



# NGTB10N60FG

## N-Channel IGBT 600V, 10A, V<sub>CE(sat)</sub>;1.5V, TO-220F-3FS

ON Semiconductor®

<http://onsemi.com>

### Features

- IGBT V<sub>CE(sat)</sub>=1.5V typ. (I<sub>C</sub>=10A, V<sub>GE</sub>=15V)
- IGBT I<sub>C</sub>=20A (T<sub>c</sub>=25°C)
- Adaption of full isolation type package
- 5μs short circuit capability
- Diode V<sub>F</sub>=1.3V typ.(I<sub>F</sub>=10A)
- Diode t<sub>rr</sub>=70ns typ.
- Enhancement type

### Applications

- Power factor correction of white goods appliance
- General purpose inverter



TO-220F-3FS

### Specifications

**Absolute Maximum Ratings** at T<sub>a</sub> = 25°C, Unless otherwise specified

| Parameter                    | Symbol                       | Conditions  | Value                                 | Unit |   |
|------------------------------|------------------------------|---|---------------------------------------|------|---|
| Collector to Emitter Voltage | V <sub>CES</sub>             |   | 600                                   | V    |   |
| Gate to Emitter Voltage      | V <sub>GES</sub>             |   | ±20                                   | V    |   |
| Collector Current (DC)       | I <sub>C</sub> <sup>*1</sup> | Limited by T <sub>jmax</sub>  | @ T <sub>c</sub> =25°C <sup>*2</sup>  | 20   | A |
|                              |                              |   | @ T <sub>c</sub> =100°C <sup>*2</sup> | 10   | A |
| Collector Current (Pulse)    | I <sub>CP</sub>              | Pulse width Limited by T <sub>jmax</sub>                                  | 72                                    | A    |   |
| Diode Average Output Current | I <sub>O</sub>               |   | 10                                    | A    |   |
| Allowable Power Dissipation  | P <sub>D</sub>               | T <sub>c</sub> =25°C (Our ideal heat dissipation condition) <sup>*2</sup> | 40                                    | W    |   |
| Junction Temperature         | T <sub>j</sub>               |   | 150                                   | °C   |   |
| Storage Temperature          | T <sub>stg</sub>             |   | - 55 to +150                          | °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 aluminium.

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.

### Electrical Characteristics

 at T<sub>a</sub> = 25°C, Unless otherwise specified

| Parameter                               | Symbol               | Conditions                                  | Value                 |      |      | Unit |
|---|----------------------|---|-----------------------|------|------|------|
|   |                      |   | min                   | typ  | max  |      |
| Collector to Emitter Breakdown Voltage  | V <sub>(BR)CES</sub> | I <sub>C</sub> =500μA, V <sub>GE</sub> =0V  | 600                   |      |      | V    |
| Collector to Emitter Cut off Current    | I <sub>CES</sub>     | V <sub>CE</sub> =600V, V <sub>GE</sub> =0V  | T <sub>c</sub> =25°C  |      | 10   | μA   |
|   |                      |   | T <sub>c</sub> =125°C |      | 1    | mA   |
| Gate to Emitter Leakage Current         | I <sub>GES</sub>     | V <sub>GE</sub> =±20V, V <sub>CE</sub> =0V  |                       |      | ±100 | nA   |
| Gate to Emitter Threshold Voltage       | V <sub>GE(off)</sub> | V <sub>CE</sub> =20V, I <sub>C</sub> =250μA | 4.5                   |      | 6.5  | V    |
| Collector to Emitter Saturation Voltage | V <sub>CE(sat)</sub> | V <sub>GE</sub> =15V, I <sub>C</sub> =10A   | T <sub>c</sub> =25°C  | 1.5  | 1.7  | V    |
|   |                      |   | T <sub>c</sub> =125°C | 1.7  |      | V    |
| Diode Forward Voltage                   | V <sub>F</sub>       | I <sub>F</sub> =10A                         |                       | 1.3  |      | V    |
| Input Capacitance                       | C <sub>ies</sub>     | V <sub>CE</sub> =20V, f=1MHz                |                       | 1440 |      | pF   |
| Output Capacitance                      | C <sub>oes</sub>     |   |                       | 60   |      | pF   |
| Reverse Transfer Capacitance            | C <sub>res</sub>     |   |                       | 30   |      | pF   |

### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

Continued on next page.

