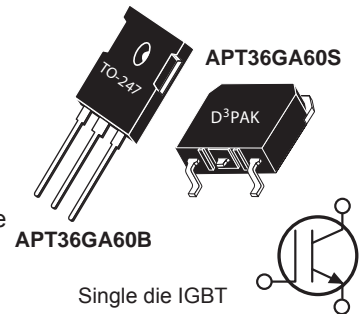


High Speed PT IGBT

POWER MOS 8® is a high speed Punch-Through switch-mode IGBT. Low E_{off} is achieved through leading technology silicon design and lifetime control processes. A reduced $E_{off} - V_{CE(ON)}$ tradeoff results in superior efficiency compared to other IGBT technologies. Low gate charge and a greatly reduced ratio of C_{res}/C_{ies} provide excellent noise immunity, short delay times and simple gate drive. The intrinsic chip gate resistance and capacitance of the poly-silicone gate structure help control di/dt during switching, resulting in low EMI, even when switching at high frequency.



FEATURES

- Fast switching with low EMI
- Very Low E_{off} for maximum efficiency
- Ultra low C_{res} for improved noise immunity
- Low conduction loss
- Low gate charge
- Increased intrinsic gate resistance for low EMI
- RoHS compliant

TYPICAL APPLICATIONS

- ZVS phase shifted and other full bridge
- Half bridge
- High power PFC boost
- Welding
- UPS, solar, and other inverters
- High frequency, high efficiency industrial

Absolute Maximum Ratings

| Symbol | Parameter | Ratings | Unit |
|----------------|---|-------------|------|
| V_{ces} | Collector Emitter Voltage | 600 | V |
| I_{C1} | Continuous Collector Current @ $T_c = 25^\circ\text{C}$ | 65 | A |
| I_{C2} | Continuous Collector Current @ $T_c = 100^\circ\text{C}$ | 36 | |
| I_{CM} | Pulsed Collector Current ¹ | 109 | |
| V_{GE} | Gate-Emitter Voltage ² | ± 30 | V |
| P_D | Total Power Dissipation @ $T_c = 25^\circ\text{C}$ | 290 | W |
| SSOA | Switching Safe Operating Area @ $T_j = 150^\circ\text{C}$ | 109A @ 600V | |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -55 to 150 | °C |
| T_L | Lead Temperature for Soldering: 0.063" from Case for 10 Seconds | 300 | |

Static Characteristics

$T_J = 25^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---------------|-------------------------------------|------------------------------|-----|-----|-----------|---------------|
| $V_{BR(CEs)}$ | Collector-Emitter Breakdown Voltage | $V_{GE} = 0V, I_C = 1.0mA$ | 600 | | | V |
| $V_{CE(on)}$ | Collector-Emitter On Voltage | $V_{GE} = 15V, I_C = 20A$ | | 2.0 | 2.5 | |
| $V_{GE(th)}$ | Gate Emitter Threshold Voltage | $V_{GE} = V_{CE}, I_C = 1mA$ | 3 | 4.5 | 6 | |
| I_{CES} | Zero Gate Voltage Collector Current | $V_{CE} = 600V, V_{GE} = 0V$ | | | 250 | μA |
| I_{GES} | Gate-Emitter Leakage Current | $V_{GS} = \pm 30V$ | | | 2500 | |
| | | | | | ± 100 | nA |

Thermal and Mechanical Characteristics

| Symbol | Characteristic | Min | Typ | Max | Unit |
|-----------------|--|-----|-----|------|--------|
| $R_{\theta JC}$ | Junction to Case Thermal Resistance | - | - | 0.43 | °C/W |
| W_T | Package Weight | - | 5.9 | - | g |
| Torque | Mounting Torque (TO-247 Package), 4-40 or M3 screw | | | 10 | in-lbf |

