TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74AC374P,TC74AC374F,TC74AC374FT
TC74AC534P,TC74AC534F

Octal D-Type Flip-Flop with 3-state Output

TC74AC374P/F/FT	Non-Inverting
TC74AC534P/F	Inverting

The TC74AC374 and TC74AC534 are advanced high speed CMOS OCTAL FLIP-FLOPS fabricated with silicon gate and double-layer metal wiring C^2MOS technology.

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

These 8-bit D-type flip-flops are controlled by a clock input (CK) and a output enable input ($\overline{OE}$).

When the $\overline{OE}$ input is high, the eight outputs are in a high impedance state.

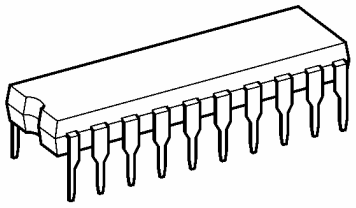
The TC74AC374 has non-inverting outputs, and TC74AC534 has inverting outputs.

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

Features

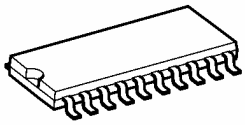
- High speed: f_{max} = 200 MHz (typ.) at V_{CC} = 5 V
- Low power dissipation: I_{CC} = 8 μA (max) at Ta = 25°C
- High noise immunity: $V_{NIH} = V_{NIL}$ = 28% V_{CC} (min)
- Symmetrical output impedance: $|I_{OH}| = I_{OL}$ = 24 mA (min)
  Capability of driving 50 Ω transmission lines.
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: V_{CC} (opr) = 2 to 5.5 V
- Pin and function compatible with 74F374/534

TC74AC374P, TC74AC534P



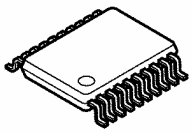
DIP20-P-300-2.54A

TC74AC374F, TC74AC534F



SOP20-P-300-1.27A

TC74AC374FT



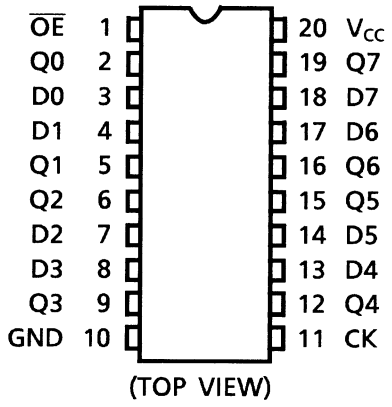
TSSOP20-P-0044-0.65A

Weight

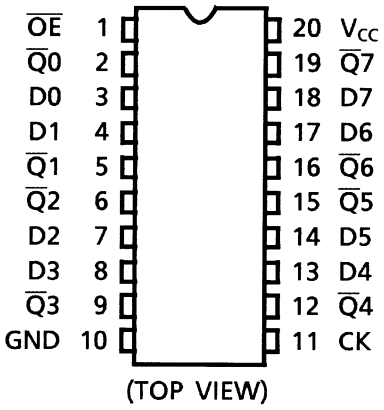
DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)
TSSOP20-P-0044-0.65A	: 0.08 g (typ.)

Pin Assignment

TC74AC374

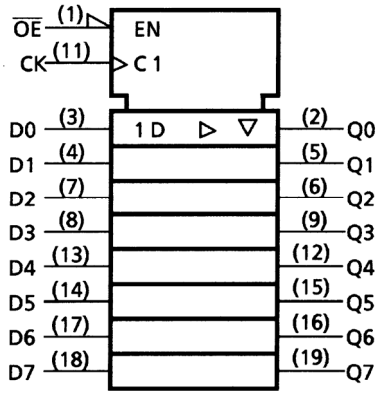


TC74AC534

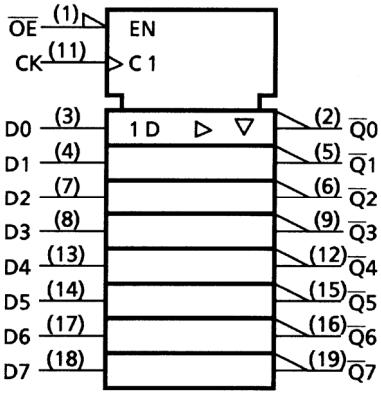


IEC Logic Symbol

TC74AC374



TC74AC534



Truth Table

Inputs			Outputs	
$\overline{OE}$	CK	D	Q (374)	$\overline{Q}$ (534)
H	X	X	Z	Z
L	↓	X	Q_n	$\overline{Q}_n$
L	↑	L	L	H
L	↑	H	H	L

