

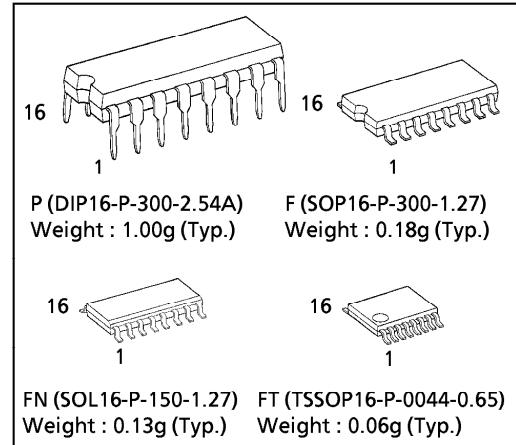
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC4051BP, TC4051BF, TC4051BFN, TC4051BFT
TC4052BP, TC4052BF, TC4052BFN, TC4052BFT
TC4053BP, TC4053BF, TC4053BFN, TC4053BFT

TC4051B SINGLE 8-CHANNEL MULTIPLEXER / DEMULTIPLEXER
TC4052B DIFFERENTIAL 4-CHANNEL MULTIPLEXER / DEMULTIPLEXER
TC4053B TRIPLE 2-CHANNEL MULTIPLEXER / DEMULTIPLEXER

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

TC4051B, TC4052B and TC4053B are multiplexers with capabilities of selection and mixture of analog signal and digital signal. TC4051B has 8 channels configuration. TC4052B has 4 channel×2 configuration and TC4053B has 2 channel×3 configuration. The digital signal to the control terminal turns "ON" the corresponding switch of each channel, with large amplitude ($V_{DD}-V_{EE}$) can be switched by the control signal with small logical amplitude ($V_{DD}-V_{SS}$). For example, in the case of $V_{DD}=5V$ $V_{SS}=0V$ and $V_{EE}=-5V$, signals between $-5V$ and $+5V$ can be switched from the logical circuit with single power supply of 5 volts. As the ON-resistance of each switch is low, these can be connected to the circuits with low input impedance.



MAXIMUM RATINGS

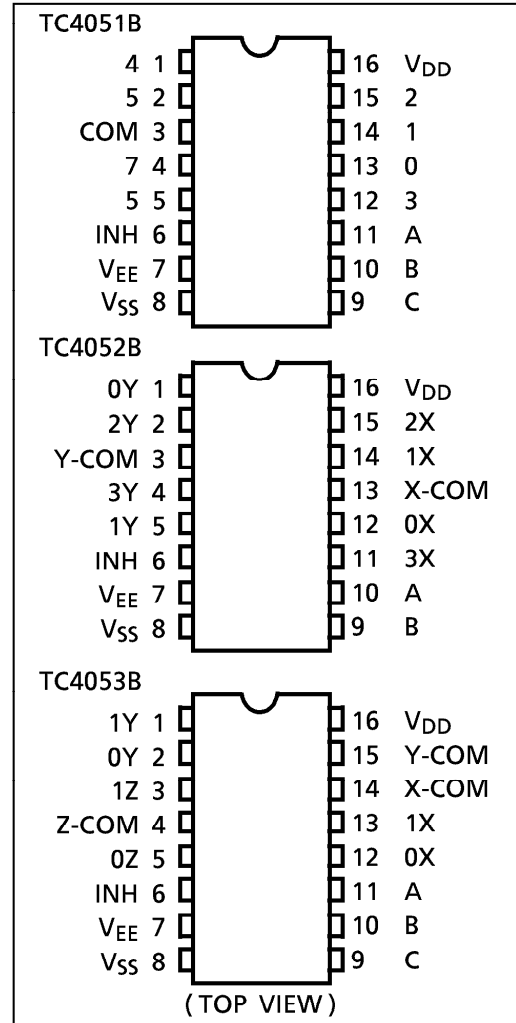
| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|-------------------------------------------|-----------------|-----------------------------|------|
| DC Supply Voltage | $V_{DD}-V_{SS}$ | -0.5~20 | V |
| DC Supply Voltage | $V_{DD}-V_{EE}$ | -0.5~20 | V |
| Control Input Voltage | V_{CIN} | $V_{SS}-0.5\sim V_{DD}+0.5$ | V |
| Switch I/O Voltage | V_I/V_O | $V_{EE}-0.5\sim V_{DD}+0.5$ | V |
| Control Input Current | I_{CIN} | ± 10 | mA |
| Potential difference across I/O during ON | V_I-V_O | -0.5~0.5 | V |
| 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 |

