

TC74HC377AP, TC74HC377AF, TC74HC377AFW

OCTAL D - TYPE FLIP - FLOP

The TC74HC377A is a high speed CMOS OCTAL D - TYPE FLIP - FLOP fabricated with silicon gate C²MOS technology. It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation. This 8 - bit D - type flip - flop is controlled by a clock input (CK) and an output enable input (\bar{G}).

The signal level applied to the D inputs are transferred to Q outputs during the positive going transition of CK.

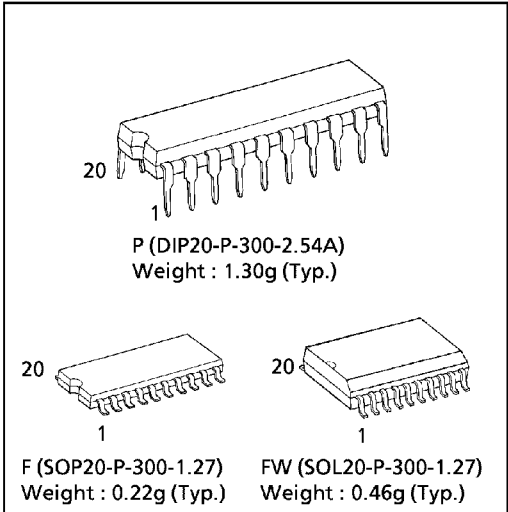
When the \bar{G} is high, the eight outputs are in a high impedance state.

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

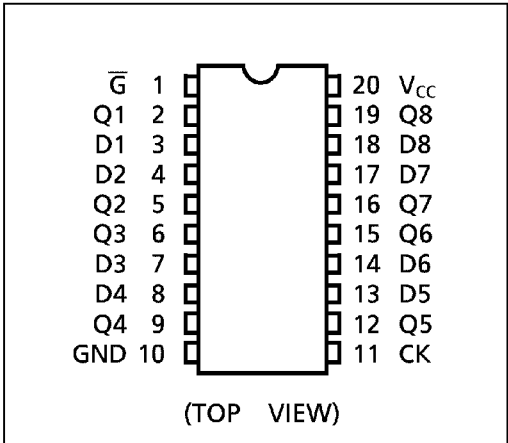
FEATURES :

- High Speed..... $f_{MAX} = 73\text{MHz}(\text{typ.})$
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 10 LSTTL Loads
- Symmetrical Output Impedance... $|I_{OH}| = I_{OL} = 4\text{mA}(\text{Min.})$
- 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 74LS377

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



PIN ASSIGNMENT

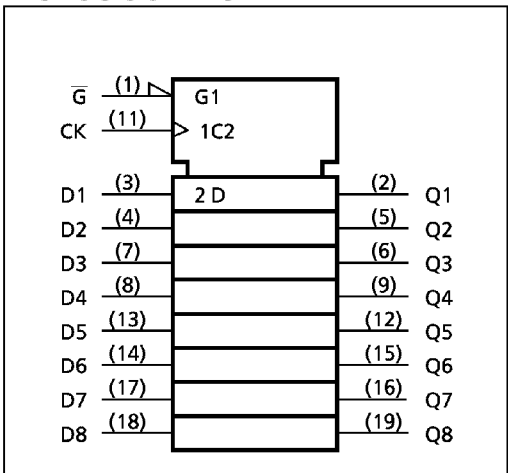


TRUTH TABLE

| INPUTS | | | OUTPUTS |
|-----------|----|---|-----------|
| \bar{G} | CK | D | Q |
| H | X | X | NO CHANGE |
| L | | L | L |
| L | | H | H |
| X | | X | NO CHANGE |

