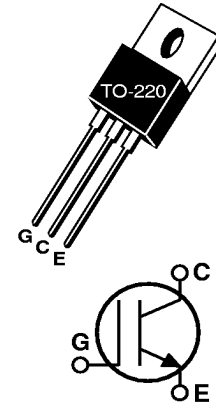


Thunderbolt IGBT™

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

Symbol	Parameter	APT6GT60KR	UNIT
V_{CES}	Collector-Emitter Voltage	600	Volts
V_{CGR}	Collector-Gate Voltage ($R_{GE} = 20K\Omega$)	600	
V_{EC}	Emitter-Collector Voltage	15	
V_{GE}	Gate-Emitter Voltage	± 20	
I_{C1}	Continuous Collector Current @ $T_C = 25^\circ\text{C}$	13	Amps
I_{C2}	Continuous Collector Current @ $T_C = 110^\circ\text{C}$	6	
I_{CM1}	Pulsed Collector Current ① @ $T_C = 25^\circ\text{C}$	26	
I_{CM2}	Pulsed Collector Current ① @ $T_C = 110^\circ\text{C}$	12	
E_{AS}	Single Pulse Avalanche Energy ②	9	mJ
P_D	Total Power Dissipation	63	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 ($V_{GE} = 0V, I_C = 0.5mA, T_J = -55^\circ\text{C}$)	600			Volts
RBV_{CES}	Collector-Emitter Reverse Breakdown Voltage ($V_{GE} = 0V, I_C = 50mA$)	-15			
$V_{GE(TH)}$	Gate Threshold Voltage ($V_{CE} = V_{GE}, I_C = 200\mu A, T_J = 25^\circ\text{C}$)	3	4	5	
$V_{CE(ON)}$	Collector-Emitter On Voltage ($V_{GE} = 15V, I_C = I_{C2}, T_J = 25^\circ\text{C}$)	1.6	2.0	2.5	
	Collector-Emitter On Voltage ($V_{GE} = 15V, I_C = I_{C2}, T_J = 150^\circ\text{C}$)		2.3	2.8	
I_{CES}	Collector Cut-off Current ($V_{CE} = V_{CES}, V_{GE} = 0V, T_J = 25^\circ\text{C}$)			20	μA
	Collector Cut-off Current ($V_{CE} = V_{CES}, V_{GE} = 0V, T_J = 150^\circ\text{C}$)			100	
I_{GES}	Gate-Emitter Leakage Current ($V_{GE} = \pm 25V, V_{CE} = 0V$)			± 100	nA

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

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DYNAMIC CHARACTERISTICS

APT6GT60KR

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	Capacitance $V_{GE} = 0V$ $V_{CE} = 25V$ $f = 1\text{ MHz}$		350		pF
C_{oes}	Output Capacitance			40		
C_{res}	Reverse Transfer Capacitance			25		
Q_g	Total Gate Charge ^③	Gate Charge $V_{GE} = 15V$ $V_{CC} = 0.66V_{CES}$ $I_C = I_{C2}$		24		nC
Q_{ge}	Gate-Emitter Charge			17		
Q_{gc}	Gate-Collector ("Miller") Charge			3		
$t_d(on)$	Turn-on Delay Time	Resistive Switching (25°C) $V_{GE} = 15V$ $V_{CC} = 0.66V_{CES}$ $I_C = I_{C2}$ $R_G = 50\Omega$		5		ns
t_r	Rise Time			8		
$t_d(off)$	Turn-off Delay Time			25		
t_f	Fall Time			95		
$t_d(on)$	Turn-on Delay Time	Inductive Switching (150°C) $V_{CLAMP(Peak)} = 0.66V_{CES}$ $V_{GE} = 15V$ $I_C = I_{C2}$ $R_G = 50\Omega$ $T_J = +150^\circ C$		11		ns
t_r	Rise Time			5		
$t_d(off)$	Turn-off Delay Time			62		
t_f	Fall Time			70		
E_{on}	Turn-on Switching Energy	$R_G = 50\Omega$ $T_J = +150^\circ C$		0.07		mJ
E_{off}	Turn-off Switching Energy			0.10		
E_{ts}	Total Switching Losses			0.17		
$t_d(on)$	Turn-on Delay Time	Inductive Switching (25°C) $V_{CLAMP(Peak)} = 0.66V_{CES}$ $V_{GE} = 15V$ $I_C = I_{C2}$ $R_G = 50\Omega$ $T_J = +25^\circ C$		10		ns
t_r	Rise Time			5		
$t_d(off)$	Turn-off Delay Time			51		
t_f	Fall Time			48		
E_{ts}	Total Switching Losses			0.13		mJ
gfe	Forward Transconductance	$V_{CE} = 20V, I_C = I_{C2}$	4.2			S

THERMAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			2.0	$^\circ C/W$
$R_{\theta JA}$	Junction to Ambient			80	
Torque	Mounting Torque using a 6-32 or 3mm Binding Head Machine Screw		10		lb•in

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

② $I_C = I_{C2}, V_{CC} = 50V, R_{GE} = 25\Omega, L = 500\mu H, T_J = 25^\circ C$

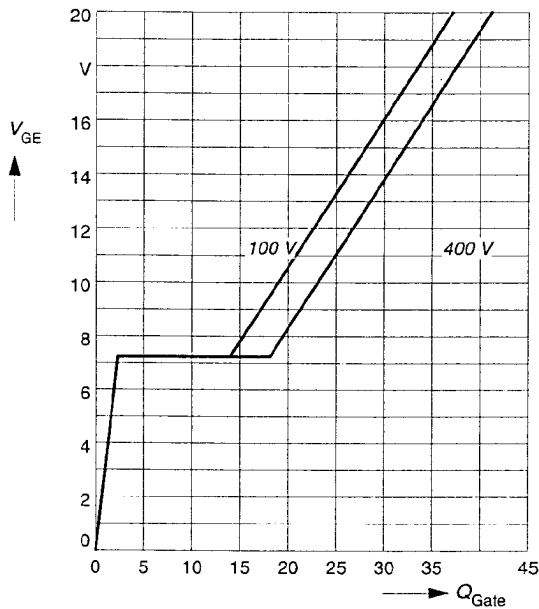
③ See MIL-STD-750 Method 3471

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

Typ. gate charge

$$V_{GE} = f(Q_{Gate})$$

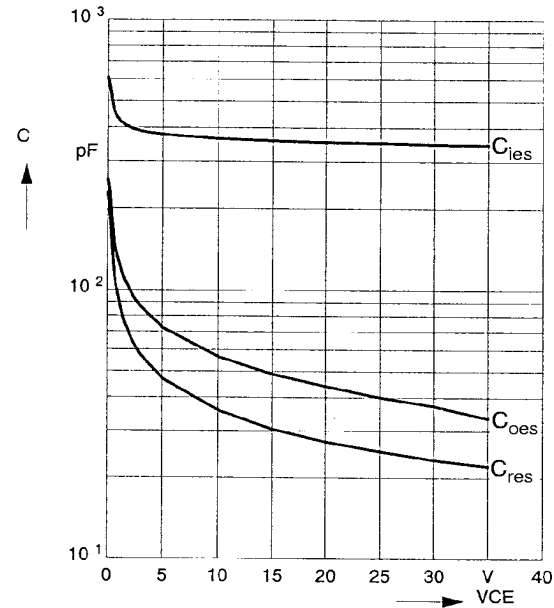
parameter: $I_{C\ puls} = 6\ A$



Typ. capacitances

$$C = f(V_{CE})$$

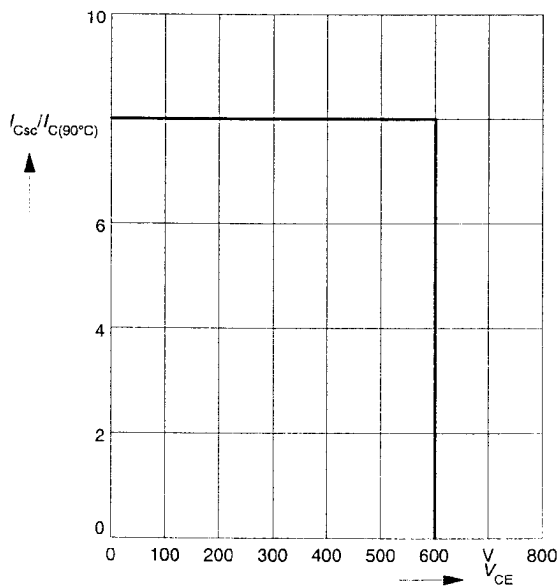
parameter: $V_{GE} = 0V, f = 1\ MHz$



Short circuit safe operating area

$$I_{Csc} = f(V_{CE}), T_j = 150^\circ C$$

