

NGB8207AN, NGB8207ABN

Ignition IGBT

20 A, 365 V, N-Channel D²PAK

This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Overvoltage clamped protection for use in inductive coil drivers applications. Primary uses include Ignition, Direct Fuel Injection, or wherever high voltage and high current switching is required.

Features

- Ideal for Coil-on-Plug and Driver-on-Coil Applications
- Gate-Emitter ESD Protection
- Temperature Compensated Gate-Collector Voltage Clamp Limits Stress Applied to Load
- Integrated ESD Diode Protection
- Low Threshold Voltage for Interfacing Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- Minimum Avalanche Energy – 500 mJ
- Gate Resistor (R_G) = 70 Ω
- This is a Pb-Free Device

Applications

- Ignition Systems

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating | Symbol | Value | Unit |
|--|-------------------|----------------|--------------------------|
| Collector-Emitter Voltage | V_{CES} | 365 | V |
| Gate-Emitter Voltage | V_{GE} | ± 15 | V |
| Collector Current-Continuous @ $T_C = 25^\circ\text{C}$ - Pulsed | I_C | 20 50 | A_{DC} A_{AC} |
| Continuous Gate Current | I_G | 1.0 | mA |
| Transient Gate Current ($t \leq 2$ ms, $f \leq 100$ Hz) | I_G | 20 | mA |
| ESD (Charged-Device Model) | ESD | 2.0 | kV |
| ESD (Human Body Model) $R = 1500 \Omega$, $C = 100$ pF | ESD | 8.0 | kV |
| ESD (Machine Model) $R = 0 \Omega$, $C = 200$ pF | ESD | 500 | V |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C (Note 1) | P_D | 165 1.1 | W W/ $^\circ\text{C}$ |
| Operating & Storage Temperature Range | T_J , T_{stg} | -55 to +175 | $^\circ\text{C}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Assuming infinite heatsink Case-to-Ambient



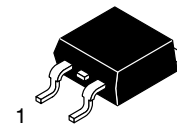
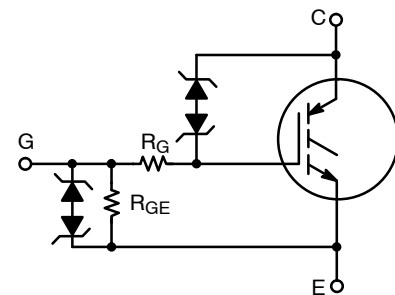
ON Semiconductor[®]

<http://onsemi.com>

20 AMPS, 365 VOLTS

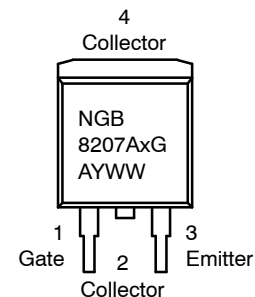
$V_{CE(on)} = 1.75$ V

Typ @ $I_C = 10$ A, $V_{GE} \geq 4.5$ V



**D²PAK
CASE 418B
STYLE 4**

MARKING DIAGRAM



NGB8207Ax = Device Code

x = N or B

A = Assembly Location

Y = Year

WW = Work Week

G = Pb-Free Package

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|---------------|---------------------------------|-----------------------|
| NGB8207ANT4G | D ² PAK (Pb-Free) | 800 / Tape & Reel |
| NGB8207ABNT4G | D ² PAK (Pb-Free) | 800 / Tape & Reel |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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UNCLAMPED COLLECTOR-TO-EMITTER AVALANCHE CHARACTERISTICS ($-40^{\circ} \leq T_J \leq 150^{\circ}C$)

| Characteristic | Symbol | Value | Unit |
|---|-------------|------------|------|
| Single Pulse Collector-to-Emitter Avalanche Energy $V_{CC} = 50\text{ V}$, $V_{GE} = 10\text{ V}$, Pk $I_L = 16.5\text{ A}$, $L = 3.7\text{ mH}$, $R_g = 1\text{ k}\Omega$ Starting $T_J = 25^{\circ}C$ $V_{CC} = 50\text{ V}$, $V_{GE} = 10\text{ V}$, Pk $I_L = 10\text{ A}$, $L = 6.1\text{ mH}$, $R_g = 1\text{ k}\Omega$ Starting $T_J = 125^{\circ}C$ | E_{AS} | 500 306 | mJ |
| Reverse Avalanche Energy $V_{CC} = 100\text{ V}$, $V_{GE} = 20\text{ V}$, Pk $I_L = 25.8\text{ A}$, $L = 6.0\text{ mH}$, Starting $T_J = 25^{\circ}C$ | $E_{AS(R)}$ | 2000 | mJ |

