

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**TC74AC374P, TC74AC374F, TC74AC374FW, TC74AC374FT**  
**TC74AC534P, TC74AC534F, TC74AC534FW**
**OCTAL D - TYPE FLIP - FLOP WITH 3 - STATE OUTPUT**
**TC74AC374P/F/FW/FT NON - INVERTING**  
**TC74AC534P/F/FW INVERTING**

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

The TC74AC374 and TC74AC534 are advanced high speed CMOS OCTAL FLIP - FLOPS fabricated with silicon gate and double - layer metal wiring C<sup>2</sup>MOS technology.

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

These 8 - bit D - type flip - flops are controlled by a clock input (CK) and a output enable input ( $\overline{OE}$ ).

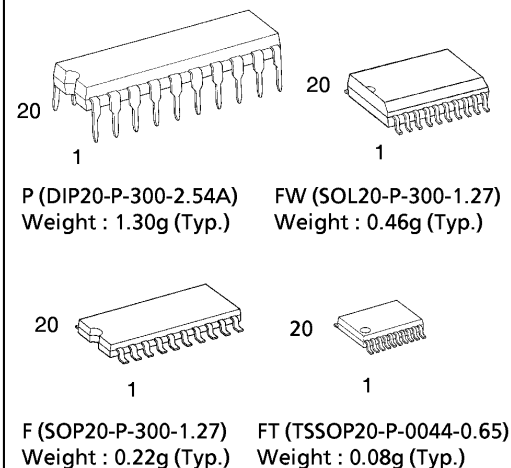
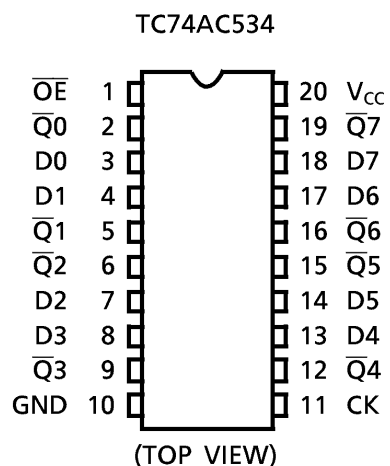
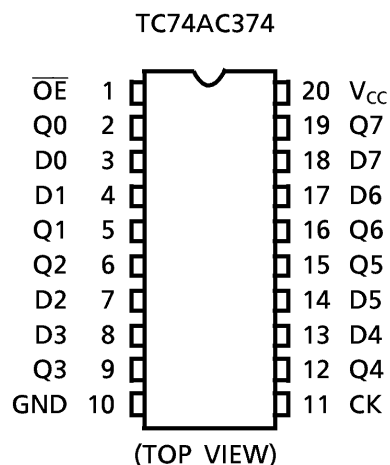
When the  $\overline{OE}$  input is high, the eight outputs are in a high impedance state.

The TC74AC374 has non - inverting outputs, and TC74AC534 has inverting outputs.

