



# PUMD6H

50 V, 100 mA NPN/PNP Resistor-Equipped double Transistor;  
R1 = 4.7 k $\Omega$ , R2 = open

22 March 2021

Product data sheet

## 1. General description

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

NPN/NPN complement: PUMH7H

PNP/PNP complement: PUMB3H

## 2. Features and benefits

- 100 mA output current capability
- Built-in resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- High-temperature applications up to 175 °C

## 3. Applications

- Digital applications
- Cost saving alternative for BC847 / BC857 series in digital applications
- Controlling IC inputs
- Switching loads

## 4. Quick reference data

Table 1. Quick reference data

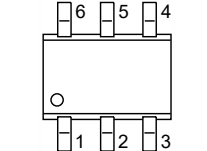
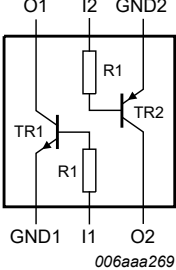
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor, for the PNP transistor with negative polarity</b>						
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	50	V
I <sub>O</sub>	output current		-	-	100	mA
R1	bias resistor 1	T <sub>amb</sub> = 25 °C	[1]	4.7	6.1	k $\Omega$

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

50 V, 100 mA NPN/PNP Resistor-Equipped double Transistor; R1 = 4.7 k $\Omega$ , R2 = open

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	GND1	GND (emitter) TR1	 <p>TSSOP6 (SOT363)</p>	 <p>006aaa269</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
PUMD6H	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]
PUMD6H	7G%

[1] % = placeholder for manufacturing site code

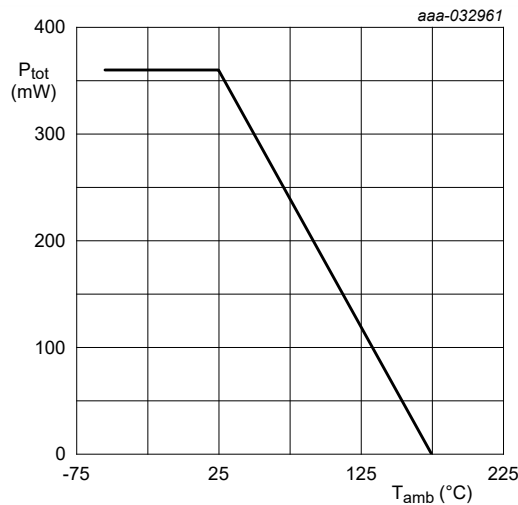
## 8. Limiting values

**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
<b>Per transistor, for the PNP transistor with negative polarity</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		-	7	V
V <sub>I</sub>	input voltage			-7	30	V
I <sub>O</sub>	output current			-	100	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	240	mW
<b>Per device</b>						
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	360	mW
T <sub>j</sub>	junction temperature			-	175	°C
T <sub>amb</sub>	ambient temperature			-55	175	°C
T <sub>stg</sub>	storage temperature			-65	175	°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

