

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

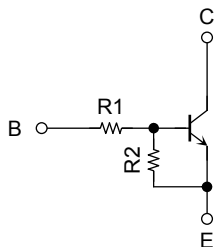
## RN1961FE, RN1962FE, RN1963FE RN1964FE, RN1965FE, RN1966FE

Switching, Inverter Circuit, Interface Circuit and  
Driver Circuit Applications

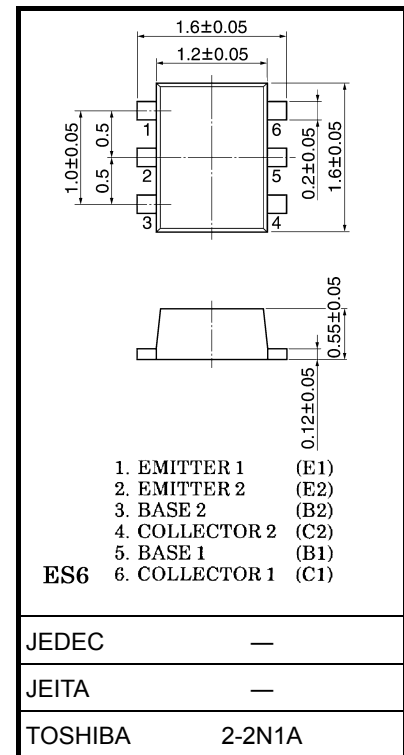
Unit: mm

- 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 enable the manufacture of ever more compact equipment and save assembly cost.
- Complementary to RN2961FE to RN2966FE

### Equivalent Circuit and Bias Resistor Values



Type No.	R1 (kΩ)	R2 (kΩ)
RN1961FE	4.7	4.7
RN1962FE	10	10
RN1963FE	22	22
RN1964FE	47	47
RN1965FE	2.2	47
RN1966FE	4.7	47



Weight: 3mg (typ.)

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

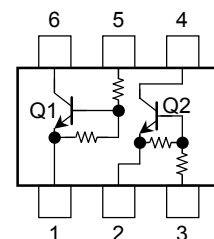
Characteristics	Symbol	Rating	Unit
Collector-base voltage	RN1961FE to 1966FE $V_{CBO}$	50	V
Collector-emitter voltage	$V_{CEO}$	50	V
Emitter-base voltage	RN1961FE to 1964FE $V_{EBO}$	10	V
	RN1965FE, 1966FE	5	V
Collector current	$I_C$	100	mA
Collector power dissipation	RN1961FE to 1966FE $P_C$ (Note 1)	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

