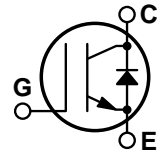
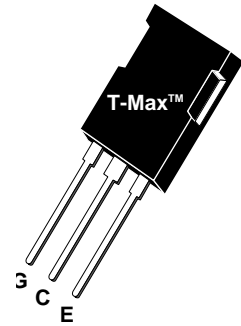


POWER MOS 7® IGBT

The POWER MOS 7® IGBT is a new generation of high voltage power IGBTs. Using Punch Through Technology this IGBT is ideal for many high frequency, high voltage switching applications and has been optimized for high frequency switchmode power supplies.

- Low Conduction Loss
- Low Gate Charge
- Ultrafast Tail Current shutoff
- 100 kHz operation @ 800V, 14A
- 50 kHz operation @ 800V, 25A
- RBSOA rated



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MAXIMUM RATINGS

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

Symbol	Parameter	APT35GP120B2DF2	UNIT
V_{CES}	Collector-Emitter Voltage	1200	Volts
V_{GE}	Gate-Emitter Voltage	± 20	
V_{GEM}	Gate-Emitter Voltage Transient	± 30	
I_{C1}	Continuous Collector Current @ $T_C = 25^\circ\text{C}$	96	Amps
I_{C2}	Continuous Collector Current @ $T_C = 110^\circ\text{C}$	46	
I_{CM}	Pulsed Collector Current ^① @ $T_C = 25^\circ\text{C}$	140	
RBSOA	Reverse Bias Safe Operating Area @ $T_J = 150^\circ\text{C}$	140A @ 960V	
P_D	Total Power Dissipation	543	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

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
BV_{CES}	Collector-Emitter Breakdown Voltage ($V_{GE} = 0V, I_C = 500\mu\text{A}$)	1200			Volts
$V_{GE(TH)}$	Gate Threshold Voltage ($V_{CE} = V_{GE}, I_C = 1\text{mA}, T_J = 25^\circ\text{C}$)	3	4.5	6	
$V_{CE(ON)}$	Collector-Emitter On Voltage ($V_{GE} = 15V, I_C = 35A, T_J = 25^\circ\text{C}$)		3.3	3.9	
	Collector-Emitter On Voltage ($V_{GE} = 15V, I_C = 35A, T_J = 125^\circ\text{C}$)		3		
I_{CES}	Collector Cut-off Current ($V_{CE} = V_{CES}, V_{GE} = 0V, T_J = 25^\circ\text{C}$) ^②			500	μA
	Collector Cut-off Current ($V_{CE} = V_{CES}, V_{GE} = 0V, T_J = 125^\circ\text{C}$) ^②			3000	
I_{GES}	Gate-Emitter Leakage Current ($V_{GE} = \pm 20V$)			± 100	nA

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

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

DYNAMIC CHARACTERISTICS

APT35GP120B2DF2

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT	
C_{ies}	Input Capacitance	Capacitance $V_{GE} = 0V, V_{CE} = 25V$ $f = 1 \text{ MHz}$		3240		pF	
C_{oes}	Output Capacitance			248			
C_{res}	Reverse Transfer Capacitance			31			
V_{GEP}	Gate-to-Emitter Plateau Voltage	Gate Charge $V_{GE} = 15V$ $V_{CE} = 600V$ $I_C = 35A$		7		V	
Q_g	Total Gate Charge ^③			150		nC	
Q_{ge}	Gate-Emitter Charge			21			
Q_{gc}	Gate-Collector ("Miller") Charge			62			
RBSOA	Reverse Bias Safe Operating Area	$T_J = 150^\circ\text{C}, R_G = 5\Omega, V_{GE} = 15V, L = 100\mu\text{H}, V_{CE} = 960V$	140			A	
$t_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) $V_{CC} = 800V$ $V_{GE} = 15V$ $I_C = 35A$ $R_G = 5\Omega$ $T_J = +25^\circ\text{C}$		16		ns	
t_r	Current Rise Time			26			
$t_{d(off)}$	Turn-off Delay Time			94			
t_f	Current Fall Time			53			
E_{on1}	Turn-on Switching Energy ^④				TBD		μJ
E_{on2}	Turn-on Switching Energy (Diode) ^⑤				1740		
E_{off}	Turn-off Switching Energy ^⑥				907		
$t_{d(on)}$	Turn-on Delay Time		Inductive Switching (125°C) $V_{CC} = 800V$ $V_{GE} = 15V$ $I_C = 35A$ $R_G = 5\Omega$ $T_J = +125^\circ\text{C}$		16		ns
t_r	Current Rise Time			26			
$t_{d(off)}$	Turn-off Delay Time			147			
t_f	Current Fall Time			100			
E_{on1}	Turn-on Switching Energy ^④				TBD		μJ
E_{on2}	Turn-on Switching Energy (Diode) ^⑤				2842		
E_{off}	Turn-off Switching Energy ^⑥				2325		

