CML Semiconductor Products

PRODUCT INFORMATION

FX336 R2000 Filter Array

Publication D/336/3 July 1994

Features/Applications

- R2000 Trunked Radio Audio Processing
- High Order 300Hz Highpass Filter
- Low Group Delay 2550Hz Lowpass Filter
- On-Chip 120–175Hz Bandpass
- Uncommitted Amplifier and Analogue Switch
- Typical 43dB Rejection Below 170 Hz
- Switched Capacitor Filters
- Xtal Controlled
- Single 5 Volt CMOS Process
- Chip Enable Powersave Feature
- Surface Mount or DIL Package Styles

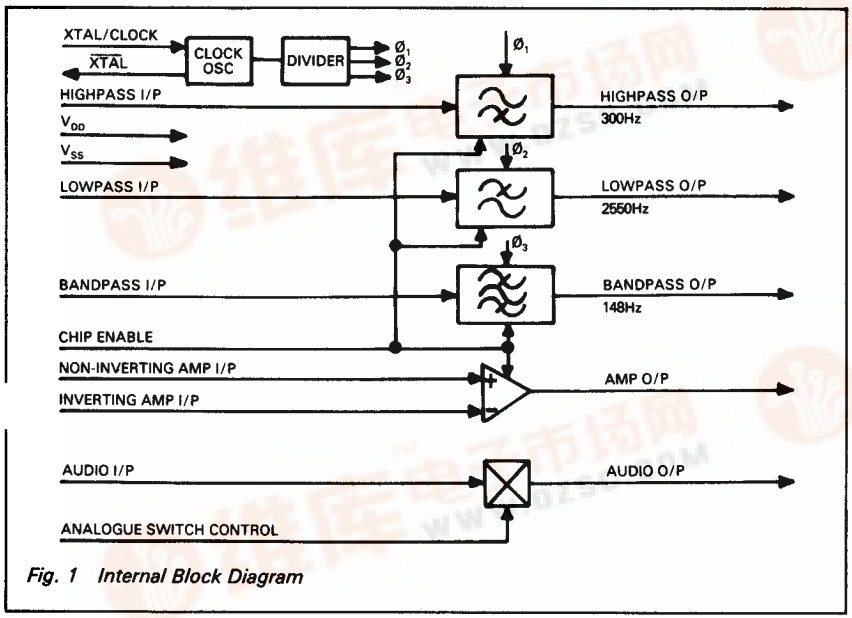


Fig. 1 Internal Block Diagram

FX336

Brief Description

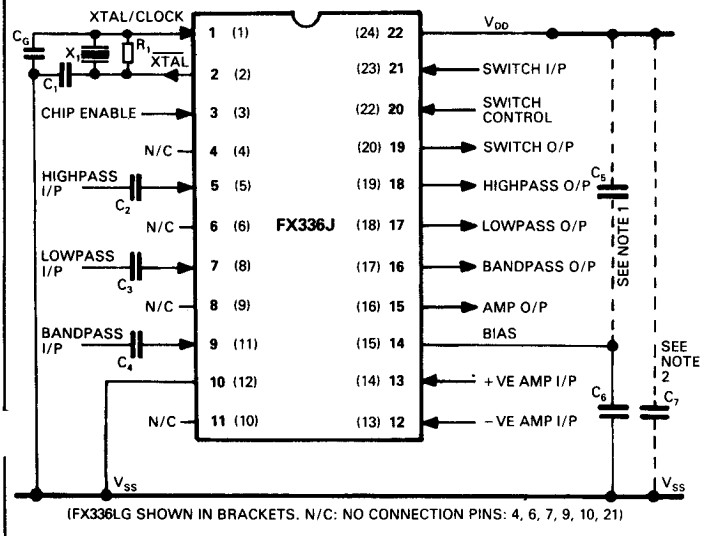
The device is a single chip CMOS filter array used to process speech and 50 baud FSK signals as specified in the Radiocom 2000 system specification. The device consists of:

(a) Highpass audio filter with typically 43dB

The group delay of this lowpass filter is controlled over the range 900 – 2100Hz, hence allowing the filter to pass 1200 Baud FFSK data.

