74HC164D-HX/74HC164N-HX QUADRUPLE 2-INPUT POSITIVE-NAND GATES

Description

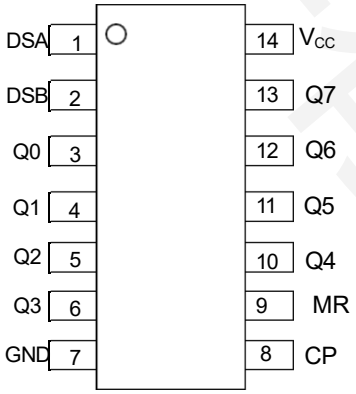
The 74HC164D-HX/74HC164N-HX is an 8-bit, edge-triggered shift register featuring serial input and parallel output. A LOW-to-HIGH transition on the clock input (CP) shifts the stored data one bit to the right; the shifted-in bit is the logical AND of inputs DSA and DSB.

A LOW level applied to the master reset input ($\overline{MR}$) asynchronously clears the register and forces all outputs LOW.

Features

- ★ Wide Operation Voltage Range: 2~6V
- ★ Asynchronous Reset Input
- ★ Low Input Current: 0.1μA
- ★ Latch-up performance ≤ 250 mA
- ★ ESD protection:
  - -HBM: ANSI/ESDA/JEDEC JS-001 2023 exceeds 1500 V
  - -CDM: ANSI/ESDA/JEDEC JS-002 2022 exceeds 1000 V
- ★ Package Options 74HC164D-HX SOP-14
  74HC164N-HX DIP-14

Pin Configuration

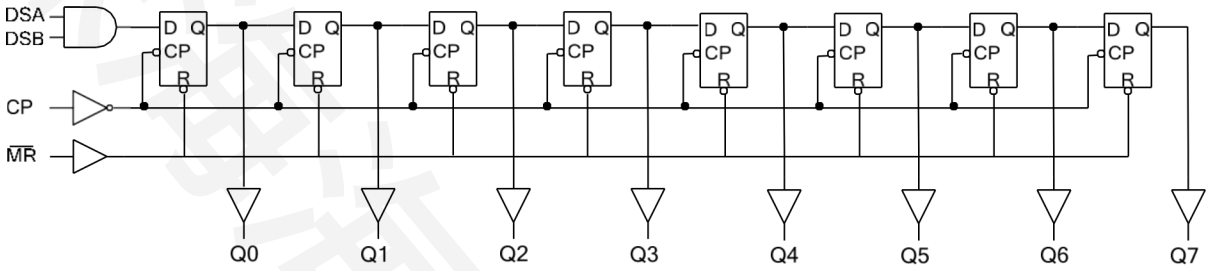


Function Table

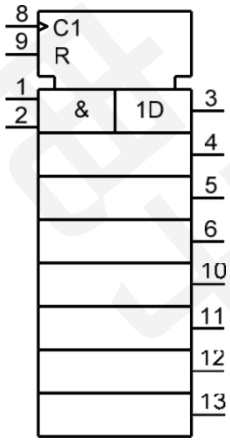
INPUT				OUTPUT	
$\overline{MR}$	CP	DSA	DSB	Q0	Q1 to Q7
L	X	X	X	L	L to L
H	L	X	X	Q0	Q1 to Q7
H	↑	H	L	L	Q0 to Q6
H	↑	H	H	H	Q0 to Q6
H	↑	L	H	L	Q0 to Q6
H	↑	L	L	L	Q0 to Q6

Functional Diagram

Logic Diagram



IEC Logic Symbol



Absolute Maximum Ratings (T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{CC}	-0.5 ~ 7.0	V
VCC or GND Current	I_{CC}	±50	mA
Output Current	I_{OUT}	±25	mA
Input Diode Current	I_{IK}	±20	mA
Switch Diode 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	CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	V_{CC}	-	2.0	5.0	6.0	V
Input Voltage	V_{IN}	-	0	-	VCC	V
Output Voltage	V_{OUT}	-	0	-	VCC	V
Input Transition Rise or Fall Rate	△t/△v	V_{CC}=2V	-	-	1000	ns
		V_{CC}=4.5V	-	6.0	500	ns
		V_{CC}=6V	-	-	400	ns
Operating Temperature	T_A	-	-40	-	+125	°C

Thermal Data

PARAMETER		SYMBOL	RATINGS	UNIT
Ambient to Junction	DIP-14	θ_{JA}	100	°C/W
	SOP-14U		125	°C/W

