

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

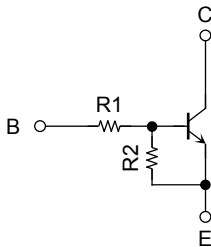
RN4988FE

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.

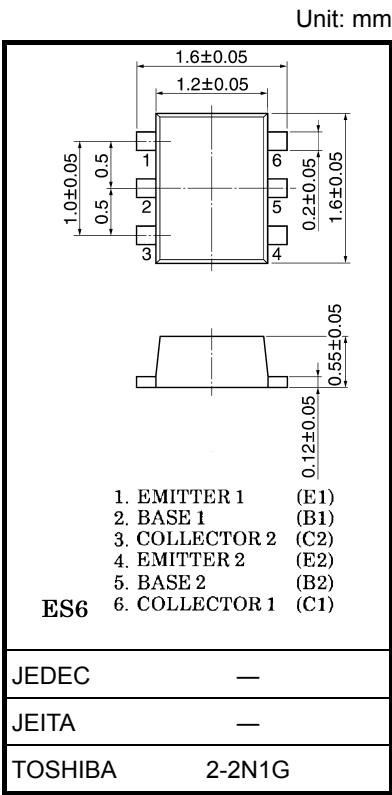
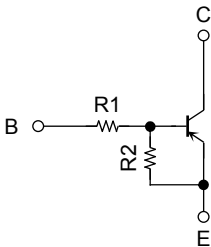
Equivalent Circuit and Bias Resistor Values

Q1



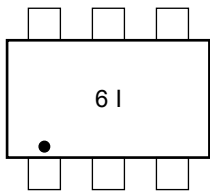
R1: 22 kΩ
R2: 47 kΩ
(Q1, Q2 common)

Q2

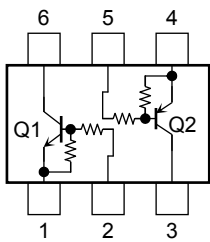


Weight: 0.003 g (typ.)

Marking



Equivalent Circuit (top view)



Start of commercial production
2000-05

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}	7	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}	–7	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 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).

Note 1: Total rating

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	$V_{CB} = 50\text{ V}, I_E = 0$	—	—	100	nA
	I_{CEO}	$V_{CE} = 50\text{ V}, I_B = 0$	—	—	500	
Emitter cut-off current	I_{EBO}	$V_{EB} = 7\text{ V}, I_C = 0$	0.078	—	0.145	mA
DC current gain	h_{FE}	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$	80	—	—	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$	—	0.1	0.3	V
Input voltage (ON)	$V_I(ON)$	$V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$	1.0	—	2.6	V
Input voltage (OFF)	$V_I(OFF)$	$V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$	0.6	—	1.16	V
Transition frequency	f_T	$V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$	—	250	—	MHz
Collector output capacitance	C_{ob}	$V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$	—	3	6	pF

