



# THE DATASHEET OF PUMH9,115





# PUMH9

50 V, 100 mA NPN/NPN resistor-equipped double transistor;  
R1 = 10 k $\Omega$ , R2 = 47 k $\Omega$

1 July 2022

Product data sheet

## 1. General description

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

PNP/PNP complement: PUMB9

NPN/PNP complement: PUMD9

## 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

- Digital application in automotive and industrial segments
- Cost-saving alternative for BC847 series in digital applications
- Controlling IC inputs
- Switching loads

## 4. Quick reference data

Table 1. Quick reference data

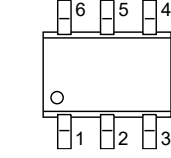
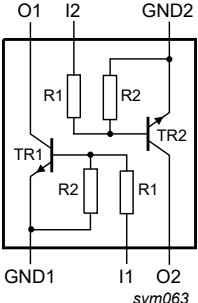
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Per transistor</b>							
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	50	V	
I <sub>O</sub>	output current		-	-	100	mA	
R1	bias resistor 1 (input)		[1]	7	10	13	k $\Omega$
R2/R1	bias resistor ratio		[1]	3.7	4.7	5.7	

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

50 V, 100 mA NPN/NPN 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	 <p><b>TSSOP6 (SOT363)</b></p>	 <p><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
PUMH9	TSSOP6	plastic, surface-mounted package; 6 leads; 0.65 mm pitch; 2.1 mm x 1.25 mm x 0.95 mm body	SOT363

## 7. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
PUMH9	H%9

[1] % = placeholder for manufacturing site code

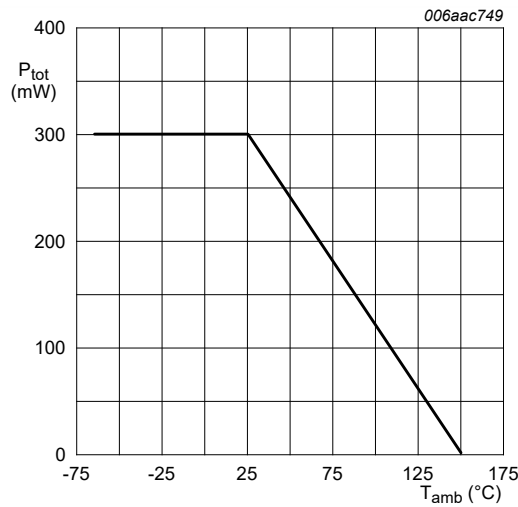
## 8. Limiting values

**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		-	6	V
$V_I$	input voltage	positive		-	40	V
		negative		-	-6	V
$I_O$	output current			-	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	-	200	mW
<b>Per device</b>						
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	-	300	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, 35 μm copper, tin-plated and standard footprint.



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

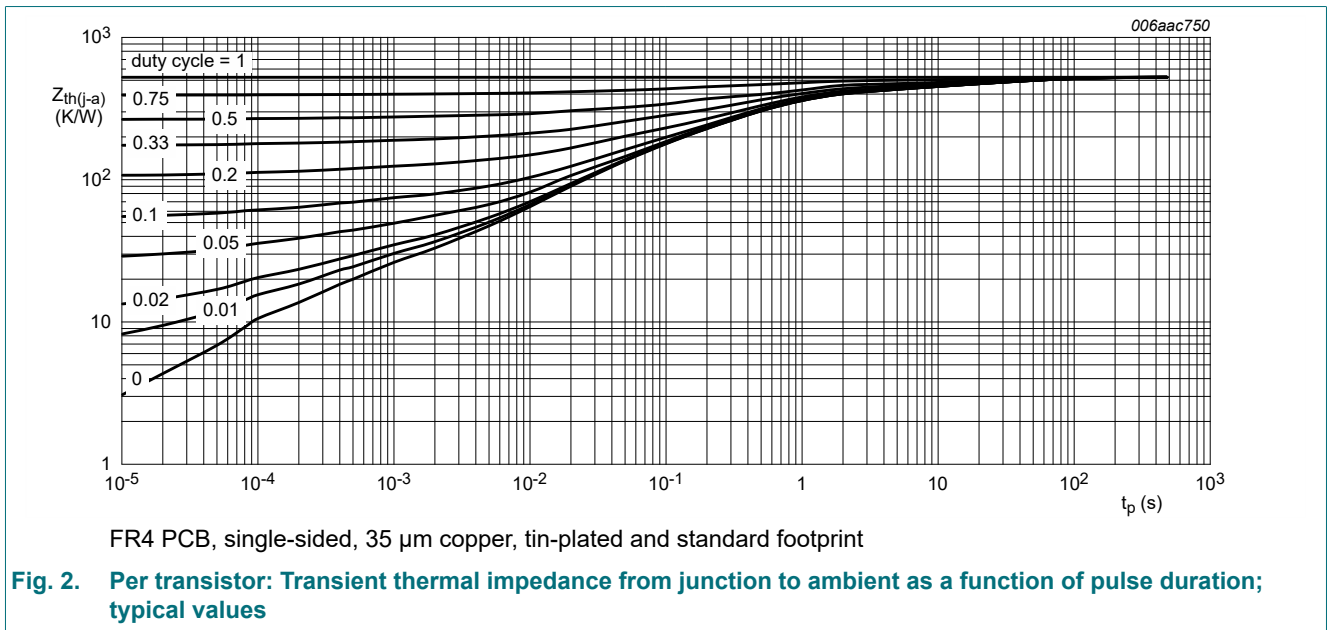
**Fig. 1. Per device: Power derating curve**

