

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

# RN1901FE/02FE/03FE/04FE/05FE/06FE

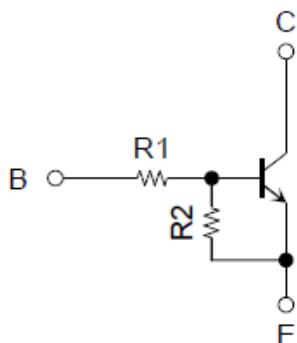
## 1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

## 2. Features

- (1) AEC-Q101 qualified (Please see the orderable part number list)
- (2) Small package (Dual type)
- (3) The integrated bias resistor reduces the number of external parts required, making it possible to reduce system size and assembly time.
- (4) Complementary to RN2901FE to RN2906FE

## 3. Equivalent Circuit

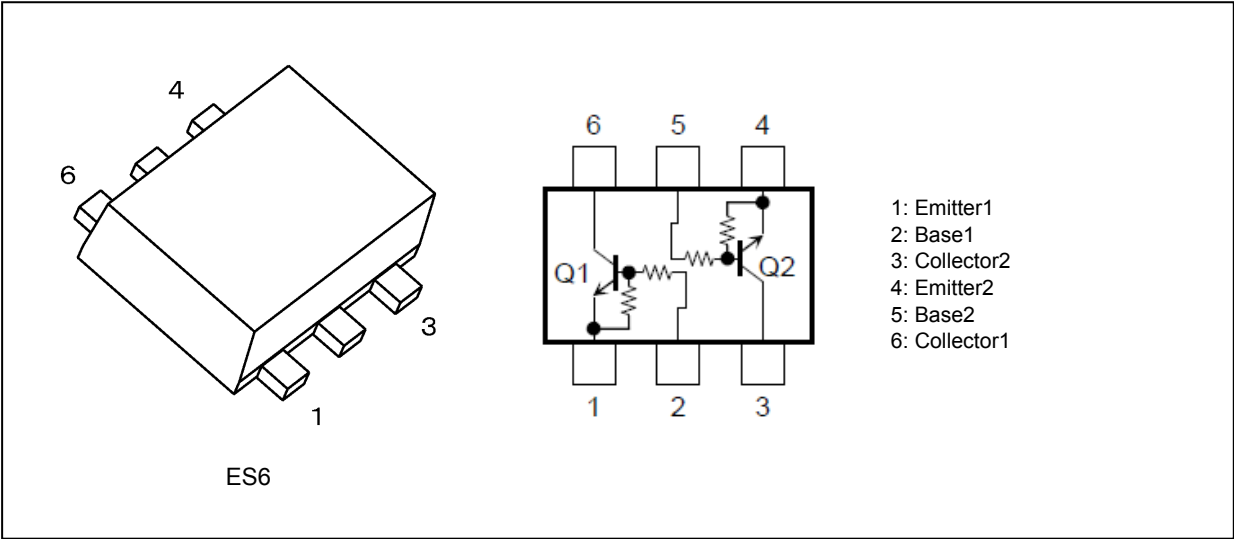


## 4. Bias Resistor Values

Part No.	R1 (k $\Omega$ )	R2 (k $\Omega$ )
RN1901FE	4.7	4.7
RN1902FE	10	10
RN1903FE	22	22
RN1904FE	47	47
RN1905FE	2.2	47
RN1906FE	4.7	47

Start of commercial production  
2000-05

5. Packaging and Pin Assignment



6. Orderable part number

Orderable part number		AEC-Q101	Note
RN1901FE	RN1901FE,LF	—	General Use
	RN1901FE,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1901FE,LXHF	YES	Automotive Use
RN1902FE	RN1902FE,LF	—	General Use
	RN1902FE,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1902FE,LXHF	YES	Automotive Use
RN1903FE	RN1903FE,LF	—	General Use
	RN1903FE,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1903FE,LXHF	YES	Automotive Use
RN1904FE	RN1904FE,LF	—	General Use
	RN1904FE,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1904FE,LXHF	YES	Automotive Use
RN1905FE	RN1905FE,LF	—	General Use
	RN1905FE,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1905FE,LXHF	YES	Automotive Use
RN1906FE	RN1906FE,LF	—	General Use
	RN1906FE,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1906FE,LXHF	YES	Automotive Use

Note 1: For more information, please contact our sales or use the inquiry form on our website.

