



PMBT4401YS

40 V, 600 mA, double NPN switching transistor

2 July 2015

Product data sheet

1. General description

Double NPN switching transistor in a very small SOT363 (TSSOP6) Surface-Mounted Device (SMD) plastic package.

Double PNP complement: PMBT4403YS

2. Features and benefits

- Double general-purpose switching transistor
- High current (max. 600 mA)
- Voltage max. 40 V
- AEC-Q101 qualified

3. Applications

- Switching and linear amplification

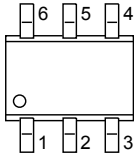
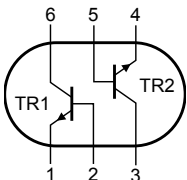
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor						
V_{CE0}	collector-emitter voltage	open base	-	-	40	V
I_C	collector current		-	-	600	mA
Per transistor						
h_{FE}	DC current gain	$V_{CE} = 1\text{ V}; I_C = 150\text{ mA}; t_p \leq 300\text{ }\mu\text{s};$ $\delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	100	-	300	
		$V_{CE} = 2\text{ V}; I_C = 500\text{ mA}; t_p \leq 300\text{ }\mu\text{s};$ $\delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	40	-	-	

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E	emitter TR1	 TSSOP6 (SOT363)	 sym020
2	B	base TR1		
3	C	collector TR2		
4	E	emitter TR2		
5	B	base TR2		
6	C	collector TR1		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMBT4401YS	TSSOP6	plastic surface-mounted package; 6 leads	SOT363

7. Marking

Table 4. Marking codes

Type number	Marking code
PMBT4401YS	BG% [1]

[1] % = placeholder for manufacturing site code

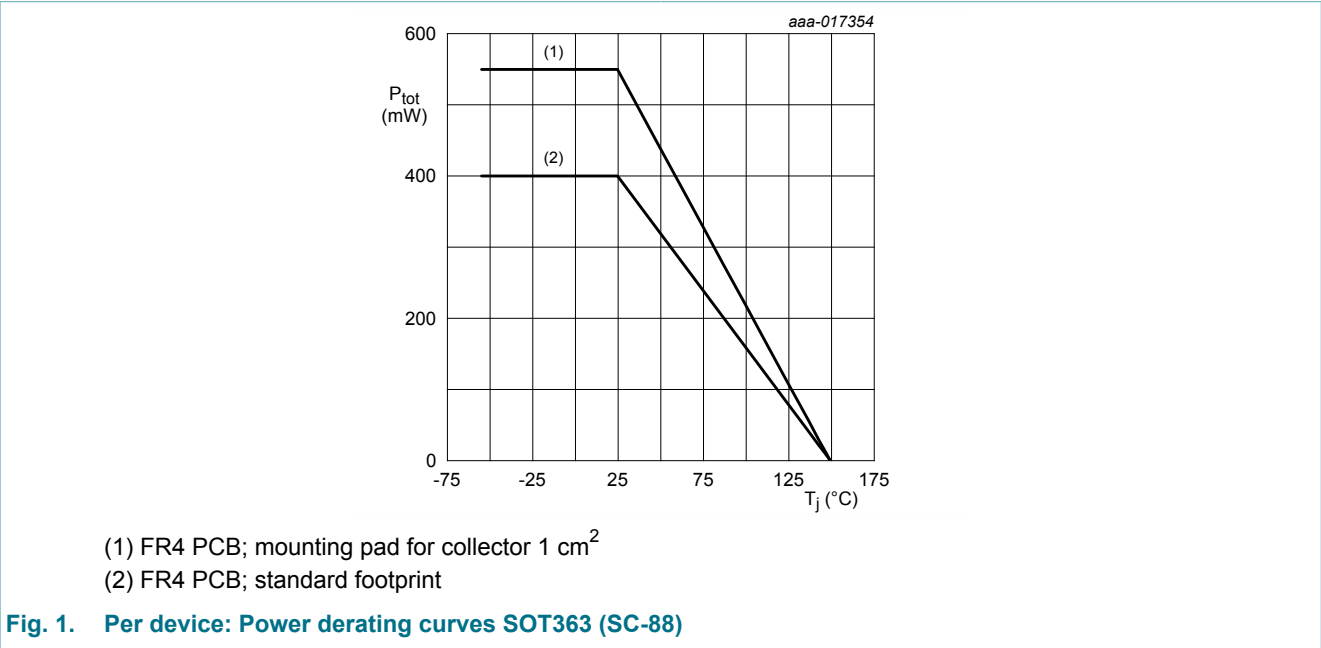
8. Limiting values

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		-	60	V
V _{CEO}	collector-emitter voltage	open base		-	40	V
V _{EBO}	emitter-base voltage	open collector		-	6	V
I _C	collector current	single pulse; t _p ≤ 1 ms		-	600	mA
I _{CM}	peak collector current			-	800	mA
I _{BM}	peak base current			-	200	mA
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	250	mW
			[2]	-	300	mW
Per device						
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	400	mW
			[2]	-	550	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.

