National Semiconductor

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.

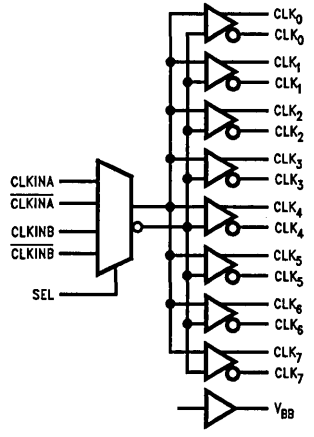
A V_{BB} output is provided for single-ended operation.

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

Ordering Code: See Section 5

Logic Symbol



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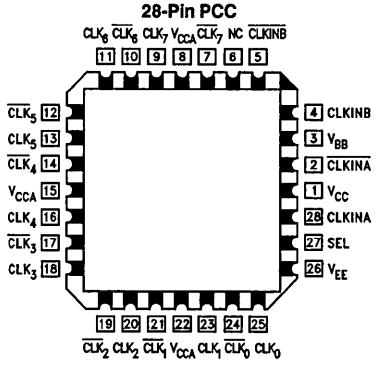
Pin Names	Description
$CLKIN_n$, $\overline{CLKIN}_n$	Differential Clock Inputs
SEL	Select
CLK_{0-7}, $\overline{CLK}_{0-8}$	Differential Clock Outputs
V_{BB}	V_{BB} Output
NC	No Connect

Truth Table

CLKINA	$\overline{\text{CLKINA}}$	CLKINB	$\overline{\text{CLKINB}}$	SEL	CLK_n	$\overline{CLK}_n$
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

Connection Diagram



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Absolute Maximum Ratings

Above which the useful life may be impaired (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Storage Temperature (T_{STG})	−65°C to +150°C
Maximum Junction Temperture (T_J)	
Plastic	+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)	≥2000V

Note 1: Absolute maximum ratings are those values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

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

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

Commercial Version

DC Electrical Characteristics

V_{EE} = −4.2V to −5.7V, V_{CC} = V_{CCA} = GND, T_C = 0°C to +85°C (Note 3)

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_{VBB} = −250 μA	
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			μA	V_{IN} = V_{IL} (Min)	
I_{IH}	Input HIGH Current			240	μA	V_{IN} = V_{IH} (Max)	
I_{CBO}	Input Leakage Current	−10			μA	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°C			T_C = +25°C			T_C = +85°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, $CLKIN_n$ to CLK_n											
	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	ps	(Notes 1, 4)
t_{OSLH}	Gate-Gate Skew LH		20	30		20	50		20	50		(Notes 2, 4)
t_{OSHL}	Gate-Gate Skew HL		20	50		20	50		20	50		(Notes 2, 4)
t_{OST}	Gate-Gate LH-HL Skew		30	60		30	60		30	60		(Notes 3, 4)
t_S	Setup Time SEL to $CLKIN_n$	300			300			300			ps	
t_H	Setup Time SEL to $CLKIN_n$	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 1: 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 2: 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 3: t_{OST} describes the maximum worst case difference in any of the t_{PS}, t_{OSLH} or t_{OST} delay paths combined.

Note 4: The skew specifications pertain to differential I/O paths.

Industrial Version

DC Electrical Characteristics V_{EE} = −4.2V to −5.7V, V_{CC} = V_{CCA} = GND (Note 1)

Symbol	Parameter	T_C = −40°C		T_C = 0°C to +85°C		Units	Conditions	
		Min	Max	Min	Max			
V_{OH}	Output HIGH Voltage	−1085	−870	−1025	−870	mV	V_{IN} = V_{IH} (Max) or V_{IL} (Min)	Loading with 50Ω to −2.0V
V_{OL}	Output LOW Voltage	−1830	−1575	−1830	−1620	mV		
V_{OHC}	Output HIGH Voltage	−1095		−1035		mV	V_{IN} = V_{IH} or V_{IL} (Min)	Loading with 50Ω to −2.0V
V_{OLC}	Output LOW Voltage		−1565		−1610	mV		
V_{BB}	Output Reference Voltage	−1395	−1255	−1380	−1260	mV	I_{VBB} = −250 μA	
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		μA	V_{IN} = V_{IL} (Min)	
I_{IH}	Input HIGH Current		240		240	μA	V_{IN} = V_{IH} (Max)	
I_{CBO}	Input Leakage Current	−10		−10		μA	V_{IN} = V_{EE}	
I_{EE}	Power Supply Current	−100	−40	−100	−40	mA	Inputs Open	

Note 1: 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.

