



# CD4028 (LX) BCD to decimal decoder

## Product Specification

### Specification Revision History:

Version	Date	Description
2023-04-A1	2023-04	New



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## 1、 General Description

The CD4028 is a 4-bit BCD to decimal decoder, a 4-bit BCD to octal decoder with active LOW enable or an 8-output(Y0 to Y7) inverting demultiplexer.

### Features:

- Supply voltage range:3V to 15V
- Temperature range:-40℃ to +125℃
- Packaging information: DIP16/SOP16/TSSOP16

### Ordering Information:

#### Tube packing specifications:

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
CD4028BE(LX)	DIP16	CD4028BE	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing:2.54mm
CD4028BM(LX)	SOP16	CD4028BM	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
CD4028BPW(LX)	TSSOP16	CD4028	96 PCS/tube	200 tube/box	19200 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing:0.65mm

#### Reel packing specifications:

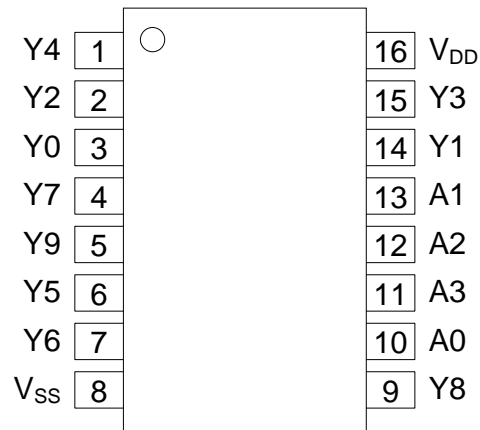
Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
CD4028BM(LX)	SOP16(1)	CD4028BM	2500PCS/reel	5000PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
CD4028BM(LX)	SOP16(2)	CD4028BM	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
CD4028BPW(LX)	TSSOP16	CD4028	5000PCS/reel	10000PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing:0.65mm

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.





## 2.2、Pin Configurations



## 2.3、Pin Description

Pin No.	Pin Name	Description
1	Y4	output(active HIGH)
2	Y2	output(active HIGH)
3	Y0	output(active HIGH)
4	Y7	output(active HIGH)
5	Y9	output(active HIGH)
6	Y5	output(active HIGH)
7	Y6	output(active HIGH)
8	V <sub>SS</sub>	ground supply voltage
9	Y8	output(active HIGH)
10	A0	address input
11	A3	address input
12	A2	address input
13	A1	address input
14	Y1	output(active HIGH)
15	Y3	output(active HIGH)
16	V <sub>DD</sub>	supply voltage



## 2.4、Function Table

Input				Output									
A3	A2	A1	A0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9
L	L	L	L	H	L	L	L	L	L	L	L	L	L
L	L	L	H	L	H	L	L	L	L	L	L	L	L
L	L	H	L	L	L	H	L	L	L	L	L	L	L
L	L	H	H	L	L	L	H	L	L	L	L	L	L
L	H	L	L	L	L	L	L	H	L	L	L	L	L
L	H	L	H	L	L	L	L	L	H	L	L	L	L
L	H	H	L	L	L	L	L	L	L	H	L	L	L
L	H	H	H	L	L	L	L	L	L	L	H	L	L
H	L	L	L	L	L	L	L	L	L	L	L	H	L
H	L	L	H	L	L	L	L	L	L	L	L	L	H
H	L	H	X	L	L	L	L	L	L	L	L	L	L
H	H	X	X	L	L	L	L	L	L	L	L	L	L

Note: H=HIGH voltage level; L=LOW voltage level; X=don't care.

## 3、Electrical Parameter

### 3.1、Absolute Maximum Ratings

(Voltages are referenced to  $V_{SS}$  (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Max.	Unit
supply voltage	$V_{DD}$	-	-0.5	+18	V
input voltage	$V_I$	all inputs	-0.5	$V_{DD}+0.5$	V
DC input current	$I_{IK}$	any one input	-	$\pm 10$	mA
storage temperature	$T_{stg}$	-	-65	+150	$^{\circ}C$
soldering temperature	$T_L$	10s	DIP		$^{\circ}C$
			SOP/TSSOP		

### 3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	$V_{DD}$	-	3	-	15	V
ambient temperature	$T_{amb}$	in free air	-40	-	+125	$^{\circ}C$



### 3.3、Electrical Characteristics

#### 3.3.1、DC Characteristics 1

( $T_{amb} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , voltages are referenced to  $V_{SS}$  (ground=0V), unless otherwise specified.)

