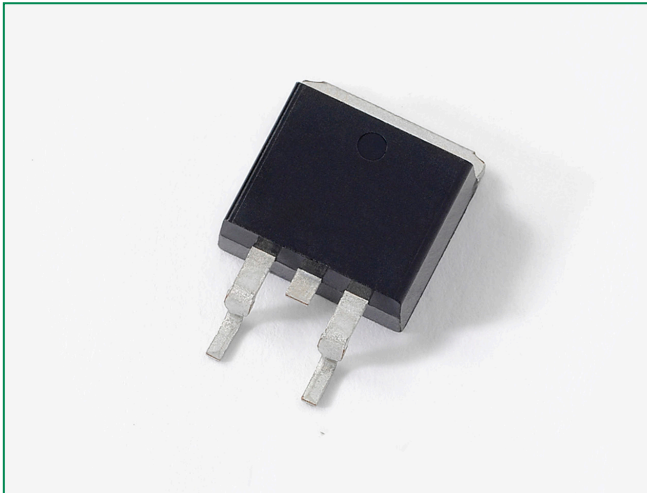


# NGB8207ABN - 20 A, 365 V, N-Channel Ignition IGBT,



20 Amps, 365 Volts  
 $V_{CE(on)} \leq 1.5 V @$   
 $I_C = 10A, V_{GE} \geq 4.5 V$

### Maximum Ratings and Thermal Characteristics ( $T_J = 25^\circ C$ unless otherwise noted)

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

### Description

This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Over–Voltage 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.

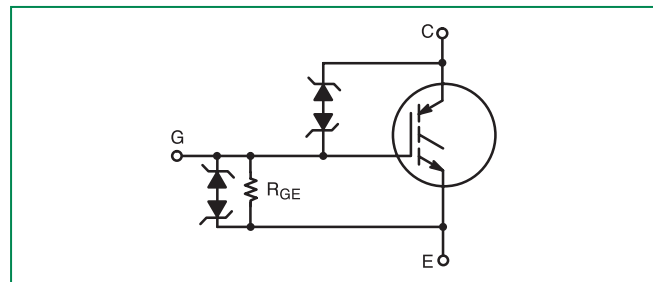
### Features

- 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  $\Omega$
- These are Pb–Free Devices

### Applications

- Ignition Systems

### Functional Diagram



### Additional Information



Datasheet



Resources



Samples

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.

**Unclamped Collector–To–Emitter Avalanche Characteristics ( $-55^{\circ} \leq T_J \leq 175^{\circ}\text{C}$ )**

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

**Thermal Characteristics**

|   | Symbol          | Value | Unit                        |
|---|-----------------|-------|-----------------------------|
| Thermal Resistance, Junction to Case  | $R_{\theta JC}$ | 0.9   | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction to Ambient (Note 2)                              | $R_{\theta JA}$ | 50    | $^{\circ}\text{C}/\text{W}$ |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds | $T_L$           | 275   | $^{\circ}\text{C}$          |