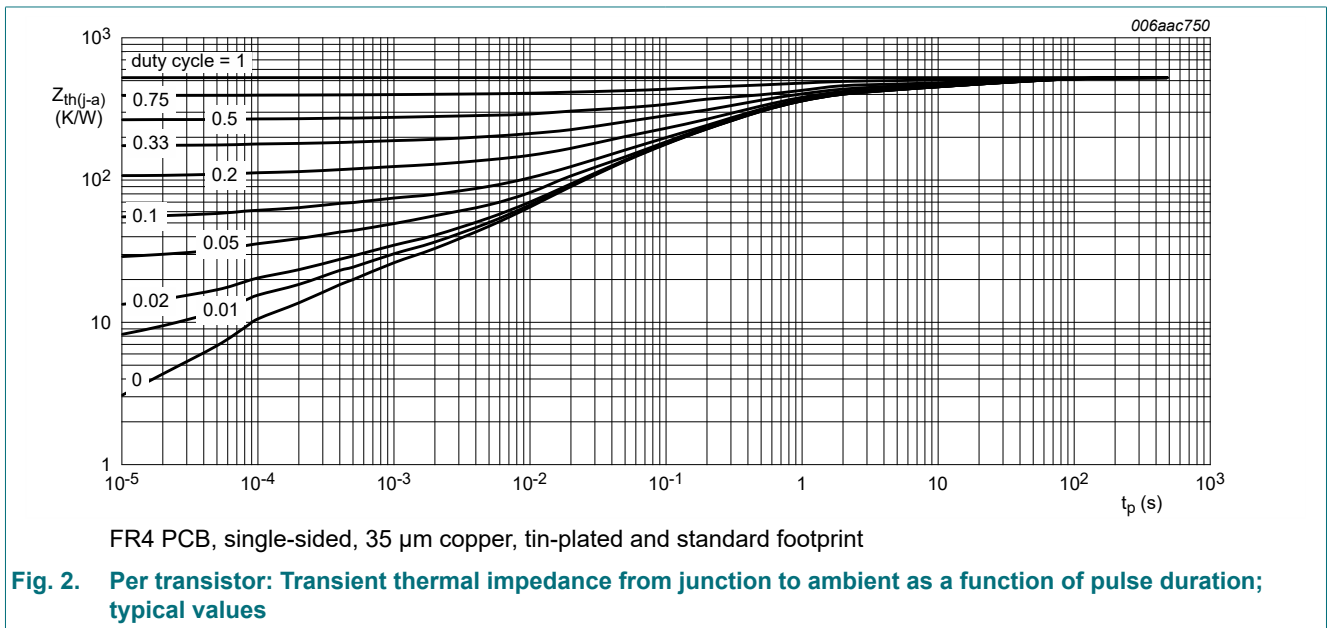
**Fig. 1. Per device: Power derating curve**

## 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
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	230	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 Printed-Circuit Board (PCB), single-sided, 35 μm copper, tin-plated and standard footprint.



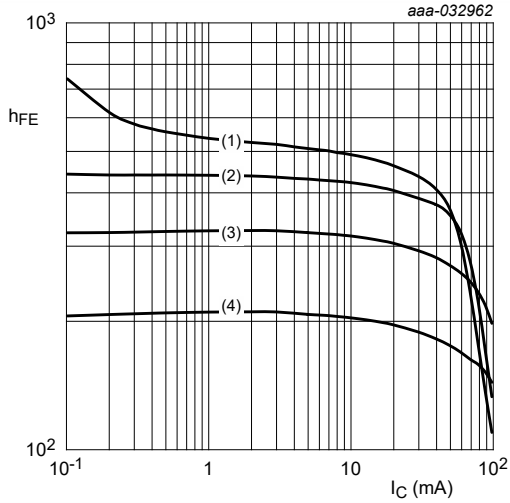
## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Per transistor, for the PNP transistor with negative polarity</b>							
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100 \mu\text{A}$ ; $I_E = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	50	-	-	V	
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2 \text{ mA}$ ; $I_B = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	50	-	-	V	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	100	nA	
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 30 \text{ V}$ ; $I_B = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	100	nA	
		$V_{CE} = 30 \text{ V}$ ; $I_B = 0 \text{ A}$ ; $T_{\text{amb}} = 150 \text{ }^\circ\text{C}$	-	-	5	$\mu\text{A}$	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 7 \text{ V}$ ; $I_C = 0 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	100	nA	
$h_{FE}$	DC current gain	$V_{CE} = 5 \text{ V}$ ; $I_C = 1 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	200	-	-		
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10 \text{ mA}$ ; $I_B = 0.5 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	100	mV	
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5 \text{ V}$ ; $I_C = 100 \mu\text{A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	585	500	mV	
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3 \text{ V}$ ; $I_C = 10 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	1.3	0.88	-	V	
R1	bias resistor 1	$T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	3.3	4.7	6.1	kΩ
<b>TR1 (NPN)</b>							
$C_c$	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	$V_{CE} = 5 \text{ V}$ ; $I_C = 10 \text{ mA}$ ; $f = 100 \text{ MHz}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[2]	230	-	MHz	
<b>TR2 (PNP)</b>							
$C_c$	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	$V_{CE} = -5 \text{ V}$ ; $I_C = -10 \text{ mA}$ ; $f = 100 \text{ MHz}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[2]	180	-	MHz	

