

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

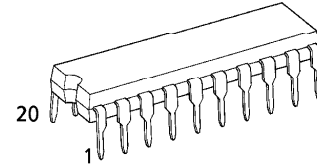
TC74HC299AP, TC74HC299AF

8-BIT PIPO SHIFT REGISTER WITH ASYNCHRONOUS CLEAR

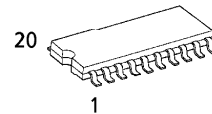
The TC74HC299A is a high speed CMOS 8-BIT PIPO SHIFT REGISTER fabricated with silicon gate C²MOS technology. It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation. It has four modes (HOLD, SHIFT LEFT, SHIFT RIGHT and LOAD DATA) controlled by the two selection inputs (S0, S1). When one or both enable ($\overline{G1}$, $\overline{G2}$) are high, the eight I/O outputs are forced to the high-impedance state; however, sequential operation or clearing of the register is not affected. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES:

- High Speed..... $f_{MAX} = 42\text{MHz}(\text{typ.})$ at $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$ at $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}(\text{Min.})$
- Output Drive Capability 15 LSTTL Loads For QA~QH
10 LSTTL Loads For QA', QH'
- Symmetrical Output Impedance...
 $|I_{OH}| = I_{OL} = 6\text{mA}(\text{min.})$ For QA~QH
 $|I_{OH}| = I_{OL} = 4\text{mA}(\text{min.})$ For QA', QH'
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range.... $V_{CC}(\text{opr.}) = 2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 74LS299



P (DIP20-P-300-2.54A)
Weight : 1.30g (Typ.)



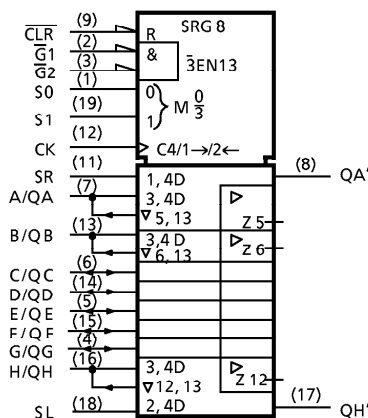
F (SOP20-P-300-1.27)
Weight : 0.22g (Typ.)

PIN ASSIGNMENT

S0	1	20	V_{CC}
$\overline{G1}$	2	19	S1
$\overline{G2}$	3	18	SL
G/QG	4	17	QH'
E/QE	5	16	H/QH
C/QC	6	15	F/QF
A/QA	7	14	D/QD
QA'	8	13	B/QB
CLR	9	12	CK
GND	10	11	SR

(TOP VIEW)

IEC LOGIC SYMBOL



APPLICATION NOTES

- 1) Do not apply a signal to any bus terminal when it is in the output mode. Damage may result.
- 2) All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors.

961001EBA2

● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

TRUTH TABLE

MODE	INPUTS								INPUTS/ OUTPUTS		OUTPUTS	
	$\overline{\text{CLR}}$	FUNCTION SELECT		OUTPUT CONTROL		CLOCK	SERIAL					
		S1	S0	$\overline{\text{G1}}^*$	$\overline{\text{G2}}^*$	CK	SL	SR	A/QA	H/QH	QA'	QH'
Z	L	H	H	X	X	X	X	X	Z	Z	L	L
CLR	L	L	X	L	L	X	X	X	L	L	L	L
	L	X	L	L	L	X	X	X	L	L	L	L
HOLD	H	L	L	L	L	X	X	X	QA0	QH0	QA0	QH0
SHIFT	H	L	H	L	L		X	H	H	QGn	H	QGn
RIGHT	H	L	H	L	L		X	L	L	QGn	L	QGn
SHIFT	H	H	L	L	L		H	X	QBn	H	QBn	H
LEFT	H	H	L	L	L		L	X	QBn	L	QBn	L
LOAD	H	H	H	X	X		X	X	a	h	a	h

* When one or both output controls are high, the eight input/output terminals are in the high-impedance state; however sequential or clearing of the register is not affected.

