

# PBLS4004D,115 Datasheet

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DiGi Electronics Part Number	PBLS4004D,115-DG
Manufacturer	<a href="#">Nexperia USA Inc.</a>
Manufacturer Product Number	PBLS4004D,115
Description	TRANS PREBIAS 1NPN 1PNP 6TSOP
Detailed Description	Pre-Biased Bipolar Transistor (BJT) 1 NPN Pre-Biased, 1 PNP 50V, 40V 100mA, 700mA 150MHz 600mW Surface Mount 6-TSOP



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DiGi is a global authorized distributor of electronic components.

## Purchase and inquiry

**Manufacturer Product Number:**

PBL54004D,115

**Series:**

-

**Transistor Type:**

1 NPN Pre-Biased, 1 PNP

**Voltage - Collector Emitter Breakdown (Max):**

50V, 40V

**Resistor - Emitter Base (R2):**

22kOhms

**Vce Saturation (Max) @ Ib, Ic:**

150mV @ 500µA, 10mA / 310mV @ 100mA, 1A

**Frequency - Transition:**

150MHz

**Mounting Type:**

Surface Mount

**Supplier Device Package:**

6-TSOP

**Manufacturer:**

Nexperia USA Inc.

**Product Status:**

Active

**Current - Collector (Ic) (Max):**

100mA, 700mA

**Resistor - Base (R1):**

22kOhms

**DC Current Gain (hFE) (Min) @ Ic, Vce:**

60 @ 5mA, 5V / 300 @ 100mA, 5V

**Current - Collector Cutoff (Max):**

1µA, 100nA

**Power - Max:**

600mW

**Package / Case:**

SC-74, SOT-457

**Base Product Number:**

PBL54004

## Environmental & Export classification

**RoHS Status:**

ROHS3 Compliant

**REACH Status:**

REACH Unaffected

**HTSUS:**

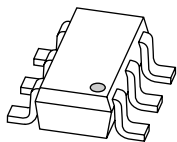
8541.21.0095

**Moisture Sensitivity Level (MSL):**

1 (Unlimited)

**ECCN:**

EAR99



# PBL54004D

## 40 V PNP BISS loadswitch

Rev. 03 — 6 January 2009

Product data sheet

## 1. Product profile

### 1.1 General description

PNP low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor and NPN Resistor-Equipped Transistor (RET) in a SOT457 (SC-74) small Surface-Mounted Device (SMD) plastic package.

### 1.2 Features

- Low  $V_{CEsat}$  (BISS) and resistor-equipped transistor in one package
- Low threshold voltage (< 1 V) compared to MOSFET
- Low drive power required
- Space-saving solution
- Reduction of component count

### 1.3 Applications

- Supply line switches
- Battery charger switches
- High-side switches for LEDs, drivers and backlights
- Portable equipment

### 1.4 Quick reference data

Table 1. Quick reference data

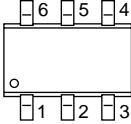
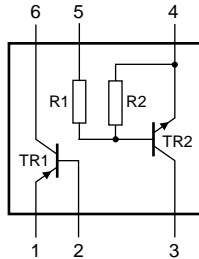
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1; PNP low <math>V_{CEsat}</math> transistor</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	-40	V
$I_C$	collector current		[1]	-	-1	A
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -500$ mA; $I_B = -50$ mA	[2]	240	340	m $\Omega$
<b>TR2; NPN resistor-equipped transistor</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	50	V
$I_O$	output current		-	-	100	mA
R1	bias resistor 1 (input)		15.4	22	28.6	k $\Omega$
R2/R1	bias resistor ratio		0.8	1	1.2	

[1] Device mounted on a ceramic Printed-Circuit Board (PCB), Al<sub>2</sub>O<sub>3</sub>, standard footprint.

[2] Pulse test:  $t_p \leq 300$   $\mu$ s;  $\delta \leq 0.02$ .

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	emitter TR1		
2	base TR1		
3	output (collector) TR2		
4	GND (emitter) TR2		
5	input (base) TR2		
6	collector TR1		

*sym036*

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBL54004D	SC-74	plastic surface-mounted package (TSOP6); 6 leads	SOT457

