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NGTB50N60S1WG

IGBT - Inverter Welding

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective 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 welding applications. Incorporated into the device is a soft and fast co-packaged free wheeling diode with a low forward voltage.

Features

- $T_{Jmax} = 175^{\circ}C$
- Soft Fast Reverse Recovery Diode
- Optimized for High Speed Switching
- 5 μs Short-Circuit Capability
- This is a Pb-Free Device

Typical Applications

- Welding

ABSOLUTE MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|--|-----------|-------------|-------------|
| Collector-emitter voltage | V_{CES} | 600 | V |
| Collector current @ $T_C = 25^{\circ}C$ @ $T_C = 100^{\circ}C$ | I_C | 100 50 | A |
| Diode Forward Current @ $T_C = 25^{\circ}C$ @ $T_C = 100^{\circ}C$ | I_F | 100 50 | A |
| Diode Pulsed Current T_{PULSE} Limited by T_{Jmax} | I_{FM} | 200 | A |
| Pulsed collector current, T_{pulse} limited by T_{Jmax} | I_{CM} | 200 | A |
| Short-circuit withstand time $V_{GE} = 15 V$, $V_{CE} = 400 V$, $T_J \leq +150^{\circ}C$ | t_{SC} | 5 | μs |
| Gate-emitter voltage | V_{GE} | ± 20 | V |
| Transient gate-emitter voltage ($T_{PULSE} = 5 \mu s$, $D < 0.10$) | | ± 30 | V |
| Power Dissipation @ $T_C = 25^{\circ}C$ @ $T_C = 100^{\circ}C$ | P_D | 417 208 | W |
| Operating junction temperature range | T_J | -55 to +175 | $^{\circ}C$ |
| Storage temperature range | T_{stg} | -55 to +175 | $^{\circ}C$ |
| Lead temperature for soldering, 1/8" from case for 5 seconds | T_{SLD} | 260 | $^{\circ}C$ |

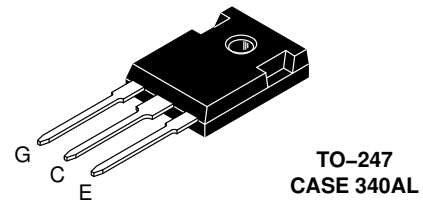
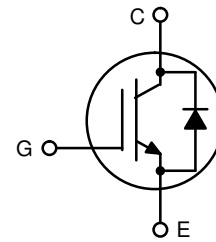
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



ON Semiconductor®

www.onsemi.com

50 A, 600 V
 $V_{CEsat} = 1.80 V$
 $E_{OFF} = 0.46 mJ$



MARKING DIAGRAM



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

ORDERING INFORMATION

| Device | Package | Shipping |
|---------------|---------------------|-----------------|
| NGTB50N60S1WG | TO-247 (Pb-Free) | 30 Units / Rail |

NGTB50N60S1WG

THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|--|-----------------|-------|-----------------------------|
| Thermal resistance junction-to-case, for IGBT | $R_{\theta JC}$ | 0.36 | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance junction-to-case, for Diode | $R_{\theta JC}$ | 0.60 | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance junction-to-ambient | $R_{\theta JA}$ | 40 | $^{\circ}\text{C}/\text{W}$ |

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 | $V_{GE} = 15\text{ V}, I_C = 50\text{ A}$ $V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 175^{\circ}\text{C}$ | V_{CEsat} | 1.50 – | 1.80 2.19 | 2.00 – | V |
| Gate-emitter threshold voltage | $V_{GE} = V_{CE}, I_C = 350\ \mu\text{A}$ | $V_{GE(th)}$ | 4.5 | 5.5 | 6.5 | V |
| Collector-emitter cut-off current, gate-emitter short-circuited | $V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$ $V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 150^{\circ}\text{C}$ | I_{CES} | – – | – – | 0.5 4.0 | mA |
| Gate leakage current, collector-emitter short-circuited | $V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$ | I_{GES} | – | – | 200 | nA |

DYNAMIC CHARACTERISTIC

| | | | | | | |
|------------------------------|--|-----------|---|------|---|----|
| Input capacitance | $V_{CE} = 20\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$ | C_{ies} | – | 5328 | – | pF |
| Output capacitance | | C_{oes} | – | 252 | – | |
| Reverse transfer capacitance | | C_{res} | – | 148 | – | |
| Gate charge total | $V_{CE} = 480\text{ V}, I_C = 50\text{ A}, V_{GE} = 15\text{ V}$ | Q_g | – | 220 | – | nC |
| Gate to emitter charge | | Q_{ge} | – | 52 | – | |
| Gate to collector charge | | Q_{gc} | – | 116 | – | |

SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

| | | | | | | | |
|-------------------------|--|--------------|----------|------|------|----|----|
| Turn-on delay time | $T_J = 25^{\circ}\text{C}$ $V_{CC} = 400\text{ V}, I_C = 50\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$ | $t_{d(on)}$ | – | 100 | – | ns | |
| Rise time | | t_r | – | 47 | – | | |
| Turn-off delay time | | $t_{d(off)}$ | – | 237 | – | | |
| Fall time | | | t_f | – | 67 | – | mJ |
| Turn-on switching loss | | E_{on} | – | 1.50 | – | | |
| Turn-off switching loss | | E_{off} | – | 0.46 | – | | |
| Total switching loss | | | E_{ts} | – | 1.96 | – | |
| Turn-on delay time | $T_J = 150^{\circ}\text{C}$ $V_{CC} = 400\text{ V}, I_C = 50\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$ | $t_{d(on)}$ | – | 90 | – | ns | |
| Rise time | | t_r | – | 49 | – | | |
| Turn-off delay time | | $t_{d(off)}$ | – | 245 | – | | |
| Fall time | | | t_f | – | 96 | – | mJ |
| Turn-on switching loss | | E_{on} | – | 1.90 | – | | |
| Turn-off switching loss | | E_{off} | – | 0.83 | – | | |
| Total switching loss | | | E_{ts} | – | 2.73 | – | |

DIODE CHARACTERISTIC

| | | | | | | |
|--------------------------|---|-----------|--------|--------------|-----------|---------------|
| Forward voltage | $V_{GE} = 0\text{ V}, I_F = 50\text{ A}$ $V_{GE} = 0\text{ V}, I_F = 50\text{ A}, T_J = 175^{\circ}\text{C}$ | V_F | – – | 2.10 2.20 | 2.90 – | V |
| Reverse recovery time | $T_J = 25^{\circ}\text{C}$ $I_F = 50\text{ A}, V_R = 400\text{ V}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ | t_{rr} | – | 94 | – | ns |
| Reverse recovery charge | | Q_{rr} | – | 0.45 | – | μC |
| Reverse recovery current | | I_{rrm} | – | 8 | – | 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.

