

100311

Low Skew 1:9 Differential Clock Driver

General Description

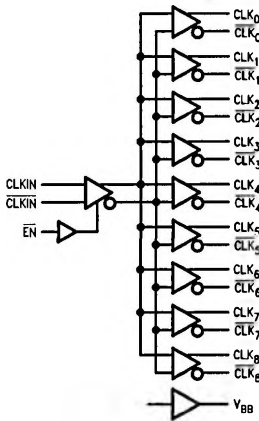
The 100311 contains nine low skew differential drivers, designed for generation of multiple, minimum skew differential clocks from a single differential input (CLKIN, $\overline{\text{CLKIN}}$). If a single-ended input is desired, the V_{BB} output pin may be used to drive the remaining input line. A HIGH on the enable pin ($\overline{\text{EN}}$) will force a LOW on all of the CLK_n outputs and a HIGH on all of the $\overline{\text{CLK}}_n$ output pins. The 100311 is ideal for distributing a signal throughout a system without worrying about the original signal becoming too corrupted by undesirable delays and skew. The 100311 is pin-for-pin compatible with the Motorola 100E111.

Features

- Low output to output skew (≤ 50 ps)
- 2000V ESD protection
- 1:9 low skew clock driver
- Differential inputs and outputs

Ordering Code: See Section 4

Logic Symbol



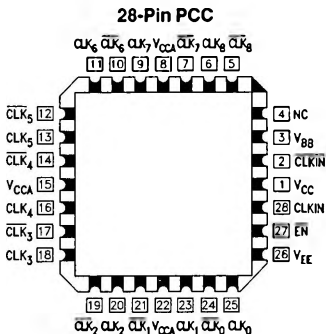
TL/F/10648-1

Pin Names	Description
CLKIN, $\overline{\text{CLKIN}}$	Differential Clock Inputs
$\overline{\text{EN}}$	Enable
CLK_{0-8} , $\overline{\text{CLK}}_{0-8}$	Differential Clock Outputs
V_{BB}	V_{BB} Output
NC	No Connect

Truth Table

CLKIN	$\overline{\text{CLKIN}}$	$\overline{\text{EN}}$	CLK_n	$\overline{\text{CLK}}_n$
L	H	L	L	H
H	L	L	H	L
X	X	H	L	H

Connection Diagram



TL/F/10648-2

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 Temperature (T _J)	
Ceramic	+175°C
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

Recommended Operating Conditions

Case Temperature (T _C)	
Commercial	0°C to +85°C
Industrial	-40°C to +85°C
Supply Voltage (V _{EE})	
Commercial	-5.7V to -4.2V
Industrial	-5.7V to -4.2V

Commercial Version—100311

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} = -300 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 CLKIN, $\overline{\text{CLKIN}}$ EN			100 250	μA	V _{IN} = V _{IH} (Max)	
I _{CBO}	Input Leakage Current	-10			μA	V _{IN} = V _{EE}	
I _{EE}	Power Supply Current	-115		-57	mA	Inputs Open	
V _{PP}	Minimum Input Swing	250			mV		
V _{CMR}	Common Mode Range	-1.6		-0.4	V		

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.

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—100311 (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	Max	Min	Max	Min	Max		
f_{max}	Max Toggle Frequency	750		750		750		MHz	
t_{PLH} t_{PHL}	Propagation Delay, CLKIN to CLKN								<i>Figures 1 and 2</i>
	Differential Single-Ended	0.750 0.650	0.950 1.050	0.775 0.675	0.975 1.175	0.840 0.740	1.040 1.240	ns	
t_{PLH} t_{PHL}	Propagation Delay Enable and Disable to Output	0.75	1.20	0.80	1.25	0.85	1.35	ns	<i>Figures 1 and 2</i>
t_R	Release Time \overline{EN} to CLKIN	0.30		0.30		0.30		ns	
t_{skew}	Gate to Gate Skew		50		50		50	ps	
t_s	Setup Time SEL to CLKIN _N	250		250		300		ps	
t_h	Hold Time SEL to CLKIN _N	0		0		0		ns	
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	275	750	275	750	275	750	ps	<i>Figures 1 and 2</i>

Note 1: Gate to gate skew is defined as the different in propagation delays between each of the outputs.

