

NGD18N40CLBT4

Ignition IGBT 18 Amps, 400 Volts

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.

- 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

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

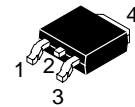
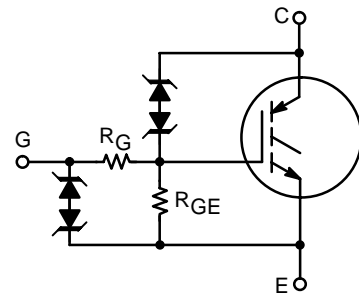
| Rating | Symbol | Value | Unit |
|---|----------------|----------------|------------------------------------|
| Collector-Emitter Voltage | V_{CES} | 430 | V_{DC} |
| Collector-Gate Voltage | V_{CER} | 430 | V_{DC} |
| Gate-Emitter Voltage | V_{GE} | 18 | V_{DC} |
| Collector Current-Continuous @ $T_C = 25^\circ\text{C}$ - Pulsed | I_C | 15 50 | A_{DC} A_{AC} |
| ESD (Human Body Model) $R = 1500 \Omega$, $C = 100 \text{ pF}$ | ESD | 8.0 | kV |
| ESD (Machine Model) $R = 0 \Omega$, $C = 200 \text{ pF}$ | ESD | 800 | V |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 115 0.77 | Watts $\text{W}/^\circ\text{C}$ |
| Operating and Storage Temperature Range | T_J, T_{stg} | -55 to +175 | $^\circ\text{C}$ |



ON Semiconductor®

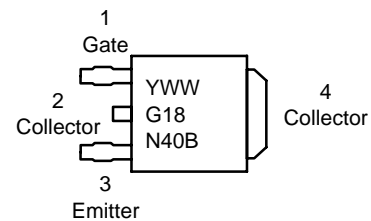
<http://onsemi.com>

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



G18N40B = NGD18N40CLB
Y = Year
WW = Work Week

ORDERING INFORMATION

| Device | Package | Shipping† |
|---------------|---------|------------------|
| NGD18N40CLB | DPAK | 75 Units/Rail |
| NGD18N40CLBT4 | DPAK | 2500/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.

NGD18N40CLBT4

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

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

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

| | | | |
|--|-----------|-----|---------------|
| Short Circuit Withstand Time 1 (See Figure 17, 3 Pulses with 10 ms Period) | t_{sc1} | 750 | μs |
| 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 | $^{\circ}\text{C/W}$ |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 95 | $^{\circ}\text{C/W}$ |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds | T_L | 275 | $^{\circ}\text{C}$ |

ELECTRICAL CHARACTERISTICS

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

OFF CHARACTERISTICS

| | | | | | | | |
|---|---------------|--|--|-----|-----|-----|--------------------|
| Collector-Emitter Clamp Voltage | BV_{CES} | $I_C = 2.0\text{ mA}$ | $T_J = -40^{\circ}\text{C}$ to 150°C | 380 | 395 | 420 | V_{DC} |
| | | $I_C = 10\text{ mA}$ | $T_J = -40^{\circ}\text{C}$ to 150°C | 390 | 405 | 430 | |
| Zero Gate Voltage Collector Current | I_{CES} | $V_{CE} = 350\text{ V}$, $V_{GE} = 0\text{ V}$ | $T_J = 25^{\circ}\text{C}$ | - | 2.0 | 20 | μA_{DC} |
| | | | $T_J = 150^{\circ}\text{C}$ | - | 10 | 40* | |
| | | | $T_J = -40^{\circ}\text{C}$ | - | 1.0 | 10 | |
| Reverse Collector-Emitter Leakage Current | I_{ECS} | $V_{CE} = -24\text{ V}$ | $T_J = 25^{\circ}\text{C}$ | - | 0.7 | 1.0 | mA |
| | | | $T_J = 150^{\circ}\text{C}$ | - | 12 | 25* | |
| | | | $T_J = -40^{\circ}\text{C}$ | - | 0.1 | 1.0 | |
| Reverse Collector-Emitter Clamp Voltage | $BV_{CES(R)}$ | $I_C = -75\text{ mA}$ | $T_J = 25^{\circ}\text{C}$ | 27 | 33 | 37 | V_{DC} |
| | | | $T_J = 150^{\circ}\text{C}$ | 30 | 36 | 40 | |
| | | | $T_J = -40^{\circ}\text{C}$ | 25 | 32 | 35 | |
| Gate-Emitter Clamp Voltage | BV_{GES} | $I_G = 5.0\text{ mA}$ | $T_J = -40^{\circ}\text{C}$ to 150°C | 11 | 13 | 15 | V_{DC} |
| Gate-Emitter Leakage Current | I_{GES} | $V_{GE} = 10\text{ V}$ | $T_J = -40^{\circ}\text{C}$ to 150°C | 384 | 640 | 700 | μA_{DC} |
| Gate Resistor (Optional) | R_G | - | $T_J = -40^{\circ}\text{C}$ to 150°C | - | 70 | - | Ω |
| Gate Emitter Resistor | R_{GE} | - | $T_J = -40^{\circ}\text{C}$ to 150°C | 10 | 16 | 26 | k Ω |

