



PMBT2227AYS-Q

40 V, 600 mA, NPN/PNP double switching transistor

10 March 2022

Product data sheet

1. General description

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

NPN/PNP complement: PMBT2222AYS

PNP/PNP complement: PMBT2907AYS

2. Features and benefits

- Double general-purpose switching transistor
- High current (max. 600 mA)
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- Switching and linear amplification

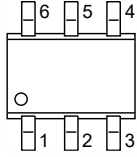
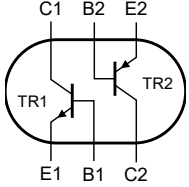
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TR1 (NPN)						
V_{CEO}	collector-emitter voltage	open base	-	-	40	V
h_{FE}	DC current gain	$V_{CE} = 10\text{ V}; I_C = 150\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	100	-	300	
TR2 (PNP)						
V_{CEO}	collector-emitter voltage	open base	-	-	-60	V
h_{FE}	DC current gain	$V_{CE} = -10\text{ V}; I_C = -150\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	100	-	300	
Per transistor; for the PNP transistor with negative polarity						
I_C	collector current		-	-	600	mA
I_{CM}	peak collector current	single pulse; $t_p \leq 1\text{ ms}$	-	-	800	mA

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E1	emitter TR1	 <p>TSSOP6 (SOT363)</p>	 <p><i>sym139</i></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
PMBT2227AYS-Q	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]
PMBT2227AYS-Q	Y5%

[1] % = placeholder for manufacturing site code

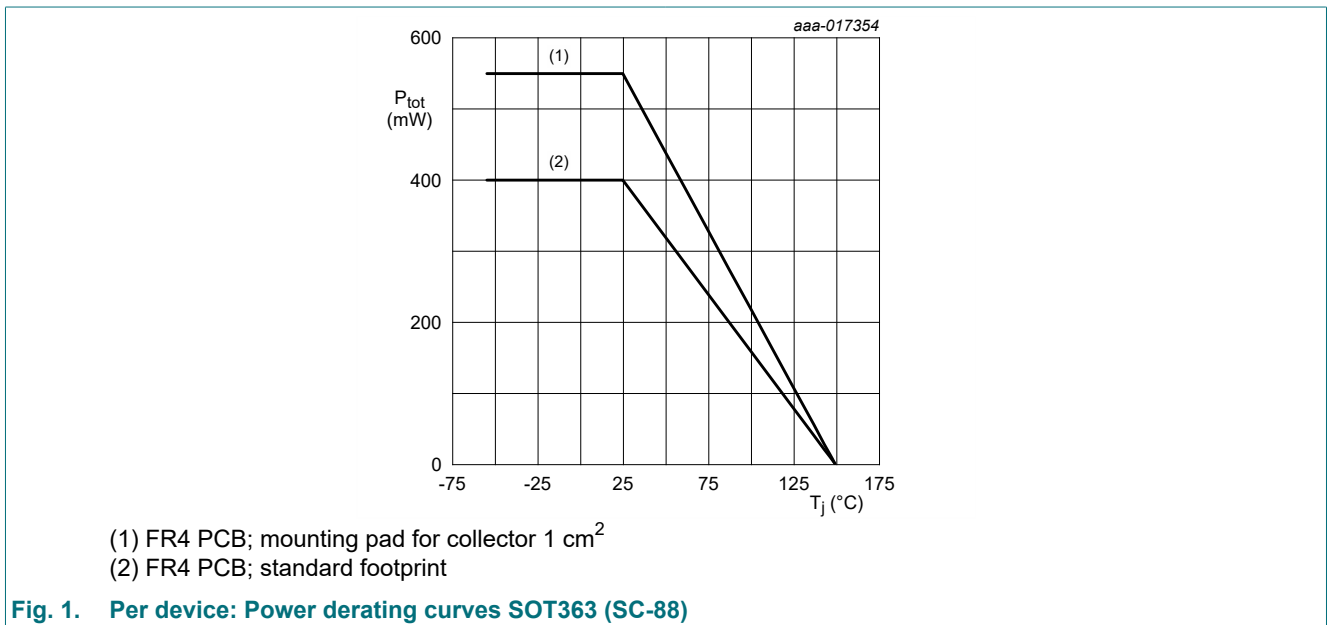
8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
TR1 (NPN)						
V_{CBO}	collector-base voltage	open emitter		-	75	V
V_{CEO}	collector-emitter voltage	open base		-	40	V
TR2 (PNP)						
V_{CBO}	collector-base voltage	open emitter		-	-60	V
V_{CEO}	collector-emitter voltage	open base		-	-60	V
Per transistor; for the PNP transistor with negative polarity						
V_{EBO}	emitter-base voltage	open collector		-	6	V
I_C	collector current			-	600	mA
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms		-	800	mA
I_{BM}	peak base current			-	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	250	mW
			[2]	-	300	mW
Per device						
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °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, 35 µm copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided, 35 µm copper, tin-plated; 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]	-	-	228	K/W

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

[2] Device mounted on an FR4 PCB, single-sided, 35 μ m copper, tin-plated; mounting pad for collector 1 cm².

