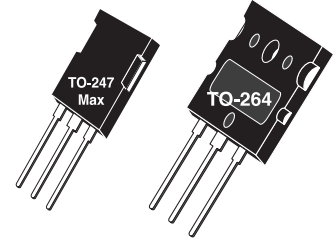


## Ultra Fast NPT - IGBT®

The Ultra Fast NPT - IGBT® is a new generation of high voltage power IGBTs. Using Non-Punch-Through Technology, the Ultra Fast NPT-IGBT® offers superior ruggedness and ultrafast switching speed.



### Features

- Low Saturation Voltage
- Low Tail Current
- RoHS Compliant 
- Short Circuit Withstand Rated
- High Frequency Switching
- Ultra Low Leakage Current

Unless stated otherwise, Microsemi discrete IGBTs contain a single IGBT die. This device is recommended for applications such as induction heating (IH), motor control, general purpose inverters and uninterruptible power supplies (UPS).



### MAXIMUM RATINGS

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

| Symbol         | Parameter  | Rated      | Unit             |
|----------------|--|------------|------------------|
| $V_{ces}$      | Collector Emitter Voltage  | 1200       | V                |
| $V_{GE}$       | Gate-Emitter Voltage   | $\pm 30$   |                  |
| $I_{C1}$       | Continuous Collector Current @ $T_C = 25^\circ\text{C}$                              | 160        | A                |
| $I_{C2}$       | Continuous Collector Current @ $T_C = 110^\circ\text{C}$                             | 70         |                  |
| $I_{CM}$       | Pulsed Collector Current <sup>①</sup>  | 280        |                  |
| SCWT           | Short Circuit Withstand Time: $V_{CE} = 600V, V_{GE} = 15V, T_C = 125^\circ\text{C}$ | 10         | $\mu\text{s}$    |
| $P_D$          | Total Power Dissipation @ $T_C = 25^\circ\text{C}$                                   | 961        | W                |
| $T_J, T_{STG}$ | 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        | Parameter   | Min  | Typ | Max       | Unit          |
|---------------|---|------|-----|-----------|---------------|
| $V_{(BR)CES}$ | Collector-Emitter Breakdown Voltage ( $V_{GE} = 0V, I_C = 1.0mA$ )                                | 1200 |     |           | Volts         |
| $V_{GE(TH)}$  | Gate Threshold Voltage ( $V_{CE} = V_{GE}, I_C = 2.5mA, T_J = 25^\circ\text{C}$ )                 | 3.5  | 5.0 | 6.5       |               |
| $V_{CE(ON)}$  | Collector-Emitter On Voltage ( $V_{GE} = 15V, I_C = 70A, T_J = 25^\circ\text{C}$ )                |      | 2.5 | 3.2       |               |
|               | Collector-Emitter On Voltage ( $V_{GE} = 15V, I_C = 70A, T_J = 125^\circ\text{C}$ )               |      | 3.3 |           |               |
|               | Collector-Emitter On Voltage ( $V_{GE} = 15V, I_C = 140A, T_J = 25^\circ\text{C}$ )               |      | 3.5 |           |               |
| $I_{CES}$     | Collector Cut-off Current ( $V_{CE} = 1200V, V_{GE} = 0V, T_J = 25^\circ\text{C}$ ) <sup>②</sup>  |      | 10  | 1000      | $\mu\text{A}$ |
|               | Collector Cut-off Current ( $V_{CE} = 1200V, V_{GE} = 0V, T_J = 125^\circ\text{C}$ ) <sup>②</sup> |      | 100 |           |               |
| $I_{GES}$     | Gate-Emitter Leakage Current ( $V_{GE} = \pm 20V$ )   |      |     | $\pm 250$ | nA            |