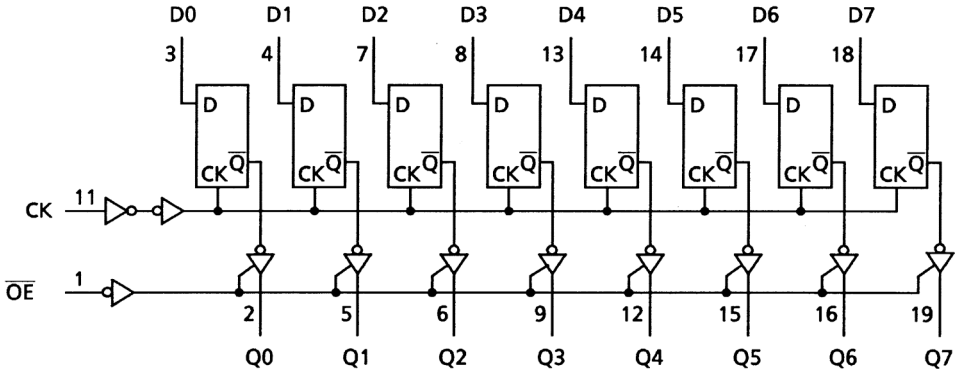
X: Don't care

Z: High impedance

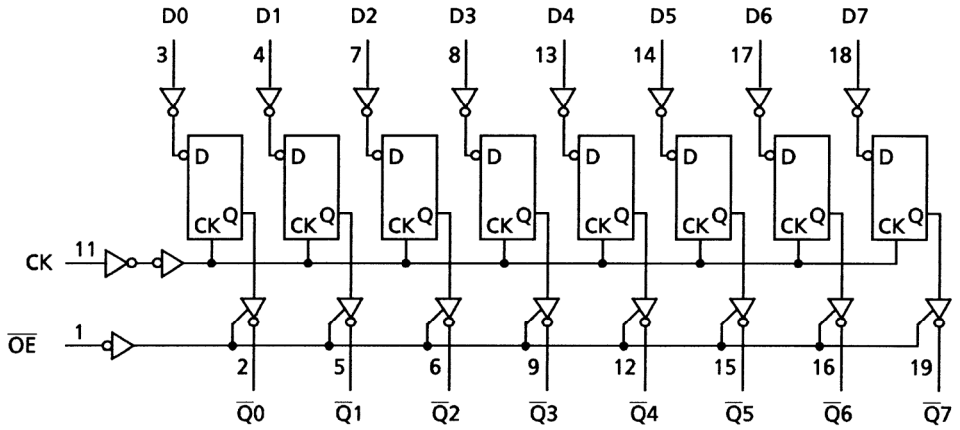
Q_n ($\overline{Q}_n$): No change

System Diagram

TC74AC374



TC74AC534



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}	±200	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180 (SOP/TSSOP)	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 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 ± 0.3 V) 0 to 20 (V_{CC} = 5 ± 0.5 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 VCC 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
				3.0	2.10	—	—	2.10	—	
				5.5	3.85	—	—	3.85	—	
Low-level input voltage	V_{IL}	—		2.0	—	—	0.50	—	0.50	V
				3.0	—	—	0.90	—	0.90	
				5.5	—	—	1.65	—	1.65	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −50 μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			I_{OH} = −4 mA	3.0	2.58	—	—	2.48	—	
			I_{OH} = −24 mA	4.5	3.94	—	—	3.80	—	
			I_{OH} = −75 mA (Note)	5.5	—	—	—	3.85	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50 μA	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
			I_{OL} = 12 mA	3.0	—	—	0.36	—	0.44	
			I_{OL} = 24 mA	4.5	—	—	0.36	—	0.44	
			I_{OL} = 75 mA (Note)	5.5	—	—	—	—	1.65	
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	—	±5.0	μA
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	—	8.0	—	80.0	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 Requirements (input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition		Ta = 25°C	Ta = −40 to 85°C	Unit
			V_{CC} (V)	Limit	Limit	
Minimum pulse width (CK)	$t_{W(H)}$	—	3.3 ± 0.3	7.0	7.0	ns
	$t_{W(L)}$		5.0 ± 0.5	5.0	5.0	
Minimum set-up time	t_s	—	3.3 ± 0.3	9.0	9.0	ns
			5.0 ± 0.5	5.0	5.0	
Minimum hold time	t_h	—	3.3 ± 0.3	0.0	0.0	ns
			5.0 ± 0.5	0.0	0.0	

