CEL

APEX & APEX LT SERIES TRANSCEIVER MODULES

ZAXM-201-1, ZALM-301-1

Integrated Transceiver Modules for ZigBee / IEEE 802.15.4

Evaluation Kits available; ZAXM-201-KIT-1 and ZALM-301-KIT-1

DESCRIPTION

Apex modules provide a cost-effective RF transceiver solution for 2.4GHz ZigBee and IEEE 802.15.4 data links and wireless networks.

The ZAXM-201-1 Apex module is based on the Ember™ EM250 platform. It combines Ember's transceiver IC and 16-bit microprocessor with an onboard 100mW Power Amplifier. It's designed to support point to point, point to multi-point, and *EmberZNet* applications.

The ZALM-301-1 Apex "LT" module is based on Ember's EM260 ZigBee network processor. Also onboard are a 100mW Power Amplifier and SPI-based microprocessor interface, providing you with the flexibility to choose an external microprocessor based on your application's needs.

Both APEX and APEX LT provide over 4000 feet of range and are designed to deliver constant RF output power across the 2.1 to 3.6V voltage input, ensuring consistent performance over the entire life of the battery.

GENERAL FEATURES

- **1 – 100 mW output power, software controlled**
- **Designed for *EmberZNet* networks**
- **Miniature footprint: 1.00" x 1.275"**
- **Integrated PCB trace antenna**
- **Optional MMCX connector for external antenna**
- **16 RF channels (Channel 16 operates at reduced power levels)**
- **Over 4000 feet of range**
- **Integrated hardware support for Ember InSight Development Environment**
- **Non-intrusive debug interface (SIF)**
- **AES 128 bit encryption**
- **Low power consumption**
- **Constant RF output power over 2.1 – 3.6 V voltage range**
- **FCC and IC certified, CE certification in process**
- **RoHS compliant**

ZAXM-201-1 APEX MODULE

- **Ember™ EM250 platform**
- **128 kB Flash memory**
- **5 kB SRAM**
- **16-bit XAP2b microprocessor**
- **16 general purpose I/O ports**
- **DMA – SPI, I²C and UART interfaces**
- **Integrated ADC with 12-bit resolution**

ZALM-301-1 APEX LT MODULE

- **Ember™ EM260 platform**
- **Integrated IEEE 802.15.4 PHY and MAC**
- **Dedicated network processor**
- **SPI or UART interface to application microcontroller**
- **Handles all ZigBee processing and timing intensive tasks**

The information in this document is subject to change without notice, please confirm data is current
Document No: 0002/3-00-07-00-00-000 (Issue A)
Date Published: December 17, 2007

LS RESEARCH
Wireless Product Development

ORDERING INFORMATION

Part Number	Order Number	Supplying Form
ZAXM-200 Series APEX MODULE	ZAXM-201-1	100 mW Output power, PCB Trace Antenna
	ZAXM-201-1C	100 mW Output power, optional MMCX Connector
	ZAXM-201-KIT-1	Engineering Evaluation Kit
ZALM-300 Series APEX LT MODULE	ZALM-301-1	Output power 100 mW, PCB Trace Antenna
	ZALM-301-1C	100 mW Output power, optional MMCX Connector
	ZALM-301-KIT-1	Engineering Evaluation Kit

ABSOLUTE MAXIMUM RATINGS

Rating	Value	Unit
Power Supply Voltage	3.6	Vdc
Voltage on Any Digital Pin	V_{DD} + 0.3, Max 3.6	Vdc
RF Input Power	+10	dBm
Storage Temperature Range	-45 to 125	°C

Note: Exceeding the maximum ratings may cause permanent damage to the module or devices.

OPERATING CONDITIONS

Characteristic	Min	Typ	Max	Unit
Power Supply Voltage (V_{DD})	2.1		3.6	V
Input Frequency	2405		2480	MHz
Ambient Temperature Range	-40	25	85	°C
Logic Input Low Voltage	0		20% V_{DD}	V
Logic Input High Voltage	80% V_{DD}		V_{DD}	V

ELECTRICAL SPECIFICATIONS *(@ 25°C, VDD = 3.3V unless otherwise noted)*

Parameter	Min	Typ	Max	Unit
General Charcteristics				
RF Frequency Range	2400		2483.5	MHz
RF Data Rate		250		kbps
Microcontroller Operating Frequency (APEX only)		12		MHz
Flash Memory (APEX only)		128		kB
RAM (APEX only)		5		kB
Power Consumption				
Transmit Mode (100mW output):				
APEX		170		mA
APEX LT		170		mA
Receive Mode:				
APEX		37		mA
APEX LT		37		mA
Standby Mode:				
10mW			5	µA
100mW			5	µA
Transmitter				
Nominal Output Power		20		dBm
Programmable Output Power Range		32		dB
Error Vector Magnitude		15	35	%
Receiver				
Receiver Sensitivity (1% PER) – normal mode	-92	-96		dBm
Receiver Sensitivity (1% PER) – *boost mode**	-93	-97		dBm
Saturation (Maximum Input Level) (1% PER)	0			dBm
802.15.4 Adjacent Channel Rejection:				
APEX	35			dB
APEX LT	30			dB
802.15.4 Alternate Channel Rejection	40			dB
802.11 g Rejection (±10 MHz):				
APEX	40			dB
APEX LT	30			dB
Control DC Characteristics				
Logic Input Low	0		0.2 x V_{DD}	V
Logic Input High	0.8 x V_{DD}		V_{DD}	V
Logic Output Low	0		0.18 x V_{DD}	V
Logic Output High	0.82 x V_{DD}		V_{DD}	V
Output source current (standard pad – APEX)			4	mA
Output sink current (standard pad – APEX)			4	mA
Output source current (high current pad – APEX)			8	mA
Output sink current (high current pad – APEX)			8	mA
I/O pin pull-up and pull-down resistor (APEX)		30		kΩ

* ***Boost Mode*** is an optional software-selectable high performance mode designed to increase receiver sensitivity.

