

## DESCRIPTION

The 73M223 modem device receives and transmits serial and binary data over existing telephone networks using Frequency Shift Keying (FSK). It provides the filtering, modulation, and demodulation to implement a serial, asynchronous data communication channel. The 73M223 employs the CCITT V.23 signaling frequencies of 1302 and 2097 Hz, operating at 1200 baud, and is intended for half duplex operation over a two-line system.

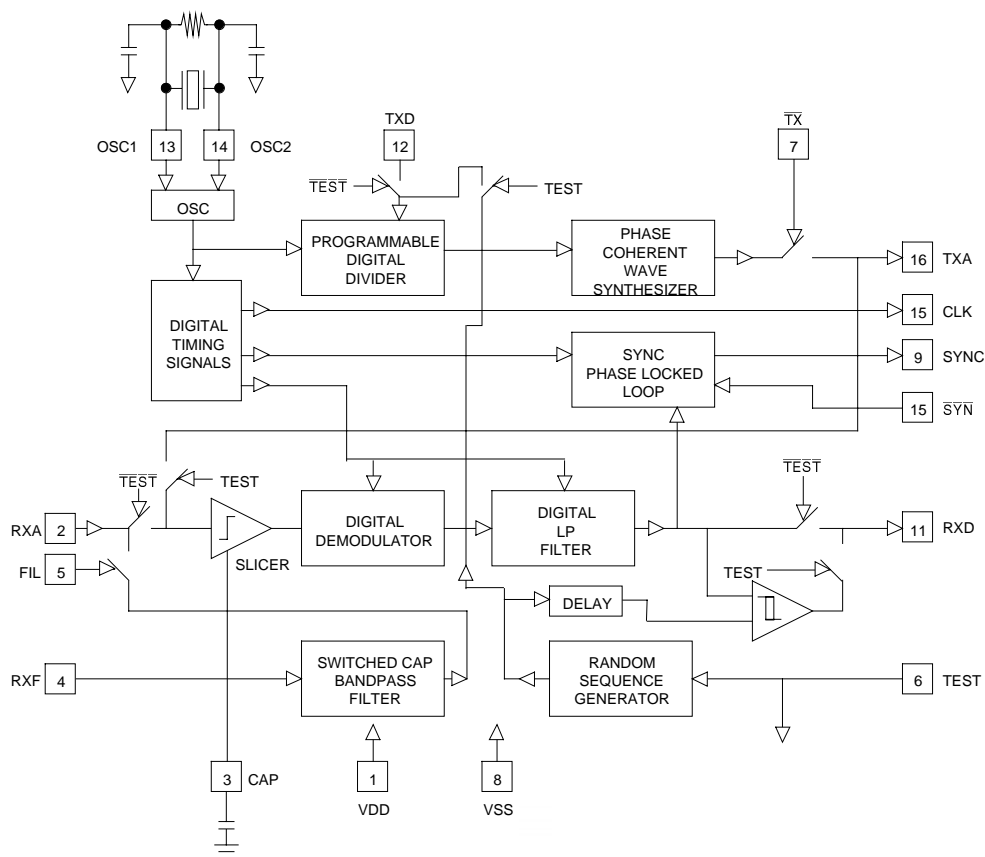
The 73M223 provides a cost-effective alternative to existing modem solutions. It is ideally suited for R.F. data links, credit verification systems, point-of-sale terminals, and remote process control.

CMOS technology ensures small size, low-power consumption and enhanced reliability.

## FEATURES

- **Low cost FSK Modem**
- **1200 baud operation**
- **CMOS switched capacitor technology**
- **Built-in self-test feature**
- **On-chip filtering, and Modulation/Demodulation**
- **Uses CCITT V.23 frequencies**
- **On chip crystal oscillator**
- **Low power/High reliability**
- **Does not require a microprocessor**
- **10 mW @ 5 V supply**
- **16-pin plastic packages**

## BLOCK DIAGRAM



# 73M223

## 1200 Baud FSK Modem

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### FUNCTIONAL DESCRIPTION

The 73M223 has four main functional sections: timing, transmit, receive, and test. Each section of the chip will be individually described below.

#### TIMING

The timing section contains the oscillator (OSC) and logic which generates digital timing signals used throughout the chip. The time base can be derived from 3.18 MHz crystal or an external digital input. The digital timing logic divides the oscillator frequency to give a 1200 Hz output than can be used for system timing. The signaling frequencies are 1302 Hz for logic "1" and 2097 Hz for logic "0." The modem will operate with clock inputs from 330 kHz to 7.0 MHz. However, the signaling frequencies and the system timing will be directly proportional to the difference in clock frequency.

