



FX366 AMPS/TACS Quad Filter Array

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Provisional Issue

Features/Applications

- **Separate Bandpass and Lowpass Gain/Filter Blocks**
- **Global AMPS/TACS Cellular Applications**
 - Bandpass Filters**
 - 4.5dB Gain (300Hz to 3000Hz)
 - **Lowpass Filters (3000Hz)**
- **Input Gain Adjustments**
- **Output Enable/Mute for Squelch Functions**
- **Small Outline Surface Mount and DIL Packages**
- **Low-Power 5V CMOS**

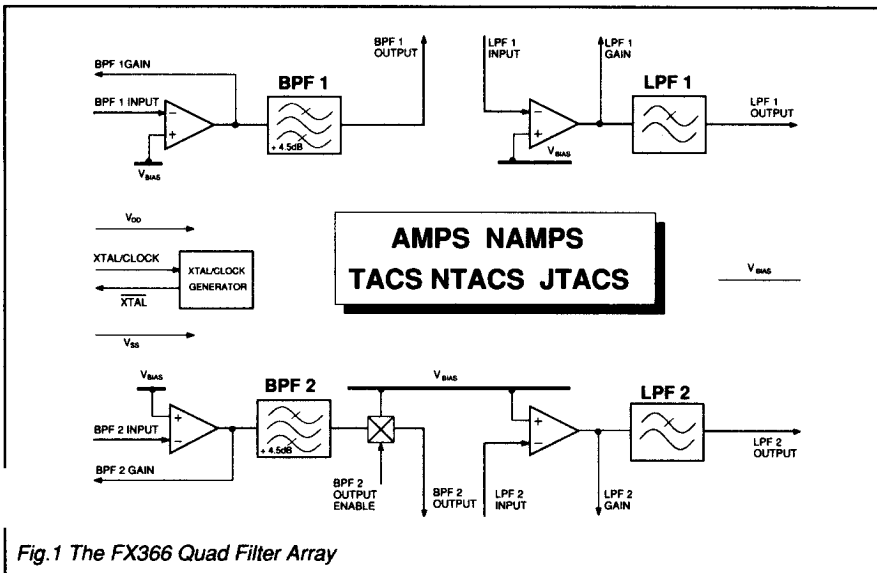


Fig.1 The FX366 Quad Filter Array



Island Labs

FX366

Brief Description

The **FX366** AMPS/TACS Quad Filter Array comprises 4 separate individual filter/gain blocks in a single microcircuit, containing:

- 2 Bandpass Filters BPF 1 and BPF 2.
 - 14th order 300Hz to 3000Hz -
- 2 Lowpass Filters LPF1 and LPF 2.
 - 10th order 3100Hz -

Each filter block has an amplifier at its input for use with external components to provide functions such as, level adjustment, pre- or de-emphasis and limiting.

BPF 2 has the added facility of Output Enable which could be used as 'audio mute' in a squelch or Inband-Mixing environment.

The provision of 2 bandpass and 2 lowpass filter sections allows 2 audio channels, each of LPF and BPF pairing for use in a full-duplex Tx/Rx cellular system.

All on-chip filters meet the AMPS and TACS cellular system speechband specifications; Including NAMPS, NTACS and JTACS. Switched capacitor filter technology is employed on this chip with all switching clocks derived from an externally applied single Xtal/clock source.

These simple, comprehensive amplifier/filter combinations eliminate the need for several separate integrated circuits therefore saving power and space.

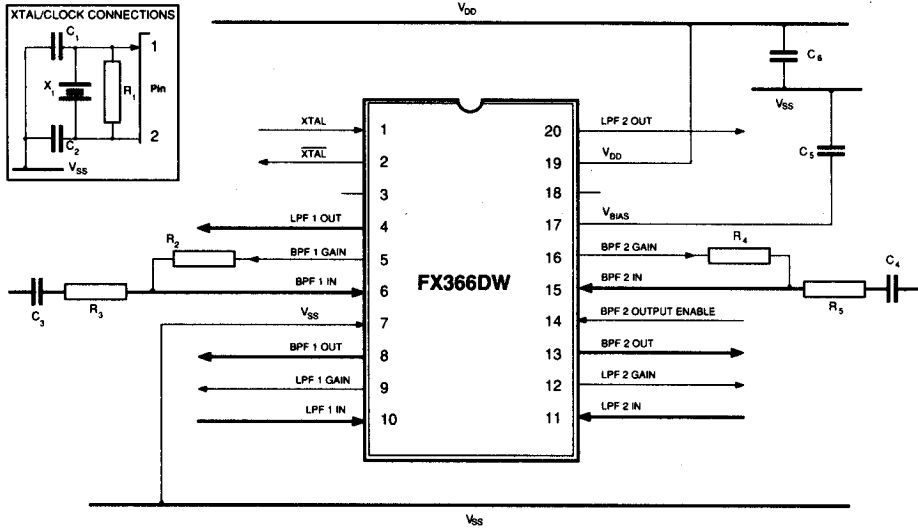
The **FX366** is a low-power, single 5V CMOS device and is available in a 22-pin cerdip Dual-in-Line and a 20-pin plastic Small Outline (S.O.I.C.) surface mount package.

