TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74LVX273F,TC74LVX273FW,TC74LVX273FT

## Octal D-Type Flip-Flop with Clear

The TC74LVX273F/ FW/ FT is a high-speed CMOS octal D-flip flop fabricated with silicon gate CMOS technology. Designed for use in 3-V systems, it achieves high-speed operation while maintaining the CMOS low power dissipation.

This device is suitable for low-voltage and battery operated systems.

Information signals applied to D inputs are transferred to the Q outputs on the positive going edge of the clock pulse. When the $\overline{CLR}$ input is held low, the Q outputs are in the low logic level independent of the other inputs.

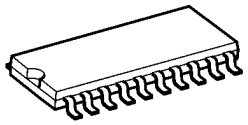
An input protection circuit ensures that 0 to 5.5V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

### Features

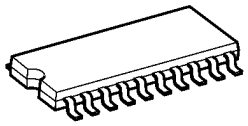
- High-speed: $f_{max}$ = 150 MHz (typ.) ($V_{CC}$ = 3 V)
- Low power dissipation: $I_{CC}$ = 4 μA (max) (Ta = 25°C)
- Input voltage level: $V_{IL}$ = 0.8 V (max) ($V_{CC}$ = 3 V)
  $V_{IH}$ = 2.0 V (min) ($V_{CC}$ = 3 V)
- Power-down protection provided on all inputs
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Low niose: $V_{OLP}$ = 0.8 V (max)
- Pin and function compatible with 74HC273

