

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8184P, TA8184F

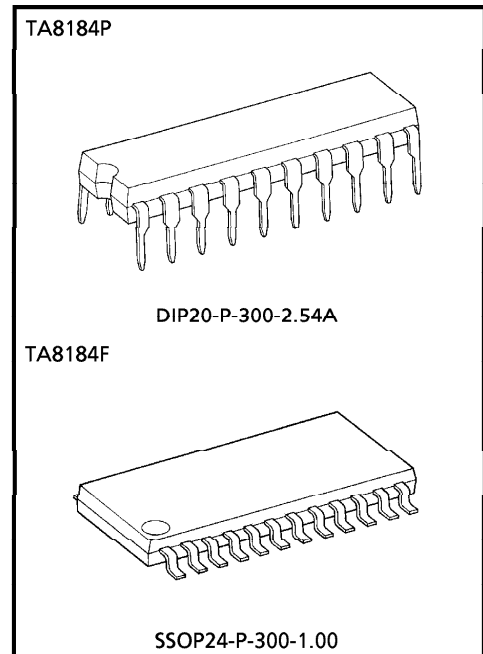
DUAL CHANNEL VOLTAGE / TONE CONTROL IC

The TA8184P, TA8184F is DC controlled dual volume, balance, tone (Bass and treble) IC.

It is suitable for car stereo, radio cassette, music center, TV multiplex sound receiver and remote controlled applications.

FEATURES

- Dual Channel
- Wide Volume Control Range
 - : Maximum Attenuation ATT = 100dB (Typ.)
 - (Vol. → MIN., $V_{IN} = 1V_{rms}$, BW = 400Hz~30kHz)
- Wide Tone Control Range
 - : Bass $V_B = +12.5 \sim -12.5$ dB (Typ.), (f = 100Hz)
 - : Treble $V_T = +12.5 \sim -12.5$ dB (Typ.), (f = 10kHz)
- Built In Loudness Control
- Operating Supply Voltage Range
 - : $V_{CC} (opr) = 7.5 \sim 15$ V (TA8184P) ($T_a = 25^\circ\text{C}$)
 - : $V_{CC} (opr) = 7.5 \sim 12.5$ V (TA8184F) ($T_a = 25^\circ\text{C}$)



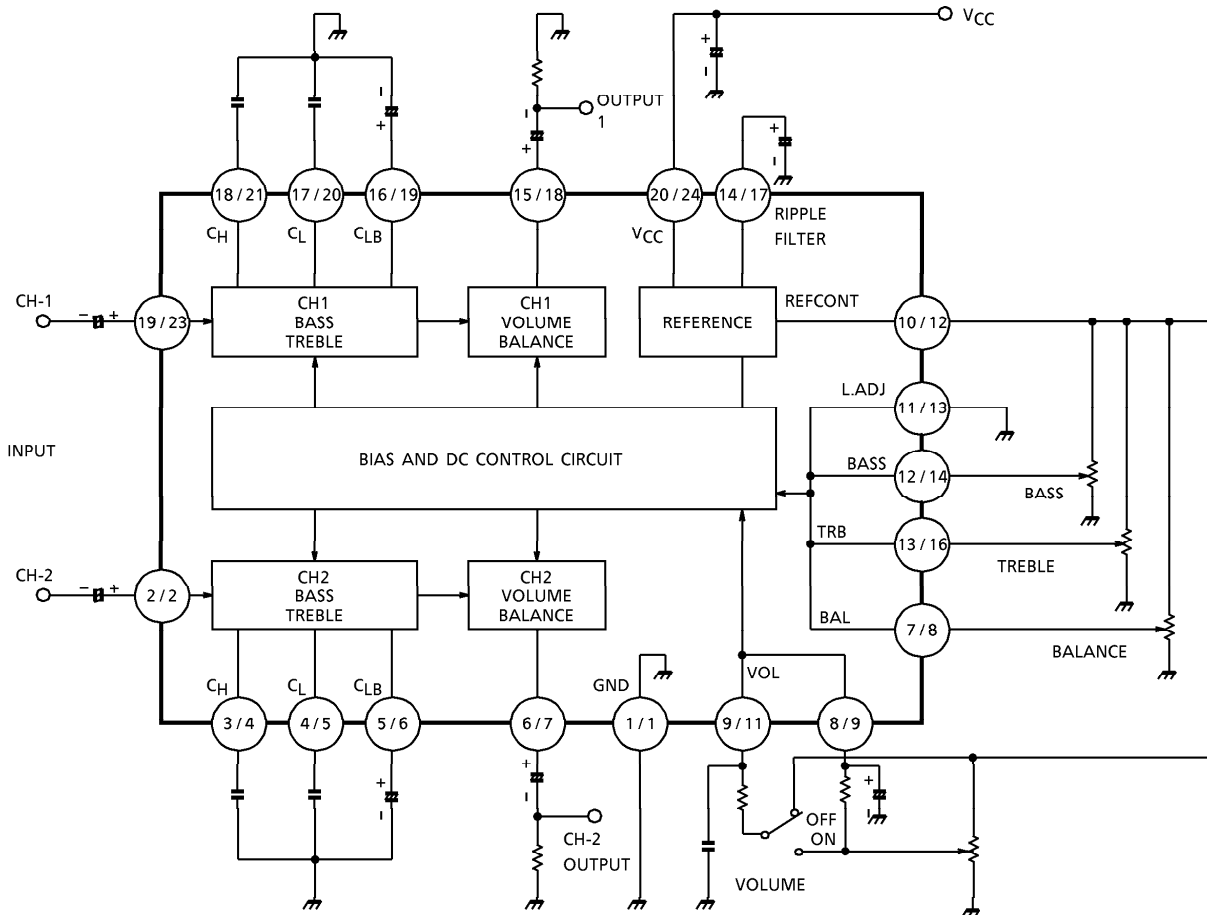
Weight

| | |
|-------------------|----------------|
| DIP20-P-300-2.54A | : 1.4g (Typ.) |
| SSOP24-P-300-1.00 | : 0.31g (Typ.) |

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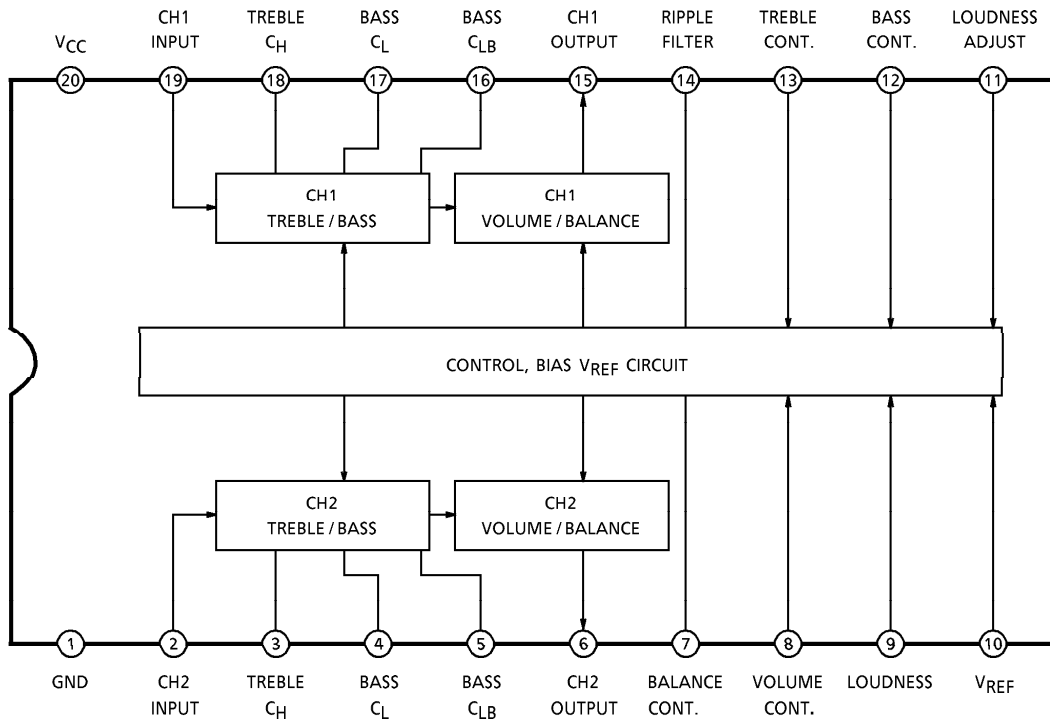
BLOCK DIAGRAM