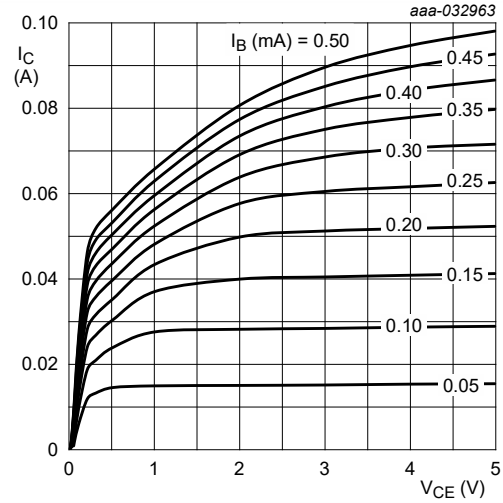
[1] See section "Test information" for resistor calculation and test conditions

[2] Characteristics of built-in transistor



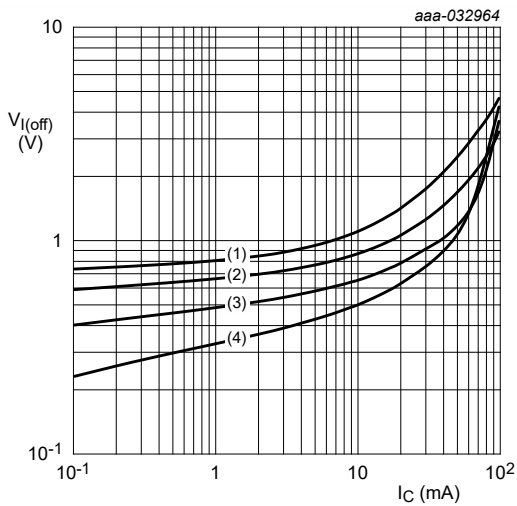
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 175^\circ C$   
 (2)  $T_{amb} = 150^\circ C$   
 (3)  $T_{amb} = 25^\circ C$   
 (4)  $T_{amb} = -40^\circ C$

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



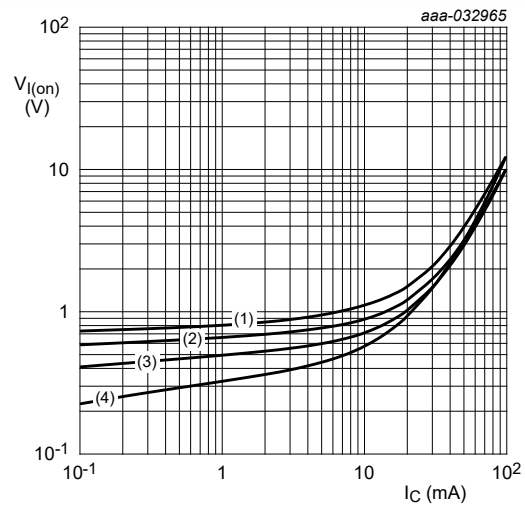
$T_{amb} = 25^\circ C$

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



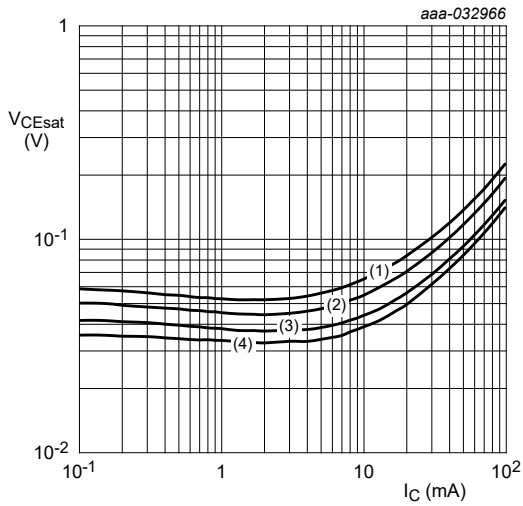
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -40^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 100^\circ C$   
 (4)  $T_{amb} = 175^\circ C$