2. When surface mounted to an FR4 board using the minimum recommended pad size.

**Electrical Characteristics - OFF**

| Characteristic                            | Symbol           | Test Conditions   | Temperature                                      | Min   | Typ  | Max  | Unit          |
|---|------------------|---|--|-------|------|------|---------------|
| Collector–Emitter Clamp Voltage           | $BV_{CES}$       | $I_C = 2.0 \text{ mA}$  | $T_J = -40^\circ\text{C}$ to $175^\circ\text{C}$ | 325   | 350  | 375  | V             |
|   |                  | $I_C = 10 \text{ mA}$   | $T_J = -40^\circ\text{C}$ to $175^\circ\text{C}$ | 340   | 365  | 390  |               |
| Zero Gate Voltage Collector Current       | $I_{CES}$        | $V_{GE} = 0 \text{ V}$ ,<br>$V_{CE} = 24 \text{ V}$<br>$V_{CE} = 250 \text{ V}$<br>$V_{GE} = 0 \text{ V}$ | $T_J = 25^\circ\text{C}$                         | –     | 0.1  | 2.0  | $\mu\text{A}$ |
|   |                  |   | $T_J = 175^\circ\text{C}$                        | 70    | 85   | 150  |               |
|   |                  |   | $T_J = -40^\circ\text{C}$                        | –     | 0.25 | 2.5  |               |
| Reverse Collector–Emitter Clamp Voltage   | $B_{V_{CES(R)}}$ | $I_C = -75 \text{ mA}$  | $T_J = 25^\circ\text{C}$                         | 30    | 33   | 39   | V             |
|   |                  |   | $T_J = 175^\circ\text{C}$                        | 30    | 36   | 42   |               |
|   |                  |   | $T_J = -40^\circ\text{C}$                        | 29    | 32   | 35   |               |
| Reverse Collector–Emitter Leakage Current | $I_{CES(R)}$     | $V_{CE} = -24 \text{ V}$  | $T_J = 25^\circ\text{C}$                         | 0.10  | 0.25 | 0.85 | mA            |
|   |                  |   | $T_J = 175^\circ\text{C}$                        | 20    | 25   | 40   |               |
|   |                  |   | $T_J = -40^\circ\text{C}$                        | –     | 0.03 | 0.3  |               |
| Gate–Emitter Clamp Voltage                | $BV_{GES}$       | $I_G = \pm 5.0 \text{ mA}$  | $T_J = -40^\circ\text{C}$ to $175^\circ\text{C}$ | 12    | 13   | 14.5 | V             |
| Gate–Emitter Leakage Current              | $I_{GES}$        | $V_{GE} = \pm 10.0 \text{ V}$   | $T_J = -40^\circ\text{C}$ to $175^\circ\text{C}$ | 500   | 700  | 1000 | $\mu\text{A}$ |
| Gate Resistor                             | $R_G$            | –   | $T_J = -40^\circ\text{C}$ to $175^\circ\text{C}$ | –     | 70   | –    | $\Omega$      |
| Gate Emitter Resistor                     | $R_{GE}$         |   | $T_J = -40^\circ\text{C}$ to $175^\circ\text{C}$ | 14.25 | 16   | 25   | k $\Omega$    |

**Electrical Characteristics - ON (Note 3)**

| Characteristic                               | Symbol       | Test Conditions                                      | Temperature               | Min  | Typ  | Max  | Unit                 |
|--|--------------|--|---------------------------|------|------|------|----------------------|
| Gate Threshold Voltage                       | $V_{GE(th)}$ | $I_C = 1.0 \text{ mA}$ ,<br>$V_{GE} = V_{CE}$        | $T_J = 25^\circ\text{C}$  | 1.2  | 1.5  | 2.0  | V                    |
|  |              |  | $T_J = 175^\circ\text{C}$ | 0.6  | 0.8  | 1.2  |                      |
|  |              |  | $T_J = -40^\circ\text{C}$ | 1.4  | 1.7  | 2.0  |                      |
| Threshold Temperature Coefficient (Negative) | –            | –  | –                         | 12   | 12   | 12   | mV/ $^\circ\text{C}$ |
| Collector–to–Emitter On–Voltage              | $V_{GE(on)}$ | $I_C = 6.0 \text{ mA}$ ,<br>$V_{GE} = 4.0 \text{ V}$ | $T_J = 25^\circ\text{C}$  | 1.0  | 1.3  | 1.6  | V                    |
|  |              |  | $T_J = 175^\circ\text{C}$ | 0.8  | 1.1  | 1.4  |                      |
|  |              |  | $T_J = -40^\circ\text{C}$ | 1.15 | 1.4  | 1.75 |                      |
|  |              | $I_C = 10 \text{ mA}$ ,<br>$V_{GE} = 4.5 \text{ V}$  | $T_J = 25^\circ\text{C}$  | –    | 0.62 | 1.0  |                      |

\*Maximum Value of Characteristic across Temperature Range.

