

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**TC74HC240AP, TC74HC240AF, TC74HC240AFW, TC74HC241AP
TC74HC241AF, TC74HC244AP, TC74HC244AF, TC74HC244AFW**

OCTAL BUS BUFFER
TC74HC240AP/AF/AFW INVERTED, 3 - STATE OUTPUTS
TC74HC241AP/AF NON - INVERTED, 3 - STATE OUTPUTS
TC74HC244AP/AF/AFW NON - INVERTED, 3 - STATE OUTPUTS

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

The TC74HC240A, 241A and 244A are high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate C²MOS technology.

They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

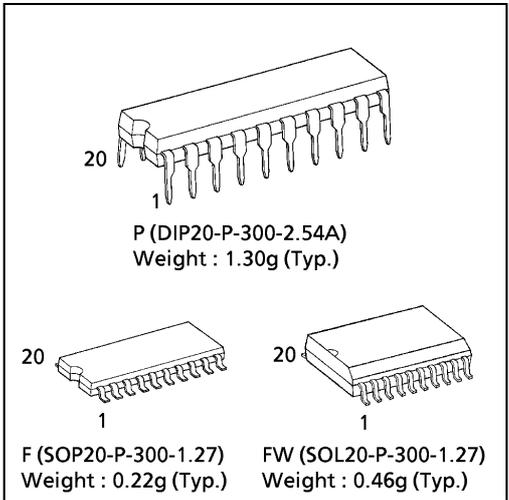
The 74HC240A is an inverting 3 - state buffer having two active - low output enables. The TC74HC241A and TC74HC244A are non - inverting 3 - state buffers that differ only in that the 241A has one active - high and one active - low output enable, and the 244A has two active - low output enables.

These devices are designed to be used with 3 - state memory address drivers, etc.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES :

- High Speed..... $t_{pd} = 10\text{ns}(\text{typ.})$ at $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$ at $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC} (\text{Min.})$
- Output Drive Capability..... 15 LSTTL Loads
- Symmetrical Output Impedance... $|I_{OH}| = I_{OL} = 6\text{mA}(\text{Min.})$
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range... $V_{CC} (\text{opr.}) = 2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 74LS 240 / 241 / 244

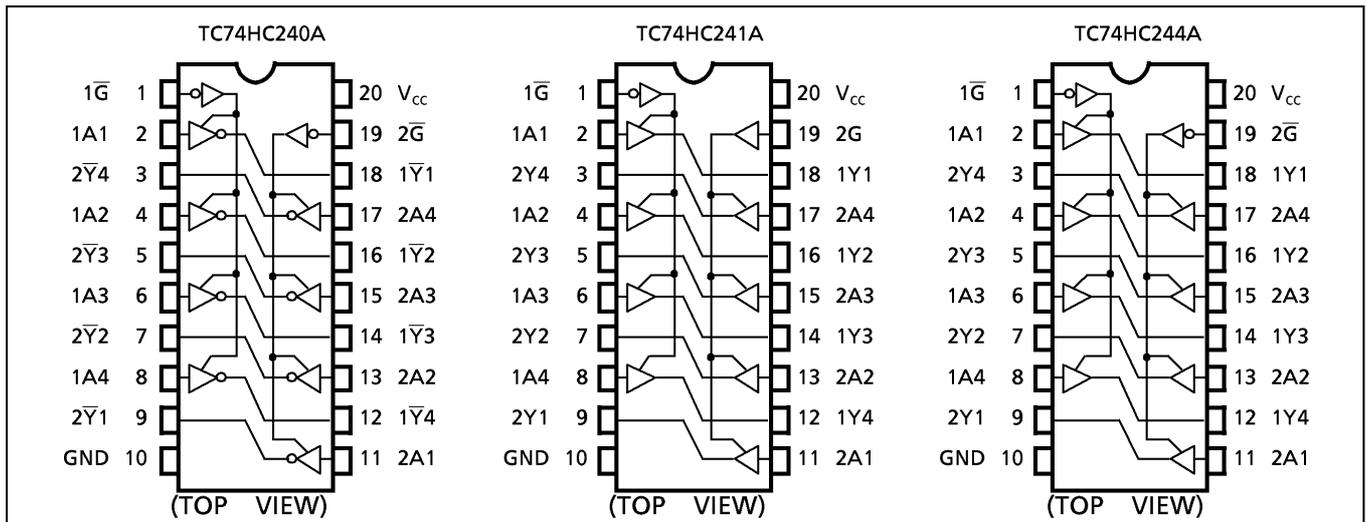


TRUTH TABLE

| INPUTS | | | OUTPUTS | |
|-----------|------------|-------|---------|----------------------------|
| \bar{G} | G^Δ | A_n | Y_n | $\bar{Y}_n^{\Delta\Delta}$ |
| L | H | L | L | H |
| L | H | H | H | L |
| H | L | X | Z | Z |