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case (IGBT)			.23	°C/W
$R_{\theta JC}$	Junction to Case (DIODE)			.59	
W_T	Package Weight			6.10	gm

- ① Repetitive Rating: Pulse width limited by maximum junction temperature.
- ② For Combi devices, I_{ces} includes both IGBT and FRED leakages
- ③ See MIL-STD-750 Method 3471.
- ④ E_{on1} is the clamped inductive turn-on-energy of the IGBT only, without the effect of a commutating diode reverse recovery current adding to the IGBT turn-on loss. (See Figure 24.)
- ⑤ E_{on2} is the clamped inductive turn-on energy that includes a commutating diode reverse recovery current in the IGBT turn-on switching loss. A Combi device is used for the clamping diode as shown in the E_{on2} test circuit. (See Figures 21, 22.)
- ⑥ E_{off} is the clamped inductive turn-off energy. (See Figures 21, 23.)

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

TYPICAL PERFORMANCE CURVES

APT35GP120B2DF2

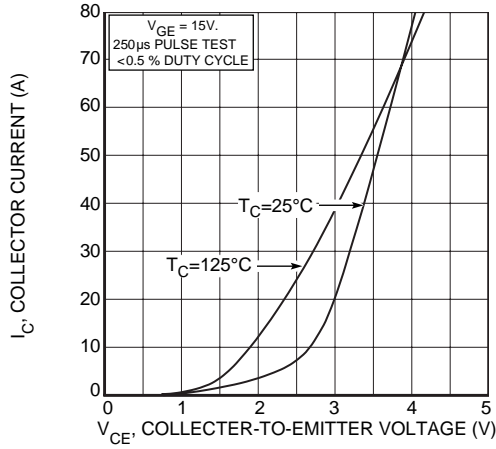


FIGURE 1, Output Characteristics ($V_{GE} = 15V$)

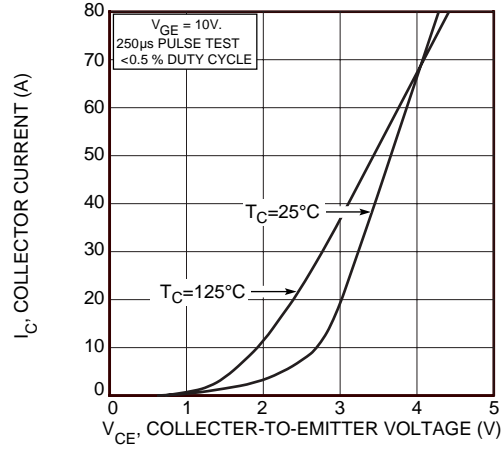


FIGURE 2, Output Characteristics ($V_{GE} = 10V$)

