Ordering number:ENN2713A

Monolithic Linear IC

LA7953

Audio Controller for TV Use

Overview

The LA7953 Audio Controller is a single-chip, liner 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.

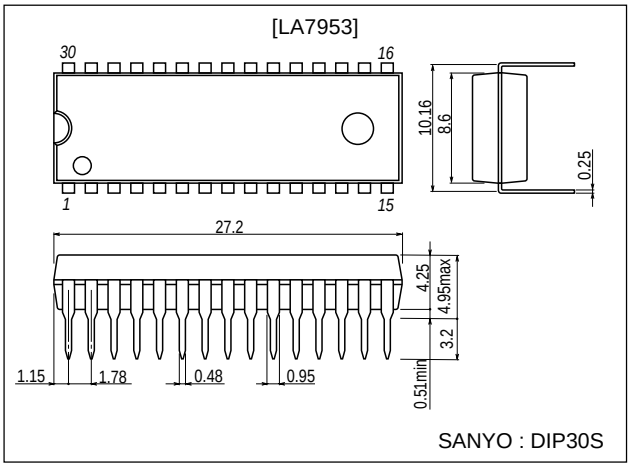
Features

- On-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.

Package Dimensions

unit:mm

3061-DIP30S



Specifications

Maximum Ratings at Ta = 25˚C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		14	V
Input applied voltage 1	$V_{1, 3, 5, 7, 9, 11, 13, 15}$ max	V_{CC}=14V	12	V
Input applied voltage 2	$V_{2, 14, 16, 30}$ max	V_{CC}=14V	14	V
Input applied voltage 3	V_4 max, V_6 max	V_{CC}=14V	14	V
Mute input applied voltage	V_8 max	V_{CC}=14V	14	V
Expansion input applied voltage	V_{12} max	V_{CC}=14V	14	V
LINE-OUT output current	$I_{17, 29}$ max		5	mA
Maximum output current	$I_{23, 25}$ max		5	mA
Expansion output current	I_{19} max		5	mA
Tone control input applied voltage	V_{20} max, V_{28} max	V_{CC}=14V	14	V
Bass filter applied voltage	V_{22} max, V_{26} max	V_{CC}=14V	14	V
Treble filter applied voltage	V_{21} max, V_{27} max	V_{CC}=14V	14	V

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Parameter	Symbol	Conditions	Ratings	Unit
Expasion filter applied voltage	V_{18} max	V_{CC}=14V	12	V
Allowable power dissipation	Pd max	Ta≤65˚C	1100	mW
Operating temperature	Topr		–20 to +65	˚C
Storage temperature	Tstg		–55 to +150	˚C

Operating Conditions at Ta = 25˚C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		12	V
Operating voltage range	V_{CC} op		10.5 to 13.2	V