THERMAL CHARACTERISTICS

| | | | |
|---|-----------------|-----|---------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.9 | $^{\circ}C/W$ |
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 50 | $^{\circ}C/W$ |
| Maximum Temperature for Soldering Purposes, 0.125 in from case for 5 seconds (Note 3) | T_L | 275 | $^{\circ}C$ |

2. When surface mounted to an FR4 board using the minimum recommended pad size.
3. For further details, see Soldering and Mounting Techniques Reference Manual: SOLDERM/D.

ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Test Conditions | Temperature | Min | Typ | Max | Unit |
|----------------|--------|-----------------|-------------|-----|-----|-----|------|
|----------------|--------|-----------------|-------------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | | | |
|---|---------------|---|--|-------|------|------|------------|
| Collector-Emitter Clamp Voltage | BV_{CES} | $I_C = 2.0\text{ mA}$ | $T_J = -40^{\circ}C$ to $150^{\circ}C$ | 325 | 350 | 375 | V |
| | | $I_C = 10\text{ mA}$ | $T_J = -40^{\circ}C$ to $150^{\circ}C$ | 340 | 365 | 390 | |
| Zero Gate Voltage Collector Current | I_{CES} | $V_{CE} = 24\text{ V}$ $V_{GE} = 0\text{ V}$ | $T_J = 25^{\circ}C$ | | 0.1 | 2.0 | μA |
| | | | $T_J = 25^{\circ}C$ | - | 1.0 | 5 | |
| | | | $T_J = 150^{\circ}C$ | - | 10 | 125 | |
| Reverse Collector-Emitter Clamp Voltage | $BV_{CES(R)}$ | $I_C = -75\text{ mA}$ | $T_J = 25^{\circ}C$ | 25 | 27 | 29 | V |
| | | | $T_J = 150^{\circ}C$ | 25 | 29 | 31 | |
| | | | $T_J = -40^{\circ}C$ | 24 | 26 | 29 | |
| Reverse Collector-Emitter Leakage Current | $I_{CES(R)}$ | $V_{CE} = -24\text{ V}$ | $T_J = 25^{\circ}C$ | - | 0.5 | 1.1 | mA |
| | | | $T_J = 150^{\circ}C$ | 20 | 25 | 40 | |
| | | | $T_J = -40^{\circ}C$ | - | 0.03 | 1.0 | |
| Gate-Emitter Clamp Voltage | BV_{GES} | $I_G = \pm 5.0\text{ mA}$ | $T_J = -40^{\circ}C$ to $150^{\circ}C$ | 12 | 13 | 14.5 | V |
| Gate-Emitter Leakage Current | I_{GES} | $V_{GE} = \pm 10\text{ V}$ | $T_J = -40^{\circ}C$ to $150^{\circ}C$ | 500 | 700 | 1000 | μA |
| Gate Resistor | R_G | | $T_J = -40^{\circ}C$ to $150^{\circ}C$ | | 70 | | Ω |
| Gate-Emitter Resistor | R_{GE} | | $T_J = -40^{\circ}C$ to $150^{\circ}C$ | 14.25 | 16 | 25 | k Ω |

ON CHARACTERISTICS (Note 4)

| | | | | | | | |
|--|--------------|---|----------------------|------|------|------|-----------------|
| Gate Threshold Voltage | $V_{GE(th)}$ | $I_C = 1.0\text{ mA}$ $V_{GE} = V_{CE}$ | $T_J = 25^{\circ}C$ | 1.2 | 1.5 | 2.0 | V |
| | | | $T_J = 150^{\circ}C$ | 0.7 | 1.0 | 1.3 | |
| | | | $T_J = -40^{\circ}C$ | 1.4 | 1.7 | 2.0 | |
| Threshold Temperature Coefficient (Negative) | | | | - | 4.0 | - | mV/ $^{\circ}C$ |
| Collector-to-Emitter On-Voltage | $V_{CE(on)}$ | $I_C = 6.0\text{ A}$ $V_{GE} = 4.0\text{ V}$ | $T_J = 25^{\circ}C$ | 1.15 | 1.5 | 1.75 | V |
| | | | $T_J = 150^{\circ}C$ | 1.2 | 1.4 | 1.75 | |
| | | | $T_J = -40^{\circ}C$ | 1.2 | 1.6 | 1.75 | |
| | | $I_C = 10\text{ mA}$ $V_{GE} = 4.5\text{ V}$ | $T_J = 25^{\circ}C$ | - | 0.62 | 1.0 | |

*Maximum Value of Characteristic across Temperature Range.