Parameter	Symbol	$V_{DD}$	Conditions	Min.	Typ.	Max.	Unit
HIGH-level input voltage	$V_{IH}$	5V	-	3.5	-	-	V
		10V	-	7	-	-	V
		15V	-	11	-	-	V
LOW-level input voltage	$V_{IL}$	5V	-	-	-	1.5	V
		10V	-	-	-	3	V
		15V	-	-	-	4	V
HIGH-level output voltage	$V_{OH}$	5V	$ I_O  < 1\mu\text{A}$	4.95	-	-	V
		10V	$ I_O  < 1\mu\text{A}$	9.95	-	-	V
		15V	$ I_O  < 1\mu\text{A}$	14.95	-	-	V
LOW-level output voltage	$V_{OL}$	5V	$ I_O  < 1\mu\text{A}$	-	-	0.05	V
		10V	$ I_O  < 1\mu\text{A}$	-	-	0.05	V
		15V	$ I_O  < 1\mu\text{A}$	-	-	0.05	V
HIGH-level output current	$I_{OH}$	5V	$V_O = 4.6\text{V}$	-	-	-0.34	mA
		5V	$V_O = 2.5\text{V}$	-	-	-1.3	mA
		10V	$V_O = 9.5\text{V}$	-	-	-0.55	mA
		15V	$V_O = 13.5\text{V}$	-	-	-1.65	mA
LOW-level output current	$I_{OL}$	5V	$V_O = 0.4\text{V}$	0.34	-	-	mA
		10V	$V_O = 0.5\text{V}$	0.46	-	-	mA
		15V	$V_O = 1.5\text{V}$	1.4	-	-	mA
input leakage current	$I_I$	15V	$V_I = 15\text{V}$ or GND	-	-	$\pm 2$	$\mu\text{A}$
supply current	$I_{DD}$	5V	$V_I = 5\text{V}$ or GND; $I_O = 0\text{A}$	-	-	7.5	$\mu\text{A}$
		10V	$V_I = 10\text{V}$ or GND; $I_O = 0\text{A}$	-	-	15	$\mu\text{A}$
		15V	$V_I = 15\text{V}$ or GND; $I_O = 0\text{A}$	-	-	30	$\mu\text{A}$



### 3.3.2、DC Characteristics 2

( $T_{amb}=-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ , voltages are referenced to  $V_{SS}$  (ground=0V), unless otherwise specified.)

Parameter	Symbol	$V_{DD}$	Conditions	Min.	Typ.	Max.	Unit
HIGH-level input voltage	$V_{IH}$	5V	-	3.5	-	-	V
		10V	-	7	-	-	V
		15V	-	11	-	-	V
LOW-level input voltage	$V_{IL}$	5V	-	-	-	1.5	V
		10V	-	-	-	3	V
		15V	-	-	-	4	V
HIGH-level output voltage	$V_{OH}$	5V	$ I_O <1\mu\text{A}$	4.95	-	-	V
		10V	$ I_O <1\mu\text{A}$	9.95	-	-	V
		15V	$ I_O <1\mu\text{A}$	14.95	-	-	V
LOW-level output voltage	$V_{OL}$	5V	$ I_O <1\mu\text{A}$	-	-	0.05	V
		10V	$ I_O <1\mu\text{A}$	-	-	0.05	V
		15V	$ I_O <1\mu\text{A}$	-	-	0.05	V
HIGH-level output current	$I_{OH}$	5V	$V_O=4.6\text{V}$	-	-	-0.3	mA
		5V	$V_O=2.5\text{V}$	-	-	-1.15	mA
		10V	$V_O=9.5\text{V}$	-	-	-0.45	mA
		15V	$V_O=13.5\text{V}$	-	-	-1.4	mA
LOW-level output current	$I_{OL}$	5V	$V_O=0.4\text{V}$	0.29	-	-	mA
		10V	$V_O=0.5\text{V}$	0.38	-	-	mA
		15V	$V_O=1.5\text{V}$	1.2	-	-	mA
input leakage current	$I_I$	15V	$V_I=15\text{V}$ or GND	-	-	$\pm 4$	$\mu\text{A}$
supply current	$I_{DD}$	5V	$V_I=5\text{V}$ or GND; $I_O=0\text{A}$	-	-	7.5	$\mu\text{A}$
		10V	$V_I=10\text{V}$ or GND; $I_O=0\text{A}$	-	-	15	$\mu\text{A}$
		15V	$V_I=15\text{V}$ or GND; $I_O=0\text{A}$	-	-	30	$\mu\text{A}$

### 3.3.3、AC Characteristics 1

( $T_{amb}=-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{SS}=0\text{V}$ , unless otherwise specified.)

