Discrete IGBTs Silicon N-Channel IGBT

# GT30J65MRB

## 1. Applications

- Power Factor Correction (PFC)
- Current-Resonant Inverter Switching
- Welding

## 2. Features

(1) 7th generation

(2) The RC-IGBT consists of a freewheeling diode (FWD) monolithically integrated in an IGBT chip.

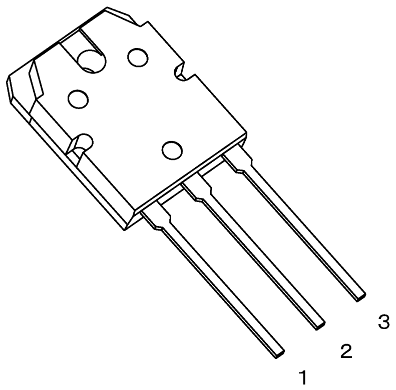
(3) Enhancement mode

(4) High-speed switching: $t_f$ = 40 ns (typ.) ($I_C$ = 15 A, $R_G$ = 56 Ω)

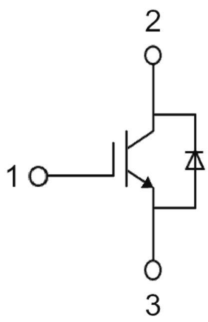
(5) Low saturation voltage: $V_{CE(sat)}$ = 1.40 V (typ.) ($I_C$ = 30 A)

(6) High junction temperature: $T_j$ = 175 °C (max)

## 3. Packaging and Internal Circuit




TO-3P(N)




1: Gate
2: Collector (Heatsink)
3: Emitter

Start of commercial production
2022-12

## 4. Absolute Maximum Ratings (Note) ($T_a$ = 25 ℃, unless otherwise specified)

| Characteristics | | Symbol | Test Condition | Rating | Unit |
|---|---|---|---|---|---|
| Collector-emitter voltage | (Note1) | $V_{CES}$ | | 650 | V |
| Gate-emitter voltage | | $V_{GES}$ | | ±25 | V |
| Collector current (DC) | | $I_C$ | ($T_c$ = 25 ℃) | 60 | A |
| | | | ($T_c$ = 100 ℃) | 30 | |
| Collector current (1 ms) | | $I_{CP}$ | | 120 | A |
| Diode forward current (DC) | | $I_F$ | ($T_c$ = 25 ℃) | 30 | A |
| | | | ($T_c$ = 100 ℃) | 15 | |
| Diode forward current (100 μs) | | $I_{FP}$ | | 60 | A |
| Collector power dissipation | | $P_C$ | ($T_c$ = 25 ℃) | 200 | W |
| Junction temperature | (Note1) | $T_j$ | | 175 | ℃ |
| Storage temperature | | $T_{stg}$ | | -55 to 175 | ℃ |
| Mounting torque | | TOR | | 0.8 | N · m |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note1: To perform derating ensures the device reliability.
In operation, the collector emitter voltage($V_{CES}$) should be below 550 V, as well as junction temperature($T_j$) should be below 140 ℃.

## 5. Thermal Characteristics

| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| Junction-to-case thermal resistance | $R_{th(j-c)}$ | 0.75 | ℃/W |

# 6. Electrical Characteristics

## 6.1. Static Characteristics ($T_a$ = 25 °C, unless otherwise specified)

| Characteristics | Symbol | Test Condition | | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | $I_{GES}$ | $V_{GE}$ = ±25 V, $V_{CE}$ = 0 V | | — | — | ±100 | nA |
| Collector cut-off current | $I_{CES}$ | $V_{CE}$ = 650 V, $V_{GE}$ = 0 V | | — | — | 10 | μA |
| Gate-emitter cut-off voltage | $V_{GE(OFF)}$ | $V_{CE}$ = 5 V, $I_C$ = 30 mA | | 4.2 | — | 6.2 | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C$ = 30 A, $V_{GE}$ = 15 V, (pulse test) | $T_c$ = 25 °C | — | 1.40 | 1.80 | V |
| | | | $T_c$ = 175 °C | — | 1.65 | — | |

