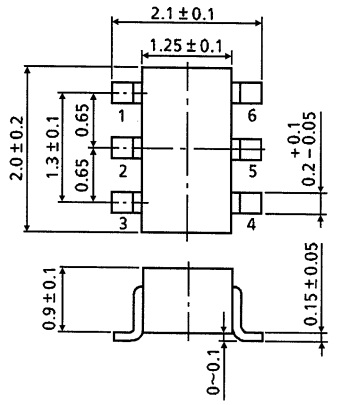
TOSHIBA Transistor
Silicon NPN Epitaxial Type (PCT Process) Silicon PNP Epitaxial Type (PCT Process)

RN49A5

Switching, Inverter Circuit, Interface Circuit and Driver Circuit Applications

- Two devices are incorporated into an Ultra-Super-Mini (6-pin) package.
- Incorporating a bias resistor into a transistor reduces the parts count. Reducing the parts count enables the manufacture of ever more compact equipment and lowers assembly cost.
- Diverse resistance values are available suited to a range of different circuit designs.

Unit: mm



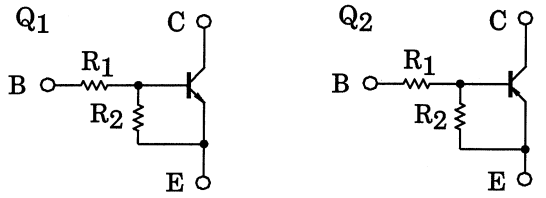
1. EMITTER 1 (E1)
2. BASE 1 (B1)
3. COLLECTOR 2 (C2)
4. EMITTER 2 (E2)
5. BASE 2 (B2)
6. COLLECTOR 1 (C1)

US6

JEDEC	—
JEITA	—
TOSHIBA	2-2J1A

Weight: 6.8 mg (typ.)

Equivalent Circuit and Bias Resister Values



Q1

R1: 10 kΩ, R2 : 47 kΩ

Q2

R1: 2.2 kΩ, R2: 10 kΩ

Q1: RN1107F Equivalent

Q2: RN2327A Equivalent

Q1 Absolute Maximum Ratings (Ta = 25°C)

Characteristic	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

Q2 Absolute Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-base voltage	V_{CBO}	−15	V
Collector-emitter voltage	V_{CEO}	−12	V
Emitter-base voltage	V_{EBO}	−6	V
Collector current	I_C	−500	mA

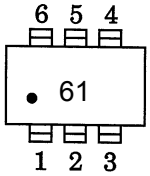
Q1, Q2 Common Absolute Maximum Ratings (Ta = 25°C)

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

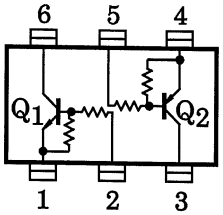
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

*: Total rating

Marking



Equivalent Circuit (Top View)



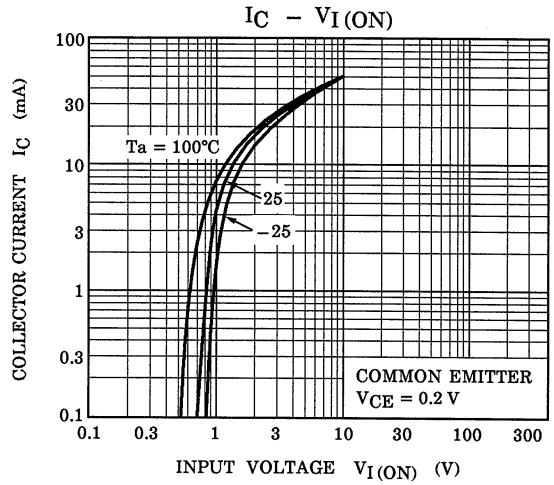
Q1 Electrical Characteristics (Ta = 25°C)

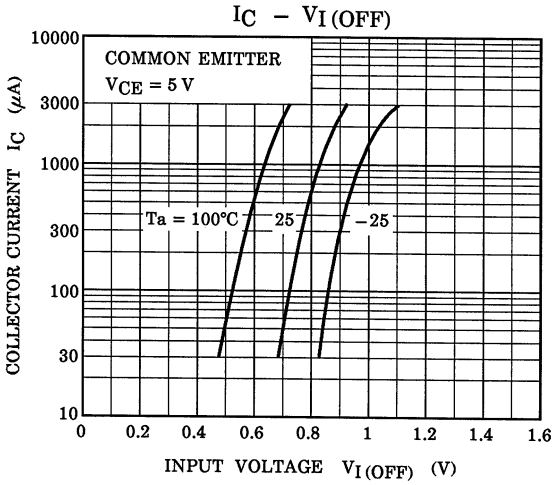
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	—	V_{CB} = 50 V, I_E = 0	—	—	100	nA
	I_{CEO}	—	V_{CE} = 50 V, I_B = 0	—	—	500	
Emitter cut-off current	I_{EBO}	—	V_{EB} = 6 V, I_C = 0	0.081	—	0.15	mA
DC current gain	h_{FE}	—	V_{CE} = 5 V, I_C = 10 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	—	250	—	MHz
Collector output capacitance	C_{ob}	—	V_{CB} = 10 V, I_E = 0, f = 1 MHz	—	3	6	pF
Input resistor	R1	—	—	7	10	13	kΩ
Resistor ratio	R1/R2	—	—	0.191	0.213	0.232	—

