

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC4028BP, TC4028BF, TC4028BFN

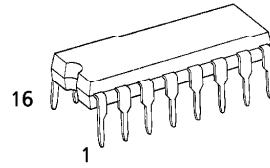
TC4028B BCD-TO-DECIMAL DECODER

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

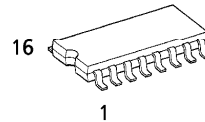
Of ten outputs from Q0 to Q9, one output corresponding to input BCD code goes to the "H" level and all the others remain at the "L" level.

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.

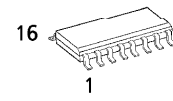
(Note) The JEDEC SOP (FN) is not available in Japan.



P (DIP16-P-300-2.54A)
Weight : 1.00g (Typ.)



F (SOP16-P-300-1.27)
Weight : 0.18g (Typ.)

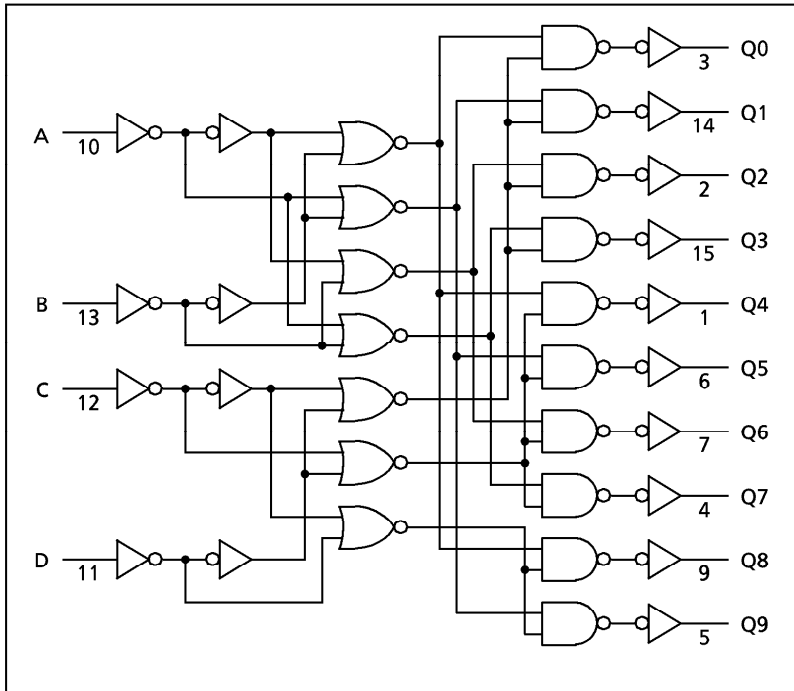


FN (SO16-P-150-1.27)
Weight : 0.13g (Typ.)

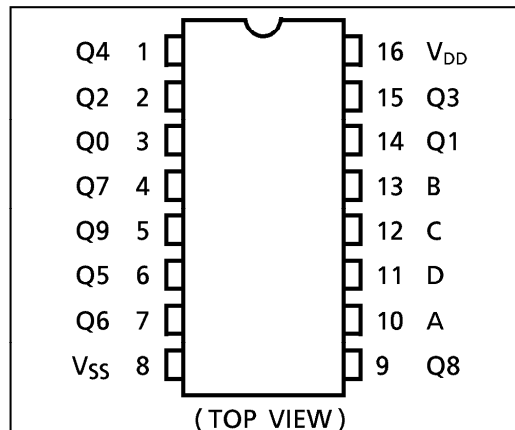
MAXIMUM RATINGS

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|-----------------------------|-----------|----------------------------------|------|
| DC Supply Voltage | V_{DD} | $V_{SS} - 0.5 \sim V_{SS} + 20$ | V |
| Input Voltage | V_{IN} | $V_{SS} - 0.5 \sim V_{DD} + 0.5$ | V |
| Output Voltage | V_{OUT} | $V_{SS} - 0.5 \sim V_{DD} + 0.5$ | V |
| DC Input Current | I_{IN} | ± 10 | mA |
| Power Dissipation | P_D | 300 (DIP) / 180 (SOIC) | mW |
| Operating Temperature Range | T_{opr} | -40~85 | °C |
| Storage Temperature Range | T_{stg} | -65~150 | °C |

LOGIC DIAGRAM



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 | 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 | 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 |
| H | H | 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 |
| H | H | H | 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 |

