

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

# RN2101MFV/02MFV/03MFV/04MFV/05MFV/06MFV

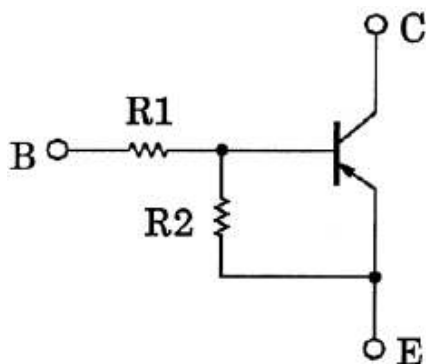
## 1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

## 2. Features

- (1) AEC-Q101 qualified (Please see the orderable part number list)
- (2) Ultra-small package, suited to very high density mounting
- (3) The integrated bias resistor reduces the number of external parts required, making it possible to reduce system size and assembly time.
- (4) Toshiba offers transistors with a wide range of resistance to accommodate various circuit designs.
- (5) Complementary to RN1101MFV to RN1106MFV

## 3. Equivalent Circuit

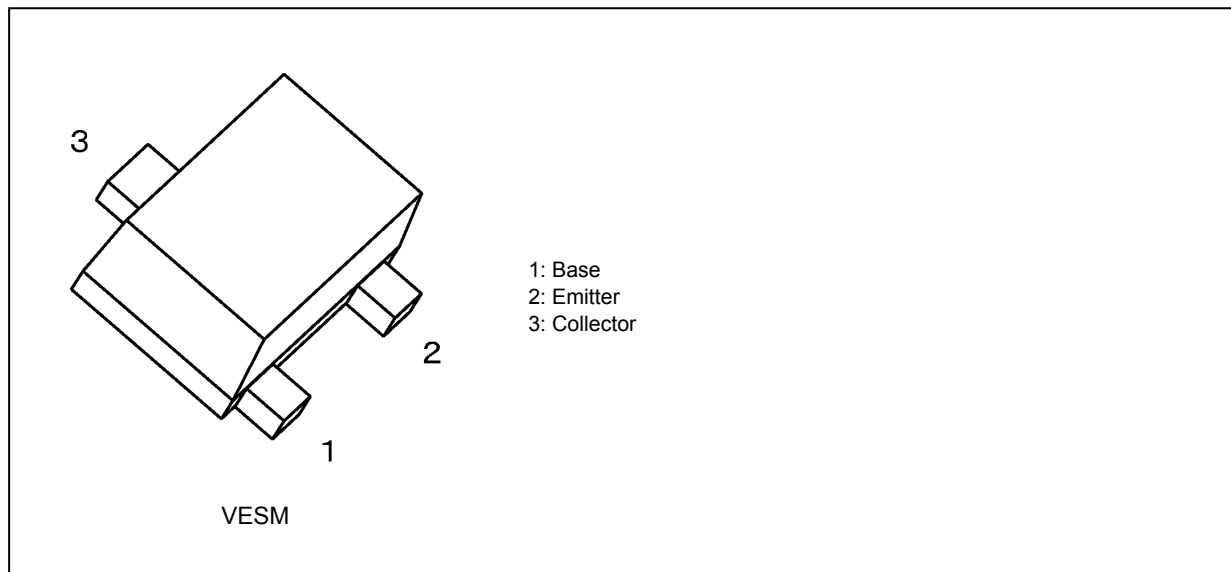


## 4. Bias Resistor Values

Part No.	R1 (kΩ)	R2 (kΩ)
RN2101MFV	4.7	4.7
RN2102MFV	10	10
RN2103MFV	22	22
RN2104MFV	47	47
RN2105MFV	2.2	47
RN2106MFV	4.7	47

Start of commercial production  
2005-02

### 5. Packaging and Pin Assignment



### 6. Orderable part number

Orderable part number		AEC-Q101	Note	Note
RN2101MFV	RN2101MFV,L3F	—		General Use
	RN2101MFV,L3XGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2101MFV,L3XHF	YES		Automotive Use
RN2102MFV	RN2102MFV,L3F	—		General Use
	RN2102MFV,L3XGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2102MFV,L3XHF	YES		Automotive Use
RN2103MFV	RN2103MFV,L3F	—		General Use
	RN2103MFV,L3XGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2103MFV,L3XHF	YES		Automotive Use
RN2104MFV	RN2104MFV,L3F	—		General Use
	RN2104MFV,L3XGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2104MFV,L3XHF	YES		Automotive Use
RN2105MFV	RN2105MFV,L3F	—		General Use
	RN2105MFV,L3XGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2105MFV,L3XHF	YES		Automotive Use
RN2106MFV	RN2106MFV,L3F	—		General Use
	RN2106MFV,L3XGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2106MFV,L3XHF	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, $T_a = 25\text{ }^\circ\text{C}$ )

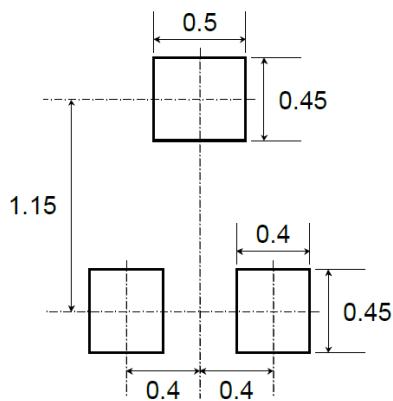
Characteristics		Symbol	Rating	Unit
Collector-base voltage	RN2101MFV~RN2106MFV	$V_{CBO}$	-50	V
Collector-emitter voltage		$V_{CEO}$	-50	
Emitter-base voltage	RN2101MFV~RN2104MFV	$V_{EBO}$	-10	
	RN2105MFV,RN2106MFV		-5	
Collector current	RN2101MFV~RN2106MFV	$I_C$	-100	mA
Collector power dissipation		$P_C$ (Note 1)	150	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: Mounted on an FR4 board (25.4 mm × 25.4 mm × 1.6 mm)