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

DYNAMIC CHARACTERISTICS

APT70GR120B2\_L

| Symbol          | Parameter                       | Test Conditions   | Min | Typ  | Max  | Unit |
|-----------------|---------------------------------|---|-----|------|------|------|
| $C_{ies}$       | Input Capacitance               | Capacitance<br>$V_{GE} = 0V, V_{CE} = 25V$<br>$f = 1MHz$  |     | 7260 |      | pF   |
| $C_{oes}$       | Output Capacitance              |   |     | 643  |      |      |
| $C_{res}$       | Reverse Transfer Capacitance    |   |     | 199  |      |      |
| $V_{GEP}$       | Gate to Emitter Plateau Voltage | Gate Charge<br>$V_{GE} = 15V$<br>$V_{CE} = 600V$<br>$I_C = 70A$   |     | 7.5  |      | V    |
| $Q_g^{(3)}$     | Total Gate Charge               |   |     | 412  | 544  | nC   |
| $Q_{ge}$        | Gate-Emitter Charge             |   |     | 48   | 62   |      |
| $Q_{gc}$        | Gate- Collector Charge          |   | 204 | 275  |      |      |
| $t_{d(on)}$     | Turn-On Delay Time              | Inductive Switching (25°C)<br>$V_{CC} = 600V$<br>$V_{GE} = 15V$<br>$I_C = 70A$<br>$R_G = 4.3 \Omega^{(4)}$<br>$T_J = +25^\circ C$   |     | 33   |      | ns   |
| $t_r$           | Current Rise Time               |   |     | 48   |      |      |
| $t_{d(off)}$    | Turn-Off Delay Time             |   |     | 278  |      |      |
| $t_f$           | Current Fall Time               |   |     | 64   |      |      |
| $E_{on2}^{(5)}$ | Turn-On Switching Energy        | Inductive Switching (25°C)<br>$V_{CC} = 600V$<br>$V_{GE} = 15V$<br>$I_C = 70A$<br>$R_G = 4.3 \Omega^{(4)}$<br>$T_J = +25^\circ C$   |     | 3816 | 5720 | μJ   |
| $E_{off}^{(6)}$ | Turn-Off Switching Energy       |   |     | 2582 | 3870 |      |
| $t_{d(on)}$     | Turn-On Delay Time              | Inductive Switching (125°C)<br>$V_{CC} = 600V$<br>$V_{GE} = 15V$<br>$I_C = 70A$<br>$R_G = 4.3 \Omega^{(4)}$<br>$T_J = +125^\circ C$ |     | 33   |      | ns   |
| $t_r$           | Current Rise Time               |   |     | 48   |      |      |
| $t_{d(off)}$    | Turn-Off Delay Time             |   |     | 320  |      |      |
| $t_f$           | Current Fall Time               |   |     | 74   |      |      |
| $E_{on2}^{(5)}$ | Turn-On Switching Energy        | Inductive Switching (125°C)<br>$V_{CC} = 600V$<br>$V_{GE} = 15V$<br>$I_C = 70A$<br>$R_G = 4.3 \Omega^{(4)}$<br>$T_J = +125^\circ C$ |     | 5651 | 8475 | μJ   |
| $E_{off}^{(6)}$ | Turn-Off Switching Energy       |   |     | 3323 | 4980 |      |

THERMAL AND MECHANICAL CHARACTERISTICS

| Symbol          | Characteristic                             | Min | Typ | Max | Unit |
|-----------------|--|-----|-----|-----|------|
| $R_{\theta JC}$ | Junction to Case Thermal Resistance (IGBT) |     |     | .13 | °C/W |
| $R_{\theta JA}$ | Junction to Ambient Thermal Resistance     |     |     | 40  |      |
| $W_T$           | Package Weight                             | B2  | .22 |     | oz   |
|                 |  | L   | 6   |     | g    |
|                 |  | L   | .36 |     | oz   |
|                 |  | L   | 10  |     | g    |

- 1 Repetitive Rating: Pulse width and case temperature limited by maximum junction temperature.
  - 2 Pulse test: Pulse Width < 380μs, duty cycle < 2%.
  - 3 See Mil-Std-750 Method 3471.
  - 4  $R_G$  is external gate resistance, not including internal gate resistance or gate driver impedance. (MIC4452)
  - 5  $E_{on2}$  is the clamped inductive turn on energy that includes a commutating diode reverse recovery current in the IGBT turn on energy loss. A combi device is used for the clamping diode.
  - 6  $E_{off}$  is the clamped inductive turn-off energy measured in accordance with JEDEC standard JESD24-1.
- Microsemi reserves the right to change, without notice, the specifications and information contained herein.

