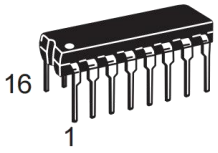
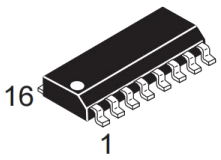
BCD-to-Decimal Decoder

Features

- Wide supply voltage range: 3.0V to 15V
- High noise immunity: 0.45 VDD (typ.)
- Low power TTL compatibility: fan out of 2 driving 74L or 1 driving 74LS
- Low power
- Glitch free outputs
- “Positive logic” on inputs and outputs



DIP16



SOP16

Applications

- Code conversion
- Address decoding
- Indicator-tube decode

ORDERING INFORMATION

DEVICE	Package Type	MARKING	Packing	Packing Qty
CD4028BE	DIP16	CD4028BE	TUBE	1000pcs/box
CD4028BM/TR	SOP16	CD4028B	REEL	2500pcs/reel

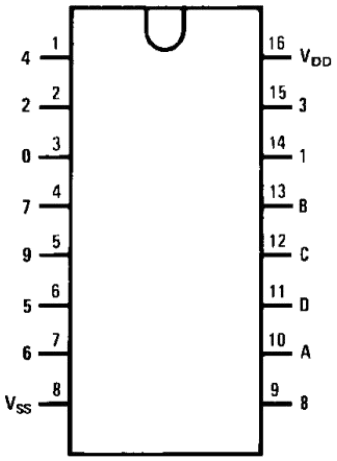
General Description

The CD4028B is a BCD to decimal or binary-to-octal decoder consisting of 4 inputs, decoding logic gates, and 10 output buffers. A BCD code applied to the 4 inputs, A, B, C, and D, results in a high level at the selected 1-of-10 decimal decoded outputs. Similarly, a 3-bit binary code applied to inputs A, B, and C is decoded in octal at outputs 0–7. A high level signal at the D input inhibits octal decoding and causes outputs 0–7 to go LOW.

All inputs are protected against static discharge damage by diode clamps to VDD and VSS.

