



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.

## Specifications

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

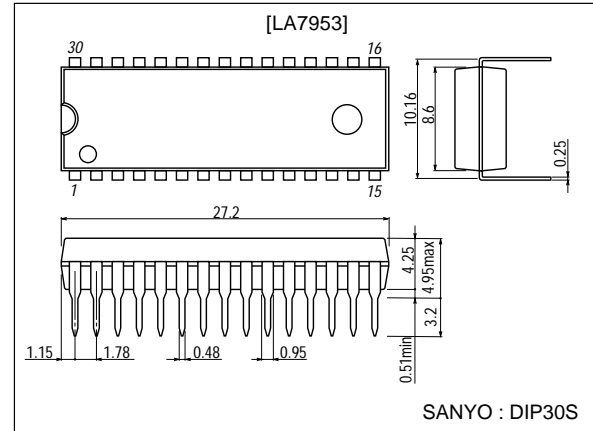
Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC}$ max		14	V
Input applied voltage 1	$V_1, 3, 5, 7, 9, 11, 13, 15$ max	$V_{CC}=14\text{V}$	12	V
Input applied voltage 2	$V_2, 14, 16, 30$ max	$V_{CC}=14\text{V}$	14	V
Input applied voltage 3	$V_4$ max, $V_6$ max	$V_{CC}=14\text{V}$	14	V
Mute input applied voltage	$V_8$ max	$V_{CC}=14\text{V}$	14	V
Expansion input applied voltage	$V_{12}$ max	$V_{CC}=14\text{V}$	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	$V_{CC}=14\text{V}$	14	V
Bass filter applied voltage	$V_{22}$ max, $V_{26}$ max	$V_{CC}=14\text{V}$	14	V
Treble filter applied voltage	$V_{21}$ max, $V_{27}$ max	$V_{CC}=14\text{V}$	14	V

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## Package Dimensions

unit:mm

3061-DIP30S



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Parameter	Symbol	Conditions	Ratings	Unit
Expansion filter applied voltage	$V_{18}$ max	$V_{CC}=14V$	12	V
Allowable power dissipation	$P_d$ max	$T_a \leq 65^\circ C$	1100	mW
Operating temperature	$T_{opr}$		-20 to +65	$^\circ C$
Storage temperature	$T_{stg}$		-55 to +150	$^\circ C$

## Operating Conditions at $T_a = 25^\circ C$

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 $T_a = 25^\circ C, V_{CC}=12V$

