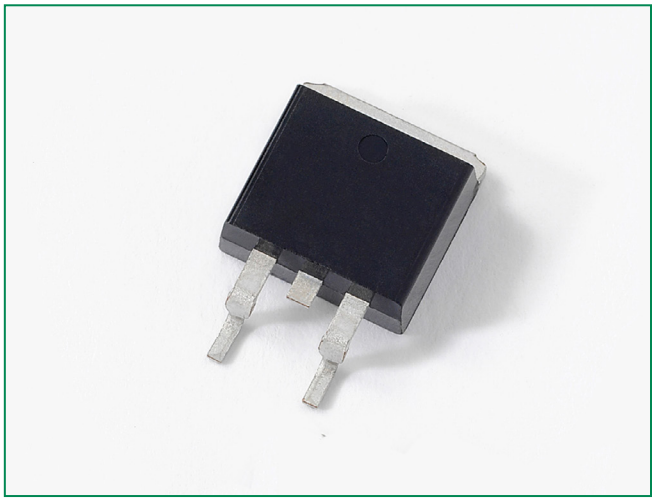
# NGB18N40ACLB - 18 A, 400 V, N-Channel Ignition IGBT, D²PAK



18 Amps, 400 Volts
$V_{CE}$(on) ≤ 2.0 V @
$I_C$ = 10 A, $V_{GE}$ ≥ 4.5 V

## Maximum Ratings (TJ = 25°C unless otherwise noted)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector–Emitter Voltage | $V_{CES}$ | 430 | $V_{DC}$ |
| Collector–Gate Voltage | $V_{CER}$ | 430 | $V_{DC}$ |
| Gate–Emitter Voltage | $V_{GE}$ | 18 | $V_{DC}$ |
| Collector Current–Continuous<br>@ TC = 25°C – Pulsed | $I_C$ | 18<br>50 | $A_{DC}$<br>$A_{AC}$ |
| ESD (Human Body Model) R = 1500 Ω, C = 100 pF | ESD | 8.0 | kV |
| ESD (Machine Model) R = 0 Ω, C = 200 pF | ESD | 800 | V |
| Total Power Dissipation @ TC = 25°C<br>Derate above 25°C | PD | 115<br>0.77 | Watts<br>W/°C |
| Operating and Storage Temperature Range | $T_J$, $T_{stg}$ | –55 to +175 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

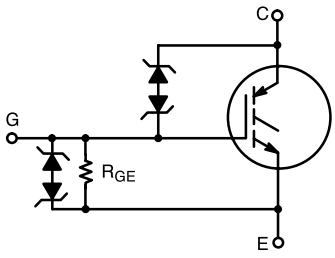
## Description

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 Applications
- DPAK Package Offers Smaller Footprint for Increased Board Space
- Gate–Emitter ESD Protection
- Temperature Compensated Gate–Collector Voltage Clamp Limits Stress Applied to Load
- Integrated ESD Diode Protection
- New Design Increases Unclamped Inductive Switching (UIS) Energy Per Area
- Low Threshold Voltage Interfaces Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- Optional Gate Resistor ($R_G$) and Gate–Emitter Resistor ($R_{GE}$)
- Emitter Ballasting for Short–Circuit Capability
- These are Pb–Free Devices

## Functional Diagram




## Additional Information

Datasheet | Resources | Samples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## Unclamped Collector–To–Emitter Avalanche Characteristics (–55°≤ $T_J$ ≤ 150°C)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Single Pulse Collector–to–Emitter Avalanche Energy | | | |
| $V_{CC}$ = 50 V, $V_{GE}$ = 5.0 V, $P_k$ $I_L$ = 21.1 A, L = 1.8 mH, Starting $T_J$ = 25°C | $E_{AS}$ | 400 | mJ |
| $V_{CC}$ = 50 V, $V_{GE}$ = 5.0 V, $P_k$ $I_L$ = 18.3 A, L = 1.8 mH, Starting $T_J$ = 125°C | | 300 | |
| Reverse Avalanche Energy | | | |
| $V_{CC}$ = 100 V, $V_{GE}$ = 20 V, $P_k$ $I_L$ = 25.8 A, L = 6.0 mH, Starting $T_J$ = 25°C | $E_{AS\ (R)}$ | 2000 | mJ |

