



MeshConnect™ Module Series

Module and Extended Range Module

Integrated Transceiver Modules for IEEE 802.15.4

Development Kits available: ZICM2410P0-KIT2-1, ZICM2410P2-KIT1-1

DESCRIPTION

CEL's MeshConnect™ Module Series provides high performance and low cost 2.4 GHz IEEE 802.15.4 modules for a broad range of wireless networks. The MeshConnect certified and qualified modules, enable customer to accelerate time to market by greatly reducing design and certification phases of development.

CEL's MeshConnect™ radio modules leverage the advanced features of the MeshConnect™ Integrated Circuit (IC). The IC is a true single-chip solution, compliant with IEEE 802.15.4 specifications, a complete wireless solution for all applications. The IC consists of an RF transceiver with baseband modem, a hardwired MAC and an embedded 8051 microcontroller with internal Flash memory. The device provides numerous general-purpose I/O pins, peripheral functions such as timers and UARTs and is one of the first devices to provide an embedded Voice CODEC. This device is also ideal for low power applications.

The original MeshConnect module delivers excellent performance at a surprisingly low cost. The module's +6dBm output power means better range, more reliable transmission and fewer nodes in your network. It also makes these modules ideal for applications where cost and power constraints do not allow for external power amplifiers or peripheral range extension components.

The MeshConnect Extended Range module adds a power amplifier (PA) and low noise amplifier (LNA) to increase range to over two miles - plus more reliable transmission and fewer nodes in your network. It is especially useful for open outdoor applications where the nodes are physically far apart, or for indoor use where the nodes have to operate in a noisy RF environment. The Extended Range Module's outstanding +123 dB budget link ensures high quality connection even in such harsh environments.

CEL MeshConnect™ Module Series



- 96 kB FLASH Memory
- 8 kB SRAM
- 8051 MCU core
- up to 22 GPIO Pins
- SPI (Master/Slave) + UARTs
- I²S/PCM Interface with two 128-byte FIFOs
- μ -law/a-law/ADPCM Voice Codec
- 4-channel 8-bit ADC

FEATURES

- High RF performance:
 - Up to 123 dB RF Link Budget
 - RX Sensitivity: -97 dBm and -103.0 dBm
 - RF TX Power: +6 dBm and +20 dBm
- Scalable Data Rate: 250 kbps, 500 kbps and 1 Mbps
- Small footprint: 1" x 1.413" (25.4 mm x 35.9 mm)
- Voice Codec Support: μ -law/a-law/ADPCM
- 4 Level Power Management Scheme w/ Deep Sleep Mode (0.3 μ A)
- Integrated PCB trace antenna
- 16 RF channels
- Range:
 - ZICM2410P0: 2000+ feet (609+ meters)
 - ZICM2410P2: 16000+ feet (4876+ meters)
- AES 128-bit encryption
- Extended software support:
 - SNAP™
 - SMAC, MAC
 - Audio
- FCC, CE and IC certifications
- ROHS compliant

APPLICATIONS

Industrial Controls

- Food processing controls
- Traffic Management
- Sensor Networks
- Asset Management
- Barcode reader
- Patient Monitoring
- Glucose monitor

Home & Building Automation

- Security
- HVAC control
- Lighting control
- Thermostats

ORDERING INFORMATION

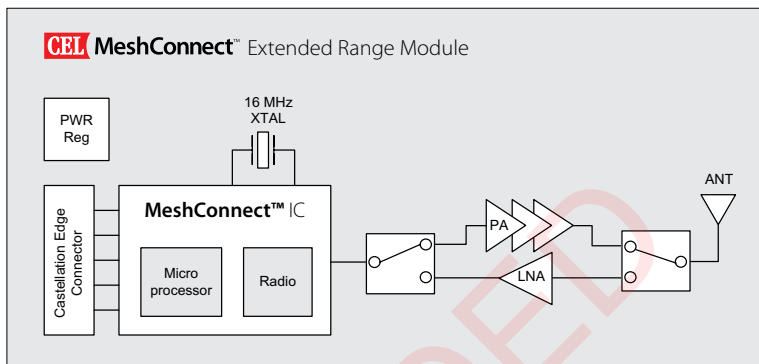
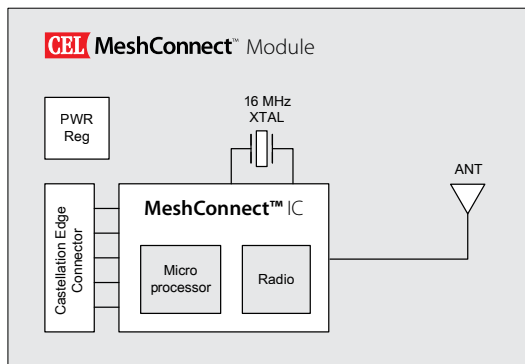
| Part Number | Order Number | Description | Mins/Mults |
|--|-------------------|--|------------|
| MeshConnect™ Module | ZICM2410P0-1 | +6 dBm Output power, PCB Trace antenna | 140/140 |
| | ZICM2410P0-1-SN | +6 dBm Output power, PCB Trace antenna, SNAP OS with MAC address | 140/140 |
| | ZICM2410P0-1C | +6 dBm Output power, with u.FL Connector for external antenna | 140/140 |
| | ZICM2410P0-1C-SN | +6 dBm Output power, with u.FL Connector for external antenna, SNAP OS with MAC address | 140/140 |
| | ZICM2410P0-KIT2-1 | +6 dBm Engineering Development Kit | 1/1 |
| MeshConnect™ Extended Range Module | ZICM2410P2-2 | +20 dBm Output power, PCB Trace antenna | 140/140 |
| | ZICM2410P2-2-SN | +20 dBm Output power, PCB Trace antenna, SNAP OS with MAC address | 140/140 |
| | ZICM2410P2-2C | +20 dBm Output power, with u.FL Connector for external antenna | 140/140 |
| | ZICM2410P2-2C-SN | +20 dBm Output power, with u.FL Connector for external antenna, SNAP OS with MAC address | 140/140 |
| | ZICM2410P2-KIT1-1 | Evaluation board for +20 dBm module | 1/1 |

