

# BCM856BS; BCM856BS/DG BCM856DS; BCM856DS/DG

PNP/PNP matched double transistors

Rev. 01 — 7 August 2008

Product data sheet

## 1. Product profile

### 1.1 General description

PNP/PNP matched double transistors in small Surface-Mounted Device (SMD) plastic packages. The transistors are fully isolated internally.

Table 1. Product overview

Type number	Package		Package configuration
	NXP	JEITA	
BCM856BS BCM856BS/DG	SOT363	SC-88	very small
BCM856DS BCM856DS/DG	SOT457	SC-74	small

### 1.2 Features

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

### 1.3 Applications

- Current mirror
- Differential amplifier

### 1.4 Quick reference data

Table 2. 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	$V_{CE} = -5\text{ V};$ $I_C = -2\text{ mA}$	200	290	450	

**Table 2. Quick reference data ...continued**

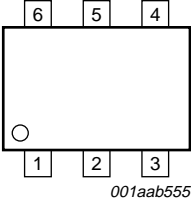
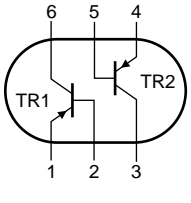
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per device</b>						
$h_{FE1}/h_{FE2}$	$h_{FE}$ matching	$V_{CE} = -5\text{ V};$ $I_C = -2\text{ mA}$	[1] 0.9	1	-	
$V_{BE1}-V_{BE2}$	$V_{BE}$ matching	$V_{CE} = -5\text{ V};$ $I_C = -2\text{ mA}$	[2] -	-	2	mV

[1] The smaller of the two values is taken as the numerator.

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

## 2. Pinning information

**Table 3. Pinning**

Pin	Description	Simplified outline	Graphic symbol
1	emitter TR1	 <p>001aab555</p>	 <p>sym018</p>
2	base TR1		
3	collector TR2		
4	emitter TR2		
5	base TR2		
6	collector TR1		

## 3. Ordering information

**Table 4. Ordering information**

Type number	Package		
	Name	Description	Version
BCM856BS	SC-88	plastic surface-mounted package; 6 leads	SOT363
BCM856BS/DG			
BCM856DS	SC-74	plastic surface-mounted package (TSOP6); 6 leads	SOT457
BCM856DS/DG			

## 4. Marking

**Table 5. Marking codes**

Type number	Marking code <sup>[1]</sup>
BCM856BS	*BS
BCM856BS/DG	PB*
BCM856DS	DS
BCM856DS/DG	R9

- [1] \* = -: made in Hong Kong  
 \* = p: made in Hong Kong  
 \* = t: made in Malaysia  
 \* = W: made in China

## 5. Limiting values

**Table 6. 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	-	-5	V
$I_C$	collector current		-	-100	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C			
	BCM856BS (SOT363) BCM856BS/DG (SOT363)		[1] -	200	mW
	BCM856DS (SOT457) BCM856DS/DG (SOT457)		[1] -	250	mW
<b>Per device</b>					
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C			
	BCM856BS (SOT363) BCM856BS/DG (SOT363)		[1] -	300	mW
	BCM856DS (SOT457) BCM856DS/DG (SOT457)		[1] -	380	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.

## 6. Thermal characteristics

**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air				
	BCM856BS (SOT363) BCM856BS/DG (SOT363)		[1]	-	625	K/W
	BCM856DS (SOT457) BCM856DS/DG (SOT457)		[1]	-	500	K/W
<b>Per device</b>						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air				
	BCM856BS (SOT363) BCM856BS/DG (SOT363)		[1]	-	416	K/W
	BCM856DS (SOT457) BCM856DS/DG (SOT457)		[1]	-	328	K/W

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

## 7. Characteristics

**Table 8. Characteristics**

$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -30\text{ V};$ $I_E = 0\text{ A}$	-	-	-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	$V_{EB} = -5\text{ V};$ $I_C = 0\text{ A}$	-	-	-100	nA
$h_{FE}$	DC current gain	$V_{CE} = -5\text{ V};$ $I_C = -10\text{ }\mu\text{A}$	-	250	-	
		$V_{CE} = -5\text{ V};$ $I_C = -2\text{ mA}$	200	290	450	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -10\text{ mA};$ $I_B = -0.5\text{ mA}$	-	-50	-200	mV
		$I_C = -100\text{ mA};$ $I_B = -5\text{ mA}$	-	-200	-400	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -10\text{ mA};$ $I_B = -0.5\text{ mA}$	[1]	-	-760	mV
		$I_C = -100\text{ mA};$ $I_B = -5\text{ mA}$	[1]	-	-920	mV

