WINSOURCE ELECTRONICS

THE DATASHEET OF

APT31N60BCSG

ADVANCED POWER TECHNOLOGY®

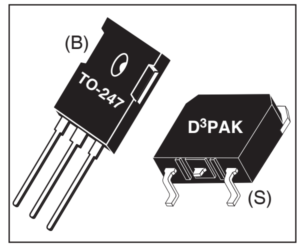
600V 31A 0.100Ω

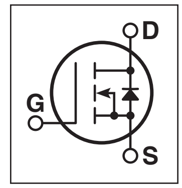
APT31N60BCS APT31N60SCS
APT31N60BCSG* APT31N60SCSG*

***G Denotes RoHS Compliant, Pb Free Terminal Finish.**

COOLMOS Power Semiconductors

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^3 Package**

MAXIMUM RATINGS

All Ratings: T_C = 25°C unless otherwise specified.

Symbol	Parameter	APT31N60B_SCS(G)	UNIT
V_{DSS}	Drain-Source Voltage	600	Volts
I_D	Continuous Drain Current @ T_C = 25°C	31	Amps
	Continuous Drain Current @ T_C = 100°C	19	
I_{DM}	Pulsed Drain Current ①	93	
V_{GS}	Gate-Source Voltage Continuous	±30	Volts
P_D	Total Power Dissipation @ T_C = 25°C	255	Watts
	Linear Derating Factor	2.00	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	
$^{dv}/_{dt}$	MOSFET dv/dt Ruggedness (V_{DS} = 480V)	50	V/ns
I_{AR}	Avalanche Current ②	11	Amps
E_{AR}	Repetitive Avalanche Energy ②	1.2	mJ
E_{AS}	Single Pulse Avalanche Energy ③	800	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage (V_{GS} = 0V, I_D = 250μA)	600			Volts
$R_{DS(on)}$	Drain-Source On-State Resistance ② (V_{GS} = 10V, I_D = 18A)			0.100	Ohms
I_{DSS}	Zero Gate Voltage Drain Current (V_{DS} = 600V, V_{GS} = 0V)			10	μA
	Zero Gate Voltage Drain Current (V_{DS} = 600V, V_{GS} = 0V, T_C = 150°C)		TBD		
I_{GSS}	Gate-Source Leakage Current (V_{GS} = ±20V, V_{DS} = 0V)			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = 1.2mA)	2.1	3	3.9	Volts

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

APT Website - http://www.advancedpower.com

"COOLMOS™ comprise a new family of transistors developed by Infineon Technologies AG. "COOLMOS" is a trademark of Infineon Technologies AG."

050-7238 Rev A 1-2007

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1 MHz		3055		pF
C_{oss}	Output Capacitance			3260		
C_{rss}	Reverse Transfer Capacitance			28		
Q_g	Total Gate Charge ⑤	V_{GS} = 10V V_{DD} = 400V I_D = 18A @ 25°C		65	85	nC
Q_{gs}	Gate-Source Charge			14		
Q_{gd}	Gate-Drain ("Miller") Charge			22		
$t_{d(on)}$	Turn-on Delay Time	**RESISTIVE SWITCHING** V_{GS} = 15V V_{DD} = 400V I_D = 18A @ 25°C R_G = 3.3Ω		10		ns
t_r	Rise Time			5		
$t_{d(off)}$	Turn-off Delay Time			110		
t_f	Fall Time			5		
E_{on}	Turn-on Switching Energy ⑥	**INDUCTIVE SWITCHING @ 25°C** V_{DD} = 400V, V_{GS} = 15V I_D = 18A, R_G = 4.3Ω		290		µJ
E_{off}	Turn-off Switching Energy			125		
E_{on}	Turn-on Switching Energy ⑥	**INDUCTIVE SWITCHING @ 125°C** V_{DD} = 400V, V_{GS} = 15V I_D = 18A, R_G = 4.3Ω		170		
E_{off}	Turn-off Switching Energy			100		

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
I_S	Continuous Source Current (Body Diode)			18	Amps
I_{SM}	Pulsed Source Current ① (Body Diode)			93	
V_{SD}	Diode Forward Voltage ④ (V_{GS} = 0V, I_S = -18A)			1.2	Volts
t_{rr}	Reverse Recovery Time (I_S = -18A, dI_S/dt = 100A/µs)		450		ns
Q_{rr}	Reverse Recovery Charge (I_S = -18A, dI_S/dt = 100A/µs)		12		µC
$^{dv}/_{dt}$	Peak Diode Recovery $^{dv}/_{dt}$ ⑦			4	V/ns

THERMAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.5	°C/W
$R_{\theta JA}$	Junction to Ambient			62	

① Repetitive Rating: Pulse width limited by maximum junction temperature

② Repetitive avalanche causes additional power losses that can be calculated as $P_{AV} = E_{AR}*f$

③ Starting T_j = +25°C, L = 33.23mH, R_G = 25Ω, Peak I_L = 11A

④ Pulse Test: Pulse width < 380µs, Duty Cycle < 2%

⑤ See MIL-STD-750 Method 3471

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

⑦ We do not recommend using this CoolMOS™ product in topologies that have fee wheeling load current conducted in the body diode that is hard commutated. The current commutation is very "snappy", resulting in high di/dt at the completion of commutation, and the likelihood of severe over-voltage transients due to the resulting high dv/dt.

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

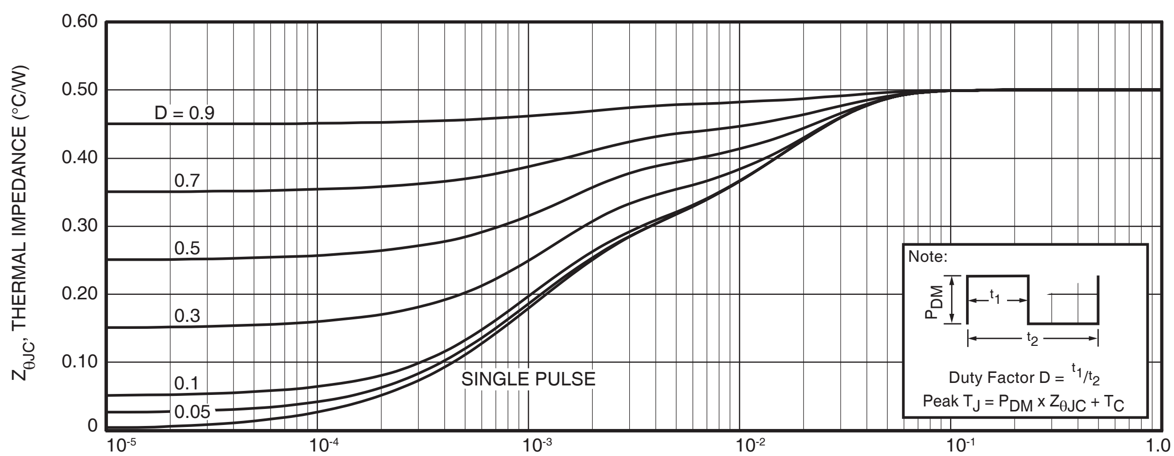


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

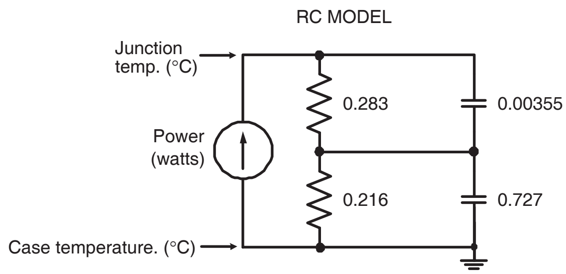


FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL

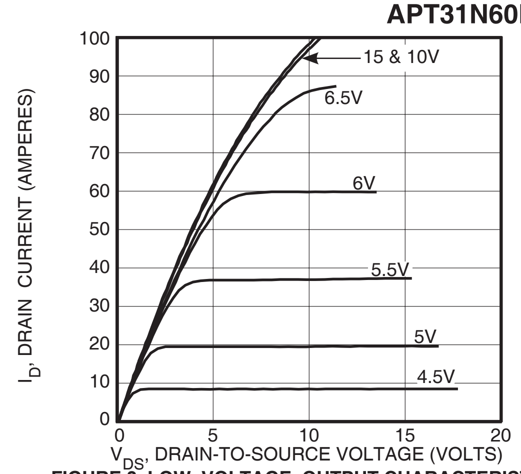


FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

