

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

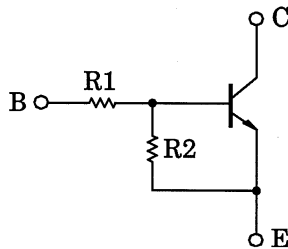
RN1601, RN1602, RN1603 RN1604, RN1605, RN1606

Unit: mm

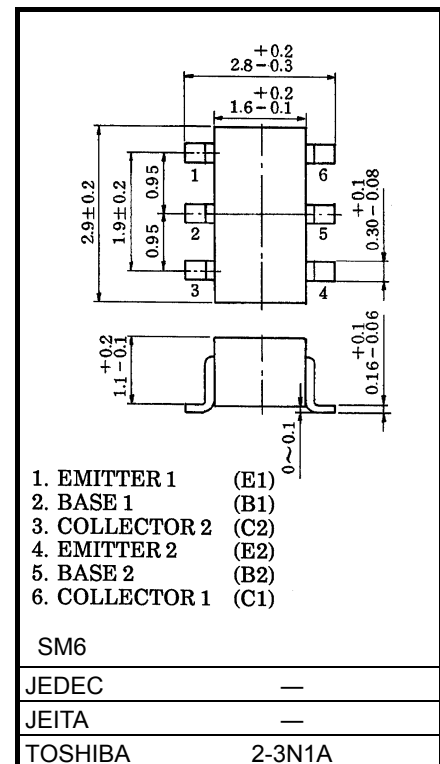
Switching, Inverter Circuit, Interface Circuit
and Driver Circuit Applications

- 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

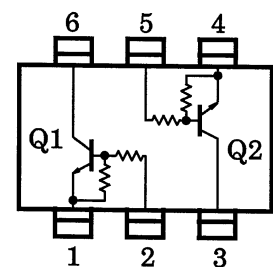


Weight: 15mg (typ.)

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

Characteristic	Symbol	Rating	Unit
Collector-base voltage	V_{CBO}	50	V
Collector-emitter voltage	V_{CEO}	50	V
Emitter-base voltage	V_{EBO}	10	V
		5	V
Collector current	I_C	100	mA
Collector power dissipation	P_C^*	300	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-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.

