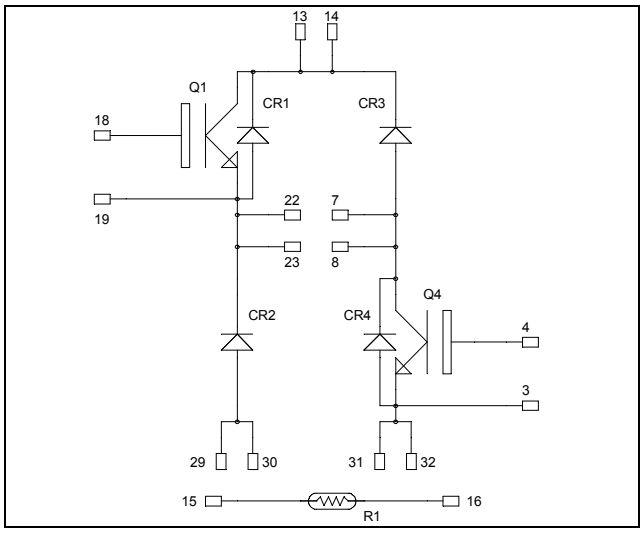
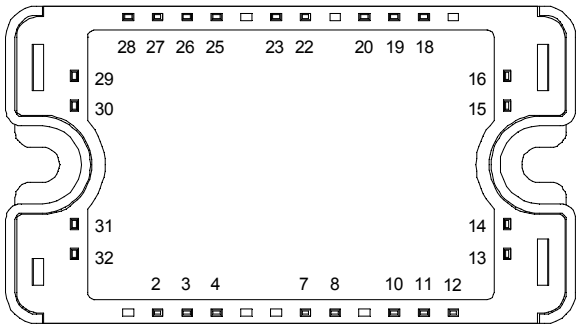
# APTGL60DH120T3G

## *Asymmetrical - Bridge Trench + Field Stop IGBT4 Power module*

$V_{CES}$ = 1200V
$I_C$ = 60A @ Tc = 80°C




All multiple inputs and outputs must be shorted together
Example: 13/14 ; 29/30 ; 22/23 …

**Application**

- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies

**Features**

- Trench + Field Stop IGBT 4 Technology
  - Low voltage drop
  - Low leakage current
  - Low switching losses
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - RBSOA and SCSOA rated
  - Symmetrical design
- Kelvin emitter for easy drive
- Very low stray inductance
- High level of integration
- 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
- Easy paralleling due to positive TC of VCEsat
- Each leg can be easily paralleled to achieve a phase leg of twice the current capability
- RoHS compliant

## Absolute maximum ratings

| *Symbol* | *Parameter* | | *Max ratings* | *Unit* |
|---|---|---|---|---|
| $V_{CES}$ | Collector - Emitter Breakdown Voltage | | 1200 | V |
| $I_C$ | Continuous Collector Current | $T_C$ = 25°C | 80 | A |
| | | $T_C$ = 80°C | 60 | |
| $I_{CM}$ | Pulsed Collector Current | $T_C$ = 25°C | 100 | |
| $V_{GE}$ | Gate – Emitter Voltage | | ±20 | V |
| $P_D$ | Maximum Power Dissipation | $T_C$ = 25°C | 280 | W |
| RBSOA | Reverse Bias Safe Operating Area | $T_j$ = 150°C | 100A @ 1100V | |

**CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

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

## Electrical Characteristics

| *Symbol* | *Characteristic* | *Test Conditions* | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $I_{CES}$ | Zero Gate Voltage Collector Current | $V_{GE}$ = 0V, $V_{CE}$ = 1200V | | | | 250 | µA |
| $V_{CE(sat)}$ | Collector Emitter saturation Voltage | $V_{GE}$ = 15V<br>$I_C$ = 50A | $T_j$ = 25°C | | 1.85 | 2.25 | V |
| | | | $T_j$ = 150°C | | 2.25 | | |
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{GE}$ = $V_{CE}$ , $I_C$ = 1.6mA | | 5.0 | 5.8 | 6.5 | V |
| $I_{GES}$ | Gate – Emitter Leakage Current | $V_{GE}$ = 20V, $V_{CE}$ = 0V | | | | 400 | nA |