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

TC74LVX273F

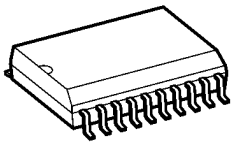


SOP20-P-300-1.27A



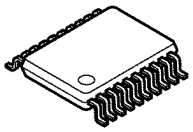
SOP20-P-300-1.27

TC74LVX273FW



SOL20-P-300-1.27

TC74LVX273FT

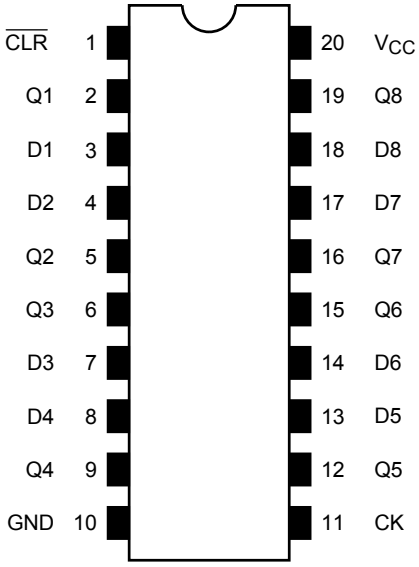


TSSOP20-P-0044-0.65A

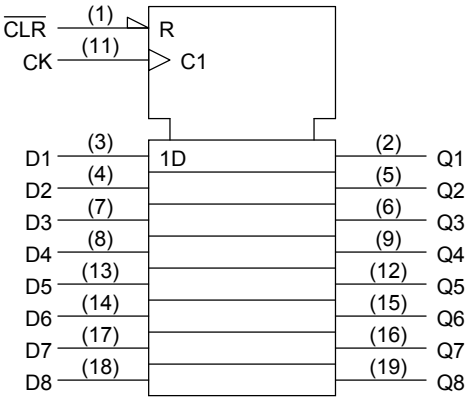
Weight

| | |
|---|---|
| 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.) |

## Pin Assignment (top view)




## IEC Logic Symbol

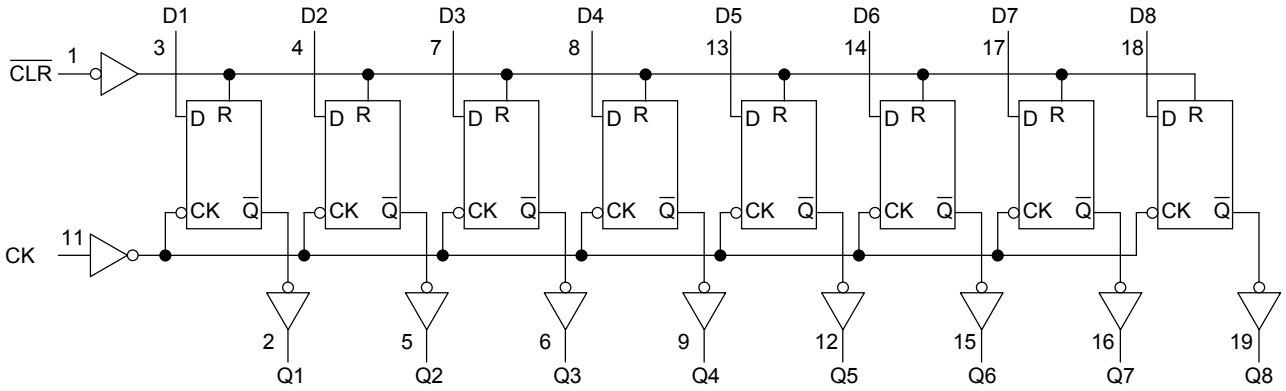



## Truth Table

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

X: Don't care

## System Diagram



## Absolute Maximum Ratings (Note)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage range | $V_{CC}$ | −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 $V_{CC}$ + 0.5 | V |
| Input diode current | $I_{IK}$ | −20 | mA |
| Output diode current | $I_{OK}$ | ±20 | mA |
| DC output current | $I_{OUT}$ | ±25 | mA |
| DC $V_{CC}$/ground current | $I_{CC}$ | ±75 | mA |
| Power dissipation | $P_D$ | 180 | mW |
| Storage temperature | $T_{stg}$ | −65 to 150 | °C |

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

## Recommended Operating Conditions (Note)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | 2.0 to 3.6 | V |
| Input voltage | $V_{IN}$ | 0 to 5.5 | 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 | ns/V |

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 | | Sym-bol | Test Condition | | $V_{CC}$ (V) | Ta = 25°C Min | Typ. | Max | Ta = −40 to 85°C Min | Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Input voltage | H-level | $V_{IH}$ | — | | 2.0 | 1.5 | — | — | 1.5 | — | V |
| | | | | | 3.0 | 2.0 | — | — | 2.0 | — | |
| | | | | | 3.6 | 2.4 | — | — | 2.4 | — | |
| | L-level | $V_{IL}$ | — | | 2.0 | — | — | 0.5 | — | 0.5 | |
| | | | | | 3.0 | — | — | 0.8 | — | 0.8 | |
| | | | | | 3.6 | — | — | 0.8 | — | 0.8 | |
| Output voltage | H-level | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = −50 μA | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | $I_{OH}$ = −50 μA | 3.0 | 2.9 | 3.0 | — | 2.9 | — | |
| | | | | $I_{OH}$ = −4 mA | 3.0 | 2.58 | — | — | 2.48 | — | |
| | L-level | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 50 μA | 2.0 | — | 0 | 0.1 | — | 0.1 | |
| | | | | $I_{OL}$ = 50 μA | 3.0 | — | 0 | 0.1 | — | 0.1 | |
| | | | | $I_{OL}$ = 4 mA | 3.0 | — | — | 0.36 | — | 0.44 | |
| Input leakage current | | $I_{IN}$ | $V_{IN}$ = 5.5 V or GND | | 3.6 | — | — | ±0.1 | — | ±1.0 | μA |
| Quiescent supply current | | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 3.6 | — | — | 4.0 | — | 40.0 | μA |

### Timing Requirements (input: $t_r = t_f = 3$ ns)

| Characteristics | Symbol | Test Condition | $V_{CC}$ (V) | Ta = 25°C Limit | Ta = −40 to 85°C Limit | Unit |
|---|---|---|---|---|---|---|
| Minimum pulse width (CK) | $t_{W(L)}$ $t_{W(H)}$ | — | 2.7 | 8.0 | 9.5 | ns |
| | | | 3.3 ± 0.3 | 5.5 | 6.5 | |
| Minimum pulse width ($\overline{CLR}$) | $t_{W(L)}$ | — | 2.7 | 7.5 | 8.5 | ns |
| | | | 3.3 ± 0.3 | 5.0 | 6.0 | |
| Minimum set-up time | $t_s$ | — | 2.7 | 8.0 | 9.5 | ns |
| | | | 3.3 ± 0.3 | 5.5 | 6.5 | |
| Minimum hold time | $t_h$ | — | 2.7 | 1.0 | 1.0 | ns |
| | | | 3.3 ± 0.3 | 1.0 | 1.0 | |
| Minimum removal time ($\overline{CLR}$) | $t_{rem}$ | — | 2.7 | 4.0 | 4.0 | ns |
| | | | 3.3 ± 0.3 | 2.5 | 2.5 | |

