**Product data sheet** 

## 1. General description

NPN/NPN matched double transistor in a very small SOT363 (TSSOP6) Surface-Mounted Device (SMD) plastic package. The transistors are fully isolated internally.

# 2. Features and benefits

- Current gain matching
- Base-emitter voltage matching
- Drop-in replacement for standard double transistors
- AEC-Q101 qualified

## 3. Applications

- Current mirror
- Differential amplifier

## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Тур	Max	Unit		
Per transistor	Per transistor								
V <sub>CEO</sub>	collector-emitter voltage	open base		-	-	65	V		
I <sub>C</sub>	collector current			-	-	100	mA		
Per transistor							•		
h <sub>FE</sub>	DC current gain	$V_{CE} = 5 \text{ V}; I_{C} = 2 \text{ mA}; T_{amb} = 25 ^{\circ}\text{C}$		200	290	450			
Per device									
h <sub>FE1</sub> /h <sub>FE2</sub>	h <sub>FE</sub> matching	$V_{CE} = 5 \text{ V}; I_{C} = 2 \text{ mA}; T_{amb} = 25 ^{\circ}\text{C}$	[1]	0.9	1	-			
V <sub>BE1</sub> -V <sub>BE2</sub>	V <sub>BE</sub> matching		[2]	-	-	2	mV		

- [1] The smaller of the two values is taken as numerator.
- [2] The smaller of the two values is subtracted from the larger value.





## **NPN/NPN** matched double transistor

# 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	Е	emitter TR1	654	6 5 4
2	В	base TR1		7500
3	С	collector TR2	0	TR1 TR2
4	E	emitter TR2	☐1 ☐2 ☐3 <b>———</b> —————————————————————————————————	
5	В	base TR2	TSSOP6 (SOT363)	1 2 3
6	С	collector TR1		sym020

# 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BCM846BS	TSSOP6	plastic surface-mounted package; 6 leads	SOT363

# 7. Marking

Table 4. Marking codes

Type number	Marking code
Type manuscr	[1]
BCM846BS	F2%

[1] % = placeholder for manufacturing site code

### **NPN/NPN** matched double transistor

## 8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
Per transis	tor		'			_
$V_{CBO}$	collector-base voltage	open emitter		-	80	V
$V_{CEO}$	collector-emitter voltage	open base		-	65	V
$V_{EBO}$	emitter-base voltage	open collector		-	6	V
I <sub>C</sub>	collector current			-	100	mA
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms		-	200	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	200	mW
Per device						
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	300	mW
Tj	junction temperature			-	150	°C
T <sub>amb</sub>	ambient temperature			-55	150	°C
T <sub>stg</sub>	storage temperature			-65	150	°C

<sup>[1]</sup> Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

## 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Тур	Max	Unit	
Per transistor	Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	625	K/W	
Per device								
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	416	K/W	

