

**TC74VHCT374AF, TC74VHCT374AFW, TC74VHCT374AFT**

**OCTAL D - TYPE FLIP - FLOP WITH 3 - STATE OUTPUT**

The TC74VHCT374A is an advanced high speed CMOS OCTAL FLIP - FLOP with 3 - STATE OUTPUT fabricated with silicon gate C<sup>2</sup>MOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. This 8 - bit D - type flip - flop is controlled by a clock input (CK) and a output enable input (OE). When the OE input is high, the eight outputs are in a high impedance state. The input voltage are compatible with TTL output voltage. This device may be used as a level converter for interfacing 3.3V to 5V system. Input protection and output circuit ensure that 0 to 5.5V can be applied to the input and output\*1 pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input / output voltages such as battery back up, hot board insertion, etc.

\*1: output in off-state

**FEATURES:**

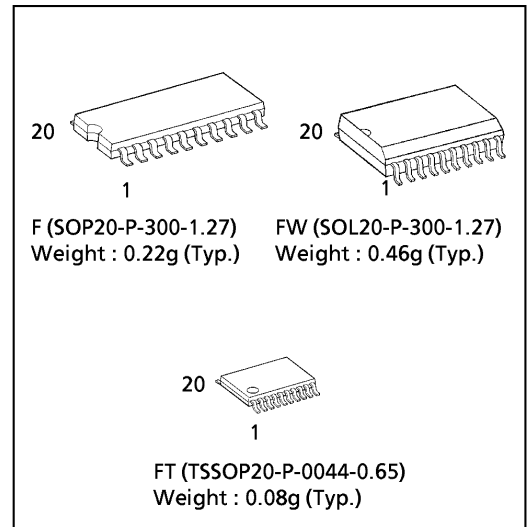
- High Speed..... $f_{MAX} = 140\text{MHz}(\text{typ.})$   
at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs....  $V_{IL} = 0.8\text{V}(\text{Max.})$   
 $V_{IH} = 2.0\text{V}(\text{Min.})$
- Power Down Protection is provided on all inputs and outputs.
- Balanced Propagation Delays.....  $t_{PLH} \approx t_{PHL}$
- Low Noise .....  $V_{OLP} = 1.6\text{V}(\text{Max.})$
- Pin and Function Compatible with the 74 series (74AC / HC / F / ALS / LS etc.) 374 type.

**TRUTH TABLE**

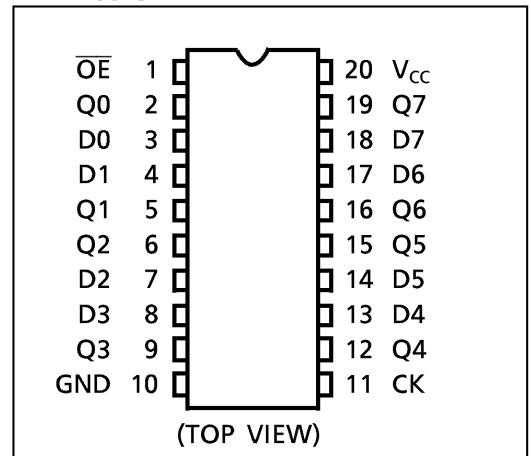
INPUTS			OUTPUT
OE	CK	D	
H	X	X	Z
L		X	Q <sub>n</sub>
L		L	L
L		H	H

X : Don't Care  
Z : High Impedance  
Q<sub>n</sub> : No Change

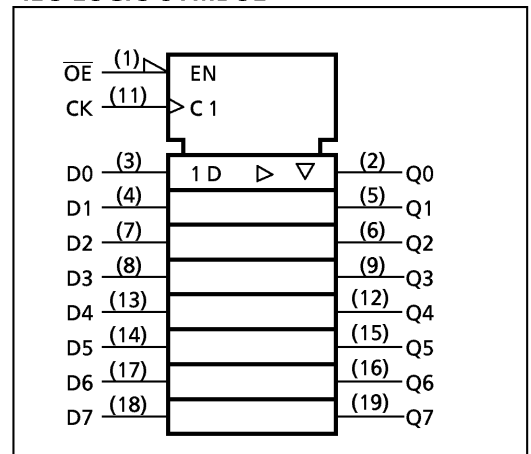
(Note) The JEDEC SOP (FW) is not available in Japan.