Note: Refer to Ember EM250/EM260 datasheets for additional details.

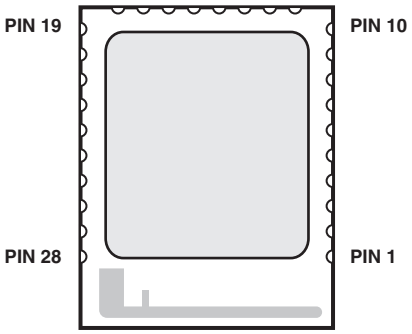


Figure 1 (Top View)

PIN SIGNALS I/O PORT CONFIGURATION

APEX and APEX LT modules have 28 edge I/O interfaces for connection to the user's host board. *Figure 1* shows the layout of the 28 edge castellations.

THE APEX MODULE

APEX modules provide 16 GPIO ports that are shared with other peripheral or alternate functions. The alternate functions can be utilized on a variety of different GPIOs as detailed on the following page in the Table of Pin Assignments. All the GPIO pads are selectable as input, output, or bi-directional and have an internal pull-up or pull-down.

The integrated Serial Controller SC1 can be configured for SPI (master-only), I^2C (master-only), or UART functionality. The Serial Controller SC2 can be configured for SPI (master or slave) or I^2C (master-only) operation. The integrated ADC can sample analog signals from three GPIO pins single-ended or differentially. The integrated voltage reference VREF for the ADC can be made available to a GPIO port.

Please consult the Ember EM250 datasheet for details on configuring and controlling the information flow of the APEX module interface ports to setup the following:

- GPIO Data Registers
- Alternate function routing
- External Interrupts
- Serial Controller SC1 module (UART mode, SPI Master mode, I^2C Master mode)
- Serial Controller SC2 module (SPI modes, I^2C Master mode)
- General Purpose Timers
- ADC Module
- Event Manager

THE APEX LT MODULE

APEX LT modules provide a connection to the Ember Serial API over the SPI allowing the application development to be completed on a host microprocessor of your choice. In addition to the SPI signals, two additional signals (nHOST_INT and nWAKE) provide a handshake mechanism. The module provides a slave device with all transactions initiated by the host. Please consult the EM260 datasheet for details on the SPI Protocol including:

- Physical Interface Configuration
- SPI Transactions
- SPI Protocol Timing Parameters & Waveforms
- Data Formatting
- SPI Commands & Responses
- Handling Resets and Power Cycling
- Transaction Examples

APEX I/O PIN ASSIGNMENTS

Pin #	Name	Type	Description
1	GROUND	GND	Ground
2	GROUND	GND	Ground
3	GROUND	GND	Ground
4	V_{DD}	PI	Power Supply Input
5	RSTB	DI	Reset, active low
6	GPIO11	DI/DO	General Purpose Digital I/O, SC1 UART CTS, SC1 SPI master clock, or Capture Input A of Timer 2
7	GPIO12	DI/DO	General Purpose Digital I/O, SC1 UART RTS, or Capture Input B of Timer 2
8	GPIO0	DI/DO	General Purpose Digital I/O, SC2 SPI MOSI, or Capture Input A of Timer 1
9	GPIO1	DI/DO	General Purpose Digital I/O, SC2 SPI MISO, SC2 I^2C SDA, or Capture Input A of Timer 2
10	GPIO2	DI/DO	General Purpose Digital I/O, SC2 SPI master clock, SC2 I^2C SCL, or Capture Input B of Timer 2
11	GPIO3	DI/DO	General Purpose Digital I/O, SC2 SPI slave select, or Capture Input B of Timer 1
12	GPIO4	DI/DO/AI	General Purpose Digital I/O, ADC Input 0, or PTI frame signal
13	GPIO5	DI/DO/AI	General Purpose Digital I/O, ADC Input 1, or PTI data signal
14	GPIO6	DI/DO/AI	General Purpose Digital I/O, ADC Input 2, Timer 2 Clock Input, or Timer 1 Enable
15	GPIO7	DO	Regulator Enable, active high (see section 8)
16	GPIO8	DI/DO/AO	General Purpose Digital I/O, ADC Reference Output, Timer 1 Clock Input, Timer 2 Enable, or Source A Interrupt
17	GPIO9	DI/DO	General Purpose Digital I/O, SC1 TXD, SC1 MO, SC1 I^2C Data, or Capture Input A of Timer 1
18	GPIO10	DI/DO	General Purpose Digital I/O, SC1 RXD, SC1 MI, SC1 I^2C Clock, or Capture Input B of Timer 1
19	CLK	DI	SIF Interface clock
20	MISO	DO	SIF Interface master in/slave out
21	MOSI	DI	SIF Interface master out/slave in
22	LOADB	DI/DO	SIF Interface load strobe
23	GPIO16	DI/DO	General Purpose Digital I/O, Output B of Timer 1, Capture Input B of Timer 2, or Source D Interrupt
24	GPIO15	DI/DO	General Purpose Digital I/O, Output A of Timer 1, Capture Input A of Timer 2, or Source C Interrupt
25	GPIO14	DI/DO	General Purpose Digital I/O, Output B of Timer 2, Capture Input B of Timer 1, or Source B Interrupt
26	GPIO13	DI/DO	General Purpose Digital I/O, Output A of Timer 2, or Capture Input A of Timer 1
27	GROUND	GND	Ground
28	GROUND	GND	Ground

Unused I/O pins should be left unconnected and the pin state set via the Host Protocol.

