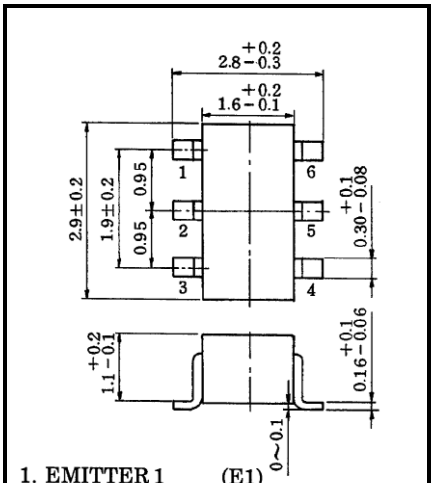
TOSHIBA Transistor Silicon NPN Epitaxial Type (PCT Process) (Bias Resistor built-in Transistor)

RN1601, RN1602, RN1603
RN1604, RN1605, RN1606

Unit: mm

Switching, Inverter Circuit,
Interface Circuit and Driver Circuit

- Including two devices in SM6 (super-mini-type with six (6) leads)
- With built-in bias resistors
- Simplified circuit design
- Reduce a quantity of parts and manufacturing process and miniaturize equipment.
- Various resistance values are available to suit various circuit designs.
- Complementary to RN2601 to RN2606



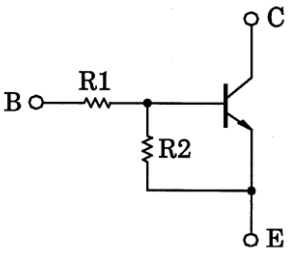
1. EMITTER 1 (E1)
2. BASE 1 (B1)
3. COLLECTOR 2 (C2)
4. EMITTER 2 (E2)
5. BASE 2 (B2)
6. COLLECTOR 1 (C1)

SM6

JEDEC	—
JEITA	—
TOSHIBA	2-3N1A

Weight: 15mg (typ.)

Equivalent Circuit and Bias Resistor Values



Part 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

Start of commercial production
1988-11

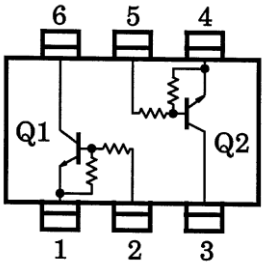
Absolute Maximum Ratings (Ta = 25°C) (Q1, Q2 Common)

Characteristic		Symbol	Rating	Unit
Collector-base voltage	RN1601 to 1606	V_{CBO}	50	V
Collector-emitter voltage		V_{CEO}	50	V
Emitter-base voltage	RN1601 to 1604	V_{EBO}	10	V
	RN1605, 1606		5	
Collector current	RN1601 to 1606	I_C	100	mA
Collector power dissipation		P_C*	300	mW
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	−55 to150	°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

Internal Circuit (Top View)

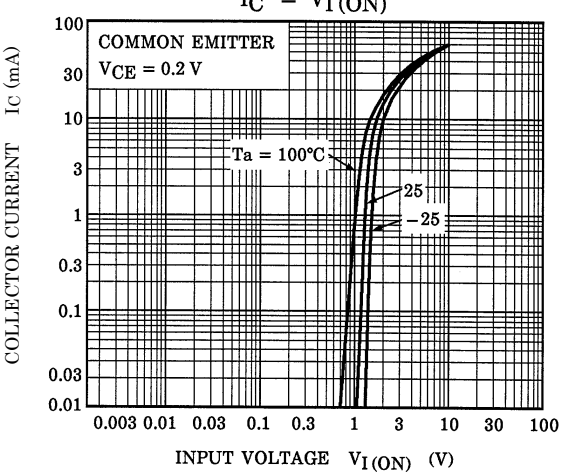


Electrical Characteristics (Ta = 25°C) (Q1, Q2 Common)

