PBLS4002Y; PBLS4002V

40 V PNP BISS loadswitch

Rev. 02 — 19 July 2005 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 one package.

Table 1: Product overview

Type number	Package	
	Philips	JEITA
PBLS4002Y	SOT363	SC-88
PBLS4002V	SOT666	-

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 2: Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TR1; PNP low V_{CEsat} transistor							
V_{CEO}	collector-emitter voltage	open base		-	-	–40	V
I_C	collector-current (DC)			-	-	–500	mA
R_{CEsat}	collector-emitter saturation resistance	I_C = –500 mA; I_B = –50 mA	[1]	-	440	700	mΩ
TR2; NPN resistor-equipped transistor							
V_{CEO}	collector-emitter voltage	open base		-	-	50	V

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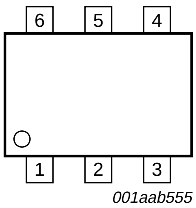
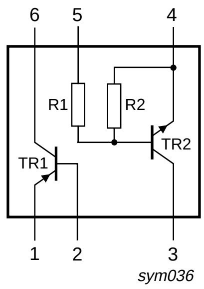
Table 2: Quick reference data *…continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_O	output current		-	-	100	mA
R1	bias resistor 1 (input)		3.3	4.7	6.1	kΩ
R2/R1	bias resistor ratio		0.8	1	1.2	

[1] Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

2. Pinning information

Table 3: Pinning

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

3. Ordering information

Table 4: Ordering information

Type number	Package		
	Name	Description	Version
PBLS4002Y	SC-88	plastic surface mounted package; 6 leads	SOT363
PBLS4002V	-	plastic surface mounted package; 6 leads	SOT666

4. Marking

Table 5: Marking codes

Type number	Marking code [1]
PBLS4002Y	S2*
PBLS4002V	K2

[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
TR1; PNP low V_{CEsat} transistor						
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		-	–6	V
I_C	collector current (DC)			-	–500	mA
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms		-	–1	A
I_B	base current (DC)			-	–50	mA
I_{BM}	peak base current	single pulse; $t_p \leq 1$ ms		-	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	200	mW
TR2; NPN resistor-equipped transistor						
V_{CBO}	collector-base voltage	open emitter		-	50	V
V_{CEO}	collector-emitter voltage	open base		-	50	V
V_{EBO}	emitter-base voltage	open collector		-	10	V
V_I	input voltage					
	positive			-	+30	V
	negative			-	–10	V
I_O	output current			-	100	mA
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms		-	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	200	mW
Per device						
P_{tot}	total power dissipation			-	300	mW
T_{stg}	storage temperature			–65	+150	°C
T_j	junction temperature			-	150	°C
T_{amb}	ambient 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
Per device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air					
	SOT363		[1]	-	-	416	K/W
	SOT666		[1] [2]	-	-	416	K/W

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

[2] Reflow soldering is the only recommended soldering method.