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

*Maximum Value of Characteristic across Temperature Range.

NGD18N40CLBT4

ELECTRICAL CHARACTERISTICS (continued)

| Characteristic | Symbol | Test Conditions | Temperature | Min | Typ | Max | Unit |
|---|--------------------------|---|--|------|------|------|----------------------------|
| ON CHARACTERISTICS (Note 2) | | | | | | | |
| 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 | - | $\text{mV}/^\circ\text{C}$ |
| 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°C | 8.0 | 14 | 25 | Mhos |

DYNAMIC CHARACTERISTICS

| | | | | | | | |
|----------------------|-----------|---|--|-----|-----|------|----|
| Input Capacitance | C_{ISS} | $V_{CC} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$ $f = 1.0 \text{ MHz}$ | $T_J = -40^\circ\text{C}$ 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

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

NGD18N40CLBT4

TYPICAL ELECTRICAL CHARACTERISTICS (unless otherwise noted)

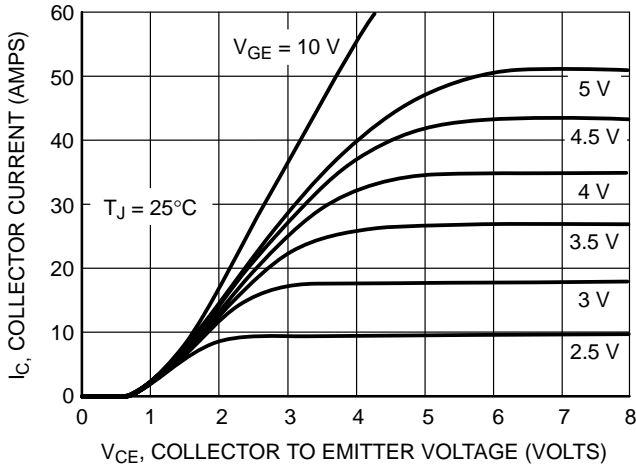


Figure 1. Output Characteristics

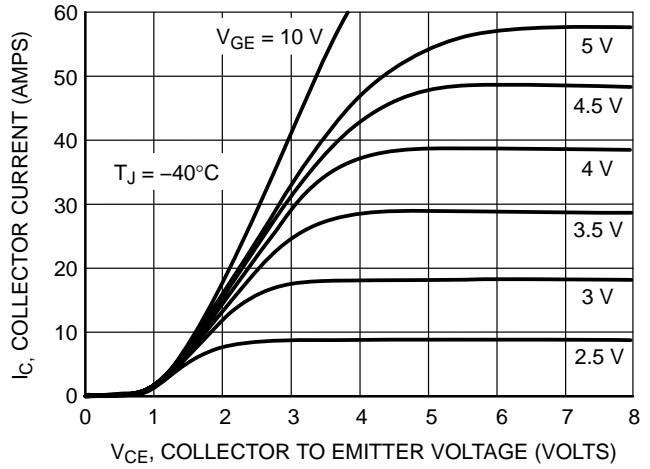


