

TC74HC595AP, TC74HC595AF, TC74HC595AFN

8-BIT SHIFT REGISTER / LATCH (3-STATE)

The TC74HC595A is a high speed 8-BIT SHIFT REGISTER / LATCH fabricated with silicon gate C²MOS technology. It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation. The TC74HC595A contains an 8-bit static shift register which feeds an 8-bit storage register.

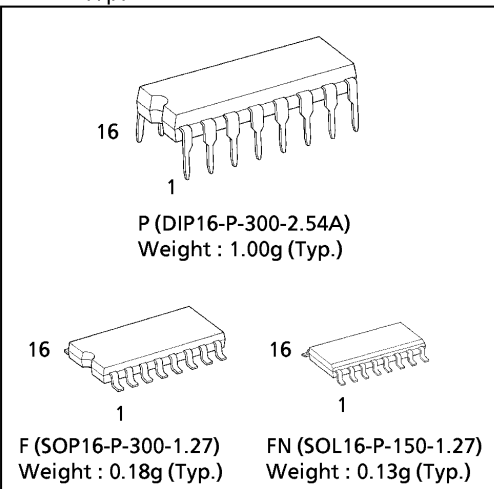
Shift operation is accomplished on the positive going transition of the SCK input. The output register is loaded with the contents of the shift register on the positive going transition of the RCK input. Since RCK and SCK signal are independent, parallel outputs can be held stable during the shift operation. And, since the parallel outputs are 3-state, it can be directly connected to 8-bit bus. This register can be used in serial-to-parallel conversion, data receivers, etc.

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

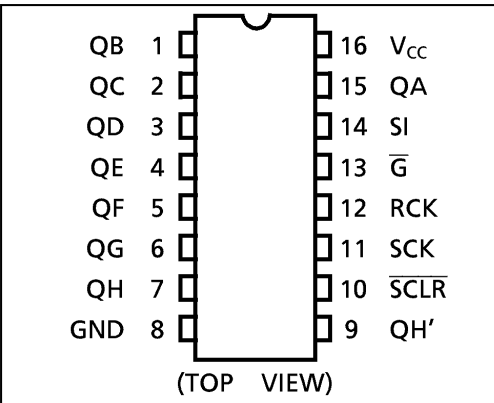
FEATURES :

- High Speed..... $f_{MAX} = 55\text{MHz}(\text{typ.})$
at $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$ at $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}(\text{Min.})$
- Output Drive Capability..... 15 LSTTL Loads For QA~QH
10 LSTTL Loads For QH'
- Symmetrical Output Impedance... $|I_{OH}| = I_{OL} = 6\text{mA}(\text{Min.})$
For QA~QH
 $|I_{OH}| = I_{OL} = 4\text{mA}(\text{Min.})$
For QH'
- Balanced Propagation Delays..... $t_{PLH} \approx t_{PHL}$
- Wide Operating Voltage Range... $V_{CC}(\text{opr.}) = 2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 74LS595

(Note) The JEDEC SOP (FN) is not available in Japan.



