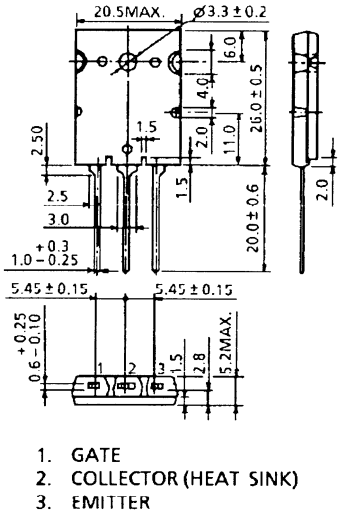
TOSHIBA Insulated Gate Bipolar Transistor Silicon N Channel IGBT

# GT40T301

Parallel Resonance Inverter Switching Applications

- FRD included between emitter and collector
- Enhancement mode type
- High speed IGBT : $t_f$ = 0.25 μs (typ.) ($I_C$ = 40 A)
  FRD : $t_{rr}$ = 0.7 μs (typ.) (di/dt = −20 A/μs)
- Low saturation voltage: $V_{CE\ (sat)}$ = 3.7 V (typ.) ($I_C$ = 40 A)

Unit: mm




1. GATE
2. COLLECTOR (HEAT SINK)
3. EMITTER

| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-21F2C |

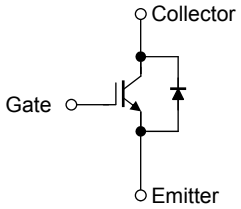
Weight: 9.75 g (typ.)

## Absolute Maximum Ratings (Ta = 25°C)

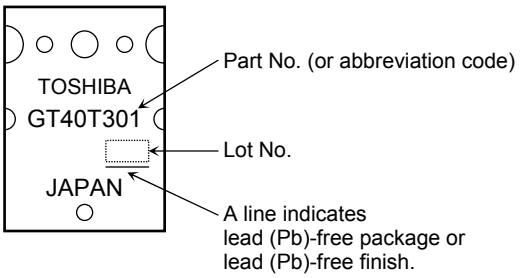
| Characteristics | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Collector-emitter voltage | | $V_{CES}$ | 1500 | V |
| Gate-emitter voltage | | $V_{GES}$ | ±25 | V |
| Collector current | DC | $I_C$ | 40 | A |
| | 1 ms | $I_{CP}$ | 80 | |
| Emitter-collector forward current | DC | $I_{ECF}$ | 30 | A |
| | 1 ms | $I_{ECPF}$ | 80 | |
| Collector power dissipation (Tc = 25°C) | | $P_C$ | 200 | W |
| Junction temperature | | $T_j$ | 150 | °C |
| Storage temperature range | | $T_{stg}$ | −55~150 | °C |

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).

