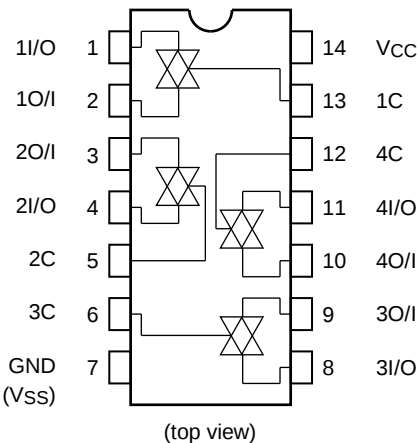
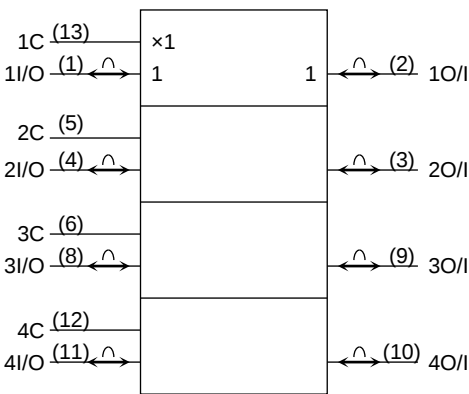


Pin Assignment



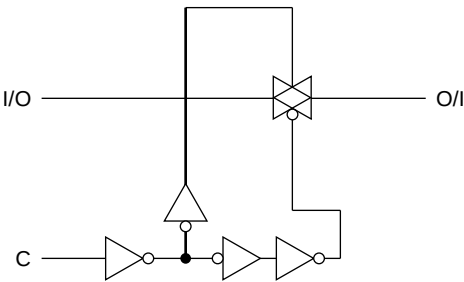
IEC Logic Symbol



Truth Table

| Control | Switch Function |
|---------|-----------------|
| H       | On              |
| L       | Off             |

System diagram (Per Circuit)



## Absolute Maximum Ratings (Note)

| Characteristics             | Symbol     | Rating                             | Unit |
|-----------------------------|------------|------------------------------------|------|
| Supply voltage range        | $V_{CC}$   | -0.5 to 13                         | V    |
| Control input voltage       | $V_{IN}$   | -0.5 to $V_{CC} + 0.5$             | V    |
| Switch I/O voltage          | $V_{I/O}$  | -0.5 to $V_{CC} + 0.5$             | V    |
| Control input diode current | $I_{IK}$   | $\pm 20$                           | mA   |
| I/O diode current           | $I_{I/OK}$ | $\pm 20$                           | mA   |
| Switch through Current      | $I_T$      | $\pm 25$                           | mA   |
| DC $V_{CC}$ /ground current | $I_{CC}$   | $\pm 50$                           | mA   |
| Power dissipation           | $P_D$      | 500 (DIP) (Note 1)/180 (SOP/TSSOP) | 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.

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 1: 500 mW in the range of  $T_a = -40$  to  $65^\circ\text{C}$ . From  $T_a = 65$  to  $85^\circ\text{C}$  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 to 12                                                                                                                                                            | V    |
| Control input voltage    | $V_{IN}$   | 0 to $V_{CC}$                                                                                                                                                      | V    |
| Switch I/O voltage       | $V_{I/O}$  | 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 ( $V_{CC} = 2.0 \text{ V}$ )<br>0 to 500 ( $V_{CC} = 4.5 \text{ V}$ )<br>0 to 400 ( $V_{CC} = 6.0 \text{ V}$ )<br>0 to 250 ( $V_{CC} = 10.0 \text{ V}$ ) | ns   |

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused control inputs must be tied to either  $V_{CC}$  or GND.

