HARRIS SEMICONDUCTOR

CD74HC4015

High Speed CMOS Logic
Dual 4-Stage Static Shift Register

November 1997

Features

- Maximum Frequency, Typically 60MHz
  C_L = 15pF, V_{CC} = 5V, T_A = 25°C
- Positive-Edge Clocking
- Overriding Reset
- Buffered Inputs and Outputs
- Fanout (Over Temperature Range)
  - Standard Outputs . . . . . 10 LSTTL Loads
  - Bus Driver Outputs . . . . . 15 LSTTL Loads
- Wide Operating Temperature Range . . . -55°C to 125°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
  - 2V to 6V Operation
  - High Noise Immunity: N_{IL} = 30%, N_{IH} = 30% of V_{CC} at V_{CC} = 5V

Description

The Harris CD74HC4015 consists of two identical, independent, 4-stage serial-input/parallel-output registers. Each register has independent Clock (CP) and Reset (MR) inputs as well as a single serial Data input. "Q" outputs are available from each of the four stages on both registers. All register stages are D-type, master-slave flip-flops. The logic level present at the Data input is transferred into the first register stage and shifted over one stage at each positive-going clock transition. Resetting of all stages is accomplished by a high level on the reset line.

The device can drive up to 10 low power Schottky equivalent loads. The CD74HC4015 is an enhanced version of equivalent CMOS types.

Ordering Information

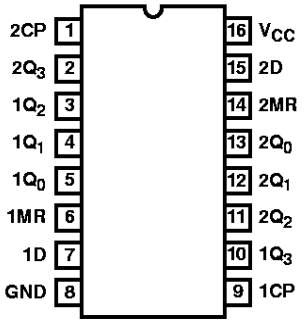
PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CD74HC4015E	-55 to 125	20 Ld PDIP	E16.3

NOTES:

1. When ordering, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.
2. Wafer or die for this part number is available which meets all electrical specifications. Please contact your local sales office or Harris customer service for ordering information.

Pinout

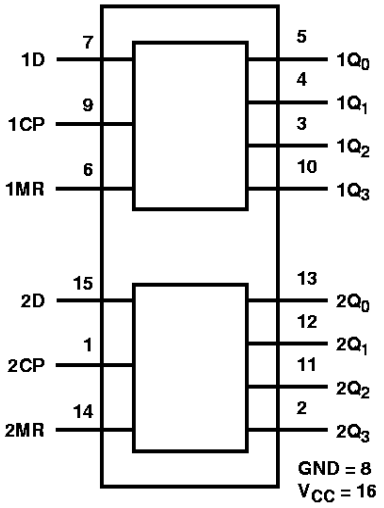
CD74HC4015
(PDIP)
TOP VIEW



CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

File Number **1678.1**

Functional Diagram



TRUTH TABLE

INPUTS			OUTPUTS			
CP	D	R	Q_0	Q_1	Q_2	Q_3
↑	l	L	L	q'_0	q'_1	q'_2
↑	h	L	H	q'_0	q'_1	q'_2
↓	X	L	q'_0	q'_1	q'_2	q'_3
X	X	H	L	L	L	L

NOTES:
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
X = Don't Care.
↑ = Low to High Clock Transition
↓ = High to Low Clock Transition
q'_n = Lower case letters indicate the state of the referenced output one set-up time prior to the Low to High clock transition.

Absolute Maximum Ratings

DC Supply Voltage, V_{CC} . . . . . -0.5V to 7V
DC Input Diode Current, I_{IK}
For V_I < -0.5V or V_I > V_{CC} + 0.5V . . . . . ±20mA
DC Output Diode Current, I_{OK}
For V_O < -0.5V or V_O > V_{CC} + 0.5V . . . . . ±20mA
DC Output Source or Sink Current per Output Pin, I_O
For V_O > -0.5V or V_O < V_{CC} + 0.5V . . . . . ±25mA
DC V_{CC} or Ground Current, I_{CC} . . . . . ±50mA

