

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC4028BP, TC4028BF, TC4028BFN

TC4028B BCD – TO – DECIMAL DECODER

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

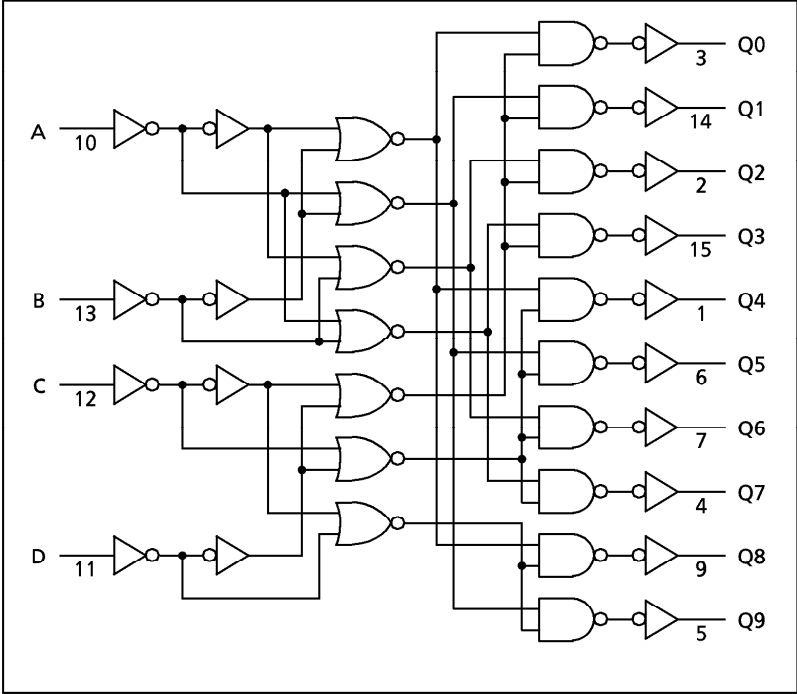
Of ten outputs from Q0 to Q9, one output corresponding to input BCD code goes to the “H” level and all the others remain at the “L” level.

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.

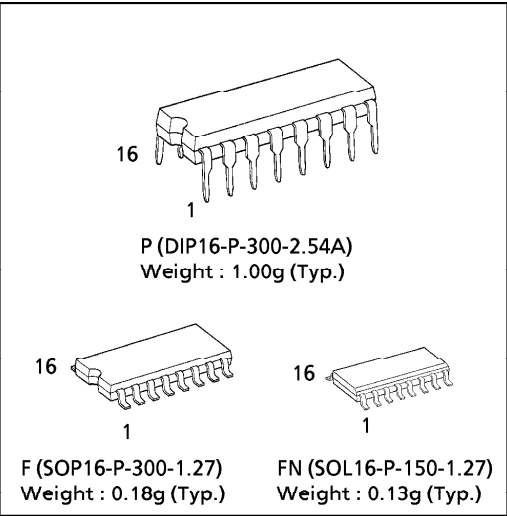
MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	V <sub>DD</sub>	V <sub>SS</sub> – 0.5~V <sub>SS</sub> + 20	V
Input Voltage	V <sub>IN</sub>	V <sub>SS</sub> – 0.5~V <sub>DD</sub> + 0.5	V
Output Voltage	V <sub>OUT</sub>	V <sub>SS</sub> – 0.5~V <sub>DD</sub> + 0.5	V
DC Input Current	I <sub>IN</sub>	± 10	mA
Power Dissipation	P <sub>D</sub>	300 (DIP) / 180 (SOIC)	mW
Operating Temperature Range	T <sub>opr</sub>	– 40~85	°C
Storage Temperature Range	T <sub>stg</sub>	– 65~150	°C

