

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74AC299P, TC74AC299F

8-Bit PIPO Shift Register with Asynchronousclear

The TC74AC299 is an advanced high speed CMOS 8-BIT PIPO SHIFT REGISTER fabricated with silicon gate and double-layer metal wiring C²MOS technology.

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

It has a 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.

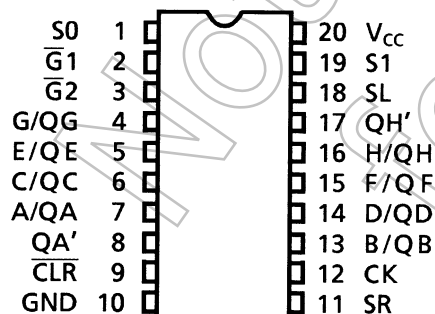
Features (Note 1)(Note 2)

- High speed: $f_{max} = 150$ MHz (typ.) at $V_{CC} = 5$ V
- Low power dissipation: $I_{CC} = 8$ μ A (max) at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\%$ V_{CC} (min)
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 24$ mA (min)
Capability of driving 50 Ω transmission lines.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC}(\text{opr}) = 2$ to 5.5 V
- Pin and function compatible with 74F299

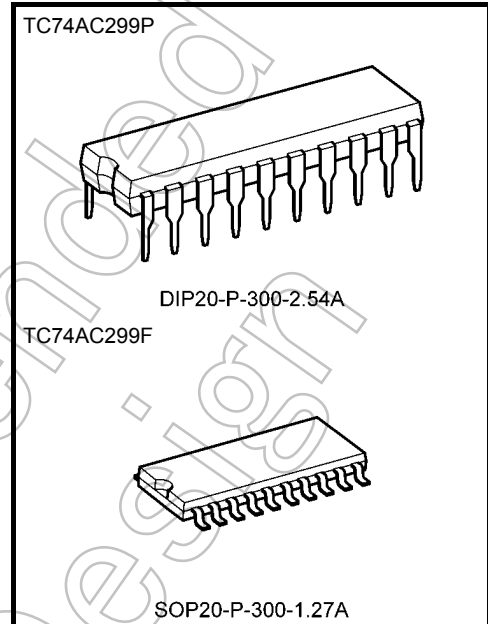
Note 1: Do not apply a signal to any bus terminal when it is in the output mode. Damage may result.

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



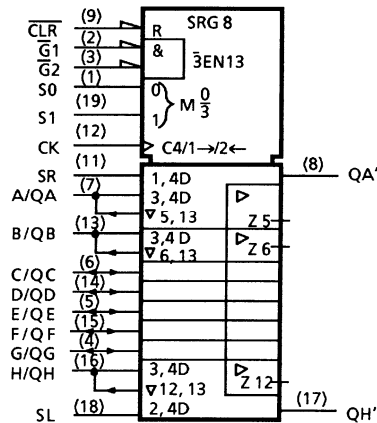
(TOP VIEW)



Weight	
DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)

Start of commercial production
1988-05

IEC Logic Symbol



Truth Table

Mode	Inputs								Inputs/ Outputs		Outputs	
	CLR	Function select		Outputs Control		CK	Serial		A/QA	H/QH	QA'	QH'
		S1	S0	G1 (Note)	G2 (Note)		SL	SR				
Clear	L	H	H	X	X	X	X	X	Z	Z	L	L
	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

