National Semiconductor

CGS74CT2527
1-to-8 Minimum Skew (450 ps) Clock Driver

General Description

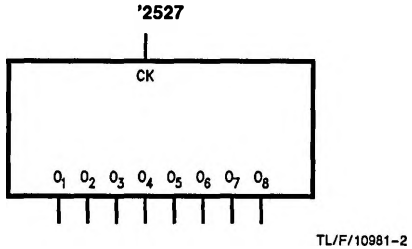
These minimum skew clock drivers are designed for Clock Generation and Support (CGS) applications operating at high frequencies. This device guarantees minimum output skew across the outputs of a given device. The '2527 is a minimum skew clock driver with one input driving eight outputs, specifically designed for clock distribution applications.

Features

- Guaranteed and tested:
  450 ps Pin-to-pin skew (t_{OSHL} and t_{OHLH})
- High performance version of existing CGS74CT2525
- Implemented on National's FACT™ family process
- 1 input to 8 outputs low skew clock distribution
- Symmetric output current drive: 24 mA I_{OH}/I_{OL}
- Industrial temperature of −40°C to +85°C
- 28 pin PCC for optimum skew performance
- Guaranteed 2K volts ESD protection

Ordering Code: See Section 5

Logic Symbol



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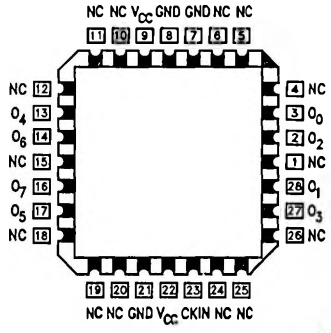
Connection Diagram

Pin Assignment for PCC



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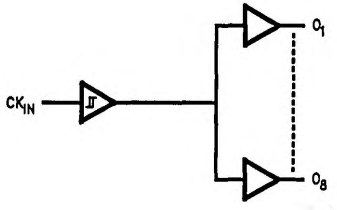
Functional Description

The output pins act as a single entity and will follow the state of the CK_{IN} when clock distribution chip is selected.

Pin Description

Pin Names	Description
CK_{IN}	Clock Input
O_1–O_8	Outputs



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Truth Table

Inputs	Outputs
CK_{IN}	O_1–O_8
L	L
H	H

Absolute Maximum Ratings (Note)

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

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Input Diode Current (I_{IK})	
V_i = −0.5V	−20 mA
V_i = V_{CC} +0.5V	+20 mA
DC Input Voltage (V_I)	−0.5V to V_{CC} +0.5V
DC Output Diode Current (I_O)	
V_o = 0.5V	−20 mA
V_o = V_{CC} +0.5V	+20 mA
DC Output Voltage (V_O)	−0.5V to V_{CC} +0.5V
DC Output Source or Sink Current (I_O)	±50 mA
DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND})	±50 MA
Storage Temperature (T_{STG})	−65°C to +150°C
Junction Temperature Coeff. (θ_J)	
PCC (0 LFM Air Flow)	71°C/W
PCC (225 LFM Air Flow)	53°C/W
PCC (500 LFM Air Flow)	47°C/W

Note: *Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of CGS circuits outside databook specifications.*

Recommended Operating Conditions

Supply Voltage (V_{CC})	
'CT	4.5V to 5.5V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	−40°C to +85°C
Minimum Input Edge Rate ($\Delta V/\Delta t$)	
V_{IN} from 0.8V to 2.0V	
V_{CC} @ 4.5V, 5.5V	125 mV/ns

DC Electrical Characteristics for CGS74CT Family Devices

Symbol	Parameter	V_{CC} (V)	CGS74CT T_A = +25°C		CGS74CT T_A = −40°C to +85°C	Units	Conditions
			Typ	Guaranteed Limits			
V_{IH}	Minimum High Level Input Voltage	4.5 5.5	1.5 1.5	2.0 2.0	2.0 2.0	V	V_{OUT} = 0.1V or V_{CC} −0.1V
V_{IL}	Maximum Low Level Input Voltage	4.5 5.5	1.5 1.5	0.8 0.8	0.8 0.8	V	V_{OUT} = 0.1V or V_{CC} −0.1V
V_{OH}	Minimum High Level Output Voltage	4.5 5.5	4.49 5.49	4.4 5.4	4.4 5.4	V	V_{IN} = V_{IL} or V_{IH} I_{OUT} = −50 μA
		4.5 5.5		3.86 4.86	3.76 4.76	V	*V_{IN} = V_{IL} or V_{IH} I_{OH} −24 mA
V_{OL}	Minimum Low Level Output Voltage	4.5 5.5	0.001 0.001	0.1 0.1	0.1 0.1	V	V_{IN} = V_{IL} or V_{IH} I_{OUT} = 50 μA
		4.5 5.5		0.36 0.36	0.44 0.44	V	*V_{IN} = V_{IL} or V_{IH} I_{OL} 24 mA
I_{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	mA	V_I = V_{CC}, GND
I_{CCT}	Maximum I_{CC}/Input	5.5	0.6		1.5	mA	V_I = V_{CC} − 2.1V
I_{OLD}	†Minimum Dynamic Output Current	5.5			75	mA	V_{OLD} = 1.65V Max
I_{OHD}		5.5			−75	mA	V_{OHD} = 3.85V Min
I_{CC}	Minimum Quiescent Supply Current	5.5		8.0	80.0	μA	V_{IN} = V_{CC} or GND

*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

AC Electrical Characteristics

over Recommended Operating Free Air Temperature Range. All typical values are measured at V_{CC} = 5V, T_A = 25°C

