



# PEMH15

NPN/NPN resistor-equipped double transistor; R1 = 4.7 k $\Omega$ ,  
R2 = 4.7 k $\Omega$

29 December 2022

Product data sheet

## 1. General description

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

## 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
- Control of IC inputs
- Replaces general-purpose transistors in digital applications

## 4. Quick reference data

Table 1. Quick reference data

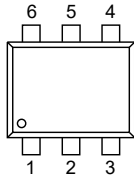
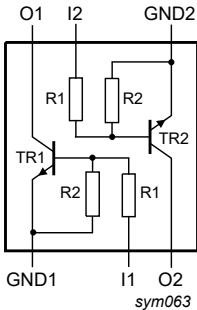
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Per transistor</b>							
V <sub>CEO</sub>	collector-emitter voltage	open base		-	-	50	V
I <sub>O</sub>	output current			-	-	100	mA
R1	bias resistor 1 (input)	T <sub>amb</sub> = 25 °C	[1]	3.3	4.7	6.1	k $\Omega$
R2/R1	bias resistor ratio		[1]	0.8	1	1.2	

[1] See "Section 11: Test information" for resistor calculation and test conditions.

NPN/NPN resistor-equipped double transistor; R1 = 4.7 kΩ, R2 = 4.7 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;"><b>SOT666</b></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
<a href="#">PEMH15</a>	SOT666	plastic, surface-mounted package; 6 leads; 0.5 mm pitch; 1.6 mm x 1.2 mm x 0.55 mm body	<a href="#">SOT666</a>

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PEMH15	5F

## 8. Limiting values

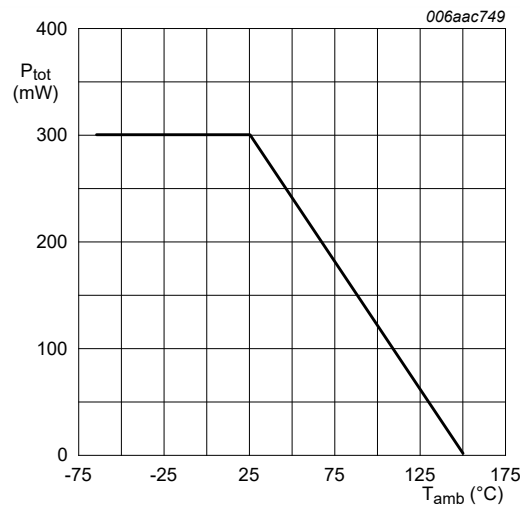
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
<b>Per transistor</b>						
$V_{CBO}$	collector-base voltage	open emitter		-	50	V
$V_{CEO}$	collector-emitter voltage	open base		-	50	V
$V_{EBO}$	emitter-base voltage	open collector		-	10	V
$V_I$	input voltage	positive		-	30	V
		negative		-	-10	V
$I_O$	output current			-	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1] [2]	-	200	mW
<b>Per device</b>						
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ °C}$	[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, 35 μm 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**

