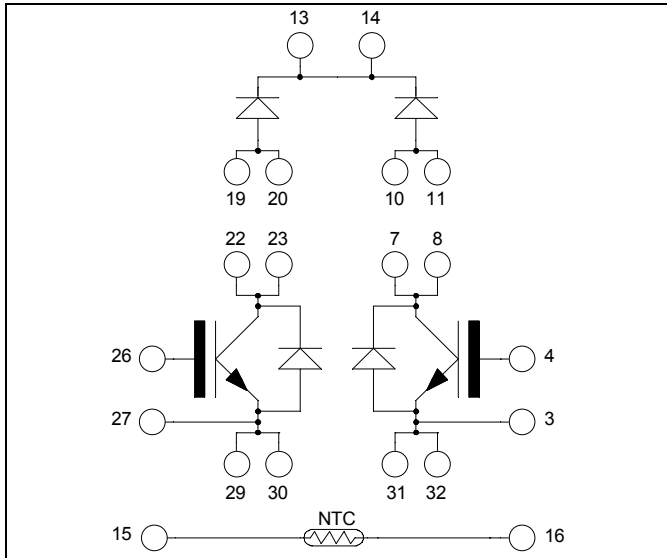


## Dual Boost chopper NPT IGBT Power Module

$$V_{CES} = 1200V$$

$$I_C = 50A @ T_c = 80^{\circ}C$$

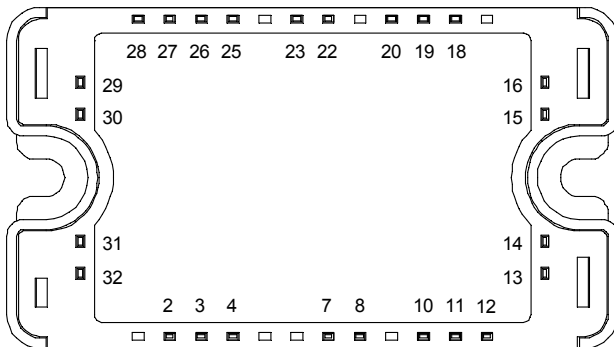


### Application

- AC and DC motor control
- Switched Mode Power Supplies
- Power Factor Correction (PFC)
- Interleaved PFC

### 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
  - RBSOA and SCSOA rated
  - Symmetrical design
- Kelvin emitter for easy drive
- Very low stray inductance
- High level of integration
- Internal thermistor for temperature monitoring



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

### 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 single boost 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>70            | A    |
|           |                                       | $T_c = 80^{\circ}C$<br>50            |      |
| $I_{CM}$  | Pulsed Collector Current              | $T_c = 25^{\circ}C$<br>150           |      |
| $V_{GE}$  | Gate - Emitter Voltage                | $\pm 20$                             | V    |
| $P_D$     | Maximum Power Dissipation             | $T_c = 25^{\circ}C$<br>312           | W    |
| RBSOA     | Reverse Bias Safe Operating Area      | $T_j = 150^{\circ}C$<br>100A @ 1200V |      |

**CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on [www.microsemi.com](http://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  | $V_{GE} = 0V$<br>$V_{CE} = 1200V$        | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ |            | 250<br>500 | $\mu\text{A}$ |
| $V_{CE(sat)}$ | Collector Emitter saturation Voltage | $V_{GE} = 15V$<br>$I_C = 50A$            | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ | 3.2<br>4.0 | 3.7        | V             |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE2}$ , $I_C = 1\text{ mA}$ | 4.5                                                   |            | 6.5        | V             |
| $I_{GES}$     | Gate – Emitter Leakage Current       | $V_{GE} = 20\text{ V}$ , $V_{CE} = 0V$   |                                                       |            | 100        | nA            |

