

# NGTB05N60R2DT4G



ON Semiconductor®

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## IGBT 600V, 8A, N-Channel

### Features

- Reverse Conducting II IGBT
- IGBT  $V_{CE(sat)}=1.65V$  (typ) [ $I_C=5A$ ,  $V_{GE}=15V$ ]
- IGBT  $t_f=95ns$  (typ)
- Diode  $V_F=1.5V$  (typ) [ $I_F=5A$ ]
- Diode  $t_{rr}=70ns$  (typ)
- $5\mu s$  Short Circuit Capability

### Applications

- General Purpose Inverter

### Specifications

**Absolute Maximum Ratings** at  $T_a=25^\circ C$ , Unless otherwise specified

| Parameter  | Symbol    | Value                  | Unit       |
|--|-----------|------------------------|------------|
| Collector to Emitter Voltage                               | $V_{CES}$ | 600                    | V          |
| Gate to Emitter Voltage                                    | $V_{GES}$ | $\pm 20$               | V          |
| Collector Current (DC)                                     | $I_C$ *1  | 16                     | A          |
| Limited by $T_{jmax}$                                      |           | @ $T_c=100^\circ C$ *2 | 8          |
| Collector Current (Peak)                                   | $I_{CP}$  | 20                     | A          |
| Pulse width Limited by $T_{jmax}$                          |           |                        |            |
| Diode Average Output Current                               | $I_O$     | 8                      | A          |
| Power Dissipation  | $P_D$     | 56                     | W          |
| $T_c=25^\circ C$ (Our ideal heat dissipation condition) *2 |           |                        |            |
| Junction Temperature                                       | $T_j$     | 175                    | $^\circ C$ |
| Storage Temperature  | $T_{stg}$ | -55 to +175            | $^\circ C$ |

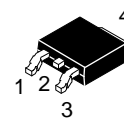
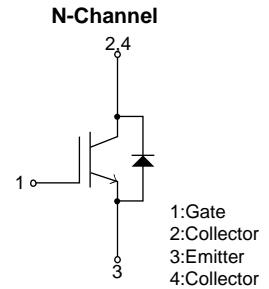
Note : \*1 Collector Current is calculated from the following formula.

$$I_C(T_c) = \frac{T_{jmax} - T_c}{R_{th(j-c)} \times V_{CE(sat)}(I_C(T_c))}$$

\*2 Our condition is radiation from backside.

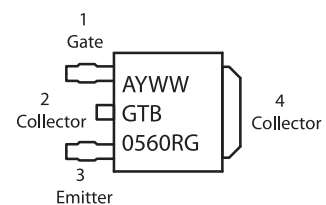
The method is applying silicone grease to the backside of the device and attaching the device to water-cooled radiator made of aluminum.

### Electrical Connection



DPAK  
CASE 369C

### Marking Diagram



GTB0560R = Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

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.

### ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

# NGTB05N60R2DT4G

## Electrical Characteristics at Ta=25°C, Unless otherwise specified

| Parameter                               | Symbol              | Conditions   | Value                                     |      |      | Unit |
|---|---------------------|--|---|------|------|------|
|   |                     |  | min                                       | typ  | max  |      |
| Collector to Emitter Breakdown Voltage  | V(BR)CES            | IC=1mA, VGE=0V   | 600                                       |      |      | V    |
| Collector to Emitter Cut off Current    | ICES                | VCE=600V, VGE=0V   | Tc=25°C                                   |      | 10   | μA   |
|   |                     |  | Tc=150°C                                  |      | 1    | mA   |
| Gate to Emitter Leakage Current         | IGES                | VGE=±20V, VCE=0V   |   |      | ±100 | nA   |
| Gate to Emitter Threshold Voltage       | VGE(th)             | VCE=20V, IC=80μA   | 4.5                                       |      | 7.0  | V    |
| Collector to Emitter Saturation Voltage | VCE(sat)            | VGE=15V, IC=5A   | Tc=25°C                                   | 1.65 | 2.0  | V    |
|   |                     |  | Tc=100°C                                  | 1.85 | 2.2  | V    |
| Forward Diode Voltage                   | VF                  | IF=5A  |   | 1.5  | 2.1  | V    |
| Input Capacitance                       | Cies                | VCE=20V, f=1MHz  |   | 740  |      | pF   |
| Output Capacitance                      | Coes                |  |   | 30   |      | pF   |
| Reverse Transfer Capacitance            | Cres                |  |   | 20   |      | pF   |
| Turn-ON Delay Time                      | t <sub>d(on)</sub>  |  |   | 44   |      | ns   |
| Rise Time                               | t <sub>r</sub>      | VCC=300V, IC=5A<br>RG=30Ω, L=500μH<br>VGE=0V/15V<br>Vclamp=400V<br>Tc=25°C<br>See Fig.1, See Fig.2 |   | 26   |      | ns   |
| Turn-ON Time                            | ton                 |  |   | 139  |      | ns   |
| Turn-OFF Delay Time                     | t <sub>d(off)</sub> |  |   | 82   |      | ns   |
| Fall Time                               | t <sub>f</sub>      |  |   | 95   |      | ns   |
| Turn-OFF Time                           | toff                |  |   | 186  |      | ns   |
| Turn-ON Energy                          | Eon                 |  |   | 188  |      | μJ   |
| Turn-OFF Energy                         | Eoff                |  |   | 60   |      | μJ   |
| Total Gate Charge                       | Qg                  |  |   | 30   |      | nC   |
| Gate to Emitter Charge                  | Qge                 | VCE=300V, VGE=15V, IC=5A   |   | 6    |      | nC   |
| Gate to Collector "Miller" Charge       | Qgc                 |  |   | 14   |      | nC   |
| Diode Reverse Recovery Time             | t <sub>rr</sub>     |  | IF=5A, di/dt=300A/μs, VCC=300V, See Fig.3 |      | 70   |      |