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

**Electrical Characteristics - ON (Note 4)**

| Characteristic                                  | Symbol                    | Test Conditions                                  | Temperature               | Min  | Typ  | Max  | Unit |
|---|---------------------------|--|---------------------------|------|------|------|------|
| Collector-to-Emitter On-Voltage                 | $V_{CE(on)}$              | $I_C = 8.0\text{ A},$<br>$V_{GE} = 4.0\text{ V}$ | $T_J = 25^\circ\text{C}$  | 1.1  | 1.5  | 1.7  | V    |
|   |                           |  | $T_J = 175^\circ\text{C}$ | 1.0  | 1.3  | 1.6  |      |
|   |                           |  | $T_J = -40^\circ\text{C}$ | 1.2  | 1.5  | 1.85 |      |
|   |                           | $I_C = 10\text{ A},$<br>$V_{GE} = 3.7\text{ V}$  | $T_J = 25^\circ\text{C}$  | 1.2  | 1.6  | 1.9  |      |
|   |                           |  | $T_J = 175^\circ\text{C}$ | 1.1  | 1.45 | 1.8  |      |
|   |                           |  | $T_J = -40^\circ\text{C}$ | 1.3  | 1.7  | 2.0  |      |
|   |                           | $I_C = 10\text{ A},$<br>$V_{GE} = 4.0\text{ V}$  | $T_J = 25^\circ\text{C}$  | 1.1  | 1.5  | 1.85 |      |
|   |                           |  | $T_J = 175^\circ\text{C}$ | 1.1  | 1.4  | 1.75 |      |
|   |                           |  | $T_J = -40^\circ\text{C}$ | 1.35 | 1.7  | 2.1  |      |
|   |                           | $I_C = 10\text{ A},$<br>$V_{GE} = 4.5\text{ V}$  | $T_J = 25^\circ\text{C}$  | 1.2  | 1.5  | 1.8  |      |
|   |                           |  | $T_J = 175^\circ\text{C}$ | 1.1  | 1.4  | 1.7  |      |
|   |                           |  | $T_J = -40^\circ\text{C}$ | 1.2  | 1.6  | 2.0  |      |
|   |                           | $I_C = 15\text{ A},$<br>$V_{GE} = 4.0\text{ V}$  | $T_J = 25^\circ\text{C}$  | 1.45 | 1.85 | 2.15 |      |
|   |                           |  | $T_J = 175^\circ\text{C}$ | 1.6  | 1.9  | 2.4  |      |
|   |                           |  | $T_J = -40^\circ\text{C}$ | 1.5  | 1.9  | 2.25 |      |
| $I_C = 20\text{ A},$<br>$V_{GE} = 4.0\text{ V}$ | $T_J = 25^\circ\text{C}$  | 1.6  | 2.1                       | 2.6  |      |      |      |
|   | $T_J = 175^\circ\text{C}$ | 2.0  | 2.4                       | 3.1  |      |      |      |
|   | $T_J = -40^\circ\text{C}$ | 1.6  | 2.1                       | 2.5  |      |      |      |
| Forward Transconductance                        | gfs                       | $V_{CE} = 5.0\text{ V},$<br>$I_C = 6.0\text{ A}$ | $T_J = 25^\circ\text{C}$  | -    | 15.8 | -    | Mhos |

**Dynamic Characteristics**

| Characteristic       | Symbol    | Test Conditions                               | Temperature              | Min | Typ | Max | Unit |
|----------------------|-----------|---|--------------------------|-----|-----|-----|------|
| Input Capacitance    | $C_{ISS}$ | $V_{CE} = 25\text{ V}$<br>$f = 10\text{ kHz}$ | $T_J = 25^\circ\text{C}$ | 750 | 810 | 900 | pF   |
| Output Capacitance   | $C_{OSS}$ |   |                          | 75  | 90  | 105 |      |
| Transfer Capacitance | $C_{RSS}$ |   |                          | 4   | 7   | 12  |      |