## Dynamic Characteristics

| Symbol       | Characteristic               | Test Conditions                                                                              | Min                       | Typ  | Max | Unit |
|--------------|------------------------------|----------------------------------------------------------------------------------------------|---------------------------|------|-----|------|
| $C_{ies}$    | Input Capacitance            | $V_{GE} = 0V$                                                                                |                           | 3450 |     | pF   |
| $C_{oes}$    | Output Capacitance           | $V_{CE} = 25V$                                                                               |                           | 330  |     |      |
| $C_{res}$    | Reverse Transfer Capacitance | $f = 1\text{MHz}$                                                                            |                           | 220  |     |      |
| $Q_g$        | Total gate Charge            | $V_{GS} = 15V$                                                                               |                           | 330  |     | nC   |
| $Q_{ge}$     | Gate – Emitter Charge        | $V_{Bus} = 600V$                                                                             |                           | 35   |     |      |
| $Q_{gc}$     | Gate – Collector Charge      | $I_C = 50A$                                                                                  |                           | 200  |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $25^\circ\text{C}$ )                                                   |                           | 35   |     | ns   |
| $T_r$        | Rise Time                    | $V_{GE} = 15V$                                                                               |                           | 65   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          | $V_{Bus} = 600V$                                                                             |                           | 320  |     |      |
| $T_f$        | Fall Time                    | $I_C = 50A$                                                                                  |                           | 30   |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $125^\circ\text{C}$ )                                                  |                           | 35   |     | ns   |
| $T_r$        | Rise Time                    | $V_{GE} = \pm 15V$                                                                           |                           | 65   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          | $V_{Bus} = 600V$                                                                             |                           | 360  |     |      |
| $T_f$        | Fall Time                    | $I_C = 50A$                                                                                  |                           | 40   |     |      |
| $E_{on}$     | Turn-on Switching Energy     | $V_{GE} = \pm 15V$<br>$V_{Bus} = 600V$                                                       | $T_j = 125^\circ\text{C}$ | 6.9  |     | mJ   |
| $E_{off}$    | Turn-off Switching Energy    | $I_C = 50A$<br>$R_G = 5\ \Omega$                                                             | $T_j = 125^\circ\text{C}$ | 3.05 |     |      |
| $I_{sc}$     | Short Circuit data           | $V_{GE} \leq 15V$ ; $V_{Bus} = 900V$<br>$t_p \leq 10\mu\text{s}$ ; $T_j = 125^\circ\text{C}$ |                           | 300  |     | A    |

## Chopper 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         | $V_R = 1200V$                              | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ |             | 100<br>500 | $\mu\text{A}$ |
| $I_F$     | DC Forward Current                      | $T_c = 80^\circ\text{C}$                   |                                                       | 60          |            | A             |
| $V_F$     | Diode Forward Voltage                   | $I_F = 60A$                                |                                                       | 2.5         | 3          | V             |
|           |                                         | $I_F = 120A$                               |                                                       | 3           |            |               |
|           |                                         | $I_F = 60A$ , $T_j = 125^\circ\text{C}$    |                                                       | 1.8         |            |               |
| $t_{rr}$  | Reverse Recovery Time                   | $I_F = 60A$                                | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ | 265<br>350  |            | ns            |
| $Q_{rr}$  | Reverse Recovery Charge                 | $V_R = 800V$<br>$di/dt = 200A/\mu\text{s}$ | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ | 560<br>2890 |            | nC            |

## Thermal and package characteristics

| Symbol            | Characteristic                                                            |             |               | Min  | Typ | Max | Unit |
|-------------------|---------------------------------------------------------------------------|-------------|---------------|------|-----|-----|------|
| R <sub>thJC</sub> | Junction to Case Thermal Resistance                                       |             | IGBT          |      |     | 0.4 | °C/W |
|                   |                                                                           |             | Chopper diode |      |     | 0.9 |      |
| V <sub>ISOL</sub> | RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz |             |               | 4000 |     |     | 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    |