# NGTB10N60FG

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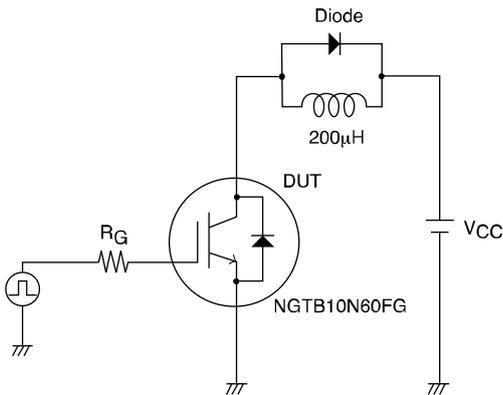
| Parameter                         | Symbol       | Conditions  | Value |     |     | Unit |
|-----------------------------------|--------------|---|-------|-----|-----|------|
|                                   |              |   | min   | typ | max |      |
| Turn-ON Delay Time                | $t_{d(on)}$  |   |       | 40  |     | ns   |
| Rise Time                         | $t_r$        | $V_{CC}=300V, I_C=10A$                              |       | 23  |     | ns   |
| Turn-ON Time                      | $t_{on}$     | $R_G=30\Omega, L=200\mu H$                          |       | 110 |     | ns   |
| Turn-OFF Delay Time               | $t_{d(off)}$ | $V_{GE}=0V/15V$                                     |       | 145 |     | ns   |
| Fall Time                         | $t_f$        | $V_{clamp}=400V$                                    |       | 90  |     | ns   |
| Turn-OFF Time                     | $t_{off}$    | See Fig.1, See Fig.2                                |       | 240 |     | ns   |
| Total Gate Charge                 | $Q_g$        |   |       | 55  |     | nC   |
| Gate to Emitter Charge            | $Q_{ge}$     | $V_{CE}=300V, V_{GE}=15V, I_C=10A$                  |       | 20  |     | nC   |
| Gate to Collector "Miller" Charge | $Q_{gc}$     |   |       | 10  |     | nC   |
| Diode Reverse Recovery Time       | $t_{rr}$     | $I_F=10A, di/dt=100A/\mu s, V_{CC}=50V$ , See Fig.3 |       | 70  |     | ns   |

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.

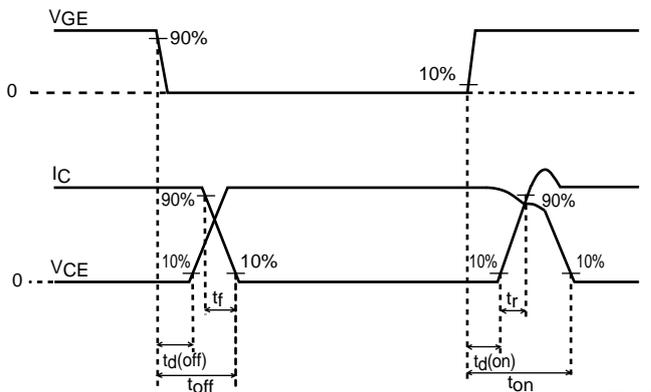
## Thermal Characteristics at $T_a = 25^\circ C$ , Unless otherwise specified

| Parameter                                 | Symbol                | Conditions  | Value | Unit         |
|---|-----------------------|---|-------|--------------|
| Thermal Resistance IGBT (junction- Case)  | $R_{th(j-c)}$ (IGBT)  | $T_c=25^\circ C$ (Our ideal heat dissipation condition)*2 | 3.09  | $^\circ C/W$ |
| Thermal Resistance Diode (junction- Case) | $R_{th(j-c)}$ (Diode) | $T_c=25^\circ C$ (Our ideal heat dissipation condition)*2 | 4     | $^\circ C/W$ |
| Thermal Resistance (junction- ambient)    | $R_{th(j-a)}$         |   | 59.5  | $^\circ C/W$ |