PIN CONNECTION : 

TA8184F : pin ③, ⑩, ⑮, ⑳ : N.C

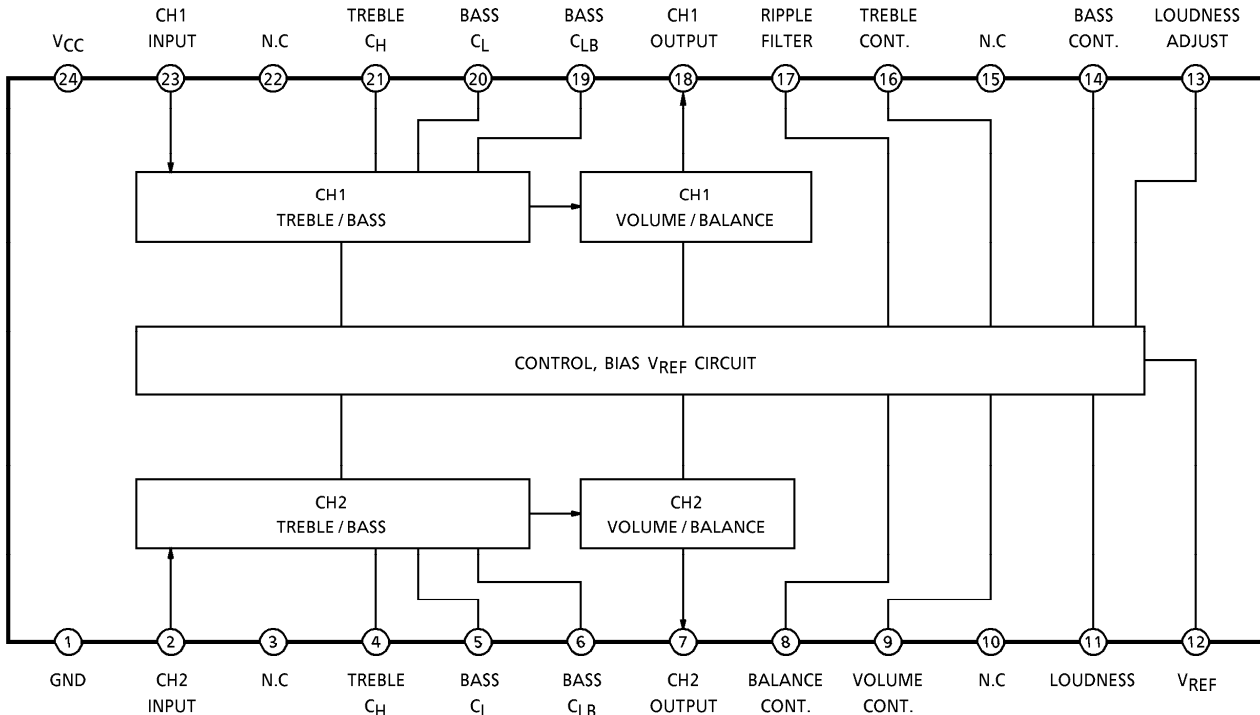
PIN CONNECTION (TA8184P)



PIN FUNCTION

| PIN No. | SYMBOL | EXPLANATION | PIN No. | SYMBOL | EXPLANATION |
|---------|---------------------|-----------------------------------|---------|---------------------|-----------------------------------|
| 1 | GND | GND | 11 | L.ADJ. | LOUDNESS ADJUST |
| 2 | IN2 | CH2, INPUT | 12 | BASS | BASS CONTROL |
| 3 | C _H (2) | CH2, TREBLE CONTROL TIME CONSTANT | 13 | TRBL | TREBLE CONTROL |
| 4 | C _L (2) | CH2, BASS CONTROL TIME CONSTANT | 14 | RIP | RIPPLE FILTER |
| 5 | C _{LB} (2) | CH2, BASS CONTROL TIME CONSTANT | 15 | OUT1 | CH1, OUTPUT |
| 6 | OUT2 | CH2, OUTPUT | 16 | C _{LB} (1) | CH1, BASS CONTROL TIME CONSTANT |
| 7 | BAL | BALANCE CONTROL | 17 | C _L (1) | CH1, BASS CONTROL TIME CONSTANT |
| 8 | VOL | VOLUME CONTROL | 18 | C _H (1) | CH1, TREBLE CONTROL TIME CONSTANT |
| 9 | LOUD | LOUDNESS SWITCH | 19 | IN1 | CH1, INPUT |
| 10 | REF | REFERENCE | 20 | V _{CC} | V _{CC} |

PIN CONNECTION (TA8184F)



PIN FUNCTION

| PIN No. | SYMBOL | EXPLANATION | PIN No. | SYMBOL | EXPLANATION |
|---------|---------|-----------------------------------|---------|---------|-----------------------------------|
| 1 | GND | GND | 13 | L.ADJ. | LOUDNESS ADJUST |
| 2 | IN2 | CH2, INPUT | 14 | BASS | BASS CONTROL |
| 3 | N.C | | 15 | N.C | |
| 4 | CH (2) | CH2, TREBLE CONTROL TIME CONSTANT | 16 | TRBL | TREBLE CONTROL |
| 5 | CL (2) | CH2, BASS CONTROL TIME CONSTANT | 17 | RIP | RIPPLE FILTER |
| 6 | CLB (2) | CH2, BASS CONTROL TIME CONSTANT | 18 | OUT1 | CH1, OUTPUT |
| 7 | OUT2 | CH2, OUTPUT | 19 | CLB (1) | CH1, BASS CONTROL TIME CONSTANT |
| 8 | BAL | BALANCE CONTROL | 20 | CL (1) | CH1, BASS CONTROL TIME CONSTANT |
| 9 | VOL | VOLUME CONTROL | 21 | CH (1) | CH1, TREBLE CONTROL TIME CONSTANT |
| 10 | N.C | | 22 | N.C | |
| 11 | LOUD | LOUDNESS SWITCH | 23 | IN1 | CH1, INPUT |
| 12 | REF | REFERENCE | 24 | VCC | VCC |

OPERATING PRECAUTIONS AND APPLICATION METHODS (Pin No. : (P/F))