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PBL54004D	R4

## 5. Limiting values

Table 5. Limiting values

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

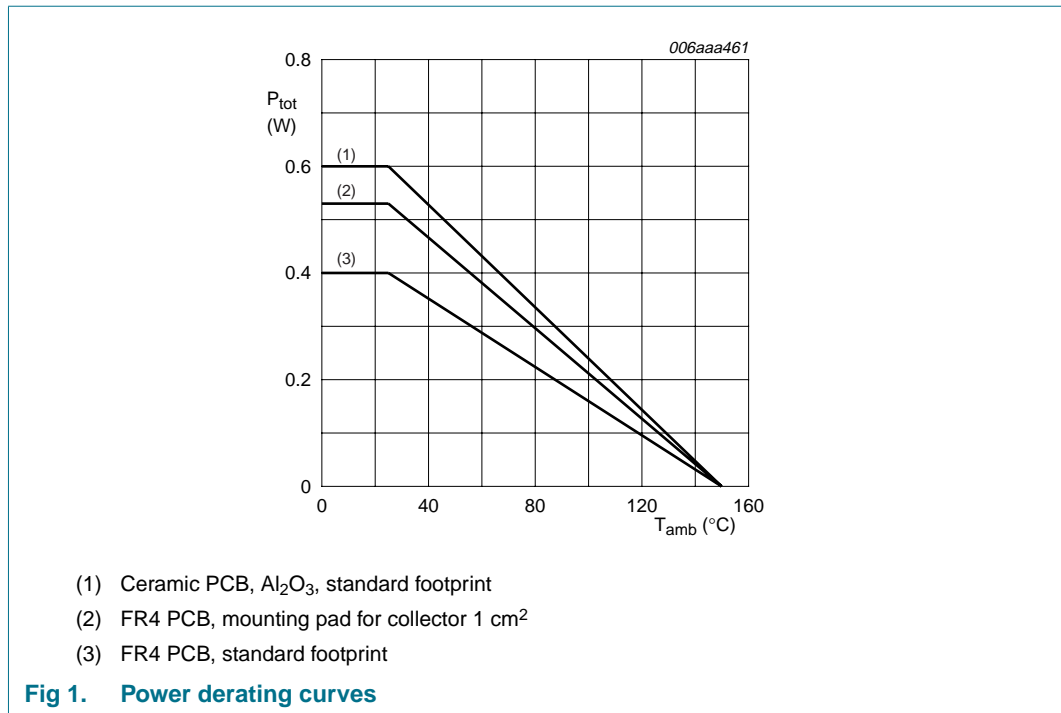
Symbol	Parameter	Conditions	Min	Max	Unit
<b>TR1; PNP low <math>V_{CEsat}</math> transistor</b>					
$V_{CBO}$	collector-base voltage	open emitter	-	-40	V
$V_{CEO}$	collector-emitter voltage	open base	-	-40	V
$V_{EBO}$	emitter-base voltage	open collector	-	-5	V
$I_C$	collector current	[1]	-	-0.7	A
		[2]	-	-0.85	A
		[3]	-	-1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-2	A
$I_B$	base current		-	-0.3	A
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms	-	-1	A

**Table 5. Limiting values ...continued***In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit	
$P_{\text{tot}}$	total power dissipation	$T_{\text{amb}} \leq 25\text{ °C}$	[1]	-	250	mW
			[2]	-	350	mW
			[3]	-	400	mW
<b>TR2; NPN resistor-equipped transistor</b>						
$V_{\text{CBO}}$	collector-base voltage	open emitter	-	50	V	
$V_{\text{CEO}}$	collector-emitter voltage	open base	-	50	V	
$V_{\text{EBO}}$	emitter-base voltage	open collector	-	10	V	
$V_{\text{I}}$	input voltage					
			positive	-	+40	V
			negative	-	-10	V
$I_{\text{O}}$	output current		-	100	mA	
$I_{\text{CM}}$	peak collector current	single pulse; $t_{\text{p}} \leq 1\text{ ms}$	-	100	mA	
$P_{\text{tot}}$	total power dissipation	$T_{\text{amb}} \leq 25\text{ °C}$	-	200	mW	
<b>Per device</b>						
$P_{\text{tot}}$	total power dissipation	$T_{\text{amb}} \leq 25\text{ °C}$	[1]	-	400	mW
			[2]	-	530	mW
			[3]	-	600	mW
$T_{\text{j}}$	junction temperature		-	150	°C	
$T_{\text{amb}}$	ambient temperature		-65	+150	°C	
$T_{\text{stg}}$	storage temperature		-65	+150	°C	

[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>.[3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.