Δ : for TC74HC241A only
 $\Delta\Delta$: for TC74HC240A only
X : Don't Care
Z : High Impedance

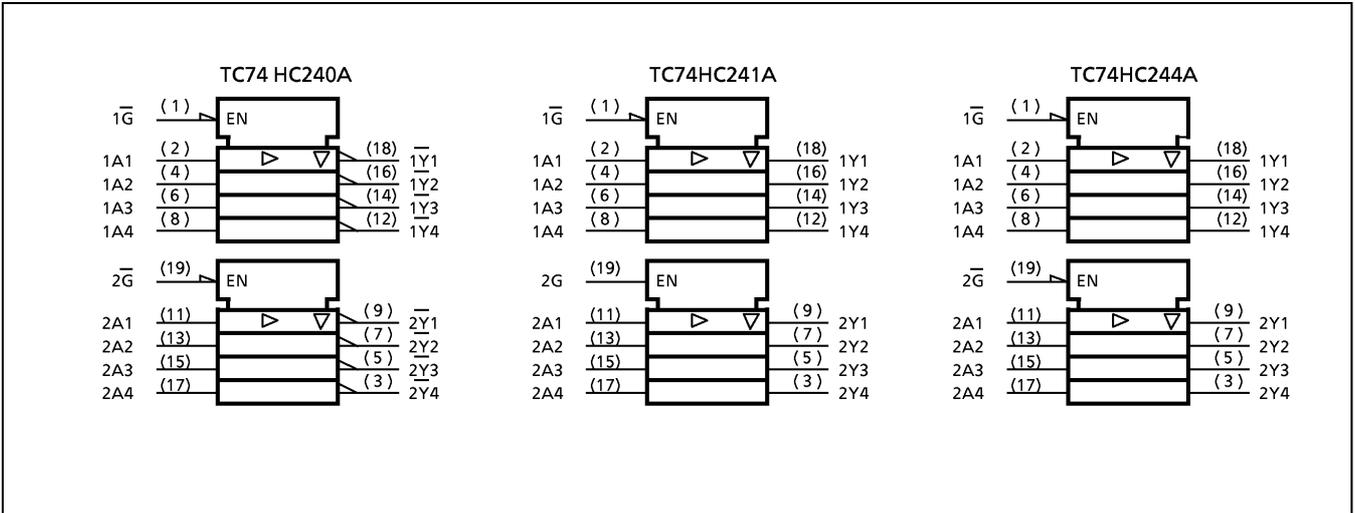
PIN ASSIGNMENT



980508EBA2

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IEC LOGIC SYMBOL



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ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | VALUE | UNIT |
|------------------------------|-----------|------------------------|------|
| Supply Voltage Range | V_{CC} | -0.5~7 | V |
| DC Input Voltage | V_{IN} | -0.5~ $V_{CC} + 0.5$ | V |
| DC Output Voltage | V_{OUT} | -0.5~ $V_{CC} + 0.5$ | V |
| Input Diode Current | I_{IK} | ±20 | mA |
| Output Diode Current | I_{OK} | ±20 | mA |
| DC Output Current | I_{OUT} | ±35 | mA |
| DC V_{CC} / Ground Current | I_{CC} | ±75 | mA |
| Power Dissipation | P_D | 500 (DIP)* / 180 (SOP) | mW |
| Storage Temperature | T_{stg} | -65~150 | °C |

*500mW in the range of $T_a = -40^{\circ}\text{C} \sim 65^{\circ}\text{C}$. From $T_a = 65^{\circ}\text{C}$ to 85°C a derating factor of $-10\text{mW}/^{\circ}\text{C}$ shall be applied until 300mW.

RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | VALUE | UNIT |
|--------------------------|------------|---|------|
| Supply Voltage | V_{CC} | 2~6 | V |
| Input Voltage | V_{IN} | 0~ V_{CC} | V |
| Output Voltage | V_{OUT} | 0~ V_{CC} | V |
| Operating Temperature | T_{opr} | -40~85 | °C |
| Input Rise and Fall Time | t_r, t_f | 0~1000 ($V_{CC} = 2.0\text{V}$) 0~500 ($V_{CC} = 4.5\text{V}$) 0~400 ($V_{CC} = 6.0\text{V}$) | ns |

DC ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITION | V_{CC} (V) | $T_a = 25^{\circ}\text{C}$ | | | $T_a = -40 \sim 85^{\circ}\text{C}$ | | UNIT | |
|--------------------------------------|----------|--|---------------------------|----------------------------|-------------|----------------------|-------------------------------------|----------------------|---------------|---|
| | | | | MIN. | TYP. | MAX. | MIN. | MAX. | | |
| High - Level Input Voltage | V_{IH} | | 2.0 4.5 6.0 | 1.50 3.15 4.20 | — — — | — — — | 1.50 3.15 4.20 | — — — | V | |
| Low - Level Input Voltage | V_{IL} | | 2.0 4.5 6.0 | — — — | — — — | 0.50 1.35 1.80 | — — — | 0.50 1.35 1.80 | — — — | V |
| High - Level Output Voltage | V_{OH} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OH} = -20\mu\text{A}$ | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 4.5 6.0 | 4.4 5.9 | 4.5 6.0 | — — | 4.4 5.9 | — — | |
| Low - Level Output Voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 20\mu\text{A}$ | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | | 4.5 6.0 | — — | 0.0 0.0 | 0.1 0.1 | — — | 0.1 0.1 | |
| 3 - State Output Off - State Current | I_{OZ} | $V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND | 6.0 | — | — | ±0.5 | — | ±5.0 | μA | |
| | | | 6.0 | — | — | ±0.1 | — | ±1.0 | | |
| Input Leakage Current | I_{IN} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | ±0.1 | — | ±1.0 | μA | |
| Quiescent Supply Current | I_{CC} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | 4.0 | — | 40.0 | μA | |

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 6\text{ns}$)

| PARAMETER | SYMBOL | TEST CONDITION | CL (pF) | V _{CC} (V) | Ta = 25°C | | | Ta = -40~85°C | | UNIT |
|-------------------------------|------------------------|-------------------------|------------|------------------------|-----------|------|------|---------------|------|------|
| | | | | | MIN. | TYP. | MAX. | MIN. | MAX. | |
| Output Transition Time | t_{TLH} t_{THL} | | 50 | 2.0 | — | 25 | 60 | — | 75 | ns |
| | | | | 4.5 | — | 7 | 12 | — | 15 | |
| | | | | 6.0 | — | 6 | 10 | — | 13 | |
| Propagation Delay Time | t_{pLH} t_{pHL} | | 50 | 2.0 | — | 36 | 90 | — | 115 | |
| | | | | 4.5 | — | 12 | 18 | — | 23 | |
| | | | | 6.0 | — | 10 | 15 | — | 20 | |
| | | | 150 | 2.0 | — | 51 | 130 | — | 165 | |
| | | | | 4.5 | — | 17 | 26 | — | 33 | |
| | | | | 6.0 | — | 14 | 22 | — | 28 | |
| Output Enable time | t_{pZL} t_{pZH} | $R_L = 1\text{k}\Omega$ | 50 | 2.0 | — | 48 | 125 | — | 155 | |
| | | | | 4.5 | — | 16 | 25 | — | 31 | |
| | | | | 6.0 | — | 14 | 21 | — | 26 | |
| | | | 150 | 2.0 | — | 63 | 165 | — | 205 | |
| | | | | 4.5 | — | 21 | 33 | — | 41 | |
| | | | | 6.0 | — | 18 | 28 | — | 35 | |
| Output Disable time | t_{pLZ} t_{pHZ} | $R_L = 1\text{k}\Omega$ | 50 | 2.0 | — | 32 | 125 | — | 155 | |
| | | | | 4.5 | — | 15 | 25 | — | 31 | |
| | | | | 6.0 | — | 14 | 21 | — | 26 | |
| Input Capacitance | C_{IN} | | | | — | 5 | 10 | — | 10 | pF |
| Output Capacitance | C_{OUT} | | | | — | 10 | — | — | — | |
| Power Dissipation Capacitance | $C_{PD}(1)$ | TC74HC240A | | | — | 31 | — | — | — | |
| | | TC74HC241A / 244A | | | — | 33 | — | — | — | — |

