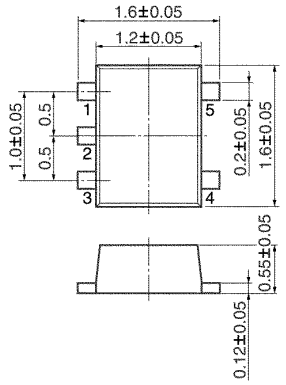
TOSHIBA Transistor Silicon NPN・PNP Epitaxial Type
(PCT Process) (Bias Resistor Built-in Transistor)

RN47A1JE

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.

Unit: mm



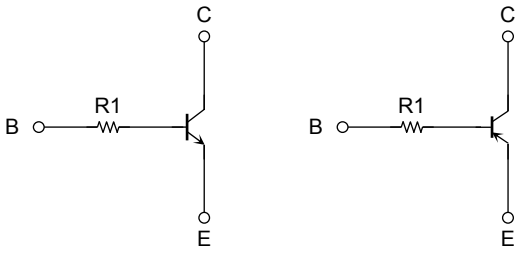
	1.EMITTER1	(E1)
	2.BASE1	(B1)
	3.EMITTER2	(E2)
	4.COLLECTOR2	(C2)
	5.COLLECTOR1	(C1)
ESV	BASE2	(B2)

JEDEC	—
JEITA	—
TOSHIBA	2-2P1E

Weight: 0.003g (typ.)

Equivalent Circuit and Bias Resistor Values

Q1 **Q2**

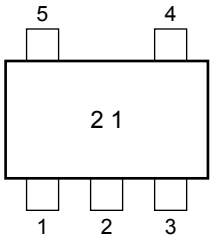


R1: 4.7 kΩ (Q1, Q2 common)

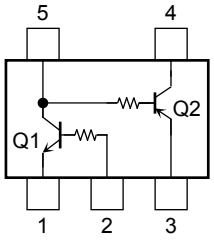
Q1: RN1110F

Q2: RN2110F

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_{CEO}	50	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	100	mA

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

Characteristics	Symbol	Rating	Unit
Collector-base voltage	V_{CBO}	−50	V
Collector-emitter voltage	V_{CEO}	−50	V
Emitter-base voltage	V_{EBO}	−5	V
Collector current	I_C	−100	mA

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

Characteristics	Symbol	Rating	Unit
Collector power dissipation	P_C (Note 1)	100	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

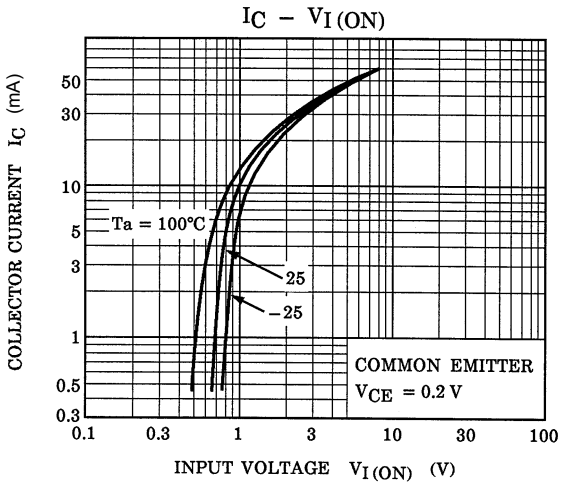
Electrical Characteristics (Ta = 25°C) (Q1)

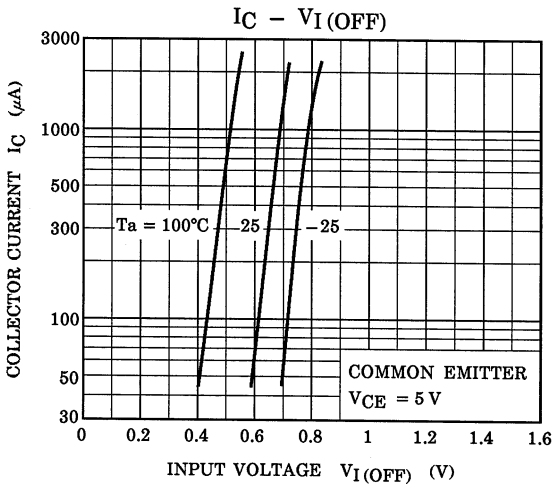
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	V_{CB} = 50 V, I_E = 0	—	—	100	nA
Emitter cut-off current	I_{EBO}	V_{EB} = 5 V, I_C = 0	—	—	100	nA
DC current gain	h_{FE}	V_{CE} = 5 V, I_C = 1 mA	120	—	700	
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	I_C = 5 mA, I_B = 0.25 mA	—	0.1	0.3	V
Transition frequency	f_T	V_{CE} = 10 V, I_C = 5 mA	—	250	—	MHz
Collector output capacitance	C_{ob}	V_{CB} = 10 V, I_E = 0, f = 1 MHz	—	3	—	pF
Input resistor	R1	—	3.29	4.7	6.11	kΩ

