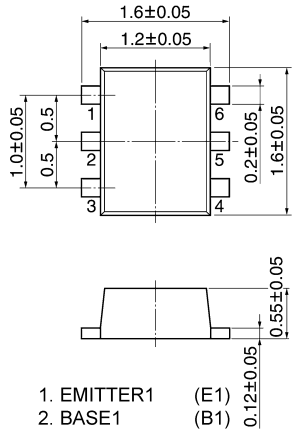
TOSHIBA Transistor Silicon PNP · NPN Epitaxial Type
(PCT Process) (Bias Resistor Built-in Transistor)

RN4904FE

Switching, Inverter Circuit, Interface Circuit and
Driver Circuit Applications

- Two devices are incorporated into an Extreme-Super-Mini (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



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

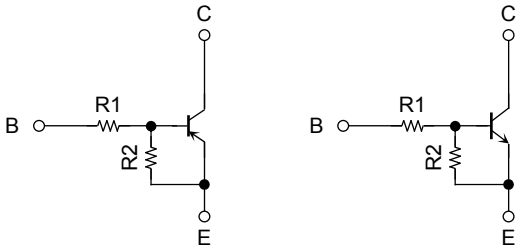
ES6

JEDEC	—
JEITA	—
TOSHIBA	2-2N1G

Weight: 0.003 g (typ.)

Equivalent Circuit and Bias Resistor Values

Q1 **Q2**

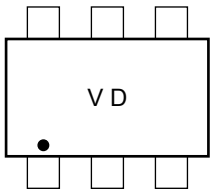


R1: 47 kΩ

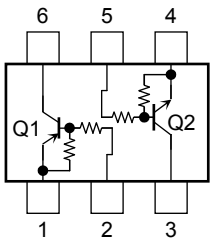
R2: 47 kΩ

(Q1, Q2 common)

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}	−10	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}	10	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
	I_{CEO}	V_{CE} = –50 V, I_B = 0	—	—	–500	
Emitter cut-off current	I_{EBO}	V_{EB} = –10 V, I_C = 0	–0.082	—	–0.15	mA
DC current gain	h_{FE}	V_{CE} = –5 V, I_C = –10 mA	80	—	—	
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	I_C = –5 mA, I_B = –0.25 mA	—	–0.1	–0.3	V
Input voltage (ON)	$V_{I\ (ON)}$	V_{CE} = –0.2 V, I_C = –5 mA	–1.5	—	–5.0	V
Input voltage (OFF)	$V_{I\ (OFF)}$	V_{CE} = –5 V, I_C = –0.1 mA	–1.0	—	–1.5	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	6	pF

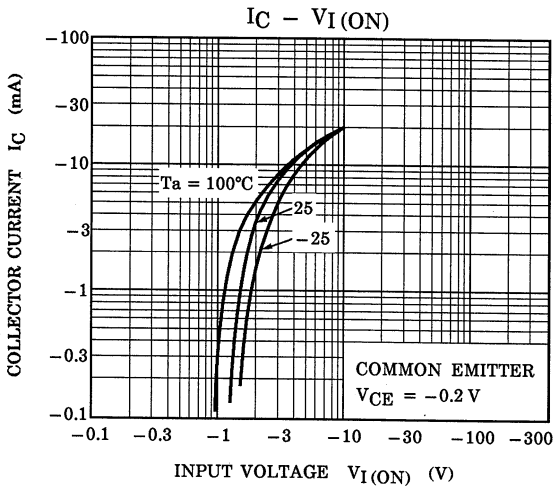
Electrical Characteristics (Ta = 25°C) (Q2)

