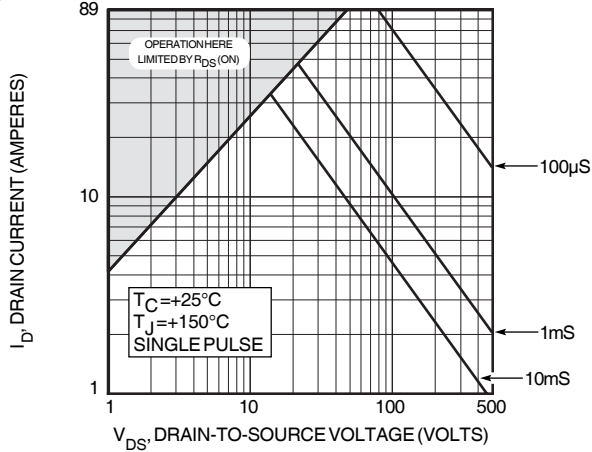


FIGURE 10, MAXIMUM SAFE OPERATING AREA

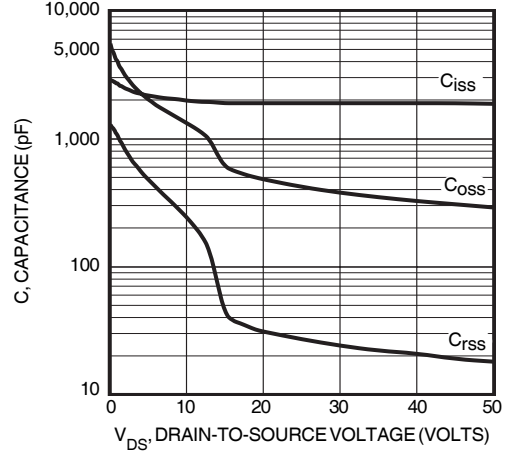


FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

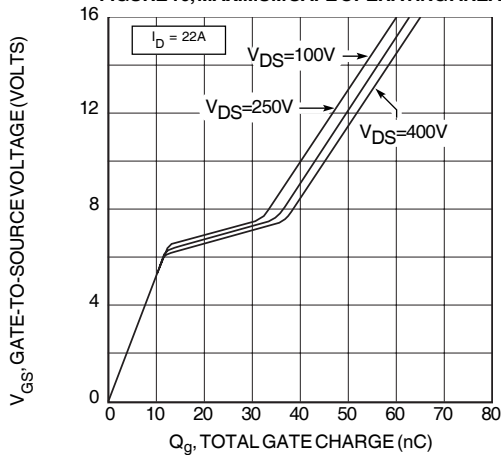


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

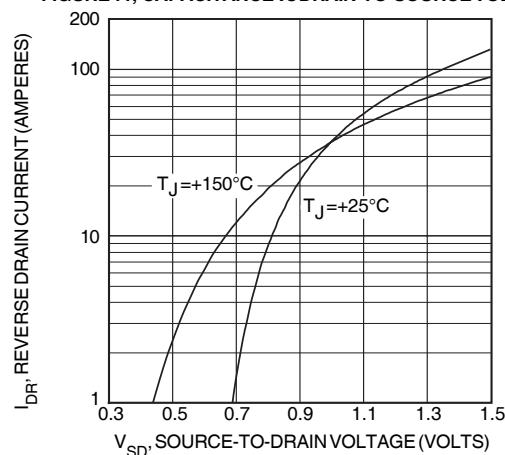


FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE

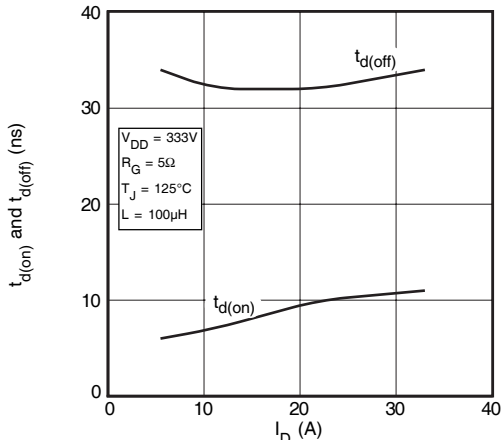


FIGURE 14, DELAY TIMES vs CURRENT

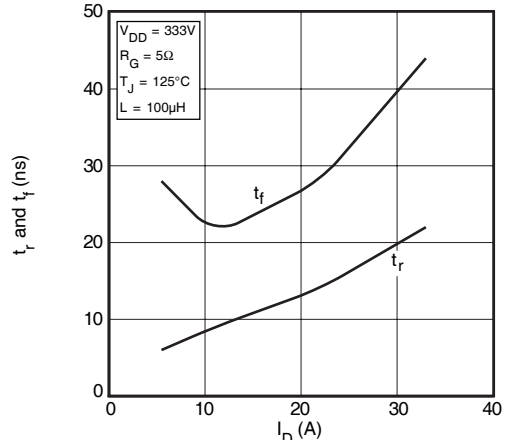


FIGURE 15, RISE AND FALL TIMES vs CURRENT

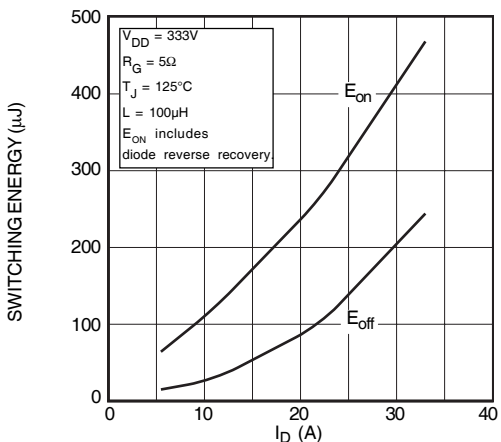


FIGURE 16, SWITCHING ENERGY vs CURRENT

