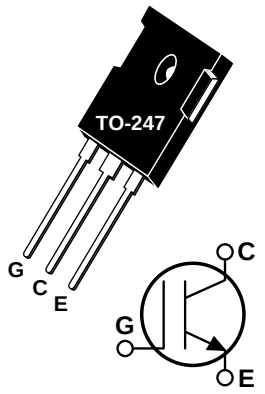
APT20GT60BR

600V 40A

Thunderbolt IGBT™



The Thunderbolt IGBT™ is a new generation of high voltage power IGBTs. Using Non-Punch Through Technology the Thunderbolt IGBT™ offers superior ruggedness and ultrafast switching speed.

- **Low Forward Voltage Drop**
- **High Freq. Switching to 150KHz**
- **Low Tail Current**
- **Ultra Low Leakage Current**
- **Avalanche Rated**
- **RBSOA and SCSOA Rated**

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

Symbol	Parameter	APT20GT60BR	UNIT
V_{CES}	Collector-Emitter Voltage	600	Volts
V_{CGR}	Collector-Gate Voltage (R_{GE} = 20KΩ)	600	
V_{EC}	Emitter-Collector Voltage	15	
V_{GE}	Gate-Emitter Voltage	±20	
I_{C1}	Continuous Collector Current @ T_C = 25°C	40	Amps
I_{C2}	Continuous Collector Current @ T_C = 90°C	20	
I_{CM}	Pulsed Collector Current ① @ T_C = 25°C	80	
I_{LM}	RBSOA Clamped Inductive Load Current @ R_g = 11Ω T_C = 125°C	40	
E_{AS}	Single Pulse Avalanche Energy ②	40	mJ
P_D	Total Power Dissipation	175	Watts
T_J,T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	°C
T_L	Max. Lead Temp. for Soldering: 0.063" from Case for 10 Sec.	300	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
BV_{CES}	Collector-Emitter Breakdown Voltage (V_{GE} = 0V, I_C = 0.5mA)	600			Volts
RBV_{CES}	Collector-Emitter Reverse Breakdown Voltage (V_{GE} = 0V, I_C = 50mA)	-15			
$V_{GE}(TH)$	Gate Threshold Voltage (V_{CE} = V_{GE}, I_C = 500µA, T_j = 25°C)	3	4	5	
$V_{CE}(ON)$	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = I_{C2}, T_j = 25°C)	1.6	2.0	2.5	
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = I_{C2}, T_j = 125°C)			2.8	
I_{CES}	Collector Cut-off Current (V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 25°C)			40	µA
	Collector Cut-off Current (V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 125°C)			1000	
I_{GES}	Gate-Emitter Leakage Current (V_{GE} = ±20V, V_{CE} = 0V)			±100	nA

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

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

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052-6210 RevC 3-2001

DYNAMIC CHARACTERISTICS

APT20GT60BR

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	**Capacitance** V_{GE} = 0V, V_{CE} = 25V, f = 1 MHz		1045	1200	pF
C_{oes}	Output Capacitance			110	160	
C_{res}	Reverse Transfer Capacitance			65	110	
Q_g	Total Gate Charge ③	**Gate Charge** V_{GE} = 15V, V_{CC} = 0.5V_{CES}, I_C = I_{C2}		91	140	nC
Q_{ge}	Gate-Emitter Charge			5.9	10	
Q_{gc}	Gate-Collector ("Miller") Charge			40	60	
$t_d(on)$	Turn-on Delay Time	**Resistive Switching (25°C)** V_{GE} = 15V, V_{CC} = 0.5V_{CES}, I_C = I_{C2}, R_G = 10Ω		9.0	20	ns
t_r	Rise Time			27	50	
$t_d(off)$	Turn-off Delay Time			112	170	
t_f	Fall Time			162	320	
$t_d(on)$	Turn-on Delay Time	**Inductive Switching (150°C)** V_{CLAMP}(Peak) = 0.66V_{CES}, V_{GE} = 15V, I_C = I_{C2}, R_G = 10Ω, T_J = +150°C		13	26	ns
t_r	Rise Time			15	30	
$t_d(off)$	Turn-off Delay Time			170	260	
t_f	Fall Time			110	220	
E_{on}	Turn-on Switching Energy			235	470	uJ
E_{off}	Turn-off Switching Energy			595	1190	
E_{ts}	Total Switching Losses			830	1660	
$t_d(on)$	Turn-on Delay Time	**Inductive Switching (25°C)** V_{CLAMP}(Peak) = 0.66V_{CES}, V_{GE} = 15V, I_C = I_{C2}, R_G = 10Ω, T_J = +25°C		12	20	ns
t_r	Rise Time			16	30	
$t_d(off)$	Turn-off Delay Time			129	190	
t_f	Fall Time			45	90	
E_{ts}	Total Switching Losses			575	1150	uJ
gfe	Forward Transconductance	V_{CE} = 20V, I_C = I_{C2}	4			S