## 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]	-	-	625	K/W
<b>Per device</b>							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	417	K/W

[1] Device mounted on an FR4 PCB, single-sided, 35 μm copper, tin-plated and standard footprint.



## 10. Characteristics

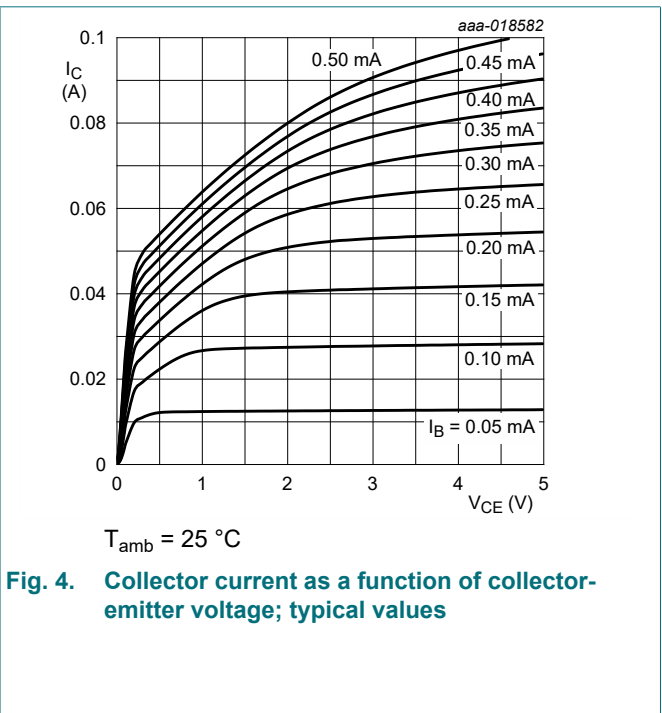
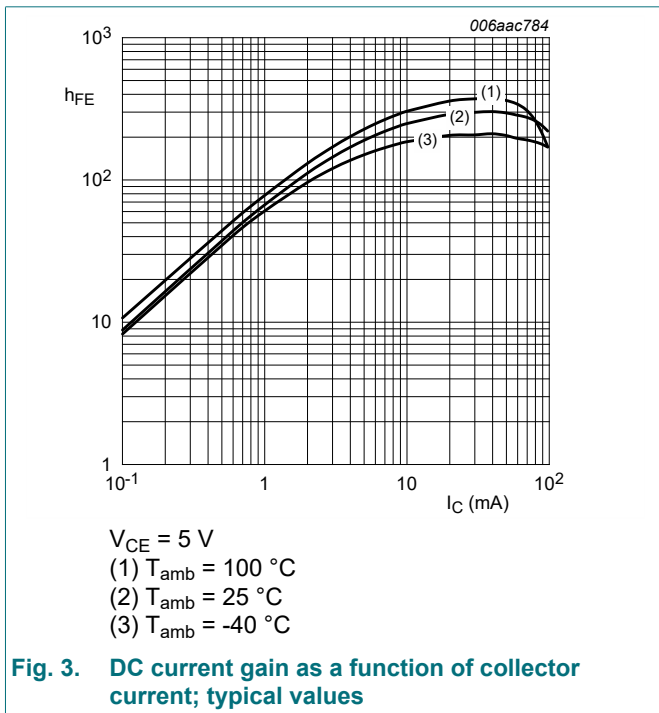
**Table 7. Characteristics**

