TOSHIBA Transistor Silicon NPN Triple Diffused Type (PCT process)

# 2SC3138

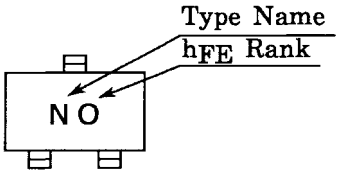
High Voltage Switching Applications

- High voltage: $V_{CBO}$ = 200 V (max)
  $V_{CEO}$ = 200 V (max)
- Small flat package
- Complementary to 2SA1255

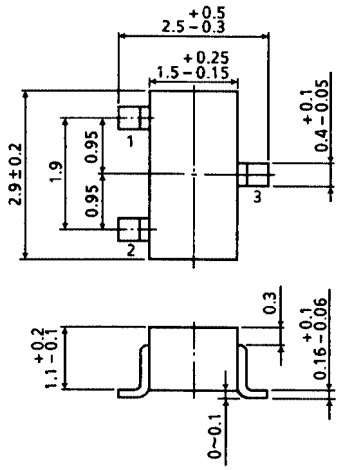
## Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Collector-base voltage | $V_{CBO}$ | 200 | V |
| Collector-emitter voltage | $V_{CEO}$ | 200 | V |
| Emitter-base voltage | $V_{EBO}$ | 5 | V |
| Collector current | $I_C$ | 50 | mA |
| Base current | $I_B$ | 20 | mA |
| Collector power dissipation | $P_C$ | 150 | mW |
| Junction temperature | $T_j$ | 125 | °C |
| Storage temperature range | $T_{stg}$ | −55~125 | °C |

## Marking




Unit: mm




| | |
|---|---|
| JEDEC | TO-236MOD |
| JEITA | SC-59 |
| TOSHIBA | 2-3F1A |

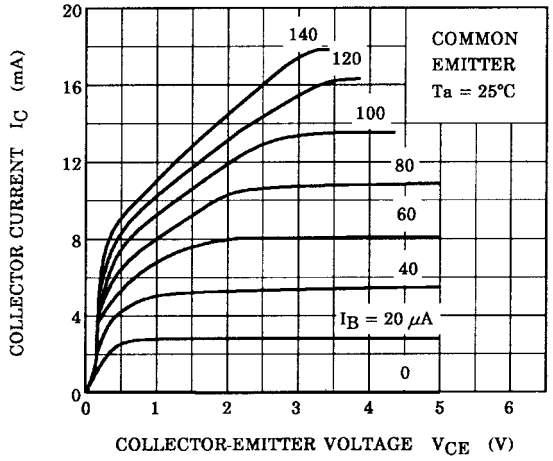
Weight: 0.012 g (typ.)

