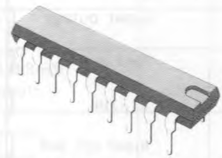
SGS-THOMSON
MICROELECTRONICS

LM1837

DUAL LOW NOISE TAPE PREAMPLIFIER WITH AUTOREVERSE

- PROGRAMMABLE TURN-ON DELAY
- TRANSIENT-FREE MUTING AND POWER-UP – NO POPS
- LOW-NOISE – 0.6 µV CCIR/ARM
- HIGH POWER SUPPLY REJECTION – 95dB
- LOW DISTORTION – 0.03% AND HIGH SLEW RATE – 6V/µs
- SHORT CIRCUIT PROTECTION
- INTERNAL DIODES FOR DIODE SWITCHING APPLICATIONS

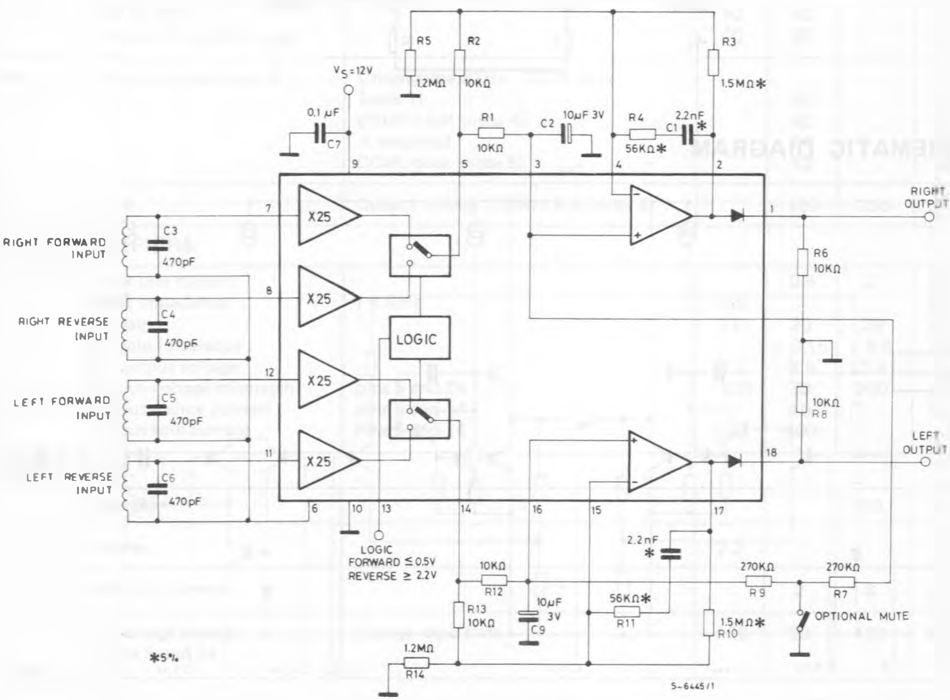
The LM1837 is a dual autoreversing high gain tape preamplifier for applications requiring optimum noise performance. It has forward (left, right) and reverse (left, right) inputs which are selectable through a high impedance logic pin. It is an ideal choice for a tape playback amplifier when a combination of low noise, autoreversing, good power supply rejection, and no power-up transients are desired. The application also provides transient-free muting with a single pole grounding switch.



DIP-18 Plastic

ORDERING NUMBER: LM1837

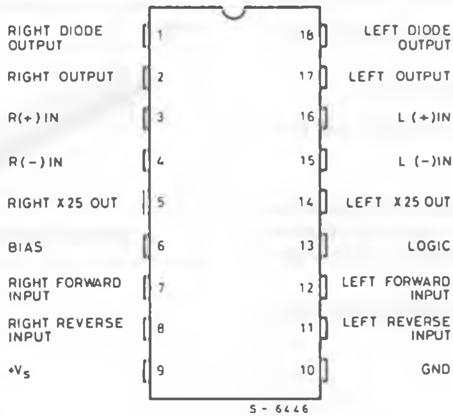
Fig. 1 – Autotoreversing tape plyback application