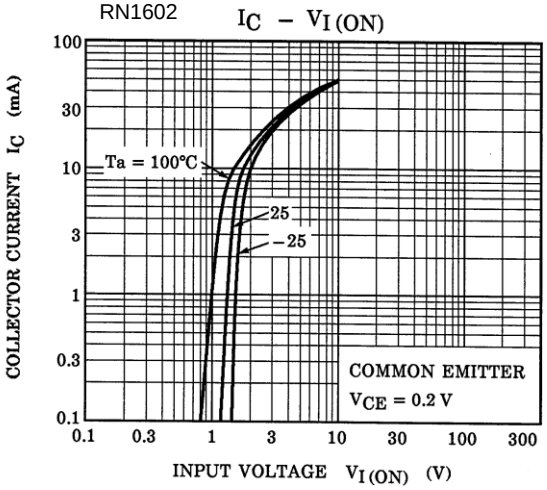
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN1601 to 1606	I_{CBO}	V_{CB} = 50 V, I_E = 0 mA	—	—	100	nA
		I_{CEO}	V_{CE} = 50 V, I_B = 0 mA	—	—	500	
Emitter cut-off current	RN1601	I_{EBO}	V_{EB} = 10 V, I_C = 0 mA	0.82	—	1.52	mA
	RN1602			0.38	—	0.71	
	RN1603			0.17	—	0.33	
	RN1604			0.082	—	0.15	
	RN1605		V_{EB} = 5 V, I_C = 0 mA	0.078	—	0.145	
	RN1606			0.074	—	0.138	
DC current gain	RN1601	h_{FE}	V_{CE} = 5 V, I_C = 10 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 mA, I_B = 0.25 mA	—	0.1	0.3	V
Input voltage (ON)	RN1601	$V_{I\ (ON)}$	V_{CE} = 0.2 V, I_C = 5 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 V, I_C = 0.1 mA	1.0	—	1.5	V
	RN1605 to 1606			0.5	—	0.8	
Transition frequency	RN1601 to 1606	f_T	V_{CE} = 10 V, I_C = 5 mA	—	250	—	MHz
Collector output capacitance	RN1601 to 1606	C_{ob}	V_{CB} = 10 V, I_E = 0 mA,f = 1 MHz	—	3	6	pF
Input resistance	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	
Resistance 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	

Characteristics curves (Q1, Q2 Common)

