

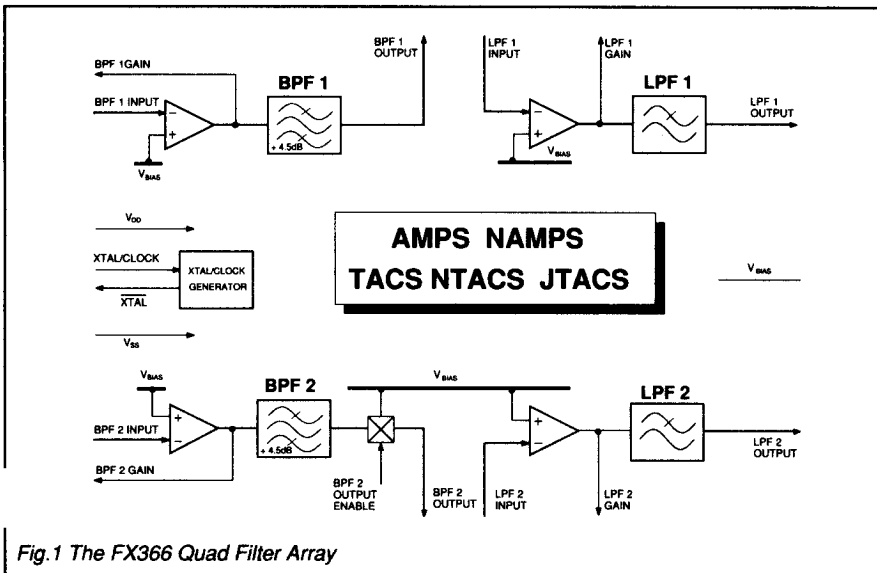


# FX366 AMPS/TACS Quad Filter Array

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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**



# FX366

Fig.1 The FX366 Quad Filter Array

## 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.

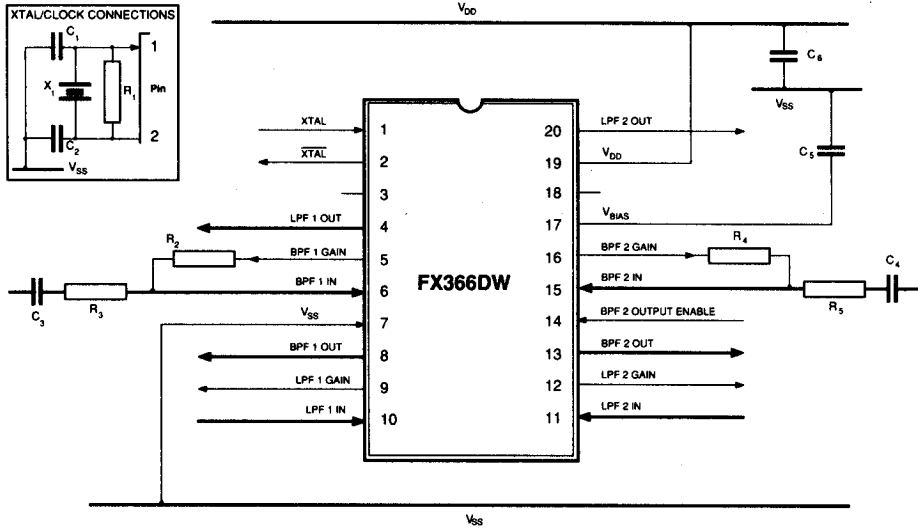
The **FX366** is a low-power, single 5V CMOS device and is available in a 22-pin cerdip Dual-in-Line and a 20-pin plastic Small Outline (S.O.I.C.) surface mount package.

