



PEMD9

50 V, 100 mA NPN/PNP resistor-equipped double transistor;
R1 = 10 k Ω , R2 = 47 k Ω

29 December 2022

Product data sheet

1. General description

NPN/PNP double Resistor-Equipped Transistor (RET) in an ultra small and flat lead SOT666 Surface-Mounted Device (SMD) plastic package.

NPN/NPN complement: PEMH9

PNP/PNP complement: PEMB9

2. Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs

3. Applications

- Low current peripheral driver
- Controlling IC inputs
- Replacement of general purpose transistors in digital applications

4. Quick reference data

Table 1. Quick reference data

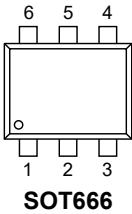
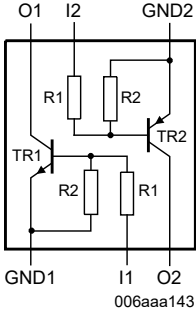
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor, for the PNP transistor (TR2) with negative polarity						
V _{CEO}	collector-emitter voltage	open base	-	-	50	V
I _O	output current		-	-	100	mA
R1	bias resistor 1 (input)	[1]	7	10	13	k Ω
R2/R1	bias resistor ratio	[1]	3.7	4.7	5.7	

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

50 V, 100 mA NPN/PNP resistor-equipped double transistor; R1 = 10 kΩ, R2 = 47 kΩ

5. Pinning information

Table 2. Pinning information

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 3. Ordering information

Type number	Package		
	Name	Description	Version
PEMD9	SOT666	plastic, surface-mounted package; 6 leads; 0.5 mm pitch; 1.6 mm x 1.2 mm x 0.55 mm body	SOT666

