DATA SHEET

PCK111

Low voltage 1:10 differential ECL/PECL/HSTL clock driver

Product data

Supersedes data of 2003 Dec 03

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PCK111

FEATURES

- 85 ps part-to-part skew typical
- 20 ps output-to-output skew typical
- Differential design
- V_{BB} output
- Low voltage V_{EE} range of -2.25 V to -3.8 V for ECL
- Low voltage V_{CC} range of $+2.375$ V to $+3.8$ V for PECL
- 75 kΩ input pull-down resistors
- ECL/PECL outputs
- Form, fit, and function compatible with MC100EP111

DESCRIPTION

The PCK111 is a low skew 1-to-10 differential driver, designed with clock distribution in mind. It accepts two clock sources into an input multiplexer. The PECL input signals can be either differential or single-ended if the V_{BB} output is used. The selected signal is fanned out to 10 identical differential outputs.

The PCK111 is specifically designed, modeled and produced with low skew as the key goal. Optimal design and layout serve to minimize gate-to-gate skew within a device, and empirical modeling is used to determine process control limits that ensure consistent t_{PD} distributions from lot to lot. The net result is a dependable, guaranteed low skew device.

To ensure that the tight skew specification is met, it is necessary that both sides of the differential output are terminated into 50 Ω, even if only one side is being used. In most applications, all ten differential pairs will be used, and therefore terminated. In the case where fewer than ten pairs are used, it is necessary to terminate at least the output pairs on the same package side as the pair(s) being used on that side, in order to maintain minimum skew. Failure to do this will result in small degradations of propagation delay (on the order of 10–20 ps) of the output(s) being used, which, while not being catastrophic to most designs, will mean a loss of skew margin.

The PCK111 can be used for high performance clock distribution in +3.3 V or +2.5 V systems. Designers can take advantage of the PCK111's performance to distribute low skew clocks across the backplane or the board. In a PECL environment, series or Thevenin line terminations are typically used as they require no additional power supplies.

The PCK111 may be driven single-endedly utilizing the V_{BB} bias output with the $\overline{CLK0}$ input. If a single-ended signal is to be used, the V_{BB} pin should be connected to the $\overline{CLK0}$ input and bypassed to ground via a 0.01 μF capacitor. The V_{BB} output can only source/sink 0.2 mA, therefore, it should be used as a switching reference for the PCK111 only. Part-to-part skew specifications are not guaranteed when driving the PCK111 single-endedly.
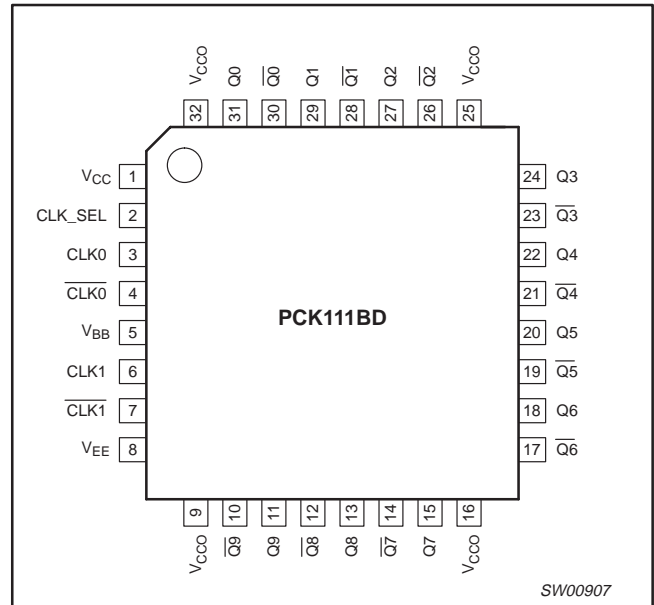
PINNING