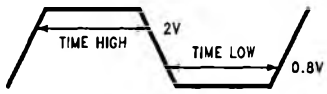
Symbol	Parameter	V_{CC}* (V)	CGS74CT2527						Units
			T_A = +25°C, C_L = 50 pF, R_L = 500Ω			T_A = −40°C to +85°C, C_L = 50 pF, R_L = 500Ω			
			Min	Typ	Max	Min	Typ	Max	
f_{MAX}	Maximum Frequency	5.0					100		MHz
t_{PLH}	Low-to-High Propagation Delay CK to O_n	5.0	3.6		9.5	3.0		10.5	ns
t_{PHL}	High-to-Low Propagation Deay CK to O_n	5.0	3.6		9.5	3.0		10.5	ns
t_{OSHL}	Maximum Skew Common Edge Output-to-Output Variation (Note 1)	5.0		150	450		150	450	ps
t_{OSLH}	Maximum Skew Common Edge Output-to-Output Variation (Note 1)	5.0		150	450			450	ps
t_{rise}, t_{fall}	Rise/Fall Time (from 0.8V/2.0V to 2.0V/0.8V)				1.5			1.5	ns

*Voltage Range 5.0 is 5.0V ±0.5V

Note 1: Output-to-Output Skew is defined as the absolute value of the difference between the actual propagation delay for any outputs within the same packaged device. The specifications apply to any outputs switching in the same direction either HIGH to LOW (t_{OSHL}) or LOW to HIGH (t_{OSLH}) or in opposite directions both HL and LH (t_{OST}).

Extended Electrical Characteristics: (66.67 MHz)

CGS74CT2527	T_A = −40°C to +85°C, C_L = 50 pF, R_L = 500Ω	Units
Time High*	4	ns
Time Low*	4	ns



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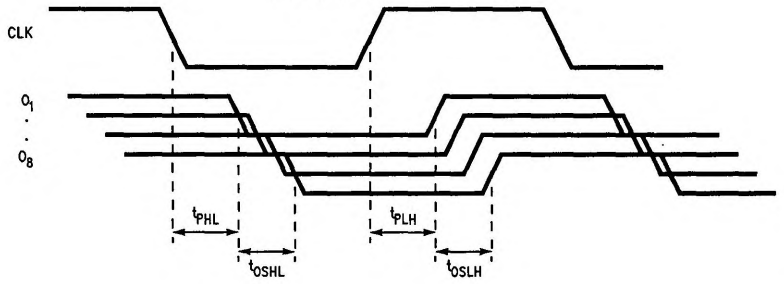
Time high is measured with outputs at above 2V.

Time low is measured with outputs at below 0.8V.

Extended Electrical Characteristics: (66.67 MHz) (Continued)

1 to 8 Min-Skew Clock Driver



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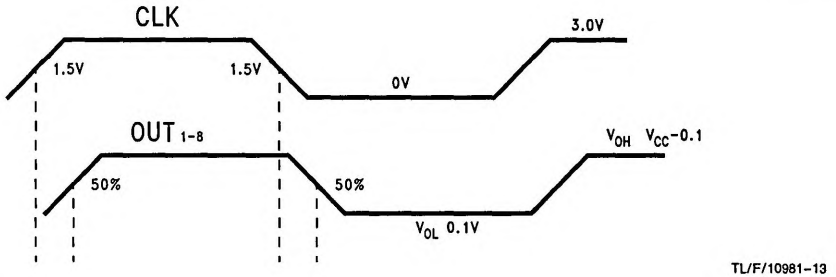

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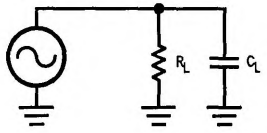
Test Circuit



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R_L is 500Ω

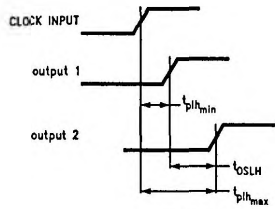
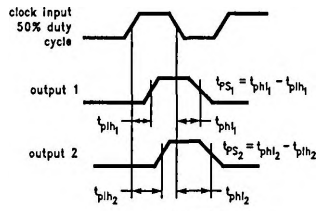
C_L is 50 pF for all prop delays and skew measurements.

Notes:

1. Refer to Minimum Skew Parameters Measurement Information Chart for definitions of each skew specification.
2. Load capacitance includes the test jig.

Minimum Skew Parameters

Parameter Measurement Information (Preliminary)

Definition	Example	Significance
t_{OSHL}, t_{OSLH} **Common Edge Skew:** Output Skew for HIGH-to-LOW Transitions: $t_{OSHL} = \lvert t_{PHL_{max}} - t_{PHL_{min}} \rvert$ Output Skew for LOW-to-HIGH Transitions: $t_{OSLH} = \lvert t_{PLH_{max}} - t_{PLH_{min}} \rvert$ Propagation delays are measured across the outputs of any given device.	 **FIGURE A**	• t_{OS}, Output Skew or Common Edge Skew • Skew parameter to observe propagation delay differences in applications requiring synchronous data/ clock operations.
t_{PS} **Pin Skew or Transition Skew:** $t_{PS} = \lvert t_{PHL_i} - t_{PLH_i} \rvert$ Both HIGH-to-LOW and LOW-to-HIGH propagation delays are measured at each output pin across the given device. T_{PS} is the maximum difference for outputs i = 1 to 8 within a device package.	 **FIGURE B**	• t_{PS}, Pin Skew or Transition Skew • Skew parameter to observe duty cycle degradation of any output signal (pin).