

TC74LCX273F, TC74LCX273FW, TC74LCX273FT, TC74LCX273FK

Low-Voltage Octal D-Type Flip-Flop with Clear with 5-V Tolerant Inputs and Outputs

The TC74LCX273F/FW/FT/FK is a high-performance CMOS octal D-type flip-flop. Designed for use in 3.3-V systems, it achieves high-speed operation while maintaining the CMOS low-power dissipation.

The device is designed for low-voltage (3.3 V) VCC applications, but it could be used to interface to 5-V supply environment for both inputs and outputs.

This 8 bit D-type flip-flop is controlled by a clock input (CK) and a clear input ($\overline{\text{CLR}}$). When the $\overline{\text{CLR}}$ input is low, the eight outputs are at a low logic level.

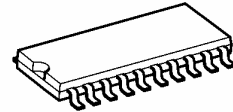
All inputs are equipped with protection circuits against static discharge.

Features

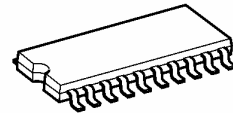
- Low-voltage operation: VCC = 2.0 to 3.6 V
- High-speed operation: tpd = 8.5 ns (max) (VCC = 3.0 to 3.6 V)
- Output current: |IOH|/IOL = 24 mA (min) (VCC = 3.0 V)
- Latch-up performance: ±500 mA
- Available in JEDEC SOP, JEITA SOP and TSSOP
- Power-down protection is provided on all inputs and outputs
- Pin and function compatible with the 74 series (74AC/VHC/HC/F/ALS/LS etc.) 273 type

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

TC74LCX273F

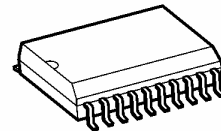


SOP20-P-300-1.27A



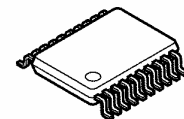
SOP20-P-300-1.27

TC74LCX273FW



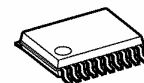
SOL20-P-300-1.27

TC74LCX273FT



TSSOP20-P-0044-0.65A

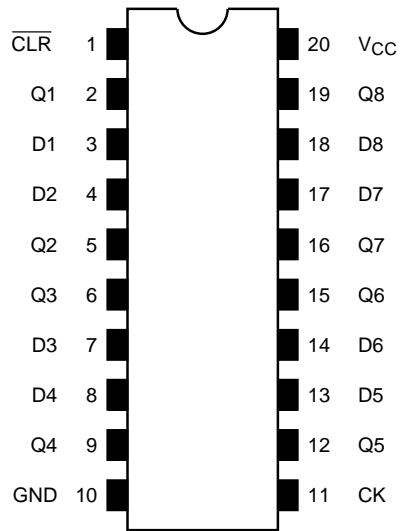
TC74LCX273FK



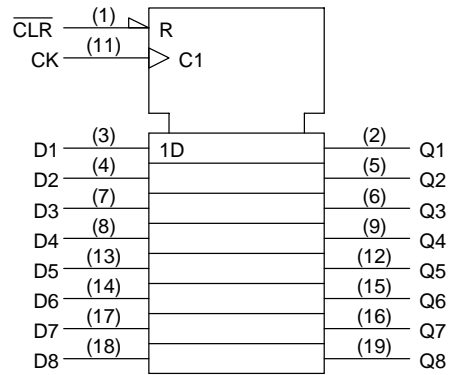
VSSOP20-P-0030-0.50

| | |
|----------------------|-----------------|
| Weight | |
| 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.) |
| TSSOP20-P-0044-0.65A | : 0.08 g (typ.) |
| VSSOP20-P-0030-0.50 | : 0.03 g (typ.) |

Pin Assignment (top view)



