

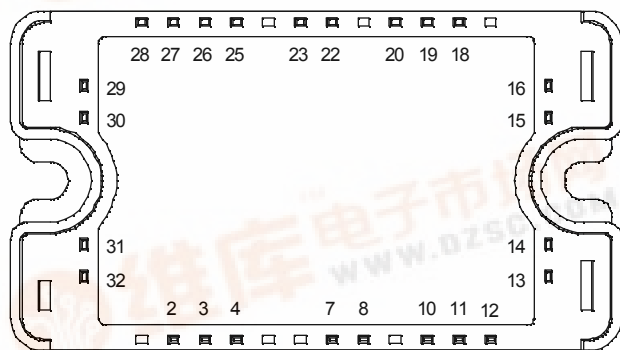
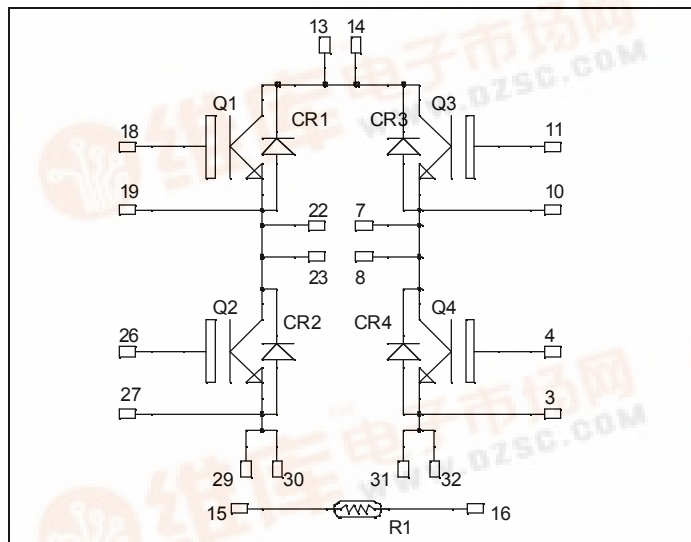


# APTGF25H120T3G

## Full - Bridge NPT IGBT Power Module

$$V_{CES} = 1200V$$

$$I_C = 25A @ T_c = 80^{\circ}C$$



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
- Motor control

### Features

- Non Punch Through (NPT) Fast IGBT®
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 50 kHz
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - Avalanche energy rated
  - 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  $T_C$  of  $V_{CEsat}$
- 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          | $T_C = 25^{\circ}C$<br>40<br>$T_C = 80^{\circ}C$<br>25 | A    |
| $I_{CM}$  | Pulsed Collector Current              | $T_C = 25^{\circ}C$<br>100                             | A    |
| $V_{GE}$  | Gate - Emitter Voltage                | $\pm 20$                                               | V    |
| $P_D$     | Maximum Power Dissipation             | $T_C = 25^{\circ}C$<br>208                             | W    |
| RBSOA     | Reverse Bias Safe Operating Area      | $T_j = 125^{\circ}C$<br>50A@1150V                      |      |



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

All ratings @  $T_j = 25^\circ\text{C}$  unless otherwise specified

**Electrical Characteristics**

| Symbol        | Characteristic                       | Test Conditions                                 |                                                       | Min | Typ        | Max        | Unit          |
|---------------|--------------------------------------|-------------------------------------------------|-------------------------------------------------------|-----|------------|------------|---------------|
| $I_{CES}$     | Zero Gate Voltage Collector Current  | $V_{GE} = 0\text{V}$<br>$V_{CE} = 1200\text{V}$ | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ |     |            | 250<br>500 | $\mu\text{A}$ |
| $V_{CE(sat)}$ | Collector Emitter saturation Voltage | $V_{GE} = 15\text{V}$<br>$I_C = 25\text{A}$     | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ | 2.5 | 3.2<br>4.0 | 3.7        | V             |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE}, I_C = 1\text{mA}$             |                                                       | 4   |            | 6          | V             |
| $I_{GES}$     | Gate – Emitter Leakage Current       | $V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$       |                                                       |     |            | 400        | nA            |

