

**TOSHIBA**

**TC74LCX240F/FW/FT**

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC74LCX240F, TC74LCX240FW, TC74LCX240FT

## LOW VOLTAGE OCTAL BUS BUFFER (INVERTED) WITH 5V TOLERANT INPUTS AND OUTPUTS

The TC74LCX240 is a high performance CMOS OCTAL BUS BUFFER. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

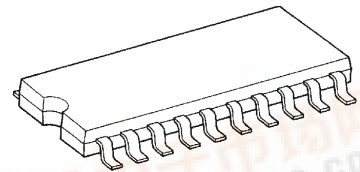
The device is designed for low-voltage (3.3V)  $V_{CC}$  applications, but it could be used to interface to 5V supply environment for both inputs and outputs.

The 74LCX240 is an inverting 3-state buffer having two active-low output enables. This device is designed to be used with 3-state memory address drivers, etc.

All inputs are equipped with protection circuits against static discharge.

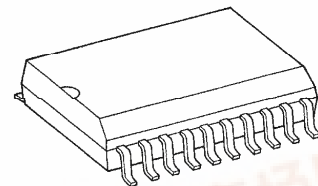
(Note) The JEDEC SOP (FW) is not available in Japan.

TC74LCX240F



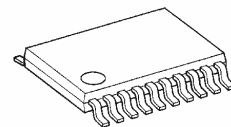
SOP20-P-300-1.27

TC74LCX240FW



SOL20-P-300-1.27

TC74LCX240FT



TSSOP20-P-0044-0.65

### FEATURES

- Low voltage operation :  $V_{CC} = 2.0 \sim 3.6V$
- High speed operation :  $t_{pd} = 6.5ns$  (Max.)  
( $V_{CC} = 3.0 \sim 3.6V$ )
- Output current :  $|I_{OH}| / I_{OL} = 24mA$  (Min.)  
( $V_{CC} = 3.0V$ )
- Latch-up performance :  $\pm 500mA$
- Available in JEDEC SOP, EIAJ SOP and TSSOP
- Power down protection is provided on all inputs and outputs.
- Pin and function compatible with the 74 series (74AC/VHC/HC/F/ALS/LS etc.) 240 type.

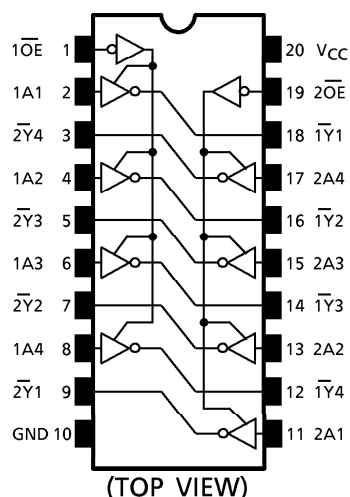
### Weight

|                     |                |
|---------------------|----------------|
| SOP20-P-300-1.27    | : 0.22g (Typ.) |
| SOL20-P-300-1.27    | : 0.46g (Typ.) |
| TSSOP20-P-0044-0.65 | : 0.08g (Typ.) |

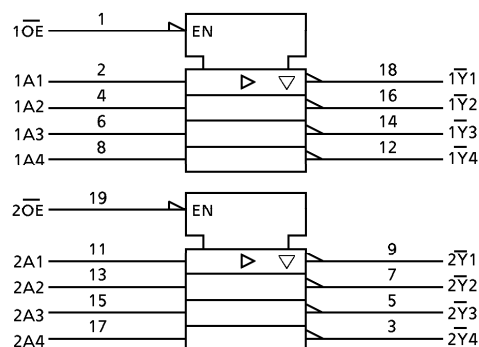
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## PIN ASSIGNMENT



## IEC LOGIC SYMBOL



## TRUTH TABLE

| INPUTS |    | OUTPUTS |
|--------|----|---------|
| OE     | An |         |
| L      | L  | H       |
| L      | H  | L       |
| H      | X  | Z       |

