

# Consumer Microcircuits Limited

PRODUCT INFORMATION

## FX106 Audio Processor for NBFM Radio

With compliments of Island Labs

Publication D/106/1 May 1985

PROVISIONAL ISSUE

### Features

- Dual Audio BP Filters
- Dual LP Data Filters
- Peak Limiter and Post Filter
- Pre-emphasis and De-emphasis
- 5-Volt Low Power CMOS

### Applications

- Cordless Telephones
- Full Duplex Mobile Radio
- Portable Two-way Radio
- Telephony
- Intercoms



30 SET. 1985

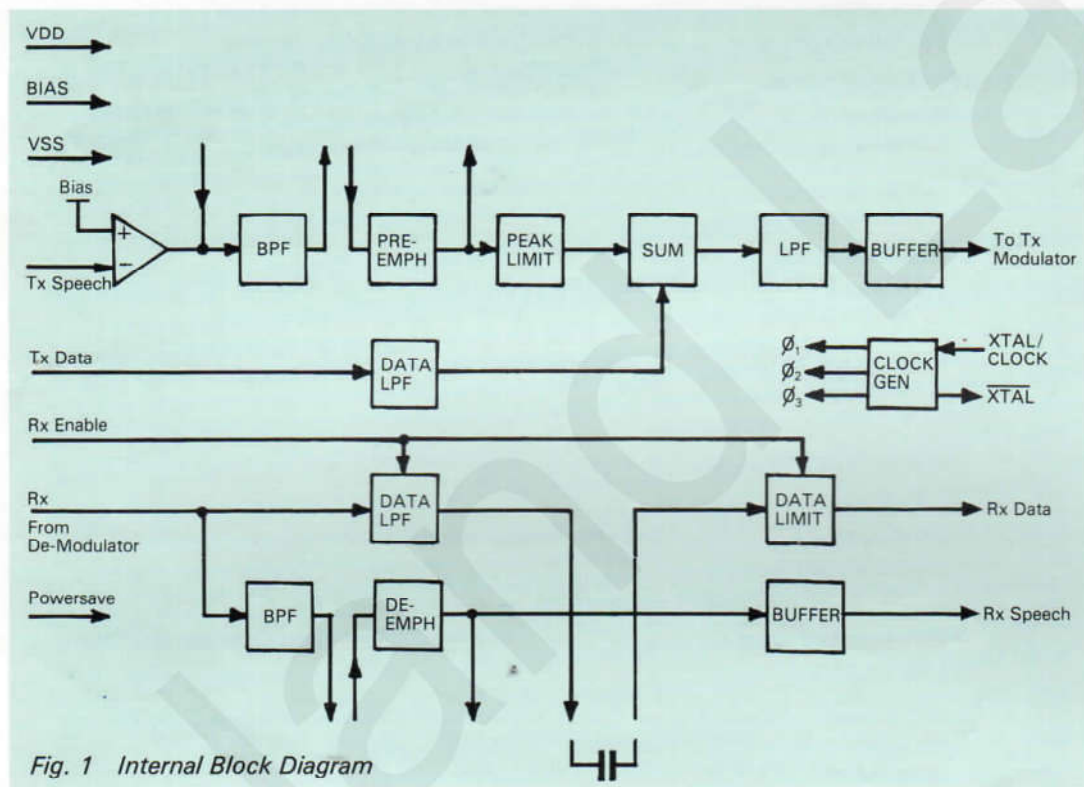


Fig. 1 Internal Block Diagram

# FX106

### Brief Description

The FX106 is an audio frequency processing circuit designed for use in narrow band FM transceivers. The single chip contains circuit elements to process voice frequencies and sub-audio data in full duplex operation. The low-power CMOS process operating from a single supply and choice of DIL or surface mounted packages makes the device suitable for portable or fixed applications. The transmit section contains an input amplifier with facilities for external gain adjustment, bandpass filter, pre-emphasis amplifier, peak deviation limiter, post-limiter filter, output

buffer and transmit data filter. The receiver section contains a bandpass filter, de-emphasis amplifier, output buffer, receiver data filter and limiter. Facilities are provided to disable the operation of the circuit except the receiver data channel, thereby saving power consumption in the standby mode.

