DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Information
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Outlines

74HC/HCT164
8-bit serial-in/parallel-out shift register

Product specification
File under Integrated Circuits, IC06

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Philips Semiconductors

PHILIPS

8-bit serial-in/parallel-out shift register 74HC/HCT164

FEATURES

- Gated serial data inputs
- Asynchronous master reset
- Output capability: standard
- I_{CC} category: MSI

GENERAL DESCRIPTION

The 74HC/HCT164 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT164 are 8-bit edge-triggered shift registers with serial data entry and an output from each of the eight stages.

Data is entered serially through one of two inputs (D_{sa} or D_{sb}); either input can be used as an active HIGH enable for data entry through the other input.
Both inputs must be connected together or an unused input must be tied HIGH.

Data shifts one place to the right on each LOW-to-HIGH transition of the clock (CP) input and enters into Q_0, which is the logical AND of the two data inputs (D_{sa},D_{sb}) that existed one set-up time prior to the rising clock edge.

A LOW level on the master reset ($\overline{MR}$) input overrides all other inputs and clears the register asynchronously, forcing all outputs LOW.

QUICK REFERENCE DATA

GND = 0 V; T_{amb} = 25 °C; $t_r = t_f$ = 6 ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
t_{PHL}/ t_{PLH}	propagation delay CP to Q_n $\overline{MR}$ to Q_n	C_L = 15 pF; V_{CC} = 5 V	 12 11	 14 16	 ns ns
f_{max}	maximum clock frequency		78	61	MHz
C_I	input capacitance		3.5	3.5	pF
C_{PD}	power dissipation capacitance per package	notes 1 and 2	40	40	pF

Notes

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

   $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where:

   f_i = input frequency in MHz

   f_o = output frequency in MHz

   $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs

   C_L = output load capacitance in pF

   V_{CC} = supply voltage in V

2. For HC the condition is V_I = GND to V_{CC}
   For HCT the condition is V_I = GND to V_{CC} – 1.5 V

ORDERING INFORMATION

See *"74HC/HCT/HCU/HCMOS Logic Package Information"*.

PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1, 2	D_{sa}, D_{sb}	data inputs
3, 4, 5, 6, 10, 11, 12, 13	Q_0 to Q_7	outputs
7	GND	ground (0 V)
8	CP	clock input (LOW-to-HIGH, edge-triggered)
9	$\overline{MR}$	master reset input (active LOW)
14	V_{CC}	positive supply voltage

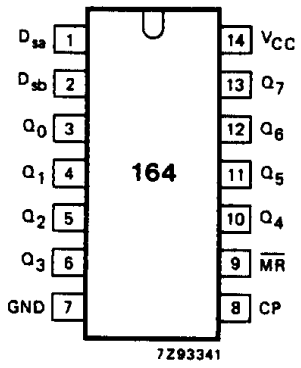

Fig.1 Pin configuration.

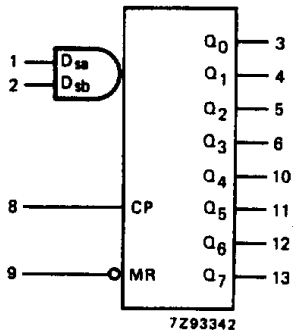

Fig.2 Logic symbol.

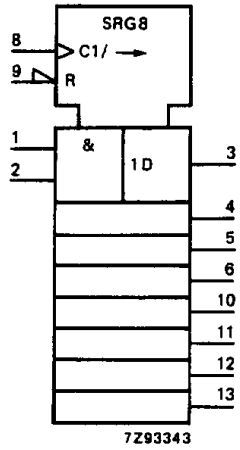

Fig.3 IEC logic symbol.

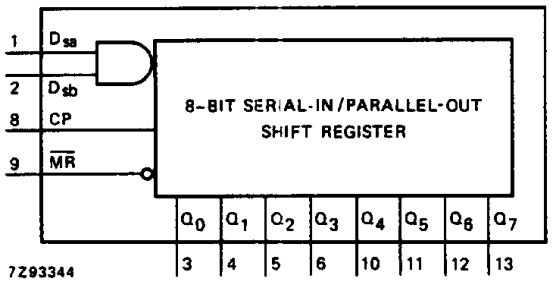

Fig.4 Functional diagram.