DI = Digital Input
DO = Digital Output
AI = Analog Input
AO = Analog Output
PI = Power Input
GND = Ground

APEX LT I/O PIN ASSIGNMENTS

Pin #	Name	Type	Description
1	GROUND	GND	Ground
2	GROUND	GND	Ground
3	GROUND	GND	Ground
4	GROUND	GND	Ground
5	V_{DD}	PI	Power Supply Input
6	nRESET	DI	Reset, active low
7	MOSI	DI	SPI Data, Master Out/Slave In (from Host to APEX LT)
8	MISO	DO	SPI Data, Master In/Slave Out (from APEX LT to Host)
9	SCLK	DI	SPI Clock (from Host to APEX LT)
10	VPA_EN	DI	APEX LT Enable, active high (see section 8)
11	nRTS	DO	UART RTS
12	nSSEL_INT/nCTS	DI	SPI Slave Select (from Host to APEX LT)/UART CTS
13	PTI_EN	DO	PTI Frame signal
14	PTI_DATA	DO	PTI Data signal
15	TXD	DO	UART TXD
16	nHOST_INT/RXD	DO/DI	Host Interrupt Signal (from APEX LT to Host) or UART RXD
17	nWAKE	DI	Wake Interrupt Signal (from host to APEX LT)
18	GROUND	GND	Ground
19	SIF_CLK	DI	SIF Interface clock
20	SIF_MISO	DO	SIF Interface master in/slave out
21	SIF_MOSI	DI	SIF Interface master out/slave in
22	nSIF_LOAD	DI/DO	SIF Interface load strobe
23	SDBG	DO	Spare Debug Signal
24	LINK_ACTIVITY	DO	Link and Activity signal
25	GROUND	GND	Ground
26	GROUND	GND	Ground
27	GROUND	GND	Ground
28	GROUND	GND	Ground

Unused I/O pins should be left unconnected and the pin state set via the Host Protocol.

DI = Digital Input
DO = Digital Output
AI = Analog Input
AO = Analog Output
PI = Power Input
GND = Ground

SIF INTERFACE

APEX and APEX LT modules provide access to the SIF module programming and debug interface. Consult the EM250 and EM260 datasheets for further details on the following SIF features:

- Production Testing
- Firmware Download
- Product Control and Characterization
- XAP2b Code Development (APEX only)

POWER AMPLIFIER REGULATOR CONTROL LINE

Both the APEX and APEX LT modules include a separate 1.8V regulator for a power amplifier bias that enables consistent module output performance over the wide 2.1 – 3.6 V voltage range. To prevent excessive sleep currents, this regulator should be disabled when the module is in sleep mode. An external pull up resistor option is provided on each module (R6) that allows the regulator to be constantly enabled. This option increases the sleep current of the module to a point well above the specified values.

SPECIFICATIONS — GPIO7 (APEX), VPA_EN (APEX LT)

Parameter	Min	Typ	Max	Unit
Regulator enable voltage	0.95			V
Regulator disable voltage			0.4	V
Enable line current (VEN = 0)			0.1	µA
Enable line current (VEN = VDD)			10	µA
Turn on Time			250	µsec

On the APEX LT module the VPA_EN control must be provided by the host microprocessor. In normal operation, the VPA_EN line must be set high. It must be set low when the module is put into sleep mode in conjunction with putting the EM260 into deep sleep. Upon module wake-up, a 250µsec turn-on time must be provided prior to any transmission, allowing the module's regulator to settle. Note that this 250µsec requirement applies only to the external power amplifier, the wake-up time for the EM260 is separate from this value.

On the APEX module, the regulator control line is connected to the module via the GPIO7 port. The host can drive this port as it does on the APEX LT module, but it can also use the default serial digital function of this port as an external voltage regulator enable. Please consult the EM250 datasheet for details on the operation of this function. Note that both these approaches preclude the use of the GPIO7 port for any other functions, including use as the ADC3 input.

If the application does not put the module to sleep or if sleep current is not an issue, the power amplifier regulator may be permanently enabled by tying the control line high. In this setup, the sleep current will increase by 80µA over the 5µA Standby Current figure provided in Electrical Specifications.

ANTENNA

APEX and APEX LT modules include an integrated PCB trace antenna. An optional MMCX connector can be specified, enabling connection to a 50-ohm external antenna of the user's choice. See Ordering Information.

The PCB antenna employs an F-Antenna topology that is compact and supports an omni-directional radiation pattern. To maximize antenna efficiency, an adequate ground plane must be provided on the host PCB. If positioned correctly, the ground plane on the host board under the module can contribute significantly to antenna performance.