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

**FEATURES:**

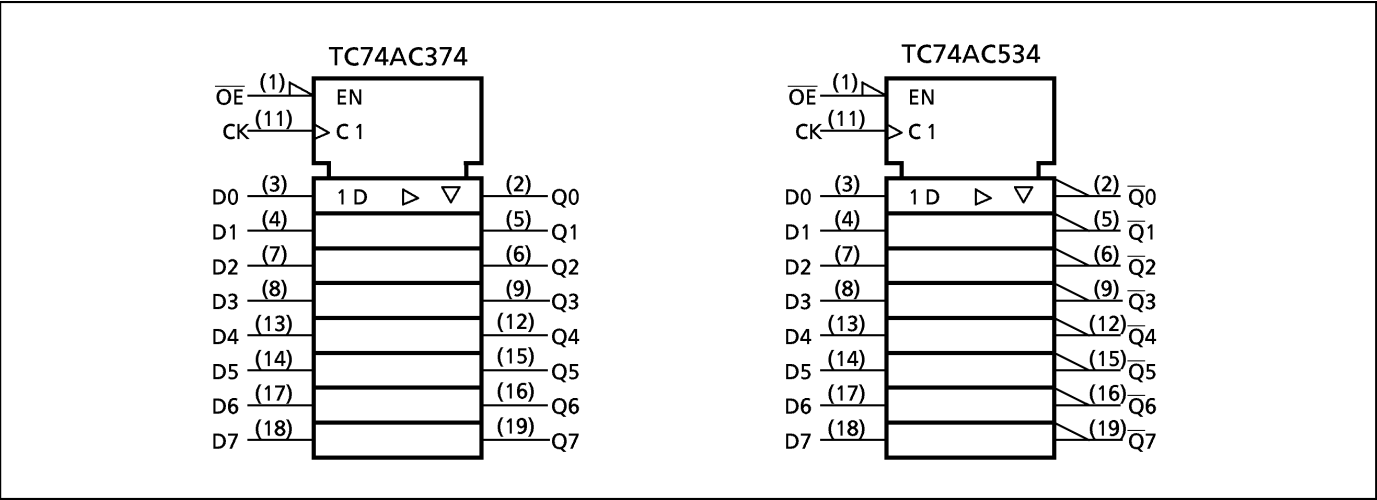
- High Speed..... $f_{MAX} = 200\text{MHz}(\text{typ.})$  at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 8\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}(\text{Min.})$
- Symmetrical Output Impedance  $|I_{OH}| = |I_{OL}| = 24\text{mA}(\text{Min.})$   
Capability of driving  $50\Omega$  transmission lines.
- Balanced Propagation Delays..... $t_{PLH} \approx t_{PHL}$
- Wide Operating Voltage Range..... $V_{CC}(\text{opr}) = 2\text{V} \sim 5.5\text{V}$
- Pin and Function Compatible with 74F 374/534