## Electrical Characteristics

## DC Characteristics

| Characteristics                                       | Symbol           | Test Condition                                                                                                             | V <sub>CC</sub> (V)       | Ta = 25°C                    |                  |                              | Ta = -40 to 85°C             |                              | Unit |
|-------------------------------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------|------------------|------------------------------|------------------------------|------------------------------|------|
|                                                       |                  |                                                                                                                            |                           | Min                          | Typ.             | Max                          | Min                          | Max                          |      |
| High-level control input voltage                      | V <sub>IHC</sub> | —                                                                                                                          | 2.0<br>4.5<br>9.0<br>12.0 | 1.50<br>3.15<br>6.30<br>8.40 | —<br>—<br>—<br>— | —<br>—<br>—<br>—             | 1.50<br>3.15<br>6.30<br>8.40 | —<br>—<br>—<br>—             | V    |
| Low-level control input voltage                       | V <sub>ILC</sub> | —                                                                                                                          | 2.0<br>4.5<br>9.0<br>12.0 | —<br>—<br>—<br>—             | —<br>—<br>—<br>— | 0.50<br>1.35<br>2.70<br>3.60 | —<br>—<br>—<br>—             | 0.50<br>1.35<br>2.70<br>3.60 | V    |
| ON resistance                                         | R <sub>ON</sub>  | V <sub>IN</sub> = V <sub>IHC</sub>                                                                                         | 4.5                       | —                            | 96               | 170                          | —                            | 200                          | Ω    |
|                                                       |                  | V <sub>I/O</sub> = V <sub>CC</sub> to GND                                                                                  | 9.0                       | —                            | 55               | 85                           | —                            | 100                          |      |
|                                                       |                  | I <sub>I/O</sub> ≤ 1 mA                                                                                                    | 12.0                      | —                            | 45               | 80                           | —                            | 90                           |      |
|                                                       |                  | V <sub>IN</sub> = V <sub>IHC</sub>                                                                                         | 2.0                       | —                            | 160              | —                            | —                            | —                            |      |
|                                                       |                  | V <sub>I/O</sub> = V <sub>CC</sub> or GND                                                                                  | 4.5                       | —                            | 70               | 100                          | —                            | 130                          |      |
|                                                       |                  | I <sub>I/O</sub> ≤ 1 mA                                                                                                    | 9.0                       | —                            | 50               | 75                           | —                            | 95                           |      |
|                                                       |                  | I <sub>I/O</sub> ≤ 1 mA                                                                                                    | 12.0                      | —                            | 45               | 70                           | —                            | 90                           |      |
|                                                       |                  | I <sub>I/O</sub> ≤ 1 mA                                                                                                    | 12.0                      | —                            | 45               | 70                           | —                            | 90                           |      |
| Difference of ON resistance between switches          | ΔR <sub>ON</sub> | V <sub>IN</sub> = V <sub>IHC</sub>                                                                                         | 4.5                       | —                            | 10               | —                            | —                            | —                            | Ω    |
|                                                       |                  | V <sub>I/O</sub> = V <sub>CC</sub> to GND                                                                                  | 9.0                       | —                            | 5                | —                            | —                            | —                            |      |
|                                                       |                  | I <sub>I/O</sub> ≤ 1 mA                                                                                                    | 12.0                      | —                            | 5                | —                            | —                            | —                            |      |
| Input/output leakage current (switch off)             | I <sub>OFF</sub> | V <sub>OS</sub> = V <sub>CC</sub> or GND<br>V <sub>IS</sub> = GND or V <sub>CC</sub><br>V <sub>IN</sub> = V <sub>ILC</sub> | 12.0                      | —                            | —                | ±100                         | —                            | ±1000                        | nA   |
| Switch input leakage current (switch on, output open) | I <sub>IZ</sub>  | V <sub>OS</sub> = V <sub>CC</sub> or GND<br>V <sub>IN</sub> = V <sub>IHC</sub>                                             | 12.0                      | —                            | —                | ±100                         | —                            | ±1000                        | nA   |
| Control input current                                 | I <sub>IN</sub>  | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                                                   | 12.0                      | —                            | —                | ±100                         | —                            | ±1000                        | nA   |
| Quiescent supply current                              | I <sub>CC</sub>  | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                                                   | 6.0                       | —                            | —                | 1.0                          | —                            | 10.0                         | μA   |
|                                                       |                  |                                                                                                                            | 9.0                       | —                            | —                | 4.0                          | —                            | 40.0                         |      |
|                                                       |                  |                                                                                                                            | 12.0                      | —                            | —                | 8.0                          | —                            | 80.0                         |      |

