

# 适用于 MCU 应用的 CC3120MOD SimpleLink™ Wi-Fi CERTIFIED™ 网络处理器物联网模块解决方案

## 1 特性

- CC3120MOD 是一个的 Wi-Fi® 模块，其中包含 CC3120RNMARGK Wi-Fi 网络处理器 (NWP) 该完全集成的工业温度级绿色模块包括所有必需的时钟、串行外设接口 (SPI) 闪存和无源器件。
- FCC、IC、CE、MIC 和 SRRC 认证
- Wi-Fi CERTIFIED™ 模块，支持 Wi-Fi Alliance 成员申请证书转让
- 采用专用 Internet-on-a chip™ Wi-Fi NWP，可充分减轻应用 MCU 的 Wi-Fi 和互联网协议负载
- Wi-Fi® 模式
  - 802.11b/g/n 基站
  - 802.11b/g/n 接入点 (AP) 支持多达 4 个基站
  - Wi-Fi Direct® 客户端/组所有者
- WPA2 个人版和企业版安全性：WEP、WPA/WPA2 PSK、WPA2 企业版 (802.1x)、WPA3 个人版以及 WPA3 企业版
- IPv4 和 IPv6 TCP/IP 协议栈
  - 业界通用 BSD 套接字应用编程接口 (API)
    - 16 个同步 TCP 或 UDP 套接字
    - 6 个同步 TLS 和 SSL 套接字
- IP 寻址：具有重复地址检测 (DAD) 功能的静态 IP、LLA、DHCPv4 和 DHCPv6
- 适用于自主和快速 Wi-Fi 连接的 SimpleLink™ 连接管理器
- 可通过 SmartConfig™ 技术、AP 模式和 WPS2 选项灵活配置 Wi-Fi
- RESTful API 支持 (使用内部 HTTP 服务器)
- 广泛的安全特性
  - 硬件特性
    - 独立执行环境
    - 器件身份
  - 网络安全
    - 个人和企业 Wi-Fi 安全性
    - 安全套接字 (SSLv3、TLS1.0/1.1/TLS1.2)
    - HTTPS 服务器
    - 受信任根证书目录
    - TI 信任根公开密钥
  - 软件 IP 保护
    - 安全密钥存储
    - 文件系统安全性
    - 软件篡改检测
    - 克隆保护
- 在专用 NWP 上运行的嵌入式网络应用
  - 具有动态用户回调的 HTTP/HTTPS Web 服务器
  - mDNS、DNS-SD、DHCP 服务器
- Ping
- 恢复机制 - 能够恢复到出厂默认设置
- Wi-Fi TX 功率
  - 1 DSSS 时为 17.0dBm
  - 54 OFDM 时为 13.5dBm
- Wi-Fi RX 灵敏度
  - 1 DSSS 时为 -95.0dBm
  - 54 OFDM 时为 -73.5dBm
- 应用吞吐量
  - UDP : 16Mbps
  - TCP : 13Mbps
- 电源管理子系统
  - 集成式直流/直流转换器支持宽电源电压范围：
    - V<sub>BAT</sub> 宽电压模式：2.3V 至 3.6V
  - 高级低功耗模式
    - 关断：1 μA
    - 休眠：5 μA
    - 低功耗深度睡眠 (LPDS)：115 μA
    - RX 流量：54 OFDM 时为 59mA
    - TX 流量：54 OFDM 时为 229mA，最大功率
    - 空闲连接 (MCU 处于 LPDS 状态)：DTIM = 1 时为 690 μA
- 模块上的其它集成组件
  - 具有内部振荡器的 40.0MHz 晶体
  - 32.768kHz 晶体 (RTC)
  - 32Mbit SPI 串行闪存
  - 射频滤波器和无源器件
- 1.27mm 间距、63 引脚 20.5mm × 17.5mm LGA 封装，可实现轻松组装和低成本 PCB 设计
- 环境温度范围：-40°C 至 +85°C
- 模块支持 [SimpleLink 开发人员生态系统](#)

