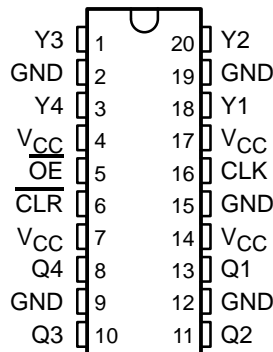


# CDC339 CLOCK DRIVER WITH 3-STATE OUTPUTS

SCAS331 – DECEMBER 1992 – REVISED MARCH 1994

- Low Output Skew, Low Pulse Skew for Clock-Distribution and Clock-Generation Applications
- TTL-Compatible Inputs and Outputs
- Distributes One Clock Input to Eight Outputs
  - Four Same-Frequency Outputs
  - Four Half-Frequency Outputs
- Distributed  $V_{CC}$  and Ground Pins Reduce Switching Noise
- High-Drive Outputs ( $-48\text{-mA } I_{OH}$ ,  $48\text{-mA } I_{OL}$ )
- State-of-the-Art EPIC-II B™ BiCMOS Design Significantly Reduces Power Dissipation
- Package Options Include Plastic Small-Outline (DW) and Shrink Small-Outline (DB) Packages

DB OR DW PACKAGE  
(TOP VIEW)



## description

The CDC339 is a high-performance, low-skew clock driver. It is specifically designed for applications requiring synchronized output signals at both the primary clock frequency and one-half the primary clock frequency. The four Y outputs switch in phase and at the same frequency as the clock (CLK) input. The four Q outputs switch at one-half the frequency of CLK.

When the output-enable ( $\overline{OE}$ ) input is low and the clear ( $\overline{CLR}$ ) input is high, the Y outputs follow CLK and the Q outputs toggle on low-to-high transitions of CLK. Taking  $\overline{CLR}$  low asynchronously resets the Q outputs to the low level. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

The CDC339 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

FUNCTION TABLE

INPUTS			OUTPUTS	
$\overline{OE}$	$\overline{CLR}$	CLK	Y1–Y4	Q1–Q4
H	X	X	Z	Z
L	L	L	L	L
L	L	H	H	L
L	H	L	L	$Q_0^{\dagger}$
L	H	$\uparrow$	H	$\overline{Q}_0^{\dagger}$

$\dagger$  The level of the Q outputs before the indicated steady-state input conditions were established.



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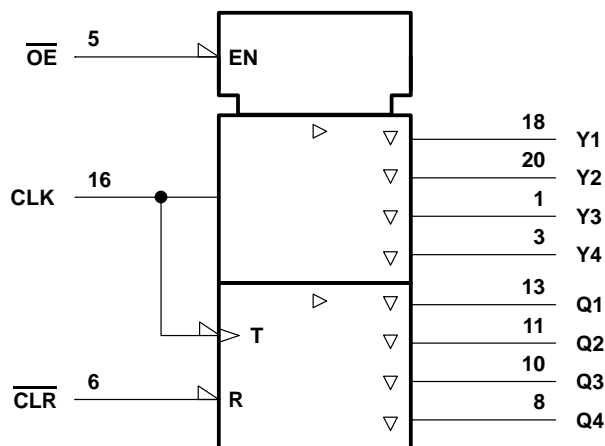
PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