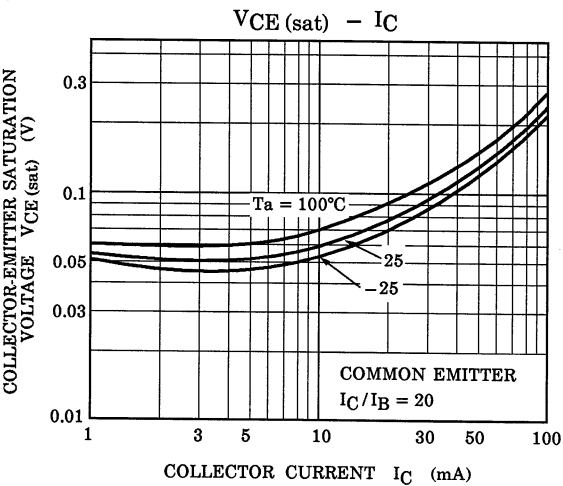
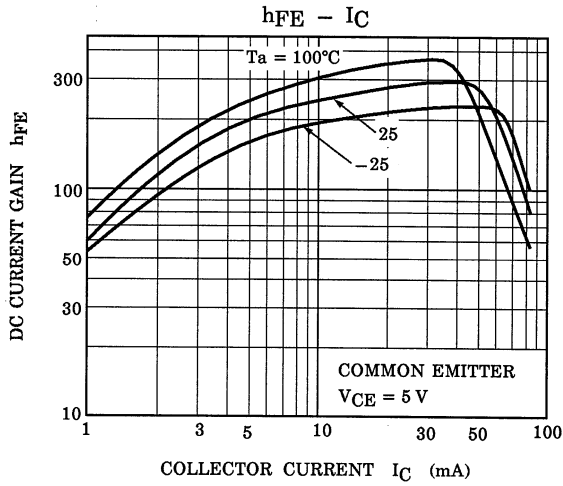
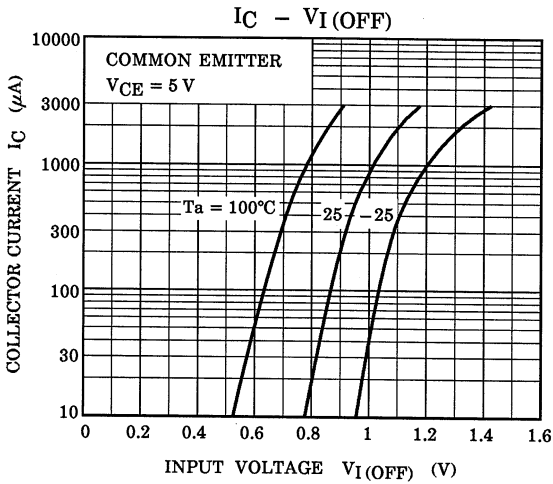
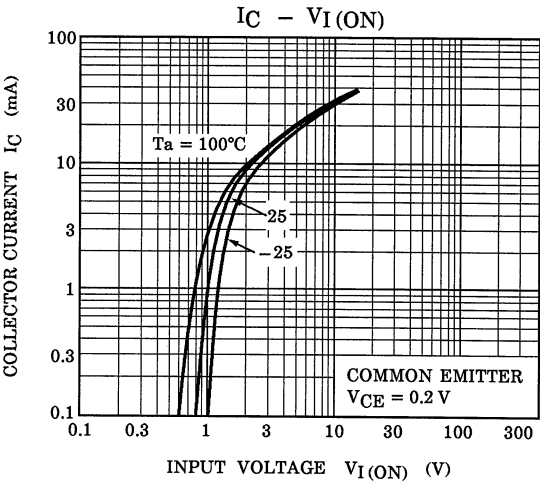
Electrical Characteristics (Ta = 25°C) (Q2)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	$V_{CB} = -50\text{ V}, I_E = 0$	—	—	-100	nA
	I_{CEO}	$V_{CE} = -50\text{ V}, I_B = 0$	—	—	-500	
Emitter cut-off current	I_{EBO}	$V_{EB} = -7\text{ V}, I_C = 0$	-0.078	—	-0.145	mA
DC current gain	h_{FE}	$V_{CE} = -5\text{ V}, I_C = -10\text{ mA}$	80	—	—	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = -5\text{ mA}, I_B = -0.25\text{ mA}$	—	-0.1	-0.3	V
Input voltage (ON)	$V_I(ON)$	$V_{CE} = -0.2\text{ V}, I_C = -5\text{ mA}$	-1.0	—	-2.6	V
Input voltage (OFF)	$V_I(OFF)$	$V_{CE} = -5\text{ V}, I_C = -0.1\text{ mA}$	-0.6	—	-1.16	V
Transition frequency	f_T	$V_{CE} = -10\text{ V}, I_C = -5\text{ mA}$	—	200	—	MHz
Collector output capacitance	C_{ob}	$V_{CB} = -10\text{ V}, I_E = 0, f = 1\text{ MHz}$	—	3	6	pF

