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 C^2MOS technology.

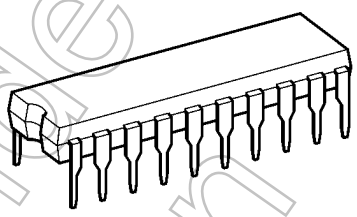
It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

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.

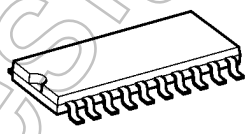
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

TC74HC299AP



DIP20-P-300-2.54A

TC74HC299AF



SOP20-P-300-1.27A

Weight

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

SOP20-P-300-1.27A : 0.22 g (typ.)

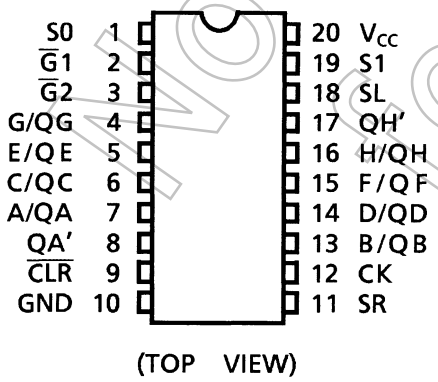
Features (Note 1) (Note 2)

- High speed: f_{max} = 42 MHz (typ.) at V_{CC} = 5 V
- Low power dissipation: I_{CC} = 4 μA (max) at Ta = 25°C
- High noise immunity: $V_{NIH} = V_{NIL}$ = 28% V_{CC} (min)
- Outputs drive capability
  : 15 LSTTL loads for QA to QH
  10 LSTTL loads for QA', QH'
- Symmetrical output impedance
  : $|I_{OH}| = I_{OL}$ = 6 mA (min) For QA to QH
  $|I_{OH}| = I_{OL}$ = 4 mA (min) For QA', QH'
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: V_{CC} (opr) = 2 to 6 V
- Pin and function compatible with 74LS299

Note 1: Do not apply a signal to any bus terminal when it is in the output mode. Damage may result.

Note 2: All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors.

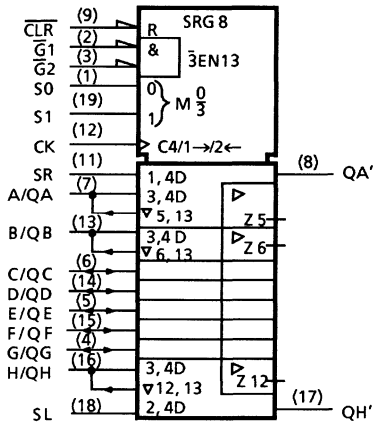
Pin Assignment



(TOP VIEW)

Start of commercial production
1987-10

IEC Logic Symbol



Truth Table

Mode	Inputs								Inputs /Outputs		Outputs	
	$\overline{CLR}$	Function Select		Outputs Control		Clock	Serial		A/QA	H/QH	QA'	QH'
		S1	S0	$\overline{G1}$ (Note)	$\overline{G2}$ (Note)	CK	SL	SR				
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 Right	H	L	H	L	L	↑	X	H	H	QGn	H	QGn
	H	L	H	L	L	↑	X	L	L	QGn	L	QGn
Shift Left	H	H	L	L	L	↑	H	X	QBn	H	QBn	H
	H	H	L	L	L	↑	L	X	QBn	L	QBn	L
Load	H	H	H	X	X	↑	X	X	a	h	a	h