**Table 8. Characteristics ...continued**  
 $T_{amb} = 25^{\circ}\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{BE}$	base-emitter voltage	$V_{CE} = -5\text{ V};$ $I_C = -2\text{ mA}$	[2] -600	-650	-700	mV
		$V_{CE} = -5\text{ V};$ $I_C = -10\text{ mA}$	[2] -	-	-760	mV
$C_c$	collector capacitance	$V_{CB} = -10\text{ V};$ $I_E = I_e = 0\text{ A};$ $f = 1\text{ MHz}$	-	-	2.2	pF
$C_e$	emitter capacitance	$V_{EB} = -0.5\text{ V};$ $I_C = I_c = 0\text{ A};$ $f = 1\text{ MHz}$	-	10	-	pF
$f_T$	transition frequency	$V_{CE} = -5\text{ V};$ $I_C = -10\text{ mA};$ $f = 100\text{ MHz}$	100	175	-	MHz
NF	noise figure	$V_{CE} = -5\text{ V};$ $I_C = -0.2\text{ mA};$ $R_S = 2\text{ k}\Omega;$ $f = 10\text{ Hz to}$ $15.7\text{ kHz}$	-	1.6	-	dB
		$V_{CE} = -5\text{ V};$ $I_C = -0.2\text{ mA};$ $R_S = 2\text{ k}\Omega;$ $f = 1\text{ kHz};$ $B = 200\text{ Hz}$	-	3.1	-	dB
<b>Per device</b>						
$h_{FE1}/h_{FE2}$	$h_{FE}$ matching	$V_{CE} = -5\text{ V};$ $I_C = -2\text{ mA}$	[3] 0.9	1	-	
$V_{BE1}-V_{BE2}$	$V_{BE}$ matching	$V_{CE} = -5\text{ V};$ $I_C = -2\text{ mA}$	[4] -	-	2	mV

[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 taken as the numerator.

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

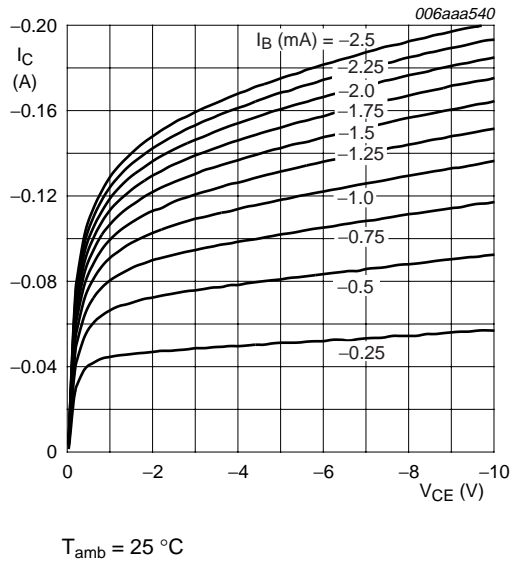


Fig 1. Collector current as a function of collector-emitter voltage; typical values