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

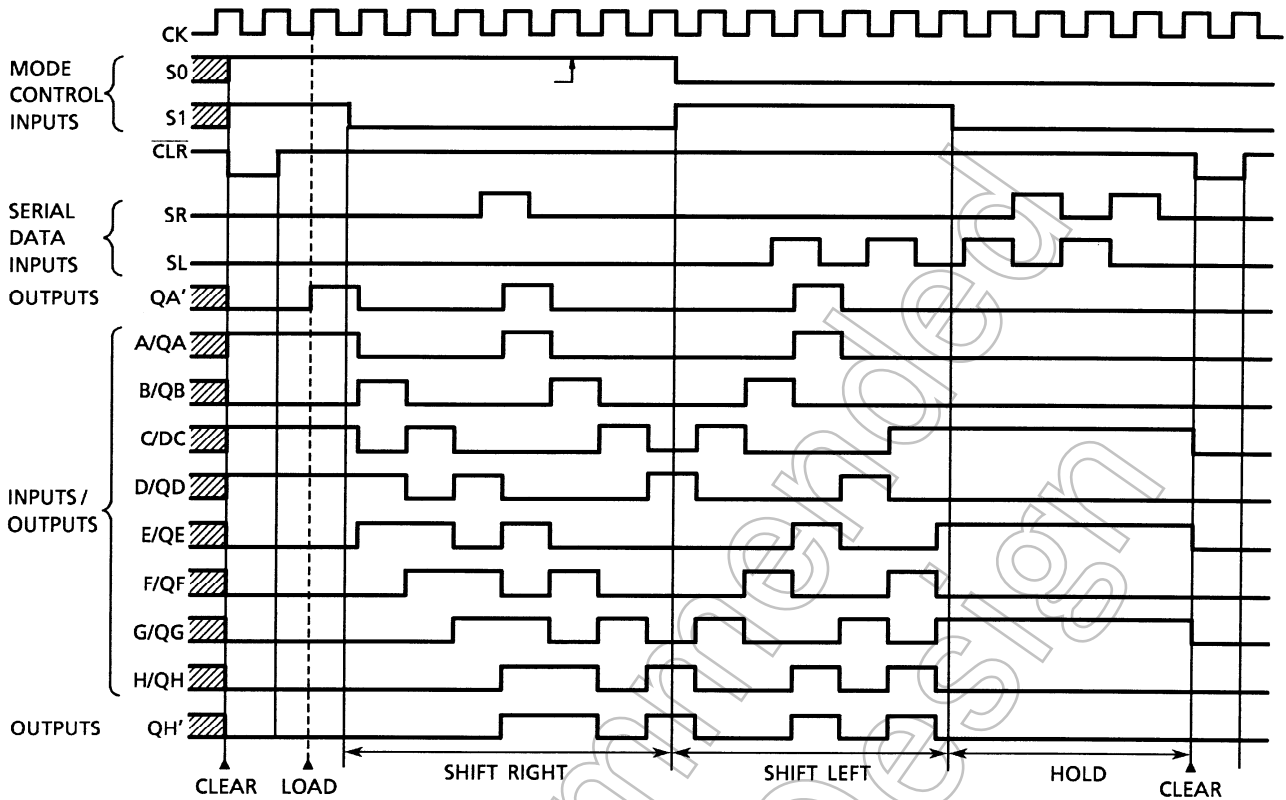
Qn0: The level of Qn before the indicated steady-state input conditions were established.

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

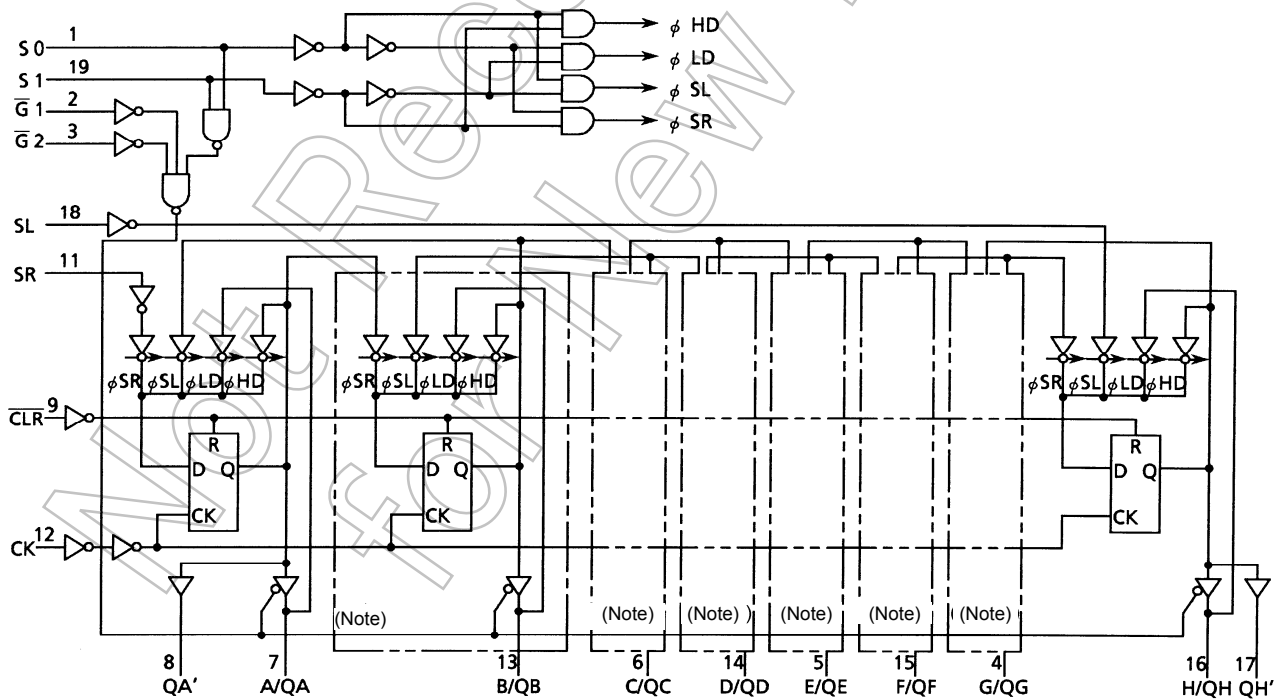
a, h: The level of the steady-state inputs A, H, respectively.