## Electrical Characteristics (Ta = 25°C)

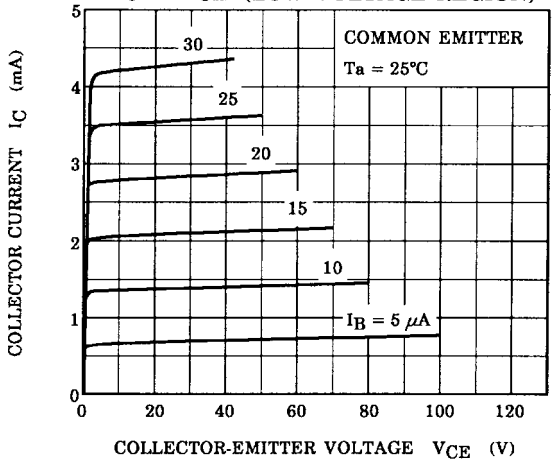
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Collector cut-off current | | $I_{CBO}$ | $V_{CB}$ = 200 V, $I_E$ = 0 | — | — | 0.1 | μA |
| Emitter cut-off current | | $I_{EBO}$ | $V_{EB}$ = 5 V, $I_C$ = 0 | — | — | 0.1 | μA |
| Collector-base breakdown voltage | | $V_{(BR)\ CBO}$ | $I_C$ = 0.1 mA, $I_E$ = 0 | 200 | — | — | V |
| Collector-emitter breakdown voltage | | $V_{(BR)\ CEO}$ | $I_C$ = 1 mA, $I_B$ = 0 | 200 | — | — | V |
| DC current gain | | $h_{FE}$ (Note) | $V_{CE}$ = 3 V, $I_C$ = 10 mA | 70 | — | 240 | |
| Collector-emitter saturation voltage | | $V_{CE\ (sat)}$ | $I_C$ = 10 mA, $I_B$ = 1 mA | — | 0.1 | 0.5 | V |
| Base-emitter saturation voltage | | $V_{BE\ (sat)}$ | $I_C$ = 10 mA, $I_B$ = 1 mA | — | 0.75 | 1.5 | V |
| Transition frequency | | $f_T$ | $V_{CE}$ = 10 V, $I_C$ = 2 mA | 50 | 100 | — | MHz |
| Collector output capacitance | | $C_{ob}$ | $V_{CB}$ = 10 V, $I_E$ = 0, f = 1 MHz | — | 2 | 4 | pF |
| Switching time | Turn-on time | $t_{on}$ | $V_{CC}$ = 50 V, $I_C$ = 6 mA, $I_{B1} = -I_{B2}$ = 0.6 mA, pulse width = 5 μs, duty cycle ≦ 2% | — | 0.3 | — | μs |
| | Storage time | $t_{stg}$ | | — | 2 | — | |
| | Fall time | $t_f$ | | — | 0.4 | — | |

Note: $h_{FE}$ classification O: 70~140, Y: 120~240

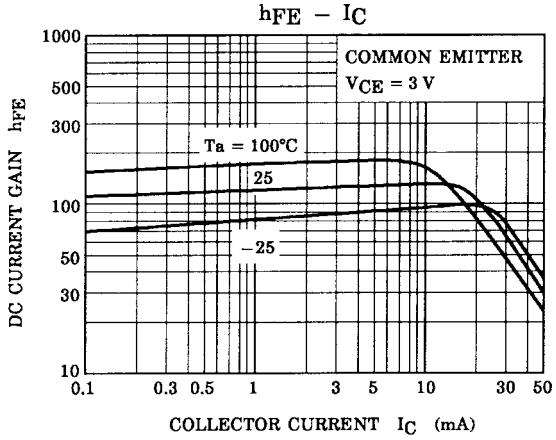
$I_C$ – $V_{CE}$ (LOW VOLTAGE REGION)



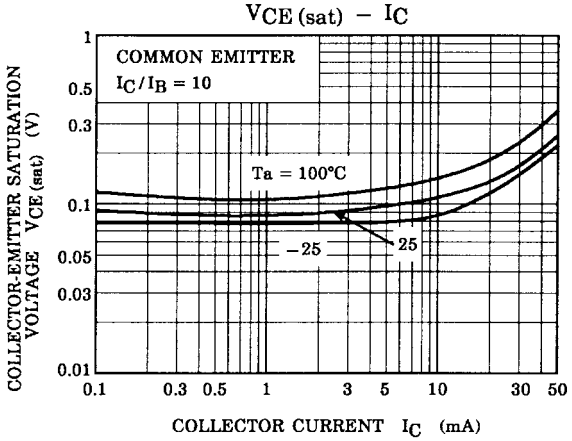

$I_C$ – $V_{CE}$ (LOW VOLTAGE REGION)