Note: 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

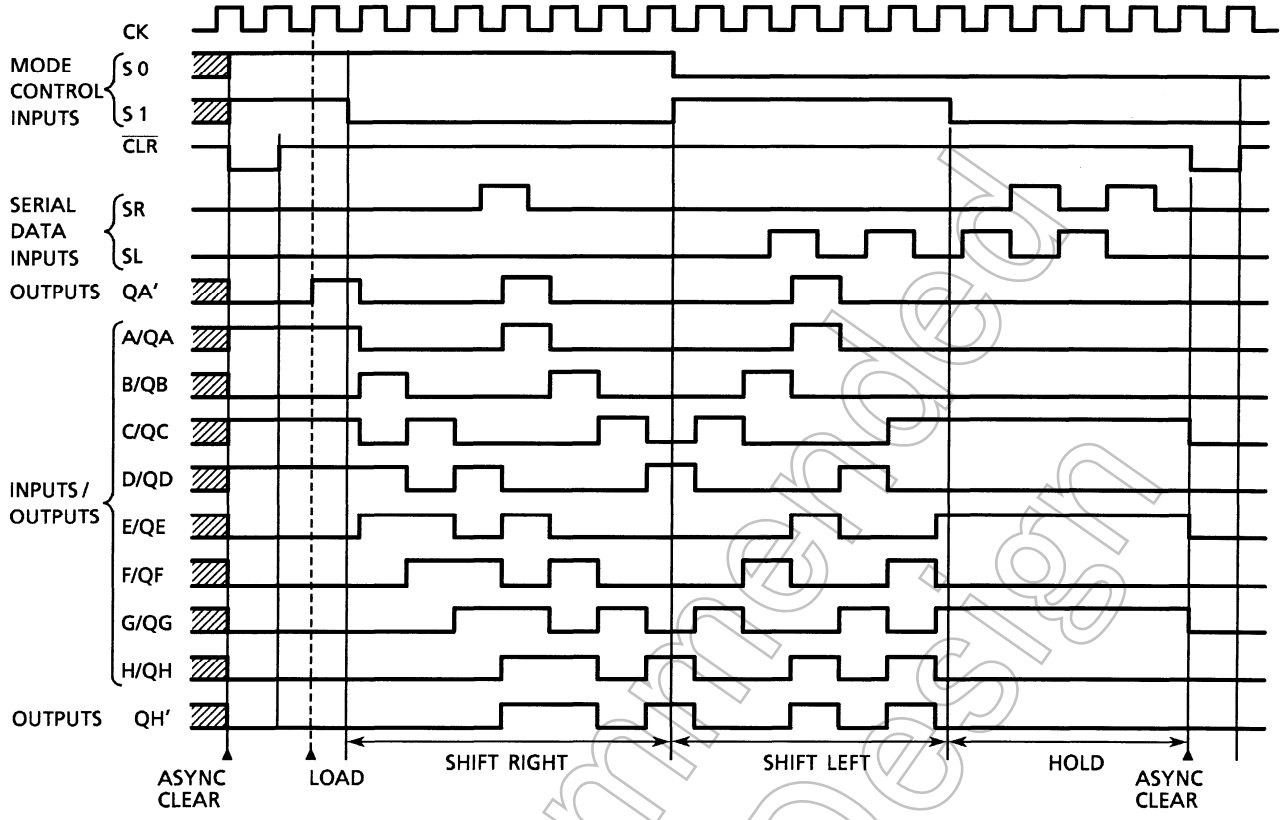
Qn0: The level of Qn before the indicated steady-state input conditions were established.

Qnn: The level of Qn before the most recent active transition indicated by ↓ or ↑.

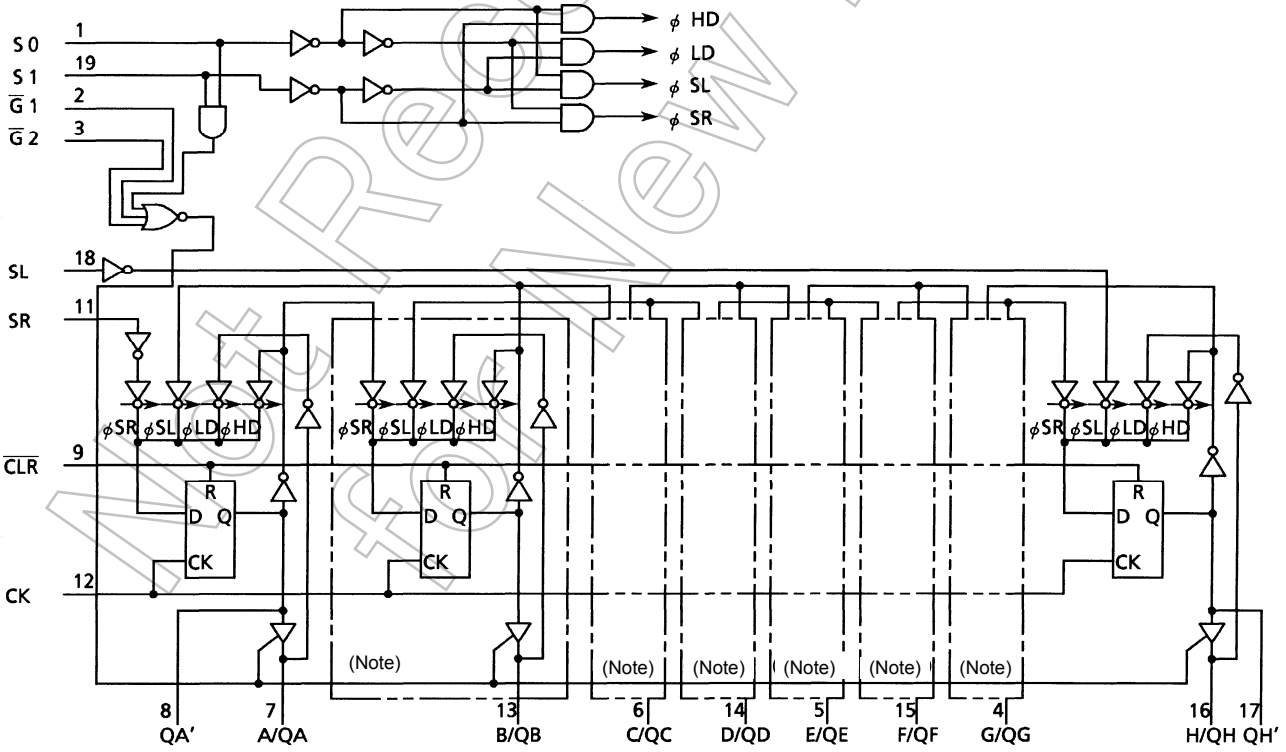
a, h: The level of the steady-state inputs A, H, respectively.

