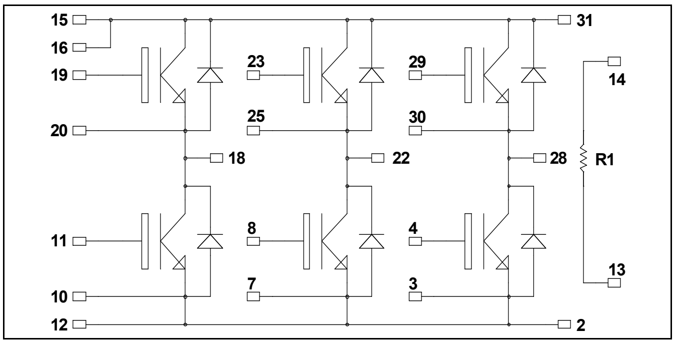
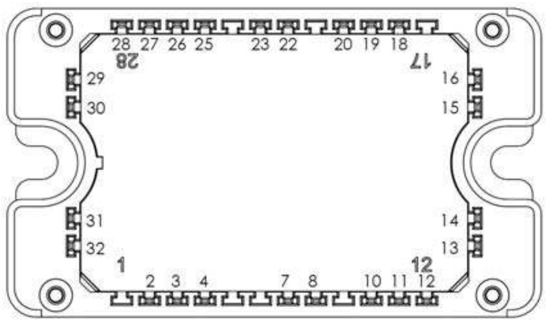
# APTGT30X60T3G

**_3 Phase bridge_**
**_Trench + Field Stop IGBT3_**
**_Power Module_**

**$V_{CES}$ = 600V**
**$I_C$ = 30A @ Tc = 80°C**




It is recommended to connect a decoupling capacitor between pins 31 & 2 to reduce switching overvoltages, if DC Power is connected between pins 15, 16 & 12.
Pins 15 & 16 must be shorted together.




**Application**

- Motor control

**Features**

- **Trench + Field Stop IGBT3**
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 20 kHz
  - Low leakage current
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- Very low stray inductance
- Internal thermistor for temperature monitoring

**Benefits**

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- RoHS compliant

## All ratings @ $T_j$ = 25°C unless otherwise specified

### Absolute maximum ratings (Per IGBT)

| *Symbol* | *Parameter* | | *Max ratings* | *Unit* |
|---|---|---|---|---|
| $V_{CES}$ | Collector - Emitter Voltage | | 600 | V |
| $I_C$ | Continuous Collector Current | $T_C$ = 25°C | 50 | A |
| | | $T_C$ = 80°C | 30 | |
| $I_{CM}$ | Pulsed Collector Current | $T_C$ = 25°C | 60 | |
| $V_{GE}$ | Gate – Emitter Voltage | | ±20 | V |
| $P_D$ | Power Dissipation | $T_C$ = 25°C | 90 | W |
| RBSOA | Reverse Bias Safe Operating Area | $T_J$ = 150°C | 60A @ 550V | |

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

## Electrical Characteristics (Per IGBT)

| *Symbol* | *Characteristic* | *Test Conditions* | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $I_{CES}$ | Zero Gate Voltage Collector Current | $V_{GE}$ = 0V, $V_{CE}$ = 600V | | | | 250 | µA |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | $V_{GE}$ =15V<br>$I_C$ = 30A | $T_j$ = 25°C | | 1.5 | 1.9 | V |
| | | | $T_j$ = 150°C | | 1.7 | | |
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{GE}$ = $V_{CE}$ , $I_C$ = 400µA | | 5.0 | 5.8 | 6.5 | V |
| $I_{GES}$ | Gate – Emitter Leakage Current | $V_{GE}$ = 20V, $V_{CE}$ = 0V | | | | 300 | nA |