Z : High Impedance

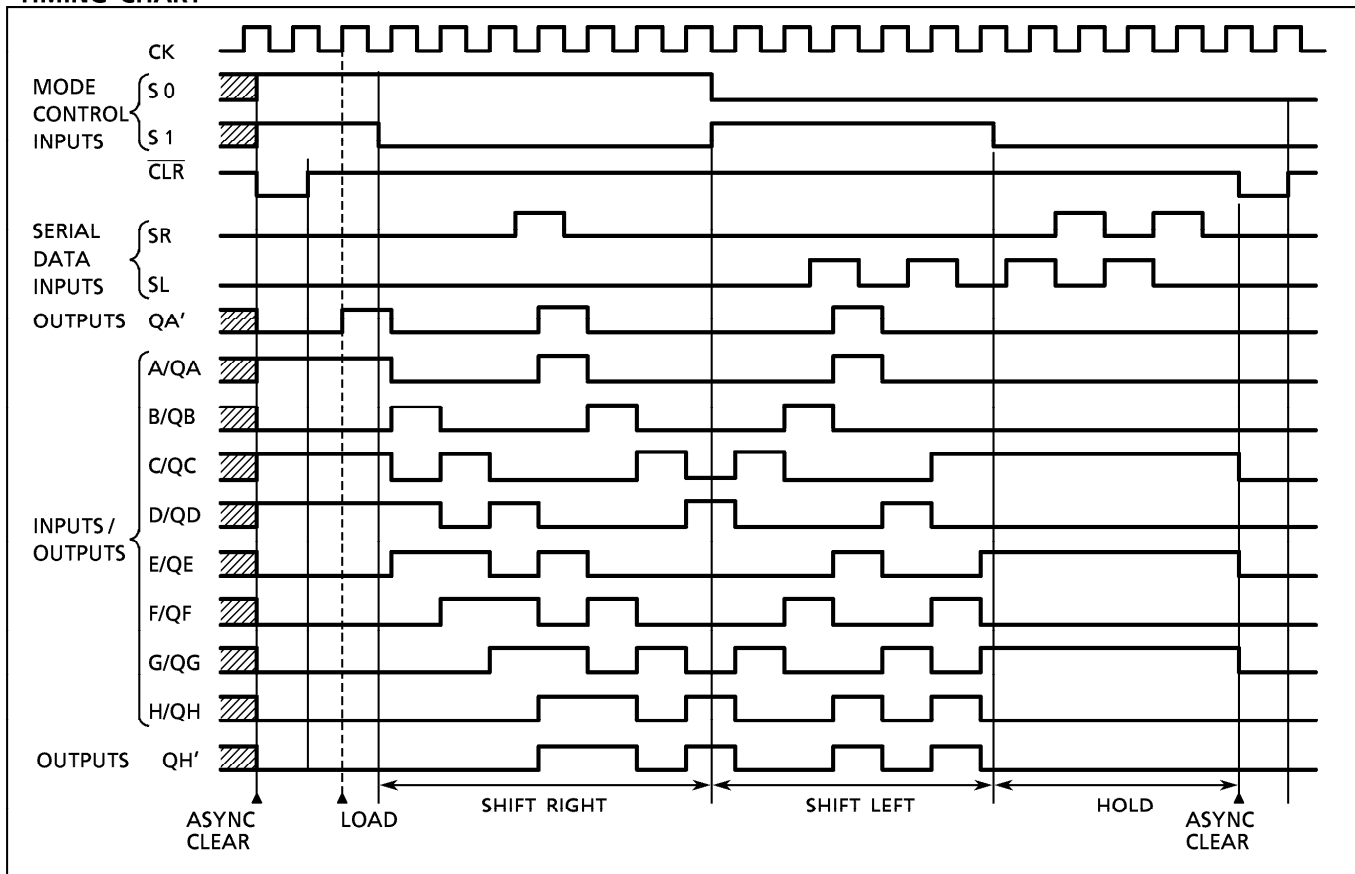
Qn0 : The level of Qn before the indicated steady - state input conditions were established.

Qnn : The level of Qn before the most recent active transition indicated by $\downarrow$ or $\uparrow$.

a, h : The level of the steady - state inputs A, H, respectively.

X : Don't Care.

