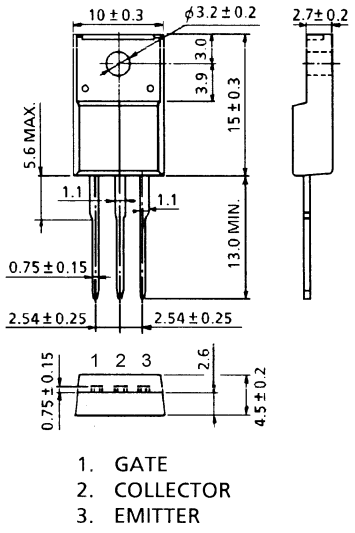
TOSHIBA Insulated Gate Bipolar Transistor Silicon N Chanenel IGBT

# GT20J321

High Power Switching Applications
Fast Switching Applications

- The 4th generation
- Enhancement-mode
- Fast switching (FS): Operating frequency up to 50 kHz (reference)
  High speed: $t_f$ = 0.04 μs (typ.)
  Low switching loss : $E_{on}$ = 0.40 mJ (typ.)
  : $E_{off}$ = 0.43 mJ (typ.)
- Low saturation voltage: $V_{CE\ (sat)}$ = 2.0 V (typ.)
- FRD included between emitter and collector

Unit: mm




1. GATE
2. COLLECTOR
3. EMITTER

| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-10R1C |

Weight: 1.7 g (typ.)

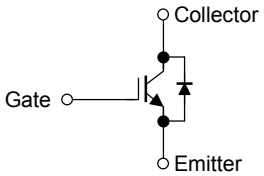
## Maximum Ratings (Ta = 25°C)

| Characteristics | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Collector-emitter voltage | | $V_{CES}$ | 600 | V |
| Gate-emitter voltage | | $V_{GES}$ | ±20 | V |
| Collector current | DC | $I_C$ | 20 | A |
| | 1 ms | $I_{CP}$ | 40 | |
| Emitter-collector forward current | DC | $I_F$ | 20 | A |
| | 1 ms | $I_{FM}$ | 40 | |
| Collector power dissipation (Tc = 25°C) | | $P_C$ | 45 | W |
| Junction temperature | | $T_j$ | 150 | °C |
| Storage temperature range | | $T_{stg}$ | −55 to 150 | °C |

## Thermal Characteristics

| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| Thermal resistance (IGBT) | $R_{th\ (j\text{-}c)}$ | 2.78 | °C/W |
| Thermal resistance (diode) | $R_{th\ (j\text{-}c)}$ | 4.23 | °C/W |

