

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

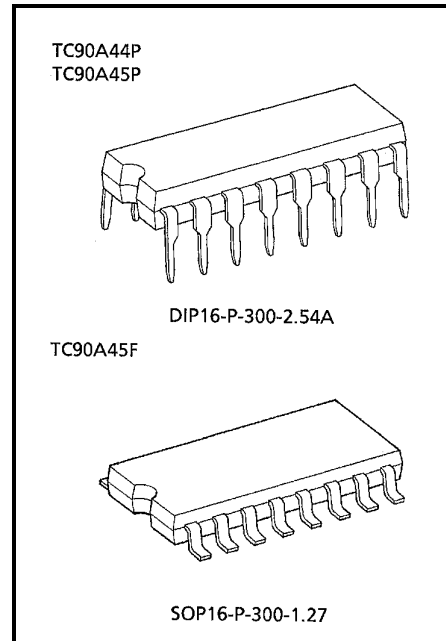
TC90A44P, TC90A45P, TC90A45F

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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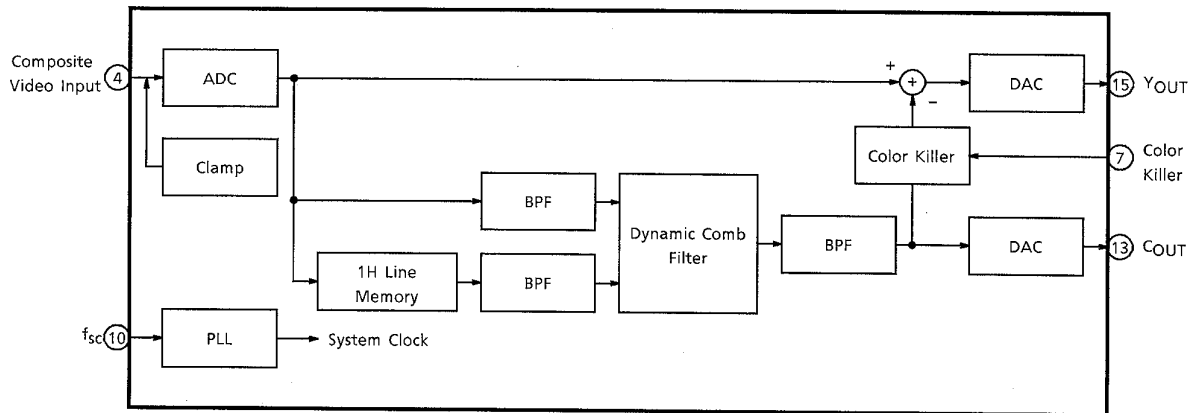
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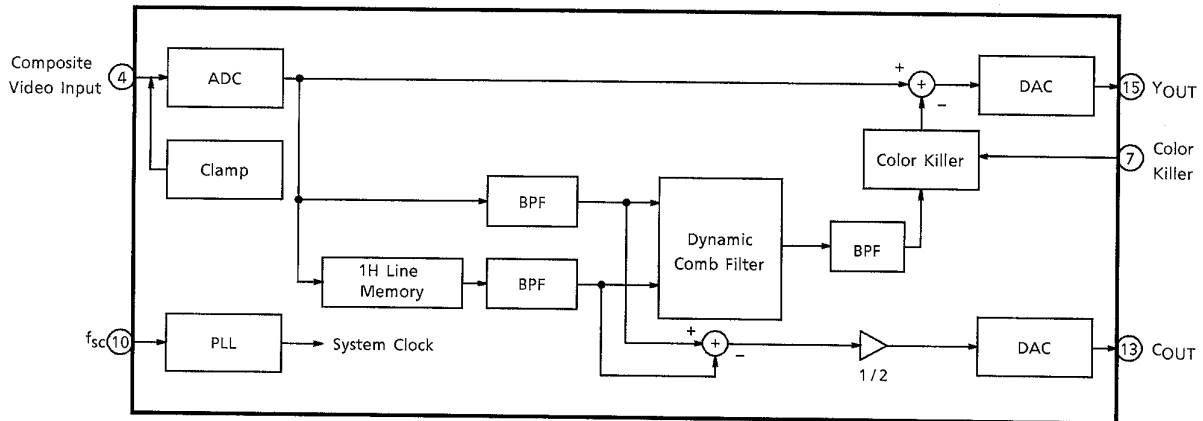
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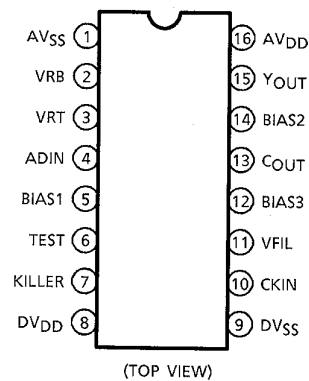
TC90A44P BLOCK DIAGRAM