**PIN ASSIGNMENT****TRUTH TABLE**

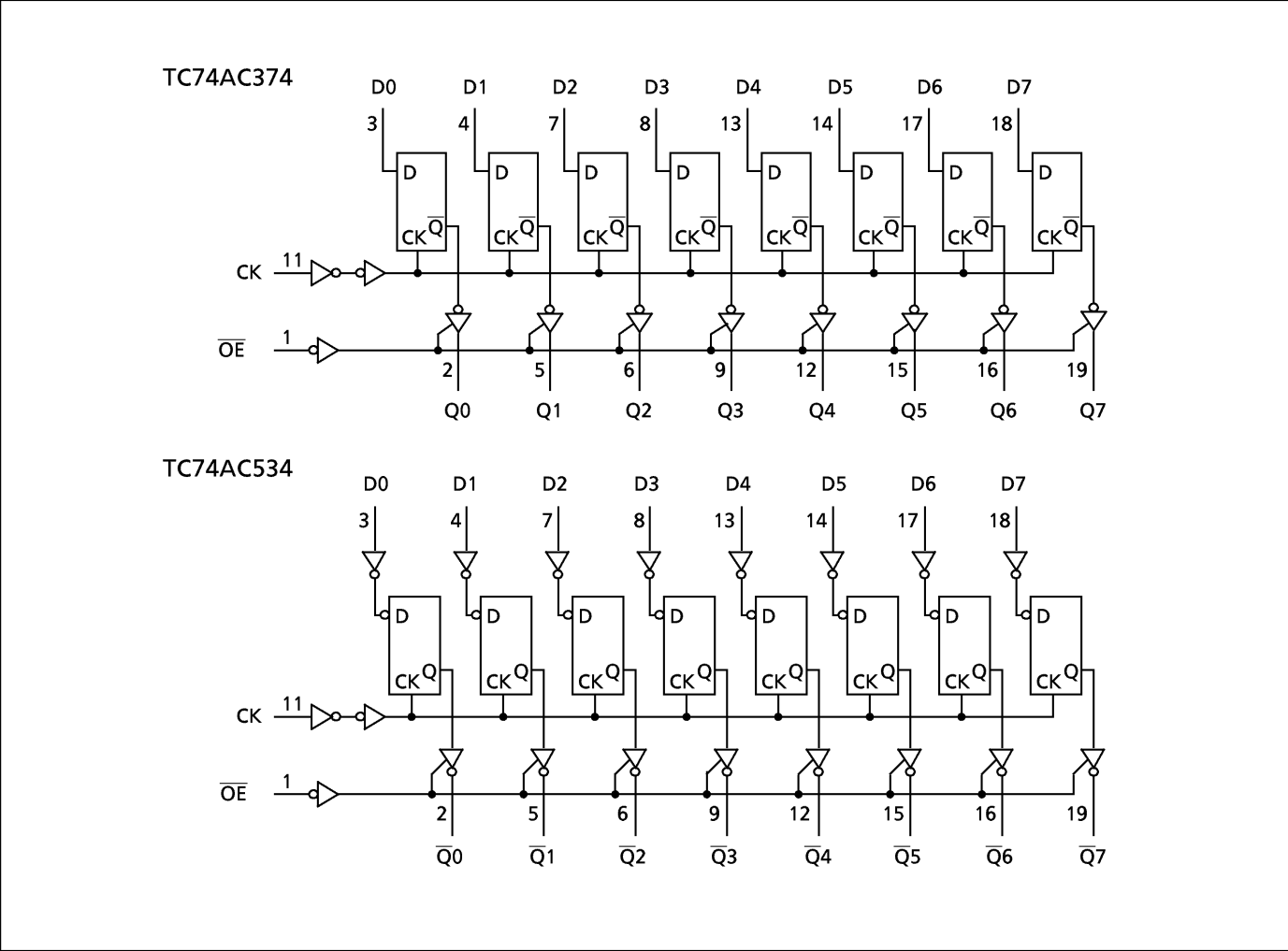
| INPUTS          |    |   | OUTPUTS |                      |
|-----------------|----|---|---------|----------------------|
| $\overline{OE}$ | CK | D | Q(374)  | $\overline{Q}$ (534) |
| H               | X  | X | Z       | Z                    |
| L               |    | X | $Q_n$   | $\overline{Q}_n$     |
| L               |    | L | L       | H                    |
| L               |    | H | H       | L                    |

X : Don't Care  
 Z : High Impedance  
 $Q_n(\overline{Q}_n)$  : No Change

IEC LOGIC SYMBOL



SYSTEM DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                   | SYMBOL    | VALUE                        | UNIT               |
|-----------------------------|-----------|------------------------------|--------------------|
| Supply Voltage Range        | $V_{CC}$  | $-0.5 \sim 7.0$              | V                  |
| DC Input Voltage            | $V_{IN}$  | $-0.5 \sim V_{CC} + 0.5$     | V                  |
| DC Output Voltage           | $V_{OUT}$ | $-0.5 \sim V_{CC} + 0.5$     | V                  |
| Input Diode Current         | $I_{IK}$  | $\pm 20$                     | mA                 |
| Output Diode Current        | $I_{OK}$  | $\pm 50$                     | mA                 |
| DC Output Current           | $I_{OUT}$ | $\pm 50$                     | mA                 |
| DC $V_{CC}$ /Ground Current | $I_{CC}$  | $\pm 200$                    | mA                 |
| Power Dissipation           | $P_D$     | 500 (DIP)* / 180 (SOP/TSSOP) | mW                 |
| Storage Temperature         | $T_{stg}$ | $-65 \sim 150$               | $^{\circ}\text{C}$ |