4. Pulse Test: Pulse Width $\leq 300\text{ }\mu S$, Duty Cycle $\leq 2\%$.

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ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Test Conditions | Temperature | Min | Typ | Max | Unit |
|------------------------------------|--------------|---|---------------------------|------|------|------|------|
| ON CHARACTERISTICS (Note 4) | | | | | | | |
| Collector-to-Emitter On-Voltage | $V_{CE(on)}$ | $I_C = 8.0\text{ A}$ $V_{GE} = 4.0\text{ V}$ | $T_J = 25^\circ\text{C}$ | 1.2 | 1.65 | 2.0 | V |
| | | | $T_J = 150^\circ\text{C}$ | 1.4 | 1.6 | 2.0 | |
| | | | $T_J = -40^\circ\text{C}$ | 1.4 | 1.7 | 2.0 | |
| | | $I_C = 10\text{ A}$ $V_{GE} = 3.7\text{ V}$ | $T_J = 25^\circ\text{C}$ | 1.35 | 1.8 | 2.2 | |
| | | | $T_J = 150^\circ\text{C}$ | 1.5 | 1.9 | 2.2 | |
| | | | $T_J = -40^\circ\text{C}$ | 1.5 | 1.85 | 2.2 | |
| | | $I_C = 10\text{ A}$ $V_{GE} = 4.0\text{ V}$ | $T_J = 25^\circ\text{C}$ | 1.35 | 1.8 | 2.1 | |
| | | | $T_J = 150^\circ\text{C}$ | 1.5 | 1.8 | 2.1 | |
| | | | $T_J = -40^\circ\text{C}$ | 1.5 | 1.8 | 2.1 | |
| | | $I_C = 10\text{ A}$ $V_{GE} = 4.5\text{ V}$ | $T_J = 25^\circ\text{C}$ | 1.35 | 1.75 | 2.05 | |
| | | | $T_J = 150^\circ\text{C}$ | 1.4 | 1.75 | 2.1 | |
| | | | $T_J = -40^\circ\text{C}$ | 1.4 | 1.8 | 2.1 | |
| Forward Transconductance | gfs | $I_C = 6.0\text{ A}$ $V_{CE} = 5.0\text{ V}$ | $T_J = 25^\circ\text{C}$ | - | 15.8 | - | Mhos |

DYNAMIC CHARACTERISTICS

| | | | | | | | |
|----------------------|-----------|---|--------------------------|-----|-----|-----|----|
| Input Capacitance | C_{ISS} | $f = 10\text{ kHz}$ $V_{CE} = 25\text{ V}$ | $T_J = 25^\circ\text{C}$ | 750 | 810 | 900 | pF |
| Output Capacitance | C_{OSS} | | | 75 | 90 | 105 | |
| Transfer Capacitance | C_{RSS} | | | 4 | 7 | 12 | |

