

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

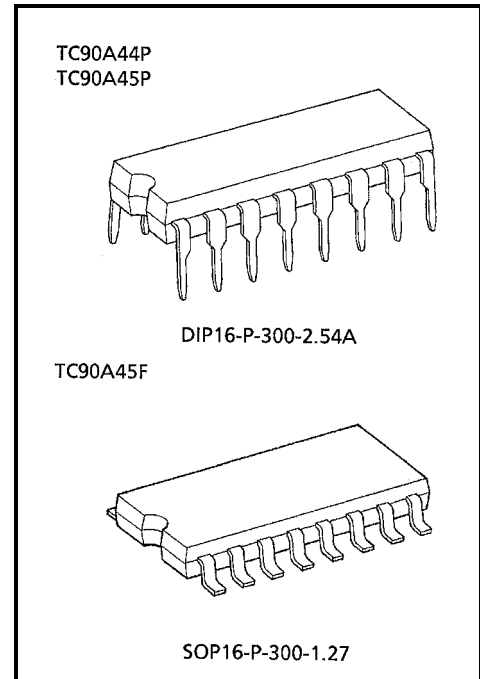
# TC90A44P, TC90A45P, TC90A45F

## NTSC 2-LINE DIGITAL Y / C SEPARATION IC

The TC90A44P, TC90A45P / F separates luminance (Y) and chrominance (C) signals from NTSC system composite video signal by using 2 horizontal (H) lines separation. The Y / C separation unit for TV and VCR set is able to assembled at low cost, because it requires few external parts and no adjustment.

### FEATURES

- TV system : NTSC
- PLL4 × multiplication circuit
- sync. tip clamping circuit
- Internal 8 bit A / D converter
- Internal 8 bit D / A converters (2 ch.)
- 1 H line memory
- Dynamic comb filter
- Color killer mode (Y / C separation OFF)
- DIP16 / SOP16 package
- 5 V single power supply



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

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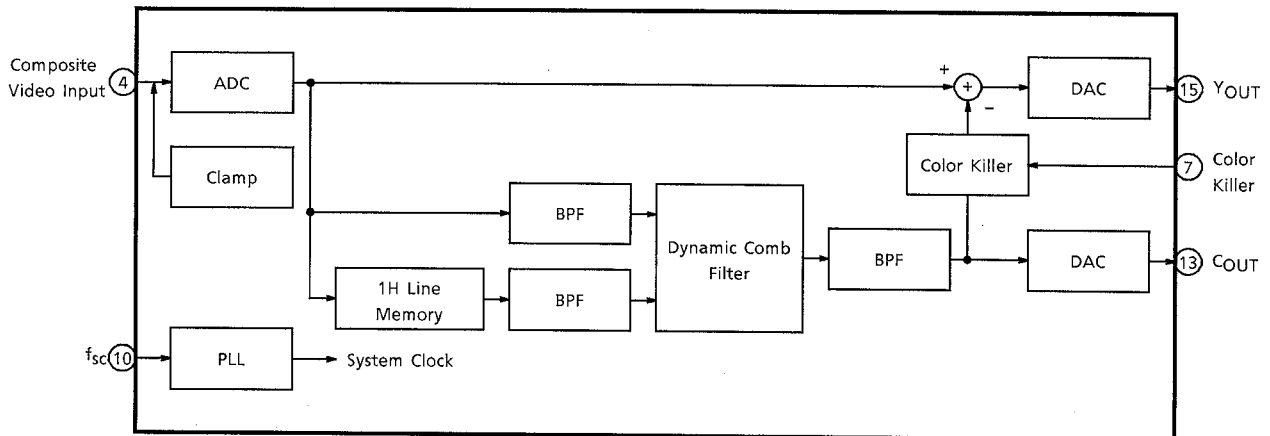
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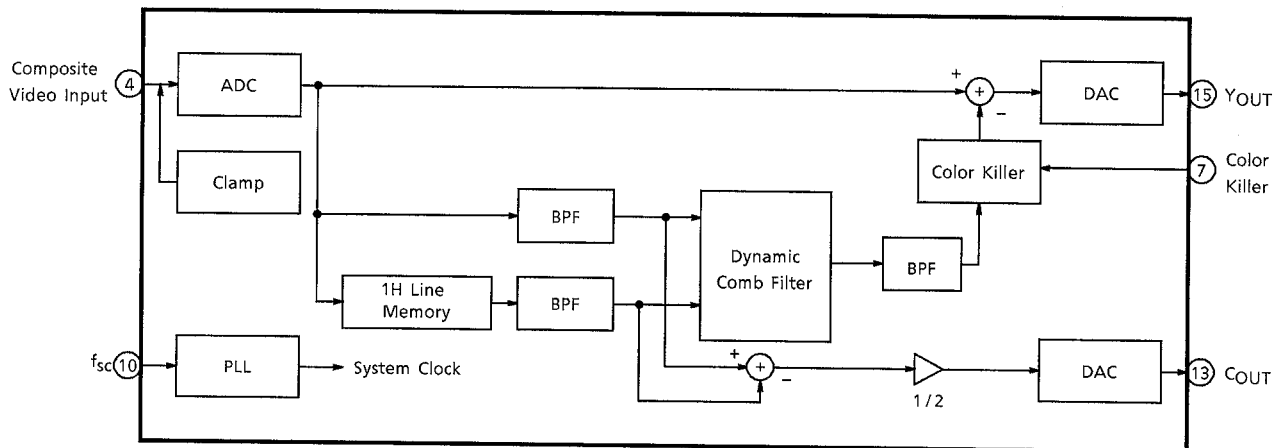
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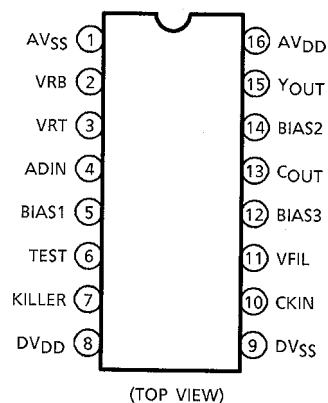
## TC90A44P BLOCK DIAGRAM



