

CD4049M/CD4049C Hex Inverting Buffer CD4050BM/CD4050BC Hex Non-Inverting Buffer

General Description

These hex buffers are monolithic complementary MOS (CMOS) integrated circuits constructed with N- and P-channel enhancement mode transistors. These devices feature logic level conversion using only one supply voltage (V_{DD}). The input signal high level (V_{IH}) can exceed the V_{DD} supply voltage when these devices are used for logic level conversions. These devices are intended for use as hex buffers, CMOS to DTL/TTL converters, or as CMOS current drivers, and at $V_{DD} = 5.0V$, they can drive directly two DTL/TTL loads over the full operating temperature range.

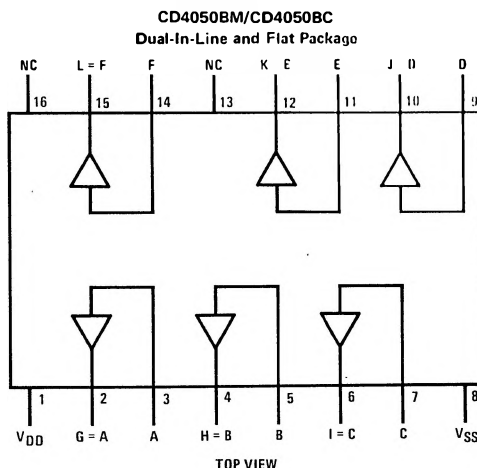
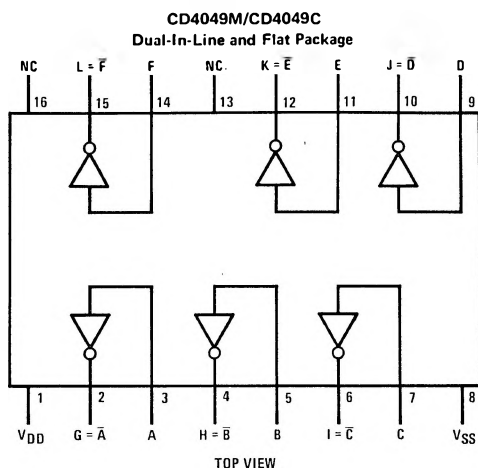
Features

- Wide supply voltage range 3.0V to 15V
- Direct drive to 2 TTL loads at 5.0V over full temperature range
- High source and sink current capability
- Special input protection permits input voltages greater than V_{DD}

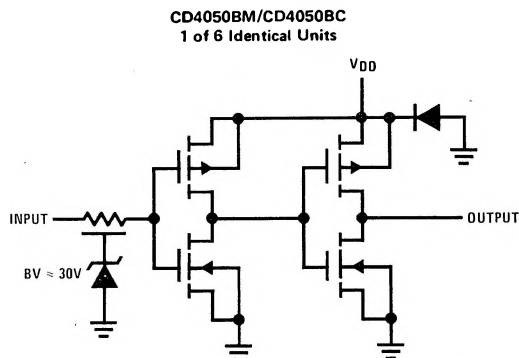
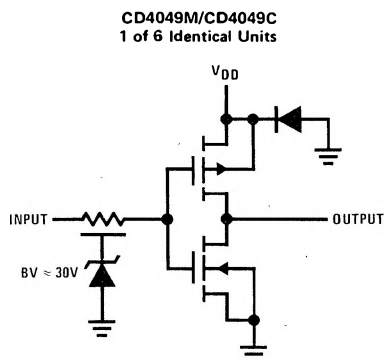
Applications

- CMOS hex inverter/buffer
- CMOS to DTL/TTL hex converter
- CMOS current "sink" or "source" driver
- CMOS high-to-low logic level converter

Connection Diagrams



Schematic Diagrams



Absolute Maximum Ratings

(Notes 1 and 2)

V _{DD} Supply Voltage	-0.5V to +18V
V _{IN} Input Voltage	-0.5V to +18V
V _{OUT} Voltage at Any Output Pin	-0.5V to V _{DD} + 0.5V
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