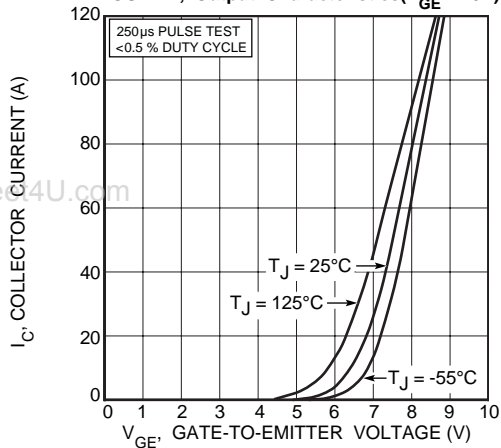


FIGURE 3, Transfer Characteristics

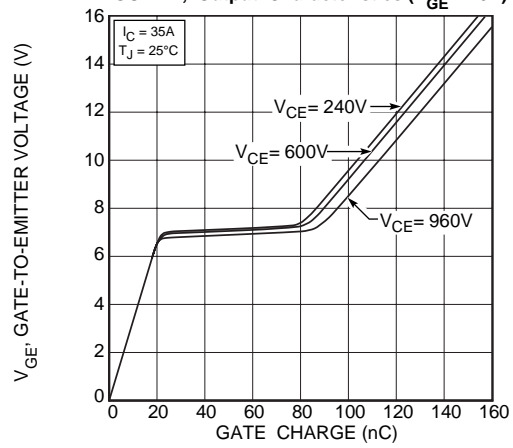


FIGURE 4, Gate Charge

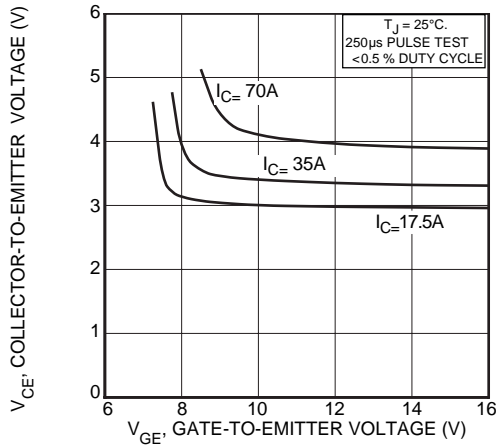


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

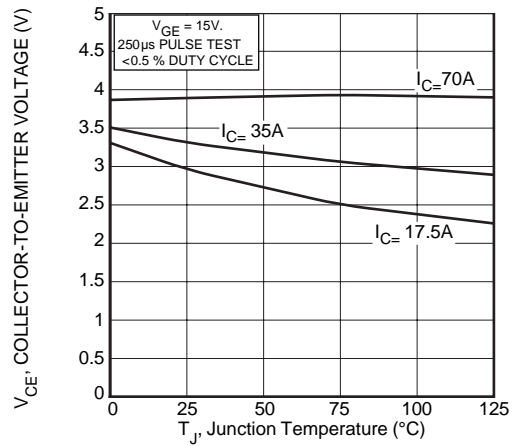


FIGURE 6, On State Voltage vs Junction Temperature

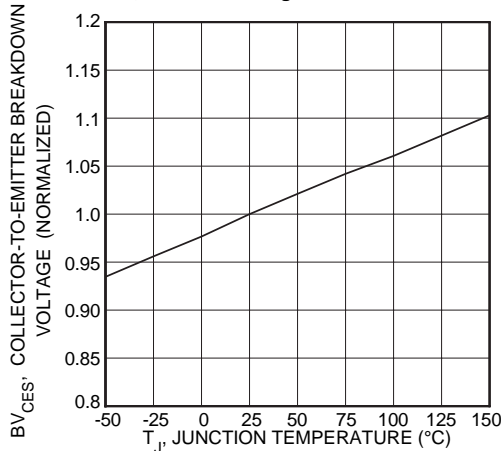


FIGURE 7, Breakdown Voltage vs. Junction Temperature

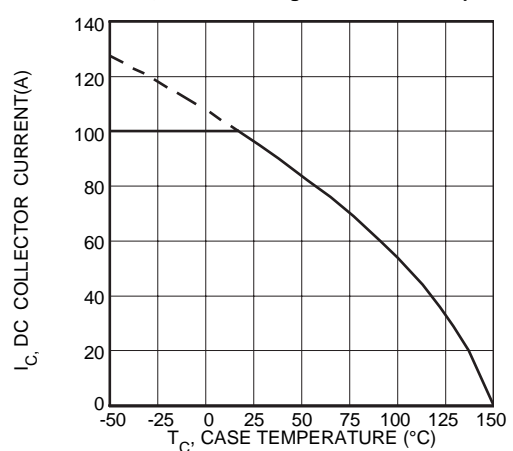


FIGURE 8, DC Collector Current vs Case Temperature

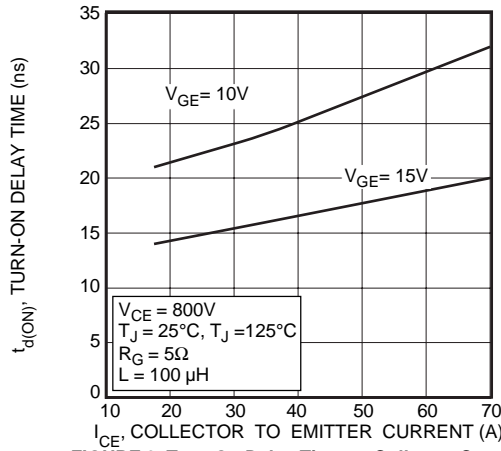


FIGURE 9, Turn-On Delay Time vs Collector Current