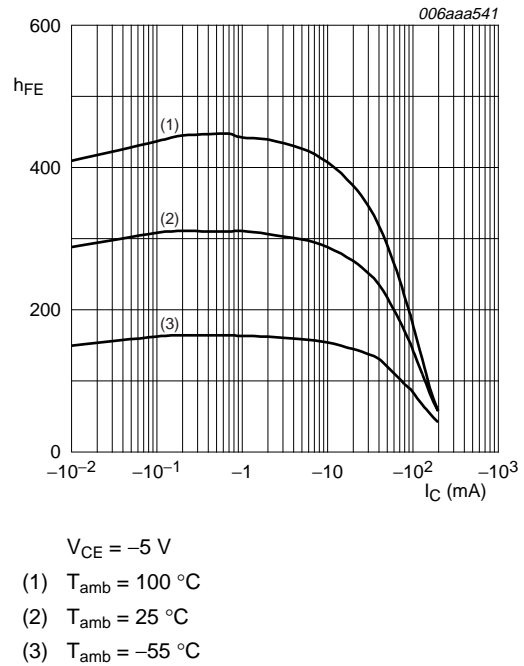


Fig 2. DC current gain as a function of collector current; typical values

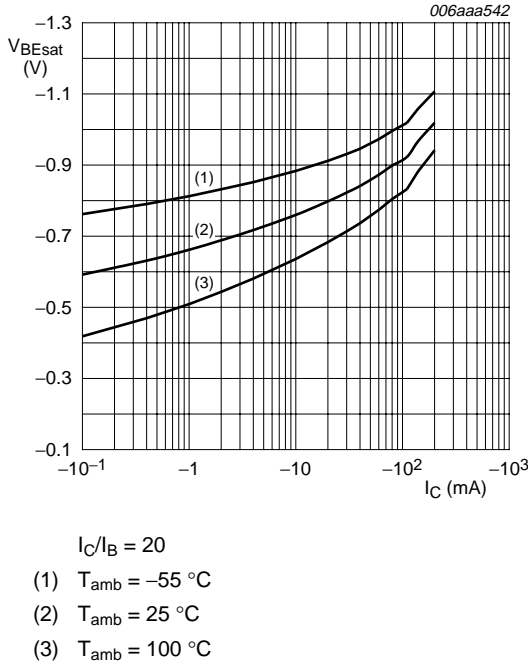


Fig 3. Base-emitter saturation voltage as a function of collector current; typical values

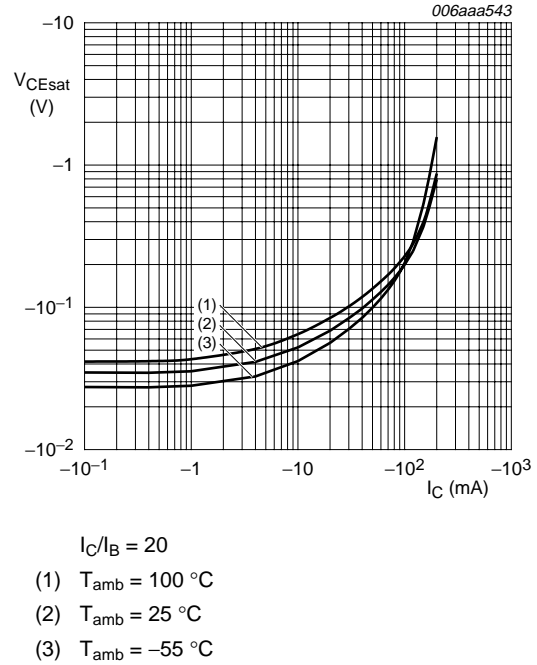
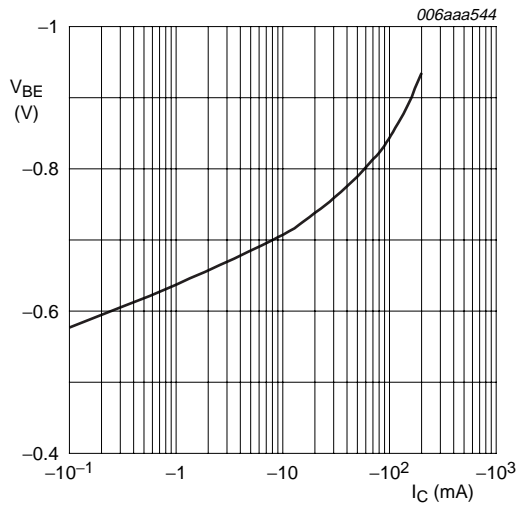
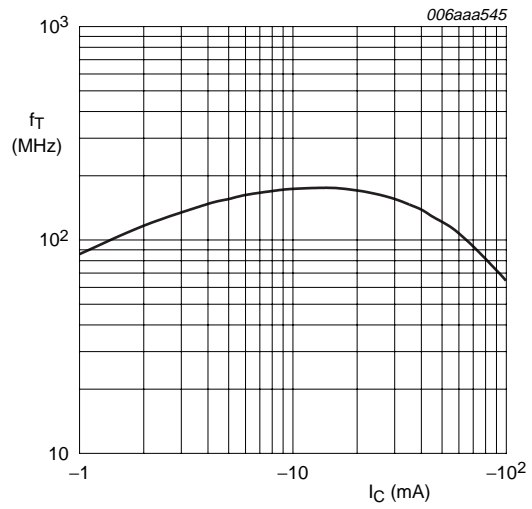


