



# PBL54003Y

40 V 500 mA PNP/NPN loadswitch double transistor

08 October 2024

Product data sheet

## 1. General description

PNP low  $V_{CEsat}$  transistor and NPN Resistor- Equipped Transistor (RET) in a very small SOT363 (SC-88) Surface-Mounted Device (SMD) plastic package.

## 2. Features and benefits

- Low  $V_{CEsat}$  and resistor-equipped transistor in one package
- Low threshold voltage (<1 V) compared to MOSFET
- Low drive power required
- Space-saving solution
- Reduction of component count

## 3. Applications

- Supply line switches
- Battery charger switches
- High-side switches for LEDs, drivers and backlights
- Portable equipment

## 4. Quick reference data

Table 1. Quick reference data

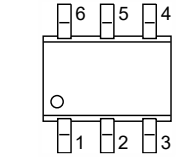
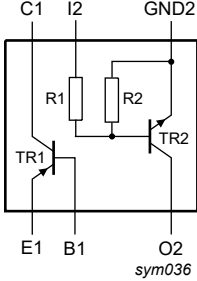
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1; PNP low <math>V_{CEsat}</math> transistor</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	-40	V
$I_C$	collector current		-	-	-500	mA
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -500$ mA; $I_B = -50$ mA; $T_{amb} = 25$ °C [1]	-	440	700	mΩ
<b>TR2; NPN resistor-equipped transistor</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	50	V
$I_O$	output current		-	-	100	mA
R1	bias resistor 1 (input)	[2]	7	10	13	kΩ
R2/R1	bias resistor ratio	[2]	0.8	1	1.2	

[1] Pulse test:  $t_p \leq 300$  μs;  $\delta \leq 0.02$

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

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E1	emitter TR1	 <p>TSSOP6 (SOT363)</p>	
2	B1	base TR1		
3	O2	output (collector) TR2		
4	GND2	GND (emitter) TR2		
5	I2	input (base) TR2		
6	C1	collector TR1		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
<a href="#">PBL54003Y</a>	TSSOP6	plastic, surface-mounted package; 6 leads; 0.65 mm pitch; 2.1 mm x 1.25 mm x 0.95 mm body	<a href="#">SOT363</a>

## 7. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
PBL54003Y	S3%

[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>TR1; PNP low <math>V_{CEsat}</math> transistor</b>					
$V_{CBO}$	collector-base voltage	open emitter	-	-40	V
$V_{CEO}$	collector-emitter voltage	open base	-	-40	V
$V_{EBO}$	emitter-base voltage	open collector	-	-6	V
$I_C$	collector current		-	-500	mA
$I_{CM}$	peak collector current	$t_p \leq 1$ ms; single pulse	-	-1	A
$I_B$	base current		-	-50	mA
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms	-	-100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	200	mW
<b>TR2; NPN resistor-equipped 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	-	40	V
		negative	-	-10	V
$I_O$	output current		-	100	mA
$I_{CM}$	peak collector current	$t_p \leq 1$ ms; single pulse	-	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	200	mW
<b>Per device</b>					
$P_{tot}$	total power dissipation		-	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  $\mu$ m copper, tin-plated and standard footprint.

