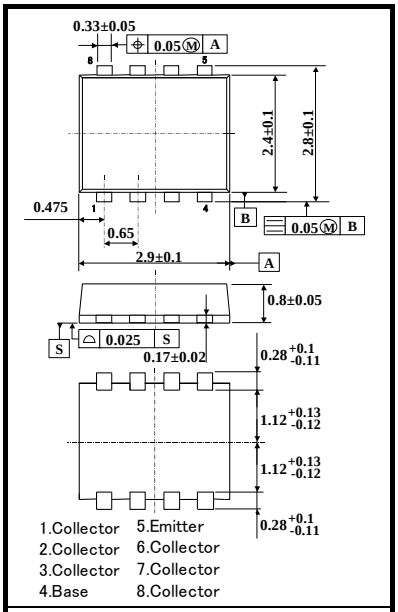
TOSHIBA Transistor Silicon NPN Epitaxial Type

# TPCP8504

High Speed Switching Applications
DC-DC Converter Applications

- High DC current gain : $h_{FE}$ = 400 to 1000 ($I_C$ = 0.2 A)
- Low collector-emitter saturation : $V_{CE\ (sat)}$ = 0.12 V (max)
- High-speed switching : $t_f$ = 25 ns (typ.)

Unit: mm




| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-3V1A |

Weight: 0.017 g (typ.)

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

| Characteristics | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Collector-base voltage | | $V_{CBO}$ | 20 | V |
| Collector-emitter voltage | | $V_{CEO}$ | 10 | V |
| Emitter-base voltage | | $V_{EBO}$ | 7 | V |
| Collector current | DC (Note 1) | $I_C$ | 2.0 | A |
| | Pulse (Note 1 ) | $I_{CP}$ | 3.5 | |
| Base current | | $I_B$ | 0.2 | A |
| Collector power dissipation (Note 2) | t = 10s | $P_C$ | 2.8 | W |
| | DC | | 1.2 | |
| Junction temperature | | $T_j$ | 150 | °C |
| Storage temperature range | | $T_{stg}$ | −55 to 150 | °C |

Note 1: Please use devices on condition that the junction temperature is below 150°C.

Note 2: Mounted on FR4 board (glass epoxy, 1.6 mm thick, Cu area: 645 $mm^2$)

Note 3: 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).

**Figure 1. Circuit configuration (top view)**

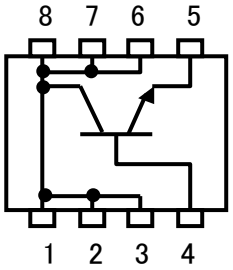
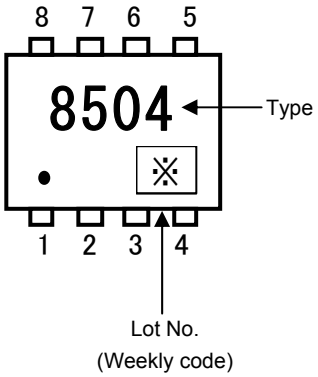
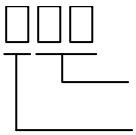



**Figure 2. Marking (Note 4)**




Note 4: ● on lower left on the marking indicates Pin 1.

※ Weekly code: (Three digits)



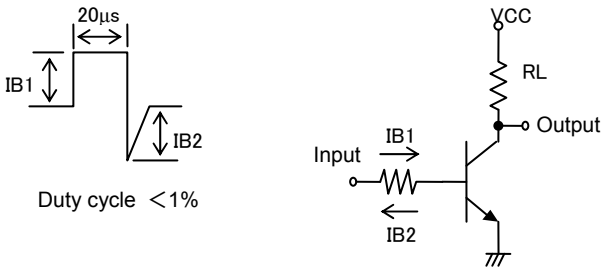
Week of manufacture
(01 for first week of year, continues up to 52 or 53)

Year of manufacture
(One low-order digits of calendar year)