## TC90A45P / F BLOCK DIAGRAM

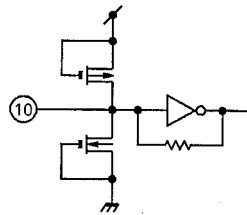
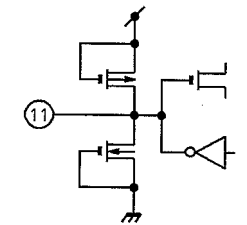
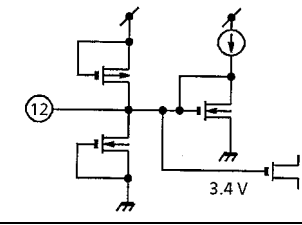
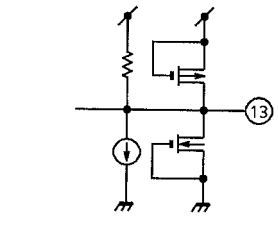
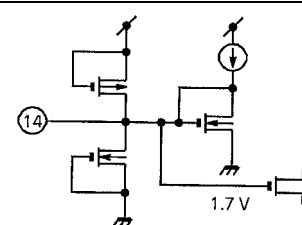
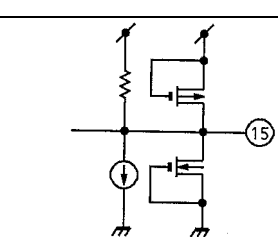


## TERMINAL CONNECTION DIAGRAM



## TERMINAL FUNCTION

PIN No.	NAME	FUNCTION	I / O	INTERFACE CIRCUIT
1	AV <sub>SS</sub>	Ground for analog components.	-	—
2	VRB	ADC bias lower limit reference voltage. This defaults internally to approximately 2.25 V, so this pin should normally be connected to ground (AV <sub>SS</sub> ) through a 0.01 $\mu$ F capacitor.	-	
3	VRT	ADC bias higher limit reference voltage. This defaults internally to approximately 2.8 V, so this pin should normally be connected to ground (AV <sub>SS</sub> ) through a 0.01 $\mu$ F capacitor.	-	
4	ADIN	Composite video signal input.	I	
5	BIAS1	ADC bias voltage. This defaults internally to approximately 1.3 V, so this pin should normally be connected to ground (AV <sub>SS</sub> ) through a 0.01 $\mu$ F capacitor.	-	
6	TEST	Test terminal. Normally connected to ground (DV <sub>SS</sub> ).	-	
7	KILLER	This pin is switch for color killer circuit. H : For B / W signal, Y / C separation OFF. L : Normal Y / C separation	I	

