

AUDIO BANDPASS FILTER

FEATURES:

- 300 Hz to 3000/3400 Hz Audio Bandpass Filter
- Low Group Delay Distortion
- On-Chip Uncommitted Amplifier
- Low CMOS Power Requirements
- "Powersave" Option

APPLICATIONS:

- Alarm Systems
- Portable Audio Equipment
- Data Signalling — Modems
- PABX and Trunk Equipment
- Cordless Telephones and Intercoms
- Mobile Radio Audio Processing
- Medical Instrumentation
- Delta Modulation Audio Filtering

DESCRIPTION:

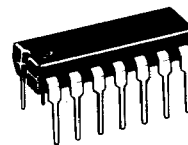
The MX326 is a general purpose switched capacitor audio bandpass filter. The filter frequency response is clock related; however, the programmable divider allows for a standard 300-3000 Hz or 300-3400 Hz frequency response (see Fig. 3). As shown in Figure 1, the device consists of:

- a 6th order low group delay distortion lowpass filter,
- a 4th order highpass filter, and
- an uncommitted amplifier.

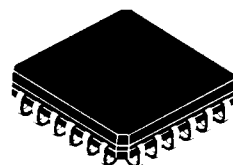
The two filters are connected in series, providing an audio bandpass filter. The lowpass filter may be used independently.

The uncommitted amplifier can be used for specific applications such as pre-emphasis, de-emphasis, buffering, and gain control. An on-chip oscillator utilizes an external resonator or crystal to provide all reference clocks for the switched capacitor filters. Alternatively, an externally derived clock may be used.

The two clock select lines enable the device to be used with various clock frequencies without significantly altering the filter response. Alternatively, re-programming the clock select lines or varying the clock frequency will shift the filter cutoff frequencies (see Fig. 3). The chip enable input is used to disable the filter and amplifier sections, thus reducing current consumption.



**MX326J (CDIP)
MX326P (PDIP)
14 pins**



**MX326LH
(24p PLCC)**

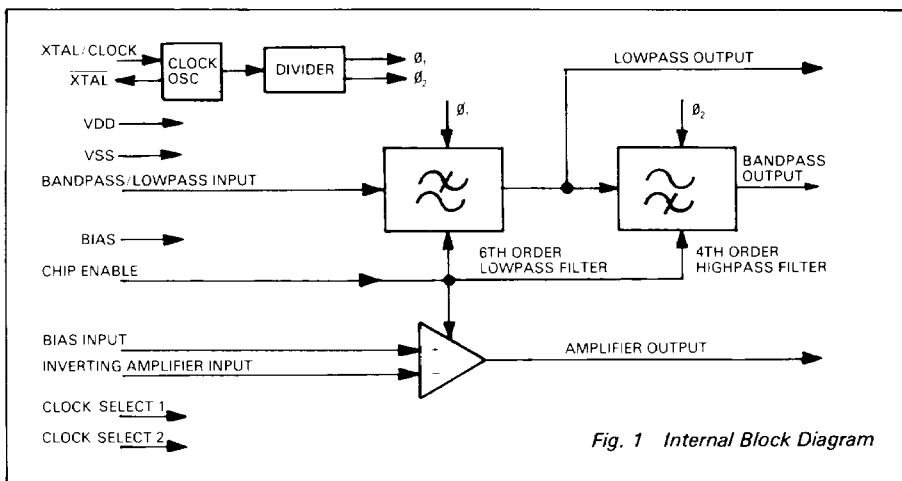


Fig. 1 Internal Block Diagram

MX326 PIN FUNCTION TABLE

PIN		FUNCTION/DESCRIPTION															
MX326J	MX326LH																
1	1	VDD: Positive Supply.															
2	2	Select 2: Inputs to on chip programmable divider used to select required															
3	3	Select 1: operating xtal/clock frequency. Both pins have 1M Ω internal pull down resistors (see Fig. 3). The upper and lower cutoff frequencies are controlled by the clock frequency ϕ , division ratio n and a design constant. The typical lower cutoff frequency f_L is given by: $f_L = 2.5 \frac{\phi}{n}$ where f_L is -3dB frequency in Hz ϕ is clock frequency in kHz n is set by S1, S2. The corresponding upper cutoff frequency f_H is given by $f_H = 34 \frac{\phi}{n}$ The relationship between S1, S2 and n is:															
		<table> <tr> <th>S1</th><th>S2</th><th>n</th></tr> <tr> <td>0</td><td>0</td><td>10</td></tr> <tr> <td>0</td><td>1</td><td>6</td></tr> <tr> <td>1</td><td>0</td><td>20</td></tr> <tr> <td>1</td><td>1</td><td>12</td></tr> </table>	S1	S2	n	0	0	10	0	1	6	1	0	20	1	1	12
S1	S2	n															
0	0	10															
0	1	6															
1	0	20															
1	1	12															
4	7	Lowpass O/P: This is the output of the lowpass filter section and is internally biased to VDD/2.															
5	10	Chip Enable: Internally pulled to VDD. A logic '0' applied to this input will disable all filters and the uncommitted amplifier. (Powersave)															
6	11	$\overline{\text{Xtal}}$: Xtal output. Inverting output of on chip oscillator.															
7	12	Xtal/Clock: Input to on-chip inverting oscillator. Xtal resonator input or externally derived clock may be applied to this input.															
8	13	V_{SS}: Negative Supply.															
9	14	Bandpass/Lowpass I/P: Input to lowpass filter, which is connected in series with the Highpass filter to form the Bandpass section.															
10	17	Bias: VDD/2 Bias pin externally decoupled by C ₄ (see Fig. 2, Note 1).															
11	19	Bandpass O/P: Output from Highpass filter, internally biased to VDD/2.															
12	21	Amp I/P (+ VE): Uncommitted amplifier, non-inverting input.															
13	23	Amp I/P (- VE): Uncommitted amplifier, inverting input.															
14	24	Amp O/P: Uncommitted amplifier output.															