PIN ASSIGNMENT



TRUTH TABLE

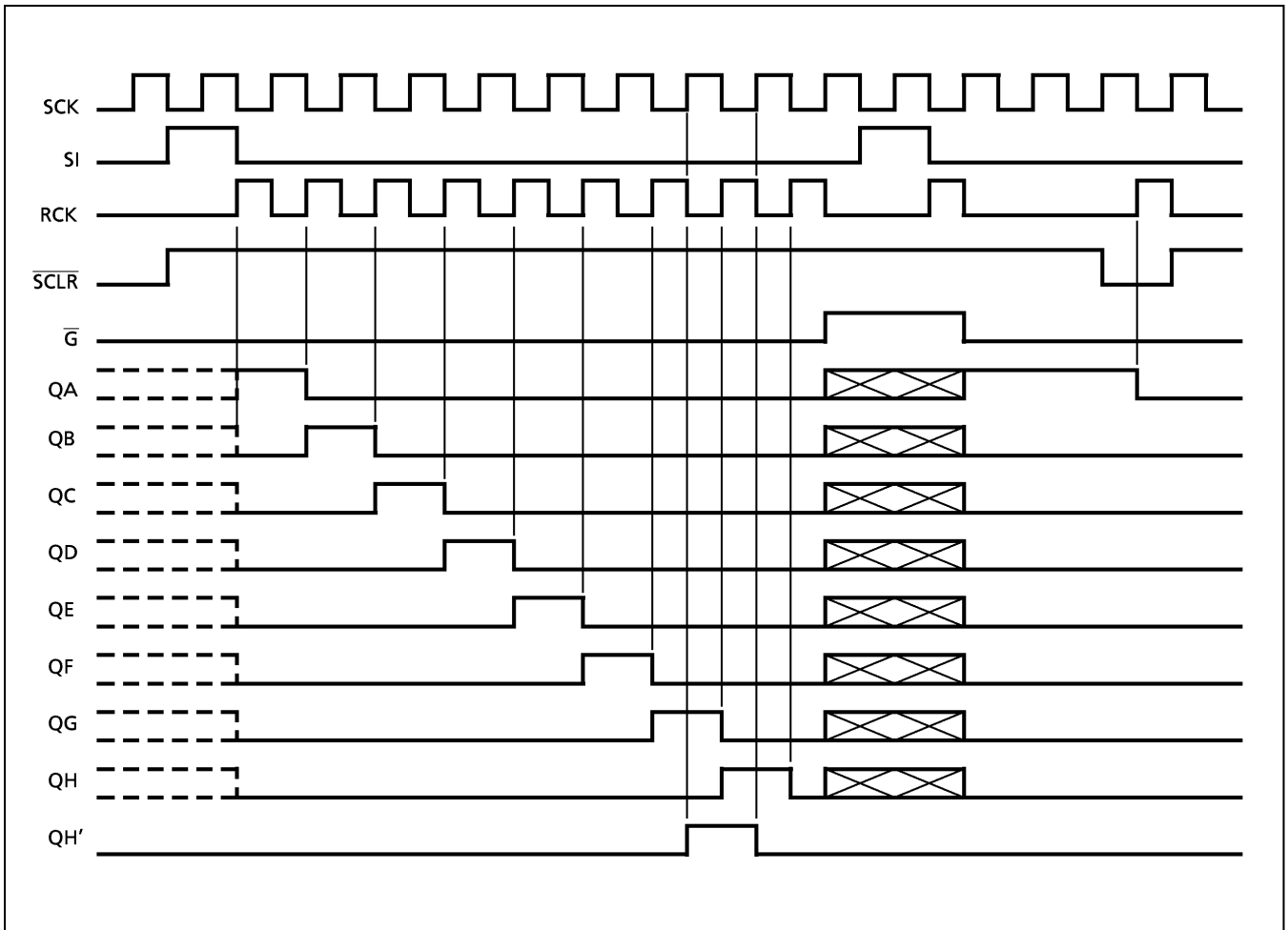
| INPUTS | | | | | FUNCTION |
|--------|-----|------|-----|-------|--|
| SI | SCK | SCLR | RCK | G-bar | |
| X | X | X | X | H | QA thru QH outputs disable |
| X | X | X | X | L | QA thru QH outputs enable |
| X | X | L | X | X | Shift register is cleared. |
| L | | H | X | X | First stage of S. R. becomes "L". Other stages store the data of previous stage, respectively. |
| H | | H | X | X | First stage of S. R. becomes "H". Other stages store the data of previous stage, respectively. |
| X | | H | X | X | State of S. R. is not changed. |
| X | X | X | | X | S.R. data is stored into storage register. |
| X | X | X | | X | Storage register stage is not changed. |

