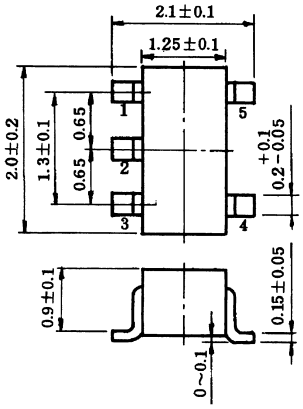
TOSHIBA Transistor Silicon NPN・PNP Epitaxial Type
(PCT process) (Bias Resistor built-in Transistor)

RN47A4

Switching, Inverter Circuit, Interface Circuit and
Driver Circuit Applications

- Two devices are incorporated into an Ultra-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. EMITTER 1 (E1)
2. BASE 1 (B1)
3. EMITTER 2 (E2)
4. COLLECTOR 2 (C2)
5. COLLECTOR 1 (C1)
BASE 2 (B2)

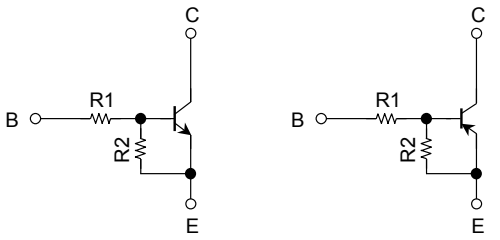
USV

JEDEC	—
JEITA	—
TOSHIBA	2-2L1D

Weight: 0.0062g (typ.)

Equivalent Circuit and Bias Resistor Values

Q1 **Q2**



Q1

R1: 47 kΩ, R2: 47 kΩ

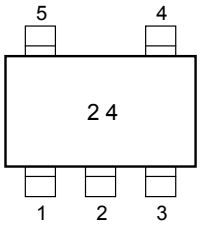
Q2

R1: 10 kΩ, R2: 47 kΩ

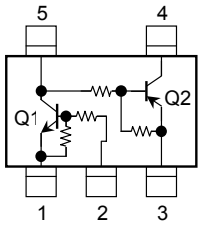
Q1: RN1104F

Q2: RN2107F

Marking



Equivalent Circuit (top view)



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

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}	−6	V
Collector current	I_C	−100	mA

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

Characteristics	Symbol	Rating	Unit
Collector power dissipation	P_C (Note)	200	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−55~150	°C

Note: Total rating

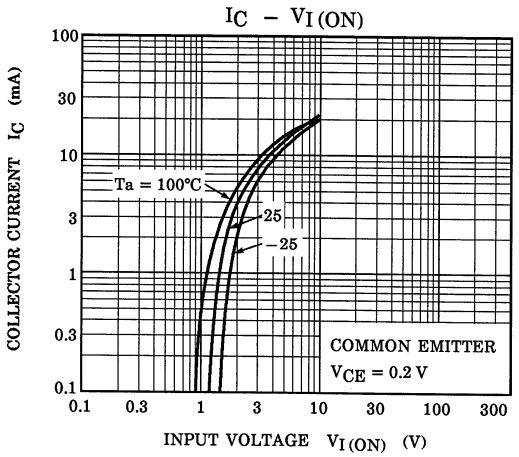
Electrical Characteristics (Ta = 25°C) (Q1)

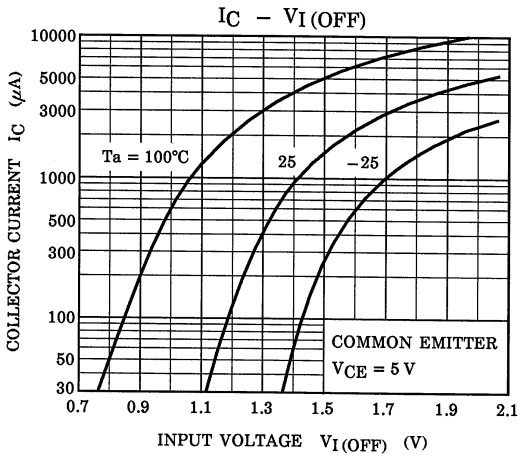
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	V_{CB} = 50 V, I_E = 0	—	—	100	nA
	I_{CEO}	V_{CE} = 50 V, I_B = 0	—	—	500	
Emitter cut-off current	I_{EBO}	V_{EB} = 10 V, I_C = 0	0.082	—	0.15	mA
DC current gain	h_{FE}	V_{CE} = 5 V, I_C = 10 mA	80	—	—	
Collector-emitter 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	—	250	—	MHz
Collector output capacitance	C_{ob}	V_{CB} = 10 V, I_E = 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	