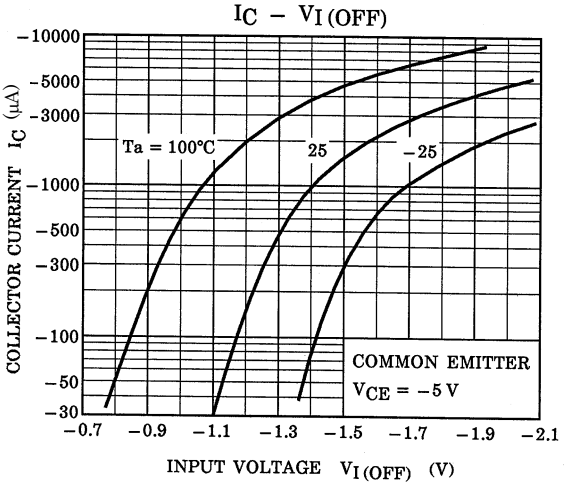
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	V_{CB} = 50 V, I_E = 0	—	—	100	nA
	I_{CEO}	V_{CE} = 50 V, I_B = 0	—	—	500	
Emitter cut-off current	I_{EBO}	V_{EB} = 10 V, I_C = 0	0.082	—	0.15	mA
DC current gain	h_{FE}	V_{CE} = 5 V, I_C = 10 mA	80	—	—	
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	I_C = 5 mA, I_B = 0.25 mA	—	0.1	0.3	V
Input voltage (ON)	$V_{I\ (ON)}$	V_{CE} = 0.2 V, I_C = 5 mA	1.5	—	5.0	V
Input voltage (OFF)	$V_{I\ (OFF)}$	V_{CE} = 5 V, I_C = 0.1 mA	1.0	—	1.5	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	6	pF

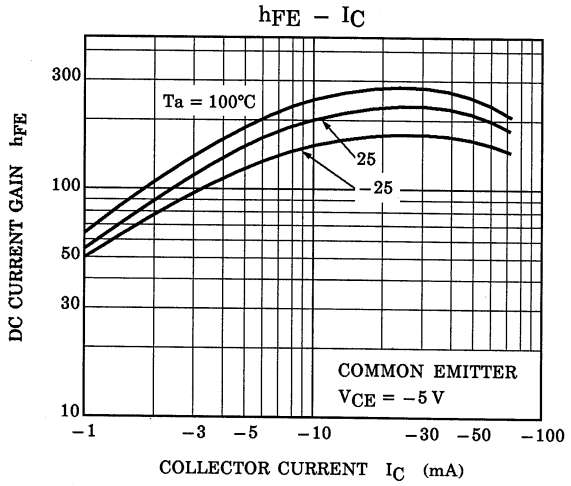
Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)

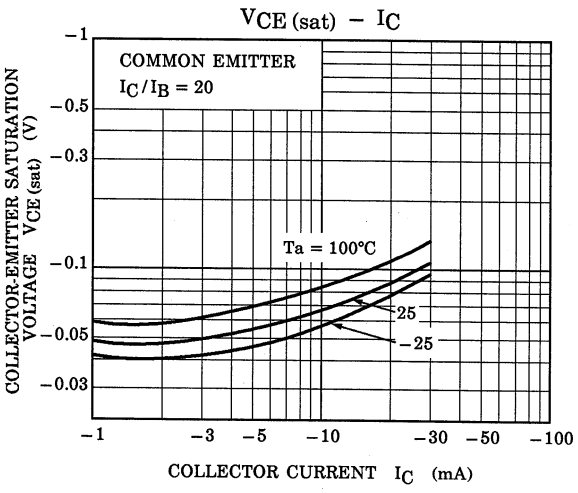
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input resistor	R1	—	32.9	47	61.1	kΩ
Resistor ratio	R1/R2	—	0.9	1.0	1.1	

Q1

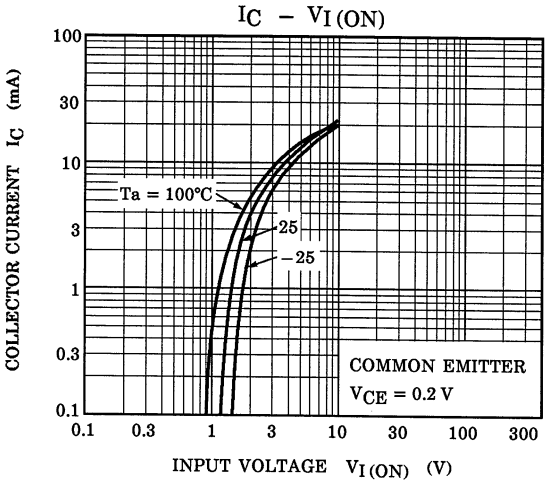

I_C – $V_{I(ON)}$
COLLECTOR CURRENT I_C (mA)
−100
−30
−10
−3
−1
−0.3
−0.1
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −0.2 V
−0.1 −0.3 −1 −3 −10 −30 −100 −300
INPUT VOLTAGE $V_{I(ON)}$ (V)