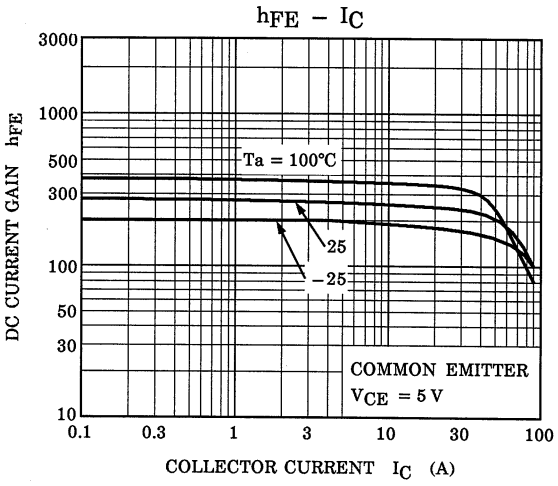
Electrical Characteristics (Ta = 25°C) (Q2)

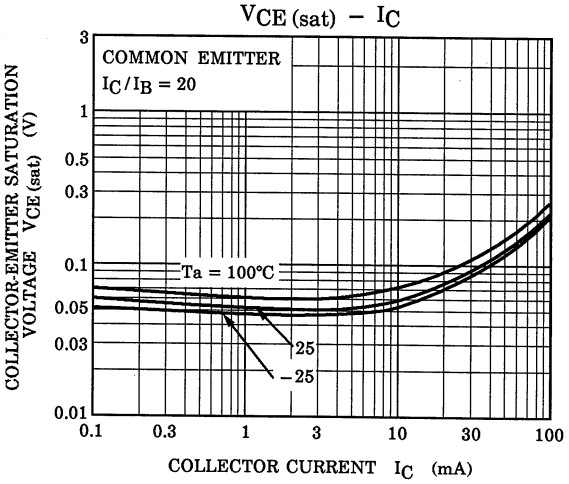
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	V_{CB} = −50 V, I_E = 0	—	—	−100	nA
Emitter cut-off current	I_{EBO}	V_{EB} = −5 V, I_C = 0	—	—	−100	nA
DC current gain	h_{FE}	V_{CE} = −5 V, I_C = −1 mA	120	—	700	
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	I_C = −5 mA, I_B = −0.25 mA	—	−0.1	−0.3	V
Transition frequency	f_T	V_{CE} = −10 V, I_C = −5 mA	—	200	—	MHz
Collector output capacitance	C_{ob}	V_{CB} = −10 V, I_E = 0, f = 1 MHz	—	3	—	pF
Input resistor	R1	—	3.29	4.7	6.11	kΩ

Q1

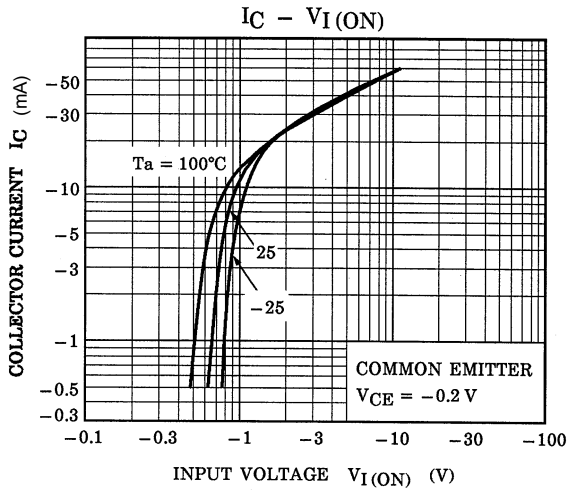

I_C – $V_{I(ON)}$
COLLECTOR CURRENT I_C (mA)
50
30
10
5
3
1
0.5
0.3
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 0.2 V
0.1
0.3
1
3
10
30
100
INPUT VOLTAGE $V_{I(ON)}$ (V)

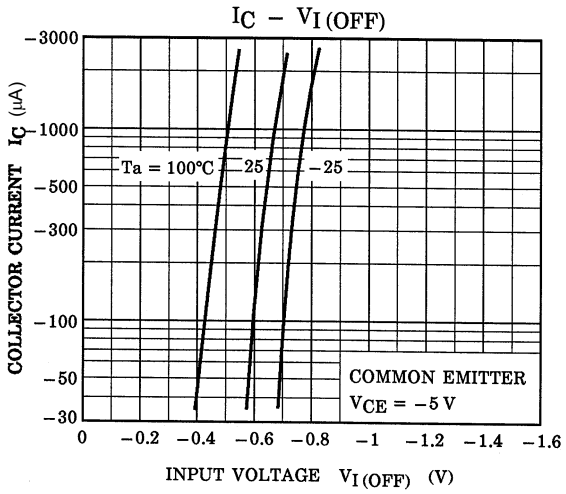

I_C – $V_{I(OFF)}$
COLLECTOR CURRENT I_C (μA)
3000
1000
500
300
100
50
30
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 5 V
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
INPUT VOLTAGE $V_{I(OFF)}$ (V)