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\Theta JC}$	Junction to Case			0.72	°C/W
$R_{\Theta JA}$	Junction to Ambient			40	
W_T	Package Weight		0.22		oz
			6.1		gm
Torque	Mounting Torque (using a 6-32 or 3mm Binding Head Machine Screw)			10	lb•in
				1.1	N•m

① Repetitive Rating: Pulse width limited by maximum junction temperature.

② I_C = I_{C2}, V_{CC} = 50V, R_{GE} = 25Ω, L = 200µH, T_j = 25°C

③ See MIL-STD-750 Method 3471

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

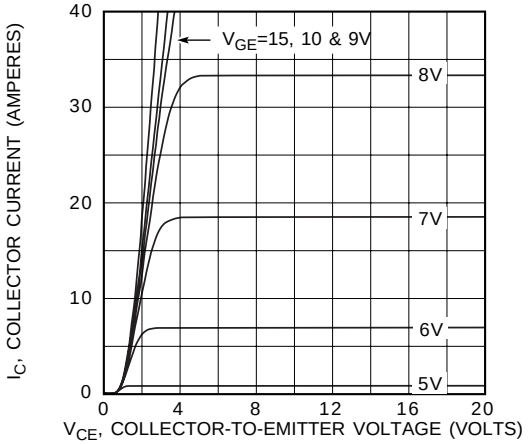


Figure 1, Typical Output Characteristics (T_J = 25°C)

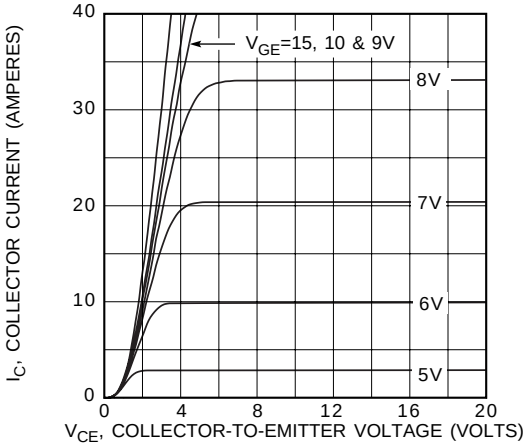


Figure 2, Typical Output Characteristics (T_J = 150°C)