**AC Characteristics (input: $t_r = t_f = 3$ ns)**

| Characteristics | Symbol | Test Condition | | | Ta = 25°C | | | Ta = −40 to 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ (V) | $C_L$ (pF) | Min | Typ. | Max | Min | Max | |
| Propagation delay time (CK-Q) | $t_{pLH}$ $t_{pHL}$ | — | 2.7 | 15 | — | 9.0 | 16.9 | 1.0 | 20.5 | ns |
| | | | | 50 | — | 11.5 | 20.4 | 1.0 | 24.0 | |
| | | | 3.3 ± 0.3 | 15 | — | 7.1 | 11.0 | 1.0 | 13.0 | |
| | | | | 50 | — | 9.6 | 14.5 | 1.0 | 16.5 | |
| Propagation delay time ($\overline{CLR}$ -Q) | $t_{pHL}$ | — | 2.7 | 15 | — | 9.3 | 17.6 | 1.0 | 20.5 | ns |
| | | | | 50 | — | 11.8 | 21.1 | 1.0 | 24.0 | |
| | | | 3.3 ± 0.3 | 15 | — | 7.3 | 11.5 | 1.0 | 13.5 | |
| | | | | 50 | — | 9.8 | 15.0 | 1.0 | 17.0 | |
| Maximum clock frequency | $f_{max}$ | — | 2.7 | 15 | 55 | 110 | — | 45 | — | MHz |
| | | | | 50 | 45 | 60 | — | 40 | — | |
| | | | 3.3 ± 0.3 | 15 | 95 | 150 | — | 80 | — | |
| | | | | 50 | 60 | 90 | — | 50 | — | |
| Output to output skew | $t_{osLH}$ $t_{osHL}$ | (Note 1) | 2.7 | 50 | — | — | 1.5 | — | 1.5 | ns |
| | | | 3.3 ± 0.3 | 50 | — | — | 1.5 | — | 1.5 | |
| Input capacitance | $C_{IN}$ | (Note 2) | | | — | 4 | 10 | — | 10 | pF |
| Power dissipation capacitance | $C_{PD}$ | (Note 3) | | | — | 31 | — | — | — | pF |

Note 1: Parameter guaranteed by design.
($t_{osLH} = |t_{pLHm} - t_{pLHn}|$, $t_{osHL} = |t_{pHLm} - t_{pHLn}|$)

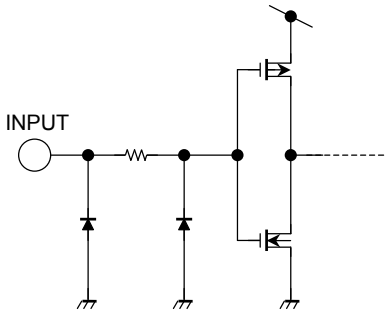
Note 2: Parameter guaranteed by design.

Note 3: $C_{PD}$ 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) = 22 + 9·n