### 8. Land Pattern Dimensions (for reference only)



Unit: mm

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN2101MFV~ RN2106MFV	$I_{CBO}$	$V_{CB} = -50\text{ V}, I_E = 0\text{ mA}$	—	—	-100	nA
		$I_{CEO}$	$V_{CE} = -50\text{ V}, I_B = 0\text{ mA}$	—	—	-500	
Emitter cut-off current	RN2101MFV	$I_{EBO}$	$V_{EB} = -10\text{ V}, I_C = 0\text{ mA}$	-0.82	—	-1.52	mA
	RN2102MFV			-0.38	—	-0.71	
	RN2103MFV			-0.17	—	-0.33	
	RN2104MFV			-0.082	—	-0.15	
	RN2105MFV		$V_{EB} = -5\text{ V}, I_C = 0\text{ mA}$	-0.078	—	-0.145	
	RN2106MFV			-0.074	—	-0.138	
DC current gain	RN2101MFV	$h_{FE}$	$V_{CE} = -5\text{ V}, I_C = -10\text{ mA}$	30	—	—	—
	RN2102MFV			50	—	—	
	RN2103MFV			70	—	—	
	RN2104MFV			80	—	—	
	RN2105MFV			80	—	—	
	RN2106MFV			80	—	—	
Collector-emitter saturation voltage	RN2101MFV~ RN2106MFV	$V_{CE(sat)}$	$I_C = -5\text{ mA}, I_B = -0.5\text{ mA}$	—	-0.1	-0.3	V
Input voltage (ON)	RN2101MFV	$V_{I(ON)}$	$V_{CE} = -0.2\text{ V}, I_C = -5\text{ mA}$	-1.1	—	-2.0	V
	RN2102MFV			-1.2	—	-2.4	
	RN2103MFV			-1.3	—	-3.0	
	RN2104MFV			-1.5	—	-5.0	
	RN2105MFV			-0.6	—	-1.1	
	RN2106MFV			-0.7	—	-1.3	
Input voltage (OFF)	RN2101MFV~ RN2104MFV	$V_{I(OFF)}$	$V_{CE} = -5\text{ V}, I_C = -0.1\text{ mA}$	-1.0	—	-1.5	V
	RN2105MFV, RN2106MFV			-0.5	—	-0.8	
Transition frequency	RN2101MFV~ RN2106MFV	$f_T$	$V_{CE} = -10\text{ V}, I_C = -5\text{ mA}$	—	250	—	MHz
Collector output capacitance	RN2101MFV~ RN2106MFV	$C_{ob}$	$V_{CB} = -10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	0.9	—	pF
Input resistance	RN2101MFV	$R_1$	-	3.29	4.7	6.11	k $\Omega$
	RN2102MFV			7	10	13	
	RN2103MFV			15.4	22	28.6	
	RN2104MFV			32.9	47	61.1	
	RN2105MFV			1.54	2.2	2.86	
	RN2106MFV			3.29	4.7	6.11	
Resistor ratio	RN2101MFV~ RN2104MFV	R1/R2	-	0.8	1.0	1.2	—
	RN2105MFV			0.0376	0.0468	0.0562	
	RN2106MFV			0.08	0.1	0.12	