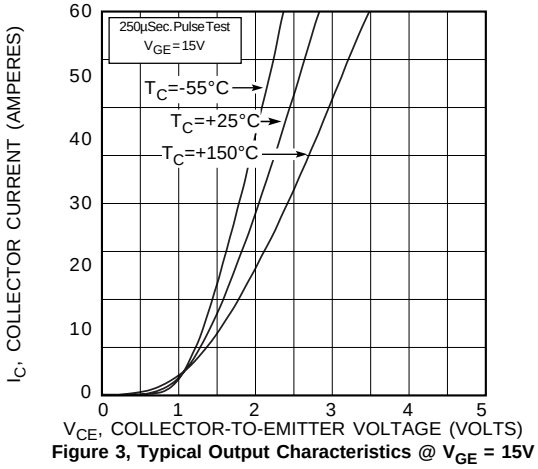


Figure 3, Typical Output Characteristics @ V_{GE} = 15V

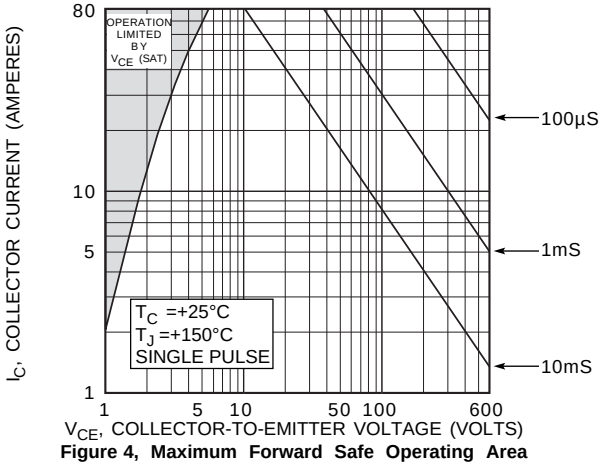


Figure 4, Maximum Forward Safe Operating Area

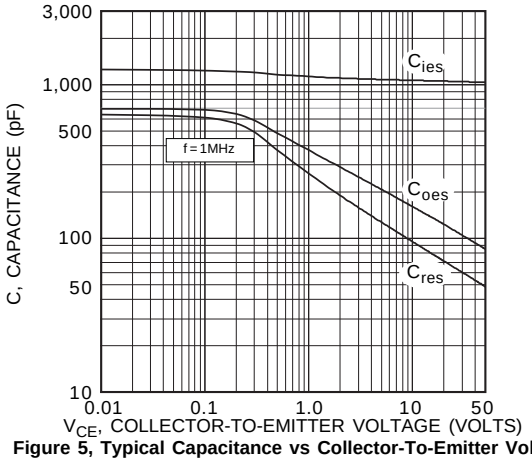


Figure 5, Typical Capacitance vs Collector-To-Emitter Voltage

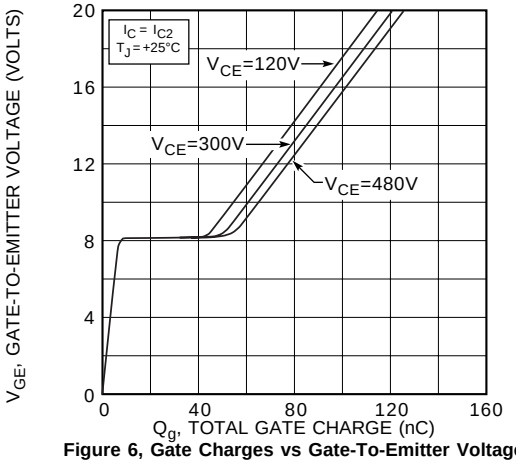


Figure 6, Gate Charges vs Gate-To-Emitter Voltage

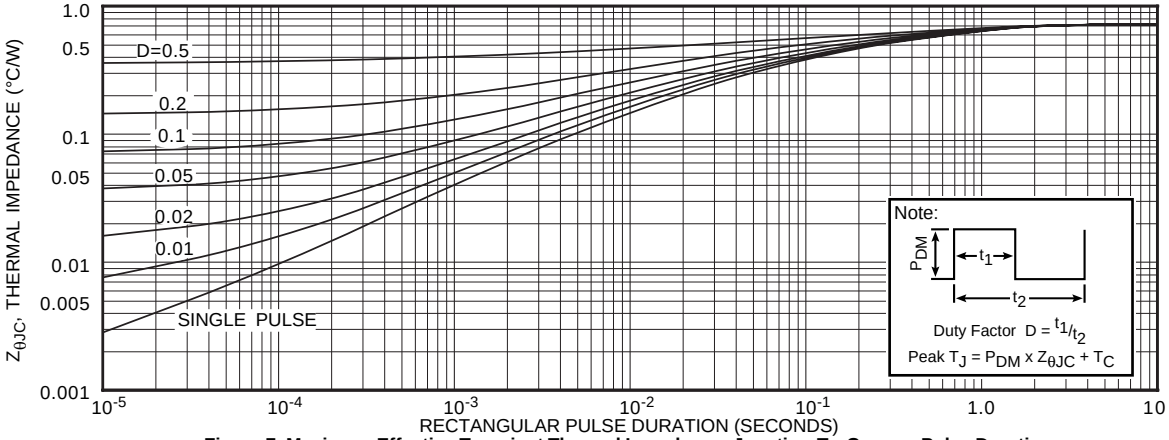


