



NHUMB11/1/2 series

80 V, 100 mA PNP/PNP resistor-equipped double transistors

Rev. 1 — 23 July 2020

Product data sheet

1. General description

PNP/PNP Resistor-Equipped double Transistor (RET) family in a very small SOT363 (SC-88) Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

Type number	R1	R2	Package		NPN/PNP complement:	NPN/PNP complement:
	k Ω	k Ω	Nexperia	JEITA		
NHUMB11	10	10	SOT363	SC-88	NHUMH11	NHUMD3
NHUMB1	22	22			NHUMH1	NHUMD2
NHUMB2	47	47			NHUMH2	NHUMD12

2. Features and benefits

- 100 mA output current capability
- High breakdown voltage
- Built-in resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- AEC-Q101 qualified

3. Applications

- Digital applications
- Cost saving alternative for BC856 series in digital applications
- Controlling IC inputs
- Switching loads

4. Quick reference data

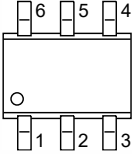
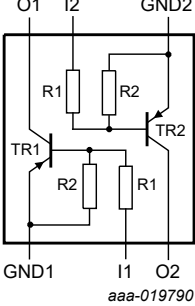
Table 2. Quick reference data

$T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor						
V_{CEO}	collector-emitter voltage	open base	-	-	-80	V
I_O	output current		-	-	-100	mA

5. Pinning information

Table 3. Pinning

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	GND1	GND (emitter) TR1		
2	I1	input (base) TR1		
3	O2	output (collector) TR2		
4	GND2	GND (emitter) TR2		
5	I2	input (base) TR2		
6	O1	output (collector) TR1		

6. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
NHUMB11	SC-88	plastic surface-mounted package; 6 leads	SOT363
NHUMB1			
NHUMB2			

7. Marking

Table 5. Marking

Type number	Marking code [1]
NHUMB11	2B%
NHUMB1	6C%
NHUMB2	6E%

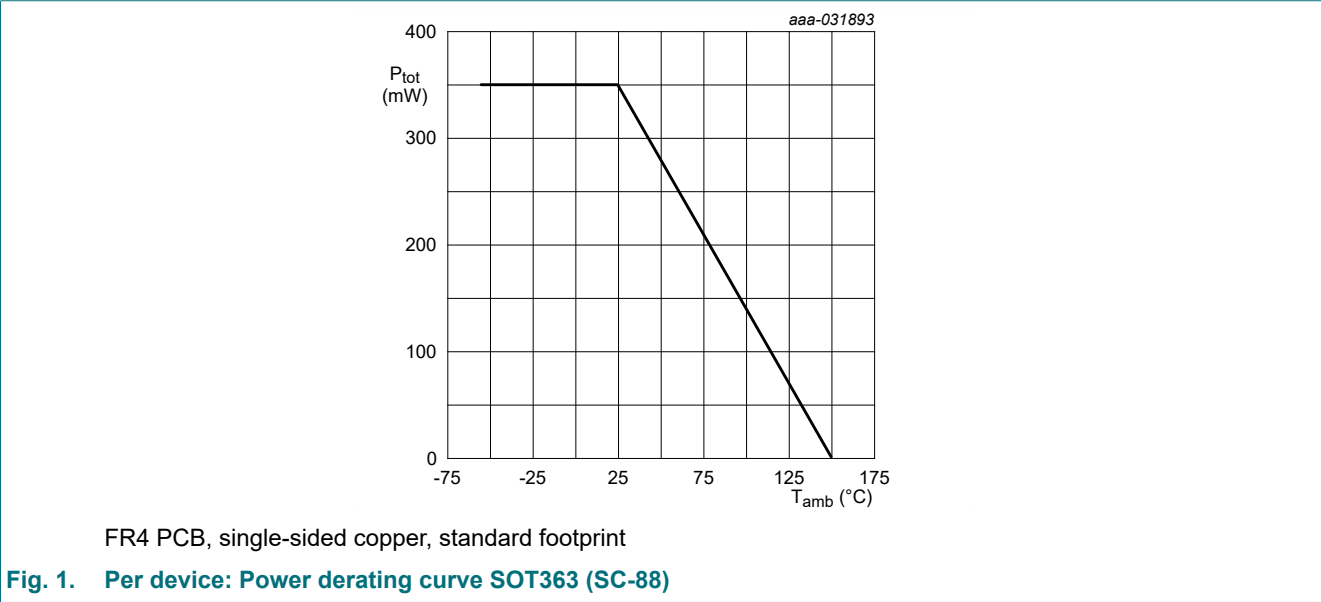
[1] % = placeholder for manufacturing site code

8. Limiting values

Table 6. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).
 $T_{amb} = 25\text{ °C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Max	Unit
Per transistor					
V_{CBO}	collector-base voltage	open emitter	-	-80	V
V_{CEO}	collector-emitter voltage	open base	-	-80	V
V_{EBO}	emitter-base voltage	open collector	-	-10	V
V_I	input voltage				
	NHUMB11		-40	+10	V
	NHUMB1		-60	+10	V
	NHUMB2		-80	+10	V
I_O	output current		-	-100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$ [1]	-	235	mW
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$ [1]	-	350	mW
T_j	junction temperature		-	150	°C
T_{amb}	ambient temperature		-55	150	°C
T_{stg}	storage temperature		-65	150	°C

[1] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated and standard footprint.