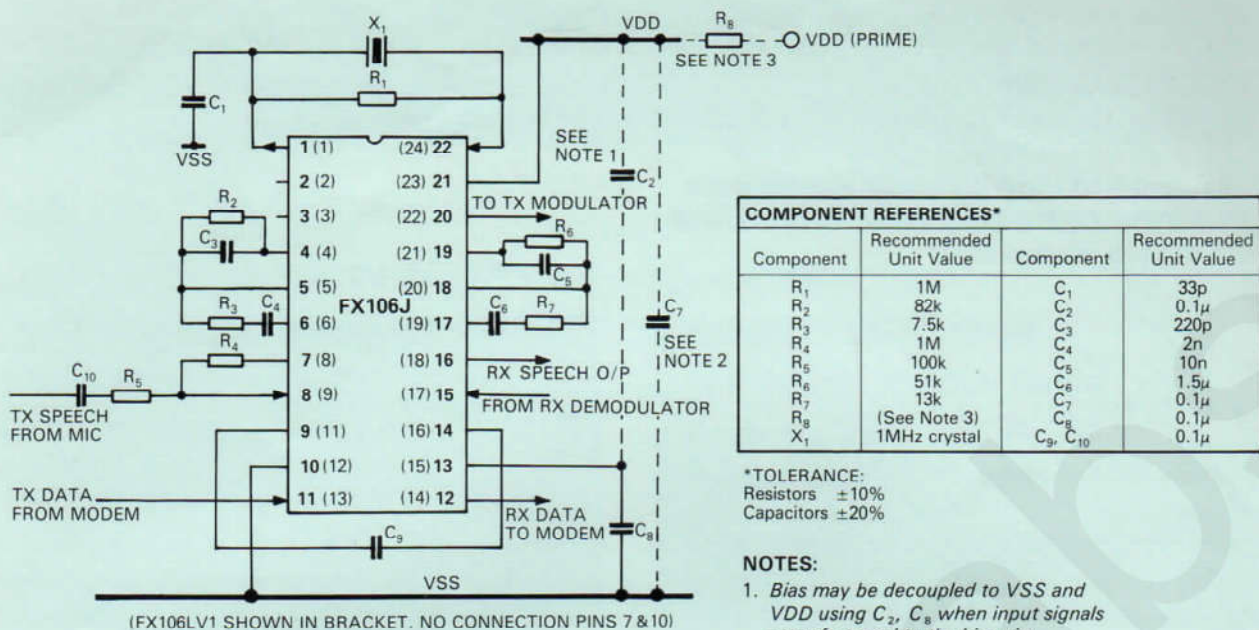
The FX106 makes extensive use of switched capacitor filter techniques and all sampling clocks are derived from a clock oscillator divider circuit using an externally connected 1MHz crystal or ceramic resonator.

