MOTOROLA
SEMICONDUCTORS
P.O. BOX 20912 • PHOENIX, ARIZONA 85036

TDA1524A

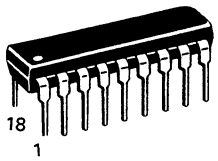
STEREO TONE CONTROL

The TDA1524A is an active balance, volume, bass and treble control for use in car radios, stereo TV receivers and audio systems. Functions are controlled by four non-critical single potentiometers with excellent channel to channel tracking characteristics. Bass and treble contours are defined by a single capacitor per control per channel. Volume control can be linear across the audio spectrum, or a loudness contour can be used.

- Low Noise
- Low Distortion
- High Signal Handling Capability
- Wide Supply Range
- Popular Multi-Sourced Device

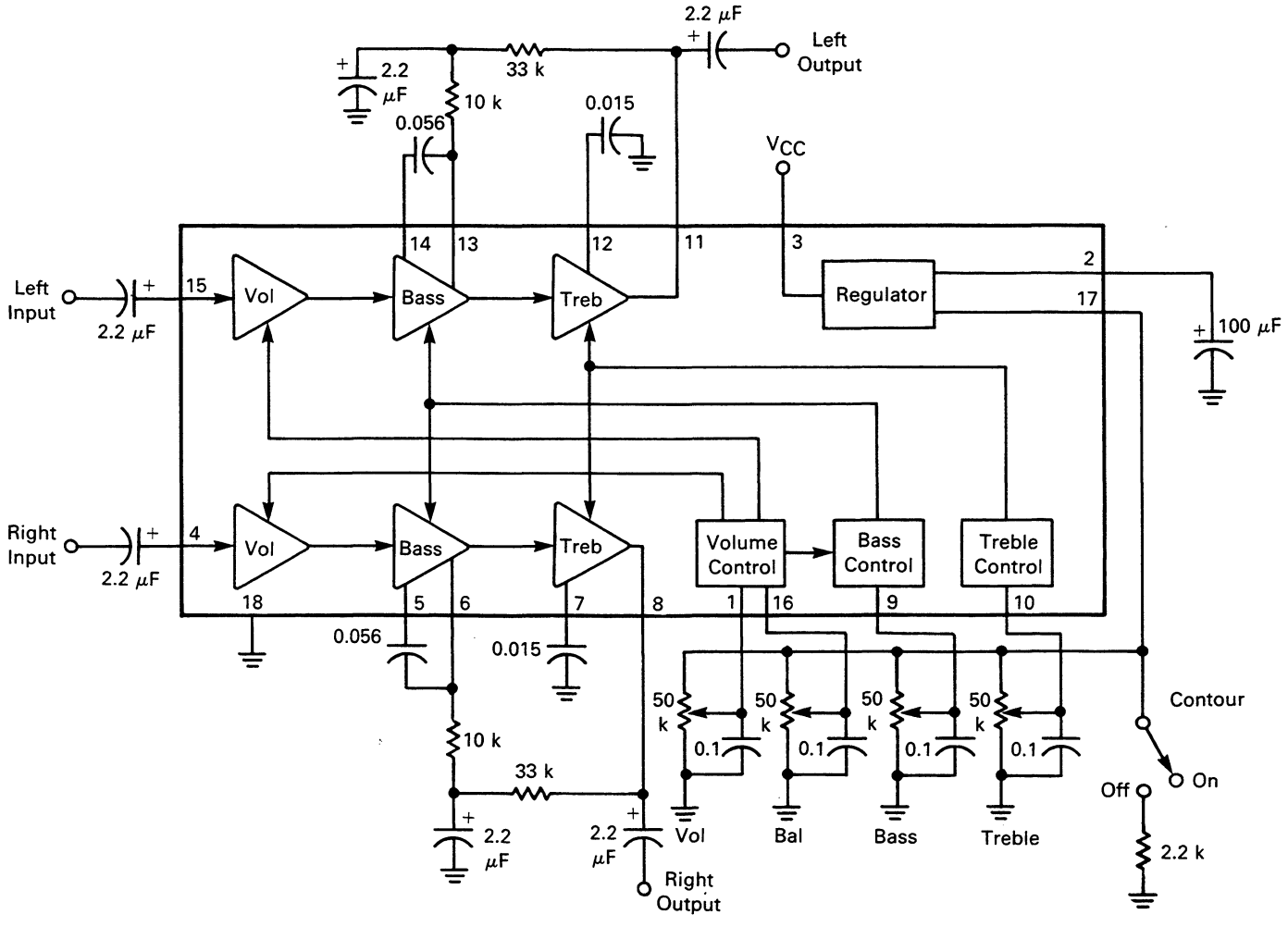
STEREO TONE CONTROL SYSTEM

SILICON MONOLITHIC INTEGRATED CIRCUIT



P SUFFIX
PLASTIC PACKAGE
CASE 707-02

FIGURE 1 — BLOCK DIAGRAM AND TYPICAL APPLICATION



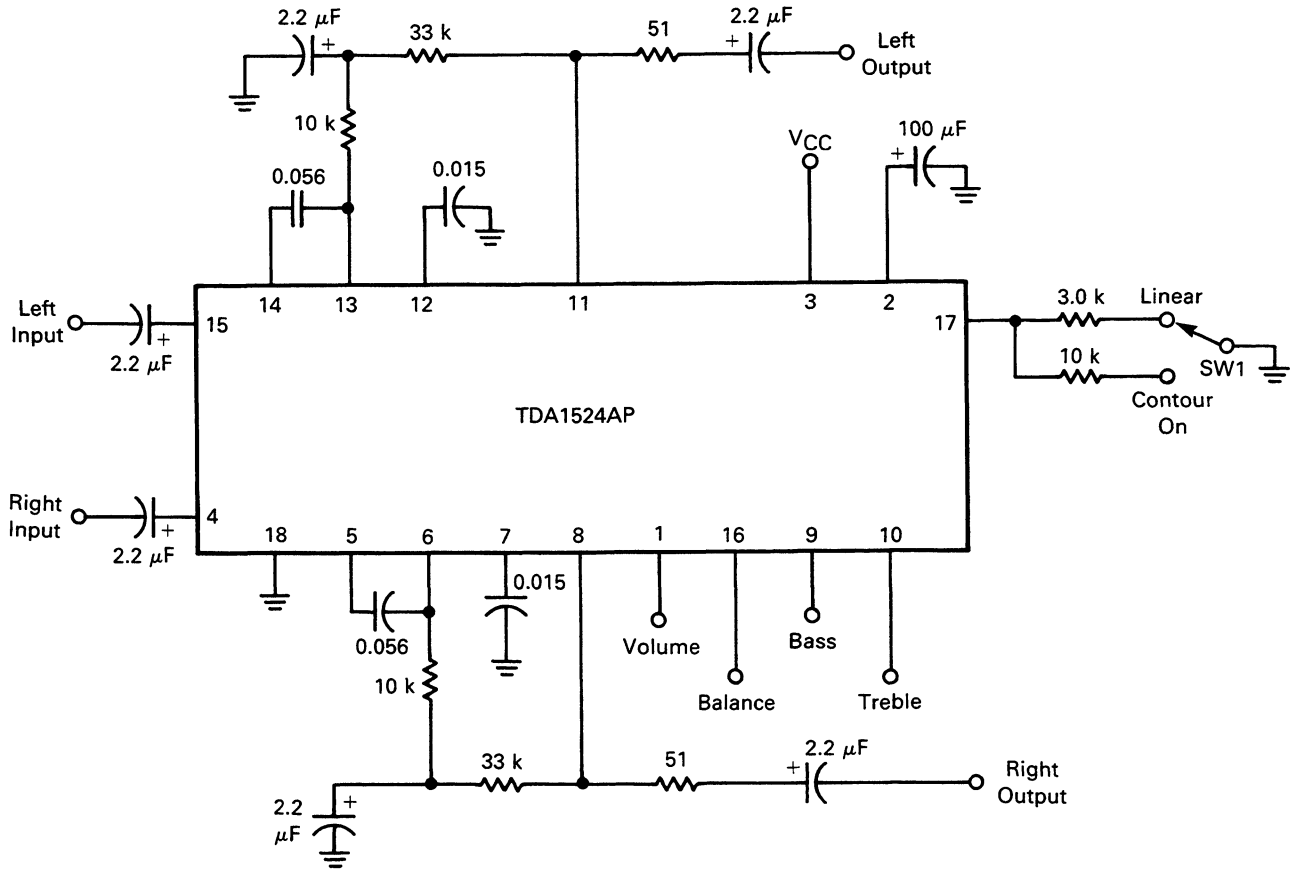
MAXIMUM RATINGS (T_A = +25°C)

