

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.

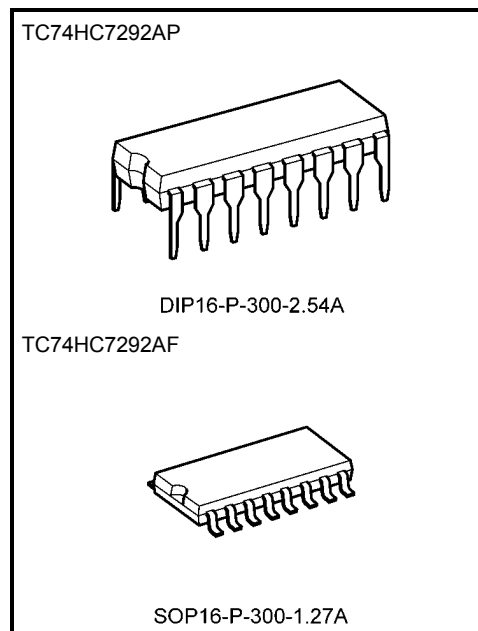
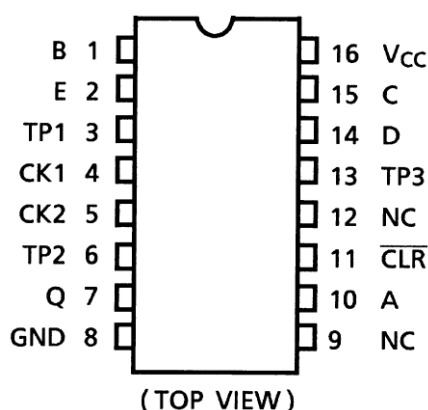
To facilitate incoming inspection, test points are provided. (TP1, TP2 and TP3)

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

## Features

- High speed:  $f_{max} = 70 \text{ MHz (typ.) at } V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 4 \mu\text{A (max) at } T_a = 25^\circ\text{C}$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 4 \text{ mA (min)}$
- Balanced propagation delays:  $t_{PLH} \approx t_{PHL}$
- Wide operating voltage range:  $V_{CC} \text{ (opr)} = 2 \text{ to } 6 \text{ V}$
- Pin and function compatible with 74LS292

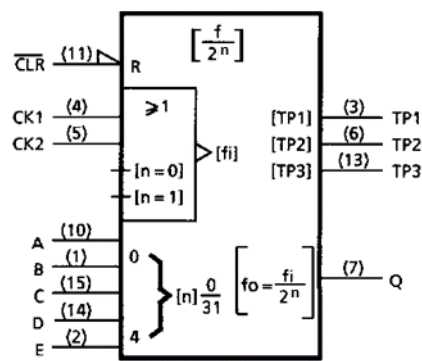
## Pin Assignment



Weight	
DIP16-P-300-2.54A	: 1.00 g (typ.)
SOP16-P-300-1.27A	: 0.18 g (typ.)