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



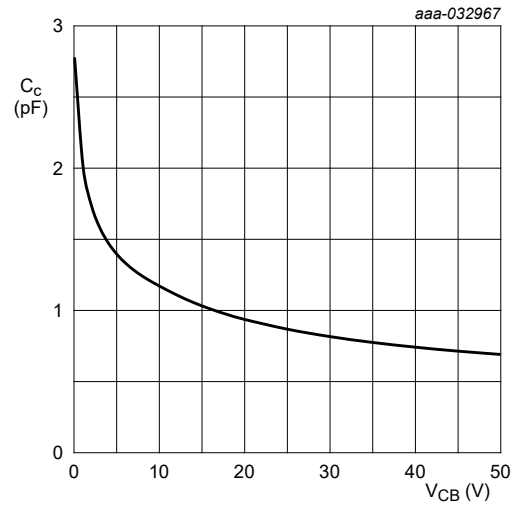
$V_{CE} = 0.3\text{ V}$   
 (1)  $T_{amb} = -40^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 100^\circ C$   
 (4)  $T_{amb} = 175^\circ C$

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



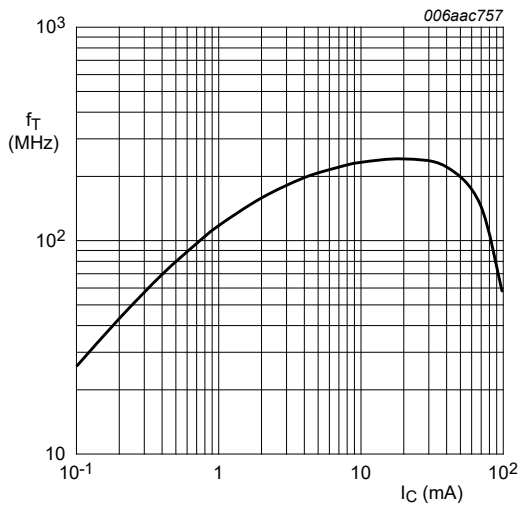
$I_C/I_B = 20$   
 (1)  $T_{amb} = 175^\circ\text{C}$   
 (2)  $T_{amb} = 100^\circ\text{C}$   
 (3)  $T_{amb} = 25^\circ\text{C}$   
 (4)  $T_{amb} = -40^\circ\text{C}$

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



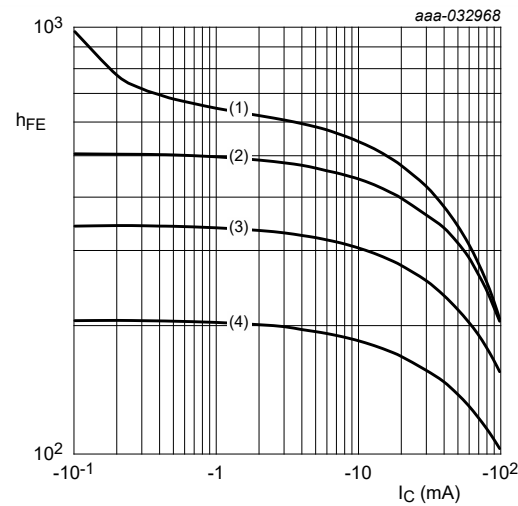
$f = 1\text{ MHz}$   
 $T_{amb} = 25^\circ\text{C}$

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)  $T_{amb} = 175^\circ\text{C}$   
 (2)  $T_{amb} = 100^\circ\text{C}$   
 (3)  $T_{amb} = 25^\circ\text{C}$   
 (4)  $T_{amb} = -40^\circ\text{C}$

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

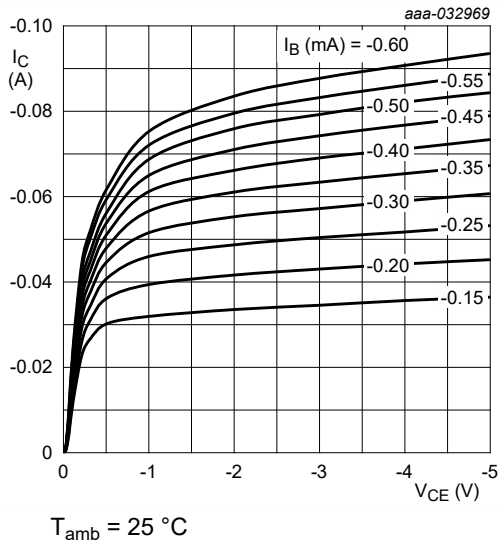


Fig. 11. TR2 (PNP): Collector current as a function of collector-emitter voltage; typical values

