

**TC74AC393P, TC74AC393F, TC74AC393FN, TC74AC393FT**

**DUAL BINARY COUNTER**

The TC74AC393 is an advanced high speed CMOS 4 - BIT BINARY COUNTER fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

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

It contains two independent counter circuits in one package, so that counting or frequency division of eight binary bits can be achieved with one IC.

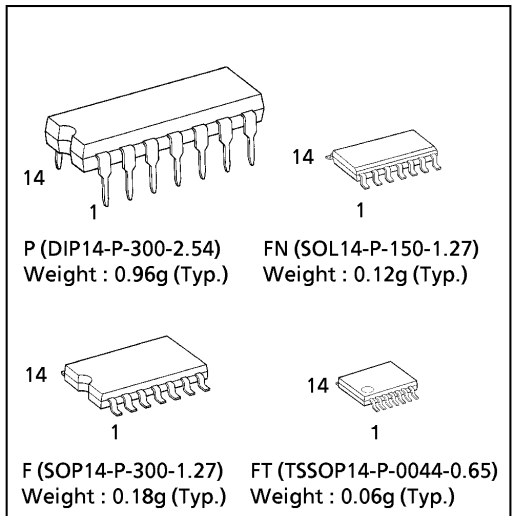
This device changes state on the negative going transition of the  $\overline{\text{CLOCK}}$  pulse. The counter can be reset to "0" (QA~QD="L") by a high at the CLEAR input regardless of other inputs.

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

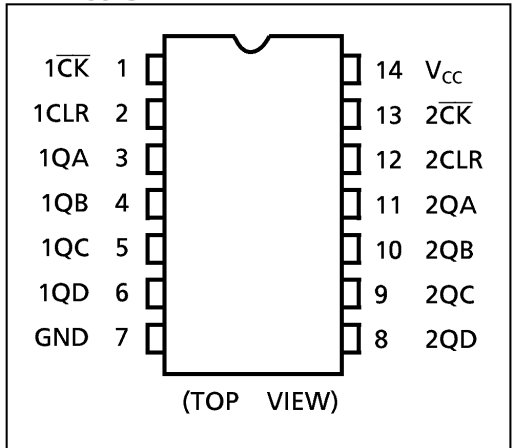
**FEATURES :**

- High Speed..... $f_{\text{MAX}} = 180\text{MHz}(\text{typ.})$   
at  $V_{\text{CC}} = 5\text{V}$
- Low Power Dissipation..... $I_{\text{CC}} = 8\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{\text{NIH}} = V_{\text{NIL}} = 28\% V_{\text{CC}} (\text{Min.})$
- Symmetrical Output Impedance... $|I_{\text{OH}}| = I_{\text{OL}} = 24\text{mA}(\text{Min.})$   
Capability of driving  $50\Omega$  transmission lines.
- Balanced Propagation Delays..... $t_{\text{pLH}} \approx t_{\text{pHL}}$
- Wide Operating Voltage Range... $V_{\text{CC}} (\text{opr}) = 2\text{V} \sim 5.5\text{V}$
- Pin and Function Compatible with 74F393

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



**PIN ASSIGNMENT**

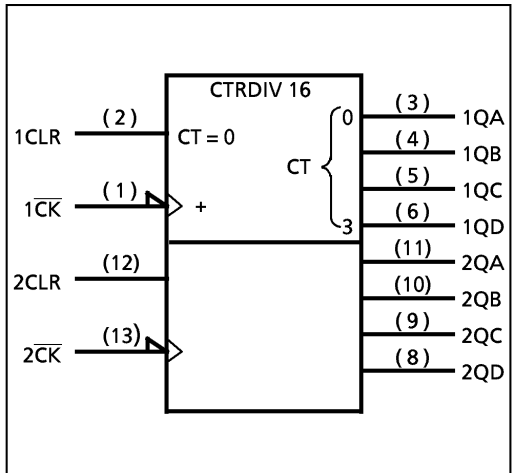


**TRUTH TABLE**

INPUTS		OUTPUTS			
$\overline{\text{CK}}$	CLR	QA	QB	QC	QD
X	H	L	L	L	L
$\downarrow$	L	COUNT UP			
$\uparrow$	L	NO CHANGE			