(c) Narrow bandpass filter for processing

Pin Number			Function
FX336J	FX336LG	FX336LS	
1	1	1	**Xtal/Clock:** This is the input to the clock oscillator inverter. 1MHz xtal input or externally derived clock can be injected into this input.
2	2	2	**$\overline{\text{Xtal}}$:** Output of clock oscillator inverter.
3	3	3	**Chip Enable:** This input has an internal 1MΩ pull up resistor to V_{DD}. When pulled to V_{SS} (logic '0') all internal amplifiers are disabled and current consumption is reduced.
4	4	4, 5	**No Connection.**
5	5	6	**Highpass I/P:** Input to highpass filter.
6	6, 7	7, 8	**No Connection.**
7	8	9	**Lowpass I/P:** Input to lowpass filter.
8	9, 10	10, 11, 12	**No Connection.**
9	11	13	**Bandpass I/P:** Input to narrow bandpass filter.
10	12	14	V_{SS}: Negative supply.
11	—	15	**No Connection.**
12	13	16	**Amp Negative:** Inverting input of uncommitted amplifier.
13	14	17	**Amp Positive:** Non-inverting input of uncommitted amplifier.
14	15	18	**Bias:** This is the bias or analogue ground pin and is set internally at $V_{DD}/2$. It should be decoupled to V_{SS} by an externally connected 1.0μF (min).
—	—	19	**No Connection.**
15	16	20	**Amp O/P:** Output of uncommitted amplifier.
16	17	21	**Bandpass O/P:** Output of narrow bandpass filter.
17	18	22	**Lowpass O/P:** Output of lowpass filter.
18	19	23	**Highpass O/P:** Output of highpass filter.
19	20	24	**Switch O/P:** Output of analogue switch. This output is internally biased to approximately $V_{DD}/2$.
—	21	25	**No connection.**
20	22	26	**Switch Control:** Control input of analogue switch, internally pulled to V_{DD} by 1MΩ resistor with switch in 'closed' position. When this input is pulled to V_{SS} the switch is in 'open' position.
21	23	27	**Switch I/P:** Input of analogue switch.
22	24	28	V_{DD}: Positive supply.
			Note: Output Loading.



(FX336LG SHOWN IN BRACKETS. N/C: NO CONNECTION PINS: 4, 6, 7, 9, 10, 21)