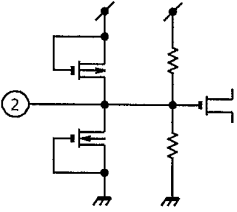
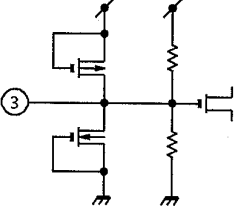
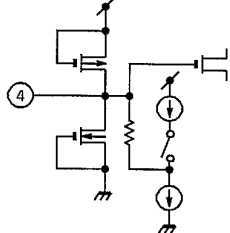
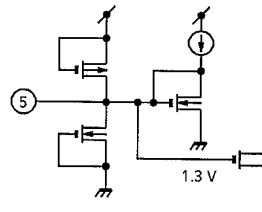
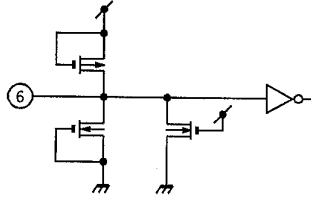
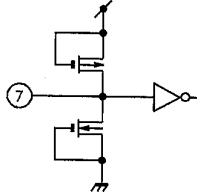
TC90A45P / F BLOCK DIAGRAM

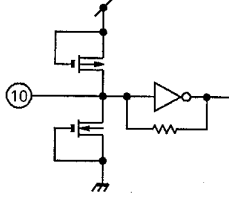
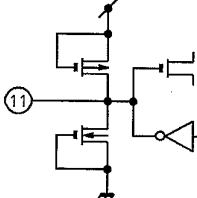
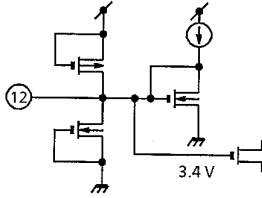
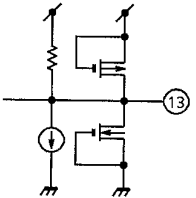
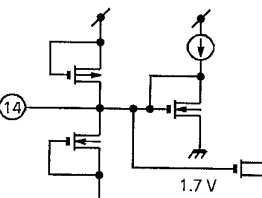
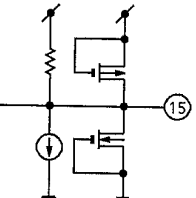


TERMINAL CONNECTION DIAGRAM



TERMINAL FUNCTION

| PIN No. | NAME | FUNCTION | I/O | INTERFACE CIRCUIT |
|---------|------------------|--|-----|---|
| 1 | AV _{SS} | 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 _{SS}) through a 0.01 μ 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 _{SS}) through a 0.01 μ 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 _{SS}) through a 0.01 μ F capacitor. | - |  |
| 6 | TEST | Test terminal. Normally connected to ground (DV _{SS}). | - |  |
| 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 _{DD} | Power supply for digital components (+5 V). | - | - |
| 9 | DV _{SS} | Ground for digital components. | - | - |
| 10 | CKIN | Clock input. After applying capacitor for DC cut, input a color-burst-synchronized f _{SC} 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 _{SS}) through a 0.01 μF capacitor. | - |  |
| 13 | C _{OUT} | 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 _{SS}) through a 0.01 μF capacitor. | - |  |
| 15 | Y _{OUT} | Luminance signal output. | O |  |
| 16 | AV _{DD} | 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_{p-p} (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_{p-p} (Typ.).

C output level is 437 mV_{p-p} (Typ.). (Input condition is 0.75V_{p-p})

MAXIMUM RATINGS (Ta = 25°C)

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

(Note) : Ta = 70°C

RECOMMENDED OPERATING CONDITION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-----------------------|------------------|----------------|------|------|-----------------|------|
| Power Supply Voltage | V _{DD} | - | 4.75 | 5.00 | 5.25 | V |
| Input Voltage | V _{IN} | - | 0 | - | V _{DD} | V |
| Operating Temperature | T _{opr} | - | -10 | - | 70 | °C |

ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS (Ta = 25°C, V_{DD} = 5 V)

| CHARACTERISTIC | | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|------------------------|------------|--------------------------------|---------------|---|------|------|------|------|
| Power Supply Voltage | | V _{DD} | 1 | CLOCK = 3.579545 MHz V _{IN} = 0.75 V _{p-p} | 4.75 | 5.00 | 5.25 | V |
| Supply Current | | I _{DD} | 1 | | 45 | 60 | 75 | mA |
| Output Voltage Level | | Y _{OUT} (sync tip) | 1 | | 2.55 | 2.70 | 2.85 | V |
| | | C _{OUT} (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 _{IH} | 1 | 4 | - | - | V | |
| | Low Level | V _{IL} | 1 | - | - | 1 | V | |

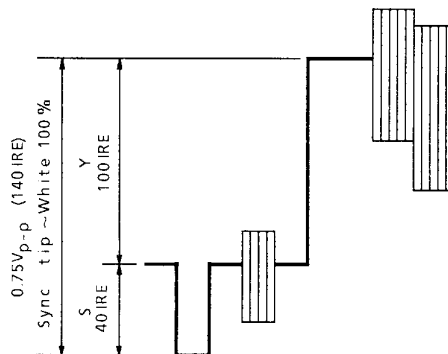
AC CHARACTERISTICS

(1)Y output (Ta = 25°C, V_{DD} = 5 V, input clock : 3.579545 MHz 0.4 V_{p-p}, S₁ = 1)

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

(Note) : f₁ = f_H = 15.73426 kHz, f₂ = f_{SC} = 3.579545 MHz, f₃ = f_{SC} + 1 / 2f_H = 3.587412 MHz,
f₄ = 1 / 3 (4f_{SC}) = 4.772727 MHz

CONDITION OF INPUT SIGNAL



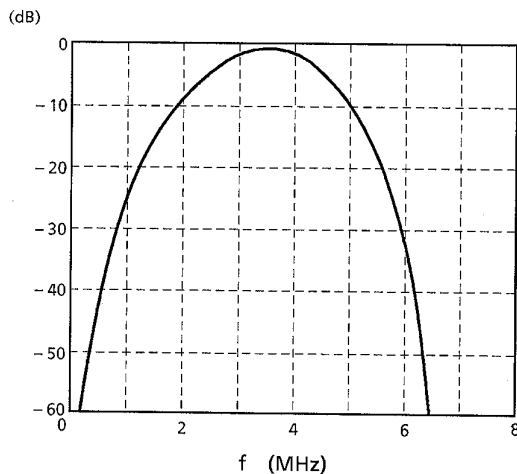
(2)C output (Ta = 25°C, V_{DD} = 5 V, input clock : 3.579545MHz 0.4 V_{p-p}, S1 = 2)

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

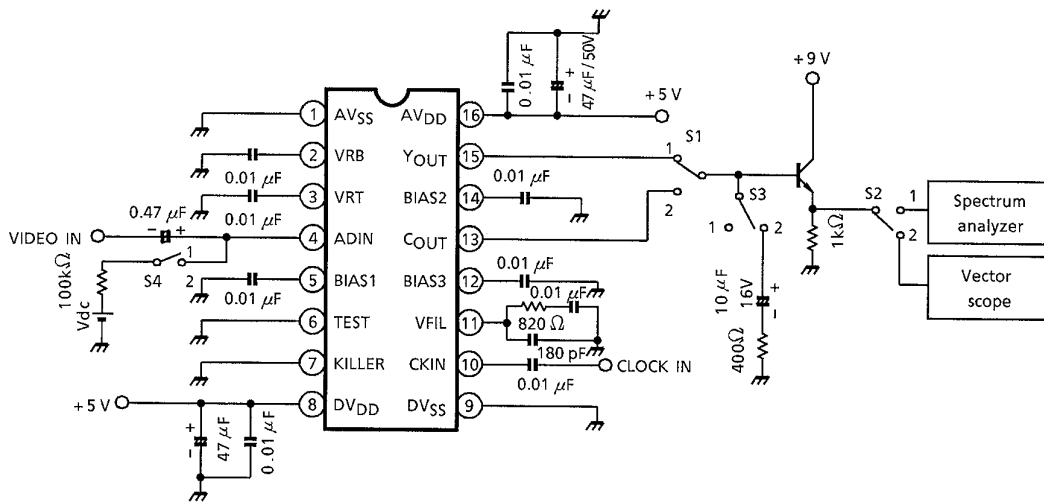
(3)PLL circuit characteristics

| CHARACTERISTICS | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|-----------------|---------------|----------------|------|------|------|------------------|
| Pull-In Frequency Range | f _{ck} | 1 | - | 3.5 | 3.6 | 3.7 | MHz |
| Input Amplitude (f _{sc} Components) | V _{ck} | 1 | - | 0.35 | 0.5 | - | V _{p-p} |