## 7. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25\text{ }^{\circ}\text{C}$ ) (Q1, Q2 Common)

Characteristics		Symbol	Rating	Unit
Collector-base voltage	RN1901FE~RN1906FE	$V_{CBO}$	50	V
Collector-emitter voltage		$V_{CEO}$	50	
Emitter-base voltage	RN1901FE~RN1904FE	$V_{EBO}$	10	
	RN1905FE,RN1906FE		5	
Collector current	RN1901FE~RN1906FE	$I_C$	100	mA
Collector power dissipation (Note 1)		$P_C$	100	mW
Junction temperature		$T_j$	150	$^{\circ}\text{C}$
Storage temperature		$T_{stg}$	-55 to 150	

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

### 8. Electrical Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$ ) (Q1, Q2 Common)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN1901FE~RN1906FE	$I_{CBO}$	$V_{CB} = 50\text{ V}, I_E = 0\text{ mA}$	—	—	100	nA
		$I_{CEO}$	$V_{CE} = 50\text{ V}, I_B = 0\text{ mA}$	—	—	500	
Emitter cut-off current	RN1901FE	$I_{EBO}$	$V_{EB} = 10\text{ V}, I_C = 0\text{ mA}$	0.82	—	1.52	mA
	RN1902FE			0.38	—	0.71	
	RN1903FE			0.17	—	0.33	
	RN1904FE			0.082	—	0.15	
	RN1905FE	$V_{EB} = 5\text{ V}, I_C = 0\text{ mA}$		0.078	—	0.145	
	RN1906FE			0.074	—	0.138	
DC current gain	RN1901FE	$h_{FE}$	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$	30	—	—	—
	RN1902FE			50	—	—	
	RN1903FE			70	—	—	
	RN1904FE			80	—	—	
	RN1905FE			80	—	—	
	RN1906FE			80	—	—	
Collector-emitter saturation voltage	RN1901FE~RN1906FE	$V_{CE(sat)}$	$I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$	—	0.1	0.3	V
Input voltage (ON)	RN1901FE	$V_{I(ON)}$	$V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$	1.1	—	2.0	
	RN1902FE			1.2	—	2.4	
	RN1903FE			1.3	—	3.0	
	RN1904FE			1.5	—	5.0	
	RN1905FE			0.6	—	1.1	
	RN1906FE			0.7	—	1.3	
Input voltage (OFF)	RN1901FE~RN1904FE	$V_{I(OFF)}$	$V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$	1.0	—	1.5	
	RN1905FE, RN1906FE			0.5	—	0.8	
Transition frequency	RN1901FE~RN1906FE	$f_T$	$V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$	—	250	—	MHz
Collector output capacitance	RN1901FE~RN1906FE	$C_{ob}$	$V_{CB} = 10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	3	6	pF
Input resistance	RN1901FE	$R_1$	-	3.29	4.7	6.11	k $\Omega$
	RN1902FE			7	10	13	
	RN1903FE			15.4	22	28.6	
	RN1904FE			32.9	47	61.1	
	RN1905FE			1.54	2.2	2.86	
	RN1906FE			3.29	4.7	6.11	
Resistor ratio	RN1901FE~RN1904FE	R1/R2	-	0.9	1.0	1.1	—
	RN1905FE			0.0421	0.0468	0.0515	
	RN1906FE			0.09	0.1	0.11	

