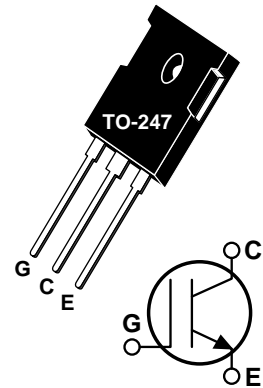


## Fast IGBT

The Fast IGBT is a new generation of high voltage power IGBTs. Using Non-Punch Through Technology the Fast IGBT offers superior ruggedness, fast switching speed and low Collector-Emitter On voltage.

- Low Forward Voltage Drop
- Low Tail Current
- RBSOA and SCSOA Rated
- High Freq. Switching to 20KHz
- Ultra Low Leakage Current



### MAXIMUM RATINGS (IGBT)

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

Symbol	Parameter	APT33GF120BR	UNIT
$V_{CES}$	Collector-Emitter Voltage	1200	Volts
$V_{CGR}$	Collector-Gate Voltage ( $R_{GE} = 20\text{K}\Omega$ )	1200	
$V_{GE}$	Gate Emitter Voltage	$\pm 20$	
$I_{C1}$	Continuous Collector Current @ $T_C = 25^\circ\text{C}$	52	Amps
$I_{C2}$	Continuous Collector Current @ $T_C = 105^\circ\text{C}$	33	
$I_{CM}$	Pulsed Collector Current <sup>①</sup> @ $T_C = 25^\circ\text{C}$	104	
$I_{LM}$	RBSOA Clamped Inductive Load Current @ $R_g = 11\Omega$ $T_C = 125^\circ\text{C}$	66	
$E_{AS}$	Single Pulse Avalanche Energy <sup>②</sup>	65	mJ
$P_D$	Total Power Dissipation	297	Watts
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 150	$^\circ\text{C}$
$T_L$	Max. Lead Temp. for Soldering: 0.063" from Case for 10 Sec.	300	

### STATIC ELECTRICAL CHARACTERISTICS (IGBT)

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$BV_{CES}$	Collector-Emitter Breakdown Voltage ( $V_{GE} = 0\text{V}$ , $I_C = 0.5\text{mA}$ )	1200			Volts
$V_{GE(TH)}$	Gate Threshold Voltage ( $V_{CE} = V_{GE}$ , $I_C = 700\mu\text{A}$ , $T_j = 25^\circ\text{C}$ )	4.5	5.5	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage ( $V_{GE} = 15\text{V}$ , $I_C = 25\text{A}$ , $T_j = 25^\circ\text{C}$ )		2.7	3.2	
	Collector-Emitter On Voltage ( $V_{GE} = 15\text{V}$ , $I_C = 25\text{A}$ , $T_j = 125^\circ\text{C}$ )		3.3	3.9	
$I_{CES}$	Collector Cut-off Current ( $V_{CE} = V_{CES}$ , $V_{GE} = 0\text{V}$ , $T_j = 25^\circ\text{C}$ )			0.5	mA
	Collector Cut-off Current ( $V_{CE} = V_{CES}$ , $V_{GE} = 0\text{V}$ , $T_j = 125^\circ\text{C}$ )			5.0	
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{GE} = \pm 20\text{V}$ , $V_{CE} = 0\text{V}$ )			$\pm 100$	nA

