

## High-Speed CMOS Logic Digital Phase-Locked Loop

### Features

- Digital Design Avoids Analog Compensation Errors
- Easily Cascadable for Higher Order Loops
- Useful Frequency Range
  - K-Clock ..... DC to 55MHz (Typ)
  - I/D-Clock ..... DC to 35MHz (Typ)
- Dynamically Variable Bandwidth
- Very Narrow Bandwidth Attainable
- Power-On Reset
- Output Capability
  - Standard ..... XORPD<sub>OUT</sub>, ECPD<sub>OUT</sub>
  - Bus Driver ..... I/D<sub>OUT</sub>
- Fanout (Over Temperature Range)
  - Standard Outputs ..... 10 LSTTL Loads
  - Bus Driver Outputs ..... 15 LSTTL Loads
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- 'HC297 Types
  - Operation Voltage ..... 2 to 6V
  - High Noise Immunity N<sub>IL</sub> = 30%, N<sub>IH</sub> = 30% of V<sub>CC</sub> at 5V
- CD74HCT297 Types
  - Operation Voltage ..... 4.5 to 5.5V
  - Direct LSTTL Input Logic Compatibility  
V<sub>IL</sub> = 0.8V (Max), V<sub>IH</sub> = 2V (Min)
  - CMOS Input Compatibility I<sub>I</sub> ≤ 1μA at V<sub>OL</sub>, V<sub>OH</sub>

### Description

The 'HC297 and CD74HCT297 are high-speed silicon gate CMOS devices that are pin-compatible with low power Schottky TTL (LSTTL).

These devices are designed to provide a simple, cost-effective solution to high-accuracy, digital, phase-locked-loop applications. They contain all the necessary circuits, with the exception of the divide-by-N counter, to build first-order phase-locked-loops.

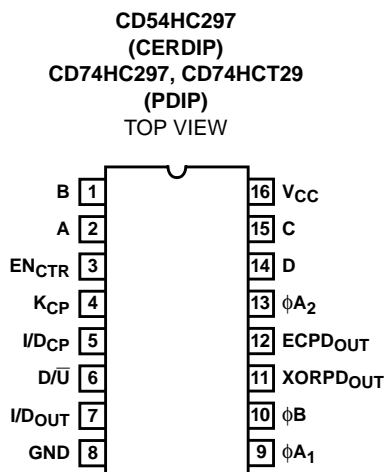
Both EXCLUSIVE-OR (XORPD) and edge-controlled phase detectors (ECPD) are provided for maximum flexibility. The input signals for the EXCLUSIVE-OR phase detector must have a 50% duty factor to obtain the maximum lock-range.

Proper partitioning of the loop function, with many of the building blocks external to the package, makes it easy for the designer to incorporate ripple cancellation (see Figure 2) or to cascade to higher order phase-locked-loops.

The length of the up/down K-counter is digitally programmable according to the K-counter function table. With A, B, C and D all LOW, the K-counter is disabled. With A HIGH and B, C and D LOW, the K-counter is only three stages long, which widens the bandwidth or capture range and shortens the lock time of the loop. When A, B, C and D are all programmed HIGH, the K-counter becomes seventeen stages long, which narrows the bandwidth or capture range and lengthens the lock time. Real-time control of loop bandwidth by manipulating the A to D inputs can maximize the overall performance of the digital phase-locked-loop.

The 'HC297 and CD74HCT297 can perform the classic first order phase-locked-loop function without using analog components. The accuracy of the digital phase-locked-loop (DPLL) is not affected by V<sub>CC</sub> and temperature variations but depends solely on accuracies of the K-clock and loop propagation delays.