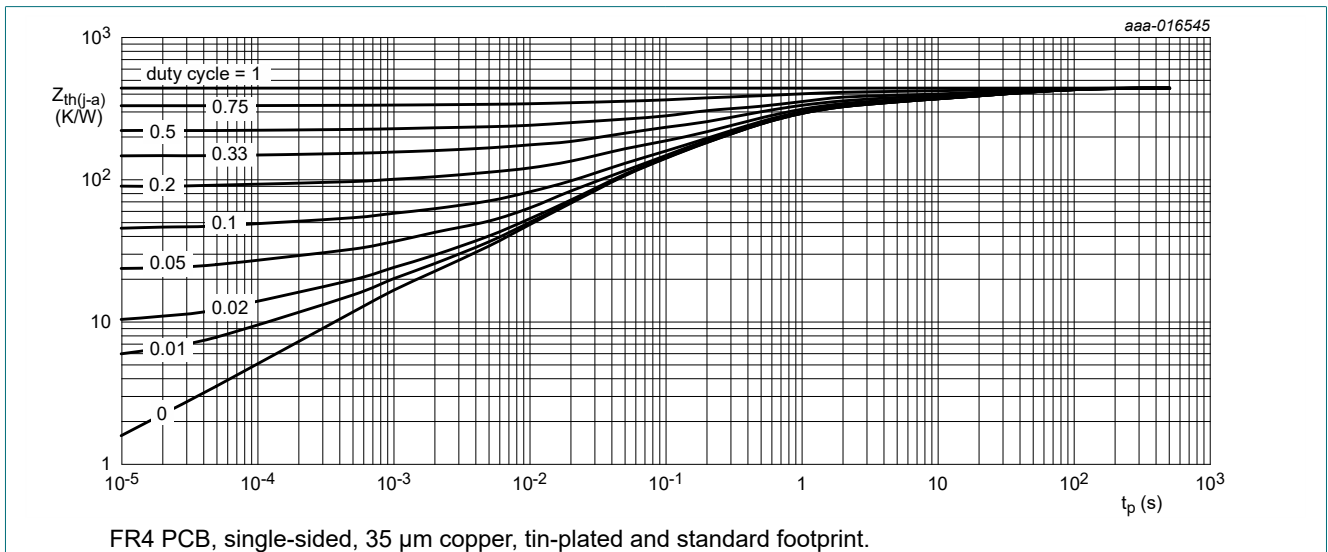


Fig. 2. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

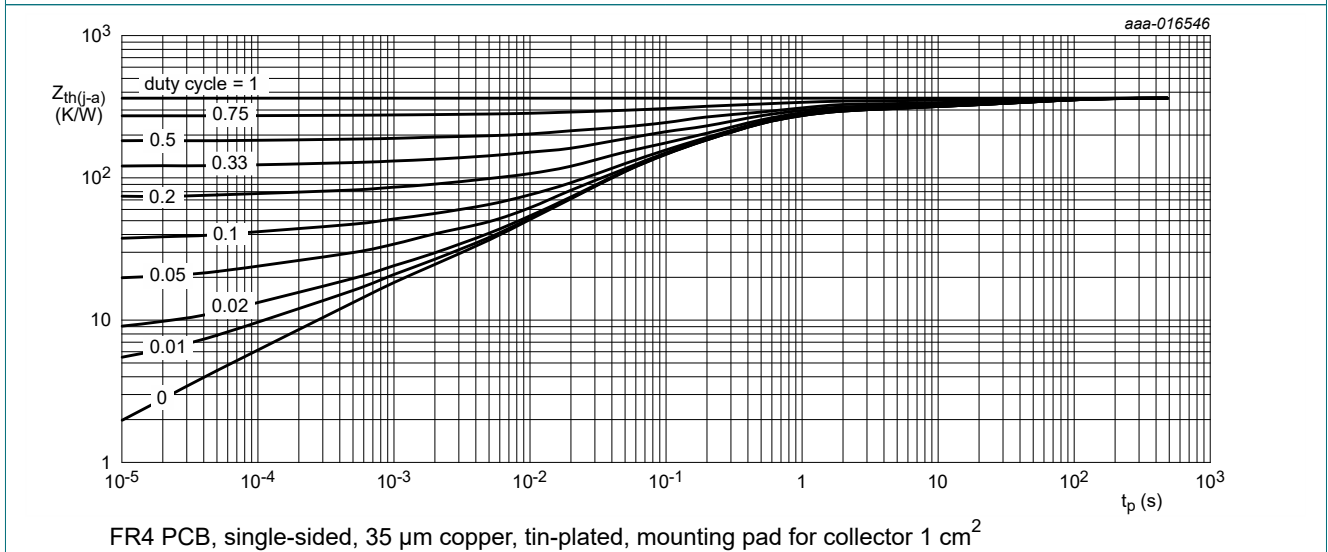


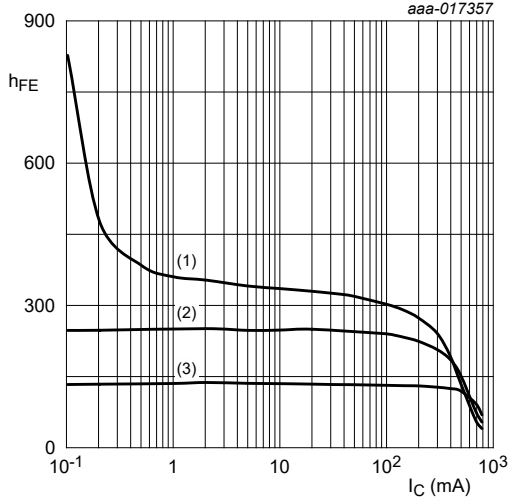
Fig. 3. Per Transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