Pin configurations
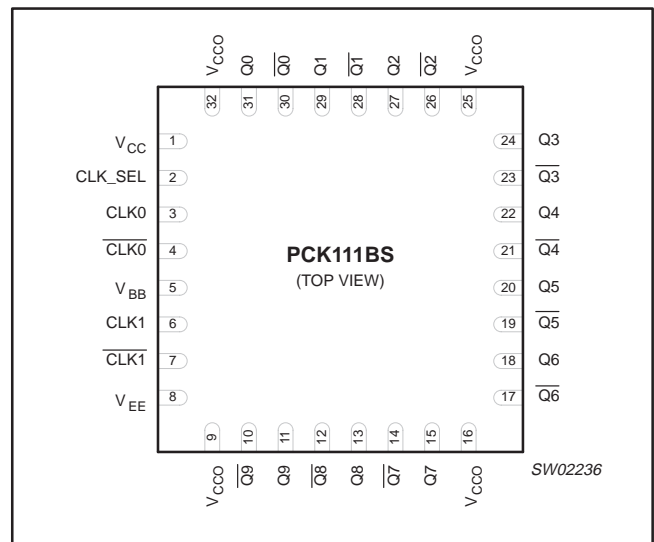

Figure 1. LQFP32 pin configuration

Figure 2. HVQFN32 pin configuration

ORDERING INFORMATION

Type number	Package				Temperature range
	Name	Description		Version	
PCK111BD	LQFP32	plastic low profile quad flat package; 32 leads; body $7 \times 7 \times 1.4$ mm		SOT358-1	-40 °C to $+85$ °C
PCK111BS	HVQFN32	plastic thermal enhanced very thin quad flat package; no leads; 32 terminals; body $5 \times 5 \times 0.85$ mm		SOT617-1	-40 °C to $+85$ °C

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Pin description

| SYMBOL	PIN	DESCRIPTION
V_{CC}	1	Supply voltage
CLK_SEL	2	Active CMOS clock select input
CLK0, $\overline{CLK0}$	3, 4	Differential ECL/PECL/HSTL input pair
V_{BB}	5	Reference voltage output
CLK1, $\overline{CLK1}$	6, 7	Differential ECL/PECL/HSTL input pair
V_{EE}	8	Ground
V_{CCO}	9, 16, 25, 32	Output drive power supply voltage
Q0–Q9	31, 29, 27, 24, 22, 20, 18, 15, 13, 11	Differential PECL outputs
$\overline{Q0}$–$\overline{Q9}$	30, 28, 26, 23, 21, 19, 17, 14, 12, 10	Differential PECL outputs

LOGIC SYMBOL

SW00908
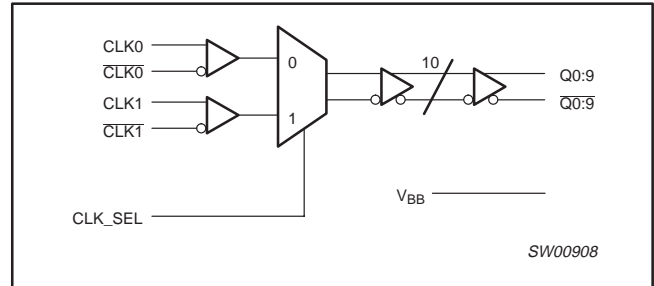
Figure 3. Logic symbol

FUNCTION TABLE

CLK_SEL	Active input
0	CLK0, $\overline{CLK0}$
1	CLK1, $\overline{CLK1}$

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

SYMBOL	PARAMETER	LIMITS	UNIT
V_{CC}	Supply voltage	−0.5 to +4.6	V
ESDHBM	Electrostatic discharge (Human Body Model; 1.5 kΩ, 100 pF)	>1.75	kV
ESDMM	Electrostatic discharge (Machine Model; 0 kΩ, 200 pF)	>200	V
ESDCDM	Electrostatic discharge (Charge Device Model)	>1000	V

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNIT
V_{CC}	Supply voltage		2.25	3.8	V
V_{IR}	Receiver input voltage		V_{EE}	V_{CC}	V
V_{DIFF}	Input differential voltage[1]	$V_{(CLKinN)}$–$V_{(CLKin)}$	—	1.00	V
T_{amb}	Operating ambient temperature range in free air		−40	+85	°C

NOTE:

1. To idle an unused differential clock input, connect one input terminal (e.g. CLK1) to V_{BB} and leave its complimentary input terminal (e.g. $\overline{CLK1}$) open-circuit, in which case $\overline{CLK1}$ will default LOW by its internal pull-down reistor. Inputs should not be shorted to ground or V_{CC}.