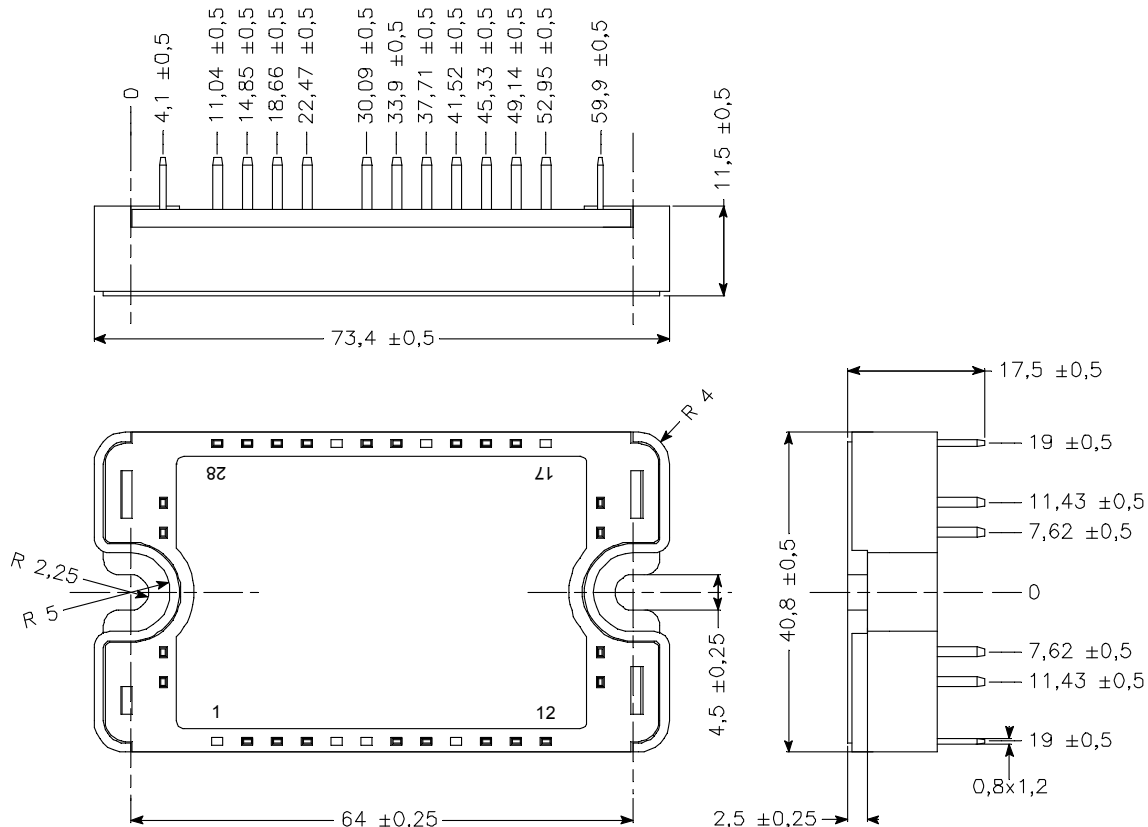
## Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

| Symbol                            | Characteristic             | Min | Typ  | Max | Unit |
|-----------------------------------|----------------------------|-----|------|-----|------|
| R <sub>25</sub>                   | Resistance @ 25°C          |     | 50   |     | kΩ   |
| ΔR <sub>25</sub> /R <sub>25</sub> |                            |     | 5    |     | %    |
| B <sub>25/85</sub>                | T <sub>25</sub> = 298.15 K |     | 3952 |     | K    |
| ΔB/B                              | T <sub>C</sub> = 100°C     |     | 4    |     | %    |

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

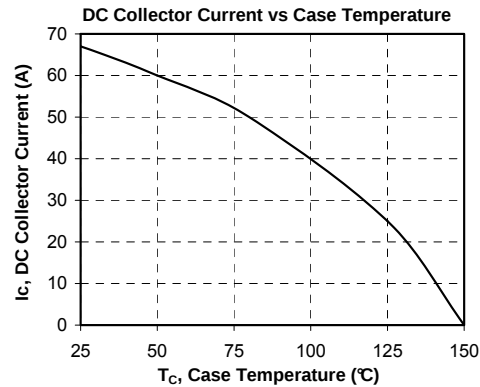
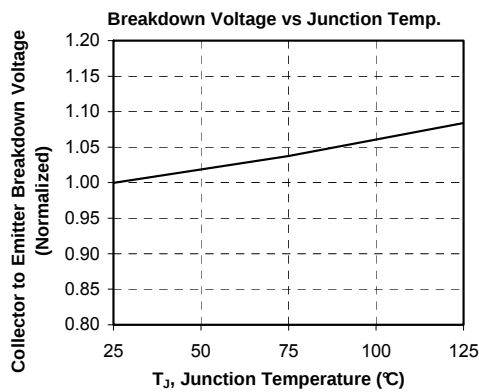
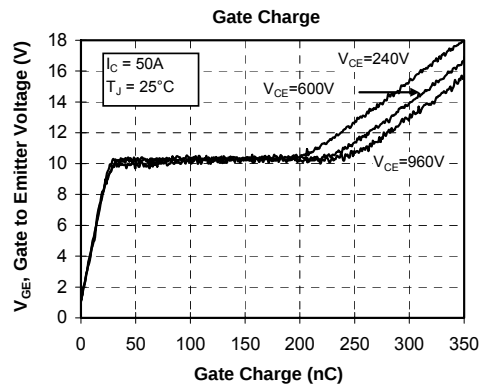
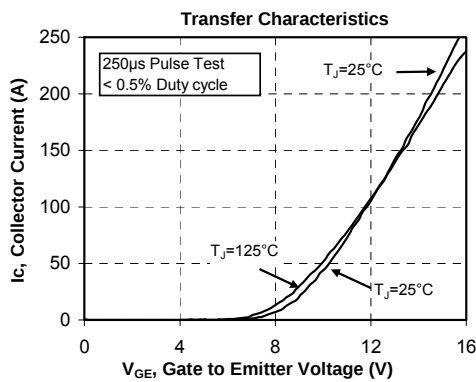
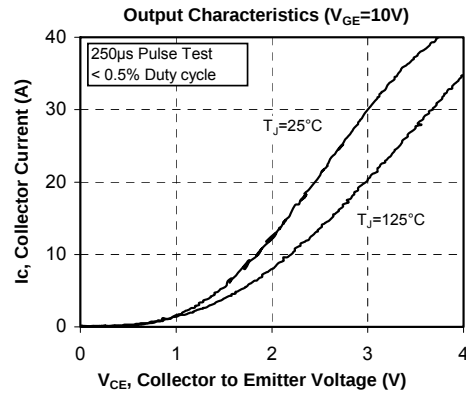
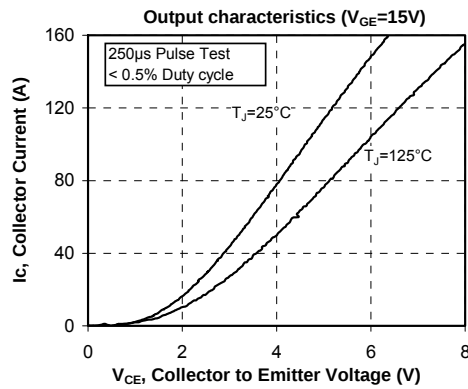
T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