## 6. Thermal characteristics

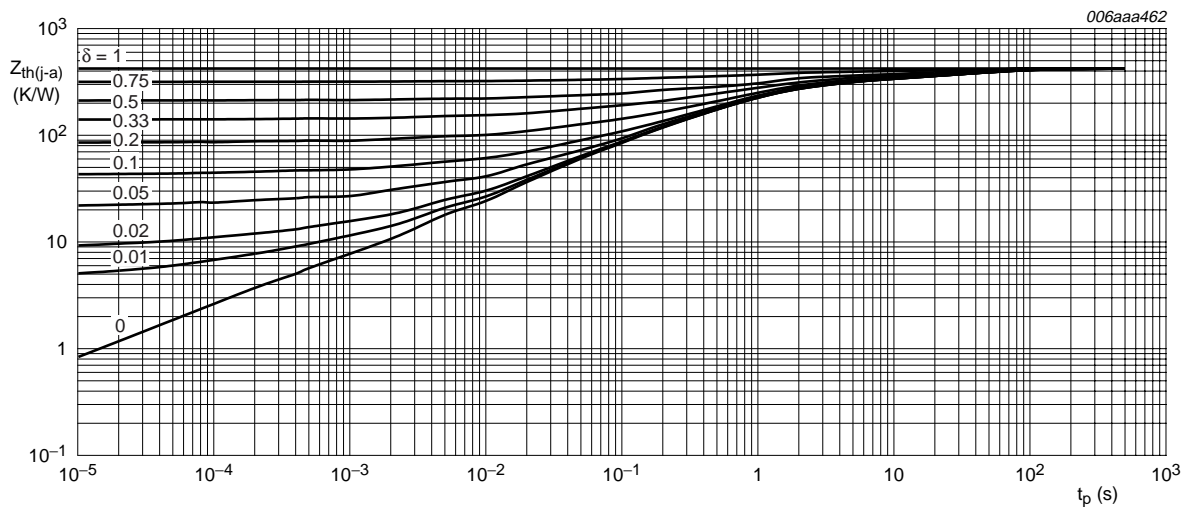
**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per device</b>						
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	312 K/W
			[2]	-	-	236 K/W
			[3]	-	-	210 K/W
<b>Per TR1; PNP low V<sub>CEsat</sub> transistor</b>						
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point		-	-	105	K/W

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

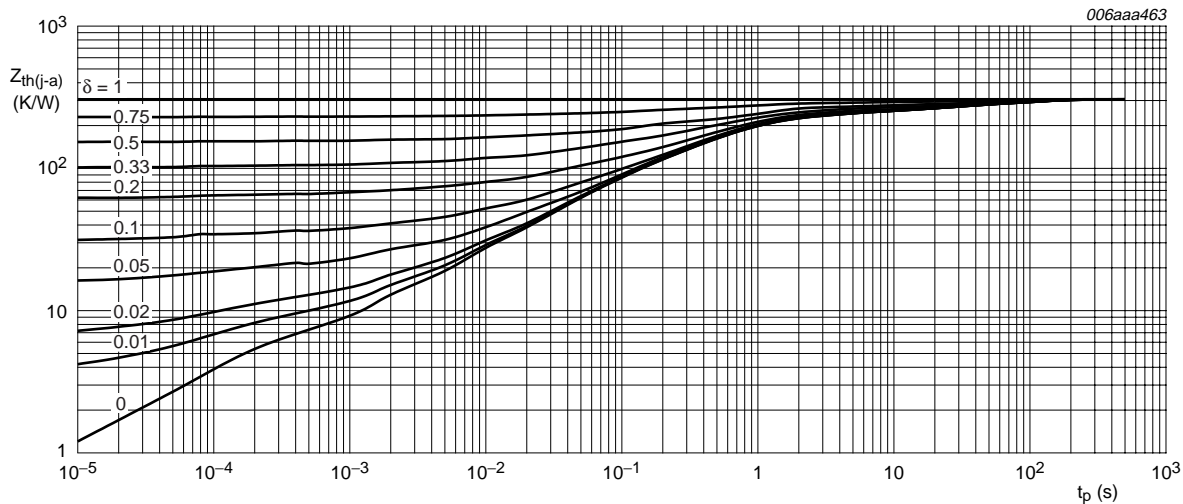
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.