## 10. Marking

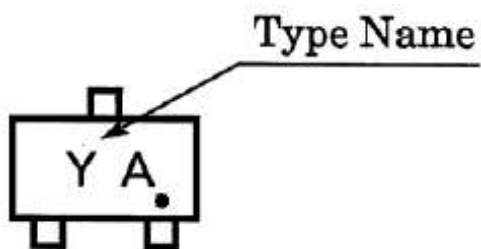


Fig. 10.1 Marking RN2101MFV

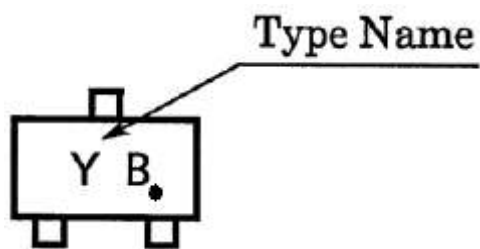


Fig. 10.2 Marking RN2102MFV

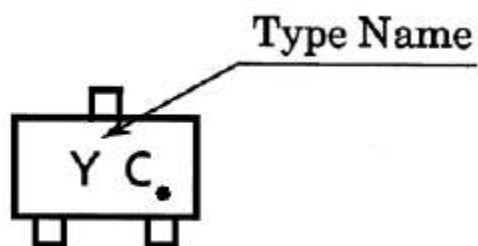


Fig. 10.3 Marking RN2103MFV

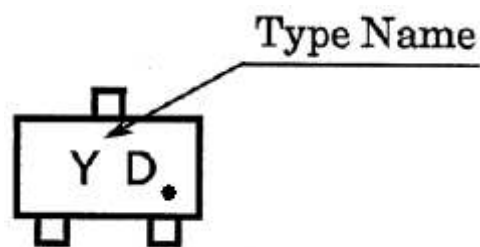


Fig. 10.4 Marking RN2104MFV

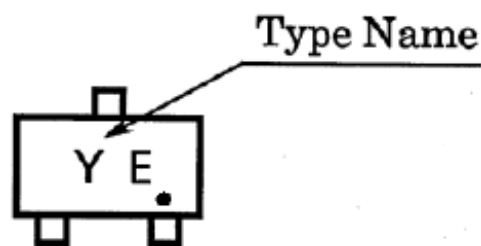


Fig. 10.5 Marking RN2105MFV

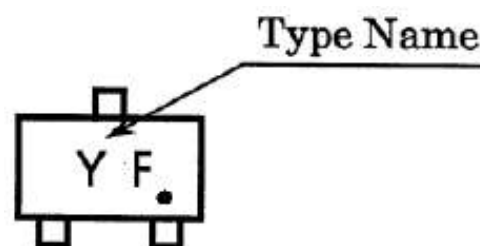


Fig. 10.6 Marking RN2106MFV

### 11. Characteristics Curves (Note)

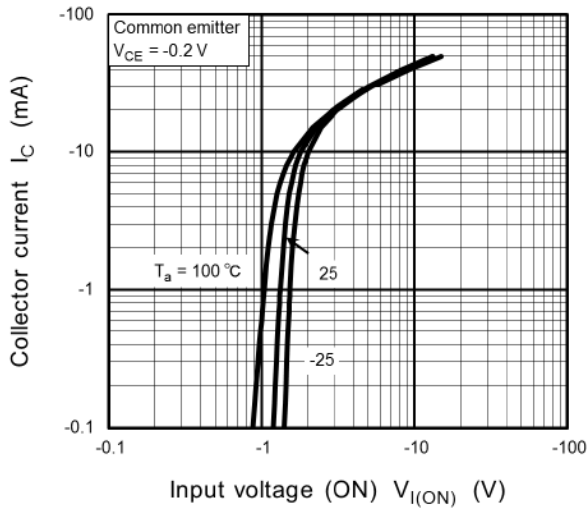


Fig. 11.1 RN2101MFV  $I_C$ - $V_{I(ON)}$