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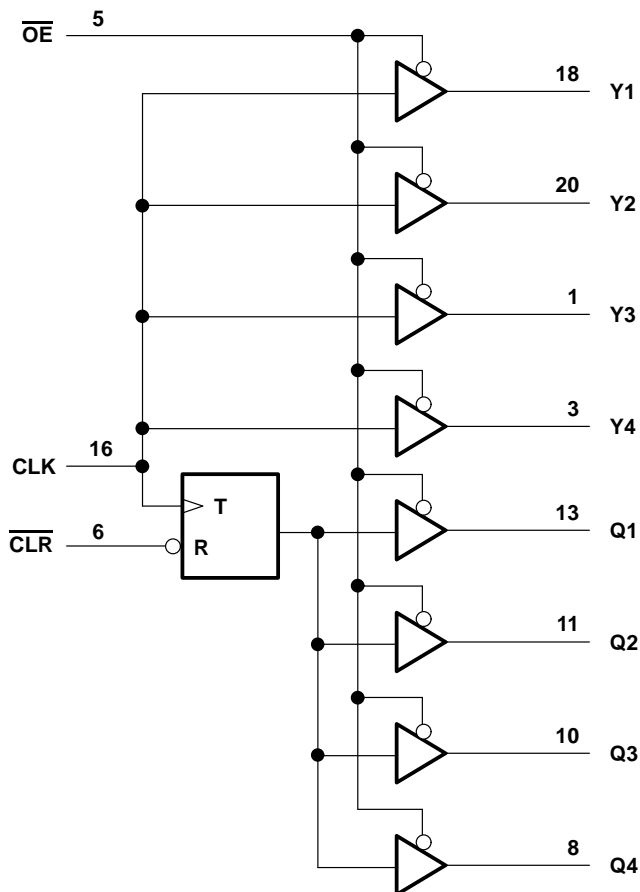
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**logic symbol†**



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

**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 disabled or power-off state, $V_O$	–0.5 V to 5.5 V
Current into any output in the low state, $I_O$	96 mA
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	–18 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ )	–50 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2): DB package	0.6 W
DW package	1.6 W
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. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

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## recommended operating conditions (see Note 3)

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage	4.75	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		-48	mA
$I_{OL}$	Low-level output current		48	mA
$f_{clock}$	Input clock frequency		80	MHz
$T_A$	Operating free-air temperature	-40	85	°C

NOTE 3: Unused pins (input or I/O) 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,	$I_{OH} = -48$ mA	2			V
$V_{OL}$	$V_{CC} = 4.75$ V,	$I_{OL} = 48$ mA			0.5	V
$I_{IH}$	$V_{CC} = 5.25$ V,	$V_I = 2.7$ V			50	μA
$I_{IL}$	$V_{CC} = 5.25$ V,	$V_I = 0.5$ V			-50	μA
$I_{OZ}$	$V_{CC} = 5.25$ V,	$V_O = 2.7$ V or 0.5 V			±50	μA
$I_{O}^{\ddagger}$	$V_{CC} = 5.25$ V,	$V_O = 2.5$ V	-50		-180	mA
$I_{CC}$	$V_{CC} = 5.25$ V, $V_I = V_{CC}$ or GND	$I_O = 0$ , Outputs high			70	mA
		Outputs low			85	
		Outputs disabled			70	
$C_i$	$V_I = 2.5$ V or 0.5 V			3		pF
$C_o$	$V_O = 2.5$ V or 0.5 V			8		pF

† All typical values are at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$ .

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

## timing requirements over recommended ranges of supply voltage and operating free-air temperature

		MIN	MAX	UNIT
$f_{clock}$	Clock frequency		80	MHz
$t_w$	Pulse duration	CLR low	4	ns
		CLK low	4	
		CLK high	4	
$t_{su}$	Setup time	CLR inactive before CLK↑	2	ns
	Clock duty cycle	40%	60%	



