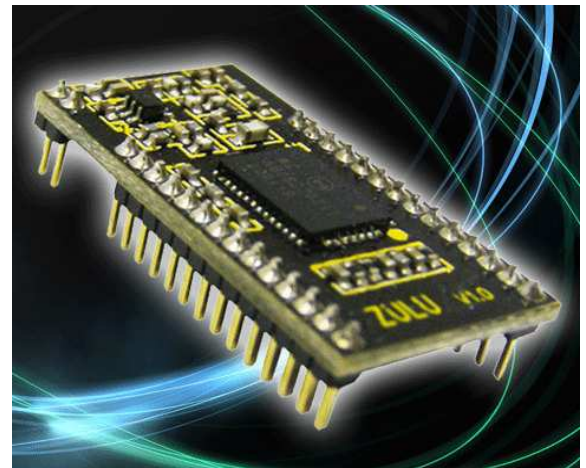


RF Wireless MCU

- RF Transceiver combined with Onboard 8051 μ controller
- Up to 2km Range
- Operates from 1.8—3.6V
- Dimensions: 25 x 11 mm
- SMT and PDIP variants



Features

- Ultra Low Power: 1.8 to 3.6 V Operation
- Typical sleep mode current < 0.1 μ A; retains state and RAM contents over full supply range; fast wakeup of < 2 μ s
- Less than 600 nA with RTC running
- Less than 1 μ A with RTC running and radio state retained
- Two built-in brown-out detectors cover sleep and active modes

10-Bit Analog to Digital Converter

- Up to 300 ksp/s
- Up to 18 external inputs
- External pin or internal VREF (no external capacitor required)
- Built-in temperature sensor
- External conversion start input option
- Auto burst mode c/w 16-bit auto averaging accumulator

Dual Comparators

- Programmable hysteresis and response time
- Configurable as interrupt or reset source
- Low current (< 0.5 μ A)

On-Chip Debug

- On-chip debug circuitry facilitates full-speed, non-intrusive in-system debug (No emulator required)
- Provides breakpoints, single stepping
- Inspect/modify memory and registers

High-Speed 8051 μ C Core

- Pipelined instruction architecture; executes 70% of instructions in 1 or 2 system clocks
- Up to 25 MIPS throughput with 25 MHz clock

Memory

- 4352 bytes internal data RAM (256 + 4096)
- 64 kB Flash; In-system programmable in 1024-byte sectors—1024 bytes are reserved in the 64 kB device

Transceiver Features

- Frequency range = 433,470,868,915MHz ISM Band
- Sensitivity = -121 dBm
- FSK, GFSK, and OOK modulation
- Max output power = +20 dBm
- RF power consumption
 - ⇒18.5mA receive
 - ⇒18 mA @+1 dBm transmit
 - ⇒30mA @+13 dBm transmit
 - ⇒85mA @+20 dBm transmit
- Data rate = 0.123 to 256 kbps
- Auto-frequency calibration (AFC)
- transmit/receive switch control
- Programmable packet handler
- TX and RX 64 byte FIFOs
- Frequency hopping capability
- On-chip crystal tuning

Digital Peripherals

- 19 or 16 port I/O plus 3 GPIO pins; Hardware enhanced UART, SPI, and I2C serial ports available concurrently
- Low power 32-bit SmaRTClock

Four general purpose 16-bit counter/timers; six channel programmable counter array (PCA)

Clock Sources

- Precision internal oscillators: 24.5 MHz with \pm 2% accuracy supports UART operation; spread-spectrum mode for reduced EMI; Low power 20 MHz internal oscillator
- External oscillator: Crystal, RC, C, CMOS clock
- SmaRTClock oscillator: 32.768 kHz crystal or self-oscillate
- Can switch between clock sources on-the-fly; useful in power saving modes and in implementing various power saving modes

I/O Port

- 19 or 20 port I/O (5 V tolerant except for GPIO_2)

Applications

- Remote Control
- Remote Networking
- Remote Switching
- Remote Traffic Lights
- Inventory tracking,
- Trash and vending monitoring,
- Data links and barcode reading .
- Lighting and water controls,
- Security and access systems,
- Gate controls,
- Remote activation,
- Scoreboards,
- Ordering and paging systems