TRUTH TABLE

| CONTROL INPUTS | | | | "ON" CHANNEL | | |
|----------------|----|---|---|--------------|---------|------------|
| INHIBIT | C△ | B | A | TC4051B | TC4052B | TC4053B |
| L | L | L | L | 0 | 0X, 0Y | 0X, 0Y, 0Z |
| L | L | L | H | 1 | 1X, 1Y | 1X, 0Y, 0Z |
| L | L | H | L | 2 | 2X, 2Y | 0X, 1Y, 0Z |
| L | L | H | H | 3 | 3X, 3Y | 1X, 1Y, 0Z |
| L | H | L | L | 4 | — | 0X, 0Y, 1Z |
| L | H | L | H | 5 | — | 1X, 0Y, 1Z |
| L | H | H | L | 6 | — | 0X, 1Y, 1Z |
| L | H | H | H | 7 | — | 1X, 1Y, 1Z |
| H | * | * | * | NONE | NONE | NONE |

* : Don't Care △ Except TC4052B

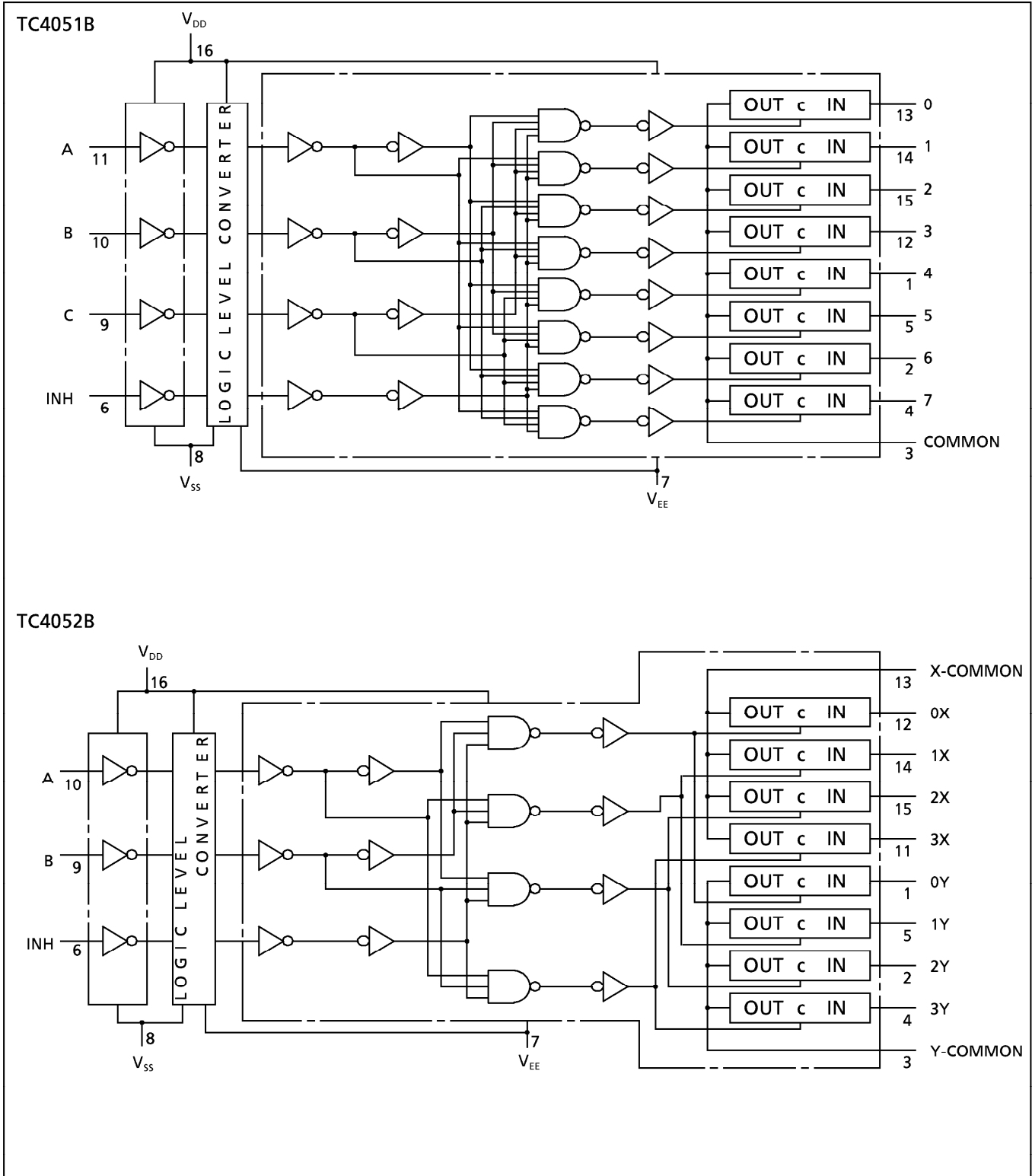
PIN ASSIGNMENT



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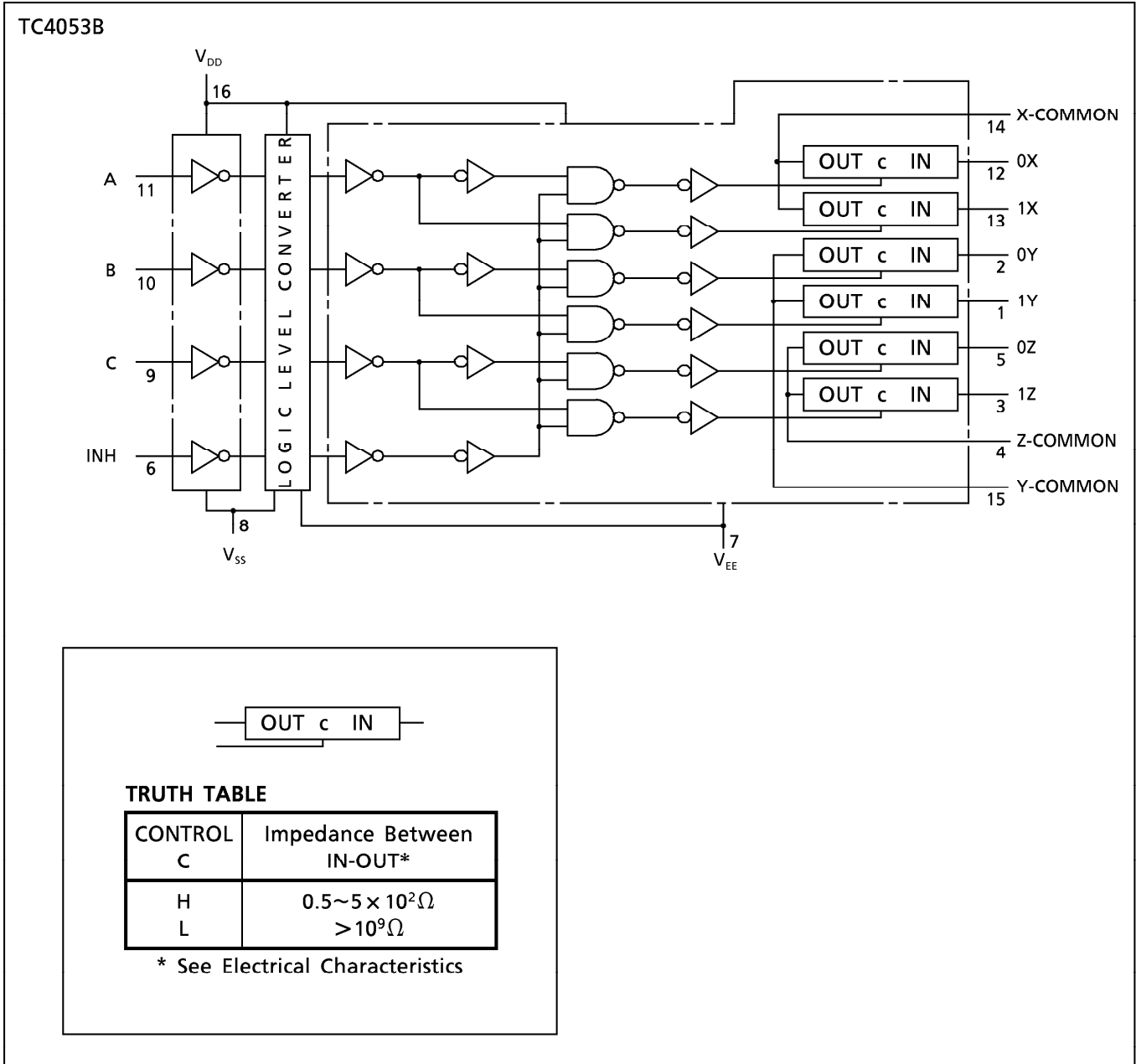
LOGIC DIAGRAM



