



# BCM846BSH-Q

65 V, 100 mA NPN/NPN matched double transistor

6 May 2021

Product data sheet

## 1. General description

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

PNP/PNP complement: BCM856BSH-Q

## 2. Features and benefits

- Low collector capacitance
- Low collector-emitter saturation voltage
- Current gain matching
- Base-emitter voltage matching
- Drop-in replacement for standard double transistors
- No mutual interference between the transistors
- High-temperature applications up to 175 °C
- Qualified according to AEC-Q101 and recommended for use in automotive applications

## 3. Applications

- Current mirror
- Differential amplifier

## 4. Quick reference data

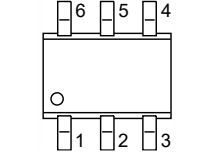
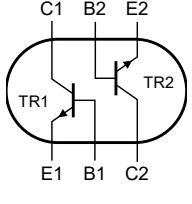
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$V_{CE0}$	collector-emitter voltage	open base	-	-	65	V
$I_C$	collector current		-	-	100	mA
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 2\text{ mA}; T_{amb} = 25\text{ °C}$	200	300	450	
<b>Per device</b>						
$h_{FE1}/h_{FE2}$	DC current gain matching	$V_{CE} = 5\text{ V}; I_C = 2\text{ mA}; T_{amb} = 25\text{ °C}$	0.95	1	1.05	
$V_{BE1}-V_{BE2}$	base-emitter voltage matching	[1]	-	-	2	mV

[1] The smaller of the two values is subtracted from the larger value.

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E1	emitter TR1	 <p>TSSOP6 (SOT363)</p>	 <p>sym140</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
BCM846BSH-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]
BCM846BSH-Q	7N%

[1] % = placeholder for manufacturing site code

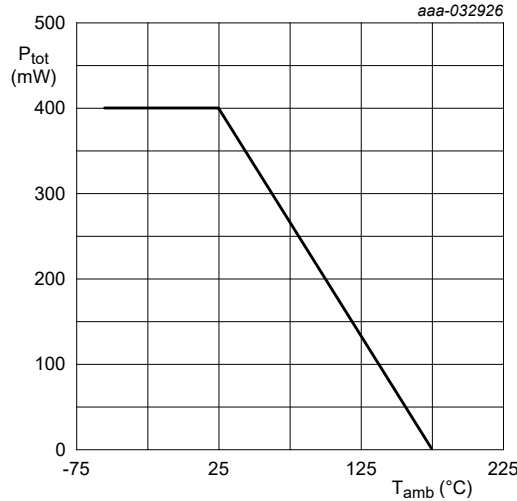
## 8. Limiting values

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	-	80	V
$V_{CEO}$	collector-emitter voltage	open base	-	65	V
$V_{EBO}$	emitter-base voltage	open collector	-	7	V
$I_C$	collector current		-	100	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	200	mA
$I_{BM}$	peak base current		-	200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	270	mW
<b>Per device</b>					
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	400	mW
$T_j$	junction temperature		-	175	°C
$T_{amb}$	ambient temperature		-55	175	°C
$T_{stg}$	storage temperature		-65	175	°C