**Noise Characteristics (Ta = 25°C, input: $t_r = t_f = 3$ ns, $C_L = 50$ pF)**

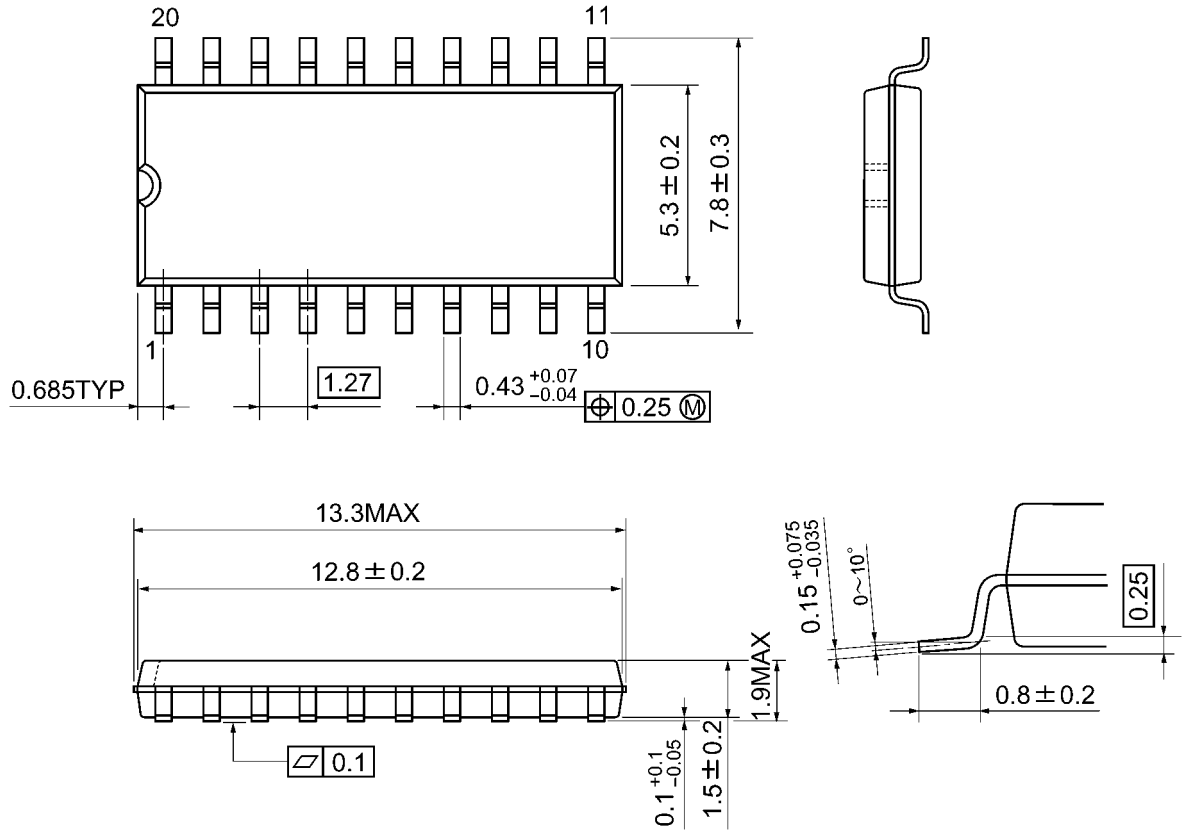
| Characteristics | Symbol | Test Condition | | Typ. | Limit | Unit |
|---|---|---|---|---|---|---|
| | | | $V_{CC}$ (V) | | | |
| Quiet output maximum dynamic $V_{OL}$ | $V_{OLP}$ | — | 3.3 | 0.5 | 0.8 | V |
| Quiet output minimum dynamic $V_{OL}$ | $V_{OLV}$ | — | 3.3 | −0.5 | −0.8 | V |
| Minimum high level dynamic input voltage $V_{IH}$ | $V_{IHD}$ | — | 3.3 | — | 2.0 | V |
| Maximum low level dynamic input voltage $V_{IL}$ | $V_{ILD}$ | — | 3.3 | — | 0.8 | V |