## Dynamic Characteristics

| *Symbol* | *Characteristic* | *Test Conditions* | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $C_{ies}$ | Input Capacitance | $V_{GE}$ = 0V<br>$V_{CE}$ = 25V<br>f = 1MHz | | | 2770 | | pF |
| $C_{oes}$ | Output Capacitance | | | | 205 | | |
| $C_{res}$ | Reverse Transfer Capacitance | | | | 160 | | |
| $Q_G$ | Gate charge | $V_{GE}$= ±15V ; $V_{CE}$=600V<br>$I_C$=50A | | | 0.38 | | µC |
| $T_{d(on)}$ | Turn-on Delay Time | Inductive Switching (25°C)<br>$V_{GE}$ = ±15V<br>$V_{CE}$ = 600V<br>$I_C$ = 50A<br>$R_G$ = 8.2Ω | | | 130 | | ns |
| $T_r$ | Rise Time | | | | 20 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | | 300 | | |
| $T_f$ | Fall Time | | | | 45 | | |
| $T_{d(on)}$ | Turn-on Delay Time | Inductive Switching (150°C)<br>$V_{GE}$ = ±15V<br>$V_{CE}$ = 600V<br>$I_C$ = 50A<br>$R_G$ = 8.2Ω | | | 150 | | ns |
| $T_r$ | Rise Time | | | | 35 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | | 350 | | |
| $T_f$ | Fall Time | | | | 80 | | |
| $E_{on}$ | Turn-on Switching Energy | $V_{GE}$ = ±15V<br>$V_{CE}$ = 600V<br>$I_C$ = 50A<br>$R_G$ = 8.2Ω | $T_J$ = 25°C | | 3.8 | | mJ |
| | | | $T_J$ = 150°C | | 5.5 | | |
| $E_{off}$ | Turn-off Switching Energy | | $T_J$ = 25°C | | 2.5 | | mJ |
| | | | $T_J$ = 150°C | | 4.5 | | |
| $I_{sc}$ | Short Circuit data | $V_{GE}$ ≤15V ; $V_{Bus}$ = 900V<br>$t_p$ ≤10µs ; $T_j$ = 150°C | | | 200 | | A |

## Reverse diode ratings and characteristics

| *Symbol* | *Characteristic* | *Test Conditions* | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | Maximum Peak Repetitive Reverse Voltage | | | 1200 | | | V |
| $I_{RM}$ | Maximum Reverse Leakage Current | $V_R$=1200V | $T_j$ = 25°C | | | 250 | µA |
| $I_F$ | DC Forward Current | | Tc = 80°C | | 90 | | A |
| $V_F$ | Diode Forward Voltage | $I_F$ = 50A<br>$V_{GE}$ = 0V | $T_j$ = 25°C | | 1.5 | 2.0 | V |
| | | | $T_j$ = 150°C | | 1.43 | | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 50A<br>$V_R$ = 600V<br>di/dt =1300A/µs | $T_j$ = 25°C | | 155 | | ns |
| | | | $T_j$ = 150°C | | 300 | | |
| $Q_{rr}$ | Reverse Recovery Charge | | $T_j$ = 25°C | | 4.8 | | µC |
| | | | $T_j$ = 150°C | | 10 | | |
| $E_r$ | Reverse Recovery Energy | | $T_j$ = 25°C | | 1.7 | | mJ |
| | | | $T_j$ = 150°C | | 3.6 | | |

## Thermal and package characteristics

| Symbol | Characteristic | | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{thJC}$ | Junction to Case Thermal Resistance | | IGBT | | | 0.53 | °C/W |
| | | | Diode | | | 0.62 | |
| $V_{ISOL}$ | RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz | | | 4000 | | | V |
| $T_J$ | Operating junction temperature range | | | -40 | | 175 | °C |
| $T_{STG}$ | Storage Temperature Range | | | -40 | | 125 | |
| $T_C$ | Operating Case Temperature | | | -40 | | 100 | |
| Torque | Mounting torque | To heatsink | M4 | 2 | | 3 | N.m |
| Wt | Package Weight | | | | | 110 | g |