X: Don't care.

Timing Chart



System Diagram



Note: Equivalent circuits

Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	−0.5 to 7	V
DC input voltage	V_{IN}	−0.5 to V_{CC} + 0.5	V
DC output voltage	V_{OUT}	−0.5 to V_{CC} + 0.5	V
Input diode current	I_{IK}	±20	mA
Output diode current	I_{OK}	±20	mA
DC output current (QH')	I_{OUT}	±25	mA
DC output current (QA to QH)	I_{OUT}	±35	mA
DC V_{CC}/ground current	I_{CC}	±75	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	T_{stg}	−65 to 150	°C

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: 500 mW in the range of Ta = −40 to 65°C. From Ta = 65 to 85°C a derating factor of −10 mW/°C shall be applied until 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2 to 6	V
Input voltage	V_{IN}	0 to V_{CC}	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	−40 to 85	°C
Input rise and fall time	t_r, t_f	0 to 1000 (V_{CC} = 2.0 V)	ns
		0 to 500 (V_{CC} = 4.5 V)	
		0 to 400 (V_{CC} = 6.0 V)	

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either V_{CC} or GND.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition			V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40 to 85°C Min	Ta = −40 to 85°C Max	Unit
High-level input voltage	V_{IH}	—			2.0	1.50	—	—	1.50	—	V
					4.5	3.15	—	—	3.15	—	
					6.0	4.20	—	—	4.20	—	
Low-level input voltage	V_{IL}	—			2.0	—	—	0.50	—	0.50	V
					4.5	—	—	1.35	—	1.35	
					6.0	—	—	1.80	—	1.80	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}		I_{OH} = −20 μA	2.0	1.9	2.0	—	1.9	—	V
					4.5	4.4	4.5	—	4.4	—	
					6.0	5.9	6.0	—	5.9	—	
			QA', QH'	I_{OH} = −4 mA	4.5	4.18	4.31	—	4.13	—	
				I_{OH} = −5.2 mA	6.0	5.68	5.80	—	5.63	—	
			QA to QH	I_{OH} = −6 mA	4.5	4.18	4.31	—	4.13	—	
				I_{OH} = −7.8 mA	6.0	5.68	5.80	—	5.63	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}		I_{OL} = 20 μA	2.0	—	0.0	0.1	—	0.1	V
					4.5	—	0.0	0.1	—	0.1	
					6.0	—	0.0	0.1	—	0.1	
			QA', QH'	I_{OL} = 4 mA	4.5	—	0.17	0.26	—	0.33	
				I_{OL} = 5.2 mA	6.0	—	0.18	0.26	—	0.33	
			QA to QH	I_{OL} = 6 mA	4.5	—	0.17	0.26	—	0.33	
				I_{OL} = 7.8 mA	6.0	—	0.18	0.26	—	0.33	
3-state output off state current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND			6.0	—	—	±0.5	—	±5.0	μA
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND			6.0	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND			6.0	—	—	4.0	—	40.0	μA

Timing Recommended Operating Conditions (input: $t_r = t_f = 6$ ns)