<sup>[1]</sup> Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

BCM846BS

### NPN/NPN matched double transistor

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
Per transi	stor						
I <sub>CBO</sub>	collector-base cut-off	V <sub>CB</sub> = 30 V; I <sub>E</sub> = 0 A; T <sub>amb</sub> = 25 °C		-	-	15	nA
	current	V <sub>CB</sub> = 30 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C		-	-	5	μΑ
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = 5 V; I <sub>C</sub> = 0 A; T <sub>amb</sub> = 25 °C		-	-	100	nA
h <sub>FE</sub>	DC current gain	$V_{CE}$ = 5 V; $I_{C}$ = 2 mA; $T_{amb}$ = 25 °C		200	290	450	
		V <sub>CE</sub> = 5 V; I <sub>C</sub> = 10 μA; T <sub>amb</sub> = 25 °C		-	250	-	
V <sub>CEsat</sub>	collector-emitter	$I_C$ = 10 mA; $I_B$ = 0.5 mA; $T_{amb}$ = 25 °C		-	50	200	mV
	saturation voltage	$I_C$ = 100 mA; $I_B$ = 5 mA; pulsed;		-	200	400	mV
V <sub>BEsat</sub>	base-emitter saturation	$t_p \le 300 \ \mu s; \ \delta \le 0.02; \ T_{amb} = 25 \ ^{\circ}C$	[1]	-	910	-	mV
	voltage	$I_C$ = 10 mA; $I_B$ = 0.5 mA; $T_{amb}$ = 25 °C	[1]	-	760	-	mV
$V_{BE}$	base-emitter voltage	$V_{CE}$ = 5 V; $I_{C}$ = 10 mA; $T_{amb}$ = 25 °C	[2]	-	-	770	mV
$V_{BE}$	base-emitter voltage	$V_{CE}$ = 5 V; $I_{C}$ = 2 mA; $T_{amb}$ = 25 °C	[2]	610	660	710	mV
C <sub>C</sub>	collector capacitance	V <sub>CB</sub> = 10 V; I <sub>E</sub> = 0 A; i <sub>e</sub> = 0 A; f = 1 MHz; T <sub>amb</sub> = 25 °C		-	-	1.5	pF
C <sub>E</sub>	emitter capacitance	$V_{EB} = 0.5 \text{ V}; I_{C} = 0 \text{ A}; i_{c} = 0 \text{ A};$ $f = 1 \text{ MHz}; T_{amb} = 25 ^{\circ}\text{C}$		-	11	-	pF
f <sub>T</sub>	transition frequency	$V_{CE}$ = 5 V; $I_{C}$ = 10 mA; f = 100 MHz; $T_{amb}$ = 25 °C		100	250	-	MH
NF	noise figure	$V_{CE}$ = 5 V; $I_{C}$ = 0.2 mA; $R_{S}$ = 2 k $\Omega$ ; f = 1 kHz; B = 200 Hz; $T_{amb}$ = 25 °C		-	3.3	-	dB
		$V_{CE}$ = 5 V; $I_{C}$ = 0.2 mA; $R_{S}$ = 2 k $\Omega$ ; $T_{amb}$ = 25 °C; f = 10 Hz to 15.7 kHz		-	2.8	-	dB
Per device	<b>e</b>		1	1	1	1	
h <sub>FE1</sub> /h <sub>FE2</sub>	h <sub>FE</sub> matching	$V_{CE}$ = 5 V; $I_{C}$ = 2 mA; $T_{amb}$ = 25 °C	[3]	0.9	1	-	
V <sub>BE1</sub> -V <sub>BE2</sub>	V <sub>BE</sub> matching		[4]	-	-	2	mV

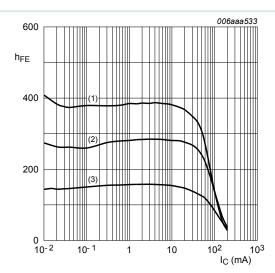
<sup>[1]</sup>  $V_{BEsat}$  decreases by about 1.7 mV/K with increasing temperature.

<sup>[2]</sup> V<sub>BE</sub> decreases by about 2 mV/K with increasing temperature.

<sup>[3]</sup> The smaller of the two values is taken as numerator.

<sup>[4]</sup> The smaller of the two values is subtracted from the larger value.

### NPN/NPN matched double transistor



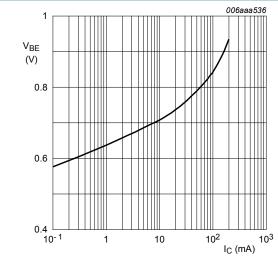
$$V_{CE} = 5 V$$

(1) 
$$T_{amb} = 100 \, ^{\circ}C$$

(2) 
$$T_{amb}$$
 = 25 °C

$$(3) T_{amb} = -55 °C$$

Fig. 1. DC current gain as a function of collector current; typical values



 $V_{CE}$  = 5 V;  $T_{amb}$  = 25 °C

Fig. 3. Base-emitter voltage as a function of collector current; typical values

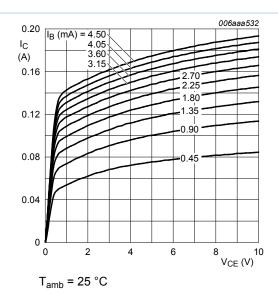
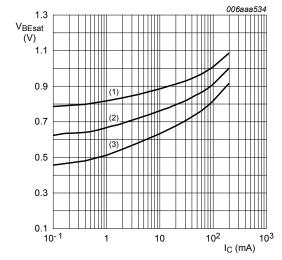


Fig. 2. Collector current as a function of collectoremitter voltage; typical values