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.

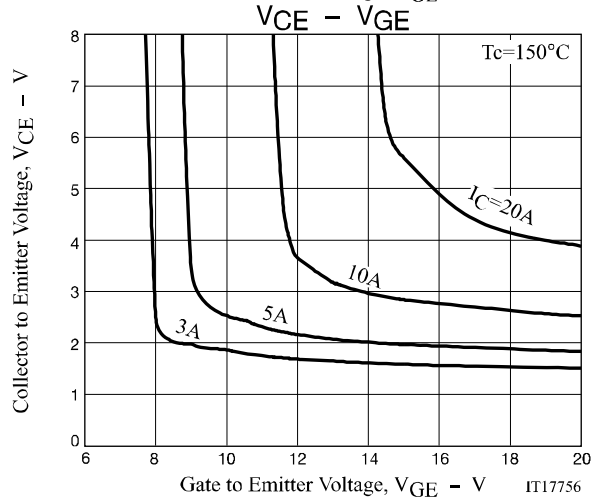
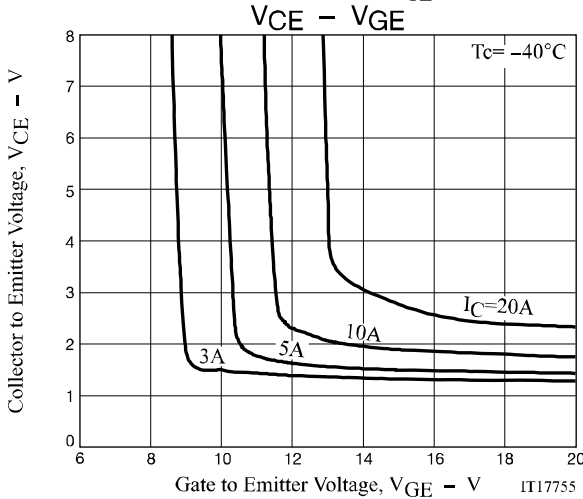
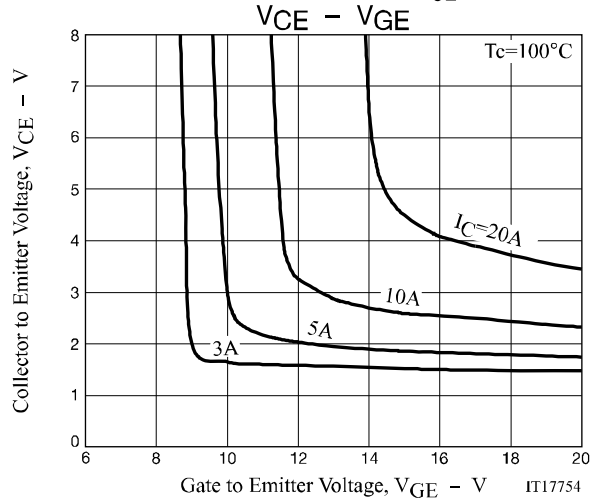
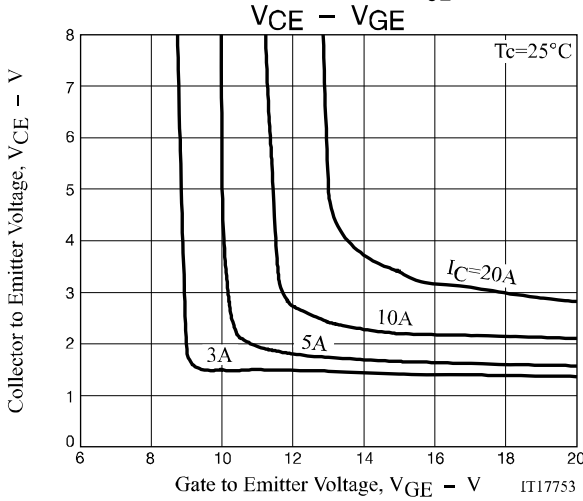
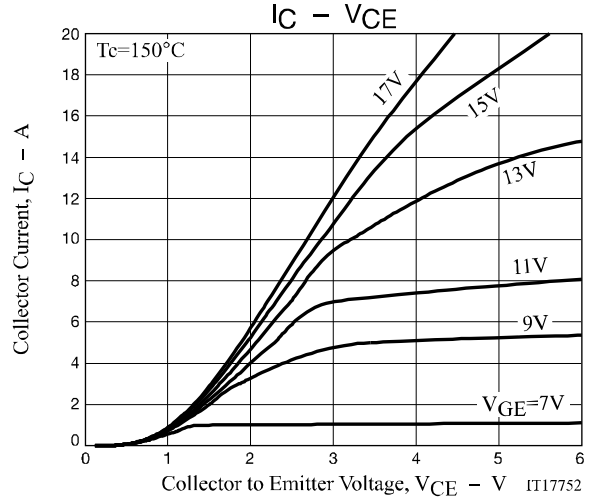
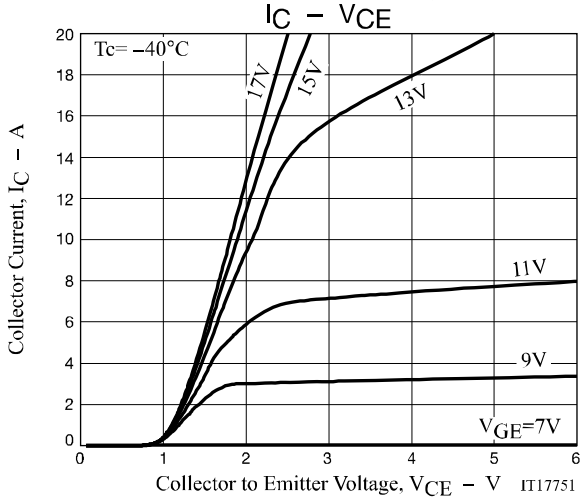
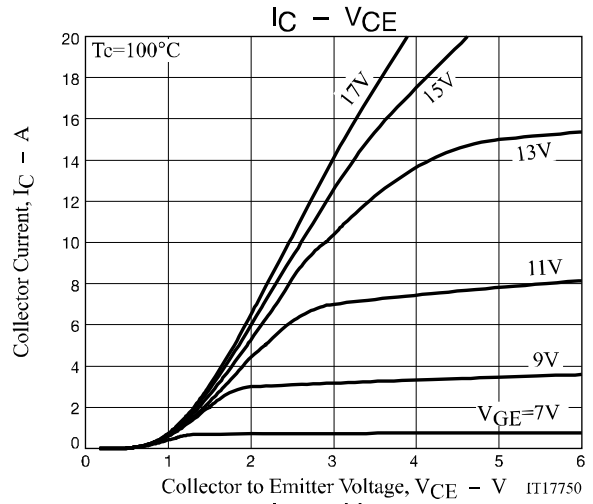
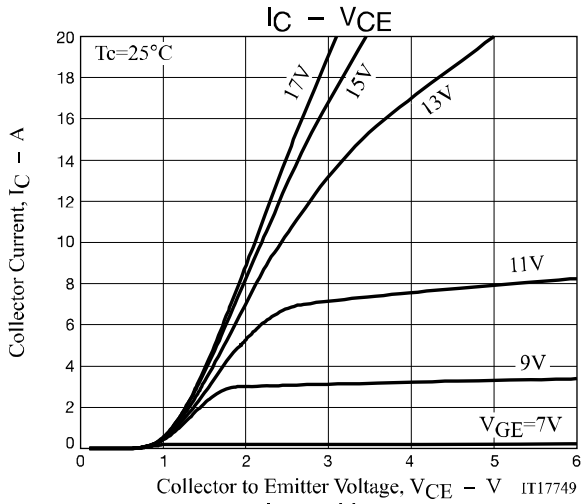
## Thermal Characteristics at Ta=25°C, Unless otherwise specified

| Parameter                                  | Symbol          | Conditions   | Value | Unit |
|--|-----------------|--|-------|------|
| Thermal Resistance IGBT (Junction to Case) | Rth(j-c) (IGBT) | Tc=25°C<br>(Our ideal heat dissipation condition) *2 | 2.7   | °C/W |
| Thermal Resistance (Junction to Ambient)   | Rth(j-a)        |  | 100   | °C/W |

