

# NGD18N40CLBT4G Datasheet



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|                              |   |
|------------------------------|---|
| DiGi Electronics Part Number | NGD18N40CLBT4G-DG                                 |
| Manufacturer                 | <a href="#">Littelfuse Inc.</a>                   |
| Manufacturer Product Number  | NGD18N40CLBT4G                                    |
| Description                  | IGBT 430V 15A 115W DPAK                           |
| Detailed Description         | IGBT 430 V 15 A 115 W Surface Mount TO-252 (DPAK) |

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## Purchase and inquiry

Manufacturer Product Number:

NGD18N40CLBT4G

Series:

-

IGBT Type:

-

Current - Collector (Ic) (Max):

15 A

Vce(on) (Max) @ Vge, Ic:

2.5V @ 4V, 15A

Switching Energy:

-

Td (on/off) @ 25°C:

-

Operating Temperature:

-55°C ~ 175°C (Tj)

Package / Case:

TO-252-3, DPAK (2 Leads + Tab), SC-63

Base Product Number:

NGD18N40

Manufacturer:

Littelfuse Inc.

Product Status:

Obsolete

Voltage - Collector Emitter Breakdown (Max):

430 V

Current - Collector Pulsed (Icm):

50 A

Power - Max:

115 W

Input Type:

Logic

Test Condition:

-

Mounting Type:

Surface Mount

Supplier Device Package:

TO-252 (DPAK)

## Environmental & Export classification

RoHS Status:

ROHS3 Compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.29.0095

Moisture Sensitivity Level (MSL):

1 (Unlimited)

ECCN:

EAR99

# NGD18N40CLB, NGD18N40ACLB

## Ignition IGBT, 18 A, 400 V N-Channel DPAK

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

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ 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>@ $T_C = 25^\circ\text{C}$ - Pulsed                   | $I_C$          | 15<br>50       | $A_{DC}$<br>$A_{AC}$        |
| ESD (Human Body Model)<br>$R = 1500 \Omega$ , $C = 100 \text{ pF}$                    | ESD            | 8.0            | kV                          |
| ESD (Machine Model) $R = 0 \Omega$ , $C = 200 \text{ pF}$                             | ESD            | 800            | V                           |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 115<br>0.77    | Watts<br>$W/^\circ\text{C}$ |
| Operating and Storage Temperature Range   | $T_J, T_{stg}$ | -55 to<br>+175 | $^\circ\text{C}$            |

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.

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



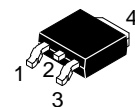
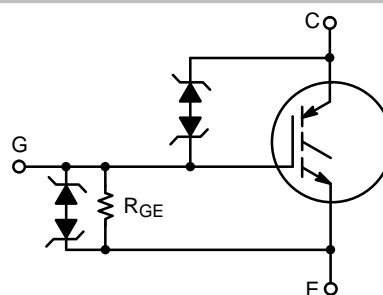
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

**18 AMPS, 400 VOLTS**

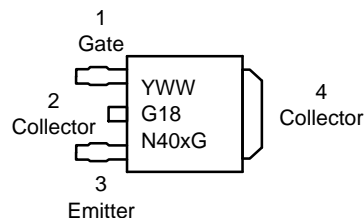
$V_{CE(on)} \leq 2.0 \text{ V @}$

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



DPAK  
CASE 369C  
STYLE 7

### MARKING DIAGRAM



G18N40x = Device Code  
x = B or A

Y = Year

WW = Work Week

G = Pb-Free Device

### ORDERING INFORMATION

| Device          | Package           | Shipping†           |
|-----------------|-------------------|---------------------|
| NGD18N40CLBT4G  | DPAK<br>(Pb-Free) | 2500/Tape &<br>Reel |
| NGD18N40ACLBT4G | DPAK<br>(Pb-Free) | 2500/Tape &<br>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.

**NGD18N40CLB, NGD18N40ACLB**

**UNCLAMPED COLLECTOR-TO-EMITTER AVALANCHE CHARACTERISTICS** ( $-55^{\circ} \leq T_J \leq 175^{\circ}C$ )

| Characteristic  | Symbol      | Value             | Unit |
|---|-------------|-------------------|------|
| Single Pulse Collector-to-Emitter Avalanche Energy<br>$V_{CC} = 50\text{ V}$ , $V_{GE} = 5.0\text{ V}$ , Pk $I_L = 21.1\text{ A}$ , $L = 1.8\text{ mH}$ , Starting $T_J = 25^{\circ}C$<br>$V_{CC} = 50\text{ V}$ , $V_{GE} = 5.0\text{ V}$ , Pk $I_L = 16.2\text{ A}$ , $L = 3.0\text{ mH}$ , Starting $T_J = 25^{\circ}C$<br>$V_{CC} = 50\text{ V}$ , $V_{GE} = 5.0\text{ V}$ , Pk $I_L = 18.3\text{ A}$ , $L = 1.8\text{ mH}$ , Starting $T_J = 125^{\circ}C$ | $E_{AS}$    | 400<br>400<br>300 | mJ   |
| Reverse Avalanche Energy<br>$V_{CC} = 100\text{ V}$ , $V_{GE} = 20\text{ V}$ , Pk $I_L = 25.8\text{ A}$ , $L = 6.0\text{ mH}$ , Starting $T_J = 25^{\circ}C$  | $E_{AS(R)}$ | 2000              | mJ   |

