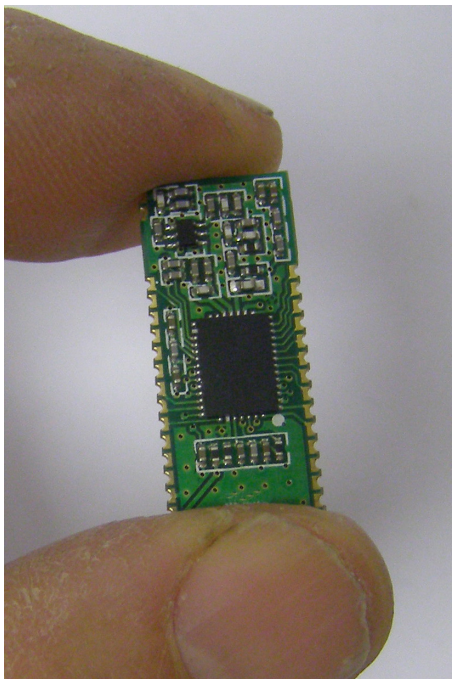
Radio MODEM Module

Features

- Intelligent RF Modem Module
- Serial Data Interface with Handshake
- Host Data Rates up to 38,400 Baud
- RF Data Rates to 56Kbps
- Range up to 2,000 Metres
- Minimal external components
- Direct Led Drive Shows Data Flow
- 8 User Selectable Channels
- Secure Data Protocol
- Ultra Low Power 2.2 - 3.6V Operation
- CE Compliant for Licence Free Use
- 868MHz or 915MHz Versions
- 100mW Transmit Power (+13dBm)
- Receiver Sensitivity –116dBm



Applications

- Remote Networking
- USB/RS232 Cable Replacement
- Remote Data Log
- Meter Reading

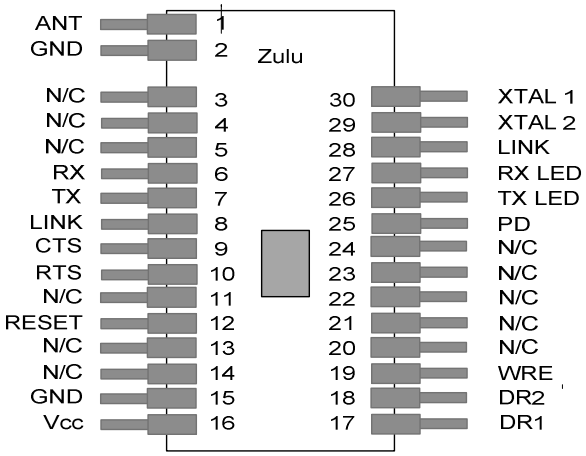
The ZULU Modem module is a highly integrated RF Modem and intelligent controller with simple interface to achieve a wireless serial data link for data (upto 38K4bps) over 2KM range.

The user interface is standard RS232 style control operating at low voltage. All RF operation is automatically controlled (with error checking etc) so the Zulu can be treated as a simple Communications device.

Possible applications include one-to-one and multi-node wireless links in applications including car and building security, EPOS, inventory tracking, remote industrial process monitoring and computer networking. Because of their small size and low power requirements this module is ideal for use in portable, battery-powered applications such as hand-held terminals.

Part No	Description
ZULU-M868	Radio Telemetry Module DIP Package
ZULU-M868-SO	Radio Telemetry Module SMT Package

Pinout



Pin Description

Pin No	Name	Direction	Description
1	ANT	In	Antenna Input / Output 50ohm Impedance
2, 15	GND	In	Connect to Ground
3-5, 11, 13-14, 20-24	N/C	N/A	Unused Leave Disconnected.
6	RX	In	(Low Level RS232) Data in
7	TX	Out	Low Level RS232 Data Out
8	LINK	In	Connect to LINK on Pin 28
9	CTS	Out	Low Level RS232 CTS
10	RTS	In	Low Level RS232 RTS
12	RESET	In	Device Reset Input (Tie High via 10K Resistor)
16	Vcc	In	+2.2-3.6v
17-18	DR1-DR2	In	Host Data Rate selection.
19	WRE	In	When High configuration data is held in EEPROM. When Low configuration data is held in volatile memory and lost on power cycle.
25	PD	In	Power down mode. Take low to enter Sleep mode
26	TX LED	Out	RF TX LED indicator
27	RX LED	Out	RF RX LED indicator
28	LINK	Out	Connect to LINK on Pin 8
29-30	XTAL1-2	In	Connect 30MHz XTAL here to drive RF Circuit

Pin Descriptions:

RX, TX
This is the Data Input / Output. Data is transmitted and received at the low voltage level (dependant on Vcc being used).