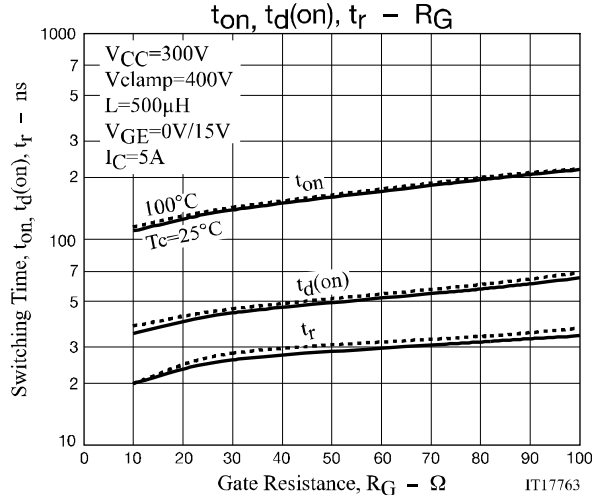
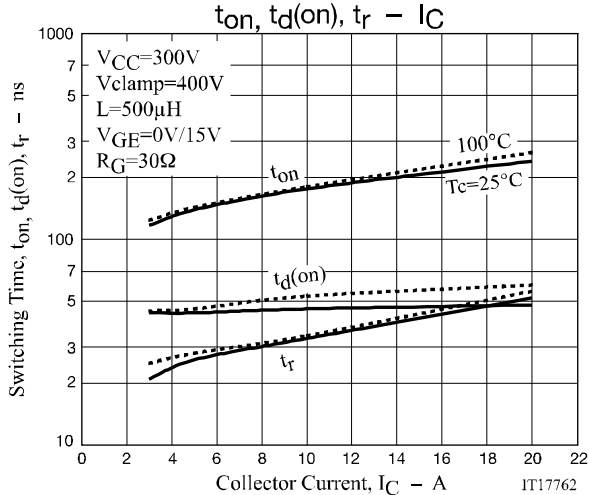
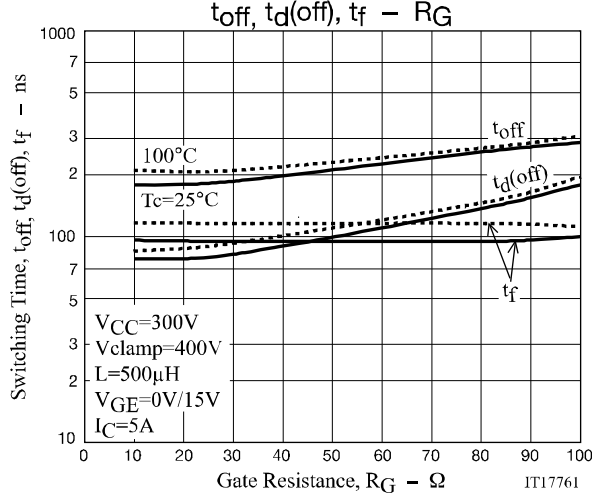
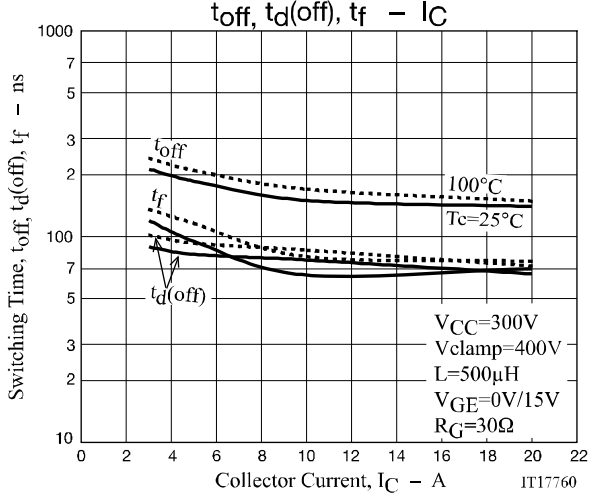
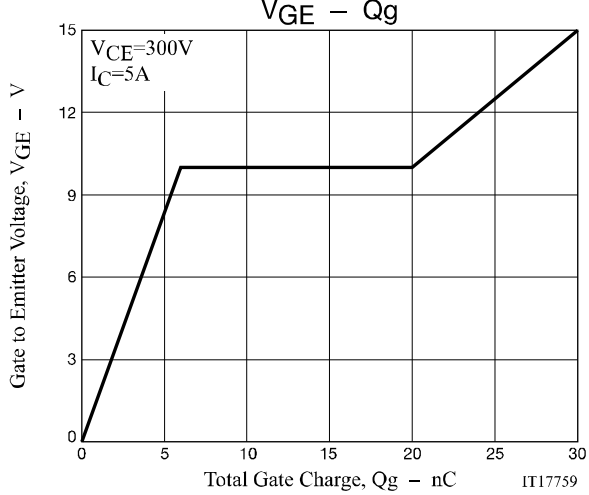
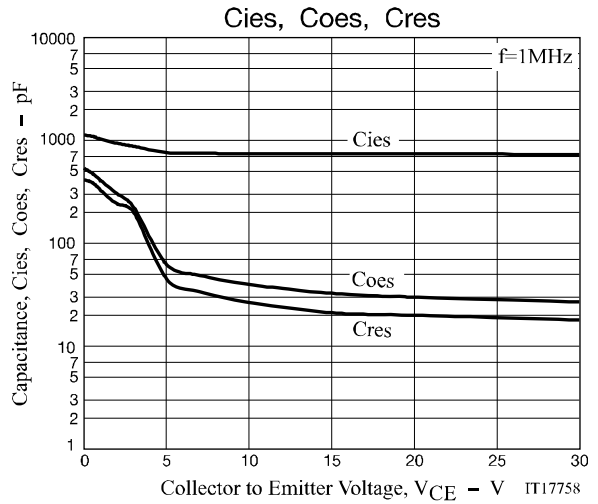
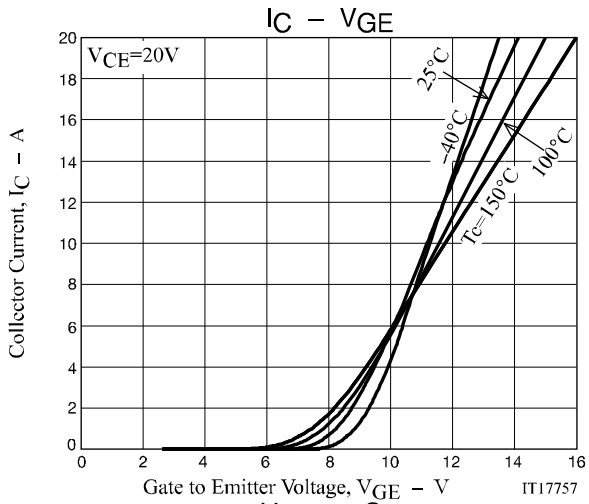
Note : \*2 Our condition is radiation from backside.

