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TOSHIBA Transistor Silicon NPN Epitaxial Type (PCT Process) (Bias Resistor built-in Transistor)

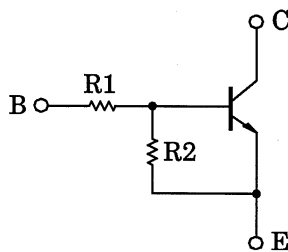
## RN1601, RN1602, RN1603 RN1604, RN1605, RN1606

Unit: mm

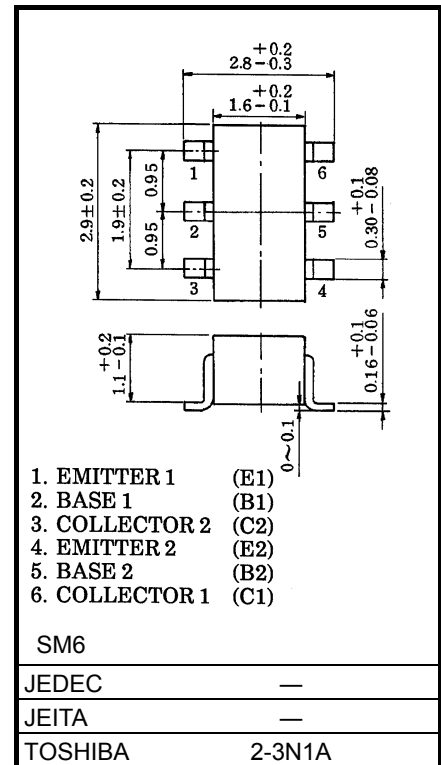
Switching, Inverter Circuit, Interface Circuit and Driver Circuit Applications

- Including two devices in SM6 (super-mini-type with six (6) leads)
- With built-in bias resistors
- Simplified circuit design
- Reduced number of parts and manufacturing process
- Complementary to RN2601 to RN2606

### Equivalent Circuit and Bias Resistor Values



Type No.	R1 (kΩ)	R2 (kΩ)
RN1601	4.7	4.7
RN1602	10	10
RN1603	22	22
RN1604	47	47
RN1605	2.2	47
RN1606	4.7	47

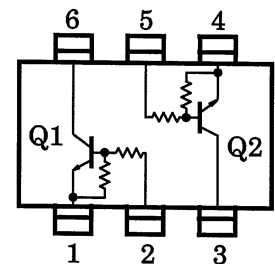


Weight: 15mg (typ.)

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

Characteristic	Symbol	Rating	Unit
Collector-base voltage	V <sub>CBO</sub>	50	V
Collector-emitter voltage			
Emitter-base voltage	V <sub>EBO</sub>	10	V
		5	
Collector current	I <sub>C</sub>	100	mA
Collector power dissipation	P <sub>C</sub> *	300	mW
Junction temperature	T <sub>j</sub>	150	°C
Storage temperature range	T <sub>stg</sub>	-55 to 150	°C

### Equivalent Circuit (Top View)



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).