X : Don't Care

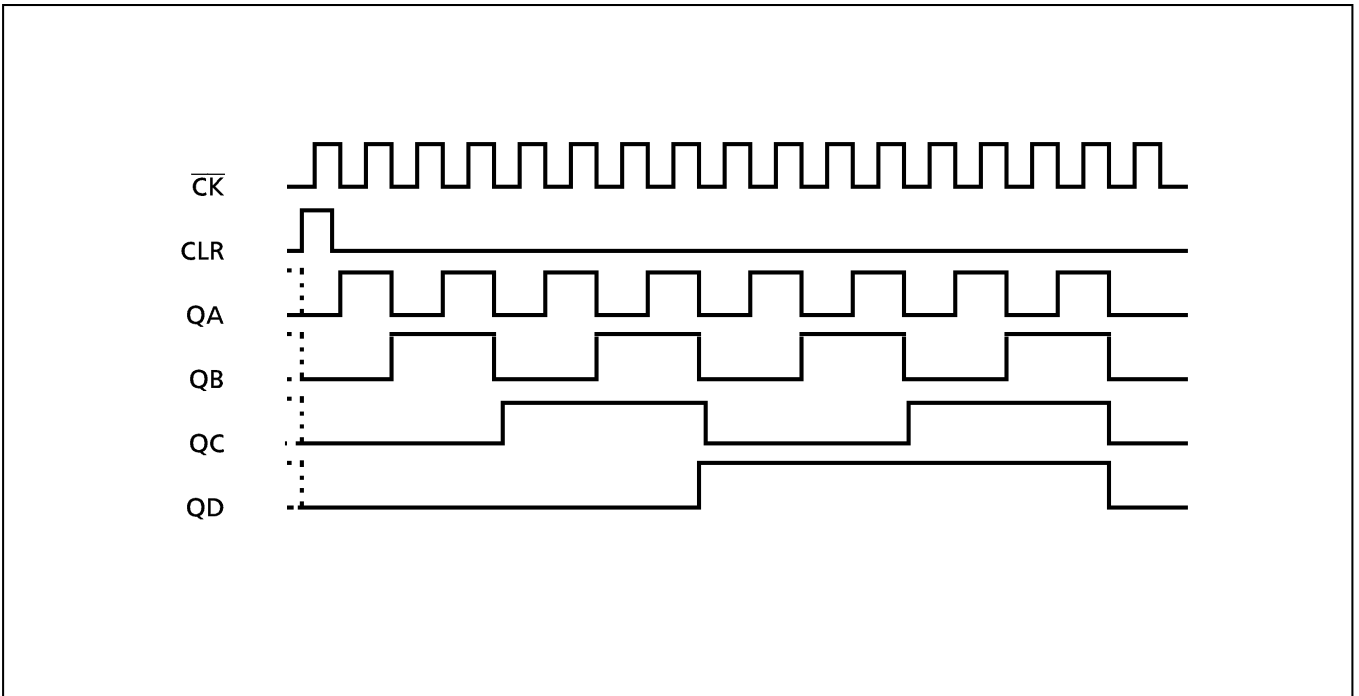
**IEC LOGIC SYMBOL**



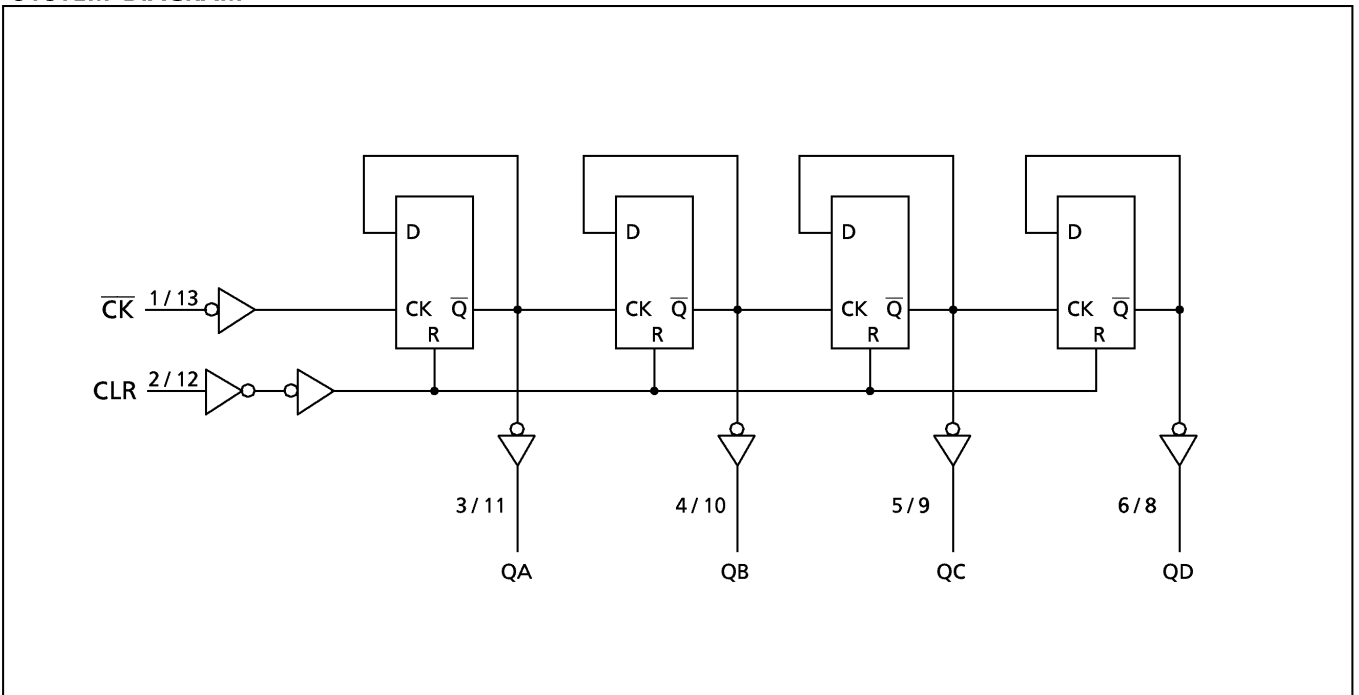
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TIMING CHART



SYSTEM DIAGRAM



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## 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  $T_a = -40^{\circ}\text{C} \sim 65^{\circ}\text{C}$ . From  $T_a = 65^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  a derating factor of  $-10\text{mW}/^{\circ}\text{C}$  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 ( $V_{CC} = 3.3 \pm 0.3\text{V}$ ) 0~20 ( $V_{CC} = 5 \pm 0.5\text{V}$ )	ns / V

## 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			
			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	$V_{OH}$	$V_{IN} = V_{IH}$	$I_{OH} = -50\mu\text{A}$	2.0	1.9	2.0	—	1.9	V			
				3.0	2.9	3.0	—	2.9		—		
		$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -4\text{mA}$	3.0	2.58	—	—	2.48		—		
				4.5	3.94	—	—	3.80		—		
Low - Level Output Voltage	$V_{OL}$	$V_{IN} = V_{IH}$	$I_{OL} = 50\mu\text{A}$	2.0	—	0.0	0.1	—	0.1	V		
				3.0	—	0.0	0.1	—	0.1			
		$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 12\text{mA}$	3.0	—	—	0.36	—	0.44			
				4.5	—	—	0.36	—	0.44			
Input Leakage Current	$I_{IN}$	$V_{IN} = V_{CC}$ or GND	5.5	—	—	± 0.1	—	± 1.0	$\mu\text{A}$			
			Quiescent Supply Current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	5.5	—	—		8.0	—	80.0

\* : This spec indicates the capability of driving  $50\Omega$  transmission lines.

One output should be tested at a time for a 10ms maximum duration.

