



# BCM56DS

80 V, 1 A NPN/NPN matched double transistors

10 April 2018

Product data sheet

## 1. General description

NPN/NPN matched double transistors in a small SOT457 (SC-74) Surface-Mounted Device (SMD) plastic package.

PNP/PNP complement: BCM53DS

## 2. Features and benefits

- High collector current capability  $I_C$  and  $I_{CM}$
- Reduces component count
- Reduces pick and place costs
- Current gain matching 5%
- Application-optimized pinout
- AEC-Q101 qualified

## 3. Applications

- Current mirror
- Differential amplifier
- Linear voltage regulators
- MOSFET drivers
- High-side switches
- Power management
- Amplifiers

## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	80	V
$I_C$	collector current		-	-	1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	2	A
$h_{FE}$	DC current gain	$V_{CE} = 2$ V; $I_C = 150$ mA; $T_{amb} = 25$ °C	[1]	63	-	250
<b>Per device</b>						
$h_{FE1}/h_{FE2}$	DC current gain matching	$V_{CE} = 5$ V; $I_C = 2$ mA; $T_{amb} = 25$ °C	0.95	1	1.05	

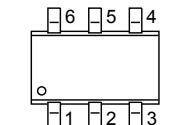
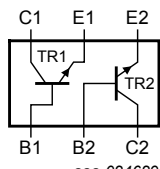
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{BE1}-V_{BE2}$	base-emitter voltage matching		[2]	-	-	2	mV

[1] Pulse test:  $t_p \leq 300 \mu\text{s}$ ;  $\delta \leq 0.02$

[2] 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	B1	base TR1	 <p>TSOP6 (SOT457)</p>	 <p>aaa-024629</p>
2	B2	base TR2		
3	C2	collector TR2		
4	E2	emitter TR2		
5	E1	emitter TR1		
6	C1	collector TR1		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BCM56DS	TSOP6	plastic, surface-mounted package (SC-74)	SOT457

## 7. Marking

Table 4. Marking codes

Type number	Marking code
BCM56DS	3D

## 8. Limiting values

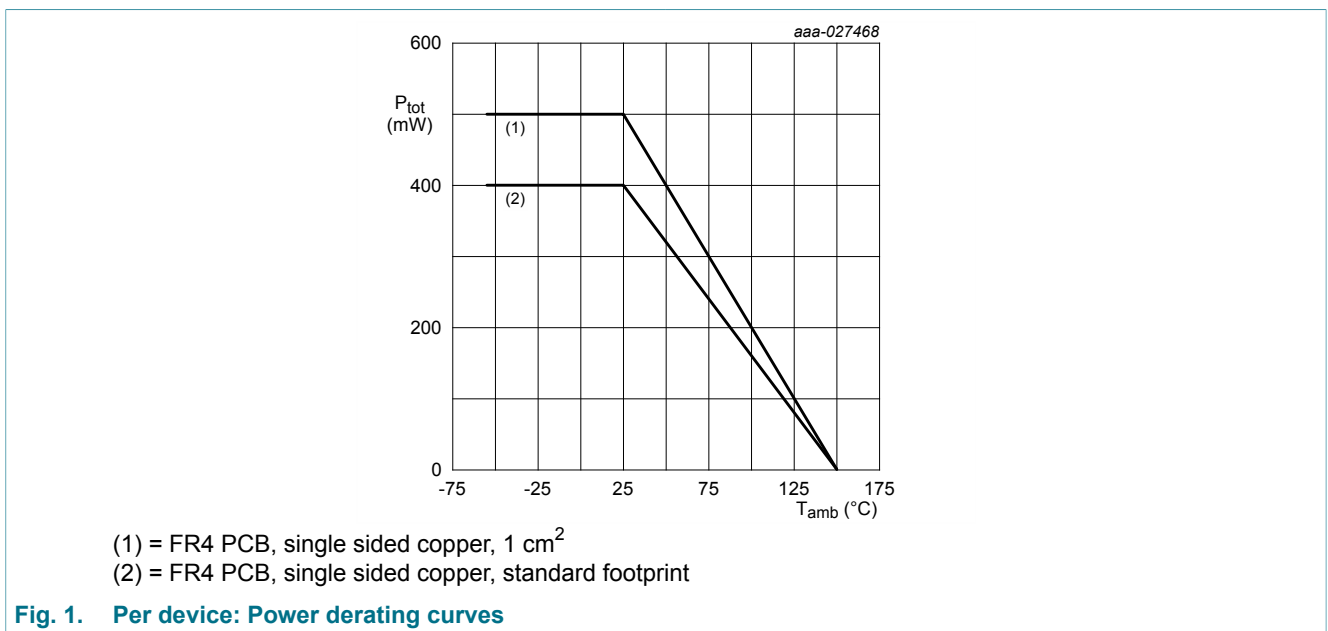
**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC60134).