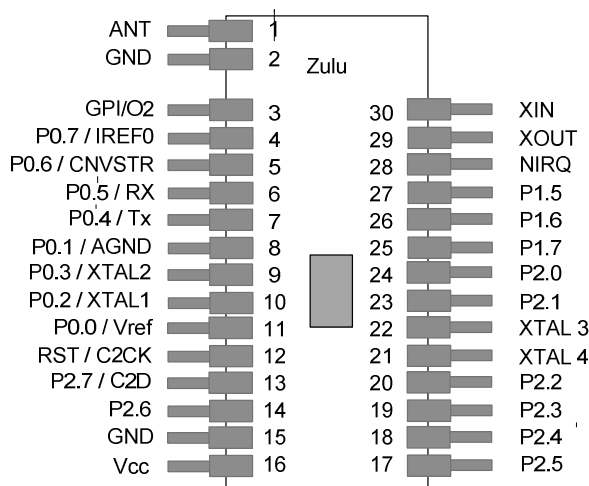
General Description of Operation

The ZULU Transceiver Module provides a highly integrated 'plug and play' Radio solution. Based on the Silicon Labs Si1000 Chipset, the Zulu Transceiver integrates a high power RF Transmitter (+20dBm) with high sensitivity receiver (-121dBm), and an 8051 microcontroller. **For detailed operation of the device please see Silicon Labs Datasheet: Si1000.pdf.**

Ordering Information

| Part No | Description |
|-------------|--------------------------------------|
| ZULU-433 | Zulu Module DIP Package 433MHz (TBC) |
| ZULU-433-SO | Zulu Module SMT Package 433MHz (TBC) |
| ZULU-868 | Zulu Module DIP Package 868MHz |
| ZULU-868-SO | Zulu Module SMT Package 868MHz |
| ZULU-915 | Zulu Module DIP Package 915MHz (TBC) |
| ZULU-915-SO | Zulu Module SMT Package 915MHz (TBC) |

Pinout



Pin Description

| Pin No | Name | Direction | Description |
|--------|----------------|------------------------------------|--|
| 1 | ANT | A In/Out | Antenna Input / Output 50ohm Impedance |
| 2, 15 | GND | In | Connect to Ground |
| 3 | GPIO2 | D In/Out Or A In/Out | General Purpose I/O controlled by the EZRadioPro peripheral. May be configured through the EZRadioPro registers to perform various functions including: Clock Output, FIFO status, POR, Wake-up timer, Low Battery Detect, TRSW, Ant Diversity control. Refer to Silabs AN440 for register descriptions. |
| 4 | P0.7 IREF0 | D In/Out or A In A Out | Port 0.7 See Si1000 Port I/O section for complete description External Convert Start Input for ADC0. See Si1000 ADC0 section for complete description. |
| 5 | P0.6 CNVSTR | D In / Out or A In | Port 0.6 See Si1000 Port I/O section for complete description External Convert Start Input for ADC0. See ADC0 section. See Si1000 ADC0 for complete description. |
| 6 | P0.5 RX | D In / Out or A In D In | Port 0.5 See Si1000 Port I/O section for complete description UART RX Pin. See Si1000 Port I/O section |
| 7 | P0.4 TX | D In / Out or A In D Out | Port 0.4 See Si1000 Port I/O section for complete description UART TX Pin. See Si1000 Port I/O section |
| 8 | P0.1 AGND | D In / Out or A In GND | Port 0.1 See Si1000 Port I/O section for complete description Optional Analogue GND See Si1000 Port I/O section |

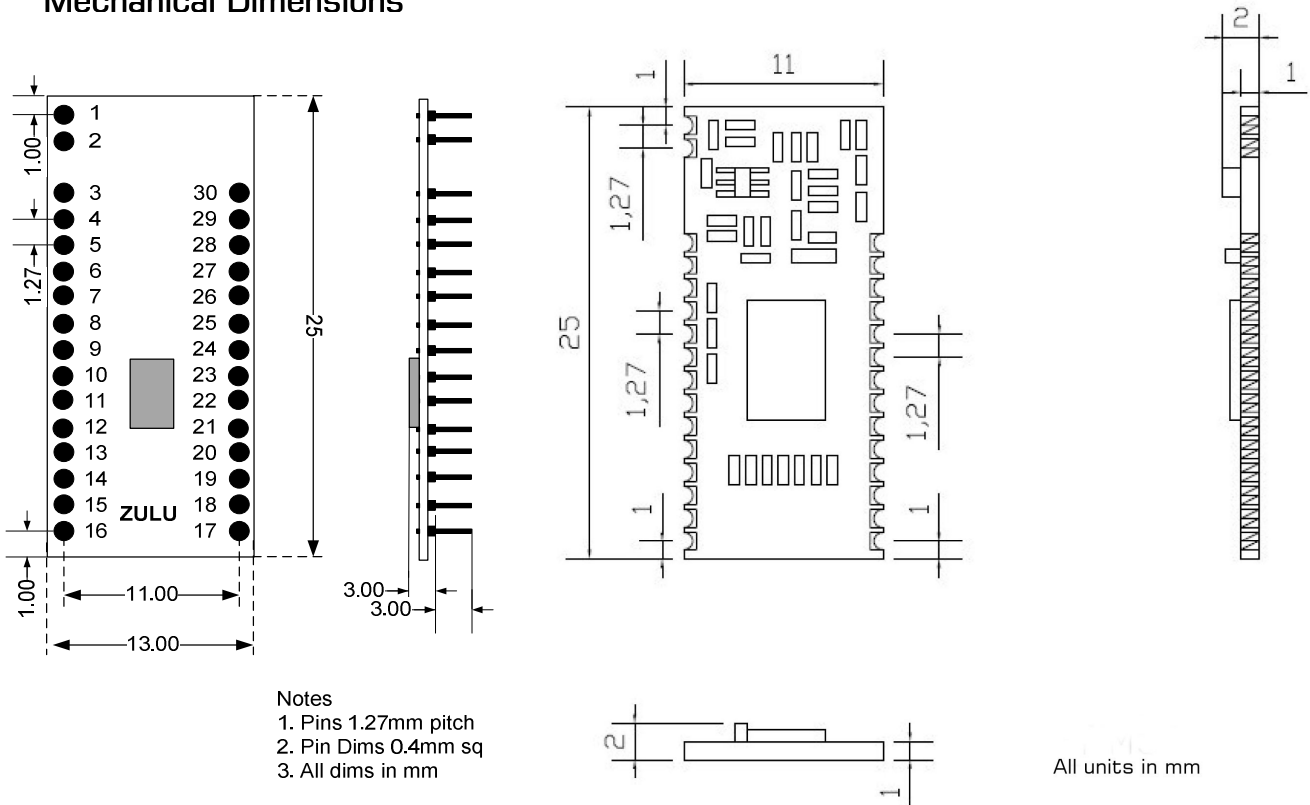
Pin Description (continued)