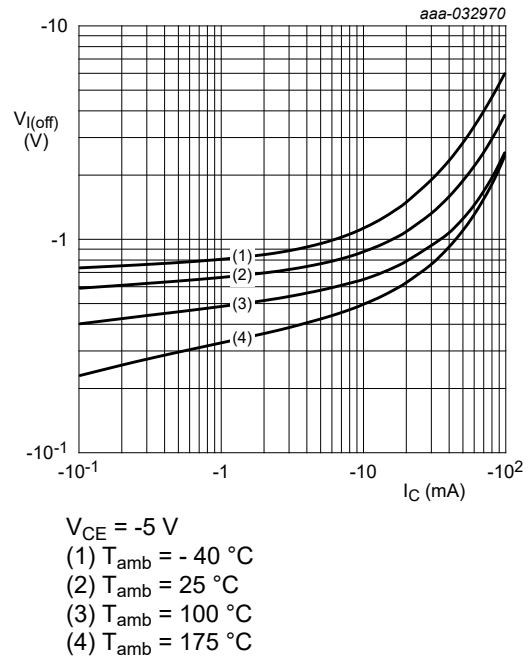


Fig. 12. TR2 (PNP): Off-state input voltage as a function of collector current; typical values

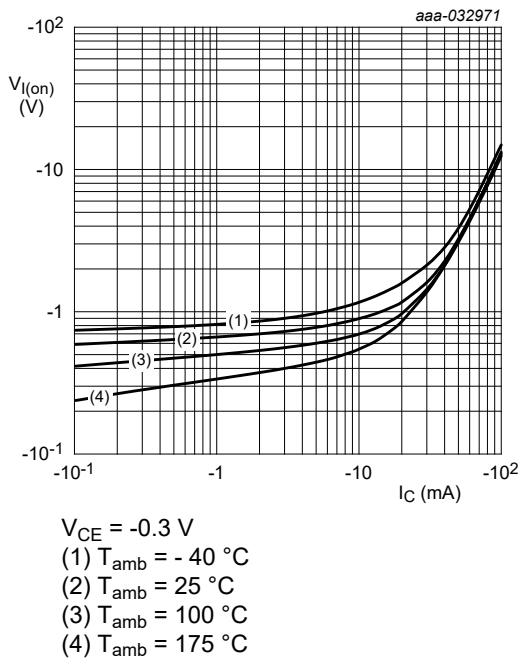


Fig. 13. TR2 (PNP): On-state input voltage as a function of collector current; typical values

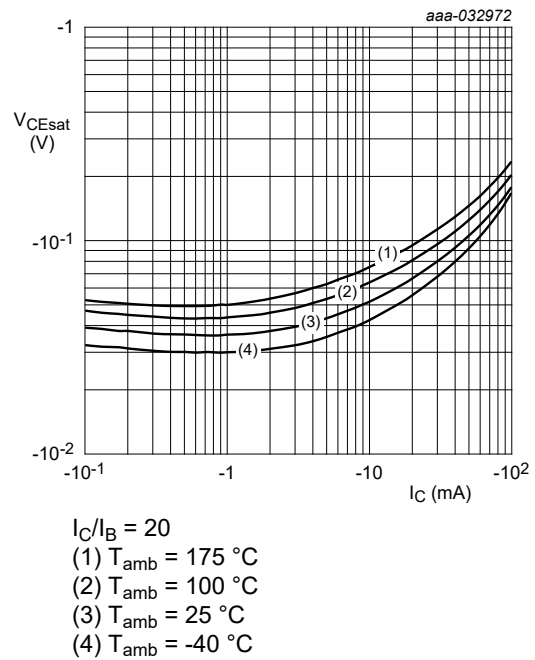
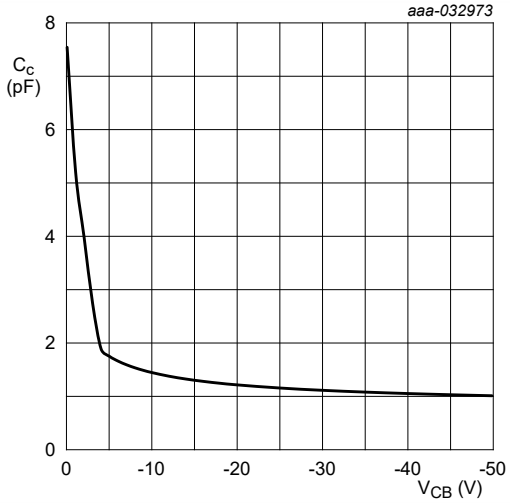