Symbol	Parameter	Conditions		Min	Max	Unit
<b>Per transistor</b>						
$V_{CBO}$	collector-base voltage	open emitter		-	100	V
$V_{CEO}$	collector-emitter voltage	open base		-	80	V
$V_{EBO}$	emitter-base voltage	open collector		-	5	V
$I_C$	collector current			-	1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms		-	2	A
$I_{Blim}$	limiting base current			-	0.2	A
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms		-	0.3	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	270	mW
			[2]	-	320	mW
<b>Per device</b>						
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	400	mW
			[2]	-	500	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 Printed-Circuit Board (PCB), single-sided copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.



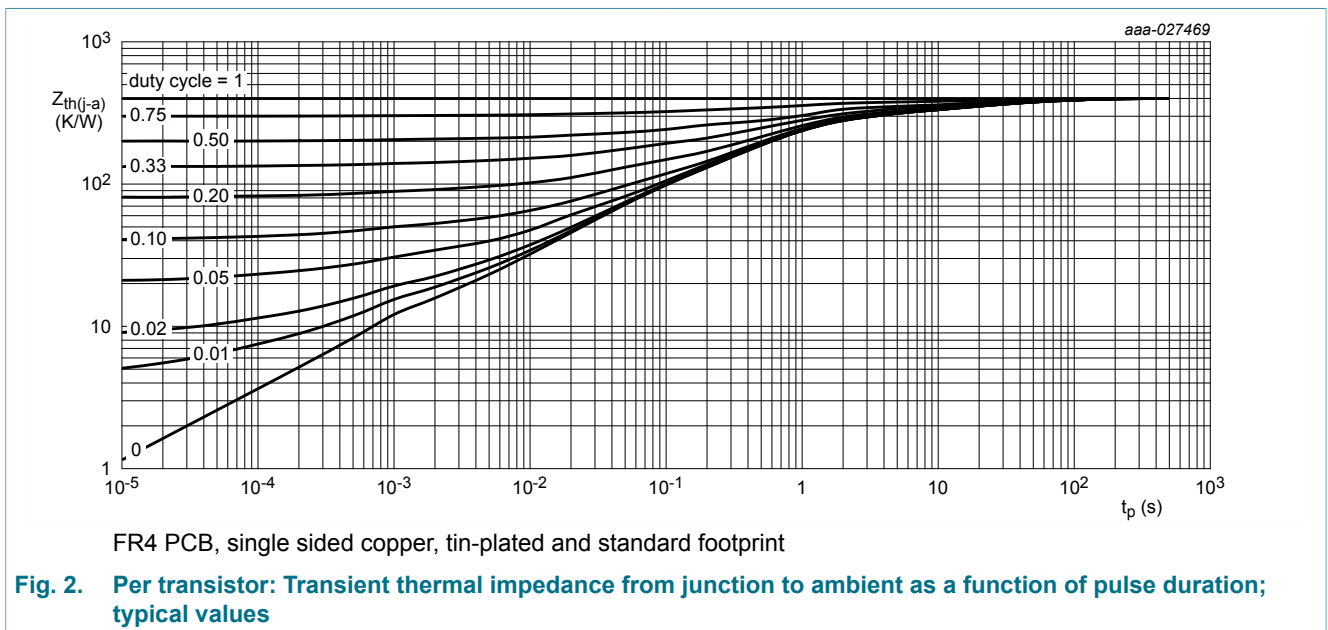
## 9. Thermal characteristics

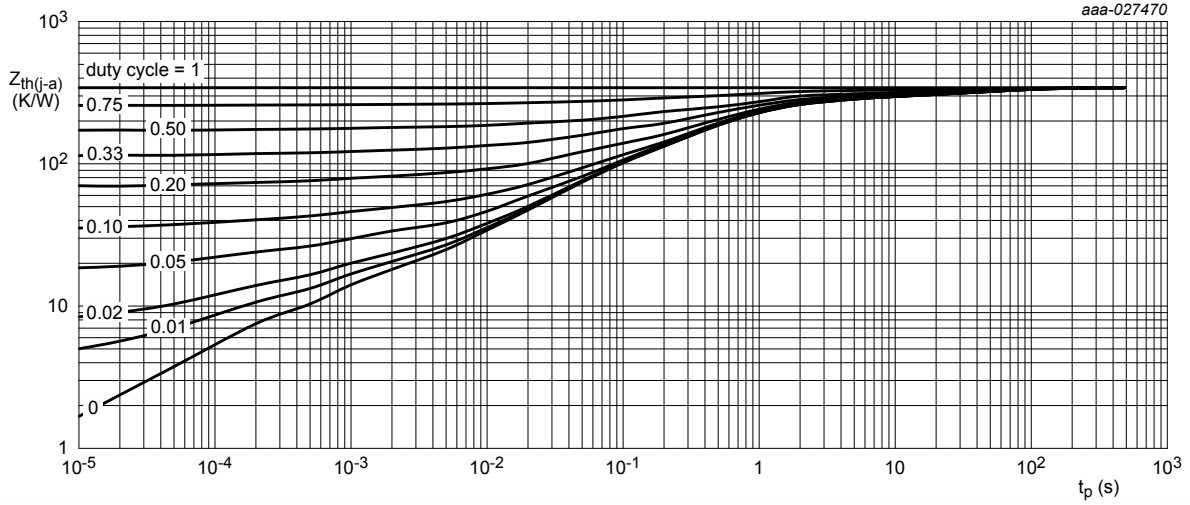
Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Per transistor</b>							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	463	K/W
			[2]	-	-	391	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	150	K/W
<b>Per device</b>							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	313	K/W
			[2]	-	-	250	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; mounting pad for collector 1 cm<sup>2</sup>.





FR4 PCB, single sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>

**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
<b>Per transistor</b>						