MX326 ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings

Exceeding the maximum rating can result in device damage. Operation of the device outside the operating limits is not implied.

Supply voltage		−0.3V to 7.0V
Input voltage at any pin (ref VSS = 0V)		−0.3V to (VDD + 0.3V)
Output sink/source current (total)		20mA
Operating temperature range:	MX326J	−30°C to +85°C
	MX326LH, MX326P	−30°C to +70°C
Storage temperature range:	MX326J	−55°C to +125°C
	MX326LH, MX326P	−40°C to +85°C
Maximum device dissipation:		All versions 100mW

Operating Limits

All characteristics measured using the following parameters unless otherwise specified:

VDD = 5V, T_{amb} = 25°C, ϕ = 1MHz, (pin 2 and pin 3 open circuit), Δf_{ϕ} = 0, f_{in} = 1kHz, 100 mV rms.

Characteristics	See Note	Min	Typ	Max	Unit
Static Characteristics					
Supply voltage		4.5	5	5.5	V
Supply current (Enabled)		—	3.5	—	mA
Supply current (Disabled)		—	1	2	mA
Input impedance (Filters & Amplifier)		100	—	—	k Ω
Output impedance (Filters)		—	3	—	k Ω
Output impedance (Amplifier open loop)		—	800	—	Ω
Output impedance (Amplifier closed loop)		—	6	—	Ω
Input logic '1'		3.5	—	—	V
Input logic '0'		—	—	1.5	V
On-chip crystal oscillator: R in		10	—	—	M Ω
R out		5	—	15	k Ω
Inverter gain		10	—	20	dB
Gain Bandwidth Product		3	—	—	MHz
Crystal/Resonator Frequency	1		1		MHz
Dynamic Characteristics					
Passband Ripple (400 – 2800Hz)		—	—	2	dB
Cut off frequency LP (−3dB)		—	3400	—	Hz
HP (−3dB)		—	260	—	Hz
Stopband Attenuation (f>6kHz)		—	35	—	dB
(f<200Hz)		—	15	—	dB
Output Noise (rms)	2	—	1.6	—	mV
Signal Input Range(rms)	3	—	0.4	1.0	V
Insertion loss (1kHz)			0		dB
Aliasing Frequency		ϕ			Hz
		2n			
Uncommitted Amplifier					
Open loop gain	4	—	30	—	dB
Gain BW product		—	1	—	MHz

Notes:

- 1). For other frequencies see Fig. 3.
- 2). Measured with input ac short circuit.
- 3). 'MAX' figure specified for nominal 3% distortion (30dB SINAD).
'TYP' figure specified for minimum distortion (MAX SINAD).
- 4). Relative to 1kHz, 100 mV rms input level.

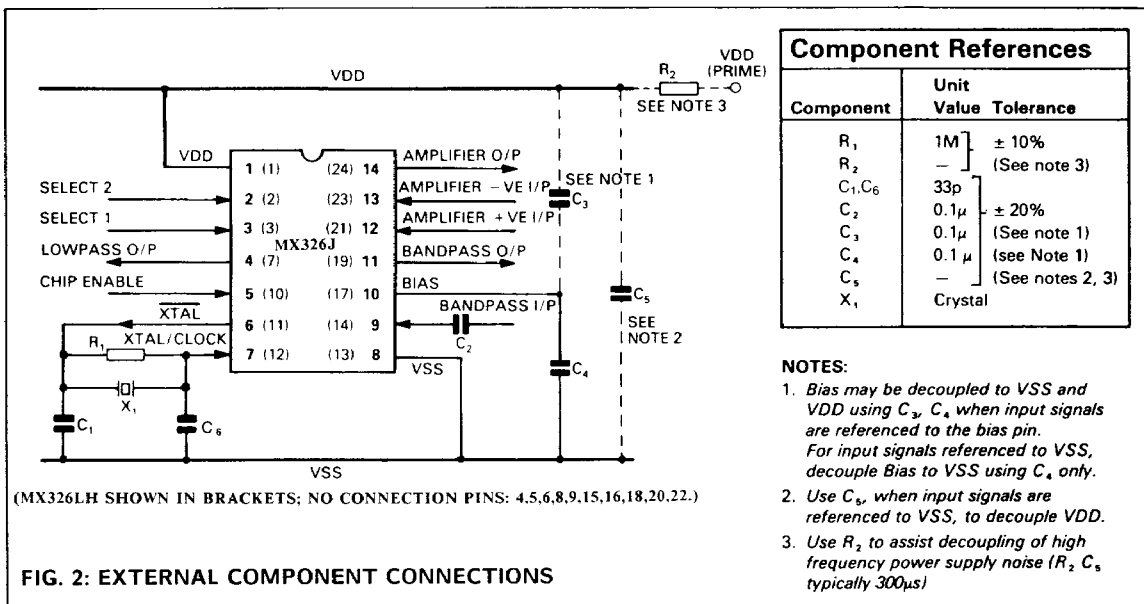


FIG. 2: EXTERNAL COMPONENT CONNECTIONS