7. Marking

Table 4. Marking codes

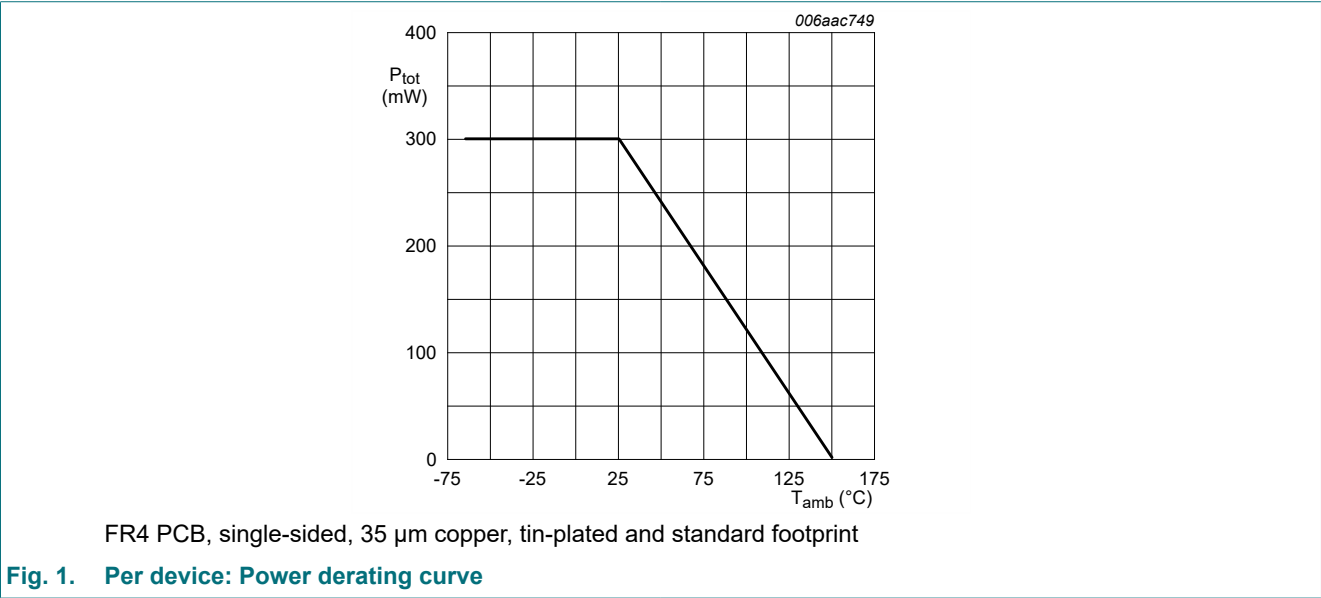
Type number	Marking code
PEMD9	D9

8. Limiting values

Table 5. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
Per transistor, for the PNP transistor (TR2) with negative polarity						
V _{CBO}	collector-base voltage	open emitter		-	50	V
V _{CEO}	collector-emitter voltage	open base		-	50	V
V _{EBO}	emitter-base voltage	open collector		-	6	V
V _I	input voltage	input voltage TR1		-	40	V
				-	-6	V
		input voltage TR2		-	6	V
				-	-40	V
I _O	output current			-	100	mA
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1] [2]	-	200	mW
Per device						
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1] [2]	-	300	mW
T _j	junction temperature			-	150	°C
T _{amb}	ambient temperature			-65	150	°C
T _{stg}	storage temperature			-65	150	°C

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35 μm copper, tin-plated and standard footprint.
[2] Reflow soldering is the only recommended soldering method.

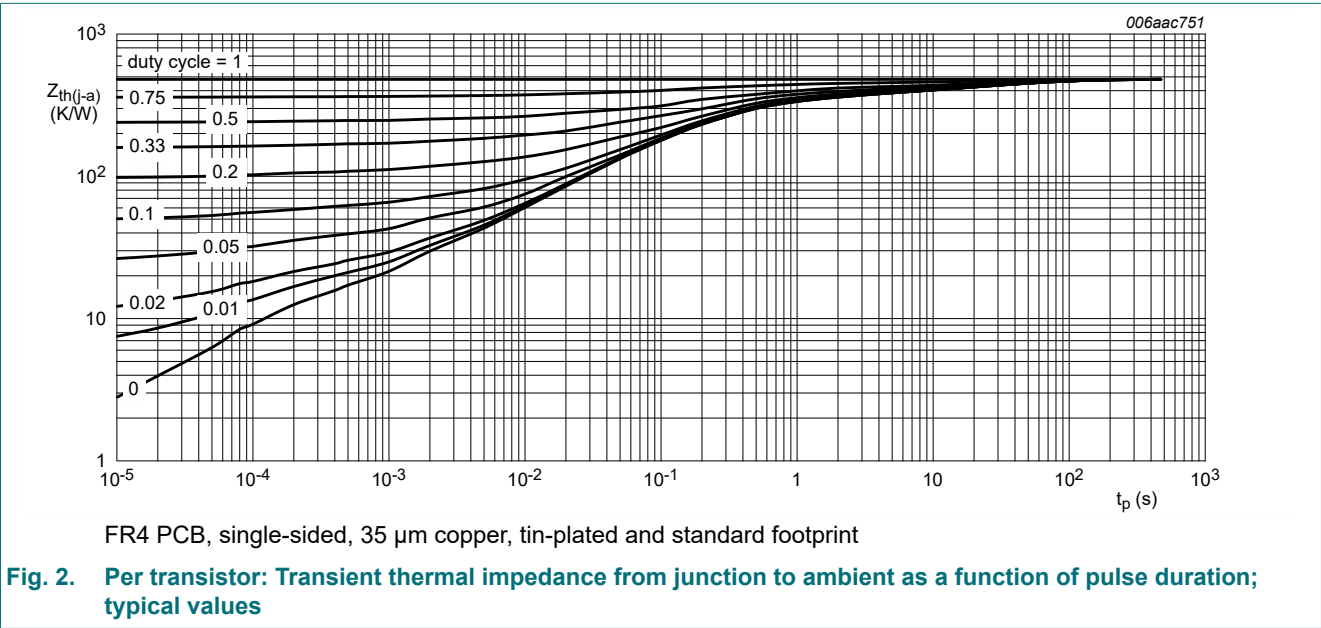


9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] [2]	-	-	625	K/W
Per device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] [2]	-	-	417	K/W

[1] Device mounted on an FR4 PCB, single-sided, 35 μm copper, tin-plated and standard footprint.
[2] Reflow soldering is the only recommended soldering method.