## Pin Number

## Function

FX106J	FX106LV1	
1	1	<i>See Figures 2 and 3</i>
2	2	<b>Xtal:</b> Inverting output of the on-chip crystal oscillator.
3	3	<b>Powersave:</b> Internally pulled to Vdd, a logic '0' applied to this pin will disable all parts of the circuit except the data LPF and data limiter.
4	4	<b>Rx enable:</b> Internally pulled to Vdd, a logic '0' applied to this pin will disable the data LPF and data limiter.
5	5	
6	6	
7	8	<b>Pre-emph. O/P:</b> } <b>Pre-emph. I/P:</b> } <b>Tx Bandpass O/P:</b> } These pins are used to connect the external components required for the pre-emphasis frequency response.
8	9	
9	11	<b>Gain adjust:</b> } <b>Tx speech I/P:</b> } These pins are used to set the gain of the Tx input amplifier by externally connected resistors.
10	12	
11	13	<b>Analogue data O/P:</b> This pin outputs the received data signal after filtering, normally connected to Pin 14 (16) via an external capacitor.
12	14	<b>Vss:</b> Negative supply.
13	15	<b>Tx data I/P:</b> This pin is the input to the Tx data filter.
14	16	<b>Rx data O/P:</b> This pin is the logic level output of the limiter used to limit the received analogue data signal.
15	17	<b>V bias:</b> Vdd/2 bias pin, externally decoupled by capacitor.
16	18	<b>Data limiter I/P:</b> Input of the data limiter, normally coupled via capacitor to Rx data LPF output.
17	19	<b>Rx speech + data I/P:</b> This is the input to the Rx bandpass filter and Rx data LPF.
18	20	
19	21	
20	22	<b>Rx speech O/P:</b> This is the output of the buffer amplifier following the de-emphasis amplifier.
21	23	<b>Rx bandpass O/P:</b> } <b>De-emphasis I/P:</b> } <b>De-emphasis O/P:</b> } These pins are used to connect the external components required for the de-emphasis frequency response.
22	24	
		<b>Tx speech + data O/P:</b> This is the combined speech and data output following summation and post limiter filtering.
		<b>Vdd:</b> Positive supply.
		<b>Xtal/Clock:</b> Input to the on-chip crystal oscillator, a 1MHz crystal or ceramic resonator is connected between this pin and pin 1. This input is used as the input from an external 1MHz clock oscillator.



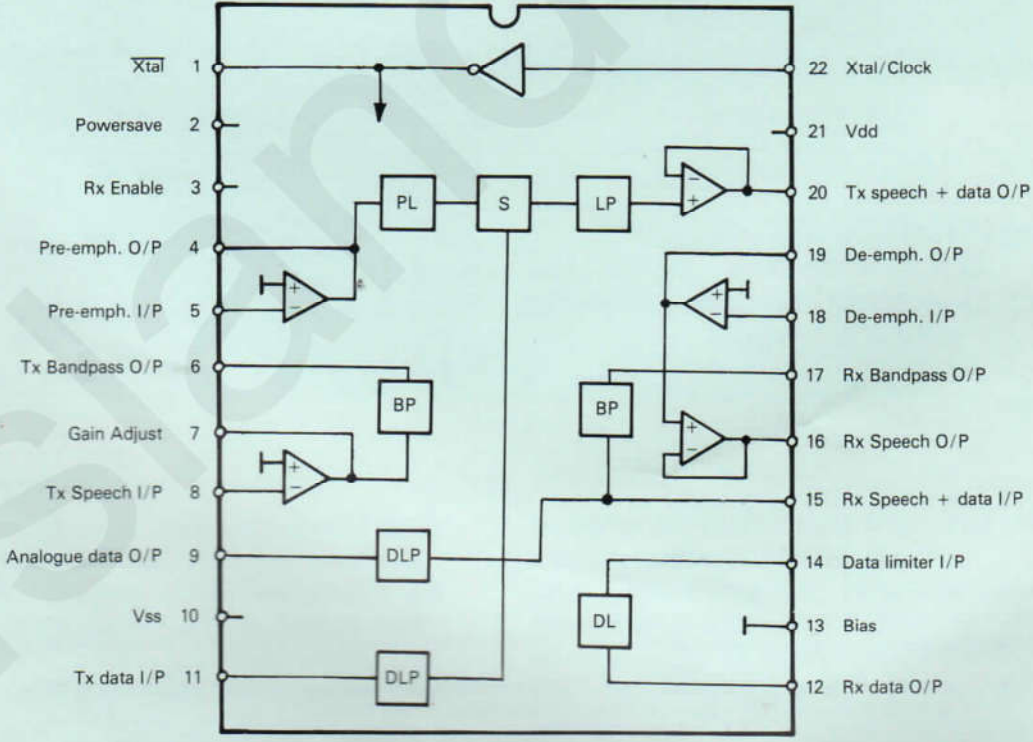


COMPONENT REFERENCES*			
Component	Recommended Unit Value	Component	Recommended Unit Value
R <sub>1</sub>	1M	C <sub>1</sub>	33p
R <sub>2</sub>	82k	C <sub>2</sub>	0.1μ
R <sub>3</sub>	7.5k	C <sub>3</sub>	220p
R <sub>4</sub>	1M	C <sub>4</sub>	2n
R <sub>5</sub>	100k	C <sub>5</sub>	10n
R <sub>6</sub>	51k	C <sub>6</sub>	1.5μ
R <sub>7</sub>	13k	C <sub>7</sub>	0.1μ
R <sub>8</sub>	(See Note 3)	C <sub>8</sub>	0.1μ
X <sub>1</sub>	1MHz crystal	C <sub>9</sub> , C <sub>10</sub>	0.1μ

