TOSHIBA Insulated Gate Bipolar Transistor Silicon N Channel IGBT

# GT15J331

High Power Switching Applications

Motor Control Applications

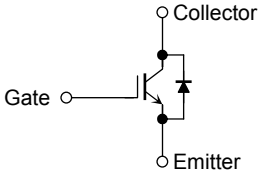
- Fourth-generation IGBT
- Enhancement mode type
- High speed: $t_f$ = 0.10 μs (typ.)
- Low saturation voltage: $V_{CE\ (sat)}$ = 1.75 V (typ.)
- FRD included between emitter and collector

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

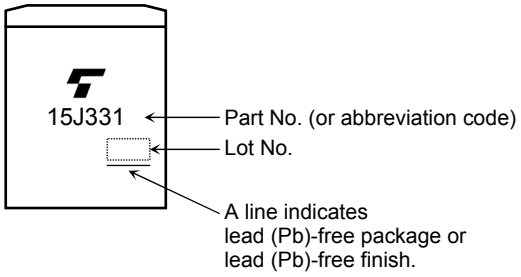
| Characteristic | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Collector-emitter voltage | | $V_{CES}$ | 600 | V |
| Gate-emitter voltage | | $V_{GES}$ | ±20 | V |
| Collector current | DC | $I_C$ | 15 | A |
| | 1 ms | $I_{CP}$ | 30 | |
| Emitter-collector forward current | DC | $I_F$ | 15 | A |
| | 1 ms | $I_{FM}$ | 30 | W |
| Collector power dissipation (Tc = 25°C) | | $P_C$ | 70 | 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

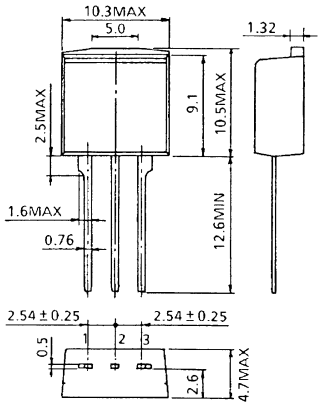



## Marking




Unit: mm

TO-220FL

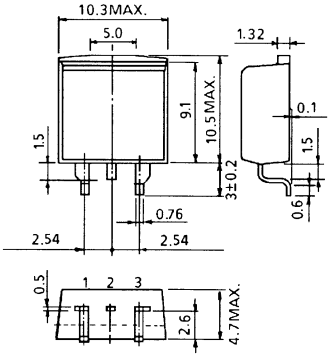



1. GATE
2. COLLECTOR (HEAT SINK)
3. EMITTER

| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-10S1C |

Weight: 1.5 g

TO-220SM




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

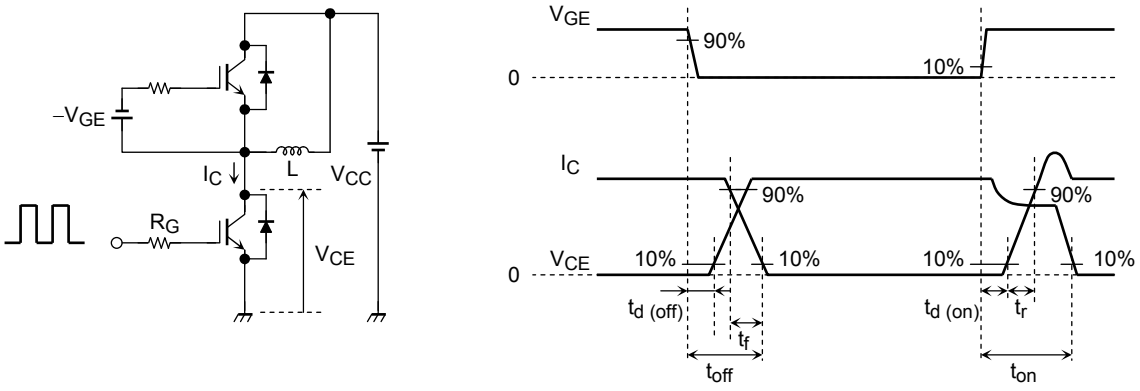
| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-10S2C |