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

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = −40 to 85°C		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
Propagation delay time (CK-Q, $\overline{Q}$)	t_{pLH}	—	3.3 ± 0.3	—	8.5	15.8	1.0	18.0	ns
	t_{pHL}		5.0 ± 0.5	—	6.1	8.7	1.0	10.0	
Output enable time	t_{pZL}	—	3.3 ± 0.3	—	7.5	14.0	1.0	16.0	ns
	t_{pZH}		5.0 ± 0.5	—	6.1	8.7	1.0	10.0	
Output disable time	t_{pLZ}	—	3.3 ± 0.3	—	5.5	12.3	1.0	14.0	ns
	t_{pHZ}		5.0 ± 0.5	—	4.7	7.0	1.0	8.0	
Maximum clock frequency	f_{max}	—	3.3 ± 0.3	55	120	—	55	—	MHz
			5.0 ± 0.5	100	160	—	100	—	
Input capacitance	C_{IN}	—		—	5	10	—	10	pF
Output capacitance	C_{OUT}	—		—	10	—	—	—	pF
Power dissipation capacitance	C_{PD} (Note)	—		—	37	—	—	—	pF

Note: C_{PD} 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:

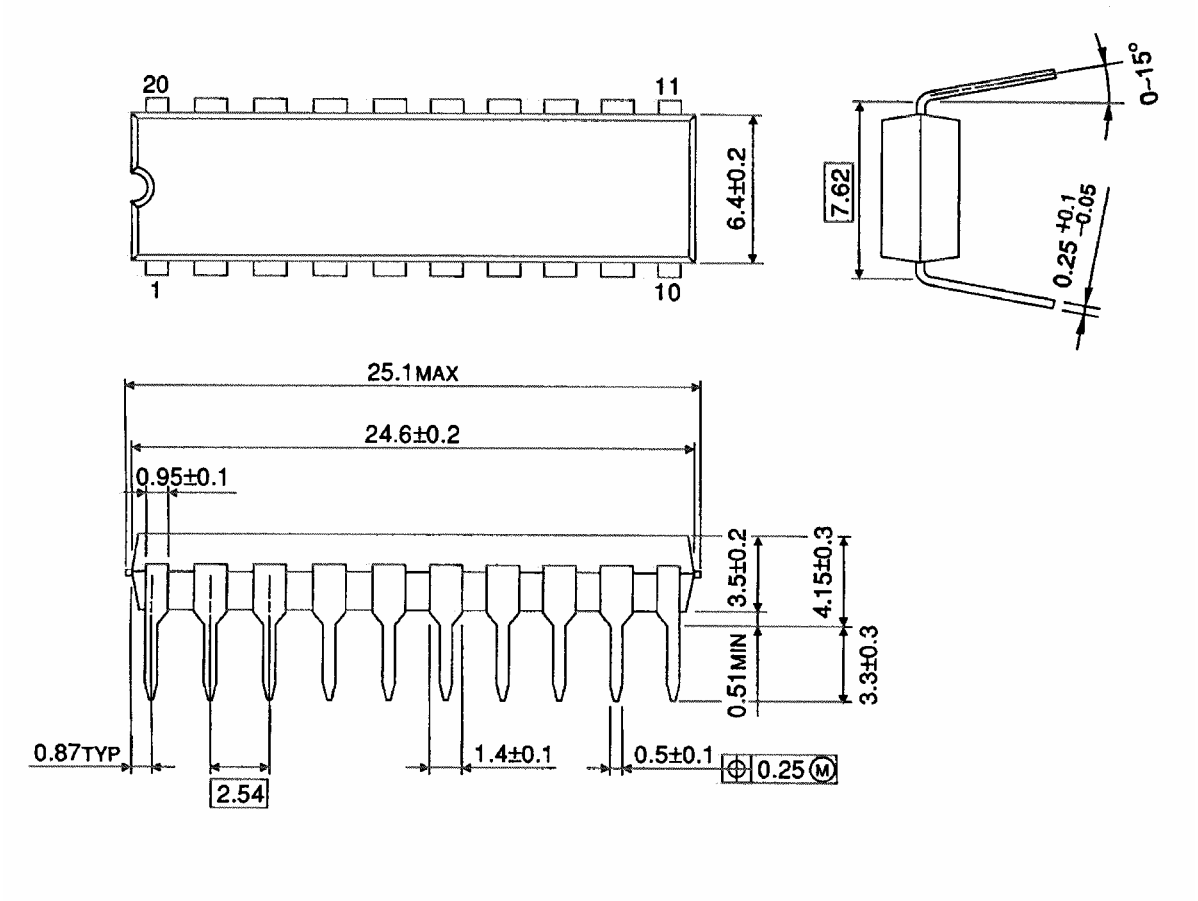
$$I_{CC}\ (opr) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8\ (per\ F/F)$$