| Pin No | Name | Direction | Description |
|--------|-------|-----------------------|---|
| 9 | P0.3 | D In / Out or A In | Port 0.3 See Si1000 Port I/O section for complete description |
| | XTAL2 | A Out | External Clock Output. This pin is the excitation driver for an external crystal or resonator. |
| | | D In | External Clock Input. This pin is the external clock input in external CMOS clock mode. |
| | | A In | External Clock Input. This pin is the external clock input in capacitor or RC oscillator configurations. See Si1000 Oscillator section for complete details. |
| 10 | P0.2 | D In/Out or A In | Port 0.2. See Si1000 Port I/O Section for a complete description. |
| | XTAL1 | A In | External Clock Input. This pin is the external oscillator return for a crystal or resonator. See Si1000 Oscillator section. |
| 11 | P0.0 | D In/Out or A In | Port 0.0. See Si1000 Port I/O section for a complete description. |
| | VREF | AI | External VREF Input. |
| | | AO | Internal VREF Output. External VREF decoupling capacitors are recommended. See Si1000 Voltage Reference section. |
| 12 | RST | D In/Out | Device Reset. Open-drain output of internal POR or VDD monitor. An external source can initiate a system reset by driving this pin low for at least 15 μ s. A 1–5k pull-up to VDD_MCU is recommended. See Reset Sources section for a complete description. |
| | C2CK | | Clock signal for the C2 Debug Interface |
| 13 | P2.7 | D In/Out | Port 2.7. This pin can only be used as GPIO. The Crossbar cannot route signals to this pin and it cannot be configured as an analog input. See Si1000 Port I/O section for a complete description. |
| | C2D | | Bi-directional data signal for the C2 Debug Interface. |
| 14 | P2.6 | D In / Out or A In | Port 2.6. See Si1000 Port I/O section for a complete description. |
| 16 | Vcc | In | Positive power supply, 1.8 to 3.6 V. |

Pin Description (continued)

| Pin No | Name | Direction | Description |
|--------|-------|-----------------------|---|
| 17 | P2.5 | D In / Out or A In | Port 2.5. See Si1000 Port I/O section for a complete description. |
| 18 | P2.4 | D In / Out or A In | Port 2.4. See Si1000 Port I/O section for a complete description. |
| 19 | P2.3 | D In/Out or A In | Port 2.3. See Si1000 Port I/O section for a complete description. |
| 20 | P2.2 | D In/Out or A In | Port 2.2. See Si1000 Port I/O section for a complete description. |
| 21 | XTAL4 | AO | SmaRTClock Oscillator Crystal Output. |
| 22 | XTAL3 | A in | SmaRTClock Oscillator Crystal Input. |
| 23 | P2.1 | D In/Out or A In | Port 2.1. See Si1000 Port I/O section for a complete description. |
| 24 | P2.0 | D In/Out or A In | Port 2.0. See Si1000 Port I/O section for a complete description. |
| 25 | P1.7 | D In/Out or A In | Port 1.7. See Si1000 Port I/O section for a complete description. |
| 26 | P1.6 | D In/Out or A In | Port 1.6. See Si1000 Port I/O section for a complete description. |
| 27 | P1.5 | D In/Out or A In | Port 1.5. See Si1000 Port I/O section for a complete description. |
| 28 | NIRQ | D Out | RF22 peripheral interrupt status pin. Will be set low to indicate a pending EZRadioPro interrupt event. See the Silabs AN440 Control Logic Registers for more details. This pin is an open-drain output with a 220k internal pull-up resistor. An external pull-up resistor is recommended. |
| 29 | XOUT | A Out | AO EZRadioPro peripheral crystal oscillator output. Connect to an external 30 MHz crystal or leave floating if driving the XIN pin with an external signal source. |
| 30 | XIN | A in | EZRadioPro peripheral crystal oscillator input. Connect to an external 30 MHz crystal or to an external source. If using an external clock source with no crystal, dc coupling with a nominal 0.8 VDC level is recommended with a minimum ac amplitude of 700 mVpp. |