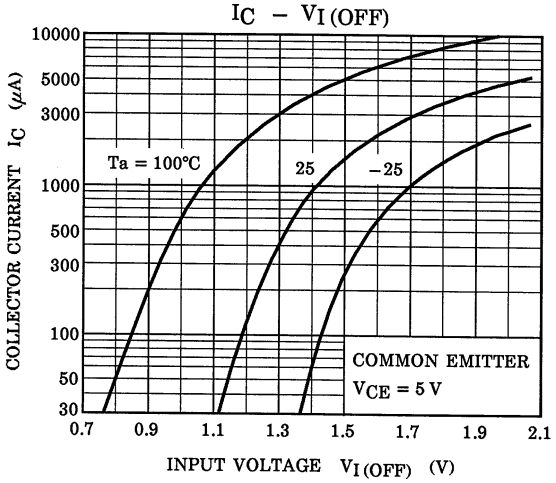

I_C – $V_{I(OFF)}$
COLLECTOR CURRENT I_C (μA)
−10000
−5000
−3000
−1000
−500
−300
−100
−50
−30
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −5 V
−0.7 −0.9 −1.1 −1.3 −1.5 −1.7 −1.9 −2.1
INPUT VOLTAGE $V_{I(OFF)}$ (V)

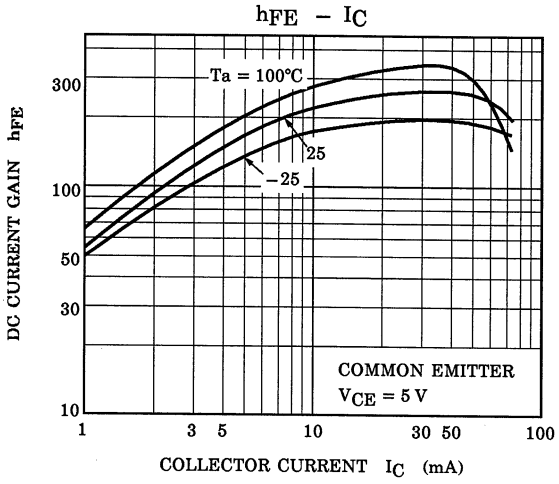

h_{FE} – I_C
DC CURRENT GAIN h_{FE}
300
100
50
30
10
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −5 V
−1 −3 −5 −10 −30 −50 −100
COLLECTOR CURRENT I_C (mA)

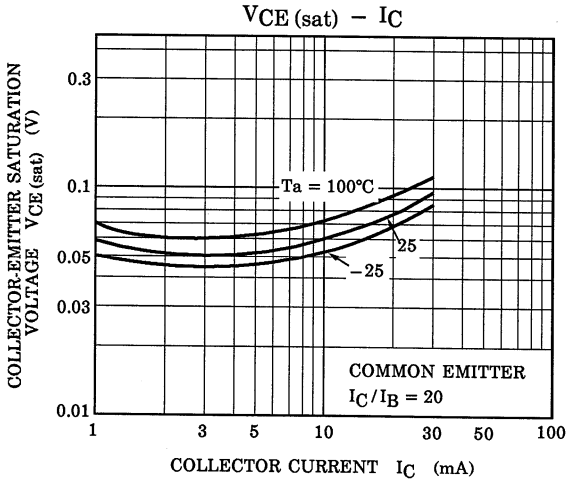

$V_{CE(sat)}$ – I_C
COLLECTOR-EMITTER SATURATION VOLTAGE $V_{CE(sat)}$ (V)
−1
−0.5
−0.3
−0.1
−0.05
−0.03
COMMON EMITTER
I_C/I_B = 20
Ta = 100°C
25
−25
−1 −3 −5 −10 −30 −50 −100
COLLECTOR CURRENT I_C (mA)

Q2


I_C – $V_{I(ON)}$
COLLECTOR CURRENT I_C (mA)
INPUT VOLTAGE $V_{I(ON)}$ (V)
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 0.2 V
100
30
10
3
1
0.3
0.1
0.1
0.3
1
3
10
30
100
300


I_C – $V_{I(OFF)}$
COLLECTOR CURRENT I_C (μA)
INPUT VOLTAGE $V_{I(OFF)}$ (V)
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 5 V
10000
5000
3000
1000
500
300
100
50
30
0.7
0.9
1.1
1.3
1.5
1.7
1.9
2.1


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


$V_{CE(sat)}$ – I_C
COLLECTOR-EMITTER SATURATION VOLTAGE $V_{CE(sat)}$ (V)
COLLECTOR CURRENT I_C (mA)
Ta = 100°C
25
−25
COMMON EMITTER
I_C / I_B = 20
0.3
0.1
0.05
0.03
0.01
1
3
5
10
30
50
100

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