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



FR4 PCB, single-sided, 35 μm copper, tin-plated and standard footprint

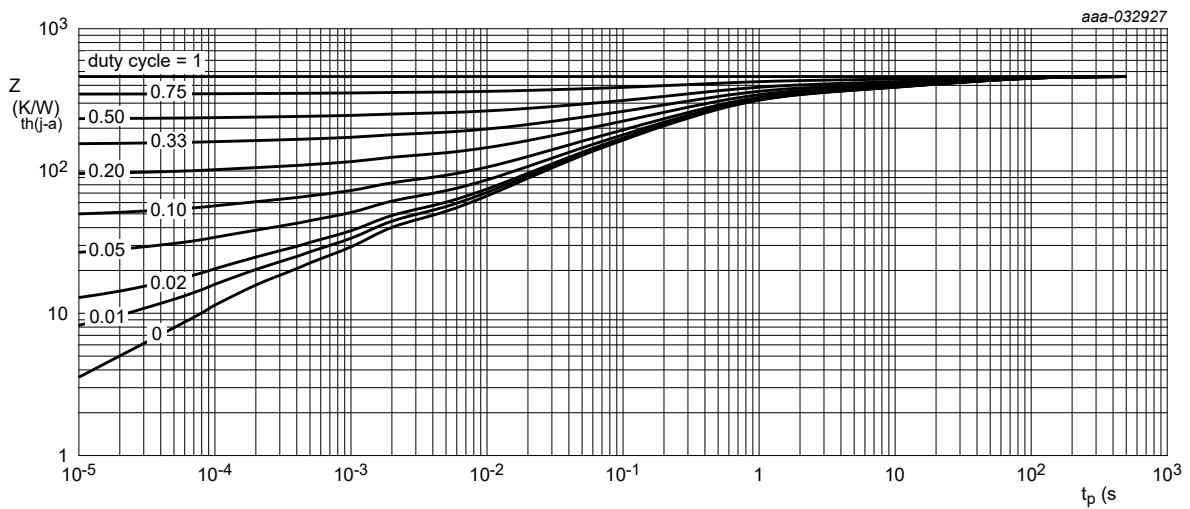
Fig. 1. Per device: Power derating curve

## 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Per transistor</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	556	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point			-	-	170	K/W
<b>Per device</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	375	K/W

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



FR4 PCB, single-sided, 35 μm copper, tin-plated and 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>						
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100 \mu\text{A}$ ; $I_E = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	80	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2 \text{ mA}$ ; $I_B = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	65	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_C = 0 \text{ A}$ ; $I_E = 100 \mu\text{A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	7	-	-	V
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 30 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	15	nA
		$V_{CB} = 30 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $T_j = 150 \text{ }^\circ\text{C}$	-	-	5	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 7 \text{ V}$ ; $I_C = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	100	nA
$h_{FE}$	DC current gain	$V_{CE} = 5 \text{ V}$ ; $I_C = 2 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	200	300	450	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10 \text{ mA}$ ; $I_B = 0.5 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	50	100	mV
		$I_C = 100 \text{ mA}$ ; $I_B = 5 \text{ mA}$ ; pulsed; $t_p \leq 300 \mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	200	300	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 10 \text{ mA}$ ; $I_B = 0.5 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	750	850	mV
		$I_C = 100 \text{ mA}$ ; $I_B = 5 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	875	-	mV
$V_{BE}$	base-emitter voltage	$V_{CE} = 5 \text{ V}$ ; $I_C = 2 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[2]	655	700	mV
		$V_{CE} = 5 \text{ V}$ ; $I_C = 10 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[2]	705	770	mV
$C_c$	collector capacitance	$V_{CB} = 10 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $i_e = 0 \text{ A}$ ; $f = 1 \text{ MHz}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	1.2	-	pF
$C_e$	emitter capacitance	$V_{EB} = 0.5 \text{ V}$ ; $I_C = 0 \text{ A}$ ; $i_c = 0 \text{ A}$ ; $f = 1 \text{ MHz}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	11	-	pF
$f_T$	transition frequency	$V_{CE} = 5 \text{ V}$ ; $I_C = 10 \text{ mA}$ ; $f = 100 \text{ MHz}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	100	-	-	MHz
NF	noise figure	$V_{CE} = 5 \text{ V}$ ; $I_C = 0.2 \text{ mA}$ ; $R_S = 2 \text{ k}\Omega$ ; $f = 10 \text{ Hz to } 15.7 \text{ kHz}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	1.7	-	dB
		$V_{CE} = 5 \text{ V}$ ; $I_C = 0.2 \text{ mA}$ ; $R_S = 2 \text{ k}\Omega$ ; $f = 1 \text{ kHz}$ ; $B = 200 \text{ Hz}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	3.1	-	dB
<b>Per device</b>						
$h_{FE1}/h_{FE2}$	DC current gain matching	$V_{CE} = 5 \text{ V}$ ; $I_C = 2 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	0.95	1	1.05	
$V_{BE1}-V_{BE2}$	base-emitter voltage matching		[3]	-	-	2

[1]  $V_{BEsat}$  decreases by about 1.7 mV/K with increasing temperature.