IEC Logic Symbol

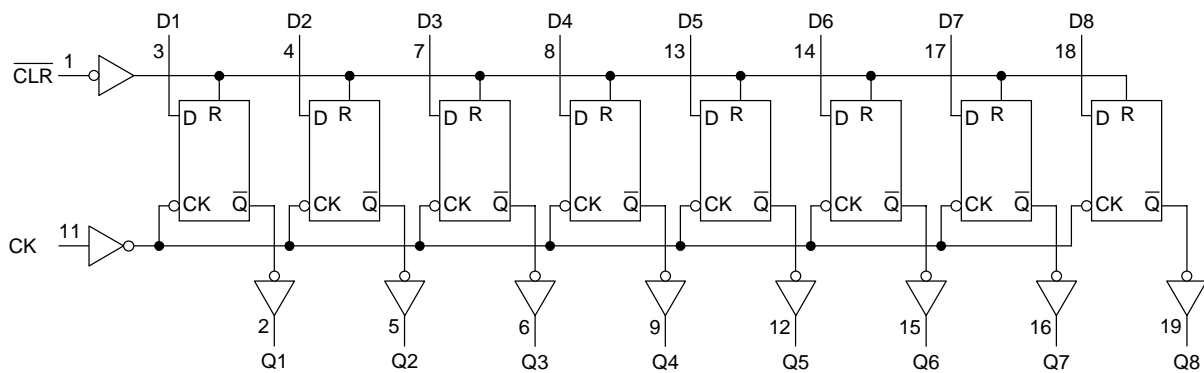


Truth Table

| Inputs | | | Outputs | Function |
|-------------------------|---|--------------|---------|-----------|
| $\overline{\text{CLR}}$ | D | CK | Q | |
| L | X | X | L | Clear |
| H | L | \uparrow | L | — |
| H | H | \uparrow | H | — |
| H | X | \downarrow | Qn | No change |

X: Don't care

System Diagram



Absolute Maximum Ratings (Note 1)

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|------------------|------------------------------------|-------------|
| Power supply voltage | V_{CC} | -0.5 to 7.0 | V |
| DC input voltage | V_{IN} | -0.5 to 7.0 | V |
| DC output voltage | V_{OUT} | -0.5 to 7.0 (Note 2) | V |
| | | -0.5 to $V_{CC} + 0.5$ (Note 3) | |
| Input diode current | I_{IK} | -50 | mA |
| Output diode current | I_{OK} | ± 50 (Note 4) | mA |
| DC output current | I_{OUT} | ± 50 | mA |
| Power dissipation | P_D | 180 | mW |
| DC V_{CC} /ground current | I_{CC}/I_{GND} | ± 100 | mA |
| 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: $V_{CC} = 0$ V

Note 3: High or low state. I_{OUT} absolute maximum rating must be observed.

Note 4: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$

Recommended Operating Conditions (Note 1)

| Characteristics | Symbol | Rating | Unit |
|--------------------------|-----------------|------------------------|-------------|
| Power supply voltage | V_{CC} | 2.0 to 3.6 | V |
| | | -1.5 to 3.6 (Note 2) | |
| Input voltage | V_{IN} | 0 to 5.5 | V |
| Output voltage | V_{OUT} | 0 to 5.5 (Note 3) | V |
| | | 0 to V_{CC} (Note 4) | |
| Output current | I_{OH}/I_{OL} | ± 24 (Note 5) | mA |
| | | ± 12 (Note 6) | |
| Operating temperature | T_{opr} | -40 to 85 | $^{\circ}C$ |
| Input rise and fall time | dt/dv | 0 to 10 (Note 7) | ns/V |

Note 1: The recommended operating conditions are required to ensure the normal operation of the device. Unused inputs must be tied to either V_{CC} or GND.