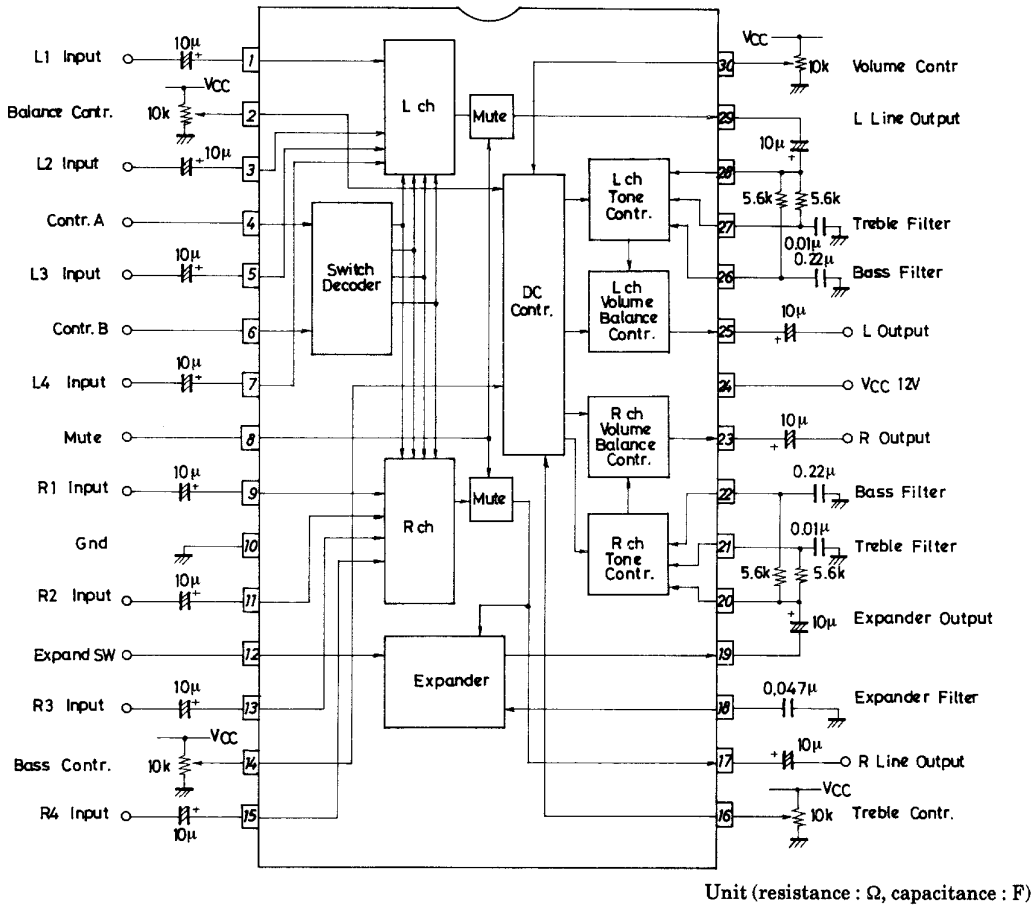
Parameter	Symbol	Conditions	Test Circuit	Ratings			Unit
				min	typ	max	
[Audio SW]							
Input bias voltage	$V_{1, 3, 5, 7, 9, 11, 13, 15}$		1	4.4	5.3	6.2	V
LINE-OUT output bias voltage	$V_{17, 29}$	S4, S5=H	1	2.1	3.0	3.9	V
LINE-OUT output DC offset voltage	$V_{OS}$	Differential voltage when LINE-OUT 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	$G_{LV}$	$V_{IN}=500mV_{rms}, f=1kHz$	2	-1	0	+1	dB
LINE-OUT distortion ratio	$THD_L$	$V_{IN}=500mV_{rms}, f=100Hz, 1kHz, L.P.F=80kHz$	2		0.05	0.2	%
LINE-OUT noise	$V_{NL}$	$R_g=600\Omega, 15kHz$ band	2		10	30	$\mu V_{rms}$
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	$k\Omega$
LINE-OUT output impedance	$Z_{17, 29}$		1		50	150	$\Omega$
[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	$V_O$	$V_{IN}=500mV_{rms}, f=1kHz, V_{30}=12V, V_2=V_{14}=V_{16}=6V$	2	390	450	630	$mV_{rms}$
Channel balance	$C_{Ba}$	$V_{IN}=500mV_{rms}, f=1kHz, V_{30}=12V, V_2=V_{14}=V_{16}=6V$	2	-1	+0.4	+1	dB
Dynamic range	$THD_D$	$V_{IN}=0.8mV_{rms}, f=40Hz, 15kHz, L.P.F=80kHz, V_{30}=12V, V_2=V_{14}=V_{16}=6V$	2		0.25	2	%
Left & right channel attenuation	$ATT$	$V_{OUT}=500mV_{rms}$ (0dB), $f=1kHz, V_{30}=0V, V_2=V_{14}=V_{16}=6V$	2	65	72		dB
Bass control, boost	$GB_{BOOST}$	$V_{OUT}=500mV_{rms}$ (1k), $f=40Hz, V_{30}=V_{14}=12V, V_2=V_{16}=6V$	2	7	9	12	dB
Bass control, cut	$GB_{CUT}$	$V_{OUT}=500mV_{rms}$ (1k), $f=40Hz, V_{30}=12V, V_{14}=0V, V_2=V_{16}=6V$	2	-1.3	-9	-6.5	dB
Treble control, boost	$GB_{BOOST}$	$V_{OUT}=500mV_{rms}$ (1k), $f=15kHz, V_{30}=V_{11}=12V, V_2=V_{14}=6V$	2	6.5	9	13	dB
Treble control, cut	$GT_{CUT}$	$V_{OUT}=500mV_{rms}$ (1k), $f=15kHz, V_{30}=12V, V_{14}=0V, V_2=V_{16}=6V$	2	-18	-9	-6.5	dB
Balance control	$ATT_{BR}$	$V_{OUT}=500mV_{rms}$ (0dB), $f=1kHz, V_{30}=12V, V_2=0V, V_{14}=V_{16}=6V$	2		-55	-40	dB
Balance control	$ATT_{BL}$	$V_{OUT}=500mV_{rms}$ (0dB), $f=1kHz, V_{30}=V_2=12V, V_{14}=V_{16}=6V$	2		-55	-40	dB
Crosstalk	$CT$	$V_{OUT}=500mV_{rms}$ (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	$\mu V_{rms}$
Total harmonic distortion	$THD$	$V_{IN}=500mV_{rms}, f=1kHz, L.P.F=80kHz, V_{30}=12V, V_2=V_{14}=V_{16}=6V$	2		0.2	0.5	%
Expansion characteristics	$P_{EXP}$	$V_{IN}=500mV_{rms}, f=1kHz, C=0.047\mu, V_{30}=12V, V_2=V_{14}=V_{16}=6V$	2	125	145	165	$^\circ C$
Expansion characteristics	$G_{EXP}$	$V_{IN}=500mV_{rms}, f=1kHz, C=0.047\mu, V_{30}=12V, V_2=V_{14}=V_{16}=6V$	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	$\Omega$