Rating	Value	Units
Power Supply Voltage	20	V
Power Dissipation Derate above 25°C	1250 10	mW mW/°C
Operating Temperature Range	−40 to +85	°C
Storage Temperature Range	−65 to +150	°C

DC CHARACTERISTICS (T_A = 25°C, circuit of Figure 2, SW1 at "contour on", V_1, V_9, V_{10}, V_{16} = 1.9 V, unless otherwise noted)

Characteristic	Pin	V_{CC} (Vdc)	Min	Typ	Max	Units
Supply Voltage, V_{CC}	3	—	7.5	—	16.5	Vdc
Supply Current	3	8.5 12 15	19 25 30	27 35 43	35 45 56	mA
DC Input Level	4, 15	8.5 12 15	3.8 5.3 6.5	4.25 5.9 7.3	4.7 6.6 8.2	Vdc
DC Output Level	8, 11	8.5 12 15	3.3 4.6 5.7	4.25 6.0 7.5	5.2 7.4 9.3	Vdc
Regulator Output Voltage	17	8.5 12 15	3.5 3.55 3.6	3.75 3.8 3.85	4.0 4.05 4.1	Vdc
Regulator Output Voltage, SW1 in "Linear" Position	17	8.5	3.5	3.75	4.0	Vdc

FIGURE 2 — TEST CIRCUIT



AC CHARACTERISTICS (V_{CC} = 8.5 Vdc, T_A = 25°C, circuit of Figure 2, contour switch (SW1) to "Linear" position, frequency 1.0 kHz, gains expressed as 20 log [voltage ratio] unless otherwise noted)

Characteristic	V_1	V_9	V_{10}	V_{16}	Measure Pin(s)	Min	Typ	Max	Units
Gain at Max Volume Control (Input = 50 mVrms)	V_{17}	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	8, 11	20.5	21.5	23	dB
Distortion at 1.8 Vrms Output (Output signal handling)					8, 11	—	—	0.5	%
AC Input Resistance					4, 15	10	—	—	kΩ
Output to Output Difference, One Input Driven (100 mVrms)					8, 11	46	—	—	dB
Noise Output (20 Hz–20 kHz, Inputs are Grounded)					8, 11	—	250	400	μVrms
Gain at Mid Volume, Left Channel (Input = 100 mVrms)	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	8, 11	−13	−10	−7.0	dB
Gain Difference Left to Right						—	—	1.5	
1.0 kHz Gain Difference Output to Output (Input = 100 mVrms)	2.1	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	8, 11	—	—	2.5	dB
70 Hz Gain at Mid Bass Setting (Input = 100 mVrms)						—	0	—	
70 Hz Gain Difference Output to Output						—	—	2.5	
70 Hz Bass Control — Boost		V_{17}				10	—	—	
— Cut		0				10	—	—	
16 kHz Gain at Mid Treble Setting (Input = 100 mVrms)	2.1	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	8, 11	—	0	—	dB
16 kHz Gain Difference Output to Output						—	—	2.5	
16 kHz Treble Control — Boost			V_{17}			12	—	—	
— Cut			0			12	—	—	
Balance Control Range of Right Channel	2.1	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	Adj*	8	35	—	—	dB
Balance Control Range of Left Channel				Adj*	11	35	—	—	dB
Output Ripple (No Signal, 200 mVrms @ 120 Hz Added to V_{CC})				$\frac{V_{17}}{2}$	8, 11	—	—	3.5	mVrms
1.0 kHz Gain (Input = 1.8 Vrms)	1.6	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	8, 11	—	−20	—	dB
Noise Output (20 Hz–20 kHz, Inputs ac Grounded)						—	75	120	μVrms
Distortion (Input = 1.4 Vrms) (Input Signal Handling)						—	—	0.5	%
Distortion (Input = 1.8 Vrms)						—	—	0.7	%
Gain Difference Output to Output						—	—	2.5	dB
Separation (One Input Driven, Output to Output)						46	—	—	dB
1.0 kHz Gain (Input = 2.0 Vrms)	1.3	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	8, 11	—	−40	—	dB
Gain Difference Output to Output						—	—	6.0	
Contour Boost at 70 Hz (Contour Switch in "Contour On" Position)						8	—	—	
Gain at Minimum Volume (Input 2.0 Vrms)	0	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	$\frac{V_{17}}{2}$	8, 11	—	—	−70	dB

Adj* — means vary the control over the full range from V_{17} to 0.

