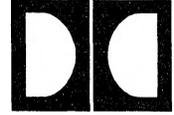




National  
Semiconductor  
Corporation



# LM1112A/LM1112B/LM1112C

## Dolby® B-Type Noise Reduction Processor

### General Description

The LM1112 is a monolithic integrated circuit specifically designed to realize the Dolby B-type noise reduction system.

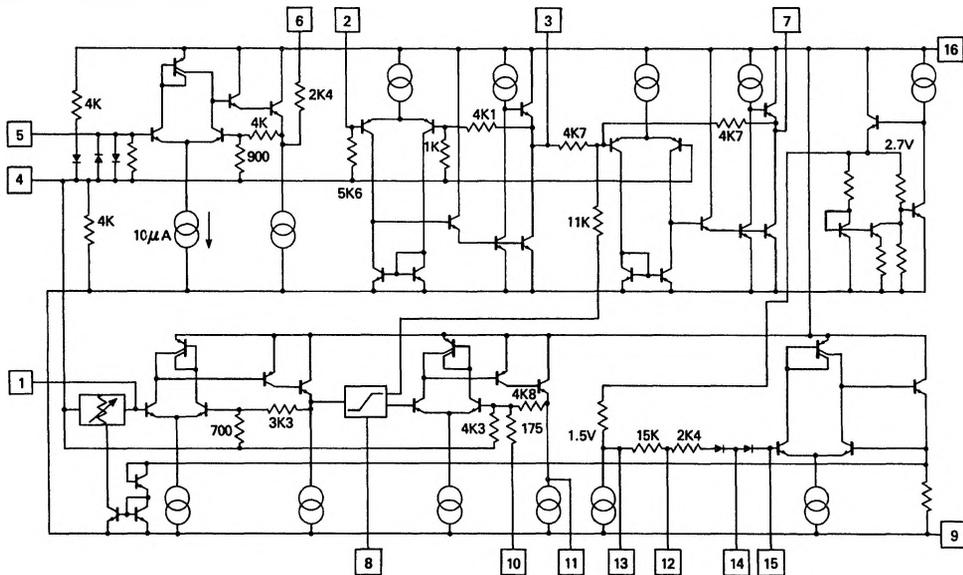
It is a replacement for the LM1111 and the Signetics NE-645/648 but with improved performance figures.

### Features

- Very high signal/noise ratio, 74 dB encode (CCIR/ARM)
- Wide supply voltage range, 6V to 20V
- Very close matching to standard Dolby characteristics
- Audible switch-on transients greatly reduced
- Improved temperature performance
- Reduced number of precision external components
- Improved transient stability
- Input protection diodes

Available only to licensees of Dolby Laboratories Licensing Corporation, San Francisco, from whom licensing and application information must be obtained. Dolby and the double-D symbol are registered trademarks of Dolby Laboratories Licensing Corporation.

### Schematic Diagram



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## Absolute Maximum Ratings

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

Storage Temperature Range            -65°C to +150°C  
Lead Temperature (Soldering, 10 sec.)   260°C

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

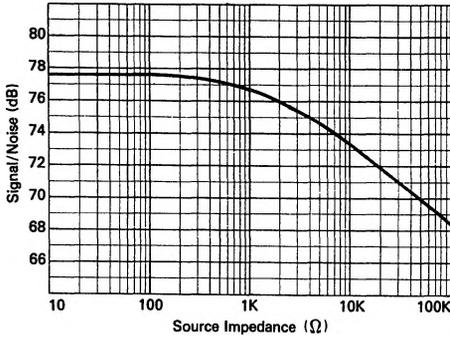
## Electrical Characteristics $V_S = 12V, T_A = 25^\circ C$ . 0 dB refers to Dolby level which is 580 mVrms at pin 3.