## AC Characteristics (CL = 50 pF, input: tr = tf = 6 ns)

| Characteristics                           | Symbol                 | Test Condition                                                             | VCC (V) | Ta = 25°C |      |     | Ta = -40 to 85°C |     | Unit |
|-------------------------------------------|------------------------|----------------------------------------------------------------------------|---------|-----------|------|-----|------------------|-----|------|
|                                           |                        |                                                                            |         | Min       | Typ. | Max | Min              | Max |      |
| Phase difference between input and output | $\phi_{I-O}$           | —                                                                          | 2.0     | —         | 10   | 50  | —                | 65  | ns   |
|                                           |                        |                                                                            | 4.5     | —         | 4    | 10  | —                | 13  |      |
|                                           |                        |                                                                            | 9.0     | —         | 3    | 8   | —                | 10  |      |
|                                           |                        |                                                                            | 12.0    | —         | 3    | 7   | —                | 9   |      |
| Output enable time                        | $t_{pZL}$<br>$t_{pZH}$ | $R_L = 1\text{ k}\Omega$<br>$C_L = 50\text{ pF}$                           | 2.0     | —         | 18   | 100 | —                | 125 | ns   |
|                                           |                        |                                                                            | 4.5     | —         | 8    | 20  | —                | 25  |      |
|                                           |                        |                                                                            | 9.0     | —         | 6    | 12  | —                | 22  |      |
|                                           |                        |                                                                            | 12.0    | —         | 6    | 12  | —                | 18  |      |
| Output disable time                       | $t_{pLZ}$<br>$t_{pHZ}$ | $R_L = 1\text{ k}\Omega$<br>$C_L = 50\text{ pF}$                           | 2.0     | —         | 20   | 115 | —                | 145 | ns   |
|                                           |                        |                                                                            | 4.5     | —         | 10   | 23  | —                | 29  |      |
|                                           |                        |                                                                            | 9.0     | —         | 8    | 20  | —                | 25  |      |
|                                           |                        |                                                                            | 12.0    | —         | 8    | 18  | —                | 22  |      |
| Maximum control input frequency           |                        | $R_L = 1\text{ k}\Omega$<br>$C_L = 50\text{ pF}$<br>$V_{OUT} = 1/2 V_{CC}$ | 2.0     | —         | 30   | —   | —                | —   | MHz  |
|                                           |                        |                                                                            | 4.5     | —         | 30   | —   | —                | —   |      |
|                                           |                        |                                                                            | 9.0     | —         | 30   | —   | —                | —   |      |
|                                           |                        |                                                                            | 12.0    | —         | 30   | —   | —                | —   |      |
| Control input capacitance                 | $C_{IN}$               | —                                                                          |         | —         | 5    | 10  | —                | 10  | pF   |
| Switch terminal capacitance               | $C_{I/O}$              | —                                                                          |         | —         | 6    | —   | —                | —   | pF   |
| Feed through capacitance                  | $C_{IOS}$              | —                                                                          |         | —         | 0.5  | —   | —                | —   | pF   |
| Power dissipation capacitance             | $CPD$                  | (Note 1)                                                                   |         | —         | 15   | —   | —                | —   | pF   |

Note 1: CPD 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:

$$I_{CC}(\text{opr}) = CPD \cdot V_{CC} \cdot f_{IN} + I_{CC} / 4 \text{ (per channel)}$$

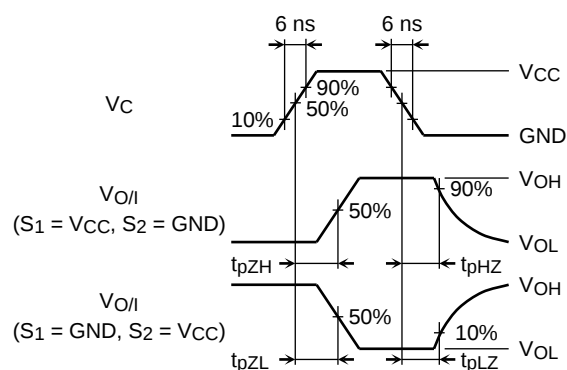
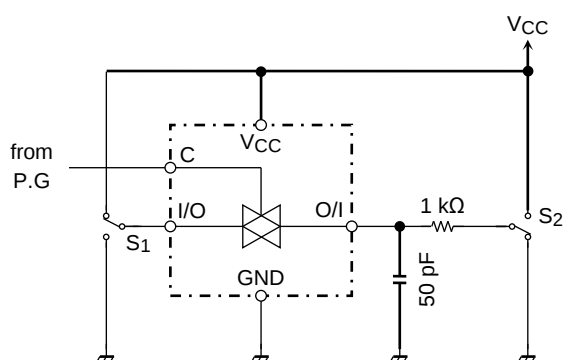
## Analog Switch Characteristics (Note) (GND = 0 V, Ta = 25°C)