## 6.2. Dynamic Characteristics ($T_a$ = 25 °C, unless otherwise specified)

| Characteristics | Symbol | Test Condition | | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Input capacitance | $C_{ies}$ | $V_{CE}$ = 25 V, $V_{GE}$ = 0 V, f = 100 kHz | | — | 2150 | — | pF |
| Reverse transfer capacitance | $C_{res}$ | | | — | 18 | — | |
| Output capacitance | $C_{oes}$ | | | — | 45 | — | |
| Total gate charge | $Q_g$ | $V_{CC}$ = 520 V, $V_{GE}$ = 15 V, $I_C$ = 30 A | | — | 70 | — | nC |
| Switching time (turn-on delay time) | $t_{d(on)}$ | $V_{CC}$ = 400 V, $I_C$ = 15 A, $V_{GE}$ = 15 V/0 V, $R_G$ = 56 Ω, L = 100 μH, Duty ≤ 1 % See Fig. 6.2.1, 6.2.2 | $T_c$ = 25 °C | — | 75 | — | ns |
| | | | $T_c$ = 175 °C | — | 70 | — | |
| Switching time (rise time) | $t_r$ | $V_{CC}$ = 400 V, $I_C$ = 15 A, $V_{GE}$ = 15 V/0 V, $R_G$ = 56 Ω, L = 100 μH, Duty ≤ 1 % See Fig. 6.2.1, 6.2.2 | $T_c$ = 25 °C | — | 25 | — | ns |
| | | | $T_c$ = 175 °C | — | 25 | — | |
| Switching time (turn-off delay time) | $t_{d(off)}$ | $V_{CC}$ = 400 V, $I_C$ = 15 A, $V_{GE}$ = 15 V/0 V, $R_G$ = 56 Ω, L = 100 μH, Duty ≤ 1 % See Fig. 6.2.1, 6.2.2 | $T_c$ = 25 °C | — | 400 | — | ns |
| | | | $T_c$ = 175 °C | — | 500 | — | |
| Switching time (fall time) | $t_f$ | $V_{CC}$ = 400 V, $I_C$ = 15 A, $V_{GE}$ = 15 V/0 V, $R_G$ = 56 Ω, L = 100 μH, Duty ≤ 1 % See Fig. 6.2.1, 6.2.2 | $T_c$ = 25 °C | — | 40 | — | ns |
| | | | $T_c$ = 175 °C | — | 25 | — | |
| Switching loss (turn-on switching loss) | $E_{on}$ | $V_{CC}$ = 400 V, $I_C$ = 15 A, $V_{GE}$ = 15 V/0 V, $R_G$ = 56 Ω, L = 100 μH, Duty ≤ 1 % See Fig. 6.2.1, 6.2.2 | $T_c$ = 25 °C | — | 1.40 | — | mJ |
| | | | $T_c$ = 175 °C | — | 1.80 | — | |
| Switching loss (turn-off switching loss) | $E_{off}$ | $V_{CC}$ = 400 V, $I_C$ = 15 A, $V_{GE}$ = 15 V/0 V, $R_G$ = 56 Ω, L = 100 μH, Duty ≤ 1 % See Fig. 6.2.1, 6.2.2 | $T_c$ = 25 °C | — | 0.22 | — | mJ |
| | | | $T_c$ = 175 °C | — | 0.35 | — | |