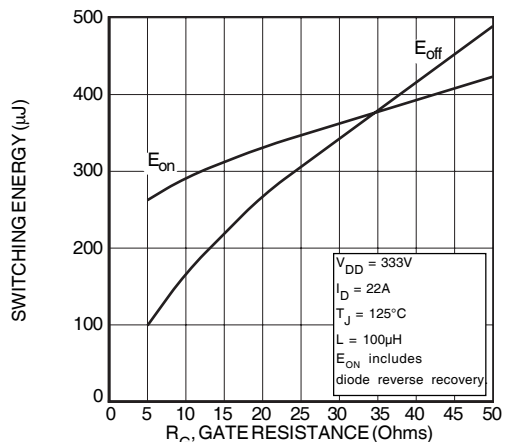


FIGURE 17, SWITCHING ENERGY vs. GATE RESISTANCE

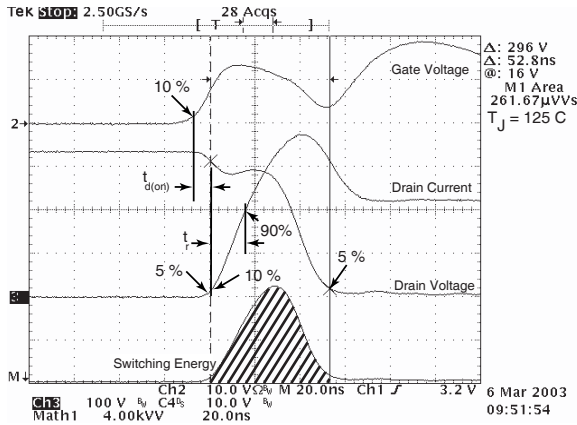


Figure 18, Turn-on Switching Waveforms and Definitions

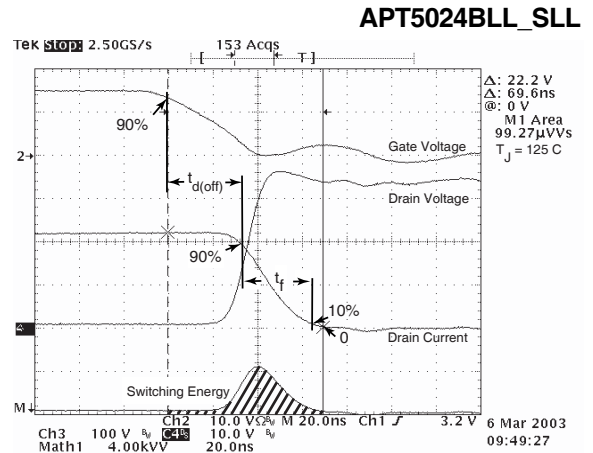


Figure 19, Turn-off Switching Waveforms and Definitions

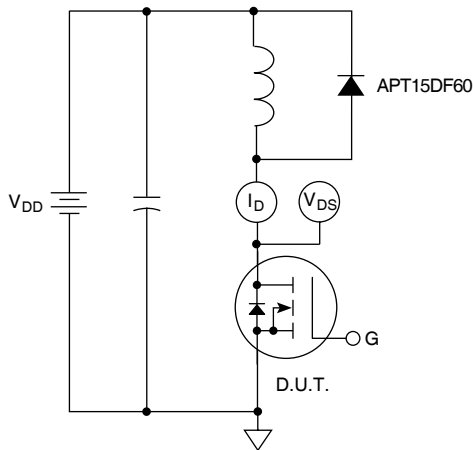
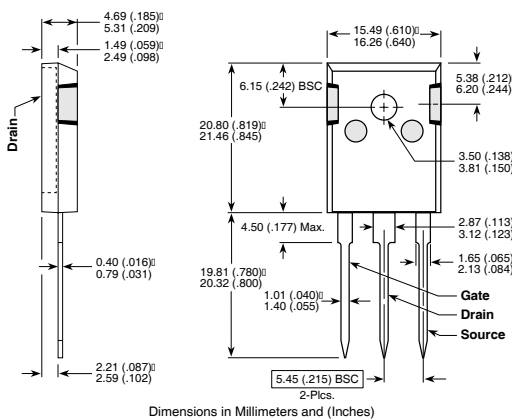


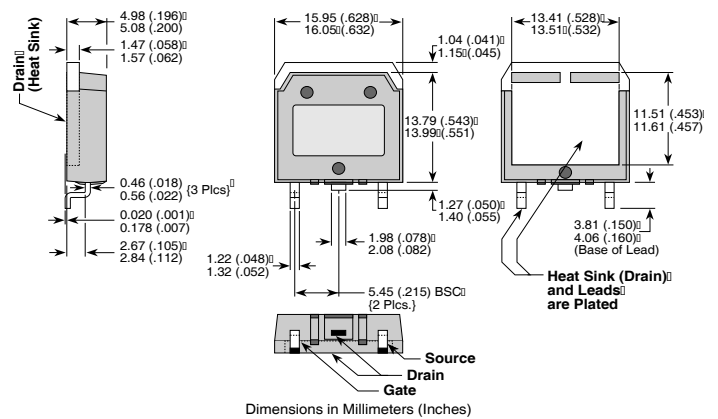
Figure 20, Inductive Switching Test Circuit

### TO-247 Package Outline



Dimensions in Millimeters and (Inches)

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



Dimensions in Millimeters (Inches)