(1) How to Determine Tone Controlled Frequency Characteristic Time Constants

Bass characteristics determining elements : C_L , C_{LB} terminals (4/5), (5/6), (16/19), (17/20)

Fig.1 Low-bandwidth cut-off frequencies f_{L1} , f_{L2} , f_{L3} of bass characteristics are determined by the following equations :

$$f_{L1} = \frac{1}{2\pi \cdot C_{LB} \cdot 10k\Omega} \dots\dots (1)$$

(10k Ω is determined in IC interior)

$$f_{L2} = \frac{1}{2\pi \cdot C_{LB} \cdot 1k\Omega} \dots\dots (2)$$

(1k Ω is determined in IC interior)

$$f_{L3} = \frac{1}{2\pi \cdot C_L \cdot 10k\Omega} \dots\dots (3)$$

(10k Ω is determined in IC interior)

Under reference circuits of $C_L = 0.33\mu F$ and $C_{LB} = 10\mu F$, setting is made as follows :

$$f_{L1} \doteq 1.59\text{Hz}, f_{L2} \doteq 15.9\text{Hz}, f_{L3} \doteq 48.2\text{Hz}$$

When the characteristics during boosting are considered, crossing with 0dB axis is made at f_{L1} , increase starts by 20dB/dec., and flat characteristics of Gain = 20dB is obtained at f_{L2} .

Low-bandwidth f response is determined at f_{L3} -namely, C_L and gain starts decreasing from f_{L3} by -20dB/dec.

As explained above, low-bandwidth characteristics can be varied by varying C_L and C_{LB} .

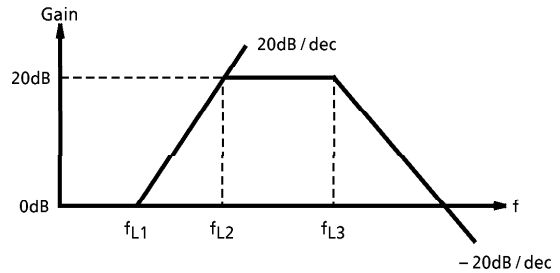


Fig.1 Bass characteristics (during boosting)

Treble characteristics determining element : C_H (3/4), (18/21)

Fig.2 High-bandwidth cut-off frequencies f_{H1} and f_{H2} of treble characteristics can be determined by the following equations :

$$f_{H1} = \frac{1}{2\pi \cdot C_H \cdot 10k\Omega} \dots\dots (4)$$

(10k Ω is determined in IC interior)

$$f_{H2} = \frac{1}{2\pi \cdot C_H \cdot 1k\Omega} \dots\dots (5)$$

(1k Ω is determined in IC interior.)

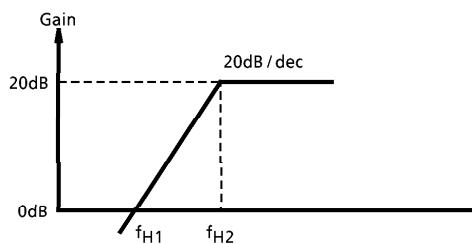


Fig.2 Treble characteristics (during boosting)

Under reference circuit of $C_H = 0.0082\mu F$ setting is made as follows :

$$f_{H1} \doteq 1.94\text{kHz}, f_{H2} = 19.4\text{kHz}$$

As explained above, high-bandwidth characteristics can be varied by varying C_H .

By creating the status of $C_L \rightarrow$ decrease and $C_H \rightarrow$ increase, low/high bandwidth gains ($f = 100\text{Hz}$, 10kHz) increase but gain near $f = 1\text{kHz}$ is also increased.

On the other hand, when the status of $C_L \rightarrow$ increase and $C_H \rightarrow$ decrease is created, take note that gain near $f = 1\text{kHz}$ approaches 0dB while low/high-bandwidth gains are decreased.

(2) Loudness control

By connecting pin⑨ / ⑪ (loudness terminal) to pin (8/9) (volume terminal), "Loudness" status can be created.

Loudness boost amount is determined by pin (9/11) DC voltage (refer to the subsequently described G_V-V (9/11) data).

Loudness is controlled by considering that sound levels will become uniform for all frequency levels through increasing low / high-bandwidth gains when volume is reduced—namely, sound volume is low.

When loudness control is not used, connect pin (9/11) to pin (10/12) (reference terminal).

The capacitor (Typ. $0.047\mu\text{F}$) between pin (9/11) and GND is for reducing pop sound during loudness→ON while the capacitor (Typ. $1\mu\text{F}$) between pin (8/9) and GND is used for the same purpose during loudness→OFF.

(3) Loudness adjustment

When loudness is set, the boost amount can be varied by adjusting voltage at pin⑪ / ⑬. Under V (11/13) = 0V, maximum boost amount is obtained and under V (11/13) = V_{REF} (connected to pin⑩ / ⑫), minimum boost amount is obtained (refer to the subsequently described G_V-V (11/13) data).

(4) Relations between tone control and loudness

Because of the circuit configuration on this IC, the sum of boost amount by bass/treble control and boost amount by loudness setting is restricted to become below a constant value. Therefore, the greater the boost amount in-creases, the lower the boost amount by bass/treble control is reduced because loudness is extensively applied. As opposed to this phenomenon, on the other hand, the cut amount increases. (Refer to the subsequent descriptions on tone control frequency response during loudness.)

MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|-----------------------|---------|----------------------------|--------------|------------------|
| Power Supply Voltage | TA8184P | V_{CC} | 15 | V |
| | TA8184F | | 12.5 | |
| Power Dissipation | TA8184P | P_{D} (Note 1) | 1200 | mW |
| | TA8184F | | 750 (Note 2) | |
| Operating Temperature | | T_{opr} | - 30~85 | $^\circ\text{C}$ |
| Storage Temperature | | T_{stg} | - 55~150 | $^\circ\text{C}$ |