Figure 2. Output Characteristics

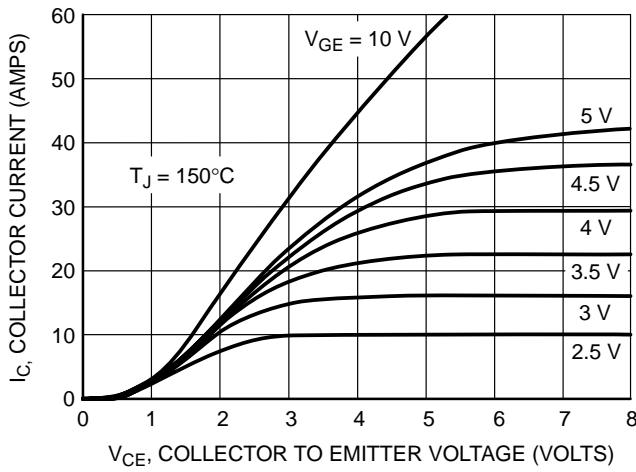


Figure 3. Output Characteristics

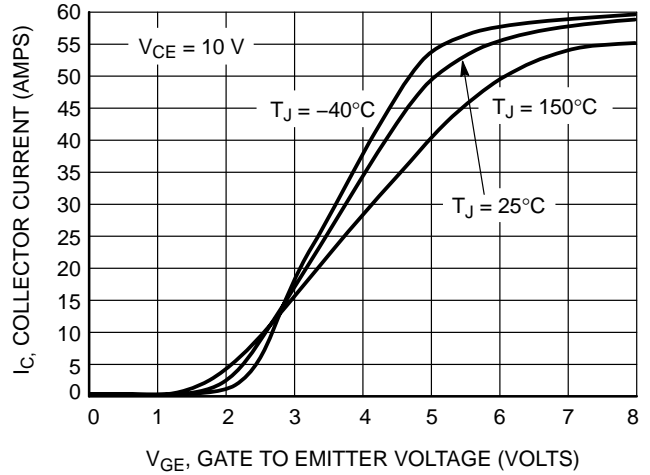


Figure 4. Transfer Characteristics

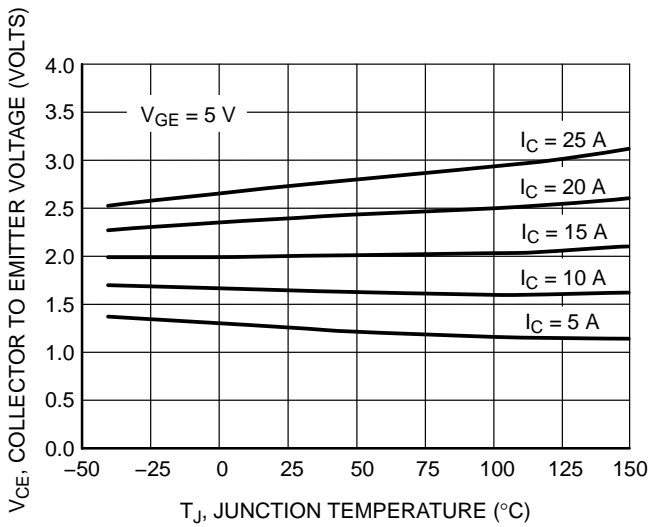


Figure 5. Collector-to-Emitter Saturation Voltage versus Junction Temperature

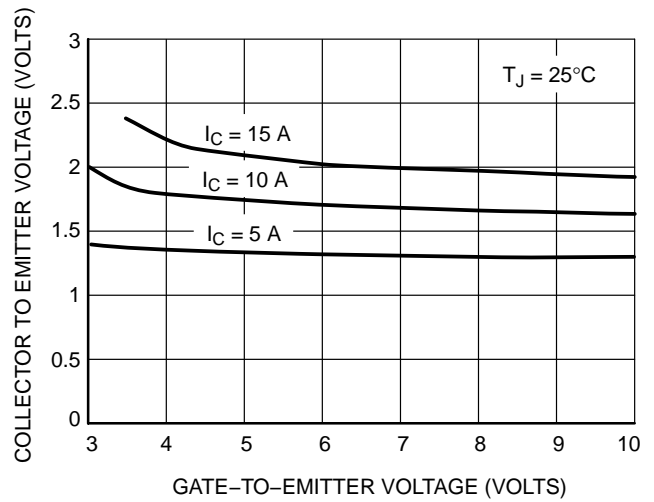


Figure 6. Collector-to-Emitter Voltage versus Gate-to-Emitter Voltage

NGD18N40CLBT4

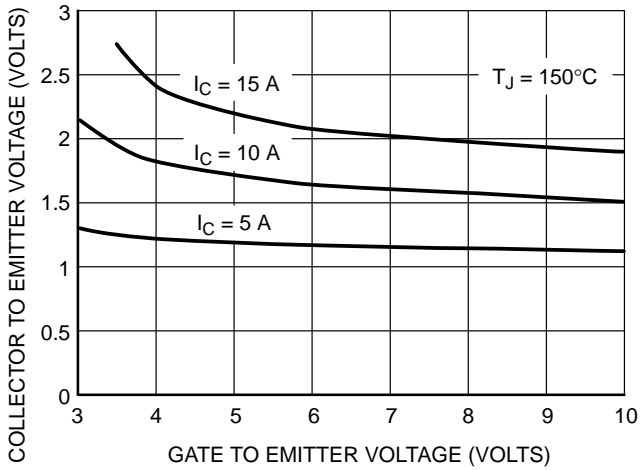


Figure 7. Collector-to-Emitter Voltage versus Gate-to-Emitter Voltage

