



# PMBT3904YS

40 V, 200 mA NPN/NPN general-purpose double transistor

25 June 2019

Product data sheet

## 1. General description

NPN/NPN general-purpose double transistor in a SOT363 (SC-88) very small Surface-Mounted Device (SMD) plastic package.

## 2. Features and benefits

- General-purpose double transistor
- Board-space reduction

## 3. Applications

- General-purpose switching and amplification

## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$V_{CE0}$	collector-emitter voltage	open base	-	-	40	V
$I_C$	collector current		-	-	200	mA
$h_{FE}$	DC current gain	$V_{CE} = 1 \text{ V}; I_C = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	100	180	300	

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E1	emitter TR1	<p>TSSOP6 (SOT363)</p>	<p>sym020</p>
2	B1	base TR1		
3	C2	collector TR2		
4	E2	emitter TR2		
5	B2	base TR2		
6	C1	collector TR1		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMBT3904YS	TSSOP6	plastic surface-mounted package; 6 leads	SOT363

## 7. Marking

Table 4. Marking codes

Type number	Marking code[1]
PMBT3904YS	BC%

[1] % = placeholder for manufacturing site code

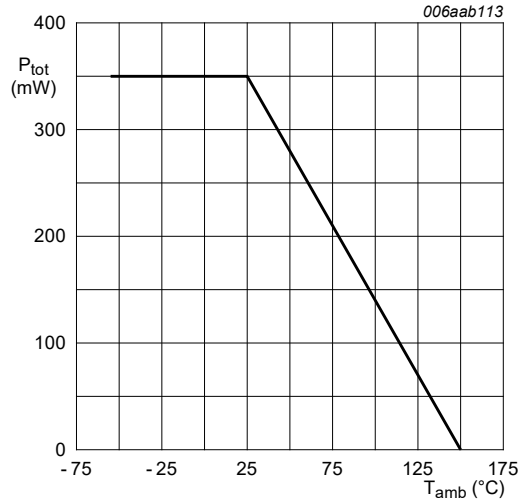
## 8. Limiting values

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		-	60	V
$V_{CEO}$	collector-emitter voltage	open base		-	40	V
$V_{EBO}$	emitter-base voltage	open collector		-	6	V
$I_C$	collector current			-	200	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms		-	200	mA
$I_{BM}$	peak base current			-	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	230	mW
<b>Per device</b>						
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	350	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 copper, tin-plated and standard footprint.



FR4 PCB, standard footprint

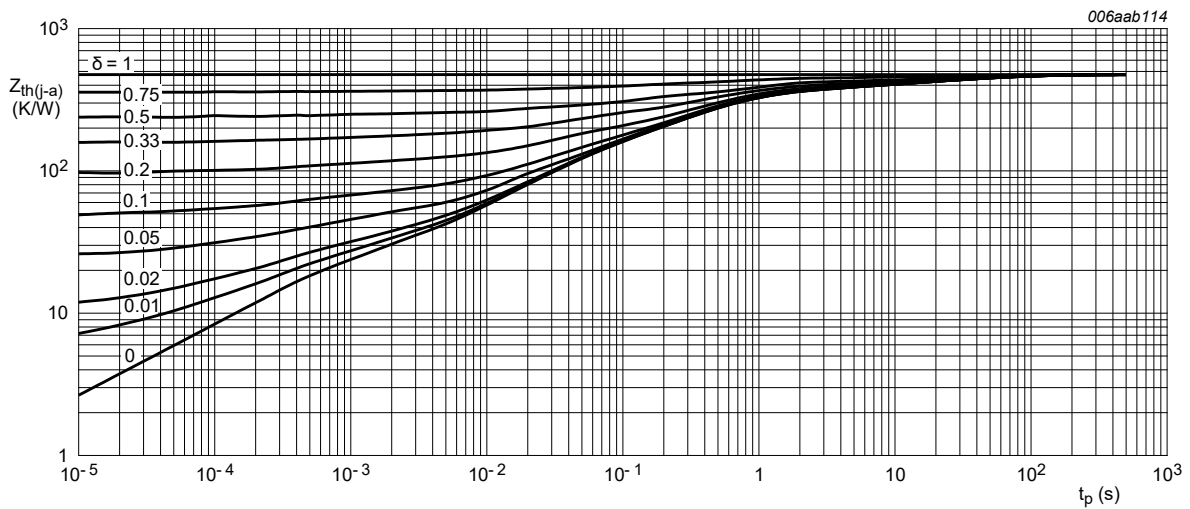
Fig. 1. Per device: Power derating curve

### 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Per transistor</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	543	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point			-	-	290	K/W
<b>Per device</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	357	K/W

[1] Device mounted on anFR4 PCB, single-sided copper, tin-plated and standard footprint.



