

# 100310 Low Skew 2:8 Differential Clock Driver

## General Description

The 100310 is a low skew 8-bit differential clock driver which is designed to select between two separate differential clock inputs. The low output to output skew (< 50 ps) is maintained for either clock input. A LOW on the select pin (SEL) selects CLKINA,  $\overline{\text{CLKINA}}$  and a HIGH on the SEL pin selects the CLKINB,  $\overline{\text{CLKINB}}$  inputs.

The 100310 is ideal for those applications that need the ability to freely select between two clocks, or to maintain the ability to switch to an alternate or backup clock should a problem arise with the primary clock source.

A  $V_{\text{BB}}$  output is provided for single-ended operation.

## Features

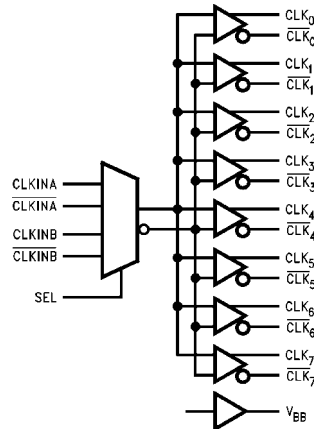
- Low output to output skew
- Differential inputs and outputs
- Allows multiplexing between two clock inputs
- Voltage compensated operating range: -4.2V to -5.7V
- Available to industrial grade temperature range (PLCC package only)

## Ordering Code:

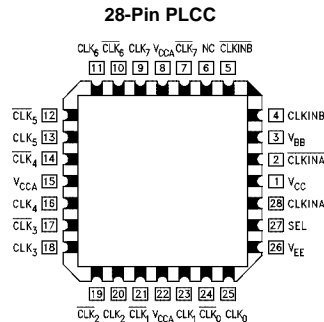
Order Number	Package Number	Package Description
100310QC	V28A	28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square
100310QI	V28A	28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square Industrial Temperature Range (-40°C to +85°C)

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

## Logic Symbol



## Connection Diagram



## Pin Descriptions

Pin Names	Description
CLKIN <sub>n</sub> , $\overline{\text{CLKIN}}_n$	Differential Clock Inputs
SEL	Select
CLK <sub>0-7</sub> , $\overline{\text{CLK}}_{0-8}$	Differential Clock Outputs
V <sub>BB</sub>	V <sub>BB</sub> Output
NC	No Connect

## Truth Table

CLKINA	$\overline{\text{CLKINA}}$	CLKINB	$\overline{\text{CLKINB}}$	SEL	CLK <sub>n</sub>	$\overline{\text{CLK}}_n$
H	L	X	X	L	H	L
L	H	X	X	L	L	H
X	X	H	L	H	H	L
X	X	L	H	H	L	H

**Absolute Maximum Ratings** (Note 1)

Storage Temperature ( $T_{STG}$ )	-65°C to +150°C
Maximum Junction Temperature ( $T_J$ )	+150°C
Pin Potential to Ground Pin ( $V_{EE}$ )	-7.0V to +0.5V
Input Voltage (DC)	$V_{EE}$ to +0.5V
Output Current (DC Output HIGH)	-50 mA
ESD (Note 2)	$\geq 2000V$

**Recommended Operating Conditions**

Case Temperature ( $T_C$ )	Commercial	0°C to +85°C
	Industrial	-40°C to +85°C
Supply Voltage ( $V_{EE}$ )		-5.7V to -4.2V

**Note 1:** The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum rating. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Note 2:** ESD testing conforms to MIL-STD-883, Method 3015.

**Commercial Version****DC Electrical Characteristics** (Note 3)

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$ ,  $T_C = 0^\circ C$  to  $+85^\circ C$

Symbol	Parameter	Min	Typ	Max	Units	Conditions	
$V_{OH}$	Output HIGH Voltage	-1025	-955	-870	mV	$V_{IN} = V_{IH}$ (Max) or $V_{IL}$ (Min)	Loading with 50Ω to -2.0V
$V_{OL}$	Output LOW Voltage	-1830	-1705	-1620	mV		
$V_{OHC}$	Output HIGH Voltage	-1035			mV	$V_{IN} = V_{IH}$ or $V_{IL}$ (Max)	Loading with 50Ω to -2.0V
$V_{OLC}$	Output LOW Voltage			-1610	mV		
$V_{BB}$	Output Reference Voltage	-1380	-1320	-1260	mV	$I_{V_{BB}} = -250 \mu A$	
$V_{DIFF}$	Input Voltage Differential	150			mV	Required for Full Output Swing	
$V_{CM}$	Common Mode Voltage	$V_{CC} - 2.0$		$V_{CC} - 0.5$	V		
$V_{IH}$	Input HIGH Voltage	-1165		-870	mV	Guaranteed HIGH Signal for All Inputs	
$V_{IL}$	Input LOW Voltage	-1830		-1475	mV	Guaranteed LOW Signal for All Inputs	
$I_{IL}$	Input LOW Current	0.50			$\mu A$	$V_{IN} = V_{IL}$ (Min)	
$I_{IH}$	Input HIGH Current			240	$\mu A$	$V_{IN} = V_{IH}$ (Max)	
$I_{CBO}$	Input Leakage Current	-10			$\mu A$	$V_{IN} = V_{EE}$	
$I_{EE}$	Power Supply Current	-100		-40	mA	Inputs Open	

