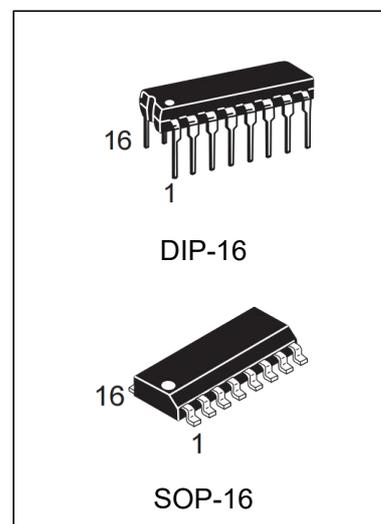


BCD-to-Decimal Decoder

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

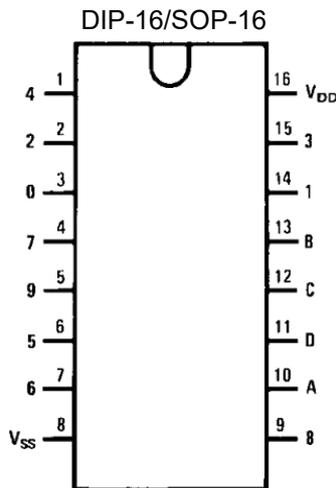
DEVICE	Package Type	MARKING	Packing	Packing Qty
CD4028BPG	DIP-16	CD4028B	TUBE	1000pcs/box
CD4028BDRG	SOP-16	CD4028B	REEL	2500pcs/reel
CD4028BDRG4	SOP-16	CD4028B	REEL	4000pcs/reel

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.

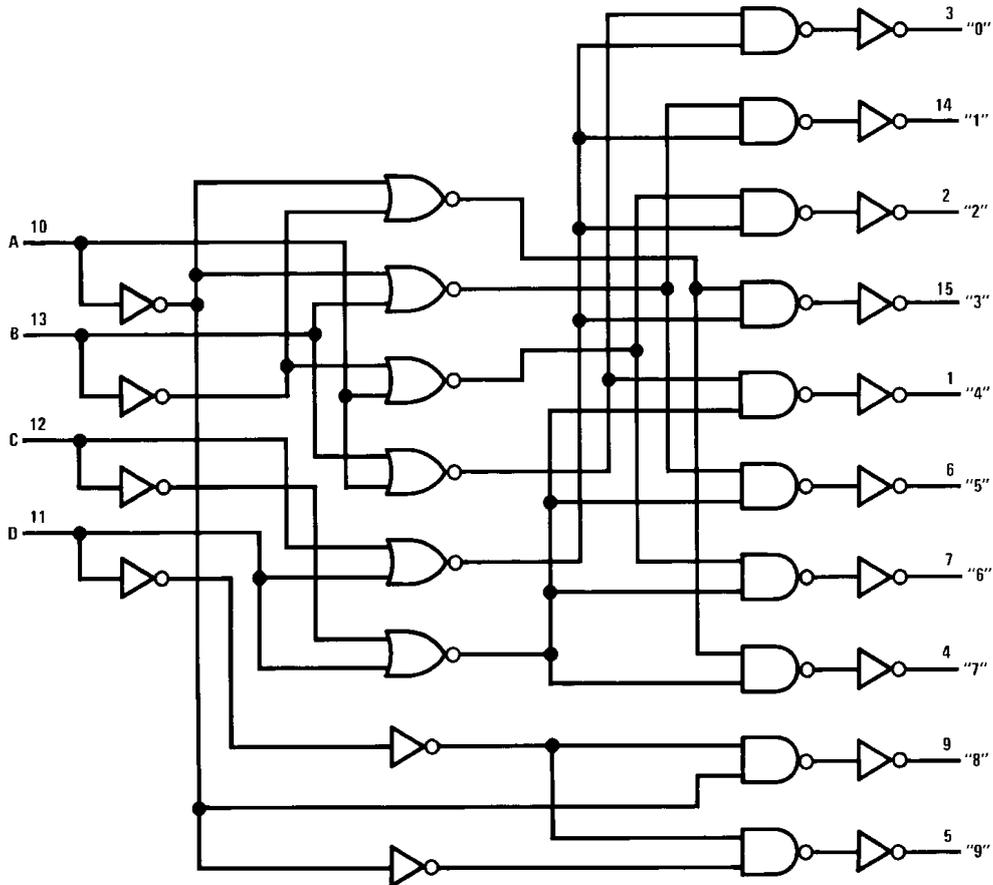
All inputs are protected against static discharge damage by diode clamps to VDD and VSS.