H = HIGH LEVEL L = LOW LEVEL

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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} < 1μA 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} < 1μA 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 V _{OH} = 2.5V V _{OH} = 9.5V V _{OH} = 13.5V V _{IN} = V _{SS} , V _{DD} | 5 | -0.61 | — | -0.51 | -1.0 | — | -0.42 | — | mA |
| | | | 5 | -2.50 | — | -2.10 | -4.0 | — | -1.70 | — | |
| | | | 10 | -1.50 | — | -1.30 | -2.2 | — | -1.10 | — | |
| | | | 15 | -4.00 | — | -3.40 | -9.0 | — | -2.80 | — | |
| Output Low Current | I _{OL} | V _{OL} = 0.4V V _{OL} = 0.5V V _{OL} = 1.5V V _{IN} = V _{SS} , V _{DD} | 5 | 0.61 | — | 0.51 | 1.2 | — | 0.42 | — | mA |
| | | | 10 | 1.50 | — | 1.30 | 3.2 | — | 1.10 | — | |
| | | | 15 | 4.00 | — | 3.40 | 12.0 | — | 2.80 | — | |
| | | | 5 | 3.5 | — | 3.5 | 2.75 | — | 3.5 | — | |
| Input High Voltage | V _{IH} | V _{OUT} = 0.5V, 4.5V V _{OUT} = 1.0V, 9.0V V _{OUT} = 1.5V, 13.5V I _{OUT} < 1μA | 10 | 7.0 | — | 7.0 | 5.50 | — | 7.0 | — | V |
| | | | 15 | 11.0 | — | 11.0 | 8.25 | — | 11.0 | — | |
| | | | 5 | — | 1.5 | — | 2.25 | 1.5 | — | 1.5 | |
| Input Low Voltage | V _{IL} | V _{OUT} = 0.5V, 4.5V V _{OUT} = 1.0V, 9.0V V _{OUT} = 1.5V, 13.5V I _{OUT} < 1μA | 10 | — | 3.0 | — | 4.50 | 3.0 | — | 3.0 | V |
| | | | 15 | — | 4.0 | — | 6.75 | 4.0 | — | 4.0 | |
| | | | 18 | — | 0.1 | — | 10 ⁻⁵ | 0.1 | — | 1.0 | |
| Input Current | "H" Level | I _{IH} | V _{IH} = 18V | 18 | — | 0.1 | — | 10 ⁻⁵ | 0.1 | — | 1.0 |
| | "L" Level | I _{IL} | V _{IL} = 0V | 18 | — | -0.1 | — | -10 ⁻⁵ | -0.1 | — | -1.0 |
| 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.

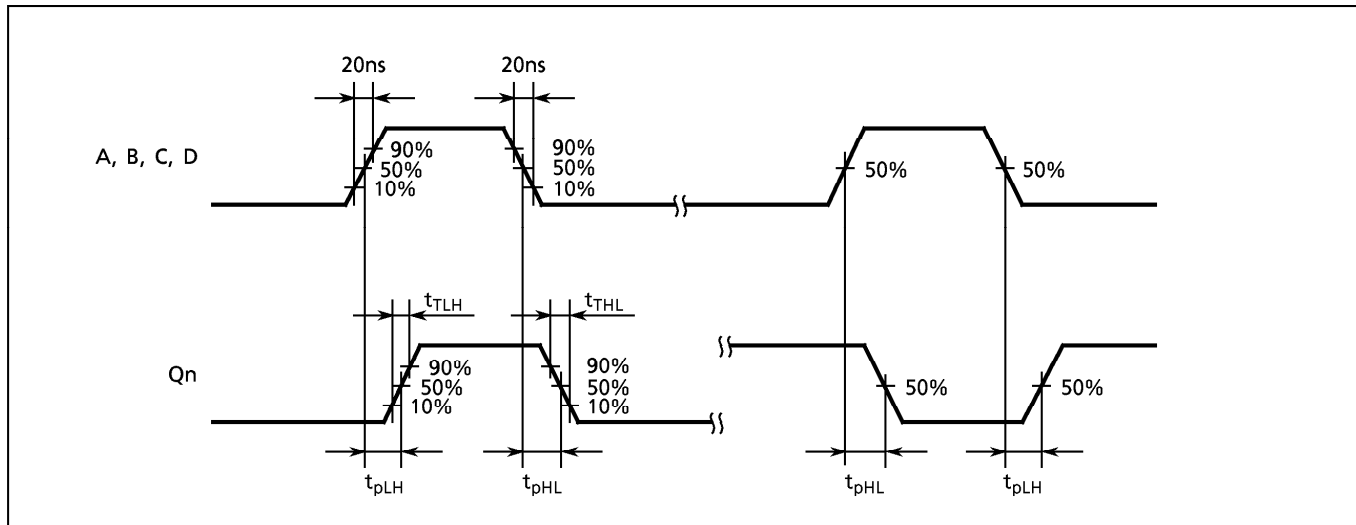
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DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, Vss = 0V, CL = 50pF)

