



CD4076BM/CD4076BC TRI-STATE® Quad D Flip-Flop

General Description

The CD4076BM/CD4076BC TRI-STATE quad D flip-flop is a monolithic complementary MOS (CMOS) integrated circuit constructed with N- and P-channel enhancement mode transistors. The four D type flip-flops operate synchronously from a common clock. The TRI-STATE output allows the device to be used in bus organized systems. The outputs are placed in the TRI-STATE mode when either of the two output disable pins are in the logic "1" level. The input disables allow the flip flops to remain in their present state without disrupting the clock. If either of the two input disables is taken to a logic "1" level, the Q outputs are fed back to the inputs and in this manner the flip-flops do not change state.

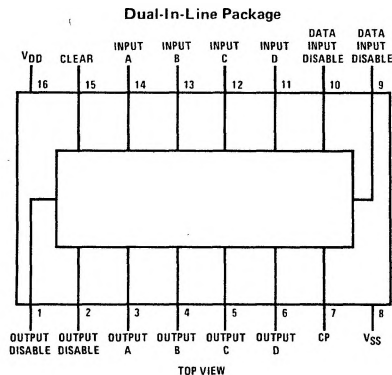
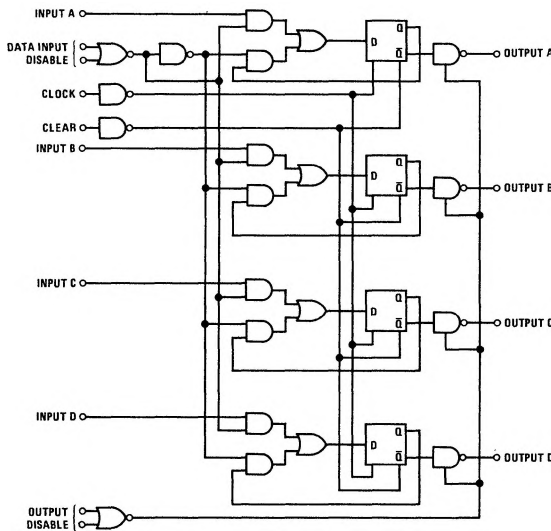
Clearing is enabled by taking the clear input to a logic "1" level. Clocking occurs on the positive-going transition.

All inputs are protected against damage due to static discharge by diode clamps to V_{DD} and V_{SS} .

Features

- Wide supply voltage range 3.0V to 15V
- High noise immunity 0.45 V_{DD} (typ.)
- Low power TTL compatibility fan out of 2 driving 74L or 1 driving 74LS
- High impedance TRI-STATE outputs
- Inputs can be disabled without gating the clock
- Equivalent to MM54C173/MM74C173

Logic and Connection Diagrams



Truth Table

t_n		t_{n+1}
DATA INPUT DISABLE	DATA INPUT	
Logic "1" on One or Both Inputs	X	Q_n
Logic "0" on Both Inputs	1	1
Logic "0" on Both Inputs	0	0

Absolute Maximum Ratings (Notes 1 and 2)

V _{DD} dc Supply Voltage	-0.5 to +18 VDC
V _{IN} Input Voltage	-0.5 to V _{DD} +0.5 VDC
T _S Storage Temperature Range	-65°C to +150°C
P _D Package Dissipation	500 mW
T _L Lead Temperature (Soldering, 10 seconds)	300°C

Operating Conditions (Note 2)

V _{DD} dc Supply Voltage	3 to 15 VDC
V _{IN} Input Voltage	0 to V _{DD} VDC
T _A Operating Temperature Range	-55°C to +125°C
CD4076BM	-55°C to +125°C
CD4076BC	-40°C to +85°C

DC Electrical Characteristics CD4076BM (Note 2)