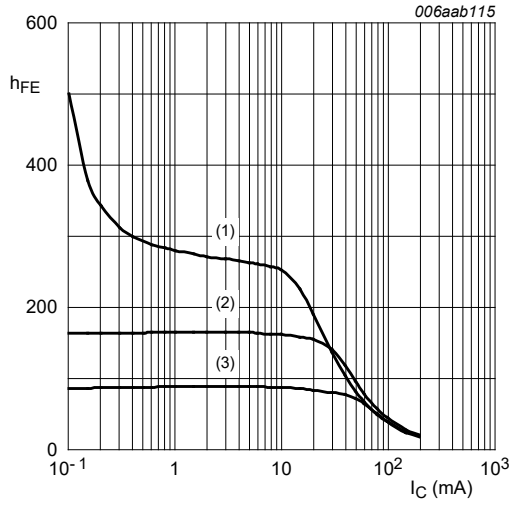
FR4 PCB, standard footprint

Fig. 2. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

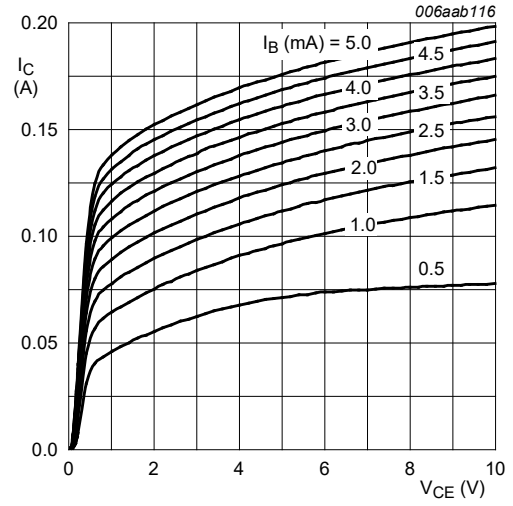
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Per transistor</b>							
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 30\text{ V}$ ; $I_E = 0\text{ A}$ ; $T_{amb} = 25\text{ °C}$	-	-	50	nA	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 6\text{ V}$ ; $I_C = 0\text{ A}$ ; $T_{amb} = 25\text{ °C}$	-	-	50	nA	
$h_{FE}$	DC current gain	$V_{CE} = 1\text{ V}$ ; $I_C = 0.1\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	60	180	-		
		$V_{CE} = 1\text{ V}$ ; $I_C = 1\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	80	180	-		
		$V_{CE} = 1\text{ V}$ ; $I_C = 10\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	100	180	300		
		$V_{CE} = 1\text{ V}$ ; $I_C = 50\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	60	105	-		
		$V_{CE} = 1\text{ V}$ ; $I_C = 100\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	30	50	-		
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10\text{ mA}$ ; $I_B = 1\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	-	75	200	mV	
		$I_C = 50\text{ mA}$ ; $I_B = 5\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	-	120	300	mV	
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 10\text{ mA}$ ; $I_B = 1\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	650	750	850	mV	
		$I_C = 50\text{ mA}$ ; $I_B = 5\text{ mA}$	-	850	950	mV	
$t_d$	delay time	$I_C = 10\text{ mA}$ ; $I_{Bon} = 1\text{ mA}$ ; $I_{Boff} = -1\text{ mA}$ ; $V_{CC} = 3\text{ V}$ ; $T_{amb} = 25\text{ °C}$	-	-	35	ns	
$t_r$	rise time		-	-	35	ns	
$t_{on}$	turn-on time		-	-	70	ns	
$t_s$	storage time		-	-	200	ns	
$t_f$	fall time		-	-	50	ns	
$t_{off}$	turn-off time		-	-	250	ns	
$C_c$	collector capacitance		$V_{CB} = 5\text{ V}$ ; $I_E = 0\text{ A}$ ; $i_e = 0\text{ A}$ ; $f = 1\text{ MHz}$	-	-	4	pF
$C_e$	emitter capacitance		$V_{EB} = 0.5\text{ V}$ ; $I_C = 0\text{ A}$ ; $i_c = 0\text{ A}$ ; $T_{amb} = 25\text{ °C}$	-	-	8	pF
$f_T$	transition frequency	$V_{CE} = 20\text{ V}$ ; $I_C = 10\text{ mA}$ ; $f = 100\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	300	-	-	MHz	
NF	noise figure	$V_{CE} = 5\text{ V}$ ; $I_C = 100\text{ }\mu\text{A}$ ; $R_S = 1\text{ k}\Omega$ ; $T_{amb} = 25\text{ °C}$ ; $f = 10\text{ Hz to }15.7\text{ kHz}$	-	-	5	dB	