Parameter	Symbol	$V_{DD}$	Conditions	Min.	Typ.	Max.	Unit
An to Yn HIGH to LOW propagation delay time	$t_{PHL}$	5V	$C_L=50\text{pF}$ see Figure 4	-	100	200	ns
		10V		-	40	80	ns
		15V		-	30	60	ns
An to Yn LOW to HIGH propagation delay time	$t_{PLH}$	5V		-	90	180	ns
		10V		-	40	80	ns
		15V		-	30	60	ns
transition time	$t_{THL}, t_{TLH}$	5V		-	60	120	ns
		10V		-	30	60	ns
		15V		-	20	40	ns





### 3.3.4、AC Characteristics 2

( $T_{amb} = -40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $V_{SS} = 0\text{V}$ , unless otherwise specified.)

Parameter	Symbol	$V_{DD}$	Conditions	Min.	Typ.	Max.	Unit
An to Yn HIGH to LOW propagation delay time	tPHL	5V	C <sub>L</sub> =50pF see Figure 4	-	-	240	ns
		10V		-	-	96	ns
		15V		-	-	72	ns
An to Yn LOW to HIGH propagation delay time	tPLH	5V		-	-	216	ns
		10V		-	-	96	ns
		15V		-	-	70	ns
transition time	t <sub>THL</sub> , t <sub>TLH</sub>	5V		-	-	144	ns
		10V		-	-	72	ns
		15V		-	-	48	ns

## 4、Testing Circuit

### 4.1、AC Testing Circuit

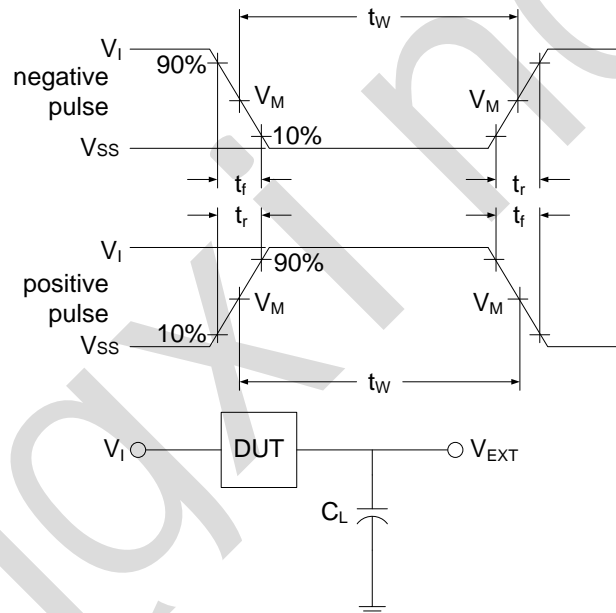


Figure 3. Load circuit

C<sub>L</sub> includes probe and jig capacitance.

### 4.2、Test Data

Supply voltage	Input		Load	V <sub>EXT</sub>		
V <sub>DD</sub>	V <sub>I</sub>	t <sub>r</sub> = t <sub>f</sub>	C <sub>L</sub>	t <sub>PLH</sub> /t <sub>PHL</sub>	t <sub>PLZ</sub> /t <sub>PZL</sub>	t <sub>PHZ</sub> /t <sub>PZH</sub>
5V to 15V	V <sub>DD</sub>	≤ 20ns	50pF	Open	V <sub>DD</sub>	V <sub>SS</sub>