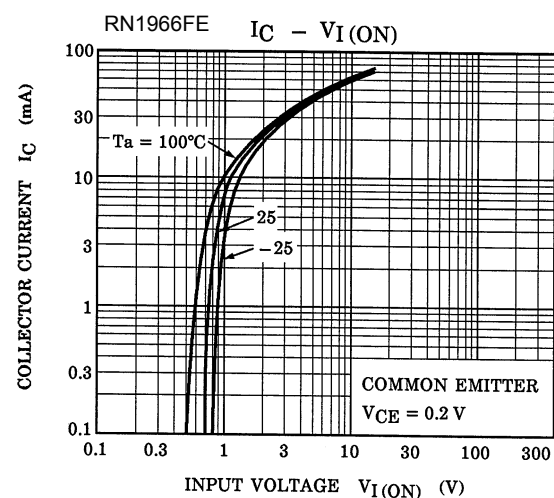
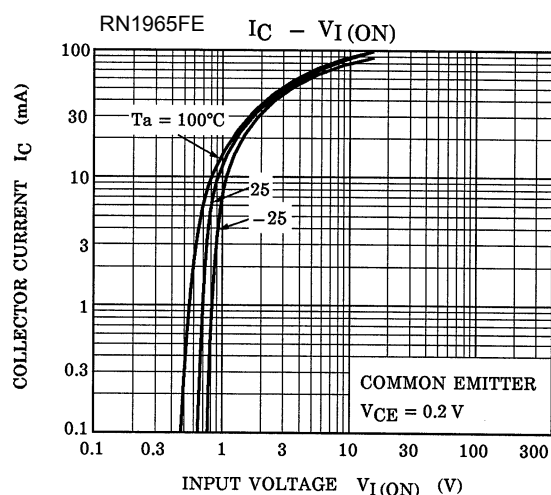
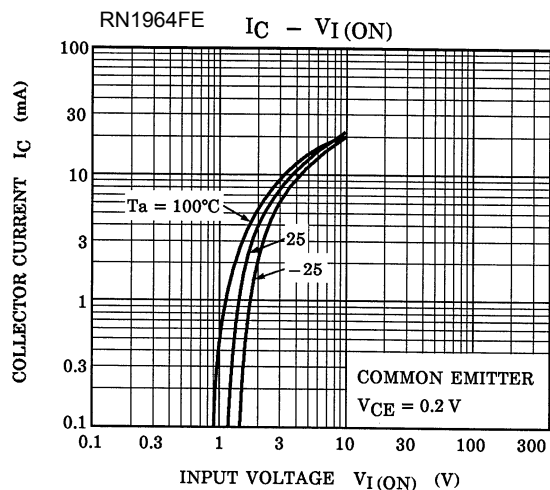
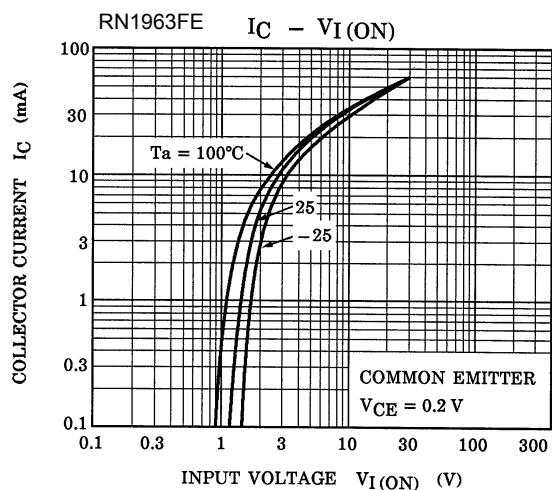
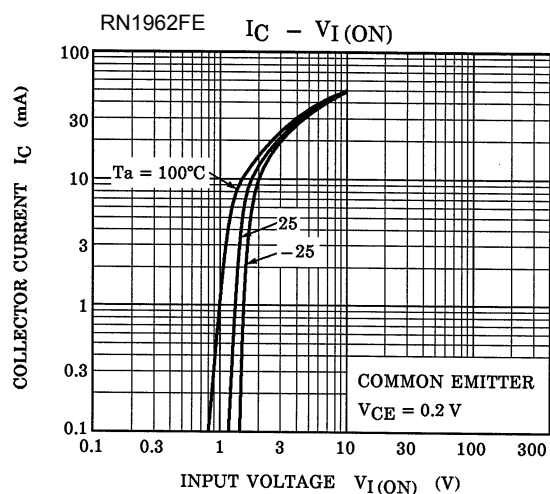
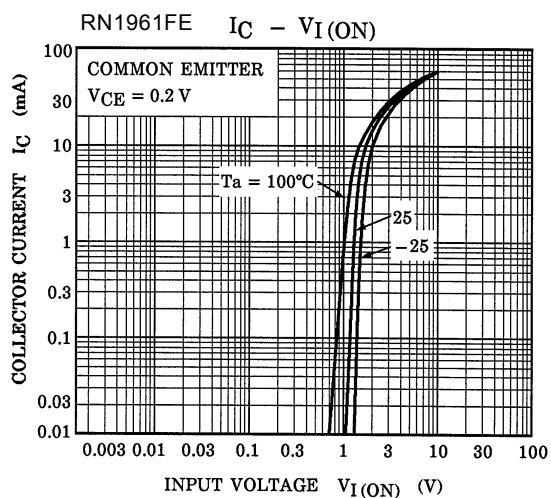
### Equivalent Circuit (top view)



