



# PUMH9-Q

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

7 October 2021

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-Q

NPN/PNP complement: PUMD9-Q

## 2. Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- Qualified according to AEC-Q101 and recommended for use in automotive applications

## 3. Applications

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

## 4. Quick reference data

Table 1. Quick reference data

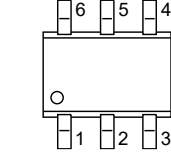
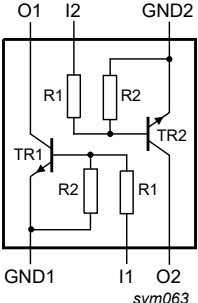
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	50	V
I <sub>O</sub>	output current		-	-	100	mA
R1	bias resistor 1	[1]	7	10	13	k $\Omega$
R2/R1	bias resistor ratio	[1]	3.7	4.7	5.7	

[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>TSSOP6 (SOT363)</p>	 <p>sym063</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-Q	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[1]
PUMH9-Q	H%9

[1] % = placeholder for manufacturing site code

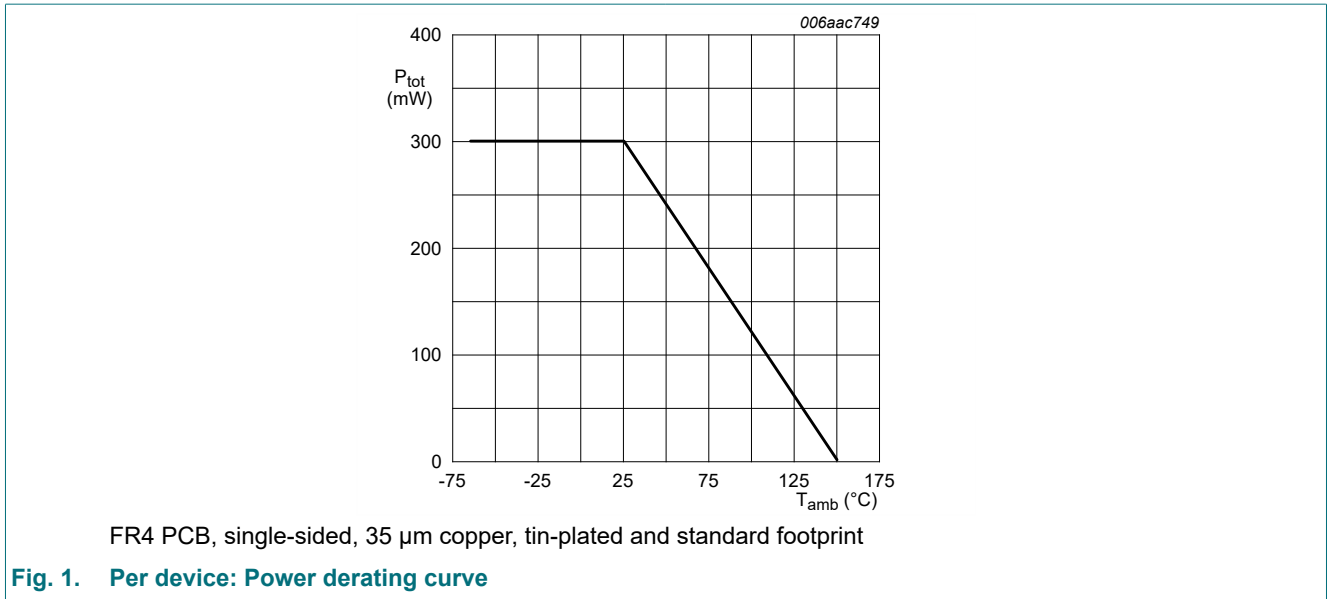
## 8. Limiting values

**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 <sub>CBO</sub>	collector-base voltage	open emitter		-	50	V
V <sub>CEO</sub>	collector-emitter voltage	open base		-	50	V
V <sub>EBO</sub>	emitter-base voltage	open collector		-	6	V
V <sub>I</sub>	input voltage	positive		-	40	V
		negative		-	-6	V
I <sub>O</sub>	output current			-	100	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	200	mW
<b>Per device</b>						
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	300	mW
T <sub>j</sub>	junction temperature			-	150	°C
T <sub>amb</sub>	ambient temperature			-55	150	°C
T <sub>stg</sub>	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.