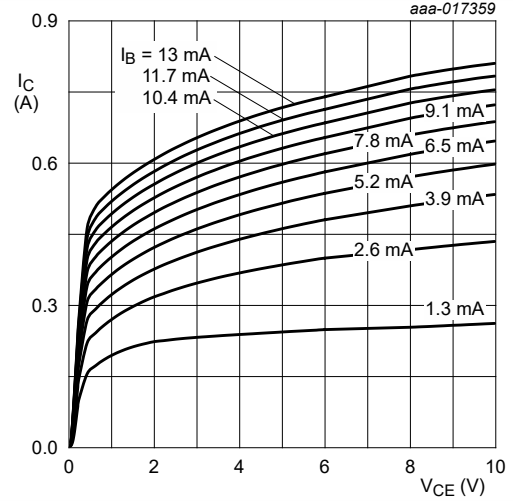
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TR1 (NPN)						
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100 \mu\text{A}; I_E = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	75	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 1 \text{ mA}; I_B = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	40	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_C = 0 \text{ A}; I_E = 100 \mu\text{A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	6	-	-	V
I_{CBO}	collector-base cut-off current	$V_{CB} = 60 \text{ V}; I_E = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	10	nA
		$V_{CB} = 60 \text{ V}; I_E = 0 \text{ A}; T_j = 125 \text{ }^\circ\text{C}$	-	-	10	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5 \text{ V}; I_C = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	10	nA
h_{FE}	DC current gain	$V_{CE} = 10 \text{ V}; I_C = 1 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	50	-	-	
		$V_{CE} = 10 \text{ V}; I_C = 10 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	75	-	-	
		$V_{CE} = 10 \text{ V}; I_C = 150 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	100	-	300	
		$V_{CE} = 10 \text{ V}; I_C = 500 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02$	40	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 150 \text{ mA}; I_B = 15 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	300	mV
		$I_C = 500 \text{ mA}; I_B = 50 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	1	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 150 \text{ mA}; I_B = 15 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	0.6	-	1.2	V
		$I_C = 500 \text{ mA}; I_B = 50 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	2	V
t_d	delay time	$I_C = 150 \text{ mA}; I_{B\text{on}} = 15 \text{ mA}; I_{B\text{off}} = -15 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	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		-	-	260	ns
C_c	collector capacitance		$V_{CB} = 10 \text{ V}; I_E = 0 \text{ A}; i_e = 0 \text{ A}; f = 1 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	8
C_e	emitter capacitance	$V_{EB} = 0.5 \text{ V}; I_C = 0 \text{ A}; i_c = 0 \text{ A}; f = 1 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	25	pF
f_T	transition frequency	$V_{CE} = 20 \text{ V}; I_C = 20 \text{ mA}; f = 100 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	300	-	MHz
NF	noise figure	$V_{CE} = 5 \text{ V}; I_C = 0.1 \text{ mA}; R_S = 1 \text{ k}\Omega; f = 1 \text{ kHz}$	-	-	4	dB
TR2 (PNP)						
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = -100 \mu\text{A}; I_E = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-60	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = -10 \text{ mA}; I_B = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-60	-	-	V

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_C = 0 \text{ A}; I_E = -100 \mu\text{A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-6	-	-	V
I_{CBO}	collector-base cut-off current	$V_{CB} = -50 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-10	nA
		$V_{CB} = -50 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 125 \text{ }^\circ\text{C}$	-	-	-10	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = -5 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-50	nA
h_{FE}	DC current gain	$V_{CE} = -10 \text{ V}; I_C = -1 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	100	-	-	
		$V_{CE} = -10 \text{ V}; I_C = -10 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	100	-	-	
		$V_{CE} = -10 \text{ V}; I_C = -150 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	100	-	300	
		$V_{CE} = -10 \text{ V}; I_C = -500 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	50	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -150 \text{ mA}; I_B = -15 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-400	mV
		$I_C = -500 \text{ mA}; I_B = -50 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-1.6	V
V_{BEsat}	base-emitter saturation voltage	$I_C = -150 \text{ mA}; I_B = -15 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-1.3	V
		$I_C = -500 \text{ mA}; I_B = -50 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-2.6	V
t_d	delay time	$I_C = -150 \text{ mA}; I_{Bon} = -15 \text{ mA}; I_{Boff} = 15 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	12	ns
t_r	rise time		-	-	30	ns
t_{on}	turn-on time		-	-	42	ns
t_s	storage time		-	-	300	ns
t_f	fall time		-	-	65	ns
t_{off}	turn-off time		-	-	365	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
C_e	emitter capacitance	$V_{EB} = -2 \text{ V}; I_C = 0 \text{ A}; i_c = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	30	pF
f_T	transition frequency	$V_{CE} = -20 \text{ V}; I_C = -50 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	200	-	MHz



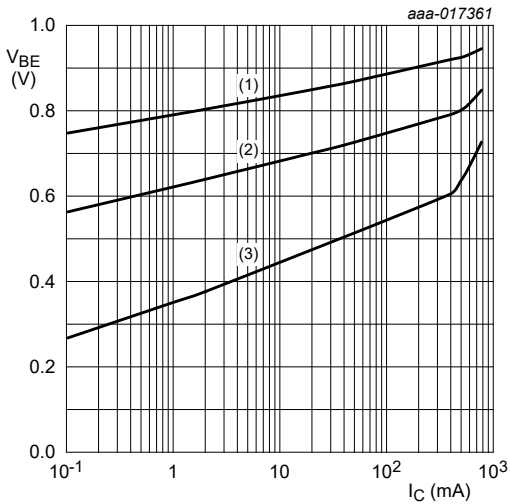
$V_{CE} = 10\text{ V}$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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



