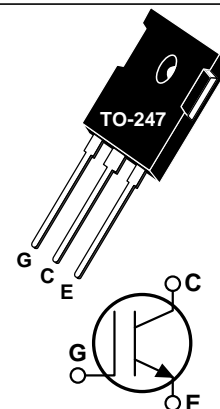


## Thunderbolt IGBT™

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	APT15GT60BR	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	$\pm 20$	
$I_{C1}$	Continuous Collector Current @ $T_C = 25^\circ\text{C}$	31	Amps
$I_{C2}$	Continuous Collector Current @ $T_C = 110^\circ\text{C}$	15	
$I_{CM1}$	Pulsed Collector Current <sup>①</sup> @ $T_C = 25^\circ\text{C}$	60	
$I_{CM2}$	Pulsed Collector Current <sup>①</sup> @ $T_C = 110^\circ\text{C}$	30	
$E_{AS}$	Single Pulse Avalanche Energy <sup>②</sup>	24	mJ
$P_D$	Total Power Dissipation	135	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 ( $V_{GE} = 0V, I_C = 0.5mA, T_j = -55^\circ\text{C}$ )	600			Volts
$RBV_{CES}$	Collector-Emitter Reverse Breakdown Voltage ( $V_{GE} = 0V, I_C = 50mA$ )	-15			
$V_{GE(TH)}$	Gate Threshold Voltage ( $V_{CE} = V_{GE}, I_C = 400\mu A, T_j = 25^\circ\text{C}$ )	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 ( $V_{GE} = 15V, I_C = I_{C2}, T_j = 150^\circ\text{C}$ )			2.8	
$I_{CES}$	Collector Cut-off Current ( $V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 25^\circ\text{C}$ )			40	$\mu A$
	Collector Cut-off Current ( $V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 150^\circ\text{C}$ )			1000	
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{GE} = \pm 20V, V_{CE} = 0V$ )			$\pm 100$	nA

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

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## DYNAMIC CHARACTERISTICS

APT15GT60BR

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
$C_{ies}$	Input Capacitance	<b>Capacitance</b> $V_{GE} = 0V$ $V_{CE} = 25V$ $f = 1\text{ MHz}$		825		pF
$C_{oes}$	Output Capacitance			90		
$C_{res}$	Reverse Transfer Capacitance			52		
$Q_g$	Total Gate Charge <sup>③</sup>	<b>Gate Charge</b> $V_{GE} = 15V$ $V_{CC} = 0.5V_{CES}$ $I_C = I_{C2}$		73		nC
$Q_{ge}$	Gate-Emitter Charge			33		
$Q_{gc}$	Gate-Collector ("Miller") Charge			6		
$t_{d(on)}$	Turn-on Delay Time	<b>Resistive Switching (25°C)</b> $V_{GE} = 15V$ $V_{CC} = 0.80V_{CES}$ $I_C = I_{C2}$ $R_G = 10\Omega$		9		ns
$t_r$	Rise Time			28		
$t_{d(off)}$	Turn-off Delay Time			85		
$t_f$	Fall Time			110		
$t_{d(on)}$	Turn-on Delay Time	<b>Inductive Switching (150°C)</b> $V_{CLAMP(Peak)} = 0.66V_{CES}$ $V_{GE} = 15V$ $I_C = I_{C2}$ $R_G = 10\Omega$ $T_J = +150^\circ C$		13		ns
$t_r$	Rise Time			7		
$t_{d(off)}$	Turn-off Delay Time			155		
$t_f$	Fall Time			45		
$E_{on}$	Turn-on Switching Energy	$R_G = 10\Omega$ $T_J = +150^\circ C$		0.15		mJ
$E_{off}$	Turn-off Switching Energy			40		
$E_{ts}$	Total Switching Losses			0.55		
$t_{d(on)}$	Turn-on Delay Time	<b>Inductive Switching (25°C)</b> $V_{CLAMP(Peak)} = 0.66V_{CES}$ $V_{GE} = 15V$ $I_C = I_{C2}$ $R_G = 10\Omega$ $T_J = +25^\circ C$		13		ns
$t_r$	Rise Time			7		
$t_{d(off)}$	Turn-off Delay Time			130		
$t_f$	Fall Time			25		
$E_{ts}$	Total Switching Losses			24		
gfe	Forward Transconductance	$V_{CE} = 20V, I_C = I_{C2}$	3	11		S

## THERMAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.93	°C/W
$R_{\theta JA}$	Junction to Ambient			40	
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  $I_C = I_{C2}, V_{CC} = 50V, R_{GE} = 25\Omega, L = 200\mu H, T_J = 25^\circ C$

③ See MIL-STD-750 Method 3471

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