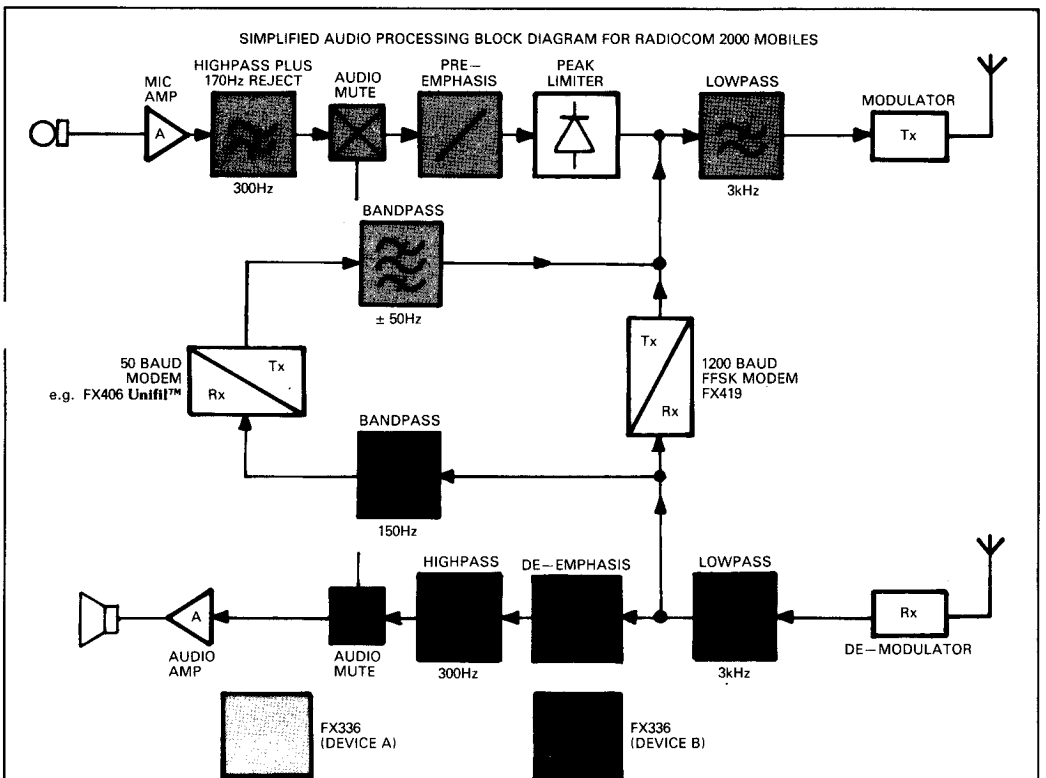
Component References

Component	Typical Unit Value	
R_1	1MΩ	Note 3
C_1	33p	
C_2	0.1μ	
C_3	0.1μ	
C_4	0.1μ	
C_5	0.1μ	Note 1
C_6	1.0μ Min.	Note 1
C_7	0.1μ Min.	Note 3
C_G	47p	Note 3
X_1	1MHz	Note 3
R = ±10%	C = ±20%	

NOTES:

1. *Bias may be decoupled to V_{SS} and V_{DD} using C_5, C_6 when input signals are referenced to the bias pin. For input signals referenced to V_{SS}, decouple Bias to V_{SS} using C_6 only.*
2. *Use C_7, when input signals are referenced to V_{SS}, to decouple V_{DD}.*
3. *Xtal circuitry shown is in accordance with CML application note D/XT/I April 1986.*

Fig. 2 External Component Connections



Specification

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 V_{SS} = OV)		−0.3V to (V_{DD} + 0.3V)
Output sink/source current (total)		20mA
Operating Temperature:	FX336J	-30°C to +85°C
	FX336LG/LS	-30°C to +70°C
Storage Temperature:	FX336J	-55°C to +125°C
	FX336LG/LS	-40°C to +85°C

Operating Limits

All characteristics measured using the following parameters unless otherwise specified:
V_{DD} = 5V, T_{amb} = 25°C, Ø = 1MHz, Δf_O = 0, f_{in} = 1kHz, V_{in} = 1.0 V(rms)

Characteristics		See Note	Min	Typ	Max	Unit
Static Characteristics						
Supply voltage			4.5	5	5.5	V
Supply current (Enabled)			—	6.8	—	mA
Supply current (Disabled)			—	600	—	μA
Input impedance (Filters & Amplifier)			100	800	—	kΩ
Output impedance (Filters & Amplifier)			—	1.0	—	kΩ
Input logic '1'			70%V_{DD}	—	—	V
Input logic '0'			—	—	30%V_{DD}	V
Dynamic Characteristics						
Passband Ripple	(300-2550Hz) HP+LP	1	—	—	2	dB
	(280-300Hz) HP+LP	2	+1	0	−2	dB
	(120−175Hz) BP	2	—	—	3	dB
Cut-off Frequency	(−3dB) HP		—	265	—	Hz
	(−3dB) LP		—	3800	—	Hz
	(−6dB)>150Hz BP		—	190	—	Hz
	(−6dB)<150Hz BP		—	115	—	Hz
Stopband Attenuation	<170Hz HP		40	43	—	dB
	>9000Hz LP		40	47	—	dB
	<65Hz>290Hz BP		30	40	—	dB
Group Delay Distortion	(900-2100Hz) LP		—	30	60	μs
	(900-2100Hz) HP+LP		—	300	—	μs
	(136-164Hz) BP	3	—	1.7	—	ms
Output Noise	LP	4	—	2.0	—	mV(rms)
	HP	4	—	2.0	—	mV(rms)
	BP	4	—	2.0	—	mV(rms)
Signal Input	LP	5	—	0.5	1.0	V(rms)
	HP	5	—	0.5	1.0	V(rms)
	BP	5	—	0.5	1.0	V(rms)
Passband Gain	(1kHz) HP+LP		−0.5	+0.5	+1.5	dB
	(150Hz) BP		−1	0	+1	dB
Aliasing Frequency			50	—	—	kHz
Audio Switch						
Output Noise (rms)		4	—	—	1	mV
Channel Resistance (on)			—	500	—	kΩ
Channel Resistance (off)			10	—	—	MΩ
Uncommitted Amplifier						
Open loop gain			35	50	—	dB
Bandwidth			—	200	—	kHz