APPLICATIONS

- Serial data transfer

FUNCTION TABLE

OPERATING MODES	INPUTS				OUTPUTS	
	$\overline{MR}$	CP	D_{sa}	D_{sb}	Q_0	$Q_1 - Q_7$
reset (clear)	L	X	X	X	L	L – L
shift	H	↑	l	l	L	$q_0 - q_6$
	H	↑	l	h	L	$q_0 - q_6$
	H	↑	h	l	L	$q_0 - q_6$
	H	↑	h	h	H	$q_0 - q_6$

Note

1. H = HIGH voltage level
   h = HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition
   L = LOW voltage level
   l = LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition
   q = lower case letters indicate the state of the referenced input one set-up time prior to the LOW-to-HIGH clock transition
   ↑ = LOW-to-HIGH clock transition

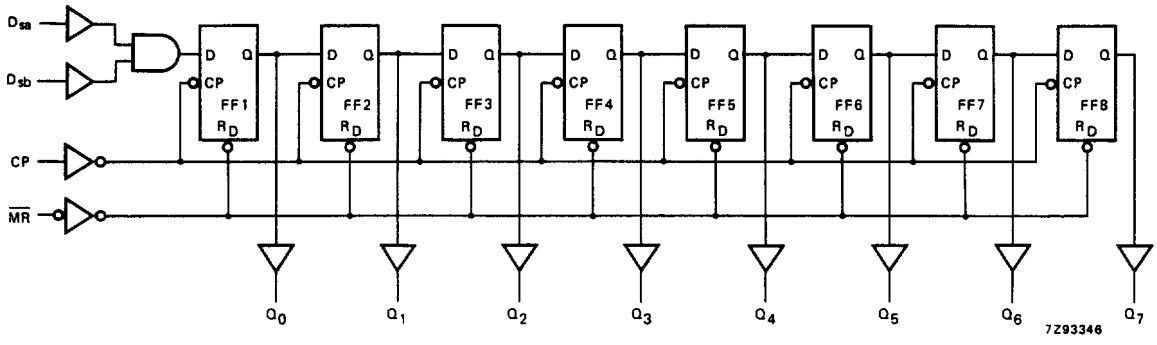

Fig.5 Logic diagram.

DC CHARACTERISTICS FOR 74HC

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Output capability: standard
I_{CC} category: MSI

AC CHARACTERISTICS FOR 74HC

GND = 0 V; $t_r = t_f$ = 6 ns; C_L = 50 pF

SYMBOL	PARAMETER	T_{amb} (°C)							UNIT	TEST CONDITIONS	
		74HC								V_{CC} (V)	WAVEFORMS
		+25			–40 to +85		–40 to +125				
		min.	typ.	max.	min.	max.	min.	max.			
t_{PHL}/ t_{PLH}	propagation delay CP to Q_n		41 15 12	170 34 29		215 43 37		255 51 43	ns	2.0 4.5 6.0	Fig.6
t_{PHL}	propagation delay $\overline{MR}$ to Q_n		39 14 11	140 28 24		175 35 30		210 42 36	ns	2.0 4.5 6.0	Fig.6
t_{THL}/ t_{TLH}	output transition time		19 7 6	75 15 13		95 19 16		110 22 19	ns	2.0 4.5 6.0	Fig.6
t_W	clock pulse width HIGH or LOW	80 16 14	14 5 4		100 20 17		120 24 20		ns	2.0 4.5 6.0	Fig.6
t_W	master reset pulse width; LOW	60 12 10	17 6 5		75 15 13		90 18 15		ns	2.0 4.5 6.0	Fig.6
t_{rem}	removal time $\overline{MR}$ to CP	60 12 10	17 6 5		75 15 13		90 18 15		ns	2.0 4.5 6.0	Fig.6
t_{su}	set-up time D_{sa}, D_{sb} to CP	60 12 10	8 3 2		75 15 13		90 18 15		ns	2.0 4.5 6.0	Fig.6
t_h	hold time D_{sa}, D_{sb} to CP	4 4 4	–6 –2 –2		4 4 4		4 4 4		ns	2.0 4.5 6.0	Fig.6
f_{max}	maximum clock pulse frequency	6 30 35	23 71 85		5 24 28		4 20 24		MHz	2.0 4.5 6.0	Fig.6

DC CHARACTERISTICS FOR 74HCT

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Output capability: standard
I_{CC} category: MSI

Note to HCT types

The value of additional quiescent supply current (ΔI_{CC}) for a unit load of 1 is given in the family specifications. To determine ΔI_{CC} per input, multiply this value by the unit load coefficient shown in the table below.