Serial Data Format
Baud Rate: Defined by DR1 and DR2 Pins
Data Bits: 8
Parity: None
Stop Bits: 1
Flow Control: Hardware CTS / RTS

CTS, RTS
Clear to Send and Request to Send are standard data flow control as use in RS232 systems, these are standard but operate at the Zulu Vcc low level voltage.

RESET
Connection to GND Resets the Zulu Module. Zulu Modem starts up when this input is taken from GND to Vcc.
Normal operation: connect to Vcc through a 10Kohm Resistor

Vcc:
Supply Voltage (2.2—3.6V)

DR1 - DR2
These inputs define the host interface Baud Rate. They are read when RESET pin goes high.
Tip: It is good practice to operate the host interface at half the speed of the RF data rate (set by Register R5

DR1	DR2	Host Baud Rate
Open	Open	4,800
Fitted	Open	9,600
Open	Fitted	19,200
Fitted	Fitted	38,400

PD
This input enables 'Sleep' Mode. For normal operation connect to Vcc. No RF packets will be received by the module when it is in sleep mode.

WRE
Controls where the User configuration parameters are saved in EEPROM (Non-Volatile) or RAM (Volatile) Un-used.

Tx / Rx LED
Direct LED Drive which operates whenever there is RF activity.

XTAL1, XTAL2
The Zulu module requires a 30MHz drive Crystal to be connected between XTAL1-2
Any standard crystal +/-10ppm ~20pF such as FEC 184-2247.

Operation Overview

The ZULU MODEM Module provides a simple Modem interface to the host controller. It handles all RF data communications automatically and without any requirement from the user (RF packetising , Preamble, Encoding, CRC Check etc).
With this powerful high-speed Radio link. The following networks can be realised;

One-to-One operation; for point to point data communication

One-to-Many; A network consisting a master and many slaves (the receivers all have the same address)

Many-to-One; where the transmitters all send to a single receiver address.

Because each ZULU MODEM can contain a unique address, multiple ZULU networks can co-exist in the same area.

Broadcast operation; where a single master Zulu MODEM addresses many ZULU MODEMS concurrently. (using many ZULU MODEM modules set to the same address),

Operating Modes

Configuration Mode: In Configuration mode the Zulu MODEM can receive a number of commands and the internal registers can be preset to control its operation. In this mode the Zulu MODEM is 'Offline' and cannot send or receive RF data.

Normal Operation : ZULU MODEM is 'Online' automatically transmitting and receiving data from its host and across the RF network.

Each ZULU MODEM has its own preset address. This is user set during configuration. Any data received is examined and the address header embedded within the data packet is compared with its address. Only data received with matching address will be processed and output to the host, all other data will be discarded.
All ZULU MODEM modules are shipped with a default address of 7E7E7E.

The ZULU MODEM contains an on-board data buffer equal to two data packets. Therefore if RTS is asserted (then the host is unable to receive data) the module will store a max of two data packets, all further data packets received will be discarded.

Configuration Mode (offline)

Commands can be set using a standard Terminal program or by sending the relevant ASCII characters.
Each Command must be followed by the Carriage Return <CR> or 'Enter'
Note All commands are entered in upper case

Command	Description	Response from Zulu
+++	Enter Configuration Mode	Zulu responds with Status info
?	retrieve the current register values	Zulu responds with all Register Values
F	set factory default; R1=7F7F7F R2=7F7F7F R3 = 3 R4 = 7 R5 = 1	'OK'
H	Help	Brief description of commands available
P	Ping Mode This sends a ping request . On receiving, the recipient Zulu Modem will respond with its address and the level of RSSI (Received Signal Strength) The Ping command is continuously repeated every 1 second until any command or character is entered.	The originating Zulu Modem will respond with the Recipient Zulu Modems' response, eg. Received from 7F7F7F (D5) Where 7F7F7F = the recipient Address D5= RSSI **RSSI** Is a Hex value corresponding to the received signal strength Min = 20hex Max =E0hex
S	Save Configuration	'SAVED'
Q	exit configuration mode and return to online mode	No response

Register Setting (Configuration Mode)

The internal registers enable various parameters to be controlled.

To set a register type 'R#=x' where # is the register number (1-6) and x is the value to set

For example to set the channel to channel 3 you would type the following.
R3=3<CR> (Where <CR> is carriage return or enter on the keyboard)
The modem will then return 'OK' or 'Error' if an incorrect command is entered.