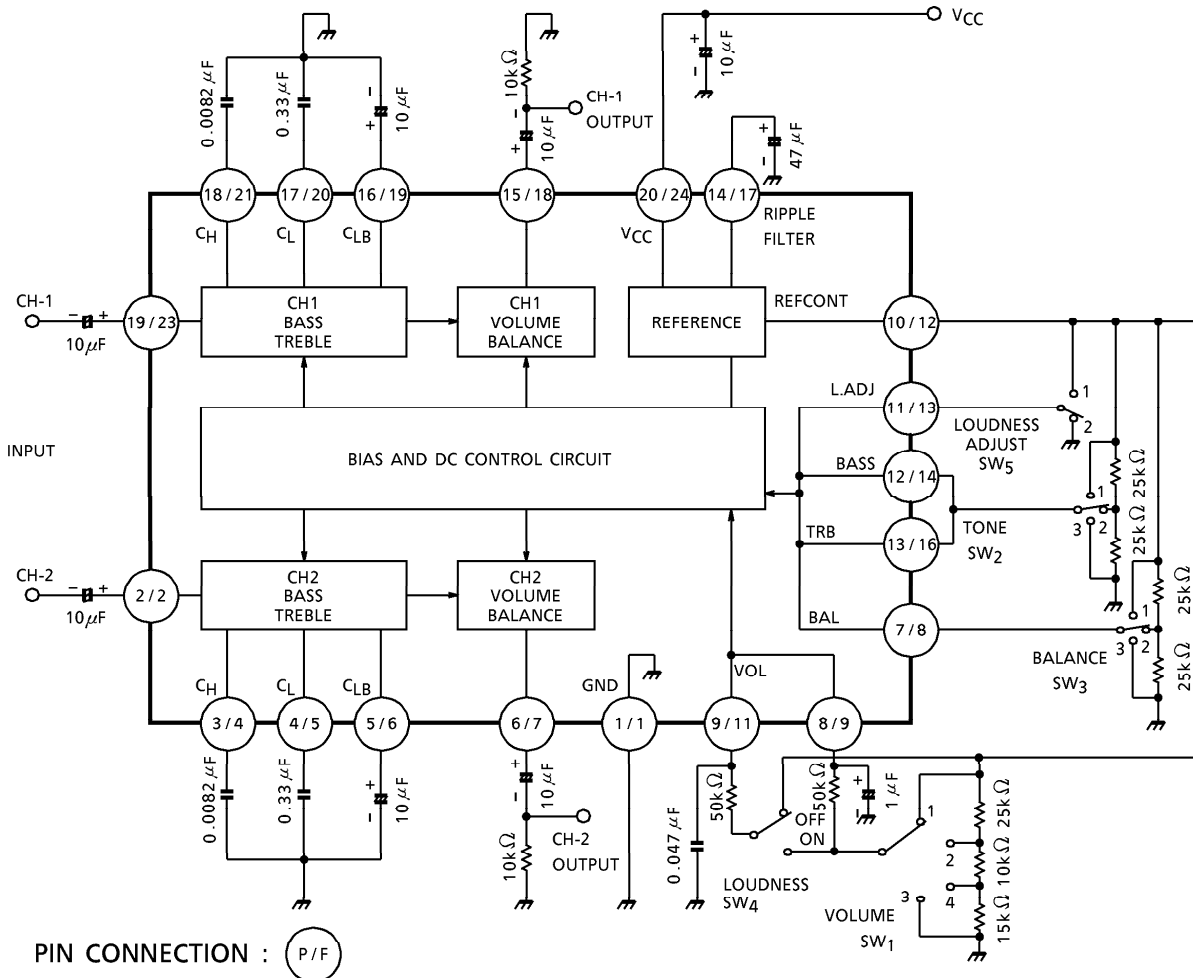
(Note 1) Derated above $T_a = 25^\circ\text{C}$ in the proportion of $9.6\text{mW}/^\circ\text{C}$ for TA8184P, and of $6.0\text{mW}/^\circ\text{C}$ for TA8184F.

(Note 2) Value for mounting on PC board (60mm × 85mm × 1.2mm, Glass epoxy.)

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{CC} = 8V$, $f = 1kHz$, $T_a = 25^\circ C$)

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---------------------------|-----------|---------------|--|--|-------|-------|------|---------------|
| Quiescent Current | I_{CCQ} | — | $V_{IN} = 0$ | | — | 19 | 27 | mA |
| Voltage Reference | V_{ref} | — | — | | 4.7 | 5.1 | 5.5 | V |
| Maximum Output Voltage | V_{OM} | — | TONE / BAL = CENTER VOL = MAX., THD = 1% | | 1.2 | 1.6 | — | V_{rms} |
| Voltage Gain | G_V | — | TONE / BAL = CENTER VOL = MAX., $V_{IN} = 0.1V_{rms}$ | | -2.0 | 0 | 2.0 | dB |
| Maximum Attenuation | ATT | — | TONE / BAL = CENTER BW = 400Hz~30kHz VOL = MIN., $V_{IN} = 1V_{rms}$ | | 85 | 100 | — | dB |
| Bass Control Range | V_B MAX | — | TONE = MAX. | VOL = MAX. BAL = CENTER | 9.5 | 12.5 | 15.5 | dB |
| | V_B MIN | — | TONE = MIN. | $f_{IN} = 1kHz \rightarrow 100Hz$ $V_{IN} = 0.1V_{rms}$ | -15.5 | -12.5 | -9.5 | |
| Treble Control Range | V_T MAX | — | TONE = MAX. | VOL = MAX. BAL = CENTER | 9.0 | 12.5 | 16.0 | dB |
| | V_T MIN | — | TONE = MIN. | $f_{IN} = 1kHz \rightarrow 10kHz$ $V_{IN} = 0.1V_{rms}$ | -16.0 | -12.5 | -9.0 | |
| Total Harmonic Distortion | THD | — | TONE / BAL = CENTER, $f = 1kHz$, VOL = MAX., $V_{IN} = 1V_{rms}$ | | — | 0.05 | 0.2 | % |
| Output Noise Voltage | V_{NO} | — | TONE / BAL = CENTER BW = 20Hz~20kHz VOL = MIN., input open | | — | 4 | 10 | μV_{rms} |
| Loudness Control | V_{LB} | — | $f = 100Hz$ | TONE / BAL = CENTER LOUDNESS = ON $V_{IN} = 1V_{rms}$ VOL = SW ₁ (4) | 8 | 11 | 14 | dB |
| | V_{LT} | — | $f = 10kHz$ | LOUDNESS TEST = SW ₅ (2) | 8 | 11 | 14 | |

