

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4049BP, TC4049BF TC4050BP, TC4050BF

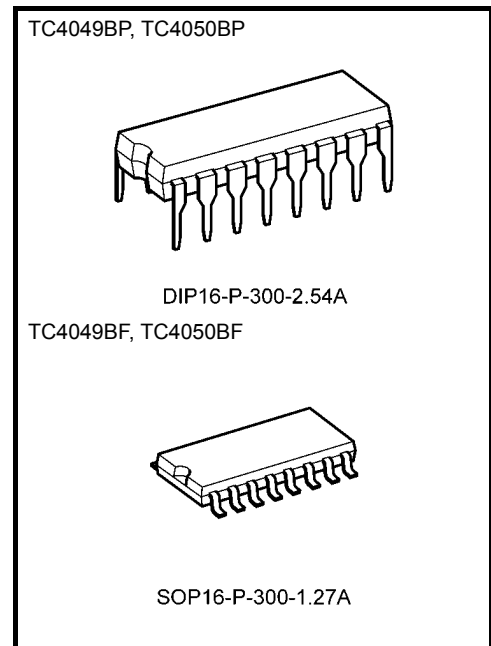
TC4049B Hex Buffer/Converter (inverting type)

TC4050B Hex Buffer/Converter (non-inverting type)

TC4049B, TC4050B contain six circuits of buffers. TC4049B is inverter type and TC4050B is non-inverter type.

Since one TTL or DTL can be directly driven having large output current, these are useful for interfacing from CMOS to TTL or DTL. As voltage up to $V_{SS} + 18$ volts can be applied to the input regardless of V_{DD} , these can be also used as the level converter IC's which converts CMOS logical circuits of 15 volts or 10 volts system to CMOS/TTL logical circuits of 5 volts system.

Ideal switching characteristic has been obtained by the circuit diagram of three stage inverters for TC4049B and two stage inverters for TC4050B.



Weight

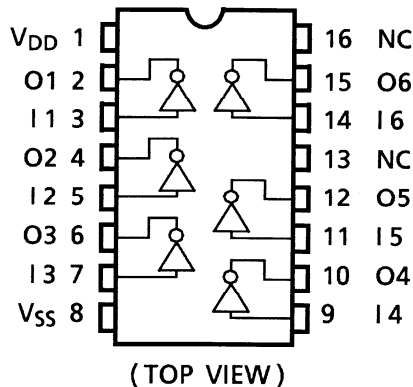
DIP16-P-300-2.54A : 1.00 g (typ.)

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

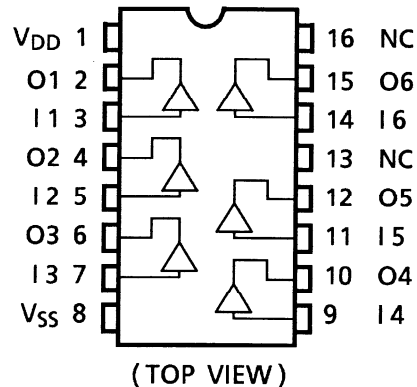
Start of commercial production
1978-05

Pin Assignment

TC4049B

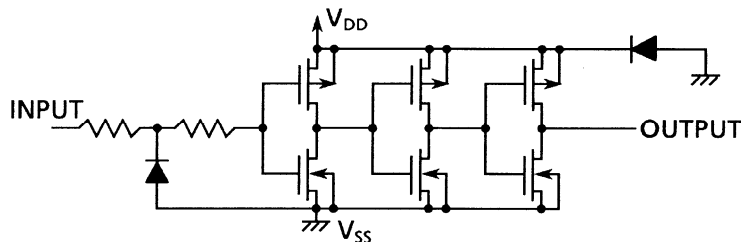


TC4050B

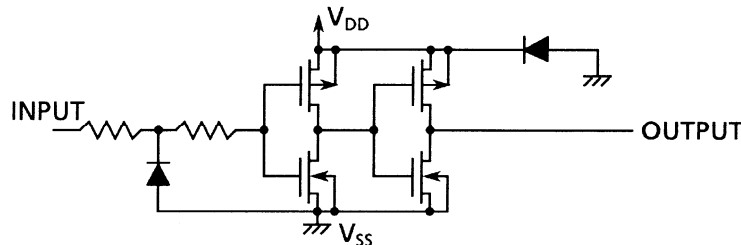


Circuit Diagram

1/6 TC4049B



1/6 TC4050B



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 $V_{SS} + 20$ | V |
| Output voltage | V_{OUT} | $V_{SS} - 0.5$ to $V_{DD} + 0.5$ | V |
| DC input current | I_{IN} | -10 | mA |
| Power dissipation | P_D | 300 (DIP)/180 (SOP) | 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 ($V_{SS} = 0\text{ V}$) (Note)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|-------------------|----------|----------------|-----|------|-----|------|
| DC supply voltage | V_{DD} | — | 3 | — | 18 | V |
| Input voltage | V_{IN} | — | 0 | — | 18 | 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 ($V_{SS} = 0\text{ V}$)