Weight: 1.4 g

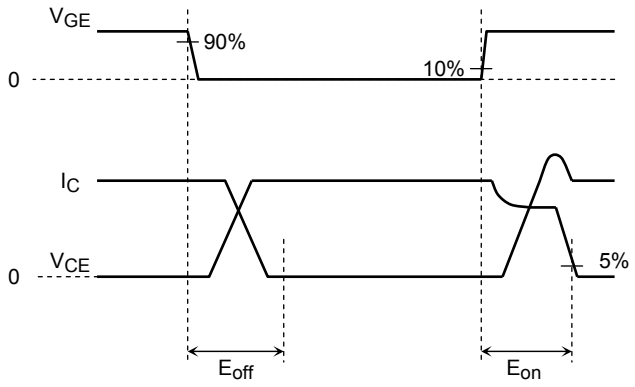
## Electrical Characteristics (Ta = 25°C)

| Characteristic | | 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 | | $V_{GE\ (OFF)}$ | $I_C$ = 1.5 mA, $V_{CE}$ = 5 V | 4.5 | — | 7.5 | V |
| Collector-emitter saturation voltage | | $V_{CE\ (sat)}$ | $I_C$ = 15 A, $V_{GE}$ = 15 V | — | 1.75 | 2.3 | V |
| Input capacitance | | $C_{ies}$ | $V_{CE}$ = 20 V, $V_{GE}$ = 0, f = 1 MHz | — | 2400 | — | pF |
| Switching time | Rise time | $t_r$ | Inductive Load<br>$V_{CC}$ = 300 V, $I_C$ = 15 A<br>$V_{GG}$ = 15 V, $R_G$ = 43 Ω<br>(Note1) | — | 0.04 | — | μs |
| | Turn-on time | $t_{on}$ | | — | 0.22 | — | |
| | Fall time | $t_f$ | | — | 0.10 | 0.23 | |
| | Turn-off time | $t_{off}$ | | — | 0.37 | — | |
| Peak forward voltage | | $V_F$ | $I_F$ = 15 A, $V_{GE}$ = 0 | — | — | 2.0 | V |
| Reverse recovery time | | $t_{rr}$ | $I_F$ = 15 A, di/dt = −100 A/μs | — | — | 200 | ns |
| Thermal resistance (IGBT) | | $R_{th\ (j\text{-}c)}$ | — | — | — | 1.79 | °C/W |
| Thermal resistance (Diode) | | $R_{th\ (j\text{-}c)}$ | — | — | — | 3.45 | °C/W |

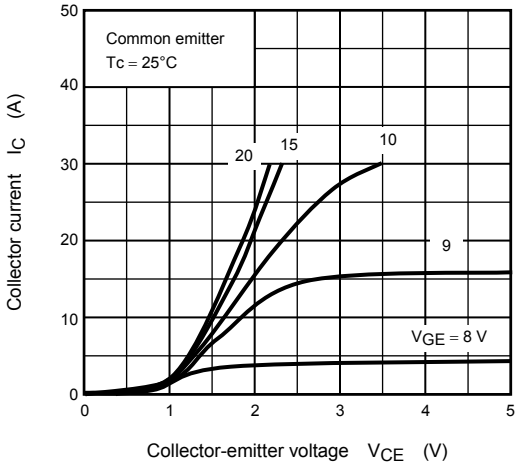
Note1: Switching time measurement circuit and input/output waveforms