### 9. Marking

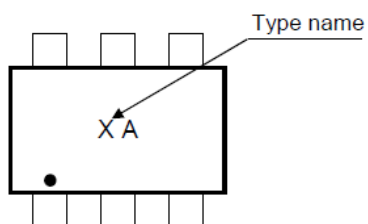


Fig. 9.1 Marking RN1901FE

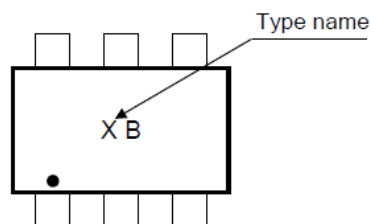


Fig. 9.2 Marking RN1902FE

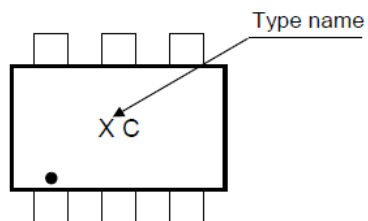


Fig. 9.3 Marking RN1903FE

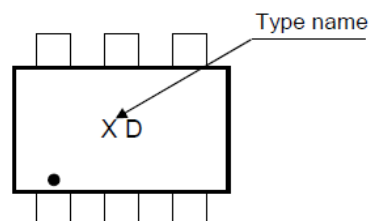


Fig. 9.4 Marking RN1904FE

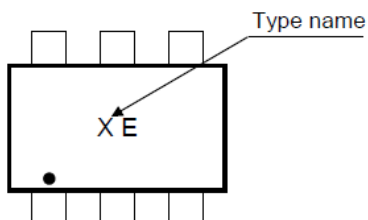


Fig. 9.5 Marking RN1905FE

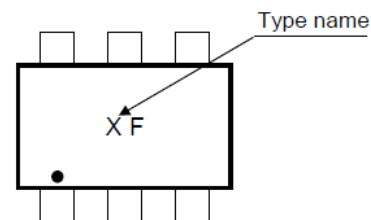


Fig. 9.6 Marking RN1906FE