**Note 3:** The specified limits represent the "worst case" value for the parameter. Since these values normally occur at the temperature extremes, additional noise immunity and guardbanding can be achieved by decreasing the allowable system operating ranges. Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

## Commercial Version (Continued) AC Electrical Characteristics

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = 0^\circ C$			$T_C = +25^\circ C$			$T_C = +85^\circ C$			Units	Conditions
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
$f_{MAX}$	Max Toggle Frequency CLKIN A/B to $Q_n$	750			750			750			MHz	
	SEL to $Q_n$	575			575			575			MHz	
$t_{PLH}$ $t_{PHL}$	Propagation Delay, CLKIN <sub>n</sub> to CLK <sub>n</sub>											
	Differential	0.80	0.90	1.00	0.82	0.92	1.02	0.89	1.01	1.09	ns	Figure 3
	Single-Ended	0.80	0.96	1.20	0.82	0.98	1.22	0.89	1.06	1.29		
$t_{PLH}$ $t_{PHL}$	Propagation Delay, SEL to Output	0.75	0.99	1.20	0.80	1.02	1.25	0.85	1.10	1.35	ns	Figure 2
$t_{PS}$	LH-HL Skew		10	30		10	30		10	30		(Note 4)(Note 7)
$t_{OSLH}$	Gate-Gate Skew LH		20	30		20	50		20	50		(Note 5)(Note 7)
$t_{OSHL}$	Gate-Gate Skew HL		20	50		20	50		20	50		(Note 5)(Note 7)
$t_{OST}$	Gate-Gate LH-HL Skew		30	60		30	60		30	60		(Note 6)(Note 7)
$t_S$	Setup Time SEL to CLKIN <sub>n</sub>	300			300			300			ps	
$t_H$	Setup Time SEL to CLKIN <sub>n</sub>	0			0			0			ps	
$t_{TLH}$ $t_{THL}$	Transition Time 20% to 80%, 80% to 20%	275	510	750	275	500	750	275	480	750	ps	Figure 4

**Note 4:**  $t_{PS}$  describes opposite edge skews, i.e. the difference between the delay of a differential output signal pair's LOW-to-HIGH and HIGH-to-LOW propagation delays. With differential signal pairs, a LOW-to-HIGH or HIGH-to-LOW transition is defined as the transition of the true output or input pin.

**Note 5:**  $t_{OSLH}$  describes in-phase gate-to-gate differential propagation skews with all differential outputs going LOW-to-HIGH;  $t_{OSHL}$  describes the same conditions except with the outputs going HIGH-to-LOW.

**Note 6:**  $t_{OST}$  describes the maximum worst case difference in any of the  $t_{PS}$ ,  $t_{OSLH}$  or  $t_{OST}$  delay paths combined.