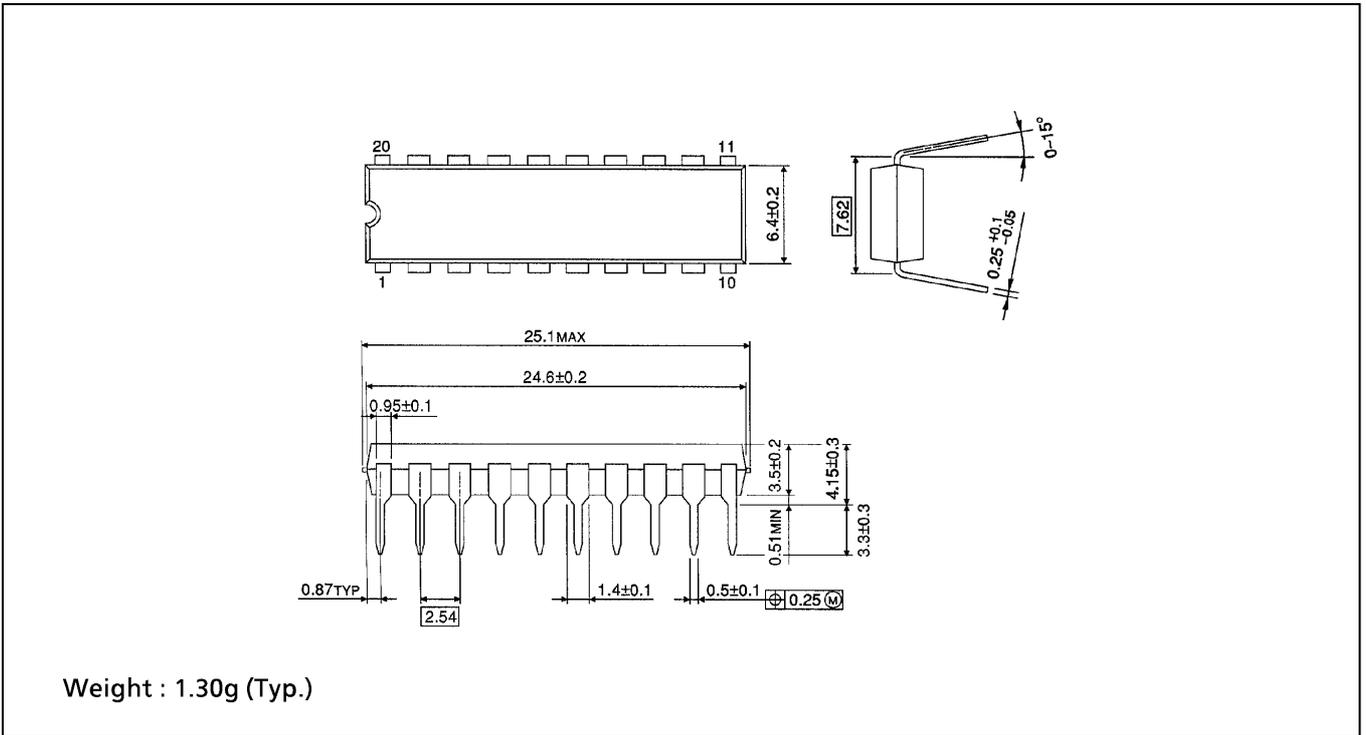
Note (1) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 8 \text{ (per bit)}$$