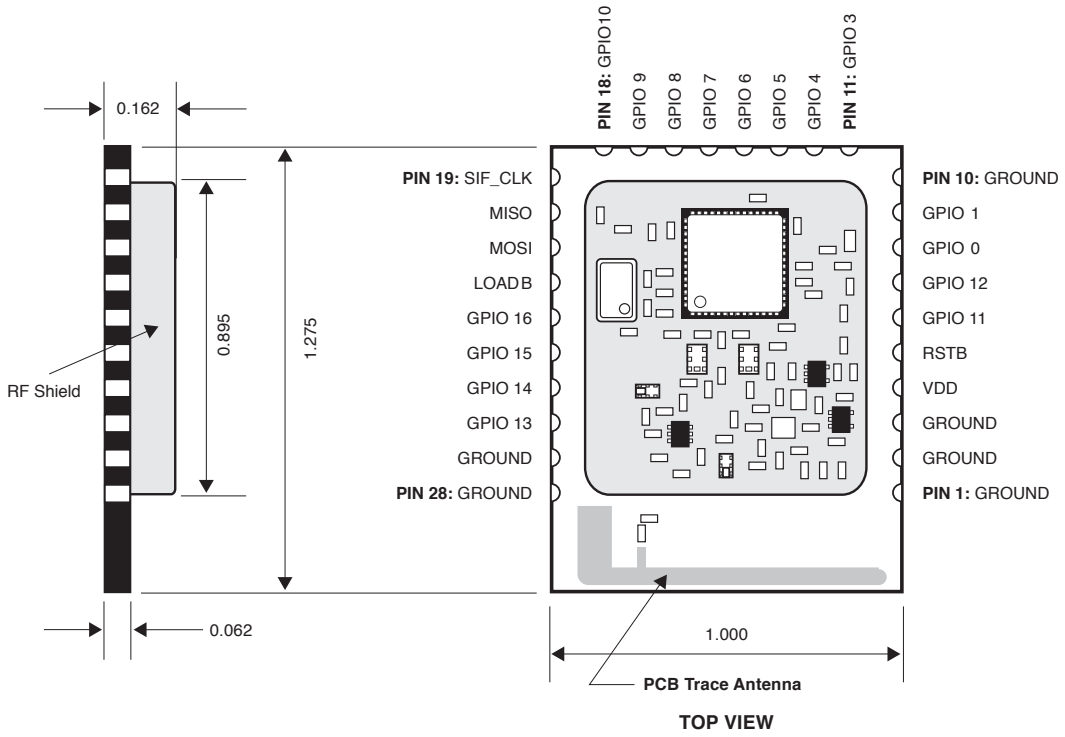
The position of the module on the host board and overall design of the product enclosure contribute to antenna performance. Poor design effects radiation patterns and can result in reflection, diffraction, and/or scattering of the transmitted signal. Measured radiation patterns of these modules are available from California Eastern Labs and can be used to benchmark design performance.

Here are some design guidelines to help ensure antenna performance:

- Never place the ground plane or route copper traces directly underneath the antenna portion of the module.
- Never place the antenna close to metallic objects.
- In the overall design, ensure that wiring and other components are not placed near the antenna.
- Do not place the antenna in a metallic or metallized plastic enclosure.
- Keep plastic enclosures 1 cm or more from the antenna in any direction.

DIMENSIONS: ZAXM-201-1 Apex

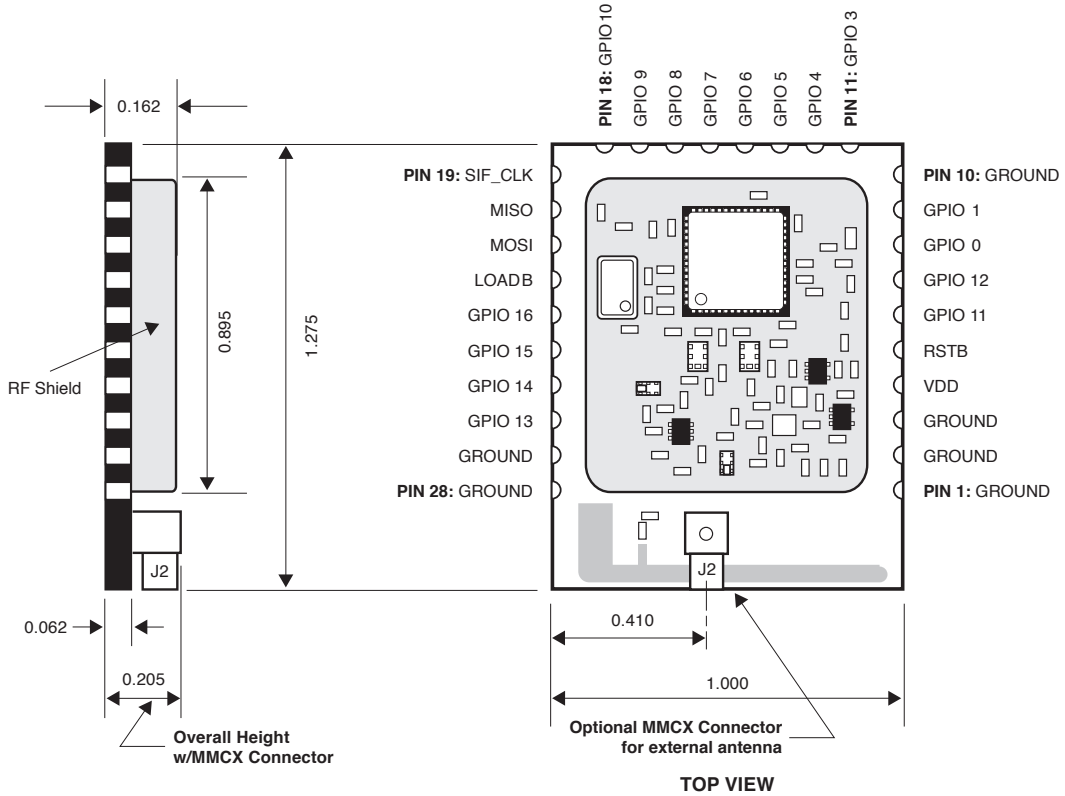
Dimensions in inches. Tolerances = +/-0.005" unless otherwise noted.