#### TRANSMITTER

The 73M223 transmitter consists of a programmable divider that drives a coherent phase frequency synthesizer. The programmable divider is digitally controlled via the Data Input pin (TXD). The output of the divider clocks a 16 segment phase coherent frequency synthesizer. A sine wave is constructed by eight weighted capacitors which are the inputs to a low pass filter. The synthesized signal is output directly to the transmit pin TXA. The transmit signal can be disabled by using the digital control pin TX.

#### RECEIVER

The 73M223's receiver is comprised of three sections: the input bandpass filter, the synchronization loop, and the demodulator.

The input bandpass filter is a four pole Butterworth filter, implemented using switched capacitor technology. This filter reduces wideband noise which significantly improves data error rates. The 73M223 can be configured with the bandpass filter in series with the receiver by setting FIL = 1 and inserting the received signal at RXF (recommended configuration). The bandpass filter can be deleted from the system by setting FIL = 0 and inputting the received signal through RXA.

The demodulator is used to detect a received mark or space.

The synchronization for sampling the digital output at RXD is derived from a digital phase locked loop. The phase locked loop is clocked at 16 times the bit rate with a maximum lock period of 8 clocks to lock on the data output signal. When  $\overline{\text{SYN}}$  is low the output of SYNC is nominally 1200 Hz, but is resynchronized to the center of the data bit on each data transition. When  $\overline{\text{SYN}}$  is high, SYNC will output a 1200 Hz clock, which is not synchronized to the data on RXD.

#### SELF TEST MODE

The 73M223 features an autotest mode which provides easy field test capability of the chip's functionality. The modem is placed in the test mode by taking the test pin high. In the test mode the Data Input pin is disconnected and the programmable divider is driven by a pseudo random PN sequence generator and the transmitter's output is connected to the receiver's input. The input data to the programmable divider is delayed by the system delay time and compared to the digital output on sync transitions. If the detected data matches the delayed input data from the PN sequence counter, the 73M223 is properly functioning as indicated by RXD low. A high on the RXD pin indicates a functional problem on the 73M223.

# 73M223

## 1200 Baud FSK Modem

### PIN DESCRIPTION

| PIN NO. | PIN NAME                | DESCRIPTION   |
|---------|-------------------------|---|
| 1       | VDD                     | Positive Supply Voltage. Bypasses to Vss with 0.1 $\mu$ F capacitor.  |
| 2       | RXA                     | Receive Analog Input. Analog input from the telephone network.  |
| 3       | CAP                     | Capacitor. Connect a 0.1 $\mu$ F capacitor between Pin 3 and ground (VSS).  |
| 4       | RXF                     | Filtered Receive Analog Input   |
| 5       | FIL                     | Analog Input Control. A logical 1 selects the filtered input. A logical 0 selects the non-filtered input.   |
| 6       | TEST                    | Self-Test Mode Control. Normal operation when a logical 0. A logical 1 places the device into the self-test mode. A low appears at RXD, to indicate a properly functioning device.  |
| 7       | $\overline{\text{TX}}$  | Transmitter Control. A logical 0 selects transmit mode. A logical 1 selects a stand-by condition forcing TXA to VDD/2 VDC.  |
| 8       | VSS                     | Ground  |
| 9       | SYNC                    | Synchronous Clock Output. Digital output synchronized with the 1200 bit/s received data when $\overline{\text{SYN}}$ is low and used to sample the received data or eye pattern. The falling edge of SYNC should be used to sample RXD. When $\overline{\text{SYN}}$ is high a 1200 Hz clock is output. |
| 10      | $\overline{\text{SYN}}$ | Sync Enable. A logic 0 locks the SYNC clock PLL to the 1200 baud receive data. A logic 1 disables the receive data PLL, and connects SYNC to the 1200 HZ reference.   |
| 11      | RXD                     | Receiver Digital Output   |
| 12      | TXD                     | Transmitter Digital Input   |
| 13      | OSC1                    | Crystal Input (3.1872 MHz) or External Clock Input  |
| 14      | OSC2                    | Crystal Return  |
| 15      | CLK                     | 1200 Hz Square wave Output. Can drive up to 10 CMOS loads.  |
| 16      | TXA                     | Transmitter Analog Output   |

### ELECTRICAL SPECIFICATIONS

Recommended conditions apply unless otherwise specified.