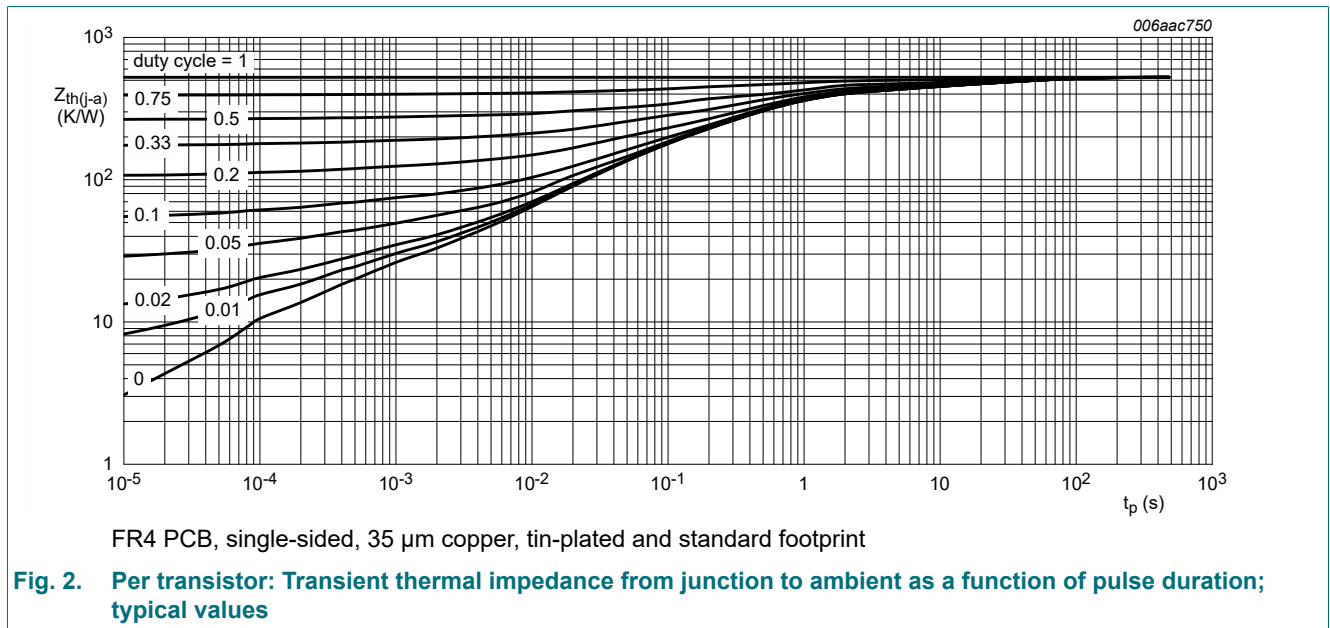


## 9. Thermal characteristics

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

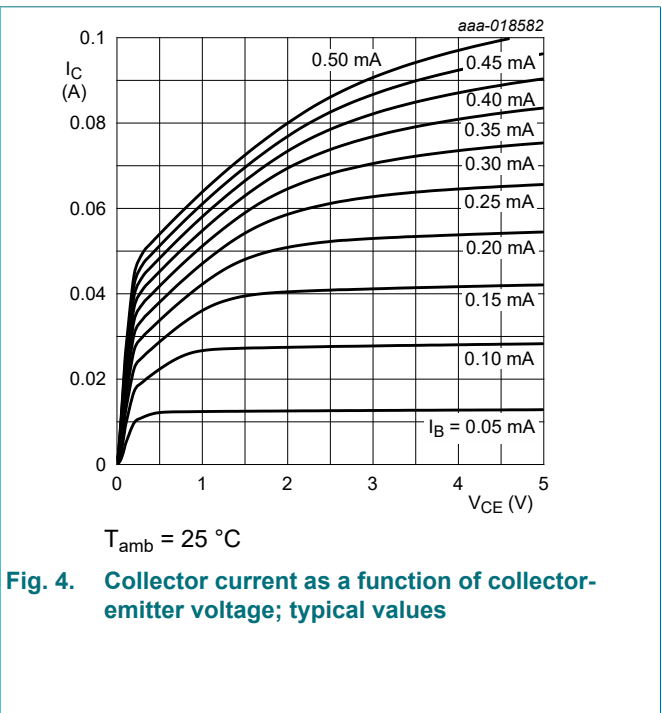
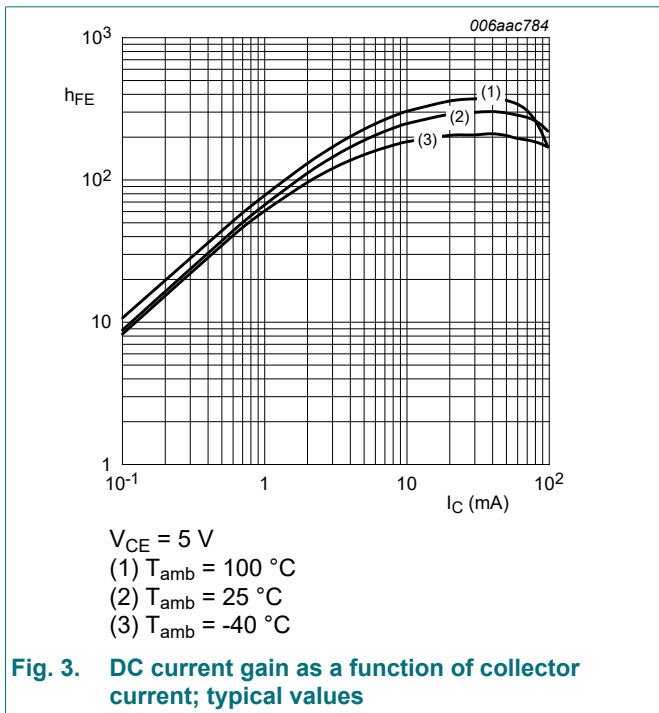
**Table 7. Characteristics**