TOP VIEW

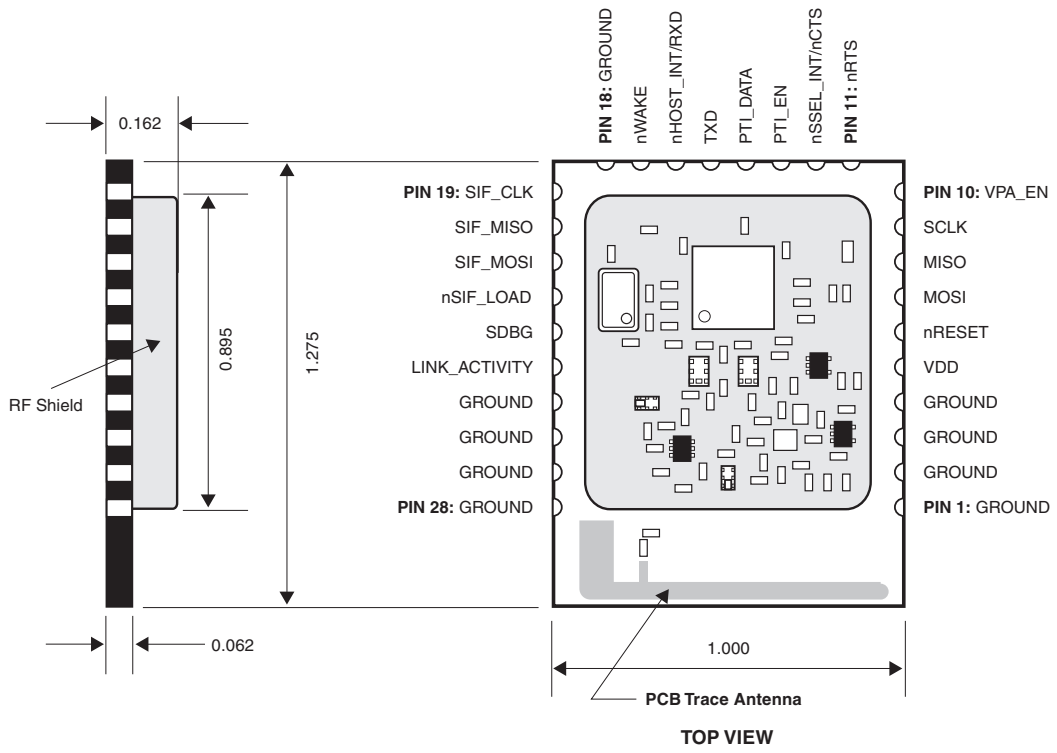
DIMENSIONS: ZAXM-201-1C Apex with Optional MMCX Connector

Dimensions in inches. Tolerances = +/-0.005" unless otherwise noted.



TOP VIEW

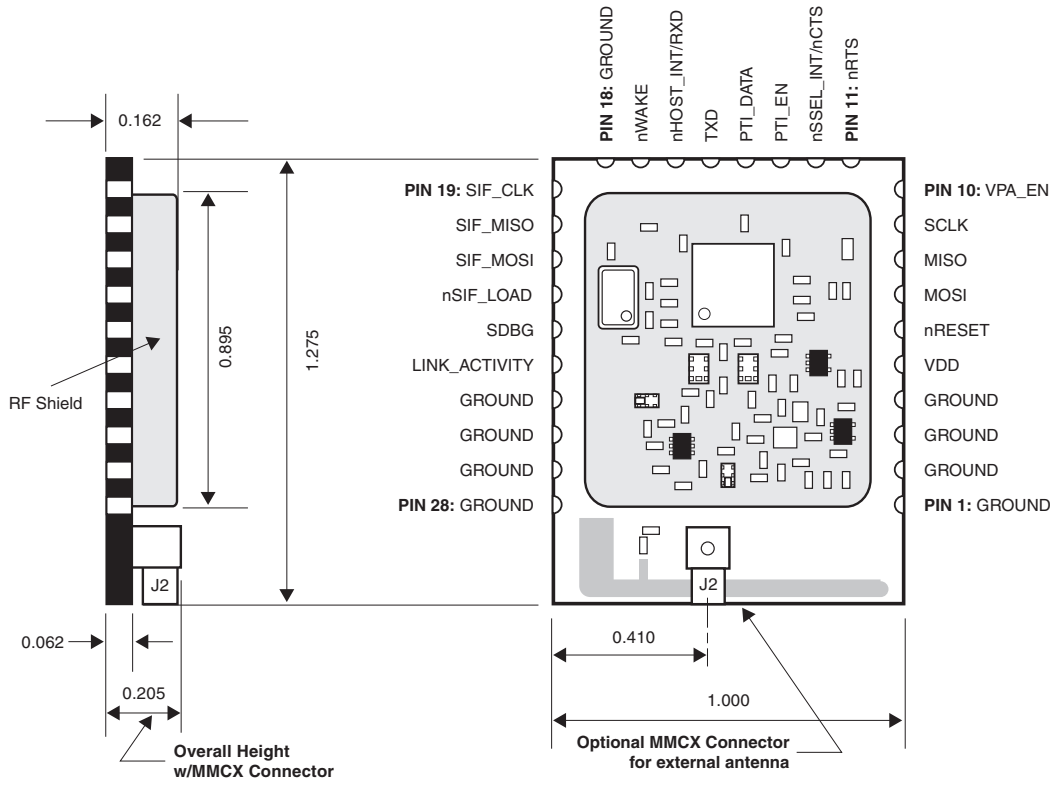
DIMENSIONS: ZALM-301-1 Apex LT *Dimensions in inches. Tolerances = +/-0.005" unless otherwise noted.*