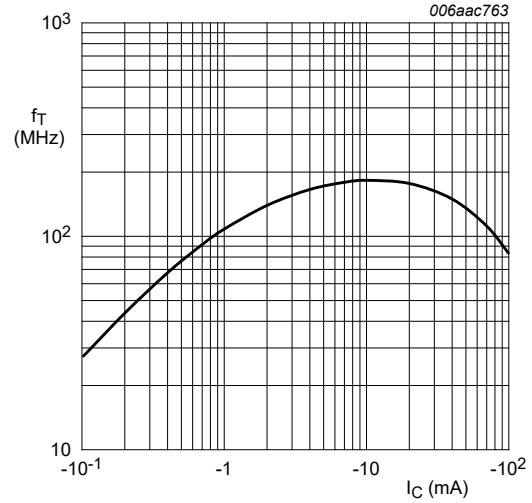
Fig. 14. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values





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

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



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

**Fig. 16. TR2 (PNP): 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)

$$R_1 = \frac{V(I_{I2}) - V(I_{I1})}{I_{I2} - I_{I1}}$$

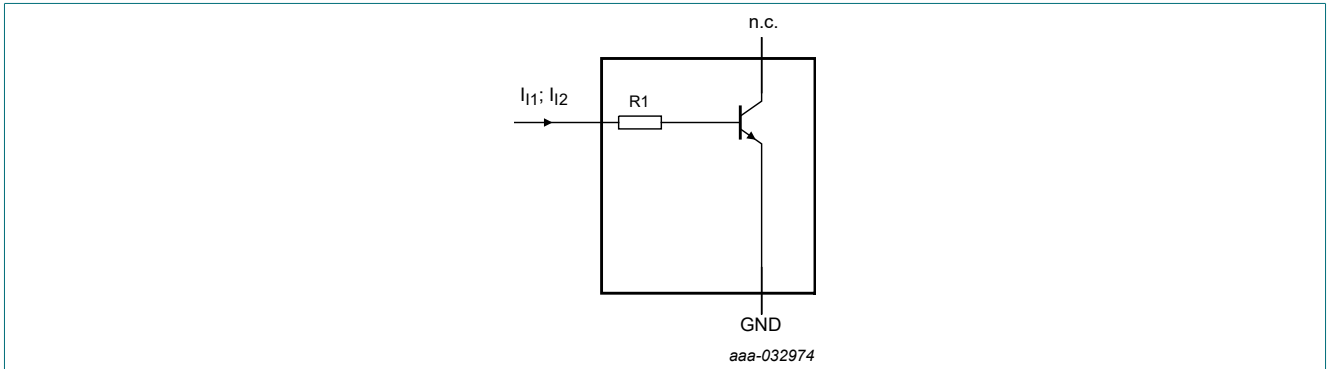