Note 2: Data retention only

Note 3: $V_{CC} = 0$ V

Note 4: High or low state

Note 5: $V_{CC} = 3.0$ to 3.6 V

Note 6: $V_{CC} = 2.7$ to 3.0 V

Note 7: $V_{IN} = 0.8$ to 2.0 V, $V_{CC} = 3.0$ V

Electrical Characteristics

DC Characteristics (Ta = -40 to 85°C)

| Characteristics | | Symbol | Test Condition | V _{CC} (V) | Min | Max | Unit |
|---------------------------------------|---------|------------------|--|---------------------------|------------|-----------------------|------|
| | | | | | | | |
| Input voltage | H-level | V _{IH} | | 2.7 to 3.6 | 2.0 | — | V |
| | L-level | V _{IL} | | 2.7 to 3.6 | — | 0.8 | |
| Output voltage | H-level | V _{OH} | V _{IN} = V _{IH} or V _{IL} | I _{OH} = -100 μA | 2.7 to 3.6 | V _{CC} - 0.2 | V |
| | | | | I _{OH} = -12 mA | 2.7 | 2.2 | |
| | | | | I _{OH} = -18 mA | 3.0 | 2.4 | |
| | | | | I _{OH} = -24 mA | 3.0 | 2.2 | |
| | L-level | V _{OL} | V _{IN} = V _{IH} or V _{IL} | I _{OL} = 100 μA | 2.7 to 3.6 | — | 0.2 |
| | | | | I _{OL} = 12 mA | 2.7 | — | 0.4 |
| | | | | I _{OL} = 16 mA | 3.0 | — | 0.4 |
| | | | | I _{OL} = 24 mA | 3.0 | — | 0.55 |
| Input leakage current | | I _{IN} | V _{IN} = 0 to 5.5 V | 2.7 to 3.6 | — | ±5.0 | μA |
| Power-off leakage current | | I _{OFF} | V _{IN} /V _{OUT} = 5.5 V | 0 | — | 10.0 | μA |
| Quiescent supply current | | I _{CC} | V _{IN} = V _{CC} or GND | 2.7 to 3.6 | — | 10.0 | μA |
| | | | V _{IN} = 3.6 to 5.5 V | 2.7 to 3.6 | — | ±10.0 | |
| Increase in I _{CC} per input | | ΔI _{CC} | V _{IN} = V _{CC} - 0.6 V | 2.7 to 3.6 | — | 500 | |

AC Characteristics (Ta = -40 to 85°C)

| Characteristics | | Symbol | Test Condition | V _{CC} (V) | Min | Max | Unit |
|--|--|----------------------|----------------|---------------------|-----|-----|------|
| | | | | | | | |
| Maximum clock frequency | f _{MAX} | (Figure 1, Figure 2) | 2.7 | — | — | MHz | |
| | | | 3.3 ± 0.3 | 150 | — | | |
| Propagation delay time (CK-Q) | t _{PLH} t _{PHL} | (Figure 1, Figure 2) | 2.7 | — | 9.5 | ns | |
| | | | 3.3 ± 0.3 | 1.5 | 8.5 | | |
| Propagation delay time ($\overline{\text{CLR}}$ -Q) | t _{PHL} | (Figure 1, Figure 3) | 2.7 | — | 9.5 | ns | |
| | | | 3.3 ± 0.3 | 1.5 | 8.5 | | |
| Minimum pulse width (CK) | t _w (H) t _w (L) | (Figure 1, Figure 2) | 2.7 | 3.3 | — | ns | |
| | | | 3.3 ± 0.3 | 3.3 | — | | |
| Minimum pulse width ($\overline{\text{CLR}}$) | t _w (L) | (Figure 3) | 2.7 | 3.3 | — | ns | |
| | | | 3.3 ± 0.3 | 3.3 | — | | |
| Minimum setup time | t _s | (Figure 1, Figure 2) | 2.7 | 2.5 | — | ns | |
| | | | 3.3 ± 0.3 | 2.5 | — | | |
| Minimum hold time | t _h | (Figure 1, Figure 2) | 2.7 | 1.5 | — | ns | |
| | | | 3.3 ± 0.3 | 1.5 | — | | |
| Minimum removal time | t _{rem} | (Figure 4) | 2.7 | 2.5 | — | ns | |
| | | | 3.3 ± 0.3 | 2.0 | — | | |
| Output to output skew | t _{osLH} t _{osHL} | (Note) | 2.7 | — | — | ns | |
| | | | 3.3 ± 0.3 | — | 1.0 | | |