PIN No.	NAME	FUNCTION	I/O	INTERFACE CIRCUIT
8	DV <sub>DD</sub>	Power supply for digital components (+5 V).	-	-
9	DV <sub>SS</sub>	Ground for digital components.	-	-
10	CKIN	Clock input. After applying capacitor for DC cut, input a color-burst-synchronized f <sub>SC</sub> clock signal to this pin.	I	
11	VFIL	Connect a VCO filter to this pin.	-	
12	BIAS3	DAC bias voltage. This defaults internally to approximately 3.4 V, so this pin should normally be connected to ground (AV <sub>SS</sub> ) through a 0.01 μF capacitor.	-	
13	C <sub>OUT</sub>	Chrominance signal output.	O	
14	BIAS2	DAC bias voltage. This defaults internally to approximately 1.7 V, so this pin should normally be connected to ground (AV <sub>SS</sub> ) through a 0.01 μF capacitor.	-	
15	Y <sub>OUT</sub>	Luminance signal output.	O	
16	AV <sub>DD</sub>	Power supply for analog components (+5 V)	-	-

**FUNCTION BLOCK DESCRIPTIONS**

## (1) Input clamp (CLAMP)

This is sync tip clamp circuit for composite signal.

This circuit makes feedback so that the min. data after A / D converter at Y / C separation equal to internal DC bias level.

## (2) A / D converter (ADC)

This is high speed series-parallel 8 bit A / D converter (Dynamic Range: 1.0V). Recommendable Input level is 0.75 V<sub>p-p</sub> (Sync tip~white 100%).

## (3) Line memory

This block is DRAM line memory for 1 H delay.

## (4) Band-pass filter (BPF)

This filter extracts the signal of chrominance band from composite video signal. The center frequency is  $f_{sc}$ .

## (5) Dynamic comb filter (DCF)

This block is logical comb filter to extract the chrominance signal. Filtering logic applies a correlation of two lines to reduce color dot crawl and cross color.

## (6) Color killer circuit (KILLER)

This block is applied for black and white (B / W) signal regardless of have color burst or no color burts. When pin 10 (KILLER) is "H", logic stop Y / C separation and output composite video signal from pin 14 (YOUT).

## (7) PLL (4 times multiply clock generator)

This block is 4 times multiplier and makes  $4f_{sc}$  as system clock.

This block supplies system clock ( $4f_{sc}$ ) to each block via buffer and generates timing signal for memories.

## (8) D / A converter (DAC)

This is high speed 8 bit D / A converter. Y output level is 1.73 V<sub>p-p</sub> (Typ.).

C output level is 437 mV<sub>p-p</sub> (Typ.). (Input condition is 0.75V<sub>p-p</sub>)

## MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Power Supply Voltage		V <sub>DD</sub>	V <sub>SS</sub> ~V <sub>SS</sub> + 6.5	V
Input Voltage		V <sub>IN</sub>	-0.3~V <sub>DD</sub> + 0.3	V
Power Dissipation	TC90A44P/45P	P <sub>D</sub> (Note)	600	mW
	TC90A45F		440	
Storage Temperature		T <sub>stg</sub>	-55~125	°C

(Note) : Ta = 70°C

## RECOMMENDED OPERATING CONDITION

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage	V <sub>DD</sub>	-	4.75	5.00	5.25	V
Input Voltage	V <sub>IN</sub>	-	0	-	V <sub>DD</sub>	V
Operating Temperature	T <sub>opr</sub>	-	-10	-	70	°C

## ELECTRICAL CHARACTERISTICS DC CHARACTERISTICS (Ta = 25°C, V<sub>DD</sub> = 5 V)

CHARACTERISTIC		SYMBOL	TEST CIR- CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage		V <sub>DD</sub>	1	CLOCK = 3.579545 MHz V <sub>IN</sub> = 0.75 V <sub>p-p</sub>	4.75	5.00	5.25	V
Supply Current		I <sub>DD</sub>	1		45	60	75	mA
Output Voltage Level	Y <sub>OUT</sub> (sync tip)	1	1		2.55	2.70	2.85	V
	C <sub>OUT</sub> (center)				3.70	3.85	4.00	
Terminal Voltage Level	VRB	1			2.15	2.25	2.35	V
	VRT				2.7	2.8	2.9	
	ADIN (sync tip)				1.9	2.0	2.1	
	BIAS1				1.0	1.3	1.7	
	BIAS2				1.2	1.7	2.1	
	BIAS3				3.0	3.4	4.0	
	VFIL				1.2	1.9	3.0	
CKIN	1.8	2.3			2.8			
Input Voltage	High Level	V <sub>IH</sub>			1	4	-	-
	Low Level	V <sub>IL</sub>		1	-	-	1	V

