

LM1131A/LM1131B/LM1131C

Dual Dolby® B-Type Noise Reduction Processor

General Description

The LM1131 is a monolithic integrated circuit specifically designed to realize the Dolby B-Type noise reduction system.

The circuit includes two completely separate noise reduction processors and will operate in both encode and decode modes. It is ideal for stereo applications in compact equipment or for mono applications in 3-head equipment where two processors with very closely matched internal gains are required.

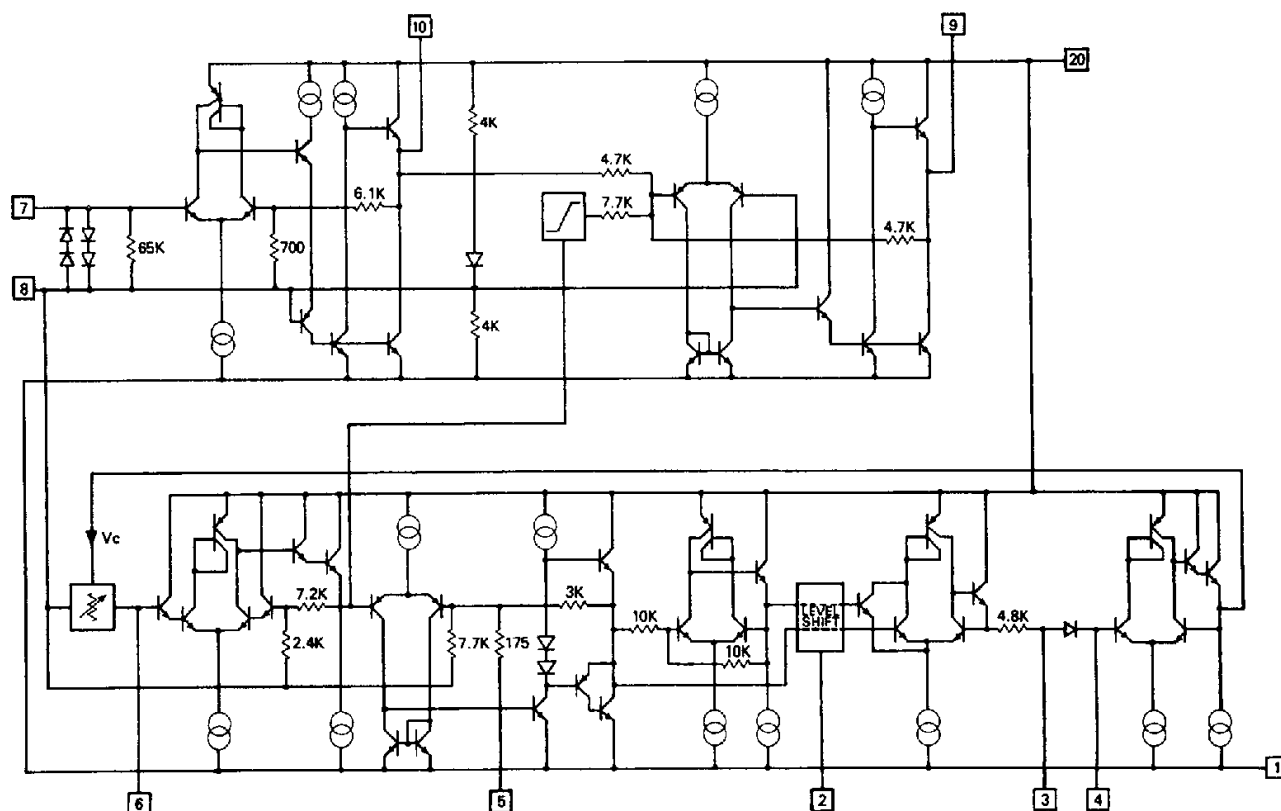
Features

- Stereo Dolby noise reduction with one IC

- Wide supply voltage range, 5V–20V
- Very high signal/noise ratio, 79 dB encode, 90 dB decode (CCIR/ARM)
- Very close gain matching for 3-head recorders
- Close matching to standard Dolby characteristics
- Very low temperature drift of Dolby characteristics
- High signal handling capability, $> +20$ dB ($V_S = 20$ V)
- Full-wave rectifier in both channels
- Operates with both single and split supply voltages
- Excellent transient response characteristics
- Minimal input switch-on transients
- Reduced number of external components per channel
- Improved input protection

Available to licensees of Dolby Laboratories Licensing Corporation, San Francisco, from whom licensing and application information must be obtained.