10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor, for the PNP transistor (TR2) with negative polarity							
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100\ \mu\text{A}$; $I_E = 0\ \text{A}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$		50	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2\ \text{mA}$; $I_B = 0\ \text{A}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$		50	-	-	V
I_{CBO}	collector-base cut-off current	$V_{CB} = 50\ \text{V}$; $I_E = 0\ \text{A}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$		-	-	100	nA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 30\ \text{V}$; $I_B = 0\ \text{A}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$		-	-	1	μA
		$V_{CE} = 30\ \text{V}$; $I_B = 0\ \text{A}$; $T_j = 150\ ^\circ\text{C}$		-	-	5	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\ \text{V}$; $I_C = 0\ \text{mA}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$		-	-	150	μA
h_{FE}	DC current gain	$V_{CE} = 5\ \text{V}$; $I_C = 5\ \text{mA}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$		100	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5\ \text{mA}$; $I_B = 0.25\ \text{mA}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$		-	-	100	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\ \text{V}$; $I_C = 100\ \mu\text{A}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$		-	0.7	0.5	V
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\ \text{V}$; $I_C = 1\ \text{mA}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$		1.4	0.8	-	V
R1	bias resistor 1 (input)		[1]	7	10	13	kΩ
R2/R1	bias resistor ratio		[1]	3.7	4.7	5.7	
TR1 (NPN)							
C_c	collector capacitance	$V_{CB} = 10\ \text{V}$; $I_E = 0\ \text{A}$; $i_e = 0\ \text{A}$; $f = 1\ \text{MHz}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$		-	-	2.5	pF
f_T	transition frequency	$V_{CE} = 5\ \text{V}$; $I_C = 10\ \text{mA}$; $f = 100\ \text{MHz}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$	[2]	-	230	-	MHz
TR2 (PNP)							
C_c	collector capacitance	$V_{CB} = -10\ \text{V}$; $I_E = 0\ \text{A}$; $i_e = 0\ \text{A}$; $f = 1\ \text{MHz}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$		-	-	3	pF
f_T	transition frequency	$V_{CE} = -5\ \text{V}$; $I_C = -10\ \text{mA}$; $f = 100\ \text{MHz}$; $T_{\text{amb}} = 25\ ^\circ\text{C}$	[2]	-	180	-	MHz

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

[2] Characteristics of built-in transistor

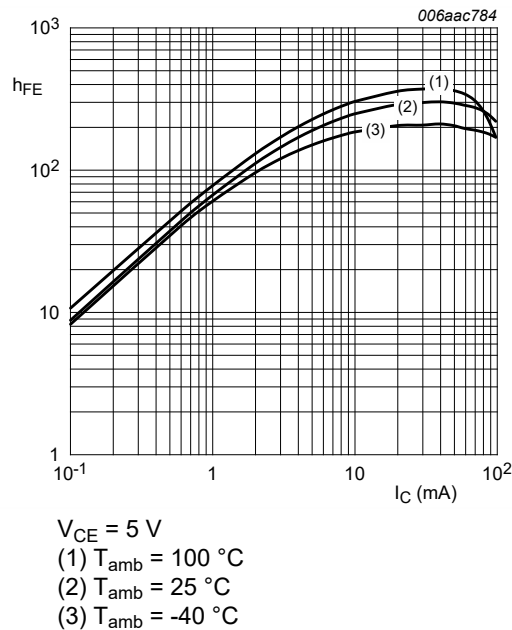


Fig. 3. TR1 (NPN): DC current gain as a function of collector current; typical values

