RTF-DATA-SAW 4800bps AM Transceiver Modules
RTL-DATA-SAW

Digital data transceiver module suitable for half-duplex two-way radio transmission with fast RX-TX switching. A wide LF bandwidth allows data rates of up to 4800 baud .

Features

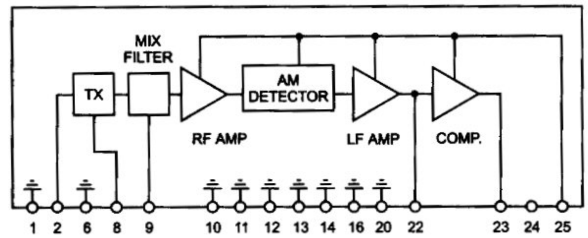
- High-miniaturization SIL thick-film hybrid circuit
- Operating frequency: 433.92 MHz
- High Stability SAW resonator transmitter section
- TX power: 8 mW (9 dBm ± 2 dB) into 50Ω load
- LF bandwidth : 5 KHz max. square wave - RTF model
  3 KHz max. square wave - RTL model
- Super-regenerative Receiver section
- RF sensitivity measured with On-Off input signal: better than 7μV (-90dBm) for **RTF-DATA-SAW**
- RF Sensitivity better than 2.24μV (-100dBm) for **RTL-DATA-SAW**
- Tx-Rx switching time : better than 100ms, with receiver section ON
- Dimensions: 63.5 x 17.9 x 5 mm. Pin pitch 2.54 mm

Consumption @, +5V

- Tx section: ≤4.5 mA with square wave modulation
- Rx section: ≤ 2.5 mA ,
- With both sections Off: Zero consumption

PIN Descriptions

1) Ground
2) TX data input
   0V=Tx Off
   5V= Tx Continuous On
6) Ground
8) Tx +5V supply
9) Antenna
10) Ground
11) Ground
12) Ground
13) Ground
14) Ground
16) Ground
20) Ground
22) RX analog Out
23) RX digital Out
24) Not Used
25) RX + 5V Supply



Application Note

Transmitting & Receiving RS 232 data

Transmission of digital data using the RTF-DATA-SAW transmitter/receiver module requires an understanding of the characteristics of the module in order to implement a half-duplex data link.

Digital Data

Digital data consists of 1's and 0's, or "bits". When transmitted over an RF link, data is sent as a serial stream, one bit at a time. Many different data formats may be used, but the RS-232 format is universally known and is often used.

RS 232 protocol

The electrical signals defined by the RS-232C standard are a little odd by modern standards. For data signals, a "0" is represented by a voltage between +5 and +25V and a "1"' by a voltage between -5V and -12V, i.e. negative true. The control lines, when used, are the other way up, with a "1" being a voltage of +5V to +25V, i.e. positive true. For this reason, in non-standard applications, it is normal to use the more conventional levels of 0V for a "0" and +5V for a "1", still with the RS-232 data format, as this interfaces directly to standard logic.

The RS-232 standard is to all intents is an asynchronous data transmission protocol. Each transmitted word or frame consists of a Start bit, 5 to 8 Data bits, possibly a parity bit and one or more Stop bits. By far the most used format is 8 Data bits, no parity and one Stop bit, usually expressed as "8N1" (see Fig. 1). This is the format that will be used in the following discussion.

The Start bit is used to synchronize the receiver decoder with the transmitted data. The Data bits contain the information, least significant bit first. The Stop bit is the "space" between consecutive words. There is no limit to the number of words that can be transmitted in this way.

Transmission speed is measured in bits per second, otherwise known as the Baud rate. Common rates are 1200, 2400 and 4800 Baud. The maximum Baud rate that can be used is limited by the bit time approaching the transmitter turn-on and turn-off times . Data rate, bit and word times at 8N1 are :

1200Baud...........833μs/bit.............8.33ms/word
2400Baud...........416μs/bit.............4.16ms/word
4800Baud...........208μs/bit.............2.08ms/word

Transmitter

The transmitter is turned "On", or keyed, with +5V on Pin 2. Transmitting RS-232 type data is done by using positive-true signals, where a logic "1" turns-on the transmitter. Thus the Start bit would turn the transmitter On and after the Data bits had been transmitted, the Stop bit would return the transmitter to the quiescent (Off) state. The transmitter SAW resonator takes a finite time to start and stop. The typical start time is 50µs and the stop time 10µs. However, these times are not constant. Thus the maximum rate that can reliably be used with the RTF module is 4800 Baud .