X : Don't Care

Z : High Impedance

## MAXIMUM RATINGS

| PARAMETER                   | SYMBOL           | RATING                        | UNIT |
|-----------------------------|------------------|-------------------------------|------|
| Supply Voltage Range        | $V_{CC}$         | -0.5~7.0                      | V    |
| DC Input Voltage            | $V_{IN}$         | -0.5~7.0                      | V    |
| DC Output Voltage           | $V_{OUT}$        | -0.5~7.0 (Note 1)             | V    |
|                             |                  | -0.5~ $V_{CC} + 0.5$ (Note 2) |      |
| Input Diode Current         | $I_{IK}$         | -50                           | mA   |
| Output Diode Current        | $I_{OK}$         | ±50 (Note 3)                  | mA   |
| DC Output Current           | $I_{OUT}$        | ±50                           | mA   |
| Power Dissipation           | $P_D$            | 180                           | mW   |
| DC $V_{CC}$ /Ground Current | $I_{CC}/I_{GND}$ | ±100                          | mA   |
| Storage Temperature         | $T_{stg}$        | -65~150                       | °C   |

(Note 1) Output in Off-State

(Note 2) High or Low State.  $I_{OUT}$  absolute maximum rating must be observed.(Note 3)  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$ 

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

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | SYMBOL          | RATING               | UNIT |
|--------------------------|-----------------|----------------------|------|
| Supply Voltage           | $V_{CC}$        | 2.0~3.6              | V    |
|                          |                 | 1.5~3.6 (Note 4)     |      |
| Input Voltage            | $V_{IN}$        | 0~5.5                | V    |
| Output Voltage           | $V_{OUT}$       | 0~5.5 (Note 5)       | V    |
|                          |                 | 0~ $V_{CC}$ (Note 6) |      |
| Output Current           | $I_{OH}/I_{OL}$ | $\pm 24$ (Note 7)    | mA   |
|                          |                 | $\pm 12$ (Note 8)    |      |
| Operating Temperature    | $T_{opr}$       | -40~85               | °C   |
| Input Rise And Fall Time | $dt/dv$         | 0~10 (Note 9)        | ns/V |

(Note 4) Data Retention Only

(Note 5) Output in Off-State

(Note 6) High or Low State

(Note 7)  $V_{CC} = 3.0 \sim 3.6V$ (Note 8)  $V_{CC} = 2.7 \sim 3.0V$ (Note 9)  $V_{IN} = 0.8 \sim 2.0V$ ,  $V_{CC} = 3.0V$ 

## ELECTRICAL CHARACTERISTICS

DC characteristics ( $T_a = -40 \sim 85^\circ C$ )