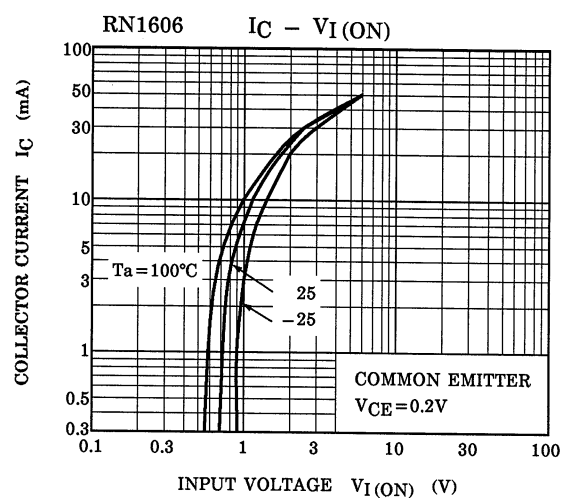
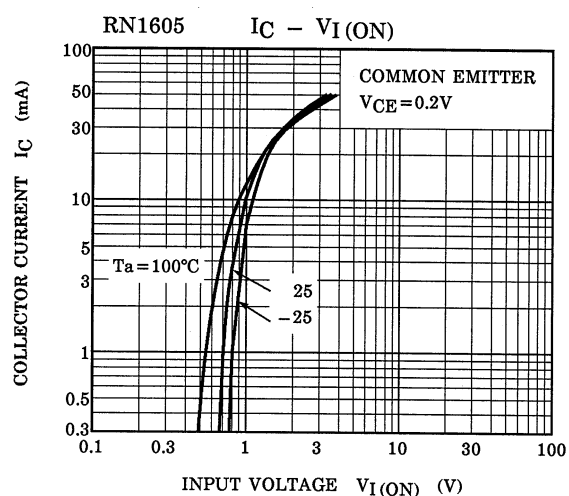
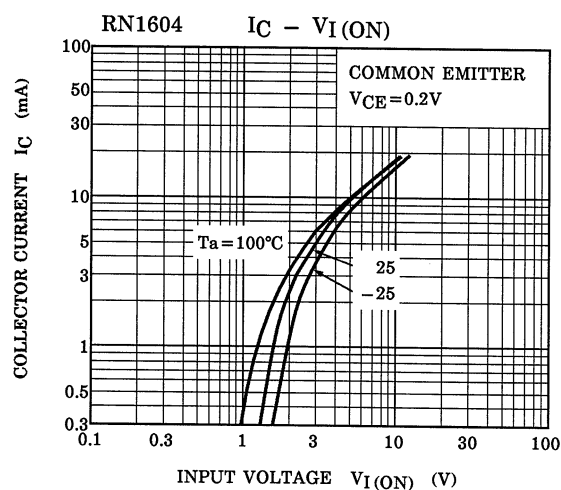
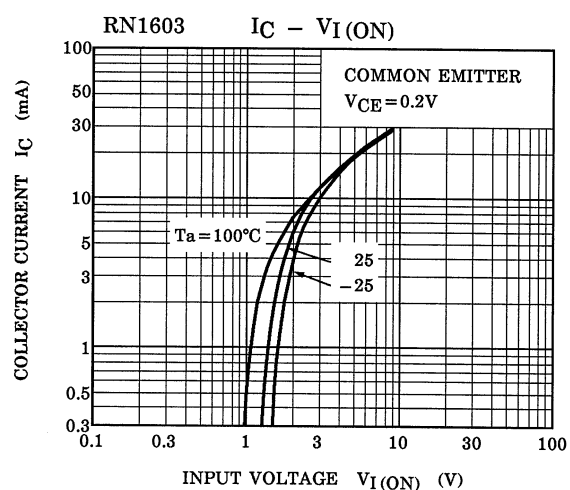
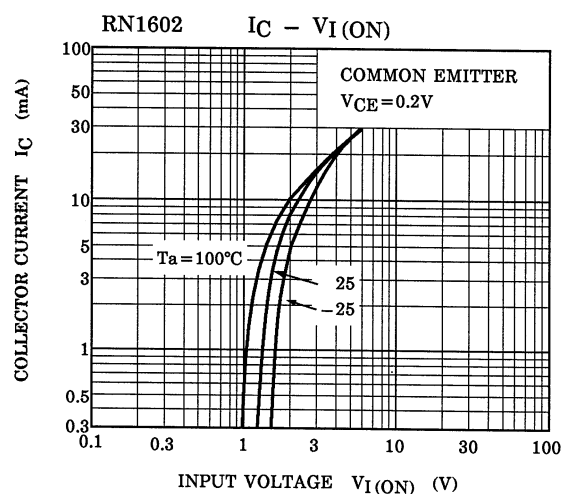
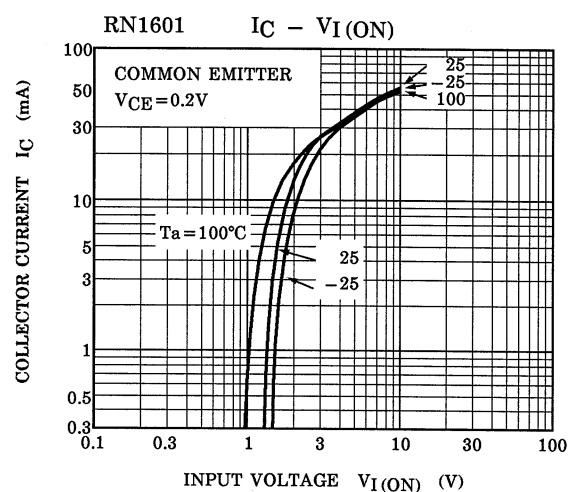
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc.).

