SGS-THOMSON MICROELECTRONICS

TDA7284

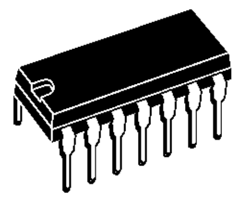
RECORD/PLAYBACK CIRCUIT WITH ALC

ADVANCE DATA

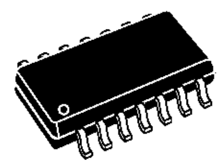
- WIDE OPERATING SUPPLY VOLTAGE (3V to 12V)
- VERY LOW INPUT NOISE (V_I = 1.2μV)
- INTERNAL COMPENSATION FOR HIGH GAIN APPLICATION (DOUBLE SPEED RECORDING)
- BUILT-IN ALC CIRCUITRY
- GOOD SVR
- DC CONTROLLED SWITCHES FOR MUTE OR EQUALIZATION SWITCHING FUNCTIONS

DESCRIPTION

The TDA7284 is a monolithic integrated circuit in a DIP/SO-14 designed for 6V, 9V and 12V AC/DC portable cassette equipment application.



DIP14

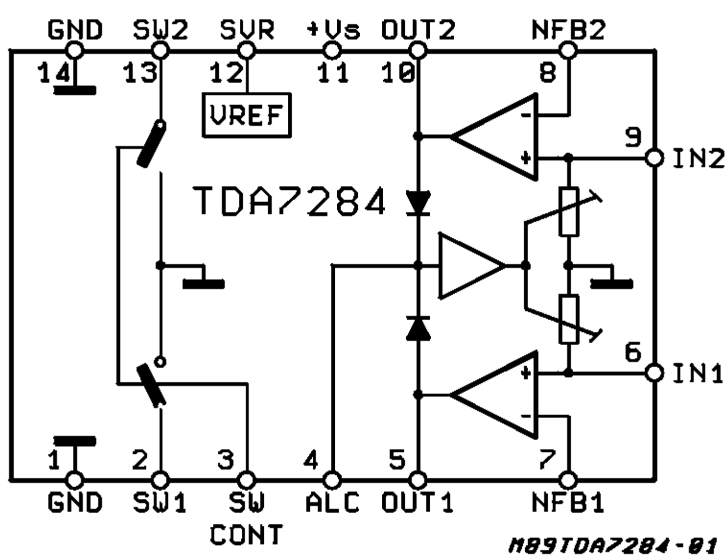


SO14

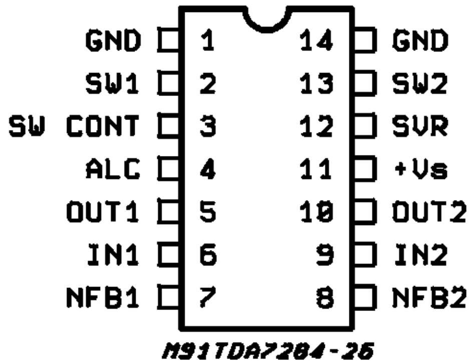
ORDERING NUMBER:

TDA7284 TDA7284D

BLOCK DIAGRAM



PIN CONNECTION (Top view)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	Supply Voltage	14	V
T_{OP}	Operating Temperature Range	-20 to 70	°C
T_{stg}, T_j	Storage and Junction Temperature Range	-40 to 150	°C

THERMAL DATA

Symbol	Description		S014	DIP14	Unit
$R_{th\ j\text{-}amb}$	Thermal Resistance Junction-ambient	Max	200	120	°C/W

DC CHARACTERISTICS (T_{amb} = 25°; V_S = 6V; V_i = 0V; R_i = 10KΩ; ALC = OFF)

Terminal No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Terminal Voltage (V)	0	0	0	0	2.6	0	1.3	1.3	0	2.6	6	4.6	0	0

