

**U74HC377****CMOS IC****OCTAL D-TYPE FLIP-FLOPS
WITH CLOCK ENABLE****■ DESCRIPTION**

The device is positive-edge-triggered octal D-type flip-flops with an enable input.

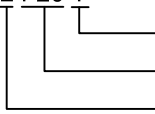
Information at the data (D) inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock (CLK) pulse, if $\overline{EN}$ is low. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going 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 $\overline{EN}$.

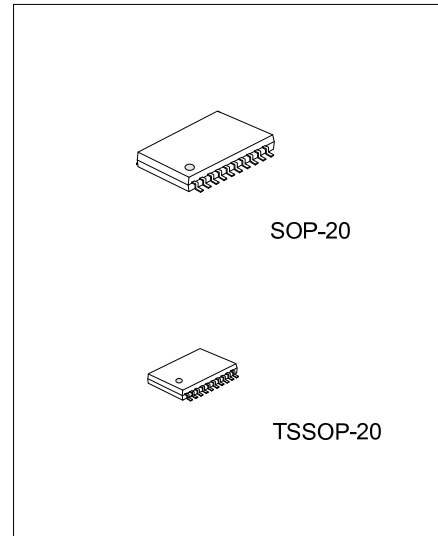
■ FEATURES

- * Wide Operating Voltage Range of 2V to 6V
- * Outputs Can Drive Up To 10 LSTTL Loads
- * Low Power Consumption, $I_{CC}=8\mu A$ (Max.)
- * Typical $t_{PD}=12ns$
- * $\pm 4mA$ Output Drive at 5V
- * Low Input Current of $1\mu A$ Max.
- * Eight Flip-Flops With Single-Rail Outputs
- * Clock Enable Latched to Avoid False Clocking
- * Applications Include
 - Buffer/Storage Registers
 - Shift Registers
 - Pattern Generators

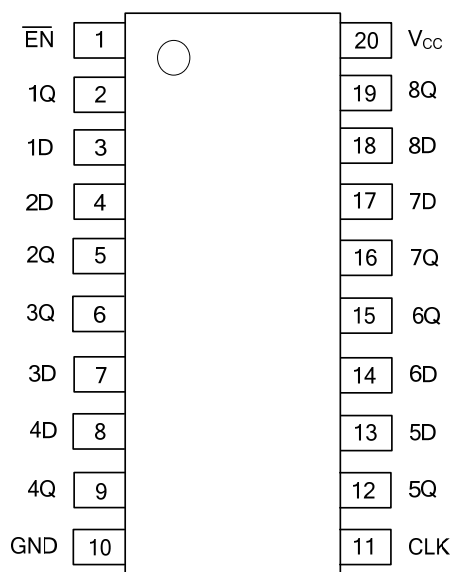
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
U74HC377L-S20-T	U74HC377G-S20-T	SOP-20	Tube
U74HC377L-S20-R	U74HC377G-S20-R	SOP-20	Tape Reel
U74HC377L-P20-T	U74HC377G-P20-T	TSSOP-20	Tube
U74HC377L-P20-R	U74HC377G-P20-R	TSSOP-20	Tape Reel

U74HC377L-P20-T 	(1) Packing Type (2) Package Type (3) Lead Plating	(1) T: Tube, R: Tape Reel (2) P20: TSSOP-20, S20: SOP-20 (3) L: Lead Free, G: Halogen Free
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■ PIN CONFIGURATION



