AN_2901CE_019 JULY 2005

Using the New Features of the 73M2901CE

Introduction

The 73M2901CE integrated circuit modem includes several new features that make it the right choice for many new designs. The new features include:

- SMS mode and V.23 half duplex (HDX) support
- Leased line support
- Energy incoming ring detection
- Improved Caller ID performance, including compliance with EIA777A
- New Caller ID TYPE II mode
- Selectable answer tone detection
- Various S register features added

To take advantage of these new features, the following information is provided.

SMS and V.23 Half Duplex

SMS (Short Messaging Services) is the communications mode used to transmit text messages for cell phones and eventually wire line phones as well (see the separate application note, *73M2901CE SMS and Half Duplex V.23 Operation*). The V.23 half duplex mode has been included with the addition of the B10 command (ATB10). The B10 command allows the used to turn the transmitter on and off using the serial interface $\overline{\text{RTS}}$ signal. In this way the modems can easily communicate in half duplex mode using $\overline{\text{RTS}}$ to enable the transmit and $\overline{\text{CTS}}$ to indicate the modem is ready to send data. The V.23 receiver response time has also been improved to allow for fast line turnaround (reversal of the data flow). The pattern generator has also been modified to send the proper alternating pattern used in the SMS handshake. SMS messaging is very similar to the format used for Caller ID, so the 2901CE can also be used to send Caller ID messages to equipment designed to use and display Caller ID information. A typical command line for a dial up connection would be: ATY0B10S73-32C2R2S10=255<cr>. These commands are broken out as follows:

Y0	Clear channel mode (1200 bps)
B10	V.23 HDX gated by $\overline{\text{RTS}}$
S73-32	No 125mS wait between commands
C2	$\overline{\text{DCD}}$ follows the raw received carrier
R2	Toggle $\overline{\text{DTR}}$ to hang up
S10=255	Disable loss of carrier timeout

Note that $\overline{\text{RTS}}$/$\overline{\text{CTS}}$ flow control cannot be used when using V.23 half duplex since $\overline{\text{RTS}}$ is used to turn the carrier on and off. XON/XOFF flow control should be used instead if flow control is needed. The transmitter $\overline{\text{RTS}}$ to carrier on delay time is 10mS and the off delay is 5mS.

Leased Line Mode

The 73M2901CE adds a leased line mode that allows a modem to go into the data mode without having to go through a normal handshake or the need for a connection to another modem. The leased line mode is enabled using the @L1 command in the initialization string. The 73M2901CE leased line mode should not be thought of as limited to only leased line. It is also suited to radio links and any applications where the modem needs to be ready to go when it is first connected. Leased line mode can be used with all modulation modes that are supported by the 73M2901CE. Table 1 shows typical command initialization strings that can be used.

Table 1: Leased Line Initialization Commands

V22bis LL	ATFS99=1Y6K3C1R2S30=4S70=12S26+4O2@L1
V22 LL	ATFS99=1Y6K3C1R2S30=8@L1
B212 LL	ATFS99=1Y6K3C1R2S30=16@L1
B103 LL	ATFS99=1Y6K3C1R2S30=32@L1
B202 RX LL	ATFS99=1Y6K3C1R2B4@L1
B202 TX LL	ATFS99=1Y6K3C1R2B5@L1
V23 HDX LL	ATFS99=1Y0C2R2B10@L1
V23 TX1200 LL	ATFS99=1Y6K3C1R2B3@L1
V23 TX75 LL	ATFS99=1Y6K3C1R2B2@L1
V21 LL	ATFS99=1Y6K3C1R2S30=64@L1

These commands are broken out as follows:

F	Set to factor defaults
S99=1	Set to U.S configuration (default)
Y0	Used clear channel mode (no speed buffering)
Y6	Use DTE/DCE speed buffering
K3	Use RTS/CTS flow control
C1	Use qualified carrier detection
C2	Use raw carrier detection
R2	Disconnect on $\overline{\text{DTR}}$ toggle
S30=n	Set S30 to a modulation mode
Bn	Set to modulation mode
O2	Respond to retrain requests
S26+4	Enable sending auto retrain requests
S70=12	Lower retrain request threshold to 12
@L1	Leased line mode

Once the initialization string is given, the modems are started by sending ATD to one modem and ATA to the other. The modems will then begin sending carriers and look for carrier from the other modem. When the modems disconnect using R2 and $\overline{\text{DTR}}$, an “OK” result code is sent on RXD. The modem will stop sending carrier at the end of the OK message, the delay time determined by the DTE speed and the time it takes to output the message.

It is important to note the auto retrain feature (O2) should be enabled when using V.22 *bis*. V.22 *bis* requires training when it connects and auto retrain is off by default. Make sure “S26+4” is also sent so it can also initiate a retrain as well.

