



PUMD6

50 V, 100 mA NPN/PNP Resistor-Equipped Transistor;
R1 = 4.7 k Ω , R2 = open

27 April 2023

Product data sheet

1. General description

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

NPN/PNP complement: PUMH7

PNP/PNP complement: PUMB3

2. Features and benefits

- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- AEC-Q101 qualified

3. Applications

- Digital application in industrial segments
- Switching loads
- Low current peripheral driver
- Controlling IC inputs
- Cost-saving alternative to BC847 / BC857 series in digital applications

4. Quick reference data

Table 1. Quick reference data

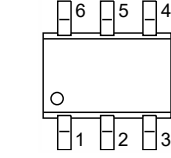
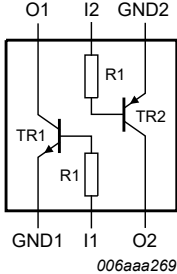
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
V _{CEO}	collector-emitter voltage	open base	[1]	-	-	50	V
I _O	output current		[1]	-	-	100	mA
R1	bias resistor 1 (input)	T _{amb} = 25 °C	[2]	3.3	4.7	6.1	k Ω

[1] For the PNP transistor with negative polarity.

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

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	GND1	GND (emitter) TR1	 <p>TSSOP6 (SOT363)</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
PUMD6	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]
PUMD6	D%6

[1] % = placeholder for manufacturing site code

8. Limiting values

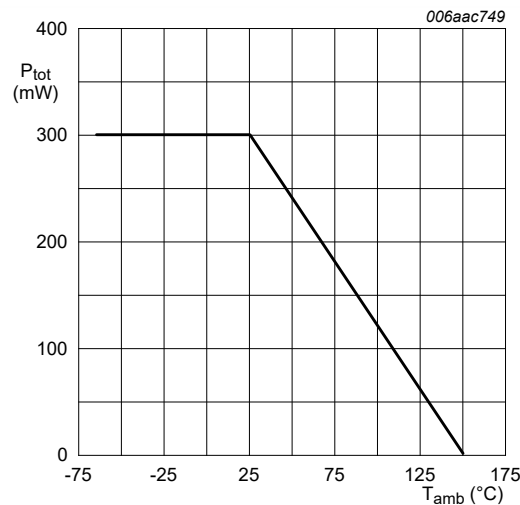
Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
Per transistor						
V_{CBO}	collector-base voltage	open emitter	[1]	-	50	V
V_{CEO}	collector-emitter voltage	open base	[1]	-	50	V
V_{EBO}	emitter-base voltage	open collector	[1]	-	5	V
V_I	input voltage	TR1 (NPN)		-5	30	V
		TR2 (PNP)		-30	5	V
I_O	output current		[1]	-	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[2]	-	200	mW
Per device						
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[2]	-	300	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			-65	150	°C
T_{stg}	storage temperature			-65	150	°C

[1] For the PNP transistor with negative polarity.