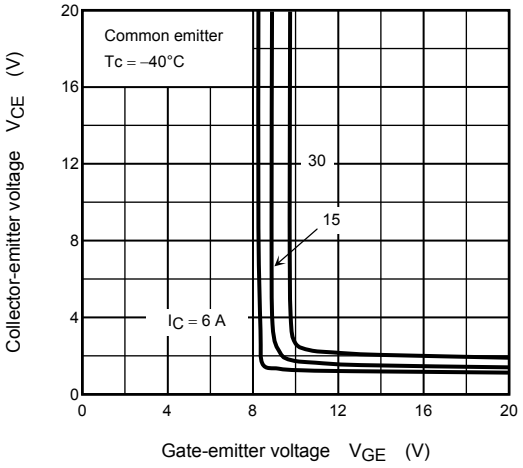

Note2: Switching loss measurement waveforms



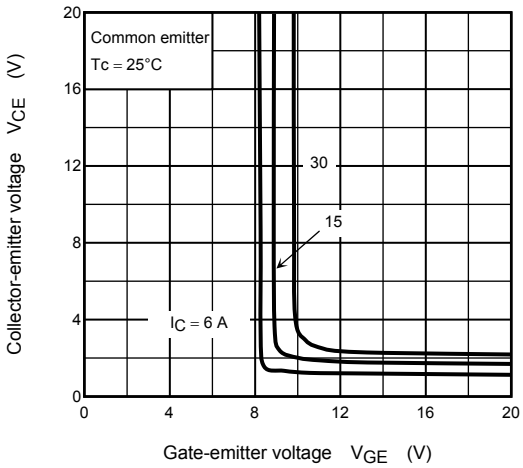
$I_C - V_{CE}$



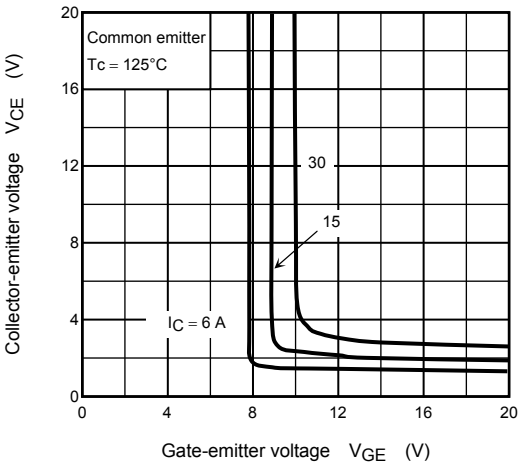

$V_{CE} - V_{GE}$



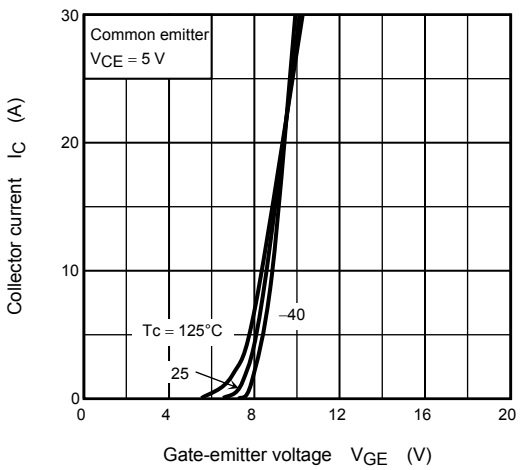

$V_{CE} - V_{GE}$



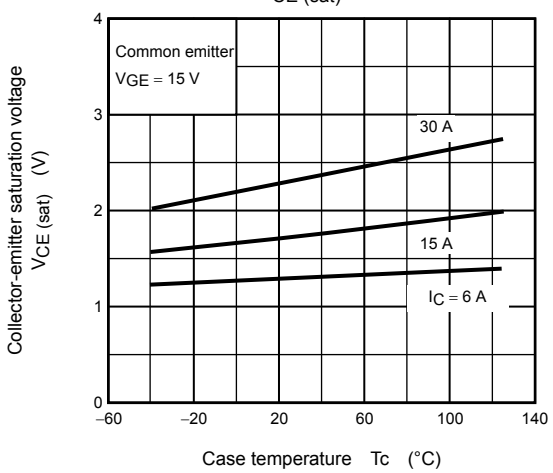

$V_{CE} - V_{GE}$



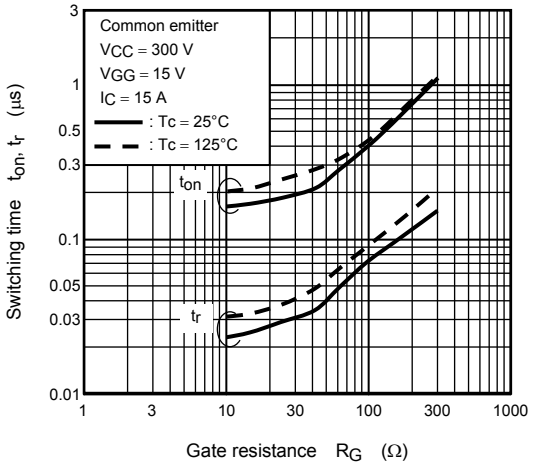