X : Don't Care

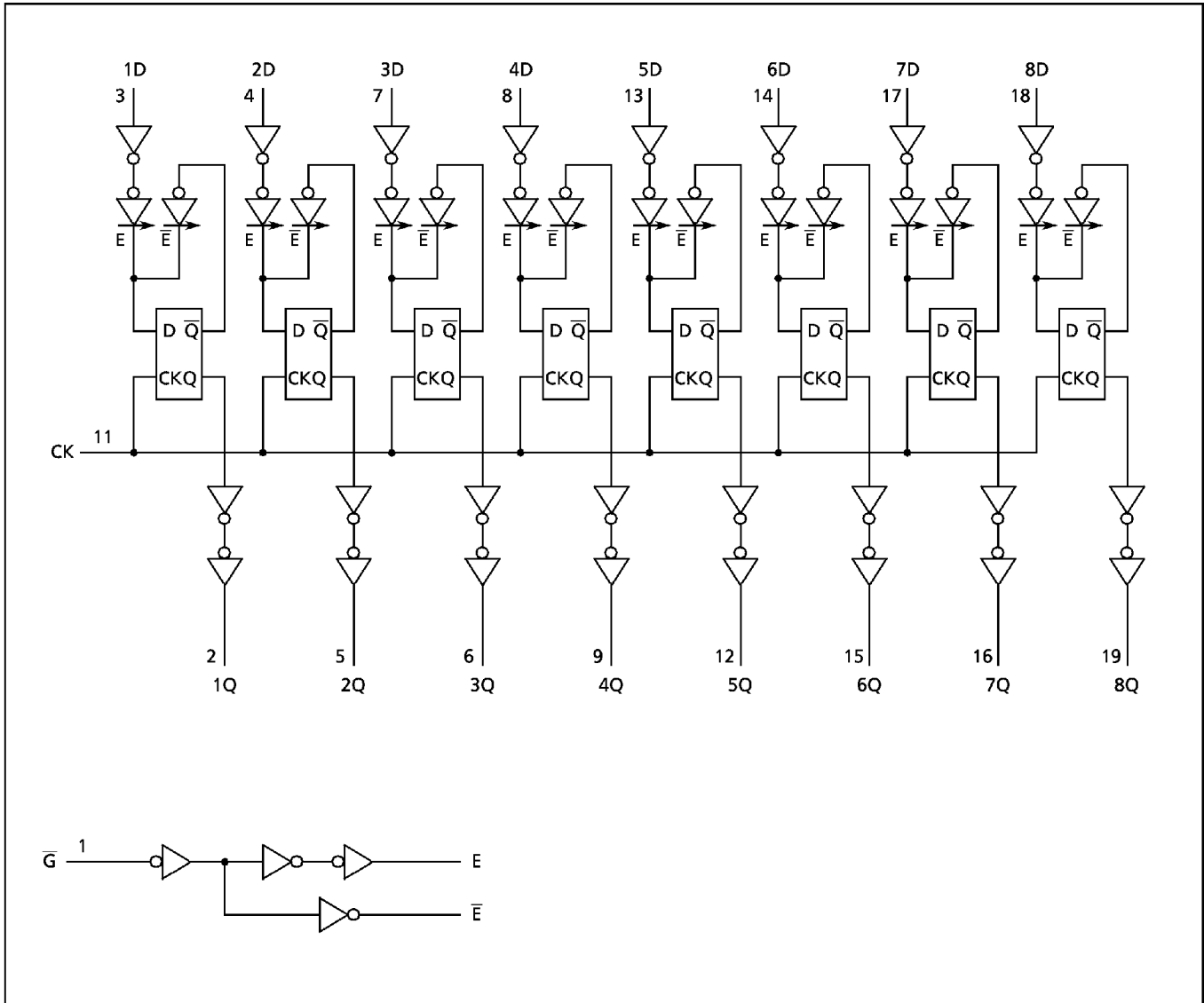
IEC LOGIC SYMBOL



961001EBA2

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SYSTEM DIAGRAM



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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} | ± 25 | mA |
| DC V_{CC} /Ground Current | I_{CC} | ± 50 | 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 | 1.50 | — | — | 1.50 | — | V | |
| | | | 4.5 | 3.15 | — | — | 3.15 | — | | |
| | | | 6.0 | 4.20 | — | — | 4.20 | — | | |
| Low - Level Input Voltage | V_{IL} | | 2.0 | — | — | 0.50 | — | 0.50 | V | |
| | | | 4.5 | — | — | 1.35 | — | 1.35 | | |
| | | | 6.0 | — | — | 1.80 | — | 1.80 | | |
| High - Level Output Voltage | V_{OH} | $V_{IN} = V_{IH}$ | $I_{OH} = -20\mu\text{A}$ | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | $I_{OH} = -4\text{ mA}$ | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | $I_{OH} = -5.2\text{ mA}$ | 6.0 | 5.9 | 6.0 | — | 5.9 | — | |
| Low - Level Output Voltage | V_{OL} | $V_{IN} = V_{IL}$ | $I_{OL} = 20\mu\text{A}$ | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | $I_{OL} = 4\text{ mA}$ | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | $I_{OL} = 5.2\text{ mA}$ | 6.0 | — | 0.0 | 0.1 | — | 0.1 | |
| 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 | | |

TIMING REQUIREMENTS (Input $t_r = t_f = 6\text{ns}$)

| PARAMETER | SYMBOL | TEST CONDITION | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | $T_a = -40\sim 85^\circ\text{C}$ | UNIT |
|---|--------------------------|----------------|--------------|--------------------------|-------|----------------------------------|------|
| | | | | TYP. | LIMIT | LIMIT | |
| Minimum Pulse Width (CK) | $t_{W(H)}$ $t_{W(L)}$ | | 2.0 | — | 75 | 95 | ns |
| | | | 4.5 | — | 15 | 19 | |
| | | | 6.0 | — | 13 | 16 | |