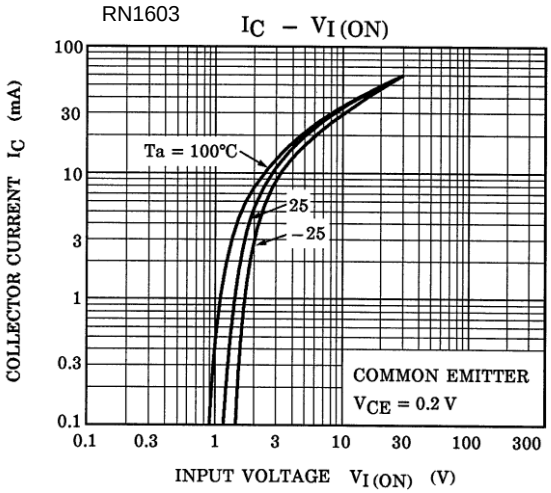
RN1601



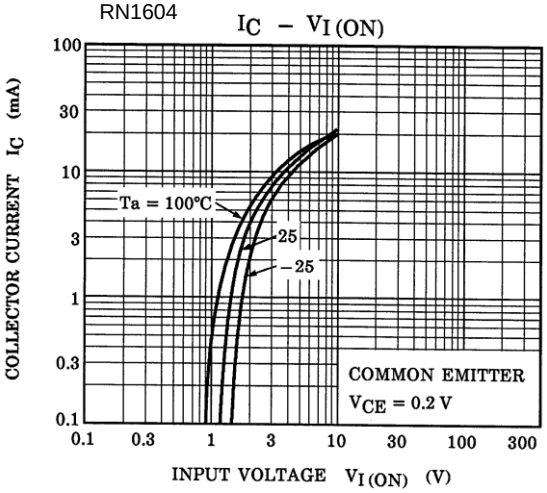
RN1602



RN1603



RN1604



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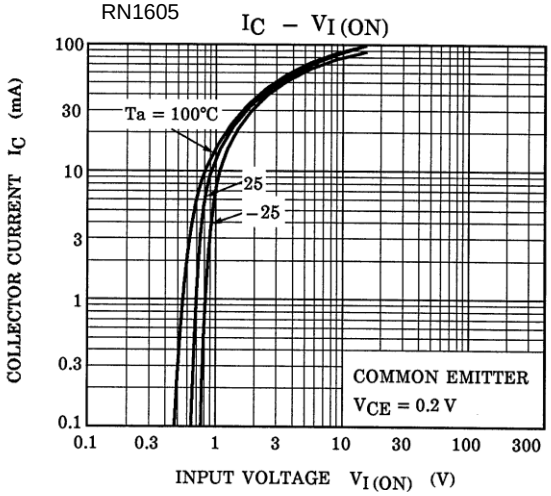
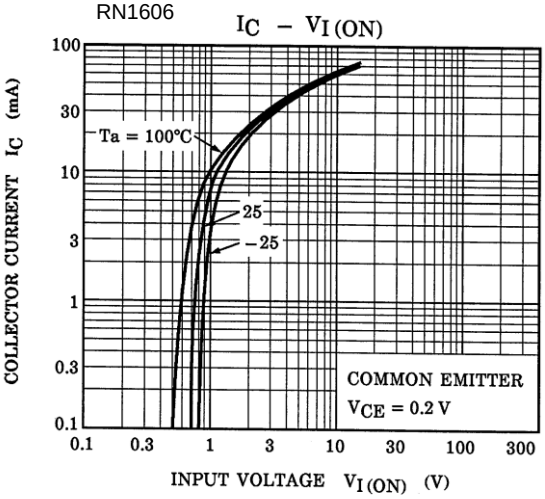


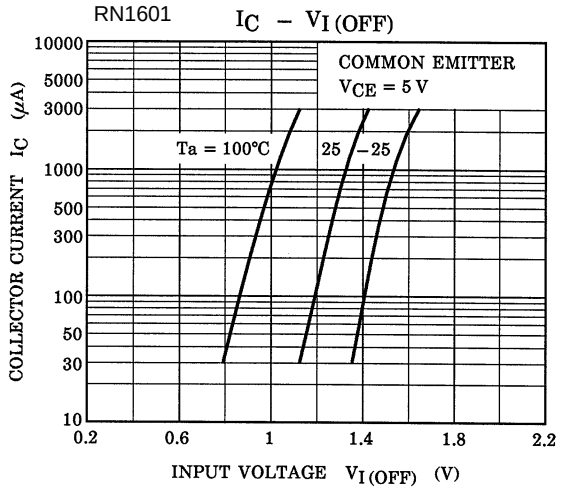
RN1606



The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Characteristics curves (Q1, Q2 Common)

RN1601



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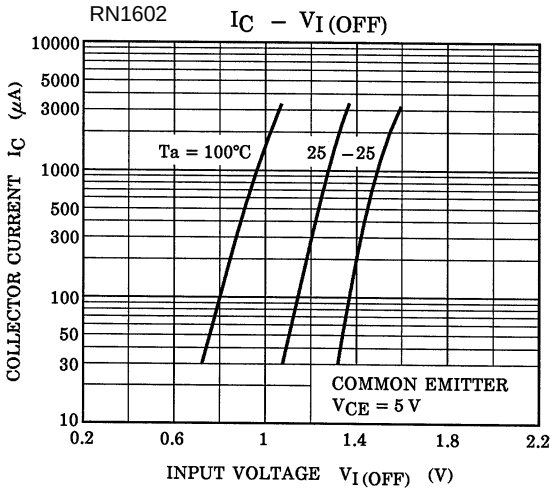

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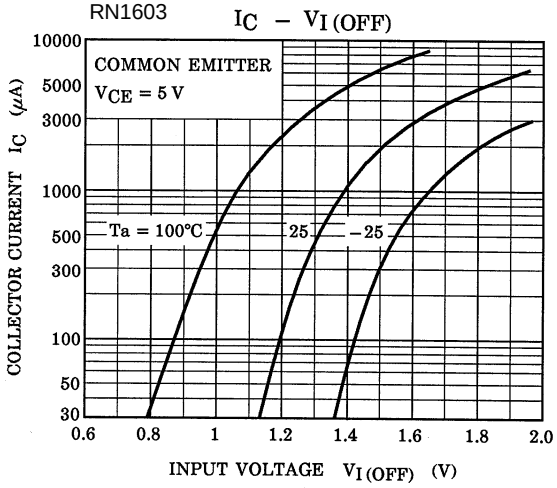

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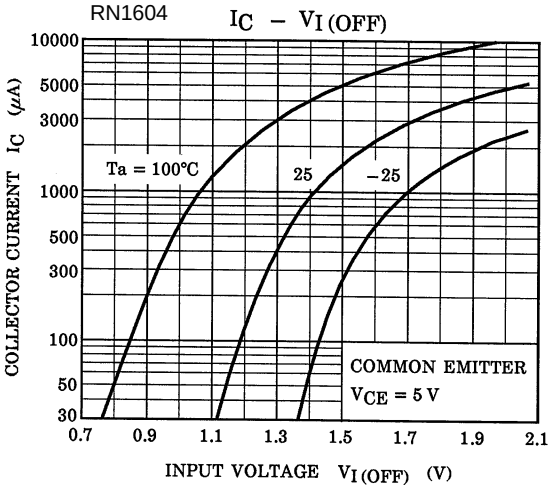