**MAXIMUM SHORT-CIRCUIT TIMES** ( $-55^{\circ}C \leq T_J \leq 150^{\circ}C$ )

|  |           |     |         |
|--|-----------|-----|---------|
| Short Circuit Withstand Time 1 (See Figure 17, 3 Pulses with 10 ms Period) | $t_{sc1}$ | 750 | $\mu s$ |
| Short Circuit Withstand Time 2 (See Figure 18, 3 Pulses with 10 ms Period) | $t_{sc2}$ | 5.0 | ms      |

**THERMAL CHARACTERISTICS**

|   |                 |     |               |
|---|-----------------|-----|---------------|
| Thermal Resistance, Junction to Case  | $R_{\theta JC}$ | 1.3 | $^{\circ}C/W$ |
| Thermal Resistance, Junction to Ambient                                       | $R_{\theta JA}$ | 95  | $^{\circ}C/W$ |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds | $T_L$           | 275 | $^{\circ}C$   |

**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 $150^{\circ}C$ | 380 | 395 | 420 | $V_{DC}$     |
|   |               | $I_C = 10\text{ mA}$                               | $T_J = -40^{\circ}C$ to $150^{\circ}C$ | 390 | 405 | 430 |              |
| Zero Gate Voltage Collector Current       | $I_{CES}$     | $V_{CE} = 350\text{ V}$ ,<br>$V_{GE} = 0\text{ V}$ | $T_J = 25^{\circ}C$                    | -   | 2.0 | 20  | $\mu A_{DC}$ |
|   |               |  | $T_J = 150^{\circ}C$                   | -   | 10  | 40* |              |
|   |               |  | $T_J = -40^{\circ}C$                   | -   | 1.0 | 10  |              |
| Reverse Collector-Emitter Leakage Current | $I_{ECS}$     | $V_{CE} = -24\text{ V}$                            | $T_J = 25^{\circ}C$                    | -   | 0.7 | 1.0 | mA           |
|   |               |  | $T_J = 150^{\circ}C$                   | -   | 12  | 25* |              |
|   |               |  | $T_J = -40^{\circ}C$                   | -   | 0.1 | 1.0 |              |
| Reverse Collector-Emitter Clamp Voltage   | $BV_{CES(R)}$ | $I_C = -75\text{ mA}$                              | $T_J = 25^{\circ}C$                    | 27  | 33  | 37  | $V_{DC}$     |
|   |               |  | $T_J = 150^{\circ}C$                   | 30  | 36  | 40  |              |
|   |               |  | $T_J = -40^{\circ}C$                   | 25  | 32  | 35  |              |
| Gate-Emitter Clamp Voltage                | $BV_{GES}$    | $I_G = 5.0\text{ mA}$                              | $T_J = -40^{\circ}C$ to $150^{\circ}C$ | 11  | 13  | 15  | $V_{DC}$     |
| Gate-Emitter Leakage Current              | $I_{GES}$     | $V_{GE} = 10\text{ V}$                             | $T_J = -40^{\circ}C$ to $150^{\circ}C$ | 384 | 640 | 700 | $\mu A_{DC}$ |
| Gate Emitter Resistor                     | $R_{GE}$      | -  | $T_J = -40^{\circ}C$ to $150^{\circ}C$ | 10  | 16  | 26  | k $\Omega$   |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

\*Maximum Value of Characteristic across Temperature Range.