[2] Device mounted on an FR4 PCB; single-sided copper; tin-plated and mounting pad for collector 1 cm².

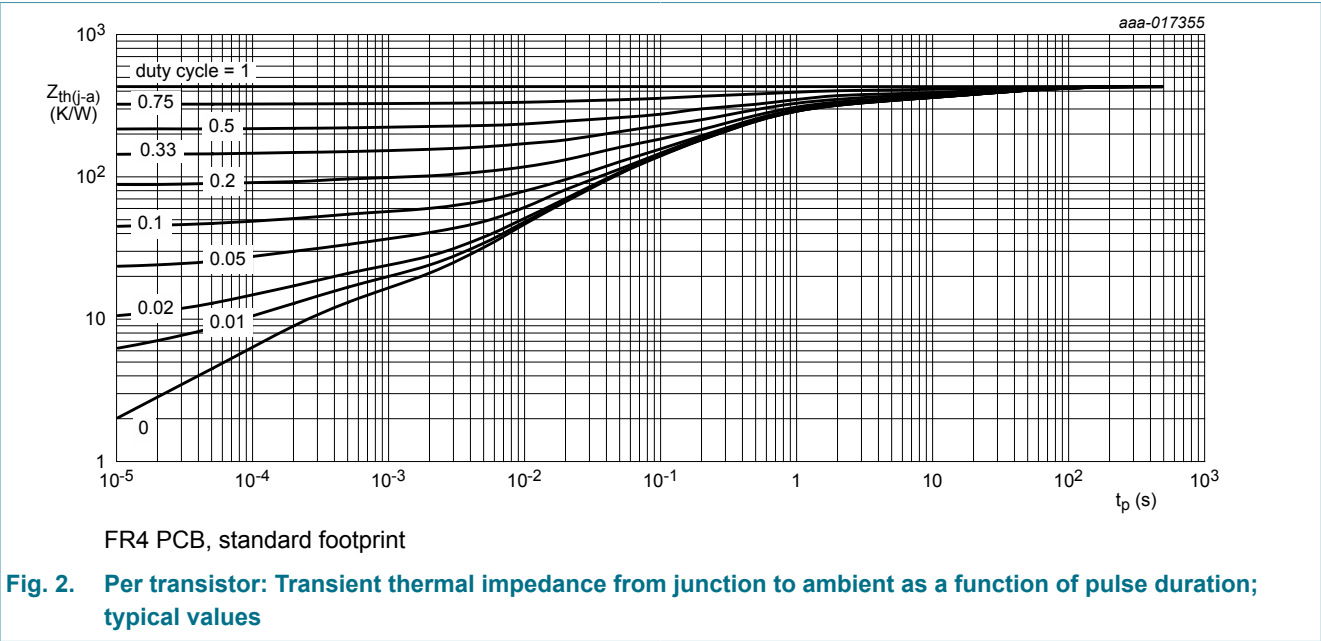


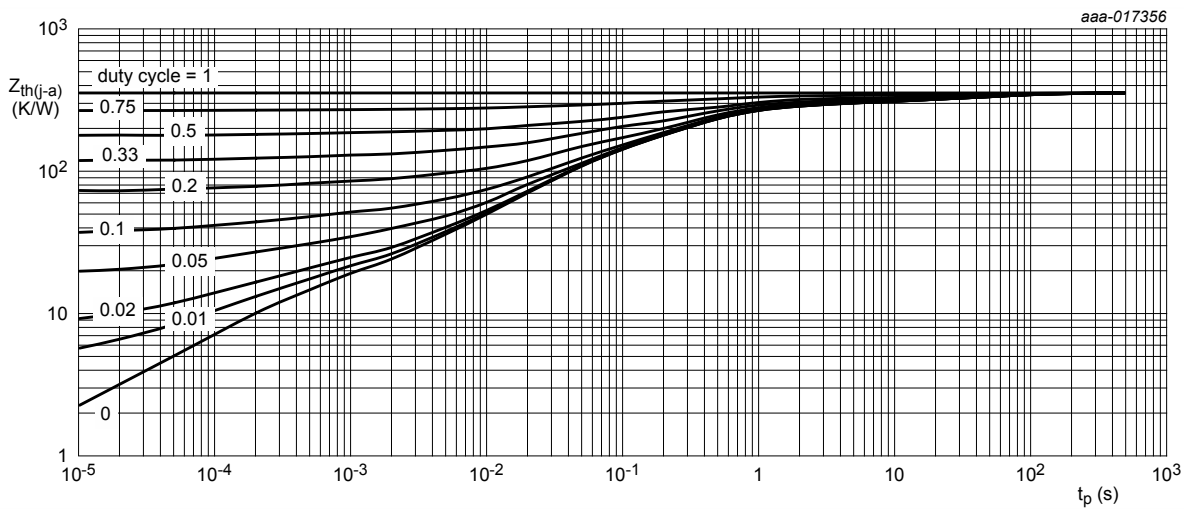
9. Thermal characteristics

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]	-	-	500	K/W
			[2]	-	-	417	K/W
Per device							
R _{th(j-a)}	thermal resistance from junction to ambient	in free air	[1]	-	-	313	K/W
			[2]	-	-	227	K/W

[1] Device mounted on an FR4 PCB; single-sided copper; tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB; single-sided copper; tin-plated and mounting pad for collector 1 cm².





FR4 PCB, mounting pad for collector 1 cm²

Fig. 3. 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
Per transistor						
I_{CBO}	collector-base cut-off current	$V_{CB} = 50\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	50	nA
		$V_{CB} = 50\text{ V}; I_E = 0\text{ A}; T_j = 125\text{ }^{\circ}\text{C}$	-	-	10	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 6\text{ V}; I_C = 0\text{ A}; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	50	nA
h_{FE}	DC current gain	$V_{CE} = 1\text{ V}; I_C = 0.1\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$	20	-	-	
		$V_{CE} = 1\text{ V}; I_C = 1\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$	40	-	-	
		$V_{CE} = 1\text{ V}; I_C = 10\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$	80	-	-	