 $I_{\rm C}/I_{\rm B} = 20$ 

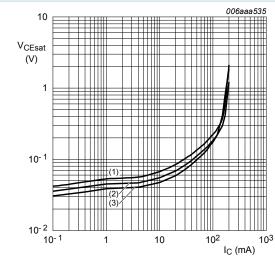
(1)  $T_{amb} = -55 \, ^{\circ}C$ 

(2)  $T_{amb}$  = 25 °C

(3)  $T_{amb} = 100 \, ^{\circ}C$ 

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

### NPN/NPN matched double transistor



$$I_{\rm C}/I_{\rm B} = 20$$

(1) 
$$T_{amb}$$
 = 100 °C

(2) 
$$T_{amb}$$
 = 25 °C

(3) 
$$T_{amb} = -55$$
 °C

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

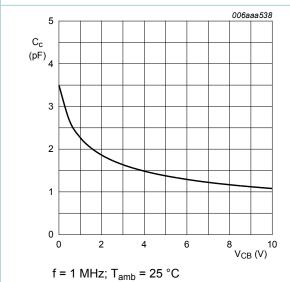


Fig. 7. Collector capacitance as a function of collectorbase voltage; typical values

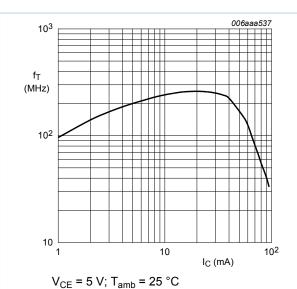
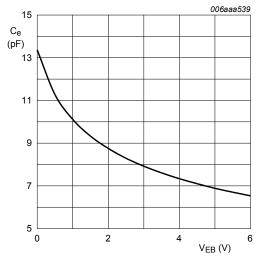


Fig. 6. Transition frequency as a function of collector current; typical values

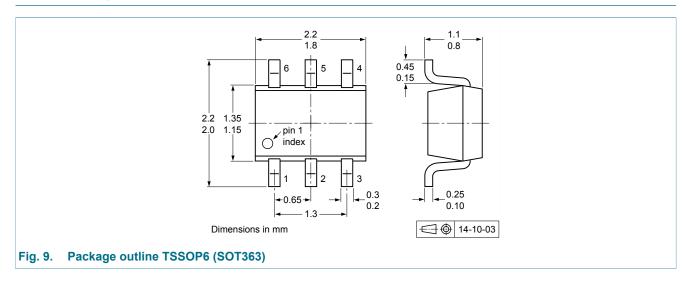


f = 1 MHz; T<sub>amb</sub> = 25 °C

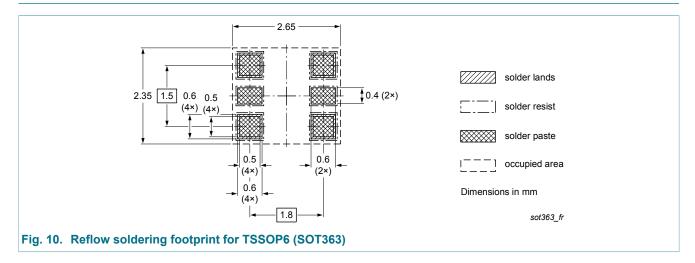
. Emitter capacitance as a function of emitterbase voltage; typical values

### NPN/NPN matched double transistor

# 11. Package outline

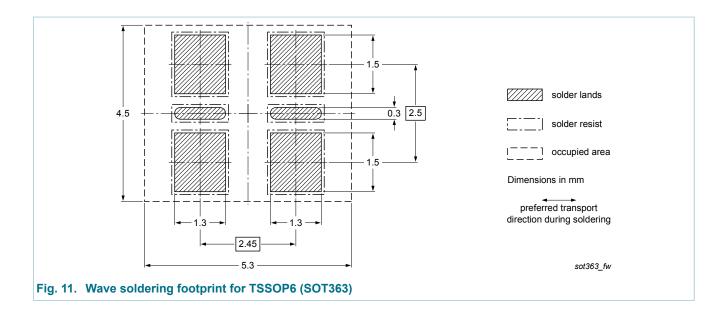


# 12. Soldering



7/12

## **NPN/NPN** matched double transistor



## **NPN/NPN** matched double transistor

# 13. Revision history

## Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BCM846BS v.2	20150626	Product data sheet	-	BCM846BS v.1
Modification:	Product status char	iged		
BCM846BS v.1	20150424	Objective data sheet	-	-

#### NPN/NPN matched double transistor

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### 14.1 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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Date of release: 26 June 2015