TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4028BP,TC4028BF

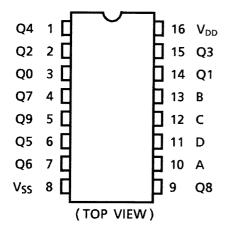
TC4028B BCD-to-Decimal Decoder

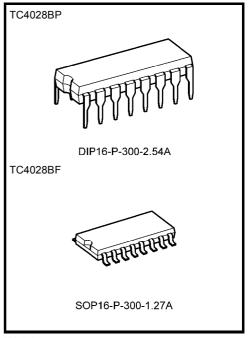
TC4028B is a BCD-to-DECIMAL decoder which converts BCD signal into DECIMAL signal.

Of ten outputs from Q0 to Q9, one output corresponding to input BCD code goes to the "H" level and all the others remain at the "L" level.

When D is used as inhibit input by use of three input lines from A to C, this decoder can be served as a BINARY-to-OCTAL decoder.

Pin Assignment





Weight

DIP16-P-300-2.54A : 1.00 g (typ.) SOP16-P-300-1.27A : 0.18 g (typ.)

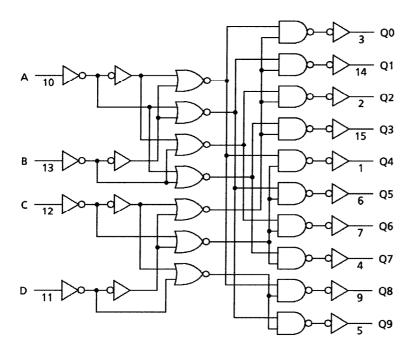
Truth Table

	Inp	outs	_		-	_	_	Out	puts	_	-		_
D	С	В	Α	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
L	L	L	L	Н	L	L	L	L	L	L	L	L	L
L	L	L	Н	L	Н	L	L	L	L	L	L	L	L
L	L	Н	L	L	L	Н	L	L	L	L	L	L	L
L	L	Н	Н	L	L	L	Н	L	L	L	L	L	L
L	Н	L	L	L	L	L	L	Н	L	L	L	L	L
L	Н	L	Н	L	L	L	L	L	Н	L	L	L	L
L	Н	Н	L	L	L	L	L	L	L	Н	L	L	L
L	Н	Н	Н	L	L	L	L	L	L	L	Н	L	L
Н	L	L	L	L	L	L	L	L	L	L	L	Н	L
Н	L	L	Н	L	L	L	L	L	L	L	L	L	Н
Н	L	Н	L	L	L	L	L	L	L	L	L	L	L
Н	L	Н	Η	L	L	L	L	L	L	L	L	L	L
Н	Н	L	L	L	L	L	L	L	L	L	L	L	L
Н	Н	L	Н	L	L	L	L	L	L	L	L	L	L
Н	Н	Н	L	L	L	L	L	L	L	L	L	L	L
Н	Н	Н	Н	L	L	L	L	L	L	L	L	L	L

H = High level

L = Low level

Logic Diagram



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Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
DC supply voltage	V_{DD}	V_{SS} – 0.5 to V_{SS} + 20	V
Input voltage	V _{IN}	V _{SS} – 0.5 to V _{DD} + 0.5	V
Output voltage	V _{OUT}	V_{SS} – 0.5 to V_{DD} + 0.5	V
DC input current	I _{IN}	±10	mA
Power dissipation	PD	300 (DIP)/180 (SOIC)	mW
Operating temperature range	T _{opr}	-40 to 85	°C
Storage temperature range	T _{stg}	-65 to 150	°C

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Operating Ranges (V_{SS} = 0 V) (Note)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
DC supply voltage	V_{DD}	_	3	_	18	V
Input voltage	V _{IN}	_	0	_	V_{DD}	V

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either V_{DD} or V_{SS} .

Static Electrical Characteristics ($V_{SS} = 0 V$)