Figure 1: Test and Application Circuit

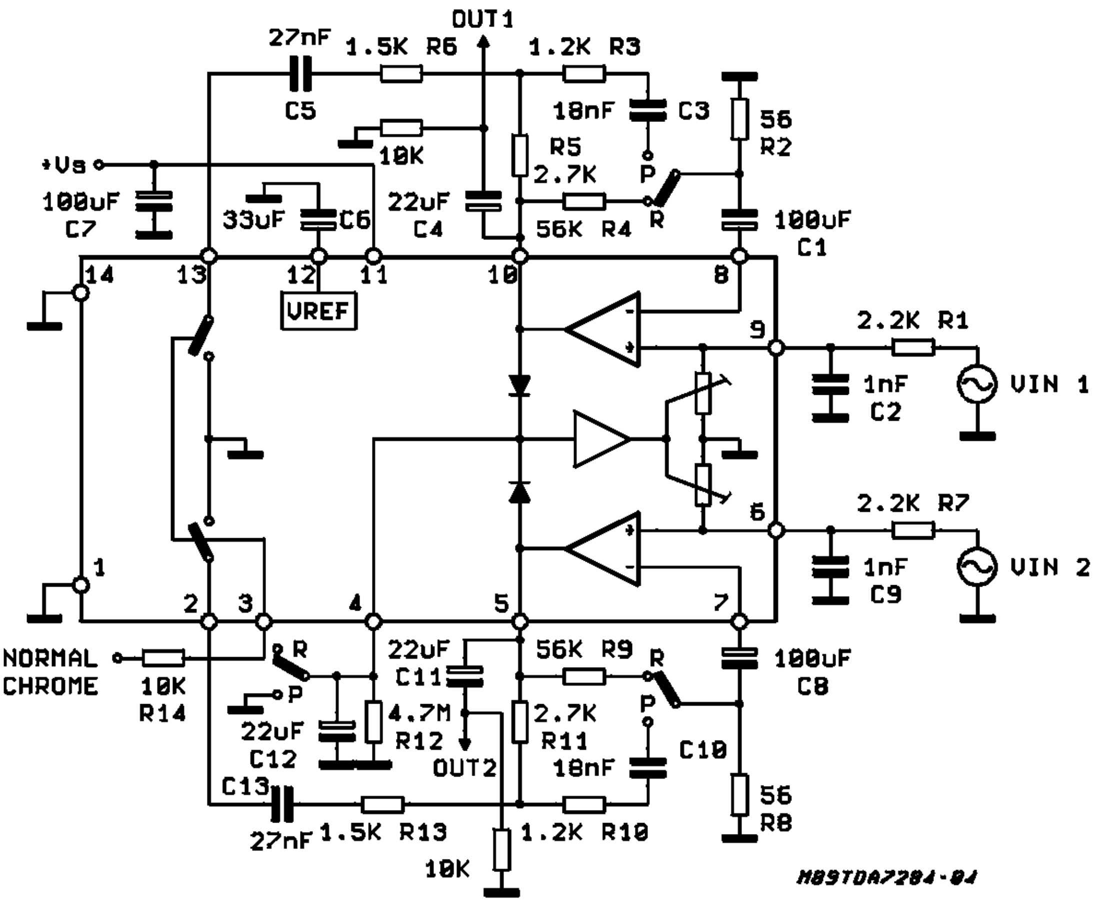
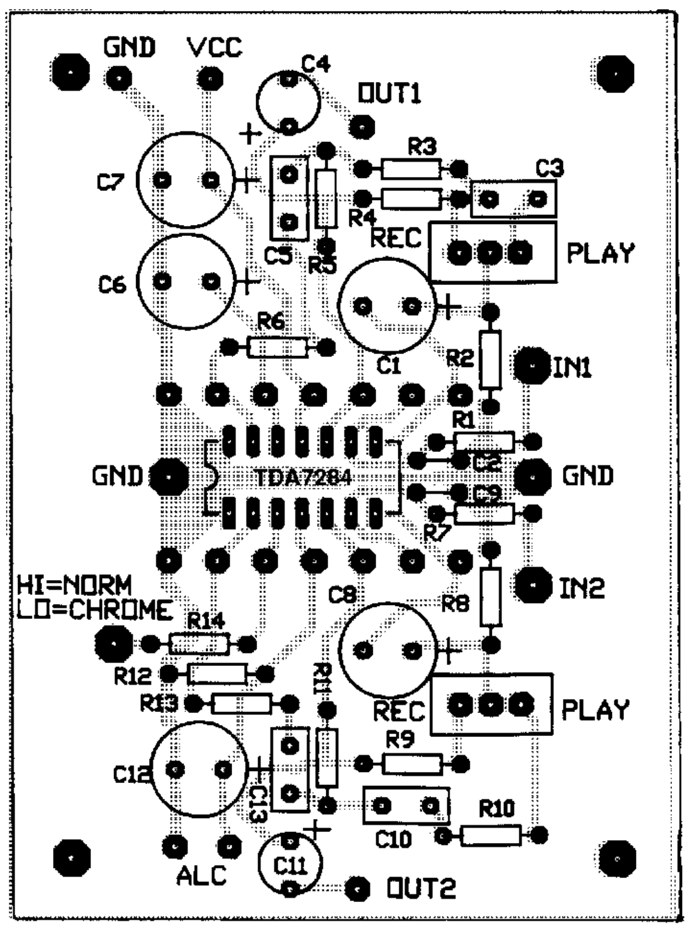


Figure 2: P.C. Board and Component Layout of the Circuit of Fig. 1 (1:1 scale).



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ELECTRICAL CHARACTERISTICS (V_S = 6V, T_{amb} = 25°C unless otherwise specified refer to test circuit)

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
V_S	Supply Voltage			3		12	V
I_d	Quiescent Current				4.5	8	mA
E_n	Input Noise	R_g = 2.2KΩ BW = 22Hz to 22kHz			1.2		µV
R_I	Input Resistance			30	50	70	KΩ
G_O	Open Loop Gain			65	78		dB
V_O	Output Voltage	THD ≤ 1%	ALC OFF ALC ON	1.2 0.7	1.8 0.9	 1.1	V_{rms} V_{rms}
THD	Total Harmonic Distortion	V_O = 1V_{rms} ALC = ON V_I = 100mV			0.1 0.3	0.5 1	% %
	ALC Range	ΔV_O = 3dB			47		dB
CB	Channel Balance	ALC ON			0	2	dB
SVR	Supply Voltage Rejection	f = 120Hz, C_{SVR} = 33µF V_R = 100mV, R_g = 10KΩ ALC = Off			50		dB
CS	Cross-talk	ALC OFF			70		dB
Pin 3	Turn Off Threshold	I_O = <1µA		0.8	1.3		V
Pin 3	Turn On Threshold				1.7	2.25	V
Pin 3	Turn On Saturation	R_L = 10KΩ			0.1	0.2	V

