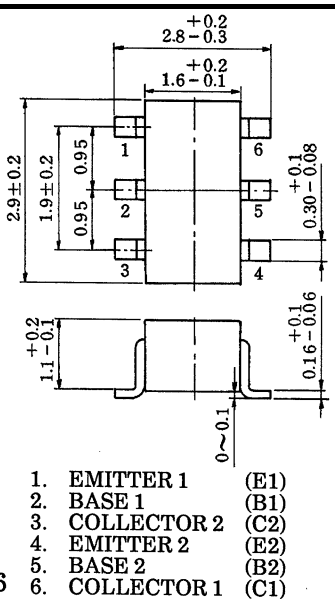
TOSHIBA Transistor Silicon PNP · NPN Epitaxial Type
(PCT Process) (Bias Resistor Built-in Transistor)

RN4605

Switching, Inverter Circuit, Interface Circuit
and Driver Circuit Applications

- Including two devices in SM6 (super mini type with 6 leads)
- With built-in bias resistors
- Simplify circuit design
- Reduce a quantity of parts and manufacturing process

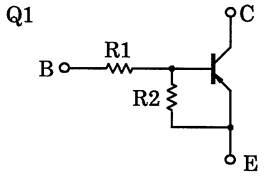
Unit: mm

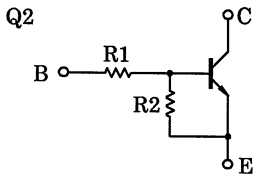


JEDEC	—
JEITA	—
TOSHIBA	2-3N1A

Weight: 15 mg (typ.)

Equivalent Circuit and Bias Resister Values





R1: 2.2kΩ
R2: 47kΩ
(Q1, Q2 Common)

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}	−5	V
Collector current	I_C	−100	mA

Q2 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}	5	V
Collector current	I_C	100	mA

Start of commercial production
1988-11

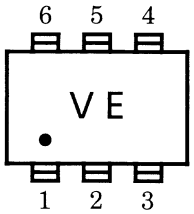
Q1, Q2 Common Absolute Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Collector power dissipation	P_C *	300	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−55 to 150	°C

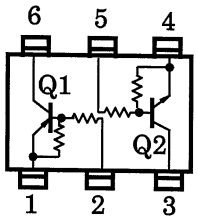
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

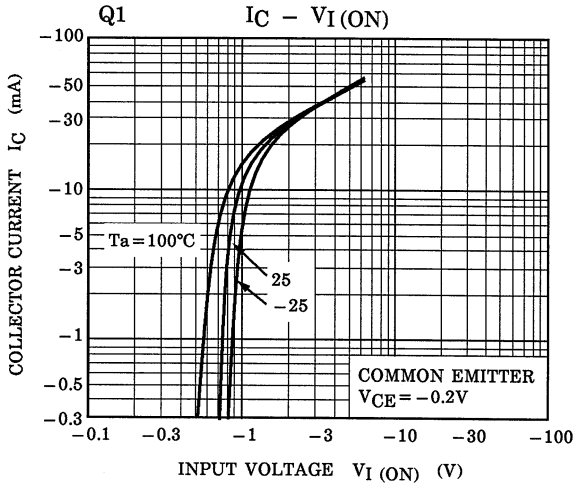
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	—	V_{CB} = −50V, I_E = 0	—	—	−100	nA
	I_{CEO}	—	V_{CE} = −50V, I_B = 0	—	—	−500	
Emitter cut-off current	I_{EBO}	—	V_{EB} = −5V, I_C = 0	−0.078	—	−0.145	mA
DC current gain	h_{FE}	—	V_{CE} = −5V, I_C = −10mA	80	—	—	—
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	—	I_C = −5mA, I_B = −0.25mA	—	−0.1	−0.3	V
Input voltage (ON)	$V_{I\ (ON)}$	—	V_{CE} = −0.2V, I_C = −5mA	−0.6	—	−1.1	V
Input voltage (OFF)	$V_{I\ (OFF)}$	—	V_{CE} = −5V, I_C = −0.1mA	−0.5	—	−0.8	V
Transition frequency	f_T	—	V_{CE} = −10V, I_C = −5mA	—	200	—	MHz
Collector output capacitance	C_{ob}	—	V_{CB}=−10V, I_E = 0, f = 1 MHz	—	3	6	pF

