

Index to RCA High-Reliability IC's

High-Voltage CD4000B-Series CMOS IC's
(See pages 27 through 52 for technical data)

Typ No.	Description	No. of Leads	Type No.	Description	No. of Leads
CD4000B	Dual 3-input NOR gate plus inverter	14	CD4052B	4-channel analog multiplexer/ demultiplexer	16
CC4000UB	Dual 3-input NOR gate plus inverter	14	CD4053B	Triple 2-channel analog multiplexer/ demultiplexer	16
CD4001B	Quad 2-input NOR gate	14	CD4060B	14-stage binary ripple counter/ divider and oscillator	16
CC4001UB	Quad 2-input NOR gate	14	CD4063B	4-bit magnitude comparator	16
CD4002B	Dual 4-input NOR gate	14	CD4066B	Quad bilateral switch	14
CC4002UB	Dual 4-input NOR gate	14	CD4067B	16-channel analog multiplexers/ demultiplexers	24
CC4006B	18-stage static shift register	14	CD4068B	8-input NAND/AND gate	14
CC4007UB	Dual complementary pair plus inverter	14	CD4069UB	Hex inverter	14
CC4008B	4-bit full adder with parallel carry-out	16	✓ CD4070B	Quad exclusive-OR gate	14
CC4009UB	Hex buffer/converter (inverting)	16	✓ CD4071B	Quad 2-input OR gate	14
CD4010B	Hex buffer/converter (non-inverting)	16	CD4072B	Dual 4-input OR gate	14
CD4011B	Quad 2-input NAND gate	14	CD4073B	Triple 3-input AND gate	14
CC4011UB	Quad 2-input NAND gate	14	CD4075B	Triple 3-input OR gate	14
CD4012B	Dual 4-input NAND gate	14	CD4076B	4-bit "D" flip-flop (3-state outputs)	14
CD4012UB	Dual 4-input NAND gate	14	CD4077B	Quad exclusive-NOR gate	14
CD4013B	Dual "D" flip-flop with set/reset capability	14	CD4078B	8-input NOR/OR gate	14
CD4014B	8-stage static shift register	16	CD4081B	Quad 2-input AND gate	14
CD4015B	Dual 4-stage static shift register	16	CD4082B	Dual 4-input AND gate	14
CD4016B	Quad bilateral switch	14	CD4085B	Dual 2-wide, 2-input AND/OR INVERT (AO1) gate	14
CD4017B	Decade counter/divider	16	CD4086B	Expandable 4-wide, 2-input AND/OR/INVERT (AO1) gate	14
CD4018B	Presetable divide-by "N" counter	16	CD4089B	Binary rate multiplier	16
CD4019B	Quad AND/OR select gate	16	CD4093B	Quad 2-input NAND Schmitt Trigger	14
CD4020B	14-stage Binary Ripple Counter	16	CD4094B	8-stage shift-and-store bus register	16
CD4021B	8-stage static shift register	16	CD4095B	Gated "J-K" flip-flop (non-inverting)	14
CD4022B	Divide-by-8 counter/divider	16	CD4096B	Gated "J-K" flip-flop (inverting and non-inverting)	14
CD4023B	Triple 3-input NAND gate	14	CD4097B	8-channel analog multiplexer/ demultiplexer	24
CD4023UB	Triple 3-input NAND gate	14	CD4098B	Dual monostable multivibrator	16
CD4024B	7-stage binary ripple counter	14	CD4099B	8-bit addressable latch	16
CD4025B	Triple 3-input NOR gate	14	CD4502B	Strobed hex inverter/buffer	16
CD4025UB	Triple 3-input NOR gate	14	CD4503B	Hex buffer (non-inverting)	16
CD4026B	Decade counter/divider	16	CD4508B	Dual 4-bit latch	24
CD4027B	Dual "J-K" flip-flop with set/reset capability	16	CD4510B	Presetable 4-bit BCD up/down counter	16
CD4028B	BCD-to-decimal decoder	16	CD4511B	BCD-to-7-segment latch decoder/ driver	16
CD4029B	Presetable up/down counter	16	CD4512B	8-channel data selector (3-state output)	16
CD4030B	Quad exclusive-OR gate	14	CD4514B	4-bit latch/4-to-16 line decoder (outputs low)	24
CD4031B	64-stage static shift register	16	CD4515B	4-bit latch/4-to-16 line decoder (outputs low)	24
CD4033B	Decade counter/divider	16	CD4516B	Presetable 4-bit binary up/down counter	16
CD4034B	8-stage static shift register	24	CD4517B	Dual 64-bit shift register	16
CD4035B	4-stage parallel-in/parallel-out shift register	16	CD4518B	Dual BCD up counter	16
CD4040B	12-stage binary ripple counter	16	CD4520B	Dual binary up counter	16
CD4041UB	Quad true/complement buffer	14	CD4527B	BCD rate multiplier	16
CD4042B	Quad clocked "D" latch	16	CD4532B	8-input priority encoder	16
CD4043B	Quad NOR R/S latch (3-state outputs)	16	CD4536B	Programmable timer	16
CD4044B	Quad NAND R/S latch (3-state outputs)	16	CD4538B	Dual precision monostable multivibrator	16
CD4045B	21-stage timer	14	CD4555B	Dual 1-of-4 decoder/demultiplexer (outputs high)	16
CD4046B	Micropower phase-locked loop	16			
CD4047B	Monostable/astable multivibrator	14			
CD4048B	Multifunctional expandable 8-input gate (3-state output)	16			
CD4049UB	Hex buffer/converter (inverting)	16			
CD4050B	Hex buffer/converter (non-inverting)	16			
CD4051B	8-channel analog multiplexer/ demultiplexer	16			

Reliability Levels, Nomenclature and Lot Screening Tests

The term *high reliability* as applied to integrated circuits covers a broad spectrum of reliability classes. These classes were originally defined by device manufacturers based on test methods described in MIL-STD-883, a compendium of quality and conformance tests and later were standardized by the government. MIL-STD-883 establishes uniform methods and procedures for testing microcircuits including basic environmental tests to determine resistance to deleterious effects of natural elements and conditions surrounding military and space operations and physical and electrical tests.

Today, there are both in-house and government-defined reliability classes. The contents of in-house programs vary with the manufacturer. The government program, referred to as MIL-M-38510, consists of a general specification and a detailed specification. This specification establishes the general requirements for microcircuits and the quality- and reliability-assurance requirements that must be met in the procurement of microcircuits. Detailed test requirements and inspections are defined for each device in the appropriate detail specification. The general specification applies to all technologies, such as TTL, ECL, linear and CMOS; the detailed specification delineates the requirements for a circuit function within a technology.

MIL-M-38510 CD4000-Series CMOS IC's

The purpose of the MIL-M-38510 program is to achieve standardization among integrated-circuit suppliers and to assure delivery of devices whose long-term life will satisfy the requirements of the system for which they are intended. Three reliability classes — S, B, and C — are described in MIL-M-38510; the screening tests for these reliability

classes are performed according to MIL-STD-883, Method 5004. Class S devices are of the highest reliability level and are intended for critical applications where replacement of components is not practical.

The qualification and quality conformance tests delineated in MIL-STD-883, Method 5005 are accelerated stress tests that subject devices to stress levels greater than those normally experienced in a typical application. These tests consist of: Group A, Electrical; Group B, Package and Internal Mechanical Strength; Group C, Indicators of Long Term Reliability; and Group D for package and chip. Both qualification devices and a sample of devices from the production line are subjected to this series of accelerated tests. The tests performed on the qualification devices are called qualification tests; the tests performed on production-line devices after a specific type has been qualified are called conformance tests. Electrical end-point limits for the tests are defined by MIL-M-38510 and are more demanding of CMOS than of TTL. DC parameters are measured at -55°C, +25°C, and +125°C.

In summary, then, devices are manufactured in accordance with the MIL-M-38510 (general and detailed) specification, which includes portions of the MIL-STD-883 test method. The device class is determined by the level of inspections, screening, and conformance testing to which the devices are subjected.

CMOS integrated circuits are supplied to MIL-M-38510 under a series of /050 and /170 numbers. Detailed ratings and characteristics for these integrated circuits are given in the /050 and /170 detailed electrical specifications. MIL-M-38510 specifications can be obtained from the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA, 19120.

RCA JAN Qualified-Parts Listing and MIL-M-38510 Detail Specifications (Slash Sheets) as of Jan. 1982

Detail Specification	RCA Type	Available JAN Devices			Detail Specification	RCA Type	Available JAN Devices		
		S	B	1 x 10 ⁵ Rad Si			S	B	1 x 10 ⁵ Rad Si
MIL-M-38510/5001	CD4011A		A		MIL-M-38510/5301	CD4007A		A	
02	CD4012A		A		02	CD4019A		A	
03	CD4023A		A		03	CD4030A			
51	CD4011B		P	P	04	CD4048A			
52	CD4012B		P	P	51	CD4007B			
53	CD4023B		P	P	52	CD4019B			
MIL-M-38510/5101	CD4013A		A		53	CD4030B			
02	CD4027A		A		54	CD4048B			
03	CD4043A				MIL-M-38510/5401	CD4008A			
51	CD4013B		P	P	51	CD4008B			
52	CD4027B				MIL-M-38510/5501	CD4009A			
53	CD4043B				02	CD4010A			
MIL-M-38510/5201	CD4000A		A		03	CD4049A		A	
02	CD4001A		A		04	CD4050A		A	
03	CD4002A		A		05	CD4041A			
04	CD4025A		A		51	CD4009UB			
51	CD4000B				52	CD4010B			
52	CD4001B		P	P	53	CD4049UB		P	P
53	CD4002B		P	P	54	CD4050B		P	P
54	CD4025B				55	CD4041B			

Screening Levels for RCA MIL-STD-883 Slash-Series CMOS Integrated Circuits

Screening Levels†		Application	Description
RCA Levels	MIL-STD-883, Method 5004 Format		
Packaged Devices (D, F, K, or L Suffix)			
/1S	Class S with SEM Inspection and Condition A Precap Visual Inspection	Aerospace and Missiles	For devices intended for use where maintenance and replacement are impossible and reliability is imperative
/1R*	Class S with SEM Inspection and Condition B Precap Visual Inspection (for LSI types)		
/1SJ or /1RJ*	Same as /1S or /1R + Radiation Hardened to 10 ⁶ rads(Si)		
/1SZ or /1RZ*	Same as /1S or /1R + Radiation Hardened to 10 ⁶ rads(Si)		
/3	Class B	Military and Industrial For example, In Airborne Electronics	For devices intended for use where maintenance and replacement can be performed but are difficult and expensive
/3W‡	Class B with High- and Low-Temperature DC and Dynamic Testing omitted		
Chips (H Suffix)			
/S	SEM Inspection and Condition A Visual Inspection	Aerospace and Missiles	For hybrid applications where maintenance and replacement are extremely difficult and reliability is imperative
/R*	SEM Inspection and Condition B Visual Inspection (for LSI types)		
/SJ or /RJ*	Same as /S or /R + Radiation Hardened to 10 ⁶ rads(Si)		
/SZ or /RZ*	Same as /S or /R + Radiation Hardened to 10 ⁶ rads(Si)		
/M	Condition B Precap Visual Inspection	Military and Industrial	For general applications

*1R or /R screening is used instead of /1S or /S screening for LSI circuits for which their large size makes the Condition A Precap Visual Inspection impractical

†For screening details refer to Total Lot Screening Chart

‡/3W screening of CDP1800 series includes dynamic testing at +25°C.

RCA MIL-STD-883 Slash-Series Linear IC's

The RCA CA3000 slash-series of high-reliability linear integrated circuits includes a broad range of types for use in satellites and other aerospace, military, and critical industrial applications in which maintenance is extremely difficult. These integrated circuits are processed and screened in accordance with MIL-STD-883, Method 5004 format. A comprehensive listing of CA3000-series high-reliability types is included in the *Index to RCA High-Reliability IC's* (refer to page 7). High-reliability versions of any commercially available standard-product CA3000-series types not listed in this Index can also be supplied on a custom basis.

The RCA CA3000 slash-series types are supplied to three screening levels (/1, /3, and /3W) that meet the electrical, mechanical, and environmental test methods and procedures established for microelectronics in MIL-STD-883. The following charts and diagrams illustrate the type number nomenclature system and the processing and testing that types are subjected to for each screening level, define the various screening levels, and outline the detailed screening procedures and sampling inspections for CA3000 slash-series high-reliability integrated circuits.

RCA MIL-STD-883 CD4000B Slash-Series High-Voltage CMOS IC's

The RCA high-reliability CD4000B series of high-voltage CMOS integrated circuits consists of a broad range of SSI, MSI-1, and MSI-2 (LSI) functions from simple gates to complex counters, registers, and arithmetic circuits. Specific design features for CMOS devices and the performance advantages of CMOS technology — low power consump-

tion, high noise immunity, high speed, high fanout, TTL and DTL logic compatibility, excellent temperature stability, and fully protected inputs and outputs — provide the logic system designer with a capability to achieve outstanding performance, high reliability, and simplified circuitry in a wide variety of equipment designs.

Features

- Capability to 20 V, tested at 18 V in conformance with JEDEC specifications
- 100% tested for quiescent current at 18 V
- Maximum input current (leakage) of 1 μ A at 18 V over full package-temperature range; 100 nA at 18 V at 25°C
- Standardized symmetrical output characteristics
- 5-V, 10-V, and 15-V parametric ratings
- 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 Standard No. 13A, "Standard Specifications for description of 'B' Series CMOS Devices"

Buffered Vs. Unbuffered Gates

The new industry standard establishes a suffix "UB" for CMOS products that meet all B-series specifications except that the logical outputs of the devices are not buffered and the V_{IL} and V_{IH} specifications are 20% and 80% of V_{DD} , respectively. The suffix "B" defines high-voltage buffered-output devices in which the output "on" impedance is independent of any and all valid input logic conditions, both preceding and present.

RCA will supply both buffered ("B") and unbuffered ("UB") versions of the popular NOR and NAND gates. We make available to designers the advantages of both. The following table briefly compares the features of the two versions.

Recommended Operating Conditions

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

Characteristic	Limits		Units
	Min.	Max.	
Supply-Voltage Range (For $T_A =$ Full Package-Temperature Range)	3	15	V

Characteristic	Buffered Version ("B")	Unbuffered Version ("UB")
Propagation Delay (Speed)	Moderate	Fast
Noise Immunity/Margin	Excellent	Good
Output Impedance and Output Transition Time	Constant	Variable
AC Gain	High	Low
Output Oscillation for Slow Inputs	Yes	No
Input Capacitance	Low	High

Maximum Ratings, Absolute-Maximum Values

DC SUPPLY-VOLTAGE RANGE, (V_{DD}) (Voltages referenced to V_{SS} Terminal)	-0.5 to +18 V
INPUT VOLTAGE RANGE, ALL INPUTS	-0.5 to $V_{DD} + 0.5V$
DC INPUT CURRENT, ANY ONE INPUT	± 10 mA
POWER DISSIPATION PER PACKAGE (P_D): For $T_A = -55$ to $+100^\circ C$ (PACKAGE TYPES D,F,K)	500 mW
For $T_A = +100$ to $+125^\circ C$ (PACKAGE TYPES D,F,K)	Derate Linearly at 12 mW/ $^\circ C$ to 200 mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR For $T_A =$ FULL PACKAGE-TEMPERATURE RANGE (All Package Types)	100 mW
OPERATING-TEMPERATURE RANGE (T_A): PACKAGE TYPES D,F,K,H	-55 to $+125^\circ C$
STORAGE TEMPERATURE RANGE (T_{stg})	-65 to $+150^\circ C$
LEAD TEMPERATURE (DURING SOLDERING): At distance 1/16 \pm 1/32 inch (1.59 \pm 0.79 mm) from case for 10 s max	+265 $^\circ C$

Family	Test P ints	Operating Voltage Range	Recommended Voltage Range
CD4000A	2.8 V, 17 V	3 V to 15 V	3 V to 12 V
CD4000B	2.8 V, 20 V	3 V to 20 V	3 V to 18 V

Fig. 11 illustrates a typical functional test on a CD4001 quad two-input NOR gate. Each gate is checked with the pattern below the test circuit. The test is performed at relatively low frequency and with no load other than stray and probe capacitance.

