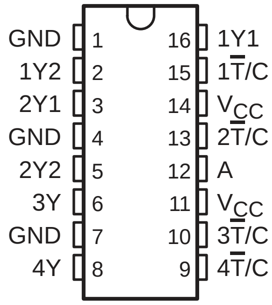
CDC328
1-LINE TO 6-LINE CLOCK DRIVER WITH SELECTABLE POLARITY

SCBS116B – JANUARY 1991 – REVISED MARCH 1994

- **Replaces SN74ABT328**
- **Low Output Skew for Clock-Distribution and Clock-Generation Applications**
- **TTL-Compatible Inputs and Outputs**
- **Distributes One Clock Input to Six Clock Outputs**
- **Polarity Control Selects True or Complementary Outputs**
- **Distributed V_{CC} and GND Pins Reduce Switching Noise**
- **High-Drive Outputs (–15-mA I_{OH}, 64-mA I_{OL})**
- **State-of-the-Art *EPIC*-II*B* ™ BiCMOS Design Significantly Reduces Power Dissipation**
- **Package Options Include Plastic Small-Outline (D) and Shrink Small-Outline (DB) Packages**

D OR DB PACKAGE
(TOP VIEW)



description

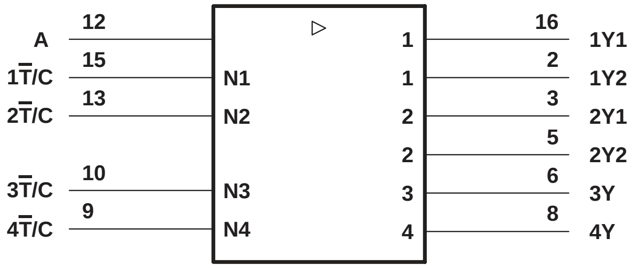
The CDC328 contains a clock-driver circuit that distributes one input signal to six outputs with minimum skew for clock distribution. Through the use of the polarity-control inputs ($\overline{\text{T}}$/C), various combinations of true and complementary outputs can be obtained.

The CDC328 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE

INPUTS		OUTPUT
$\overline{\text{T}}$/C	A	Y
L	L	L
L	H	H
H	L	H
H	H	L

logic symbol†

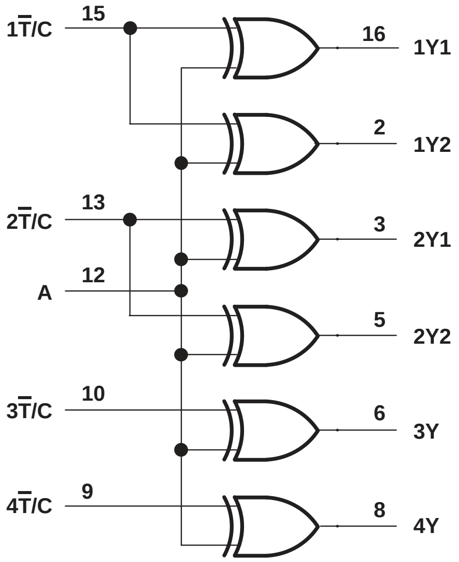


---

† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

EPIC-IIB is a trademark of Texas Instruments Incorporated.

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} . . . . –0.5 V to 7 V
Input voltage range, V_I (see Note 1) . . . . –0.5 V to 7 V
Voltage range applied to any output in the high state
or power-off state, V_O (see Note 1) . . . . –0.5 V to V_{CC} + 0.5 V
Current into any output in the low state, I_O . . . . 128 mA
Input clamp current, I_{IK} ($V_I < 0$) . . . . –18 mA
Output clamp current, I_{OK} ($V_O < 0$) . . . . –50 mA
Continuous total power dissipation at (or below) 25°C free-air temperature (see Note 2) . . . . 1000 mW
Storage temperature range, T_{stg} . . . . –65°C to 150°C

† 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 beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. For operation above 25°C free-air temperature, derate to 478 mW at 85°C at the rate of 8.7 mW/°C.