Parameter	Conditions	LM112A			LM112B			LM112C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Supply Voltage Range		6		20	6		20	6		20	V
Supply Current			15	20		15	20		15	20	mA
Voltage Gain (Pin 5-3)  (Pin 5-6) (Pin 3-7)	1 kHz Pins 6 and 12 Connected	24.5	25.5	26.5	24.5	25.5	26.5	24	25.5	27	dB
	1 kHz Pin 6 Open		14.7			14.7			14.7		dB
	1 kHz (Noise Reduction Out)	-0.5	0	0.5	-0.5	0	0.5	-1	0	1	dB
Distortion	1 kHz, 0 dB		0.03	0.1		0.03	0.1		0.03	0.1	%
	10 kHz, +10 dB		0.2			0.2			0.2		%
Signal Handling	1 kHz, 0.3% Distortion										
	$V_S = 6V$		8.5			8.5			8.5		dB
	$V_S = 12V$	13	15.5		13	15.5		13	15.5		dB
	$V_S = 18V$		19			19			19		dB
Signal/Noise Ratio at Pin 7 (Note 1)	Pins 6 and 2 Connected										
Encode Mode (CCIR/ARM) NR In	$R_S = 10k$	71.5	74		71	74		70	74		dB
	$R_S = 1k$		77			77			77		dB
	NR Out $R_S = 10k$		83			83			83		dB
Decode Mode (CCIR/ARM)	$R_S = 10k$		83			83			83		dB
Encode Characteristics	Input to Pin 5 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	-21.3	-22.8	-21.8	-20.8	-23.3	-21.8	-20.3	dB
	10 kHz, -30 dB	-24.0	-23.5	-23.0	-24.5	-23.5	-22.5	-25.0	-23.5	-22.0	dB
	10 kHz, -40 dB	-30.1	-29.6	-29.1	-30.3	-29.6	-28.9	-30.6	-29.6	-28.6	dB
Input Resistance	Pin 5	45	65	80	45	65	80	45	65	80	k $\Omega$
	Pin 2	4.3	5.6	6.9	4.3	5.6	6.9	4.3	5.6	6.9	k $\Omega$
Output Resistance	Pin 6	1.8	2.4	3.0	1.8	2.4	3.0	1.8	2.4	3.0	k $\Omega$
	Pin 3		30	45		30	45		30	45	$\Omega$
	Pin 7		30	45		30	45		30	45	$\Omega$
PSRR	f = 120 Hz		40			40			40		dB
Load Impedance	Pin 3		5			5			5		k $\Omega$
	Pin 7		5			5			5		k $\Omega$

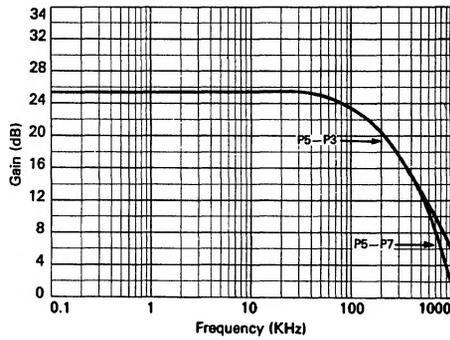
Note 1: Gaussian noise, measured over a period of 50 ms with a CCIR filler and an average responding meter.

# Typical Performance Characteristics

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

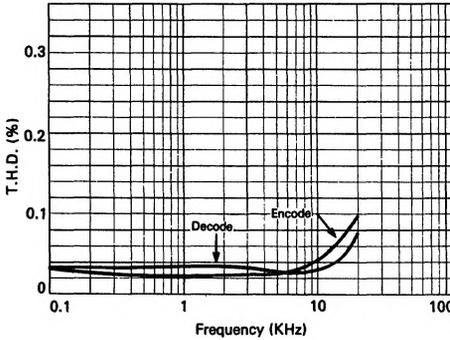


**Gain vs Frequency (NR OFF)**

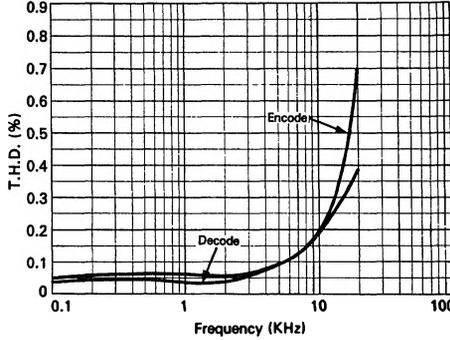


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**Total Harmonic Distortion — 0 dB Level**