Fig 4. Collector-emitter saturation voltage as a function of collector current; typical values



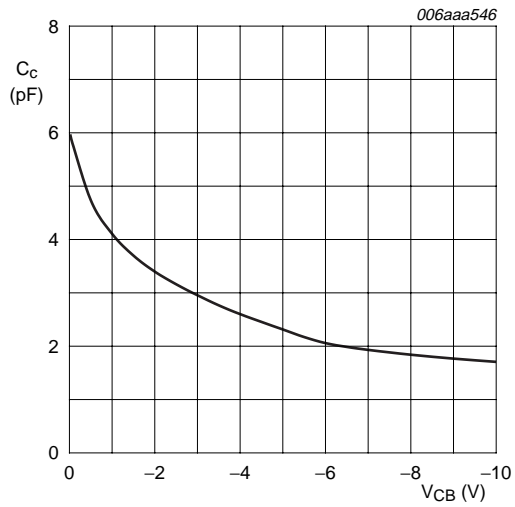
$V_{CE} = -5$  V;  $T_{amb} = 25$  °C

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



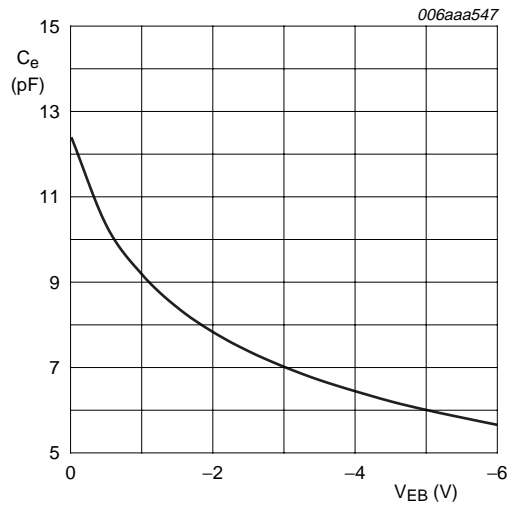
$V_{CE} = -5$  V;  $T_{amb} = 25$  °C

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



$f = 1$  MHz;  $T_{amb} = 25$  °C

**Fig 7. Collector capacitance as a function of collector-base voltage; typical values**



$f = 1$  MHz;  $T_{amb} = 25$  °C