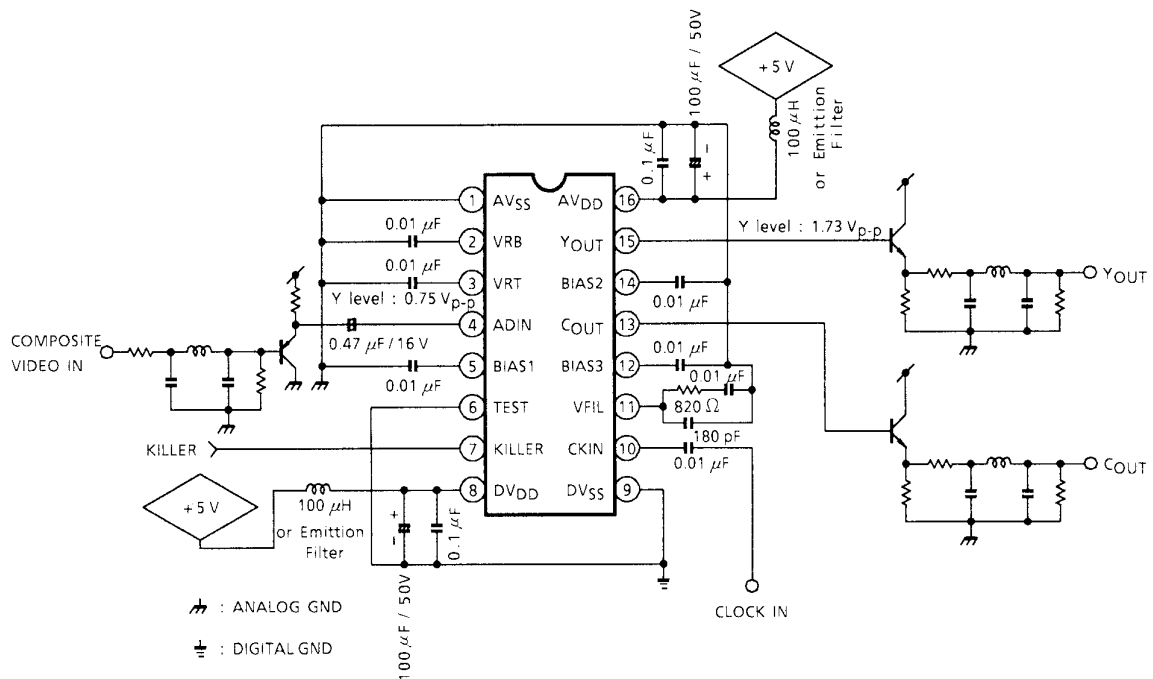
BPF CHARACTERISTICS OF COLOR SIGNAL OUTPUT (TC90A45P / F)