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

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

## DYNAMIC CHARACTERISTICS (IGBT)

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
$C_{ies}$	Input Capacitance	<b>Capacitance</b> $V_{GE} = 0V$ $V_{CE} = 25V$ $f = 1\text{ MHz}$		1855		pF
$C_{oes}$	Output Capacitance			230		
$C_{res}$	Reverse Transfer Capacitance			110		
$Q_g$	Total Gate Charge <sup>③</sup>	<b>Gate Charge</b> $V_{GE} = 15V$ $V_{CC} = 0.5V_{CES}$ $I_C = I_{C2}$		170		nC
$Q_{ge}$	Gate-Emitter Charge			19		
$Q_{gc}$	Gate-Collector ("Miller") Charge			100		
$t_{d(on)}$	Turn-on Delay Time	<b>Resistive Switching (25°C)</b> $V_{GE} = 15V$ $V_{CC} = 0.8V_{CES}$ $I_C = I_{C2}$ $R_G = 10\Omega$		24		ns
$t_r$	Rise Time			85		
$t_{d(off)}$	Turn-off Delay Time			170		
$t_f$	Fall Time			125		
$t_{d(on)}$	Turn-on Delay Time	<b>Inductive Switching (150°C)</b> $V_{CLAMP(Peak)} = 0.66V_{CES}$ $V_{GE} = 15V$ $I_C = I_{C2}$ $R_G = 10\Omega$ $T_J = +150^\circ\text{C}$		25		ns
$t_r$	Rise Time			60		
$t_{d(off)}$	Turn-off Delay Time			210		
$t_f$	Fall Time			74		
$E_{on}$	Turn-on Switching Energy			2.8		
$E_{off}$	Turn-off Switching Energy		2.8			
$E_{ts}$	Total Switching Losses		5.6			
$t_{d(on)}$	Turn-on Delay Time	<b>Inductive Switching (25°C)</b> $V_{CLAMP(Peak)} = 0.66V_{CES}$ $V_{GE} = 15V$ $I_C = I_{C2}$ $R_G = 10\Omega$ $T_J = +25^\circ\text{C}$		27		ns
$t_r$	Rise Time			65		
$t_{d(off)}$	Turn-off Delay Time			190		
$t_f$	Fall Time			70		
$E_{ts}$	Total Switching Losses			5.2		
gfe	Forward Transconductance	$V_{CE} = 20V, I_C = 25A$	8.5	20		S