## Maximum Short-Circuit Times (–55° ≤ $T_J$ ≤ 150°C)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Short Circuit Withstand Time 1<br>(See Figure 17, 3 Pulses with 10 ms Period) | $t_{sc1}$ | 750 | µs |
| Short Circuit Withstand Time 2<br>(See Figure 18, 3 Pulses with 10 ms Period) | $t_{sc2}$ | 5.0 | ms |

## Thermal Characteristics

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.3 | °C/W |
| Thermal Resistance, Junction to Ambient D²PAK (Note 1) | $R_{\theta JA}$ | 50 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds | $T_L$ | 275 | °C |

## Electrical Characteristics - OFF

| Characteristic | Symbol | Test Conditions | Temperature | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Collector–Emitter Clamp Voltage** | $BV_{CES}$ | IC = 2.0 mA | TJ = –40°C to 150°C | **380** | **395** | **420** | $V_{DC}$ |
| | | IC = 10 mA | TJ = –40°C to 150°C | **390** | **405** | **430** | |
| Zero Gate Voltage Collector Current | $I_{CES}$ | $V_{CE}$ = 350 V, $V_{GE}$ = 0 V | $T_J$ = 25°C | – | 2.0 | 20 | µA |
| | | | $T_J$ = 150°C | – | 10 | 40* | |
| | | | $T_J$ = –40°C | – | 1.0 | 10 | |
| Reverse Collector–Emitter Leakage Current | $I_{ECS}$ | $V_{CE}$ = –24 V | $T_J$ = 25°C | – | 0.7 | 2.0 | mA |
| | | | $T_J$ = 150°C | – | 12 | 25* | |
| | | | $T_J$ = –40°C | – | 0.1 | 1.0 | |
| Reverse Collector–Emitter Clamp Voltage | $B_{VCES(R)}$ | $I_C$ = –75 mA | $T_J$ = 25°C | 27 | 33 | 37 | $V_{DC}$ |
| | | | $T_J$ = 150°C | 30 | 36 | 40 | |
| | | | $T_J$ = –40°C | 25 | 32 | 35 | |
| Gate–Emitter Clamp Voltage | $BV_{GES}$ | $I_G$ = 5.0 mA | $T_J$ = –40°C to 150°C | 11 | 13 | 15 | $V_{DC}$ |
| Gate–Emitter Leakage Current | $I_{GES}$ | $V_{GE}$ = 10 V | $T_J$ = –40°C to 150°C | 384 | 640 | 1000 | $µA_{DC}$ |
| Gate Emitter Resistor | $R_{GE}$ | – | $T_J$ = –40°C to 150°C | 10 | 16 | 26 | kΩ |


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## Electrical Characteristics - ON (Note 2)

| Characteristic | Symbol | Test Conditions | Temperature | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Collector–to–Emitter On–Voltage | $V_{CE(on)}$ | $I_C$ = 6.0 A, $V_{GE}$ = 4.0 V | $T_J$ = 25°C | 1.0 | 1.4 | 1.6 | $V_{DC}$ |
| | | | $T_J$ = 150°C | 0.9 | 1.3 | 1.6 | |
| | | | $T_J$ = –40°C | 1.1 | 1.45 | 1.7* | |
| | | $I_C$ = 8.0 A, $V_{GE}$ = 4.0 V | $T_J$ = 25°C | 1.3 | 1.6 | 1.9* | |
| | | | $T_J$ = 150°C | 1.2 | 1.55 | 1.8 | |
| | | | $T_J$ = –40°C | 1.4 | 1.6 | 1.9* | |
| | | $I_C$ = 10 A, $V_{GE}$ = 4.0 V | $T_J$ = 25°C | 1.4 | 1.8 | 2.05 | |
| | | | $T_J$ = 150°C | 1.5 | 1.8 | 2.0 | |
| | | | $T_J$ = –40°C | 1.4 | 1.8 | 2.1* | |
| | | $I_C$ = 15 A, $V_{GE}$ = 4.0 V | $T_J$ = 25°C | 1.6 | 1.9 | 2.2 | |
| | | | $T_J$ = 150°C | 1.7 | 2.1 | 2.3 | |
| | | | $T_J$ = –40°C | 1.6 | 1.8 | 2.2 | |
| | | $I_C$ = 10 A, $V_{GE}$ = 4.5 V | $T_J$ = 25°C | 1.3 | 1.8 | 2.0* | |
| | | | $T_J$ = 150°C | 1.3 | 1.75 | 2.0* | |
| | | | $T_J$ = –40°C | 1.4 | 1.8 | 2.0* | |
| | | $I_C$ = 6.5 A, $V_{GE}$ = 3.7 V | $T_J$ = 25°C | – | – | 1.65 | |
| Forward Transconductance | gfs | $V_{CE}$ = 5.0 V, $I_C$ = 6.0 A | $T_J$ = –40°C to 150°C | 8.0 | 14 | 25 | Mhos |