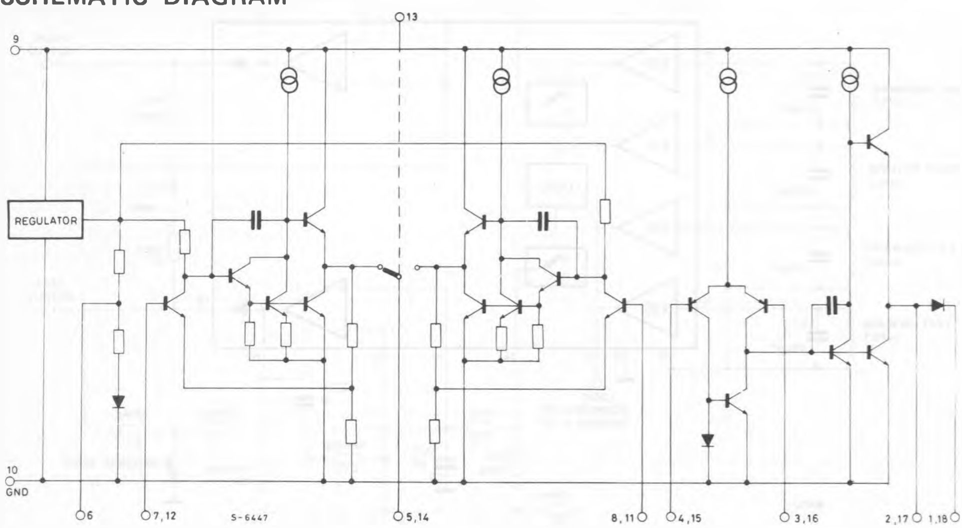
ABSOLUTE MAXIMUM RATINGS

V_S	Supply voltage	18	V
	Voltage on pins 1 and 18	18	V
P_{tot}	Package dissipation	1390	mW
T_{stg}	Storage temperature	-65 to 150	°C
T_{op}	Operating temperature	0 to 70	°C
	Minimum voltage on any pin	-0.1	V

CONNECTION DIAGRAM
(top view)



SCHEMATIC DIAGRAM



THERMAL DATA

$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	90	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, V_S = 12V, see test circuits)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_S	Supply voltage	R5 removed from circuit for low voltage operation	4		18	V
I_S	Supply current	V_S = 12V		9	15	mA
d	Total harmonic distortion	f = 1KHz V_i = 0.3mV pins 2 and 17, see test circuit		0.03		%
	THD + noise (note 1)	f = 1KHz V_o = 1V pins 2 and 17, see test circuit		0.1	0.25	%
SVR	Power supply rejection	input ref. f = 1KHz, 1 Vrms	80	95		dB
C_S	Channel separation (note 2)	f = 1KHz, output = 1 Vrms Output to output				
	Left to right		40	60		dB
	Forward to reverse		40	60		dB
S/N	Signal-to-noise (note 3)	Unweighted 32Hz - 12.74 KHz (note 1)		58		dB
		CCIR/ARM (note 4)		62		dB
		A weighted		64		dB
		CCIR, peak (note 5)		52		dB
e_N	Noise	Output voltage CCIR/ARM (note 4)		120	200	µV

INPUT AMPLIFIERS

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_b	Input bias current			0.5	2	µA
	Input impedance	f = KHz	150			KΩ
	AC gain		27	28	29	dB
	AC gain imbalance			± 0.15	± 0.5	dB
V_O	DC output voltage		2.1	2.5	2.9	V
V_O	Output voltage mismatch	pins 5 and 14	- 200	30	200	mV
I_O+	Output source current	pins 5 and 14	2	10		mA
I_O-	Output sink current	Pins 5 and 14	300	600		µA

LOGIC LEVEL

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
	Forward				0.5	V
	Reverse		2.2			V
	Logic pin current			2	6	µA
	DC voltage change at pins 5 and 14	Change logic state	-100	20	100	mV

