

# NGTB50N60SWG

## IGBT

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective Field Stop (FS) Trench construction, and provides superior performance in demanding switching applications, offering both low on state voltage and minimal switching loss. The IGBT is well suited for half bridge resonant applications. Incorporated into the device is a soft and fast co-packaged free wheeling diode with a low forward voltage.

### Features

- Low Saturation Voltage using Trench with Fieldstop Technology
- Low Switching Loss Reduces System Power Dissipation
- Low Gate Charge
- Soft, Fast Free Wheeling Diode
- This is a Pb-Free Device

### Typical Applications

- Inductive Heating
- Soft Switching

### ABSOLUTE MAXIMUM RATINGS

| Rating   | Symbol    | Value       | Unit             |
|--|-----------|-------------|------------------|
| Collector-emitter voltage  | $V_{CES}$ | 600         | V                |
| Collector current<br>@ $T_c = 25^\circ\text{C}$<br>@ $T_c = 100^\circ\text{C}$     | $I_c$     | 100<br>50   | A                |
| Pulsed collector current, $T_{pulse}$<br>limited by $T_{Jmax}$                     | $I_{CM}$  | 200         | A                |
| Diode forward current<br>@ $T_c = 25^\circ\text{C}$<br>@ $T_c = 100^\circ\text{C}$ | $I_F$     | 100<br>50   | A                |
| Diode pulsed current, $T_{pulse}$ limited<br>by $T_{Jmax}$                         | $I_{FM}$  | 200         | A                |
| Gate-emitter voltage   | $V_{GE}$  | $\pm 20$    | V                |
| Power Dissipation<br>@ $T_c = 25^\circ\text{C}$<br>@ $T_c = 100^\circ\text{C}$     | $P_D$     |             | W                |
| Operating junction temperature<br>range  | $T_J$     | -55 to +150 | $^\circ\text{C}$ |
| Storage temperature range  | $T_{stg}$ | -55 to +150 | $^\circ\text{C}$ |
| Lead temperature for soldering, 1/8"<br>from case for 5 seconds                    | $T_{SLD}$ | 260         | $^\circ\text{C}$ |

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.



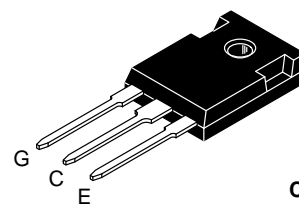
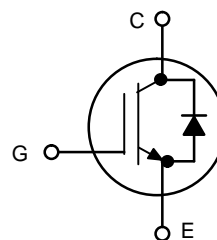
**ON Semiconductor®**

<http://onsemi.com>

**50 A, 600 V**

**$V_{CEsat} = 2.4 \text{ V}$**

**$E_{off} = 0.60 \text{ mJ}$**



**TO-247  
CASE 340L  
STYLE 4**

### MARKING DIAGRAM



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

### ORDERING INFORMATION

| Device       | Package             | Shipping        |
|--------------|---------------------|-----------------|
| NGTB50N60SWG | TO-247<br>(Pb-Free) | 30 Units / Rail |

# NGTB50N60SWG

## THERMAL CHARACTERISTICS

| Rating   | Symbol          | Value | Unit |
|--|-----------------|-------|------|
| Thermal resistance junction-to-case, for IGBT  | $R_{\theta JC}$ | 0.87  | °C/W |
| Thermal resistance junction-to-case, for Diode | $R_{\theta JC}$ | 1.46  | °C/W |
| Thermal resistance junction-to-ambient         | $R_{\theta JA}$ | 40    | °C/W |

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|-----------|-----------------|--------|-----|-----|-----|------|
|-----------|-----------------|--------|-----|-----|-----|------|

### STATIC CHARACTERISTIC

|   |   |               |     |            |          |    |
|---|---|---------------|-----|------------|----------|----|
| Collector-emitter breakdown voltage, gate-emitter short-circuited | $V_{GE} = 0\text{ V}, I_C = 500\ \mu\text{A}$   | $V_{(BR)CES}$ | 600 | –          | –        | V  |
| Collector-emitter saturation voltage                              | $V_{GE} = 15\text{ V}, I_C = 50\text{ A}$<br>$V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 150^\circ\text{C}$       | $V_{CEsat}$   | –   | 2.4<br>2.6 | 2.6<br>– | V  |
| Gate-emitter threshold voltage                                    | $V_{GE} = V_{CE}, I_C = 150\ \mu\text{A}$   | $V_{GE(th)}$  | 4.5 | 5.5        | 6.5      | V  |
| Collector-emitter cut-off current, gate-emitter short-circuited   | $V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$<br>$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 150^\circ\text{C}$ | $I_{CES}$     | –   | –          | 0.2<br>2 | mA |
| Gate leakage current, collector-emitter short-circuited           | $V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$   | $I_{GES}$     | –   | –          | 100      | nA |

