

# DATA SHEET

**PTN2111**

**1:10 LVDS clock distribution device**

Product Data

2001 Jun 19

# 1:10 LVDS clock distribution device

# PTN2111

## FEATURES

- 100 ps part-to-part skew
- 35 ps output-to-output skew
- Differential design
- Meets LVDS specification for driver outputs and receiver inputs
- Reference voltage available output  $V_{BB}$
- Low voltage  $V_{CC}$  range of +2.375 V to 2.625 V
- High signalling rate capability (above 622 MHz)
- Supports open, short, and terminated input fail-safe (HIGH output state)
- Programmable drivers power off control
- Available in LQFP32 package

## DESCRIPTION

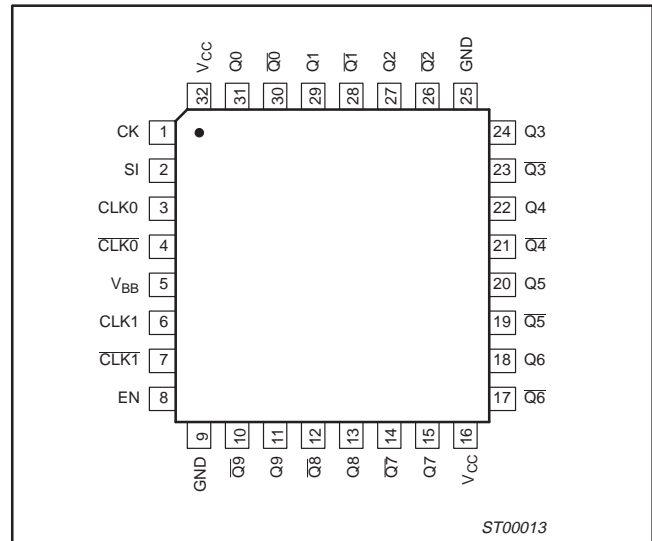
The PTN2111 is a low skew programmable 1:10 LVDS clock distribution device. The selected input signal is fanned out to 10 identical differential outputs.

The PTN2111 features an 11-bit Shift Register with a serial-in and a Control Register. The purpose of the Control Register is to enable or power off each output clock channel and to select the clock input.

The PTN2111 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. The final result is a dependable guaranteed low skew device.

The PTN2111 can be used for high performance clock distribution in +2.5 V systems with LVDS levels. Designers can take advantage of the device's performance to distribute low skew clocks across the backplane or the board.

