



PEMH13

50 V, 100 mA NPN/NPN resistor-equipped double transistor;
R1 = 4.7 k Ω , R2 = 47 k Ω

29 December 2022

Product data sheet

1. General description

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

NPN/PNP complement: PEMD13

PNP/PNP complement: PEMB13

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

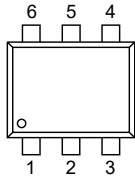
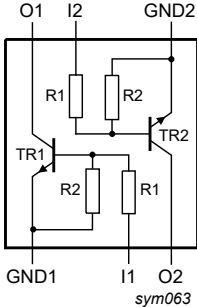
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
Per transistor							
V _{CEO}	collector-emitter voltage	open base	-	-	50	V	
I _O	output current		-	-	100	mA	
R1	bias resistor 1 (input)		[1]	3.3	4.7	6.1	k Ω
R2/R1	bias resistor ratio		[1]	8	10	12	

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

50 V, 100 mA NPN/NPN resistor-equipped double transistor; R1 = 4.7 kΩ, R2 = 47 kΩ

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	GND1	GND (emitter) TR1	 <p style="text-align: center;">SOT666</p>	 <p style="text-align: center;"><i>sym063</i></p>
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
PEMH13	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
PEMH13	21

8. Limiting values

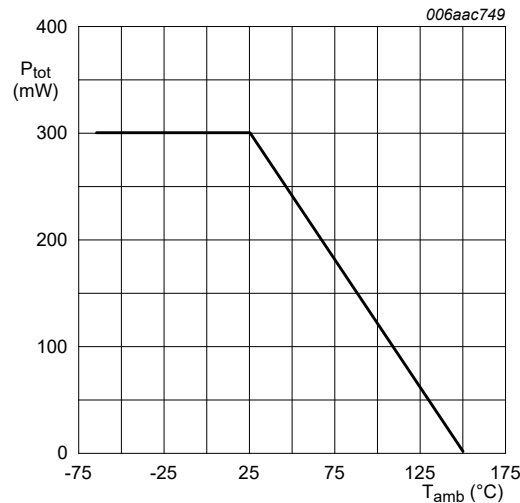
Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
Per transistor						
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		-	5	V
V_I	input voltage	positive		-	30	V
		negative		-	-5	V
I_O	output current			-	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1] [2]	-	200	mW
Per device						
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[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 copper, tin-plated and standard footprint.

[2] Reflow soldering is the only recommended soldering method.



