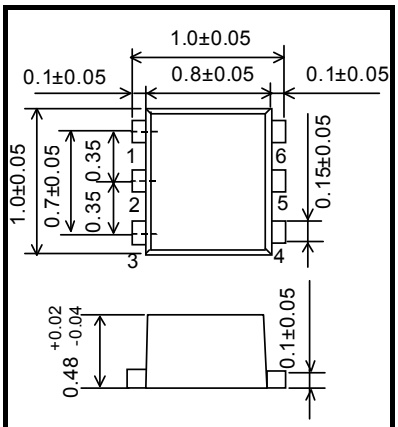
TOSHIBA Transistor Silicon NPN・PNP Epitaxial Type
(PCT process) (Bias Resistor Built-in Transistor)

# RN4981FS

Switching, Inverter Circuit, Interface Circuit and
Driver Circuit Applications.

- Two devices are incorporated into a fine pitch small mold (6-pin) package.
- Incorporating a bias resistor into a transistor reduces parts count.
  Reducing the parts count enables the manufacture of ever more compact equipment and lowers assembly cost.

Unit: mm

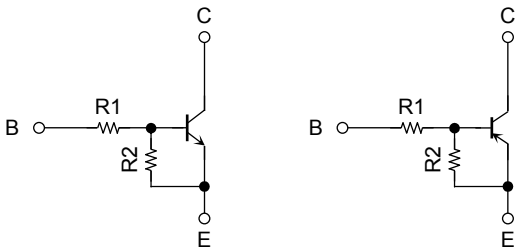



| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-1F1D |

Weight: 0.001g (typ.)

## Equivalent Circuit and Bias Resistor Values

**Q1** **Q2**

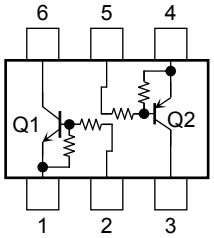



R1: 4.7 kΩ

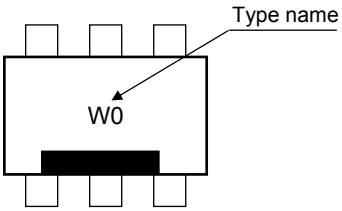
R2: 4.7 kΩ

(Q1, Q2 common)

## Equivalent Circuit (top view)




## Marking



## Absolute Maximum Ratings (Ta = 25°C) (Q1)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Collector-base voltage | $V_{CBO}$ | 20 | V |
| Collector-emitter voltage | $V_{CEO}$ | 20 | V |
| Emitter-base voltage | $V_{EBO}$ | 10 | V |
| Collector current | $I_C$ | 50 | mA |

## Absolute Maximum Ratings (Ta = 25°C) (Q2)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Collector-base voltage | $V_{CBO}$ | −20 | V |
| Collector-emitter voltage | $V_{CEO}$ | −20 | V |
| Emitter-base voltage | $V_{EBO}$ | −10 | V |
| Collector current | $I_C$ | −50 | mA |

## Absolute Maximum Ratings (Ta = 25°C) (Q1, Q2 common)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Collector power dissipation | $P_C$ (Note 1) | 50 | mW |
| 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).

Note 1: Total rating

## Electrical Characteristics (Ta = 25°C) (Q1)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Collector cut-off current | $I_{CBO}$ | $V_{CB}$ = 20 V, $I_E$ = 0 | — | — | 100 | nA |
| | $I_{CEO}$ | $V_{CE}$ = 20 V, $I_B$ = 0 | — | — | 500 | |
| Emitter cut-off current | $I_{EBO}$ | $V_{EB}$ = 10 V, $I_C$ = 0 | 0.89 | — | 1.33 | mA |
| DC current gain | $h_{FE}$ | $V_{CE}$ = 5 V, $I_C$ = 10 mA | 30 | — | — | |
| Collector-emitter saturation voltage | $V_{CE\ (sat)}$ | $I_C$ = 5 mA, $I_B$ = 0.25 mA | — | — | 0.15 | V |
| Input voltage (ON) | $V_{I\ (ON)}$ | $V_{CE}$ = 0.2 V, $I_C$ = 5 mA | 1.0 | — | 2.0 | V |
| Input voltage (OFF) | $V_{I\ (OFF)}$ | $V_{CE}$ = 5 V, $I_C$ = 0.1 mA | 0.8 | — | 1.5 | V |
| Collector output capacitance | $C_{ob}$ | $V_{CB}$ = 10 V, $I_E$ = 0, f = 1 MHz | — | 1.2 | — | pF |