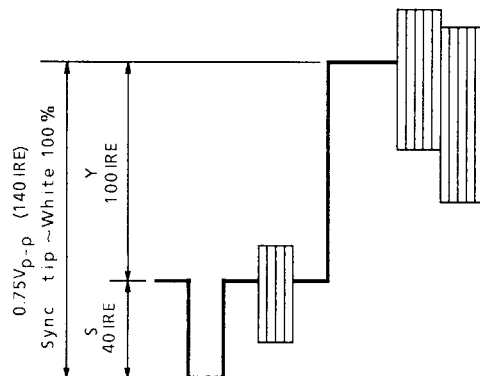
## AC CHARACTERISTICS

(1)Y output (Ta = 25°C, V<sub>DD</sub> = 5 V, input clock : 3.579545 MHz 0.4 V<sub>p-p</sub>, S<sub>1</sub> = 1)

CHARACTERISTICS		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Level		V <sub>IN</sub>	1	0~140 IRE	-	0.75	-	V <sub>p-p</sub>
Low Frequency Gain		G <sub>V</sub>	1	S <sub>2</sub> = 1, S <sub>3</sub> = 1, S <sub>4</sub> = 2 V <sub>IN</sub> = 15.73426 kHz, 0.75 V <sub>p-p</sub> , V <sub>dc</sub> = 2.5 V	6.8	7.2	7.7	dB
Frequency Response	f <sub>2</sub> / f <sub>1</sub>	MTF1	1	S <sub>2</sub> = 1, S <sub>3</sub> = 1, S <sub>4</sub> = 2 V <sub>IN</sub> = 0.75 V <sub>p-p</sub> , V <sub>dc</sub> = 2.5 V	-0.8	-1.0	-2.0	dB
	f <sub>4</sub> / f <sub>1</sub>	MTF2			-1.5	-2.0	-3.0	
Comb Characteristics	f <sub>2</sub> / f <sub>3</sub>	COMBY	1			-	-46	-40
Output Impedance		Z <sub>o</sub>	1	S <sub>2</sub> = 2, S <sub>4</sub> = 2 V <sub>IN</sub> = 15.73426 kHz, 0.75 V <sub>p-p</sub> , V <sub>dc</sub> = 2.5 V $Z_o = \frac{V_1 - V_2}{V_2} \times 400$ V <sub>1</sub> : S <sub>3</sub> = 1, V <sub>2</sub> : S <sub>3</sub> = 2	250	400	700	Ω

(Note) : f<sub>1</sub> = f<sub>H</sub> = 15.73426 kHz, f<sub>2</sub> = f<sub>sc</sub> = 3.579545 MHz, f<sub>3</sub> = f<sub>sc</sub> + 1 / 2f<sub>H</sub> = 3.587412 MHz,  
f<sub>4</sub> = 1 / 3 (4f<sub>sc</sub>) = 4.772727 MHz

## CONDITION OF INPUT SIGNAL



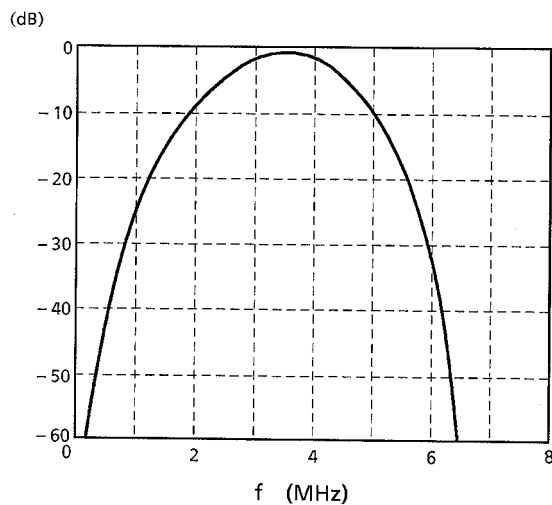
### (2)C output (Ta = 25°C, VDD = 5 V, input clock : 3.579545MHz 0.4 Vp-p, S1 = 2)