Figure 3: Drain Current vs. Supply Voltage

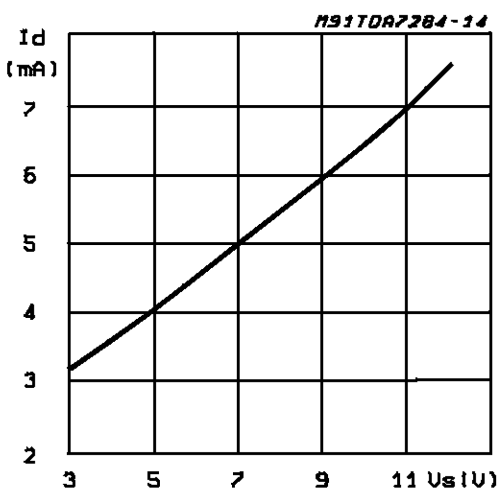
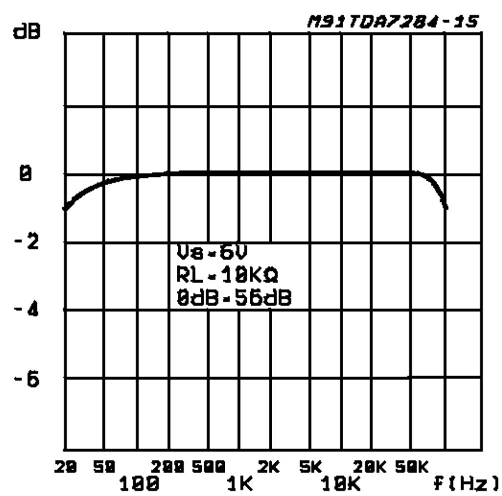