The information in this document is subject to change without notice, please confirm data is current

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MODULE BLOCK DIAGRAM



DEVELOPMENT KIT

CEL's MeshConnect Development Kit assist users in both evaluation and development. As a stand-alone radio system, the kit allows users to place the modules in to the target environment and evaluate performance on-site. The MeshConnect Development Kit also serves as an invaluable aid in application development. Through the many interface headers on the board, the user has access to all the MeshConnect module pins enabling easy connection to target systems for application development. The key components of the MeshConnect Development Kits are the CEL's MeshConnect radio module and the interface board.

The MeshConnect module contains the CEL transceiver IC, Crystals, Power Regulator and an integrated PCB antenna or connector for an external antenna (optional). The interface board features a serial communication interface, a power management module, and peripherals such as potentiometers, LEDs, and GPIO headers.

For more detail information regarding MeshConnect Development Kits, refer to the respective development kit user guides documents. (Available at CEL's website <http://www.cel.com>)

| Order Number | Description |
|-------------------|-------------------------------------|
| ZICM2410P0-KIT2-1 | +6dBm Engineering Development Kit |
| ZICM2410P2-KIT1-1 | Evaluation board for +20 dBm module |

MeshConnect™ Module Development Kit

Kit Contents:

- Evaluation Boards w/Module (3)
- AA Batteries (4)
- USB Cables (1)
- Universal AC/DC Power Supply (2)
- Jumpers (10)
- Software & Technical Information CD (2)
- USB/WNA w/Cable (1)

MeshConnect™ Extended Range Module Development Kit

Kit Contents:

- Evaluation Boards w/Module (1)
- Jumpers (2)
- USB Cables (1)
- Software & Technical Information CD (2)

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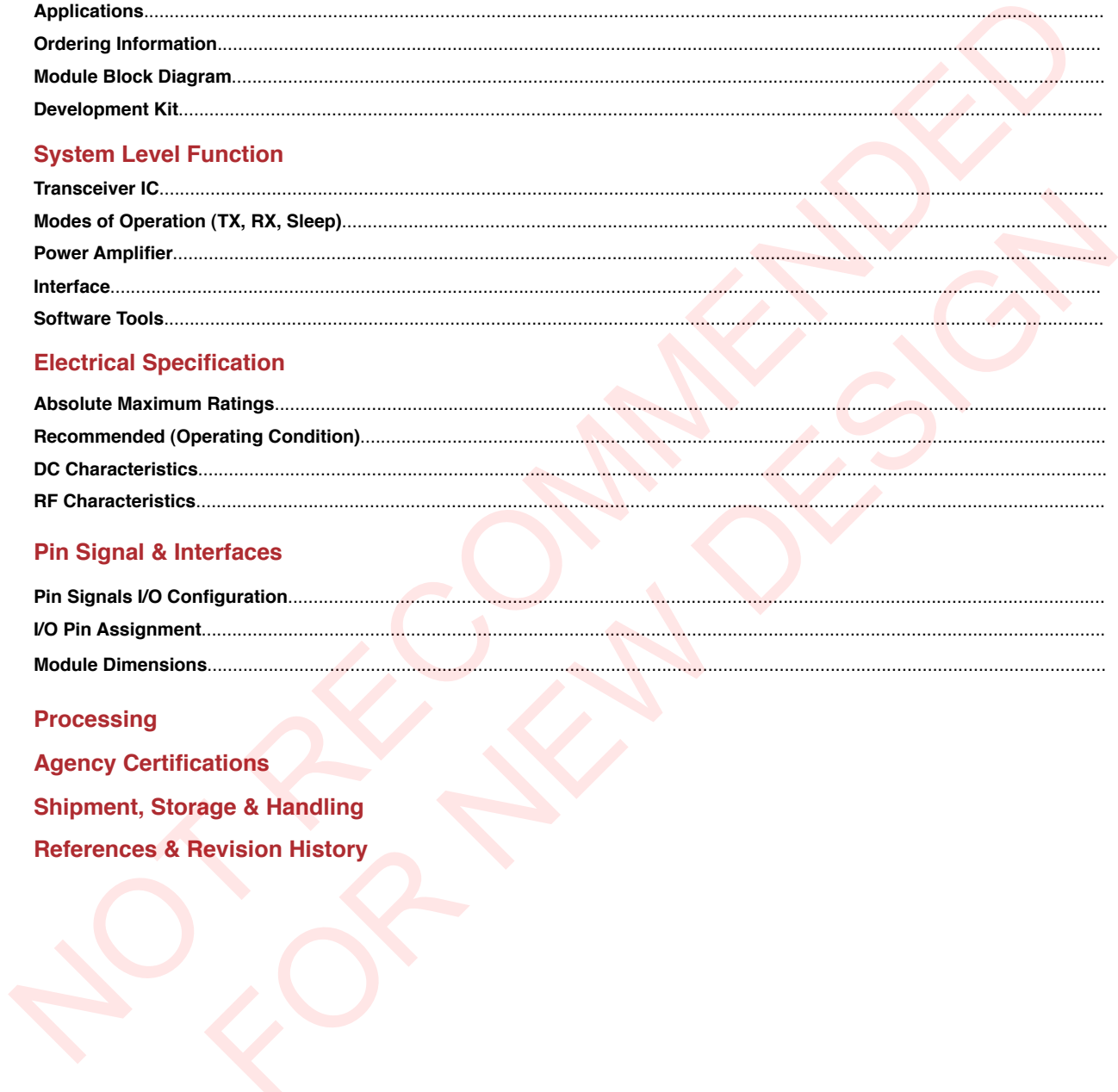
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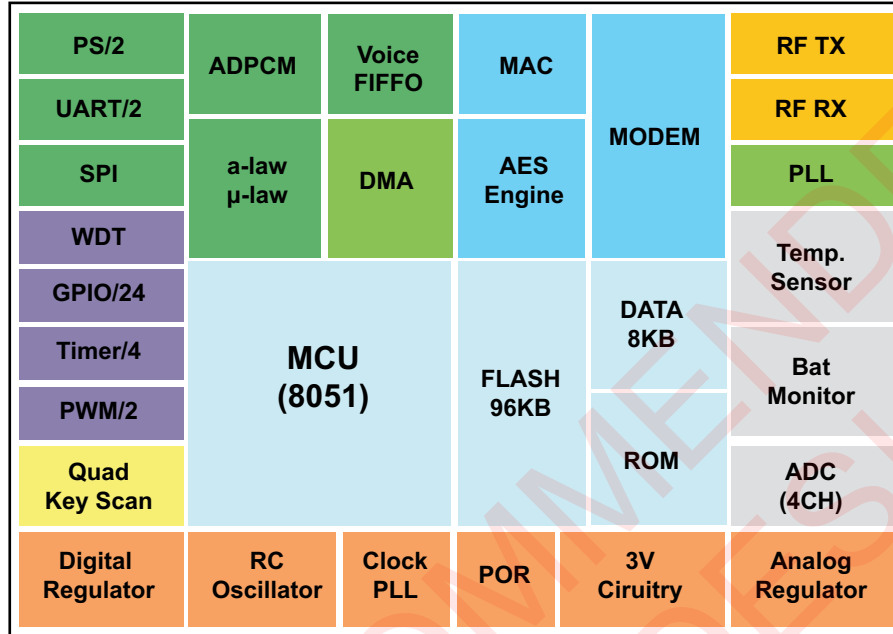
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TRANSCEIVER IC