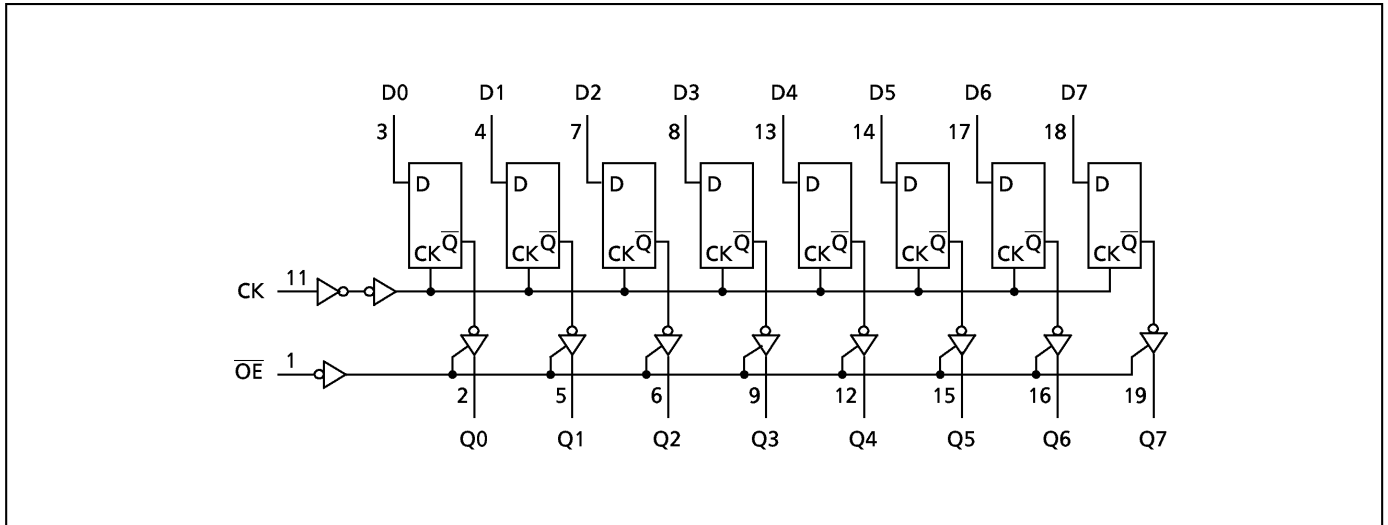
**PIN ASSIGNMENT**



**IEC LOGIC SYMBOL**



SYSTEM DIAGRAM



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	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	$I_{IK}$	-20	mA
Output Diode Current	$I_{OK}$	±20 (Note 3)	mA
DC Output Current	$I_{OUT}$	±25	mA
DC Vcc/Ground Current	$I_{CC}$	±75	mA
Power Dissipation	$P_D$	180	mW
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)  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	$V_{CC}$	4.5~5.5	V
Input Voltage	$V_{IN}$	0~5.5	V
Output Voltage	$V_{OUT}$	0~5.5 (Note 4)	V
		0~ $V_{CC}$ (Note 5)	
Operating Temperature	$T_{opr}$	-40~85	°C
Input Rise and Fall Time	$dt / dv$	0~20	ns / V

(Note 4) Output in Off-State

(Note 5) High or Low State

## DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITON		V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		UNIT
					MIN.	TYP.	MAX.	MIN.	MAX.	
High - Level Input Voltage	V <sub>IH</sub>			4.5~5.5	2.0	—	—	2.0	—	V
Low - Level Input Voltage	V <sub>IL</sub>			4.5~5.5	—	—	0.8	—	0.8	V
High - Level Output Voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -50μA	4.5	4.40	4.50	—	4.40	—	V
			I <sub>OH</sub> = -8mA	4.5	3.94	—	—	3.80	—	
Low - Level Output Voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 50μA	4.5	—	0.0	0.10	—	0.10	V
			I <sub>OL</sub> = 8mA	4.5	—	—	0.36	—	0.44	
3 - State Output Off - State Current	I <sub>OZ</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = V <sub>CC</sub> or GND		5.5	—	—	±0.25	—	±2.50	μA
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5V or GND		0~5.5	—	—	±0.1	—	±1.0	
Quiescent Supply Current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		5.5	—	—	4.0	—	40.0	
	I <sub>CCT</sub>	PER INPUT : V <sub>IN</sub> = 3.4V OTHER INPUT : V <sub>CC</sub> or GND		5.5	—	—	1.35	—	1.50	mA
Output Leakage Current	I <sub>OPD</sub>	V <sub>OUT</sub> = 5.5V		0	—	—	+0.5	—	+5.0	μA

TIMING REQUIREMENTS (Input t<sub>r</sub> = t<sub>f</sub> = 3ns)