Connection Diagram

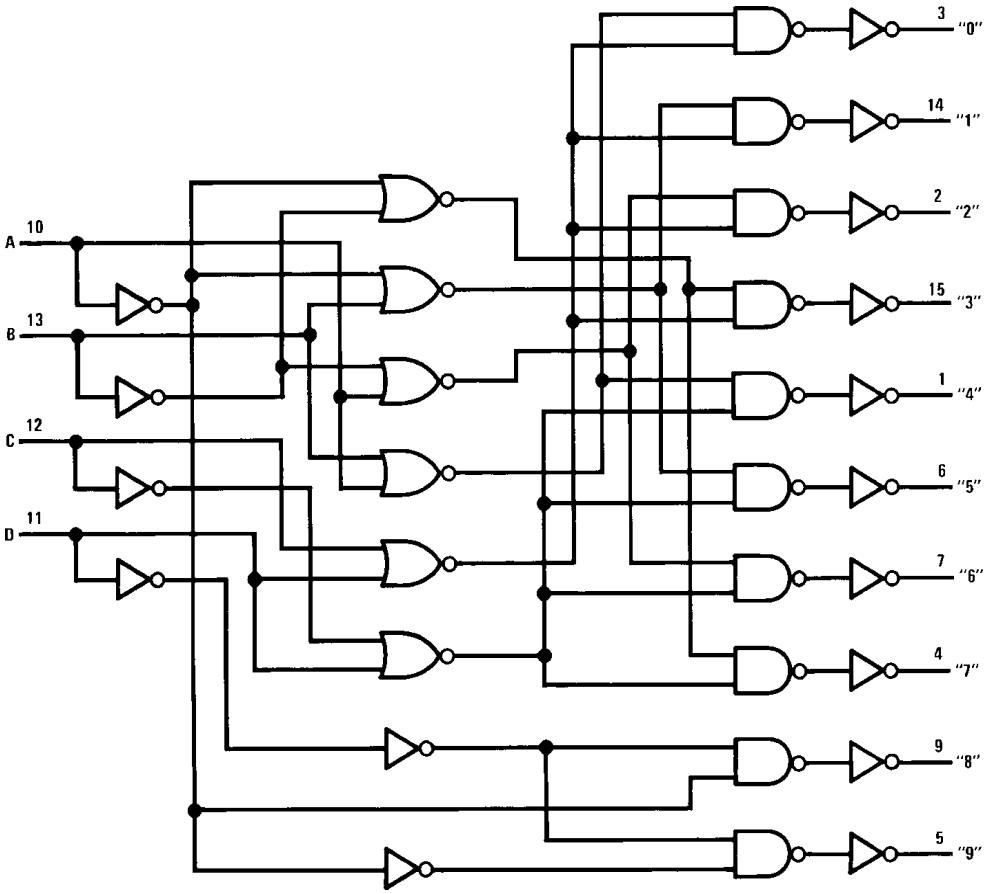
DIP16/SOP16



Truth Table

		D	C	B	A	0	1	2	3	4	5	6	7	8	9	
		0	0	0	0	1	0	0	0	0	0	0	0	0	0	
		0	0	0	1	0	1	0	0	0	0	0	0	0	0	
		0	0	1	0	0	0	1	0	0	0	0	0	0	0	
		0	0	1	1	0	0	0	1	0	0	0	0	0	0	
		0	1	0	0	0	0	0	0	1	0	0	0	0	0	BCD States
		0	1	0	1	0	0	0	0	0	1	0	0	0	0	
		0	1	1	0	0	0	0	0	0	0	1	0	0	0	
1	HIGH Level	0	1	1	1	0	0	0	0	0	0	0	1	0	0	
0	LOW Level	1	0	0	0	0	0	0	0	0	0	0	0	1	0	
		1	0	0	1	0	0	0	0	0	0	0	0	0	1	
		1	0	1	0	0	0	0	0	0	0	0	0	1	0	
		1	0	1	1	0	0	0	0	0	0	0	0	0	1	
		1	1	0	0	0	0	0	0	0	0	0	0	1	0	Extraordinary States
		1	1	0	1	0	0	0	0	0	0	0	0	0	1	
		1	1	1	0	0	0	0	0	0	0	0	0	1	0	
		1	1	1	1	0	0	0	0	0	0	0	0	0	1	

Logic Diagram



ABSOLUTE MAXIMUM RATINGS

CONDITION		MIN	MAX
Supply Voltage (V_{DD})		-0.5V	+18V
Input Voltage (V_{IN})		-0.5V	Vdd+0.5V
Storage Temperature Range (T_S)		-65℃	+150℃
Power Dissipation (P_D)	Dual-In-Line	700 mW	
	Small Outline	500 mW	
(Soldering, 10 seconds)		260℃	

Recommended Operating Condiyions

CHARACTERISTIC	Min.	Max.	Units
Supply Voltage (V_{DD})	3	15	V
Input Voltage (V_{IN})	0	V_{DD}	V
Operating Temperature Range (T_A)	-40	+85	℃

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 “Recom- mended Operating Conditions” and “Electrical Characteristics” provides conditions for actual device operation.

Note 2: VSS = 0V unless otherwise specified.

DC Electrical Characteristics (Note 2)