A true monolithic solution, the MeshConnect IC incorporates the RF transceiver with baseband modem, a hardwired MAC, and an embedded 8051 microcontroller, offering an excellent low cost high performance solution for all IEEE 802.15.4 applications.



With an industry best +6 dBm output power, the MeshConnect IC will support a wide variety of applications without the need for external amplification. Combined with a highly sensitive -97 dBm receiver the MeshConnect IC leads the industry with 103 dB link budget.

In addition to excellent RF performance at 250 kbps data rates, the IC adds high speed modes, Turbo (500 kbps) and Premium (1 Mbps), for networks looking for increased throughput. The device provides numerous general-purpose I/O pins, peripheral functions such as timers and UARTs and is one of the first devices to provide an embedded Voice CODEC.

CEL provides its customers with the IEEE 802.15.4 stack as part of the software library. Also available are the hardware & software tools required to develop custom applications.

The combination of industry leading link budget, high speed RF, and integrate voice CODEC make the IC a truly distinct single chip solution.

The Extended Range module adds both an PA and LNA to maximize RF performance. The PA enable the Extended Range module to output up to +20 dBm transmit power. In the receive path the addition of the LNA boosts the already sensitive receiver up to -103 dBm. The Extended Range link budget boasts a very robust 123 dB enabling a line of sight range over 3 miles.

ANTENNA

CEL's MeshConnect modules include an integrated Printed Circuit Board (PCB) trace antenna. An optional u.FL connector can be specified, providing connection to a 50-ohm external antenna of the user's choice. See Ordering Information on page 1.

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. Correctly positioned, the ground plane on the host PCB will contribute significantly to the antenna performance (it should not be directly under the F-Antenna). The position of the module on the host board and overall design of the product enclosure contribute to antenna performance. Poor design affects radiation patterns and can result in reflection, diffraction, and/or scattering of the transmitted signal.

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 metalized plastic enclosure.
- Keep plastic enclosures 1 cm or more from the antenna in any direction.

For optimum antenna performance, the MeshConnect 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 antenna. 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.

MODES OF OPERATION

There are three power down modes in the IC. Each mode can be set using the PDMODE [1:0] bits in the PDCON register and power down modes can be started by setting the PDSTART bit to 1. Each mode has a different current consumption and wake-up sources, please refer to the IC datasheet for further information on the available power down modes. Table 8 describes the three power down modes.

Table 8 – Power Down Modes

| PDMODE [1:0] | Description | Wake-Up Source | Regulator for Digital block |
|--------------|---------------------------|---|--|
| 0 | Active (Normal Operation) | - | - |
| 1 | PM1 mode | Hardware Reset, Sleep Timer interrupt, External interrupt | ON |
| 2 | PM2 mode | Hardware Reset, Sleep Timer interrupt, External interrupt | OFF (After wake-up, register configuration is required) |
| 3 | PM3 mode | Hardware Reset, External interrupt | OFF (After wake-up, register configuration is required) |

POWER AMPLIFIER

The ZICM2410P0 MeshConnect module does not incorporate an external Power Amplifier and therefore the RF output port is connected directly (through matching components) to the RF antenna. As CEL's IC IEEE 802.15.4 transceiver already offers the industry's best link budget at 103 dB, even without an external PA the MeshConnect can maintain wireless connection over long distance (2,000 ft line-of-sight).