SWITCHING CHARACTERISTICS

| | | | | | | | |
|---|--------------|--|--|--------------------------|------|------|-----------------|
| Turn-On Delay Time (Resistive) Low Voltage | $t_{d(on)}$ | $V_{CE} = 14\text{ V}$ $R_L = 1.0\ \Omega$ $V_{GE} = 5.0\text{ V}$ $R_G = 1000\ \Omega$ | $T_J = 25^\circ\text{C}$ | 0.5 | 0.55 | 0.7 | μSec |
| Rise Time (Resistive) Low Voltage | t_r | | $T_J = 25^\circ\text{C}$ | 2.0 | 2.32 | 2.7 | |
| Turn-Off Delay Time (Resistive) Low Voltage | $t_{d(off)}$ | $V_{CE} = 14\text{ V}$ $R_L = 1.0\ \Omega$ $V_{GE} = 5.0\text{ V}$ $R_G = 1000\ \Omega$ | $T_J = 25^\circ\text{C}$ | 2.0 | 2.5 | 3.0 | |
| Fall Time (Resistive) Low Voltage | t_f | | $T_J = 25^\circ\text{C}$ | 8.0 | 10 | 13 | |
| Turn-On Delay Time (Resistive) High Voltage | $t_{d(on)}$ | | $V_{CE} = 300\text{ V}$ $R_L = 46\ \Omega$ $V_{GE} = 5.0\text{ V}$ $R_G = 1000\ \Omega$ | $T_J = 25^\circ\text{C}$ | 0.5 | 0.65 | |
| Rise Time (Resistive) High Voltage | t_r | $T_J = 25^\circ\text{C}$ | | 0.7 | 1.8 | 2.0 | |
| Turn-Off Delay Time (Resistive) High Voltage | $t_{d(off)}$ | $V_{CE} = 300\text{ V}$ $R_L = 46\ \Omega$ $V_{GE} = 5.0\text{ V}$ $R_G = 1000\ \Omega$ | $T_J = 25^\circ\text{C}$ | 4.0 | 4.7 | 6.0 | |
| Fall Time (Resistive) High Voltage | t_f | | $T_J = 25^\circ\text{C}$ | 6.0 | 10 | 15 | |

*Maximum Value of Characteristic across Temperature Range.

4. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.

TYPICAL ELECTRICAL CHARACTERISTICS

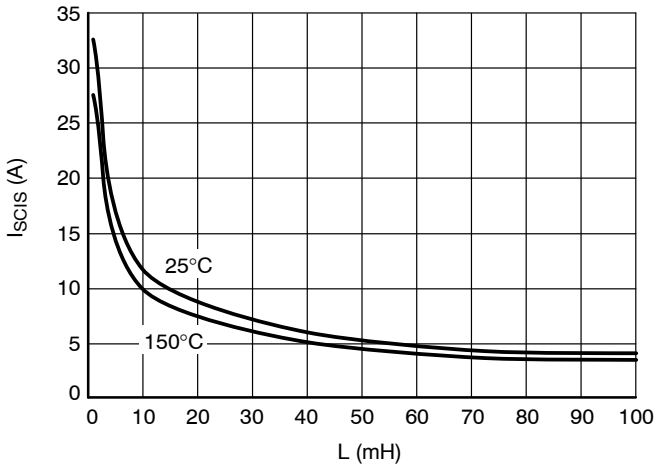


Figure 1. Typical Self Clamped Inductive Switching Performance (SCIS)

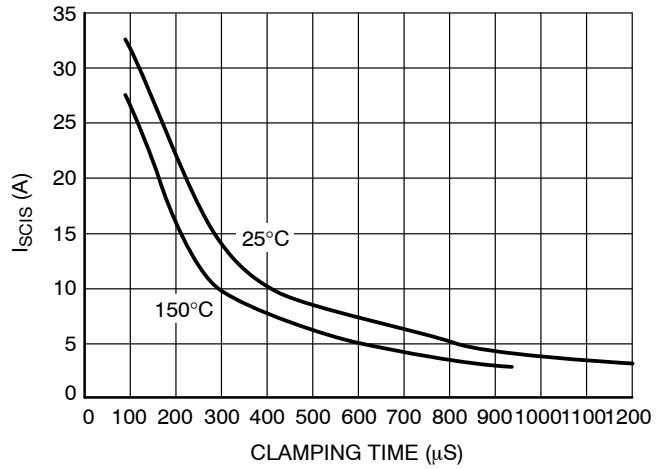


Figure 2. Typical Self Clamped Inductive Switching Performance (SCIS)