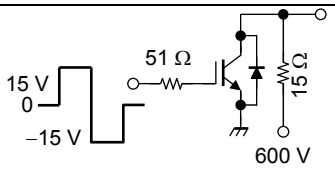
## Equivalent Circuit



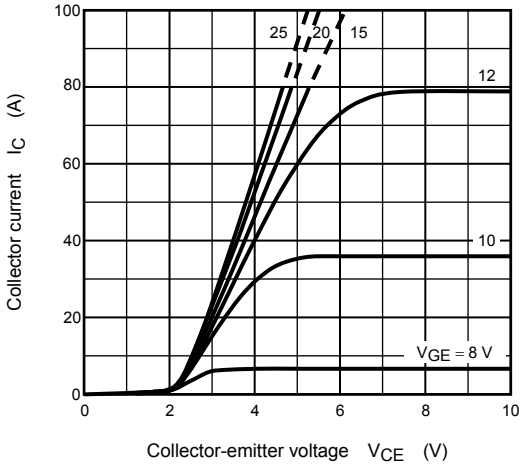

## Marking



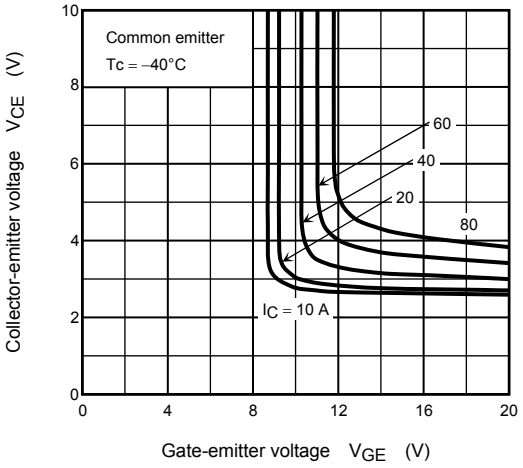
## Electrical Characteristics (Ta = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GES}$ | $V_{GE}$ = ±25 V, $V_{CE}$ = 0 | — | — | ±500 | nA |
| Collector cut-off current | | $I_{CES}$ | $V_{CE}$ = 1500 V, $V_{GE}$ = 0 | — | — | 1.0 | mA |
| Gate-emitter cut-off voltage | | $V_{GE\ (OFF)}$ | $I_C$ = 40 mA, $V_{CE}$ = 5 V | 4.0 | — | 7.0 | V |
| Collector-emitter saturation voltage | | $V_{CE\ (sat)}$ | $I_C$ = 40 A, $V_{GE}$ = 15 V | — | 3.7 | 5.0 | V |
| Input capacitance | | $C_{ies}$ | $V_{CE}$ = 10 V, $V_{GE}$ = 0, f = 1 MHz | — | 2900 | — | pF |
| Switching time | Rise time | $t_r$ |  | — | 0.40 | — | μs |
| | Turn-on time | $t_{on}$ | | — | 0.45 | — | |
| | Fall time | $t_f$ | | — | 0.23 | 0.40 | |
| | Turn-off time | $t_{off}$ | | — | 0.6 | — | |
| Emitter-collector forward voltage | | $V_{ECF}$ | $I_{ECF}$ = 30 A, $V_{GE}$ = 0 | — | 1.9 | 2.5 | V |
| Reverse recovery time | | $t_{rr}$ | $I_{ECF}$ = 30 A, $V_{GE}$ = 0, di/dt = −20 A/μs | — | 0.7 | 3.0 | μs |
| Thermal resistance | | $R_{th\ (j\text{-}c)}$ | IGBT | — | — | 0.625 | °C/W |
| | | | Diode | — | — | 1.25 | |