#### ABSOLUTE MAXIMUM RATINGS

Operation outside these rating limits may cause permanent damage to this device.

| PARAMETER                            | RATING                   |
|--------------------------------------|--------------------------|
| Power Supply Voltage (VDD-VSS)       | 14 V                     |
| Analog Input Voltage at RXA          | - 0.3 to VDD V           |
| Analog Input Voltage at RXF          | - 3 to VDD V             |
| Digital Input Voltage                | VSS – 0.3 to VDD + 0.3 V |
| Storage Temperature Range            | - 65 to + 150 °C         |
| Operating Temperature Range          | - 25 to + 70 °C          |
| Lead Temperature (10 secs soldering) | 260 °C                   |

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## 1200 Baud FSK Modem

### ELECTRICAL CHARACTERISTICS

Unless otherwise specified,  $4.5 < VDD < 13$  VDC,  $VSS = 0$  VDC,  $-25^{\circ} C < T_A$

#### POWER SUPPLY

| PARAMETER                 | TEST CONDITIONS                  | MIN       | NOM | MAX                | UNIT |    |
|---------------------------|----------------------------------|-----------|-----|--------------------|------|----|
| VDD Voltage Supply Range  |                                  | 4.5       |     | 13                 | V    |    |
| Supply Current            | VDD = 5V 25° C                   |           | 2.0 |                    | mA   |    |
|                           | VDD = 12V 25° C                  |           | 5.0 |                    | mA   |    |
| Digital Inputs            |                                  |           |     |                    |      |    |
| Input Low Voltage VIL     |                                  | VSS - 0.3 |     | VSS + 1.5          | V    |    |
| Input High Voltage VIH    |                                  | VDD - 1.5 |     | VDD + 0.3          | V    |    |
| Input Low Current IIL     |                                  | -1        |     |                    | μA   |    |
| Input High Current IIH    |                                  |           |     | 1                  | μA   |    |
| Digital Outputs           |                                  |           |     |                    |      |    |
| Output Low Voltage VOL    | IOL < 1 μA                       |           |     | 0.05               | V    |    |
| Output High Voltage VOH   | IOL < -1 μA VDD = 5V             | 4.95      |     |                    | V    |    |
| Output Low Current IOL    | VOL = 0.4V VDD = 5V              | 0.5       |     |                    | mA   |    |
| Output High Current IOH   | VOH = 4.5V VDD = 5V              | -0.2      |     |                    | mA   |    |
| Analog Input Level @ RXA  | Centered at VDD/2 + 0.5V         | 0.2       |     | VDD/4              | Vpp  |    |
| Analog Input Level @ RXF  | *DC Level between VDD & VSS      | 0.2       |     | VDD/2              | VDC  |    |
| Error Rate                | S/N = 8 dB Input @ RXF           |           |     | $5 \times 10^{-3}$ |      |    |
| Analog Output Level @ TXA | RL ≥ 10K TX̄ = 0                 |           |     | VDD/4              | Vpp  |    |
|                           | TX̄ = 1                          |           |     | VDD/2              | VDC  |    |
| Output Frequency @ TXA    | XTAL = 3.1872 MHz TXD=1          |           |     | 1302               | Hz   |    |
|                           | TXD=0                            |           |     | 2097               | Hz   |    |
| Output Harmonics          | 2nd to 14th Harmonics            |           |     | -60                | -50  | dB |
|                           | 15th Harmonic                    |           |     |                    | -20  | dB |
| Input Filter (RFX)        | *Input = 200 mVp-p to VDD/2 Vp-p |           |     |                    |      |    |
|                           | Lower 3 dB Corner                |           |     | 760                | Hz   |    |
|                           | Upper 3 dB Corner                |           |     | 2625               | Hz   |    |

\* Note: The 73M223 RXF input is AC coupled internally but the DC value of the input must be between the two supplies VDD & VSS.

