

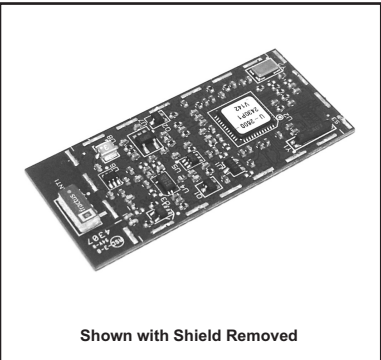


ZMN2405HPA

- **2.4 GHz ZigBee Transceiver Module**
- **Small Size, Light Weight, Built-In Antenna**
- **Sleep Current less than 3 μ A**
- **FCC and ETSI Certified for Unlicensed Operation**

High Power ZigBee Module with Chip Antenna

The ZMN2405HPA 2.4 GHz transceiver module is a low cost, high-power solution for point-to-point, point-to-multipoint and MESH wireless systems. The ZMN2405HPA module provides the flexibility and versatility to serve applications ranging from cable replacements to sensor networks. Based on the IEEE 802.15.4 wireless standard and the ZigBee protocol stack, the ZMN2405HPA module is easy to integrate, requires no external antenna, and provides robust wireless communications including MESH network operation. The ZMN2405HPA includes RFM's powerful CSM application profile, which eliminates the need for customer firmware programming.



ZMN2405HPA Absolute Maximum Ratings

| Rating | Value | Units |
|---|--------------|--------------|
| All Input/Output Pins | -0.3 to +3.6 | V |
| Non-Operating Ambient Temperature Range | -40 to +85 | $^{\circ}$ C |

ZMN2405HPA Electrical Characteristics

| Characteristic | Sym | Notes | Minimum | Typical | Maximum | Units |
|--|-----|-------|-----------------|---------|---------|----------|
| Operating Frequency Range | | | 2405 | | 2475 | MHz |
| Operating Frequency Tolerance | | | -300 | | 300 | kHz |
| Spread Spectrum Method | | | Direct Sequence | | | |
| Modulation Type | | | O-QPSK | | | |
| Number of RF Channels | | | | 15 | | |
| RF Data Transmission Rate | | | | 250 | | kb/s |
| Symbol Rate Tolerance | | | | | 120 | ppm |
| RF Channel Spacing | | | | 5 | | MHz |
| Receiver Sensitivity, 10E-5 BER | | | | -95 | | dBm |
| Upper Adjacent Channel Rejection, +5 MHz | | | | 41 | | dB |
| Lower Adjacent Channel Rejection, -5 MHz | | | | 30 | | dB |
| Upper Alternate Channel Rejection, +10 MHz | | | | 55 | | dB |
| Lower Alternate Channel Rejection, -10 MHz | | | | 53 | | dB |
| Maximum RF Transmit Power | | | 14 | 15 | 16 | dBm |
| Transmit Power Adjustment | | | | | 20 | dB |
| Optimum Antenna Impedance | | | | 50 | | Ω |

ZMN2405HPA Electrical Characteristics

| Characteristic | Sym | Notes | Minimum | Typical | Maximum | Units |
|---|-----------------|-------|---------|---------|---------|-------------------|
| ADC Input Range | | | 0 | | 3.3 | V |
| ADC Input Resolution | | | 7 | | 12 | bits |
| ADC Input Impedance | | | 55 | | | MΩ |
| PWM Output Resolution | | | | | 12 | bits |
| UART Baud Rate | | | 1.2 | | 115.2 | kb/s |
| Digital I/O: | | | | | | |
| Logic Low Input Level | | | -0.3 | | 0.5 | V |
| Logic High Input Level | | | 2.8 | | 3.6 | V |
| Logic Input Internal Pull-up/Pull-down Resistor | | | 20 | | | KΩ |
| GPIO3 Logic Low Sink Current | | | | | 20 | mA |
| Power Supply Voltage Range | V _{CC} | | +3.3 | | +5.5 | V _{dc} |
| Power Supply Voltage Ripple | | | | | 10 | mV _{P-P} |
| Receive Mode Current | | | | 33 | | mA |
| Transmit Mode Current | | | | 130 | | mA |
| Sleep Mode Current | | | | | 3 | μA |
| Operating Temperature Range | | | -40 | | 85 | °C |

