



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.

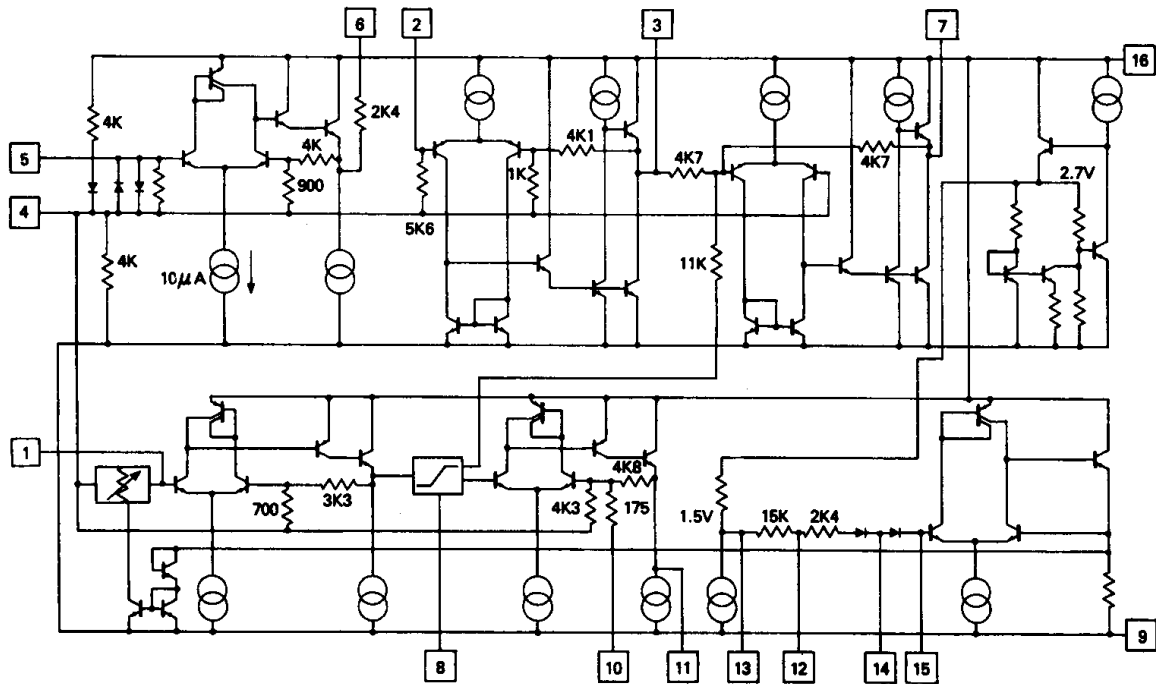
It is a replacement for the LM1111 and the Signetics NE-645/648 but with improved performance figures.

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



TL/H/7876-1

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 $+70^{\circ}\text{C}$

Storage Temperature Range -65°C to $+150^{\circ}\text{C}$
Lead Temperature (Soldering, 10 sec.) 260°C

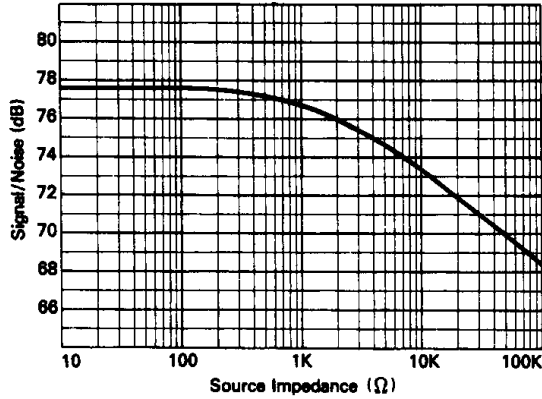
Electrical Characteristics $V_S = 12\text{V}$, $T_A = 25^{\circ}\text{C}$. 0 dB refers to Dolby level which is 580 mVrms at pin 3.