### DYNAMIC CHARACTERISTIC

|                              |  |           |   |      |   |    |
|------------------------------|--|-----------|---|------|---|----|
| Input capacitance            | $V_{CE} = 20\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$    | $C_{ies}$ | – | 3100 | – | pF |
| Output capacitance           |  | $C_{oes}$ | – | 120  | – |    |
| Reverse transfer capacitance |  | $C_{res}$ | – | 80   | – |    |
| Gate charge total            | $V_{CE} = 480\text{ V}, I_C = 50\text{ A}, V_{GE} = 15\text{ V}$ | $Q_g$     |   | 135  |   | nC |
| Gate to emitter charge       |  | $Q_{ge}$  |   | 27   |   |    |
| Gate to collector charge     |  | $Q_{gc}$  |   | 67   |   |    |

### SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

|                         |  |              |  |      |  |    |
|-------------------------|--|--------------|--|------|--|----|
| Turn-on delay time      | $T_J = 25^\circ\text{C}$<br>$V_{CC} = 400\text{ V}, I_C = 50\text{ A}$<br>$R_g = 10\ \Omega$<br>$V_{GE} = 0\text{ V}/15\text{ V}$  | $t_{d(on)}$  |  | 70   |  | ns |
| Rise time               |  | $t_r$        |  | 32   |  |    |
| Turn-off delay time     |  | $t_{d(off)}$ |  | 144  |  |    |
| Fall time               |  | $t_f$        |  | 66   |  |    |
| Turn-off switching loss |  | $E_{off}$    |  | 0.60 |  |    |
| Turn-on delay time      | $T_J = 150^\circ\text{C}$<br>$V_{CC} = 400\text{ V}, I_C = 50\text{ A}$<br>$R_g = 10\ \Omega$<br>$V_{GE} = 0\text{ V}/15\text{ V}$ | $t_{d(on)}$  |  | 70   |  | ns |
| Rise time               |  | $t_r$        |  | 36   |  |    |
| Turn-off delay time     |  | $t_{d(off)}$ |  | 150  |  |    |
| Fall time               |  | $t_f$        |  | 85   |  |    |
| Turn-off switching loss |  | $E_{off}$    |  | 1.11 |  |    |

### DIODE CHARACTERISTIC

|                          |   |           |  |             |     |    |
|--------------------------|---|-----------|--|-------------|-----|----|
| Forward voltage          | $V_{GE} = 0\text{ V}, I_F = 25\text{ A}$<br>$V_{GE} = 0\text{ V}, I_F = 25\text{ A}, T_J = 150^\circ\text{C}$ | $V_F$     |  | 1.2<br>1.11 | 1.5 | V  |
| Reverse recovery time    | $T_J = 25^\circ\text{C}$<br>$I_F = 25\text{ A}, V_R = 200\text{ V}$<br>$di_F/dt = 200\text{ A}/\mu\text{s}$   | $t_{rr}$  |  | 376         |     | ns |
| Reverse recovery charge  |   | $Q_{rr}$  |  | 4145        |     | nc |
| Reverse recovery current |   | $I_{rrm}$ |  | 22          |     | A  |

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.