Note: Parameter guaranteed by design.
 (t_{osLH} = |t_{PLHm} - t_{PLHn}|, t_{osHL} = |t_{PHLm} - t_{PHLn}|)

Dynamic Switching Characteristics

(Ta = 25°C, input: tr = tf = 2.5 ns, CL = 50 pF, RL = 500 Ω)

| Characteristics | Symbol | Test Condition | VCC (V) | Typ. | Unit |
|----------------------------------|--------|--|---------|------|------|
| | | | | | |
| Quiet output maximum dynamic VOL | VOLP | V _{IH} = 3.3 V, V _{IL} = 0 V | 3.3 | 0.8 | V |
| Quiet output minimum dynamic VOL | VOLV | V _{IH} = 3.3 V, V _{IL} = 0 V | 3.3 | 0.8 | V |

Capacitive Characteristics (Ta = 25°C)

| Characteristics | Symbol | Test Condition | VCC (V) | Typ. | Unit |
|-------------------------------|------------------|---------------------------------|---------|------|------|
| | | | | | |
| Input capacitance | C _{IN} | — | 3.3 | 7 | pF |
| Output capacitance | C _{OUT} | | 0 | 8 | pF |
| Power dissipation capacitance | C _{PD} | f _{IN} = 10 MHz (Note) | 3.3 | 25 | 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:

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

AC Test Circuit

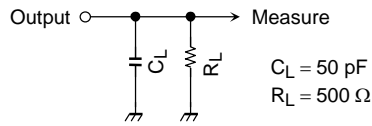


Figure 1

AC Waveform

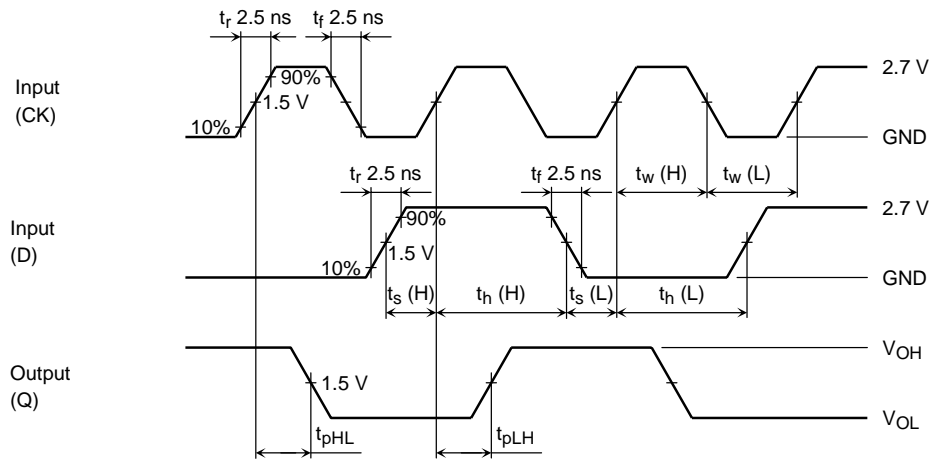


Figure 2 t_{pLH} , t_{pHL} , t_w , t_s , t_h

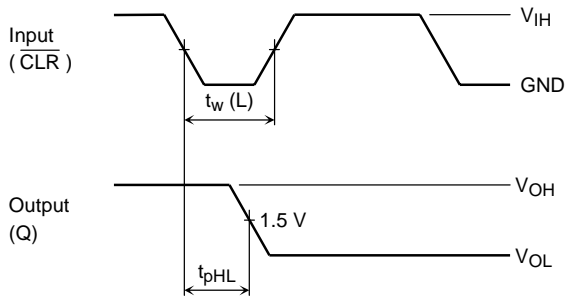


Figure 3 t_{pHL}

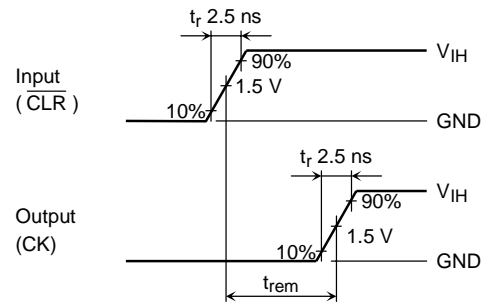
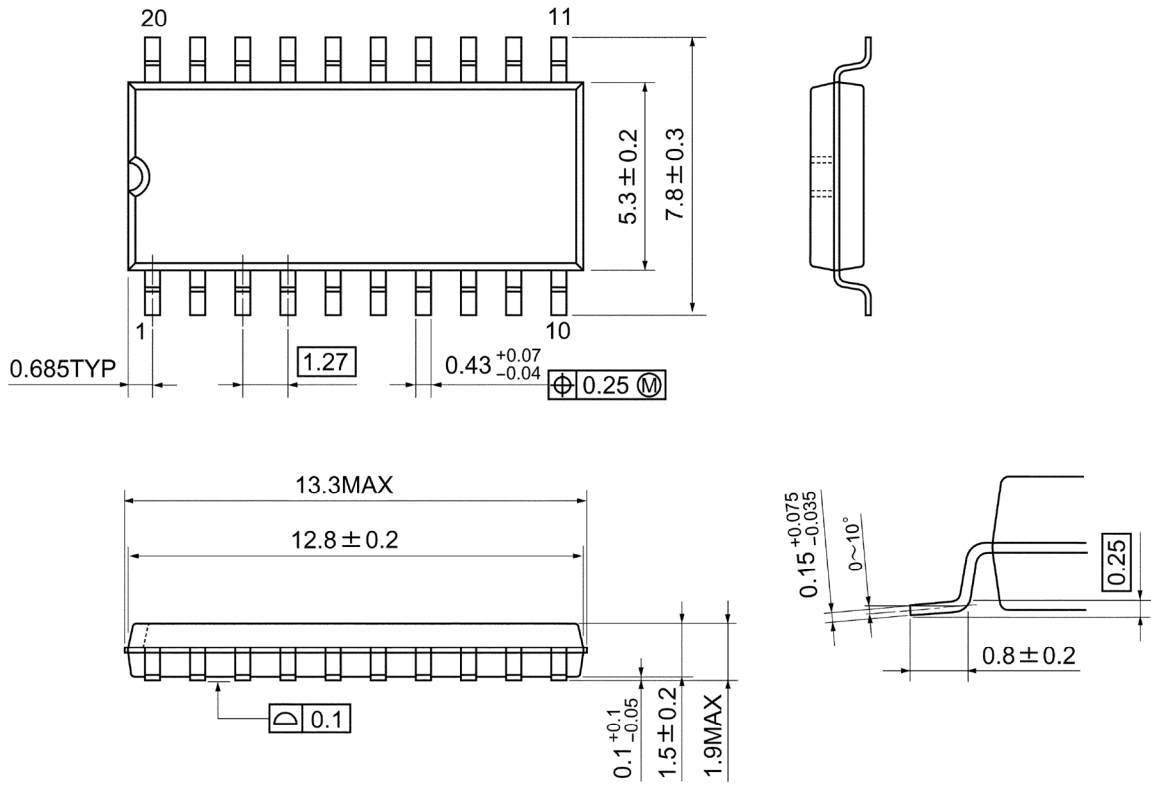