Figure 7, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

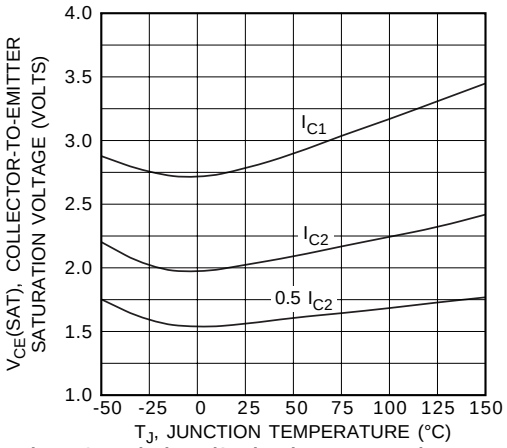


Figure 8, Typical V_{CE}(SAT) Voltage vs Junction Temperature

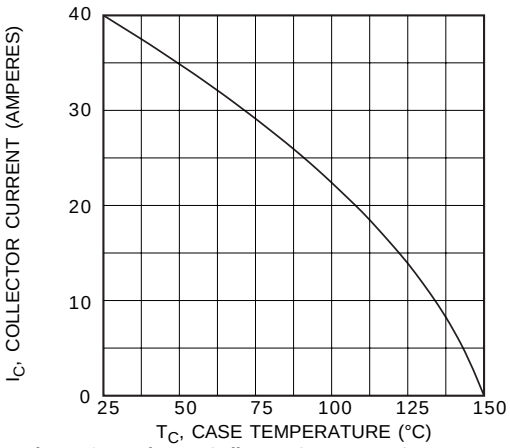


Figure 9, Maximum Collector Current vs Case Temperature

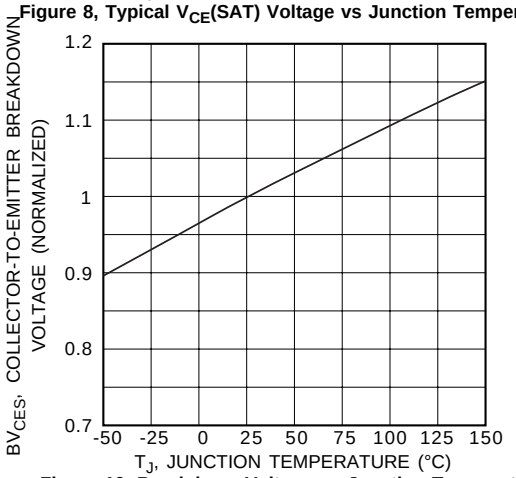


Figure 10, Breakdown Voltage vs Junction Temperature

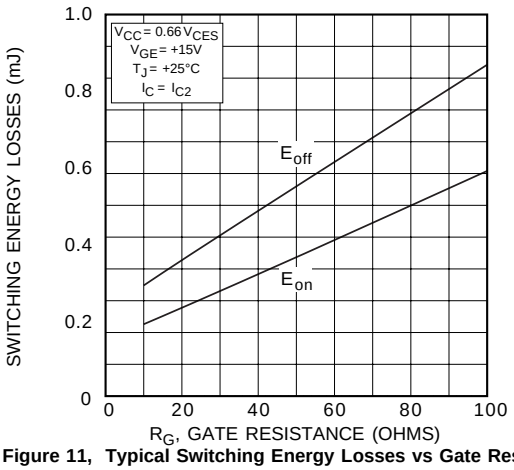