**Fig.1 Switching Time Test Circuit**

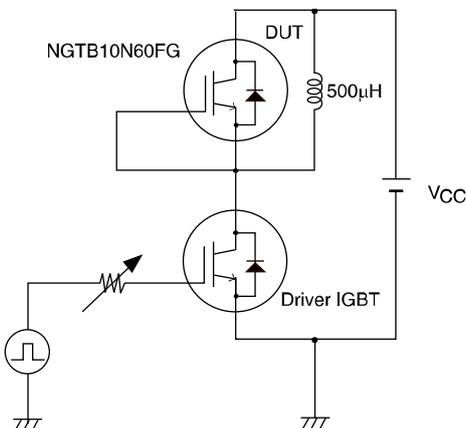


**Fig.2 Timing Chart**

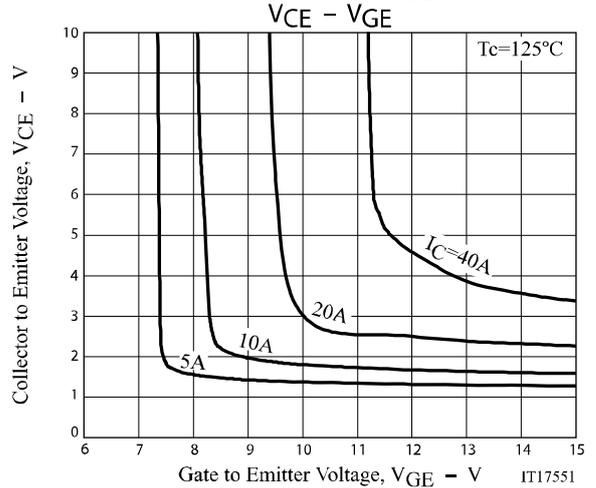
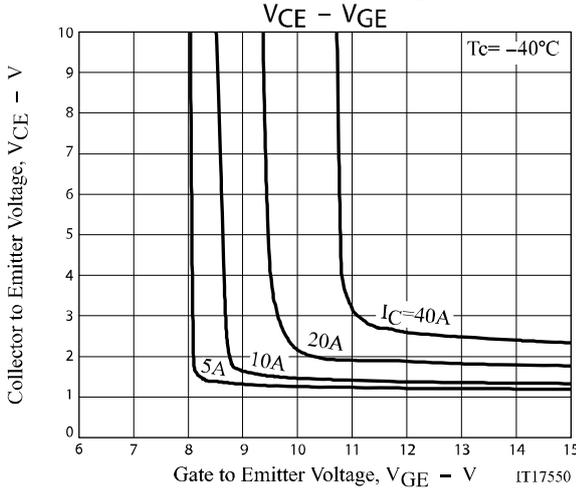
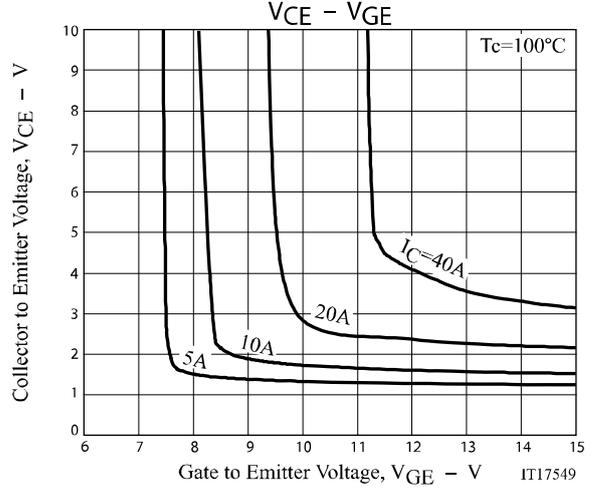