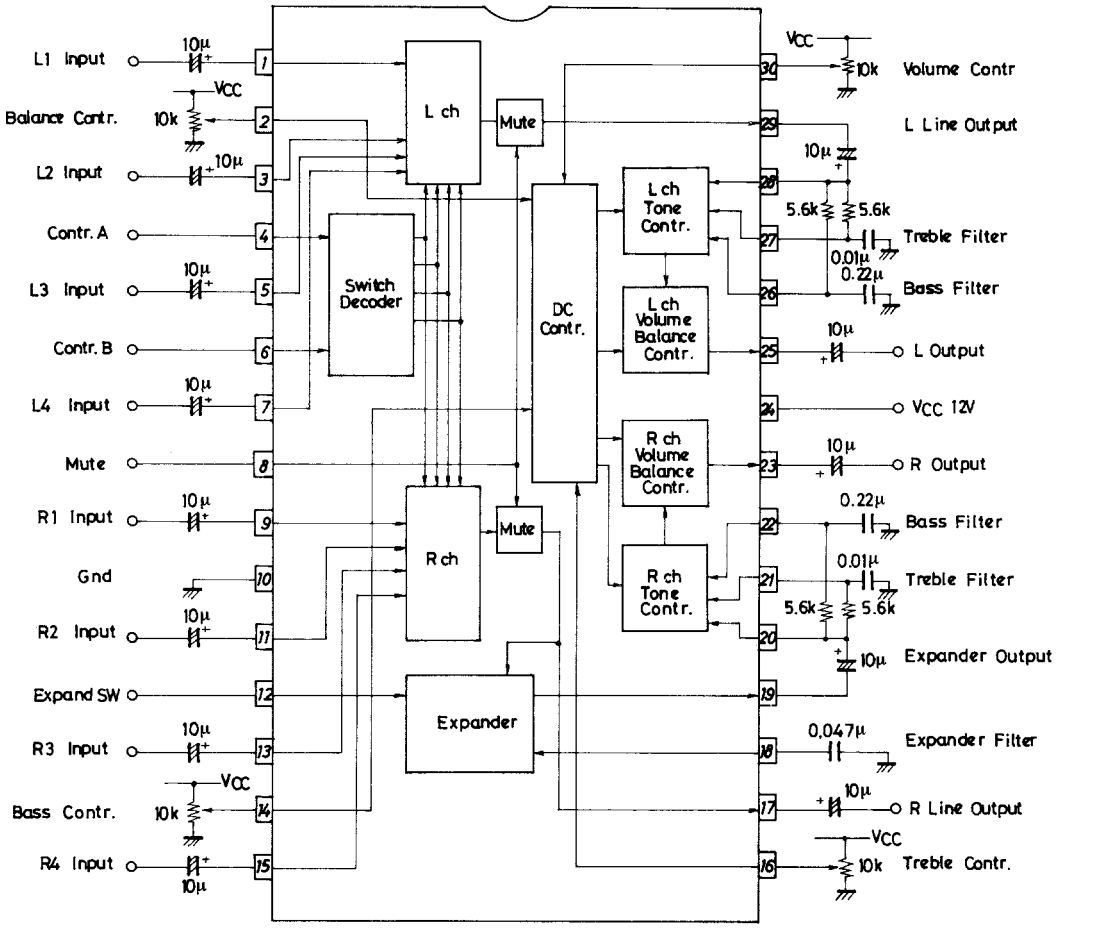
Operating Characteristics at Ta = 25˚C, V_{CC}=12V

Parameter	Symbol	Conditions	Test Circuit	Ratings			Unit
				min	typ	max	
[Audio SW]							
Input bias voltage	$V_{1, 3, 5, 7, 9, 11, 13, 15}$		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}=500mVrms, f=1kHz	2	–1	0	+1	dB
LINE-OUT distortion ratio	THD_L	V_{IN}=500mVrms, f=100Hz, 1kHz, L.P.F=80kHz	2		0.05	0.2	%
LINE-OUT noise	V_{NL}	Rg=600Ω, 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	kΩ
LINE-OUT output impedance	Z_{17}, Z_{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}=12V, V_2=V_{14}=V_{16}=6V	1	4	5.5	7	V
Left & right channel output DC offset	$V_{23 to 25}$	V_{30}=12V, V_2=V_{14}=V_{16}=6V	1	–2	+0.2	+2	V
Output voltage	V_O	V_{IN}=500mVrms, f=1kHz, V_{30}=12V, V_2=V_{14}=V_{16}=6V	2	390	450	630	mVrms
Channel balance	C_{Ba}	V_{IN}=500mVrms, f=1kHz, V_{30}=12V, V_2=V_{14}=V_{16}=6V	2	–1	+0.4	+1	dB
Dynamic range	THD_D	V_{IN}=0.8mVrms, f=40Hz, 15kHz, L.P.F=80kHz, V_{30}=12V, V_2=V_{14}=V_{16}=6V	2		0.25	2	%
Left & right channel attenuation	A_{TT}	V_{OUT}=500mVrms (0dB), f=1kHz, V_{30}=0V, V_2=V_{14}=V_{16}=6V	2	65	72		dB
Bass control, boost	GB_{BOOST}	V_{OUT}=500mVrms (1k), f=40Hz, V_{30}=V_{14}=12V, V_2=V_{16}=6V	2	7	9	12	dB
Bass control, cut	GB_{CUT}	V_{OUT}=500mVrms (1k), f=40Hz, V_{30}=12V, V_{14}=0V, V_2=V_{16}=6V	2	–1.3	–9	–6.5	dB
Treble control, boost	GB_{BOOST}	V_{OUT}=500mVrms (1k), f=15kHz, V_{30}=V_{11}=12V, V_2=V_{14}=6V	2	6.5	9	13	dB
Treble control, cut	GT_{CUT}	V_{OUT}=500mVrms (1k), f=15kHz, V_{30}=12V, V_{14}=0V, V_2=V_{16}=6V	2	–18	–9	–6.5	dB
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	˚C
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

