MITSUBISHI LINEAR ICs

M51523AL

DUAL ELECTRONIC VOLUME CONTROL

DESCRIPTION

The M51523AL is a semiconductor integrated circuit containing a dual channel electronic volume control housed in a miniature 14-pin molded plastic zig-zag inline (ZIP) package.

Application of a DC voltage to the control pins permits the attenuation of the left and right channels to be changed as well as changes in the balance. Also included is a temperature-compensated reference voltage supply, enabling the M51523AL to be used as a control voltage source.

FEATURES

- High attenuation capacity ..... 92dB(typ.)
  (f=1kHz, V_i=150mVrms JIS-A network)
- Low distortion ..... 0.015%(typ.)
  (f=1kHz, V_i=150mVrms at maximum volume)
- Low noise ..... 3.6μVrms(typ.)
  (JIS-A network at minimum volume)
- Good matching between ch1 and ch2
- Includes a balance circuit
- Built-in stabilized power supply circuit makes device immune to fluctuations in supply voltage
- Good temperature characteristics

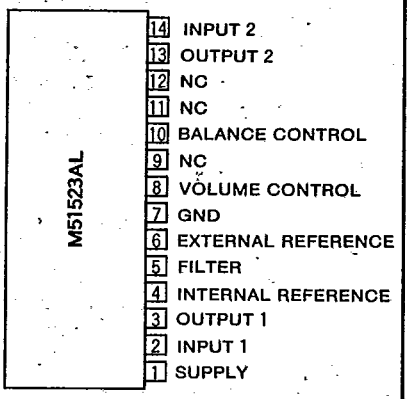
APPLICATION

Volume controls for car stereos, radio cassette recorders, TVs, VTRs, etc.

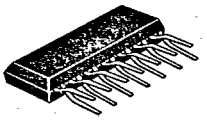
RECOMMENDED OPERATING CONDITIONS

Supply voltage range ..... 8~16V
Rated supply voltage 12V

PIN CONFIGURATION (TOP VIEW)

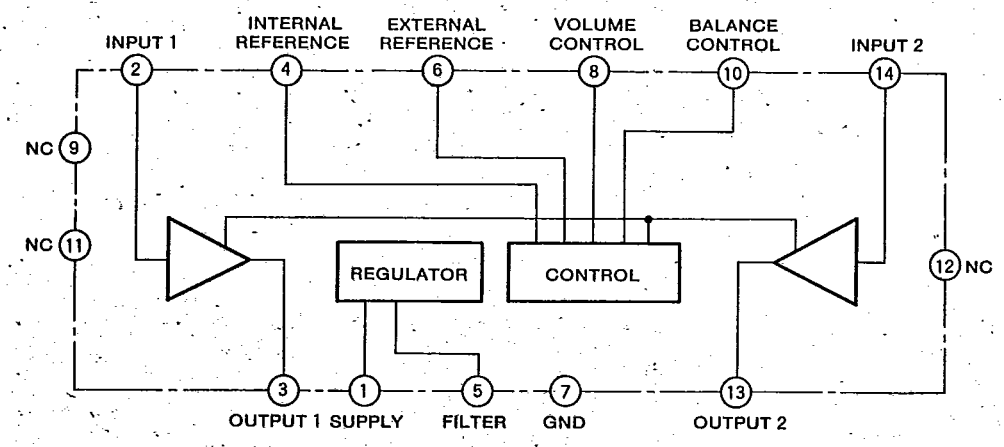


NC : NO CONNECTION



14-pin molded plastic ZIP

BLOCK DIAGRAM



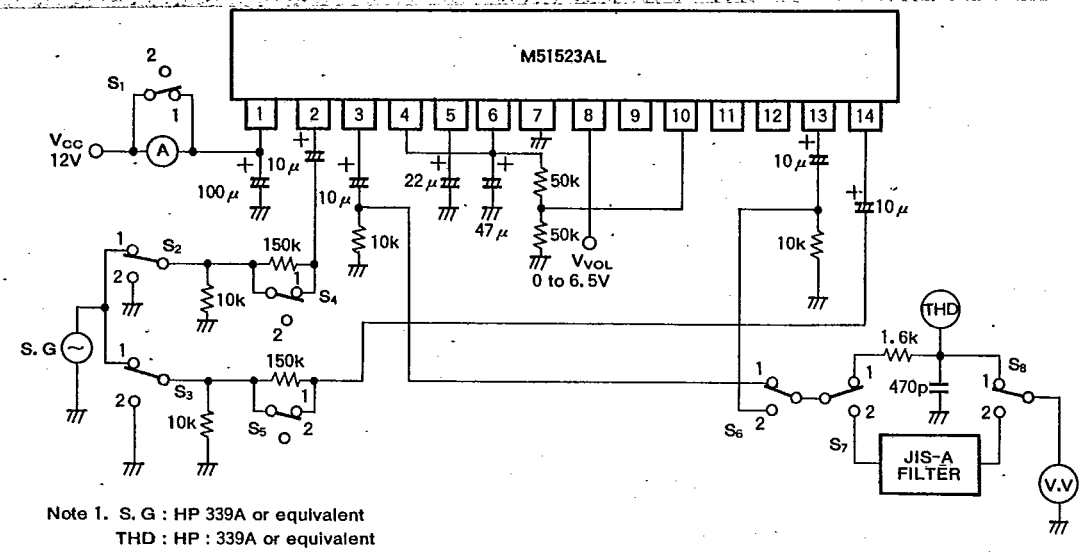
ABSOLUTE MAXIMUM RATINGS (T_a=25℃, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage	Quiescent	18	V
I_{CC}	Circuit current		30	mA
P_d	Power dissipation		550	mW
K_θ	Thermal derating	$T_a \geqq 25$℃	5.5	mW/℃
T_{opr}	Operating temperature range		−20～+75	℃
T_{stg}	Storage temperature range		−40～+125	℃