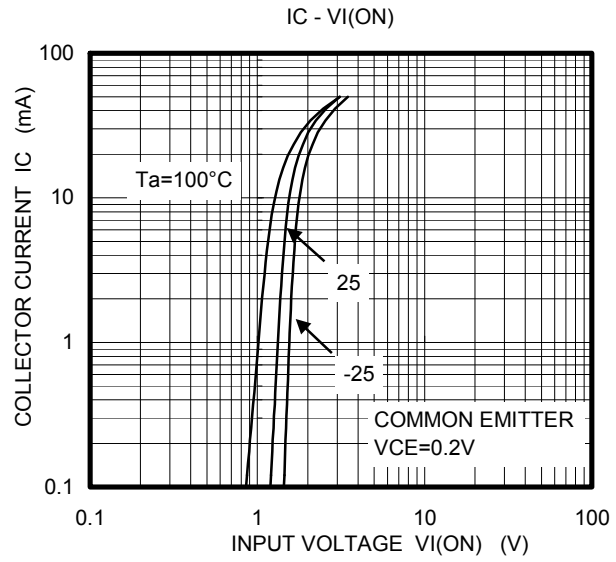
## Electrical Characteristics (Ta =25°C) (Q2)

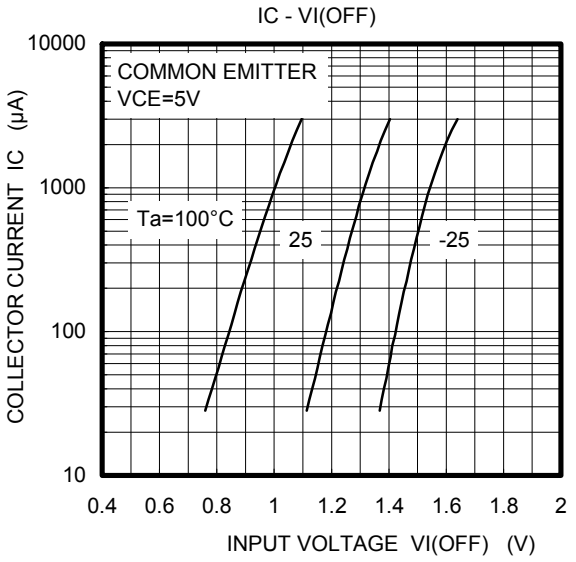
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Collector cut-off current | $I_{CBO}$ | $V_{CB}$ = −20 V, $I_E$ = 0 | — | — | −100 | nA |
| | $I_{CEO}$ | $V_{CE}$ = −20 V, $I_B$ = 0 | — | — | −500 | |
| Emitter cut-off current | $I_{EBO}$ | $V_{EB}$ = −10 V, $I_C$ = 0 | −0.89 | — | −1.33 | mA |
| DC current gain | $h_{FE}$ | $V_{CE}$ = −5 V, $I_C$ = −10 mA | 30 | — | — | |
| Collector-emitter saturation voltage | $V_{CE\ (sat)}$ | $I_C$ = −5 mA, $I_B$ = −0.25 mA | — | — | −0.15 | V |
| Input voltage (ON) | $V_{I\ (ON)}$ | $V_{CE}$ = −0.2 V, $I_C$ = −5 mA | −1.0 | — | −2.0 | V |
| Input voltage (OFF) | $V_{I\ (OFF)}$ | $V_{CE}$ = −5 V, $I_C$ = −0.1 mA | −0.8 | — | −1.5 | V |
| Collector output capacitance | $C_{ob}$ | $V_{CB}$ = −10 V, $I_E$ = 0, f = 1 MHz | — | 1.2 | — | pF |

