

CD74HC4017

High Speed CMOS Logic Decade Counter/Divider with 10 Decoded Outputs

Features

- Fully Static Operation
- Buffered Inputs
- Common Reset
- Positive Edge Clocking
- Typical $f_{MAX} = 50\text{MHz}$ at $V_{CC} = 5\text{V}$, $C_L = 15\text{pF}$, $T_A = 25^\circ\text{C}$
- 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 $V_{CC} = 5\text{V}$

Description

The Harris CD74HC4017 is a high speed silicon gate CMOS 5-stage Johnson counter with 10 decoded outputs. Each of the decoded outputs is normally low and sequentially goes high on the low to high transition clock period of the 10 clock period cycle. The CARRY (TC) output transitions low to high after OUTPUT 10 goes low, and can be used in conjunction with the CLOCK ENABLE (\overline{CE}) to cascade several stages. The CLOCK ENABLE input disables counting when in the high state. A RESET (MR) input is also provided which when taken high sets all the decoded outputs, except "0", low.

The device can drive up to 10 low power Schottky equivalent loads.

Ordering Information

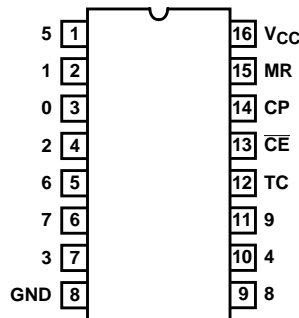
PART NUMBER	TEMP. RANGE ($^\circ\text{C}$)	PACKAGE	PKG. NO.
CD74HC4017E	-55 to 125	16 Ld PDIP	E16.3

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.

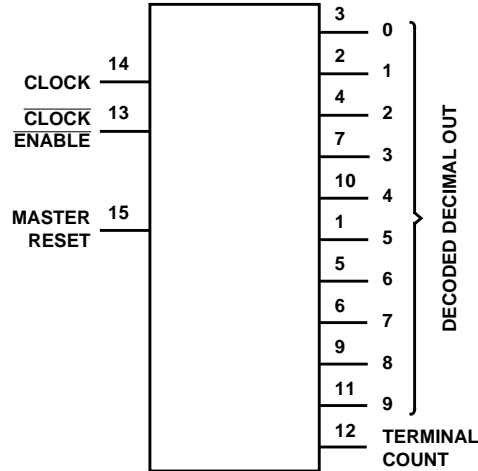
Pinout

CD74HC4017
(PDIP)
TOP VIEW



CD74HC4017

Functional Diagram



TRUTH TABLE

CP	\overline{CE}	MR	OUTPUT STATE †
L	X	L	No Change
X	H	L	No Change
X	X	H	"0" = H, "1"- "9" = L
↑	L	L	Increments Counter
↓	X	L	No Change
X	↑	L	No Change
H	↓	L	Increments Counter

NOTE:

H = High Level

L = Low Level

↑ = High to Low Transition

↓ = Low to High Transition

X = Don't Care.

† If $n < 5$ TC = H, Otherwise = L

CD74HC4017

Absolute Maximum Ratings

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

Thermal Information

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

Operating Conditions

Temperature Range, T_A $-55^{\circ}C$ to $125^{\circ}C$
 Supply Voltage Range, V_{CC}
 HC Types 2V to 6V
 HCT Types 4.5V to 5.5V
 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)

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:

- 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	-0.02	2	1.9	-	-	1.9	-	1.9	-	V
			-0.02	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
			-0.02	-0.02	6	5.9	-	-	5.9	-	5.9	-	V
High Level Output Voltage TTL Loads	V_{OH}	V_{IH} or V_{IL}	-	-	-	-	-	-	-	-	-	V	
			-4	-4	4.5	3.98	-	-	3.84	-	3.7	-	V
			-5.2	-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	0.02	2	-	-	0.1	-	0.1	-	0.1	V
			0.02	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
			0.02	0.02	6	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads	V_{OL}	V_{IH} or V_{IL}	-	-	-	-	-	-	-	-	-	V	
			4	4	4.5	-	-	0.26	-	0.33	-	0.4	V
			5.2	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	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.

