TOSHIBA Transistor Silicon NPN · PNP Epitaxial Type (PCT Process) (Bias Resistor Built-in Transistor)

# RN47A4JE

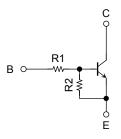
# Switching, Inverter Circuit, Interface Circuit and Driver Circuit Applications

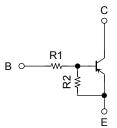
- Two devices are incorporated into an Extreme-Super-Mini (5-pin) package.
- Incorporating a bias resistor into a transistor reduces parts count.
   Reducing the parts count enables the manufacture of ever more compact equipment and lowers assembly cost.

#### **Equivalent Circuit and Bias Resistor Values**

Q1

Q2





Q1

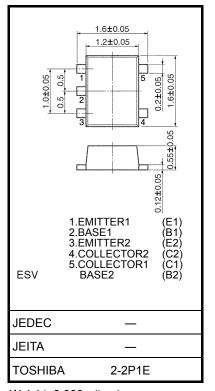
R1: 47 k $\Omega$ , R2: 47 k $\Omega$ 

Q2

R1: 10 k $\Omega$ , R2: 47 k $\Omega$ 

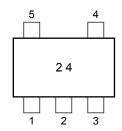
Q1: RN1104F Q2: RN2107F

#### Unit: mm

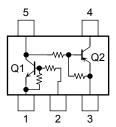


Weight: 0.003g (typ.)

#### Marking



#### **Equivalent Circuit (top view)**



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

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CBO}$	50	V
Collector-emitter voltage	V <sub>CEO</sub>	50	V
Emitter-base voltage	V <sub>EBO</sub>	10	V
Collector current	IC	100	mA

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

Characteristics	Symbol	Rating	Unit
Collector-base voltage	V <sub>CBO</sub>	-50	V
Collector-emitter voltage	V <sub>CEO</sub>	-50	V
Emitter-base voltage	V <sub>EBO</sub>	-6	V
Collector current	IC	-100	mA

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

Characteristics	Symbol	Rating	Unit
Collector power dissipation	P <sub>C</sub> (Note 1)	100	mW
Junction temperature	Tj	150	°C
Storage temperature range	T <sub>stg</sub>	-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.

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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)

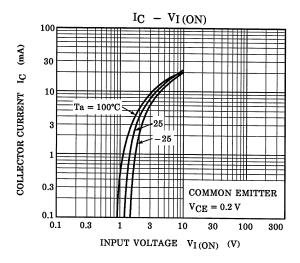
Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Collector cut-off current	I <sub>CBO</sub>	$V_{CB} = 50 \text{ V}, I_{E} = 0$	_	_	100	nA
	I <sub>CEO</sub>	$V_{CE} = 50 \text{ V}, I_{B} = 0$	_	_	500	TIA .
Emitter cut-off current	I <sub>EBO</sub>	V <sub>EB</sub> = 10 V, I <sub>C</sub> = 0	0.082	_	0.15	mA
DC current gain	h <sub>FE</sub>	$V_{CE} = 5 \text{ V}, I_{C} = 10 \text{ mA}$	80	_	_	
Collector-emitter saturation voltage	V <sub>CE</sub> (sat)	$I_C = 5 \text{ mA}, I_B = 0.25 \text{ mA}$	_	0.1	0.3	V
Input voltage (ON)	V <sub>I (ON)</sub>	$V_{CE} = 0.2 \text{ V}, I_{C} = 5 \text{ mA}$	1.5	_	5.0	V
Input voltage (OFF)	V <sub>I (OFF)</sub>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 0.1 mA	1.0	_	1.5	V
Transition frequency	f <sub>T</sub>	V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5 mA	_	250	_	MHz
Collector output capacitance	C <sub>ob</sub>	V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0, f = 1 MHz	_	3	_	pF
Input resistor	R1	_	32.9	47	61.1	kΩ
Resistor ratio	R1/R2	_	0.8	1.0	1.2	