[2]  $V_{BE}$  decreases by about 2 mV/K with increasing temperature.

[3] The smaller of the two values is subtracted from the larger value.

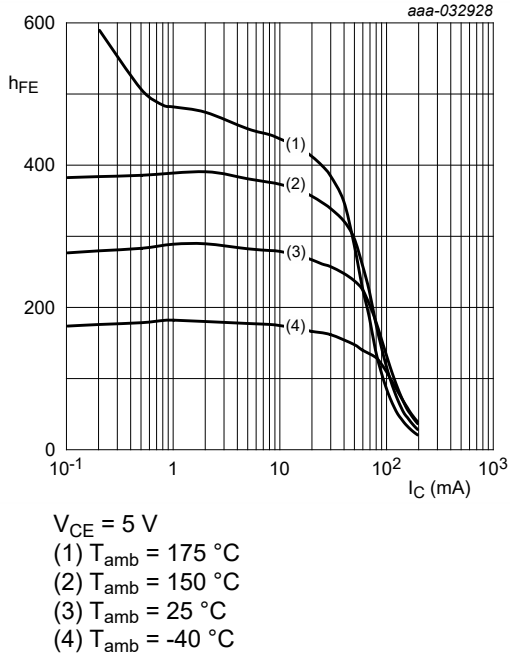


Fig. 3. DC current gain as a function of collector current; typical values

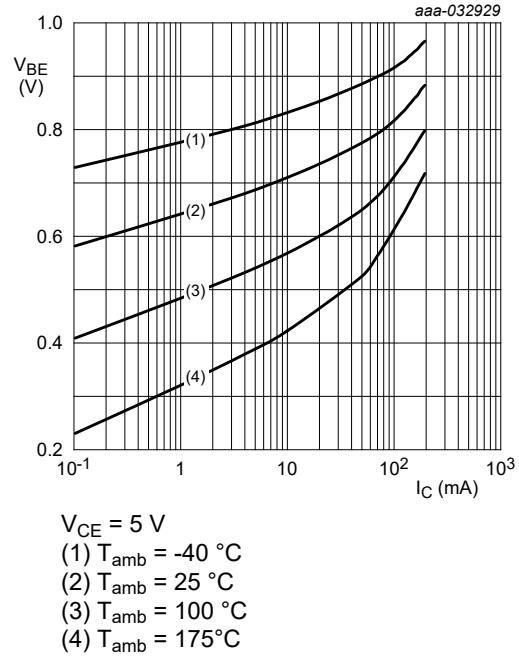


Fig. 4. Base-emitter voltage as a function of collector current; typical values

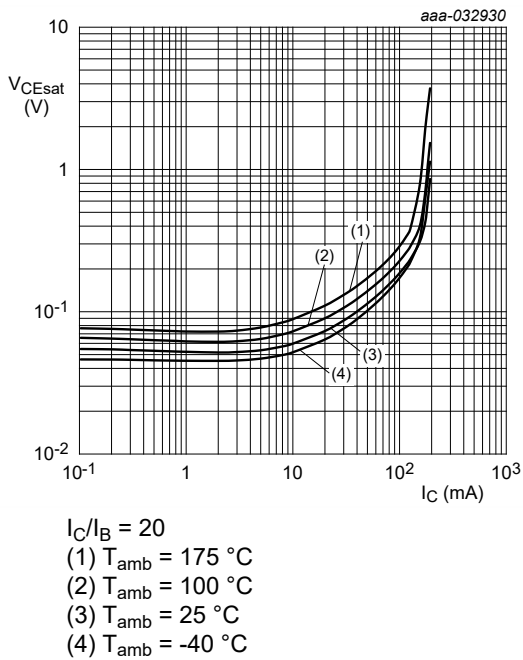


Fig. 5. Collector-emitter saturation voltage as a function of collector current; typical values