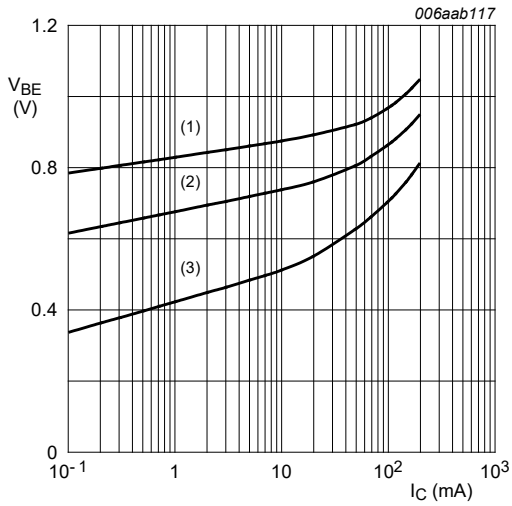
$V_{CE} = 1\text{ V}$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 3. DC current gain as a function of collector current; typical values**



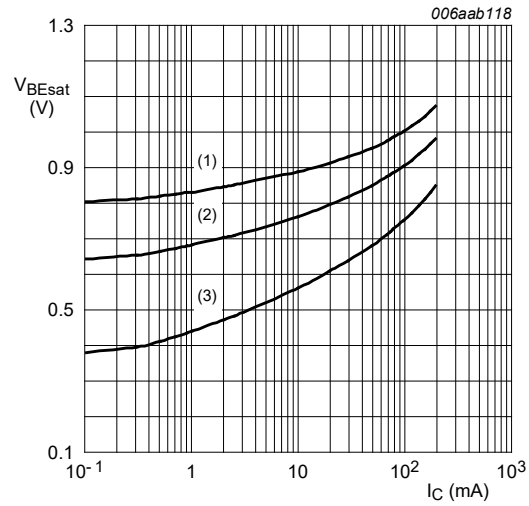
$T_{amb} = 25\text{ °C}$

**Fig. 4. Collector current as a function of collector-emitter voltage; typical values**



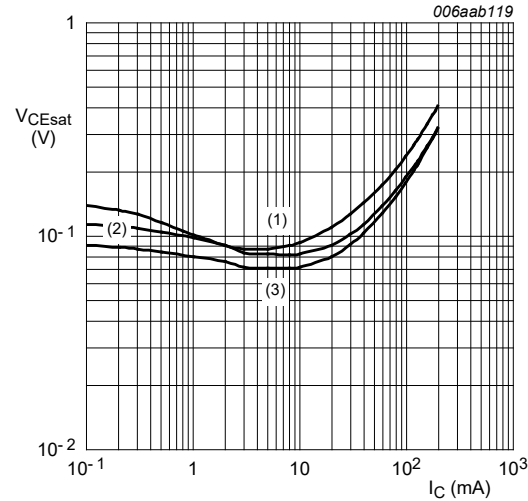
$V_{CE} = 1\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 150\text{ °C}$

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



$I_C/I_B = 10$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 150\text{ °C}$

**Fig. 6. Base-emitter saturation voltage as a function of collector current; typical values**



$I_C/I_B = 10$   
 (1)  $T_{amb} = 150\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

Fig. 7. Collector-emitter saturation voltage as a function of collector current; typical values

### 11. Test information

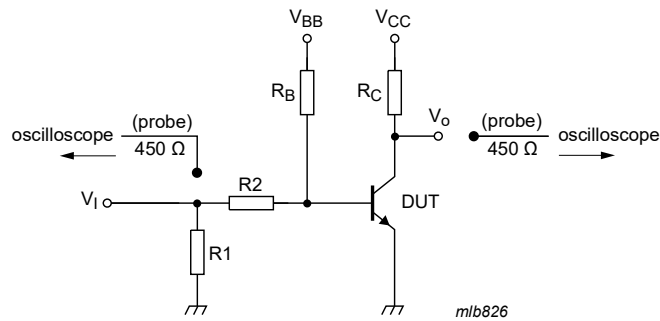


Fig. 8. Test circuit for switching times

### 12. Package outline

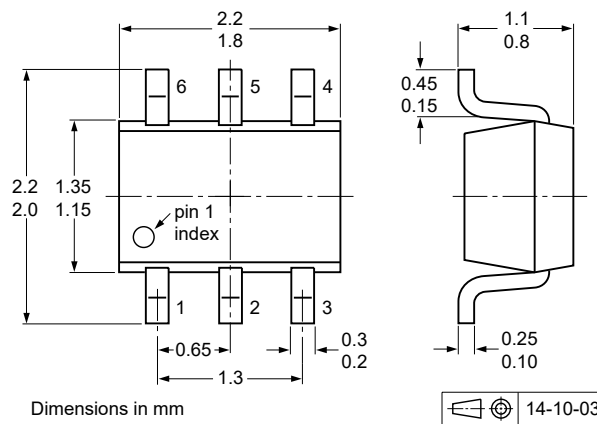


Fig. 9. Package outline TSSOP6 (SOT363)

