

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

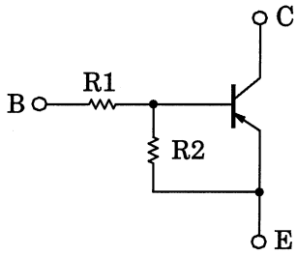
# RN2301, RN2302, RN2303 RN2304, RN2305, RN2306

Switching, Inverter Circuit, Interface Circuit and Driver Circuit

- AEC-Q101 Qualified (Note1)
- With built-in bias resistors.
- Simplify 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 RN1301 to RN1306

Note1: For detail information, please contact our sales representative.

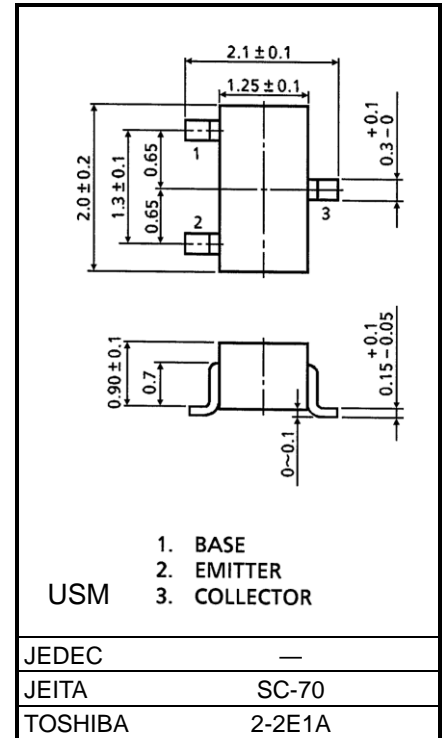
### Equivalent Circuit



### Bias Resistor Values

Part 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

Unit: mm



JEDEC	—
JEITA	SC-70
TOSHIBA	2-2E1A

Weight: 0.006g (typ.)

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

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>	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.

