

OCTAL-D-TYPE FLIP FLOP

PRELIMINARY DATA

- **HIGH SPEED**
 $f_{MAX} = 55 \text{ MHz (TYP.) at } V_{CC} = 5V$
- **LOW POWER DISSIPATION**
 $I_{CC} = 4 \mu A \text{ (MAX.) at } 25^\circ C$
- **HIGH NOISE IMMUNITY**
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- **OUTPUT DRIVE CAPABILITY**
 10 LSTTL LOADS
- **SYMMETRICAL OUTPUT IMPEDANCE**
 $|I_{OH}| = I_{OL} = 4 \text{ mA (MIN.)}$
- **BALANCED PROPAGATION DELAYS**
 $t_{PLH} = t_{PHL}$
- **WIDE OPERATING VOLTAGE RANGE**
 $V_{CC} \text{ (OPR)} = 2V \text{ to } 6V$
- **PIN AND FUNCTION COMPATIBLE**
 WITH 54/74LS377

DESCRIPTION

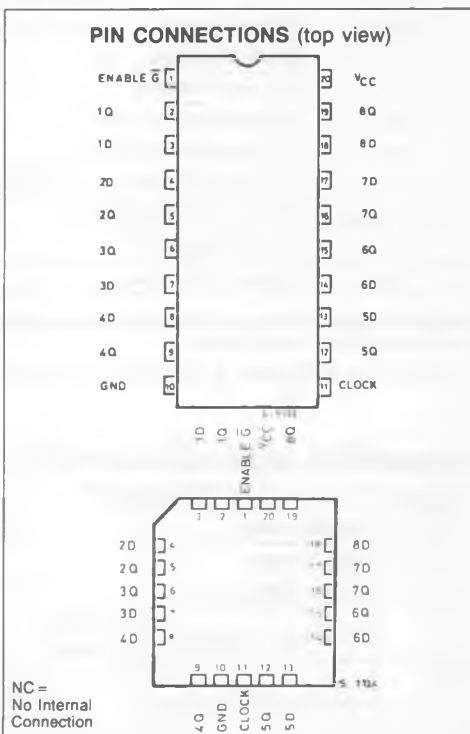
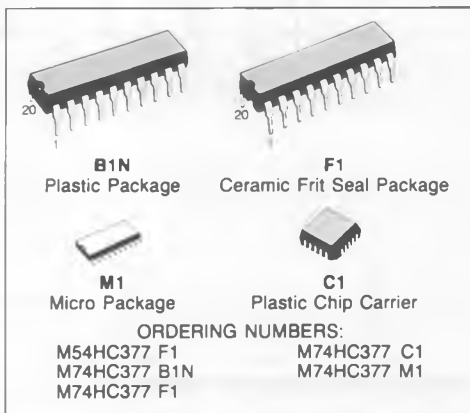
The M54/74HC377 is a high speed CMOS OCTAL-D-TYPE FLIP FLOP fabricated in silicon gate C²MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.

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 the enable input $\bar{G}$ 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. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

