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RECEIVE CALLER ID

NORTH AMERICA CALLER ID USING Z02201/Z02922

INTRODUCTION

Caller ID (or CND–Call Number Delivery) is a service provided by the telephone company to identify the calling party to the receiving party. Because Caller ID is not normally a standard part of the telephone service, a telephone customer must subscribe to Caller ID as an additional service. This application note describes the methods employed by the North American telephone system for Type 1 (on-hook) Caller ID, and how the engineer can build a decoder using the Z02201/Z02922. The actual contents of the Caller ID packets can be obtained from your local telephone company.

DELIVERY METHOD

The Type 1 Caller ID signal is sent in the silence period between the first and second rings sent to the customer premises equipment (CPE) or the customer telephone. The standard ring signal has a cadence of 2 sec-ON and 4 sec-OFF. Other distinctive ring patterns may be offered by the telephone system during the 2 sec-ON period (such as a double ring), while the 4 sec-OFF period remains unchanged. The silent interval for Caller ID transmission must be a minimum of 3 seconds. If a minimum of 3 seconds of silence cannot be provided by the system, Caller ID is not delivered. See Figure 1 for the complete delivery method.

The Caller ID signal does not transmit until 500 ms after the first ring has ended. As a result, it is easier to properly recognize both standard and distinctive ring patterns. The distinctive ring patterns have ring bursts less than 500 ms apart. After 500 ms of silence, the CPE observes the remainder of the silence period for the Caller ID signal. If the telephone line is picked up during the transmission of the Caller ID signal, the telephone system will interrupt its transmission and proceed with the line-seizure phase. The Caller ID signal is not retransmitted.

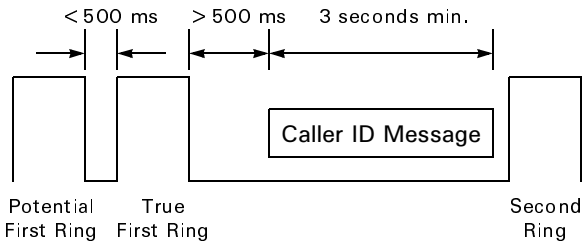

Figure 1. Caller ID Signal Delivery Method

In North America, the Caller ID data signal is sent as a 1200 bps FSK modulated signal, following the Bell 202 protocol. The ITU V.23 standard is used in other parts of the world. The Z02201/Z02922 data pump chips can demodulate both signals using its V.23 demodulator.

DATA FORMATS

The Caller ID data is sent using an 8-bit asynchronous format. There is one start bit, 8 data bits, and 1 stop bit with no parity bits for each character in the message. The format of the data stream is separated into 4 main groups. These are:

1. The Channel Seizure signal
2. The Carrier signal
3. The Data Packets
4. The Checksum

The Channel Seizure signal precedes each Caller ID signal and consists of 30 bytes of 0x55 (the ASCII 'U' character). This signal serves as an alert function for the CPE.

The Carrier signal is a 150 ±25 ms constant marking signal.

The Data Packets follow the Carrier signal. Each packet contains a type byte, a length byte, and the data itself. There can be one or more packets in the data portion of the signal.

The Checksum is a single byte that represents the two's complement of the modulo-256 sum of the other data bytes (including the type and length bytes). In practice, when all the bytes in the data portion of the signal are added to this byte, the result will be zero if the signal was received correctly. It will be non-zero if there was an error in the signal.

The Z02201/Z02922 data pump is capable of receiving and demodulating the data. All bits received (including the start and stop bits) are presented to the controller. It is up to the controller to decode the message, ensure its correctness, and act on the received data.

DAA MODIFICATIONS

The telephone must receive the Caller ID signal without taking the telephone off-hook. In effect, the DC current loop cannot be completed, but the data pump must still be presented with the Caller ID signal. The most cost-effective way to accomplish a guaranteed Caller ID signal reception is to use a relay to switch in a capacitively-coupled signal path into the primary circuit of the line-coupling transformer (Figure 2). The relay switches on, between the first and second rings, in expectation of a Caller ID signal. The controller then sets a timer for 3 seconds to await complete reception. At 3 seconds, the relay switches off. As a result, the large voltage ring signals are prevented from being passed onto the data pump.