TIMING REQUIREMENTS (Input  $t_r = t_f = 3\text{ns}$ )

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C		Ta = -40~85°C		UNIT
			V <sub>CC</sub> (V)	LIMIT	LIMIT	LIMIT	
Minimum Pulse Width ( $\overline{\text{CK}}$ )	$t_{W(H)}$		3.3 ± 0.3	7.0	7.0	7.0	ns
	$t_{W(L)}$		5.0 ± 0.5	5.0	5.0	5.0	
Minimum Pulse Width (CLR)	$t_{W(H)}$		3.3 ± 0.3	7.0	7.0	7.0	
			5.0 ± 0.5	5.0	5.0	5.0	
Minimum Removal Time	$t_{rem}$		3.3 ± 0.3	6.0	6.0	6.0	
			5.0 ± 0.5	3.0	3.0	3.0	

AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50pF, R<sub>L</sub> = 500Ω, Input  $t_r = t_f = 3\text{ns}$ )

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT	
			V <sub>CC</sub> (V)	MIN.	TYP.	MAX.	MIN.		MAX.
Propagation Delay Time ( $\overline{\text{CK}}-\text{QA}$ )	$t_{pLH}$		3.3 ± 0.3	—	8.0	13.2	1.0	15.0	ns
	$t_{pHL}$		5.0 ± 0.5	—	5.0	8.3	1.0	9.5	
Propagation Delay Time ( $\overline{\text{CK}}-\text{QB}$ )	$t_{pLH}$		3.3 ± 0.3	—	10.1	16.7	1.0	19.0	
	$t_{pHL}$		5.0 ± 0.5	—	5.9	10.5	1.0	12.0	
Propagation Delay Time ( $\overline{\text{CK}}-\text{QC}$ )	$t_{pLH}$		3.3 ± 0.3	—	12.0	20.2	1.0	23.0	
	$t_{pHL}$		5.0 ± 0.5	—	6.8	12.3	1.0	14.0	
Propagation Delay Time ( $\overline{\text{CK}}-\text{QD}$ )	$t_{pLH}$		3.3 ± 0.3	—	13.0	23.0	1.0	26.0	
	$t_{pHL}$		5.0 ± 0.5	—	7.5	13.2	1.0	15.0	
Propagation Delay Time (CLR-Qn)	$t_{pHL}$		3.3 ± 0.3	—	8.0	13.2	1.0	15.0	MHz
			5.0 ± 0.5	—	5.1	8.8	1.0	10.0	
Maximum Clock Frequency	f <sub>MAX</sub>		3.3 ± 0.3	65	125	—	65	—	pF
			5.0 ± 0.5	100	160	—	100	—	
Input Capacitance	C <sub>IN</sub>			—	5	10	—	10	
Power Dissipation Capacitance	C <sub>PD</sub> (1)			—	36	—	—	—	

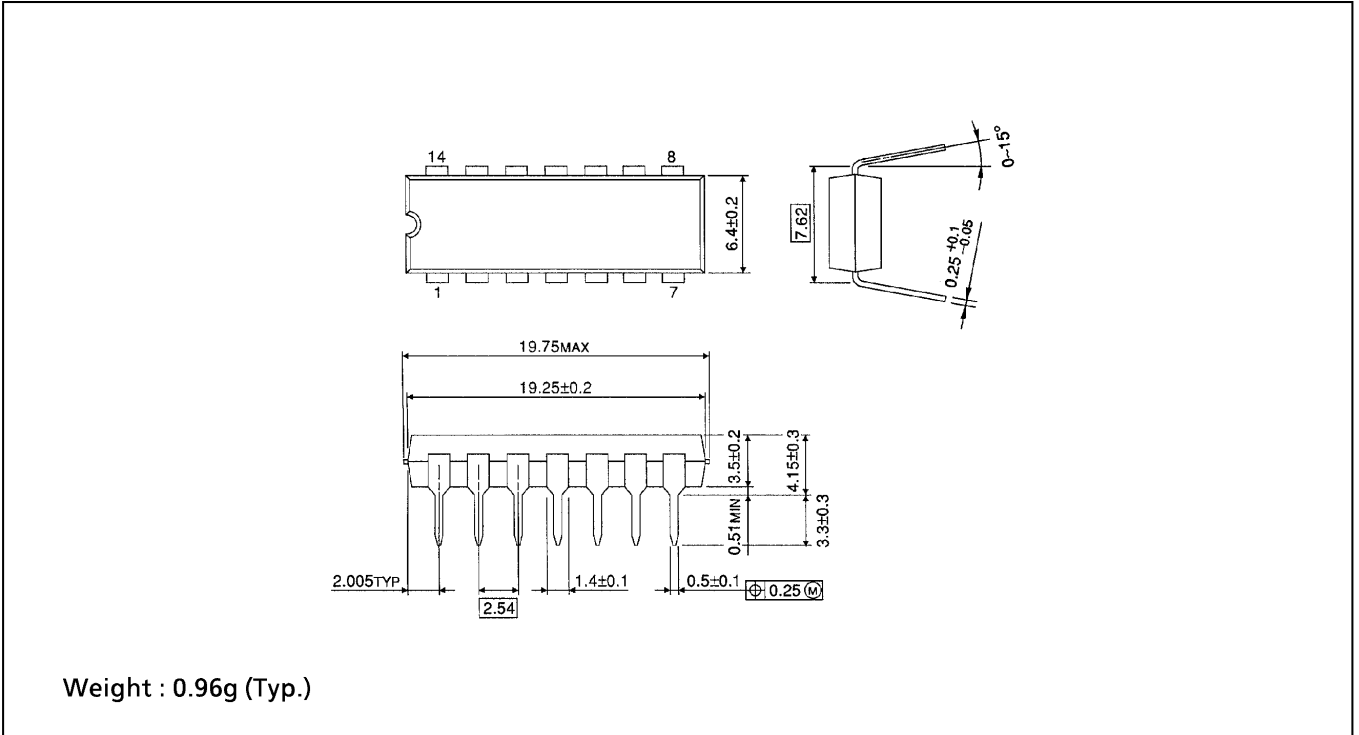
Note (1) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC}(\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2 \text{ (per counter)}$$