Operating Conditions

Temperature Range, T_A . . . . . -55°C to 125°C
Supply Voltage Range, V_{CC}
HC Types . . . . . 2V to 6V
DC Input or Output Voltage, V_I, V_O . . . . . 0V to V_{CC}
Input Rise and Fall Time
2V . . . . . 1000ns (Max)
4.5V. . . . . 500ns (Max)
6V . . . . . 400ns (Max)

Thermal Information

Thermal Resistance (Typical, Note 3) θ_{JA} (°C/W)
PDIP Package 90
Maximum Junction Temperature 150oC
Maximum Storage Temperature Range . . . . . -65°C to 150°C
Maximum Lead Temperature (Soldering 10s) . . . . . 300°C
(SOIC - Lead Tips Only)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

3. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

DC Electrical Specifications

PARAMETER	SYMBOL	TEST CONDITIONS		V_{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
		V_I (V)	I_O (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX	
High Level Input Voltage	V_{IH}	-	-	2	1.5	-	-	1.5	-	1.5	-	V
				4.5	3.15	-	-	3.15	-	3.15	-	V
				6	4.2	-	-	4.2	-	4.2	-	V
Low Level Input Voltage	V_{IL}	-	-	2	-	-	0.5	-	0.5	-	0.5	V
				4.5	-	-	1.35	-	1.35	-	1.35	V
				6	-	-	1.8	-	1.8	-	1.8	V
High Level Output Voltage CMOS Loads	V_{OH}	V_{IH} or V_{IL}	-0.02	2	1.9	-	-	1.9	-	1.9	-	V
			-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
			-0.02	6	5.9	-	-	5.9	-	5.9	-	V
High Level Output Voltage TTL Loads			-	-	-	-	-	-	-	-	-	V
			-4	4.5	3.98	-	-	3.84	-	3.7	-	V
			-5.2	6	5.48	-	-	5.34	-	5.2	-	V
Low Level Output Voltage CMOS Loads	V_{OL}	V_{IH} or V_{IL}	0.02	2	-	-	0.1	-	0.1	-	0.1	V
			0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
			0.02	6	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads			-	-	-	-	-	-	-	-	-	V
			4	4.5	-	-	0.26	-	0.33	-	0.4	V
			5.2	6	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I_I	V_{CC} or GND	-	6	-	-	±0.1	-	±1	-	±1	µA
Quiescent Device Current	I_{CC}	V_{CC} or GND	0	6	-	-	8	-	80	-	160	µA

NOTE: For dual-supply systems theoretical worst case (V_I = 2.4V, V_{CC} = 5.5V) specification is 1.8mA.

Prerequisite for Switching Specifications

PARAMETER	SYMBOL	V_{CC} (V)	25°C		-40°C TO 85°C		-55°C TO 125°C		UNITS
			MIN	MAX	MIN	MAX	MIN	MAX	
Maximum Clock Frequency	f_{MAX}	2	6	-	5	-	4	-	MHz
		4.5	30	-	24	-	20	-	MHz
		6	35	-	28	-	24	-	MHz
Clock Pulse Width	t_W	2	80	-	100	-	120	-	ns
		4.5	16	-	20	-	24	-	ns
		6	14	-	17	-	20	-	ns
MR Pulse Width	t_W	2	150	-	190	-	225	-	ns
		4.5	30	-	38	-	45	-	ns
		6	26	-	33	-	38	-	ns
MR Recovery Time	t_{REC}	2	50	-	65	-	75	-	ns
		4.5	10	-	13	-	15	-	ns
		6	9	-	11	-	13	-	ns
Set-up Time, Data-In to CP	t_{SUL}, t_{SUH}	2	60	-	75	-	90	-	ns
		4.5	12	-	15	-	18	-	ns
		6	10	-	13	-	15	-	ns
Hold Time, Data-In to CP	t_H	2	0	-	0	-	0	-	ns
		4.5	0	-	0	-	0	-	ns
		6	0	-	0	-	0	-	ns