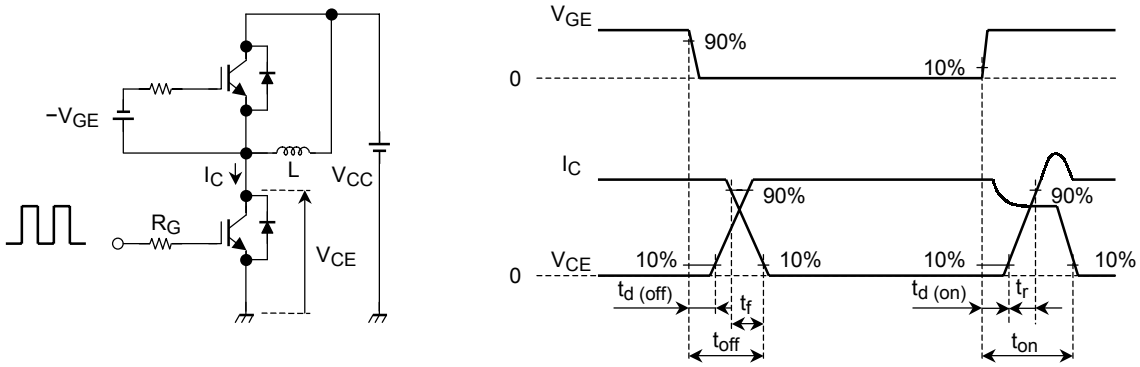
## Equivalent Circuit



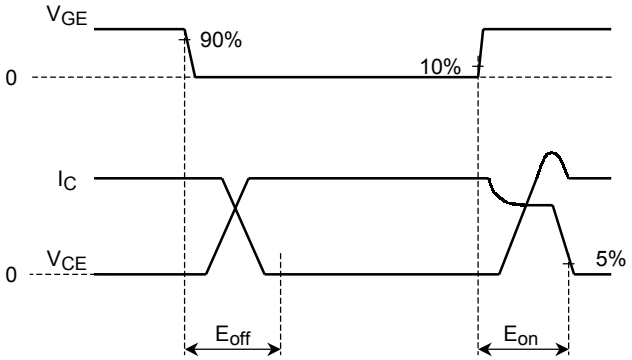
## Electrical Characteristics (Ta = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GES}$ | $V_{GE}$ = ±20 V, $V_{CE}$ = 0 | — | — | ±500 | nA |
| Collector cut-off current | | $I_{CES}$ | $V_{CE}$ = 600 V, $V_{GE}$ = 0 | — | — | 1.0 | mA |
| Gate-emitter cut-off voltage | | $V_{GE\ (OFF)}$ | $I_C$ = 2 mA, $V_{CE}$ = 5 V | 3.5 | — | 6.5 | V |
| Collector-emitter saturation voltage | | $V_{CE\ (sat)}$ | $I_C$ = 20 A, $V_{GE}$ = 15 V | — | 2.0 | 2.45 | V |
| Input capacitance | | $C_{ies}$ | $V_{CE}$ = 10 V, $V_{GE}$ = 0, f = 1 MHz | — | 3000 | — | pF |
| Switching time | Turn-on delay time | $t_{d\ (on)}$ | Inductive Load<br>$V_{CC}$ = 300 V, $I_C$ = 20 A<br>$V_{GG}$ = +15 V, $R_G$ = 33 Ω<br>(Note 1)<br>(Note 2) | — | 0.06 | — | μs |
| | Rise time | $t_r$ | | — | 0.04 | — | |
| | Turn-on time | $t_{on}$ | | — | 0.17 | — | |
| | Turn-off delay time | $t_{d\ (off)}$ | | — | 0.24 | — | |
| | Fall time | $t_f$ | | — | 0.04 | — | |
| | Turn-off time | $t_{off}$ | | — | 0.34 | — | |
| Switching loss | Turn-on switching loss | $E_{on}$ | | — | 0.40 | — | mJ |
| | Turn-off switching loss | $E_{off}$ | | — | 0.43 | — | |
| Peak forward voltage | | $V_F$ | $I_F$ = 20 A, $V_{GE}$ = 0 | — | — | 2.1 | V |
| Reverse recovery time | | $t_{rr}$ | $I_F$ = 20 A, di/dt = −100 A/μs | — | 100 | — | ns |

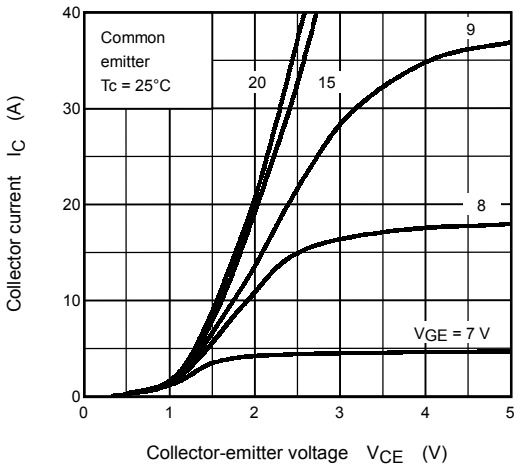
Note 1: Switching time measurement circuit and input/output waveforms