\*TOLERANCE:  
Resistors ±10%  
Capacitors ±20%

- NOTES:**
1. Bias may be decoupled to VSS and VDD using C<sub>2</sub>, C<sub>8</sub> when input signals are referenced to the bias pin. For input signals referenced to VSS, decouple Bias to VSS using C<sub>9</sub> only.
  2. Use C<sub>7</sub> when input signals are referenced to VSS, to decouple VDD.
  3. Use R<sub>8</sub> to assist decoupling of high frequency power supply noise (R<sub>8</sub> C<sub>7</sub>, typically 300μs)

Fig. 2 External Component Connections



- KEY:**
- PL — Peak limiter
  - S — Summing amplifier
  - BP — Bandpass filter (speech), 300Hz – 3kHz
  - LP — Lowpass filter (speech + data), 3kHz
  - DLP — Data lowpass filter, 100Hz

Fig. 3 Functional Block Diagram

## 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 VSS = 0V)	-0.3V to (VDD + 0.3V)
Output sink/source current (total)	20mA
Operating temperature range: FX106J	-30°C to + 85°C
FX106LV1	-30°C to + 70°C
Storage temperature range: FX106J	-55°C to + 125°C
FX106LV1	-40°C to + 85°C

### Operating Limits

All characteristics measured using the following parameters unless otherwise specified.

VDD = 5V, T<sub>amb</sub> = 25°C,  $\phi$  = 1MHz,  $\Delta f_{\phi}$  = 0, reference input frequency = 1kHz (0dB)

Characteristics	See Note	Min	Typ	Max	Unit
<b>D.C. Characteristics</b>					
Supply voltage		4.5	5.0	5.5	V
Supply current:			5.0		mA
Supply current (standby)			500		$\mu$ A
Input logic '1'		3.5			V
Input logic '0'				1.5	V
Output logic '1'	1	4.0			V
Output logic '0'	1			1.0	V
<b>A.C. Characteristics</b>					
Input impedance					
Input amplifiers		1			M $\Omega$
Data Input		100			k $\Omega$
Output impedance					
Output buffer amplifier				10	$\Omega$
Pre- and de-emphasis amplifier				800	$\Omega$
Data limiter				800	$\Omega$
Open loop voltage gain					
All amplifiers	2	35			dB
<b>Filter Characteristics</b>					
Bandpass filter gain at 1kHz	3	-1		+1	dB
Bandpass filter frequency response	3				
$f \leq 100\text{Hz}$		-25	-30		dB
$f \leq 300\text{Hz}$		-3		+1	dB
$500\text{Hz} \leq f \leq 3000\text{Hz}$		-0.75		+0.75	dB
$f \leq 9000\text{Hz}$		-15			dB
Lowpass filter gain at 1kHz	3	3		5	dB
Lowpass filter frequency response	3				
$f \leq 3000\text{Hz}$		-0.75		+0.75	dB
$f = 3400\text{Hz}$		-2		+1	dB
$f \leq 9000\text{Hz}$		-15			dB
Transmit data filter gain	4	-3		-1	dB
Receive data filter gain	4	15	20	25	dB
Data filter frequency response	4				dB
$f \leq 100\text{Hz}$		-0.75		+0.75	dB
$f \geq 300\text{Hz}$		-30	-35	-40	dB
Maximum a.c. signal for all filters		4.0			V pk-pk
<b>Peak limiter Characteristic</b>					
Maximum a.c. signal before clipping				3.2	V pk-pk
<b>Data Limiter Characteristic</b>					
Sensitivity	5			40	mV r.m.s.

