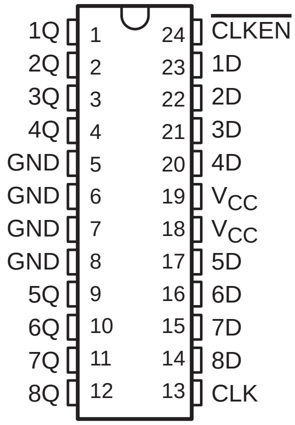
74AC11377
OCTAL D-TYPE FLIP-FLOP WITH CLOCK ENABLE

SCAS101 – D3420, FEBRUARY 1990 – REVISED APRIL 1993

- **Contains Eight D-Type Flip-Flops**
- **Clock Enable Latched to Avoid False Clocking**
- **Applications Include: Buffer/Storage Registers, Shift Registers, Pattern Generators**
- **Flow-Through Architecture Optimizes PCB Layout**
- **Center-Pin V_{CC} and GND Configuration Minimizes High-Speed Switching Noise**
- ***EPIC*™ (Enhanced-Performance Implanted CMOS) 1-μm Process**
- **500-mA Typical Latch-Up Immunity at 125°C**
- **Package Options Include Plastic Small Outline Packages and Standard Plastic 300-mil DIPs**

DW OR NT PACKAGE
(TOP VIEW)



description

These circuits are positive-edge-triggered D-type flip-flops with a clock enable input.

Information at the D inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse if $\overline{\text{CLKEN}}$ is low. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going pulse. When the clock input is at either the high or low level, the D input signal has no effect at the output. The circuits are designed to prevent false clocking by transitions at the $\overline{\text{CLKEN}}$ input.

The 74AC11377 is characterized for operation from – 40°C to 85°C.

FUNCTION TABLE
(each flip-flop)

INPUTS			OUTPUT
$\overline{\text{CLKEN}}$	CLK	D	Q
H	X	X	Q_0
L	↑	H	H
L	↑	L	L
X	L	X	Q_0

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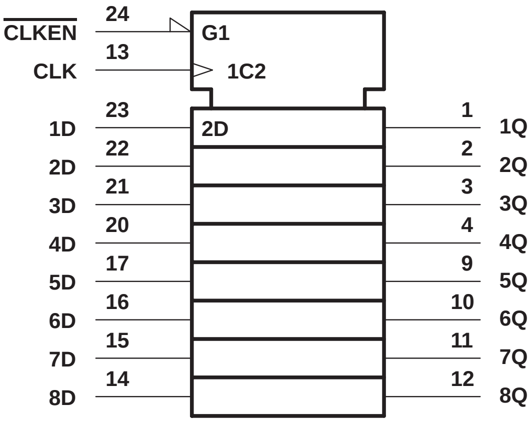
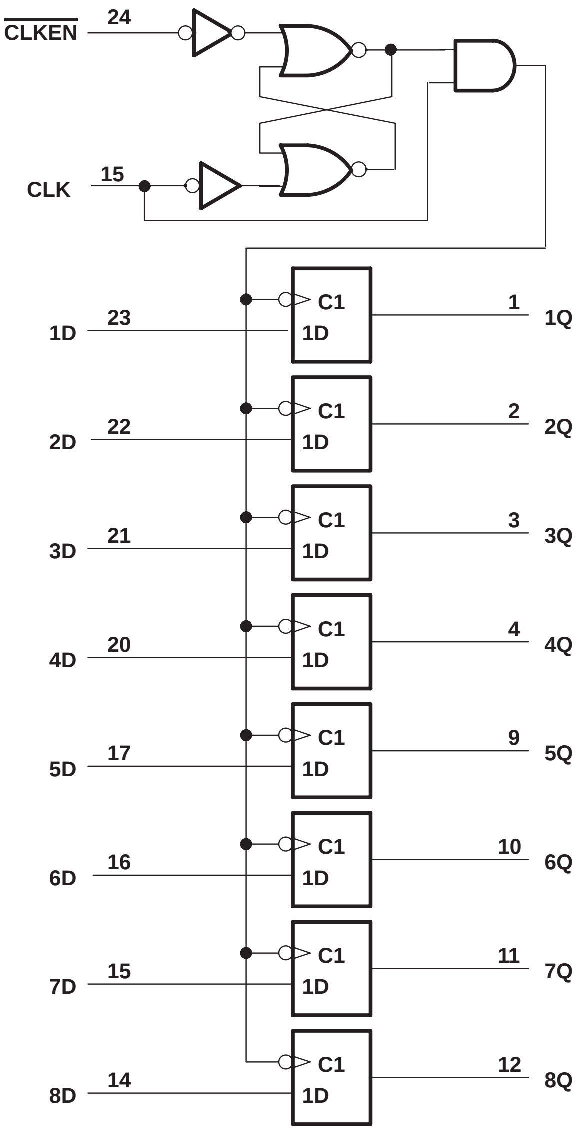
logic symbol†