| PARAMETER                             |           | SYMBOL           | TEST CONDITION                                                                    |                           | V <sub>CC</sub> (V) | MIN.                  | MAX. | UNIT |
|---------------------------------------|-----------|------------------|-----------------------------------------------------------------------------------|---------------------------|---------------------|-----------------------|------|------|
| Input Voltage                         | "H" Level | V <sub>IH</sub>  |                                                                                   |                           | 2.7~3.6             | 2.0                   | —    | V    |
|                                       | "L" Level | V <sub>IL</sub>  |                                                                                   |                           | 2.7~3.6             | —                     | 0.8  |      |
| Output Voltage                        | "H" Level | V <sub>OH</sub>  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                              | I <sub>OH</sub> = - 100μA | 2.7~3.6             | V <sub>CC</sub> - 0.2 | —    | V    |
|                                       |           |                  |                                                                                   | I <sub>OH</sub> = - 12mA  | 2.7                 | 2.2                   | —    |      |
|                                       |           |                  |                                                                                   | I <sub>OH</sub> = - 18mA  | 3.0                 | 2.4                   | —    |      |
|                                       |           |                  |                                                                                   | I <sub>OH</sub> = - 24mA  | 3.0                 | 2.2                   | —    |      |
|                                       | "L" Level | V <sub>OL</sub>  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                              | I <sub>OL</sub> = 100μA   | 2.7~3.6             | —                     | 0.2  |      |
|                                       |           |                  |                                                                                   | I <sub>OL</sub> = 12mA    | 2.7                 | —                     | 0.4  |      |
|                                       |           |                  |                                                                                   | I <sub>OL</sub> = 16mA    | 3.0                 | —                     | 0.4  |      |
|                                       |           |                  |                                                                                   | I <sub>OL</sub> = 24mA    | 3.0                 | —                     | 0.55 |      |
| Input Leakage Current                 |           | I <sub>IN</sub>  | V <sub>IN</sub> = 0~5.5V                                                          | 2.7~3.6                   | —                   | ± 5.0                 | μA   |      |
| 3-State Output Off-State Current      |           | I <sub>OZ</sub>  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>OUT</sub> = 0~5.5V | 2.7~3.6                   | —                   | ± 5.0                 | μA   |      |
| Power Off Leakage Cuurent             |           | I <sub>OFF</sub> | V <sub>IN</sub> / V <sub>OUT</sub> = 5.5V                                         | 0                         | —                   | 10.0                  | μA   |      |
| Quiescent Supply Current              |           | I <sub>CC</sub>  | V <sub>IN</sub> = V <sub>CC</sub> or GND                                          | 2.7~3.6                   | —                   | 10.0                  | μA   |      |
|                                       |           |                  | V <sub>IN</sub> / V <sub>OUT</sub> = 3.6~5.5V                                     | 2.7~3.6                   | —                   | ± 10.0                |      |      |
| Increase In I <sub>CC</sub> Per Input |           | ΔI <sub>CC</sub> | V <sub>IH</sub> = V <sub>CC</sub> - 0.6V                                          | 2.7~3.6                   | —                   | 500                   | μA   |      |

AC characteristic (Ta = -40~85°C)

| PARAMETER              | SYMBOL            | TEST CONDITION | V <sub>CC</sub> (V) | MIN. | MAX. | UNIT |
|------------------------|-------------------|----------------|---------------------|------|------|------|
|                        |                   |                |                     |      |      |      |
| Propagation Delay Time | t <sub>pLH</sub>  | (Fig.1, 2)     | 2.7                 | —    | 7.5  | ns   |
|                        | t <sub>pHL</sub>  |                | 3.3 ± 0.3           | 1.5  | 6.5  |      |
| Output Enable Time     | t <sub>pZL</sub>  | (Fig.1, 3)     | 2.7                 | —    | 9.0  | ns   |
|                        | t <sub>pZH</sub>  |                | 3.3 ± 0.3           | 1.5  | 8.0  |      |
| Output Disable Time    | t <sub>pLZ</sub>  | (Fig.1, 3)     | 2.7                 | —    | 8.0  | ns   |
|                        | t <sub>pHZ</sub>  |                | 3.3 ± 0.3           | 1.5  | 7.0  |      |
| Output To Output Skew  | t <sub>osLH</sub> | (Note 10)      | 2.7                 | —    | —    | ns   |
|                        | t <sub>osHL</sub> |                | 3.3 ± 0.3           | —    | 1.0  |      |

(Note 10) Parameter guaranteed by design.

$$(t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)$$

DYNAMIC SWITCHING CHARACTERISTICS (Ta = 25°C, Input t<sub>r</sub> = t<sub>f</sub> = 2.5ns, C<sub>L</sub> = 50pF, R<sub>L</sub> = 500Ω)

| PARAMETER                                    | SYMBOL           | TEST CONDITION                               | V <sub>CC</sub> (V) | TYP. | UNIT |
|----------------------------------------------|------------------|----------------------------------------------|---------------------|------|------|
|                                              |                  |                                              |                     |      |      |
| Quiet Output Maximum Dynamic V <sub>OL</sub> | V <sub>OLP</sub> | V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V | 3.3                 | 0.8  | V    |
| Quiet Output Minimum Dynamic V <sub>OL</sub> | V <sub>OLV</sub> | V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V | 3.3                 | 0.8  | V    |