Dynamic Characteristics

T_J = 25°C unless otherwise specified

APT36GA60B

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|-------------------------------|-------------------------------|--|-----|------|-----|------|
| C _{ies} | Input Capacitance | Capacitance V _{GE} = 0V, V _{CE} = 25V f = 1MHz | | 2880 | | pF |
| C _{oes} | Output Capacitance | | | 226 | | |
| C _{res} | Reverse Transfer Capacitance | | | 328 | | |
| Q _g | Total Gate Charge | Gate Charge V _{GE} = 15V V _{CE} = 300V I _C = 20A | | 102 | | nC |
| Q _{ge} | Gate-Emitter Charge | | | 18 | | |
| Q _{gc} | Gate- Collector Charge | | | 34 | | |
| SSOA | Switching Safe Operating Area | T _J = 150°C, R _G = 10Ω ⁴ , V _{GE} = 15V, L = 100uH, V _{CE} = 600V | 109 | | | A |
| t _{d(on)} | Turn-On Delay Time | Inductive Switching (25°C) V _{CC} = 400V V _{GE} = 15V I _C = 20A R _G = 10Ω ⁴ T _J = +25°C | | 16 | | ns |
| t _r | Current Rise Time | | | 14 | | |
| t _{d(off)} | Turn-Off Delay Time | | | 122 | | |
| t _f | Current Fall Time | | | 77 | | |
| E _{on2} | Turn-On Switching Energy | Inductive Switching (125°C) V _{CC} = 400V V _{GE} = 15V I _C = 20A R _G = 10Ω ⁴ T _J = +125°C | | 307 | | μJ |
| E _{off} ⁶ | Turn-Off Switching Energy | | | 254 | | |
| t _{d(on)} | Turn-On Delay Time | | | 14 | | ns |
| t _r | Current Rise Time | | | 15 | | |
| t _{d(off)} | Turn-Off Delay Time | | | 149 | | |
| t _f | Current Fall Time | | | 113 | | |
| E _{on2} | Turn-On Switching Energy | | 508 | | μJ | |
| E _{off} ⁶ | Turn-Off Switching Energy | | 439 | | | |

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.

Typical Performance Curves

APT36GA60B_S

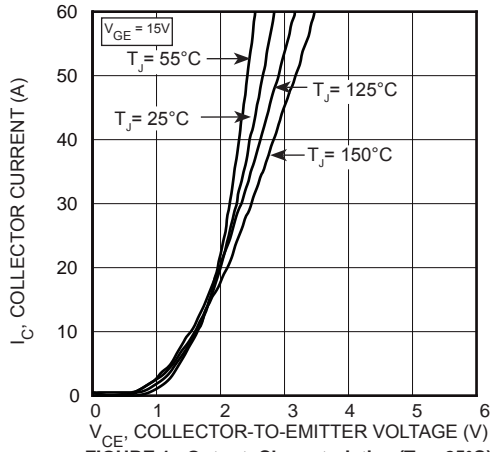


FIGURE 1, Output Characteristics ($T_J = 25^\circ\text{C}$)

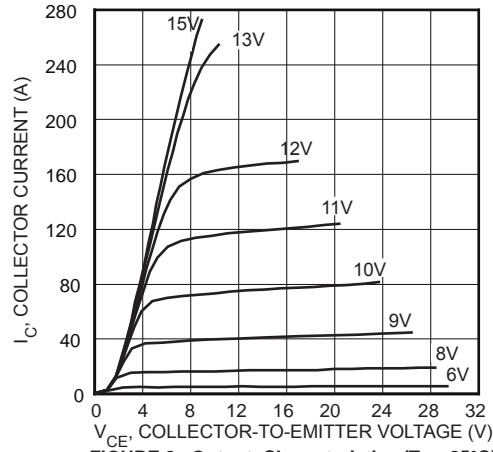


FIGURE 2, Output Characteristics ($T_J = 25^\circ\text{C}$)