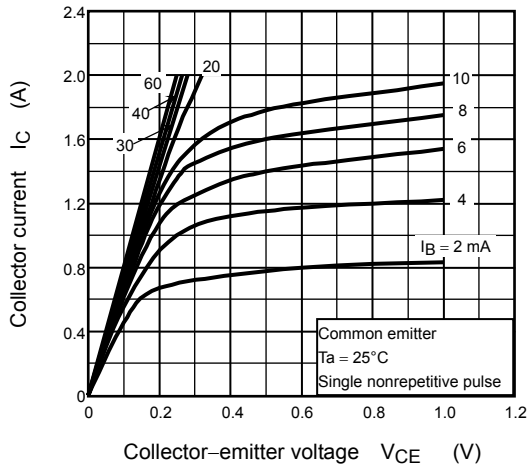
## Electrical Characteristics (Ta = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Collector cut-off current | | $I_{CBO}$ | $V_{CB}$ = 20 V, $I_E$ = 0 | — | — | 100 | nA |
| Emitter cut-off current | | $I_{EBO}$ | $V_{EB}$ = 7 V, $I_C$ = 0 | — | — | 100 | nA |
| Collector-emitter breakdown voltage | | $V_{(BR)\ CEO}$ | $I_C$ = 10 mA, $I_B$ = 0 | 10 | — | — | V |
| DC current gain | | $h_{FE}$ (1) | $V_{CE}$ = 2 V, $I_C$ = 0.2 A | 400 | — | 1000 | |
| | | $h_{FE}$ (2) | $V_{CE}$ = 2 V, $I_C$ = 0.6 A | 200 | — | — | |
| Collector-emitter saturation voltage | | $V_{CE\ (sat)}$ | $I_C$ = 0.6 A, $I_B$ = 12 mA | — | — | 0.12 | V |
| Base-emitter saturation voltage | | $V_{BE\ (sat)}$ | $I_C$ = 0.6 A, $I_B$ = 12 mA | — | — | 1.1 | V |
| Collector output capacitance | | $C_{ob}$ | $V_{CB}$ = 10 V, $I_E$ = 0, f = 1MHz | — | 10 | — | pF |
| Switching time | Rise time | $t_r$ | See Figure 3 circuit diagram<br>$V_{CC} \simeq$ 6 V, $R_L$ = 10 Ω<br>$I_{B1} = -I_{B2}$ = 12 mA | — | 60 | — | ns |
| | Storage time | $t_{stg}$ | | — | 215 | — | |
| | Fall time | $t_f$ | | — | 25 | — | |

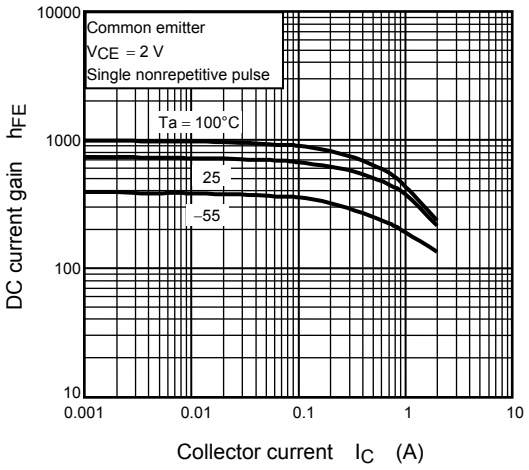
**Figure 3. Switching Time Test Circuit & Timing Chart**



