

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

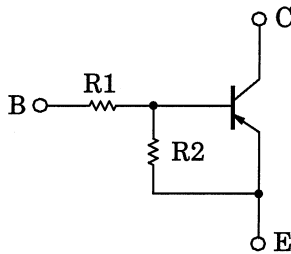
## RN2301, RN2302, RN2303 RN2304, RN2305, RN2306

Unit: mm

Switching, Inverter Circuit, Interface Circuit and Driver Circuit Applications

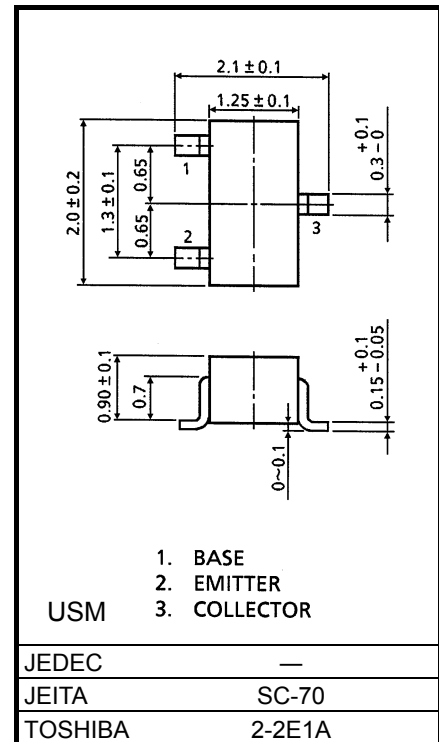
- With built-in bias resistors
- Simplify circuit design
- Reduce a quantity of parts and manufacturing process
- Complementary to RN1301 to RN1306

### Equivalent Circuit



### Bias Resistor Values

Type No.	R1 (kΩ)	R2 (kΩ)
RN2301	4.7	4.7
RN2302	10	10
RN2303	22	22
RN2304	47	47
RN2305	2.2	47
RN2306	4.7	47



Weight: 0.006g

### Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Collector-base voltage	RN2301 to RN2306	V <sub>CB0</sub>	-50	V
Collector-emitter voltage		V <sub>CEO</sub>	-50	V
Emitter-base voltage	RN2301 to RN2304	V <sub>EBO</sub>	-10	V
	RN2305, RN2306		-5	
Collector current	RN2301 to RN2306	I <sub>C</sub>	-100	mA
Collector power dissipation		P <sub>C</sub>	100	mW
Junction temperature		T <sub>j</sub>	150	°C
Storage temperature range		T <sub>stg</sub>	-55 to 150	°C

