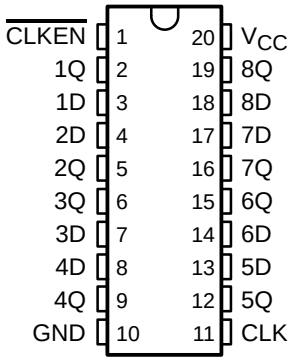
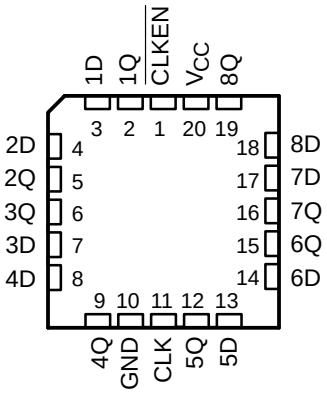
- **Eight Flip-Flops With Single-Rail Outputs**
- **Clock Enable Latched to Avoid False Clocking**
- **Applications Include:**
  - **Buffer/Storage Registers**
  - **Shift Registers**
  - **Pattern Generators**
- **Package Options Include Plastic Small-Outline (DW) and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs**

SN54HC377 . . . J OR W PACKAGE
SN74HC377 . . . DW OR N PACKAGE
(TOP VIEW)



SN54HC377 . . . FK PACKAGE
(TOP VIEW)



description

These devices are positive-edge-triggered octal D-type flip-flops with an enable input. The ’HC377 are similar to the ’HC273 but feature a latched clock-enable ($\overline{\text{CLKEN}}$) input instead of a common clear.

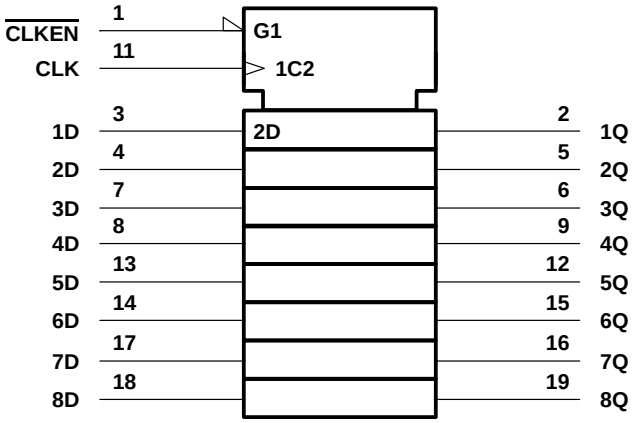
Information at the data (D) inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock (CLK) pulse if $\overline{\text{CLKEN}}$ is low. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the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

The SN54HC377 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74HC377 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE
(each flip-flop)

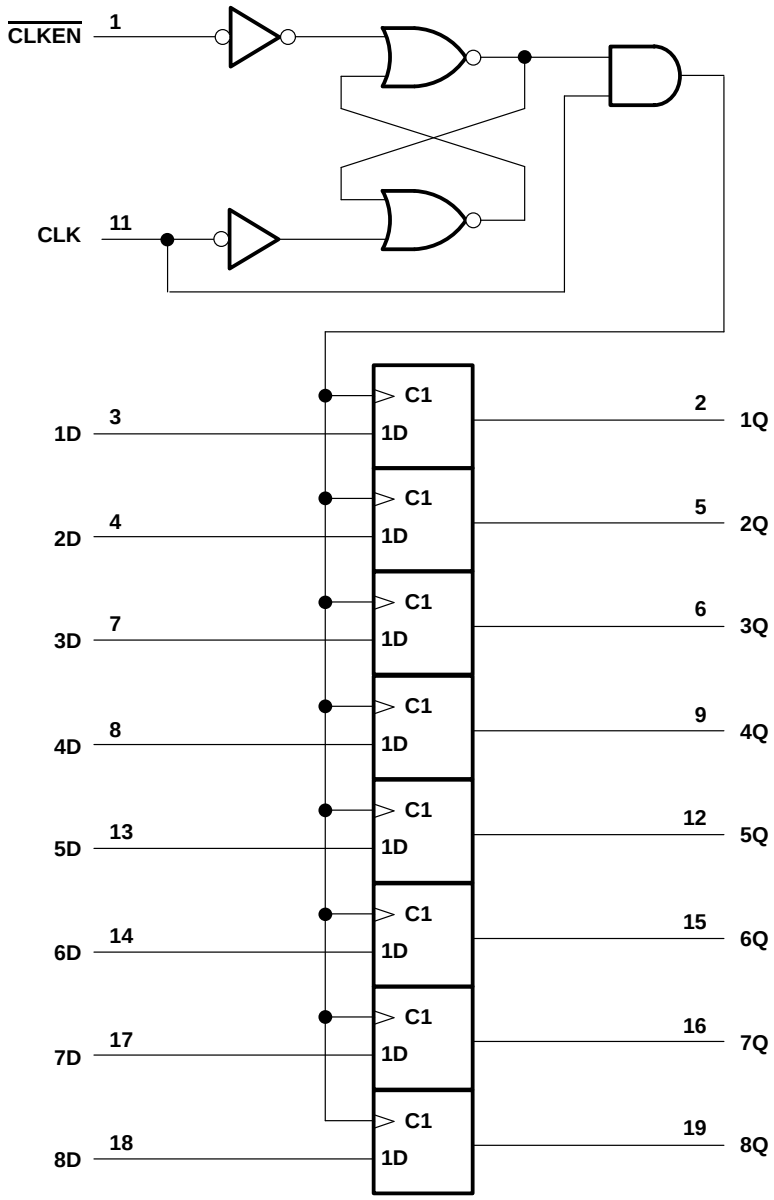
INPUTS			OUTPUT
$\overline{\text{CLKEN}}$	CLK	D	Q
H	X	X	Q_0
L	↑	H	H
L	↑	L	L
X	L	X	Q_0

