

# 74AC11377

## Octal D-type flip-flop with enable

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ACL Products	

### FEATURES

- Eight edge-triggered D-type flip-flops
- Buffered common clock
- Buffered clock enable
- Output capability:  $\pm 24$  mA
- CMOS (AC) and TTL (ACT) voltage level inputs
- $50\Omega$  incident wave switching
- Center-pin  $V_{CC}$  and ground configuration to minimize high-speed switching noise
- I<sub>CC</sub> category: MSI

### DESCRIPTION

The 74AC/ACT11377 high-performance CMOS devices combine very high speed and high output drive comparable to the most advanced TTL families.

The 74AC/ACT11377 provides eight positive edge-triggered D-type flip-flops with individual Data inputs and Q outputs. The common buffered Clock (CP) input loads all flip-flops simultaneously when the Enable ( $\bar{E}$ ) is Low.

The  $\bar{E}$  input must be stable one setup time prior to the Low-to-High clock transition for predictable operation.

### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS $T_{amb} = 25^\circ\text{C}; \text{GND} = 0\text{V};$ $V_{CC} = 5.0\text{V}$	TYPICAL		UNIT
			AC	ACT	
$t_{PLH}/t_{PHL}$	Propagation delay CP to $Q_n$	$C_L = 50\text{pF}$	7.2		ns
$C_{PD}$	Power dissipation capacitance per flip-flop <sup>1</sup>	$f = 1\text{MHz}; C_L = 50\text{pF}$	72		pF
$C_{IN}$	Input capacitance	$V_I = 0\text{V or } V_{CC}$	4.0	4.0	pF
$I_{LATCH}$	Latch-up current	Per Jeduc JC40.2 Standard 17	500	500	mA
$f_{MAX}$	Maximum clock frequency	$C_L = 50\text{pF}$	100		MHz

#### Note:

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ):

$$P_D = C_{PD} \times V_{CC}^2 \times f_I + \sum (C_L \times V_{CC}^2 \times f_O) \text{ where:}$$

$f_I$  = input frequency in MHz,  $C_L$  = output load capacitance in pF,

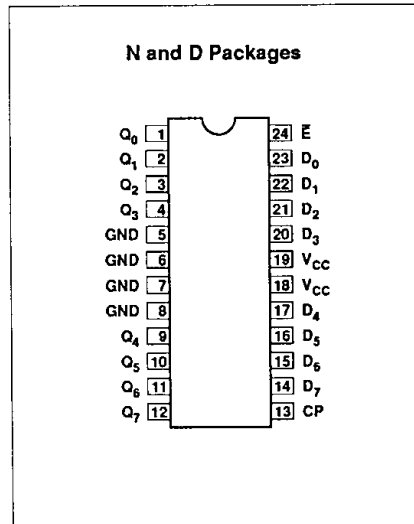
$f_O$  = output frequency in MHz,  $V_{CC}$  = supply voltage in V,

$\sum (C_L \times V_{CC}^2 \times f_O)$  = sum of outputs

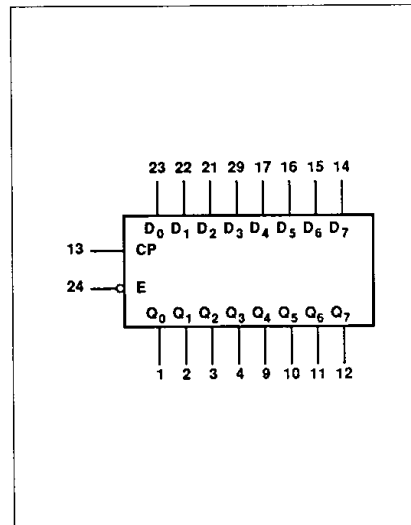
### ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE
24-pin plastic DIP (300mil-wide)	-40°C to +85°C	74AC11377N 74ACT11377N
24-pin plastic SOL (300mil-wide)	-40°C to +85°C	74AC11377D 74ACT11377D