Fig. 17. TR1 (NPN): Resistor test circuit

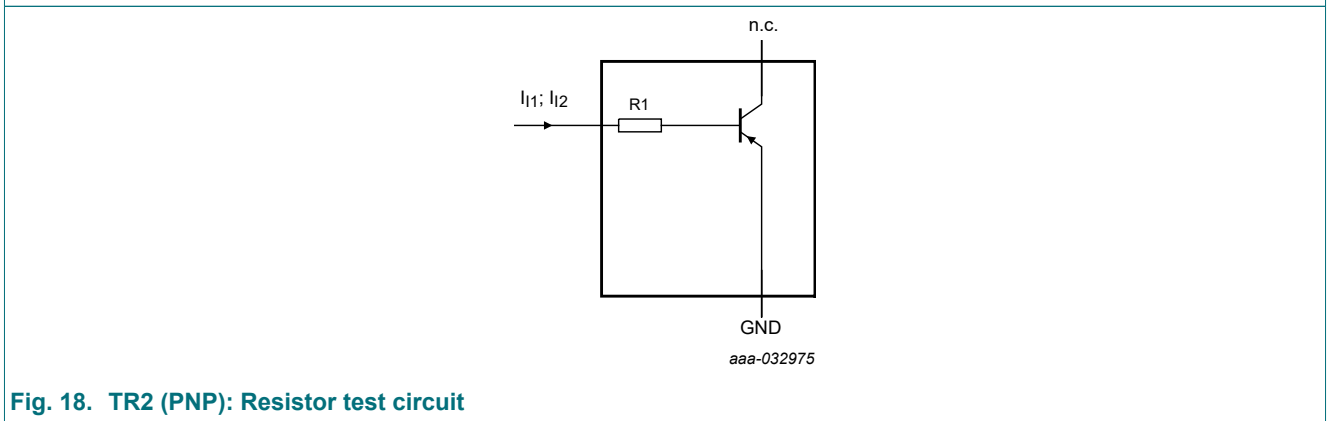


Fig. 18. TR2 (PNP): Resistor test circuit

### Resistor test conditions

Table 8. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions	
			I <sub>I1</sub>	I <sub>I2</sub>
<b>Per transistor, for the PNP transistor with negative polarity</b>				
PUMD6H	4.7	open	600 μA	700 μA

## 12. Package outline

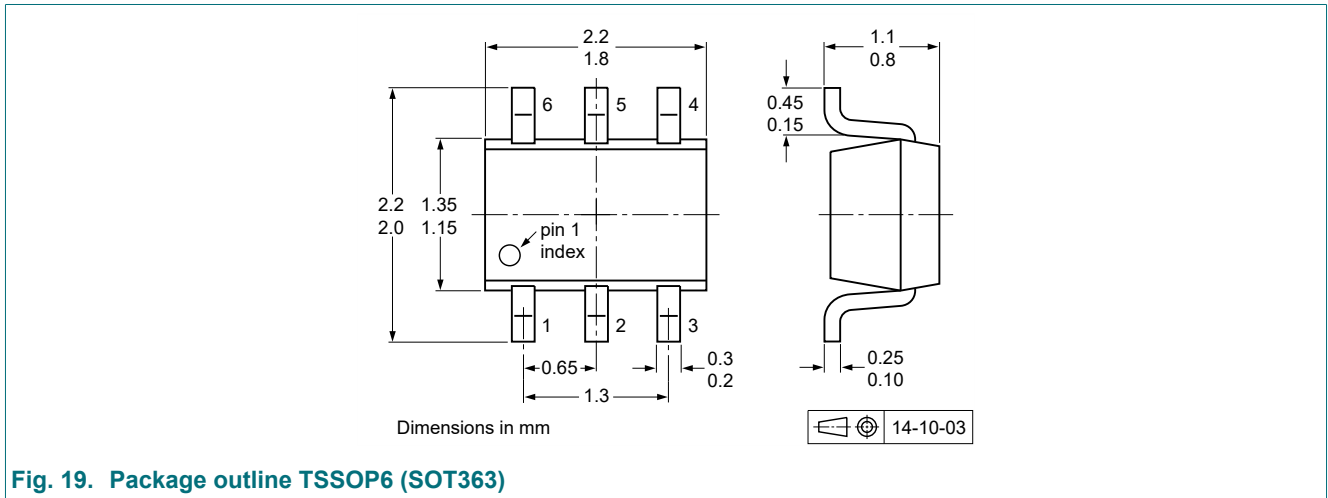


Fig. 19. Package outline TSSOP6 (SOT363)