Figure 4: Recording Closed Loop Gain vs. Frequency



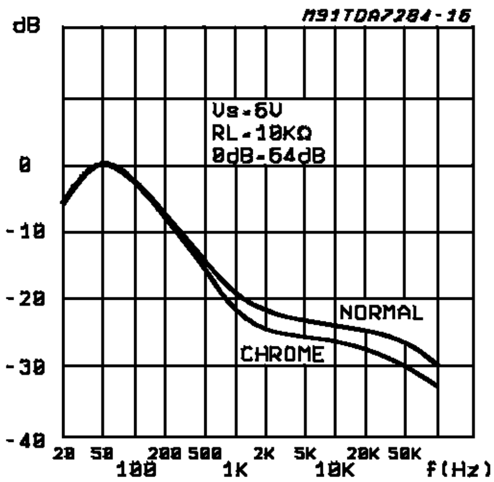


Figure 5: Playback Closed Loop Gain vs Frequency

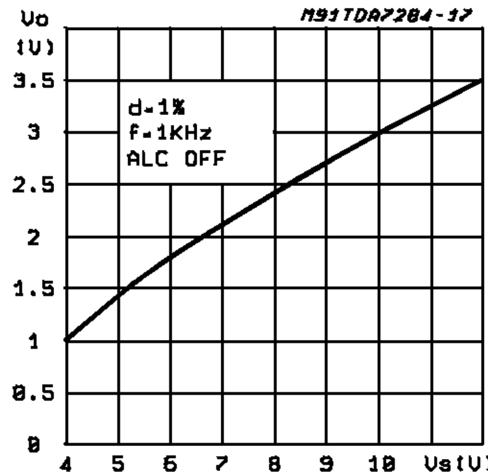


Figure 6: Normalized Output Voltage vs. Supply Voltage

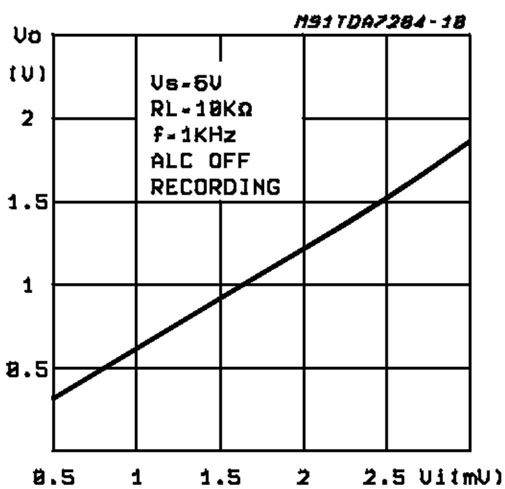


Figure 7: Output Voltage vs. Input Voltage

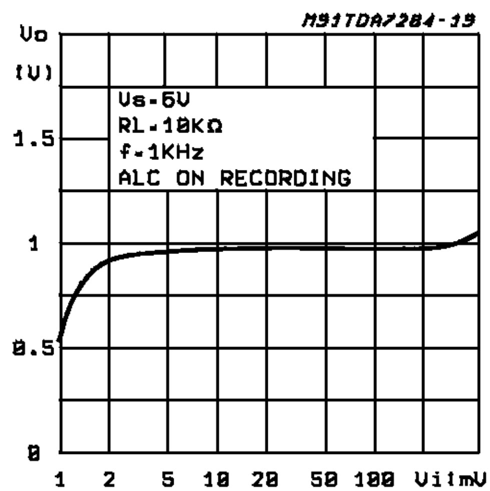


Figure 8: Output Voltage vs. Input Voltage

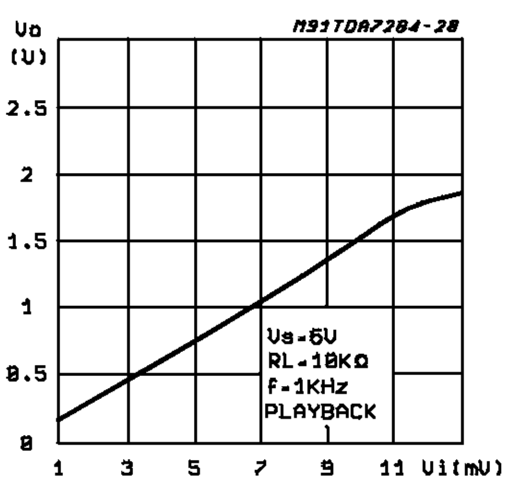


Figure 9: Output Voltage vs. Input Voltage

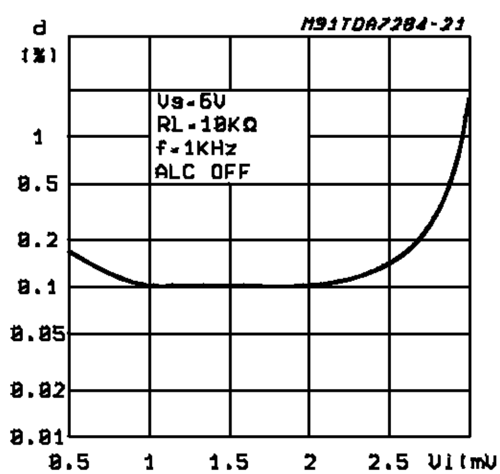


Figure 10: Distortion vs. Input Voltage

Figure 11: Distortion vs. Input Voltage

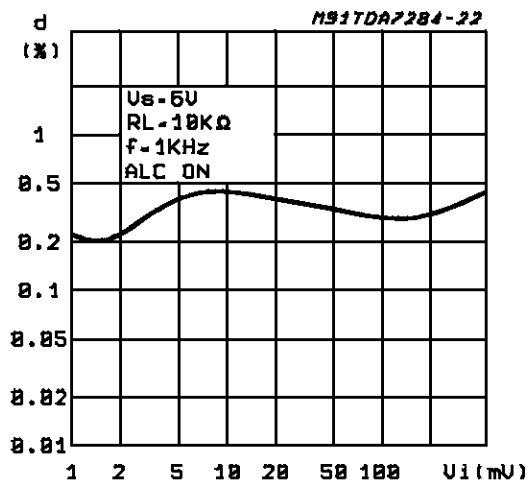


Figure 12: SVR vs. Frequency (ALC = Off)

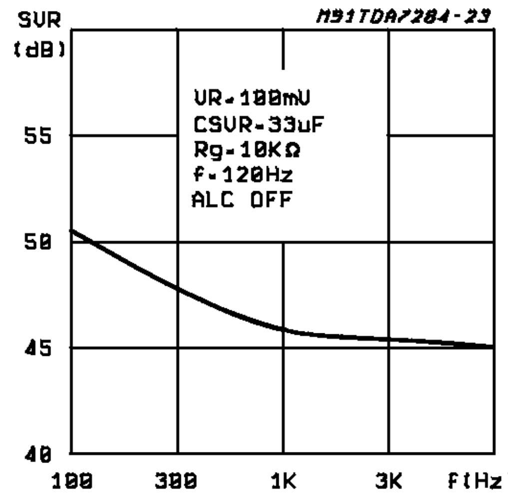


Figure 13: Crosstalk vs. Frequency (ALC = Off)

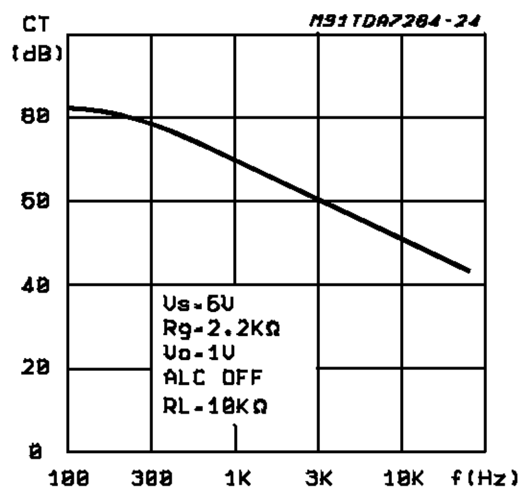
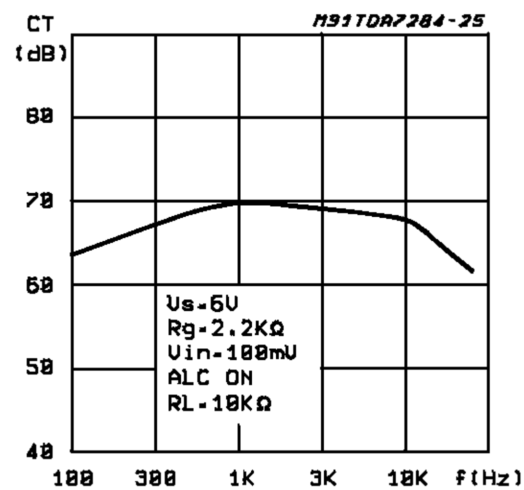