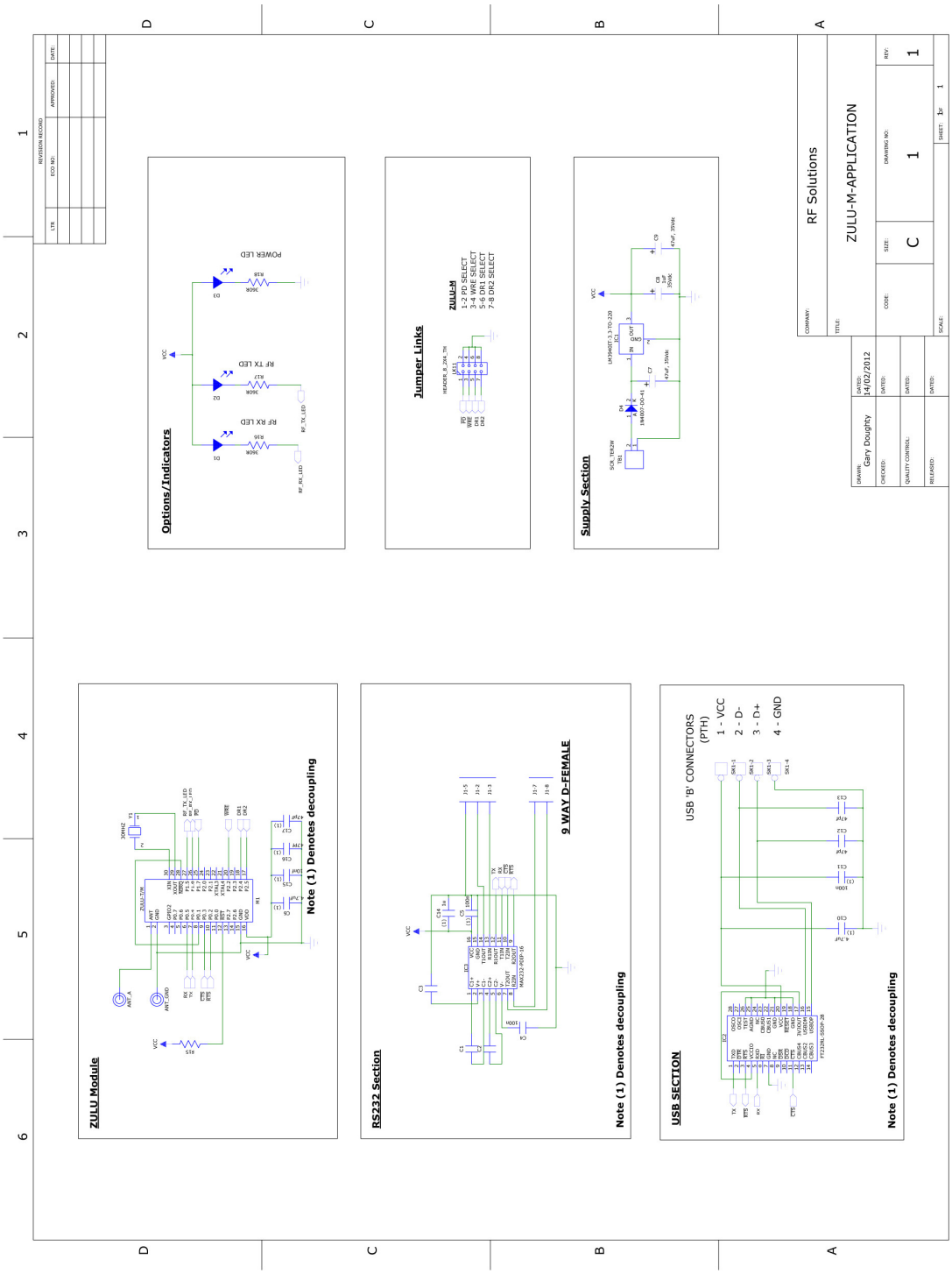
One you have set the register values you must save the changes by typing S<CR>
The modem will return with 'SAVED'

Register	Value Range	Description	Example
R1	0000 - FFFF (24 bit address)	sets the recipient Zulu MODEM Address	R1=0001 (Data sent is addressed to Zulu MODEM with address 0001)
R2	0000 - FFFF (24 bit address)	Set own Zulu Modem address	R2=F001 (Data sent is from Zulu MODEM with address F001)
R3	Ch 1-8	Set RF channel	R3=2 (Transmit on Channel 2)
R4	0 = -8dBm 1 = -5dBm 2 = -2dBm 3 = +1dBm 4 = +4dBm 5 = +7dBm 6 = +10dBm 7 = +13dBm	Set the RF Transmit Power output	R4=7 (sets Transmit Power to max)*
R5	0 = 9,600 1 = 19,200 2 = 28,800 3 = 56,000	set the RF baud rate	R5=3 (sets the RF data rate to 56Kbps) **Tip!:** The lower the RD Data Rate the longer the achievable range!