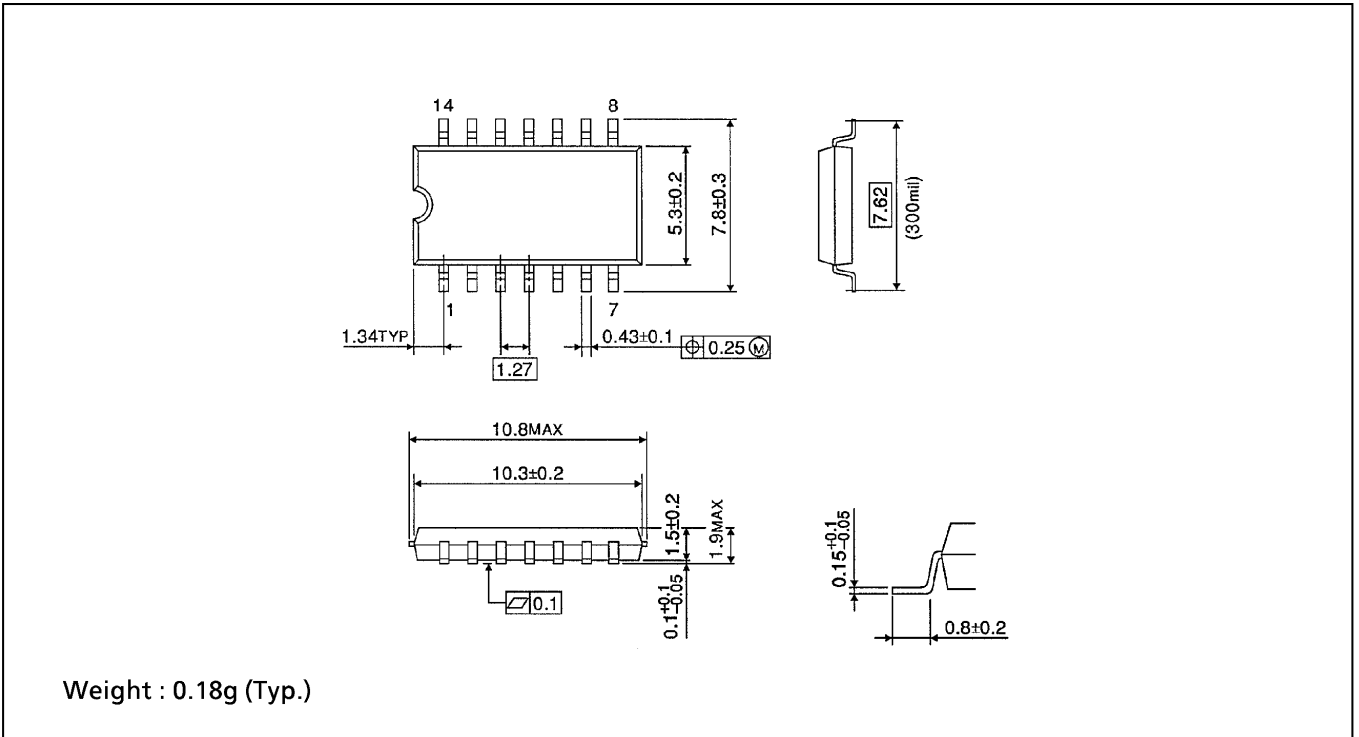
**DIP 14PIN OUTLINE DRAWING (DIP14-P-300-2.54)**