**Fig 8. Emitter capacitance as a function of emitter-base voltage; typical values**

## 8. Application information

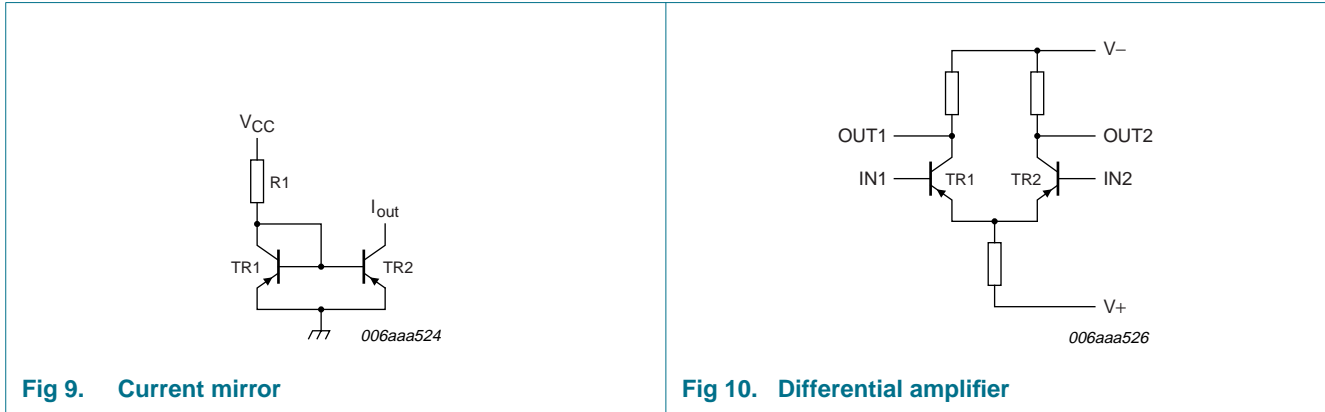


Fig 9. Current mirror

Fig 10. Differential amplifier

## 9. Test information

### 9.1 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.

## 10. Package outline

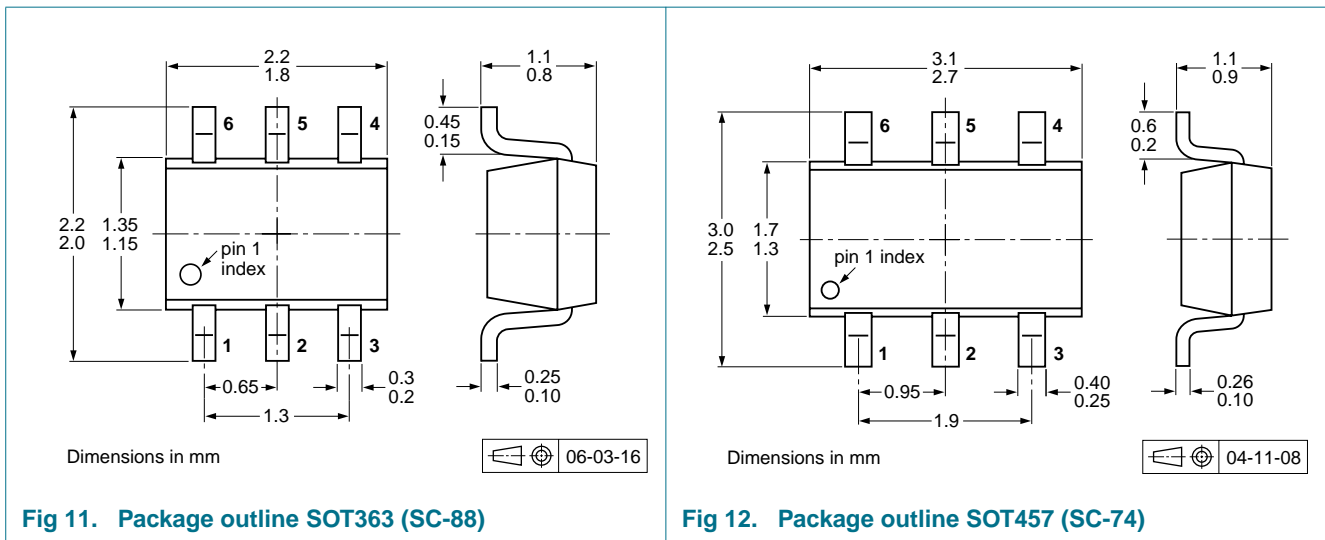


Fig 11. Package outline SOT363 (SC-88)

Fig 12. Package outline SOT457 (SC-74)