The Extended Range module adds both an PA and LNA to maximize RF performance. The PA enable the Extended Range module to output up to +20 dBm transmit power. In the receive path the addition of the LNA boosts the already sensitive receiver up to -103 dBm. The Extended Range link budget boasts a very robust 123 dB enabling a line of sight range over 3 miles.

INTERFACE

The MeshConnect has all major communication interfaces routed from the IC to the module edge connectors:

- UART1 & UART 2
- I²S
- SPI

VOICE CODEC

The MeshConnect IC includes three voice codec algorithms: μ -law, a-law and ADPCM.

The μ -law algorithm is a companding algorithm primarily used in the digital telecommunication systems of North America and Japan. As with other companding algorithms, its purpose is to reduce the dynamic range of an audio signal. In the analog domain this can increase the signal-to-noise ratio (SNR) achieved during transmission and in the digital domain, it can reduce the quantization error (hence increasing signal to quantization noise ratio). These SNR improvements can be traded for reduced bandwidth and equivalent SNR instead. The a-law algorithm is a standard companding algorithm used in European digital communications systems to optimize/modify the dynamic range of an analog signal for digitizing.

The a-law algorithm provides a slightly larger dynamic range than the μ -law at the cost of worse proportional distortion for small signals.

Adaptive DPCM (ADPCM) is a variant of DPCM [Differential (or Delta) pulse-code modulation] that varies the size of the quantization step, allowing further reduction of the required bandwidth for a given signal-to-noise ratio. DPCM encodes the PCM values as differences between the current and the previous value. For audio applications this type of encoding reduces the number of bits required per sample by about 25% compared to PCM.

SOFTWARE TOOLS

CEL offers complete SW tools for MeshConnect that customers need to create their application.

DEVICE PROGRAMMER

- Device Programmer is used to program the application firmware to the on-chip Flash program memory of the IC device.
- Device Programmer supports:
 - **ISP Mode:** Download the firmware from the host PC via serial communication through the IC's UART1 interface.
 - The evaluation boards utilize a USB -> Serial converter.
 - **OTA Mode:** Download the firmware from the host PC using wireless communication (Over-The-Air).
 - This requires two nodes, the host (connected to a PC) and the target device to be programmed.

Device Programmer can read/write hardware information (i.e. IEEE Address, Channel #, etc) directly via the aforementioned communication modes.

SOFTWARE TOOLS (Continued)**PACKET ANALYZER AND WIRELESS NETWORK ANALYZER**

- Packet Analyzer monitors traffic over a wireless network channel by capturing RF packet data in real-time.
- Packet Analyzer requires the Wireless Network Analyzer to “sniff” the RF packets.
- Packet Analyzer also includes diagnostic tools:
 - Energy Scan: Evaluates the received signal power within the bandwidth of an IEEE 802.15.4 channel yielding available channels.
 - Active Scan: Scanning for active Coordinators and Routers broadcasting a Beacon frame.
- Can be used in conjunction with any IEEE 802.15.4 or network.

KEIL 8051 DEVELOPMENT TOOLS (Evaluation version provided in development kit).

- Supports all 8051 derivatives and variants.
- Easy-to-Use μ Vision Integrated Development Environment (IDE) supports the complete development cycle.
- Supports memory banking for CODE and variables beyond the 64 kbyte threshold.

Numerous optimization levels yield the ability to place more features into less memory providing the utmost code density.

NOT RECOMMENDED FOR NEW DESIGN

ABSOLUTE MAXIMUM RATINGS

| Description | MeshConnect™ Module | | MeshConnect™ Extended Range Module | | Unit |
|------------------------------|------------------------|-----|---------------------------------------|-----|------|
| | Min | Max | Min | Max | |
| Power Supply Voltage (Vcc) | -0.3 | 3.3 | -0.3 | 3.3 | VDC |
| Voltage on any digital pin | -0.3 | 3.3 | -0.3 | 3.3 | VDC |
| Input RF Level | | 10 | | -6 | dBm |
| Storage Temperature | -55 | 125 | -55 | 125 | °C |
| Reflow Soldering Temperature | | 250 | | 250 | °C |

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

RECOMMENDED (OPERATING CONDITIONS)

| Description | MeshConnect™ Module MeshConnect™ Extended Range Module | | | Unit |
|---|---|-----|------|------|
| | Min | Typ | Max | |
| Operating ambient temperature range, T _A | -40 | 25 | 85 | °C |
| Operating Supply Voltage | 2.1 | 3.0 | 3.3 | VDC |
| Input Frequency | 2.405 | | 2.48 | GHz |

DC CHARACTERISTICS (@ 25°C, VCC = 3.0V unless otherwise noted)

| Description | MeshConnect™ Module | | | MeshConnect™ Extended Range Module | | | Unit |
|--------------------------------------|------------------------|-----|-----|---------------------------------------|-----|-----|------|
| | Min | Typ | Max | Min | Typ | Max | |
| Vcc Supply (Vcc) | 2.1 | | 3.3 | 2.1 | | 3.3 | VDC |
| Rx mode Current (Vcc=3.0V) | | 35 | 38 | | 38 | 42 | mA |
| Tx mode Current (Vcc=3.0V, Pout Max) | | 44 | 48 | | 200 | | mA |
| Tx mode Current (Vcc=2.1V, Pout Max) | | 44 | 48 | | 295 | | mA |
| Tx mode Current (Vcc=3.0V, 0 dBm) | | 31 | | | 75 | | mA |
| Sleep Mode (Deep) Current | | 1 | | | 1 | | μA |