ELECTRICAL CHARACTERISTICS (T_a=25℃, V_{CC}=12V, f=1kHz, unless otherwise noted)

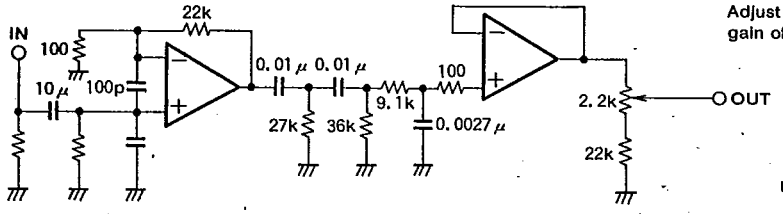
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{CCO}	Quiescent circuit current	V_{VOL}=0V, V_I=0	7	12	20	mA
ATT	Attenuation level	V_{VOL}=0V, V_I=150mVrms	83	92		dB
C. B	Channel balance	V_{VOL}=2.8V, V_I=1Vrms	−3	0	3	dB
THD	Total harmonic distortion	V_{VOL}=6.5V, V_I=150mVrms		0.015	0.1	%
R_I	Input resistance	V_{VOL}=6.5V, V_I=1Vrms	50	150		kΩ
$V_{I(max)}$	Maximum input voltage	THD=1%	1.0	1.5		Vrms
N_O	Output noise voltage	V_I=0, JIS-A network		3.6	10	μVrms

TEST CIRCUIT



Note 1. S. G : HP 339A or equivalent
THD : HP : 339A or equivalent
V. V : Kikusui Model 1635 or equivalent
Note 2. A low-noise power supply should be used. (Less than 2μV)

● Where the specified JIS-A filter is not used, the following circuit can be substituted. Note that output is increased by a factor of 100.



Adjust for an IN → OUT gain of 40 dB at 1 kHz.

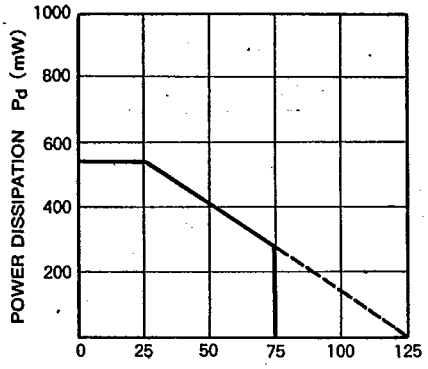
Unit Resistance : Ω
Capacitance : F

TEST METHODS (T_a=25℃, V_{CC}=12V, f=1kHz, unless otherwise noted)

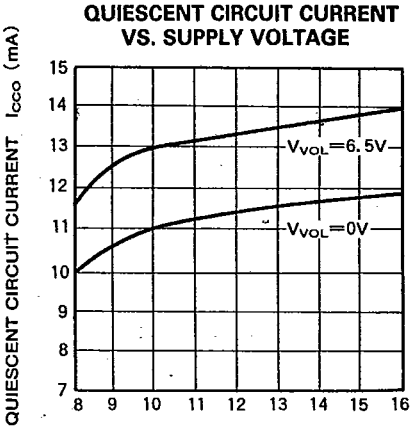
Parameter	Switch condition								Method
	S1	S2	S3	S4	S5	S6	S7	S8	
I_{CCO}	2	2	2	1	1		1	1	Measure with ammeter
ATT	1	1	1	1	1	1 2	1	1	Vary V_{VOL} from 0 to 6.5V and calculate using ATT=20 log(V_O/V_I)dB
C. B	1	1	1	1	1	1 2	1	1	Channel balance at V_{VOL}=2.8V
THD	1	1	1	1	1	1 2	1	1	At f=1kHz, V_I=150mVrms, and maximum volume, measure with distortion meter
R_I	1	1	1	1→2 1	1 1→2	1 2	1	1	Taking output V_O1 at S4=1, and output V_O2 at S_4=2, calculate using R_I=150/(V_O1/V_O2−1)kΩ
$V_{I(max)}$	1	1	1	1	1	1 2	1	1	At f=1kHz, the input voltage required to produce a THD of 1% at maximum volume
N_O	1	2	2	1	1	1 2	2	2	AT minimum volume level, R_g=10kΩ, JIS-A filter

