

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC4024BP, TC4024BF, TC4024BFN

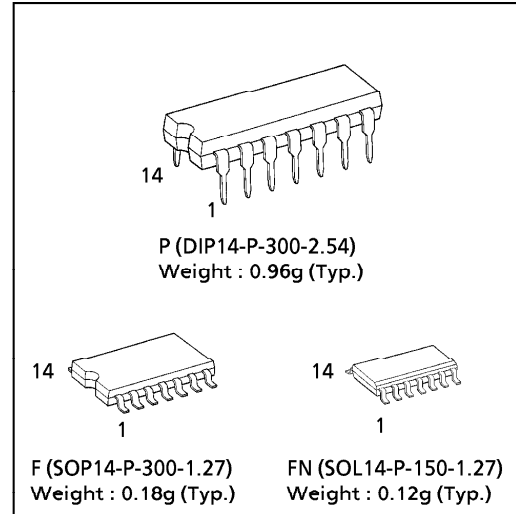
TC4024B 7 STAGE RIPPLE-CARRY BINARY COUNTER / DIVIDERS

TC4024B is 7 stage ripple carry type binary counter having asynchronous clear function.
 The counter advances its counting state by falling edge of **CLOCK** input.
 When **RESET** input is placed at "H", all the internal flip-flop are reset making all the outputs Q1 through Q7 to be "L" regardless of **CLOCK** input.
 This is suitable for frequency divider circuits and control circuits.

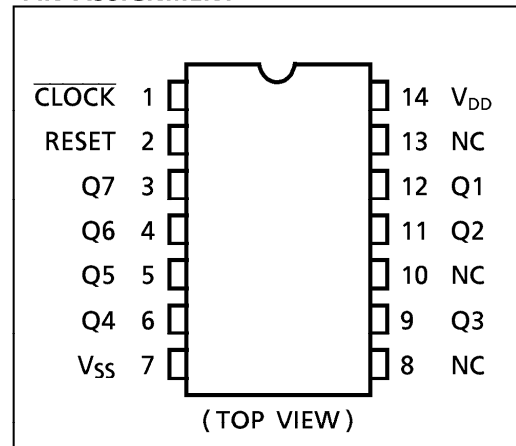
(Note) The JEDEC SOP (FN) is not available in Japan.