**NGD18N40CLB, NGD18N40ACLB**

**ELECTRICAL CHARACTERISTICS (continued)**

| Characteristic                                | Symbol                   | Test Conditions                               | Temperature                                     | Min  | Typ  | Max  | Unit     |
|---|--------------------------|---|---|------|------|------|----------|
| <b>ON CHARACTERISTICS (Note 2)</b>            |                          |   |   |      |      |      |          |
| Gate Threshold Voltage                        | $V_{GE(th)}$             | $I_C = 1.0 \text{ mA}, V_{GE} = V_{CE}$       | $T_J = 25^\circ\text{C}$                        | 1.1  | 1.4  | 1.9  | $V_{DC}$ |
|   |                          |   | $T_J = 150^\circ\text{C}$                       | 0.75 | 1.0  | 1.4  |          |
|   |                          |   | $T_J = -40^\circ\text{C}$                       | 1.2  | 1.6  | 2.1* |          |
| Threshold Temperature Coefficient (Negative)  | -                        | -   | -   | -    | 3.4  | -    | mV/°C    |
| Collector-to-Emitter On-Voltage               | $V_{CE(on)}$             | $I_C = 6.0 \text{ A}, V_{GE} = 4.0 \text{ V}$ | $T_J = 25^\circ\text{C}$                        | 1.0  | 1.4  | 1.6  | $V_{DC}$ |
|   |                          |   | $T_J = 150^\circ\text{C}$                       | 0.9  | 1.3  | 1.6  |          |
|   |                          |   | $T_J = -40^\circ\text{C}$                       | 1.1  | 1.45 | 1.7* |          |
|   |                          | $I_C = 8.0 \text{ A}, V_{GE} = 4.0 \text{ V}$ | $T_J = 25^\circ\text{C}$                        | 1.3  | 1.6  | 1.9* |          |
|   |                          |   | $T_J = 150^\circ\text{C}$                       | 1.2  | 1.55 | 1.8  |          |
|   |                          |   | $T_J = -40^\circ\text{C}$                       | 1.4  | 1.6  | 1.9* |          |
|   |                          | $I_C = 10 \text{ A}, V_{GE} = 4.0 \text{ V}$  | $T_J = 25^\circ\text{C}$                        | 1.4  | 1.8  | 2.05 |          |
|   |                          |   | $T_J = 150^\circ\text{C}$                       | 1.4  | 1.8  | 2.0  |          |
|   |                          |   | $T_J = -40^\circ\text{C}$                       | 1.4  | 1.8  | 2.1* |          |
|   |                          | $I_C = 15 \text{ A}, V_{GE} = 4.0 \text{ V}$  | $T_J = 25^\circ\text{C}$                        | 1.8  | 2.2  | 2.5  |          |
|   |                          |   | $T_J = 150^\circ\text{C}$                       | 2.0  | 2.4  | 2.6* |          |
|   |                          |   | $T_J = -40^\circ\text{C}$                       | 1.7  | 2.1  | 2.5  |          |
|   |                          | $I_C = 10 \text{ A}, V_{GE} = 4.5 \text{ V}$  | $T_J = 25^\circ\text{C}$                        | 1.3  | 1.8  | 2.0* |          |
| $T_J = 150^\circ\text{C}$                     | 1.3                      |   | 1.75  | 2.0* |      |      |          |
| $T_J = -40^\circ\text{C}$                     | 1.4                      |   | 1.8   | 2.0* |      |      |          |
| $I_C = 6.5 \text{ A}, V_{GE} = 3.7 \text{ V}$ | $T_J = 25^\circ\text{C}$ | -   | -   | 1.65 |      |      |          |
|   |                          |   |   |      |      |      |          |
| Forward Transconductance                      | gfs                      | $V_{CE} = 5.0 \text{ V}, I_C = 6.0 \text{ A}$ | $T_J = -40^\circ\text{C to } 150^\circ\text{C}$ | 8.0  | 14   | 25   | Mhos     |

**DYNAMIC CHARACTERISTICS**

|                      |           |  |   |     |     |      |    |
|----------------------|-----------|--|---|-----|-----|------|----|
| Input Capacitance    | $C_{ISS}$ | $V_{CC} = 25 \text{ V}, V_{GE} = 0 \text{ V}$<br>$f = 1.0 \text{ MHz}$ | $T_J = -40^\circ\text{C to } 150^\circ\text{C}$ | 400 | 800 | 1000 | pF |
| Output Capacitance   | $C_{OSS}$ |  |   | 50  | 75  | 100  |    |
| Transfer Capacitance | $C_{RSS}$ |  |   | 4.0 | 7.0 | 10   |    |

**SWITCHING CHARACTERISTICS**

|                                 |              |  |                          |   |     |     |                 |
|---------------------------------|--------------|--|--------------------------|---|-----|-----|-----------------|
| Turn-Off Delay Time (Resistive) | $t_{d(off)}$ | $V_{CC} = 300 \text{ V}, I_C = 6.5 \text{ A}$<br>$R_G = 1.0 \text{ k}\Omega, R_L = 46 \Omega,$ | $T_J = 25^\circ\text{C}$ | - | 4.0 | 10  | $\mu\text{Sec}$ |
| Fall Time (Resistive)           | $t_f$        | $V_{CC} = 300 \text{ V}, I_C = 6.5 \text{ A}$<br>$R_G = 1.0 \text{ k}\Omega, R_L = 46 \Omega,$ | $T_J = 25^\circ\text{C}$ | - | 9.0 | 15  |                 |
| Turn-On Delay Time              | $t_{d(on)}$  | $V_{CC} = 10 \text{ V}, I_C = 6.5 \text{ A}$<br>$R_G = 1.0 \text{ k}\Omega, R_L = 1.5 \Omega$  | $T_J = 25^\circ\text{C}$ | - | 0.7 | 4.0 | $\mu\text{Sec}$ |
| Rise Time                       | $t_r$        | $V_{CC} = 10 \text{ V}, I_C = 6.5 \text{ A}$<br>$R_G = 1.0 \text{ k}\Omega, R_L = 1.5 \Omega$  | $T_J = 25^\circ\text{C}$ | - | 4.5 | 7.0 |                 |

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

\*Maximum Value of Characteristic across Temperature Range.