## THERMAL AND MECHANICAL CHARACTERISTICS (IGBT and FRED)

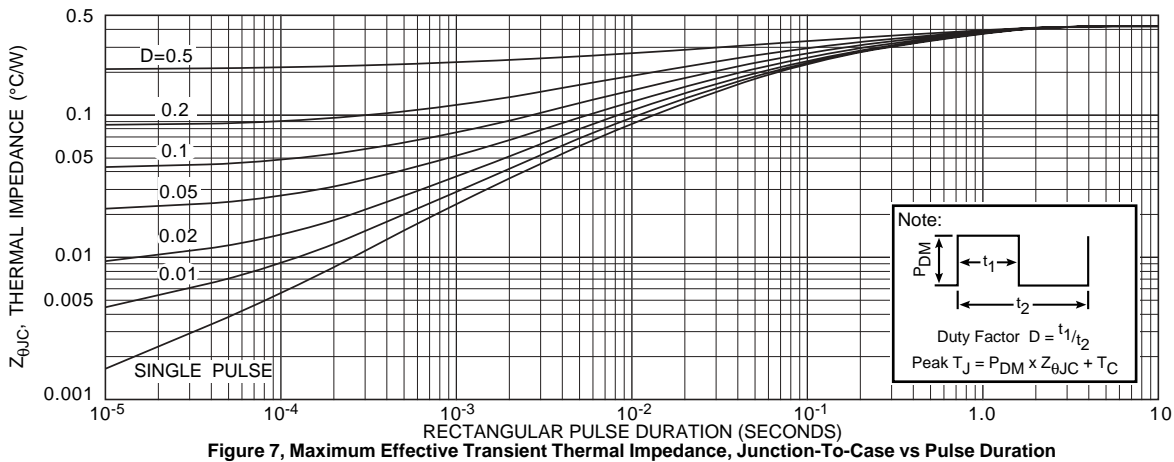
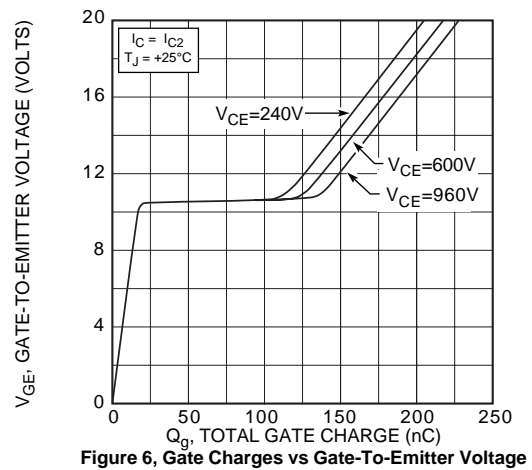
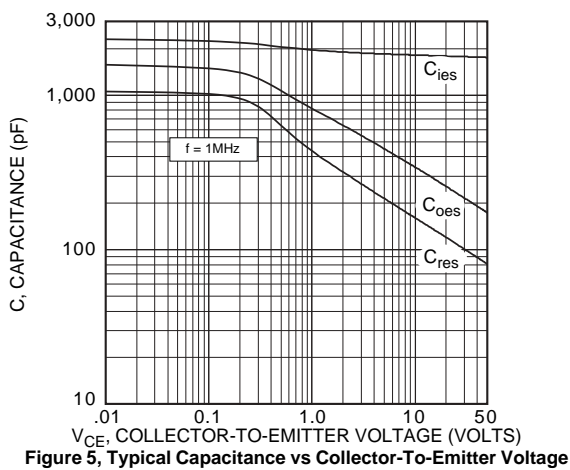
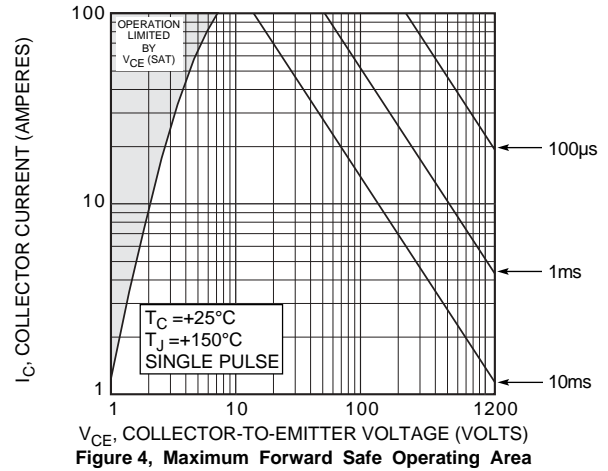
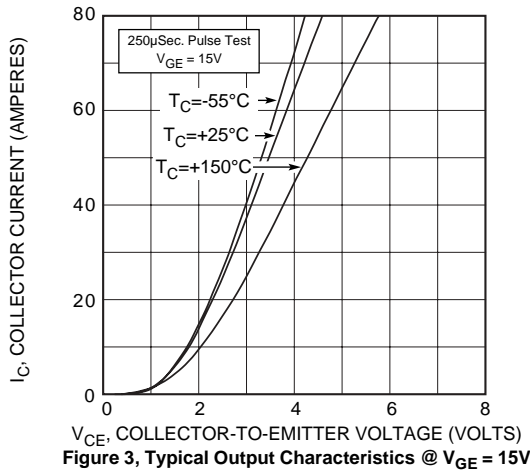
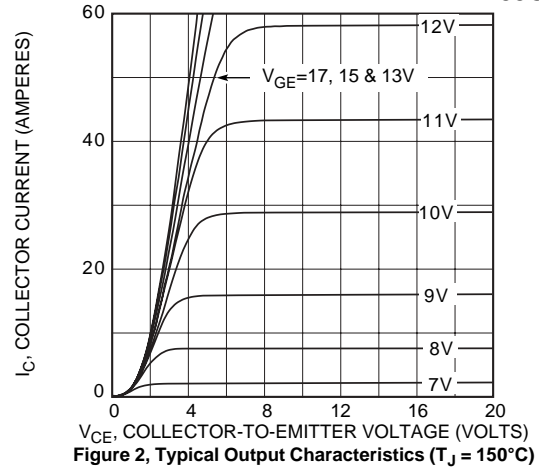
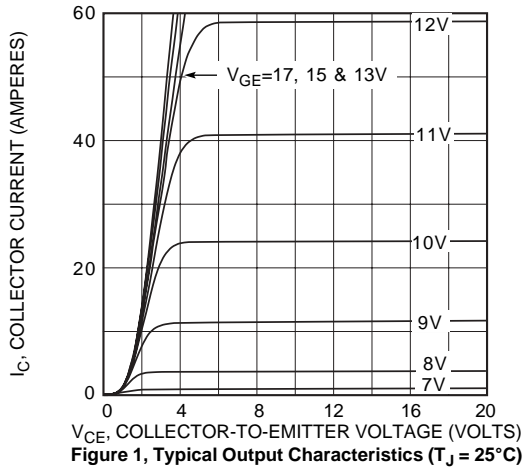
Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.42	°C/W
$R_{\theta JA}$	Junction to Ambient			40	
$W_T$	Package Weight		0.22		oz
			5.90		gm

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

②  $I_C = I_{C2}, V_{CC} = 50V, R_{GE} = 25\Omega, L = 120\mu\text{H}, T_J = 25^\circ\text{C}$

