CD4020B, CD4024B, CD4040B Types

CMOS Ripple-Carry Binary Counter/Dividers

High-Voltage Types (20-Volt Rating)

CD4020B – 14 Stage
CD4024B – 7 Stage
CD4040B – 12 Stage

■ CD4020B, CD4024B, and CD4040B are ripple-carry binary counters. All counter stages are master-slave flip-flops. The state of a counter advances one count on the negative transition of each input pulse; a high level on the RESET line resets the counter to its all zeros state. Schmitt trigger action on the input-pulse line permits unlimited rise and fall times. All inputs and outputs are buffered.

The CD4020B and CD4040B types are supplied in 16-lead hermetic dual-in-line ceramic packages (D and F suffixes), 16-lead dual-in-line plastic packages (E suffix), 16-lead ceramic flat packages (K suffix), and in chip form (H suffix).

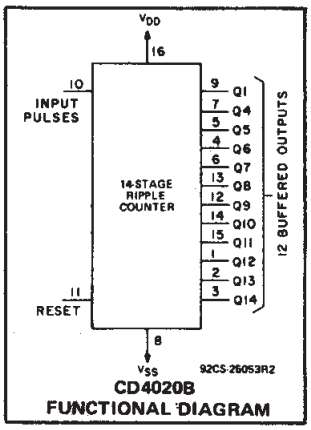
The CD4024B types are supplied in 14-lead hermetic dual-in-line ceramic packages (D and F suffixes), 14-lead dual-in-line plastic packages (E suffix), and in chip form (H suffix).

Features:

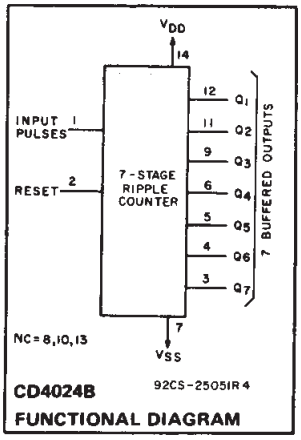
- Medium-speed operation
- Fully static operation
- Buffered inputs and outputs
- 100% tested for quiescent current at 20 V
- Standardized, symmetrical output characteristics
- Fully static operation
- Common reset
- 5-V, 10-V, and 15-V parametric ratings
- Maximum input current of 1 μA at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- Noise margin (over full package-temperature range):
  1 V at V_{DD} = 5 V
  2 V at V_{DD} = 10 V
  2.5 V at V_{DD} = 15 V
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

Applications:

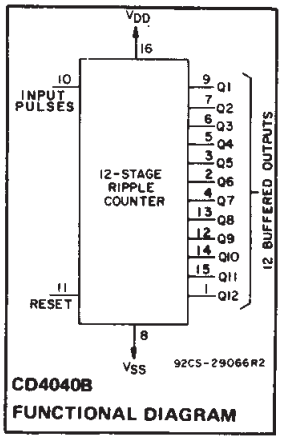
- Control counters
- Timers
- Frequency dividers
- Time-delay circuits



CD4020B
FUNCTIONAL DIAGRAM



CD4024B
FUNCTIONAL DIAGRAM



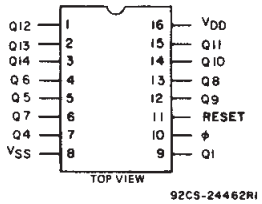
CD4040B
FUNCTIONAL DIAGRAM

MAXIMUM RATINGS, *Absolute-Maximum Values:*

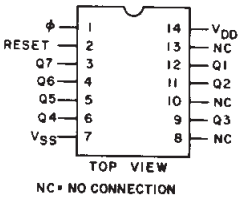
DC SUPPLY-VOLTAGE RANGE, (V_{DD})
(Voltages referenced to V_{SS} Terminal) ..... -0.5V to +20V
INPUT VOLTAGE RANGE, ALL INPUTS ..... -0.5V to V_{DD} +0.5V
DC INPUT CURRENT, ANY ONE INPUT ..... ±10mA
POWER DISSIPATION PER PACKAGE (P_D):
For T_A = -55°C to +100°C 500mW
For T_A = +100°C to +125°C ..... Derate Linearly at 12mW/°C to 200mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR
FOR T_A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types) 100mW
OPERATING-TEMPERATURE RANGE (T_A) ..... -55°C to +125°C
STORAGE TEMPERATURE RANGE (T_{stg}) ..... -65°C to +150°C
LEAD TEMPERATURE (DURING SOLDERING):
At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10s max ..... +265°C