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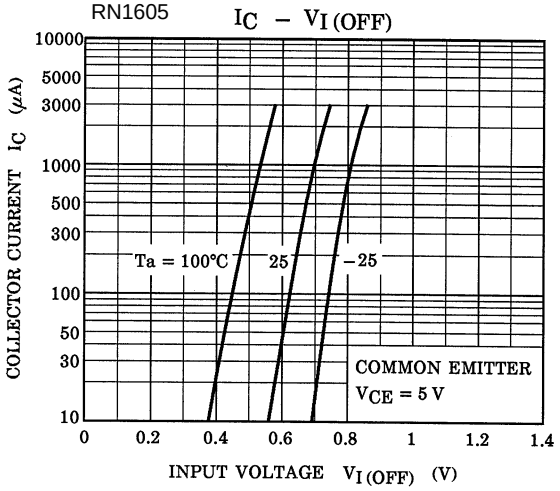

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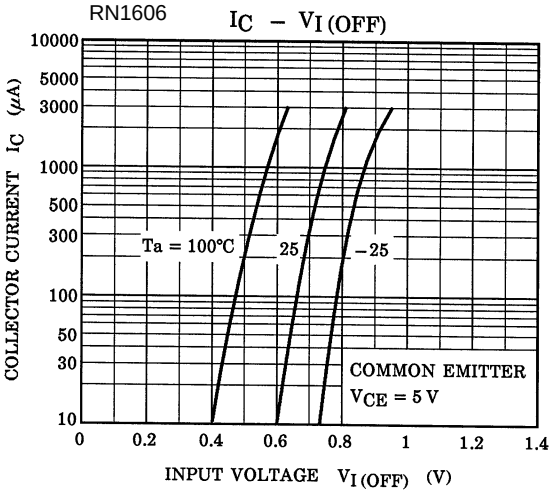

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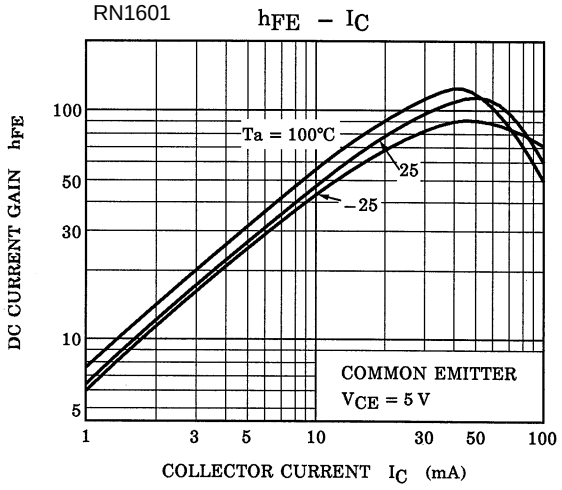
Characteristics curves (Q1, Q2 Common)

RN1601



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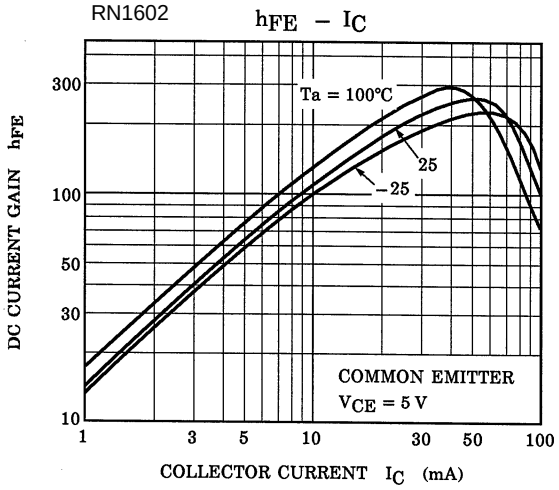