Note: 1.  $I_{\text{source}} = 100\mu\text{A}$ ,  $I_{\text{sink}} = 100\mu\text{A}$

2.  $F = 1\text{kHz}$ ,  $V_{\text{in}} = 7.0\text{mV r.m.s.}$

3.  $V_{\text{in}} = 300\text{mV r.m.s.}$

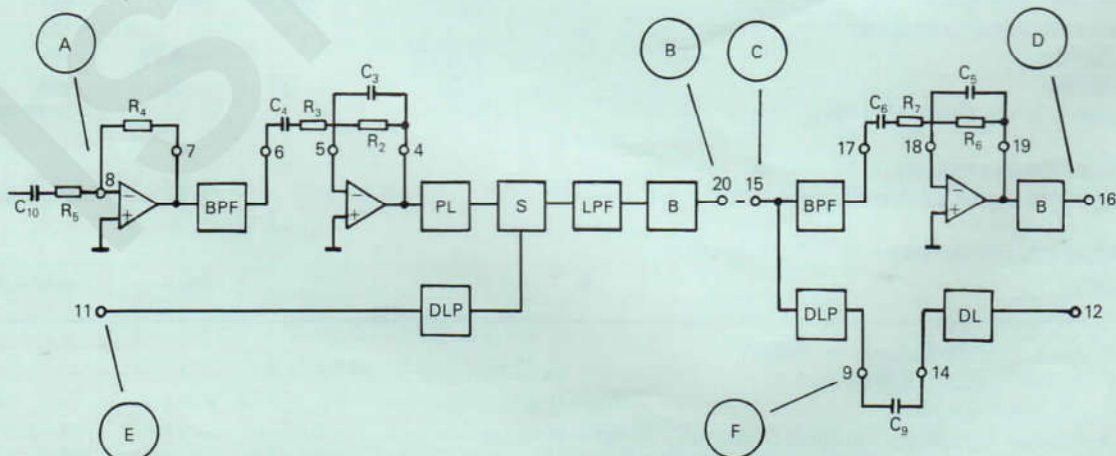