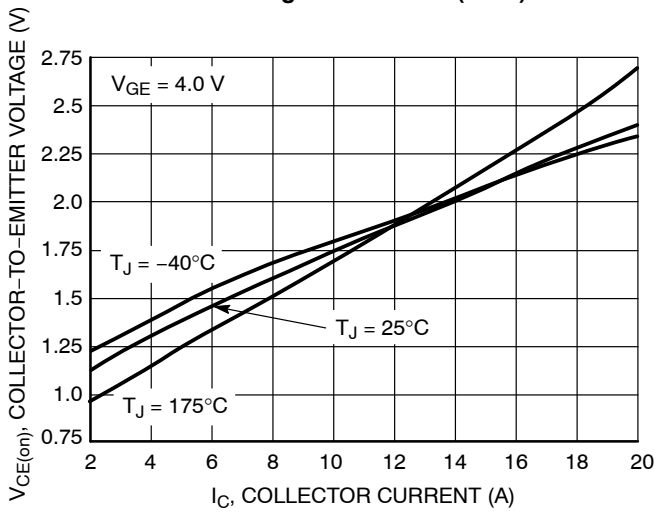


Figure 3. Collector-to-Emitter Voltage vs. Collector Current

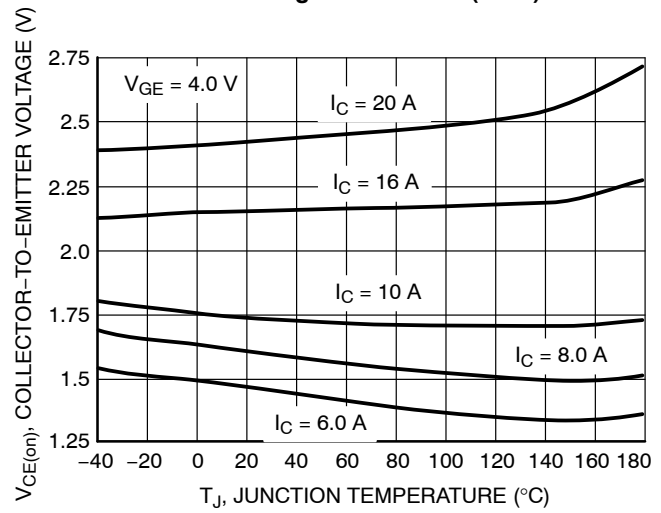


Figure 4. Collector-to-Emitter Voltage vs. Junction Temperature

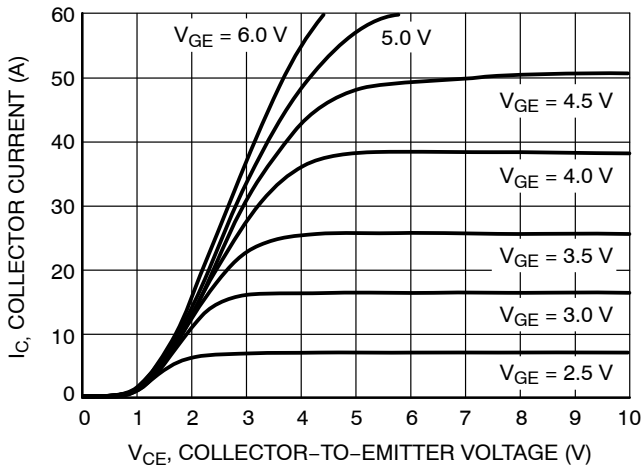


Figure 5. On-Region Characteristics @ T_J = 25°C

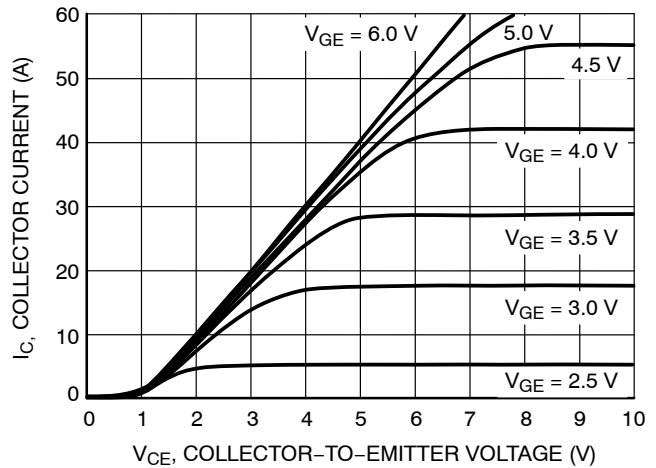


Figure 6. On-Region Characteristics @ T_J = -40°C

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TYPICAL ELECTRICAL CHARACTERISTICS