And the total C_{PD} when n pcs. of F/F operate can be gained by the following equation:

$$C_{PD}\ (total) = 25 + 12 \cdot n$$

Package Dimensions

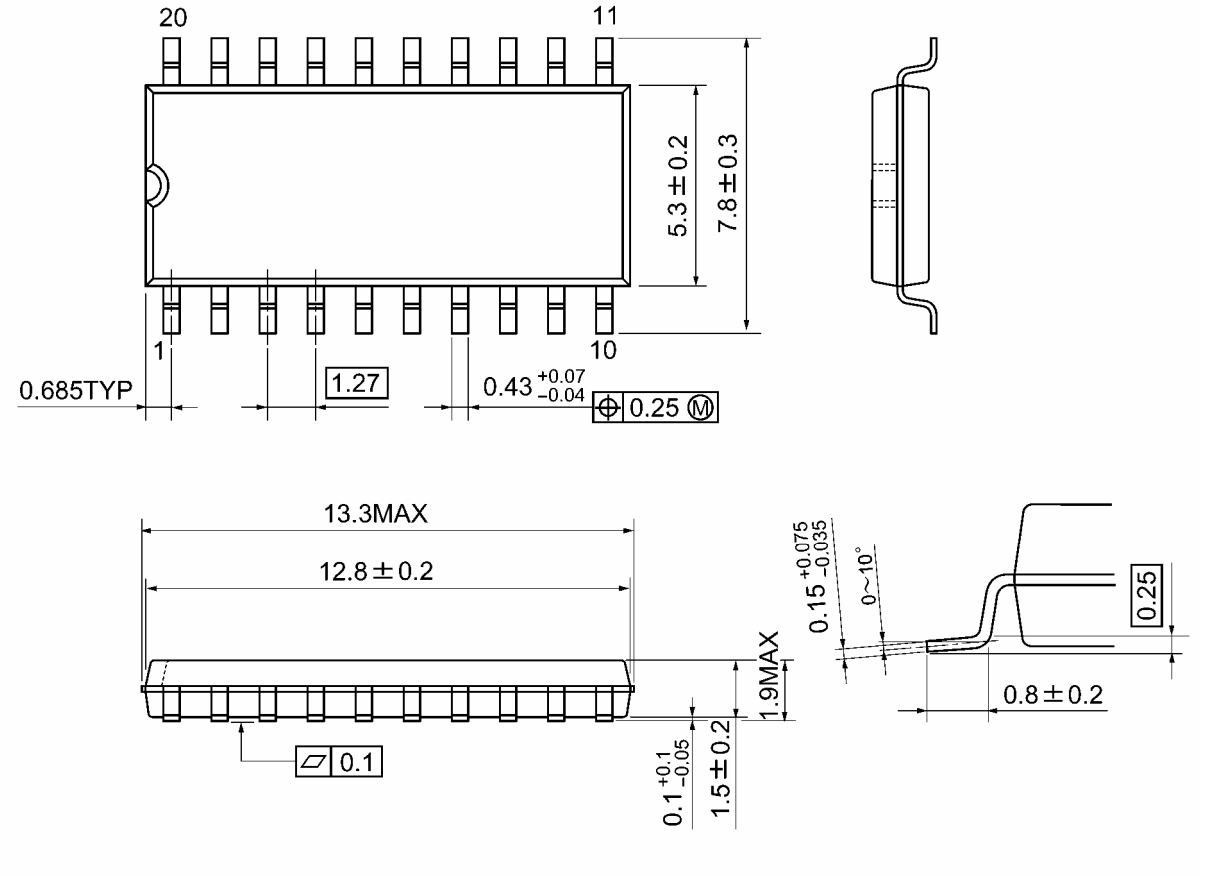
DIP20-P-300-2.54A Unit : mm



Weight: 1.30 g (typ.)