## 2 应用

- 用于物联网应用 (IoT)，例如：
  - 云连接
  - 互联网网关
  - 住宅和楼宇自动化
  - 电器
  - 门禁
  - 安全系统



- 智能能源
- 工业控制
- 智能插座和仪表计量
- 无线音频
- IP 网络传感器节点
- 资产跟踪
- 医疗设备

### 3 说明

向适用于物联网应用的低成本、低功耗 MCU 添加了 Wi-Fi®。CC3120MOD 是一款 FCC、IC、CE、MIC、SRRC 和 Wi-Fi CERTIFIED™ 模块，属于 SimpleLink™ Wi-Fi 系列，可极大地简化互联网连接的实施。CC3120MOD 集成了针对 Wi-Fi 和互联网的所有协议，极大程度降低了对主机 MCU 软件的要求。借助内置安全协议，CC3120MOD 解决方案可提供稳健且简单的安全体验。此外，CC3120MOD 是一个完整的平台解决方案，包括各种工具和软件、示例应用、用户和编程指南、参考设计以及 TI E2E™ 支持社区。CC3120MOD 采用 LGA 封装，易于布置所有必需组件，包括串行闪存、射频滤波器、晶体和全集成无源器件。

Wi-Fi 网络处理器子系统具有 Wi-Fi Internet-on-a chip™ 电路，并包含一个额外的专用 Arm® MCU，可减少主机 MCU 的联网活动。此子系统包含 802.11b/g/n 无线电、基带和具有强大加密引擎的 MAC，采用 256 位加密，可实现快速、安全的互联网连接。CC3120MOD 模块支持基站、接入点和 Wi-Fi Direct 模式。此模块支持 WPA2 个人版和企业版安全性、以及 WPA3 个人版和企业版安全性。此子系统包含嵌入式 TCP/IP、TLS/SSL 堆栈、HTTP 服务器和多种互联网协议。CC3120MOD 模块支持各种 Wi-Fi 配置方法，包括基于 AP 模式的 HTTP、SmartConfig™ 技术和 WPS2.0。

CC3120MOD 模块属于 TI 的第二代 SimpleLink Wi-Fi 系列，拥有全新特性和增强功能，例如：

- IPv6
- 增强的 Wi-Fi 配置
- 优化的低功耗管理
- Wi-Fi AP 可连接多达 4 个基站
- 可同时打开更多的 BSD 套接字以及最多 16 个 BSD 套接字，其中 6 个是安全型
- HTTPS 支持
- 支持 RESTful API
- 非对称密钥
- 加密库

电源管理子系统包括支持宽电源电压范围的集成式 DC/DC 转换器。该子系统支持低功耗模式，例如 RTC 休眠和关断模式，这需要大概的电流。分别需要 5μA 和 1μA 的电流。CC3120MOD 模块随附一个占用空间小的用户友好型主机驱动程序，可简化网络应用的集成和开发。主机驱动程序可轻松移植到大多数平台和操作系统 (OS)。采用严格的 ANSI-C (C99) 标准编写，只需极小的平台适配层（移植层）。CC3120MOD 模块可通过 SPI 或 UART 接口连接至任何 8 位、16 位或 32 位 MCU。该器件驱动程序可最大程度地减少主机内存占用要求，让 TCP 客户端应用只需不到 7KB 的代码存储器和 700B 的 RAM。

CC3120MOD 模块是 SimpleLink™ 微控制器 (MCU) 平台的一部分，该平台包括 Wi-Fi、低功耗蓝牙®、Sub-1GHz 和主机 MCU，它们共用一个通用、易于使用的开发环境，其中包含单核软件开发套件 (SDK) 和丰富的工具集。借助一次性集成的 SimpleLink 平台，可以将产品系列中的任何器件组合添加到自己的设计中，从而在设计要求变更时实现完全的代码重复使用。

CC3120MOD 模块提供易于布局的 LGA 封装，作为完整的平台解决方案提供，其中包括各种工具和软件、示例应用、用户和编程指南、参考设计以及 TI E2E 支持社区。此模块系列还是 SimpleLink MCU 产品系列的一部分，并且可为 SimpleLink 开发人员的生态系统提供支持。有关更多信息，请访问 [www.ti.com/SimpleLink](http://www.ti.com/SimpleLink)。