| Characteristics                               | Symbol           | Test Condition                                                                           | V <sub>CC</sub> (V) | Typ. | Unit |
|-----------------------------------------------|------------------|------------------------------------------------------------------------------------------|---------------------|------|------|
|                                               |                  |                                                                                          |                     |      |      |
| Sine wave distortion<br>(T.H.D)               |                  | f <sub>IN</sub> = 1 kHz, V <sub>IN</sub> = 4 V <sub>p-p</sub> , @V <sub>CC</sub> = 4.5 V | 4.5                 | 0.05 | %    |
|                                               |                  | R <sub>L</sub> = 10 kΩ, V <sub>IN</sub> = 8 V <sub>p-p</sub> , @V <sub>CC</sub> = 9.0 V  | 9.0                 | 0.04 |      |
|                                               |                  | C <sub>L</sub> = 50 pF                                                                   |                     |      |      |
| Frequency response<br>(switch on)             | f <sub>max</sub> | Adjust f <sub>IN</sub> voltage to obtain 0dBm at V <sub>OS</sub>                         | 4.5                 | 200  | MHz  |
|                                               |                  | Increase f <sub>IN</sub> frequency until dB meter reads -3dB                             | 9.0                 | 200  |      |
|                                               |                  | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 10 pF                                            |                     |      |      |
| Feedthrough attenuation<br>(switch off)       |                  | f <sub>IN</sub> = 1 MHz, sine wave                                                       |                     |      | dB   |
|                                               |                  | V <sub>IN</sub> is centered at V <sub>CC</sub> /2                                        | 4.5                 | -60  |      |
|                                               |                  | Adjust input for 0dBm                                                                    | 9.0                 | -60  |      |
| Crosstalk<br>(control input to signal output) |                  | R <sub>L</sub> = 600 Ω, C <sub>L</sub> = 50 pF                                           | 4.5                 | 60   | mV   |
|                                               |                  | f <sub>IN</sub> = 1 MHz, square wave (t <sub>r</sub> = t <sub>f</sub> = 6 ns)            | 9.0                 | 100  |      |
|                                               |                  |                                                                                          |                     |      |      |
| Crosstalk<br>(between any switches)           |                  | Adjust V <sub>IN</sub> to obtain 0dBm at input                                           | 4.5                 | -60  | dB   |
|                                               |                  | R <sub>L</sub> = 600 Ω, C <sub>L</sub> = 50 pF                                           | 9.0                 | -60  |      |
|                                               |                  | f <sub>IN</sub> = 1 MHz, sine wave                                                       |                     |      |      |

Note: These characteristics are determined by design of devices.

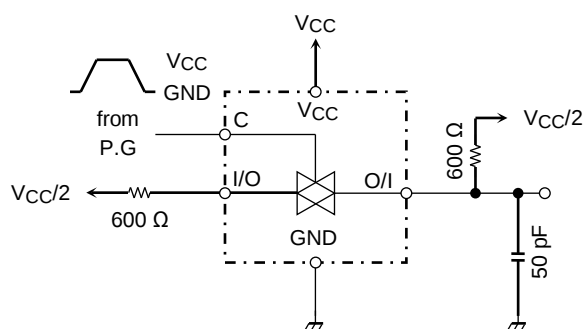
## Switching Characteristics Test Circuits