## 13. Soldering

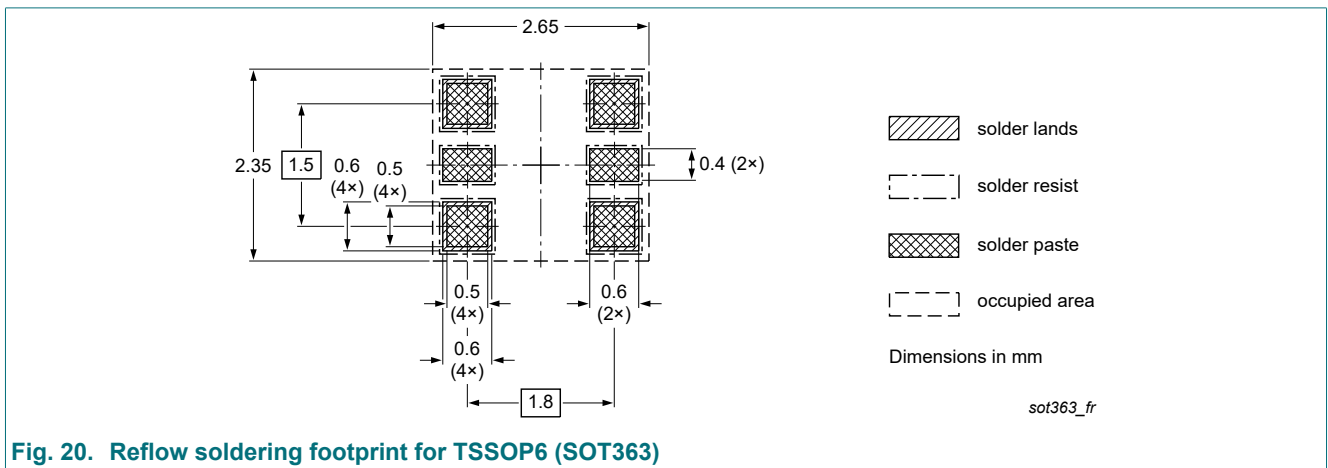


Fig. 20. Reflow soldering footprint for TSSOP6 (SOT363)

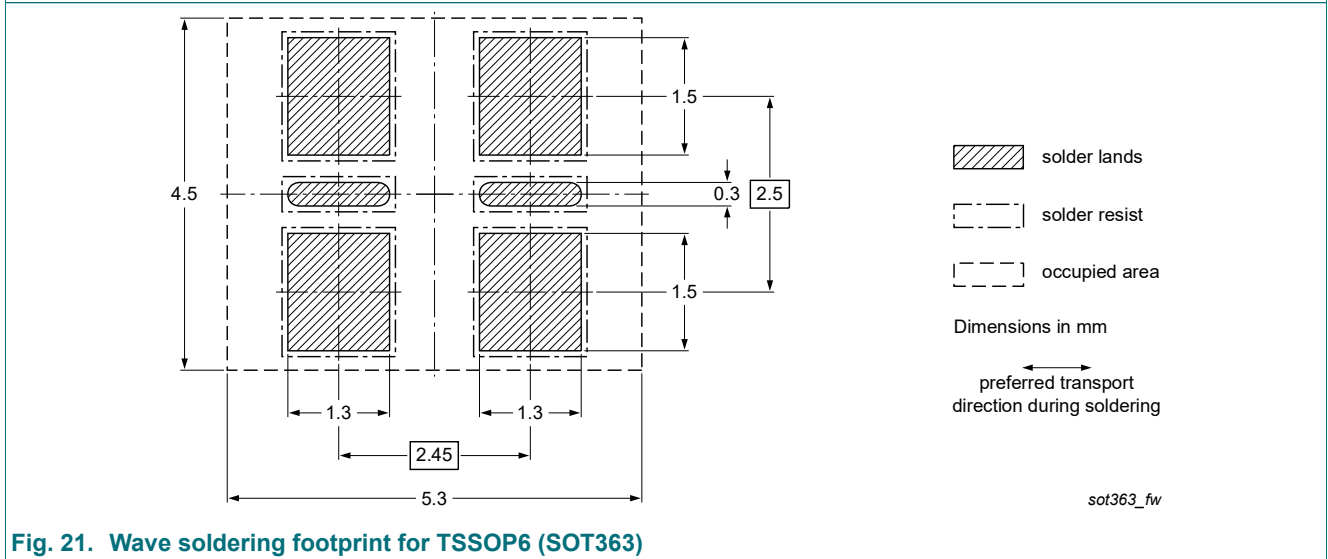


Fig. 21. Wave soldering footprint for TSSOP6 (SOT363)

### 14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PUMD6H v.1	20210322	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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 22 March 2021

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