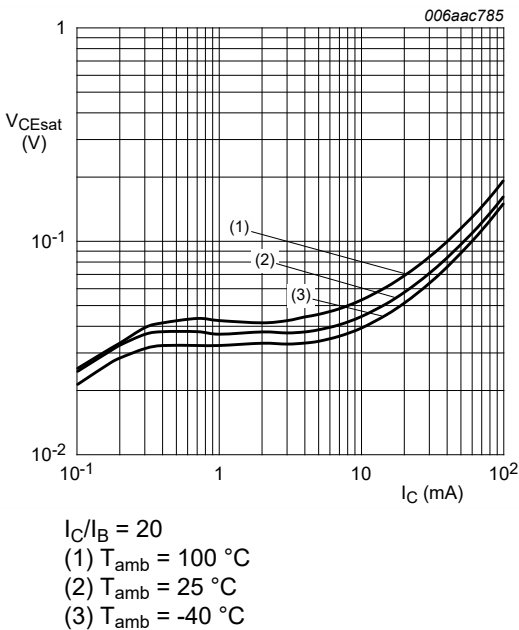


Fig. 4. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values

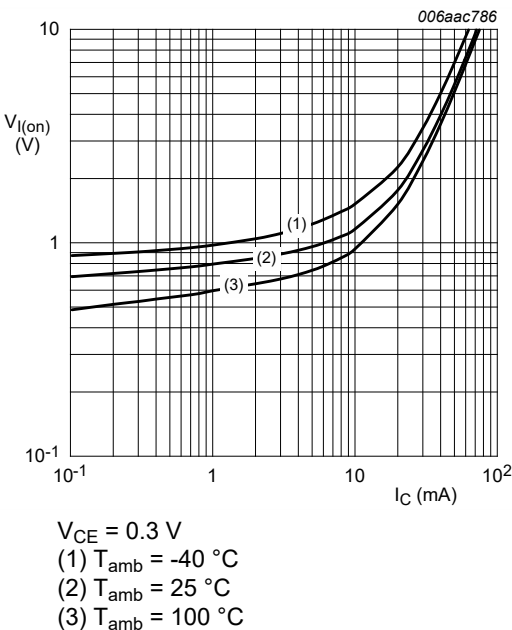


Fig. 5. TR1 (NPN): On-state input voltage as a function of collector current; typical values

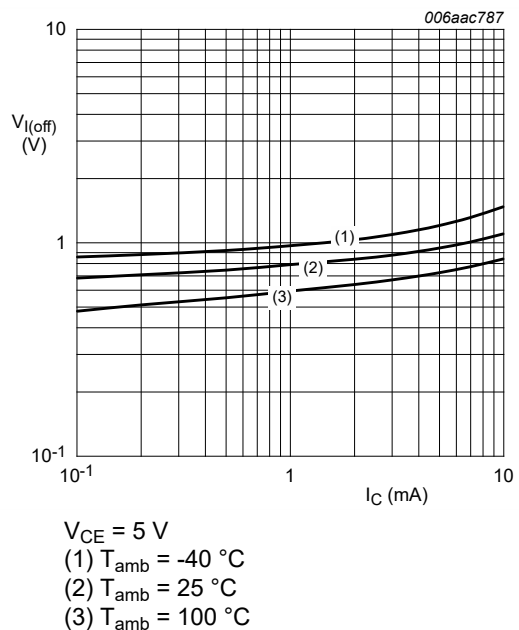


Fig. 6. TR1 (NPN): Off-state input voltage as a function of collector current; typical values

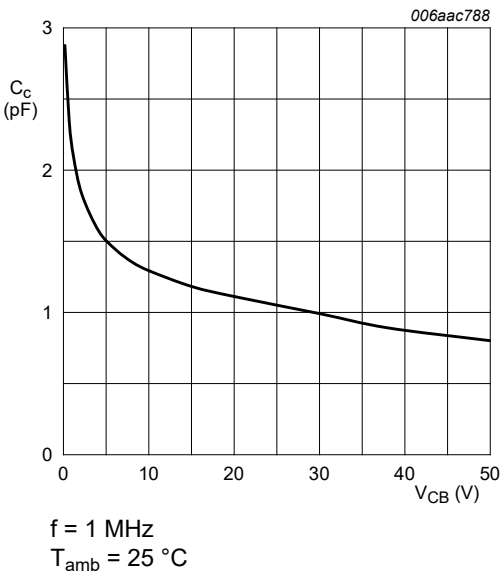


Fig. 7. TR1 (NPN): Collector capacitance as a function of collector-base voltage; typical values

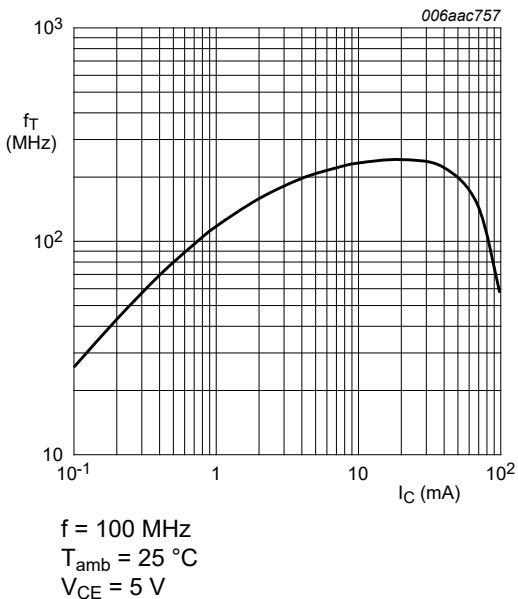


Fig. 8. TR1 (NPN): Transition frequency as a function of collector current; typical values of built-in transistor