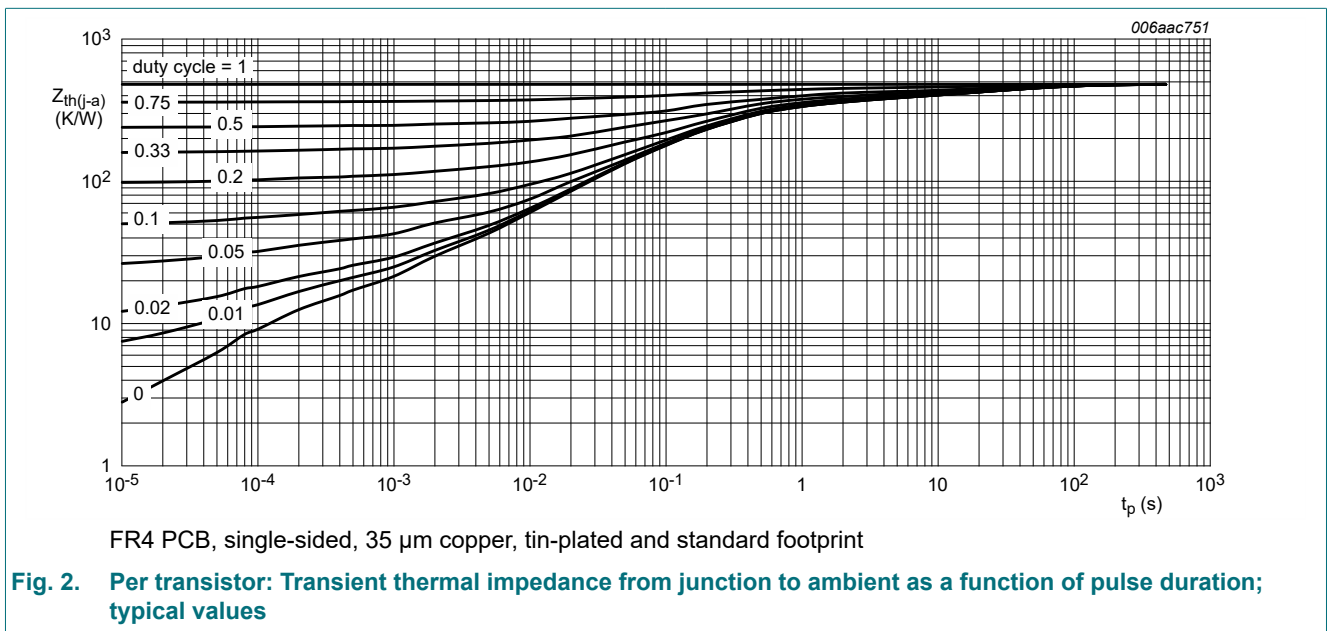
## 9. Thermal characteristics

Table 6. Thermal characteristics

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

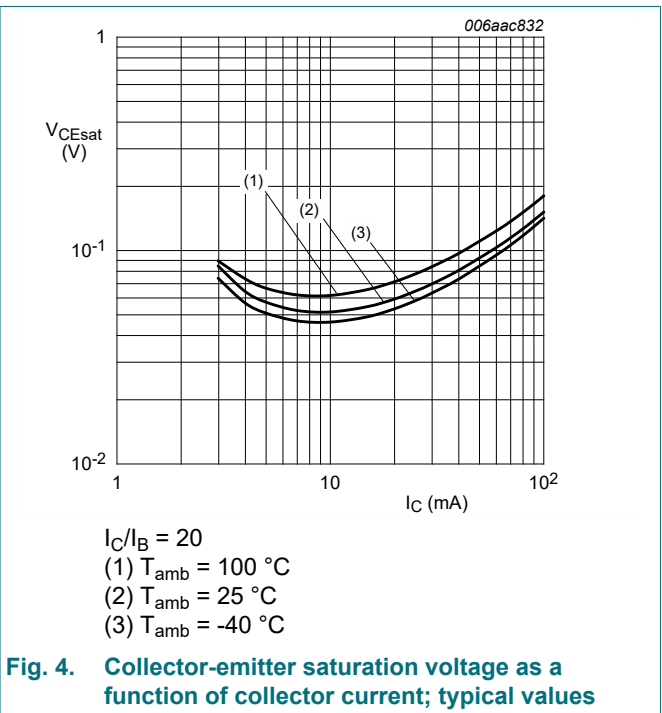
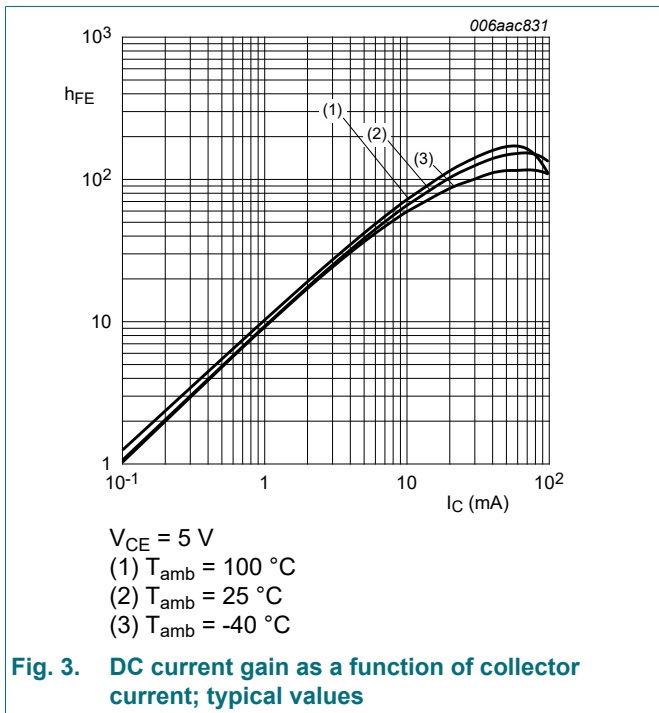