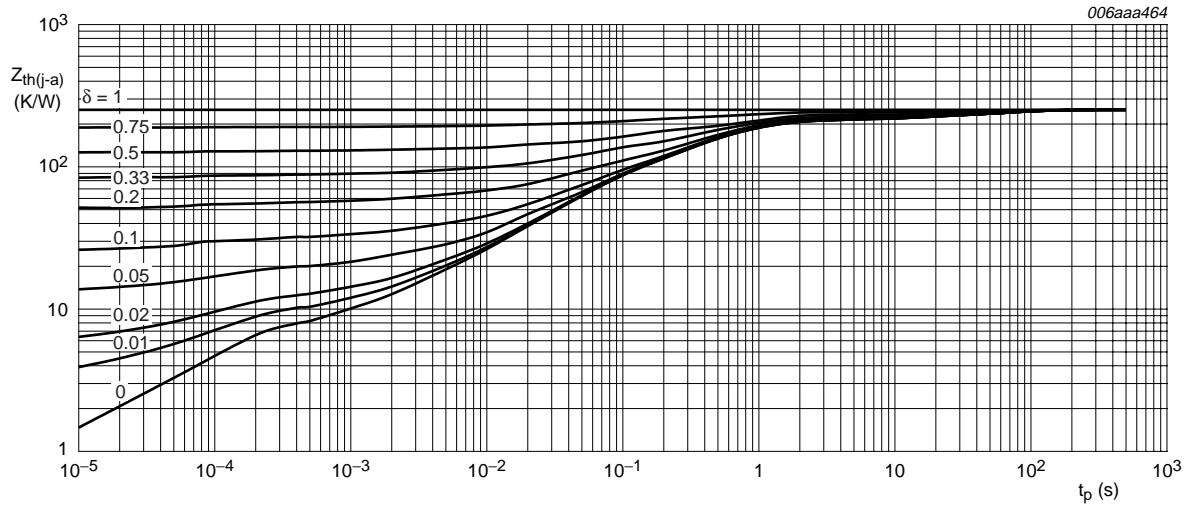
FR4 PCB, standard footprint

**Fig 2. TR1 (PNP): Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**



FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

**Fig 3. TR1 (PNP): Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**



Ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint

**Fig 4. TR1 (PNP): Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

## 7. Characteristics

**Table 7. Characteristics**

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

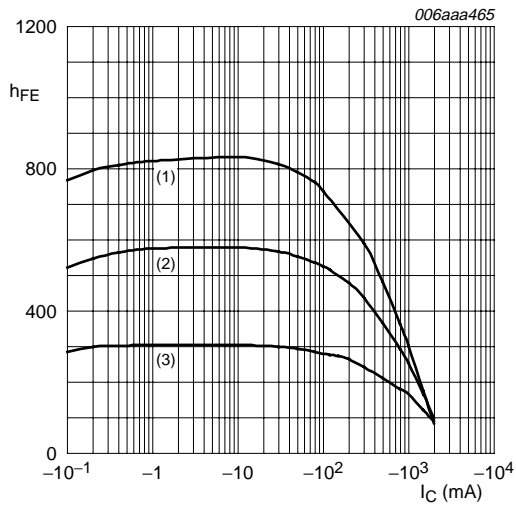
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1; PNP low <math>V_{CEsat}</math> transistor</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -40\text{ V}; I_E = 0\text{ A}$	-	-	-0.1	$\mu\text{A}$
		$V_{CB} = -40\text{ V}; I_E = 0\text{ A}; T_j = 150^{\circ}\text{C}$	-	-	-50	$\mu\text{A}$
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = -30\text{ V}; V_{BE} = 0\text{ V}$	-	-	-0.1	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5\text{ V}; I_C = 0\text{ A}$	-	-	-0.1	$\mu\text{A}$
$h_{FE}$	DC current gain	$V_{CE} = -5\text{ V}; I_C = -1\text{ mA}$	300	-	-	
		$V_{CE} = -5\text{ V}; I_C = -100\text{ mA}$	[1] 300	-	800	
		$V_{CE} = -5\text{ V}; I_C = -500\text{ mA}$	[1] 215	-	-	
		$V_{CE} = -5\text{ V}; I_C = -1\text{ A}$	[1] 150	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -100\text{ mA}; I_B = -1\text{ mA}$	-	-80	-140	mV
		$I_C = -500\text{ mA}; I_B = -50\text{ mA}$	[1] -	-120	-170	mV
		$I_C = -1\text{ A}; I_B = -100\text{ mA}$	[1] -	-220	-310	mV
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -500\text{ mA}; I_B = -50\text{ mA}$	[1] -	240	340	m $\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -1\text{ A}; I_B = -50\text{ mA}$	[1] -	-	-1.1	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = -5\text{ V}; I_C = -1\text{ A}$	[1] -	-	-1	V