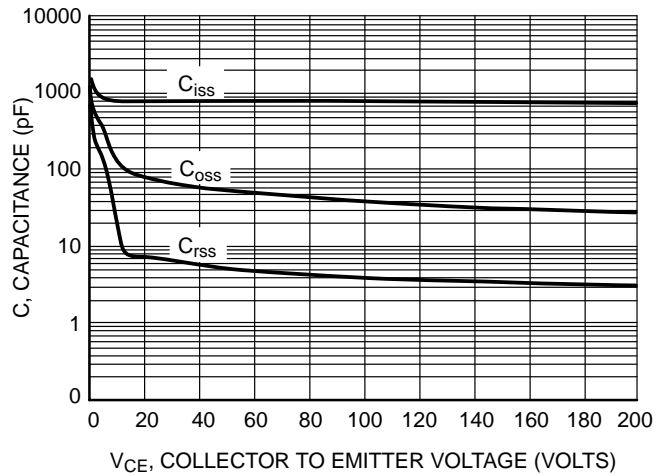


Figure 8. Capacitance Variation

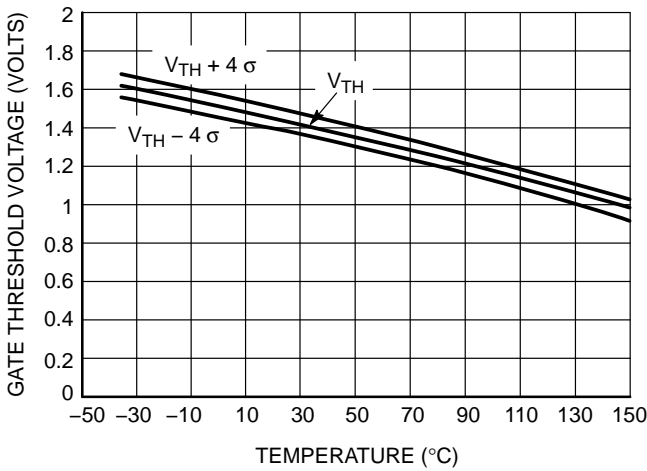


Figure 9. Gate Threshold Voltage versus Temperature

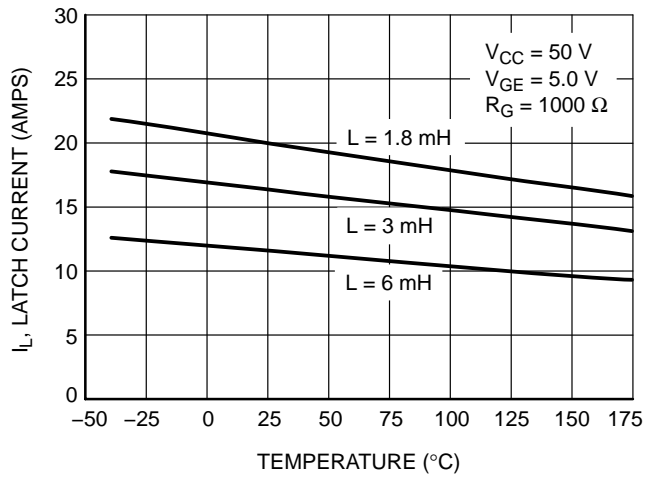


Figure 10. Minimum Open Secondary Latch Current versus Temperature

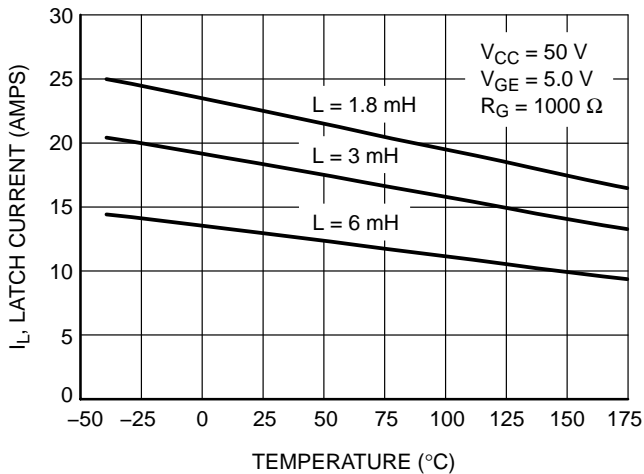


Figure 11. Typical Open Secondary Latch Current versus Temperature

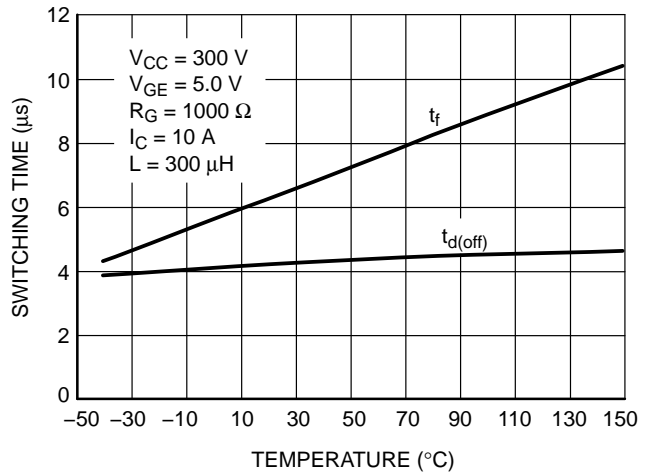


Figure 12. Inductive Switching Fall Time versus Temperature

NGD18N40CLBT4

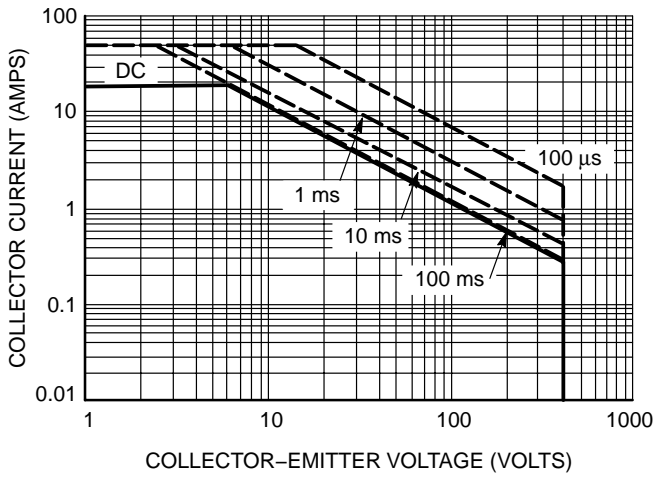