## PIN CONFIGURATION



## PIN DESCRIPTION

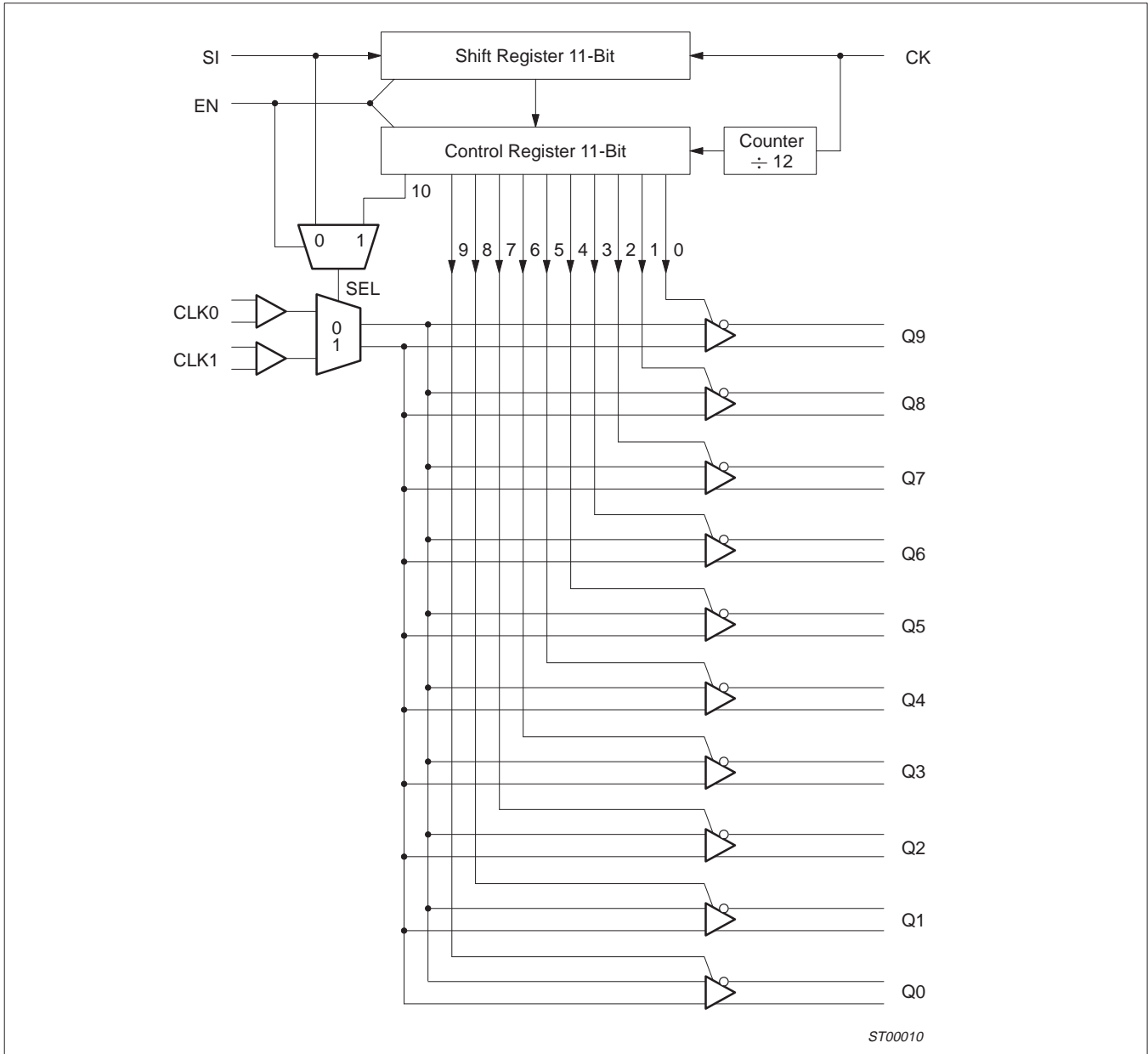
PIN NUMBER	SYMBOL	NAME AND FUNCTION
1	CK	Control register clock
2	SI	Control register serial-in/CLK_SEL
3	CLK0	Differential input
4	$\overline{\text{CLK0}}$	Differential input
5	$V_{BB}$	Output reference voltage
6	CLK1	Differential input
7	$\overline{\text{CLK1}}$	Differential input
8	EN	Device enable/program
9, 25	GND	Ground
16, 32	$V_{CC}$	Supply voltage
31, 29, 27, 24, 22, 20, 18, 15, 13, 11	Q[0:9]	Differential outputs
30, 28, 26, 23, 21, 19, 17, 14, 12, 10	$\overline{\text{Q}}[0:9]$	Differential outputs

TYPE NUMBER	NAME	DESCRIPTION	VERSION
PTN2111BD	LQFP32	Plastic low profile quad flat package; 32 leads; body 7 x 7 x 1.4 mm	SOT358-1

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## LOGIC DIAGRAM



## 1:10 LVDS clock distribution device

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**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	-0.3 to 2.8	V
$I_{OSD}$	Driver short circuit current	continuous	
ESD	Electrostatic discharge (Human Body Model 1.5 k $\Omega$ , 100 pF)	>2	kV
$T_j$	Junction temperature	150	$^{\circ}\text{C}$

**RECOMMENDED OPERATING CONDITIONS**

SYMBOL	PARAMETER	MIN	MAX	UNIT
$V_{CC}$	Supply voltage	2.375	2.625	V
$V_{IR}$	Receiver input voltage	GND	$V_{CC}$	
$T_{amb}$	Operating ambient temperature range in free air	-40	+85	$^{\circ}\text{C}$

**DC ELECTRICAL CHARACTERISTICS**

$T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  unless otherwise specified;  $V_{CC} = 2.5\text{ V} \pm 5\%$  (Notes 1, 2)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP <sup>2</sup>	MAX	UNIT
<b>Driver</b>						
$V_{OD}$	Output differential voltage	$R_L = 100\ \Omega$	250	350	450	mV
$\Delta V_{OD}$	$V_{OD}$ magnitude change	$R_L = 100\ \Omega$			50	mV
$V_{OS}$	Offset voltage	$R_L = 100\ \Omega$	1.125	1.25	1.375	V
$\Delta V_{OS}$	$V_{OS}$ magnitude change	$R_L = 100\ \Omega$			50	mV
$I_{OSD}$	Output short circuit current	$V_O = 0\text{ V}$		15	40	mA
		$V_{OD} = 0\text{ V}$		7	15	mA
<b>Receiver</b>						
$V_{IDH}$	Input threshold HIGH				100	mV
$V_{IDL}$	Input threshold LOW		-100			mV
$I_{IN}$	Input current	$V_{IN} = 0\text{ V}$		50	100	$\mu\text{A}$
		$V_{IN} = V_{CC}$		50	100	$\mu\text{A}$
<b>Device</b>						
$V_{BB}$	Output reference voltage	$V_{CC} = 2.5\text{ V};$ $I_{OUT} \leq 100\ \mu\text{A}$	1.15	1.25	1.35	V
$I_{CCD}$	Power supply current	All drivers enabled and loaded; input frequency = 800 MHz		190	230	mA
$C_{IN}$	Input capacitance	$V_{IN} = 0\text{ V}$ to $V_{CC}$		5		pF
$C_{OUT}$	Output capacitance			5		pF
$V_{IH}$	Logic input HIGH threshold	$V_{CC} = 2.5\text{ V}$	2			V
$V_{IL}$	Logic input LOW threshold	$V_{CC} = 2.5\text{ V}$			0.8	V
$I_I$	Logic input current	$V_{CC} = 2.5\text{ V};$ $V_{IN} = V_{CC}$ or GND			$\pm 10$	$\mu\text{A}$