$I_C - V_{GE}$



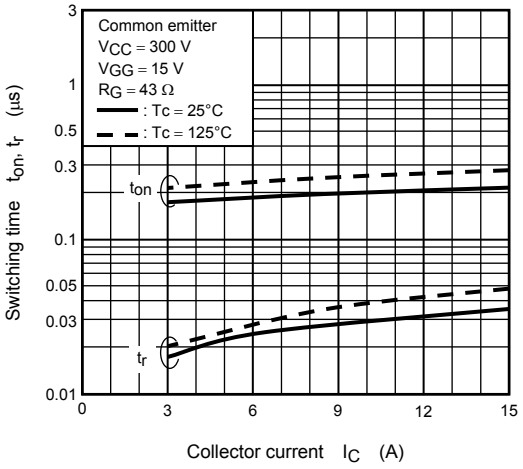

$V_{CE\ (sat)} - Tc$



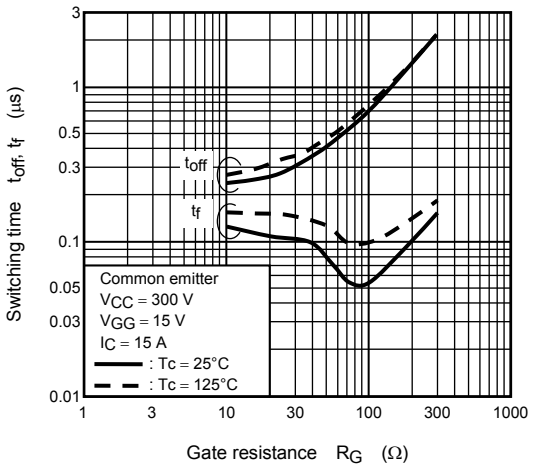
Switching time $t_{on}$, $t_r$ – $R_G$



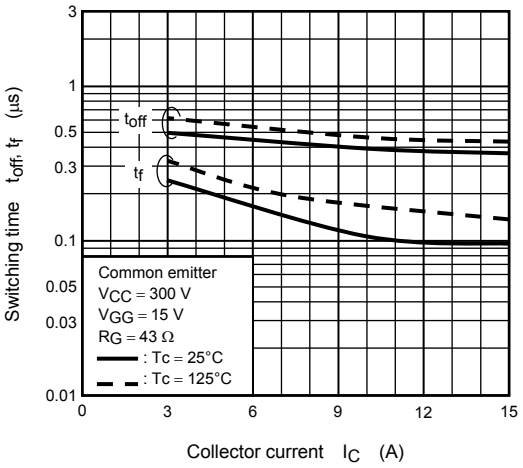

Switching time $t_{on}$, $t_r$ – $I_C$



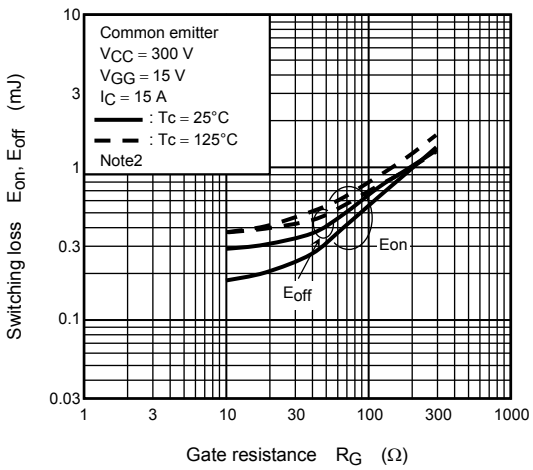

Switching time $t_{off}$, $t_f$ – $R_G$



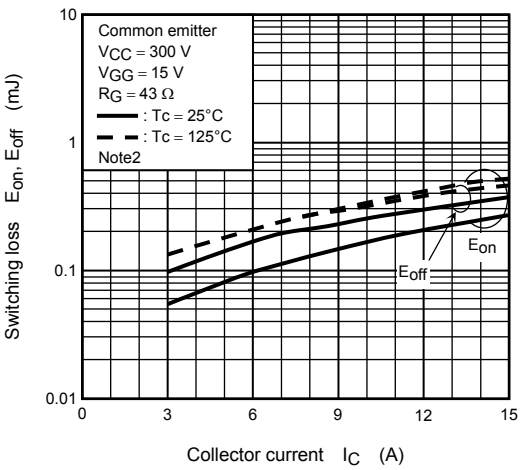

