National Semiconductor

April 1987

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

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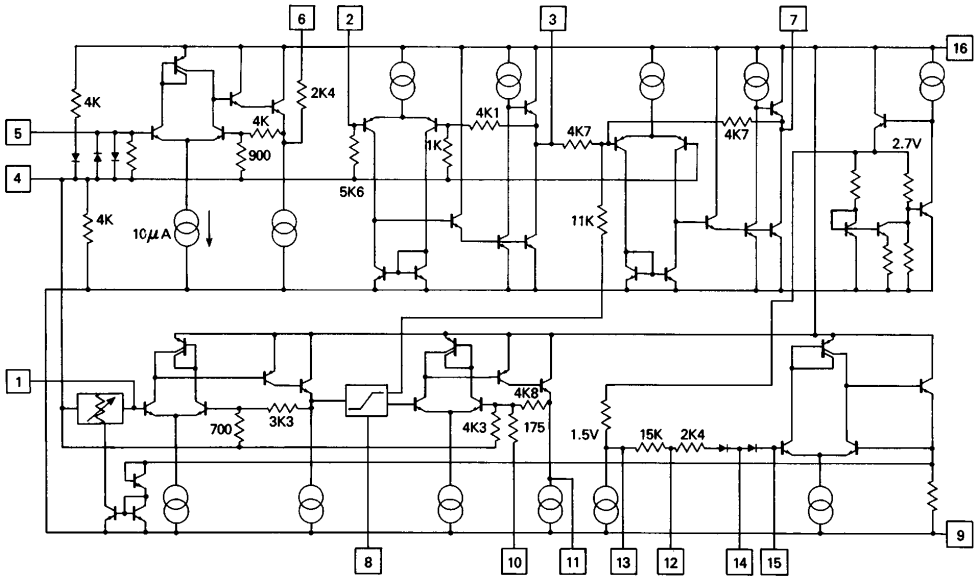
Schematic Diagram



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LM1112A/LM1112B/LM1112C Dolby B-Type Noise Reduction Processor

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
Lead Temperature (Soldering, 10 sec.)	260°C

Electrical Characteristics

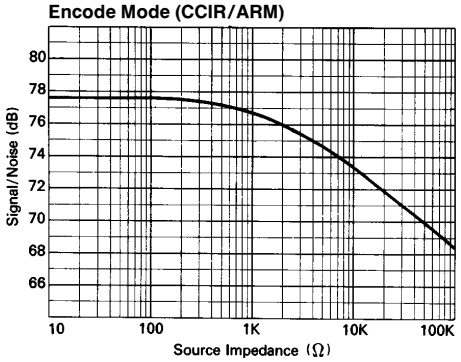
V_S = 12V, T_A = 25°C. 0 dB refers to Dolby level which is 580 mVrms at pin 3.

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)	1 kHz Pin 6 Open		14.7			14.7			14.7		dB
(Pin 3–7)	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	kΩ
	Pin 2	4.3	5.6	6.9	4.3	5.6	6.9	4.3	5.6	6.9	kΩ
Output Resistance	Pin 6	1.8	2.4	3.0	1.8	2.4	3.0	1.8	2.4	3.0	kΩ
	Pin 3		30	45		30	45		30	45	Ω
	Pin 7		30	45		30	45		30	45	Ω
PSRR	f = 120 Hz		40			40			40		dB
Load Impedance Pin 3		5			5			5			kΩ
Pin 7		5			5			5			kΩ

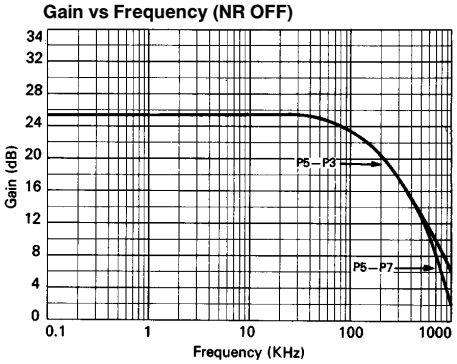
Note 1: Gaussian noise, measured over a period of 50 ms with a CCIR filler and an average responding meter.