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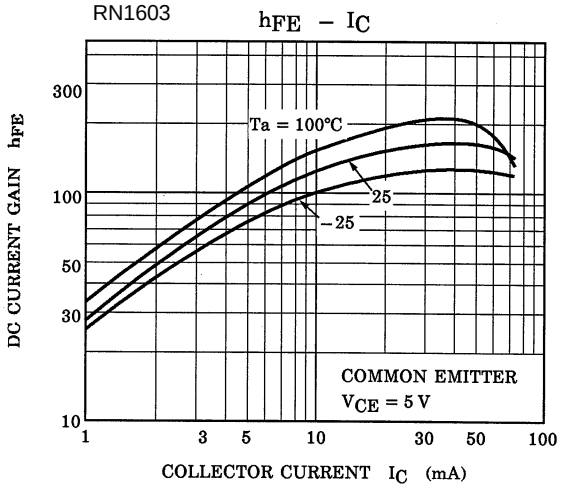
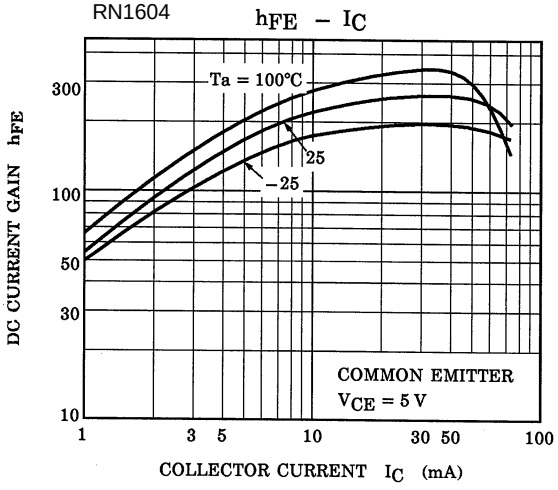


RN1604



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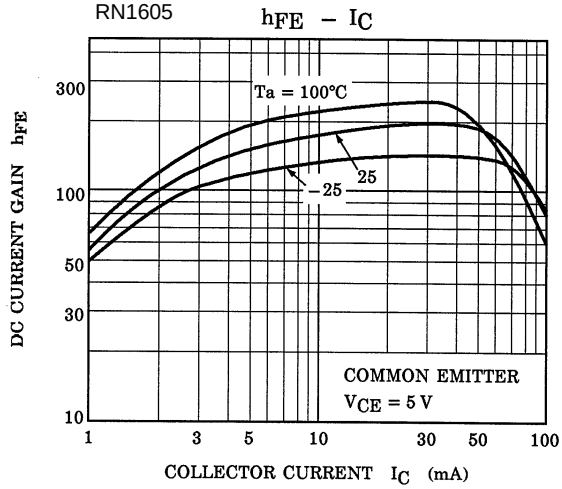

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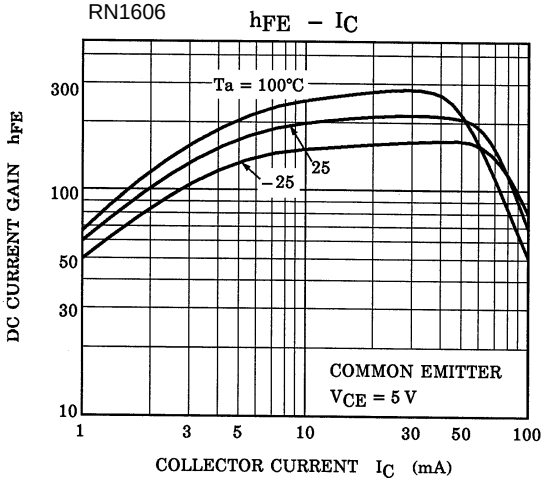

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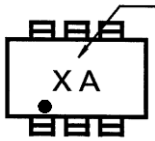
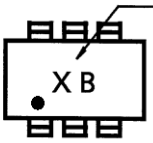
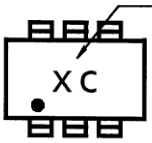
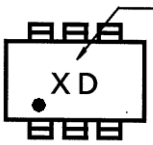
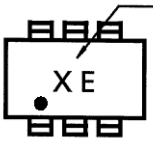
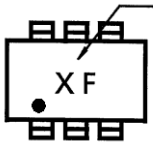
Marking

Part No.	Marking
RN1601	Part No.(abbreviation code) 
RN1602	Part No.(abbreviation code) 
RN1603	Part No.(abbreviation code) 
RN1604	Part No.(abbreviation code) 
RN1605	Part No.(abbreviation code) 
RN1606	Part No.(abbreviation code) 

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