**Switching Characteristics**

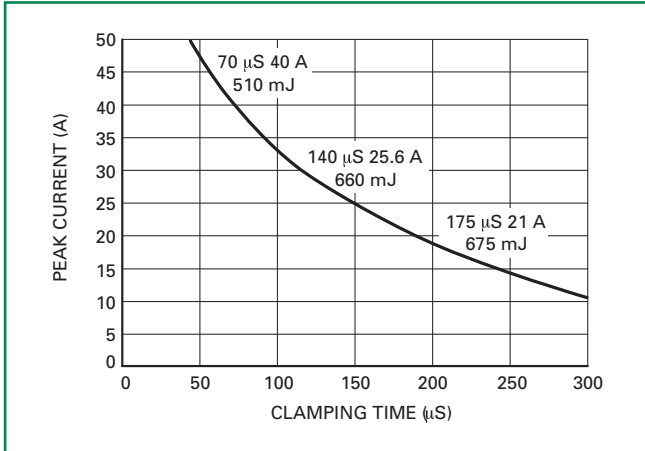
| Characteristic                                  | Symbol       | Test Conditions  | Temperature              | Min | Typ  | Max  | Unit |
|---|--------------|--|--------------------------|-----|------|------|------|
| Turn-On Delay Time (Resistive)<br>Low Voltage   | $t_{d(on)}$  | $V_{CE} = 14\text{ V}$<br>$R_L = 1.0\ \Omega$<br>$V_{GE} = 5.0\text{ V}$<br>$R_G = 1000\ \Omega$ | $T_J = 25^\circ\text{C}$ | 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)<br>Low Voltage  | $t_{d(off)}$ |  | $T_J = 25^\circ\text{C}$ | 2.0 | 2.5  | 3.0  |      |
| Fall Time (Resistive)<br>Low Voltage            | $t_f$        |  | $T_J = 25^\circ\text{C}$ | 8.0 | 10   | 13   |      |
| Turn-On Delay Time (Resistive)<br>High Voltage  | $t_{d(on)}$  | $V_{CE} = 300\text{ V}$<br>$R_L = 46\ \Omega$<br>$V_{GE} = 5.0\text{ V}$<br>$R_G = 1000\ \Omega$ | $T_J = 25^\circ\text{C}$ | 0.5 | 0.65 | 0.75 |      |
| Rise Time (Resistive)<br>High Voltage           | $t_r$        |  | $T_J = 25^\circ\text{C}$ | 0.7 | 1.8  | 2.0  |      |
| Turn-Off Delay Time (Resistive)<br>High Voltage | $t_{d(off)}$ |  | $T_J = 25^\circ\text{C}$ | 4.0 | 4.7  | 6.0  |      |
| Fall Time (Resistive)<br>High Voltage           | $t_f$        |  | $T_J = 25^\circ\text{C}$ | 6.0 | 10   | 15   |      |

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

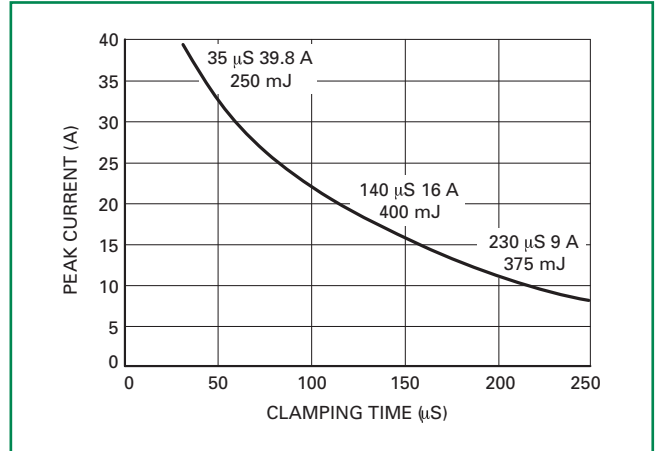
\*Maximum Value of Characteristic across Temperature Range.

**Ratings and Characteristic Curves**

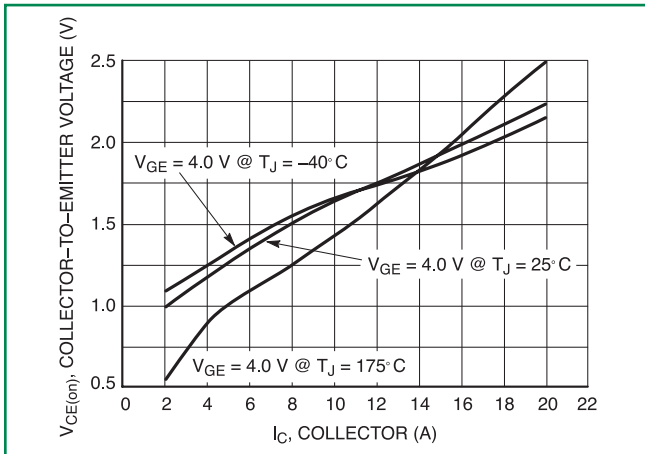
**Figure 1. Typical Self Clamped Inductive Switching Performance (SCIS) @ 25°C**