*Total rating

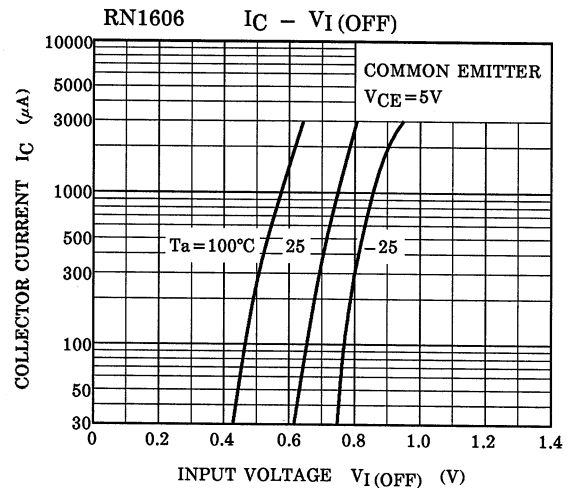
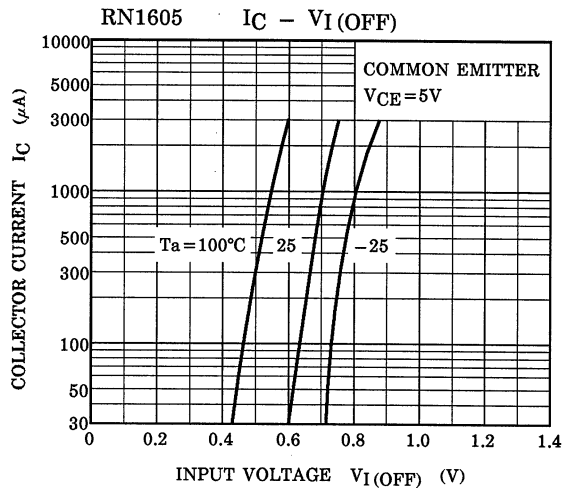
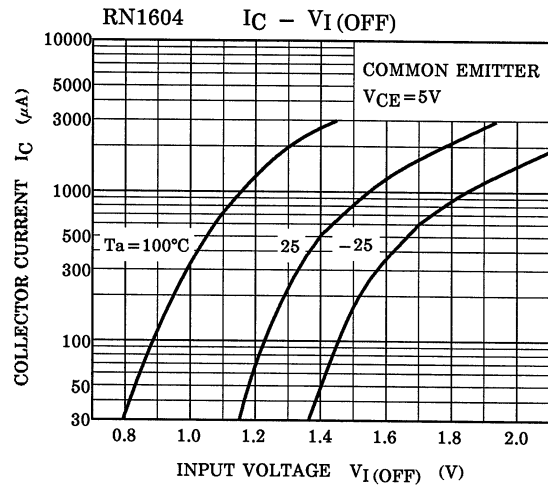
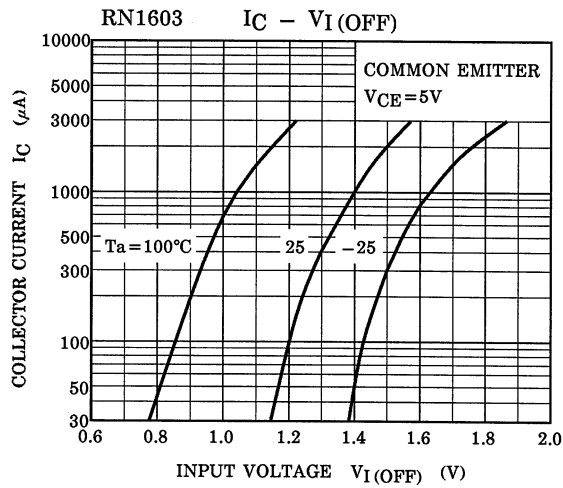
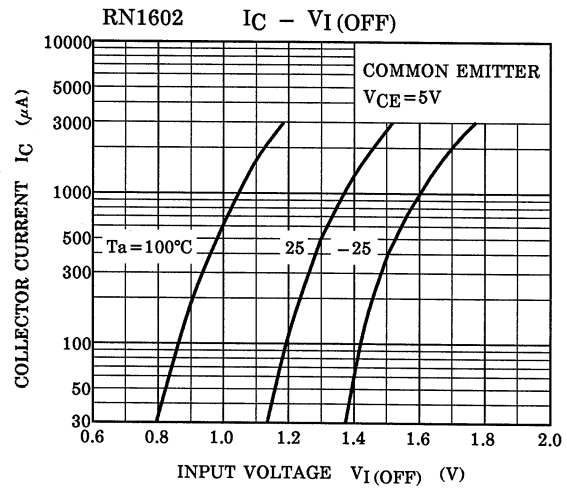
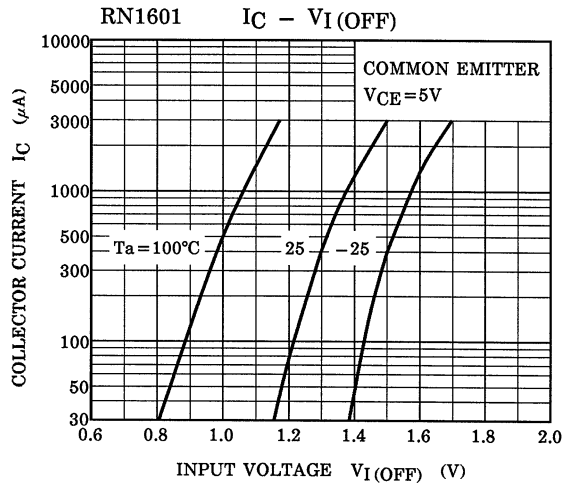
Electrical Characteristics (Ta = 25°C) (Q1, Q2 Common)