PARAMETER	CONDITIONS	-55°C		25°C			125°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I _{DD} Quiescent Device Current	V _{DD} = 5V		5			5		150	μA
	V _{DD} = 10V		10			10		300	μA
	V _{DD} = 15V		20			20		600	μA
V _{OL} Low Level Output Voltage	V _{DD} = 5V		0.05			0.05		0.05	V
	V _{DD} = 10V		0.05			0.05		0.05	V
	V _{DD} = 15V		0.05			0.05		0.05	V
V _{OH} High Level Output Voltage	V _{DD} = 5V	4.95		4.95			4.95		V
	V _{DD} = 10V	9.95		9.95			9.95		V
	V _{DD} = 15V	14.95		14.95			14.95		V
V _{IL} Low Level Input Voltage	V _{DD} = 5V, V _O = 0.5V or 4.5V		1.5			1.5		1.5	V
	V _{DD} = 10V, V _O = 1V or 9V		3.0			3.0		3.0	V
	V _{DD} = 15V, V _O = 1.5V or 13.5V		4.0			4.0		4.0	V
V _{IH} High Level Input Voltage	V _{DD} = 5V, V _O = 0.5V or 4.5V	3.5		3.5			3.5		V
	V _{DD} = 10V, V _O = 1V or 9V	7.0		7.0			7.0		V
	V _{DD} = 15V, V _O = 1.5V or 13.5V	11.0		11.0			11.0		V
I _{OL} Low Level Output Current	V _{DD} = 5V, V _O = 0.4V	0.64		0.51	0.88		0.36		mA
	V _{DD} = 10V, V _O = 0.5V	1.6		1.3	2.25		0.9		mA
	V _{DD} = 15V, V _O = 1.5V	4.2		3.4	8.8		2.4		mA
I _{OH} High Level Output Current	V _{DD} = 5V, V _O = 4.6V	-0.64		-0.51	-0.88		-0.36		mA
	V _{DD} = 10V, V _O = 9.5V	-1.6		-1.3	-2.25		-0.9		mA
	V _{DD} = 15V, V _O = 13.5V	-4.2		-3.4	-8.8		-2.4		mA
I _{IN} Input Current	V _{DD} = 15V, V _{IN} = 0V		-0.1		-10 ⁻⁵	-0.1		-1.0	μA
	V _{DD} = 15V, V _{IN} = 15V		0.1		10 ⁻⁵	0.1		1.0	μA
I _{OZ} Output Current in High Impedance State	V _{DD} = 15V, V _{IN} = 0V		-0.1		-10 ⁻⁵	-0.1		-1.0	μA
	V _{DD} = 15V, V _{IN} = 15V		0.1		10 ⁻⁵	0.1		1.0	μA

DC Electrical Characteristics CD4076BC (Note 2)

PARAMETER	CONDITIONS	-40°C		25°C			85°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I _{DD} Quiescent Device Current	V _{DD} = 5V		20			20		150	μA
	V _{DD} = 10V		40			40		300	μA
	V _{DD} = 15V		80			80		600	μA
V _{OL} Low Level Output Voltage	V _{DD} = 5V		0.05			0.05		0.05	V
	V _{DD} = 10V		0.05			0.05		0.05	V
	V _{DD} = 15V		0.05			0.05		0.05	V
V _{OH} High Level Output Voltage	V _{DD} = 5V	4.95		4.95			4.95		V
	V _{DD} = 10V	9.95		9.95			9.95		V
	V _{DD} = 15V	14.95		14.95			14.95		V
V _{IL} Low Level Input Voltage	V _{DD} = 5V, V _O = 0.5V or 4.5V		1.5			1.5		1.5	V
	V _{DD} = 10V, V _O = 1V or 9V		3.0			3.0		3.0	V
	V _{DD} = 15V, V _O = 1.5V or 13.5V		4.0			4.0		4.0	V
V _{IH} High Level Input Voltage	V _{DD} = 5V, V _O = 0.5V or 4.5V	3.5		3.5			3.5		V
	V _{DD} = 10V, V _O = 1V or 9V	7.0		7.0			7.0		V
	V _{DD} = 15V, V _O = 1.5V or 13.5V	11.0		11.0			11.0		V
I _{OL} Low Level Output Current	V _{DD} = 5V, V _O = 0.4V	0.52		0.44	0.88		0.36		mA
	V _{DD} = 10V, V _O = 0.5V	1.3		1.1	2.25		0.9		mA
	V _{DD} = 15V, V _O = 1.5V	3.6		3.0	8.8		2.4		mA
I _{OH} High Level Output Current	V _{DD} = 5V, V _O = 4.6V	-0.52		-0.44	-0.88		-0.36		mA
	V _{DD} = 10V, V _O = 9.5V	-1.3		-1.1	-2.25		-0.9		mA
	V _{DD} = 15V, V _O = 13.5V	-3.6		-3.0	-8.8		-2.4		mA

DC Electrical Characteristics (Cont'd.) CD4076BC (Note 2)

PARAMETER	CONDITIONS	-40°C		25°C			85°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I _{IN} Input Current	V _{DD} = 15V, V _{IN} = 0V		-0.3		-10 ⁻⁵	-0.3		-1.0	μA
	V _{DD} = 15V, V _{IN} = 15V		0.3		10 ⁻⁵	0.3		1.0	μA
I _{OZ} Output Current in High Impedance State	V _{DD} = 15V, V _{IN} = 0V		-0.3		-10 ⁻⁵	-0.3		-1.0	μA
	V _{DD} = 15V, V _{IN} = 15V		0.3		10 ⁻⁵	0.3		1.0	μA

AC Electrical Characteristics T_A = 25°C, C_L = 50 pF, R_L = 200k, Input t_r = t_f = 20 ns, unless otherwise specified