## NGD18N40CLB, NGD18N40ACLB

### TYPICAL ELECTRICAL CHARACTERISTICS (unless otherwise noted)

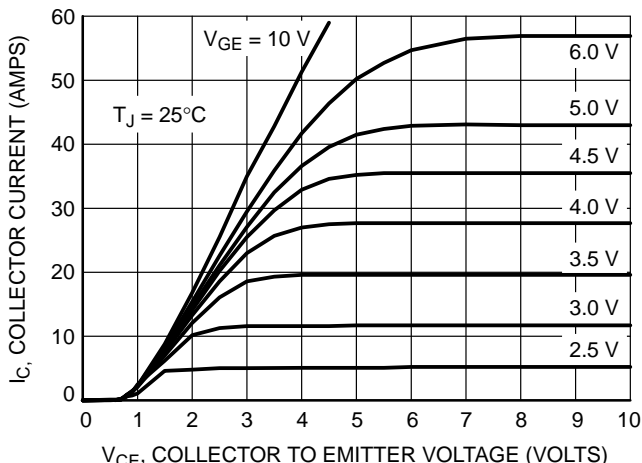


Figure 1. Output Characteristics

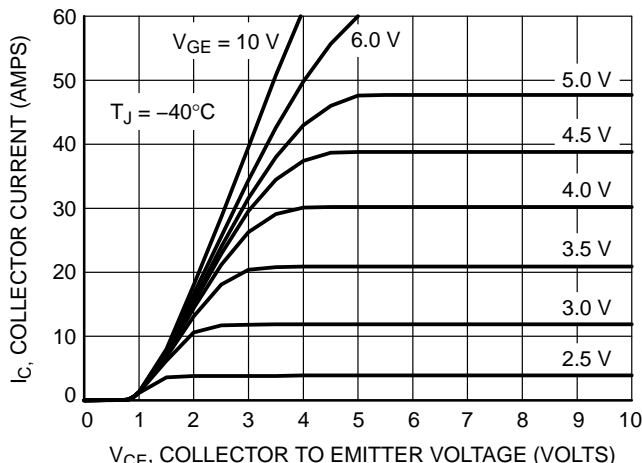


Figure 2. Output Characteristics

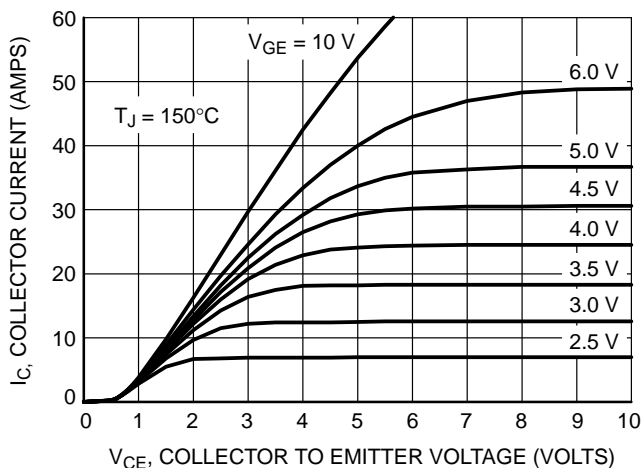


Figure 3. Output Characteristics

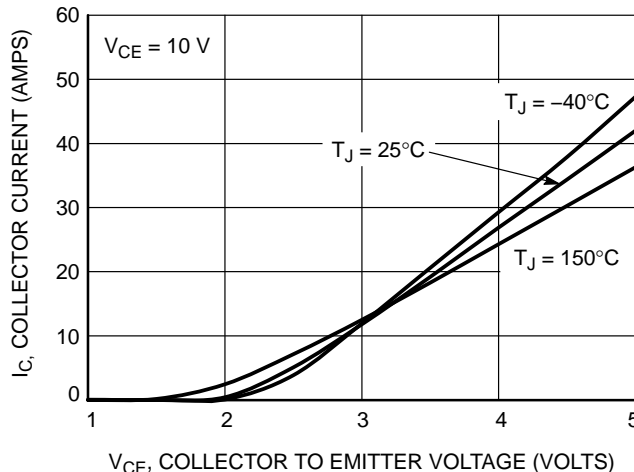


Figure 4. Transfer Characteristics

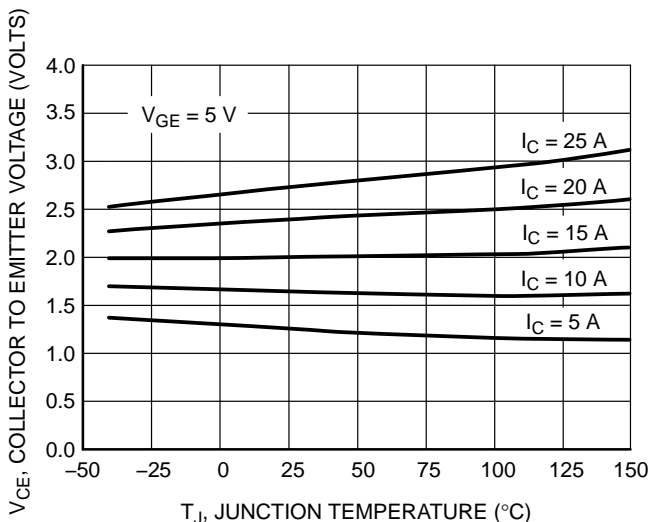