TERMINAL ASSIGNMENTS

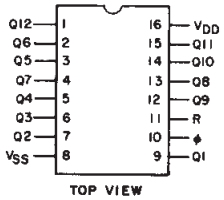
CD4020B



CD4024B



CD4040B



Downloaded from DatasheetLib.com - datasheet search engine

RECOMMENDED OPERATING CONDITIONS at T_A = 25°C, Unless Otherwise Specified

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC		V_{DD}	Min.	Max.	UNITS
Supply Voltage Range (at T_A = Full Package-Temperature Range)			3	18	V
Input-Pulse Frequency,	f_ϕ	5 10 15	– – –	3.5 8 12	MHz
Input-Pulse Width,	t_W	5 10 15	140 60 40	– – –	ns
Input-Pulse Rise or Fall Time,	$t_{r\phi}$, $t_{f\phi}$	5 10 15	Unlimited		μs
Reset Pulse Width,	t_W	5 10 15	200 80 60	–	ns
Reset Removal Time,	t_{REM}	5 10 15	350 150 100	– – –	ns

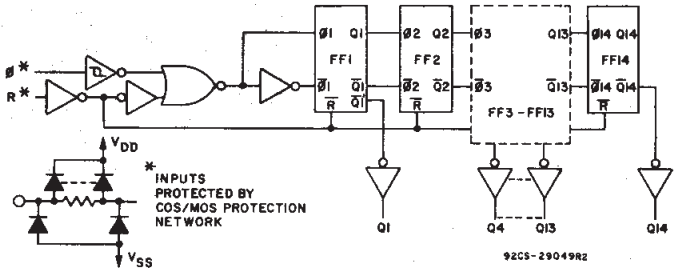


Fig. 1 – Logic diagram for CD4020B.

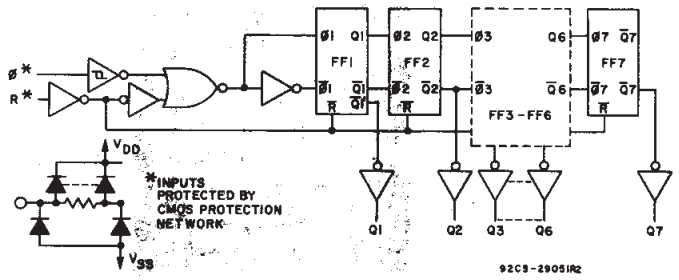


Fig. 2 – Logic diagram for CD4024B.

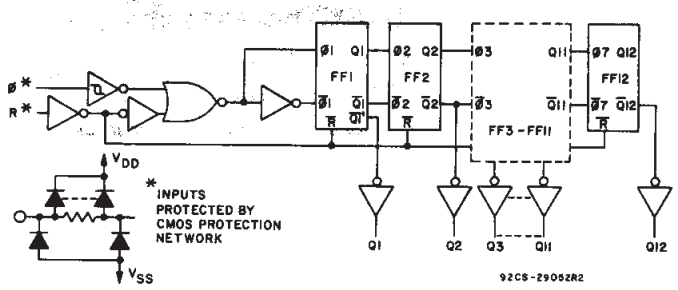


Fig. 3 – Logic diagram for CD4040B.

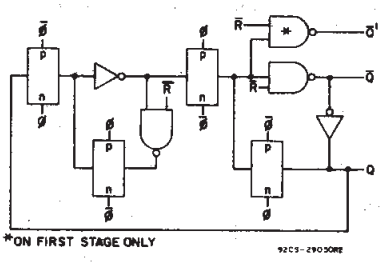


Fig. 4 – Detail of typical flip-flop stage.