Recommended Operating Conditions

(Note 2)

V _{DD} Supply Voltage	3V to 15V
V _{IN} Input Voltage	0V to 15V
V _{OUT} Voltage at Any Output Pin	0 to V _{DD}
T _A Operating Temperature Range	-55°C to +125°C
CD4049M, CD4050BM	-55°C to +125°C
CD4049C, CD4050BC	-40°C to +85°C

DC Electrical Characteristics CD4049M/CD4050BM (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		1.0		0.01	1.0		30	μA
	V _{DD} = 10V		2.0		0.01	2.0		60	μA
	V _{DD} = 15V		4.0		0.03	4.0		120	μA
V _{OL} Low Level Output Voltage	V _{IH} = V _{DD} , V _{IL} = 0, I _O < 1 μA								
	V _{DD} = 5V		0.05		0	0.05		0.05	V
	V _{DD} = 10V		0.05		0	0.05		0.05	V
V _{OH} High Level Output Voltage	V _{IH} = V _{DD} , V _{IL} = 0, I _O < 1 μA								
	V _{DD} = 5V	4.95		4.95	5		4.95		V
	V _{DD} = 10V	9.95		9.95	10		9.95		V
V _{IL} Low Level Input Voltage (CD4050BM Only)	V _{DD} = 15V	14.95		14.95	15		14.95		V
	V _{DD} = 5V, V _O = 0.5V		1.5		2.25	1.5		1.5	V
	V _{DD} = 10V, V _O = 1V		3.0		4.5	3.0		3.0	V
V _{IL} Low Level Input Voltage (CD4049M Only)	V _{DD} = 15V, V _O = 1.5V		4.0		6.75	4.0		4.0	V
	V _{DD} = 5V, V _O = 4.5V		1.0		1.5	1.0		1.0	V
	V _{DD} = 10V, V _O = 9V		2.0		2.5	2.0		2.0	V
V _{IH} High Level Input Voltage (CD4050BM Only)	V _{DD} = 15V, V _O = 13.5V		3.0		3.5	3.0		3.0	V
	V _{DD} = 5V, V _O = 4.5V	3.5		3.5	2.75		3.5		V
	V _{DD} = 10V, V _O = 9V	7.0		7.0	5.5		7.0		V
V _{IH} High Level Input Voltage (CD4049M Only)	V _{DD} = 15V, V _O = 13.5V	11.0		11.0	8.25		11.0		V
	V _{DD} = 5V, V _O = 0.5V	4.0		4.0	3.5		4.0		V
	V _{DD} = 10V, V _O = 1V	8.0		8.0	7.5		8.0		V
I _{OL} Low Level Output Current (Note 3)	V _{DD} = 15V, V _O = 1.5V	12.0		12.0	11.5		12.0		V
	V _{IH} = V _{DD} , V _{IL} = 0V		5.6		4.6	5		3.2	mA
	V _{DD} = 5V, V _O = 0.4V		12		9.8	12		6.8	mA
I _{OH} High Level Output Current (Note 3)	V _{DD} = 10V, V _O = 0.5V		35		29	40		20	mA
	V _{DD} = 5V, V _O = 4.6V	-1.3		-1.1	-1.6		-0.72		mA
	V _{DD} = 10V, V _O = 9.5V	-2.6		-2.2	-3.6		-1.5		mA
I _{IN} Input Current	V _{DD} = 15V, V _O = 13.5V	-8.0		-7.2	-12		-5.0		mA
	V _{DD} = 5V, V _O = 0.5V		-1.3		-1.6		-0.72		mA
	V _{DD} = 10V, V _O = 9.5V		-2.6		-2.2		-1.5		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

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: These are peak output current capabilities. Continuous output current is rated at 12 mA maximum. The output current should not be allowed to exceed this value for extended periods of time.

