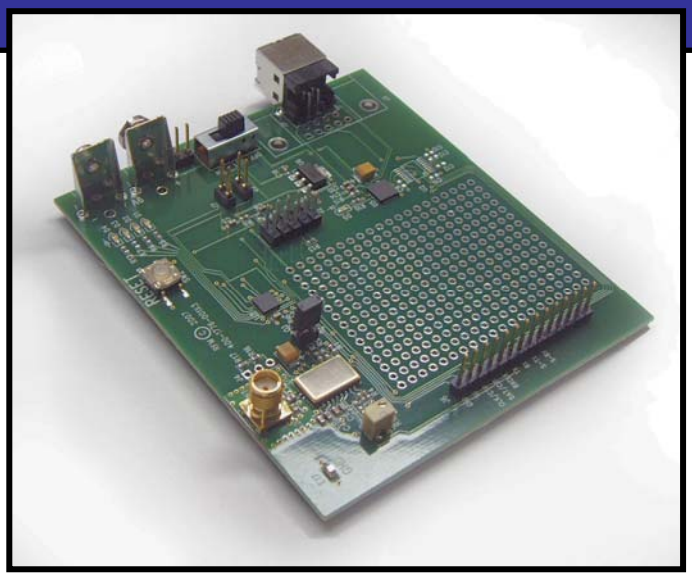
Third Generation Virtual Wire Development Kit User Guide

RF Monolithics, Inc.



General Overview

The Third Generation (3G) VWO Development Kits are available as:

- DR7000-DK (433.92 MHz)
- DR7001-DK (315.00 MHz)
- DR7003-DK (303.825 MHz)
- DR8000-DK (916.5 MHz)
- DR8001-DK (868.35 MHz)
- DR8100-DK (916.5 MHz w/DSSS)

The 3G Development kits allows for complete evaluation and application development of RFM's SRR (Short Range Radio) line of RFIC's. A communication link or Range Test can be executed with the Data Terminal to evaluate system performance.

Kit Includes:

- 2x USB 2.0 Cables
- 2x 9V batteries
- VWO Configuration software
- 2x tuned, SMA antennas
- 2x DR development boards
- CD with documentation

Key Features:

- Full development with Silicon Labs C8051F330 IDE (sold separately)
- Comprehensive Evaluation of Third Generation Virtual Wire devices
- Individual parameter configuration
- Adjustable RF output power
- USB 2.0 serial communication
- Example Code
- Third Generation demo software
- 2-way communication link
- Range Test
- Data Terminal Program
- Diagnostic LED's
- "Out of the box" operation

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1.0 Overview

The DRXXXX-DK kit allows for full demonstration or development of the third-generation (3G) TRXXXX Virtual Wire device. The kit provides "Out of the box" operation with or without the accompanying software. Two-way Range Test capability is included by simply snapping on the included 9V battery, turn on power, and configuring the opposite board for transmit. A small area is available for custom development with other popular microprocessors. The DRXXXX Data Radio boards are configured to operate at a data rate of 4.8 kbps. The kits are shipped with a pair of data radio boards and matching antennas. Data Radio boards with antennas can be purchased separately for development of applications.