		$V_{CE} = 1\text{ V}; I_C = 150\text{ mA}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^{\circ}\text{C}$	100	-	300	
		$V_{CE} = 2\text{ V}; I_C = 500\text{ mA}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^{\circ}\text{C}$	40	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 150\text{ mA}; I_B = 15\text{ mA}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	400	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	750	mV
V_{BEsat}	base-emitter saturation voltage	$I_C = 150\text{ mA}; I_B = 15\text{ mA}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	950	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	1.2	V
t_d	delay time	$I_C = 150\text{ mA}; I_{B(on)} = 15\text{ mA}; I_{B(off)} = -15\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	10	ns
t_r	rise time		-	-	25	ns
t_{on}	turn-on time		-	-	35	ns
t_s	storage time		-	-	200	ns
t_f	fall time		-	-	60	ns
t_{off}	turn-off time		-	-	250	ns
C_C	collector capacitance	$V_{CB} = 10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	8	pF
C_E	emitter capacitance	$V_{EB} = 500\text{ mV}; I_C = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	30	pF
f_T	transition frequency	$V_{CE} = 20\text{ V}; I_C = 20\text{ mA}; f = 100\text{ MHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$	250	-	-	MHz
NF	noise figure	$V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}; R_S = 1\text{ k}\Omega; f = 1\text{ kHz}$	-	-	4	dB