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

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | SYMBOL    | VALUE                                                                                 | UNIT               |
|--------------------------|-----------|---------------------------------------------------------------------------------------|--------------------|
| Supply Voltage           | $V_{CC}$  | $2.0 \sim 5.5$                                                                        | V                  |
| Input Voltage            | $V_{IN}$  | $0 \sim V_{CC}$                                                                       | V                  |
| Output Voltage           | $V_{OUT}$ | $0 \sim V_{CC}$                                                                       | V                  |
| Operating Temperature    | $T_{opr}$ | $-40 \sim 85$                                                                         | $^{\circ}\text{C}$ |
| Input Rise and Fall Time | $dt/dV$   | 0 ~ 100 ( $V_{CC} = 3.3 \pm 0.3\text{V}$ )<br>0 ~ 20 ( $V_{CC} = 5 \pm 0.5\text{V}$ ) | ns / V             |

## DC ELECTRICAL CHARACTERISTICS

| PARAMETER                            | SYMBOL   | TEST CONDITION                                                                    | $V_{CC}$<br>(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<br>3.0<br>5.5         | 1.50<br>2.10<br>3.85       | —<br>—<br>—       | —<br>—<br>—          | 1.50<br>2.10<br>3.85                | —<br>—<br>—          | V             |
| Low - Level Input Voltage            | $V_{IL}$ |                                                                                   | 2.0<br>3.0<br>5.5         | —<br>—<br>—                | —<br>—<br>—       | 0.50<br>0.90<br>1.65 | —<br>—<br>—                         | 0.50<br>0.90<br>1.65 | V             |
| High - Level Output Voltage          | $V_{OH}$ | $V_{IN} = V_{IH} \text{ or } V_{IL}$                                              | $I_{OH} = -50\mu\text{A}$ | 2.0<br>3.0<br>4.5          | 1.9<br>2.9<br>4.4 | 2.0<br>3.0<br>4.5    | —<br>—<br>—                         | 1.9<br>2.9<br>4.4    | V             |
|                                      |          |                                                                                   | $I_{OH} = -4\text{mA}$    | 3.0                        | 2.58              | —                    | —                                   | 2.48                 |               |
|                                      |          |                                                                                   | $I_{OH} = -24\text{mA}$   | 4.5                        | 3.94              | —                    | —                                   | 3.80                 |               |
|                                      |          |                                                                                   | $I_{OH} = -75\text{mA}^*$ | 5.5                        | —                 | —                    | —                                   | 3.85                 |               |
|                                      |          |                                                                                   |                           |                            |                   |                      |                                     |                      |               |
|                                      |          |                                                                                   |                           |                            |                   |                      |                                     |                      |               |
| Low - Level Output Voltage           | $V_{OL}$ | $V_{IN} = V_{IH} \text{ or } V_{IL}$                                              | $I_{OL} = 50\mu\text{A}$  | 2.0<br>3.0<br>4.5          | —<br>—<br>—       | 0.0<br>0.0<br>0.0    | 0.1<br>0.1<br>0.1                   | —<br>—<br>—          | V             |
|                                      |          |                                                                                   | $I_{OL} = 12\text{mA}$    | 3.0                        | —                 | —                    | 0.36                                | —                    |               |
|                                      |          |                                                                                   | $I_{OL} = 24\text{mA}$    | 4.5                        | —                 | —                    | 0.36                                | —                    |               |
|                                      |          |                                                                                   | $I_{OL} = 75\text{mA}^*$  | 5.5                        | —                 | —                    | —                                   | 0.44<br>0.44<br>1.65 |               |
|                                      |          |                                                                                   |                           |                            |                   |                      |                                     |                      |               |
|                                      |          |                                                                                   |                           |                            |                   |                      |                                     |                      |               |
| 3 - State Output Off - State Current | $I_{OZ}$ | $V_{IN} = V_{IH} \text{ or } V_{IL}$<br>$V_{OUT} = V_{CC} \text{ or } \text{GND}$ | 5.5                       | —                          | —                 | $\pm 0.5$            | —                                   | $\pm 5.0$            | $\mu\text{A}$ |
| Input Leakage Current                | $I_{IN}$ | $V_{IN} = V_{CC} \text{ or } \text{GND}$                                          | 5.5                       | —                          | —                 | $\pm 0.1$            | —                                   | $\pm 1.0$            |               |
| Quiescent Supply Current             | $I_{CC}$ | $V_{IN} = V_{CC} \text{ or } \text{GND}$                                          | 5.5                       | —                          | —                 | 8.0                  | —                                   | 80.0                 |               |

\* : This spec indicates the capability of driving  $50\Omega$  transmission lines.