CAPACITIVE CHARACTERISTICS (Ta = 25°C)

| PARAMETER                     | SYMBOL           | TEST CONDITION                    | V <sub>CC</sub> (V) | TYP. | UNIT |
|-------------------------------|------------------|-----------------------------------|---------------------|------|------|
|                               |                  |                                   |                     |      |      |
| Input Capacitance             | C <sub>IN</sub>  | —                                 | 3.3                 | 7    | pF   |
| Output Capacitance            | C <sub>OUT</sub> |                                   | 3.3                 | 8    | pF   |
| Power Dissipation Capacitance | C <sub>PD</sub>  | f <sub>IN</sub> = 10MHz (Note 11) | 3.3                 | 25   | pF   |

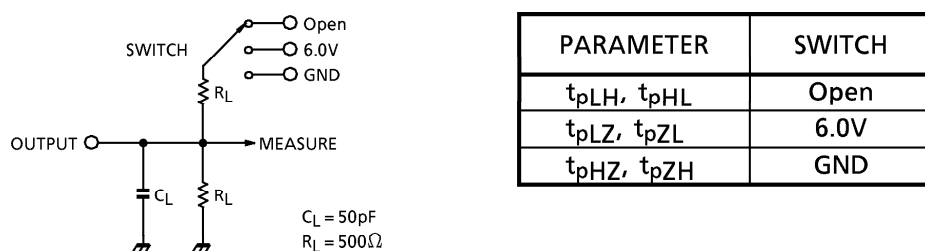
(Note 11) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption.

Average operating current can be obtained by the equation :