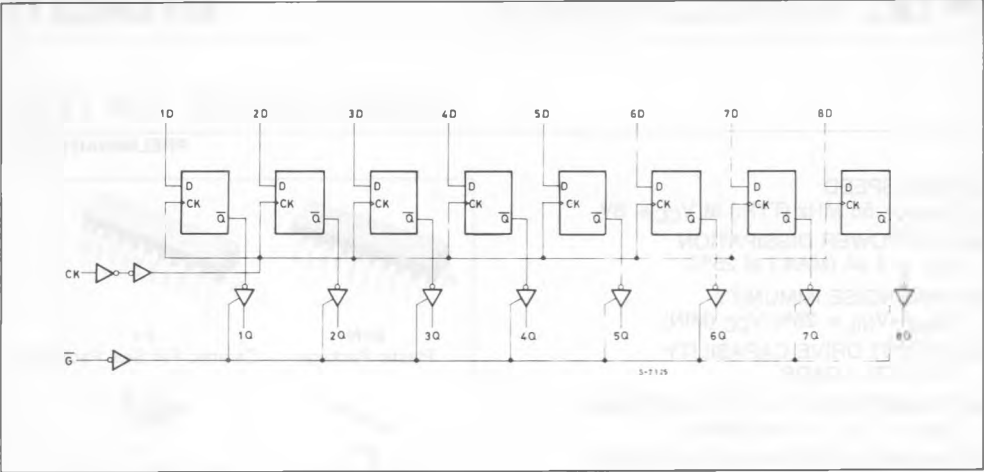
TRUTH TABLE

INPUTS			OUTPUT
$\bar{G}$	CLOCK	DATA	Q
H	X	X	NO CHANGE
L		L	L
L		H	H
X		X	NO CHANGE

X: DON'T CARE



LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	- 0.5 to 7	V
V_I	DC Input Voltage	- 0.5 to $V_{CC} + 0.5$	V
V_O	DC Output Voltage	- 0.5 to $V_{CC} + 0.5$	V
I_{IK}	DC Input Diode Current	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Source Sink Current Per Output Pin	± 25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 50	mA
P_D	Power Dissipation	500 (*)	mW
T_{stg}	Storage Temperature	- 65 to 150	$^{\circ}C$

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(*) 500 mW: $\equiv$ 65 $^{\circ}C$ derate to 300 mW by 10 mW/ $^{\circ}C$: 65 $^{\circ}C$ to 85 $^{\circ}C$

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2 to 6	V
V_I	Input Voltage	0 to V_{CC}	V
V_O	Output Voltage	0 to V_{CC}	V
T_A	Operating Temperature 74HC Series 54HC Series	- 40 to 85 - 55 to 125	$^{\circ}C$
t_r, t_f	Input Rise and Fall Time	$V_{CC} \begin{cases} 2 \text{ V} & 0 \text{ to } 1000 \\ 4.5 \text{ V} & 0 \text{ to } 500 \\ 6 \text{ V} & 0 \text{ to } 400 \end{cases}$	ns

DC SPECIFICATIONS

Symbol	Parameter	V_{CC}	Test Condition	$T_A = 25^\circ\text{C}$ 54HC and 74HC			-40 to 85°C 74HC		-55 to 125°C 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	High Level Input Voltage	2.0 4.5 6.0		1.5 3.15 4.2	— — —	— — —	1.5 3.15 4.2	— — —	1.5 3.15 4.2	— — —	V
V_{IL}	Low Level Input Voltage	2.0 4.5 6.0		— — —	— — —	0.5 1.35 1.8	— — —	0.5 1.35 1.8	— — —	0.5 1.35 1.8	V
V_{OH}	High Level Output Voltage	2.0	V_I	I_O	1.9	2.0	—	1.9	—	1.9	V
		4.5	V_{IH}		4.4	4.5	—	4.4	—	4.4	
		6.0	or	$-20\ \mu\text{A}$	5.9	6.0	—	5.9	—	5.9	
		4.5	V_{IL}	$-4.0\ \text{mA}$	4.18	4.31	—	4.13	—	4.10	
V_{OL}	Low Level Output Voltage	2.0	V_{IH}	$20\ \mu\text{A}$	—	0.0	0.1	—	0.1	—	V
		4.5			—	0.0	0.1	—	0.1	—	
		6.0	or		—	0.0	0.1	—	0.1	—	
		4.5	V_{IL}	$4.0\ \text{mA}$	—	0.17	0.26	—	0.33	—	
I_I	Input Leakage Current	6.0	$V_I = V_{CC}$ or GND	$5.2\ \text{mA}$	—	0.18	0.26	—	0.33	—	μA
		6.0			—	—	± 0.1	—	± 1.0	—	
I_{CC}	Quiescent Supply Current	6.0	$V_I = V_{CC}$ or GND		—	—	4	—	40	—	μA

AC ELECTRICAL CHARACTERISTICS ($V_{CC} = 5\text{V}$, $T_A = 25^\circ\text{C}$, $C_L = 15\text{pF}$, Input $t_r = t_f = 6\text{ns}$)

Symbol	Parameter	54HC and 74HC			Unit
		Min.	Typ.	Max.	
t_{TLH} t_{THL}	Output Transition Time		4	8	ns
t_{PLH} t_{PHL}	Propagation Delay Time (CLOCK)		17	27	ns
f_{MAX}	Maximum Clock Frequency	33	55		MHz

AC ELECTRICAL CHARACTERISTICS ($C_L = 50\text{pF}$, Input $t_r = t_f = 6\text{ns}$)