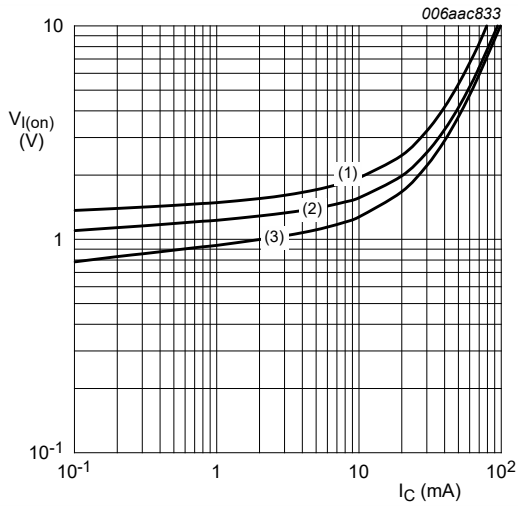
## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Per transistor</b>							
$V_{(BR)CBO}$	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	$\mu A$	
		$V_{CE} = 30 \text{ V}; I_B = 0 A; T_{amb} = 150 \text{ }^\circ C$	-	-	5	$\mu A$	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5 \text{ V}; I_C = 0 A$	-	-	900	$\mu A$	
$h_{FE}$	DC current gain	$V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$	30	-	-		
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10 \text{ mA}; I_B = 0.5 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$	-	-	150	mV	
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5 \text{ V}; I_C = 100 \mu A; T_{amb} = 25 \text{ }^\circ C$	-	1.1	0.5	V	
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3 \text{ V}; I_C = 20 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$	2.5	1.9	-	V	
R1	bias resistor 1 (input)	$T_{amb} = 25 \text{ }^\circ C$	[1]	3.3	4.7	6.1	kΩ
R2/R1	bias resistor ratio		[1]	0.8	1	1.2	
$C_c$	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	

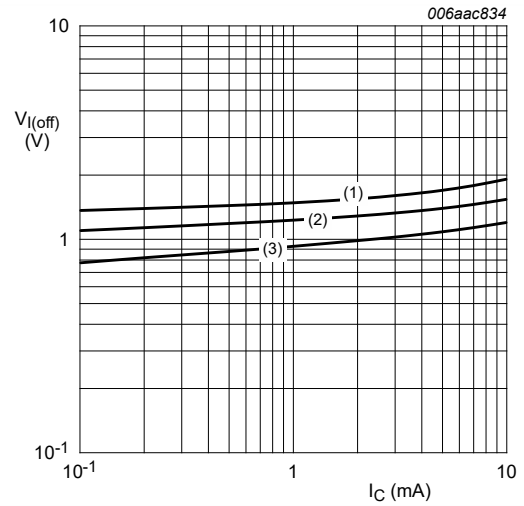
- [1] See "Section 11: Test information" for resistor calculation and test conditions.
- [2] Characteristics of built-in transistor





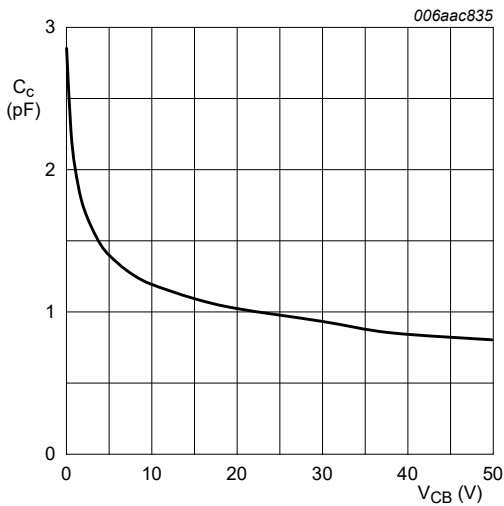
$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