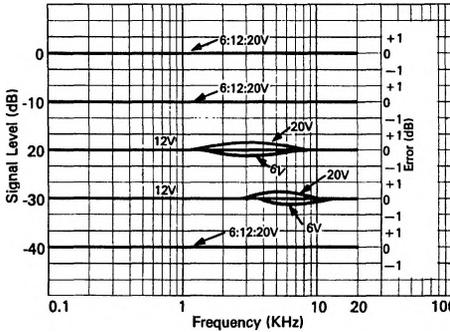


**Total Harmonic Distortion — + 10 dB Level**

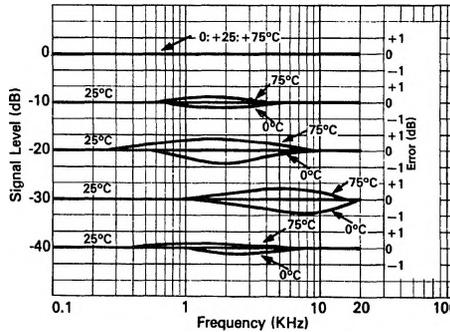


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**Back to Back Response Error vs Frequency and Supply Voltage (Standard Dolby Encoder)**

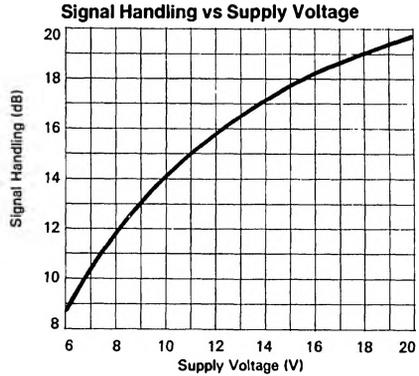
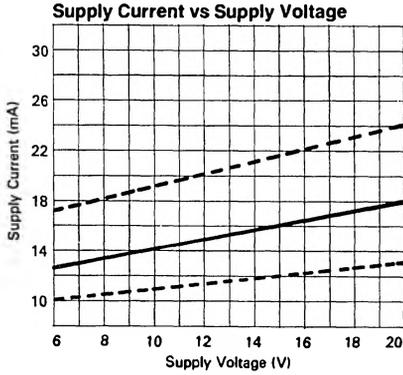


**Back to Back Response vs Frequency and Temperature (Encoder Temperature 25°C)**



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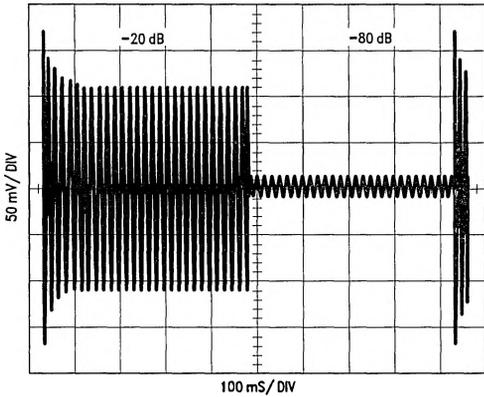
**Typical Performance Characteristics** (Continued)



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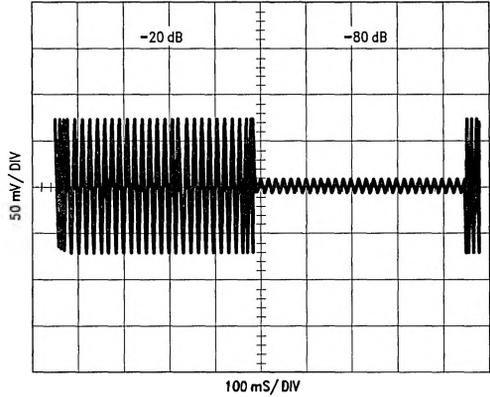
**TRANSIENT RESPONSE TO ABRUPT LEVEL CHANGE (Measured at pin 7)**

