

# DATA SHEET

## **PCK3807A**

1:10 LVTTL clock distribution device

Product data sheet  
Supersedes data of 2003 Jun 27

2004 Aug 27

# 1:10 LVTTTL clock distribution device

# PCK3807A

## DESCRIPTION

This low skew clock driver offers 1:10 fan-out. The large fan out from a single input reduces loading on the preceding driver and provides an efficient clock distribution network. The PCK3807A offers low capacitance inputs with hysteresis for improved noise margins. Multiple power and grounds reduce noise. Typical applications are clock and signal distribution.

The PCK3807A operates from a single 2.5 V or 3.3 V supply voltage and over the full industrial temperature range of -40 °C to +85 °C.

## FEATURES

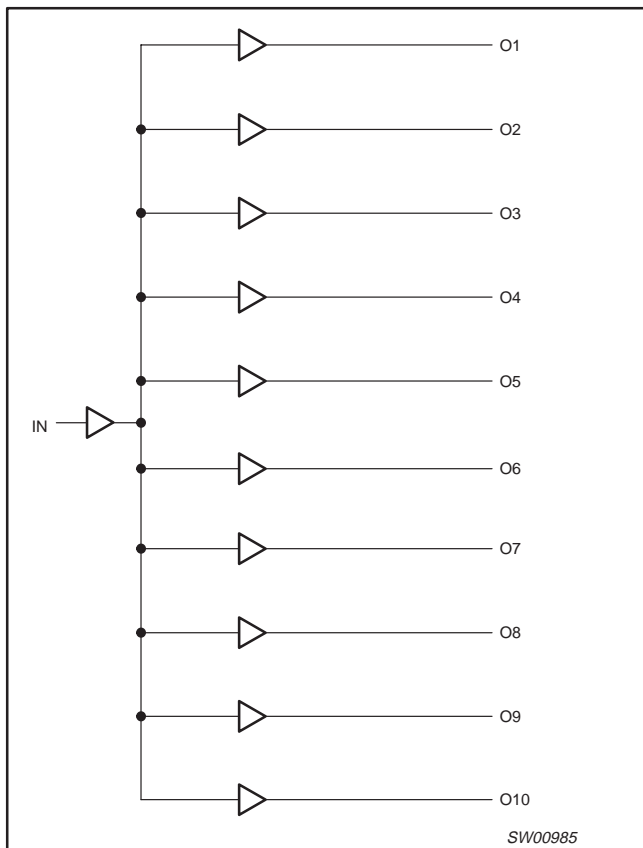
- Low output skew < 120 ps (max)
- Very low duty cycle distortion < 200 ps (max) for  $V_{CC} = 2.5\text{ V}$

- High speed: propagation delay < 3.5 ns (max)
- Very low CMOS power levels
- TTL compatible inputs and outputs
- 1:10 fanout
- Maximum output rise and fall times < 1.5 ns
- Low input capacitance: 2.5 pF typical
- $V_{CC} = 2.3\text{ V}$  to 3.6 V
- Overvoltage tolerance on inputs
- Available in SSOP, TSSOP, SO and QSOP packages
- >150 MHz operation

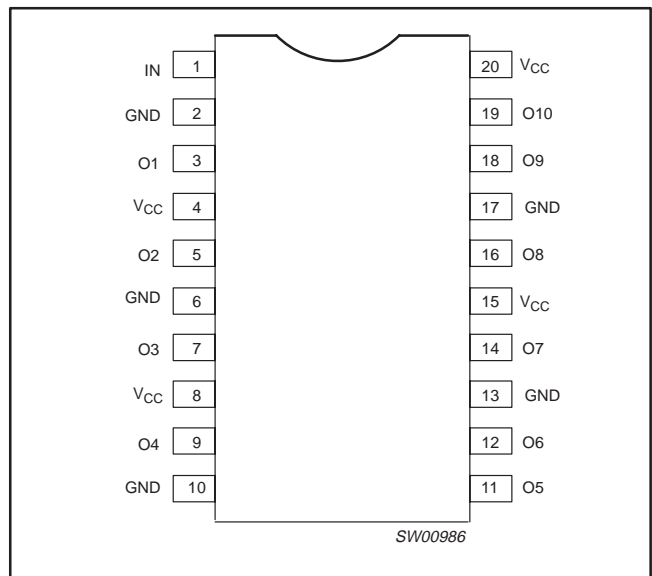
## ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE	DRAWING NUMBER
20-Pin Plastic SO	-40 °C to +85 °C	PCK3807AD	SOT163-1
20-Pin Plastic SSOP	-40 °C to +85 °C	PCK3807ADB	SOT339-1
20-Pin Plastic TSSOP	-40 °C to +85 °C	PCK3807APW	SOT360-1
20-Pin Plastic SSOP (QSOP)	-40 °C to +85 °C	PCK3807ADS	SOT724-1

## FUNCTIONAL BLOCK DIAGRAM



## PIN CONFIGURATION



## PIN DESCRIPTION

Symbol	Pin	Description
IN	1	Clock input
O1 to O10	3, 5, 7, 9, 11, 12, 14, 16, 18, 19	Clock outputs
GND	2, 10, 13, 17	Ground
V <sub>CC</sub>	20	Supply voltage

# 1:10 LVTTTL clock distribution device

PCK3807A

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

SYMBOL	DESCRIPTION	MIN	MAX	UNIT
$V_{TERM}^2$	Terminal voltage with respect to GND	-0.5	+4.6	V
$V_{TERM}^3$	Terminal voltage with respect to GND	-0.5	+7	V
$V_{TERM}^4$	Terminal voltage with respect to GND	-0.5	$V_{CC} + 0.5$	V
$T_{stg}$	Storage temperature	-65	+150	°C
$I_O$	DC output current	-60	+60	mA

### NOTES:

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
- $V_{CC}$  terminals.
- Input terminal.
- Outputs terminals.