[2] 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

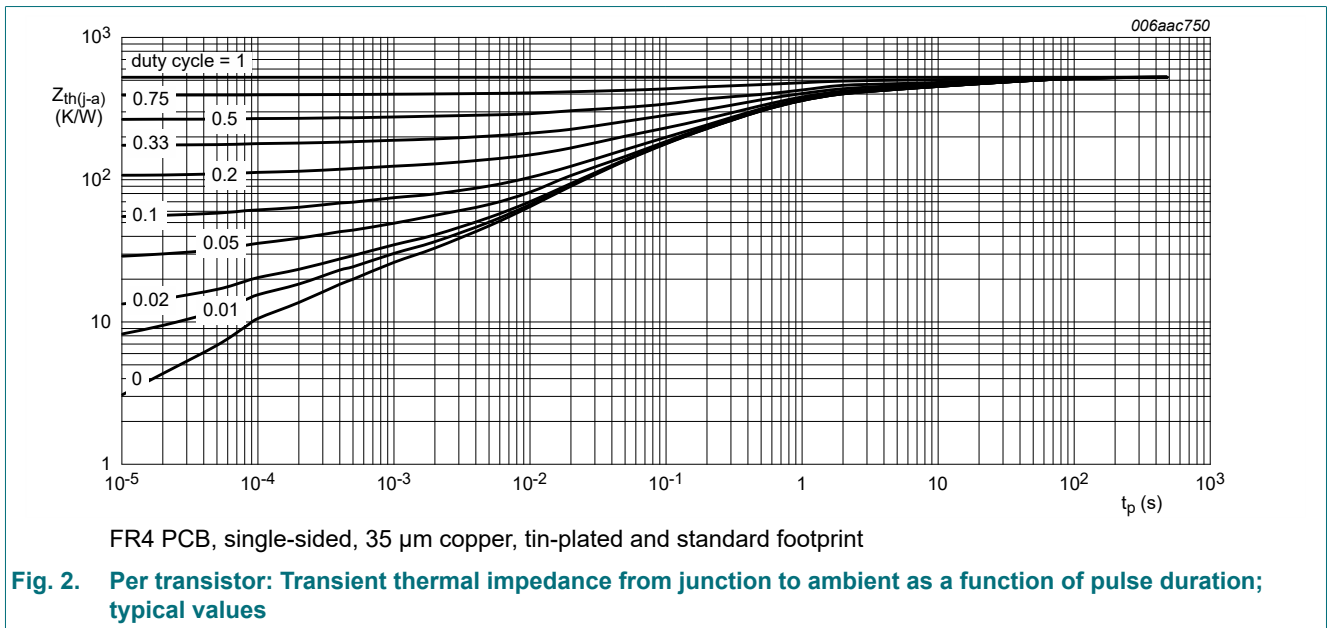
Fig. 1. Per device: Power derating curve

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	625	K/W
Per device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	416	K/W

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



10. Characteristics

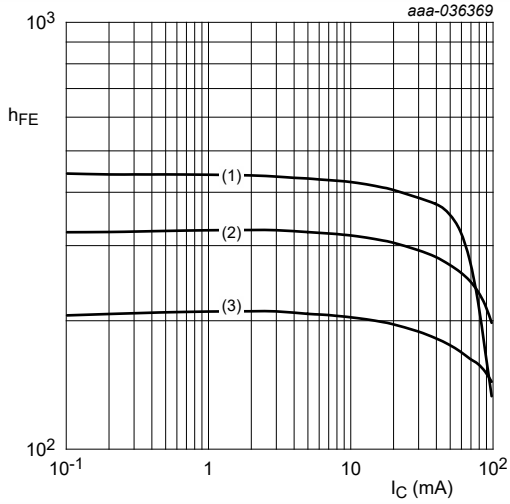
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100 \mu\text{A}$; $I_E = 0 \text{ A}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	50	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2 \text{ mA}$; $I_B = 0 \text{ A}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	50	-	-	V
I_{CBO}	collector-base cut-off current	$V_{CB} = 50 \text{ V}$; $I_E = 0 \text{ A}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	100	nA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 30 \text{ V}$; $I_B = 0 \text{ A}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	100	nA
		$V_{CE} = 30 \text{ V}$; $I_B = 0 \text{ A}$; $T_j = 150 \text{ }^\circ\text{C}$	[1]	-	-	5	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5 \text{ V}$; $I_C = 0 \text{ A}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	100	nA
h_{FE}	DC current gain	$V_{CE} = 5 \text{ V}$; $I_C = 1 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	200	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5 \text{ mA}$; $I_B = 0.25 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	100	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5 \text{ V}$; $I_C = 100 \mu\text{A}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	585	500	mV
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3 \text{ V}$; $I_C = 10 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	1.3	0.88	-	V
R1	bias resistor 1 (input)	$T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[2]	3.3	4.7	6.1	kΩ
TR1 (NPN)							
C_c	collector capacitance	$V_{CB} = 10 \text{ V}$; $I_E = 0 \text{ A}$; $i_e = 0 \text{ A}$; $f = 1 \text{ MHz}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$		-	-	2.5	pF
f_T	transition frequency	$V_{CE} = 5 \text{ V}$; $I_C = 10 \text{ mA}$; $f = 100 \text{ MHz}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[3]	-	230	-	MHz
TR2 (PNP)							
C_c	collector capacitance	$V_{CB} = -10 \text{ V}$; $I_E = 0 \text{ A}$; $i_e = 0 \text{ A}$; $f = 1 \text{ MHz}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$		-	-	3	pF
f_T	transition frequency	$V_{CE} = -5 \text{ V}$; $I_C = -10 \text{ mA}$; $f = 100 \text{ MHz}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[3]	-	180	-	MHz

[1] For the PNP transistor with negative polarity.