73M2901CE Energy Ring Detection

The 73M2901CE has a new feature that was added with the intention of lowering the total modem cost by eliminating some of the more expensive external components. The threshold for the ring detector depends on the setting of the S123 register and the components in the Caller ID path, especially the transformer. The number that S123 is set to represents the amplitude threshold of the ring signal (see Table 2). In a conventional ring detect circuit the threshold is set by the hardware, usually the values of the Zener diodes in the ring detect circuit.

Table 2: Approximate Thresholds for Energy Ring Detection

US Wet Transformer					
S123 Register Setting with Frequency Checking	20	15	10	5	3
Vrms min off to on	45	34	24	12	7
Vrms min on to off	42	32	22	10	5
CTR-21 Dry Transformer					
S123 Register Setting with Frequency Checking	20	15	10	5	3
Vrms min off to on	5	5	5	5	5
Vrms min on to off	5	5	5	5	5

Having the ability to set the threshold over a wide range through the S123 register eliminates the need to change components to adjust the ring detection sensitivity. Energy ring detection uses the Caller ID path and coupling transformer to path to pass the incoming ring signal to the modem so it can detect the ring signal using the internal DSP. In an average design this can save at least $0.35 in the total parts cost or even more in lower volume products. Wet transformers generally have poorer frequency response in the ring frequency range than dry transformers. This means that the threshold must be sent to a lower number for wet transformers than with some V.90-rated dry transformers. This also means that lower frequency ring signal detection will also require a lower setting. The range of values for S123 can be from 1 to 127 when checking frequency or 129 to 255 when not checking frequency. The practical range is from 3 to 30 when checking frequency, depending on the transformer, Caller ID series resistor, capacitor, and the ring frequency.

The other ring parameters such as ring frequency (S17 and S18) and cadence (S51-S58) still need to be programmed when using energy ring detection.

The typical initialization string for ring detection and auto answer for the U.S. would be:

ATS123=7S0=1<CR><LF>

For other countries, the other ring parameters should also be individually programmed, or the S99 register can be used to program all the country parameters.

Caller ID Mode Changes

There are two different types of TYPE II caller ID; normal TYPE II and snoop mode TYPE II.

Normal TYPE II Caller ID is on when S110 bit 3 is turned on. The modem must be off hook (in use) for this mode to be active. When the modem detects an alerting tone telling it that a call is waiting and that a Caller ID message is about to be sent. The modem then sends a DTMF digit “D” to notify the CO that A TYPE II Caller ID device is present. The CO then sends the Caller ID message, and after receiving the message the 73M2901CE will go on-hook (hang up).

TYPE II snoop mode is enabled when S95=$99 (99 hex). In this mode the modem will report either a TYPE I or TYPE II Caller ID message when the modem is on hook. If another Caller ID device is off hook the modem will detect the Caller ID handshake and output the Caller ID data, but the 73M2901CE will not actively participate otherwise.

TYPE II Caller ID performance has been improved and, using proper coupling circuitry to monitor the CID signal, the 73M2901CE can pass all EIA-777A tests.

Selectable Answer Tone Frequency Detection

It is now possible to select which frequencies will be detected as an answer tone during the handshake. A new S register, S120, has been added for this purpose. This adds some flexibility to the handshake in dial-up applications. The register bit definitions are as follows:

Bit 0 1650Hz – V21 Marks (default)
Bit 1 1300Hz – V23 Marks
Bit 2 2100Hz – ITU Answer Tone (default)
Bit 3 Reserved
Bit 4 2225Hz – Bell Answer Tone (default)
Bit 5 2250Hz – S0 (default)
Bit 6 Reserved
Bit 7 Reserved

Other S Register Additions and Changes

S118 Caller ID Ring Interrupt Delay

(Default = 20)
Disables ring interrupt detection for the specified period during CID enable/disable transitions, measured in ms. This can be used with the Clare optical DAA to delay ring detection when the Caller ID path is switched. Noise generated from switching can falsely trigger a ring detection in some case.

S119 Wait Before Connect

(Default = FFh)
Normally the TX and RX data paths are enabled at the same time. This register allows programmable delay between completion of handshake and "CONNET" (ready to receive data). This changes only the timing of when data can be received. The transmit data path will not be enabled until the end of the normal timeout. Setting the value at this register will affect timing for all modes. Resolution is in 10 ms increments. The normal TX/RX delay times are as follows:

QAM Answer Mode = 200 ms
PSK Answer Mode = 770 ms
PSK Originate Mode = 770 ms
FSK Originate Mode = 300 ms

When S119 = $FF (Default), the 73M2901CE uses same value of wait as in the past.

S121 Answer Tone Qualify Time

(Default = 0)
The value of this register extends the answer tone qualification time beyond the 155ms minimum in 10ms units. For example a value of 10 would yield a total answer tone qualification time of 255 ms (100ms + 155ms).

S122 Parallel Pick Up Debounce Timer

(Default = 0)
Register S122 sets the duration of the Parallel Pick-Up debounce timer in 10ms increments. This can be used to improve the noise immunity of the Parallel Pick-Up detection.