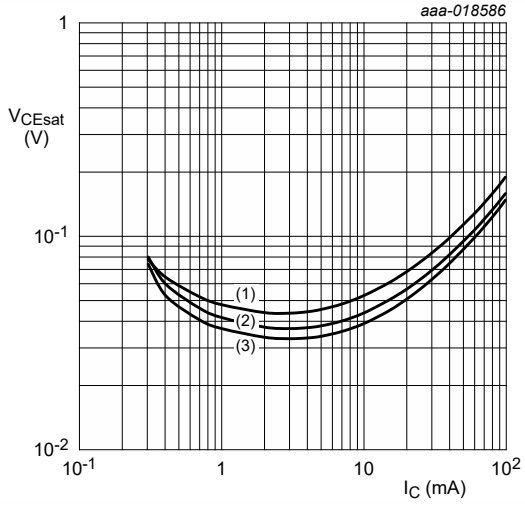
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

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		[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.

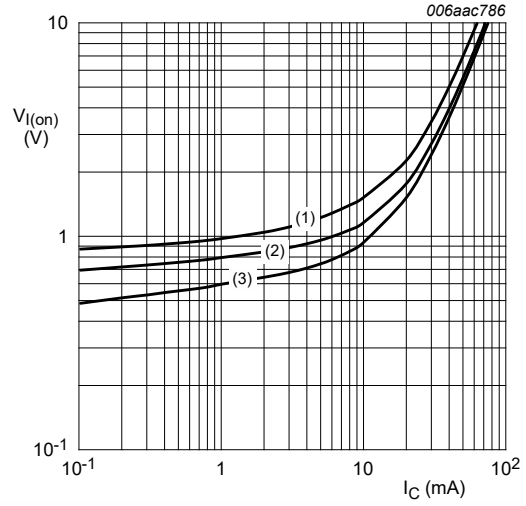
[2] Characteristics of built-in transistor





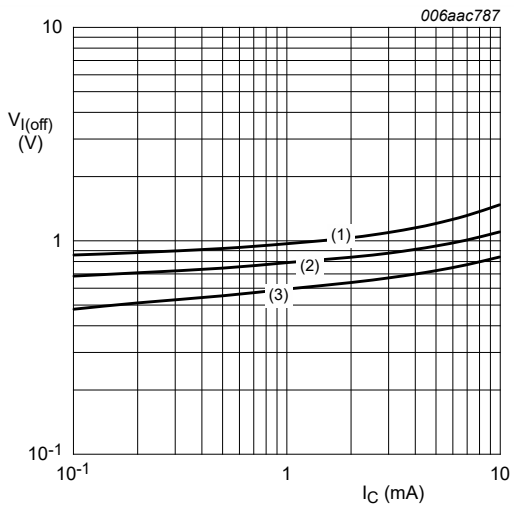
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -40^\circ C$