Figure 5. Collector-to-Emitter Saturation Voltage versus Junction Temperature

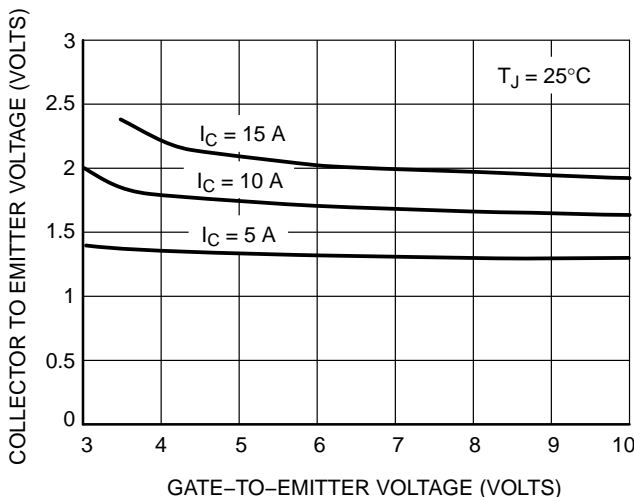


Figure 6. Collector-to-Emitter Voltage versus Gate-to-Emitter Voltage

# NGD18N40CLB, NGD18N40ACLB

## TYPICAL ELECTRICAL CHARACTERISTICS (unless otherwise noted)

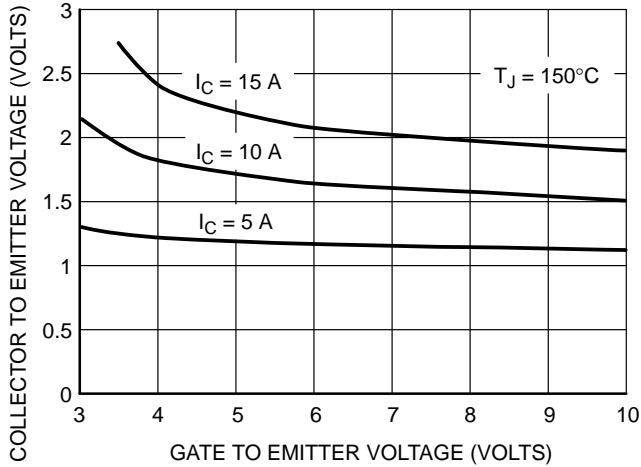


Figure 7. Collector-to-Emitter Voltage versus Gate-to-Emitter Voltage

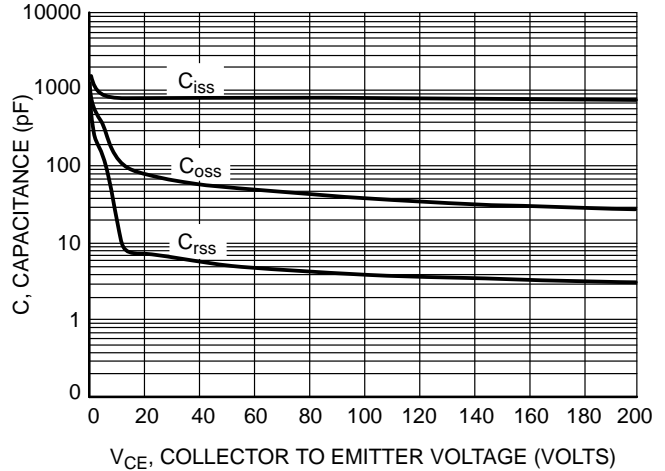


Figure 8. Capacitance Variation