FR4 PCB, single-sided, 35 μm copper, tin-plated and standard footprint

Fig. 1. Per device: Power derating curve

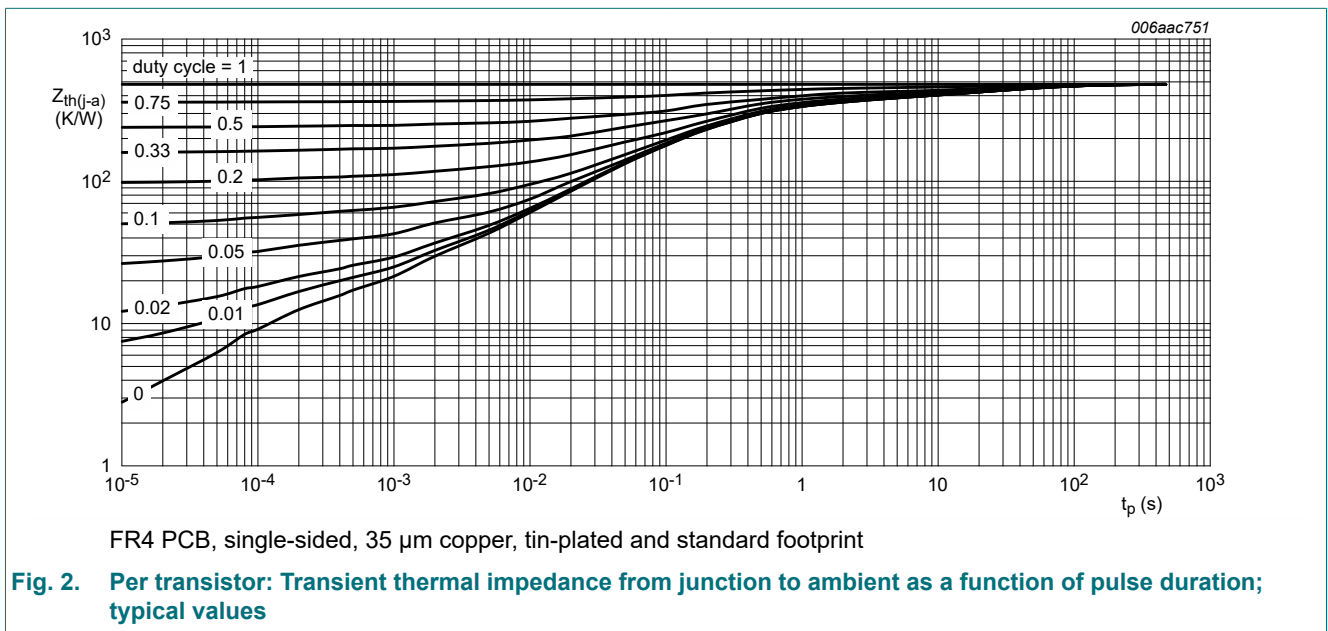
9. Thermal characteristics

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 copper, tin-plated and standard footprint.

[2] Reflow soldering is the only recommended soldering method.

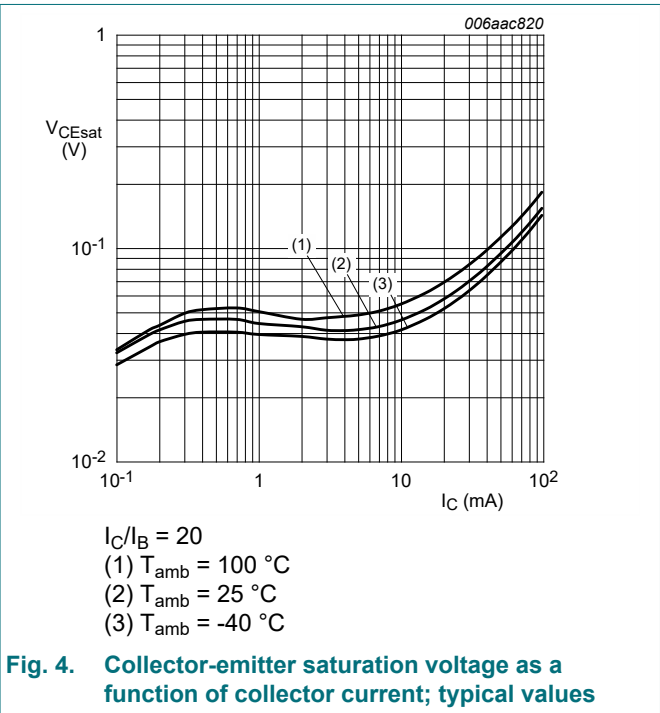
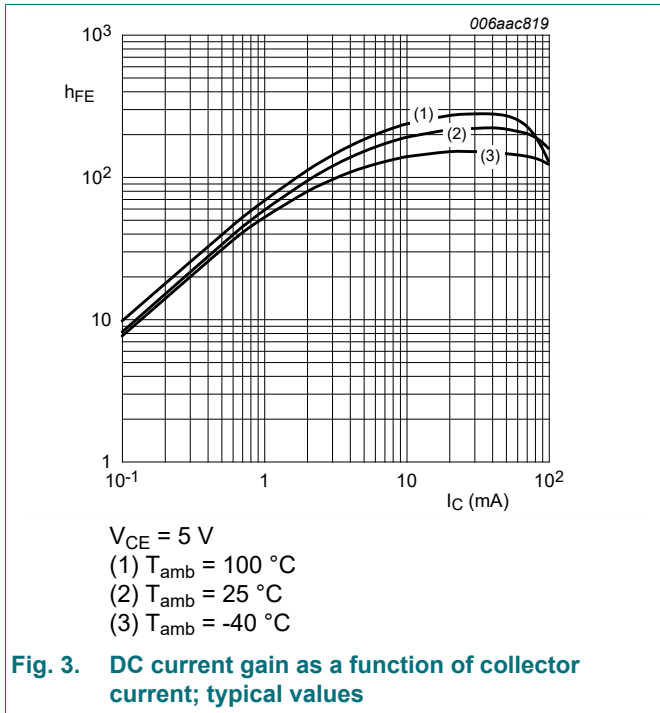


