

## CMOS DECADE COUNTER/DIVIDER

### FEATURES

- ◆ 10 Decoded Decimal Outputs
- ◆ Direct Reset
- ◆ Trigger from either Edge of Clock Input
- ◆ Carry Output for Cascading Stages
- ◆ Fully Static Operation—DC to 12MHz @ 10Vdc

### DESCRIPTION

The 4017B consists of a 5-stage Johnson Decade Counter and an Output Decoder. Inputs include Clock, Reset, and Clock Enable signals.

The counter has interchangeable Clock and Clock Enable lines for incrementing on either a positive-going or negative-going transition, respectively. A high Reset signal clears the counter to its zero count.

Use of the Johnson decade counter configuration permits high-speed operation, 2-input decode gating, and spike-free decoded outputs. Anti-lock gating is provided, thus assuring proper counting sequence. The 10 decoded outputs are normally low and go high only at their respective decoded time slot. Each decoded output remains high for one full clock cycle. A Carry-out (COUT) signal completes one cycle every 10 clock input cycles and is used to directly clock the succeeding counter in multi-stage applications.

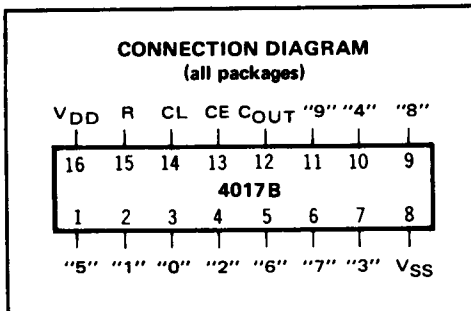
This part can be used in frequency division circuits as well as decade counter or decimal decode display applications.

**FUNCTIONAL TRUTH TABLE**  
(Positive Logic)

Clock	Clock Enable	Reset	Decode Output = n
0	X	0	n
X	1	0	n
X	X	1	"0"
	0	0	n + 1
	X	0	n
X		0	n
1		0	n + 1

x = Don't Care

If  $n < 5$  Carry = "1", Otherwise = "0"

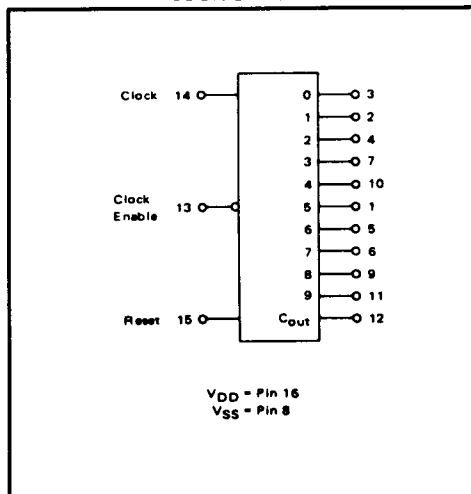


### RECOMMENDED OPERATING CONDITIONS

For maximum reliability:

DC Supply Voltage	$V_{DD} - V_{SS}$	3 to 15	Vdc
Operating Temperature	$T_A$		
C, D, F, H Device		-55 to +125	°C
E Device		-40 to +85	°C

### BLOCK DIAGRAM



## ELECTRICAL CHARACTERISTICS

STATIC CHARACTERISTICS <sup>1</sup>

PARAMETER	V <sub>DD</sub> (Vdc)	CONDITIONS	T <sub>LOW</sub> <sup>2</sup>		+25°C			T <sub>HIGH</sub> <sup>2</sup>		Units	
			Min.	Max.	Min.	Typ.	Max.	Min.	Max.		
QUIESCENT DEVICE CURRENT	I <sub>DD</sub>	5	V <sub>IN</sub> =V <sub>SS</sub> or V <sub>DD</sub>	–	5	–	0.05	5	–	150	μAdc
		10	All valid input	–	10	–	0.1	10	–	300	
		15	combinations	–	20	–	0.2	20	–	600	

NOTES: <sup>1</sup> Remaining Static Electrical Characteristics are listed under "4000B Series Family Specifications".

<sup>2</sup> T<sub>LOW</sub> = -55°C for C, D, F, H device.  
 = -40°C for E device.  
 T<sub>HIGH</sub> = +125°C for C, D, F, H device.  
 = + 85°C for E device.

## ELECTRICAL CHARACTERISTICS

DYNAMIC CHARACTERISTICS ( $C_L = 50\text{pF}$ ,  $T_A = 25^\circ\text{C}$ )