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DC ELECTRICAL CHARACTERISTICS

$V_{CC} = 0$ V, $V_{EE} = -2.25$ to -3.80 V

SYMBOL	PARAMETER	CONDITION	−40 °C MIN	−40 °C MAX	25 °C MIN	25 °C MAX	85 °C MIN	85 °C MAX	UNIT
I_{EE}	Internal supply current	Absolute value of current	45	85	60	95	65	105	mA
I_{CC}	Output and internal supply current	All outputs terminated 50 Ω to $V_{CC} = -2.0$ V	270	360	290	380	300	380	mA
I_{IN}	Input current	Includes pullup/pulldown resistors	—	150	—	150	—	150	μA
V_{BB}	Internal bias voltage		−1.38	−1.23	−1.38	−1.23	−1.38	−1.23	V
V_{IH}	Input HIGH voltage	Single ended	−1.165	−0.880	−1.165	−0.880	−1.165	−0.880	V
		CLK_SEL	$0.2V_{EE}$	V_{CC}	$0.2V_{EE}$	V_{CC}	$0.2V_{EE}$	V_{CC}	V
V_{IL}	Input LOW voltage	Single ended	−1.810	−1.475	−1.810	−1.475	−1.810	−1.475	V
		CLK_SEL	V_{EE}	$0.8V_{EE}$	V_{EE}	$0.8V_{EE}$	V_{EE}	$0.8V_{EE}$	V
V_{PP}	Input amplitude	Difference of input = $V_{IH} - V_{IL}$ (Note 1)	0.5	1.3	0.5	1.3	0.5	1.3	V
V_{CMR}	Common mode voltage	Cross point of input = average (V_{IH}, V_{IL})	$V_{EE} + 1.0$	−0.3	$V_{EE} + 1.0$	−0.3	$V_{EE} + 1.0$	−0.3	V
V_{OH}	Output HIGH voltage	$I_{OH} = -30$ mA	−1.3	−0.95	—	—	−1.2	0.90	V
V_{OL}	Output LOW voltage	$I_{OL} = -5$ mA	−1.85	−1.4	—	—	−1.90	−1.5	V
V_{OUTpp}	Differential output swing		350	—	—	—	500	—	MV

NOTE:
1. V_{PP} minimum and maximum required to maintain AC specifications. Actual device function will tolerate minimum V_{PP} of 100 mV.

DC ELECTRICAL CHARACTERISTICS

$V_{CC} = V_{CCO} = 2.25$ to 3.80 V, $V_{EE} = 0$ V

SYMBOL	PARAMETER	CONDITION	−40 °C MIN	−40 °C MAX	25 °C MIN	25 °C MAX	85 °C MIN	85 °C MAX	UNIT
I_{EE}	Internal supply current	Absolute value of current	45	85	60	95	65	105	mA
I_{CC}	Output and internal supply current	All outputs terminated 50 Ω to $V_{CC} = -2.0$ V	270	360	290	380	300	380	mA
I_{IN}	Input current	Includes pullup/pulldown resistors	—	150	—	150	—	150	μA
V_{BB}	Internal bias voltage		V_{CC} −1.38	V_{CC} −1.23	V_{CC} −1.38	V_{CC} −1.23	V_{CC} −1.38	V_{CC} −1.23	V
V_{IH}	Input HIGH voltage	Single ended	V_{CC} −1.165	V_{CC} −0.880	V_{CC} −1.165	V_{CC} −0.880	V_{CC} −1.165	V_{CC} −0.880	V
		CLK_SEL	$0.8V_{CC}$	V_{CC}	$0.8V_{CC}$	V_{CC}	$0.8V_{CC}$	V_{CC}	V
V_{IL}	Input LOW voltage	Single ended	V_{CC} −1.810	V_{CC} −1.475	V_{CC} −1.810	V_{CC} −1.475	V_{CC} −1.810	V_{CC} −1.475	V
		CLK_SEL	V_{EE}	$0.2V_{CC}$	V_{EE}	$0.2V_{CC}$	V_{EE}	$0.2V_{CC}$	V
V_{PP}	Input amplitude	Difference of input = $V_{IH} - V_{IL}$ (Note 1)	0.5	1.3	0.5	1.3	0.5	1.3	V
V_{CMR}	Common mode voltage	Cross point of input = average (V_{IH}, V_{IL})	1.0	V_{CC}−0.3	1.0	V_{CC}−0.3	1.0	V_{CC}−0.3	V
V_{IHCMR}	Input HIGH voltage (HSTL)		1.2	V_{CC}	1.2	V_{CC}	1.2	V_{CC}	V
V_x	Input crossover voltage (HSTL)	Cross point of input = average (V_{IH}, V_{IL})	0.68	0.9	0.68	0.9	0.68	0.9	V
V_{OH}	Output HIGH voltage	$I_{OH} = -30$ mA	V_{CC} −1.30	V_{CC} −0.95	—	—	V_{CC} −1.20	V_{CC} −0.90	V
V_{OL}	Output LOW voltage	$I_{OL} = -5$ mA	V_{CC} −1.85	V_{CC} −1.40	—	—	V_{CC} −1.90	V_{CC} −1.50	V
V_{OUTpp}	Differential output swing		350	—	—	—	500	—	MV