**Table 7. Characteristics ...continued** $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

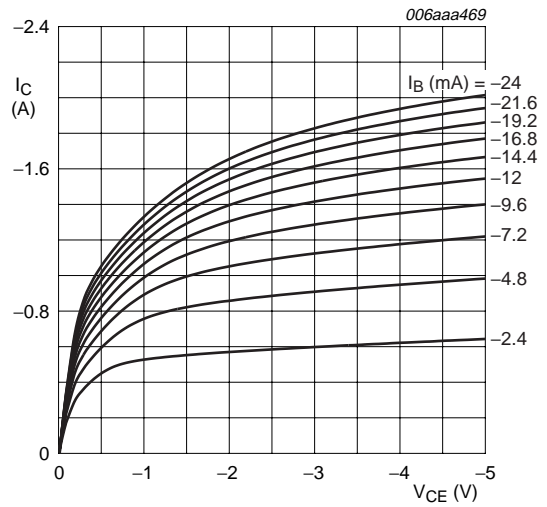
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$f_T$	transition frequency	$I_C = -50\text{ mA}$ ; $V_{CE} = -10\text{ V}$ ; $f = 100\text{ MHz}$	150	-	-	MHz
$C_C$	collector capacitance	$V_{CB} = -10\text{ V}$ ; $I_E = i_e = 0\text{ A}$ ; $f = 1\text{ MHz}$	-	-	12	pF
<b>TR2; NPN resistor-equipped transistor</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50\text{ V}$ ; $I_E = 0\text{ A}$	-	-	100	nA
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 30\text{ V}$ ; $I_B = 0\text{ A}$	-	-	1	$\mu\text{A}$
		$V_{CE} = 30\text{ V}$ ; $I_B = 0\text{ A}$ ; $T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}$ ; $I_C = 0\text{ A}$	-	-	180	$\mu\text{A}$
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}$ ; $I_C = 5\text{ mA}$	60	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10\text{ mA}$ ; $I_B = 0.5\text{ mA}$	-	-	150	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\text{ V}$ ; $I_C = 100\text{ }\mu\text{A}$	-	1.1	0.8	V
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V}$ ; $I_C = 5\text{ mA}$	2.5	1.7	-	V
R1	bias resistor 1 (input)		15.4	22	28.6	k $\Omega$
R2/R1	bias resistor ratio		0.8	1	1.2	
$C_C$	collector capacitance	$V_{CB} = 10\text{ V}$ ; $I_E = i_e = 0\text{ A}$ ; $f = 1\text{ MHz}$	-	-	2.5	pF

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



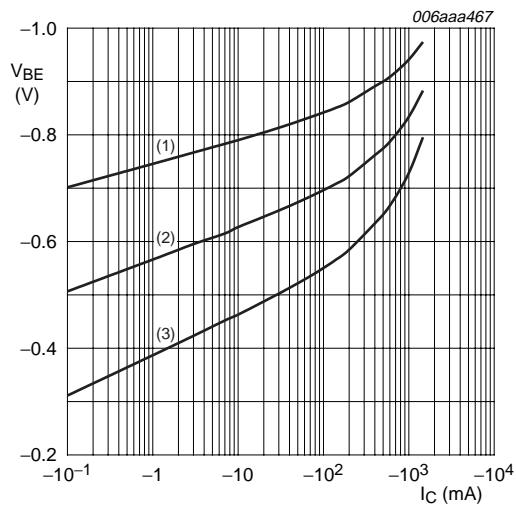
$V_{CE} = -5\text{ V}$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 5. TR1 (PNP): DC current gain as a function of collector current; typical values**



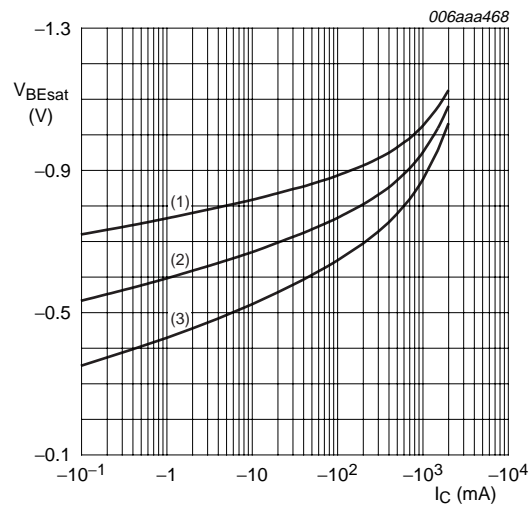
$T_{amb} = 25\text{ °C}$

**Fig 6. TR1 (PNP): Collector current as a function of collector-emitter voltage; typical values**



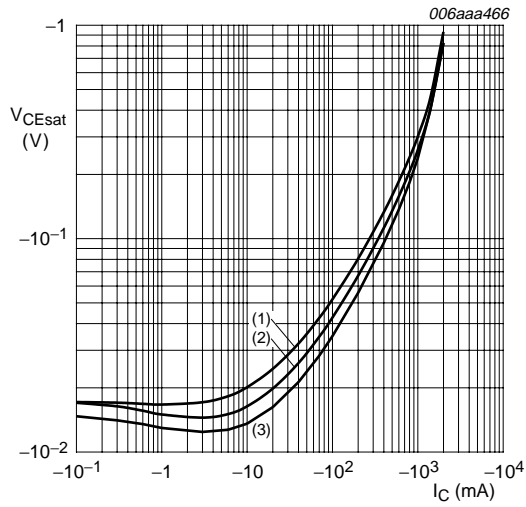
$V_{CE} = -5\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