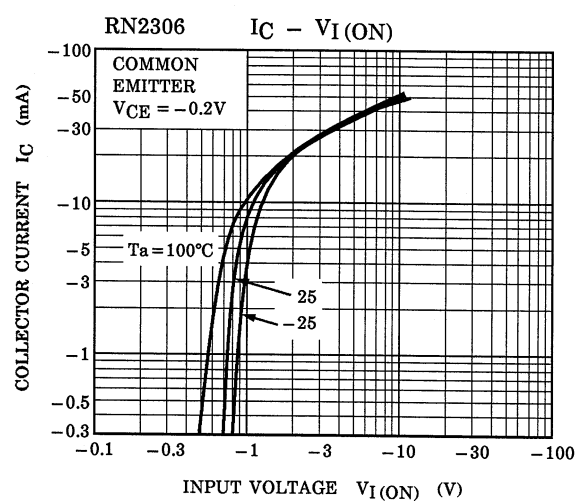
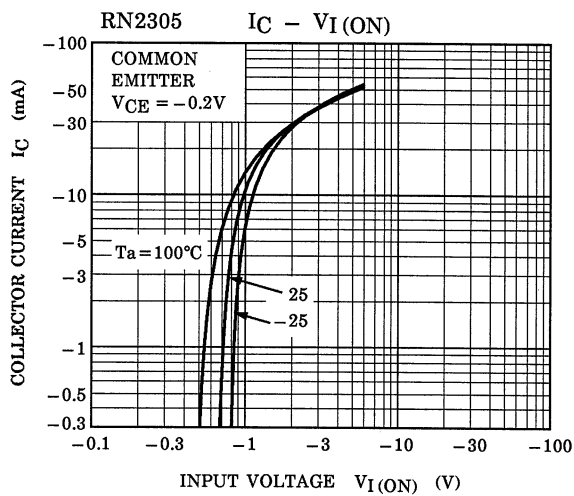
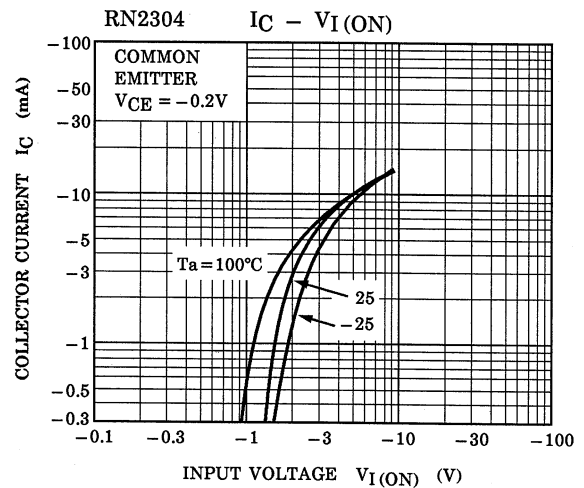
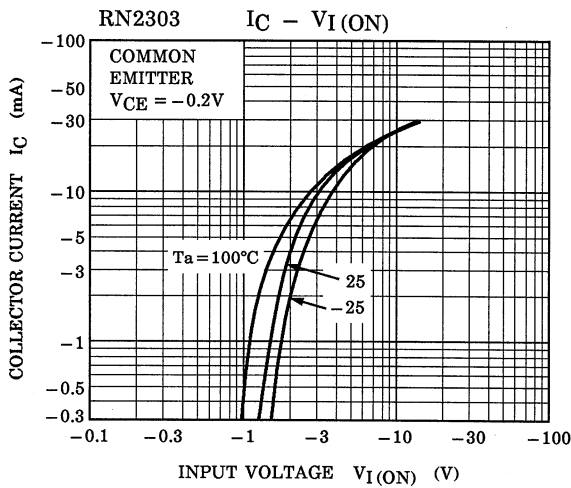
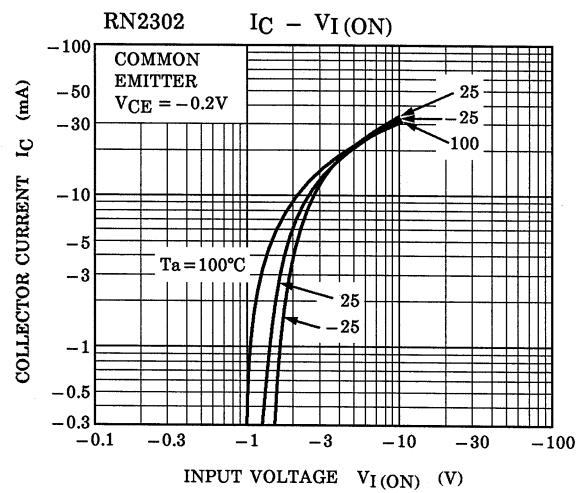
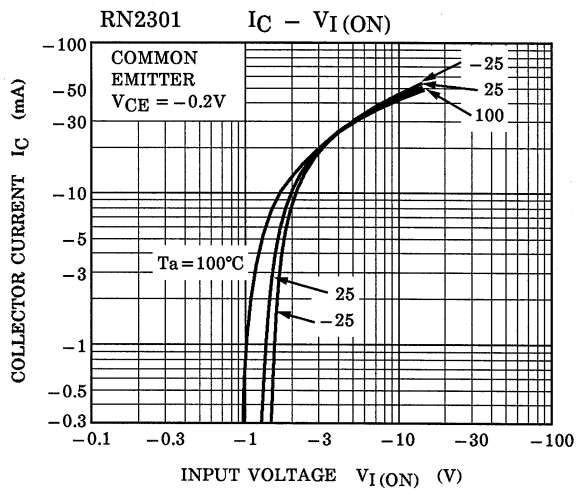
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