Unit in mm



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

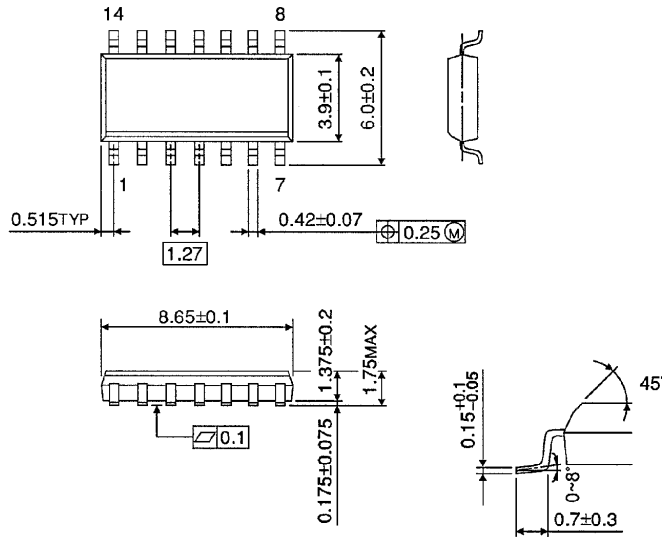
Unit in mm



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

Unit in mm

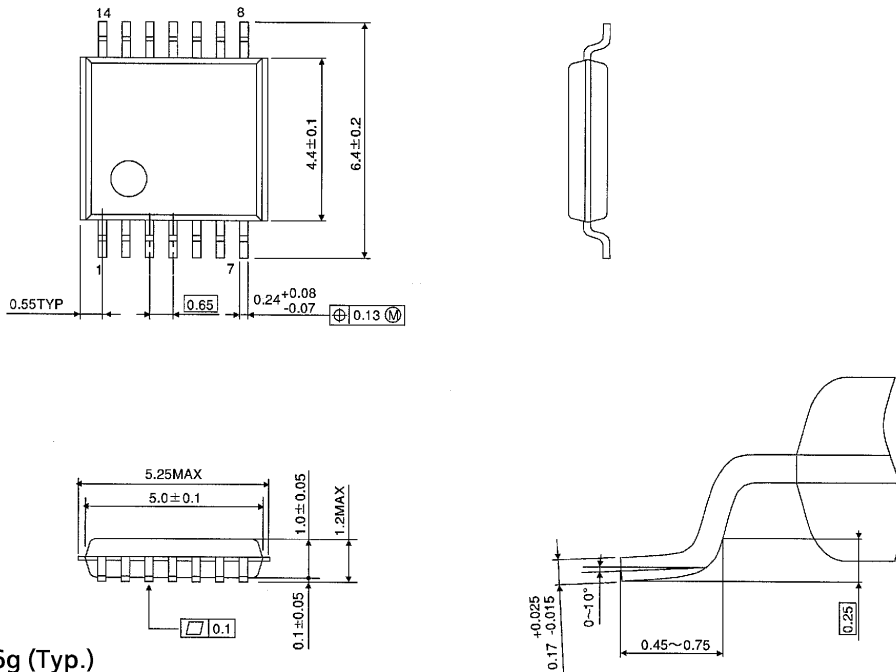
(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

**TSSOP 14PIN (170mil BODY) OUTLINE DRAWING (TSSOP14-P-0044-0.65)**

Unit in mm



Weight : 0.06g (Typ.)