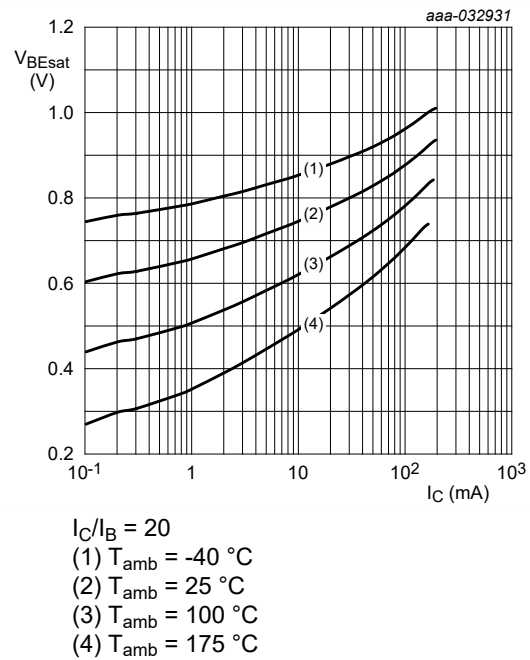


Fig. 6. Base-emitter saturation voltage as a function of collector current; typical values

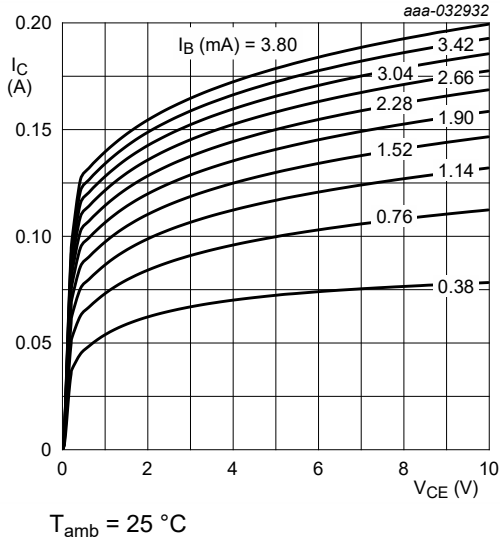


Fig. 7. Collector current as a function of collector-emitter voltage; typical values

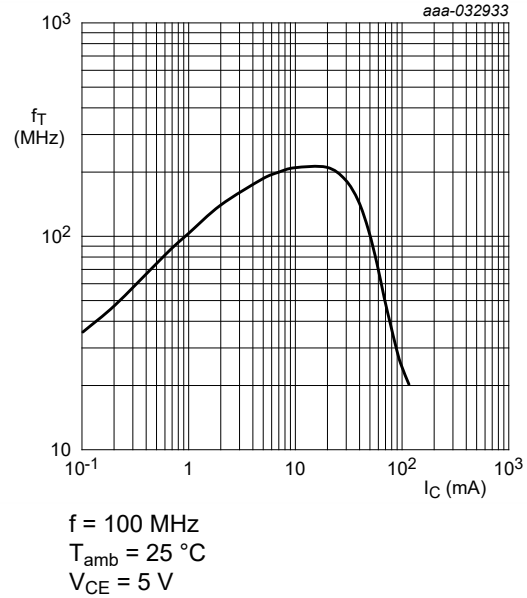


Fig. 8. Transition frequency as a function of collector current; typical values

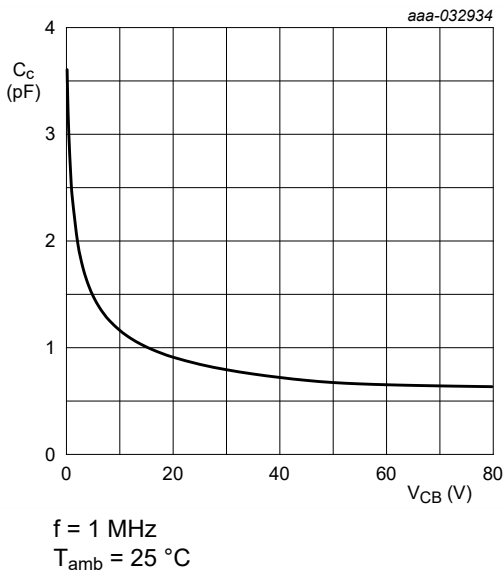


Fig. 9. Collector capacitance as a function of collector-base voltage; typical values