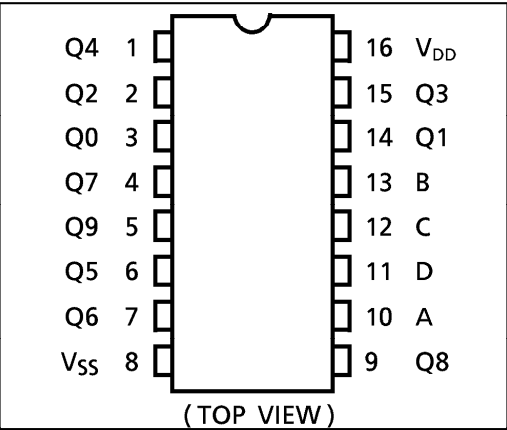
LOGIC DIAGRAM



(Note) The JEDEC SOP (FN) is not available in Japan.



PIN ASSIGNMENT



TRUTH TABLE

INPUTS				OUTPUTS													
D	C	B	A	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9				
L	L	L	L	H	L	L	L	L	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	L	L
L	L	H	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L
L	L	H	H	L	L	L	H	L	L	L	L	L	L	L	L	L	L
L	H	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L
L	H	L	H	L	L	L	L	L	H	L	L	L	L	L	L	L	L
L	H	H	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L
L	H	H	H	L	L	L	L	L	L	L	H	L	L	L	L	L	L
H	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L
H	L	L	H	L	L	L	L	L	L	L	L	L	H	L	L	L	L
H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
H	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L
H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L
H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L
H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L

961001EBA2

● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

RECOMMENDED OPERATING CONDITIONS ( $V_{SS} = 0V$ )

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
DC Supply Voltage	$V_{DD}$		3	—	18	V
Input Voltage	$V_{IN}$		0	—	$V_{DD}$	V

STATIC ELECTRICAL CHARACTERISTICS ( $V_{SS} = 0V$ )

CHARACTERISTIC	SYM-BOL	TEST CONDITION	$V_{DD}$ (V)	- 40°C		25°C			85°C		UNIT
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
High-Level Output Voltage	$V_{OH}$	$ I_{OUT}  < 1\mu A$ $V_{IN} = V_{SS}, V_{DD}$	5	4.95	—	4.95	5.00	—	4.95	—	V
			10	9.95	—	9.95	10.00	—	9.95	—	
			15	14.95	—	14.95	15.00	—	14.95	—	
Low-Level Output Voltage	$V_{OL}$	$ I_{OUT}  < 1\mu A$ $V_{IN} = V_{SS}, V_{DD}$	5	—	0.05	—	0.00	0.05	—	0.05	V
			10	—	0.05	—	0.00	0.05	—	0.05	
			15	—	0.05	—	0.00	0.05	—	0.05	
Output High Current	$I_{OH}$	$V_{OH} = 4.6V$	5	-0.61	—	-0.51	-1.0	—	-0.42	—	mA
		$V_{OH} = 2.5V$	5	-2.50	—	-2.10	-4.0	—	-1.70	—	
		$V_{OH} = 9.5V$	10	-1.50	—	-1.30	-2.2	—	-1.10	—	
		$V_{OH} = 13.5V$	15	-4.00	—	-3.40	-9.0	—	-2.80	—	
		$V_{IN} = V_{SS}, V_{DD}$									
Output Low Current	$I_{OL}$	$V_{OL} = 0.4V$	5	0.61	—	0.51	1.2	—	0.42	—	mA
		$V_{OL} = 0.5V$	10	1.50	—	1.30	3.2	—	1.10	—	
		$V_{OL} = 1.5V$	15	4.00	—	3.40	12.0	—	2.80	—	
		$V_{IN} = V_{SS}, V_{DD}$									
Input High Voltage	$V_{IH}$	$V_{OUT} = 0.5V, 4.5V$	5	3.5	—	3.5	2.75	—	3.5	—	V
		$V_{OUT} = 1.0V, 9.0V$	10	7.0	—	7.0	5.50	—	7.0	—	
		$V_{OUT} = 1.5V, 13.5V$	15	11.0	—	11.0	8.25	—	11.0	—	
		$ I_{OUT}  < 1\mu A$									
Input Low Voltage	$V_{IL}$	$V_{OUT} = 0.5V, 4.5V$	5	—	1.5	—	2.25	1.5	—	1.5	V
		$V_{OUT} = 1.0V, 9.0V$	10	—	3.0	—	4.50	3.0	—	3.0	
		$V_{OUT} = 1.5V, 13.5V$	15	—	4.0	—	6.75	4.0	—	4.0	
		$ I_{OUT}  < 1\mu A$									
Input Current	"H" Level	$I_{IH}$	$V_{IH} = 18V$	18	—	0.1	—	$10^{-5}$	0.1	—	μA
	"L" Level	$I_{IL}$	$V_{IL} = 0V$	18	—	-0.1	—	$-10^{-5}$	-0.1	—	
Quiescent Supply Current	$I_{DD}$	$V_{IN} = V_{SS}, V_{DD}^*$	5	—	5	—	0.005	5	—	150	μA
			10	—	10	—	0.010	10	—	300	
			15	—	20	—	0.015	20	—	600	

