TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

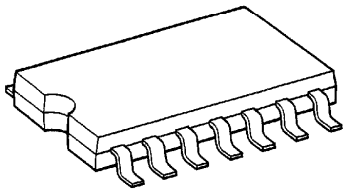
TC74LCX74F, TC74LCX74FN, TC74LCX74FT

LOW VOLTAGE DUAL D-TYPE FLIP FLOP WITH 5V TOLERANT INPUTS AND OUTPUTS

The TC74LCX74 is a high performance CMOS D-TYPE FLIP FLOP. 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 inputs.
The signal level applied to the D INPUT is transferred to Q OUTPUT during the positive going transition of the CK pulse.
$\overline{CLR}$ and $\overline{PR}$ are independent of the CK and are accomplished by setting the appropriate input low.
All inputs are equipped with protection circuits against static discharge.

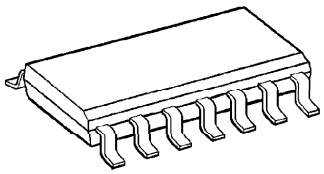
(Note) The JEDEC SOP (FN) is not available in Japan.

TC74LCX74F



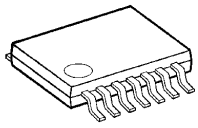
SOP14-P-300-1.27

TC74LCX74FN



SOL14-P-150-1.27

TC74LCX74FT



TSSOP14-P-0044-0.65

Weight
SOP14-P-300-1.27 : 0.18g (Typ.)
SOL14-P-150-1.27 : 0.12g (Typ.)
TSSOP14-P-0044-0.65 : 0.06g (Typ.)

FEATURES

- Low voltage operation : $V_{CC} = 2.0 \sim 3.6V$
- High speed operation : $t_{pd} = 7.0ns$ (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.) 74 type.

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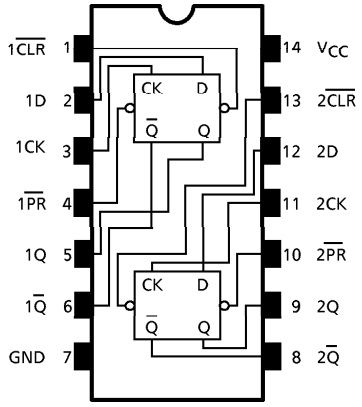
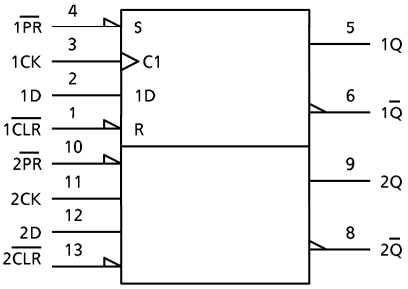
PIN ASSIGNMENT



IEC LOGIC SYMBOL



TRUTH TABLE

INPUTS				OUTPUTS		FUNCTION
$\overline{CLR}$	$\overline{PR}$	D	CK	Q	$\overline{Q}$	
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	$\overline{Q}_n$	NO CHANGE

X : Don't care

MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Power Supply Voltage	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) VCC = 0V
(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}	±24 (Note 7)	mA
		±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) VCC = 0V
(Note 6) High or Low State
(Note 7) V_{CC} = 3.0~3.6V
(Note 8) V_{CC} = 2.7~3.0V
(Note 9) V_{IN} = 0.8~2.0V, V_{CC} = 3.0V

ELECTRICAL CHARACTERISTICS

DC characteristics (Ta = −40~85°C)

PARAMETER		SYMBOL	TEST CONDITION		V_{CC} (V)	MIN.	MAX.	UNIT
Input Voltage	"H" Level	V_{IH}			2.7~3.6	2.0	—	V
	"L" Level	V_{IL}			2.7~3.6	—	0.8	
Output Voltage	"H" Level	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −100μA	2.7~3.6	V_{CC} −0.2	—	V
				I_{OH} = −12mA	2.7	2.2	—	
				I_{OH} = −18mA	3.0	2.4	—	
				I_{OH} = −24mA	3.0	2.2	—	
	"L" Level	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 100μA	2.7~3.6	—	0.2	
				I_{OL} = 12mA	2.7	—	0.4	
				I_{OL} = 16mA	3.0	—	0.4	
				I_{OL} = 24mA	3.0	—	0.55	
Input Leakage Current		I_{IN}	V_{IN} = 0~5.5V		2.7~3.6	—	±5.0	μA
Power Off Leakage Cuurent		I_{OFF}	V_{IN} / V_{OUT} = 5.5V		0	—	10.0	μA
Quiescent Supply Current		I_{CC}	V_{IN} = V_{CC} or GND		2.7~3.6	—	10.0	μA
			V_{IN} / V_{OUT} = 3.6~5.5V		2.7~3.6	—	±10.0	
Quiescent In I_{CC} Per Input		ΔI_{CC}	V_{IH} = V_{CC} − 0.6V		2.7~3.6	—	500	μA

