LOW SKEW PLL CLOCK DRIVER TURBOCLOCK™ JR.

IDT59920A

FEATURES:

- **Eight zero delay outputs**
- **Selectable positive or negative edge synchronization**
- **Synchronous output enable**
- **Output frequency: 15MHz to 100MHz**
- **CMOS outputs**
- **3 skew grades:**
  IDT59920A-2: t_{SKEW0}<250ps
  IDT59920A-5: t_{SKEW0}<500ps
  IDT59920A-7: t_{SKEW0}<750ps
- **3-level inputs for PLL range control**
- **PLL bypass for DC testing**
- **External feedback, internal loop filter**
- **46mA I_{OL} high drive outputs**
- **Low Jitter: <200ps peak-to-peak**
- **Outputs drive 50Ω terminated lines**
- **Pin-compatible with Cypress CY7B9920**
- **Available in SOIC package**

DESCRIPTION:

The IDT59920A is a high fanout phase lock loop clock driver intended for high performance computing and data-communications applications. The IDT59920A has CMOS outputs.

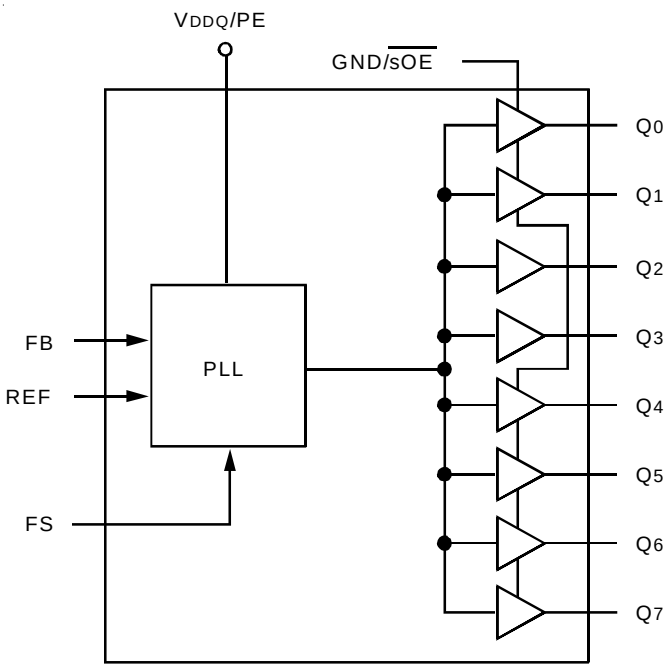
The IDT59920A maintains Cypress CY7B9920 compatibility while providing two additional features: Synchronous Output Enable (GND/$\overline{sOE}$), and Positive/Negative Edge Synchronization (V_{DDQ}/PE). When the GND/$\overline{sOE}$ pin is held low, all outputs are synchronously enabled (CY7B9920 compatibility). However, if GND/$\overline{sOE}$ is held high, all outputs except Q2 and Q3 are synchronously disabled.

Furthermore, when the V_{DDQ}/PE is held high, all outputs are synchronized with the positive edge of the REF clock input (CY7B9920 compatibility). When V_{DDQ}/PE is held low, all outputs are synchronized with the negative edge of REF.

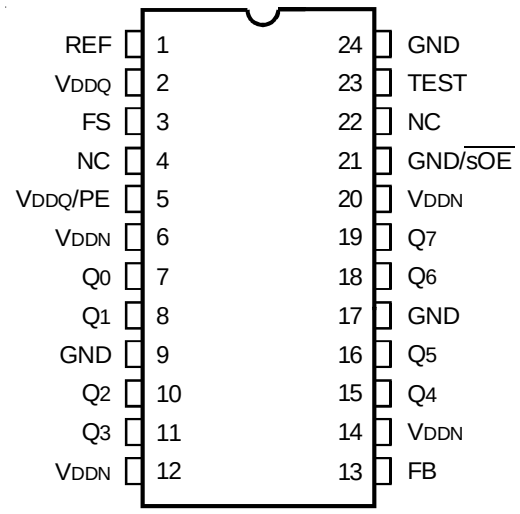
The FB signal is compared with the input REF signal at the phase detector in order to drive the VCO. Phase differences cause the VCO of the PLL to adjust upwards or downwards accordingly.