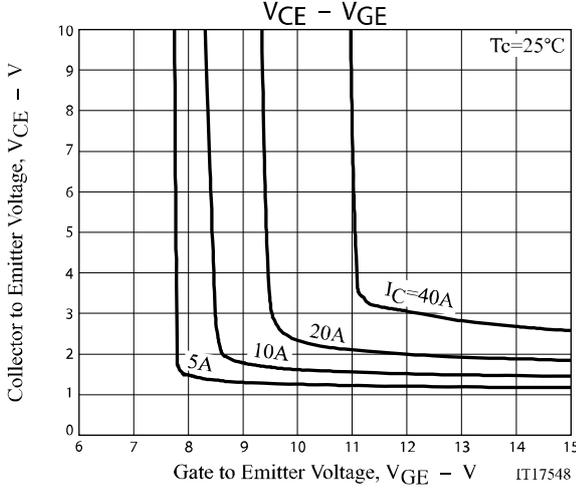
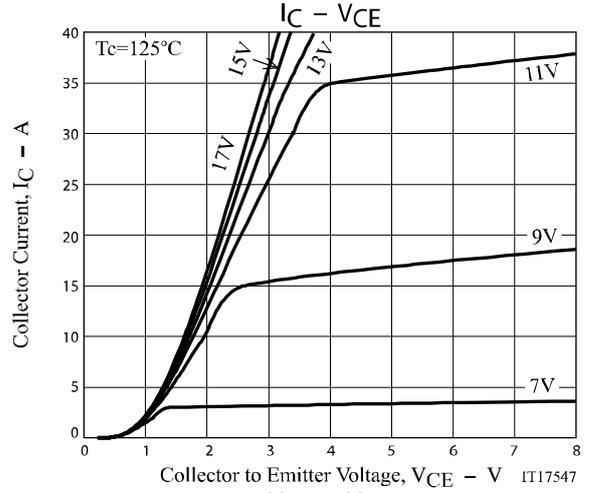
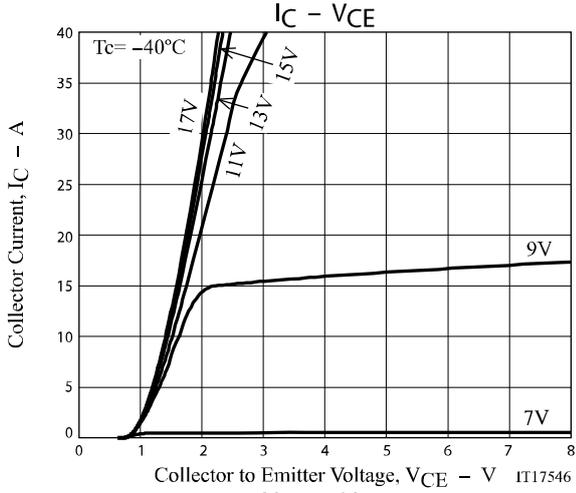
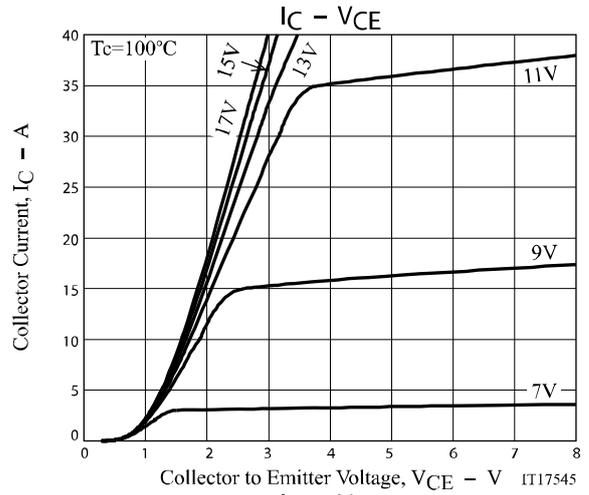
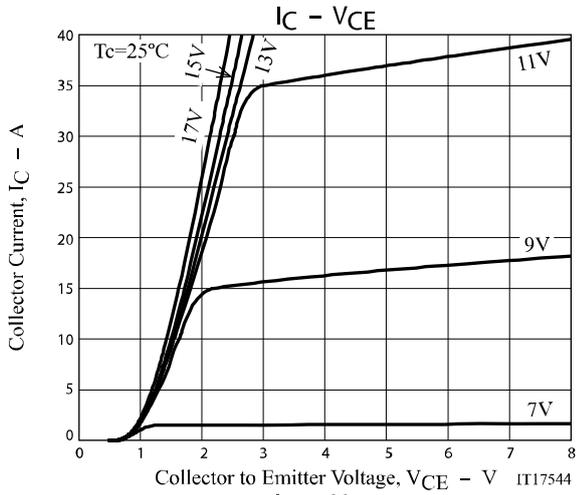