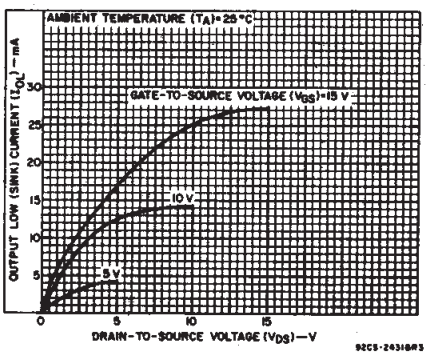


Fig. 5 – Typical output low (sink) current characteristics.

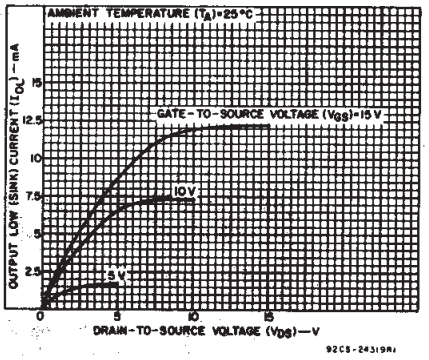


Fig. 6 – Minimum output low (sink) current characteristics.

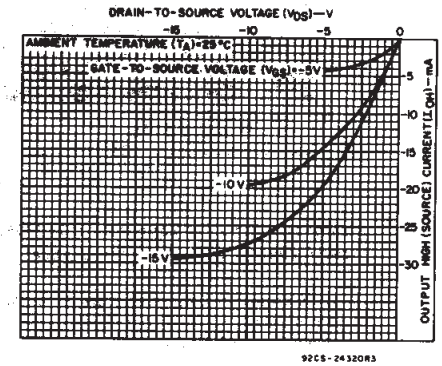


Fig. 7 – Typical output high (source) current characteristics.

Downloaded from DatasheetLib.com - datasheet search engine

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
								+25			
	V_O (V)	V_{IN} (V)	V_{DD} (V)	−55	−40	+85	+125	Min.	Typ.	Max.	
Quiescent Device Current, I_{DD} Max.	–	0,5	5	5	5	150	150	–	0.04	5	μA
	–	0,10	10	10	10	300	300	–	0.04	10	
	–	0,15	15	20	20	600	600	–	0.04	20	
	–	0,20	20	100	100	3000	3000	–	0.08	100	
Output Low (Sink) Current I_{OL} Min.	0.4	0,5	5	0.64	0.61	0.42	0.36	0.51	1	–	mA
	0.5	0,10	10	1.6	1.5	1.1	0.9	1.3	2.6	–	
	1.5	0,15	15	4.2	4	2.8	2.4	3 4	6.8	–	
Output High (Source) Current, I_{OH} Min.	4.6	0,5	5	−0.64	−0.61	−0.42	−0.36	−0.51	−1	–	
	2.5	0,5	5	−2	−1.8	−1.3	−1.15	−1.6	−3.2	–	
	9.5	0,10	10	−1.6	−1.5	−1.1	−0.9	−1.3	−2.6	–	
	13.5	0,15	15	−4.2	−4	−2.8	−2.4	−3.4	−6.8	–	
Output Voltage: Low-Level, V_{OL} Max.	–	0,5	5	0.05				–	0	0.05	V
	–	0,10	10	0.05				–	0	0.05	
	–	0,15	15	0.05				–	0	0.05	
Output Voltage: High-Level, V_{OH} Min.	–	0,5	5	4.95				4.95	5	–	
	–	0,10	10	9.95				9.95	10	–	
	–	0,15	15	14.95				14.95	15	–	
Input Low Voltage, V_{IL} Max.	0.5, 4.5	–	5	1.5				—	—	1.5	V
	1, 9	–	10	3				—	—	3	
	1.5,13.5	–	15	4				—	—	4	
Input High Voltage, V_{IH} Min.	0.5, 4.5	–	5	3.5				3.5	—	—	
	1, 9	–	10	7				7	—	—	
	1.5,13.5	–	15	11				11	—	—	
Input Current I_{IN} Max.	–	0,18	18	±0.1	±0.1	±1	±1	–	$\pm 10^{-5}$	±0.1	μA