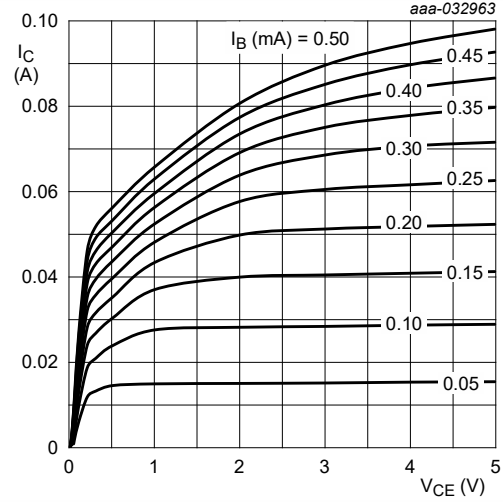
[2] See section "Test information" for resistor calculation and test conditions.

[3] Characteristics of built-in transistor



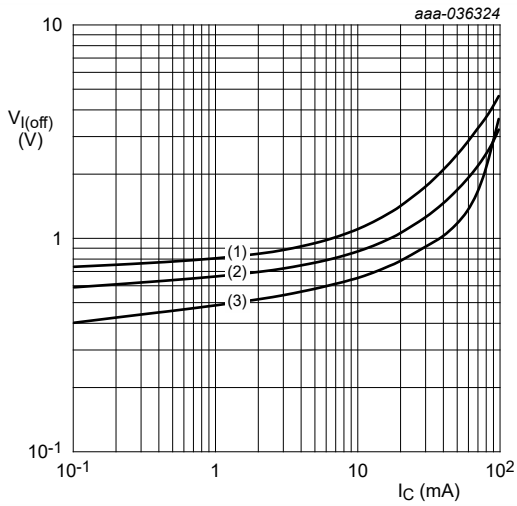
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



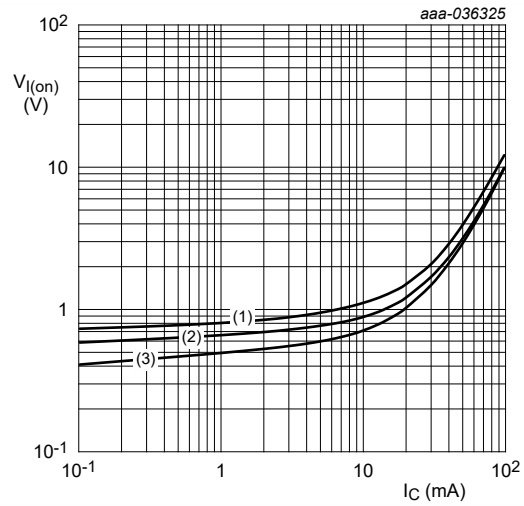
$T_{amb} = 25\text{ }^{\circ}\text{C}$

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



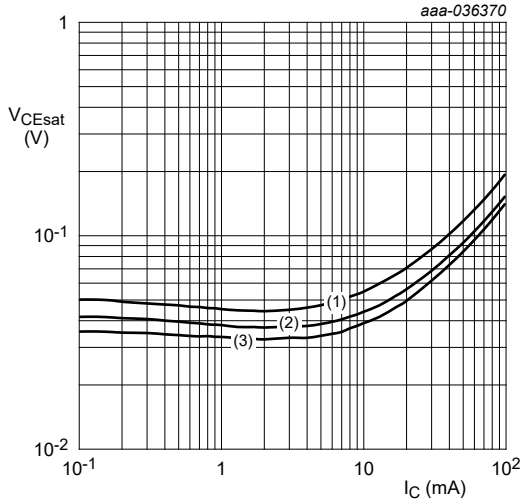
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