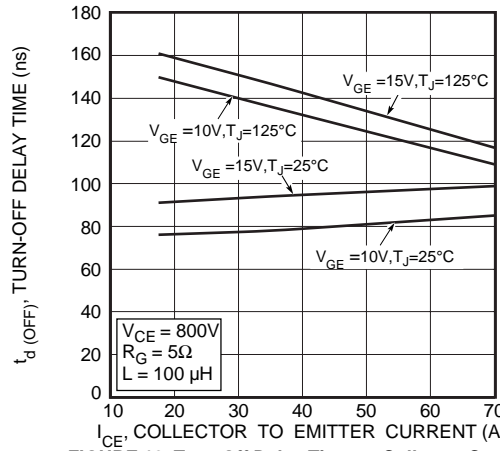


FIGURE 10, Turn-Off Delay Time vs Collector Current

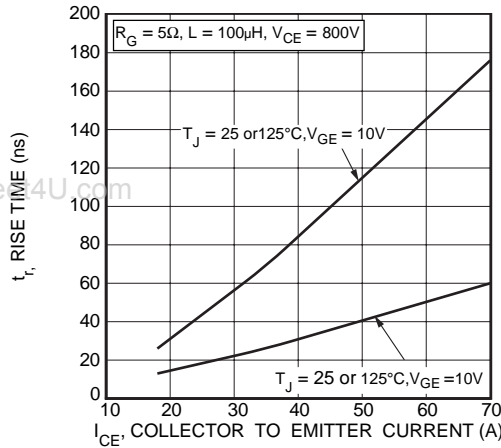


FIGURE 11, Current Rise Time vs Collector Current

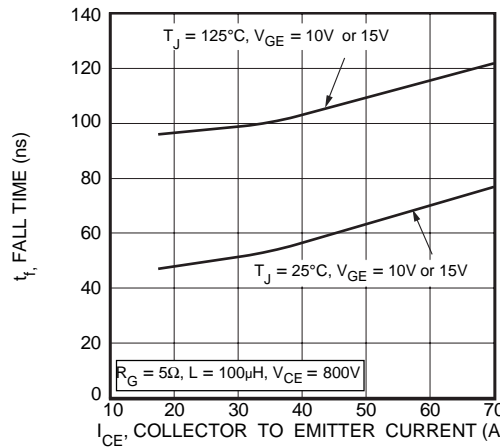


FIGURE 12, Current Fall Time vs Collector Current

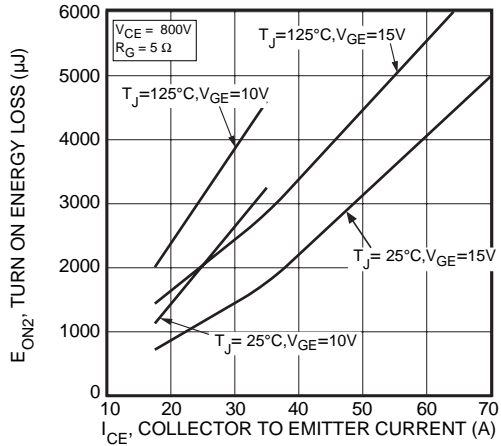


FIGURE 13, Turn-On Energy Loss vs Collector Current

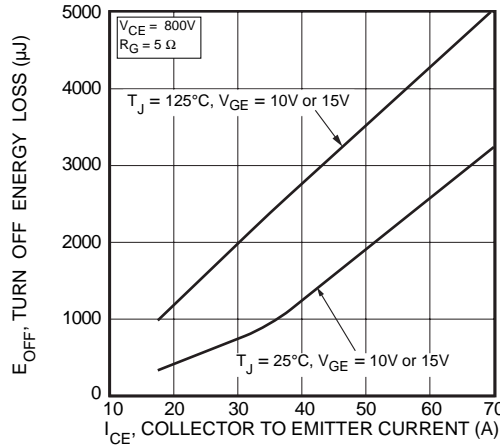


FIGURE 14, Turn Off Energy Loss vs Collector Current

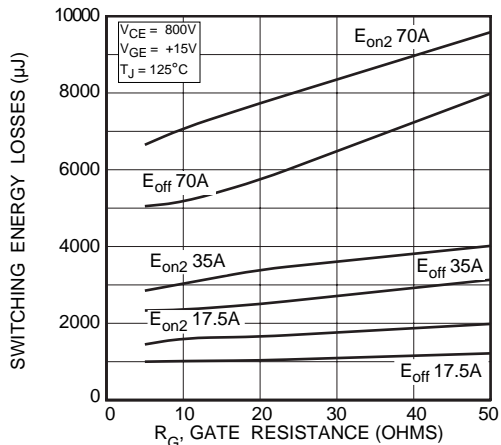


FIGURE 15, Switching Energy Losses vs. Gate Resistance

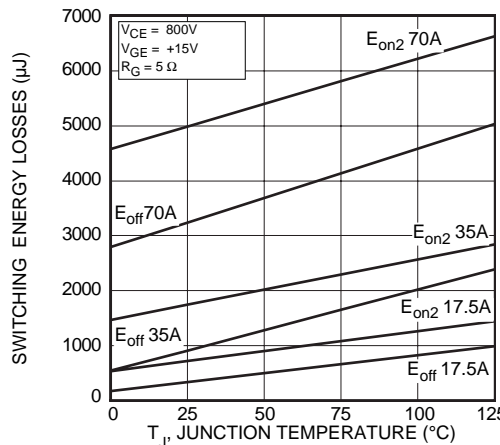


