

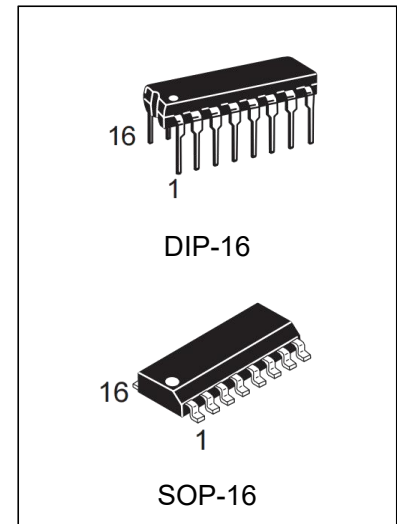
## BCD-to-Decimal Decoder

### 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

### Applications

- Code conversion
- Address decoding
- Indicator-tube decode



### Ordering Information

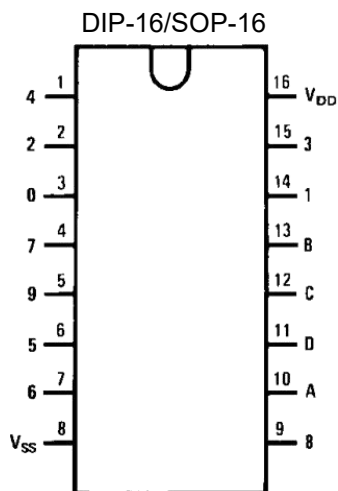
DEVICE	Package Type	MARKING	Packing	Packing Qty
CD4028BE	DIP-16	CD4028B	TUBE	1000pcs/box
CD4028BM/TR	SOP-16	CD4028B	REEL	2500pcs/reel

## 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.

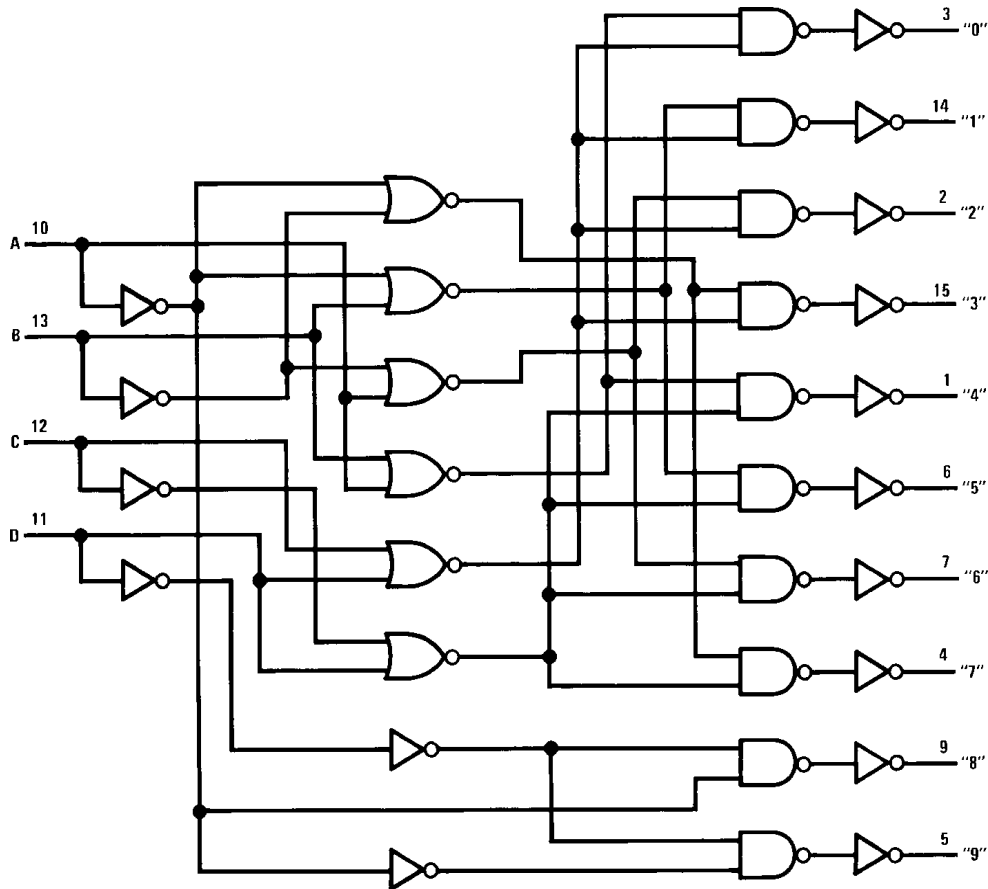
## Connection Diagram



## Truth Table

		D	C	B	A	0	1	2	3	4	5	6	7	8	9		
1 0	HIGH Level	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	BCD States
	LOW Level	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	
		0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	
		0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	
		0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	
		0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	
		0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	
		0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	
		1	0	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	0	1	
		1	0	1	0	0	0	0	0	0	0	0	0	1	0	Extraordinary States	
		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		
		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 (VDD)		-0.5V	+18V
Input Voltage (VIN)		-0.5V	Vdd+0.5V
Storage Temperature Range (TS)		-65°C	+150°C
Power Dissipation (PD)	Dual-In-Line	700 mW	
	Small Outline	500 mW	
(Soldering, 10 seconds)		245°C	

Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured.