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



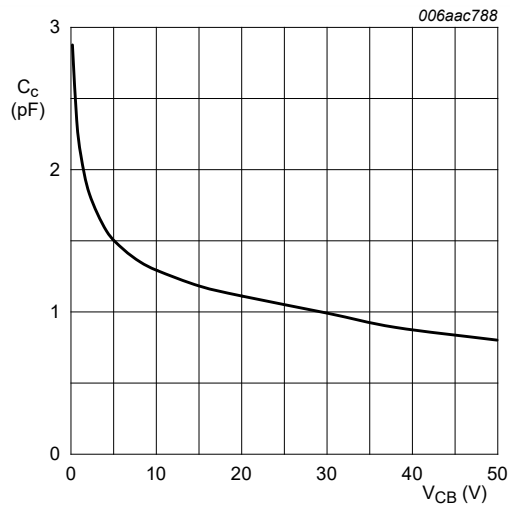
$V_{CE} = 0.3 V$   
 (1)  $T_{amb} = -40^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 100^\circ C$

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



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

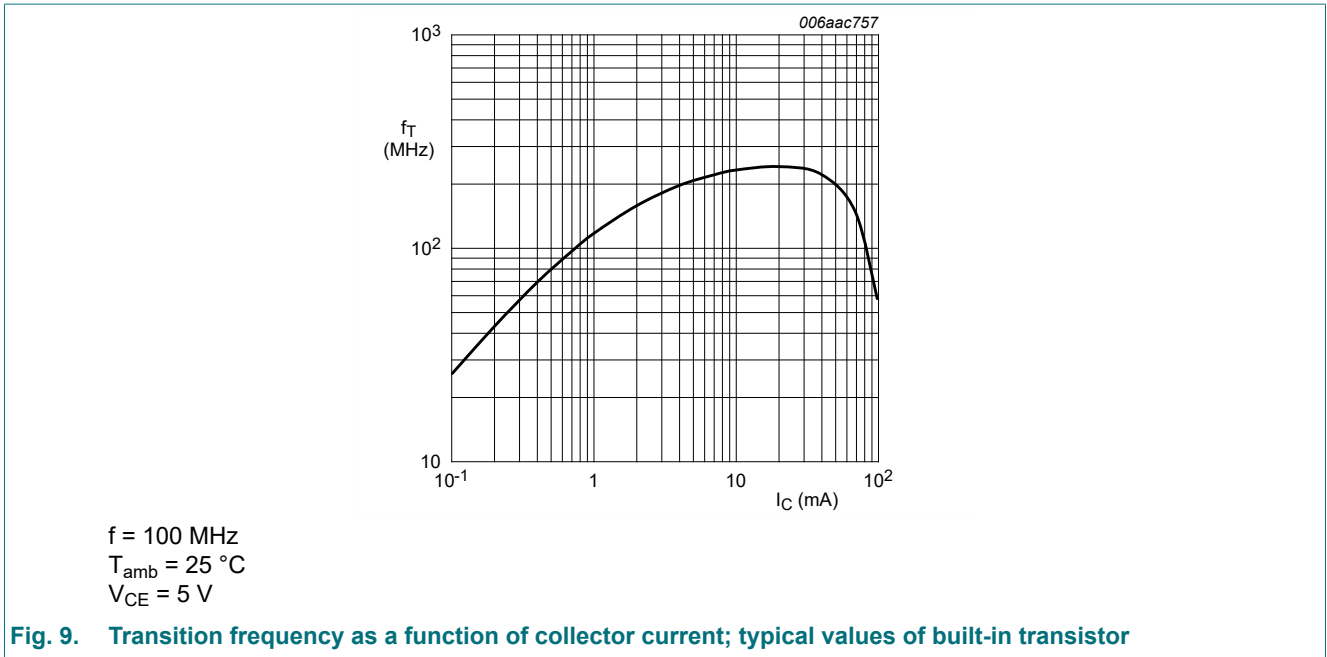
**Fig. 7. Off-state input voltage as a function of collector current; typical values**



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

**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

### 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)

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

- Calculation of bias resistor ratio (R2/R1)