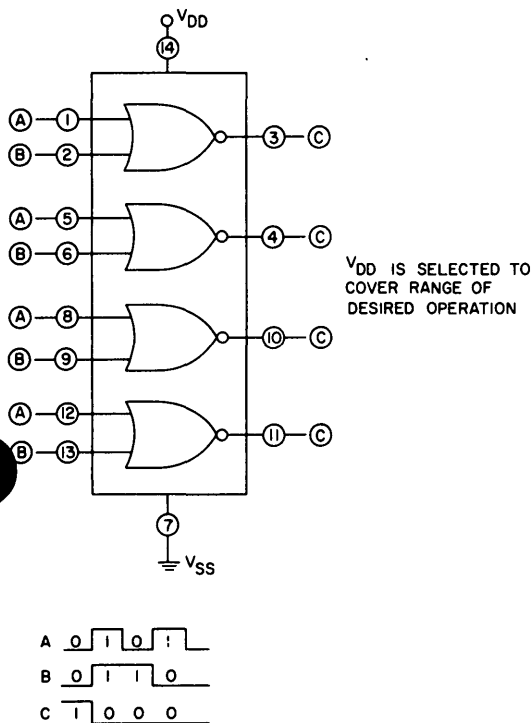


Fig. 11 — Typical functional test on a CD4001 quad two-input NOR gate.

DC tests are performed under quiescent conditions. The following tests are made on RCA COS/MOS devices:

- 1) Leakage
 - a) total quiescent
 - b) input
- 2) Diode check (contact test)
- 3) Breakdown-voltage test
- 4) Output-voltage levels
- 5) Noise immunity
- 6) Output drive current
- 7) Threshold voltage (only a wafer fabrication, not specified in data sheets)

The supply voltages used for parametric and functional testing range from 2.8 and 17 volts for the CD4000A series and 2.8 to 20 volts for the CD4000B series.

Quiescent leakage currents are measured by eliminating current path from V_{DD} to V_{SS} , i.e., by turning off either the n-channel or the p-channel device, as shown in Fig. 12. Current may be measured in either the V_{DD} line or the V_{SS} line, whichever is more convenient. Unused inputs must be

connected either high or low, depending on the channel in which leakage is to be measured.

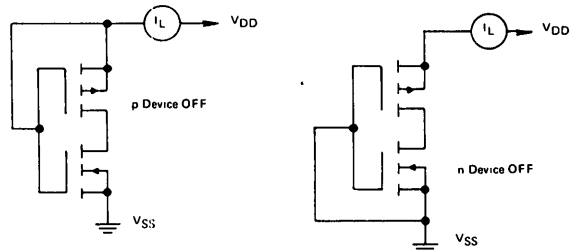


Fig. 12 — Method of measuring quiescent leakage currents.

Input leakage is measured by means of the gate input, as shown in Fig. 13. Typical input impedance is 10^{12} ohms; therefore, typical input leakages are in the picoampere range. Input leakage on RCA COS/MOS devices is now guaranteed to 1 microampere at all voltages and temperatures.

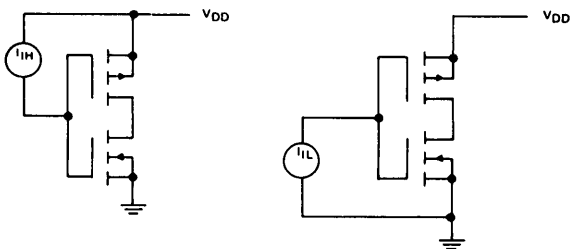


Fig. 13 — Method of measuring input leakage current.

The protective-diode check is made in the circuit shown in Fig. 14. With S1 connected to either current source, the voltage drop from the gate input to ground is one diode drop. A limit of 1.5 volts maximum is generally used to indicate a good diode. The protective diode to the n-type substrate is tested with S1 connected to the +100 microampere supply. The protective diode to the p-type well is tested with S1 connected to the -100-microampere supply. This test is also useful as a "contact test" to check for proper insertion of the device under test in the event of functional test failures.

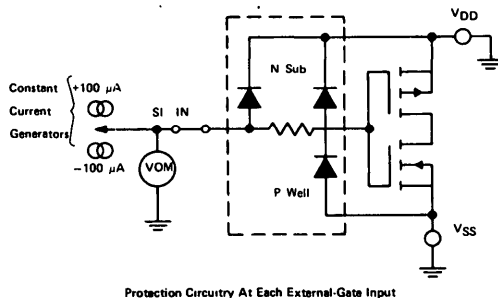


Fig. 14 — Circuit used to make protective-diode check.

Classification According to Circuit Complexity

Gates/ Inverters (SSI)	Buffers/Flip-Flop/ Latches/Multi-Level Gates (MSI-1)	Complex Logic (MSI-2)		
CD4000B	CD4009UB*	CD4006B	CD4053B*	CD4555B
CD4000UB	CD4010B*	CD4008B	CD4060B	CD4556B
CD4001B	CD4013B	CD4014B	CD4063B	CD4585B
CD4001UB	CD4019B	CD4015B	CD4067B*	CD4724B
CD4002B	CD4027B	CD4017B	CD4076B	CD40100B
CD4002UB	CD4030B	CD4018B	CD4089B	CD40101B
CD4007UB	CD4041UB*	CD4020B	CD4094B	CD40102B
CD4011B	CD4042B	CD4021B	CD4097B*	CD40103B
CD4011UB	CD4043B	CD4022B	CD4099B	CD40104B
CD4012B	CD4044B	CD4024B	CD4508B	CD40105B
CD4012UB	CD4047B	CD4026B	CD4510B	CD40108B
CD4016B*	CD4049UB*	CD4028B	CD4511B*	CD40110B*
CD4023B	CD4050B*	CD4029B	CD4512B	CD40147B
CD4023UB	CD4070B	CD4031B*	CD4514B	CD40160B
CD4025B	CD4077B	CD4032B	CD4515B	CD40161B
CD4025UB	CD4085B	CD4033B	CD4516B	CD40162B
CD4048B	CD4086B	CD4034B	CD4517B	CD40163B
CD4066B*	CD4093B*	CD4035B	CD4518B	CD40181B
CD4068B	CD4095B	CD4038B	CD4520B	CD40182B
CD4069UB	CD4096B	CD4040B	CD4527B	CD40192B
CD4071B	CD4098B	CD4045B*	CD4532B	CD40193B
CD4072B	CD4502B*	CD4046B*	CD4536B	CD40194B
CD4073B	CD4503B*	CD4051B*	CD4538B	CD40208B
CD4075B	CD40106B*	CD4052B*		
CD4078B	CD40107B*			
CD4081B	CD40109B*			
CD4082B	CD40174B			
	CD40257B			

* Indicates type for which, because of design requirements, one or more static characteristics differ from the standardized data. These differences are defined in separate data charts on these types.

Note:

In addition to the high-voltage B-series CMOS Integrated circuits listed above, RCA also offers a comprehensive line of high-reliability A-series (3 to 12 V) types. A-series counterparts are offered for all B-series parts from CD4000 through CD4050 and for the CD4060. High-reliability versions are also offered for four A-series parts for which there are no corresponding B-series types, as follows:

- CD4036A 4-word by 8-bit static RAM
- CD4039A 4-word by 8-bit static RAM
- CD4057A LSI 4-bit ALU
- CD4059A programmable divide-by-N counter

RCA high-reliability A-series CMOS integrated circuits are provided to the same MIL-STD-883 slash-series screening level as the B-series parts. For descriptive information on RCA CD4000A-series CMOS integrated circuits, refer to the CMOS Integrated Circuits DATABOOK, SSD-250B.

**Standardized DC Electrical Characteristics
(Devices are 100 Percent Tested for Parameters Shown)**

Characteristic	Conditions			Limits at Indicated Temperatures (°C)‡ Values at -55, +25, +125 Apply to D,F,H,K,L Packages				Units
	V _O (V)	V _{IN} (V)	V _{DD} (V)	-55	+125	+25		
						Min.	Max.	
Functional Test	—	0,18	18	100%	100%	—	100%	
Quiescent Device Current, I _{DD} Max.								
Gates, Inverters†	—	0,18	18	5	150	—	5	μA
Buffers, Flip-Flops, Latches, Multi-Level Gates (MSI-1 Types)†	—	0,18	18	20	600	—	20	
Complex Logic (MSI-2 Types)†	—	0,18	18	100	3000	—	100	
Output Low (Sink) Current	0.4	0.5	5	—	—	0.51	—	mA
I _{OL} Min.	0.5	0.10	10	—	—	1.3	—	
	1.5	0.15	15	—	—	3.4	—	
Output High (Source) Current, I _{OH} Min.	4.6	0.5	5	—	—	-0.51	—	
	2.5	0.5	5	—	—	-1.6	—	
	9.5	0.10	10	—	—	-1.3	—	
	13.5	0.15	15	—	—	-3.4	—	
Output Voltage: Low-Level, V _{OL} Max.	—	0,15	15	0.05		—	0.05	V
Output Voltage: High-Level, V _{OH} Min.	—	0,15	15	14.95		14.95	—	
Input Low Voltage, V _{IL} Max.								V
B Types	0.5, 4.5	—	5	1.5		—	1.5	
UB Types	1.5, 13.5	—	15	4		—	4	
	0.5, 4.5	—	5	1		—	1	
	1.5, 13.5	—	15	2.5		—	2.5	
Input High Voltage, V _{IH} Min.								V
B Types	0.5, 4.5	—	5	3.5		3.5	—	
UB Types	1.5, 13.5	—	15	11		11	—	
	0.5, 4.5	—	5	4		4	—	
	1.5, 13.5	—	15	12.5		12.5	—	
Input Current, I _{IN} Max	—	0,18	18	±0.1	±1	—	±0.1	μA
3-State Output* Leakage Current, I _{OUT} Max.	0,18	0,18	18	±0.4	±12	—	±0.4	μA

†Classifications of RCA CD4000B-Series CMOS integrated circuits are shown on preceding page.

‡For design-parameter limits not shown, refer to RCA CMOS Integrated Circuits DATABOOK, SDD-250B.

*For applicable devices only.

**Guide to Burn-in and Life-Test Delta Limits for Class 1S
High-Voltage CD4000B Series CMOS IC's**

Critical Parameters	Symbols	Test Conditions			Delta (Δ) Limits
		V _O (V)	V _{IN} (V)	V _{DD} (V)	
Quiescent Device Current					
Gates	I _{DD}	—	0,18	18	±0.1μA
MSI-1 Types	I _{DD}	—	0,18	18	±0.2μA
MSI-2 Types	I _{DD}	—	0,18	18	±1.0μA
Output Low (Sink) Current	I _{OL}	0.4	0.5	5	±20% of initial value
Output High (Source) Current	I _{OH}	4.6	0.5	5	±20% of initial value
Types with R _{ON} limits inced of I _{OL} and I _{OH}	R _{ON}	—	—	10V	±20% of initial value

Non-Standard DC Electrical Characteristics

Characteristic	Conditions			Limits at Indicated Temperatures (°C)				Units
	V _O (V)	V _{IN} (V)	V _{DD} (V)	-55	+125	+25		
						Min.	Max.	
CD4009UB, CD4010B								
Output Low (Sink) Current I _{OL} Min	0.4	0.5	5	—	—	3	—	mA
	0.5	0.10	10	—	—	8	—	
	1.5	0.15	15	—	—	24	—	
Output High (Source) Current I _{OH} Min	4.6	0.5	5	—	—	-0.2	—	
	2.5	0.5	5	—	—	-0.8	—	
	9.5	0.10	10	—	—	-0.45	—	
13.5	0.15	15	—	—	-1.5	—		
CD4016B Signal Inputs (V_{is}) and Outputs (V_{os})								
On-Resistance R _{ON} Max (R _L 10kΩ, V _C V _{DD})	V _{SS} (V)	V _{is} (V)						Ω
	0	15	15	360	600	—	400	
	0	0.25	15	360	600	—	400	
	0	9.3	15	775	1230	—	850	
	0	10	10	600	960	—	660	
	0	0.25	10	600	960	—	660	
0	5.6	10	1870	2600	—	2000		
Input or Output Leakage Current (Switch OFF Effective OFF Resistance V _C - V _{SS})	0	0	18	± 100	± 1000	—	± 100	nA
CD4031B								
Output Low (Sink) Current I _{OL} Min Q	0.4	0.5	5	—	—	2.04	—	mA
	0.5	0.10	10	—	—	5.2	—	
	1.5	0.15	15	—	—	13.6	—	
Q̄, Q', CL _D	0.4	0.5	5	—	—	0.51	—	
	0.5	0.10	10	—	—	1.3	—	
	1.5	0.15	15	—	—	3.4	—	
Output High (Source) Current I _{OH} Min. Q, Q̄, Q', CL _D	4.6	0.5	5	—	—	-0.51	—	
	2.5	0.5	5	—	—	-1.6	—	
	9.5	0.10	10	—	—	-1.3	—	
13.5	0.15	15	—	—	-3.4	—		
CD4041UB								
Output Low (Sink) Current I _{OL} Min.	0.4	0.5	5	—	—	1.6	—	mA
	0.5	0.10	10	—	—	5	—	
	1.5	0.15	15	—	—	19	—	
Output High (Source) Current I _{OH} Min	4.6	0.5	5	—	—	-1.6	—	
	2.5	0.10	5	—	—	-6.4	—	
	9.5	0.10	10	—	—	-5	—	
13.5	0.15	15	—	—	-19	—		
CD4045B								
Output Low (Sink) Current I _{OL} Min	0.4	0.5	5	—	—	3.5	—	mA
	0.5	0.10	10	—	—	5.6	—	
	1.5	0.15	15	—	—	12.5	—	
Output High (Source) Current I _{OH} Min.	4.6	0.5	5	—	—	-3.5	—	
	9.5	0.10	10	—	—	-5.6	—	
	13.5	0.15	15	—	—	-12.5	—	
Pin 15 Output Low and High Current, I _{OL} , I _{OH}	0.4, 4.6	0.5	5	—	—	±0.1	—	
	0.5, 9.5	0.10	10	—	—	±0.2	—	
	1.5, 13.5	0.15	15	—	—	±0.5	—	
CD4046B Phase Comparator Section								
Total Device Current, I _{DD} Max Terminal 14 open, Terminal 5 = V _{DD}	—	0.20	18	4	—	—	4	mA
Terminal 14 = V _{SS} or V _{DD} , Terminal 5 = V _{DD}	—	0.20	18	160	—	—	160	μA