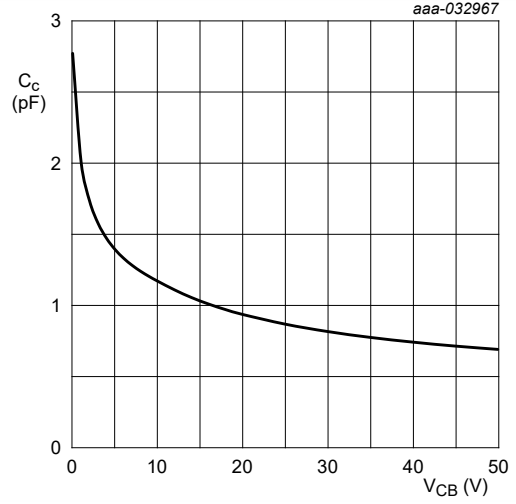
$V_{CE} = 0.3\text{ V}$
 (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



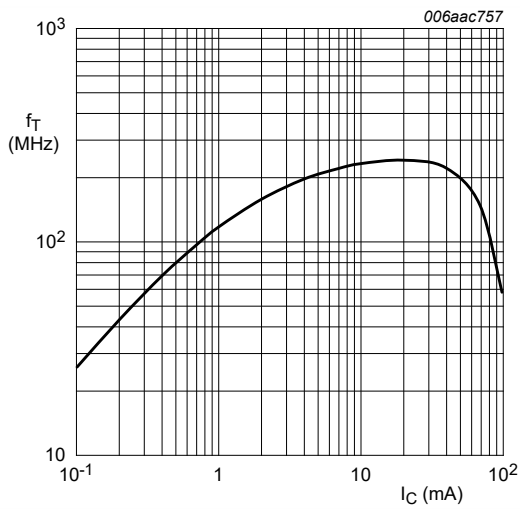
$I_C/I_B = 20$
 (1) $T_{amb} = 100^\circ\text{C}$
 (2) $T_{amb} = 25^\circ\text{C}$
 (3) $T_{amb} = -40^\circ\text{C}$

Fig. 7. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values



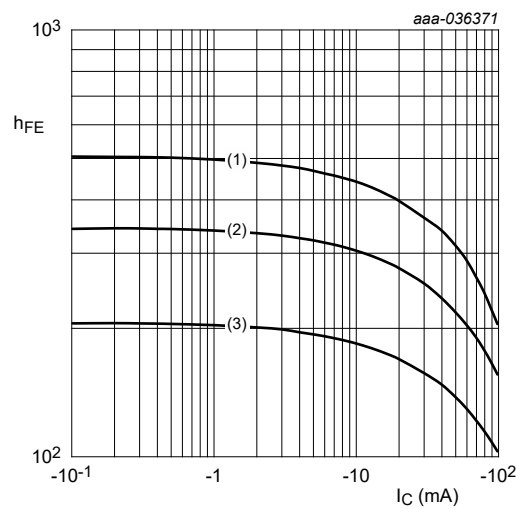
$f = 1\text{ MHz}$
 $T_{amb} = 25^\circ\text{C}$

Fig. 8. TR1 (NPN): Collector capacitance as a function of collector-base voltage; typical values



$f = 100\text{ MHz}$
 $T_{amb} = 25^\circ\text{C}$
 $V_{CE} = 5\text{ V}$

Fig. 9. TR1 (NPN): Transition frequency as a function of collector current; typical values of built-in transistor



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

Fig. 10. TR2 (PNP): DC current gain as a function of collector current; typical values

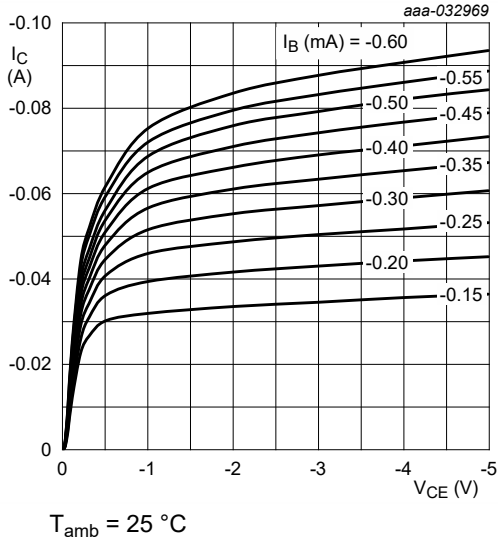


Fig. 11. TR2 (PNP): Collector current as a function of collector-emitter voltage; typical values