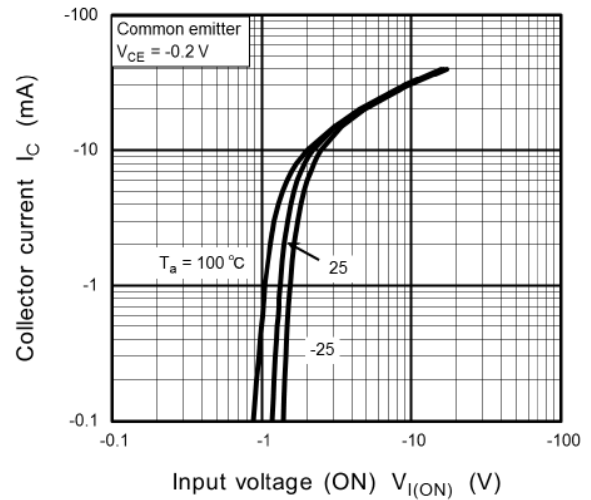


Fig. 11.2 RN2102MFV  $I_C$ - $V_{I(ON)}$

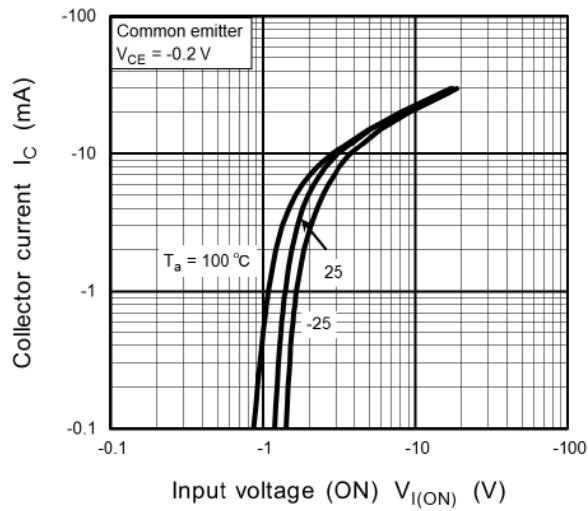


Fig. 11.3 RN2103MFV  $I_C$ - $V_{I(ON)}$

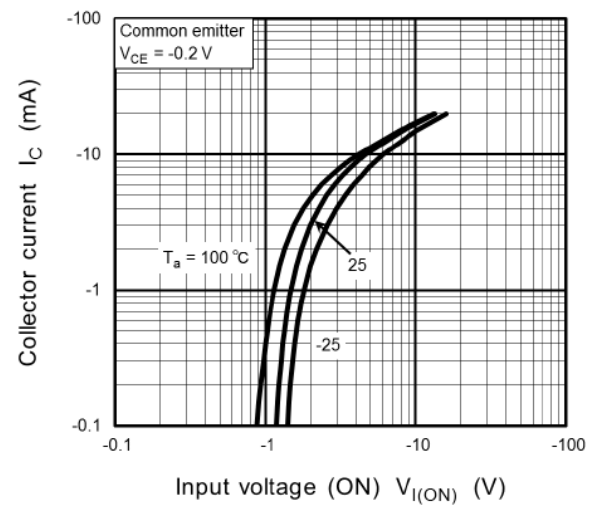


Fig. 11.4 RN2104MFV  $I_C$ - $V_{I(ON)}$

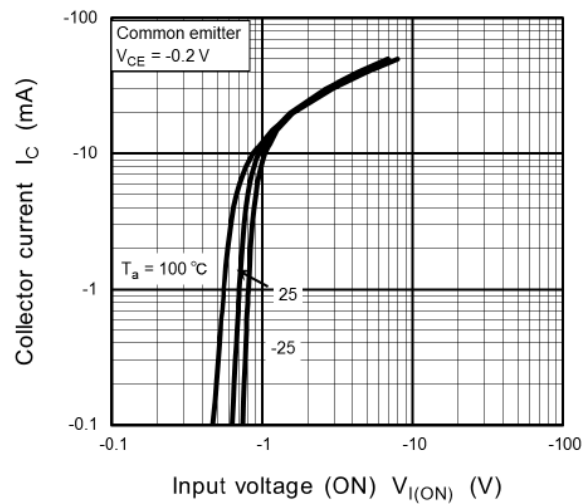


Fig. 11.5 RN2105MFV  $I_C$ - $V_{I(ON)}$

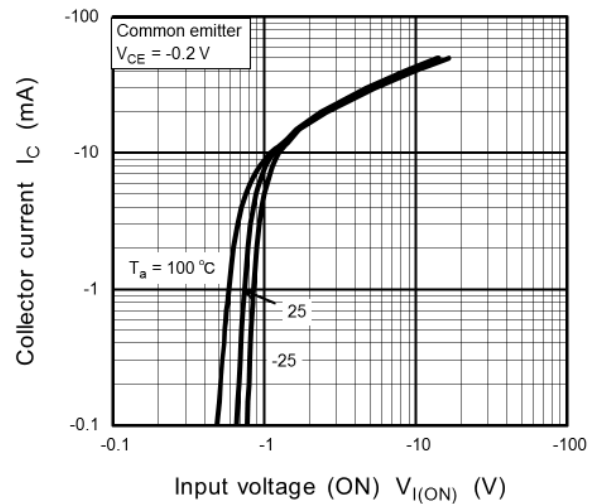
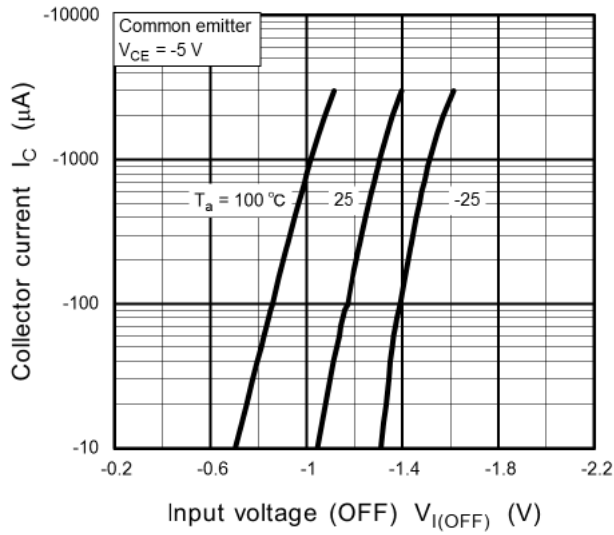
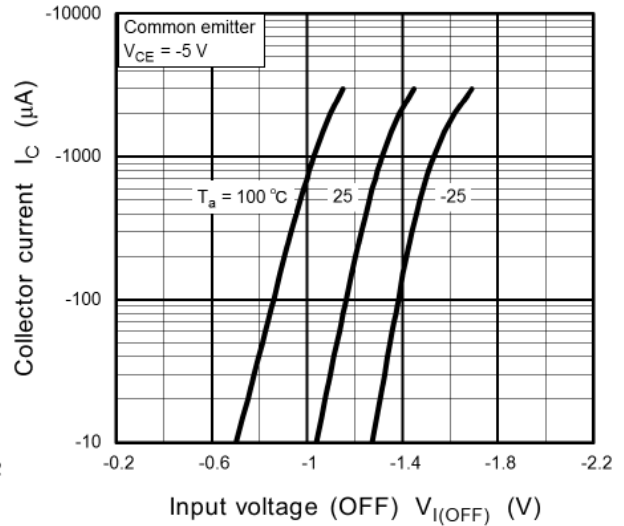


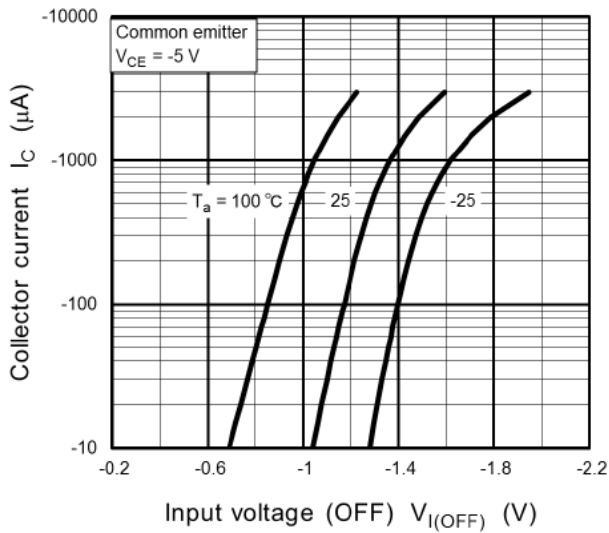
Fig. 11.6 RN2106MFV  $I_C$ - $V_{I(ON)}$