\* All valid input combinations.

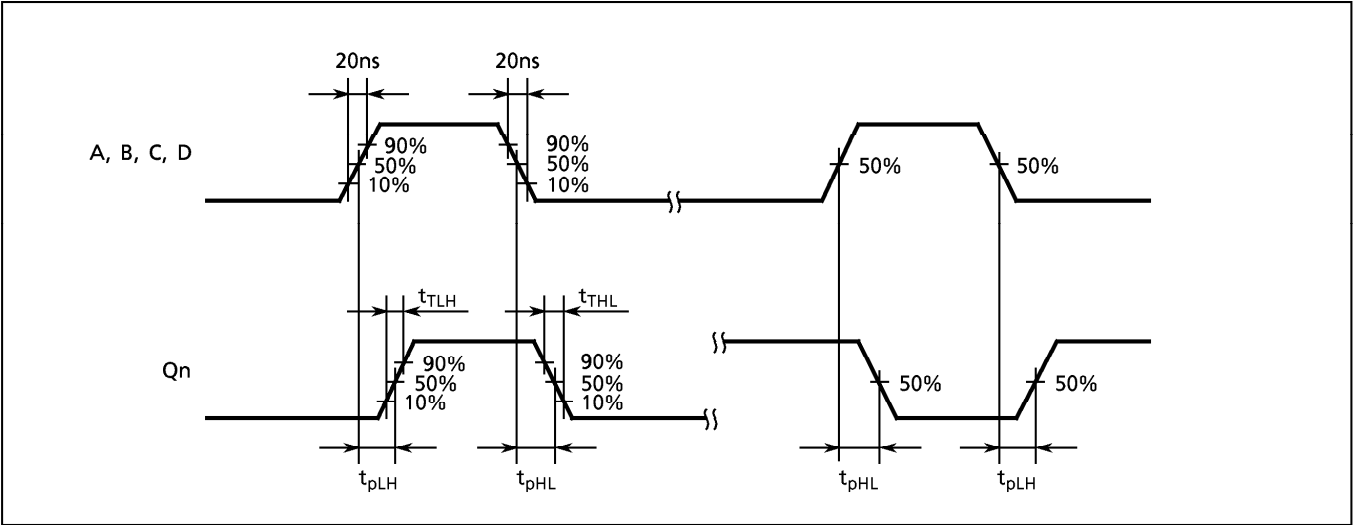
961001EBA2'

- The products described in this document are subject to foreign exchange and foreign trade control laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, Vss = 0V, CL = 50pF)