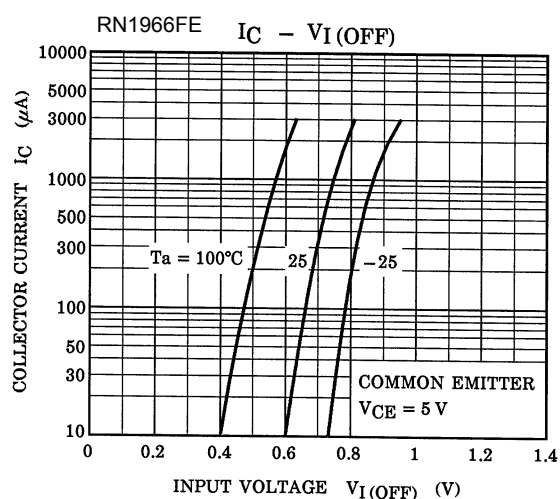
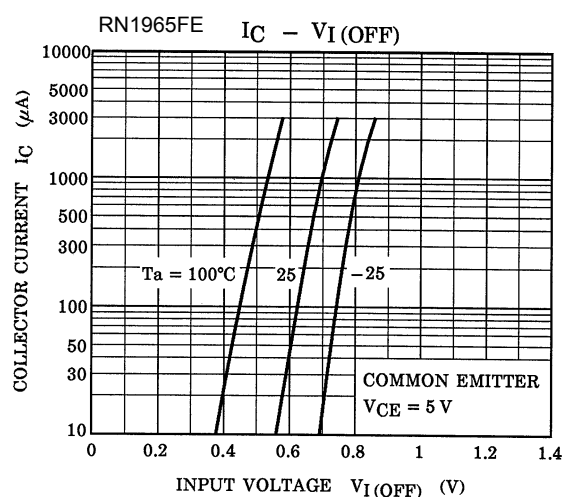
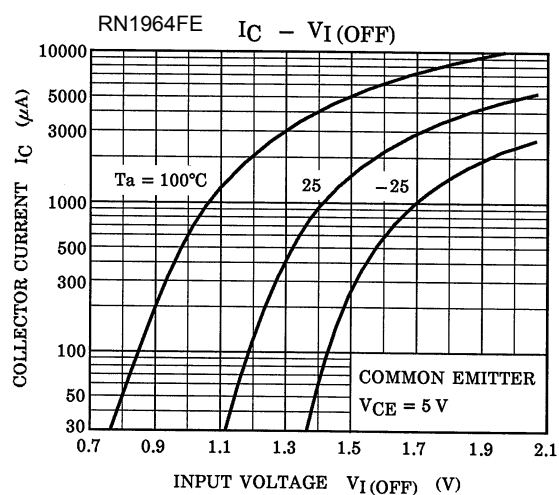
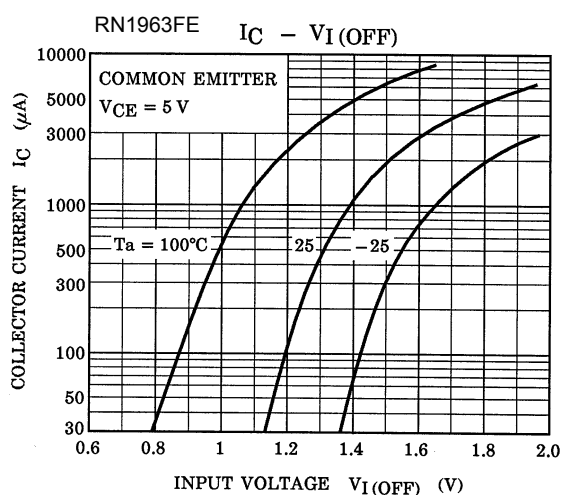
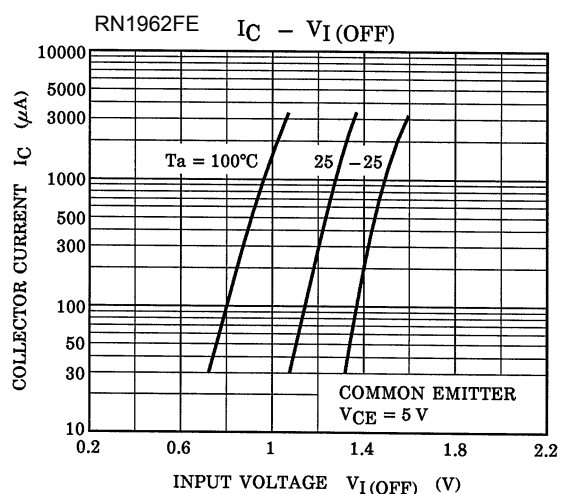
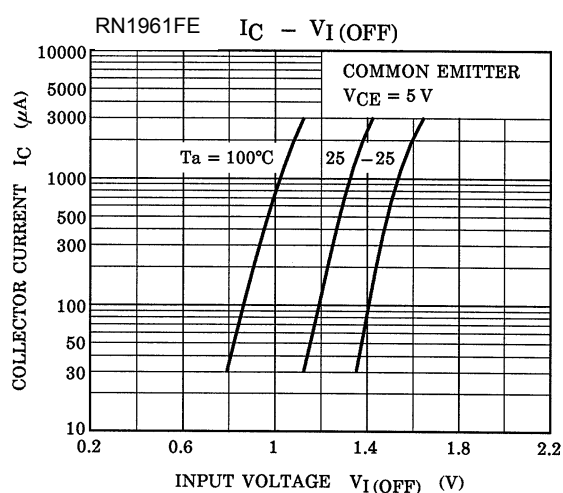
**Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)**