NGTB50N60S1WG

TYPICAL CHARACTERISTICS

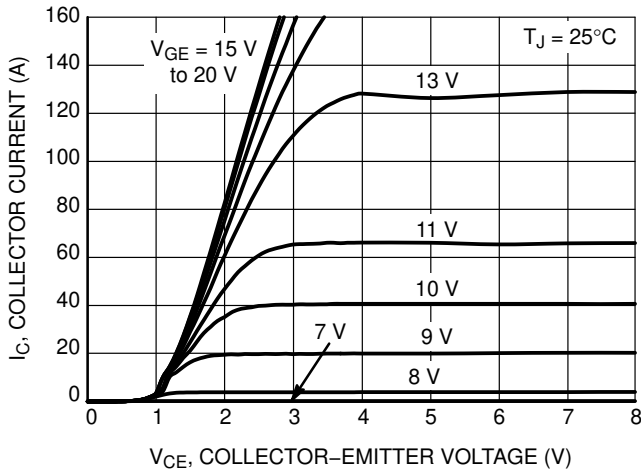


Figure 1. Output Characteristics

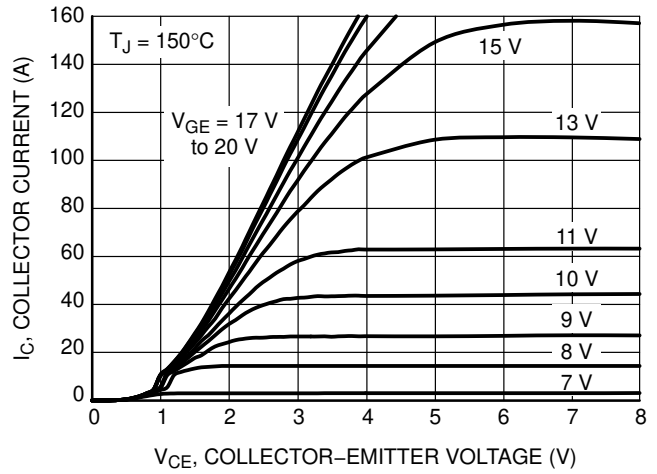


Figure 2. Output Characteristics

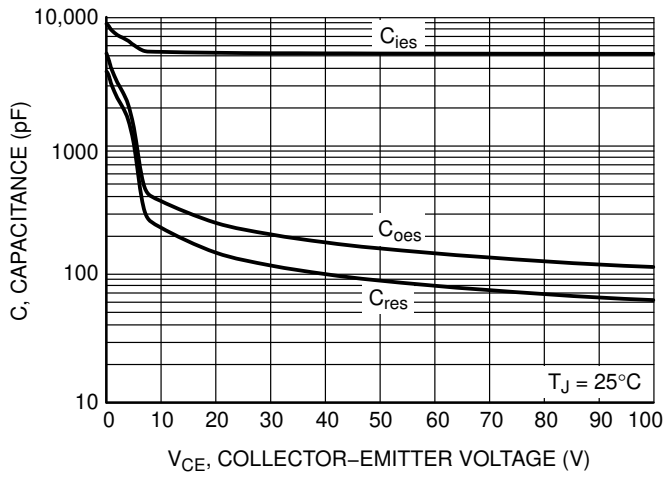


Figure 3. Typical Capacitance

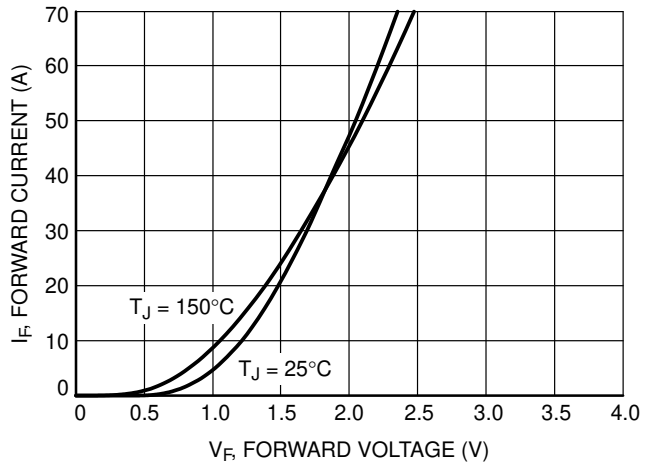


Figure 4. Diode Forward Characteristics

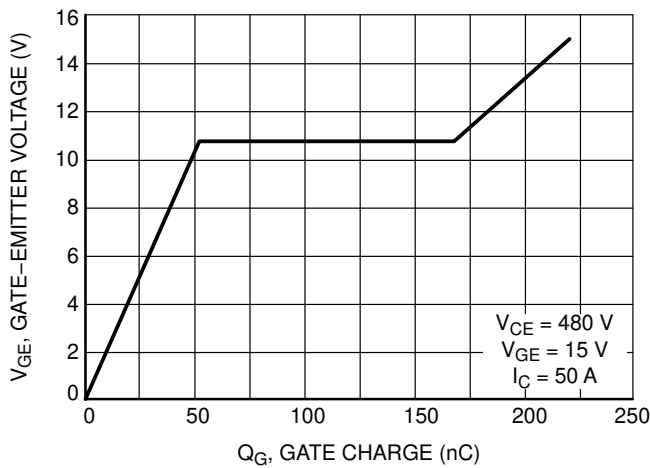


Figure 5. Typical Gate Charge

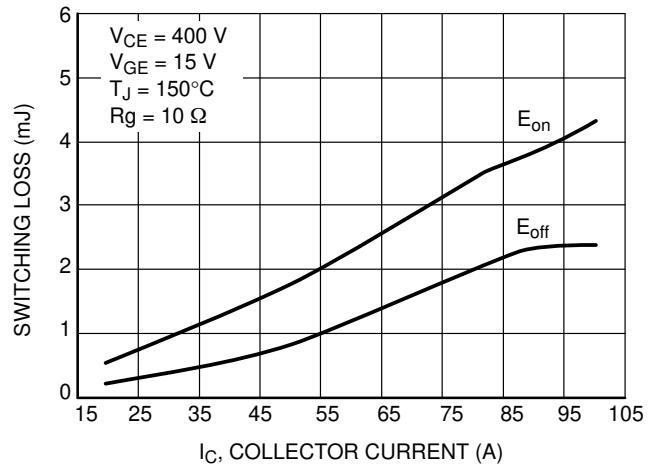


Figure 6. Switching Loss vs. I_C

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TYPICAL CHARACTERISTICS

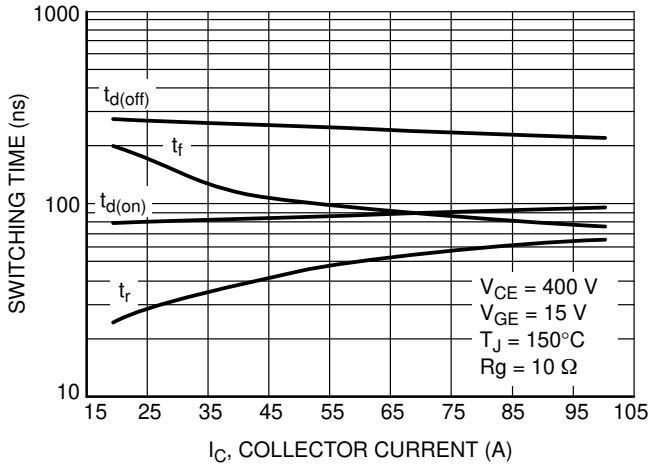