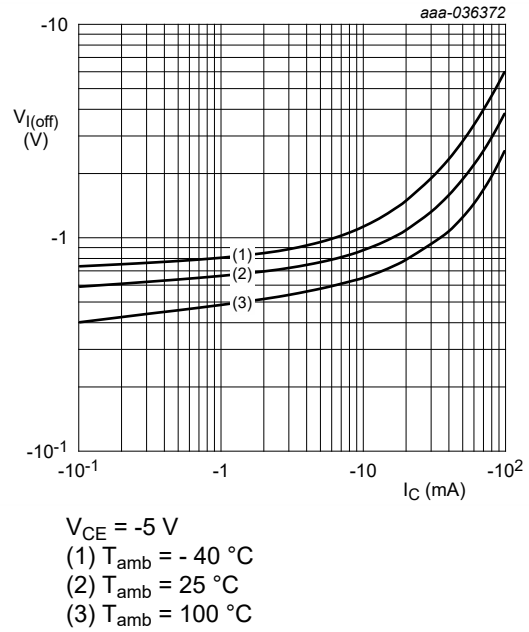


Fig. 12. TR2 (PNP): Off-state input voltage as a function of collector current; typical values

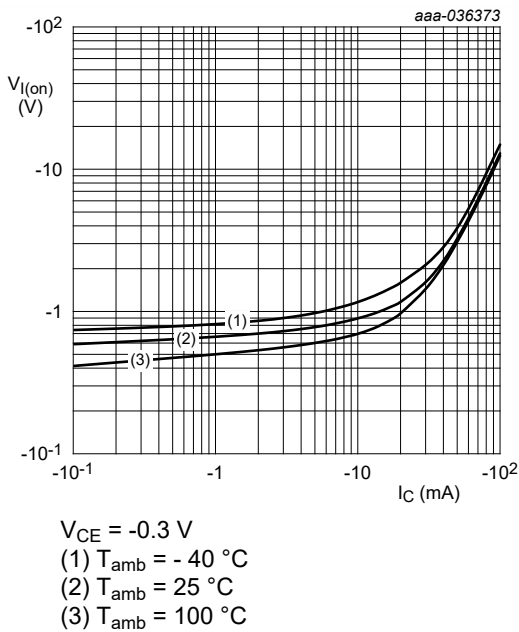


Fig. 13. TR2 (PNP): On-state input voltage as a function of collector current; typical values

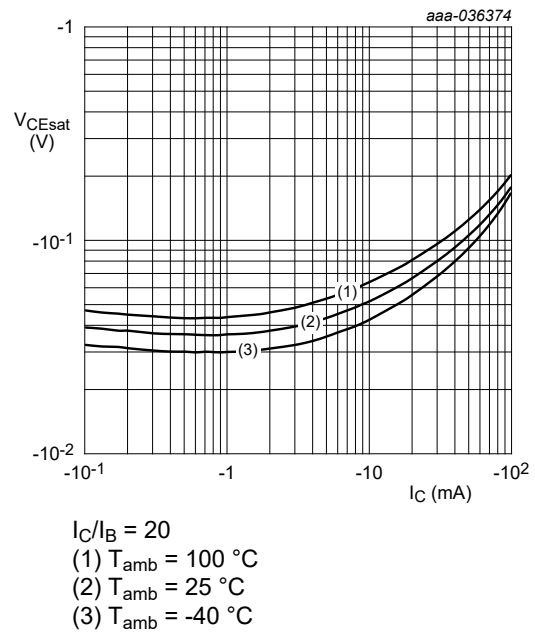
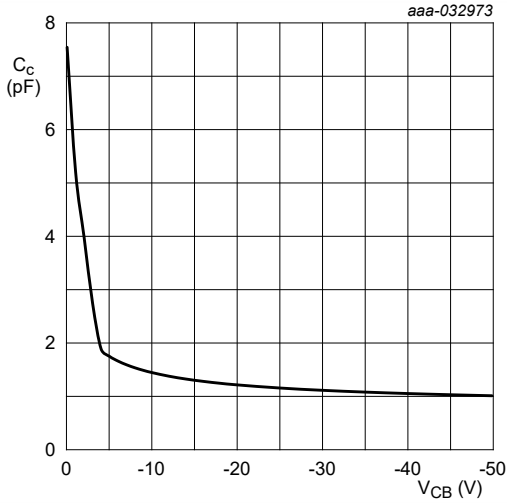
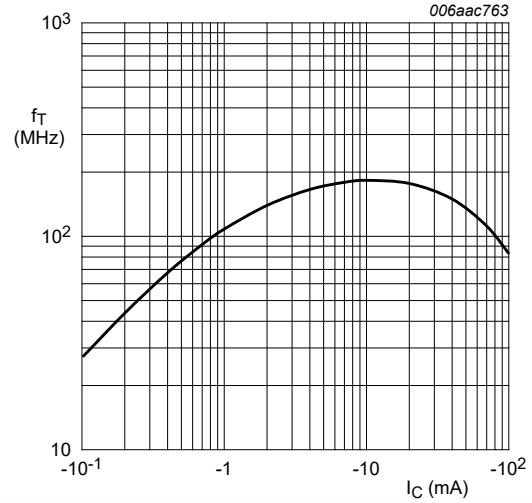