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 |



PIN ASSIGNMENT

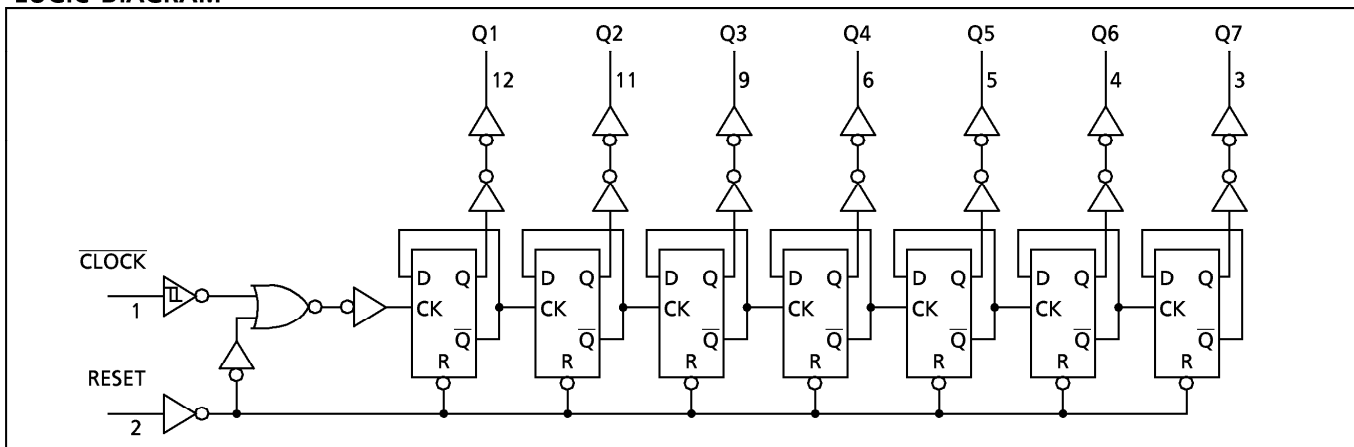


TRUTH TABLE

| $\overline{\text{CLOCK}} \Delta$ | RESET | OUTPUT STAGE |
|----------------------------------|-------|-----------------------|
| * | H | All Outputs = "L" |
| \uparrow | L | No Change |
| \downarrow | L | Advance to Next State |

Δ : Level Change, * : Don't Care

LOGIC DIAGRAM



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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} | 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 | — | | |
| | | | 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 | — | | |
| | | | 15 | 4.00 | — | 3.40 | 12.0 | — | 2.80 | — | | |
| 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 | 5 | 3.5 | — | 3.5 | 2.75 | — | 3.5 | — | V | |
| | | | 10 | 7.0 | — | 7.0 | 5.50 | — | 7.0 | — | | |
| | | | 15 | 11.0 | — | 11.0 | 8.25 | — | 11.0 | — | | |
| | | | 15 | 11.0 | — | 11.0 | 8.25 | — | 11.0 | — | | |
| 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 | 5 | — | 1.5 | — | 2.25 | 1.5 | — | 1.5 | V | |
| | | | 10 | — | 3.0 | — | 4.50 | 3.0 | — | 3.0 | | |
| | | | 15 | — | 4.0 | — | 6.75 | 4.0 | — | 4.0 | | |
| | | | 15 | — | 4.0 | — | 6.75 | 4.0 | — | 4.0 | | |
| Input Current | "H" Level | I _{IH} | V _{IH} = 18V | 18 | — | 0.1 | — | 10 ⁻⁵ | 0.1 | — | 1.0 | μA |
| | "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 | — | 15 | — | 0.015 | 20 | — | 600 | | |

* All valid input combinations.

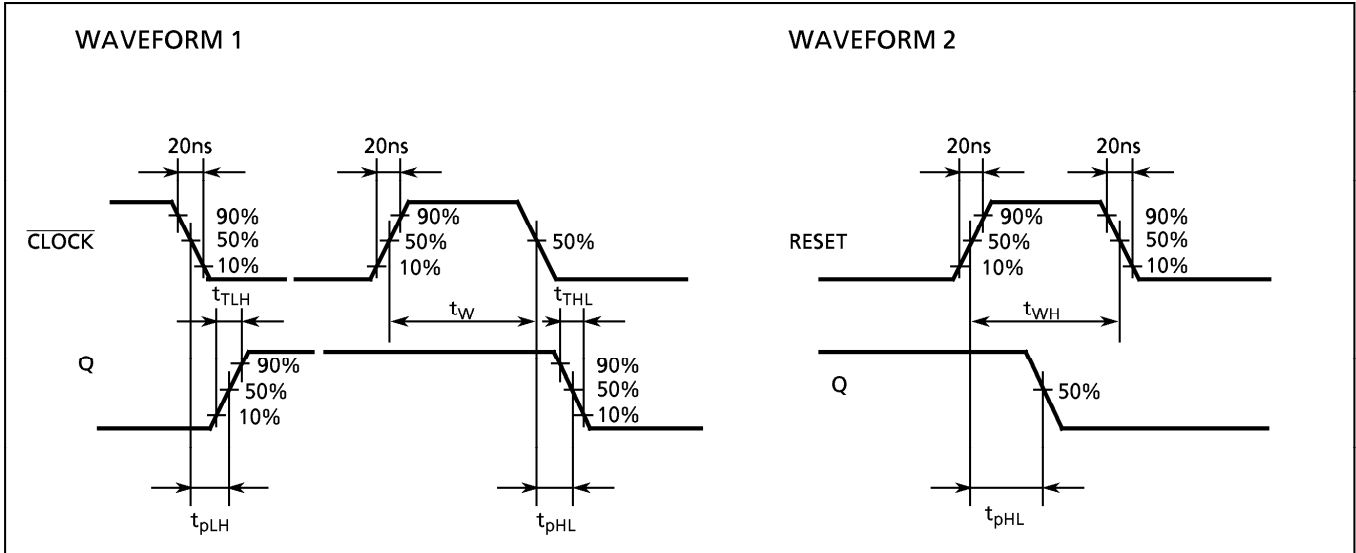
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DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, Vss = 0V, CL = 50pF)