## Dynamic Characteristics

| Characteristic | Symbol | Test Conditions | Temperature | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Input Capacitance | $C_{ISS}$ | $V_{CC}$ = 25 V, $V_{GE}$ = 0 V f = 1.0 MHz | $T_J$ = –40°C to 150°C | 400 | 800 | 1000 | pF |
| Output Capacitance | $C_{OSS}$ | | | 50 | 75 | 100 | |
| Transfer Capacitance | $C_{RSS}$ | | | 4.0 | 7.0 | 10 | |

## Switching Characteristics

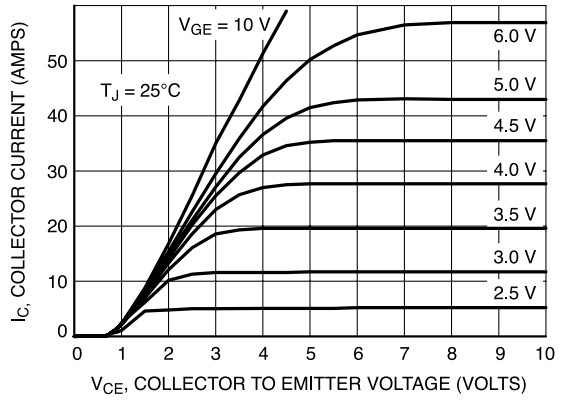
| Characteristic | Symbol | Test Conditions | Temperature | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Turn–Off Delay Time (Resistive) | $t_{d(off)}$ | $V_{CC}$ = 300 V, $I_C$ = 6.5 A $R_G$ = 1.0 kΩ, $R_L$ = 46 Ω, | $T_J$ = 25°C | – | 4.0 | 10 | µS |
| Fall Time (Resistive) | tf | $V_{CC}$ = 300 V, $I_C$ = 6.5 A $R_G$ = 1.0 kΩ, $R_L$ = 46 Ω, | $T_J$ = 25°C | – | 9.0 | 15 | |
| Turn–On Delay Time | $t_{d(on)}$ | $V_{CC}$ = 10 V, $I_C$ = 6.5 A $R_G$ = 1.0 kΩ, $R_L$ = 1.5 Ω, | $T_J$ = 25°C | – | 0.7 | 4.0 | µS |
| Rise Time | $t_r$ | $V_{CC}$ = 10 V, $I_C$ = 6.5 A $R_G$ = 1.0 kΩ, $R_L$ = 1.5 Ω, | $T_J$ = 25°C | – | 4.5 | 7.0 | |

*Maximum Value of Characteristic across Temperature Range.