AC characteristics (Ta = −40~85°C)

PARAMETER	SYMBOL	TEST CONDITION	V_{CC} (V)	MIN.	MAX.	UNIT
Maximam Clock Frequency	f_{MAX}	(Fig.1, 2)	2.7	—	—	MHz
			3.3 ± 0.3	150	—	
Propagation Delay Time (CK-Q, $\overline{Q}$)	t_{pLH} t_{pHL}	(Fig.1, 2)	2.7	—	8.0	ns
			3.3 ± 0.3	1.5	7.0	
Propagation Delay Time ($\overline{CLR}$, $\overline{PR}$-Q, $\overline{Q}$)	t_{pLH} t_{pHL}	(Fig.1, 4)	2.7	—	8.0	ns
			3.3 ± 0.3	1.5	7.0	
Minimum Pulse Width (CK)	t_{W} (H) t_{W} (L)	(Fig.1, 2, 3)	2.7	3.3	—	ns
			3.3 ± 0.3	3.3	—	
Minimum Pulse Width ($\overline{CLR}$, $\overline{PR}$)	t_{W} (L)	(Fig.1, 2, 3)	2.7	3.6	—	ns
			3.3 ± 0.3	3.3	—	
Minimum Set-up Time	t_s	(Fig.1, 2)	2.7	2.5	—	ns
			3.3 ± 0.3	2.5	—	
Minimum Hold Time	t_h	(Fig.1, 2)	2.7	1.5	—	ns
			3.3 ± 0.3	1.5	—	
Minimum Removal Time	t_{rem}	(Fig.1, 3)	2.7	3.0	—	ns
			3.3 ± 0.3	2.5	—	
Output To Output Skew	t_{osLH} t_{osHL}	(Note 10)	2.7	—	—	ns
			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 $t_r = t_f = 2.5$ns, $C_L = 50$pF, $R_L = 500\Omega$)

PARAMETER	SYMBOL	TEST CONDITION	V_{CC} (V)	TYP.	UNIT
Quiet Output Maximum Dynamic V_{OL}	V_{OLP}	V_{IH} = 3.3V, V_{IL} = 0V	3.3	0.8	V
Quiet Output Minimum Dynamic V_{OL}	$\|V_{OLV}\|$	V_{IH} = 3.3V, V_{IL} = 0V	3.3	0.8	V

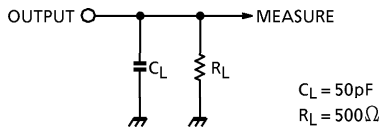
CAPACITIVE CHARACTERISTICS (Ta = 25°C)

PARAMETER	SYMBOL	TEST CONDITION	V_{CC} (V)	TYP	UNIT
Input Capacitance	C_{IN}	—	3.3	7	pF
Output Capacitance	C_{OUT}		0	8	pF
Power Dissipation Capacitance	C_{PD}	f_{IN} = 10MHz (Note 11)	3.3	25	pF

(Note 11) 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 :
$I_{CC (opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 2$ (per F / F)