Figure 4 t_{rem}

Package Dimensions

SOP20-P-300-1.27A

Unit: mm

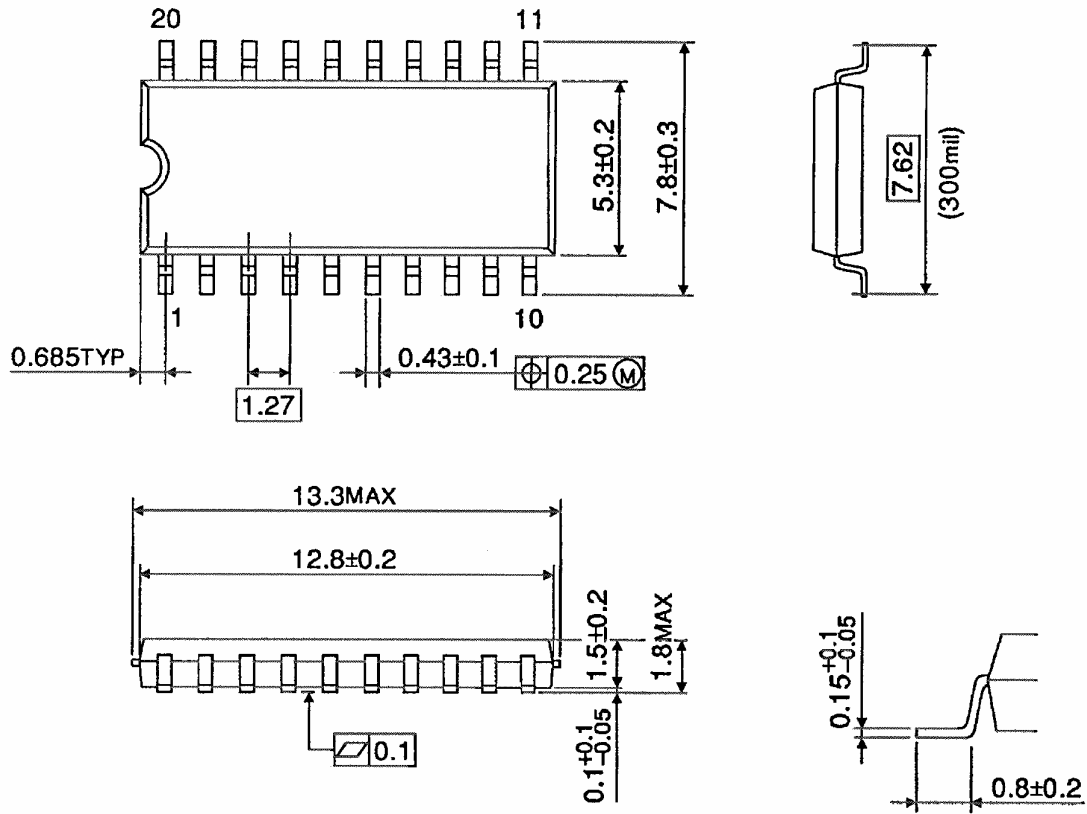


Weight: 0.22 g (typ.)