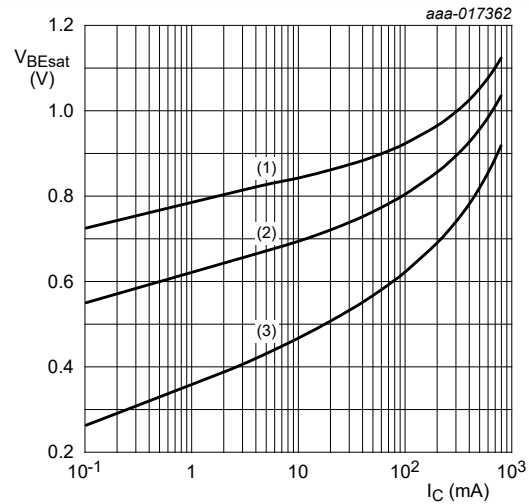
$T_{amb} = 25\text{ °C}$

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



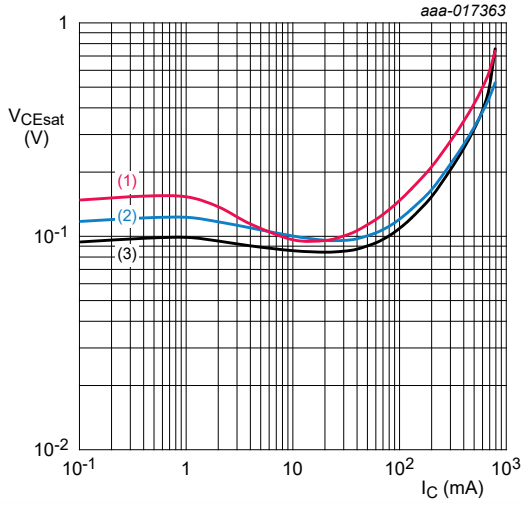
$V_{CE} = 10\text{ V}$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 150\text{ °C}$

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



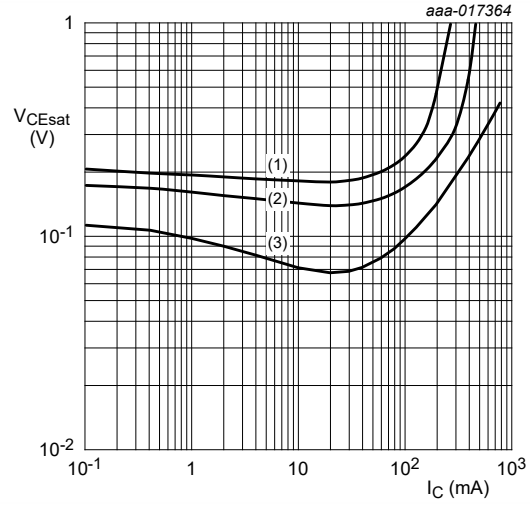
$I_C/I_B = 10$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 150\text{ °C}$

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



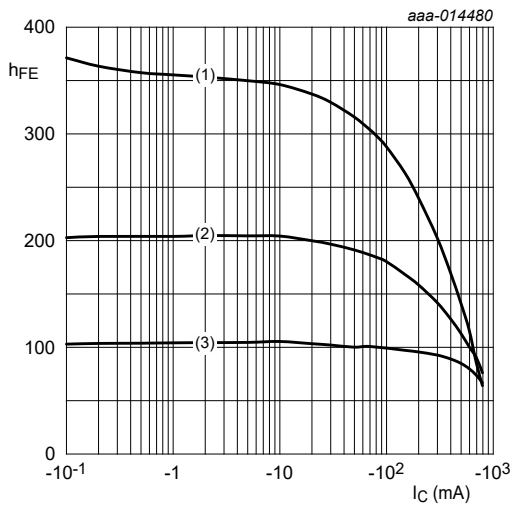
$I_C/I_B = 20$
 (1) $T_{amb} = 150\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -55\text{ }^\circ\text{C}$

Fig. 8. NPN transistor: Collector-emitter saturation voltage as a function of collector current; typical values



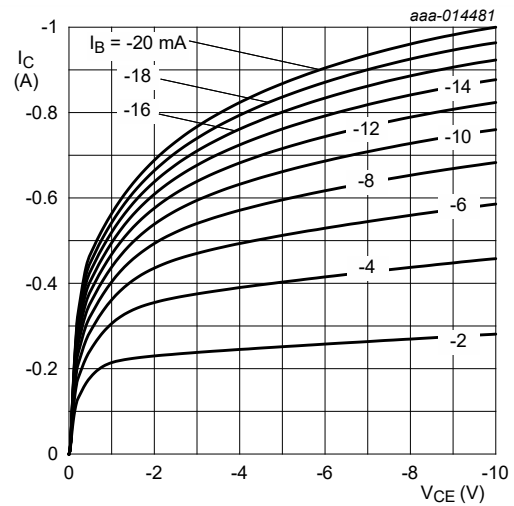
$T_{amb} = 25\text{ }^\circ\text{C}$
 (1) $I_C/I_B = 100$
 (2) $I_C/I_B = 50$
 (3) $I_C/I_B = 10$

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



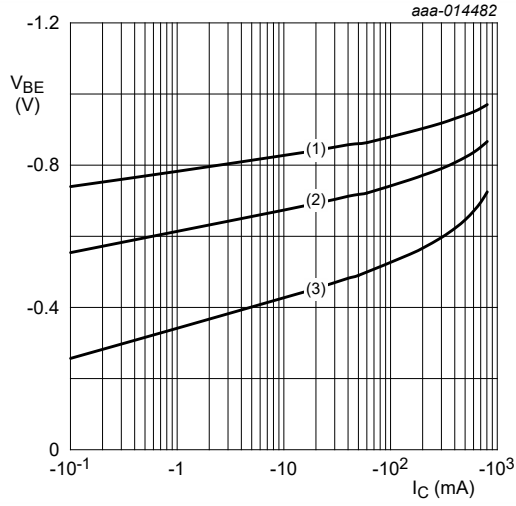
$V_{CE} = -10\text{ V}$
 (1) $T_{amb} = 150\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -55\text{ }^\circ\text{C}$