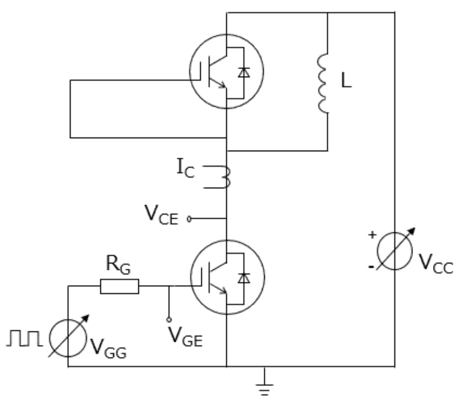



Fig. 6.2.1 Test Circuit

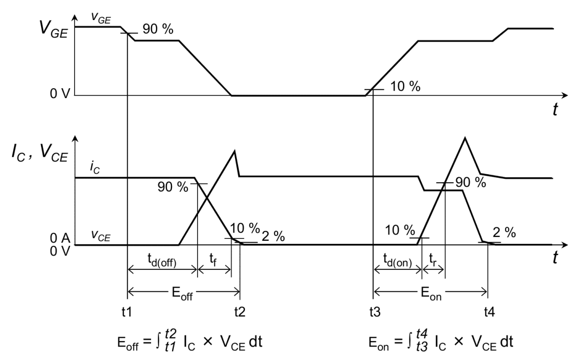



Fig. 6.2.2 Timing Chart

## 6.3. Diode Electrical Characteristics

| Characteristics | Symbol | Test Condition | | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Diode forward voltage | $V_F$ | $I_F$ = 15 A, $V_{GE}$ = 0 V (pulse test) | $T_c$ = 25 °C | — | 1.20 | 1.50 | V |
| | | | $T_c$ = 175 °C | — | 1.10 | — | |
| Reverse recovery time | $t_{rr}$ | $V_R$ = 400 V, $I_F$ = 15 A, $dI_F/dt$ = -500 A/µs See Fig.6.3.1, 6.3.2 | $T_c$ = 25 °C | — | 0.20 | — | µs |
| | | | $T_c$ = 175 °C | — | 0.27 | — | |
| Reverse recovery charge | $Q_{rr}$ | $V_R$ = 400 V, $I_F$ = 15 A, $dI_F/dt$ = -500 A/µs See Fig.6.3.1, 6.3.2 | $T_c$ = 25 °C | — | 3.5 | — | µC |
| | | | $T_c$ = 175 °C | — | 5.0 | — | |
| Peak reverse recovery current | $I_{rr}$ | $V_R$ = 400 V, $I_F$ = 15 A, $dI_F/dt$ = -500 A/µs See Fig.6.3.1, 6.3.2 | $T_c$ = 25 °C | — | 35 | — | A |
| | | | $T_c$ = 175 °C | — | 39 | — | |
| Peak rate off fall of reverse recovery current | $dI_{rr}/dt$ | $V_R$ = 400 V, $I_F$ = 15 A, $dI_F/dt$ = -500 A/µs See Fig.6.3.1, 6.3.2 | $T_c$ = 25 °C | — | -350 | — | A/µs |
| | | | $T_c$ = 175 °C | — | -310 | — | |

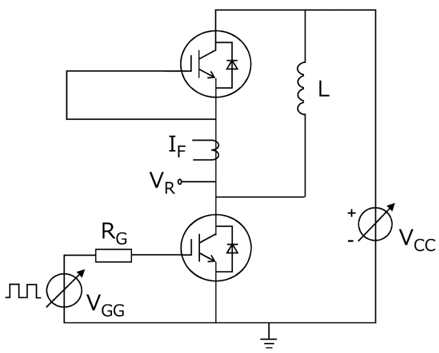



**Fig. 6.3.1 Test Circuit**

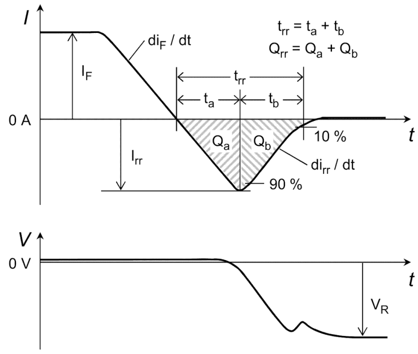



**Fig. 6.3.2 Timing Chart**

## 7. Marking (Note)

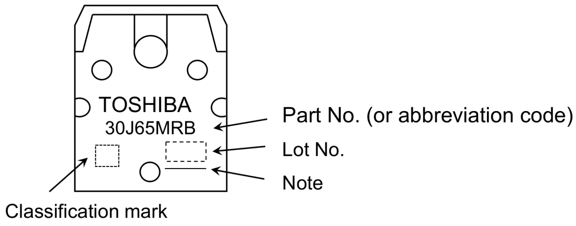



**Fig. 7.1 Marking**

Note: A line under a Lot No. identifies the indication of product Labels.
[[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.
The RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.

