

MN3004

512-STAGE LOW NOISE BBD

General Description

The MN3004 is a 512-stage high performance low noise BBD that provides a 85dB of signal to noise ratio (S/N) by increasing a capacity of capacitors with the same chip area, which is enabled by the improvement of silicon materials and process. There are many features for this device such as low insertion loss and no back gate bias voltage V_{BB} , etc.

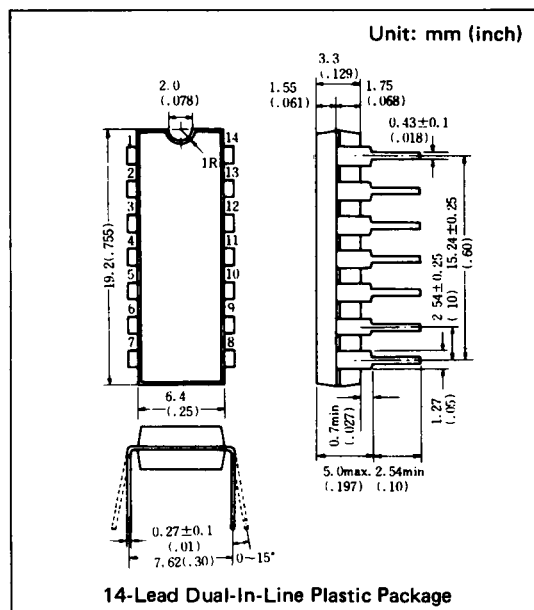
The MN3004 can delay analog signal of the audio band in the range of 2.56ms ~ 25.6ms by adjusting a clock frequency.

Features

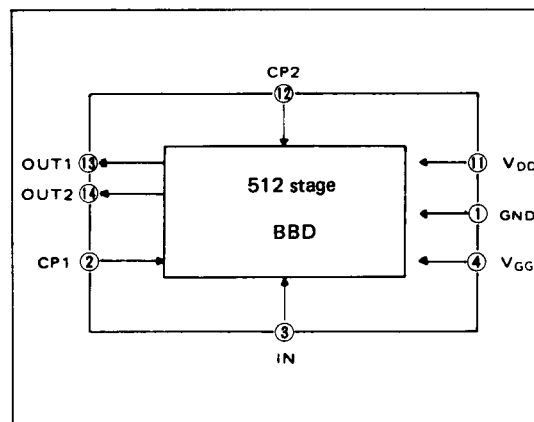
- Variable delay of audio signal: 2.56ms ~ 25.6ms
- Clock component cancellation capability.
- Low insertion loss: $L_i = 1/5\text{dB typ.}$
- Wide dynamic range: $S/N \approx 85\text{dB typ.}$
- Wide frequency response: $f_i \leq 0.3 \times f_{cp}$
- Clock frequency range: 10 ~ 100KHz
- Low noise: $V_{no} = 0.21\text{mVrms max.}$
- Low distortion: $\text{THD} = 0.4\% \text{ typ.}$

Applications

- Variable playback speed of tape recorder.
- Reverberation and echo effects of audio equipments such as stereo.
- Tremolo, vibrato and chorus effects in electronic musical instruments.
- Variable or fixed delay of analog signals.
- Telephone time compression and delay line for voice communication systems.
- Others.



Block Diagram



Quick Reference Data

Item	Symbol	Value	Unit
Supply Voltage	V_{DD}, V_{GG}	$-15, V_{DD} + 1$	V
Signal Delay Time	t_D	2.56~25.6	ms
Total Harmonic Distortion	THD	0.4	%
Signal to Noise Ratio	S/N	85	dB

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Terminal Voltage	$V_{DD}, V_{GG}, V_{CP}, V_i$	-18~+0.3	V
Output Voltage	V_o	-18~+0.3	V
Operating Temperature	Topr	-20~+60	°C
Storage Temperature	Tstg	-55~+125	°C