**Dynamic Characteristics**

| Symbol       | Characteristic               | Test Conditions                                  |                           | Min | Typ  | Max | Unit |
|--------------|------------------------------|--------------------------------------------------|---------------------------|-----|------|-----|------|
| $C_{ies}$    | Input Capacitance            | $V_{GE} = 0\text{V}$                             |                           |     | 1650 |     | pF   |
| $C_{oes}$    | Output Capacitance           | $V_{CE} = 25\text{V}$                            |                           |     | 250  |     |      |
| $C_{res}$    | Reverse Transfer Capacitance | $f = 1\text{MHz}$                                |                           |     | 110  |     |      |
| $Q_g$        | Total gate Charge            | $V_{GE} = 15\text{V}$                            |                           |     | 160  |     | nC   |
| $Q_{ge}$     | Gate – Emitter Charge        | $V_{Bus} = 300\text{V}$                          |                           |     | 10   |     |      |
| $Q_{gc}$     | Gate – Collector Charge      | $I_C = 25\text{A}$                               |                           |     | 70   |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $25^\circ\text{C}$ )       |                           |     | 60   |     | ns   |
| $T_r$        | Rise Time                    | $V_{GE} = 15\text{V}$                            |                           |     | 50   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          | $V_{Bus} = 400\text{V}$                          |                           |     | 305  |     |      |
| $T_f$        | Fall Time                    | $I_C = 25\text{A}$<br>$R_G = 22\Omega$           |                           |     | 30   |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $125^\circ\text{C}$ )      |                           |     | 60   |     | ns   |
| $T_r$        | Rise Time                    | $V_{GE} = 15\text{V}$                            |                           |     | 50   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          | $V_{Bus} = 400\text{V}$                          |                           |     | 346  |     |      |
| $T_f$        | Fall Time                    | $I_C = 25\text{A}$<br>$R_G = 22\Omega$           |                           |     | 40   |     |      |
| $E_{on}$     | Turn-on Switching Energy     | $V_{GE} = 15\text{V}$<br>$V_{Bus} = 400\text{V}$ | $T_j = 125^\circ\text{C}$ |     | 3.5  |     | mJ   |
| $E_{off}$    | Turn-off Switching Energy    | $I_C = 25\text{A}$<br>$R_G = 22\Omega$           | $T_j = 125^\circ\text{C}$ |     | 1.5  |     |      |

**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         | $V_R = 1200\text{V}$                                                            | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ |      |             | 100<br>250 | $\mu\text{A}$ |
| $I_F$     | Forward Current                         |                                                                                 | $T_c = 80^\circ\text{C}$                              |      | 25          |            | A             |
| $V_F$     | Diode Forward Voltage                   | $I_F = 25\text{A}$<br>$V_{GE} = 0\text{V}$                                      | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ |      | 2.1<br>1.9  |            | V             |
| $t_{rr}$  | Reverse Recovery Time                   | $I_F = 25\text{A}$<br>$V_R = 600\text{V}$<br>$di/dt = 1000\text{A}/\mu\text{s}$ | $T_j = 25^\circ\text{C}$                              |      | 95          |            | ns            |
|           |                                         |                                                                                 | $T_j = 125^\circ\text{C}$                             |      | 190         |            |               |
| $Q_{rr}$  | Reverse Recovery Charge                 |                                                                                 | $T_j = 25^\circ\text{C}$                              |      | 2.1         |            | $\mu\text{C}$ |
|           |                                         |                                                                                 | $T_j = 125^\circ\text{C}$                             |      | 4.5         |            |               |
| $E_r$     | Reverse Recovery Energy                 |                                                                                 | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ |      | 0.75<br>1.5 |            | mJ            |

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

| Symbol             | Characteristic             | Min | Typ  | Max | Unit |
|--------------------|----------------------------|-----|------|-----|------|
| R <sub>25</sub>    | Resistance @ 25°C          |     | 50   |     | kΩ   |
| B <sub>25/85</sub> | T <sub>25</sub> = 298.15 K |     | 3952 |     | K    |

