

CD4094B Types

CMOS 8-Stage Shift-and-Store Bus Register

High-Voltage Types (20-Volt Rating)

The RCA-CD4094B is an 8-stage serial shift register having a storage latch associated with each stage for strobing data from the serial input to parallel buffered 3-state outputs. The parallel outputs may be connected directly to common bus lines. Data is shifted on positive clock transitions. The data in each shift register stage is transferred to the storage register when the STROBE input is high. Data in the storage register appears at the outputs whenever the OUTPUT-ENABLE signal is high.

Two serial outputs are available for cascading a number of CD4094B devices. Data is available at the Q_S serial output terminal on positive clock edges to allow for high-speed operation in cascaded systems in which the clock rise time is fast. The same serial information, available at the Q_S terminal on the next negative clock edge, provides a means for cascading CD4094B devices when the clock rise time is slow.

The CD4094B types are supplied in 16-lead hermetic dual-in-line ceramic packages (D and F suffixes), 16-lead dual-in-line plastic package (E suffix), 16-lead ceramic flat package (K suffix), and in chip form (H suffix).

Features:

- 3-state parallel outputs for connection to common bus
- Separate serial outputs synchronous to both positive and negative clock edges for cascading
- Medium speed operation — 5 MHz at 10 V (typ.)
- Standardized, symmetrical output characteristics
- 100% tested for quiescent current at 20 V
- Maximum input current of 1 μ A at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- Noise margin (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
- 5-V, 10-V, and 15-V parametric ratings
- Meets all requirements of JEDEC Tentative Standard No. 13A, "Standard Specifications for Description of 'B' Series CMOS Devices"

Applications:

- Serial-to-parallel data conversion
- Remote control holding register
- Dual-rank shift, hold, and bus applications

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE RANGE, (V _{DD})	..... -0.5 to +20 V
(Voltages referenced to V _{SS} Terminal)	..... -0.5 to V _{DD} +0.5 V
INPUT VOLTAGE RANGE, ALL INPUTS	..... -0.5 to V _{DD} +0.5 V
DC INPUT CURRENT, ANY ONE INPUT	..... \pm10 mA
POWER DISSIPATION PER PACKAGE (P _D):	
For T _A = -40 to +60°C (PACKAGE TYPE E)	..... 500 mW
For T _A = +60 to +85°C (PACKAGE TYPE E)	..... Derate Linearly at 12 mW/°C to 200 mW
For T _A = -55 to +100°C (PACKAGE TYPES D, F, K)	..... 500 mW
For T _A = +100 to +125°C (PACKAGE TYPES D, F, K)	..... Derate Linearly at 12 mW/°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°C
PACKAGE TYPE E	..... -40 to +85°C
STORAGE TEMPERATURE RANGE (T _{stg})	..... -65 to +150°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°C

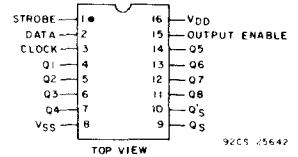
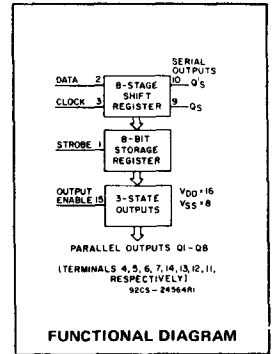


Fig. 1 — Terminal assignment.

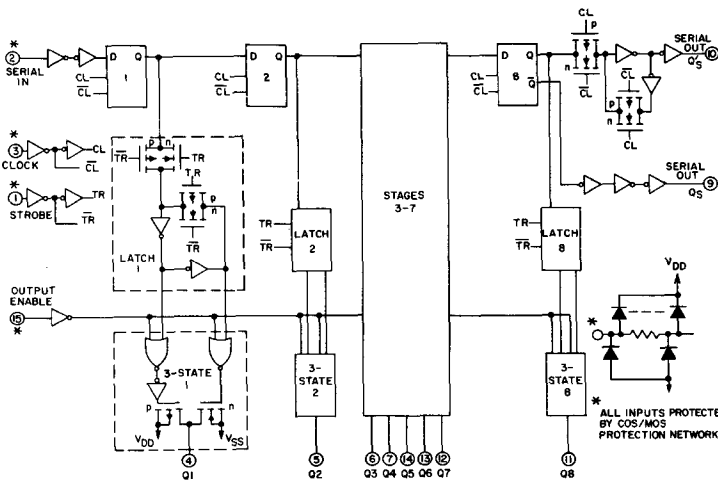


Fig. 2 — CD4094B Logic diagram.