## CAPACITANCE

$T_{amb} = +25\text{ °C}$ ,  $f = 1.0\text{ MHz}$

SYMBOL	PARAMETER	CONDITIONS	TYP	MAX	UNIT
$C_i$	Input capacitance	$V_{IN} = 0\text{ V}$	2.5	4	pF
$C_o$	Output capacitance	$V_{OUT} = 0\text{ V}$	5.5	6	pF

### NOTE:

- This parameter is measured at characterization but not tested.

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
$V_{CC}$	DC supply voltage	2.3	3.6	V
$f_{IN}$	Input signal frequency	0	150	MHz
$T_{amb}$	Operating free-air temperature range	-40	+85	°C
$C_L$	Output capacitance load	-	50	pF

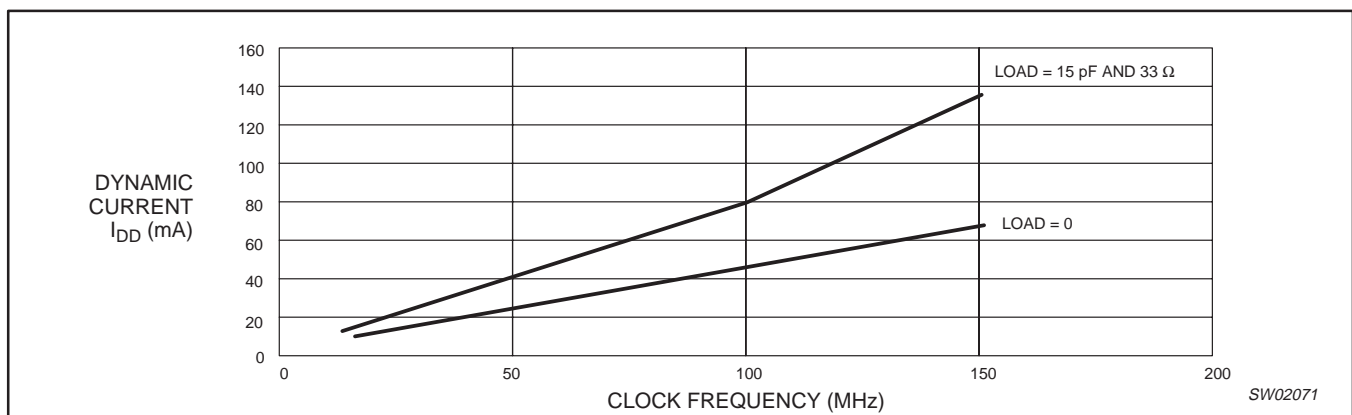


Figure 1. Dynamic current vs. clock frequency,  $V_{CC} = 3.3\text{ V}$

## 1:10 LVTTTL clock distribution device

PCK3807A

**POWER SUPPLY CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNIT
$\Delta I_{CC}$	Quiescent power supply current, TTL inputs HIGH	$V_{CC} = \text{max}; V_{IN} = V_{CC} - 0.6 \text{ V}$		–	3	30	$\mu\text{A}$
$I_{CCD}$	Dynamic power supply current	$V_{CC} = 2.7 \text{ V}$ Input toggling 50% duty cycle $V_{IN} = V_{CC}$ or GND	Outputs open	–	0.31	0.45	mA/MHz
			15 pF and 33 $\Omega$ load	–	1.0	–	
		$V_{CC} = 3.6 \text{ V}$	Outputs open	–	0.5	0.75	
			15 pF and 33 $\Omega$ load	–	1.5	–	
$I_C$	Total power supply current Dynamic power supply current	$V_{CC} = 2.7 \text{ V}$ Input toggling 50% duty cycle Outputs open	$V_{IN} = V_{CC}$	–	15.5	22.8	mA
			$V_{IN} = \text{GND}$ $f_i = 50 \text{ MHz}$	–	50	75	
		$V_{CC} = 3.6 \text{ V}$	$f_i = 50 \text{ MHz}$	–	25	37	
			$f_i = 150 \text{ MHz}$	–	75	115	