**Note 7:** The skew specifications pertain to differential I/O paths.

## Industrial Version

### DC Electrical Characteristics (Note 8)

 $V_{EE} = -4.2V \text{ to } -5.7V, V_{CC} = V_{CCA} = GND$ 

Symbol	Parameter	$T_C = -40^\circ C$		$T_C = 0^\circ C \text{ to } +85^\circ C$		Units	Conditions	
		Min	Max	Min	Max			
$V_{OH}$	Output HIGH Voltage	-1085	-870	-1025	-870	mV	$V_{IN} = V_{IH} \text{ (Max)}$	Loading with 50Ω to -2.0V
$V_{OL}$	Output LOW Voltage	-1830	-1575	-1830	-1620	mV	or $V_{IL} \text{ (Min)}$	
$V_{OHC}$	Output HIGH Voltage	-1095		-1035		mV	$V_{IN} = V_{IH}$	Loading with 50Ω to -2.0V
$V_{OLC}$	Output LOW Voltage		-1565		-1610	mV	or $V_{IL} \text{ (Min)}$	
$V_{BB}$	Output Reference Voltage	-1395	-1255	-1380	-1260	mV	$I_{VBB} = -250 \mu A$	
$V_{DIFF}$	Input Voltage Differential	150		150		mV	Required for Full Output Swing	
$V_{CM}$	Common Mode Voltage	$V_{CC} - 2.0$	$V_{CC} - 0.5$	$V_{CC} - 2.0$	$V_{CC} - 0.5$	V		
$V_{IH}$	Input HIGH Voltage	-1170	-870	-1165	-870	mV	Guaranteed HIGH Signal for All Inputs	
$V_{IL}$	Input LOW Voltage	-1830	-1480	-1830	-1475	mV	Guaranteed LOW Signal for All Inputs	
$I_{IL}$	Input LOW Current	0.50		0.50		$\mu A$	$V_{IN} = V_{IL} \text{ (Min)}$	
$I_{IH}$	Input HIGH Current		240		240	$\mu A$	$V_{IN} = V_{IH} \text{ (Max)}$	
$I_{CBO}$	Input Leakage Current	-10		-10		$\mu A$	$V_{IN} = V_{EE}$	
$I_{EE}$	Power Supply Current	-100	-40	-100	-40	mA	Inputs Open	

**Note 8:** The specified limits represent the "worst case" value for the parameter. Since these values normally occur at the temperature extremes, additional noise immunity and guardbanding can be achieved by decreasing the allowable system operating ranges. Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

### AC Electrical Characteristics

 $V_{EE} = -4.2V \text{ to } -5.7V, V_{CC} = V_{CCA} = GND$ 

Symbol	Parameter	$T_C = -40^\circ C$			$T_C = +25^\circ C$			$T_C = +85^\circ C$			Units	Conditions	
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max			
$f_{MAX}$	Max Toggle Frequency												
	CLKIN A/B to $Q_n$	750			750			750			MHz		
	SEL to $Q_n$	575			575			575			MHz		
$t_{PLH}$	Propagation Delay, CLKIN <sub>n</sub> to CLK <sub>n</sub>												
$t_{PHL}$		Differential	0.78	0.88	0.98	0.82	0.92	1.02	0.89	1.01	1.09	ns	Figure 3
		Single-Ended	0.78	0.95	1.18	0.82	0.98	1.22	0.89	1.06	1.29		
$t_{PLH}$	Propagation Delay SEL to Output	0.70	0.99	1.20	0.80	1.02	1.25	0.85	1.10	1.35	ns	Figure 2	
$t_{PHL}$													
$t_{PS}$	LH-HL Skew		10	30		10	30		10	30	ps	(Note 9)(Note 12)	
$t_{OSLH}$	Gate-Gate Skew LH		20	50		20	50		20	50	ps	(Note 10)(Note 12)	
$t_{OSHL}$	Gate-Gate Skew HL		20	50		20	50		20	50	ps	(Note 10)(Note 12)	
$t_{OST}$	Gate-Gate LH-HL Skew		30	60		30	60		30	60	ps	(Note 11)(Note 12)	
$t_S$	Setup Time SEL to CLKIN <sub>n</sub>	300			300			300			ps		
$t_H$	Setup Time SEL to CLKIN <sub>n</sub>	0			0			0			ps		
$t_{TLH}$	Transition Time 20% to 80%, 80% to 20%	275	510	750	275	500	750	275	480	750	ps	Figure 4	
$t_{THL}$													

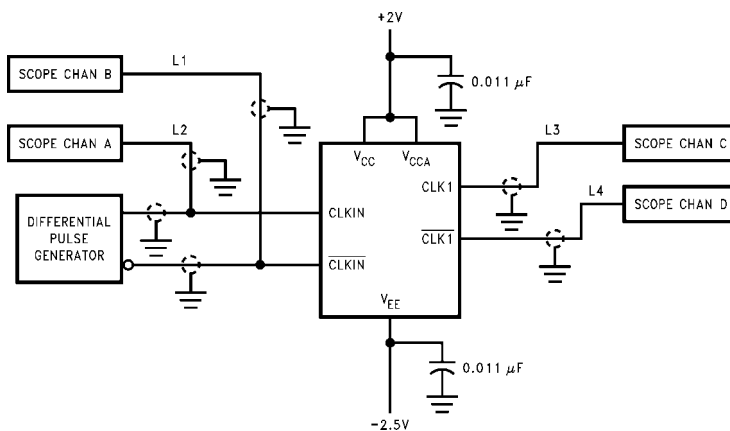
**Note 9:**  $t_{PS}$  describes opposite edge skews, i.e. the difference between the delay of a differential output signal pair's LOW-to-HIGH and HIGH-to-LOW propagation delays. With differential signal pairs, a LOW-to-HIGH or HIGH-to-LOW transition is defined as the transition of the true output or input pin.