TEST CIRCUIT

Fig.1



AC WAVEFORM

Fig.2 t_{pLH}, t_{pHL}, t_w, t_s, t_h

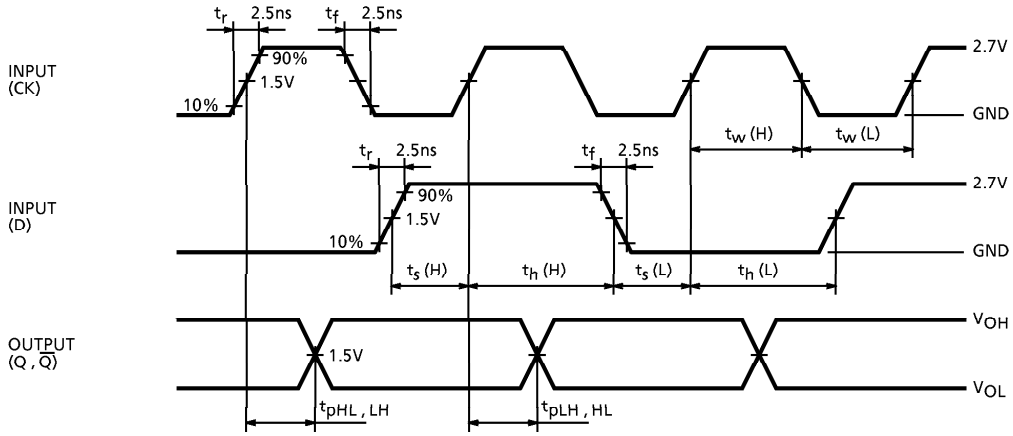


Fig.3 t_{rem}

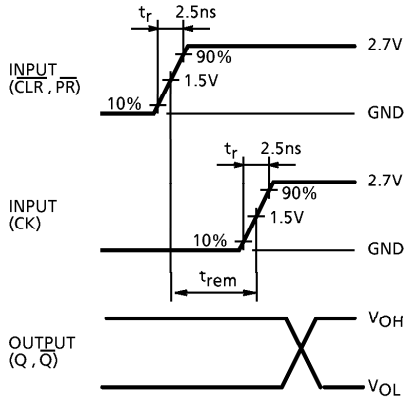
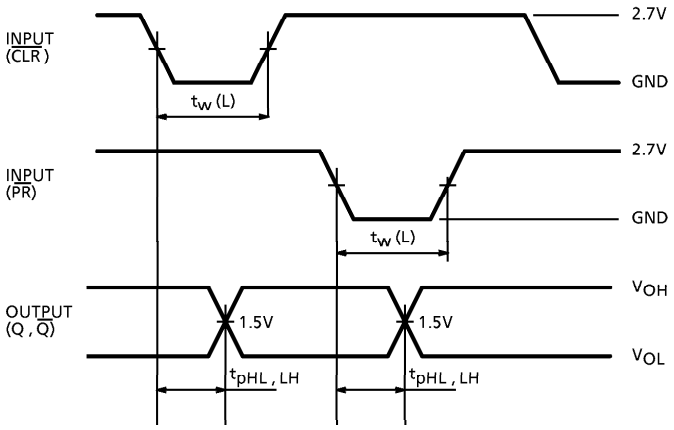