### 10. Characteristics Curves (Note)(Q1, Q2 Common)

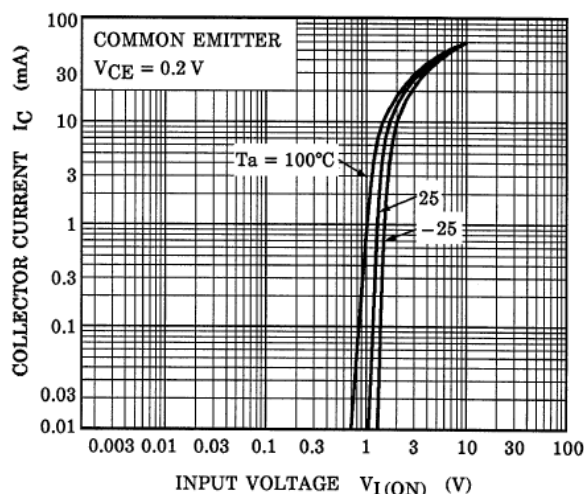


Fig. 10.1 RN1901FE  $I_C$ - $V_{I(ON)}$

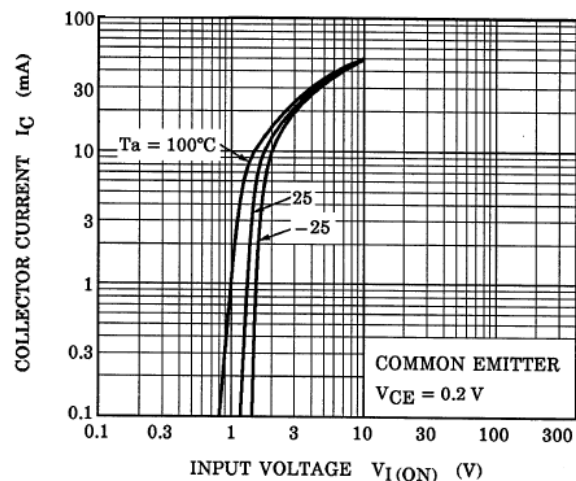


Fig. 10.2 RN1902FE  $I_C$ - $V_{I(ON)}$

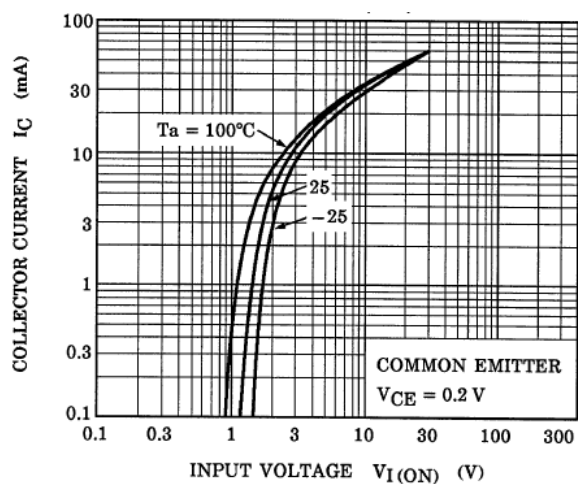


Fig. 10.3 RN1903FE  $I_C$ - $V_{I(ON)}$

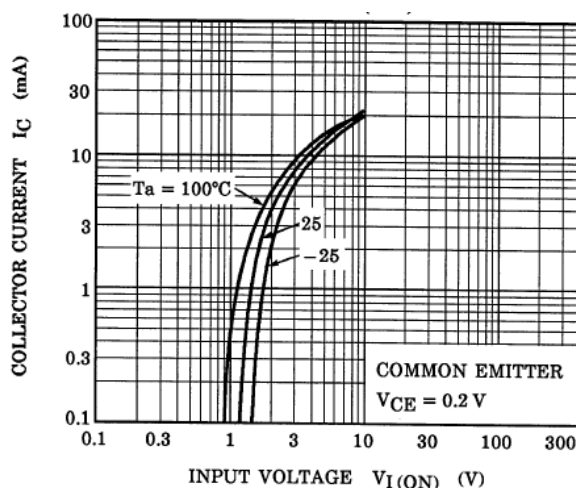


Fig. 10.4 RN1904FE  $I_C$ - $V_{I(ON)}$

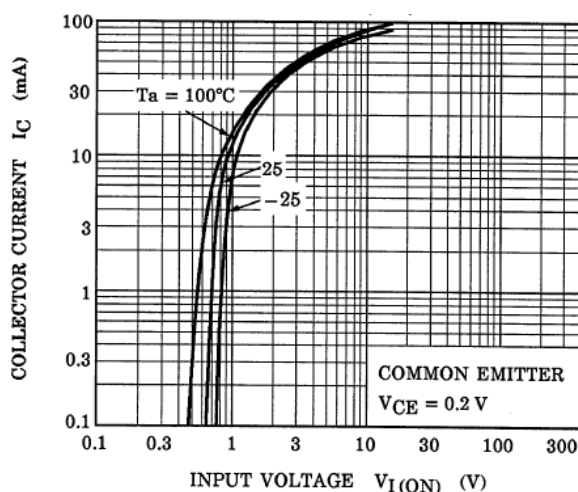


Fig. 10.5 RN1905FE  $I_C$ - $V_{I(ON)}$