### 1. $t_{pLZ}$ , $t_{pHZ}$ , $t_{pZL}$ , $t_{pZH}$

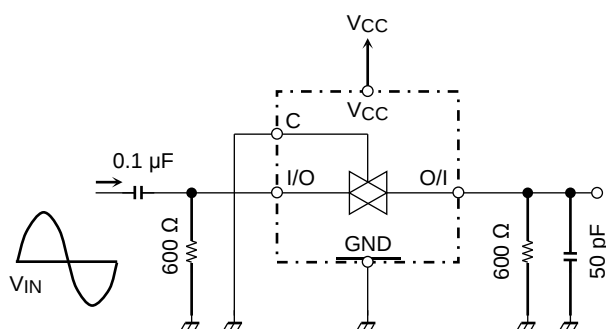


### 2. Cross Talk (control input-switch output)

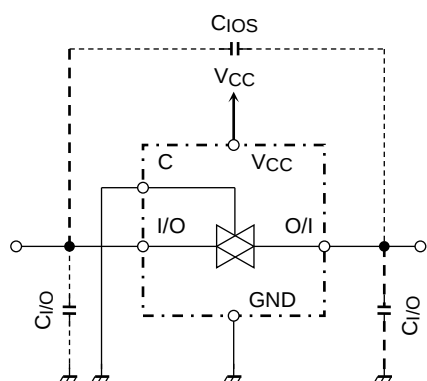
$f_{IN} = 1 \text{ MHz}$  duty = 50%  $t_r = t_f = 6 \text{ ns}$



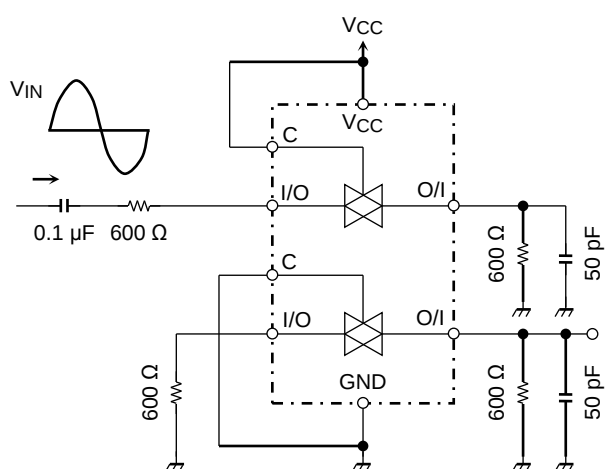
### 3. Feedthrough Attenuation



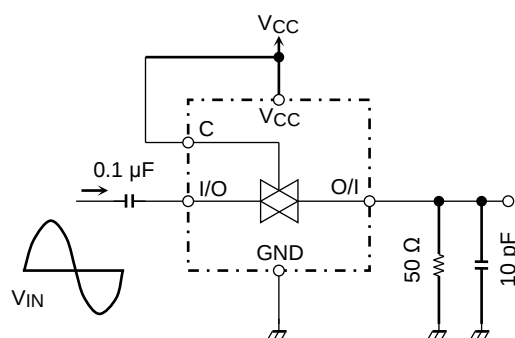
## 4. C<sub>ios</sub>, C<sub>i/o</sub>



## 5. Crosstalk (between any two switches)



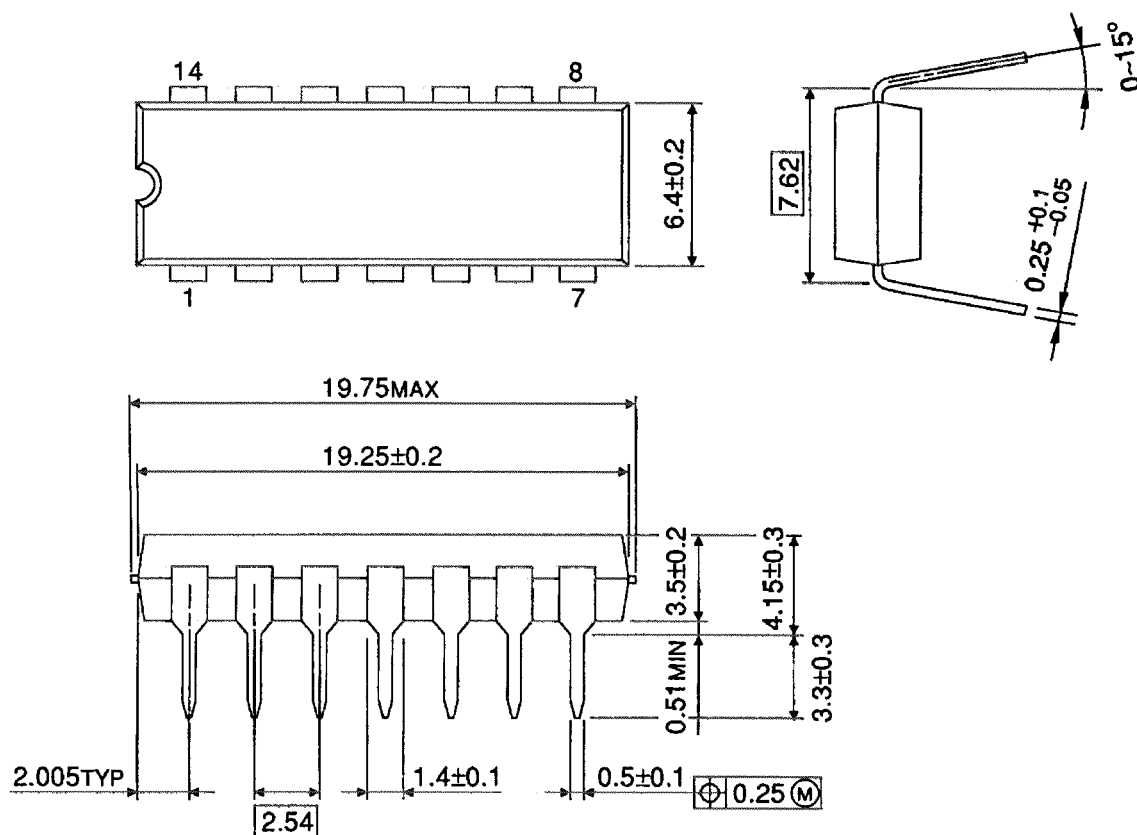
## 6. Frequency Response (switch on)