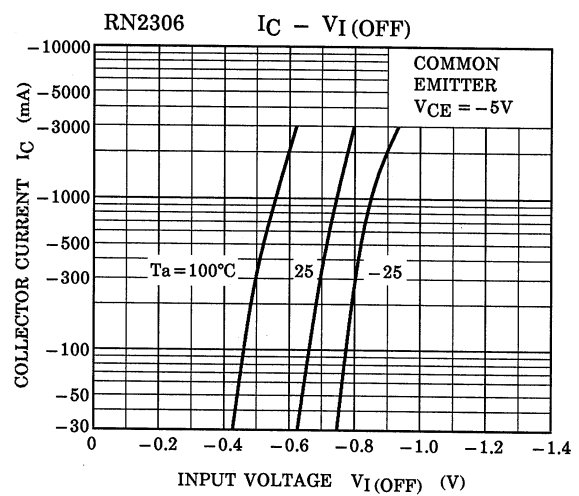
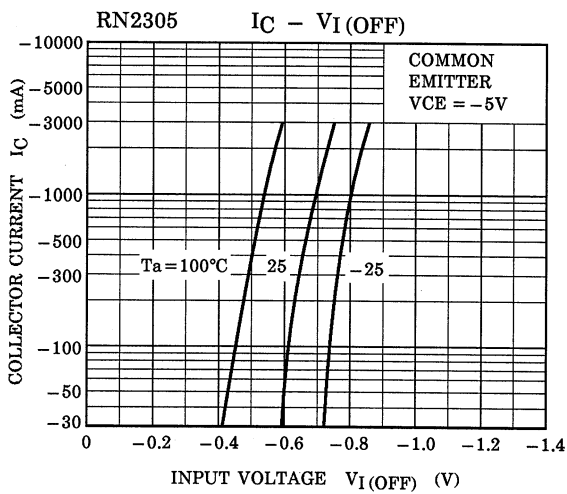
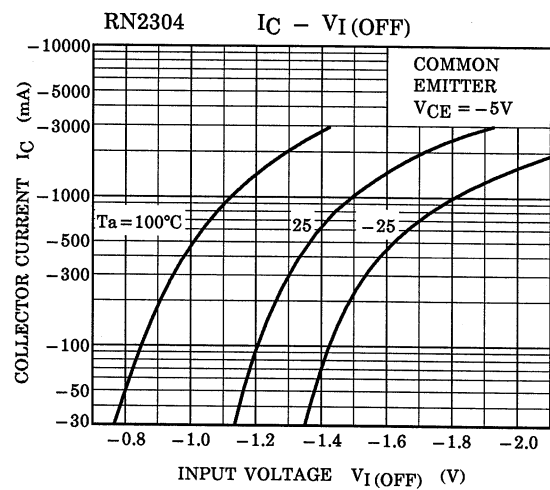
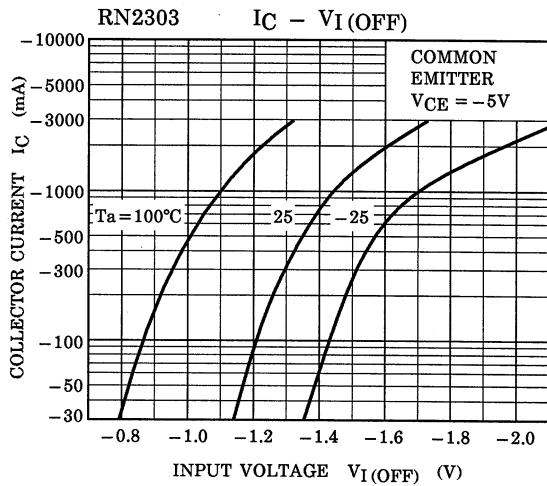
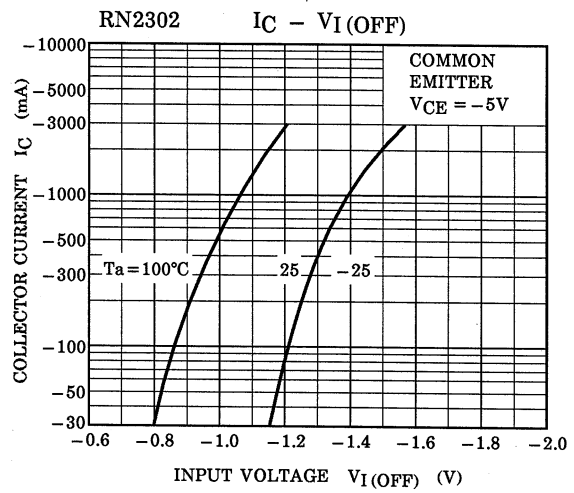
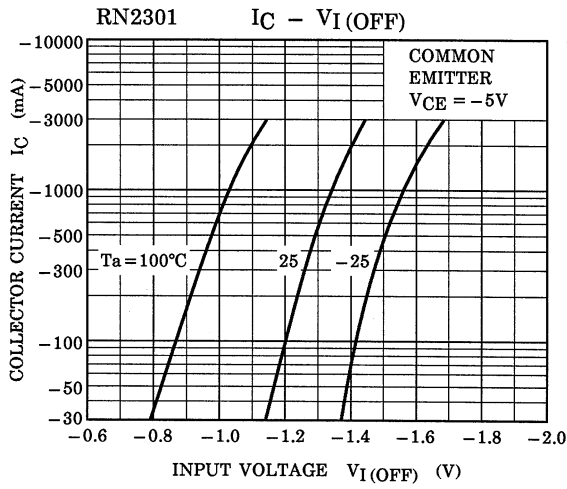
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