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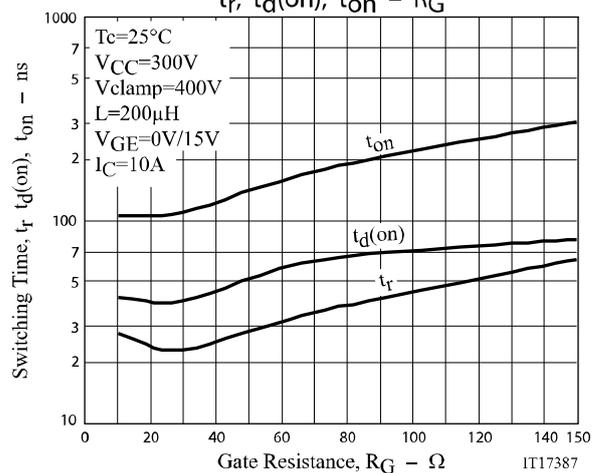
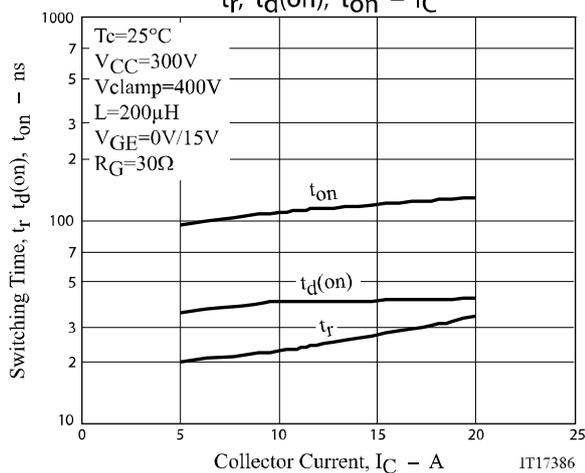
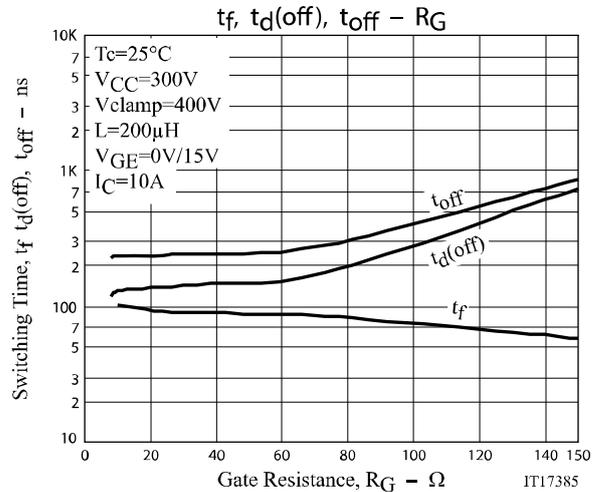