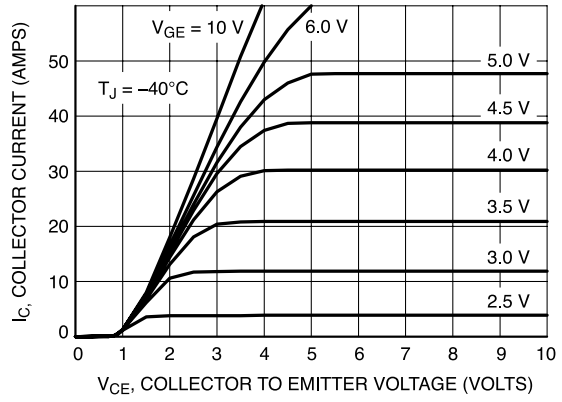
1. When surface mounted to an FR4 board using the minimum recommended pad size.
2. Pulse Test: Pulse Width ≤ 300 µS, Duty Cycle ≤ 2%.

## Ratings and Characteristic Curves

### Figure 1. Output Characteristics




### Figure 2. Output Characteristics





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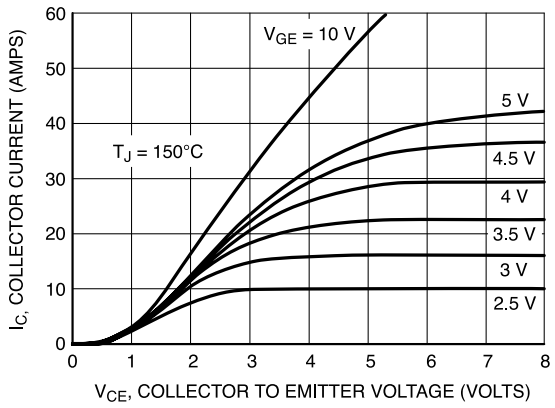
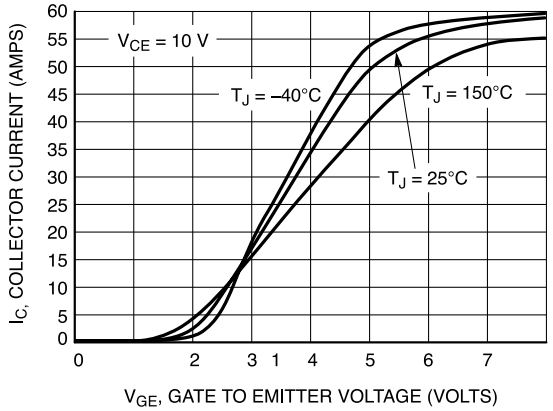
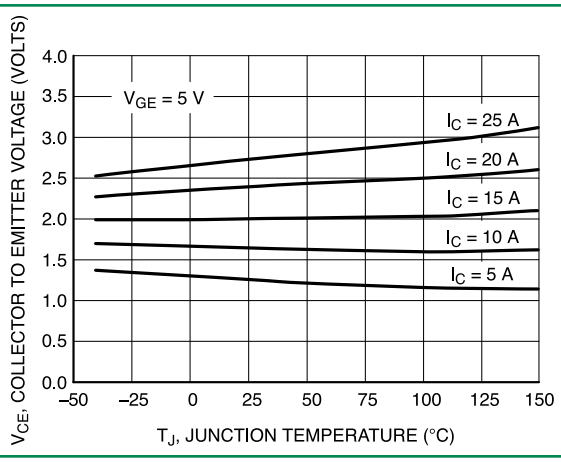
## Figure 3. Output Characteristics