TOP VIEW

DIMENSIONS: ZALM-301-1C Apex LT with Optional MMCX Connector

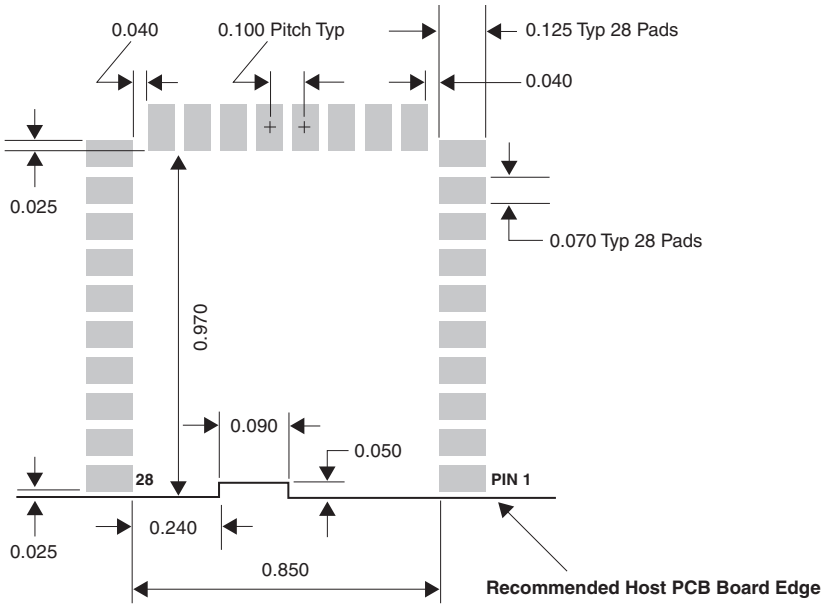
Dimensions in inches. Tolerances = +/-0.005" unless otherwise noted.



TOP VIEW

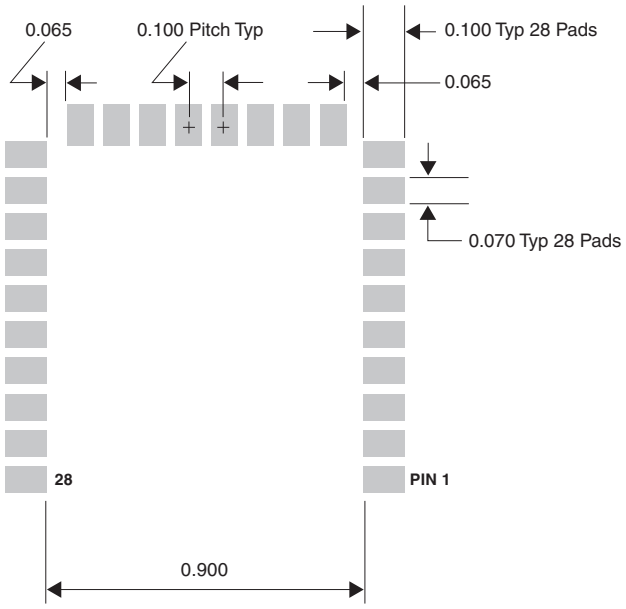
PCB COPPER PATTERN LAYOUT: Apex and Apex LT

Dimensions in inches. Tolerances = +/-0.005" unless otherwise noted.