| Minimum Set-up Time (D-CK) | t_s | | 2.0 | — | 75 | 95 | |
| | | | 4.5 | — | 15 | 19 | |
| | | | 6.0 | — | 13 | 16 | |
| Minimum Set-up Time (\bar{G} -CK) | t_s | | 2.0 | — | 75 | 95 | |
| | | | 4.5 | — | 15 | 19 | |
| | | | 6.0 | — | 13 | 16 | |
| Minimum Hold Time | t_h | | 2.0 | — | 0 | 0 | |
| | | | 4.5 | — | 0 | 0 | |
| | | | 6.0 | — | 0 | 0 | |
| Clock Frequency | f | | 2.0 | — | 7 | 6 | MHz |
| | | | 4.5 | — | 36 | 29 | |
| | | | 6.0 | — | 42 | 34 | |

AC ELECTRICAL CHARACTERISTICS ($C_L = 15\text{pF}$, $V_{CC} = 5\text{V}$, $T_a = 25^\circ\text{C}$, Input $t_r = t_f = 6\text{ns}$)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|----------------------------------|-----------|----------------|------|------|------|------|
| Output Transition Time | t_{TLH} | | — | 4 | 8 | ns |
| | t_{THL} | | | | | |
| Propagation Delay Time (CK-Q) | t_{pLH} | | — | 14 | 24 | |
| | t_{pHL} | | | | | |
| Maximum Clock Frequency | f_{MAX} | | 38 | 73 | — | MHz |

AC ELECTRICAL CHARACTERISTICS ($C_L = 50\text{pF}$, Input $t_r = t_f = 6\text{ns}$)

| 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. | |
| Output Transition Time | t_{TLH} t_{THL} | | 2.0 | — | 30 | 75 | — | 95 | ns |
| | | | 4.5 | — | 8 | 15 | — | 19 | |
| | | | 6.0 | — | 7 | 13 | — | 16 | |
| Propagation Delay Time (CK-Q) | t_{pLH} t_{pHL} | | 2.0 | — | 57 | 140 | — | 175 | |
| | | | 4.5 | — | 17 | 28 | — | 35 | |
| | | | 6.0 | — | 13 | 24 | — | 30 | |
| Maximum Clock Frequency | f_{MAX} | | 2.0 | 7 | 18 | — | 6 | — | MHz |
| | | | 4.5 | 36 | 59 | — | 29 | — | |
| | | | 6.0 | 42 | 77 | — | 34 | — | |
| Input Capacitance | C_{IN} | | — | 5 | 10 | — | 10 | pF | |
| Power Dissipation Capacitance | C_{PD} (1) | | — | 32 | — | — | — | | |

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:

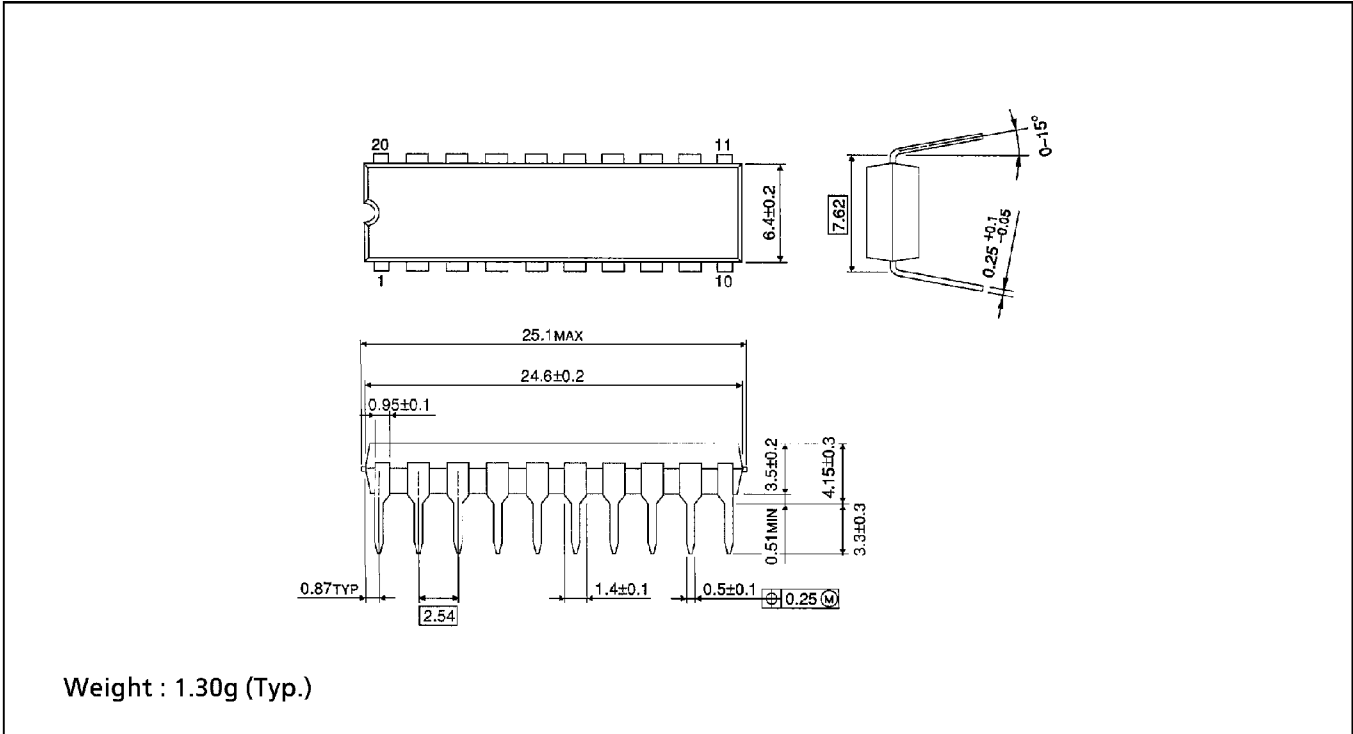
$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per Flip Flop)}$$