ZMN2405HPA Firmware Configurations

ZMN2405HPA modules are shipped loaded with one of three firmware configurations: coordinator, router or end node. Each ZigBee network will include one, and only one coordinator. This module coordinates the overall network operation and is the host application or gateway interface point for the network. The part number designation for a coordinator is **ZMN2405HPA-C**. Router modules are capable of retransmitting messages and provide the mesh networking infrastructure in a ZigBee network. The part number for a router is **ZMN2405HPA-R**. End node modules provide field connection points for sensors, data loggers, PLCs, etc. The coordinator and the routers in a ZigBee network must stay active (awake) continuously to support network operation. End nodes can be sleep duty cycled where needed for extended battery life operation. The part number designation for an end node is **ZMN2405HPA-E**. A router can provide the same field connection support as an end node, but a router cannot be sleep duty cycled without affecting mesh network operation. Specify the number of modules for each firmware configuration when ordering ZMN2405HPA modules.



CAUTION: Electrostatic Sensitive Device. Observe precautions when handling.

ZMN2405HPA Block Diagram

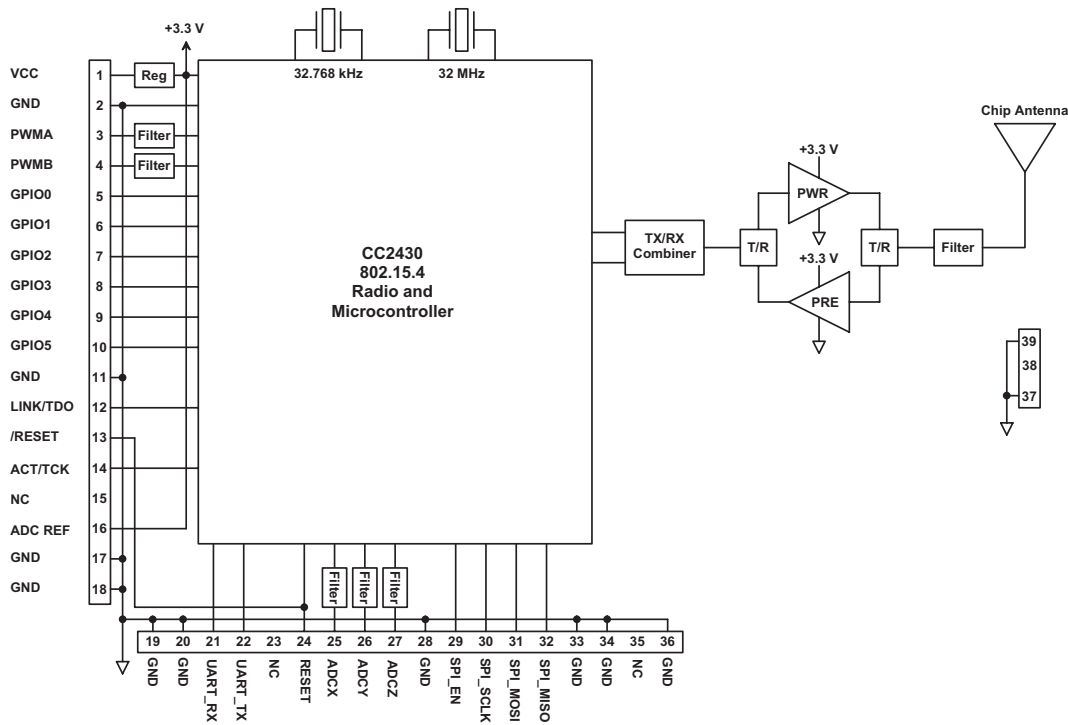


Figure 1

ZMN2405HPA Hardware

The major hardware component of the ZMN2405HPA is the CC2430 IEEE 802.15.4 compatible transceiver with integrated 8051 microcontroller. The ZMN2405HPA operates in the frequency band of 2405 to 2475 MHz at a nominal output power of 40 mW.

The ZMN2405HPA includes a low noise preamplifier in the receiver path and a power amplifier in the transmitter path, greatly increasing the operating range of the CC2430. Two crystals are provided to operate the CC2430, a 32 MHz crystal for normal operation and a 32.768 kHz crystal for precision sleep mode operation.

The ZMN2405HPA provides a variety of application hardware interfaces including an SPI interface, UART interface, three 12-bit ADC inputs, two PWM (DAC) outputs, and six general purpose digital I/O ports.