## Dynamic Characteristics (Per IGBT)

| *Symbol* | *Characteristic* | *Test Conditions* | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $C_{ies}$ | Input Capacitance | $V_{GE}$ = 0V<br>$V_{CE}$ = 25V<br>f = 1MHz | | | 1600 | | pF |
| $C_{oes}$ | Output Capacitance | | | | 110 | | |
| $C_{res}$ | Reverse Transfer Capacitance | | | | 50 | | |
| $T_{d(on)}$ | Turn-on Delay Time | Inductive Switching (25°C)<br>$V_{GE}$ = ±15V<br>$V_{Bus}$ = 300V<br>$I_C$ = 30A<br>$R_G$ = 10Ω | | | 110 | | ns |
| $T_r$ | Rise Time | | | | 45 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | | 200 | | |
| $T_f$ | Fall Time | | | | 40 | | |
| $T_{d(on)}$ | Turn-on Delay Time | Inductive Switching (150°C)<br>$V_{GE}$ = ±15V<br>$V_{Bus}$ = 300V<br>$I_C$ = 30A<br>$R_G$ = 10Ω | | | 120 | | ns |
| $T_r$ | Rise Time | | | | 50 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | | 250 | | |
| $T_f$ | Fall Time | | | | 60 | | |
| $E_{on}$ | Turn-on Switching Energy | $V_{GE}$ = ±15V<br>$V_{Bus}$ = 300V<br>$I_C$ = 30A<br>$R_G$ = 10Ω | $T_j$ = 150°C | | 0.3 | | mJ |
| $E_{off}$ | Turn-off Switching Energy | | $T_j$ = 150°C | | 1.05 | | mJ |
| $R_{thJC}$ | Junction to Case Thermal Resistance | | | | | 1.6 | °C/W |

## Reverse diode ratings and characteristics (Per diode)

| *Symbol* | *Characteristic* | *Test Conditions* | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | Peak Repetitive Reverse Voltage | | | | | 600 | V |
| $I_{RM}$ | Reverse Leakage Current | $V_R$=600V | | | | 250 | µA |
| $I_F$ | DC Forward Current | | Tc = 80°C | | 30 | | A |
| $V_F$ | Diode Forward Voltage | $I_F$ = 30A<br>$V_{GE}$ = 0V | $T_j$ = 25°C | | 1.6 | 2 | V |
| | | | $T_j$ = 150°C | | 1.5 | | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 30A<br>$V_R$ = 300V<br>di/dt =1800A/µs | $T_j$ = 25°C | | 100 | | ns |
| | | | $T_j$ = 150°C | | 150 | | |
| $Q_{rr}$ | Reverse Recovery Charge | | $T_j$ = 25°C | | 1.5 | | µC |
| | | | $T_j$ = 150°C | | 3.1 | | |
| $E_r$ | Reverse Recovery Energy | | $T_j$ = 25°C | | 0.34 | | mJ |
| | | | $T_j$ = 150°C | | 0.75 | | |
| $R_{thJC}$ | Junction to Case Thermal Resistance | | | | | 2.45 | °C/W |

## Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

| Symbol | Characteristic | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $R_{25}$ | Resistance @ 25°C | | | 50 | | kΩ |
| $\Delta R_{25}/R_{25}$ | | | | 5 | | % |
| $B_{25/85}$ | $T_{25}$ = 298.15 K | | | 3952 | | K |
| ΔB/B | | $T_C$=100°C | | 4 | | % |