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



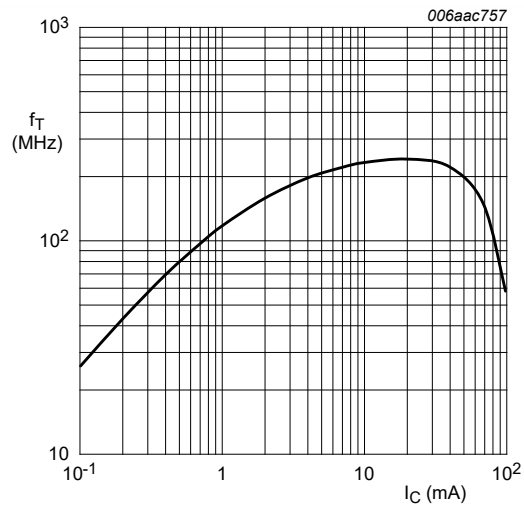
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

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



$f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$

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



$V_{CE} = 5 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$

**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)

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

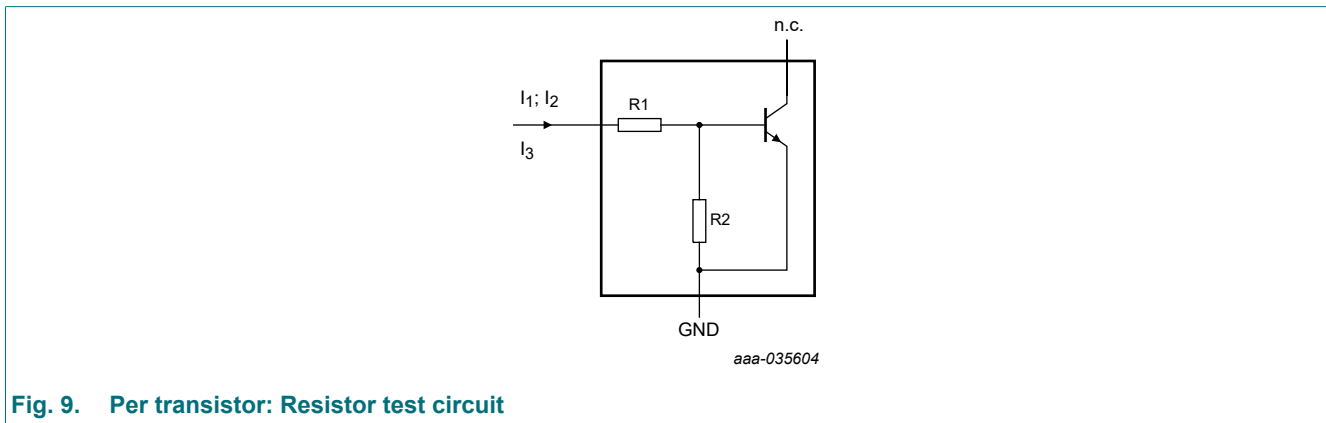


Fig. 9. Per transistor: Resistor test circuit

### Resistor test conditions

Table 8. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions		
			I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>
PEMH15	4.7	4.7	750 μA	950 μA	-850 μA

