

TC74AC138P, TC74AC138F, TC74AC138FN, TC74AC138FT

3-TO-8 LINE DECODER

The TC74AC138 is an advanced high speed CMOS 3-to-8 LINE DECODER fabricated with silicon gate and double-layer metal wiring C²MOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

When the device is enabled, 3 Binary Select inputs (A, B and C) determine which one of the outputs ($\bar{Y}0 - \bar{Y}7$) will go low.

When enable input G1 is held low or either $\bar{G}2A$ or $\bar{G}2B$ is held high, decoding function is inhibited and all outputs go high.

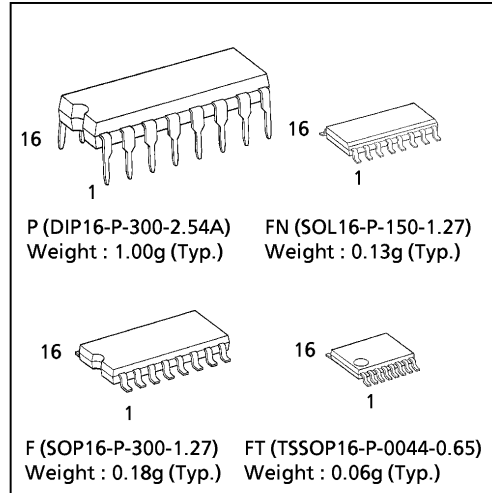
G1, $\bar{G}2A$, and $\bar{G}2B$ inputs are provided to ease cascade connection and for use as an address decoder for memory systems.

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

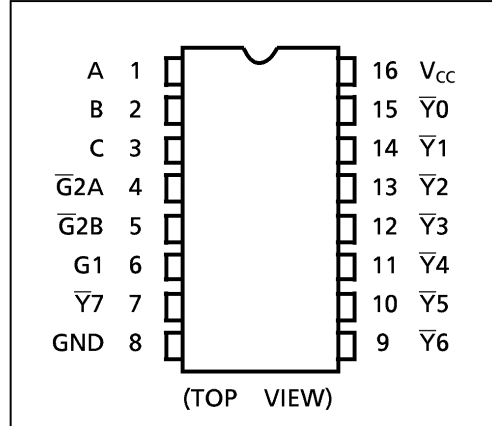
FEATURES :

- High Speed..... $t_{pd} = 5.9ns$ (typ.) at $V_{CC} = 5V$
- Low Power Dissipation..... $I_{CC} = 8\mu A$ (Max.) at $T_a = 25^\circ C$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (Min.)
- Symmetrical Output Impedance... $|I_{OH}| = I_{OL} = 24mA$ (Min.)
Capability of driving 50 Ω transmission lines.
- Balanced Propagation Delays... $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range... $V_{CC} (opr) = 2V \sim 5.5V$
- Pin and Function Compatible with 74F138

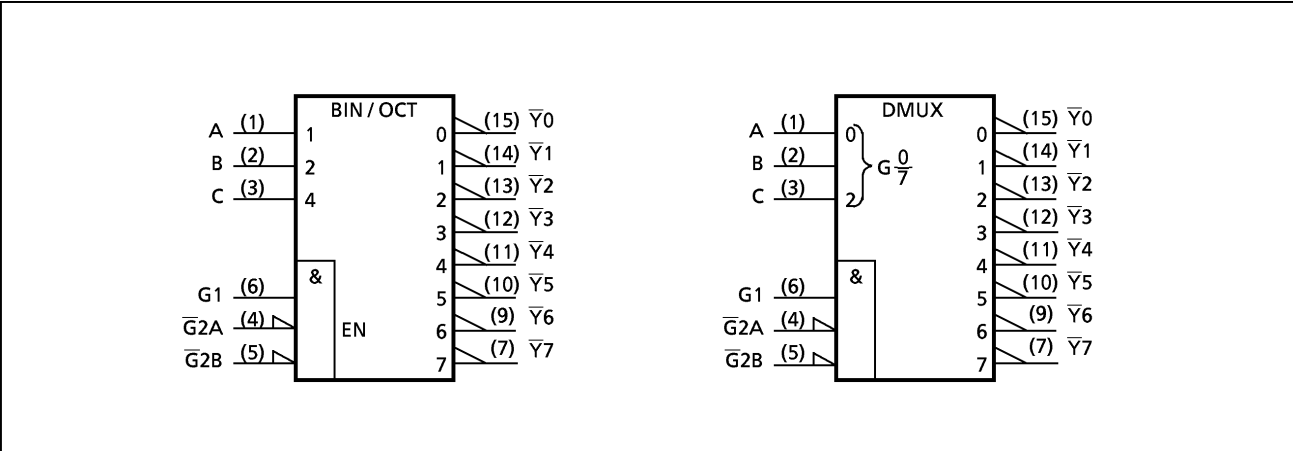
(Note) The JEDEC SOP (FN) is not available in Japan.