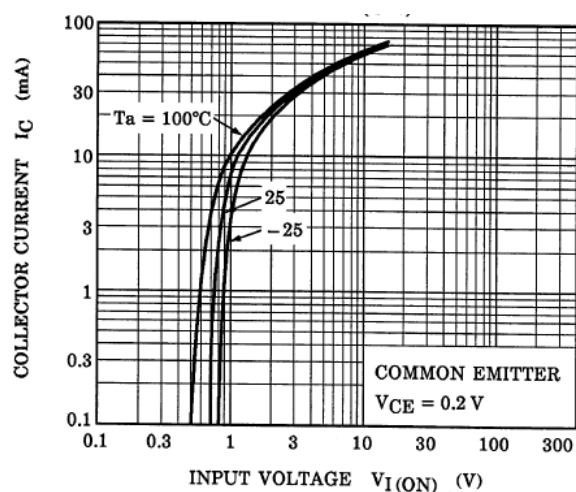


Fig. 10.6 RN1906FE  $I_C$ - $V_{I(ON)}$

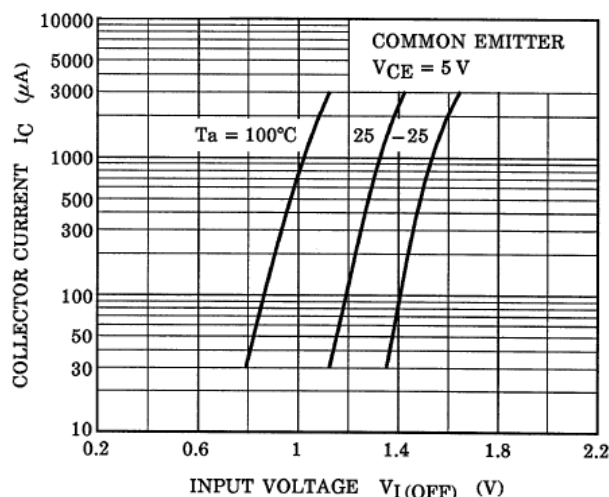


Fig. 10.7 RN1901FE  $I_C$ - $V_{I(OFF)}$

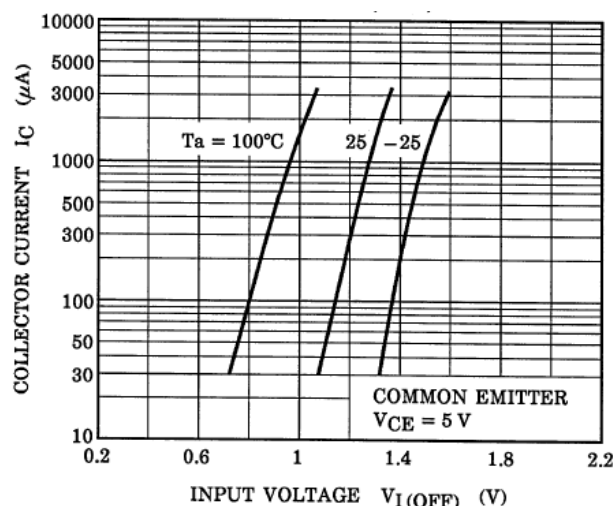


Fig. 10.8 RN1902FE  $I_C$ - $V_{I(OFF)}$

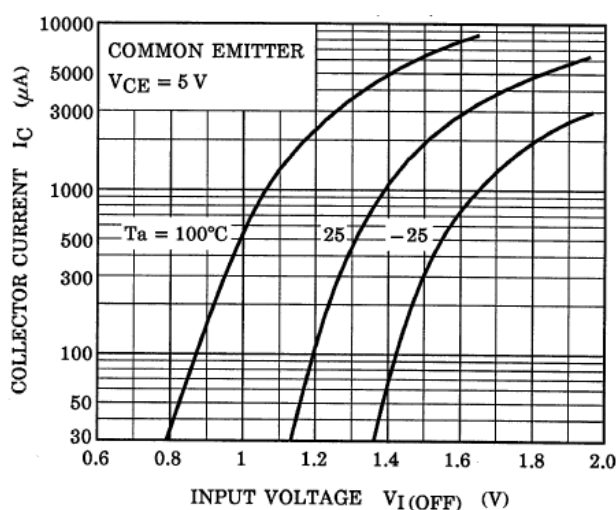


Fig. 10.9 RN1903FE  $I_C$ - $V_{I(OFF)}$

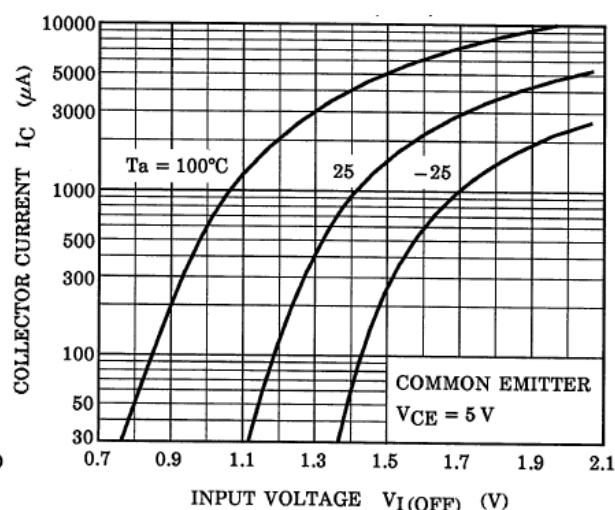


Fig. 10.10 RN1904FE  $I_C$ - $V_{I(OFF)}$

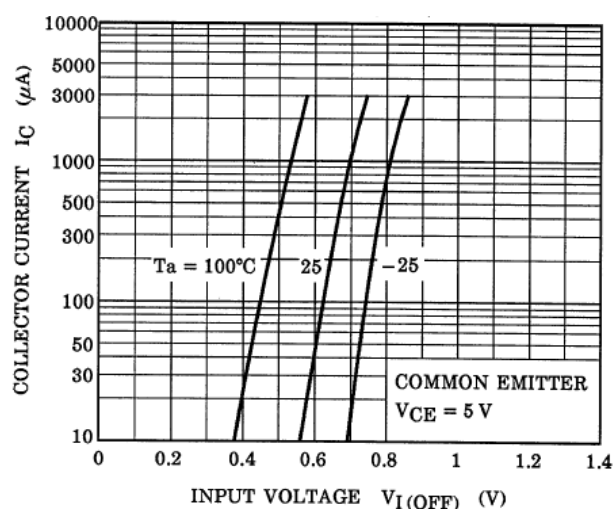