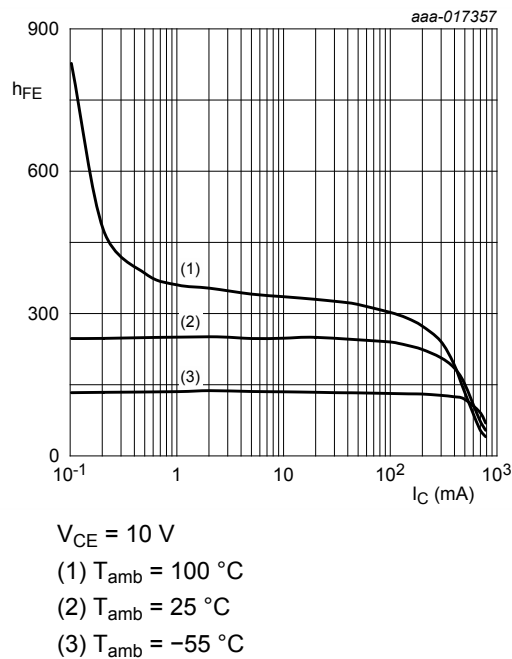


Fig. 4. DC current gain as a function of collector current; typical values

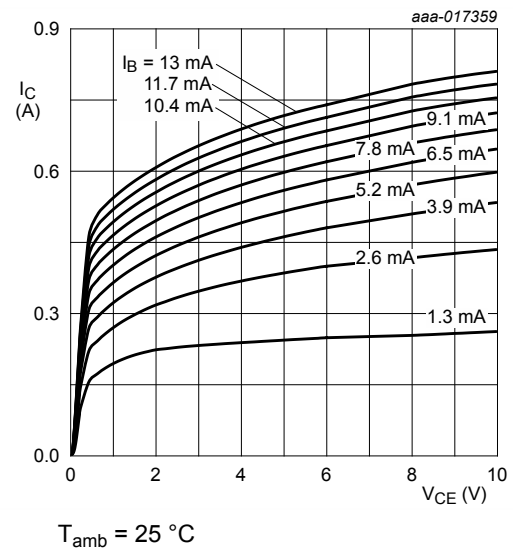


Fig. 5. Collector current as a function of collector-emitter voltage; typical values

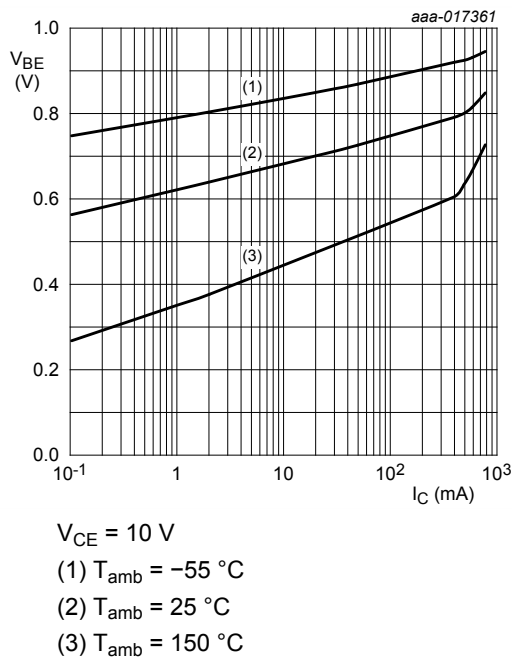


Fig. 6. Base-emitter voltage as a function of collector current; typical values

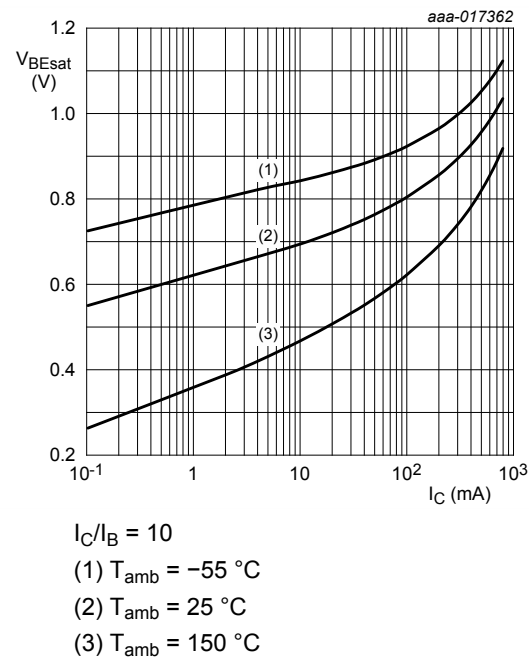
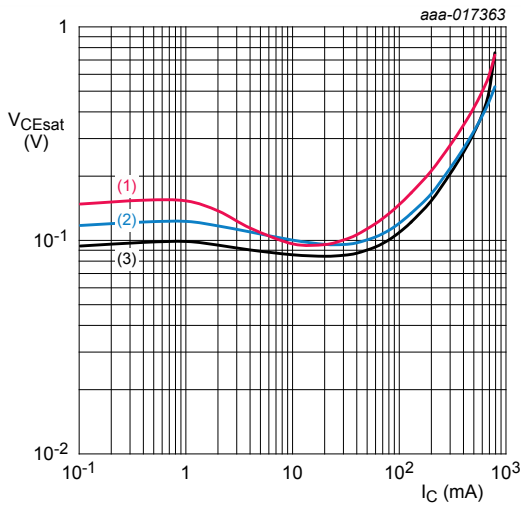
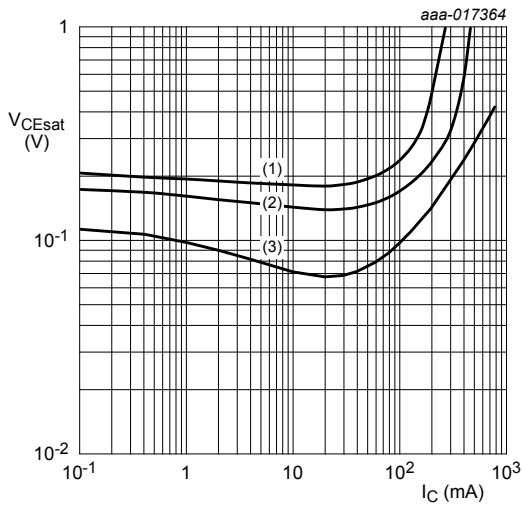