Start of commercial production  
1988-11

IEC Logic Symbol

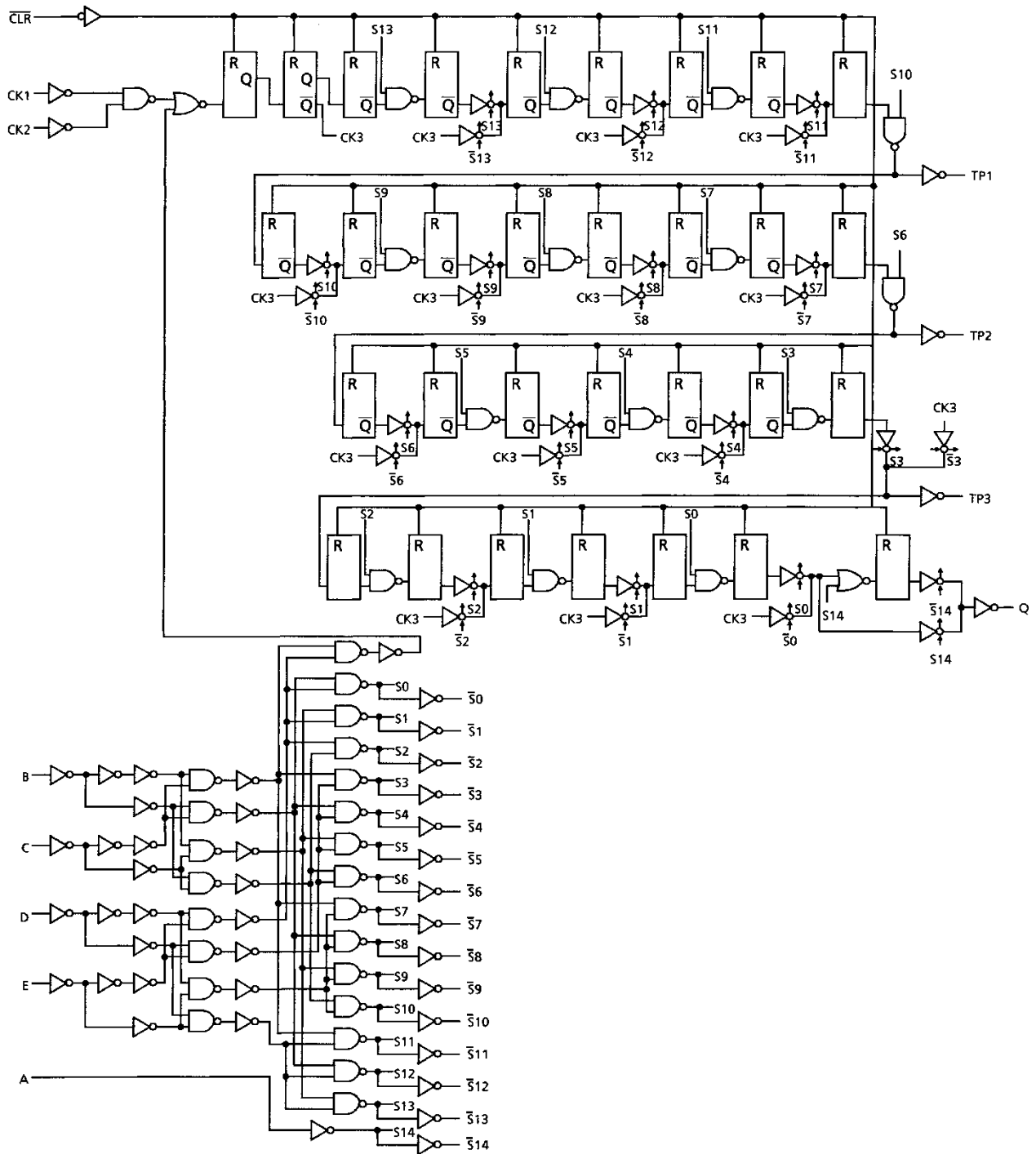


Truth Table

$\overline{\text{CLR}}$	CK1	CK2	Q Output Mode
L	X	X	Cleared to L
H	$\uparrow$	L	Up Count
H	L	$\uparrow$	
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

Characteristics	Symbol	Rating	Unit
Supply voltage range	V <sub>CC</sub>	-0.5 to 7	V
DC input voltage	V <sub>IN</sub>	-0.5 to V <sub>CC</sub> + 0.5	V
DC output voltage	V <sub>OUT</sub>	-0.5 to V <sub>CC</sub> + 0.5	V
Input diode current	I <sub>IK</sub>	±20	mA
Output diode current	I <sub>OK</sub>	±20	mA
DC output current	I <sub>OUT</sub>	±25	mA
DC V <sub>CC</sub> /ground current	I <sub>CC</sub>	±50	mA
Power dissipation	P <sub>D</sub>	500 (DIP) (Note 1)/180 (SOP)	mW
Storage temperature	T <sub>stg</sub>	-65 to 150	°C

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.  
 Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.  
 Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: 500 mW in the range of T<sub>a</sub> = -40 to 65°C. From T<sub>a</sub> = 65 to 85°C a derating factor of -10 mW/°C shall be applied until 300 mW.

## Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	2 to 6	V
Input voltage	V <sub>IN</sub>	0 to V <sub>CC</sub>	V
Output voltage	V <sub>OUT</sub>	0 to V <sub>CC</sub>	V
Operating temperature	T <sub>opr</sub>	-40 to 85	°C
Input rise and fall time	t <sub>r</sub> , t <sub>f</sub>	0 to 1000 (V <sub>CC</sub> = 2.0 V) 0 to 500 (V <sub>CC</sub> = 4.5 V) 0 to 400 (V <sub>CC</sub> = 6.0 V)	ns

Note: The operating ranges must be maintained to ensure the normal operation of the device.  
 Unused inputs must be tied to either V<sub>CC</sub> or GND.