recommended operating conditions (see Note 3)

		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage	4.75	5	5.25	V
V_{IH}	High-level input voltage	2			V
V_{IL}	Low-level input voltage			0.8	V
V_I	Input voltage	0		V_{CC}	V
I_{OH}	High-level output current			–15	mA
I_{OL}	Low-level output current			64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate			5	ns/V
f_{clock}	Input clock frequency			80	MHz
T_A	Operating free-air temperature	–40		85	°C

NOTE 3: Unused inputs must be held high or low.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS			MIN	TYP†	MAX	UNIT
V_{IK}	V_{CC} = 4.75 V,	I_I = –18 mA				–1.2	V
V_{OH}	V_{CC} = 4.75 V,	I_{OH} = – 15 mA		2.5			V
V_{OL}	V_{CC} = 4.75 V,	I_{OL} = 64 mA				0.55	V
I_I	V_{CC} = 5.25 V,	V_I = V_{CC} or GND				±1	µA
I_O‡	V_{CC} = 5.25 V,	V_O = 2.5 V		–15		–100	mA
I_{CC}	V_{CC} = 5.25 V, V_I = V_{CC} or GND	I_O = 0,	Outputs high			50	µA
			Outputs low		20	30	mA
C_i	V_I = 2.5 V or 0.5 V				3		pF

† All typical values are at V_{CC} = 5 V, T_A = 25°C

‡ Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

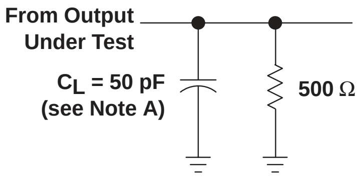
switching characteristics over recommended ranges of supply voltage and operating free-air temperature (see Figures 1 and 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	TYP	MAX	UNIT
t_{PLH}	A	Any Y	1.7		7	ns
t_{PHL}			1.5		5.4	
t_{PLH}	$\overline{T}$/C	Any Y	1.5		8	ns
t_{PHL}			1.4		6.6	
$t_{sk(o)}$	A	Any Y (same phase)			0.7	ns
		Any Y (any phase)			2.6	
t_r				1.2		ns
t_f				0.5		ns

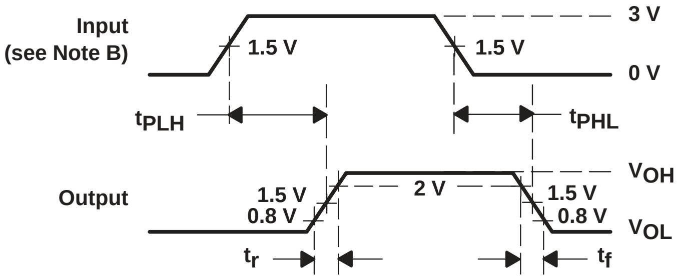
switching characteristics, V_{CC} = 5 V ± 0.25 V, T_A = 25°C to 70°C (see Figures 1 and 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	MAX	UNIT
t_{PLH}	A	Any Y	2.1	6.1	ns
t_{PHL}			1.7	4.8	
$t_{sk(o)}$	A	Any Y (same phase)		0.7	ns
		Any Y (any phase)		2.1	

PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT FOR OUTPUTS

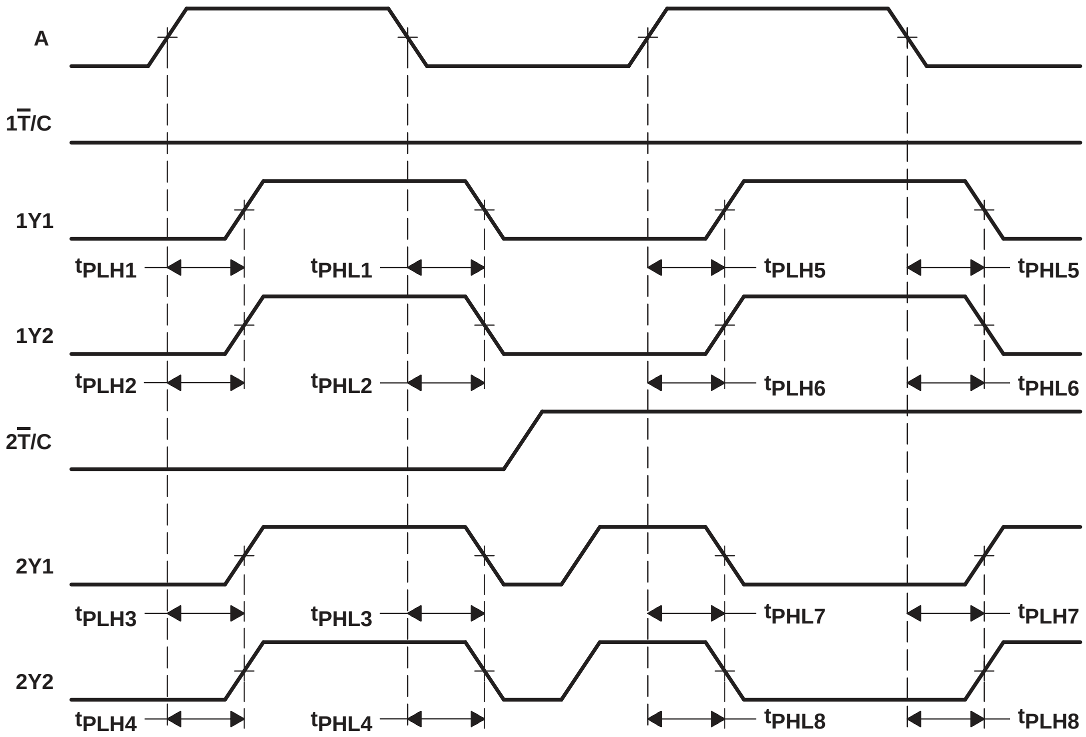


VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

NOTES: A. C_L includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.

Figure 1. Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION



NOTES:

A. Output skew, $t_{sk(o)}$, from A to any Y (same phase), can be measured only between outputs for which the respective polarity-control inputs ($\overline{T}$/C) are at the same logic level. It is calculated as the greater of:
   - The difference between the fastest and slowest of t_{PLH} from A↑ to any Y (e.g., t_{PLHn}, n = 1 to 4; or t_{PLHn}, n = 5 to 6)
   - The difference between the fastest and slowest of t_{PHL} from A↓ to any Y (e.g., t_{PHLn}, n = 1 to 4; or t_{PHLn}, n = 5 to 6)
   - The difference between the fastest and slowest of t_{PLH} from A↓ to any Y (e.g., t_{PLHn}, n = 7 to 8)
   - The difference between the fastest and slowest of t_{PHL} from A↑ to any Y (e.g., t_{PHLn}, n = 7 to 8)

B. Output skew, $t_{sk(o)}$, from A to any Y (any phase), can be measured between outputs for which the respective polarity-control inputs ($\overline{T}$/C) are at the same or different logic levels. It is calculated as the greater of:
   - The difference between the fastest and slowest of t_{PLH} from A↑ to any Y or t_{PHL} from A↑ to any Y (e.g., t_{PLHn}, n = 1 to 4; or t_{PLHn}, n = 5 to 6, and t_{PHLn}, n = 7 to 8)
   - The difference between the fastest and slowest of t_{PHL} from A↓ to any Y or t_{PLH} from A↓ to any Y (e.g., t_{PHLn}, n = 1 to 4; or t_{PHLn}, n = 5 to 6, and t_{PLHn}, n = 7 to 8)

Figure 2. Waveforms for Calculation of $t_{sk(o)}$

PACKAGE OPTION ADDENDUM

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
CDC328D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
CDC328DBLE	OBSOLETE	SSOP	DB	16		TBD	Call TI	Call TI
CDC328DR	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265