CD74HC4017

Prerequisite for Switching Specifications

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	
Maximum Clock Frequency	f _{MAX}	-	2	6	-	-	5	-	4	-	MHz
			4.5	30	-	-	35	-	20	-	MHz
			6	35	-	-	49	-	23	-	MHz
CP 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	80	-	-	100	-	120	-	ns
			4.5	16	-	-	20	-	24	-	ns
			6	14	-	-	17	-	20	-	ns
Set-up Time, \overline{CE} to CP	t _{SU}	-	2	75	-	-	95	-	110	-	ns
			4.5	15	-	-	19	-	22	-	ns
			6	13	-	-	16	-	19	-	ns
Hold Time, \overline{CE} to CP	t _H	-	2	0	-	-	0	-	0	-	ns
			4.5	0	-	-	0	-	0	-	ns
			6	0	-	-	0	-	0	-	ns
MR Removal Time	t _{REM}	-	2	5	-	-	5	-	5	-	ns
			4.5	5	-	-	5	-	5	-	ns
			6	5	-	-	5	-	5	-	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 CP to any Dec. Out	t _{PLH} , t _{PHL}	C _L = 50pF	2	-	-	230	-	290	-	345	ns
		C _L = 50pF	4.5	-	-	46	-	58	-	69	ns
		C _L = 15pF	5	-	19	-	-	-	-	-	ns
		C _L = 50pF	6	-	-	39	-	49	-	59	ns
CP to TC	t _{PLH} , t _{PHL}	C _L = 50pF	2	-	-	230	-	290	-	345	ns
		C _L = 50pF	4.5	-	-	46	-	58	-	69	ns
		C _L = 15pF	5	-	19	-	-	-	-	-	ns
		C _L = 50pF	6	-	-	39	-	49	-	59	ns
\overline{CE} to any Dec. Out	t _{PLH} , t _{PHL}	C _L = 50pF	2	-	-	250	-	315	-	375	ns
		C _L = 50pF	4.5	-	-	50	-	63	-	75	ns
		C _L = 15pF	5	-	21	-	-	-	-	-	ns
		C _L = 50pF	6	-	-	43	-	54	-	64	ns
\overline{CE} to TC	t _{PLH} , t _{PHL}	C _L = 50pF	2	-	-	250	-	315	-	375	ns
		C _L = 50pF	4.5	-	-	50	-	63	-	75	ns
		C _L = 15pF	5	-	21	-	-	-	-	-	ns
		C _L = 50pF	6	-	-	43	-	54	-	64	ns

CD74HC4017

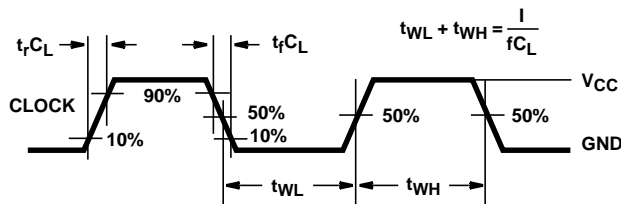
Switching Specifications Input t_r , $t_f = 6\text{ns}$ (Continued)

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	
MR to any Dec. Out	t_{PLH} , t_{PHL}	$C_L = 50\text{pF}$	2	-	-	230	-	290	-	345	ns
		$C_L = 50\text{pF}$	4.5	-	-	46	-	58	-	69	ns
		$C_L = 15\text{pF}$	5	-	19	-	-	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	-	39	-	49	-	59	ns
MR to TC	t_{PLH} , t_{PHL}	$C_L = 50\text{pF}$	2	-	-	230	-	290	-	345	ns
		$C_L = 50\text{pF}$	4.5	-	-	46	-	58	-	69	ns
		$C_L = 15\text{pF}$	5	-	19	-	-	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	-	39	-	49	-	59	ns
Transition Time TC, Dec. Out	t_{TLH} , t_{THL}	$C_L = 50\text{pF}$	2	-	-	75	-	95	-	110	ns
		$C_L = 50\text{pF}$	4.5	-	-	15	-	19	-	22	ns
		$C_L = 50\text{pF}$	6	-	-	13	-	16	-	19	ns
Input Capacitance	C_{IN}	$C_L = 50\text{pF}$	-	-	-	10	-	10	-	10	pF
Maximum CP Frequency	f_{MAX}	$C_L = 15\text{pF}$	5	-	60	-	-	-	-	-	MHz
Power Dissipation Capacitance (Notes 4, 5)	C_{PD}	$C_L = 15\text{pF}$	5	-	39	-	-	-	-	-	pF

NOTES:

4. C_{PD} is used to determine the dynamic power consumption, per package.
5. $P_D = V_{CC}^2 f_i \Sigma C_L V_{CC}^2 f_o$ where f_i = input frequency, f_o = output frequency, C_L = output load capacitance, V_{CC} = supply voltage.