## 11. Packing information

**Table 9. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

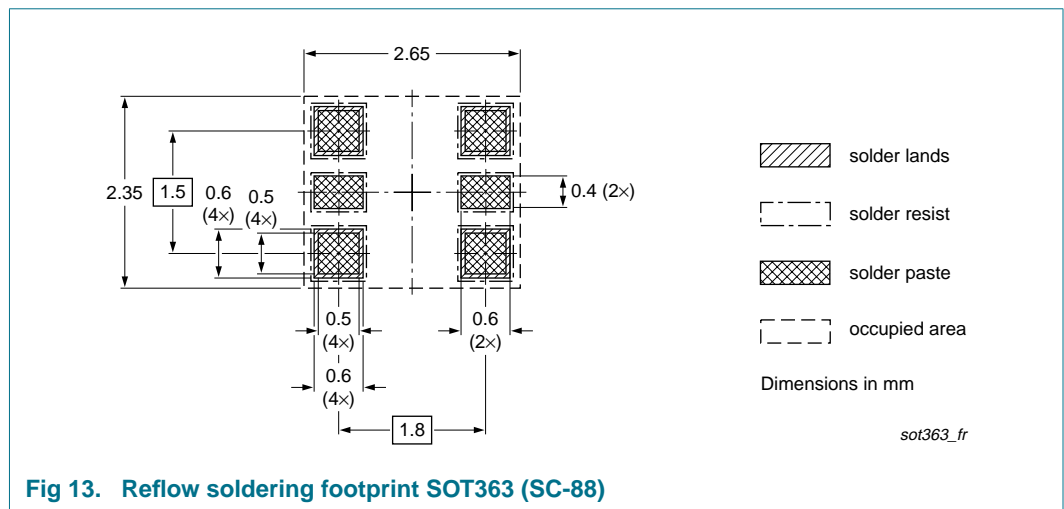
Type number	Package	Description	Packing quantity	
			3000	10000
BCM856BS	SOT363	4 mm pitch, 8 mm tape and reel; T1	[2] -115	-135
		4 mm pitch, 8 mm tape and reel; T2	[3] -125	-165
BCM856BS/DG	SOT363	4 mm pitch, 8 mm tape and reel; T1	[2] -115	-135
		4 mm pitch, 8 mm tape and reel; T2	[3] -125	-165
BCM856DS	SOT457	4 mm pitch, 8 mm tape and reel; T1	[2] -115	-135
		4 mm pitch, 8 mm tape and reel; T2	[3] -125	-165
BCM856DS/DG	SOT457	4 mm pitch, 8 mm tape and reel; T1	[2] -115	-135
		4 mm pitch, 8 mm tape and reel; T2	[3] -125	-165

[1] For further information and the availability of packing methods, see [Section 15](#).

[2] T1: normal taping

[3] T2: reverse taping

## 12. Soldering



**Fig 13. Reflow soldering footprint SOT363 (SC-88)**

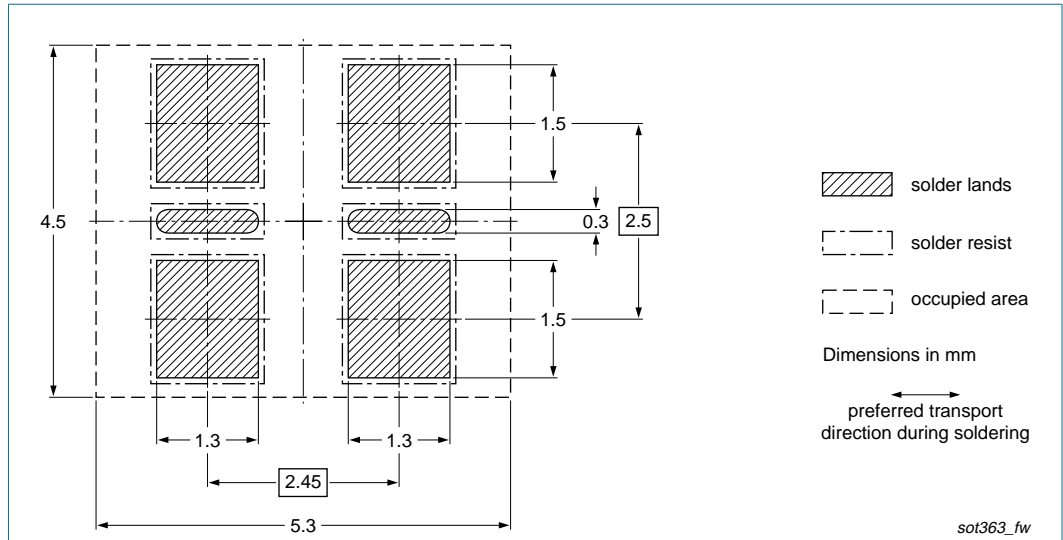


Fig 14. Wave soldering footprint SOT363 (SC-88)