† 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 V_{CC} + 0.5 V
Output voltage range, V_O (see Note 1) . . . . – 0.5 V to V_{CC} + 0.5 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) . . . . ± 20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) . . . . ± 50 mA
Continuous output current, I_O (V_O = 0 to V_{CC}) . . . . ± 50 mA
Continuous current through V_{CC} or GND . . . . ± 200 mA
Storage temperature range . . . . – 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.

NOTE 1: The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

recommended operating conditions

			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		3	5	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 3 V	2.1			V
		V_{CC} = 4.5 V	3.15			
		V_{CC} = 5.5 V	3.85			
V_{IL}	Low-level input voltage	V_{CC} = 3 V			0.9	V
		V_{CC} = 4.5 V			1.35	
		V_{CC} = 5.5 V			1.65	
V_I	Input voltage		0		V_{CC}	V
V_O	Output voltage		0		V_{CC}	V
I_{OH}	High-level output current	V_{CC} = 3 V			– 4	mA
		V_{CC} = 4.5 V			– 24	
		V_{CC} = 5.5 V			–24	
I_{OL}	Low-level output current	V_{CC} = 3 V			12	mA
		V_{CC} = 4.5 V			24	
		V_{CC} = 5.5 V			24	
$\Delta t/\Delta v$	Input transition rise or fall rate		0		10	ns/V
T_A	Operating free-air temperature		– 40		85	°C

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

PARAMETER	TEST CONDITIONS	V_{CC}	T_A = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
V_{OH}	I_{OH} = – 50 μA	3 V	2.9			2.9		V
		4.5 V	4.4			4.4		
		5.5 V	5.4			5.4		
	I_{OH} = – 4 mA	3 V	2.58			2.48		
	I_{OH} = – 24 mA	4.5 V	3.94			3.8		
		5.5 V	4.94			4.8		
	I_{OH} = – 75 mA†	5.5 V				3.85		
V_{OL}	I_{OL} = 50 μA	3 V			0.1		0.1	V
		4.5 V			0.1		0.1	
		5.5 V			0.1		0.1	
	I_{OL} = 12 mA	3 V			0.36		0.44	
	I_{OL} = 24 mA	4.5 V			0.36		0.44	
		5.5 V			0.36		0.44	
	I_{OL} = 75 mA†	5.5 V					1.65	
I_I	$V_I = V_{CC}$ or GND	5.5 V			± 0.1		± 1	μA
I_{CC}	$V_I = V_{CC}$ or GND, $I_O = 0$	5.5 V			8		80	μA
C_i	$V_I = V_{CC}$ or GND	5 V		4				pF