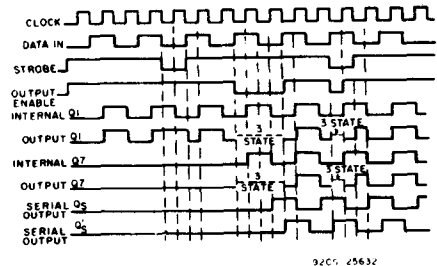


Fig. 3 — Timing diagram.

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RECOMMENDED OPERATING CONDITIONS at $T_A = 25^\circ\text{C}$, Except as Noted.
 For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC	VDD (V)	LIMITS		UNITS
		MIN.	MAX.	
Supply-Voltage Range (For T_A =Full Package-Temperature Range)		3	18	V
Data Setup Time, t_S	5 10 15	125 55 35	—	ns
Clock Pulse Width, t_W	5 10 15	200 100 83	—	ns
Clock Input Frequency, f_{CL}	5 10 15	dc	1.25 2.5 3	MHz
Clock Input Rise or Fall time, t_{rCL}, t_{fCL} *	5 10 15	—	15 5 5	μs
Strobe Pulse Width, t_W	5 10 15	200 80 70	—	ns

*If more than one unit is cascaded t_{fCL} (for Q_S only) should be made less than or equal to the sum of the fixed propagation delay at 50 pF and the transition time of the output driving stage for the estimated capacitive load.

TRUTH TABLE

CL ^A	Output Enable	Strobe	Data	Parallel Outputs		Serial Outputs	
				Q1	Q2	Q3*	Q4*
	0	X	X	OC	OC	Q7	NC
	0	X	X	OC	OC	NC	Q7
	1	0	X	NC	NC	Q7	NC
	1	1	0	0	Q _{N-1}	Q7	NC
	1	1	1	1	Q _{N-1}	Q7	NC
	1	1	1	NC	NC	NC	Q7

^A = Level Change
 X = Don't Care
 NC = No Change
 OC = Open Circuit
 Logic 1 \equiv High
 Logic 0 \equiv Low

* At the positive clock edge information in the 7th shift register stage is transferred to the 8th register stage and the Q_S output.

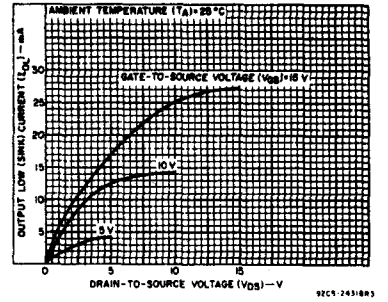


Fig. 4 - Typical output low (sink) current characteristics.

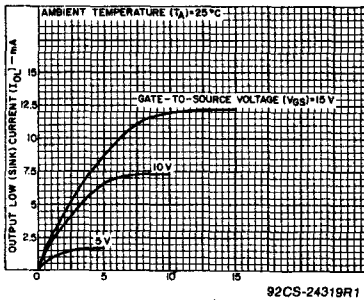


Fig. 5 - Minimum output low (sink) current characteristics.

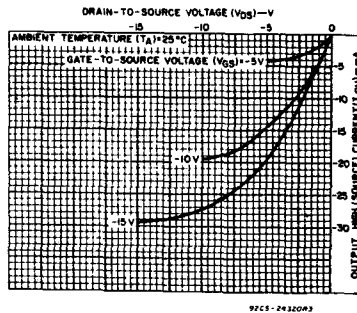


Fig. 6 - Typical output high (source) current characteristics.

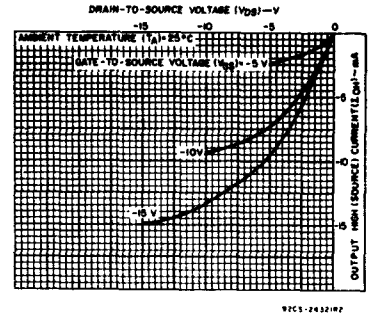


Fig. 7 - Minimum output high (source) current characteristics.

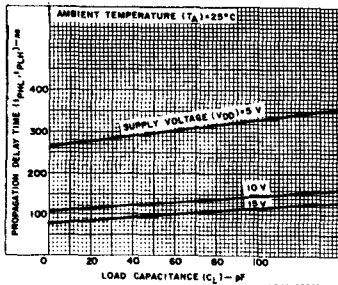


Fig. 8 - Clock-to-serial output Q_S propagation delay vs C_L .