# NGTB50N60SWG

## TYPICAL CHARACTERISTICS

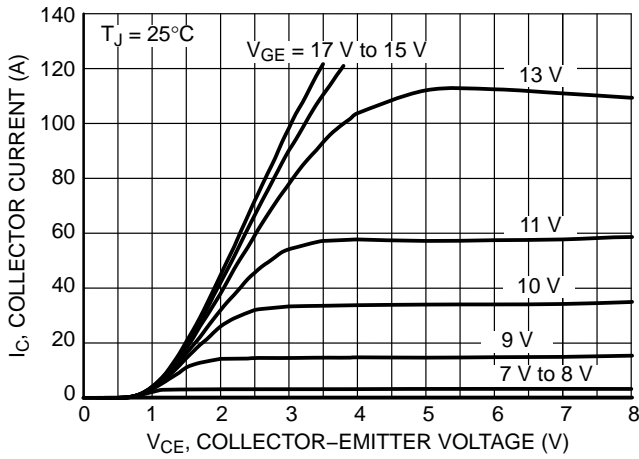


Figure 1. Output Characteristics

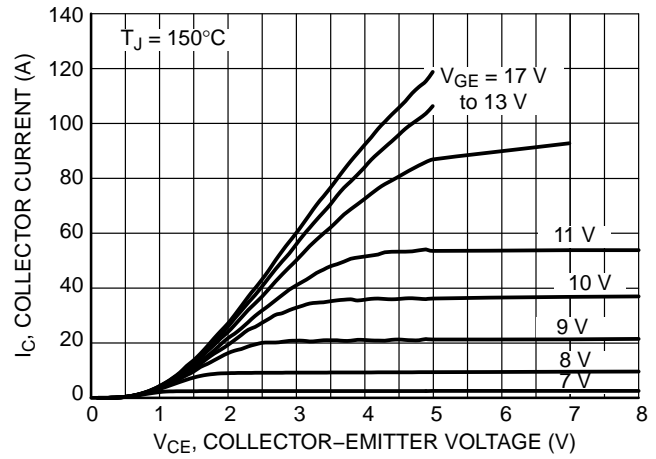


Figure 2. Output Characteristics

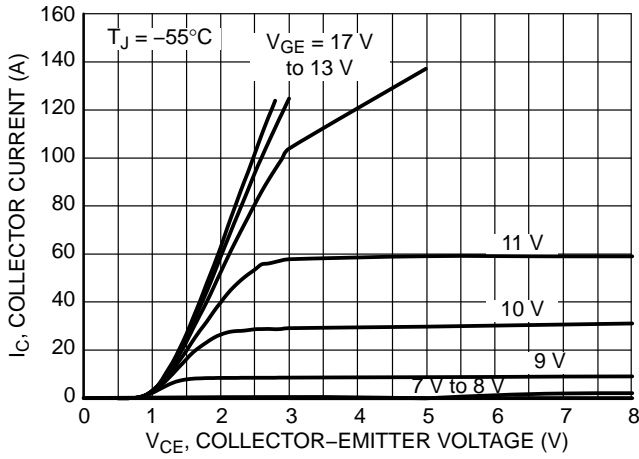


Figure 3. Output Characteristics

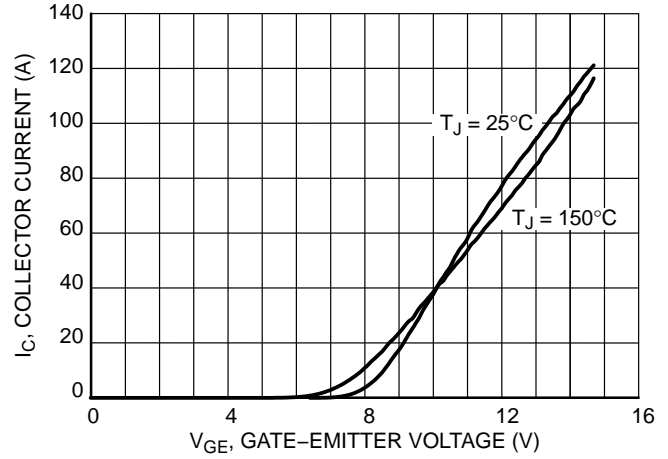


Figure 4. Typical Transfer Characteristics

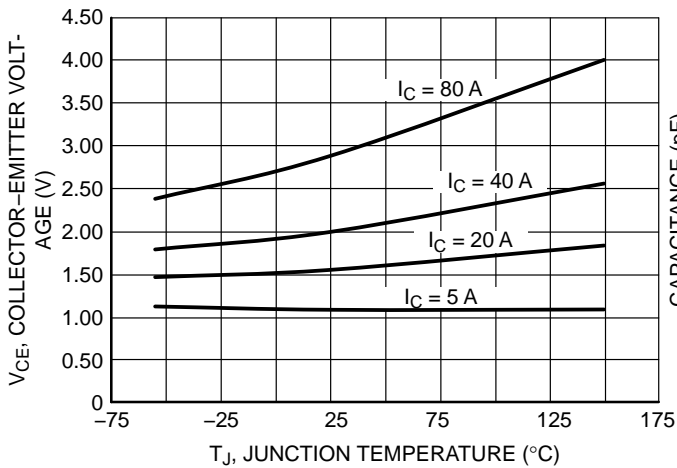


Figure 5.  $V_{CE(sat)}$  vs.  $T_J$

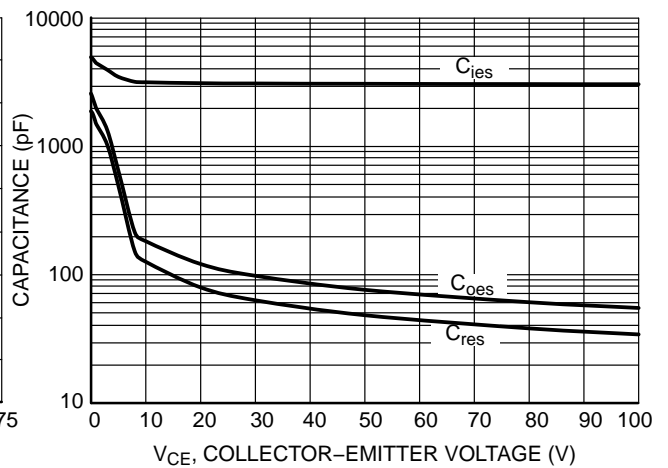


Figure 6. Typical Capacitance

# NGTB50N60SWG

## TYPICAL CHARACTERISTICS

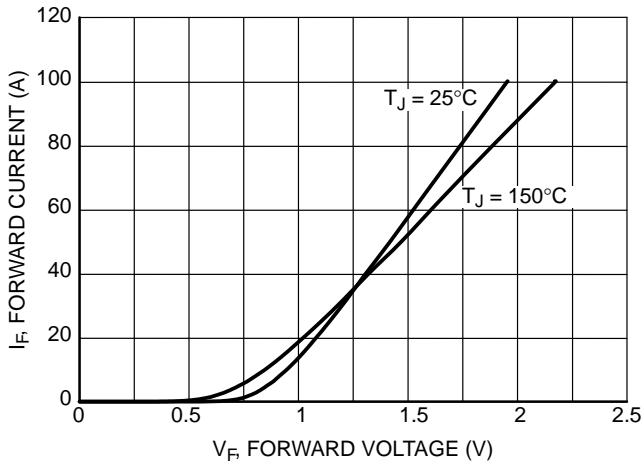