Electrical Characteristics (T_A=25°C, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage High-Level	V_{IH}	V_{CC}=2.0V	1.5	1.2	-	V
		V_{CC}=4.5V	3.15	2.4	-	V
		V_{CC}=6.0V	4.2	3.2	-	V
Input Voltage Low-Level	V_{IL}	V_{CC}=2.0V	-	0.8	0.5	V
		V_{CC}=4.5V	-	2.1	1.35	V
		V_{CC}=6.0V	-	2.8	1.8	V
Output Voltage High-Level	V_{OH}	V_{CC}=2.0V, I_{OH}=20μA	1.9	2.0	-	V
		V_{CC}=4.5V, I_{OH}=20μA	4.4	4.5	-	V
		V_{CC}=6.0V, I_{OH}=20μA	5.9	6.0	-	V
		V_{CC}=4.5V, I_{OH}=4mA	3.98	4.32	-	V
		V_{CC}=6.0V, I_{OH}= 5.2mA	5.48	5.81	-	V
Output Voltage Low-Level	V_{OL}	V_{CC}=2.0V, I_{OL}=20μA	-	0	0.1	V
		V_{CC}=4.5V, I_{OL}=20μA	-	0	0.1	V
		V_{CC}=6.0V, I_{OL}=20μA	-	0	0.1	V
		V_{CC}=4.5V, I_{OL}=4mA	-	0.15	0.26	V
		V_{CC}=6.0V, I_{OL}=5.2mA	-	0.16	0.26	V
Input Leakage Current	$I_{I(LEAK)}$	V_{IN}=V_{CC} or GND V_{CC}=6.0V	-	-	±1.0	μA
Quiescent Supply Current	I_Q	V_{IN}=V_{CC} or GND V_{CC}=6.0V, I_{OUT}=0	-	-	8	μA
Input Capacitance	C_{IN}		-	3.5	-	pF

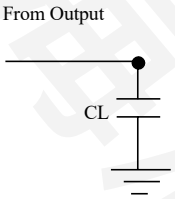
Dynamic Characteristics (GND=0V; t_R=t_F=6ns; C_L=50pF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay From CP to Qn	t_{PHL}, t_{PLH}	V_{CC} =2.0V	-	41	255	ns
		V_{CC} =4.5V	-	15	51	ns
		V_{CC} =6.0V	-	12	43	ns
Propagation Delay From $\overline{MR}$ to Qn	t_{PHL}	V_{CC} =2.0V	-	39	210	ns
		V_{CC} =4.5V	-	14	42	ns
		V_{CC} =6.0V	-	11	36	ns
Output Transition Time	t_{THL}, t_{TLH}	V_{CC} =2.0V	-	19	110	ns
		V_{CC} =4.5V	-	7	22	ns
		V_{CC} =6.0V	-	6	19	ns
Clock Pulse Width High or Low	t_W	V_{CC} =2.0V	80	14	-	ns
		V_{CC} =4.5V	16	5	-	ns
		V_{CC} =6.0V	14	4	-	ns
Master Reset Pulse Width Low	t_W	V_{CC} =2.0V	60	17	-	ns
		V_{CC} =4.5V	12	6	-	ns
		V_{CC} =6.0V	10	5	-	ns
Removal Time $\overline{MR}$ to CP	trem	V_{CC} =2.0V	60	17	-	ns
		V_{CC} =4.5V	12	6	-	ns
		V_{CC} =6.0V	10	5	-	ns
Setup Time DSA and DSB to CP	t_{SU}	V_{CC} =2.0V	60	8	-	ns
		V_{CC} =4.5V	12	3	-	ns
		V_{CC} =6.0V	10	2	-	ns
Hold Time DSA and DSB to CP	t_h	V_{CC} =2.0V	+4	-6	-	ns
		V_{CC} =4.5V	+4	-2	-	ns
		V_{CC} =6.0V	+4	-2	-	ns
Maximum Clock Pulse Frequency	f_{MAX}	V_{CC} =2.0V	6	23	-	MHZ
		V_{CC} =4.5V	30	71	-	MHZ
		V_{CC} =6.0V	35	85	-	MHZ
Clock Frequency	f_{CLOCK}	V_{CC} =2.0V	-	-	6	MHz
		V_{CC} =4.5V	-	-	31	MHz
		V_{CC} =6.0V	-	-	36	MHz

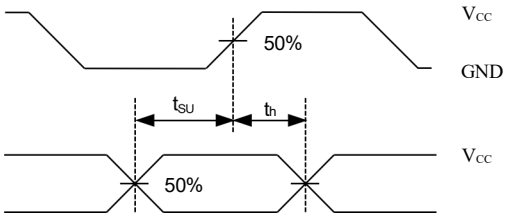
Operating Characteristics

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Dissipation Capacitance	C_{PD}	No load	-	40	-	pF