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
t _{PHL} Propagation Delay Time From Clock to Output	V _{DD} = 5V		220	400	ns
	V _{DD} = 10V		80	200	ns
	V _{DD} = 15V		65	160	ns
t _{PHL} Propagation Delay Time From Clear to Output	V _{DD} = 5V		240	490	ns
	V _{DD} = 10V		90	180	ns
	V _{DD} = 15V		70	145	ns
t _{SU} Minimum Input Data Set-Up Time	V _{DD} = 5V		40	80	ns
	V _{DD} = 10V		15	30	ns
	V _{DD} = 15V		12	25	ns
t _H Minimum Input Data Hold Time	V _{DD} = 5V		-40	0	ns
	V _{DD} = 10V		-12	0	ns
	V _{DD} = 15V		-10	0	ns
t _{SU} Minimum Input Disable Set-Up Time	V _{DD} = 5V		100	200	ns
	V _{DD} = 10V		35	70	ns
	V _{DD} = 15V		28	55	ns
t _H Minimum Input Disable Hold Time	V _{DD} = 5V		-75	0	ns
	V _{DD} = 10V		-30	0	ns
	V _{DD} = 15V		-25	0	ns
t _{PHZ'} t _{PLZ} Propagation Delay Time From Output Disable to High Impedance State	V _{DD} = 5V, R _L = 1.0k		170	340	ns
	V _{DD} = 10V, R _L = 1.0k		70	140	ns
	V _{DD} = 15V, R _L = 1.0k		56	115	ns
t _{PZH} , t _{PZL} Propagation Delay From Output Disable to Logical "1" Level or Logical "0" Level (From High Impedance State)	V _{DD} = 5V, R _L = 1.0k		170	340	ns
	V _{DD} = 10V, R _L = 1.0k		70	140	ns
	V _{DD} = 15V, R _L = 1.0k		56	115	ns
t _{THL} or t _{TLH} Transition Time	V _{DD} = 5V		100	200	ns
	V _{DD} = 10V		50	100	ns
	V _{DD} = 15V		40	80	ns
f _{CL} Maximum Clock Frequency	V _{DD} = 5V	3.0	4.0		MHz
	V _{DD} = 10V	7.0	12.0		MHz
	V _{DD} = 15V	8.75	15.0		MHz
t _{WH} Minimum Clear Pulse Width	V _{DD} = 5V		150		ns
	V _{DD} = 10V		70		ns
	V _{DD} = 15V		56		ns
t _{RCL} , t _{FCL} Maximum Clock Rise and Fall Time	V _{DD} = 5V	10			μs
	V _{DD} = 10V	5			μs
	V _{DD} = 15V	2			μs
C _{IN} Average Input Capacitance	Data Inputs (A, B, C, D)		3	7.5	pF
	Other Inputs		6	15	pF
C _{PD} Power Dissipation Capacity	All Four Flip-Flops, (Note 3)		100		pF
C _{OUT} TRI-STATE® Output Capacitance	Any Output			15	pF

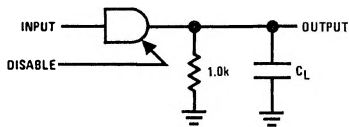
Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed; they are not meant to imply that the devices should be operated at these limits. The table of "Recommended Operating Conditions" and "Electrical Characteristics" provides conditions for actual device operation.

Note 2: V_{SS} = 0V unless otherwise specified.

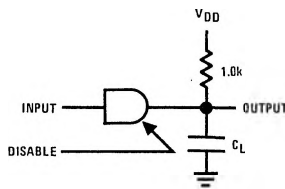
Note 3: C_{PD} determines the no load ac power consumption of any CMOS device. For complete explanation, see 54C/74C Family Characteristics application note, AN-90.

AC Test Circuits and Switching Time Waveforms

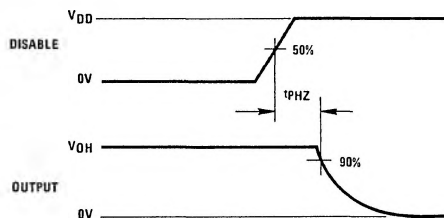
t_{PHZ} and t_{PZH}



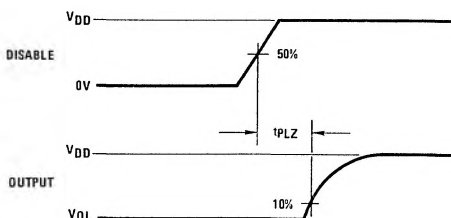
t_{PLZ} and t_{PZL}



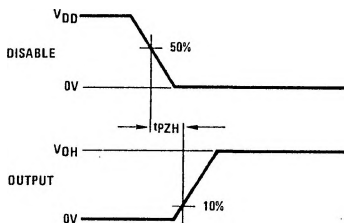
t_{PHZ}



t_{PLZ}



t_{PZH}



t_{PZL}