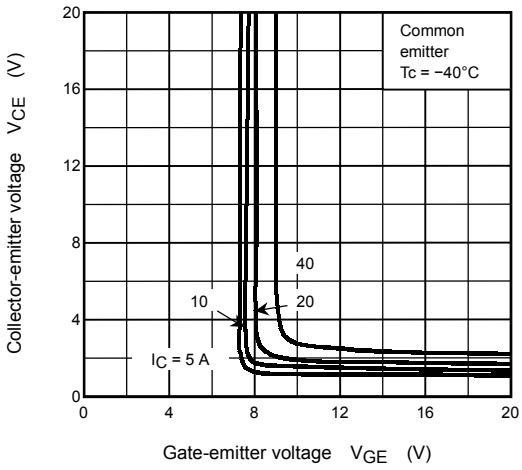

Note 2: Switching loss measurement waveforms



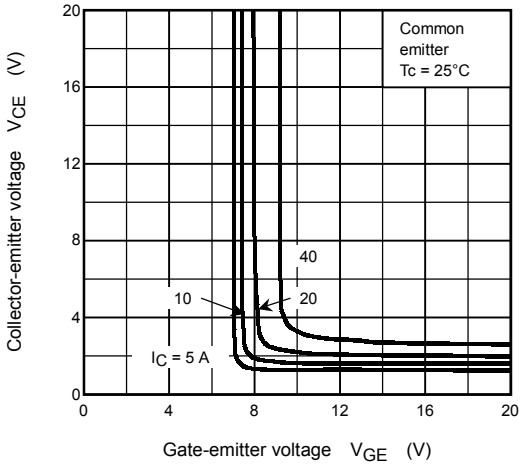
$I_C - V_{CE}$



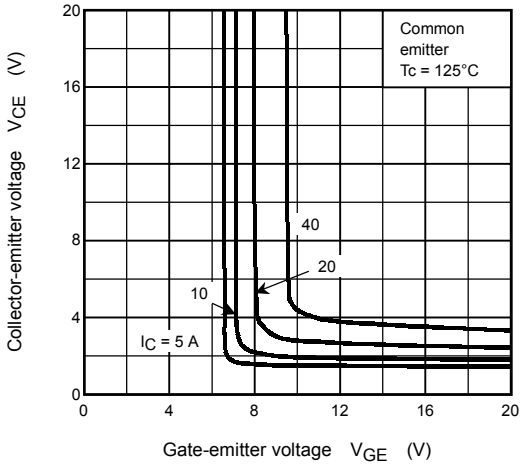

$V_{CE} - V_{GE}$



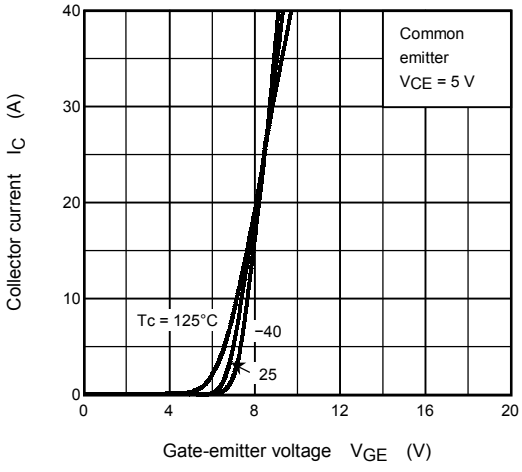

$V_{CE} - V_{GE}$