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



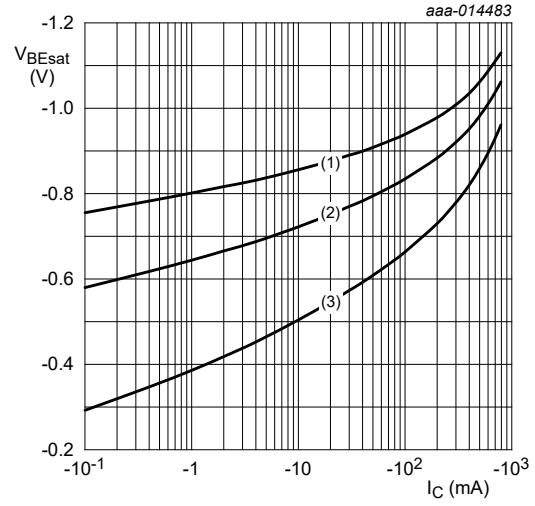
$T_{amb} = 25\text{ }^\circ\text{C}$

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



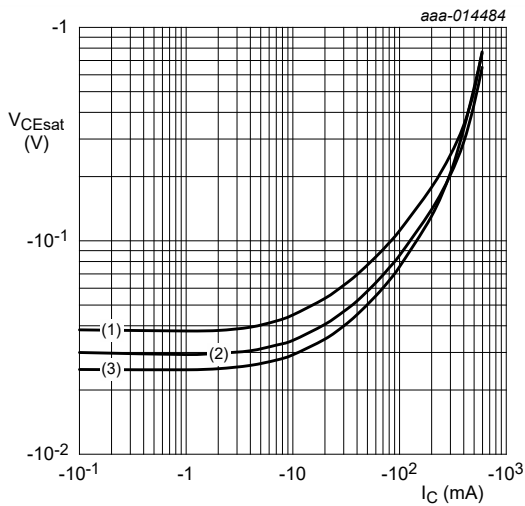
$V_{CE} = -10 \text{ V}$
 (1) $T_{amb} = -55 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 150 \text{ }^\circ\text{C}$

Fig. 12. PNP transistor: Base-emitter voltage as a function of collector current; typical values



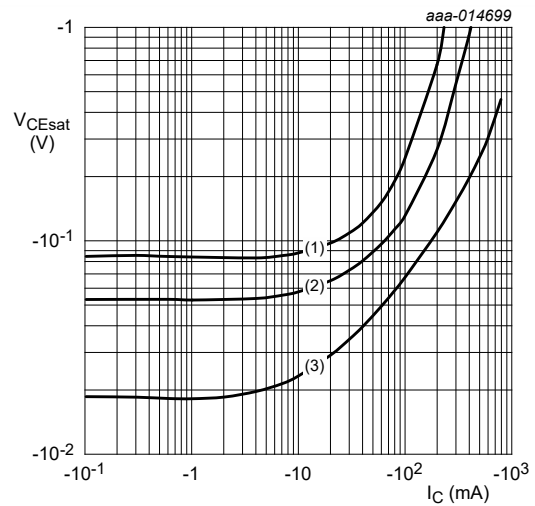
$I_C/I_B = 10$
 (1) $T_{amb} = -55 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 150 \text{ }^\circ\text{C}$

Fig. 13. PNP transistor: 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. 14. PNP transistor: 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. 15. PNP transistor: Collector-emitter saturation voltage as a function of collector current; typical values