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

timing requirements over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

			T_A = 25°C				UNIT
			MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		0	60	0	60	MHz
t_w	Pulse duration	CLK high	5		5		ns
		CLK low	5		5		
t_{su}	Setup time before CLK↑	Data high	6		6		ns
		Data low	5		5		
		$\overline{\text{CLKEN}}$ high	9		9		
		$\overline{\text{CLKEN}}$ low	9		9		
t_h	Hold time after CLK↑	$\overline{\text{CLKEN}}$ inactive or active, data	0		0		ns

timing requirements over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

			T_A = 25°C				UNIT
			MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		0	100	0	100	MHz
t_w	Pulse duration	CLK high	5		5		ns
		CLK low	5		5		
t_{su}	Setup time before CLK↑	Data high or low	4		4		ns
		$\overline{\text{CLKEN}}$ high	6		6		
		$\overline{\text{CLKEN}}$ low	6		6		
t_h	Hold time after CLK↑	$\overline{\text{CLKEN}}$ inactive or active, data	0		0		ns

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
f_{max}			60			60		MHz
t_{PLH}	CLK	Any Q	4	9.8	15.7	4	17.9	ns
t_{PHL}			4.9	11.4	18	4.9	19.9	

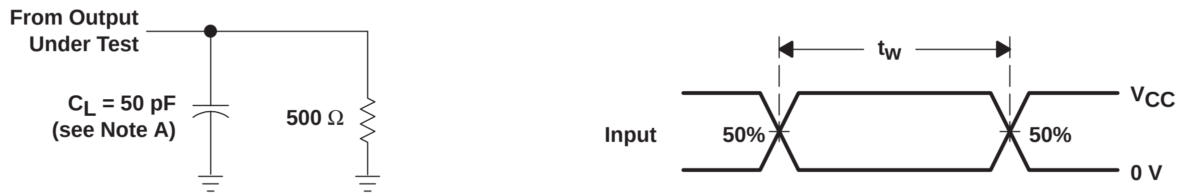
switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
f_{max}			100			100		MHz
t_{PLH}	CLK	Any Q	3.3	6.6	9.9	3.3	11.3	ns
t_{PHL}			4.1	7.8	11.5	4.1	12.9	

operating characteristics, V_{CC} = 5 V, T_A = 25°C

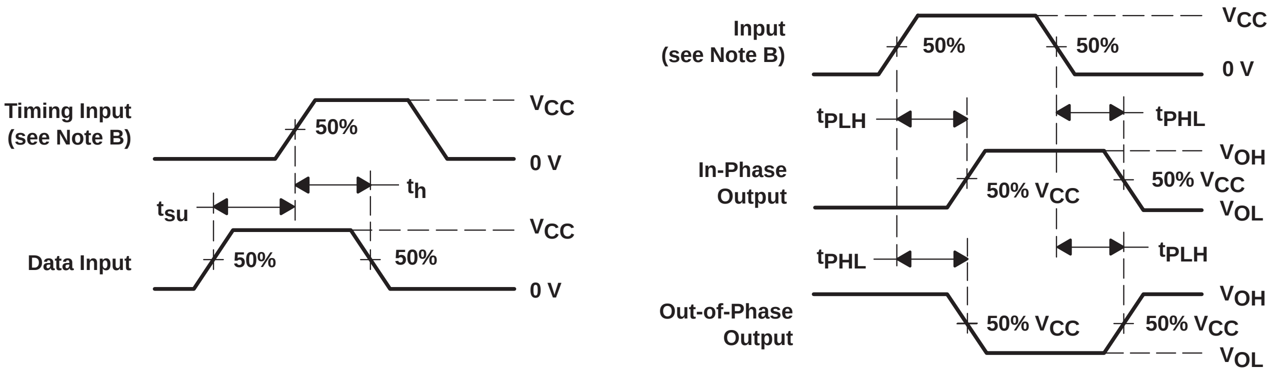
PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance	C_L = 50 pF, f = 1 MHz	72	pF

PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT

VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS

VOLTAGE WAVEFORMS

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 = 3 ns, t_f = 3 ns.

C. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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