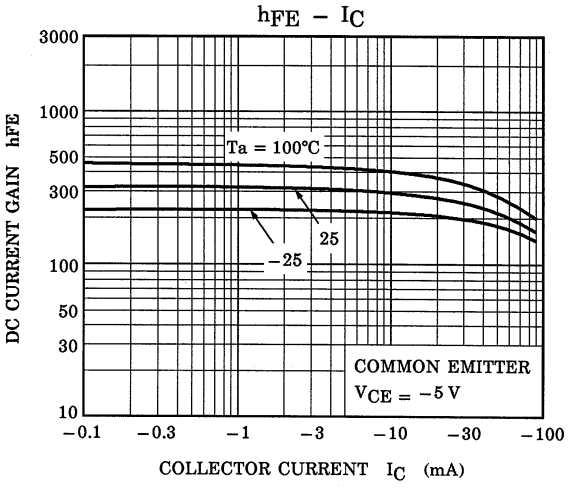

h_{FE} – I_C
DC CURRENT GAIN h_{FE}
3000
1000
500
300
100
50
30
10
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 5 V
0.1
0.3
1
3
10
30
100
COLLECTOR CURRENT I_C (A)

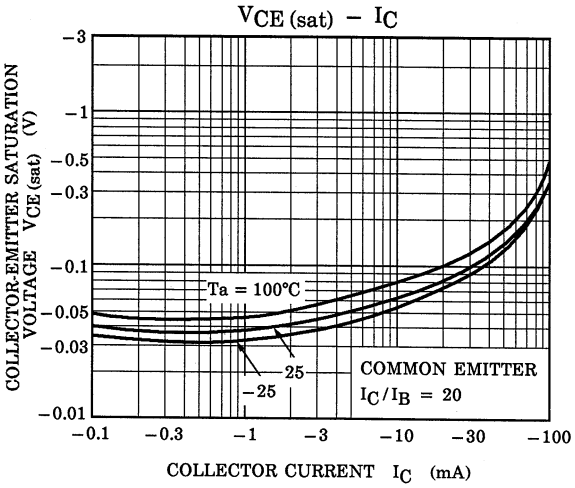

$V_{CE(sat)}$ – I_C
COLLECTOR-EMITTER SATURATION VOLTAGE $V_{CE(sat)}$ (V)
COMMON EMITTER
I_C/I_B = 20
3
1
0.5
0.3
0.1
0.05
0.03
0.01
Ta = 100°C
25
−25
0.1
0.3
1
3
10
30
100
COLLECTOR CURRENT I_C (mA)

Q2

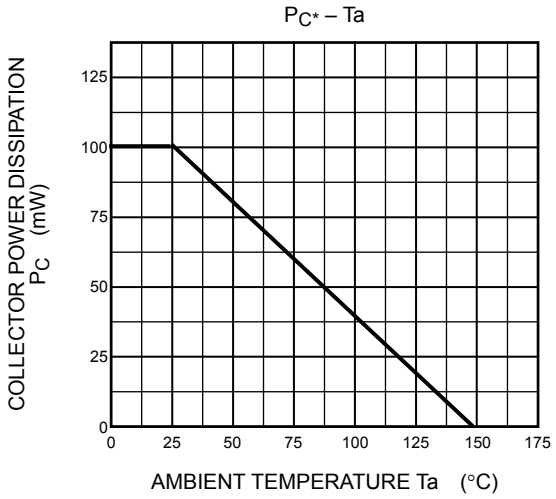

I_C – $V_{I(ON)}$
COLLECTOR CURRENT I_C (mA)
−50
−30
−10
−5
−3
−1
−0.5
−0.3
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −0.2 V
−0.1
−0.3
−1
−3
−10
−30
−100
INPUT VOLTAGE $V_{I(ON)}$ (V)


I_C – $V_{I(OFF)}$
COLLECTOR CURRENT I_C (μA)
−3000
−1000
−500
−300
−100
−50
−30
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −5 V
0
−0.2
−0.4
−0.6
−0.8
−1
−1.2
−1.4
−1.6
INPUT VOLTAGE $V_{I(OFF)}$ (V)


h_{FE} – I_C
DC CURRENT GAIN hFE
3000
1000
500
300
100
50
30
10
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −5 V
−0.1
−0.3
−1
−3
−10
−30
−100
COLLECTOR CURRENT I_C (mA)


$V_{CE(sat)}$ – I_C
COLLECTOR-EMITTER SATURATION VOLTAGE $V_{CE(sat)}$ (V)
−3
−1
−0.5
−0.3
−0.1
−0.05
−0.03
−0.01
Ta = 100°C
25
−25
COMMON EMITTER
I_C/I_B = 20
−0.1
−0.3
−1
−3
−10
−30
−100
COLLECTOR CURRENT I_C (mA)

Q1, Q2 Common



*Total Rating.

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