## Pin Number

## Function

FX366DW	FX366J	
1	1	<b>Xtal/Clock:</b> 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	<b>Xtal:</b> Output of the on-chip clock oscillator inverter.
4	4	<b>LPF 1 Output:</b> The output of LPF 1 filter/gain block.
5	5	<b>BPF 1 Gain:</b> The output of BPF 1 gain-adjusting amplifier. This output is used with BPF 1 Input and external components.
6	6	<b>BPF 1 Input:</b> The input to BPF 1 filter/gain block.
7	7	<b>V<sub>ss</sub>:</b> Negative supply (GND).
8	8	<b>BPF 1 Output:</b> The output of BPF 1.
9	10	<b>LPF 1 Gain:</b> The output of LPF 1 gain-adjusting amplifier. This output is used with LPF 1 Input and external components.
10	11	<b>LPF 1 Input:</b> The input to LPF 1 filter/gain block.
11	12	<b>LPF 2 Input:</b> The input to LPF 2 filter/gain block.
12	13	<b>LPF 2 Gain:</b> The output of LPF 2 gain-adjusting amplifier. This output is used with LPF 2 Input and external components.
13	15	<b>BPF 2 Output:</b> The output of BPF 2. This output is under the control of the BPF 2 Output Enable input.
14	16	<b>BPF 2 Output Enable:</b> Controls the status of BPF 2 Output. Logic "1" = Enable, Logic "0" = Muted. This pin has an internal 1.0MΩ pullup resistor.
15	17	<b>BPF 2 Input:</b> The input to BPF 2 filter/gain block.
16	18	<b>BPF 2 Gain:</b> The output of BPF 2 gain-adjusting amplifier. This output is used with BPF 2 Input and external components.
17	19	<b>V<sub>BIAS</sub>:</b> The internal analogue bias line at V <sub>DD</sub> /2. This pin should be decoupled to V <sub>ss</sub> by a capacitor of 1.0μF.
19	21	<b>V<sub>DD</sub>:</b> Positive supply rail. A single +5-volt power supply is required. Levels and voltages within this device are dependent upon this supply.
20	22	<b>LPF 2 Output:</b> The output of LPF 2.
3, 18	3, 9, 14, 20	No internal connection. Leave open circuit.

# Application Information



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

- Configurations R<sub>2</sub>, R<sub>3</sub>, C<sub>3</sub> and R<sub>4</sub>, R<sub>5</sub>, C<sub>4</sub> 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<sub>DD</sub>) is fitted with a current limiting device (resistor or fast-reaction fuse).

Fig.2 Recommended External Components

## The FX366 in a System

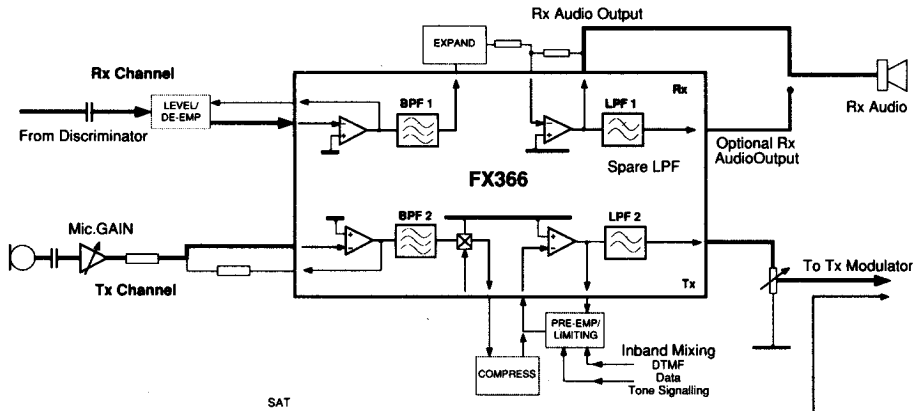
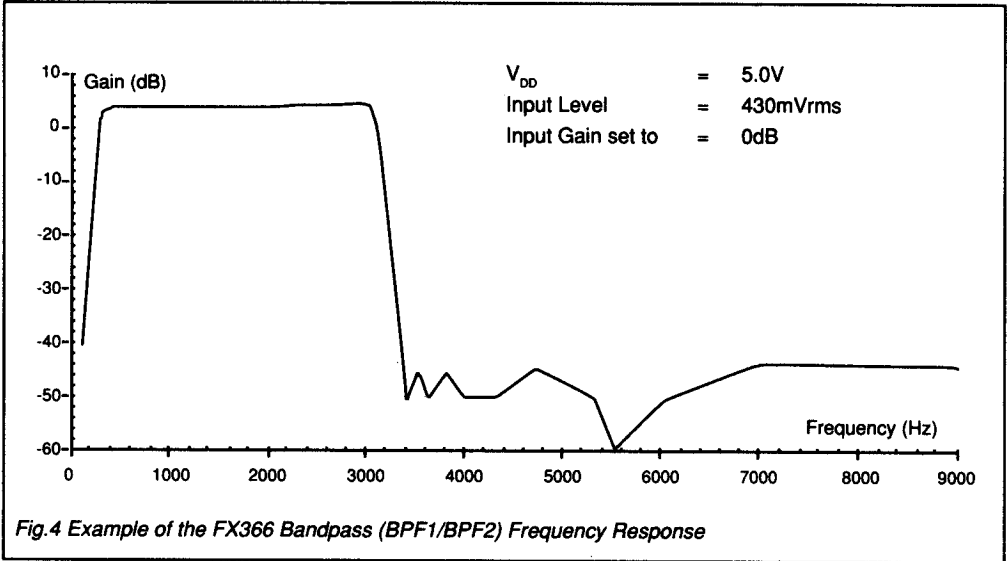