Characteristics	Symbol	Test Condition		Ta = 25°C		Ta = −40 to 85°C	Unit
			V_{CC} (V)	Typ.	Limit	Limit	
Minimum pulse width (CK)	$t_{W(H)}$ / $t_{W(L)}$	—	2.0	—	75	95	ns
			4.5	—	15	19	
			6.0	—	13	16	
Minimum pulse width ($\overline{CLR}$)	$t_{W(L)}$	—	2.0	—	75	88	ns
			4.5	—	15	18	
			6.0	—	12	15	
Minimum set-up time ($\overline{SL}$, SR, A to H)	t_s	—	2.0	—	100	125	ns
			4.5	—	20	25	
			6.0	—	17	21	
Minimum set-up time (S0, S1)	t_s	—	2.0	—	100	125	ns
			4.5	—	20	25	
			6.0	—	17	21	
Minimum hold time (SL, SR, A to H)	t_h	—	2.0	—	0	0	ns
			4.5	—	0	0	
			6.0	—	0	0	
Minimum hold time (S0, S1)	t_h	—	2.0	—	0	0	ns
			4.5	—	0	0	
			6.0	—	0	0	
Minimum removal time ($\overline{CLR}$)	t_{rem}	—	2.0	—	50	65	ns
			4.5	—	10	13	
			6.0	—	8	10	
Clock frequency	f	—	2.0	—	6	5	ns
			4.5	—	30	24	
			6.0	—	35	23	

AC Characteristics ($C_L = 15$ pF, $V_{CC} = 5$ V, Ta = 25°C, input: $t_r = t_f = 6$ ns)

Characteristics	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	ns
Propagation delay time ($\overline{CLR}$-QA', QH')	t_{pHL}	—	—	17	30	ns
Maximum clock frequency	f_{max}	—	35	73	—	MHz

AC Characteristics (input: $t_r = t_f = 6$ ns)

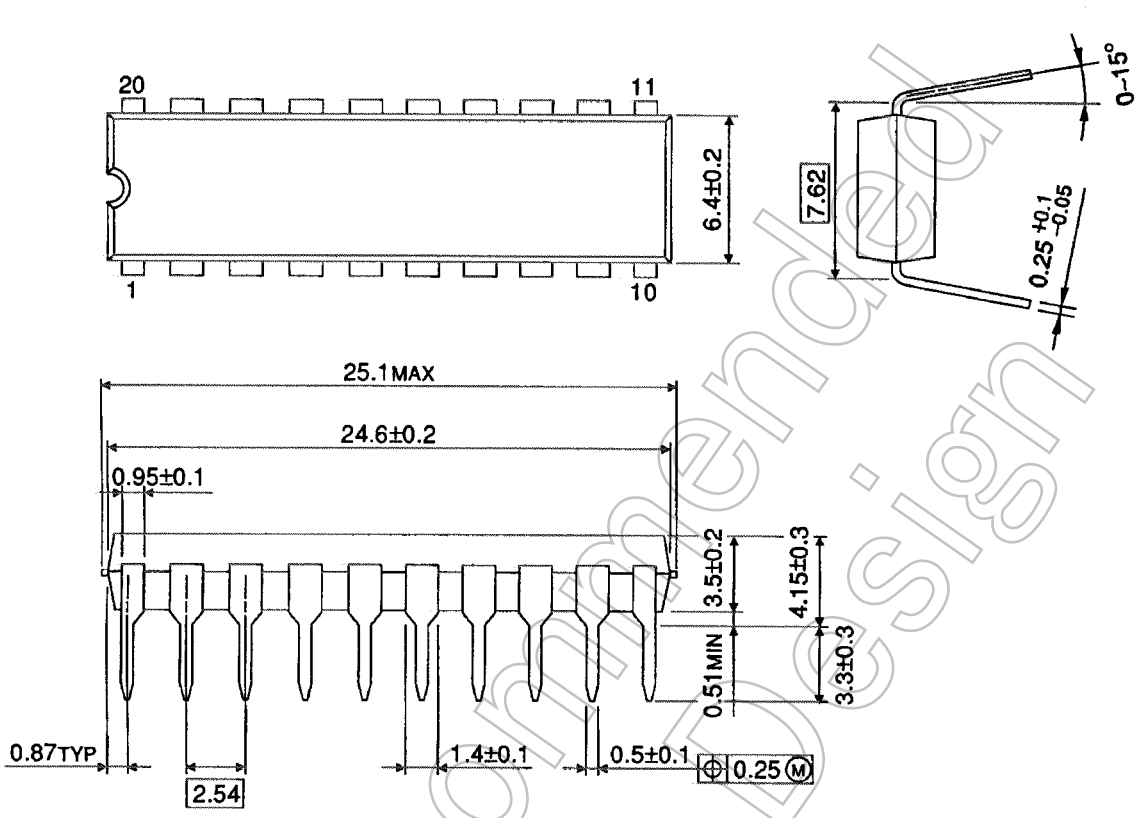
Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = −40 to 85°C		Unit
			CL (pF)	V_{CC} (V)	Min	Typ.	Max	Min	Max	
Output transition time (QA to QH)	t_{TLH} t_{THL}	—	50	2.0	—	25	60	—	75	ns
				4.5	—	7	12	—	15	
				6.0	—	6	10	—	13	
Output transition time (QA', QH')	t_{TLH} t_{THL}	—	50	2.0	—	30	75	—	95	ns
				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	ns
				4.5	—	23	34	—	43	
				6.0	—	18	29	—	37	
Propagation delay time ($\overline{CLR}$ -QA', QH')	t_{pHL}	—	50	2.0	—	85	175	—	220	ns
				4.5	—	24	35	—	44	
				6.0	—	18	30	—	37	
Propagation delay time (CK-QA to QH)	t_{pLH} t_{pHL}	—	50	2.0	—	80	160	—	200	ns
				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 ($\overline{CLR}$ -QA to QH)	t_{pHL}	—	50	2.0	—	85	190	—	240	ns
				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}	$R_L = 1$ kΩ	50	2.0	—	60	130	—	165	ns
				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}	$R_L = 1$ kΩ	50	2.0	—	54	150	—	190	ns
				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	—	—	—	pF
Power dissipation capacitance	C_{PD} (Note)	—			—	170	—	—	—	pF