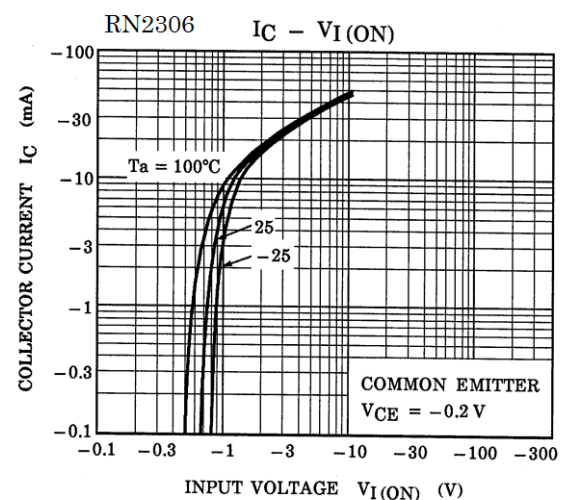
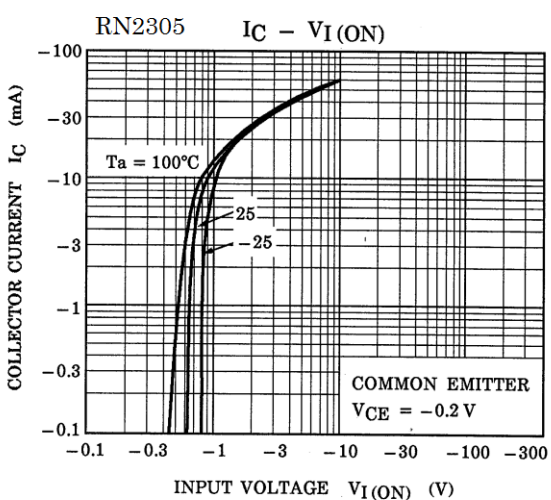
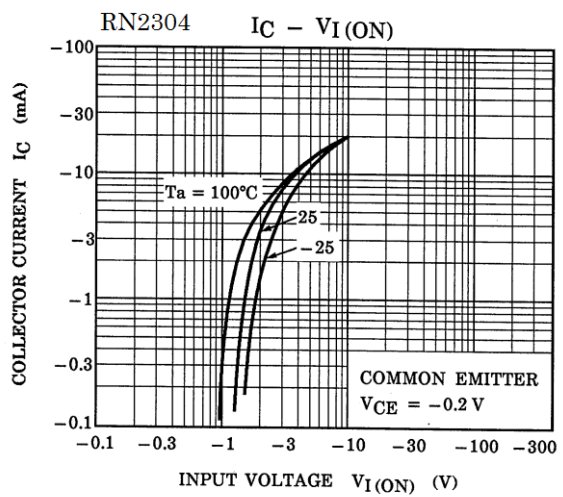
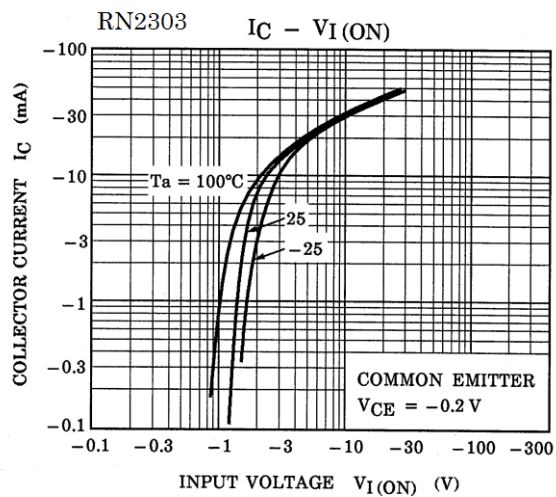
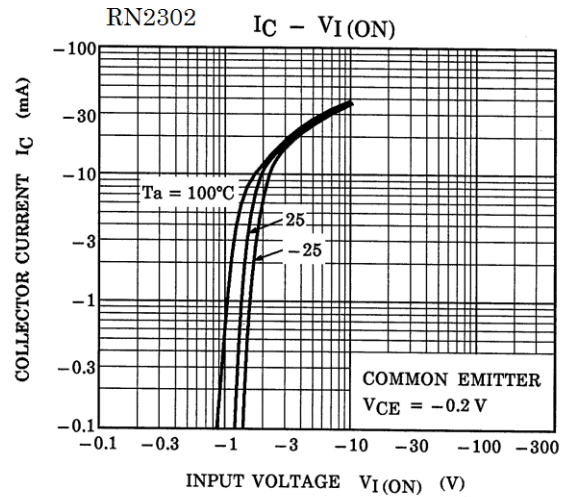
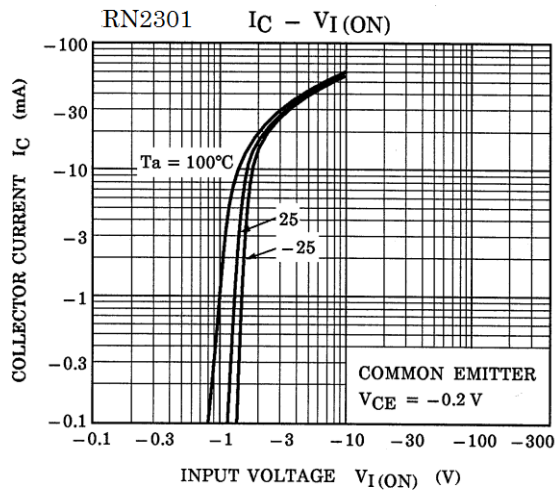
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Start of commercial production  
1987-09