(All curves taken in the test circuit of Figure 2, V_{CC} = 8.5 Vdc, unless otherwise noted)

FIGURE 3 — VOLUME CONTROL CHARACTERISTIC

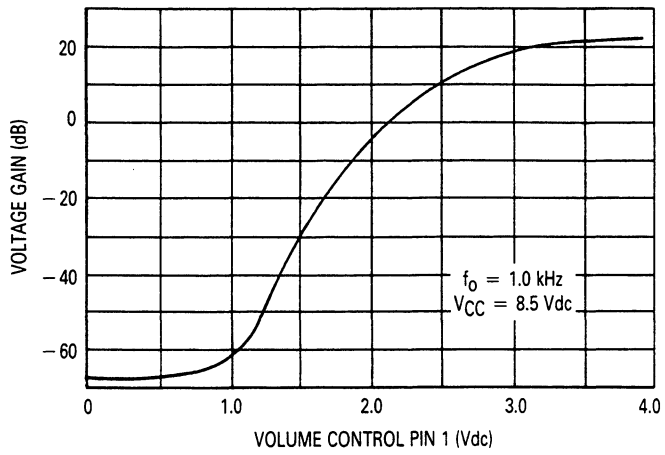


FIGURE 4 — BALANCE CONTROL CHARACTERISTIC

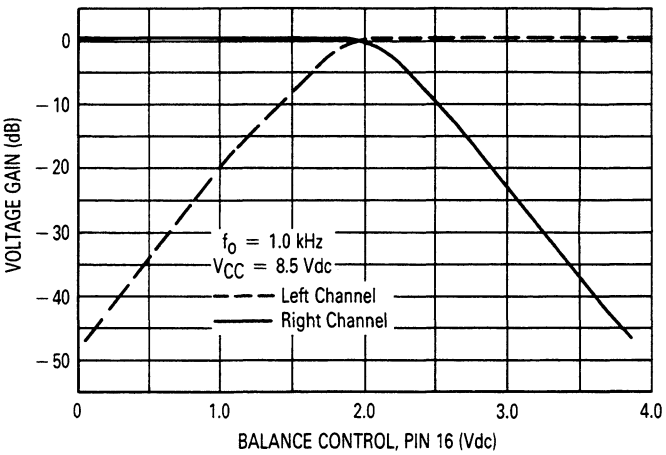


FIGURE 5 — BASS CONTROL CHARACTERISTIC

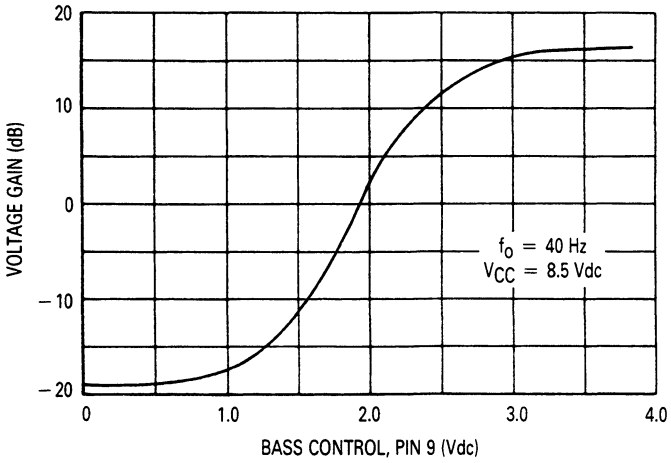


FIGURE 6 — TREBLE CONTROL CHARACTERISTIC

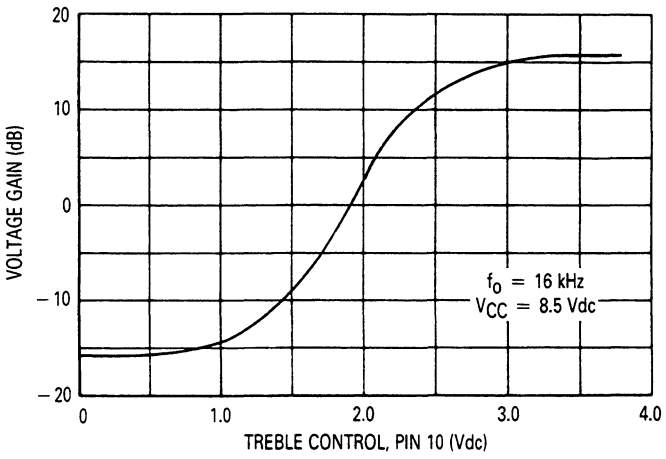


FIGURE 7 — TOTAL HARMONIC DISTORTION versus FREQUENCY

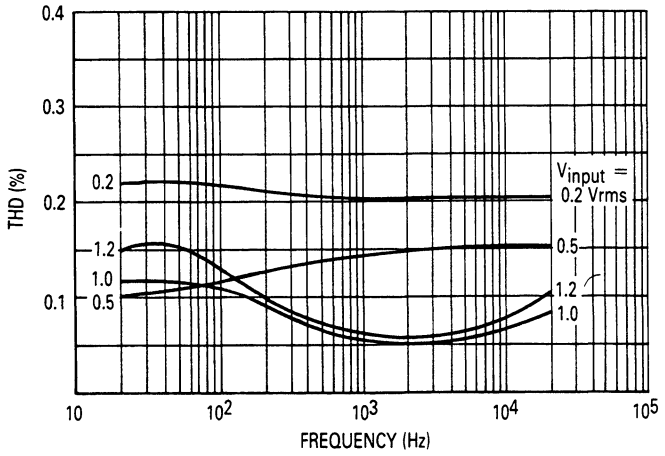


FIGURE 8 — TOTAL HARMONIC DISTORTION versus OUTPUT

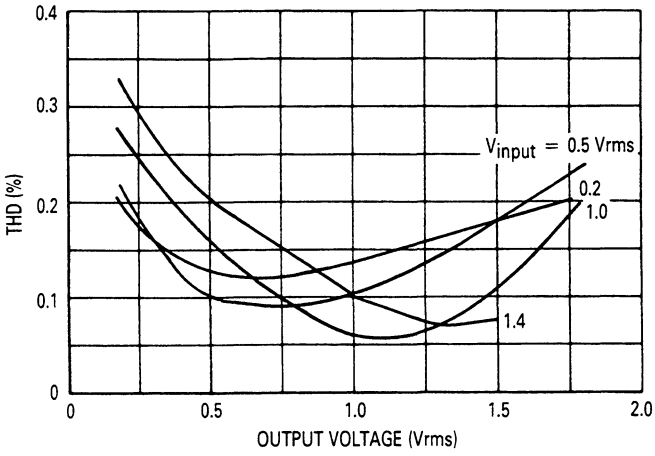