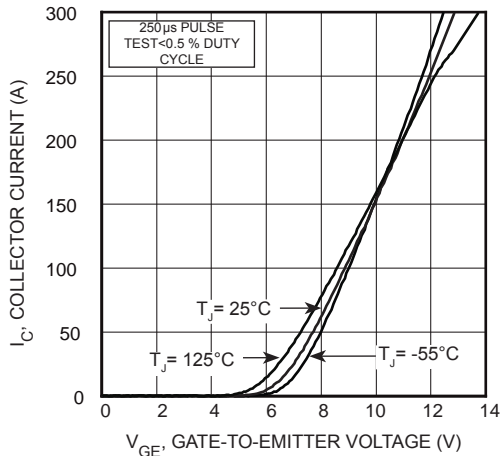


FIGURE 3, Transfer Characteristics

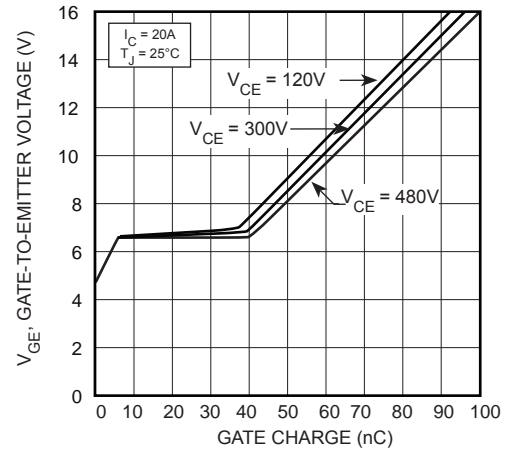


FIGURE 4, Gate charge

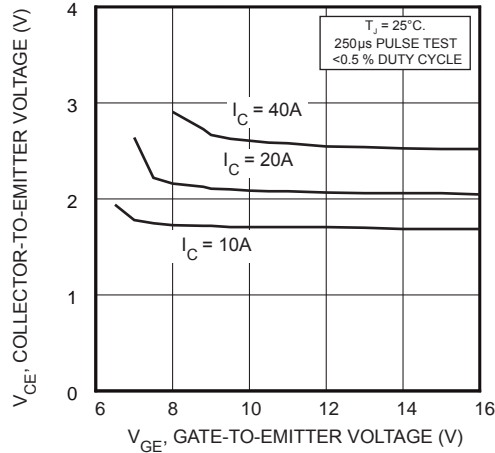


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

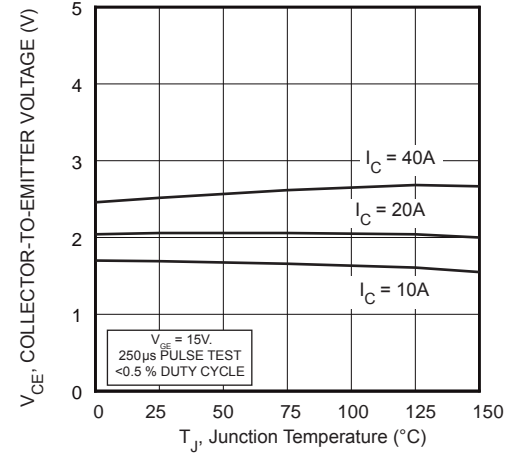


FIGURE 6, On State Voltage vs Junction Temperature

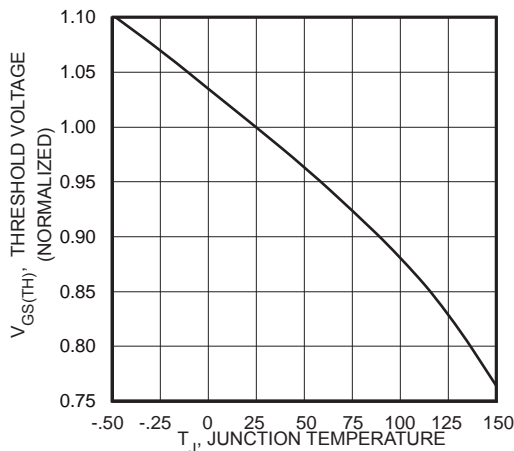


FIGURE 7, Threshold Voltage vs Junction Temperature