## Package Dimensions

DIP14-P-300-2.54

Unit : mm

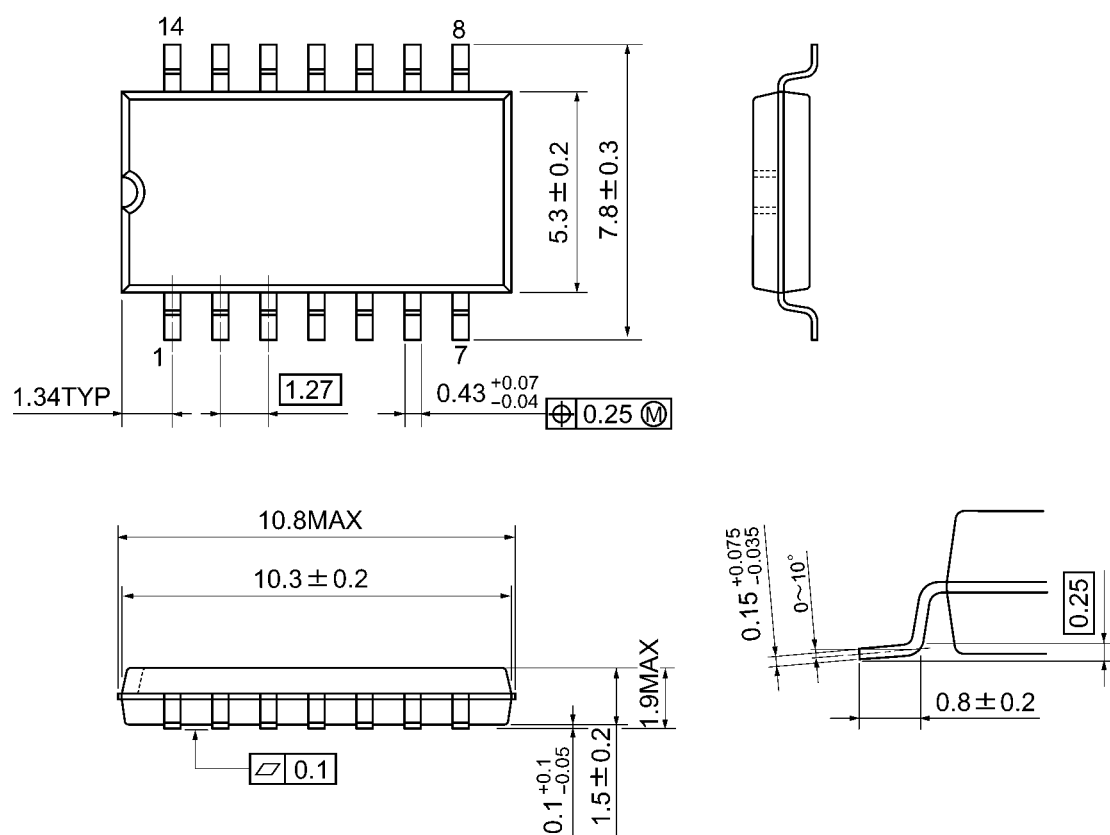


Weight: 0.96 g (typ.)