Notes: *1. Absolute ripple—see Fig. 4.*
2. Absolute ripple—see Fig. 5.
3. Relative delay between 136 and 164Hz.
4. Measured with input a.c. s/c; at 30kHz Bw.
5. (MAX) figure specified for nominal 2% distortion (20dB).

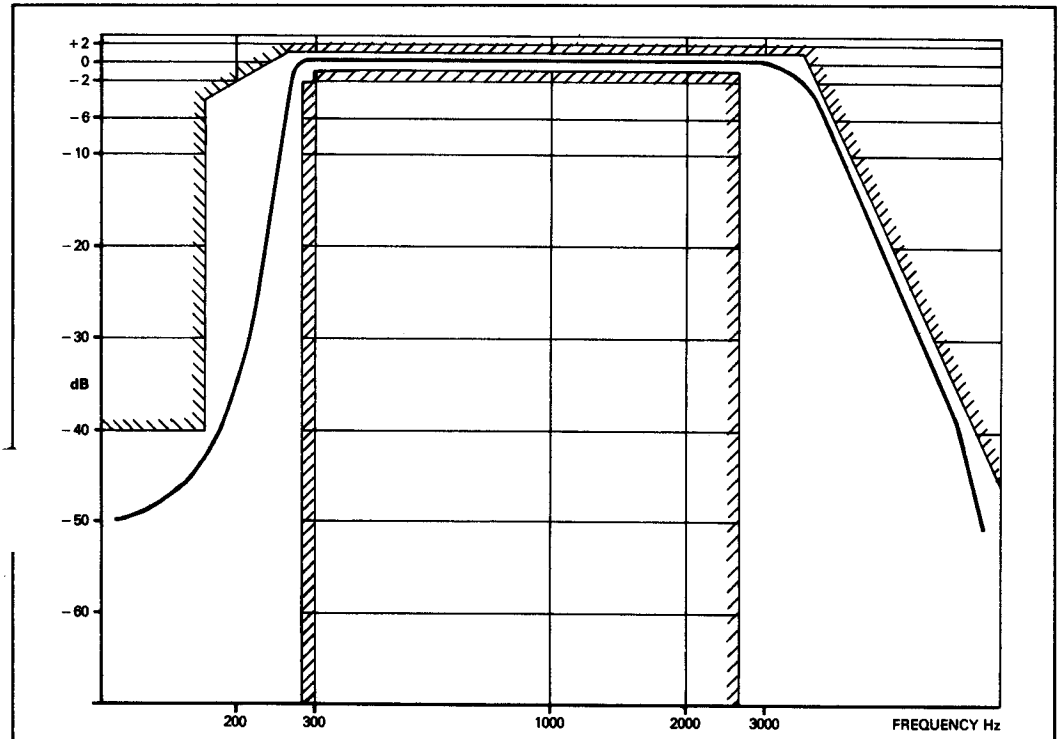
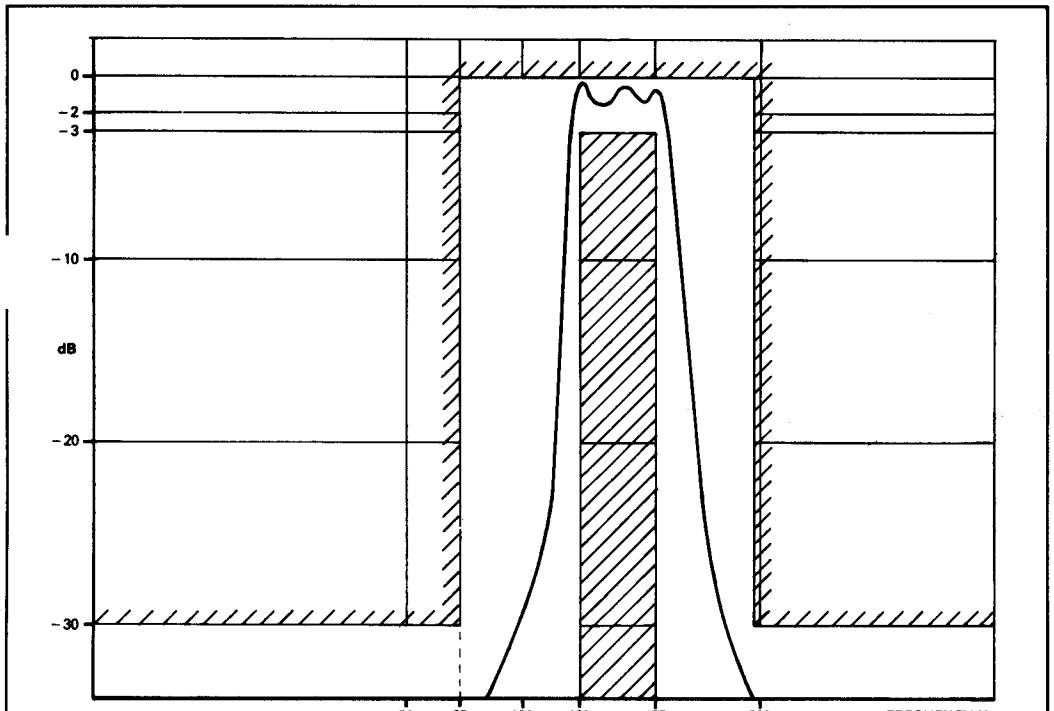