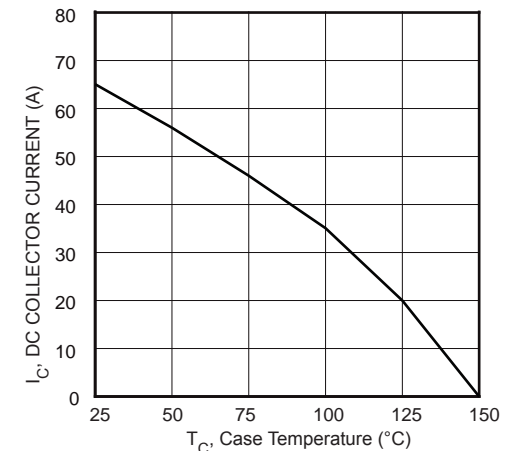


FIGURE 8, DC Collector Current vs Case Temperature

Typical Performance Curves

APT36GA60B_S

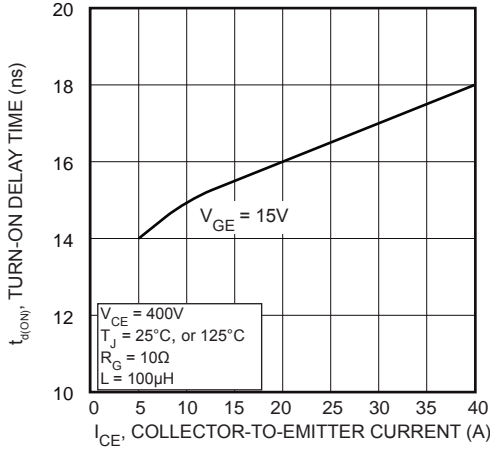


FIGURE 9, Turn-On Delay Time vs Collector Current

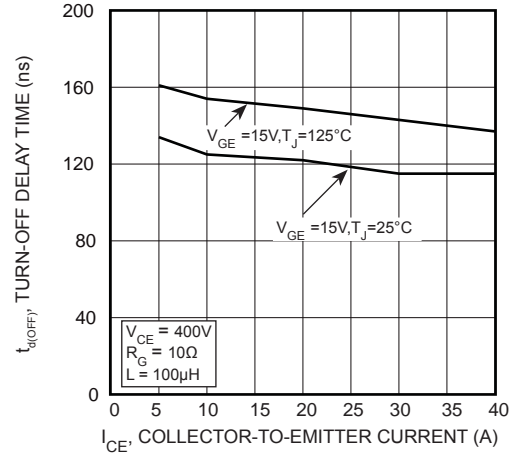


FIGURE 10, Turn-Off Delay Time vs Collector Current

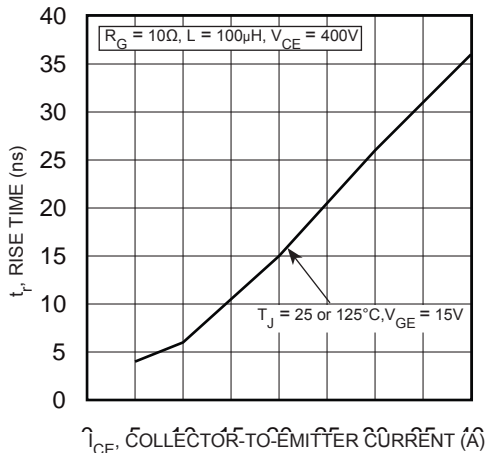


FIGURE 11, Current Rise Time vs Collector Current

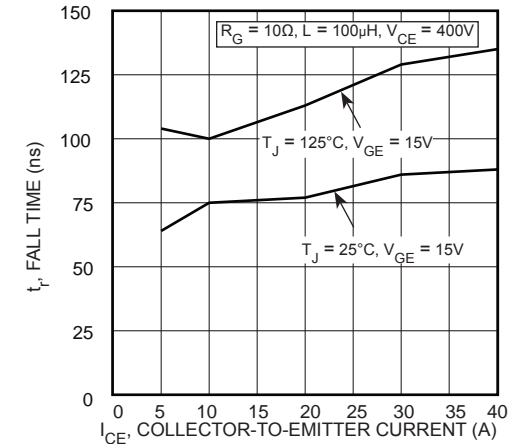