Fig. 10.11 RN1905FE  $I_C$ - $V_{I(OFF)}$

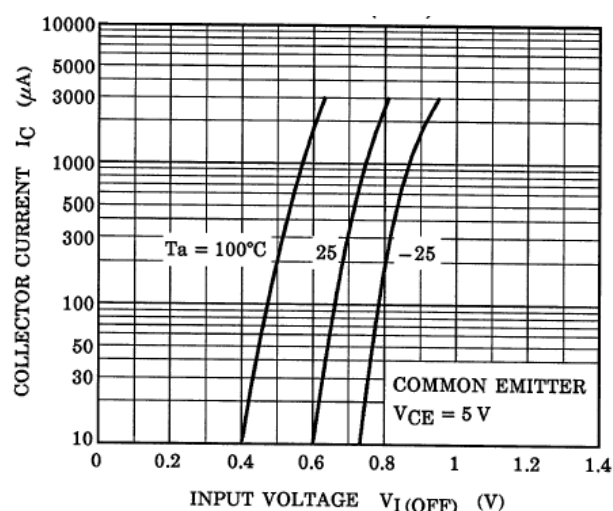


Fig. 10.12 RN1906FE  $I_C$ - $V_{I(OFF)}$



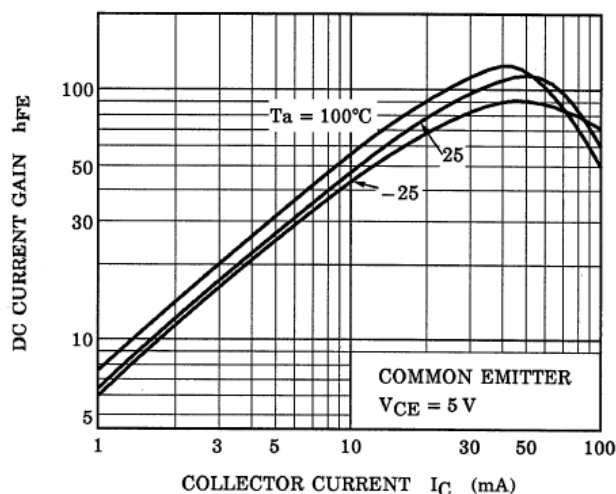


Fig. 10.13 RN1901FE  $h_{FE}$ - $I_C$

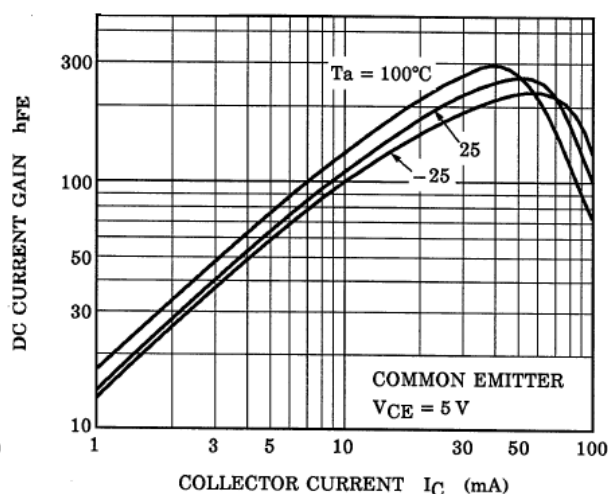


Fig. 10.14 RN1902FE  $h_{FE}$ - $I_C$

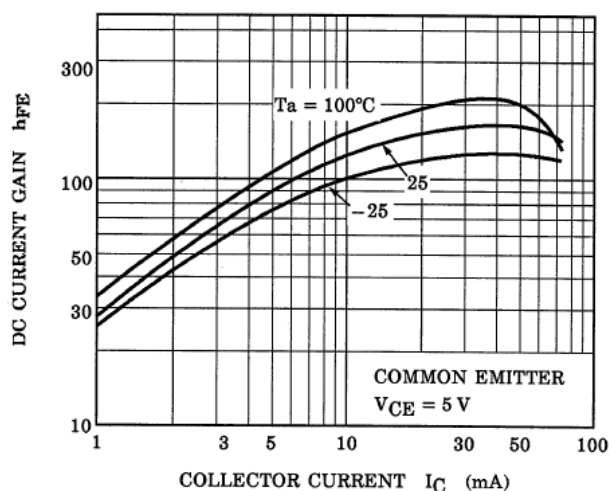


Fig. 10.15 RN1903FE  $h_{FE}$ - $I_C$

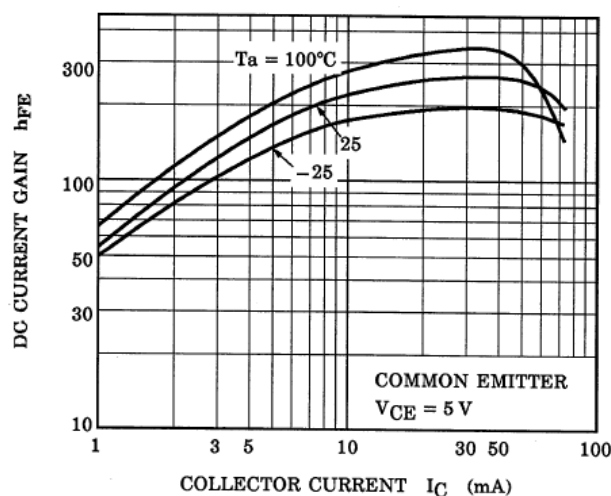


Fig. 10.16 RN1904FE  $h_{FE}$ - $I_C$