An internal loop filter moderates the response of the VCO to the phase detector. The loop filter transfer function has been chosen to provide minimal jitter (or frequency variation) while still providing accurate responses to input frequency changes.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



SOIC
TOP VIEW

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Description	Max	Unit
	Supply Voltage to Ground	–0.5 to +7	V
V_I	DC Input Voltage	–0.5 to +7	V
	Maximum Power Dissipation (T_A = 85°C)	530	mW
T_{STG}	Storage Temperature	–65 to +150	°C

NOTE:
1. Stresses beyond those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

CAPACITANCE (T_A = +25°C, f = 1MHz, V_{IN} = 0V)

Parameter	Description	Typ.	Max.	Unit
C_{IN}	Input Capacitance	5	7	pF

NOTE:
1. Capacitance applies to all inputs except TEST and FS. It is characterized but not production tested.

PIN DESCRIPTION

Pin Name	Type	Description
REF	IN	Reference Clock Input
FB	IN	Feedback Input
TEST(1)	IN	When MID or HIGH, disables PLL (except for conditions of Note 1). REF goes to all outputs. Set LOW for normal operation.
GND/ $\overline{sOE}$(1)	IN	Synchronous Output Enable. When HIGH, it stops clock outputs (except Q_2 and Q_3) in a LOW state - Q_2 and Q_3 may be used as the feedback signal to maintain phase lock. Set GND/$\overline{sOE}$ LOW for normal operation.
V_{DDQ}/PE	IN	Selectable positive or negative edge control. When LOW/HIGH the outputs are synchronized with the negative/positive edge of the reference clock.
FS(2)	IN	Frequency range select. 3 level input. FS = GND: 15 to 35MHz FS = MID (or open): 25 to 60MHz FS = V_{DD}: 40 to 100MHz
Q_0 - Q_7	OUT	Eight clock output
V_{DDN}	PWR	Power supply for output buffers
V_{DDQ}	PWR	Power supply for phase locked loop and other internal circuitry
GND	PWR	Ground

NOTES:
1. When TEST = MID and GND/$\overline{sOE}$ = HIGH, PLL remains active.
2. This input is wired to V_{DD}, GND, or unconnected. Default is MID level. If it is switched in the real time mode, the outputs may glitch, and the PLL may require an additional lock time before all data sheet limits are achieved.

RECOMMENDED OPERATING RANGE

Symbol	Description	IDT59920A-5, -7 (Industrial)		IDT59920A-2 (Commercial)		Unit
		Min.	Max.	Min.	Max.	
V_{DD}	Power Supply Voltage	4.5	5.5	4.75	5.25	V
T_A	Ambient Operating Temperature	-40	+85	0	+70	°C

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Symbol	Parameter	Conditions		Min.	Max.	Unit
V_{IH}	Input HIGH Voltage	Guaranteed Logic HIGH (REF, FB Inputs Only)		V_{DD}—1.35	—	V
V_{IL}	Input LOW Voltage	Guaranteed Logic LOW (REF, FB Inputs Only)		—	1.35	V
V_{IHH}	Input HIGH Voltage[1]	3-Level Inputs Only		V_{DD}—1	—	V
V_{IMM}	Input MID Voltage[1]	3-Level Inputs Only		V_{DD}/2—0.5	V_{DD}/2+0.5	V
V_{ILL}	Input LOW Voltage[1]	3-Level Inputs Only		—	1	V
I_{IN}	Input Leakage Current (REF, FB Inputs Only)	V_{IN} = V_{DD} or GND V_{DD} = Max.		—	±5	µA
I_3	3-Level Input DC Current (TEST, FS)	V_{IN} = V_{DD}	HIGH Level	—	±200	µA
		V_{IN} = V_{DD}/2	MID Level	—	±50	
		V_{IN} = GND	LOW Level	—	±200	
I_{PU}	Input Pull-Up Current (V_{DDQ}/PE)	V_{DD} = Max., V_{IN} = GND		—	±100	µA
I_{PD}	Input Pull-Down Current (GND/$\overline{sOE}$)	V_{DD} = Max., V_{IN} = V_{DD}		—	±100	µA
V_{OH}	Output HIGH Voltage	V_{DD} = Min., I_{OH} = —16mA		—	—	V
		V_{DD} = Min., I_{OH} = —40mA		V_{DD}—0.75	—	
V_{OL}	Output LOW Voltage	V_{DD} = Min., I_{OL} = 46mA		—	0.45	V
I_{OS}	Output Short Circuit Current[2]	V_{DD} = Max., V_O = GND		—	N/A	mA