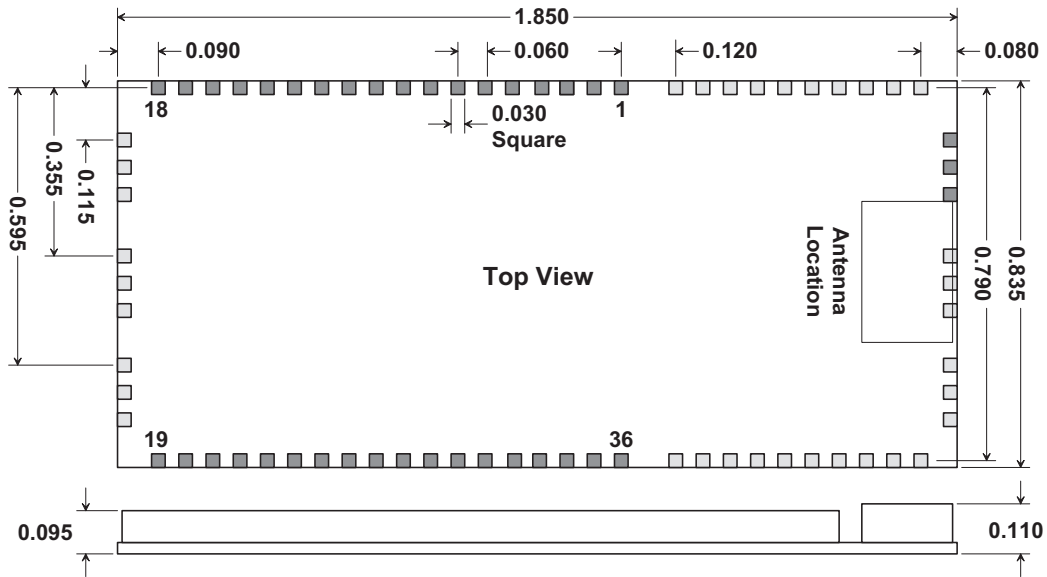
ZMN2405HPA Firmware

The main firmware components in the ZMN2405HPA include the ZigBee protocol stack and RFM's CSM standard module application profile. The ZigBee protocol stack implements networking and security, with underlying support from the 802.15.4 Media Access Control (MAC) layer. The CSM profile provides an application programming interface (API) for all the ZMN2405HPA application hardware interfaces. The CSM profile includes Network Discovery, Send/Receive Serial Data, Read/Write SPI Port, Read ADC Inputs, Write DAC Outputs, Read/Write GPIO and Module Configuration services. In addition, the CSM profile provides two sleep modes - timer sleep and interrupt sleep. See the *ZMN2405HP ZigBee Module Developer's Kit User's Manual* for complete details of the CSM profile API.