Figure 14: Crosstalk vs. Frequency (ALC = Off)



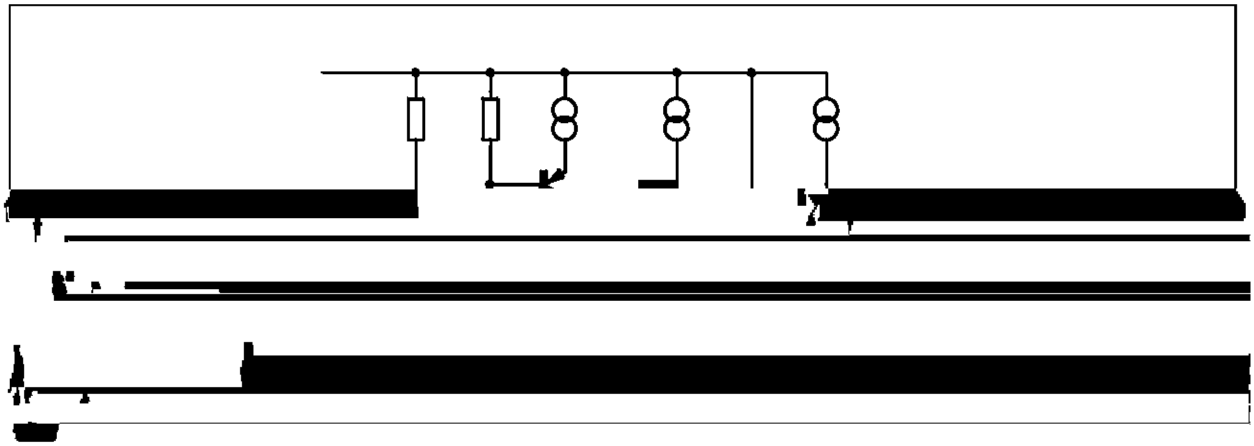
CIRCUIT DESCRIPTION

OPERATIONAL AMPLIFIER

The operational amplifier consists essentially of a very low noise input stage decoupled from the single-ended output stage by means of an emitter follower (fig. 15).

The compensations provided in order to have high gain bandwith product allowing the use for double speed recording application.

Figure 15



[redacted]

the tape and which optimizes the signal to noise ratio even there are notable variations in the input signal.

Before presenting the ALC circuit of TDA7284 it is worth describing the operation of the automatic level control as a system.A diagram showing the basis of operation is given in fig.16.

Figure 16: Basic Diagram of the ALC stage

by means of a peak-to-peak detector) into a continuous voltage which drives the networks indicated by T and Rd.

The element T transforms the continuous voltage level into a signal capable of modifying the circuit conditions symbolized by variable resistor Rd.

The value assumed by the resistor Rd is a function of the output signal level Vo and is such that the voltage Vc at the input of the op-amp is constant,even variations of Vi are present.Obviously if Vo is less than a certain value the system is not controlled.

In this case :

$$V_I = V_C = V_O / G_V$$

(G_V is the gain of the op-amp)

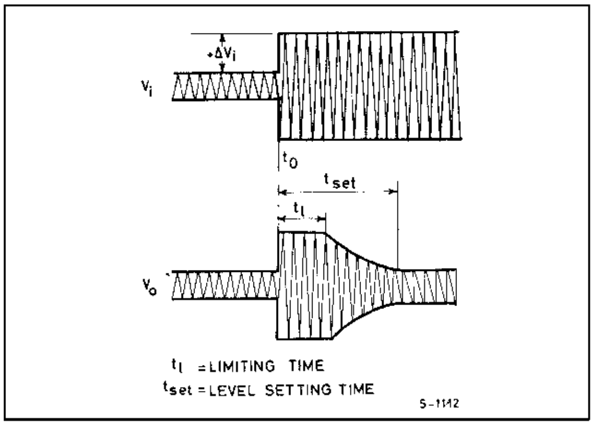
For the TDA7284 the value of V_o below which the system is not controlled is around 1 Vrms.

Let us now consider the speed of response of the system (when controlled) to positive and negative changes of the input signal i.e. the limiting time,the time for return to nominal level (1 Vrms) and the recovery time.

Limiting time, and time for return to nominal level.

[redacted]

Figure 17: Limiting and Level Setting Time



Usually such an increase drives the op-amp into saturation and the time for which it remains in this condition is called the limiting time(T1).

