An MX614 Packet Modem

Can’t find a TCM3105 IC for your 1200-bps modem project? Try the MX614!

Between 1991 and 1998, VHF and UHF packet activity grew steadily, due largely to the availability of inexpensive TNCs and even less-expensive Bell 202 modem ICs for homebrewing. Software such as Baycom, EZPacket and Poor Man’s Packet provided the first-time packet operator a means to experience the mode without investing hundreds of dollars in hardware. All you need for these TNCs is the software and an inexpensive modem built around the Texas Instruments (TI) TCM3105 Bell 202 IC. Unfortunately, the TCM3105 chip is no longer available.

A TCM3105 IC Replacement

Several articles in QST and 73 Amateur Radio Today describe projects using the TI TCM3105 as a TNC interface. In mid-1998, the source of this IC dried up: TI had canceled production of the part earlier that year. Wide use of the TCM3105 in commercial markets has kept the part from becoming available on the surplus market.

The good news is that a 16-pin DIP IC available from MX-COM (the MX614) performs the same functions as the TI TCM3105. (The two parts are not, however, pin-compatible.) Additionally, MX-COM’s MX604 is V.23 modem compatible and pin-compatible with the MX614. So you can have a Bell 202 or V.23 modem by simply changing the IC to switch between modes.

These similarities are shared by the TCM3105 and MX614:

- **Low-power operation (3.3 to 5 V)**—This permits powering the IC from a computer’s RS-232 port via the RTS, DTR and TXD lines.
- **1200 bps half-duplex Bell 202-mode operation**—Allows compatibility with the 1200-Hz mark and 2200-Hz space-signal conventions.
- **Low-level analog input**—External buffers and low-level amplifiers are not required.

Audio taken from a radio’s speaker or headphone output is all that is necessary.

- **TTL level I/O**—Connects directly to computer interface for RXD, TXD, RTS and CTS lines.
- **Mode switching**—The MX614 has an on-chip buffer stage. It also has a mode-selection input that requires switching between transmit and receive that can be controlled by the PTT line.
- **Alignment**—The MX614 does not require critical receive-bias or carrier-detect threshold alignments as does the TCM3105 circuit.
- **Serial or parallel-port operation**—The MX-COM part does not offer any component reduction with parallel-port operation, as does the TCM3105 Poor Man’s Packet design.
- **Other IC features** are available, but as they’re not required for Bell 202 operation, they’re not identified here.

Circuit Description

This project (see Figure 1) is patterned after Greg (N3PRT) Cerenzenia’s Basic Packet Modem (see Note 5). The modem is designed for use with software written to operate Baycom-style modems. PC boards and semi-kits for this project are available. The interface uses the serial-port DTR line for transmit data (TXD), the CTS line for received data (RXD) and the RTS line for PTT. Cerenzenia’s circuit uses one section of a hex inverter as a received-signal buffer. The need for that IC section is obviated by the MX614 because it contains a built-in buffer between pins 5 and 6. Two of IC2’s inverters are used as translators between the MX-614’s TTL levels and the computer’s serial-port RS-232 levels. Two more of IC2’s inverters interface the computer’s RTS line and the radio’s PTT line. A normally active-low PTT control is developed with Q2. Q3 handles active-high PTT lines. (Q3, C10 and R6 can be omitted if an active-high PTT control is not required.) Transmit audio level to the radio is controlled by R4. DS1 indicates when the MX614 is decoding a Bell 202 FSK-compatible signal.

Don’t install DS1, Q1, R2 and R3 if the modem’s power is derived from a computer’s serial port. If an external power supply (ie, not a PC’s serial port) is used to power the modem, there’s no need to install D2, D3 and D4. Also, you can then use a standard TTL 7404 hex inverter in lieu of the CMOS version at IC2; the TTL version requires too much current from a computer’s serial port. Mode controls (M0 and M1) for the MX614 are taken from two inverters tied in series (IC2A and IC2B).