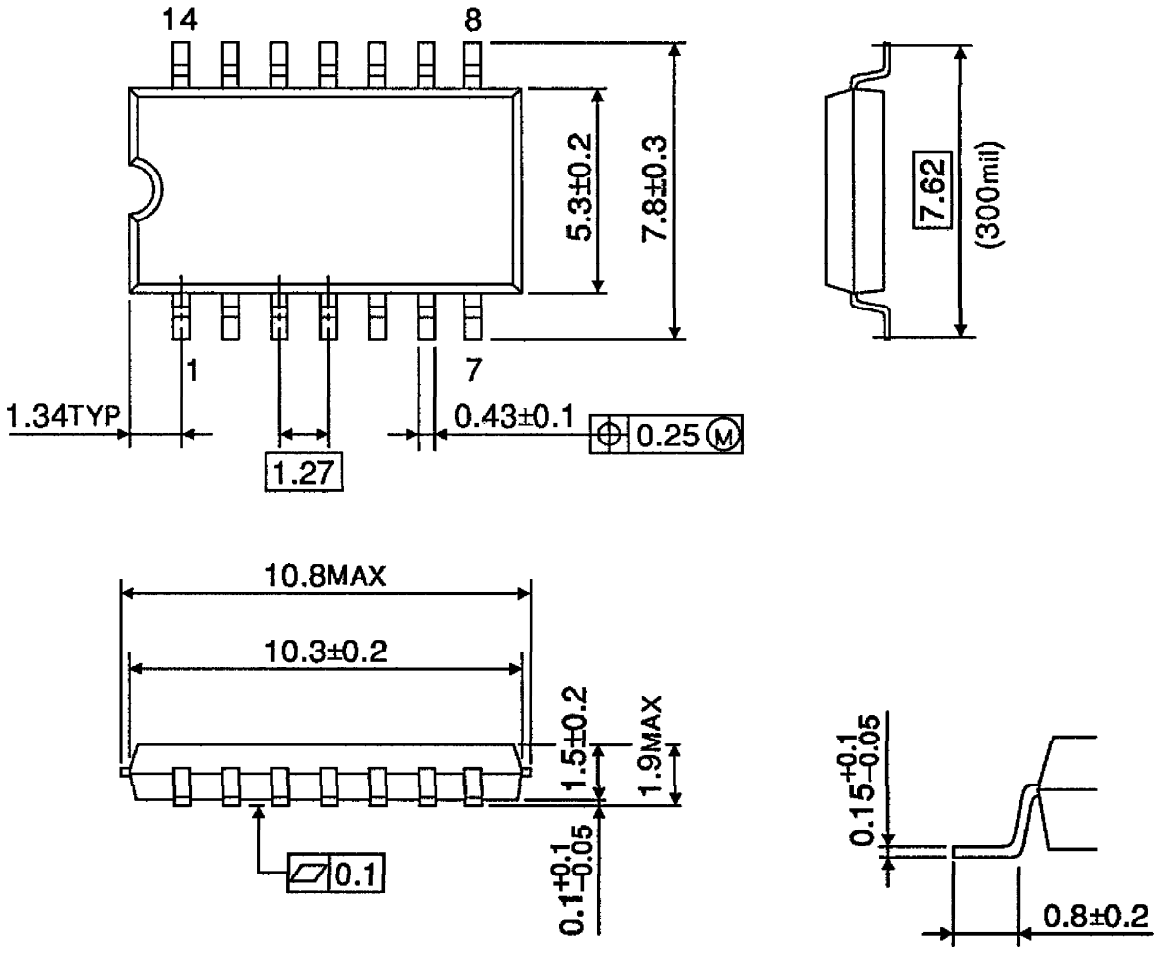
Fig.4 t_{pLH}, t_{pHL}



OUTLINE DRAWING

SOP14-P-300-1.27

Unit : mm



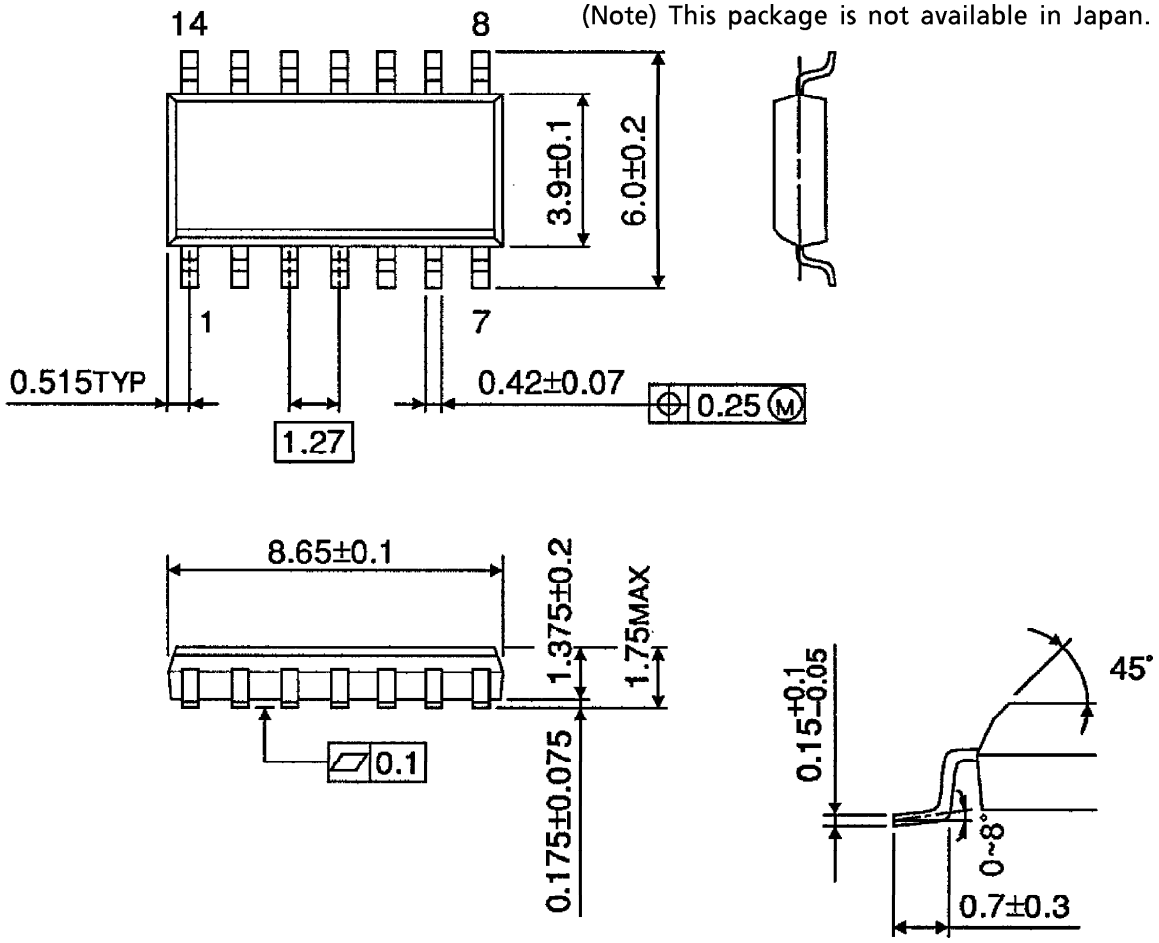
Weight : 0.18g (Typ.)

