TOSHIBA Transistor  Silicon NPN Epitaxial Type (PCT process)

2SC3303

High Current Switching Applications
DC-DC Converter Applications

- Low collector saturation voltage: $V_{CE\ (sat)} = 0.4\ V$ (max) ($I_C = 3\ A$)
- High speed switching time: $t_{stg} \approx 1.0\ \mu s$ (typ.)

Absolute Maximum Ratings ($T_a = 25^\circ C$)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage</td>
<td>$V_{CBO}$</td>
<td>100</td>
<td>V</td>
</tr>
<tr>
<td>Collector-emitter voltage</td>
<td>$V_{CEO}$</td>
<td>80</td>
<td>V</td>
</tr>
<tr>
<td>Emitter-base voltage</td>
<td>$V_{EBO}$</td>
<td>7</td>
<td>V</td>
</tr>
<tr>
<td>Collector current</td>
<td>DC $I_C$</td>
<td>5</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Pulse $I_{CP}$</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Base current</td>
<td>$I_B$</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>Collector power dissipation</td>
<td>$P_C$</td>
<td>1.0</td>
<td>W</td>
</tr>
<tr>
<td>$T_a = 25^\circ C$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_c = 25^\circ C$</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>$T_{stg}$</td>
<td>−55 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

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).

Industrial Applications

Start of commercial production
1989-02
## Electrical Characteristics (Ta = 25°C)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector cut-off current</td>
<td>ICBO</td>
<td>V_C = 100 V, I_E = 0</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>μA</td>
</tr>
<tr>
<td>Emitter cut-off current</td>
<td>I_EBO</td>
<td>V_E = 7 V, I_C = 0</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>μA</td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>V_(BR)CEO</td>
<td>I_C = 10 mA, I_B = 0</td>
<td>80</td>
<td>—</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>DC current gain</td>
<td>h_FE (1)</td>
<td>V_CE = 1 V, I_C = 1 A</td>
<td>70</td>
<td>—</td>
<td>240</td>
<td>—</td>
</tr>
<tr>
<td>DC current gain</td>
<td>h_FE (2)</td>
<td>V_CE = 1 V, I_C = 3 A</td>
<td>40</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Collector-emitter saturation voltage</td>
<td>V_CE(sat)</td>
<td>I_C = 3 A, I_B = 0.15 A</td>
<td>—</td>
<td>0.2</td>
<td>0.4</td>
<td>V</td>
</tr>
<tr>
<td>Base-emitter saturation voltage</td>
<td>V_BE(sat)</td>
<td>I_C = 3 A, I_B = 0.15 A</td>
<td>—</td>
<td>0.9</td>
<td>1.2</td>
<td>V</td>
</tr>
<tr>
<td>Transition frequency</td>
<td>f_T</td>
<td>V_CE = 4 V, I_C = 1 A</td>
<td>—</td>
<td>120</td>
<td>—</td>
<td>MHz</td>
</tr>
<tr>
<td>Collector output capacitance</td>
<td>C_ob</td>
<td>V_CB = 10 V, I_E = 0, f = 1 MHz</td>
<td>—</td>
<td>80</td>
<td>—</td>
<td>pF</td>
</tr>
</tbody>
</table>

### Switching time

<table>
<thead>
<tr>
<th>Time</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turn-on time</td>
<td>t_on</td>
<td></td>
<td>—</td>
<td>0.2</td>
<td>—</td>
<td>μs</td>
</tr>
<tr>
<td>Storage time</td>
<td>t_stg</td>
<td></td>
<td>—</td>
<td>1.0</td>
<td>—</td>
<td>μs</td>
</tr>
<tr>
<td>Fall time</td>
<td>f_r</td>
<td>I_B1 = −I_B2 = 0.15 A, DUTY CYCLE ≤ 1%</td>
<td>—</td>
<td>0.1</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Note: h_FE (1) classification  O: 70 to 140, Y: 120 to 240

### Marking

![Marking Diagram]

Note: A line under a Lot No. identifies the indication of product Labels.
Not underlined: [[Pb]]/INCLUDES > MCV
Underlined: [[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.
DC current gain $h_{FE}$

Collector-emitter voltage $V_{CE}$ (V)

Collector current $I_C$ (A)

Common emitter

$T_c = 25^\circ C$

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

Collector-emitter saturation voltage $V_{CE (sat)}$ (V)

Collector current $I_C$ (A)

Common emitter

$T_c = 100^\circ C$

$T_c = -55^\circ C$

$V_{CE}$ - $I_C$

Collector-emitter voltage $V_{CE}$ (V)

Collector current $I_C$ (A)

Common emitter

$T_c = 25^\circ C$

$V_{CE}$ - $I_C$

Collector-emitter voltage $V_{CE}$ (V)

Collector current $I_C$ (A)

Common emitter

$T_c = 100^\circ C$

$T_c = -55^\circ C$

Collector current $I_C$ (A)

$h_{FE}$ - $I_C$

DC current gain $h_{FE}$

Collector current $I_C$ (A)

Common emitter

$V_{CE (sat)} - I_C$

Collector-emitter saturation voltage $V_{CE (sat)}$ (V)

Collector current $I_C$ (A)

Common emitter

$T_c = 100^\circ C$

$T_c = -55^\circ C$
Collector current $I_C$ (A)

Base-emitter saturation voltage $V_{BE}$ (sat) (V)

Base-emitter voltage $V_{BE}$ (V)

Collector current $I_C$ (A)

Pulse width $t_w$ (s)

Transient thermal resistance $r_{th}$ (°C/W)

Collector-emitter voltage $V_{CE}$ (V)

Safe Operating Area

Curves must be derated linearly with increase in temperature.

*: Single nonrepetitive pulse

(1) Infinite heat sink
(2) No heat sink

Curves should be applied in thermal limited area. (single nonrepetitive pulse)

DC operation

*: Single nonrepetitive pulse

Collector-current $I_C$ (A)

Collector-emitter voltage $V_{CE}$ (V)

Curves must be derated linearly with increase in temperature.
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