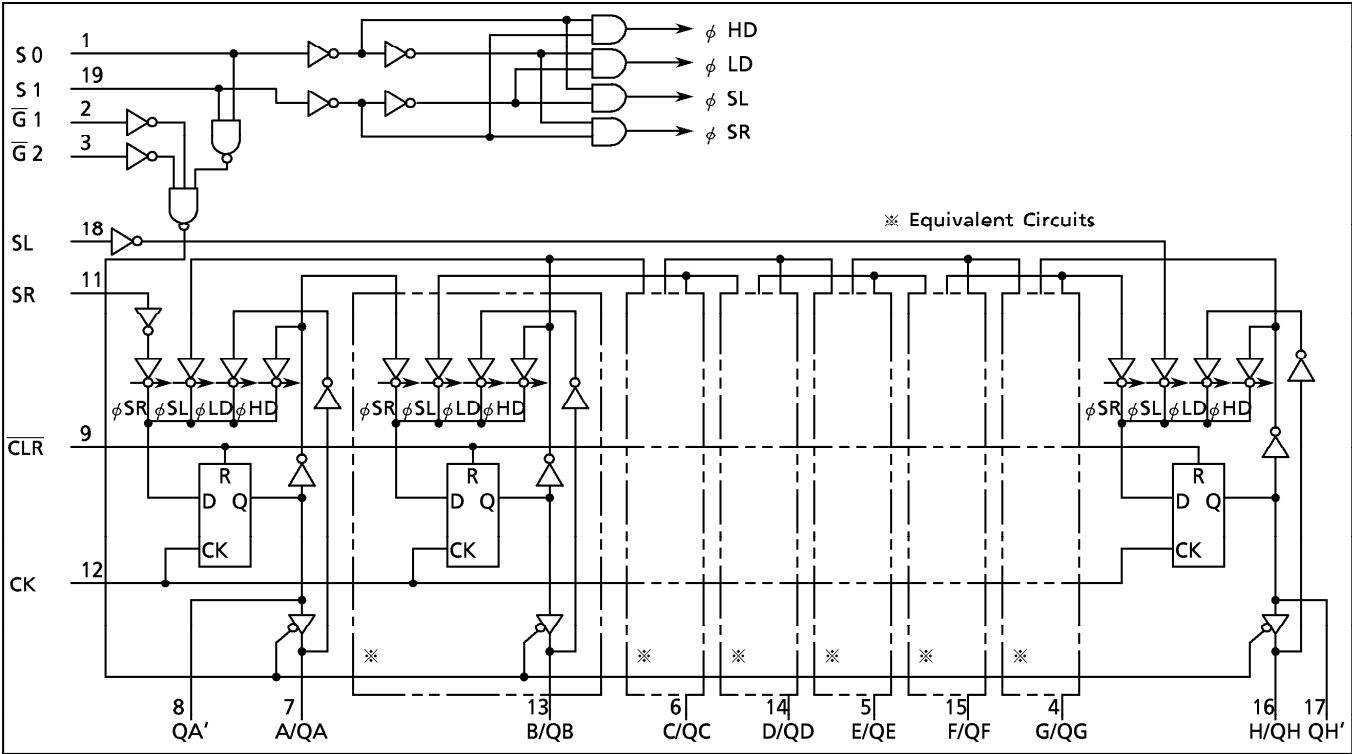
TIMING CHART



961001EBA2'

- The products described in this document are subject to foreign exchange and foreign trade control laws.
- 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.

SYSTEM DIAGRAM



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	$-0.5 \sim 7$	V
DC Input Voltage	V_{IN}	$-0.5 \sim V_{CC} + 0.5$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim V_{CC} + 0.5$	V
Input Diode Current	I_{IK}	± 20	mA
Output Diode Current	I_{OK}	± 20	mA
DC Output Current (Q_H') ($Q_A \sim Q_H$)	I_{OUT}	± 25 ± 35	mA
DC V_{CC} / Ground Current	I_{CC}	± 75	mA
Power Dissipation	P_D	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	T_{stg}	$-65 \sim 150$	$^{\circ}\text{C}$