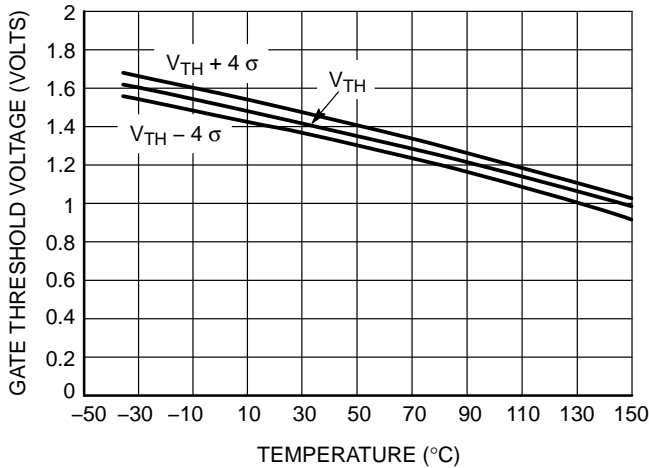


Figure 9. Gate Threshold Voltage versus Temperature

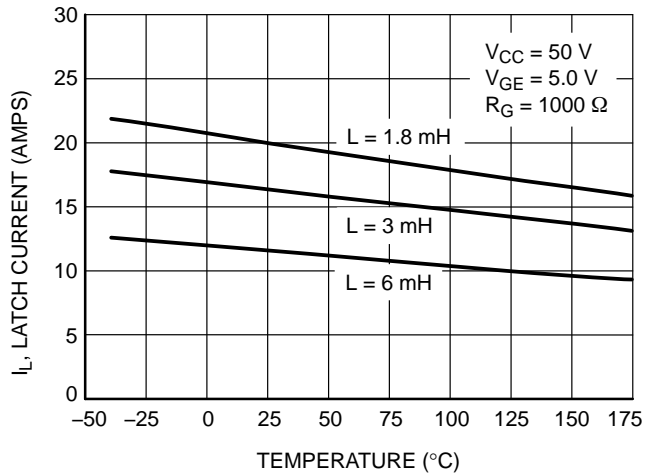


Figure 10. Minimum Open Secondary Latch Current versus Temperature

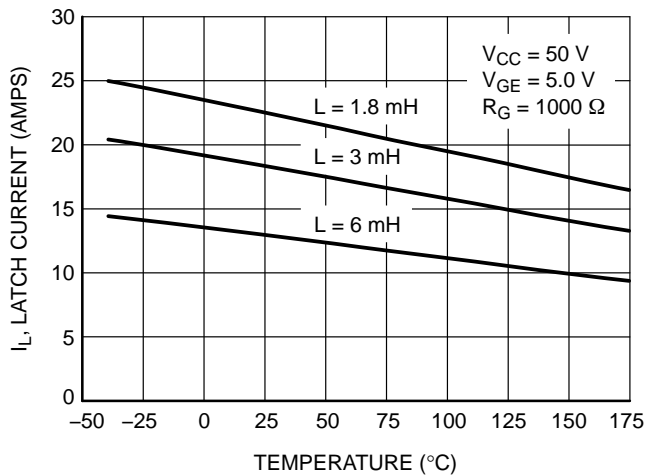


Figure 11. Typical Open Secondary Latch Current versus Temperature

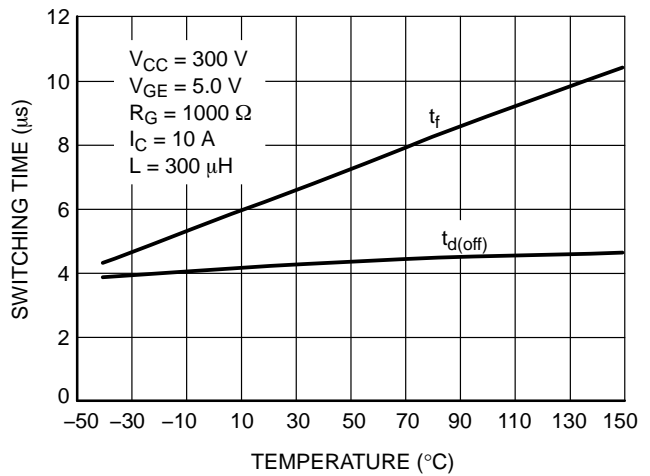
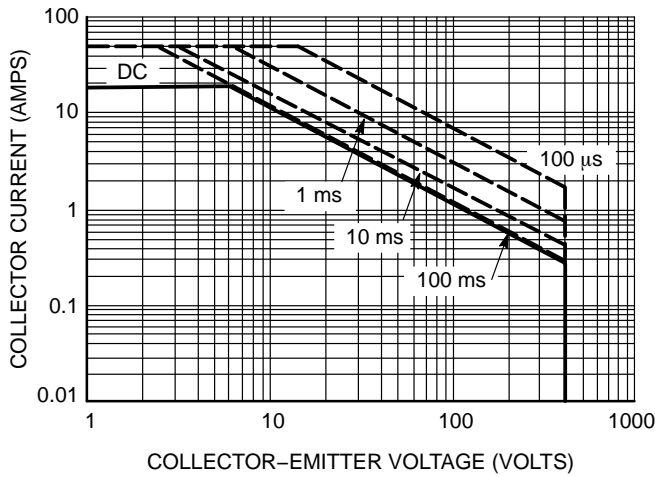
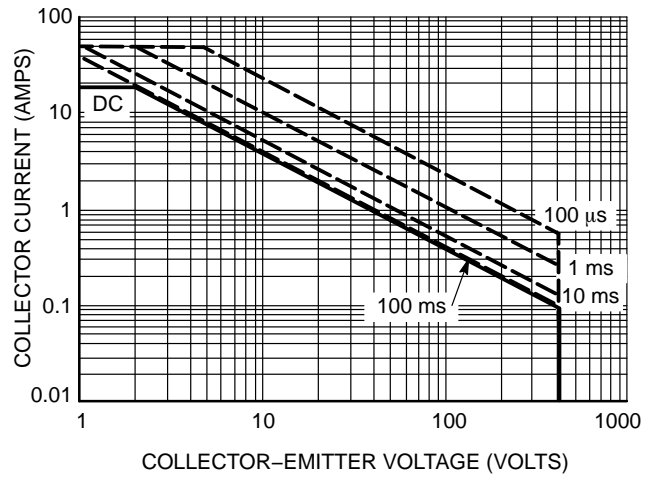


