

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC4024BP, TC4024BF, TC4024BFN

TC4024B 7 STAGE RIPPLE – CARRY BINARY COUNTER / DIVIDERS

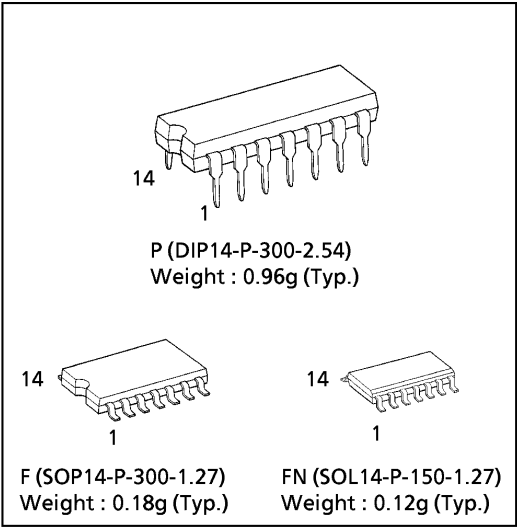
TC4024B is 7 stage ripple carry type binary counter having asynchronous clear function.

The counter advances its counting state by falling edge of $\overline{\text{CLOCK}}$ 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 $\overline{\text{CLOCK}}$ input.

This is suitable for frequency divider circuits and control circuits.

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



MAXIMUM RATINGS

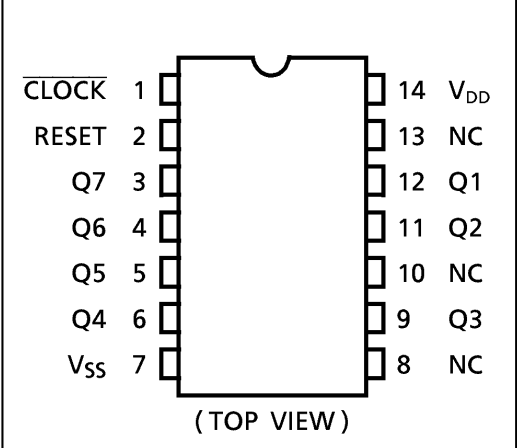
| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|-----------------------------|-----------|----------------------------------|--------------------|
| DC Supply Voltage | V_{DD} | $V_{SS} - 0.5 \sim V_{SS} + 20$ | V |
| Input Voltage | V_{IN} | $V_{SS} - 0.5 \sim V_{DD} + 0.5$ | V |
| Output Voltage | V_{OUT}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

TRUTH TABLE

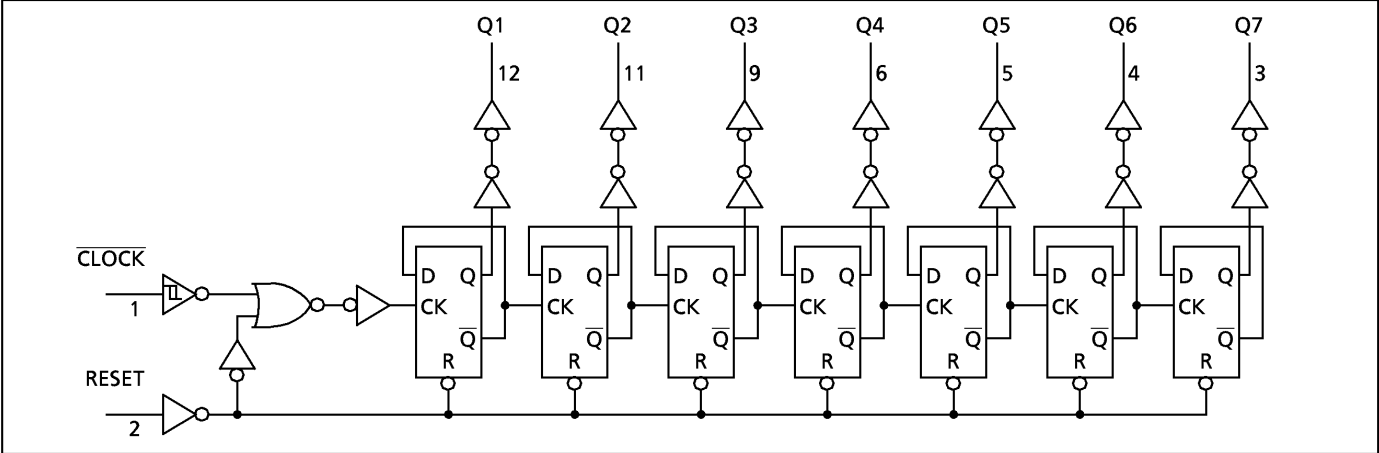
| $\overline{\text{CLOCK}} \Delta$ | RESET | OUTPUT STAGE |
|----------------------------------|-------|-----------------------|
| * | H | All Outputs = “L” |
| | L | No Change |
| | L | Advance to Next State |