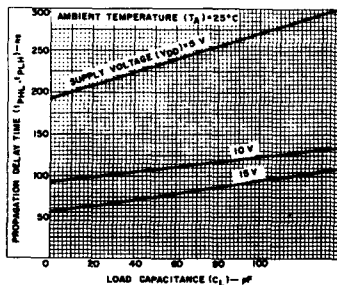


Fig. 9 - Clock-to-serial output Q'_S propagation delay vs C_L .

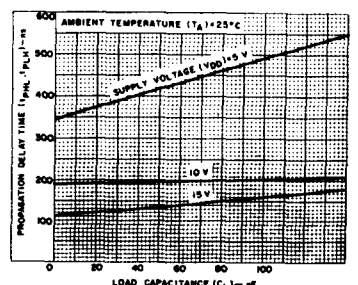


Fig. 10 - Clock-to-parallel output propagation delay vs C_L .

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STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
	V _O (V)	V _{IN} (V)	V _{DD} (V)	+25							
				-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	—	mA
	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, VOL 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, VOH Min.	—	0,5	5	4.95			4.95	5	—	—	V
	—	0,10	10	9.95			9.95	10	—	—	
	—	0,15	15	14.95			14.95	15	—	—	
Input Low Voltage, VIL 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, VIH Min.	0.5, 4.5	—	5	3.5			3.5	—	—	—	V
	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	—	±10 ⁻⁵	±0.1	μA
3-State Output Leakage Current I _{OUT} Max.	0,18	0,18	18	±0.4	±0.4	±12	±12	—	±10 ⁻⁴	±0.4	μA

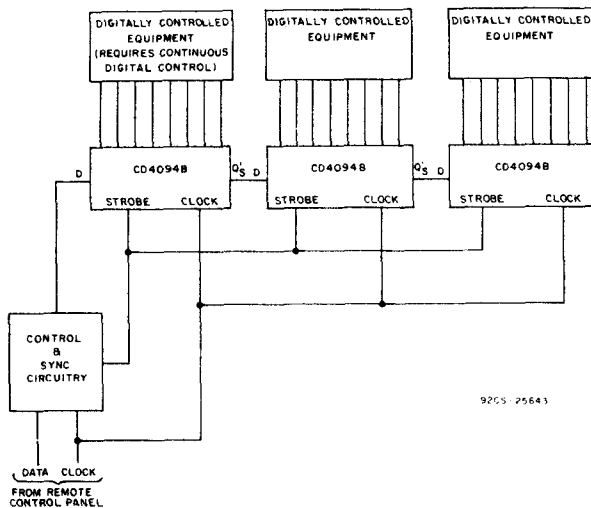


Fig. 14 — Remote control holding register.

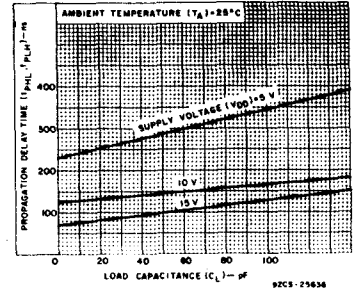


Fig. 11 — Strobe-to-parallel output propagation delay vs C_L.

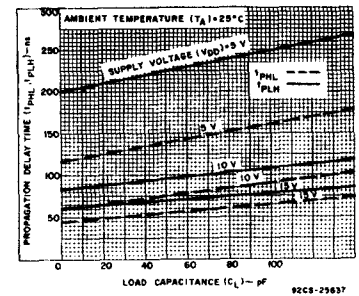


Fig. 12 — Output enable-to-parallel output propagation delay vs C_L.

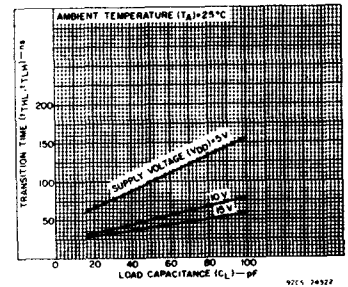


Fig. 13 — Typical transition time vs load capacitance.

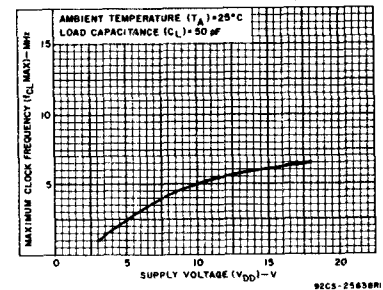


Fig. 15 — Typical maximum-clock-frequency vs supply voltage.