X : Don't Care

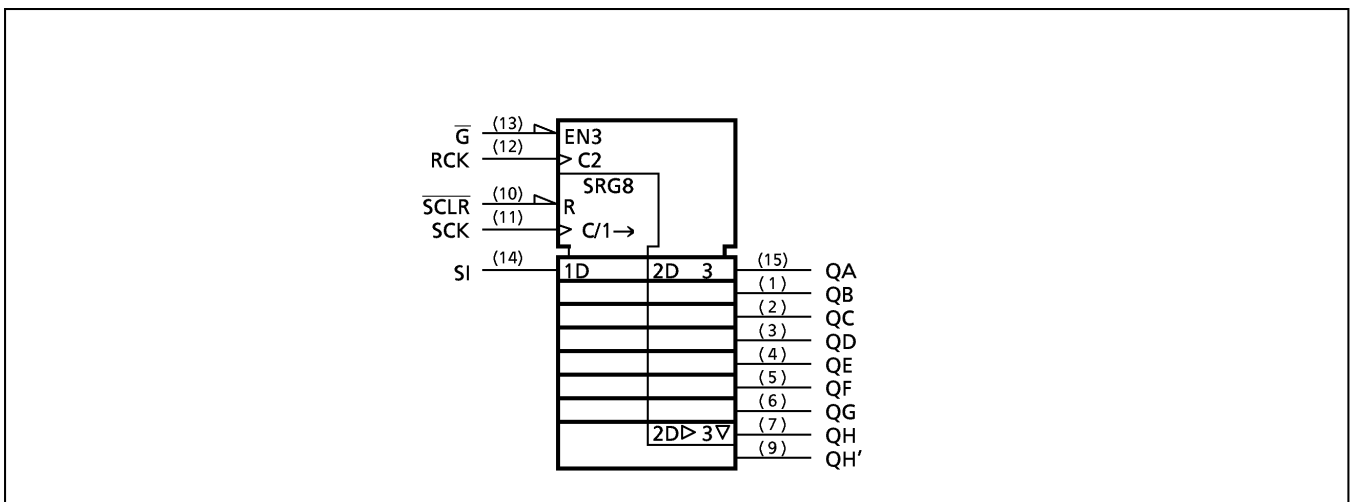
961001EBA2

● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

TIMING CHART



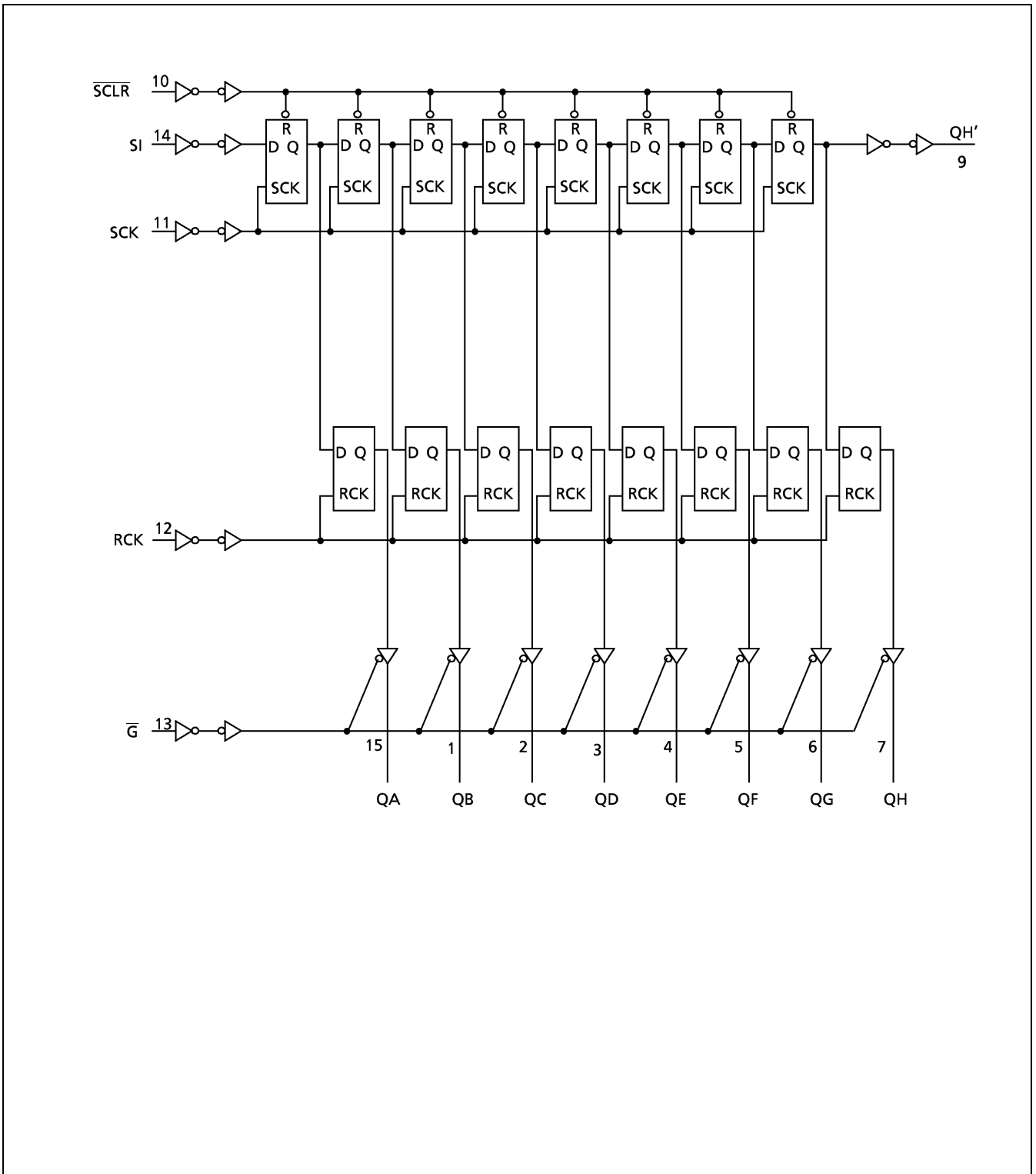
IEC LOGIC SYMBOL



961001EBA2'

- The products described in this document are subject to foreign exchange and foreign trade control laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

SYSTEM DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | VALUE | UNIT |
|------------------------------------|-----------|------------------------|------|
| Supply Voltage Range | V_{CC} | -0.5~7 | V |
| DC Input Voltage | V_{IN} | -0.5~ $V_{CC} + 0.5$ | V |
| DC Output Voltage | V_{OUT} | -0.5~ $V_{CC} + 0.5$ | V |
| Input Diode Current | I_{IK} | ±20 | mA |
| Output Diode Current | I_{OK} | ±20 | mA |
| DC Output Current (QH') (QA~QH) | I_{OUT} | ±25 ±35 | mA |
| DC V_{CC} /Ground Current | I_{CC} | ±75 | mA |
| Power Dissipation | P_D | 500 (DIP)* / 180 (SOP) | mW |
| Storage Temperature | T_{stg} | -65~150 | °C |

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

RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | VALUE | UNIT |
|--------------------------|------------|---|------|
| Supply Voltage | V_{CC} | 2~6 | V |
| Input Voltage | V_{IN} | 0~ V_{CC} | V |
| Output Voltage | V_{OUT} | 0~ V_{CC} | V |
| Operating Temperature | T_{opr} | -40~85 | °C |
| Input Rise and Fall Time | t_r, t_f | 0~1000 ($V_{CC} = 2.0\text{V}$) 0~500 ($V_{CC} = 4.5\text{V}$) 0~400 ($V_{CC} = 6.0\text{V}$) | ns |