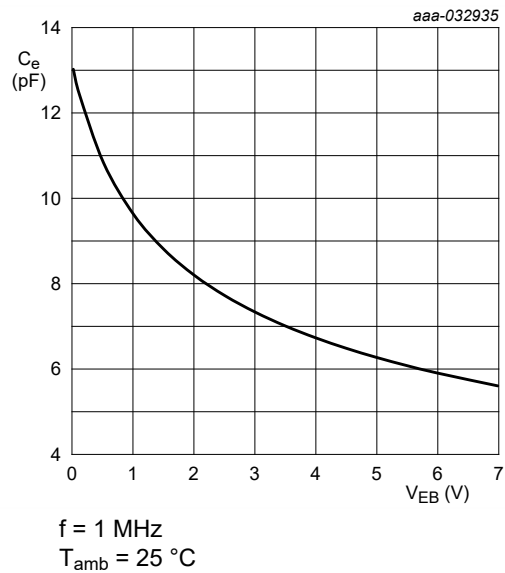


Fig. 10. Emitter capacitance as a function of emitter-base voltage; typical values

## 11. Test information

### 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

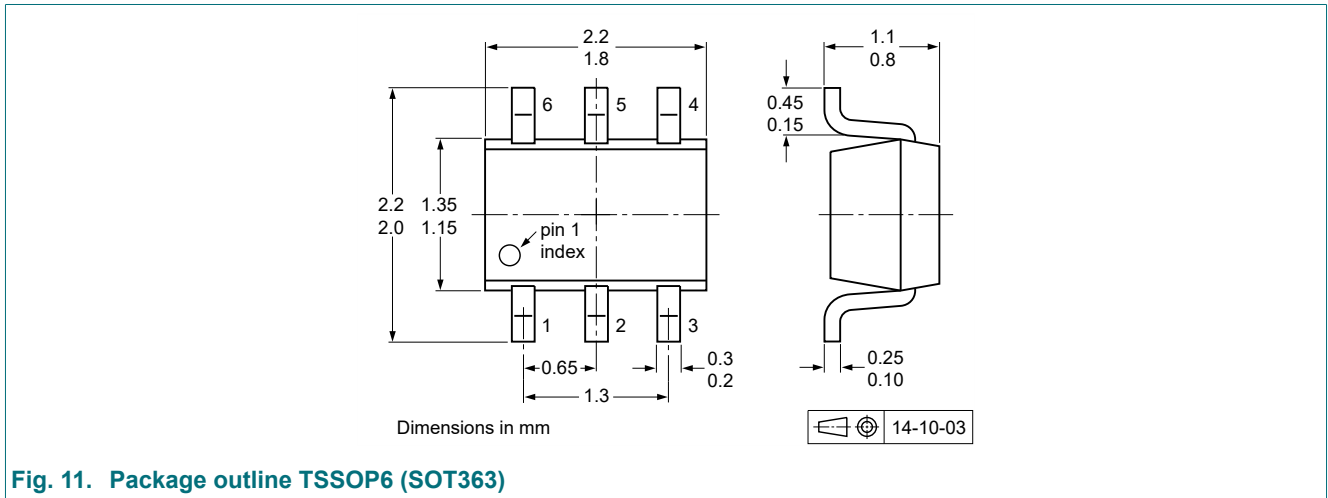


Fig. 11. Package outline TSSOP6 (SOT363)