PARAMETER	SYMBOL	TEST CONDITION	V <sub>CC</sub> (V)	Ta = 25°C		Ta = -40~85°C	UNIT
				TYP .	LIMIT	LIMIT	
Minimum Pulse Width (CK)	t <sub>W(H)</sub> t <sub>W(L)</sub>		5.0 ± 0.5	—	6.5	8.5	ns
Minimum Set - up Time	t <sub>s</sub>		5.0 ± 0.5	—	2.5	2.5	
Minimum Hold Time	t <sub>h</sub>		5.0 ± 0.5	—	2.5	2.5	

**AC ELECTRICAL CHARACTERISTICS ( Input  $t_r = t_f = 3ns$  )**

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT		
			V <sub>CC</sub> (V)	CL (pF)	MIN.	TYP.	MAX.		MIN.	MAX.
Propagation Delay Time (CK-Q)	t <sub>pLH</sub> t <sub>pHL</sub>		5.0 ± 0.5	15	—	4.1	9.4	1.0	10.5	ns
				50	—	5.6	10.4	1.0	11.5	
3-State Output Enable Time	t <sub>pZL</sub> t <sub>pZH</sub>	RL = 1kΩ	5.0 ± 0.5	15	—	6.5	10.2	1.0	11.5	
				50	—	7.3	11.2	1.0	12.5	
3-State Output Disable Time	t <sub>pLZ</sub> t <sub>pHZ</sub>	RL = 1kΩ	5.0 ± 0.5	50	—	7.0	11.2	1.0	12.0	
Maximum Clock Frequency	f <sub>MAX</sub>		5.0 ± 0.5	15	90	140	—	80	—	MHz
				50	85	130	—	75	—	
Output to Output Skew	t <sub>osLH</sub> t <sub>osHL</sub>	(Note 6)	5.0 ± 0.5	50	—	—	1.0	—	1.0	ns
Input Capacitance	C <sub>I</sub> N				—	4	10	—	10	pF
Output Capacitance	C <sub>OUT</sub>				—	9	—	—	—	
Power Dissipation Capacitance	C <sub>PD</sub>		(Note 7)		—	25	—	—	—	

(Note 6) Parameter guaranteed by design.  $t_{osLH} = |t_{pLHm} - t_{pLHn}|$ ,  $t_{osHL} = |t_{pHLm} - t_{pHLn}|$

(Note 7) C<sub>PD</sub> 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 :

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

And the total C<sub>PD</sub> when n pcs. of Latch operate can be gained by the following equation :

$$C_{PD} \text{ (total)} = 14 + 11 \cdot n$$

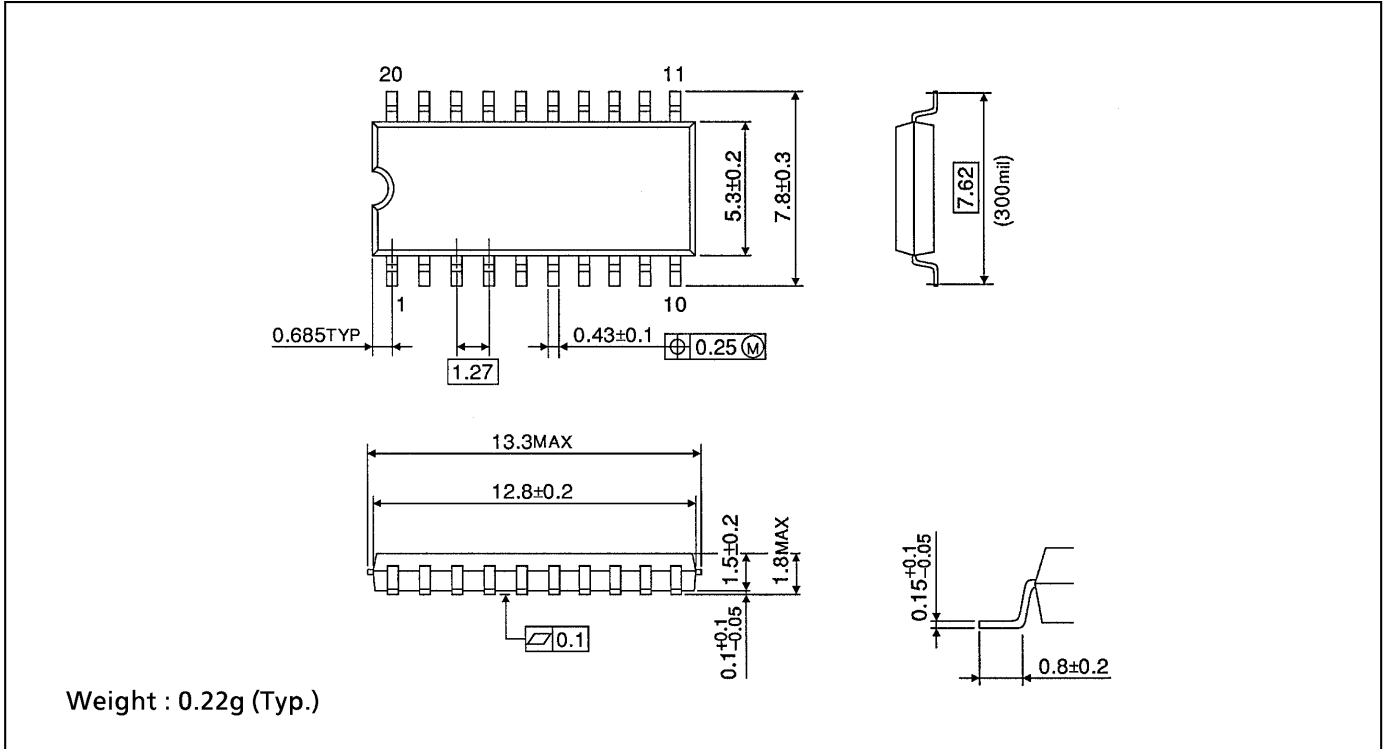
**NOISE CHARACTERISTICS ( Input  $t_r = t_f = 3ns$  )**