PIN ASSIGNMENT



IEC LOGIC SYMBOL

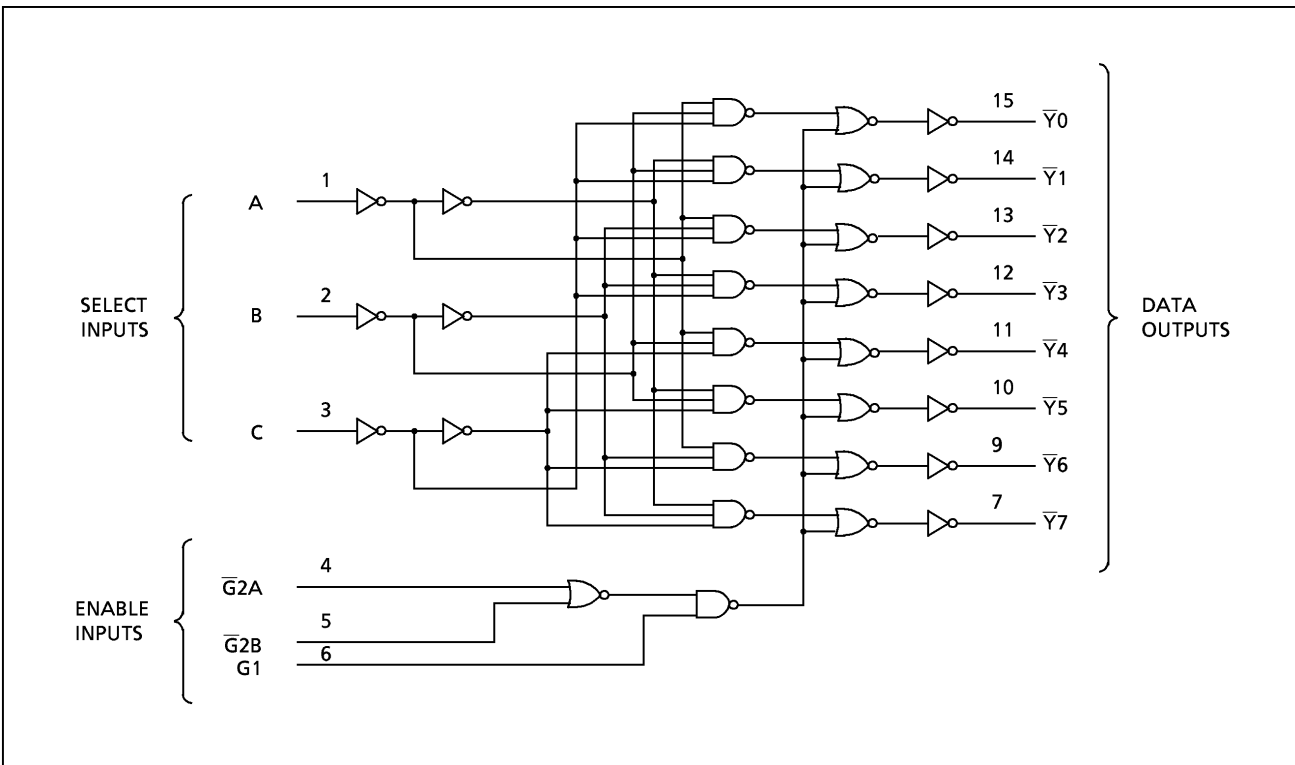


TRUTH TABLE

| INPUTS | | | | | | OUTPUTS | | | | | | | | SELECTED OUTPUT |
|--------|-------------|-------------|--------|---|---|------------|------------|------------|------------|------------|------------|------------|------------|-----------------|
| ENABLE | | | SELECT | | | $\bar{Y}0$ | $\bar{Y}1$ | $\bar{Y}2$ | $\bar{Y}3$ | $\bar{Y}4$ | $\bar{Y}5$ | $\bar{Y}6$ | $\bar{Y}7$ | |
| G1 | $\bar{G}2A$ | $\bar{G}2B$ | C | B | A | | | | | | | | | |
| L | X | X | X | X | X | H | H | H | H | H | H | H | H | NONE |
| X | H | X | X | X | X | H | H | H | H | H | H | H | H | NONE |
| X | X | H | X | X | X | H | H | H | H | H | H | H | H | NONE |
| H | L | L | L | L | L | L | H | H | H | H | H | H | H | $\bar{Y}0$ |
| H | L | L | L | L | H | H | L | H | H | H | H | H | H | $\bar{Y}1$ |
| H | L | L | L | H | L | H | H | L | H | H | H | H | H | $\bar{Y}2$ |
| H | L | L | L | H | H | H | H | L | H | H | H | H | H | $\bar{Y}3$ |
| H | L | L | H | L | L | H | H | H | L | H | H | H | H | $\bar{Y}4$ |
| H | L | L | H | L | H | H | H | H | H | L | H | H | H | $\bar{Y}5$ |
| H | L | L | H | H | L | H | H | H | H | H | L | H | H | $\bar{Y}6$ |
| H | L | L | H | H | H | H | H | H | H | H | H | L | H | $\bar{Y}7$ |

X : Don't Care

LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | VALUE | UNIT |
|------------------------------------|------------------|------------------------------|------|
| Supply Voltage Range | V _{CC} | -0.5~7.0 | 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} | ± 50 | mA |
| DC Output Current | I _{OUT} | ± 50 | mA |
| DC V _{CC} /Ground Current | I _{CC} | ± 200 | mA |
| Power Dissipation | P _D | 500 (DIP)* / 180 (SOP/TSSOP) | mW |
| Storage Temperature | T _{stg} | -65~150 | °C |

*500mW in the range of Ta = -40°C~65°C. From Ta = 65°C to 85°C a derating factor of -10mW/°C should be applied up to 300mW.

RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | VALUE | UNIT |
|--------------------------|------------------|---|--------|
| Supply Voltage | V _{CC} | 2.0~5.5 | 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 | dt / dV | 0~ 100 (V _{CC} = 3.3 ± 0.3V) 0~ 20 (V _{CC} = 5 ± 0.5V) | ns / V |

DC ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITION | V _{CC} (V) | Ta = 25°C | | | Ta = -40~85°C | | UNIT | |
|-----------------------------|-----------------|---|---|-----------|------|-------|---------------|-------|------|---|
| | | | | MIN. | TYP. | MAX. | MIN. | MAX. | | |
| High - Level Input Voltage | V _{IH} | | 2.0 | 1.50 | — | — | 1.50 | — | V | |
| | | | 3.0 | 2.10 | — | — | 2.10 | — | | |
| | | | 5.5 | 3.85 | — | — | 3.85 | — | | |
| Low - Level Input Voltage | V _{IL} | | 2.0 | — | — | 0.50 | — | 0.50 | V | |
| | | | 3.0 | — | — | 0.90 | — | 0.90 | | |
| | | | 5.5 | — | — | 1.65 | — | 1.65 | | |
| High - Level Output Voltage | V _{OH} | V _{IN} = V _{IH} or V _{IL} | I _{OH} = -50μA | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 3.0 | 2.9 | 3.0 | — | 2.9 | — | |
| | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | I _{OH} = -4mA I _{OH} = -24mA I _{OH} = -75mA* | 3.0 | 2.58 | — | — | 2.48 | — | |
| | | | | 4.5 | 3.94 | — | — | 3.80 | — | |
| | | | | 5.5 | — | — | — | 3.85 | — | |
| Low - Level Output Voltage | V _{OL} | V _{IN} = V _{IH} or V _{IL} | I _{OL} = 50μA | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | | 3.0 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | I _{OL} = 12mA I _{OL} = 24mA I _{OL} = 75mA* | 3.0 | — | — | 0.36 | — | 0.44 | |
| | | | | 4.5 | — | — | 0.36 | — | 0.44 | |
| | | | | 5.5 | — | — | — | — | 1.65 | |
| Input Leakage Current | I _{IN} | V _{IN} = V _{CC} or GND | 5.5 | — | — | ± 0.1 | — | ± 1.0 | μA | |
| Quiescent Supply Current | I _{CC} | V _{IN} = V _{CC} or GND | 5.5 | — | — | 8.0 | — | 80.0 | | |