③ See MIL-STD-750 Method 3471

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



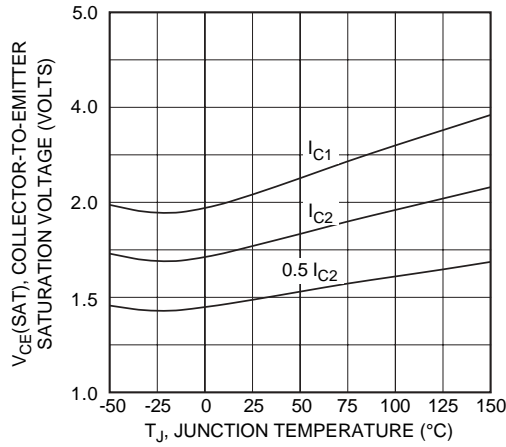


Figure 8, Typical  $V_{CE(SAT)}$  Voltage vs Junction Temperature

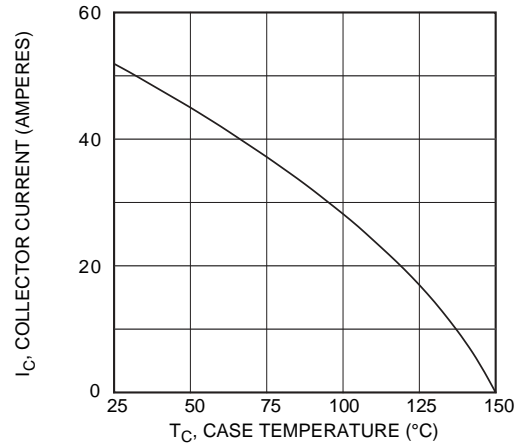


Figure 9, Maximum Collector Current vs Case Temperature

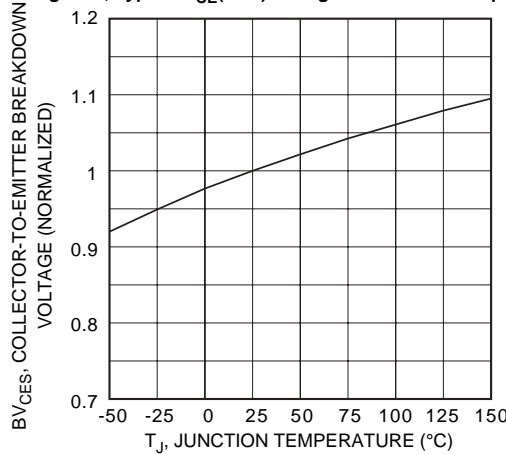


Figure 10, Breakdown Voltage vs Junction Temperature

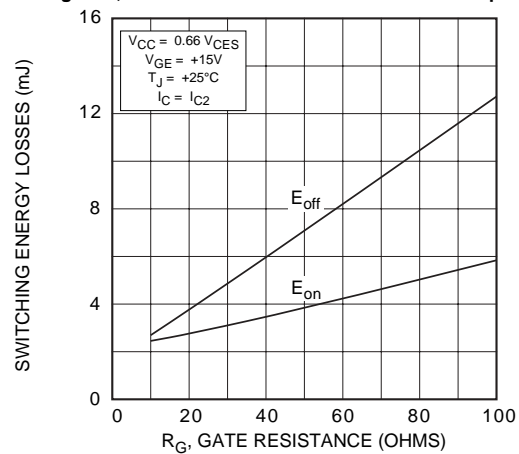