One output should be tested at a time for a 10ms maximum duration.

TIMING REQUIREMENTS ( Input  $t_r = t_f = 3\text{ns}$  )

| PARAMETER                     | SYMBOL                   | TEST CONDITION | Ta = 25°C                      |            | Ta = -40~85°C |            | UNIT |
|-------------------------------|--------------------------|----------------|--------------------------------|------------|---------------|------------|------|
|                               |                          |                | V <sub>CC</sub> (V)            | LIMIT      | LIMIT         | LIMIT      |      |
| Minimum Pulse Width<br>( CK ) | $t_{W(H)}$<br>$t_{W(L)}$ |                | $3.3 \pm 0.3$                  | 7.0        | 7.0           | 7.0        | ns   |
|                               |                          |                | $5.0 \pm 0.5$                  | 5.0        | 5.0           | 5.0        |      |
| Minimum Set - up Time         | $t_s$                    |                | $3.3 \pm 0.3$<br>$5.0 \pm 0.5$ | 9.0<br>5.0 | 9.0<br>5.0    | 9.0<br>5.0 |      |
| Minimum Hold Time             | $t_h$                    |                | $3.3 \pm 0.3$<br>$5.0 \pm 0.5$ | 0.0<br>0.0 | 0.0<br>0.0    | 0.0<br>0.0 |      |

AC ELECTRICAL CHARACTERISTICS (  $C_L = 50\text{pF}$ ,  $R_L = 500\Omega$ , Input  $t_r = t_f = 3\text{ns}$  )

| PARAMETER                                         | SYMBOL                               | TEST CONDITION |                        | Ta = 25°C |            |        | Ta = − 40~85°C |        | UNIT |
|---------------------------------------------------|--------------------------------------|----------------|------------------------|-----------|------------|--------|----------------|--------|------|
|                                                   |                                      |                | V <sub>CC</sub> (V)    | MIN.      | TYP.       | MAX.   | MIN.           | MAX.   |      |
| Propagation Delay Time<br>(CK—Q, $\overline{Q}$ ) | t <sub>pLH</sub><br>t <sub>pHL</sub> |                | 3.3 ± 0.3              | —         | 8.5        | 15.8   | 1.0            | 18.0   | ns   |
|                                                   |                                      |                | 5.0 ± 0.5              | —         | 6.1        | 8.7    | 1.0            | 10.0   |      |
| Output Enable Time                                | t <sub>pZL</sub><br>t <sub>pZH</sub> |                | 3.3 ± 0.3              | —         | 7.5        | 14.0   | 1.0            | 16.0   |      |
|                                                   |                                      |                | 5.0 ± 0.5              | —         | 6.1        | 8.7    | 1.0            | 10.0   |      |
| Output Disable Time                               | t <sub>pLZ</sub><br>t <sub>pHZ</sub> |                | 3.3 ± 0.3              | —         | 5.5        | 12.3   | 1.0            | 14.0   |      |
|                                                   |                                      |                | 5.0 ± 0.5              | —         | 4.7        | 7.0    | 1.0            | 8.0    |      |
| Maximum<br>Clock Frequency                        | f <sub>MAX</sub>                     |                | 3.3 ± 0.3<br>5.0 ± 0.5 | 55<br>100 | 120<br>160 | —<br>— | 55<br>100      | —<br>— | MHz  |
| Input Capacitance                                 | C <sub>IN</sub>                      |                |                        | —         | 5          | 10     | —              | 10     | pF   |
| Output Capacitance                                | C <sub>OUT</sub>                     |                |                        | —         | 10         | —      | —              | —      |      |
| Power Dissipation Capacitance                     | C <sub>PD</sub> (1)                  |                |                        | —         | 37         | —      | —              | —      |      |

Note (1)  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption.