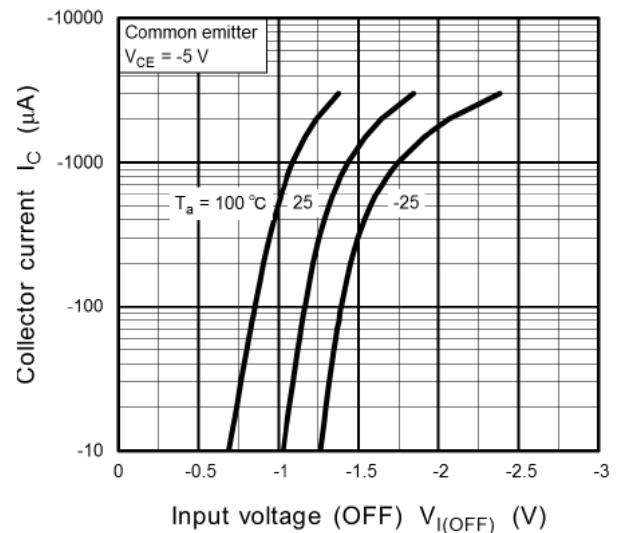
**Fig. 11.7 RN2101MFV  $I_C$ - $V_{I(OFF)}$**



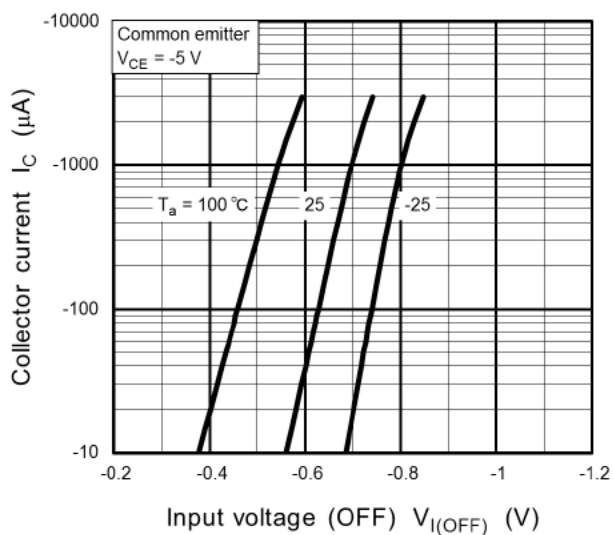
**Fig. 11.8 RN2102MFV  $I_C$ - $V_{I(OFF)}$**



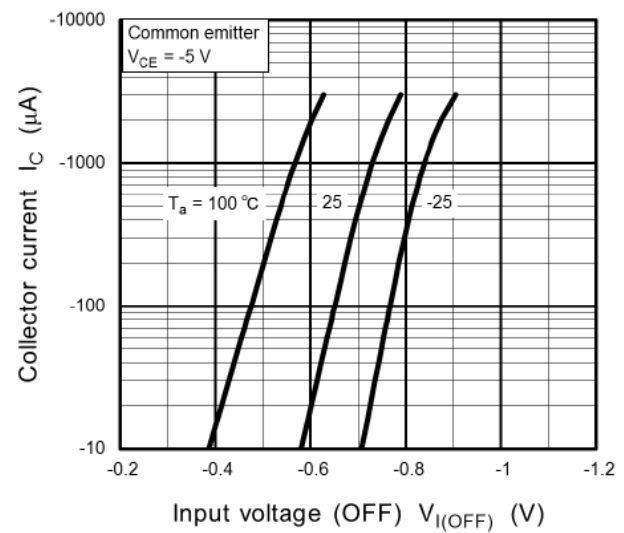
**Fig. 11.9 RN2103MFV  $I_C$ - $V_{I(OFF)}$**



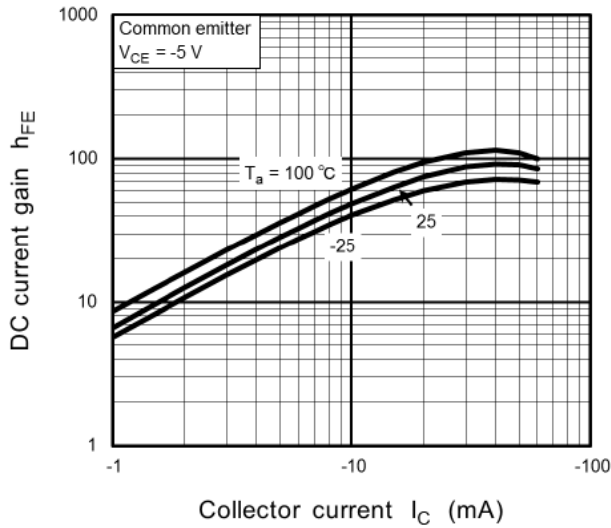
**Fig. 11.10 RN2104MFV  $I_C$ - $V_{I(OFF)}$**



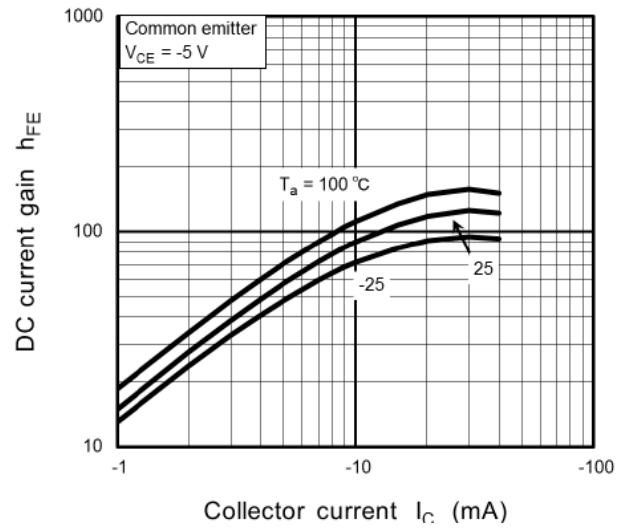
**Fig. 11.11 RN2105MFV  $I_C$ - $V_{I(OFF)}$**