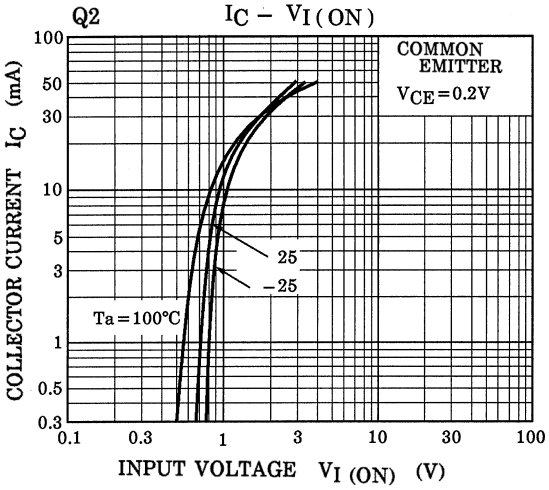
Q2 Electrical Characteristics (Ta = 25°C)

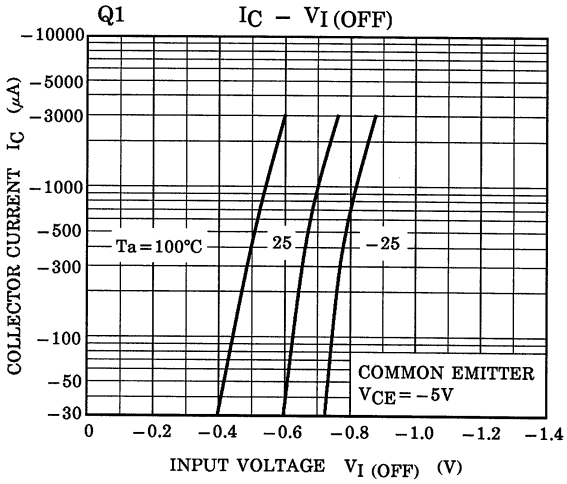
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	—	V_{CB} = 50V, I_E = 0	—	—	100	nA
	I_{CEO}	—	V_{CE} = 50V, I_B = 0	—	—	500	
Emitter cut-off current	I_{EBO}	—	V_{EB} = 5V, I_C = 0	0.078	—	0.145	mA
DC current gain	h_{FE}	—	V_{CE} = 5V, I_C = 10mA	80	—	—	—
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	—	I_C = 5mA, I_B = 0.25mA	—	0.1	0.3	V
Input voltage (ON)	$V_{I\ (ON)}$	—	V_{CE} = 0.2V, I_C = 5mA	0.6	—	1.1	V
Input voltage (OFF)	$V_{I\ (OFF)}$	—	V_{CE} = 5V, I_C = 0.1mA	0.5	—	0.8	V
Transition frequency	f_T	—	V_{CE} = 10V, I_C = 5mA	—	250	—	MHz
Collector output capacitance	C_{ob}	—	V_{CB} = 10V, I_E = 0, f = 1 MHz	—	3	6	pF

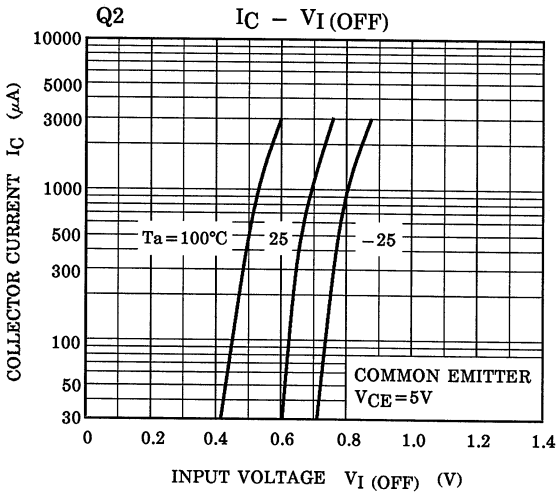
Q1, Q2 Common Electrical Characteristics (Ta = 25°C)