Figure 11, Typical Switching Energy Losses vs Gate Resistance

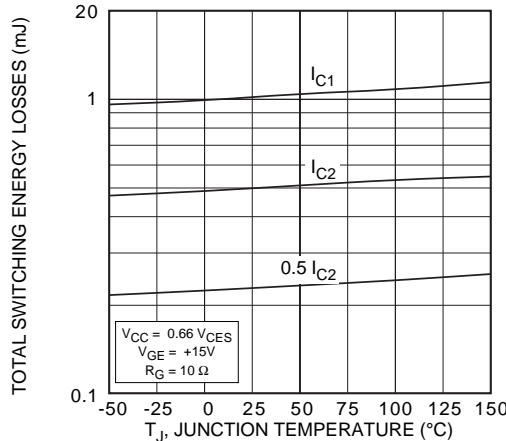


Figure 12, Typical Switching Energy Losses vs. Junction Temperature

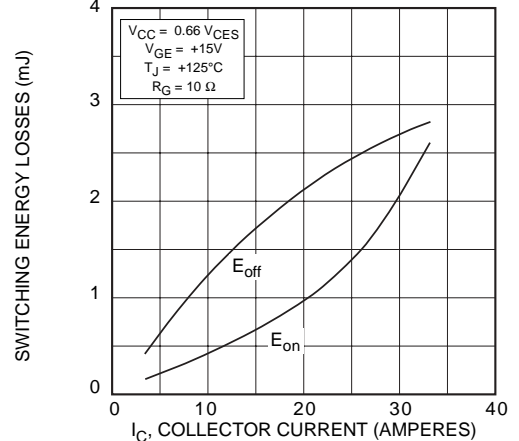


Figure 13, Typical Switching Energy Losses vs Collector Current

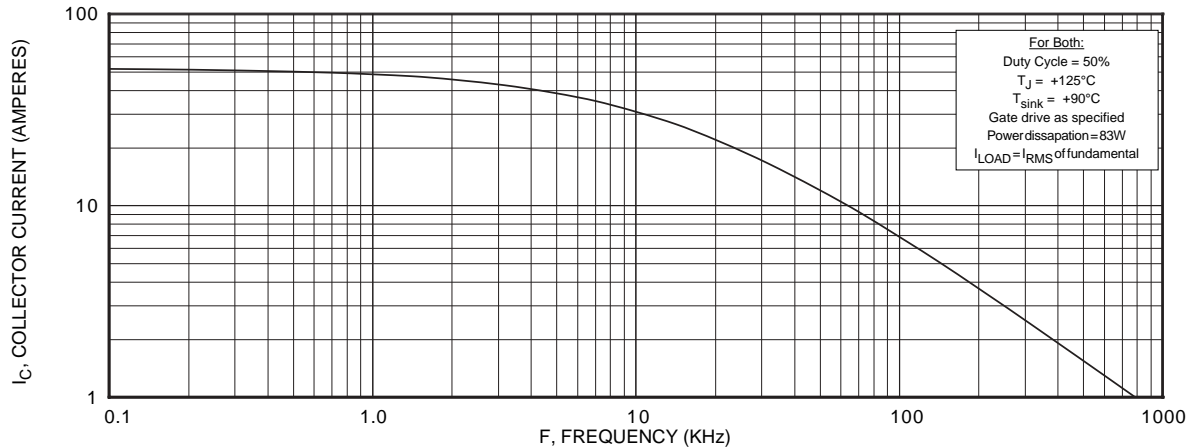


Figure 14, Typical Load Current vs Frequency

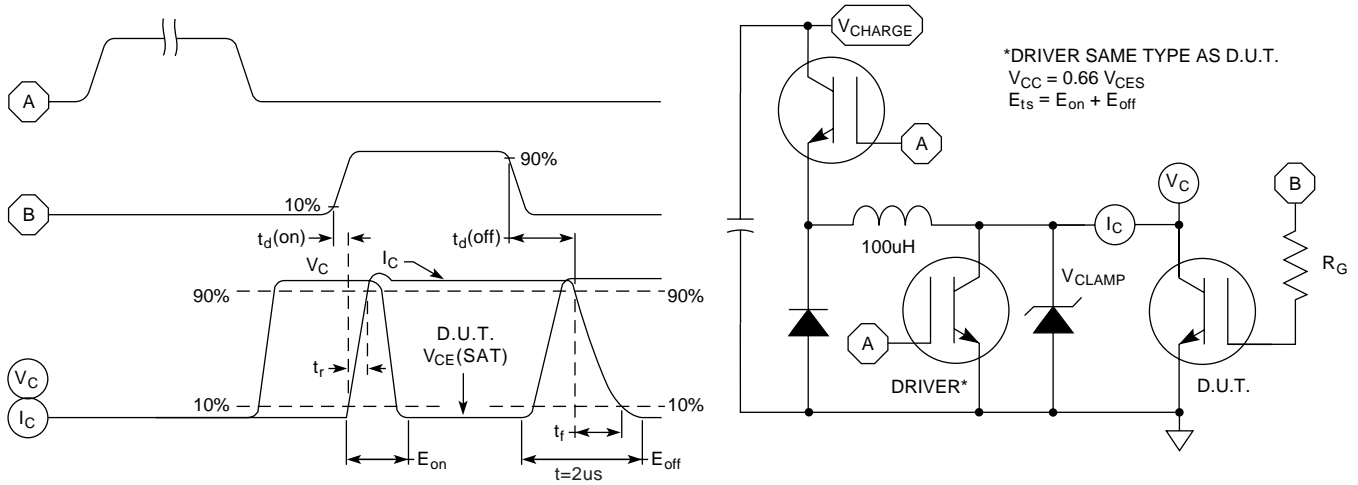


Figure 15, Switching Loss Test Circuit and Waveforms