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 7.0	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}	± 50	mA
DC output current	I_{OUT}	± 50	mA
DC V_{CC} /ground current	I_{CC}	± 250	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 $T_a = -40$ to 65°C . From $T_a = 65$ to 85°C a derating factor of $-10\text{ mW}/^\circ\text{C}$ should be applied up to 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0 to 5.5	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	dt/dV	0 to 100 ($V_{CC} = 3.3 \pm 0.3\text{ V}$) 0 to 20 ($V_{CC} = 5 \pm 0.5\text{ V}$)	ns/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		Ta = 25°C			Ta = -40 to 85°C		Unit
				V _{CC} (V)	Min	Typ.	Max	Min	Max
High-level input voltage	V _{IH}	—		2.0 3.0 5.5	1.50 2.10 3.85	— — —	— — —	1.50 2.10 3.85	V
Low-level input voltage	V _{IL}	—		2.0 3.0 5.5	— — —	— — —	0.50 0.90 1.65	— — —	V
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 µA	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5	— — —	1.9 2.9 4.4	V
				3.0 4.5	2.58 3.94	— —	— —	2.48 3.80	
				5.5	—	—	—	3.85	
			I _{OH} = -4 mA	3.0	2.58	—	—	2.48	
			I _{OH} = -24 mA (Note)	4.5	3.94	—	—	3.80	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 µA	2.0 3.0 4.5	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	V
				3.0 4.5	— —	— —	0.36 0.36	— —	
				5.5	—	—	—	1.65	
			I _{OL} = 12 mA	3.0	—	—	0.36	0.44	
			I _{OL} = 24 mA (Note)	4.5	—	—	0.36	0.44	
3-state output off-state current	I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = V _{CC} or GND		5.5	—	—	±0.5	—	µA
Input leakage current	I _{IN}	V _{IN} = V _{CC} or GND		5.5	—	—	±0.1	—	µA
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	8.0	—	µA

Note: This spec indicates the capability of driving 50 Ω transmission lines.

One output should be tested at a time for a 10 ms maximum duration.

Timing Recommended Operating Conditions (input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	$T_a = 25^\circ\text{C}$ Limit	$T_a = -40\text{ to }85^\circ\text{C}$ Limit	Unit
Minimum pulse width (CK)	t_W (L)	—	3.3 ± 0.3	8.0	8.0	ns
	t_W (H)		5.0 ± 0.5	5.0	5.0	
Minimum pulse width ($\overline{\text{CLR}}$)	t_W (L)	—	3.3 ± 0.3	7.0	7.0	ns
			5.0 ± 0.5	5.0	5.0	
Minimum set-up time (SL, SR, A~H)	t_s	—	3.3 ± 0.3	6.0	6.0	ns
			5.0 ± 0.5	4.0	4.0	
Minimum set-up time (S0, S1)	t_s	—	3.3 ± 0.3	11.9	13.6	ns
			5.0 ± 0.5	7.0	7.0	
Minimum hold time (SL, SR, A~H)	t_h	—	3.3 ± 0.3	1.0	1.0	ns
			5.0 ± 0.5	1.0	1.0	
Minimum hold time (S0, S1)	t_h	—	3.3 ± 0.3	0.0	0.0	ns
			5.0 ± 0.5	0.0	0.0	
Minimum removal time ($\overline{\text{CLR}}$)	t_{rem}	—	3.3 ± 0.3	5.0	5.0	ns
			5.0 ± 0.5	3.0	3.0	