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- The information contained herein is subject to change without notice.

LOGIC DIAGRAM



RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-----------------------|------------------|----------------|----------|------|----------|------|
| DC Supply Voltage | $V_{DD}-V_{SS}$ | | 3 | — | 18 | V |
| | $V_{DD}-V_{EE}$ | | 3 | — | 18 | |
| Control Input Voltage | V_{IN} | | V_{SS} | — | V_{DD} | V |
| Input/Output Voltage | V_{IN}/V_{OUT} | | V_{EE} | — | V_{DD} | V |

STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC | SYM-BOL | TEST CONDI-TION | V _{SS} (V) | | | - 40°C | | 25°C | | | 85°C | | UNIT |
|-----------------------------------------------------|------------------------|--------------------------------------------------------------|---------------------|---------------------|------|-----------|------|------------|-----------|------|------------|---------|----------|
| | | | V _{EE} (V) | V _{DD} (V) | MIN. | MAX. | MIN. | TYP. | MAX. | MIN. | MAX. | | |
| Control Input High Voltage | V_{IH} | $V_{IS} = V_{DD}$ thru 1k Ω | $V_{EE} = V_{SS}$ | 5 | 3.5 | — | 3.5 | 2.75 | — | 3.5 | — | V | |
| | | | $R_L = 1k\Omega$ | 10 | 7.0 | — | 7.0 | 5.50 | — | 7.0 | — | | |
| | | | to V_{SS} | 15 | 11.0 | — | 11.0 | 8.25 | — | 11.0 | — | | |
| Control Input Low Voltage | V_{IL} | | $I_{IS} < 2\mu A$ | 5 | — | 1.5 | — | 2.25 | 1.5 | — | 1.5 | V | |
| | | | on all OFF channels | 10 | — | 3.0 | — | 4.5 | 3.0 | — | 3.0 | | |
| | | | | 15 | — | 4.0 | — | 6.75 | 4.0 | — | 4.0 | | |
| On-State Resistance | R_{ON} | $0 \leq V_{IS} \leq V_{DD}$ $R_L = 10k\Omega$ | 0 | 0 | 5 | — | 850 | — | 240 | 950 | — | 1200 | Ω |
| | | | 0 | 0 | 10 | — | 210 | — | 110 | 250 | — | 300 | |
| | | | 0 | 0 | 15 | — | 140 | — | 80 | 160 | — | 200 | |
| Δ On-State Resistance Between Any 2 Switches | $R_{ON\Delta}$ | | 0 | 0 | 5 | — | — | — | 10 | — | — | — | Ω |
| | | | 0 | 0 | 10 | — | — | — | 6 | — | — | — | |
| | | | 0 | 0 | 15 | — | — | — | 4 | — | — | — | |
| Input/Output Leakage Current | I_{OFF} | $V_{IN} = 18V, V_{OUT} = 0V$ $V_{IN} = 0V, V_{OUT} = 18V$ | | 18 | — | ± 100 | — | ± 0.01 | ± 100 | — | ± 1000 | nA | |
| | | | | 18 | — | ± 100 | — | ± 0.01 | ± 100 | — | ± 1000 | | |
| Quiescent Supply Current | I_{DD} | $V_{IN} = V_{SS}, V_{DD}^*$ | | 5 | — | 5.0 | — | 0.005 | 5.0 | — | 150 | μA | |
| | | | | 10 | — | 10 | — | 0.010 | 10 | — | 300 | | |
| | | | | 15 | — | 20 | — | 0.015 | 20 | — | 600 | | |
| Input Current | I_{IN} | $V_{IH} = 18V$ $V_{IL} = 0V$ | | 18 | — | 0.1 | — | 10^{-5} | 0.1 | — | 1.0 | μA | |
| | | | | 18 | — | -0.1 | — | -10^{-5} | -0.1 | — | -1.0 | | |
| Input Capacitance | C_{IN} | | | | — | — | — | 5 | 7.5 | — | — | pF | |
| Switch Input Capacitance | C_{IN} | | | | — | — | — | 10 | — | — | — | | |
| Output Capacitance | C_{OUT} | TC4051B TC4052B TC4053B | | 10 | — | — | — | 58 | — | — | — | | pF |
| | | | | 10 | — | — | — | 30 | — | — | — | | |
| | | | | 10 | — | — | — | 17 | — | — | — | | |
| Feedthrough Capacitance | C_{IN-} C_{OUT} | TC4051B TC4052B TC4053B | | 10 | — | — | — | 0.2 | — | — | — | pF | |
| | | | | 10 | — | — | — | 0.2 | — | — | — | | |
| | | | | 10 | — | — | — | 0.2 | — | — | — | | |