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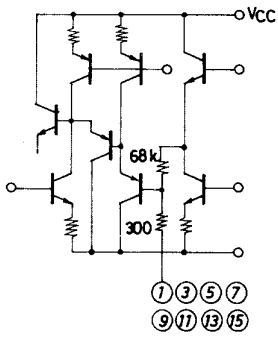
**Audio Switch Truth Table**

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

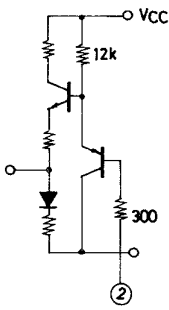
**Equivalent Circuit Block Diagram**



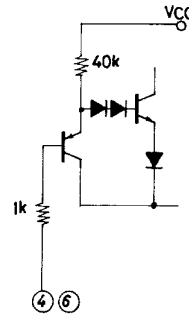
I/O Equivalent Circuits



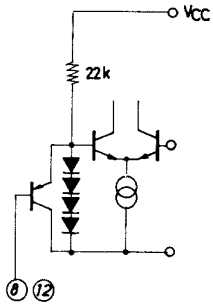
R,L Input



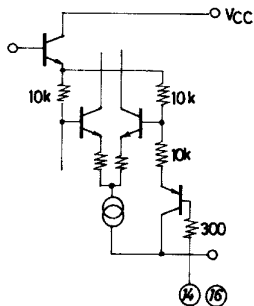
Balance Contr.



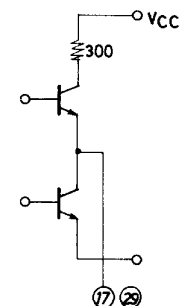
Contr. A,B



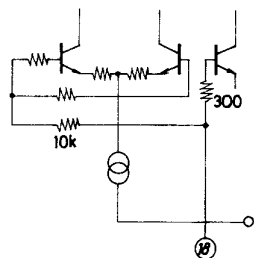
Mute, Expand SW



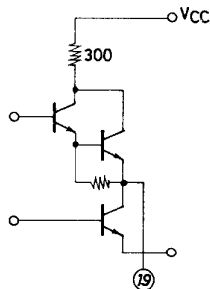
Bass, Treble Contr.