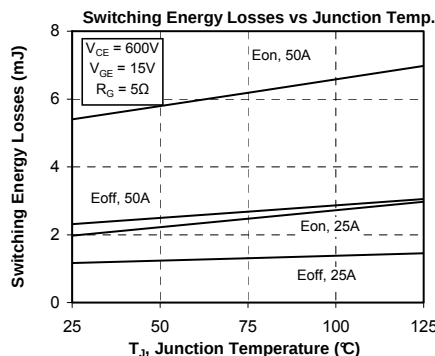
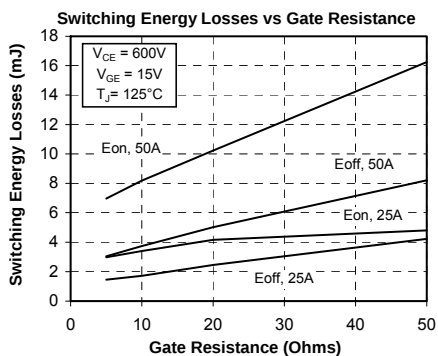
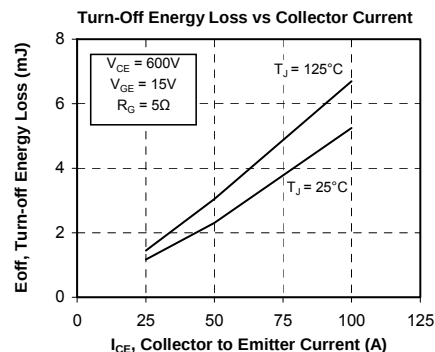
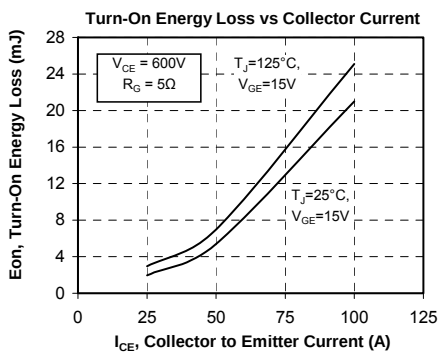
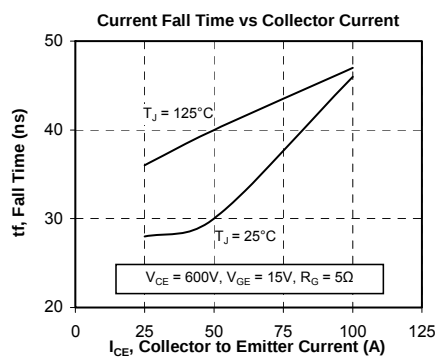
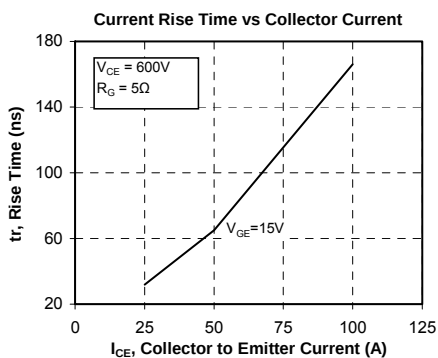
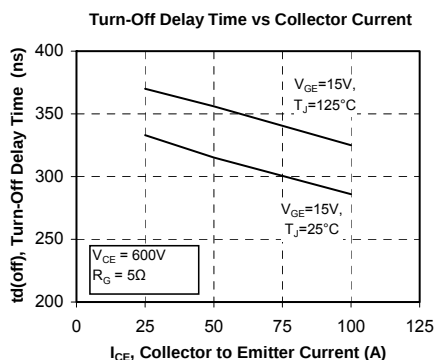
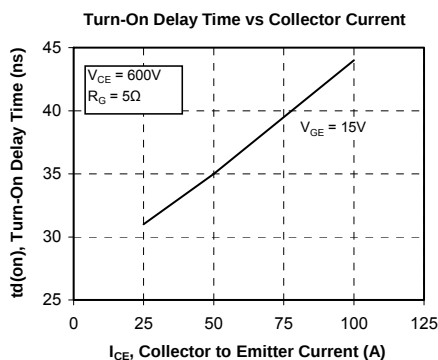
## SP3 Package outline (dimensions in mm)