**NOTES:**

- For conditions shown as Max or Min, use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at  $V_{CC} = 3.3 \text{ V}$ , +25°C ambient.
- Per TTL driven input ( $V_{IN} = V_{CC} - 0.6 \text{ V}$ ).
- This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
- Values for these conditions are examples of the  $I_C$  formula. These limits are guaranteed but not tested.
- $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$   
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD}(f_i)$   
 $I_{CC}$  = Quiescent Current ( $I_{CCL}$ ,  $I_{CCH}$  and  $I_{CCZ}$ )  
 $\Delta I_{CC}$  = Power Supply Current for a TTL High Input ( $V_{IN} = V_{CC} - 0.6 \text{ V}$ )  
 $D_H$  = Duty Cycle for TTL Inputs High  
 $N_T$  = Number of TTL Inputs at  $D_H$   
 $I_{CCD}$  = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)  
 $f_i$  = Input Frequency  
All currents are in milliamps and all frequencies are in MHz

## 1:10 LVTTTL clock distribution device

## PCK3807A

**DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE**T<sub>amb</sub> = -40 °C to +85 °C, V<sub>CC</sub> = 3.3 V ± 0.3 V, unless otherwise specified

SYMBOL	PARAMETER	TEST CONDITIONS <sup>1</sup>	MIN	TYP	MAX	UNIT	
V <sub>IH</sub>	HIGH-level input voltage (Input pins)	V <sub>CC</sub> = 3.0 V to 3.6 V	2	–	5.5	V	
	HIGH-level input voltage (I/O pins)	V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	–	3.6		
V <sub>IL</sub>	LOW-level input voltage (Input pins)	V <sub>CC</sub> = 3.0 V to 3.6 V	–0.5	–	0.8	V	
	LOW-level input voltage (I/O pins)	V <sub>CC</sub> = 2.3 V to 2.7 V	–0.5	–	0.7		
I <sub>IH</sub>	HIGH-level input current (Input pins)	V <sub>CC</sub> = Max	V <sub>I</sub> = 5.5 V	–	–	± 1	μA
	HIGH-level input current (I/O pins)		V <sub>I</sub> = V <sub>CC</sub>	–	–	± 1	
I <sub>IL</sub>	LOW-level input current (Input pins)	V <sub>CC</sub> = Max	V <sub>I</sub> = GND	–	–	± 1	μA
	LOW-level input current (I/O pins)		V <sub>I</sub> = GND	–	–	± 1	
V <sub>IK</sub>	Clamp diode voltage	V <sub>CC</sub> = Min; I <sub>IN</sub> = –18 mA	–	–0.7	–1.0	V	
I <sub>ODH</sub>	HIGH-level input current	V <sub>CC</sub> = 3.3 V; V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = 1.5 V <sup>3</sup>	–36	–120	–150	mA	
I <sub>ODL</sub>	LOW-level input current	V <sub>CC</sub> = 3.3 V; V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = 1.5 V <sup>3</sup>	50	150	200	mA	
V <sub>OH</sub>	HIGH-level output voltage	V <sub>CC</sub> = 2.3 V to 3.6 V	I <sub>OH</sub> = –0.1 mA	V <sub>CC</sub> – 0.2	–	–	V
		V <sub>CC</sub> = 2.3 V	I <sub>OH</sub> = –8 mA	1.9	–	–	
		V <sub>CC</sub> = 3.0 V	I <sub>OH</sub> = –8 mA	2.4 <sup>6</sup>	3	–	
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 2.3 V to 3.6 V	I <sub>OL</sub> = 0.1 mA	–	–	0.2	V
		V <sub>CC</sub> = 2.3 V	I <sub>OL</sub> = 8 mA	–	–	0.3	
		V <sub>CC</sub> = 3.0 V	I <sub>OL</sub> = 16 mA	–	0.2	0.4	
		V <sub>CC</sub> = 3.0 V	I <sub>OL</sub> = 24 mA	–	0.3	0.5	
I <sub>OFF</sub>	Input power off leakage	V <sub>CC</sub> = 0 V; V <sub>IN</sub> = 4.5 V	–	–	± 1	μA	
I <sub>OS</sub>	Short circuit current <sup>5</sup>	V <sub>CC</sub> = Max; V <sub>O</sub> = GND <sup>4</sup>	0	–155	–240	mA	
V <sub>hys</sub>	Input hysteresis	–	–	150	–	mV	
I <sub>CCL</sub> I <sub>CCH</sub>	Quiescent power supply current	V <sub>CC</sub> = Max V <sub>IN</sub> = GND or V <sub>CC</sub>	–	0.1	10	μA	

**NOTES:**

- For conditions shown as Max or Min, use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at V<sub>CC</sub> = 3.3 V, +25 °C ambient.
- Duration of the test should not exceed one second.
- Not more than one output shorted at one time. Duration of the test should not exceed one second.
- This parameter is guaranteed but not tested.
- V<sub>OH</sub> = V<sub>CC</sub> – 0.6 V at rated current.