The method is applying silicone grease to the backside of the device and attaching the device to water-cooled radiator made of aluminum.

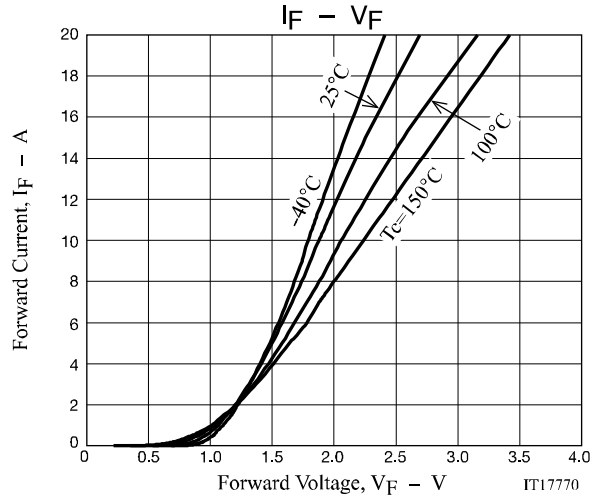
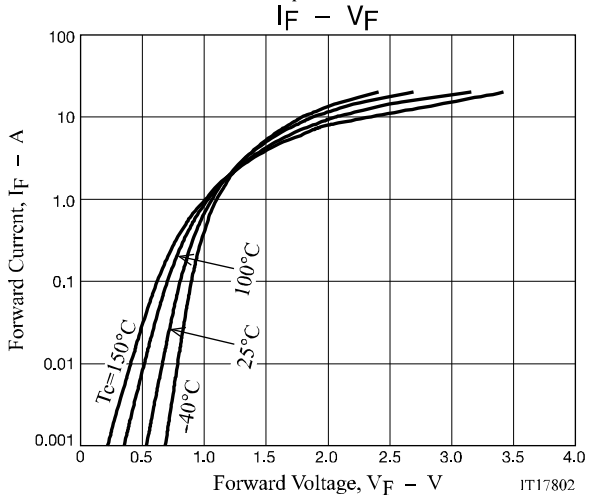
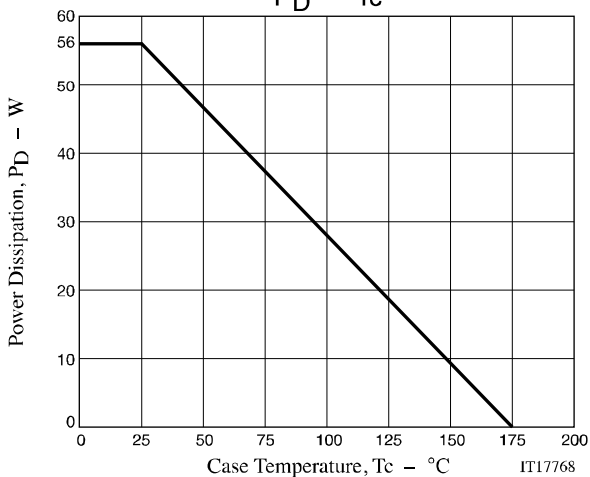
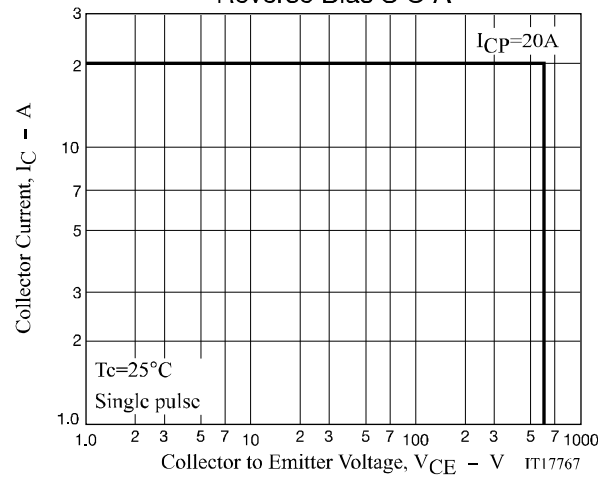