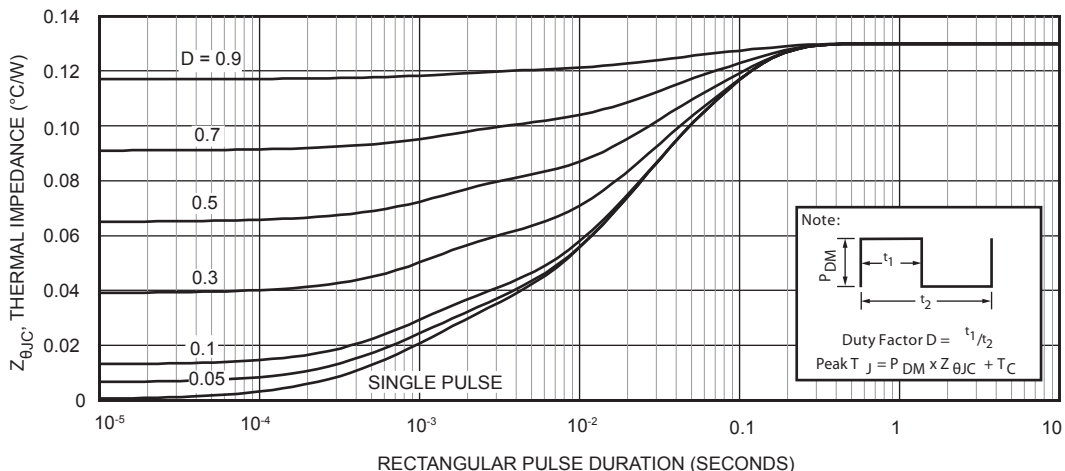


Figure 1, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

TYPICAL PERFORMANCE CURVES

APT70GR120B2\_L

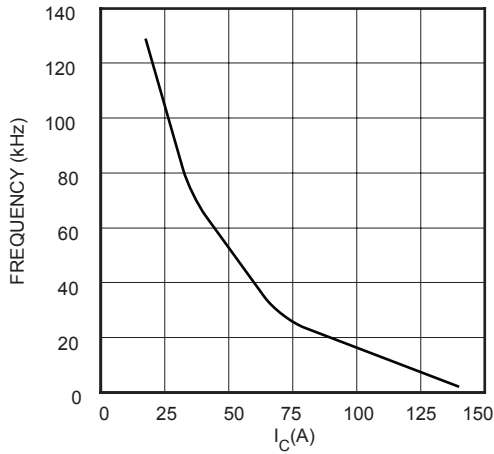


FIGURE 2, Max Frequency vs Current ( $T_{case} = 75^{\circ}C$ )

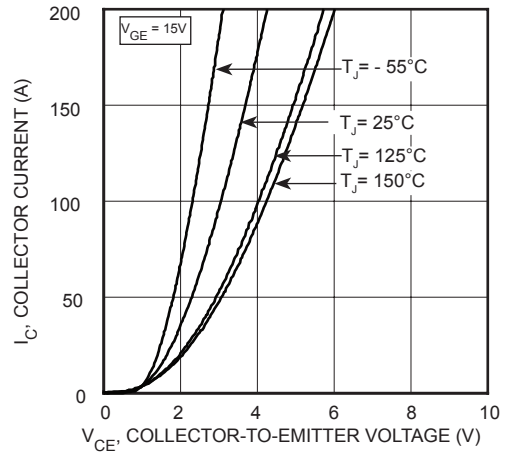


FIGURE 3, Saturation Voltage Characteristics ( $T_J = 25^{\circ}C$ )

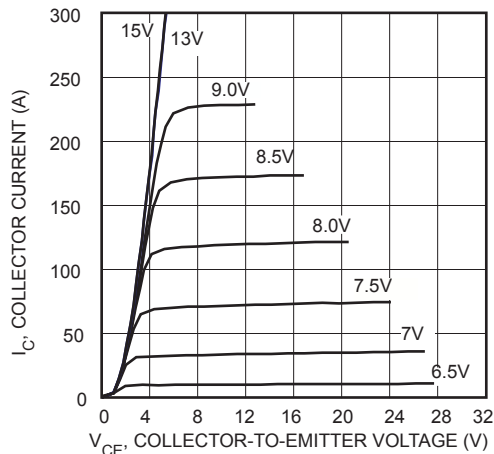


FIGURE 4, Output Characteristics ( $T_J = 25^{\circ}C$ )