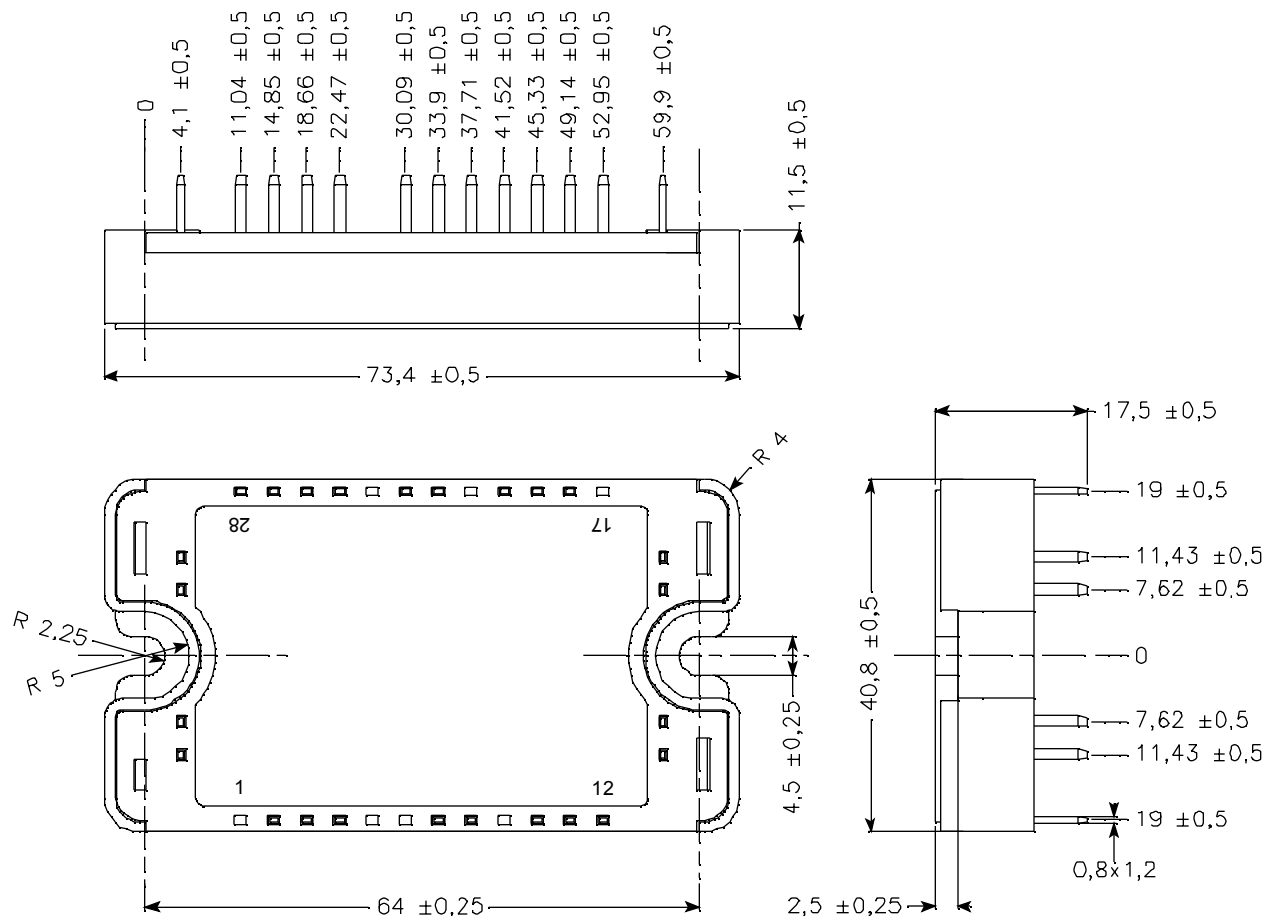
$$R_T = \frac{R_{25}}{\exp \left[ B_{25/85} \left( \frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