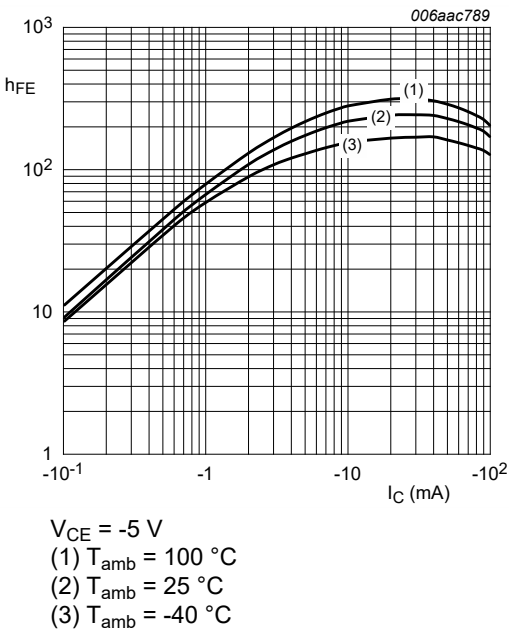


Fig. 9. TR2 (PNP): DC current gain as a function of collector current; typical values

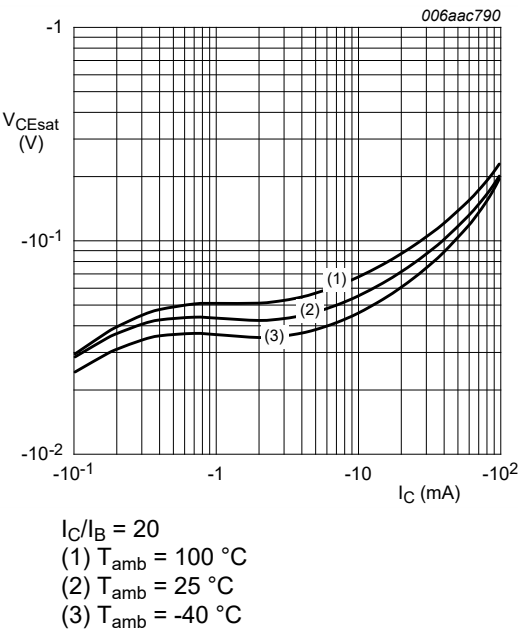


Fig. 10. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values

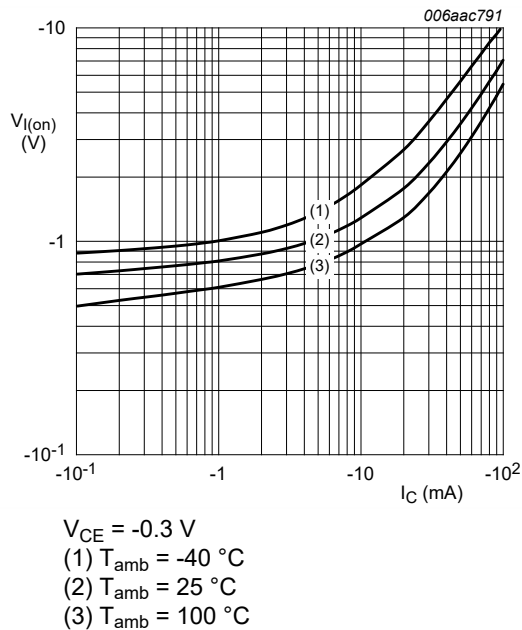


Fig. 11. TR2 (PNP): On-state input voltage as a function of collector current; typical values

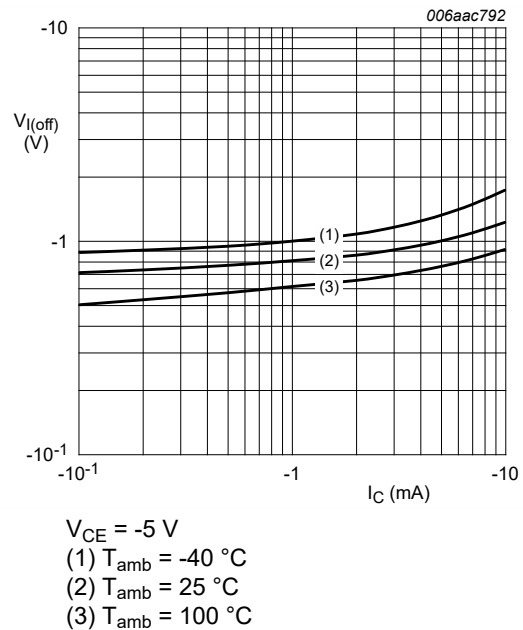


Fig. 12. TR2 (PNP): Off-state input voltage as a function of collector current; typical values