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

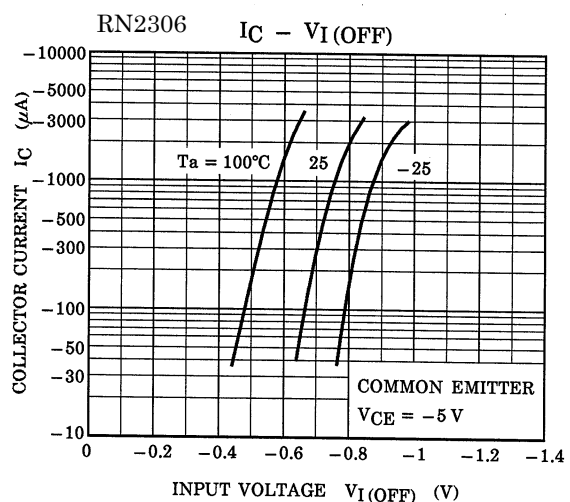
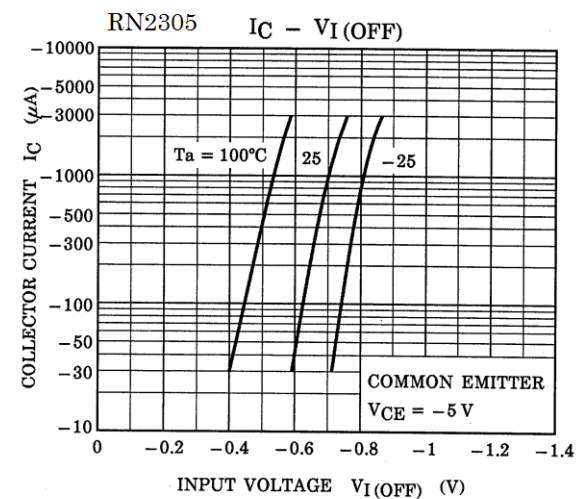
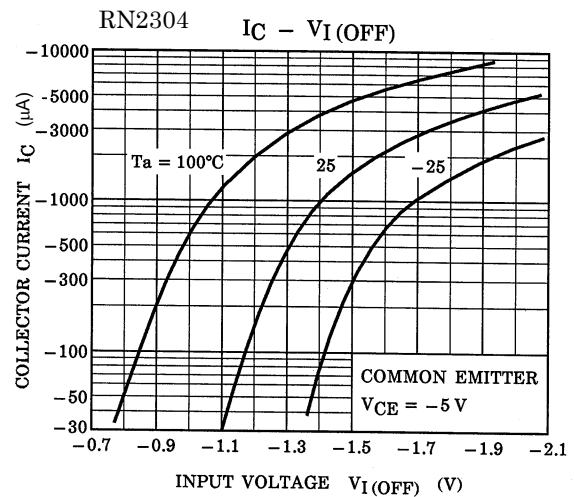
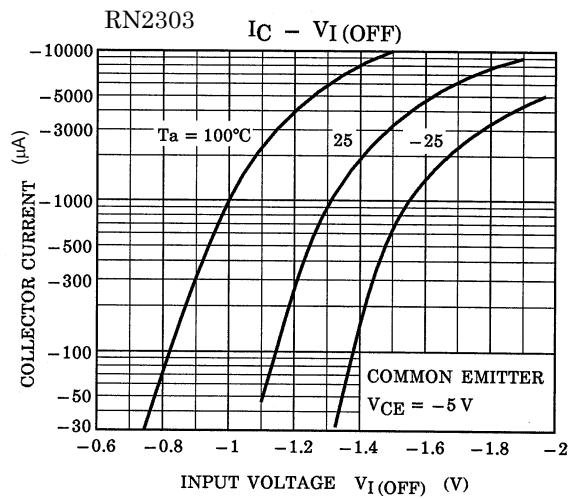
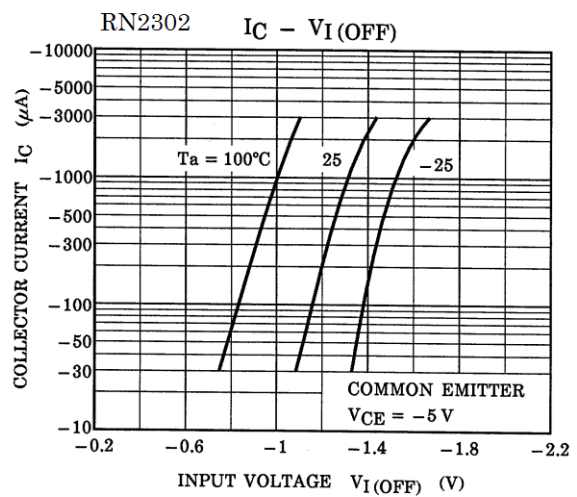
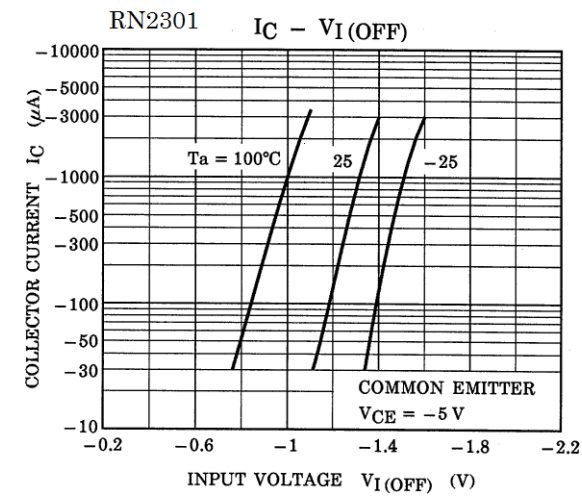
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN2301 to RN2306	ICBO	V <sub>CB</sub> = -50 V, I <sub>E</sub> = 0 mA	—	—	-100	nA
		ICEO	V <sub>CE</sub> = -50 V, I <sub>B</sub> = 0 mA	—	—	-500	
Emitter cut-off current	RN2301	IEBO	V <sub>EB</sub> = -10 V, I <sub>C</sub> = 0 mA	-0.82	—	-1.52	mA
	RN2302			-0.38	—	-0.71	
	RN2303			-0.17	—	-0.33	
	RN2304		-0.082	—	-0.15		
	RN2305		V <sub>EB</sub> = -5 V, I <sub>C</sub> = 0 mA	-0.078	—	-0.145	
	RN2306			-0.074	—	-0.138	
DC current gain	RN2301	h <sub>FE</sub>	V <sub>CE</sub> = -5 V, I <sub>C</sub> = -10 mA	30	—	—	—
	RN2302			50	—	—	
	RN2303			70	—	—	