Symbol	Parameter	Conditions	40℃		25℃			85℃		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	V_{DD} = 5V, V_{IN} = V_{DD} or V_{SS} V_{DD} = 10V, V_{IN} =V_{DD} or V_{SS} V_{DD} = 15V, V_{IN} = V_{DD} or V_{SS}		20 40 80		0.01 0.01 0.02	20 40 80		150 300 600	μA μA μA
V_{OL}	LOW Level Output Voltage	|I_O| < 1 μA, V_{IL} = 0V, V_{IH} = V_{DD} V_{DD} = 5V V_{DD} = 10V V_{DD} = 15V		0.05 0.05 0.05		0 0 0	0.05 0.05 0.05		0.05 0.05 0.05	V V V
V_{OH}	HIGH Level Output Voltage	|I_O| < 1 μA, V_{IL} = 0V, V_{IH} = V_{DD} V_{DD} = 5V V_{DD} = 10V V_{DD} = 15V	4.95 9.95 14.95		4.95 9.95 14.95	5 10 15		4.95 9.95 14.95		V V V
V_{IL}	LOW Level Input Voltage	|I_O| < 1 μA V_{DD} = 5V, V_O = 0.5V or 4.5V V_{DD} = 10V, V_O = 1V or 9V V_{DD} = 15V, V_O = 1.5V or 13.5V		1.5 3.0 4.0		2.25 4.5 6.75	1.5 3.0 4.0		1.5 3.0 4.0	V V V
V_{IH}	HIGH Level Input Voltage	|I_O| < 1 μA V_{DD} = 5V, V_O = 0.5V or 4.5V V_{DD} = 10V, V_O = 1V or 9V V_{DD} = 15V, V_O = 1.5V or 13.5V	3.5 7.0 11.0		3.5 7.0 11.0			3.5 7.0 11.0		V V V
I_{OL}	LOW Level Output Current (Note 3)	V_{IH} = V_{DD}, V_{IL} = 0V V_{DD} = 5V, V_O = 0.4V V_{DD} = 10V, V_O = 0.5V V_{DD} =15V, V_O = 1.5V	0.52 1.3 3.6		0.44 1.1 3.0	0.88 2.2 6.0		0.36 0.9 2.4		mA mA mA
I_{OH}	HIGH Level Output Current (Note 3)	V_{IH} = V_{DD}, V_{IL} = 0V V_{DD} = 5V, V_O = 4.6V V_{DD} = 10V, V_O = 9.5V V_{DD} = 15V, V_O = 13.5V	-0.2 -0.5 -1.4		-0.16 -0.4 -1.2	-0.32 -0.8 -3.5		-0.12 -0.3 -1.0		mA mA mA
I_{IN}	Input Current	V_{DD} = 5V, V_{IN} = 0V V_{DD} = 15V, V_{IN} =15V		-0.3 -0.3			-0.3 -0.3		-1.0 -1.0	μA μA

Note 3: IOL and IOH are tested one output at a time.

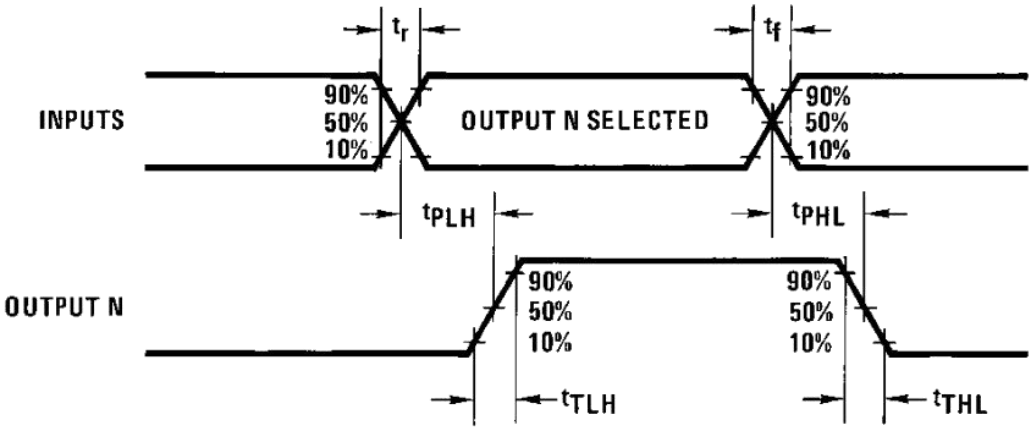
AC Electrical Characteristics (Note 4)

TA = 25℃, CL =50 pF, RL = 200k, Input tr = tf =20 ns, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PHL} or t_{PLH}	Propagation Delay Time	V_{CC} = 5V		240	480	ns
		V_{CC} = 10V		100	200	ns
		V_{CC} = 15V		70	140	ns
t_{THL} or t_{TLH}	Transition Time	V_{CC} = 5V		175	350	ns
		V_{CC} = 10V		75	150	ns
		V_{CC} = 15V		60	110	ns
C_{IN}	Input Capacitance	Any Input		5	7.5	pF