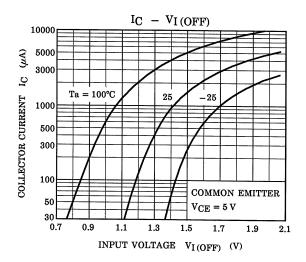
## Electrical Characteristics (Ta = 25°C) (Q2)

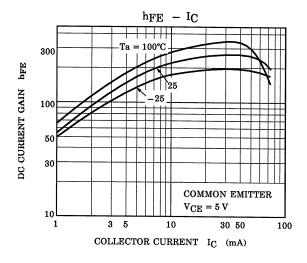
Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Collector cut-off current	I <sub>CBO</sub>	$V_{CB} = -50 \text{ V}, I_E = 0$	_	_	-100	nA
	I <sub>CEO</sub>	$V_{CE} = -50 \text{ V}, I_B = 0$	_	_	-500	шА
Emitter cut-off current	I <sub>EBO</sub>	$V_{EB} = -6 \text{ V}, I_{C} = 0$	-0.081	_	-0.15	mA
DC current gain	h <sub>FE</sub>	$V_{CE} = -5 \text{ V}, I_{C} = -10 \text{ mA}$	80	_	_	
Collector-emitter saturation voltage	V <sub>CE</sub> (sat)	$I_C = -5 \text{ mA}, I_B = -0.25 \text{ mA}$	_	-0.1	-0.3	V
Input voltage (ON)	V <sub>I (ON)</sub>	$V_{CE} = -0.2 \text{ V}, I_{C} = -5 \text{ mA}$	-0.7	_	-1.8	V
Input voltage (OFF)	V <sub>I (OFF)</sub>	$V_{CE} = -5 \text{ V}, I_{C} = -0.1 \text{ mA}$	-0.5	_	-1.0	V
Transition frequency	f <sub>T</sub>	$V_{CE} = -10 \text{ V}, I_{C} = -5 \text{ mA}$	_	200	_	MHz
Collector output capacitance	C <sub>ob</sub>	V <sub>CB</sub> = -10 V, I <sub>E</sub> = 0, f = 1 MHz	_	3	_	pF
Input resistor	R1	_	7	10	13	kΩ
Resistor ratio	R1/R2	_	0.171	0.213	0.255	

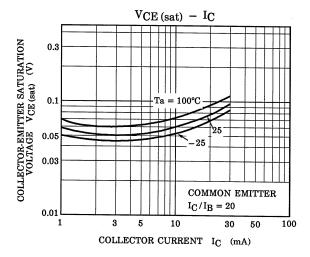
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Q1



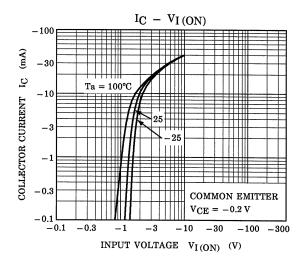


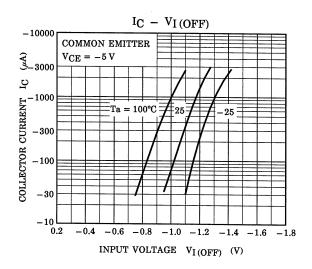


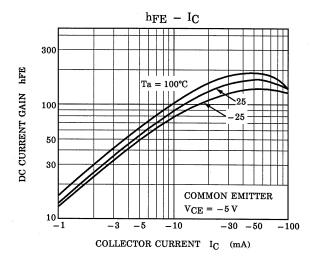


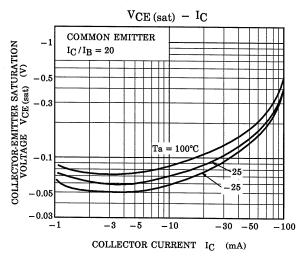
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Q2

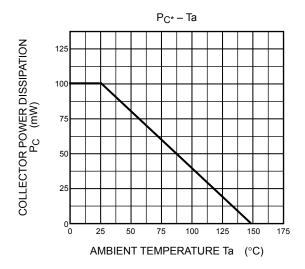








## Q1, Q2 Common



\*Total Rating.

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