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN1961FE to 1966FE	$I_{CBO}$	$V_{CB} = 50 \text{ V}, I_E = 0$	—	—	100	nA
		$I_{CEO}$	$V_{CE} = 50 \text{ V}, I_B = 0$	—	—	500	
Emitter cut-off current	RN1961FE	$I_{EBO}$	$V_{EB} = 10 \text{ V}, I_C = 0$	0.82	—	1.52	mA
	RN1962FE			0.38	—	0.71	
	RN1963FE			0.17	—	0.33	
	RN1964FE			0.082	—	0.15	
	RN1965FE	$I_{EBO}$	$V_{EB} = 5 \text{ V}, I_C = 0$	0.078	—	0.145	
	RN1966FE			0.074	—	0.138	
DC current gain	RN1961FE	$h_{FE}$	$V_{CE} = 5 \text{ V}, I_C = 10 \text{ mA}$	30	—	—	—
	RN1962FE			50	—	—	
	RN1963FE			70	—	—	
	RN1964FE			80	—	—	
	RN1965FE			80	—	—	
	RN1966FE			80	—	—	
Collector-emitter saturation voltage	RN1961FE to 1966FE	$V_{CE(sat)}$	$I_C = 5 \text{ mA}, I_B = 0.25 \text{ mA}$	—	0.1	0.3	V
Input voltage (ON)	RN1961FE	$V_{I(ON)}$	$V_{CE} = 0.2 \text{ V}, I_C = 5 \text{ mA}$	1.1	—	2.0	V
	RN1962FE			1.2	—	2.4	
	RN1963FE			1.3	—	3.0	
	RN1964FE			1.5	—	5.0	
	RN1965FE			0.6	—	1.1	
	RN1966FE			0.7	—	1.3	
Input voltage (OFF)	RN1961FE to 1964FE	$V_{I(OFF)}$	$V_{CE} = 5 \text{ V}, I_C = 0.1 \text{ mA}$	1.0	—	1.5	V
	RN1965FE, 1966FE			0.5	—	0.8	
Transition frequency	RN1961FE to 1966FE	$f_T$	$V_{CE} = 10 \text{ V}, I_C = 5 \text{ mA}$	—	250	—	MHz
Collector output capacitance	RN1961FE to 1966FE	$C_{ob}$	$V_{CB} = 10 \text{ V}, I_E = 0, f = 1 \text{ MHz}$	—	3	6	pF
Input resistor	RN1961FE	R1	—	3.29	4.7	6.11	kΩ
	RN1962FE			7	10	13	
	RN1963FE			15.4	22	28.6	
	RN1964FE			32.9	47	61.1	
	RN1965FE			1.54	2.2	2.86	
	RN1966FE			3.29	4.7	6.11	
Resistor ratio	RN1961FE to 1964FE	R1/R2	—	0.9	1.0	1.1	—
	RN1965FE			0.0421	0.0468	0.0515	
	RN1966FE			0.09	0.1	0.11	