NOTES:

1. These inputs are normally wired to V_{DD}, GND, or unconnected. Internal termination resistors bias unconnected inputs to V_{DD}/2. If these inputs are switched, the function and timing of the outputs may be glitched, and the PLL may require an additional t_{LOCK} time before all datasheet limits are achieved.
2. Outputs are not to be shorted.

POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]	Typ.	Max.	Unit
I_{DDQ}	Quiescent Power Supply Current	V_{DD} = Max., TEST = MID, REF = LOW, GND/$\overline{sOE}$ = LOW, All outputs unloaded	10	40	mA
ΔI_{DD}	Power Supply Current per Input HIGH	V_{DD} = Max., V_{IN} = 3.4V	0.4	1.5	mA
I_{DDD}	Dynamic Power Supply Current per Output	V_{DD} = Max., C_L = 0pF	100	160	µA/MHz
I_{TOT}	Total Power Supply Current	V_{DD} = 5V, F_{REF} = 25MHz, C_L = 240pF[1]	53	—	mA
		V_{DD} = 5V, F_{REF} = 33MHz, C_L = 240pF[1]	63	—	
		V_{DD} = 5V, F_{REF} = 66MHz, C_L = 240pF[1]	117	—	

NOTE:

1. For eight outputs, each loaded with 30pF.

INPUT TIMING REQUIREMENTS

Symbol	Description[1]	Min.	Max.	Unit
t_R, t_F	Maximum input rise and fall times, 0.8V to 2V	—	10	ns/V
t_{PWC}	Input clock pulse, HIGH or LOW	3	—	ns
D_H	Input duty cycle	10	90	%
R_{EF}	Reference Clock Input	15	100	MHz

NOTE:

1. Where pulse width implied by D_H is less than t_{PWC} limit, t_{PWC} limit applies.

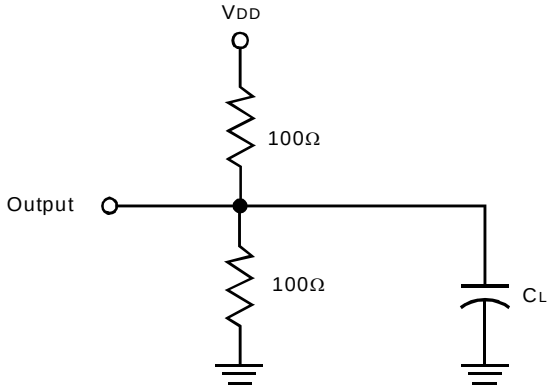
SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Symbol	Parameter		IDT59920A-2			IDT59920A-5			IDT59920A-7			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
F_{REF}	REF Frequency Range	FS = LOW	15	—	35	15	—	35	15	—	35	MHz
		FS = MED	25	—	60	25	—	60	25	—	60	
		FS = HIGH	40	—	100	40	—	100	40	—	100	
t_{RPWH}	REF Pulse Width HIGH[1,8]		3	—	—	3	—	—	3	—	—	ns
t_{RPWL}	REF Pulse Width LOW[1,8]		3	—	—	3	—	—	3	—	—	ns
t_{SKEW0}	Zero Output Skew (All Outputs)[1,3,4]		—	0.1	0.25	—	0.25	0.5	—	0.3	0.75	ns
t_{DEV}	Device-to-Device Skew[1,2,5]		—	—	0.75	—	—	1.25	—	—	1.65	ns
t_{PD}	REF Input to FB Propagation Delay[1,7]		−0.25	0	0.25	−0.5	0	0.5	−0.7	0	0.7	ns
t_{ODCV}	Output Duty Cycle Variation from 50%[1]		−0.5	0	0.5	−1.2	0	1.2	−1.5	0	1.5	ns
t_{ORISE}	Output Rise Time[1]		0.5	2	2.5	0.5	2	3.5	0.5	3	5	ns
t_{OFALL}	Output Fall Time[1]		0.5	2	2.5	0.5	2	3.5	0.5	3	5	ns
t_{LOCK}	PLL Lock Time[1,6]		—	—	0.5	—	—	0.5	—	—	0.5	ms
t_{JR}	Cycle-to-Cycle Output Jitter[1]	RMS	—	—	25	—	—	25	—	—	25	ps
		Peak-to-Peak	—	—	200	—	—	200	—	—	200	