(a) Encode ( $f = 5 \text{ kHz}$ )



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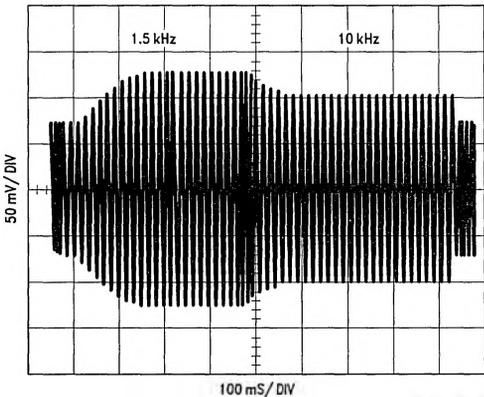
(b) Encoded and Decoded ( $f = 5 \text{ kHz}$ )



TL/H/7876-7

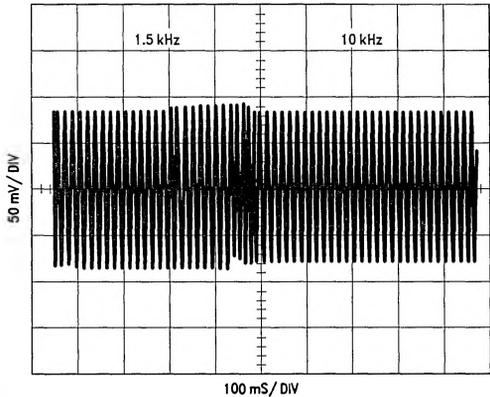
**TRANSIENT RESPONSE TO ABRUPT FREQUENCY CHANGE (Measured at pin 7)**

(a) Encode (-20 dB)



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(b) Encoded and Decoded (-20 dB)



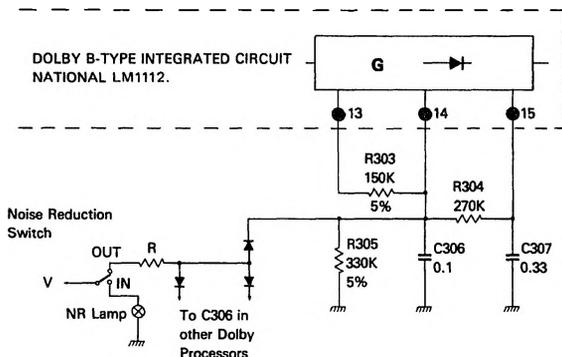
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**ELECTRICAL NOISE REDUCTION SWITCH**

In place of the normal mechanical noise reduction on/off switch, the circuit below is often used to permit electrical NR control. When using this circuit, the following points should be noted:

1. Signal boost is reduced by increasing DC voltage on Pin 14 (see curve). A voltage of approximately 3V is adequate to achieve NR OFF.

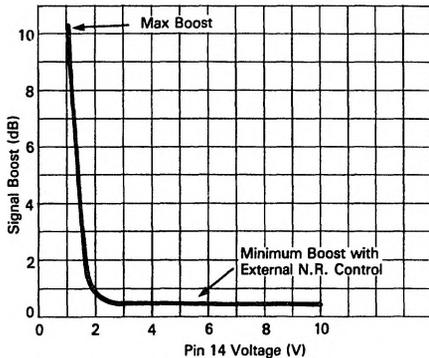
- 2. Supply current may be significantly increased by high pin 14 forced voltages. Values for V and R should thus be chosen such that pin 14 voltage is 3V-4V.
- 3. When electrical NR switching is used, signal level is slightly affected by the minimum value of the internal variable impedance. (At 10 kHz-10 dB, a residual boost of approximately 0.4 dB remains.) This is not the case for mechanical NR switching.



