



Overview

The LA7953 Audio Controller is a single-chip, linear IC featuring a built-in expansion circuit. The device also features a 4-input 1-output audio switch, an acoustic mute, a LINE-OUT output, and audio control functions for volume, balance, bass and treble on-chip.

Excellent audio reproduction can be obtained using the right channel expansion circuit.

The LA7953 operates on a single 12V power supply and is available in 30-pin plastic DIPs.

Functions

- One-chip audio controller and audio switch facilitate design
- Audio controller for volume, balance, bass and treble
- 4-input/1-output audio switch
- On-chip expansion circuit ensures excellent sound reproduction
- LINE-OUT output
- Acoustic mute

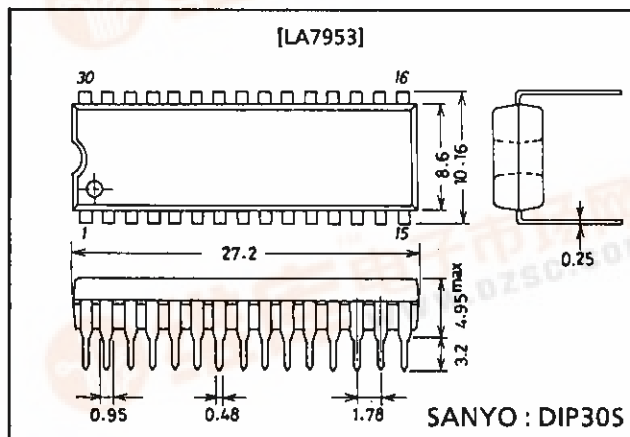
Specifications

Maximum Ratings at $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|------------------------------------|--|-----------------------------|-------------|------------------|
| Maximum supply voltage | $V_{CC \text{ max}}$ | | 14 | V |
| Input applied voltage 1 | $V_{1,3,5,7,9,11,13,15 \text{ max}}$ | $V_{CC} = 14\text{V}$ | 12 | V |
| Input applied voltage 2 | $V_{2,14,16,30 \text{ max}}$ | $V_{CC} = 14\text{V}$ | 14 | V |
| Input applied voltage 3 | $V_4 \text{ max}, V_6 \text{ max}$ | $V_{CC} = 14\text{V}$ | 14 | V |
| Mute input applied voltage | $V_8 \text{ max}$ | $V_{CC} = 14\text{V}$ | 14 | V |
| Expansion input applied voltage | $V_{12 \text{ max}}$ | $V_{CC} = 14\text{V}$ | 14 | V |
| LINE-OUT output current | $I_{17,29 \text{ max}}$ | | 5 | mA |
| Maximum output current | $I_{23,25 \text{ max}}$ | | 5 | mA |
| Expansion output current | $I_{19 \text{ max}}$ | | 5 | mA |
| Tone control input applied voltage | $V_{20 \text{ max}}, V_{28 \text{ max}}$ | $V_{CC} = 14\text{V}$ | 14 | V |
| Bass filter applied voltage | $V_{22 \text{ max}}, V_{26 \text{ max}}$ | $V_{CC} = 14\text{V}$ | 14 | V |
| Treble filter applied voltage | $V_{21 \text{ max}}, V_{27 \text{ max}}$ | $V_{CC} = 14\text{V}$ | 14 | V |
| Expansion filter applied voltage | $V_{18 \text{ max}}$ | $V_{CC} = 14\text{V}$ | 12 | V |
| Allowable power dissipation | $P_d \text{ max}$ | $T_a \leq 65^\circ\text{C}$ | 1100 | mW |
| Operating temperature | T_{opr} | | -20 to +65 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | | -55 to +150 | $^\circ\text{C}$ |

Package Dimensions

unit : mm
3061-DIP30S



SANYO : DIP30S

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Operating Conditions at $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|----------------------------|-------------------|------------|--------------|------|
| Recommended supply voltage | V_{CC} | | 12 | V |
| Operating voltage range | $V_{CC\text{OP}}$ | | 10.5 to 13.2 | V |