## 1:10 LVTTTL clock distribution device

## PCK3807A

**SWITCHING CHARACTERISTICS OVER OPERATING RANGE – INDUSTRIAL<sup>3,4</sup>**T<sub>amb</sub> = –40 °C to +85 °C, V<sub>CC</sub> = 3.3 V ± 0.3 V, unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS <sup>1</sup>	2.5 V ± 0.2 V		3.3 V ± 0.3 V		UNIT
			MIN <sup>2</sup>	MAX	MIN <sup>2</sup>	MAX	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay	50 Ω to V <sub>CC</sub> /2; C <sub>L</sub> = 10 pF (See Figure 2)	1.5	2.7	1.3	2.5	ns
t <sub>R</sub>	Output rise time	or	–	1.0	–	1.0	ns
t <sub>F</sub>	Output fall time		–	1.0		1.0	ns
t <sub>SK(o)</sub>	Output skew: skew between outputs of same package (same transition)	50 Ω AC termination; C <sub>L</sub> = 10 pF (See Figure 3);	–	0.12	–	0.12	ns
t <sub>SK(p)</sub>	Pulse skew: skew between opposite transitions of same output ( t <sub>PHL</sub> –t <sub>PLH</sub>  )	f ≤ 150 MHz; Outputs connected in groups of two	–	0.3	–	0.45	ns
t <sub>SK(t)</sub>	Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade		–	0.6	–	0.6	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay		50 Ω to V <sub>CC</sub> /2; C <sub>L</sub> = 22 pF (See Figure 2)	1.5	3.5	1.5	3
t <sub>R</sub>	Output rise time	or	–	1.0	–	1.0	ns
t <sub>F</sub>	Output fall time		–	1.0	–	1.0	ns
t <sub>SK(o)</sub>	Output skew: skew between outputs of same package (same transition)	50 Ω AC termination; C <sub>L</sub> = 22 pF (See Figure 3);	–	0.12	–	0.12	ns
t <sub>SK(p)</sub>	Pulse skew: skew between opposite transitions of same output ( t <sub>PHL</sub> –t <sub>PLH</sub>  )	f ≤ 150 MHz; Outputs connected in groups of two	–	0.3	–	0.45	ns
t <sub>SK(t)</sub>	Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade		–	0.6	–	0.6	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay		C <sub>L</sub> = 30 pF; f ≤ 67 MHz (See Figure 4)	1.5	4.0	1.5	4
t <sub>R</sub>	Output rise time		–	1.0	–	1.0	ns
t <sub>F</sub>	Output fall time		–	1.0	–	1.0	ns
t <sub>SK(o)</sub>	Output skew: skew between outputs of same package (same transition)		–	0.35	–	0.35	ns
t <sub>SK(p)</sub>	Pulse skew: skew between opposite transitions of same output ( t <sub>PHL</sub> –t <sub>PLH</sub>  )		–	0.35	–	0.35	ns
t <sub>SK(t)</sub>	Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade		–	1.0	–	0.75	ns
t <sub>jitter</sub>	RMS jitter		–	1.0	–	1.0	ps
f <sub>MAX</sub>	Maximum output frequency		Functional to 400 MHz	–	400	–	400
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay	C <sub>L</sub> = 50 pF; f ≤ 40 MHz (See Figure 5)	1.5	4.5	1.5	4.0	ns
t <sub>R</sub>	Output rise time		–	1.5	–	1.5	ns
t <sub>F</sub>	Output fall time		–	1.5	–	1.5	ns
t <sub>SK(o)</sub>	Output skew: skew between outputs of same package (same transition)		–	0.35	–	0.35	ns
t <sub>SK(p)</sub>	Pulse skew: skew between opposite transitions of same output ( t <sub>PHL</sub> –t <sub>PLH</sub>  )		–	0.75	–	0.75	ns
t <sub>SK(T)</sub>	Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade		–	1	–	0.75	ns

**NOTES:**

- See test circuits and waveforms.
- Minimum limits are guaranteed but not tested on Propagation Delays.
- t<sub>PLH</sub>, t<sub>PHL</sub>, t<sub>SK(t)</sub> are production tested. All other parameters guaranteed but not production tested.
- Propagation delay range indicated by Min and Max limit is due to V<sub>CC</sub>, operating temperature and process parameters. These propagation delay limits do not imply skew.

# 1:10 LVTTTL clock distribution device

# PCK3807A

## TEST CIRCUITS

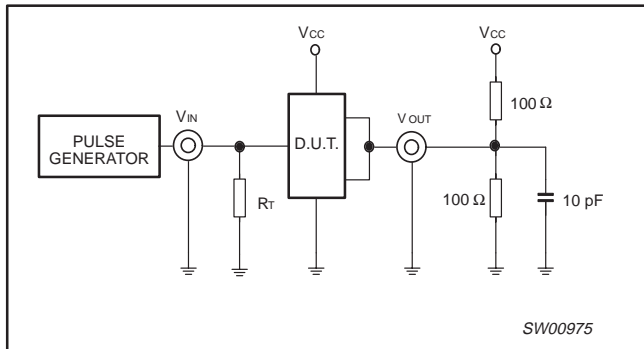
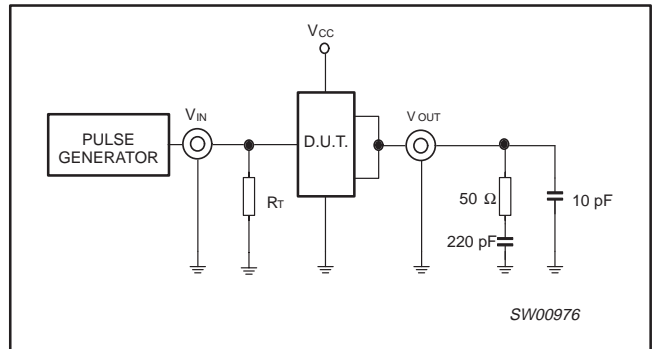


Figure 2.  $Z_O = 50\ \Omega$  TO  $V_{CC}/2$ ,  $C_L = 10\ \text{pF}$



The capacitor value for ac termination is determined by the operating frequency. For very low frequencies a higher capacitor value should be selected.