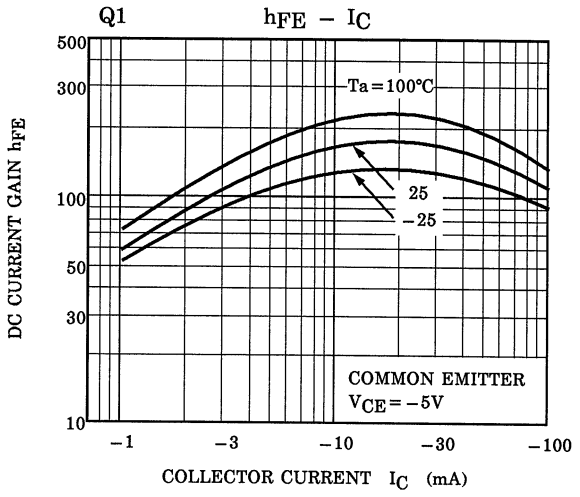
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input resistor	R1	—	—	1.54	2.2	2.86	kΩ
Resistor ratio	R1/R2	—	—	0.0421	0.0468	0.0515	—

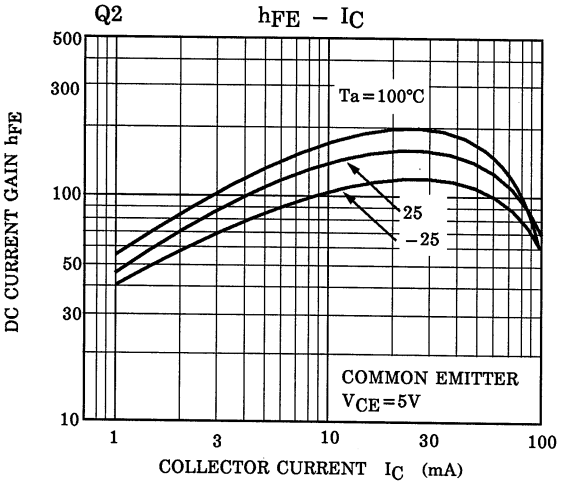

Q1
I_C – $V_{I(ON)}$
COLLECTOR CURRENT I_C (mA)
−100
−50
−30
−10
−5
−3
−1
−0.5
−0.3
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −0.2V
−0.1
−0.3
−1
−3
−10
−30
−100
INPUT VOLTAGE $V_{I(ON)}$ (V)


Q2
I_C – $V_{I(ON)}$
COLLECTOR CURRENT I_C (mA)
100
50
30
10
5
3
1
0.5
0.3
COMMON EMITTER
V_{CE} = 0.2V
25
−25
Ta = 100°C
0.1
0.3
1
3
10
30
100
INPUT VOLTAGE $V_{I(ON)}$ (V)


Q1
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} = −5V
0
−0.2
−0.4
−0.6
−0.8
−1.0
−1.2
−1.4
INPUT VOLTAGE $V_{I(OFF)}$ (V)


Q2
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} = 5V
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
INPUT VOLTAGE $V_{I(OFF)}$ (V)


Q1
h_{FE} – I_C
DC CURRENT GAIN h_{FE}
500
300
100
50
30
10
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −5V
−1
−3
−10
−30
−100
COLLECTOR CURRENT I_C (mA)


Q2
h_{FE} – I_C
DC CURRENT GAIN h_{FE}
500
300
100
50
30
10
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 5V
1
3
10
30
100
COLLECTOR CURRENT I_C (mA)

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