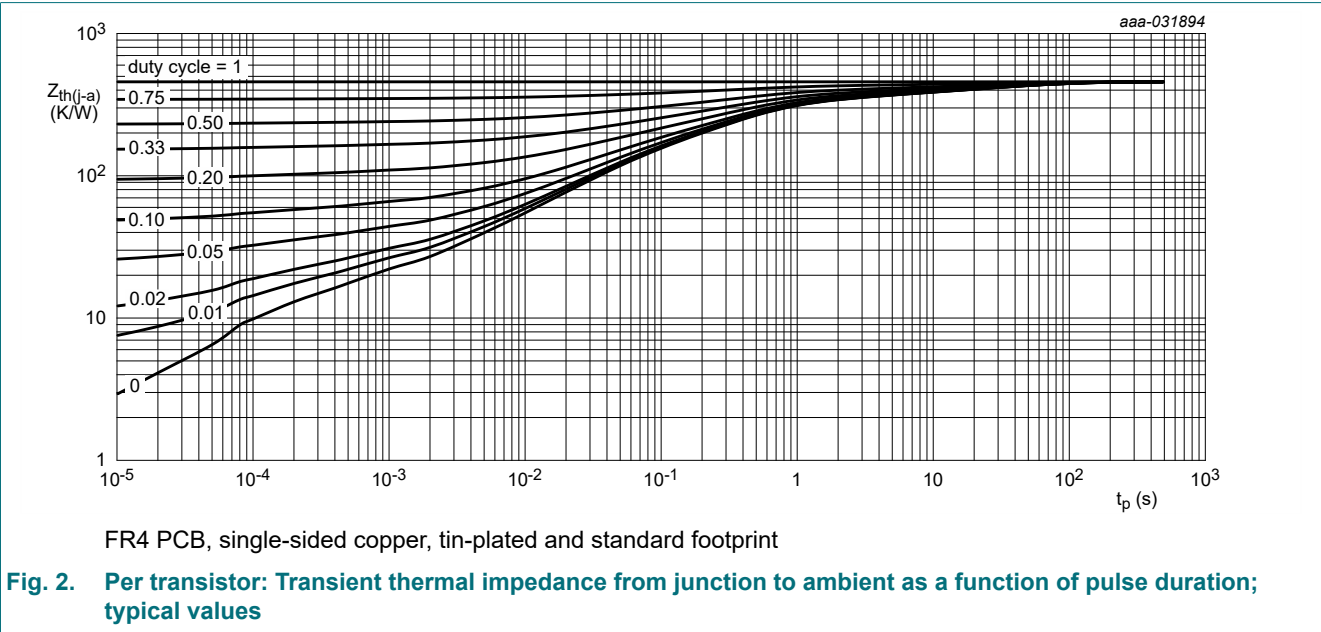
9. Thermal characteristics

Table 7. Thermal characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	532	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	150	K/W
Per device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	358	K/W

[1] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated and standard footprint.



10. Characteristics

Table 8. Characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor						
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = -100\text{ }\mu\text{A}$; $I_E = 0\text{ A}$	-80	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = -2\text{ mA}$; $I_B = 0\text{ A}$	-80	-	-	V
I_{CBO}	collector-base cut-off current	$V_{CB} = -80\text{ V}$; $I_E = 0\text{ A}$	-	-	-100	nA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = -60\text{ V}$; $I_B = 0\text{ A}$	-	-	-100	nA
		$V_{CE} = -60\text{ V}$; $I_B = 0\text{ A}$; $T_j = 150\text{ }^{\circ}\text{C}$	-	-	-5	μA
I_{EBO}	emitter-base cut-off current					
	NHUMB11	$V_{EB} = -7\text{ V}$; $I_C = 0\text{ A}$	-	-	-600	μA
	NHUMB1		-	-	-270	μA
	NHUMB2		-	-	-130	μA
h_{FE}	DC current gain					
	NHUMB11	$V_{CE} = -5\text{ V}$; $I_C = -10\text{ mA}$	50	-	-	
	NHUMB1		70	-	-	
	NHUMB2		100	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10\text{ mA}$; $I_B = -0.5\text{ mA}$	-	-	-100	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = -5\text{ V}$; $I_C = -100\text{ }\mu\text{A}$	-	-1.15	-0.8	V
$V_{I(on)}$	on-state input voltage					
	NHUMB11	$V_{CE} = -0.3\text{ V}$; $I_C = -10\text{ mA}$	-2.5	-1.8	-	V
	NHUMB1		-3	-2.3	-	V
	NHUMB2		-5	-3.3	-	V
R1	bias resistor 1 (input) [1]					
	NHUMB11		7	10	13	k Ω
	NHUMB1		15.4	22	28.6	k Ω
	NHUMB2		33	47	61	k Ω
R2/R1	bias resistor ratio	[1]	0.8	1	1.2	
f_T	transition frequency	$V_{CE} = -5\text{ V}$; $I_C = -10\text{ mA}$; $f = 100\text{ MHz}$ [2]	-	150	-	MHz
C_c	collector capacitance	$V_{CB} = -10\text{ V}$; $I_E = i_e = 0\text{ A}$; $f = 1\text{ MHz}$	-	-	3	pF