Operating Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$

| Parameter | Symbol | Conditions | Test Circuit | min | typ | max | Unit |
|--|-----------------------------------|--|--------------|------|------|------|------------------|
| [Audio SW] | | | | | | | |
| Input bias voltage | $V_{1,3,5,7}$ $V_{9,11,13,15}$ | | 1 | 4.4 | 5.3 | 6.2 | V |
| LINE-OUT output bias voltage | $V_{17,29}$ | S4,S5 = H | 1 | 2.1 | 3.0 | 3.9 | V |
| LINE-OUT output DC offset voltage | V_{OS} | Differential voltage when LINE-OUT output is switched. | 1 | -100 | 0 | +100 | mV |
| Control threshold voltage | V_{4H}, V_{6H} | | 2 | 3.0 | | | V |
| Control threshold voltage | V_{4L}, V_{6L} | | 2 | | | 1.5 | V |
| LINE-OUT voltage gain | G_{LV} | $V_{IN} = 500\text{mVrms}$, $f = 1\text{kHz}$ | 2 | -1 | 0 | +1 | dB |
| LINE-OUT distortion ratio | THD_L | $V_{IN} = 500\text{mVrms}$, $f = 100\text{Hz}, 1\text{kHz}$, L.P.F. = 80kHz | 2 | | 0.05 | 0.2 | % |
| LINE-OUT noise | V_{NL} | $R_g = 600\Omega$, 15kHz band | 2 | | 10 | 30 | μVrms |
| Mute input threshold voltage | V_{8TH} | | 2 | 3.0 | | | V |
| Mute input threshold voltage | V_{8TL} | | | | | 1.5 | V |
| Input impedance | $Z_{1,3,5,7,9,11,13,15}$ | | 1 | 47 | 68 | 89 | k Ω |
| LINE-OUT output impedance | $Z_{17,29}$ | | 1 | | 50 | 150 | Ω |
| [Audio Control] | | | | | | | |
| Quiescent current drain (Including audio switch) | I_{CC} | | 1 | 35 | 45 | 65 | mA |
| Output bias voltage | V_{23}, V_{25} | $V_{30} = 12\text{V}, V_2 = V_{14} = V_{16} = 6\text{V}$ | 1 | 4 | 5.5 | 7 | V |
| Left&Right channel output DC offset | $V_{23\text{ to }25}$ | $V_{30} = 12\text{V}, V_2 = V_{14} = V_{16} = 6\text{V}$ | 1 | -2 | 0.2 | +2 | V |
| Output voltage | V_O | $V_{IN} = 500\text{mVrms}$, $f = 1\text{kHz}$, $V_{30} = 12\text{V}, V_2 = V_{14} = V_{16} = 6\text{V}$ | 2 | 390 | 450 | 630 | mVrms |
| Channel balance | G_{Ba} | $V_{IN} = 500\text{mVrms}$, $f = 1\text{kHz}$, $V_{30} = 12\text{V}, V_2 = V_{14} = V_{16} = 6\text{V}$ | 2 | -1 | 0.4 | +1 | dB |
| Dynamic range | THD_D | $V_{IN} = 0.8\text{mVrms}$, $f = 40\text{Hz}$, 15kHz, L.P.F. = 80kHz, $V_{30} = 12\text{V}, V_2 = V_{14} = V_{16} = 6\text{V}$ | 2 | | 0.25 | 2 | % |
| Left&Right channel attenuation | A_{TT} | $V_{OUT} = 500\text{mVrms}$ (0dB), $f = 1\text{kHz}$, $V_{30} = 0\text{V}, V_2 = V_{14} = V_{16} = 6\text{V}$ | 2 | 65 | 72 | | dB |
| Bass control, boost | GB_{BOOST} | $V_{OUT} = 500\text{mVrms}$ (1k), $f = 40\text{Hz}$, $V_{30} = V_{14} = 12\text{V}, V_2 = V_{16} = 6\text{V}$ | 2 | 7 | 9 | 12 | dB |
| Bass control, cut | GB_{CUT} | $V_{OUT} = 500\text{mVrms}$ (1k), $f = 40\text{Hz}$, $V_{30} = 12\text{V}, V_{14} = 0\text{V}, V_2 = V_{16} = 6\text{V}$ | 2 | -1.3 | -9 | -6.5 | dB |
| Treble control, boost | GB_{BOOST} | $V_{OUT} = 500\text{mVrms}$ (1k), $f = 15\text{kHz}$, $V_{30} = V_{11} = 12\text{V}, V_2 = V_{14} = 6\text{V}$ | 2 | 6.5 | 9 | 13 | dB |
| Treble control, cut | GT_{CUT} | $V_{OUT} = 500\text{mVrms}$ (1k), $f = 15\text{kHz}$, $V_{30} = 12\text{V}, V_{14} = 0\text{V}, V_2 = V_{16} = 6\text{V}$ | 2 | -18 | -9 | -6.5 | dB |