## Package Dimensions

SOP14-P-300-1.27A

Unit: mm

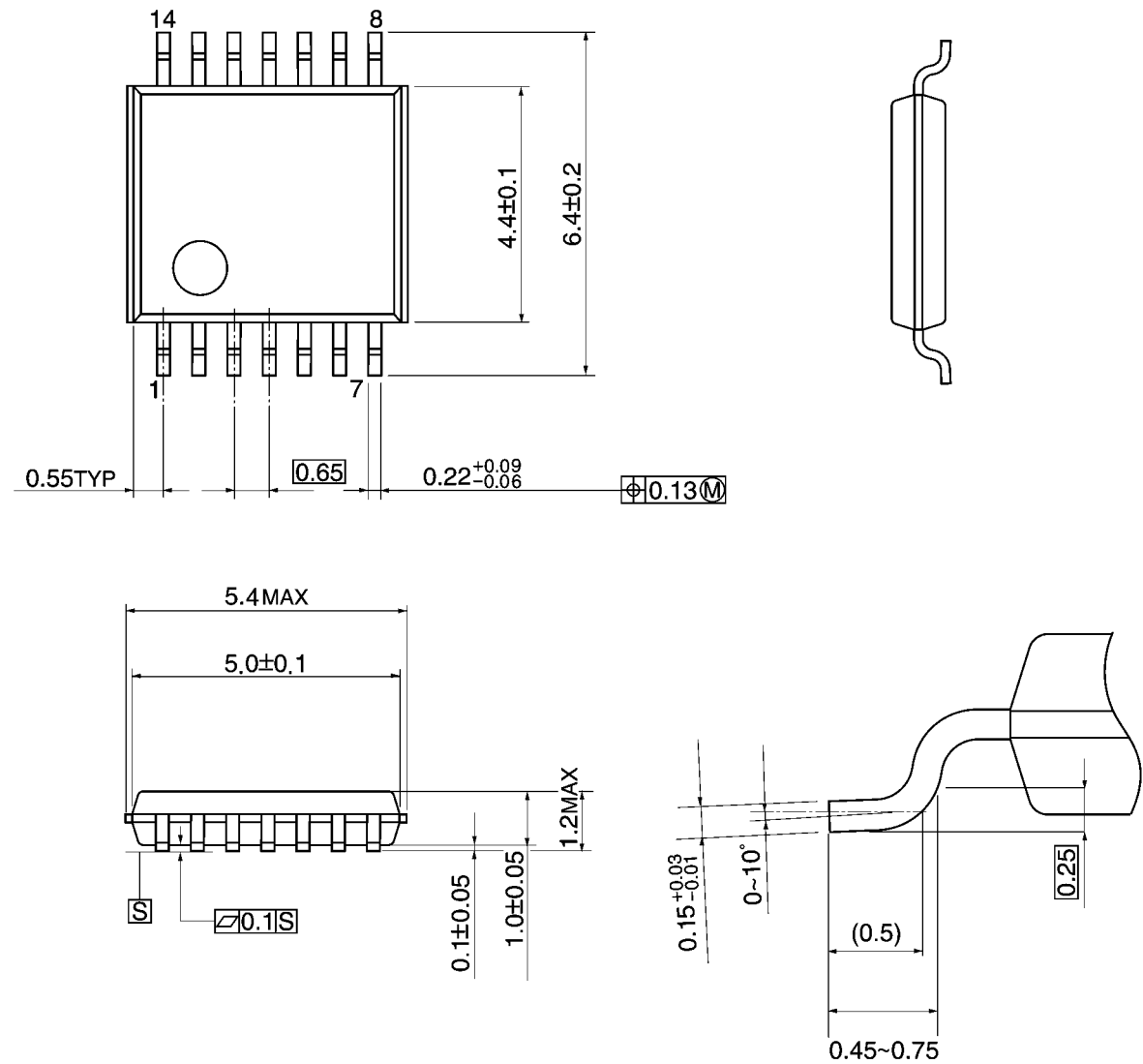


Weight: 0.18 g (typ.)

Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm



Weight: 0.06 g (typ.)

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