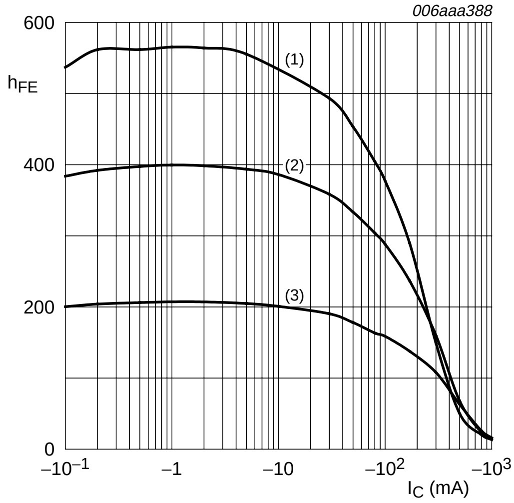
7. Characteristics

Table 8: Characteristics

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TR1; PNP low V_{CEsat} transistor							
I_{CBO}	collector-base cut-off current	V_{CB} = –40 V; I_E = 0 A		-	-	–100	nA
		V_{CB} = –40 V; I_E = 0 A; T_j = 150 °C		-	-	–50	μA
I_{EBO}	emitter-base cut-off current	V_{EB} = –5 V; I_C = 0 A		-	-	–100	nA
h_{FE}	DC current gain	V_{CE} = –2 V; I_C = –10 mA		200	-	-	
		V_{CE} = –2 V; I_C = –100 mA	[1]	150	-	-	
		V_{CE} = –2 V; I_C = –500 mA	[1]	40	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = –10 mA; I_B = –0.5 mA		-	-	–50	mV
		I_C = –100 mA; I_B = –5 mA		-	-	–130	mV
		I_C = –200 mA; I_B = –10 mA		-	-	–200	mV
		I_C = –500 mA; I_B = –50 mA	[1]	-	-	–350	mV
R_{CEsat}	collector-emitter saturation resistance	I_C = –500 mA; I_B = –50 mA	[1]	-	440	700	mΩ
V_{BEsat}	base-emitter saturation voltage	I_C = –500 mA; I_B = –50 mA	[1]	-	-	–1.2	V
V_{BEon}	base-emitter turn-on voltage	V_{CE} = –2 V; I_C = –100 mA	[1]	-	-	–1.1	V
f_T	transition frequency	I_C = –100 mA; V_{CE} = –5 V; f = 100 MHz		100	300	-	MHz
C_c	collector capacitance	V_{CB} = –10 V; I_E = i_e = 0 A; f = 1 MHz		-	-	10	pF
TR2; NPN resistor-equipped transistor							
I_{CBO}	collector-base cut-off current	V_{CB} = 50 V; I_E = 0 A		-	-	100	nA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 30 V; I_B = 0 A		-	-	1	μA
		V_{CE} = 30 V; I_B = 0 A; T_j = 150 °C		-	-	50	μA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A		-	-	900	μA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 10 mA		30	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA		-	-	150	mV
$V_{I(off)}$	off-state input voltage	V_{CE} = 5 V; I_C = 100 μA		-	1.1	0.5	V
$V_{I(on)}$	on-state input voltage	V_{CE} = 0.3 V; I_C = 20 mA		2.5	1.9	-	V
R1	bias resistor 1 (input)			3.3	4.7	6.1	kΩ
R2/R1	bias resistor ratio			0.8	1	1.2	
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz		-	-	2.5	pF

[1] Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.



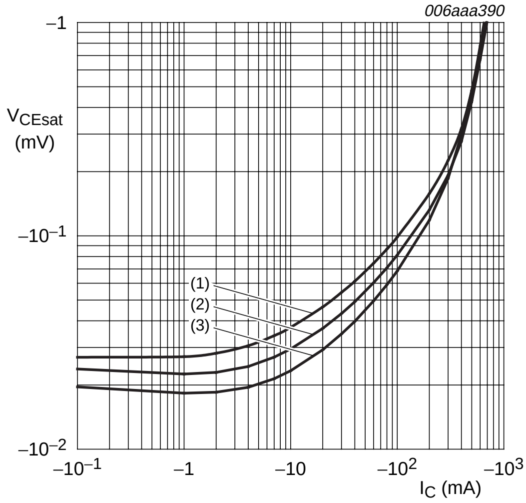
V_{CE} = −2 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −55 °C

Fig 1. TR1 (PNP): DC current gain as a function of collector current; typical values



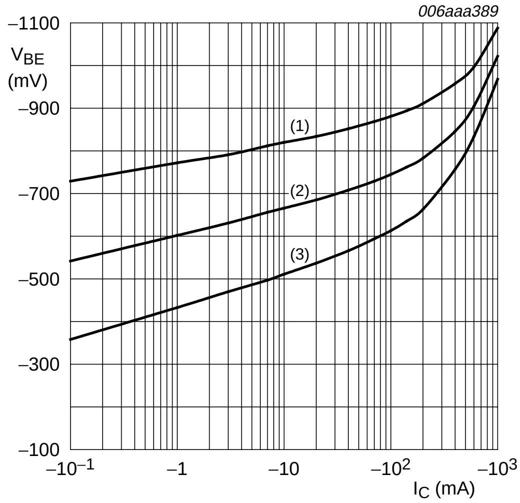
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −55 °C