Figure 13. Single Pulse Safe Operating Area (Mounted on an Infinite Heatsink at $T_A = 25^\circ\text{C}$)

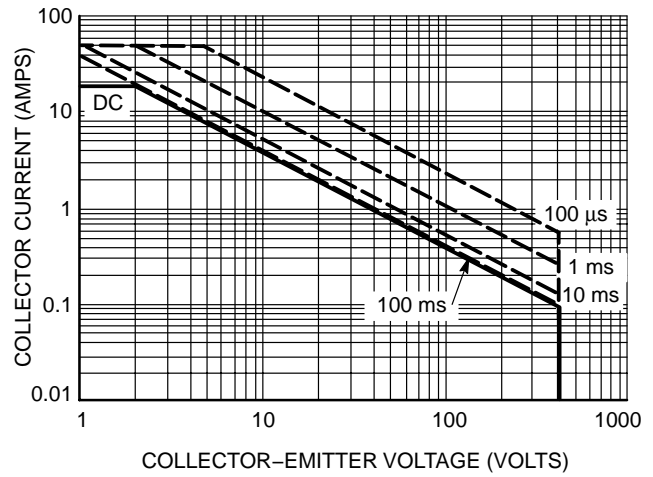


Figure 14. Single Pulse Safe Operating Area (Mounted on an Infinite Heatsink at $T_A = 125^\circ\text{C}$)

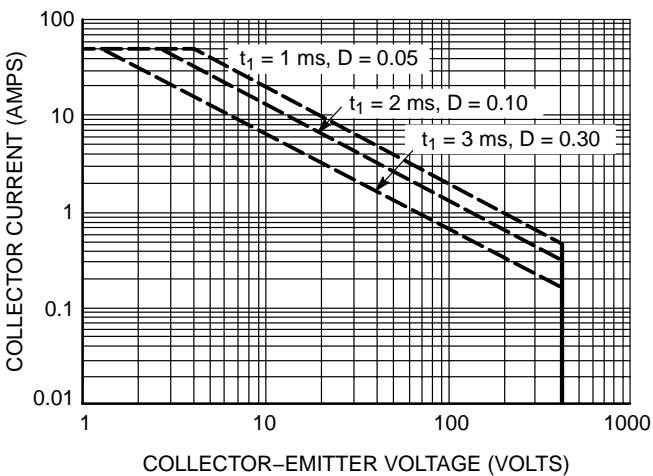


Figure 15. Pulse Train Safe Operating Area (Mounted on an Infinite Heatsink at $T_C = 25^\circ\text{C}$)

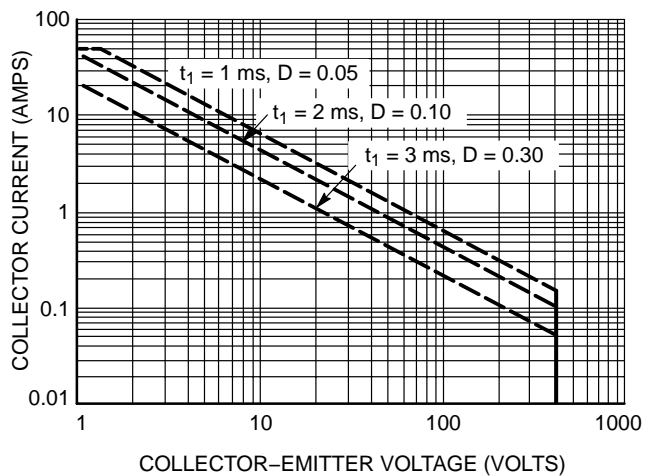


Figure 16. Pulse Train Safe Operating Area (Mounted on an Infinite Heatsink at $T_C = 125^\circ\text{C}$)