DC ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITION | V_{CC} (V) | $T_a = 25^{\circ}\text{C}$ | | | $T_a = -40 \sim 85^{\circ}\text{C}$ | | UNIT |
|---|----------|--|-----------------|----------------------------|------|------|-------------------------------------|------|---------------|
| | | | | 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 |
| | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | |
| | | QH' | 4.5 | 4.18 | 4.31 | — | 4.13 | — | V |
| | | | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| | | | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| QA~QH | | $I_{OH} = -6\text{ mA}$ $I_{OH} = -7.8\text{ mA}$ | 4.5 | 4.18 | 4.31 | — | 4.13 | — | V |
| | | | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| | | | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| 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 |
| | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | |
| | | QH' | 4.5 | — | 0.17 | 0.26 | — | 0.33 | V |
| | | | 6.0 | — | 0.18 | 0.26 | — | 0.33 | |
| | | | 6.0 | — | 0.18 | 0.26 | — | 0.33 | |
| QA~QH | | $I_{OL} = 6\text{ mA}$ $I_{OL} = 7.8\text{ mA}$ | 4.5 | — | 0.17 | 0.26 | — | 0.33 | V |
| 6.0 | | | — | 0.18 | 0.26 | — | 0.33 | | |
| 6.0 | | | — | 0.18 | 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 | |
| Quiescent Supply Current | I_{CC} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | 4.0 | — | 40.0 | |

TIMING REQUIREMENTS (Input $t_r = t_f = 6\text{ns}$)

| PARAMETER | SYMBOL | TEST CONDITION | V _{CC} (V) | Ta = 25°C | | Ta = -40~85°C | UNIT |
|---|--------------------------|----------------|---------------------|-----------|-------|---------------|------|
| | | | | TYP. | LIMIT | LIMIT | |
| Minimum Pulse Width (SCK, RCK) | $t_{W(H)}$ $t_{W(L)}$ | | 2.0 | — | 75 | 95 | ns |
| | | | 4.5 | — | 15 | 19 | |
| | | | 6.0 | — | 13 | 16 | |
| Minimum Pulse Width ($\overline{\text{SCLR}}$) | $t_{W(L)}$ | | 2.0 | — | 75 | 95 | |
| | | | 4.5 | — | 15 | 19 | |
| | | | 6.0 | — | 13 | 16 | |
| Minimum Set-up Time (SI-SCK) | t_s | | 2.0 | — | 50 | 65 | |
| | | | 4.5 | — | 10 | 13 | |
| | | | 6.0 | — | 9 | 11 | |
| Minimum Set-up Time (SCK-RCK) | t_s | | 2.0 | — | 75 | 95 | |
| | | | 4.5 | — | 15 | 19 | |
| | | | 6.0 | — | 13 | 16 | |
| Minimum Set-up Time ($\overline{\text{SCLR}}$ -RCK) | t_s | | 2.0 | — | 100 | 125 | |
| | | | 4.5 | — | 20 | 25 | |
| | | | 6.0 | — | 17 | 21 | |
| Minimum Hold Time | t_h | | 2.0 | — | 0 | 0 | |
| | | | 4.5 | — | 0 | 0 | |
| | | | 6.0 | — | 0 | 0 | |
| Minimum Removal Time ($\overline{\text{SCLR}}$) | t_{rem} | | 2.0 | — | 50 | 65 | |
| | | | 4.5 | — | 10 | 13 | |
| | | | 6.0 | — | 9 | 11 | |
| Clock Frequency | f | | 2.0 | — | 6 | 5 | MHz |
| | | | 4.5 | — | 30 | 25 | |
| | | | 6.0 | — | 35 | 28 | |

AC ELECTRICAL CHARACTERISTICS ($C_L = 15\text{pF}$, $V_{CC} = 5\text{V}$, $T_a = 25^\circ\text{C}$, Input $t_r = t_f = 6\text{ns}$)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|------------------------|----------------|------|------|------|------|
| Output Transition Time (QH') | t_{TLH} t_{THL} | | — | 4 | 8 | ns |
| Propagation Delay Time (SCK—QH') | t_{pLH} t_{pHL} | | — | 12 | 21 | |
| Propagation Delay Time ($\overline{\text{SCLR}}$ —QH') | t_{pHL} | | — | 15 | 30 | |
| Maximum Clock Frequency | f_{MAX} | | 35 | 77 | — | MHz |