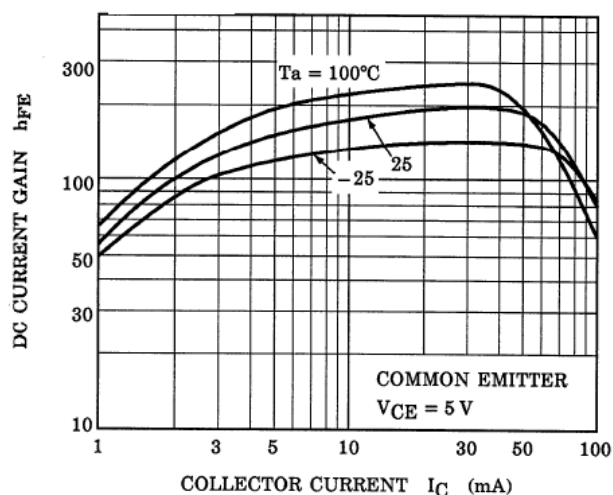


Fig. 10.17 RN1905FE  $h_{FE}$ - $I_C$

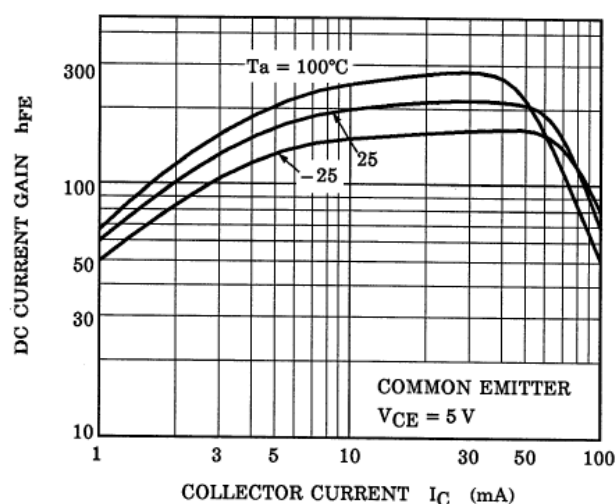


Fig. 10.18 RN1906FE  $h_{FE}$ - $I_C$



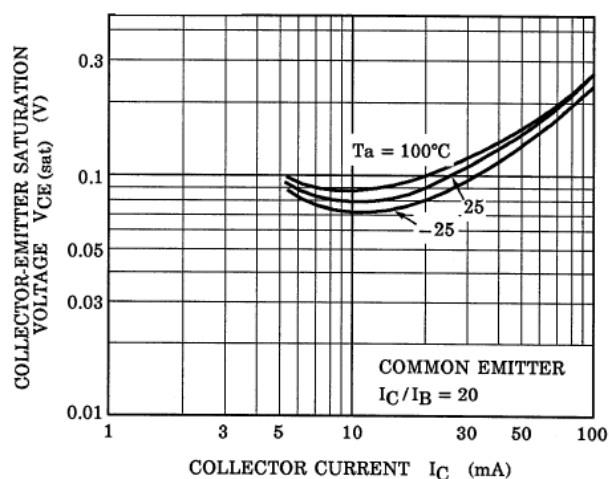


Fig. 10.19 RN1901FE  $V_{CE(sat)}-I_C$

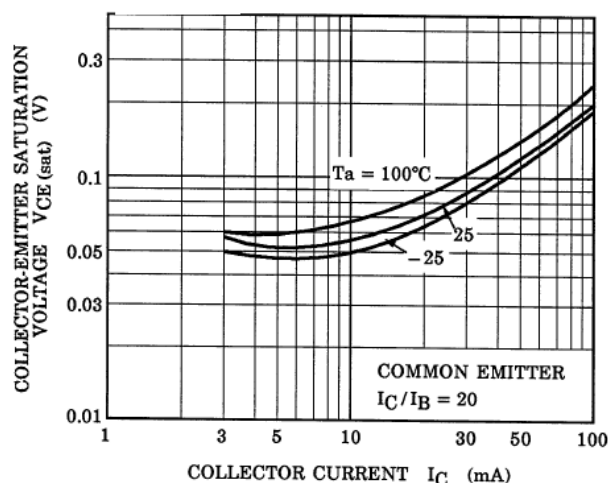


Fig. 10.20 RN1902FE  $V_{CE(sat)}-I_C$

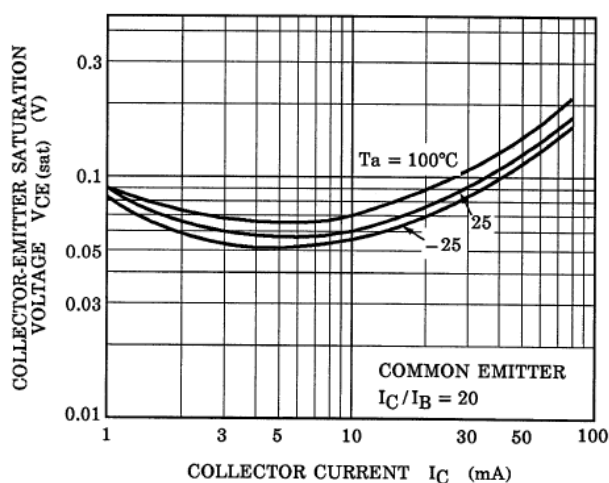


Fig. 10.21 RN1903FE  $V_{CE(sat)}-I_C$

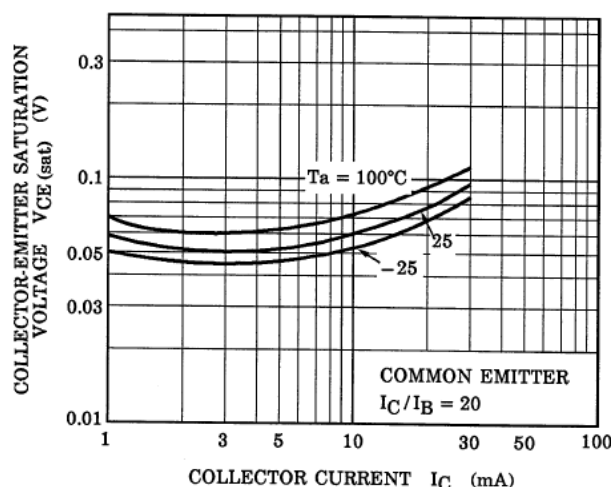