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

# TEST CIRCUIT

Fig.1



# AC WAVEFORM

Fig.2  $t_{pLH}$ ,  $t_{pHL}$

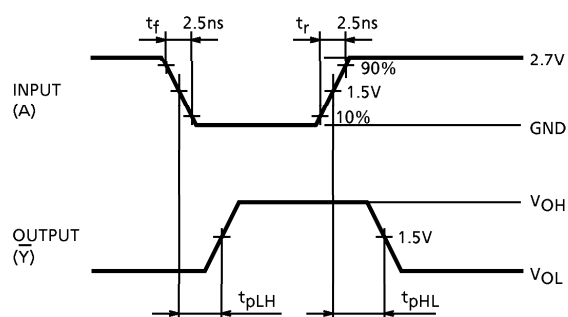
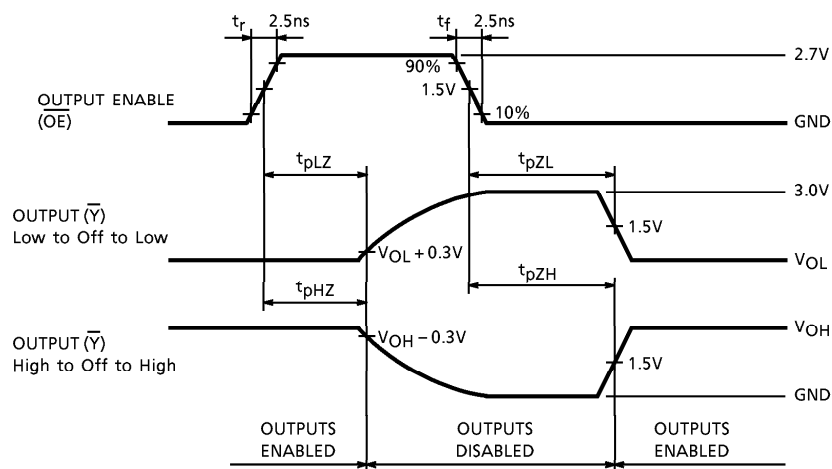
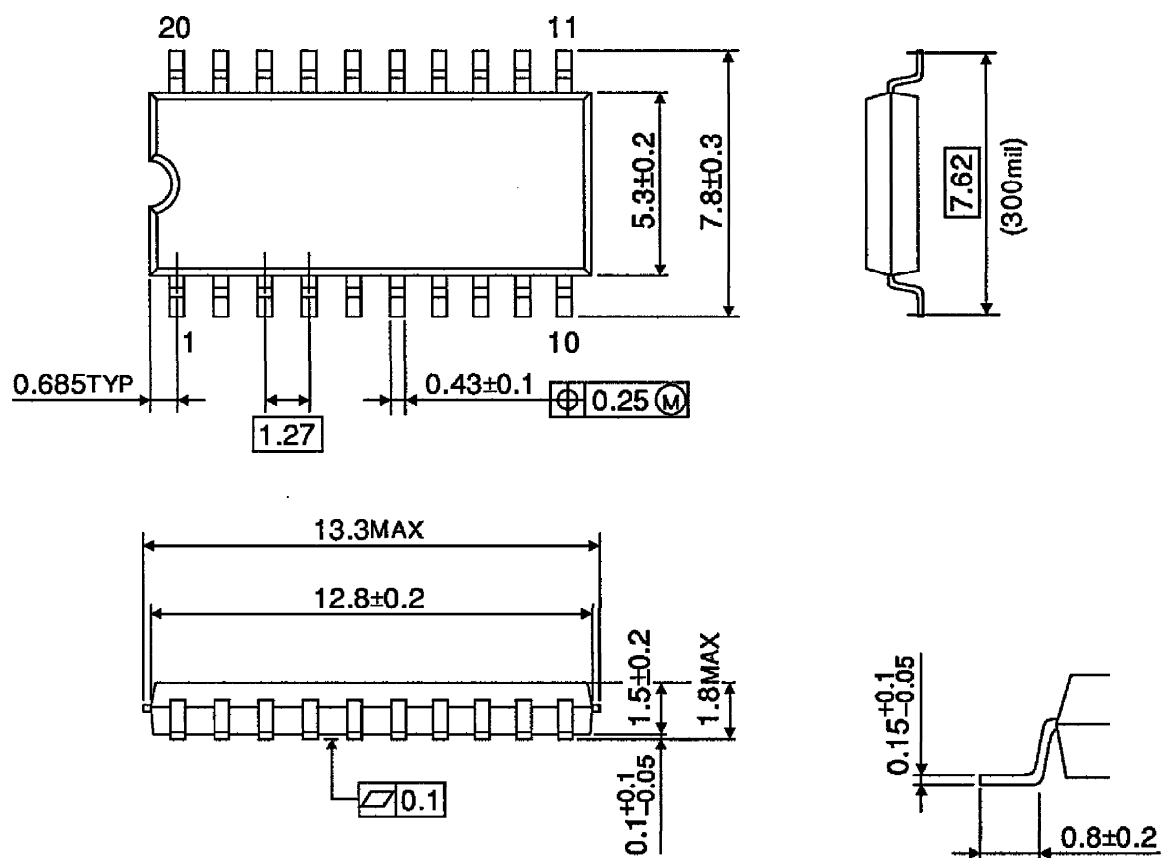