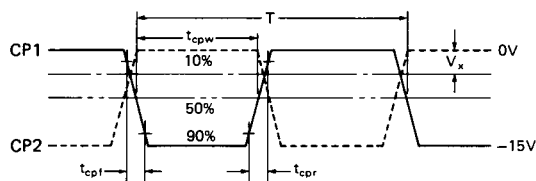
Operating Conditions (Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain Supply Voltage	V_{DD}		-14	-15	-16	V
Gate Supply Voltage	V_{GG}			$V_{DD} + 1$		V
Clock Voltage "H" Level	V_{CPH}		0		-1	V
Clock Voltage "L" Level	V_{CPL}			V_{DD}		V
Clock Input Capacitance	C_{CP}				350	pF
Clock Frequency	f_{CP}		10		100	kHz
Clock Pulse Width *1	t_{cpw}				$0.5T^{*2}$	
Clock Rise Time *1	t_{cpr}				500	ns
Clock Fall Time *1	t_{cpf}				500	ns
Clock Cross Point	V_x		0		-3	V
Input DC Bias	V_{Bias}		-5		-10	V

Electrical Characteristics (Ta = 25°C, $V_{DD} = V_{CPL} = -5V$, $V_{CPH} = 0V$, $V_{GG} = -14V$, $R_L = K\Omega$)

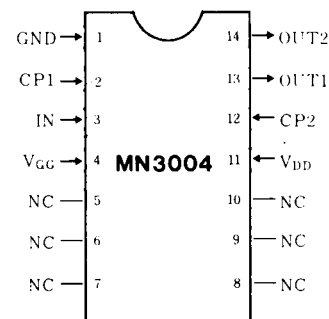
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Signal Delay Time	t_D		2.56		25.6	ms
Input Signal Frequency	f_i	$f_{CP} = 40kHz$, $V_i = 1.8V_{rms}$, 3dB down (0 dB at $f_i = 1kHz$)	12			kHz
Input Signal Swing	V_i	$f_{CP} = 40kHz$, $f_i = 1kHz$, $THD \leq 2.5\%$	1.8			Vrms
Insertion Loss	L_i	$f_{CP} = 40kHz$, $f_i = 1kHz$, $V_i = 1.8V_{rms}$	-4	1.5	4	dB
Total Harmonic Distortion	THD	$f_{CP} = 40kHz$, $f_i = 1kHz$, $V_i = 1V_{rms}$		0.4	2.5	%
Noise Voltage	V_{no}	$f_{CP} = 100kHz$ Weighted by "A" curve			0.21	mVrms
Signal to Noise Ratio	S/N			85		dB

*1 Clock Pulse Waveforms



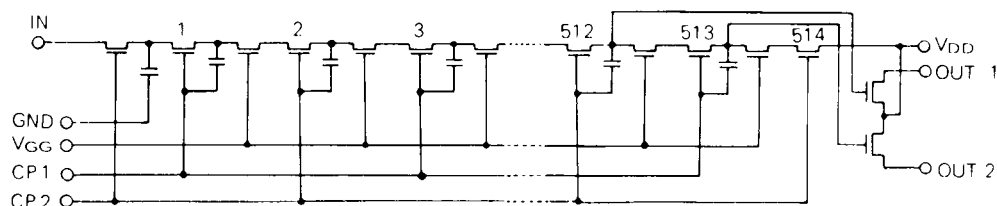
*2 $T = 1/f_{cp}$ (Clock Period)