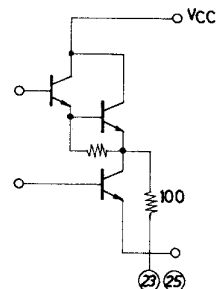
R,L Line Output



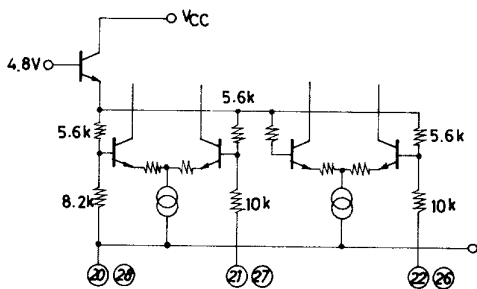
Expander Filter



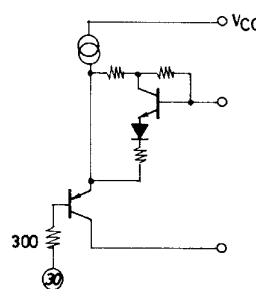
Expander Output



R,L Output



Treble, Bass Filter

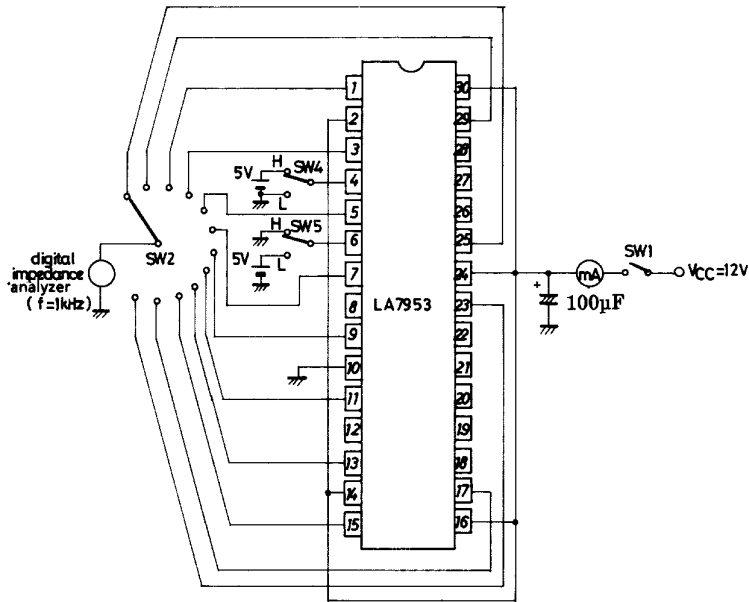


Volume Contr.

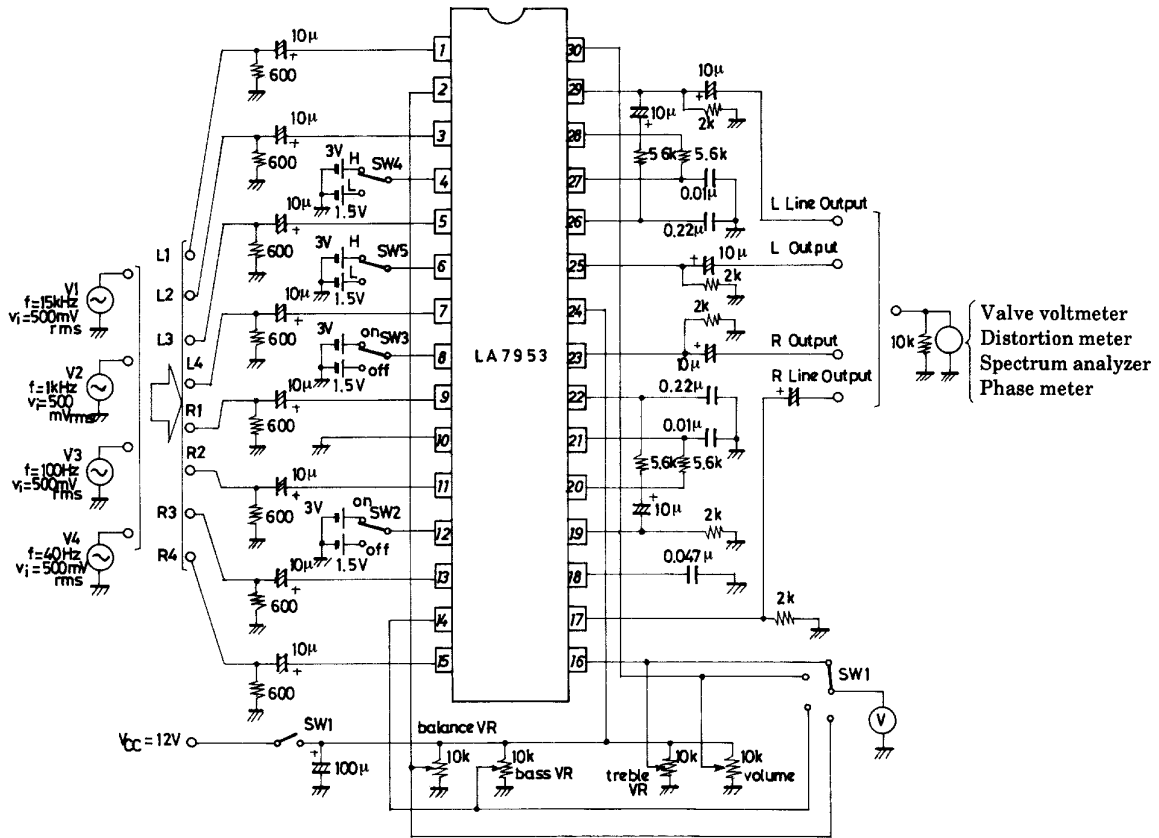
Unit (resistance :  $\Omega$ )

