

**TC74HC164AP, TC74HC164AF, TC74HC164AFN**

**8 - BIT SHIFT REGISTER (S - IN, P - OUT)**

The TC74HC164A is a high speed CMOS 8 - BIT SERIAL - IN PARALLEL - OUT SHIFT REGISTER fabricated with silicon gate C<sup>2</sup>MOS technology.

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

It consists of a serial - in, parallel - out 8 - bit shift register with a CK input and an overriding  $\overline{\text{CLR}}$  input.

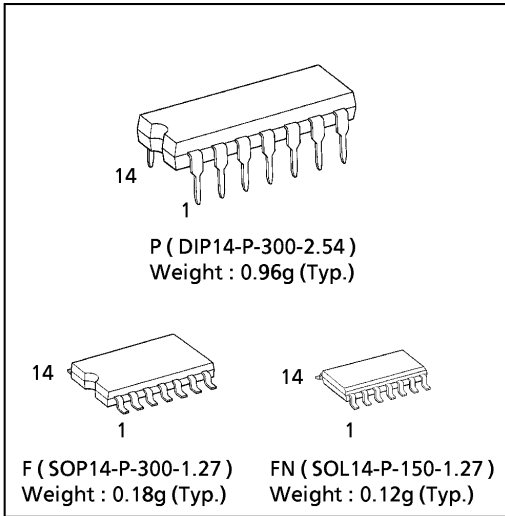
Two serial data inputs (A, B) are provided so that one may be used as a data enable.

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

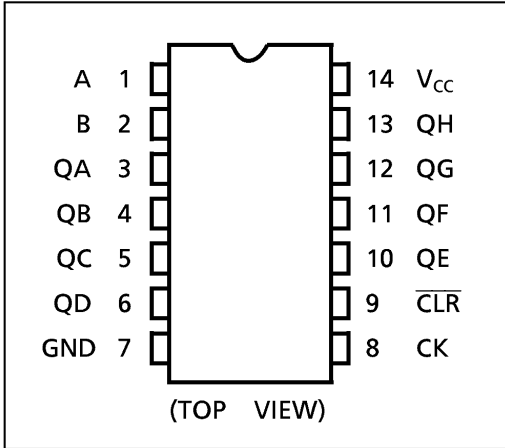
**FEATURES :**

- High Speed..... $f_{\text{MAX}} = 58\text{MHz}$  (typ.) at  $V_{\text{CC}} = 5\text{V}$
- Low Power Dissipation..... $I_{\text{CC}} = 4\mu\text{A}$ (Max.) at  $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{\text{NIH}} = V_{\text{NIL}} = 28\% V_{\text{CC}}$  (Min.)
- Output Drive Capability..... 10 LSTTL Loads
- Symmetrical Output Impedance...  $|I_{\text{OH}}| = I_{\text{OL}} = 4\text{mA}$ (Min.)
- Balanced Propagation Delays.....  $t_{\text{PLH}} \approx t_{\text{PHL}}$
- Wide Operating Voltage Range...  $V_{\text{CC}}$  (opr.) = 2V ~ 6V
- Pin and Function Compatible with 74LS164

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



**PIN ASSIGNMENT**

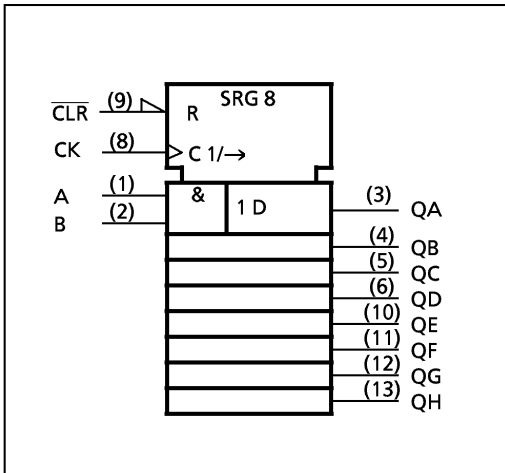


**TRUTH TABLE**

INPUTS				OUTPUTS			
$\overline{\text{CLR}}$	CK	SERIAL IN		QA	QB	...	QH
		A	B				
L	X	X	X	L	L	...	L
H		X	X	NO CHANGE			
H		L	X	L	QA <sub>n</sub>	...	QG <sub>n</sub>
H		X	L	L	QA <sub>n</sub>	...	QG <sub>n</sub>
H		H	H	H	QA <sub>n</sub>	...	QG <sub>n</sub>

X : Don't Care  
 QA<sub>n</sub> ~ QG<sub>n</sub> : The level of QA ~ QG, respectively, before the most recent positive edge of clock.