## Input Equivalent Circuit



## Package Dimensions

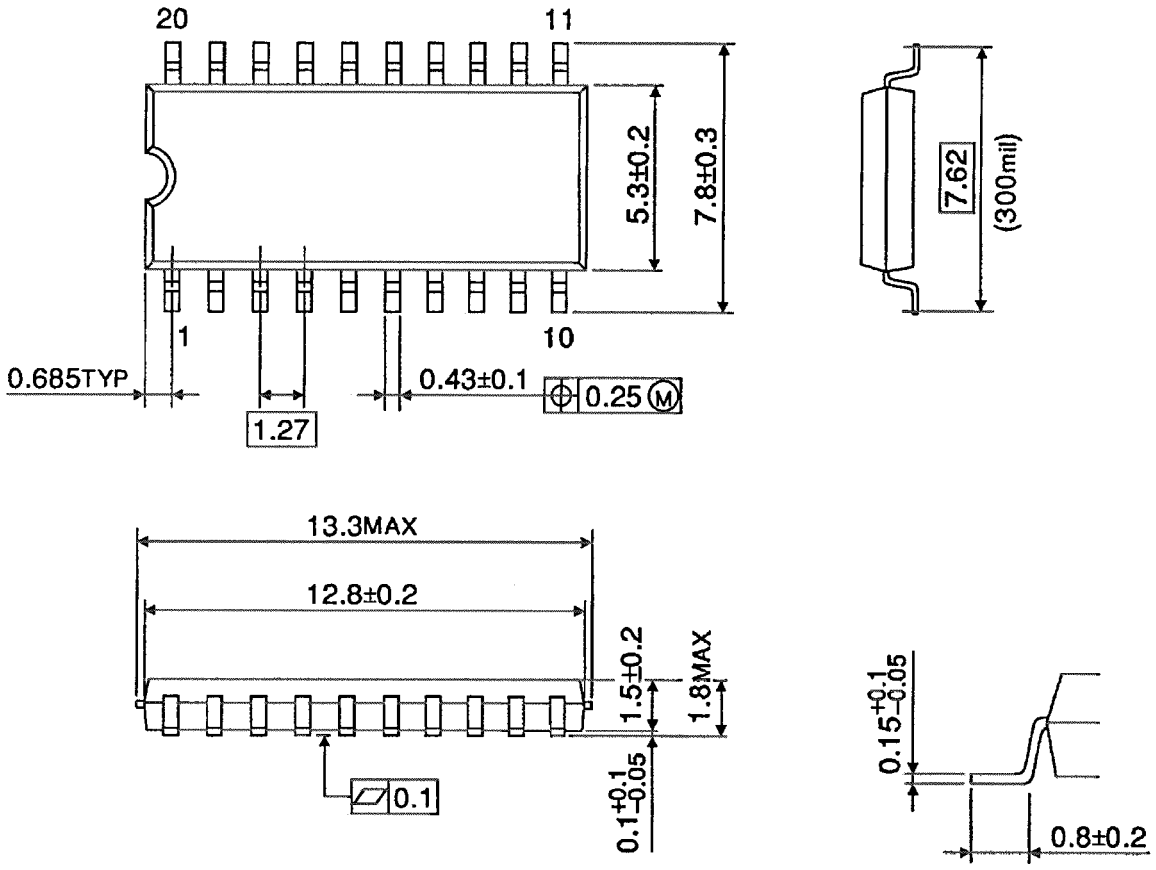
SOP20-P-300-1.27A Unit: mm




Weight: 0.22 g (typ.)

## Package Dimensions

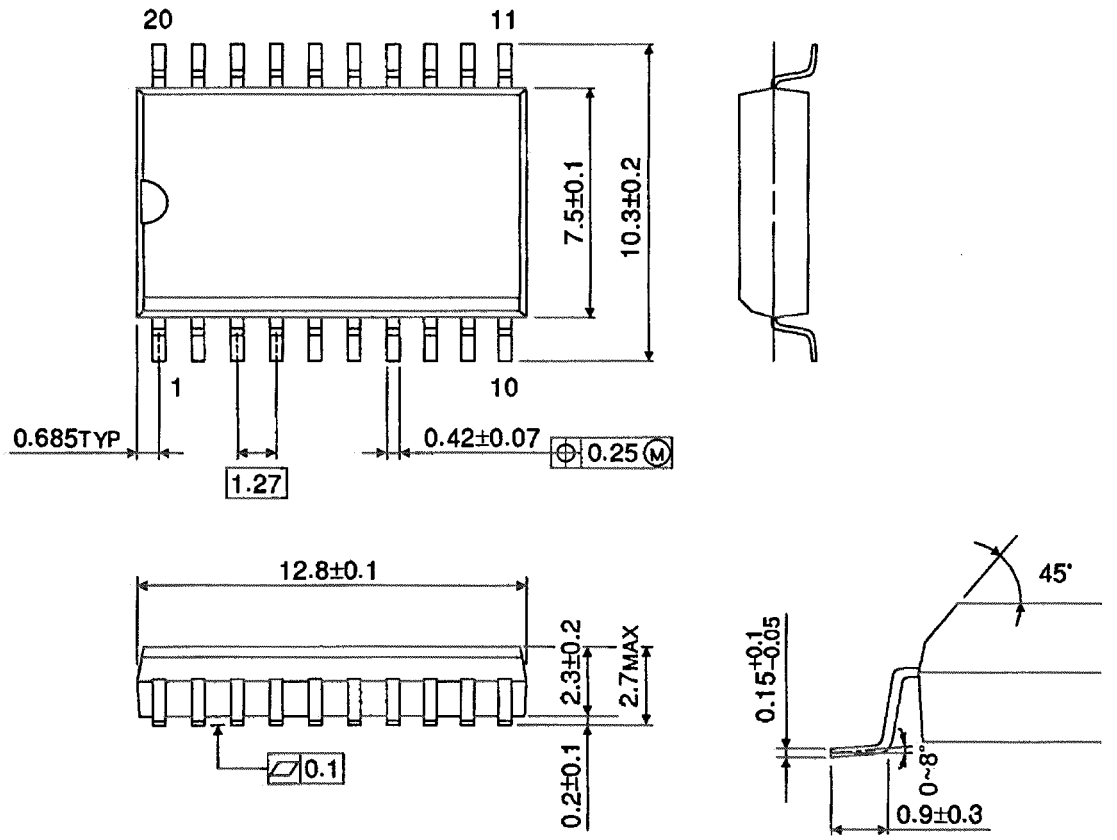
SOP20-P-300-1.27 Unit : mm




Weight: 0.22 g (typ.)