T1 depends on the relationship between the external capacitances, the time constant T=R1 • C1, the supply voltage and the signal variation.

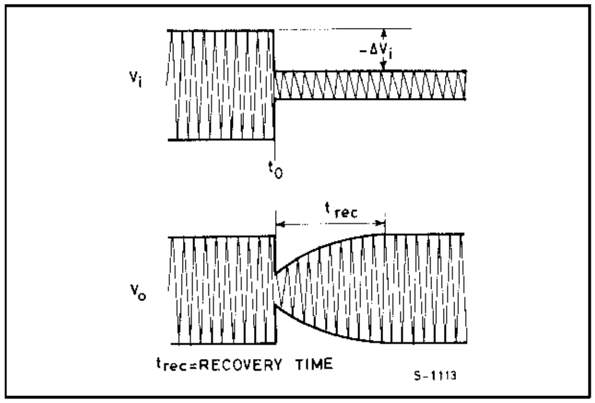
The criteria for choosing the length of T1 are the result of several compromises. In particular if T1 is too long, there will be audible distortion during playback (during T1 the output is a square wave),and if it is too short, the sensation of increased level will be lost while dynamic compression phenomena and instability may occur.

The time for return to nominal level is defined as the total time between the instant To and the instant in which the output reassumes the nominal value. This time (Ts) is roughly equal to 5 • T1.

On the basis of tests carried out it has been found that a musical signal with high dynamic range (ΔV_I =+40 dB) is to be recorded, the best value of Ts is between 200 and 300ms.

Recovery time.
let us now suppose that at the instant To the input signal decreases of ΔVi (fig. 18).

Figure 18: Recovery Time



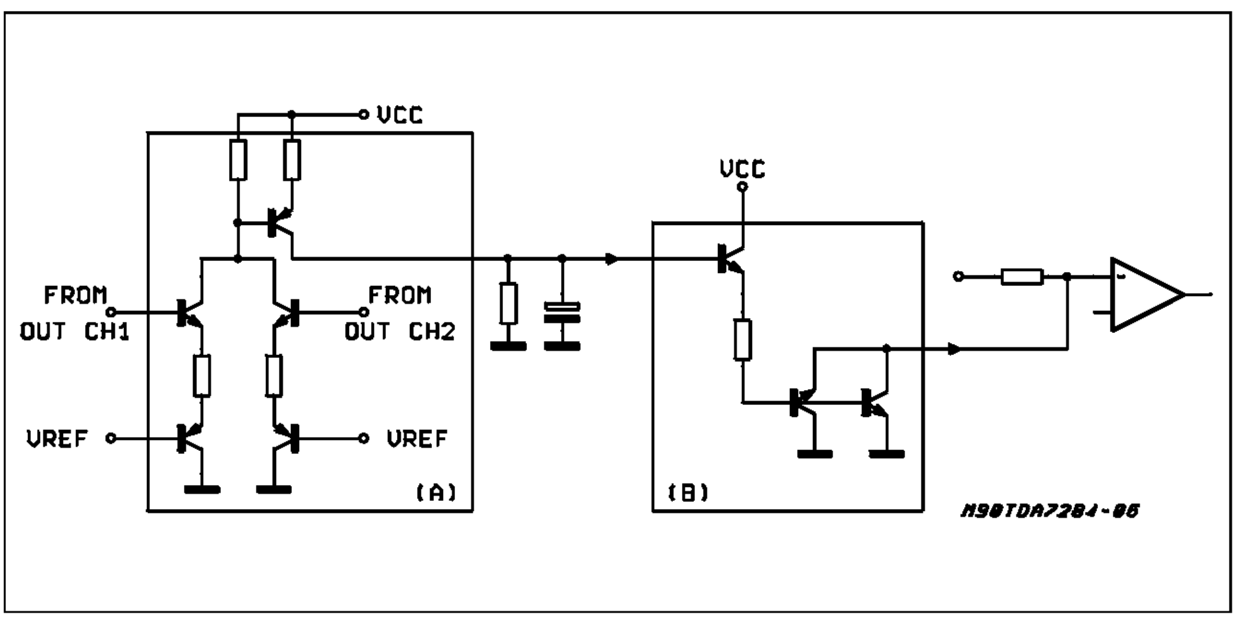
The recovery time (Trec) is defined as the time between the instant To and the instant in which the output signal returns to the nominal level.

This time depends essentially on the discharge time constant of R2 • C2 (see fig. 16) and on the size of the step -ΔVi. In this case too, if this time is too long the signal to noise ratio on the tape deteriorates.

If it is too short the sensation of the low signal level is lost during playback.

The ALC system of the TDA7284
Fig. 16 becomes the following (fig. 19) where the

Figure 19



peak-to-peak detector of fig. 16 is now inside the broken line 1 while the system which allows a dinamic resistance varying with the DC voltage level (i.e. inversely proportional to the op-amp output signal),is inside the broken line 2.

It should be noted that the generator resistance Ri has no influence on the controlled voltage value Vc, although its value should be between 1 and 47 Kohm.

The lower limit is determined by the minimum dynamic resistance of 10 ohm and therefore to have a control range of 40 dB for the input signal, Ri must be greather than 1.5 Kohm.