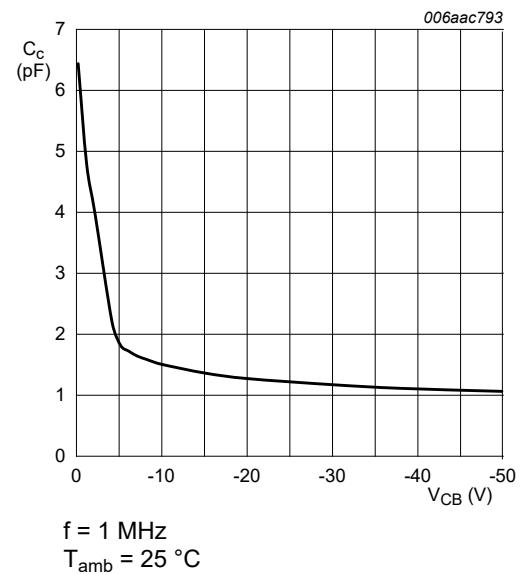


Fig. 13. TR2 (PNP): Collector capacitance as a function of collector-base voltage; typical values

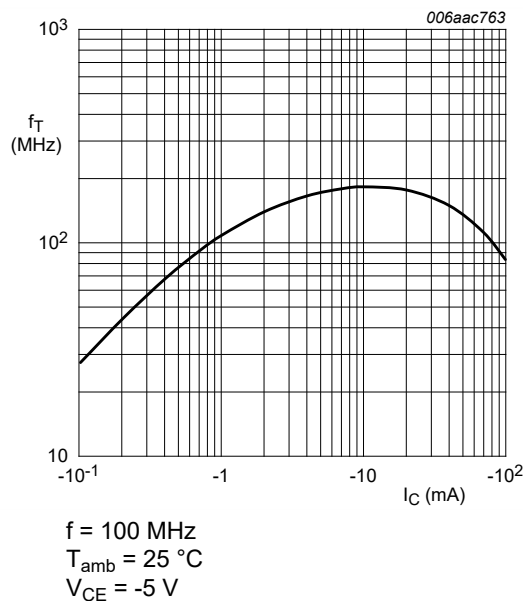


Fig. 14. TR2 (PNP): Transition frequency as a function of collector current; typical values of built-in transistor

11. Test information

Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R_1 = \frac{V(I_2) - V(I_1)}{I_2 - I_1}$$

- Calculation of bias resistor ratio (R2/R1)