## 8. Characteristics Curves (Note)

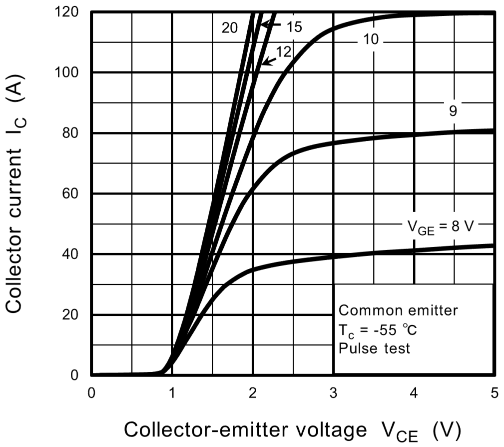



**Fig. 8.1 $I_C$ - $V_{CE}$**

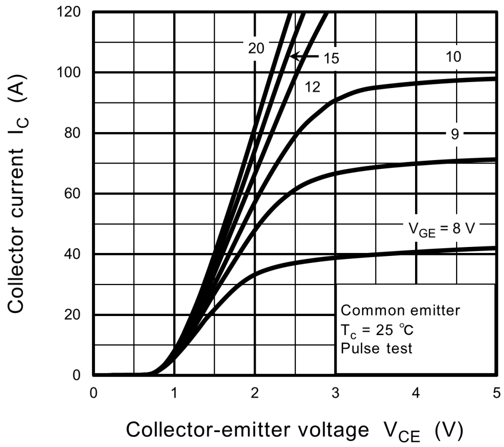



**Fig. 8.2 $I_C$ - $V_{CE}$**

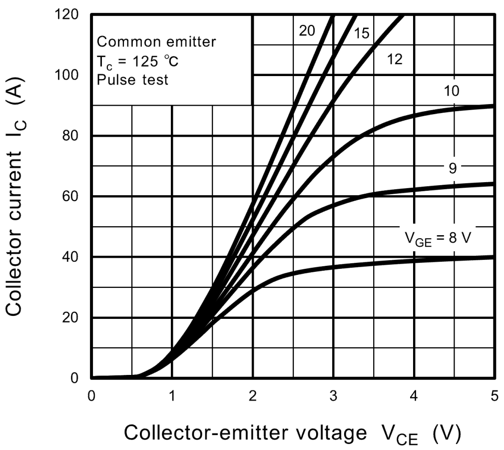



**Fig. 8.3 $I_C$ - $V_{CE}$**

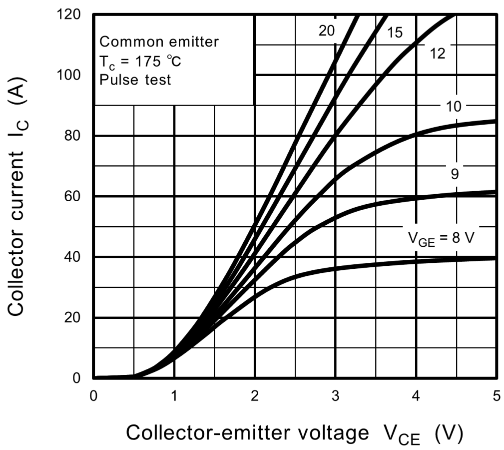



**Fig. 8.4 $I_C$ - $V_{CE}$**

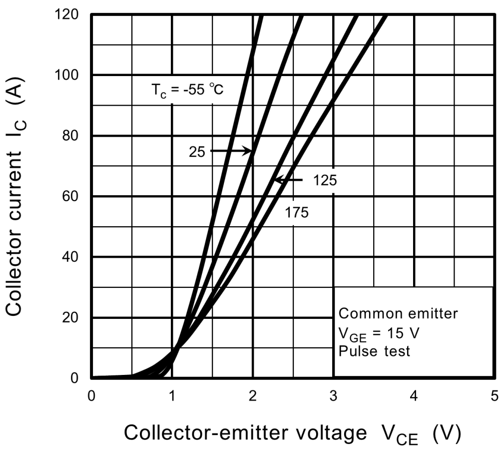



**Fig. 8.5 $I_C$ - $V_{CE}$**

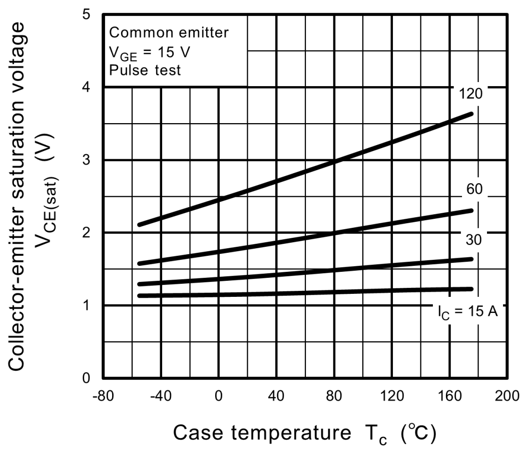