* : This spec indicates the capability of driving 50Ω transmission lines.
One output should be tested at a time for a 10ms maximum duration.

AC ELECTRICAL CHARACTERISTICS ($C_L = 50\text{pF}$, $R_L = 500\Omega$, Input $t_r = t_f = 3\text{ns}$)

| PARAMETER | SYMBOL | TEST CONDITION | Ta = 25°C | | | Ta = -40~85°C | | UNIT | |
|--|---------------------|----------------|---------------------|------|------|---------------|------|------|------|
| | | | V _{CC} (V) | MIN. | TYP. | MAX. | MIN. | | MAX. |
| Propagation Delay Time (A, B, C - \bar{Y}) | t_{pLH} | | 3.3 ± 0.3 | — | 8.5 | 14.2 | 1.0 | 16.3 | ns |
| | t_{pHL} | | 5.0 ± 0.5 | — | 6.4 | 9.2 | 1.0 | 10.5 | |
| Propagation Delay Time (G1 - \bar{Y}) | t_{pLH} | | 3.3 ± 0.3 | — | 7.5 | 12.8 | 1.0 | 14.7 | |
| | t_{pHL} | | 5.0 ± 0.5 | — | 6.1 | 8.9 | 1.0 | 10.2 | |
| Propagation Delay Time ($\bar{G}2$ - \bar{Y}) | t_{pLH} | | 3.3 ± 0.3 | — | 8.8 | 15.0 | 1.0 | 17.3 | |
| | t_{pHL} | | 5.0 ± 0.5 | — | 7.2 | 10.5 | 1.0 | 12.0 | |
| Input Capacitance | C _{IN} | | — | 5 | 10 | — | 10 | pF | |
| Power Dissipation Capacitance | C _{PD} (1) | | — | 143 | — | — | — | | |