Switching time $t_{off}$, $t_f$ – $I_C$



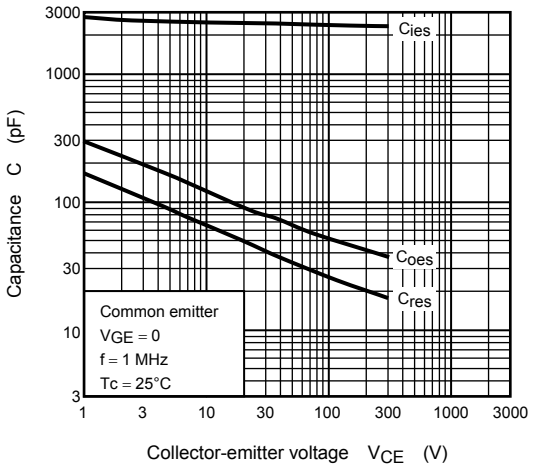

Switching loss $E_{on}$, $E_{off}$ – $R_G$



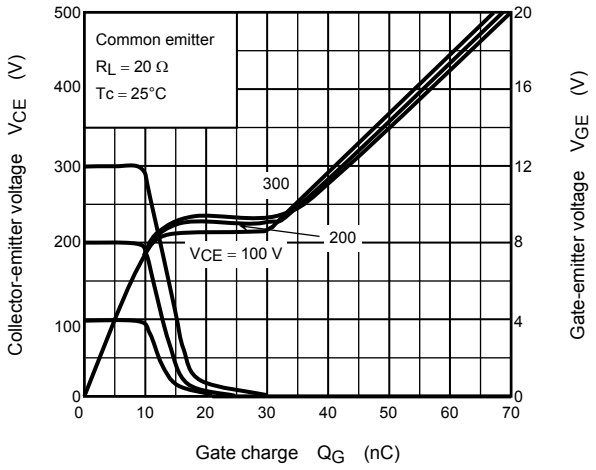

Switching loss $E_{on}$, $E_{off}$ – $I_C$



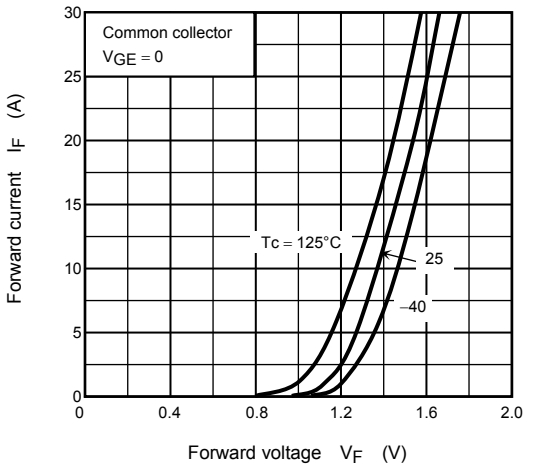
$C - V_{CE}$



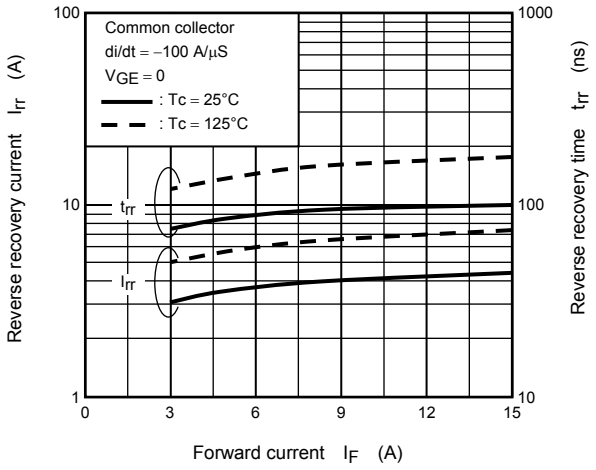

$V_{CE}, V_{GE} - Q_G$



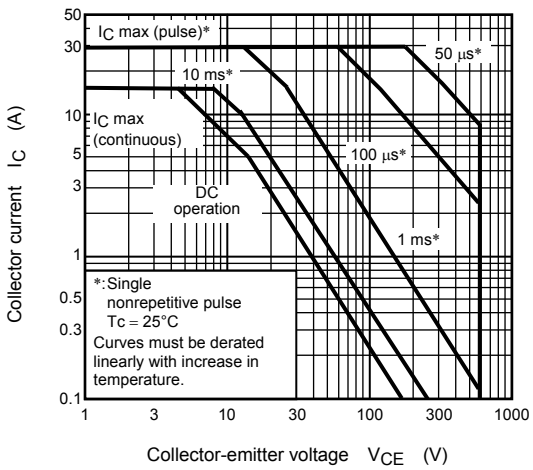

$I_F - V_F$