Fig. 10.22 RN1904FE  $V_{CE(sat)}-I_C$

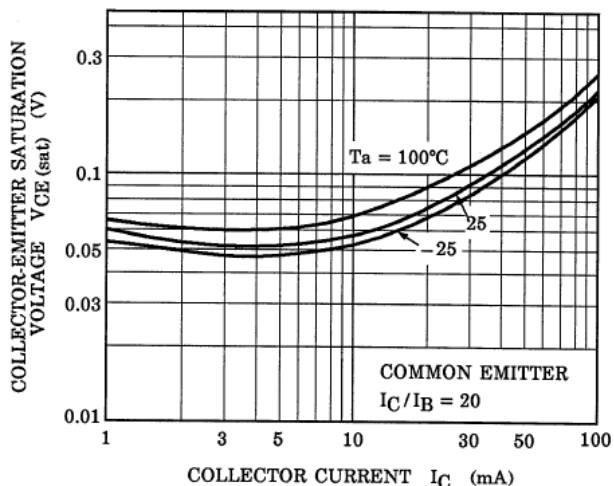


Fig. 10.23 RN1905FE  $V_{CE(sat)}-I_C$

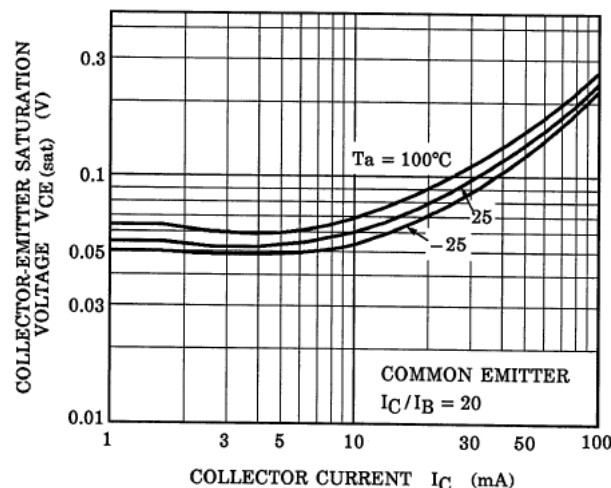
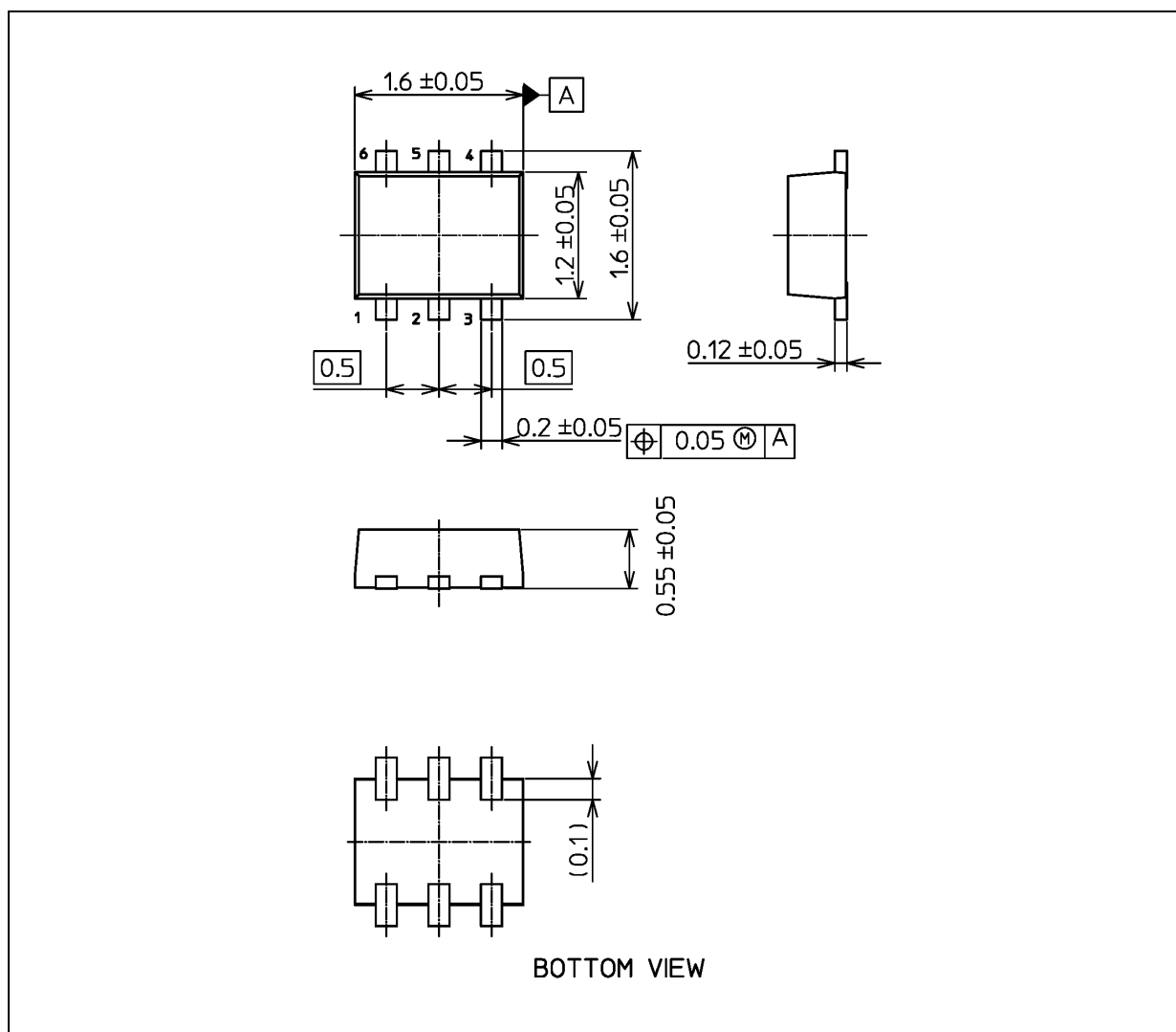


Fig. 10.24 RN1906FE  $V_{CE(sat)}-I_C$

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

### Package Dimensions

Unit: mm



Weight: 3.0 mg (typ.)

Package Name(s)
TOSHIBA: 1-2X1S
Nickname: ES6

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