

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**TC74LCX273F, TC74LCX273FW, TC74LCX273FT**

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

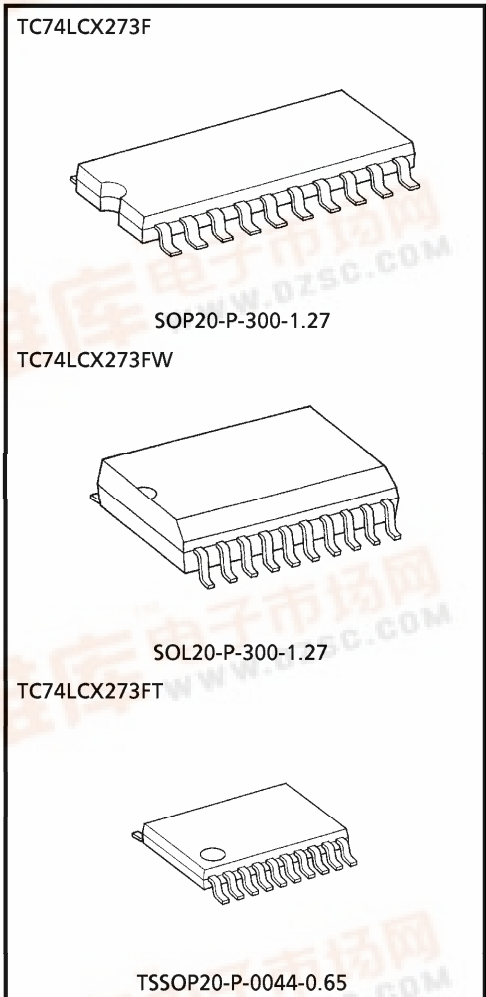
The TC74LCX273 is a high performance CMOS OCTAL D-TYPE FLIP FLOP. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

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

This 8bit D-type flip-flop is controlled by a clock input (CK) and a clear input ( $\overline{CLR}$ ). When the  $\overline{CLR}$  input is low, the eight outputs are at a low logic level.

All inputs are equipped with protection circuits against static discharge.

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



**FEATURES**

- Low voltage operation :  $V_{CC} = 2.0\sim 3.6\text{ V}$
- High speed operation :  $t_{pd} = 8.5\text{ ns (max)}$   
( $V_{CC} = 3.0\sim 3.6\text{ V}$ )
- Output current :  $|I_{OH}|/I_{OL} = 24\text{ mA (min)}$   
( $V_{CC} = 3.0\text{ V}$ )
- Latch-up performance :  $\pm 500\text{ mA}$
- 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.) 273 type.

Weight

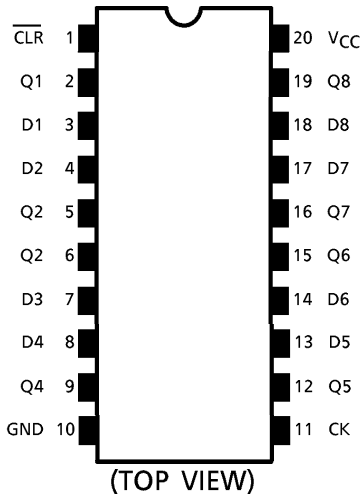
SOP20-P-300-1.27	: 0.22 g (Typ.)
SOL20-P-300-1.27	: 0.46 g (Typ.)
TSSOP20-P-0044-0.65	: 0.08 g (Typ.)

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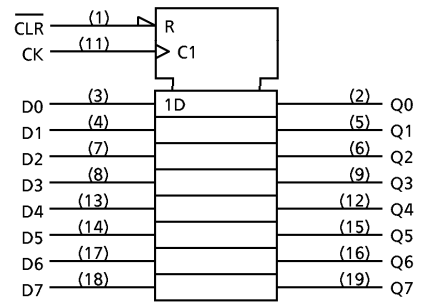
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**PIN ASSIGNMENT**