[1] See section "Test information" for resistor calculation and test conditions

[2] Characteristics of built-in transistor

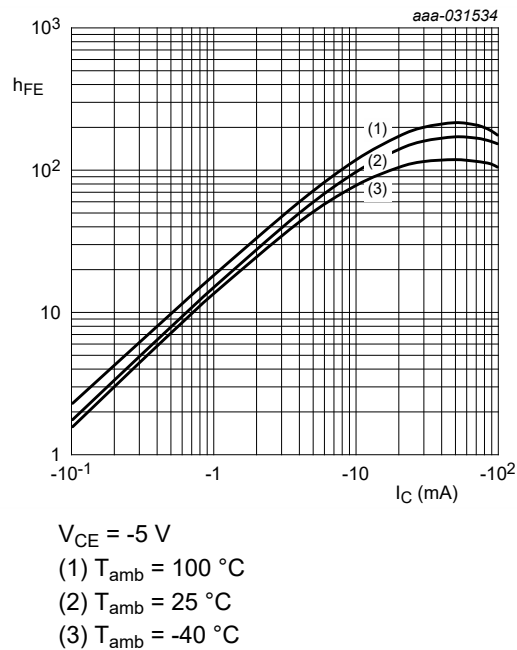


Fig. 3. NHUMB11: DC current gain as a function of collector current; typical values

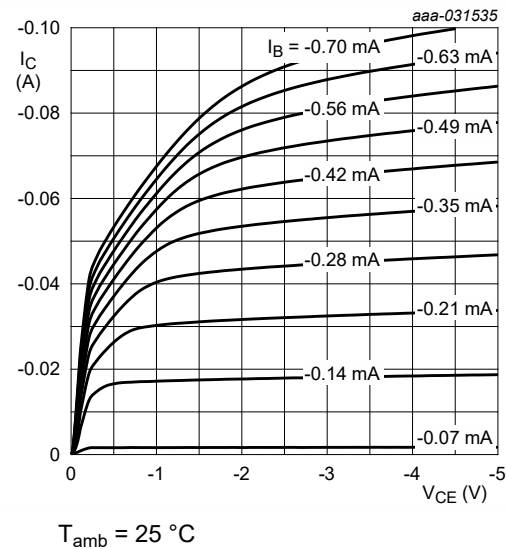


Fig. 4. NHUMB11: Collector current as a function of collector-emitter voltage; typical values

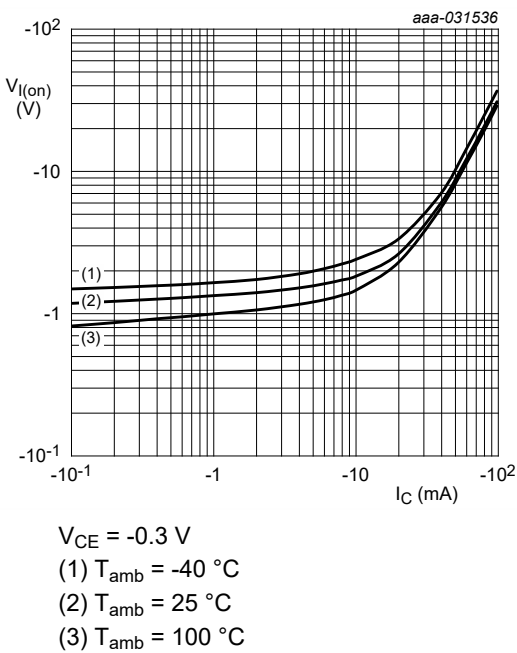


Fig. 5. NHUMB11: On-state input voltage as a function of collector current; typical values

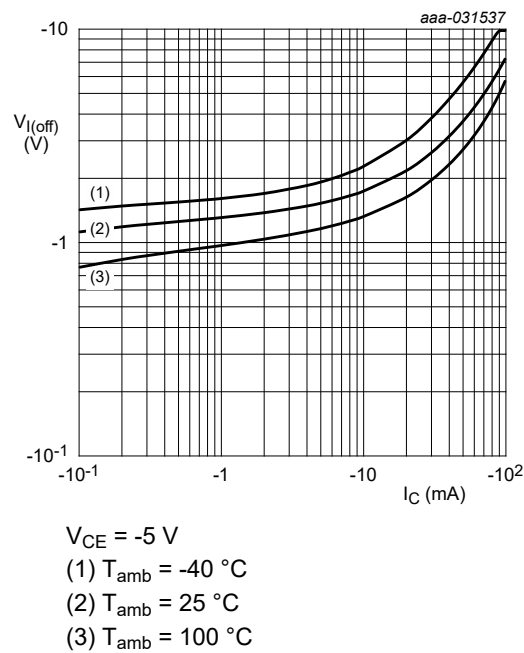


Fig. 6. NHUMB11: Off-state input voltage as a function of collector current; typical values