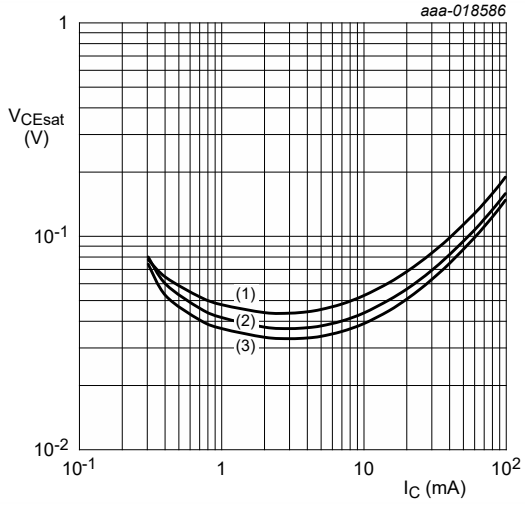
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Per transistor</b>							
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100\text{ }\mu\text{A}; I_E = 0\text{ A}$	50	-	-	V	
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2\text{ mA}; I_B = 0\text{ A}$	50	-	-	V	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50\text{ V}; I_E = 0\text{ A}$	-	-	100	nA	
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 30\text{ V}; I_B = 0\text{ A}$	-	-	100	nA	
		$V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_J = 150\text{ °C}$	-	-	5	$\mu\text{A}$	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	150	$\mu\text{A}$	
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 5\text{ mA}$	100	-	-		
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 5\text{ mA}; I_B = 0.25\text{ mA}$	-	-	100	mV	
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}$	-	0.7	0.5	V	
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V}; I_C = 1\text{ mA}$	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	
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz}$	-	-	2.5	pF	
$f_T$	transition frequency	$V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$	[2]	230	-	MHz	

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

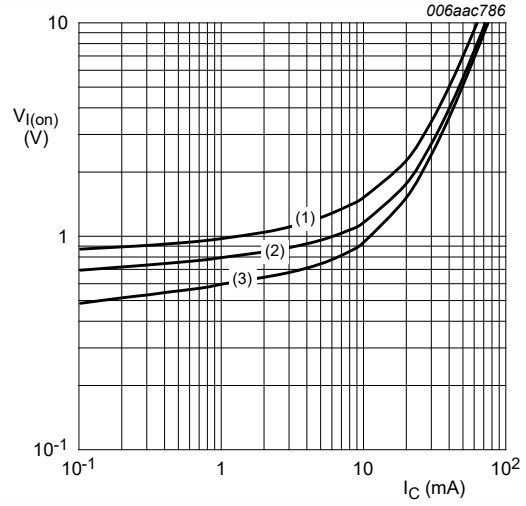
[2] Characteristics of built-in transistor





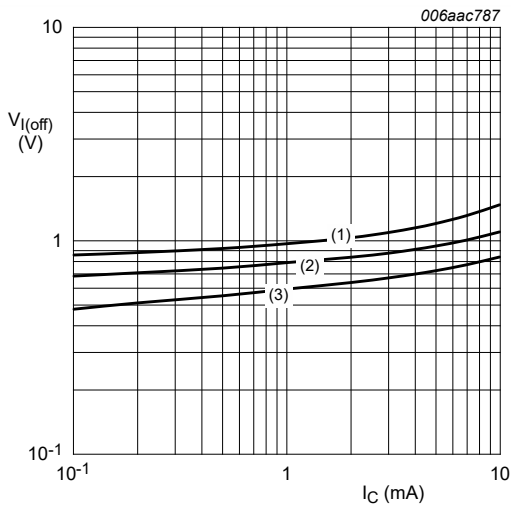
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40\text{ }^\circ\text{C}$

**Fig. 5. Collector-emitter saturation voltage as a function of collector current; typical values**



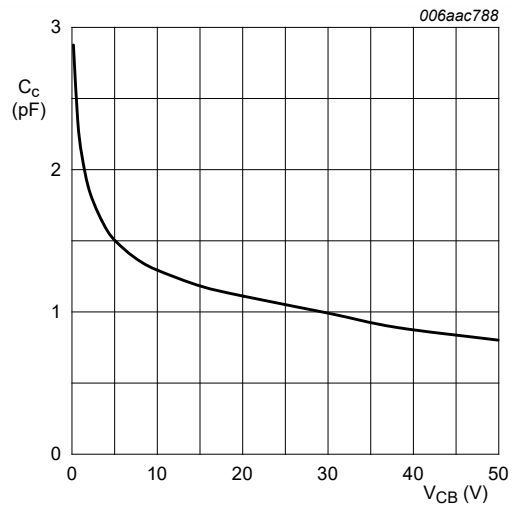
$V_{CE} = 0.3\text{ V}$   
 (1)  $T_{amb} = -40\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