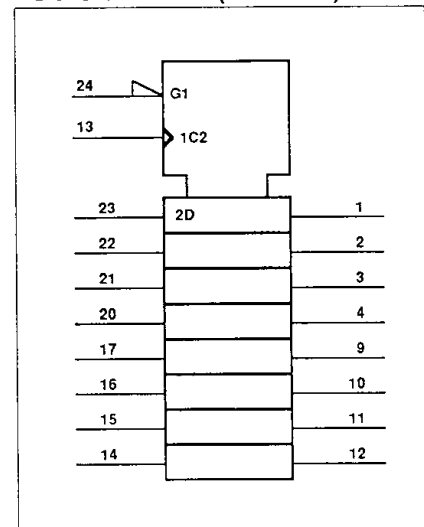
### PIN CONFIGURATION



### LOGIC SYMBOL



### LOGIC SYMBOL (IEEE/IEC)



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### PIN DESCRIPTION

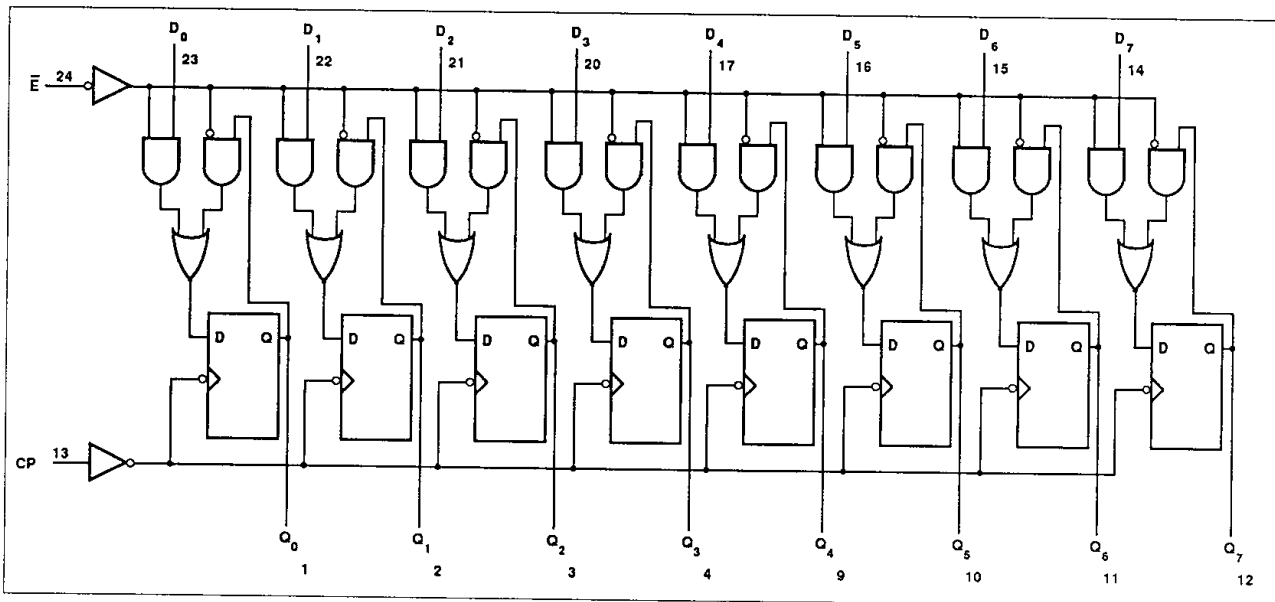
PIN NUMBER	SYMBOL	NAME AND FUNCTION
24	$\bar{E}$	Enable input (active-Low)
13	CP	Clock pulse input
23, 22, 21, 20, 17, 16, 15, 14	$D_0 - D_7$	Data inputs
1, 2, 3, 4, 9, 10, 11, 12	$Q_0 - Q_7$	Data outputs
5, 6, 7, 8	GND	Ground (0V)
18, 19	$V_{CC}$	Positive supply voltage

### MODE SELECT—FUNCTION TABLE

OPERATING MODE	INPUTS			OUTPUTS
	CP	$\bar{E}$	$D_n$	$Q_n$
Load "1"	↑	l	h	H
Load "0"	↑	l	l	L
Hold (do nothing)	↑ X	h H	X X	no change no change

H = High voltage level steady state  
 h = High voltage level one setup time prior to the Low-to-High clock transition  
 L = Low voltage level steady state  
 l = Low voltage level one setup time prior to the Low-to-High clock transition  
 X = Don't care  
 ↑ = Low-to-High clock transition