*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}	$2 \sim 6$	V
Input Voltage	V_{IN}	$0 \sim V_{CC}$	V
Output Voltage	V_{OUT}	$0 \sim V_{CC}$	V
Operating Temperature	T_{opr}	$-40 \sim 85$	$^{\circ}\text{C}$
Input Rise and Fall Time	t_r, t_f	$0 \sim 1000 (V_{CC} = 2.0\text{V})$ $0 \sim 500 (V_{CC} = 4.5\text{V})$ $0 \sim 400 (V_{CC} = 6.0\text{V})$	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 4.5 6.0	1.50 3.15 4.20	— — —	— — —	1.50 3.15 4.20	— — —	V
Low - Level Input Voltage	V_{IL}		2.0 4.5 6.0	— — —	— — —	0.50 1.35 1.80	— — —	0.50 1.35 1.80	V
High - Level Output Voltage	V_{OH}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OH} = -20\mu\text{A}$	2.0 4.5 6.0	1.9 4.4 5.9	2.0 4.5 6.0	— — —	1.9 4.4 5.9	— — —	V
		Q'_A, Q'_H $I_{OH} = -4 \text{ mA}$ $I_{OH} = -5.2 \text{ mA}$	4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	— —	
		$Q_A \sim Q_H$ $I_{OH} = -6 \text{ mA}$ $I_{OH} = -7.8 \text{ mA}$	4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	— —	
Low - Level Output Voltage	V_{OL}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OL} = 20\mu\text{A}$	2.0 4.5 6.0	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	0.1 0.1 0.1	V
		Q'_A, Q'_H $I_{OL} = 4 \text{ mA}$ $I_{OL} = 5.2 \text{ mA}$	4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	0.33 0.33	
		$Q_A \sim Q_H$ $I_{OL} = 6 \text{ mA}$ $I_{OL} = 7.8 \text{ mA}$	4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	0.33 0.33	
3 - State Output Off - State Current	I_{OZ}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = V_{CC} \text{ or GND}$	6.0	—	—	± 0.5	—	± 5.0	μA
Input Leakage Current	I_{IN}	$V_{IN} = V_{CC} \text{ or GND}$	6.0	—	—	± 0.1	—	± 1.0	
Quiescent Supply Current	I_{CC}	$V_{IN} = V_{CC} \text{ or GND}$	6.0	—	—	4.0	—	40.0	

TIMING RECOMMENDED OPERATING CONDITIONS (Input $t_r = t_f = 6\text{ns}$)

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			UNIT
			V _{CC} (V)	TYP.	LIMIT	
Minimum Pulse Width (CK)	$t_{W(H)}$ $t_{W(L)}$		2.0	—	75	95
			4.5	—	15	19
			6.0	—	13	16
Minimum Pulse Width ($\overline{\text{CLR}}$)	$t_{W(L)}$		2.0	—	75	88
			4.5	—	15	18
			6.0	—	12	15
Minimum Set-up Time ($\overline{\text{SL}}$, SR, A~H)	t_s		2.0	—	100	125
			4.5	—	20	25
			6.0	—	17	21
Minimum Set-up Time (S0, S1)	t_s		2.0	—	100	125
			4.5	—	20	25
			6.0	—	17	21
Minimum Hold Time (SL, SR, A~H)	t_h		2.0	—	0	0
			4.5	—	0	0
			6.0	—	0	0
Minimum Hold Time (S0, S1)	t_h		2.0	—	0	0
			4.5	—	0	0
			6.0	—	0	0
Minimum Removal Time (CLR)	t_{rem}		2.0	—	50	65
			4.5	—	10	13
			6.0	—	8	10
Clock Frequency	f		2.0	—	6	5
			4.5	—	30	24
			6.0	—	35	23

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

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time (QA', QH')	t _{TLH} t _{THL}		—	4	8	ns
Propagation Delay Time (CK—QA', QH')	t _{pLH} t _{pHL}		—	19	30	
Propagation Delay Time (CLR—QA', QH')	t _{pLH} t _{pHL}		—	17	30	
Maximum Clock Frequency	f _{MAX}		35	73	—	MHz

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 6\text{ns}$)