**Fig. 8.6 $V_{CE(sat)}$ - $T_c$**

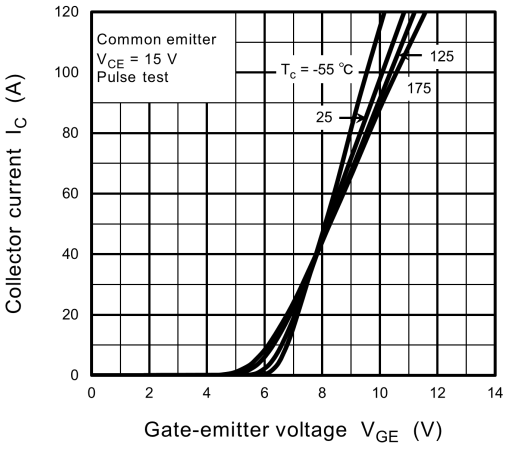



**Fig. 8.7 $I_C$ - $V_{GE}$**

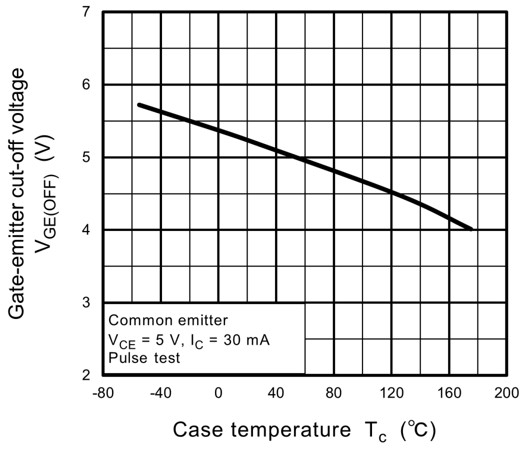



**Fig. 8.8 $V_{GE(OFF)}$ - $T_c$**

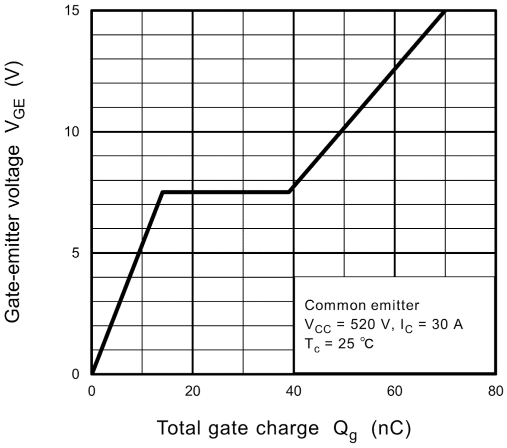



**Fig. 8.9 $V_{GE}$ - $Q_g$**

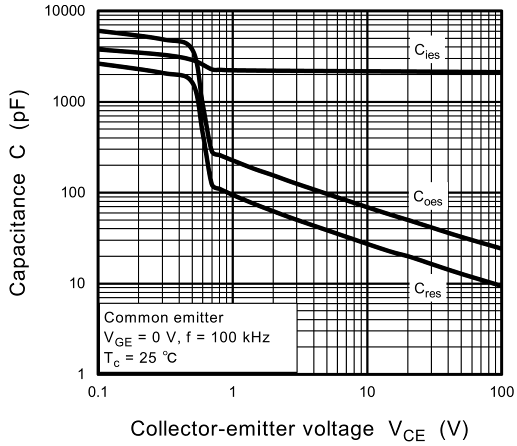



**Fig. 8.10 C - $V_{CE}$**

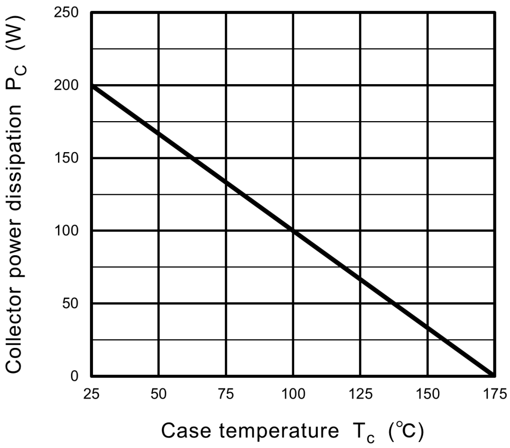



**Fig. 8.11 $P_C$ - $T_c$**

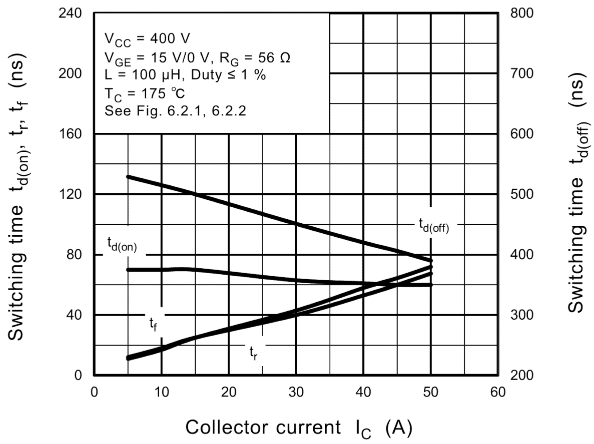