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			UNIT
			V <sub>CC</sub> (V)	TYP.	MAX.	
Quiet Output Maximum Dynamic V <sub>OL</sub>	V <sub>OLP</sub>	C <sub>L</sub> = 50pF	5.0	1.1 (1.2)	1.5 (1.6)	V
Quiet Output Minimum Dynamic V <sub>OL</sub>	V <sub>OLV</sub>	C <sub>L</sub> = 50pF	5.0	-1.1 (-1.2)	-1.5 (-1.6)	V
Minimum High Level Dynamic Input Voltage	V <sub>IHD</sub>	C <sub>L</sub> = 50pF	5.0	—	2.0	V
Maximum Low Level Dynamic Input Voltage	V <sub>ILD</sub>	C <sub>L</sub> = 50pF	5.0	—	0.8	V

(Note) The value in ( ) only applies to JEDEC SOP (FW) devices.

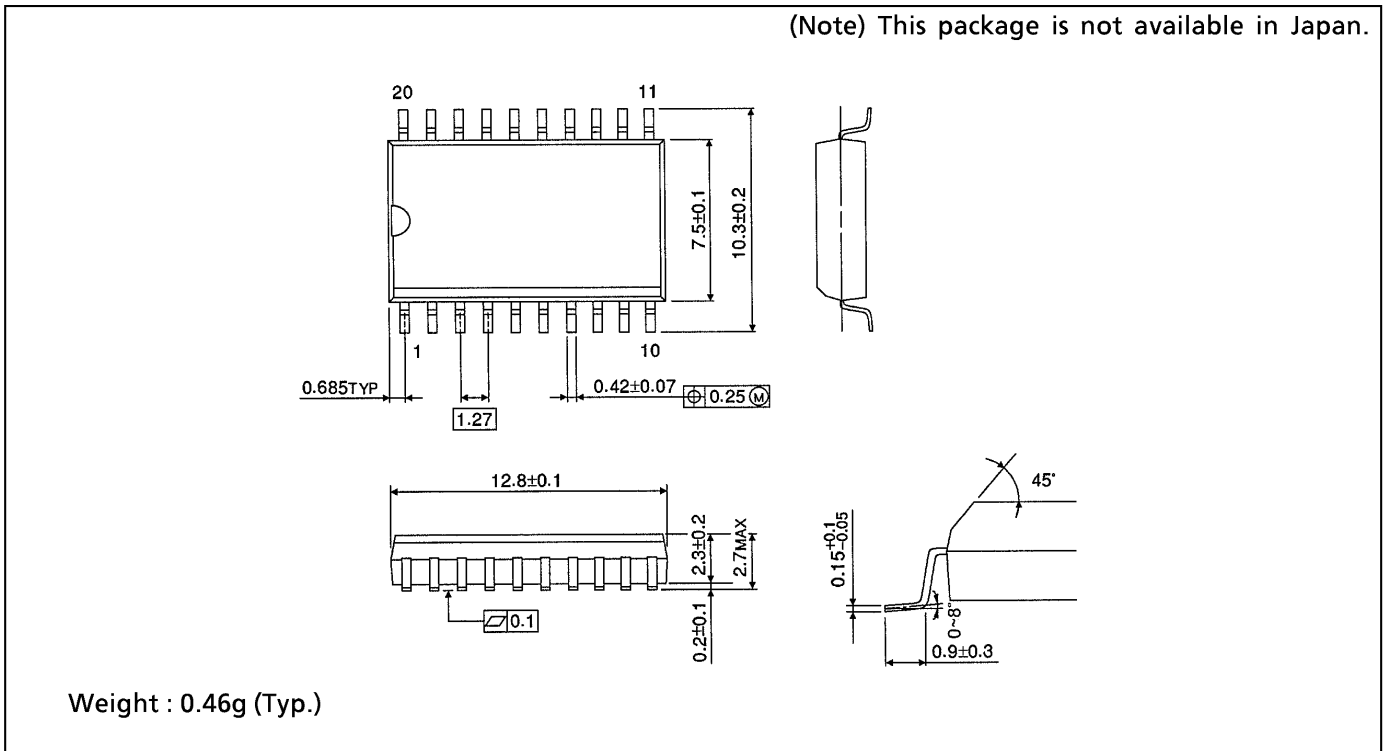
**SOP 20PIN (200mil BODY) PACKAGE DIMENSIONS (SOP20-P-300-1.27)**