| Parameter | Conditions | LM1112A | | | LM1112B | | | LM1112C | | | 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) | 1 kHz Pins 6 and 12 Connected | 24.5 | 25.5 | 26.5 | 24.5 | 25.5 | 26.5 | 24 | 25.5 | 27 | dB |
| | (Pin 5-6) (Pin 3-7) | | 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 | | | | | | | | | | |
| | $V_S = 6\text{V}$ | | 8.5 | | | 8.5 | | | 8.5 | | dB |
| | $V_S = 12\text{V}$ | 13 | 15.5 | | 13 | 15.5 | | 13 | 15.5 | | dB |
| | $V_S = 18\text{V}$ | | 19 | | | 19 | | | 19 | | dB |
| Signal/Noise Ratio at Pin 7 (Note 1) | Pins 6 and 2 Connected | | | | | | | | | | |
| Encode Mode (CCIR/ARM) NR In | $R_S = 10\text{k}$ | 71.5 | 74 | | 71 | 74 | | 70 | 74 | | dB |
| | $R_S = 1\text{k}$ | | 77 | | | 77 | | | 77 | | dB |
| | NR Out | | 83 | | | 83 | | | 83 | | dB |
| Decode Mode (CCIR/ARM) | $R_S = 10\text{k}$ | | 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 Ω |
| | Pin 2 | 4.3 | 5.6 | 6.9 | 4.3 | 5.6 | 6.9 | 4.3 | 5.6 | 6.9 | k Ω |
| Output Resistance | Pin 6 | 1.8 | 2.4 | 3.0 | 1.8 | 2.4 | 3.0 | 1.8 | 2.4 | 3.0 | k Ω |
| | Pin 3 | | 30 | 45 | | 30 | 45 | | 30 | 45 | Ω |
| | Pin 7 | | 30 | 45 | | 30 | 45 | | 30 | 45 | Ω |
| PSRR | $f = 120\text{ Hz}$ | | 40 | | | 40 | | | 40 | | dB |
| Load Impedance | Pin 3 | 5 | | | 5 | | | 5 | | | k Ω |
| | Pin 7 | 5 | | | 5 | | | 5 | | | k Ω |

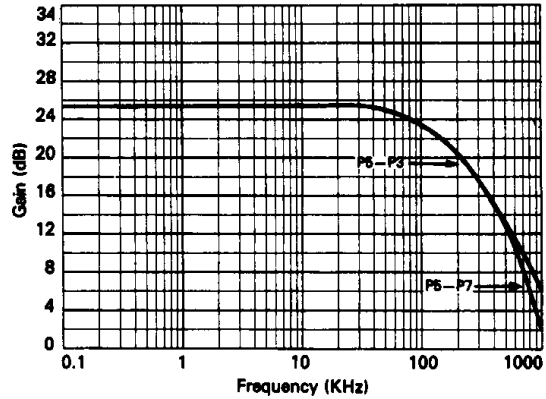
Note 1: Gaussian noise, measured over a period of 50 ms with a CCIR filler and an average responding meter.

Typical Performance Characteristics

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

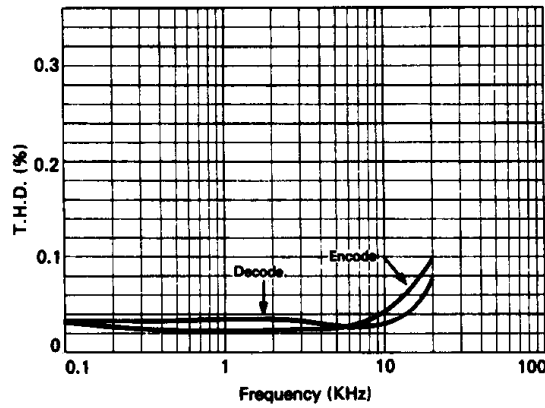


Gain vs Frequency (NR OFF)