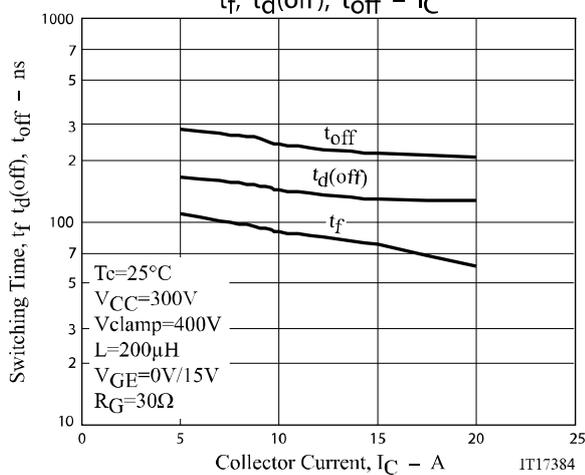
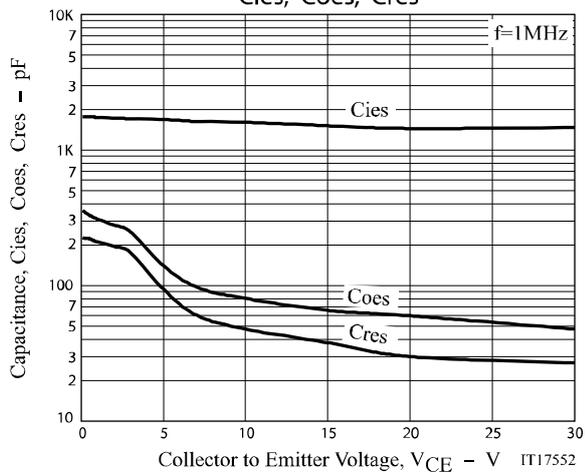
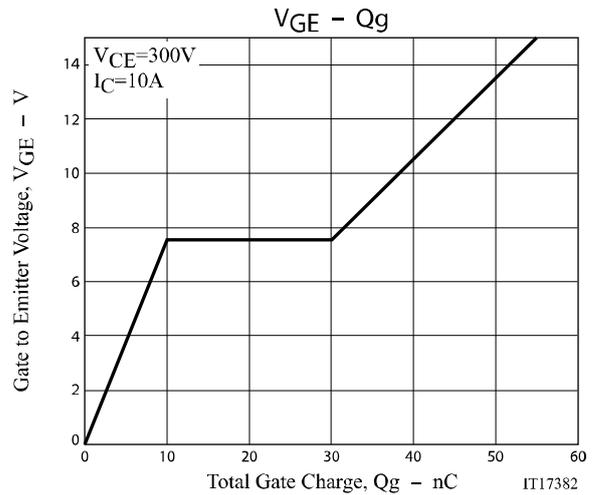
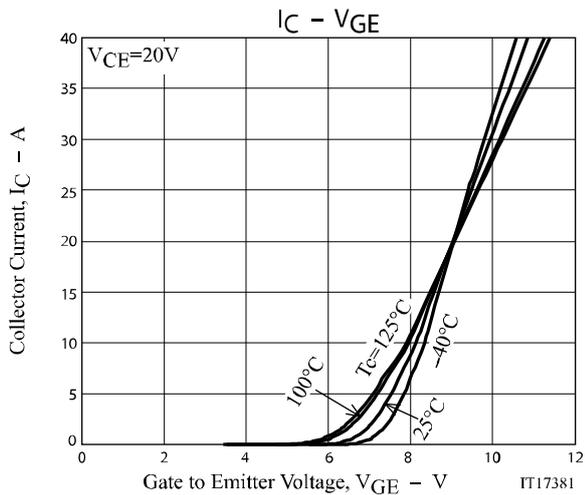
**Fig.3 Reverse Recovery Time Test Circuit**