# CDC339

## CLOCK DRIVER

### WITH 3-STATE OUTPUTS

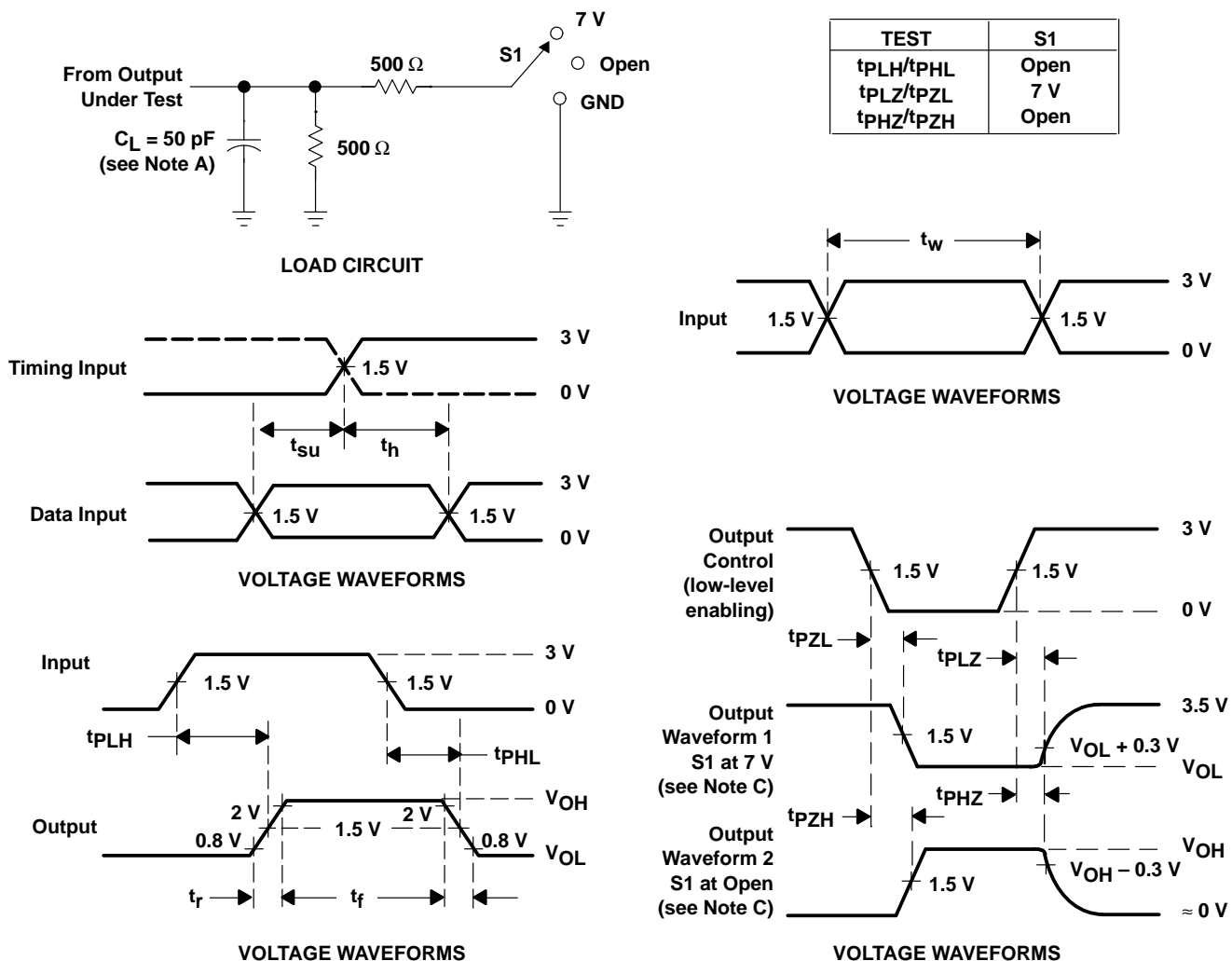
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switching characteristics over recommended ranges of supply voltage and operating free-air temperature (see Figures 1 and 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	TYP†	MAX	UNIT
$f_{\max}$			80			MHz
$t_{PLH}$	CLK	Any Y or Q	3		9	ns
$t_{PHL}$			3		9	
$t_{PHL}$	$\overline{CLR}$	Any Q	4		9	ns
$t_{PZH}$	$\overline{OE}$	Any Y or Q	2		7	ns
$t_{PZL}$			3		7	
$t_{PHZ}$	$\overline{OE}$	Any Y or Q	2		7	ns
$t_{PLZ}$			2		7	
$t_{sk(o)}$	CLK↑	Y↑			0.75	ns
		Q↑			0.9	
		Y↑ and Q↑			0.9	
$t_r$				0.9		ns
$t_f$				0.7		ns