## 9. Thermal characteristics

**Table 6. Thermal characteristics**

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

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

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1; PNP low <math>V_{CEsat}</math> transistor</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -40\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-100	nA
		$V_{CB} = -40\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^\circ\text{C}$	-	-	-50	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5\text{ V}; I_C = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-100	nA
$h_{FE}$	DC current gain	$V_{CE} = -2\text{ V}; I_C = -10\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	200	-	-	
		$V_{CE} = -2\text{ V}; I_C = -100\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$ [1]	150	-	-	
		$V_{CE} = -2\text{ V}; I_C = -500\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$ [1]	40	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -10\text{ mA}; I_B = -0.5\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-50	mV
		$I_C = -100\text{ mA}; I_B = -5\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-130	mV
		$I_C = -200\text{ mA}; I_B = -10\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-200	mV
		$I_C = -500\text{ mA}; I_B = -50\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$ [1]	-	-	-350	mV
$R_{CEsat}$	collector-emitter saturation resistance	[1]	-	440	700	m $\Omega$
$V_{BEsat}$	base-emitter saturation voltage	[1]	-	-	-1.2	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = -2\text{ V}; I_C = -100\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$ [1]	-	-	-1.1	V
$C_c$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	10	pF
$f_T$	transition frequency	$V_{CE} = -5\text{ V}; I_C = -100\text{ mA}; f = 100\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	100	300	-	MHz
<b>TR2; NPN resistor-equipped transistor</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	100	nA
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	1	$\mu\text{A}$
		$V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ }^\circ\text{C}$	-	-	50	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	400	$\mu\text{A}$
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 5\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	30	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 0.5\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	150	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	1.1	0.8	V
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V}; I_C = 10\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	2.5	1.8	-	V
R1	bias resistor 1 (input)	[2]	7	10	13	k $\Omega$
R2/R1	bias resistor ratio	[2]	0.8	1	1.2	
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	2.5	pF

[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$

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

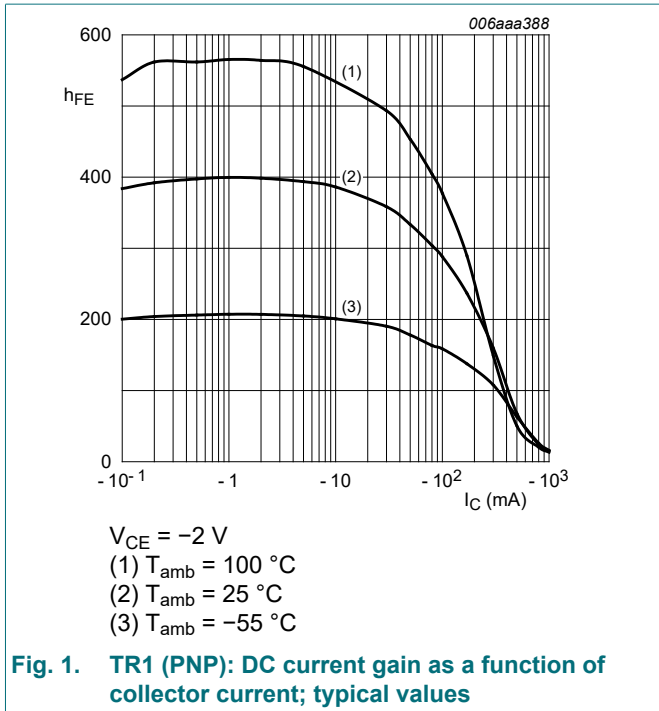


Fig. 1. TR1 (PNP): DC current gain as a function of collector current; typical values