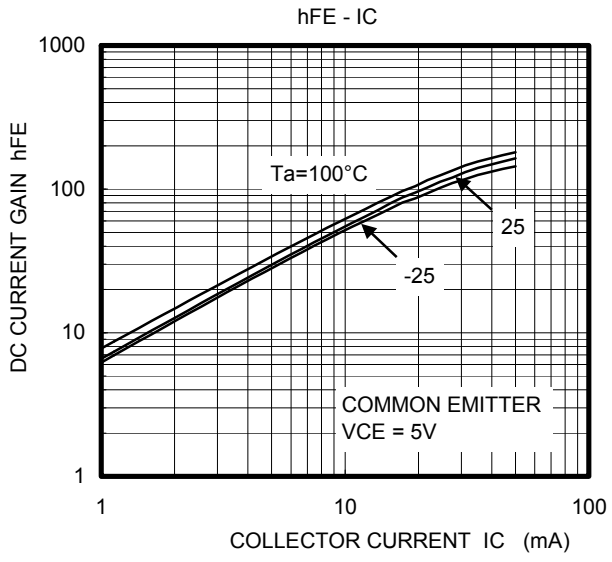
## Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)

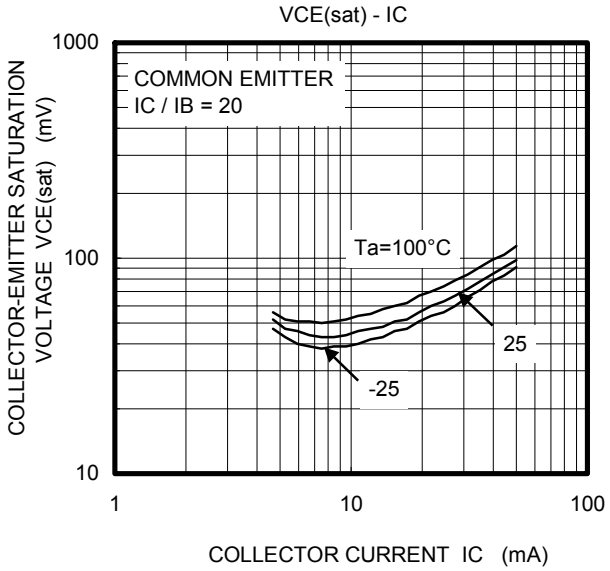
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Input resistor | R1 | — | 3.76 | 4.7 | 5.64 | kΩ |
| Resistor ratio | R1/R2 | — | 0.8 | 1.0 | 1.2 | |

**Q1**

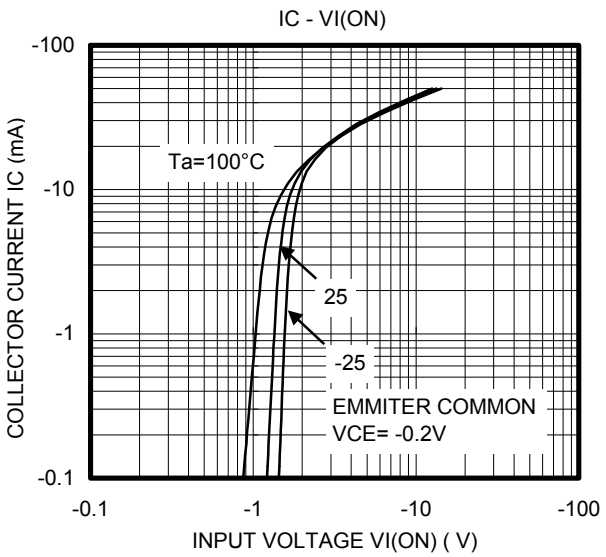

IC - VI(ON)
COLLECTOR CURRENT IC (mA)
INPUT VOLTAGE VI(ON) (V)
Ta=100°C
25
-25
COMMON EMITTER
VCE=0.2V
100
10
1
0.1
0.1
1
10
100

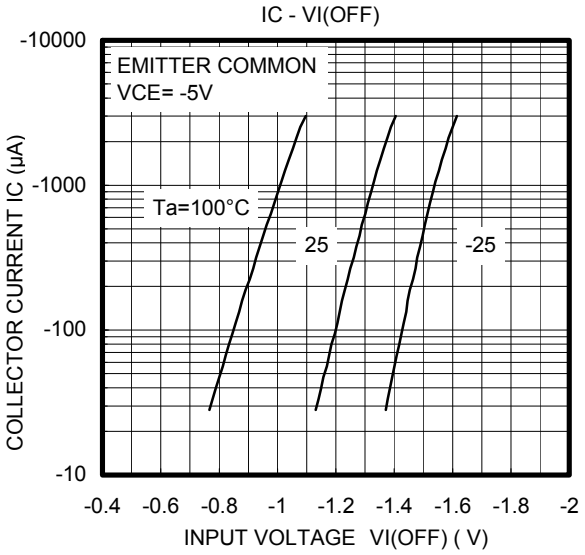

IC - VI(OFF)
COLLECTOR CURRENT IC (μA)
INPUT VOLTAGE VI(OFF) (V)
COMMON EMITTER
VCE=5V
Ta=100°C
25
-25
10000
1000
100
10
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