Terminal Assignments

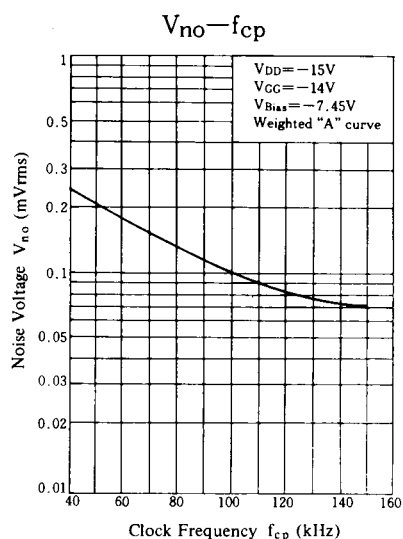
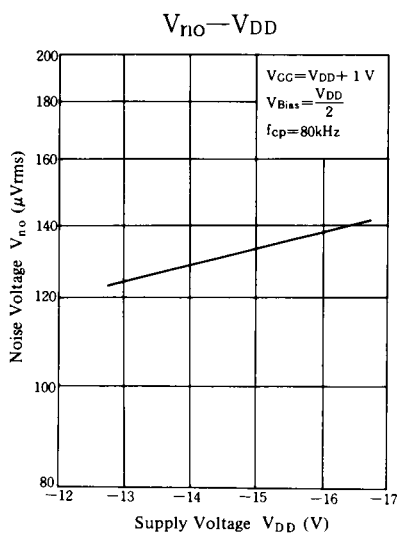
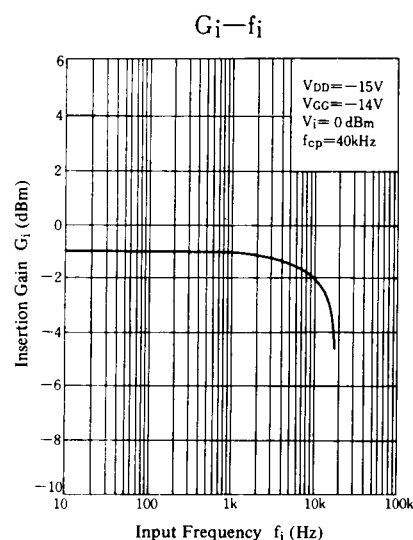
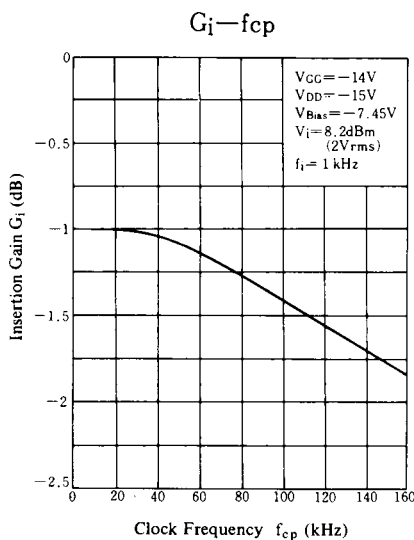