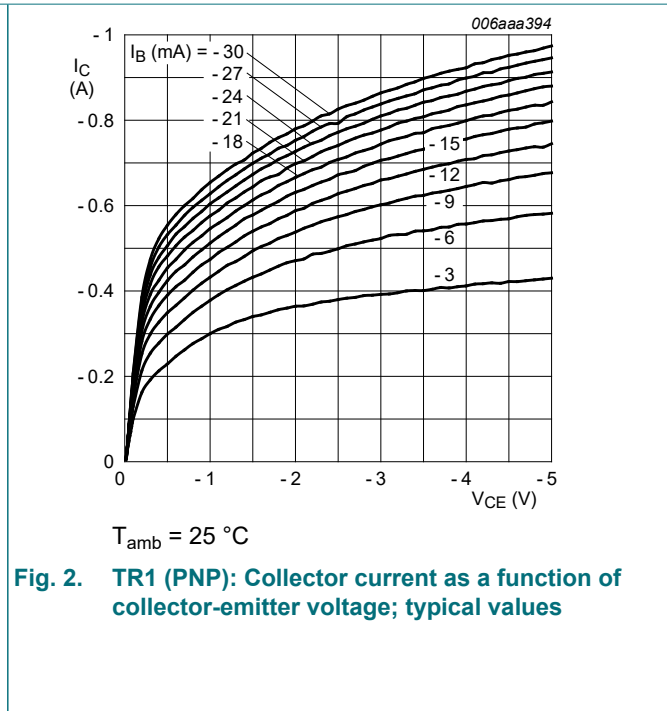


Fig. 2. TR1 (PNP): Collector current as a function of collector-emitter voltage; typical values

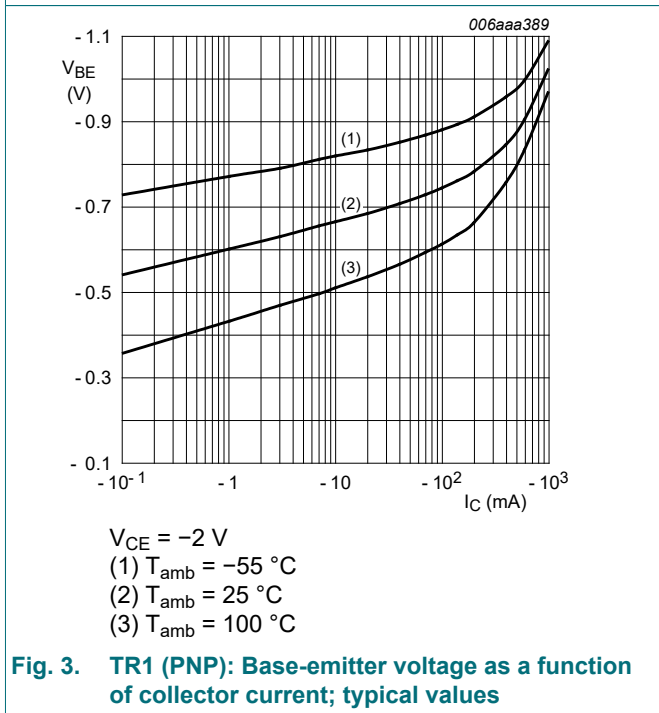


Fig. 3. TR1 (PNP): Base-emitter voltage as a function of collector current; typical values

