

TC74HC74AP, TC74HC74AF, TC74HC74AFN

DUAL D-TYPE FLIP FLOP PRESET AND CLEAR

The TC74HC74A is a high speed CMOS D 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.

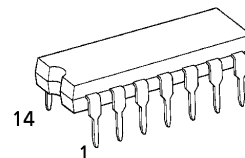
The signal level applied to the D INPUT is transferred to Q OUTPUT during the positive going transition of the CLOCK pulse.

CLEAR and PRESET are independent of the CLOCK and are accomplished by setting the appropriate input to an "L" level. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

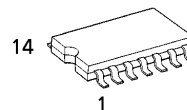
FEATURES :

- High Speed..... $f_{MAX} = 77\text{MHz}$ (typ.)
at $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 2\mu\text{A}$ (Max.) at $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (Min.)
- Output Drive Capability..... 10 LSTTL Loads
- Symmetrical Output Impedance... $|I_{OH}| = I_{OL} = 4\text{mA}$ (Min.)
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range... V_{CC} (opr.) = 2V~6V
- Pin and Function Compatible with 74LS74

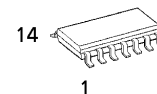
(Note) The JEDEC SOP (FN) is not available in Japan.



P (DIP14-P-300-2.54)
Weight : 0.96g (Typ.)

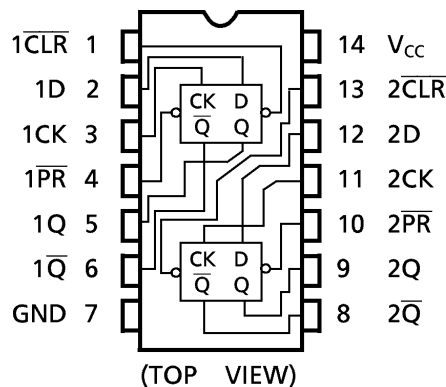


F (SOP14-P-300-1.27)
Weight : 0.18g (Typ.)



FN (SOL14-P-150-1.27)
Weight : 0.12g (Typ.)

PIN ASSIGNMENT

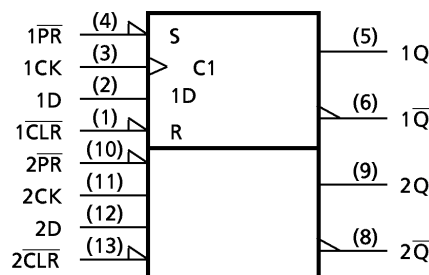


TRUTH TABLE

| INPUTS | | | | OUTPUTS | | FUNCTION |
|--------|----|---|----|----------------|-----------------|-----------|
| CLR | PR | D | CK | Q | Q̄ | |
| L | H | X | X | L | H | CLEAR |
| H | L | X | X | H | L | PRESET |
| L | L | X | X | H | H | — |
| H | H | L | ┌ | L | H | — |
| H | H | H | ┌ | H | L | — |
| H | H | X | └ | Q _n | Q̄ _n | NO CHANGE |