Fig.3  $t_{pLZ}$ ,  $t_{pHZ}$ ,  $t_{pZL}$ ,  $t_{pZH}$



OUTLINE DRAWING  
SOP20-P-300-1.27

Unit : mm

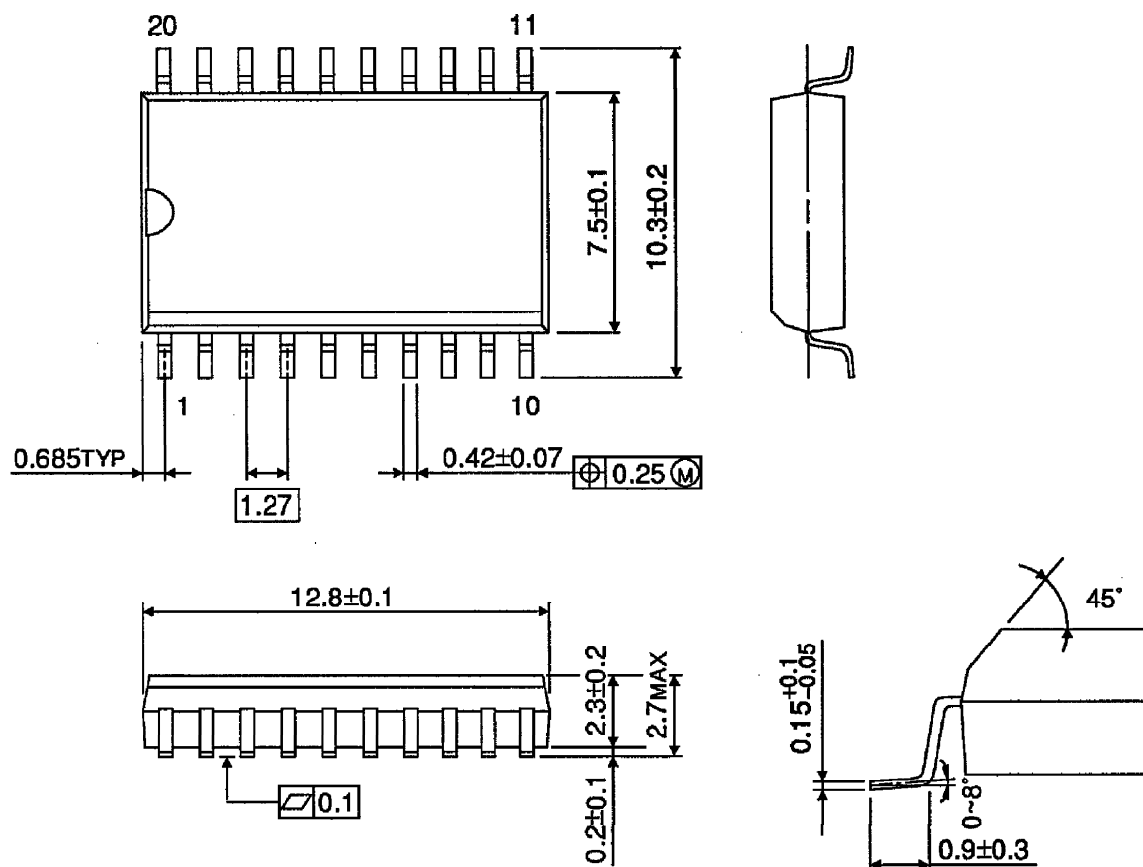


Weight : 0.22g (Typ.)

## OUTLINE DRAWING SOL20-P-300-1.27

Unit : mm

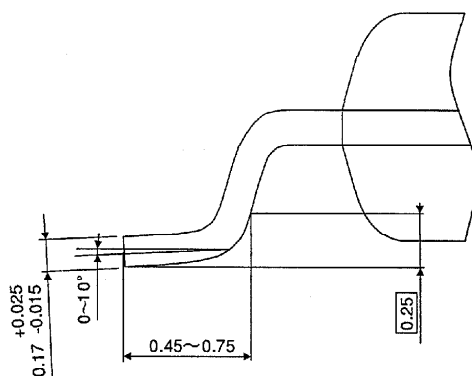
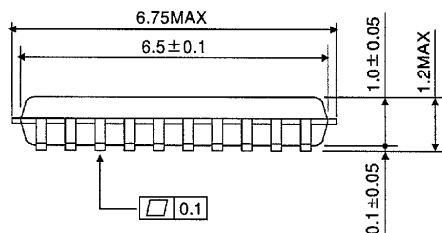
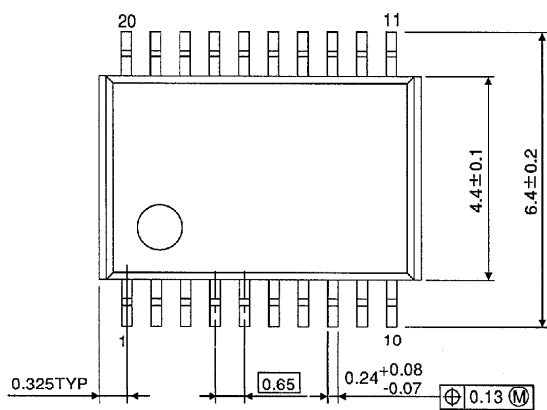
(Note) This package is not available in Japan.



Weight : 0.46g (Typ.)

**OUTLINE DRAWING**  
TSSOP20-P-0044-0.65

Unit : mm



Weight : 0.08g (Typ.)