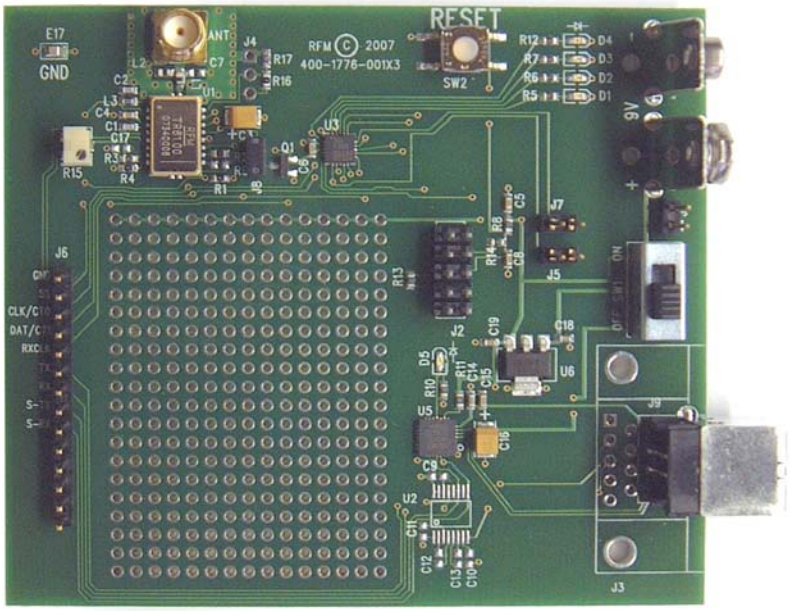


Figure 1. 3G VWO Development Board

2.0 Development Board Operation

2.1 Antennas

Two dipole antennas are included. These antennas are tuned for resonance around the device center frequency and provide excellent performance for range test or other link development. Suitable antennas are crucial to the success of a Virtual Wire application. Here are several key points to consider in designing antennas for your application:

- Where possible, the antenna should be placed on the outside of the product. Also, try to place the antenna on the top of the product. If the product is "body worn", try to get the antenna away for the body as far as practical.

- Regulatory agencies prefer antennas that are permanently fixed to the product. Antennas can be supplied with a cable, provided a non-standard connector is used to discourage antenna substitution (these connectors are often referred to as "Part 15" connectors).

- An antenna can not be placed inside a metal case, as the case will shield it. Also, some plastics (and coatings) significantly attenuate RF signals and these materials should not be used for product cases, if the antenna is going to be inside the case.

- Many other antenna designs are possible, but efficient antenna development requires access to antenna test equipment such as a vector network analyzer, calibrated test antenna, antenna range, etc. Unless you have access to this type of equipment, the use of an antenna consultant is recommended.

- A patch or slot antenna can be used in some applications where an external antenna would be subject to damage. These types of antennas usually have to be designed on a case-by-case basis.

2.2 Microcontroller Programming Header

For development using the on-board Silicon Labs C8051F330 microcontroller, a header is available for programming and debug capability using the Silicon Labs USB Debug Adapter module (sold separately). Full development is possible by purchasing the C8051F330DK Development Kit. All firmware code for the development kit is available from the RFM website.

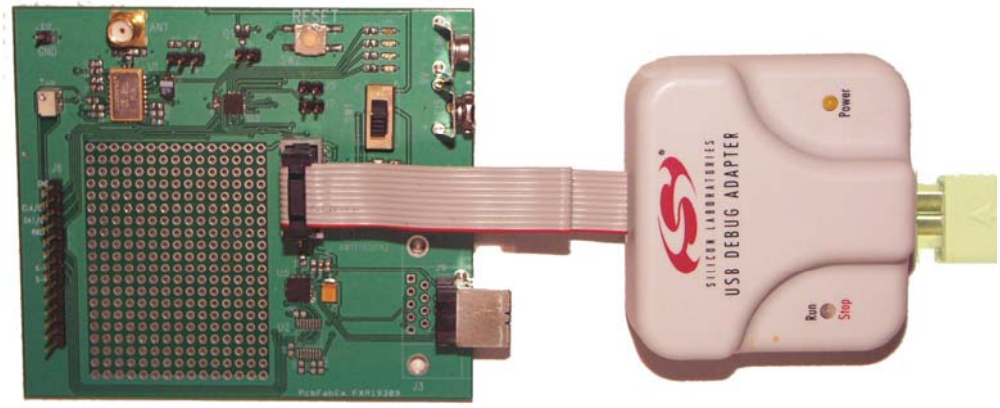


Figure 2. Development/Programming Connection

2.3 Power Supply

The development board may be powered from one of three methods: 9V battery, USB port, or external power supply applied to J1.

An on-board regulator converts the 9V battery and External Power Supply to 3.3V. The External Power Supply input should not exceed +25V.

After power is applied slide switch SW1 to the ON position. The four LED's should light up in sequence and then the system "heartbeat" indicator will flash.