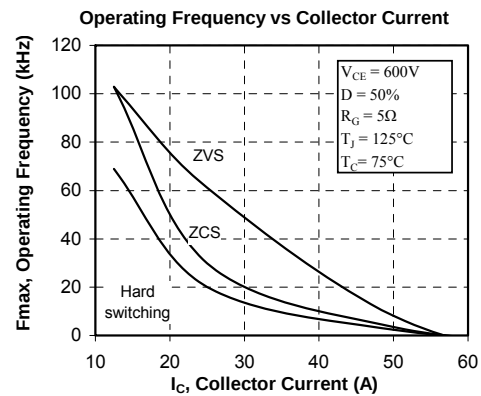
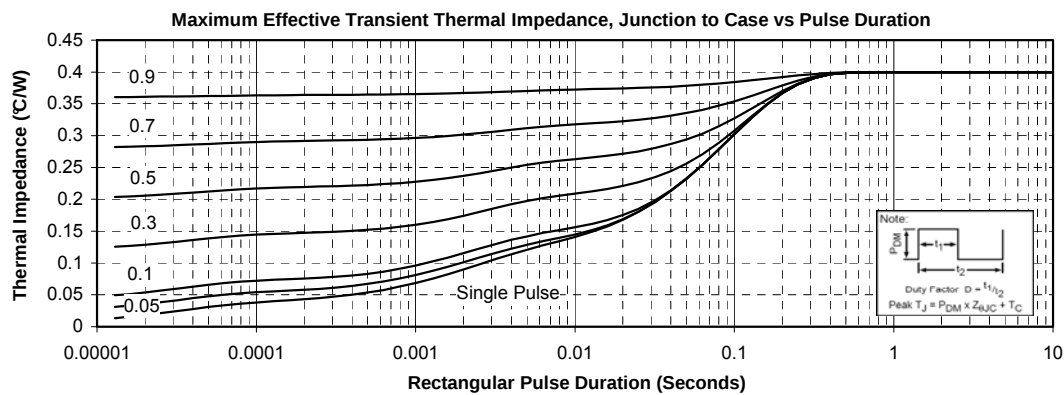
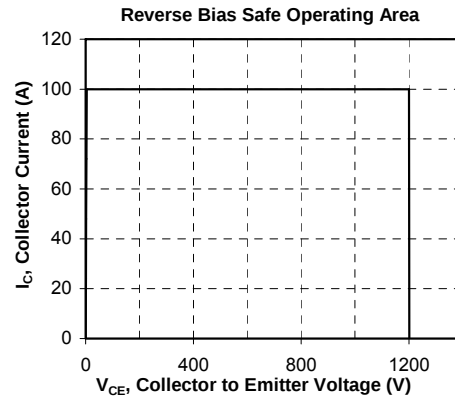
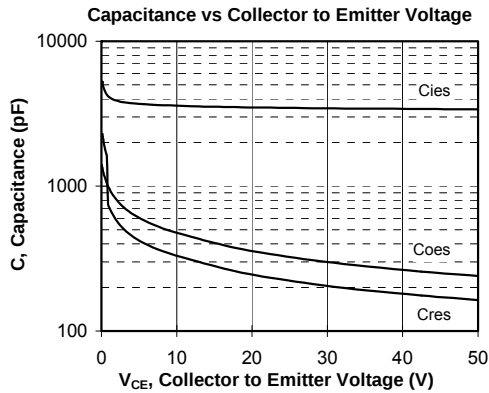


