National Semiconductor

PRELIMINARY

CGS74LCT2524
1 to 4 Minimum Skew (450 ps) 3V Clock Driver

General Description

This minimum skew clock driver is a 3V option of the current '2524 Minimum Skew Clock Driver and is designed for Clock Generation and Support (CGS) applications operating at low voltage, high frequencies. This device guarantees minimum output skew across the outputs of a given device.

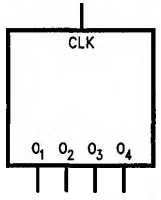
Skew parameters are also provided as a means to measure duty cycle requirements as those found in high speed clocking systems. The '2524 is a minimum skew clock driver with one input driving four outputs, specifically designed for signal generation and clock distribution applications.

Features

- Ideal for low power/low noise high speed applications
- Guaranteed and tested:
  — 450 ps pin-to-pin skew (T_{OSHL} and T_{OHLH}) M package
- Implemented on National's FACT™ family process
- 1 input to 4 outputs low skew clock distribution
- Symmetric output current drive
  — 24 mA I_{OH}/I_{OL}
- Industrial temperature of −40°C to +85°C
- 8-pin DIP and SOIC packages
- Low dynamic power consumption above 20 MHz
- Guaranteed 2 kV ESD protection

Logic Symbol

'2524



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

Pin Description

Pin Names	Description
CLK	Clock Input
O1–O4	Outputs

Truth Table

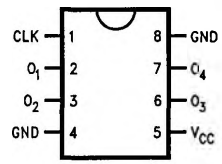
'2524

Inputs CLK	Outputs O1–O4
L	L
H	H

L = Low Logic Level
H = High Logic Level

Connection Diagrams

Pin Assignment for M and N
'2524



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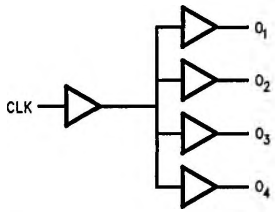

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See NS Package Number M08A and N08E

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 Voltage Diode Current (I_{IK})		
$V = -0.5V$		−20 mA
$V = V_{CC} + 0.5V$		+20 mA
DC Input Voltage (V_I)		−0.5V to V_{CC} +0.5V
DC Output Diode Current (I_O)		
$V = -0.5V$		−20 mA
$V = V_{CC} + 0.5V$		+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 (θ_J)		
M Package	0 LFM	167°C/W
	225 LFM	132°C/W
	500 LFM	117°C/W
N Package	0 LFM	115°C/W
	225 LFM	79°C/W
	500 LFM	62°C/W

Note: *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 DC and AC Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The Recommended Operating Conditions will define the conditions for actual device operation.*

Recommended Operating Conditions

Supply Voltage (V_{CC})	3.0V to 3.6V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	
Industrial	−40°C to +85°C
Commercial	0°C to +70°C
Minimum Input Edge Rate ($\Delta V/\Delta t$)	
V_{IN} from 0.8V to 2.0V	
V_{CC} @ 3.0V	125 mV/ns

DC Electrical Characteristics Over recommended operating free air temperature range

Symbol	Parameter	Conditions	V_{CC} (V)	CGS74CT2524			Units
				$T_A = +25°C$	$T_A = -40°C$ to $+85°C$		
				Typ	Guaranteed Limits		
V_{IH}	Minimum High Level Input Voltage	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	3.3	1.5	2.0	2.0	V
V_{IL}	Maximum Low Level Input Voltage	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	3.3	1.5	0.8	0.8	V
V_{OH}	Minimum High Level Output Voltage	$V_{IN} = V_{IL}$ or V_{IH}, $I_{OUT} = -50\ \mu A$	3.3	2.99	2.9	2.9	V
		$V_{IN} = V_{IL}$ or V_{IH}, $I_{OH} = -24$ mA	3.3		2.56	2.46	V
V_{OL}	Minimum Low Level Output Voltage	$V_{IN} = V_{IL}$ or V_{IH}, $I_{OUT} = 50\ \mu A$	3.3	0.002	0.1	0.1	V
		$V_{IN} = V_{IL}$ or V_{IH}, $I_{OL} = 24$ mA	3.3		0.36	0.44	V
I_{IN}	Maximum Input Leakage Current	$V_I = V_{CC}$, GND	3.6		±0.1	±1.0	μA
I_{CC_T}	Maximum I_{CC}/Input	$V_I = 2.4V$	3.6			1.0	mA
I_{OLD}	Minimum Dynamic Output Current	$V_{OLD} = 0.8V$ (max)	3.6			36	mA
I_{OHD}		$V_{OHD} = 2.0V$ (min)	3.6			−25	mA
I_{CC}	Minimum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	3.6		2.5	25	μA