Typical Performance Characteristics

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



Gain vs Frequency (NR OFF)



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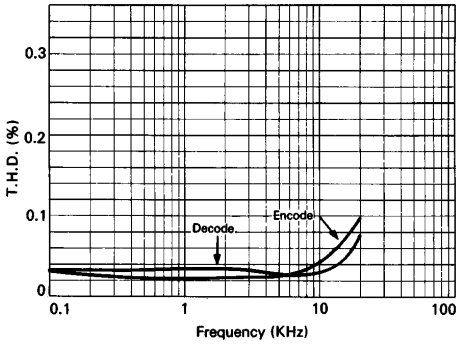
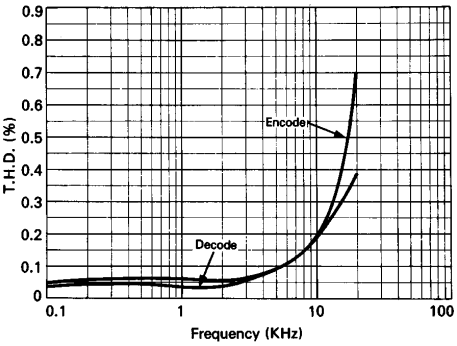
Total Harmonic Distortion — 0 dB Level



Total Harmonic Distortion — +10 dB Level



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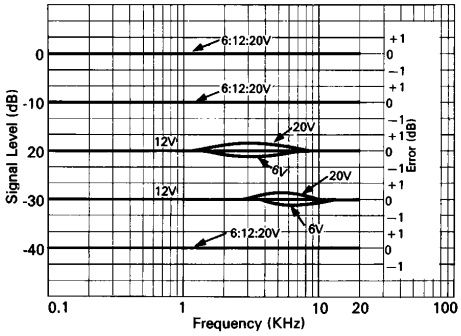
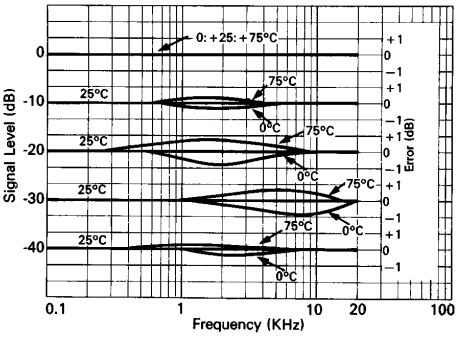
Back to Back Response Error vs Frequency and Supply Voltage (Standard Dolby Encoder)



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



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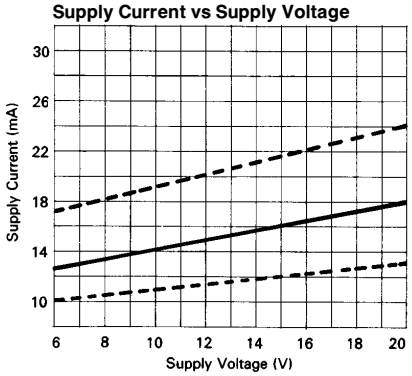
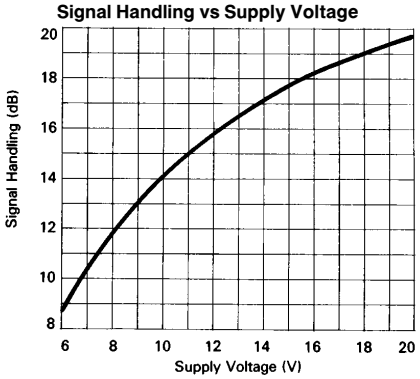
Typical Performance Characteristics (Continued)

Supply Current vs Supply Voltage



Signal Handling vs Supply Voltage



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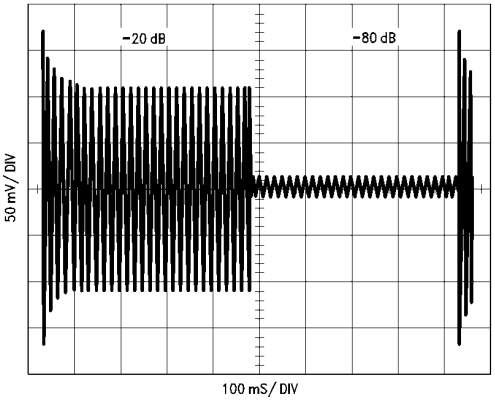
TRANSIENT RESPONSE TO ABRUPT LEVEL CHANGE (Measured at pin 7)

