

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74HC564AP, TC74HC564AF TC74HC574AP, TC74HC574AF, TC74HC574AFW

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

TC74HC564AP/AF Inverting

TC74HC574AP/AF/AFW Non-Inverting

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

The TC74HC564A and HC574A are high speed CMOS OCTAL FLIP-FLOPs with 3-STATE OUTPUT fabricated with silicon gate C²MOS technology.

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

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

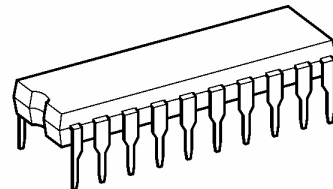
The TC74HC564A has inverting outputs, and the TC74HC574A has non-inverting outputs.

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

Features

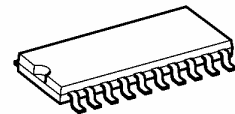
- High speed: $f_{max} = 62$ MHz (typ.) at $V_{CC} = 5$ V
- Low power dissipation: $I_{CC} = 4$ μ A (max) at $T_a = 25^\circ$ C
- High noise immunity: $V_{NIH} = V_{NIL} = 28\%$ V_{CC} (min)
- Output drive capability: 15 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 6$ mA (min)
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC} (opr) = 2$ to 6 V
- Pin and function compatible with 74LS564/574

TC74HC564AP, TC74HC574AP

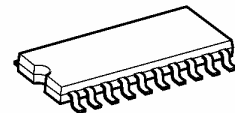


DIP20-P-300-2.54A

TC74HC564AF, TC74HC574AF

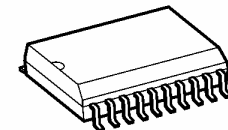


SOP20-P-300-1.27A



SOP20-P-300-1.27

TC74HC574AFW



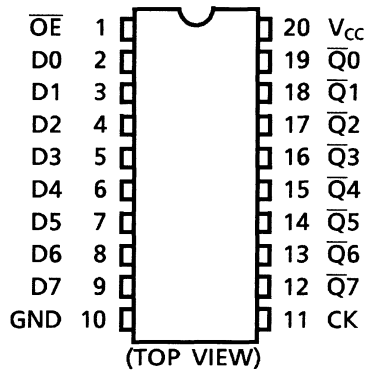
SOL20-P-300-1.27

Weight

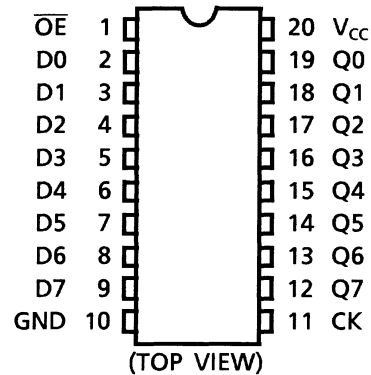
DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)
SOP20-P-300-1.27	: 0.22 g (typ.)
SOL20-P-300-1.27	: 0.46 g (typ.)

Pin Assignment

TC74HC564A

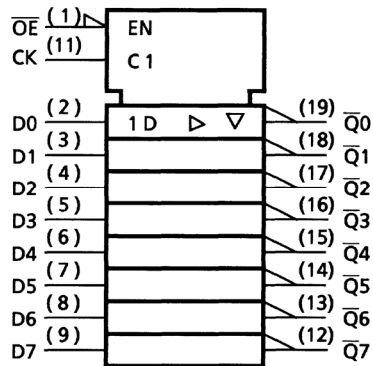


TC74HC574A

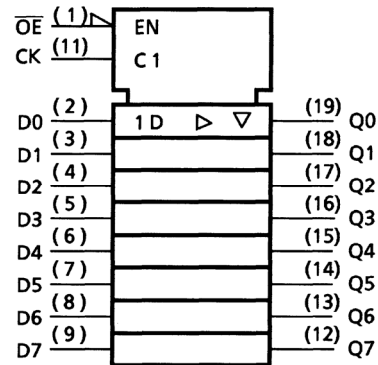


IEC Logic Symbol

TC74HC564A



TC74HC574A



Truth Table

Inputs			Outputs	
\overline{OE}	CK	D	Q (574A)	\overline{Q} (564A)
H	X	X	Z	Z
L	\downarrow	X	Q_n	\overline{Q}_n
L	\uparrow	L	L	H
L	\uparrow	H	H	L