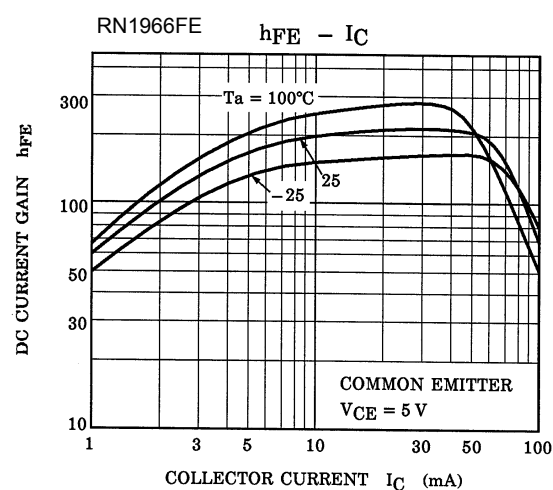
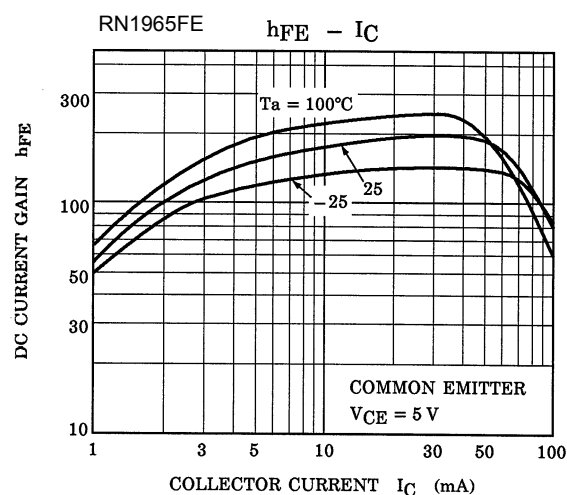
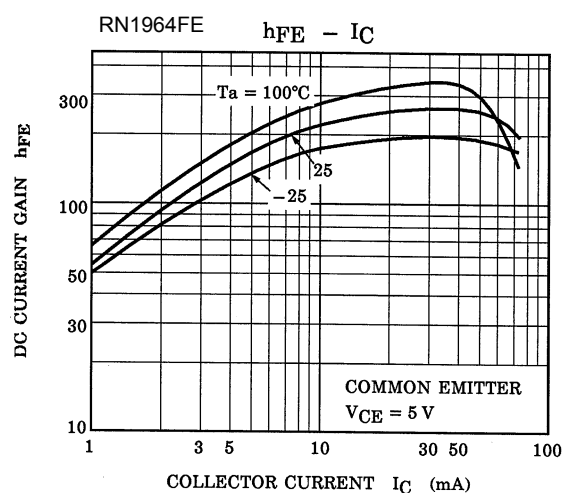
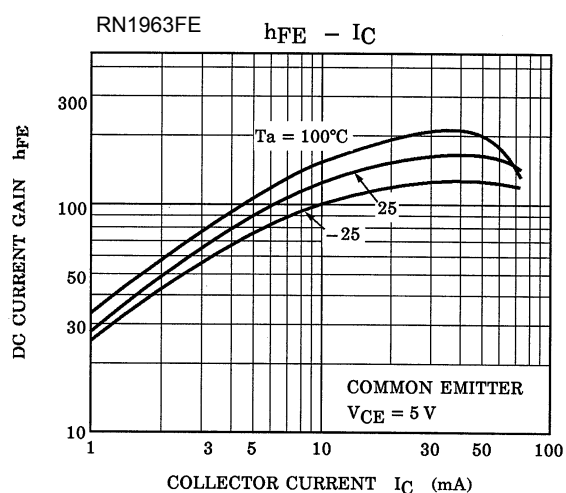
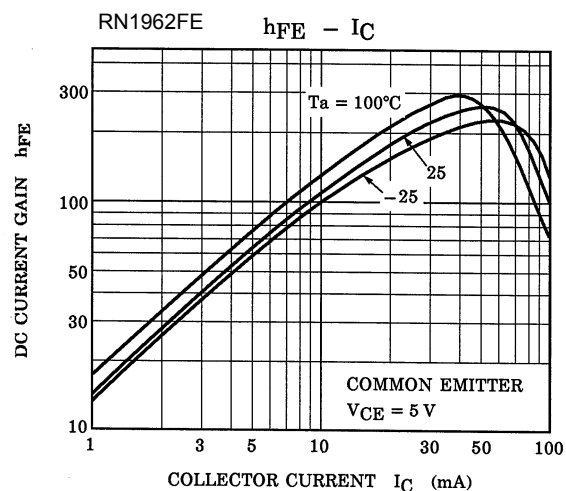
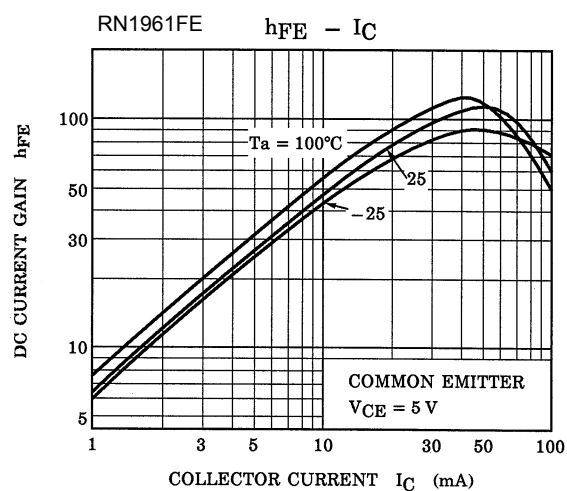
## Q1, Q2 Common