Figure 3.  $Z_O = 50\ \Omega$  AC termination,  $C_L = 10\ \text{pF}$

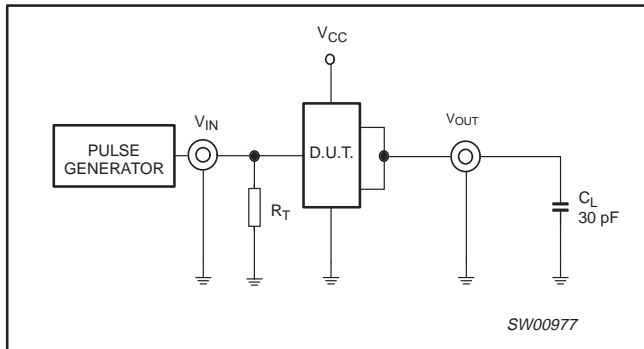


Figure 4.  $C_L = 30\ \text{pF}$  circuit

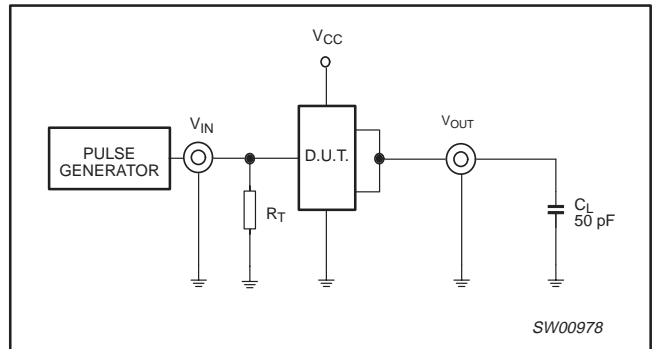


Figure 5.  $C_L = 50\ \text{pF}$  circuit

# 1:10 LVTTTL clock distribution device

# PCK3807A

## TIMING DIAGRAMS

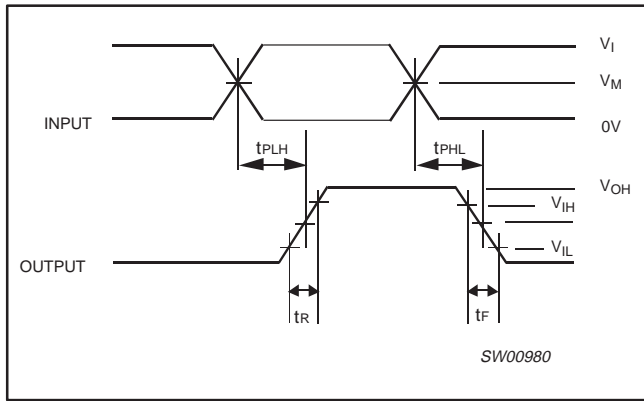


Figure 6. Package delay (see Table 1)

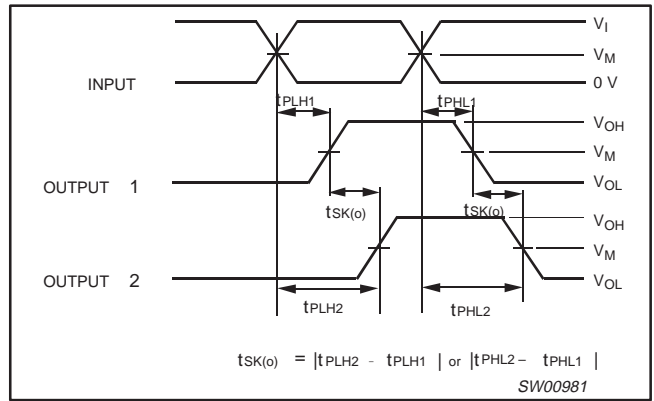


Figure 7. Output skew –  $t_{SK(o)}$  (see Table 1)

$$t_{SK(o)} = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

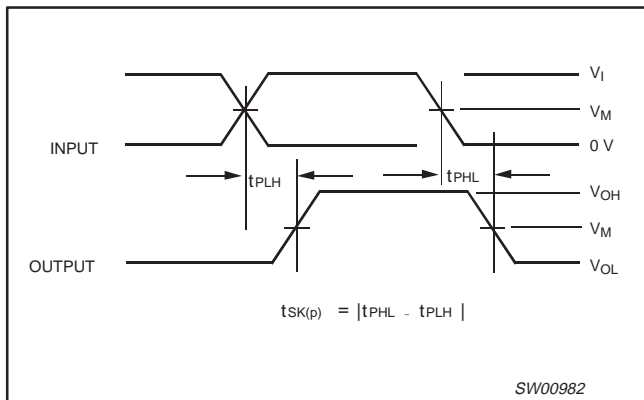


Figure 8. Pulse skew –  $t_{SK(p)}$  (see Table 1)