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100 \mu\text{A}; I_E = 0 \text{ A}$	100	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2 \text{ mA}; I_B = 0 \text{ A}$	80	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_C = 0 \text{ A}; I_E = 100 \mu\text{A}$	5	-	-	V
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 30 \text{ V}; I_E = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	100	nA
		$V_{CB} = 30 \text{ V}; I_E = 0 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$	-	-	10	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5 \text{ V}; I_C = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	100	nA
$h_{FE}$	DC current gain	$V_{CE} = 5 \text{ V}; I_C = 2 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	63	-	-	
		$V_{CE} = 2 \text{ V}; I_C = 150 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ [1]	63	-	250	
		$V_{CE} = 2 \text{ V}; I_C = 500 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ [1]	40	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 500 \text{ mA}; I_B = 50 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ [1]	-	-	500	mV
$V_{BE}$	base-emitter voltage	$V_{CE} = 2 \text{ V}; I_C = 500 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ [1]	-	-	1	V
$C_c$	collector capacitance	$V_{CB} = 10 \text{ V}; I_E = 0 \text{ A}; i_e = 0 \text{ A}; f = 1 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	4.5	-	pF
$f_T$	transition frequency	$V_{CE} = 5 \text{ V}; I_C = 50 \text{ mA}; f = 100 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	100	155	-	MHz
<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		[2]	-	-	2