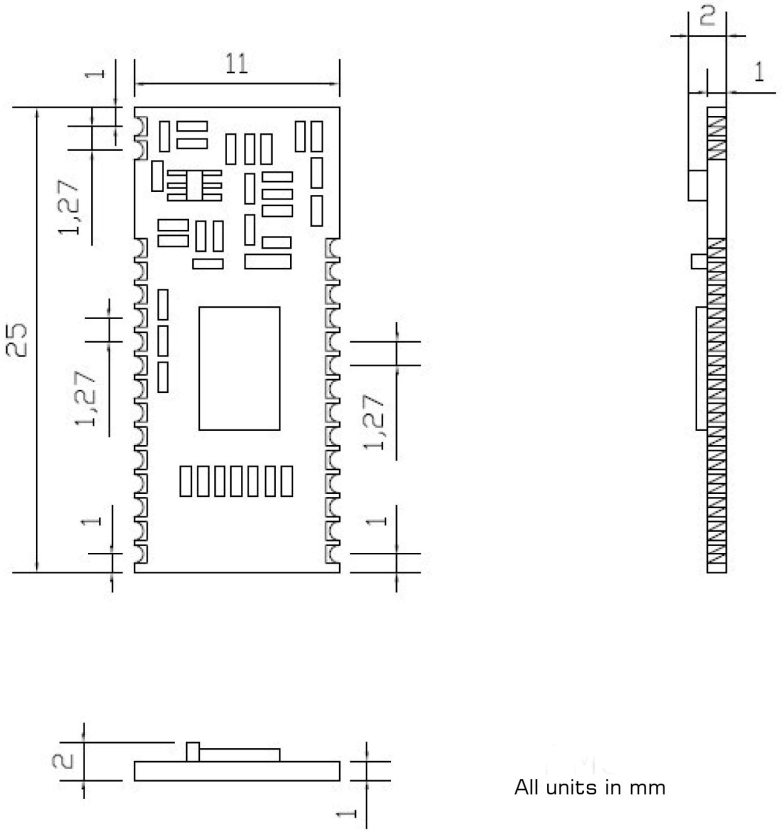
*Note : reducing Tx power reduces battery consumption!

Application Circuit

Connection of the ZULU Modem to an RS232 or USB host terminal device such as a PC serial port may easily be achieved using the Application Schematic below.
The 9 way 'D' socket (J1) provides the standard pin out required to connect directly to the serial port of any std PC using a 9 way male/female cable. The MAX3232 (a low voltage RS232 line driver) provides level conversion between the RS232 levels on the serial port and the logic levels pins of the ZULU Modem module.
Alternatively the same can be achieved using the ZULU Eval Boards



Mechanical Dimensions



All units in mm

Range

The antenna choice and position directly controls the system range. Keep it clear of other metal in the system. The best position by far, is protruding vertically from the top of the product. This is often not desirable for practical reasons and thus a compromise may be needed. Note that the space around the antenna is as important as the antenna itself. All radio systems are dependant on a radio signal being received through airspace.

The range quoted is the optimal in direct line of sight without obstacles and in good atmospheric conditions.

Range is affected by many things, for example local environmental conditions, atmospheric conditions, interference from other radio transmitters. For evaluating the local environment please see our RF Meter (DS006)

In very worse case applications the range quoted may be reduced below 30% of the optimal range stated.

Recommended Antenna

The BEAD Antenna provides a Miniature PCB mounting solution where a high performance is required from a small space . Available as straight or 90 degree mount this antenna is a general purpose omni-directional. It measures 8.5mm long, Dia 7. Please see Datasheet ANT-BEAD-868

Technical Specifications

Absolute Maximums:

Temperature Range: Storage –50 to +125°C.

Parameter	Min	Max	Units
Supply Voltage	-0.3	3.6	V
Voltage on any Input	-0.3	Vcc+0.	V
Max Input power (thro Antenna)		+10	dBm

DC Characteristics

Parameter	Min	Typical	Max	Units
Supply Voltage	2.2		3.6	V
Operating Temperature	-40		+85	°C
Zulu Tx Supply Current: When Transmitting When sleeping		 100 1		 mA uA
Zulu Rx Supply Current: When Receiving When sleeping		 18.5 1		 mA uA