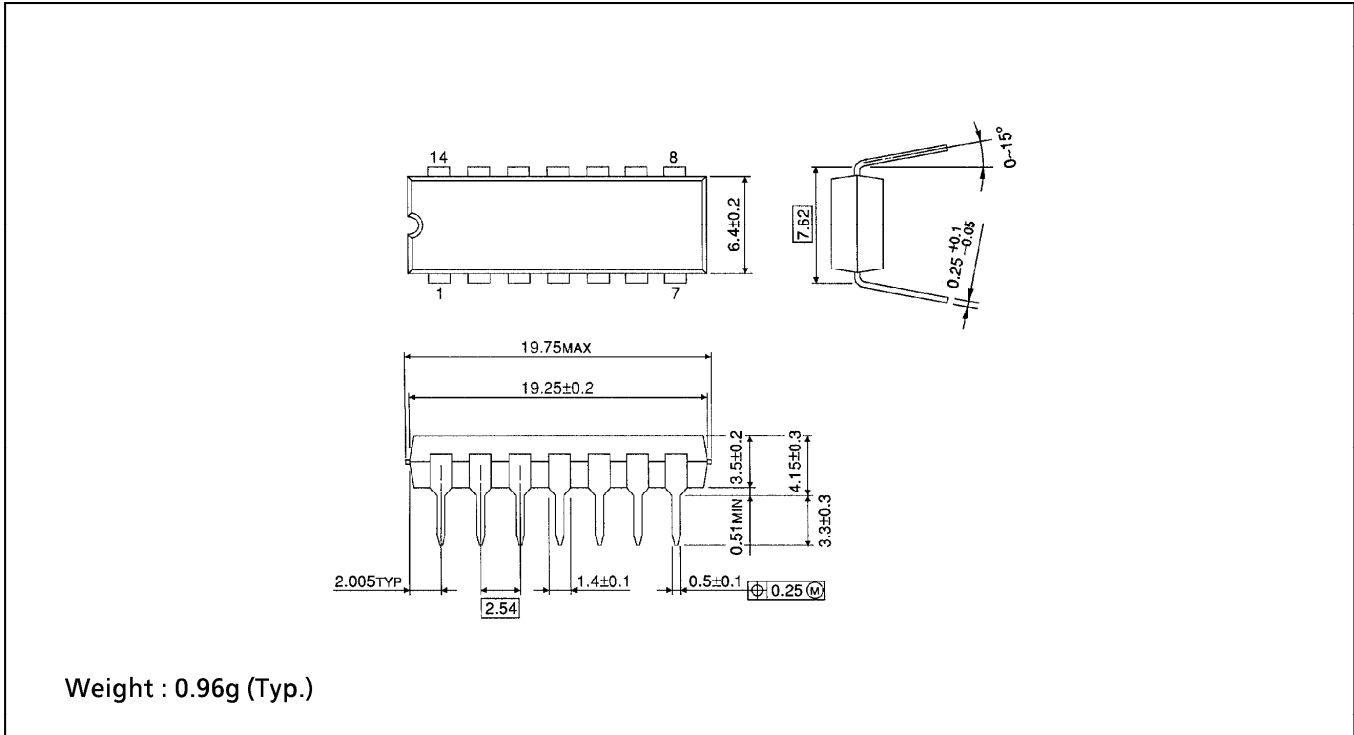
| CHARACTERISTIC | SYMBOL | TEST CONDITION | V _{DD} (V) | MIN. | TYP. | MAX. | UNIT |
|---|--------------------------------------|----------------|---------------------|----------|------|------|------|
| | | | | | | | |
| Output Transition Time (Low to High) | t _{TLH} | | 5 | — | 70 | 200 | ns |
| | | | 10 | — | 35 | 100 | |
| | | | 15 | — | 30 | 80 | |
| Output Transition Time (High to Low) | t _{THL} | | 5 | — | 70 | 200 | |
| | | | 10 | — | 35 | 100 | |
| | | | 15 | — | 30 | 80 | |
| Propagation Delay Time ($\overline{\text{CLOCK}}$ - Q1) | t _{pLH} | | 5 | — | 140 | 360 | |
| | | | 10 | — | 70 | 160 | |
| | | | 15 | — | 50 | 130 | |
| Propagation Delay Time ($\overline{\text{CLOCK}}$ - Q1) | t _{pHL} | | 5 | — | 140 | 360 | |
| | | | 10 | — | 70 | 160 | |
| | | | 15 | — | 50 | 130 | |
| Propagation Delay Time ($\overline{\text{CLOCK}}$ - Q7) | t _{pLH} | | 5 | — | 400 | 1200 | |
| | | | 10 | — | 160 | 520 | |