## Thermal and package characteristics

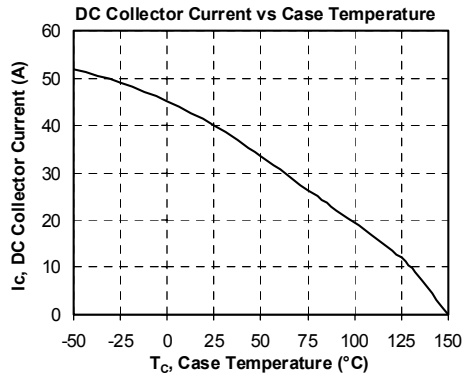
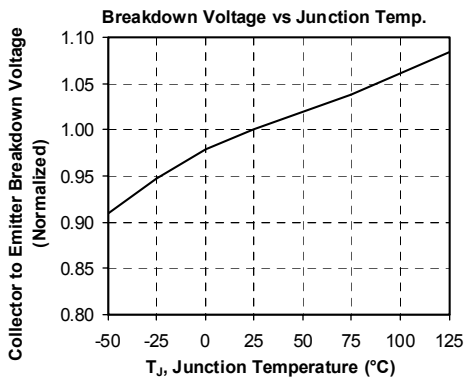
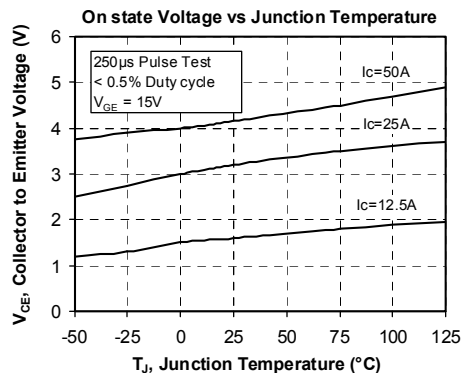
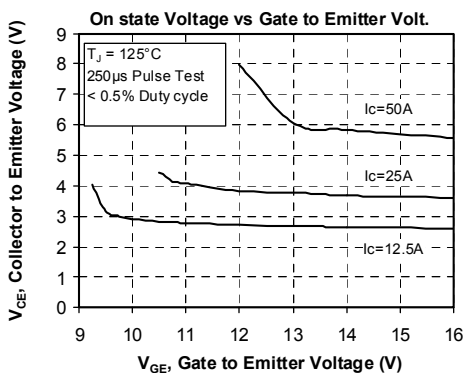
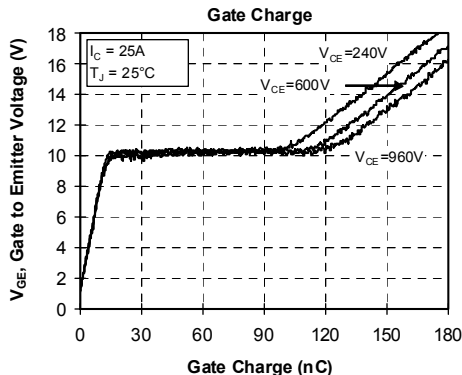
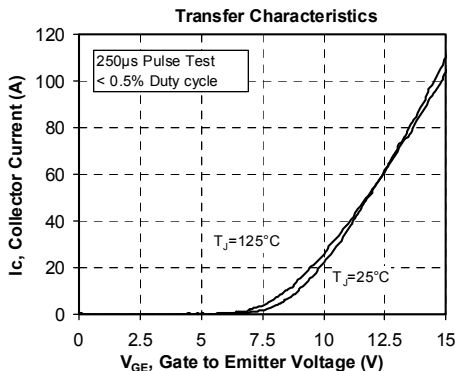
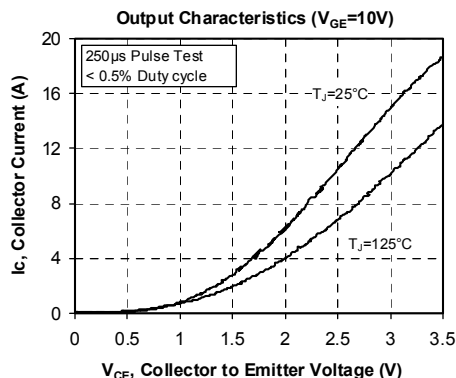
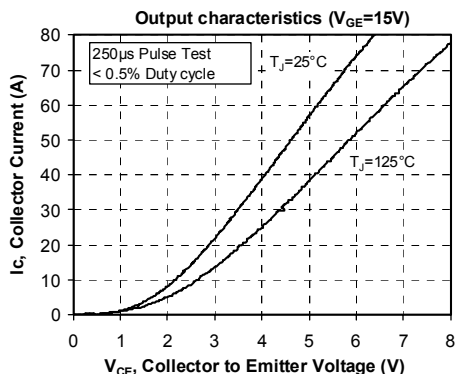
| Symbol            | Characteristic                                                            |             |    | Min   | Typ | Max | Unit |
|-------------------|---------------------------------------------------------------------------|-------------|----|-------|-----|-----|------|
| R <sub>thJC</sub> | Junction to Case Thermal Resistance                                       |             |    | IGBT  |     | 0.6 | °C/W |
|                   |                                                                           |             |    | Diode |     | 1.2 |      |
| V <sub>ISOL</sub> | RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz |             |    | 2500  |     |     | V    |
| T <sub>J</sub>    | Operating junction temperature range                                      |             |    | -40   |     | 150 | °C   |
| T <sub>STG</sub>  | Storage Temperature Range                                                 |             |    | -40   |     | 125 |      |
| T <sub>C</sub>    | Operating Case Temperature                                                |             |    | -40   |     | 100 |      |
| Torque            | Mounting torque                                                           | To heatsink | M4 | 2.5   |     | 4.7 | N.m  |
| Wt                | Package Weight                                                            |             |    |       |     | 110 | g    |