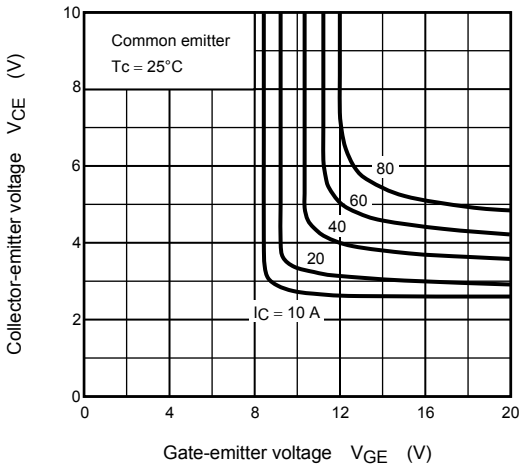
$I_C - V_{CE}$



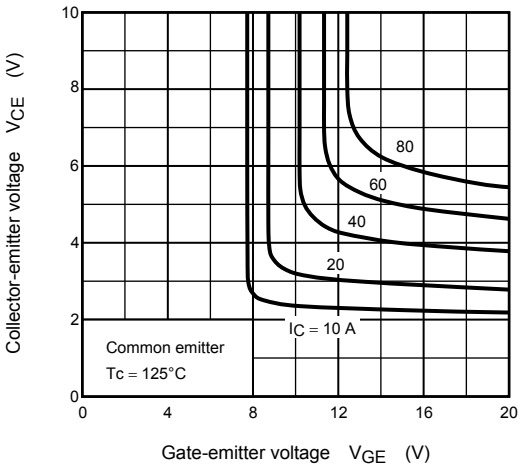

$V_{CE} - V_{GE}$



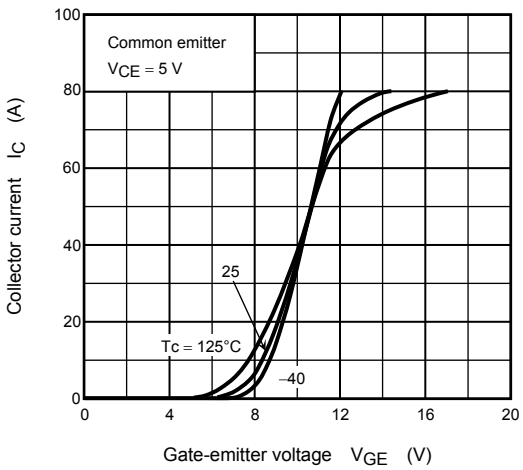

$V_{CE} - V_{GE}$



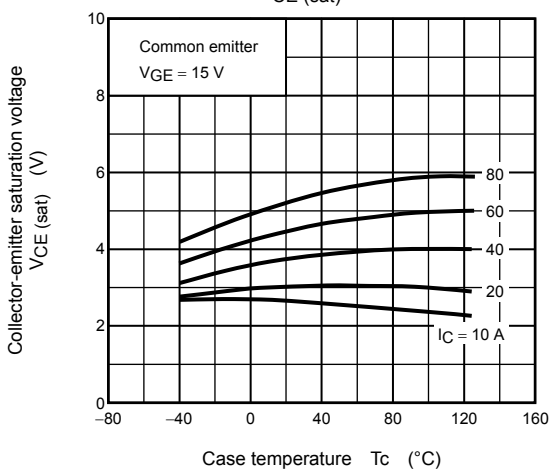

$V_{CE} - V_{GE}$



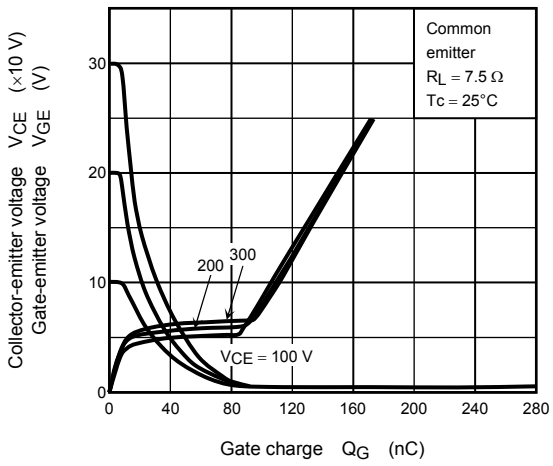

$I_C - V_{GE}$



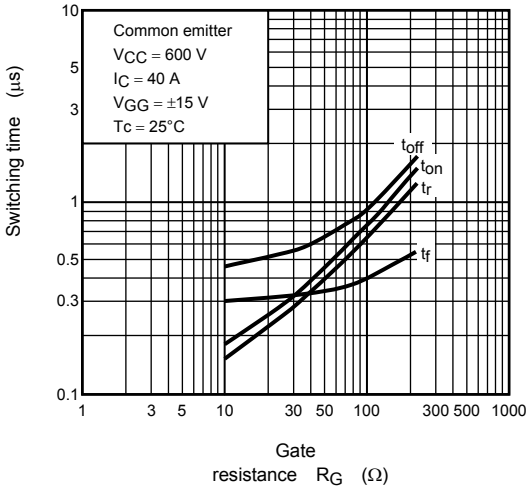

$V_{CE\ (sat)} - Tc$



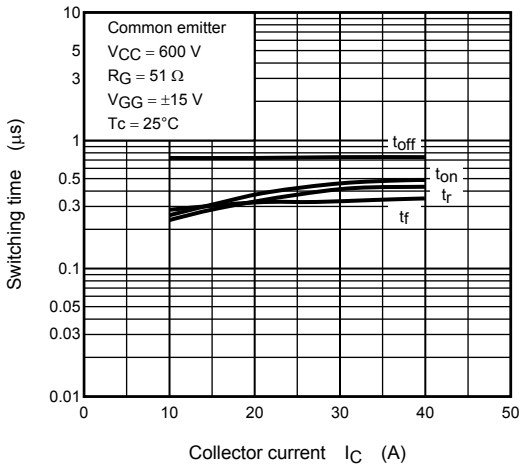
$V_{CE}$, $V_{GE}$ – $Q_G$



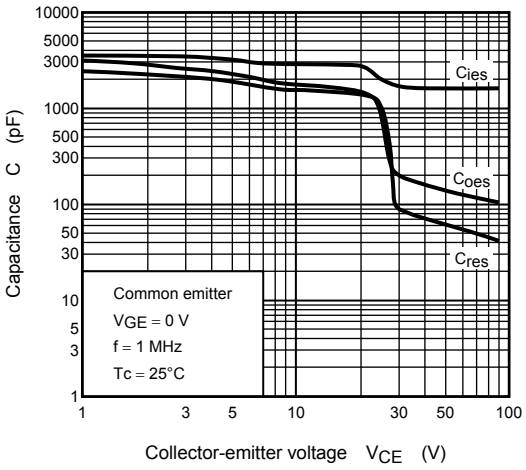

Switching time – $R_G$