X : Don't Care

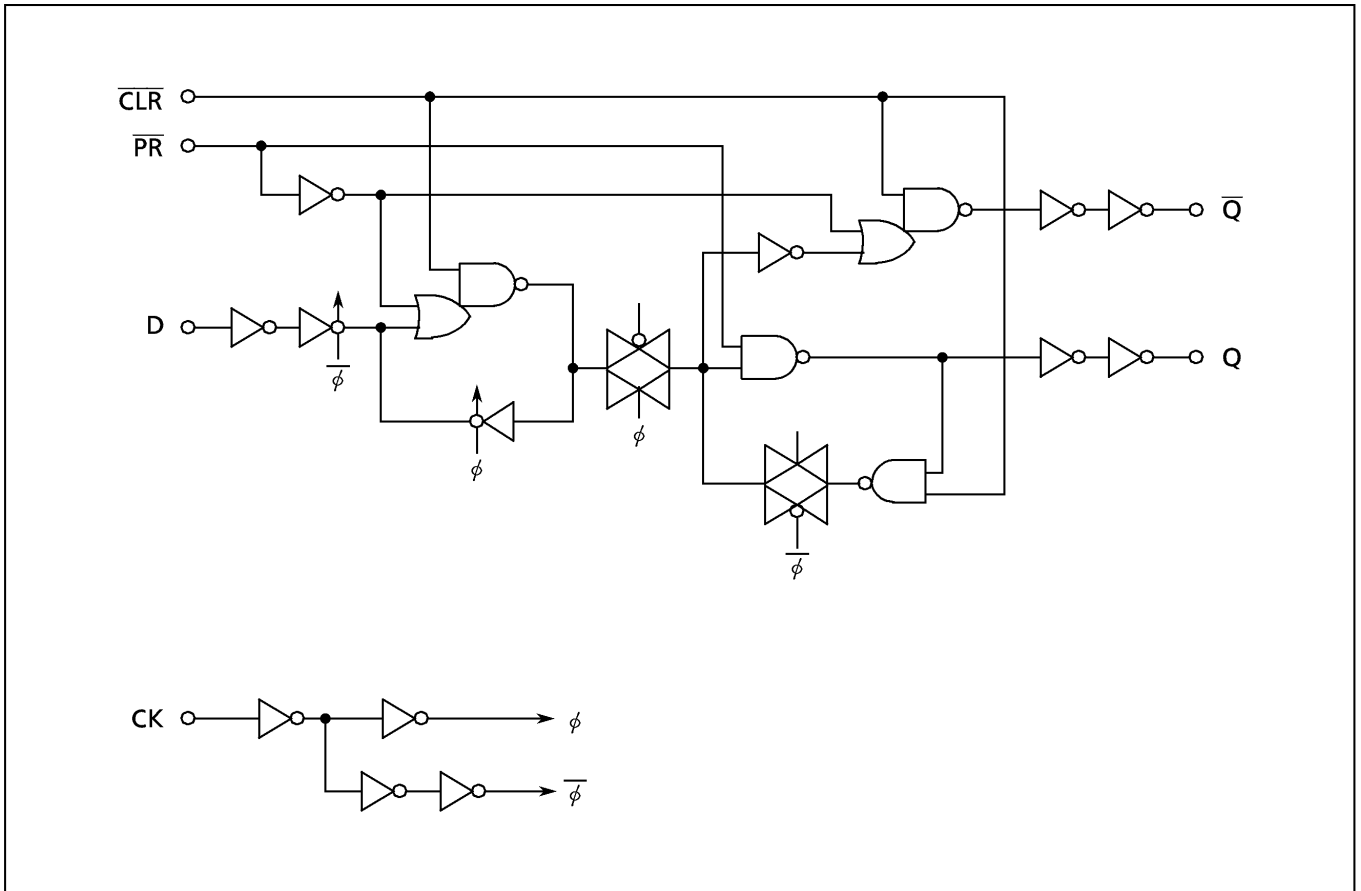
IEC LOGIC SYMBOL



961001EBA2

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SYSTEM DIAGRAM



961001EBA2'

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- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

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} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OH} = -20\mu\text{A}$ | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | | 6.0 | 5.9 | 6.0 | — | 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 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | |
| Low - Level Output Voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 4\text{ mA}$ $I_{OL} = 5.2\text{ mA}$ | 4.5 | — | 0.17 | 0.26 | — | 0.33 | V |
| | | | | 6.0 | — | 0.18 | 0.26 | — | 0.33 | |
| | | | | 6.0 | — | 0.18 | 0.26 | — | 0.33 | |
| 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 | — | — | 2.0 | — | 20.0 | | |

TIMING REQUIREMENTS (Input $t_r = t_f = 6ns$)

| PARAMETER | SYMBOL | TEST CONDITION | V _{CC} (V) | Ta = 25°C | | Ta = -40~85°C | UNIT |
|--|--|----------------|---------------------|-----------|-------|---------------|------|
| | | | | TYP. | LIMIT | LIMIT | |
| Minimum Pulse Width (CK) | t _{W(L)} t _{W(H)} | | 2.0 | — | 75 | 95 | ns |
| | | | 4.5 | — | 15 | 19 | |
| | | | 6.0 | — | 13 | 16 | |
| Minimum Pulse Width (\overline{CLR} , \overline{PR}) | t _{W(L)} | | 2.0 | — | 75 | 95 | |
| | | | 4.5 | — | 15 | 19 | |
| | | | 6.0 | — | 13 | 16 | |
| Minimum Set-up Time | 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 | |
| Minimum Removal Time (\overline{CLR} , \overline{PR}) | t _{rem} | | 2.0 | — | 25 | 30 | |
| | | | 4.5 | — | 5 | 6 | |
| | | | 6.0 | — | 4 | 5 | |
| Clock Frequency | f | | 2.0 | — | 6 | 5 | MHz |
| | | | 4.5 | — | 31 | 25 | |
| | | | 6.0 | — | 36 | 29 | |

AC ELECTRICAL CHARACTERISTICS (C_L = 15pF, V_{CC} = 5V, Ta = 25°C, Input $t_r = t_f = 6ns$)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|------------------|----------------|------|------|------|------|
| Output Transition Time | t _{TLH} | | — | 6 | 12 | ns |
| | t _{THL} | | | | | |
| Propagation Delay Time (CK-Q, \overline{Q}) | t _{pLH} | | — | 13 | 26 | |
| | t _{pHL} | | | | | |
| Propagation Delay Time (\overline{CLR} , \overline{PR} -Q, \overline{Q}) | t _{pLH} | | — | 14 | 26 | |
| | t _{pHL} | | | | | |
| Maximum Clock Frequency | f _{MAX} | | 36 | 77 | — | MHz |