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	

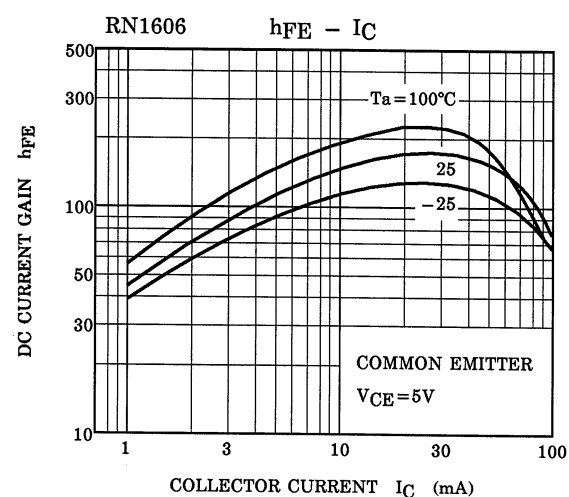
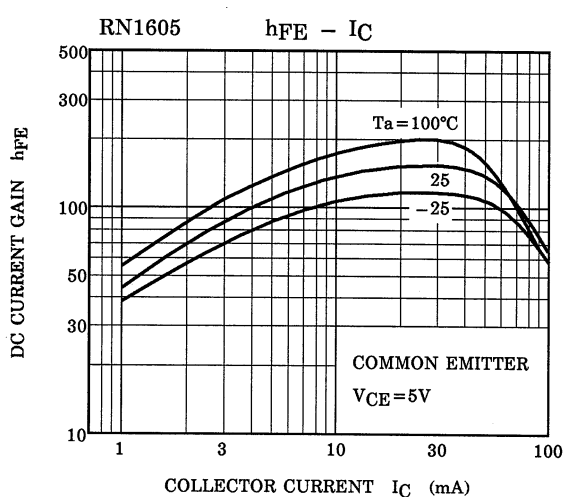
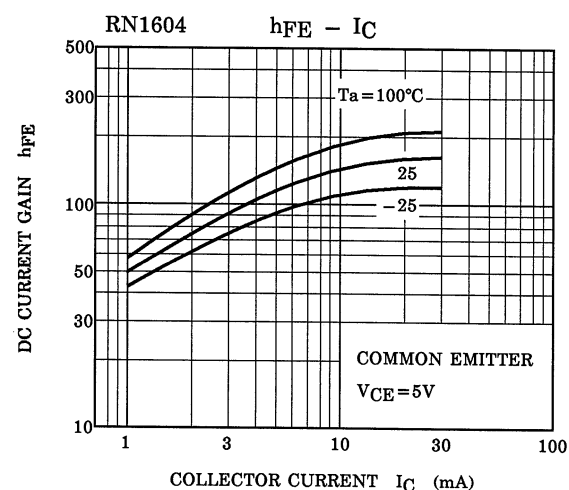
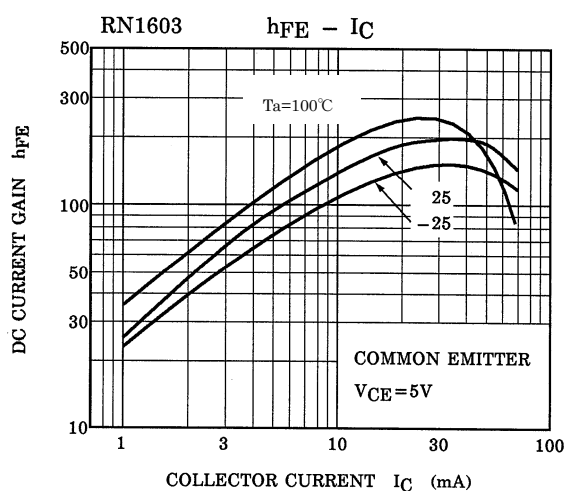
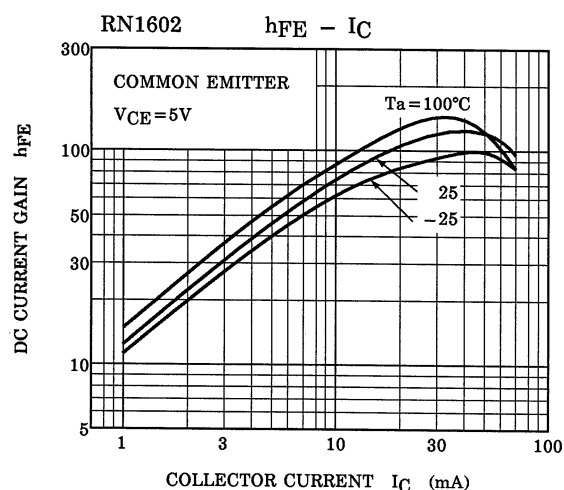
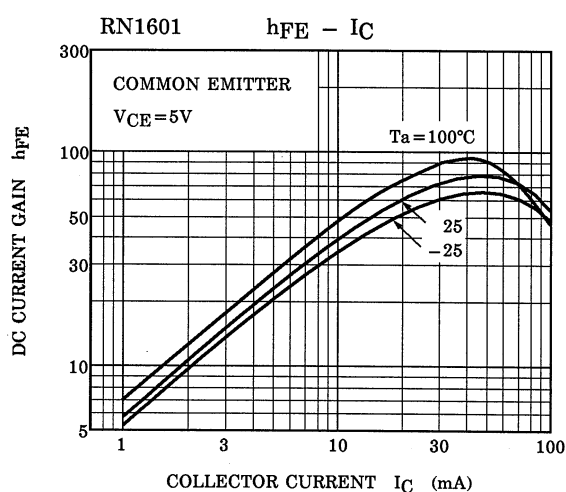
(Q1, Q2 Common)