Figure 7. Diode Forward Characteristics

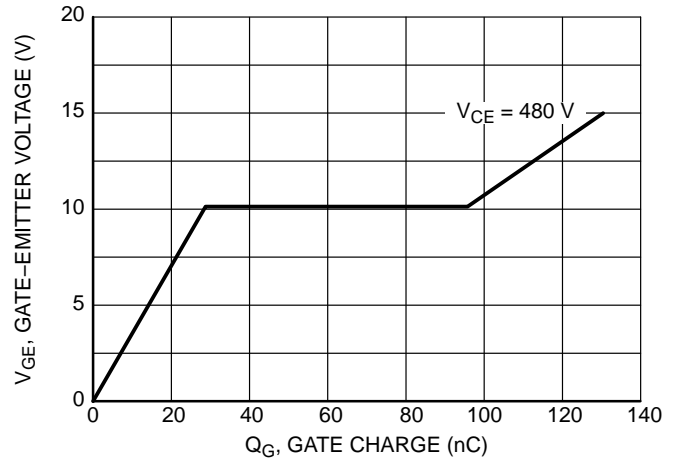


Figure 8. Typical Gate Charge

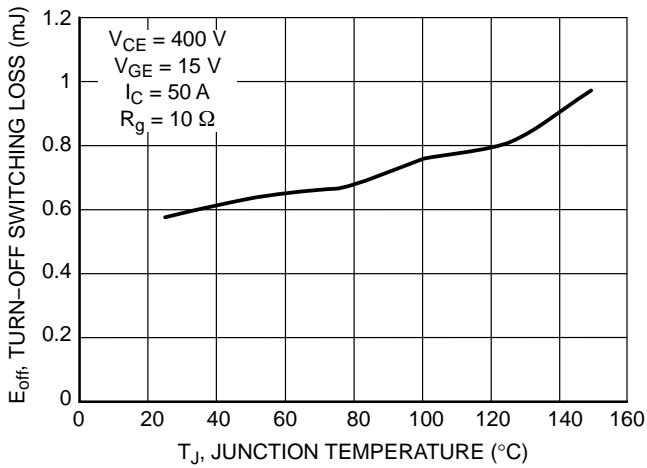


Figure 9. Switching Loss vs. Temperature

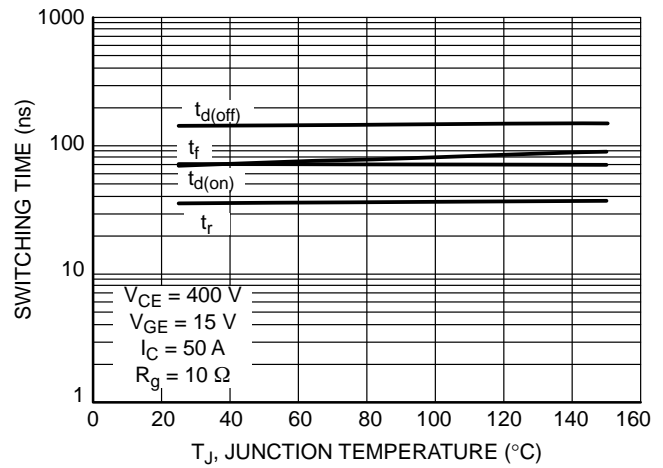


Figure 10. Switching Time vs. Temperature

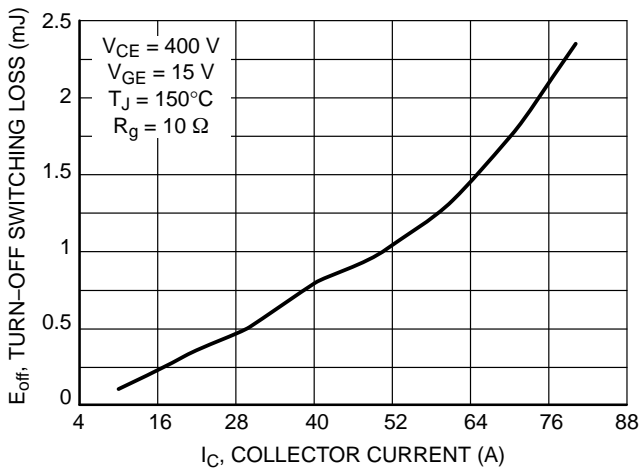


Figure 11. Switching Loss vs.  $I_C$

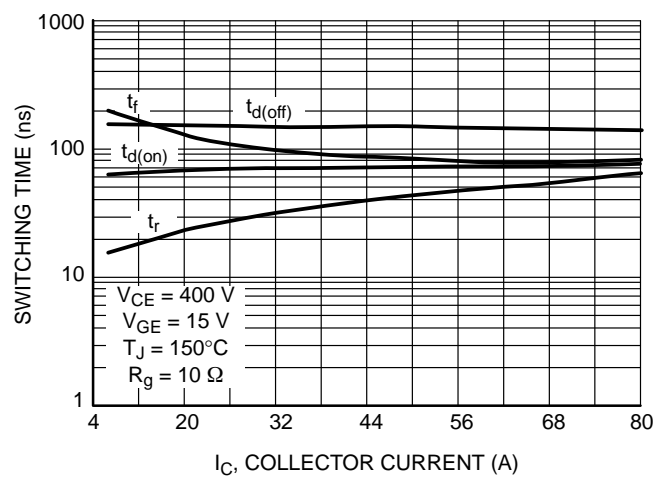


Figure 12. Switching Time vs. Current

# NGTB50N60SWG

## TYPICAL CHARACTERISTICS

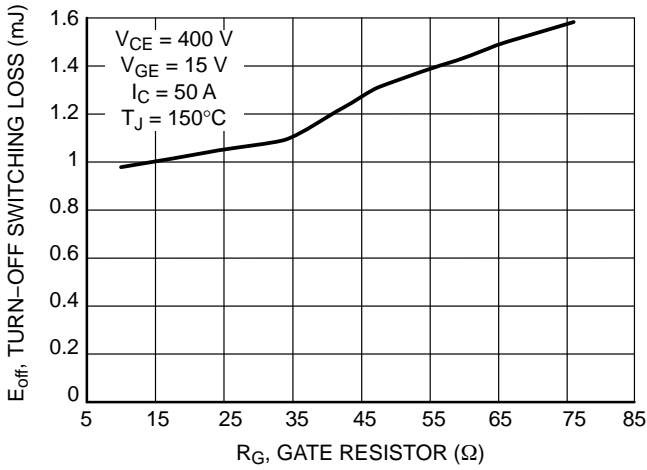