Fig. 7. Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$
(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. 8. Collector-emitter saturation voltage as a function of collector current; typical values



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

Fig. 9. Collector-emitter saturation voltage as a function of collector current; typical values

11. Test information

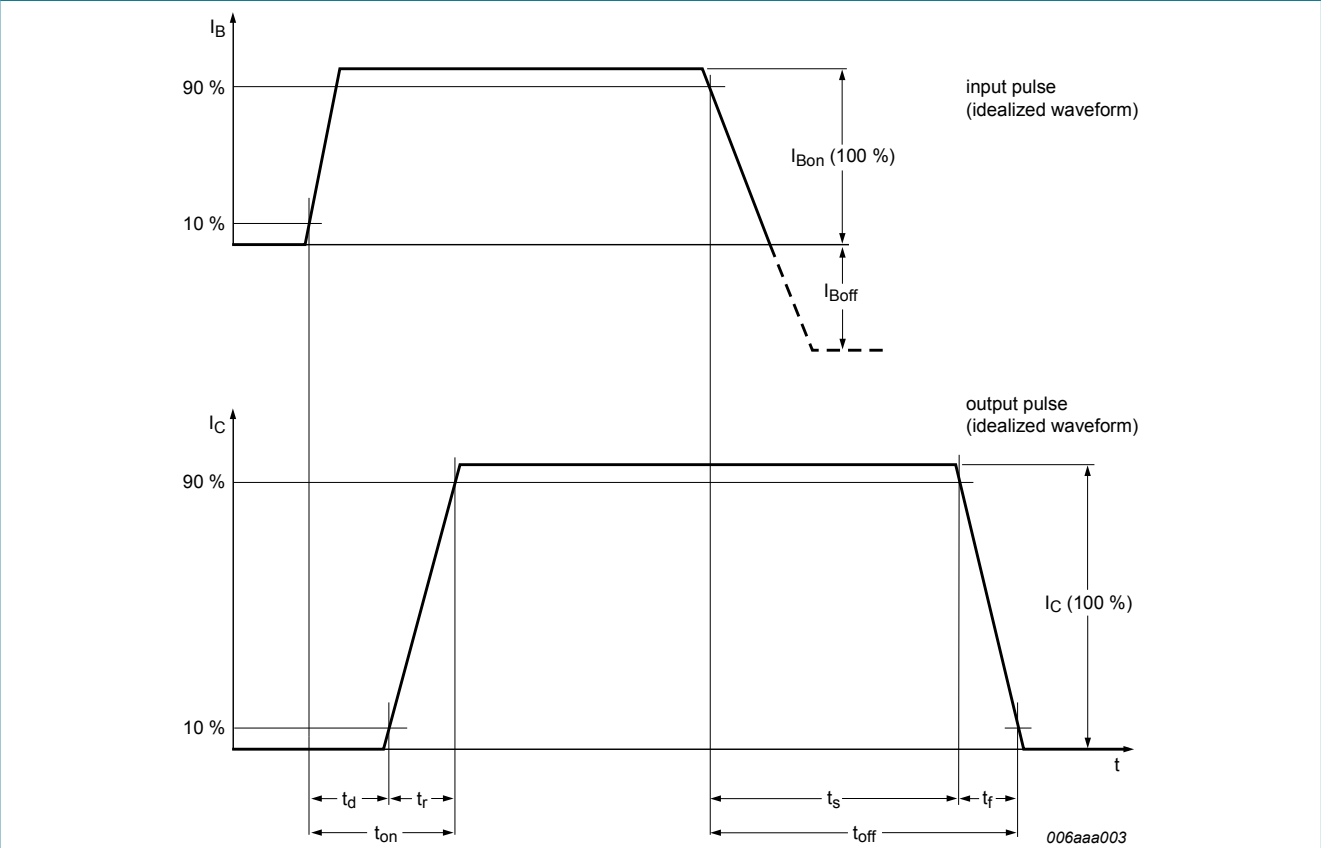


Fig. 10. BISS transistor switching time definition

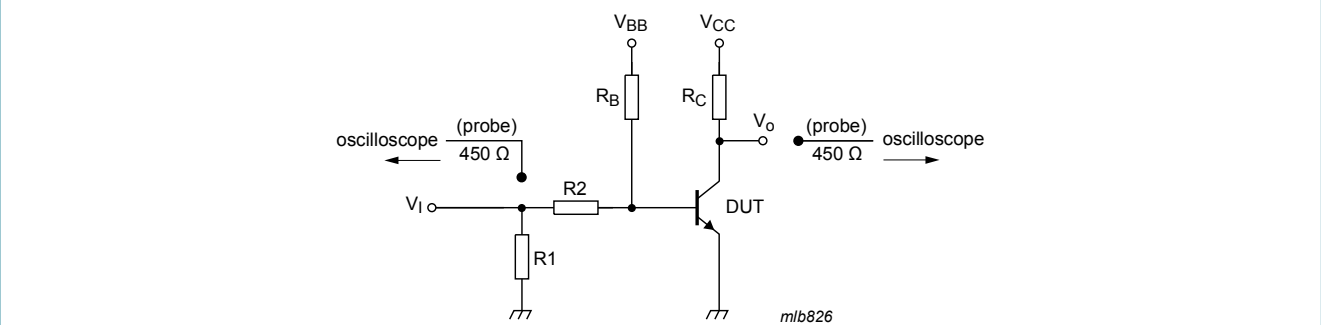
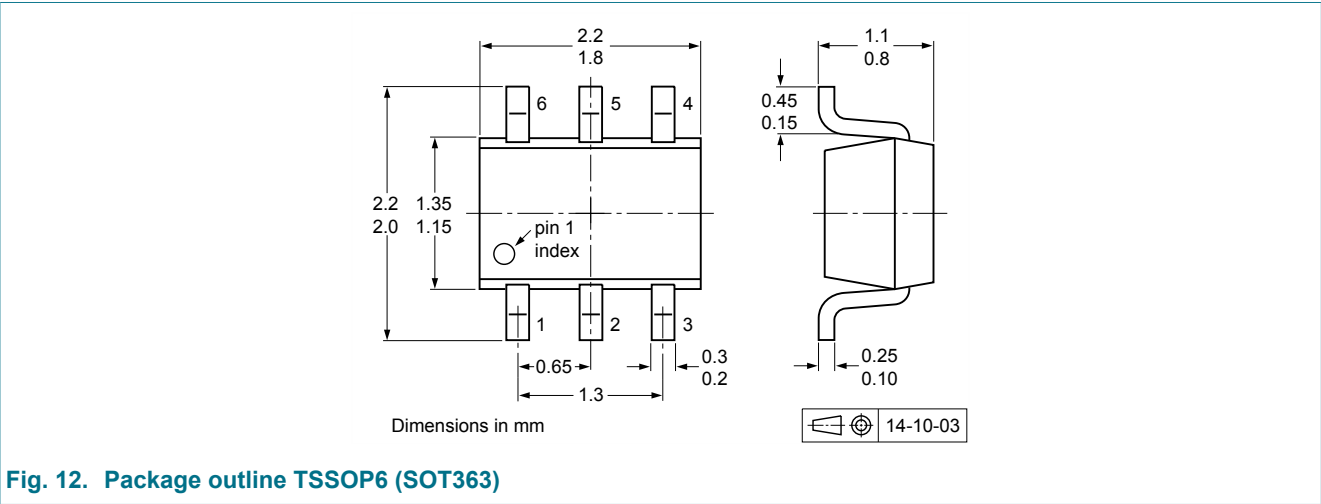