AC Characteristics ($C_L = 50\text{ pF}$, $R_L = 500\ \Omega$, input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$			$T_a = -40\text{ to }85^\circ\text{C}$		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max
Propagation delay time (CK-QA', QH')	t_{pLH}	—	3.3 ± 0.3	—	10.6	18.4	1.0	21.0
	t_{pHL}		5.0 ± 0.5	—	6.8	10.5	1.0	12.0
Propagation delay time ($\overline{\text{CLR}}$ -QA', QH')	t_{pLH}	—	3.3 ± 0.3	—	8.1	14.0	1.0	16.0
	t_{pHL}		5.0 ± 0.5	—	6.1	9.2	1.0	10.5
Propagation delay time (CK-QA~QH)	t_{pLH}	—	3.3 ± 0.3	—	10.9	19.3	1.0	22.0
	t_{pHL}		5.0 ± 0.5	—	7.3	10.5	1.0	12.0
Propagation delay time ($\overline{\text{CLR}}$ -QA~QH)	t_{pLH}	—	3.3 ± 0.3	—	9.8	16.7	1.0	19.0
	t_{pHL}		5.0 ± 0.5	—	6.7	10.9	1.0	12.4
Output enable time	t_{pZL}	—	3.3 ± 0.3	—	9.9	17.5	1.0	20.0
	t_{pZH}		5.0 ± 0.5	—	6.6	9.6	1.0	11.0
Output disable time	t_{pLZ}	—	3.3 ± 0.3	—	8.1	14.0	1.0	16.0
	t_{pHZ}		5.0 ± 0.5	—	6.4	9.6	1.0	11.0
Maximum clock frequency	f_{max}	—	3.3 ± 0.3	45	90	—	45	—
			5.0 ± 0.5	80	140	—	80	—
Input capacitance	C_{IN}	—	—	—	5	10	—	10
Bus input capacitance	$C_{\text{I/O}}$	—	—	—	13	—	—	—
Power dissipation capacitance	C_{PD} (Note)	—	—	—	137	—	—	—

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

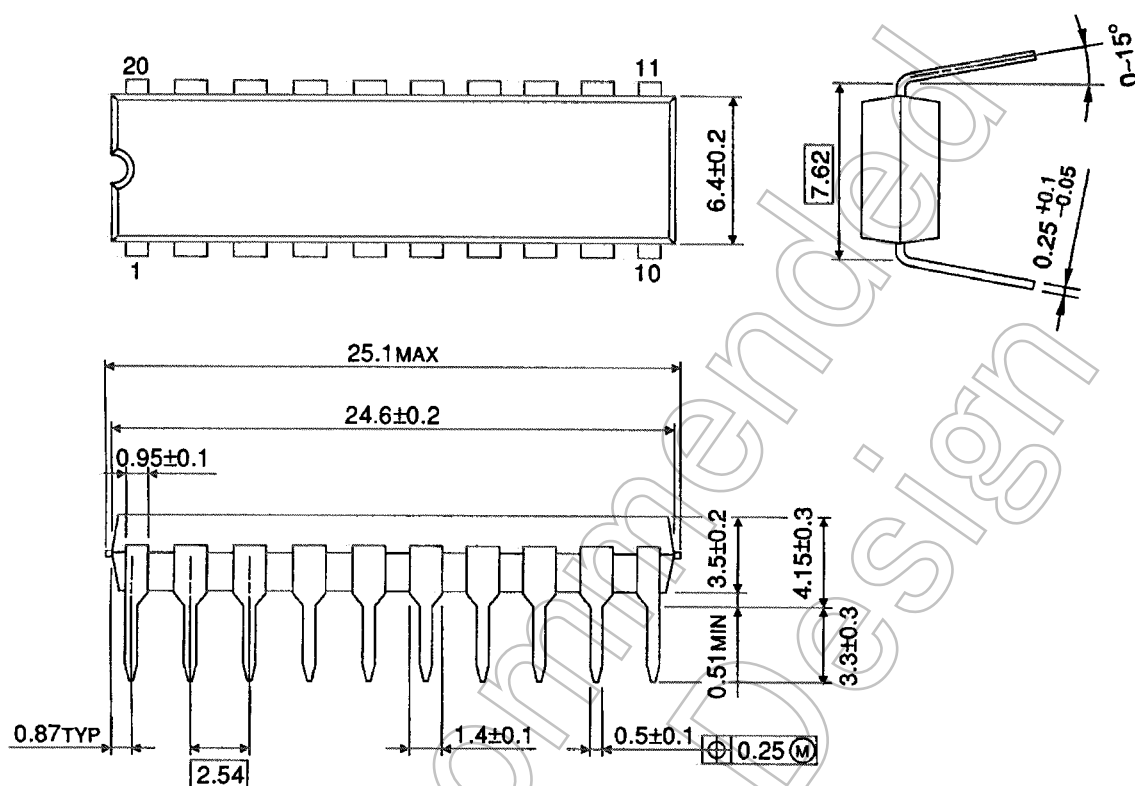
Average operating current can be obtained by the equation:

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

Package Dimensions

DIP20-P-300-2.54A

Unit : mm

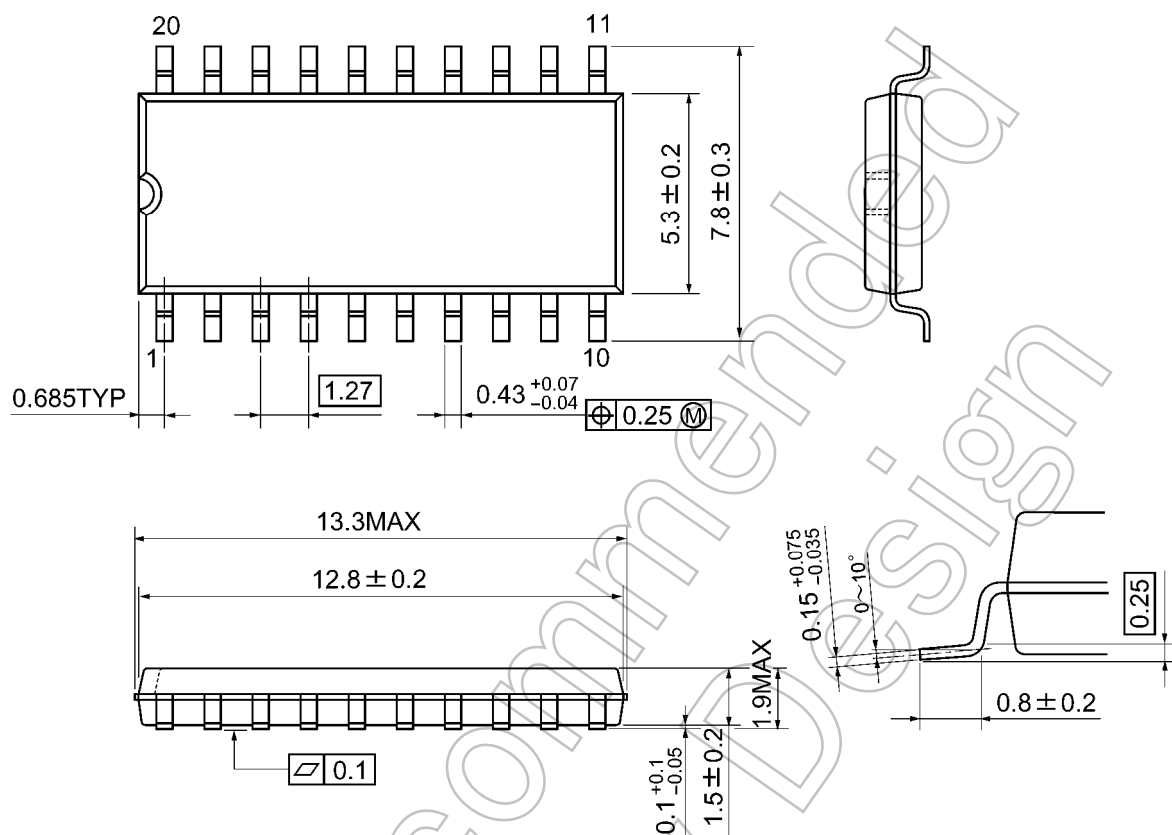


Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

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