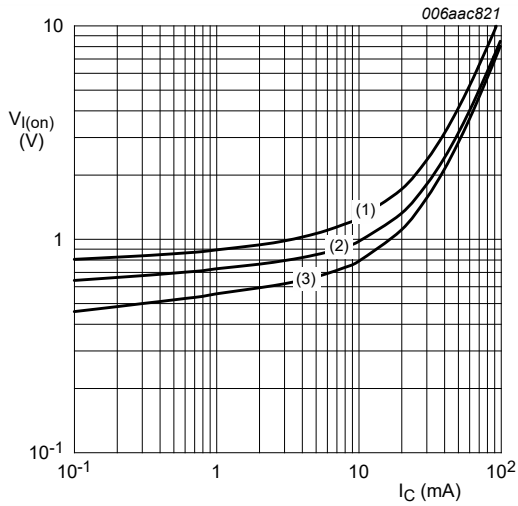
10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
Per transistor							
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100 \mu A; I_E = 0 A; T_{amb} = 25 \text{ }^\circ C$	50	-	-	V	
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2 \text{ mA}; I_B = 0 A; T_{amb} = 25 \text{ }^\circ C$	50	-	-	V	
I_{CBO}	collector-base cut-off current	$V_{CB} = 50 \text{ V}; I_E = 0 A; T_{amb} = 25 \text{ }^\circ C$	-	-	100	nA	
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 30 \text{ V}; I_B = 0 A; T_{amb} = 25 \text{ }^\circ C$	-	-	1	μA	
		$V_{CE} = 30 \text{ V}; I_B = 0 A; T_j = 150 \text{ }^\circ C$	-	-	5	μA	
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5 \text{ V}; I_C = 0 A; T_{amb} = 25 \text{ }^\circ C$	-	-	170	μA	
h_{FE}	DC current gain	$V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$	100	-	-		
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5 \text{ mA}; I_B = 0.25 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$	-	-	100	mV	
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5 \text{ V}; I_C = 100 \mu A; T_{amb} = 25 \text{ }^\circ C$	-	0.6	0.5	V	
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3 \text{ V}; I_C = 5 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$	1.3	0.9	-	V	
R1	bias resistor 1 (input)		[1]	3.3	4.7	6.1	kΩ
R2/R1	bias resistor ratio		[1]	8	10	12	
C_c	collector capacitance	$V_{CB} = 10 \text{ V}; I_E = 0 A; i_e = 0 A; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ C$	-	-	2.5	pF	
f_T	transition frequency	$V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ C$	[2]	-	230	-	MHz

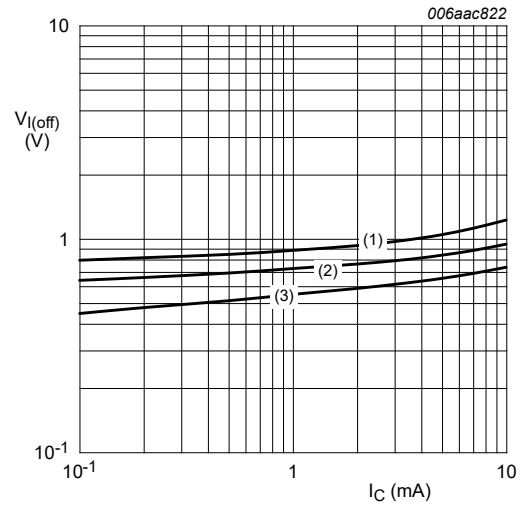
- [1] See section "Test information" for resistor calculation and test conditions.
- [2] Characteristics of built-in transistor





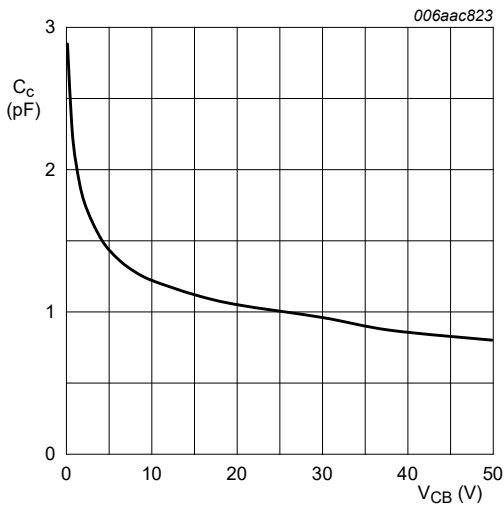
$V_{CE} = 0.3$ V
 (1) $T_{amb} = -40$ °C
 (2) $T_{amb} = 25$ °C
 (3) $T_{amb} = 100$ °C