Schematic Diagram (1 channel shown only)



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Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	24V
Operating Temperature Range	-20°C to +70°C
Storage Temperature Range	-65°C to +150°C

Soldering Information

Dual-In-Line Package	260°C
Soldering (10 seconds)	
Small Outline Package	215°C
Vapor Phase (60 seconds)	
Infrared (15 seconds)	220°C

See AN-450 "Surface Mounting Methods and Their Effect on Product Reliability" for other methods of soldering surface mount devices.

Electrical Characteristics

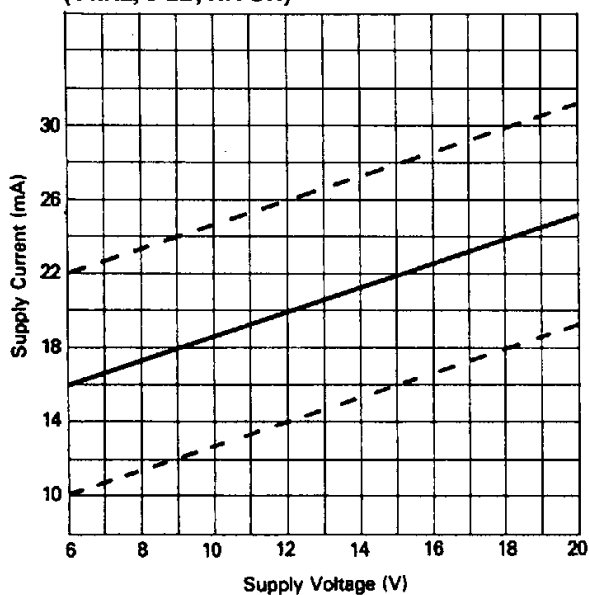
$V_S = 12V$, $T_A = 25^\circ C$ unless otherwise specified. 0 dB refers to Dolby level and is 580 mV, measured at TP1 and TP2.

Parameter	Conditions	LM1131A			LM1131B			LM1131C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Supply Voltage Range		5		20	5		20	5		20	V
Supply Current			20			20		20			mA
Voltage Gain (Pins 7-10 and 14-11)	1 kHz Decode	19.2	19.7	20.2	18.7	19.7	20.7	18.2	19.7	21.2	dB
(Pins 10-9 and 11-12)	1 kHz Decode	-0.5	0	0.5	-0.5	0	0.5	-1.0	0	1.0	dB
Difference in Voltage	1 kHz Noise	-0.2	0	0.2	-0.5	0	0.5	-1.0	0	1.0	dB
Gain between Channels	Reduction OFF										
Crosstalk between Channels	1 kHz, 0 dB	-60	-90		-60	-90		-60	-90		dB
Signal/Noise Ratio at Pins 9 and 12	(Note 1)										
Encode	$R_S = 10\text{ k}\Omega$	77	79		75.5	79		74	79		dB
	$R_S = 1\text{ k}\Omega$		82			82			82		dB
Decode	$R_S = 10\text{ k}\Omega$		90			90			90		dB
	$R_S = 1\text{ k}\Omega$		92			92			92		dB
Encode Characteristics	10 kHz, 0 dB	0	0.5	1.0	0.2	0.5	1.2	-0.5	0.5	1.5	dB
	1.3 kHz, -20 dB	-16.2	-15.7	-15.2	-16.7	-15.7	-14.7	-17.2	-15.7	-14.2	dB
	5 kHz, -20 dB	-17.3	-16.8	-16.3	-17.8	-16.8	-15.8	-18.3	-16.8	-15.3	dB
	3 kHz, -30 dB	-21.7	-21.2	-20.7	-22.2	-21.2	-20.2	-22.7	-21.2	-19.7	dB
	5 kHz, -30 dB	-22.3	-21.8	-23.0	-22.8	-21.8	-20.8	-23.3	-21.8	-20.3	dB
	10 kHz, -40 dB	-30.1	-29.6	-29.1	-30.3	-29.6	-28.9	-30.6	-29.6	-28.6	dB
Variation in Encode Characteristics											
Temperature	0°C-70°C		< ±0.5			< ±0.5			< ±0.5		dB
Voltage	5V-20V		< ±0.2			< ±0.2			< ±0.2		dB
Distortion	1 kHz, 0 dB		0.03	0.1		0.03	0.1		0.03	0.2	%
	10 kHz, 10 dB		0.2			0.2			0.2		%
Signal Handling	1 kHz, Dist = 0.3%										
	$V_S = 5V$		6.5			6.5			6.5		dB
	$V_S = 7V$		10.5			10.5			10.5		dB
	$V_S = 12V$	14.0	16.0		14.0	16.0		14.0	16.0		dB
	$V_S = 20V$		21.0			21.0			21.0		dB
Input Resistance	Pins 7 and 14	45	65	80	45	65	80	45	65	80	k Ω
Output Resistance	Pins 9 and 12		30	55		30	55		30	55	Ω
	Pins 10 and 11		30	55		30	55		30	55	Ω