Industrial Version (Continued)

AC Electrical Characteristics V_{EE} = −4.2V to −5.7V, V_{CC} = V_{CCA} = GND

Symbol	Parameter	T_C = −40°C			T_C = +25°C			T_C = +85°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, $CLKIN_n$, to CLK_n											
	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} t_{PHL}	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_{PS}	LH-HL Skew		10	30		10	30		10	30	ps	(Notes 1, 4)
t_{OSLH}	Gate-Gate Skew LH		20	50		20	50		20	50		(Notes 2, 4)
t_{OSHL}	Gate-Gate Skew HL		20	50		20	50		20	50		(Notes 2, 4)
t_{OST}	Gate-Gate LH-HL Skew		30	60		30	60		30	60		(Notes 3, 4)
t_S	Setup Time SEL to $CLKIN_n$	300			300			300			ps	
t_H	Setup Time SEL to $CLKIN_n$	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*

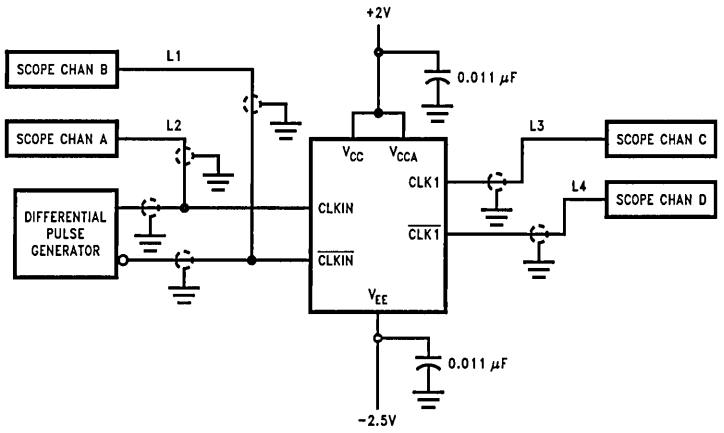
Note 1: t_{PS} describes opposite edge skews, i.e. the difference between the delay of a differential output signal pair's low to high and high to low propagation delays. With differential signal pairs, a low to high or high to low transition is defined as the transition of the true output or input pin.

Note 2: 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 3: t_{OST} describes the maximum worst case difference in any of the t_{PS}, t_{OSLH} or t_{OST} delay paths combined.

Note 4: The skew specifications pertain to differential I/O paths.

Test Circuit



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Note 1: Shown for testing CLKIN to CLK1 in the differential mode.

Note 2: L1, L2, L3 and L4 = equal length 50Ω impedance lines.

Note 3: All unused inputs and outputs are loaded with 50Ω in parallel with ≤3 pF to GND.

Note 4: Scope should have 50Ω input terminator internally.

FIGURE 1. AC Test Circuit

Switching Waveforms

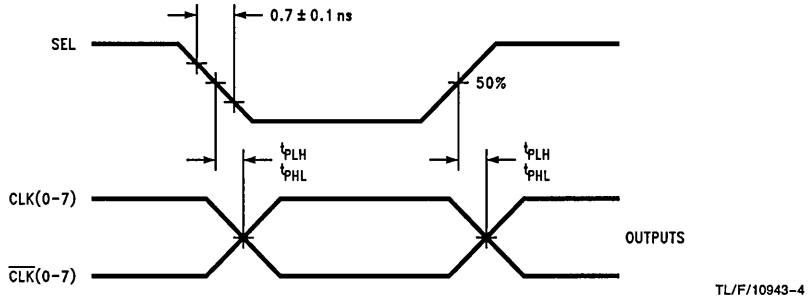

FIGURE 2. Propagation Delay, SEL to Outputs

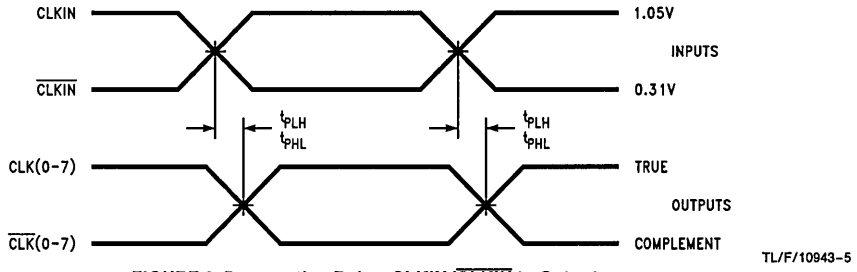

FIGURE 3. Propagation Delay, CLKIN/$\overline{CLKIN}$ to Outputs

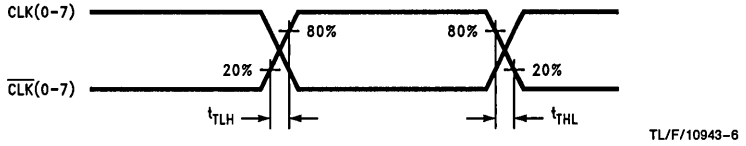

FIGURE 4. Transition Times