Figure 7. Switching Time vs. I_C

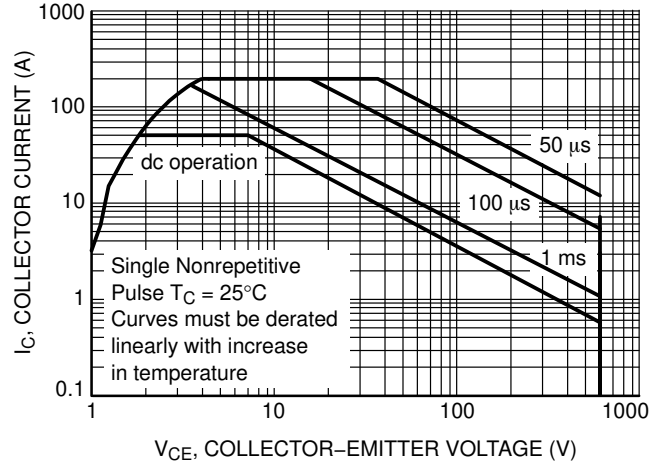


Figure 8. Safe Operating Area

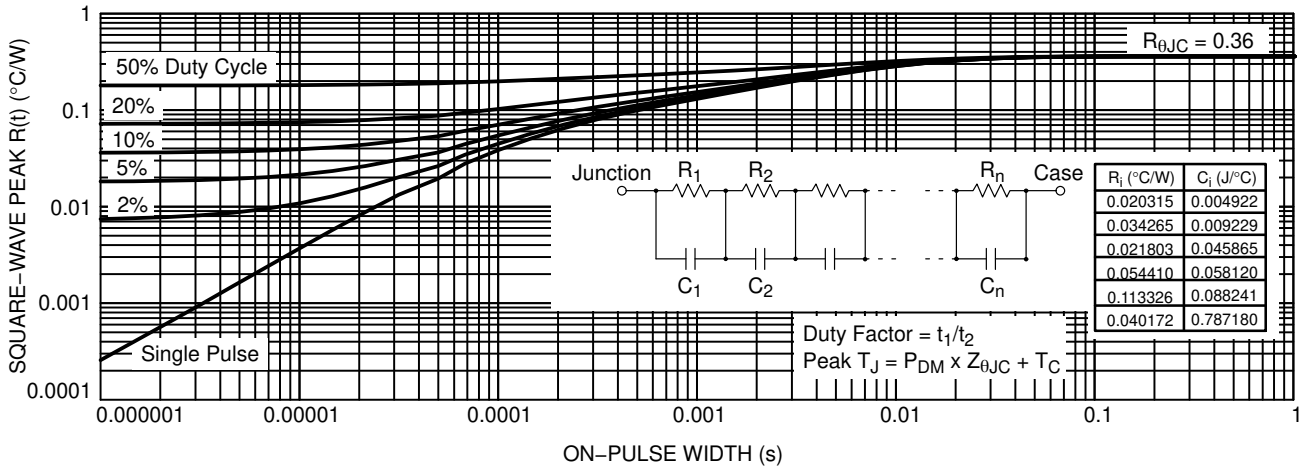


Figure 9. IGBT Transient Thermal Impedance

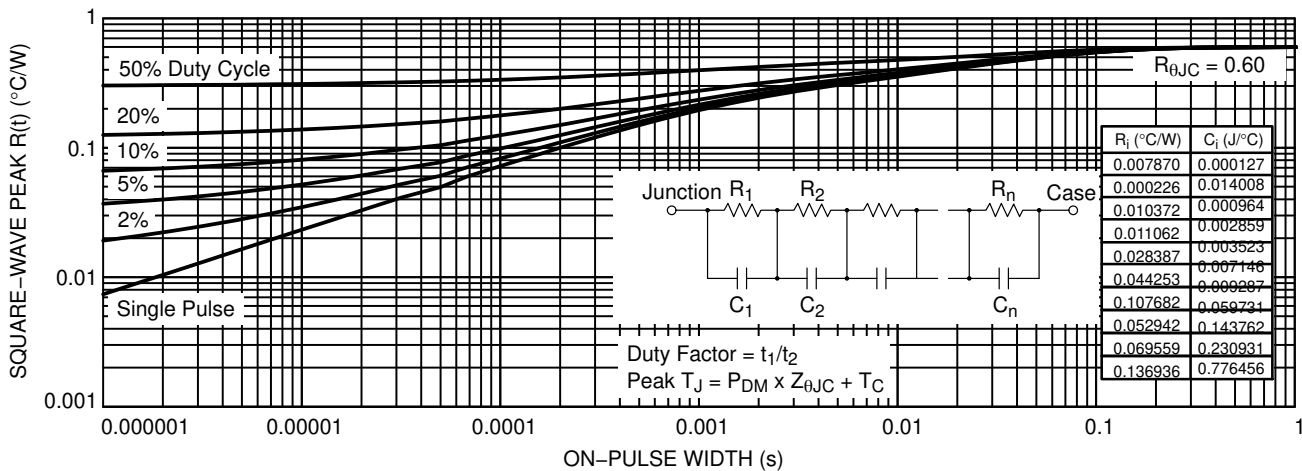
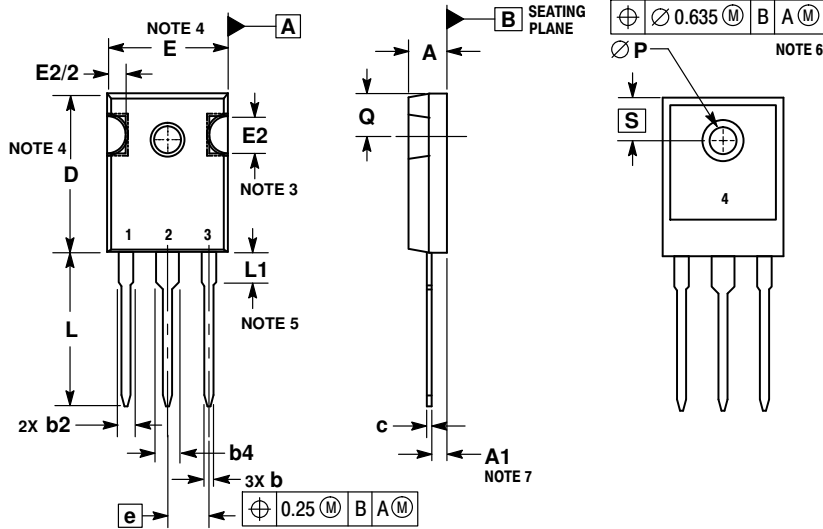


Figure 10. Diode Transient Thermal Impedance

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PACKAGE DIMENSIONS

TO-247 CASE 340AL ISSUE A



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. SLOT REQUIRED, NOTCH MAY BE ROUNDED.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREME OF THE PLASTIC BODY.
5. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.
6. $\varnothing P$ SHALL HAVE A MAXIMUM DRAFT ANGLE OF 1.5° TO THE TOP OF THE PART WITH A MAXIMUM DIAMETER OF 3.91.
7. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.

| DIM | MILLIMETERS | |
|-----|-------------|-------|
| | MIN | MAX |
| A | 4.70 | 5.30 |
| A1 | 2.20 | 2.60 |
| b | 1.00 | 1.40 |
| b2 | 1.65 | 2.35 |
| b4 | 2.60 | 3.40 |
| c | 0.40 | 0.80 |
| D | 20.30 | 21.40 |
| E | 15.50 | 16.25 |
| E2 | 4.32 | 5.49 |
| e | 5.45 BSC | |
| L | 19.80 | 20.80 |
| L1 | 3.50 | 4.50 |
| P | 3.55 | 3.65 |
| Q | 5.40 | 6.20 |
| S | 6.15 BSC | |

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