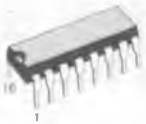
SGS-THOMSON MICROELECTRONICS

M54HC174
M74HC174

HEX D-TYPE FLIP-FLOP WITH CLEAR

- HIGH SPEED
  f_{MAX} = 48 MHz (TYP.) at V_{CC} = 5V
- LOW POWER DISSIPATION
  I_{CC} = 4 μA (MAX.) at T_A = 25°C
- HIGH NOISE IMMUNITY
  V_{NIH} = V_{NIL} = 28% V_{CC} (MIN.)
- OUTPUT DRIVE CAPABILITY
  10 LSTTL LOADS
- BALANCED PROPAGATION DELAYS
  t_{PLH} = t_{PHL}
- WIDE OPERATING VOLTAGE RANGE
  V_{CC} (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE
  WITH 54/74LS174



B1N
Plastic Package

F1
Ceramic Frit Seal Package

M1
Micro Package

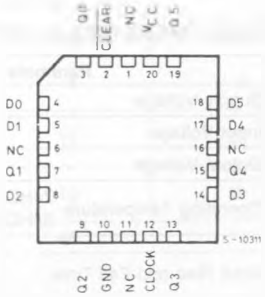
C1
Plastic Chip Carrier

ORDERING NUMBERS:
M54HC174 F1
M74HC174 B1N
M74HC174 F1
M74HC174 C1
M74HC174 M1

DESCRIPTION

The M54/74HC174 is a high speed CMOS HEX D-TYPE FLIP-FLOP WITH CLEAR fabricated in silicon gate C²MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.
Information signals applied to D inputs are transfered to the Q output on the positive going edge of the clock pulse. When the $\overline{CLEAR}$ input is held low, the Q outputs are held low independently of the other inputs. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

PIN CONNECTIONS (top view)



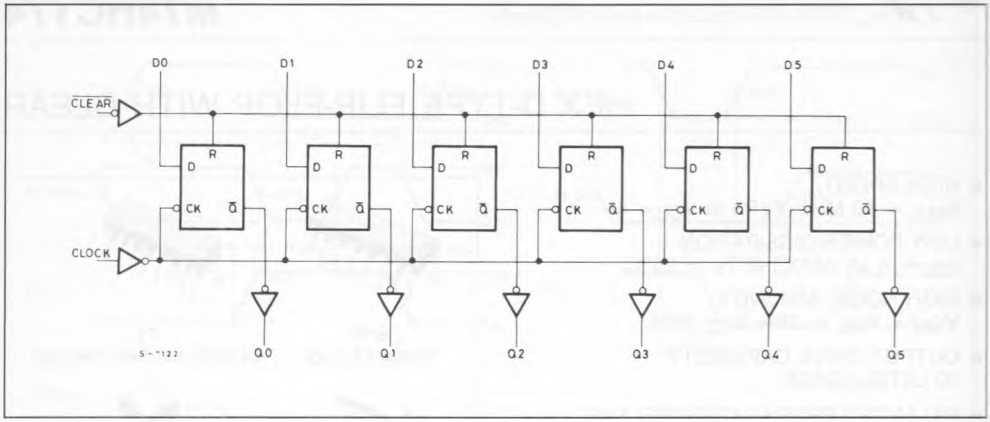
NC = No Internal Connection

TRUTH TABLE

INPUTS			OUTPUT	FUNCTION
$\overline{CLEAR}$	D	CLOCK	Q	
L	X	X	L	CLEAR
H	L	↑	L	—
H	H	↑	H	—
H	X	↓	Qn	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	°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: ≅ 65 °C to 300 mW by 10 mW/°C: 65 to 85°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		°C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 2 V V_{CC} = 4.5V V_{CC} = 6 V	0 to 1000 0 to 500 0 to 400		ns