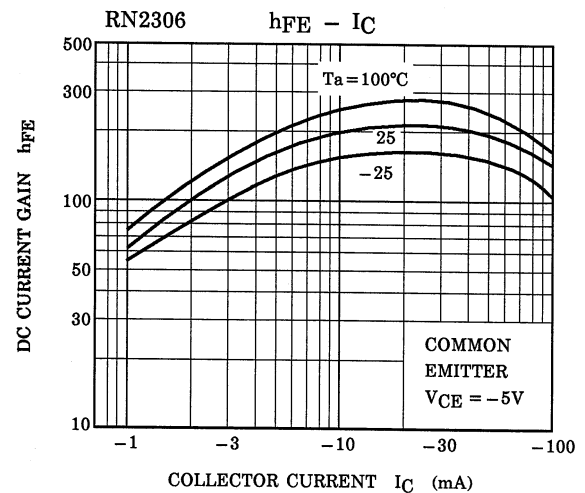
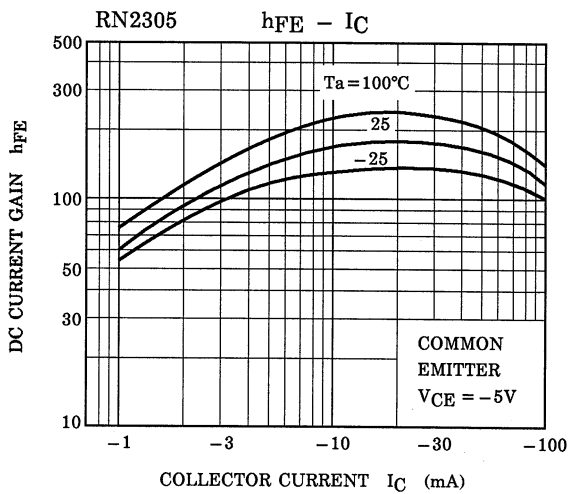
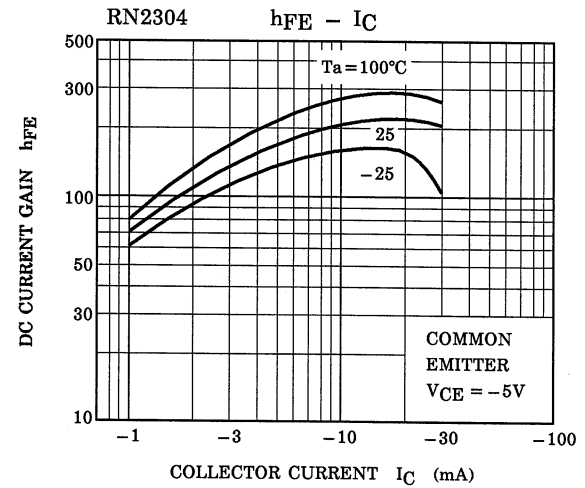
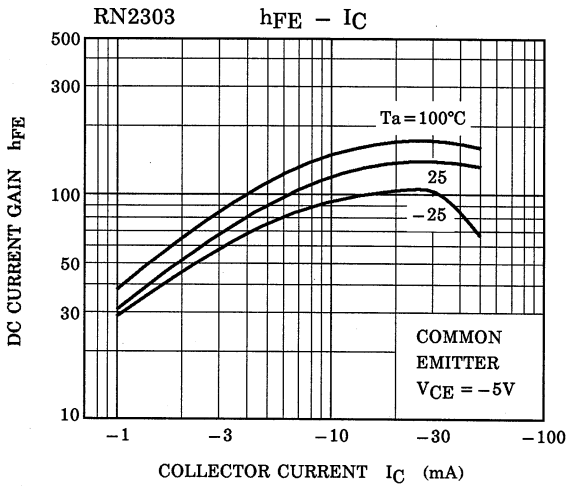