FIGURE 16, Switching Energy Losses vs Junction Temperature

TYPICAL PERFORMANCE CURVES

APT35GP120B2DF2

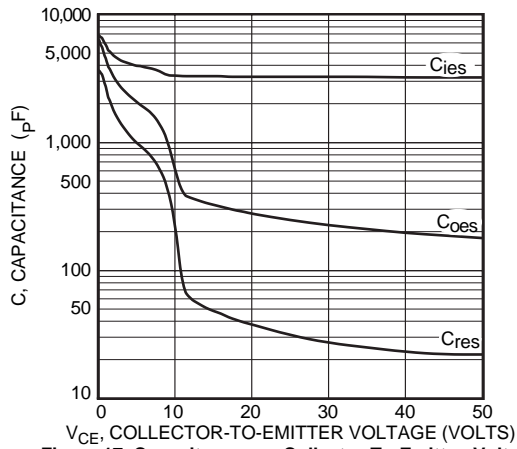


Figure 17, Capacitance vs Collector-To-Emitter Voltage

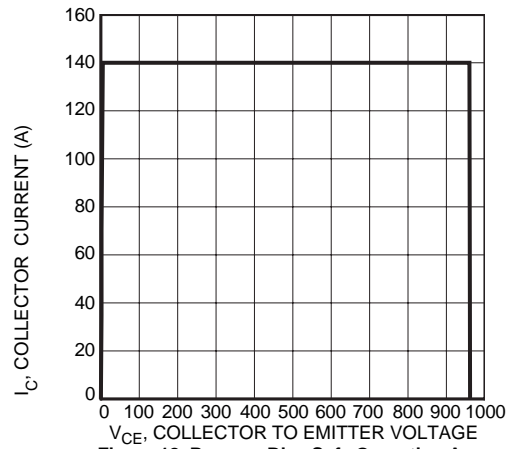


Figure 18, Reverse Bias Safe Operating Area

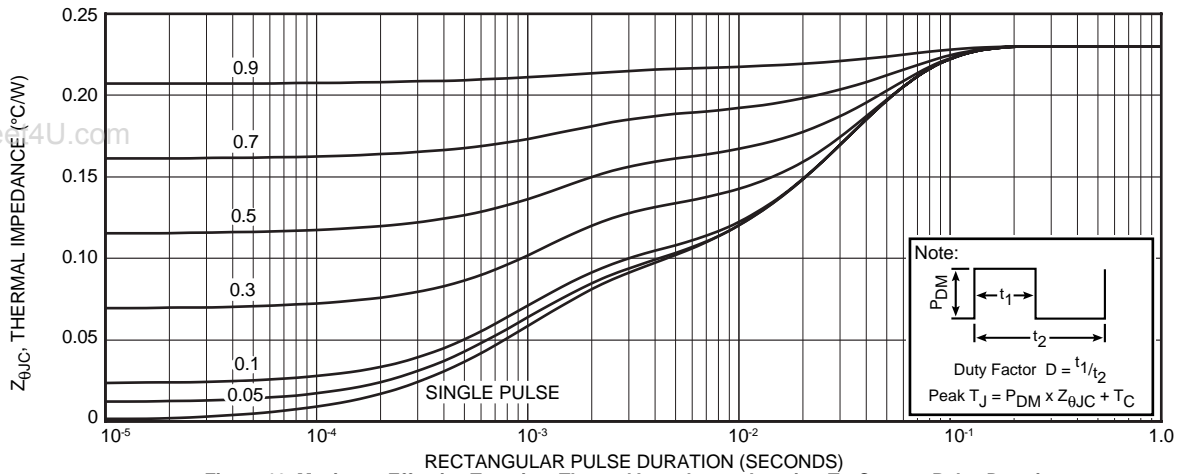


Figure 19, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

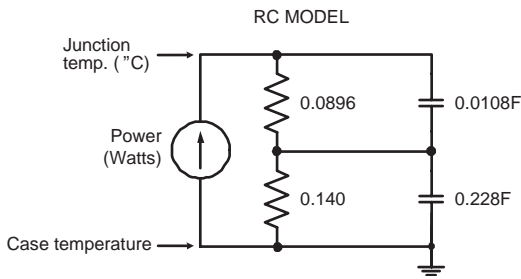


FIGURE 19B, TRANSIENT THERMAL IMPEDANCE MODEL

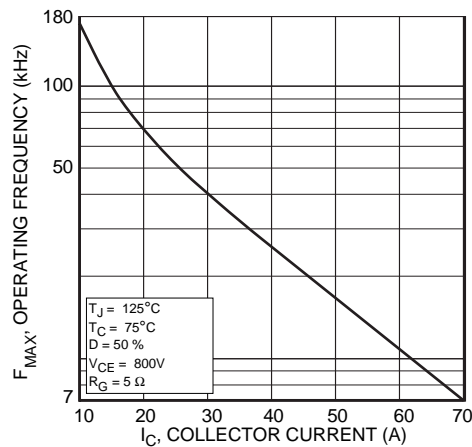


Figure 20, Operating Frequency vs Collector Current

$$F_{max} = \min(f_{max1}, f_{max2})$$