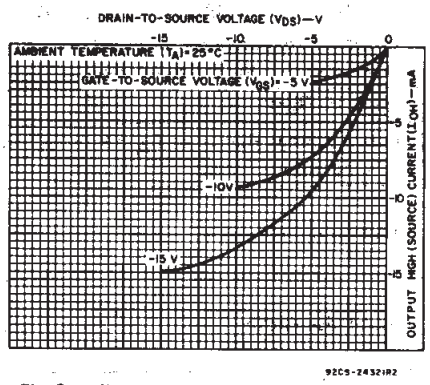


Fig. 8 – Minimum output high (source) current characteristics.

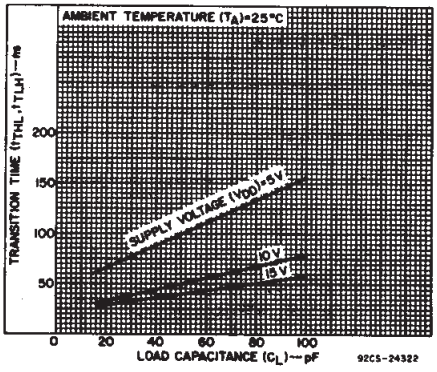
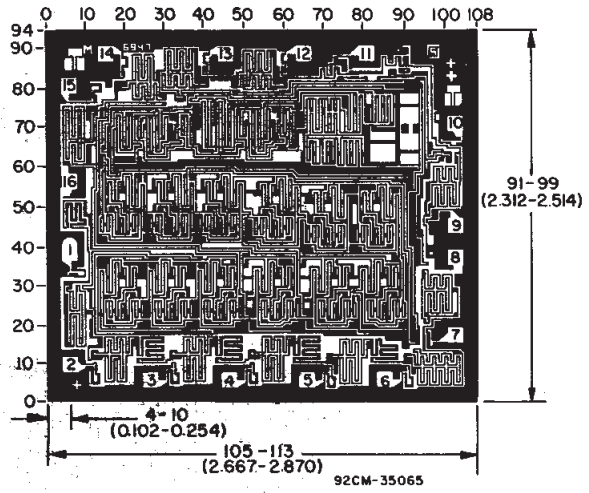
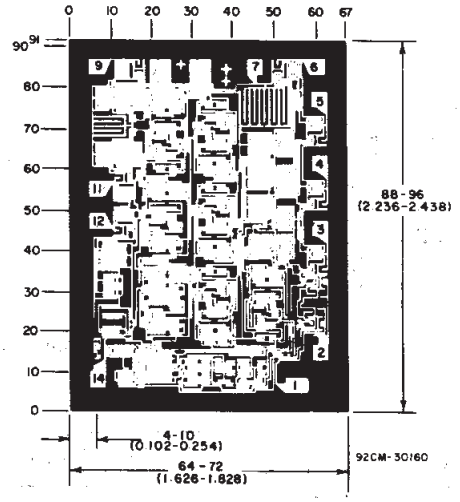


Fig. 9 – Typical transition time as a function of load capacitance.



Dimensions and Pad Layout for CD4020BH. Dimensions and pad layout for CD4040BH are identical.



Dimensions and Pad Layout for CD4024BH.

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10^{-3} inch).

Downloaded from DatasheetLib.com - datasheet search engine

DYNAMIC ELECTRICAL CHARACTERISTICS at T_A = 25°C, Input t_r, t_f = 20 ns, C_L = 50 pF, R_L = 200 kΩ