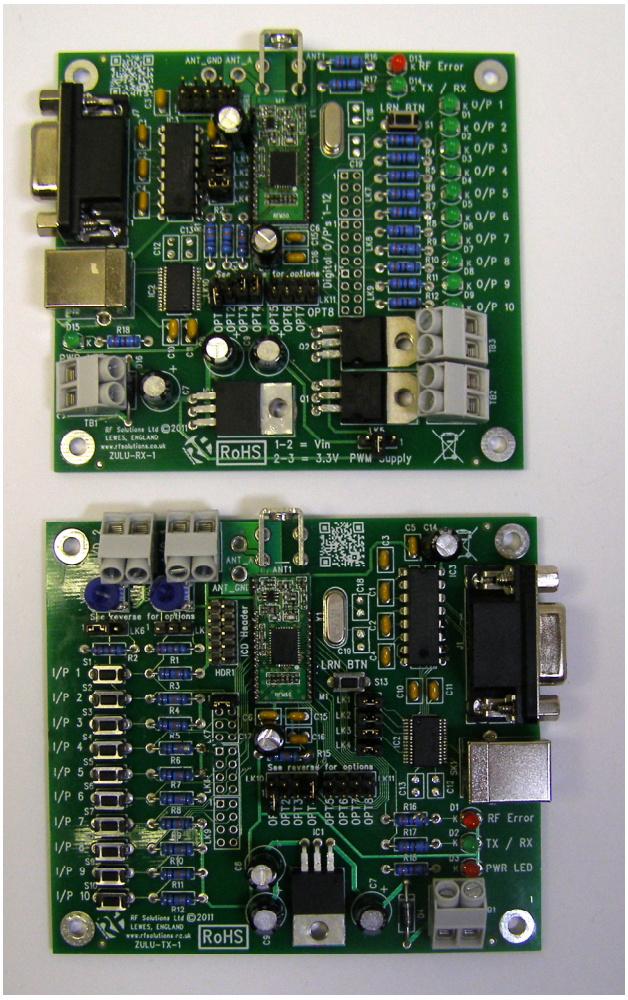
AC Characteristics

Parameter	Min	Typical	Max	Units
Operating Frequency	848		888	MHz
Operating Temperature	-40		+85	°C
Zulu Tx Output Power			+20	dBm
Zulu Tx—Rx FSK Raw RF Data Rate			256	Kbps
Zulu Rx Sensitivity		-116		dBm

Intentionally Blank

Zulu Evaluation Board

The ZULU EVAL Boards provide a ready made platform which can be used to build several projects which demonstrate the capabilities of ZULU Modules providing ready made Telemetry and Modem Solutions.



Features

- Easy assemble Projects;
- Watchdog Feature
- Direct Antenna Connection
- 9-12Vdc Power in Screw Term
- LED Indication of
  - Power
  - Transmit / Receiver
  - RF Error
- All Thro Hole Components

ZULU Telemetry

- 10 Channel Telemetry
- 10 LED Outputs
- 2 Analogue RF Links
- 2 Analogue Outputs