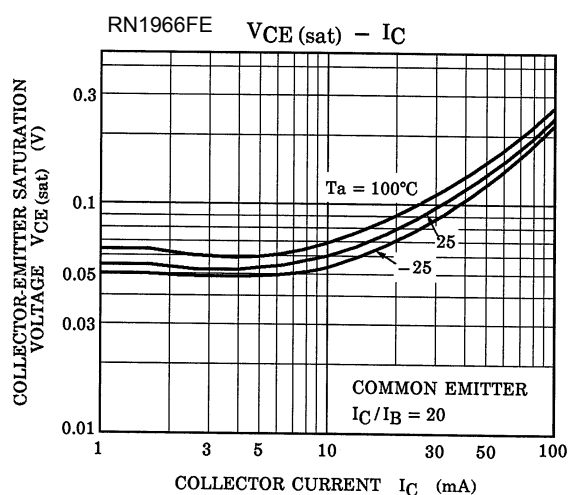
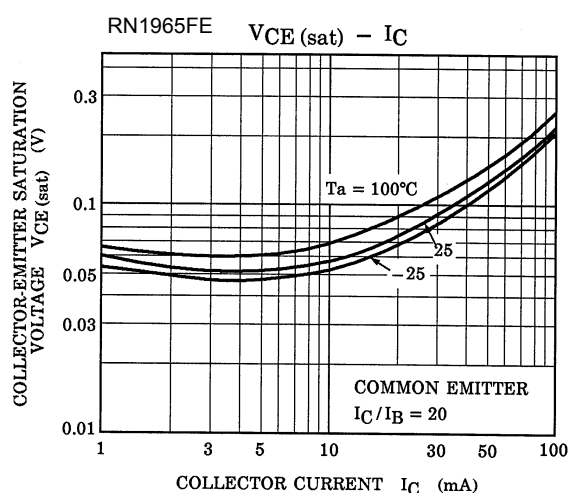
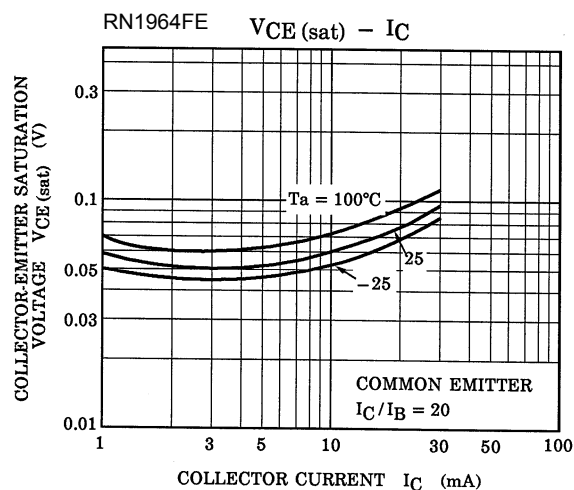
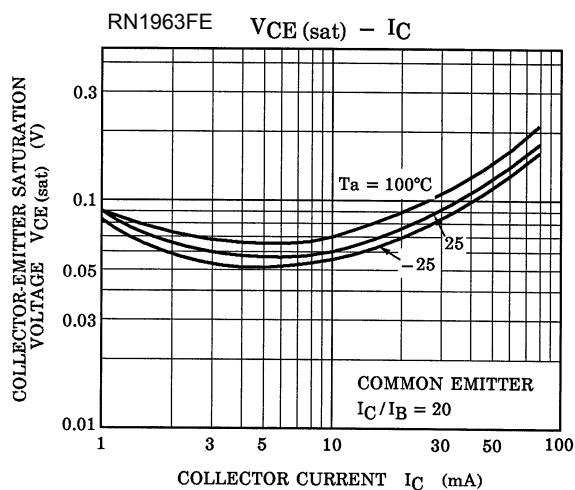
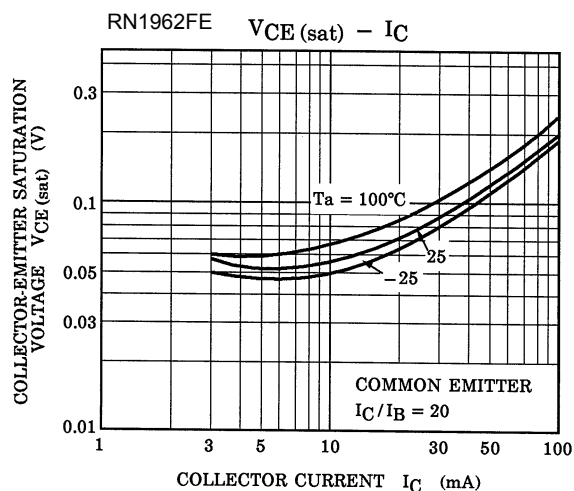
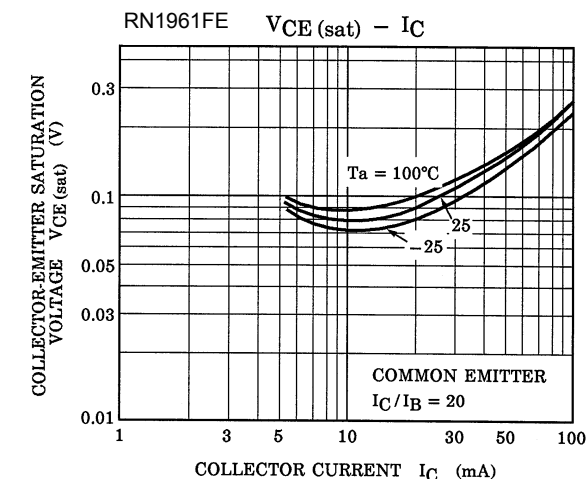
## Q1, Q2 Common