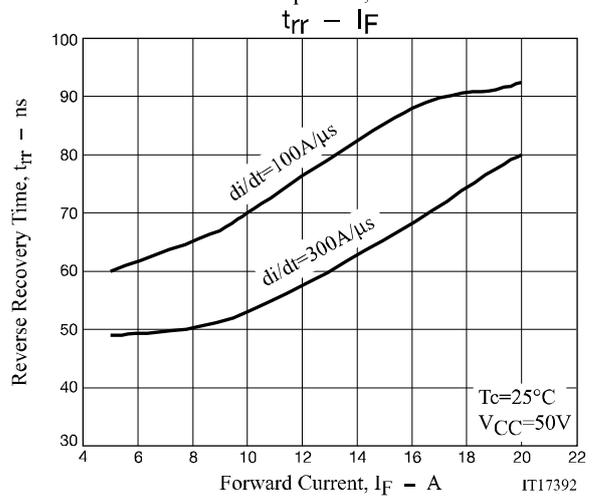
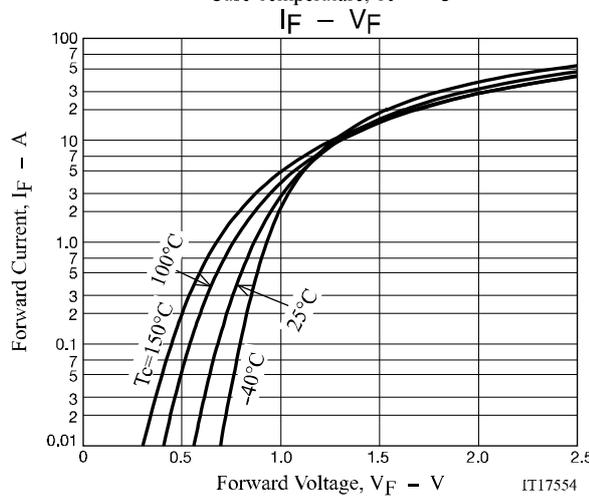
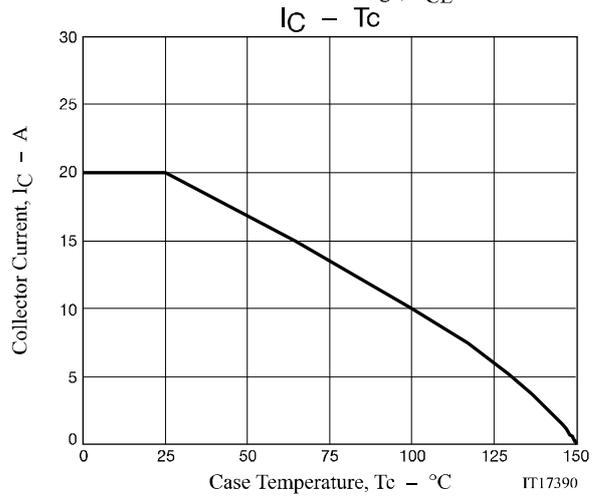
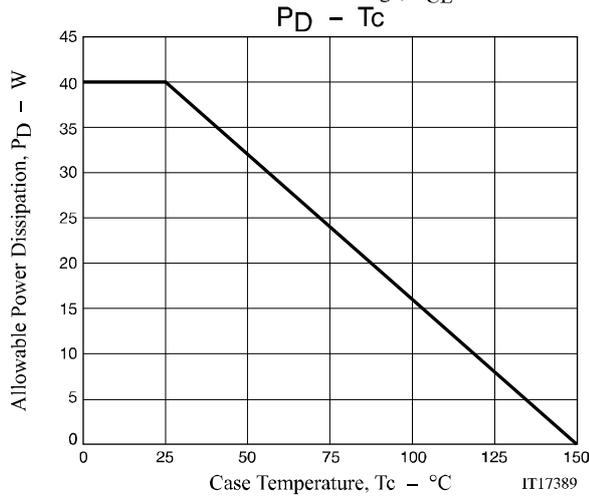
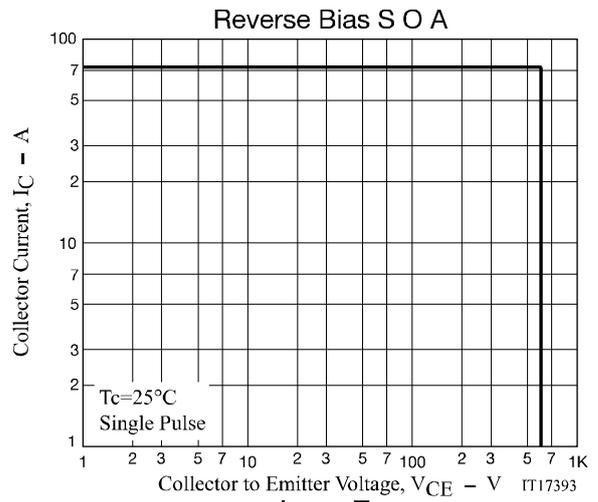
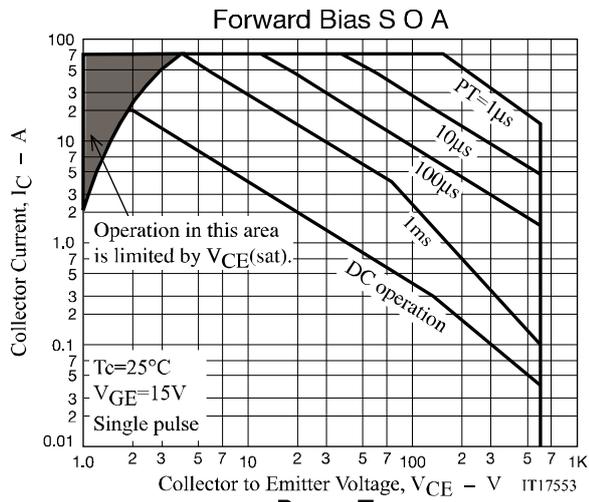
# NGTB10N60FG