**IEC LOGIC SYMBOL**

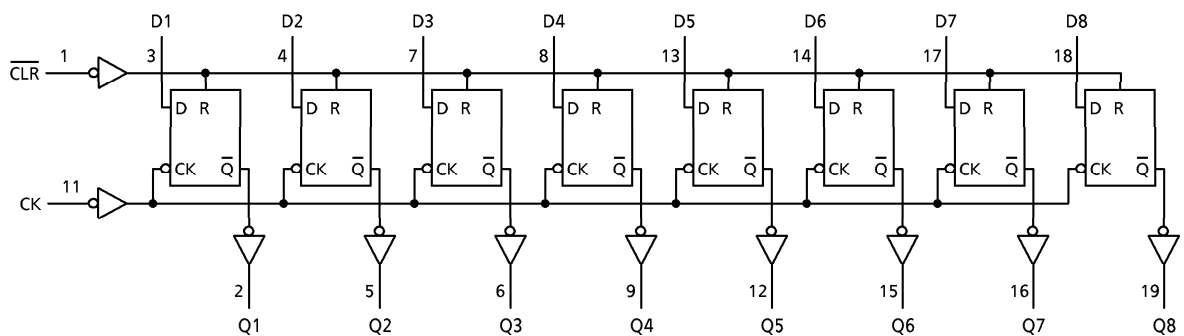


**TRUTH TABLE**

INPUTS			OUTPUTS	FUNCTION
CLR	D	CK	Q	
L	X	X	L	Clear
H	L		L	—
H	H		H	—
H	X		Qn	No change

X : Don't Care

**SYSTEM DIAGRAM**



## 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) :  $V_{CC} = 0\text{ V}$

(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	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) :  $V_{CC} = 0\text{ V}$

(Note 6) : High or Low State

(Note 7) :  $V_{CC} = 3.0\sim 3.6\text{ V}$

(Note 8) :  $V_{CC} = 2.7\sim 3.0\text{ V}$

(Note 9) :  $V_{IN} = 0.8\sim 2.0\text{ V}$ ,  $V_{CC} = 3.0\text{ V}$

**ELECTRICAL CHARACTERISTICS**

DC characteristics (Ta = -40~85°C)

PARAMETER		SYMBOL	TEST CONDITION		MIN	MAX	UNIT	
				V <sub>CC</sub> (V)				
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> = -100 μA	2.7~3.6	V <sub>CC</sub> - 0.2	—	V
				I <sub>OH</sub> = -12 mA	2.7	2.2	—	
				I <sub>OH</sub> = -18 mA	3.0	2.4	—	
				I <sub>OH</sub> = -24 mA	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> = 100 μA	2.7~3.6	—	0.2	
				I <sub>OL</sub> = 12 mA	2.7	—	0.4	
				I <sub>OL</sub> = 16 mA	3.0	—	0.4	
				I <sub>OL</sub> = 24 mA	3.0	—	0.55	
Input Leakage Current		I <sub>IN</sub>	V <sub>IN</sub> = 0~5.5 V	2.7~3.6	—	± 5.0	μA	
Power Off Leakage Current		I <sub>OFF</sub>	V <sub>IN</sub> / V <sub>OUT</sub> = 5.5 V	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> = 3.6~5.5 V	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> - 0.6 V	2.7~3.6	—	500	μA	

AC characteristics (Ta = -40~85°C)

PARAMETER	SYMBOL	TEST CONDITION	V <sub>CC</sub> (V)	MIN	MAX	UNIT
Maximum Clock Frequency	f <sub>MAX</sub>	(Fig.1, 2)	2.7	—	—	MHz
			3.3 ± 0.3	150	—	
Propagation Delay Time (CK-Q)	t <sub>pLH</sub> t <sub>pHL</sub>	(Fig.1, 2)	2.7	—	9.5	ns
			3.3 ± 0.3	1.5	8.5	
Propagation Delay Time (CLR-Q)	t <sub>pHL</sub>	(Fig.1, 3)	2.7	—	9.5	ns
			3.3 ± 0.3	1.5	8.5	
Minimum Pulse Width (CK)	t <sub>w</sub> (H) t <sub>w</sub> (L)	(Fig.1, 2)	2.7	3.3	—	ns
			3.3 ± 0.3	3.3	—	
Minimum Pulse Width (CLR)	t <sub>w</sub> (L)	(Fig.1, 3)	2.7	3.3	—	ns
			3.3 ± 0.3	3.3	—	
Minimum Set-Up Time	t <sub>s</sub>	(Fig.1, 2)	2.7	2.5	—	ns
			3.3 ± 0.3	2.5	—	
Minimum Hold Time	t <sub>h</sub>	(Fig.1, 2)	2.7	1.5	—	ns
			3.3 ± 0.3	1.5	—	
Minimum Removal Time	t <sub>rem</sub>	(Fig.1, 4)	2.7	2.5	—	ns
			3.3 ± 0.3	2.0	—	
Output To Output Skew	t <sub>osLH</sub> t <sub>osHL</sub>	(Note 10)	2.7	—	—	ns
			3.3 ± 0.3	—	1.0	