Switching Specifications Input t_r, t_f = 6ns

PARAMETER	SYMBOL	TEST CONDITIONS	V_{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
Propagation Delay (Figure 1) Clock to Q_n	t_{PLH}, t_{PHL}	C_L = 50pF	2	-	-	175	-	220	-	270	ns
			4.5	-	-	35	-	44	-	54	ns
		C_L =15pF	5	-	14	-	-	-	-	-	ns
		C_L = 50pF	6	-	-	30	-	37	-	46	ns
MR to Q_n, (Clock High)	t_{PLH}, t_{PHL}	C_L = 50pF	2	-	-	275	-	345	-	415	ns
			4.5	-	-	55	-	64	-	83	ns
		C_L =15pF			25	-	-	-	-	-	ns
		C_L = 50pF	6	-	-	47	-	54	-	71	ns
MR to Q_n, (Clock Low)	t_{PLH}, t_{PHL}	C_L = 50pF	2	-	-	325	-	400	-	490	ns
			4.5	-	-	65	-	81	-	98	ns
		C_L =15pF			25	-	-	-	-	-	ns
		C_L = 50pF	6	-	-	55	-	69	-	83	ns
Output Transition Time (Figure 1)	t_{TLH}, t_{THL}	C_L = 50pF	2	-	-	75	-	95	-	110	ns
			4.5	-	-	15	-	19	-	22	ns
			6	-	-	13	-	16	-	19	ns
Input Capacitance	C_{IN}	C_L = 50pF	-	-	-	10	-	10	-	10	pF
Maximum Clock Frequency	f_{MAX}	C_L =15pF	5	-	60	-	-	-	-	-	MHz
Power Dissipation Capacitance (Notes 4, 5)	C_{PD}	C_L =15pF	5	-	43	-	-	-	-	-	pF

NOTES:

4. C_{PD} is used to determine the dynamic power consumption, per shift register.
5. $P_D = V_{CC}^2 f_i + \Sigma C_L V_{CC}^2$ where f_i = Input Frequency, C_L = Output Load Capacitance, V_{CC} = Supply Voltage.

Test Circuit and Waveform

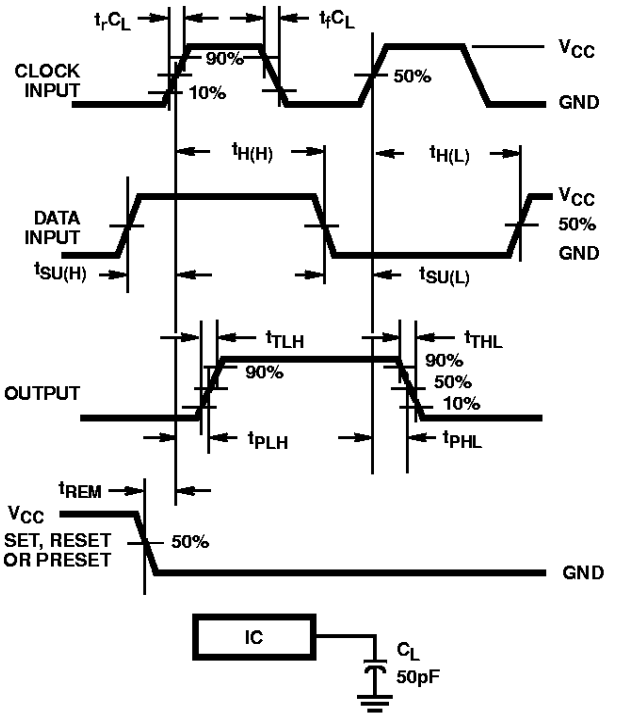


FIGURE 1. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

All Harris Semiconductor products are manufactured, assembled and tested under **ISO9000** quality systems certification.

Sales Office Headquarters

For general information regarding Harris Semiconductor and its products, call **1-800-4-HARRIS**

NORTH AMERICA
Harris Semiconductor
P. O. Box 883, Mail Stop 53-210
Melbourne, FL 32902
TEL: 1-800-442-7747
(407) 729-4984
FAX: (407) 729-5321

EUROPE
Harris Semiconductor
Mercure Center
100, Rue de la Fusee
1130 Brussels, Belgium
TEL: (32) 2.724.2111
FAX: (32) 2.724.22.05

ASIA
Harris Semiconductor PTE Ltd.
No. 1 Tannery Road
Cencon 1, #09-01
Singapore 1334
TEL: (65) 748-4200
FAX: (65) 748-0400

HARRIS SEMICONDUCTOR