TEST CIRCUIT

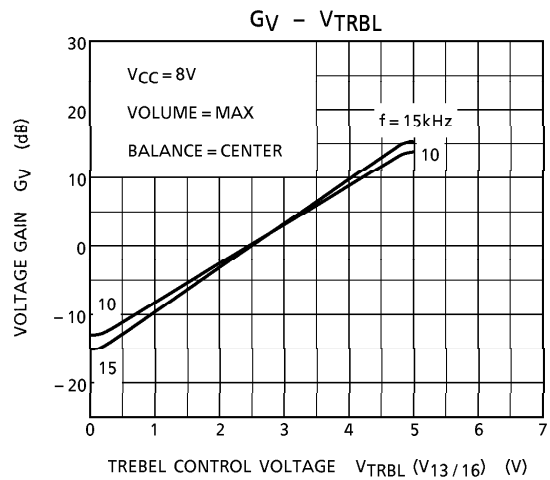
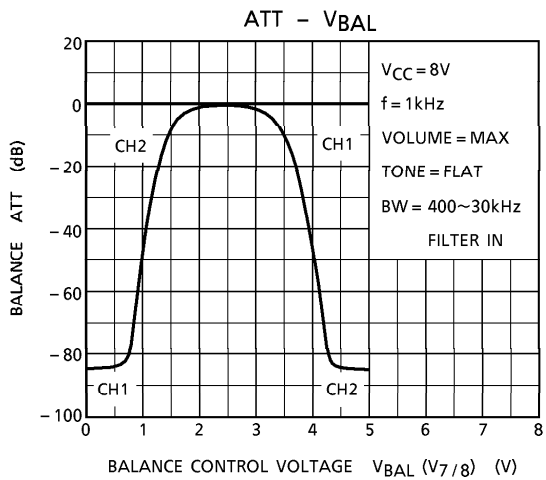
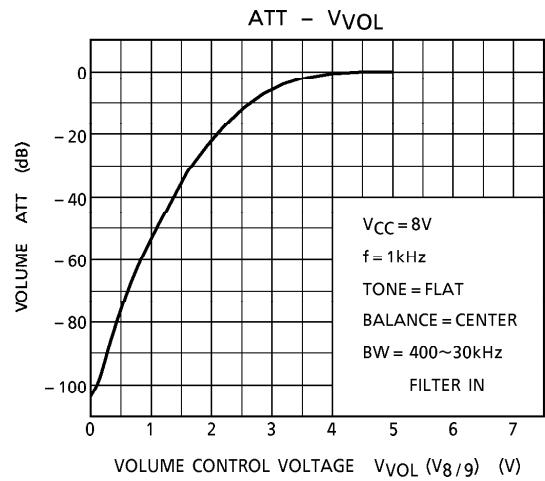
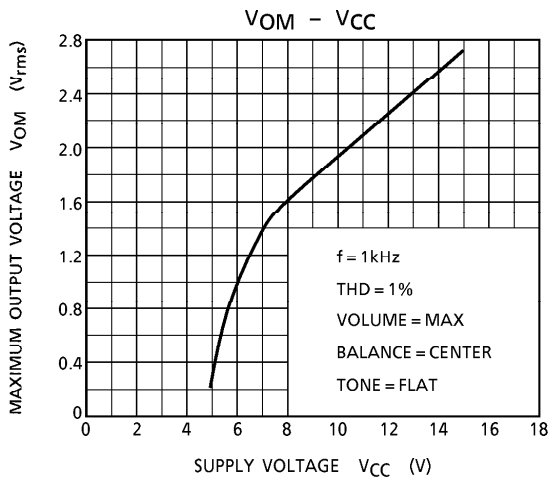
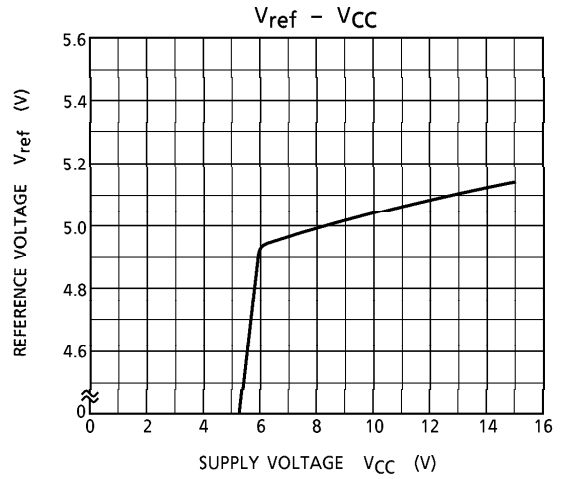
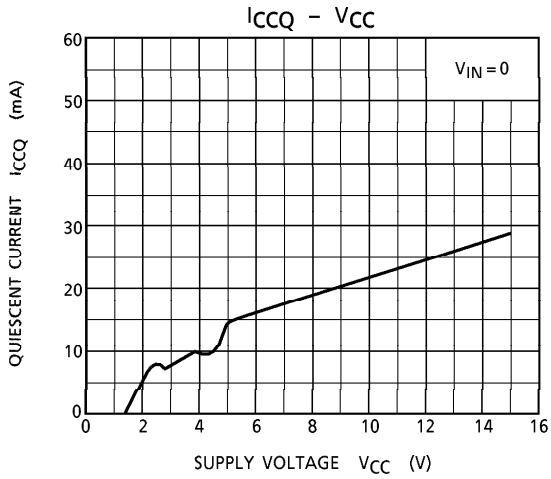


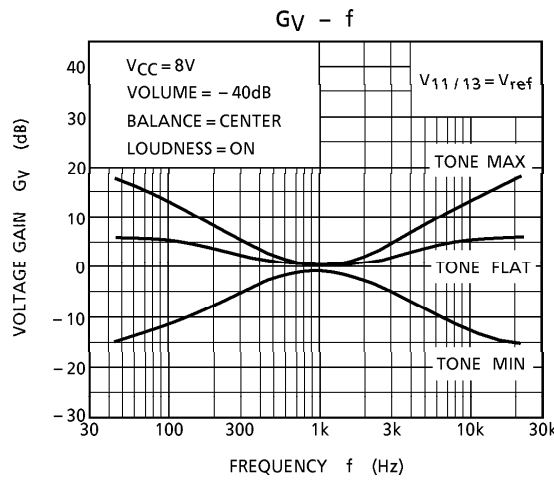
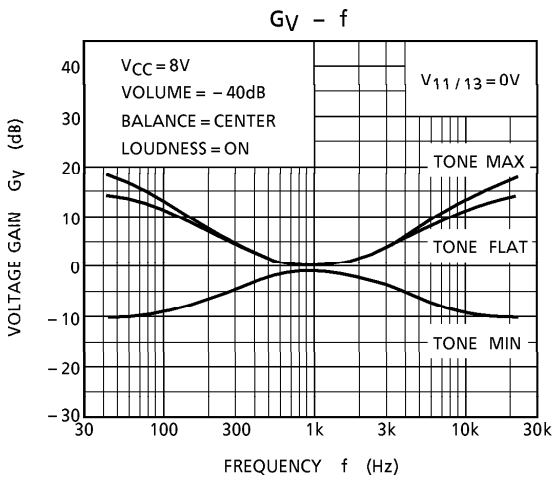
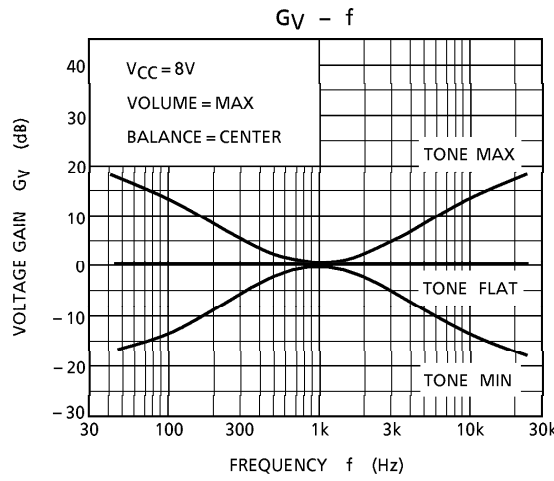
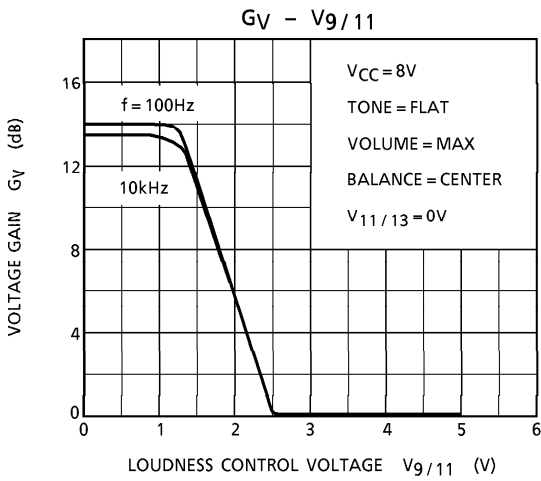
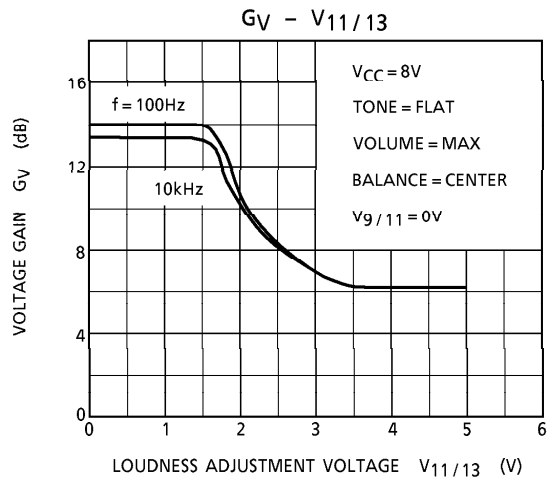
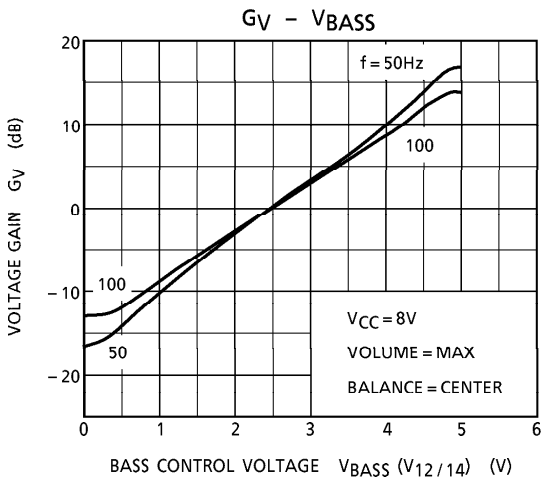
PIN CONNECTION : $\text{\textcircled{P/F}}$