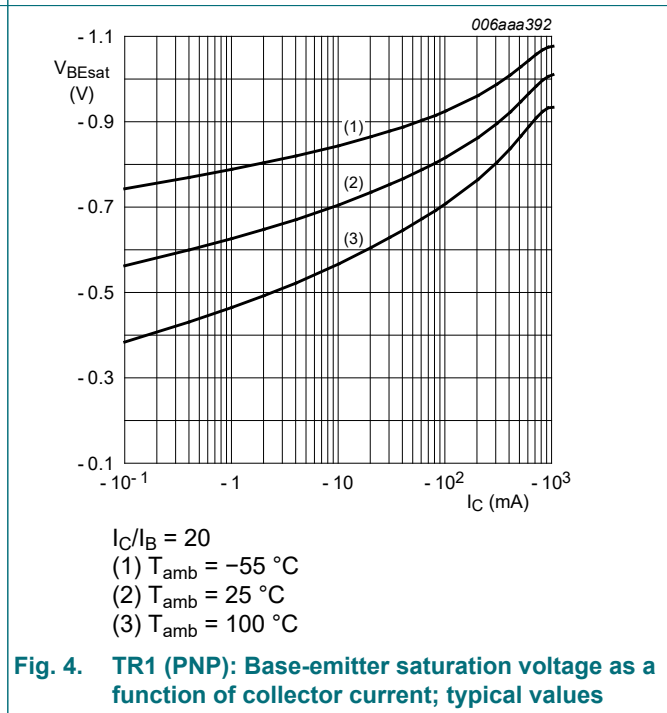
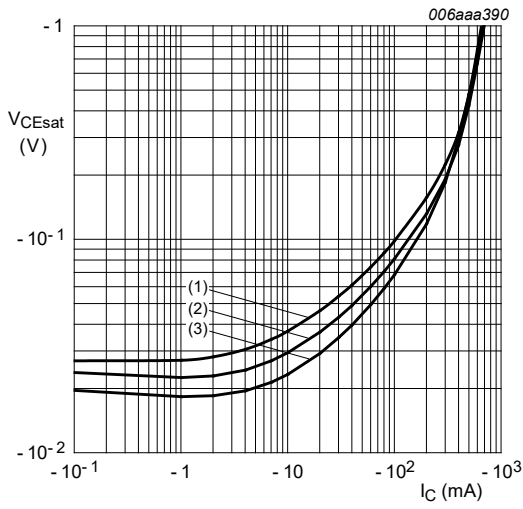
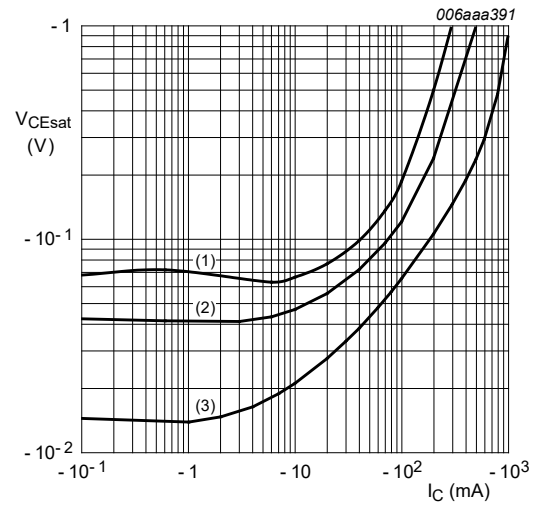


Fig. 4. TR1 (PNP): Base-emitter saturation voltage as a function of collector current; typical values



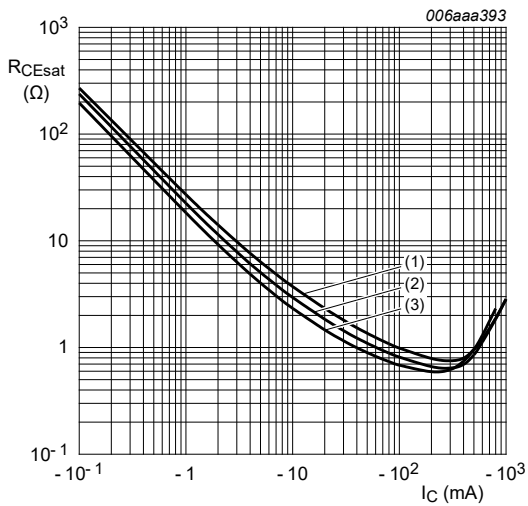
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 5. TR1 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values**



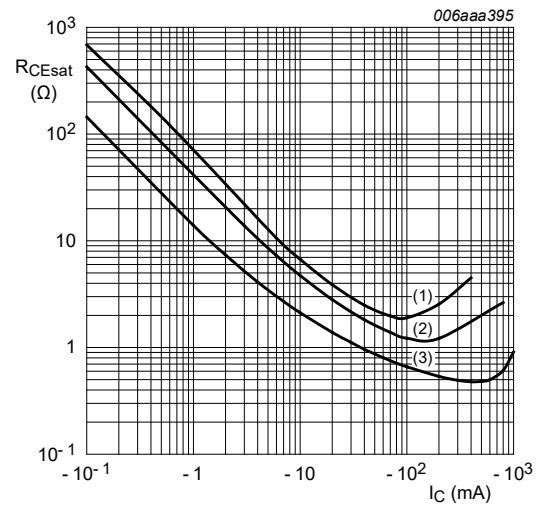
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig. 6. TR1 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values**