**Fig 7. TR1 (PNP): Base-emitter voltage as a function of collector current; typical values**



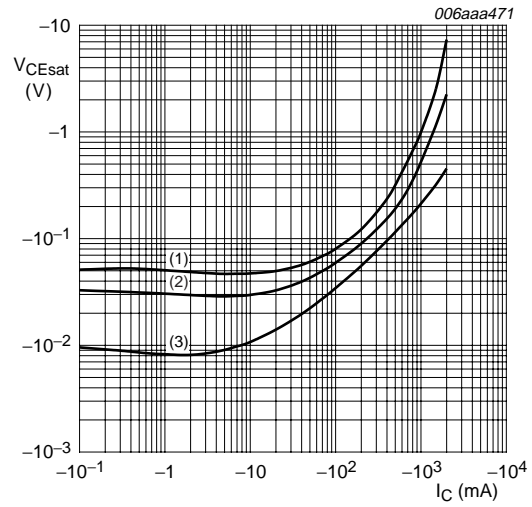
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

**Fig 8. TR1 (PNP): Base-emitter saturation voltage as a function of collector current; typical values**



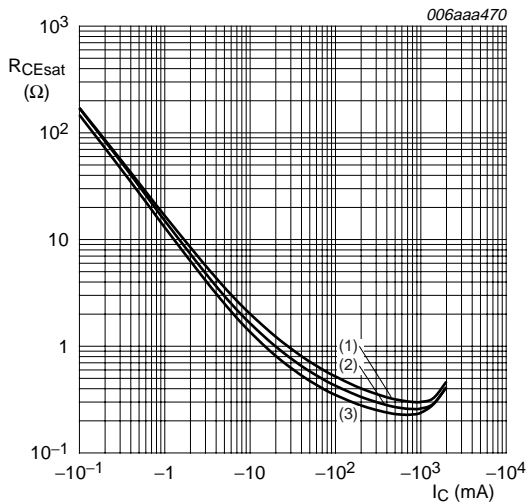
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 9. TR1 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values**



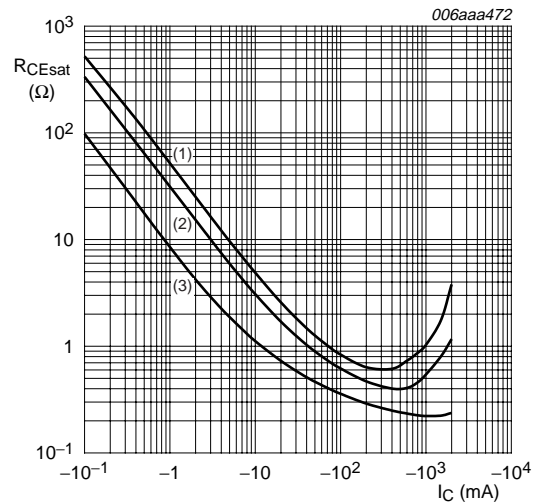
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig 10. TR1 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values**



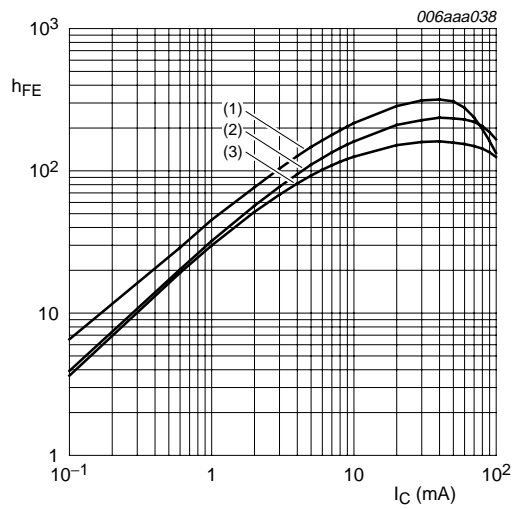
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 11. TR1 (PNP): Collector-emitter saturation resistance as a function of collector current; typical values**



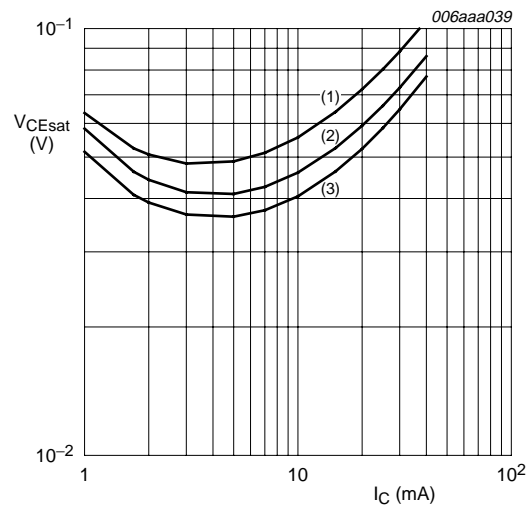
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig 12. TR1 (PNP): Collector-emitter saturation resistance as a function of collector current; typical values**