OUTLINE DRAWING

SOL14-P-150-1.27

Unit : mm

(Note) This package is not available in Japan.

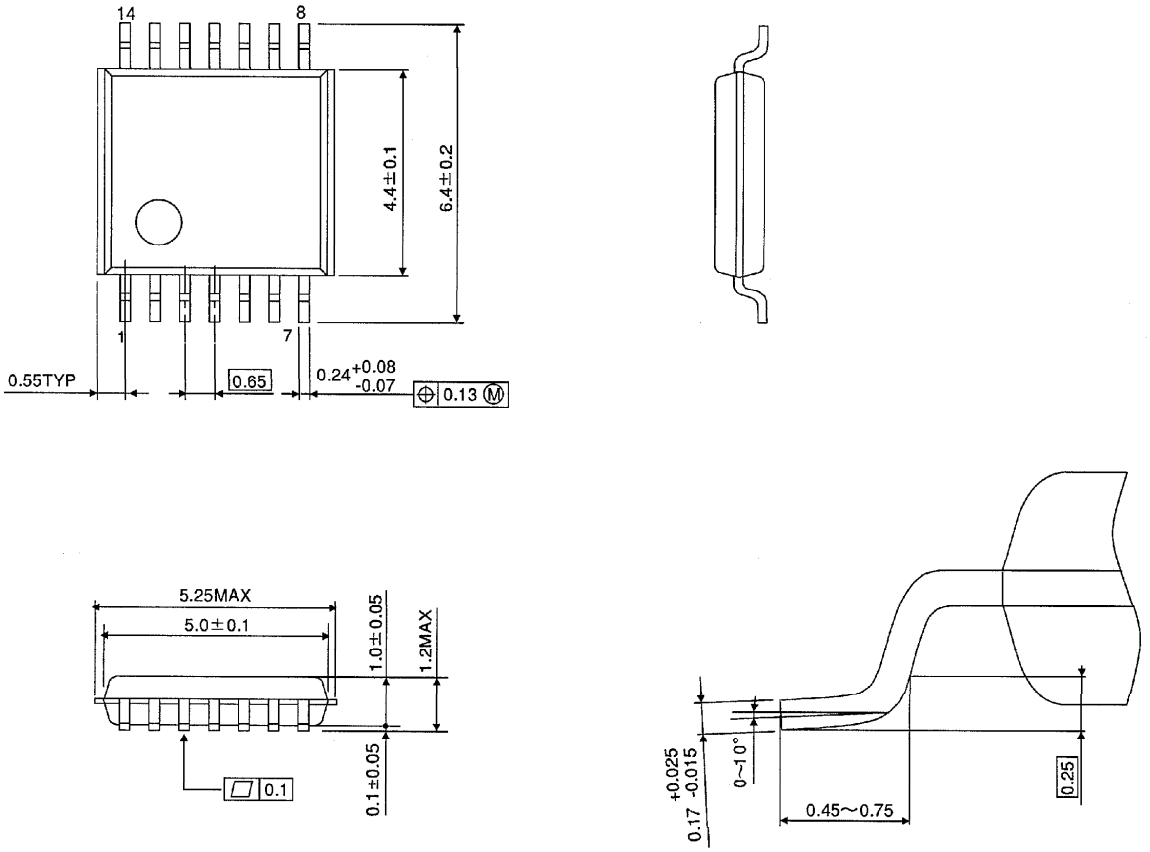


Weight : 0.12g (Typ.)

OUTLINE DRAWING

TSSOP14-P-0044-0.65

Unit : mm



Weight : 0.06g (Typ.)