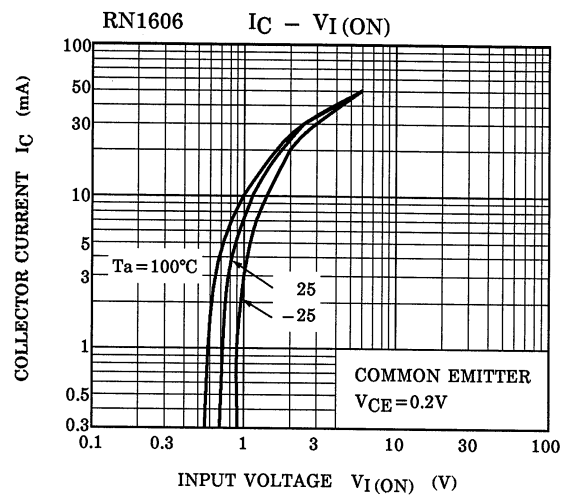
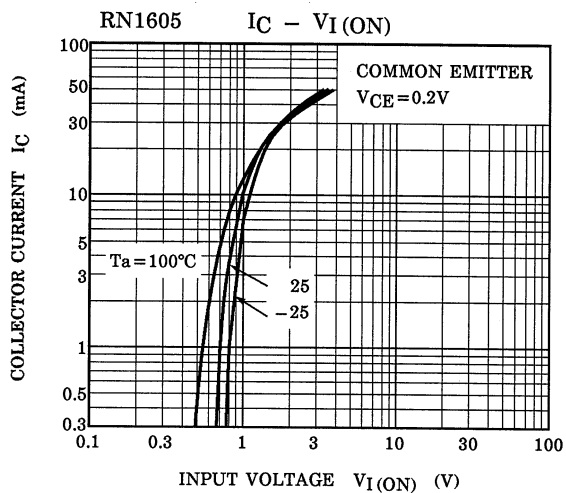
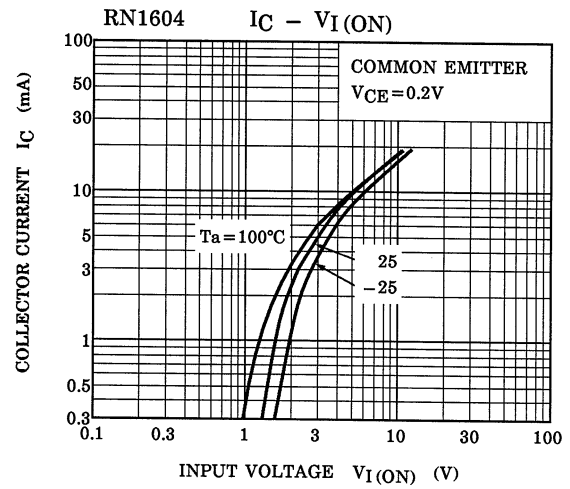
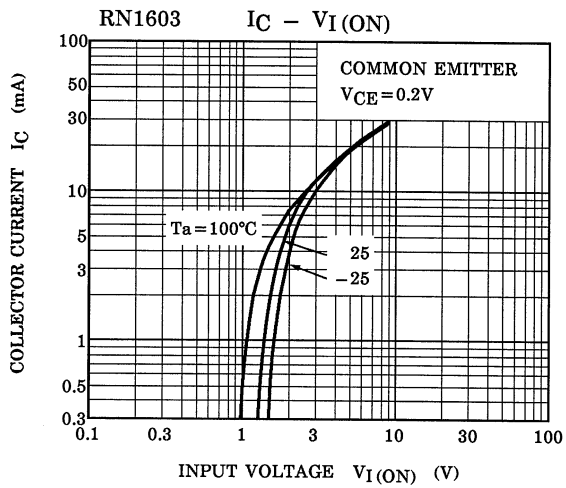
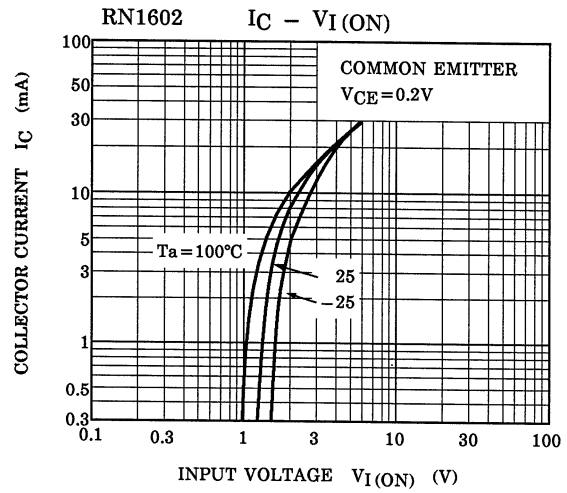
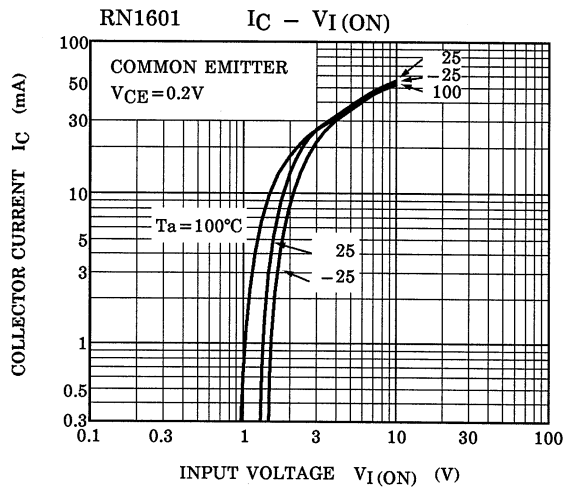
\*Total rating