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

| PARAMETER | SYMBOL | TEST CONDITION | V _{CC} (V) | Ta = 25°C | | | Ta = -40~85°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, \overline{Q}) | t _{pLH} t _{pHL} | | 2.0 | — | 48 | 150 | — | 190 | |
| | | | 4.5 | — | 16 | 30 | — | 38 | |
| | | | 6.0 | — | 13 | 26 | — | 32 | |
| Propagation Delay Time (\overline{CLR} , \overline{PR} -Q, \overline{Q}) | t _{pLH} t _{pHL} | | 2.0 | — | 51 | 150 | — | 190 | |
| | | | 4.5 | — | 17 | 30 | — | 38 | |
| | | | 6.0 | — | 15 | 26 | — | 32 | |
| Maximum Clock Frequency | f _{MAX} | | 2.0 | 6 | 21 | — | 5 | — | MHz |
| | | | 4.5 | 31 | 63 | — | 25 | — | |
| | | | 6.0 | 36 | 67 | — | 29 | — | |
| Input Capacitance | C _{IN} | | | — | 5 | 10 | — | 10 | pF |
| Power Dissipation Capacitance | C _{PD} | (1) | | — | 34 | — | — | — | |

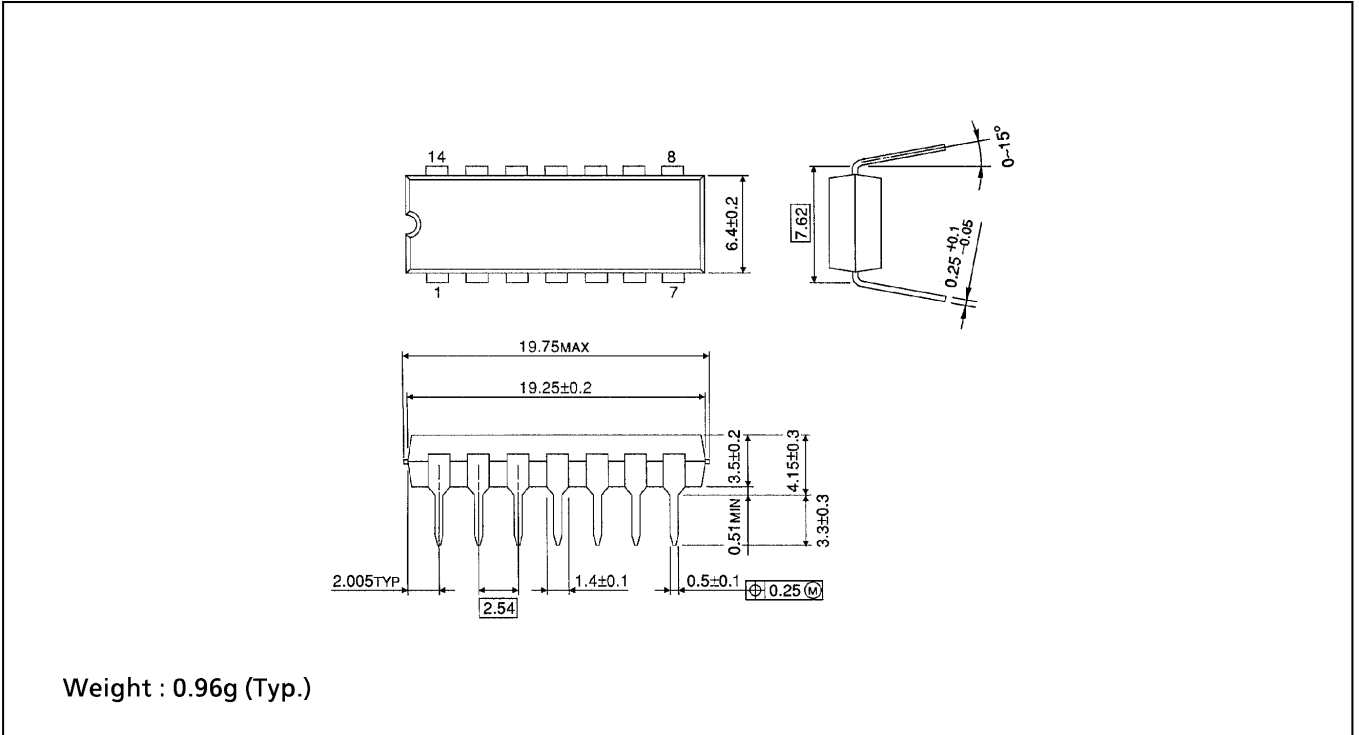
Note (1) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2 \text{ (per F/F)}$$