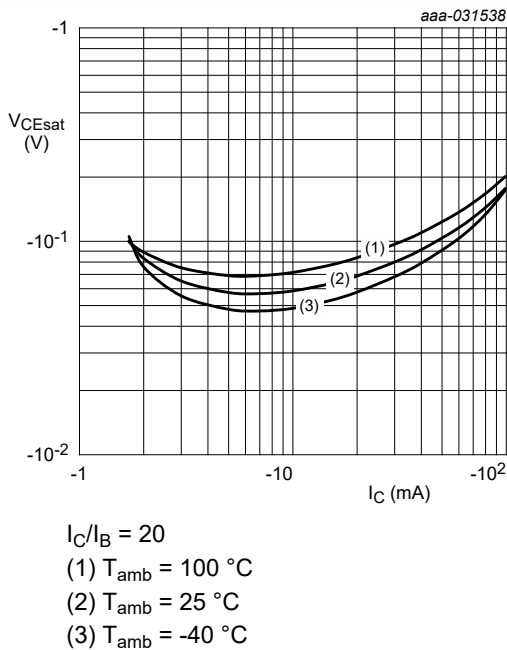


Fig. 7. NHUMB11: Collector-emitter saturation voltage as a function of collector current; typical values

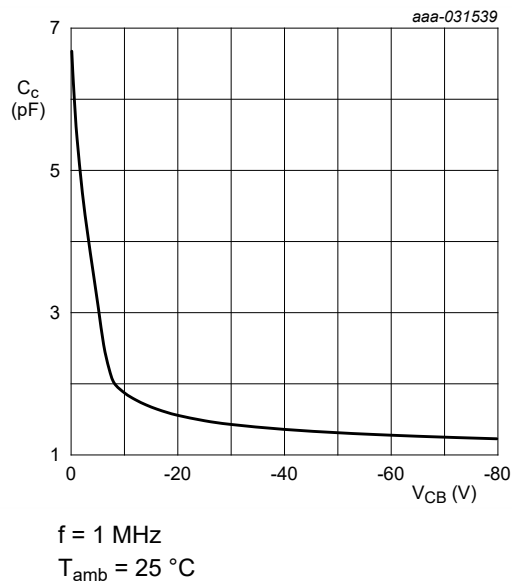


Fig. 8. NHUMB11: Collector capacitance as a function of collector-base voltage; typical values

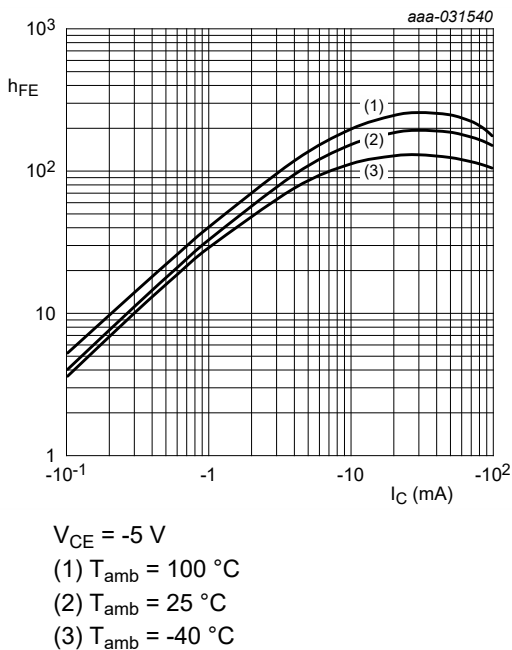


Fig. 9. NHUMB11: DC current gain as a function of collector current; typical values

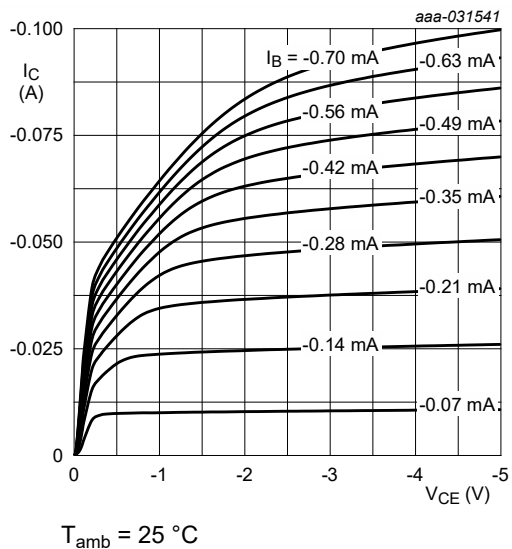


Fig. 10. NHUMB11: Collector current as a function of collector-emitter voltage; typical values

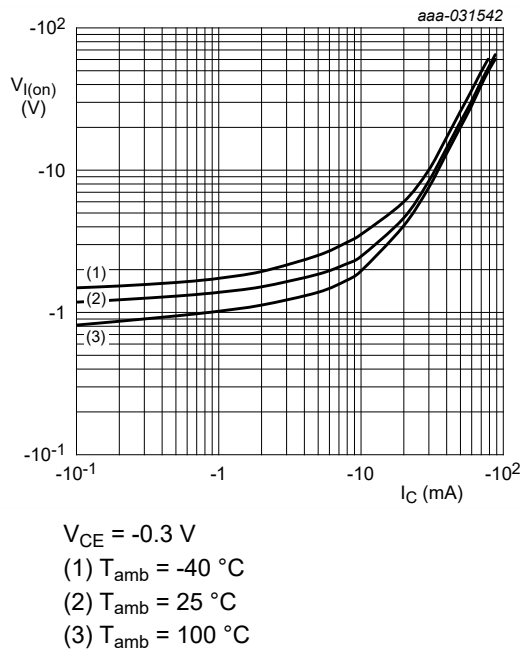


Fig. 11. NHUMB1: On-state input voltage as a function of collector current; typical values