**Fig. 6. 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)  $T_{amb} = 100\text{ }^\circ\text{C}$

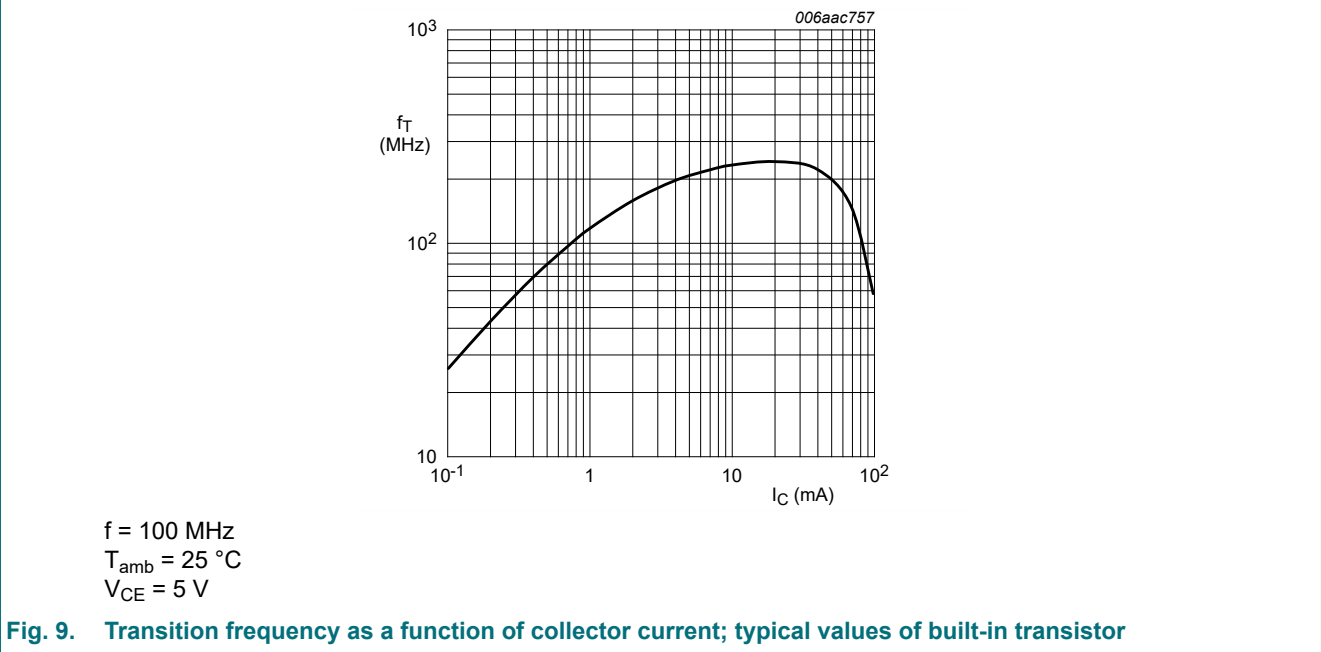
**Fig. 7. Off-state input voltage as a function of collector current; typical values**



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

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

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



## 11. Test information

### Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R1 = \frac{V(I12) - V(I11)}{I12 - I11}$$

- Calculation of bias resistor ratio (R2/R1)