### Pinout



### Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54HC297F3A	-55 to 125	16 Ld CERDIP
CD74HC297E	-55 to 125	16 Ld PDIP
CD74HCT297E	-55 to 125	16 Ld PDIP

The phase detector generates an error signal waveform that, at zero phase error, is a 50% duty factor square wave. At the limits of linear operation, the phase detector output will be either HIGH or LOW all of the time depending on the direction of the phase error ( $\phi_{IN} - \phi_{OUT}$ ). Within these limits the phase detector output varies linearly with the input phase error according to the gain  $K_d$ , which is expressed in terms of phase detector output per cycle or phase error. The phase detector output can be defined to vary between  $\pm 1$  according to the relation:

$$\text{phase detector output} = \frac{\% \text{HIGH} - \% \text{LOW}}{100}$$

The output of the phase detector will be  $K_d \phi_e$ , where the phase error  $\phi_e = \phi_{IN} - \phi_{OUT}$ .

EXCLUSIVE-OR phase detectors (XORPD) and edge-controlled phase detectors (ECPD) are commonly used digital types. The ECPD is more complex than the XORPD logic function but can be described generally as a circuit that changes states on one of the transitions of its inputs. The gain ( $K_d$ ) for an XORPD is 4 because its output remains HIGH (XORPD<sub>OUT</sub> = 1) for a phase error of one quarter cycle.

Similarly,  $K_d$  for the ECPD is 2 since its output remains HIGH for a phase error of one half cycle. The type of phase detector will determine the zero-phase-error point, i.e., the phase separation of the phase detector inputs for a  $\phi_e$  defined to be zero. For the basic DPLL system of Figure 3,  $\phi_e = 0$  when the phase detector output is a square wave.

The XORPD inputs are one quarter cycle out-of-phase for zero phase error. For the ECPD,  $\phi_e = 0$  when the inputs are one half cycle out of phase.

The phase detector output controls the up/down input to the K-counter. The counter is clocked by input frequency  $Mf_c$  which is a multiple M of the loop center frequency  $f_c$ . When the K-counter recycles up, it generates a carry pulse. Recycling while counting down generates a borrow pulse. If the carry and the borrow outputs are conceptually combined into one output that is positive for a carry and negative for a borrow, and if the K-counter is considered as a frequency divider with the ratio  $Mf_c/K$ , the output of the K-counter will equal the input frequency multiplied by the division ratio. Thus the output from the K-counter is  $(K_d \phi_e Mf_c)/K$ .

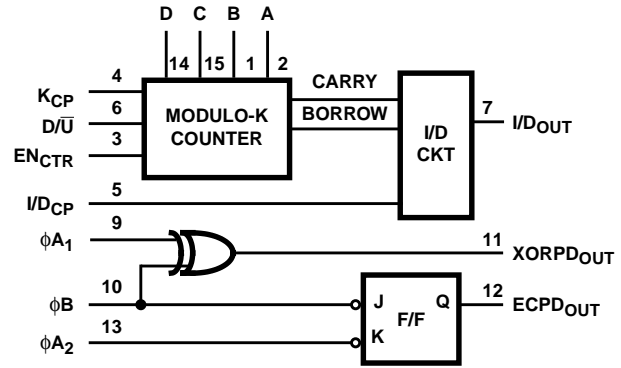
The carry and borrow pulses go to the increment/decrement (I/D) circuit which, in the absence of any carry or borrow pulses has an output that is one half of the input clock ( $I/D_{CP}$ ). The input clock is just a multiple,  $2N$ , of the loop center frequency. In response to a carry or borrow pulse, the I/D circuit will either add or delete a pulse at  $I/D_{OUT}$ . Thus the output of the I/D circuit will be  $Nf_c + (K_d \phi_e Mf_c)/2K$ .

The output of the N-counter (or the output of the phase-locked-loop) is thus:  $f_o = f_c + (K_d \phi_e Mf_c)/2KN$ .

If this result is compared to the equation for a first-order analog phase-locked-loop, the digital equivalent of the gain of the VCO is just  $Mf_c/2KN$  or  $f_c/K$  for  $M = 2N$ .

Thus, the simple first-order phase-locked-loop with an adjustable K-counter is the equivalent of an analog phase-locked-loop with a programmable VCO gain.