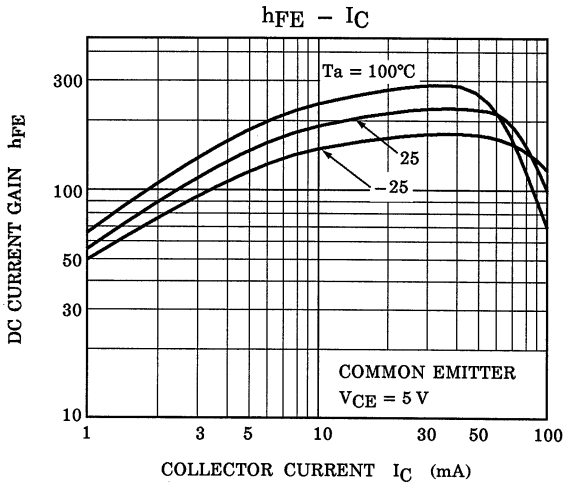
Q2 Electrical Characteristics (Ta = 25°C)

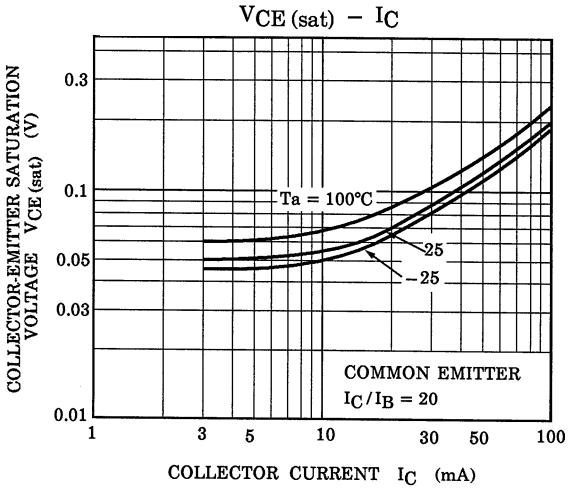
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	—	V_{CB} = −15 V, I_E = 0	—	—	−100	nA
	I_{CEO}	—	V_{CE} = −12 V, I_B = 0	—	—	−500	
Emitter cut-off current	I_{EBO}	—	V_{EB} = −6 V, I_C = 0	−0.378	—	−0.703	mA
DC current gain	h_{FE}	—	V_{CE} = −1 V, I_C = −50 mA	140	—	—	—
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	—	I_C = −50 mA, I_B = −1 mA	—	−0.1	−0.3	V
Input voltage (ON)	$V_{I\ (ON)}$	—	V_{CE} = −0.2 V, I_C = 50 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} = −5 V, I_C = −20 mA	—	200	—	MHz
Collector output capacitance	C_{ob}	—	V_{CB} = −10 V, I_E = 0	—	3	6	pF
Input resistor	R1	—	—	1.54	2.2	2.86	kΩ
Resistor ratio	R1/R2	—	—	0.187	0.22	0.253	—

Q1

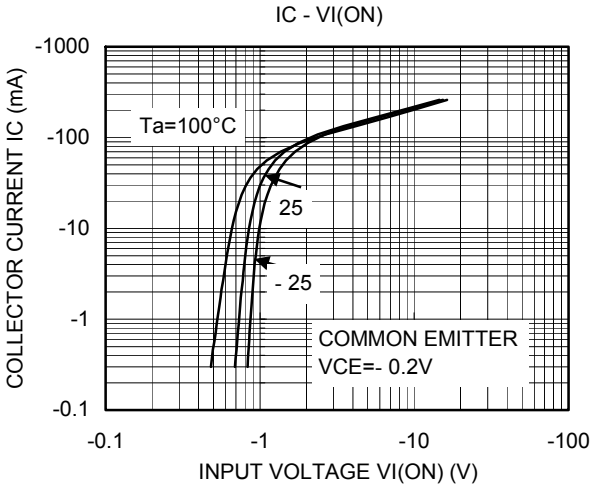

I_C – $V_{I(ON)}$
COLLECTOR CURRENT I_C (mA)
100
30
10
3
1
0.3
0.1
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 0.2 V
0.1 0.3 1 3 10 30 100 300
INPUT VOLTAGE $V_{I(ON)}$ (V)