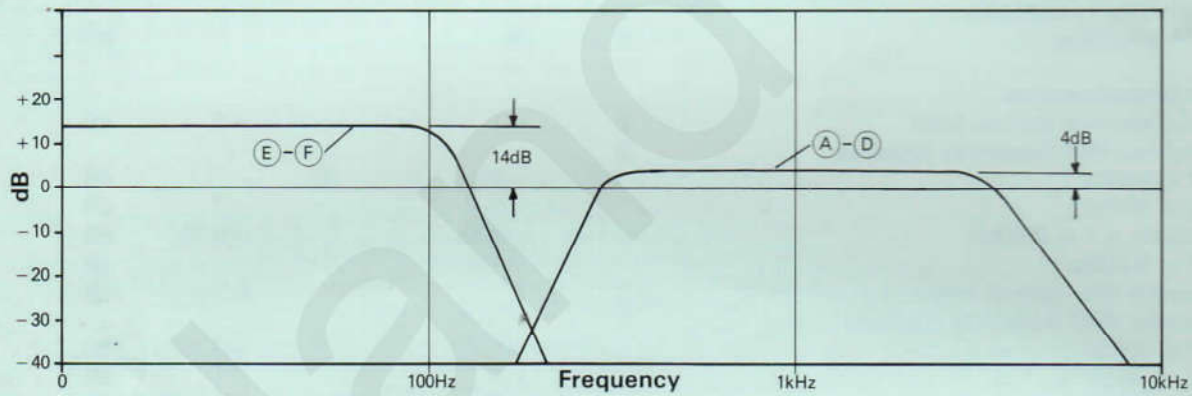
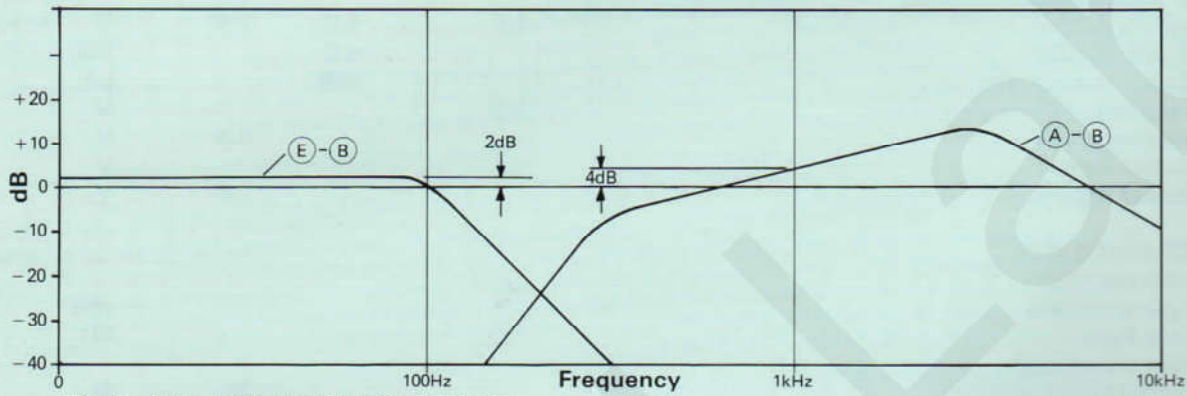
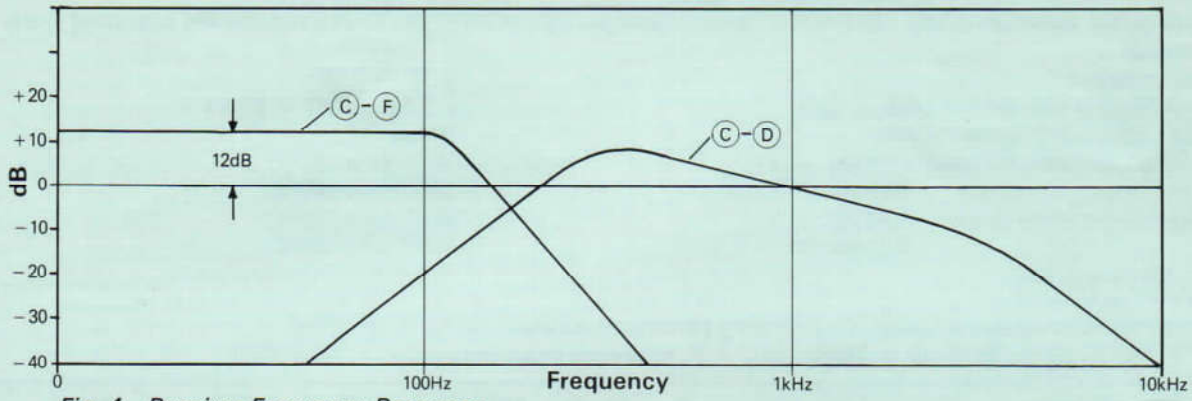
4. Reference frequency = 85Hz (0dB),  $V_{\text{in}} = 300\text{mV r.m.s.}$