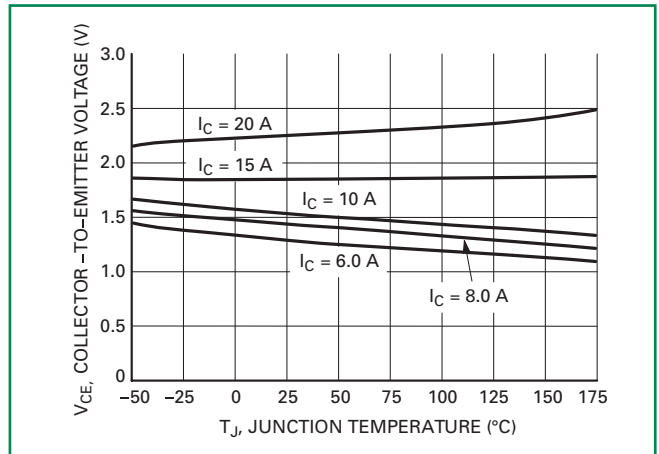
**Figure 2. Typical Self Clamped Inductive Switching Performance (SCIS) @ 150°C**



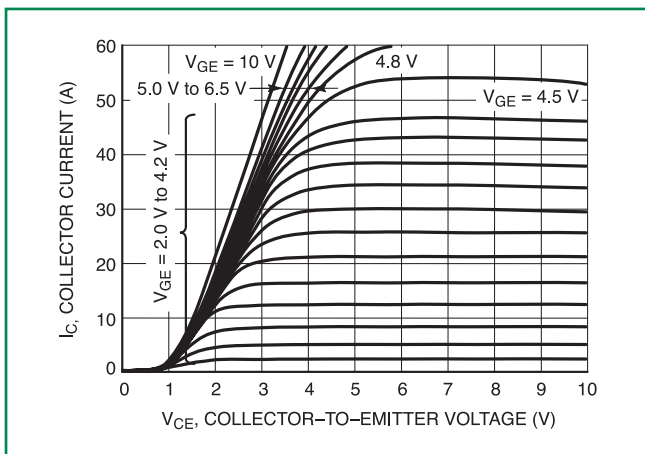
**Figure 3. Collector-to-Emitter Voltage vs. Collector Current**



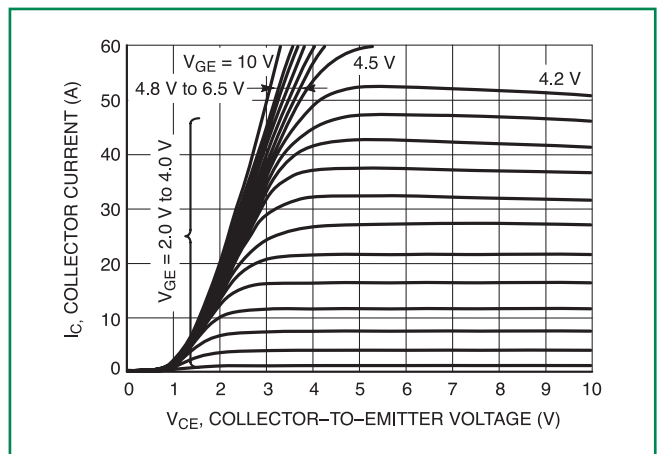
**Figure 4. Collector-to-Emitter Voltage vs. Junction Temp**



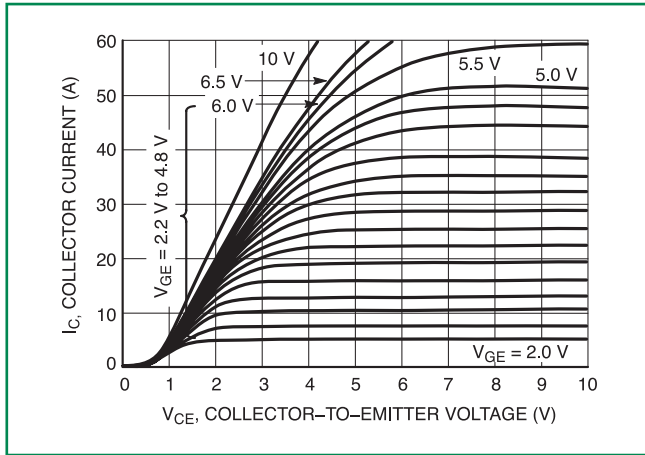
**Figure 5. On-Region Characteristics @ Tj = 25°C**