# 73M223 1200 Baud FSK Modem

## APPLICATION INFORMATION

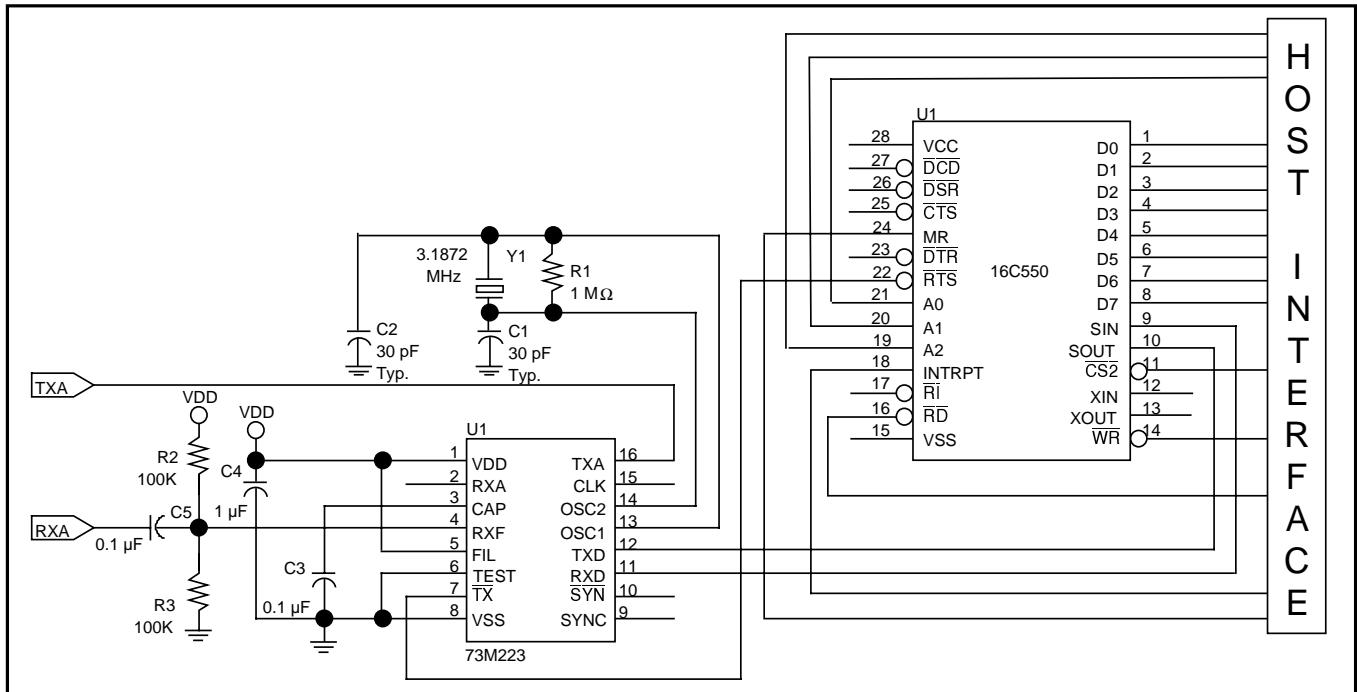
The 73M223 modem chip allows low cost communications in a private network, utilizing twisted pair telephone wires. This chip is the prime choice of those designers who require an efficient, high performance modem solution for dedicated private networks, HDX dial-up and other specialized applications. Such applications include credit verification systems, point-of-sale terminals, remote process control, satellite and RF telemetry, private data links and acoustic modem designs. No microprocessors or external adjustments are necessary with this device.

Utilizing a crystal input of 3.1872 MHz\*, the 73M223 is a V.23 main channel 1200 Baud, FSK modem. The signaling frequencies generated are 1302 Hz for a logic "1" and 2097 Hz for a logic "0." Crystals with frequencies varying between 330 kHz to 7.0 MHz or higher can be used. The baud rate and signaling frequencies vary linearly with variation in crystal

frequency. If compatibility with V.23 is not required, a color burst 3.579 MHz crystal can be used as long as the other modem uses the same frequency offset.

A typical implementation on the 73M223 is shown in the figure below. A 73M1550 UART receives data to be transmitted from a microprocessor bus. The UART sends the data in a serial format to the 73M223 modem after inserting the necessary start and stop bits. The modem transmits this data to the far end via the TXA pin. Full-duplex operation can be implemented by utilizing separate transmit and receive circuits. A USART can be used instead of a UART if synchronous operation is desired. With synchronous operation, a USART uses the modem's SYNC signal for timing to sample the received data, and the modem's CLK signal for timing to send data to be transmitted.

\* Available from Ecliptek Corp. (714) 433-1200 and SMI Inc. (916) 477-5085.



73M223 TYPICAL APPLICATION

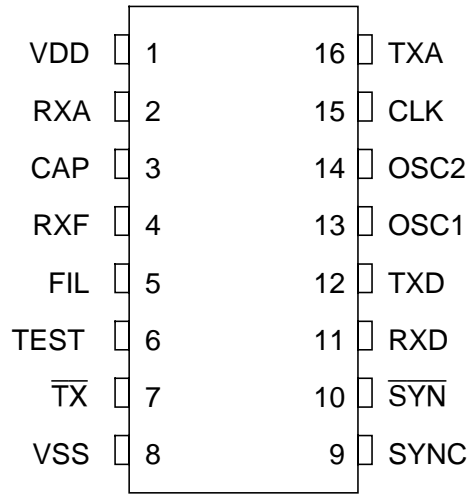
# 73M223

## 1200 Baud FSK Modem

### PACKAGE PIN DESIGNATIONS

(Top View)

CAUTION: Use handling procedures necessary for a static sensitive component.



**16-Pin DIP and  
16-Lead SOL**

### ORDERING INFORMATION

| PART DESCRIPTION   | ORDER NUMBER | PACKAGING MARK |
|--------------------|--------------|----------------|
| 73M223             |              |                |
| 16-Pin Plastic DIP | 73M223-CP    | 73M223-CP      |
| 16-Lead SOL        | 73M223-CL    | 73M223-CL      |

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