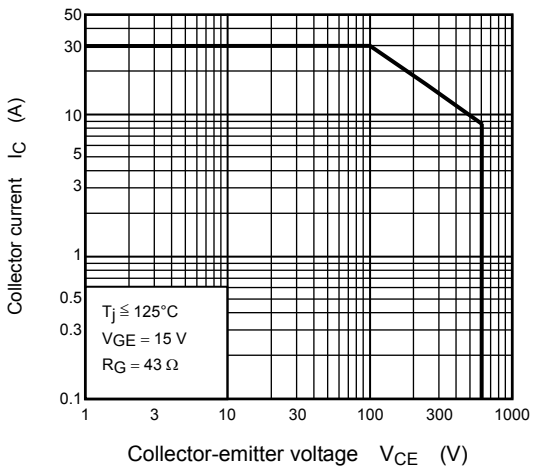

$t_{rr}, I_{rr} - IF$

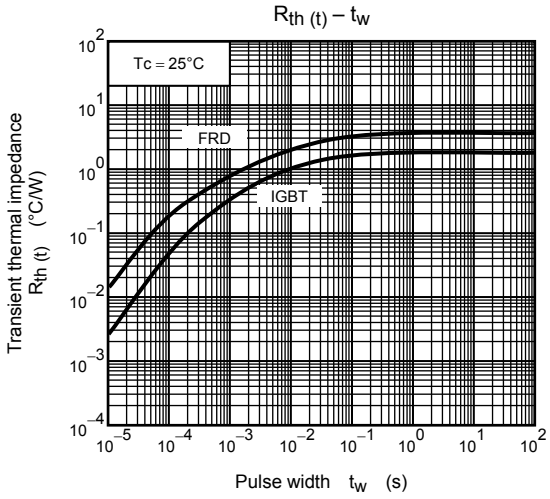



Safe operating area




Reverse bias SOA




$R_{th\ (t)} - t_w$
Tc = 25°C
FRD
IGBT
Transient thermal impedance $R_{th}$ (t) (°C/W)
Pulse width $t_w$ (s)

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20070701-EN

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