### Electrical Characteristics

#### DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
				V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
High-level input voltage	V <sub>IH</sub>	—		2.0 4.5 6.0	1.50 3.15 4.20	— — —	— — —	1.50 3.15 4.20	V	
Low-level input voltage	V <sub>IL</sub>	—		2.0 4.5 6.0	— — —	— — —	0.50 1.35 1.80	— — —	0.50 1.35 1.80	V
High-level output voltage (Q)	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	2.0 4.5 6.0	1.9 4.4 5.9	2.0 4.5 6.0	— — —	1.9 4.4 5.9	— — —	V
			I <sub>OH</sub> = -4 mA	4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	— —	
			I <sub>OH</sub> = -5.2 mA							
Low-level output voltage (Q)	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA	2.0 4.5 6.0	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	0.1 0.1 0.1	V
			I <sub>OL</sub> = 4 mA	4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	0.33 0.33	
			I <sub>OL</sub> = 5.2 mA							
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	4.0	—	40.0	μA

#### Timing Requirements (input: t<sub>r</sub> = t<sub>f</sub> = 6 ns)

Characteristics	Symbol	Test Condition		Ta = 25°C		Ta = -40 to 85°C	Unit
				V <sub>CC</sub> (V)	Typ.	Limit	
Minimum pulse width (CK)	t <sub>w</sub> (L) t <sub>w</sub> (H)	—	—	2.0	—	75	95
				4.5	—	15	19
				6.0	—	13	16
Minimum pulse width (CLR)	t <sub>w</sub> (L)	—	—	2.0	—	175	220
				4.5	—	35	44
				6.0	—	30	37
Minimum removal time	t <sub>rem</sub>	—	—	2.0	—	5	5
				4.5	—	5	5
				6.0	—	5	5
Clock frequency	f	—	—	2.0	—	5	4
				4.5	—	27	22
				6.0	—	32	26

### AC Characteristics ( $C_L = 15 \text{ pF}$ , $V_{CC} = 5 \text{ V}$ , $T_a = 25^\circ\text{C}$ , input: $t_r = t_f = 6 \text{ ns}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output transition time (Q)	$t_{TLH}$ $t_{THL}$	—	—	4	8	ns
Output transition time (TP)	$t_{TLH}$ $t_{THL}$	—	—	25	44	ns
Propagation delay time (CK-Q)	$t_{PLH}$ $t_{PHL}$	—	—	42	75	ns
Propagation delay time ( $\overline{\text{CLR}}$ -Q)	$t_{pHL}$	—	—	36	62	ns
Maximum clock frequency	$f_{\text{max}}$	—	30	70	—	MHz

### AC Characteristics ( $C_L = 50 \text{ pF}$ , input: $t_r = t_f = 6 \text{ ns}$ )

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit
			$V_{CC}$ (V)	Min	Typ.	Max	Min	Max
Output transition time (Q)	$t_{TLH}$ $t_{THL}$	—	2.0	—	27	75	—	95
			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 ( $\overline{\text{CLR}}$ -Q)	$t_{pHL}$	—	2.0	—	130	350	—	440
			4.5	—	42	70	—	88
			6.0	—	36	60	—	75
Maximum clock frequency	$f_{\text{max}}$	—	2.0	5	20	—	4	—
			4.5	27	64	—	22	—
			6.0	32	75	—	26	—
Input capacitance	$C_{IN}$	—	—	—	5	10	—	10
Power dissipation capacitance	CPD	(Note)	—	—	22	—	—	—

Note: CPD is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

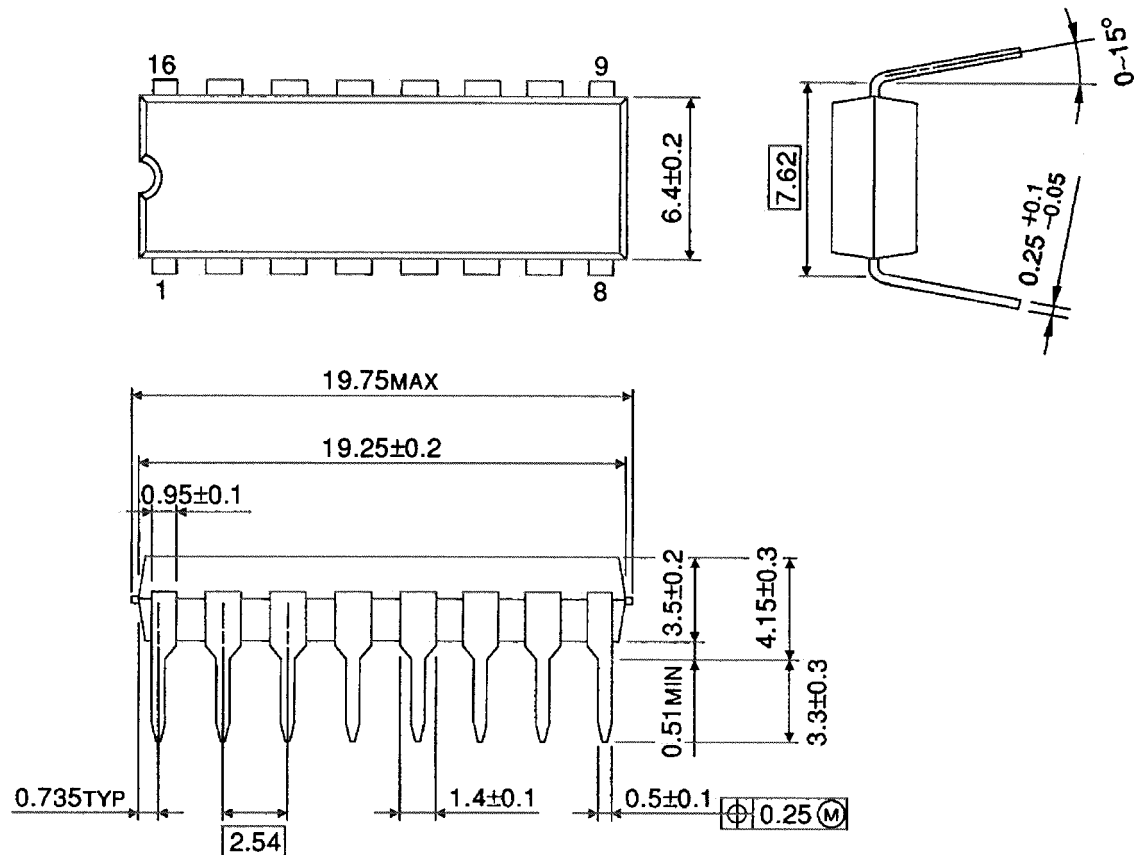
Average operating current can be obtained by the equation:

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

### Package Dimensions

DIP16-P-300-2.54A

Unit : mm



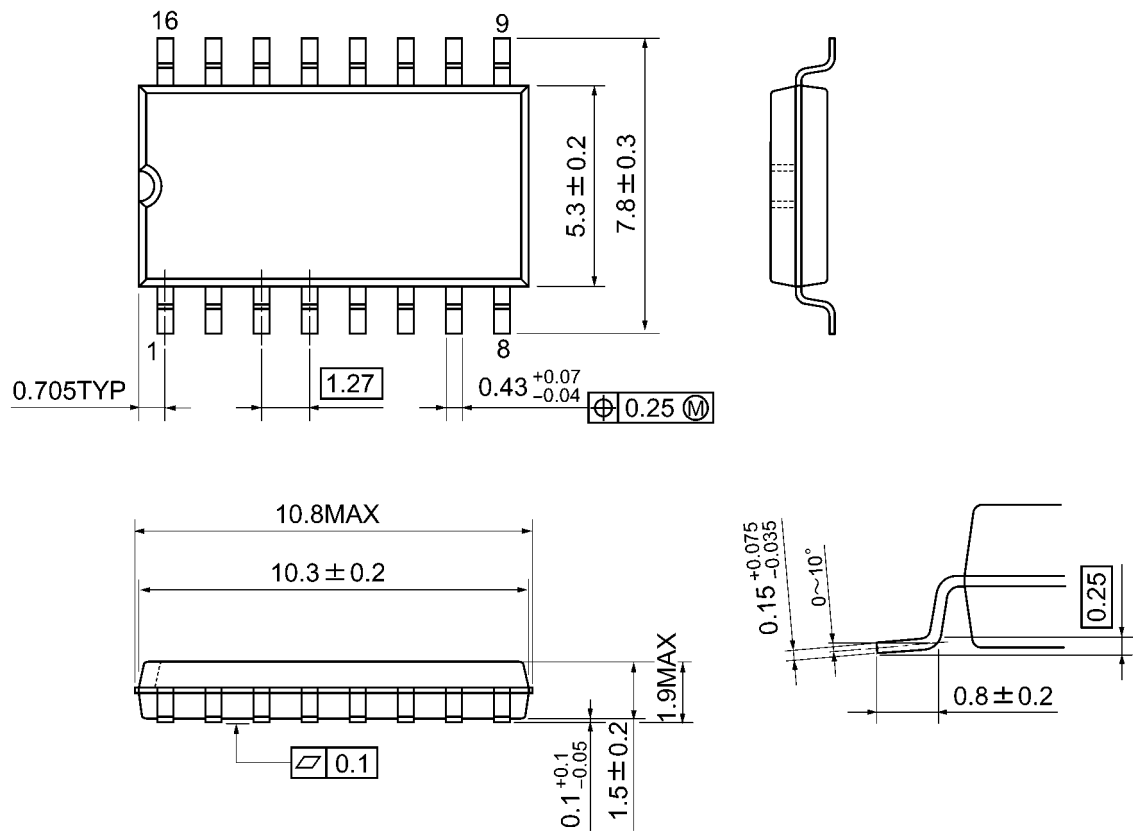
Weight: 1.00 g (typ.)



### Package Dimensions

SOP16-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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