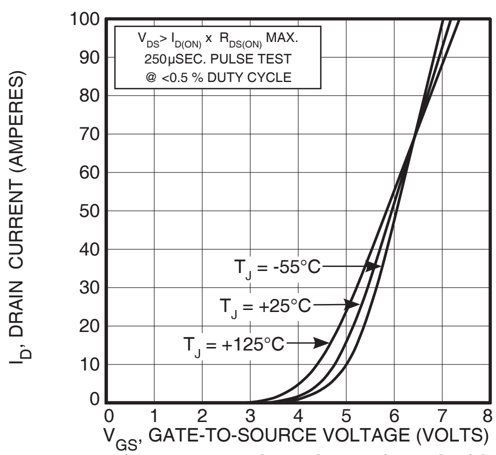


FIGURE 4, TRANSFER CHARACTERISTICS

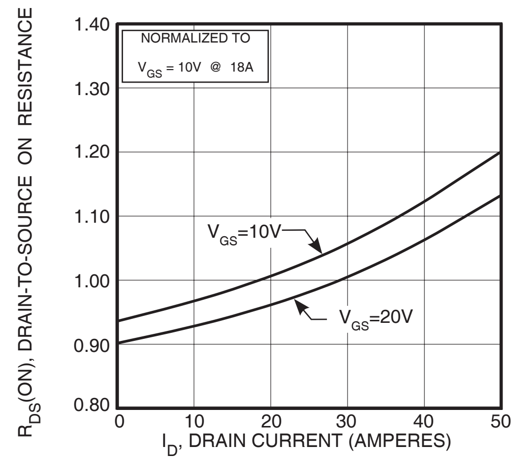


FIGURE 5, R_{DS}(ON) vs DRAIN CURRENT

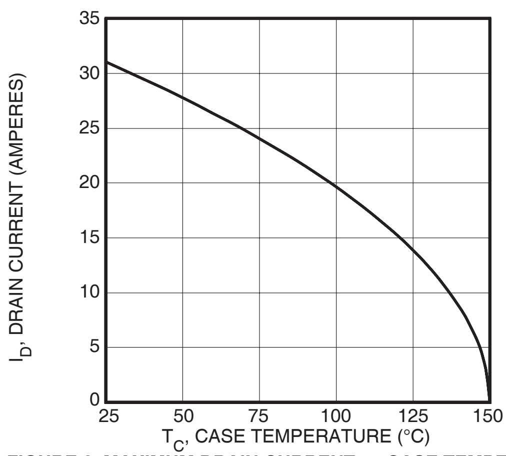


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

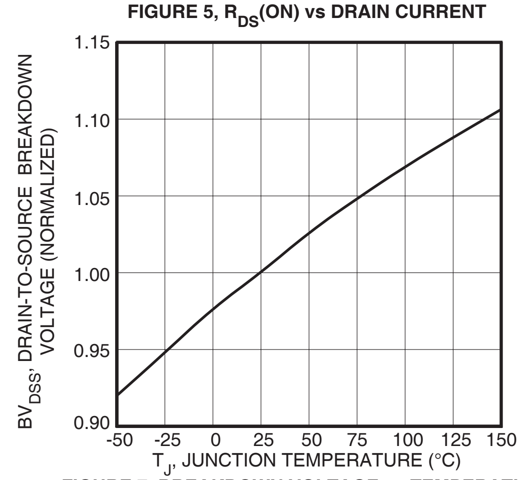


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

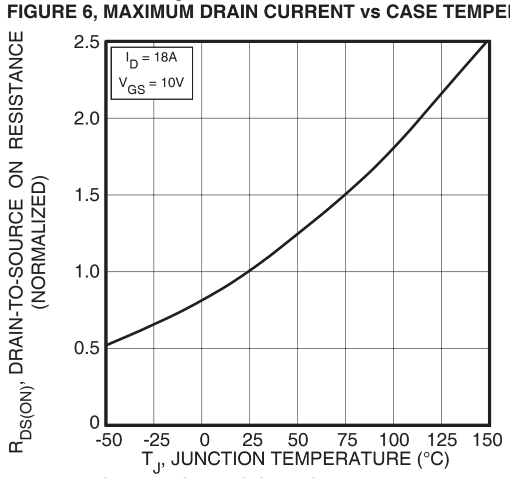


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

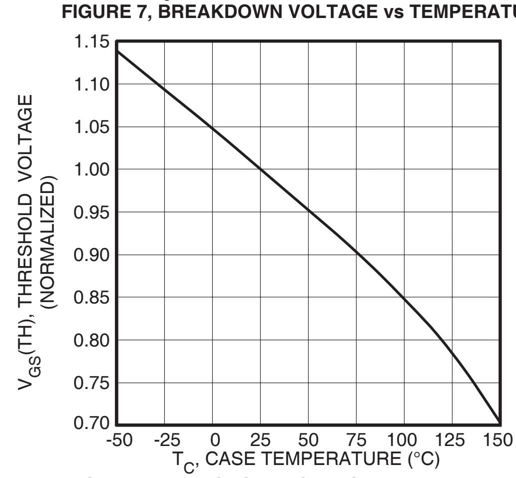


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

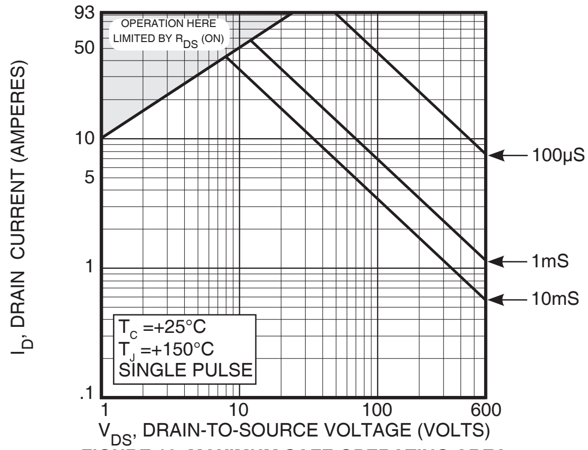