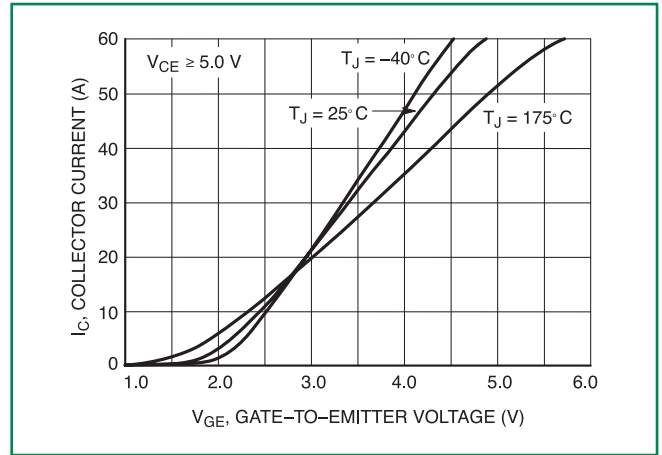
**Figure 5. On-Region Characteristics @ Tj = -40°C**



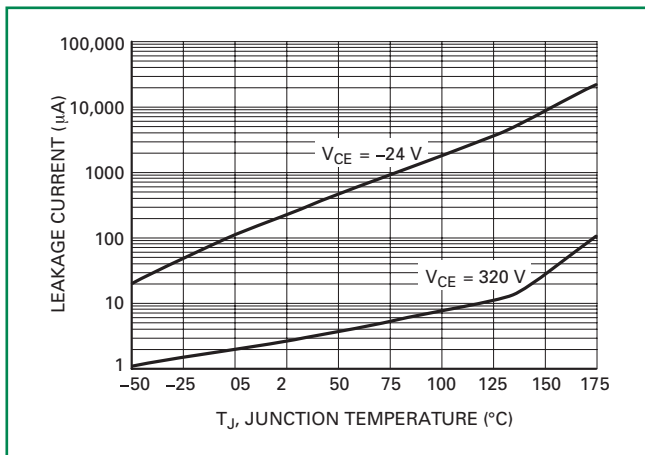
**Figure 7. On-Region Characteristics @  $T_J = 175^\circ\text{C}$**



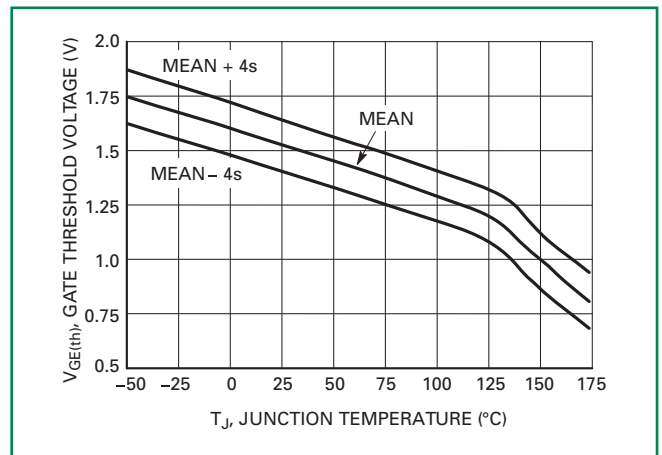
**Figure 8. Transfer Characteristics**



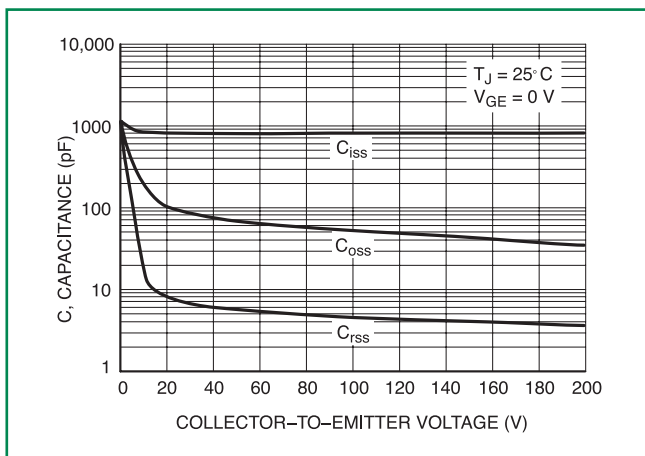
**Figure 9. Collector-to-Emitter Leakage Current vs. Temp**