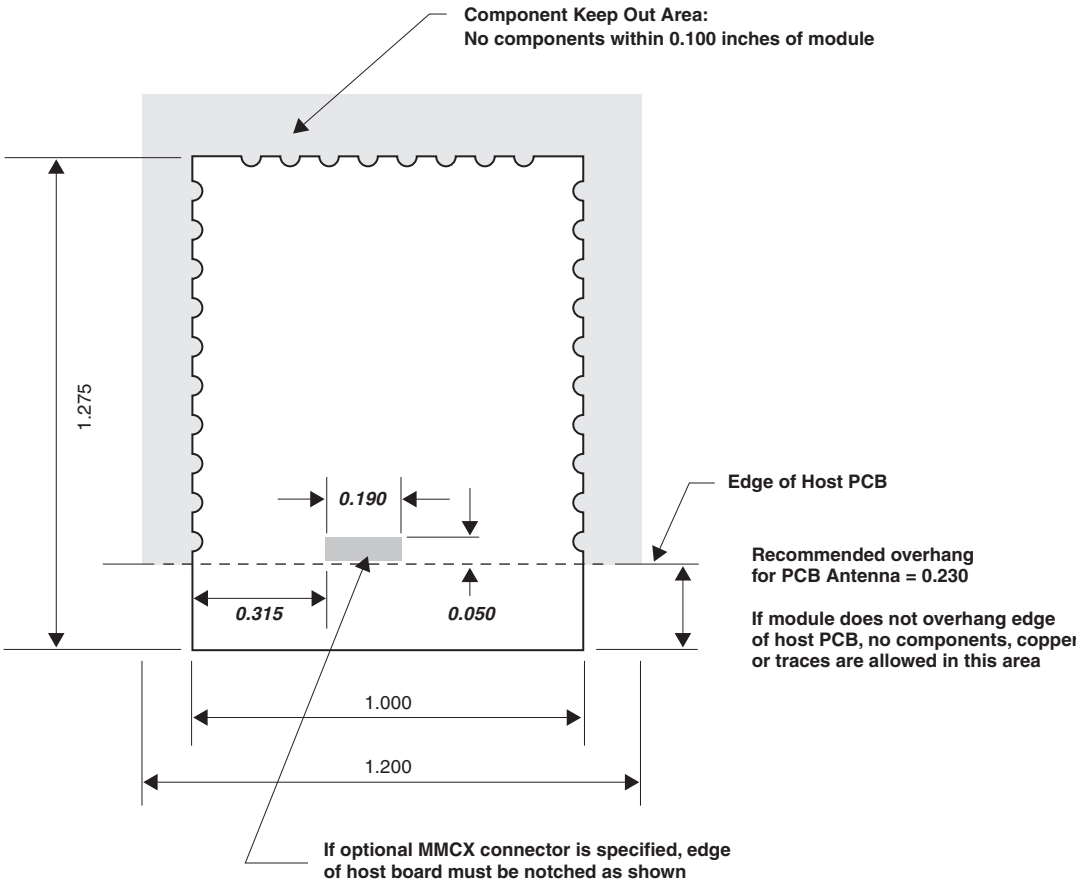
PCB PASTE STENCIL PATTERN: Apex and Apex LT

Dimensions in inches. Tolerances = +/-0.005" unless otherwise noted.



PCB KEEP-OUT AREAS: Apex and Apex LT

Dimensions in inches. Tolerances = +/-0.005" unless otherwise noted.



For optimum antenna performance, APEX and APEX LT modules should be mounted with the PCB trace antenna overhanging the edge of the host board. To further improve performance, a ground plane may be placed on the host board under the module, up to the PCB edge. The installation of an uninterrupted ground plane on a layer directly beneath the module will also allow you to run traces under this layer. CEL can provide assistance with your PCB layout.

AGENCY CERTIFICATIONS

FCC Part 15.247 Module Certified (Mobile)

APEX and APEX LT modules comply with Part 15 of the Federal Communications Commission rules and regulations. To meet the FCC Certification requirements, the user must meet these regulations:

- The text on the FCC ID label provided with the module must be placed on the outside of the final product.
- The modules may only use the antennas that have been tested and approved with these modules:
  - — The on-board PCB trace antenna
  - — Nearson S131CL-5-RMM-2450S antenna.

To meet the Section 15.209 emission requirements in the restricted frequency bands of Section 15.205, the transceiver transmitter power for both the APEX (EM250) and APEX LT (EM260) modules needs to be reduced from the typical maximum setting on the upper two channels (2475 MHz and 2480 MHz). Maximum values are TBD.

Per Section 2.109, the APEX and APEX LT modules have been certified by the FCC for use with other products without additional certification. Any modifications to this product may violate the rules of the Federal Communications Commission and make operation of the product unlawful.

Per Sections 15.107 and 15.109, the user's end product must be tested for unintentional radiators compliance.

Per Section 47 C.F.R. Sec.15.105(b), APEX and APEX LT modules are certified as mobile devices for the FCC radiation exposure limits set forth for an uncontrolled environment. The antennas used with these modules must be installed to provide a separation distance of at least 8 inches (20cm) from all persons. If the module is to be used in a handheld application, the user is responsible for passing additional FCC part 2.1091 rules (SAR) and FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, OET Bulletin and Supplement C.

IC Certification — Canada

APEX and APEX LT modules are IC certified. The labeling requirements for Industry Canada are similar to those of the FCC. A visible label on the outside of the final product must display the IC labeling. The user is responsible for the end product to comply with IC ICES-003 (Unintentional radiators).

CE Certification — Europe

EN 300-328-1 certification for use of APEX and APEX LT modules in European countries is in process. The user must ensure compliance of any final product to the European harmonized EMC and safety standards. Annex II of the R&TTE Directive provides requirements for the issuance of a Declaration of Conformity. The CE marking must be affixed legibly and indelibly to a visible location on the user's product.

To meet the EN 300-328-1 power spectral density requirements of Clause 4.3.2.2, the maximum transceiver power setting for APEX and APEX LT modules is TBD.

FCC Approved Antennas

- **Integrated PCB trace antenna**
- **Nearson S131CL-5-RMM-2450S –** A 2.4GHz Dipole antenna with a 5 inch cable and a right angle MMCX connector.

SHIPMENT, HANDLING, AND STORAGE

Shipment

Apex and Apex LT Modules are delivered as single pieces, or in 50 piece cartons in individual anti-static bags.

Handling

Apex and Apex LT Modules are designed and packaged to be processed in an automated assembly line.

!Warning Apex and Apex LT Modules contain highly sensitive electronic circuitry. Handling without proper ESD protection may destroy or damage the module permanently.

!Warning According to JEDEC ISP, Apex and Apex LT Modules are moisture sensitive devices. Appropriate handling instructions and precautions are summarized in Section 2.1. Read carefully to prevent permanent damage due to moisture intake.