AC Electrical Characteristics All typical values are measured at V_{CC} = 3.3V, T_A = 25°C

Symbol	Parameter	CT2524 V_{CC} = 3.0V to 3.6V, T_A = −40°C to +85°C, C_L = 50 pF, R_L = 500Ω			Units
		Min	Typ	Max	
t_{PLH}	Low-to-High Propagation Delay CK to O_n	3.5		15.0	ns
t_{PHL}	High-to-Low Propagation Delay CK to O	3.5		15.0	ns

Extended AC Electrical Characteristics All typical values are measured at V_{CC} = 3.3V, T_A = 25°C

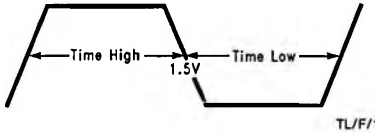
Symbol	Parameter	V_{CC} (V)	CT2524 V_{CC} = 3.0V to 3.6V, T_A = −40°C to +85°C, C_L = 50 pF, R_L = 500Ω			Units
			Min	Typ	Max	
t_{OSHL}	Maximum Skew Common Edge Output-to-Output Variation*					
	M Package	3.3			450	ps
	N Package	3.3			500	ps
t_{OSLH}	Maximum Skew Common Edge Output-to-Output Variation*					
	M Package	3.3			450	ps
	N Package	3.3			500	ps
t_{PS}	Maximum Skew Pin (Signal) Transition Variation**					
	ALL	3.3			1.0	ns
t_{RISE} t_{FALL}	Rise Time/Fall Time (from 0.8V to 2.0V/2.0V to 0.8V)					
	ALL	3.3			1.5	ns
f_{max}	Maximum Operating Frequency					
	ALL	3.3		45		MHz

*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}).

**Pin transition skew is the absolute difference between HIGH-to-LOW and LOW-to-HIGH propagation delay, measured at a given output pin.

Extended Electrical Characteristics (at f_{max})

CGS74LCT2524	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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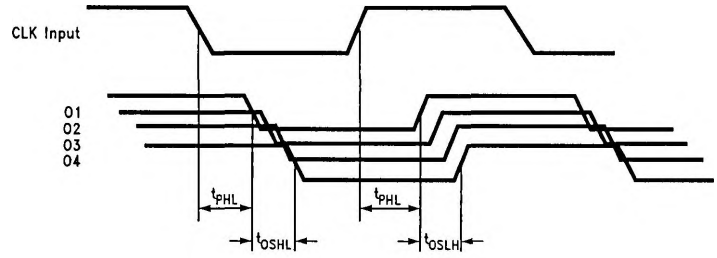
Time high is measured with outputs at above 2V.

Time low is measured with outputs at below 0.8V.

Extended Electrical Characteristics (at f_{max}) (Continued)

1 to 4 Min-Skew Clock Driver



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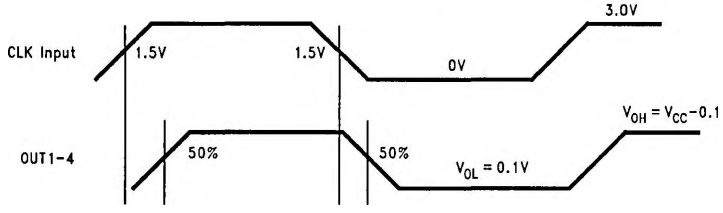

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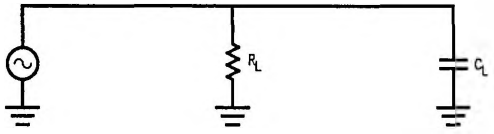
Test Circuit



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R_L is 500Ω

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

Note 1: Refer to Minimum Skew Parameters Measurement Information Chart for definitions of each skew specification.

Note 2: Load capacitance includes the test jig.