ELECTRICAL CHARACTERISTICS (continued)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
OUTPUTS AMPLIFIERS						
	Closed loop gain	stable operation	5			V/V
G_v	Open loop voltage gain	DC		100		dB
	Gain bandwidth product			5		MHz
	Slew rate			6		V/µs
V_{OS}	Input offset voltage			2	5	mV
I_{OS}	Input offset current			20	100	nA
I_I	Input bias current			250	500	nA
I_O+	Output source current	Pin 2 or 17	2	10		mA
I_O-	Output sink current	Pin 2 or 17	400	900		µA
V_O	Output voltage swing	Pin 2 or 17		11		Vp-p
	Output diode leakage	Voltage on pins 1 and 18 = 18V		0	10	µA

Note:

1 – Measured with an average responding voltmeter using the filter circuit in figure 4. This simple filter is approximately equivalent a "brick wall" filter with a passband of 20Hz to 20KHz (see Application Hints). For 1KHz THD the 400Hz high pass filter on the distortion analyzer is used.

2 – Channel separation can be measured by applyng the input signal through transformers to simulate a floating source (see Application Hints). Care must be taken to shield the coils from extraneous signal. Actual production test techniques simulate this floating source with a more complex op amp circuit.

3 – The numbers are referred to an output level of 160mV at pins 2 and 17 using the circuit figure 2. This corresponds

4 – Measured with an average responding voltmeter using the Dolby lab's standard CCIR filter having a unity gain reference 2KHz.

5 – Measured using the Rhode-Schwartz psophometer, mode UPGR.