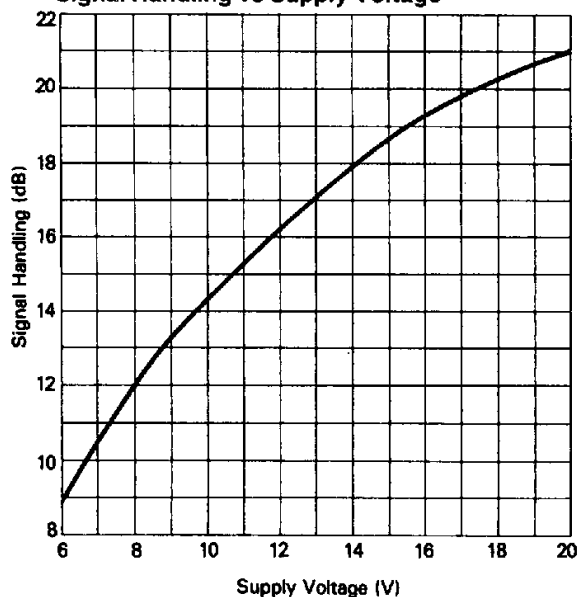
Note 1: Gaussian noise, measured over a period of 50 ms per channel, with a CCIR filter referenced to 2 kHz and an average-responding meter.

Typical Performance Characteristics

Supply Current vs Supply Voltage
(1 kHz, 0 dB; NR ON)

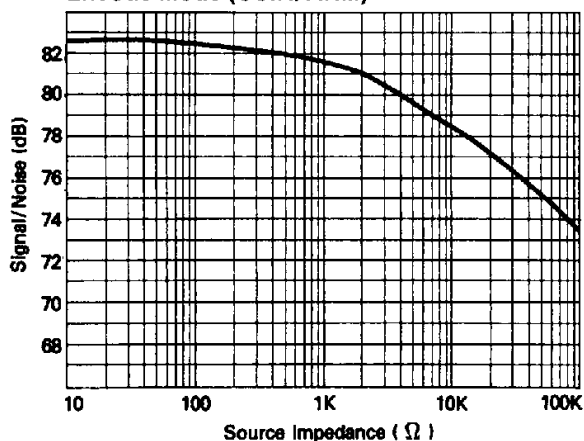


Signal Handling vs Supply Voltage

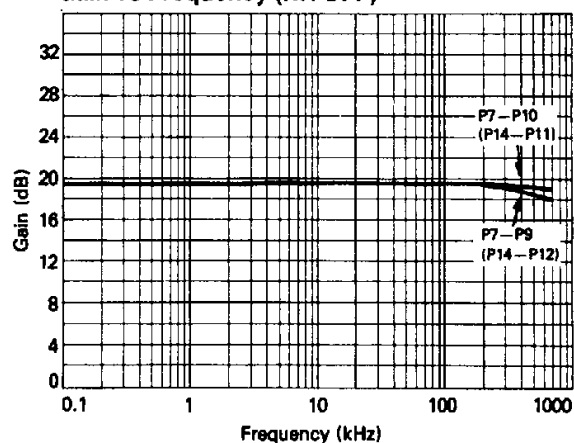


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Signal to Noise Ratio vs Source Impedance
Encode Mode (CCIR/ARM)