$$t_{SK(p)} = |t_{PHL} - t_{PLH}|$$

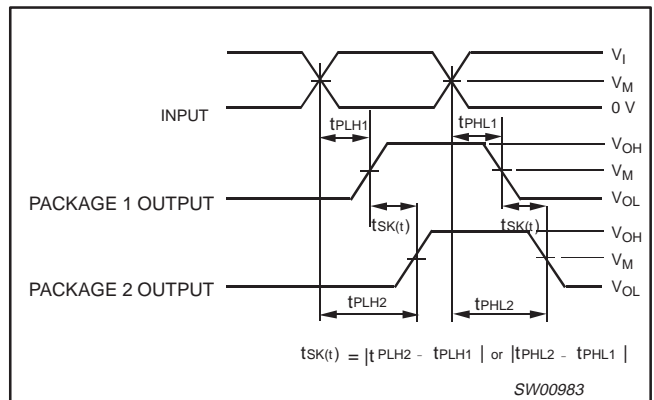


Figure 9. Package skew –  $t_{SK(y)}$  (see Table 1)

$$t_{SK(t)} = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

Table 1. Reference levels

Reference level	V <sub>I</sub>	V <sub>M</sub>
For V <sub>CC</sub> = 3.3 ± 0.3 V	3.0 V	1.5 V
For V <sub>CC</sub> = 2.5 ± 0.2 V	V <sub>CC</sub>	V <sub>CC</sub> /2

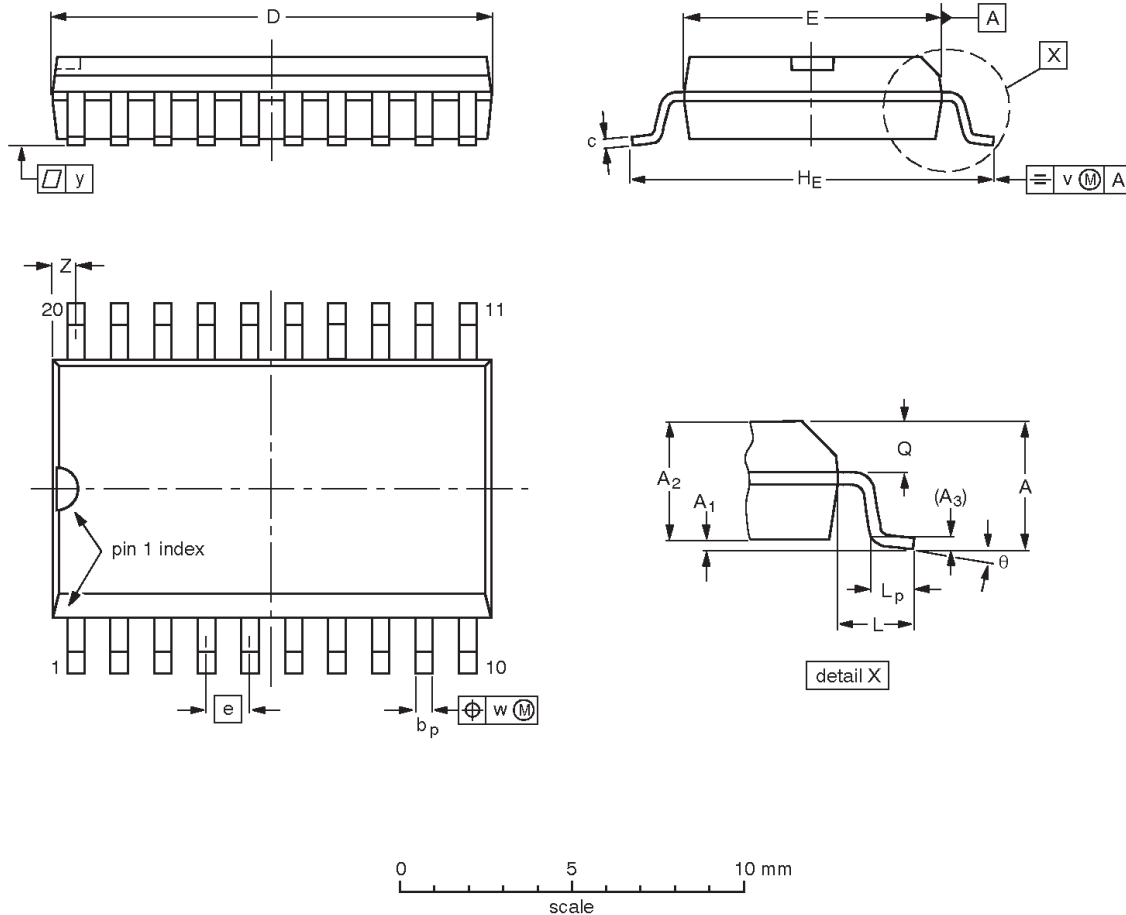


1:10 LVTTTL clock distribution device

PCK3807A

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



DIMENSIONS (inch dimensions are derived from the original mm 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	HE	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