## Functional Diagram



FUNCTION TABLE  
EXCLUSIVE-OR PHASE DETECTOR

$\phi A_1$	$\phi B$	XORPD OUT
L	L	L
L	H	H
H	L	H
H	H	L

FUNCTION TABLE  
EDGE-CONTROLLED PHASE DETECTOR

$\phi A_2$	$\phi B$	ECPD OUT
H or L	↓	H
↓	H or L	L
H or L	↑	No Change
↑	H or L	No Change

H = Steady-State High Level, L = Steady-State Low Level, ↑ = LOW to HIGH  $\phi$  Transition, ↓ = HIGH to LOW  $\phi$  Transition

K-COUNTER FUNCTION TABLE  
(DIGITAL CONTROL)

D	C	B	A	MODULO (K)
L	L	L	L	Inhibited
L	L	L	H	$2^3$
L	L	H	L	$2^4$
L	L	H	H	$2^5$
L	H	L	L	$2^6$
L	H	L	H	$2^7$
L	H	H	L	$2^8$
L	H	H	H	$2^9$
H	L	L	L	$2^{10}$
H	L	L	H	$2^{11}$
H	L	H	L	$2^{12}$
H	L	H	H	$2^{13}$
H	H	L	L	$2^{14}$
H	H	L	H	$2^{15}$
H	H	H	L	$2^{16}$
H	H	H	H	$2^{17}$

# CD54HC297, CD74HC297, CD74HCT297

## 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 Drain Current, per Output,  $I_O$   
     For  $-0.5V < V_O < V_{CC} + 0.5V$  .....  $\pm 25mA$   
 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,  $I_{CC}$  .....  $\pm 50mA$

## Thermal Information

Thermal Resistance (Typical, Note 1)  $\theta_{JA}$  ( $^{\circ}C/W$ )  
     E (PDIP) Package ..... 67  
 Maximum Junction Temperature .....  $150^{\circ}C$   
 Maximum Storage Temperature Range .....  $-65^{\circ}C$  to  $150^{\circ}C$   
 Maximum Lead Temperature (Soldering 10s) .....  $300^{\circ}C$

## 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:

1. The package thermal impedance is calculated in accordance with JESD 51-7.

## DC Electrical Specifications

PARAMETER	SYMBOL	TEST CONDITIONS		V <sub>CC</sub> (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS	
		V <sub>I</sub> (V)	I <sub>O</sub> (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX		
HC TYPES													
High Level Input Voltage	V <sub>IH</sub>	-	-	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 <sub>IL</sub>	-	-	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 <sub>OH</sub>	V <sub>IH</sub> or V <sub>IL</sub>	-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			-6 (Note 2)	4.5	3.98	-	-	3.84	-	3.7	-	V	
			-7.8 (Note 2)	6	5.48	-	-	5.34	-	5.2	-	V	
Low Level Output Voltage CMOS Loads			V <sub>OL</sub>	V <sub>IH</sub> or V <sub>IL</sub>	0.02	2	-	-	0.1	-	0.1	-	0.1
	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	4 (Note 2)			4.5	-	-	0.26	-	0.33	-	0.4	V
		5.2 (Note 2)			6	-	-	0.26	-	0.33	-	0.4	V

**CD54HC297, CD74HC297, CD74HCT297**

**DC Electrical Specifications (Continued)**

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	
Input Leakage Current	$I_I$	$V_{CC}$ or GND	-	6	-	-	$\pm 0.1$	-	$\pm 1$	-	$\pm 1$	$\mu A$
Quiescent Device Current	$I_{CC}$	$V_{CC}$ or GND	0	6	-	-	8	-	80	-	160	$\mu A$
<b>HCT TYPES</b>												
High Level Input Voltage	$V_{IH}$	-	-	4.5 to 5.5	2	-	-	2	-	2	-	V
Low Level Input Voltage	$V_{IL}$	-	-	4.5 to 5.5	-	-	0.8	-	0.8	-	0.8	V
High Level Output Voltage CMOS Loads	$V_{OH}$	$V_{IH}$ or $V_{IL}$	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
High Level Output Voltage TTL Loads			-4	4.5	3.98	-	-	3.84	-	3.7	-	V
Low Level Output Voltage CMOS Loads	$V_{OL}$	$V_{IH}$ or $V_{IL}$	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads			4	4.5	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	$I_I$	$V_{CC}$ to GND	0	5.5	-	-	$\pm 0.1$	-	$\pm 1$	-	$\pm 1$	$\mu A$
Quiescent Device Current	$I_{CC}$	$V_{CC}$ or GND	0	5.5	-	-	8	-	80	-	160	$\mu A$
Additional Quiescent Device Current Per Input Pin: 1 Unit Load	$\Delta I_{CC}$ (Note 2)	$V_{CC}$ -2.1	-	4.5 to 5.5	-	100	360	-	450	-	490	$\mu A$