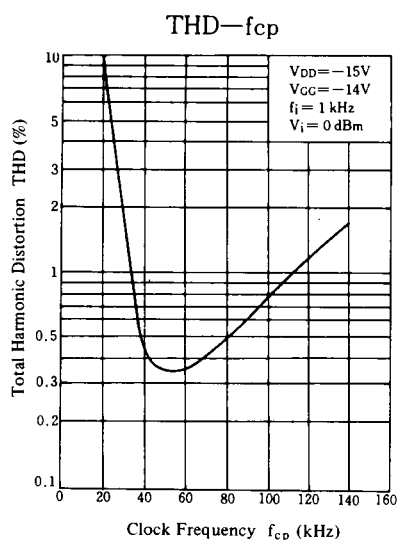
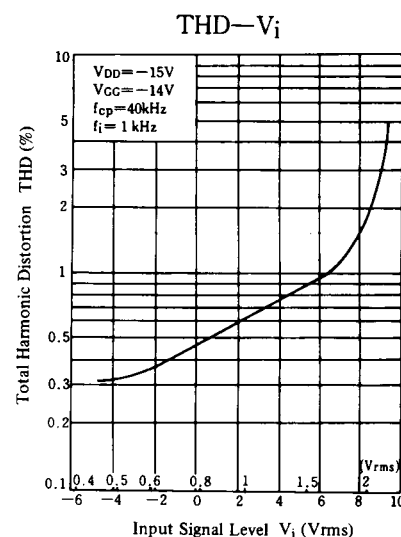
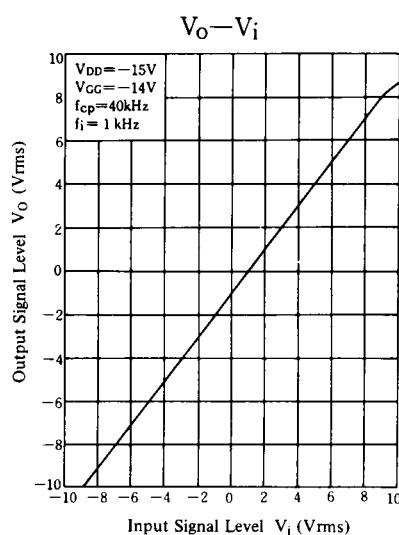
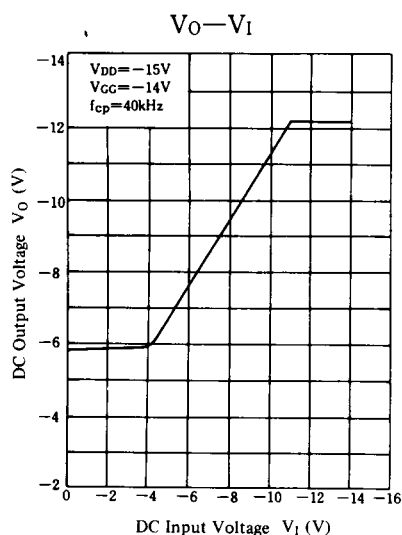


