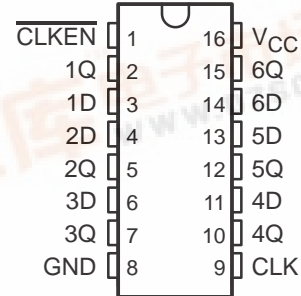


# HEX D-TYPE FLIP-FLOP WITH CLOCK ENABLE

SDFS030B – D2932, MARCH 1987 – REVISED OCTOBER 1993

- Contains Six D-Type Flip-Flops With Single-Rail Outputs
- Applications Include:  
Buffer/Storage Registers  
Shift Registers  
Pattern Generators
- Buffered Common Enable Input
- Package Options Include Plastic Small-Outline Packages and Standard Plastic 300-mil DIPs

D OR N PACKAGE  
(TOP VIEW)



## description

The SN74F378 is a positive-edge-triggered D-type flip-flop with a clock enable ( $\overline{\text{CLKEN}}$ ) input. The SN74F378 is similar to the SN74F174 but features a common clock enable instead of a common clear.

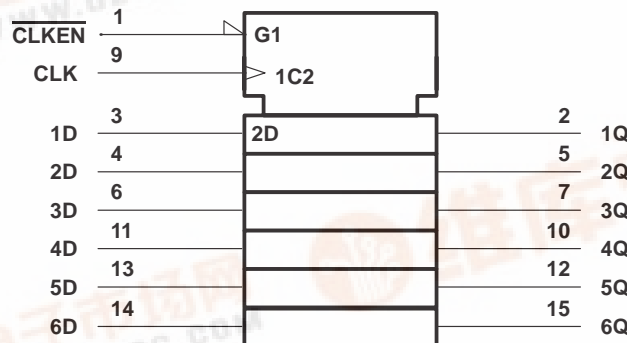
Information at the data (D) inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse if  $\overline{\text{CLKEN}}$  is low. Clock triggering occurs at a particular voltage level and is not directly related to the positive-going pulse. When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

The SN74F378 is characterized for operation from 0°C to 70°C.

FUNCTION TABLE  
(each flip-flop)

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

## logic symbol†

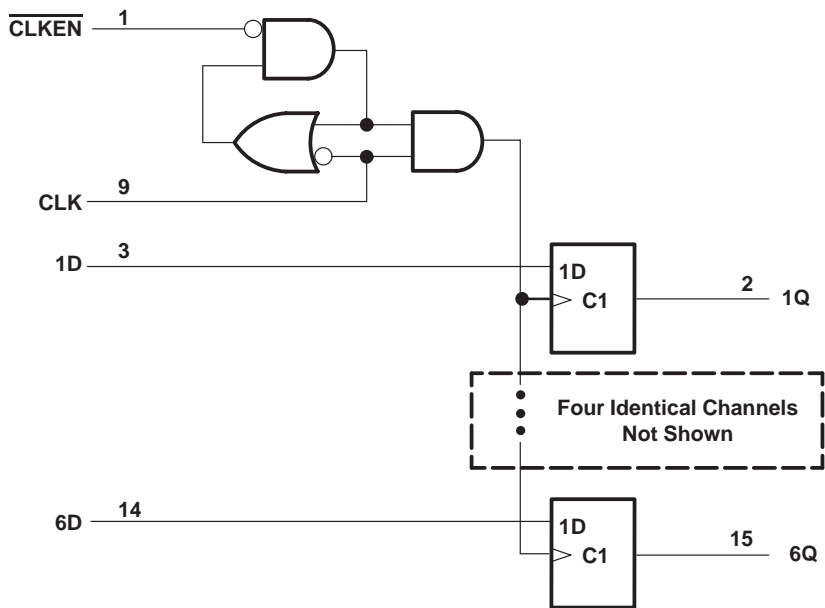


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

SN74F378  
HEX D-TYPE FLIP-FLOP  
WITH CLOCK ENABLE

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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)	–1.2 V to 7 V
Input current range	–30 mA to 5 mA
Voltage range applied to any output in the high state	–0.5 V to $V_{CC}$
Current into any output in the low state	40 mA
Operating free-air temperature range	0°C to 70°C
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-voltage ratings may be exceeded provided the input-current ratings are observed.

recommended operating conditions

		MIN	NOM	MAX	UNIT
$V_{CC}$	Supply voltage	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			V
$V_{IL}$	Low-level input voltage			0.8	V
$I_{IK}$	Input clamp current			–18	mA
$I_{OH}$	High-level output current			–1	mA
$I_{OL}$	Low-level output current			20	mA
$T_A$	Operating free-air temperature	0		70	°C

# SN74F378

## HEX D-TYPE FLIP-FLOP WITH CLOCK ENABLE

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

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$V_{IK}$	$V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$			-1.2	V
$V_{OH}$	$V_{CC} = 4.5\text{ V}$ , $I_{OH} = -1\text{ mA}$	2.5	3.4		V
	$V_{CC} = 4.75\text{ V}$ , $I_{OH} = -1\text{ mA}$	2.7			
$V_{OL}$	$V_{CC} = 4.5\text{ V}$ , $I_{OL} = 20\text{ mA}$		0.3	0.5	V
$I_I$	$V_{CC} = 5.5\text{ V}$ , $V_I = 7\text{ V}$			0.1	mA
$I_{IH}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 2.7\text{ V}$			20	$\mu\text{A}$
$I_{IL}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 0.5\text{ V}$			-0.6	mA
$I_{OS}^\ddagger$	$V_{CC} = 5.5\text{ V}$ , $V_O = 0$	-60		-150	mA
$I_{CC}$	$V_{CC} = 5.5\text{ V}$ , See Note 2		30	45	mA

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

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

NOTE 2:  $I_{CC}$  is measured with all outputs open, all data inputs and the enable input grounded, and the clock input at 4.5 V after being momentarily grounded.

### timing requirements

			$V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$		$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ , $T_A = \text{MIN to MAX}^\S$		UNIT
			MIN	MAX	MIN	MAX	
$f_{\text{clock}}$	Clock frequency		0	110	0	110	MHz
$t_w$	Pulse duration	CLK high	4		4		ns
		CLK low	6		6		
$t_{su}$	Setup time before CLK↑	Data high or low	5		5		ns
		CLKEN high	3.5		3.5		
		CLKEN low	5		5		
$t_h$	Hold time after CLK↑	Data high or low	1		1		ns
		CLKEN high or low	0		0		

### switching characteristics (see Note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5\text{ V}$ , $C_L = 50\text{ pF}$ , $R_L = 500\ \Omega$ , $T_A = 25^\circ\text{C}$			$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ , $C_L = 50\text{ pF}$ , $R_L = 500\ \Omega$ , $T_A = \text{MIN to MAX}^\S$		UNIT
			MIN	TYP	MAX	MIN	MAX	
$f_{\text{max}}$			110	125		110		MHz
$t_{PLH}$	CLK	Any Q	3.3	4.5	6.1	3.1	6.7	ns
$t_{PHL}$			3	4.2	6	2.9	6.1	

§ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

NOTE 3: Load circuits and waveforms are shown in Section 1.



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