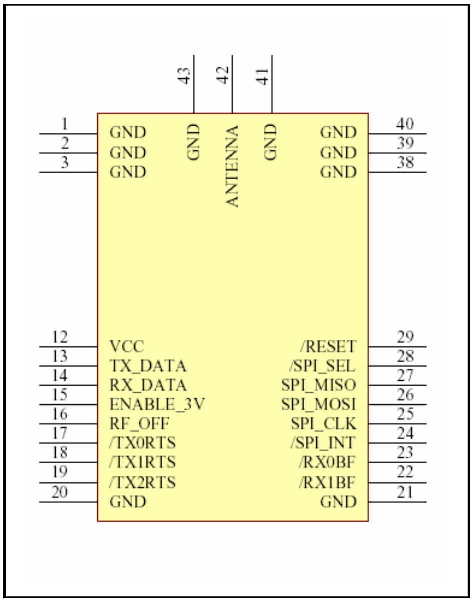
CANRF™
UHF Wireless CAN module



FEATURES:

916.5 Mhz (868.35Mhz Optional)
0.75mW
On Off Keying (OOK)
20kbps CAN bit rate
Distance > 300' (~100m)
Microchip MCP2510 SPI interface
20MHz CAN controller clock.
Bitwise Arbitration and Acknowledge
VCC - 5V
Current Consumption
  17 ma during transmit.
  9 ma during receive
  <15 uA during RF Off.
Power Off and RF Off control
DIP-40 footprint.

General Description:

The CANRF transceiver contains a 916.5 MHz (or optional 868.35Mhz) 0.75mW RF transceiver and a Microchip MC2510 CAN device. An onboard, low dropout regulator provides 3V for the transceiver and logic while the MCP2510 operates on 5V. The SPI bus interface of the MCP2510 is brought out to one side of the DIP40 package as are the user programmable digital outputs and device reset line. The other side of the package has additional control lines and TTL compatible CAN_TX and CAN_RX data signals. A version of the CANRF without the MCP2510 can be directly connected to other CAN transceiver devices.

Ordering Information:

CANRF-n-s-c-p

n = 9 for 916.5MHz, 8 for 868.35MHz, 4 for 433MHz(10kbps)
s = S for MCP2510 SPI interface, D for direct CANTX/RX interface.
c = Connector Options:
  R = Reverse SMA
  RA = Right Angle Reverse SMA
  S = SMA
  SA = Right Angle SMA
  N = No connector.
p = N for No DIP Pins

Example:
  CANRF with no options defaults to CANRF-9-S-N
  CANRF-9-D-SA is 916.5MHz with no MCP2510 and right angle SMA connector.

Pinout:

Symbol	PIN	Description
VCC	12	5V power 15ma
GND	1,2,3,20,21 38,39,40,41,43	DC and Antenna Ground.
ENABLE_3V	15	Apply VCC level to enable board
RF_OFF	16	Apply VCC level to put RF transceiver to sleep and reduce power of RF section to < 5uA.
TX_DATA	13	TTL CAN TX input – Not to be connected if CANRF has on board MCP2510.
RX_DATA	14	TTL CAN RX output – TTL CAN data that is routed to MCP2510.
/TX0RTS	17	MCP2510 /TX0 Request to Send signal
/TX1RTS	18	MCP2510 /TX1 Request to Send signal
/TX2RTS	19	MCP2510 /TX2 Request to Send signal
ANTENNA	42	30 to 70 Ohm impedance antenna although the best performance is with a 50 Ohm antenna with a high quality ground plane.
/RX0BF	22	MCP2510 /RX0 Buffer Full Signal
/RX1BF	23	MCP2510 /RX1 Buffer Full Signal
/SPI_INT	24	MCP2510 Interrupt line.
/SPI_CLK	25	MCP2510 SPI bus Clock in signal
/SPI_MOSI	26	MCP2510 Master Out Slave In.
/SPI_MISO	27	MCP2510 Master In Slave Out
/SPI_SEL	28	Select MCP2510 on CANRF for SPI transfer
/RESET	29	Reset MCP2510 device

Note 1. Consult the Microchip MCP2510 data sheet for MCP2510 programming and pin descriptions that are directly connected to the MCP2510.

Maximum Ratings:

VCC	7.0 V
All Inputs and Outputs w.r.t. GND	-0.6V to VCC+1.0V
Storage Temperature	-50C to 100C
Ambient Temperature with power applied	-40C to 85C
ESD protection on MCP2510 pins	>= 4KV

Transceiver Properties and Programming Information:

The transceiver uses an Amplifier Sequenced Hybrid construction to create a sensitive stable high performance OOK receiver. A double SAW filter stage provides excellent receiver out of band rejection and transmitter filtering to suppress output harmonics to meet FCC 15.249 and similar rules. The data slicer is configured to reject background noise and yet detect low level signals.

CAN messaging uses Carrier Sense Multiple Access with Collision Recovery; (CSMA/CR) to allow an almost 100% utilization of the communications medium. A CAN node first listens to insure that the bus is free by checking for the carrier. The node then begins transmission and during the Recessive bits it enables the receiver to check and see if another node is transmitting which is how it handles the collision recovery.