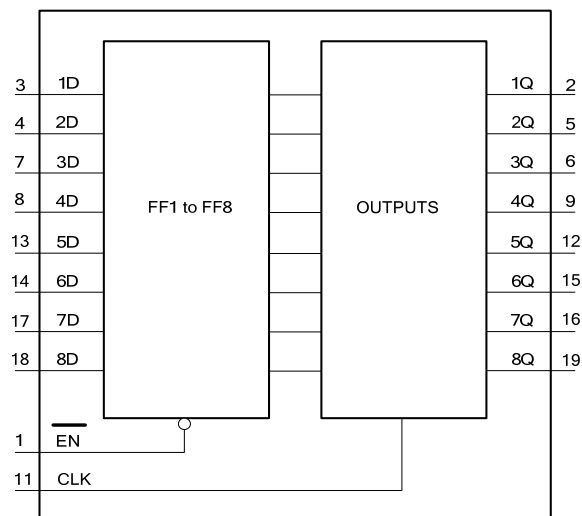
■ PIN DESCRIPTION

SYMBOL	PIN	DESCRIPTION
EN	1	Data Enable Input (Active low)
1Q	2	Flip-flop Output
1D	3	Data Input
2D	4	Data Input
2Q	5	Flip-flop Output
3Q	6	Flip-flop Output
3D	7	Data Input
4D	8	Data Input
4Q	9	Flip-flop Output
GND	10	Ground (0V)
CLK	11	Clock Input (Low-to-High, Edge Triggered)
5Q	12	Flip-flop Output
5D	13	Data Input
6D	14	Data Input
6Q	15	Flip-Flop Output
7D	16	Flip-Flop Output
7Q	17	Data Input
8D	18	Data Input
8Q	19	Flip-Flop Output
V _{CC}	20	Supply Voltage