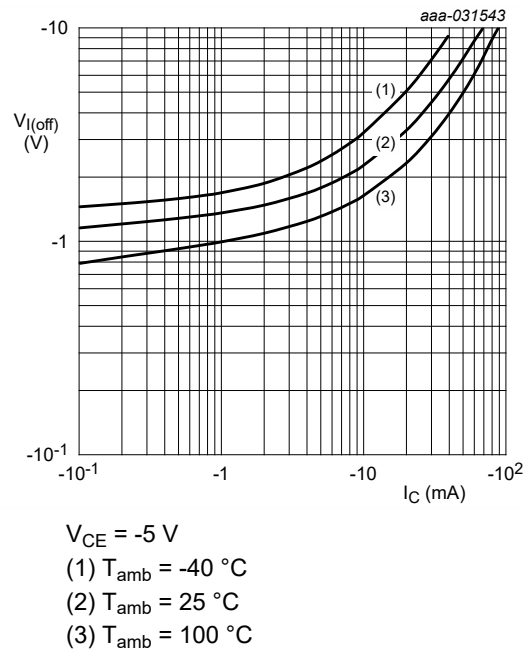


Fig. 12. NHUMB1: Off-state input voltage as a function of collector current; typical values

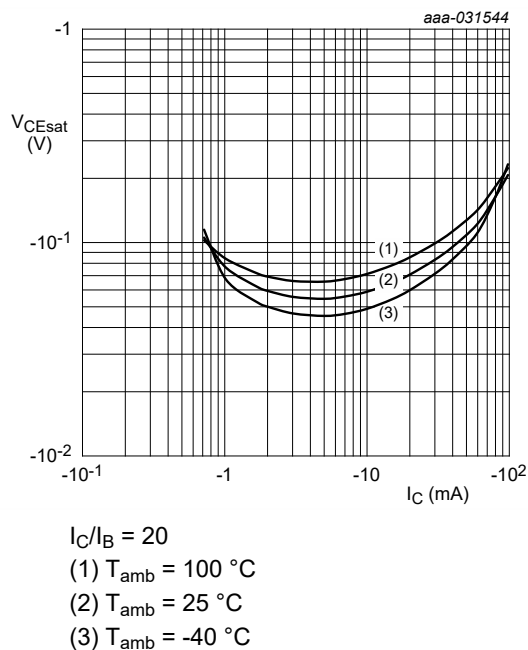


Fig. 13. NHUMB1: Collector-emitter saturation voltage as a function of collector current; typical values

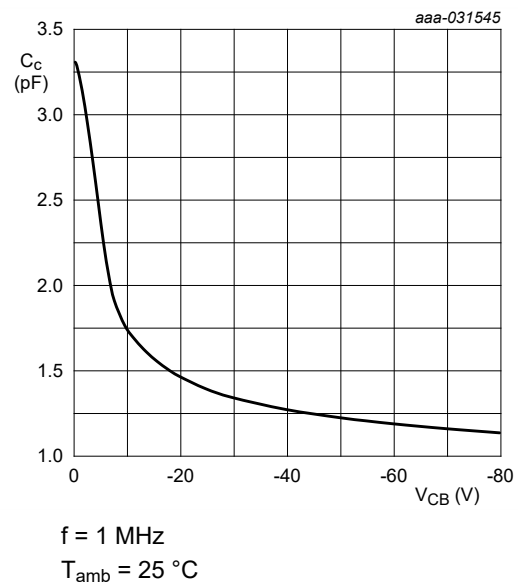


Fig. 14. NHUMB1: Collector capacitance as a function of collector-base voltage; typical values

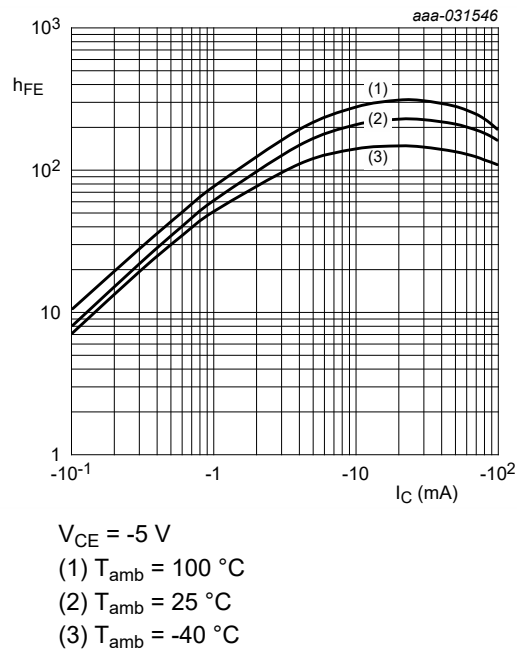


Fig. 15. NHUMB2: DC current gain as a function of collector current; typical values