NOTE:
1. V_{PP} minimum and maximum required to maintain AC specifications. Actual device function will tolerate minimum V_{PP} of 100 mV.

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AC ELECTRICAL CHARACTERISTICS

V_{CC} = 2.25 V to 3.80 V, V_{EE} = 0 V, or V_{CC} = 0 V, V_{EE} = −2.25 V to −3.80 V

| SYMBOL	PARAMETER	CONDITION	−40 °C MIN	−40 °C MAX	25 °C MIN	25 °C MAX	85 °C MIN	85 °C MAX	UNIT
t_{PD}	Differential propagation delay	Nominal (single input condition) V_{PP} = 0.650 V, $V_{CMR} = V_{CC}$ − 0.800 V (Note 1)	350	500	380	530	450	590	ps
t_{skew}	Part-to-part skew	Note 1	—	110	—	110	—	110	ps
t_{skew}	Output-to-output same part skew	Note 1	—	50	—	50	—	50	ps
t_{jitter}	Cycle-to-cycle jitter		—	1	—	1	—	1	ps
f_{MAX}	Maximum output frequency	Functional to 1.5 GHz; Timing specifications apply to 1.0 GHZ	—	1500	—	1500	—	1500	MHz
t_r/t_f	Output rise/fall time at 20% to 80%	All outputs terminated 50 Ω to V_{CC} − 2.0 V	100	300	100	300	100	300	ps

NOTE:
1. For operation with 2.5 V supply, the output termination is 50 Ω to V_{EE}.
   For operation with 3.3 V supply, the output termination is 50 Ω to V_{CC} − 2 V.

Low voltage 1:10 differential
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LQFP32:   plastic low profile quad flat package; 32 leads; body 7 x 7 x 1.4 mm   SOT358-1