**NOTES:**

- All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to device ground unless otherwise specified.
- All typical values are given for  $V_{CC} = +2.5\text{ V}$  and  $T_{amb} = +25\text{ }^{\circ}\text{C}$ , unless otherwise specified.
- $C_L$  includes probe and fixture capacitance.
- Generator waveforms for all tests unless otherwise specified:  $f = 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ , 50% duty cycle.
- The PTN2111 is a current mode device, and only functions to datasheet specifications when a resistive load is applied to the drives outputs.

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**AC ELECTRICAL CHARACTERISTICS (LVDS)** $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  unless otherwise specified;  $V_{CC} = 2.5\text{ V} \pm 5\%$  (Note 1)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
$t_{TLH}$	Transition time LOW to HIGH	$R_L = 100\ \Omega$ ; $C_L = 5\text{ pF}$		460	560	ps
$t_{THL}$	Transition time HIGH to LOW	$R_L = 100\ \Omega$ ; $C_L = 5\text{ pF}$		460	560	ps
$t_{PLH}$ $t_{PHL}$	Propagation delay to output				2	ns
$f_{MAX}$	Maximum input frequency		650	800		MHz
$t_{skew}$	Within-device skew			35		ps
	Part-to-part skew			100		ps
	Pulse skew			50		ps

**NOTE:**

1. Generator waveforms for all tests unless otherwise specified:  $f = 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ , 50% duty cycle.

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## CONTROL REGISTER SPECIFICATION

The PTN2111 is provided with an 11-bit shift register with a serial-in and a Control Register. The purpose is to enable or power-off each output clock channel and to select the clock input. The PTN2111 provides two working modes: Programmed mode, and Standard mode.

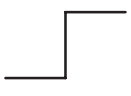
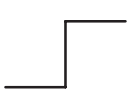

### Programmed Mode (EN = 1)

The shift register has a serial input to load the working configuration. Once the configuration is loaded with 11 clock pulses, another clock pulse loads the configuration into the Control Register. To restart the configuration of the shift register, a reset of the state machine must be done with a clock pulse on CK, and the EN set to LOW. The Control Register can be configured only one time after each reset. D0 is the first bit shifted in, D10 is the last bit shifted in. Bit D0 controls Q9, D9 controls Q0, and D10 controls CLKIN.

### Standard Mode (EN = 0)

In Standard Mode, the PTN2111 is not programmable. All clock buffer outputs are enabled. The LVDS clock input is selected from Clock0 or Clock1 with the SI pin, as shown in the Truth Table.

**Table 1. Truth Table of State Machine Inputs**

EN	SI	CK	OUTPUT
L	L	X	All outputs enabled, Clock0 selected, Control Register disabled.
L	H	X	All outputs enabled, Clock1 selected, Control Register disabled.
H	L		First stage stores "L", other stages store the data of previous stage.
H	H		First stage stores "H", other stages store the data of previous stage.
L	X		Reset of the state machine, Shift register, and Control Register.

**Table 2. Configuration of the Control Register**

Control Register bit	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
Function	Q9	Q8	Q7	Q6	Q5	Q4	Q3	Q2	Q1	Q0	CLK_SEL