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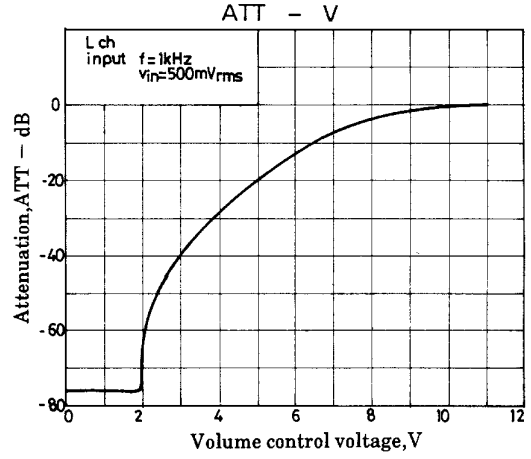
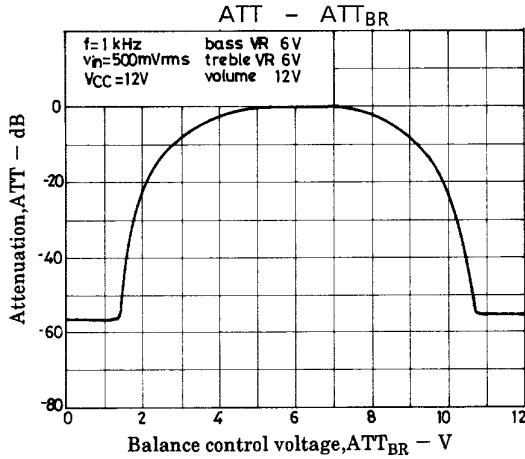
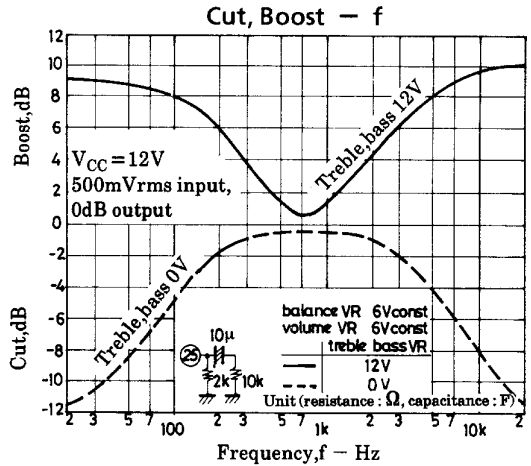
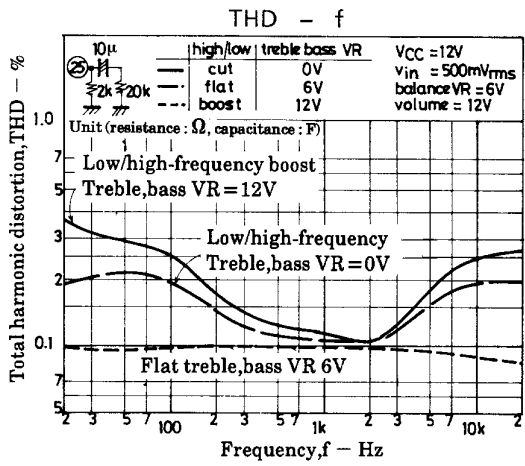
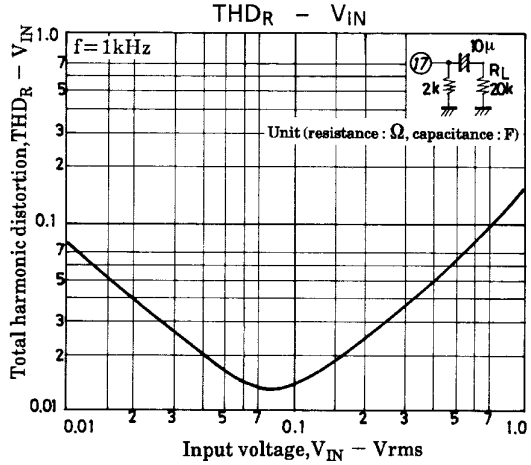
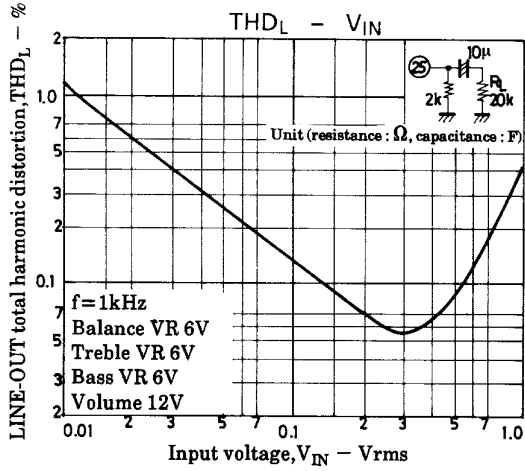
## Test Circuit (1)



## Test Circuit (2)



Unit (resistance :  $\Omega$ , capacitance : F)



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