INPUT	UNIT LOAD COEFFICIENT
D_{sa}, D_{sb}	0.25
CP	0.60
$\overline{MR}$	0.90

AC CHARACTERISTICS FOR 74HCT

GND = 0 V; $t_r = t_f$ = 6 ns; C_L = 50 pF

SYMBOL	PARAMETER	T_{amb} (°C)							UNIT	TEST CONDITIONS	
		74HCT								V_{CC} (V)	WAVEFORMS
		+25			−40 to +85		−40 to +125				
		min.	typ.	max.	min.	max.	min.	max.			
t_{PHL}/ t_{PLH}	propagation delay CP to Q_n		17	36		45		54	ns	4.5	Fig.6
t_{PHL}	propagation delay $\overline{MR}$ to Q_n		19	38		48		57	ns	4.5	Fig.6
t_{THL}/ t_{TLH}	output transition time		7	15		19		22	ns	4.5	Fig.6
t_W	clock pulse width HIGH or LOW	18	7		23		27		ns	4.5	Fig.6
t_W	master reset pulse width; LOW	18	10		23		27		ns	4.5	Fig.6
t_{rem}	removal time $\overline{MR}$ to CP	16	7		20		24		ns	4.5	Fig.6
t_{su}	set-up time D_{sa}, D_{sb} to CP	12	6		15		18		ns	4.5	Fig.6
t_h	hold time D_{sa}, D_{sb} to CP	4	−2		4		4		ns	4.5	Fig.6
f_{max}	maximum clock pulse frequency	27	55		22		18		MHz	4.5	Fig.6

AC WAVEFORMS

(1) HC : V_M = 50%; V_I = GND to V_{CC}.
HCT : V_M = 1.3 V; V_I = GND to 3 V.

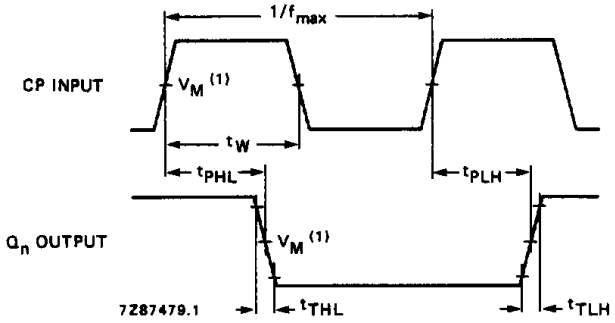

Fig.6 Waveforms showing the clock (CP) to output (Q_n) propagation delays, the clock pulse width, the output transition times and the maximum clock frequency.

(1) HC : V_M = 50%; V_I = GND to V_{CC}.
HCT : V_M = 1.3 V; V_I = GND to 3 V.

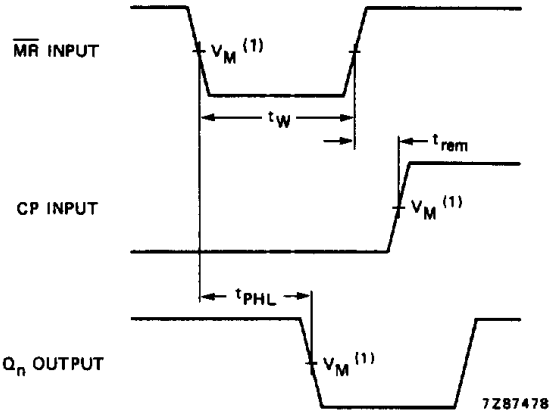

Fig.7 Waveforms showing the master reset ($\overline{MR}$) pulse width, the master reset to output (Q_n) propagation delays and the master reset to clock (CP) removal time.

(1) HC : V_M = 50%; V_I = GND to V_{CC}.
HCT : V_M = 1.3 V; V_I = GND to 3 V.

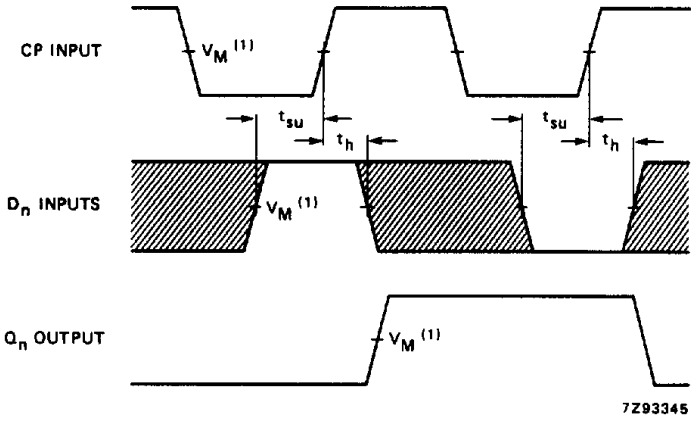

Fig.8 Waveforms showing the data set-up and hold times for D_n inputs.

PACKAGE OUTLINES

See *"74HC/HCT/HCU/HCMOS Logic Package Outlines"*.