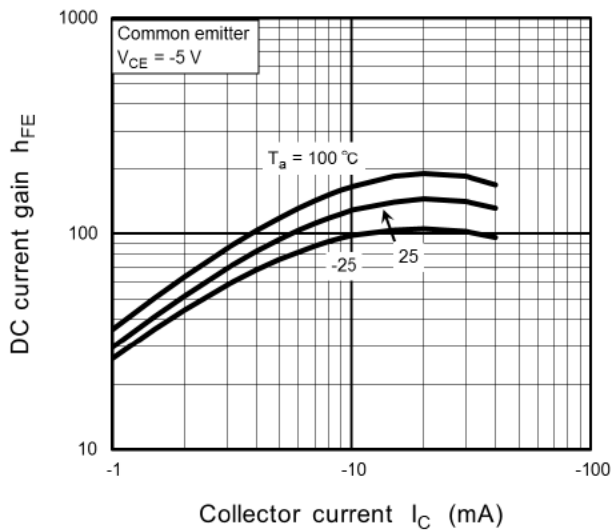
**Fig. 11.12 RN2106MFV  $I_C$ - $V_{I(OFF)}$**



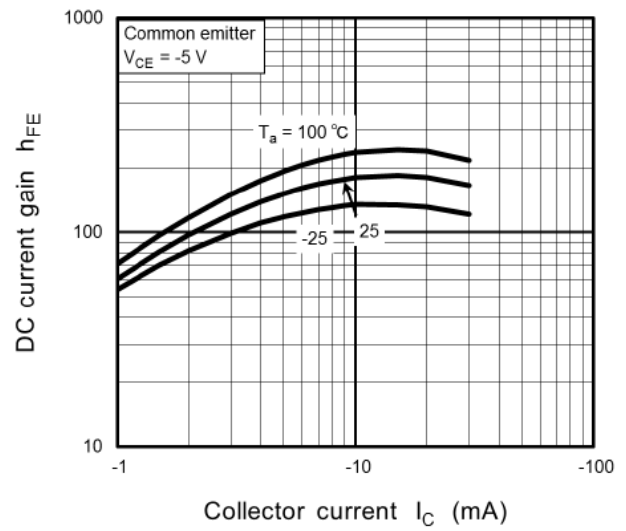
**Fig. 11.13 RN2101MFV  $h_{FE}$ - $I_C$**



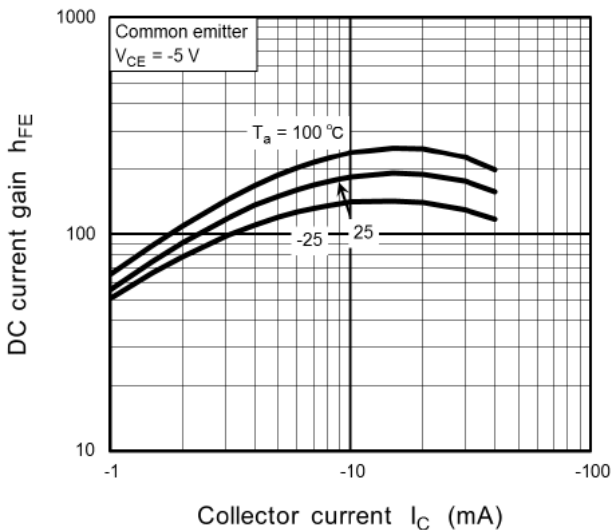
**Fig. 11.14 RN2102MFV  $h_{FE}$ - $I_C$**



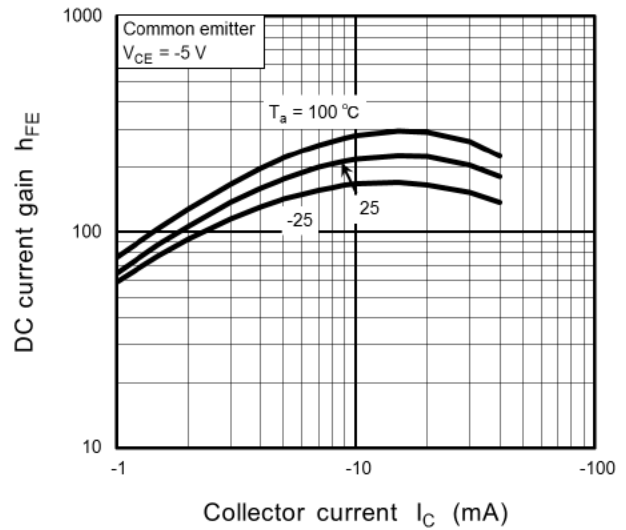
**Fig. 11.15 RN2103MFV  $h_{FE}$ - $I_C$**