$$\frac{R2}{R1} = \frac{V(I14) - V(I13)}{R1 \cdot (I14 - I13)} - 1$$

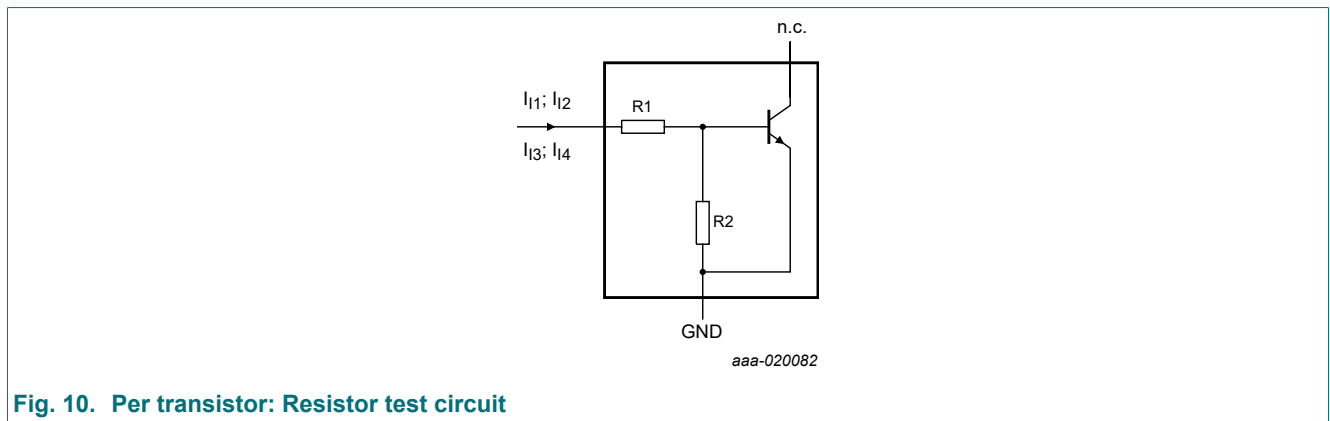


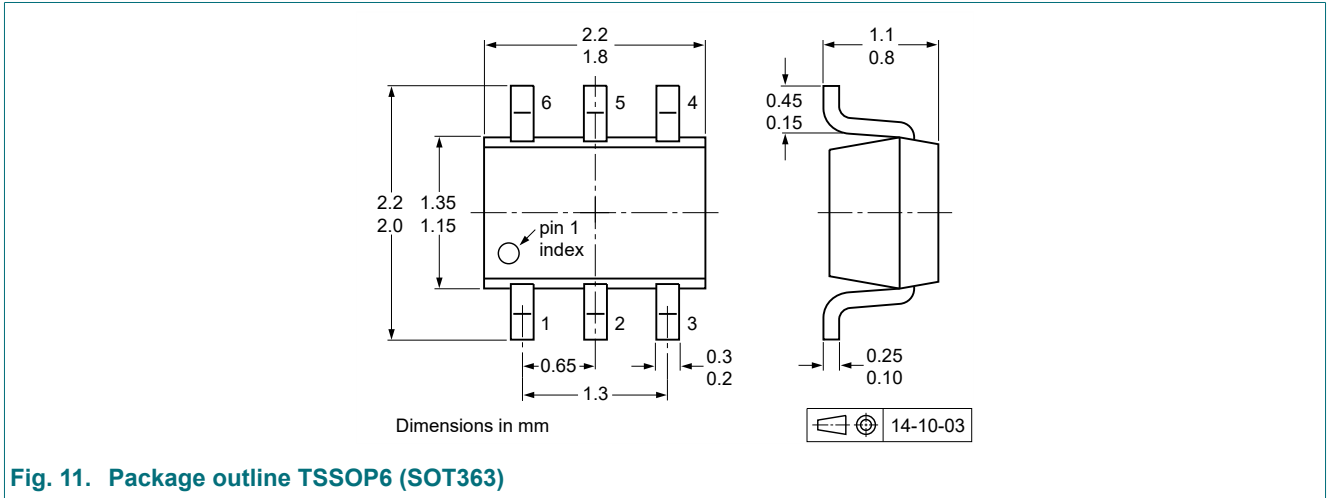
Fig. 10. Per transistor: Resistor test circuit

### Resistor test conditions

Table 8. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I <sub>I1</sub>	I <sub>I2</sub>	I <sub>I3</sub>	I <sub>I4</sub>
<b>Per transistor</b>						
PUMH9	10	47	90 μA	140 μA	-55 μA	-105 μA