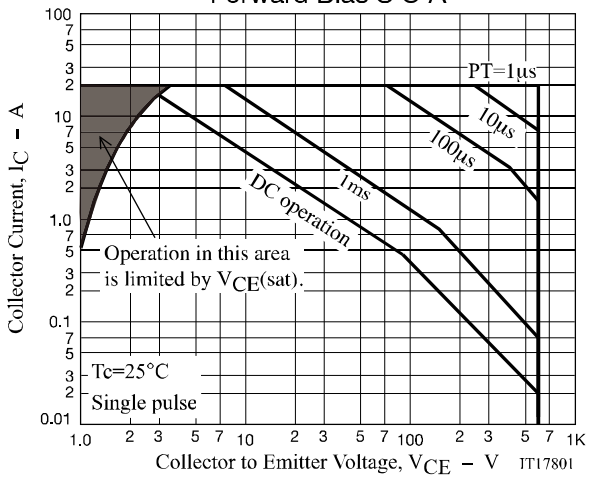
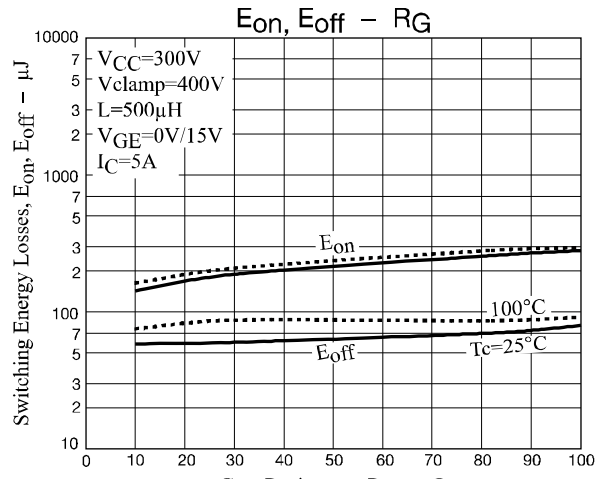
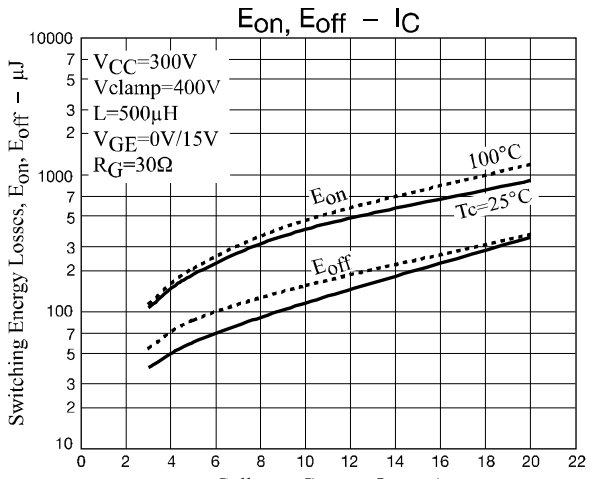
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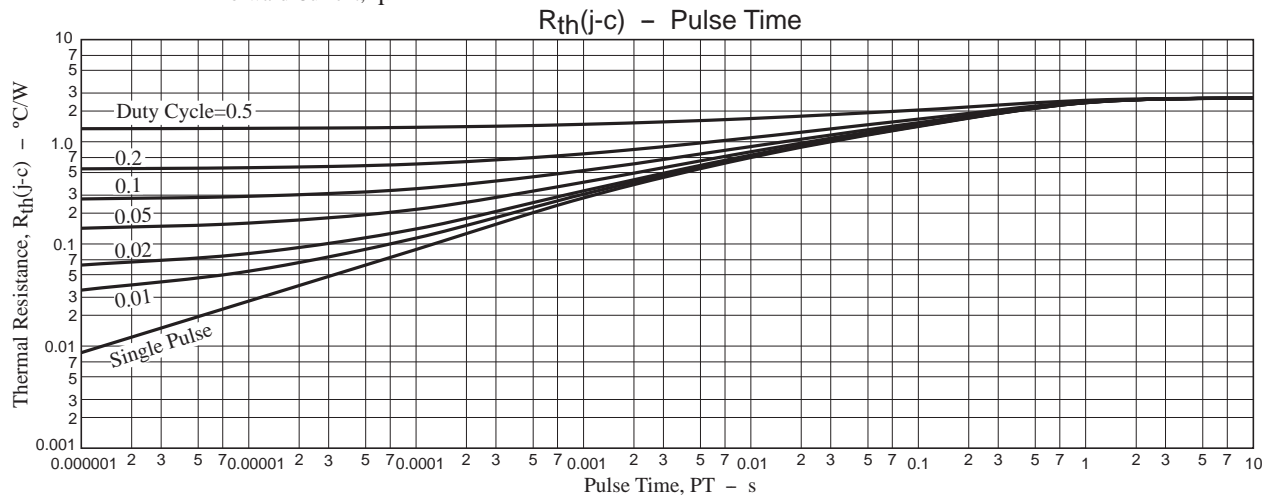
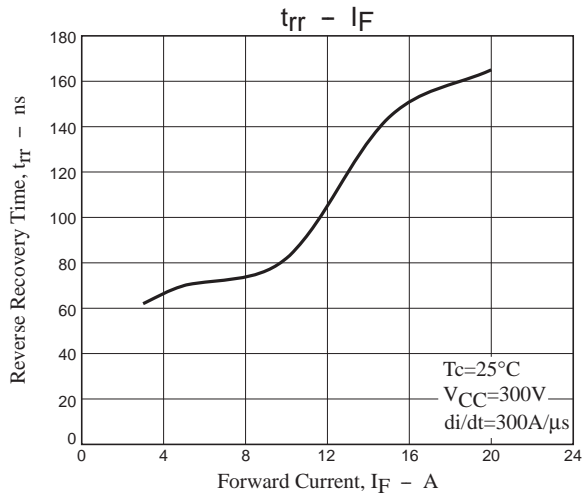