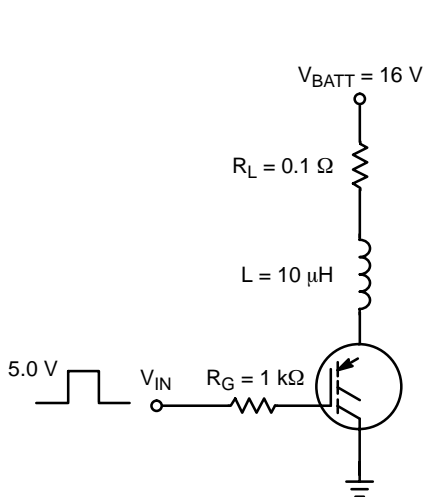


Figure 17. Circuit Configuration for Short Circuit Test #1

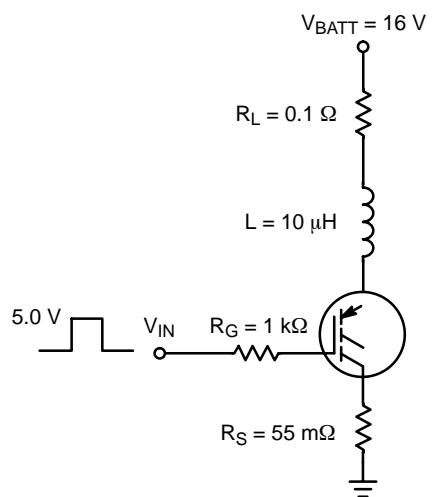
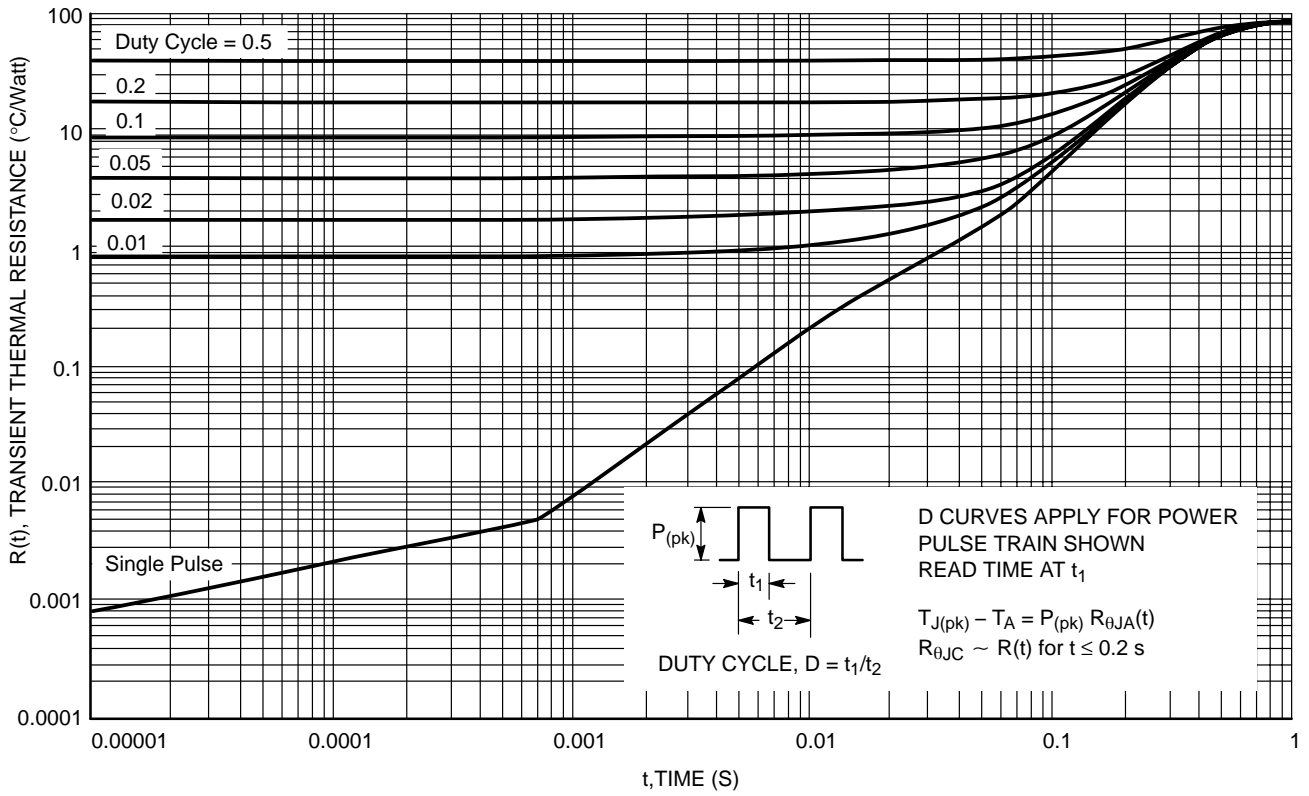