**Table 3. Truth Table of the Control Register**

D10	Dn[0:9]	Qn[0:9]
L	H	Clock0
H	H	Clock1
X	L	Qn output disabled

X = Don't Care

## AC ELECTRICAL CHARACTERISTICS (Control Register)

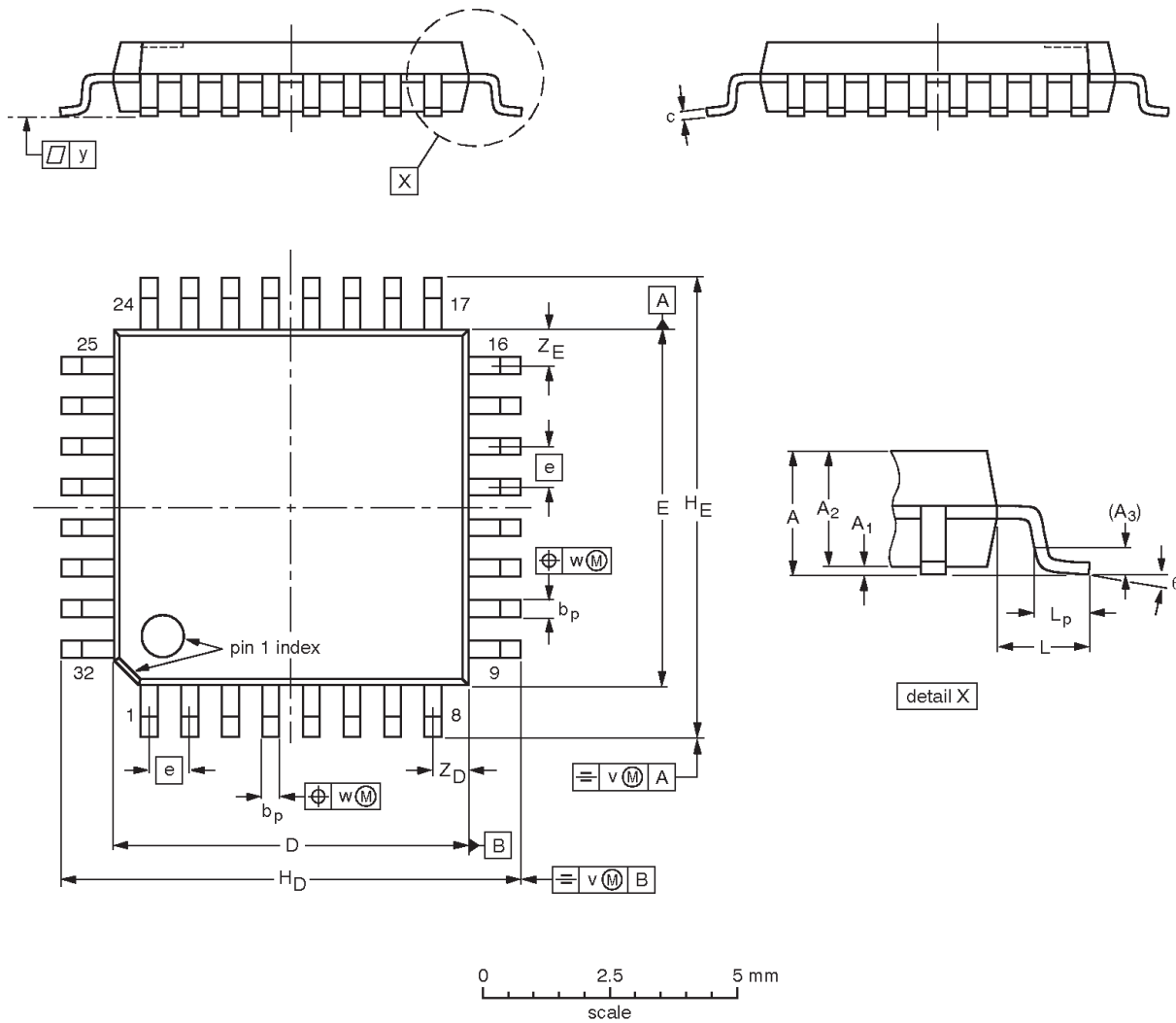
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
f <sub>MAX</sub>	Maximum frequency of shift register		50			MHz
t <sub>s</sub>	Clock to SI setup time				4.0	ns
t <sub>h</sub>	Clock to SI hold time				1.0	ns
t <sub>rem</sub>	Enable to clock removal time				4.0	ns
t <sub>w</sub>	Minimum clock pulse width		5			ns

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LQFP32: plastic low profile quad flat package; 32 leads; body 7 x 7 x 1.4 mm

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**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>D</sub>	H <sub>E</sub>	L	L <sub>p</sub>	v	w	y	Z <sub>D</sub> <sup>(1)</sup>	Z <sub>E</sub> <sup>(1)</sup>	θ
mm	1.60	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	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	EIAJ			
SOT358 -1	136E03	MS-026				99-12-27 00-01-19

## 1:10 LVDS clock distribution device

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**Data sheet status**

Data sheet status <sup>[1]</sup>	Product status <sup>[2]</sup>	Definitions
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.
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.
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[1] Please consult the most recently issued datasheet 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>.

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