### 13. Soldering

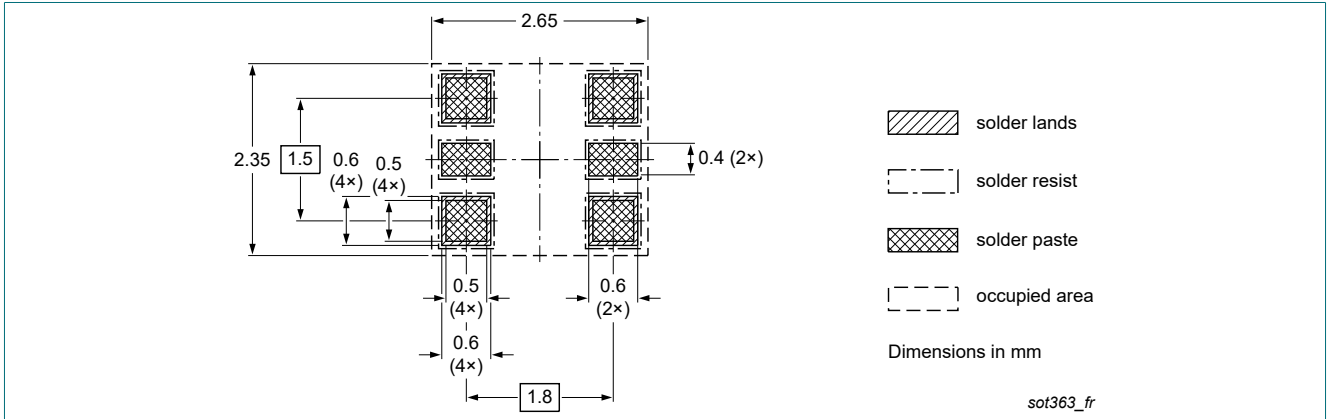


Fig. 10. Reflow soldering footprint for TSSOP6 (SOT363)

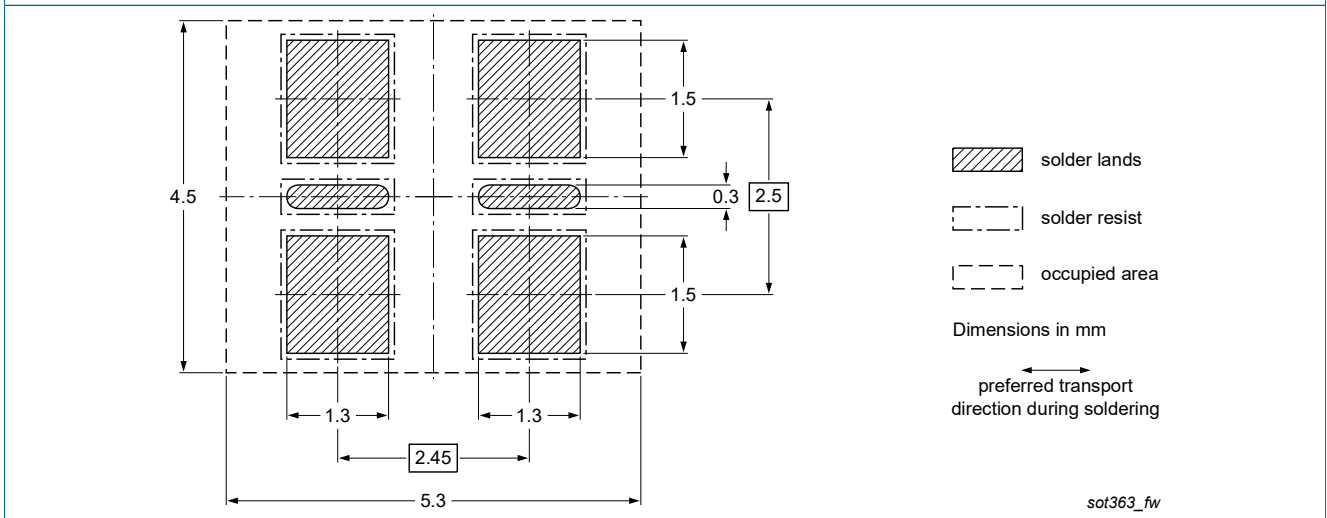


Fig. 11. Wave soldering footprint for TSSOP6 (SOT363)

## 14. Revision history

**Table 8. Revision history**

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMBT3904YS v.2	20190625	Product data sheet	-	PMBT3904YS v.1
Modifications:	<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></ul>			
PMBT3904YS v.1	20090512	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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