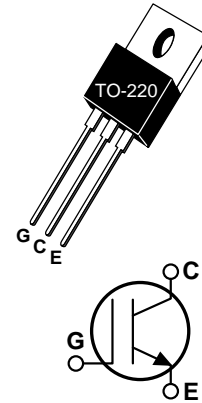


## Thunderbolt IGBT™

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




### MAXIMUM RATINGS

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

| Symbol         | Parameter   | APT12GT60KR | 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 @ $T_C = 25^\circ\text{C}$           | 25          | Amps             |
| $I_{C2}$       | Continuous Collector Current @ $T_C = 115^\circ\text{C}$          | 12          |                  |
| $I_{CM1}$      | Pulsed Collector Current <sup>①</sup> @ $T_C = 25^\circ\text{C}$  | 50          |                  |
| $I_{CM2}$      | Pulsed Collector Current <sup>①</sup> @ $T_C = 115^\circ\text{C}$ | 24          |                  |
| $E_{AS}$       | Single Pulse Avalanche Energy <sup>②</sup>                        | 18          | mJ               |
| $P_D$          | Total Power Dissipation   | 125         | 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 ( $V_{GE} = 0V, I_C = 0.4mA, T_j = -55^\circ\text{C}$ ) | 600 |     |           | Volts   |
| $RBV_{CES}$  | Collector-Emitter Reverse Breakdown Voltage ( $V_{GE} = 0V, I_C = 50mA$ )                   | -15 |     |           |         |
| $V_{GE(TH)}$ | Gate Threshold Voltage ( $V_{CE} = V_{GE}, I_C = 350\mu A, T_j = 25^\circ\text{C}$ )        | 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

APT12GT60KR

| Symbol       | Characteristic                   | Test Conditions   | MIN | TYP  | MAX | UNIT |
|--------------|----------------------------------|---|-----|------|-----|------|
| $C_{ies}$    | Input Capacitance                | <b>Capacitance</b><br>$V_{GE} = 0V$<br>$V_{CE} = 25V$<br>$f = 1\text{ MHz}$   |     | 580  |     | pF   |
| $C_{oes}$    | Output Capacitance               |   |     | 75   |     |      |
| $C_{res}$    | Reverse Transfer Capacitance     |   |     | 50   |     |      |
| $Q_g$        | Total Gate Charge <sup>③</sup>   | <b>Gate Charge</b><br>$V_{GE} = 15V$<br>$V_{CC} = 0.50V_{CES}$<br>$I_C = I_{C2}$  |     | 65   |     | nC   |
| $Q_{ge}$     | Gate-Emitter Charge              |   |     | 34   |     |      |
| $Q_{gc}$     | Gate-Collector ("Miller") Charge |   |     | 5    |     |      |
| $t_{d(on)}$  | Turn-on Delay Time               | <b>Resistive Switching (25°C)</b><br>$V_{GE} = 15V$<br>$V_{CC} = 0.66V_{CES}$<br>$I_C = I_{C2}$<br>$R_G = 10\Omega$                                   |     | 8    |     | ns   |
| $t_r$        | Rise Time                        |   |     | 22   |     |      |
| $t_{d(off)}$ | Turn-off Delay Time              |   |     | 80   |     |      |
| $t_f$        | Fall Time                        |   |     | 110  |     |      |
| $t_{d(on)}$  | Turn-on Delay Time               | <b>Inductive Switching (150°C)</b><br>$V_{CLAMP(Peak)} = 0.66V_{CES}$<br>$V_{GE} = 15V$<br>$I_C = I_{C2}$<br>$R_G = 10\Omega$<br>$T_J = +150^\circ C$ |     | 12   |     | ns   |
| $t_r$        | Rise Time                        |   |     | 6    |     |      |
| $t_{d(off)}$ | Turn-off Delay Time              |   |     | 150  |     |      |
| $t_f$        | Fall Time                        |   |     | 120  |     |      |
| $E_{on}$     | Turn-on Switching Energy         | $R_G = 10\Omega$<br>$T_J = +150^\circ C$  |     | 0.10 |     | mJ   |
| $E_{off}$    | Turn-off Switching Energy        |   |     | 0.40 |     |      |
| $E_{ts}$     | Total Switching Losses           |   |     | 0.50 |     |      |
| $t_{d(on)}$  | Turn-on Delay Time               | <b>Inductive Switching (25°C)</b><br>$V_{CLAMP(Peak)} = 0.66V_{CES}$<br>$V_{GE} = 15V$<br>$I_C = I_{C2}$<br>$R_G = 10\Omega$<br>$T_J = +25^\circ C$   |     | 12   |     | ns   |
| $t_r$        | Rise Time                        |   |     | 6    |     |      |
| $t_{d(off)}$ | Turn-off Delay Time              |   |     | 120  |     |      |
| $t_f$        | Fall Time                        |   |     | 45   |     |      |
| $E_{ts}$     | Total Switching Losses           |   |     | 0.22 |     |      |
| $g_{fe}$     | Forward Transconductance         | $V_{CE} = 20V, I_C = I_{C2}$  | 2   | 6.7  |     | S    |

## THERMAL CHARACTERISTICS

| Symbol          | Characteristic   | MIN | TYP | MAX | UNIT  |
|-----------------|--|-----|-----|-----|-------|
| $R_{\theta JC}$ | Junction to Case   |     |     | 1.0 | °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  $I_C = I_{C2}, V_{CC} = 50V, R_{GE} = 25\Omega, L = 250\mu H, T_J = 25^\circ C$

③ See MIL-STD-750 Method 3471

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