[1] Pulse test:  $t_p \leq 300 \mu\text{s}; \delta \leq 0.02$

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

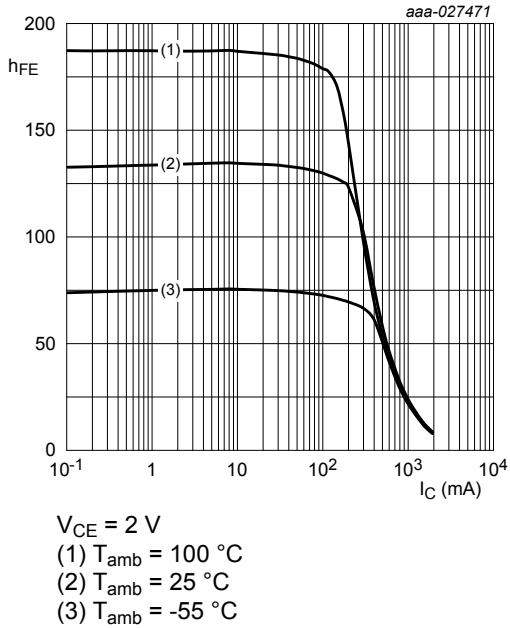


Fig. 4. DC current gain as a function of collector current; typical values

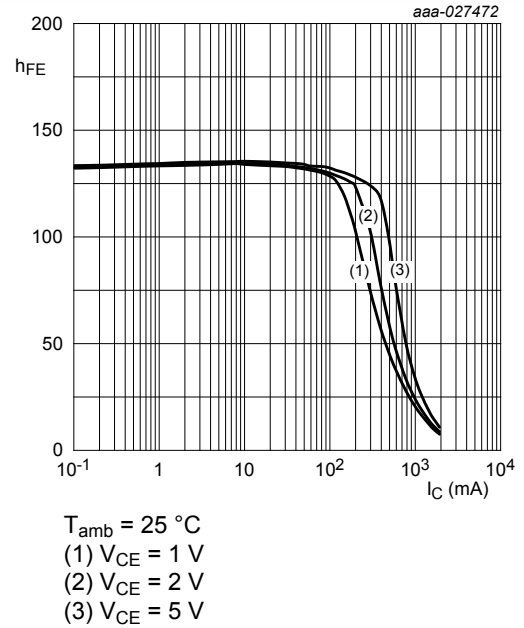


Fig. 5. DC current gain as a function of collector current; typical values

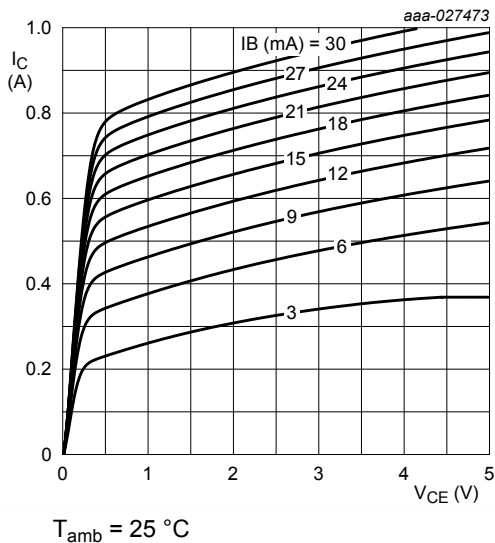


Fig. 6. Collector current as a function of collector-emitter voltage; typical values