Figure 11, Typical Switching Energy Losses vs Gate Resistance

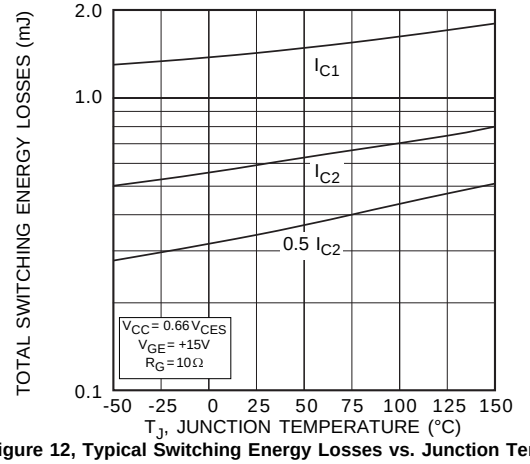


Figure 12, Typical Switching Energy Losses vs. Junction Temperature

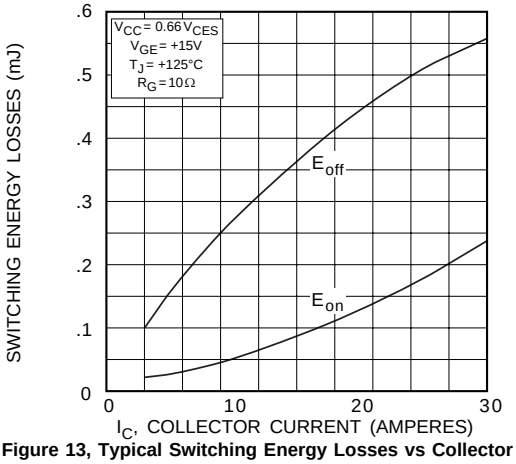


Figure 13, Typical Switching Energy Losses vs Collector Current

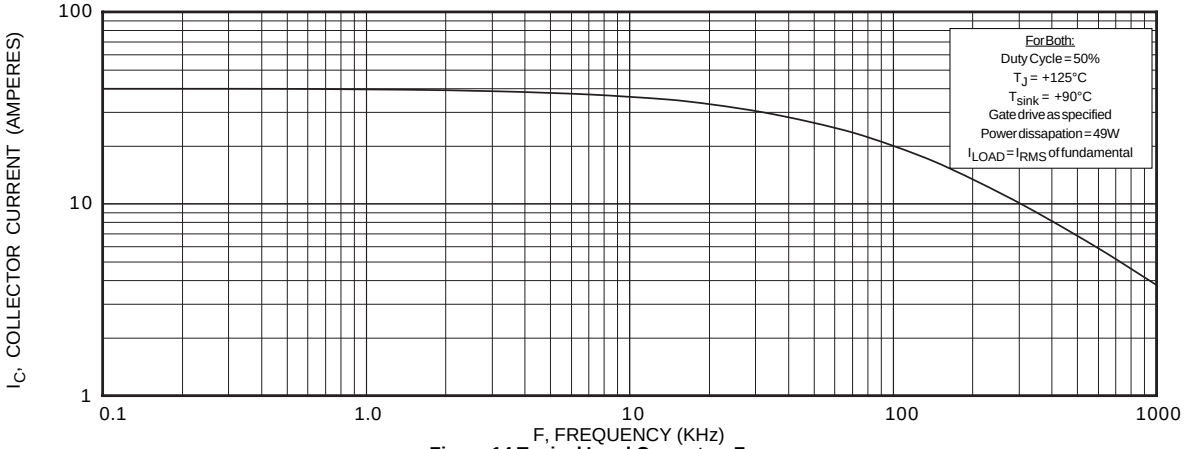


Figure 14,Typical Load Current vs Frequency

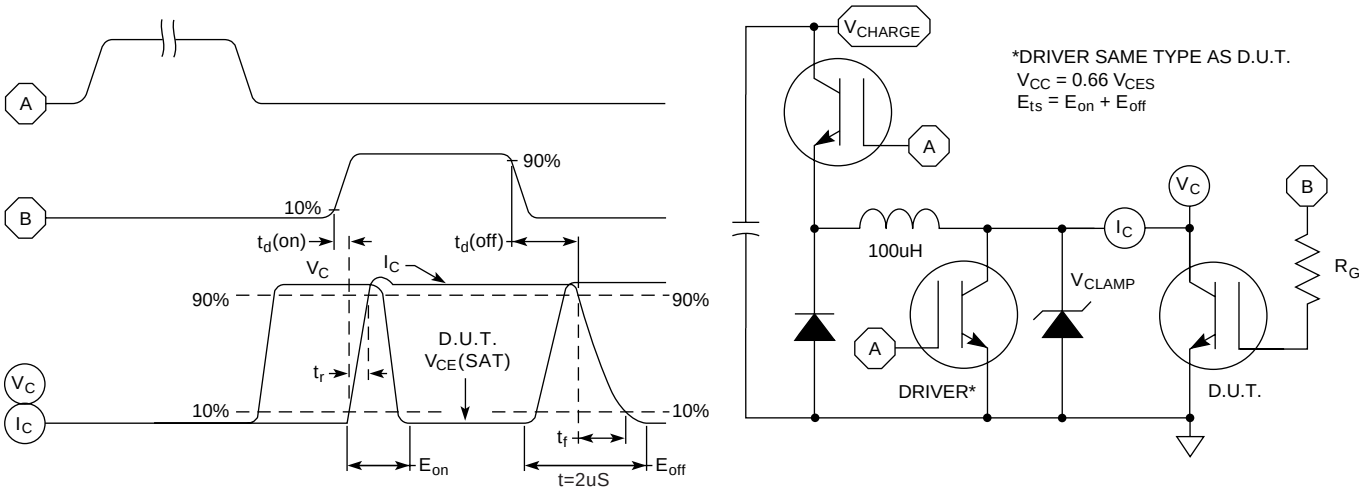


Figure 15, Switching Loss Test Circuit and Waveforms