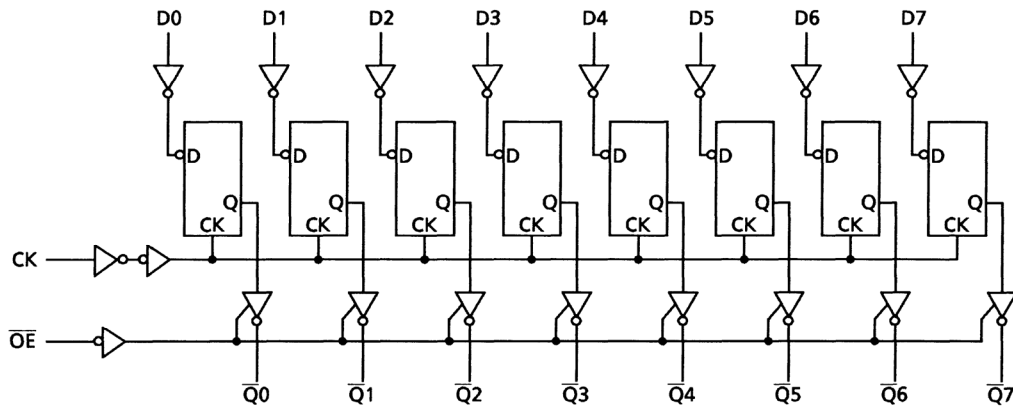
X: Don't care

Z: High impedance

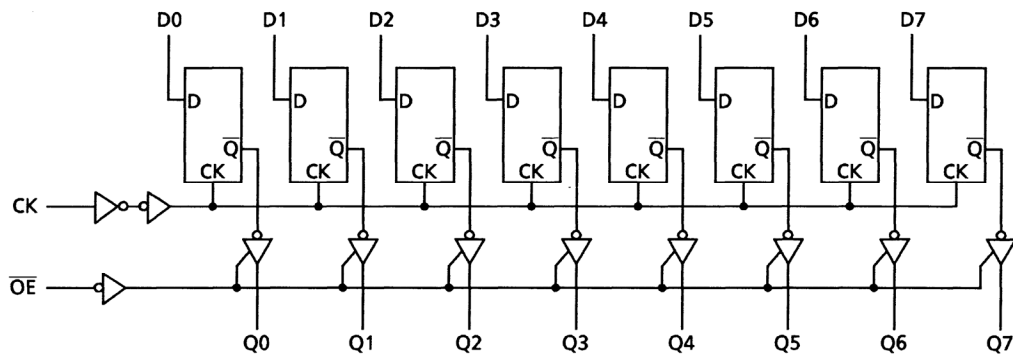
Q_n (\overline{Q}_n): No change

System Diagram

TC74HC564A



TC74HC574A



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	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	$^{\circ}C$

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Note 2: 500 mW in the range of $T_a = -40$ to $65^{\circ}C$. From $T_a = 65$ to $85^{\circ}C$ a derating factor of -10 mW/ $^{\circ}C$ shall be applied until 300 mW.

Recommended Operating Conditions (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) 0 to 500 ($V_{CC} = 4.5$ V) 0 to 400 ($V_{CC} = 6.0$ V)	ns

Note: The recommended operating conditions are required 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	$T_a = 25^\circ\text{C}$			$T_a = -40$ to 85°C		Unit		
			V_{CC} (V)	Min	Typ.	Max	Min		Max	
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}	$I_{OH} = -20 \mu\text{A}$	2.0	1.9	2.0	—	1.9	—	V
			$I_{OH} = -6 \text{ mA}$	4.5	4.4	4.5	—	4.4	—	
			$I_{OH} = -7.8 \text{ mA}$	6.0	5.9	6.0	—	5.9	—	
				4.5	4.18	4.31	—	4.13	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 20 \mu\text{A}$	2.0	—	0.0	0.1	—	0.1	V
			$I_{OL} = 6 \text{ mA}$	4.5	—	0.17	0.26	—	0.33	
			$I_{OL} = 7.8 \text{ mA}$	6.0	—	0.18	0.26	—	0.33	
				4.5	—	0.17	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 Requirements (input: $t_r = t_f = 6 \text{ ns}$)

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)	—	2.0	—	75	95	ns
	t_W (L)		4.5	—	15	19	
			6.0	—	13	16	
Minimum set-up time (Dn)	t_s	—	2.0	—	75	95	ns
			4.5	—	15	19	
			6.0	—	13	16	
Minimum hold time (Dn)	t_h	—	2.0	—	0	0	ns
			4.5	—	0	0	
			6.0	—	0	0	
Clock frequency	f	—	2.0	—	6	5	MHz
			4.5	—	31	24	
			6.0	—	36	28	