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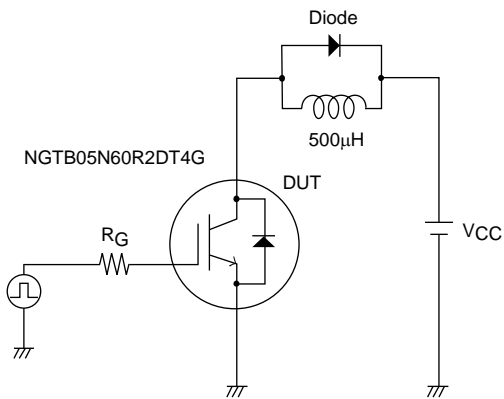
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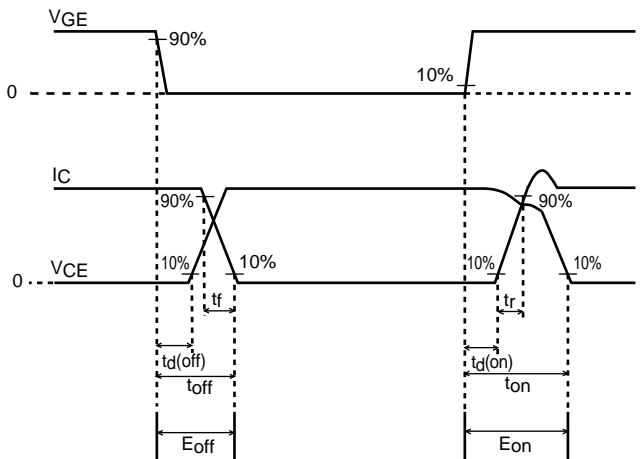
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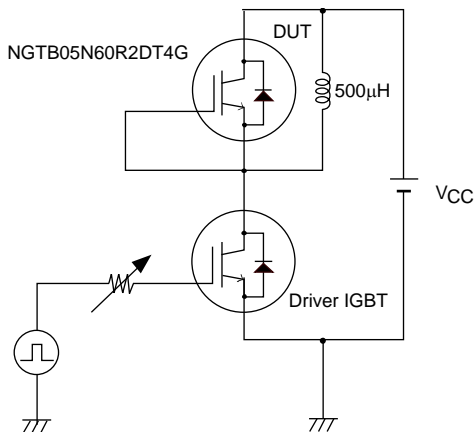
**Fig.1 Switching Time Test Circuit**