### 4.3、AC Testing Waveforms

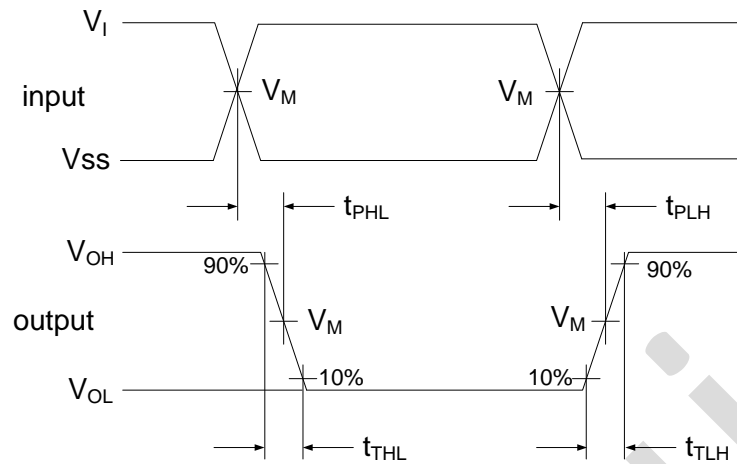


Figure 4. Propagation delay, output transition time

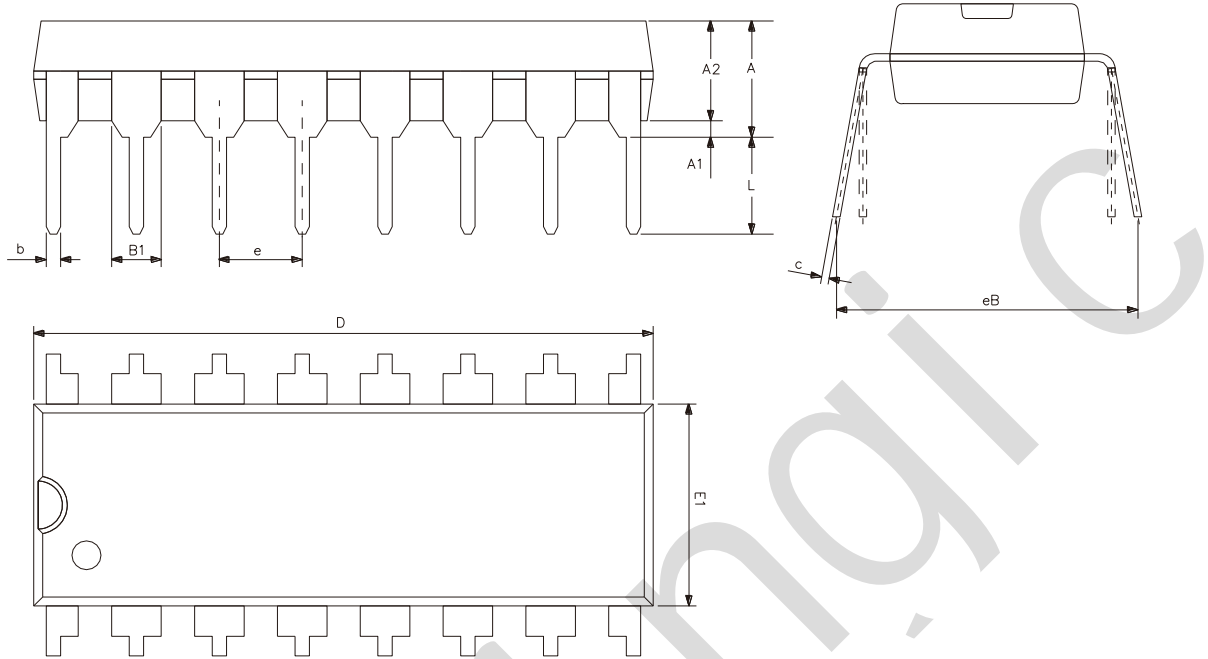
### 4.4、Measurement Points

Supply voltage	Input	Output		
$V_{DD}$	$V_M$	$V_M$	$V_X$	$V_Y$
5V to 15V	$0.5 \times V_{DD}$	$0.5 \times V_{DD}$	$0.1 \times V_{DD}$	$0.9 \times V_{DD}$