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

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit		
			CL (pF)	VCC (V)	Min	Typ.	Max		Min	Max
Output transition time	t_{TLH} t_{THL}	—	50	2.0	—	25	60	—	75	ns
				4.5	—	7	12	—	15	
				6.0	—	6	10	—	13	
Propagation delay time (CK-Q, \bar{Q})	t_{PLH} t_{PHL}	—	50	2.0	—	70	150	—	190	ns
				4.5	—	20	30	—	38	
				6.0	—	15	26	—	33	
			150	2.0	—	88	190	—	240	
				4.5	—	25	38	—	48	
				6.0	—	19	33	—	41	
Output enable time	t_{pZL} t_{pZH}	$R_L = 1$ k Ω	50	2.0	—	48	125	—	155	ns
				4.5	—	15	25	—	31	
				6.0	—	12	21	—	26	
			150	2.0	—	60	165	—	205	
				4.5	—	20	33	—	41	
				6.0	—	16	28	—	35	
Output disable time	t_{pLZ} t_{pHZ}	$R_L = 1$ k Ω	50	2.0	—	34	125	—	155	ns
				4.5	—	17	25	—	31	
				6.0	—	15	21	—	26	
Maximum clock frequency	f_{max}	—	50	2.0	6	17	—	5	—	MHz
				4.5	31	50	—	24	—	
				6.0	36	59	—	28	—	
Input capacitance	C_{IN}	—	—	—	5	10	—	10	pF	
Output capacitance	C_{OUT}	—	—	—	10	—	—	—	pF	
Power dissipation capacitance	C_{PD} (Note)	—	—	—	54	—	—	—	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:

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

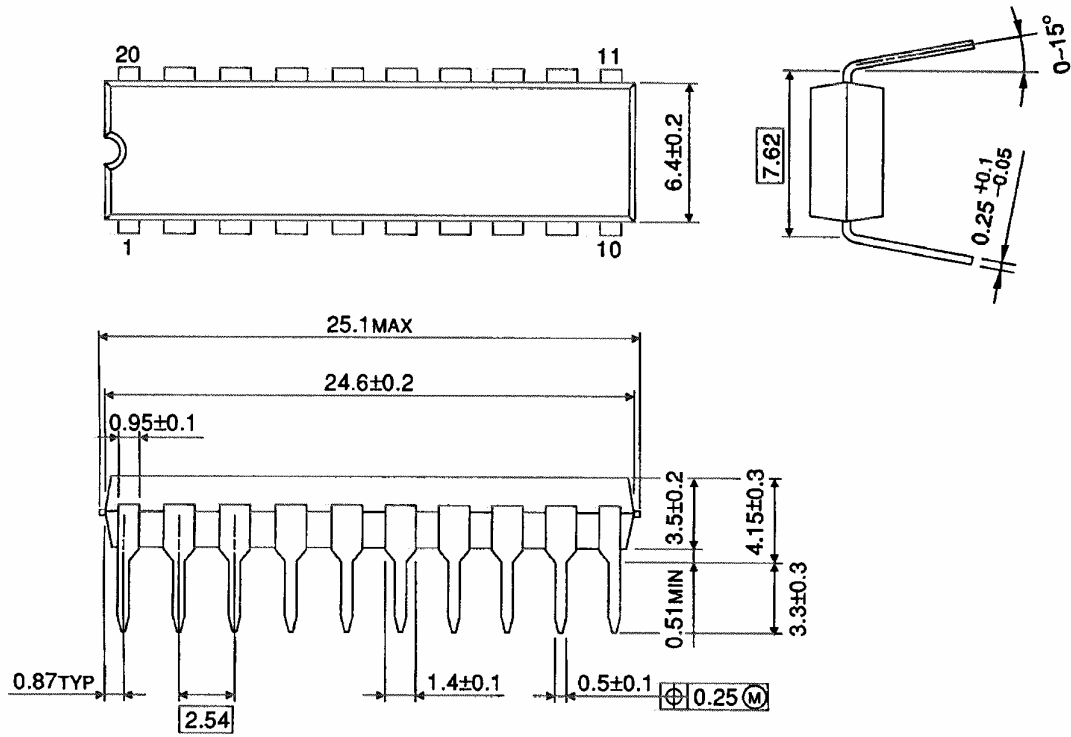
And the total C_{PD} when n pcs. of flip flop operate can be gained by the following equation:

$$C_{PD} (\text{total}) = 39 + 15 \cdot n$$

Package Dimensions

DIP20-P-300-2.54A

Unit : mm

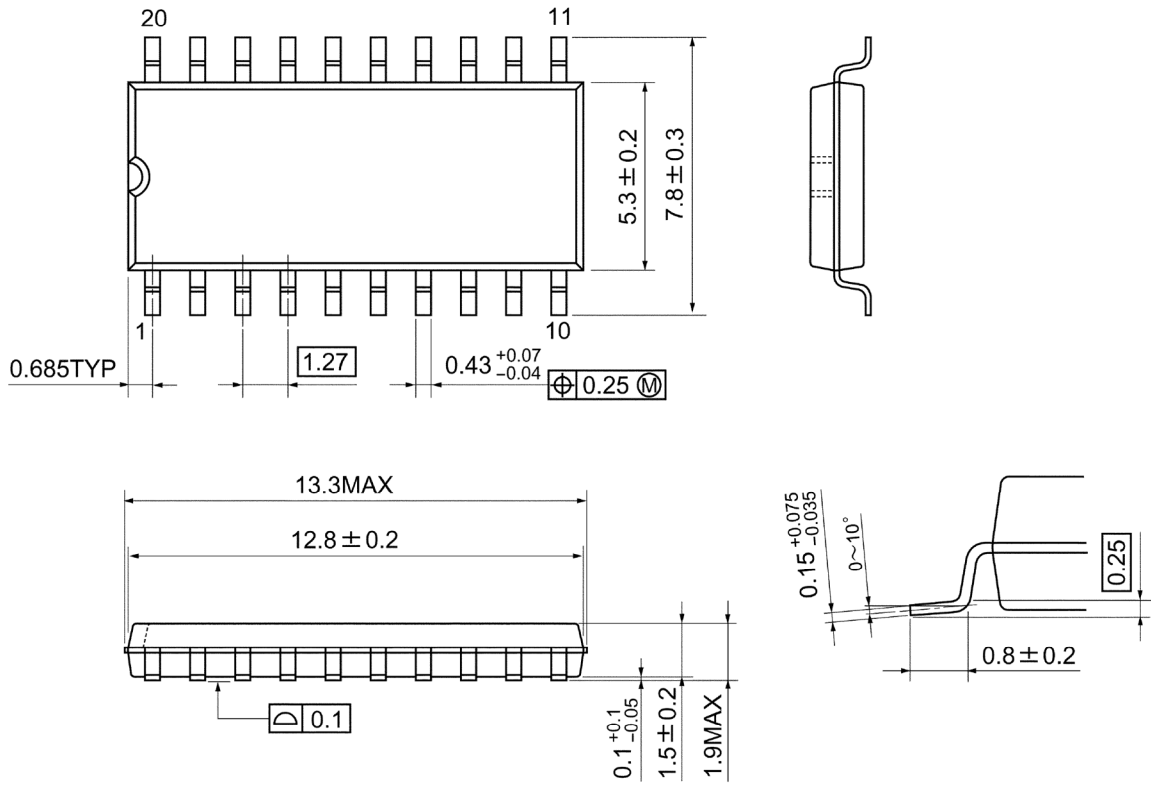


Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm

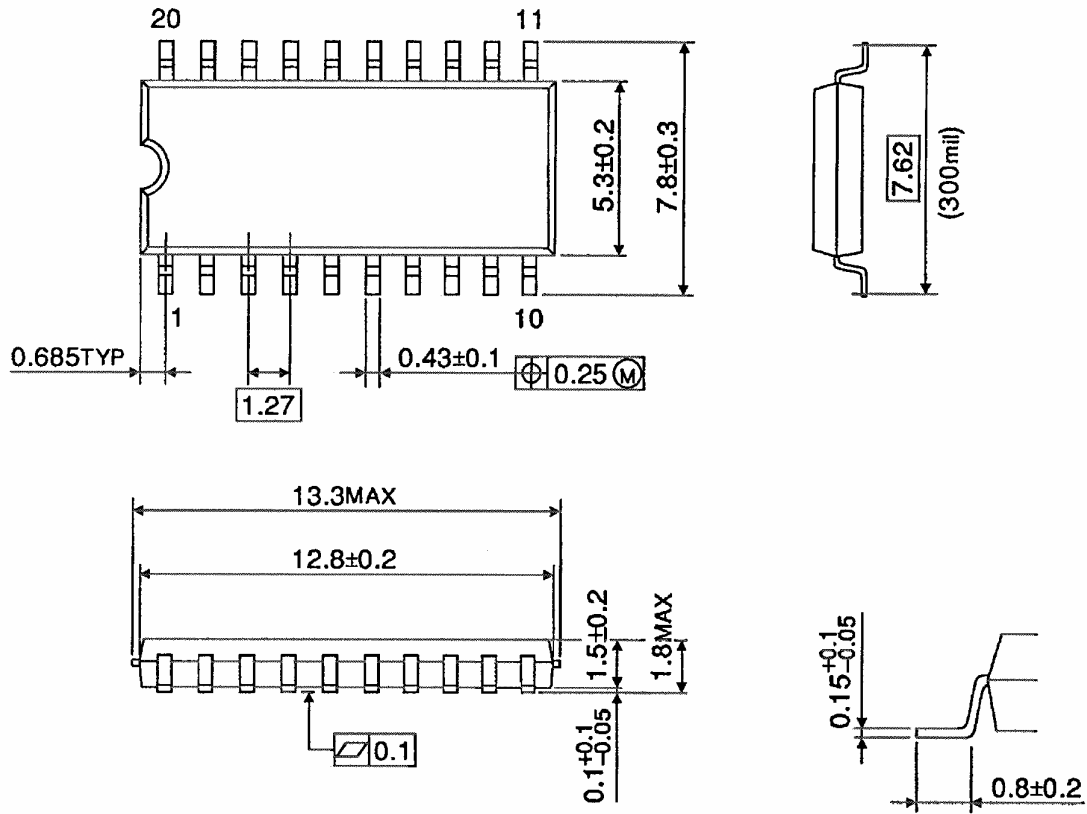


Weight: 0.22 g (typ.)

Package Dimensions

SOP20-P-300-1.27

Unit : mm