### LOGIC DIAGRAM



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## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	74AC11377			74ACT11377			UNIT
		Min	Nom	Max	Min	Nom	Max	
$V_{CC}$	DC supply voltage	3.0 <sup>1</sup>	5.0	5.5	4.5	5.0	5.5	V
$V_I$	Input voltage	0		$V_{CC}$	0		$V_{CC}$	V
$V_O$	Output voltage	0		$V_{CC}$	0		$V_{CC}$	V
$\Delta V/\Delta V$	Input transition rise or fall rate	0		10	0		10	ns/V
$T_{amb}$	Operating free-air temperature range	-40		+85	-40		+85	°C

## NOTE:

1. No electrical or switching characteristics are specified at  $V_{CC} < 3V$ . Operation between 2V and 3V is not recommended, but within that range, a device output will maintain a previously established logic state.

ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

SYMBOL	PARAMETER	TEST CONDITIONS	RATING	UNIT
$V_{CC}$	DC supply voltage		-0.5 TO +7.0	V
$I_{IK}$ or $V_I$	DC input diode current <sup>2</sup>	$V_I < 0$	-20	mA
		$V_I > V_{CC}$	20	
	DC input voltage		-0.5 to $V_{CC} + 0.5$	V
$I_{OK}$ or $V_O$	DC output diode current <sup>2</sup>	$V_O < 0$	-50	mA
		$V_O > V_{CC}$	50	
	DC output voltage		-0.5 to $V_{CC} + 0.5$	V
$I_O$	DC output source or sink current per output pin	$V_O = 0$ to $V_{CC}$	$\pm 50$	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ current		$\pm 200$	mA
	DC ground current		$\pm 200$	
$T_{STG}$	Storage temperature		-65 to 150	°C
$P_{TOT}$	Power dissipation per package	Above 70°C; derate linearly by 8mW/K	500	mW
	Power dissipation per package Plastic surface mount (SO)	Above 70°C; derate linearly by 8mW/K	400	mW

## NOTES:

1. Stresses beyond those listed 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.
2. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

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## DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS	V <sub>CC</sub> V	74AC11377				74ACT11377				UNIT	
				T <sub>amb</sub> = +25°C		T <sub>amb</sub> = -40°C to +85°C		T <sub>amb</sub> = +25°C		T <sub>amb</sub> = -40°C to +85°C			
				Min	Max	Min	Max	Min	Max	Min	Max		
V <sub>IH</sub>	High-level input voltage		3.0	2.10		2.10						V	
			4.5	3.15		3.15		2.0		2.0			
			5.5	3.85		3.85		2.0		2.0			
V <sub>IL</sub>	Low-level input voltage		3.0		0.90		0.90					V	
			4.5		1.35		1.35		0.8		0.8		
			5.5		1.65		1.65		0.8		0.8		
V <sub>OH</sub>	High-level output voltage	V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>	i <sub>OH</sub> = -50μA	3.0	2.9		2.9					V	
				4.5	4.4		4.4		4.4		4.4		
			i <sub>OH</sub> = -4mA	3.0	2.58		2.48						
				4.5	3.94		3.8		3.94		3.8		
			i <sub>OH</sub> = -24mA	3.0									
				5.5	4.94		4.8		4.94		4.8		
V <sub>OL</sub>	Low-level output voltage	V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>	i <sub>OL</sub> = 50μA	3.0		0.1		0.1				V	
				4.5		0.1		0.1		0.1			0.1
			i <sub>OL</sub> = 12mA	3.0		0.36		0.44					
				4.5		0.36		0.44		0.36			0.44
			i <sub>OL</sub> = 24mA	3.0									
				5.5		0.36		0.44		0.36			0.44
i <sub>OL</sub> = 75mA <sup>1</sup>	3.0				1.65				1.65				
	5.5												
I <sub>I</sub>	Input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5		±0.1		±1.0		±0.1		±1.0	μA	
I <sub>CC</sub>	Quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0mA	5.5		8.0		80		8.0		80	μA	
ΔI <sub>CC</sub>	Supply current, TTL inputs High <sup>2</sup>	One input at 3.4V, other inputs at V <sub>CC</sub> or GND	5.5						0.9		1.0	mA	

## NOTES:

- Not more than one output should be tested at a time, and the duration of the test should not exceed 10ms.
- This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather than 0V or V<sub>CC</sub>.