**Fig. 11.16 RN2104MFV  $h_{FE}$ - $I_C$**



**Fig. 11.17 RN2105MFV  $h_{FE(sat)}$ - $I_C$**



**Fig. 11.18 RN2106MFV  $h_{FE}$ - $I_C$**



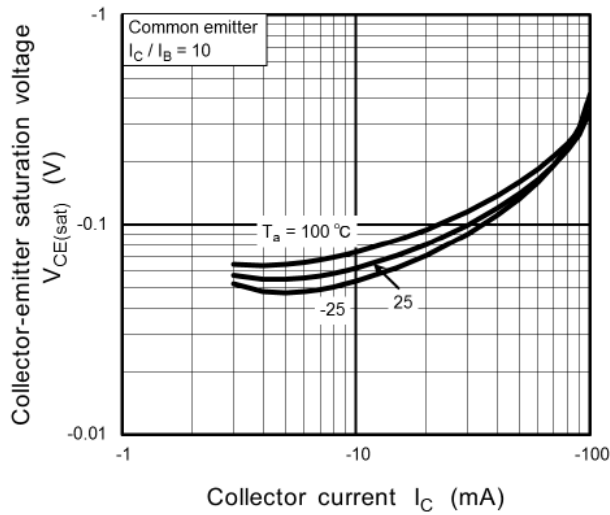


Fig. 11.19 RN2101MFV  $V_{CE(sat)}$ - $I_C$

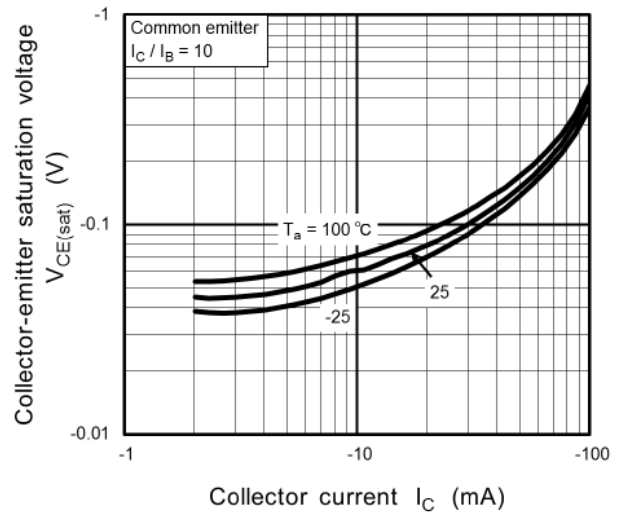


Fig. 11.20 RN2102MFV  $V_{CE(sat)}$ - $I_C$

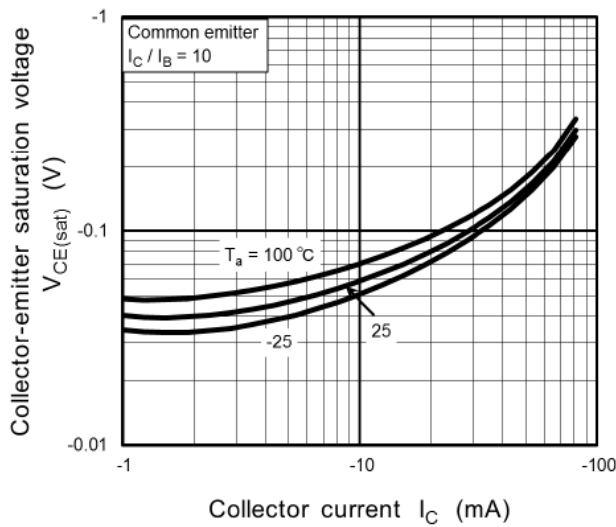


Fig. 11.21 RN2103MFV  $V_{CE(sat)}$ - $I_C$

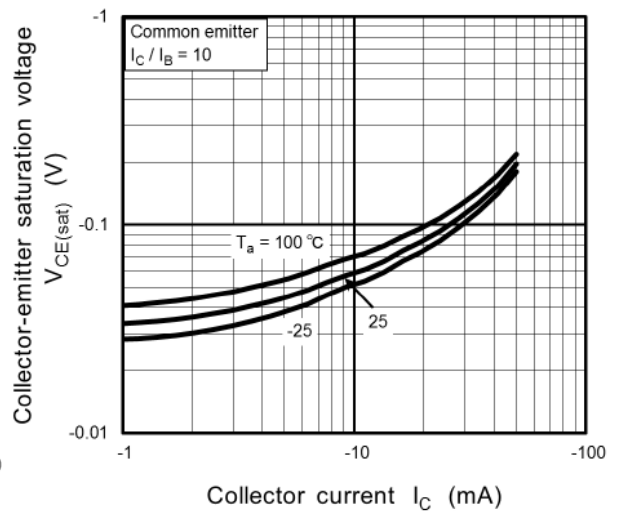