**Fig.2 Timing Chart**



**Fig.3 Reverse Recovery Time Test Circuit**

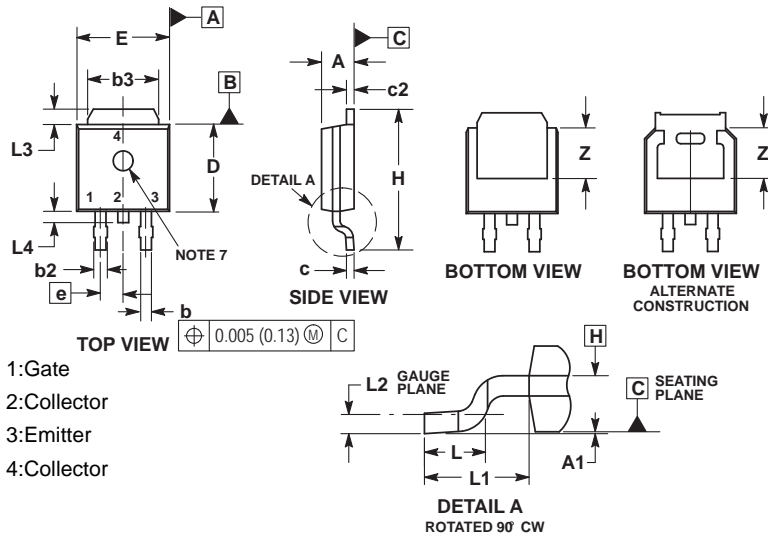


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## Package Dimensions

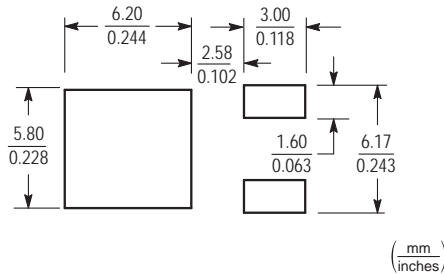
unit : mm

**DPAK (SINGLE GAUGE)**  
CASE 369C  
ISSUE E



- |   |   |  |  |   |
|---|---|--|--|---|
| STYLE 1:<br>PIN 1. BASE<br>2. COLLECTOR<br>3. EMITTER<br>4. COLLECTOR | STYLE 2:<br>PIN 1. GATE<br>2. DRAIN<br>3. SOURCE<br>4. DRAIN          | STYLE 3:<br>PIN 1. ANODE<br>2. ANODE<br>3. ANODE<br>4. CATHODE | STYLE 4:<br>PIN 1. CATHODE<br>2. ANODE<br>3. GATE<br>4. ANODE              | STYLE 5:<br>PIN 1. GATE<br>2. ANODE<br>3. CATHODE<br>4. ANODE     |
| STYLE 6:<br>PIN 1. MT1<br>2. MT2<br>3. GATE<br>4. MT2                 | STYLE 7:<br>PIN 1. GATE<br>2. COLLECTOR<br>3. EMITTER<br>4. COLLECTOR | STYLE 8:<br>PIN 1. N/C<br>2. CATHODE<br>3. ANODE<br>4. CATHODE | STYLE 9:<br>PIN 1. ANODE<br>2. CATHODE<br>3. RESISTOR ADJUST<br>4. CATHODE | STYLE 10:<br>PIN 1. CATHODE<br>2. ANODE<br>3. CATHODE<br>4. ANODE |

### SOLDERING FOOTPRINT\*



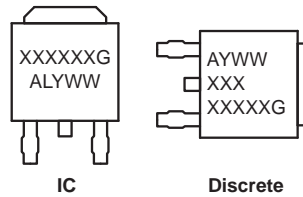
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

### NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: INCHES.
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
- 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.
- DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
- 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        | ---   |

### GENERIC MARKING DIAGRAM\*



- XXXXXX = Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking.

## ORDERING INFORMATION

| Device          | Package | Shipping         | note                     |
|-----------------|---------|------------------|--------------------------|
| NGTB05N60R2DT4G | DPAK    | 2500 pcs. / reel | Pb-Free And Halogen Free |

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