DC Electrical Characteristics CD4049C/CD4050BC (Note 2)

CD4049M/CD4049C, CD40450BM/CD4050BC

PARAMETER	CONDITIONS	-40°C		25°C			85°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I_{DD} Quiescent Device Current	$V_{DD} = 5V$		4		0.03	4.0		30	μA
	$V_{DD} = 10V$		8		0.05	8.0		60	μA
	$V_{DD} = 15V$		16		0.07	16.0		120	μA
V_{OL} Low Level Output Voltage	$V_{IH} = V_{DD}, V_{IL} = 0V,$ $ I_{O} < 1 \mu A$								
	$V_{DD} = 5V$		0.05		0	0.05		0.05	V
	$V_{DD} = 10V$		0.05		0	0.05		0.05	V
	$V_{DD} = 15V$		0.05		0	0.05		0.05	V
V_{OH} High Level Output Voltage	$V_{IH} = V_{DD}, V_{IL} = 0V,$ $ I_{O} < 1 \mu A$								
	$V_{DD} = 5V$	4.95		4.95	5		4.95		V
	$V_{DD} = 10V$	9.95		9.95	10		9.95		V
	$V_{DD} = 15V$	14.95		14.95	15		14.95		V
V_{IL} Low Level Input Voltage (CD4050BC Only)	$ I_{O} < 1 \mu A$								
	$V_{DD} = 5V, V_O = 0.5V$		1.5		2.25	1.5		1.5	V
	$V_{DD} = 10V, V_O = 1V$		3.0		4.5	3.0		3.0	V
	$V_{DD} = 15V, V_O = 1.5V$		4.0		6.75	4.0		4.0	V
V_{IL} Low Level Input Voltage (CD4049C Only)	$ I_{O} < 1 \mu A$								
	$V_{DD} = 5V, V_O = 4.5V$		1.0		1.5	1.0		1.0	V
	$V_{DD} = 10V, V_O = 9V$		2.0		2.5	2.0		2.0	V
	$V_{DD} = 15V, V_O = 13.5V$		3.0		3.5	3.0		3.0	V
V_{IH} High Level Input Voltage (CD4050BC Only)	$ I_{O} < 1 \mu A$								
	$V_{DD} = 5V, V_O = 4.5V$	3.5		3.5	2.75		3.5		V
	$V_{DD} = 10V, V_O = 9V$	7.0		7.0	5.5		7.0		V
	$V_{DD} = 15V, V_O = 13.5V$	11.0		11.0	8.25		11.0		V
V_{IH} High Level Input Voltage (CD4049C Only)	$ I_{O} < 1 \mu A$								
	$V_{DD} = 5V, V_O = 0.5V$	4.0		4.0	3.5		4.0		V
	$V_{DD} = 10V, V_O = 1V$	8.0		8.0	7.5		8.0		V
	$V_{DD} = 15V, V_O = 1.5V$	12.0		12.0	11.5		12.0		V
I_{OL} Low Level Output Current (Note 3)	$V_{IH} = V_{DD}, V_{IL} = 0V$								
	$V_{DD} = 5V, V_O = 0.4V$	4.6		4.0	5		3.2		mA
	$V_{DD} = 10V, V_O = 0.5V$	9.8		8.5	12		6.8		mA
	$V_{DD} = 15V, V_O = 1.5V$	29		25	40		20		mA
I_{OH} High Level Output Current (Note 3)	$V_{IH} = V_{DD}, V_{IL} = 0V$								
	$V_{DD} = 5V, V_O = 4.6V$	-1.0		-0.9	-1.6		-0.72		mA
	$V_{DD} = 10V, V_O = 9.5V$	-2.1		-1.9	-3.6		-1.5		mA
	$V_{DD} = 15V, V_O = 13.5V$	-7.1		-6.2	-12		-5		mA
I_{IN} Input Current	$V_{DD} = 15V, V_{IN} = 0V$	-0.3		-0.3	-10^{-5}			-1.0	μA
	$V_{DD} = 15V, V_{IN} = 15V$	0.3		0.3	10^{-5}			1.0	μA