NOTES:

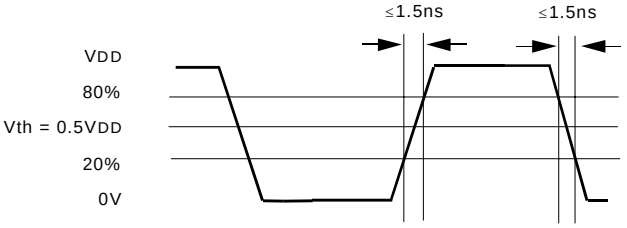
1. All timing and jitter tolerances apply for $F_{NOM} \geq 25$MHz. Guaranteed by design and characterization, not subject to production testing.
2. Skew is the time between the earliest and the latest output transition among all outputs with the specified load.
3. t_{SKEW} is the skew between all outlets. See AC TEST LOADS.
4. For IDT59920A-2 t_{SKEW0} is measured with C_L = 0pF; for C_L = 30pF, t_{SKEW0} = 0.45ns Max.
5. t_{DEV} is the output-to-output skew between any two devices operating under the same conditions (V_{DD}, ambient temperature, air flow, etc.)
6. t_{LOCK} is the time that is required before synchronization is achieved. This specification is valid only after V_{DD} is stable and within normal operating limits. This parameter is measured from the application of a new signal or frequency at REF or FB until t_{PD} is within specified limits.
7. t_{PD} is measured with REF input rise and fall times (from 0.2V_{DD} to 0.8V_{DD}) of 1.5ns.
8. Refer to INPUT TIMING REQUIREMENTS for more detail.

AC TEST LOADS AND WAVEFORMS

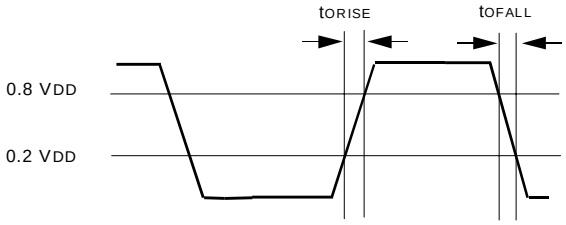


CL = 50pF (CL = 30pF for -2 and -5 devices)