Pin Number

Function

FX366DW	FX366J	
1	1	Xtal/Clock: A 4.433619MHz Xtal or externally derived clock is injected at this pin. Operation of the FX366 without a Xtal or clock input may cause device damage.
2	2	Xtal: Output of the on-chip clock oscillator inverter.
4	4	LPF 1 Output: The output of LPF 1 filter/gain block.
5	5	BPF 1 Gain: The output of BPF 1 gain-adjusting amplifier. This output is used with BPF 1 Input and external components.
6	6	BPF 1 Input: The input to BPF 1 filter/gain block.
7	7	V_{ss}: Negative supply (GND).
8	8	BPF 1 Output: The output of BPF 1.
9	10	LPF 1 Gain: The output of LPF 1 gain-adjusting amplifier. This output is used with LPF 1 Input and external components.
10	11	LPF 1 Input: The input to LPF 1 filter/gain block.
11	12	LPF 2 Input: The input to LPF 2 filter/gain block.
12	13	LPF 2 Gain: The output of LPF 2 gain-adjusting amplifier. This output is used with LPF 2 Input and external components.
13	15	BPF 2 Output: The output of BPF 2. This output is under the control of the BPF 2 Output Enable input.
14	16	BPF 2 Output Enable: Controls the status of BPF 2 Output. Logic "1" = Enable, Logic "0" = Muted. This pin has an internal 1.0MΩ pullup resistor.
15	17	BPF 2 Input: The input to BPF 2 filter/gain block.
16	18	BPF 2 Gain: The output of BPF 2 gain-adjusting amplifier. This output is used with BPF 2 Input and external components.
17	19	V_{BIAS}: The internal analogue bias line at V _{DD} /2. This pin should be decoupled to V _{SS} by a capacitor of 1.0μF.
19	21	V_{DD}: Positive supply rail. A single +5-volt power supply is required. Levels and voltages within this device are dependent upon this supply.
20	22	LPF 2 Output: The output of LPF 2.
3, 18	3, 9, 14, 20	No internal connection. Leave open circuit.

Application Information



Component	Value	Component	Value
R ₁	= 1.0MΩ	C ₁	= 33.0pF
		C ₂	= 47.0pF
		C ₅	1.0μF
		C ₆	0.47μF
		X ₁	4.433619MHz
Tolerances			
		C = ±20%	R = ±10%

- Configurations R₁, R₂, C₃ and R₄, R₅, C₄ should be chosen with respect to the specific application.
- Operation of any CML microcircuit without a Xtal or clock input may cause device damage. To minimise damage in the event of a Xtal/drive failure, it is recommended that the power rail (V_{DD}) is fitted with a current limiting device (resistor or fast-reaction fuse).