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†

Supply voltage range, V_{CC} . . . . . –0.5 V to 7 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) (see Note 1) . . . . . ±20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) (see Note 1) . . . . . ±20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC}) . . . . . ±25 mA
Continuous current through V_{CC} or GND . . . . . ±50 mA
Maximum power dissipation at $T_A = 55°C$ (in still air) (see Note 2): DW package . . . . . 1.6 W
N package . . . . . 1.3 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 voltage ratings may be exceeded if the input and output 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, except for the N package, which has a trace length of zero.

recommended operating conditions

			SN54HC377			SN74HC377			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage		2	5	6	2	5	6	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5			1.5			V
		V_{CC} = 4.5 V	3.15			3.15			
		V_{CC} = 6 V	4.2			4.2			
V_{IL}	Low-level input voltage	V_{CC} = 2 V	0		0.5	0		0.5	V
		V_{CC} = 4.5 V	0		1.35	0		1.35	
		V_{CC} = 6 V	0		1.8	0		1.8	
V_I	Input voltage		0		V_{CC}	0		V_{CC}	V
V_O	Output voltage		0		V_{CC}	0		V_{CC}	V
t_t	Input transition (rise and fall) time	V_{CC} = 2 V	0		1000	0		1000	ns
		V_{CC} = 4.5 V	0		500	0		500	
		V_{CC} = 6 V	0		400	0		400	
T_A	Operating free-air temperature		–55		125	–40		85	°C

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

PARAMETER	TEST CONDITIONS		V_{CC}	T_A = 25°C			SN54HC377		SN74HC377		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	$V_I = V_{IH}$ or V_{IL}	I_{OH} = –20 μA	2 V	1.9	1.998		1.9		1.9		V
			4.5 V	4.4	4.499		4.4		4.4		
			6 V	5.9	5.999		5.9		5.9		
		I_{OH} = –4 mA	4.5 V	3.98	4.3		3.7		3.84		
		I_{OH} = –5.2 mA	6 V	5.48	5.8		5.2		5.34		
V_{OL}	$V_I = V_{IH}$ or V_{IL}	I_{OL} = 20 μA	2 V		0.002	0.1		0.1		0.1	V
			4.5 V		0.001	0.1		0.1		0.1	
			6 V		0.001	0.1		0.1		0.1	
		I_{OL} = 4 mA	4.5 V		0.17	0.26		0.4		0.33	
		I_{OL} = 5.2 mA	6 V		0.15	0.26		0.4		0.33	
I_I	$V_I = V_{CC}$ or 0		6 V			±0.1	±100		±1000		±1000	nA
I_{CC}	$V_I = V_{CC}$ or 0, I_O = 0		6 V				8		160		80	μA
C_i			2 V to 6 V		3	10		10		10	pF

timing requirements over recommended operating free-air temperature range (unless otherwise noted)