Average operating current can be obtained by the equation :

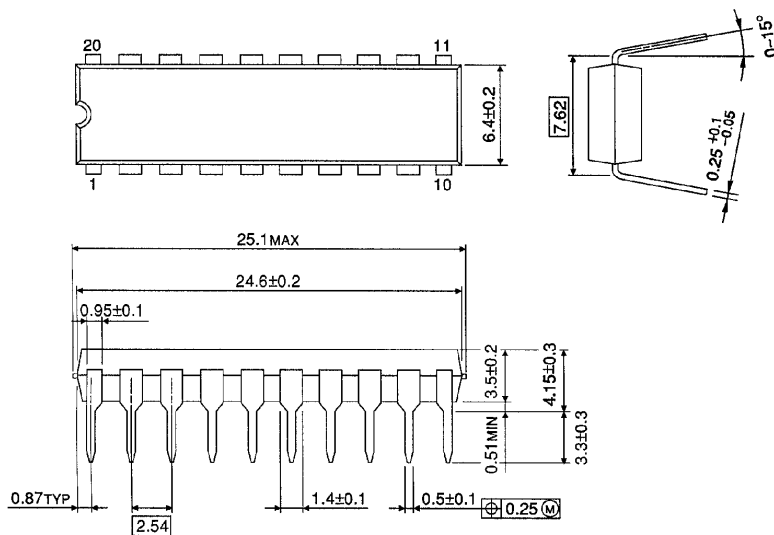
$$I_{CC}(\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ ( per F/F )}$$

And the total  $C_{PD}$  when n pcs. of F/F operate can be gained by the following equation :

$$C_{PD}(\text{total}) = 25 + 12 \cdot n$$

## DIP 20PIN PACKAGE DIMENSIONS (DIP20-P-300-2.54A)

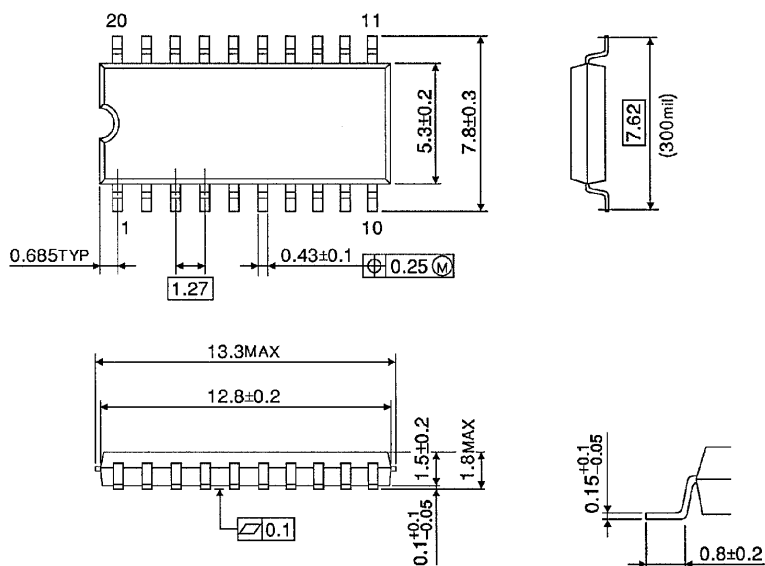
Unit in mm



Weight : 1.30g (Typ.)