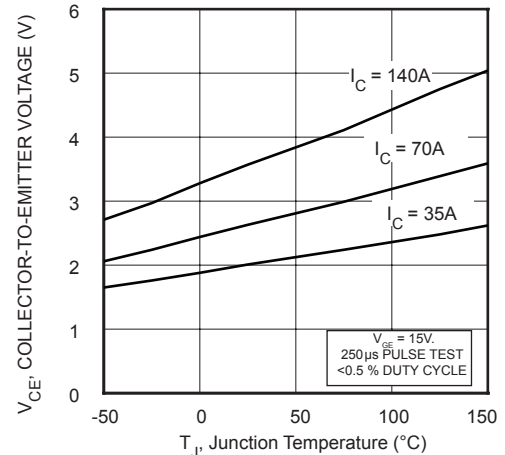


FIGURE 5, On State Voltage vs Junction Temperature

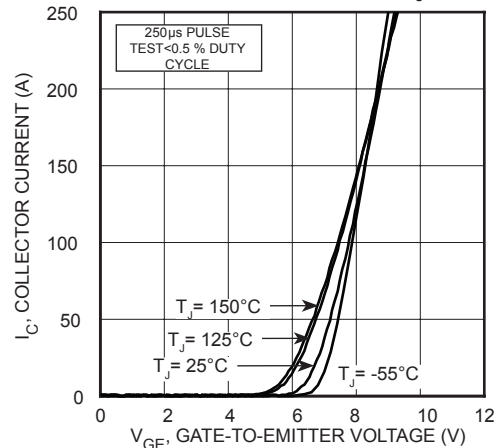


FIGURE 6, Transfer Characteristics

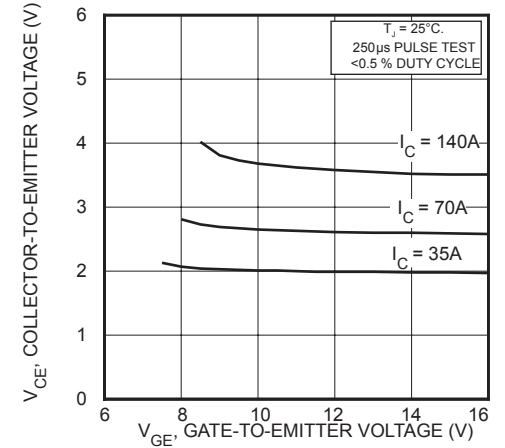


FIGURE 7, On State Voltage vs Gate-to-Emitter Voltage

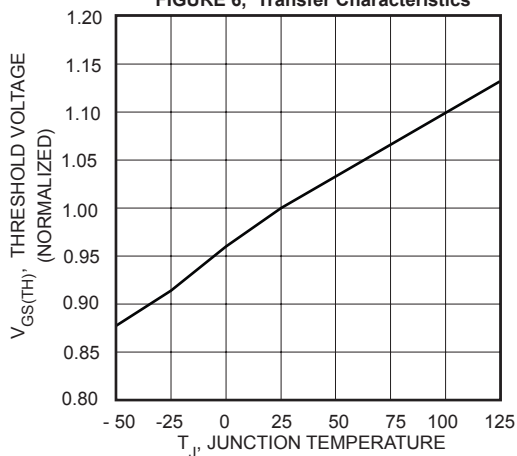


FIGURE 8, Threshold Voltage vs Junction Temperature

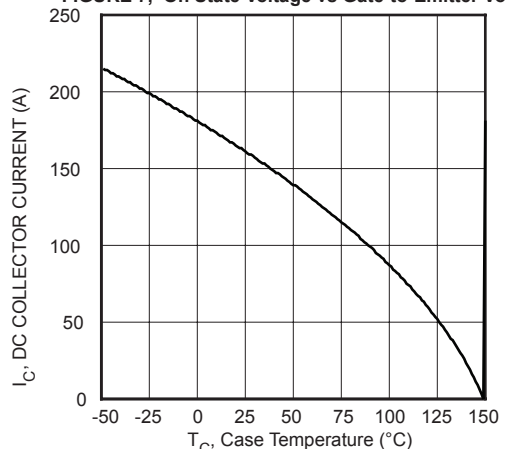


FIGURE 9, DC Collector Current vs Case Temperature

TYPICAL PERFORMANCE CURVES

APT70GR120B2\_L