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AC ELECTRICAL CHARACTERISTICS AT 3.3V  $\pm 0.3V$ 

SYMBOL	PARAMETER	WAVEFORM	74AC11377					UNIT
			T <sub>amb</sub> = +25°C			T <sub>amb</sub> = -40°C to +85°C		
			Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum clock frequency	1	60			60		ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay CP to Q <sub>n</sub>	1	4.0 4.9	9.8 11.4	15.7 18.0	4.0 4.9	17.9 19.9	ns
t <sub>S</sub>	Setup time, High or Low D <sub>n</sub> to CP	2	6.0			6.0		ns
t <sub>H</sub>	Hold time, High or Low D <sub>n</sub> to CP	2	0.0			0.0		ns
t <sub>S</sub>	Setup time, High or Low $\bar{E}$ to CP	2	9.0			9.0		ns
t <sub>H</sub>	Hold time, High or Low $\bar{E}$ to CP	2	0.0			0.0		ns
t <sub>W</sub>	Clock pulse width High or Low	1	5.0			5.0		ns

AC ELECTRICAL CHARACTERISTICS AT 5.0V  $\pm 0.5V$ 

SYMBOL	PARAMETER	WAVEFORM	74AC11377					UNIT
			T <sub>amb</sub> = +25°C			T <sub>amb</sub> = -40°C to +85°C		
			Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum clock frequency	1	100			100		ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay CP to Q <sub>n</sub>	1	3.3 4.1	6.6 7.8	9.9 11.5	3.3 4.1	11.3 12.9	ns
t <sub>S</sub>	Setup time, High or Low D <sub>n</sub> to CP	2	4.0			4.0		ns
t <sub>H</sub>	Hold time, High or Low D <sub>n</sub> to CP	2	0.0			0.0		ns
t <sub>S</sub>	Setup time, High or Low $\bar{E}$ to CP	2	6.0			6.0		ns
t <sub>H</sub>	Hold time, High or Low $\bar{E}$ to CP	2	0.0			0.0		ns
t <sub>W</sub>	Clock pulse width High or Low	1	5.0			5.0		ns