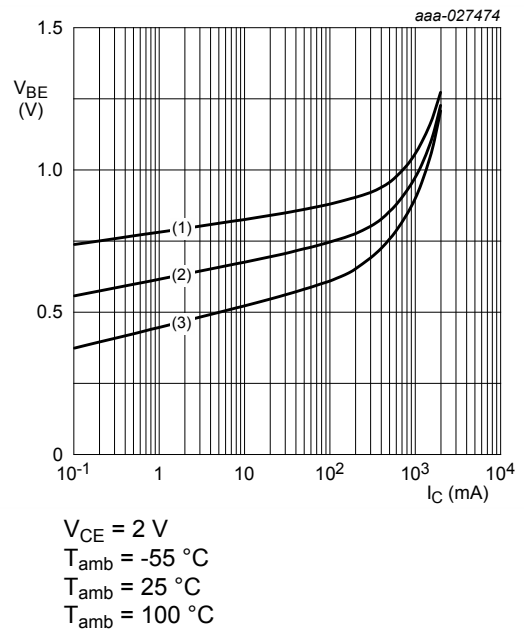
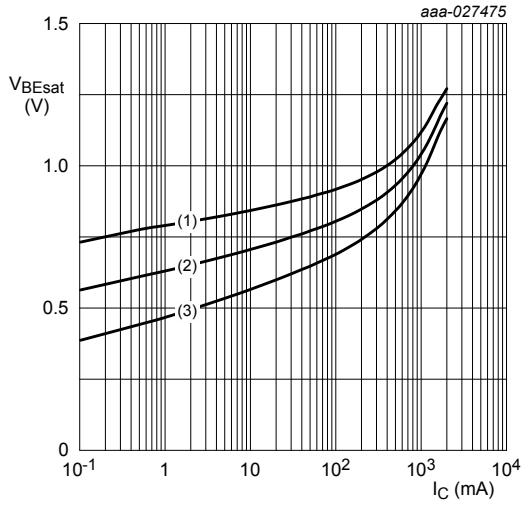
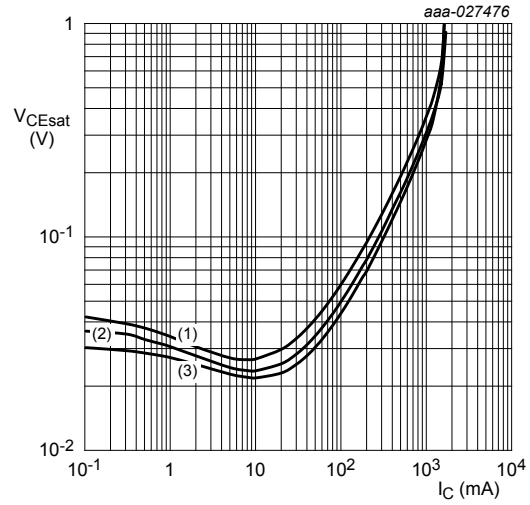


Fig. 7. Base-emitter voltage as a function of collector current; typical values



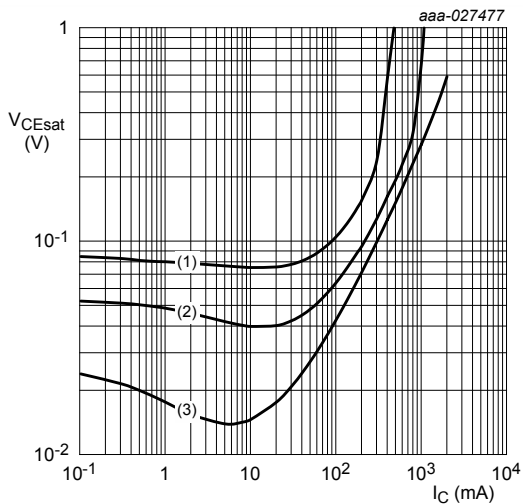
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 100^\circ C$

**Fig. 8. Base-emitter saturation voltage as a function of collector current; typical values**



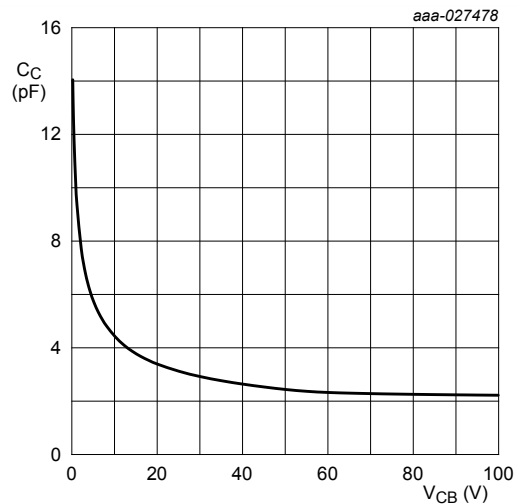
$I_C/I_B = 10$   
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -55^\circ C$

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



$T_{amb} = 25^\circ C$   
 (1)  $I_C/I_B = 50$   
 (2)  $I_C/I_B = 20$   
 (3)  $I_C/I_B = 5$