RF CHARACTERISTICS (@ 25°C, VCC = 3.0V unless otherwise noted)

| Description | MeshConnect™ Module | | | MeshConnect™ Extended Range Module | | | Unit |
|--|------------------------|-----|-------|---------------------------------------|--------|-------|---------|
| | Min | Typ | Max | Min | Typ | Max | |
| Frequency Band (16–5MHz wide channels) | 2.405 | | 2.480 | 2.405 | | 2.480 | GHz |
| Rx Sensitivity for 1%PER | | -97 | -85 | | -103.0 | -85 | dBm |
| Saturation (maximum input level) | | 5 | | | -11 | | dBm |
| Tx Output Power (Vcc=3.0V) | 4.5 | 6.0 | | | 20 | | dBm |
| TX Output Power (Vcc=2.1V) | 4.5 | 6.0 | | | 19.6 | | dBm |
| Error Vector Magnitude | | 17 | 35 | | 15 | 35 | % |
| Adjacent Channel Rejection +/- 5 MHz | 35 | 47 | | 35 | 47 | | dB |
| +/- 10 MHz | 35 | 51 | | 35 | 51 | | |
| Frequency Error Tolerance | -96.2 | | 96.2 | -96.2 | | 96.2 | kHz |
| Output Power Control Range | | 55 | | | 55 | | dB |
| Over the Air Data Rate | | 250 | 1000 | | 250 | 1000 | kbps |
| Harmonics (2 nd & 3 rd) | | | -41.2 | | | -41.2 | dBm/MHz |

PIN SIGNALS I/O PORT CONFIGURATION

MeshConnect module has 56 edge I/O interfaces for connection to the user’s host board. The MeshConnect Module Dimensions shows the layout of the 56 edge castellations.

MeshConnect I/O PIN ASSIGNMENTS

| Pin # | MeshConnect™ Module | MeshConnect™ Extended Range Module | Type | Description | Functionality | IC Pin # |
|-------|---------------------|------------------------------------|---------------------|---|--|----------|
| 1 | GND | GND | GND-RF | Ground | Ground | N/A |
| 2 | GND | GND | GND-RF | Ground | Ground | N/A |
| 3 | MS1 | NC | static control line | Mode Select, Bit #1. Active Low Internal Voltage Regulator Enable: 0: Internal Voltage Regulator Enabled 1: Internal Voltage Regulator Disabled, Supply Analog and Digital Supply Voltages Externally | No connect | 14 |
| 4 | GND | GND | GND-RF | Ground | Ground | N/A |
| 5 | GND | NC | GND | GND | Ground | 13 |
| 6 | NC | NC | NC | no connect | No connect | N/A |
| 7 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 8 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 9 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 10 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 11 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 12 | ACH0 | ACH0 | Analog Input | 1.5V Level Analog ADC0 Input | ADC input | 8 |
| 13 | ACH1 | ACH1 | Analog Input | 1.5V Level Analog ADC1 Input | ADC input | 9 |
| 14 | ACH2 | ACH2 | Analog Input | 1.5V Level Analog ADC2 Input | ADC input | 10 |
| 15 | ACH3 | ACH3 | Analog Input | 1.5V Level Analog ADC3 Input | ADC input | 11 |
| 16 | P1_7 | NC | digital I/O | Port P1.7 | Digital I/O | 20 |
| 17 | P1_6 | NC | digital I/O | Port P1.6 | Digital I/O | 21 |
| 18 | P1_4 | P1_4 | digital I/O | Port P1.4/ QUADZB/ Sleep Timer OSC Buffer Input | digital I/O or dedicated function port | 22 |
| 19 | P1_3 | P1_3 | digital I/O | Port P1.3/ QUADZA/ Sleep Timer OSC Buffer Output/ RTCLKOUT | digital I/O or dedicated function port | 23 |
| 20 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 21 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 22 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 23 | P1_1 | P1_1 | digital I/O | Port P1.1/ TXD1 | digital I/O or dedicated function port | 24 |
| 24 | VCC_3V | VCC_3V | Power | 3.0V Power supply for Analog Internal Voltage Regulator | Power Input | 7 |
| 25 | P1_0 | P1_0 | digital I/O | Port P1.0/ RXD1 | digital I/O or dedicated function port | 26 |
| 26 | P3_7 | P3_7 | digital I/O | Port P3.7/ 12mA Drive capability/ PWM3/ CTS1/ SPICSN | digital I/O with high current capability | 27 |
| 27 | P3_6 | P3_6 | digital I/O | Port P3.6/ 12mA Drive capability/ PWM2/ RTS1/ SPICLK | digital I/O with high current capability | 28 |

Note:

1. Digital 1.5V regulator output. Sources little current. If it is used by the host board, care must be taken to ensure noise is not introduced as it could degrade RF performance.

MeshConnect I/O PIN ASSIGNMENTS (Continued)