Fig. 14. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values



$f = 1$ MHz
 $T_{amb} = 25$ °C

Fig. 15. TR2 (PNP): Collector capacitance as a function of collector-base voltage; typical values



$f = 100$ MHz
 $T_{amb} = 25$ °C
 $V_{CE} = -5$ V

Fig. 16. TR2 (PNP): Transition frequency as a function of collector current; typical values of built-in transistor

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)

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

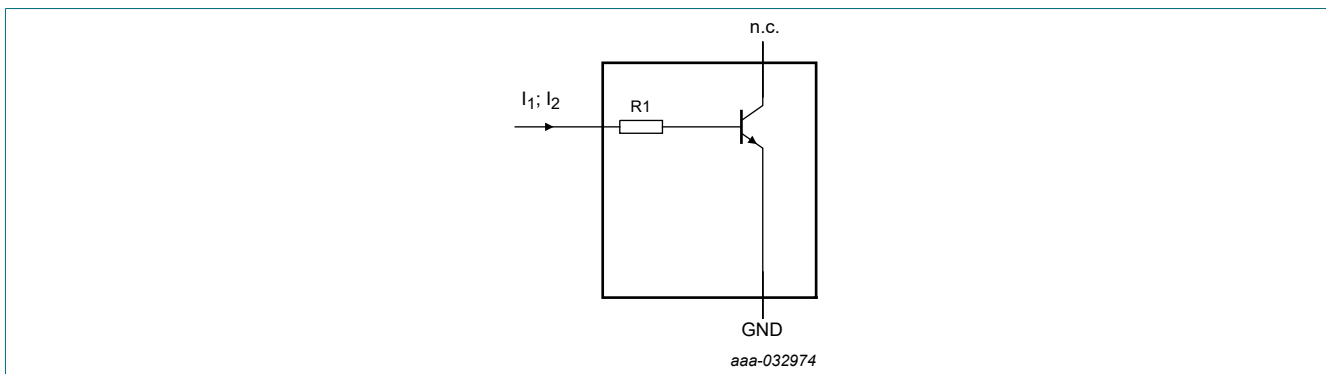


Fig. 17. TR1 (NPN): Resistor test circuit

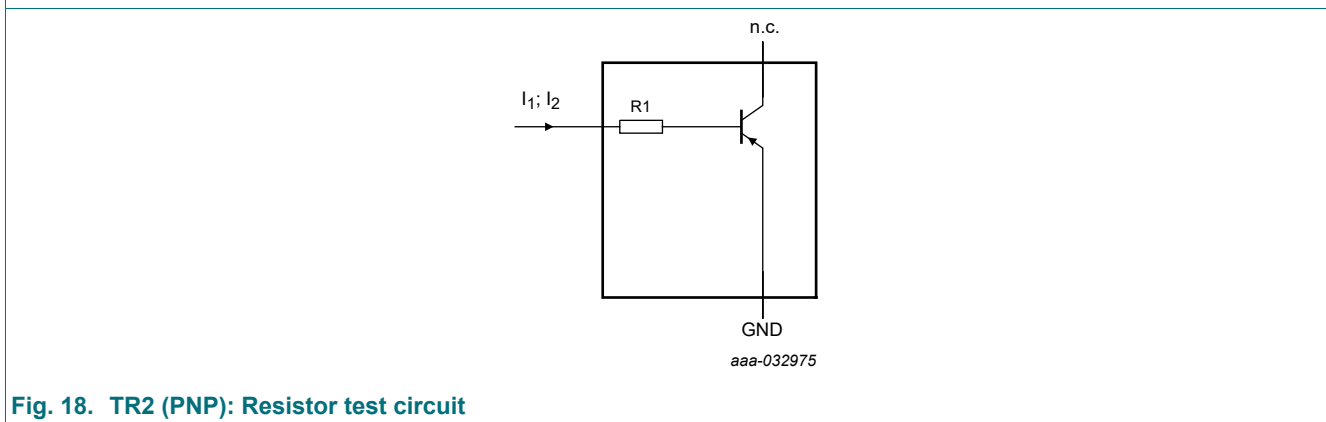


Fig. 18. TR2 (PNP): Resistor test circuit

Resistor test conditions

Table 8. Resistor test conditions

PUMD6	R1 (kΩ)	R2 (kΩ)	Test conditions	
			I ₁	I ₂
TR1 (NPN)	4.7	open	600 μA	700 μA
TR2 (PNP)	4.7	open	-600 μA	-700 μA

12. Package outline

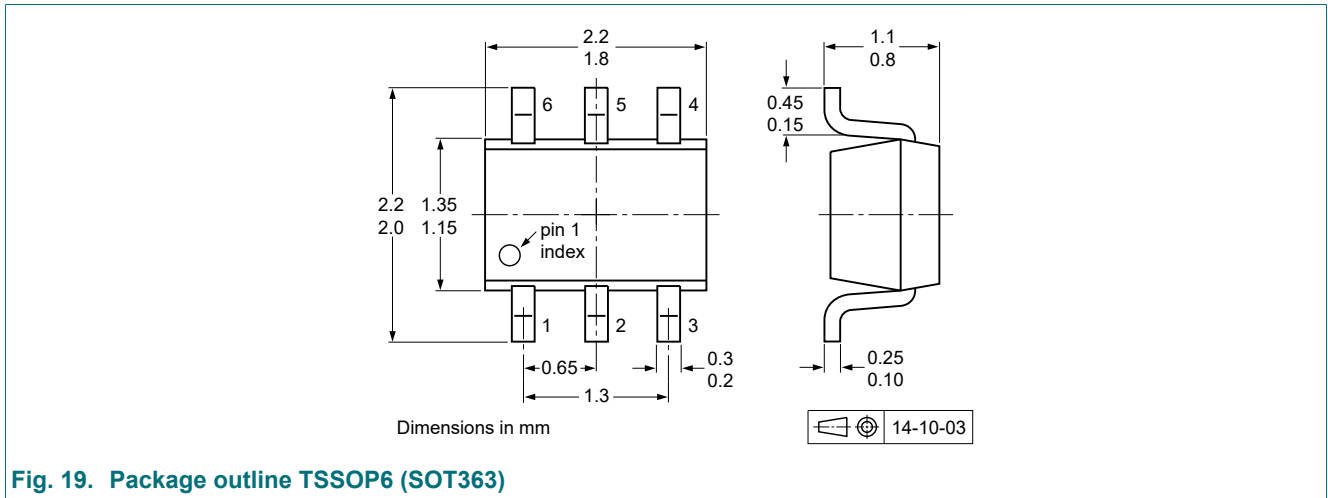


Fig. 19. Package outline TSSOP6 (SOT363)