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

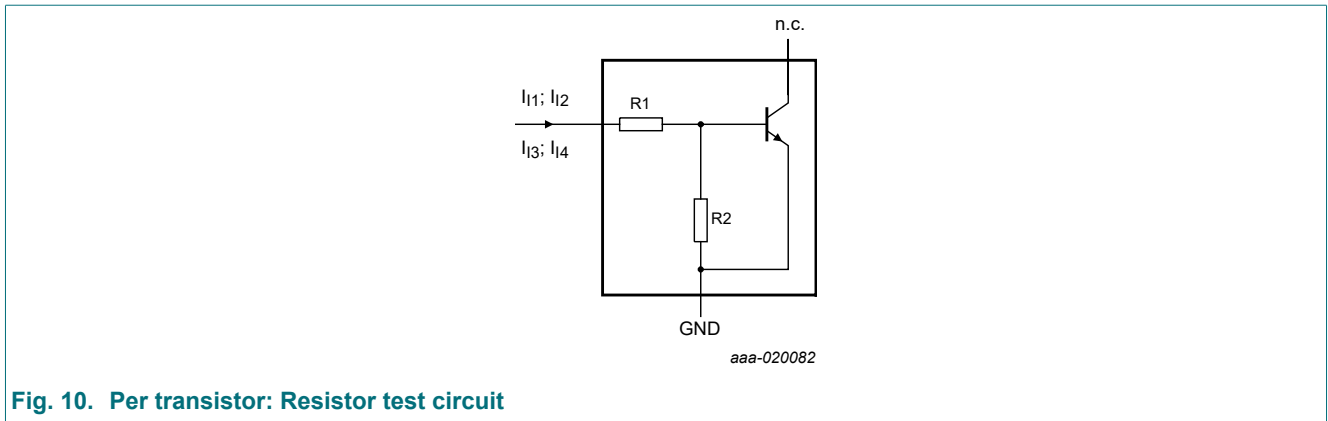


Fig. 10. Per transistor: Resistor test circuit

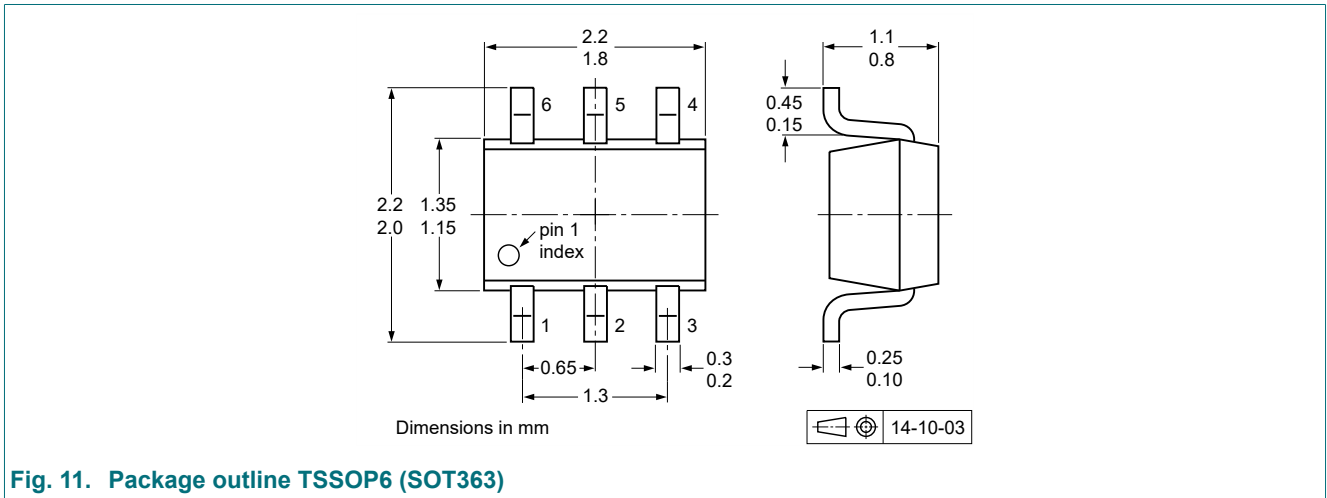
### Resistor test conditions

Table 8. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I11	I12	I13	I14
<b>Per transistor</b>						
PUMH9-Q	10	47	90 μA	140 μA	-55 μA	-105 μA