11. Test information

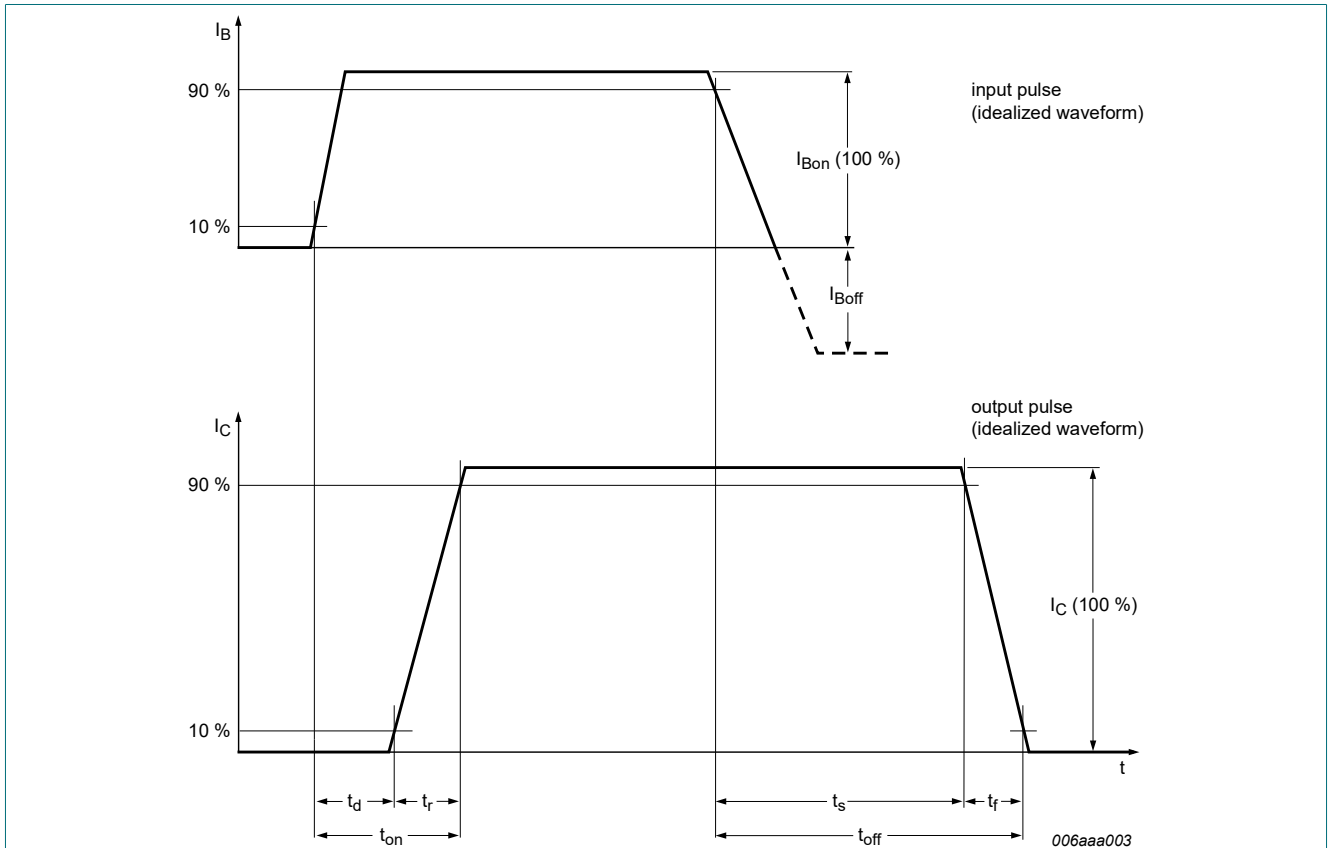


Fig. 16. TR1 (NPN): BISS transistor switching time definition

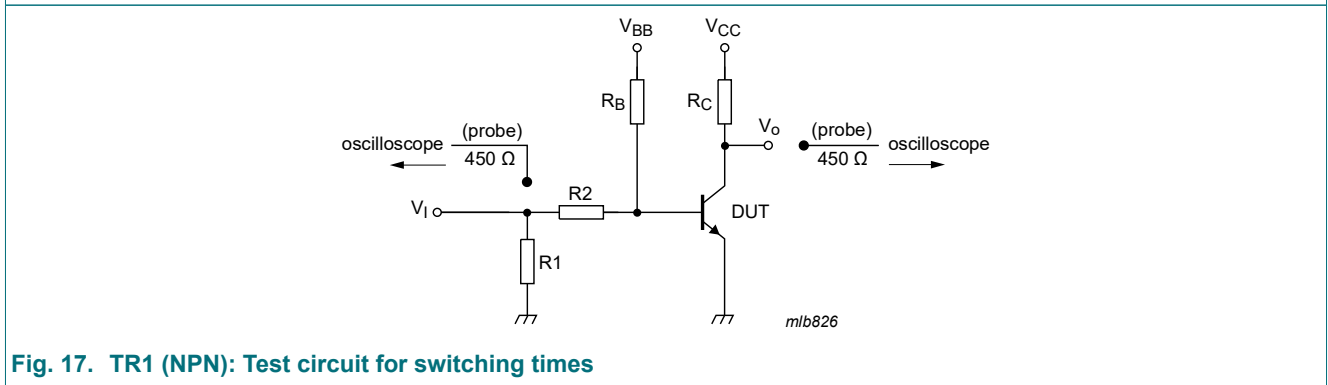


Fig. 17. TR1 (NPN): Test circuit for switching times

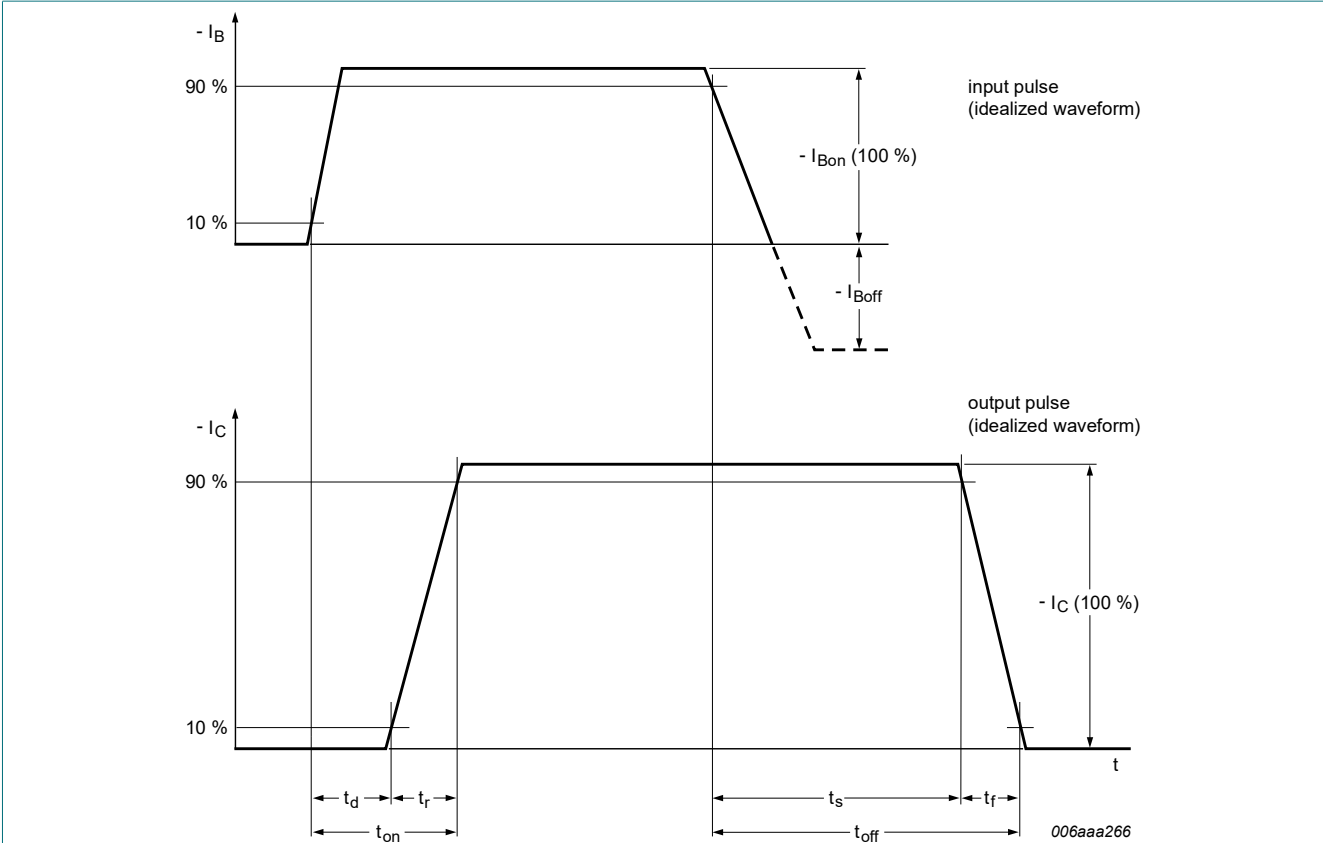