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



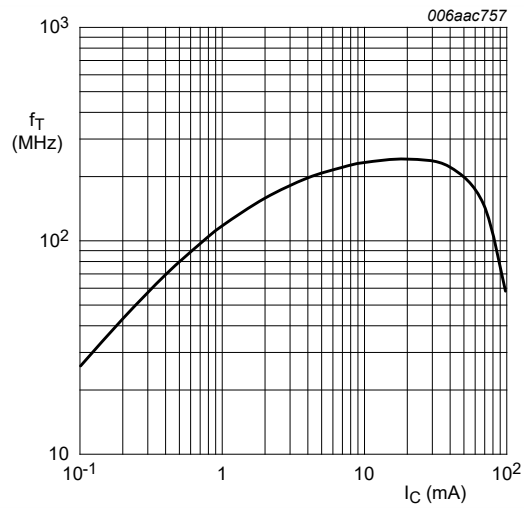
$V_{CE} = 5$ V
 (1) $T_{amb} = -40$ °C
 (2) $T_{amb} = 25$ °C
 (3) $T_{amb} = 100$ °C

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



$f = 1$ MHz; $T_{amb} = 25$ °C

Fig. 7. Collector capacitance as a function of collector-base voltage; typical values



$V_{CE} = 5$ V; $T_{amb} = 25$ °C

Fig. 8. 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)

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

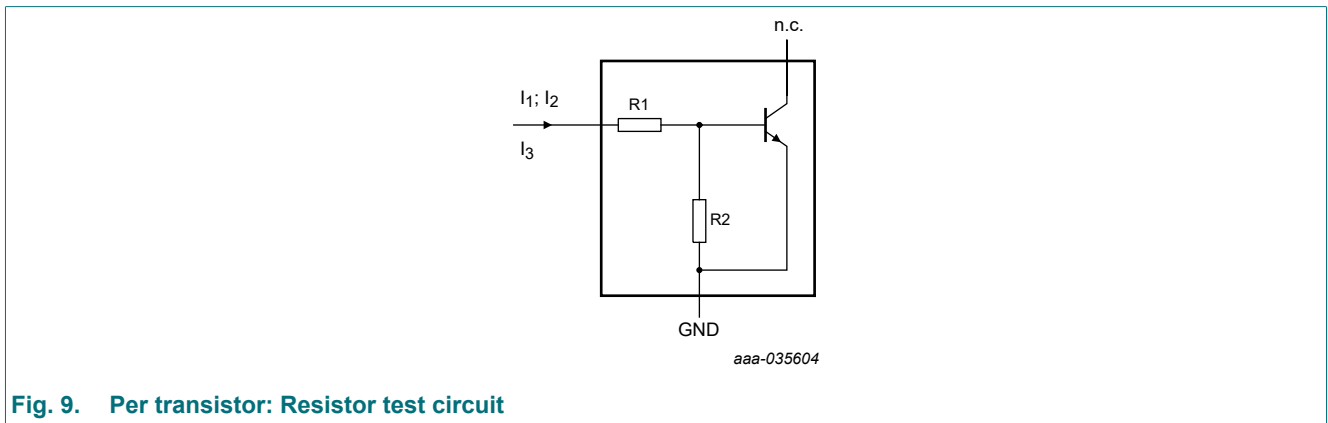


Fig. 9. Per transistor: Resistor test circuit

Resistor test conditions

Table 8. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions		
			I ₁	I ₂	I ₃
PEMH13	4.7	47	600 μA	700 μA	-100 μA