TA8184F : pin ③, ⑩, ⑮, ⑳ : N.C

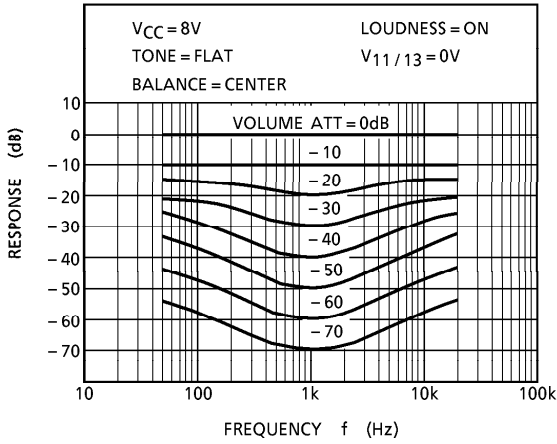
SWITCH EXPLANATION

| SWITCH NAME | POSITION | | | | | ON | OFF |
|-----------------------------------|----------|--------|---------|---------------|-------------|--------------|-----|
| | 1 | 2 | 3 | 4 | | | |
| SW ₁ : VOLUME | MAX. | CENTER | MIN. | LOUDNESS TEST | — | — | |
| SW ₂ : TONE | MAX. | CENTER | MIN. | — | — | — | |
| SW ₃ : BALANCE | CH2 CUT | CENTER | CH1 CUT | — | — | — | |
| SW ₄ : LOUDNESS | — | — | — | — | LOUDNESS ON | LOUDNESS OFF | |
| SW ₅ : LOUDNESS ADJUST | MIN. | MAX. | — | — | — | — | |

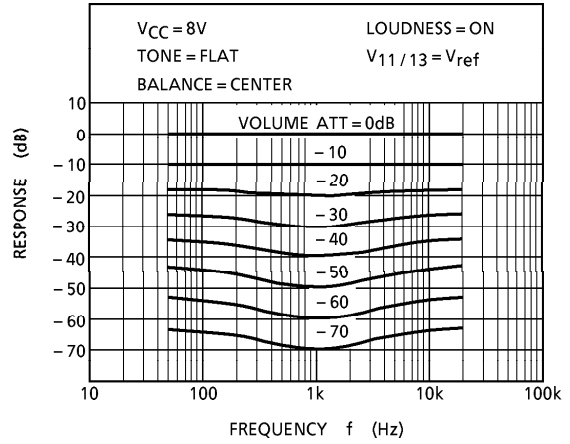




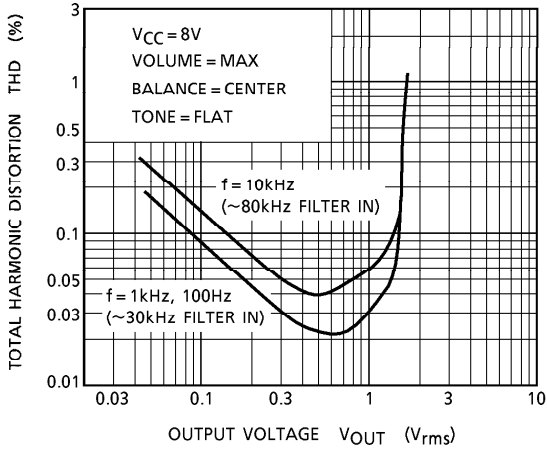
LOUDNESS (1)



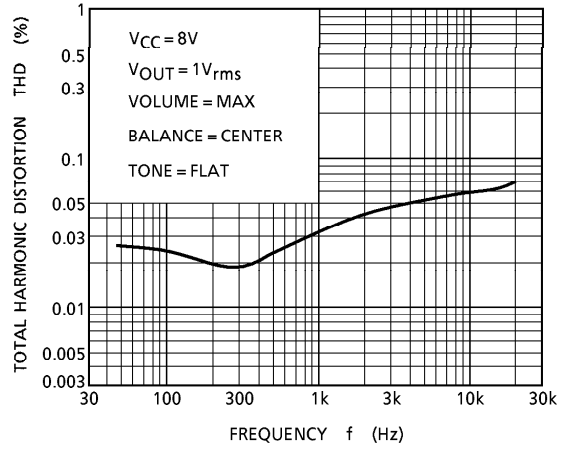
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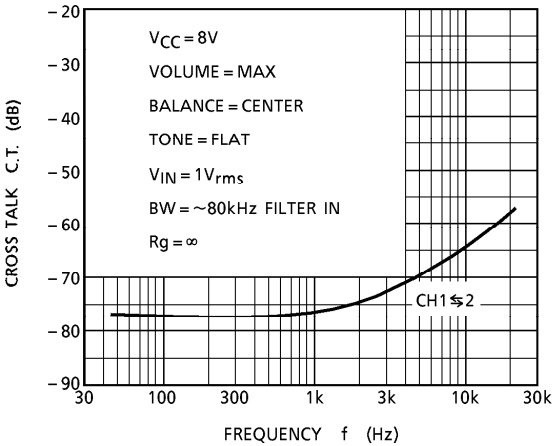
THD - V_{OUT}