Fig. 18. TR2 (PNP): BISS transistor switching time definition

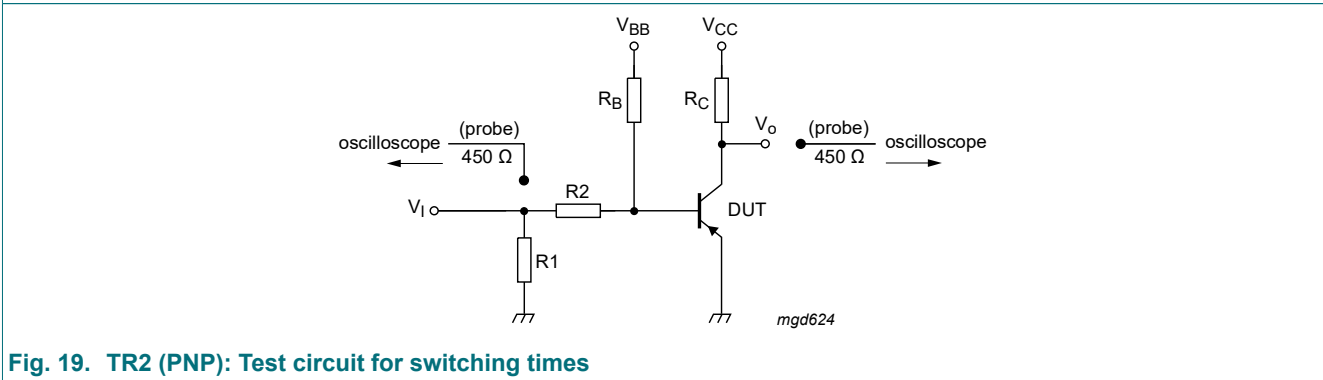


Fig. 19. TR2 (PNP): Test circuit for switching times

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

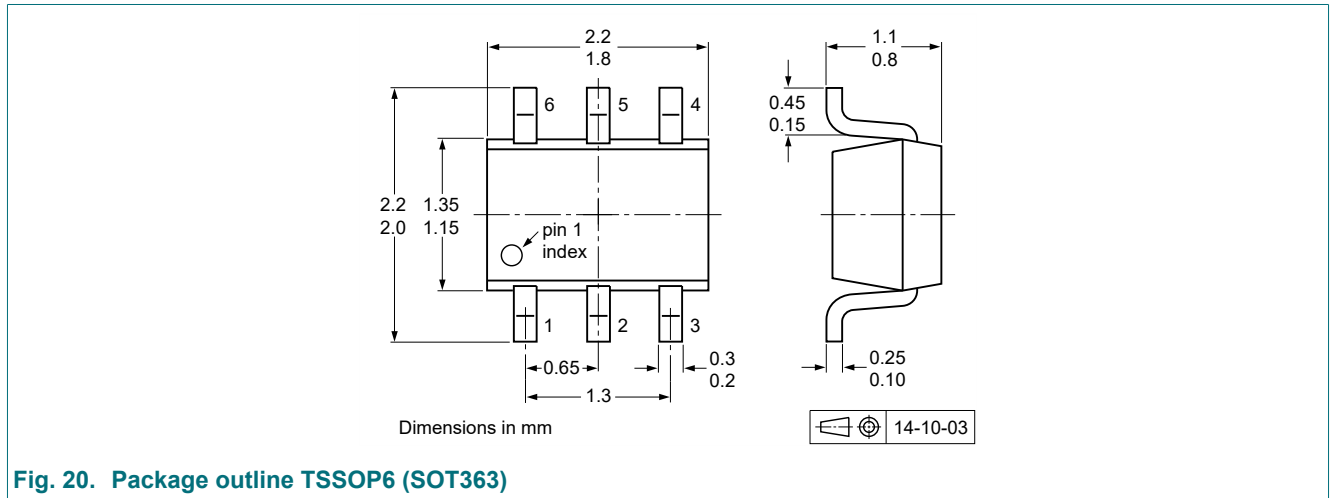


Fig. 20. Package outline TSSOP6 (SOT363)