5. Input voltage required to produce logic levels (note 1) at the output, output duty cycle  $50 \pm 5\%$ .

Input sinewave at 85Hz a.c. coupled.



## Typical Frequency Response Characteristics



## Package Outlines

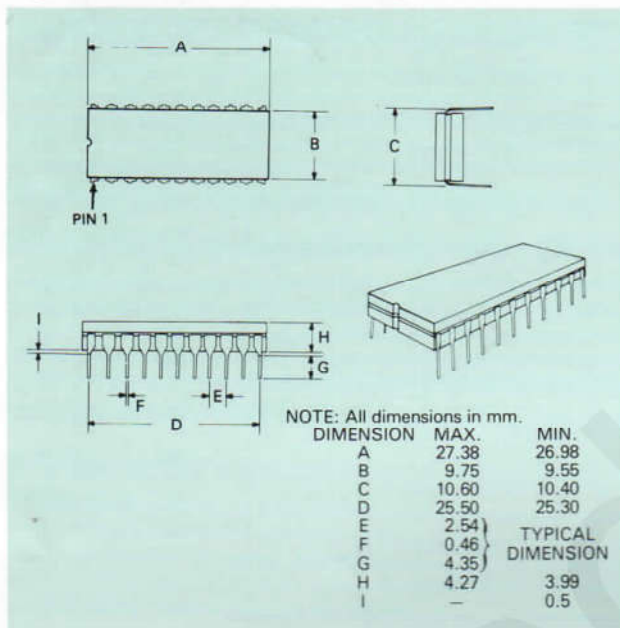
The cerdip package of the FX106J is shown in Figure 8. The FX106LV1 of Figure 9 is supplied in a conductive tray.

The FX106LV1 has an indent (spot) adjacent to Pin 1 and a chamfered corner between Pins 3 and 4 to allow complete identification. Pins number counter-clockwise when viewed from the top (indent side).

## Handling Precautions

The FX106J/LV1 is a CMOS LSI circuit which includes input protection. However, precautions should be taken to prevent static discharges which can cause damage.

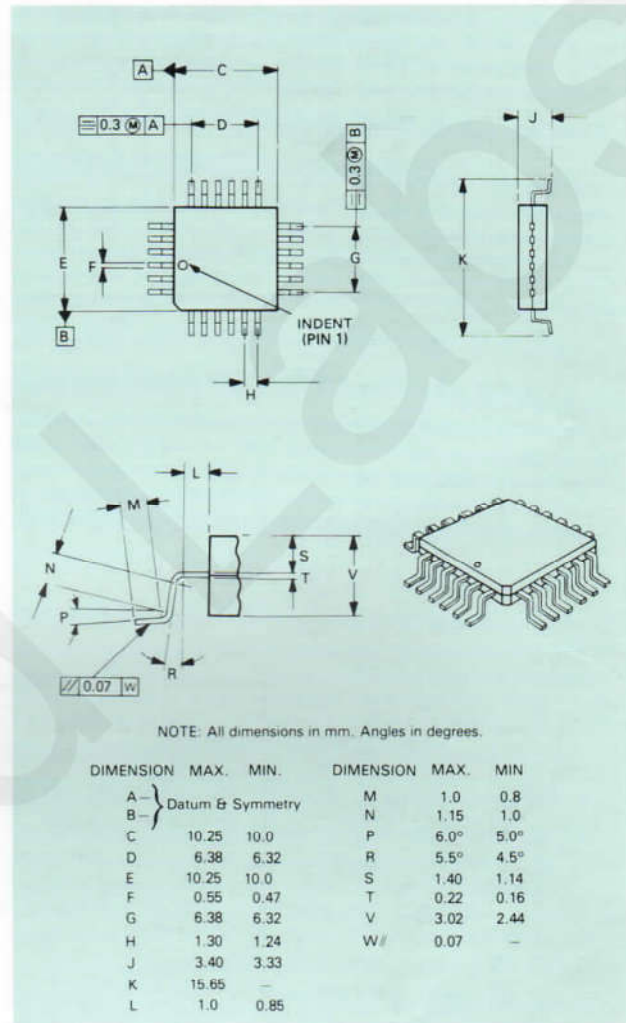
Fig. 8 FX106J D.I.L. Package



## Ordering Information

**FX106J** 22-pin Cerdip D.I.L.  
**FX106LV1** 24-pin quad plastic encapsulated, bent and cropped.

Fig. 9 FX106LV1 Package



CML does not assume any responsibility for the use of any circuitry described. No circuit patent licences are implied and CML reserves the right at any time without notice to change the said circuitry.



**CONSUMER MICROCIRCUITS LIMITED**

WHEATON ROAD · INDUSTRIAL ESTATE EAST  
 WITHAM · ESSEX CM8 3TD · ENGLAND

Telephone: 0376 513833

Telex: 99382 CMICRO G

Telefax: (0376) 518247

© 1985 Consumer Microcircuits Limited