	RN2304			80	—	—	
	RN2305			80	—	—	
	RN2306			80	—	—	
Collector-emitter saturation voltage	RN2301 to RN2306	V <sub>CE (sat)</sub>	I <sub>C</sub> = -5 mA, I <sub>B</sub> = -0.25 mA	—	-0.1	-0.3	V
Input voltage (ON)	RN2301	V <sub>I (ON)</sub>	V <sub>CE</sub> = -0.2 V, I <sub>C</sub> = -5 mA	-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 RN2304	V <sub>I (OFF)</sub>	V <sub>CE</sub> = -5 V, I <sub>C</sub> = -0.1 mA	-1.0	—	-1.5	V
	RN2305, RN2306			-0.5	—	-0.8	
Transition frequency	RN2301 to RN2306	f <sub>T</sub>	V <sub>CE</sub> = -10 V, I <sub>C</sub> = -5 mA	—	200	—	MHz
Collector output capacitance	RN2301 to RN2306	C <sub>ob</sub>	V <sub>CB</sub> = -10 V, I <sub>E</sub> = 0 mA f = 1 MHz	—	3	6	pF
Input resistor	RN2301	R <sub>1</sub>	—	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 RN2304	R <sub>1/R2</sub>	—	0.9	1.0	1.1	—
	RN2305			0.0421	0.0468	0.0515	
	RN2306			0.09	0.1	0.11	