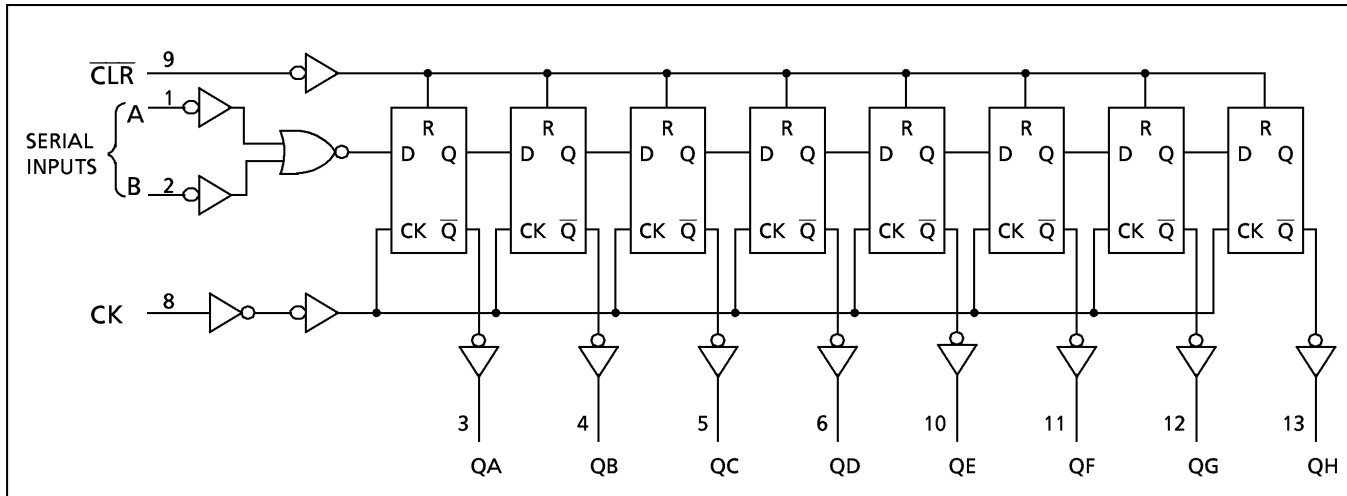
**IEC LOGIC SYMBOL**



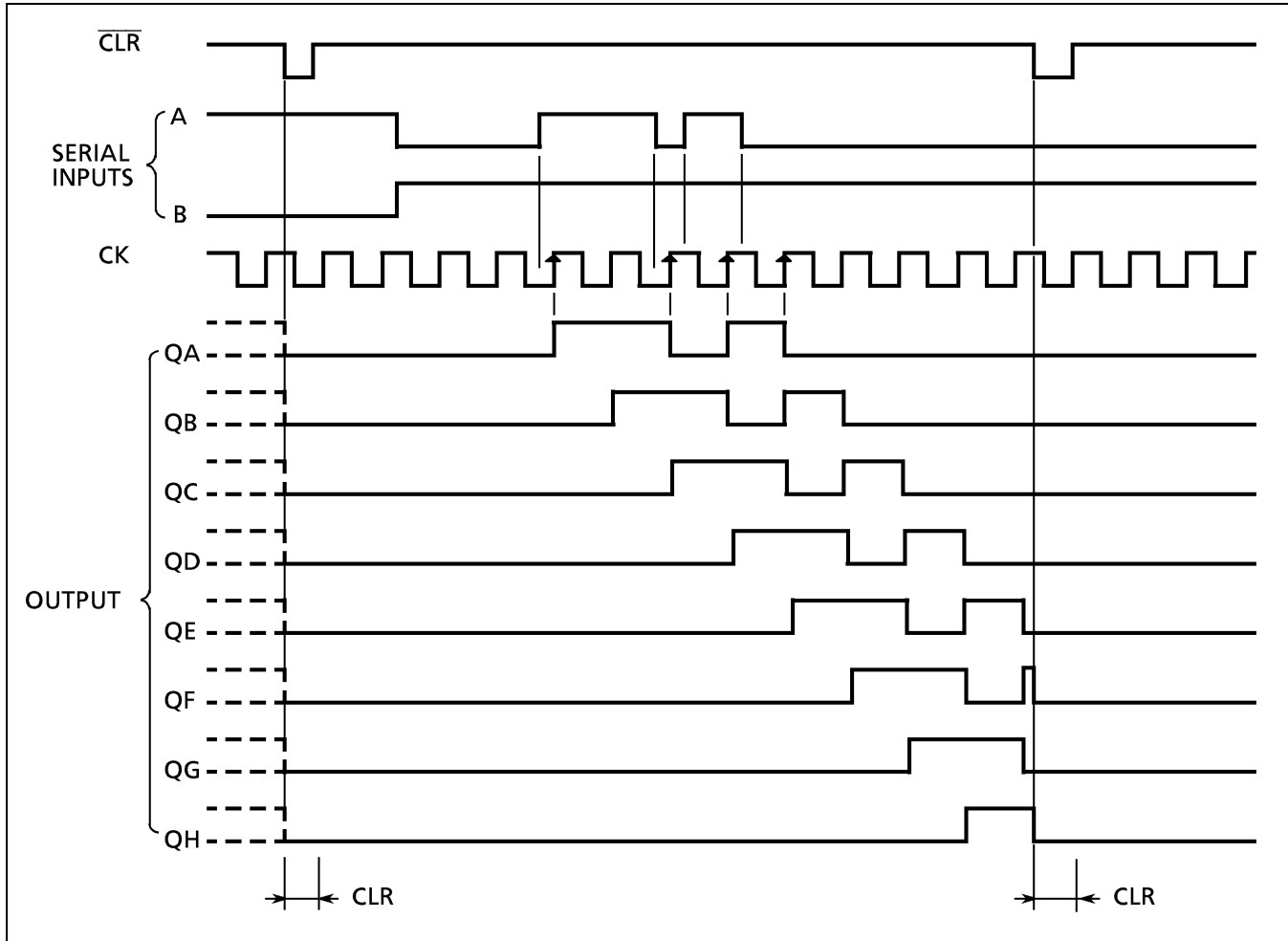
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SYSTEM DIAGRAM