Package Dimensions

SOP20-P-300-1.27

Unit : mm

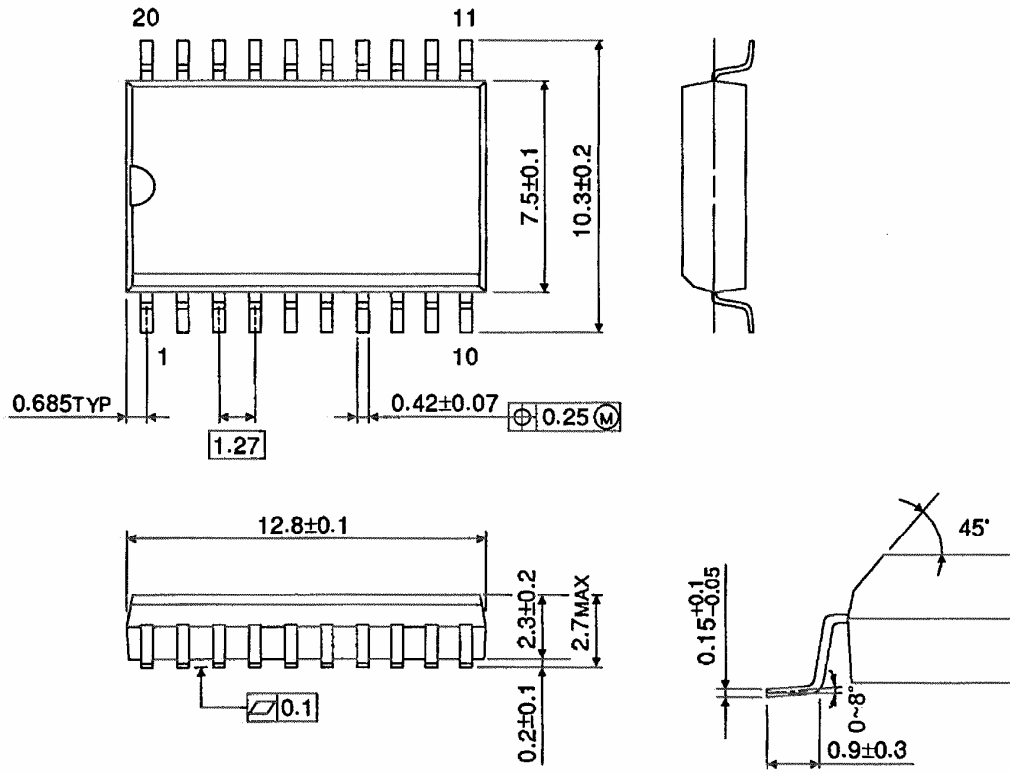


Weight: 0.22 g (typ.)

Package Dimensions (Note)

SOL20-P-300-1.27

Unit : mm



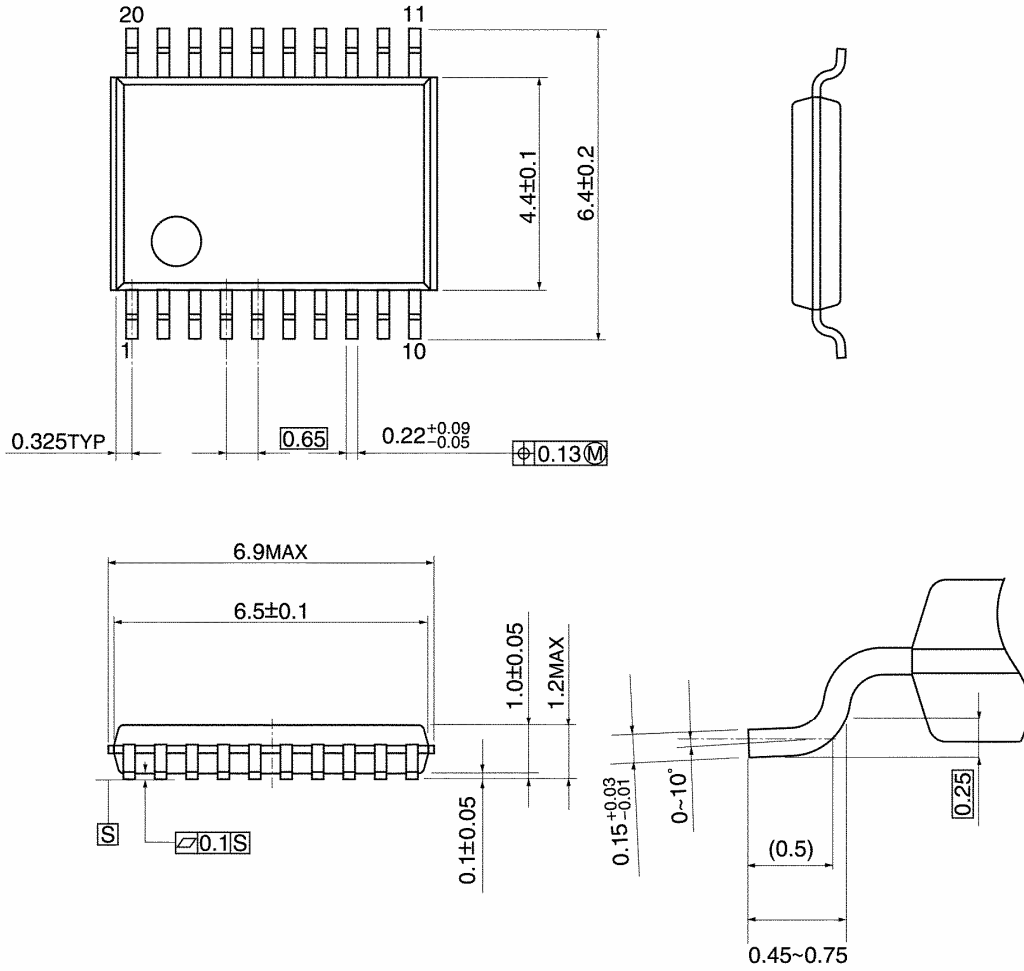
Note: This package is not available in Japan.