* All valid input combinations.

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

| CHARACTERISTIC | SYMBOL | TEST CONDITION | V _{DD} (V) | | | MIN. | TYP. | MAX. | UNIT |
|---------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------|---------------------|---------------------|------|------|------|------|
| | | | V _{SS} (V) | V _{EE} (V) | V _{DD} (V) | | | | |
| Phase Difference Between Input to Output | φ _I - O | | 0 | 0 | 5 | — | 15 | 45 | ns |
| | | | 0 | 0 | 10 | — | 8 | 20 | |
| | | | 0 | 0 | 15 | — | 6 | 15 | |
| Propagation Delay Time (A, B, C, - OUT) | t _{pZL} t _{pZH} t _{pLZ} t _{pHZ} | R _L = 1kΩ | 0 | 0 | 5 | — | 170 | 550 | |
| | | | 0 | 0 | 10 | — | 90 | 240 | |
| | | | 0 | 0 | 15 | — | 70 | 160 | |
| | | | 0 | -5 | 5 | — | 100 | 240 | |
| | | | 0 | -7.5 | 7.5 | — | 80 | 160 | |
| Propagation Delay Time (INH - OUT) | t _{pZL} t _{pZH} | R _L = 1kΩ | 0 | 0 | 5 | — | 120 | 380 | |
| | | | 0 | 0 | 10 | — | 60 | 200 | |
| | | | 0 | 0 | 15 | — | 50 | 160 | |
| | | | 0 | -5 | 5 | — | 80 | 200 | |
| | | | 0 | -7.5 | 7.5 | — | 60 | 160 | |
| Propagation Delay Time (INH - OUT) | t _{pLZ} t _{pHZ} | R _L = 1kΩ | 0 | 0 | 5 | — | 170 | 450 | |
| | | | 0 | 0 | 10 | — | 90 | 210 | |
| | | | 0 | 0 | 15 | — | 70 | 160 | |
| | | | 0 | -5 | 5 | — | 100 | 210 | |
| | | | 0 | -7.5 | 7.5 | — | 80 | 160 | |
| - 3dB Cutoff Frequency TC4051B TC4052B TC4053B | f _{MAX} (I - O) | R _L = 1kΩ (*1) | -5 | -5 | 5 | — | 20 | — | MHz |
| | | | -5 | -5 | 5 | — | 30 | — | |
| | | | -5 | -5 | 5 | — | 40 | — | |
| Total Harmonic Distortion | — | R _L = 10kΩ f = 1kHz (*2) | -2.5 | -2.5 | 2.5 | — | 0.15 | — | % |
| | | | -5 | -5 | 5 | — | 0.03 | — | |
| | | | -7.5 | -7.5 | 7.5 | — | 0.02 | — | |
| - 50dB Feedthrough (SWITCH OFF) | — | R _L = 1kΩ (*3) | -5 | -5 | 5 | — | 500 | — | kHz |
| Crosstalk | — | R _L = 1kΩ (*4) | -5 | -5 | 5 | — | 1.5 | — | MHz |
| Crosstalk (CONTROL - OUT) | — | R _{IN} = 1kΩ R _{OUT} = 10kΩ C _L = 15pF | 0 | 0 | 5 | — | 200 | — | mV |
| | | | 0 | 0 | 10 | — | 400 | — | |
| | | | 0 | 0 | 15 | — | 600 | — | |