Start of commercial production  
1988-11

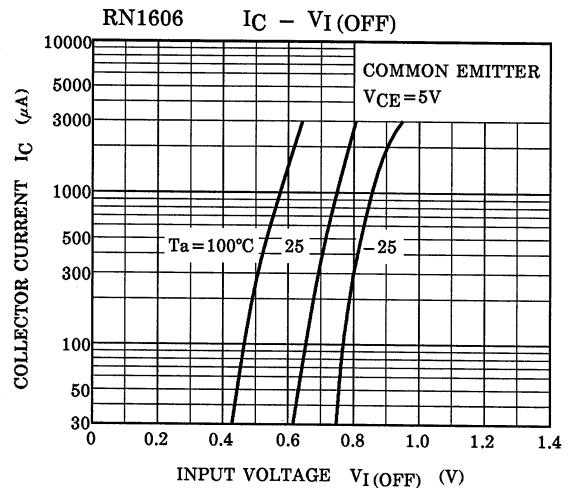
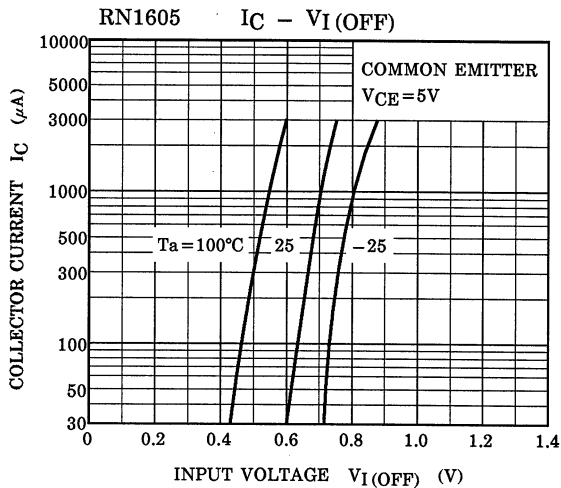
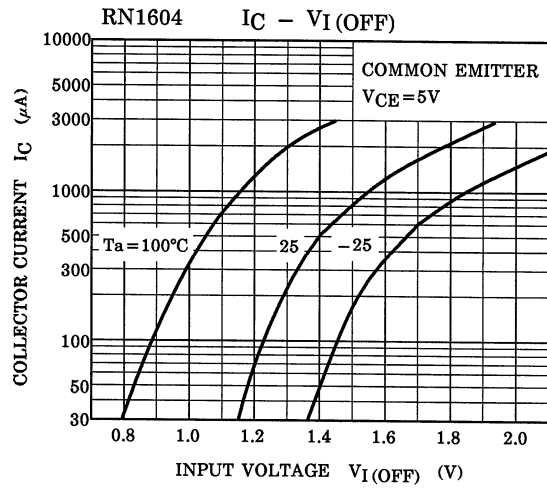
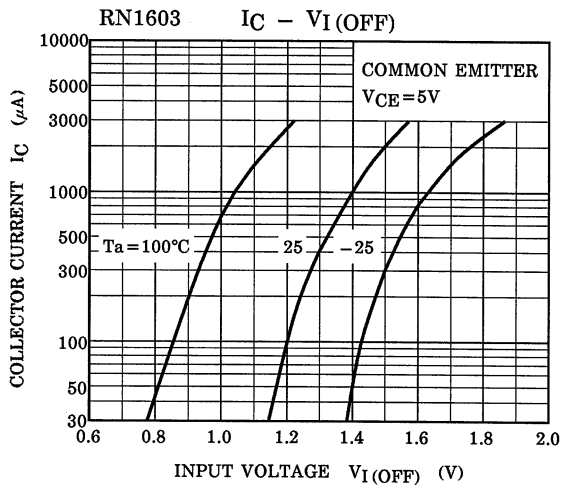
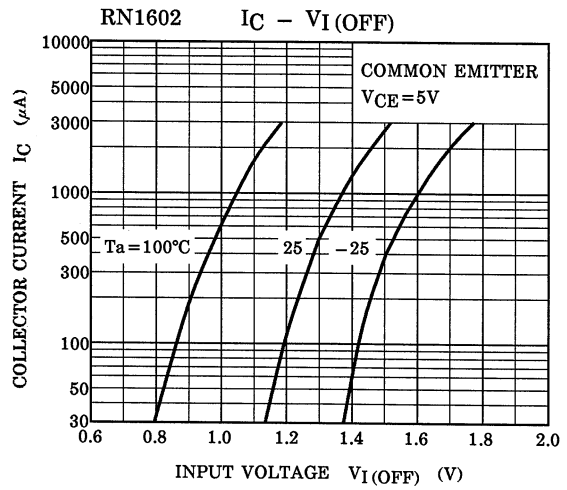
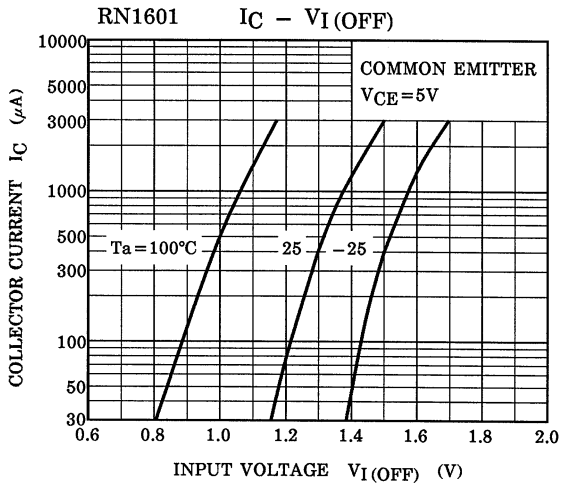
## Electrical Characteristics (Ta = 25°C) (Q1, Q2 Common)