Non-Standard DC Electrical Characteristics

Characteristic	Conditions			Limits at Indicated Temperatures (°C)				Units
	V _O (V)	V _{IN} (V)	V _{DD} (V)	-55	+125	+25		
						Min.	Max.	
CD4049UB, CD4050B								
Output Low (Sink) Current I _{OL} Min.	0.4	0.5	4.5	—	—	2.6	—	mA
	0.4	0.5	5	—	—	3.2	—	
	0.5	0.10	10	—	—	8	—	
	1.5	0.15	15	—	—	24	—	
Output High (Source) Current I _{OH} Min.	4.6	0.5	5	—	—	-0.8	—	mA
	2.5	0.5	5	—	—	-3.2	—	
	9.5	0.10	10	—	—	-1.8	—	
	13.5	0.15	15	—	—	-6	—	
CD4051B, CD4052B, CD4053B, CD4066B, CD4067B, CD4097B								
On Resistance R _{ON} Max. 0 ≤ V _{is} ≤ V _{DD}	V _{SS} -V	V _{EE} -V	5	800	1300	—	1050	Ω
On Resistance R _{ON} Max. (R _L = 10kΩ, V _C = V _{DD}) CD4066B only	0	0	10	310	550	—	400	
	0	0	15	200	320	—	240	
OFF Channel Leakage Current Any Channel OFF Max. All Channels (Common OUT/IN) OFF Max.	0	0	18	± 100	± 1000	—	± 100	nA
Input/Output Leakage Current (Switch off Effective off resistance V _C = V _{SS}) CD4066B only	0	0	18	± 100	± 1000	—	± 100	
CD4093B, CD40106B								
Positive Trigger Threshold Voltage V _p Min.	—	a	5	—	—	2.2	—	V
	—	a	10	4.6	4.6	4.6	—	
	—	a	15	—	—	6.8	—	
	—	a	5	—	—	—	3.6	
	V _p Max	—	a	10	7.1	7.1	—	
	—	a	15	—	—	—	10.8	
Negative Trigger Threshold Voltage V _N Min.	—	a	5	—	—	0.9	—	
	—	a	10	2.5	2.5	2.5	—	
	—	a	15	—	—	4	—	
	—	a	5	—	—	—	2.8	
	V _N Max.	—	a	10	5.2	5.2	—	5.2
	—	a	15	—	—	—	7.4	
Hysteresis Voltage V _H Min.	—	a	5	—	—	0.3	—	
	—	a	10	1.2	1.2	1.2	—	
	—	a	15	—	—	1.6	—	
	—	a	5	—	—	—	1.6	
	V _H Max.	—	a	10	3.4	3.4	—	3.4
	—	a	15	—	—	—	5	
*Input on Terminals 1, 5, 8, 12, or 2, 6, 9, 13; other inputs to V _{DD} .								
CD4502B								
Output Low (Sink) Current I _{OL} Min.	0.4	0.15	5	—	—	3.06	—	mA
	0.5	0.10	10	—	—	7.8	—	
	1.5	0.15	15	—	—	20.4	—	
CD4503B								
Output Low (Sink) Current I _{OL} Min.	0.4	0	5	—	—	2.1	—	mA
	0.5	0	10	—	—	5.5	—	
	1.5	0	15	—	—	16.1	—	
Output High (Source) Current I _{OH} Min.	4.6	5	5	—	—	-1.02	—	
	2.5	5	5	—	—	-4.8	—	
	9.5	10	10	—	—	-2.6	—	
	13.5	15	15	—	—	-6.8	—	
CD4511B								
Output Drive Voltage High Level V _{OH} Min. (I _{OH} = 20 mA)	—	—	5	—	—	3.4	—	V
	—	—	15	—	—	13.7	—	

Non-Standard DC Electrical Characteristics

Characteristic	Conditions			Limits at Indicated Temperatures (°C)				Units
	V _O (V)	V _{IN} (V)	V _{DD} (V)	-55	+125	+25 Min. Max.		
CD40107B								
Output Low (Sink) Current I _{OL} Min.	0.4	0.5	5	—	—	16	—	mA
	1	0.5	5	—	—	34	—	
	0.5	0.10	10	—	—	37	—	
	1	0.10	10	—	—	68	—	
	0.5	0.15	15	—	—	50	—	
Output High (Source) Current I _{OH} Min.	No Internal Pull-Up Device							
Input Low Voltage* V _{IL} Max.	4.5	—	5	1.5	1.5	—	1.5	V
	13.5	—	15	4	4	—	4	
Input High Voltage* V _{IH} Min.	0.5, 4.5	—	5	3.5	3.5	3.5	—	
	1.5, 13.5	—	15	11	11	11	—	
*Measured with external pull-up resistor, R _L = 10kΩ to V _{DD} .								
CD40109B								
Input Low Voltage V _{IL} Max.	1.9	V _{CC} -V	10	1.5	1.5	—	1.5	V
Input High Voltage V _{IH} Max.	1.5, 13.5	10	15	3	3	—	3	V
	1.9	5	10	3.5	3.5	3.5	—	
	1.5, 13.5	10	15	7	7	7	—	

AC Electrical Characteristics at 25°C

Type	Conditions‡ V _{DD} = 5V C _L = 50 pF	t _{PHL} * t _{PLH} * Propagation Delay Time ns	t _{THL} * t _{TLH} * Trans. Time ns	f _{CL} Max. Clock Input Freq. MHz	Type	Conditions‡ V _{DD} = 5V C _L = 50 pF	t _{PHL} * t _{PLH} * Propagation Delay Time ns	t _{THL} * t _{TLH} * Trans. Time ns	f _{CL} Max. Cl ck Input Freq. MHz
CD4000B	—	250	200	—	CD4013B, 27B	Clock to Q or \bar{Q} Outputs	300	200	3.5
CD4001B	—	250	200	—		Set to Q or Reset to \bar{Q} t _{PLH}	300	—	—
CD4002B	—	250	200	—		Set to \bar{Q} or Reset to Q	400	—	—
CD4025B	—	250	200	—	CD4014B, 21B	—	320	200	3
CD4000UB	—	120	200	—	CD4015B	—	320	200	3
CD4001UB	—	120	200	—	CD4016B	Sig. Input to Sig Output	100	—	—
CD4002UB	—	120	200	—		Turn-On	70	—	—
CD4025UB	—	120	200	—	CD4017B, 22B	Reset to Out	530	200	2.5
CD4006B	—	400	200	2.5		Clock to Out	650	—	—
CD4007UB	—	110	200	—		Clock to Carry Out	600	—	—
CD4008B	Sum In to Sum Out	800	200	—	CD4018B	Clocked Oper. Only	400	200	3
	Carry In to Sum Out	740	—	—	CD4019B	—	300	200	—
	Sum In to Carry Out	400	—	—	CD4020B, 24B, CD4040B	φ to Q1	360	200	3.5
	Carry In to Carry Out	200	—	—		Qn to Qn + 1	200	—	—
CD4009UB	—	140	350	—	CD4026B, 33B	Carry Output	500	200	2.5
	—	60*	70*	—		Decoder Output	700	—	—
CD4010B	—	200	350	—	CD4028B	—	350	200	—
	—	130*	70*	—	CD4029B	Q Output	500	200	2
CD4011B	—	250	200	—		Carry Output	560	—	—
CD4012B	—	250	200	—	CD4030B	—	280	200	—
CD4023B	—	250	200	—					
CD4011UB	—	120	200	—					
CD4012UB	—	120	200	—					
CD4023UB	—	120	200	—					

‡AC tests are one input/one output unless otherwise specified.

CD4000B Slash-Series CMOS IC's
AC Electrical Characteristics at 25°C (Cont'd)

Type	Conditions † V _{DD} = 5 V C _L = 50 pF	t _{PHL} * t _{PLH} ▲ Propagation Delay Time ns	t _{THL} * t _{TLH} ▲ Trans. Time ns	t _{CL} Max. Clock Input Freq. MHz
CD4031B	Clock to Q̄	500	200	2
	Clock to Q	380	—	—
	Clock to C _{LD}	200	—	—
CD4034B	Paral. In to Paral. Out	700	200	2
	3-State	400*	—	—
CD4035B	Clock to Q	500	200	2
	Reset to Q	460	—	—
CD4041UB	—	120	80	—
CD4042B	Data to Q	220	200	—
	Data to Q̄	300	—	—
	Clock to Q	450	—	—
	Clock to Q̄	500	—	—
CD4043B, 44B	Set to Reset to Q	300	200	—
	3-State Enable to Q (t _{PHZ} , t _{PLZ})	230	—	—
	(t _{PLZ} , t _{PZL})	180	—	—
CD4045B	φ to Y Output	5500	50	5
CD4047B	t _r to Q, Q̄	1000▲	200	—
	AST-Q, Q̄	700*	—	—
	Ret - Q, Q̄	600	—	—
	AST - OSC	400▲	—	—
	Res - Q, Q̄	500▲	—	—
CD4048B	Ka to Output	600	200	—
CD4049UB	—	120▲	160▲	—
	—	65*	60*	—
CD4050B	—	140▲	160▲	—
	—	110*	60*	—
CD4051B, 52B CD4053B	*Add to Sig. Out	720	—	—
	Chan On or OFF Inhibit to Sig. Out	—	—	—
	Chan. On	720	—	—
	Chan OFF	450	—	—
CD4060B	Input Pulse Opera- tion φ1 to Q4	740	200	3.5
	Qn to Qn + 1	200	—	—
	Reset Operation	360	—	—
CD4063B	Comp. Input to Output	1250	200	—
	Cascade Input to Output	1000	—	—
CD4066B	Sig. Input to Sig. Output R _L = 10KΩ V _C = V _{DD} ; V _{SS} = GND; C _L = 50 pF, V _{IS} = Sq. Wave, t _r , t _f = 20 ns, input Sig.	40	—	—

Type	Conditions † V _{DD} = 5 V C _L = 50 pF	t _{PHL} * t _{PLH} ▲ Propaga- tion Delay Time ns	t _{THL} * t _{TLH} ▲ Trans. Time ns	t _{CL} Max. Clock Input Freq. MHz
CD4066B (cont'd)	Prop. Delay, t _{pdC} t _{rc} = t _{fc} = 20 ns, R _L = 1KΩ, V _{IS} ≤ 5V, C _L = 50 pF	70	—	—
	Noise immunity, VNL V _{IS} ≤ V _{DD} , V _{DD} -V _{SS} = 15V	2 min.■	—	—
CD4067B, 97B	Addr. or Inhibit to Sig. Out Channel ON	650	—	—
	Channel OFF	440	—	—
CD4068B	—	300	200	—
CD4069UB	—	110	200	—
CD4070B, 77B	—	280	200	—
CD4071B, 72B, CD4075B	—	250	200	—
CD4073B, 81B, CD4082B	—	250	200	—
CD4076B	Clock to Q Output	600	200	—
CD4078B	—	300	200	3
CD4085B	Data	620▲	200	—
		450*	—	—
	Inhibit	500▲	—	—
CD4086B	Data	620▲	200	—
	Inhibit	500▲	—	—
CD4089B	Clock to Output	220	200	1.2
	CLR to Output	760	—	—
	Set to Output	660	—	—
	CASC. to Output	180	—	—
CD4093B	—	380	200	—
CD4094B	Clock to Ser. Output	600	200	1.25
	Clock to Par. Output	840	—	—
	Strobe to Par. Output	580	—	—
	Out Enable to Par. Out	—	—	—
	t _{PHZ}	280	—	—
t _{PLZ}	450	—	—	
CD4095B, 96B	Clock to Output	500	200	3.5
CD4098B	Trigger to Q, Q̄	500	200	—
CD4099B	Data to Output	400	200	—
CD4502B	Data or Inhibit Delay Time	380▲	200▲	—
		270*	120*	—
	Disable Delay Time t _{PHZ}	120	—	—
	t _{PZH}	220	—	—
t _{PLZ} , t _{PZL}	250	—	—	

*t_{PLZ}, t_{PHZ}
■ Noise-immunity value

†AC tests are one input/one output unless otherwise specified.

CD4000B Slash-Series CMOS IC's
AC Electrical Characteristics at 25°C (Cont'd)

Type	Conditions ‡ $V_{DD} = 5\text{ V}$ $C_L = 50\text{ pF}$	t_{PHL}^* t_{PLH}^* Propa- gation Delay Time ns	t_{THL}^* t_{TLH}^* Trans. Time ns	t_{CL} Max. Clock Input Freq. MHz
CD4503B	—	150▲	90▲	—
	—	110*	70*	—
	t_{PHZ}, t_{PZH}	140	—	—
	t_{PLZ}, t_{PZL}	180	—	—
CD4508B	Strobe In to Data Out	260	200	—
CD4510B, 16B	Clock to Q Output	400	200	2
	Preset or Reset to Q	420	—	—
	Clock to Carry Out	480	—	—
	Carry-In to Carry-Out	250	—	—
	Preset or Reset-to-Carry-Out	640	—	—
CD4511B	—	1040*	80▲	—
	—	1320▲	310*	—
CD4512B	Inhibit to Output	280	200	—
	"A" Select to Output	400	—	—
	Data to Output	360	—	—
	3-State Disable $t_{PZL}, t_{PLZ}, t_{PHZ}, t_{PZH}$	120	—	—
CD4514B, 15B	Strobe or Data	970	200	—
	Inhibit	500	—	—
CD4517B	CLK to Q16	400	200	3
CD4518B, 20B	Clock or Enable to Output	560	200	1.5
	Reset to Output	650	—	—
CD4527B	Clock to Out	220	200	1.2
	Clear to out	760	—	—
	Set to Out	660	—	—
CD4532B	Enable-In to Enable-Out or Enable-In to Group Select	220	200	—
CD4536B	CLK to Q1	2000	200	0.5
	CLK to Q16	8000	—	—
	Reset to QM	6000	—	—
CD4538B	trig to Q, \bar{Q}	300	200	—
CD4555B, 56B	Select In to Any Output	440	200	—
	Enable In to Any Output	400	—	—
CD4585B	Comp inputs to outputs	600	200	—
	Casc inputs to outputs	400	—	—
CD4724B	Data to Outputs	400	200	—
	Write Disable to Output	400	—	—
	Reset to Output	350	—	—
	Address to Output	450	—	—
CD40100B	—	720	200	1

Type	Conditions ‡ $V_{DD} = 5\text{ V}$ $C_L = 50\text{ pF}$	t_{PHL}^* t_{PLH}^* Propa- gation Delay Time ns	t_{THL}^* t_{TLH}^* Trans. Time ns	t_{CL} Max. Clock Input Freq. MHz
CD40101B	Data-In-To-Output	700	200	—
	Inhibit-In-To-Output	280	—	—
CD40102B, 103B	Clock to Output	600	200	0.7
	Carry-In/Counter Enable-to-Output	400	—	—
	Asynchronous Preset Enable-to-Output	1300	—	—
	Clear-to-Output	750	—	—
CD40104B	CLK to Q	440	200	3
	$t_{PZH}, t_{PLZ}, t_{PZL}$	160	—	—
	t_{PHZ}	90	—	—
CD40105B	Reset to Data Out	370	200	1.5
	Shift In to Out	320	—	—
CD40106B	—	280	200	—
CD40107B	$R_L = 120\Omega$	200	100	—
CD40108B	Clock or Write Enable to Q	720	200	1.5
	Read or Write Address to Q	600	—	—
	3-State Disable Delay Time t_{PZH}, t_{PHZ}	200	—	—
	t_{PZL}, t_{PLZ}	260	—	—
	—	—	—	—
CD40109B	Data Input to Output Shift Mode L-H	600*	—	—
	H-L, $V_{CC} = 10\text{ V}$	1600*	200	—
	L-H	260▲	—	—
	H-L, $V_{CC} = 10\text{ V}$	460▲	—	—
	3-State Disable Delay Shift Mode L-H (t_{PHZ})	120	—	—
	L-H (t_{PLZ})	740	—	—
	L-H (t_{PZH})	640	—	—
L-H (t_{PZL})	200	—	—	
CD40114B	Access Time from Address Change, T_{AA}	650	—	—
	Memory Enable Output Hi/Lo to High Impedance	300	—	—
	Write Enable Output Hi/Lo to High Impedance	300	—	—
	Memory Enable	500	—	—
CD40147B	In-Phase Output	900	200	—
	Out-of-Phase Output	850	—	—

‡AC tests are one input/one output unless otherwise specified.