Δ : Level Change, * : Don't Care

PIN ASSIGNMENT



LOGIC DIAGRAM



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 ($V_{SS} = 0V$)

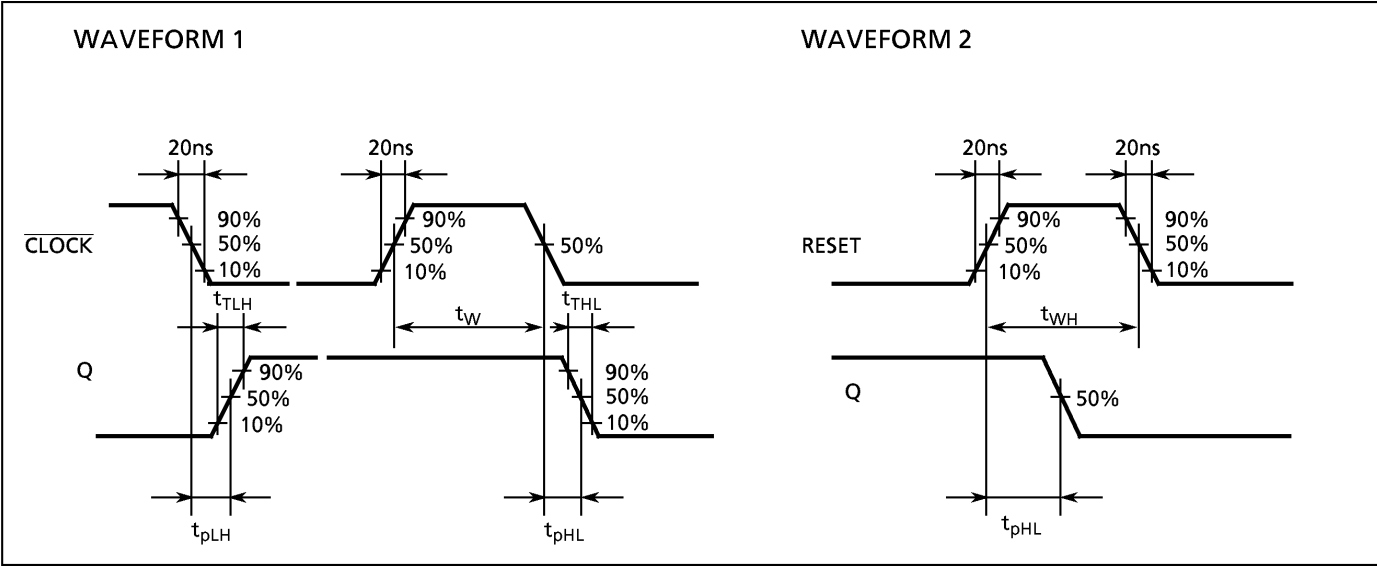
| CHARACTERISTIC | | SYM-BOL | TEST CONDITION | V _{DD} (V) | - 40°C | | 25°C | | | 85°C | | UNIT |
|---------------------------|-----------|--------------------|---|------------------------|---|----------------------|-----------------------|-------------------------|----------------------|-----------------------|----------------------|------|
| | | | | | MIN. | MAX. | MIN. | TYP. | MAX. | MIN. | MAX. | |
| High-Level Output Voltage | | V _{OH} | I _{OUT} < 1μA V _{IN} = V _{SS} | 5 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 Output Voltage | | V _{OL} | I _{OUT} < 1μA V _{IN} = V _{SS} , V _{DD} | 5 10 15 | — — — | 0.05 0.05 0.05 | — — — | 0.00 0.00 0.00 | 0.05 0.05 0.05 | — — — | 0.05 0.05 0.05 | |
| Output High Current | | I _{OH} | V _{OH} = 4.6V | 5 | - 0.61 | — | - 0.51 | - 1.0 | — | - 0.42 | — | |
| | | | 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 | — | |
| | | Output Low Current | | I _{OL} | V _{IN} = V _{SS} , V _{DD} | | | | | | | |
| V _{OL} = 0.4V | 5 | | | | 0.61 | — | 0.51 | 1.2 | — | 0.42 | — | |
| 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 | — | |
| 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} < 1μA | | | | | | | | | |
| Input Low Voltage | | V _{IL} | V _{OUT} = 0.5V, 4.5V | 5 | — | 1.5 | — | 2.25 | 1.5 | — | 1.5 | |
| | | | 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} < 1μA | | | | | | | | | |
| 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 10 15 | — — — | 5 10 15 | — — — | 0.005 0.010 0.015 | 5 10 20 | — — — | 150 300 600 | |

* All valid input combinations.