Fig. 2 – Test circuit

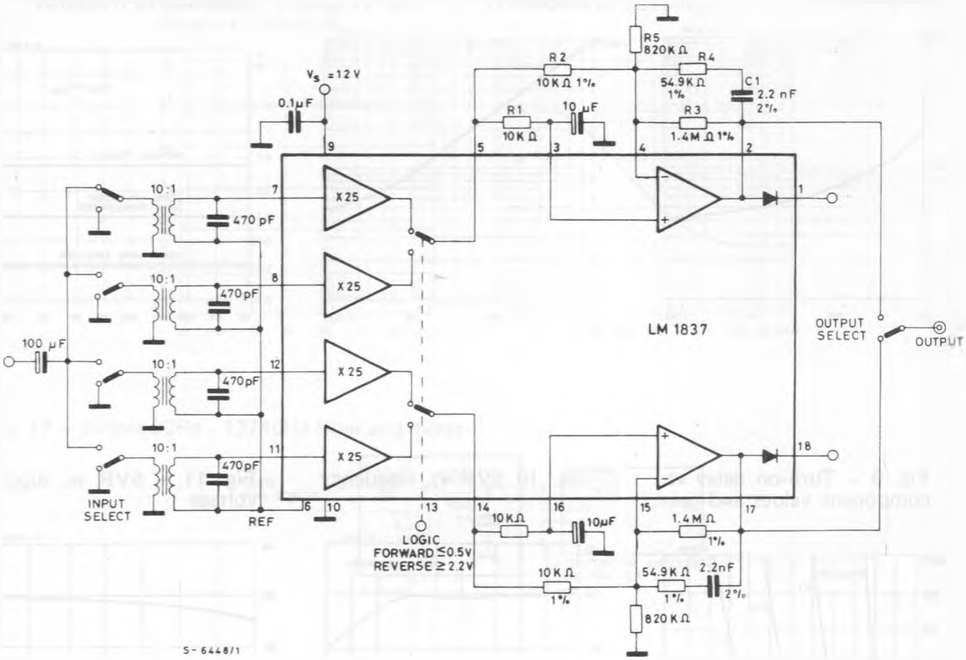


Fig. 3 – Input amplifier distortion vs. input level

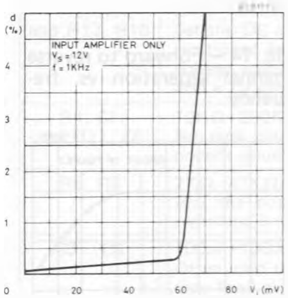


Fig. 4 – Input amplifier gain and phase vs frequency

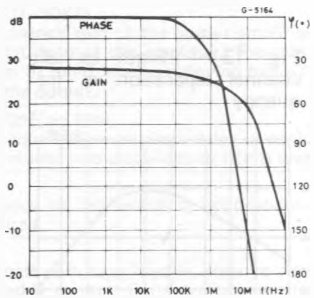


Fig. 5 – Output amplifier open loop gain and phase vs. frequency

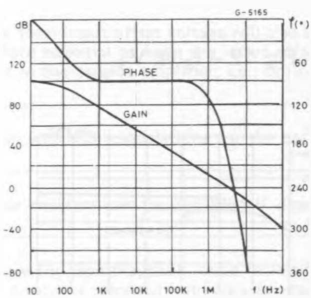


Fig. 6 – Noise voltage vs. frequency

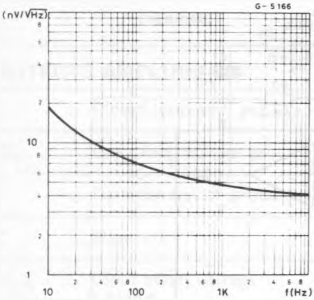


Fig. 7 – Noise current vs. frequency.

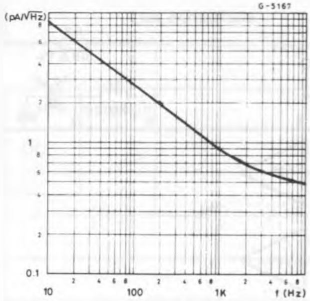


Fig. 8 – Total harmonic distortion vs. frequency

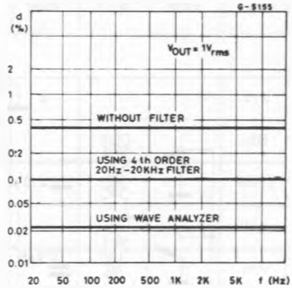


Fig. 9 – Turn-on delay vs. component values and gain

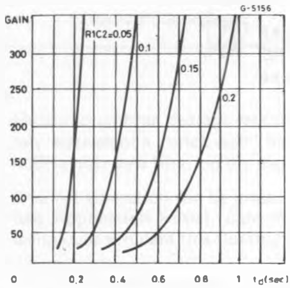


Fig. 10 SVR vs. frequency

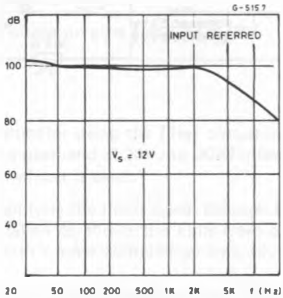


Fig. 11 – SVR vs. supply voltage

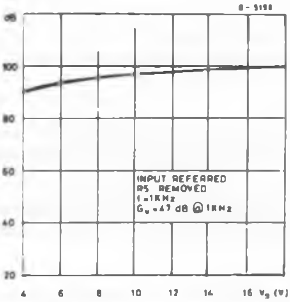


Fig. 12 – I_S vs. V_S

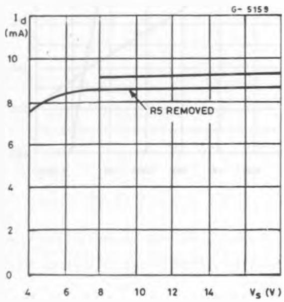


Fig. 13 – Rigth to left channel separation vs. frequency

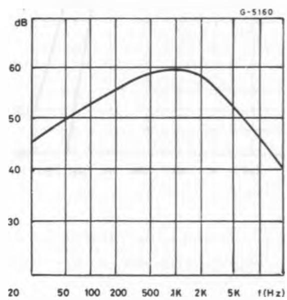


Fig. 14 – Forward to reverse channel separation vs. frequency

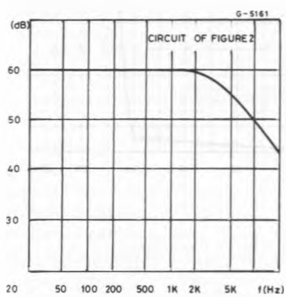


Fig. 15 — Input amplifier DC output voltage vs. temperature (pins 5, 4)