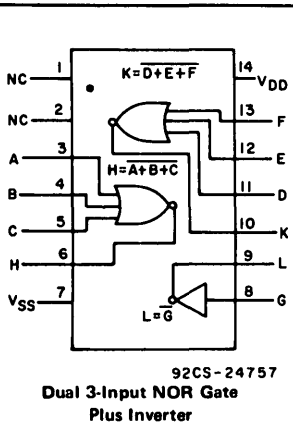
CD4000B Slash-Series CMOS IC's
AC Electrical Characteristics at 25° C (Cont'd)

Type	Conditions ‡ $V_{DD} = 5\text{ V}$ $C_L = 50\text{ pF}$	t_{PHL}^* t_{PLH}^{Δ} Propagation Delay Time ns	t_{THL}^* t_{TLH}^{Δ} Trans. Time ns	t_{CL} Max. Clock Input Freq. MHz
CD40160B, 161B,162B.	Clock to Q	400	200	2
	Clock to C_{OUT}	450	—	—
163B	T_E to C_{OUT}	250	—	—
	Clear to Q (CD40160B, CD40161B only)	500	—	—
CD40174B	Clock to Output	300	200	3.5
	Clear to Output	200	—	—
CD40181B	A or B to F (Logic Mode), A or B to G or P	800	200	—
	A or B to F, $C_N + 4$, or A = B	1000	—	—
	C_n to F	640	—	—
	C_n to $C_n + 4$	400	—	—
CD40182B	P, G_{IN} to P, G_{OUT} and Carry Outs	400	200	—
	C_n to Carry Outs	480	—	—

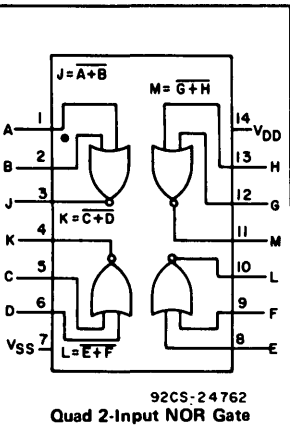
‡AC tests are one input/one output unless otherwise specified.

Type	Conditions ‡ $V_{DD} = 5\text{ V}$ $C_L = 50\text{ pF}$	t_{PHL}^* t_{PLH}^{Δ} Propagation Delay Time ns	t_{THL}^* t_{TLH}^{Δ} Trans. Time ns	t_{CL} Max. Clock Input Freq. MHz
CD40192B, 193B	Clock Up or Clock Down to Q, Reset Q	500	200	2
	\overline{PE} to Q	400	—	—
	Clock Up to Carry, Clock Down to Borrow	320	—	—
	Reset or \overline{PE} to Bor- row or Carry	600	—	—
CD40194B	CLK to Q	440	200	3
CD40208B	Clock or Write Enable to Q	720	200	1.5
	Read or Write Address to Q	600	—	—
	3-State Disable De- lay Time t_{PZH} , t_{PHZ}	200	—	—
	t_{PZL} , t_{PLZ}	260	—	—
CD40257B	Data Input to Output	300	200	—
	Select to Output	380	—	—
	Output Disable to Output	190	—	—

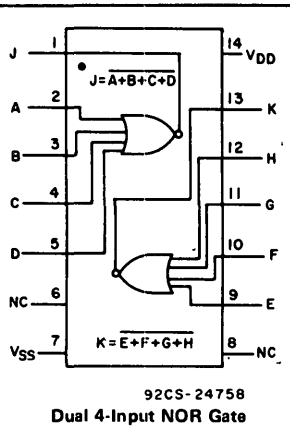
Functional Diagrams



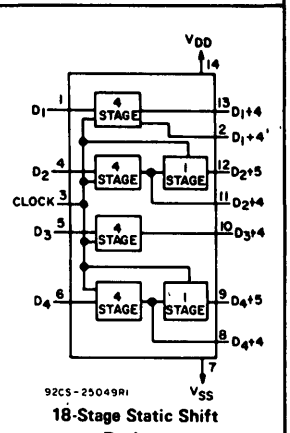
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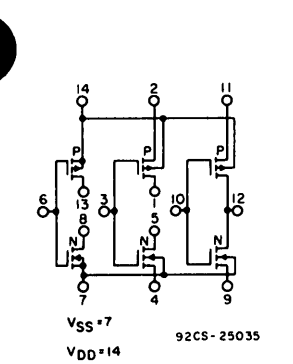
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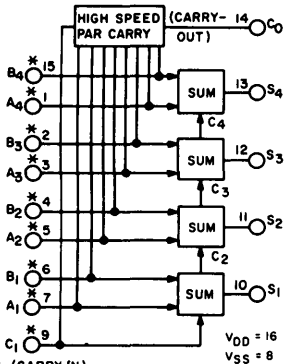
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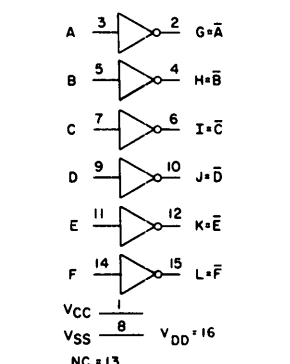
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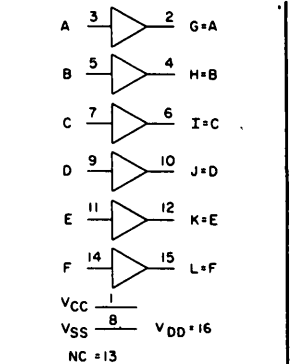
CD4007UB (File No. 977)



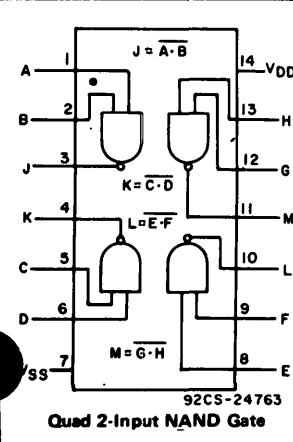
CD4008B (File No. 951)



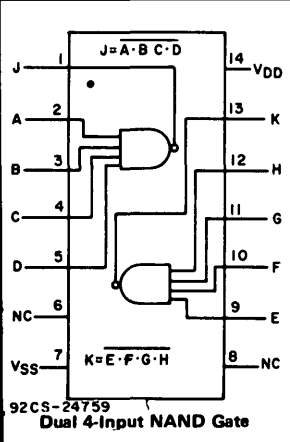
CD4009UB (File No. 940)



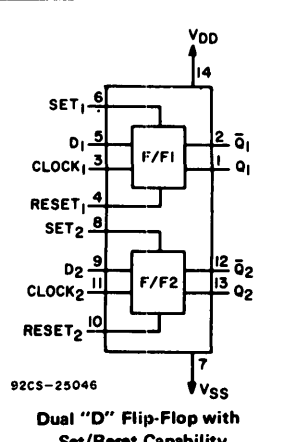
CD4010B (File No. 940)



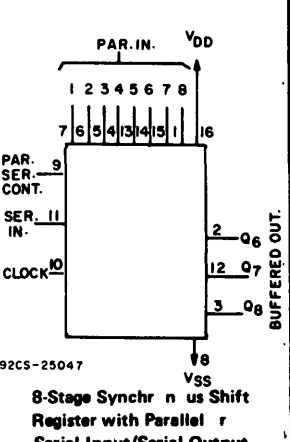
CD4011B (File No. 986)
CD4011UB (File No. 947)



CD4012B (File No. 986)
CD4012UB (File No. 947)

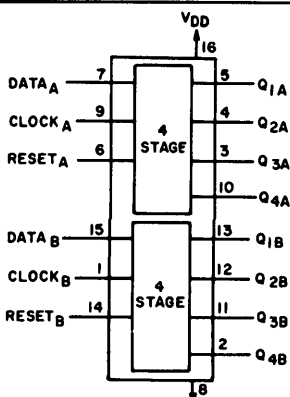


CD4013B (File No. 936)

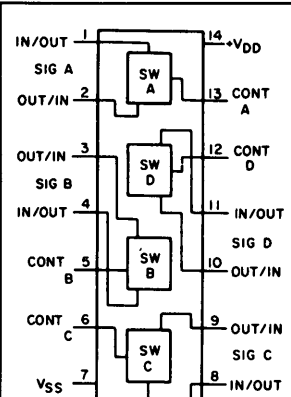


CD4014B (File No. 1043)

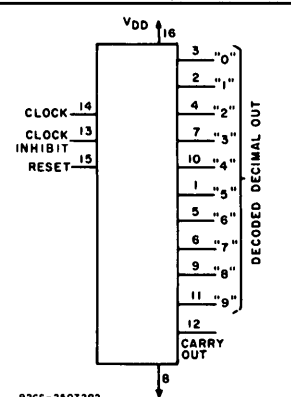
Functional Diagrams



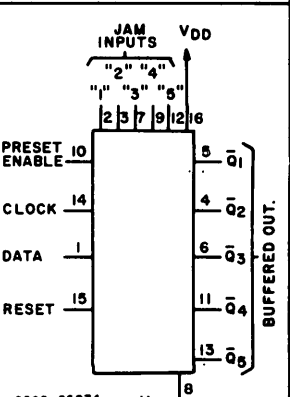
92CS-25048
Dual 4-Stage Static Shift Register with Serial Input/Parallel Output
CD4015B (File No. 1024)



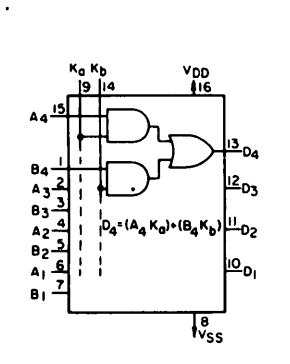
92CS-21627
Quad Bilateral Switch
CD4016B (File No. 953)



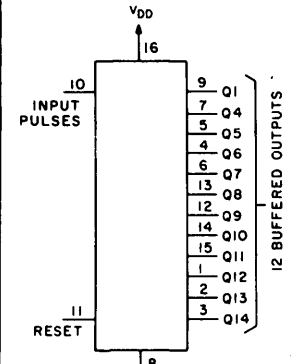
92CS-25072R2
Decade Counter/Divider with 10 Decoded Decimal Outputs
CD4017B (File No. 1113)



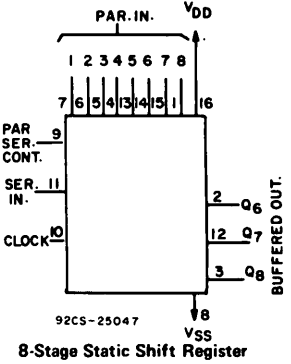
92CS-25074
Presettable Divide-by-'N' Counter Fixed or Programmable
CD4018B (File No. 1034)



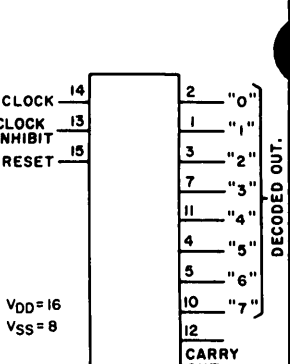
92CS-25036
Quad AND/OR Select Gate
CD4019B (File No. 1045)



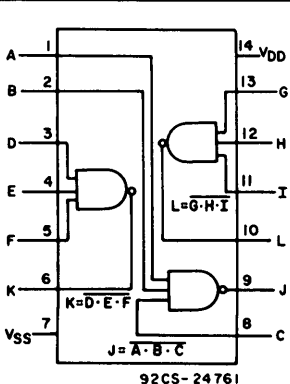
92CS 25053R2
14-Stage Binary Ripple Counter
CD4020B (File No. 1063)



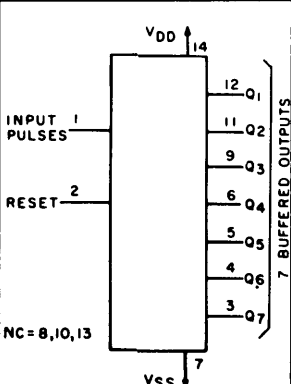
92CS-25047
8-Stage Static Shift Register Asynchronous Parallel or Synchronous Serial Input/Serial Output
CD4021B (File No. 1043)



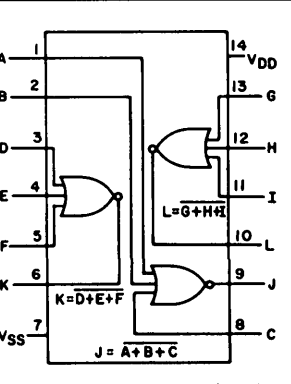
92CS-25073R2
Divide-by-8 Counter/Divider with 8 Decoded Decimal Outputs
CD4022B (File No. 1113)



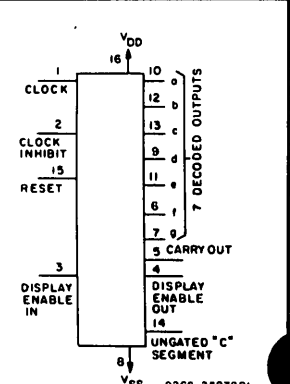
92CS-24761
Triple 3-Input NAND Gate
CD4023B (File No. 986)
CD4023UB (File No. 947)



92CS-25051R3
7-Stage Ripple-Carry Binary Counter/Divider
CD4024B (File No. 1063)

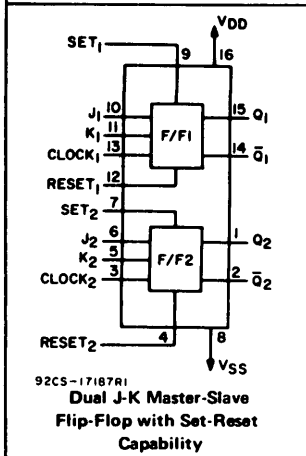


92CS-24760
Triple 3-Input NOR Gate
CD4025B (File No. 985)
CD4025UB (File No. 945)

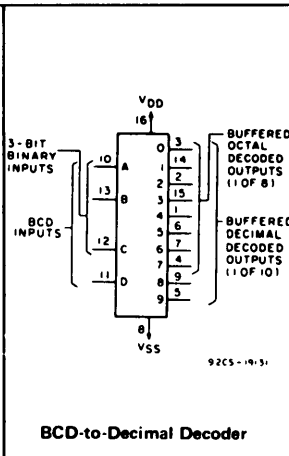


92CS-25078R1
Decade Counter/Divider with 7-Segment Display Outputs and Display Enable
CD4026B (File No. 1118)