Oh arrant it it		Sym-	Test Condition		-40°C		25°C			85°C		
Charac	cteristics	bol		V _{DD} (V)	Min	Max	Min	Тур.	Max	Min	Max	Unit
High-level voltage	l output	V _{OH}	$ I_{OUT} < 1 \mu A$ $V_{IN} = V_{SS}, V_{DD}$	5 10 15	4.95 9.95 14.95		4.95 9.95 14.95	5.00 10.00 15.00		4.95 9.95 14.95	_	V
Low-level voltage	output	V _{OL}	$ I_{OUT} < 1 \mu A$ $V_{IN} = V_{SS}, V_{DD}$	5 10	— —	0.05	— —	0.00 0.00	0.05	_ _	0.05	V
Output hig	gh current	Іон	$V_{OH} = 4.6 \text{ V}$ $V_{OH} = 2.5 \text{ V}$ $V_{OH} = 9.5 \text{ V}$ $V_{OH} = 13.5 \text{ V}$ $V_{IN} = V_{SS}, V_{DD}$	5 5 10 15	-0.61 -2.50 -1.50 -4.00	0.05 — — — —	-0.51 -2.10 -1.30 -3.40	0.00 -1.0 -4.0 -2.2 -9.0	0.05 — — — —	-0.42 -1.70 -1.10 -2.80		mA
Output lov	w current	l _{OL}	$V_{OL} = 0.4 \text{ V}$ $V_{OL} = 0.5 \text{ V}$ $V_{OL} = 1.5 \text{ V}$ $V_{IN} = V_{SS}, V_{DD}$	5 10 15	0.61 1.50 4.00	_ _ _	0.51 1.30 3.40	1.2 3.2 12.0	_ _ _	0.42 1.10 2.80	_ _ _	mA
Input high	voltage	V _{IH}	$V_{OUT} = 0.5 \text{ V}, 4.5 \text{ V}$ $V_{OUT} = 1.0 \text{ V}, 9.0 \text{ V}$ $V_{OUT} = 1.5 \text{ V}, 13.5 \text{ V}$ $ I_{OUT} < 1 \mu\text{A}$	5 10 15	3.5 7.0 11.0	 - -	3.5 7.0 11.0	2.75 5.50 8.25	_ _ _	3.5 7.0 11.0	_ _ _	V
Input low voltage		V _{IL}	$V_{OUT} = 0.5 \text{ V}, 4.5 \text{ V}$ $V_{OUT} = 1.0 \text{ V}, 9.0 \text{ V}$ $V_{OUT} = 1.5 \text{ V}, 13.5 \text{ V}$ $ I_{OUT} < 1 \mu\text{A}$	5 10 15		1.5 3.0 4.0	_ _ _	2.25 4.50 6.75	1.5 3.0 4.0	_ _ _	1.5 3.0 4.0	V
Input current	"H" level	lін	V _{IH} = 18 V	18	_	0.1	_	10 ⁻⁵	0.1	_	1.0	μΑ
Quiescent current	"L" level	I _{IL}	$V_{IL} = 0 V$ $V_{IN} = V_{SS}, V_{DD}$ (Note)	18 5 10 15		-0.1 5 10 20	_ _ _ _	0.005 0.010 0.015	-0.1 5 10 20	_ _ _ _	-1.0 150 300 600	μΑ

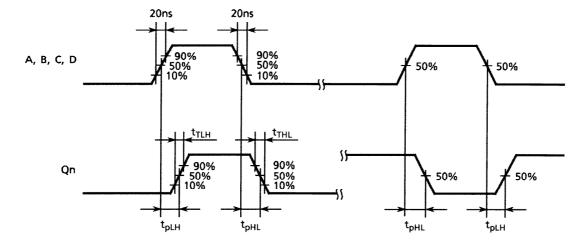
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Note: All valid input combinations.

Dynamic Electrical Characteristics (Ta = 25°C, V_{SS} = 0 V, C_L = 50 pF)

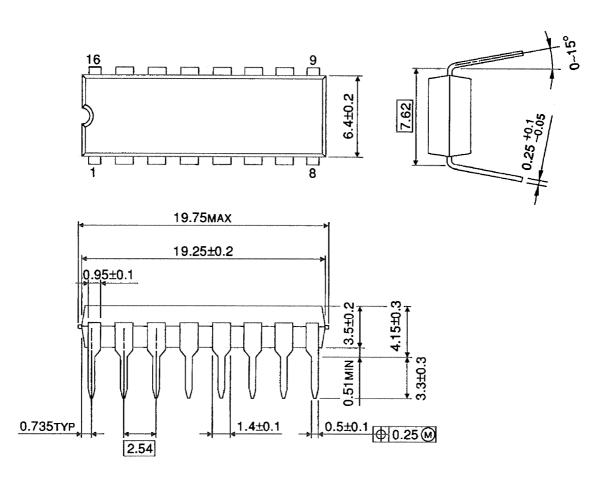
Characteristics	Symbol	Test Condition	V _{DD} (V)	Min	Тур.	Max	Unit
Output transition time (low to high)	t _{ТLН}	_	5 10 15		70 35 30	200 100 80	ns
Output transition time (high to low)	t _{THL}	_	5 10 15	 	70 35 30	200 100 80	ns
Propagation delay time	t _{pLH} t _{pHL}	_	5 10 15	 	110 55 40	350 160 120	ns
Input capacitance	C _{IN}	_		-	5	7.5	pF

Waveform for Measurement of Dynamic Characteristics



Package Dimensions

DIP16-P-300-2.54A Unit: mm

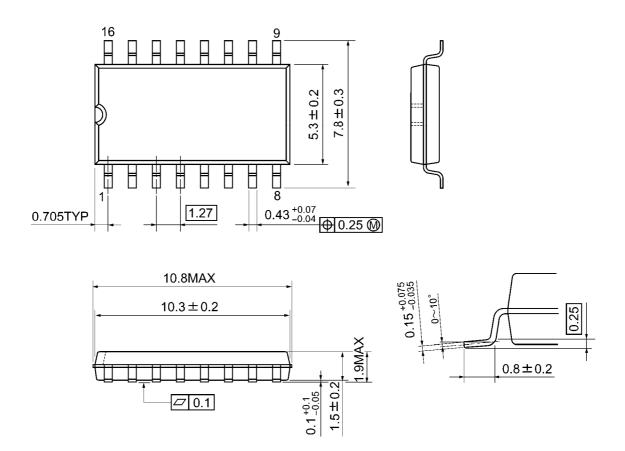


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Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A Unit: mm



Weight: 0.18 g (typ.)

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