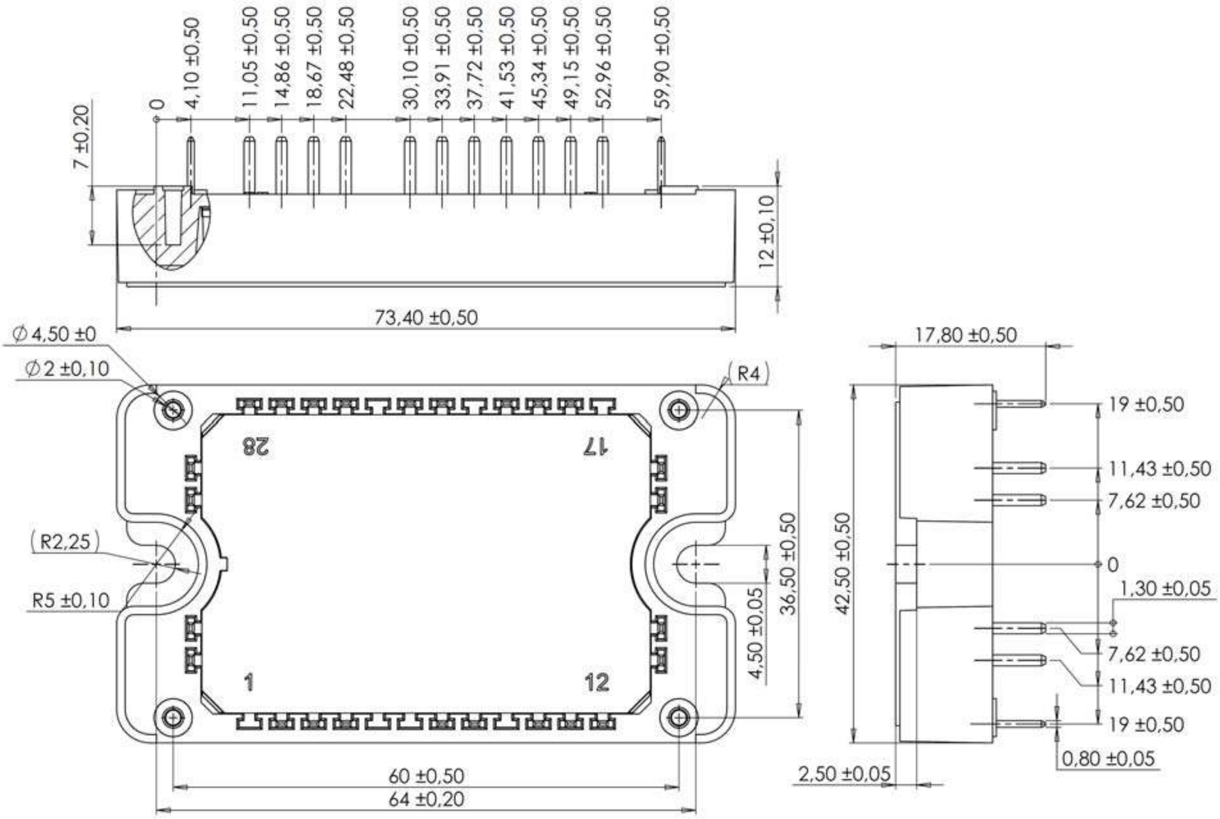
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
$R_T$: Thermistor value at T

## Thermal and package characteristics

| Symbol | Characteristic | | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{ISOL}$ | RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz | | | 4000 | | V |
| $T_J$ | Operating junction temperature range | | | -40 | 175 | °C |
| $T_{JOP}$ | Recommended junction temperature under switching conditions | | | -40 | $T_J$max -25 | °C |
| $T_{STG}$ | Storage Temperature Range | | | -40 | 125 | °C |
| $T_C$ | Operating Case Temperature | | | -40 | 125 | °C |
| Torque | Mounting torque | To heatsink | M4 | 2 | 3 | N.m |
| Wt | Package Weight | | | | 110 | g |

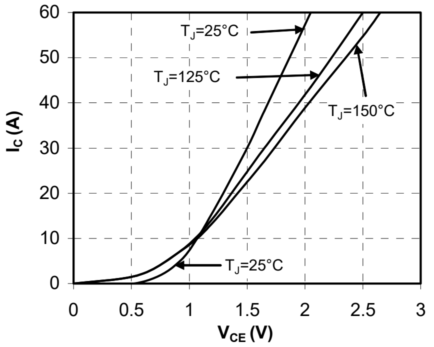
## Package outline (dimensions in mm)