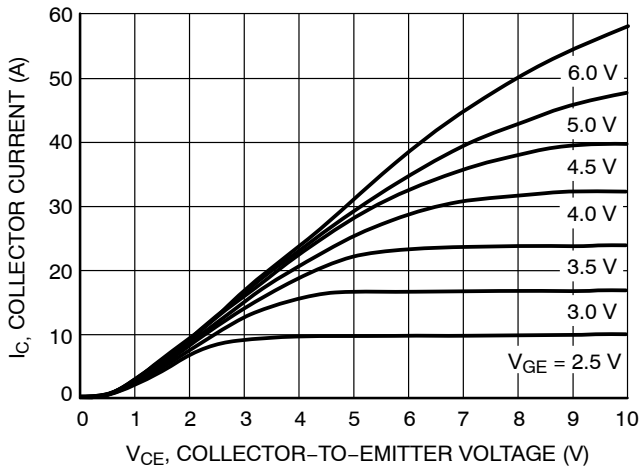


Figure 7. On-Region Characteristics
@ $T_J = 175^\circ\text{C}$

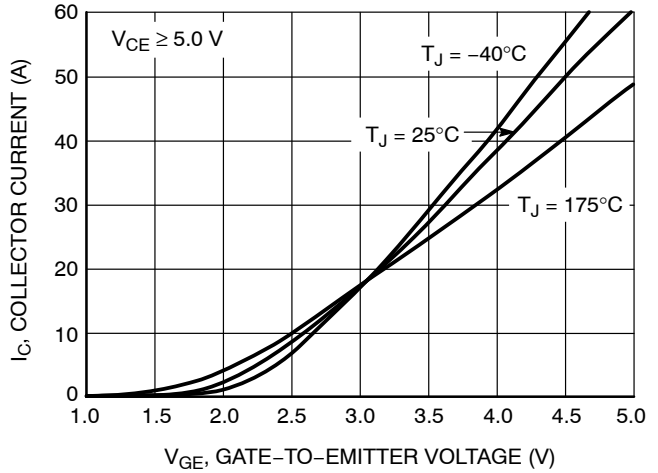


Figure 8. Transfer Characteristics

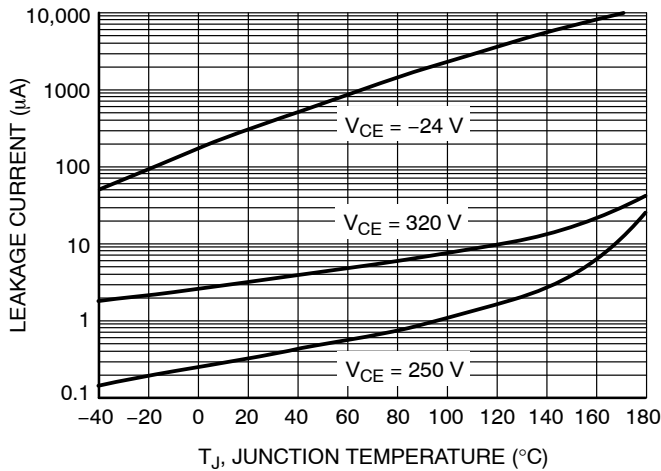


Figure 9. Collector-to-Emitter Leakage Current vs. Junction Temperature

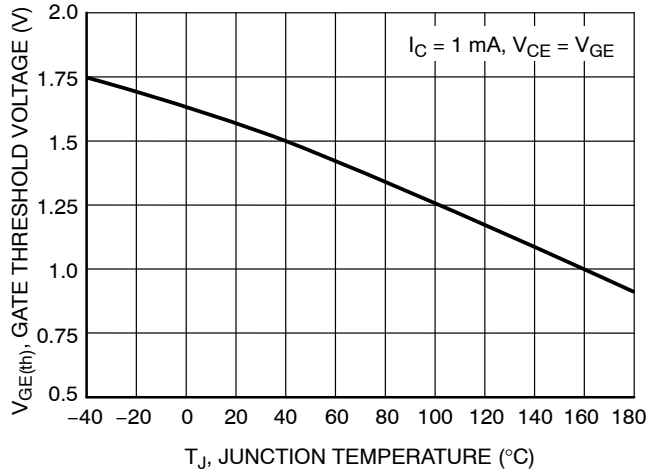


Figure 10. Gate Threshold Voltage vs. Temperature

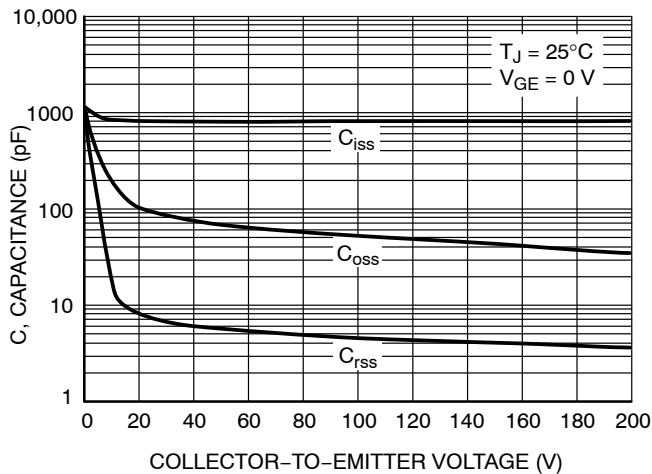


Figure 11. Capacitance Variation

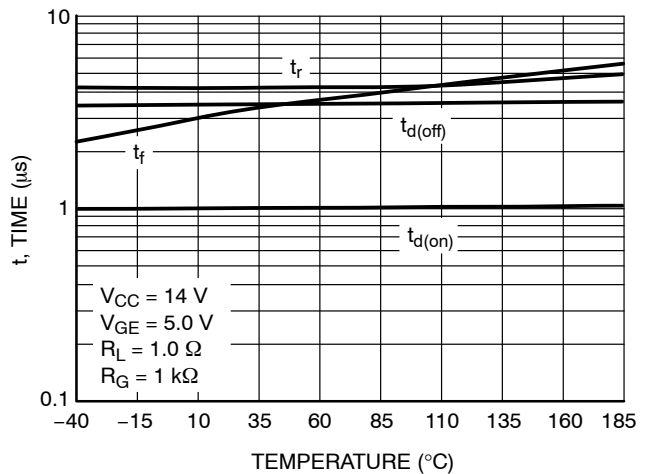


Figure 12. Resistive Switching Time Variation vs. Temperature

TYPICAL ELECTRICAL CHARACTERISTICS

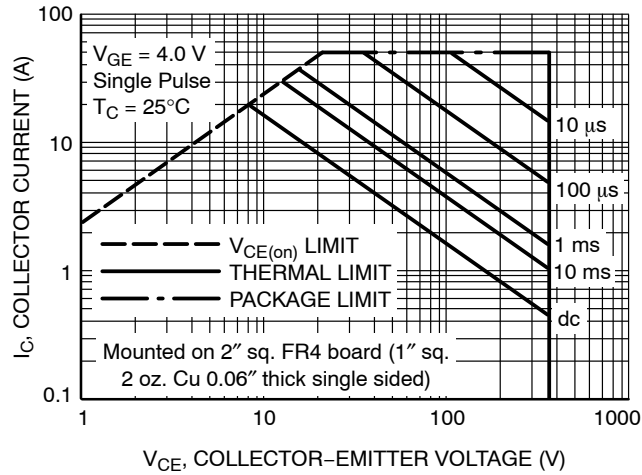