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 6\text{ns}$)

| PARAMETER | SYMBOL | TEST CONDITION | CL (pF) | V _{CC} (V) | T _a = 25°C | | | T _a = -40~85°C | | UNIT |
|--|------------------------|-------------------------|---------|---------------------|-----------------------|------|------|---------------------------|------|------|
| | | | | | MIN. | TYP. | MAX. | MIN. | MAX. | |
| Output Transition Time (Q _n) | t_{TLH} t_{THL} | | 50 | 2.0 | — | 25 | 60 | — | 75 | ns |
| | | | | 4.5 | — | 7 | 12 | — | 15 | |
| | | | | 6.0 | — | 6 | 10 | — | 13 | |
| Output Transition Time (QH') | t_{TLH} t_{THL} | | 50 | 2.0 | — | 30 | 75 | — | 95 | |
| | | | | 4.5 | — | 8 | 15 | — | 19 | |
| | | | | 6.0 | — | 7 | 13 | — | 16 | |
| Propagation Delay Time (SCK—QH') | t_{pLH} t_{pHL} | | 50 | 2.0 | — | 45 | 125 | — | 155 | |
| | | | | 4.5 | — | 15 | 25 | — | 31 | |
| | | | | 6.0 | — | 13 | 21 | — | 26 | |
| Propagation Delay Time (SCLR—QH') | t_{pHL} | | 50 | 2.0 | — | 60 | 175 | — | 220 | |
| | | | | 4.5 | — | 18 | 35 | — | 44 | |
| | | | | 6.0 | — | 15 | 30 | — | 37 | |
| Propagation Delay Time (RCK—Q _n) | t_{pLH} t_{pHL} | | 50 | 2.0 | — | 60 | 150 | — | 190 | |
| | | | | 4.5 | — | 20 | 30 | — | 38 | |
| | | | | 6.0 | — | 17 | 26 | — | 32 | |
| | | | 150 | 2.0 | — | 75 | 190 | — | 240 | |
| | | | | 4.5 | — | 25 | 38 | — | 48 | |
| | | | | 6.0 | — | 22 | 32 | — | 41 | |
| Output Enable time | t_{pZL} t_{pZH} | $R_L = 1\text{k}\Omega$ | 50 | 2.0 | — | 45 | 135 | — | 170 | |
| | | | | 4.5 | — | 15 | 27 | — | 34 | |
| | | | | 6.0 | — | 13 | 23 | — | 29 | |
| | | | 150 | 2.0 | — | 60 | 175 | — | 220 | |
| | | | | 4.5 | — | 20 | 35 | — | 44 | |
| | | | | 6.0 | — | 17 | 30 | — | 37 | |
| Output Disable time | t_{pLZ} t_{pHZ} | $R_L = 1\text{k}\Omega$ | 50 | 2.0 | — | 30 | 150 | — | 190 | |
| | | | | 4.5 | — | 15 | 30 | — | 38 | |
| | | | | 6.0 | — | 14 | 26 | — | 33 | |
| Maximum Clock Frequency | f_{MAX} | | 50 | 2.0 | 6 | 17 | — | 5 | MHz | |
| | | | | 4.5 | 30 | 50 | — | 25 | | |
| | | | | 6.0 | 35 | 59 | — | 28 | | |
| Input Capacitance | C_{IN} | | | | — | 5 | 10 | — | 10 | pF |
| Power Dissipation Capacitance | $C_{PD(1)}$ | | | | — | 184 | — | — | — | |