$$\frac{R_2}{R_1} = \frac{V(I_3)}{R_1 \cdot I_3} - 1$$

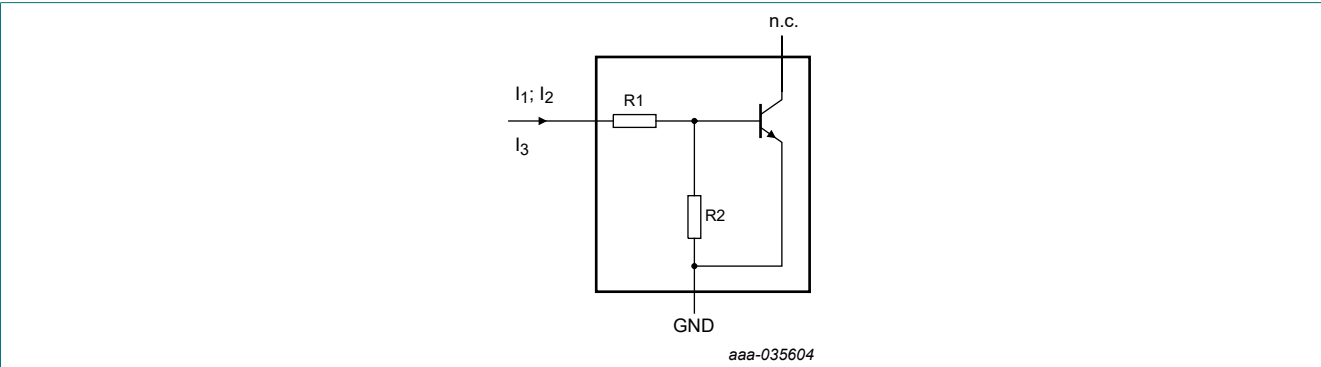


Fig. 15. TR1 (NPN): Resistor test circuit

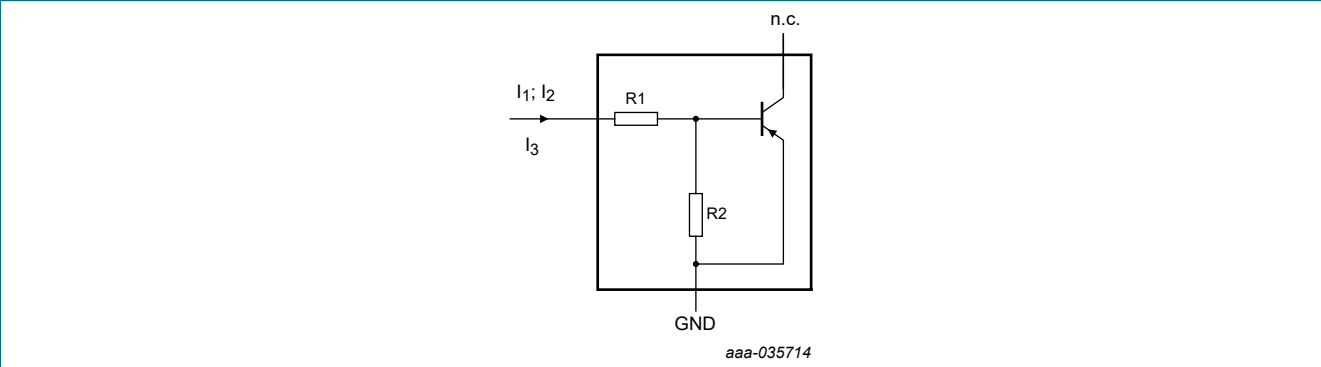


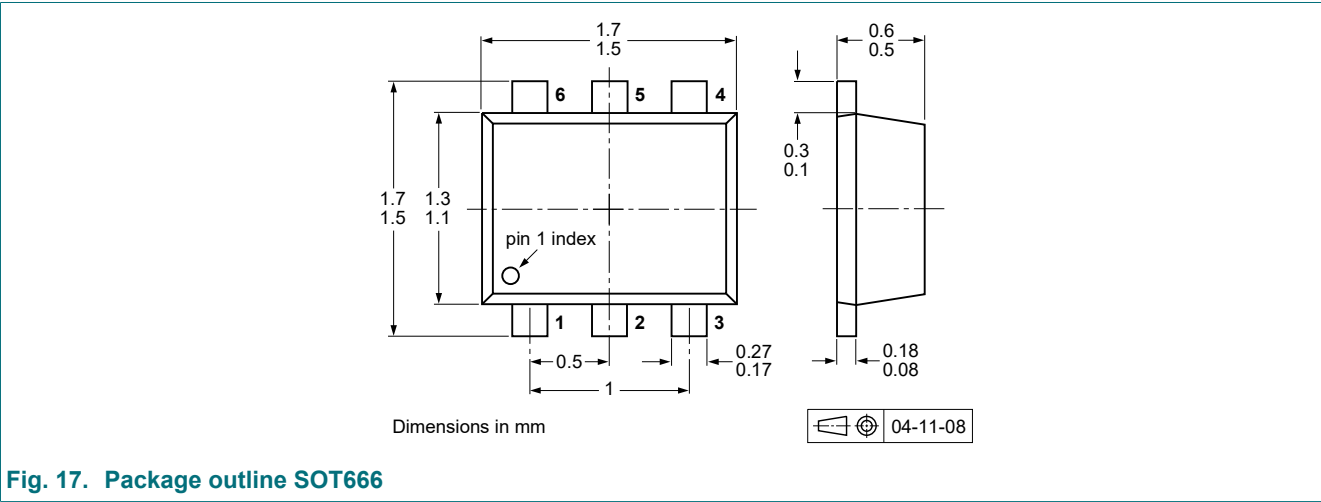
Fig. 16. TR2 (PNP): Resistor test circuit