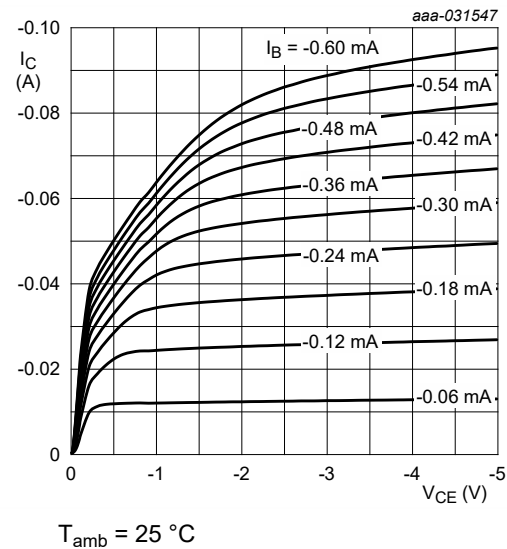


Fig. 16. NHUMB2: Collector current as a function of collector-emitter voltage; typical values

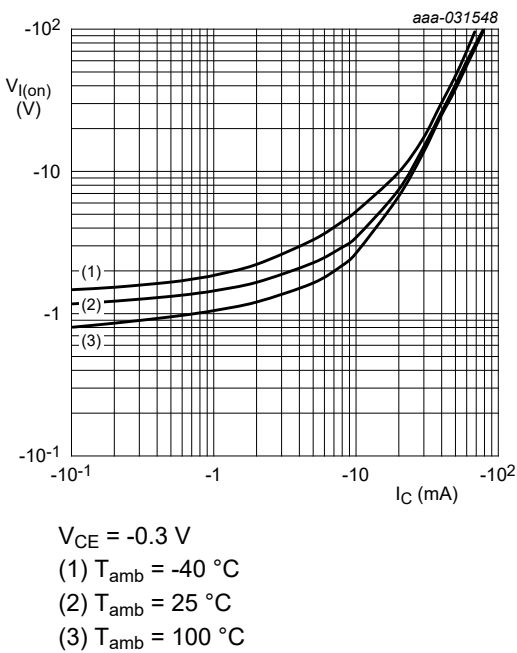


Fig. 17. NHUMB2: On-state input voltage as a function of collector current; typical values

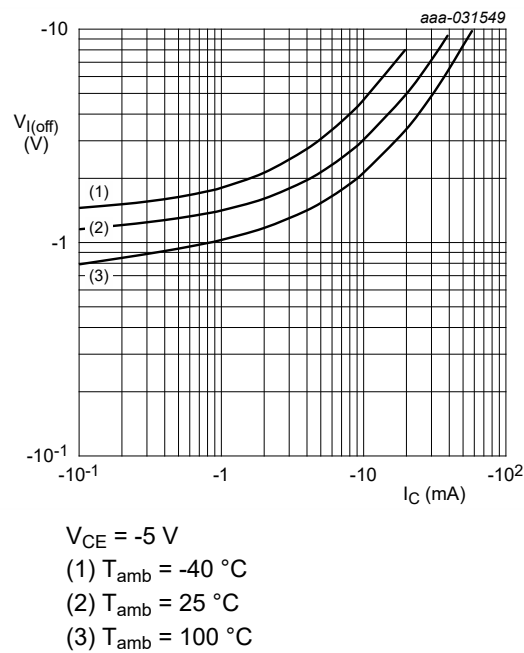


Fig. 18. NHUMB2: Off-state input voltage as a function of collector current; typical values

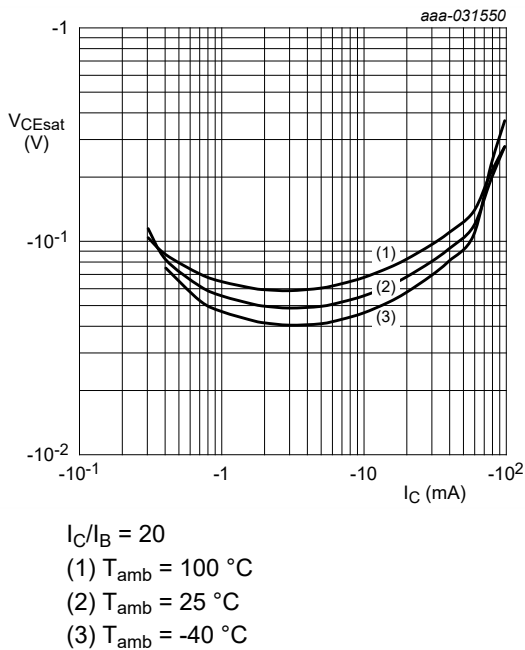


Fig. 19. NHUMB2: Collector-emitter saturation voltage as a function of collector current; typical values

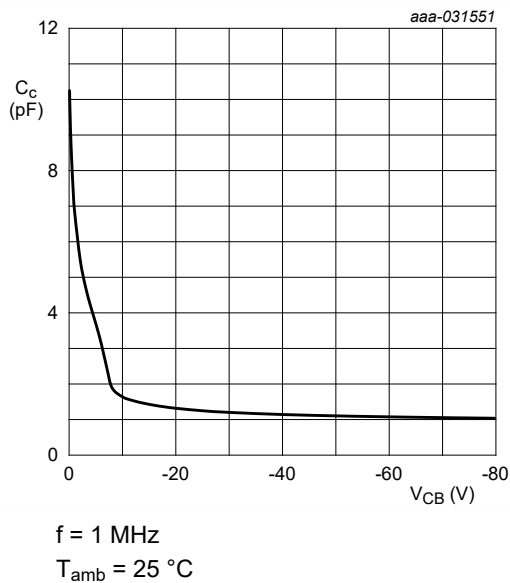


Fig. 20. NHUMB2: Collector capacitance as a function of collector-base voltage; typical values of built-in transistor