A second limit comes from the use of an RC network on Pin 2 to limit the slew-rate of the keying signal and to control the transmitted bandwidth . A 1KΩ/10nF low-pass filter is needed to comply with ETS 300 220 regulations . These values have a time constant of 10µs so will not degrade transmitter performance provided that the minimum logic 1 on Pin 2 is 4.5V, a level that standard CMOS should normally supply.

Receiver

The output stage of the super-regenerative receiver is shown in Figure 2.The detector output is DC coupled into an amplifier with an AC gain of 100. The output of this amplifier is given a nominal +100 mV offset and compared with the mean detector DC level, available on capacitor C. The offset is more than the noise level at the output of the amplifier and so ensures that the output of the comparator is low except when a signal is received.

For intermittent signals consisting of single words or short strings of words with a relatively long no-signal time, this method of generating a digital output is entirely adequate. However, it can cause problems when the long-term mark/space ratio of the received signal moves too far away from unity. When faced with long strings of non-encoded RS-232 words containing only 0s or 1s as data bits, the mean detector output voltage stored on C will change, as the RC time-constant of around 10ms is not infinite. If the string is long enough, detection errors will eventually occur.

This problem can occur whenever AC amplification is used when processing non encoded RS-232 data. There is a way around this problem using Manchester encoding, which will be described later.

The second time-constant formed by Rc and C must be considered. The ratio of R to Rc is around 50-100, a time constant of around a few seconds. This would cause long delays at switch-on or when switching from transmit to receive, as the detector is saturated when the module is transmitting. To avoid this, RC is bypassed by an active device. This limits the voltage across it and ensures that receiver sensitivity recovers to within 10 dB of normal in around 50 to 100ms and then to within 2dB after another 200 to 300ms. For most uses, a switching time of 100 ms can be assumed.
The pass-band of the receiver is about 5 KHz.

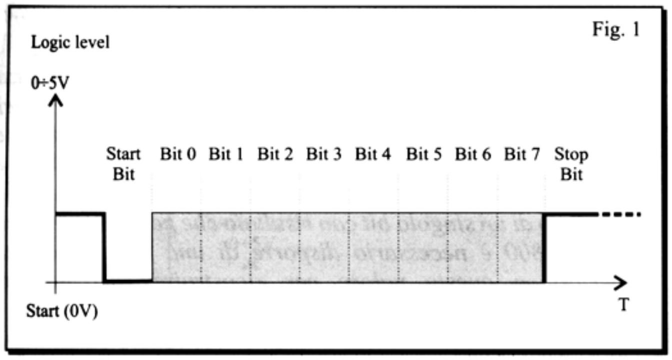


Fig. 1 RS-232 word with 8 Data bits, no parity and one Stop bit, using positive logic and 5V levels

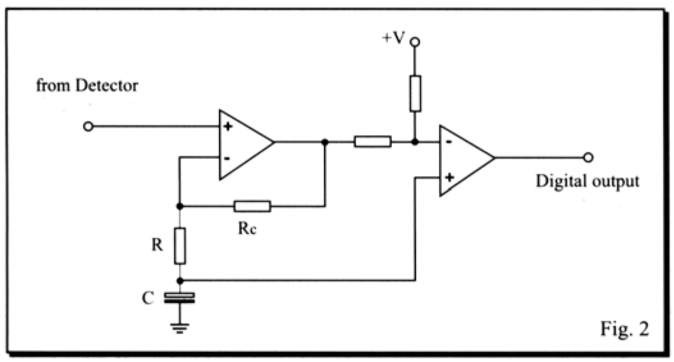
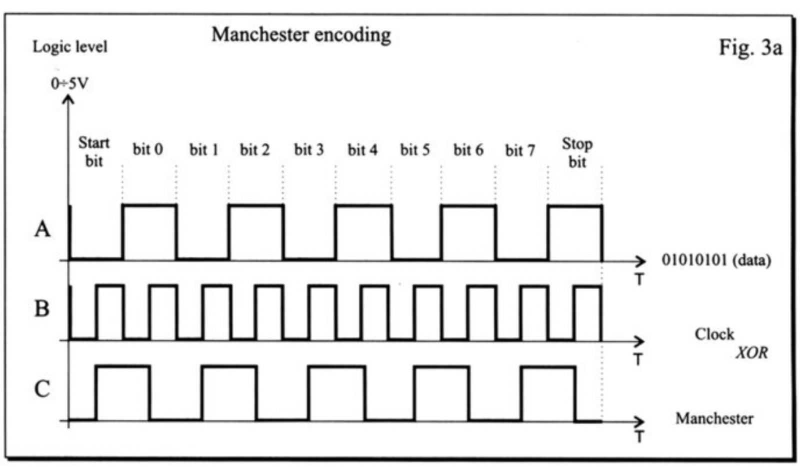
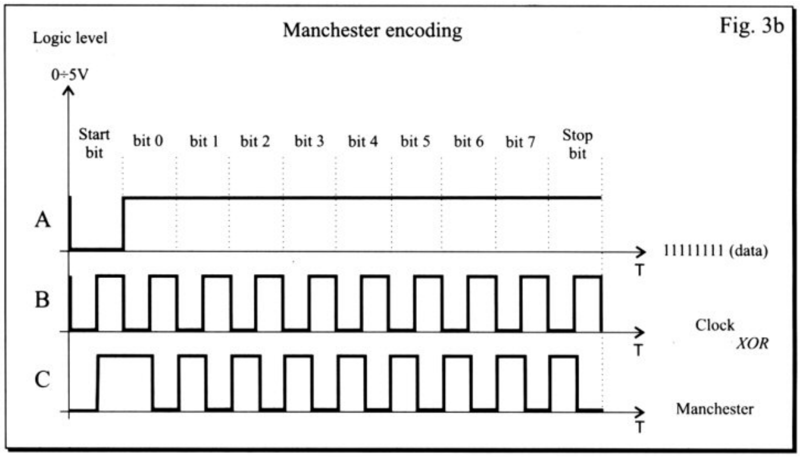