## Recommended Operating Condiyions

CHARACTERISTIC	Min.	Max.	Units
Supply Voltage (VDD)	3	15	V
Input Voltage (VIN)	0	VDD	V
Operating Temperature Range (TA)	-40	+85	°C

**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°C		25°C			85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
IDD	Quiescent Device Current	VDD = 5V, VIN = VDD or VSS		20		0.01	20		150	μA
		VDD = 10V, VIN = VDD or VSS		40		0.01	40		300	μA
		VDD = 15V, VIN = VDD or VSS		80		0.02	80		600	μA
VOL	LOW Level Output Voltage	IO  < 1 μA, VIL = 0V, VIH = VDD		0.05		0	0.05		0.05	V
		VDD = 5V		0.05		0	0.05		0.05	V
		VDD = 10V		0.05		0	0.05		0.05	V
VOH	HIGH Level Output Voltage	IO  < 1 μA, VIL = 0V, VIH = VDD	4.95		4.95	5		4.95		V
		VDD = 5V	9.95		9.95	10		9.95		V
		VDD = 10V	14.95		14.95	15		14.95		V
VIL	LOW Level Input Voltage	IO  < 1 μA		1.5		2.25	1.5		1.5	V
		VDD = 5V, VO = 0.5V or 4.5V		3.0		4.5	3.0		3.0	V
		VDD = 10V, VO = 1V or 9V		4.0		6.75	4.0		4.0	V
VIH	HIGH Level Input Voltage	IO  < 1 μA	3.5		3.5			3.5		V
		VDD = 5V, VO = 0.5V or 4.5V	7.0		7.0			7.0		V
		VDD = 10V, VO = 1V or 9V	11.0		11.0			11.0		V
IOL	LOW Level Output Current (Note 3)	VIH = VDD, VIL = 0V	0.52		0.44	0.88		0.36		mA
		VDD = 5V, VO = 0.4V	1.3		1.1	2.2		0.9		mA
		VDD = 10V, VO = 0.5V	3.6		3.0	6.0		2.4		mA
IOH	HIGH Level Output Current (Note 3)	VIH = VDD, VIL = 0V	-0.2		-0.16	-0.32		-0.12		mA
		VDD = 5V, VO = 4.6V	-0.5		-0.4	-0.8		-0.3		mA
		VDD = 10V, VO = 9.5V	-1.4		-1.2	-3.5		-1.0		mA
IIN	Input Current	VDD = 5V, VIN = 0V		-0.3			-0.3		-1.0	μA
		VDD = 15V, VIN = 15V		-0.3			-0.3		-1.0	μA

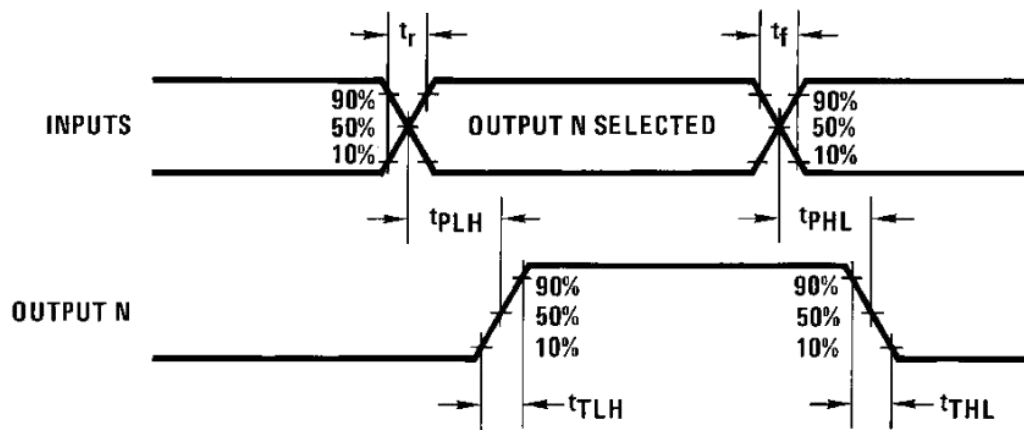
**Note 3:** IOL and IOH are tested one output at a time.