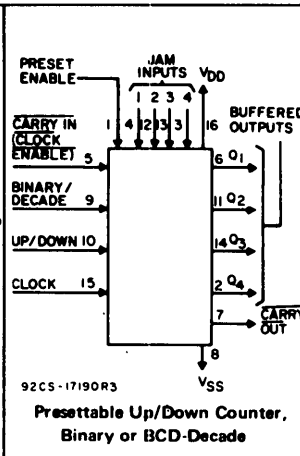
Functional Diagrams



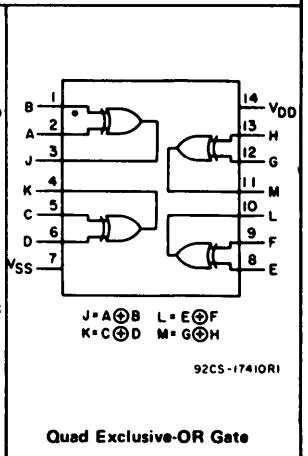
CD4027B (File No. 942)



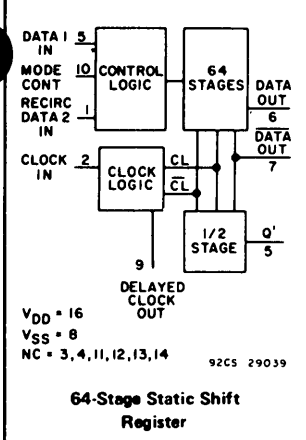
CD4028B (File No. 1016)



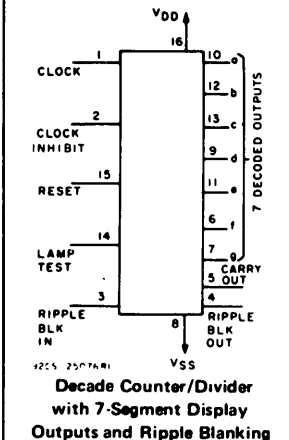
CD4029B (File No. 1028)



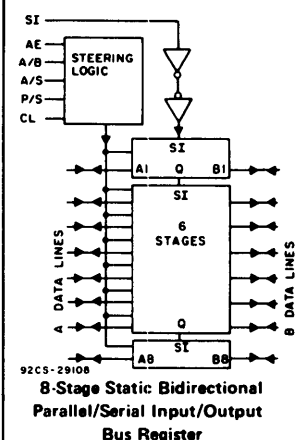
CD4030B (File No. 1055)



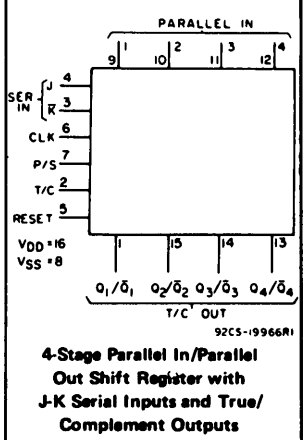
CD4031B (File No. 1073)



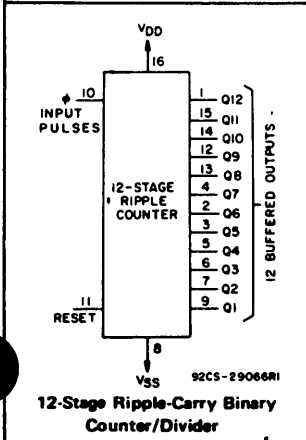
CD4033B (File No. 1118)



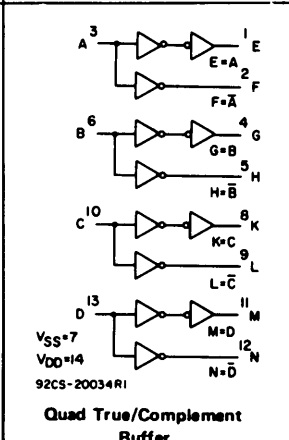
CD4034B (File No. 1062)



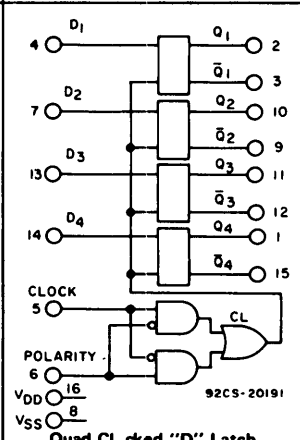
CD4035B (File No. 1101)



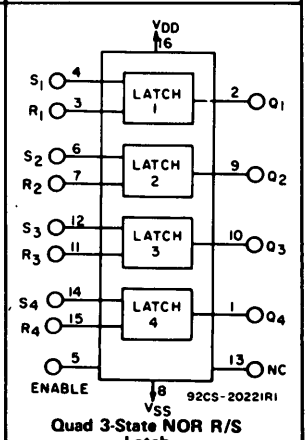
CD4040B (File No. 1063)



CD4041UB (File No. 934)

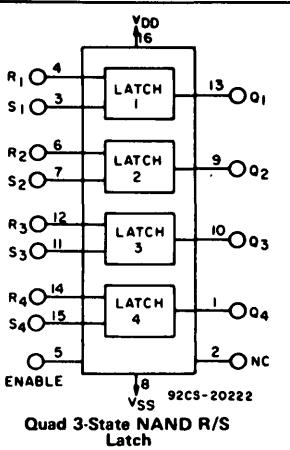


CD4042B (File No. 954)

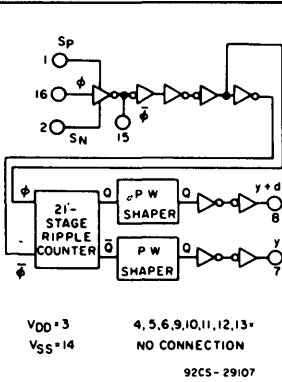


CD4043B (File No. 956)

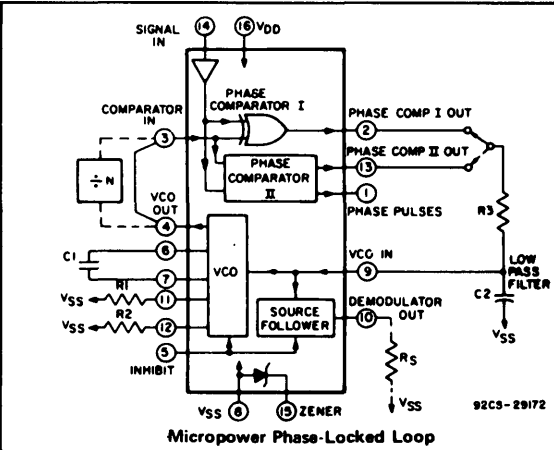
Functional Diagrams



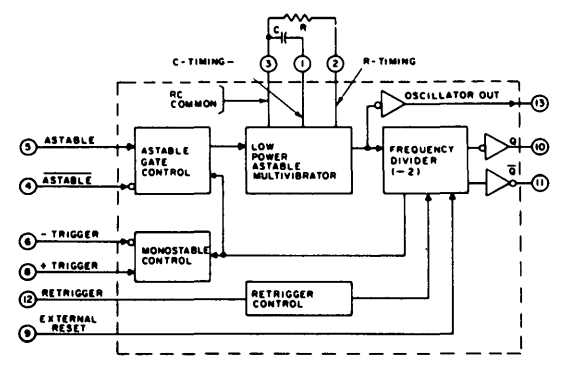
CD4044B (File No. 956)



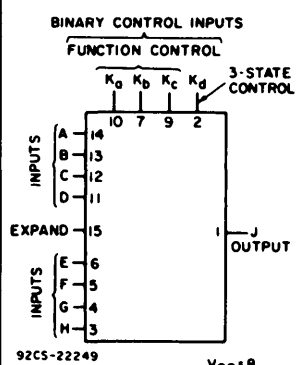
CD4045B (File No. 1119)



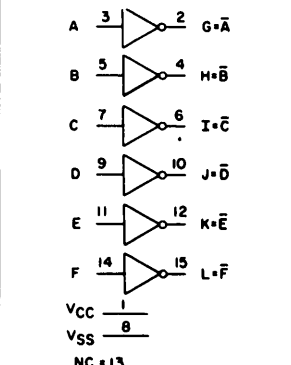
CD4046B (File No. 1099)



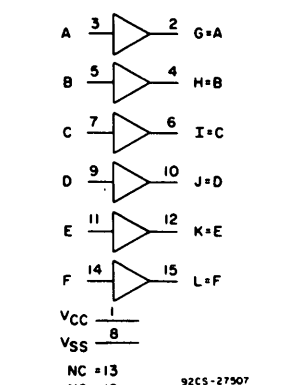
CD4047B (File No. 1123)



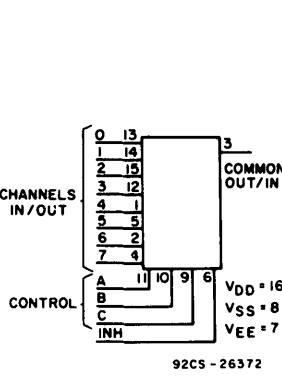
CD4048B (File No. 1124)



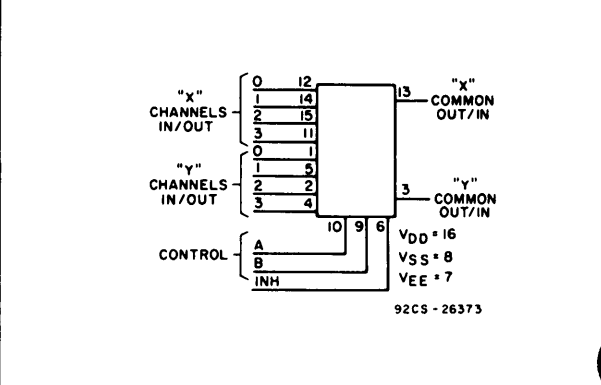
CD4049UB (File No. 926)



CD4050B (File No. 926)

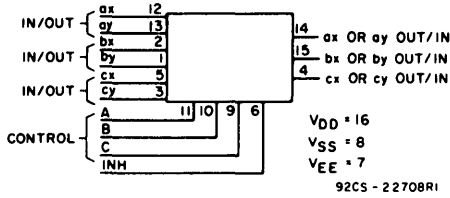


CD4051B (File No. 902)

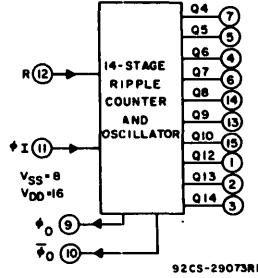


CD4052B (File No. 902)

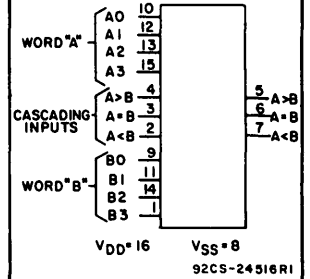
Functional Diagrams



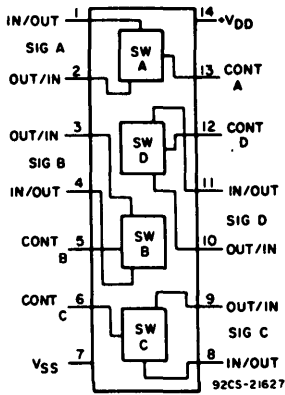
**Triple 2-Channel
Multiplexer/Demultiplexer**
CD4053B (File No. 902)



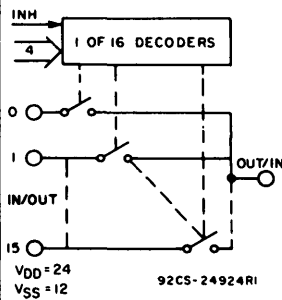
**14-Stage Ripple-Carry
Binary Counter/Divider
and Oscillator**
CD4060B (File No. 1120)



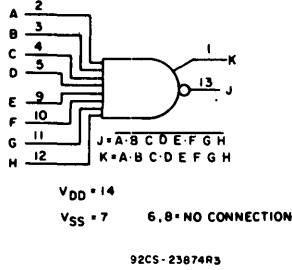
4-Bit Magnitude Comparat r
CD4063B (File No. 805)



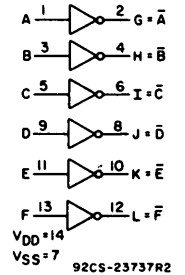
Quad Bilateral Switch
CD4066B (File No. 1114)



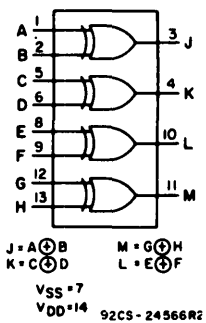
**16-Channel
Multiplexer/Demultiplexer**
CD4067B (File No. 909)



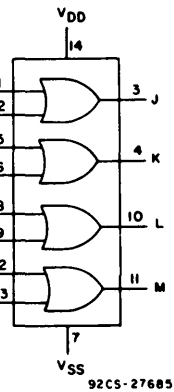
8-Input NAND/AND Gate
CD4068B (File No. 809)



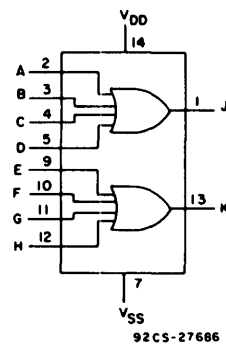
Hex Inverter
CD4069UB (File No. 804)



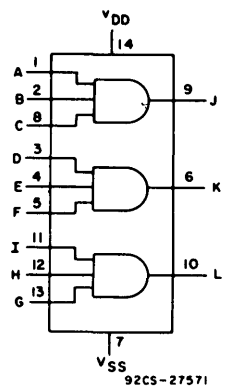
Quad Exclusive-OR Gate
CD4070B (File No. 910)



Quad 2-Input OR Gate
CD4071B (File No. 807)

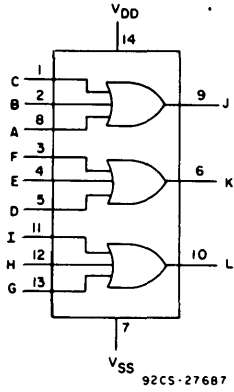


Dual 4-Input OR Gate
CD4072B (File No. 807)

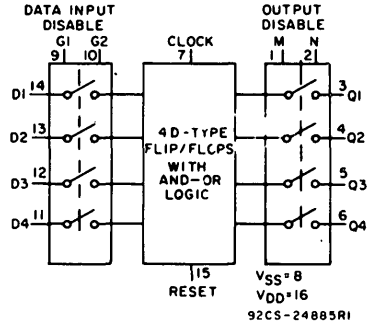


Triple 3-Input AND Gate
CD4073B (File No. 806)

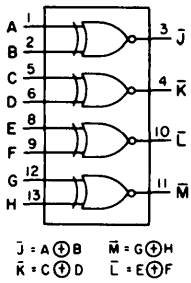
Functional Diagrams



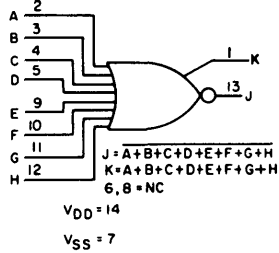
Triple 3-Input OR Gate
CD4075B (File No. 807)