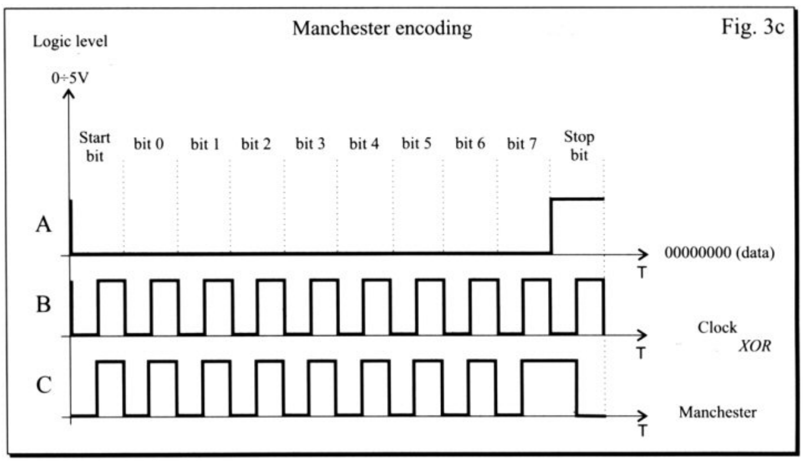
Fig. 2 Schematic diagram of Receiver (LF)

Manchester Encoding



Manchester codes have been around for a long time. The type described here is known as the Manchester II code and has several advantages over other methods of coding for transmission over channels with AC amplification. Like FSK (Frequency Shift Keying) it does not contain long strings of 1s or 0s. Unlike FSK, it is 50% efficient. The highest frequency is twice the Baud rate, the lowest is equal to the Baud rate. Figures 3a, b, & c Illustrate the encoding of RS-232 words containing alternating 1's and 0's, all 0's and all 1's.





The encoding is simply an exclusive-OR function between the data and a clock frequency of twice the bit rate. This can be carried out either in software, if a microprocessor or microcontroller is generating the data to be transmitted, or using an XOR gate and perhaps a D-type to synchronise the data to the clock frequency if required.