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

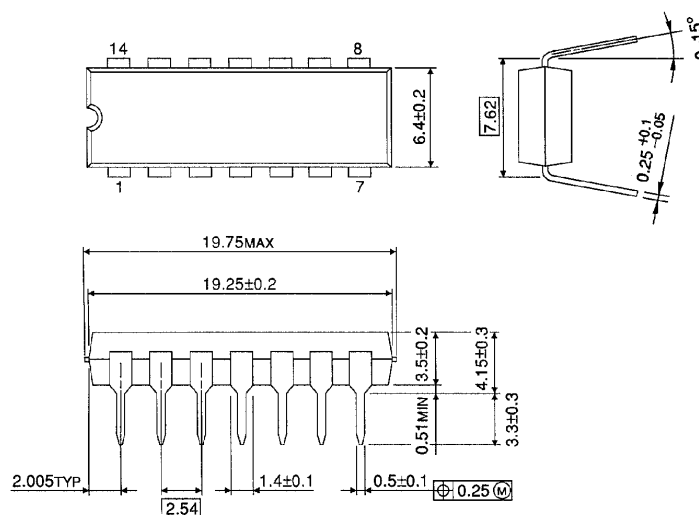
| CHARACTERISTIC | SYMBOL | TEST CONDITION | V _{DD} (V) | MIN. | TYP. | MAX. | UNIT |
|---|--------------------------------------|----------------|---------------------|----------|------|------|------|
| | | | | | | | |
| Output Transition Time (Low to High) | t _{TLH} | | 5 | — | 70 | 200 | ns |
| | | | 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 | pF |

WAVEFORMS FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS



DIP 14PIN PACKAGE DIMENSIONS (DIP14-P-300-2.54)

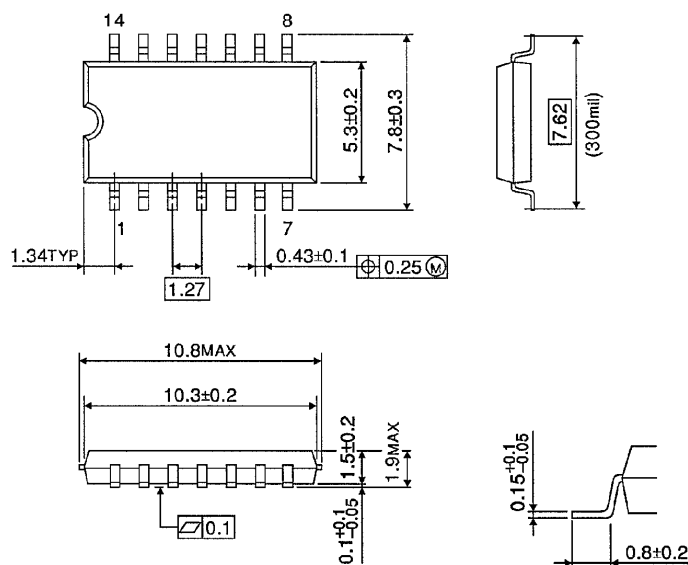
Unit in mm



Weight : 0.96g (Typ.)

SOP 14PIN (200mil BODY) PACKAGE DIMENSIONS (SOP14-P-300-1.27)

Unit in mm

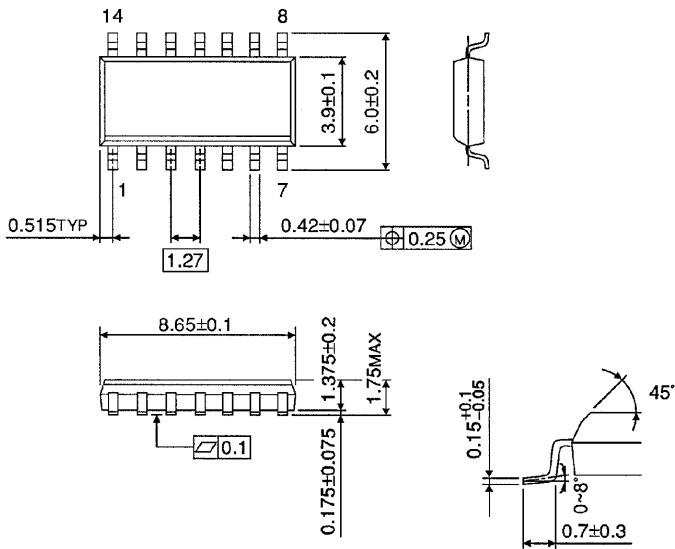


Weight : 0.18g (Typ.)

SOP 14PIN (150mil BODY) PACKAGE DIMENSIONS (SOL14-P-150 -1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

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