CHARACTERISTICS		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gain		Cv	1	S <sub>2</sub> = 1, S <sub>3</sub> = 1, S <sub>4</sub> = 1 V <sub>IN</sub> = 0.75 V <sub>p-p</sub>	5.7	6.2	6.7	dB
BPF Characteristics	TC90A44P	BWCW	1	S <sub>2</sub> = 2, S <sub>3</sub> = 1, S <sub>4</sub> = 2 V <sub>IN</sub> = 0.75 V <sub>p-p</sub> , Vdc = 2.5 V (f <sub>sc</sub> - 503496 Hz) - (f <sub>sc</sub> )	-2.5	-1.9	-1.5	dB
	TC90A45P / F				-1.5	-1.3	-1.0	
Comb Characteristics	TC90A44P	COMBC	1	S <sub>2</sub> = 1, S <sub>3</sub> = 1, S <sub>4</sub> = 2 V <sub>IN</sub> = 0.75 V <sub>p-p</sub> , Vdc = 2.5 V	-	-38	-35	dB
	TC90A45P / F				-	-46	-40	
Differential Gain		DG	1	S <sub>2</sub> = 1, S <sub>3</sub> = 1, S <sub>4</sub> = 1 Modulated lamp signal 140 IRE : 0.75 V	0	2	5	%
Differential Phase		DP			0	2	5	°
Output Impedance		Zo	1	S <sub>2</sub> = 2, S <sub>4</sub> = 2 V <sub>IN</sub> = 15.73426 kHz, 0.75 V <sub>p-p</sub> , Vdc = 2.5 V  Z <sub>o</sub> = $\frac{V_1 - V_2}{V_2} \times 400$  V <sub>1</sub> : S <sub>3</sub> = 1, V <sub>2</sub> : S <sub>3</sub> = 2	250	400	700	Ω

### (3)PLL circuit characteristics

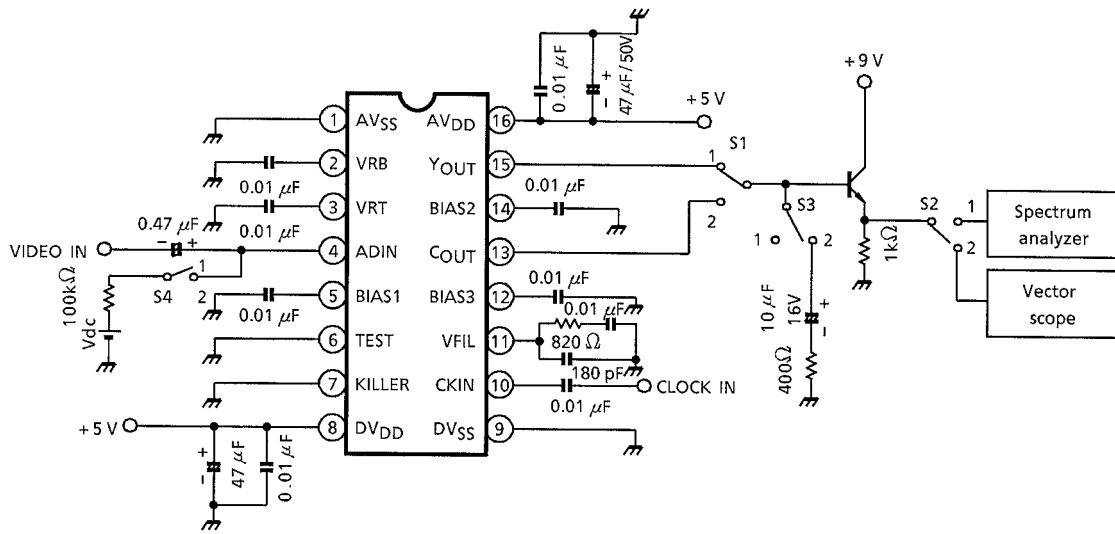
CHARACTERISTICS	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Pull-In Frequency Range	fck	1	-	3.5	3.6	3.7	MHz
Input Amplitude (f <sub>sc</sub> Components)	Vck	1	-	0.35	0.5	-	V <sub>p-p</sub>