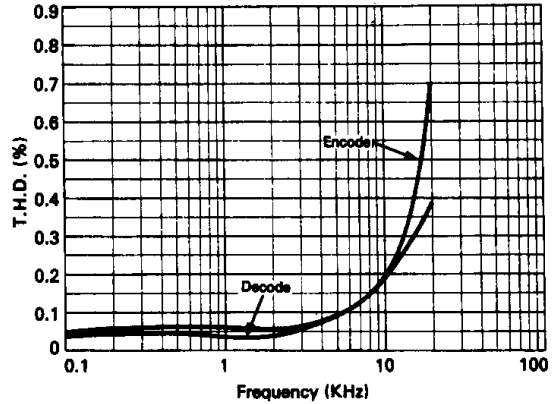


TL/H/7876-2

Total Harmonic Distortion — 0 dB Level

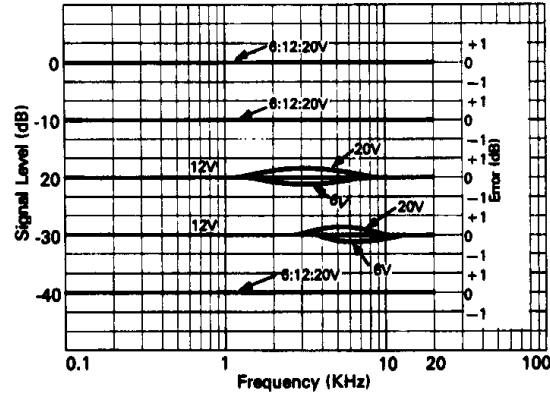


Total Harmonic Distortion — +10 dB Level

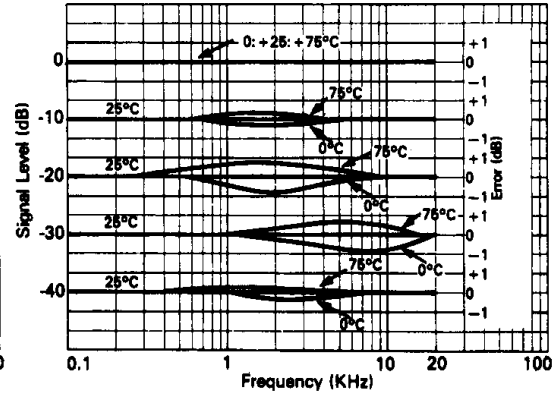


TL/H/7876-3

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

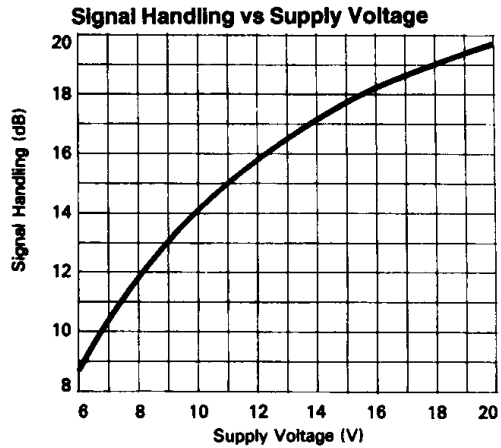
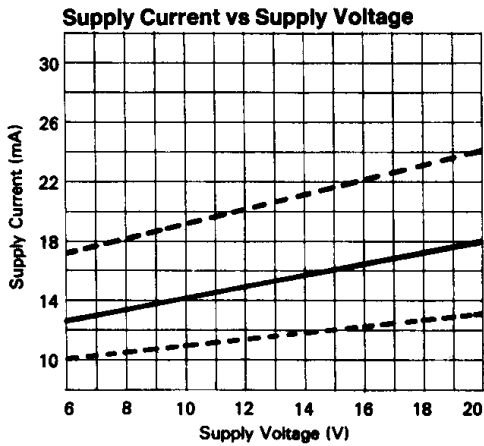


**Back to Back Response vs Frequency and
Temperature (Encoder Temperature 25°C)**



TL/H/7876-4

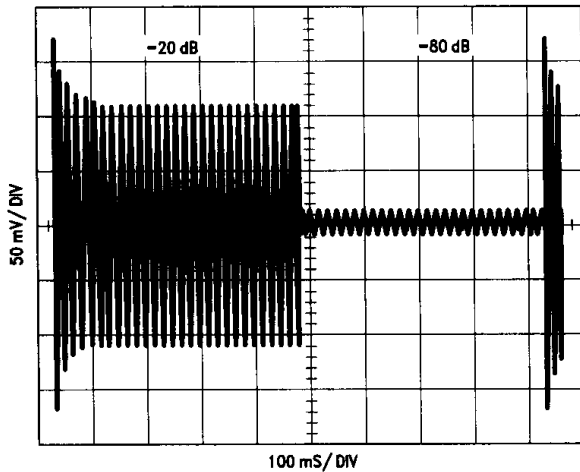
Typical Performance Characteristics (Continued)



TL/H/7876-5

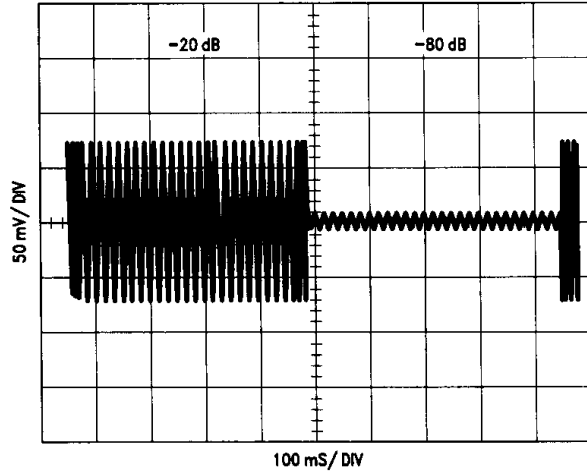
TRANSIENT RESPONSE TO ABRUPT LEVEL CHANGE (Measured at pin 7)