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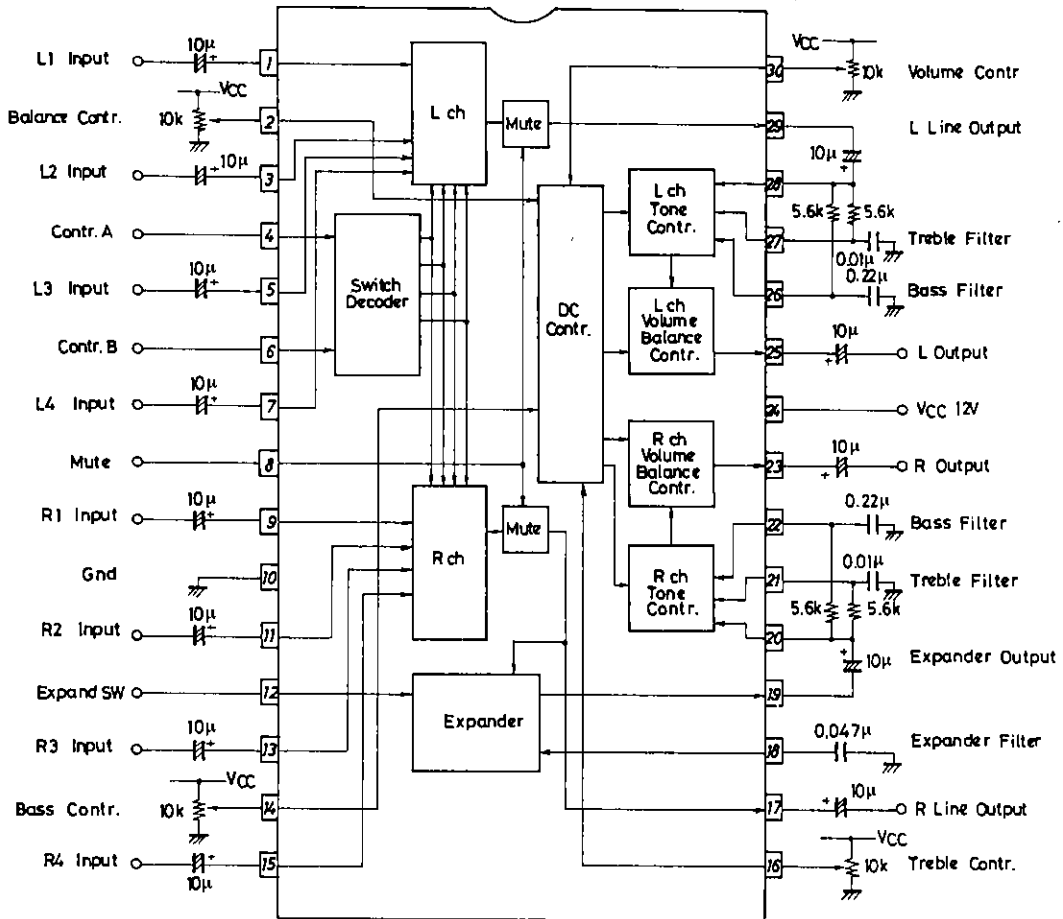
| Parameter | Symbol | Conditions | Test Circuit | min | typ | max | Unit |
|-------------------------------------|-------------------|--|--------------|-----|-----|-----|-------|
| Balance control | ATT _{BR} | V _{OUT} = 500mVrms (0dB), f = 1kHz, V ₃₀ = 12V, V ₂ = 0V, V ₁₄ = V ₁₆ = 6V | 2 | | -55 | -40 | dB |
| Balance control | ATT _{BL} | V _{OUT} = 500mVrms (0dB), f = 1kHz, V ₃₀ = V ₂ = 12V, V ₁₄ = V ₁₆ = 6V | 2 | | -55 | -40 | dB |
| Crosstalk | CT | V _{OUT} = 500mVrms (0dB), f = 1kHz, V ₃₀ = 12V, V ₂ = V ₁₄ = V ₁₆ = 6V | 2 | 65 | 80 | | dB |
| Noise | V _N | 15kHz band, V ₃₀ = 12V, V ₂ = V ₁₄ = V ₁₆ = 6V | 2 | | 80 | 240 | μVrms |
| Total harmonic distortion | THD | V _{IN} = 500mVrms, f = 1kHz, L.P.F. = 80kHz, V ₃₀ = 12V, V ₂ = V ₁₄ = V ₁₆ = 6V | 2 | | 0.2 | 0.5 | % |
| Expansion characteristics | P _{EXP} | V _{IN} = 500mVrms, f = 1kHz, C = 0.047μ, V ₃₀ = 12V, V ₂ = V ₁₄ = V ₁₆ = 6V | 2 | 125 | 145 | 165 | deg |
| Expansion characteristics | G _{EXP} | V _{IN} = 500mVrms, f = 1kHz, C = 0.047μ, V ₃₀ = 12V, V ₂ = V ₁₄ = V ₁₆ = 6V | 2 | -1 | 0 | +1 | dB |
| Expansion control threshold voltage | V _{EXPH} | | 2 | 3.0 | | | V |
| Expansion control threshold voltage | V _{EXPL} | | 2 | | | 1.5 | V |
| Left&Right channel output impedance | Z _{LR} | | 1 | | 150 | 300 | Ω |