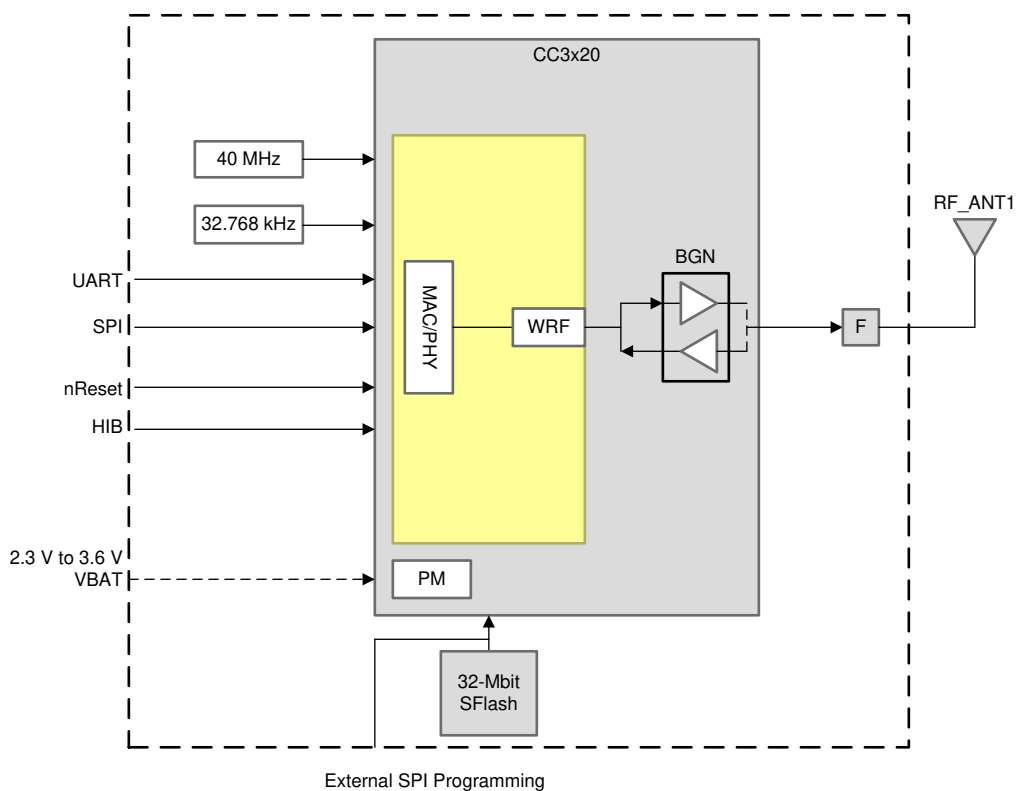
**表 3-1. 模块信息**

| 器件型号 <sup>(1)</sup> | 封装       | 封装尺寸            |
|---------------------|----------|-----------------|
| CC3120MODRNMBOBR    | MOB (63) | 20.5mm × 17.5mm |