TIMING CHART



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## 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	$I_{IK}$	$\pm 20$	mA
Output Diode Current	$I_{OK}$	$\pm 20$	mA
DC Output Current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ / Ground Current	$I_{CC}$	$\pm 50$	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  $85^{\circ}\text{C}$  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	—	
			$I_{OH} = -4\text{ mA}$ $I_{OH} = -5.2\text{ mA}$	4.5	4.18	4.31	—	4.13	—	
				6.0	5.68	5.80	—	5.63	—	
				6.0	—	—	—	—	—	
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	
			$I_{OL} = 4\text{ mA}$ $I_{OL} = 5.2\text{ mA}$	4.5	—	0.17	0.26	—	0.33	
				6.0	—	0.18	0.26	—	0.33	
				6.0	—	—	—	—	—	
Input Leakage Current	$I_{IN}$	$V_{IN} = V_{CC}$ or GND	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	
Quiescent Supply Current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	6.0	—	—	4.0	—	40.0		

**TIMING REQUIREMENTS (Input  $t_r = t_f = 6ns$ )**

PARAMETER	SYMBOL	TEST CONDITION	$V_{CC}$ (V)	Ta = 25°C		Ta = -40~85°C	UNIT
				TYP.	LIMIT	LIMIT	
Minimum Pulse Width (CK)	$t_{W(L)}$ $t_{W(H)}$		2.0	—	75	95	ns
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Pulse Width (CLR)	$t_{W(L)}$		2.0	—	80	100	
			4.5	—	16	20	
			6.0	—	14	17	
Minimum Set-up Time (A, B)	$t_s$		2.0	—	50	65	
			4.5	—	10	13	
			6.0	—	9	11	
Minimum Hold Time (A, B)	$t_h$		2.0	—	5	5	
			4.5	—	5	5	
			6.0	—	5	5	
Minimum Removal Time (CLR)	$t_{rem}$		2.0	—	5	5	
			4.5	—	5	5	
			6.0	—	5	5	
Clock Frequency	f		2.0	—	6	5	MHz
			4.5	—	31	25	
			6.0	—	36	29	

**AC ELECTRICAL CHARACTERISTICS ( $C_L = 15pF$ ,  $V_{CC} = 5V$ , Ta = 25°C, Input  $t_r = t_f = 6ns$ )**

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	$t_{TLH}$		—	4	8	ns
	$t_{THL}$					
Propagation Delay Time (CK-Qn)	$t_{pLH}$		—	15	27	
	$t_{pHL}$					
Propagation Delay Time (CLR-Qn)	$t_{pHL}$		—	16	30	
Maximum Clock Frequency	$f_{MAX}$		33	58	—	