ZMN2405HPA I/O Pad Descriptions

| Pad | Name | Description |
|---------|----------|---|
| 1 | VCC | Power supply input, +3.3 to +5.5 Vdc. |
| 2 | GND | Power supply and signal ground. Connect to the host circuit board ground. |
| 3 | PWMA | Pulse-width modulated output A. Provides a DAC function when used with an external low-pass filter. |
| 4 | PWMB | Pulse-width modulated output B. Provides a DAC function when used with an external low-pass filter. |
| 5 | GPIO0 | Configurable digital I/O port 0. When configured as an output, the power-on state is also configurable. |
| 6 | GPIO1 | Configurable digital I/O port 1. When configured as an output, the power-on state is also configurable. |
| 7 | GPIO2 | Configurable digital I/O port 2. When configured as an output, the power-on state is also configurable. |
| 8 | GPIO3 | Configurable digital I/O port 3. When configured as an output, this high current port can sink up to 20 mA. The power-on output state is also configurable. |
| 9 | GPIO4 | Configurable digital I/O port 4. When configured as an output, the power-on state is also configurable. |
| 10 | GPIO5 | Configurable digital I/O port 5. When configured as an output, the power-on state is also configurable. |
| 11 | GND | Power supply and signal ground. Connect to the host circuit board ground. |
| 12 | LINK/DD | Output signal indicating module's link status in default mode. Also used by JTAG interface as Data Output. |
| 13 | /RESET | Active low hardware reset. Hold this input low when the power supply is below 2.7 V. In parallel with pad 24. |
| 14 | ACT/DC | Output signal indicating RF data activity. Also used by JTAG interface as Data Clock Input. |
| 15 | NC | No connection. |
| 16 | ADC REF | Module's +3.3 V regulated supply, used for ratiometric ADC readings. Current drain on this output should be no greater than 5 mA. |
| 17 - 20 | GND | Power supply and signal grounds. Connect to the host circuit board ground. |
| 21 | UART_RX | Serial data input to UART. |
| 22 | UART_TX | Serial data output from UART. |
| 23 | NC | No connection. |
| 24 | /RESET | Active low hardware reset. Hold this input low when the power supply is below 2.7 V. In parallel with pad 13. |
| 25 | ADCX | 7- to 12-bit ADC input X. ADC full scale can be referenced to +3.3 V supply or internal +2.5 V reference. |
| 26 | ADCY | 7- to 12-bit ADC input Y. ADC full scale can be referenced to +3.3 V supply or internal +2.5 V reference. |
| 27 | ADCZ | 7- to 12-bit ADC input Z. ADC full scale can be referenced to +3.3 V supply or internal +2.5 V reference. |
| 28 | GND | Power supply and signal ground. Connect to the host circuit board ground. |
| 29 | SPI_EN | Active-low enable output for SPI bus devices. |
| 30 | SPI_SCLK | SPI port clock signal. |
| 31 | SPI_MOSI | SPI port data output. |
| 32 | SPI_MISO | SPI port data input. |
| 33-34 | GND | Power supply and signal ground. Connect to the host circuit board ground. |
| 35 | NC | No connection. |
| 36 | GND | Power supply and signal ground. Connect to the host circuit board ground. |
| 37 | GND | RF ground. Connect to the host circuit board ground plane. |
| 38 | RFIO | No connection. |
| 39 | GND | RF ground. Connect to the host circuit board ground plane. |

ZMN2405HPA Outline and Mounting Dimensions



Note: Light gray pads are for mechanical stability during solder reflow mounting. Host PCB should have matching pads with no electrical connection.

Figure 2

Reflow Profile

An example solder reflow profile for mounting the radio module on its host circuit board is shown in Figure 3.

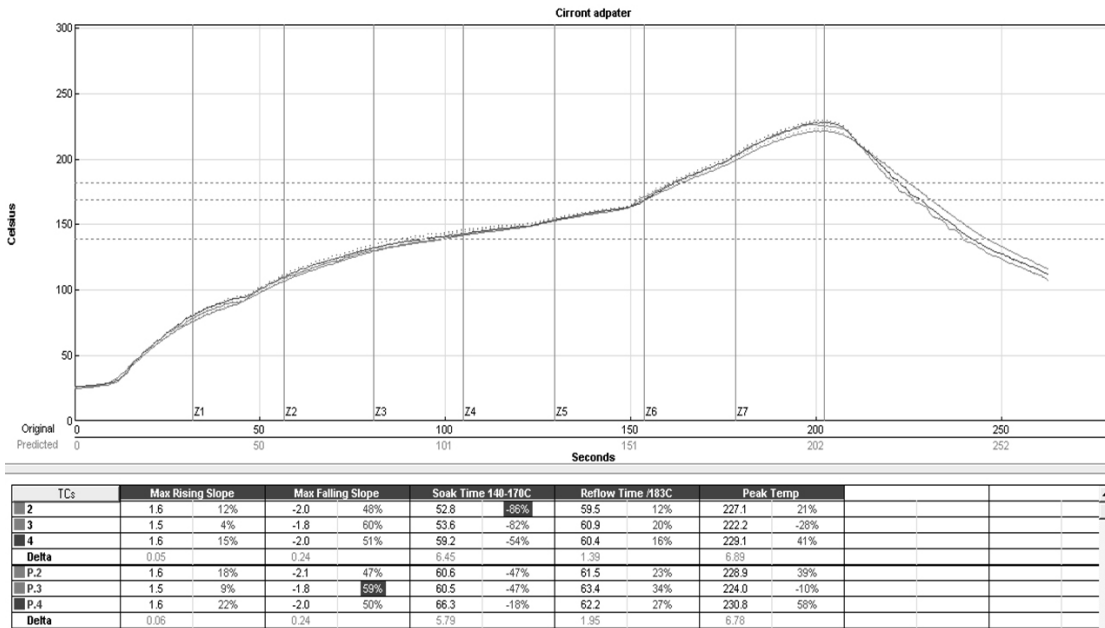


Figure 3

Note: Specifications subject to change without notice.