0   2.5   5 mm

scale
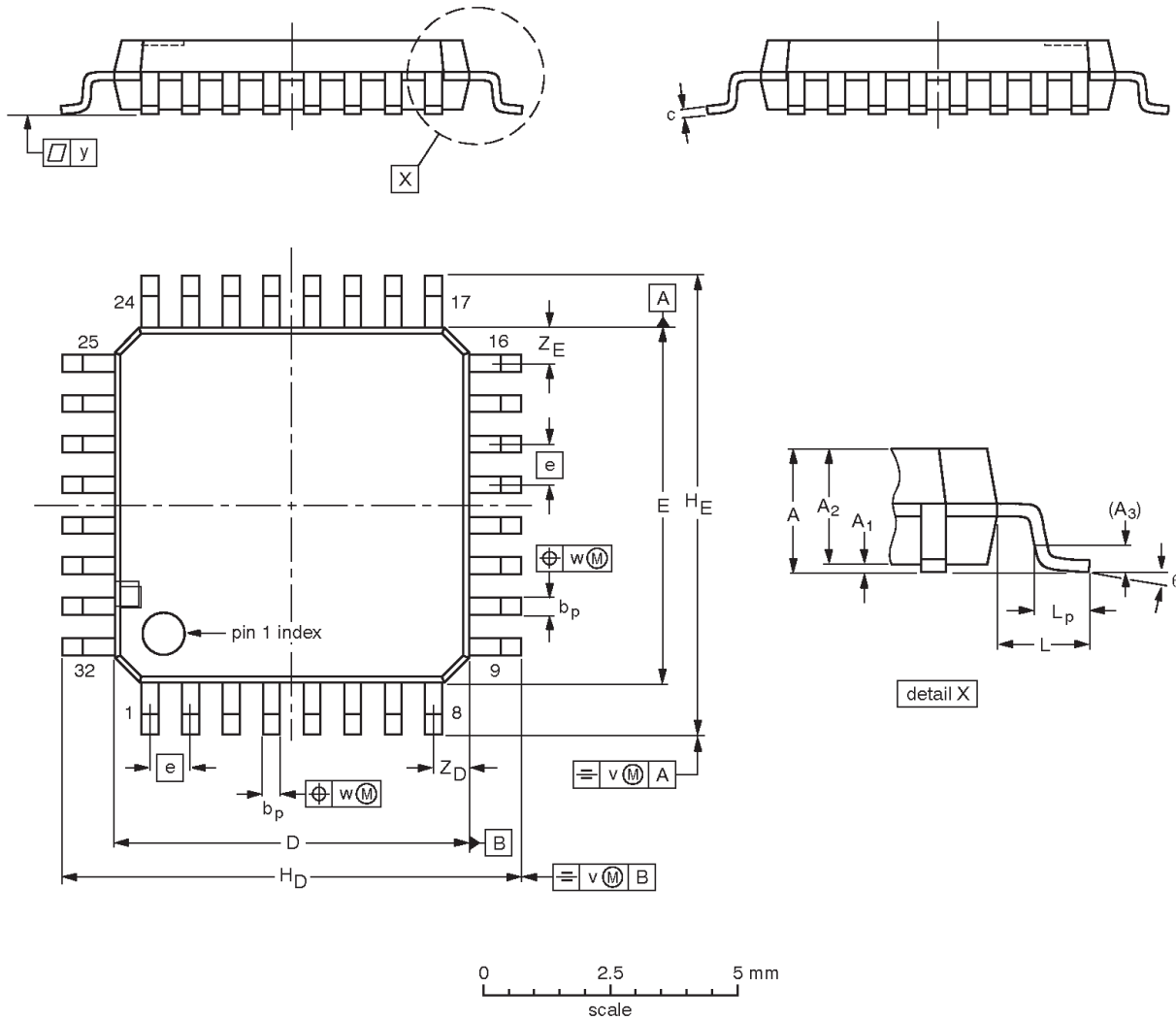
DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A$_1$	A$_2$	A$_3$	b$_p$	c	D$^{(1)}$	E$^{(1)}$	e	H$_D$	H$_E$	L	L$_p$	v	w	y	Z$_D$$^{(1)}$	Z$_E$$^{(1)}$	θ
mm	1.6	0.20 0.05	1.45 1.35	0.25	0.4 0.3	0.18 0.12	7.1 6.9	7.1 6.9	0.8	9.15 8.85	9.15 8.85	1	0.75 0.45	0.2	0.25	0.1	0.9 0.5	0.9 0.5	7° 0°

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT358 -1	136E03	MS-026				~~00-01-19~~ 03-02-25

HVQFN32: plastic thermal enhanced very thin quad flat package; no leads; 32 terminals;
body 5 x 5 x 0.85 mm