This On-Off Keying is used to make it possible to allow Arbitration and Acknowledge of CAN messages. A Recessive level is equivalent to no signal while a Dominant level sent by turning on the transmitter. During CAN arbitration, a recessive level causes the device's transmitter to be disabled and the receiver receives any dominants transmitted by other nodes. Similarly, the transmitter has it's receiver enabled during the ACK window when the receiving devices transmit for single bit interval.

During the interframe space, when the bus is idle, the data slicer threshold gradually decreases so that low level signals can be detected. However, this increased sensitivity comes at a price which results in noise pulses fooling the CAN transceiver into thinking that a start bit has occurred. The CAN device very rapidly enters the Error Passive mode after issuing a number of error flags.

A valid start bit from another CAN device will condition the data slicer and the background noise level will be suppressed for the rest of the message. If the start bit has not sufficiently conditioned the data slicer the message will not be correctly received and the transmitter will resend. During the interframe space between retries or multiple messages the data slicing level does not change excessively and the next message will be received correctly.

With the automatic retry the CAN protocol works well in this environment to ensure that a message is received by at least one device. However, a node which is a bit closer to the transmitter could receive a stronger signal and may correctly receive the first copy of the message providing an dominant ACK in the ACK slot. The more distant node, operating in the error passive state will issue an error passive error flag (transmitter off) but the message will not be re-sent because of the valid ACK from the nearer node.

So although all nodes within range of each other are capable of receiving messages from each other the distant nodes may not always receive each message unless the closer nodes do not ACK the message and the transmitter has a chance to retry. Conventional RF systems use a training preamble such as a sequence of ones and zeros before the message starts, to condition the data slicer, but for standard CAN this isn't possible due to the Protocol definition. What can be done to improve message reliability is to precede the important messages with the equivalent of a preamble by sending a short zero length message which all nodes discard. This conditions the Data Slicer on all the receivers and provides a better chance of all nodes receiving the messages.

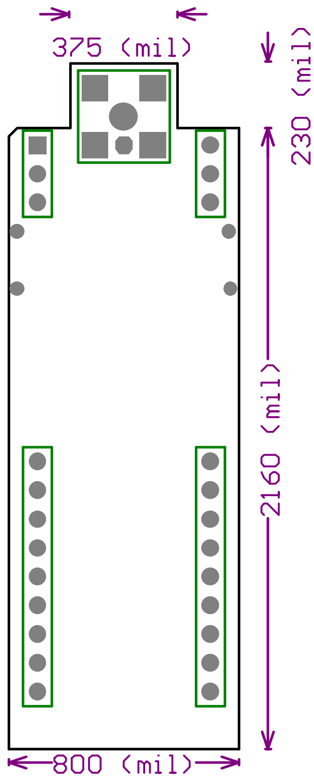
The MCP2510 has three transmit message objects with a physical priority where transmit object #2 has the highest priority and #0 has the lowest.. Loading the zero length training message into a higher priority register and setting the Message Transmit Request for both messages will always cause the training message to be sent first followed immediately by the regular message. A node close by may ACK the training message but all nodes will have their data slicers configured for the second message. The interframe space between the two messages is short enough so that the Data Slicers maintain the proper reference value for subsequent back to back messages.

Consideration must also be given to the Error Interrupts that occur when the Rx Error counter transitions through the value 127 to 128 or from 128 to 127. After a node enters the Error Passive state the Rx Error counter generally remains stuck at 128 although at times it may go as high as 136. When a message is correctly received the counter is decremented and the “Receive Error – Error Passive” state is reset while the “Error Warning” flag is set. If no subsequent messages appear the noise level will eventually cause false starts and the device will issue an Active Error Frame and then enter the Error Passive state. The “Error Warning” flag will be cleared and the “Error Passive” flag will be set in the error register. The interrupt routine must be written to handle this scenario.

As in wired CAN systems, a single node transmitting a message will continue to do so until it receives an acknowledge (ACK). Because the RF receiver is disabled during transmission the RF receiver maintains a recessive level for most of the bit period. The CAN device needs to see the data it transmits so the dominant transmitted data is fed back to the CAN device while the recessive bits are coupled from the RF receiver.

If a noise burst creates a dominant where the CAN device expects a recessive, the Transmit Error counter is incremented by 8 and if the device is Error Active, a 6 bit Error Flag transmission occurs. Once the Transmit Error Counter reaches 256 the MCP2510 goes Bus Off and then Bus On again automatically. A Transmitter Bus Off Error Interrupt also occurs.

A device such as the Philips SJA1000 stays bus off and must be put back on the bus by the interrupt service routine. The SJA1000 can also be programmed to become bus active sooner after a Bus Off condition by programming a smaller number into the Error Counters. This is not possible in the MCP2510 and will result in a longer time before the device can become Bus Active.



Package fits in 40 PIN DIP socket with 600 mil spacing.