NOTE:

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

**HCT Input Loading Table**

INPUT	UNIT LOADS
$EN_{CTR}$ , D/ $\bar{U}$	0.3
A, B, C, D, $K_{CP}$ , $\phi A_2$	0.6
$I/D_{CP}$ , $\phi A_1$ , $\phi B$	1.5

NOTE: Unit Load is  $\Delta I_{CC}$  limit specified in DC Electrical Specifications table, e.g., 360 $\mu A$  max at 25°C.

**CD54HC297, CD74HC297, CD74HCT297**

**Prerequisite For Switching Function**

PARAMETER	SYMBOL	V <sub>CC</sub> (V)	25°C		-40°C TO 85°C		-55°C TO 125°C		UNITS
			MIN	MAX	MIN	MAX	MIN	MAX	
HC TYPES									
Maximum Clock Frequency K <sub>CP</sub>	f <sub>MAX</sub>	2	6	-	5	-	4	-	MHz
		4.5	30	-	24	-	20	-	MHz
		6	35	-	28	-	24	-	MHz
Maximum Clock Frequency I/D <sub>CP</sub>	f <sub>MAX</sub>	2	4	-	3	-	2	-	MHz
		4.5	20	-	16	-	13	-	MHz
		6	24	-	19	-	15	-	MHz
Clock Pulse Width K <sub>CP</sub>	t <sub>w</sub>	2	80	-	100	-	120	-	ns
		4.5	16	-	20	-	24	-	ns
		6	14	-	17	-	20	-	ns
Clock Pulse Width I/D <sub>CP</sub>	t <sub>w</sub>	2	125	-	155	-	190	-	ns
		4.5	25	-	31	-	38	-	ns
		6	21	-	26	-	32	-	ns
Set-up Time D/ $\bar{U}$ , EN <sub>CTR</sub> to K <sub>CP</sub>	t <sub>SU</sub>	2	100	-	125	-	150	-	ns
		4.5	20	-	25	-	30	-	ns
		6	17	-	21	-	26	-	ns
Hold Time D/ $\bar{U}$ , EN <sub>CTR</sub> to K <sub>CP</sub>	t <sub>H</sub>	2	0	-	0	-	0	-	ns
		4.5	0	-	0	-	0	-	ns
		6	0	-	0	-	0	-	ns
HCT TYPES									
Maximum Clock Frequency K <sub>CP</sub>	f <sub>MAX</sub>	4.5	30	-	24	-	20	-	MHz
Maximum Clock Frequency I/D <sub>CP</sub>	f <sub>MAX</sub>	4.5	20	-	16	-	13	-	MHz
Clock Pulse Width K <sub>CP</sub>	t <sub>w</sub>	4.5	16	-	20	-	24	-	ns
Clock Pulse Width I/D <sub>CP</sub>	t <sub>w</sub>	4.5	25	-	31	-	38	-	ns
Set-up Time D/ $\bar{U}$ , EN <sub>CTR</sub> to K <sub>CP</sub>	t <sub>SU</sub>	4.5	20	-	25	-	30	-	ns
Hold Time D/ $\bar{U}$ , EN <sub>CTR</sub> to K <sub>CP</sub>	t <sub>H</sub>	4.5	0	-	0	-	0	-	ns