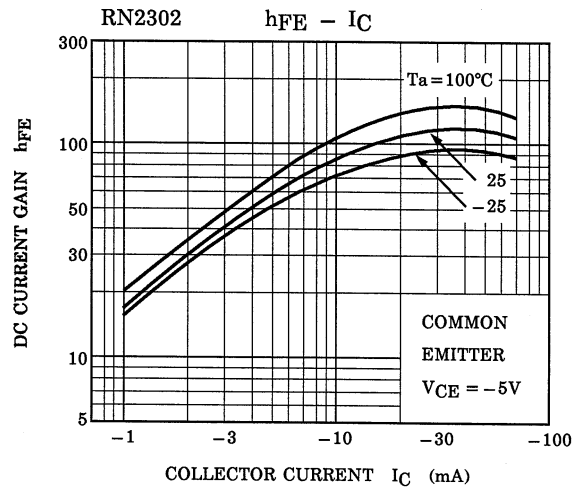
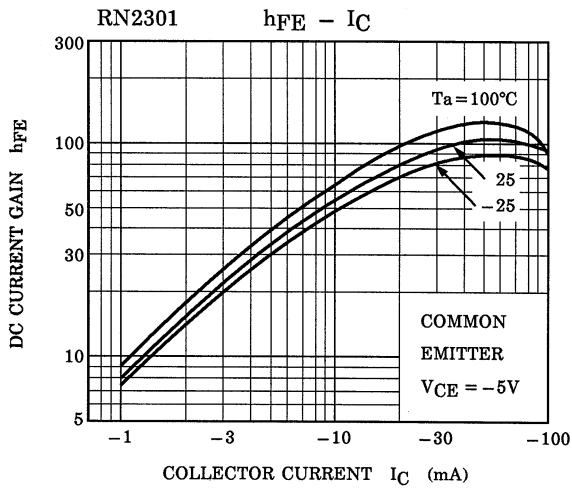
Start of commercial production  
1987-09