PARAMETER		$V_{DD}$ (Vdc)	Min.	Typ.	Max.	Units	
<b>CLOCKED OPERATION</b>							
PROPAGATION DELAY TIME To Decoded Outputs	$t_{PLH}, t_{PHL}$	5	--	350	700	ns	
		10	--	200	400		
		15	--	150	300		
	To Carry Output	$t_{PLH}, t_{PHL}$	5	--	325	650	ns
			10	--	175	350	
			15	--	125	250	
OUTPUT TRANSITION TIME Decoded Outputs	$t_{TLH}, t_{THL}$	5	--	100	200	ns	
		10	--	50	100		
		15	--	40	80		
	Carry Output	$t_{TLH}, t_{THL}$	5	--	100	200	ns
			10	--	50	100	
			15	--	40	80	
MINIMUM CLOCK PULSE WIDTH	$PW_{CL}$	5	--	100	200	ns	
		10	--	40	70		
		15	--	30	60		
MAXIMUM CLOCK FREQUENCY	$f_{CL}$	5	2.5	5.0	--	MHz	
		10	7.0	12.0	--		
		15	9.3	16.0	--		
MAXIMUM CLOCK OR ENABLE RISE AND FALL TIME	$t_{rCL}, t_{fCL}$	5	NO LIMIT				
		10					
		15					
MINIMUM ENABLE SETUP TIME	$t_{setup}$	5	--	100	300	ns	
		10	--	50	100		
		15	--	35	70		
MINIMUM ENABLE REMOVAL TIME	$t_{rem}$	5	--	250	500	ns	
		10	--	100	200		
		15	--	75	150		
<b>RESET OPERATION</b>							
PROPAGATION DELAY TIME To Decoded Outputs	$t_{PLH}, t_{PHL}$	5	--	325	650	ns	
		10	--	175	350		
		15	--	125	250		
	To Carry Output	$t_{PLH}, t_{PHL}$	5	--	325	650	ns
			10	--	175	350	
			15	--	125	250	
MINIMUM RESET PULSE WIDTH	$PW_R$	5	--	150	300	ns	
		10	--	75	150		
		15	--	60	120		
RESET REMOVAL TIME	$t_{rem}$	5	--	250	500	ns	
		10	--	100	200		
		15	--	80	160		

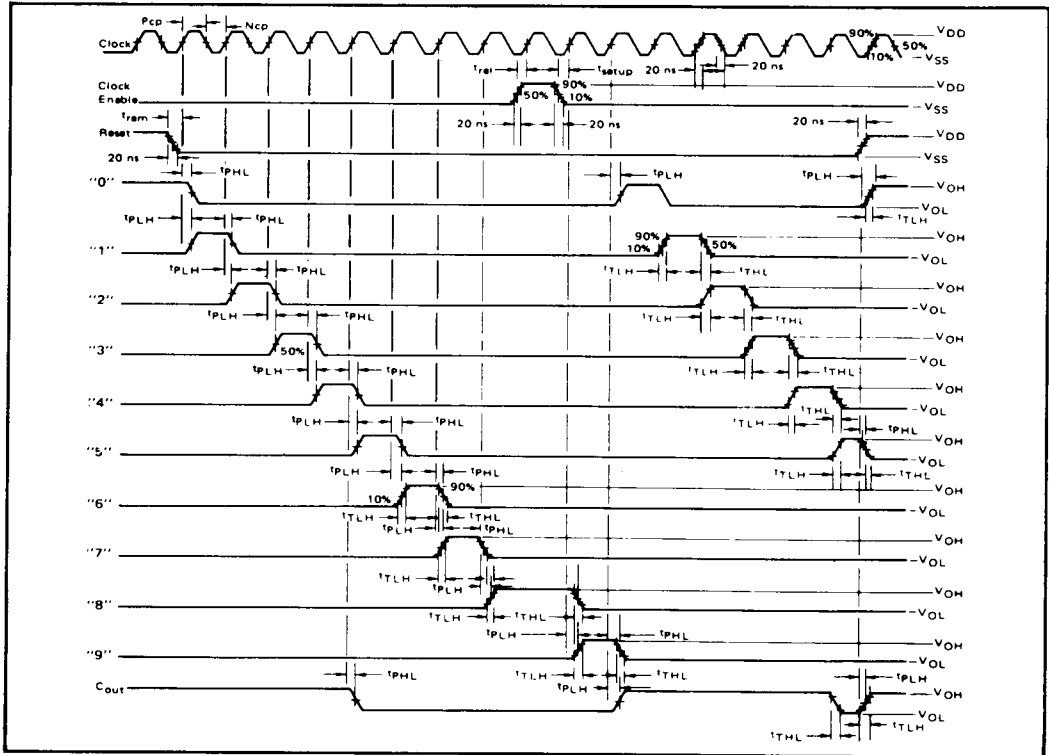
STATIC CHARACTERISTICS<sup>1</sup>

PARAMETER	$V_{DD}$	CONDITIONS	$T_{LOW}^2$		25°C			$T_{HIGH}^2$		Units
			Min	Max	Min	Typ	Max	Min	Max	
QUIESCENT DEVICE CURRENT	5 10 15	$V_{IN} = V_{SS}$ or $V_{DD}$ All Valid Input Combinations	--	5 10 20	--	--	5 10 20	--	150 300 600	$\mu\text{A}_{dc}$

NOTES: <sup>1</sup> Remaining Static Electrical Characteristics are listed under "4000B Series Family Specifications"

<sup>2</sup>  $T_{LOW} = -55^\circ\text{C}$  for C, D, F, H devices.  
 $= -40^\circ\text{C}$  for E devices.  
 $T_{HIGH} = +125^\circ\text{C}$  for C, D, F, H devices.  
 $= +85^\circ\text{C}$  for E devices.

AC MEASUREMENT DEFINITION AND FUNCTIONAL WAVEFORMS



LOGIC DIAGRAM