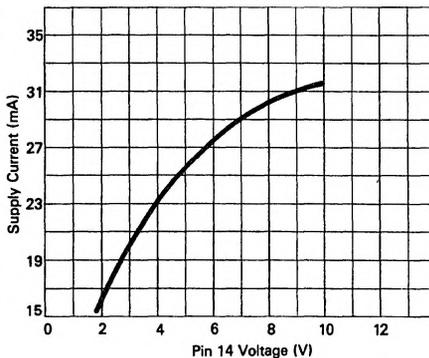
TL/H/7876-10

Note 1: Where not otherwise specified, component tolerances are ± 10%.

**Signal Boost vs Pin 14 Control Voltage (Encode, 10 kHz)**

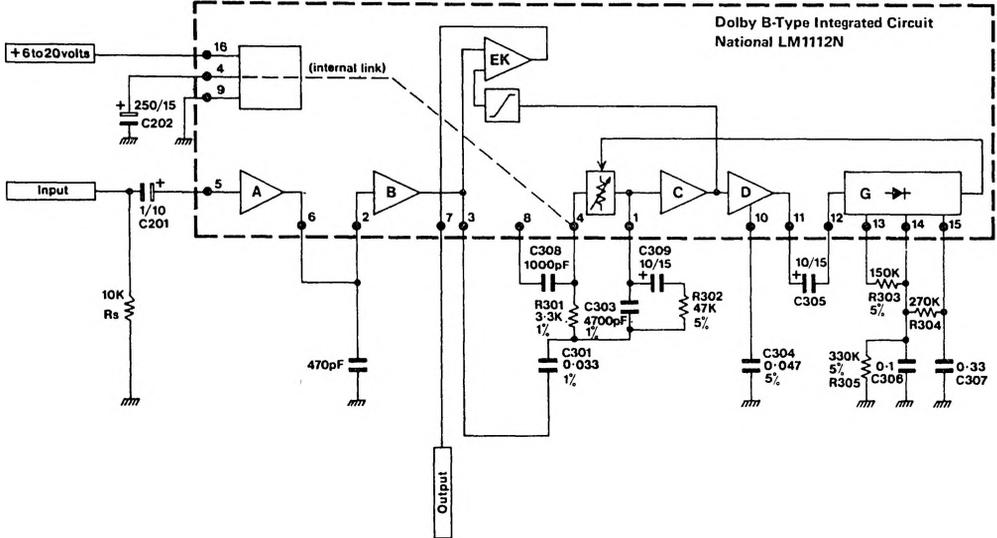


**Supply Current vs Pin 14 Control Voltage (V<sub>S</sub> = 12V) (Encode, 10 kHz)**



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### Test Circuit (Encode)



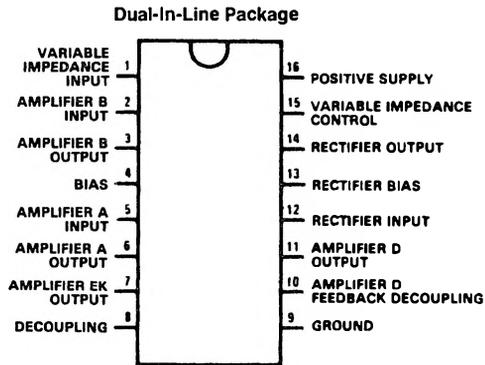
TL/H/7876-12

**Note 1:** 1 nF capacitors from pin 3 and pin 7 to ground may be required on older devices.

**Note 2:** Where not otherwise specified, component tolerances are  $\pm 10\%$ .

**Note 3:** For LM1112AN use 2% components for C304, R303, R305. (5% components may cause errors up to +0.3 dB.)

### Connection Diagram



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Order Number LM1112AN, LM1112BN  
or LM1112CN  
See NS Package Number N16E