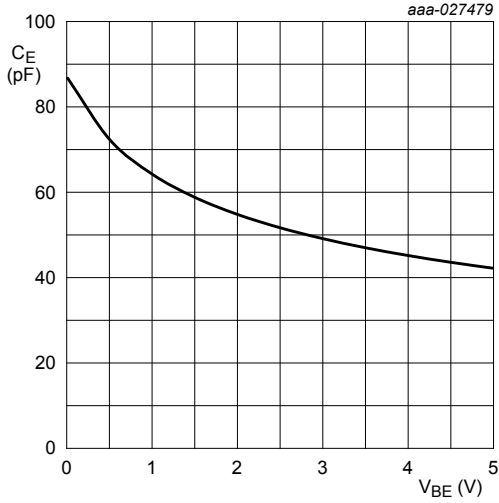
**Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values**



$f = 1\text{ MHz}$   
 $T_{amb} = 25^\circ C$

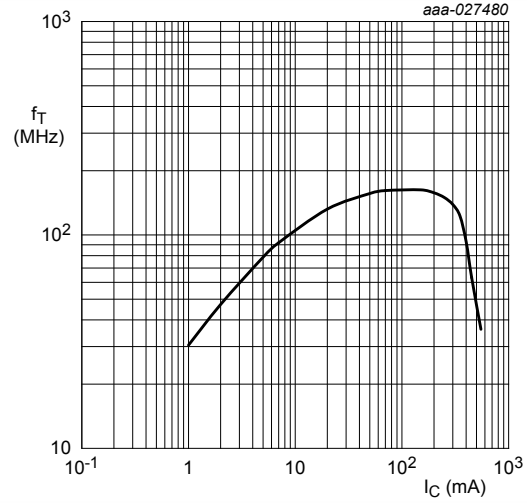
**Fig. 11. Collector capacitance as a function of collector-base voltage; typical values**





$f = 1 \text{ MHz}$   
 $T_{amb} = 25 \text{ }^\circ\text{C}$

Fig. 12. Emitter capacitance as a function of emitter-base voltage; typical values



$V_{CE} = 5 \text{ V}$   
 $f = 100 \text{ MHz}$   
 $T_{amb} = 25 \text{ }^\circ\text{C}$

Fig. 13. Transition frequency as a function of collector current; 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

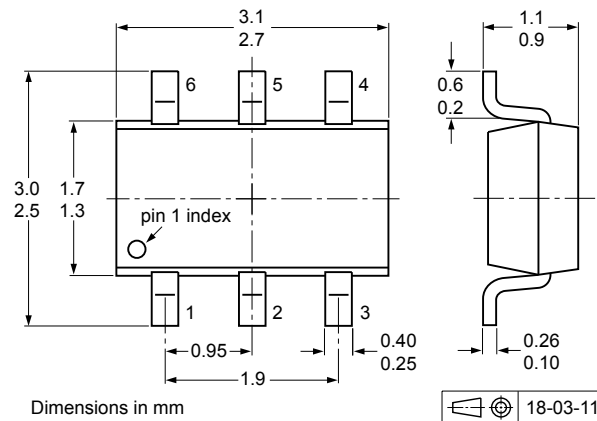


Fig. 14. Package outline TSOP6 (SOT457)