Fig.3 Example of the FX366 Employed in the Audio Stages of a TACS Application

# Application Information .....

## Performance

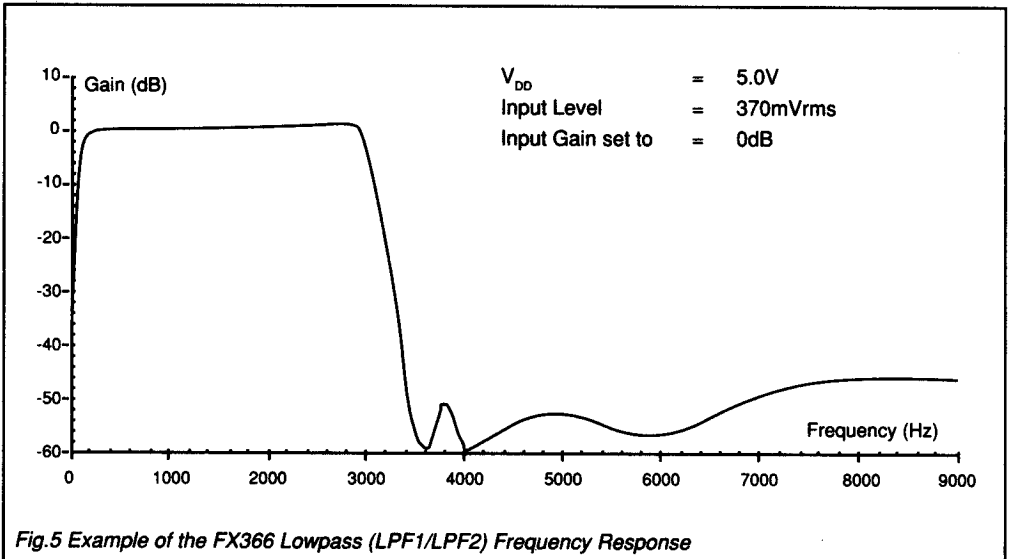
### Bandpass Sections



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:	<b>FX366DW</b>	-40 $^{\circ}C$ to +85 $^{\circ}C$
	<b>FX366J</b>	-40 $^{\circ}C$ to +85 $^{\circ}C$
Storage temperature range:	<b>FX366DW</b>	-40 $^{\circ}C$ to +85 $^{\circ}C$
	<b>FX366J</b>	-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
<b>Static Values</b>					
Supply Voltage		4.5	5.0	5.5	V
Supply Current		–	5.0	–	mA
Input Impedance (Amplifiers)		1.0	10.0	–	M $\Omega$
Input Impedance (Digital)		100	–	–	k $\Omega$
Output Impedance (BP Filters)		–	2.0	–	k $\Omega$
Output Impedance (LP Filters)		–	2.0	–	k $\Omega$
<b>On-Chip Xtal Oscillator</b>					
$R_{IN}$		10.0	–	–	M $\Omega$
$R_{OUT}$		–	10.0	–	k $\Omega$
Inverter d.c. Voltage Gain		–	10.0	–	V/V
Gain/Bandwidth Product		–	10.0	–	MHz
<b>Dynamic Values</b>					
Input Logic "1"		3.5	–	–	V
Input Logic "0"		–	–	1.5	V
<b>Analogue Levels</b>					
<b>LP Filters</b>					
Input		-30.0	–	4.5	dB
Output		-29.5	–	5.0	dB
<b>BP Filters</b>					
Input		-30.0	–	-1.5	dB
Output		-26.0	–	2.5	dB
Output Noise	2	–	-50.0	–	dBp
<b>Bandpass Filter</b>					
	1, 3				
Passband Frequencies		300	–	3000	Hz
Passband Ripple		–	$\pm 1.0$	–	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
<b>Bandpass Filter 2 Output Enable</b>					
Enable Time		–	8.0	–	$\mu S$
Disable Time		–	20.0	–	$\mu S$
<b>Lowpass Filter</b>					
	1, 3				
Cut-Off Frequency (-3dB)		–	3100	–	Hz
Passband Ripple (300Hz - 3kHz)		–	$\pm 1.0$	–	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.

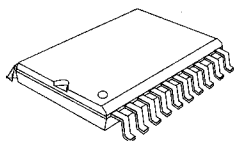
## Handling Precautions

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)

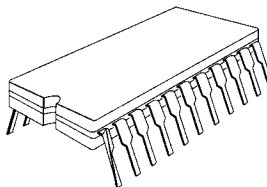
**FX366J** 22-pin cerdip DIL (J3)

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)