Fig.2 Recommended External Components

The FX366 in a System

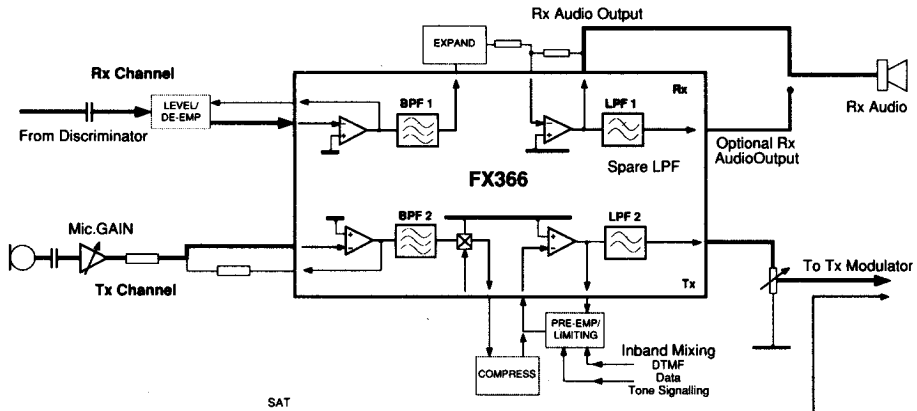
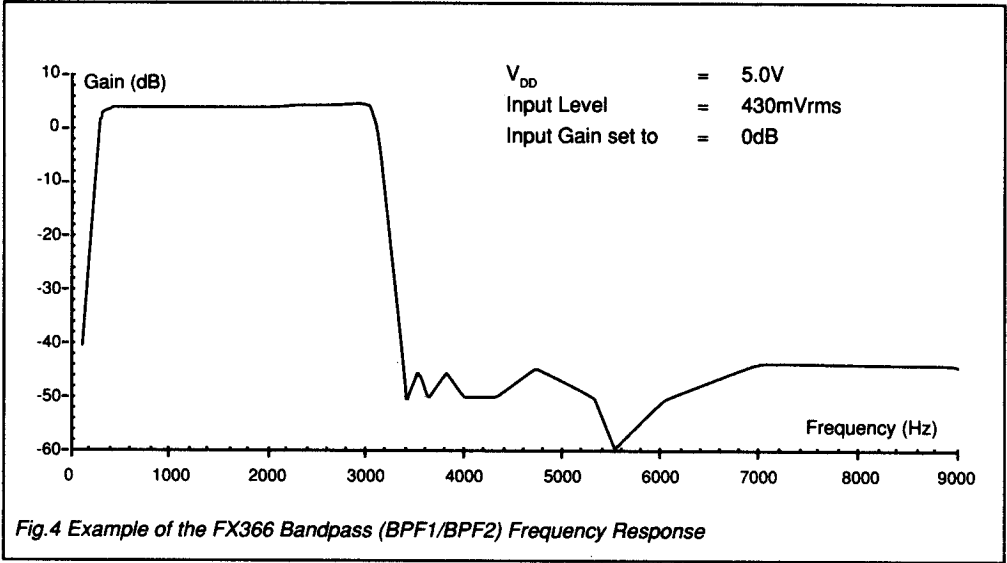


Fig.3 Example of the FX366 Employed in the Audio Stages of a TACS Application

Application Information

Performance

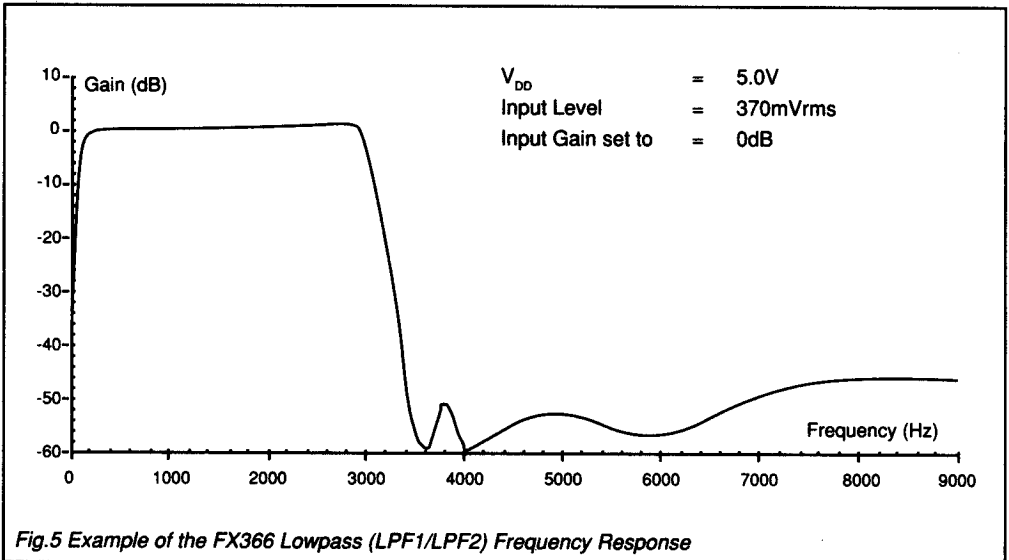
Bandpass Sections



When using the FX366 Quad Filter Array within a cellular system, the following points should be considered.