**Switching Specifications** Input t<sub>r</sub>, t<sub>f</sub> = 6ns

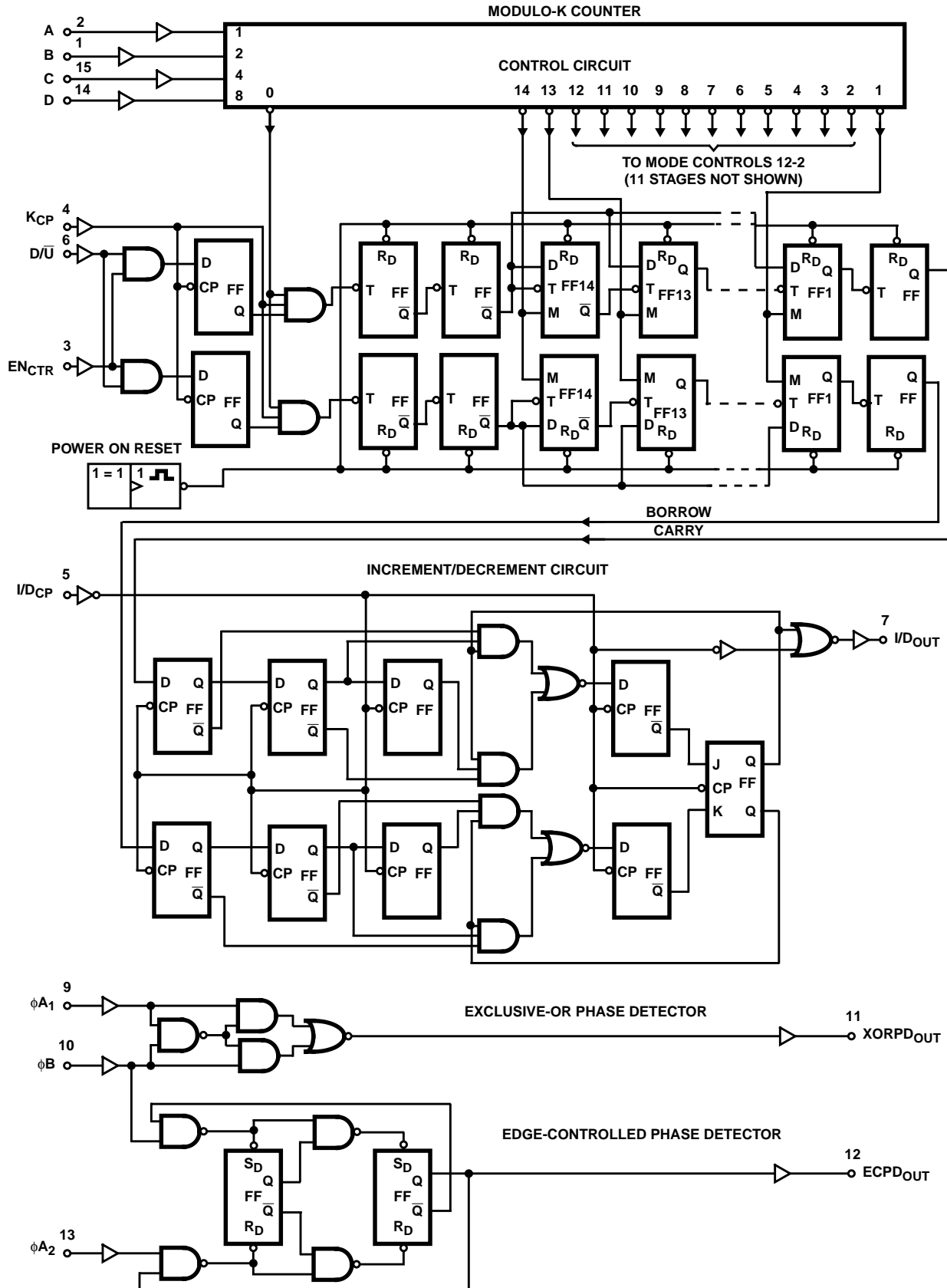
PARAMETER	SYMBOL	TEST CONDITIONS	V <sub>CC</sub> (V)	25°C		-40°C TO 85°C	-55°C TO 125°C	UNITS
				TYP	MAX	MAX	MAX	
HC TYPES								
Propagation Delay, I/D <sub>CP</sub> to I/D <sub>OUT</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>	C <sub>L</sub> = 50pF	2	-	175	220	265	ns
			4.5	-	35	44	53	ns
			6	-	30	34	43	ns