Figure 18. Circuit Configuration for Short Circuit Test #2

NGD18N40CLBT4

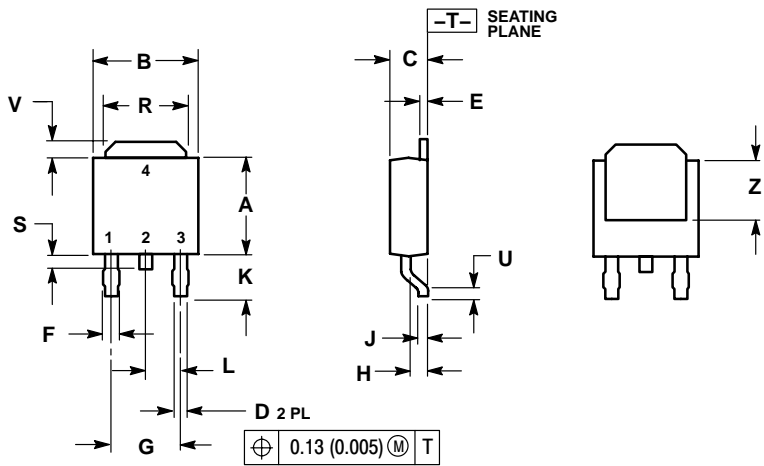


**Figure 19. Transient Thermal Resistance
(Non-normalized Junction-to-Ambient mounted on
minimum pad area)**

NGD18N40CLBT4

PACKAGE DIMENSIONS

DPAK
CASE 369C-01
ISSUE O



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.245 | 5.97 | 6.22 |
| B | 0.250 | 0.265 | 6.35 | 6.73 |
| C | 0.086 | 0.094 | 2.19 | 2.38 |
| D | 0.027 | 0.035 | 0.69 | 0.88 |
| E | 0.018 | 0.023 | 0.46 | 0.58 |
| F | 0.037 | 0.045 | 0.94 | 1.14 |
| G | 0.180 BSC | | 4.58 BSC | |
| H | 0.034 | 0.040 | 0.87 | 1.01 |
| J | 0.018 | 0.023 | 0.46 | 0.58 |
| K | 0.102 | 0.114 | 2.60 | 2.89 |
| L | 0.090 BSC | | 2.29 BSC | |
| R | 0.180 | 0.215 | 4.57 | 5.45 |
| S | 0.025 | 0.040 | 0.63 | 1.01 |
| U | 0.020 | --- | 0.51 | --- |
| V | 0.035 | 0.050 | 0.89 | 1.27 |
| Z | 0.155 | --- | 3.93 | --- |

- STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051
Phone: 81-3-5773-3850

ON Semiconductor Website: <http://onsemi.com>

Order Literature: <http://www.onsemi.com/litorder>

For additional information, please contact your local Sales Representative.

NGD18N40CLB/D