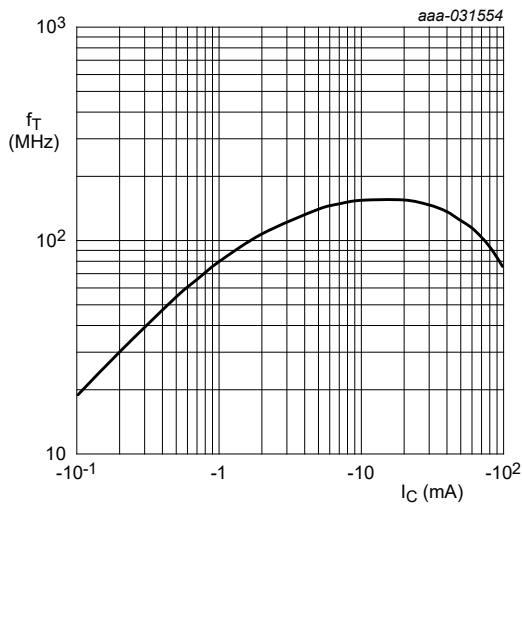


Fig. 21. Transition frequency as a function of collector current; typical values of built-in transistor

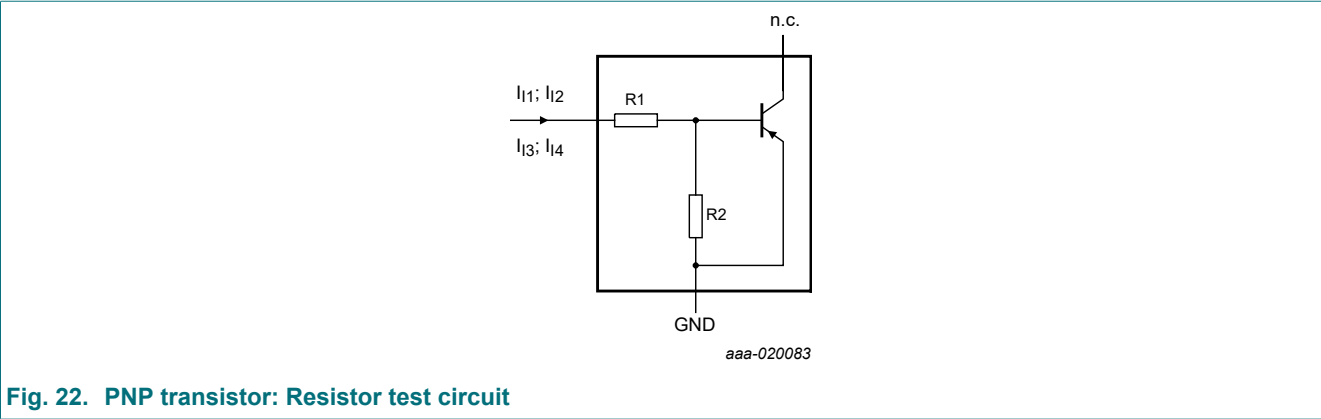
11. Test information

Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

Resistor calculation

- Calculation of bias resistor 1 (R1)
$$R_1 = \frac{V(I_{I2}) - V(I_{I1})}{I_{I2} - I_{I1}}$$
- Calculation of bias resistor ratio (R2/R1)
$$\frac{R_2}{R_1} = \frac{V(I_{I4}) - V(I_{I3})}{R_1 \cdot (I_{I4} - I_{I3})} - 1$$