FIGURE 12, Current Fall Time vs Collector Current

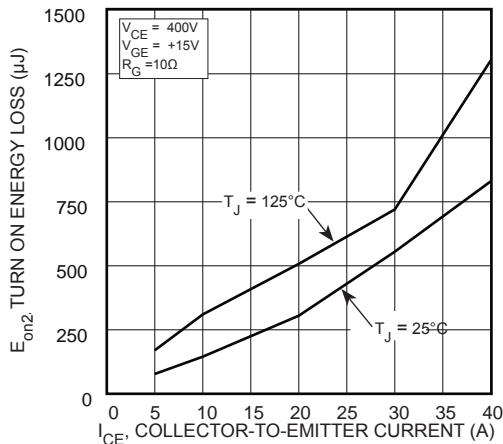


FIGURE 13, Turn-On Energy Loss vs Collector Current

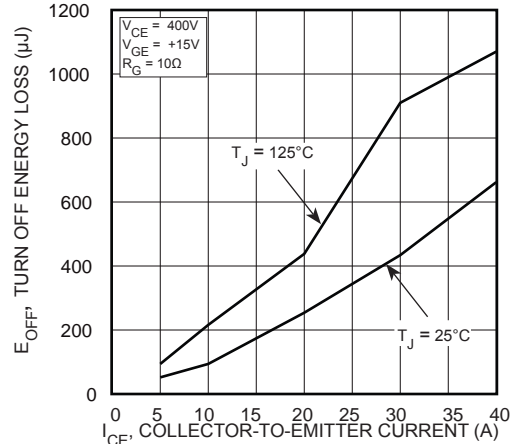


FIGURE 14, Turn-Off Energy Loss vs Collector Current

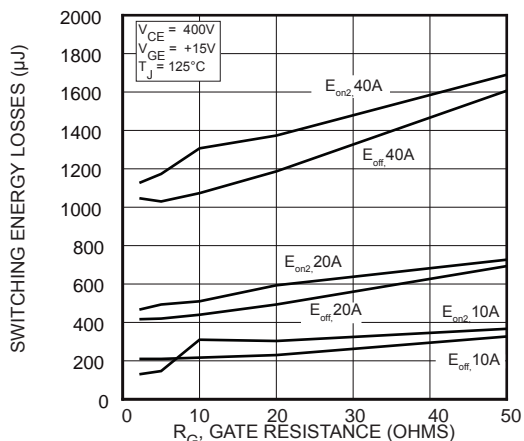


FIGURE 15, Switching Energy Losses vs Gate Resistance

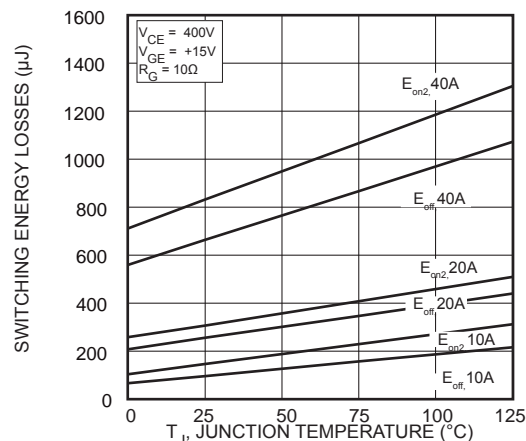


FIGURE 16, Switching Energy Losses vs Junction Temperature