Audio Switch Truth Table

| S4 (Pin 4) | S5 (Pin 6) | L1 (Pin 1) | L2 (Pin 3) | L3 (Pin 5) | L4 (Pin 7) | R1 (Pin 9) | R2 (Pin 11) | R3 (Pin 13) | R4 (Pin 15) |
|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|
| H | H | ON | OFF | OFF | OFF | ON | OFF | OFF | OFF |
| L | H | OFF | ON | OFF | OFF | OFF | ON | OFF | OFF |
| H | L | OFF | OFF | ON | OFF | OFF | OFF | ON | OFF |
| L | L | OFF | OFF | OFF | ON | OFF | OFF | OFF | ON |

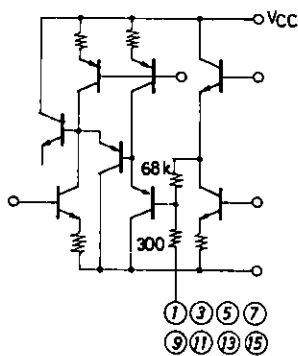
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Equivalent Circuit Block Diagram

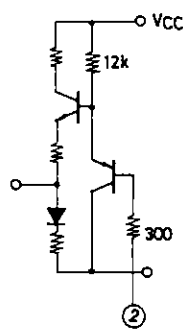


Unit (resistance : Ω , capacitance : F)

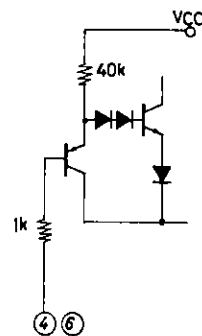
I/O Equivalent Circuits



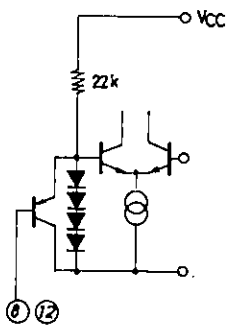
R, L Input



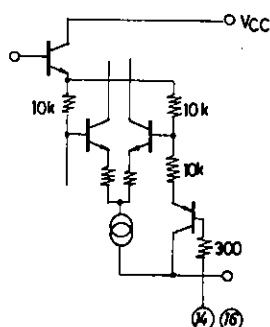
Balance Contr.



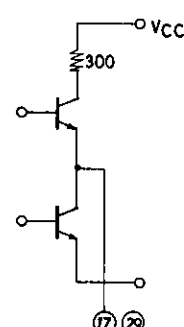
Contr. A, B



Mute, Expand SW



Bass, Treble Contr.