† All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

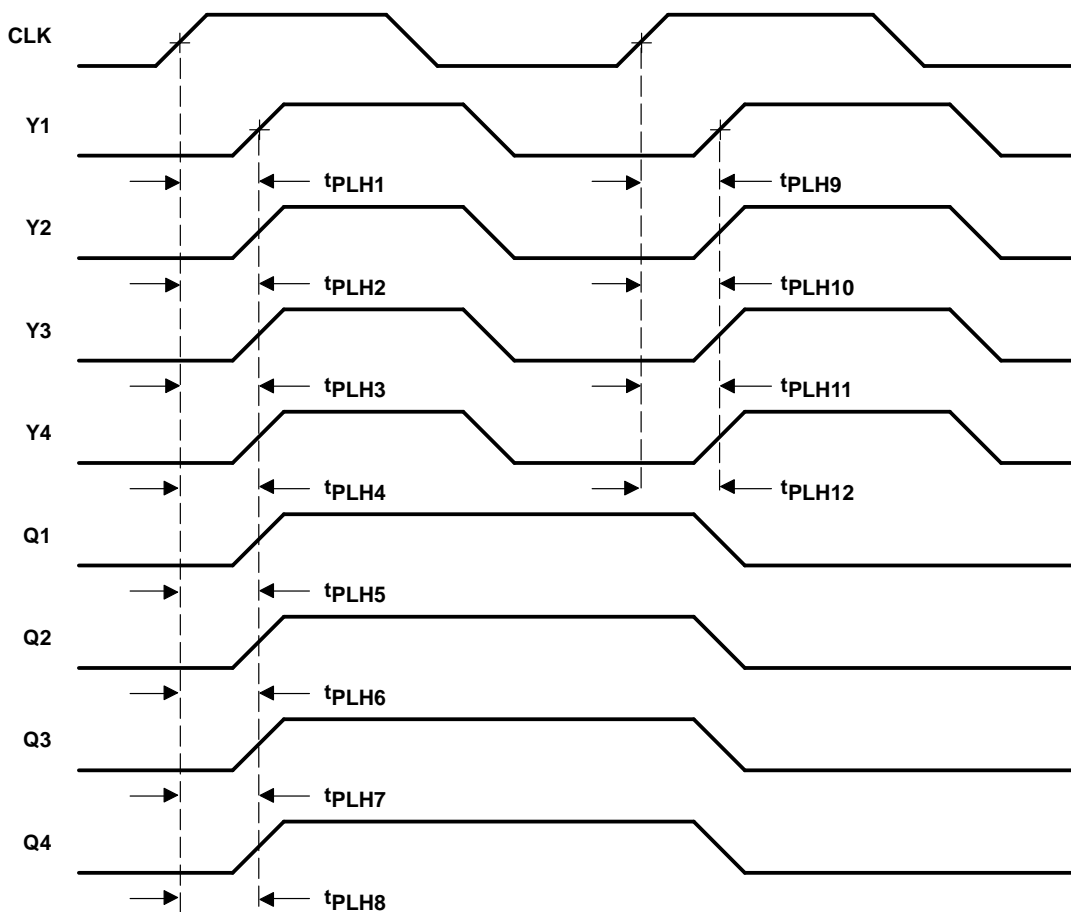
## PARAMETER MEASUREMENT INFORMATION



- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .
  - C. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
  - D. The outputs are measured one at a time with one transition per measurement.

**Figure 1. Load Circuit and Voltage Waveforms**

## PARAMETER MEASUREMENT INFORMATION



- NOTES: A. Output skew,  $t_{sk(o)}$ , from  $CLK\uparrow$  to  $Y\uparrow$ , is calculated as the greater of the difference between the fastest and slowest of  $t_{PLHn}$  ( $n = 1, 2, 3, 4$ ) or  $t_{PLHn}$  ( $n = 9, 10, 11, 12$ ).
- B. Output skew,  $t_{sk(o)}$ , from  $CLK\uparrow$  to  $Q\uparrow$ , is calculated as the greater of the difference between the fastest and slowest of  $t_{PLHn}$  ( $n = 5, 6, 7, 8$ ).
- C. Output skew,  $t_{sk(o)}$ , from  $CLK\uparrow$  to  $Y\uparrow$  and  $Q\uparrow$ , is calculated as the greater of the difference between the fastest and slowest of  $t_{PLHn}$  ( $n = 1, 2, \dots, 8$ ).

**Figure 2. Skew Waveforms and Calculations**

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