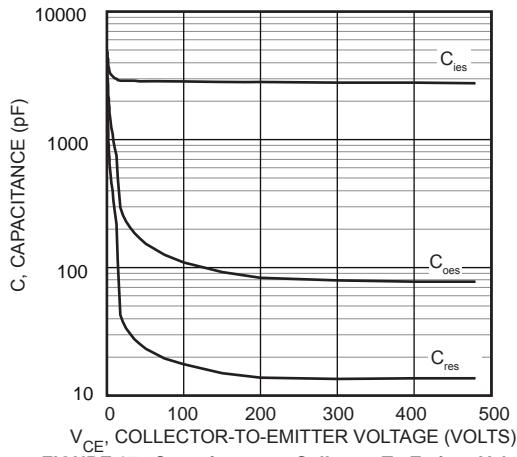


FIGURE 17, Capacitance vs Collector-To-Emitter Voltage

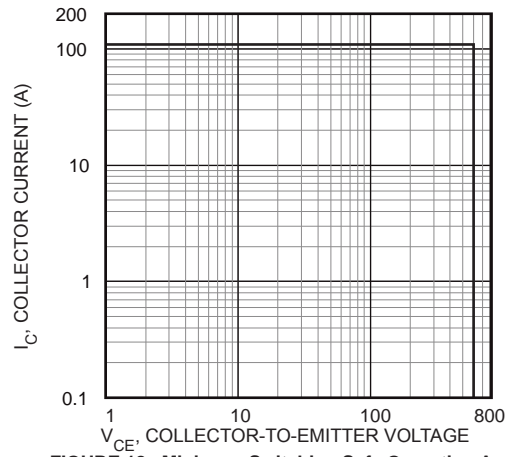


FIGURE 18, Minimum Switching Safe Operating Area

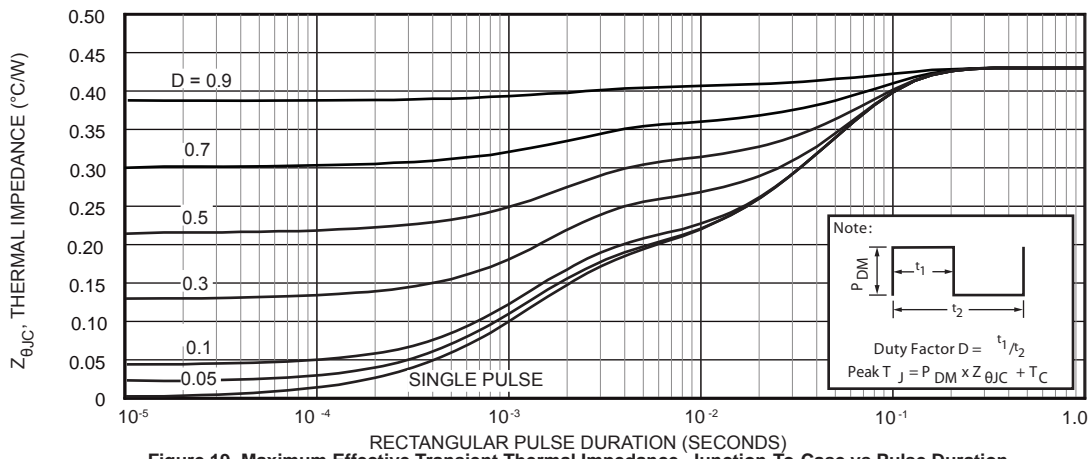


Figure 19, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

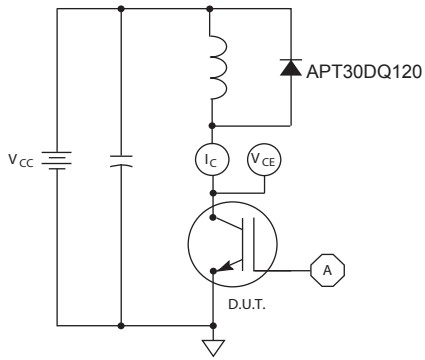


Figure 20, Inductive Switching Test Circuit

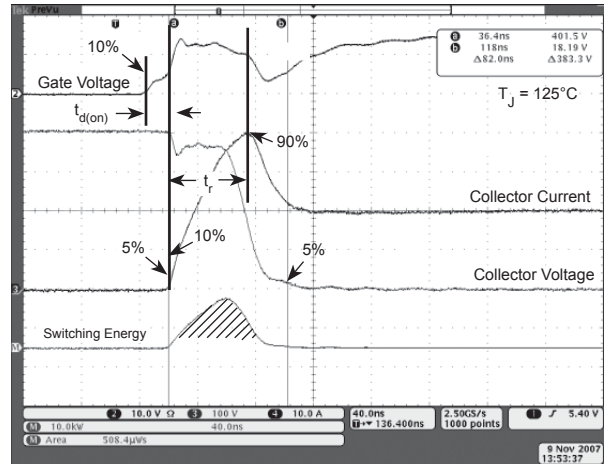