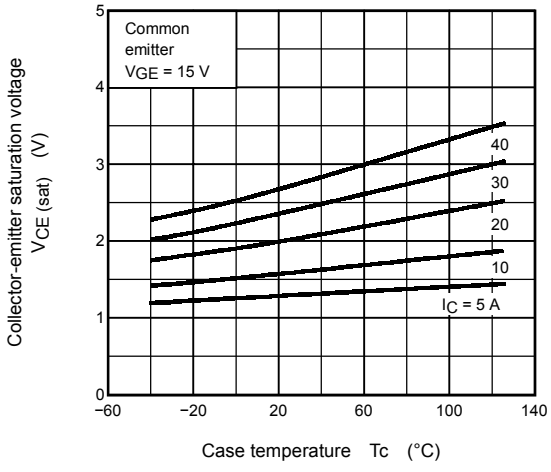

$V_{CE} - V_{GE}$



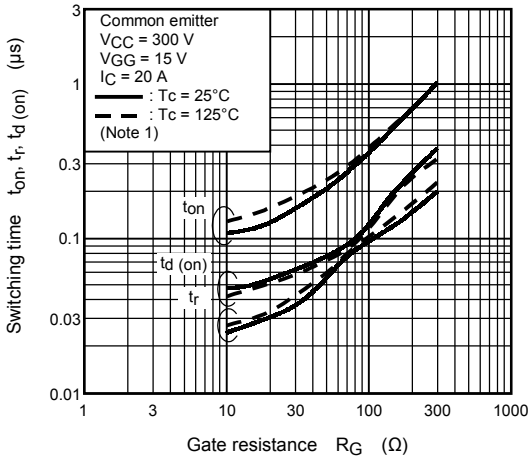

$I_C - V_{GE}$



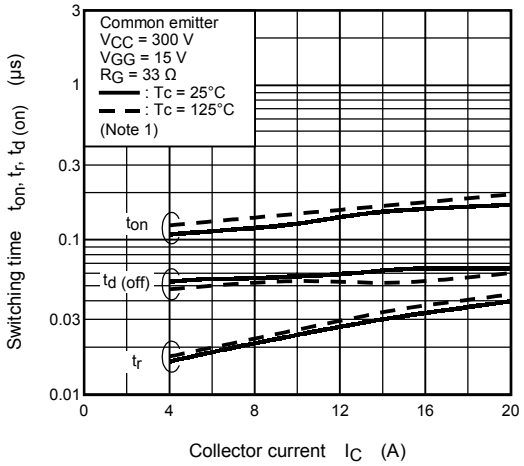

$V_{CE\ (sat)} - Tc$



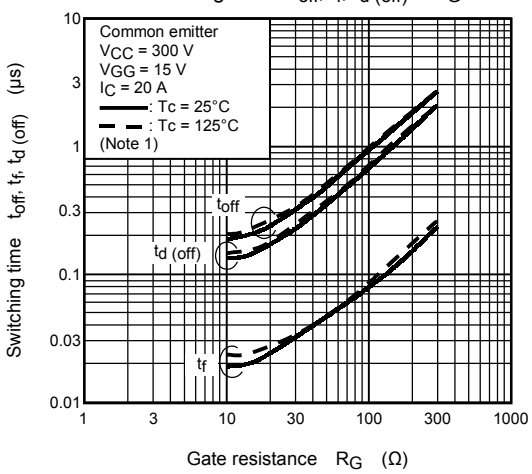
Switching time $t_{on}$, $t_r$, $t_{d\ (on)}$ – $R_G$