Unit in mm



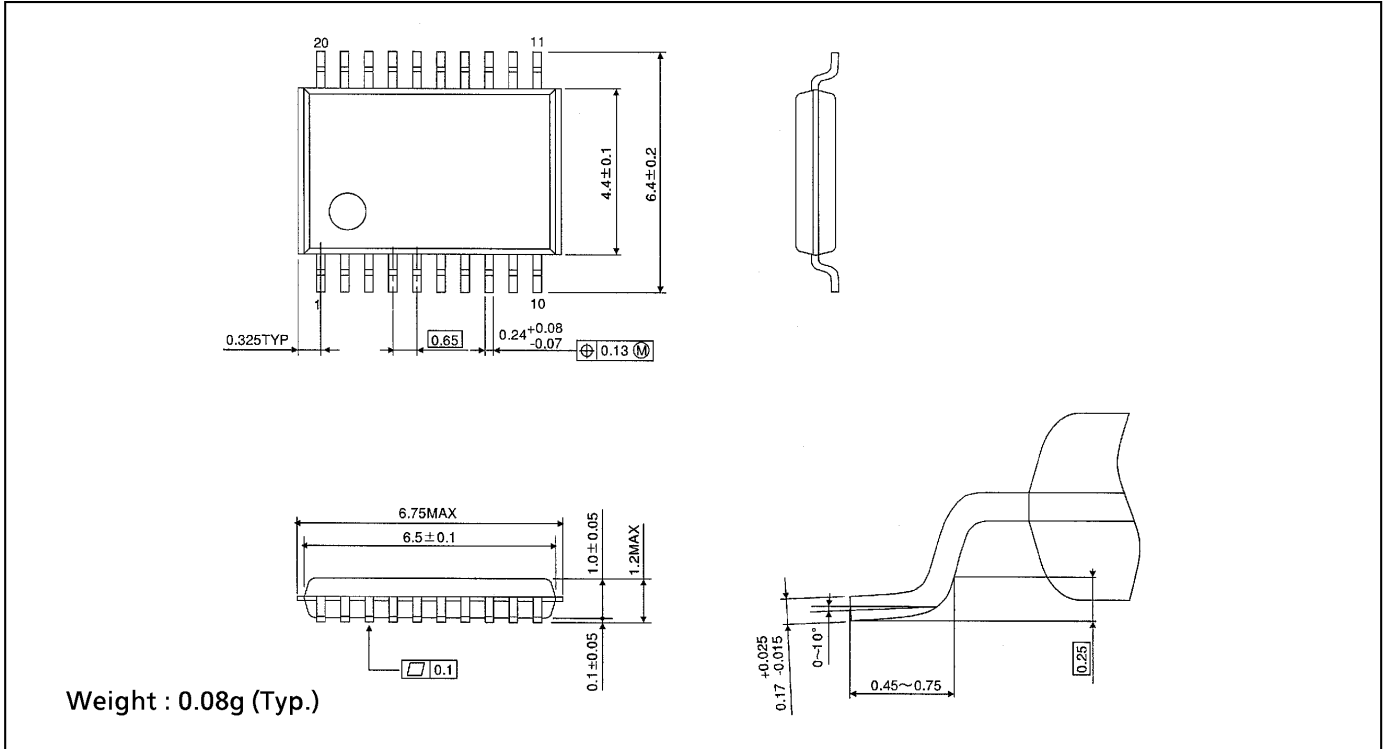
**SOP 20PIN (300mil BODY) PACKAGE DIMENSIONS (SOP20-P-300-1.27)**

Unit in mm



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

Unit in mm



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