Fig. 11.22 RN2104MFV  $V_{CE(sat)}$ - $I_C$

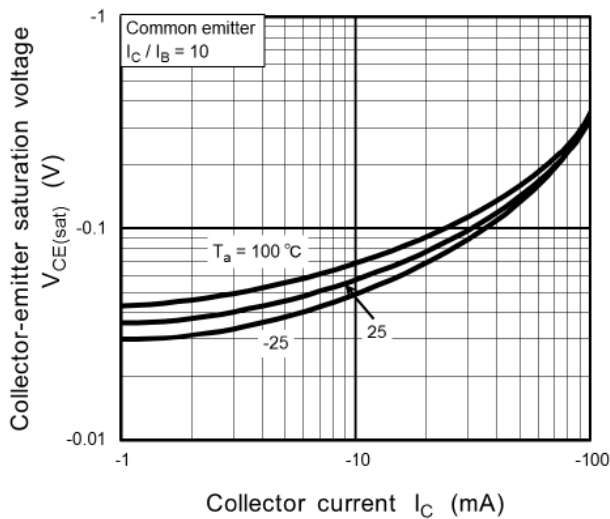


Fig. 11.23 RN2105MFV  $V_{CE(sat)}$ - $I_C$

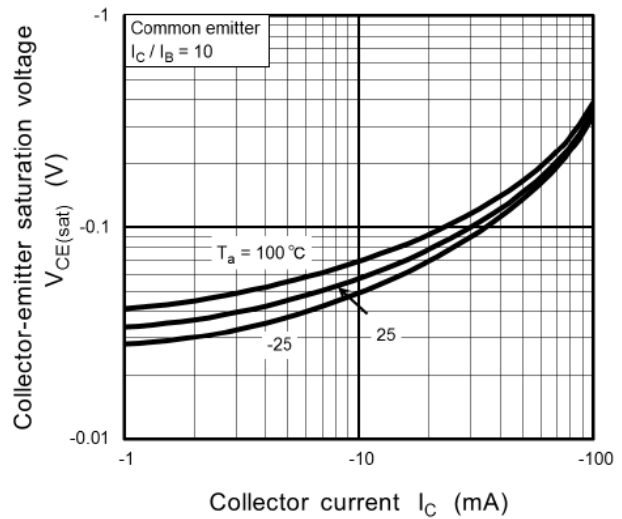
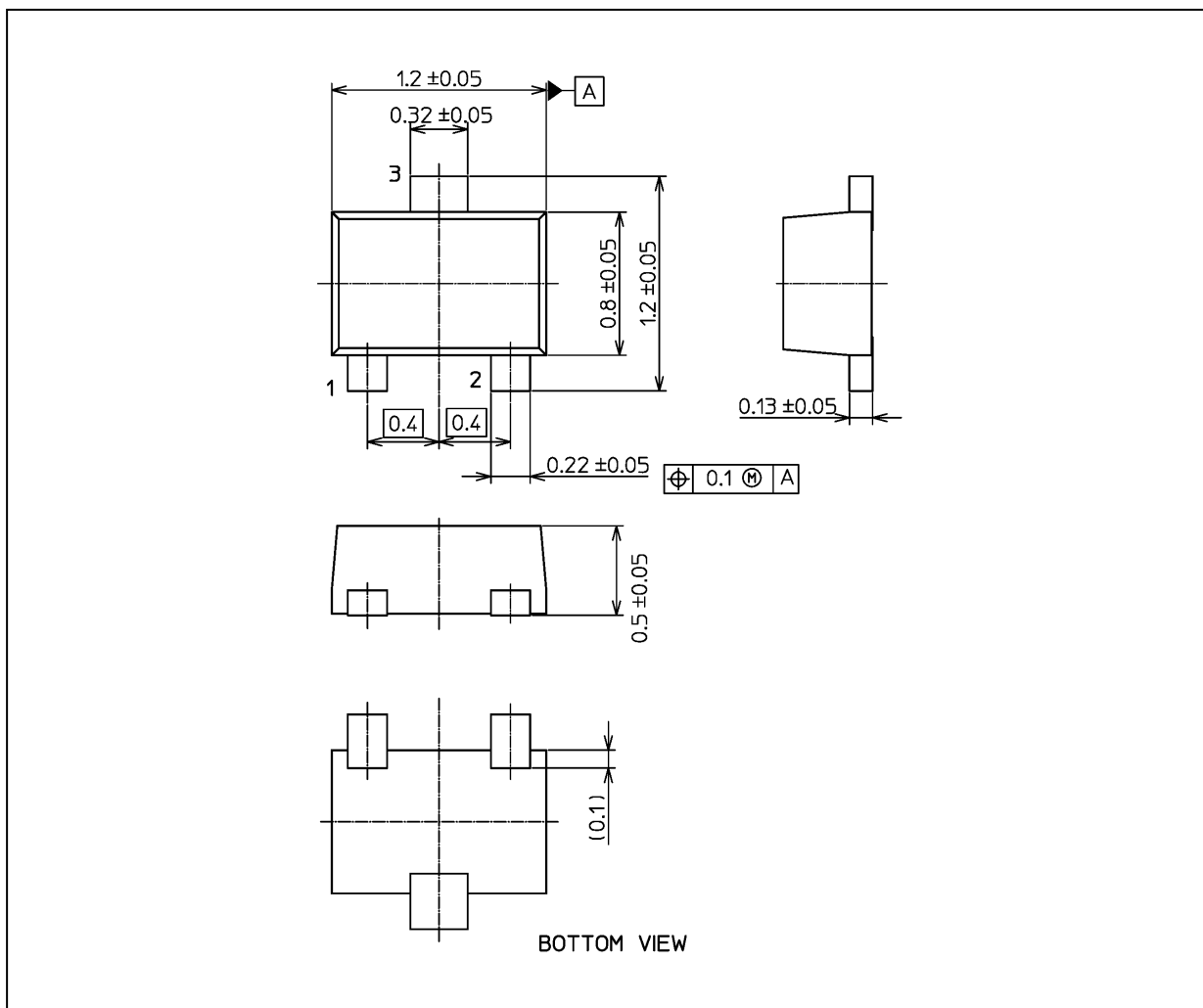


Fig. 11.24 RN2106MFV  $V_{CE(sat)}$ - $I_C$

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

### Package Dimensions

Unit: mm



Weight: 1.5 mg (typ.)

Package Name(s)
TOSHIBA: 1-1Q1S
Nickname: VESM

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