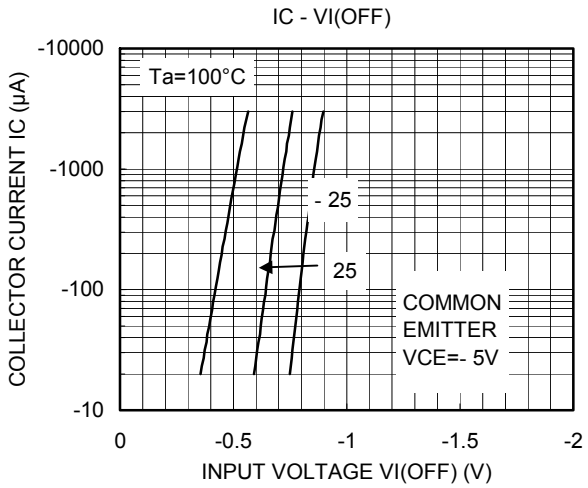

I_C – $V_{I(OFF)}$
COLLECTOR CURRENT I_C (μA)
10000
3000
1000
300
100
30
10
COMMON EMITTER
V_{CE} = 5 V
Ta = 100°C
25
−25
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6
INPUT VOLTAGE $V_{I(OFF)}$ (V)

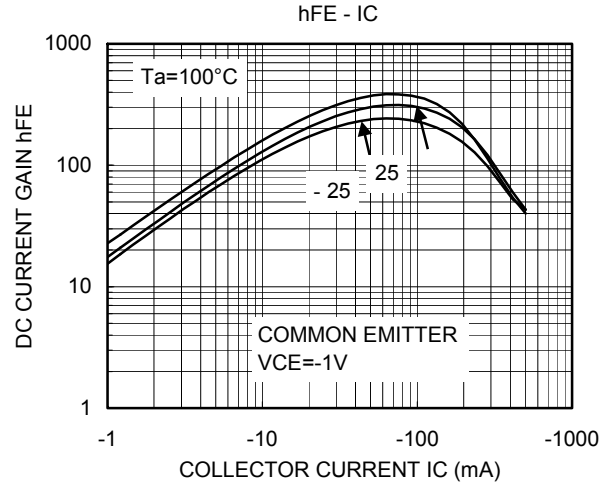

h_{FE} – I_C
DC CURRENT GAIN h_{FE}
300
100
50
30
10
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 5 V
1 3 5 10 30 50 100
COLLECTOR CURRENT I_C (mA)

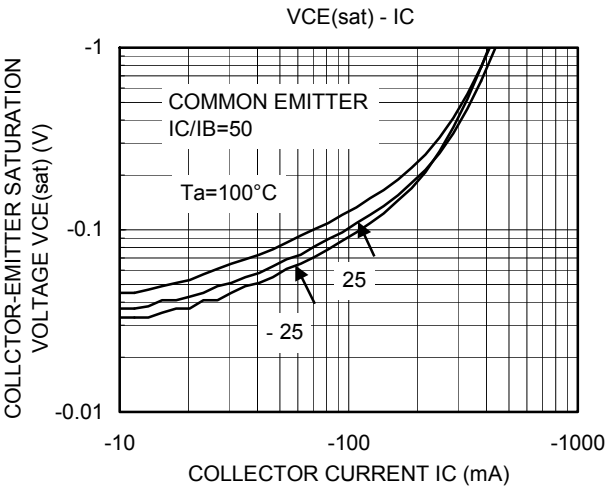

$V_{CE(sat)}$ – I_C
COLLECTOR-EMITTER SATURATION VOLTAGE $V_{CE(sat)}$ (V)
0.3
0.1
0.05
0.03
0.01
Ta = 100°C
25
−25
COMMON EMITTER
I_C/I_B = 20
1 3 5 10 30 50 100
COLLECTOR CURRENT I_C (mA)

Q2


IC - VI(ON)
COLLECTOR CURRENT IC (mA)
-1000
-100
-10
-1
-0.1
Ta=100°C
25
- 25
COMMON EMITTER
VCE=- 0.2V
-0.1
-1
-10
-100
INPUT VOLTAGE VI(ON) (V)


IC - VI(OFF)
COLLECTOR CURRENT IC (μA)
-10000
-1000
-100
-10
Ta=100°C
- 25
25
COMMON
EMITTER
VCE=- 5V
0
-0.5
-1
-1.5
-2
INPUT VOLTAGE VI(OFF) (V)


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


VCE(sat) - IC
COLLCTOR-EMITTER SATURATION
VOLTAGE VCE(sat) (V)
-1
-0.1
-0.01
COMMON EMITTER
IC/IB=50
Ta=100°C
25
- 25
-10
-100
-1000
COLLECTOR CURRENT IC (mA)

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