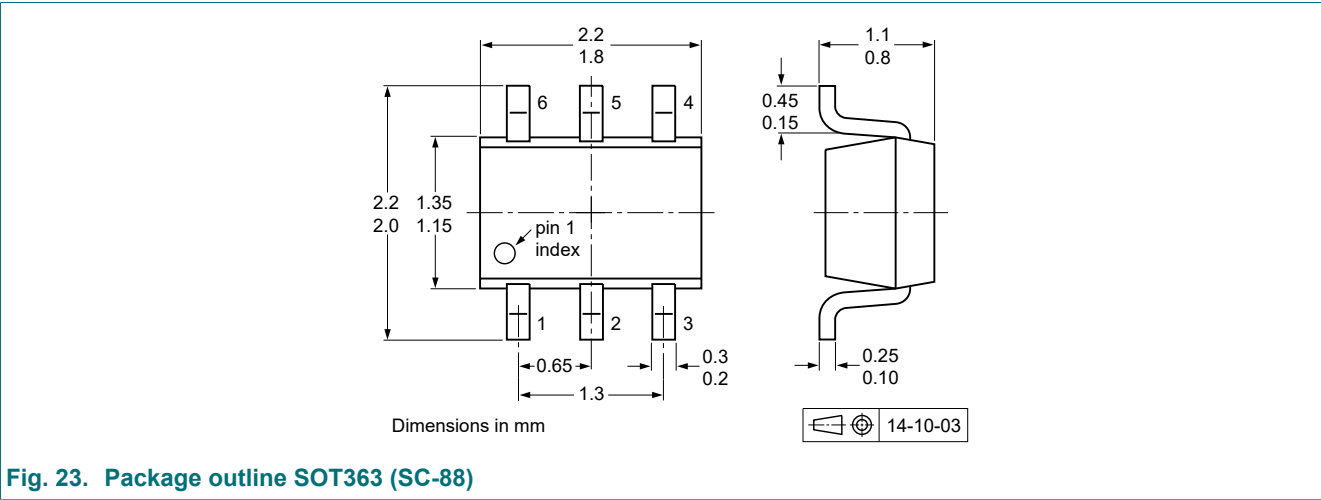


Resistor test conditions

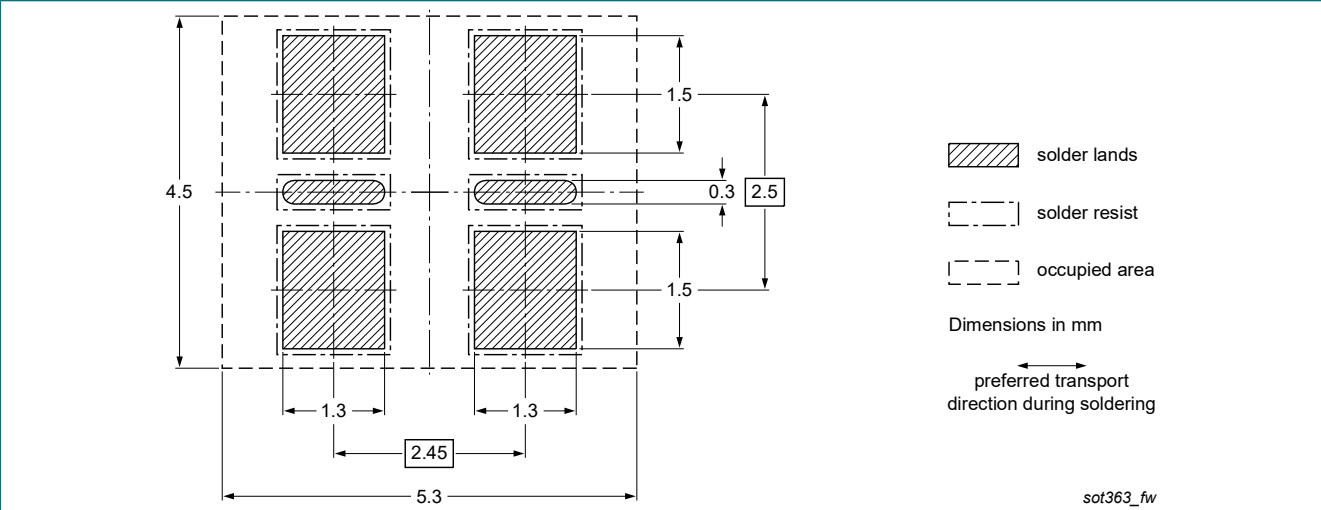
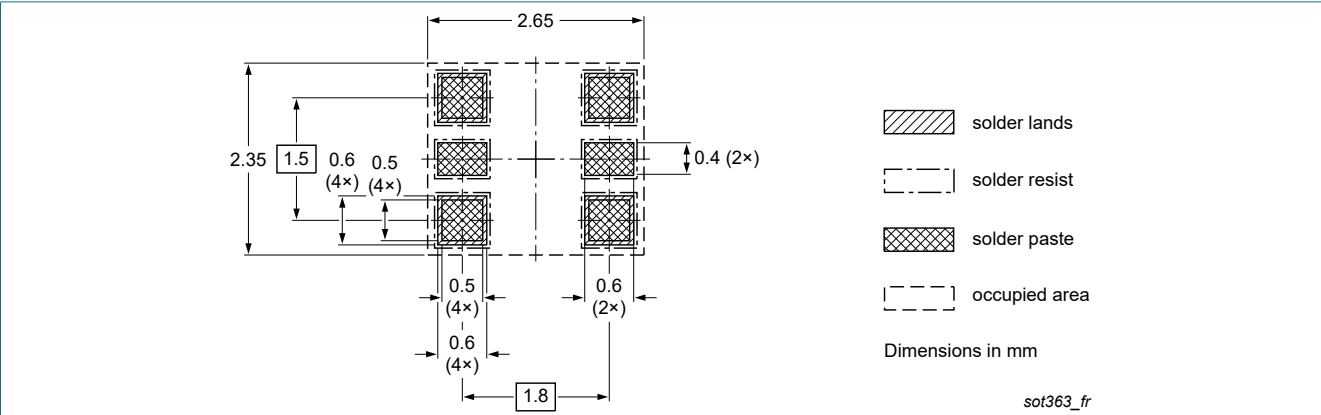
Table 9. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I _{I1}	I _{I2}	I _{I3}	I _{I4}
Per transistor						
NHUMB11	10	10	-800 μA	-1.1 mA	350 μA	450 μA
NHUMB1	22	22	-550 μA	-750 μA	150 μA	230 μA
NHUMB2	47	47	-250 μA	-350 μA	55 μA	105 μA

12. Package outline



13. Soldering



14. Revision history

Table 10. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
NHUMB11_1_2_SER v.1	20200723	Product data sheet	-	-

15. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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