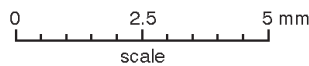
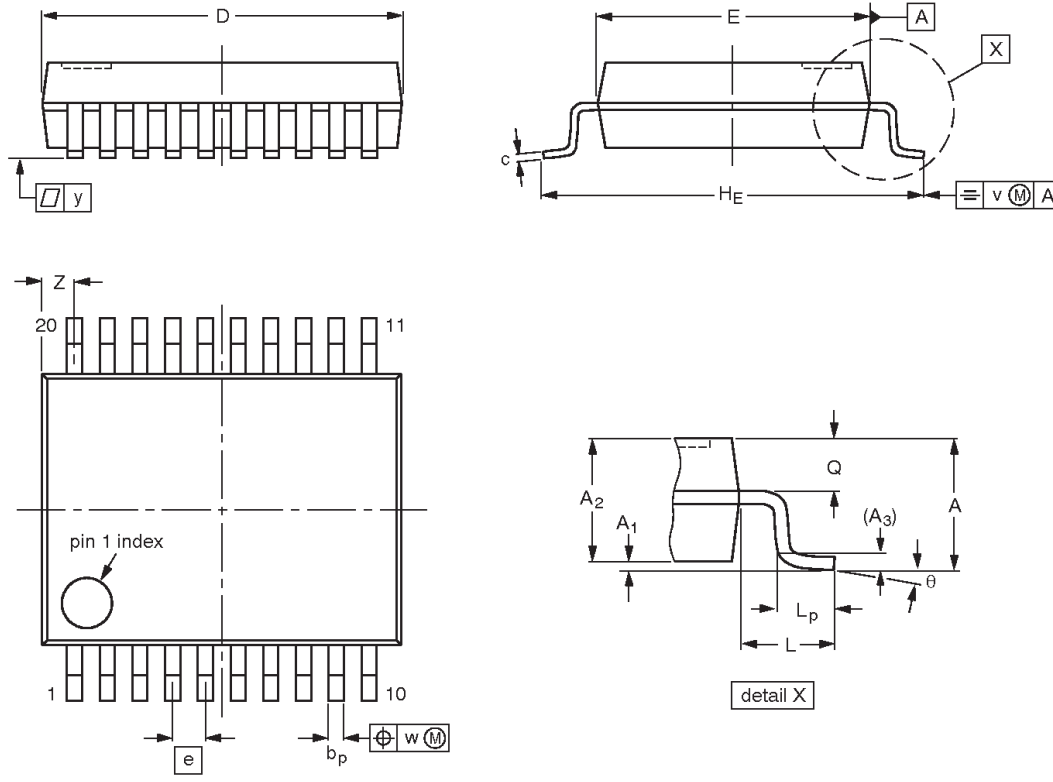
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT163-1	075E04	MS-013				-99-12-27 03-02-19

1:10 LVTTTL clock distribution device

PCK3807A

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1



**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>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	7.4 7.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.9 0.5	8° 0°

**Note**

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

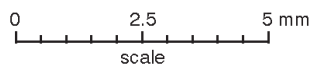
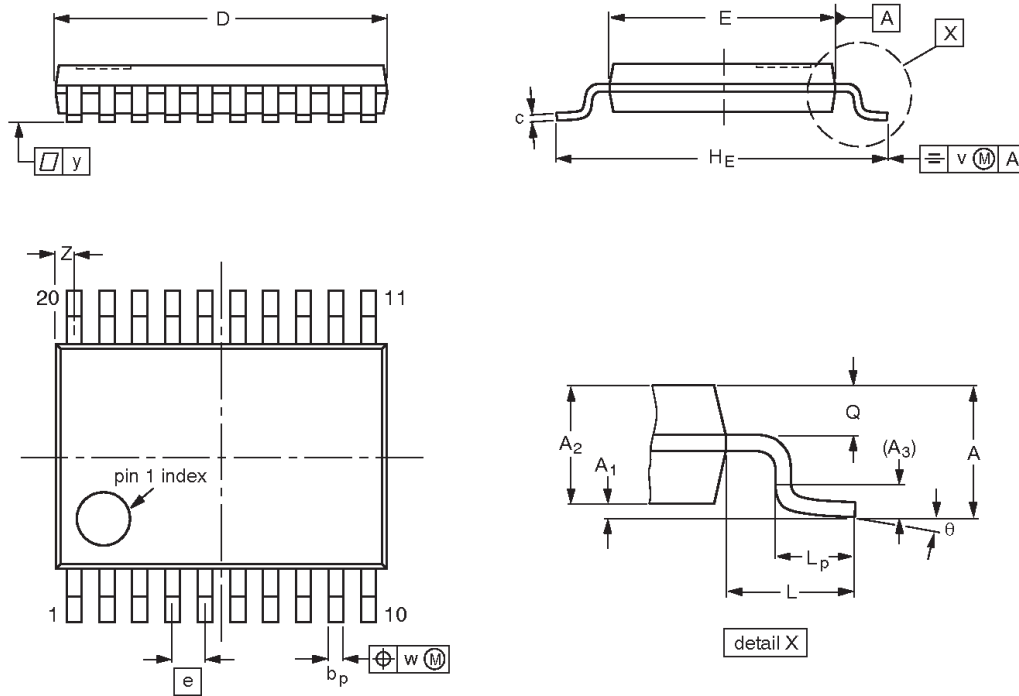
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT339-1		MO-150				99-12-27 03-02-19