Test Load

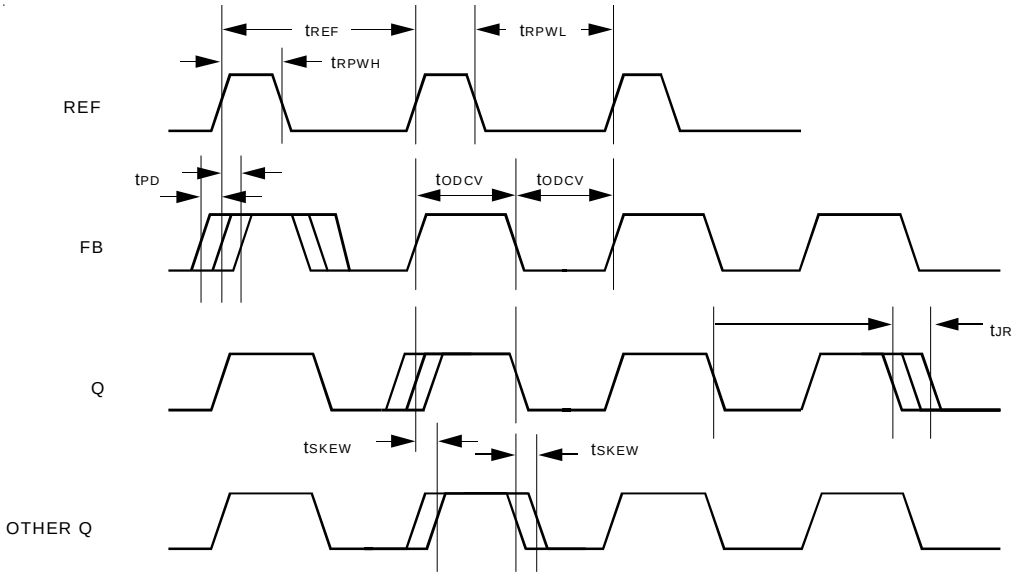


CMOS Input Test Waveform



CMOS Output Waveform

AC TIMING DIAGRAM



NOTES:

Skew: The time between the earliest and the latest output transition among all outputs when all are loaded with 50pF (30pF for -2 and -5) and terminated with VDD/2.

tSKEW: The skew between all outputs.

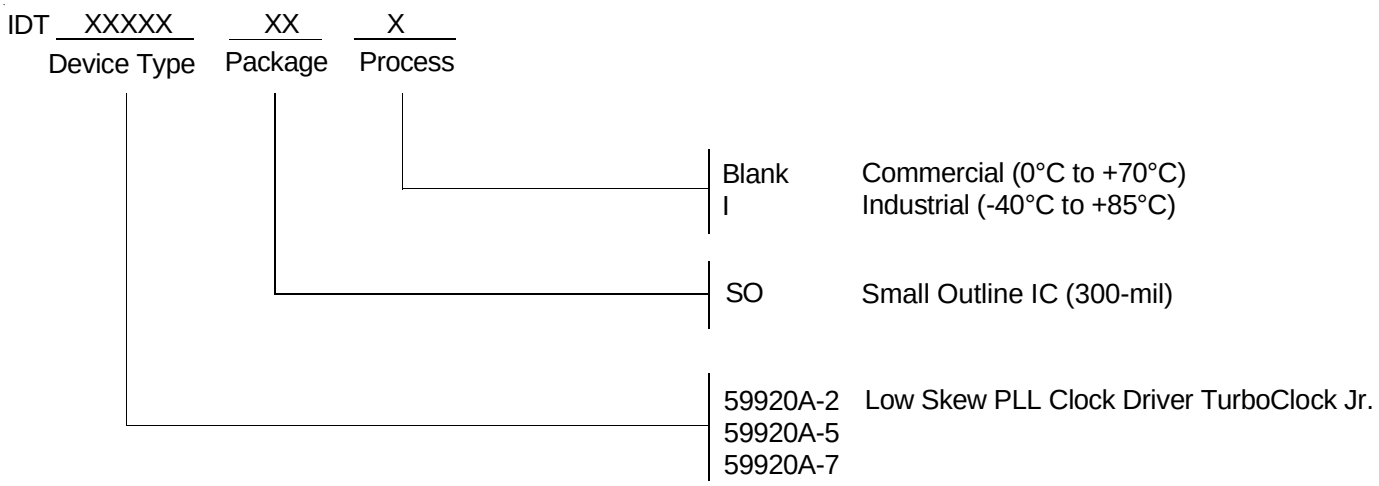
tDEV: The output-to-output skew between any two devices operating under the same conditions (VDD, ambient temperature, air flow, etc.)

tODCV: The deviation of the output from a 50% duty cycle.

tORISE and tOFALL are measured between 0.2VDD and 0.8VDD.

tLOCK: The time that is required before synchronization is achieved. This specification is valid only after VDD is stable and within normal operating limits. This parameter is measured from the application of a new signal or frequency at REF or FB until tPD is within specified limits.

ORDERING INFORMATION



CORPORATE HEADQUARTERS
2975 Stender Way
Santa Clara, CA 95054

for SALES:
800-345-7015 or 408-727-6116
fax: 408-492-8674
www.idt.com

for Tech Support:
logichelp@idt.com
(408) 654-6459