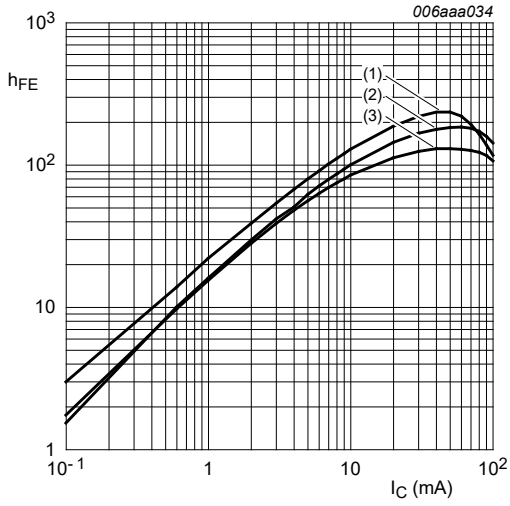
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



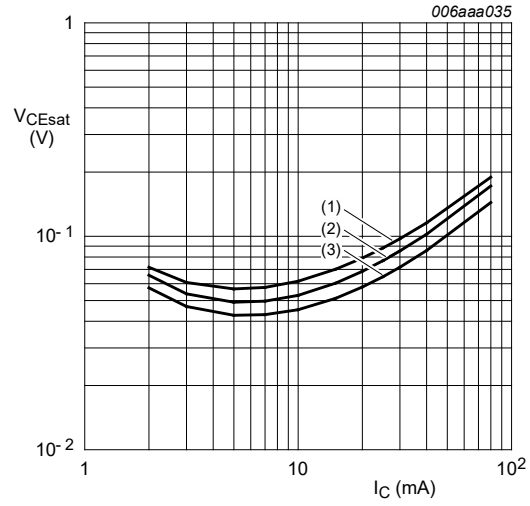
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig. 8. TR1 (PNP): Collector-emitter saturation resistance as a function of collector current; typical values**



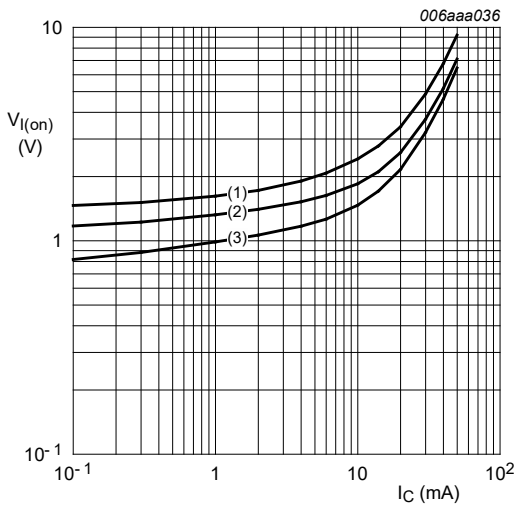
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -40\text{ °C}$

**Fig. 9. TR2 (NPN): DC current gain as a function of collector current; typical values**



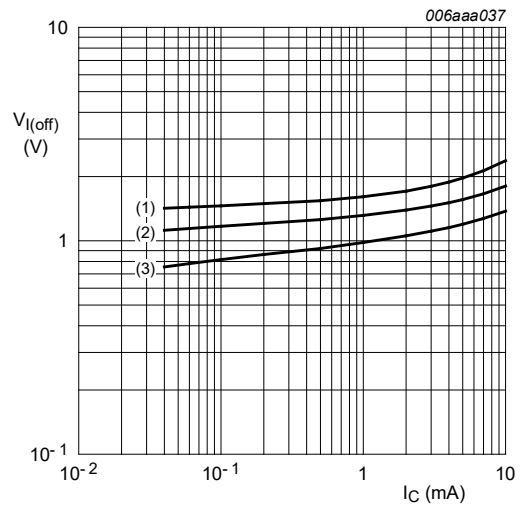
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -40\text{ °C}$