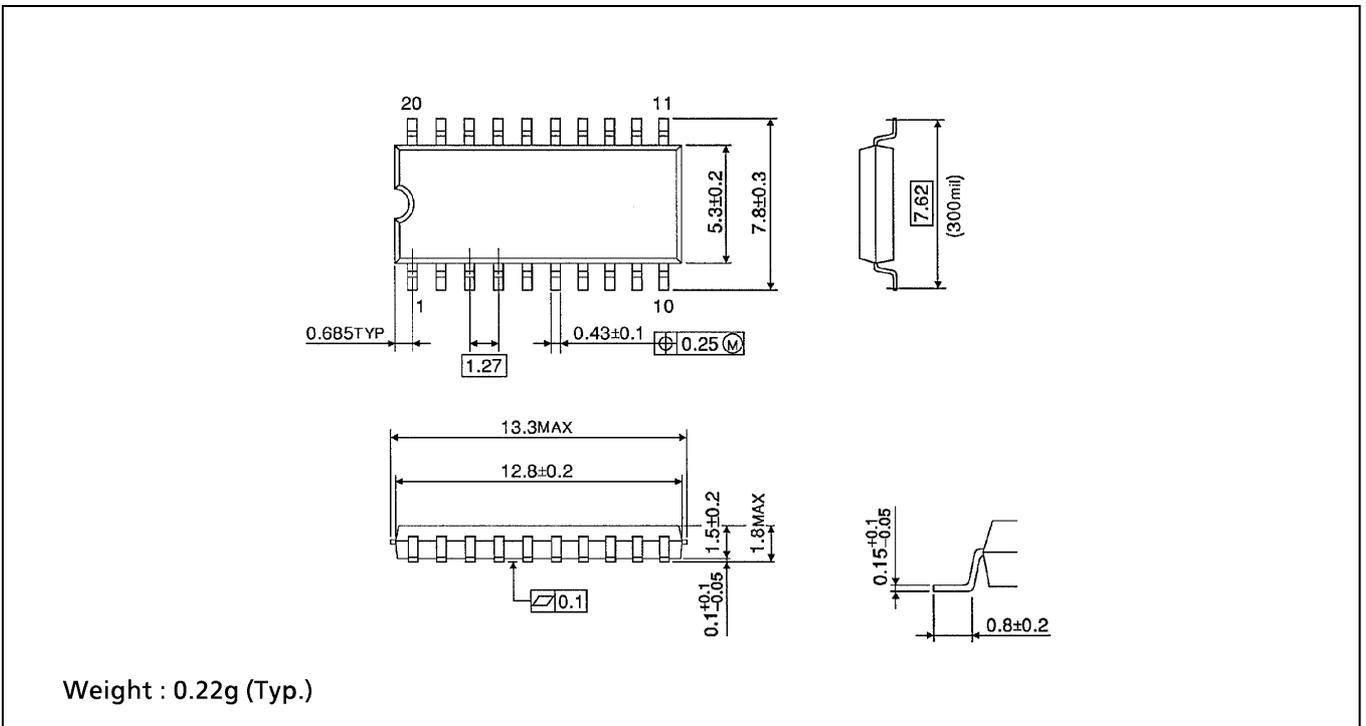
DIP 20PIN OUTLINE DRAWING (DIP20-P-300-2.54A)

Unit in mm



SOP 20PIN (200mil BODY) OUTLINE DRAWING (SOP20-P-300-1.27)

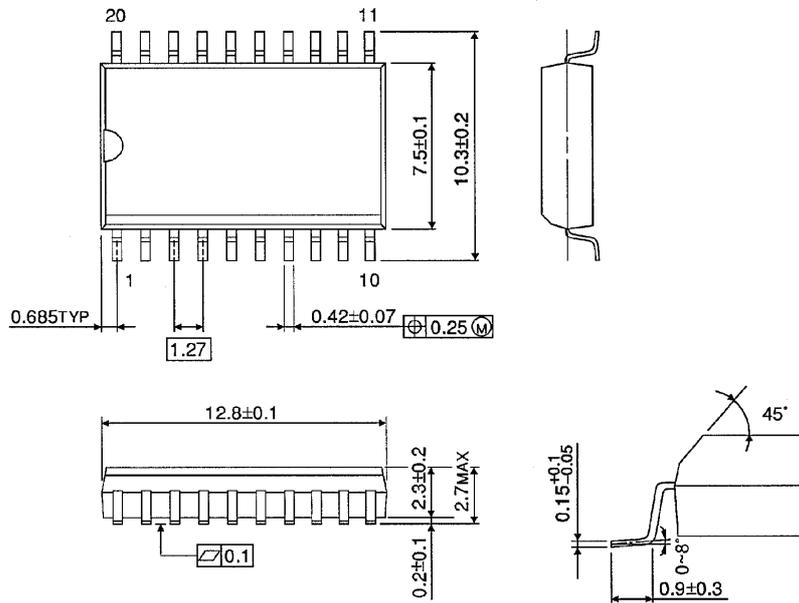
Unit in mm



SOP 20PIN (300mil BODY) OUTLINE DRAWING (SOL20-P-300-1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.46g (Typ.)