### 13. Soldering

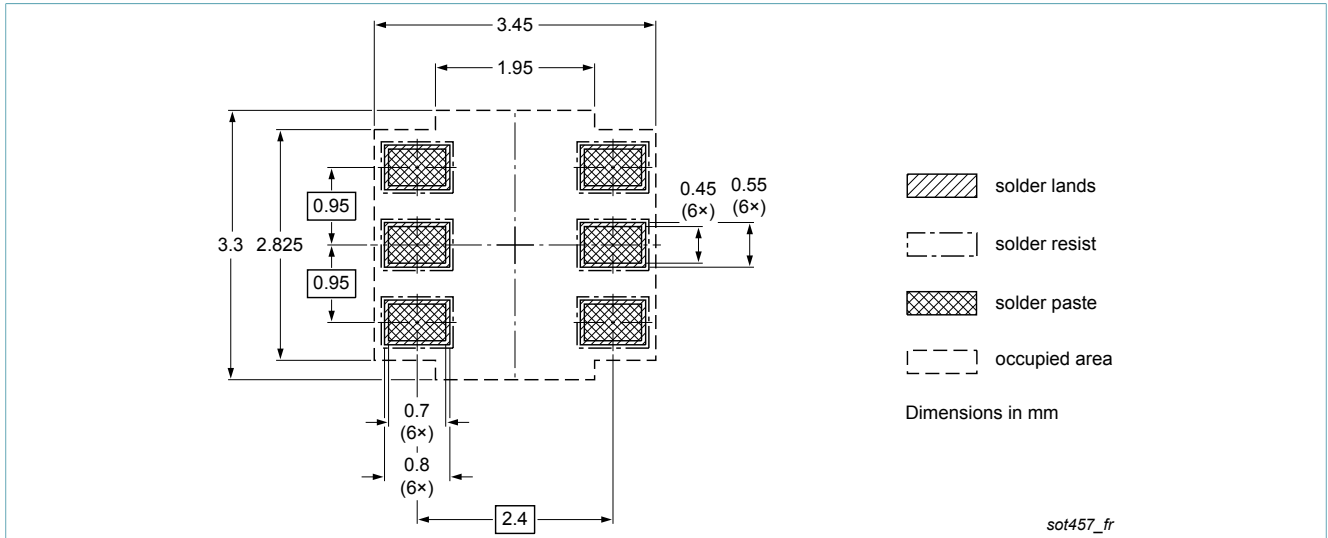


Fig. 15. Reflow soldering footprint for TSOP6 (SOT457)

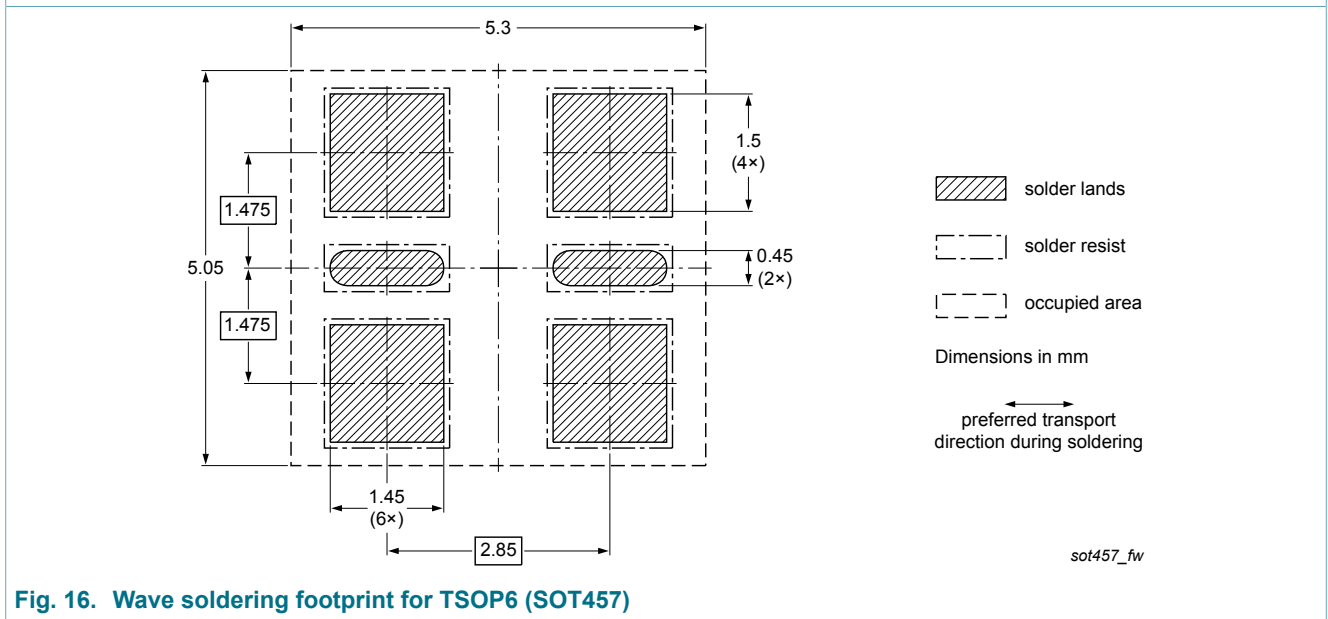


Fig. 16. Wave soldering footprint for TSOP6 (SOT457)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BCM56DS v.1	20180410	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.

- [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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