FIGURE 10, MAXIMUM SAFE OPERATING AREA

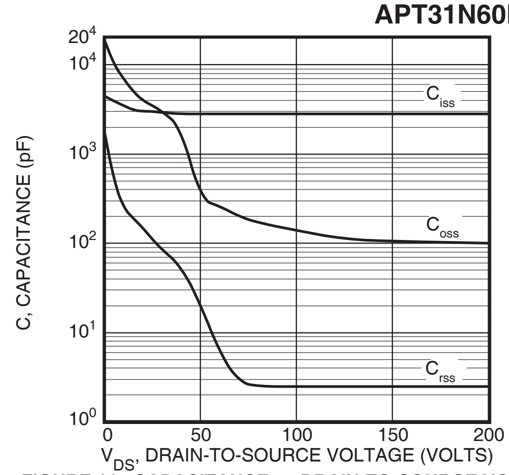


FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

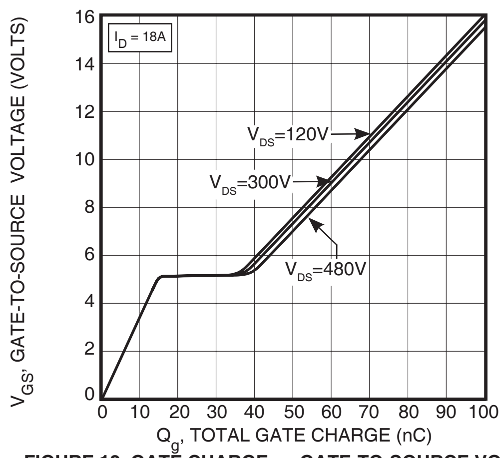


FIGURE 12, GATE CHARGE vs GATE-TO-SOURCE VOLTAGE

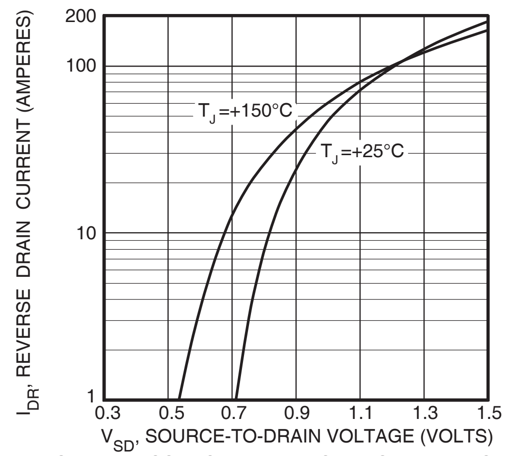


FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE

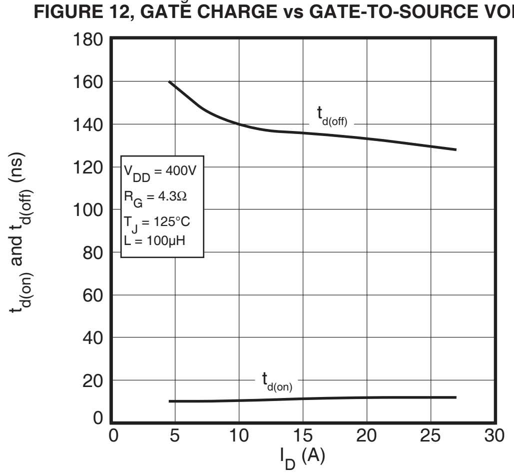


FIGURE 14, DELAY TIMES vs CURRENT

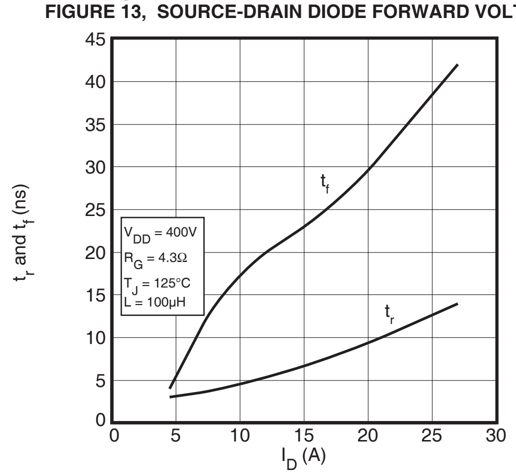


FIGURE 15, RISE AND FALL TIMES vs CURRENT

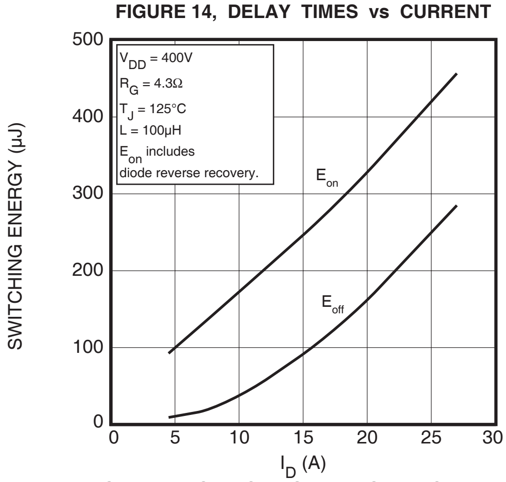


FIGURE 16, SWITCHING ENERGY vs CURRENT

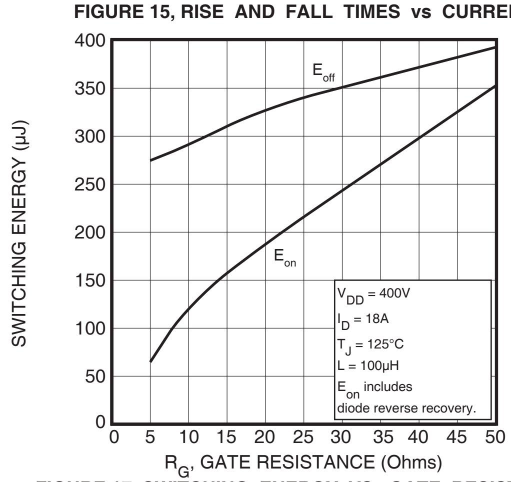