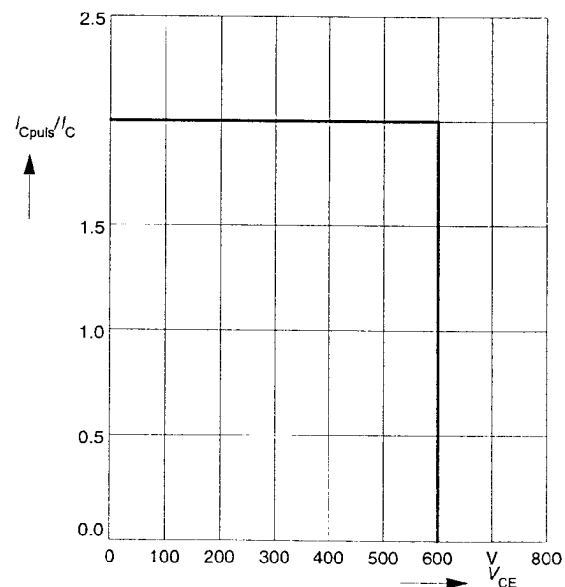
parameter: $V_{GE} = \pm 15\ V, t_{sc} \leq 10\ \mu s, L < 50\ nH$



Reverse biased safe operating area

$$I_{Cpuls} = f(V_{CE}), T_j = 150^\circ C$$

parameter: $V_{GE} = 15\ V$



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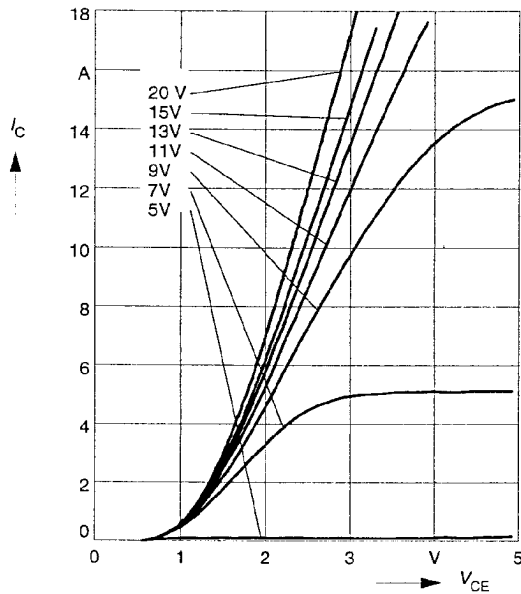
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Typ. output characteristics

$$I_C = f(V_{CE})$$

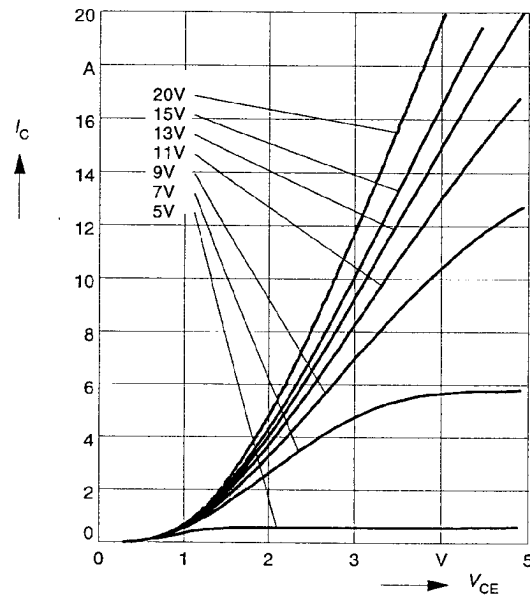
parameter: $t_p = 80 \mu s$, $T_j = 25^\circ C$



Typ. output characteristics

$$I_C = f(V_{CE})$$

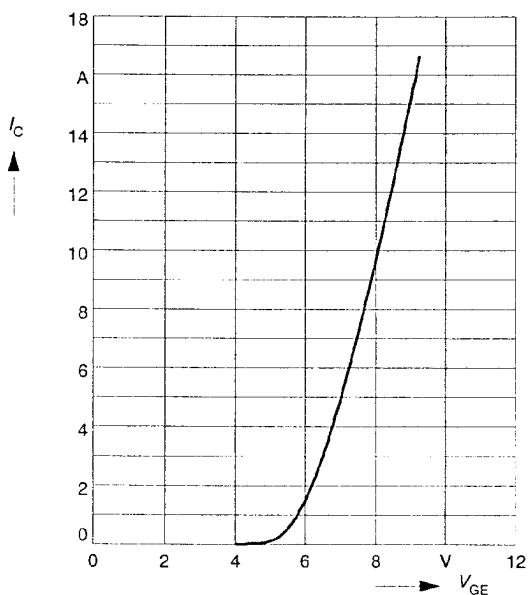
parameter: $t_p = 80 \mu s$, $T_j = 150^\circ C$



Typ. transfer characteristics

$$I_C = f(V_{GE})$$

parameter: $t_p = 80 \mu s$, $V_{CE} = 20 V$



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