			V_{CC}	T_A = 25°C		SN54HC377		SN74HC377		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		2 V	0	5	0	3	0	4	MHz
			4.5 V	0	25	0	16	0	20	
			6 V	0	29	0	19	0	23	
t_w	Pulse duration, CLK high or low		2 V	100		150		125		ns
			4.5 V	20		30		25		
			6 V	17		25		21		
t_{su}	Setup time before CLK↑	D	2 V	100		150		125		ns
			4.5 V	20		30		25		
			6 V	17		25		21		
		$\overline{CLKEN}$ high or low	2 V	100		150		125		
			4.5 V	20		30		25		
			6 V	17		25		21		
t_h	Hold time after CLK↑	$\overline{CLKEN}$ inactive or active, data	2 V	5		5		5		ns
			4.5 V	5		5		5		
			6 V	5		5		5		

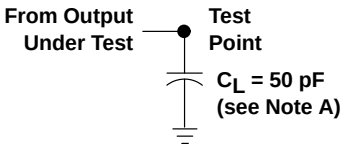
switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	T_A = 25°C			SN54HC377		SN74HC377		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			2 V	5	11		3		4		MHz
			4.5 V	25	54		16		20		
			6 V	29	64		19		23		
t_{pd}	CLK	Any	2 V		56	160		240		200	ns
			4.5 V		15	32		48		40	
			6 V		12	27		41		34	
t_t		Any	2 V		38	75		110		95	ns
			4.5 V		8	15		22		19	
			6 V		6	13		19		16	

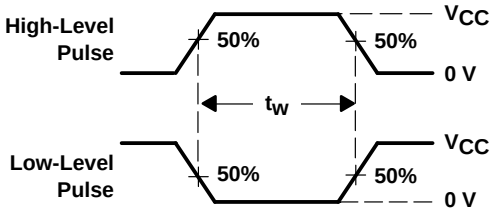
operating characteristics, T_A = 25°C

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance per flip-flop	No load	30	pF

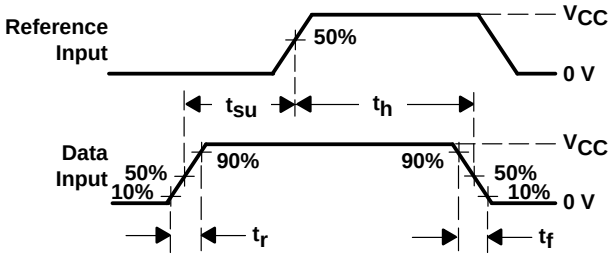
PARAMETER MEASUREMENT INFORMATION



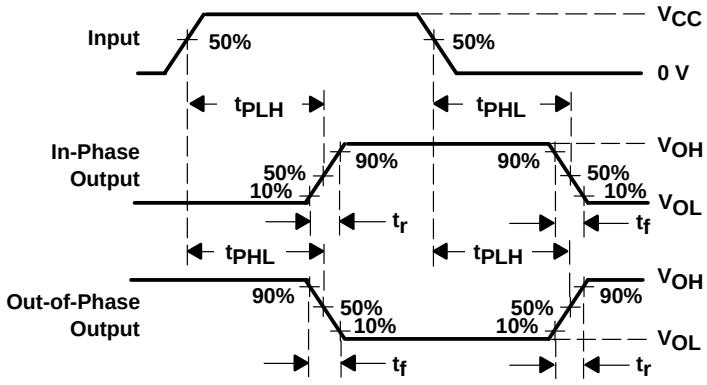
LOAD CIRCUIT



VOLTAGE WAVEFORMS
PULSE DURATIONS



VOLTAGE WAVEFORMS
SETUP AND HOLD AND INPUT RISE AND FALL TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY AND OUTPUT TRANSITION TIMES

NOTES: A. C_L includes probe and test-fixture capacitance.
B. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r = 6 ns, t_f = 6 ns.
C. For clock inputs, f_{max} is measured when the input duty cycle is 50%.
D. The outputs are measured one at a time with one input transition per measurement.
E. t_{PLH} and t_{PHL} are the same as t_{pd}.

Figure 1. Load Circuit and Voltage Waveforms

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