Characteristic		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN1601 to 1606	$I_{CBO}$	—	$V_{CB} = 50\text{ V}, I_E = 0$	—	—	100	nA
		$I_{CEO}$	—	$V_{CE} = 50\text{ V}, I_B = 0$	—	—	500	
Emitter cut-off current	RN1601	$I_{EBO}$	—	$V_{EB} = 10\text{ V}, I_C = 0$	0.82	—	1.52	mA
	RN1602		—		0.38	—	0.71	
	RN1603		—		0.17	—	0.33	
	RN1604		—		0.082	—	0.15	
	RN1605		—	$V_{EB} = 5\text{ V}, I_C = 0$	0.078	—	0.145	
	RN1606		—		0.074	—	0.138	
DC current gain	RN1601	$h_{FE}$	—	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$	30	—	—	—
	RN1602		—		50	—	—	
	RN1603		—		70	—	—	
	RN1604		—		80	—	—	
	RN1605		—		80	—	—	
	RN1606		—		80	—	—	
Collector-emitter saturation voltage	RN1601 to 1606	$V_{CE(sat)}$	—	$I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$	—	0.1	0.3	V
Input voltage (ON)	RN1601	$V_{I(ON)}$	—	$V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$	1.1	—	2.0	V
	RN1602		—		1.2	—	2.4	
	RN1603		—		1.3	—	3.0	
	RN1604		—		1.5	—	5.0	
	RN1605		—		0.6	—	1.1	
	RN1606		—		0.7	—	1.3	
Input voltage (OFF)	RN1601 to 1604	$V_{I(OFF)}$	—	$V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$	1.0	—	1.5	V
	RN1605 to 1606		—		0.5	—	0.8	
Transition frequency	RN1601 to 1606	$f_T$	—	$V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$	—	250	—	MHz
Collector output capacitance	RN1601 to 1606	$C_{ob}$	—	$V_{CB} = 10\text{ V}, I_E = 0$ $f = 1\text{ MHz}$	—	3	6	pF
Input resistor	RN1601	R1	—	—	3.29	4.7	6.11	kΩ
	RN1602		—		7	10	13	
	RN1603		—		15.4	22	28.6	
	RN1604		—		32.9	47	61.1	
	RN1605		—		1.54	2.2	2.86	
	RN1606		—		3.29	4.7	6.11	
Resistor ratio	RN1601 to 1604	R1/R2	—	—	0.9	1.0	1.1	—
	RN1605		—		0.0421	0.0468	0.0515	
	RN1606		—		0.09	0.1	0.11	