CHARACTERISTIC	TEST CONDITIONS	V_{DD} (V)	LIMITS Min.	Typ.	Max.	UNITS
Input-Pulse Operation						
Propagation Delay Time, ϕ to Q_1 Out; t_{PHL}, t_{PLH}		5	–	180	360	ns
		10	–	80	160	
		15	–	65	130	
Q_n to Q_n + 1; t_{PHL}, t_{PLH}		5	–	100	330	ns
		10	–	40	80	
		15	–	30	60	
Transition Time, t_{THL}, t_{TLH}		5	–	100	200	ns
		10	–	50	100	
		15	–	40	80	
Minimum Input-Pulse Width, t_W		5	–	70	140	ns
		10	–	30	60	
		15	–	20	40	
Input-Pulse Rise or Fall Time, $t_{r\phi}$, $t_{f\phi}$		5	Unlimited			μs
		10				
		15				
Maximum Input-Pulse Frequency, f_ϕ		5	3.5	7	–	MHz
		10	8	16	–	
		15	12	24	–	
Input Capacitance, C_I	Any Input		–	5	7.5	pF
Reset Operation						
Propagation Delay Time, t_{PHL}		5	–	140	280	ns
		10	–	60	120	
		15	–	50	100	
Minimum Reset Pulse Width, t_W		5	–	100	200	ns
		10	–	40	80	
		15	–	30	60	
Reset Removal Time, t_{REM}		5	–	175	350	ns
		10	–	75	150	
		15	–	50	100	

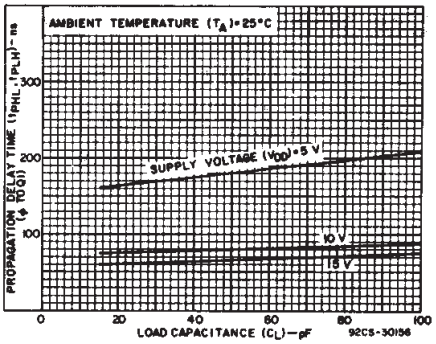


Fig. 10 – Typical propagation delay time as a function of load capacitance (ϕ to Q_1).

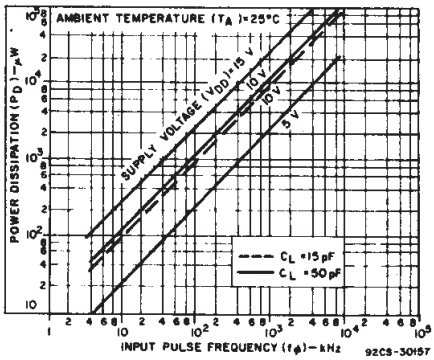


Fig. 11 – Typical dynamic power dissipation as a function of input pulse frequency for CD4020B.

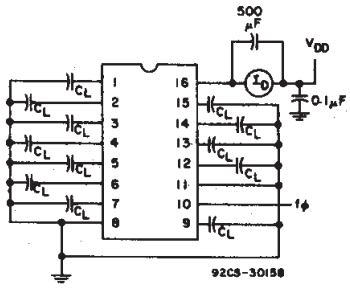


Fig. 12 – Dynamic power dissipation test circuit for CD4020B.

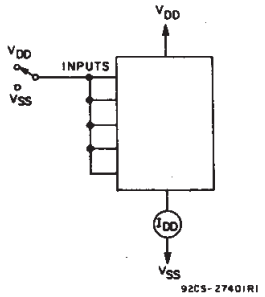


Fig. 13 – Quiescent device current test circuit.

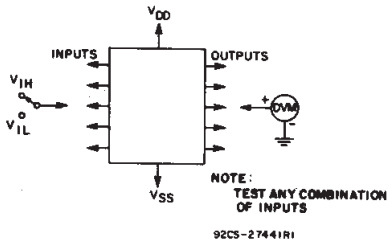


Fig. 14 – Input voltage test circuits.

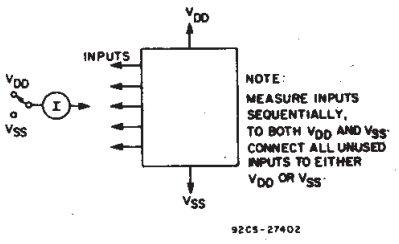


Fig. 15 – Input current test circuit.

Downloaded from DatasheetLib.com - datasheet search engine

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.

Copyright © 1999, Texas Instruments Incorporated

Downloaded from DatasheetLib.com - datasheet search engine