**Fig. 8.12 Switching Time - $I_C$**

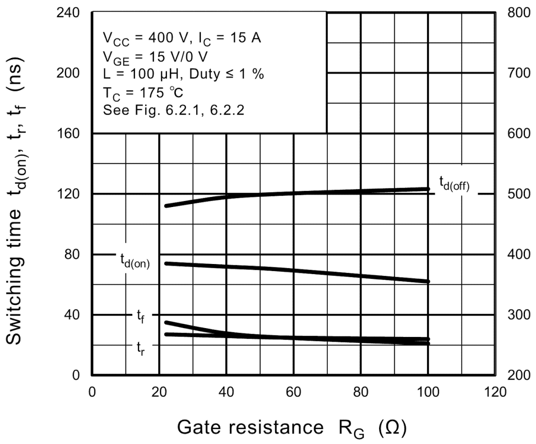



Fig. 8.13 Switching Time - $R_G$

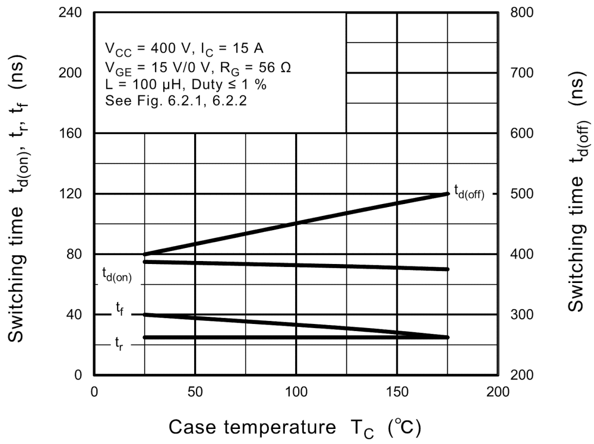



Fig. 8.14 Switching Time - $T_c$

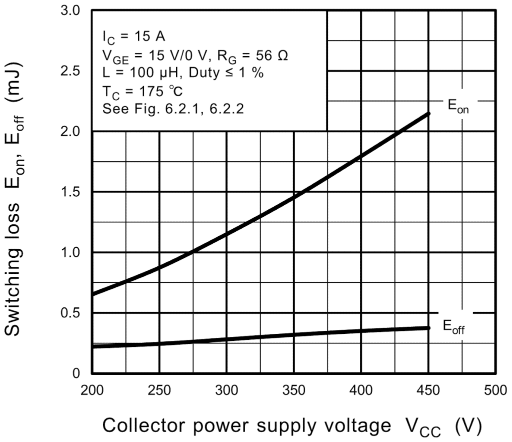



Fig. 8.15 Switching loss - $V_{CE}$

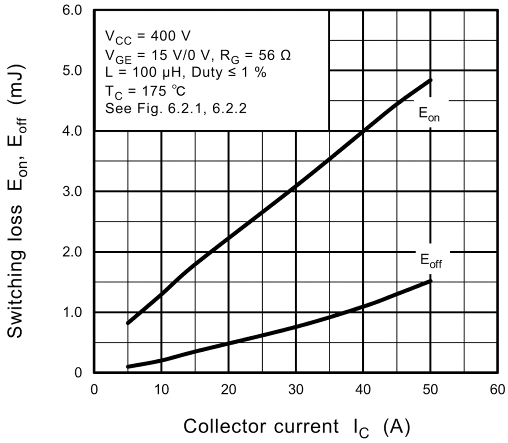



Fig. 8.16 Switching loss - $I_C$

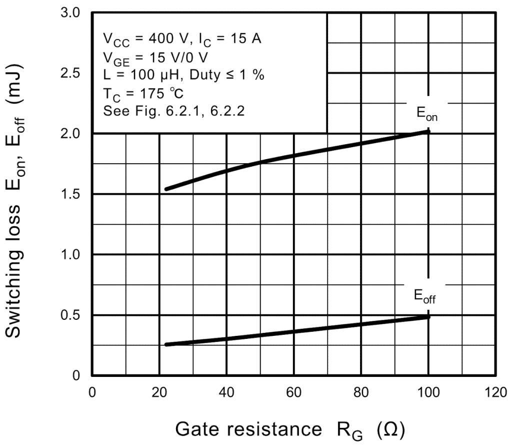



Fig. 8.17 Switching loss - $R_G$

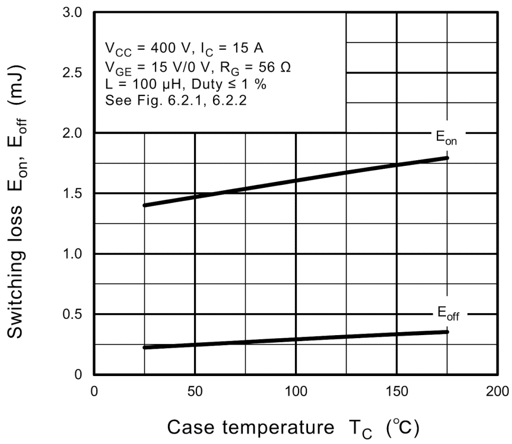



Fig. 8.18 Switching loss - $T_c$