**AC ELECTRICAL CHARACTERISTICS ( $C_L = 50pF$ , Input  $t_r = t_f = 6ns$ )**

PARAMETER	SYMBOL	TEST CONDITION	$V_{CC}$ (V)	Ta = 25°C			Ta = -40~85°C		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time	$t_{TLH}$ $t_{THL}$		2.0	—	25	75	—	95	ns
			4.5	—	7	15	—	19	
			6.0	—	6	13	—	16	
Propagation Delay Time (CK-Qn)	$t_{pLH}$ $t_{pHL}$		2.0	—	57	160	—	200	
			4.5	—	19	32	—	40	
			6.0	—	16	27	—	34	
Propagation Delay Time (CLR-Qn)	$t_{pHL}$		2.0	—	60	175	—	220	
			4.5	—	20	35	—	44	
			6.0	—	17	30	—	37	
Maximum Clock Frequency	$f_{MAX}$		2.0	6	18	—	5	—	
			4.5	31	53	—	25	—	
			6.0	36	62	—	29	—	
Input Capacitance	$C_{IN}$		—	5	10	—	10	pF	
Power Dissipation Capacitance	$C_{PD}$ (1)		—	107	—	—	—		

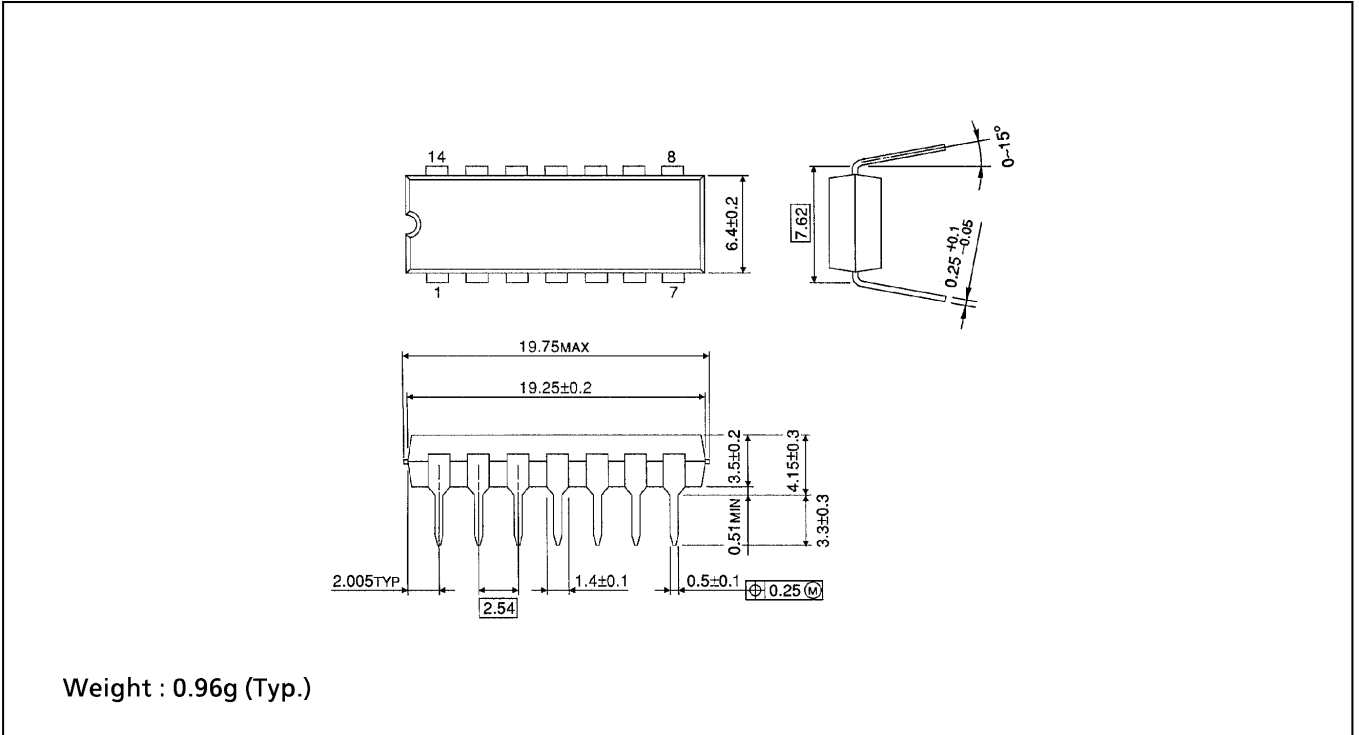
Note (1)  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