SOT617-1

terminal 1
index area

detail X

terminal 1
index area

0   2.5   5 mm

scale
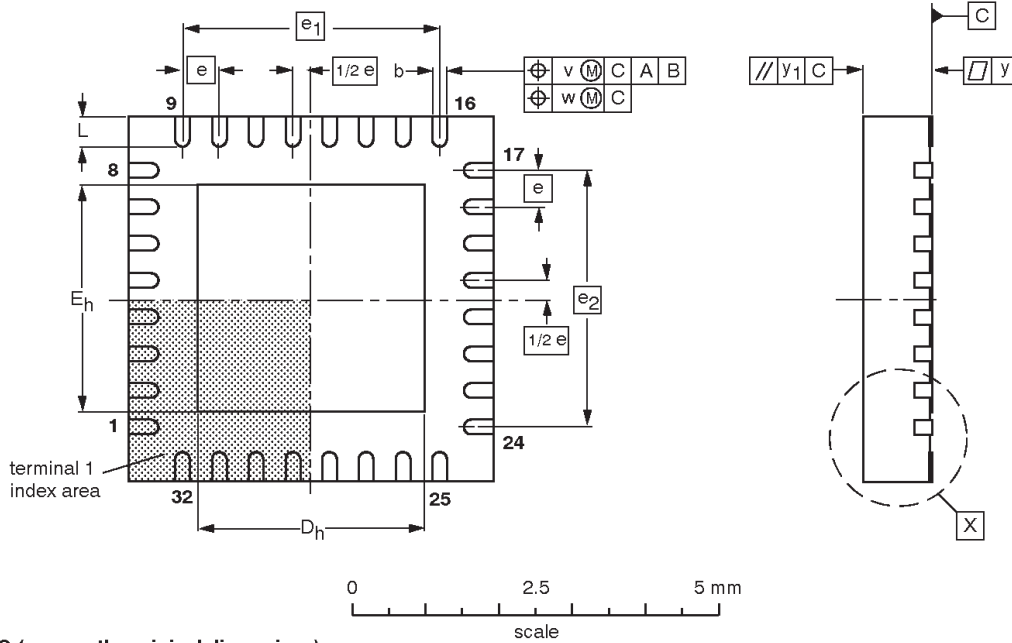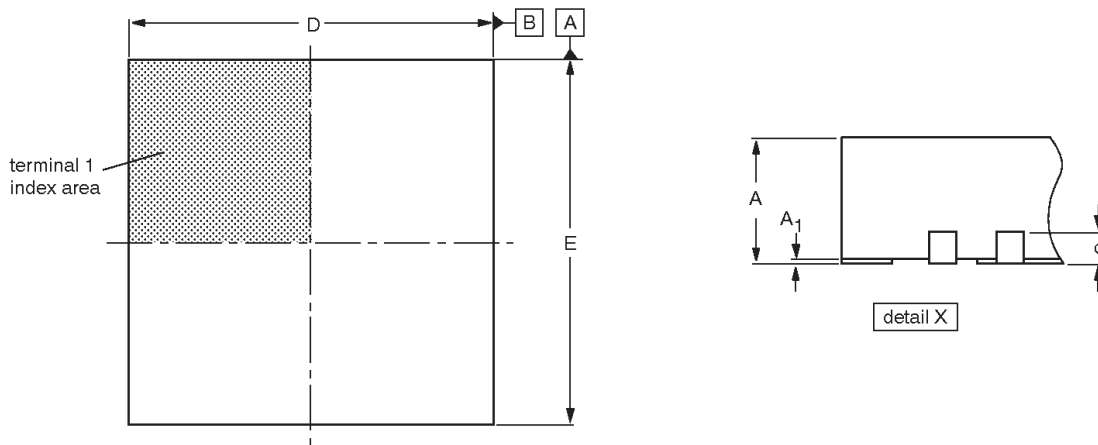
DIMENSIONS (mm are the original dimensions)

UNIT	A[1] max.	A$_1$	b	c	D[1]	D$_h$	E[1]	E$_h$	e	e$_1$	e$_2$	L	v	w	y	y$_1$
mm	1	0.05 0.00	0.30 0.18	0.2	5.1 4.9	3.25 2.95	5.1 4.9	3.25 2.95	0.5	3.5	3.5	0.5 0.3	0.1	0.05	0.05	0.1

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT617-1	- - -	MO-220	- - -			~~01-08-08~~ 02-10-18

REVISION HISTORY

Rev	Date	Description
_5	20040423	**Product data (9397 750 13082). Supersedes data of 2003 Dec 03 (9397 750 12451).** Modifications: ● Add Part type PCK111BS, HVQFN32 package option (SOT617-1).
_4	20031203	Product data (9397 750 12451); ECN 853-2281 01-A14515 dated 14 November 2003. Supersedes data of 13 December 2002 (9397 750 10865).
_3	20021213	Product data (9397 750 10865); ECN 853-2281 29225 of 22 November 2002.
_2	20020215	Product data (9397 750 09465); ECN 853-2281 27735 of 15 February 2002.

Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definitions
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.
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[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.

Definitions

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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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