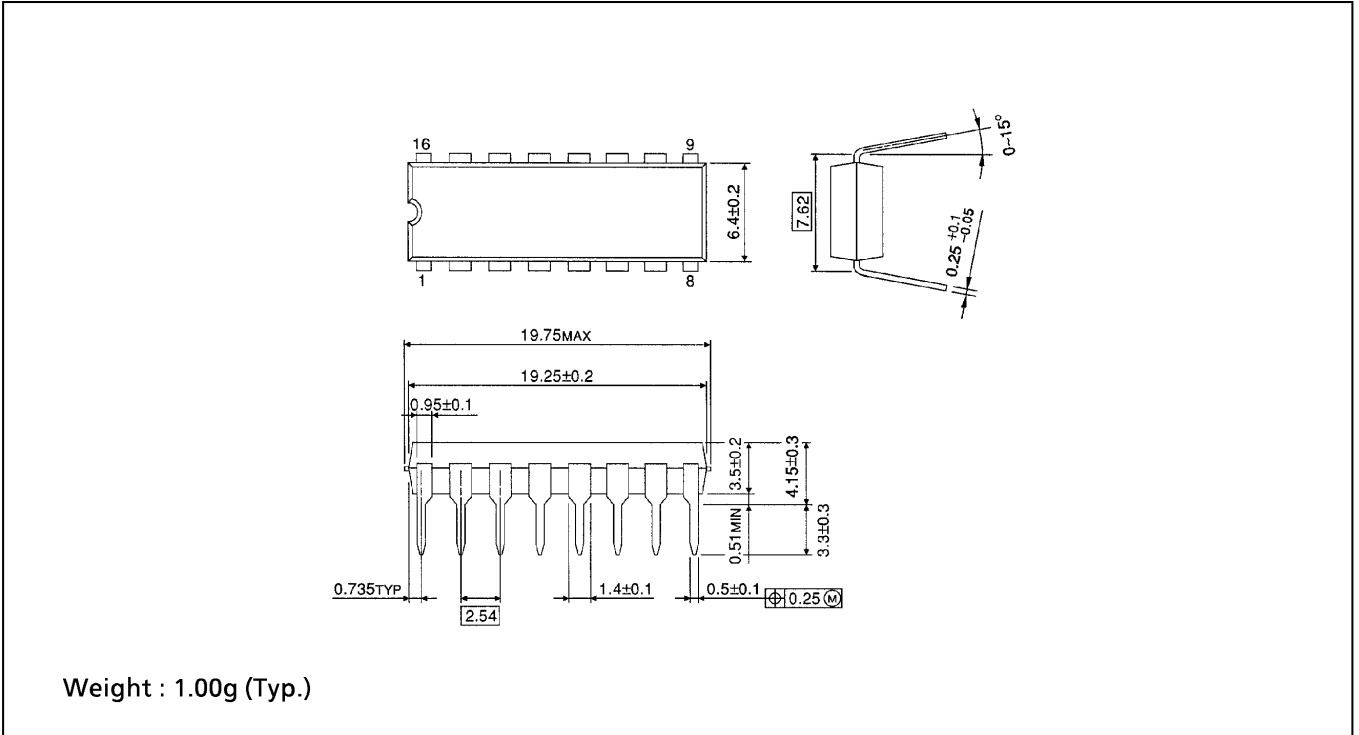
Note(1): C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