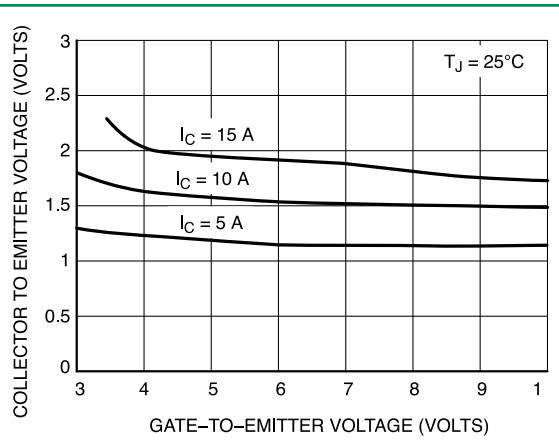

## Figure 4. Transfer Characteristics



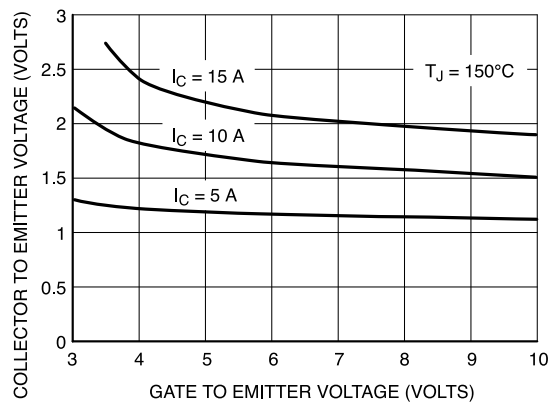

## Figure 5. Collector–to–Emitter Saturation Voltage versus Junction Temperature



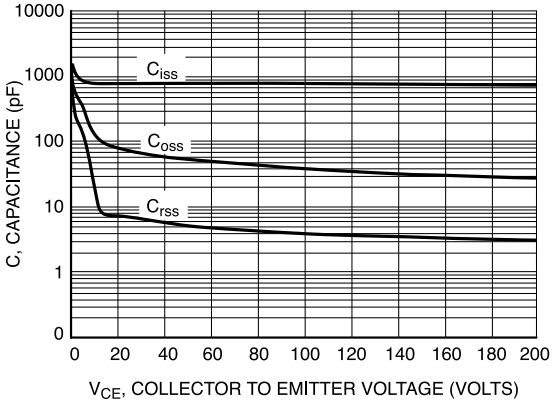

## Figure 6. Collector–to–Emitter Voltage versus Gate–to–Emitter Voltage



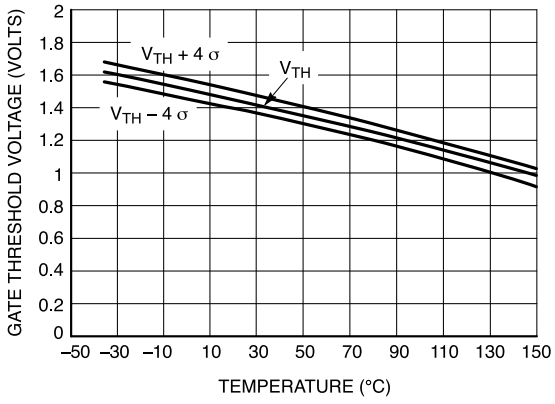

## Figure 7. Collector–to–Emitter Voltage versus Gate–to–Emitter Voltage



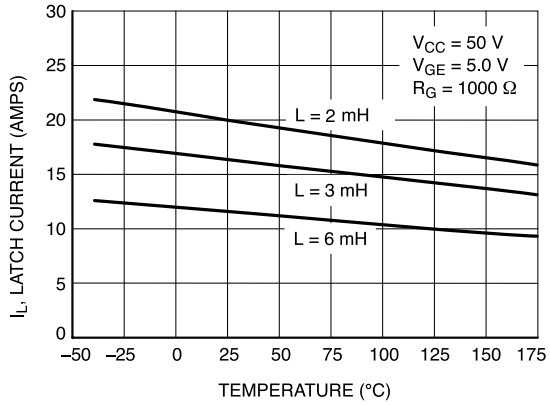

## Figure 8. Capacitance Variation



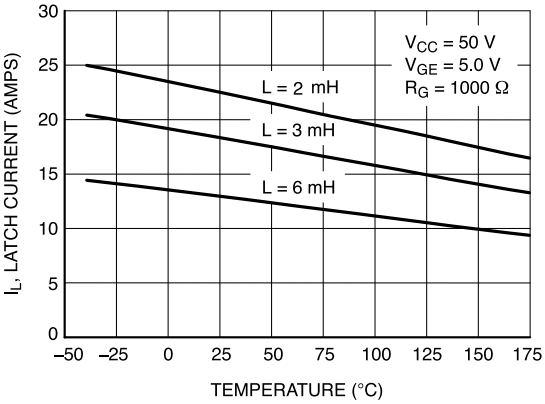
## Figure 9. Gate Threshold Voltage versus Temperature