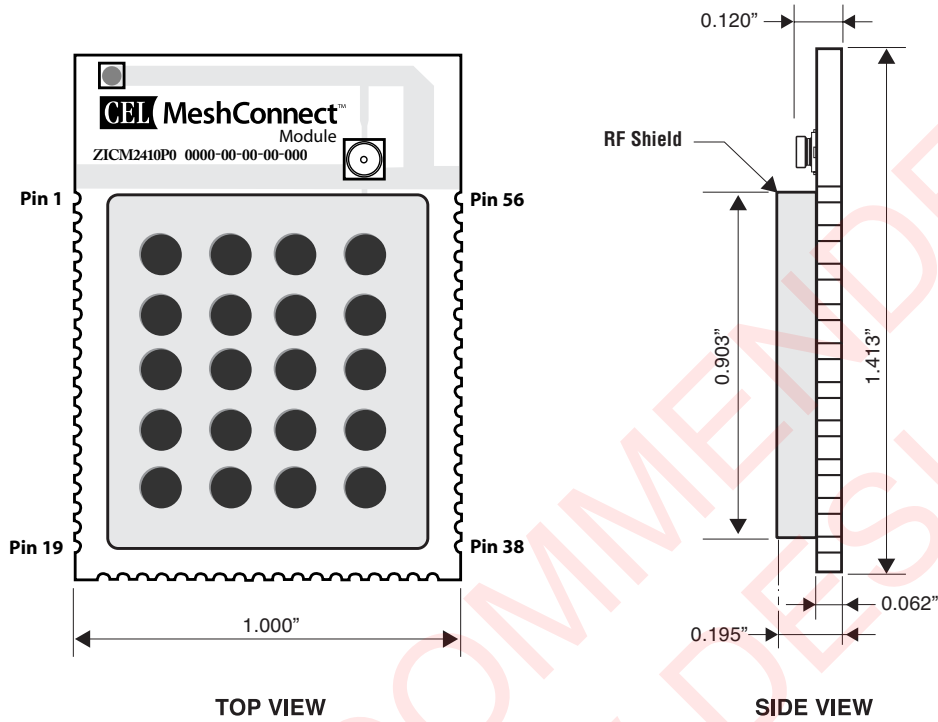
| Pin # | MeshConnect™ Module | MeshConnect™ Extended Range Module | Type | Description | Functionality | IC Pin # |
|-------|-------------------------|------------------------------------|---------------|--|---|----------|
| 28 | P3_5 | P3_5 | digital I/O | Port P3.5/T1/CTS0/QUADYB/SPIDO | digital I/O or dedicated function port | 29 |
| 29 | P3_4 | P3_4 | digital I/O | Port P3.4/T0/RTS0/QUADYA/SPIDI | digital I/O or dedicated function port | 30 |
| 30 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 31 | P3_3 | P3_3 | digital I/O | Port P3.3/INT1 (active low) | digital I/O or dedicated function port | 31 |
| 32 | P3_2 | P3_2 | digital I/O | Port P3.2/INT0 (active low) | digital I/O or dedicated function port | 32 |
| 33 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 34 | P3_1 | P3_1 | digital I/O | Port P3.1/TXD0/QUADXB | digital I/O or dedicated function port | 33 |
| 35 | P3_0 | P3_0 | digital I/O | Port P3.0/RXD0/QUADXA | digital I/O or dedicated function port | 35 |
| 36 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 37 | P0_7 | P0_7 | digital I/O | GPIO8051 Port P0.7/I2STX_MCLK | digital I/O | 36 |
| 38 | P0_6 | P0_6 | digital I/O | GPIO8051 Port P0.6/I2STX_BCLK | digital I/O | 37 |
| 39 | P0_5 | P0_5 | digital I/O | GPIO8051 Port P0.5/I2STX_LRCLK | digital I/O | 38 |
| 40 | P0_4 | P0_4 | digital I/O | GPIO8051 Port P0.4/I2STX_DO | digital I/O | 39 |
| 41 | P0_3 | P0_3 | digital I/O | GPIO8051 Port P0.3/I2SRX_MCLK | digital I/O | 40 |
| 42 | P0_2 | P0_2 | digital I/O | GPIO8051 Port P0.2/I2SRX_BCLK | digital I/O | 41 |
| 43 | P0_1 | P0_1 | digital I/O | GPIO8051 Port P0.1/I2SRX_LRCK | digital I/O | 42 |
| 44 | P0_0 | P0_0 | digital I/O | GPIO8051 Port P0.0/I2SRX_DI | digital I/O | 43 |
| 45 | DVDD_1_5 ⁽¹⁾ | NC | Power | Output of Digital Internal Voltage Regulator (1.5V) / 1.5V Power supply for Digital Core (input mode @ No REG) | Selected as Internal Regulator output or Regulated Voltage supply Input | 19 |
| 46 | ISP | ISP | Digital Input | Mode Select, Bit #2. Active High In-System Programming (ISP) Input: 0: Normal Mode 1: ISP Mode | Programming | 15 |
| 47 | RESET | RESET | Control | Reset (Active Low) | Hardware Reset | 17 |
| 48 | AVDD_1_5 ⁽¹⁾ | NC | Power | Output of Analog Internal Voltage Regulator (1.5V) / 1.5V Power supply for Mixer, VGA, and LPF (input mode @ No REG) | Selected as Internal Regulator output or Regulated Voltage supply Input | 6 |
| 49 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 50 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 51 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 52 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 53 | GND | GND | GND-Logic | Ground | Ground | 49 |
| 54 | NC | NC | NC | No Connect | No connect | N/A |
| 55 | GND | GND | GND-RF | Ground | Ground | N/A |
| 56 | GND | GND | GND-RF | Ground | Ground | N/A |

Note:

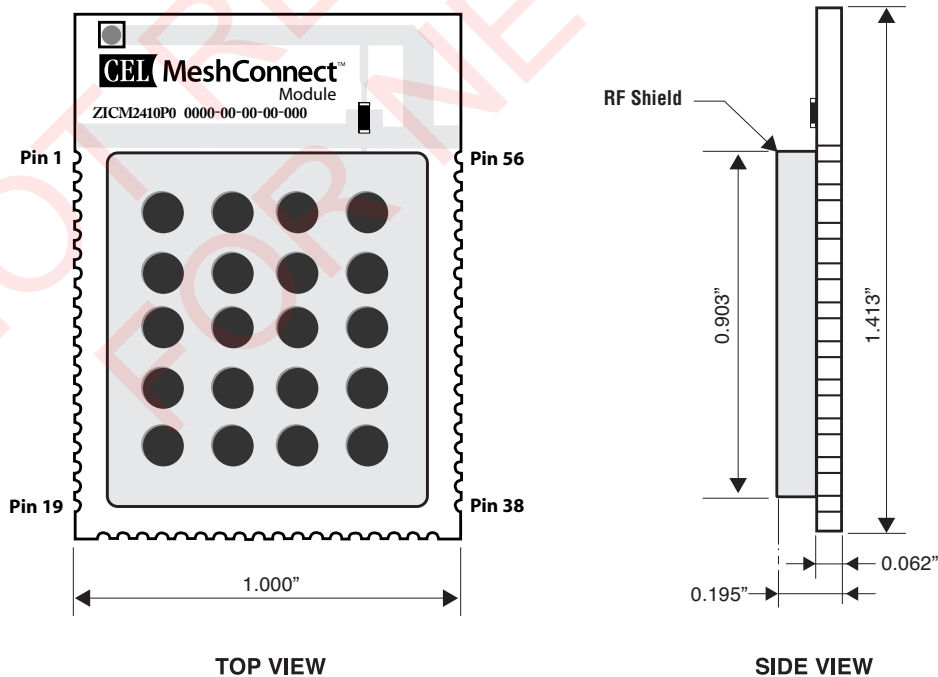
1. Digital 1.5V regulator output. Sources little current. If it is used by the host board, care must be taken to ensure noise is not introduced as it could degrade RF performance.

MODULE DIMENSIONS

MeshConnect™ Module / **MeshConnect™** Extended Range Module
w/U.FL Connector for external antenna



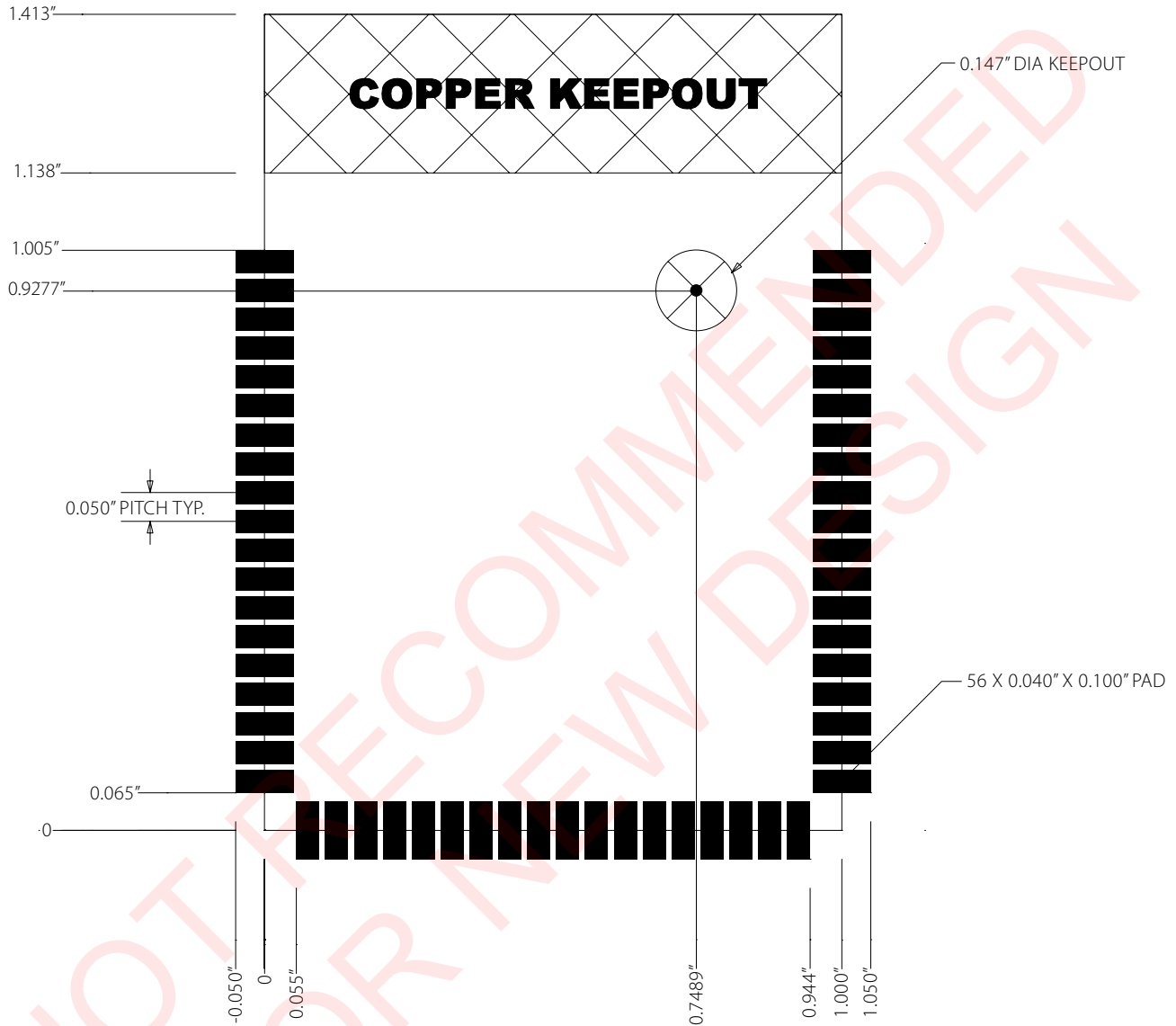
MeshConnect™ Module / **MeshConnect™** Extended Range Module
w/PCB Trace Antenna



For layout recommendation for optimum antenna performance, refer to Antenna section in this document.