Figure 13. Switching Loss vs.  $R_G$

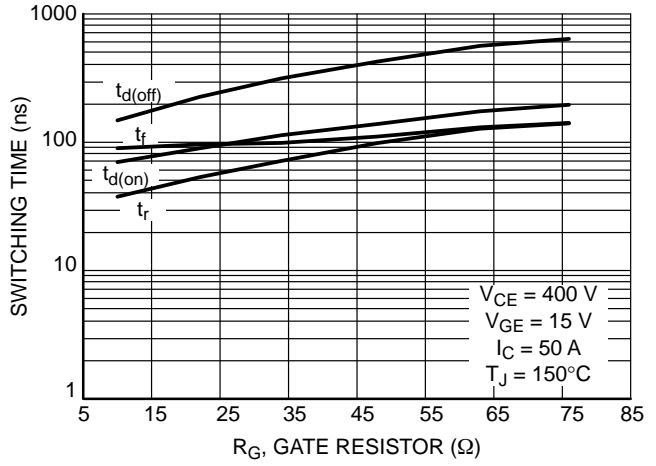


Figure 14. Switching Time vs.  $R_G$

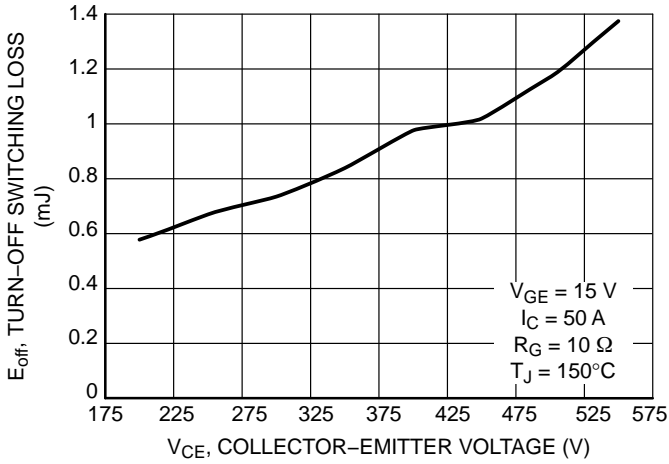


Figure 15. Switching Loss vs.  $V_{CE}$

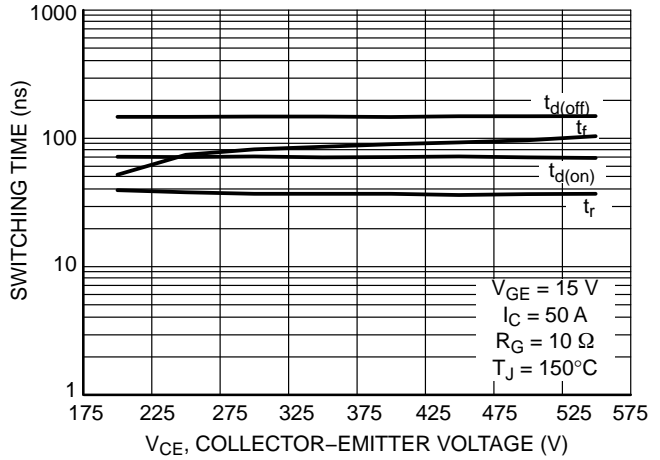


Figure 16. Switching Time vs.  $V_{CE}$

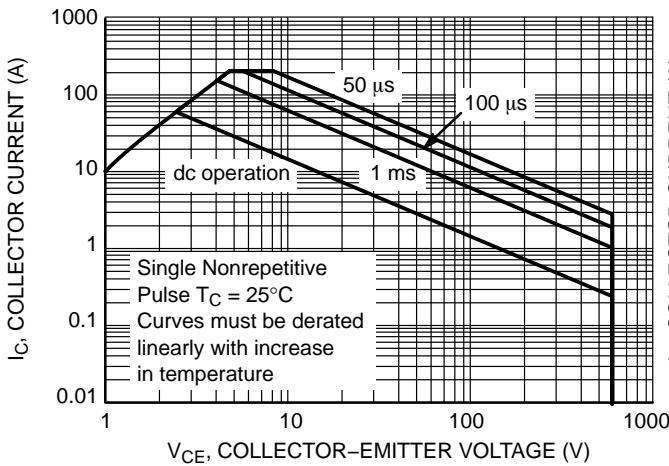


Figure 17. Safe Operating Area

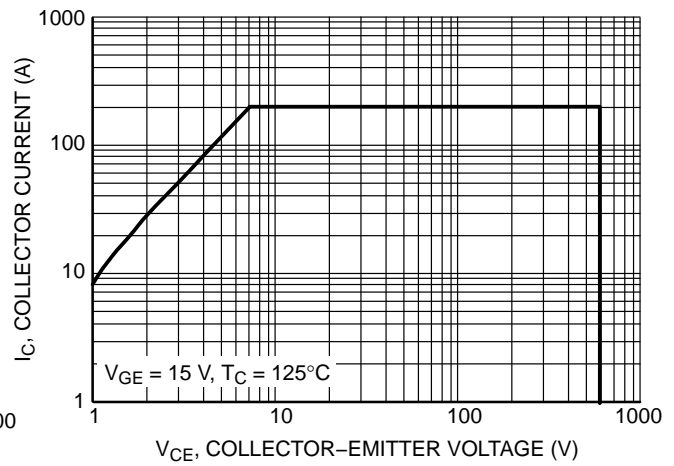


Figure 18. Reverse Bias Safe Operating Area

# NGTB50N60SWG

## TYPICAL CHARACTERISTICS

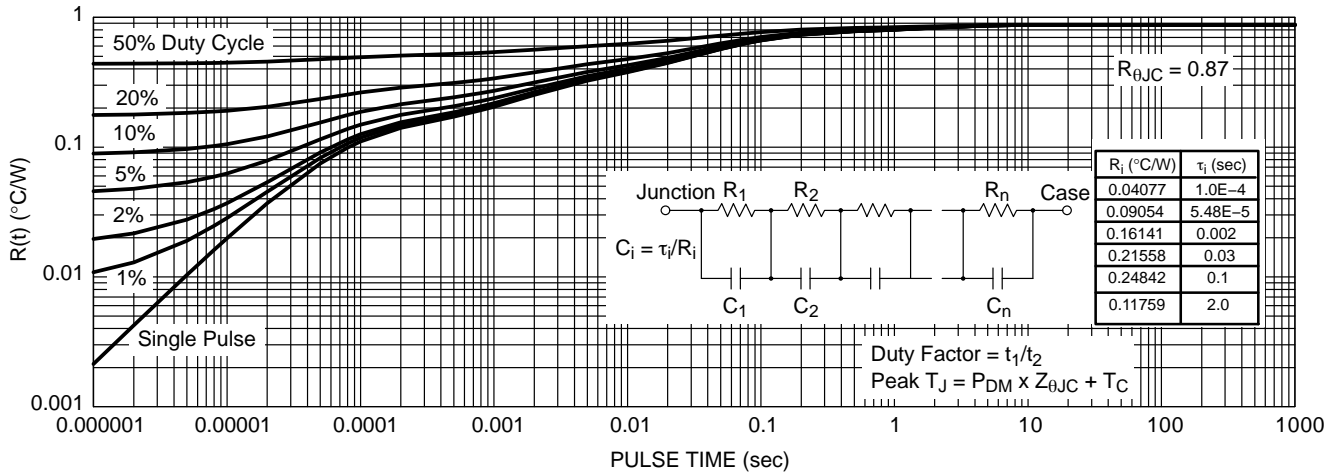


Figure 19. IGBT Transient Thermal Impedance