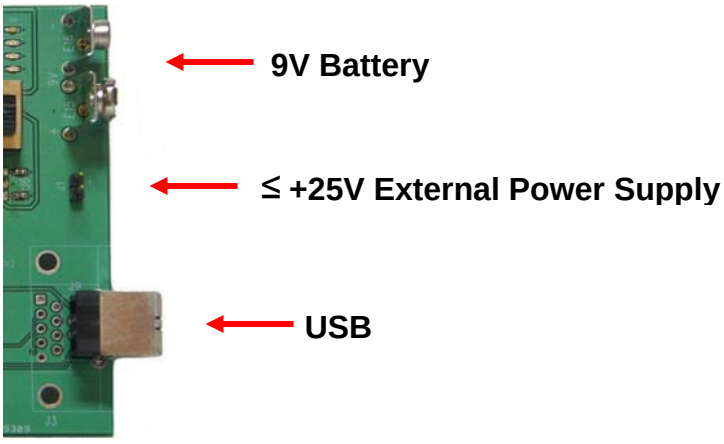


Figure 3. Power Connection Options

2.4 LEDs

There are five (5) total LED's (Refer to Figure 4) used for visual indication of:

1. Power (USB) - Green
2. System heartbeat - Yellow
3. Serial traffic - Amber
4. Data transmit (TX) – Green
5. Data packet error – Red

When the development board is initially powered on, by switching SW1 to the "ON" position, and the microcontroller voltage supply is stable the four LED's, D1, D2, D3, and D4, will light up in sequence. After the initial sequence, the system "heartbeat" LED will flash, indicating that the system is alive. If the "heartbeat" stops flashing, the microcontroller is not executing internal firmware code and the system is not functioning.

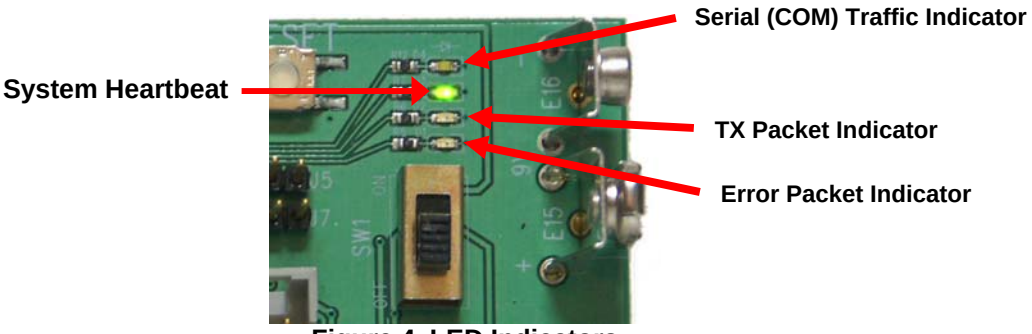


Figure 4. LED Indicators

2.5 RESET Button

The RESET button is used to reset the microcontroller and the TRXXXX device. When the RESET button is pressed, it pulls the nRST line on the microcontroller 'low' which also resets the TRXXXX device. At this point the TRXXXX device is configured to its initial second generation (2G) power-on state.

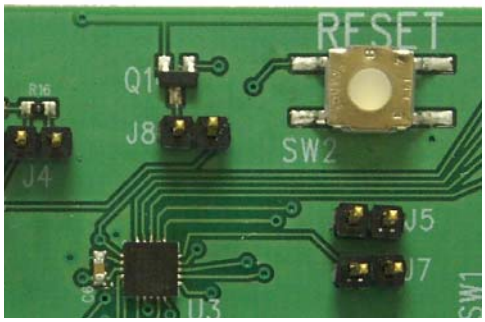


Figure 5. RESET Button

2.6 USB Port

All communication between the 3G evaluation software and the development kit are accomplished through the USB port. The development board may also be powered exclusively through the USB port. No external power source is needed. The development board uses a USB-to-UART converter IC to translate USB transactions into UART protocol. When the 3G evaluation software is installed, drivers that convert serial USB data into serial UART data are also installed. This is transparent to the user. The USB connection can be viewed as a simple RS232 UART running over a USB connection.