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 (V _{DD})	3	15	V
Input Voltage (V _{IN})	0	V _{DD}	V
Operating Temperature Range (T _A)	-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: V_{SS} = 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	
I _{DD}	Quiescent Device Current	V _{DD} = 5V, V _{IN} = V _{DD} or V _{SS}		20		0.01	20		150	μA
		V _{DD} = 10V, V _{IN} = V _{DD} or V _{SS}		40		0.01	40		300	μA
		V _{DD} = 15V, V _{IN} = V _{DD} or V _{SS}		80		0.02	80		600	μA
V _{OL}	LOW Level Output Voltage	I _O < 1 μA, V _{IL} = 0V, V _{IH} = V _{DD}		0.05		0	0.05		0.05	V
		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	I _O < 1 μA, V _{IL} = 0V, V _{IH} = V _{DD}	4.95		4.95	5		4.95		V
		V _{DD} = 5V	9.95		9.95	10		9.95		V
		V _{DD} = 10V	14.95		14.95	15		14.95		V
V _{IL}	LOW Level Input Voltage	I _O < 1 μA		1.5		2.25	1.5		1.5	V
		V _{DD} = 5V, V _O = 0.5V or 4.5V		3.0		4.5	3.0		3.0	V
		V _{DD} = 10V, V _O = 1V or 9V		4.0		6.75	4.0		4.0	V
V _{IH}	HIGH Level Input Voltage	I _O < 1 μA	3.5		3.5			3.5		V
		V _{DD} = 5V, V _O = 0.5V or 4.5V	7.0		7.0			7.0		V
		V _{DD} = 10V, V _O = 1V or 9V	11.0		11.0			11.0		V
I _{OL}	LOW Level Output Current (Note 3)	V _{IH} = V _{DD} , V _{IL} = 0V	0.52		0.44	0.88		0.36		mA
		V _{DD} = 5V, V _O = 0.4V	1.3		1.1	2.2		0.9		mA
		V _{DD} = 10V, V _O = 0.5V	3.6		3.0	6.0		2.4		mA
I _{OH}	HIGH Level Output Current (Note 3)	V _{IH} = V _{DD} , V _{IL} = 0V	-0.2		-0.16	-0.32		-0.12		mA
		V _{DD} = 5V, V _O = 4.6V	-0.5		-0.4	-0.8		-0.3		mA
		V _{DD} = 10V, V _O = 9.5V	-1.4		-1.2	-3.5		-1.0		mA
I _{IN}	Input Current	V _{DD} = 5V, V _{IN} = 0V		-0.3			-0.3		-1.0	μA
		V _{DD} = 15V, V _{IN} = 15V		-0.3			-0.3		-1.0	μA

Note 3: I_{OL} and I_{OH} are tested one output at a time.

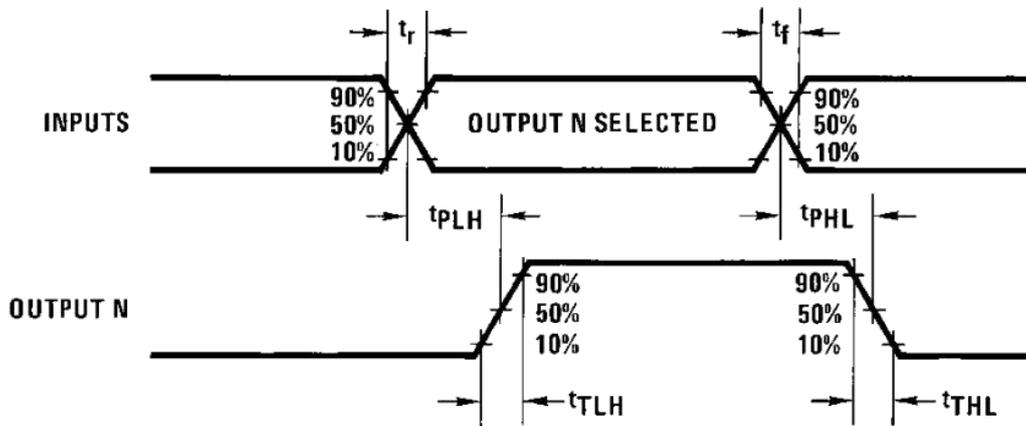
AC Electrical Characteristics (Note 4)