Many new portable radios use an unique way to effect push-to-talk through external peripherals (such as remote microphones) without using a separate connection for the PTT line itself. They use the external microphone connector and a switch in series with the fairly low-impedance mike element. A bipolar transistor in the mike’s audio path senses the lowered impedance when the external mike is switched in and turns on. When this PTT-switch transistor saturates, it provides the radio a PTT signal via internal connections. The beauty of this design is that only a pair of two-conductor miniature plugs is needed to provide connections for a remote speaker, a remote microphone and a remote microphone PTT.
The packet-modem design adds low impedance across the mike audio line in the form of a 3.3-kΩ resistor (R15) through the emitter-collector junction of Q2 to ground. This just simulates what would ordinarily be the external mike element in series with the other side of the mike element completing the path to ground. For home-station use, the series resistor is not necessary if you provide a separate PTT connection.

Configurations

If desired, this modem can be operated from the computer’s parallel port. Programs such as E2Packet and Poor Man’s Packet are written to use printer ports (LPT1 and/or LPT2). Although Poor Man’s Packet and

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other parallel-port packet programs can be configured to run a Baycom-style modem via the serial port, parallel-port operation is required if a serial port is not available. No parts-reduction advantage is realized using the MX614 circuit as would be seen with the basic Poor Man’s Packet circuit because hex-inverter sections are employed to effect IC mode selection.

The Poor Man’s Packet configuration of Figure 1 uses the computer’s parallel port for data and control and the computer’s serial port to power the modem. Points labeled P(x) indicate connections to a DB25 connector for the parallel-port interface. In the Poor Man’s Packet configuration, don’t install jumpers JU1 and JU2.

The Baycom configuration uses the computer’s serial port only. Serial-port transmit and receive data are routed via the DB9 connector pins 8 (CTS) and 4 (DTR). The modem is powered from the computer’s serial port using summing diodes connected to serial-port pins 2 (TXD) and 7 (RTS). Remember to make connection to the serial-port’s GND pin (5), too.

If you decide to power the modem from the computer’s serial port, do not install the DATA READY indicator circuit consisting of R2, R3, Q1 and DS1. Install jumpers JU1 and JU2 for serial-port operation.

Construction

My prototype of this project was haywired into an existing box already complete with connectors. Use an enclosure and the connectors and cables that suit your needs. The enclosure size you select will depend primarily on the size and number of the connectors you use. A single DB25 connector could be used for all the I/O lines, but a more-flexible approach might use phono connectors for the REC AUDIO INPUT, TX AUDIO, OPTIONAL 9-12 V INPUT and the PTT line and a DB9 connector for the serial-port connections.

Alignment and Operation

The only adjustment this modem requires is setting the transmit modulation level using TX LEVEL control R4. If the transmitter’s deviation can be measured, setting the tones for about 80% full system deviation (±4 kHz on 2 meters) should be adequate. If no means of measuring the deviation is available, simply adjusting R4 to obtain tones that sound similar to those other packet operators are using should be acceptable.

Summary

The circuit proved to be “build, plug and play” on the FAR Circuits board. We found no surprises with the MX-614 Baycom-style modem. Transmit tones are quite clean and do not exhibit any trailing chirps or squeaks. Give this modem a try!

Notes

1 All of these programs (BayCom V 1.5, PMP V 1.1 and EzPacket V 1.4) can be found at: http://ftp.funet.fi/pub/ham/Simtel.msdos/packet/. The BayCom site URL is: http://www.baycom.org. An updated version of EzPacket (V 2.0) can be found at: ftp://ftp.hzeeland.nl/pub2/hamradio/funet/packet/terminal/.


Jim Mitrenga, N9ART, received his Technician Class license in March of 1979; he upgraded to Amateur Extra Class in 1981. Jim’s wife, Sandy, is KB9MXF; their son, Greg is KG9DF, an Amateur Extra Class licensee who received his Novice ticket on his 10th birthday. They’re all active on VHF and UHF FM for family communication. HF CW is Jim’s favorite mode, but he’s active on AM, FM, SSB, SSTV, RTTY and Packet and enjoys Amateur Radio electronics design. Jim’s other interests include fishing, hiking, bicycling, gardening, computers, audio recording and broadcast engineering.

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