TYPICAL CHARACTERISTICS (T_a=25℃, V_{CC}=12V, f=1kHz, unless otherwise noted)

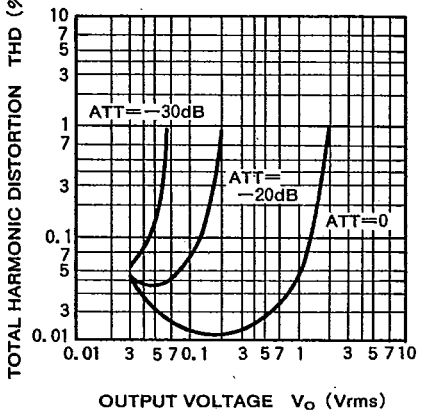
THERMAL DERATING (MAXIMUM RATING)



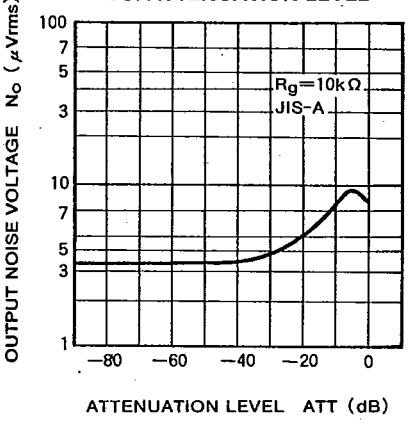
QUIESCENT CIRCUIT CURRENT VS. SUPPLY VOLTAGE



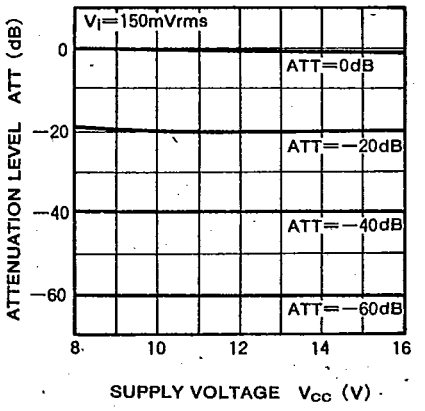
TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE



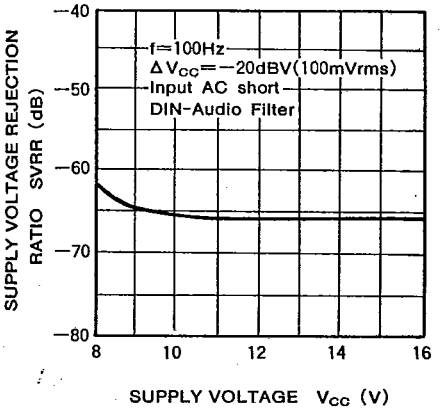
OUTPUT NOISE VOLTAGE VS. ATTENUATION LEVEL



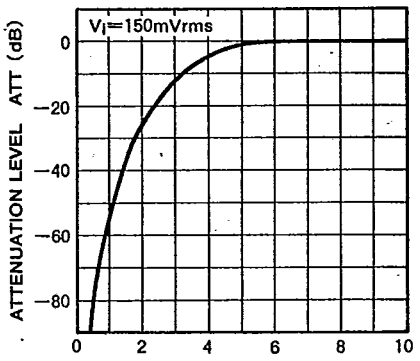
ATTENUATION LEVEL VS. SUPPLY VOLTAGE



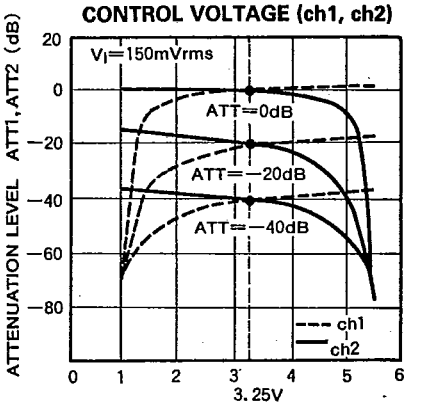
SUPPLY VOLTAGE REJECTION RATIO VS. SUPPLY VOLTAGE