Fig 2. TR1 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values



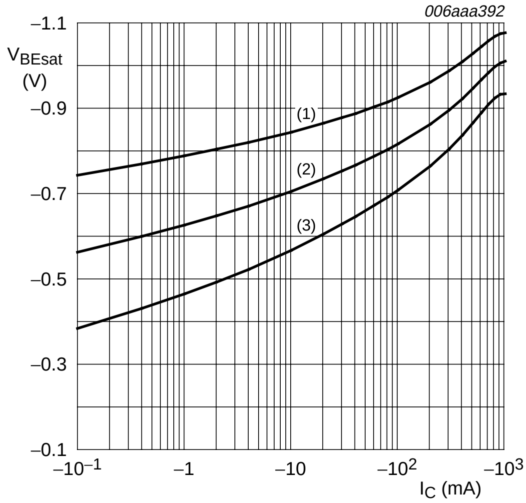
V_{CE} = −2 V

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

Fig 3. TR1 (PNP): Base-emitter voltage as a function of collector current; typical values



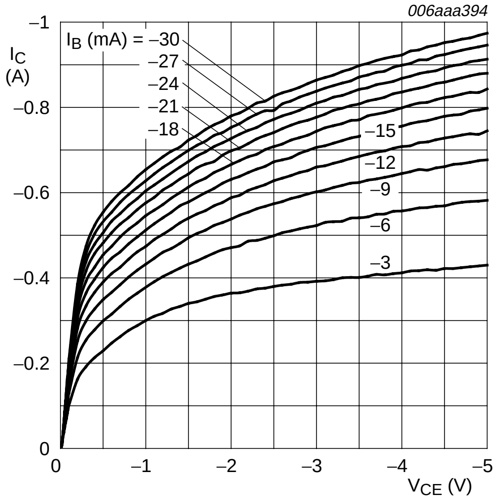
I_C/I_B = 20

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

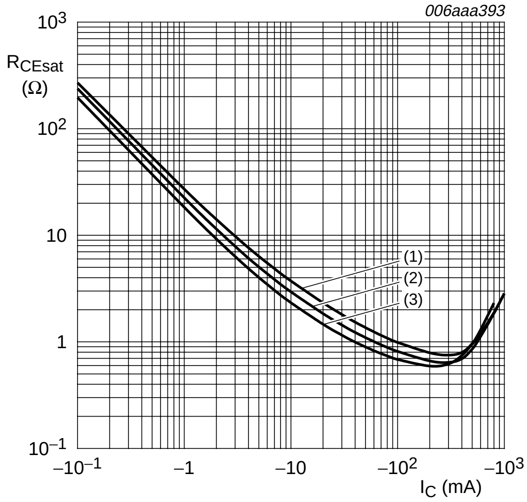
(3) T_{amb} = 100 °C

Fig 4. TR1 (PNP): Base-emitter saturation voltage as a function of collector current; typical values



T_{amb} = 25 °C

Fig 5. TR1 (PNP): Collector current as a function of collector-emitter voltage; typical values



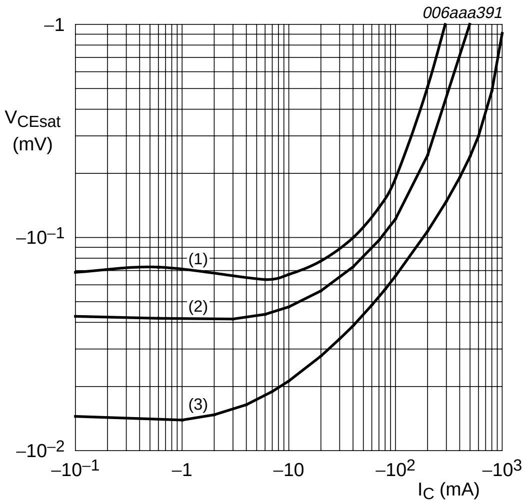
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −55 °C