### Characteristics Curves



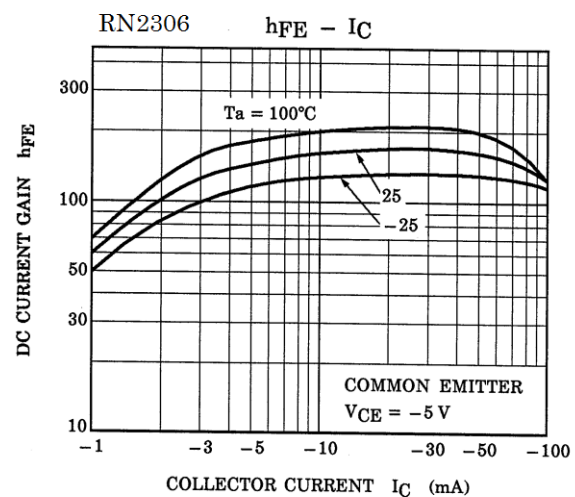
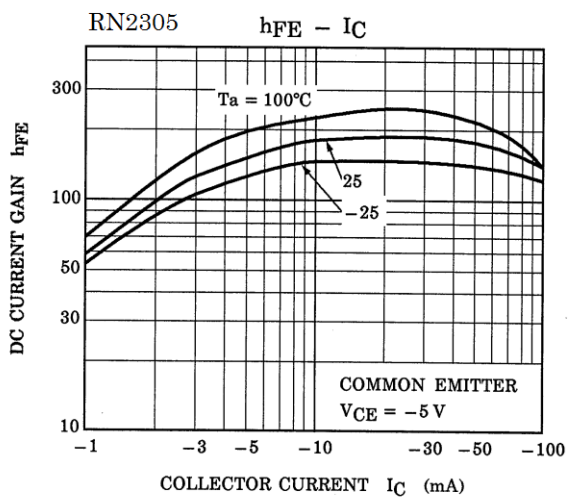
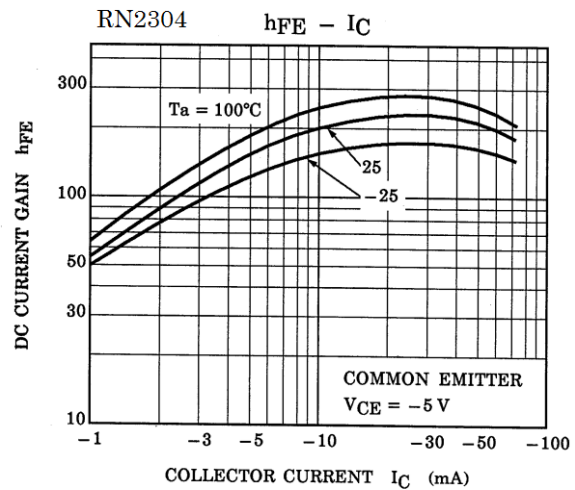
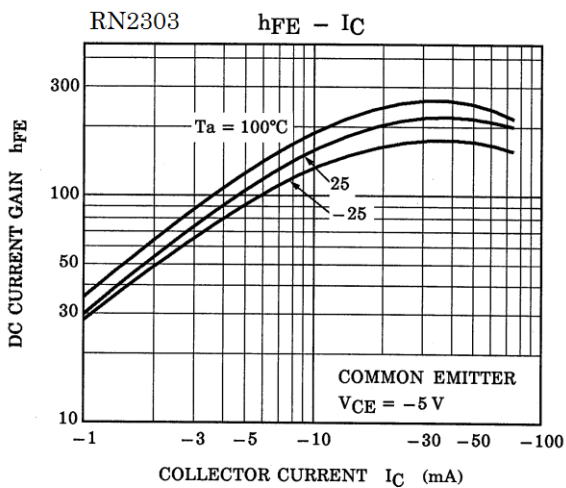
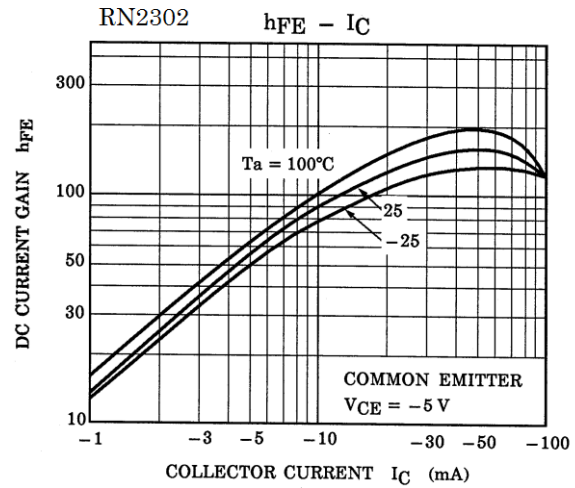
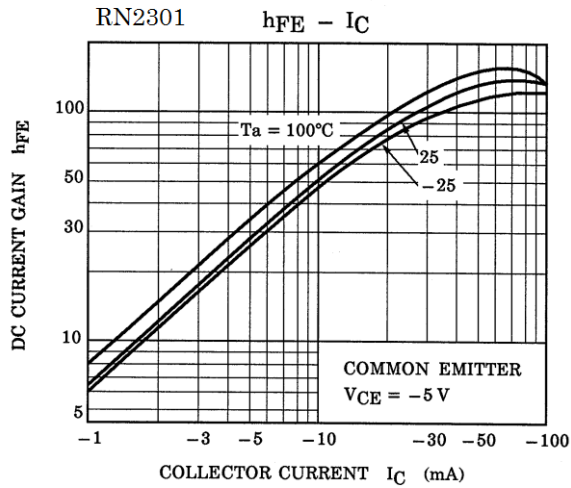
The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