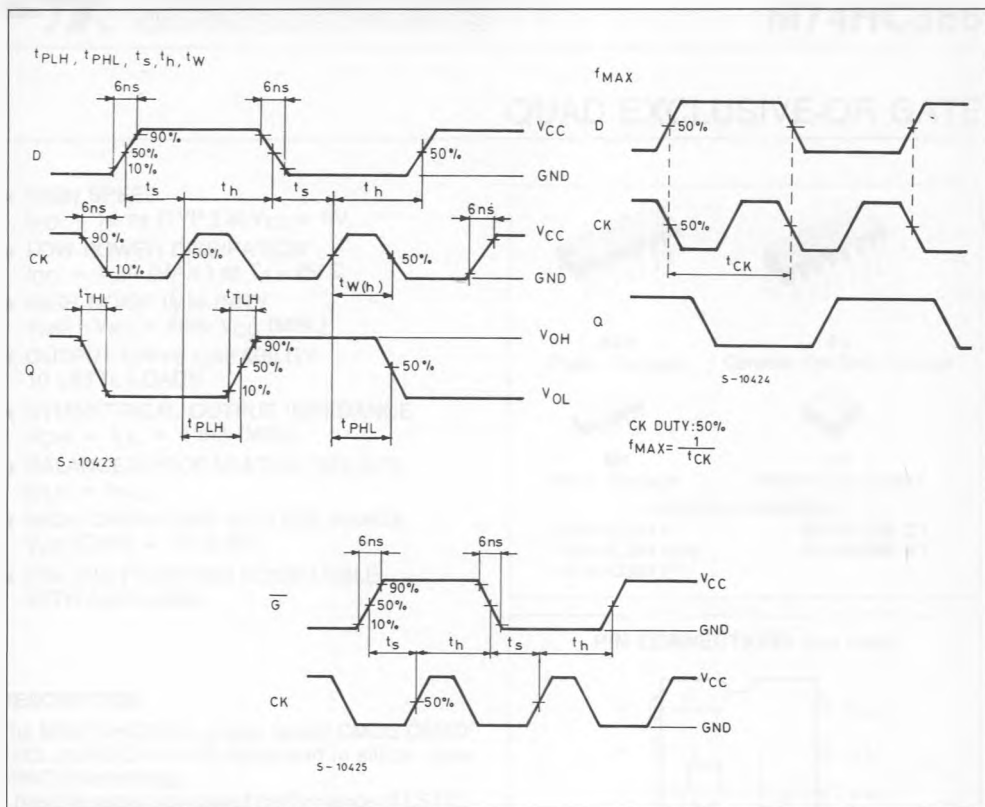
Symbol	Parameter	V_{CC}	Test Condition	$T_A = 25^\circ\text{C}$ 54HC and 74HC			-40 to 85°C 74HC		-55 to 125°C 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time	2.0 4.5 6.0		— — —	30 8 7	75 15 13	— — —	95 19 16	— — —	110 22 19	ns
t_{PLH} t_{PHL}	Propagation Delay Time (CLOCK - Q)	2.0 4.5 6.0		— — —	80 20 17	160 32 28	— — —	200 40 34	— — —	240 48 41	ns
f_{MAX}	Maximum Clock Frequency	2.0 4.5 6.0		6 30 35	13 50 59	— — —	4.8 24 28	— — —	4.0 20 24	— — —	MHz
$t_{W(H)}$ $t_{W(L)}$	Minimum Pulse Width (CLOCK)	2.0 4.5 6.0		— — —	30 8 7	75 15 13	— — —	95 19 16	— — —	110 22 19	ns
t_s	Minimum Set-up Time (DATA)	2.0 4.5 6.0		— — —	30 8 7	75 15 13	— — —	95 19 16	— — —	110 22 19	ns
t_s	Minimum Set-up Time (ENABLE $\bar{G}_C$ -CK)	2.0 4.5 6.0		— — —	48 12 10	125 25 21	— — —	155 31 26	— — —	190 38 32	ns
t_h	Minimum Hold Time	2.0 4.5 6.0		— — —	— — —	0 0 0	— — —	0 0 0	— — —	0 0 0	ns
t_h	Minimum Hold Time (ENABLE)	2.0 4.5 6.0		— — —	— — —	0 0 0	— — —	0 0 0	— — —	0 0 0	ns
C_{IN}	Input Capacitance			—	5	10	—	10	—	10	pF
$C_{PD} (*)$	Power Dissipation Capacitance			—	34	—	—	—	—	—	pF

Note (*) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit)

Average operating current can be obtained by the following equation.

$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ per Flip Flop}$$

SWITCHING CHARACTERISTICS TEST WAVEFORM

TEST CIRCUIT I_{CC} (Opr.)