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## Package Dimensions

NGTB10N60FG

### TO-220F-3FS

CASE 221AM

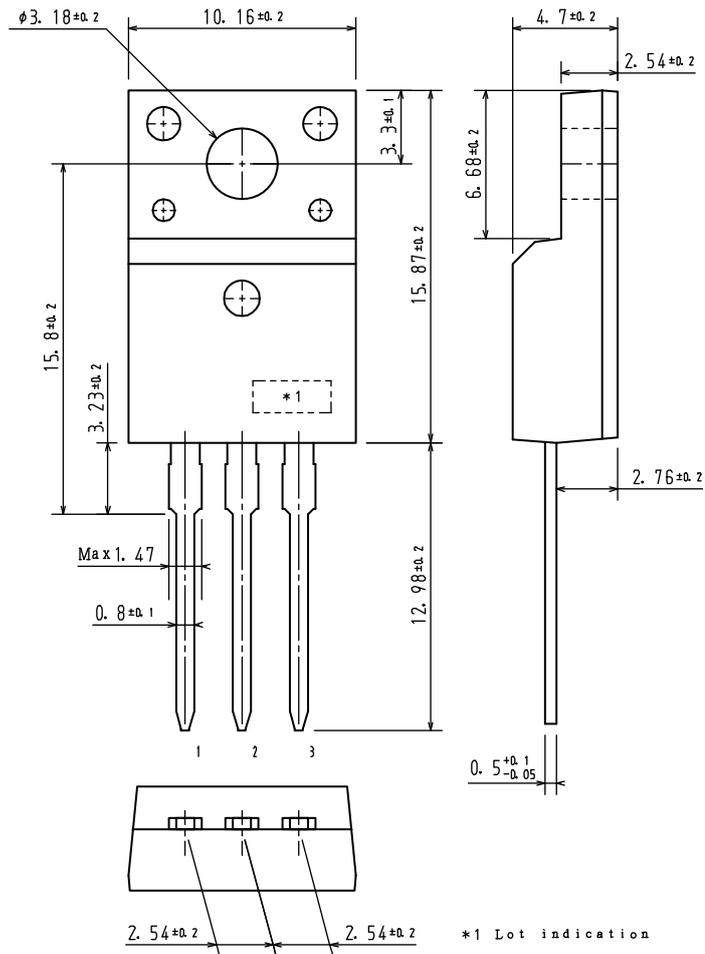
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Unit : mm

1: Gate

2: Collector

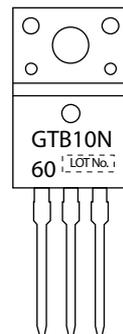
3: Emitter



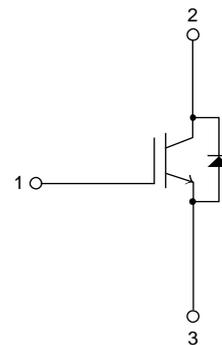
## Ordering & Package Information

| Device      | Package              | Shipping          | note    |
|-------------|----------------------|-------------------|---------|
| NGTB10N60FG | TO-220F-3FS<br>SC-67 | 50<br>pcs. / tube | Pb-Free |

## Marking



## Electrical Connection



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