1:10 LVTTTL clock distribution device

PCK3807A

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1



**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>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	8° 0°

**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

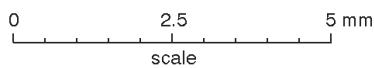
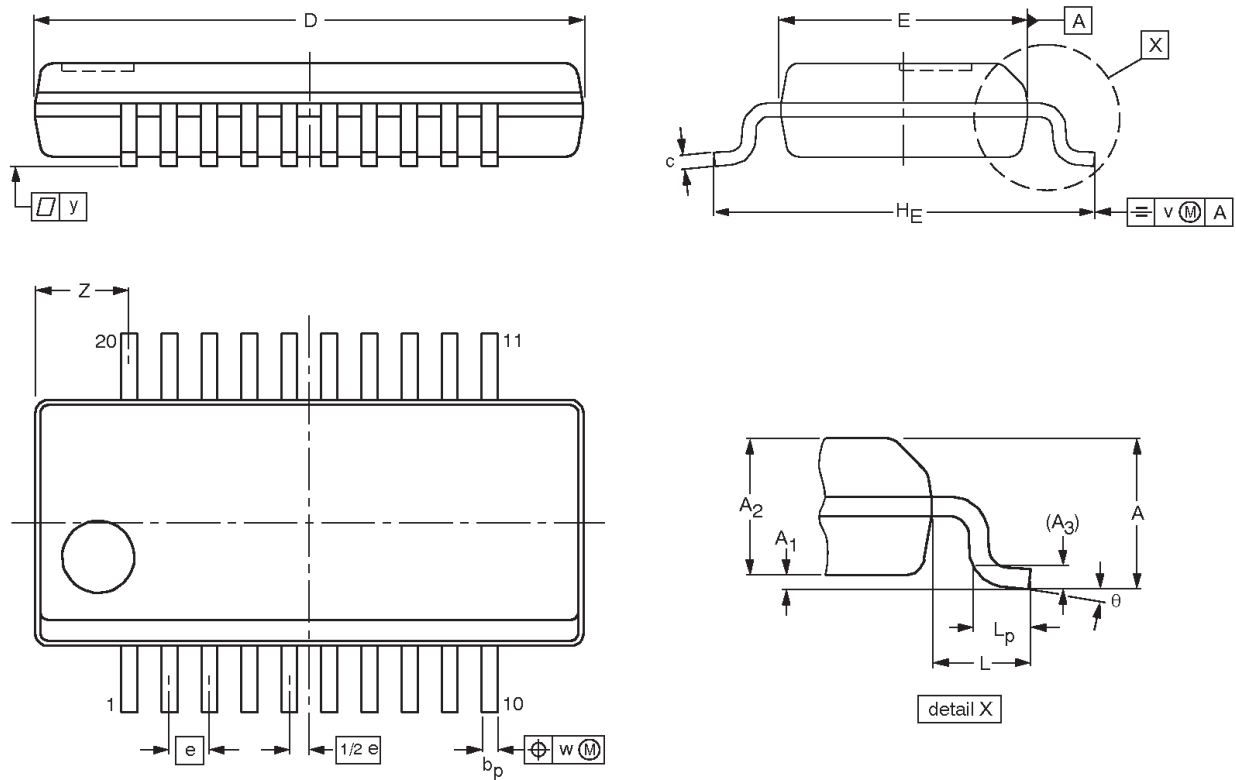
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT360-1		MO-153				-99-12-27 03-02-19

1:10 LVTTTL clock distribution device

PCK3807A

SSOP20: plastic shrink small outline package; 20 leads;  
body width 3.9 mm; lead pitch 0.635 mm

SOT724-1



**DIMENSIONS (millimetre dimensions are derived from the original inch 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>E</sub>	L	L <sub>p</sub>	v	w	y	Z <sup>(1)</sup>	θ
mm	1.73	0.25 0.10	1.55 1.40	0.25	0.31 0.20	0.25 0.18	8.8 8.6	4.0 3.8	0.635	6.2 5.8	1	0.89 0.41	0.25	0.18	0.1	1.67 1.28	8° 0°

**Note**

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT724-1		MO-137				01-07-04 03-02-18

## 1:10 LVTTTL clock distribution device

PCK3807A

## REVISION HISTORY

Rev	Date	Description
_2	20040827	<b>Product data sheet (9397 750 14007). Supersedes data of 2003 Jun 27 (9397 750 11683).</b> Modifications: <ul style="list-style-type: none"> <li>Recommended Operating Conditions table on page 3: change <math>V_{CC}</math> Min. limit from 2.5 V to 2.3 V.</li> </ul>
_1	20030627	<b>Product data (9397 750 11683); ECN 853-2431 30019 dated 18 June 2003. Initial version</b>

## Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2] [3]</sup>	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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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).

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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.

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**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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Date of release: 08-04

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