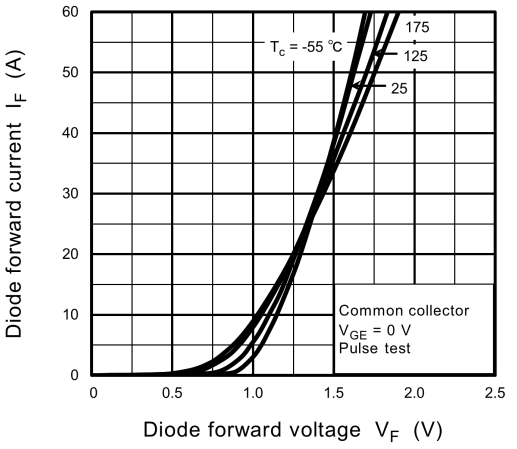



Fig. 8.19 $I_F$ - $V_F$

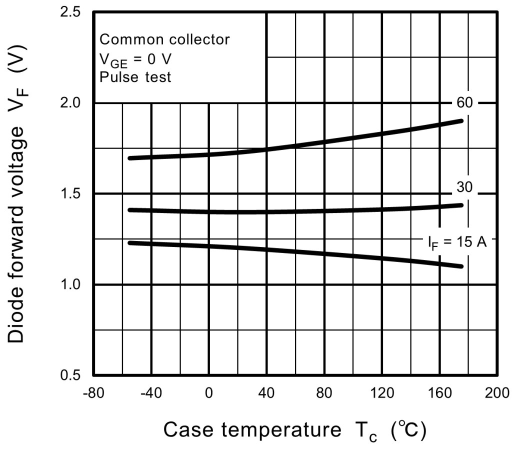



Fig. 8.20 $V_F$ - $T_c$

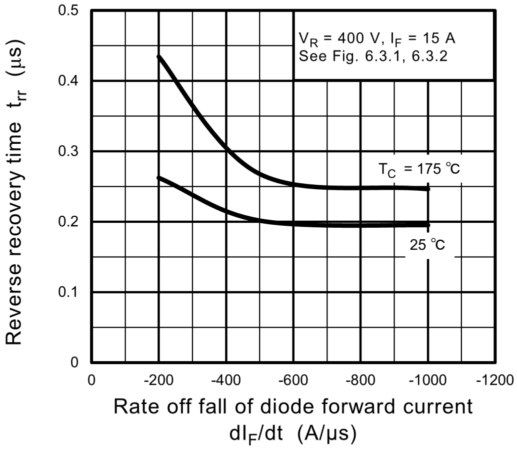



Fig. 8.21 $t_{rr}$ - $dI_F/dt$

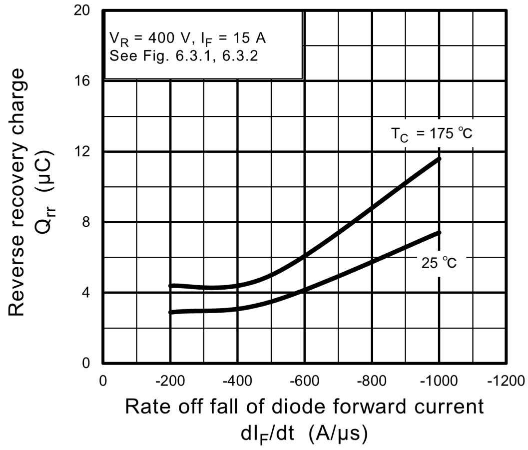



Fig. 8.22 $Q_{rr}$ - $dI_F/dt$

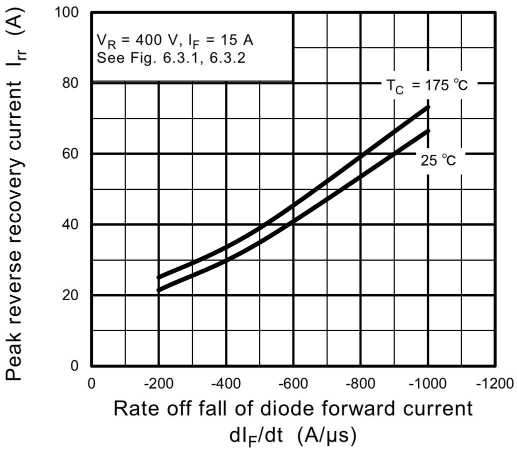



Fig. 8.23 $I_{rr}$ - $dI_F/dt$

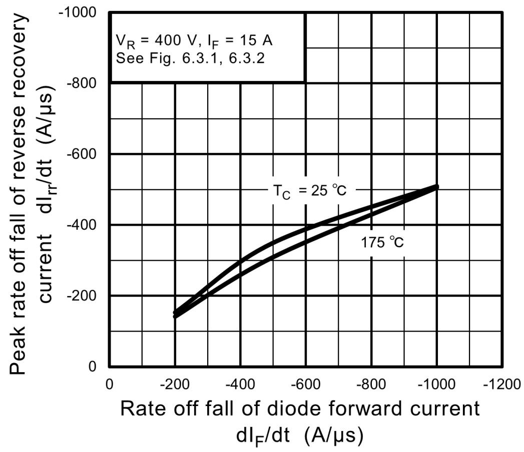



Fig. 8.24 $dI_{rr}/dt$ - $dI_F/dt$