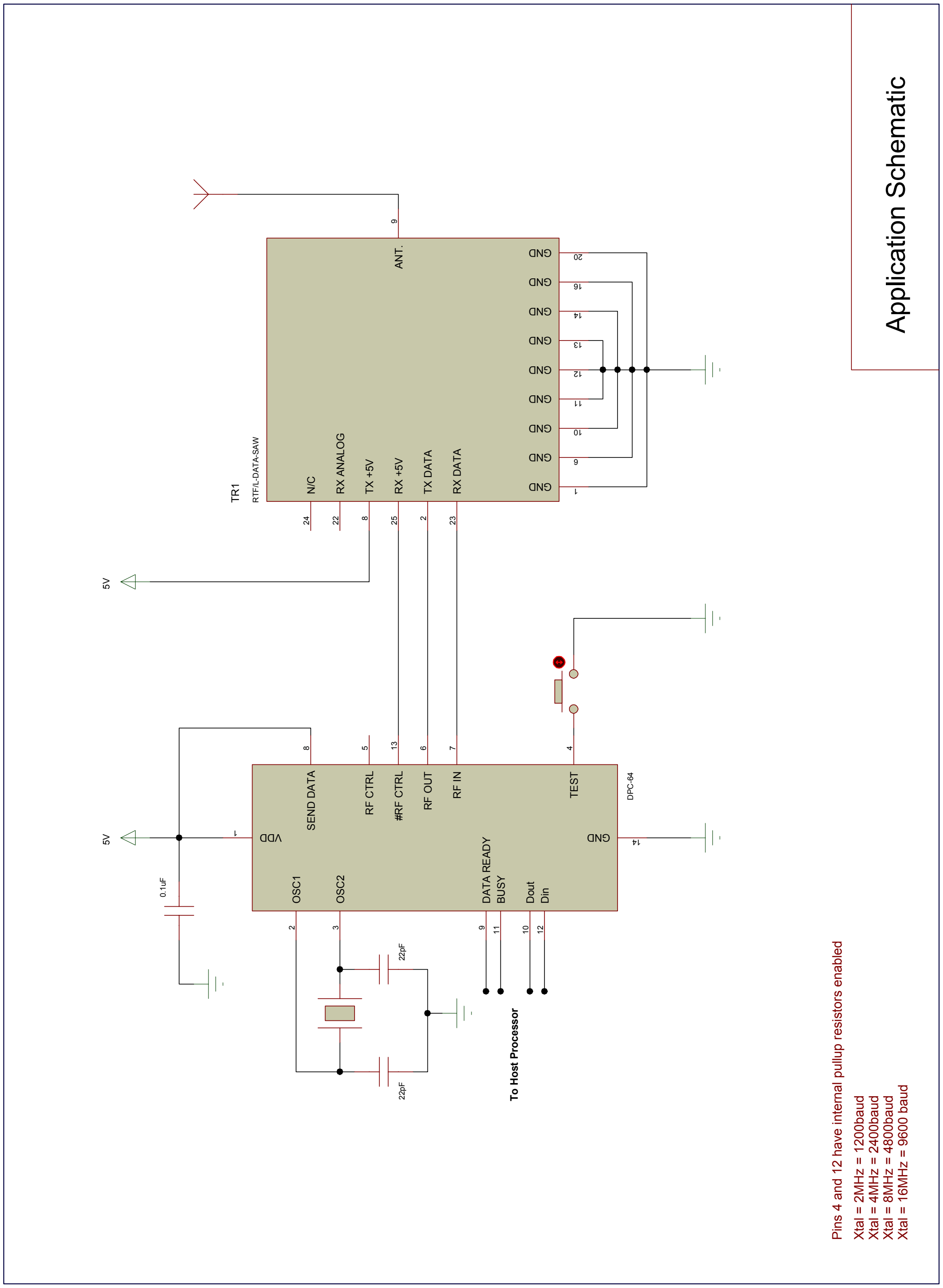
Decoding is a simple matter of detecting a long pulse period, which indicates that the decoder output must change . If the long period is a 1, then the output must become a 1, if the pulse is a 0 then the output must become a 0. This function can be easily accomplished in software or with a little more complexity, in discrete logic.
There are two drawbacks to this scheme. One is that the maximum Baud rate that can be transmitted using the RTF module drops from 4800 to 2400; the other is that transmitter power consumption rises as it is continuously transmitting, unlike the situation with unencoded RS-232 data. However, this is easily overcome by enabling the transmitter only when required.

Antenna

A suitable antenna can be simply constructed by attaching a quarter wavelength length of wire to the antenna pin. Alternatively, a wire rod or a trace on the PCB could be used. The length should be 16.5 cm from the antenna pin to the end of the antenna. The antenna choice and position directly controls the system range. Keep it clear, particularly the ‘hot’ end, of other metal in the system, particularly large ones like transformers, batteries and PCB tracks/groundplane. The best position by far, is sticking out the top of the product. This is often not desirable for practical/ergonomic reasons thus a compromise may be necessary. The space around the antenna is as important as the antenna itself.

Encoder / Decoder IC

The DPC-64 Manchester encoder/decoder and data packet controller IC is available to further simplify design integration and reduces design integration time significantly. For details on the DPC-64 please visit call or visit our website.



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