(Note 10) : Parameter guaranteed by design.  
 (t<sub>osLH</sub> = |t<sub>pLHm</sub> - t<sub>pLHn</sub>|, t<sub>osHL</sub> = |t<sub>pHLm</sub> - t<sub>pHLn</sub>|)

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

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> = 3.3 V, V <sub>IL</sub> = 0 V	3.3	0.8	V
Quiet Output Minimum Dynamic V <sub>OL</sub>	V <sub>OLV</sub>	V <sub>IH</sub> = 3.3 V, V <sub>IL</sub> = 0 V	3.3	0.8	V

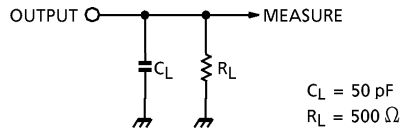
**CAPACITIVE CHARACTERISTICS** (Ta = 25°C)

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>		0	8	pF
Power Dissipation Capacitance	C <sub>PD</sub>	f <sub>IN</sub> = 10 MHz (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<sub>CC</sub>(opr.) = C<sub>PD</sub> · V<sub>CC</sub> · f<sub>IN</sub> + I<sub>CC</sub>/8 (per bit)

**TEST CIRCUIT**

Fig.1



**AC WAVEFORM**

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

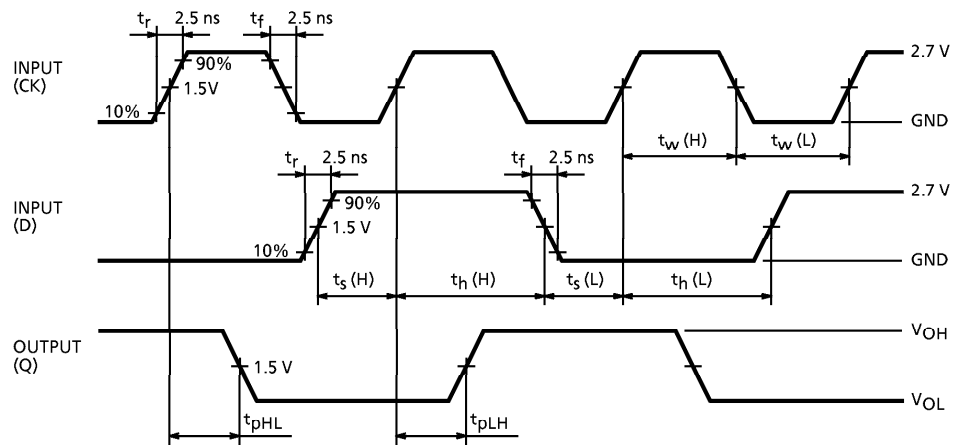


Fig.3  $t_{pLH}$ ,  $t_{pHL}$

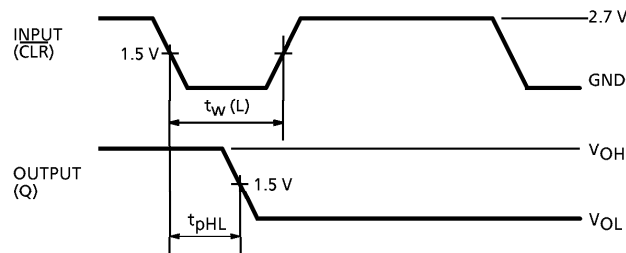
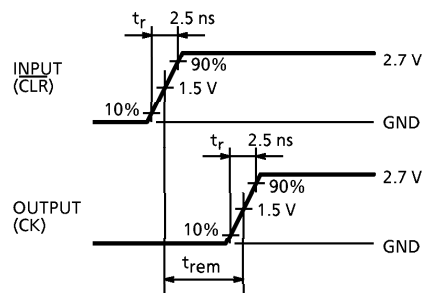
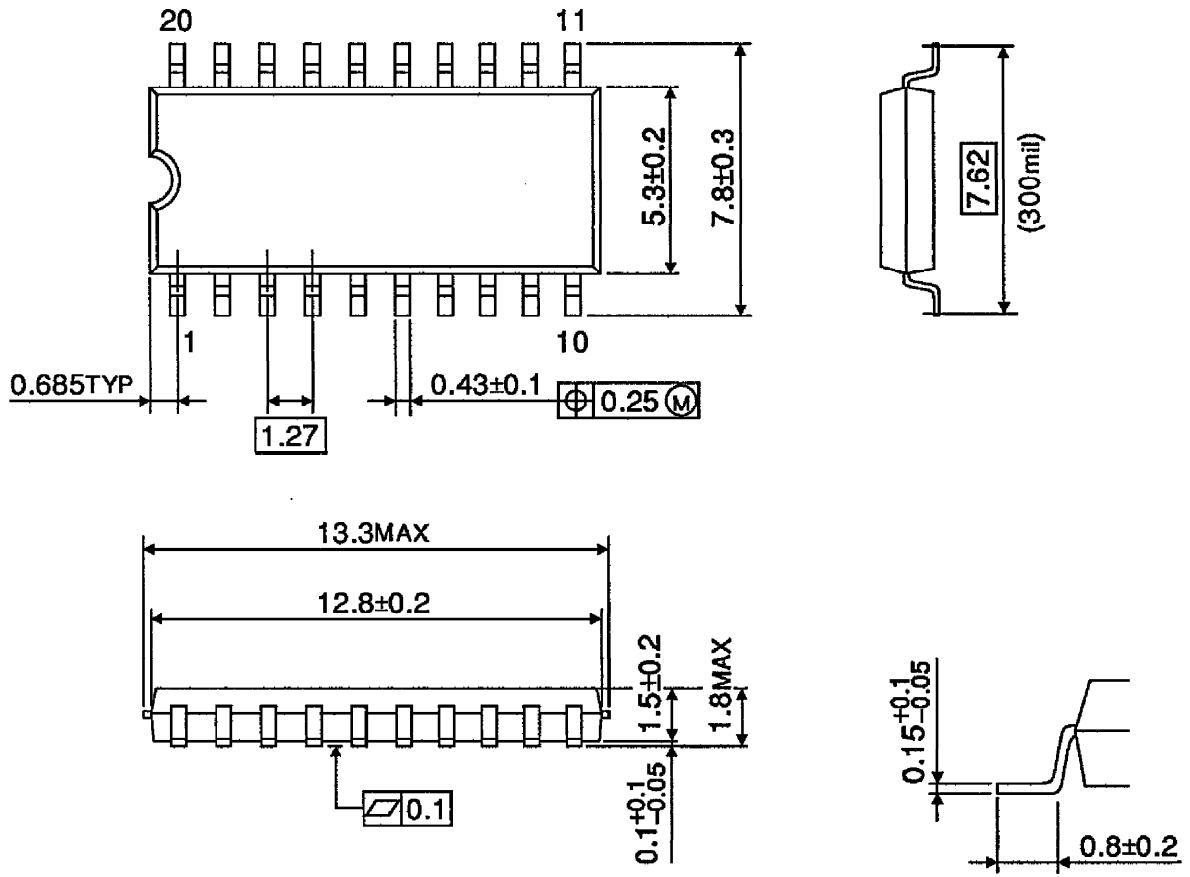