Test Circuits and Waveforms



NOTE: Outputs should be switching from 10% V_{CC} to 90% V_{CC} in accordance with device truth table. For f_{MAX} , input duty cycle = 50%.

FIGURE 1. HC CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH

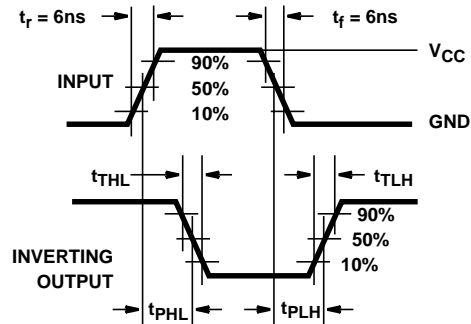


FIGURE 2. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

Test Circuits and Waveforms (Continued)

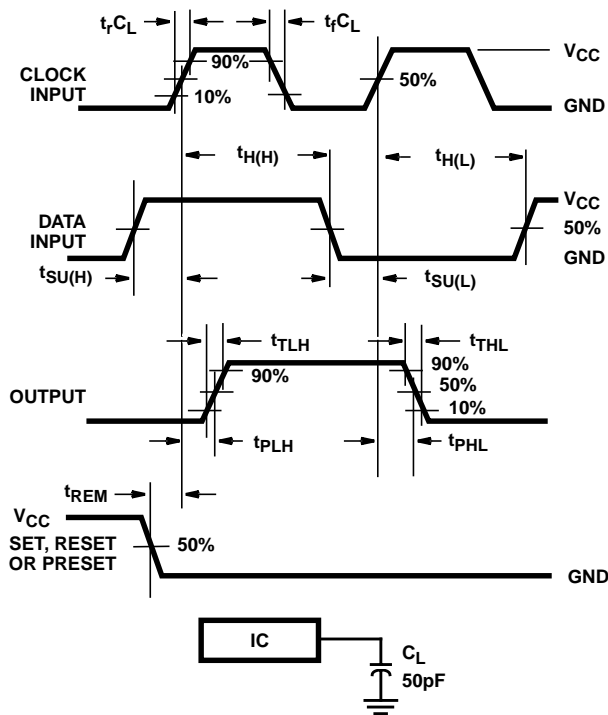


FIGURE 3. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

Timing Diagrams

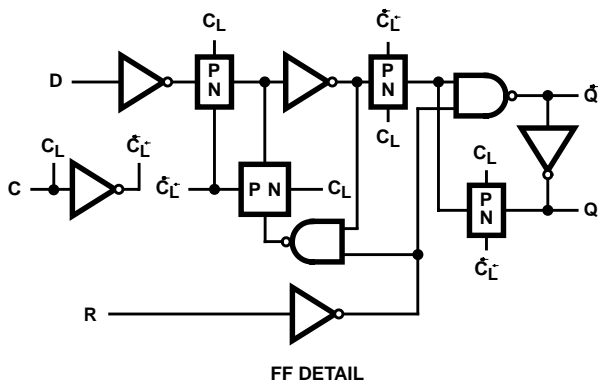


FIGURE 4.

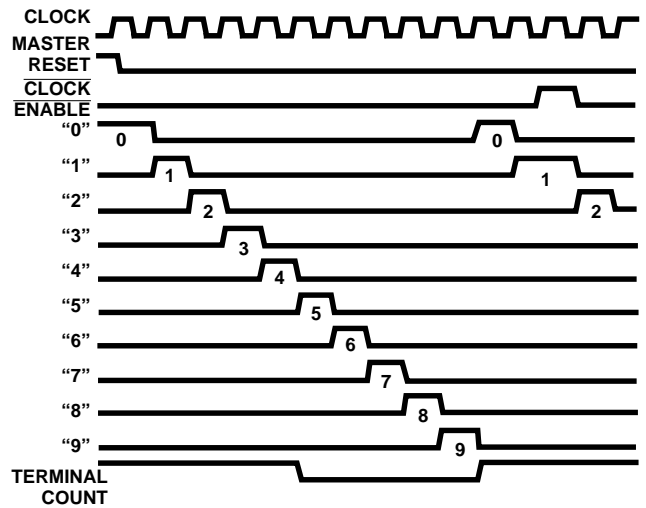


FIGURE 5.

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