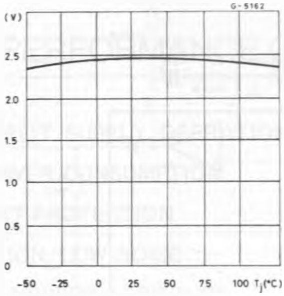


Fig. 16 — Frequency response of test circuit

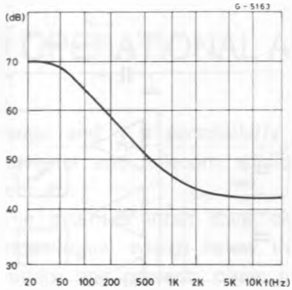
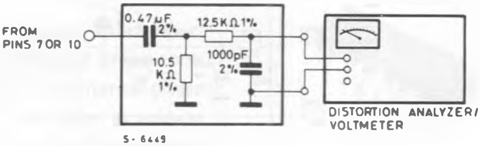


Fig. 17 — Simple 32Hz - 12740Hz filter and meter



APPLICATION INFORMATION

EXTERNAL COMPONENTS (Figures 1 and 18)

Component	Normal Range of Value and Function
R1, C2 and R12, C9	2KΩ-40KΩ, 0.1µF-10µF (low leakage). Set turn-on delay and second amplifier's low frequency pole. Leakage current in C2 results in DC offset between the amplifier's inputs and therefore this current should be kept low. R1 is set equal to R2 such that any input offset voltage due to bias current is effectively cancelled. An input offset voltage is generated by the input offset current multiplied by the value of these resistors.
R2, R3 and R13, R10	2KΩ-40KΩ, 500KΩ-10KΩ. Set the DC and frequency gain of the output amplifier. The total input offset voltage will also be multiplied by the DC gain of this amplifier. They are threfore essential to keep the input offset voltage specification in mind when employing high DC gain in the output amplifier; i.e., 5mV x 400 = 2V offset at the output.
R4, C1 and R11, C8	10KΩ-200KΩ, 470pF to 10nF. Set tape playback equalization characteristics in conjunction with R3 (calculations for the component values are included in the application (Hints section).
R6, R8	2KΩ-47KΩ. Bias the output diode in DC switching applications. These resistors can be excluded if diode switching is not desired.
C3...C6	100pF-1000pF Often used to resonate with tape head in order to compensate for tape playback losses including tape head gap and eddy current. For a typical cassette tape head, the resonant frequency selected is usually between 13KHz and 17KHz.
R5, R14	100KΩ-10MΩ. Increase the output DC bias voltage from the nominal 2.5V value (see Application information).
R7, R9	Optionally used for tape muting. The use of these resistor can also provide "no-pop" turn-off if desired (see Application information).

APPLICATION INFORMATION (continued)

Fig. 18 - Autoreversing tape plyback application.

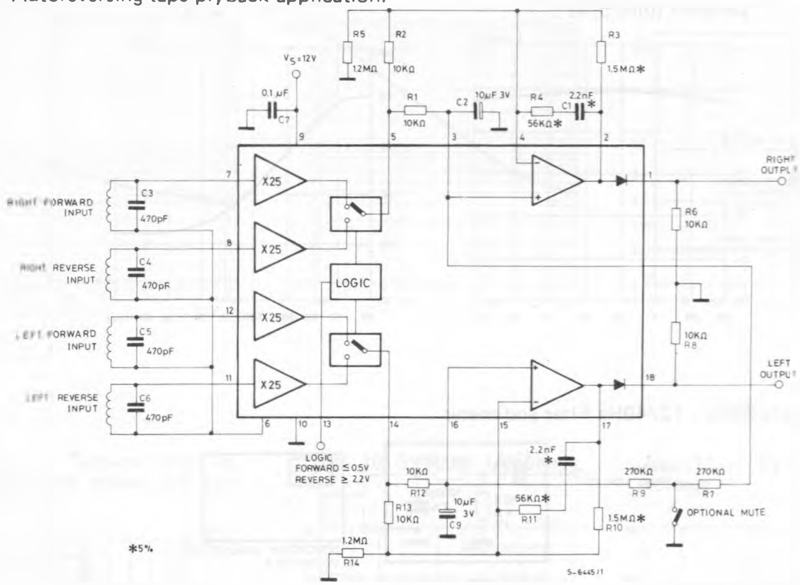


Fig. 19 - P.C. board and components layout of the circuit of Fig. 18 (1 : 1 scale)