

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC74HC7292AP, TC74HC7292AF

## PROGRAMMABLE DIVIDER / TIMER

The TC74HC7292A is a high speed CMOS PROGRAMMABLE DIVIDER / TIMER 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.

The TC74HC7292A can divide from 2<sup>2</sup> to 2<sup>31</sup>.

CK1 and CK2 are clock inputs, either one may be used for clock gating.

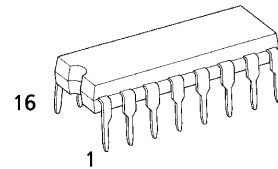
It features an active-low clear input to initialize the state of all flip-flops.

To facilitate incoming inspection, test points are provided. (TP1, TP2 and TP3)

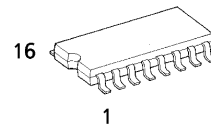
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### FEATURES :

- High Speed..... $f_{MAX} = 70\text{MHz}(\text{typ.})$   
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..... 10 LSTTL Loads
- Symmetrical Output Impedance...  $|I_{OH}| = I_{OL} = 4\text{mA}(\text{Min.})$
- 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 74LS292

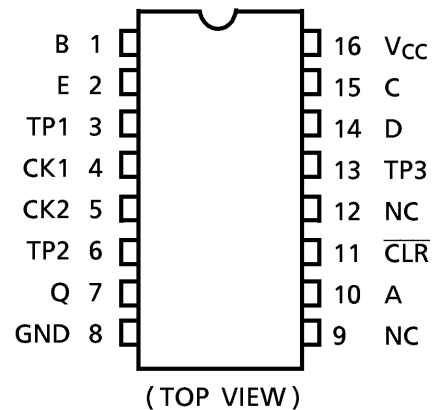


P (DIP16-P-300-2.54A)  
Weight : 1.00g (Typ.)

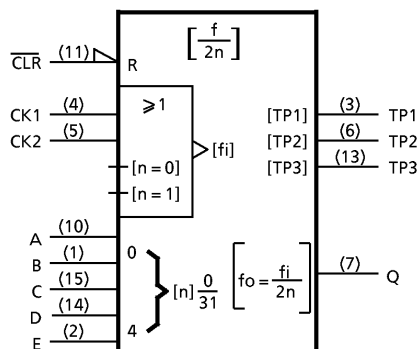


F (SOP16-P-300-1.27)  
Weight : 0.18g (Typ.)