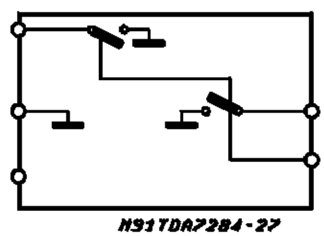
The upper limit results from the necessity to limit the attenuation of the signal by the input impedance of the op-amp.

Switches

Two DC-controlled switches are also included in the chip (fig. 20)

Fig. 19 shows the typical application circuit of the TDA7284 utilizing the equalization switch for normal or chrome tape playback equalization.The advantage is the components can be placed near

Figure 20



to the IC, while the tape selector switch can be at a remote location, hence reduce the chances of noise and oscillation due to components layout. Another advantage is that only one pole is needed for the tape selector switch as compared to the two poles needed by conventional circuits (one separate pole for each channel).

Fig. 22 shows the use of the switches to obtain the mute function.

Figure 21: Application Circuit with DC Switching of Normal/Chrome Tape Equalization

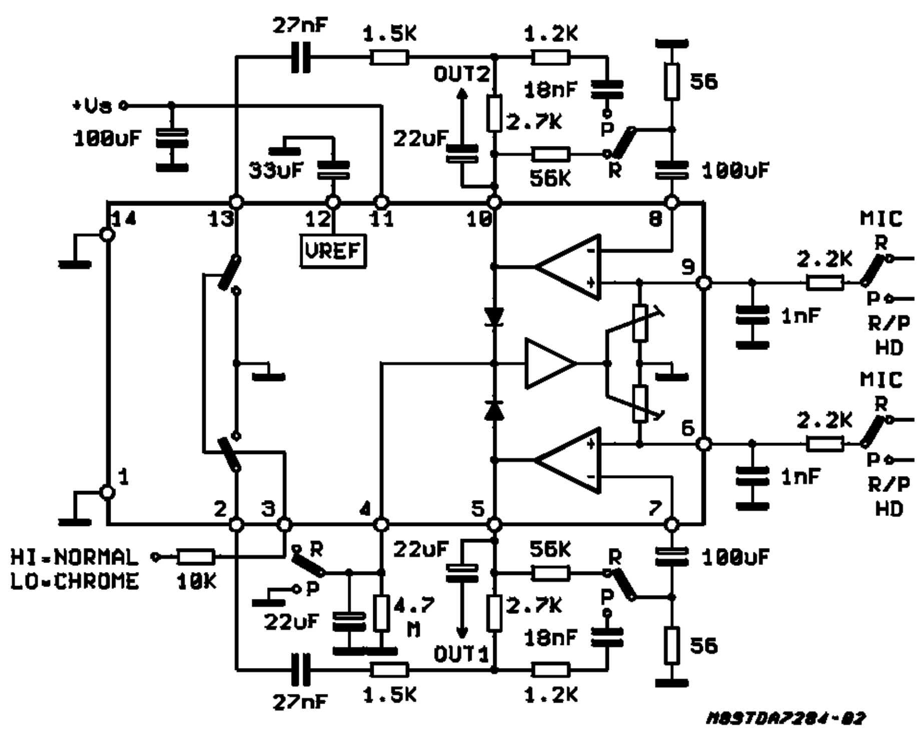


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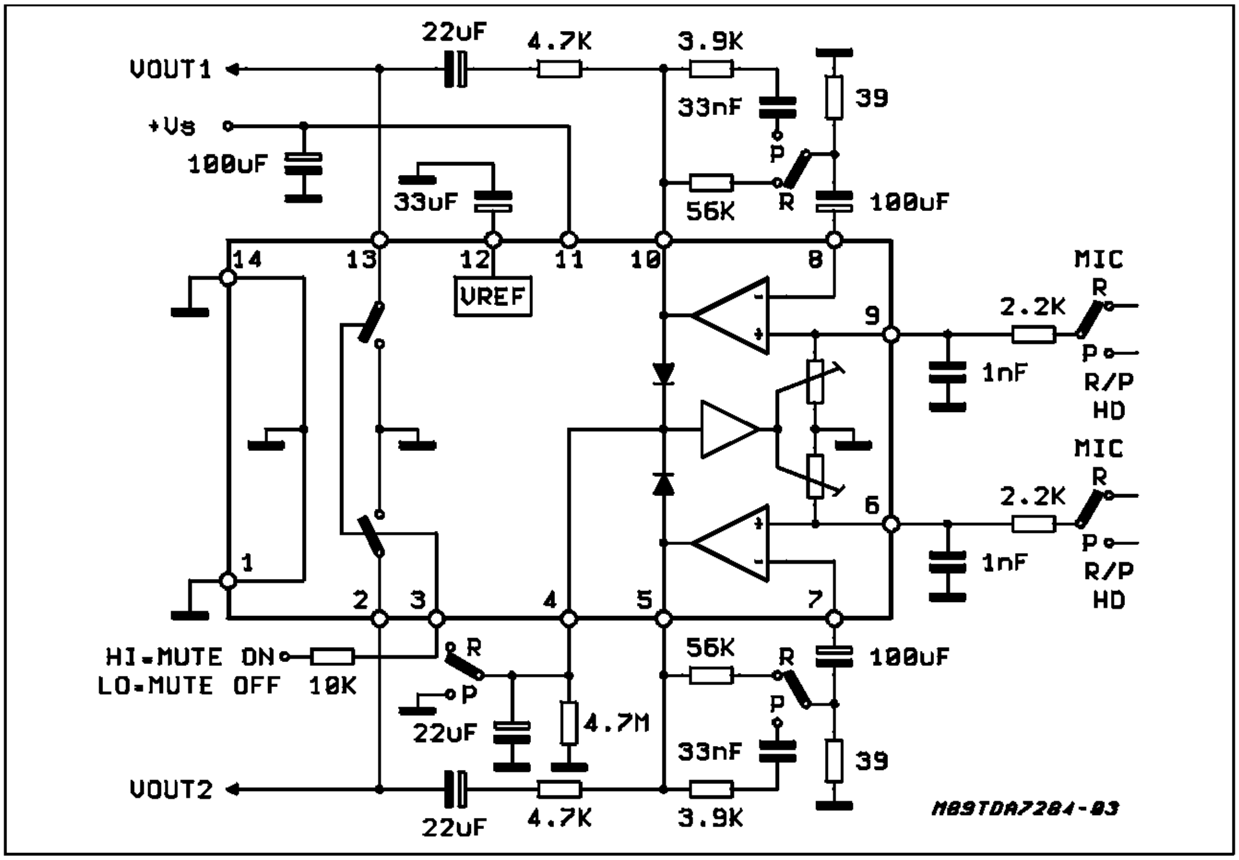
Figure 22: Application Circuit with Output Muting