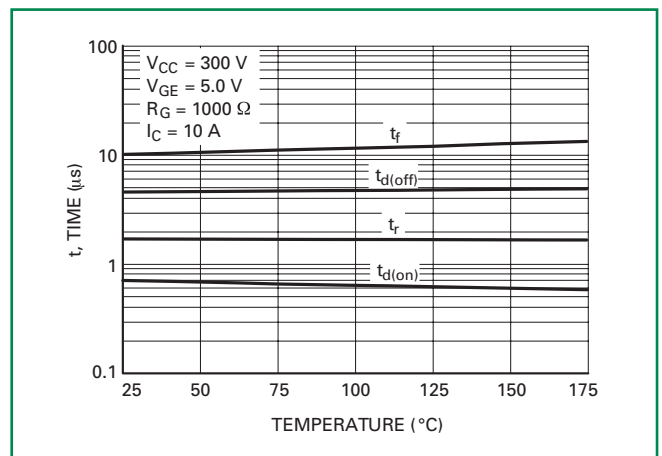
**Figure 10. Gate Threshold Voltage vs. Temperature**



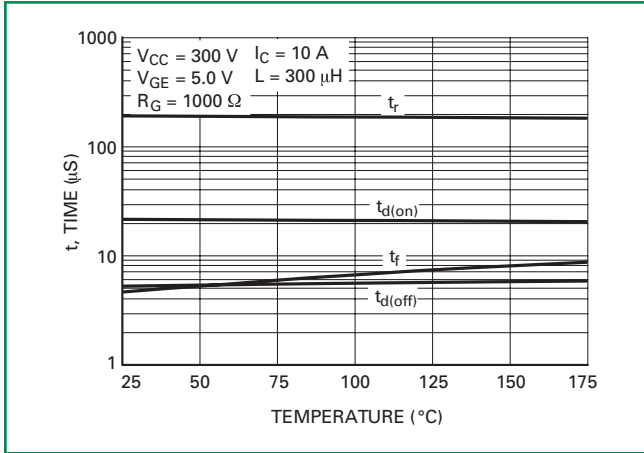
**Figure 11. Capacitance Variation**



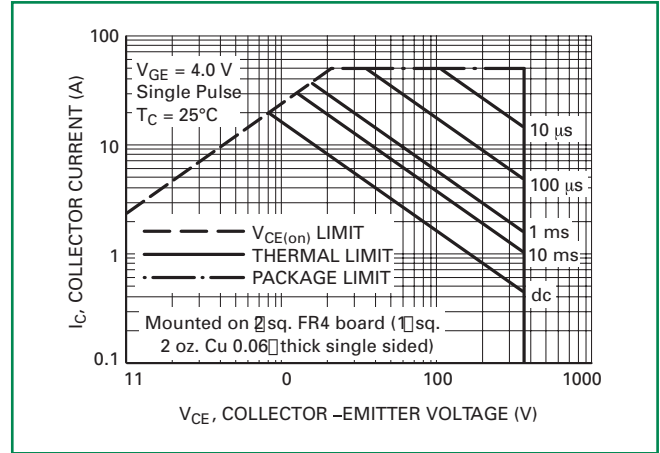
**Figure 12. Resistive Switching Time Variation vs. Temperature**



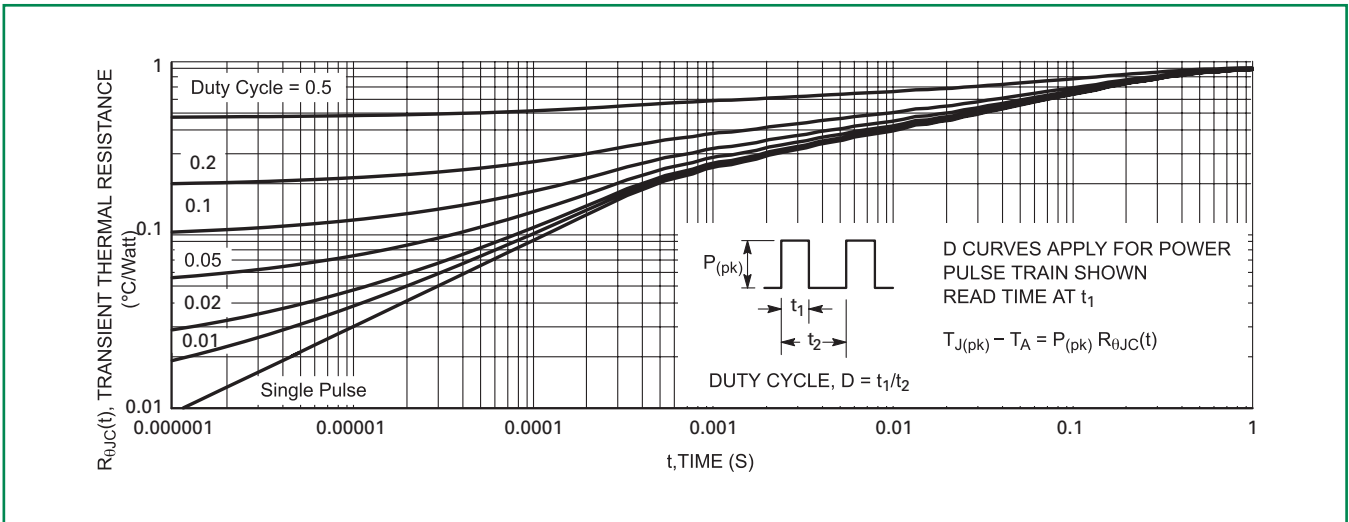
**Figure 13. Inductive Switching Time Variation vs. Temperature**