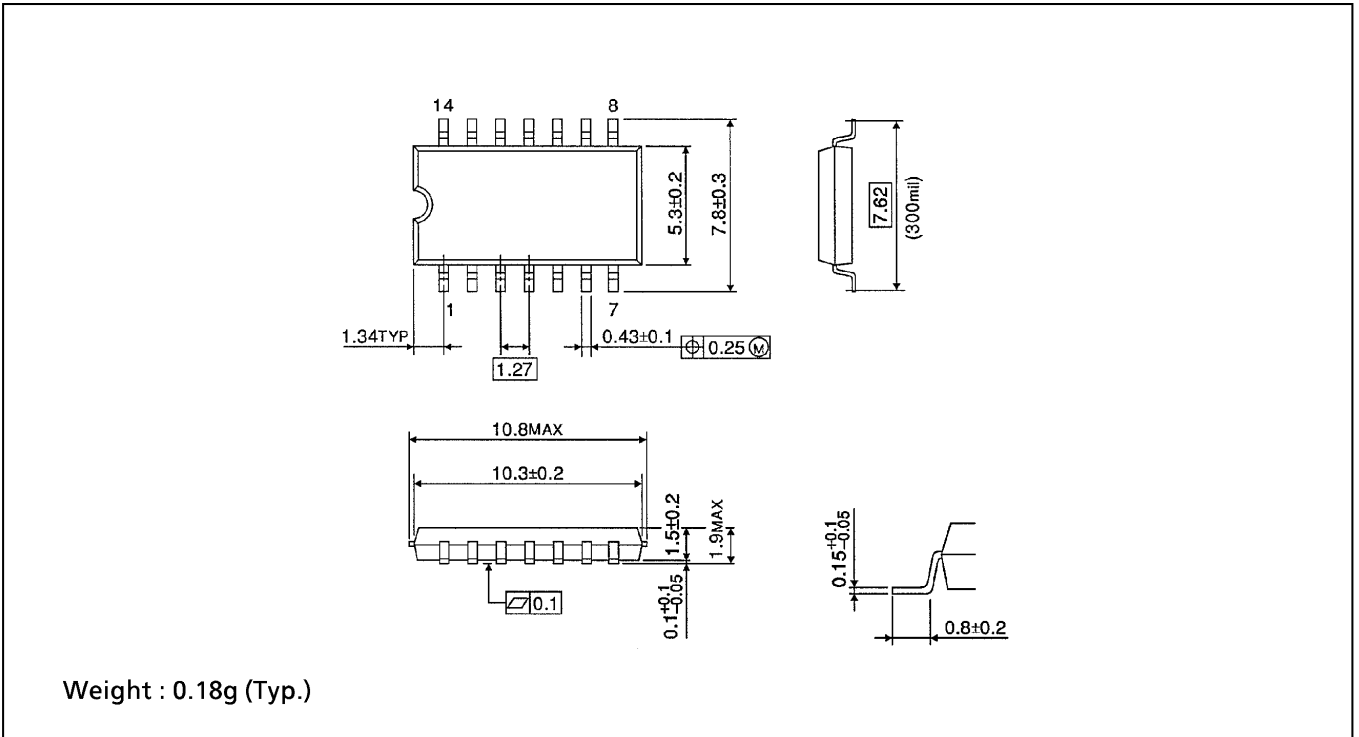
DIP 14PIN OUTLINE DRAWING (DIP14-P-300-2.54)

Unit in mm



SOP 14PIN (200mil BODY) OUTLINE DRAWING (SOP14-P-300-1.27)

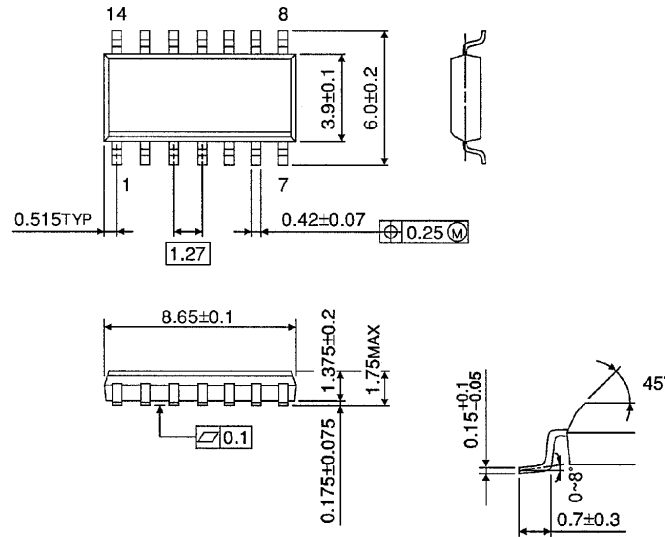
Unit in mm



SOP 14PIN (150mil BODY) OUTLINE DRAWING (SOL14-P-150 -1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)