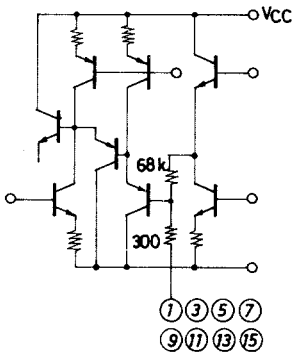
S4 (Pin 4)	S5 (Pin 6)	L1 (Pin 1)	L2 (Pin 3)	L3 (Pin 5)	L4 (Pin 7)	R1 (Pin 9)	R2 (Pin 11)	R3 (Pin 13)	R4 (Pin 15)
H	H	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
L	H	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
H	L	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
L	L	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON

Equivalent Curcuit Block Diagram

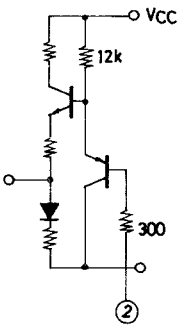


Unit (resistance : Ω, capacitance : F)

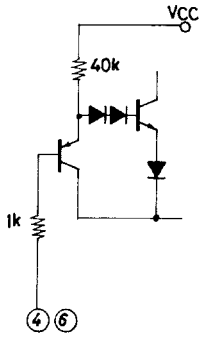
I/O Equivalent Curcuits



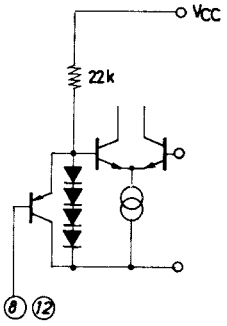
R, L Input



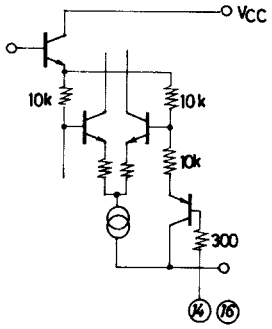
Balance Contr.



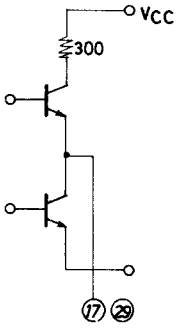
Contr. A, B



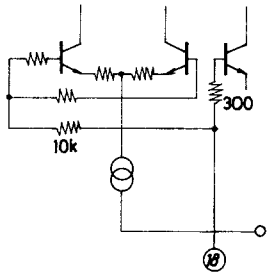
Mute, Expand SW



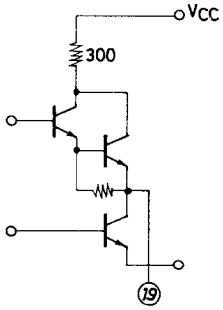
Bass, Treble Contr.