Weight: 0.46 g (typ.)

Package Dimensions

TSSOP20-P-0044-0.65A

Unit: mm

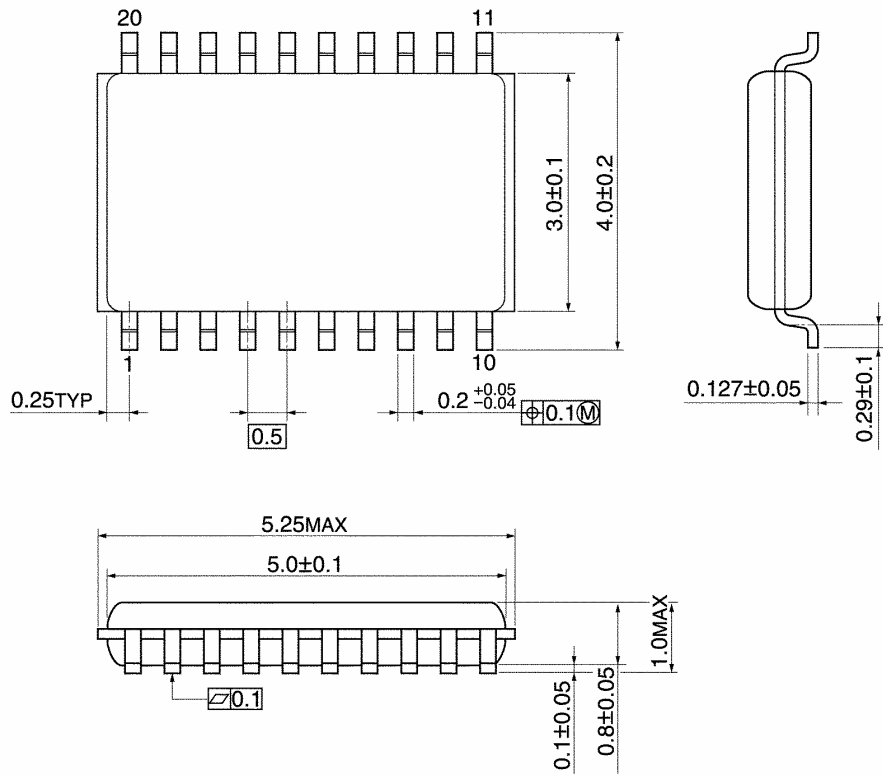


Weight: 0.08 g (typ.)

Package Dimensions

VSSOP20-P-0030-0.50

Unit: mm



Weight: 0.03 g (typ.)

Note: Lead (Pb)-Free Packages**SOP20-P-300-1.27A TSSOP20-P-0044-0.65A VSSOP20-P-0030-0.50****RESTRICTIONS ON PRODUCT USE**

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