### BPF CHARACTERISTICS OF COLOR SIGNAL OUTPUT (TC90A45P / F)

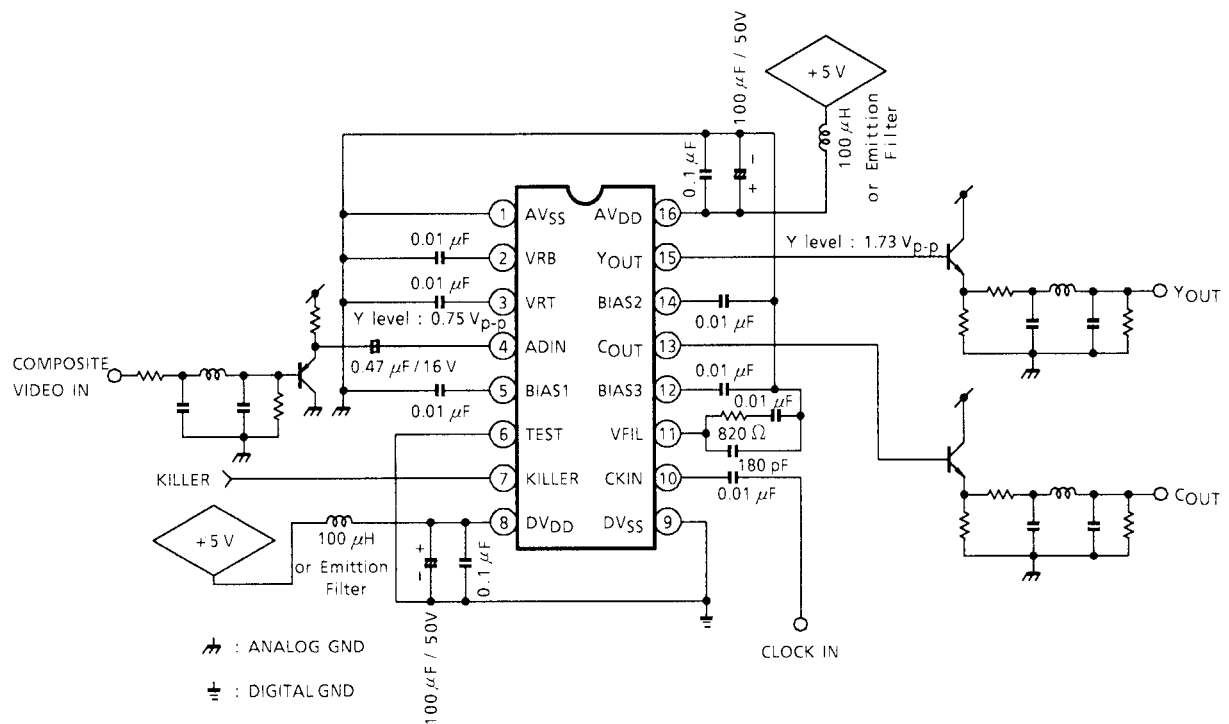




## TEST CIRCUIT 1



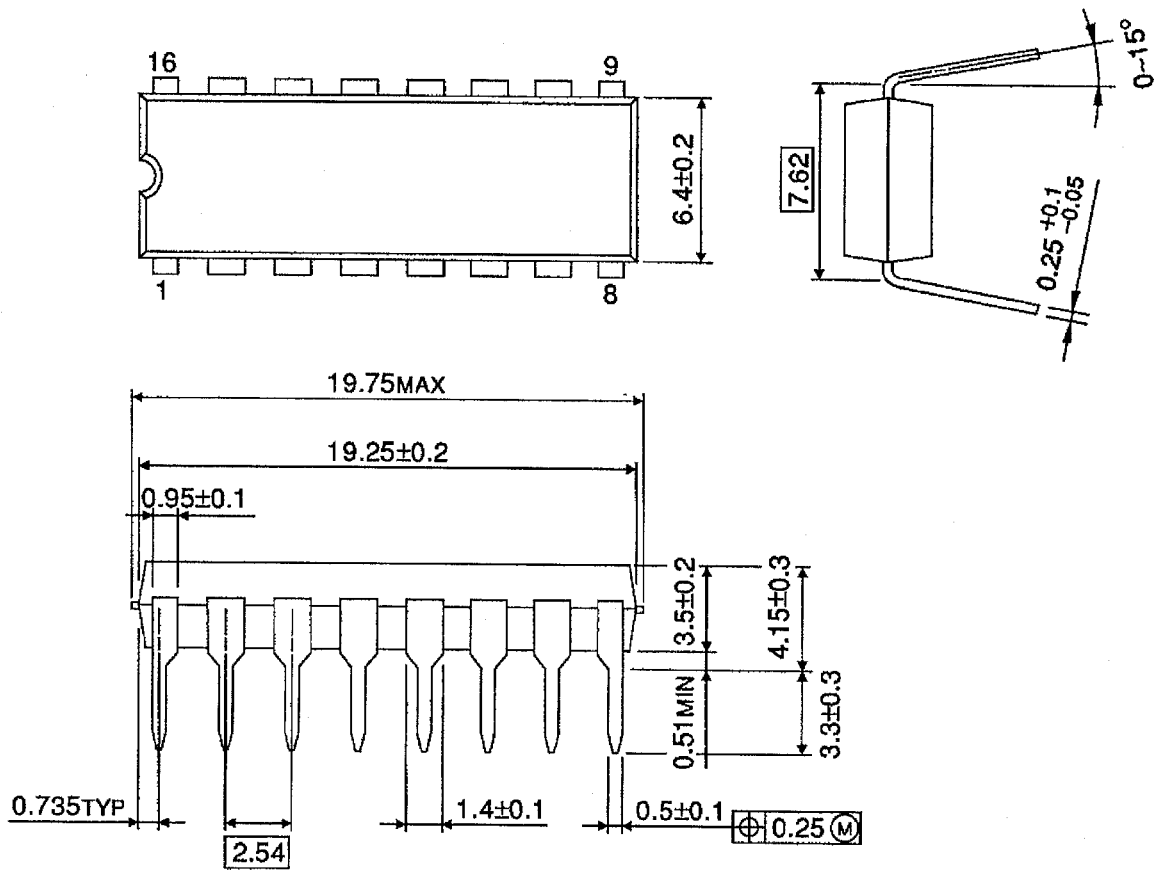
## APPLICATION CIRCUIT



## PACKAGE DIMENSIONS

DIP16-P-300-2.54A

Unit : mm