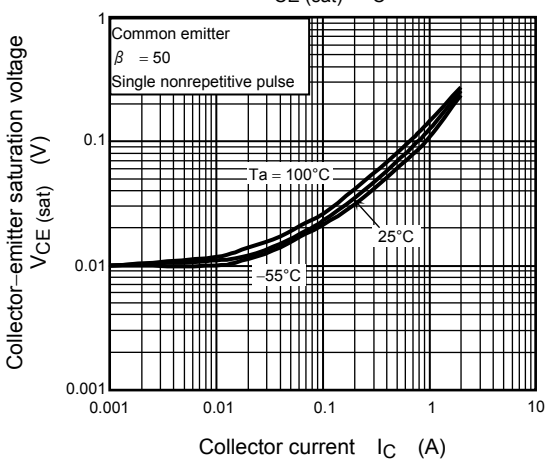
$I_C - V_{CE}$



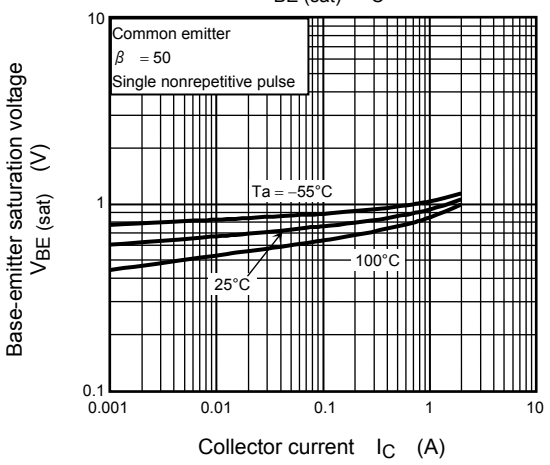

$h_{FE} - I_C$




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

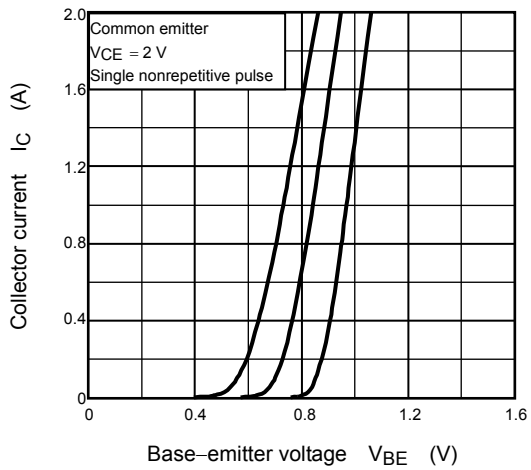



$V_{BE\ (sat)} - I_C$

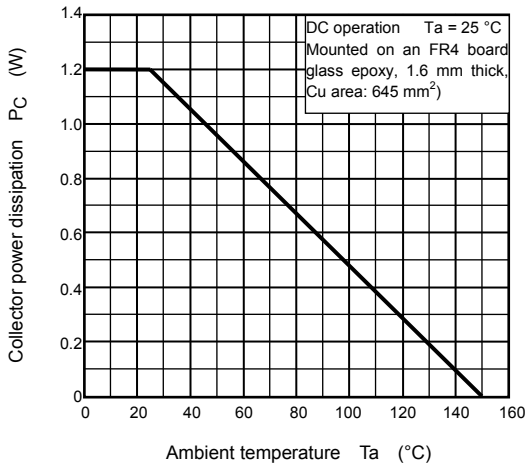



Ta = 100°C 25 –55

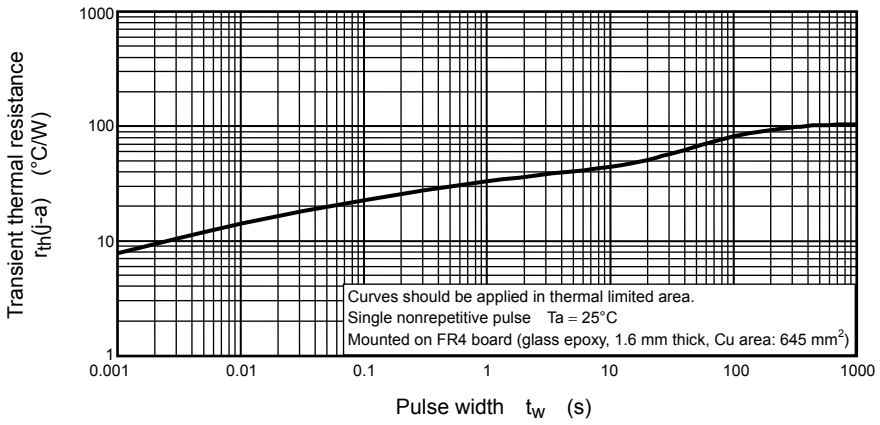
$I_C - V_{BE}$



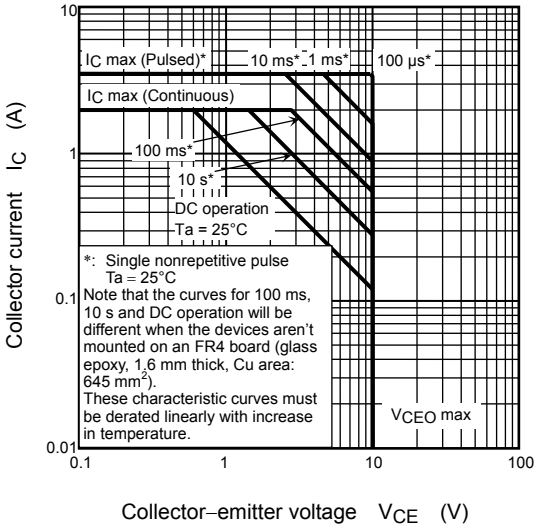

$P_C - Ta$



$r_{th} - t_w$




Safe operating area



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