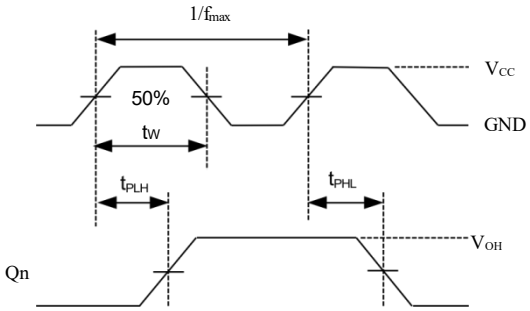
Test Circuit and Waveforms



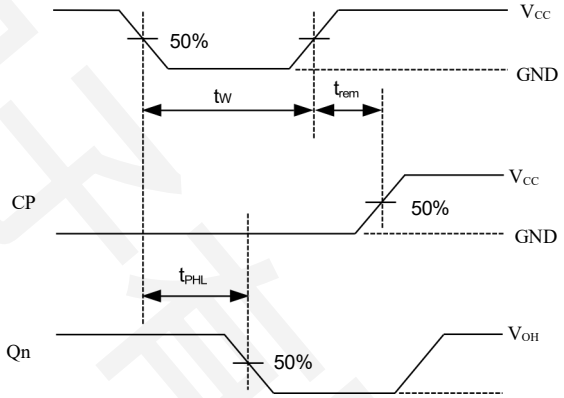
TEST CIRCUIT



SETUP TIME AND HOLD TIME



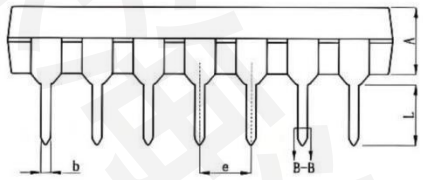
PROPAGATION DELAY TIMES FROM CP TO Qn

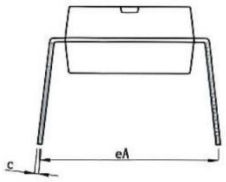


PROPAGATION DELAY TIMES FROM MR TO Qn

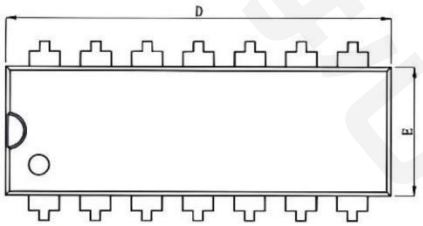
Package Information

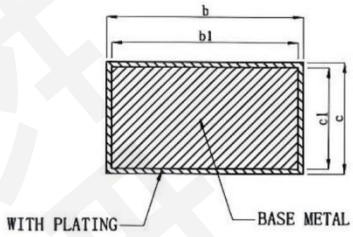
74HC164N-HX DIP 14 package information





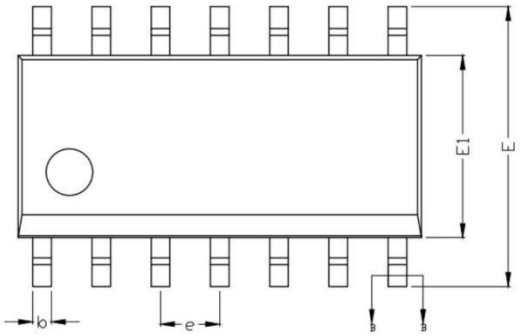
Symbol	Millimeter		
	Min	Nom	Max
A	3.20	3.30	3.40
b	0.44	---	0.53
b1	0.43	0.46	0.49
c	0.25	---	0.30
c1	0.24	0.25	0.26
D	18.95	19.05	19.15
E	6.25	6.35	6.45
e	2.54BSC		
eA	7.62	-----	9.50
L	3.00	-----	-----

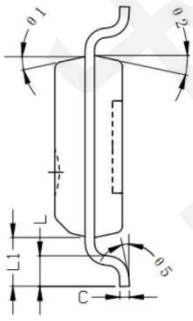


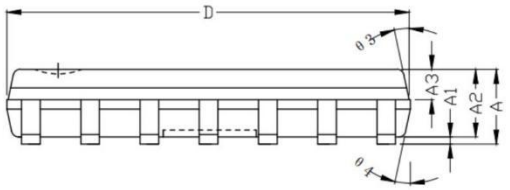


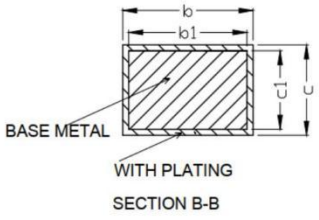
SECTION B-B

74HC164D-HX SOP 14 package information









SECTION B-B

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	--	--	1.70
A1	0.10	0.15	0.21
A2	1.40	1.45	1.50
A3	0.60	0.65	0.70
b	0.33	--	0.47
b1	0.32	0.41	0.44
c	0.20	--	0.24
c1	0.19	0.20	0.21
D	8.45	8.60	8.75
E	5.80	6.00	6.20
E1	3.85	3.90	4.00
e	1.27(BSC)		
L	0.50	0.60	0.70
L1	1.10(BSC)		
θ1	8°	~	15°
θ2	8°	~	15°
θ3	8°	~	15°
θ4	8°	~	15°
θ5	0°	~	6°