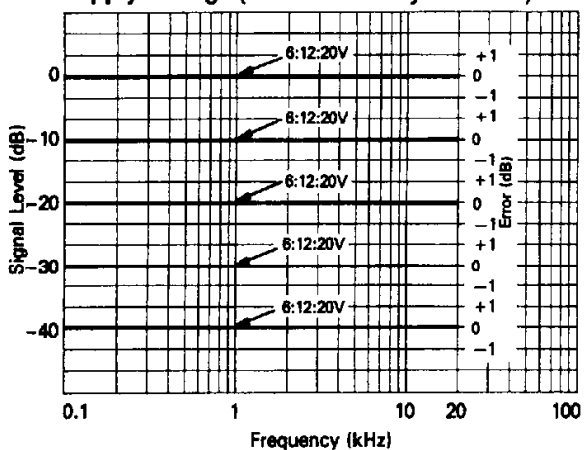


Gain vs Frequency (NR OFF)

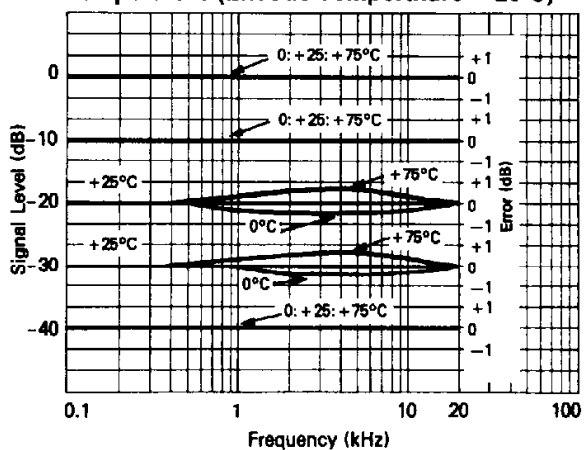


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Back to Back Response Error vs Frequency and
Supply Voltage (Standard Dolby Encoder)



Back to Back Response Error vs Frequency and
Temperature (Encode Temperature +25°C)



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Application Notes

SUPPLY VOLTAGE

LM1131 may operate with either single or split supply voltages.

Single Supply Voltage

Pin 1 is connected to ground, pin 20 to V_S .

Pins 8 and 13 are internally generated reference voltages set to approximately half-supply. They should be connected together externally.

A 220 μF capacitor must be connected between pins 8 and 13 and ground. Device turn-on time is delayed by the rise time of pins 8 and 13.

Split Supply Voltages

Pin 1 is connected to the negative supply, pin 20 to the positive supply. Pins 8 and 13 are connected to 0V and no capacitor is required. Device turn-on time is delayed only by the rise times of the supply voltages.

SIGNAL GAIN AND FILTERING

It should be noted that LM1131 has only one internal pre-amplifier, AB, with no provision for interconnection of a low pass filter to remove bias or multiplex tones. In addition, main chain gain has been reduced by 6 dB in comparison with LM1112/LM1011.

If a low pass filter is required it should be connected at the input of the LM1131. Pre-adjustment of Dolby input level may then be performed, at the input of LM1131 if required.

NOISE REDUCTION SWITCH

Noise reduction OFF is normally effected by means of a mechanical switch which open-circuits the sidechain input.

An alternative method which permits the control of NR OFF by means of a DC voltage is shown in *Figure 1*. The DC control voltage forces the internal impedance to a minimum value and heavily attenuates the sidechain input. When using this circuit the following points should be noted:

- Signal boost in encode mode (signal cut in decode) is reduced by increasing DC voltages on pins 3 and 18. A voltage of approximately 3V above signal ground is adequate to achieve NR OFF.
- Supply current may be increased significantly by high pin 3/18 forcing voltages. Thus, values for V_3 and R_3 should ideally be chosen such that pin 3/18 forced voltage is only 3V–5V greater than signal ground. Maximum permissible voltage on pin 3/18 is equal to supply voltage.
- When electrical NR switching is used in this way, NR OFF signal level is slightly affected by the restriction that the internal variable impedance cannot achieve zero impedance. Thus, at 10 kHz–10 dB, a residual boost in encode (or cut in decode) of approximately 0.4 dB remains. At low frequencies this value reduces to insignificant levels. This is not the case for mechanical NR switching.