**Fig. 10. TR2 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values**



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

**Fig. 11. TR2 (NPN): On-state input voltage as a function of collector current; typical values**



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

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

## 11. Package outline

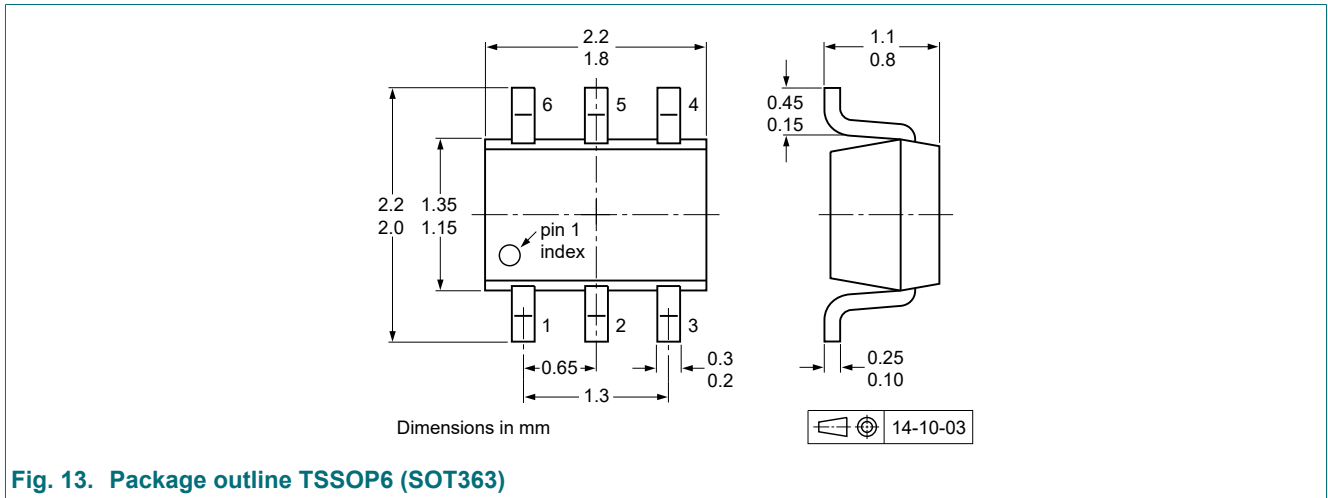


Fig. 13. Package outline TSSOP6 (SOT363)