- (1) Each bandpass filter section has a frequency range of 300Hz to 3000Hz and a typical passband gain of 4.5dB.
- (2) Each lowpass filter section has a cut-off frequency of 3100Hz and a typical passband gain of 0.5dB.
- (3) BPF2 Output Enable has an enable/disable operating time as shown on the Specification page.

Lowpass Sections



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		-0.3 to 7.0V
Input voltage at any pin (ref $V_{SS} = 0V$)		-0.3 to ($V_{DD} + 0.3V$)
Sink/source current (supply pins)		+/- 30mA
(other pins)		+/- 20mA
Total device dissipation @ $T_{AMB} 25^{\circ}C$		800mW Max.
Derating		10mW/ $^{\circ}C$
Operating temperature range:	FX366DW	-40 $^{\circ}C$ to +85 $^{\circ}C$
	FX366J	-40 $^{\circ}C$ to +85 $^{\circ}C$
Storage temperature range:	FX366DW	-40 $^{\circ}C$ to +85 $^{\circ}C$
	FX366J	-55 $^{\circ}C$ to +125 $^{\circ}C$

Operating Limits

Device characteristics are measured under the following conditions unless otherwise specified:

$V_{DD} = 5.0V$. $T_{AMB} = 25^{\circ}C$. Xtal/Clock $f_0 = 4.433619MHz$. Audio level 0dB ref: = 775mV rms @ 1.0kHz.

Characteristics	See Note	Min.	Typ.	Max.	Unit
Static Values					
Supply Voltage		4.5	5.0	5.5	V
Supply Current		–	5.0	–	mA
Input Impedance (Amplifiers)		1.0	10.0	–	M Ω
Input Impedance (Digital)		100	–	–	k Ω
Output Impedance (BP Filters)		–	2.0	–	k Ω
Output Impedance (LP Filters)		–	2.0	–	k Ω
On-Chip Xtal Oscillator					
R_{IN}		10.0	–	–	M Ω
R_{OUT}		–	10.0	–	k Ω
Inverter d.c. Voltage Gain		–	10.0	–	V/V
Gain/Bandwidth Product		–	10.0	–	MHz
Dynamic Values					
Input Logic "1"		3.5	–	–	V
Input Logic "0"		–	–	1.5	V
Analogue Levels					
LP Filters					
Input		-30.0	–	4.5	dB
Output		-29.5	–	5.0	dB
BP Filters					
Input		-30.0	–	-1.5	dB
Output		-26.0	–	2.5	dB
Output Noise	2	–	-50.0	–	dBp
Bandpass Filter					
	1, 3				
Passband Frequencies		300	–	3000	Hz
Passband Ripple		–	± 1.0	–	dB
Low Freq. Roll-Off <200Hz		12.0	–	–	dB/oct.
High Freq. – Attenuation at 3.4kHz		–	48.0	–	dB
Passband Gain		3.5	4.5	5.5	dB
Bandpass Filter 2 Output Enable					
Enable Time		–	8.0	–	μS
Disable Time		–	20.0	–	μS
Lowpass Filter					
	1, 3				
Cut-Off Frequency (-3dB)		–	3100	–	Hz
Passband Ripple (300Hz - 3kHz)		–	± 1.0	–	dB
Attenuation at 3.3kHz		–	30.0	–	dB
Attenuation at 3.6kHz		–	45.0	–	dB
Passband Gain		–	0.5	–	dB
Distortion	1, 4	–	2.0	–	%

Notes:

1. Measured with an audio input level of -3.8dB (500mVrms).
2. With a short circuit input, at any analogue output and the measurement psophometrically weighted.
3. With Input Amplifier gain at 0dB.
4. Measured in a 30.0kHz bandwidth.

Package Outlines

The FX366 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.

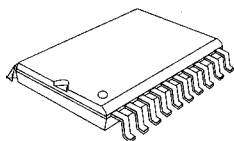
Handling Precautions

The FX366 is a CMOS LSI circuit which includes input protection. However precautions should be taken to prevent static discharges which may cause damage.

FX366DW 20-pin plastic S.O.I.C. (D3)

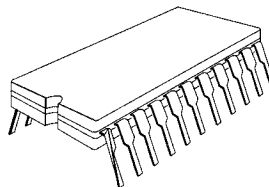
FX366J 22-pin cerdip DIL (J3)

NOT TO SCALE



Max. Body Length 12.85mm
Max. Body Width 7.59mm

NOT TO SCALE



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

Ordering Information

FX366DW 20-pin plastic S.O.I.C. (D3)

FX336J 22-pin cerdip DIL (J3)