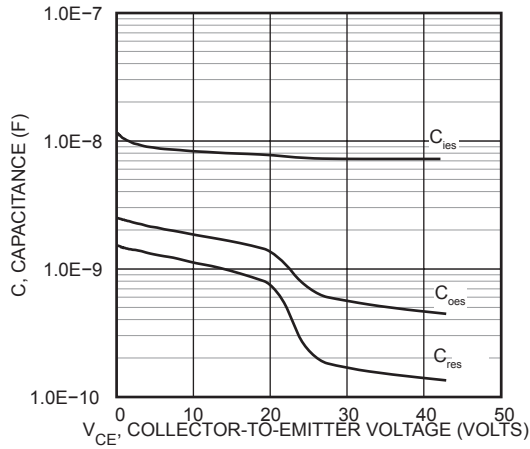


FIGURE 10, Capacitance vs Collector-To-Emitter Voltage

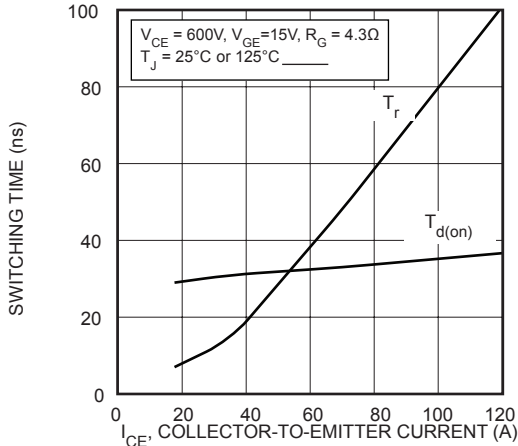


FIGURE 12, Turn-On Time vs Collector Current

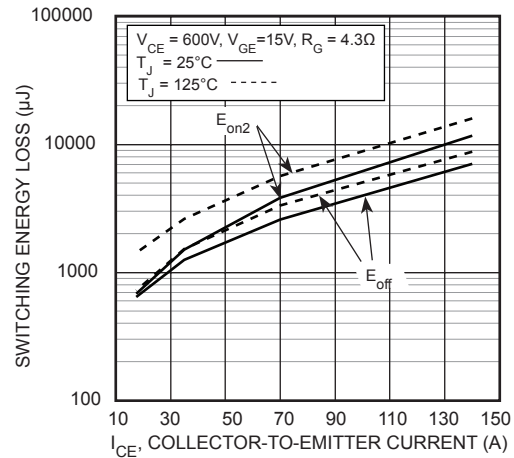


FIGURE 14, Energy Loss vs Collector Current

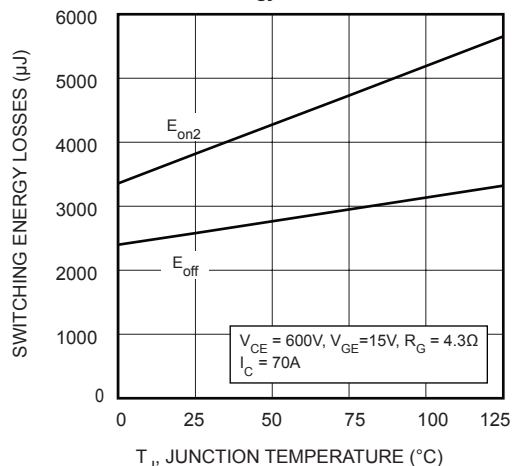


FIGURE 16, Switching Energy vs Junction Temperature

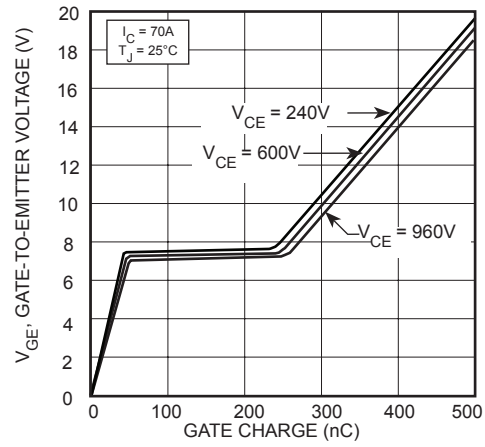


FIGURE 11, Gate charge

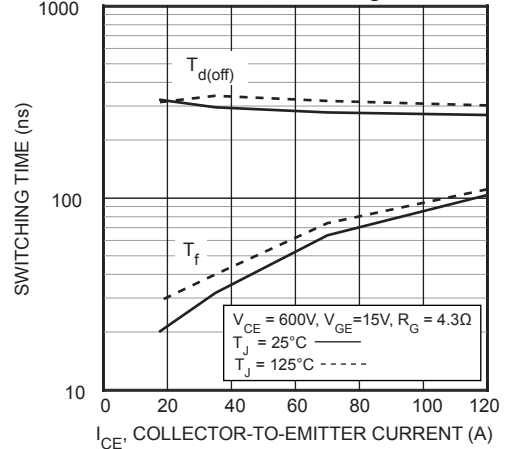


FIGURE 13, Turn-Off Time vs Collector Current