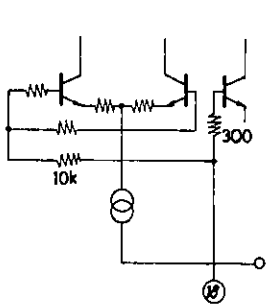
R, L Line Output

Unit (resistance : Ω)

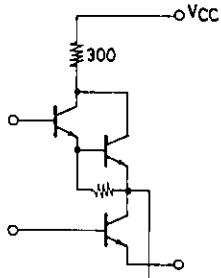
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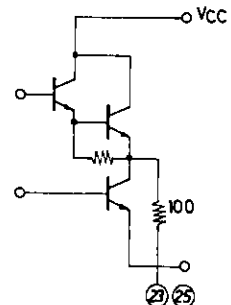
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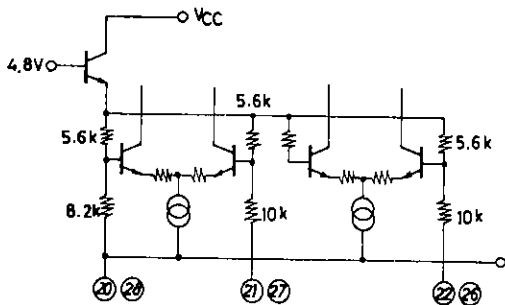
Expander Filter