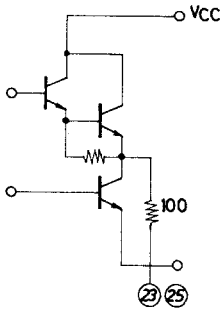
R, L Line Output



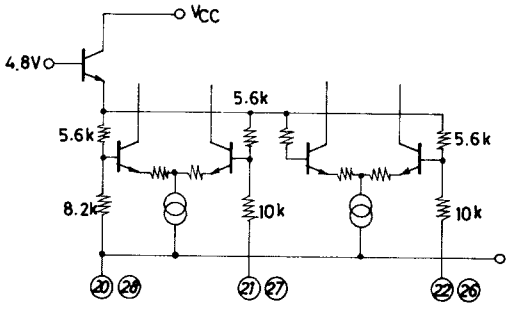
Expander Filter



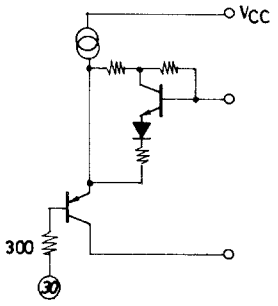
Expander Output



R, L Output



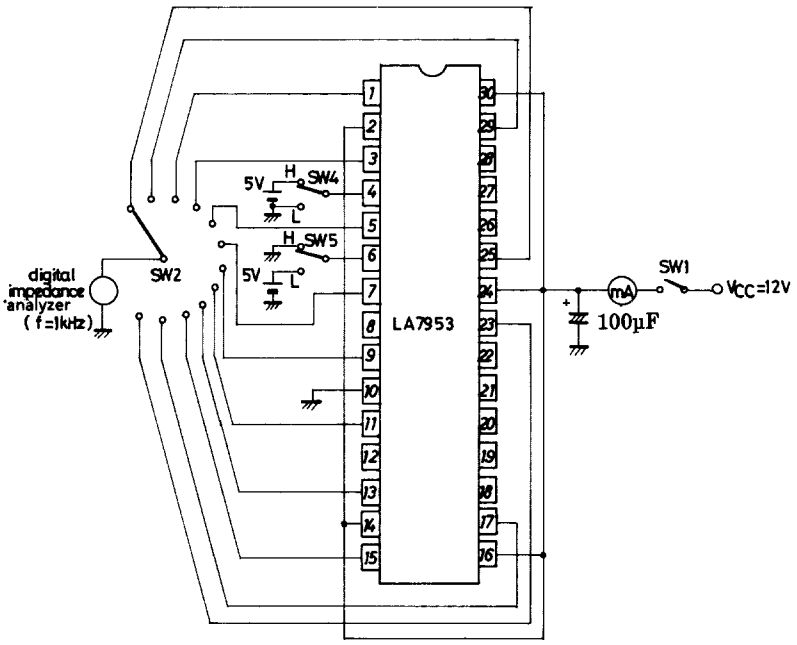
Treble, Bass Filter



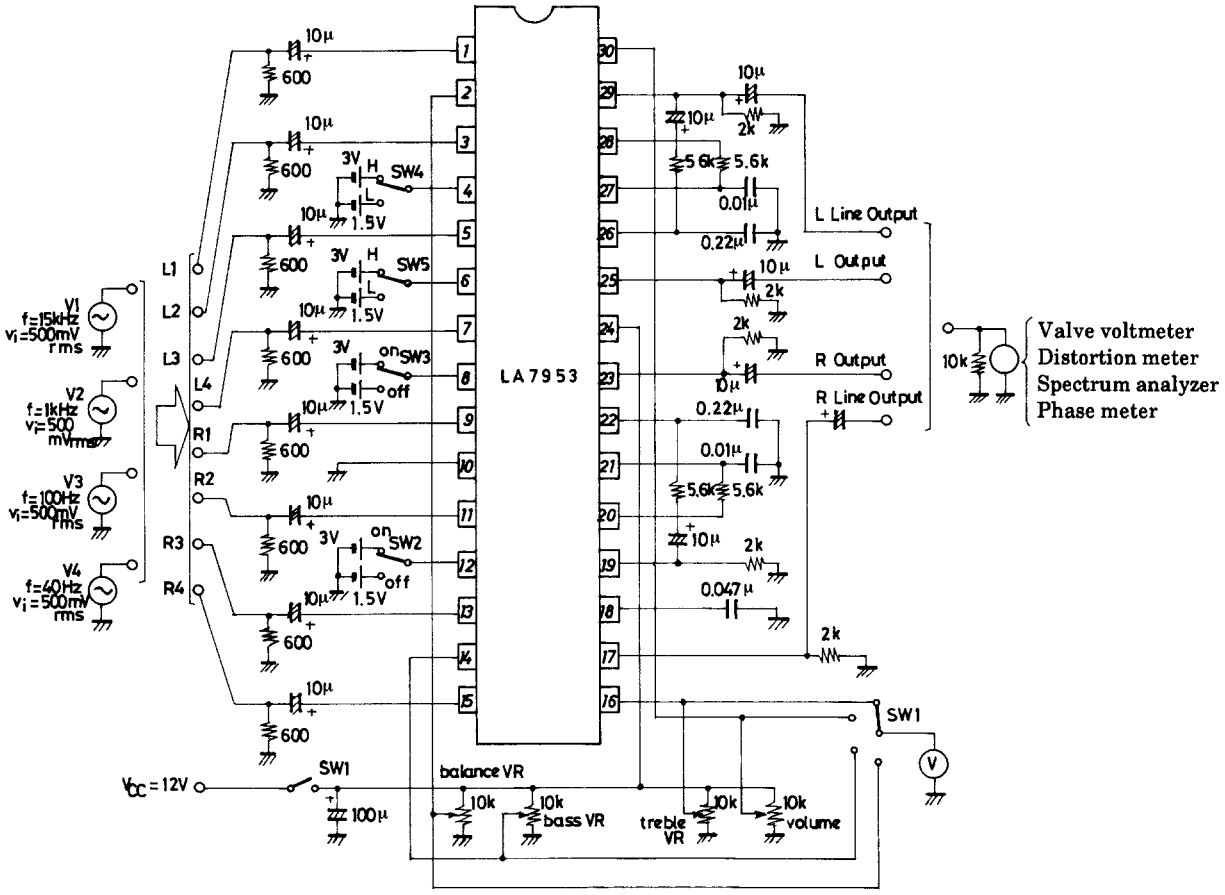
Volume Contr.