MODULE LAND FOOTPRINT

Note: Unless otherwise specified. Dimensions are in Inches [mm].



NOT FOR NEW DESIGN

PROCESSING

Recommended Reflow Profile

| Parameters Values | |
|---------------------------------------|-------------|
| Ramp up rate (from Tsoakmax to Tpeak) | 3°/sec max |
| Minimum Soak Temperature | 150°C |
| Maximum Soak Temperature | 200°C |
| Soak Time | 60-120 sec |
| TLiquidus | 217°C |
| Time above TL | 60-150 sec |
| Tpeak | 250°C |
| Time within 5° of Tpeak | 20-30 sec |
| Time from 25° to Tpeak | 8 min max |
| Ramp down rate | 6°C/sec max |

Achieve the brightest possible solder fillets with a good shape and low contact angle.

Pb-Free Soldering Paste

Use of “No Clean” soldering paste is strongly recommended, as it does not require cleaning after the soldering process.

Note: The quality of solder joints on the castellations (‘half vias’) where they contact the host board should meet the appropriate IPC Specification. See **IPC-A-610** “Acceptability of Electronic Assemblies, section 8.2.4 Castellated Terminations.”

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.

PROCESSING *(Continued)*

Hand Soldering

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

Rework

The MeshConnect Module can be unsoldered from the host board. Use of a hot air rework 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 customer's own risk. The numerous ground pins at the module perimeter should be sufficient for optimum immunity to external RF interference.

AGENCY CERTIFICATIONS

FCC Compliance Statement (Part 15.19) Section 7.15 of RSS-GEN

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Warning (Part 15.21)

Changes or modifications not expressly approved by CEL could void the user's authority to operate the equipment.

20 cm Separation Distance

To comply with FCC/IC RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM Responsibility to the FCC Rules and Regulations

The MeshConnect Module has been certified per FCC Part 15 rules for integration into products without further testing or certification. To fulfill the FCC certification requirements, the OEM of the MeshConnect Module must ensure that the information provided on the MeshConnect Label is placed on the outside of the final product. The MeshConnect Module is labeled with its own FCC ID Number. If the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: W7Z-ICP0" or "Contains FCC ID: W7Z-ICP0"

The OEM of the MeshConnect Module must only use the approved antenna, (PCB Trace Antenna) that has been certified with this module. The OEM of the MeshConnect Module must test their final product configuration to comply with Unintentional Radiator Limits before declaring FCC compliance per Part 15 of the FCC rules.

AGENCY CERTIFICATIONS *(Continued)*

IC Certification — Industry Canada Statement

The term "IC" before the certification / registration number only signifies that the Industry Canada technical specifications were met.

Section 14 of RSS-210

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population. Consult Safety Code 6, obtainable from Health Canada's website: <http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/index-eng.php>

CE Certification — Europe

The MeshConnect RF module has been tested and certified for use in the European Union.

OEM Responsibility to the European Union Compliance Rules

If the MeshConnect module is to be incorporated into a product, the OEM must verify compliance of the final product to the European Harmonized EMC and Low-Voltage / Safety Standards. A Declaration of Conformity must be issued for each of these standards and kept on file as described in Annex II of the R&TTE Directive.

The manufacturer must maintain the user's guide and adhere to the settings described in the manual for maintaining European Union Compliance. If any of the specifications are exceeded in the final product, the OEM is required to make a submission to the notified body for compliance testing.

OEM Labeling Requirements

The 'CE' mark must be placed on the OEM product in a visible location.

The CE mark shall consist of the initials "CE" with the following form:

- If the CE marking is reduced or enlarged, the proportions given in the above graduated drawing must be adhered to.
- The CE mark must be a minimum of 5mm in height
- The CE marking must be affixed visibly, legibly, and indelibly. Since the 2400 - 2483.5 MHz band is not harmonized by a few countries throughout Europe, the Restriction sign must be placed to the right of the "CE" marking as shown in the picture



SHIPMENT, HANDLING, AND STORAGE

Shipment

The MeshConnect Modules are delivered in trays of 28.

Handling

The MeshConnect Modules are designed and packaged to be processed in an automated assembly line.

Warning The MeshConnect Modules contain highly sensitive electronic circuitry. Handling without proper ESD protection may destroy or damage the module permanently.

Warning According to JEDEC ISP, the MeshConnect 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.

Moisture Sensitivity Level (MSL)

MSL3, per J-STD-033

Storage

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

REFERENCES & REVISION HISTORY

| Previous Versions | Changes to Current Version | Page(s) |
|--|---|-----------|
| 0007-00-07-00-000 (Issue A) February 05, 2009 | Initial preliminary datasheet. | N/A |
| 0007-00-07-00-000 (Issue B) June 11, 2009 | Updated Development Kit and Agency Certification | 2, 14, 15 |
| 0007-00-07-00-000 (Issue C) October 6, 2009 | Added New MeshConnect Extended Range Module | All |
| 0007-00-07-00-000 (Issue C) January 29, 2010 | Removed "Preliminary" from datasheet and "Pending" from Agency Certification | All |
| 0007-00-07-00-000 (Issue C) April 7, 2010 | Added SNAP enabled modules to Ordering Information, updated module land footprint | 1 |
| 0007-00-07-00-000 (Issue D) December 22, 2010 | MeshConnect Extend Range Module part number change to -2 | All |
| 0007-00-07-00-000 (Issue D) February 8, 2011 | MeshConnect Extend Range Module W/connector part number change to -1 | 1 |
| 0007-00-07-00-000 (Issue E) June 14, 2012 | Changed ZICM2410P2-1C part number to -2C, updated Coaxial Keepout diagram | 1, 12 |

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