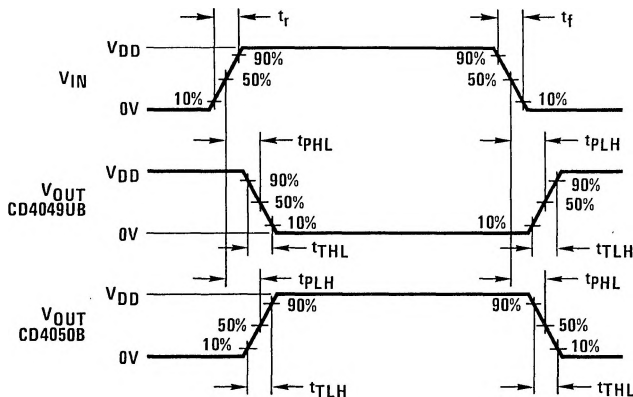
AC Electrical Characteristics CD4049M/CD4049CT_A = 25°C, C_L = 50 pF, R_L = 200k, t_r = t_f = 20 ns, unless otherwise specified.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
t _{PHL} Propagation Delay Time High-to-Low Level	V _{DD} = 5V		30	65	ns
	V _{DD} = 10V		20	40	ns
	V _{DD} = 15V		15	30	ns
t _{PLH} Propagation Delay Time Low-to-High Level	V _{DD} = 5V		45	85	ns
	V _{DD} = 10V		25	45	ns
	V _{DD} = 15V		20	35	ns
t _{THL} Transition Time High-to-Low Level	V _{DD} = 5V		30	60	ns
	V _{DD} = 10V		20	40	ns
	V _{DD} = 15V		15	30	ns
t _{TLH} Transition Time Low-to-High Level	V _{DD} = 5V		60	120	ns
	V _{DD} = 10V		30	55	ns
	V _{DD} = 15V		25	45	ns
C _{IN} Input Capacitance	Any Input		15	22.5	pF

AC Electrical Characteristics CD4050BM/CD4050BCT_A = 25°C, C_L = 50 pF, R_L = 200k, t_r = t_f = 20 ns, unless otherwise specified.

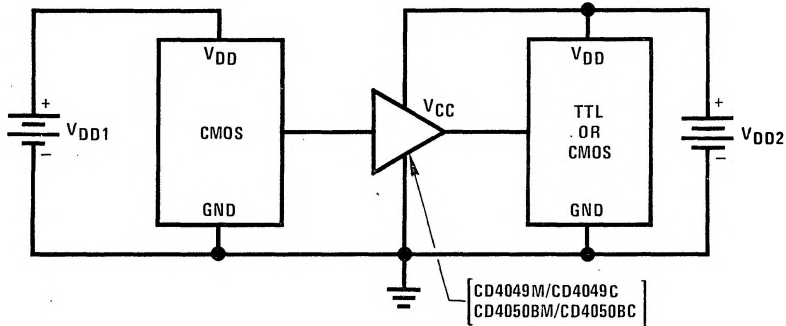
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
t _{PHL} Propagation Delay Time High-to-Low Level	V _{DD} = 5V		60	110	ns
	V _{DD} = 10V		25	55	ns
	V _{DD} = 15V		20	30	ns
t _{PLH} Propagation Delay Time Low-to-High Level	V _{DD} = 5V		60	120	ns
	V _{DD} = 10V		30	55	ns
	V _{DD} = 15V		25	45	ns
t _{THL} Transition Time High-to-Low Level	V _{DD} = 5V		30	60	ns
	V _{DD} = 10V		20	40	ns
	V _{DD} = 15V		15	30	ns
t _{TLH} Transition Time Low-to-High Level	V _{DD} = 5V		60	120	ns
	V _{DD} = 10V		30	55	ns
	V _{DD} = 15V		25	45	ns
C _{IN} Input Capacitance	Any Input		5	7.5	pF

Switching Time Waveforms



Typical Applications

CMOS to TTL or CMOS at a Lower V_{DD}



Note: $V_{DD1} \geq V_{DD2}$

Note: In the case of the CD4049M/CD4049C the output drive capability increases with increasing input voltage. E.g., if $V_{DD1} = 10V$ the CD4049M/CD4049C could drive 4 TTL loads.