## SP3 Package outline (dimensions in mm)

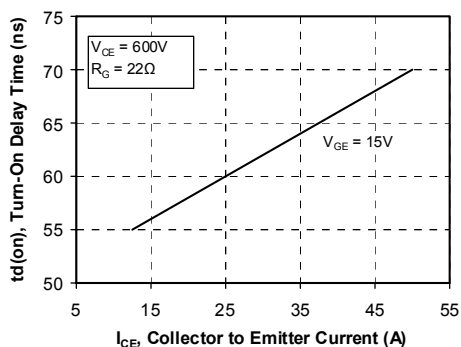


See application note 1901 - Mounting Instructions for SP3 Power Modules on [www.microsemi.com](http://www.microsemi.com)

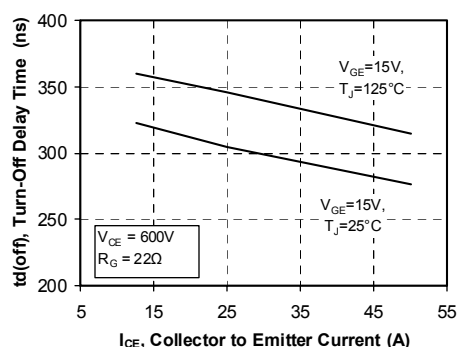
## Typical Performance Curve



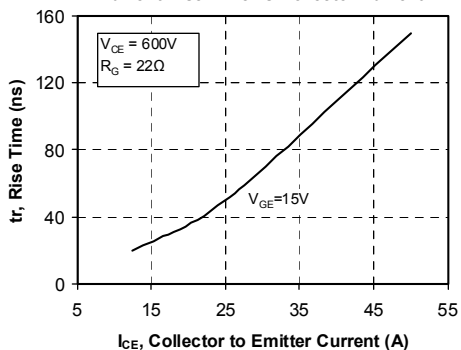
Turn-On Delay Time vs Collector Current



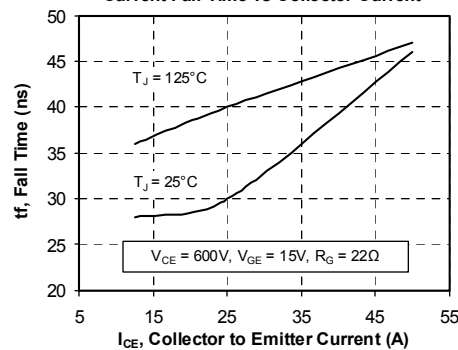
Turn-Off Delay Time vs Collector Current