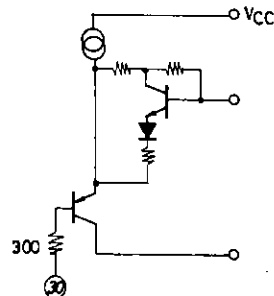
Expander Output



R, L Output



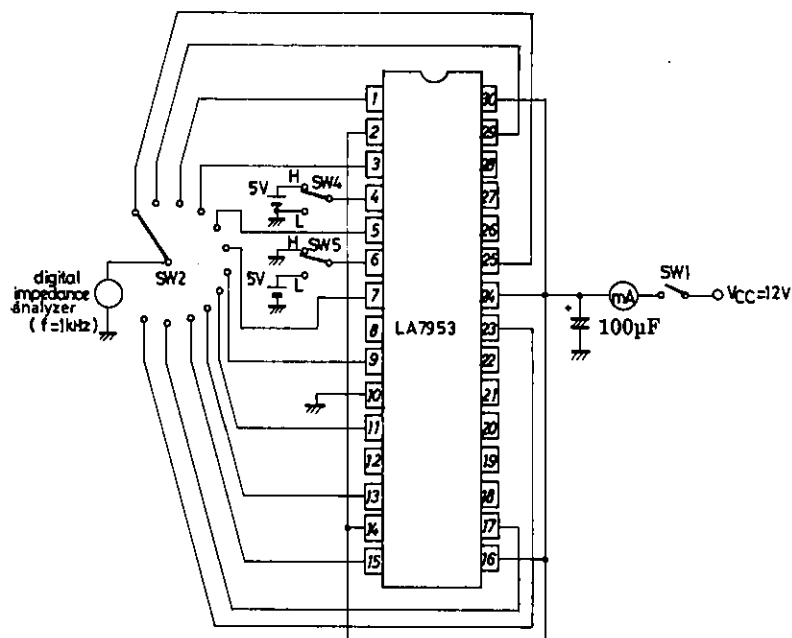
Treble, Bass Filter



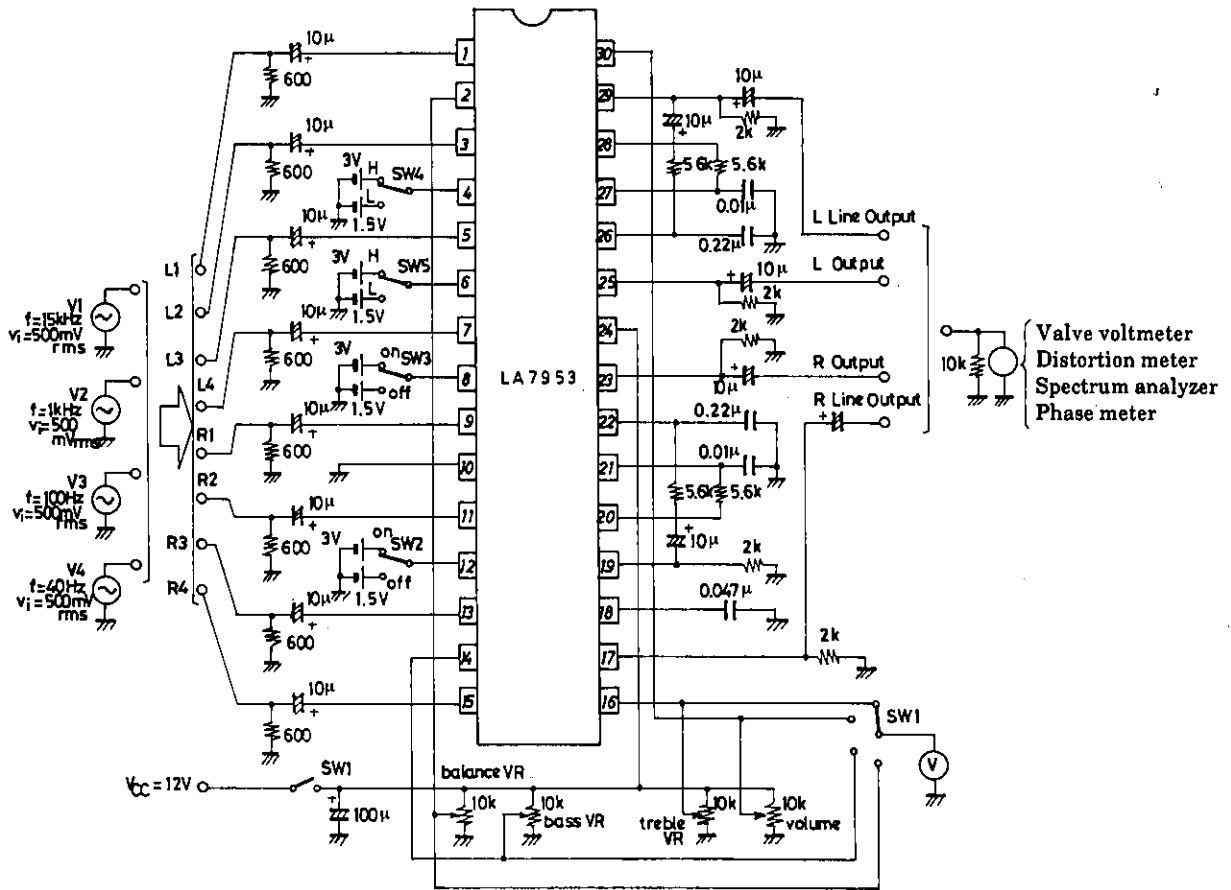
Volume Contr.

Unit (resistance : Ω)

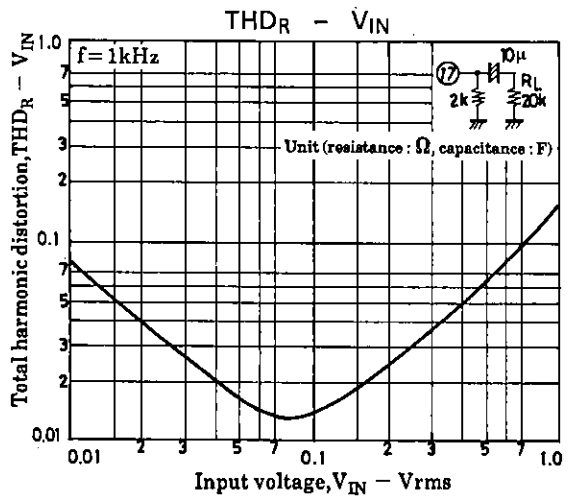
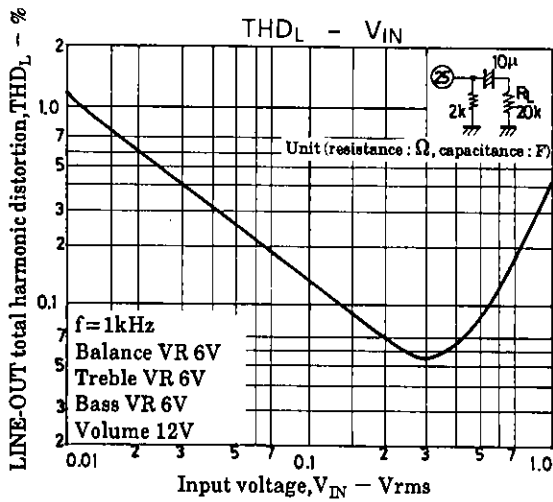
Test Circuit (1)