## 5、Package Information

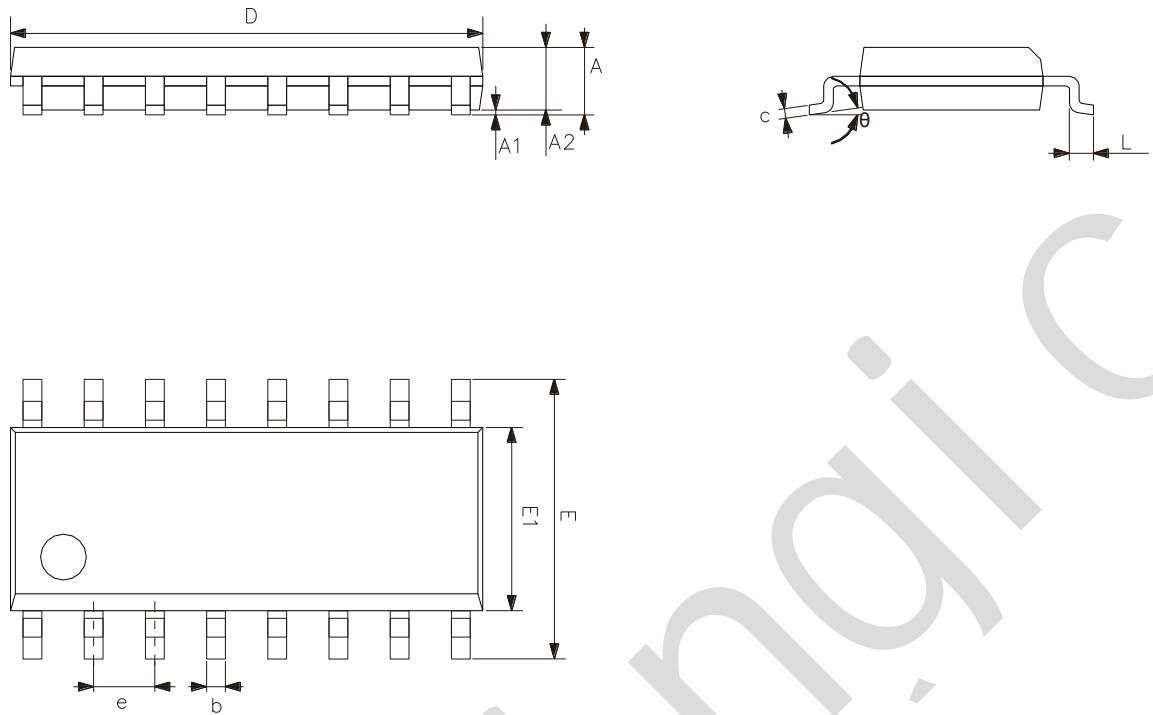
### 5.1、DIP16



Symbol	Dimensions (mm)	
	Min.	Max.
A2	3.20	3.60
A1	0.51	-
A	3.60	5.33
L	3.00	3.60
b	0.36	0.56
B1	1.52	
D	18.80	19.94
E1	6.20	6.60
e	2.54	
c	0.20	0.36
eB	7.62	9.30



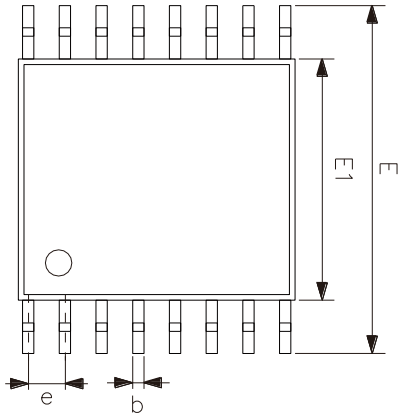
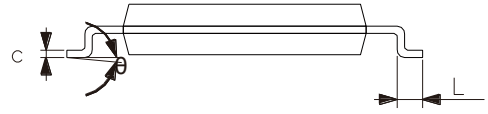
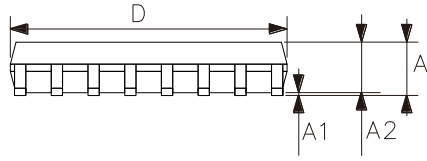
## 5.2、SOP16



Symbol	Dimensions (mm)	
	Min.	Max.
A	1.35	1.80
A1	0.10	0.25
A2	1.25	1.55
b	0.33	0.51
c	0.19	0.25
D	9.50	10.10
E	5.80	6.30
E1	3.70	4.10
e	1.27	
L	0.35	0.89
$\theta$	0°	8°



### 5.3、TSSOP16



Symbol	Dimensions (mm)	
	Min.	Max.
A	-	1.20
A1	0.05	0.15
A2	0.80	1.05
b	0.19	0.30
c	0.09	0.20
D	4.90	5.10
E1	4.30	4.50
E	6.20	6.60
e	0.65	
L	0.45	0.75
$\theta$	0°	8°



## 6、 Statements And Notes

### 6.1、 The name and content of Hazardous substances or Elements in the product

Part name	Hazardous substances or Elements									
	Lead and lead compounds	Mercury and mercury compounds	Cadmium and cadmium compounds	Hexavalent chromium compounds	Polybrominated biphenyls	Polybrominated biphenyl ethers	Dibutyl phthalate	Butylbenzyl phthalate	Di-2-ethylhexyl phthalate	Diisobutyl phthalate
Lead frame	○	○	○	○	○	○	○	○	○	○
Plastic resin	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
The lead	○	○	○	○	○	○	○	○	○	○
Plastic sheet installed	○	○	○	○	○	○	○	○	○	○
explanation	○: Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard. ×: Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements.									

### 6.2、 Notes

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