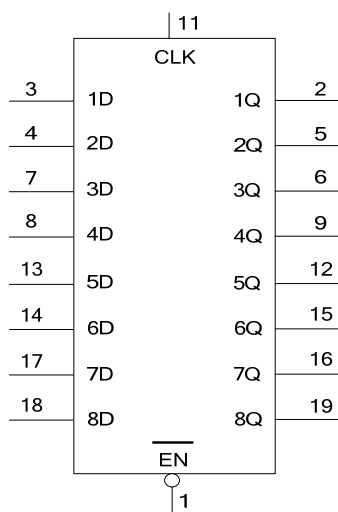
■ FUNCTION TABLE

INPUTS			OUTPUT Q
EN	CLK	D	
H	X	X	Q ₀
L	↑	H	H
L	↑	L	L
X	L	X	Q ₀

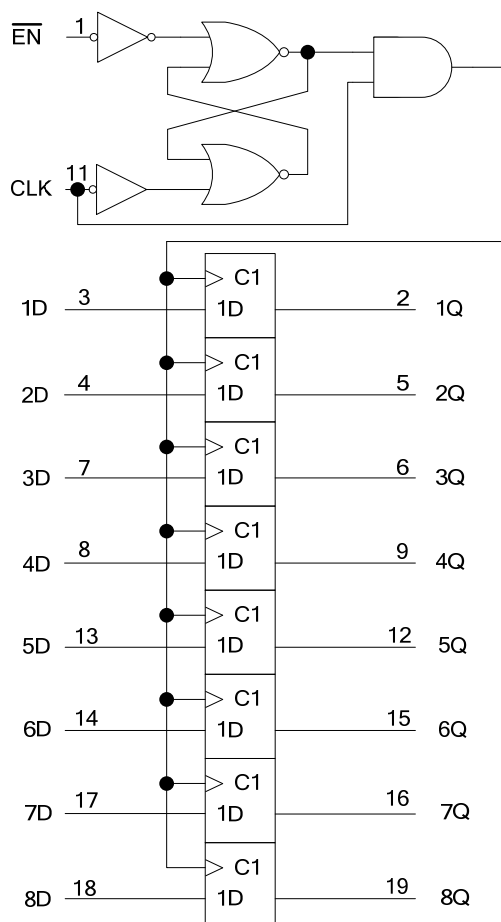
■ FUNCTIONAL DIAGRAM



■ LOGIC SYMBOL



■ **LOGIC DIAGRAM (POSITIVE LOGIC)**



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{CC}	-0.5 ~ 7	V
V_{CC} or GND Current	I_{CC}	±50	mA
Output Current	I_{OUT}	±25	mA
Input Clamp Current	I_{IK}	±20	mA
Output Clamp Current	I_{OK}	±20	mA
Storage Temperature	T_{STG}	-65 ~ + 150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	V_{CC}		2	5	6	V
High-level Input Voltage	V_{IH}	$V_{CC}=2V$	1.5			V
		$V_{CC}=4.5V$	3.15			
		$V_{CC}=6V$	4.2			
Low-level Input Voltage	V_{IL}	$V_{CC}=2V$			0.5	V
		$V_{CC}=4.5V$			1.35	
		$V_{CC}=6V$			1.8	
Input Voltage	V_{IN}		0		V_{CC}	V
Output Voltage	V_{OUT}		0		V_{CC}	V
Input Transition Rise/Fall Time	$\Delta t/\Delta v$	$V_{CC}=2V$			1000	ns
		$V_{CC}=4.5V$			500	
		$V_{CC}=6V$			400	
Operating Free-air Temperature	T_A		-40		+85	°C

Note: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOP-20	θ_{JA}	58	°C/W
	TSSOP-20		83	

■ ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage High-Level	V_{OH}	$V_{CC}=2V, I_{OH}=-20\mu A$	1.9	1.998		V
		$V_{CC}=4.5V, I_{OH}=-20\mu A$	4.4	4.499		
		$V_{CC}=6V, I_{OH}=-20\mu A$	5.9	5.999		
		$V_{CC}=4.5V, I_{OH}=-4mA$	3.98	4.3		
		$V_{CC}=6V, I_{OH}=-5.2mA$	5.48	5.8		
Output Voltage Low-Level	V_{OL}	$V_{CC}=2V, I_{OL}=20\mu A$		0.002	0.1	V
		$V_{CC}=4.5V, I_{OL}=20\mu A$		0.001	0.1	
		$V_{CC}=6V, I_{OL}=20\mu A$		0.001	0.1	
		$V_{CC}=4.5V, I_{OL}=4mA$		0.17	0.26	
		$V_{CC}=6V, I_{OL}=5.2mA$		0.15	0.26	
Input Leakage Current	$I_{I(LEAK)}$	$V_{CC}=6V, V_{IN}=V_{CC}$ or GND		±0.1	±100	nA
Quiescent Supply Current	I_{CC}	$V_{CC}=6V, V_{IN}=V_{CC}$ or GND, $I_{OUT}=0$			8	μA
Input Capacitance	C_I	$V_{CC}=2V$ to 6V		3	10	pF

■ **TIMING REQUIREMENTS** ($T_A = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Clock frequency		f _{CLOCK}	V _{CC} =2.0V			5	MHz
			V _{CC} =4.5V			25	MHz
			V _{CC} =6.0V			29	MHz
Pulse duration	CLK high or low	t _w	V _{CC} =2.0V	100			ns
			V _{CC} =4.5V	20			ns
			V _{CC} =6.0V	17			ns
Setup time before CLK↑	D	t _{su}	V _{CC} =2.0V	100			ns
			V _{CC} =4.5V	20			ns
			V _{CC} =6.0V	17			ns
	$\overline{\text{EN}}$ high or low		V _{CC} =2.0V	100			ns
			V _{CC} =4.5V	20			ns
			V _{CC} =6.0V	17			ns
Hold time after CLK↑	$\overline{\text{EN}}$ inactive or active, data	t _h	V _{CC} =2.0V	5			ns
			V _{CC} =4.5V	5			ns
			V _{CC} =6.0V	5			ns