# **CD54HC297, CD74HC297, CD74HCT297**

## **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
				TYP	MAX	MAX	MAX	
Propagation Delay, $\phi A_1, \phi B$ to XORPD <sub>OUT</sub>	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	2	-	150	190	225	ns
			4.5	-	30	38	45	ns
			6	-	26	33	38	ns
Propagation Delay, $\phi B, \phi A_2$ to ECPD <sub>OUT</sub>	$t_{PHL}, t_{PHL}$	$C_L = 50\text{pF}$	2	-	200	250	300	ns
			4.5	-	40	50	60	ns
			6	-	34	43	51	ns
Output Transition Time XORPD <sub>OUT</sub> ECPD <sub>OUT</sub>	$t_{TLH}$	$C_L = 50\text{pF}$	2	-	75	95	110	ns
			4.5	-	15	19	22	ns
			6	-	13	16	19	ns
Output Transition Time I/D <sub>OUT</sub>	$t_{TLH}$	$C_L = 50\text{pF}$	2	-	60	75	90	ns
			4.5	-	12	15	18	ns
			6	-	10	13	15	ns
Input Capacitance	$C_I$	-	-	-	10	10	10	pF
<b>HCT TYPES</b>								
Propagation Delay, I/D <sub>CP</sub> to I/D <sub>OUT</sub>	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	4.5	-	35	44	53	ns
Propagation Delay, $\phi A_1, \phi B$ to XORPD <sub>OUT</sub>	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	4.5	-	30	38	45	ns
Propagation Delay, $\phi B, \phi A_2$ to ECPD <sub>OUT</sub>	$t_{PHL}, t_{PHL}$	$C_L = 50\text{pF}$	4.5	-	40	50	60	ns
Output Transition Time XORPD <sub>OUT</sub>	$t_{TLH}$	$C_L = 50\text{pF}$	4.5	-	15	19	22	ns
Output Transition Time ECPD <sub>OUT</sub>	$t_{TLH}$	$C_L = 50\text{pF}$	4.5	-	12	15	18	ns
Input Capacitance	$C_I$	-	-	-	10	10	10	pF