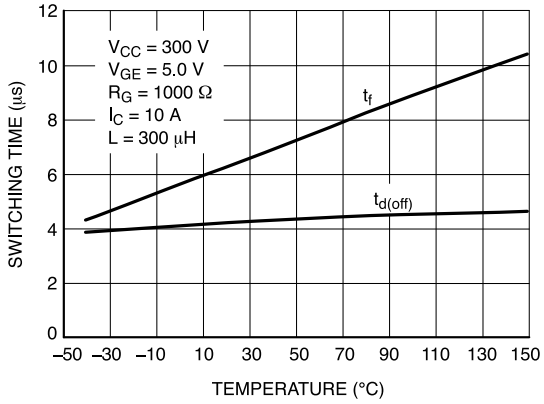

## Figure 10. Minimum Open Secondary Latch Current versus Temperature



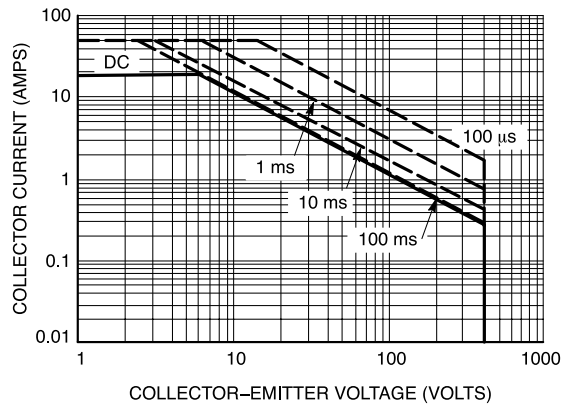

## Figure 11. Typical Open Secondary Latch Current versus Temperature




## Figure 12. Inductive Switching Fall Time versus Temperature




## Figure 13. Single Pulse Safe Operating Area
(Mounted on an Infinite Heatsink at $T_A$ = 25°C)




## Figure 14. Single Pulse Safe Operating Area
(Mounted on an Infinite Heatsink at $T_A$ = 125°C)

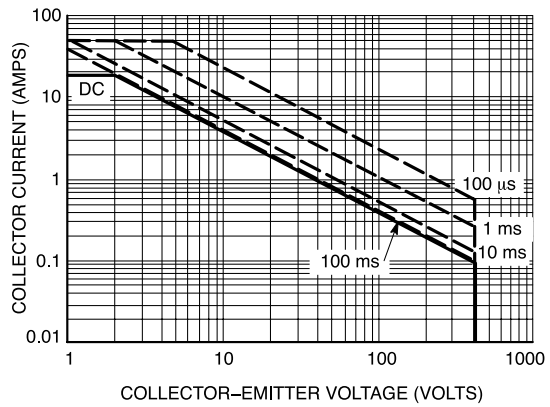




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**Figure 15. Pulse Train Safe Operating Area**
(Mounted on an Infinite Heatsink at $T_c$ = 25°C)