**AC Electrical Characteristics** (Note 4)

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

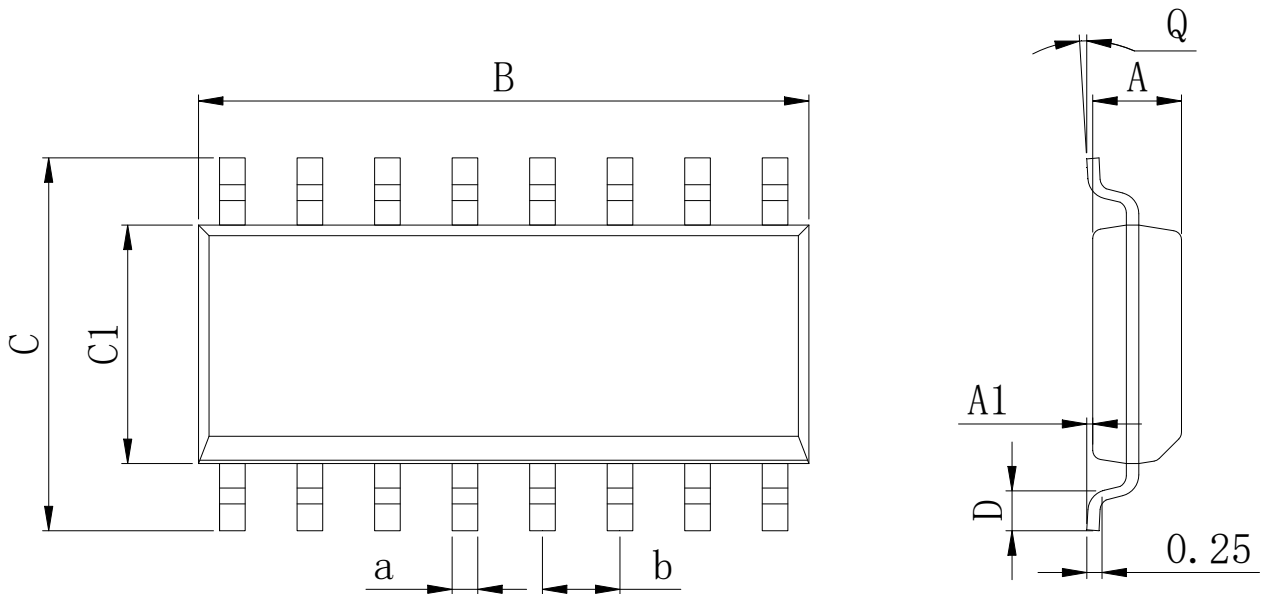
Symbol	Parameter	Conditions	Min	Typ	Max	Units
tPHL or tPLH	Propagation Delay Time	VCC = 5V		240	480	ns
		VCC = 10V		100	200	ns
		VCC = 15V		70	140	ns
tTHL or tTLH	Transition Time	VCC = 5V		175	350	ns
		VCC = 10V		75	150	ns
		VCC = 15V		60	110	ns
CIN	Input Capacitance	Any Input		5	7.5	pF

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

**Switching Time Waveforms**


## Physical Dimensions

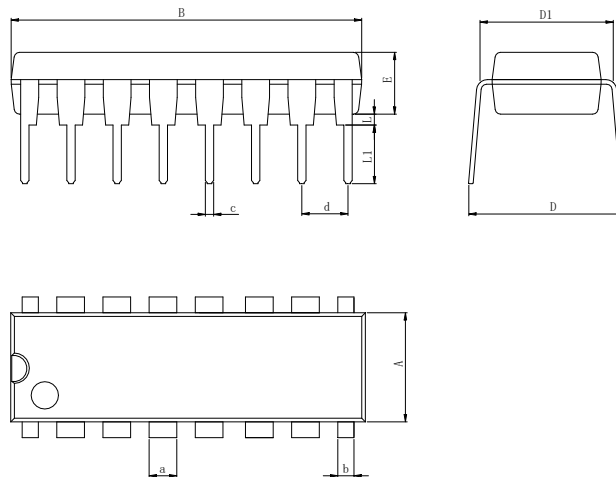
SOP-16



**Dimensions In Millimeters(SOP-16)**

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	

DIP-16



**Dimensions In Millimeters(DIP-16)**

Symbol:	A	B	D	D1	E	L	L1	a	b	c	d
Min:	6.10	18.94	8.10	7.42	3.10	0.50	3.00	1.50	0.85	0.40	2.54 BSC
Max:	6.68	19.56	10.9	7.82	3.55	0.70	3.60	1.55	0.90	0.50	

## Revision History

DATE	REVISION	PAGE
2011-9-8	New	1-8
2023-9-8	Update encapsulation type 、 Update Lead Temperature 、 Updated DIP-16 dimension、 Add annotation for Maximum Ratings.	1、 3、 6

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