## 12. Soldering

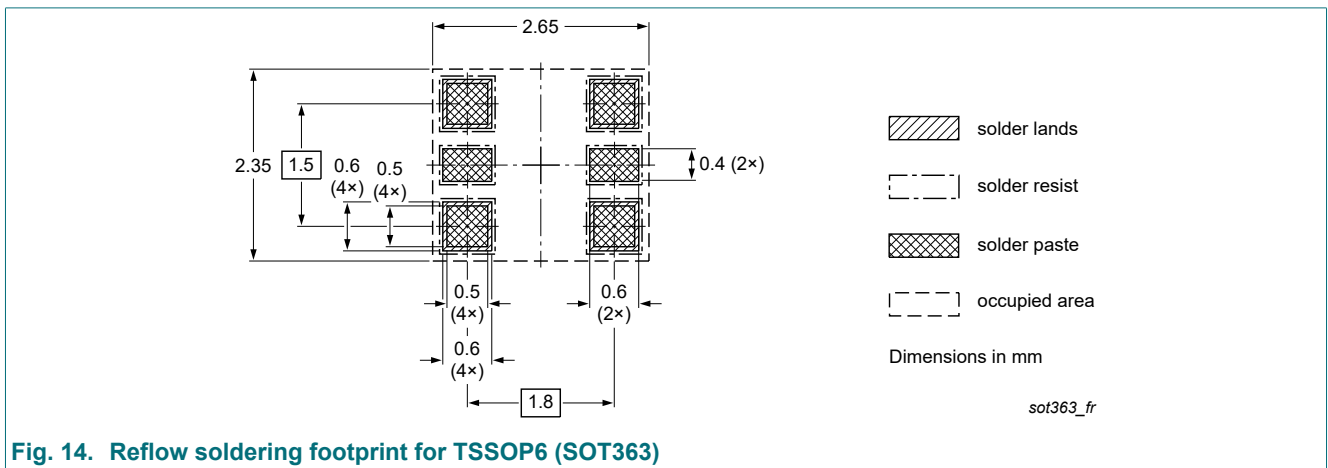


Fig. 14. Reflow soldering footprint for TSSOP6 (SOT363)

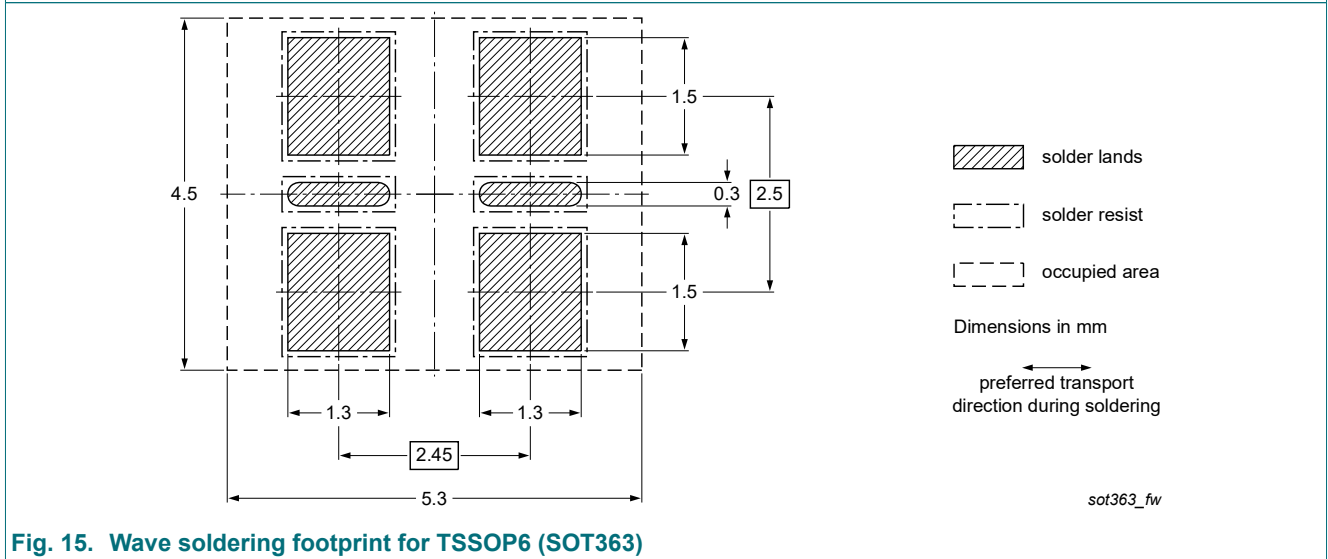


Fig. 15. Wave soldering footprint for TSSOP6 (SOT363)



## 13. Revision history

**Table 8. Revision history**

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBL54003Y v.4	20241008	Product data sheet	-	PBL54003Y_PBL54003V_3
Modifications:	<ul style="list-style-type: none"><li>Family data sheet reduced to single type data sheet.</li><li>Product changed to non automotive. Please refer to the automotive product(s) with -Q.</li></ul>			
PBL54003Y_PBL54003V_3	20090213	Product data sheet	-	PBL54003Y_PBL54003V_2
PBL54003Y_PBL54003V_2	20050714	Product data sheet	-	PBL54003Y_PBL54003V_1
PBL54003Y_PBL54003V_1	20041206	Product data sheet	-	

## 14. 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.
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