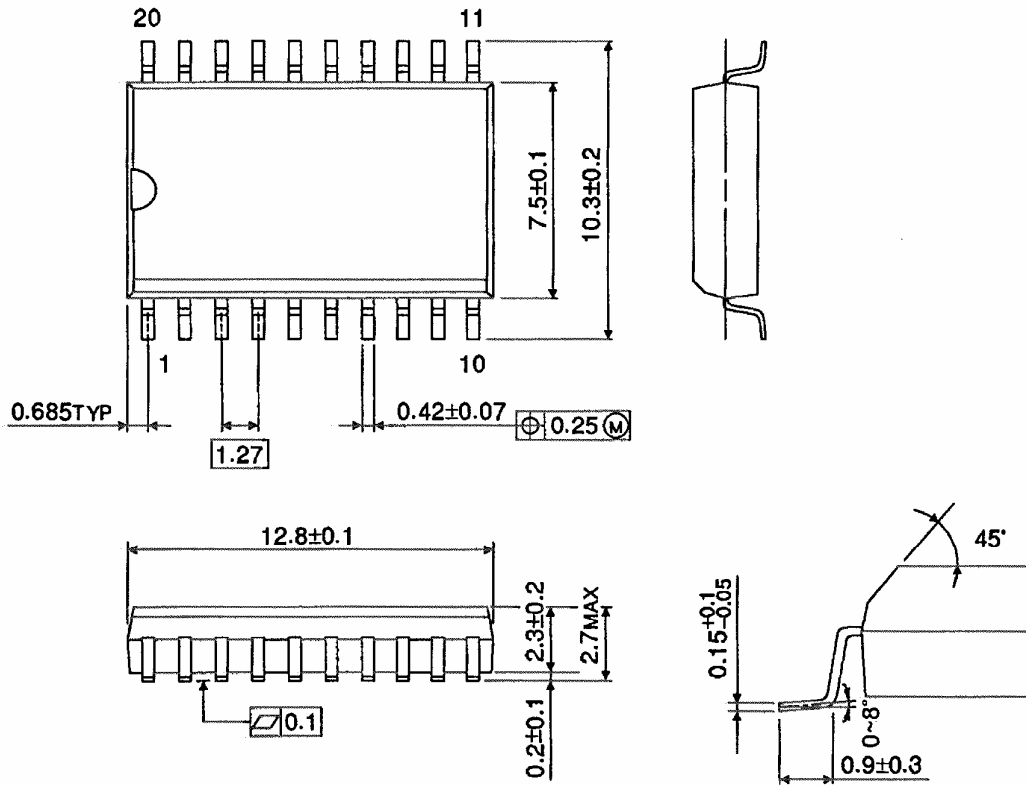


Weight: 0.22 g (typ.)

Package Dimensions (Note)

SOL20-P-300-1.27

Unit : mm



Note: This package is not available in Japan.

Weight: 0.46 g (typ.)

Note: Lead (Pb)-Free Packages**DIP20-P-300-2.54A SOP20-P-300-1.27A****RESTRICTIONS ON PRODUCT USE**

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