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



TL/H/7876-6

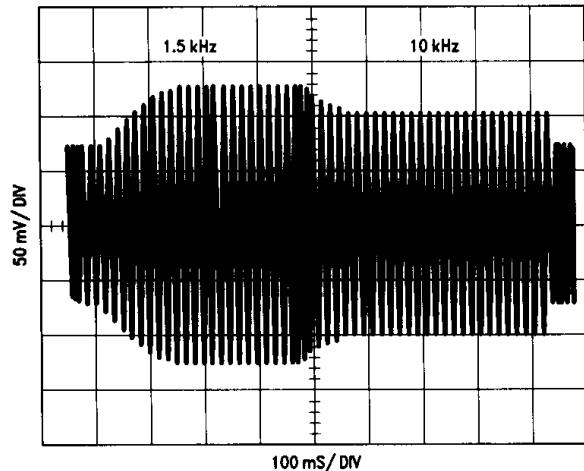
(b) Encoded and Decoded ($f = 5 \text{ kHz}$)



TL/H/7876-7

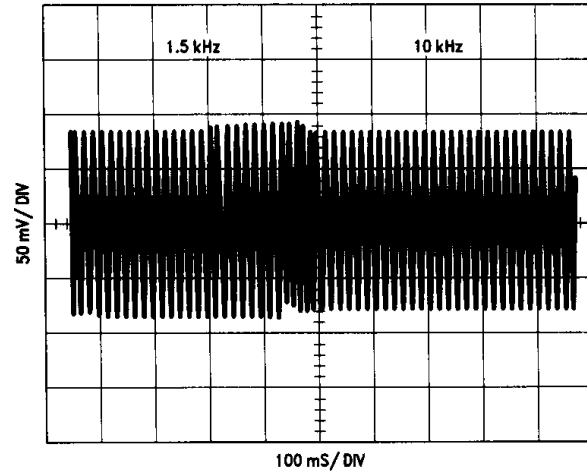
TRANSIENT RESPONSE TO ABRUPT FREQUENCY CHANGE (Measured at pin 7)

(a) Encode (-20 dB)



TL/H/7876-8

(b) Encoded and Decoded (-20 dB)



TL/H/7876-9

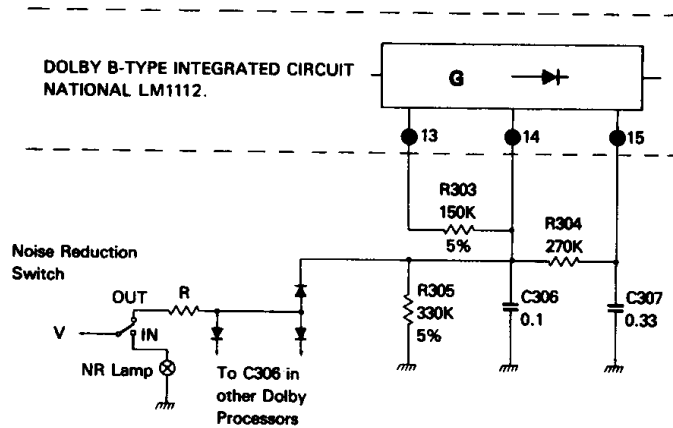
ELECTRICAL NOISE REDUCTION SWITCH

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.

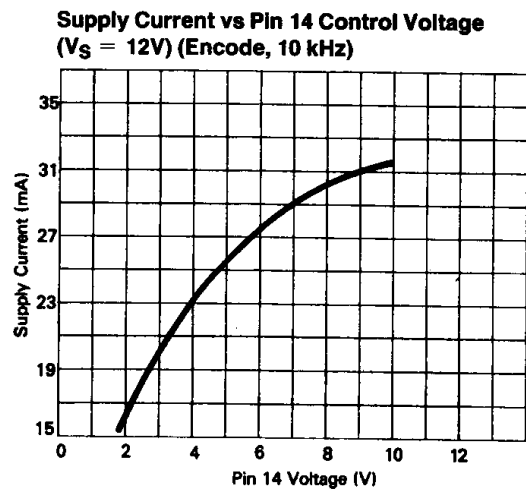
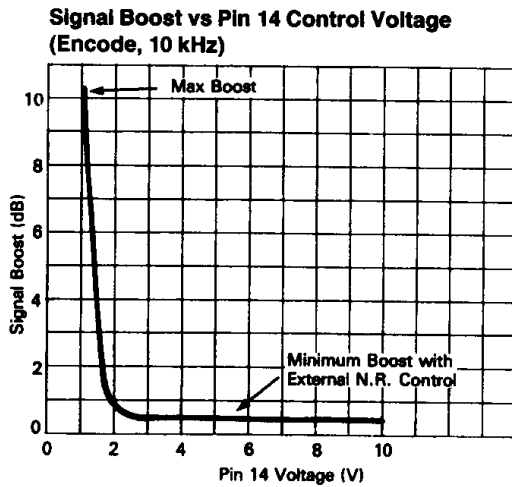
2. Supply current may be significantly increased by high pin 14 forced voltages. Values for V and R should thus be chosen such that pin 14 voltage is 3V-4V.