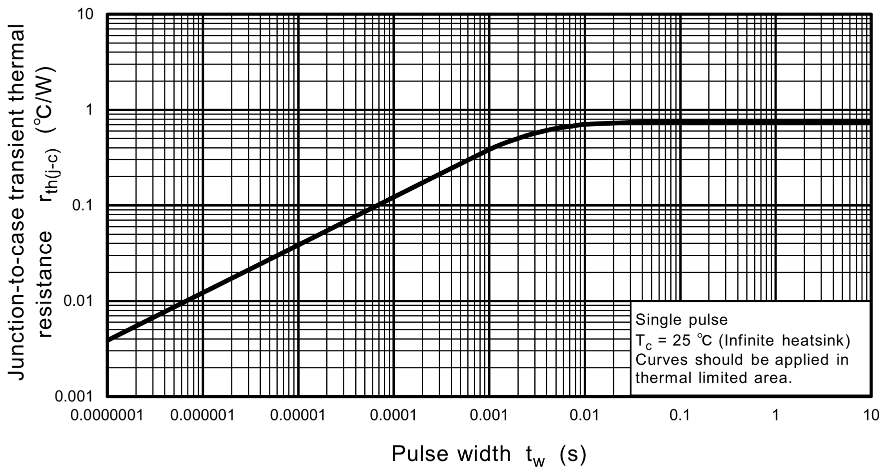



**Fig. 8.25 $r_{th(j-c)}$ - $t_w$ (Guaranteed Maximum)**

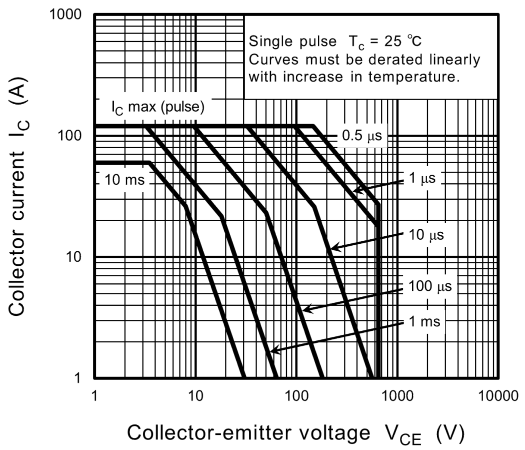
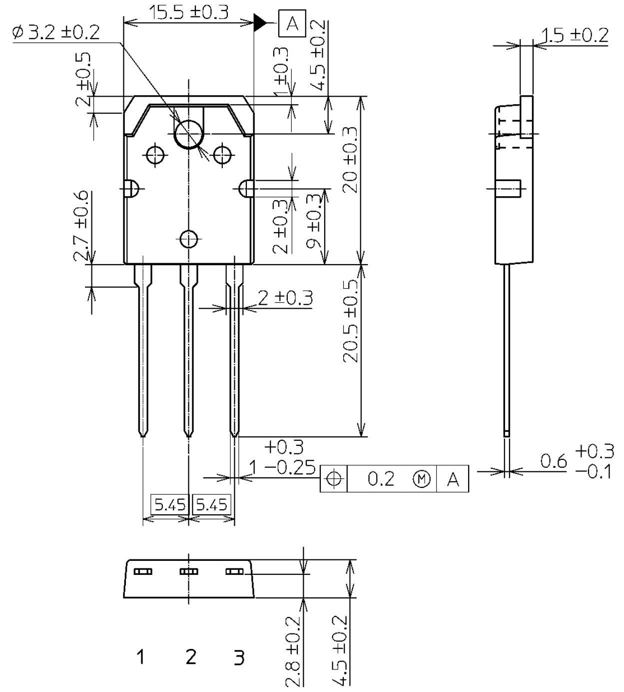



**Fig. 8.26 Safe Operating Area (Guaranteed Maximum)**

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

## Package Dimensions

Unit: mm




Weight: 4.6 g (typ.)

| Package Name(s) |
|---|
| TOSHIBA: 2-16C1S |
| Nickname: TO-3P(N) |

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