| | | | 15 | — | 115 | 430 | |
| Propagation Delay Time ($\overline{\text{CLOCK}}$ - Q7) | t _{pHL} | | 5 | — | 400 | 1200 | |
| | | | 10 | — | 160 | 520 | |
| | | | 15 | — | 115 | 430 | |
| Propagation Delay Time (RESET - Q) | t _{pHL} | | 5 | — | 140 | 280 | |
| | | | 10 | — | 70 | 120 | |
| | | | 15 | — | 50 | 100 | |
| Max. Clock Frequency | f _{CL} | | 5 | 3.5 | 14 | — | MHz |
| | | | 10 | 8.0 | 30 | — | |
| | | | 15 | 12.0 | 40 | — | |
| Max. Clock Input Rise Time Max. Clock Input Fall Time | t _{rCL} t _{fCL} | | 5 | No Limit | | | μs |
| | | | 10 | | | | |
| | | | 15 | | | | |
| Max. Clock Pulse Width | t _w | | 5 | — | 40 | 140 | ns |
| | | | 10 | — | 20 | 60 | |
| | | | 15 | — | 15 | 40 | |
| Max. Pulse Width (RESET) | t _{WH} | | 5 | — | 40 | 200 | |
| | | | 10 | — | 20 | 80 | |
| | | | 15 | — | 15 | 60 | |
| Minimum Removal Time | t _{rem} | | 5 | — | 0 | 350 | |
| | | | 10 | — | 0 | 150 | |
| | | | 15 | — | 0 | 100 | |
| Input Capacitance | C _{IN} | | | — | 5 | 7.5 | |