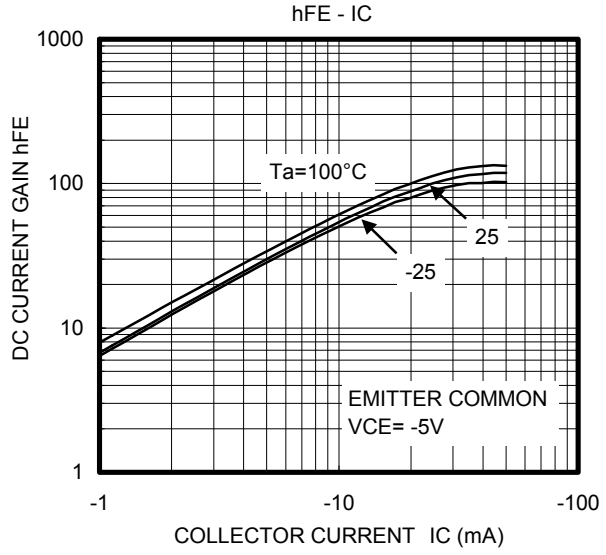

hFE - IC
DC CURRENT GAIN hFE
COLLECTOR CURRENT IC (mA)
Ta=100°C
25
-25
COMMON EMITTER
VCE = 5V
1000
100
10
1
1
10
100

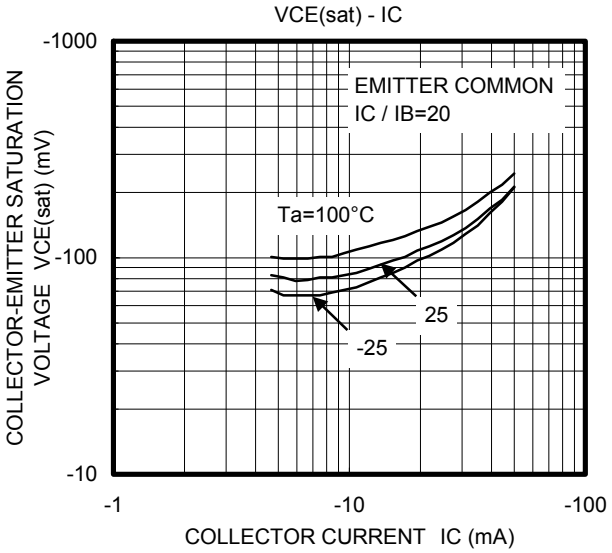

VCE(sat) - IC
COLLECTOR-EMITTER SATURATION VOLTAGE VCE(sat) (mV)
COLLECTOR CURRENT IC (mA)
COMMON EMITTER
IC / IB = 20
Ta=100°C
25
-25
1000
100
10
1
10
100

**Q2**


IC - VI(ON)
COLLECTOR CURRENT IC (mA)
-100
-10
-1
-0.1
Ta=100°C
25
-25
EMMITER COMMON
VCE= -0.2V
-0.1
-1
-10
-100
INPUT VOLTAGE VI(ON) ( V)


IC - VI(OFF)
COLLECTOR CURRENT IC (μA)
-10000
-1000
-100
-10
EMITTER COMMON
VCE= -5V
Ta=100°C
25
-25
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
INPUT VOLTAGE VI(OFF) ( V)


hFE - IC
DC CURRENT GAIN hFE
1000
100
10
1
Ta=100°C
25
-25
EMITTER COMMON
VCE= -5V
-1
-10
-100
COLLECTOR CURRENT IC (mA)


VCE(sat) - IC
COLLECTOR-EMITTER SATURATION VOLTAGE VCE(sat) (mV)
-1000
-100
-10
EMITTER COMMON
IC / IB=20
Ta=100°C
25
-25
-1
-10
-100
COLLECTOR CURRENT IC (mA)

## Handling Precaution

When handling individual devices (which are not yet mounted on a circuit board), be sure that the environment is protected against electrostatic discharge. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static materials.

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