Figure 12. Inductive Switching Fall Time versus Temperature

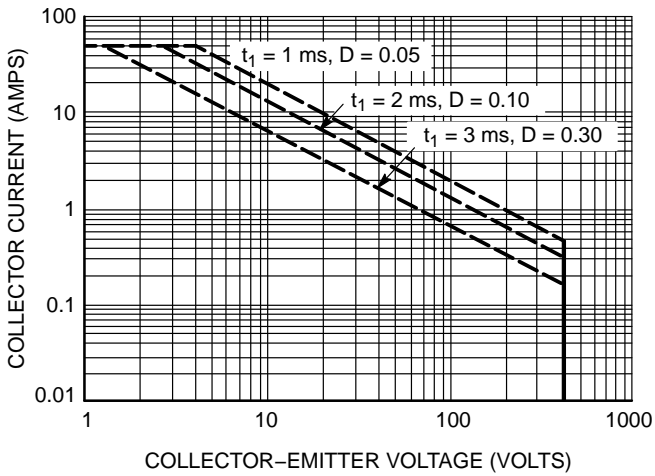
### NGD18N40CLB, NGD18N40ACLB



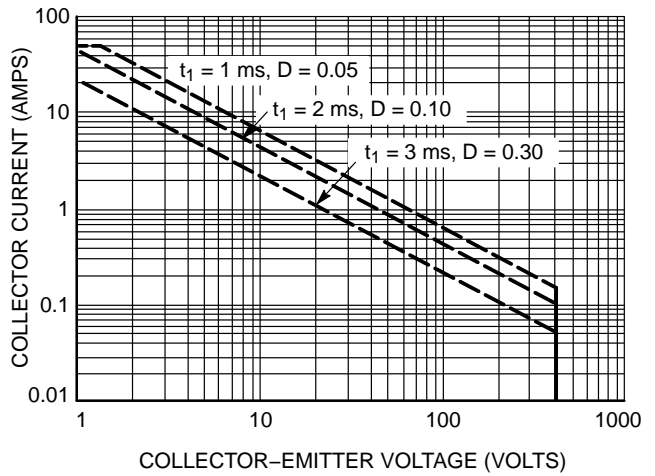
**Figure 13. Single Pulse Safe Operating Area (Mounted on an Infinite Heatsink at  $T_A = 25^\circ\text{C}$ )**



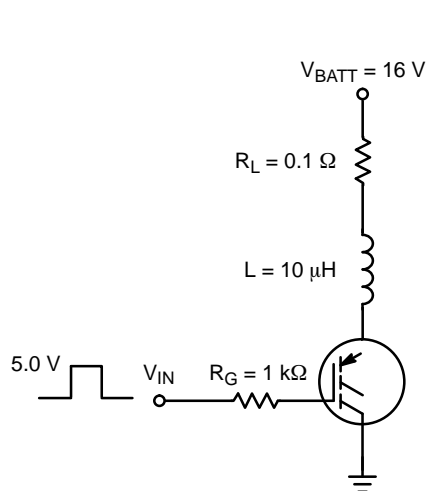
**Figure 14. Single Pulse Safe Operating Area (Mounted on an Infinite Heatsink at  $T_A = 125^\circ\text{C}$ )**



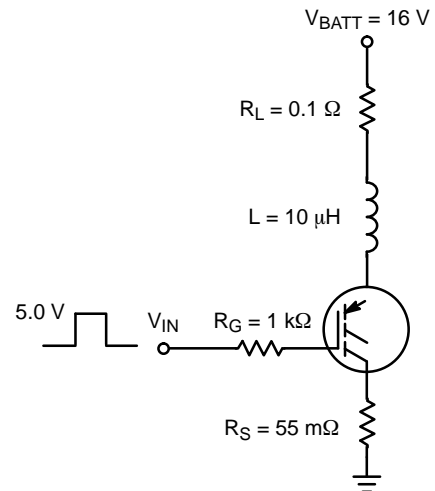
**Figure 15. Pulse Train Safe Operating Area (Mounted on an Infinite Heatsink at  $T_C = 25^\circ\text{C}$ )**