### PIN ASSIGNMENT



### IEC LOGIC SYMBOL

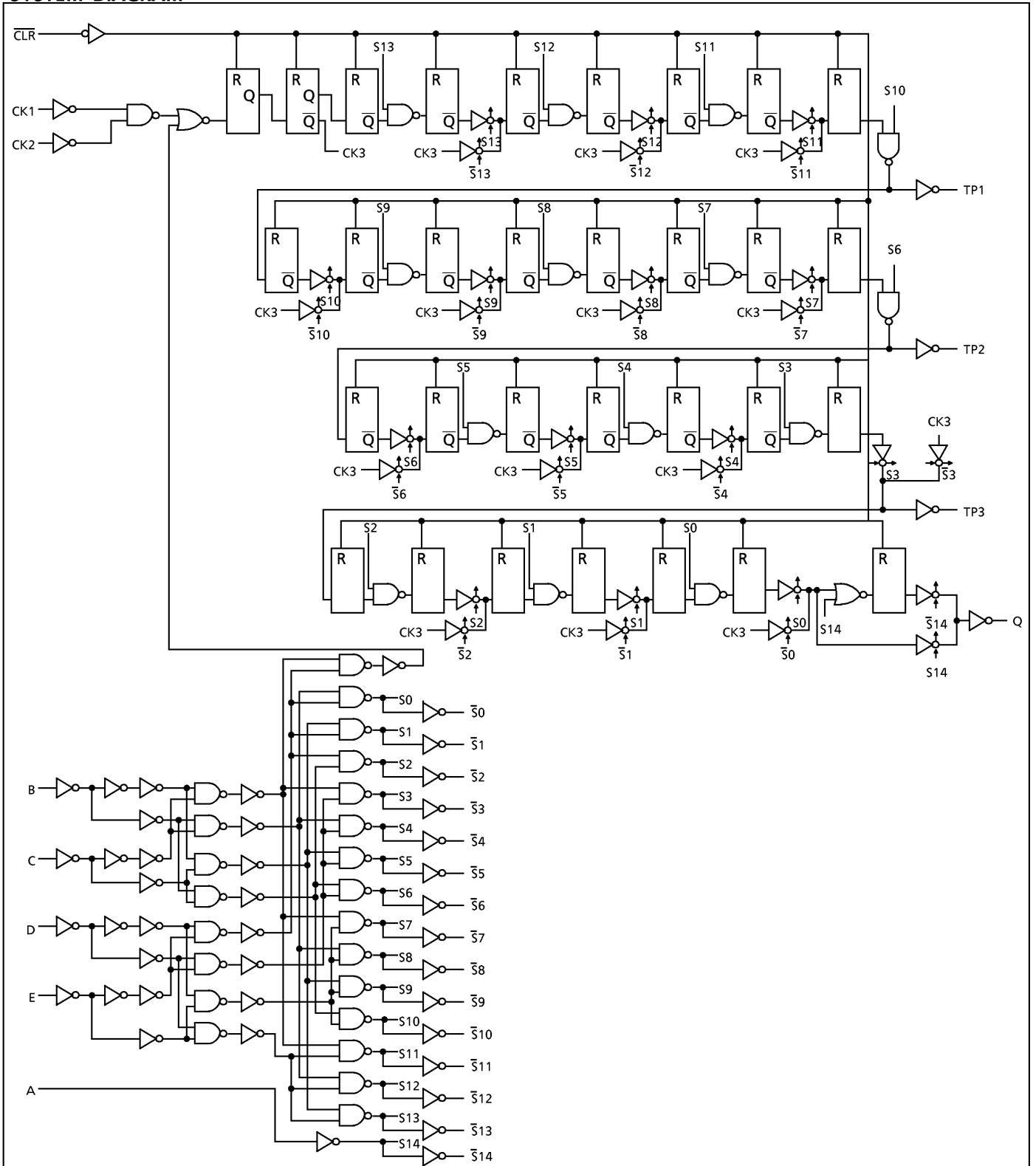


**TRUTH TABLE**

CLR	CK1	CK2	Q OUTPUT MODE
L	X	X	Cleared to L
H		L	UP Count
H	L		
H	H	X	NO Change
H	X	H	