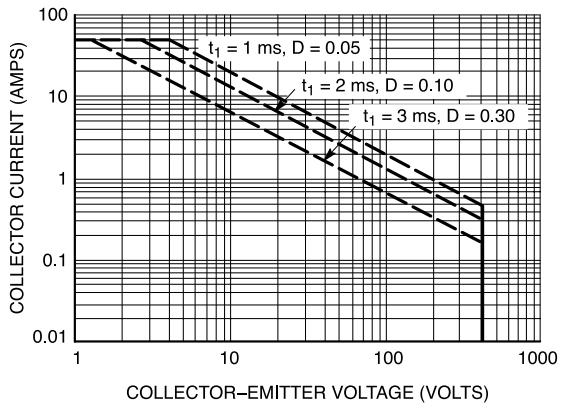



**Figure 15. Pulse Train Safe Operating Area**
(Mounted on an Infinite Heatsink at $T_c$ = 125°C)

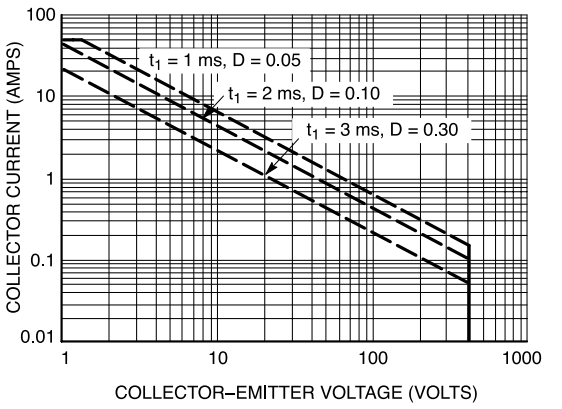



**Figure 17. Circuit Configuration for Short Circuit Test #1**

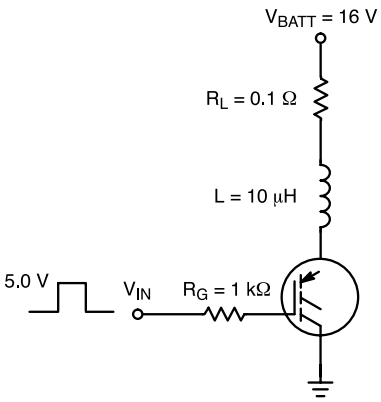



**Figure 18. Circuit Configuration for Short Circuit Test #2**

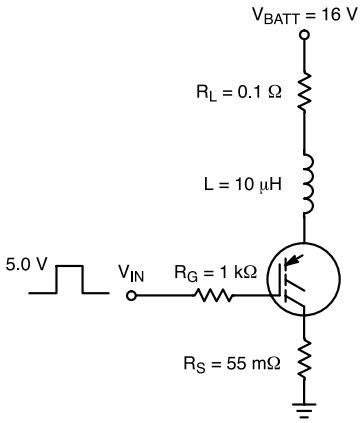
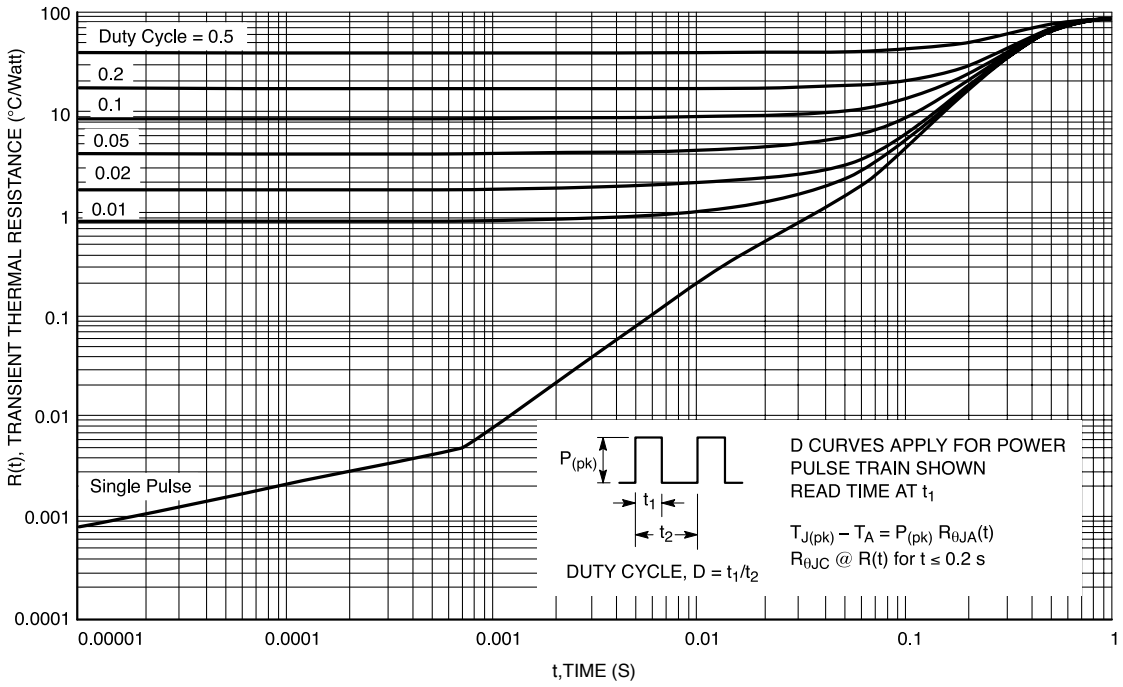