## 13. Soldering

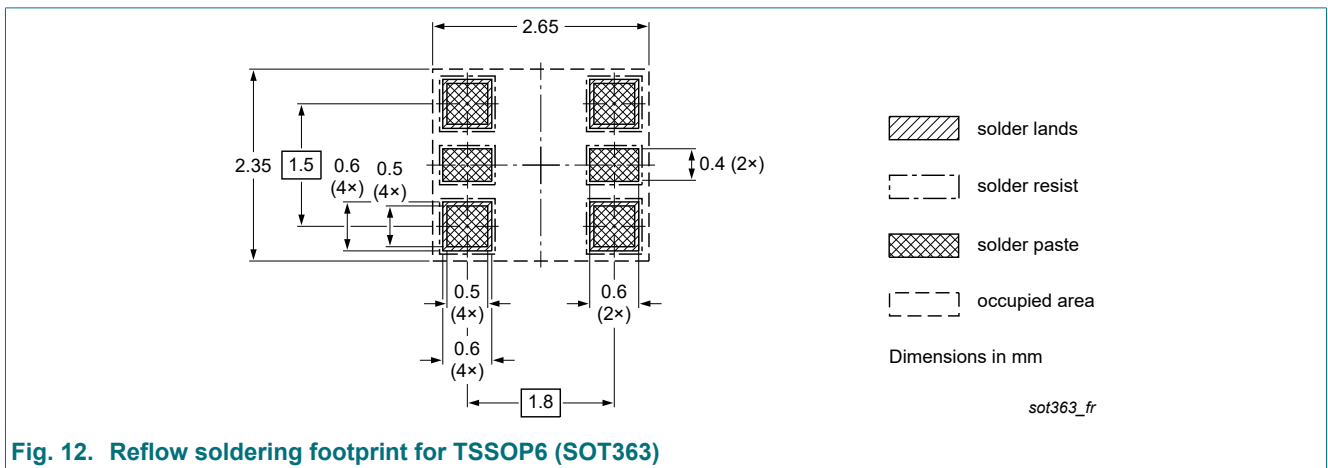


Fig. 12. Reflow soldering footprint for TSSOP6 (SOT363)

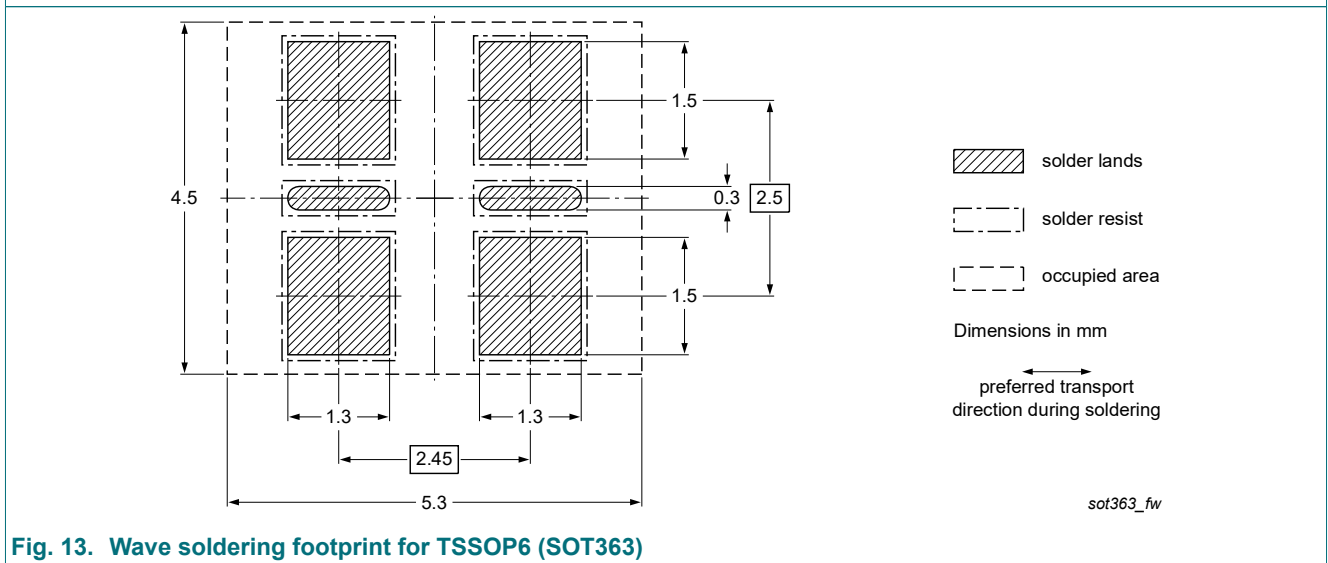


Fig. 13. Wave soldering footprint for TSSOP6 (SOT363)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BCM846BSH-Q v.1	20210506	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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