**Note 10:**  $t_{OSLH}$  describes in-phase gate-to-gate differential propagation skews with all differential outputs going LOW-to-HIGH;  $t_{OSHL}$  describes the same conditions except with the outputs going HIGH-to-LOW.

**Note 11:**  $t_{OST}$  describes the maximum worst case difference in any of the  $t_{PS}$ ,  $t_{OSLH}$  or  $t_{OST}$  delay paths combined.

**Note 12:** The skew specifications pertain to differential I/O paths.

### Test Circuit



**Note:**  
 Shown for testing CLKIN to CLK1 in the differential mode.  
 L1, L2, L3 and L4 = equal length 50Ω impedance lines.  
 All unused inputs and outputs are loaded with 50Ω in parallel with  $\leq 3$  pF to GND.  
 Scope should have 50Ω input terminator internally.

FIGURE 1. AC Test Circuit

### Switching Waveforms

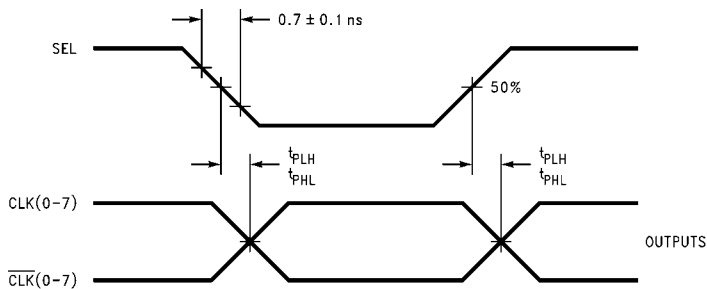


FIGURE 2. Propagation Delay, SEL to Outputs

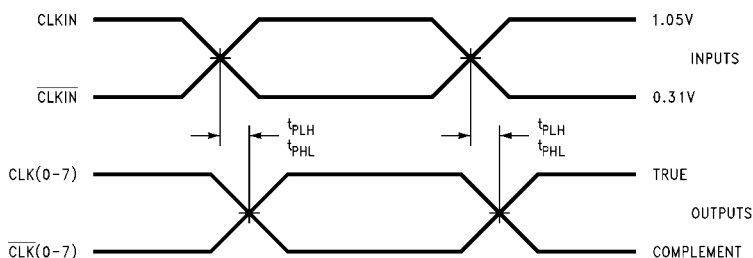


FIGURE 3. Propagation Delay, CLKIN/CLKIN to Outputs

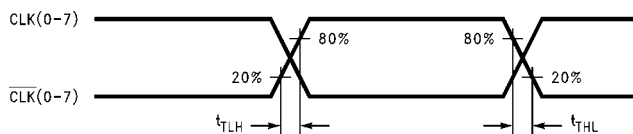
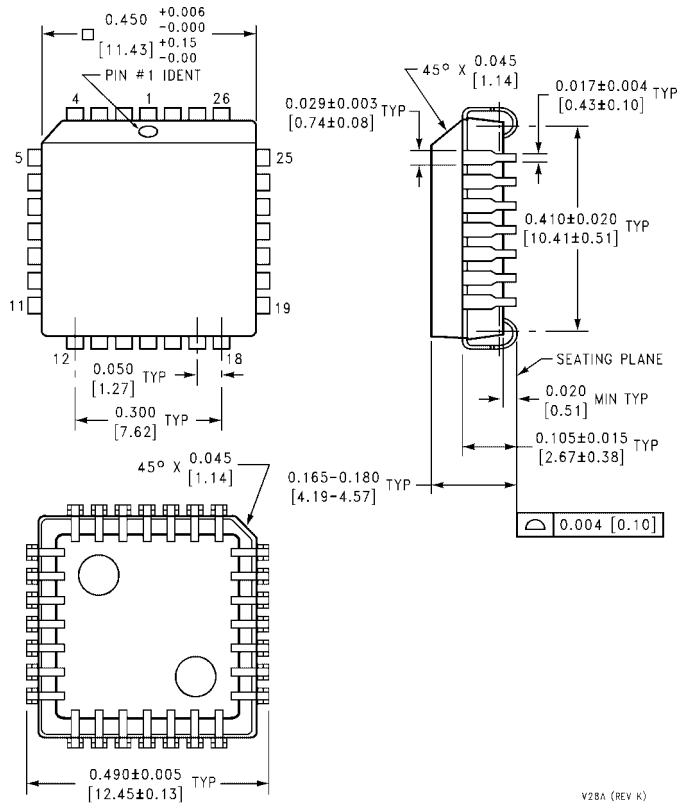


FIGURE 4. Transition Times

**Physical Dimensions** inches (millimeters) unless otherwise noted



**28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square Package Number V28A**

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