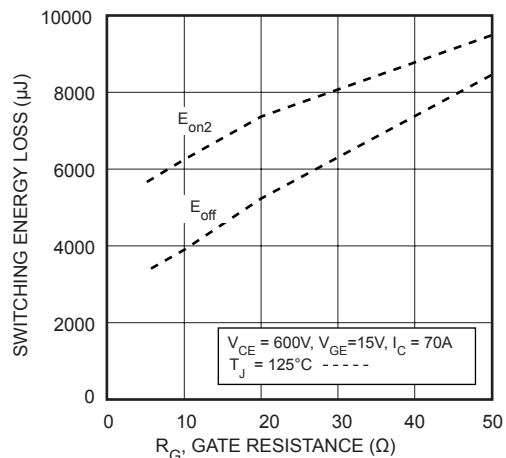


FIGURE 15, Energy Loss vs Gate Resistance

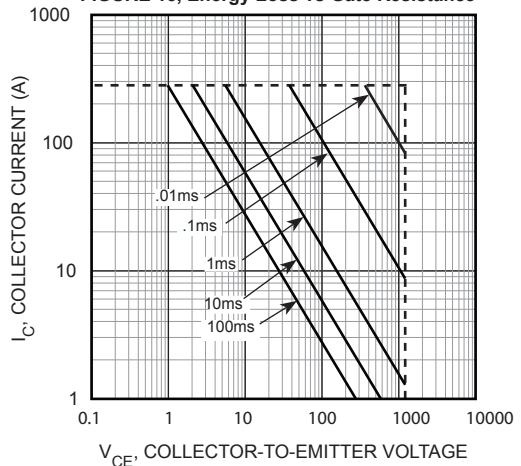
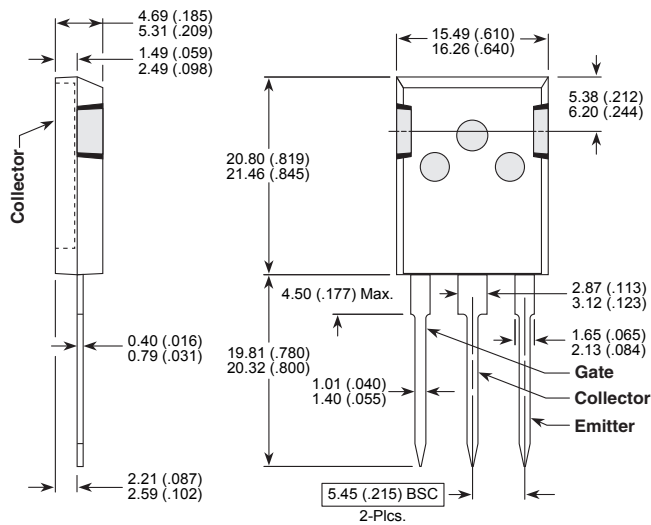


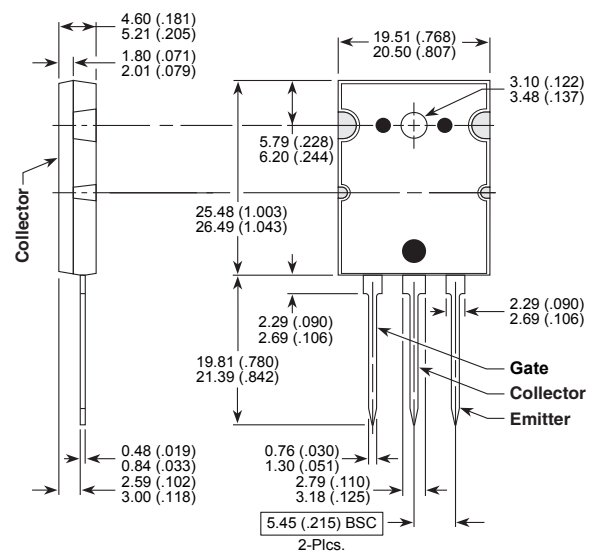
FIGURE 17, Minimum Switching Safe Operating Area

**T-MAX™ (B2) Package Outline**



These dimensions are equal to the TO-247 without the mounting hole.  
 Dimensions in Millimeters and (Inches)

**TO-264 (L) Package Outline**



Dimensions in Millimeters and (Inches)

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