Unit (resistance : Ω)

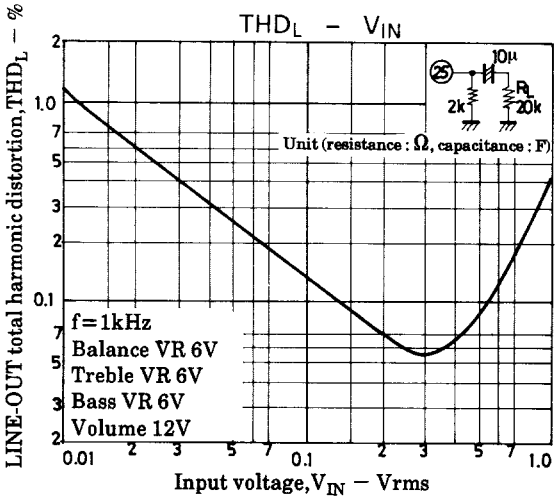
Test Circuit (1)

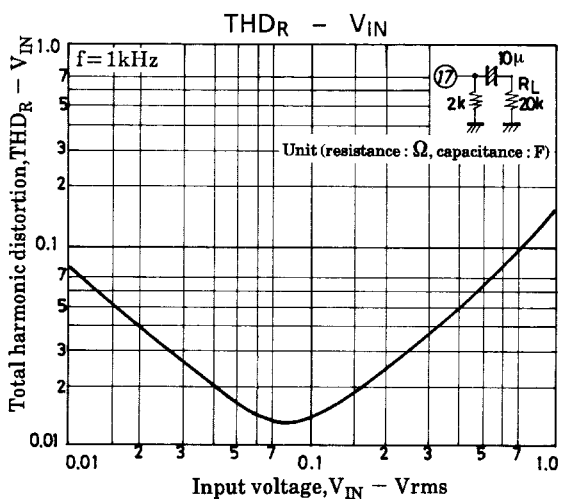


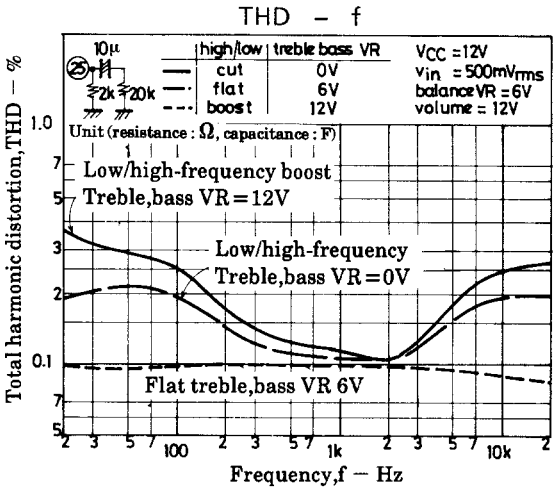
Test Circuit (2)