**Figure 14. Forward Biased Safe Operating Area**

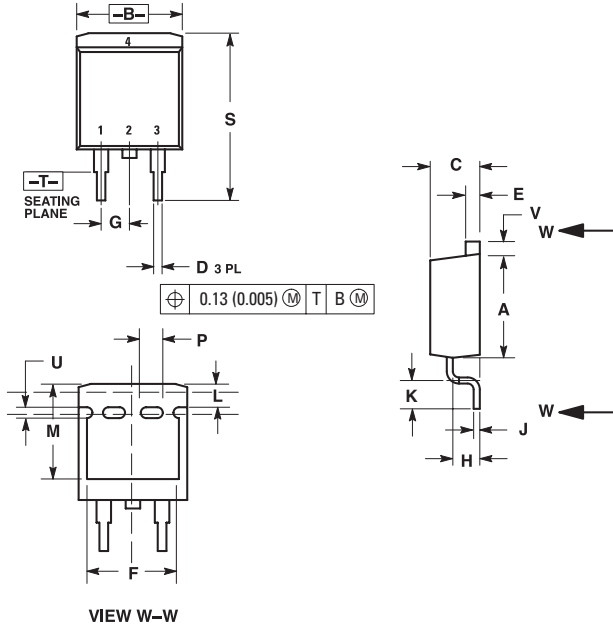


**Figure 15. Best Case Transient Thermal Resistance (Non-normalized Junction-to-Case Mounted on Cold Plate)**





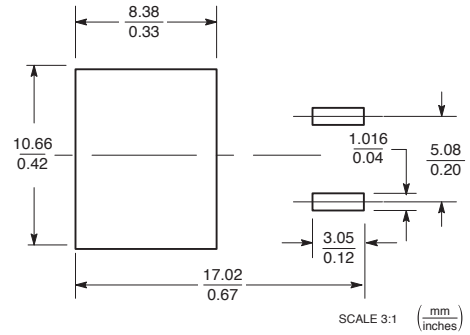
**Dimensions**



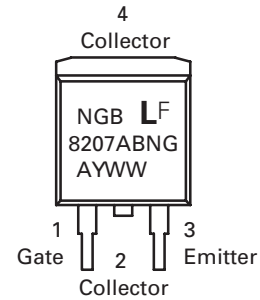
| Dim | Inches    |       | Millimeters |       |
|-----|-----------|-------|-------------|-------|
|     | Min       | Max   | Min         | Max   |
| A   | 0.340     | 0.380 | 8.64        | 9.65  |
| B   | 0.380     | 0.405 | 9.65        | 10.29 |
| C   | 0.160     | 0.190 | 4.06        | 4.83  |
| 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  |

- 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.

**Soldering Footprint**



**Part Marking System**



NGB8207ABN = Device Code

- A= Assembly Location
- Y= Year
- WW = Work Week
- G= Pb-Free Package

**ORDERING INFORMATION**

| Device       | Package                         | Shipping†            |
|--------------|---------------------------------|----------------------|
| NGB8207BNT4G | D <sup>2</sup> PAK<br>(Pb-Free) | 800 /<br>Tape & Reel |

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[IKP20N60TXKSA1](#) [IHW20N65R5XKSA1](#)