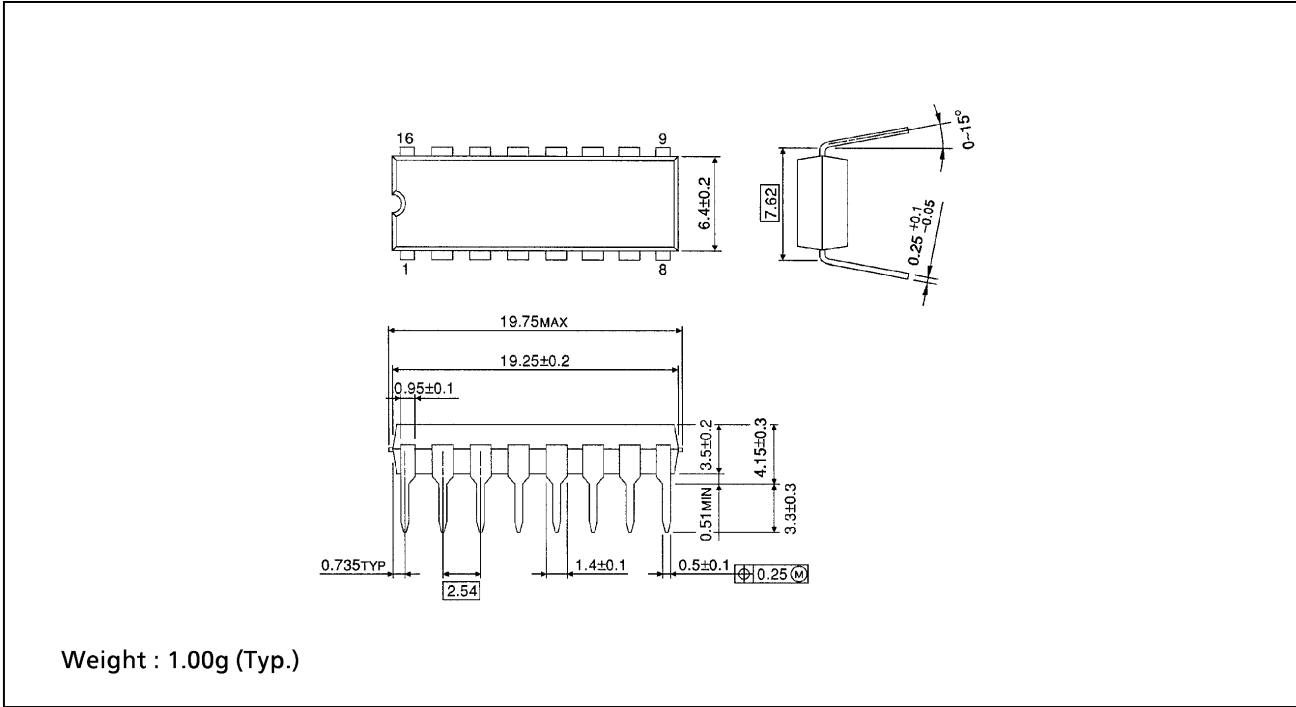
Note (1) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

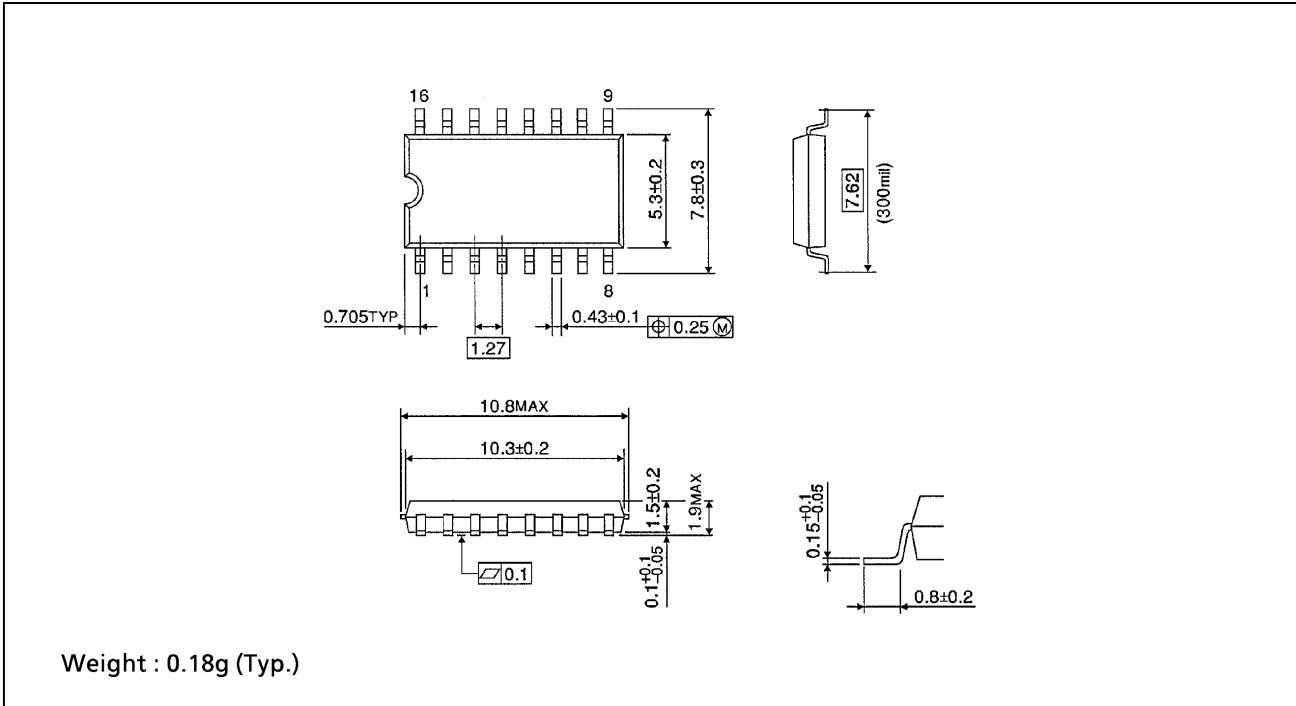
DIP 16PIN PACKAGE DIMENSIONS (DIP16-P-300-2.54A)