## SOP 20PIN (200mil BODY) PACKAGE DIMENSIONS (SOP20-P-300-1.27)

Unit in mm

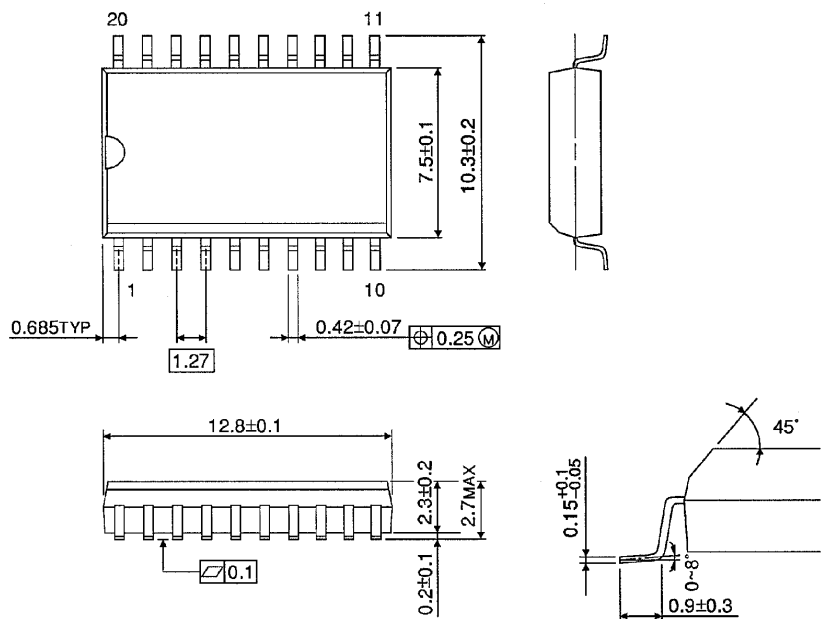


Weight : 0.22g (Typ.)

SOP 20PIN (300mil BODY) PACKAGE DIMENSIONS (SOL20-P-300-1.27)

Unit in mm

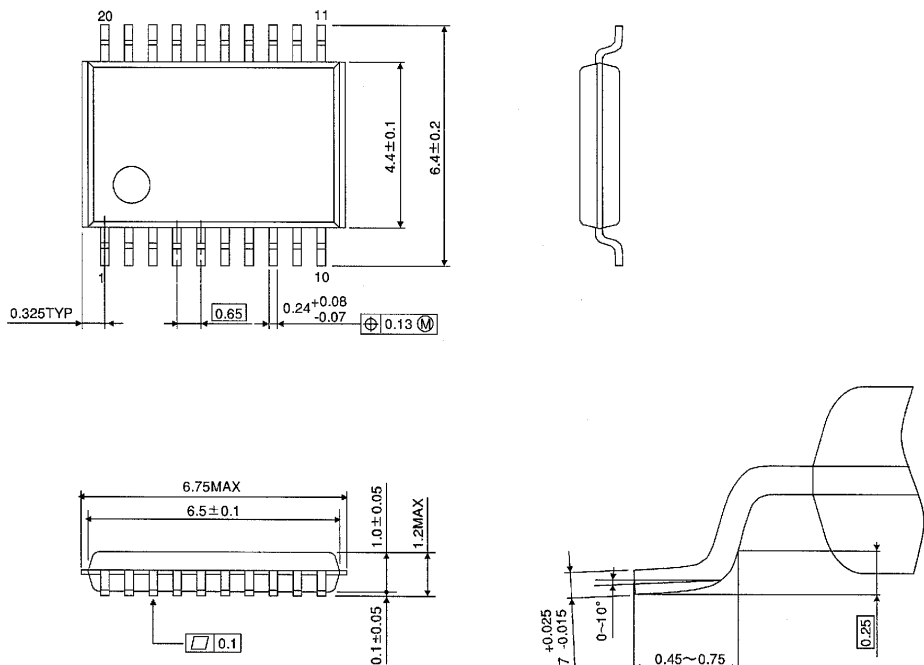
(Note) This package is not available in Japan.



Weight : 0.46g (Typ.)

TSSOP 20PIN PACKAGE DIMENSIONS (TSSOP20-P-0044-0.65)

Unit in mm



Weight : 0.08g (Typ.)

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