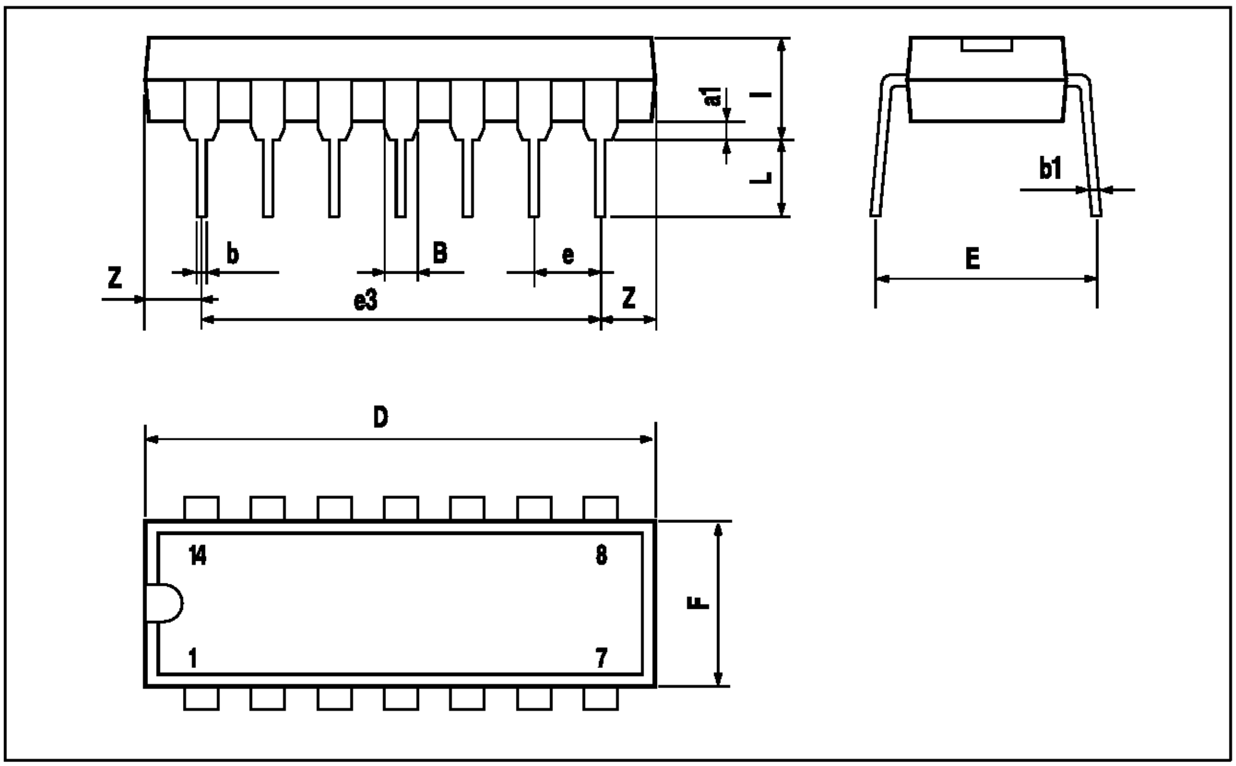
SVR

A refernce circuit is enclosed to provide a stable voltage and to supply a stable current to all current mirrors.

SVR capacitor is also connected to this block for good ripple rejection.

DIP14 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100



SO14 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.069
a1	0.1		0.2	0.004		0.008
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.15		0.157
L	0.5		1.27	0.020		0.050
M			0.68			0.027
S	8° (max.)