FIGURE 9 — TONE CONTROL RESPONSE WITH SINGLE POLE LOW-PASS FILTER

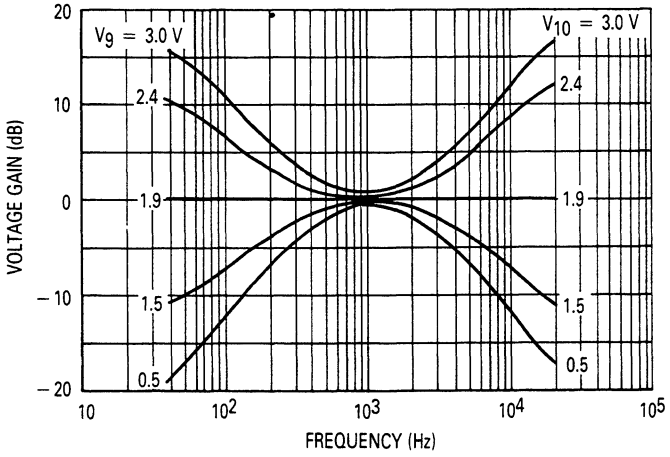


FIGURE 10 — TONE CONTROL RESPONSE WITH DOUBLE POLE LOW-PASS FILTER

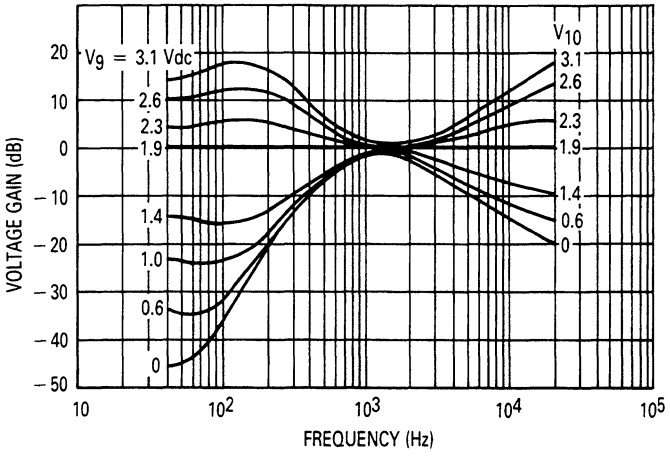


FIGURE 11 — SINGLE POLE LOW-PASS FILTER

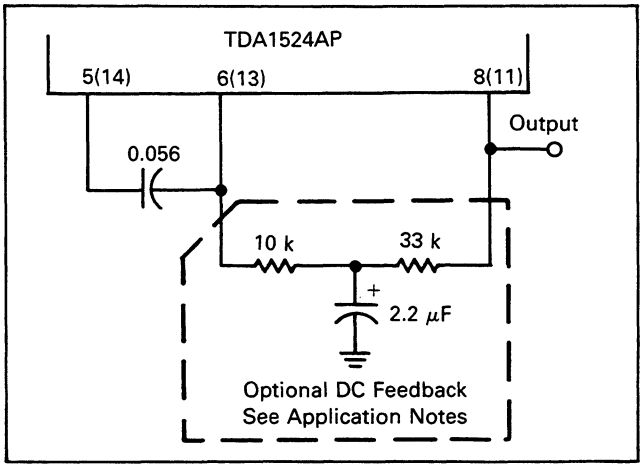


FIGURE 12 — DOUBLE POLE LOW-PASS FILTER

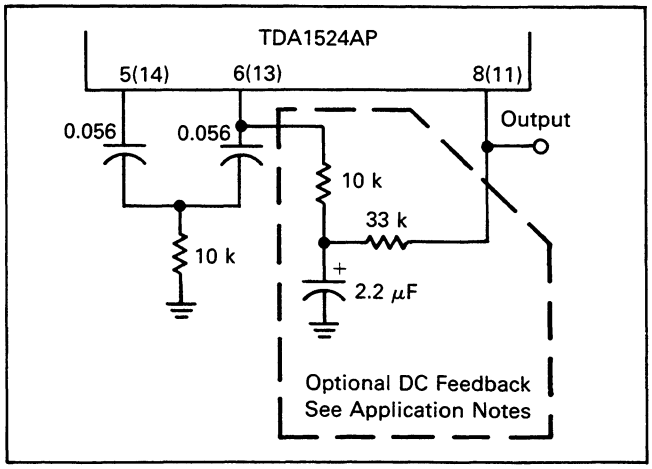


FIGURE 13 — VOLUME CONTROL RESPONSE WITH SINGLE POLE LOW-PASS FILTER

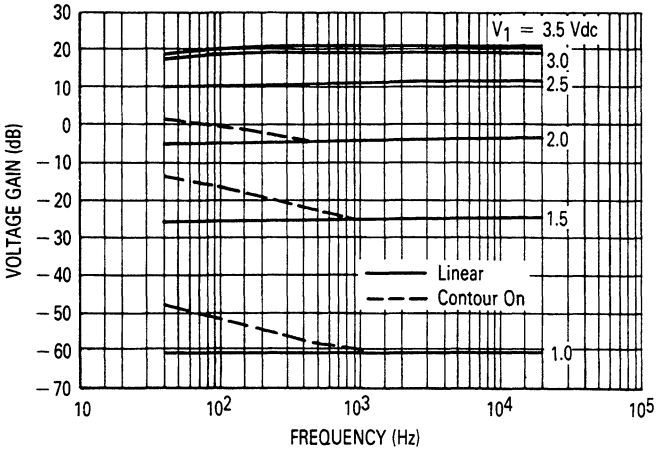


FIGURE 14 — VOLUME CONTROL RESPONSE WITH DOUBLE POLE LOW-PASS FILTER

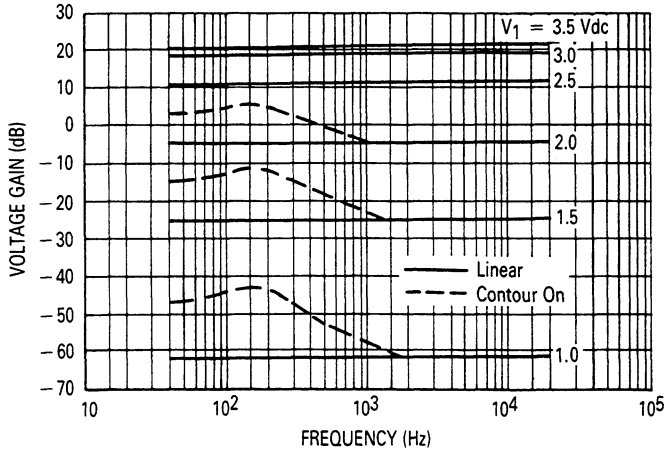
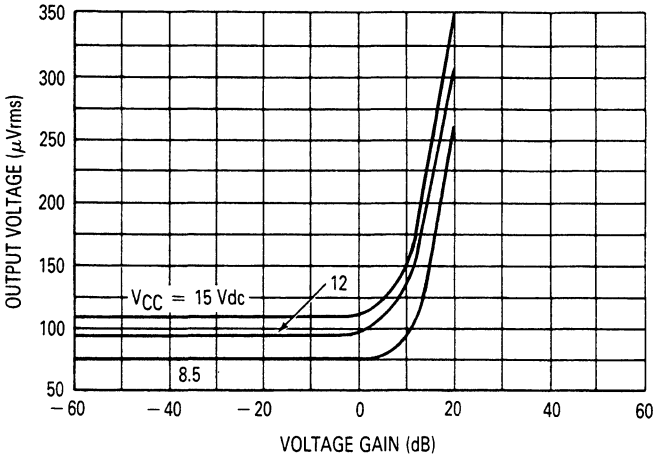