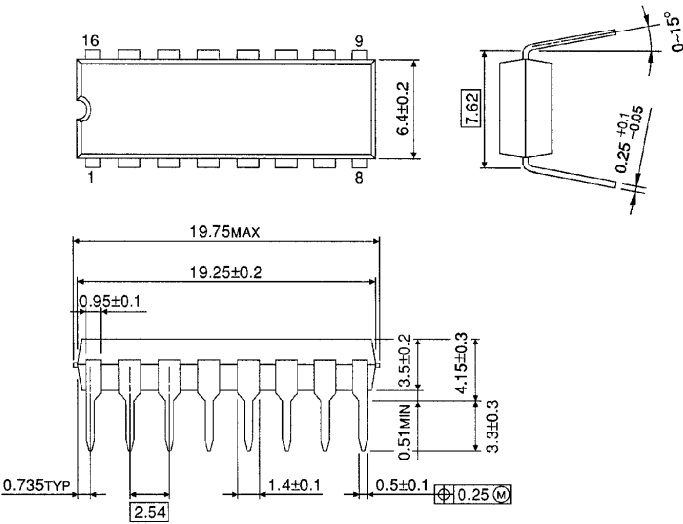
CHARACTERISTIC	SYMBOL	TEST CONDITION	V <sub>DD</sub> (V)	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Low to High)	t <sub>TLH</sub>		5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Output Transition Time (High to Low)	t <sub>THL</sub>		5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Propagation Delay Time	t <sub>pLH</sub> t <sub>pHL</sub>		5	—	110	350	ns
			10	—	55	160	
			15	—	40	120	
Input Capacitance	C <sub>IN</sub>			—	5	7.5	pF

WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS



DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A)

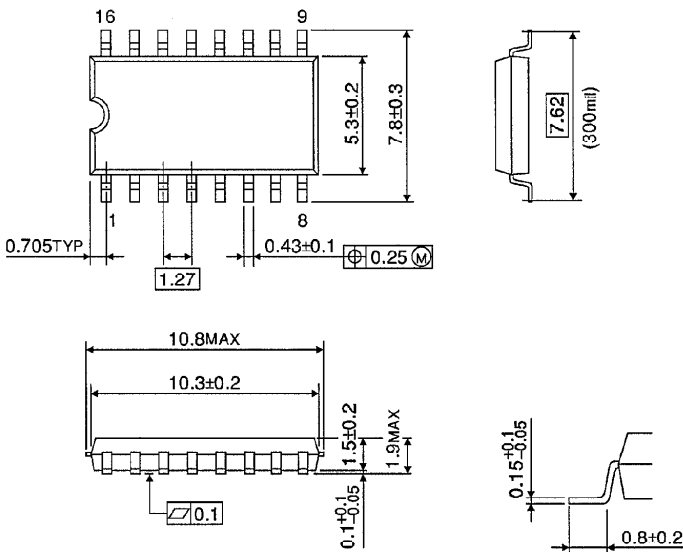
Unit in mm



Weight : 1.00g (Typ.)

SOP 16PIN (200mil BODY) OUTLINE DRAWING (SOP16-P-300-1.27)

Unit in mm

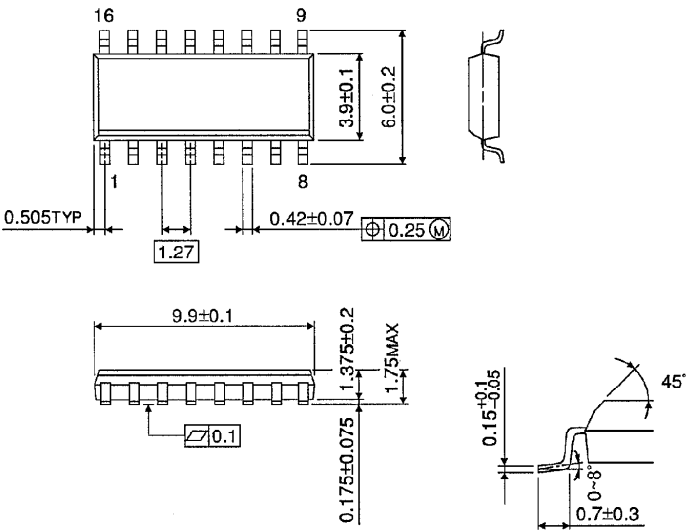


Weight : 0.18g (Typ.)

SOP 16PIN (150mil BODY) OUTLINE DRAWING (SOL16-P-150-1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)