$$f_{max1} = \frac{0.05}{t_{d(on)} + t_r + t_{d(off)} + t_f}$$

$$f_{max2} = \frac{P_{diss} - P_{cond}}{E_{on2} + E_{off}}$$

$$P_{diss} = \frac{T_J - T_C}{R_{\theta JC}}$$

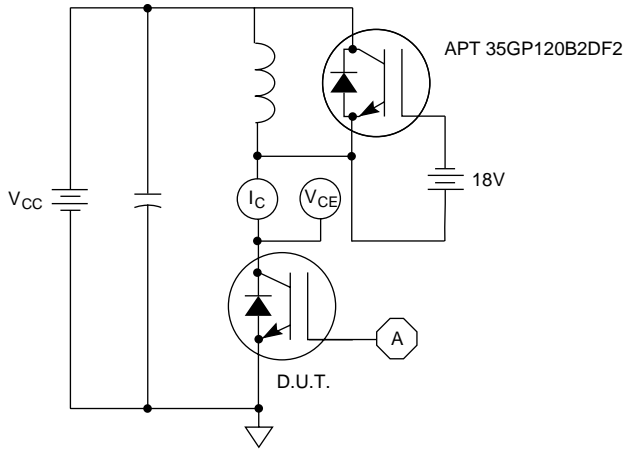


Figure 21, Inductive Switching Test Circuit

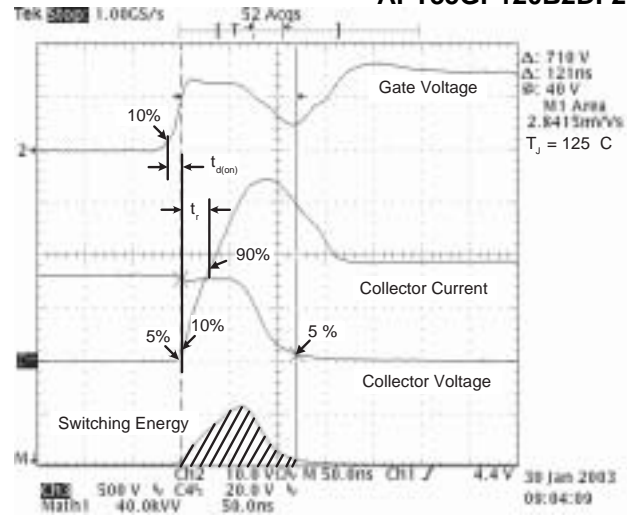


Figure 22, Turn-on Switching Waveforms and Definitions

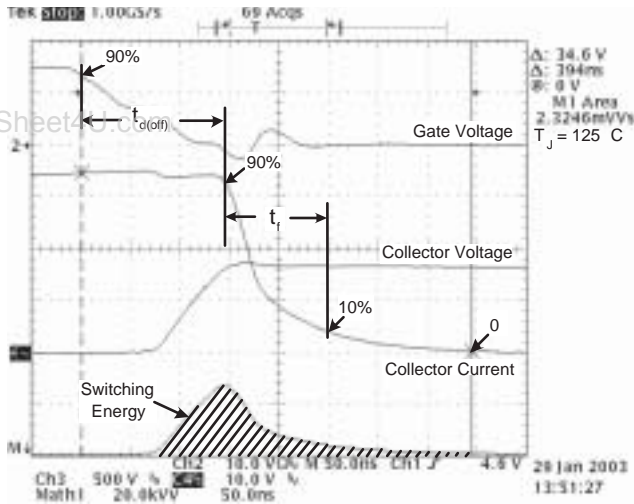


Figure 23, Turn-off Switching Waveforms and Definitions

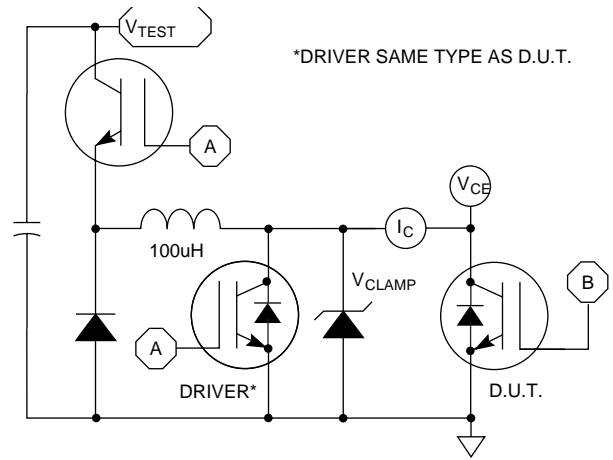


Figure 24, E_{ON1} Test Circuit

ULTRAFAST SOFT RECOVERY ANTI-PARALLEL DIODE

MAXIMUM RATINGS

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

Symbol	Characteristic / Test Conditions	APT35GP120B2DF2			UNIT
$I_F(\text{AV})$	Maximum Average Forward Current ($T_C = 127^\circ\text{C}$, Duty Cycle = 0.5)		30		Amps
$I_F(\text{RMS})$	RMS Forward Current		66		
I_{FSM}	Non-Repetitive Forward Surge Current ($T_J = 45^\circ\text{C}$, 8.3ms)		210		

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
V_F	Forward Voltage	$I_F = 35\text{A}$		3.5	Volts
		$I_F = 70\text{A}$		4.3	
		$I_F = 35\text{A}$, $T_J = 150^\circ\text{C}$		2.2	

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T-Max™ (B2) Package Outline