WAVEFORMS FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS



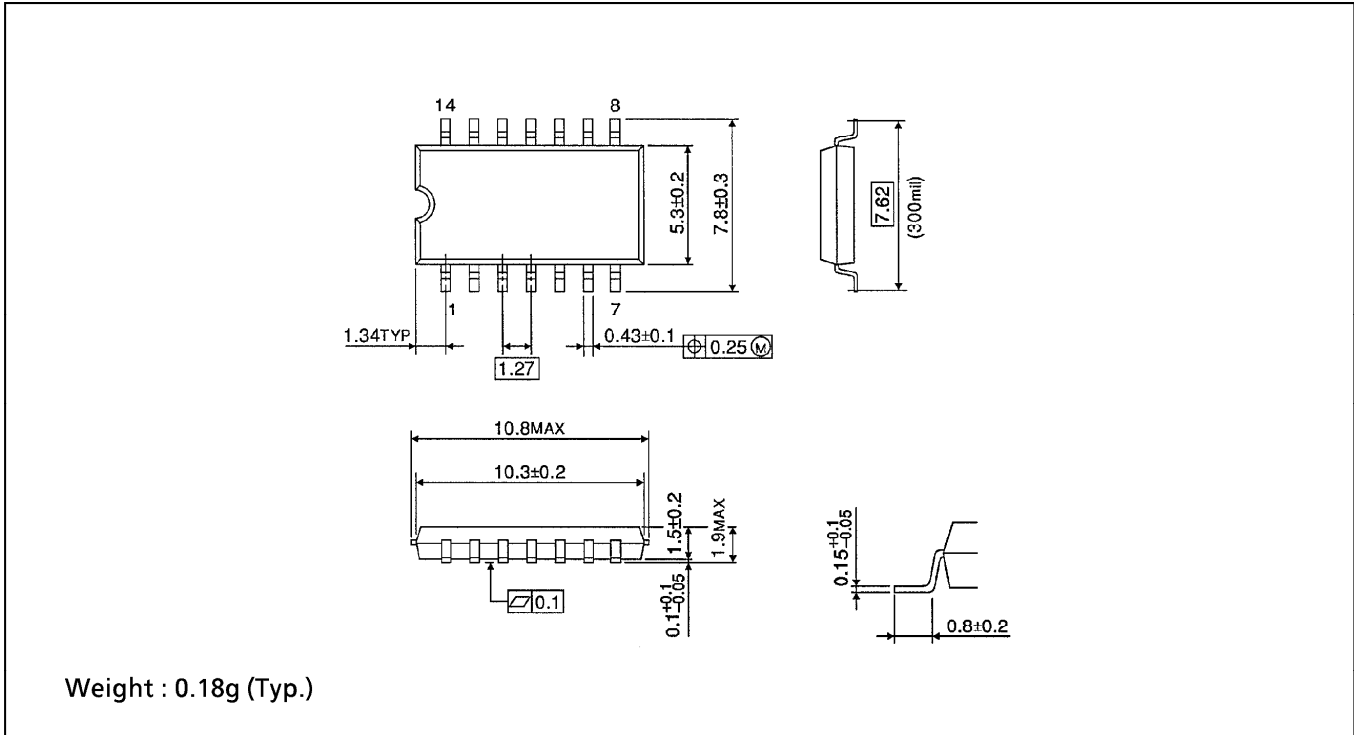
DIP 14PIN OUTLINE DRAWING (DIP14-P-300-2.54)

Unit in mm



SOP 14PIN (200mil BODY) OUTLINE DRAWING (SOP14-P-300-1.27)

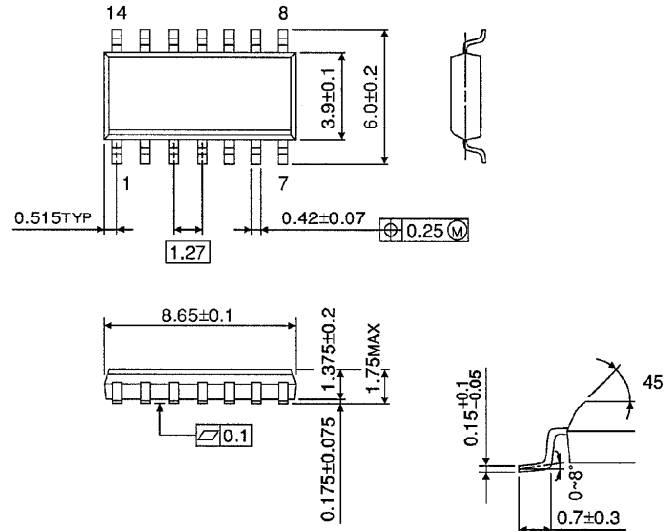
Unit in mm



SOP 14PIN (150mil BODY) OUTLINE DRAWING (SOL14-P-150-1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)