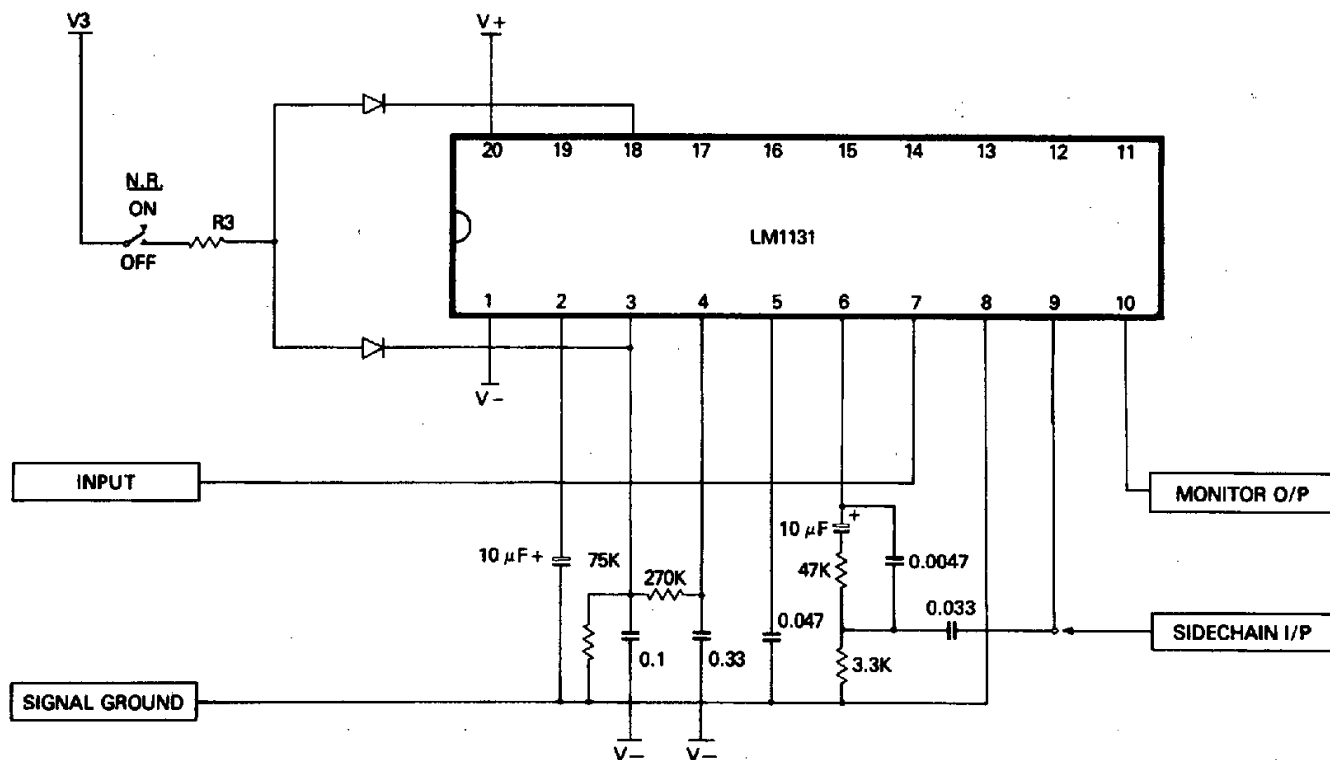
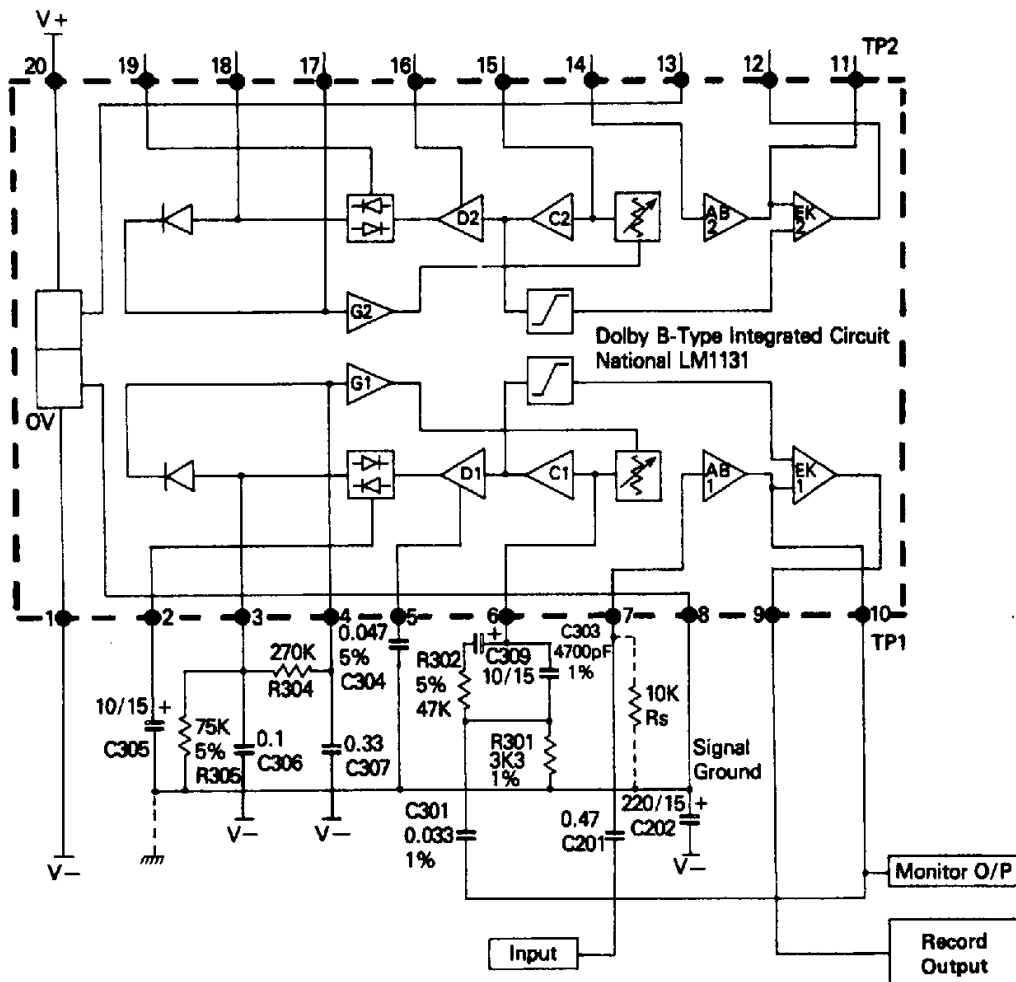