PROGRAMMING INPUTS					FREQUENCY DIVISION							
					Q		TP1		TP2		TP3	
E	D	C	B	A	BINARY	DECIMAL	BINARY	DECIMAL	BINARY	DECIMAL	BINARY	DECIMAL
L	L	L	L	L	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
L	L	L	L	H	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
L	L	L	H	L	2 <sup>2</sup>	4	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>24</sup>	16,777,216
L	L	L	H	H	2 <sup>3</sup>	8	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>24</sup>	16,777,216
L	L	H	L	L	2 <sup>4</sup>	16	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>24</sup>	16,777,216
L	L	H	L	H	2 <sup>5</sup>	32	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>24</sup>	16,777,216
L	L	H	H	L	2 <sup>6</sup>	64	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>24</sup>	16,777,216
L	L	H	H	H	2 <sup>7</sup>	128	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>24</sup>	16,777,216
L	H	L	L	L	2 <sup>8</sup>	256	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>2</sup>	4
L	H	L	L	H	2 <sup>9</sup>	512	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>2</sup>	4
L	H	L	H	L	2 <sup>10</sup>	1,024	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>4</sup>	16
L	H	L	H	H	2 <sup>11</sup>	2,048	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>4</sup>	16
L	H	H	L	L	2 <sup>12</sup>	4,096	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>6</sup>	64
L	H	H	L	H	2 <sup>13</sup>	8,192	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>6</sup>	64
L	H	H	H	L	2 <sup>14</sup>	16,384	2 <sup>9</sup>	512	Disabled Low		2 <sup>8</sup>	256
L	H	H	H	H	2 <sup>15</sup>	32,768	2 <sup>9</sup>	512	Disabled Low		2 <sup>8</sup>	256
H	L	L	L	L	2 <sup>16</sup>	65,536	2 <sup>9</sup>	512	2 <sup>3</sup>	8	2 <sup>10</sup>	1,024
H	L	L	L	H	2 <sup>17</sup>	131,072	2 <sup>9</sup>	512	2 <sup>3</sup>	8	2 <sup>10</sup>	1,024
H	L	L	H	L	2 <sup>18</sup>	262,144	2 <sup>9</sup>	512	2 <sup>5</sup>	32	2 <sup>12</sup>	4,096
H	L	L	H	H	2 <sup>19</sup>	524,288	2 <sup>9</sup>	512	2 <sup>5</sup>	32	2 <sup>12</sup>	4,096
H	L	H	L	L	2 <sup>20</sup>	1,048,576	2 <sup>9</sup>	512	2 <sup>7</sup>	128	2 <sup>14</sup>	16,384
H	L	H	L	H	2 <sup>21</sup>	2,097,152	2 <sup>9</sup>	512	2 <sup>7</sup>	128	2 <sup>14</sup>	16,384
H	L	H	H	L	2 <sup>22</sup>	4,194,304	Disabled Low		2 <sup>9</sup>	512	2 <sup>16</sup>	65,536
H	L	H	H	H	2 <sup>23</sup>	8,388,608	Disabled Low		2 <sup>9</sup>	512	2 <sup>16</sup>	65,536
H	H	L	L	L	2 <sup>24</sup>	16,777,216	2 <sup>3</sup>	8	2 <sup>11</sup>	2,048	2 <sup>18</sup>	262,144
H	H	L	L	H	2 <sup>25</sup>	33,554,432	2 <sup>3</sup>	8	2 <sup>11</sup>	2,048	2 <sup>18</sup>	262,144
H	H	L	H	L	2 <sup>26</sup>	67,108,864	2 <sup>5</sup>	32	2 <sup>13</sup>	8,192	2 <sup>20</sup>	1,048,576
H	H	L	H	H	2 <sup>27</sup>	134,217,728	2 <sup>5</sup>	32	2 <sup>13</sup>	8,192	2 <sup>20</sup>	1,048,576
H	H	H	L	L	2 <sup>28</sup>	268,435,456	2 <sup>7</sup>	128	2 <sup>15</sup>	32,768	2 <sup>22</sup>	4,194,304
H	H	H	L	H	2 <sup>29</sup>	536,870,912	2 <sup>7</sup>	128	2 <sup>15</sup>	32,768	2 <sup>22</sup>	4,194,304
H	H	H	H	L	2 <sup>30</sup>	1,073,741,824	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>24</sup>	16,777,216
H	H	H	H	H	2 <sup>31</sup>	2,147,483,648	2 <sup>9</sup>	512	2 <sup>17</sup>	131,072	2 <sup>24</sup>	16,777,216

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	$I_{OUT}$	± 25	mA
DC $V_{CC}$ /Ground Current	$I_{CC}$	± 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 (Q)	$V_{OH}$	$V_{IN} = V_{IH}$ 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	—	
			$I_{OH} = -4\text{ mA}$ $I_{OH} = -5.2\text{ mA}$	4.5	4.18	4.31	—	4.13	—	
				6.0	5.68	5.80	—	5.63	—	
Low - Level Output Voltage (Q)	$V_{OL}$	$V_{IN} = V_{IH}$ 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	
			$I_{OL} = 4\text{ mA}$ $I_{OL} = 5.2\text{ mA}$	4.5	—	0.17	0.26	—	0.33	
				6.0	—	0.18	0.26	—	0.33	
Input Leakage Current	$I_{IN}$	$V_{IN} = V_{CC}$ or GND	6.0	—	—	± 0.1	—	± 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  $t_r = t_f = 6\text{ns}$ )

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 Hold Time (CLR)	$t_{W(L)}$		2.0	—	175	220	
			4.5	—	35	44	
			6.0	—	30	37	
Minimum Removal Time	$t_{rem}$		2.0	—	5	5	
			4.5	—	5	5	
			6.0	—	5	5	
Clock Frequency	f		2.0	—	5	4	MHz
			4.5	—	27	22	
			6.0	—	32	26	

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

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Q)	$t_{TLH}$		—	4	8	ns
	$t_{THL}$					
Output Transition Time (TP)	$t_{TLH}$		—	25	44	
	$t_{THL}$					
Propagation Delay Time (CK—Q)	$t_{pLH}$		—	42	75	
	$t_{pHL}$					
Propagation Delay Time (CLR—Q)	$t_{pHL}$		—	36	62	
Maximum Clock Frequency	$f_{MAX}$		30	70	—	MHz