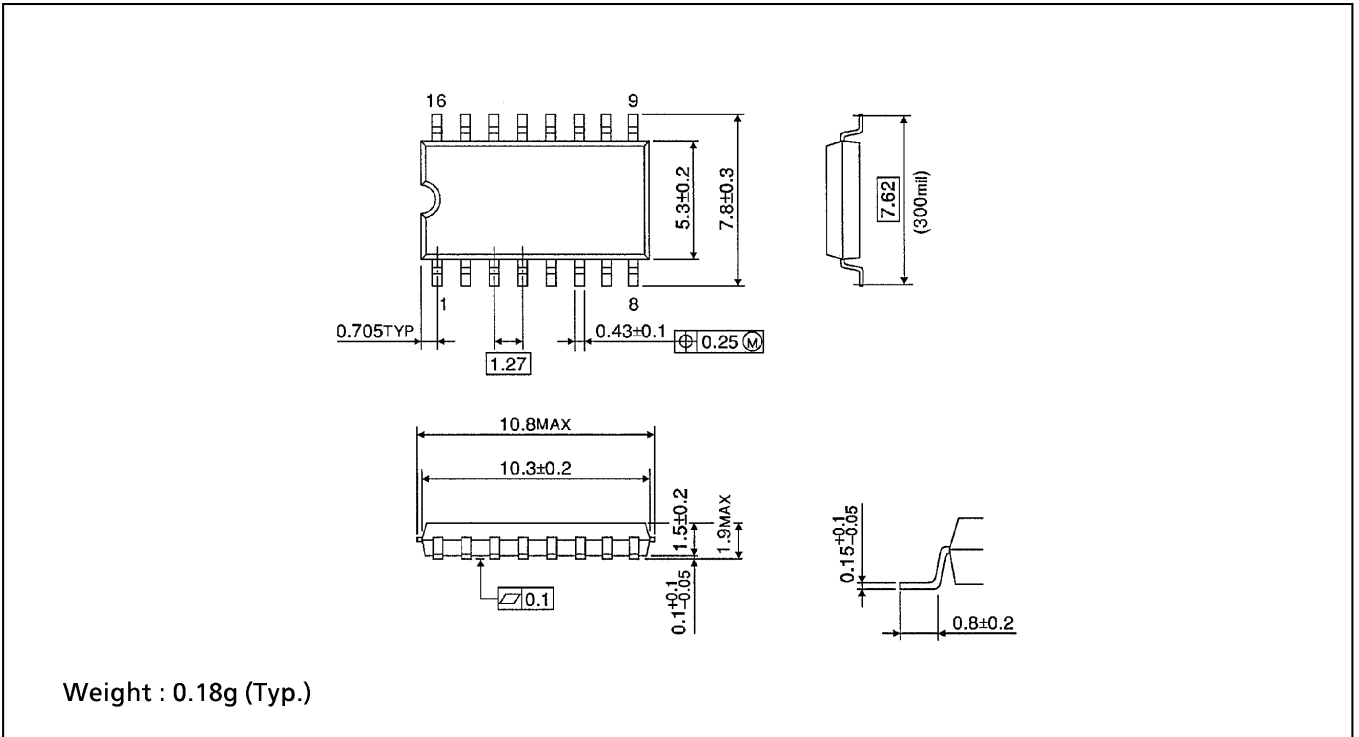
DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A)

Unit in mm



SOP 16PIN (200mil BODY) OUTLINE DRAWING (SOP16-P-300-1.27)

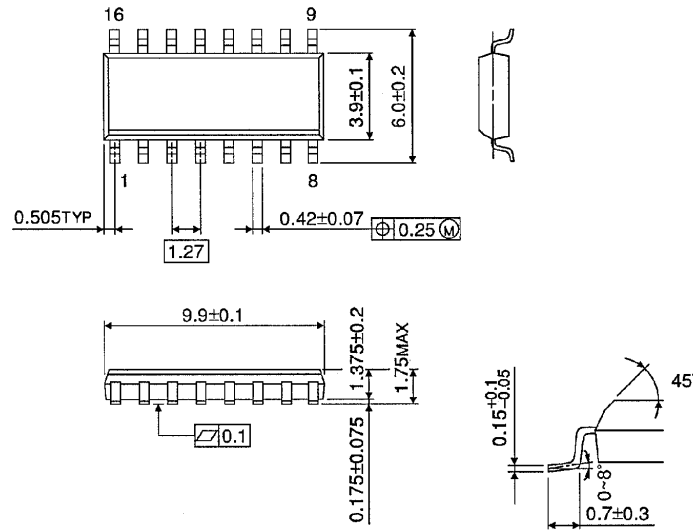
Unit in mm



SOP 16PIN (150mil BODY) OUTLINE DRAWING (SOL16-P-150 -1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)