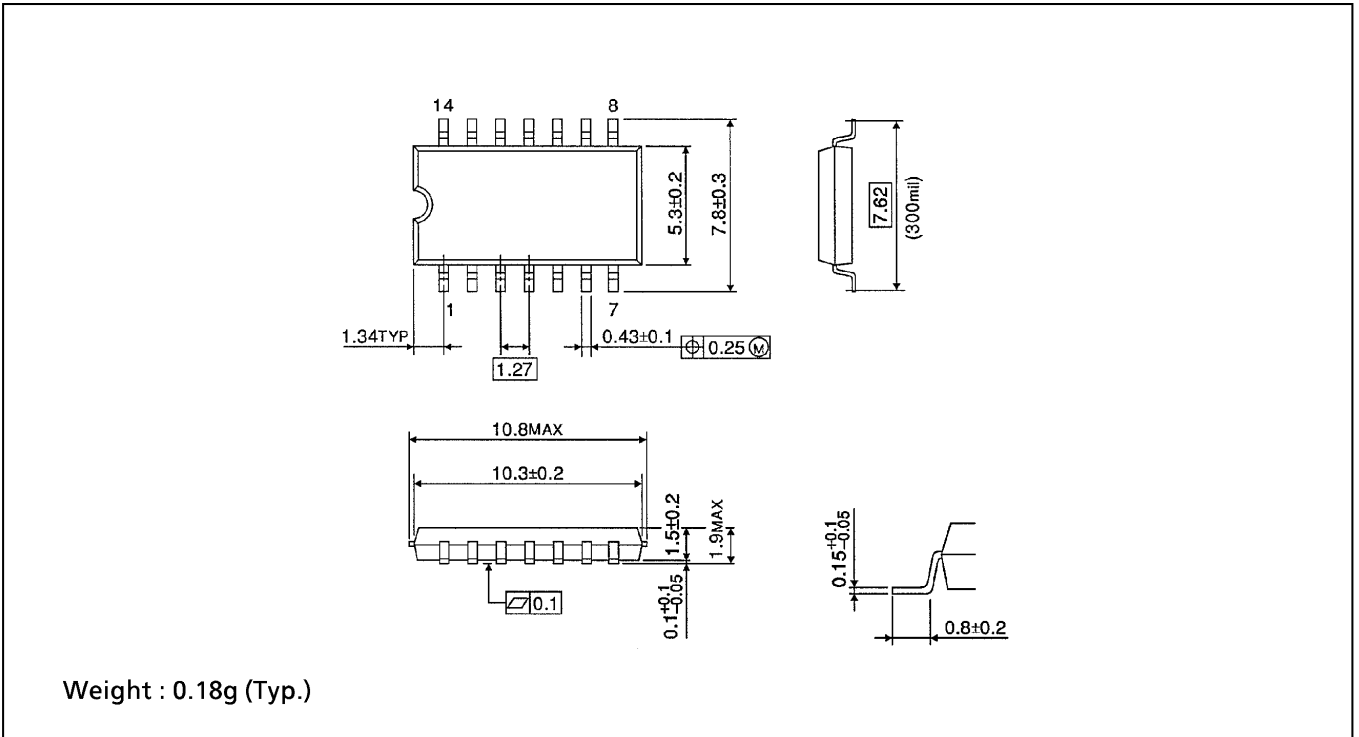
DIP 14PIN OUTLINE DRAWING ( DIP14-P-300-2.54 )

Unit in mm



SOP 14PIN ( 200mil BODY ) OUTLINE DRAWING ( SOP14-P-300-1.27 )

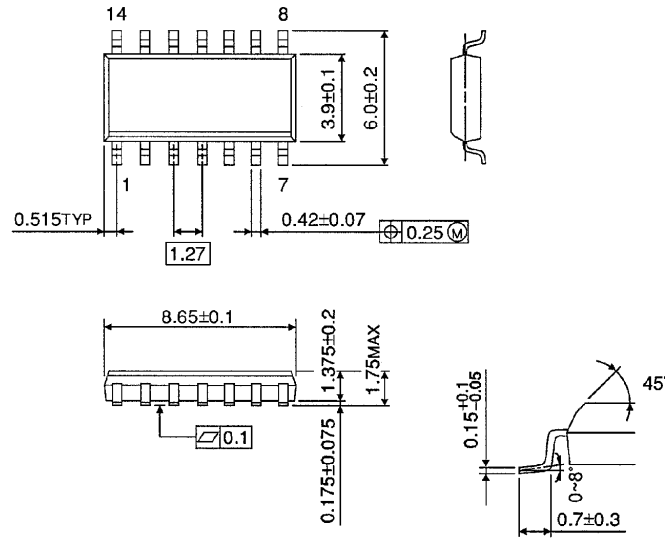
Unit in mm



**SOP 14PIN ( 150mil BODY ) OUTLINE DRAWING ( SOL14-P-150 -1.27)**

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)