13. Soldering

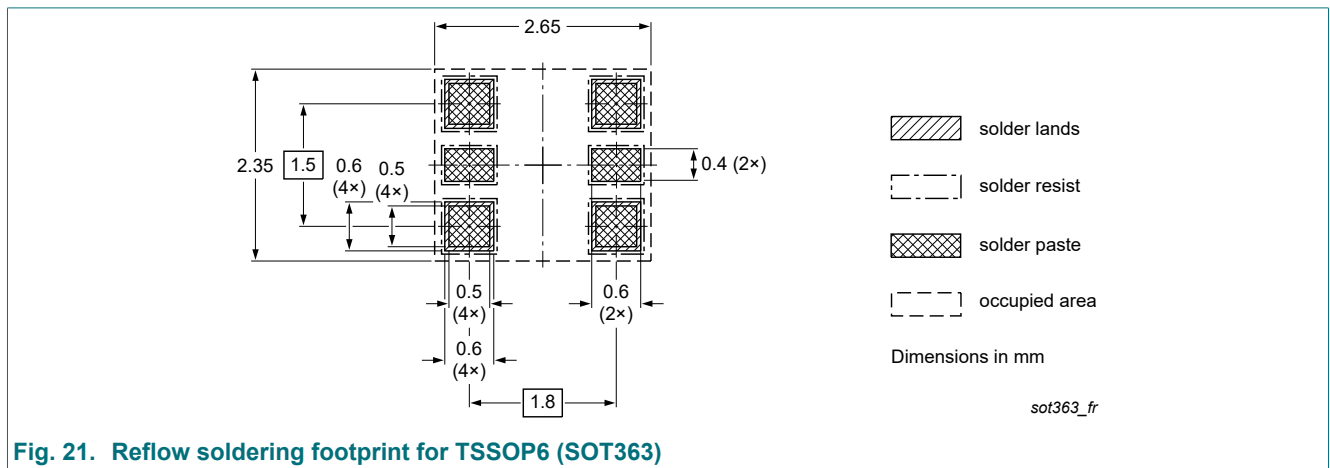


Fig. 21. Reflow soldering footprint for TSSOP6 (SOT363)

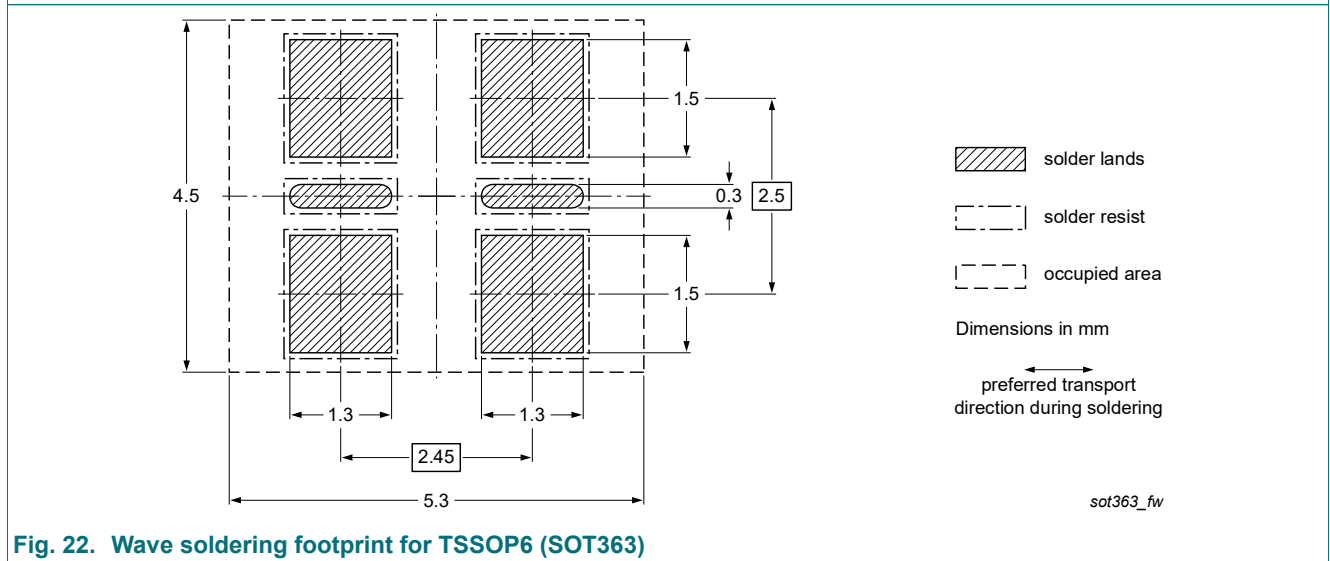


Fig. 22. Wave soldering footprint for TSSOP6 (SOT363)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMBT2227AYS-Q v.2	20220310	Product data sheet	-	PMBT2227AYS-Q v.1
Modifications:	• Product status changed			
PMBT2227AYS-Q v.1	20211220	Objective 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.

- [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".
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