Fig. 11. Test circuit for switching times

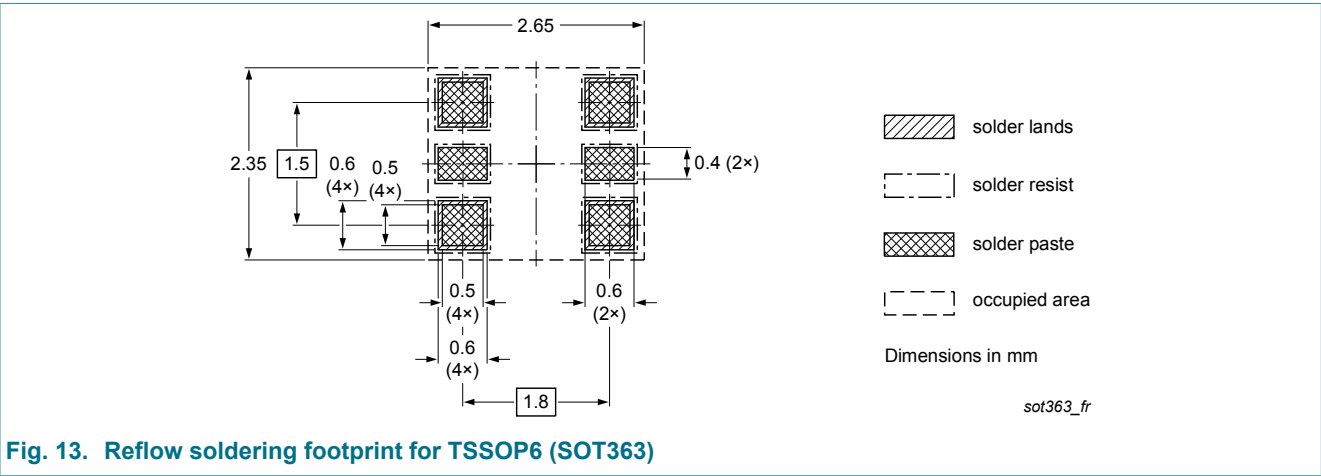
11.1 Quality information

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.

12. Package outline



13. Soldering



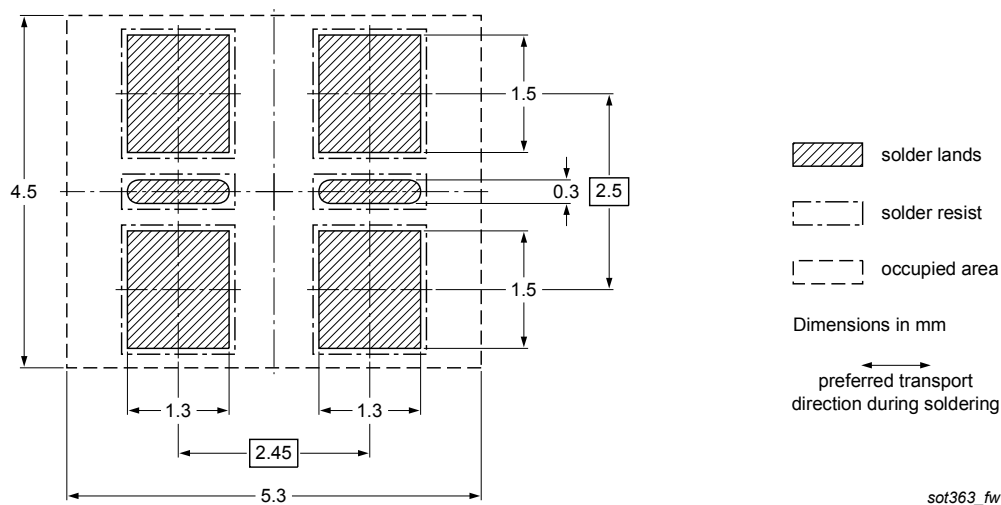


Fig. 14. Wave soldering footprint for TSSOP6 (SOT363)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMBT4401YS v.1	20150702	Product data sheet	-	-

15. Legal information

15.1 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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