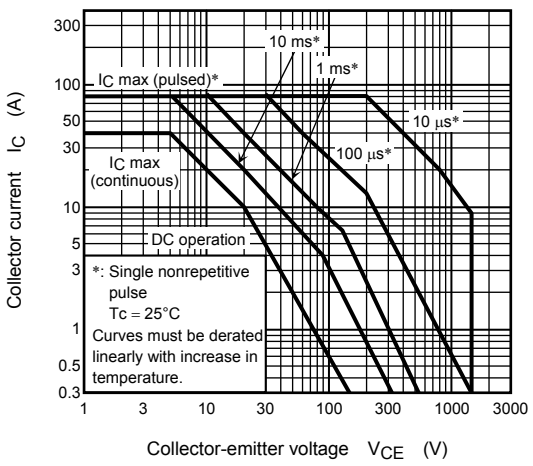

Switching time – $I_C$



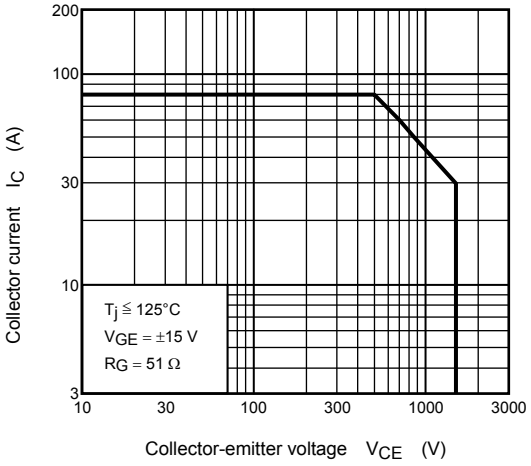

C – $V_{CE}$



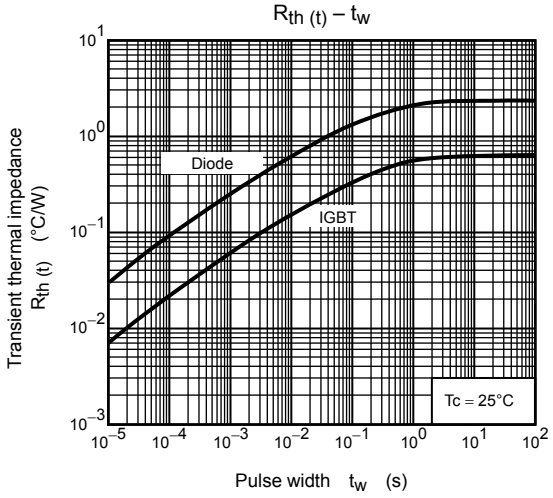

Safe operating area



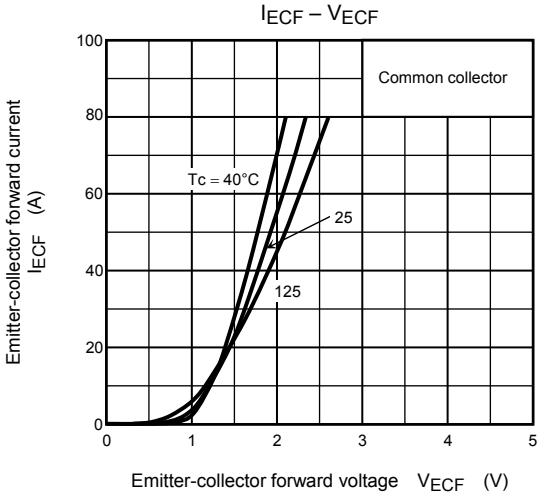

Reverse bias SOA



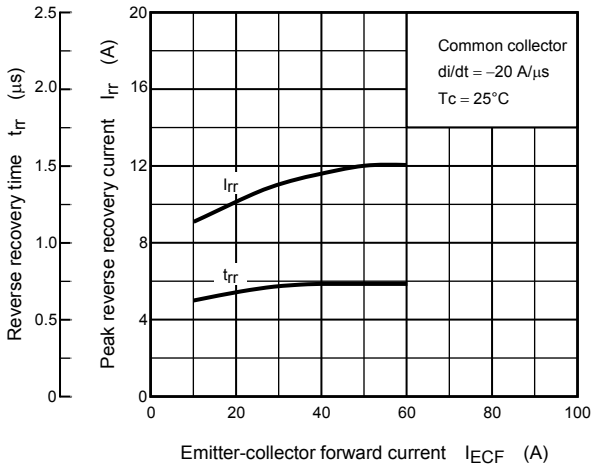
$R_{th\ (t)} - t_w$



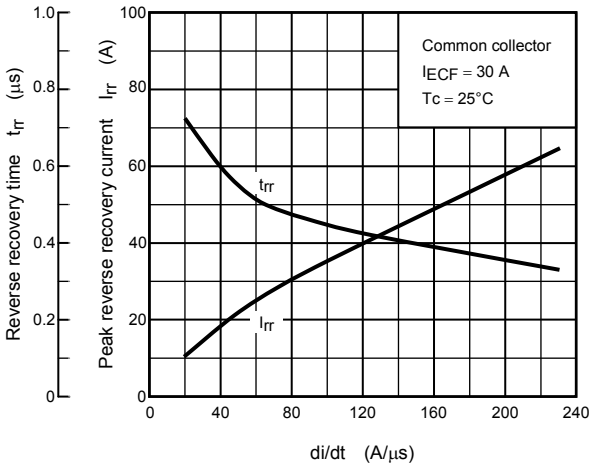

$I_{ECF} - V_{ECF}$




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




$I_{rr}, t_{rr} - di/dt$



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