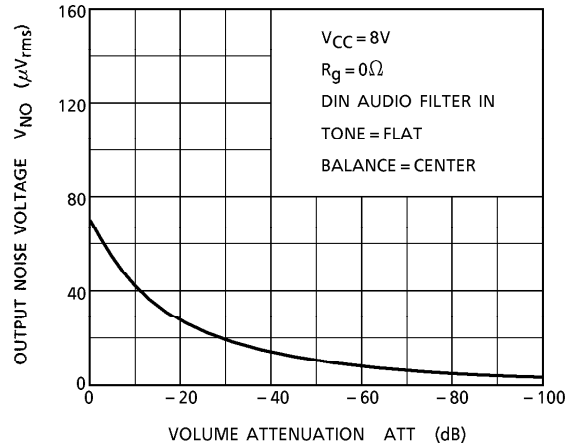
THD - f

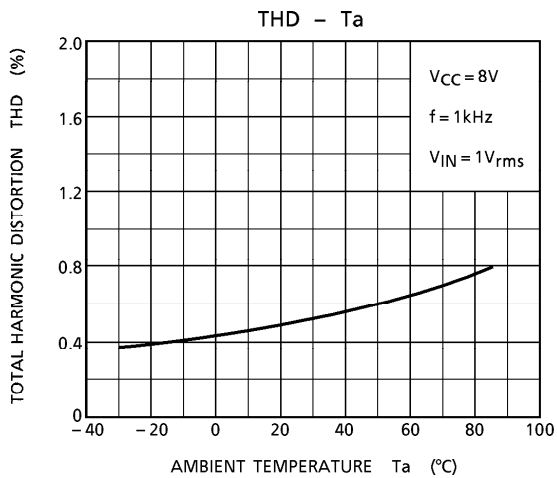
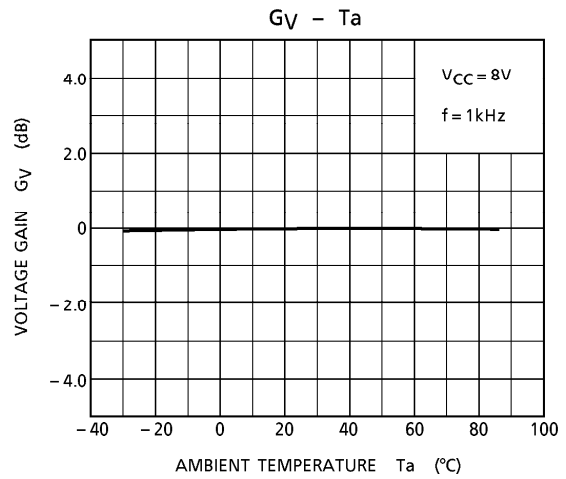
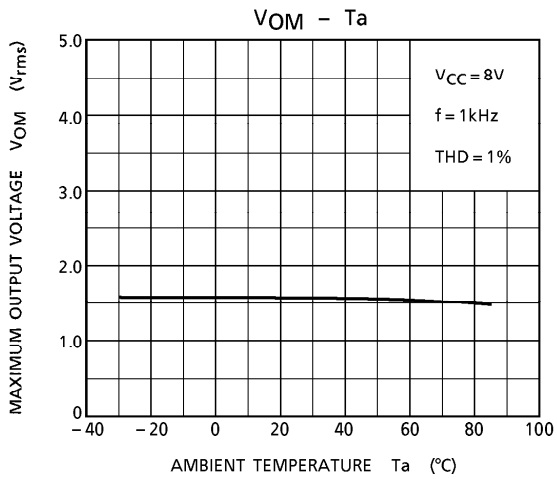
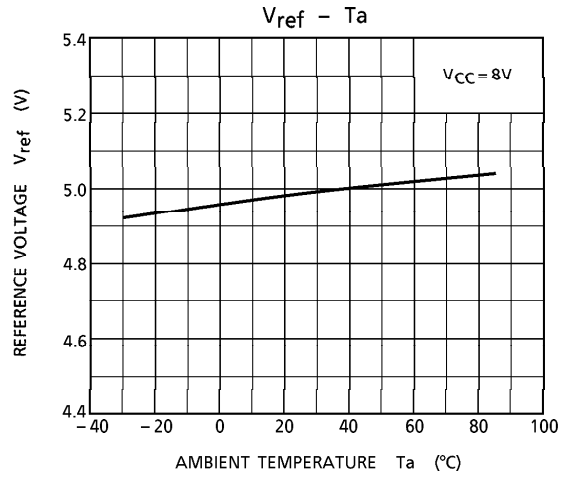
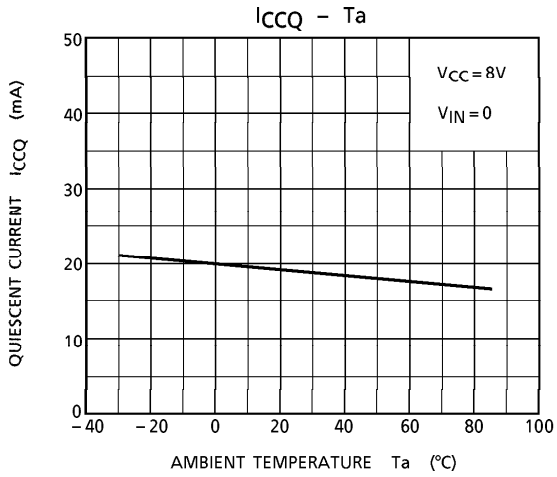