When the USB port is connected, a Green LED will light indicating that a connection is established and ready for power-up. Refer to Figure 6.

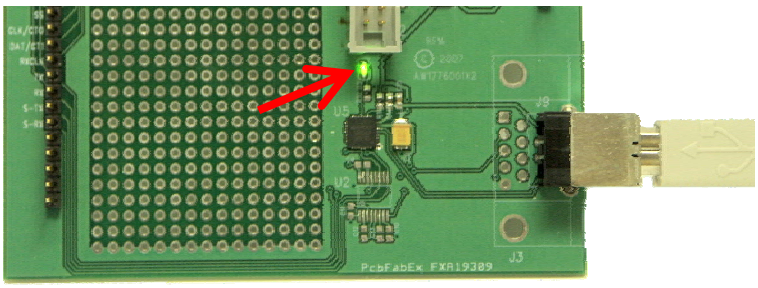


Figure 6. USB Power on LED

2.7 Current Monitor (J8)

The current monitor allows for the developer to monitor the current that ONLY the TRXXXX device is using. By removing the jumper installed at J8 (see Figure 7) and connecting an ammeter across the two pins, the current usage of the TRXXXX device may be monitored. Connecting the ammeter must be performed **BEFORE** powering the board.

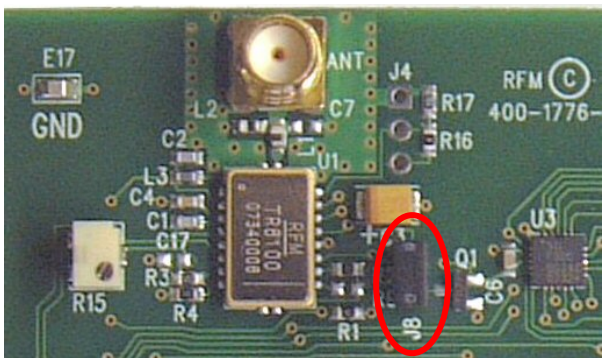


Figure 7. Current Monitor Jumper J8

2.8 TX Range Test Configuration Jumper (J5)

By placing the shorting jumper on J5 (see Figure 8) the board is configured for a Range Test transmitter at power-up. Before moving the switch SW1 to "ON" the jumper must be installed. After installation, move the switch to the "ON" position. The four LED's will sequence and the "heartbeat" LED will flash as well as the TX packet and serial traffic indicators (see section 2.4). Each time a packet is sent the TX indicator will flash. The TX indicator LED will flash rapidly indicating Range Test packet transmission. Refer to Figure 9.

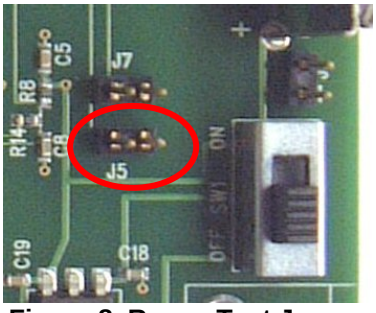


Figure 8. Range Test Jumper

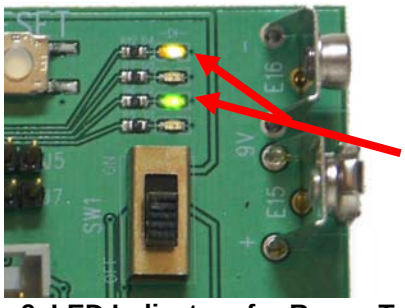


Figure 9. LED Indicators for Range Test

Should an error occur in the checksum, the Error LED (RED) will flash momentarily indicating a failed packet.

2.9 Test Points

Testpoints are provided to monitor the functions of the IC such as interface, TX data, RX data, Baseband data, recovered clock, and UART communications. Refer to Figure 10.