FIGURE 15 — NOISE OUTPUT VOLTAGE
(20 Hz to 20 kHz)



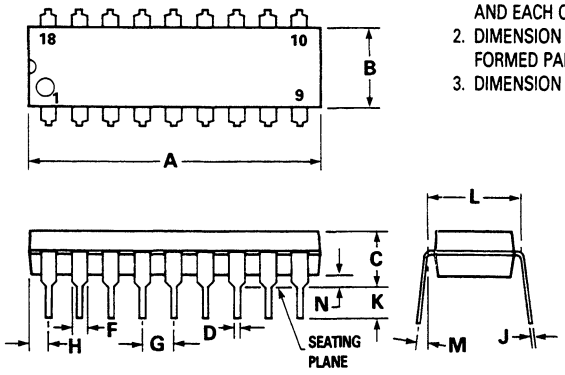
APPLICATION NOTES

The use of optional dc feedback stabilizes the dc output voltage at approximately $V_{CC}/2$ and assures large output swing capability without distortion. If this dc feedback is not used, the dc output will vary from part to part and available headroom will be somewhat reduced.

The loading of the regulator output, Pin 17 has an abrupt effect on switching the contour function and is not intended to be applied in any intermediate degree. The tests assure that the part is in linear mode for total loading of Pin 17 less than 3.0 kΩ, and is in contour mode for a total load on Pin 17 greater than 10 kΩ.

OUTLINE DIMENSIONS

NOTES:
1. POSITIONAL TOLERANCE OF LEADS (D), SHALL BE WITHIN 0.25mm(0.010) AT MAXIMUM MATERIAL CONDITION, IN RELATION TO SEATING PLANE AND EACH OTHER.
2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.



	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	22.22	23.24	0.875	0.915
B	6.10	6.60	0.240	0.260
C	3.56	4.57	0.140	0.180
D	0.36	0.56	0.014	0.022
F	1.27	1.78	0.050	0.070
G	2.54 BSC		0.100 BSC	
H	1.02	1.52	0.040	0.060
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.51	1.02	0.020	0.040

CASE 707-02
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