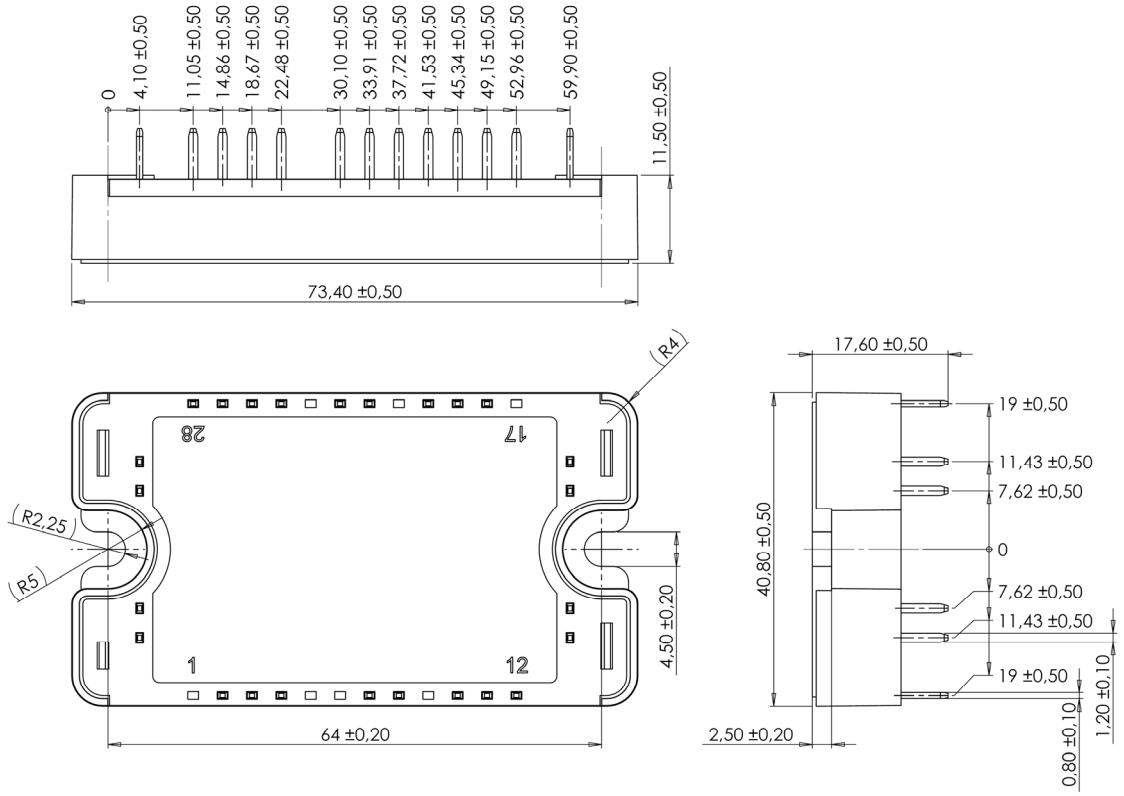
## Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

| 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 |
| $\Delta B/B$ | | $T_C$=100°C | | 4 | | % |

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

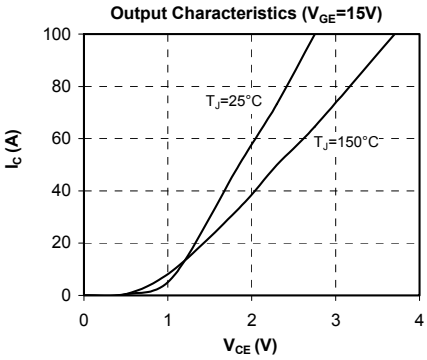
T: Thermistor temperature
$R_T$: Thermistor value at T

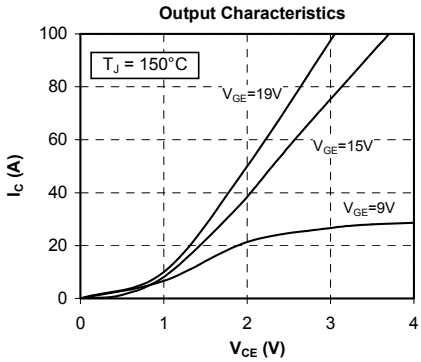
## SP3 Package outline (dimensions in mm)

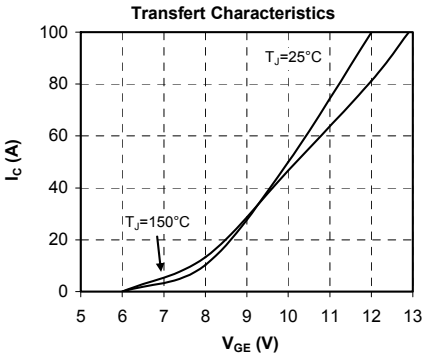


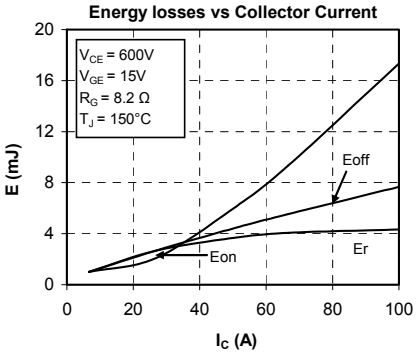

See application note 1901 - Mounting Instructions for SP3 Power Modules on www.microsemi.com