(Top View)

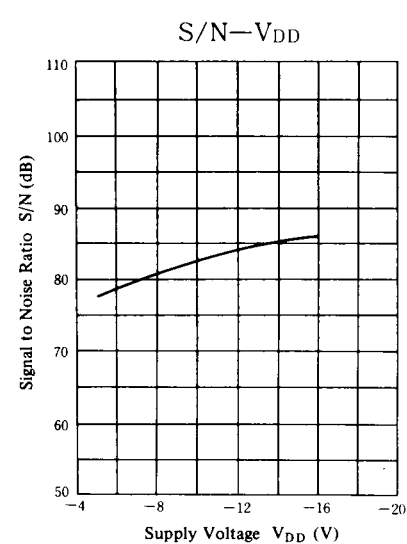
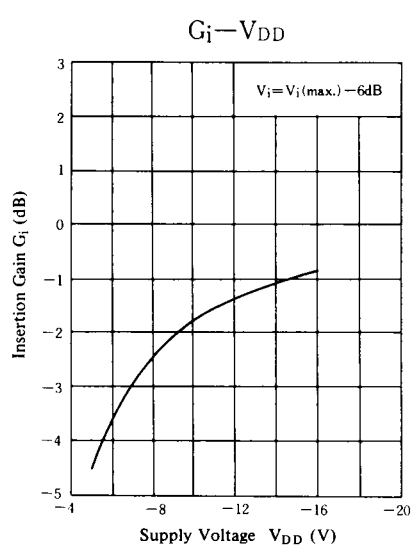
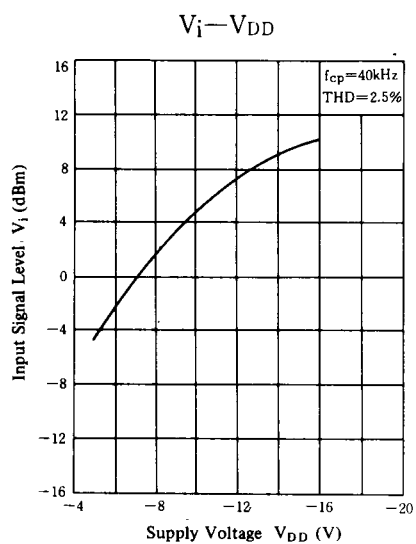
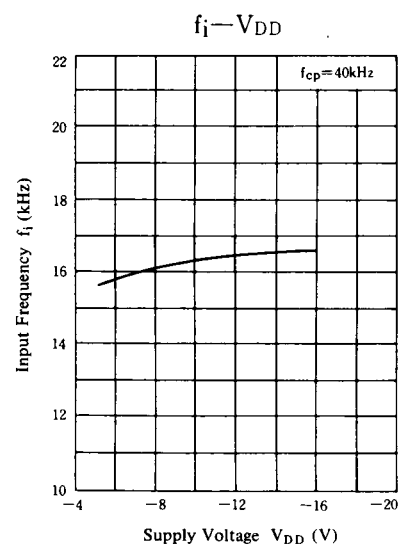
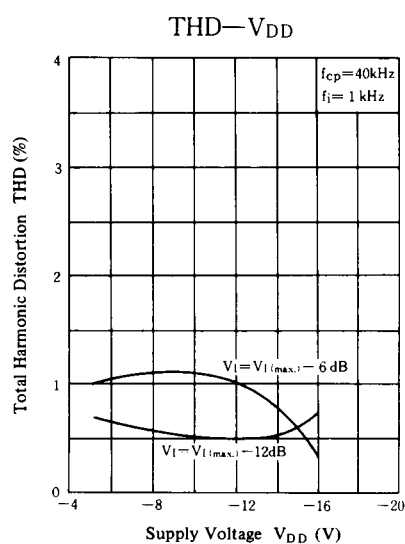
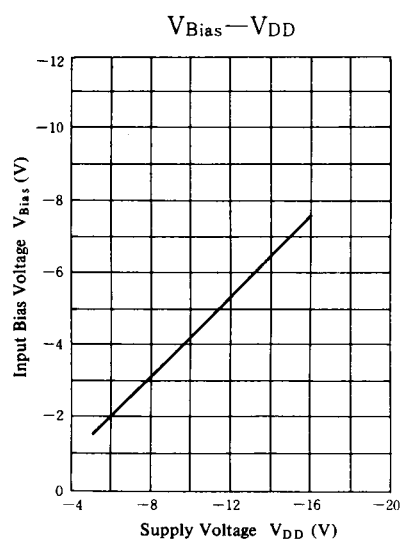
Circuit Diagram



■ Typical Electrical Characteristic Curves



■ Supply Voltage Characteristics



The circuit diagram shows a 400-Hz audio amplifier. It features three integrated circuits: two AN655 op-amp comparators and one MN3004 monostable multivibrator. The input signal is coupled through a 3.3 μF capacitor to the non-inverting input of the first AN655 (IC1). The inverting input of IC1 is biased at Vcc/2 via a 100 kΩ resistor and has a feedback network of 120 kΩ and 220 pF. The output of IC1 is coupled to the non-inverting input of the second AN655 (IC2) through a 56 kΩ resistor. The inverting input of IC2 is also biased at Vcc/2 and has a feedback network of 120 kΩ and 220 pF. The output of IC2 is coupled to the input of the MN3004 monostable multivibrator through a 33 kΩ resistor. The MN3004 is configured with its timing network (100 kΩ resistor and 3.3 μF capacitor) connected to Vcc and its output (pin 11) connected to the input of a third AN655 (IC3). The output of IC3 is coupled to the output of the circuit through a 3.3 μF capacitor. The circuit also includes a 20 kΩ Echo Control input and a 220 kΩ resistor connected to Vcc. A note at the bottom states: "* Adjust to minimize distortion (VR 100K Ω typ.)".

Echo Effect Generation Circuit (Signal Delay Over 10msec.)