Industrial Version—100311**DC Electrical Characteristics** $V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$ (Note 3)

Symbol	Parameter	$T_C = -40^\circ C$		$T_C = 0^\circ C$ to $+85^\circ C$		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	$I_{VBB} = -300\mu A$	
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	

Industrial Version—100311 (Continued)**DC Electrical Characteristics** (Continued) $V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$ (Note 3)

Symbol	Parameter	$T_C = -40^\circ C$		$T_C = 0^\circ C$ to $+85^\circ C$		Units	Conditions
		Min	Max	Min	Max		
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 CLKIN, CLKIN _N EN		100 250		100 250	μA	$V_{IN} = V_{IH}$ (Max)
I_{CBO}	Input Leakage Current	-10		-10		μA	$V_{IN} = V_{EE}$
I_{EE}	Power Supply Current	-115	-57	-115	-57	mA	Inputs Open
V_{PP}	Minimum Input Swing	250		250		mV	
V_{CMR}	Common Mode Range	-1.6	-0.4	-1.6	-0.4	V	

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.

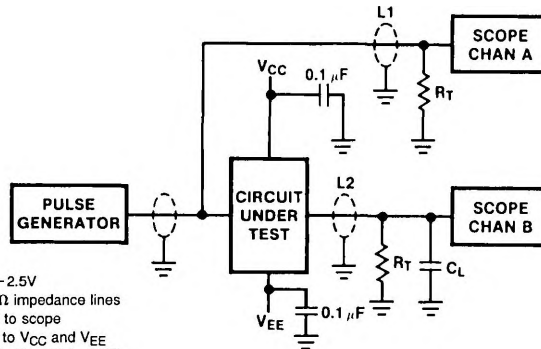
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AC Electrical Characteristics $V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = -40^\circ C$		$T_C = +25^\circ C$		$T_C = +85^\circ C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
f_{max}	Max Toggle Frequency	750		750		750		MHz	
t_{PLH} t_{PHL}	Propagation Delay, CLKIN to CLKN Differential Single-Ended	0.725 0.625	0.925 1.025	0.80 0.70	1.00 1.20	1.05 0.90	1.25 1.40	ns	Figures 1 and 2
t_{PLH} t_{PHL}	Propagation Delay Enable and Disable to Output	0.70	1.20	0.60	1.60	0.60	1.60	ns	Figures 1 and 2
t_R	Release Time EN to CLKIN	0.30		0.30		0.30		ns	
t_{skew}	Gate to Gate Skew		50		50		50	ps	
t_s	Setup Time SEL to CLKIN _N	250		200		200		ps	
t_h	Hold Time SEL to CLKIN _N	0		0		0		ns	
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	275	750	275	600	275	600	ps	Figures 1 and 2

Test Circuit

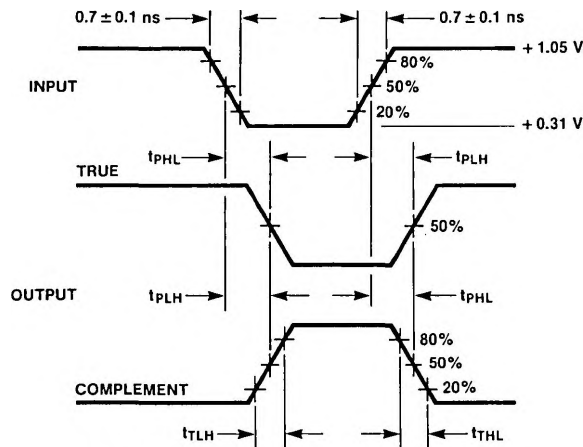


Notes: $V_{CC}, V_{CCA} = +2V$, $V_{EE} = -2.5V$
 $L1$ and $L2$ = equal length 50Ω impedance lines
 $R_T = 50\Omega$ terminator internal to scope
 Decoupling $0.1\ \mu F$ from GND to V_{CC} and V_{EE}
 All unused outputs are loaded with 50Ω to GND
 C_L = Fixture and stray capacitance $\leq 3\ pF$

TL/F/10648-3

FIGURE 1. AC Test Circuit

Switching Waveforms



TL/F/10648-4

FIGURE 2. Propagation Delay and Transition Times