13. Soldering

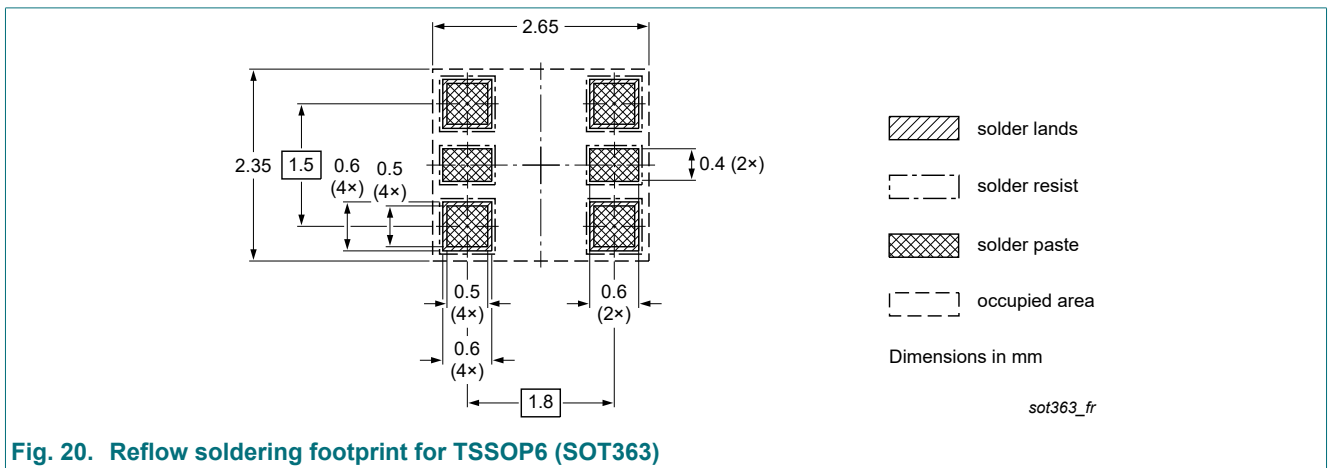


Fig. 20. Reflow soldering footprint for TSSOP6 (SOT363)

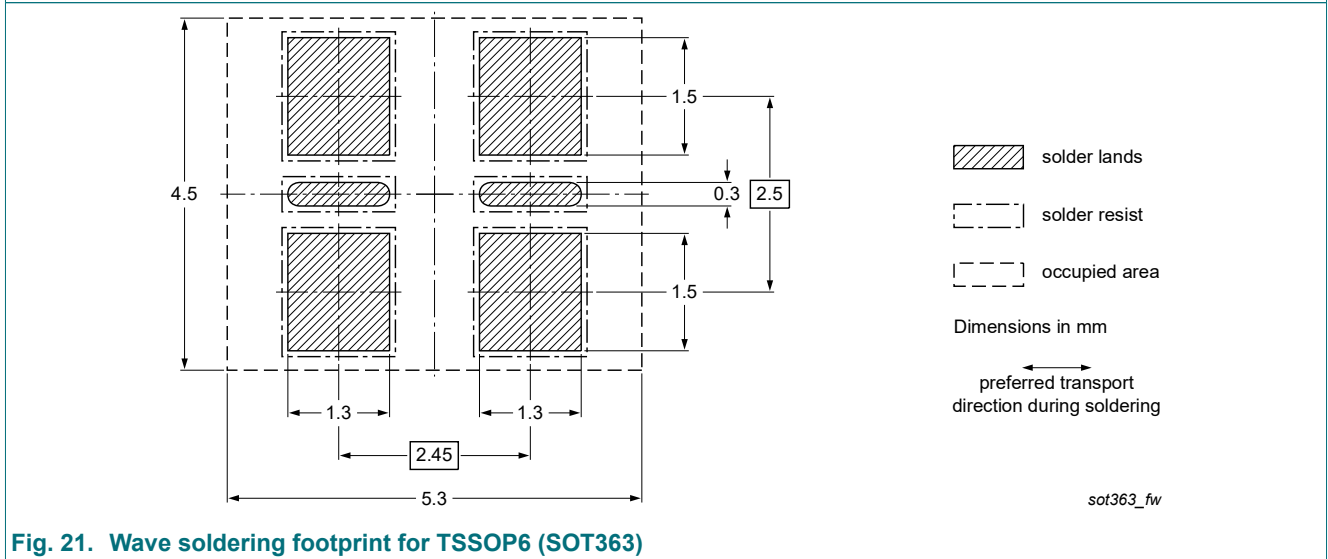


Fig. 21. Wave soldering footprint for TSSOP6 (SOT363)

14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PUMD6 v.3	20230427	Product data sheet	-	PUMD6_PEMD6 v.2
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.			
PUMD6_PEMD6 v.2	20040407	Product data sheet	-	PUMD6_PEMD6 v.1
PUMD6_PEMD6 v.1	20031104	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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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