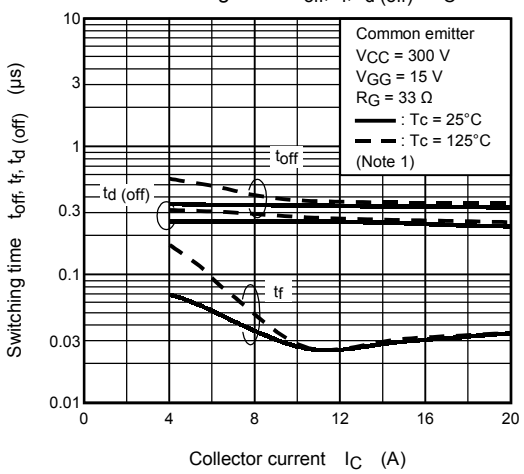

Switching time $t_{on}$, $t_r$, $t_{d\ (on)}$ – $I_C$



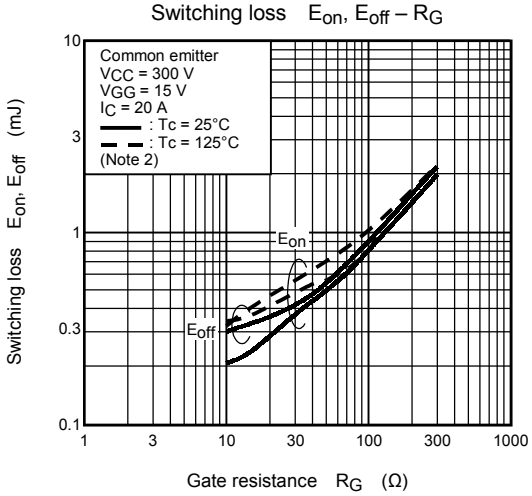

Switching time $t_{off}$, $t_f$, $t_{d\ (off)}$ – $R_G$



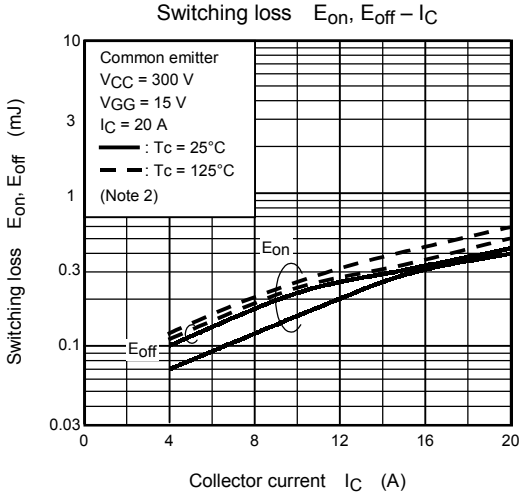

Switching time $t_{off}$, $t_f$, $t_{d\ (off)}$ – $I_C$



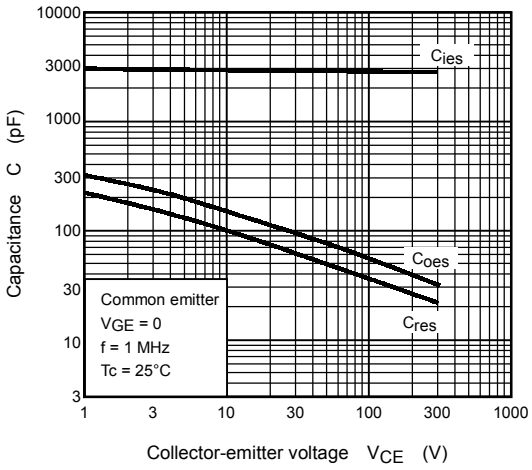

Switching loss $E_{on}$, $E_{off}$ – $R_G$



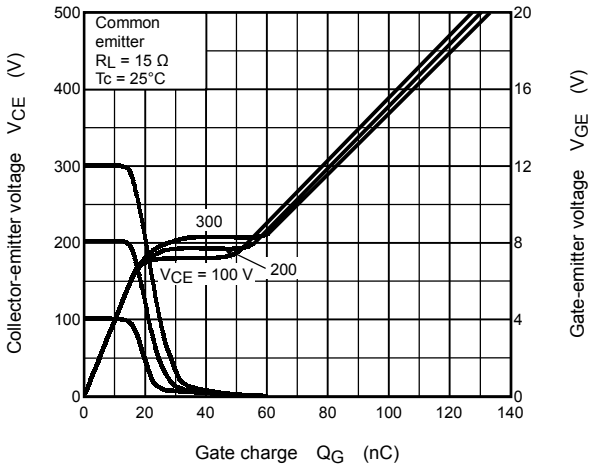