See application note 1901 - Mounting Instructions for SP3 Power Modules on [www.microsemi.com](http://www.microsemi.com)

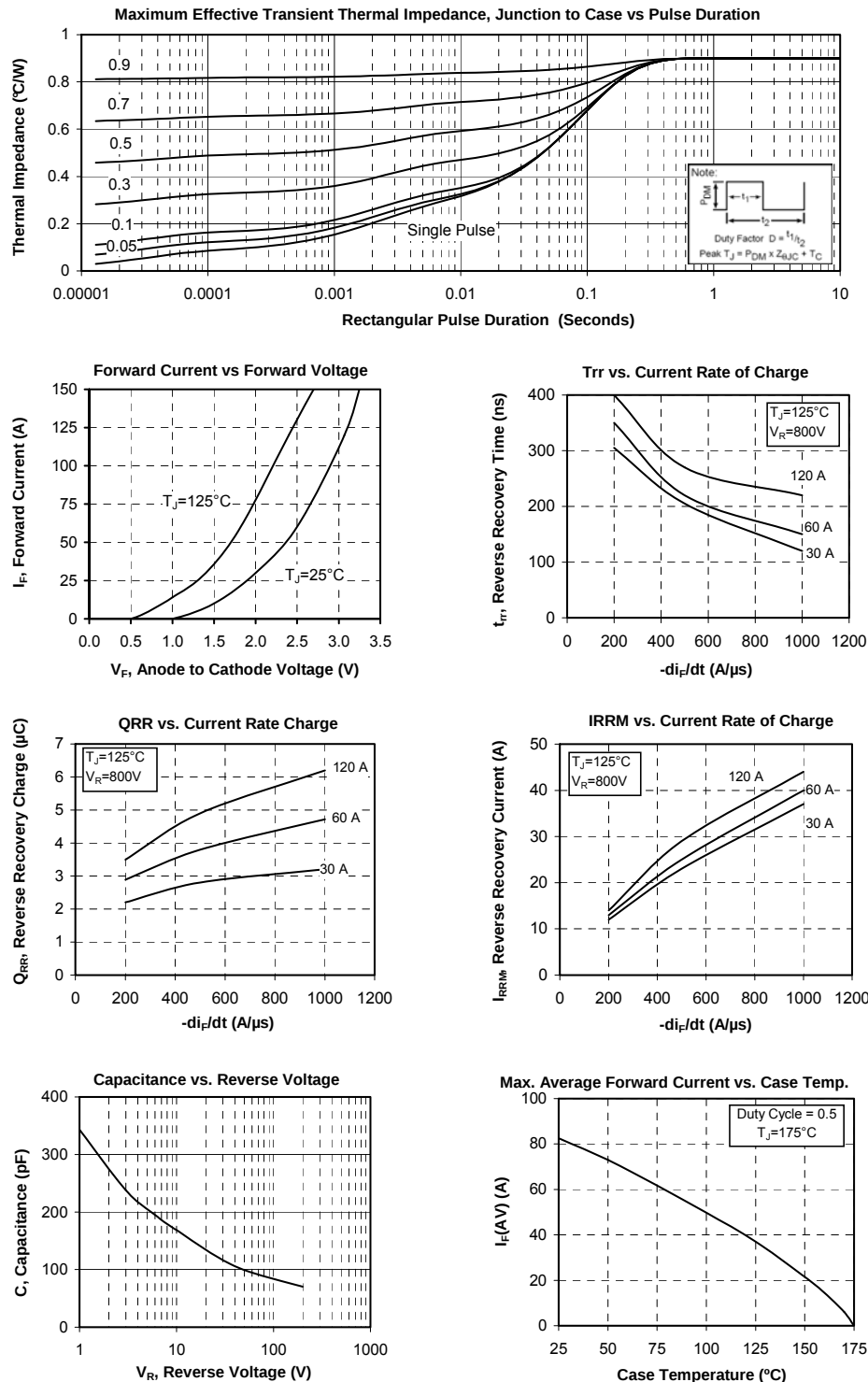
## Typical IGBT Performance Curve







## Typical chopper diode Performance Curve



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