(a) Encode (f = 5 kHz)



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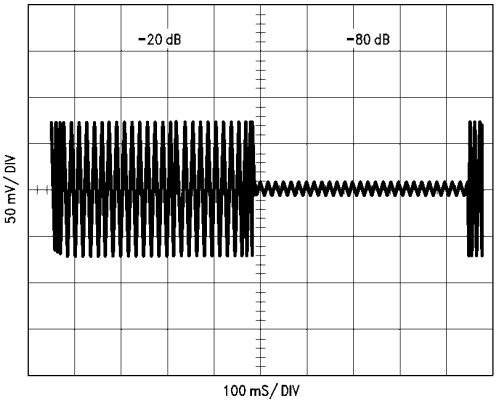
(b) Encoded and Decoded (f = 5 kHz)



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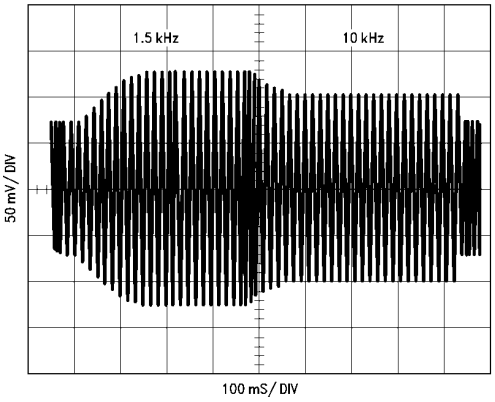
TRANSIENT RESPONSE TO ABRUPT FREQUENCY CHANGE (Measured at pin 7)

(a) Encode (−20 dB)



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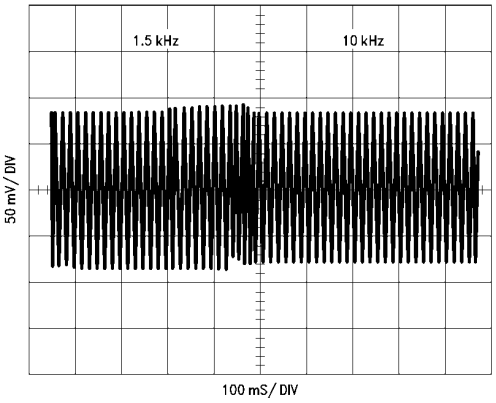
(b) Encoded and Decoded (−20 dB)



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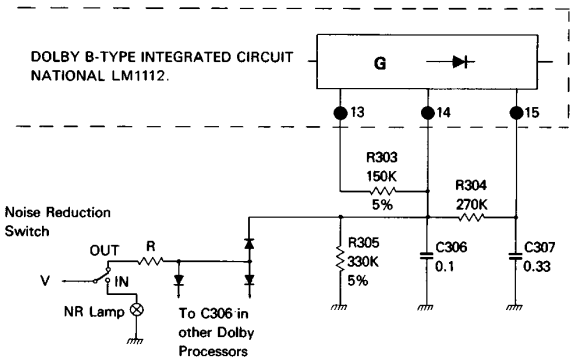
ELECTRICAL NOISE REDUCTION SWITCH

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.



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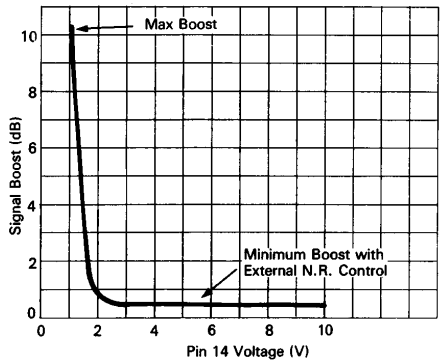
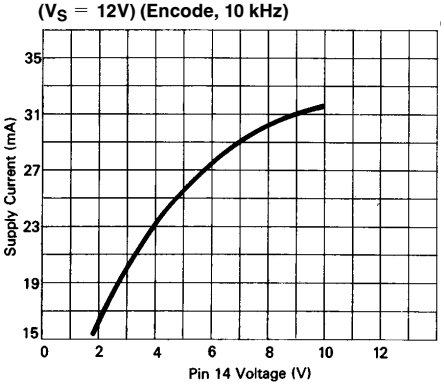
Note 1: Where not otherwise specified, component tolerances are ±10%.