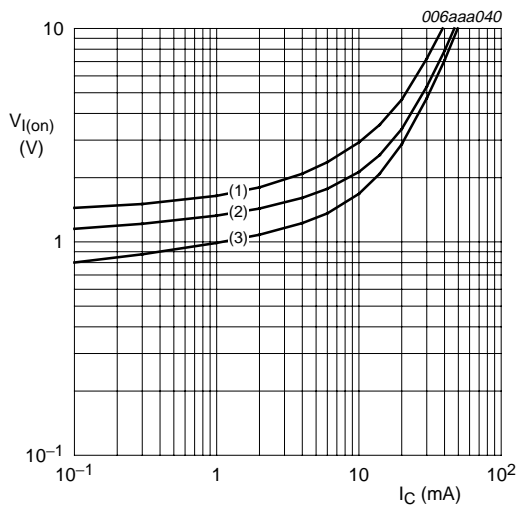
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 13. TR2 (NPN): DC current gain as a function of collector current; typical values**



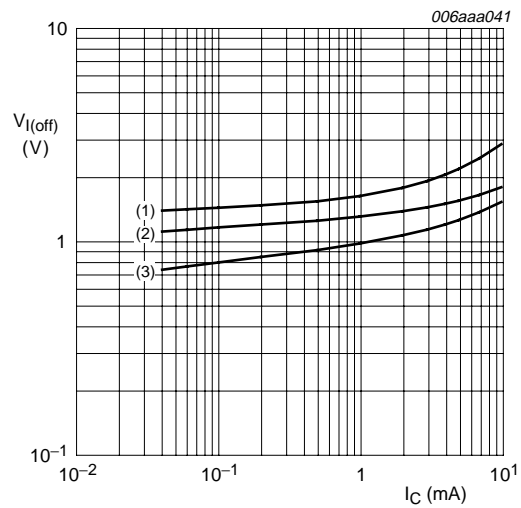
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 14. TR2 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values**



$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

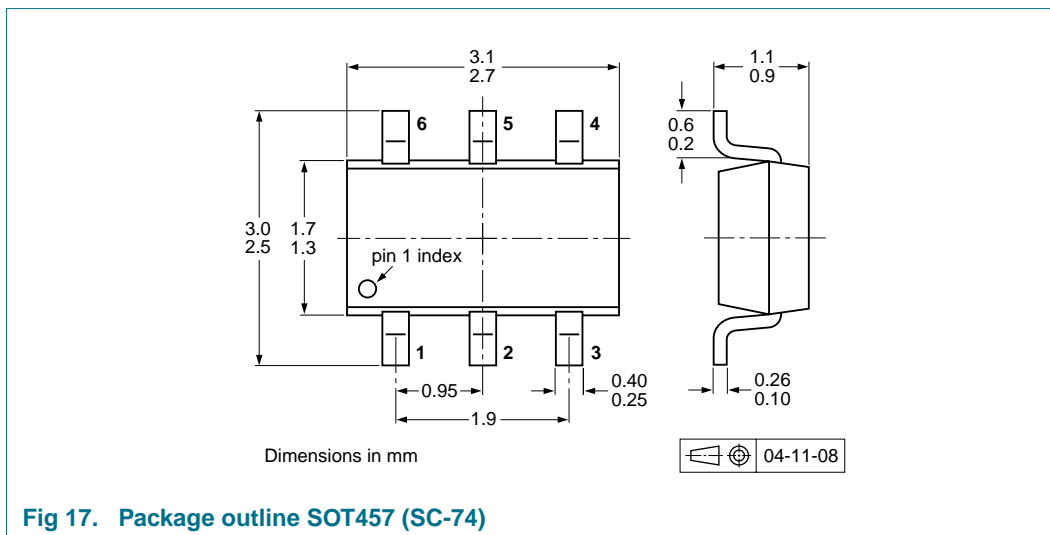
**Fig 15. TR2 (NPN): On-state input voltage as a function of collector current; typical values**



$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig 16. TR2 (NPN): Off-state input voltage as a function of collector current; typical values**

## 8. Package outline



## 9. Packing information

**Table 8. 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
PBL54004D	SOT457	4 mm pitch, 8 mm tape and reel; T1	<sup>[2]</sup> -115	-135
		4 mm pitch, 8 mm tape and reel; T2	<sup>[3]</sup> -125	-165

[1] For further information and the availability of packing methods, see [Section 13](#).