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



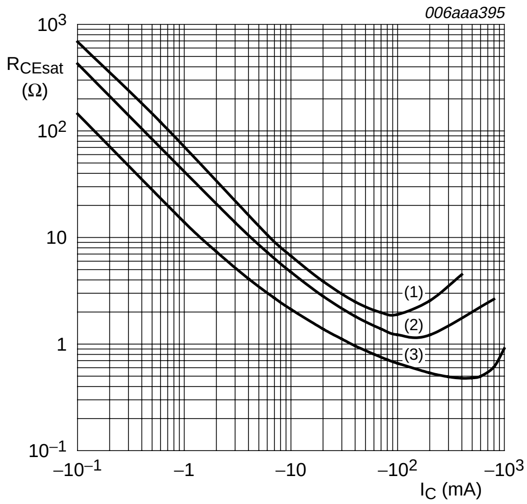
T_{amb} = 25 °C

(1) I_C/I_B = 100

(2) I_C/I_B = 50

(3) I_C/I_B = 10

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



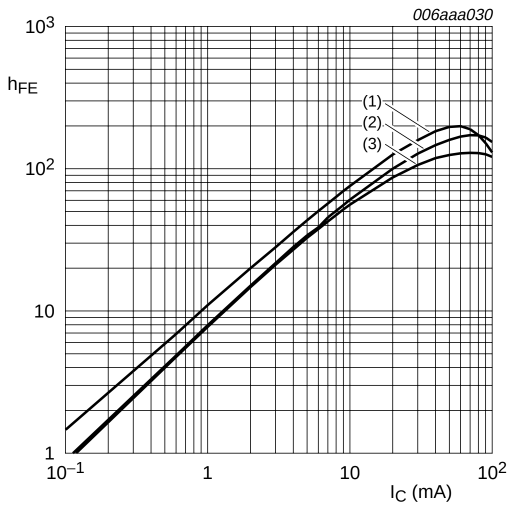
T_{amb} = 25 °C

(1) I_C/I_B = 100

(2) I_C/I_B = 50

(3) I_C/I_B = 10

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



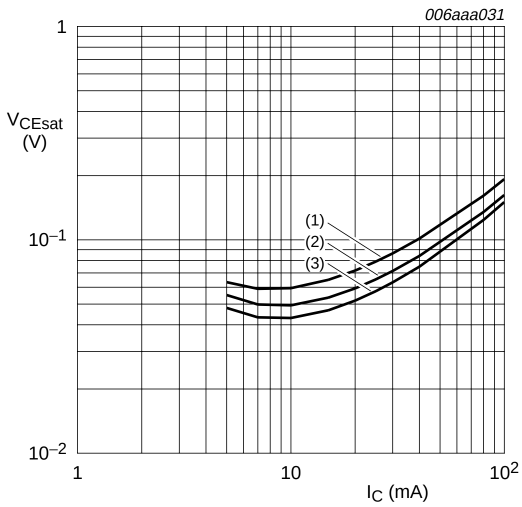
V_{CE} = 5 V

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

Fig 9. TR2 (NPN): DC current gain as a function of collector current; typical values



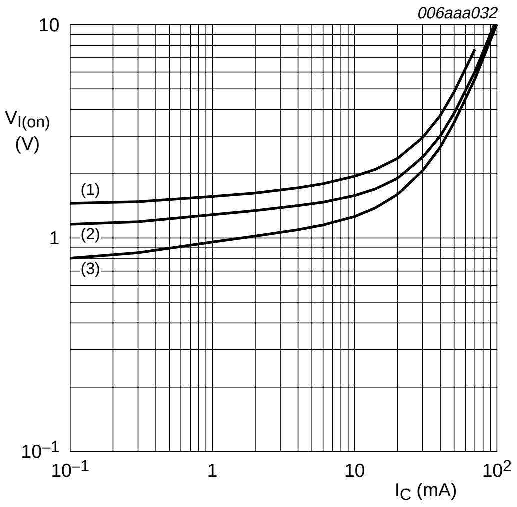
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