Mechanical Dimensions



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 Miniature Antenna 868MHz

The BEAD Antenna provides a Miniature PCB mounting solution where performance is required from a small space .

Available as straight or 90 degree mount this antenna is a general purpose omni-directional. Please see Datasheet ANT-BEAD-868



Electrical Characteristics:

Absolute Maximums:

| Parameter (Absolute Maximums) | Min | Max | Units |
|-----------------------------------|-----|-----------------|----------------|
| Supply Voltage | | 4.0 | V |
| Voltage on any Digital Input | | $V_{CC} > 2.2V$ | 5.8 |
| | | $V_{CC} < 2.2V$ | $V_{CC} + 3.6$ |
| Max Input power (thro Antenna) | | +5 | dBm |
| Storage Temperature | -55 | +125 | °C |
| Soldering Temperature (10seconds) | | +260 | °C |

Recommended Working Specifications

DC Characteristics:

| Parameter | Notes | Min | Typical | Max | Units |
|--|--|-----|----------------|-----|-------|
| Supply Voltage | | 1.8 | | 3.6 | V |
| Operating Temperature | | -40 | | +85 | °C |
| Zulu Tx Supply Current: When Transmitting | $Tx P_{out} = +20dBm$ $Tx P_{out} = +13dBm$ $Tx P_{out} = +1dBm$ | | 85 35 18 | | mA |
| Zulu Rx Supply Current: When Receiving | | | 18.5 | | mA |
| Standby Current | Low Power Digital Regulator ON (Register values retained) and Main Digital Regulator, and RC Oscillator OFF | | 450 | 800 | nA |
| Sleep Current | Sleep current RC Oscillator and Low Power Digital Regulator ON (Register values retained) and Main Digital Regulator OFF | | 1 | | uA |

Transmitter AC Characteristics

| Parameter | Notes | Min | Typical | Max | Units |
|---------------------------------|---------------------|----------|---------|--------|-------|
| TX Operating Frequency | 433 Band | 413 | 433 | 453 | MHz |
| | 868 Band | 848 | 868 | 888 | |
| | 915 Band | 895 | 915 | 935 | |
| FSK Raw RF Data Rate | | 0.123 | | 256 | Kbps |
| OOK Raw RF Data Rate | | 0.123 | | 40 | Kbps |
| Modulation Deviation | 433.470MHz | +/-0.625 | | +/-320 | KHz |
| | 868, 915MHz | +/-0.625 | | +/-160 | |
| Modulation Deviation Resolution | | | 0.625 | | KHz |
| Output Power Range | | +1 | | +20 | dBm |
| Tx RF Output Steps | Controlled by Txpow | | 3 | | dBm |

Receiver AC Characteristics

| Parameter | Notes | Min | Typical | Max | Units |
|------------------------|---|------|---------|-----|-------|
| Rx Operating Frequency | 433 Band | 413 | 433 | 453 | MHz |
| | 868 Band | 848 | 868 | 888 | |
| | 915 Band | 895 | 915 | 935 | |
| Zulu Rx Sensitivity | (BER < 0.1%) (2 kbps, GFSK, BT = 0.5, f = 5 kHz)3 | | -121 | | dBm |
| | (BER < 0.1%) (40 kbps, GFSK, BT = 0.5, f = 20 kHz)3 | | -108 | | dBm |
| | (BER < 0.1%) (125 kbps, GFSK, BT = 0.5, f = 62.5 kHz) | | -101 | | dBm |
| | (BER < 0.1%) (4.8 kbps, 350 kHz BW, OOK)3 | | -110 | | dBm |
| | (BER<0.1%)(1.2Kbps, FD=35KHz,BW=105KHz, | | -116 | | dBm |
| Rx Ch Bandwidth | | 2.6 | | 620 | KHz |
| RSSI Resolution | | | +/-0.5 | | dB |
| RSSI Range | | -120 | | 20 | dB |

Reader Response

In order to improve, we welcome any comments you may have on this datasheet or the product,
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Please let us know your name, company and email address .

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