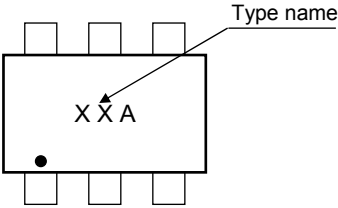
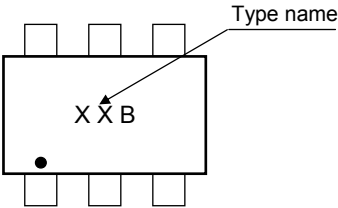
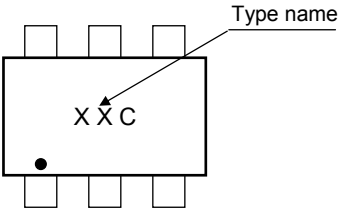
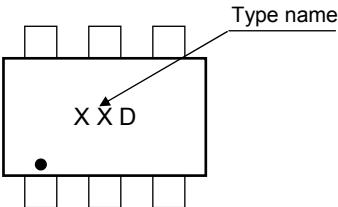
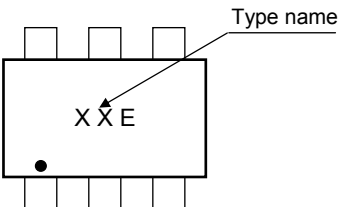
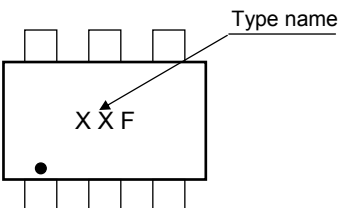
## Q1,Q2 Common



## Q1,Q2 Common



Marking

Type Name	Marking
RN1961FE	 <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X A' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X A'.</p>
RN1962FE	 <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X B' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X B'.</p>
RN1963FE	 <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X C' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X C'.</p>
RN1964FE	 <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X D' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X D'.</p>
RN1965FE	 <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X E' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X E'.</p>
RN1966FE	 <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X F' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X F'.</p>

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