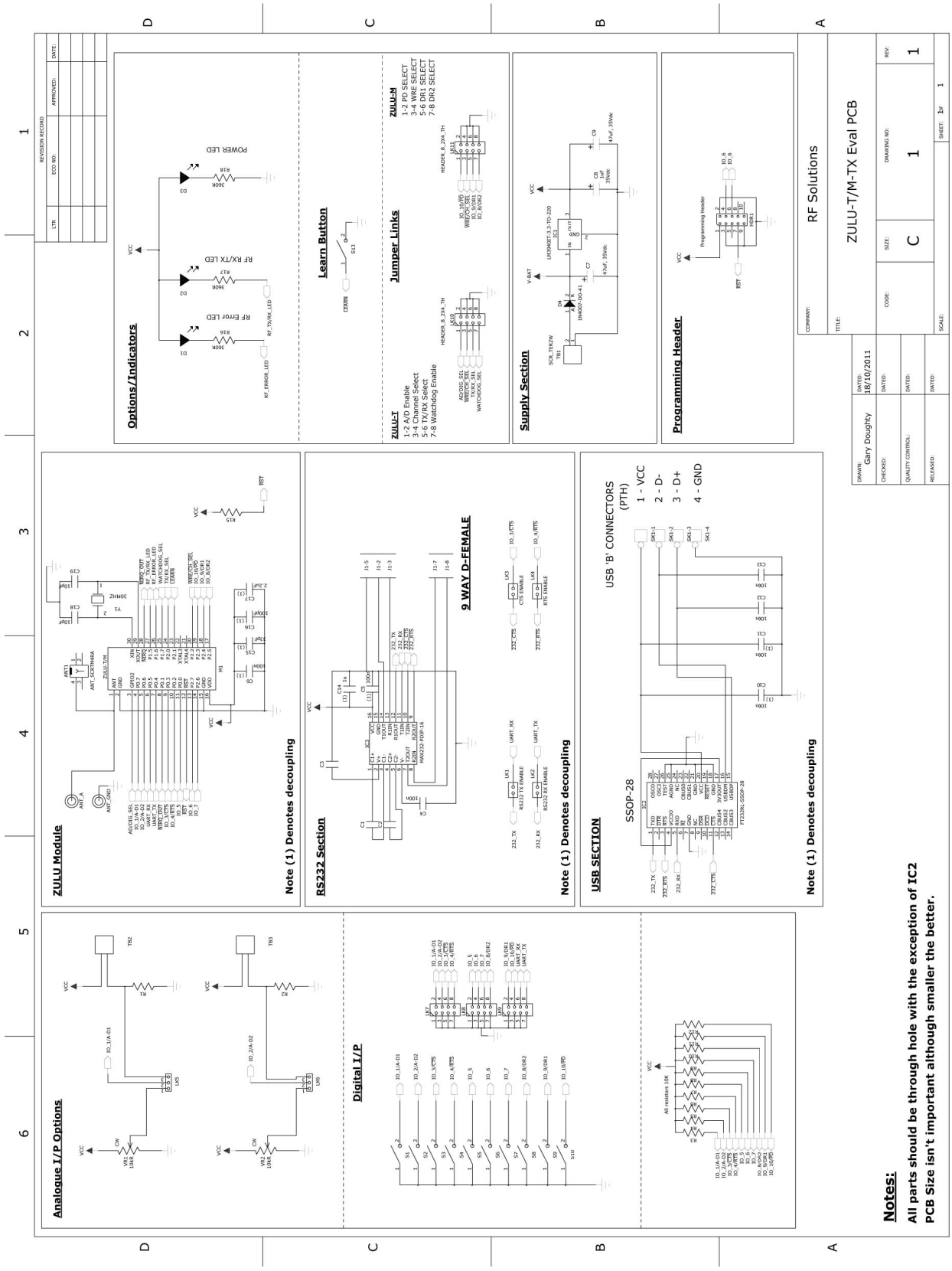
ZULU Modem

- RS232 Modem
- USB Modem

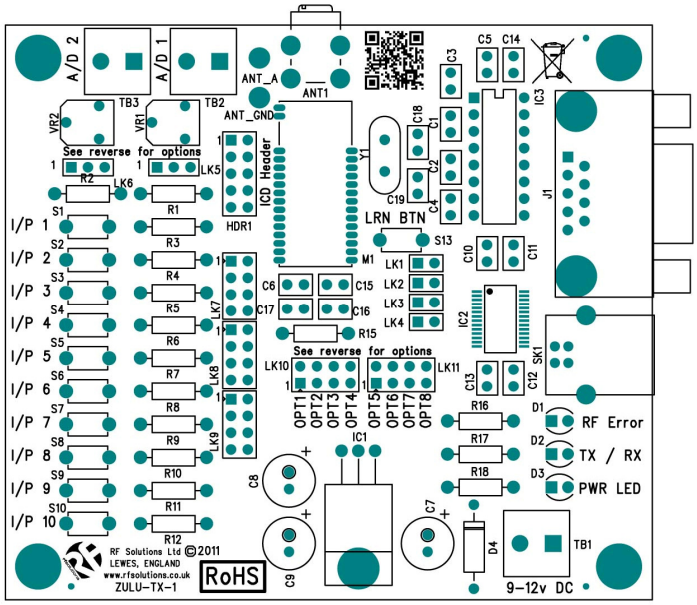
The Evaluation boards are sold as a TX and RX PCB pair, ready for component population. Schematics are shown below, not all components are fitted for each of the projects.

Part No	Description
ZULU-EVAL	Tx and RX PCB Pair
PSU-12V1-UK	Plugtop Power Supply 12V 100mA