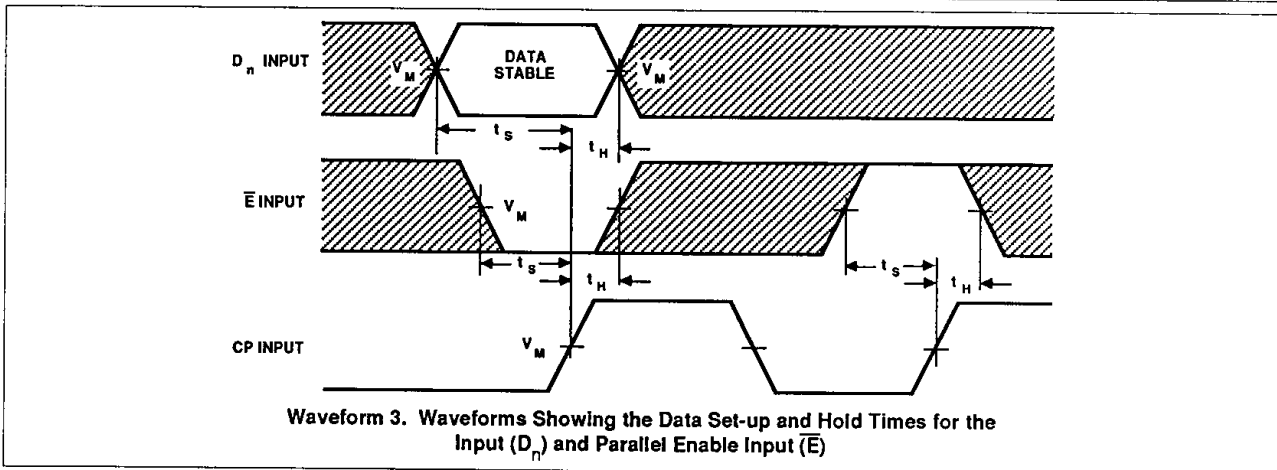
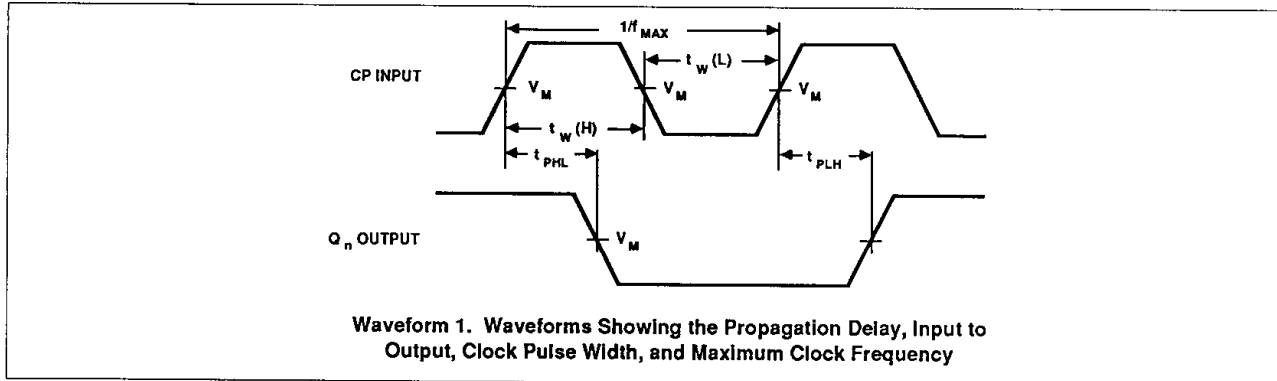
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## AC ELECTRICAL CHARACTERISTICS AT 5.0V ±0.5V

SYMBOL	PARAMETER	WAVEFORM	74ACT11377					UNIT
			T <sub>amb</sub> = +25°C			T <sub>amb</sub> = -40°C to +85°C		
			Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum clock frequency	1	100	125	12.2	100	ns	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay CP to Q <sub>n</sub>	1	4.5 4.8	9.1 9.6	12.2 12.7	4.5 4.8	13.8 14.2	ns
t <sub>s</sub>	Setup time, High or Low D <sub>n</sub> to CP	2	4.0			4.0		ns
t <sub>H</sub>	Hold time, High or Low D <sub>n</sub> to CP	2	1.0			1.0		ns
t <sub>s</sub>	Setup time, High or Low $\bar{E}$ to CP	2	5.0			5.0		ns
t <sub>H</sub>	Hold time, High or Low $\bar{E}$ to CP	2	0.0			0.0		ns
t <sub>w</sub>	Clock pulse width High or Low	1	5.0			5.0		ns

## WAVEFORMS



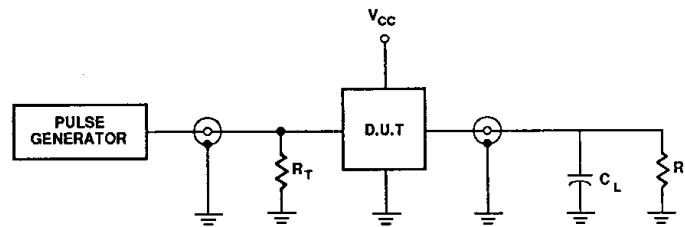
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**WAVEFORM CONDITIONS**

	INPUTS	OUTPUTS
AC	$V_{IN} = \text{GND to } V_{CC}$ $V_M = 50\% V_{CC}$	$V_{OUT} = V_{OL} \text{ to } V_{OH}$  $V_M = 50\% V_{CC}$
ACT	$V_{IN} = \text{GND to } 3.0V$ , $V_M = 1.5V$	

**TEST CIRCUIT**



**Test Circuit**

**DEFINITIONS**

- $C_L$  = Load capacitance, 50pF; includes jig and probe capacitance
- $R_L$  = Load resistor, 500Ω
- $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators
- Input pulses:  $PRR \leq 10\text{MHz}$   
 $t_r = t_f = 3\text{ns}$