Fig. 4 Typical audio bandpass filter frequency response versus R2000 filter specification.

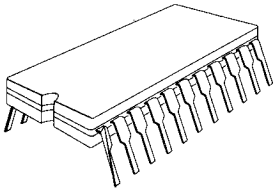


Package Outlines

The FX336 is available in the package styles outlined below. Mechanical package diagrams and specifications are detailed in Section 10 of this document.
Pin 1 identification marking is shown on the relevant diagram and pins on all package styles number anti-clockwise when viewed from the top.

FX336J 22-pin cerdip DIL (J3)

NOT TO SCALE



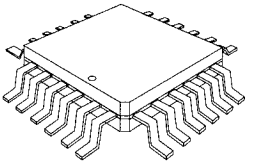
Max. Body Length 27.38mm
Max. Body Width 9.75mm

Handling Precautions

The FX336 is a CMOS LSI circuit which includes input protection. However precautions should be taken to prevent static discharges which may cause damage.

FX336LG 24-pin quad plastic encapsulated bent and cropped (L1)

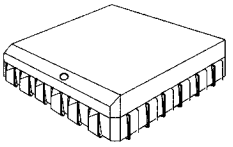
NOT TO SCALE



Max. Body Length 10.25mm
Max. Body Width 10.25mm

FX336LS 24-lead plastic leaded chip carrier (L2)

NOT TO SCALE



Max. Body Length 10.40mm
Max. Body Width 10.40mm

Ordering Information

FX336J 22-pin cerdip DIL (J3)

FX336LG 24-pin encapsulated bent and cropped (L1)

FX336LS 24-lead plastic leaded chip carrier (L2)

In the process of creating a more global image, the three standard product se
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These companies are all 100% owned operating companies of the CML Micr
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CML Microcircuits Product Prefix Codes

Until the latter part of 1996, the differentiator between products manufactured
MXCOM, Inc. and Consumer Microcircuits Limited were denoted by the prefix
respectively. These products use the same silicon etc. and today still carry th
In the latter part of 1996, both companies adopted the common prefix: CMX.

This notification is relevant product information to which it is attached.

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