Note: 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:

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

Package Dimensions

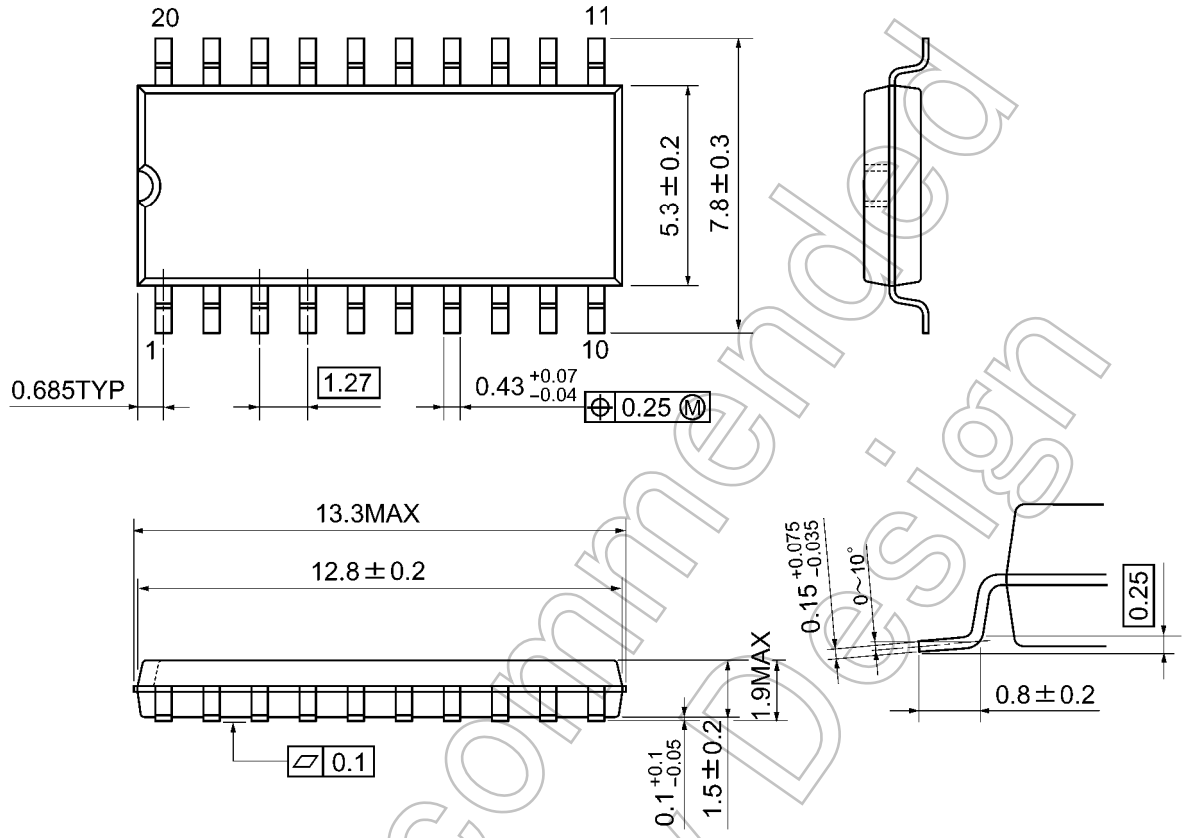
DIP20-P-300-2.54A Unit : mm



Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A Unit: mm



Weight: 0.22 g (typ.)

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