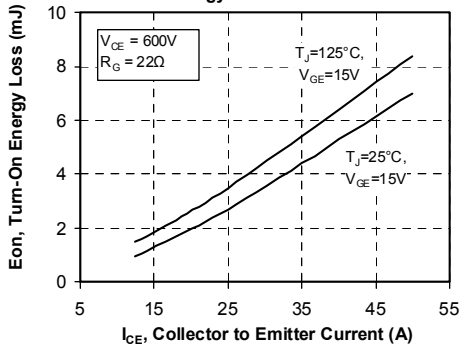
Current Rise Time vs Collector Current



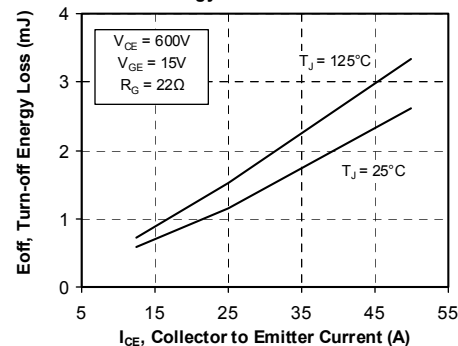
Current Fall Time vs Collector Current



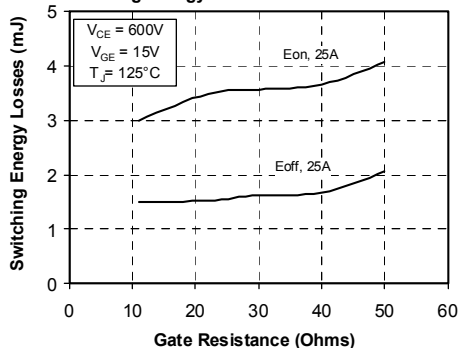
Turn-On Energy Loss vs Collector Current



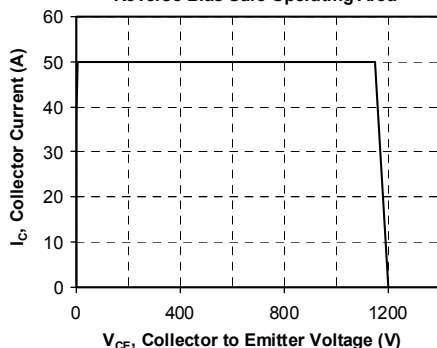
Turn-Off Energy Loss vs Collector Current

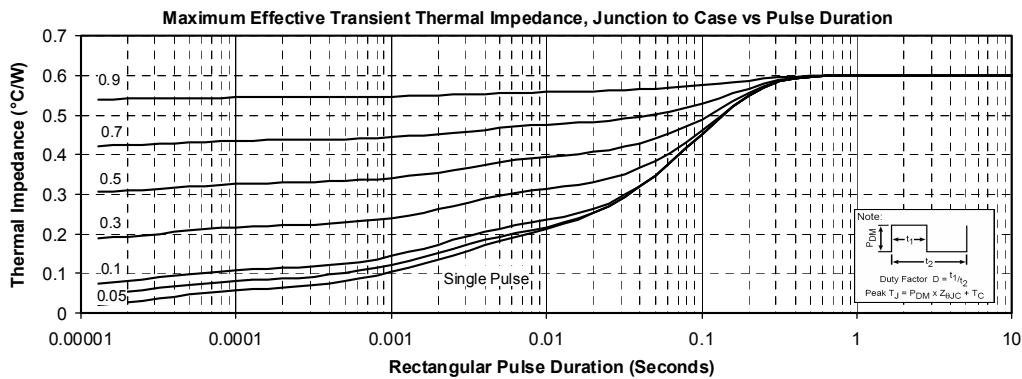
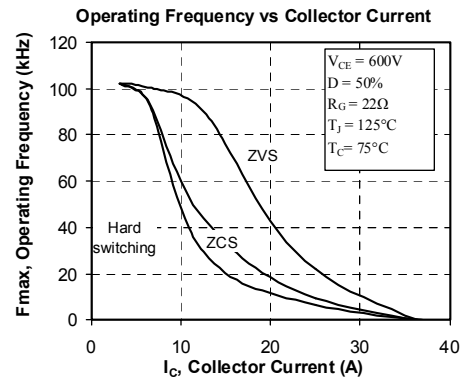
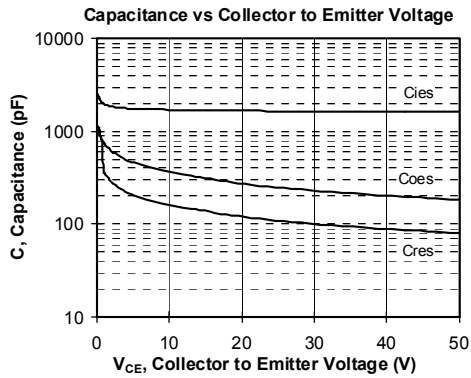


Switching Energy Losses vs Gate Resistance



Reverse Bias Safe Operating Area





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