12. Package outline

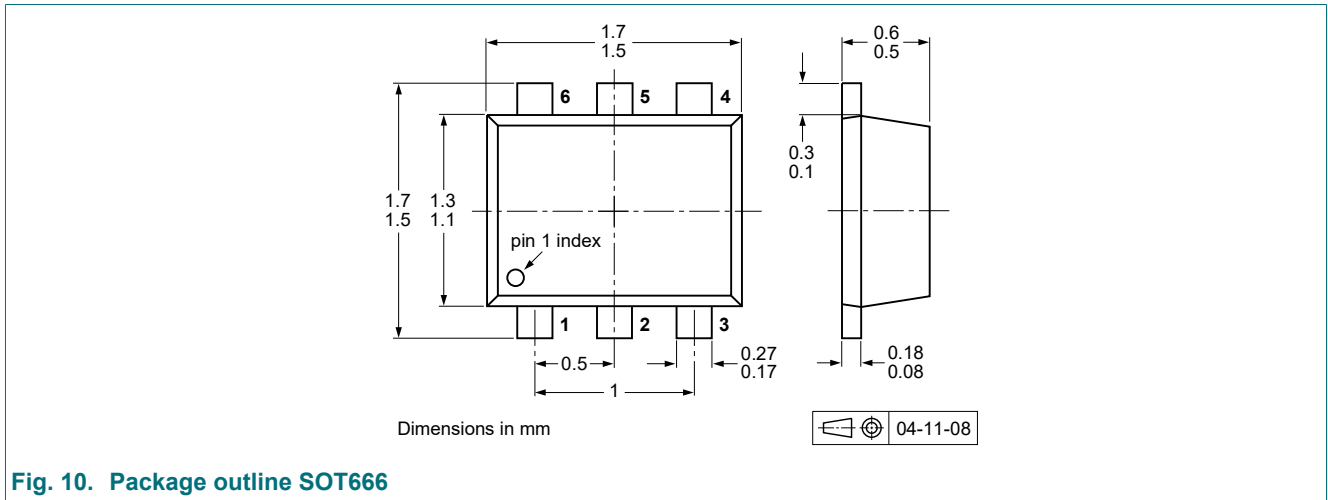


Fig. 10. Package outline SOT666

13. Soldering

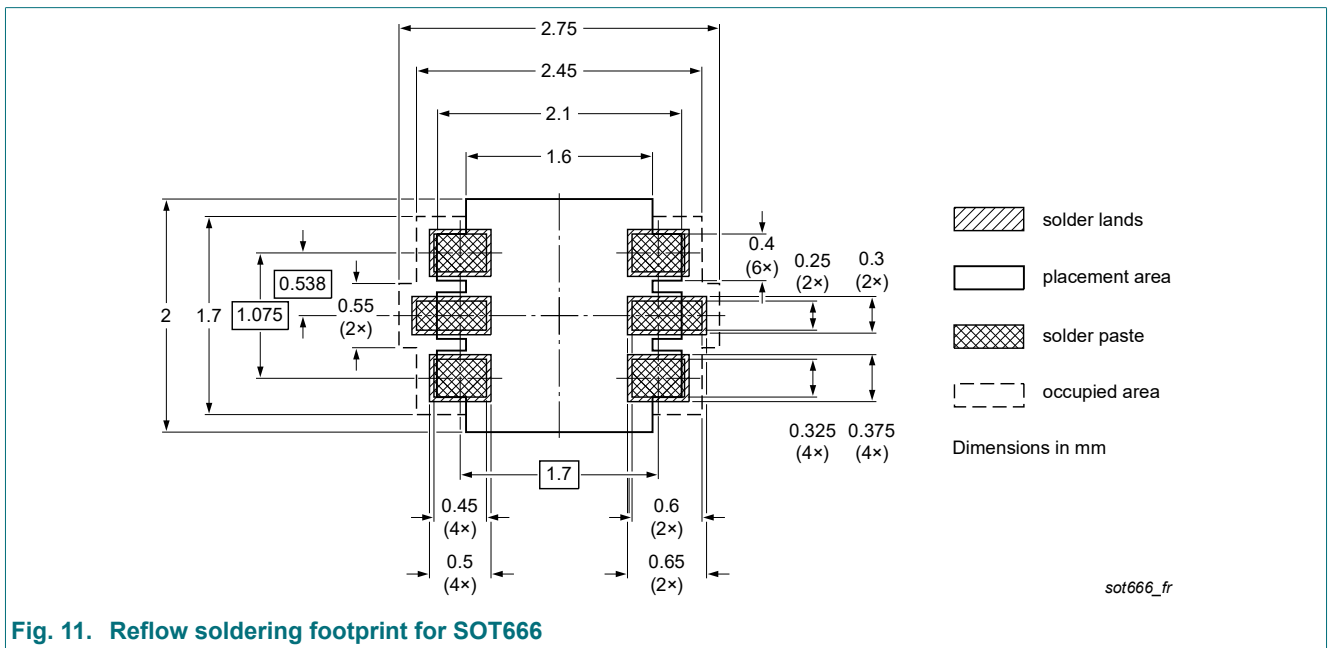


Fig. 11. Reflow soldering footprint for SOT666

14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PEMH13 v.5	20221229	Product data sheet	-	PEMH13_PUMH13 v.4
Modifications:	<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. 			
PEMH13_PUMH13 v.4	20111206	Product data sheet	-	PEMH13_PUMH13 v.3
PEMH13_PUMH13 v.3	20040414	Product data sheet	-	PEMH13_PUMH13 v.2
PEMH13_PUMH13 v.2	20031107	Product data sheet	-	PEMH13 v.1
PEMH13 v.1	20011213	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.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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Contents

1. General description.....	1
2. Features and benefits.....	1
3. Applications.....	1
4. Quick reference data.....	1
5. Pinning information.....	2
6. Ordering information.....	2
7. Marking.....	2
8. Limiting values.....	3
9. Thermal characteristics.....	4
10. Characteristics.....	5
11. Test information.....	7
12. Package outline.....	8
13. Soldering.....	8
14. Revision history.....	9
15. Legal information.....	10

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