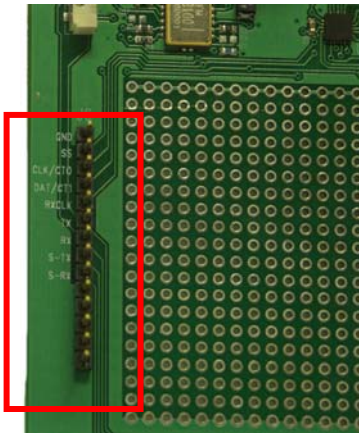


Figure 10. Testpoints

2.10 Custom Development Area

The custom development area is available for developing custom firmware with another processor other than the on-board Silicon Labs device. The testpoints to the left of the development area may be used as I/O to the device by simply soldering a wire from the testpoint to the appropriate pin on the custom device.

The 3G configuration software may be used to "disengage" the on-board processor from the I/O, enabling full custom development. Refer to Figure 11.

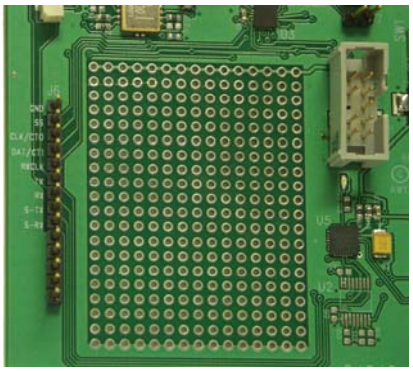


Figure 11. Prototyping Area

2.11 Communication Link Protocol

Almost all two-way wireless data communications use some form of packet protocol to automatically assure information is received correctly at the correct destination. The protocol provided with the 3G Development Kits is a *link-layer* protocol, and includes the following features:

- 16-bit ISO 3309 error detection calculation to test message integrity
- 4-bit TO/FROM address routing with 15 different node addresses available
- ASCII or binary message support, up to 32 bytes per packet
- Automatic packet retransmission until acknowledgment is received; 8 retries with semi-random back-off delays plus "acknowledge" and "link failure" alarm messages.

Also included with the Kits is a simple terminal program with source code to provide an example of interfacing host (application) software to the Virtual Wire link layer protocol. Most users will develop specific host software to match the needs of their application. The protocol software does not require or support hardware flow control, so the host software will have to do some timekeeping to interface the

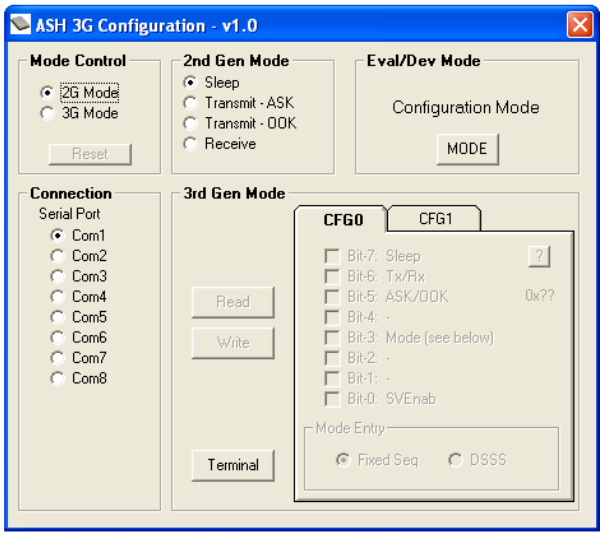
protocol software. Users familiar with hardwired packet networks may consider the 32 message bytes per packet limit quite small. Packets sent by low-power wireless systems are kept deliberately short to improve performance where on-channel burst interference and low signal-to-noise conditions are often encountered.

2.12 Communication Link Packet Structure

Figure 12. Packet Structure

The packet structure is given above. It uses a 4 byte preamble, 2 byte sync word 0xE2E2, a 1 byte TO/From address (default 2/2), the message type (RF cmd, host cmd, RF msg), the data payload, and a Frame Check Sequence (FCS) or CRC.

2.13 3G VWO Configuration Software



The configuration software enables all features of the TRXXXX device to be easily configured with just the click of a mouse. The software can Read and Write the internal registers as well as operate in backward-compatible second generation (2G) mode. See the 3G Configuration Software datasheet for detailed operational information.

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