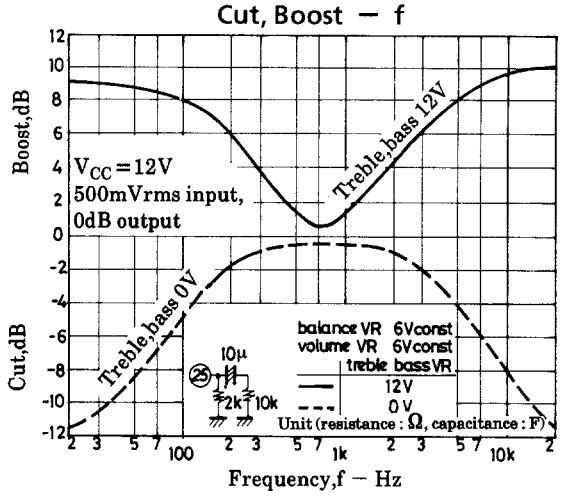


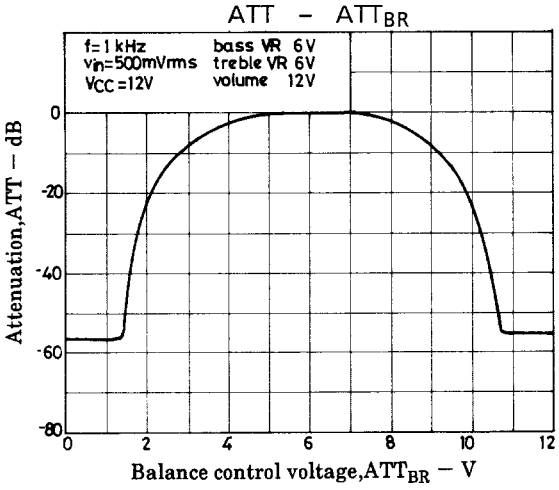
Unit (resistance : Ω, capacitance : F)

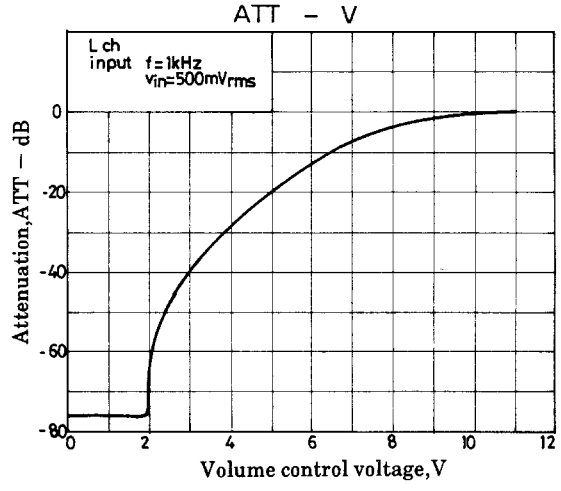

THD_L – V_IN
LINE-OUT total harmonic distortion, THD_L – %
Input voltage, V_IN – Vrms
Unit (resistance : Ω, capacitance : F)
f=1kHz
Balance VR 6V
Treble VR 6V
Bass VR 6V
Volume 12V


THD_R – V_IN
Total harmonic distortion, THD_R – V_IN
Input voltage, V_IN – Vrms
f=1kHz
Unit (resistance : Ω, capacitance : F)


THD – f
Total harmonic distortion, THD – %
Frequency, f – Hz
high/low | treble bass VR
cut 0V
flat 6V
boost 12V
V_CC =12V
v_in =500mVrms
balance VR =6V
volume = 12V
Unit (resistance : Ω, capacitance : F)
Low/high-frequency boost
Treble, bass VR=12V
Low/high-frequency
Treble, bass VR=0V
Flat treble, bass VR 6V


Cut, Boost – f
Boost, dB
Cut, dB
Frequency, f – Hz
V_CC=12V
500mVrms input,
0dB output
Treble, bass 12V
Treble, bass 0V
balance VR 6Vconst
volume VR 6Vconst
treble bass VR
12V
0V
Unit (resistance : Ω, capacitance : F)


ATT – ATT_BR
Attenuation, ATT – dB
Balance control voltage, ATT_BR – V
f=1kHz
v_in=500mVrms
V_CC=12V
bass VR 6V
treble VR 6V
volume 12V


ATT – V
Attenuation, ATT – dB
Volume control voltage, V
L ch
input f=1kHz
v_in=500mVrms