Figure 13. Forward Biased Safe Operating Area

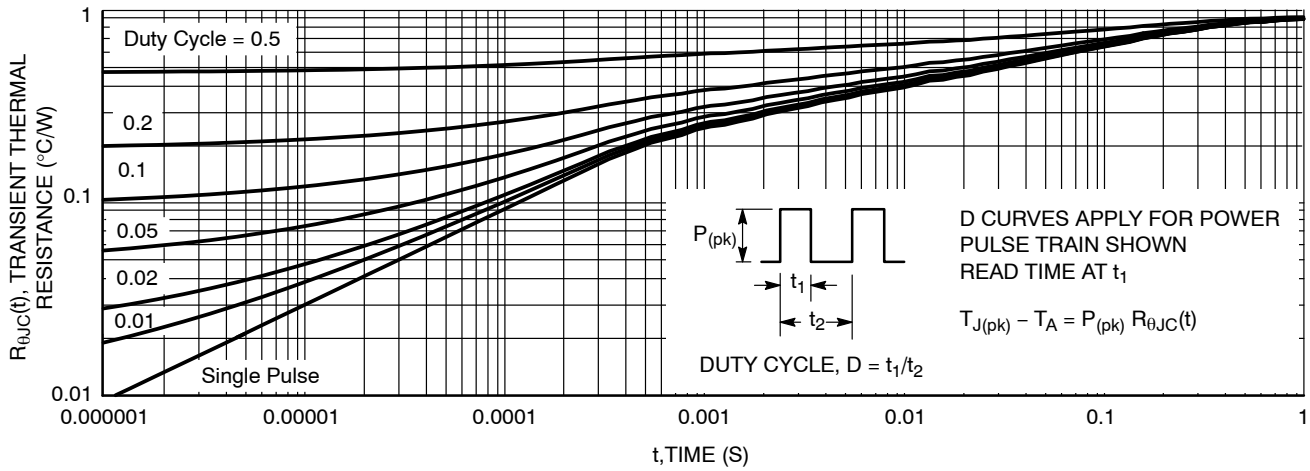
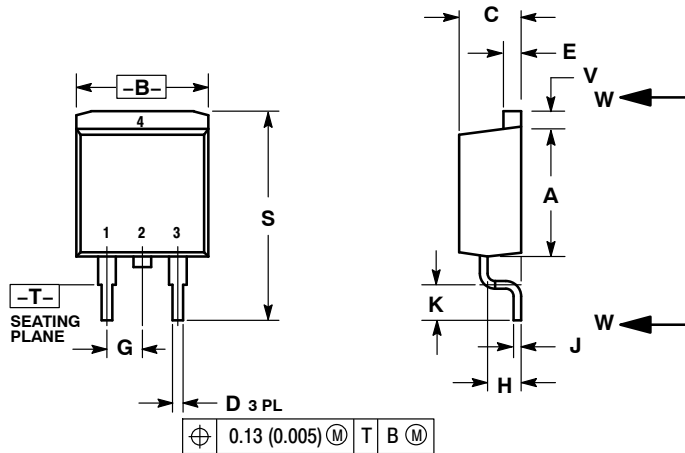


Figure 14. Best Case Transient Thermal Resistance (Non-normalized Junction-to-Case Mounted on Cold Plate)

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PACKAGE DIMENSIONS

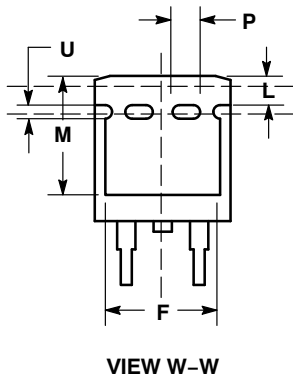
D²PAK 3
CASE 418B-04
ISSUE J



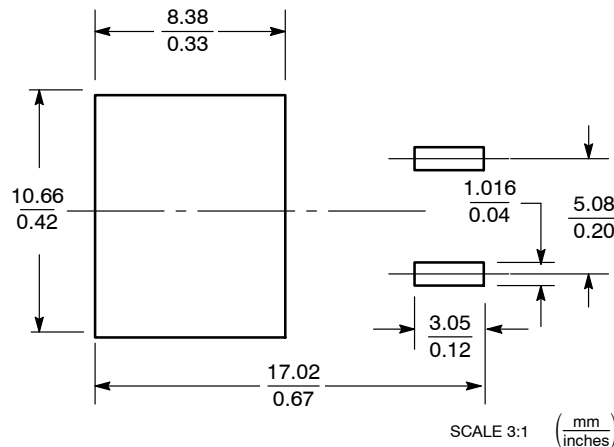
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.340 | 0.380 | 8.64 | 9.65 |
| B | 0.380 | 0.405 | 9.65 | 10.29 |
| C | 0.160 | 0.190 | 4.06 | 4.83 |
| D | 0.020 | 0.035 | 0.51 | 0.89 |
| E | 0.045 | 0.055 | 1.14 | 1.40 |
| F | 0.310 | 0.350 | 7.87 | 8.89 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.080 | 0.110 | 2.03 | 2.79 |
| J | 0.018 | 0.025 | 0.46 | 0.64 |
| K | 0.090 | 0.110 | 2.29 | 2.79 |
| L | 0.052 | 0.072 | 1.32 | 1.83 |
| M | 0.280 | 0.320 | 7.11 | 8.13 |
| N | 0.197 REF | | 5.00 REF | |
| P | 0.079 REF | | 2.00 REF | |
| R | 0.039 REF | | 0.99 REF | |
| S | 0.575 | 0.625 | 14.60 | 15.88 |
| V | 0.045 | 0.055 | 1.14 | 1.40 |

- STYLE 4:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR



SOLDERING FOOTPRINT*



SCALE 3:1 (mm/inches)

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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