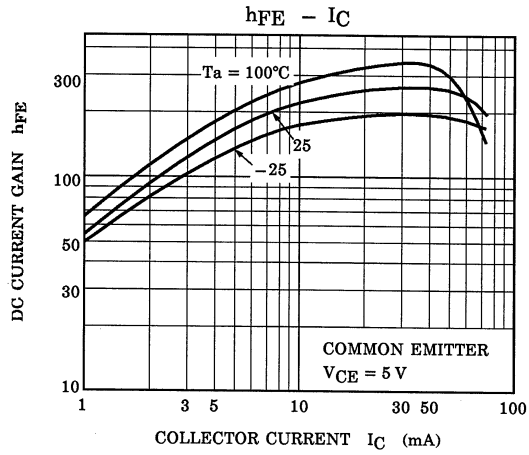
Electrical Characteristics (Ta = 25°C) (Q2)

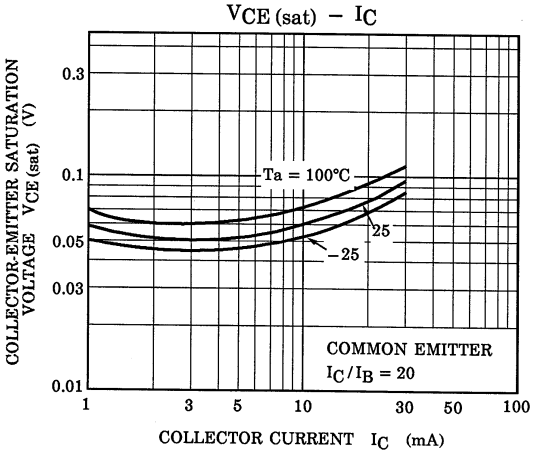
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	V_{CB} = −50 V, I_E = 0	—	—	−100	nA
	I_{CEO}	V_{CE} = −50 V, I_B = 0	—	—	−500	
Emitter cut-off current	I_{EBO}	V_{EB} = −6 V, I_C = 0	−0.081	—	−0.15	mA
DC current gain	h_{FE}	V_{CE} = −5 V, I_C = −10 mA	80	—	—	
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	−0.7	—	−1.8	V
Input voltage (OFF)	$V_{I\ (OFF)}$	V_{CE} = −5 V, I_C = −0.1 mA	−0.5	—	−1.0	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	—	7	10	13	kΩ
Resistor ratio	R1/R2	—	0.171	0.213	0.255	

Q1

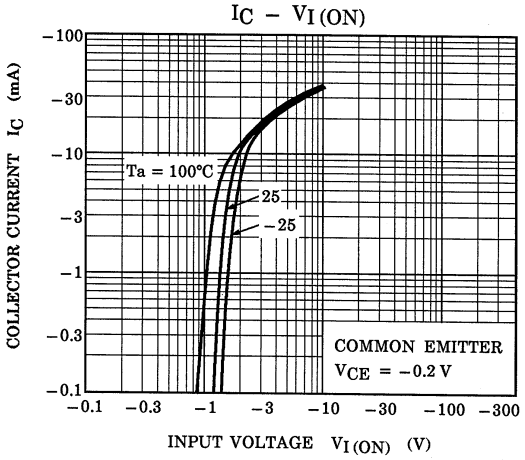

I_C – $V_{I(ON)}$
COLLECTOR CURRENT I_C (mA)
INPUT VOLTAGE $V_{I(ON)}$ (V)
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 0.2 V
100
30
10
3
1
0.3
0.1
0.1
0.3
1
3
10
30
100
300

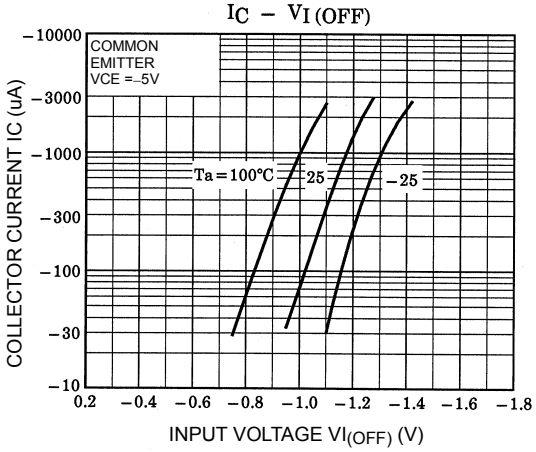

I_C – $V_{I(OFF)}$
COLLECTOR CURRENT I_C (μA)
INPUT VOLTAGE $V_{I(OFF)}$ (V)
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 5 V
10000
5000
3000
1000
500
300
100
50
30
0.7
0.9
1.1
1.3
1.5
1.7
1.9
2.1