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

$$C_{PD}(\text{total}) = 22 + 10 \cdot n$$

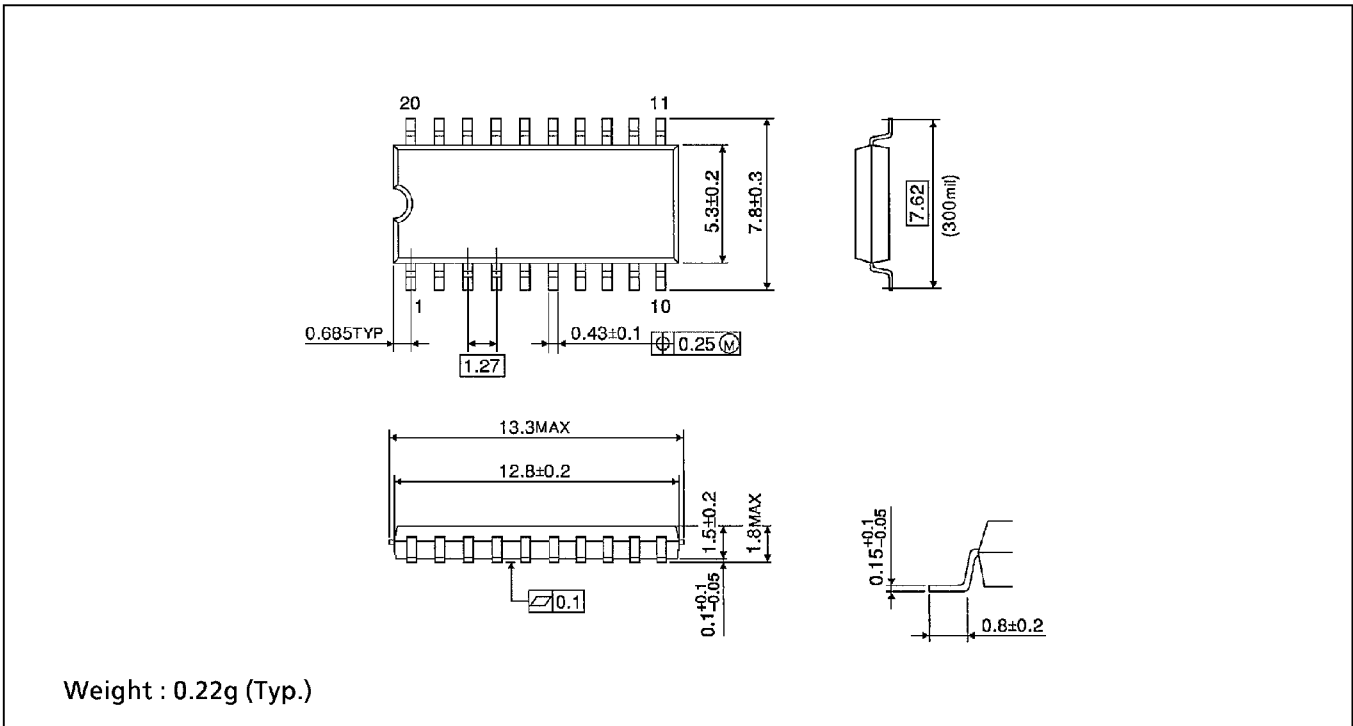
DIP 20PIN OUTLINE DRAWING (DIP20-P-300-2.54A)

Unit in mm



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

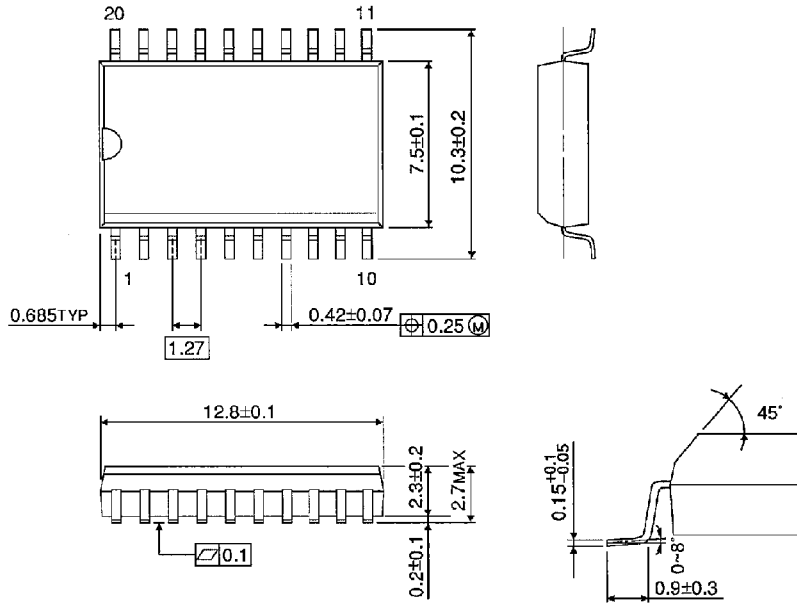
Unit in mm



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.)