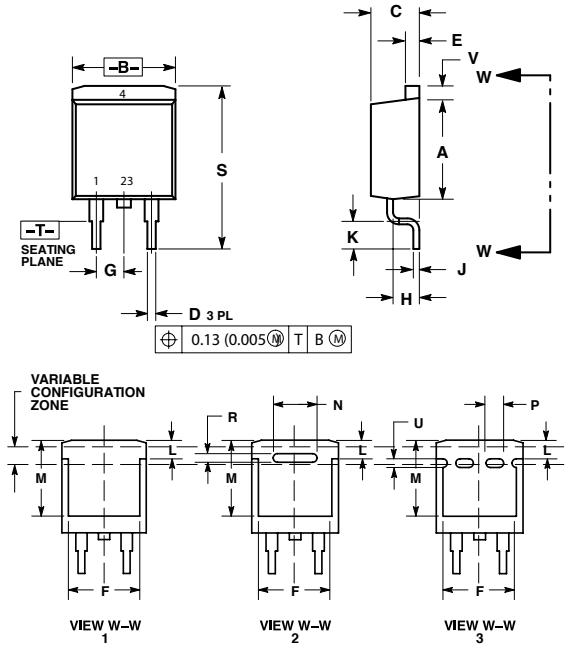
**Figure 19. Transient Thermal Resistance** (Non–normalized Junction–to–Ambient mounted on minimum pad area)



# Ignition IGBT

Surface Mount > 400v > NGB18N40ACLB

## Dimensions

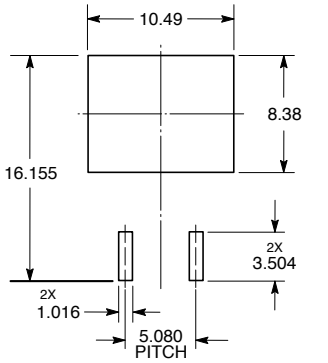



| Dim | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.086 | 0.094 | 2.18 | 2.38 |
| A1 | 0.000 | 0.005 | 0.00 | 0.13 |
| b | 0.025 | 0.035 | 0.63 | 0.89 |
| b2 | 0.028 | 0.045 | 0.72 | 1.14 |
| b3 | 0.180 | 0.215 | 4.57 | 5.46 |
| c | 0.018 | 0.024 | 0.46 | 0.61 |
| c2 | 0.018 | 0.024 | 0.46 | 0.61 |
| D | 0.235 | 0.245 | 5.97 | 6.22 |
| E | 0.250 | 0.265 | 6.35 | 6.73 |
| e | 0.090 BSC | | 2.29 BSC | |
| H | 0.370 | 0.410 | 9.40 | 10.41 |
| L | 0.055 | 0.070 | 1.40 | 1.78 |
| L1 | 0.114 REF | | 2.90 REF | |
| L2 | 0.020 BSC | | 0.51 BSC | |
| L3 | 0.035 | 0.050 | 0.89 | 1.27 |
| L4 | --- | 0.040 | --- | 1.01 |
| Z | 0.155 | --- | 3.93 | --- |

NOTES:

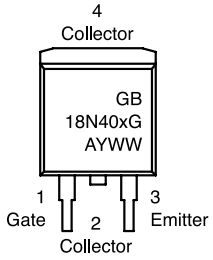
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
7. OPTIONAL MOLD FEATURE.

## Soldering Footprint




DIMENSIONS: MILLIMETERS

## Part Marking System




| | |
|---|---|
| GB18N40x | = Device Code |
| x | = B or A |
| A | = Assembly Location |
| Y | = Year |
| WW | = Work Week |
| G | = Pb–Free Package |

## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| NGB18N40ACLBT4G | DPAK (Pb–Free) | 2500 / Tape & Reel |