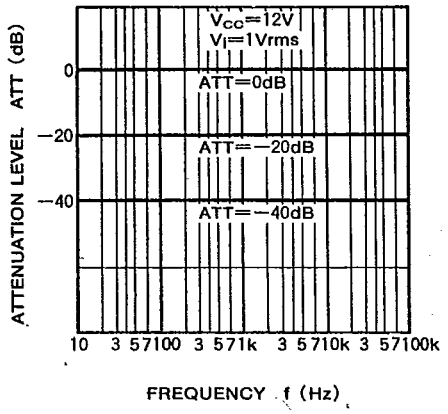
ATTENUATION LEVEL VS. VOLUME CONTROL VOLTAGE



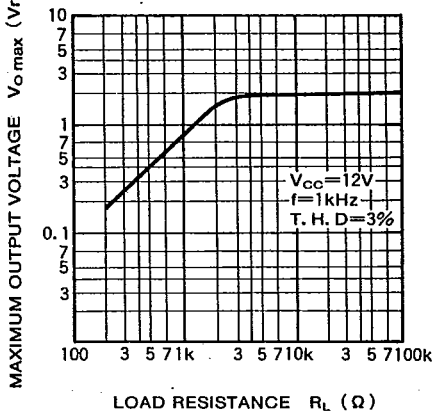
ATTENUATION LEVEL VS. BALANCE CONTROL VOLTAGE (ch1, ch2)



ATTENUATION LEVEL VS. FREQUENCY



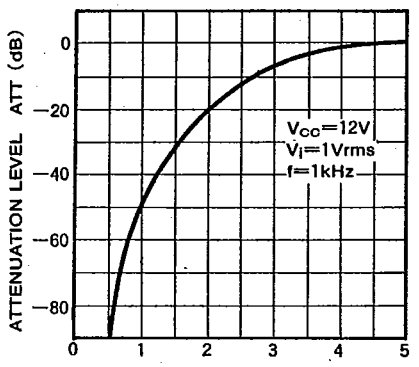
MAXIMUM OUTPUT VOLTAGE VS. LOAD RESISTANCE



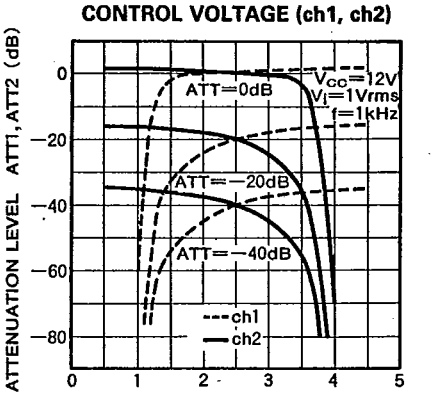
The attenuation characteristics and balance characteristics will change with the application of voltage to Pin ⑥. When the volume control voltage is equial to the Pin ⑥ voltage, there will be maximum volume. When the balance control voltage is half of the Pin ⑥ voltage, the balance will be centered.

The attenuation level characteristics and balance characteristics for an applied voltage of 5V to Pin ⑥ are shown in the following graphs.

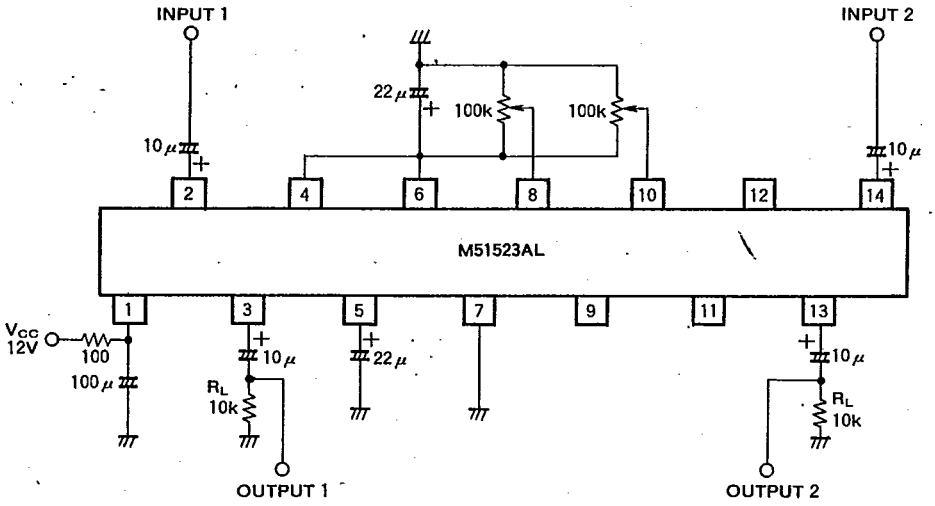
ATTENUATION LEVEL VS. VOLUME CONTROL VOLTAGE



ATTENUATION LEVEL VS. BALANCE CONTROL VOLTAGE (ch1, ch2)



APPLICATION EXAMPLE



Unit Resistance : Ω
Capacitance : F