# Logic Diagram



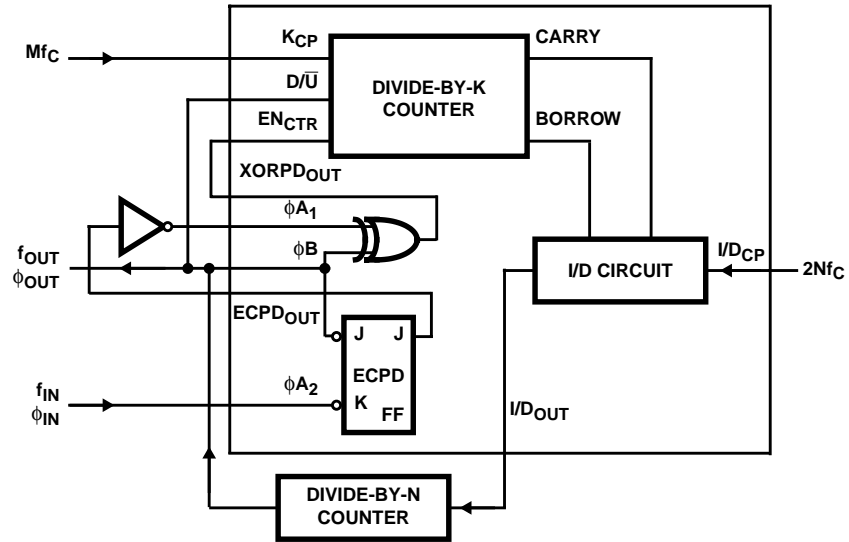


FIGURE 1. DPLL USING BOTH PHASE DETECTORS IN A RIPPLE-CANCELLATION SCHEME

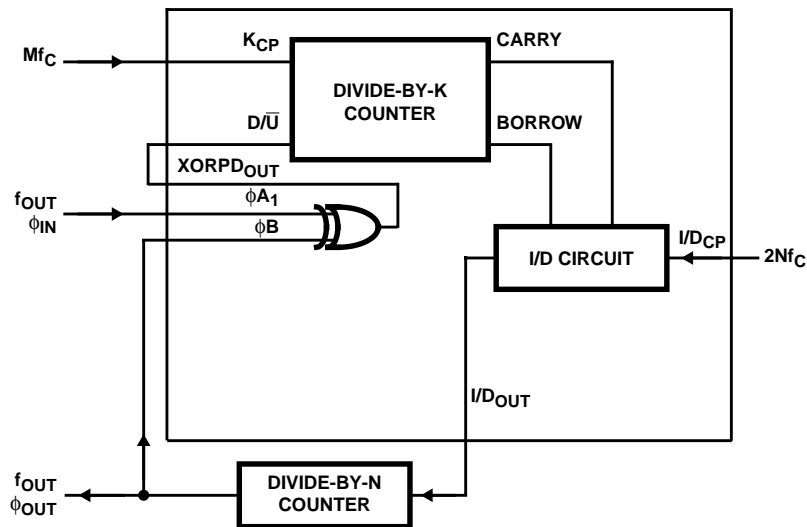


FIGURE 2. DPLL USING EXCLUSIVE-OR PHASE DETECTION

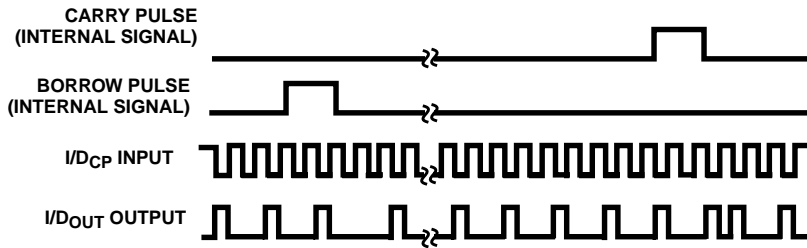


FIGURE 3. TIMING DIAGRAM:  $I/D_{OUT}$  IN-LOCK CONDITION



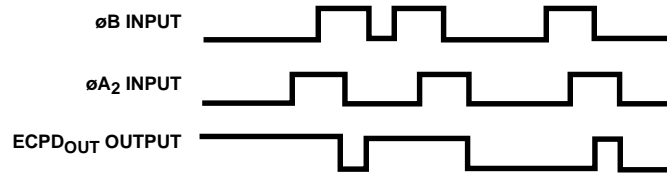


FIGURE 4. TIMING DIAGRAM: EDGE CONTROLLED PHASE COMPARATOR WAVEFORMS

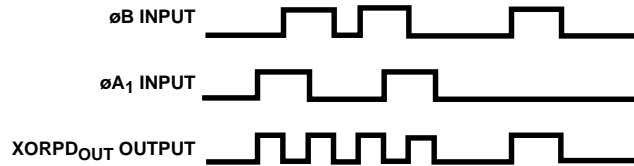


FIGURE 5. TIMING DIAGRAM: EXCLUSIVE OR PHASE DETECTOR WAVEFORMS

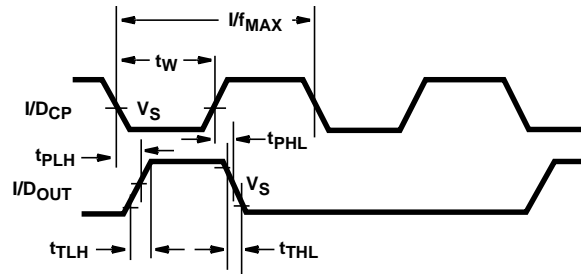


FIGURE 6. WAVEFORMS SHOWING THE CLOCK ( $I/D_{CP}$ ) TO OUTPUT ( $I/D_{OUT}$ ) PROPAGATION DELAYS, CLOCK PULSE WIDTH, OUTPUT TRANSITION TIMES AND MAXIMUM CLOCK PULSE FREQUENCY