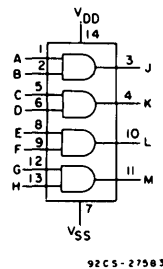
4-Bit D-Type Register
CD4076B (File No. 903)



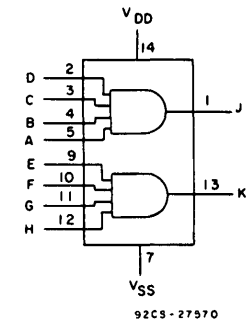
Quad Exclusive-NOR Gate
CD4077B (File No. 910)



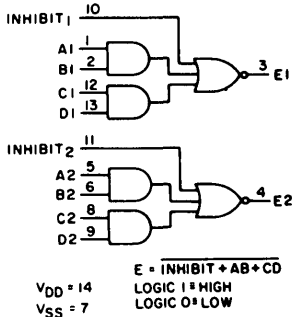
8-Input NOR/OR Gate
CD4078B (File No. 810)



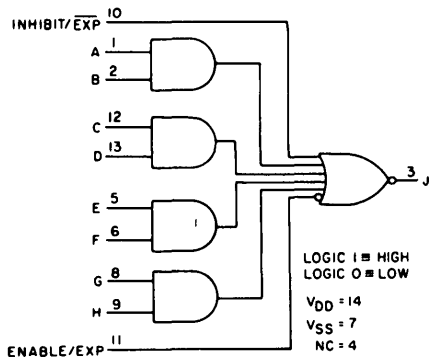
Quad 2-Input AND Gate
CD4081B (File No. 806)



Dual 4-Input AND Gate
CD4082B (File No. 806)

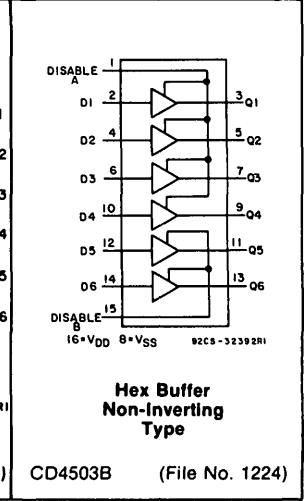
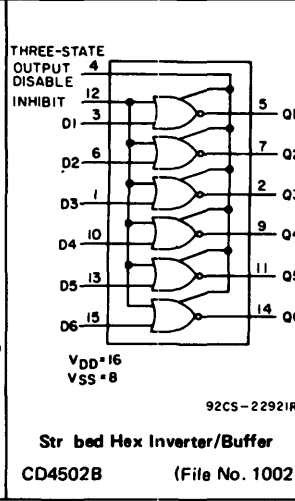
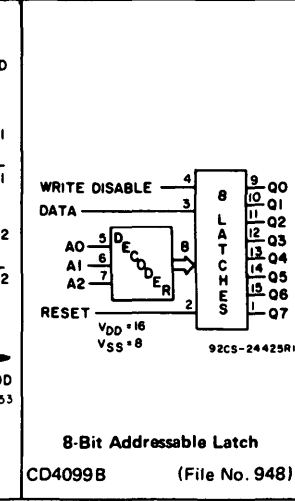
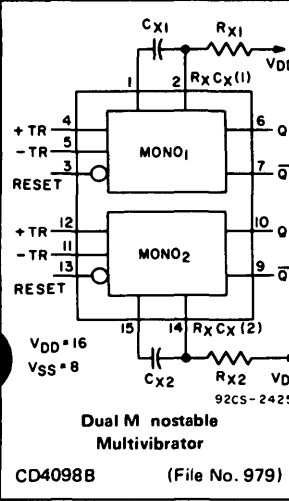
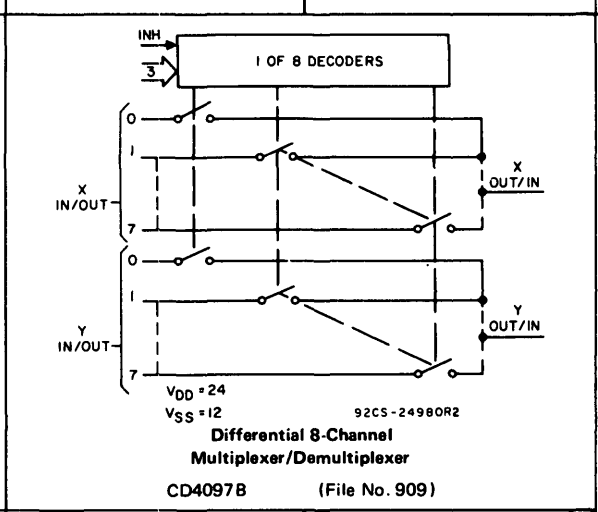
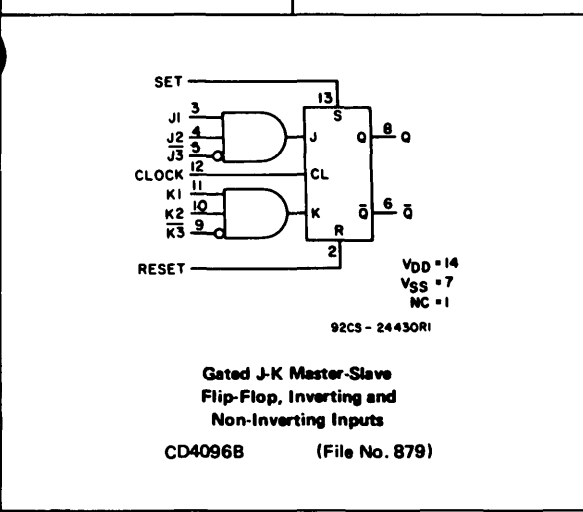
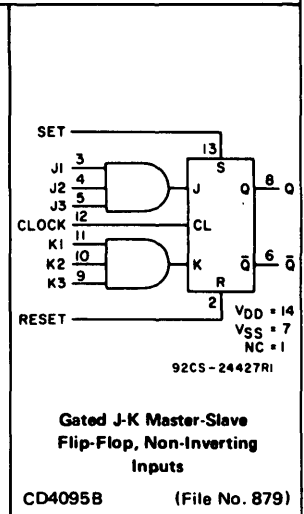
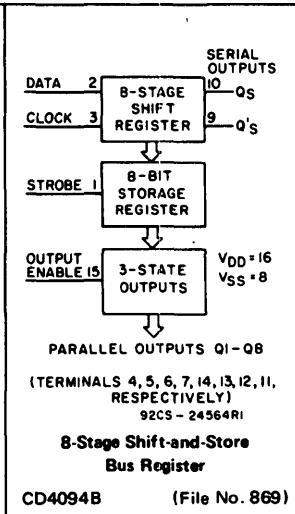
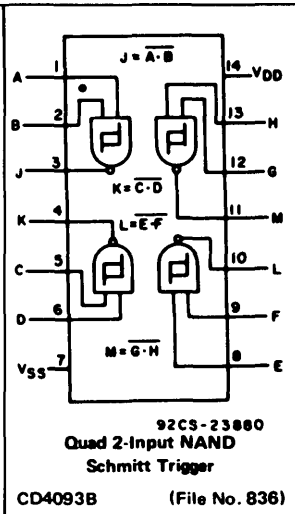
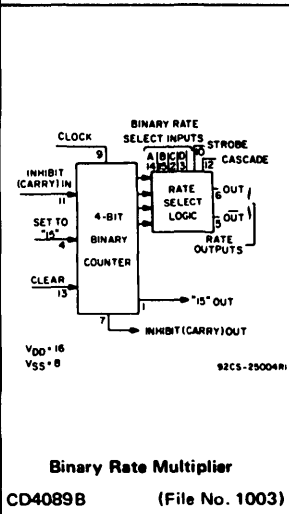


Dual 2-Wide, 2-Input AND-OR-INVERT (AOI) Gate
CD4085B (File No. 811)

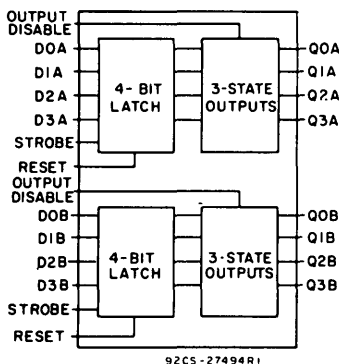


Expandable 4-Wide, 2-Input AND-OR-INVERT (AOI) Gate
CD4086B (File No. 812)

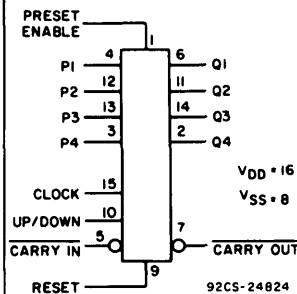
Functional Diagrams



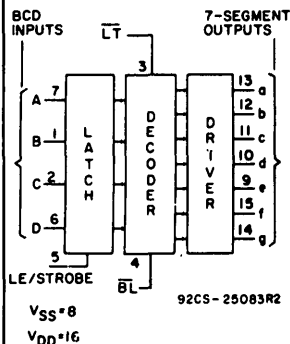
Functional Diagrams



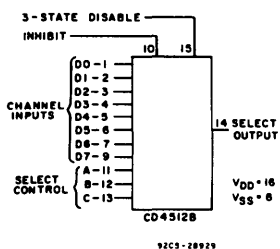
Dual 4-Bit Latch
CD4508B (File No. 1009)



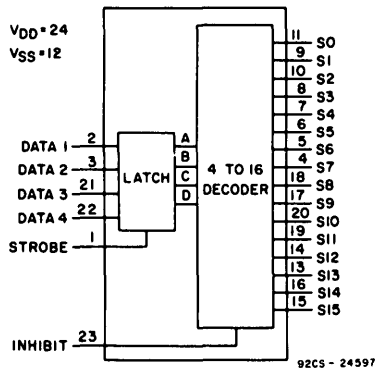
BCD Presettable Up/Down Counter
CD4510B (File No. 899)



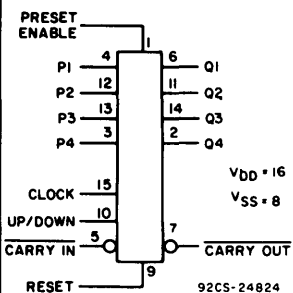
BCD-to-7-Segment Latch Decoder Driver
CD4511B (File No. 901)



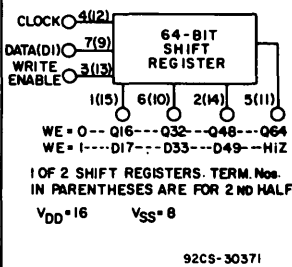
8-Channel Data Selector
CD4512B (File No. 1032)



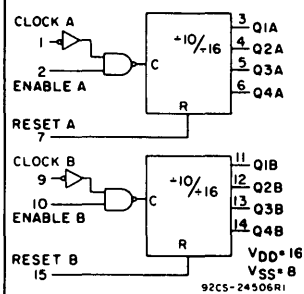
4-Bit Latch/4-to-16 Line Decoder
CD4514B (File No. 814) CD4515B (File No. 814)
Output "High" on Select Output "Low" on Select



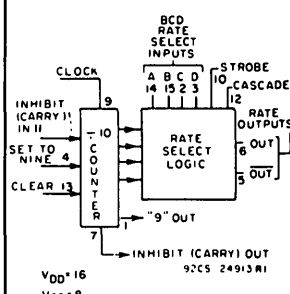
Binary Presettable Up/Down Counter
CD4516B (File No. 899)



Dual 64-Bit Shift Register
CD4517B (File No. 1148)

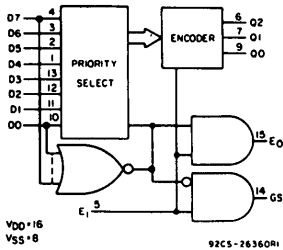


Dual Up Counter
CD4518B (File No. 808) BCD
CD4520B (File No. 808) Binary

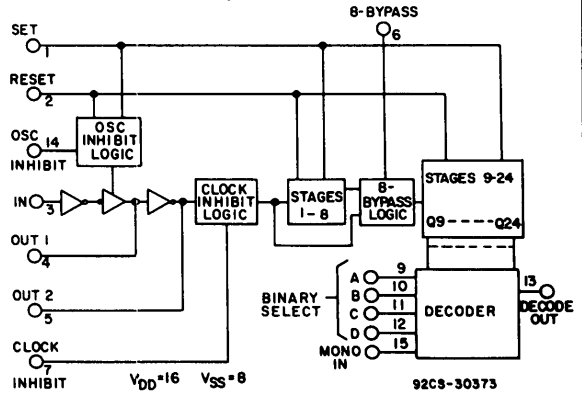


BCD Rate Multiplier
CD4527B (File No. 1006)

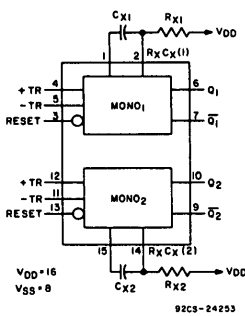
Functional Diagrams



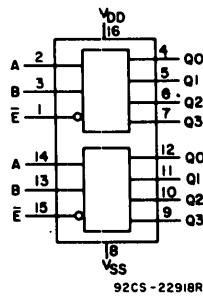
8-Bit Priority Encoder
CD4532B (File No. 876)



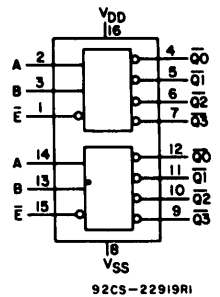
Programmable Timer
CD4536B (File No. 1186)



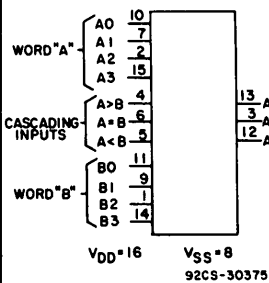
Dual Precision Monostable Multivibrator
DC4538B (File No. 1245)



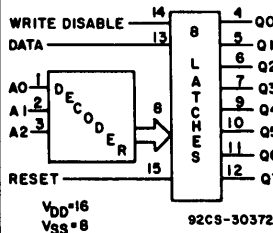
Dual Binary-to-1-of-4 Decoder/Demultiplexer Output "High" on Select
CD4555B (File No. 858)



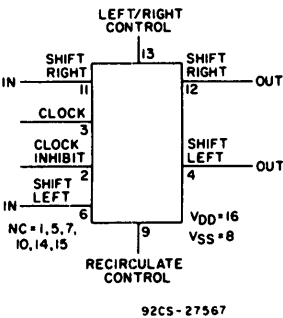
Dual Binary-to-1-of-4 Decoder/Demultiplexer Output "Low" on Select
CD4556B (File No. 858)



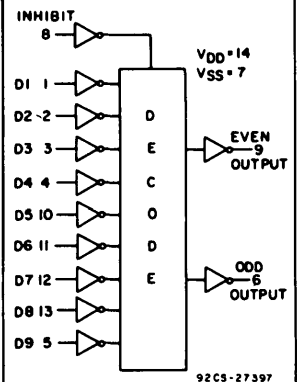
4-Bit Magnitude Comparator
CD4585B (File No. 1146)



8-Bit Addressable Latch
CD4724B (File No. 1111)

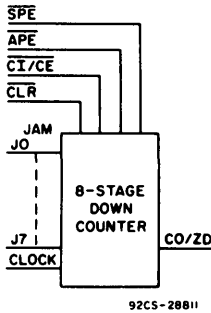


32-Stage Static Left/Right Shift Register
CD40100B (File No. 980)