FIGURE 1. LM1131 Decode Processor with Electrical NR Switch (1 Channel Shown)

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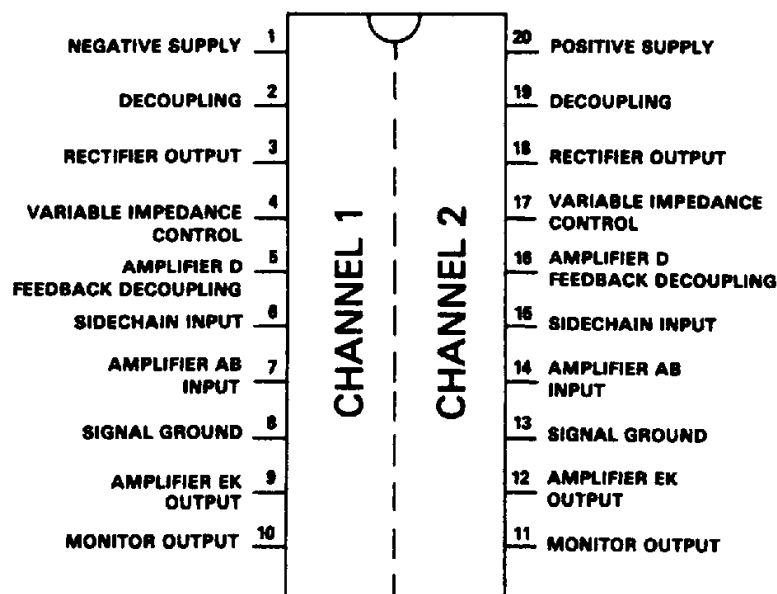
Test Circuit Encode Mode (components shown for channel 1 only)



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Connection Diagram

Dual-In-Line and Small Outline Packages



Order Number LM1131AN, LM1131BN, LM1131CM or LM1131CN
See NS Package Number M20B or N20A

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