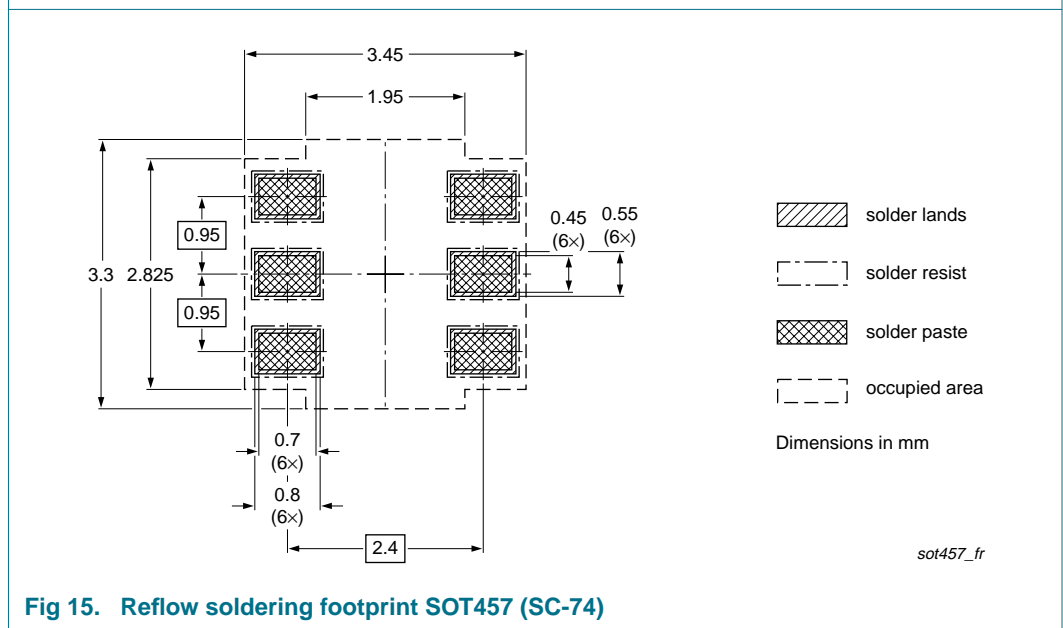


Fig 15. Reflow soldering footprint SOT457 (SC-74)

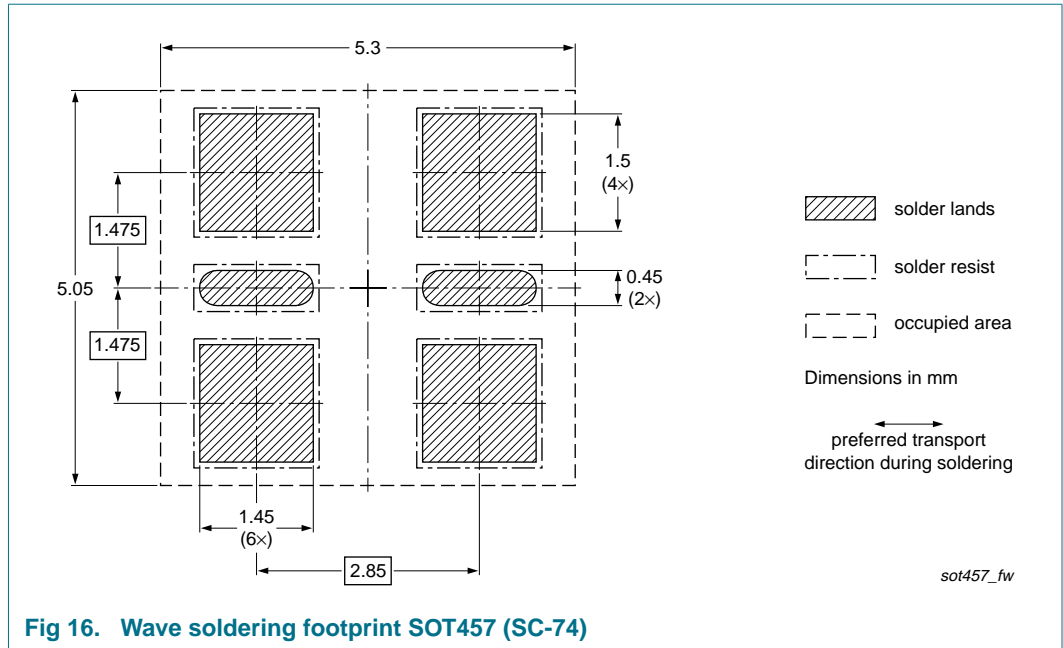


Fig 16. Wave soldering footprint SOT457 (SC-74)

## 13. Revision history

**Table 10. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BCM856BS_BCM856DS_1	20080807	Product data sheet	-	-

## 14. Legal information

### 14.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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