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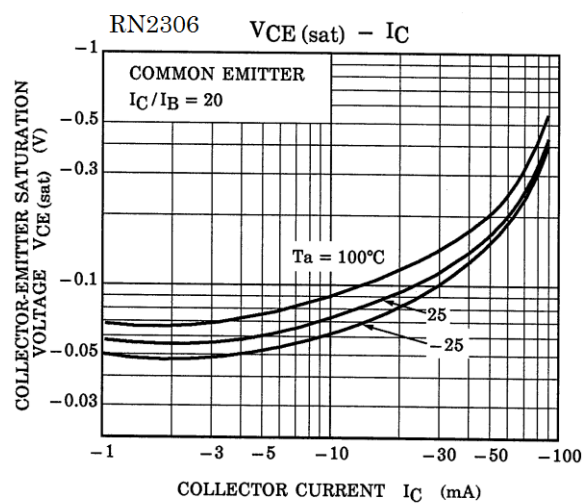
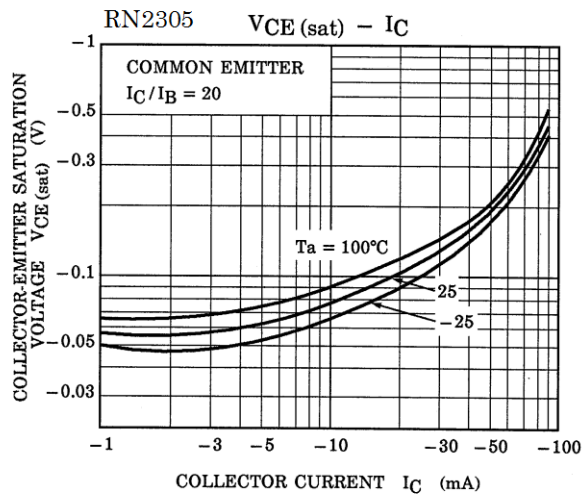
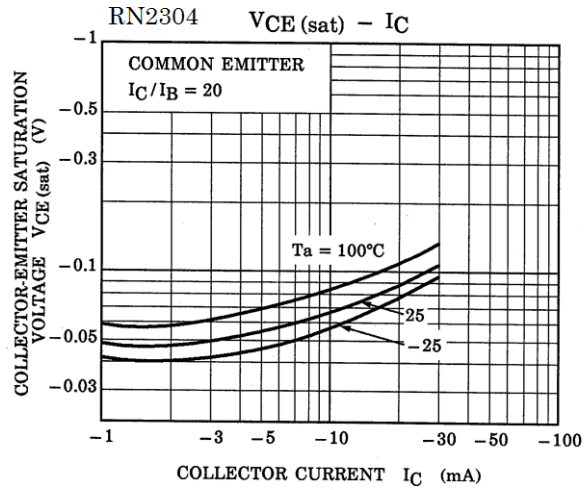
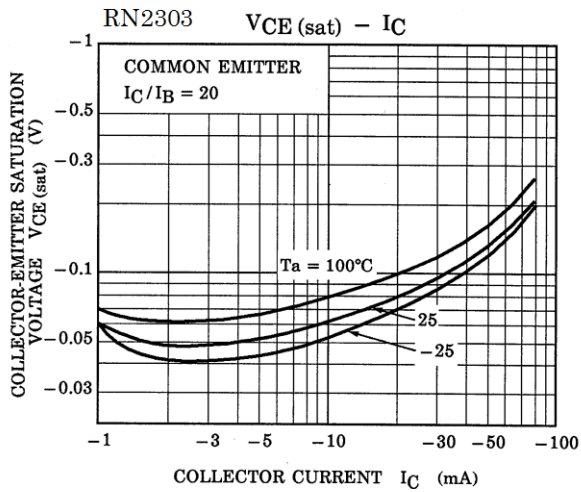
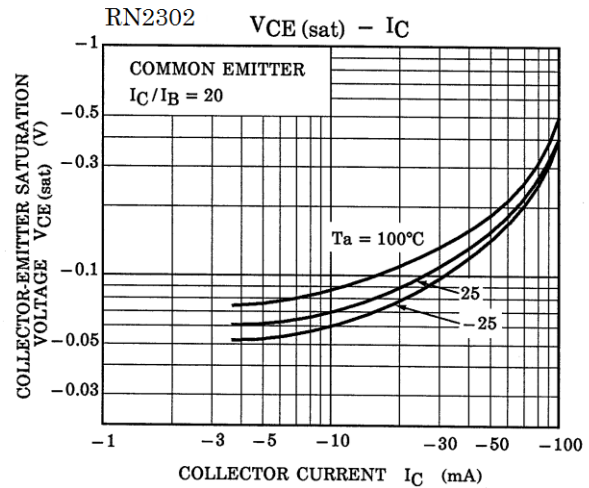
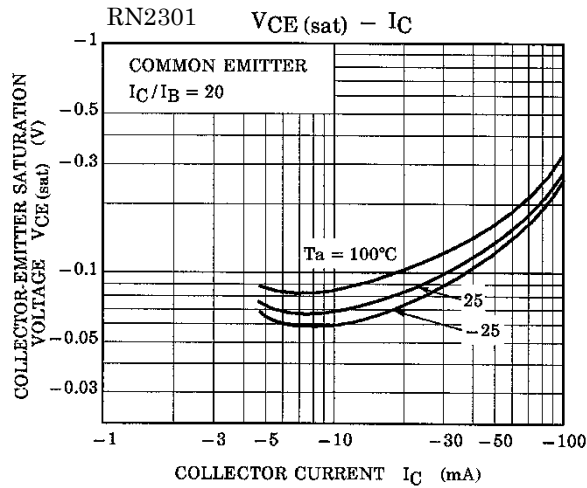
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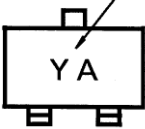
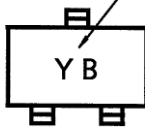
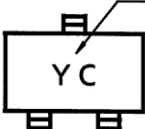
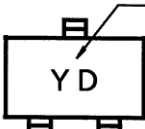
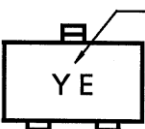
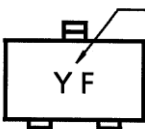


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### Marking

Part No.	Marking
RN2301	<p data-bbox="571 344 836 371">Part No.(abbreviation code)</p> 
RN2302	<p data-bbox="571 582 836 609">Part No.(abbreviation code)</p> 
RN2303	<p data-bbox="571 810 836 837">Part No.(abbreviation code)</p> 
RN2304	<p data-bbox="571 1039 836 1066">Part No.(abbreviation code)</p> 
RN2305	<p data-bbox="571 1267 836 1294">Part No.(abbreviation code)</p> 
RN2306	<p data-bbox="571 1509 836 1536">Part No.(abbreviation code)</p> 

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