Package Dimensions

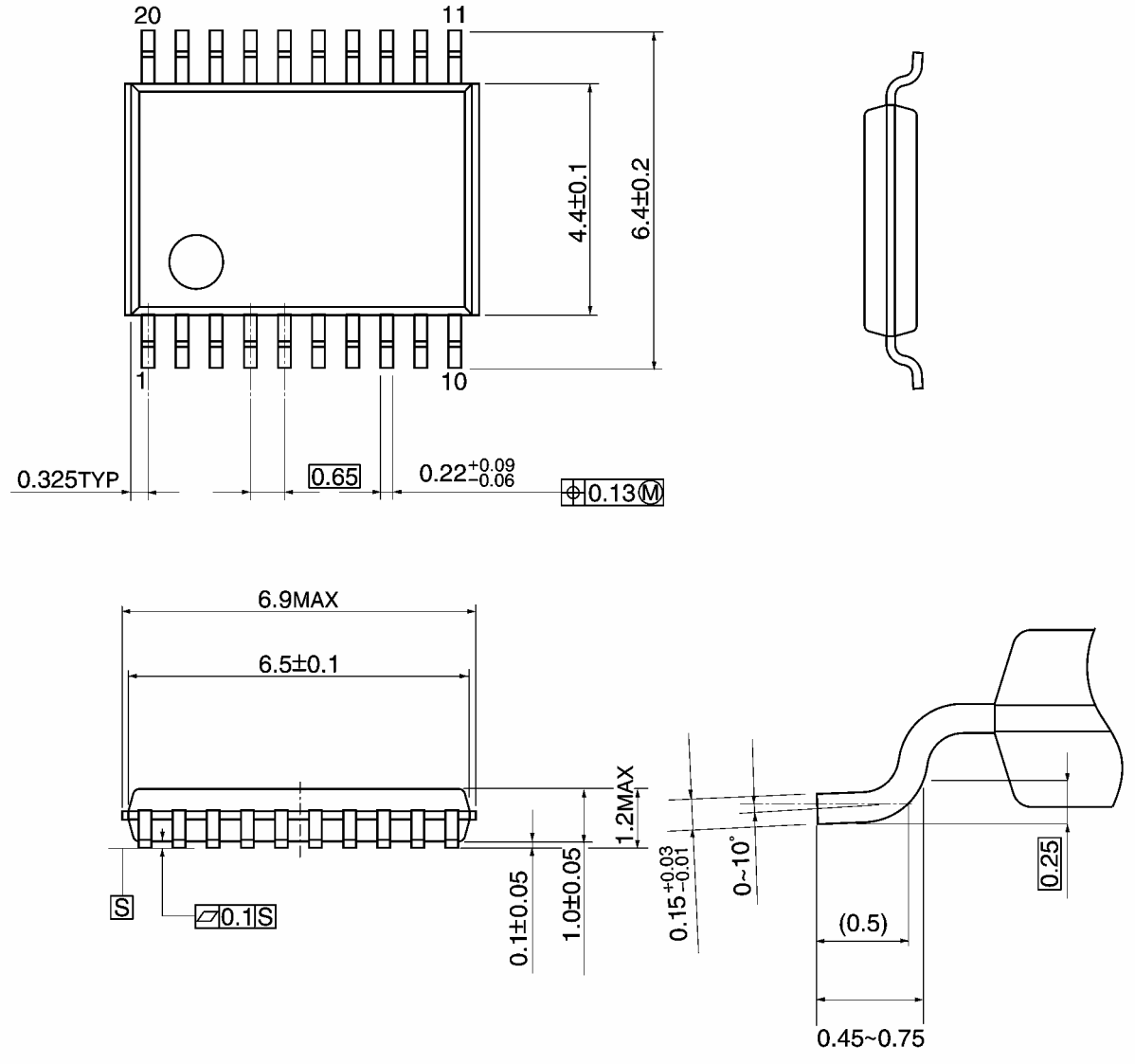
SOP20-P-300-1.27A Unit: mm



Weight: 0.22 g (typ.)

Package Dimensions

TSSOP20-P-0044-0.65A Unit: mm



Weight: 0.08 g (typ.)

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20070701-EN GENERAL

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