Switching loss $E_{on}$, $E_{off}$ – $I_C$



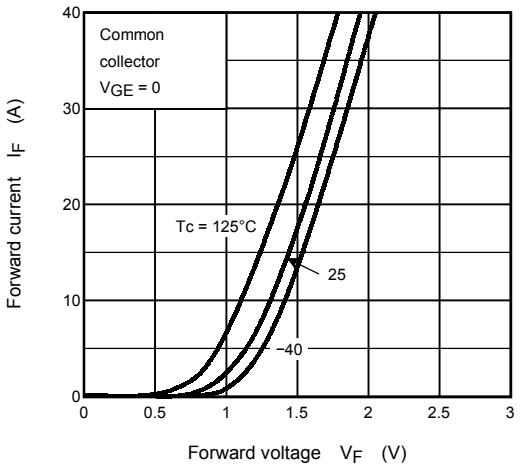
$C - V_{CE}$



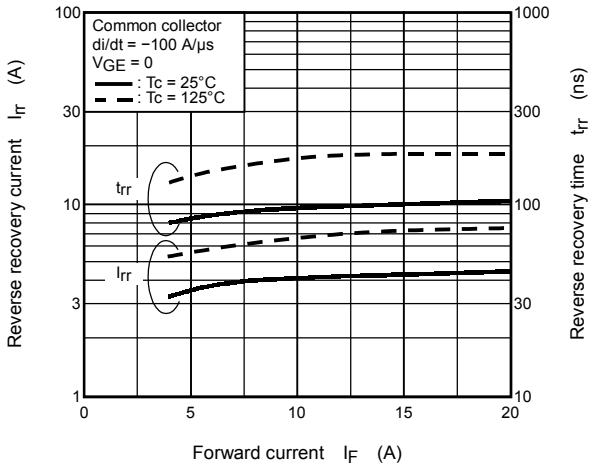

$V_{CE}, V_{GE} - Q_G$



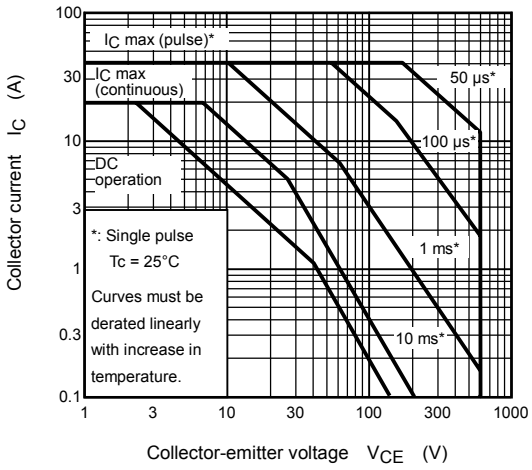

$I_F - V_F$



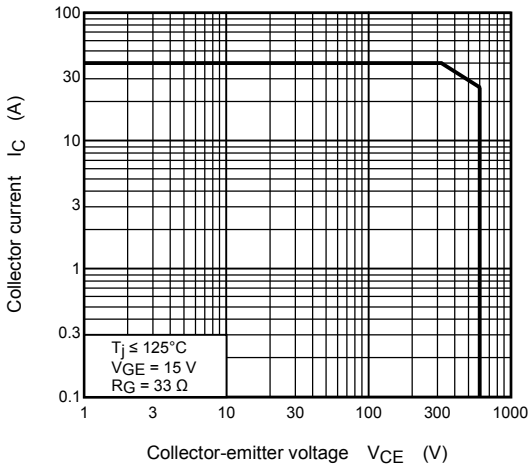

$t_{rr}, I_{rr} - I_F$

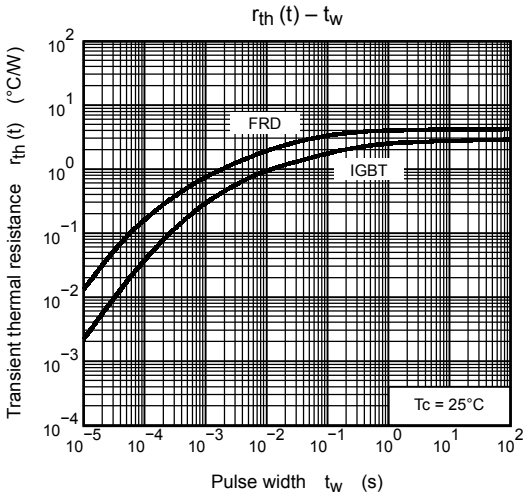



Safe Operating Area




Reverse Bias SOA





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