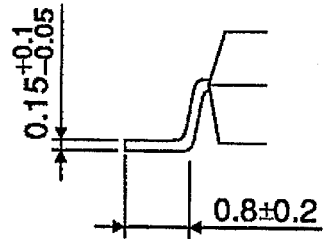
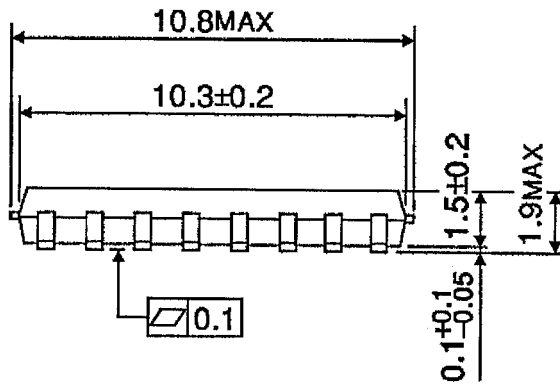
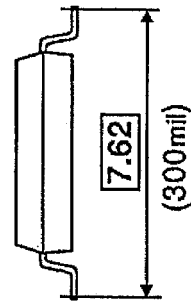
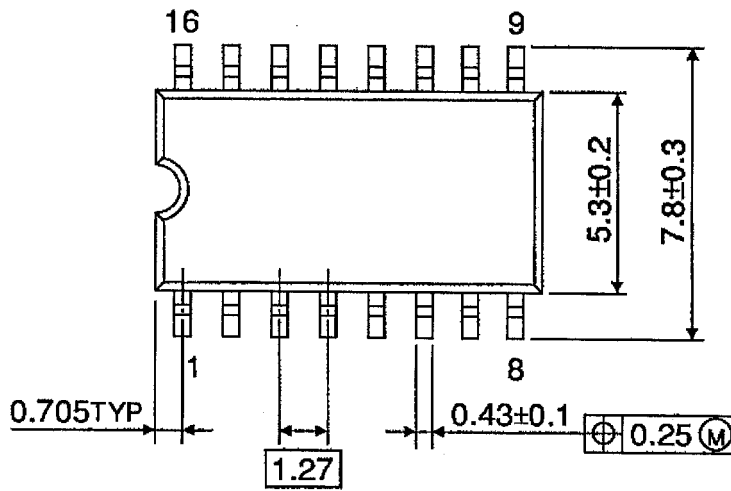


Weight : 1.00 g (Typ.)

## PACKAGE DIMENSIONS

SOP16-P-300-1.27

Unit : mm



Weight : 0.18 g (Typ.)