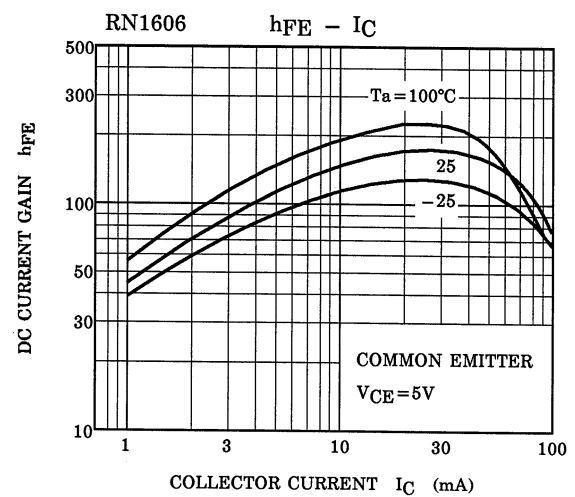
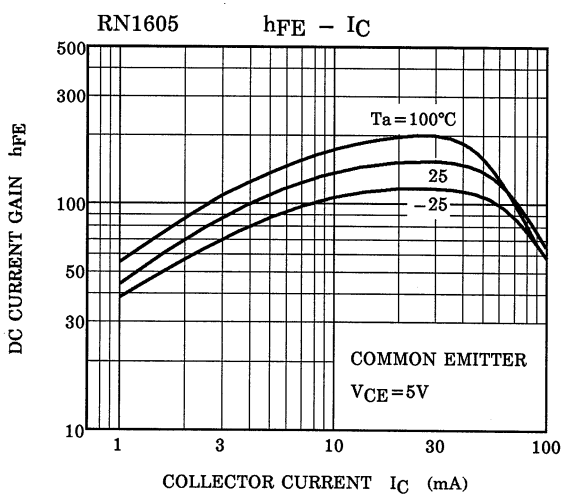
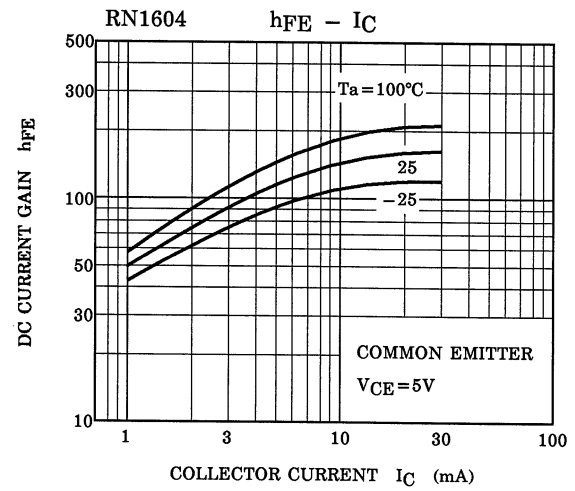
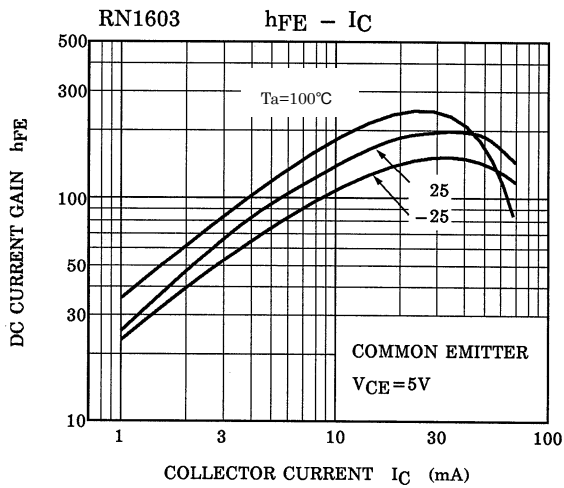
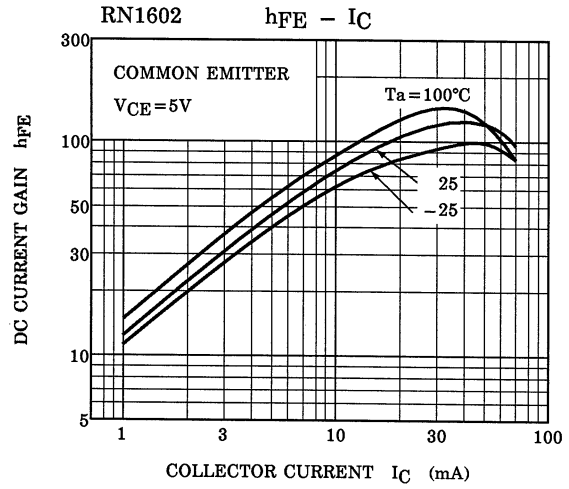
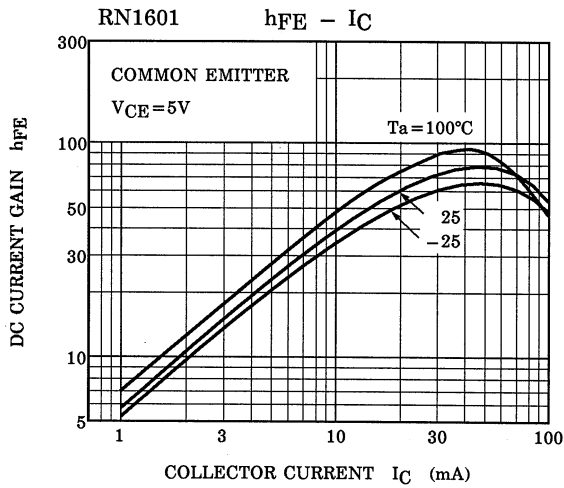
(Q1, Q2 Common)



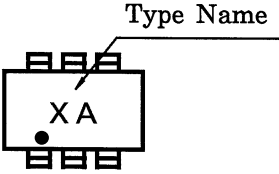
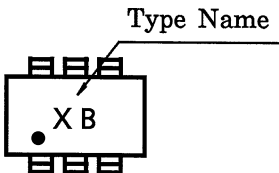
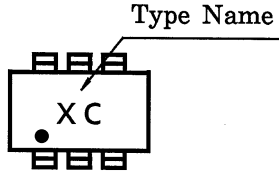
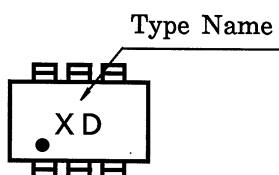
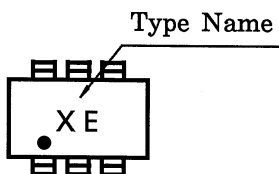
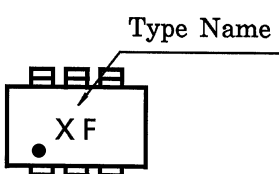
(Q1, Q2 Common)



(Q1, Q2 Common)



## Marking

Type Name	Marking
RN1601	
RN1602	
RN1603	
RN1604	
RN1605	
RN1606	

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