Fig.4  $t_{rem}$



**PACKAGE DIMENSIONS**  
SOP20-P-300-1.27

Unit : mm

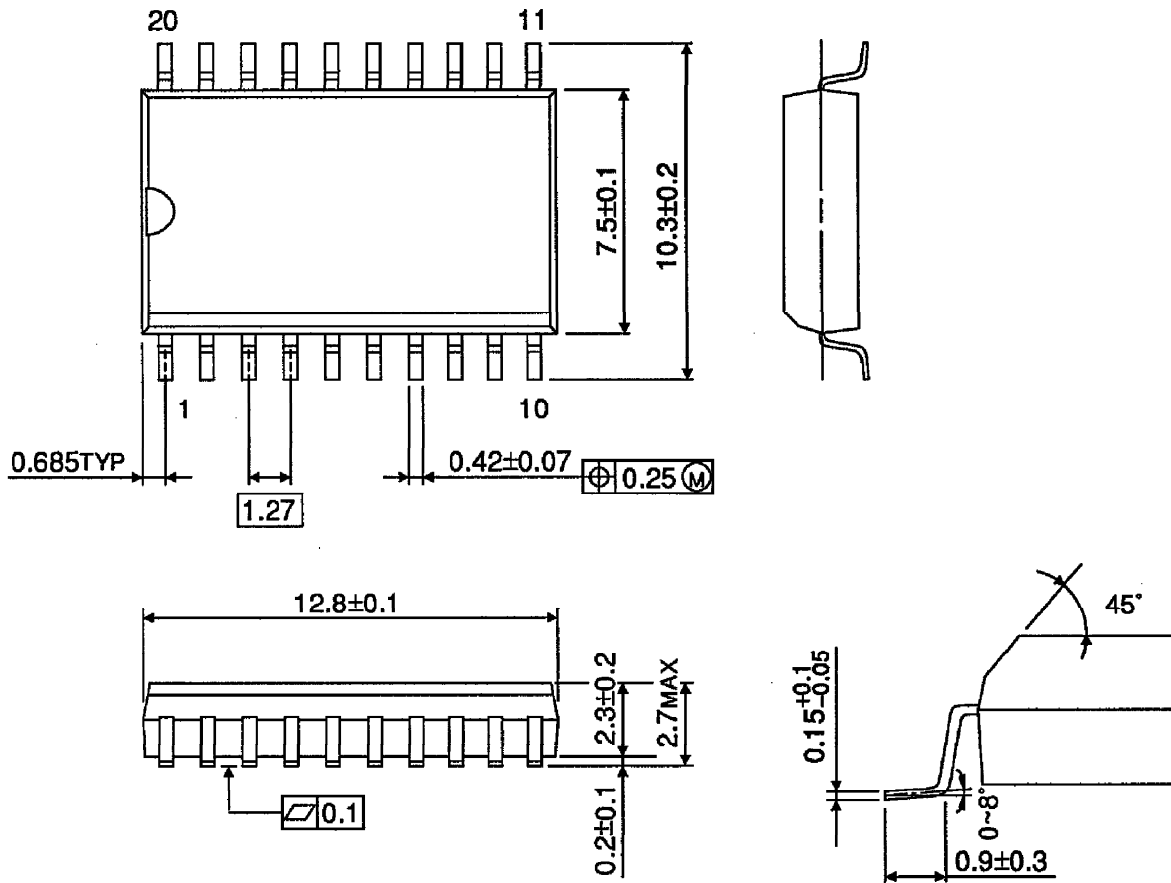


Weight : 0.22 g (Typ.)

**PACKAGE DIMENSIONS**  
SOL20-P-300-1.27

Unit : mm

(Note) This package is not available in Japan.

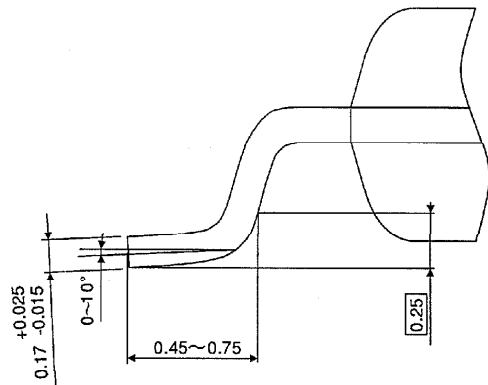
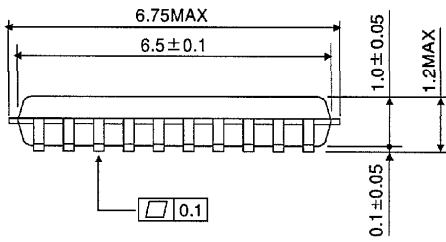
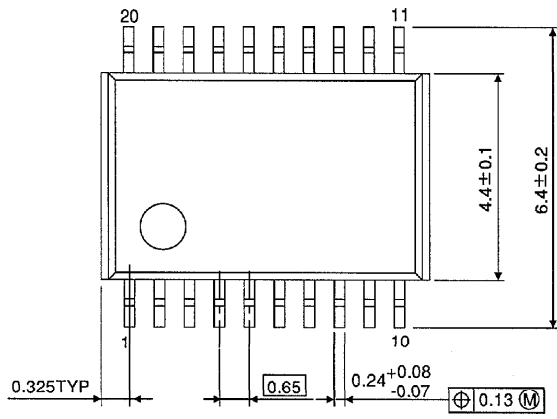


Weight : 0.46 g (Typ.)



**PACKAGE DIMENSIONS**  
TSSOP20-P-0044-0.65

Unit : mm



Weight : 0.08 g (Typ.)