Unit in mm



SOP 16PIN (200mil BODY) PACKAGE DIMENSIONS (SOP16-P-300-1.27)

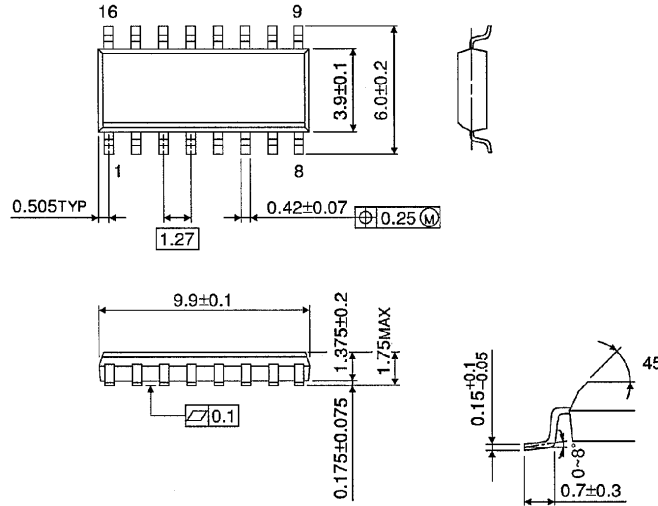
Unit in mm



SOP 16PIN (150mil BODY) PACKAGE DIMENSIONS (SOL16-P-150-1.27)

Unit in mm

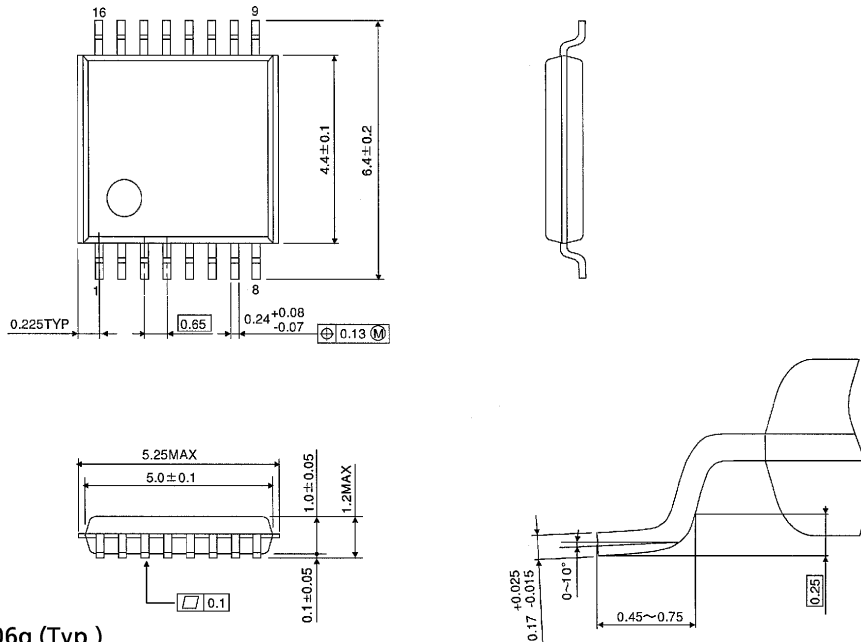
(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)

TSSOP 16PIN PACKAGE DIMENSIONS (TSSOP16-P-0044-0.65)

Unit in mm



Weight : 0.06g (Typ.)

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