Figure 21, Turn-on Switching Waveforms and Definitions

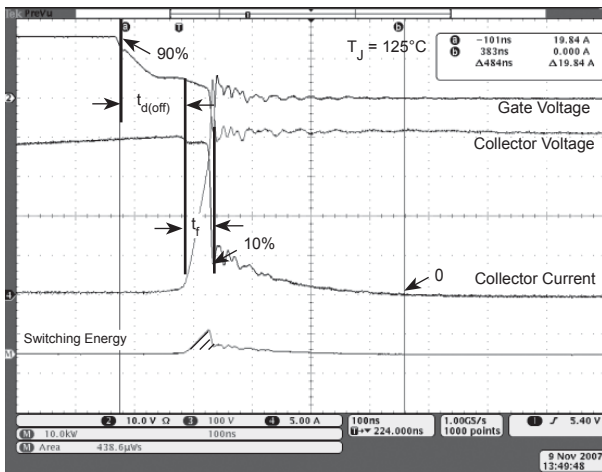
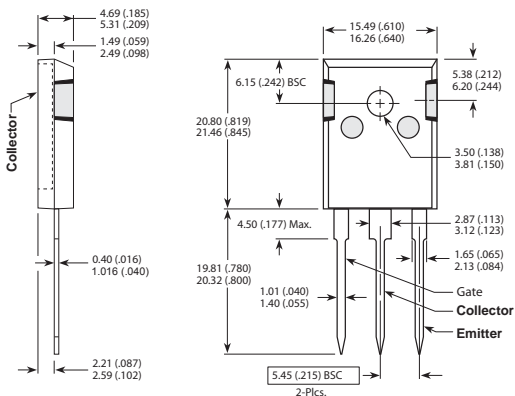


Figure 22, Turn-off Switching Waveforms and Definitions

TO-247 (B) Package Outline

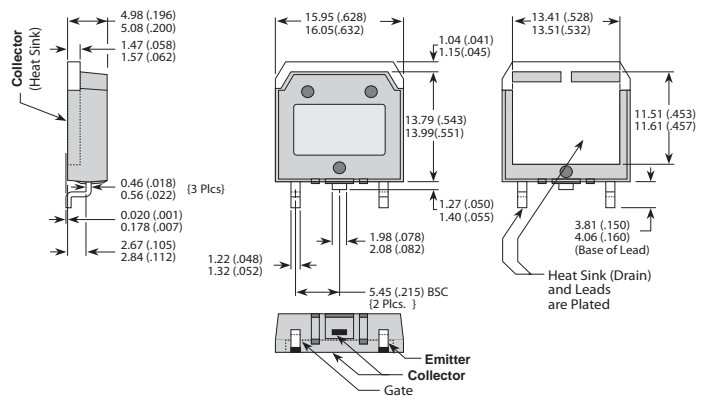
① SAC: Tin, Silver, Copper



Dimensions in Millimeters (Inches)

D³PAK Package Outline

③ 100% Sn Plated



Dimensions in Millimeters (Inches)

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