FIGURE 17, SWITCHING ENERGY VS. GATE RESISTANCE

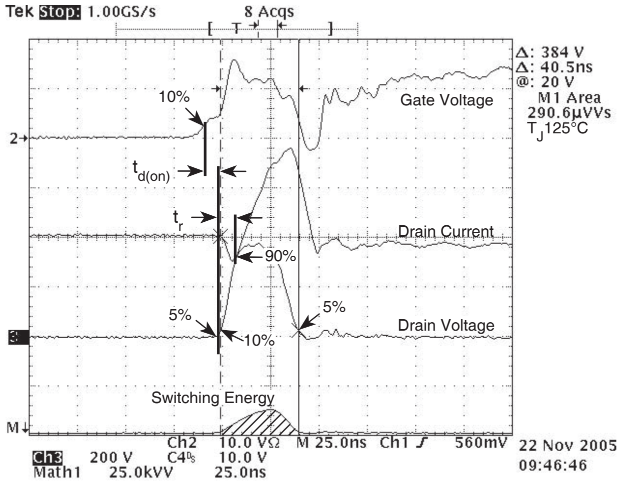


Figure 18, Turn-on Switching Waveforms and Definitions

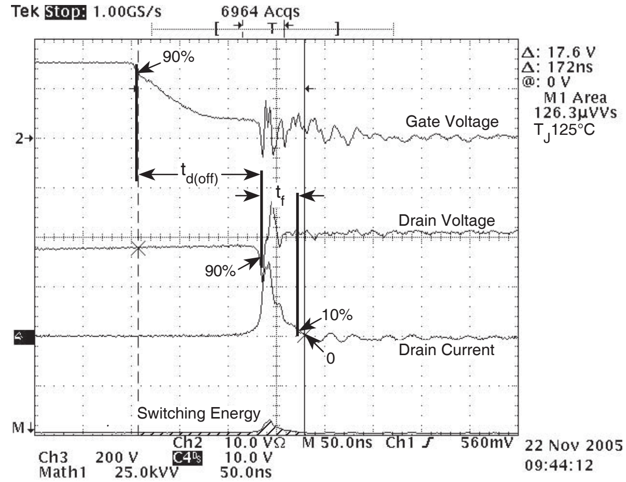


Figure 19, Turn-off Switching Waveforms and Definitions

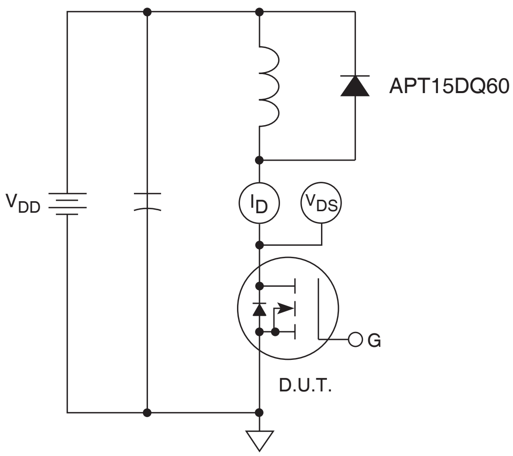
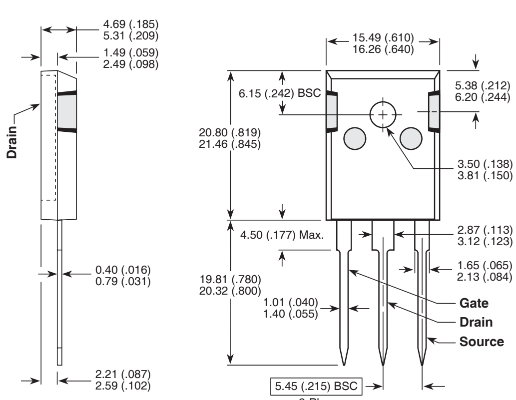


Figure 20, Inductive Switching Test Circuit

TO-247 Package Outline

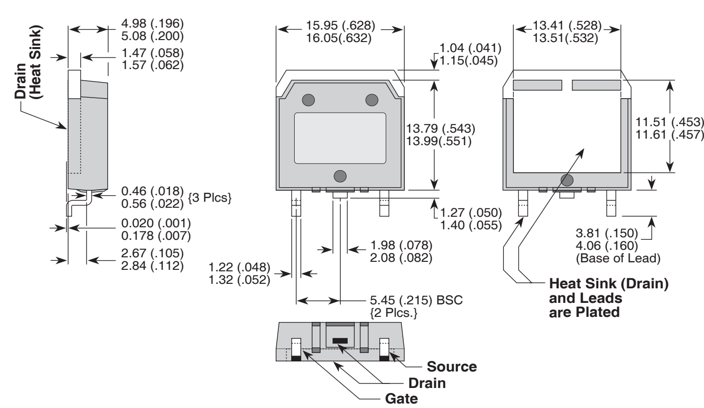
(e1) SAC: Tin, Silver, Copper



Dimensions in Millimeters and (Inches)

D3PAK Package Outline

(e3) 100% Sn



Dimensions in Millimeters (Inches)