## Package Dimensions (Note)

SOL20-P-300-1.27 Unit : mm

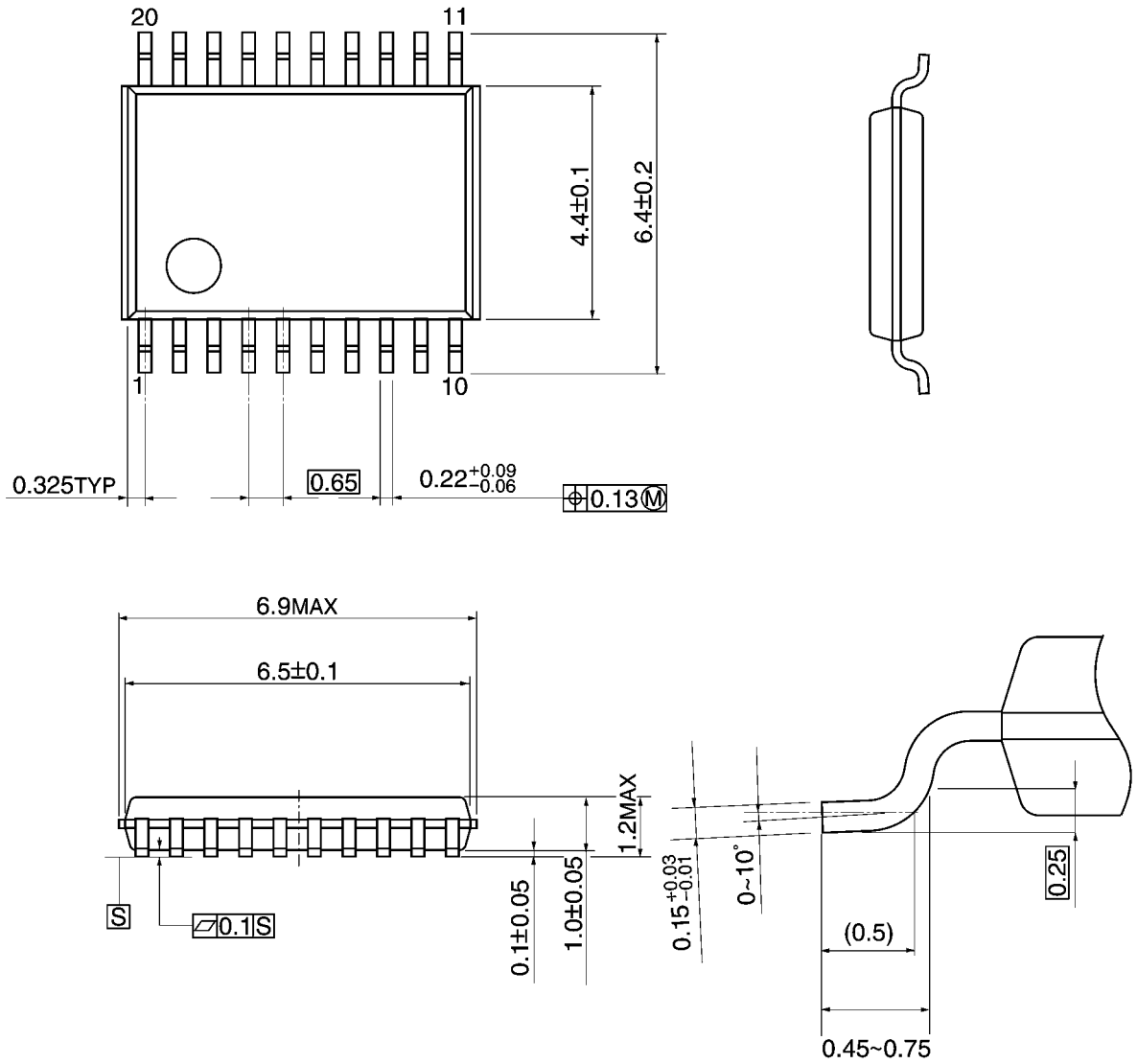



Note: This package is not available in Japan.

Weight: 0.46 g (typ.)

## Package Dimensions

TSSOP20-P-0044-0.65A Unit: mm




Weight: 0.08 g (typ.)

**Note: Lead (Pb)-Free Packages**

**SOP20-P-300-1.27A TSSOP20-P-0044-0.65A**

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