C.T. - f

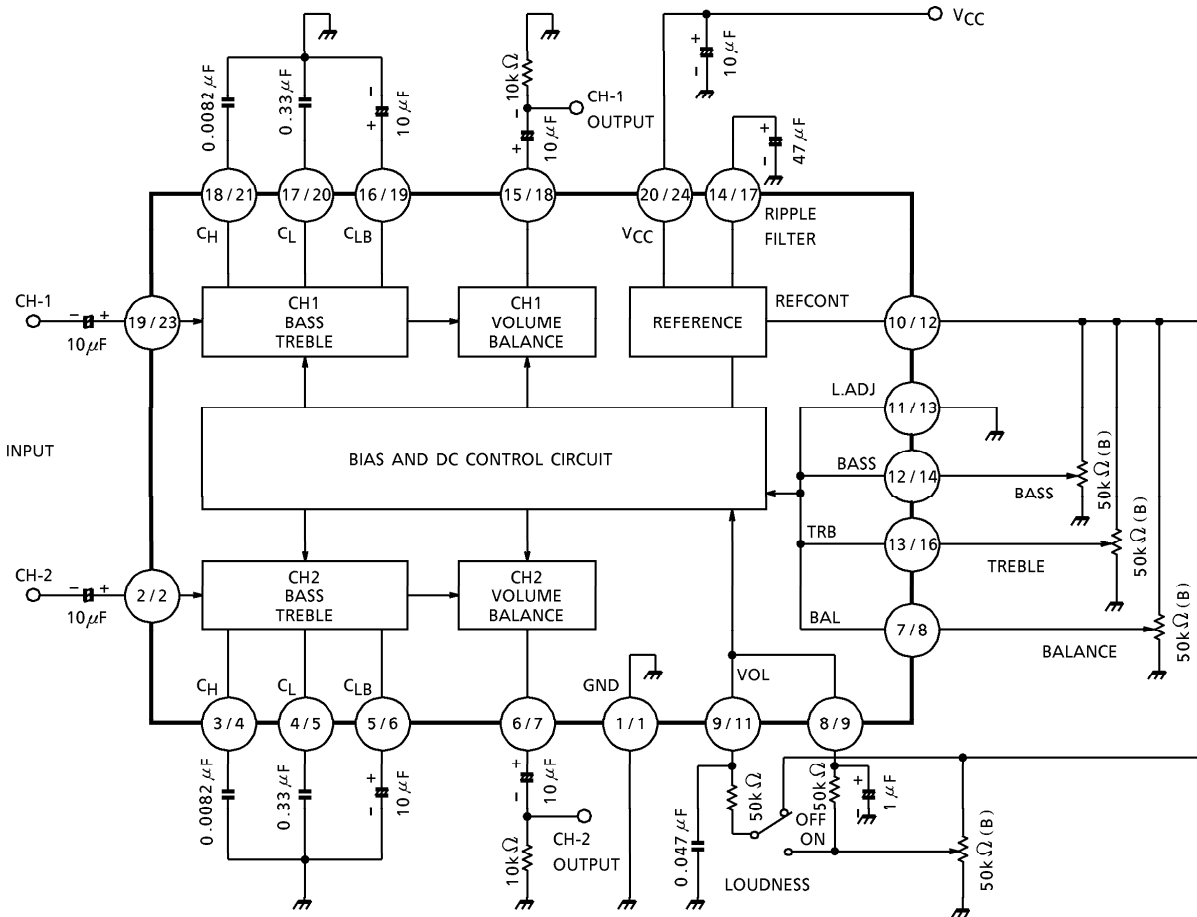


V_{NO} - ATT





APPLICATION

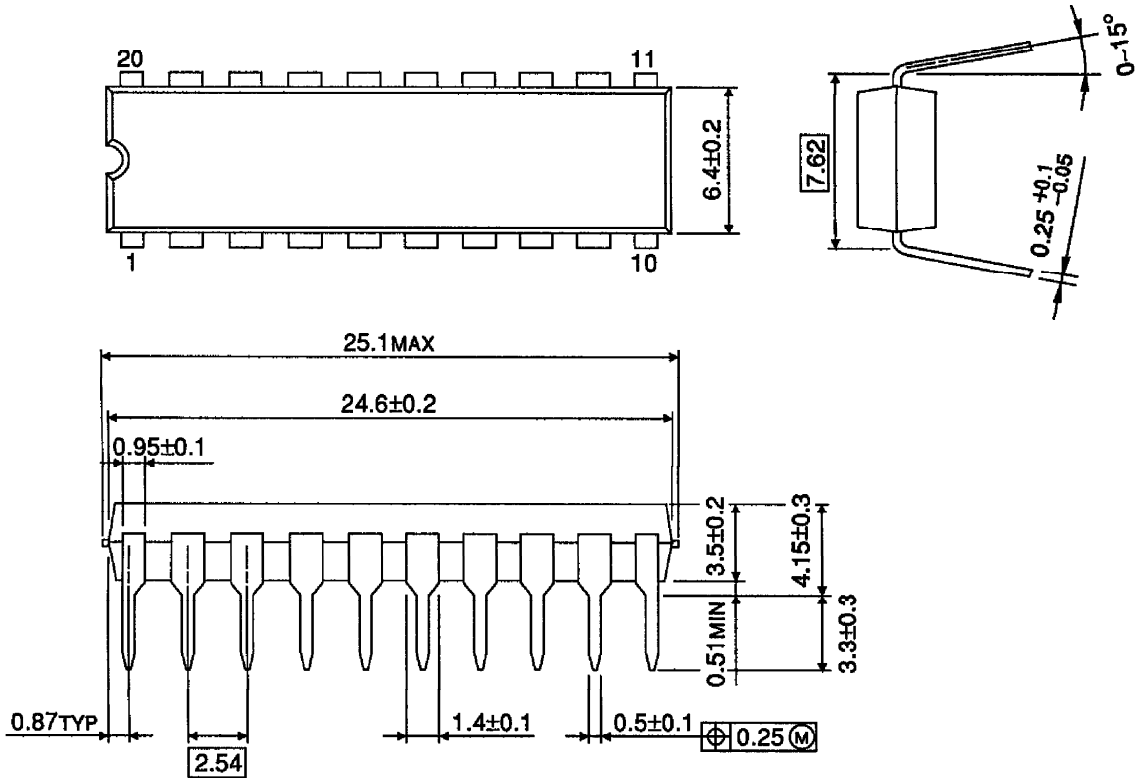


PIN CONNECTION : 

TA8184F : pin ③, ⑩, ⑮, ⑳ : N.C

OUTLINE DRAWING
DIP20-P-300-2.54A

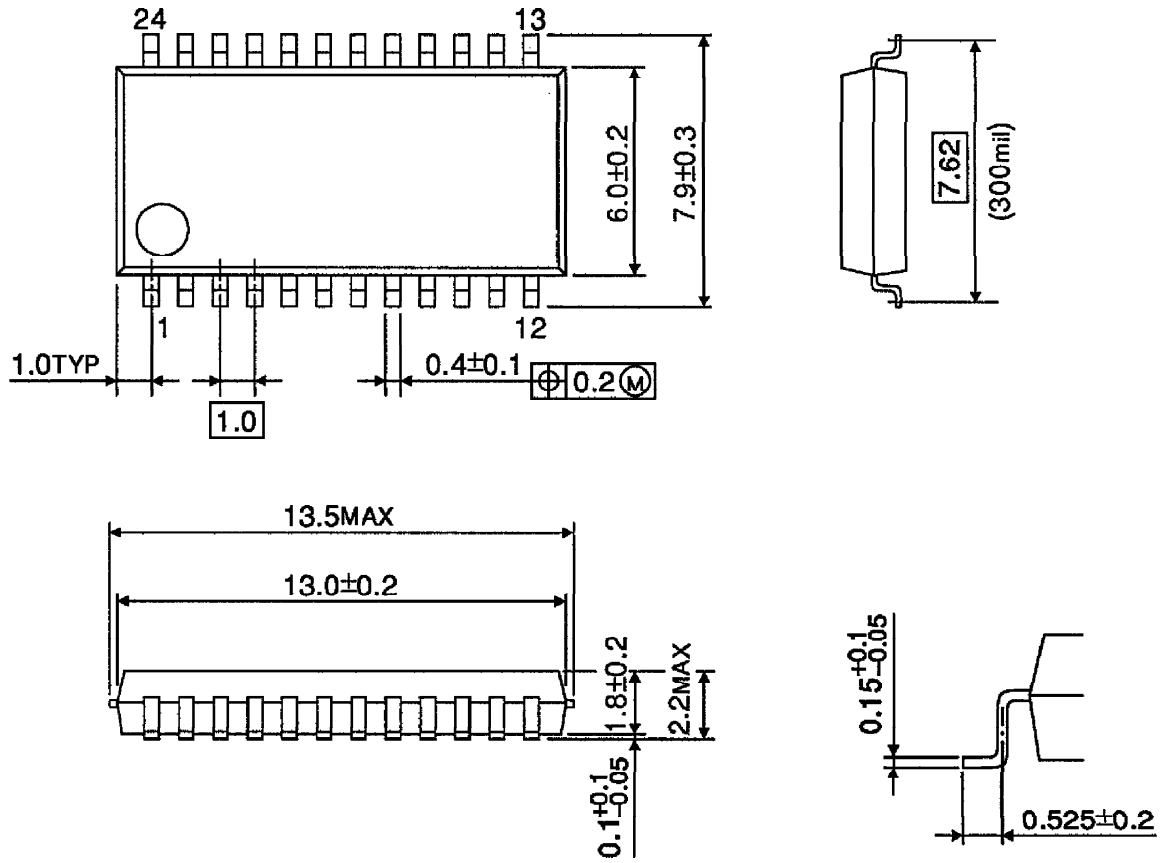
Unit : mm



Weight : 1.4g (Typ.)

OUTLINE DRAWING
SSOP24-P-300-1.00

Unit : mm



Weight : 0.31g (Typ.)