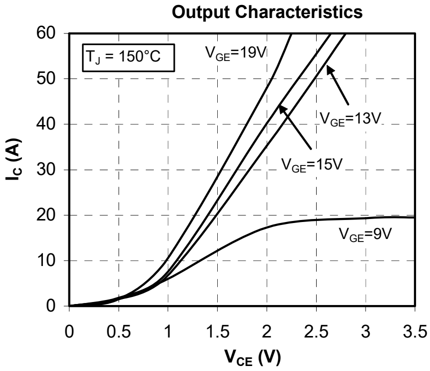

See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

## Typical Performance Curve

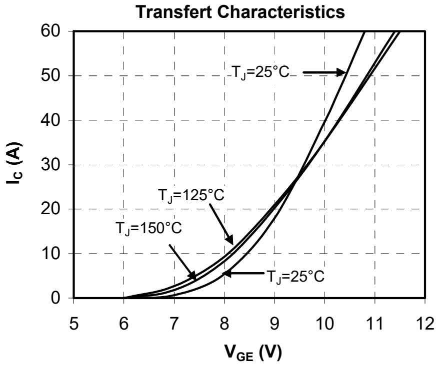
Output Characteristics ($V_{GE}$=15V)



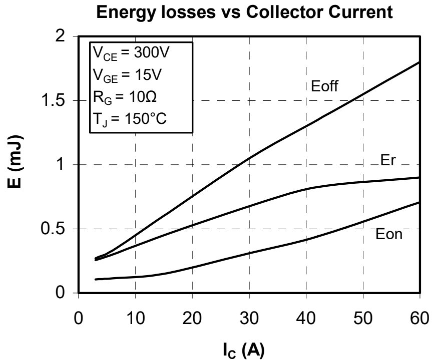

Output Characteristics



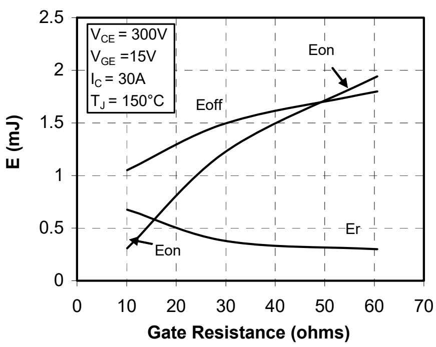

Transfert Characteristics



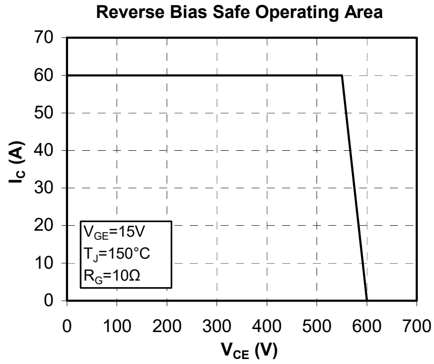

Energy losses vs Collector Current



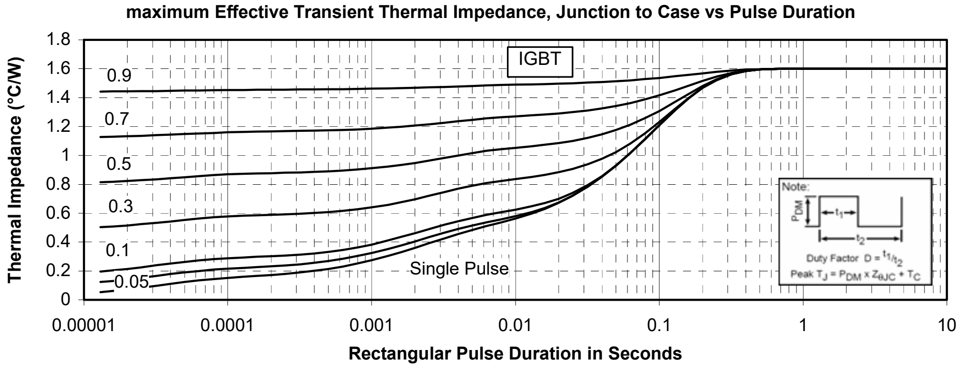

Switching Energy Losses vs Gate Resistance

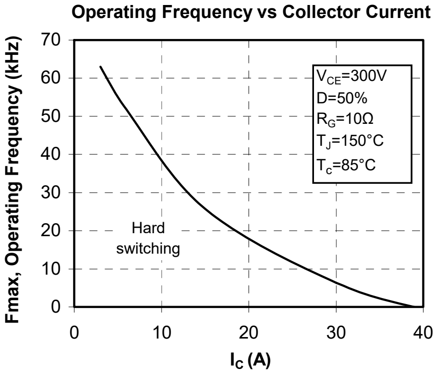


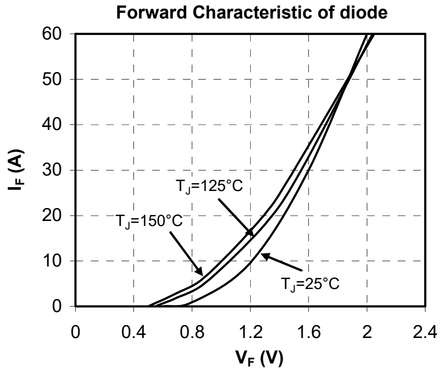

Reverse Bias Safe Operating Area

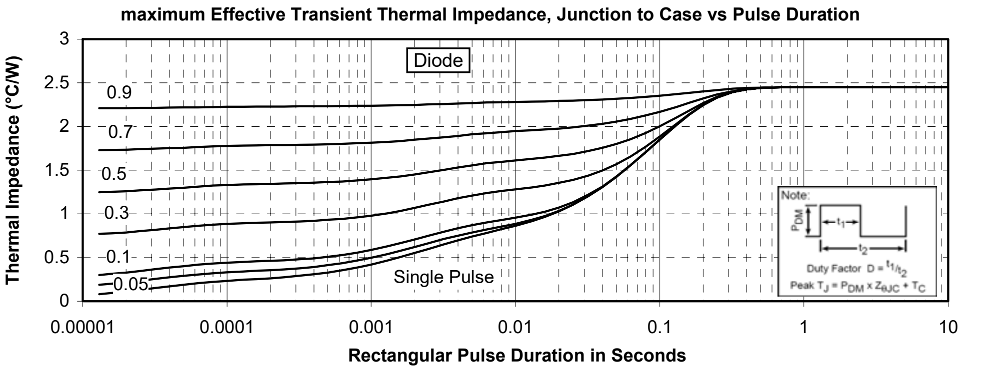



maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration




Operating Frequency vs Collector Current
Fmax, Operating Frequency (kHz)
$I_C$ (A)
$V_{CE}$=300V
D=50%
$R_G$=10Ω
$T_J$=150°C
$T_c$=85°C
Hard switching
0
10
20
30
40
50
60
70


Forward Characteristic of diode
$I_F$ (A)
$V_F$ (V)
$T_J$=125°C
$T_J$=150°C
$T_J$=25°C
0
0.4
0.8
1.2
1.6
2
2.4
10
20
30
40
50
60


maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration
Thermal Impedance (°C/W)
Rectangular Pulse Duration in Seconds
Diode
0.9
0.7
0.5
0.3
0.1
0.05
Single Pulse
Note:
Duty Factor D = $t_1/t_2$
Peak $T_J$ = $P_{DM}$ x $Z_{θJC}$ + $T_C$
0.00001
0.0001
0.001
0.01
0.1
1
10

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