*1 Sine wave of ±2.5Vp-p shall be used for V_{is} and the frequency of 20 log 10 $\frac{V_{OS}}{V_{is}}$ = -3dB shall be f_{MAX}.

*2 V_{is} shall be sine wave of ± $\left(\frac{V_{DD}-V_{EE}}{4}\right)$ p-p.

*3 Sine wave of ±2.5Vp-p shall be used for V_{is} and the frequency of 20 log 10 $\frac{V_{OS}}{V_{is}}$ = -50dB shall be feed-through.

*4 Sine wave of ±2.5Vp-p shall be used for V_{is} and the frequency of 20 log 10 $\frac{V_{OS}}{V_{is}}$ = -50dB shall be Crosstalk.

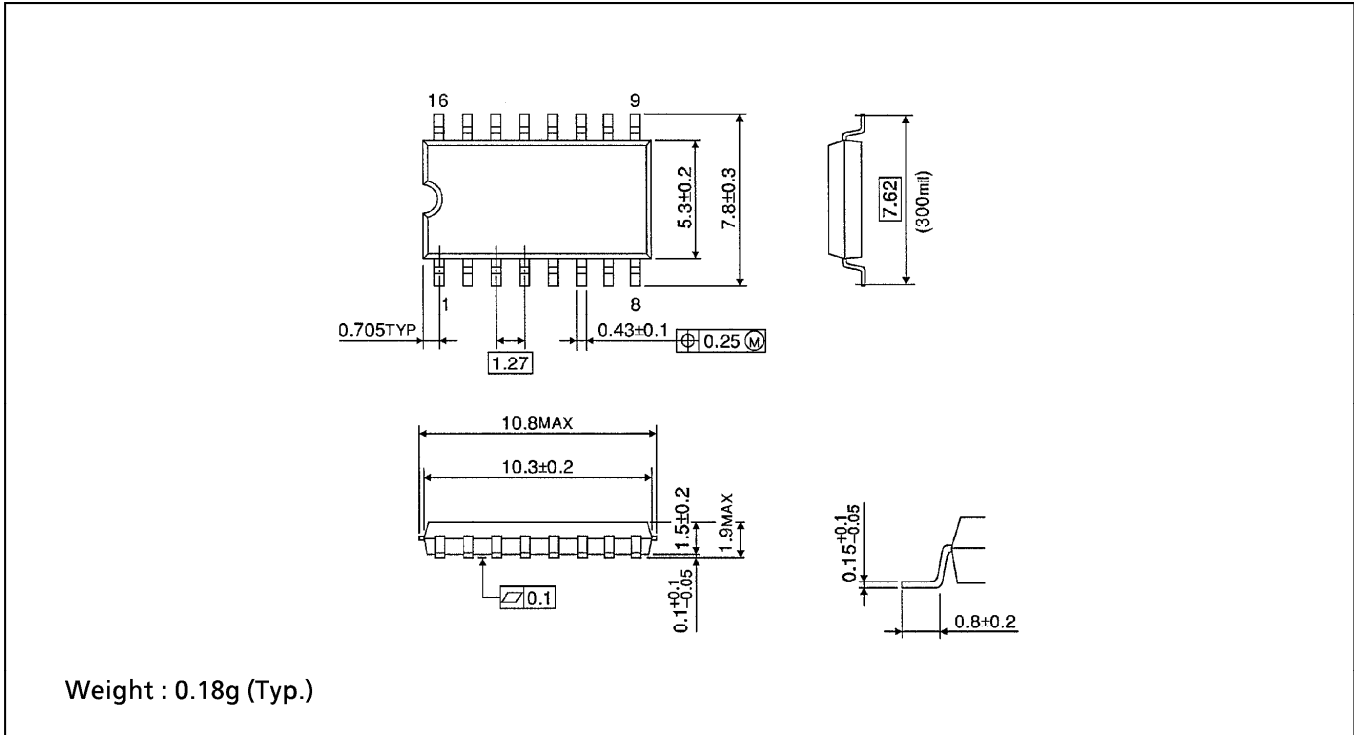
DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A)