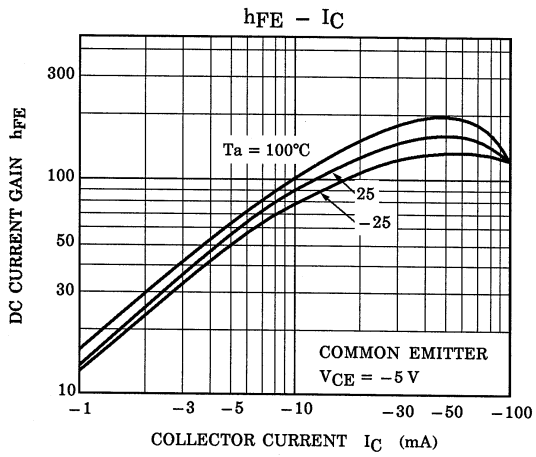

h_{FE} – I_C
DC CURRENT GAIN h_{FE}
COLLECTOR CURRENT I_C (mA)
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 5 V
300
100
50
30
10
1
3
5
10
30
50
100

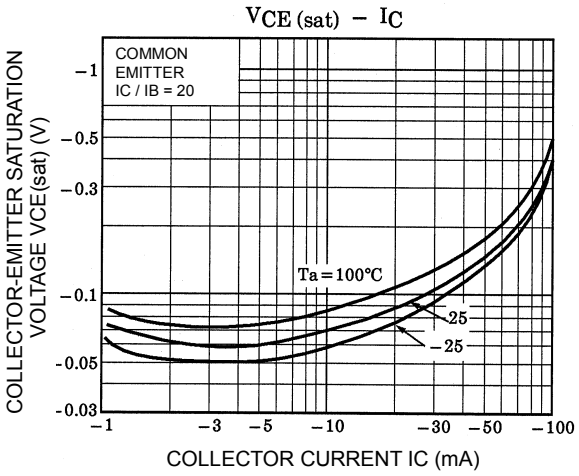

$V_{CE(sat)}$ – I_C
COLLECTOR-EMITTER SATURATION VOLTAGE $V_{CE(sat)}$ (V)
COLLECTOR CURRENT I_C (mA)
Ta = 100°C
25
−25
COMMON EMITTER
I_C/I_B = 20
0.3
0.1
0.05
0.03
0.01
1
3
5
10
30
50
100

Q2

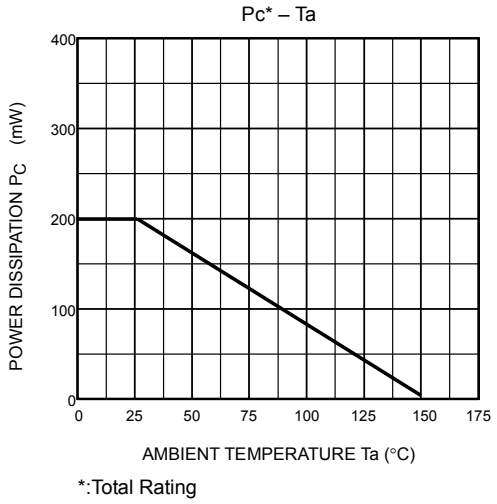

I_C – $V_{I\,(ON)}$
COLLECTOR CURRENT I_C (mA)
−100
−30
−10
−3
−1
−0.3
−0.1
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −0.2 V
−0.1 −0.3 −1 −3 −10 −30 −100 −300
INPUT VOLTAGE $V_{I\,(ON)}$ (V)


I_C – $V_{I\,(OFF)}$
COMMON
EMITTER
VCE =-5V
COLLECTOR CURRENT IC (uA)
−10000
−3000
−1000
−300
−100
−30
−10
Ta=100°C
25
−25
0.2 −0.4 −0.6 −0.8 −1.0 −1.2 −1.4 −1.6 −1.8
INPUT VOLTAGE $VI_{(OFF)}$ (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
COMMON
EMITTER
IC / IB = 20
COLLECTOR-EMITTER SATURATION
VOLTAGE VCE(sat) (V)
−1
−0.5
−0.3
−0.1
-0.05
-0.03
Ta=100°C
25
−25
−1 −3 −5 −10 −30 −50 −100
COLLECTOR CURRENT IC (mA)

Q1, Q2 Common



*:Total Rating