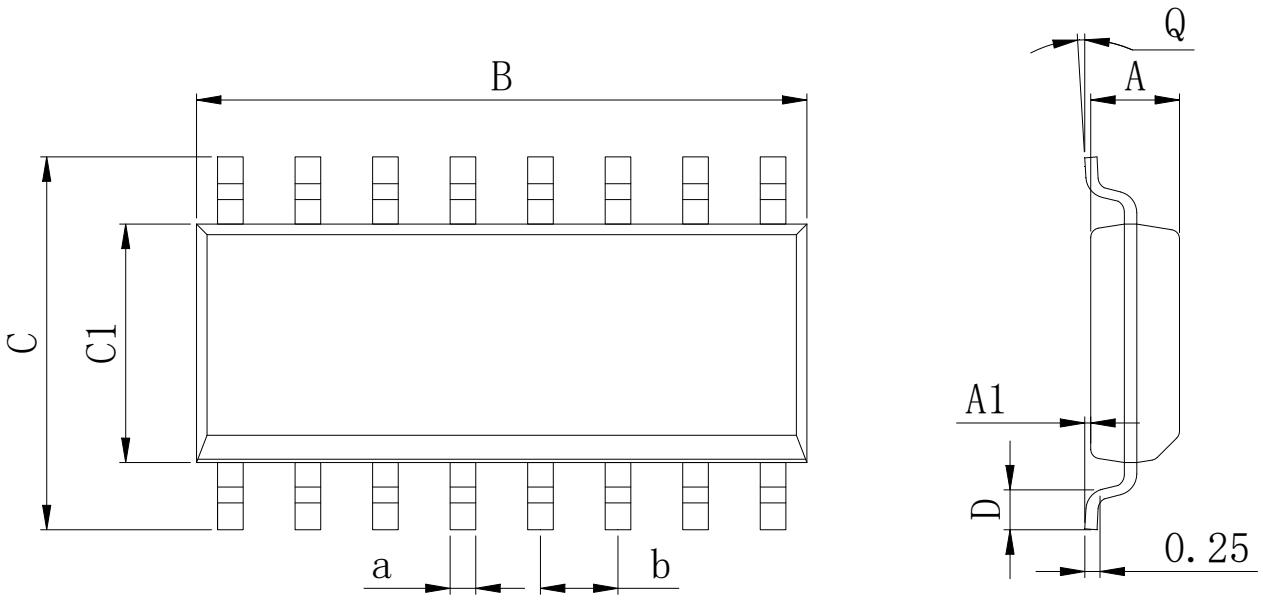
Note 4: AC Parameters are guaranteed by DC correlated testing.

witching Time Waveforms



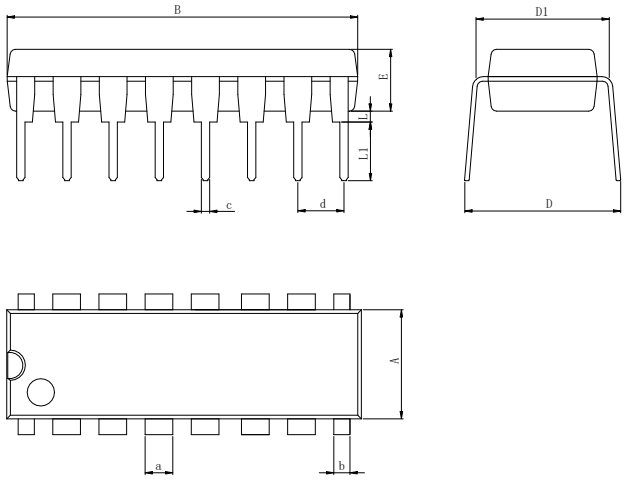
Physical Dimensions

SOP16



Dimensions In Millimeters(SOP16)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	1.35	0.05	9.80	5.80	3.80	0.40	0°	0.35	1.27 BSC
Max:	1.55	0.20	10.0	6.20	4.00	0.80	8°	0.45	

DIP16



Dimensions In Millimeters(DIP16)											
Symbol:	A	B	D	D1	E	L	L1	a	b	c	d
Min:	6.10	18.94	8.40	7.42	3.10	0.50	300	1.50	0.85	0.40	2.54 BSC
Max:	6.68	19.56	9.00	7.82	3.55	0.70	3.60	1.55	0.90	0.50	