Resistor test conditions

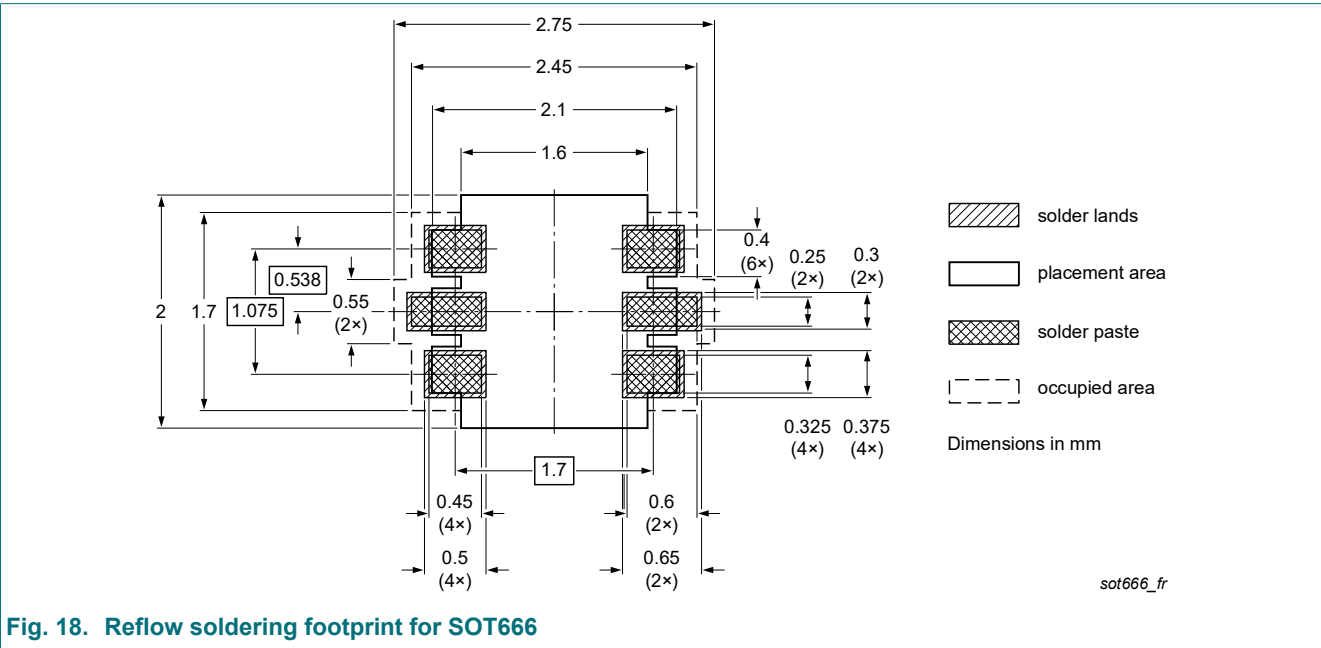
Table 8. Resistor test conditions

PEMD9	R1 (kΩ)	R2 (kΩ)	Test conditions		
			I ₁	I ₂	I ₃
TR1 (NPN)	10	47	350 μA	450 μA	-100 μA
TR2 (PNP)	10	47	-350 μA	-450 μA	100 μA

12. Package outline



13. Soldering



14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PEMD9 v.7	20221229	Product data sheet	-	PEMD9_PUMD9 v.6
Modification:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Family data sheet reduced to single type data sheet. Product(s) changed to non-automotive qualification. Packing information removed. 			
PEMD9_PUMD9 v.6	20111122	Product data sheet	-	PEMD9_PUMD9 v.5
PEMD9_PUMD9 v.5	20040415	Product data sheet	-	PEMD9_PUMD9 v.4
PEMD9_PUMD9 v.4	20031104	Product specification	-	PEMD9 v.2 PUMD9 v.3
PEMD9 v.2	20020905	Product specification	-	PEMD9 v.1
PEMD9 v.1	20011022	Preliminary specification	-	-
PUMD9 v.3	20010216	Product specification	-	PUMD9 v.2
PUMD9 v.2	19990520	Product specification	-	PUMD9 v.1
PUMD9 v.1	19990107	Product specification	-	-

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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- [2] The term 'short data sheet' is explained in section "Definitions".
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