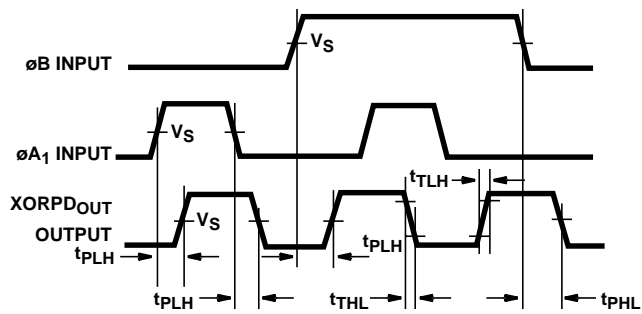


FIGURE 7. WAVEFORMS SHOWING THE PHASE INPUT ( $\phi B$ ,  $\phi A_1$ ) TO OUTPUT (XORPD<sub>OUT</sub>) PROPAGATION DELAYS AND OUTPUT TRANSITION TIMES

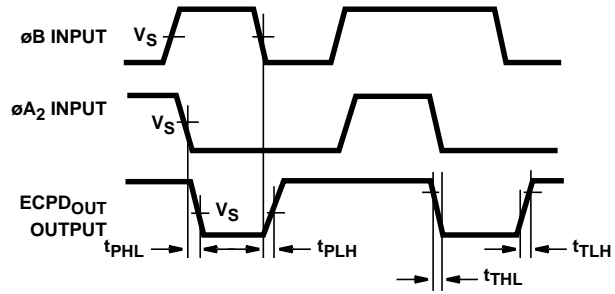
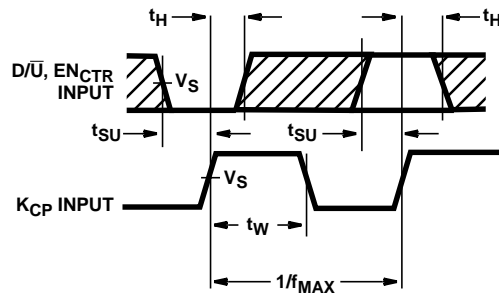


FIGURE 8. WAVEFORMS SHOWING THE PHASE INPUT ( $\phi B$ ,  $\phi A_2$ ) TO OUTPUT (ECPD<sub>OUT</sub>) PROPAGATION DELAYS AND OUTPUT TRANSITION TIMES



NOTE: The shaded areas indicate when the input is permitted to change for predictable output performance.

FIGURE 9. WAVEFORMS SHOWING THE CLOCK (K<sub>CP</sub>) PULSE WIDTH AND MAXIMUM CLOCK PULSE FREQUENCY, AND THE INPUT (D/ $\bar{U}$ , EN<sub>CTR</sub>) TO CLOCK (K<sub>CP</sub>) SETUP AND HOLD TIMES

## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">5962-8999001EA</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8999001EA CD54HC297F3A
<a href="#">CD54HC297F3A</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8999001EA CD54HC297F3A
CD54HC297F3A.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8999001EA CD54HC297F3A
<a href="#">CD74HC297E</a>	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74HC297E
CD74HC297E.A	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74HC297E
<a href="#">CD74HCT297E</a>	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74HCT297E
CD74HCT297E.A	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74HCT297E

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**OTHER QUALIFIED VERSIONS OF CD54HC297, CD74HC297 :**

- Catalog : [CD74HC297](#)
- Military : [CD54HC297](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

## TUBE



\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
CD74HC297E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HC297E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HC297E.A	N	PDIP	16	25	506	13.97	11230	4.32
CD74HC297E.A	N	PDIP	16	25	506	13.97	11230	4.32
CD74HCT297E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HCT297E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HCT297E.A	N	PDIP	16	25	506	13.97	11230	4.32
CD74HCT297E.A	N	PDIP	16	25	506	13.97	11230	4.32

J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



4040049/E 12/2002

NOTES:

- A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

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