Zulu Evaluation Board Transmitter Schematic

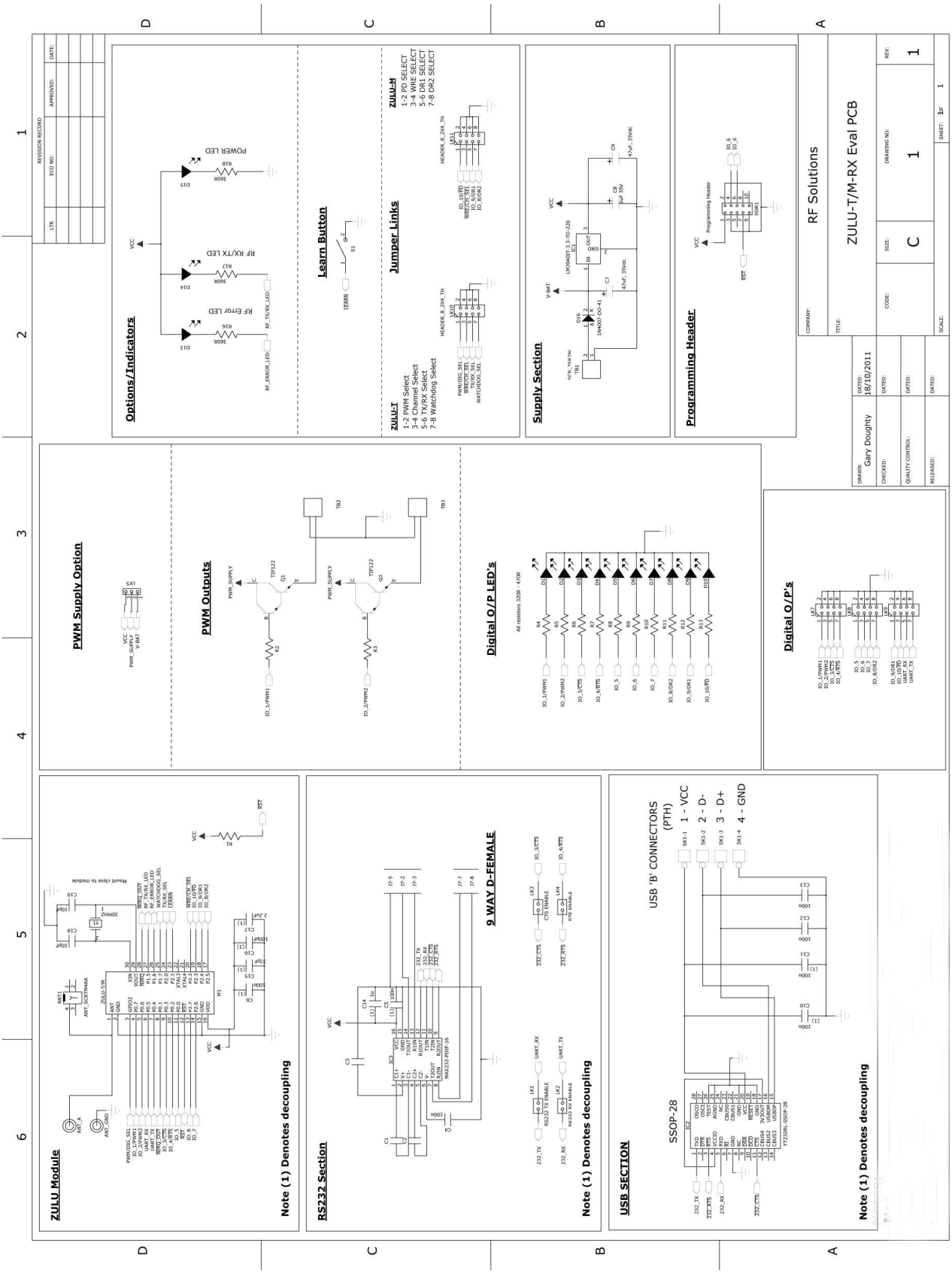


Zulu Evaluation Board Transmitter PCB Layout

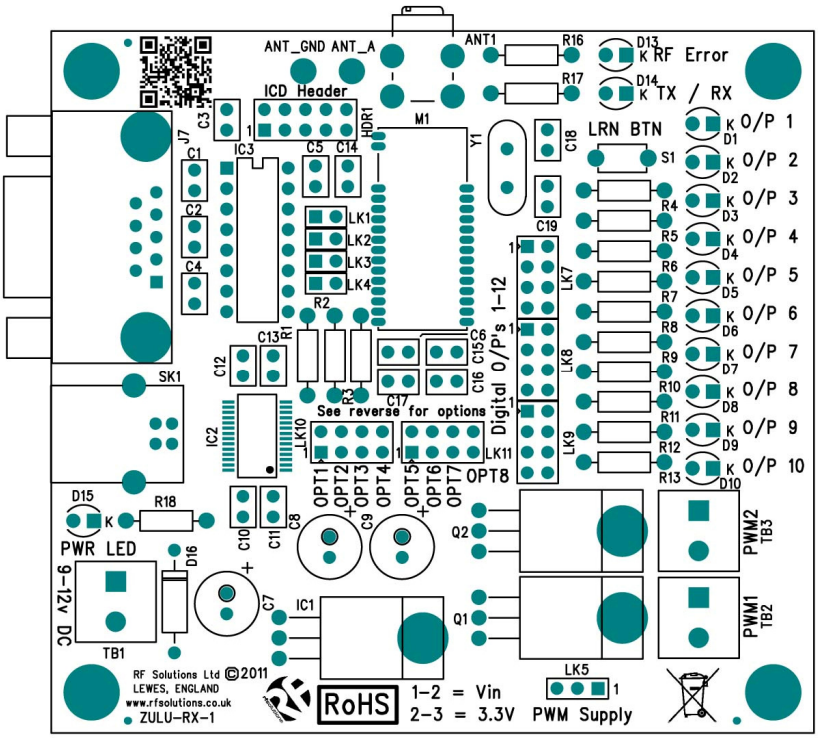


QTY	Reference	Part Name	Description	Farnell Part
1	ANT1	ANT_SCRTM4RA,ANTENNA		FEC109-6142
6	C1-6	CAP_254MM_RAD,100n		FEC114-1775
2	C7,9	CAP-254-TH		FEC171-2584
1	C8	CAP-254-TH		FEC969-3238
4	C10-13	CAP_254MM_RAD,100n		FEC114-1775
1	C14	CAP_254MM_RAD,1u		FEC969-3238
1	C15	CAP_254MM_RAD,33pF		FEC114-1761
1	C16	CAP_254MM_RAD,100pF		FEC114-1775
1	C17	CAP_254MM_RAD,2.2uF		FEC184-8563
2	C18-19	CAP_254MM_RAD,10pF		FEC114-1756
2	D1,D3	LED3MM-TH,RED	LIGHT EMITTING DIODE	FEC100-3390
1	D2	LED3MM-TH,GREEN	LIGHT EMITTING DIODE	FEC100-3199
1	D4	1N4007-DO-41		FEC165-1091
1	IC1	LM3940IT-3.3-TO-220		FEC949-4553
1	IC2	FT232RL-SSOP-28		FEC114-6032
1	J1	DCON9F	9 PIN D-TYPE FEMALE	FEC109-9294
4	LK1-4	HEADER-1X2PIN	1 X 2 PIN HEADER, 0.1" CENTERS	FEC182-2168
2	LK5-6	SIP-3P	1 X 3 PIN HEADER	FEC182-2168
2	LK10-11	HEADER_8_2X4_TH	2 X 2 PIN HEADER	FEC124-8134
1	M1	ZULU-M or ZULU-T		
1	M2	MAX232-PDIP-16	MAX232 RS 232 Driver IC	FEC938-6904
1	R1-2	RES-1/4W,2k2	RES BODY:100 CENTERS:500	FEC934-1536
11	R3-12,15	RES-1/4W,10K	RES BODY:100 CENTERS:500	FEC934-1110
3	R16-18	RES-1/4W,360R	RES BODY:100 CENTERS:500	FEC934-1790
10	S1-10	LRN_BTN_TH		
1	S13	LRN_BTN_TH		
1	SK1	USB_"B"_CON_TH,USB	USB 'B' CON.	
3	TB1-3	SCR_TER2W	2 Way Screw Terminal 5mm pitch	
2	VR1-2	VRES-TOP-ADJ-TH-3306F	10kR	FEC168-9844