Storage

Storage/shelf life in sealed bags is 12 months at <40°C and <90% relative humidity.

PROCESSING

Moisture Preconditioning

Both substrate and some components can absorb moisture. JEDEC specification J-STD-020 must be observed to prevent the delamination and cracking associated with the “popcorn” effect” during solder reflow. (The popcorn effect can be described as miniature explosions of trapped water vapor).

Baking before processing is required if module has been exposed to excessive humidity. Recommended baking procedure:

Oven: Convection flow oven.
Duration: 48 hours
Temperature: 125°C
Humidity: Below 5%.

After conditioning (baking) modules should be processed within the specified floor life:
for products with moisture sensitivity level 4, the floor life is three days, or 72 hours, assuming factory temperature and humidity conditions of <30°C, and <60% relative humidity.

If they cannot be processed within this time period, place the modules with desiccant and a moisture indicator into a humidity proof bag and use a vacuum hot barrier sealing machine for sealing.

Other storage options include nitrogen cabinets and dry boxes.

Note: Repeated baking will reduce the wetting effectiveness of the land contacts.

PROCESSING *(Continued)*

Reflow Soldering

A convection soldering oven is recommended over the infrared radiation type oven. Convection ovens allow more precise temperature control and even heating of parts, regardless of material composition, thickness or color.

Preheat Phase

Initial heating of component leads and solder paste balls, for removal of residual humidity.

Note: The preheat phase is not intended to replace prior baking procedures.

- Temperature rise rate: 1-4°C/sec

Note: Excessive slumping can result if the temperature rise is too rapid.

- Time: 60-120 seconds

Note: If the preheat is insufficient, large solder balls tend to be generated. Conversely, if preheat is excessive, small and large balls will be generated in clusters.

- End Temperature: 150-200°C

Heating/Relow Phase

The temperature rises above the liquidus temperature of the solder paste selected.
Avoid a sudden rise in temperature as any slump of the solder paste could become worse.

- Limit time above liquidus temperature to 20-40 seconds.
- Peak reflow temperature: 230-250°C

Cooling Phase

A controlled cooling phase avoids unwanted metallurgical effects of the solder, and possible mechanical tensions in the products. Controlled cooling helps achieve the brightest possible solder fillets with a good shape and low contact angle.

- Temperature fall rate: max 3°C/sec

Pb-Free Soldering Paste

Use of “No Clean” soldering paste is strongly recommended, as it does not require cleaning after the soldering process. The pastes listed in the examples below meet these criteria.

Soldering Paste: Indium 5.1 (Indium Corporation of America)
Alloy Specification: SAC305 - Sn Zinc 96.5%/Ag Silver 3.0%/Cu Copper 0.5%
Alloy Specification: SAC387 - Sn Zinc 95.5%/Ag Silver 3.8%/Cu Copper 0.7%
Melting Temperature: 217°C

Soldering Paste: LFSOLDER TLF-206-93F (Tamura Kaken [UK] Ltd.)
Alloy Specification: Sn Zinc 95.5%/Ag Silver 3.9%/Cu Copper 0.6%
Melting Temperature: 216-221°C

The final choice of the soldering paste depends on individual factory approved manufacturing procedures.
Stencil Thickness: 150 μm for host boards

Note: The quality of the solder joints on the castellations (‘half vias’) where they contact the host board should meet the appropriate IPC specification. See **IPC-A-610-12.2.4.**

PROCESSING *(Continued)*

Cleaning

In general, cleaning the populated modules is strongly discouraged. Residuals under the module cannot be easily removed with any cleaning process.

- Cleaning with water can lead to capillary effects where water is absorbed into the gap between the host board and the module. The combination of soldering flux residuals and encapsulated water could lead to short circuits between neighboring pads. Water could also damage any stickers or labels.
- Cleaning with alcohol or a similar organic solvent will likely flood soldering flux residuals into the two housings, which is not accessible for post-washing inspection. The solvent could also damage any stickers or labels.
- Ultrasonic cleaning could damage the module permanently.

The best approach is to consider using a “no clean” soldering paste and eliminate the post-soldering cleaning step.

Optical Inspection

After soldering the Module to the host board, consider optical inspection to check the following:

- Proper alignment and centering of the module over the pads.
- Proper solder joints on all pads.
- Excessive solder or contacts to neighboring pads, or vias.

Repeating Reflow Soldering

Only a single reflow soldering process is encouraged for host boards.

Wave Soldering

If a wave soldering process is required on the host boards due to the presence of leaded components, only a single wave soldering process is encouraged.

Hand Soldering

Hand soldering is possible. Use a soldering iron temperature setting equivalent to 350°C, follow IPC recommendations/ reference document IPC-7711.

Rework

Apex and Apex LT Modules can be unsoldered from the host board. Use of a hot air re-work tool and hot plate for pre-heating from underneath is recommended. Avoid overheating.

!Warning Never attempt a rework on the module itself, e.g. replacing individual components. Such actions will terminate warranty coverage.

Additional Grounding

Attempts to improve module or system grounding by soldering braids, wires, or cables onto the module RF shield cover is done at the customers own risk. The numerous ground pins at the module perimeter should be sufficient for optimum immunity to external RF interference.

Conformal Coating

Conformal coating may be necessary in certain applications. Please note that the RF shield and the sticker prevent optimum inflow of liquids or aerosols.