| Characteristics | 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\text{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\text{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} | $V_{OH} = 4.6\text{ V}$ $V_{OH} = 2.5\text{ V}$ $V_{OH} = 9.5\text{ V}$ $V_{OH} = 13.5\text{ V}$ $V_{IN} = V_{SS}, V_{DD}$ | 5 | -0.73 | — | -0.65 | -1.2 | — | -0.58 | — | mA | |
| | | | 5 | -2.40 | — | -2.10 | -3.9 | — | -1.90 | — | | |
| | | | 10 | -1.80 | — | -1.65 | -2.5 | — | -1.35 | — | | |
| | | | 15 | -4.80 | — | -4.30 | -8.0 | — | -3.50 | — | | |
| | | | | | | | | | | | | |
| Output low current | I_{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 | 3.8 | — | 3.2 | 6.4 | — | 2.9 | — | mA | |
| | | | 10 | 9.6 | — | 8.0 | 16.0 | — | 6.6 | — | | |
| | | | 15 | 28.0 | — | 24.0 | 48.0 | — | 20.0 | — | | |
| | | | | | | | | | | | | |
| 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 | 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 | — | | |
| | | | | | | | | | | | | |
| 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 | — | 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 | | |
| | | | | | | | | | | | | |
| Input current | "H" level | I_{IH} | $V_{IH} = 18\text{ V}$ | 18 | — | 0.1 | — | 10^{-5} | 0.1 | — | 1.0 | μA |
| | "L" level | I_{IL} | $V_{IL} = 0\text{ V}$ | 18 | — | -0.1 | — | -10^{-5} | -0.1 | — | -1.0 | |
| Quiescent supply current | I_{DD} | $V_{IN} = V_{SS}, V_{DD}$ (Note) | 5 | — | 1 | — | 0.002 | 1 | — | 30 | μA | |
| | | | 10 | — | 2 | — | 0.004 | 2 | — | 60 | | |
| | | | 15 | — | 4 | — | 0.008 | 4 | — | 120 | | |

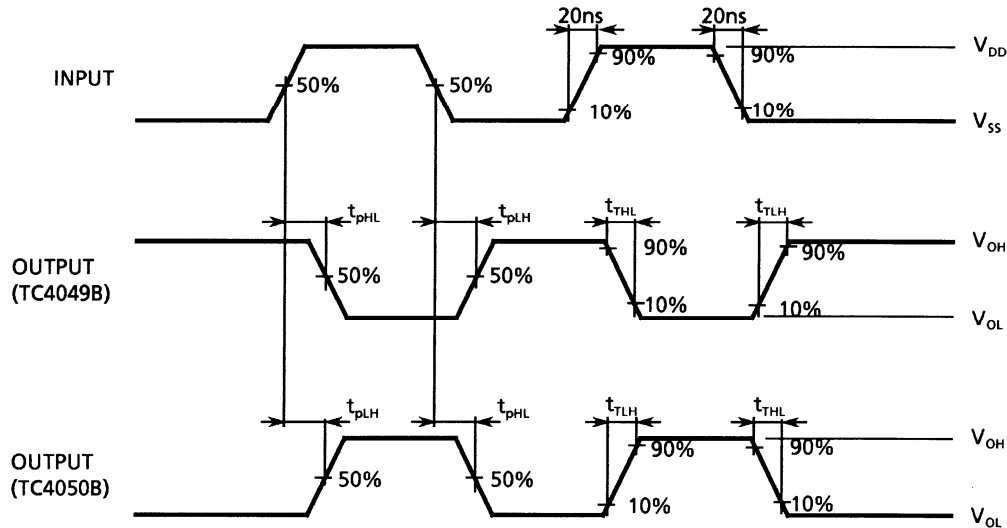
Note: All valid input combinations.

Dynamic Electrical Characteristics (Ta = 25°C, VSS = 0 V, CL = 50 pF)

| Characteristics | | Symbol | Test Condition | VDD (V) | Min | Typ. | Max | Unit | | |
|---|---|-----------|----------------|---------|-----|------|-----|------|----|----|
| | | | | | | | | | | |
| Output transition time (low to high) | t_{TLH} | — | | 5 | — | 60 | 160 | ns | | |
| | | | | 10 | — | 30 | 80 | | | |
| | | | | 15 | — | 25 | 60 | | | |
| Output transition time (high to low) | t_{THL} | — | | 5 | — | 120 | 60 | ns | | |
| | | | | 10 | — | 10 | 40 | | | |
| | | | | 15 | — | 8 | 30 | | | |
| TC4049B | Propagation delay time (low to high) | t_{pLH} | — | | 5 | — | 60 | 120 | ns | |
| | | | | | 10 | — | 35 | 65 | | |
| | | | | | 15 | — | 30 | 50 | | |
| | Propagation delay time (high to low) | t_{pHL} | — | | | 5 | — | 40 | 60 | ns |
| | | | | | | 10 | — | 20 | 30 | |
| | | | | | | 15 | — | 15 | 20 | |
| TC4050B | Propagation delay time (low to high) | t_{pLH} | — | | 5 | — | 50 | 130 | ns | |
| | | | | | 10 | — | 30 | 70 | | |
| | | | | | 15 | — | 25 | 55 | | |
| | Propagation delay time (high to low) | t_{pHL} | — | | | 5 | — | 30 | 70 | ns |
| | | | | | | 10 | — | 17 | 35 | |
| | | | | | | 15 | — | 14 | 25 | |
| Input capacitance | | C_{IN} | — | | — | 5 | 7.5 | pF | | |

Waveform for Measurement of Dynamic Characteristics

Waveform



Package Dimensions

DIP16-P-300-2.54A

Unit : mm



Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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