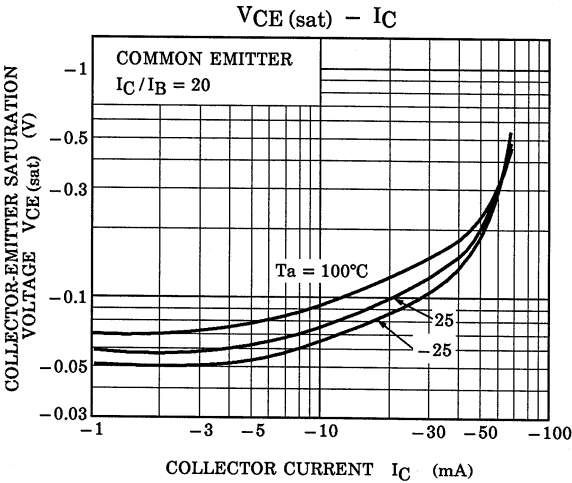
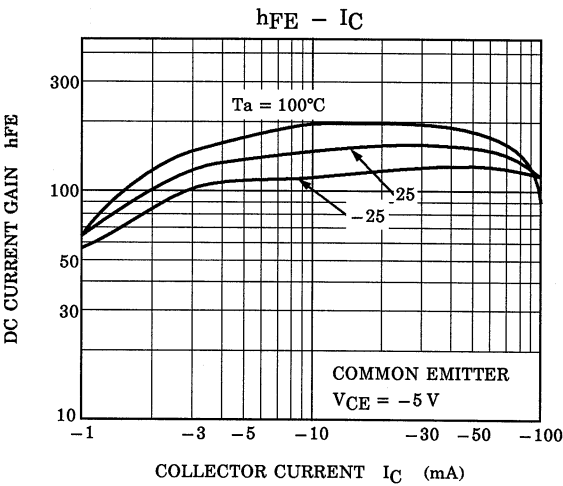
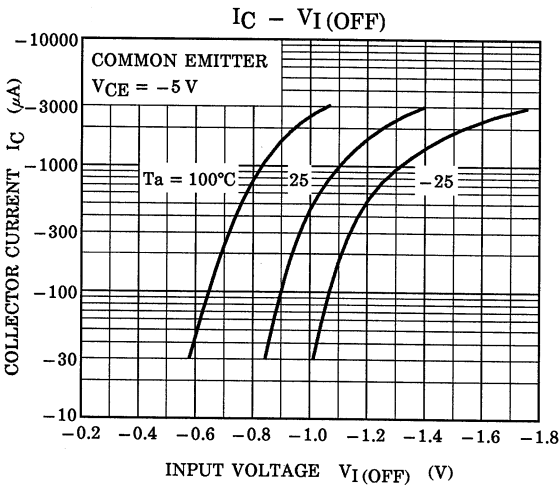
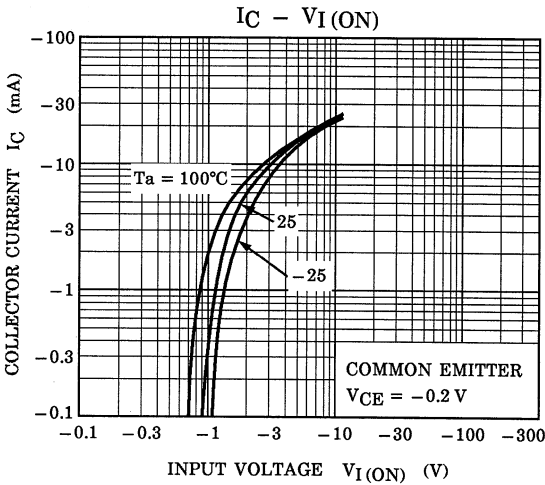
Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input resistor	R1	—	15.4	22	28.6	k Ω
Resistor ratio	R1/R2	—	0.421	0.468	0.515	

Q1



Q2



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