## 12. Package outline



### 13. Soldering

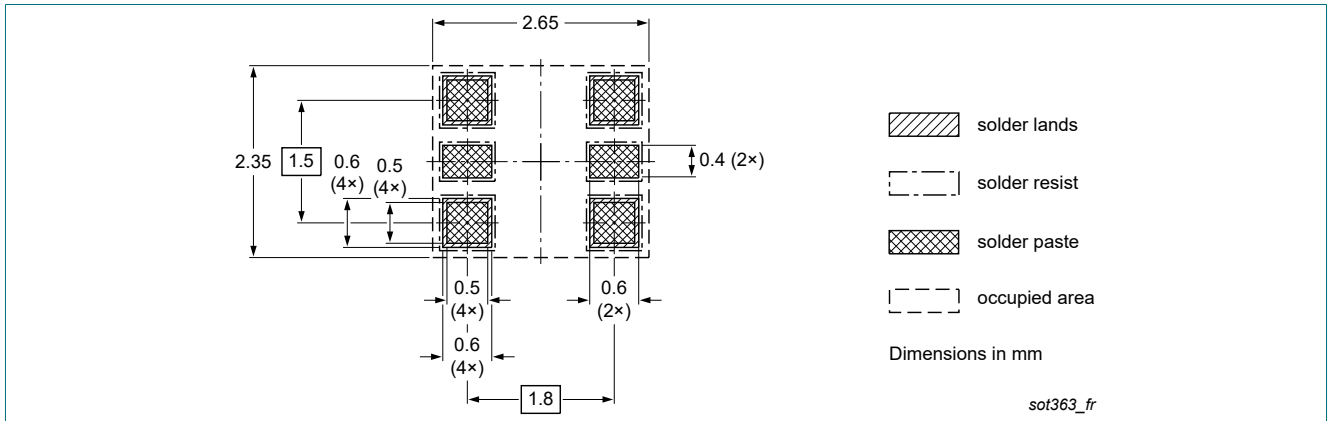


Fig. 12. Reflow soldering footprint for TSSOP6 (SOT363)

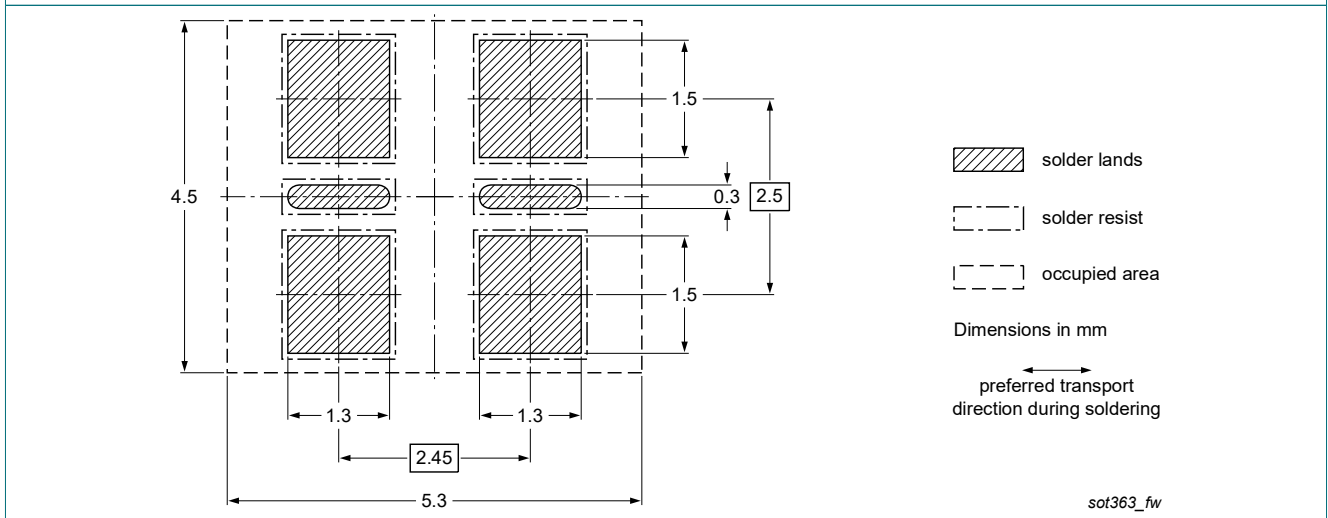


Fig. 13. Wave soldering footprint for TSSOP6 (SOT363)

## 14. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PUMH9 v.7	20220701	Product data sheet	-	PUMH9 v.6
Modification:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Family data sheet reduced to single type data sheet.</li> <li>Product changed to non-automotive qualification. Please refer to nexperia.com for automotive (-Q) product alternative(s).</li> <li>Packing information removed.</li> </ul>			
PUMH9 v.6	20190711	Product data sheet	-	PEMH9_PIMH9_PUMH9 v.5
PEMH9_PIMH9_PUMH9 v.5	20131112	Product data sheet	-	PIMH9_PUMH9_PEMH9 v.4
PIMH9_PUMH9_PEMH9 v.4	20040414	Product data sheet	-	PIMH9_PUMH9_PEMH9 v.3
PIMH9_PUMH9_PEMH9 v.3	20030915	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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