Unit in mm



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

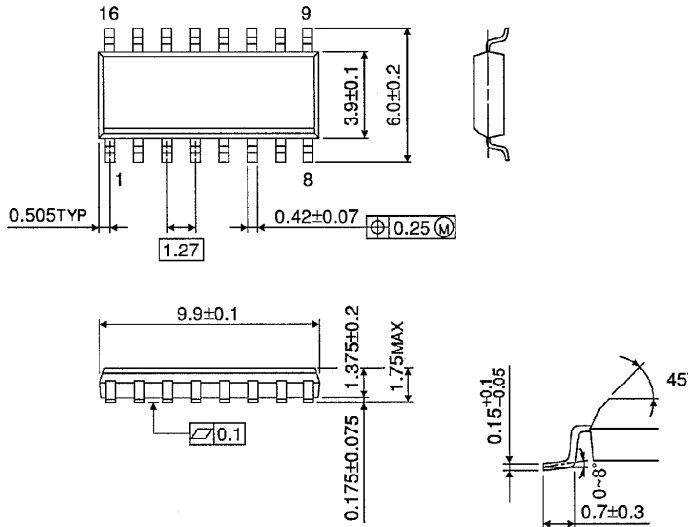
Unit in mm



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

Unit in mm

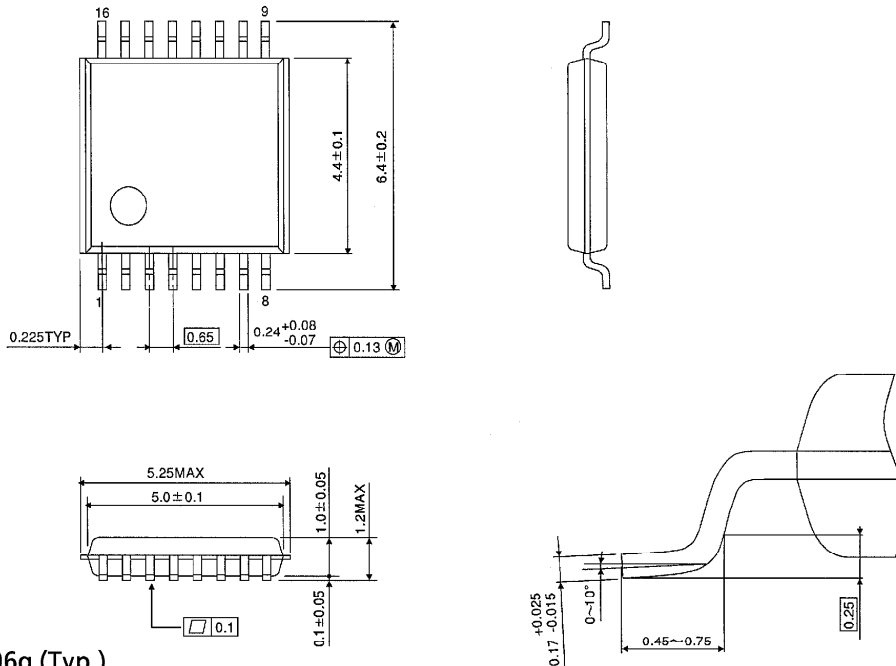
(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)

TSSOP 16PIN OUTLINE DRAWING (TSSOP16-P-0044-0.65)

Unit in mm



Weight : 0.06g (Typ.)