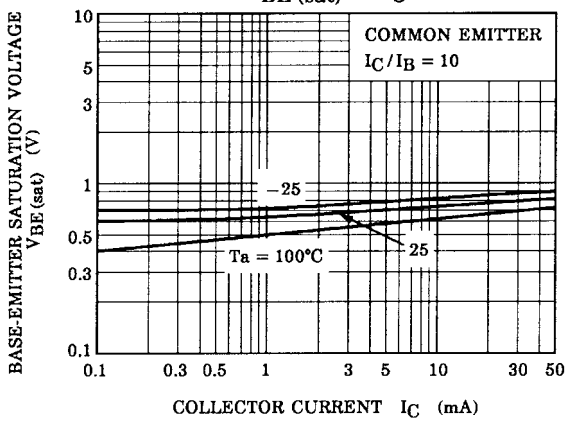

$h_{FE}$ – $I_C$



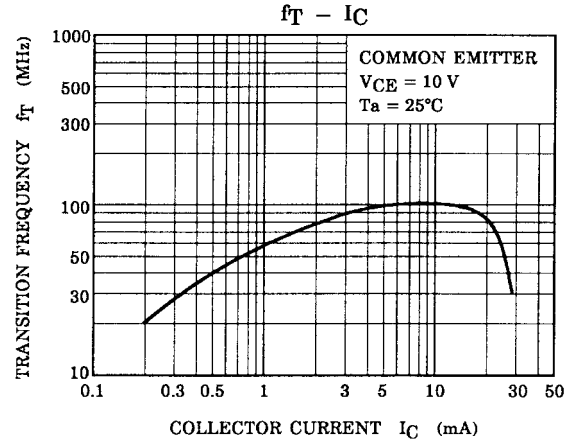

$V_{CE\,(sat)}$ – $I_C$

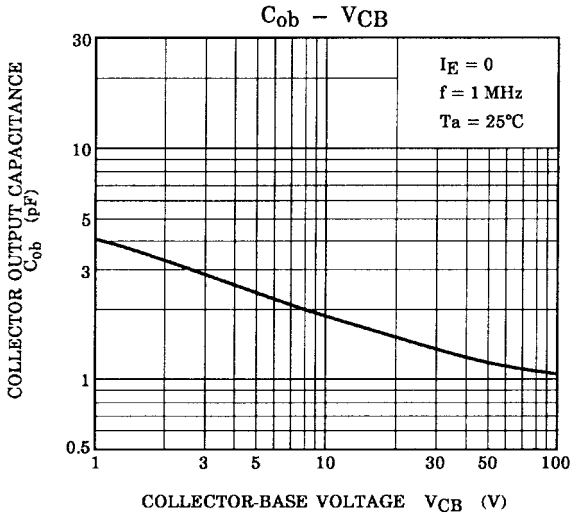


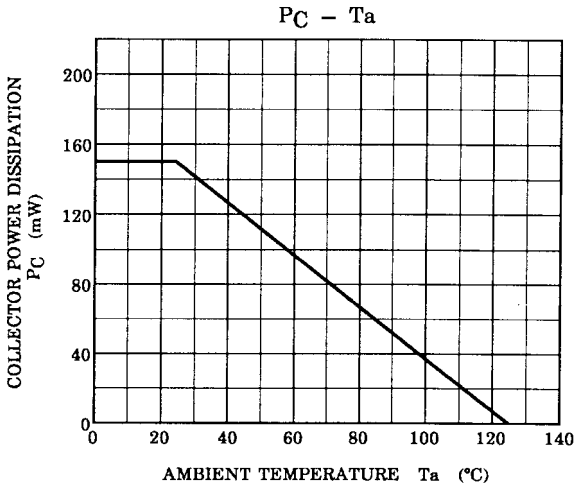

$V_{BE\,(sat)}$ – $I_C$




$f_T$ – $I_C$




$C_{ob}$ – $V_{CB}$
$I_E$ = 0
f = 1 MHz
Ta = 25°C
COLLECTOR OUTPUT CAPACITANCE $C_{ob}$ (pF)
30
10
5
3
1
0.5
1
3
5
10
30
50
100
COLLECTOR-BASE VOLTAGE $V_{CB}$ (V)


$P_C$ – Ta
COLLECTOR POWER DISSIPATION $P_C$ (mW)
200
160
120
80
40
0
0
20
40
60
80
100
120
140
AMBIENT TEMPERATURE Ta (°C)

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000707EAA

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