[2] T1: normal taping

[3] T2: reverse taping

10. Soldering

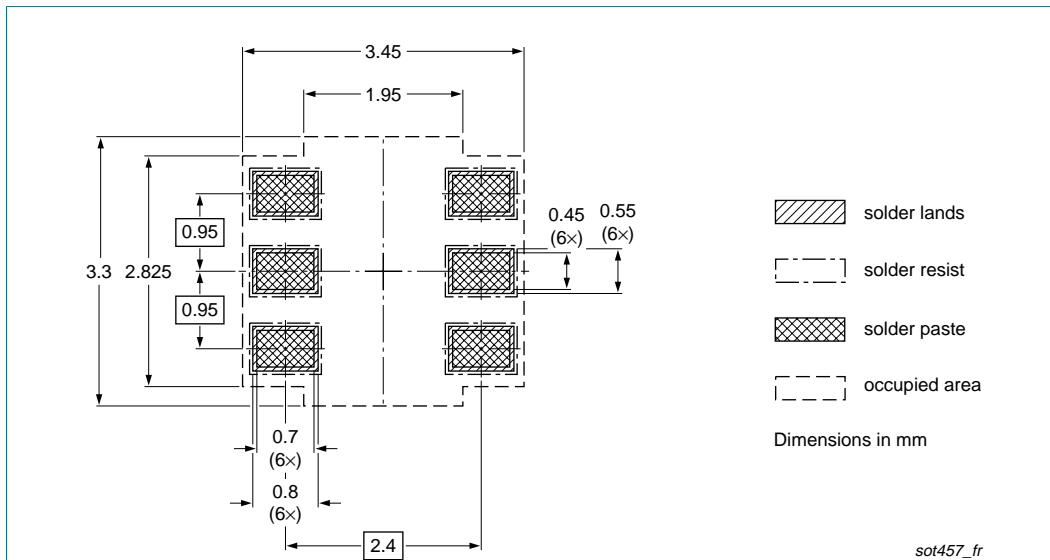


Fig 18. Reflow soldering footprint SOT457 (SC-74)

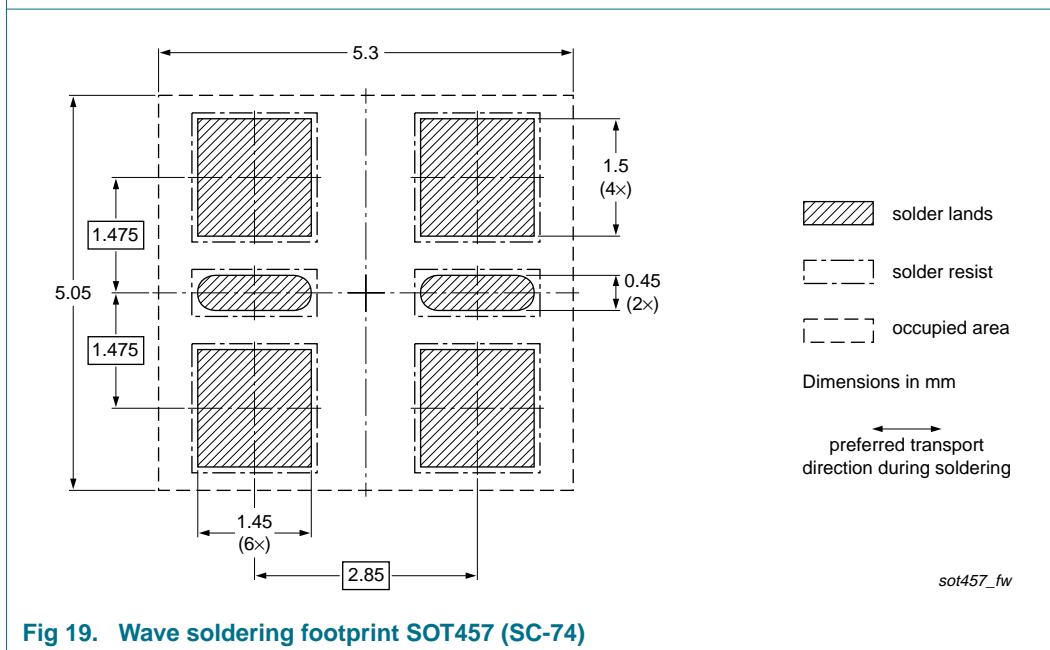


Fig 19. Wave soldering footprint SOT457 (SC-74)

## 11. Revision history

**Table 9.** Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBL54004D_3	20090106	Product data sheet	-	PBL54004D_2
Modifications:	<ul style="list-style-type: none"> <li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• <a href="#">Figure 5, 9</a> and <a href="#">10</a>: amended</li> <li>• <a href="#">Section 12 "Legal information"</a>: updated</li> </ul>			
PBL54004D_2	20050719	Product data sheet	-	PBL54004D_1
PBL54004D_1	20041109	Objective data sheet	-	-

## 12. Legal information

### 12.1 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

### 12.2 Definitions

**Draft** — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

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