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

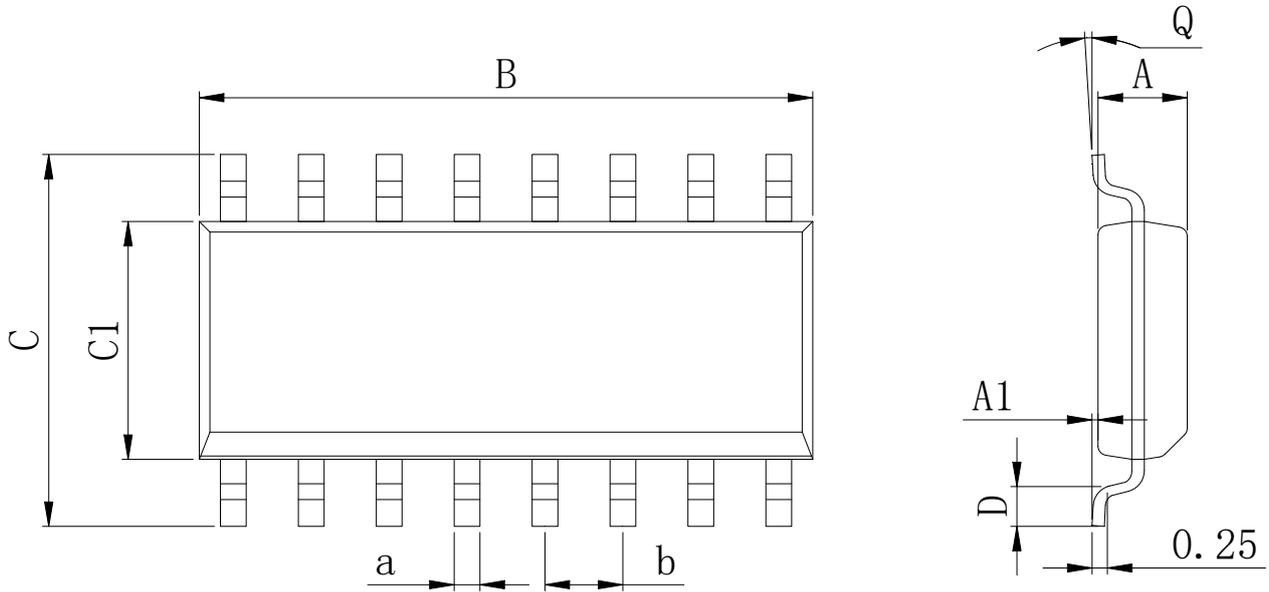
Note 4: AC Parameters are guaranteed by DC correlated testing.

Switching Time Waveforms



Physical Dimensions

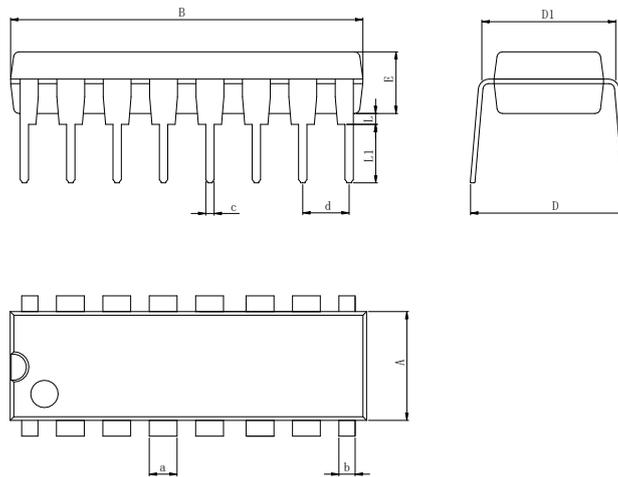
SOP-16



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

REVISION NUMBER	DATE	REVISION	PAGE
V1.0	2011-9	New	1-8
V1.1	2023-9	Update encapsulation type、Update Lead Temperature、Add annotation for Maximum Ratings.	1、 3

IMPORTANT STATEMENT:

Hanschip Semiconductor reserves the right to change its products and services without notice. Before ordering, the customer shall obtain the latest relevant information and verify whether the information is up to date and complete. Hanschip Semiconductor does not assume any responsibility or obligation for the altered documents.

Customers are responsible for complying with safety standards and taking safety measures when using Hanschip Semiconductor products for system design and machine manufacturing. You will bear all the following responsibilities: select the appropriate Hanschip Semiconductor products for your application; Design, validate and test your application; Ensure that your application meets the appropriate standards and any other safety, security or other requirements. To avoid the occurrence of potential risks that may lead to personal injury or property loss.

Hanschip Semiconductor products have not been approved for applications in life support, military, aerospace and other fields, and Hanschip Semiconductor will not bear the consequences caused by the application of products in these fields. All problems, responsibilities and losses arising from the user's use beyond the applicable area of the product shall be borne by the user and have nothing to do with Hanschip Semiconductor, and the user shall not claim any compensation liability against Hanschip Semiconductor by the terms of this Agreement.

The technical and reliability data (including data sheets), design resources (including reference designs), application or other design suggestions, network tools, safety information and other resources provided for the performance of semiconductor products produced by Hanschip Semiconductor are not guaranteed to be free from defects and no warranty, express or implied, is made. The use of testing and other quality control technologies is limited to the quality assurance scope of Hanschip Semiconductor. Not all parameters of each device need to be tested.

The documentation of Hanschip Semiconductor authorizes you to use these resources only for developing the application of the product described in this document. You have no right to use any other Hanschip Semiconductor intellectual property rights or any third party intellectual property rights. It is strictly forbidden to make other copies or displays of these resources. You should fully compensate Hanschip Semiconductor and its agents for any claims, damages, costs, losses and debts caused by the use of these resources. Hanschip Semiconductor accepts no liability for any loss or damage caused by infringement.