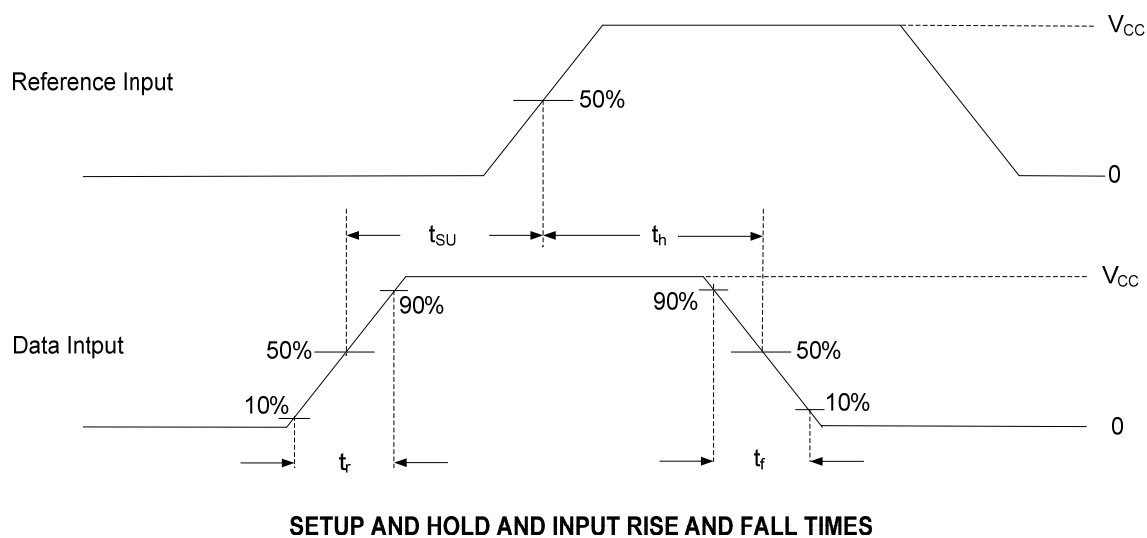
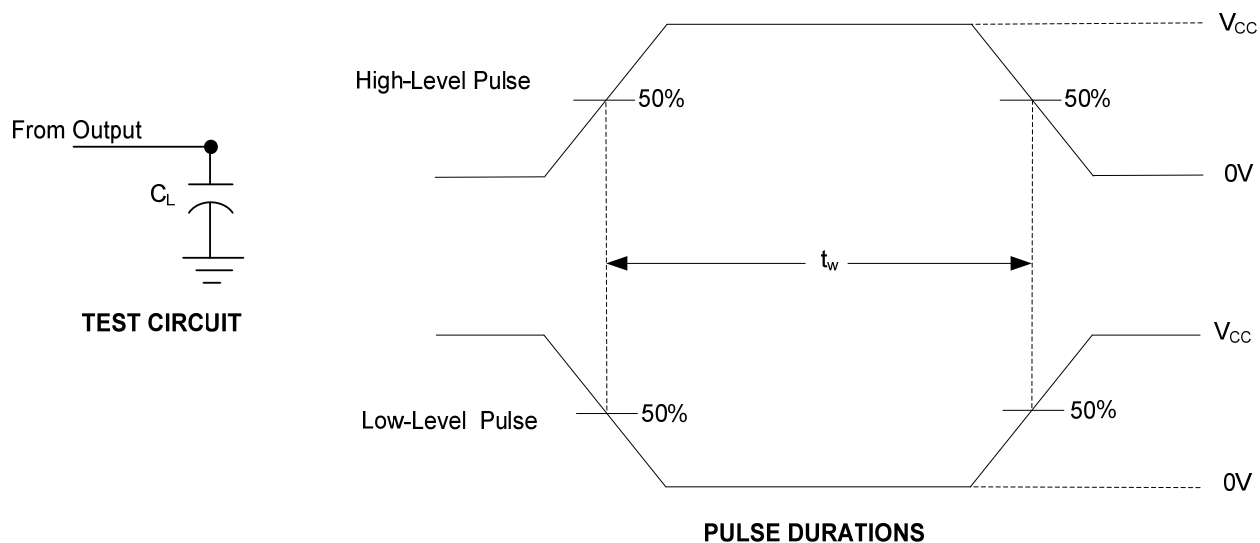
■ **SWITCHING CHARACTERISTICS** ($t_r = t_f = 6\text{ns}$, $C_L = 50\text{pF}$, $T_A = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Minimum Frequency Response	f_{MAX}	$V_{\text{CC}}=2.0\text{V}$	5	11		ns
		$V_{\text{CC}}=4.5\text{V}$	25	54		ns
		$V_{\text{CC}}=6.0\text{V}$	29	64		ns
From CLK to Q	t_{PD}	$V_{\text{CC}}=2.0\text{V}$		56	160	ns
		$V_{\text{CC}}=4.5\text{V}$		15	32	ns
		$V_{\text{CC}}=6.0\text{V}$		12	27	ns
To Any	t_t	$V_{\text{CC}}=2.0\text{V}$		38	75	ns
		$V_{\text{CC}}=4.5\text{V}$		8	15	ns
		$V_{\text{CC}}=6.0\text{V}$		6	13	ns