**Figure 16. Pulse Train Safe Operating Area (Mounted on an Infinite Heatsink at  $T_C = 125^\circ\text{C}$ )**

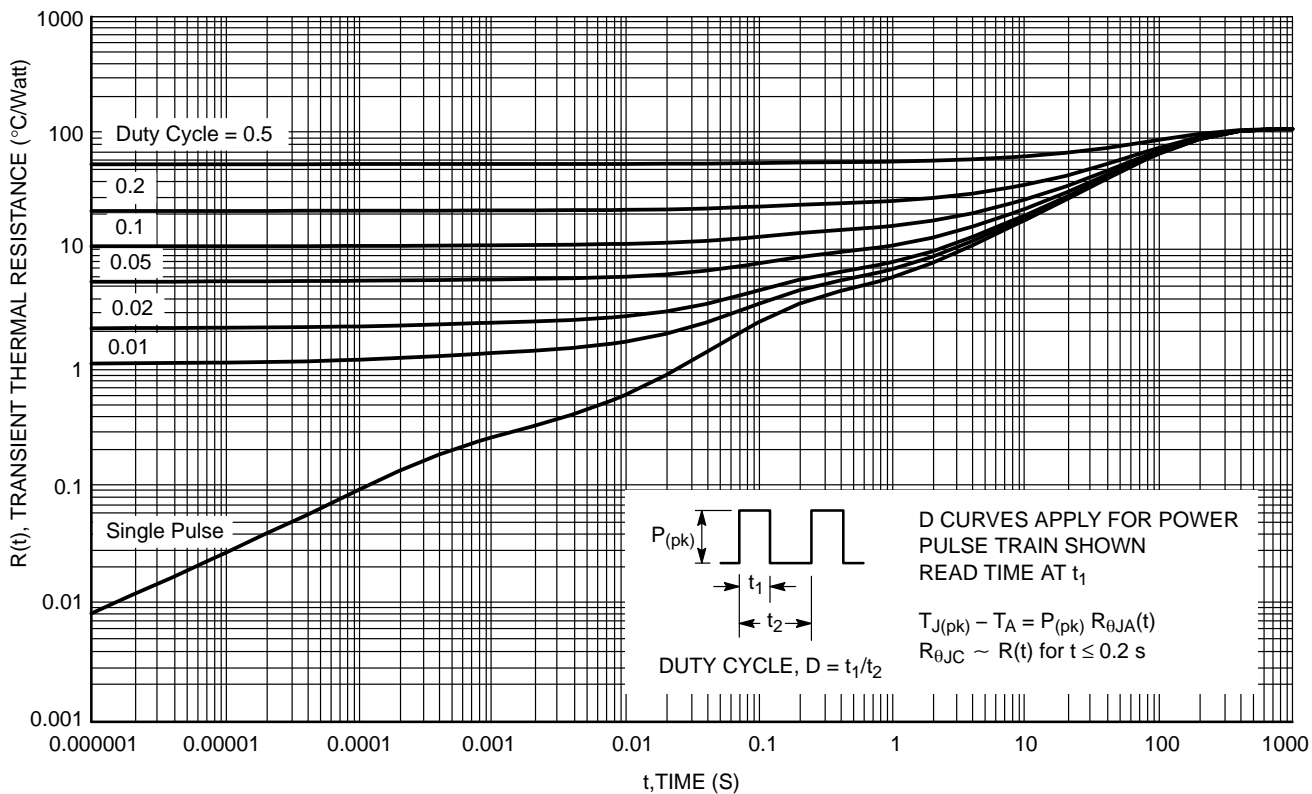


**Figure 17. Circuit Configuration for Short Circuit Test #1**



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

**NGD18N40CLB, NGD18N40ACLB**

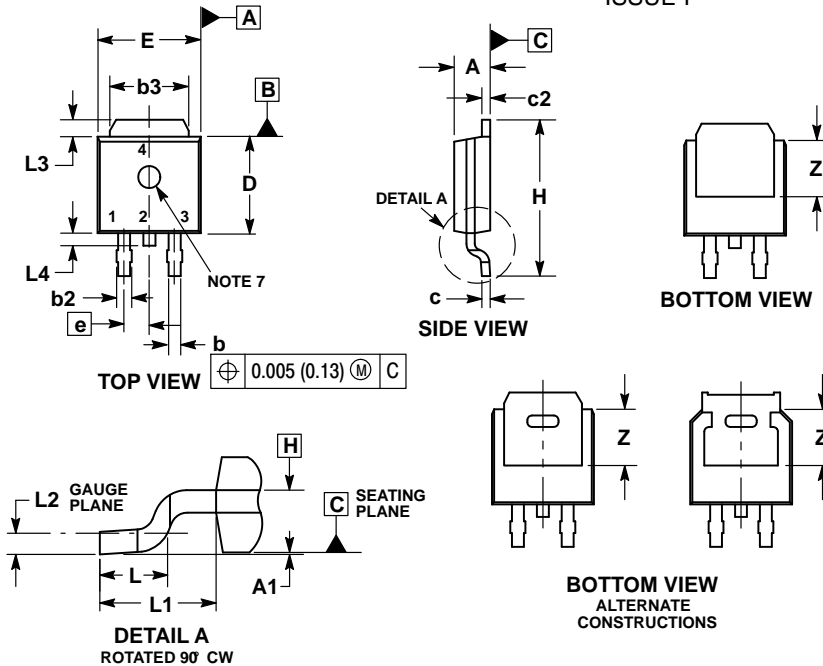


**Figure 19. Transient Thermal Resistance (Non-normalized Junction-to-Ambient mounted on minimum pad area)**

# NGD18N40CLB, NGD18N40ACLB

## PACKAGE DIMENSIONS

### DPAK (SINGLE GAUGE) CASE 369C ISSUE F



**NOTES:**

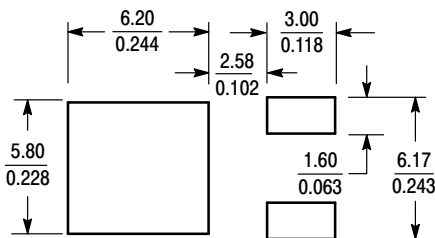
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
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.

| 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        | ---   |

**STYLE 7:**

- 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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