Fig 10. TR2 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values



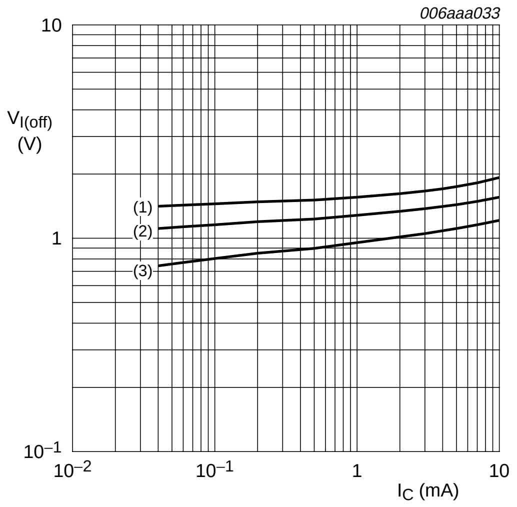
V_{CE} = 0.3 V

(1) T_{amb} = −40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

Fig 11. TR2 (NPN): On-state input voltage as a function of collector current; typical values



V_{CE} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

Fig 12. TR2 (NPN): Off-state input voltage as a function of collector current; typical values

8. Package outline

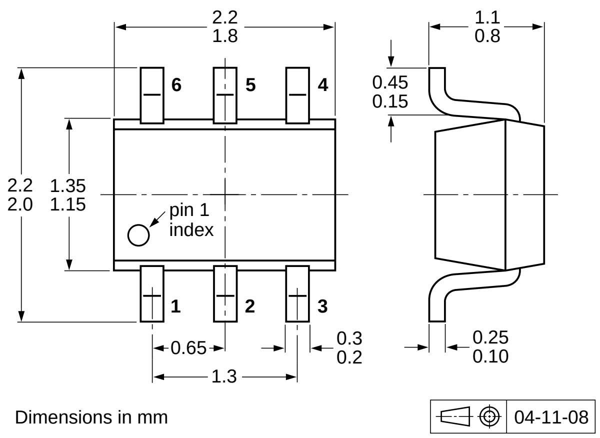


Fig 13. Package outline SOT363 (SC-88)

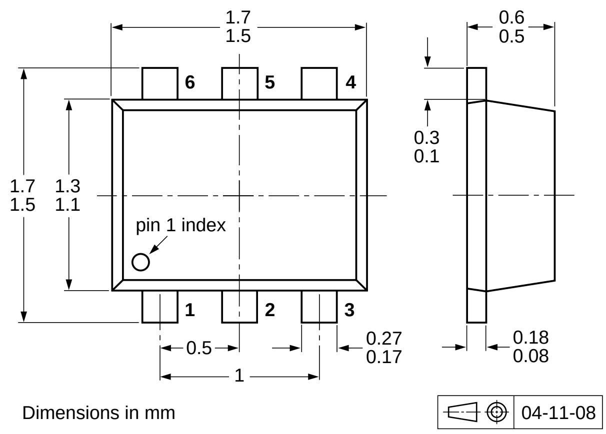


Fig 14. Package outline SOT666

9. Packing information

Table 9: Packing methods

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

Type number	Package	Description	Packing quantity			
			3000	4000	8000	10000
PBLS4002Y	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
PBLS4002V	SOT666	2 mm pitch, 8 mm tape and reel	-	-	-315	-
		4 mm pitch, 8 mm tape and reel	-	-115	-	-

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

[2] T1: normal taping

[3] T2: reverse taping

10. Revision history

Table 10: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
PBLS4002Y_PBLS4002V_2	20050719	Product data sheet	-	9397 750 15221	PBLS4002Y_ PBLS4002V_1
Modifications:	• Table 2: 'equivalent on-resistance' renamed to 'collector-emitter saturation resistance' • Table 8: 'equivalent on-resistance' renamed to 'collector-emitter saturation resistance' • Figure 4 and 6: conditions amended • Figure 6: 'equivalent on-resistance' renamed to 'collector-emitter saturation resistance' • Figure 8: 'equivalent on-resistance' renamed to 'collector-emitter saturation resistance' • Figure 7 and 8: conditions amended • Table 9: Packing method (2 mm pitch) for SOT666 added • Section 14 "Trademarks": added				
PBLS4002Y_PBLS4002V_1	20041206	Product data sheet	-	9397 750 13455	-

11. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

12. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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16. Contents

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