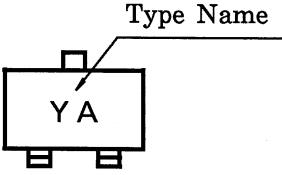
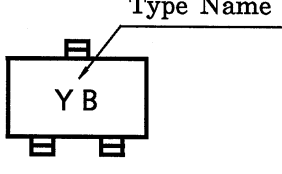
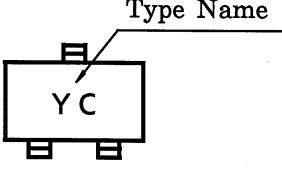
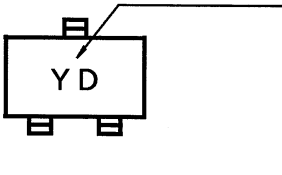
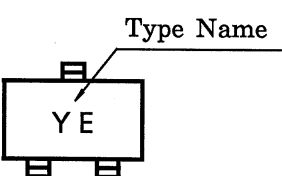
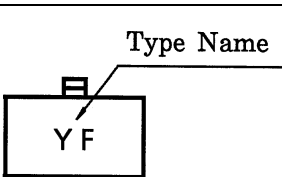
## Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN2301 to 2306	$I_{CBO}$	—	$V_{CB} = -50V, I_E = 0$	—	—	-100	nA
		$I_{CEO}$	—	$V_{CE} = -50V, I_B = 0$	—	—	-500	
Emitter cut-off current	RN2301	$I_{EBO}$	—	$V_{EB} = -10V, I_C = 0$	-0.82	—	-1.52	mA
	RN2302		—		-0.38	—	-0.71	
	RN2303		—		-0.17	—	-0.33	
	RN2304		—	-0.082	—	-0.15		
	RN2305		—	$V_{EB} = -5V, I_C = 0$	-0.078	—	-0.145	
	RN2306		—		-0.074	—	-0.138	
DC current gain	RN2301	$h_{FE}$	—	$V_{CE} = -5V, I_C = -10mA$	30	—	—	—
	RN2302		—		50	—	—	
	RN2303		—		70	—	—	
	RN2304		—		80	—	—	
	RN2305		—		80	—	—	
	RN2306		—		80	—	—	
Collector-emitter saturation voltage	RN2301 to 2306	$V_{CE(sat)}$	—	$I_C = -5mA, I_B = -0.25mA$	—	-0.1	-0.3	V
Input voltage (ON)	RN2301	$V_I(ON)$	—	$V_{CE} = -0.2V, I_C = -5mA$	-1.1	—	-2.0	V
	RN2302		—		-1.2	—	-2.4	
	RN2303		—		-1.3	—	-3.0	
	RN2304		—		-1.5	—	-5.0	
	RN2305		—		-0.6	—	-1.1	
	RN2306		—		-0.7	—	-1.3	
Input voltage (OFF)	RN2301 to 2304	$V_I(OFF)$	—	$V_{CE} = -5V, I_C = -0.1mA$	-1.0	—	-1.5	V
	RN2305, 2306		—		-0.5	—	-0.8	
Transition frequency	RN2301 to 2306	$f_T$	—	$V_{CE} = -10V, I_C = -5mA$	—	200	—	MHz
Collector output capacitance	RN2301 to 2306	$C_{ob}$	—	$V_{CB} = -10V, I_E = 0$ $f = 1MHz$	—	3	6	pF
Input resistor	RN2301	R1	—	—	3.29	4.7	6.11	kΩ
	RN2302		—		7	10	13	
	RN2303		—		15.4	22	28.6	
	RN2304		—		32.9	47	61.1	
	RN2305		—		1.54	2.2	2.86	
	RN2306		—		3.29	4.7	6.11	
Resistor ratio	RN2301 to 2304	R1/R2	—	—	0.9	1.0	1.1	—
	RN2305		—		0.0421	0.0468	0.0515	
	RN2306		—		0.09	0.1	0.11	







Type Name	Marking
RN2301	
RN2302	
RN2303	
RN2304	
RN2305	
RN2306	

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