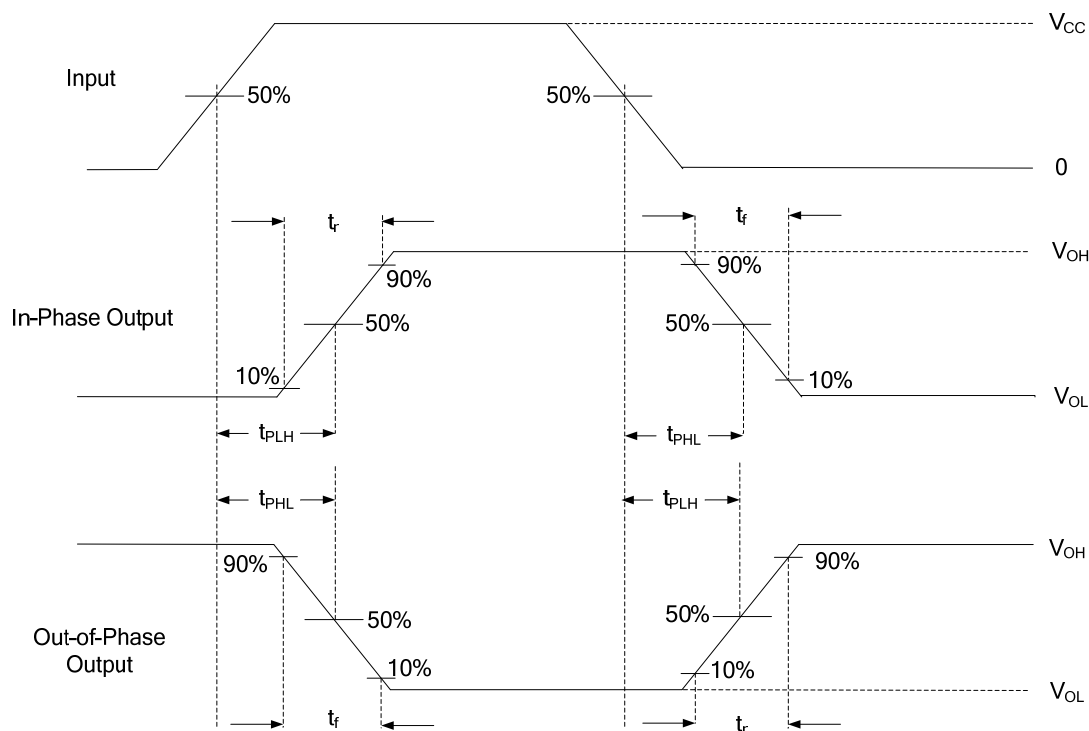
■ **OPERATING CHARACTERISTICS** ($T_A = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Dissipation Capacitance	C_{PD}	No load.		30		pF

■ TEST CIRCUIT AND WAVEFORMS



■ TEST CIRCUIT AND WAVEFORMS (Cont.)



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 pulse are supplied by generators having the following characteristics: $PRR \leq 1\text{MHz}$, $Z_0 = 50\Omega$.

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} .

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