1	Y1	XTAL1,30MHZ	30MHZ	FEC184-2247

Zulu Evaluation Board Receiver Schematic



Zulu Evaluation Board Receiver PCB Layout



QTY	Reference	Part Name	Description	Farnell Part
1	ANT1	SCRTM4RA	Antenna Mount	FEC109-6142
11	C1-6,C10-13,C16	CAP-1uFX7R	0.1uF, 25V	FEC114-1775
2	C7,9	CAP-47uF25V-EL	47uF, 25Vdc	FEC171-2584
1	C8,14	CAP-1uF250V-EL	1uF 35V	FEC969-3238
1	C15	CAP-33pF-CER	33pF	FEC114-1761
1	C17	CAP-2UF2-160VEL	2.2uF	FEC184-8563
2	C18-19	CAP-10PF-CERA	10pF	FEC114-1756
13	D1-10, 14-15	LED3LP-GRN	LED	FEC100-3199
1	D13	LED-3-LP-RED	LED	FEC100-3390
1	D16	1N4007		FEC165-1091
1	IC1	LM3940IT-3.3-TO-220		FEC949-4553
1	IC2	IC-RT232RL	FT232RL-SSOP-28	FEC114-6032
1	J7	CON-DB9F	9 PIN D-TYPE FEMALE	FEC109-9294
4	LK1-4	HEADER-1X2PIN	1 X 2 PIN HEADER, 0.1" CEN-TERS	FEC182-2168
1	LK5	SIP-3P	1 X 3 PIN HEADER	FEC182-2168
1	LK10-11	HEADER_8_2X4_TH	2 X 2 PIN HEADER	FEC124-8134
1	M1	ZULU-M or ZULU-T		
1	M2	MAX232-PDIP-16	MAX232 RS 232 Driver IC	FEC938-6904
1	Q1-2	TIP122	NPN DARLINGTON,TO220AB	FEC980-4021
3	R1-3	RES-FR4-10K-1	10K	FEC934-1110
13	R4-13, 16-18	RES-1/4W,360R	360R	FEC934-1790
1	S1	LRN_BTN_TH	Learn Button	
1	SK1	USB_"B"_CON_TH,USB	USB 'B' CON.	
3	TB1-3	SCR_TER2W	2 Way Screw Terminal 5mm Pitch	
1	Y1	XTAL1,30MHZ	CRYSTAL FEC1842247	FEC184-2247

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Application:

Would you like a reply? Y / N

Datasheet: DS-ZULUModem-1

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