TEST CIRCUIT 1



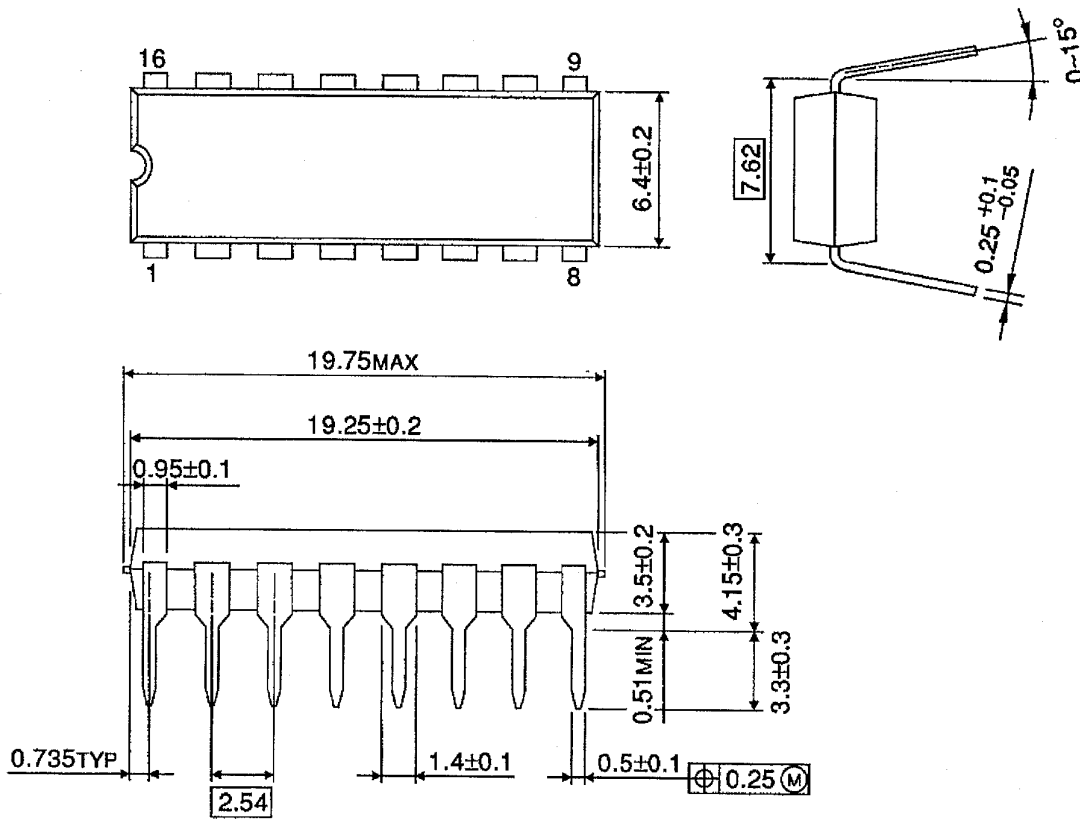
APPLICATION CIRCUIT



PACKAGE DIMENSIONS

DIP16-P-300-2.54A

Unit : mm

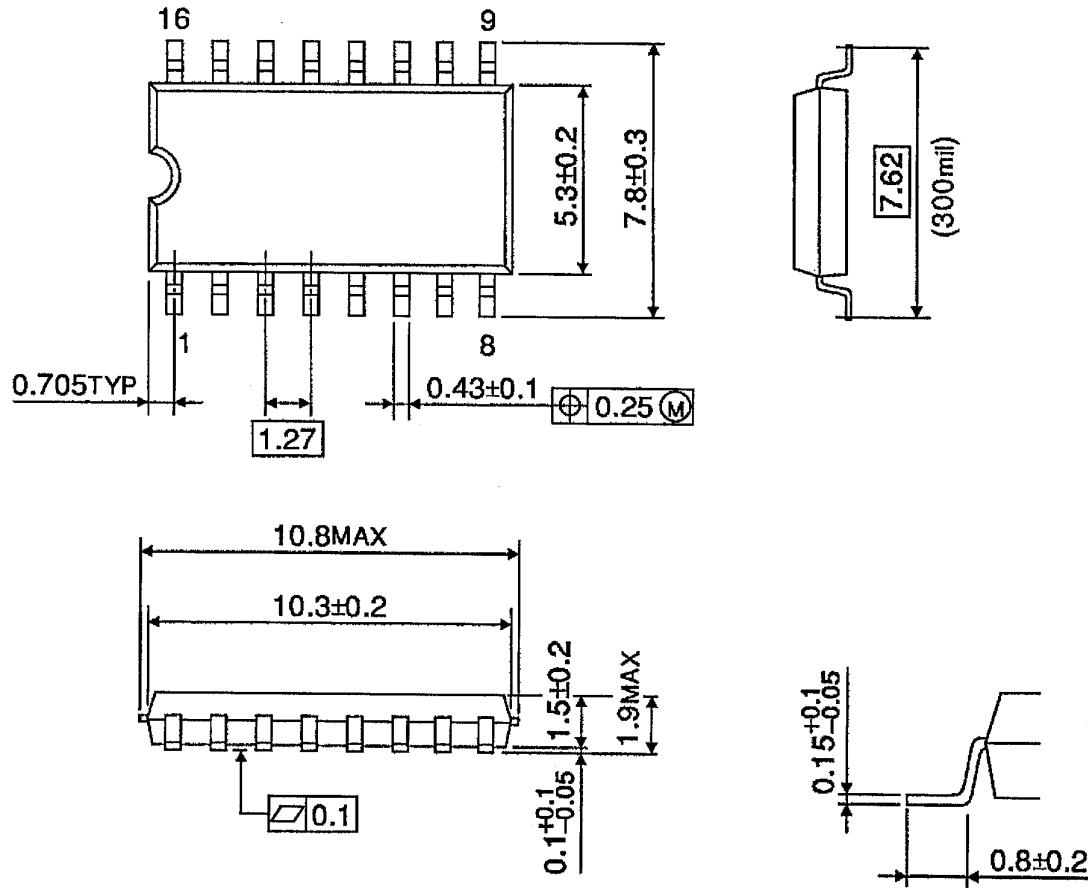


Weight : 1.00 g (Typ.)

PACKAGE DIMENSIONS

SOP16-P-300-1.27

Unit : mm



Weight : 0.18 g (Typ.)