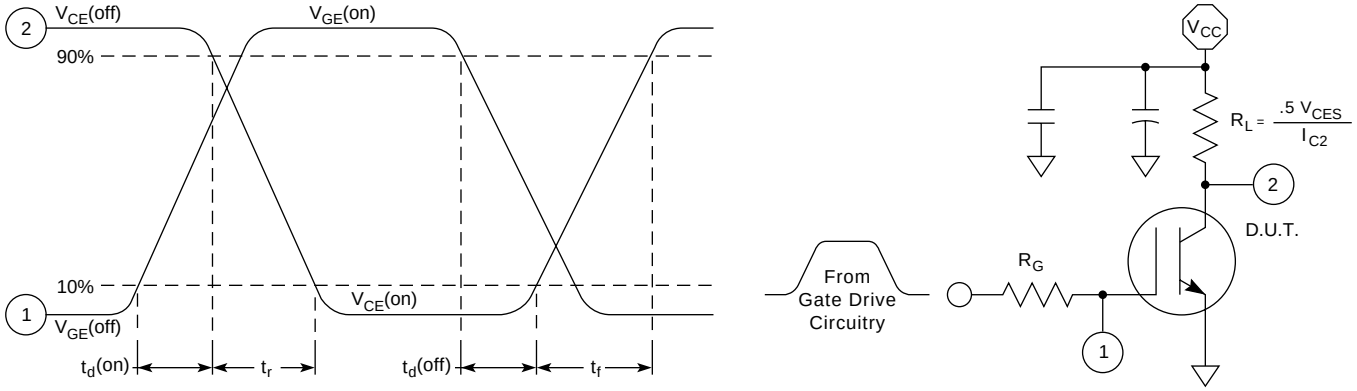
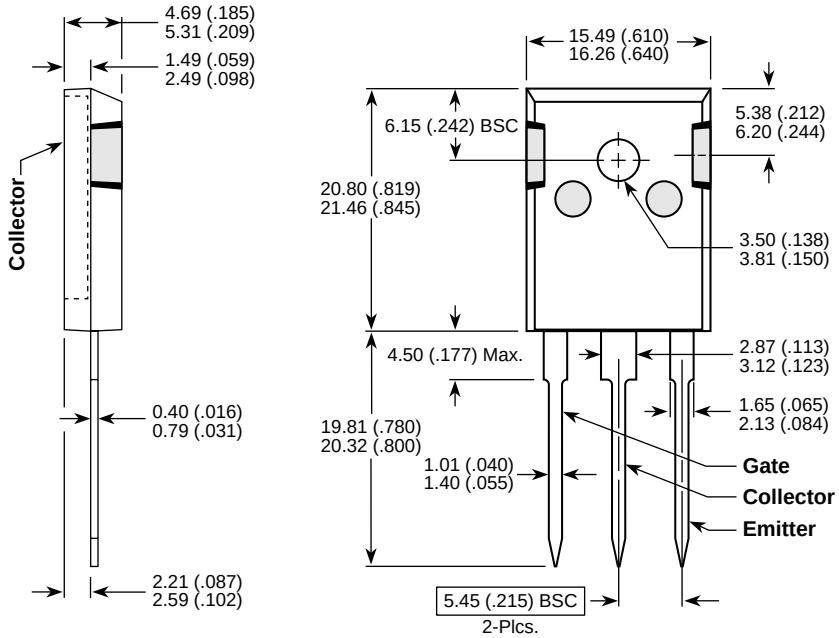


Figure 16, Resistive Switching Time Test Circuit and Waveforms

T0-247 Package Outline



Dimensions in Millimeters and (Inches)

APT's devices are covered by one or more of the following U.S.patents: 4,895,810 5,045,903 5,089,434 5,182,234 5,019,522 5,262,336 5,256,583 4,748,103 5,283,202 5,231,474 5,434,095 5,528,058