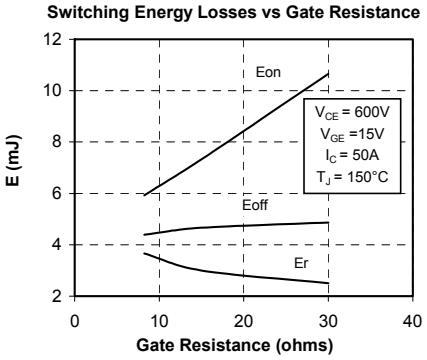
## Typical Performance Curve

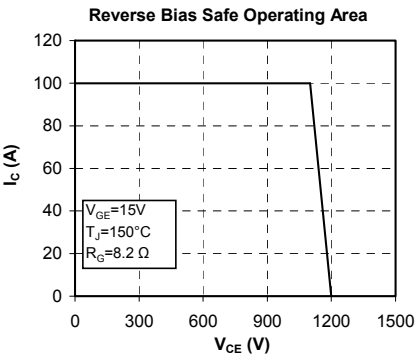


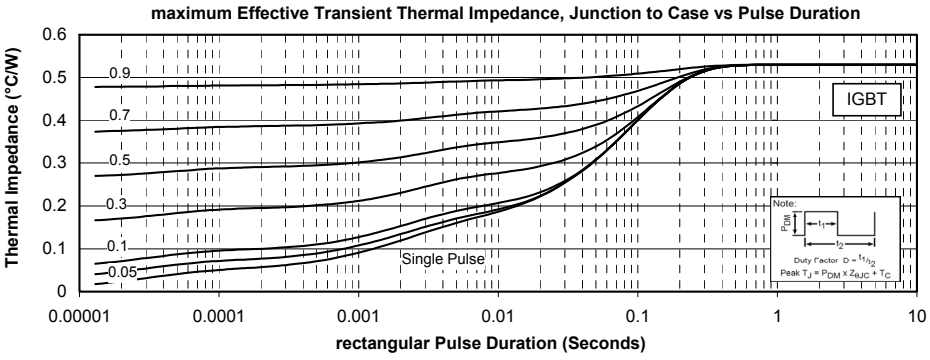



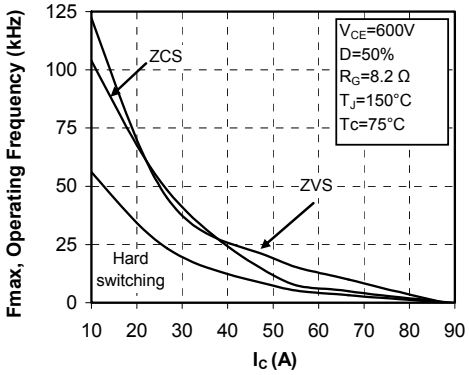



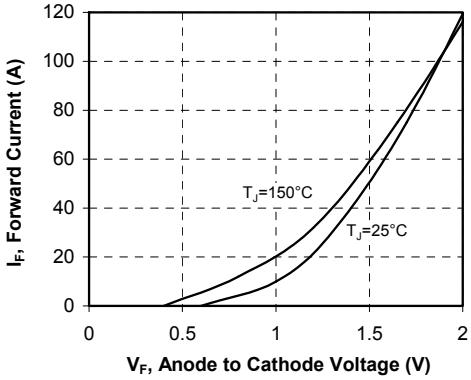



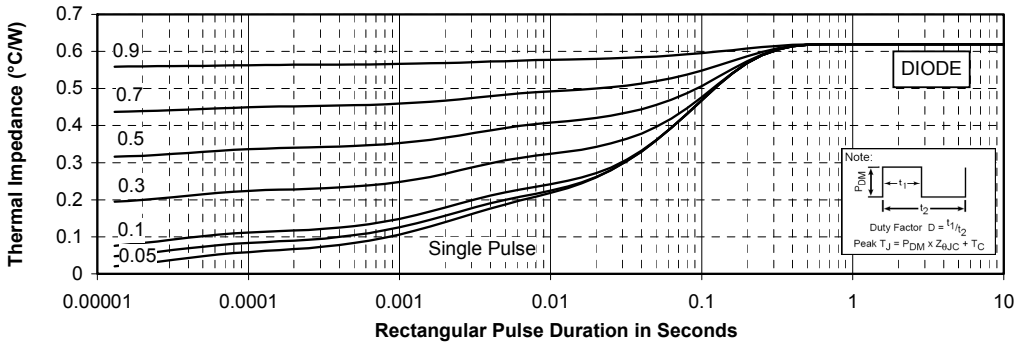
**Operating Frequency vs Collector Current**




**Forward Characteristic of diode**




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



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