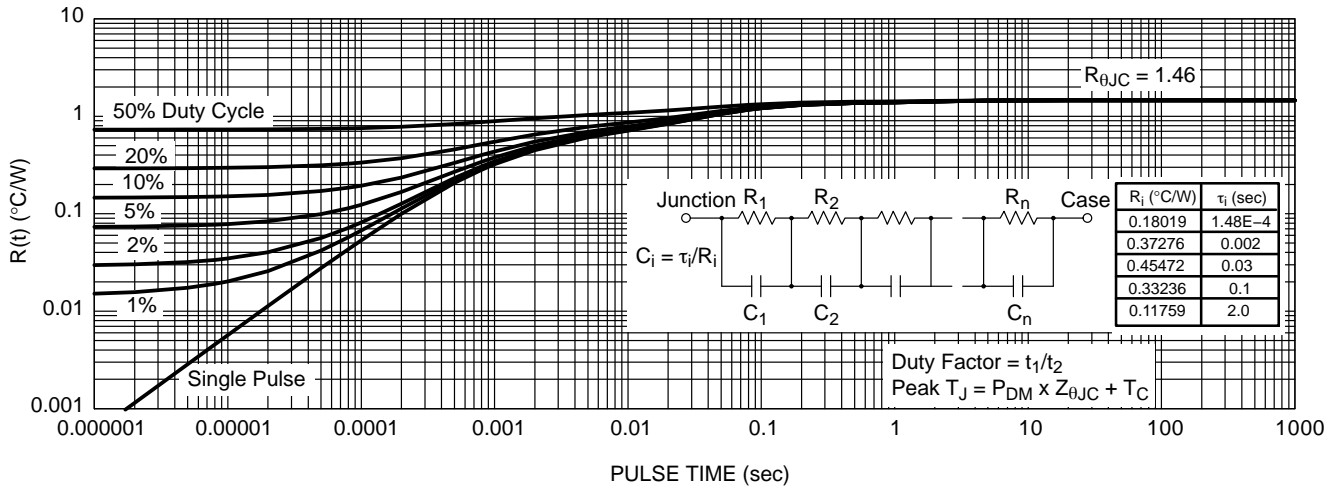


Figure 20. Diode Transient Thermal Impedance

# NGTB50N60SWG

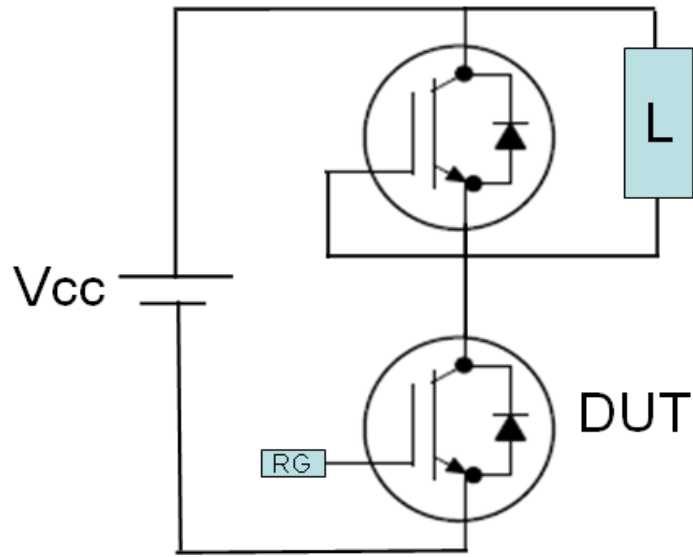


Figure 21. Test Circuit for Switching Characteristics

# NGTB50N60SWG



Figure 22. Definition of Turn On Waveform



# NGTB50N60SWG

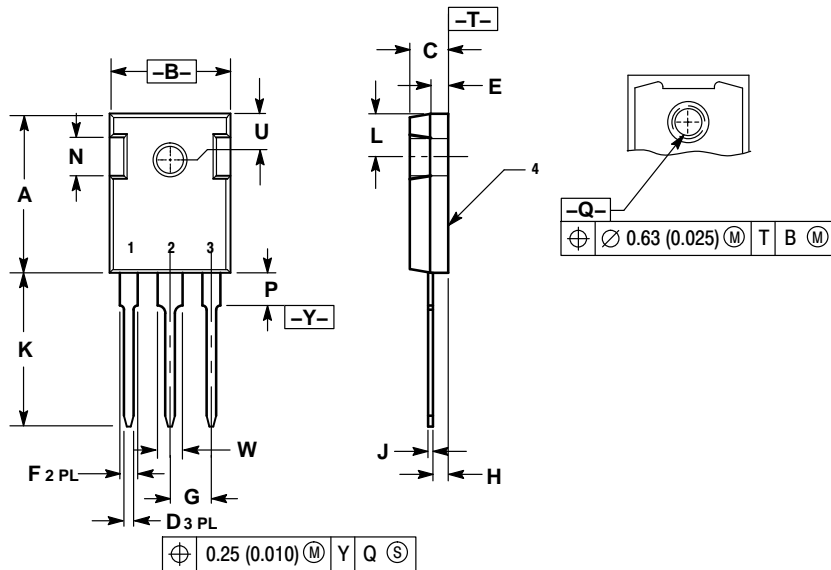


Figure 23. Definition of Turn Off Waveform

# NGTB50N60SWG

## PACKAGE DIMENSIONS

TO-247  
CASE 340L-02  
ISSUE F



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

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 20.32       | 21.08 | 0.800     | 8.30  |
| B   | 15.75       | 16.26 | 0.620     | 0.640 |
| C   | 4.70        | 5.30  | 0.185     | 0.209 |
| D   | 1.00        | 1.40  | 0.040     | 0.055 |
| E   | 1.90        | 2.60  | 0.075     | 0.102 |
| F   | 1.65        | 2.13  | 0.065     | 0.084 |
| G   | 5.45 BSC    |       | 0.215 BSC |       |
| H   | 1.50        | 2.49  | 0.059     | 0.098 |
| J   | 0.40        | 0.80  | 0.016     | 0.031 |
| K   | 19.81       | 20.83 | 0.780     | 0.820 |
| L   | 5.40        | 6.20  | 0.212     | 0.244 |
| N   | 4.32        | 5.49  | 0.170     | 0.216 |
| P   | ---         | 4.50  | ---       | 0.177 |
| Q   | 3.55        | 3.65  | 0.140     | 0.144 |
| U   | 6.15 BSC    |       | 0.242 BSC |       |
| W   | 2.87        | 3.12  | 0.113     | 0.123 |

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

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). 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](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкуренспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



Тел: +7 (812) 336 43 04 (многоканальный)  
Email: [org@lifeelectronics.ru](mailto:org@lifeelectronics.ru)