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



Supply Current vs Pin 14 Control Voltage (V_S = 12V) (Encode, 10 kHz)



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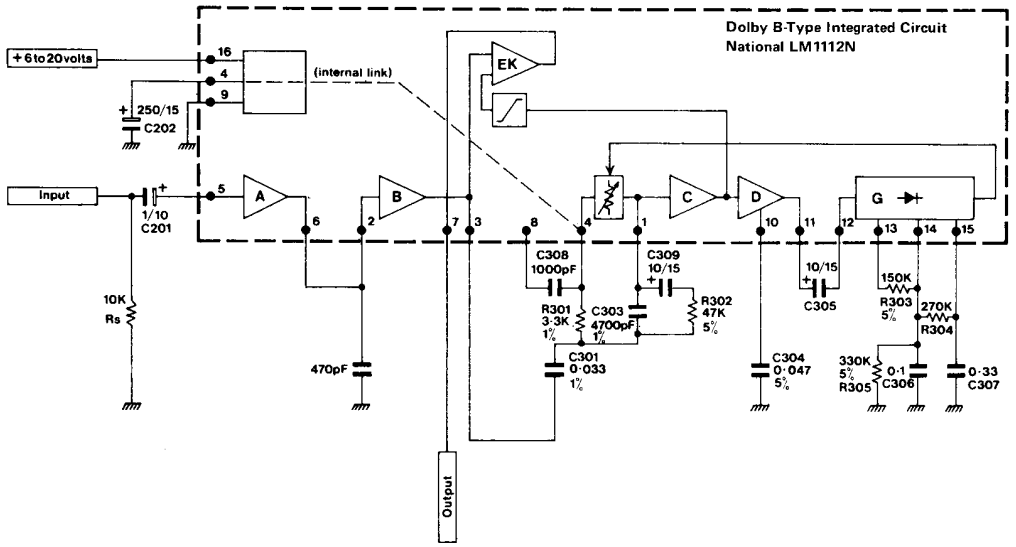
Test Circuit (Encode)



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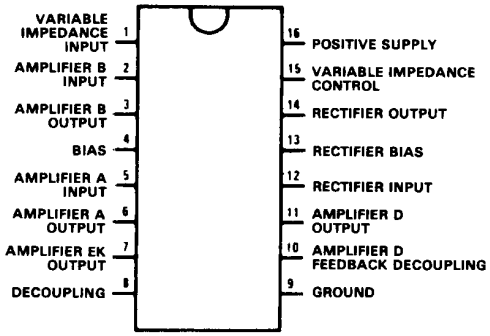
Note 1: 1 nF capacitors from pin 3 and pin 7 to ground may be required on older devices.

Note 2: Where not otherwise specified, component tolerances are ±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