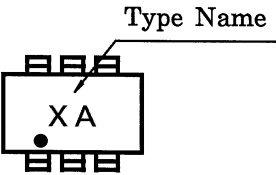
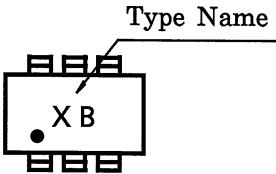
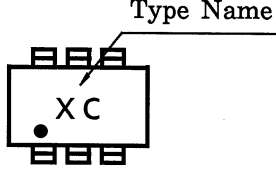
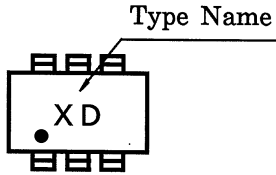
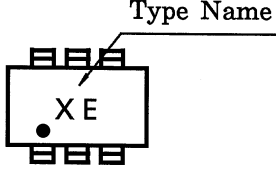
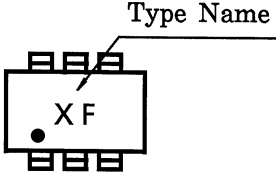
(Q1, Q2 Common)



(Q1, Q2 Common)



Marking

Type Name	Marking
RN1601	 The diagram shows a rectangular component with four pins on each of the top and bottom edges. Inside the rectangle, the text 'X A' is printed, with a small dot positioned below the 'X'. A leader line points from the text 'Type Name' to the top edge of the component.
RN1602	 The diagram shows a rectangular component with four pins on each of the top and bottom edges. Inside the rectangle, the text 'X B' is printed, with a small dot positioned below the 'X'. A leader line points from the text 'Type Name' to the top edge of the component.
RN1603	 The diagram shows a rectangular component with four pins on each of the top and bottom edges. Inside the rectangle, the text 'X C' is printed, with a small dot positioned below the 'X'. A leader line points from the text 'Type Name' to the top edge of the component.
RN1604	 The diagram shows a rectangular component with four pins on each of the top and bottom edges. Inside the rectangle, the text 'X D' is printed, with a small dot positioned below the 'X'. A leader line points from the text 'Type Name' to the top edge of the component.
RN1605	 The diagram shows a rectangular component with four pins on each of the top and bottom edges. Inside the rectangle, the text 'X E' is printed, with a small dot positioned below the 'X'. A leader line points from the text 'Type Name' to the top edge of the component.
RN1606	 The diagram shows a rectangular component with four pins on each of the top and bottom edges. Inside the rectangle, the text 'X F' is printed, with a small dot positioned below the 'X'. A leader line points from the text 'Type Name' to the top edge of the component.

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