## 12. Package outline



### 13. Soldering

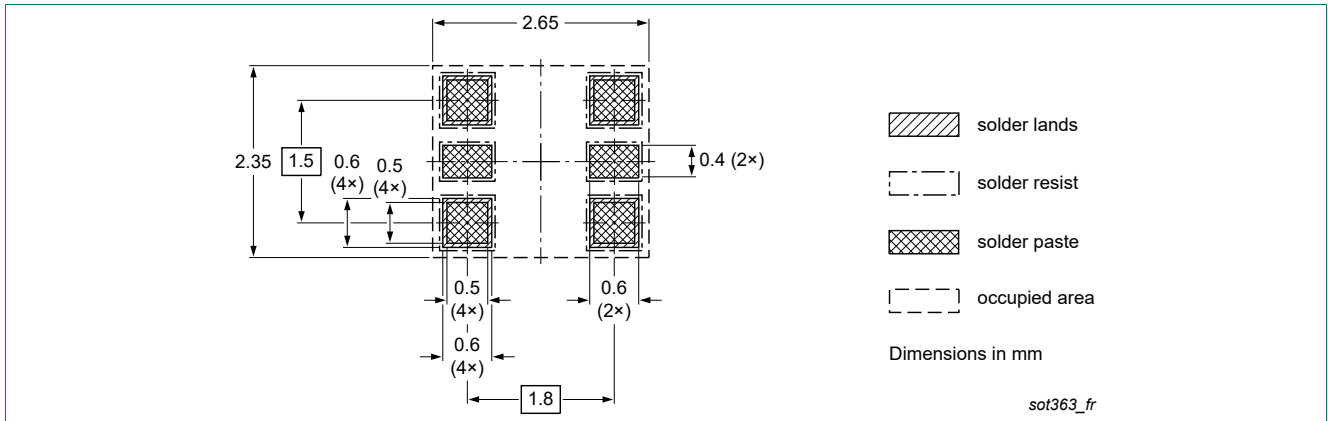


Fig. 12. Reflow soldering footprint for TSSOP6 (SOT363)

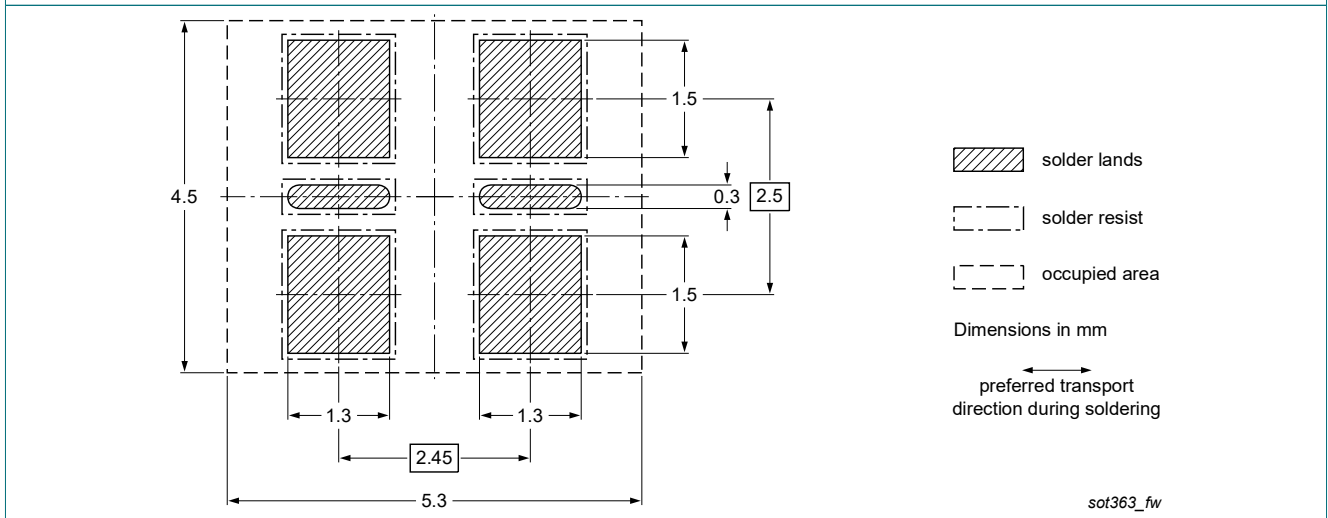


Fig. 13. Wave soldering footprint for TSSOP6 (SOT363)

## 14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PUMH9-Q v.2	20211007	Product data sheet	-	PUMH9-Q v.1
Modification:	<ul style="list-style-type: none"> <li>• Complete rework</li> <li>• General description: added new lines at the end</li> <li>• Pinning: Graphic symbol replaced</li> <li>• Limiting values: deleted parameter <math>I_{CM}</math></li> <li>• Characteristics: <math>I_{CEO}</math> max limit is updated to 100 nA</li> <li>• Characteristics: added new graphics</li> <li>• Characteristics: replaced the figure 006aac785 with aaa-018586</li> <li>• Characteristics: Updated the graphics conditions</li> <li>• Characteristics: <math>V_{(BR)EBO}</math> values is removed</li> <li>• Test information: Included resistor calculation, resistor test circuit and resistor test condition</li> </ul>			
PUMH9-Q v.1	20210625	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.

- [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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