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V_{CC}	Test Condition		$T_A = 25°C$ 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			1.5	—	—	1.5	—	1.5	—	V
		4.5			3.15	—	—	3.15	—	3.15	—	
		6.0			4.2	—	—	4.2	—	4.2	—	
V_{IL}	Low Level Input Voltage	2.0			—	—	0.5	—	0.5	—	0.5	V
		4.5			—	—	1.35	—	1.35	—	1.35	
		6.0			—	—	1.8	—	1.8	—	1.8	
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} or V_{IL}	−20 μA	4.4	4.5	—	4.4	—	4.4	—	
		6.0			5.9	6.0	—	5.9	—	5.9	—	
		4.5		−4.0 mA	4.18	4.31	—	4.13	—	4.10	—	
		6.0		−5.2 mA	5.68	5.8	—	5.63	—	5.60	—	
V_{OL}	Low Level Output Voltage	2.0	V_{IH} or V_{IL}	20 μA	—	0.0	0.1	—	0.1	—	0.1	V
		4.5			—	0.0	0.1	—	0.1	—	0.1	
		6.0			—	0.0	0.1	—	0.1	—	0.1	
		4.5		4.0 mA	—	0.17	0.26	—	0.33	—	0.40	
		6.0		5.2 mA	—	0.18	0.26	—	0.33	—	0.40	
I_I	Input Leakage Current	6.0	$V_I = V_{CC}$ or GND		—	—	±0.1	—	±1.0	—	±1.0	μA
I_{CC}	Quiescent Supply Current	6.0	$V_I = V_{CC}$ or GND		—	—	4	—	40	—	80	μA

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

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 (CK-QH)		19	30	ns
t_{PHL}	Propagation Delay Time ($\overline{CLEAR}$-QH)		19	30	ns
f_{MAX}	Maximum Clock Frequency	30	48		MHz

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

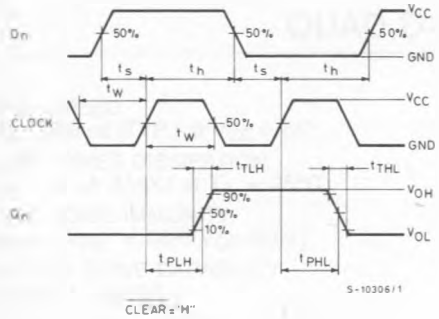
Symbol	Parameter	V_{CC}	Test Condition	T_A = 25°C 54HC and 74HC			−40 to 85°C 74HC		−55 to 125°C 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time	2.0		—	30	75	—	95		110	ns
		4.5		—	8	15	—	19		22	
		6.0		—	7	13	—	16		19	
t_{PLH} t_{PHL}	Propagation Delay Time (CK - Q)	2.0		—	92	180	—	225		270	ns
		4.5		—	23	36	—	45		54	
		6.0		—	20	31	—	38		46	
t_{PHL}	Propagation Delay Time ($\overline{CLEAR}$-Q)	2.0		—	92	180	—	225		270	ns
		4.5		—	23	36	—	45		54	
		6.0		—	20	31	—	38		46	
f_{MAX}	Maximum Clock Frequency	2.0		5	11	—	4	—	3	—	MHz
		4.5		27	44	—	22	—	18	—	
		6.0		32	52	—	26	—	21	—	
$t_{W(H)}$ $t_{W(L)}$	Minimum Pulse Width (CLOCK)	2.0		—	30	75	—	95		110	ns
		4.5		—	8	15	—	19		22	
		6.0		—	7	13	—	16		19	
$t_{W(L)}$	Minimum Pulse Width $\overline{CLEAR}$	2.0		—	30	75	—	95		110	ns
		4.5		—	8	15	—	19		22	
		6.0		—	7	13	—	16		19	
t_s	Minimum Set-up Time	2.0		—	30	75	—	95		110	ns
		4.5		—	8	15	—	19		22	
		6.0		—	7	13	—	16		19	
t_h	Minimum Hold Time	2.0		—	—	0	—	0	—	0	ns
		4.5		—	—	0	—	0	—	0	
		6.0		—	—	0	—	0	—	0	
t_{REM}	Minimum Removal Time $\overline{CLEAR}$	2.0		—	16	75	—	95	—	110	ns
		4.5		—	4	15	—	19	—	22	
		6.0		—	3	13	—	16	—	19	
C_{IN}	Input Capacitance			—	5	10	—	10		10	pF
C_{PD} (*)	Power Dissipation Capacitance			—	53	—	—	—			pF

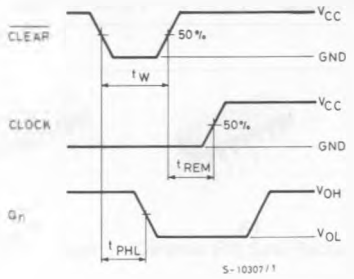
Note (*) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current is: $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/6$ (per Flip-Flop)

And the total C_{PD} when N pcs of Flip-Flop operate can be gained by the following equation: C_{PD} (total) = 38 + 15•n

SWITCHING CHARACTERISTICS TEST WAVEFORM





TEST CIRCUIT I_{CC} (Opr.)