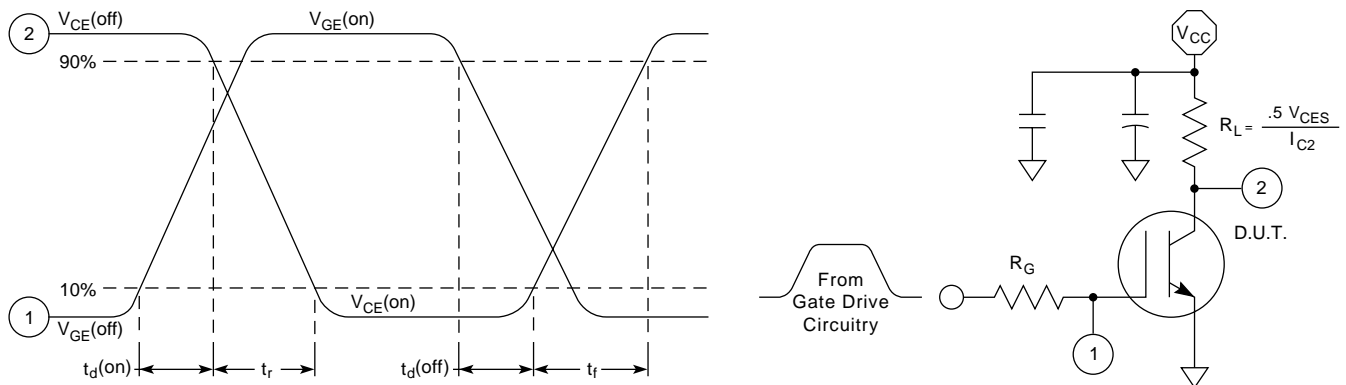
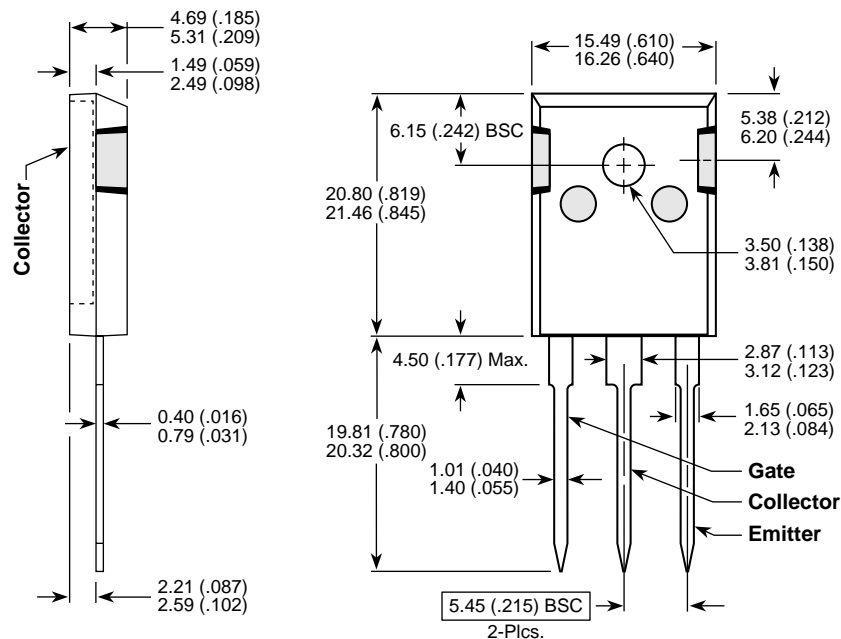


Figure 16, Resistive Switching Time Test Circuit and Waveforms

T0-247 Package Outline



Dimensions in Millimeters and (Inches)

APT's products are covered by one or more of U.S. patents 4,895,810 5,045,903 5,089,434 5,182,234 5,019,522 5,262,336 6,503,786 5,256,583 4,748,103 5,283,202 5,231,474 5,434,095 5,528,058 and foreign patents. US and Foreign patents pending. All Rights Reserved.