## 12. Package outline

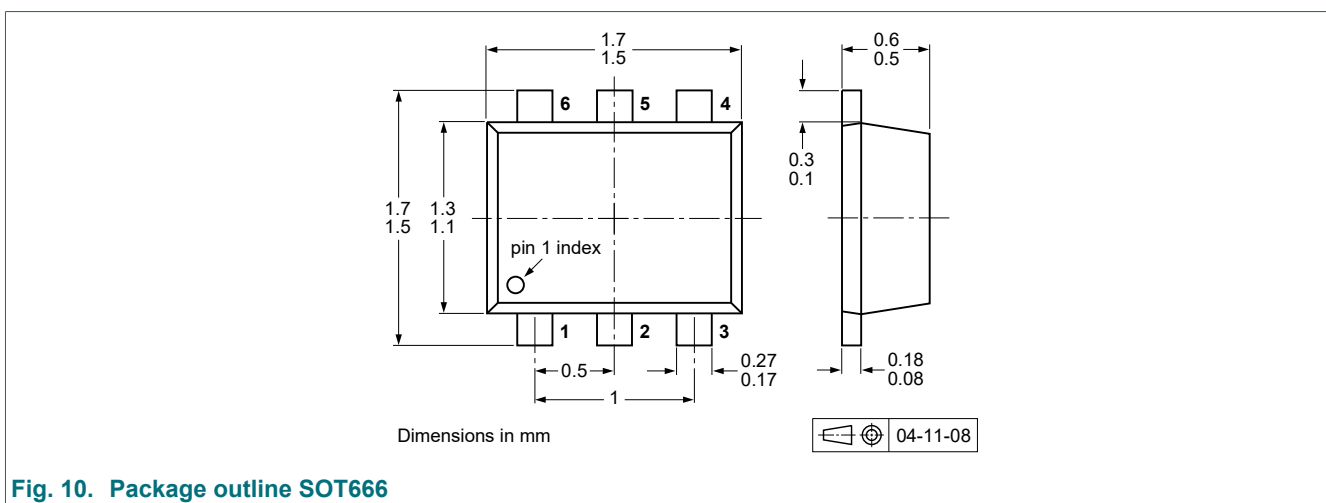


Fig. 10. Package outline SOT666

### 13. Soldering

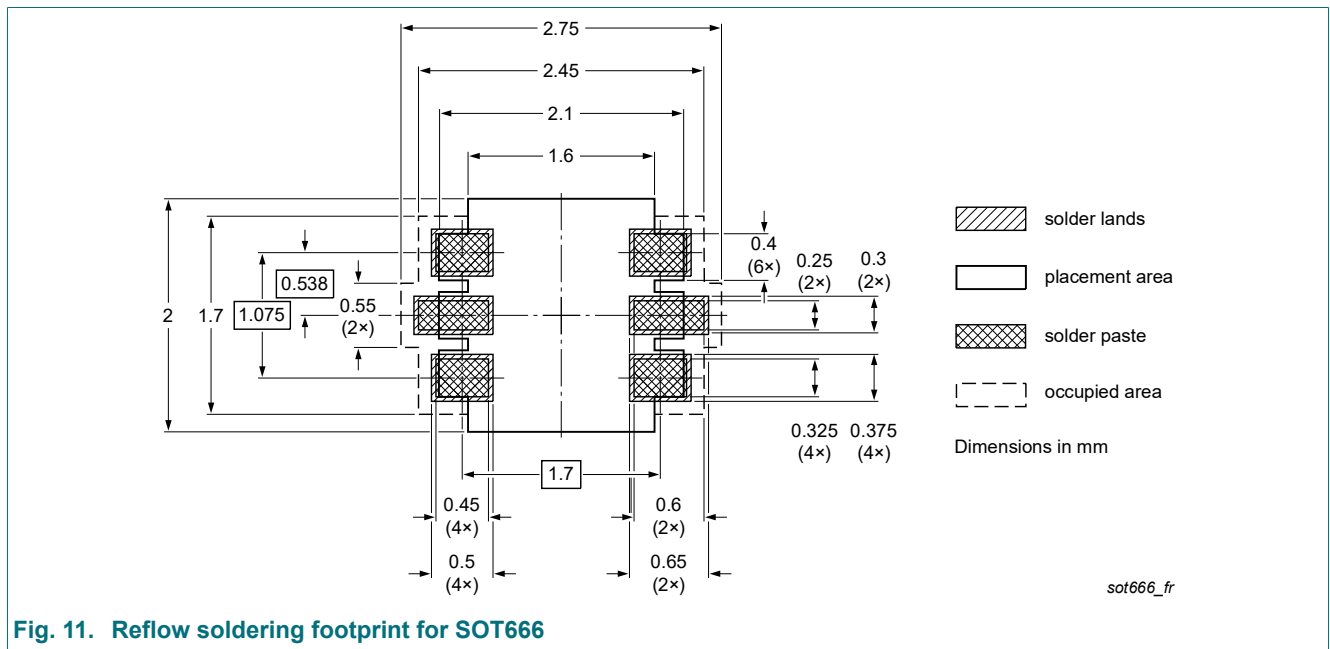


Fig. 11. Reflow soldering footprint for SOT666



## 14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PEMH15 v.7	20221229	Product data sheet	-	PEMH15 v.6
Modifications:	<ul style="list-style-type: none"> <li>Product changed to non-automotive qualification</li> </ul>			
PEMH15 v.6	20220511	Product data sheet	-	PEMH15_PUMH15 v.5
PEMH15_PUMH15 v.5	20111220	Product data sheet	-	PEMH15_PUMH15 v.4
PEMH15_PUMH15 v.4	20031020	Product data sheet	-	PEMH15_PUMH15 v.3
PEMH15_PUMH15 v.3	20011022	Product data sheet	-	PUMH15 v.2
PUMH15 v.2	20000801	Product specification	-	PUMH15 v.1
PUMH15 v.1	20031009	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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