AC ELECTRICAL CHARACTERISTICS (  $C_L = 50\text{pF}$ , Input  $t_r = t_f = 6\text{ns}$  )

PARAMETER	SYMBOL	TEST CONDITION	$V_{CC}$ (V)	Ta = 25°C			Ta = -40~85°C		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time (Q)	$t_{TLH}$ $t_{THL}$		2.0	—	27	75	—	95	ns
			4.5	—	9	15	—	19	
			6.0	—	8	13	—	16	
Output Transition Time (TP)	$t_{TLH}$ $t_{THL}$		2.0	—	90	250	—	315	
			4.5	—	30	50	—	63	
			6.0	—	25	43	—	54	
Propagation Delay Time (CK—Q)	$t_{pLH}$ $t_{pHL}$		2.0	—	150	425	—	530	
			4.5	—	48	85	—	106	
			6.0	—	41	72	—	90	
Propagation Delay Time (CLR—Q)	$t_{pHL}$		2.0	—	130	350	—	440	
			4.5	—	42	70	—	88	
			6.0	—	36	60	—	75	
Maximum Clock Frequency	$f_{MAX}$		2.0	5	20	—	4	—	MHz
			4.5	27	64	—	22	—	
			6.0	32	75	—	26	—	
Input Capacitance	$C_{IN}$			—	5	10	—	10	pF
Power Dissipation Capacitance	$C_{PD}$	Note (1)		—	22	—	—	—	

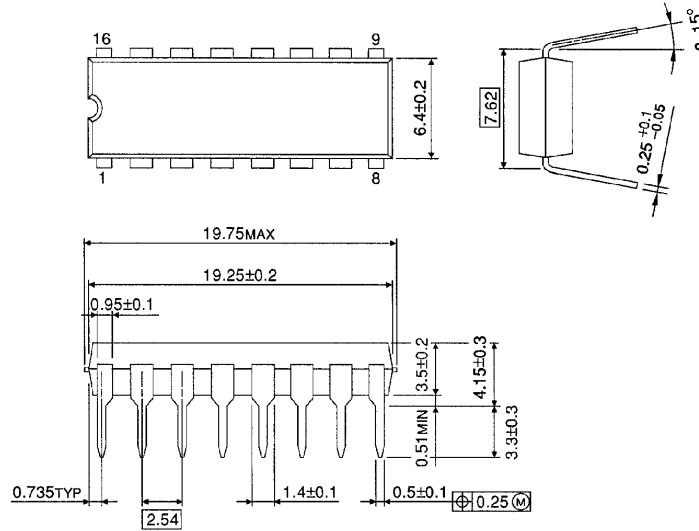
Note (1)  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

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)

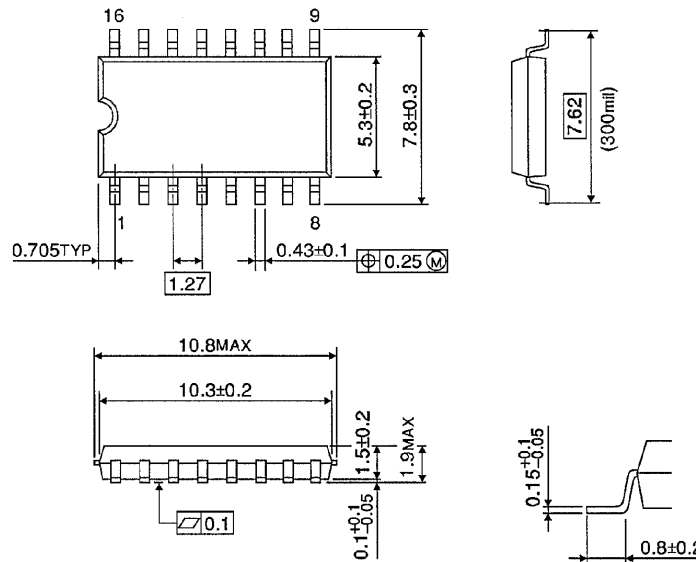
Unit in mm



Weight : 1.00g (Typ.)

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

Unit in mm



Weight : 0.18g (Typ.)

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000707EBA

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