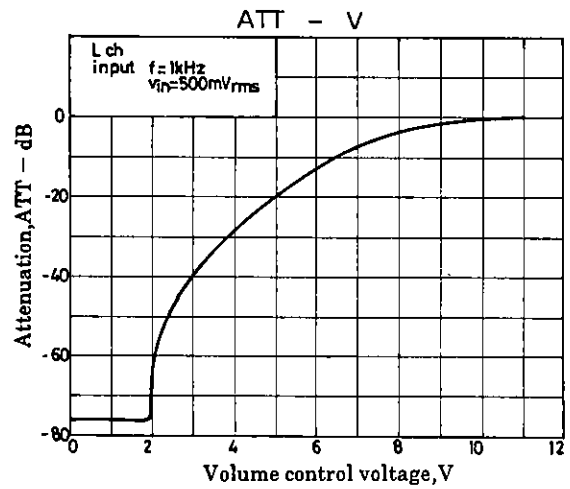
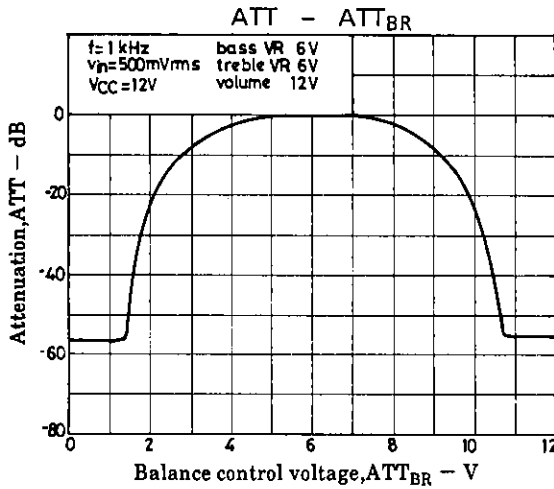
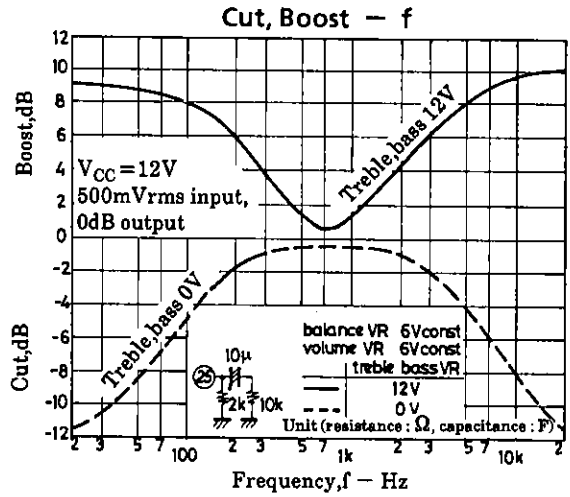
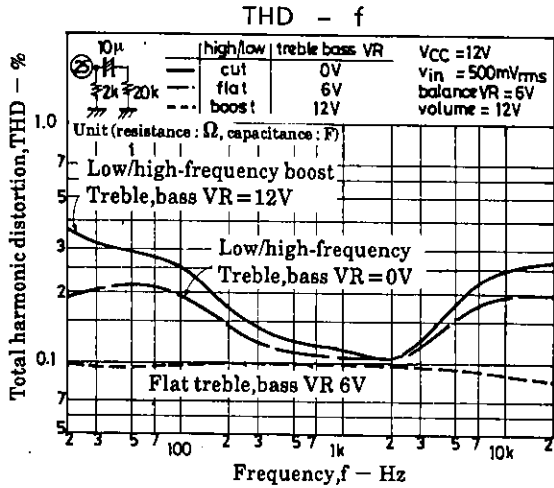


Test Circuit (2)



Unit (resistance : Ω, capacitance : F)





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