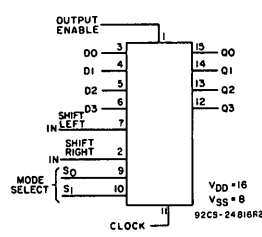
9-Bit Parity Generator/Checker
CD40101B (File No. 1000)

Functional Diagrams

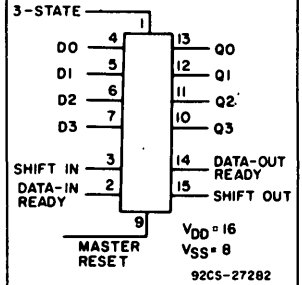


8-Stage Presettable Synchronous Down Counter

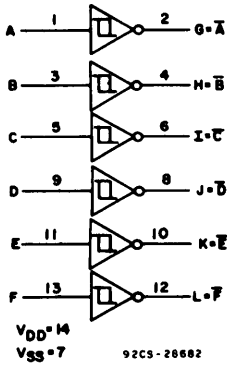
CD40102B (File No. 984) 2-Decade BCD
 CD40103B (File No. 984) 8-Bit Binary



4-Bit Bidirectional Universal Shift Register
 CD40104B, CD40194B
 (File No. 1220)

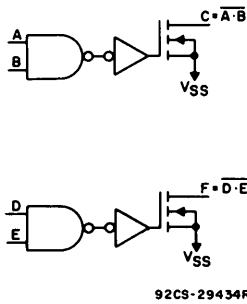


FIFO Register
 4-Bits Wide by 16-Bits Long
 CD40105B (File No. 1044)



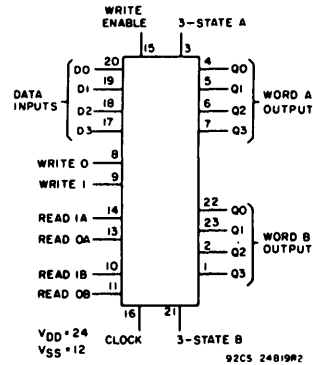
Hex Schmitt Trigger

CD40106B (File No. 1017)



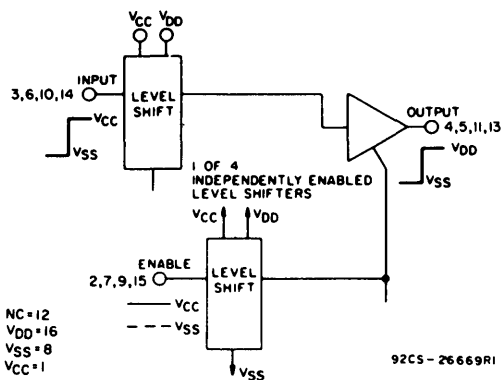
Dual 2-Input NAND Buffer/Driver

CD40107B (File No. 1015)



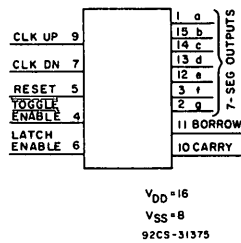
4-by-4 Multiport Register

CD40108B (File No. 1011)

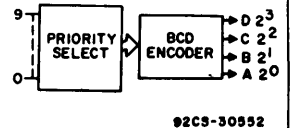


Quad Low-to-High Voltage Level Shifter

CD40109B (File No. 1018)

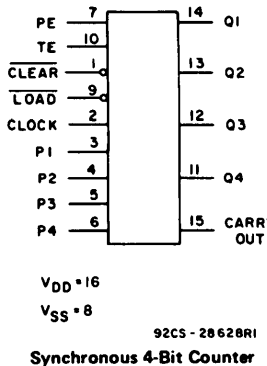


Decade Up-Down Counter/Decoder/Latch/Driver
 CD40110B (File No. 1125)



10-Line-to-4-Line BCD Priority Encoder
 CD40147B (File No. 1117)

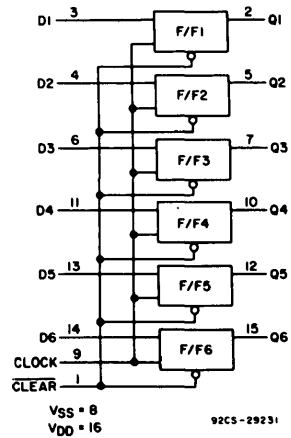
Functional Diagrams



92CS-28628R1

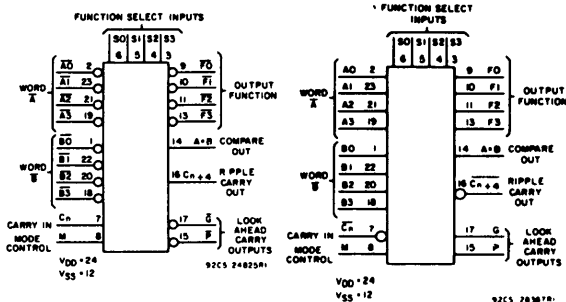
Synchronous 4-Bit Counter

- | | | | |
|--------------------------|--------------------------------|--------------------------|-------------------------------|
| CD40160B (File No. 1047) | Decade with Asynchronous Clear | CD40162B (File No. 1047) | Decade with Synchronous Clear |
| CD40161B (File No. 1047) | Binary with Asynchronous Clear | CD40163B (File No. 1047) | Binary with Synchronous Clear |



92CS-29231

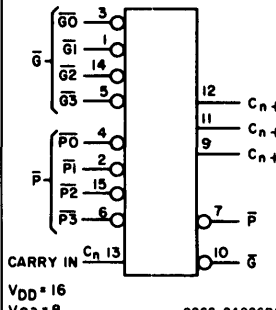
Hex "D" Type Flip-Flop
CD40174B (File No. 1031)



92CS-28587R1

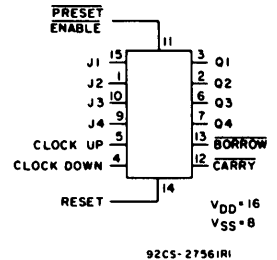
4-Bit Arithmetic Logic Unit
Active-Low Data Active-High Data

- CD40181B (File No. 989)



92CS-24826R1

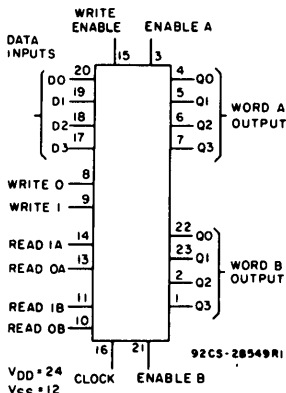
- Look-Ahead Carry Generator**
CD40182B (File No. 1008)



92CS-27561R1

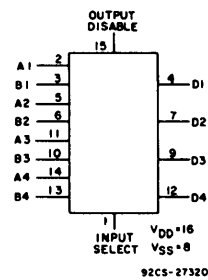
Presettable Up/Down Counter
(Dual Clock with Reset)

- | | |
|-------------------------|--------|
| CD40192B (File No. 993) | BCD |
| CD40193B (File No. 993) | Binary |



92CS-28549R1

- 4-by-4 Multiport Register**
CD40208B (File No. 1007)



92CS-27320

- Quad 2-Line-to-1-Line**
Data Selector/Multiplexer
CD40257B (File No. 982)

Burn-In and Life-Test Circuit Connections

Type	Dynamic Circuits						Bias Circuits			
	Open	Ground	9V	18V	Oscillator		Open	Ground	18V	
					50-kHz	25-kHz				
CD4000	1,2	7	6,9,10	14		3-5,8,11-13		6,9,10	7	1-5,8,11-14
CD4001		7	3,4,10,11	14		1,2,5,6,8,9,12,13		3,4,10,11	7	1,2,5,6,8,9,12-14
CD4002	6,8	7	1,13	14		2-5,9-12		1,6,8,13	7	2-5,9-12,14
CD4006	2	7	8-13	14		3	1,4-6	2,8-13	7	1,3-6,14
CD4007		4,7,9	1,5,8,12,13	2,11,14		3,6,10		1,5,8,12,13	7	2-4,6,9-11,14
CD4008		8	10-14	16		2,4,6,15	1,3,5,7,9	10-14	8	1-7,9,15,16
CD4009	13	8	2,4,6,10,12,15	1,16		3,5,7,9,11,14		2,4,6,10,12,13,15	8	1,3,5,7,9,11,14,16
CD4010	13	8	2,4,6,10,12,15	1,16		3,5,7,9,11,14		2,4,6,10,12,13,15	8	1,3,5,7,9,11,14,16
CD4011		7	3,4,10,11	14		1,2,5,6,8,9,12,13		3,4,10,11	7	1,2,5,6,8,9,12-14
CD4012	6,8	7	1,13	14		2-5,9-12		1,6,8,13	7	2-5,9-12,14
CD4013		4,6-8,10	1,2,12,13	14		3,11	5,9	1,2,12,13	7	3-6,8-11,14
CD4014		1,4-9,13-15	2,3,12	16		10	11	2,3,12	8	1,4-7,9-11,13-16
CD4015		6,8,14	2-5,10-13	16		1,9	7,15	2-5,10-13	8	1,6,7,9,14-16
CD4016		7	2,3,9,10	14		5,6,12,13	1,4,8,11	2,3,9,10	7	1,4-6,8,11-14
CD4017		8,13,15	1-7,9-12	16		14		1-7,9-12	8	13-16
CD4018		2,8,9,15	4-6,11,13	1,3,12,16		7,14	10	4-6,11,13	8	1-3,7,9,10,12,14-16
CD4019		8	10-13	16		1-7,9,14,15		10-13	8	1-7,9,14-16
CD4020		8,11	1-7,9,12-15	16		10		1-7,9,12-15	8	10,11,16
CD4021		1,4-9,13-15	2,3,12	16		10	11	2,3,12	8	1,4-7,9-11,13-16
CD4022	6,9	8,13,15	1-5,7,10-12	16		14		1-7,9-12	8	13-16
CD4023		7	6,9,10	14		1-5,8,11-13		6,9,10	7	1-5,8,11-14
CD4024	8,10,13	2,7	3-6,9,11,12	14		1		3-6,8-13	7	1,2,14
CD4025		7	6,9,10	14		1-5,8,11-13		6,9,10	7	1-5,8,11-14
CD4026		2,8,15	5	4-7,9-14		1		4-7,9-14	8	1-3,15,16
CD4027		4,7-9,12	1,2,14,15	5,6,10,11,16		3,13		1,2,14,15	8	3-7,9-13,16
CD4028		8	1-7,9,14,15	16		10,12,13	11	1-7,9,14,15	8	10-13,16
CD4029		1,3-5,8,12,13	2,6,7,11,14	9,10,16		15		2,6,7,11,14	8	1,3-5,9,10,12,13,15,16
CD4030		7	3,4,10,11	14		1,5,8,12	2,6,9,13	3,4,10,11	7	1,2,5,6,8,9,12-14
CD4031	3-5,11-14	8,15	6,7,9	1,16		2	10	3-7,9,11-14	8	1,2,10,15,16
CD4033		3,8,14,15	4,7,9-13	16		1	2	4-7,9-14	8	1-3,15,16
CD4034		1-8,11-14	16-23	9,24		15	10	1-8	12	9-11,13-24
CD4035	1,3,4 Jumpered	2,5,7-12	13,14,15	16		6		1,13-15	8	2-7,9-12,16
CD4040		8,11	1-7,9,12-15	16		10		1-7,9,12-15	8	10,11,16
CD4041		7	1,2,4,5,8,9,11,12	14		3,6,10,13		1,2,4,5,8,9,11,12	7	3,6,13,14
CD4042		8	1,2,3,9-12,15	6,16		5	4,7,13,14	1-3,9-12,15	8	4-7,13,14,16
CD4043	13	8	1,2,9,10	5,16		4,6,12,14	3,7,11,15	1,2,9,10,13	8	3-7,11,12,14-16
CD4044	2	8	1,9,10,13	5,16		4,6,12,14	3,7,11,15	1,2,9,10,13	8	3-7,11,12,14-16
CD4045	4-6,9-13,15	2,14*	7,8	1,3*		16		4-8,9-13,15	14*	1,2,3*,15,16
CD4046	1,4,6,7,10,11,13,15	8,9	2	3,5,12,16		14		1,2,4,6,7,10,11,13,15	8	3,5,9,12,14,16
CD4047		7,9,12	1,2,10,11,13	4,5,14		6,8	3	1,2,10,11,13	7	3-6,8,9,12,14
CD4048		8,15	1	2,16		9-14	3-7	1	8	2-7,9-16
CD4049	13,16	8	2,4,6,10,12,15	1		3,5,7,9,11,14		2,4,6,10,12,13,15	8	1,3,5,7,9,11,14,16
CD4050	13,16	8	2,4,6,10,12,15	1		3,5,7,9,11,14		2,4,6,10,12,13,15	8	1,3,5,7,9,11,14,16
CD4051		4-9,12,14	3	1,2,13,15,16		11	10	3	8	1,2,4-7,9-16
CD4052		4-8,11,12	3,13	1,2,14-16		10	9	3,13	8	1,2,4-7,9-12,14-16
CD4053		1,3,5-8,12	4,14,15	2,13,16		9	10,11	4,14,15	8	1,2,3,5-7,9-13,16
CD4060		8,12	1-7,9,10,13-15	16		11		1-7,9,10,13-15	8	11,12,16
CD4063		1,2,4,8,10,11,13	5-7	3,16		12,15	9,14	5-7	8	1-4,9-16
CD4066		7	2,3,9,10	14		5,6,12,13	1,4,8,11	2,3,9,10	7	1,4-6,8,11,14
CD4067		2-9,12,15-23	1	24		13,14	10,11	1	12	2-11,13-24
CD4068	6,8	7	1,13	14		2-5,9-12		1,6,8,13	7	2-5,9-12,14
CD4069		7	2,4,6,8,10,12	14		1,3,5,9,11,13		2,4,6,8,10,12	7	1,3,5,9,11,13,14
CD4070		7	3,4,10,11	14		1,5,8,12	2,6,9,13	3,4,10,11	7	1,2,5,6,8,9,12-14
CD4071		7	3,4,10,11	14		1,2,5,6,8,9,12,13		3,4,10,11	7	1,2,5,6,8,9,12-14
CD4072	6,8	7	1,13	14		2-5,9-12		1,5,8,13	7	2-5,9-12,14
CD4073		7	6,9,10	14		1-5,8,11-13		6,9,10	7	1-5,8,11-14