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.



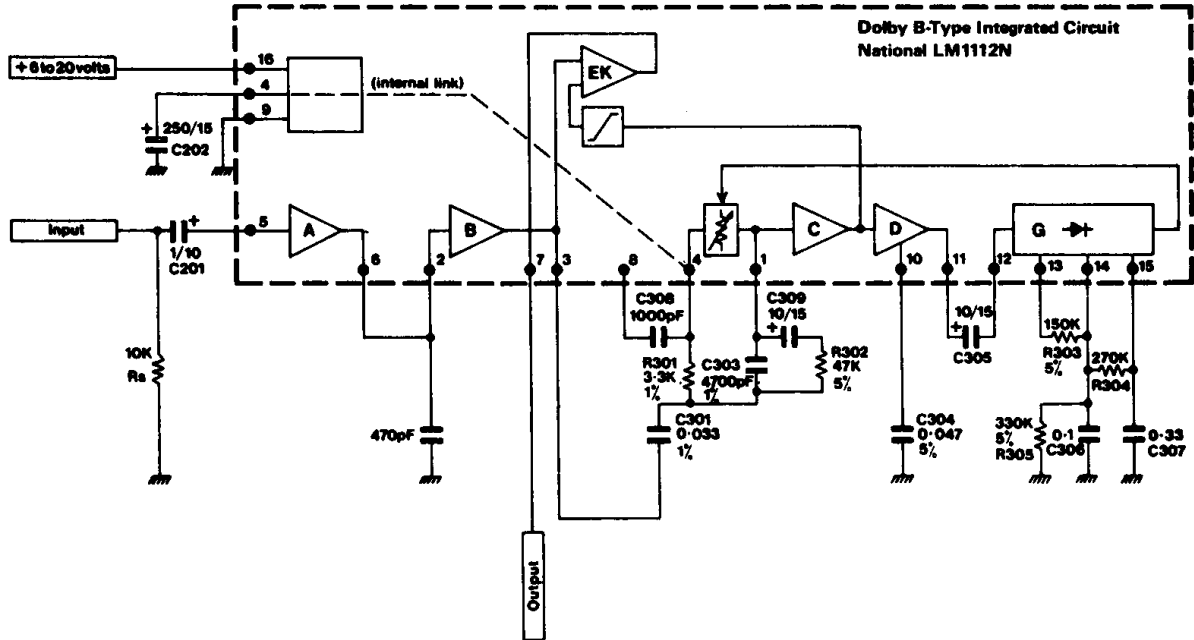
TL/H/7876-10

Note 1: Where not otherwise specified, component tolerances are $\pm 10\%$.



TL/H/7876-11

Test Circuit (Encode)



TL/H/7876-12

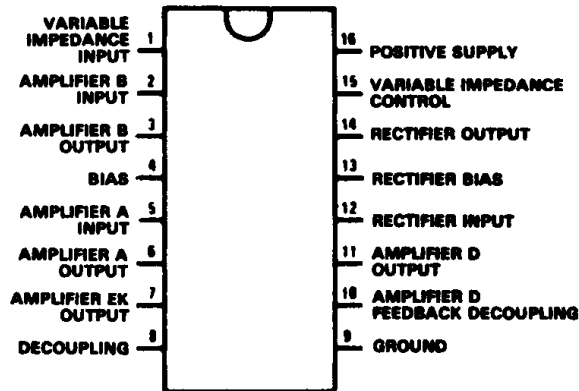
Note 1: 1 nF capacitors from pin 3 and pin 7 to ground may be required on older devices.

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

Dual-In-Line Package



TL/H/7876-13

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