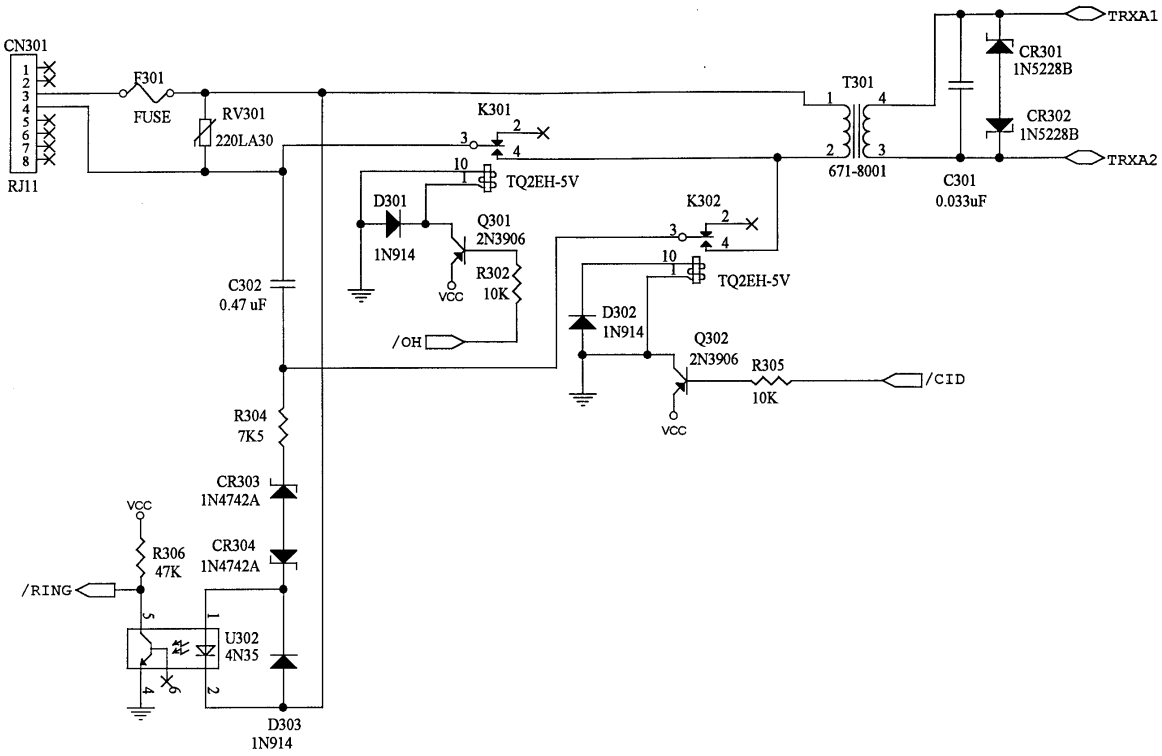

Figure 2. Example DAA Compatible with Caller ID Functionality

The capacitor should have a small-enough capacitance and large-enough voltage rating to ensure compliance with RS-490 DC and AC impedance limits. A 0.47 uF 250 volt value is suitable in North America. Zilog suggests this value for the ring-detection signal coupling. The capacitively-coupled signal can therefore be tapped off the ring detect circuit. Figure 2 provides an example.

CALLER ID SIGNAL PROCESSING BY THE DATA PUMP

Use the V.23 1200 bps receive mode to demodulate the Caller ID signal. After the Caller ID relay closes, the data pump should go into the V.23 1200 bps receive mode. The back channel (75 bps) should mute. In this configuration, the controller sets the TXSQLCH bit in the DPCTRL RAM location, thereby muting the 75 bps back channel. A normal originate mode auto-handshake results. The code listing on page 4 places the Z02201/Z02922 data pump into this mode. The controller now begins to receive data.

The general controller procedure to capture the Caller ID signal is as follows:

1. Wait for the end of the first ring. Verify silence for more than 500 ms
2. Close the Caller ID relay thus providing an AC-coupled signal path to the data pump
3. Place the data pump into the V.23 1200 bps receive mode (with a muted back channel)
4. Wait for received data. Look for the channel seizure signal. This is the 0x55H pattern (up to 30 bytes)
5. The next byte will be the first byte of the data packets that follow
6. Once all the bytes have been captured, disconnect the data pump from the signal path by opening the Caller ID relay and setting the data pump into the idle condition (CONFIG = 0)

USING THE Z02205 TO DECODE THE CALLER ID SIGNAL

Version 3.3 of the Z02205 controller software can decode the Caller ID signal used in North America. In effect, the $\overline{\text{MUTE}}$ signal is redefined to be the $\overline{\text{CID}}$ signal to drive the Caller ID shunt relay. Additionally, a new command (#CID) has been implemented to control the decode process:

Table 1. Caller ID Command Values

#CID = 0	Turn off all Caller ID processing
#CID = 1	Decode the Caller ID message, format it and output it to the terminal
#CID = 2	Decode the Caller ID message, format it and output it to the terminal

The next column shows examples of the formatting using the various #CID options:

```
at#cid = 1          (formatted)
OK

RING
04/06 01:29
101
ANDERSON ALLEN

RING
at#cid = 2          (unformatted)
OK

RING
80200108303430363031323902033130310 70
F414E444552534F4E20414C4C454E200E
```

CALLER ID RECEIVE

The following instruction set places the data pump into the V.23 1200 bps Receive Mode.

```
#define DPCTRL 0x1FA
#define TXSQLCH 0x8000
#define MDMSTATUS 5                  // Modem status register (R5)

/* do V.23 Rx 1200 */
void do_V23rx1200() {
    int ltemp;                       // 16 bit temporary variable.

    ltemp = read_DSP_RAM(DPCTRL);    // Squelch the transmitter.
    ltemp |= TXSQLCH;
    write_DSP_RAM(DPCTRL, ltemp);
    write_DSP_RAM(CONFIG, 0x4014);   // Set V.23 originate 1200 bps rx.
    while (!(inp(MDMSTATUS) & CDET));// Wait for carrier detect.
    return;
}
```

CONCLUSION

This Application Note considered both hardware and software issues. It should provide the understanding required to integrate Caller ID into a system using the Z02201/Z02922.

Written by SoftArt Microsystems, Inc.

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