CD4094B Types

DYNAMIC ELECTRICAL CHARACTERISTICS

At $T_A=25^\circ\text{C}$; Input $t_r, t_f = 20\text{ ns}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$

CHARACTERISTIC	V _{DD} (V)	LIMITS			UNITS
		MIN.	TYP.	MAX.	
Propagation Delay Time, t_{PHL}, t_{PLH} Clock to Serial Output Q_S	5	—	300	600	ns
	10	—	125	250	
	15	—	95	190	
Clock to Serial Output Q_S'	5	—	230	460	ns
	10	—	110	220	
	15	—	75	150	
Clock to Parallel Output	5	—	420	840	ns
	10	—	195	390	
	15	—	135	270	
Strobe to Parallel Output	5	—	290	580	ns
	10	—	145	290	
	15	—	100	200	
Output Enable to Parallel Output: t_{PHZ}, t_{PZH}	5	—	140	280	ns
	10	—	60	120	
	15	—	45	90	
t_{PLZ}, t_{PZL}	5	—	100	200	ns
	10	—	50	100	
	15	—	40	80	
Minimum Strobe Pulse Width, t_W	5	—	100	200	ns
	10	—	40	80	
	15	—	35	70	
Minimum Clock Pulse Width, t_W	5	—	100	200	ns
	10	—	50	100	
	15	—	40	83	
Minimum Data Setup Time, t_S	5	—	60	125	ns
	10	—	30	55	
	15	—	20	35	
Transition Time; t_{THL}, t_{TLH}	5	—	100	200	ns
	10	—	50	100	
	15	—	40	80	
Maximum Clock Input Rise or Fall Time, t_{rCL}, t_{fCL}	5	15	—	—	μs
	10	5	—	—	
	15	5	—	—	
Maximum Clock Input Frequency, f_{CL}	5	1.25	2.5	—	MHz
	10	2.5	5	—	
	15	3	6	—	
Input Capacitance C_{iN} (Any Input)	—	—	5	7.5	pF

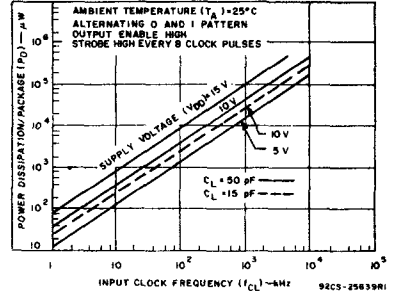


Fig. 16 - Dynamic power dissipation vs input clock frequency.

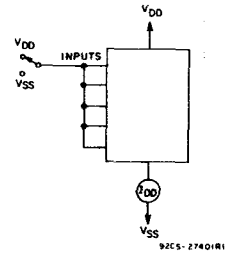


Fig. 17 - Quiescent device current test circuit.

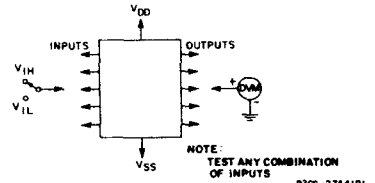


Fig. 18 - Input voltage test circuit.

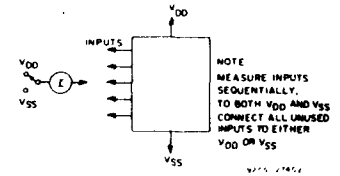
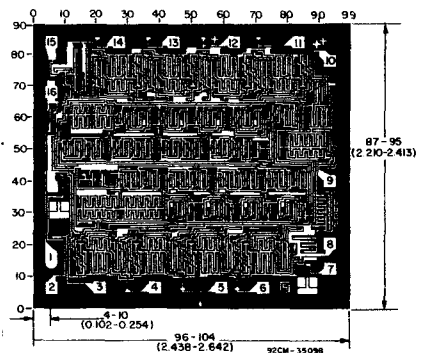


Fig. 19 - Input current test circuit.

The photographs and dimensions of each CMOS chip represent a chip when it is part of the wafer. When the wafer is separated into individual chips, the angle of cleavage may vary with respect to the chip face for different chips. The actual dimensions of the isolated chip, therefore, may differ slightly from the nominal dimensions shown. The user should consider a tolerance of -3 mils to $+16\text{ mils}$ applicable to the nominal dimensions shown.

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



Dimensions and Pad Layout for CD4094B Chip.