*No resistor

Burn-In and Life-Test Circuit Connections

Type	Dynamic Circuits						Bias Circuits		
	Open	Ground	9V	18V	Oscillator		Open	Ground	18V
					50-kHz	25-kHz			
CD4075		7	6,9,10	14	1-5,8,11-13		6,9,10	7	1-5,8,11-14
CD4076		1,2,8-10,15	3-6	16	7	11-14	3-6	8	1,2,7-16
CD4077		7	3,4,10,11	14	1,5,8,12	2,6,9,13	3,4,10,11	7	1,2,5,6,8,9,12-14
CD4078	6,8	7	1,13	14	3,5,9,11	2,4,10,12	1,6,8,13	7	2-5,9-12,14
CD4081		7	3,4,10,11	14	1,2,5,6,8,9,12,13		3,4,10,11	7	1,2,5,6,8,9,12-14
CD4082	6,8	7	1,13	14	2-5,9-12		1,6,8,13	7	2-5,9-12,14
CD4085		7	3,4	14	1,2,5,6,8,9,12,13	10,11	3,4	7	1,2,5,6,8-14
CD4086	4	7	3	14	1,2,5,6,8,9,12,13	10,11	4	7	1-3,5,6,8,9,11-14
CD4089		2,4,8,10,12,13,14,15	1,5,6,7	3,16	9	11	1,5,6,7	8	2-4,9-16
CD4093		7	3,4,10,11	2,6,9,13,14	1,5,8,12		3,4,10,11	7	1,2,5,6,8,9,12-14
CD4094		8	4-7,9-14	1,15,16	3	2	4-7,9-14	8	1-3,15,16
CD4095	1	2,7,13	6,8	3-5,9-11,14	12		1,6,8	7	2-5,9-14
CD4096	1	2,5,7,9,13	6,8	3,4,10,11,14	12		1,6,8	7	2-5,9-14
CD4097		2-9,12,13,15,16,18-23	1,17	24	10,11	14	1,17	12	2-11,13-16,18-24
CD4098		1,4,8,12,15	6,7,9,10	2,14,16	5,11	3,13	1,2,6,7,9,10,14,15	8	3-5,11-13,16
CD4099		5-8	1,9-15	16	2,4	3	1,9-15	8	2-7,16
CD4502		8	2,5,7,9,11,14	16	4	1,3,6,10,12,13,15	2,5,7,9,11,14	8	3,4,6,10,12,13,15,16
CD4503		1,8,15	3,5,7,9,11,13	16	2,4,6,10,12,14		3,5,7,9,11,14,15,16	8	1,2,4,6,10,12,14,15,16
CD4508		1,12,13	5,7,9,11,17,19,21,23	2,14,24	3,15	4,6,8,10,16,18,20,22	5,7,9,11,17,19,21,23	12	1-4,6,8,10,12-16,18,19,20,22,24
CD4510		1,3,4,8,9,12,13	2,6,7,11,14	10,16	15	5	2,6,7,11,14	8	1,3-5,9,10,12,13,15,16
CD4511	9-15	5,8		3,4,16	1,2,7	6	9-15	8	1-7,16
CD4512		8,10,15	14	16	1-7,9,11,12	13	14	8	1-7,9-13,15,16
CD4514		2,3,12	4-11,13-20	21,22,24	1	23	4-11,13-20	12	1-3,21-24
CD4515		2,3,12	4-11,13-20	21,22,24	1	23	4-11,13-20	12	1-3,21-24
CD4516		1,3,4,8,9,12,13	2,6,7,11,14	10,16	15	5	2,6,7,11,14	8	1,3-5,9,10,12,13,15,16
CD4517		3,8,13	1,2,5,8,10,11,14,15	16	4,12	7,9	1,2,5,6,10,11,14,15	8	3,4,7,9,12,13,16
CD4518		7,8,15	3-6,11-14	16	1,9	2,10	3-6,11-14	8	1,2,7,9,10,15,16
CD4520		7,8,15	3-6,11-14	16	1,9	2,10	3-6,11-14	8	1,2,7,9,10,15,16
CD4527		2,4,8,10,12-15	1,5-7	3,16	9	11	1,5-7	8	2-4,9-16
CD4532		8	6,7,9,14,15	16	1-4,10-13	5	6,7,9,14,15	8	1-5,10-13,16
CD4536		1,2,6-8,14,15	4,5,13	9-12,16	3		4,5,13	8	2,3,6,7,9-12,14,15,16
CD4538		1,4,8,12,15	6,7,9,10	2,14,16	5,11	3,13	1,2,6,7,9,10,14,15	8	3-4,11-13,16
CD4555		1,8,15	4-7,9-12	16	2,14	3,13	4-7,9-12	8	1-3,13-16
CD4556		1,8,15	4-7,9-12	16	2,14	3,13	4-7,9-12	8	1-3,13-16
CD4585		5-8,9,11,14,15	3,12,13	1,4,16	2	10	3,12,13	8	1,2,4-7,9-11,14-16
CD4724		1,2,3,8	4-7,9-12	16	14,15	13	4-7,9-12	8	1-3,13-16
CD40100	1,5,7,10,14,15	2,8,13	4,12	9,16	3	6,11	1,4,5,7,10,12,14,15	8	3,4,11-13,16
CD40101		4,7	6,9	12,14	2,3,5,8,10	1,11,13	6,9	7	2-5,8,10-14
CD40102		3,8,15	14	2,16	1,4,8,11,13	5,7,9,10,12	14	8	1-7,9-13,15,16
CD40103		3,8,15	14	2,16	1,4,6,11,13	5,7,9,10,12	14	8	1-7,9-13,15,16
CD40104		7,8,10	12-15	1,3-6,9,16	11	2	12-15	8	1-7,9-11,16
CD40105		1,8,9	2,10-14	16	3,15	4-7	10-15	8	1-7,9,16
CD40106		7	2,4,6,8,10,12	14	1,3,5,9,11,13		2,4,6,8,10,12	7	1,3,5,9,11,13,14
CD40107	1,2,6,8,12,13	7	5,9	14	3,11	4,10	1,2,5,6,8,9,12,13	7	3,4,10,11,14
CD40108		12	1,2,4-7,22,23	3,15,16,21,24	8,10,14,16,19,20	9,11,13,17,18	1,2,4-7,22,23	12	3,8-11,13-21,24
CD40109	12	8	4,5,11,13	1*,16 *VCC = 9V	3,6,10,14	2,7,9,15	4,5,11-13	8	(1,2,3,10,14) ² 6-9
CD40110		4-8	1-3,10-15	16	9		1-3,10-15	8	4-7,9,16
CD40114		2,3,8,13,15	5,7,9,11	16	1,14	4,6,10,12	5,7,9,11	8	1-4,6,10,12-16
CD40147		8	6,7,9,14	16	1,3,5,11,13	2,4,10,12,15	6,7,9,14	8	1-5,10-13,15,16
CD40160		8	11-15	1,7,9,10,16	2-6		11-15	8	1-7,9,10,16
CD40161		8	11-15	1,7,9,10,16	2-6		11-15	8	1-7,9,10,16
CD40162		8	11-15	1,7,9,10,16	2,6		11-15	8	1-7,9,10,16
CD40163		8	11-15	1,7,9,10,16	2-6		11-15	8	1-7,9,10,16

Burn-In and Life-Test Circuit Connections

Type	Dynamic Circuits						Bias Circuits		
	Open	Ground	9V	18V	Oscillator		Open	Ground	18V
					50-kHz	25-kHz			
CD40174	8	2,5,7,10,12,15	1,16	9	3,4,6,11,13,14	2,5,7,10,12,15	8	1,3,4,6,9,11,13,14,15	
CD40181	4-6,8,12	9-11,13-17	3,24	1,2,18-23	7	9,10,11,13-17	12	1-8,18-24	
CD40182	8	7,9,10,11,12	16	1-6,14,15	13	7,9-12	8	1-6,13-16	
CD40192	8,14,15	2,3,6,7,12,13	1,5,9-11,16	4		2,3,6,7,12,13	8	1,4,5,9-11,14-16	
CD40193	8,14,15	2,3,6,7,12,13	1,5,9-11,16	4		2,3,6,7,12,13	8	1,4,5,9-11,14-16	
CD40194	7,8,10	12-15	1,3-6,9,16	11	2	12-15	8	1-7,9-11,16	
CD40208	12	1,2,4-7,22,23	3,15,16,21,24	8,10,14,19,20	9,11,13,17,18	1,2,4-7,22,23	12	3,8-11,13-21,24	
CD40257	8,15	4,7,9,12	16	2,3,5,6,10,11,13,14	1	4,7,9,12	8	1-3,5,6,10,11,13-16	

NOTE: All pins except VDD and VSS may have resistor of 0-47K ohms

Reliability Data for High-Reliability CD4000-Series CMOS IC's

A considerable amount of data has been generated during qualification and conformance testing of CD4000A-and CD4000B-series CMOS integrated circuits to MIL-M-38510. These data indicate excellent package integrity for devices subjected to Group B qualification tests, and excellent stability for devices subjected to qualification life tests. Conformance test data over four million device hours of accelerated-stress testing at 125°C on a wide variety of circuits, from gates to MSI devices, show excellent results (similar to the initial conformance data obtained for

CD4000A-and CD4000B-series Reliability Qualification.

Qualification test data submitted to the Defense Electronic Supply Center on 37 CMOS IC types show excellent reliability.

Recent filed-usage data from 1976 through 1980 on 19,456 CD4000-series CMOS integrated circuits in satellites revealed 2 malfunctions for a total of more than 293 million device-hours. These data correspond to a failure rate of 0.0011%/1000 hours at a 60% confidence level.

Satellite and Military Applications For CMOS & BiPolar Devices

SATELLITES, AEROSPACE	MILITARY	SATELLITES, AEROSPACE	MILITARY
ATMOSPHERIC EXPLORER 70P HEAO SPACE SHUTTLE ITOS B-SAT SAT COM NIMBUS HELIOS OSCAR-6 PIONEER F ATS IMP SATELLITES MJS-77 (MARINER-JUPITER-SATURN) CTS IUE VELA DSPM IUS ISPM GALILEO MAGSAT ISEES DYNAMIC EXPLORER	TOW COBRA TENLEY S-3A AIRCRAFT LANS PROGRAM D-1065 COMMUNICATIONS VINSON AIRS ARC-150 ARC-164 PRC-85 STINGER CAPTOR MANPACK SKIRU AN/ALE 139 DMD/PLARS AFSCS COPPER HEAD PTARMIGAN LOW CALS-HELLFIRES CLC CUTTYSARK F-15 F-16 DMD MSC64 XM-12 TRIDENT MAYBERRY SINGGARS MILES VALLOR SPARROW MOPMS BCS SCATTERABLE MINE	PIONEER/VENUS AIRS TIROS ISSP HEART PACERS CUSTOM DEVICES HS250	PARKHILL MULTI ROLE COMBAT AIRCRAFT AN-TPN-19 AN-ASQ-119 ARCTIC BEACON AWACS MK46 NYVO B155 M-56 XM-70 ADAM FMU 112B FMU 117B ROLAND MISSILE BISS PAY PENNY GEMSS SEELEY REMBASS GPS NAVY 5" GP AEGIS PRC 77 PRC 25 SAM-D BULL-DOG CONDOR NIKE X

**CMOS CD4000-SERIES QUALIFICATION DATA
MIL-STD-883, METHOD 5005
QUALIFICATION
1000-HOUR LIFE TEST AT 125°C FOR
CD4000B SERIES**

Detail Specification	Device Hrs	Device Reject	
		Degrad.	Non-Funct.
170 AND gates	231,000	2	0
171 OR gates	231,000	1	0
172 multifunction gates	308,000	2	0
174 buffers	154,000	1	0
175 flipflops	77,000	0	0
176 latches	158,000	4	0
Total	1,159,000	10	0

**CMOS Qualification Testing for CD4000B Series—
failure rates.**

MIL-M-38510/170 SERIES		MTTF(Hrs)
1.159 × 10 ⁶ device hrs at 125°C		101,000
10 degradational rejects		
0.98%/1000 hrs @ 125°C		
0.146%/1000 hrs @ 55°C		
0.046%/1000 hrs @ 25°C		2,600,000
Zero non-functional rejects		1,740,000
0.079%/1000 hrs @ 125°C		
0.012%/1000 hrs @ 55°C		
0.0034%/1000 hrs @ 25°C		
		8,500,000
		29,200,000

Field-usage operating-life data on CD4000A family of high-reliability integrated circuits (MIL-STD-883 slash-series types)

Satellite	Oscar-6	ITOS D/F/G/H ¹	Atmosphere Explorer C/D/E ²	Satcom F1/F2 ⁵	Voyager 1/2 ⁶
Time in orbit (months)	32	85.5	49	16.5	52
Number of units	90	168	7200	1652	10346
Device—hours	2,073,600	2,585,520	84,672,000	9,812,880	193,677,120
Number of rejects	0	0	0	0	2
Failure rate (%/1000 hrs) ^{3 4}	0.045	0.035	0.001	0.0092	0.0016
MTTF (hrs) ³	2,360,000	2,900,000	96,000,000	10,750,000	63,000,000
Total device hours	292,819,000				
Total failure rate ^{3 4}	0.0011				
Total MTTF hrs ³	94,000,000				

¹Satellite D orbit time 23 months, F 36 months, G 24 months, H 2.5 months
²AE/C orbit time 34 months, AE/D 4 months, AE/E 11 months
³Failure rates and MTTF presented at 60 percent 1-sided s-confidence level
⁴Operating temperature range 25°C to 125°C; no acceleration factor used
⁵Satcom orbit time; F1, 10 months, F2, 6.5 months
⁶Voyager 1 orbit time is 27 months, Voyager 2 orbit time is 25 months as of Oct 1980

MIL-STD-883, method 5005, qualification 1000-hour life test at 125°C for CD4000A Series

Detail Specification	Device Hrs	Device Reject	
		Degrad.	Non-Funct.
50 gates	387,000	0	0
51 flipflops	258,000	1	0
52 gates	516,000	1	0
53 gates	258,000	0	0
55 buffers	563,000	4	0
56 counters	645,000	3	0
57 shift registers	387,000	3	0
Total	3,014,000	12	0

**CMOS Qualification Testing for CD4000B Series—
failure rates.**

MIL-M-38510/050 SERIES		MTTF(Hrs)
3.014 × 10 ⁶ device hrs at 125°C		225,000
12 degradational rejects		
0.44%/1000 hrs @ 125°C		
0.066%/1000 hrs @ 55°C		
0.02%/1000 hrs @ 25°C		1,545,000
Zero functional rejects		3,300,000
0.03%/1000 hrs @ 125°C		
0.0045%/1000 hrs @ 55°C		
0.0013%/1000 hrs @ 25°C		
		22,000,000
		75,000,000

Reliability Data for Radiation-Resistant CD4000-Series CMOS IC's
 Life-Test Hours and Failure Rate for Types Processed to 10⁶ Rads(Si)

MIL-M-38510 Devices			RCA MIL-STD-883 Devices		
Type	Sample Size	Device Hours	Type	Sample Size	Device Hours
CD4000A	45	45000	CD4016A	77	77000
CD4011A	77	77000	CD4028A	77	77000
CD4012B	77	77000	CD4029A	45	45000
CD4013A	77	77000	CD4035A	45	45000
CD4017A	77	77000	CD4040A	77	77000
CD4019A	77	77000	CD4046A	77	77000
CD4027A	45	45000	CD4051B	45	45000
CD4030A	45	45000	CD4061A	77	77000
CD4031A	45	45000	CD4069UB	77	77000
CD4041A	77	77000	CD4052B	45	45000
CD4050B	77	77000	CD4532B	45	45000
Total Number of Devices		1284			
Total Device Hours		1,284,000			
Functional Rejects		0			
Failure Rate at 125°C		0.071%/1000 hrs.			
Failure Rate at 55°C		0.0096%/1000 hrs.			
Failure Rate at 25°C		0.003%/1000 hrs.			
Notes: 1. Each device was tested for 1000 hours.					
2. No out-of-specification functional rejects were noted.					
3. Devices were tested at a temperature of 125°C and a supply voltage VDD of 12.5 V.					