PARAMETER	SYMBOL	TEST CONDITION	CL (pF)	V _{CC} (V)	Ta = 25°C			Ta = -40~85°C		UNIT
					MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time (QA~QH)	t_{TLH} t_{THL}		50	2.0	—	25	60	—	75	ns
				4.5	—	7	12	—	15	
				6.0	—	6	10	—	13	
Output Transition Time (QA', QH')	t_{TLH} t_{THL}		50	2.0	—	30	75	—	95	
				4.5	—	8	15	—	19	
				6.0	—	7	13	—	16	
Propagation Delay Time (CK—QA'QH')	t_{PLH} t_{PHL}		50	2.0	—	85	170	—	215	
				4.5	—	23	34	—	43	
				6.0	—	18	29	—	37	
Propagation Delay Time (CLR—QA'QH')	t_{PHL}		50	2.0	—	85	175	—	220	
				4.5	—	24	35	—	44	
				6.0	—	18	30	—	37	
Propagation Delay Time (CK—QA~QH)	t_{PLH} t_{PHL}		50	2.0	—	80	160	—	200	
				4.5	—	21	32	—	40	
				6.0	—	17	27	—	34	
			150	2.0	—	100	200	—	250	
				4.5	—	26	40	—	50	
				6.0	—	21	34	—	43	
Propagation Delay Time (CLR—QA~QH)	t_{PHL}		50	2.0	—	85	190	—	240	
				4.5	—	24	38	—	48	
				6.0	—	18	30	—	38	
			150	2.0	—	105	230	—	90	
				4.5	—	29	46	—	58	
				6.0	—	22	36	—	46	
Output Enable time	t_{pZL} t_{pZH}	$R_L = 1\text{k}\Omega$	50	2.0	—	60	130	—	165	
				4.5	—	17	26	—	33	
				6.0	—	13	22	—	28	
			150	2.0	—	78	170	—	215	
				4.5	—	23	34	—	43	
				6.0	—	17	29	—	36	
Output Disable time	t_{pLZ} t_{pHZ}	$R_L = 1\text{k}\Omega$	50	2.0	—	54	150	—	190	
				4.5	—	19	30	—	38	
				6.0	—	16	26	—	33	
Maximum Clock Frequency	f_{MAX}		50	2.0	6	12	—	5	—	MHz
				4.5	30	58	—	24	—	
				6.0	35	80	—	28	—	
Input Capacitance	C_{IN}				—	5	10	—	10	pF
Output Capacitance	C_{OUT}				—	13	—	—	—	
Power Dissipation Capacitance	$C_{\text{PD}}(1)$				—	170	—	—	—	

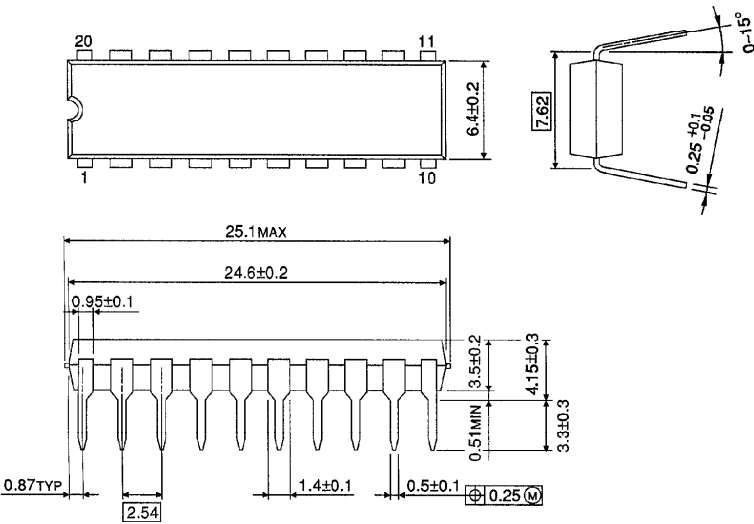
Note (1) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

DIP 20PIN OUTLINE DRAWING (DIP20-P-300-2.54A)

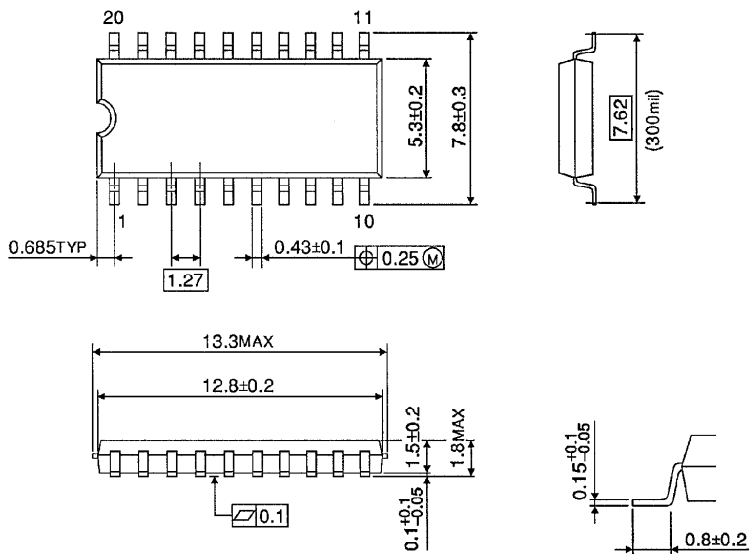
Unit in mm



Weight : 1.30g (Typ.)

SOP 20PIN (200mil BODY) OUTLINE DRAWING (SOP20-P-300-1.27)

Unit in mm



Weight : 0.22g (Typ.)