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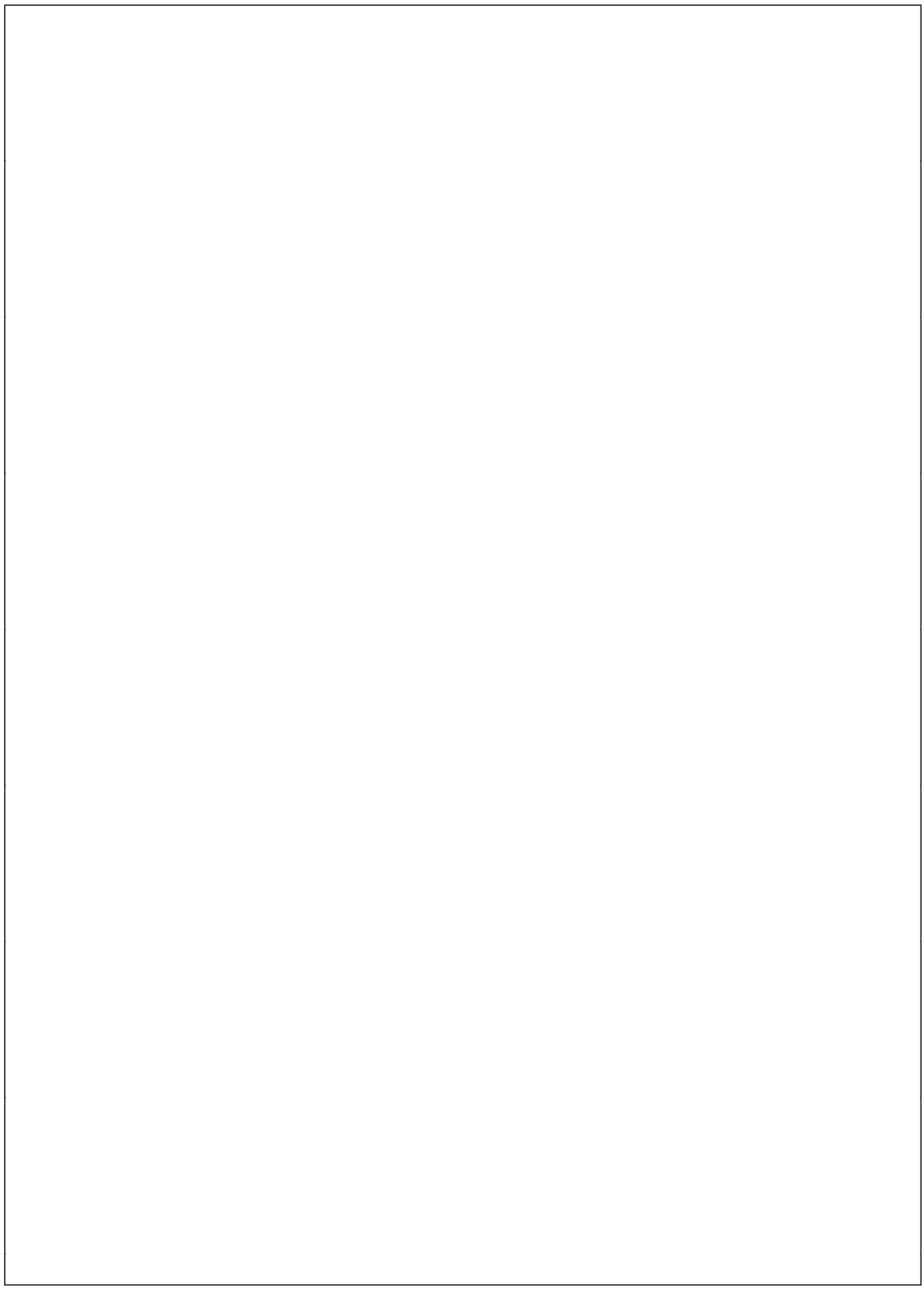
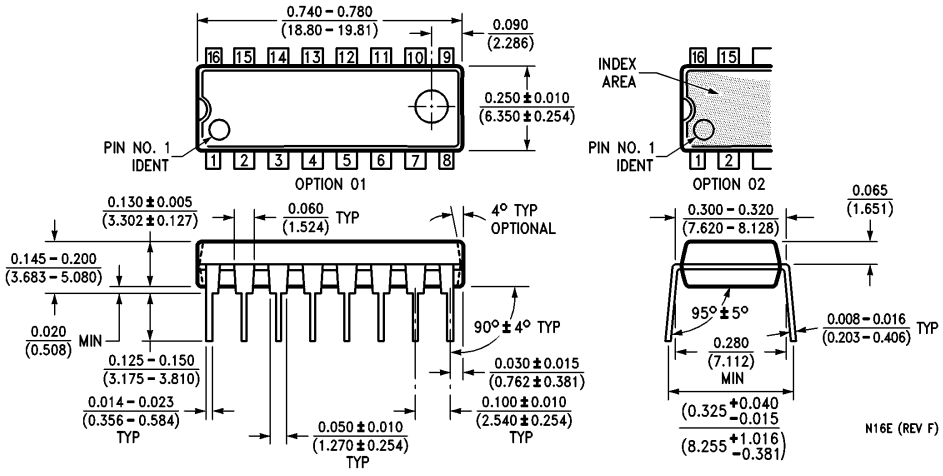
Order Number LM1112AN, LM1112BN or LM1112CN
See NS Package Number N16E



Physical Dimensions inches (millimeters)



Dual-In-Line Package (N)
Order Number LM1112AN, LM1112BN or LM1112CN
NS Package Number N16E

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