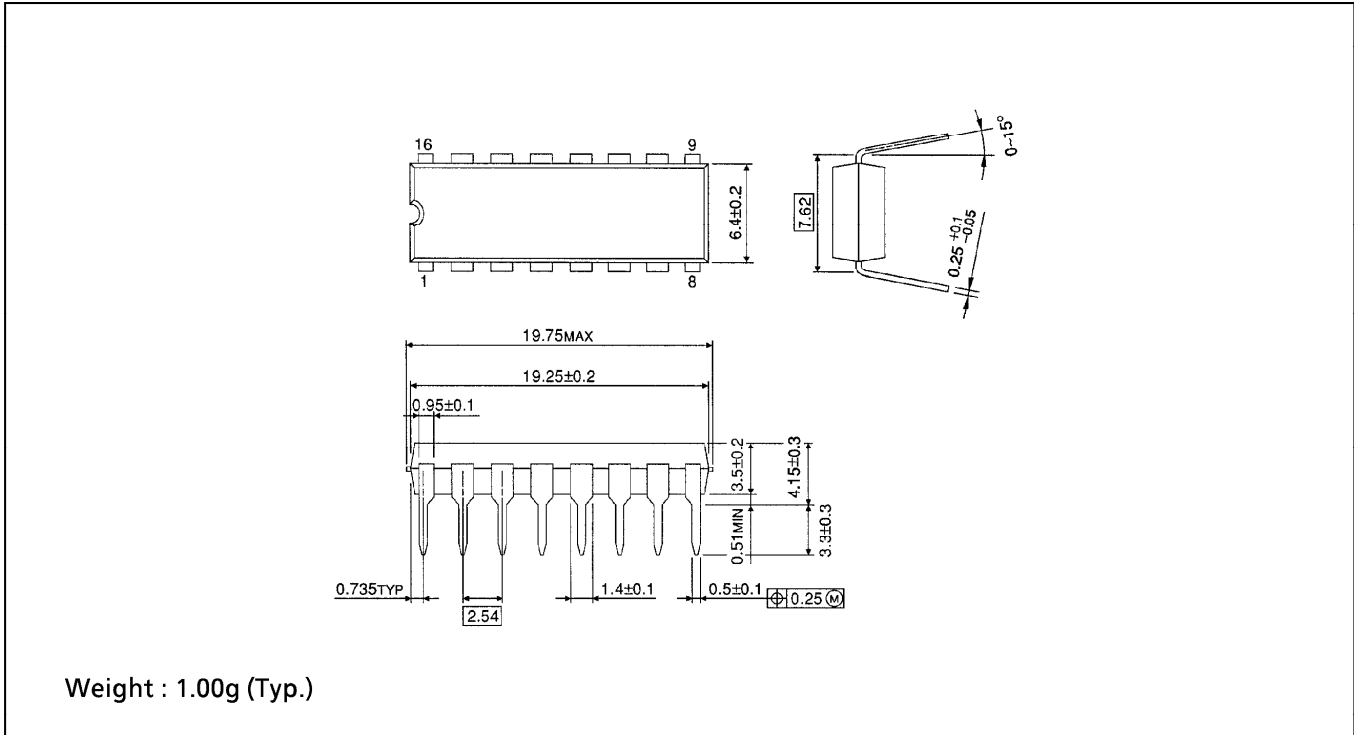
| CHARACTERISTIC | SYMBOL | TEST CONDITION | V _{DD} (V) | MIN. | TYP. | MAX. | UNIT |
|---|------------------|----------------|---------------------|------|------|------|------|
| | | | | | | | |
| Output Transition Time (Low to High) | t _{TLH} | | 5 | — | 70 | 200 | ns |
| | | | 10 | — | 35 | 100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

WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS



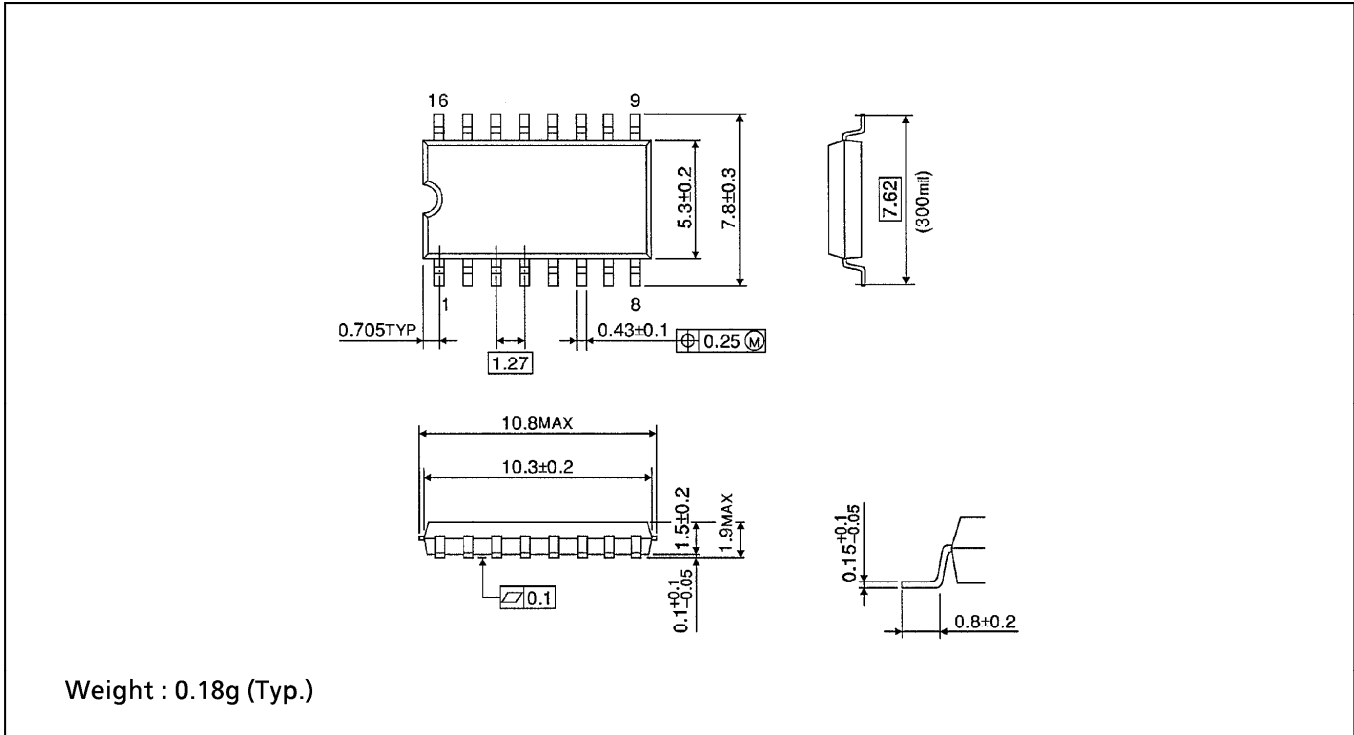
DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A)

Unit in mm



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

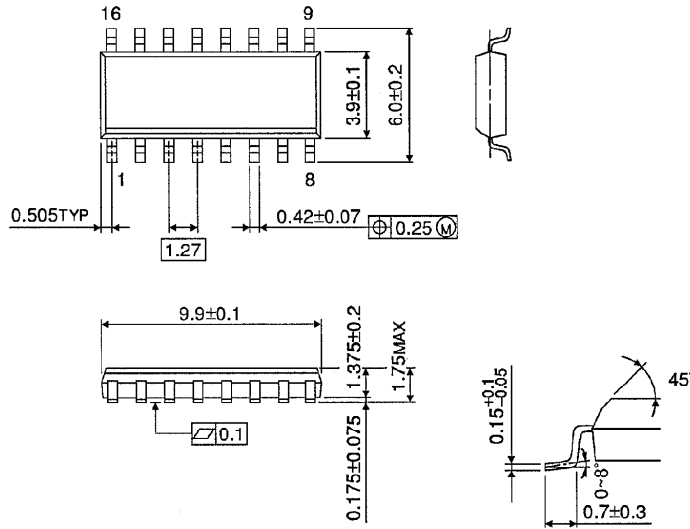
Unit in mm



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.)