(1) 有关更多信息，请参阅节 13。

## 4 功能方框图

图 4-1 显示了 CC3120MOD 模块的功能方框图。



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图 4-1. CC3120MOD 模块功能方框图

图 4-2 显示了 CC3120 硬件概览。

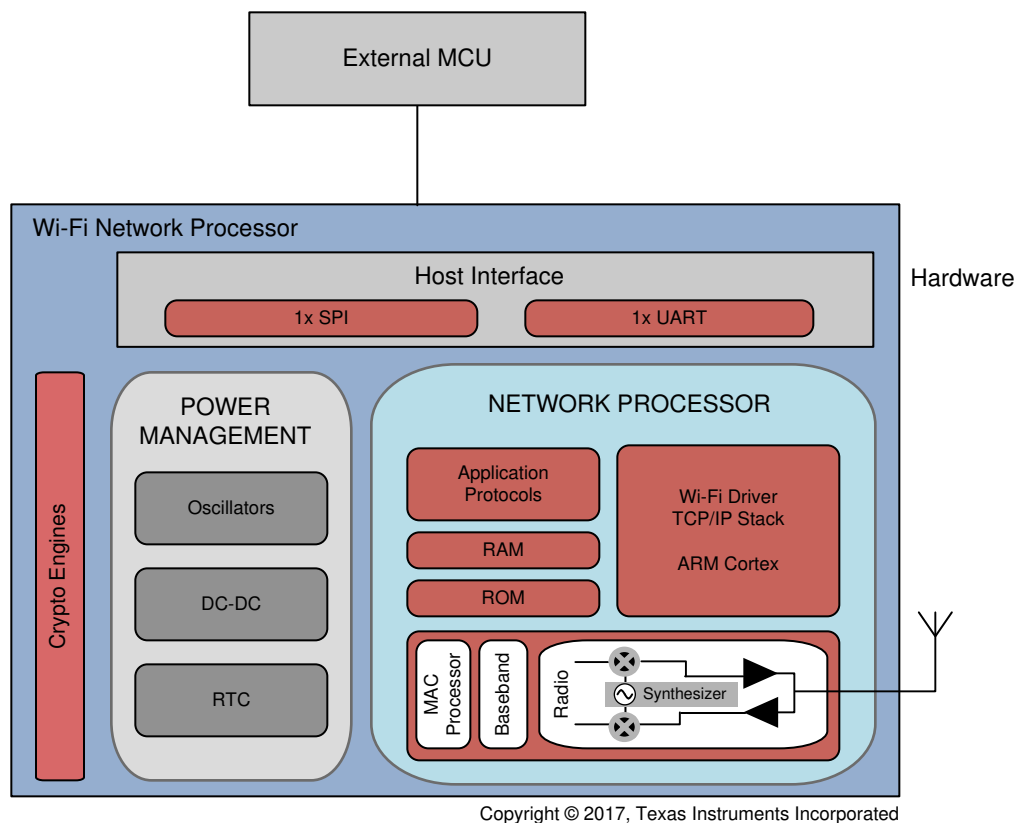


图 4-2. CC3120 硬件概览

图 4-3 显示了 CC3120 嵌入式软件概览。

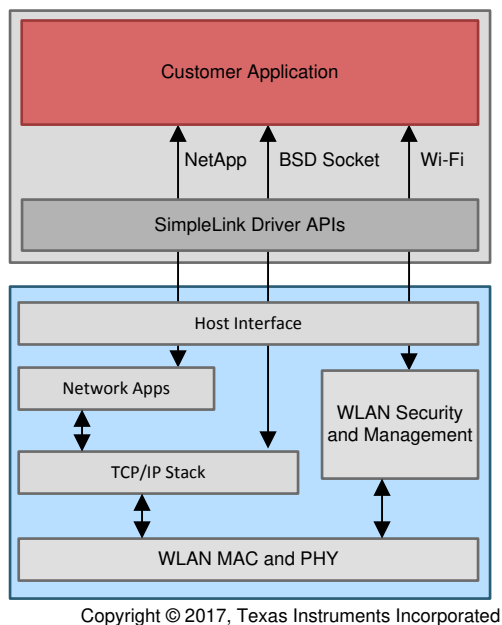


图 4-3. CC3120 嵌入式软件概览

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## 5 Device Comparison

表 5-1 shows the features supported across different CC3x20 modules.

**表 5-1. Device Features Comparison**

| FEATURE                                                | DEVICE                                                                                    |                                                                                           |                                                                                           |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
|                                                        | CC3120MOD                                                                                 | CC3220MODS                                                                                | CC3220MODSF                                                                               |
| Onboard Chip                                           | CC3120                                                                                    | CC3220S                                                                                   | CC3220SF                                                                                  |
| Onboard ANT                                            | No                                                                                        | No                                                                                        | No                                                                                        |
| sFlash                                                 | 32Mbit                                                                                    | 32Mbit                                                                                    | 32Mbit                                                                                    |
| Regulatory Certification                               | FCC, IC, CE, MIC, SRRC                                                                    | FCC, IC, CE, MIC, SRRC                                                                    | FCC, IC, CE, MIC, SRRC                                                                    |
| Wi-Fi Alliance Certification                           | Yes                                                                                       | Yes                                                                                       | Yes                                                                                       |
| Input Voltage                                          | 2.3V to 3.6V                                                                              | 2.3V to 3.6V                                                                              | 2.3V to 3.6V                                                                              |
| Package                                                | 17.5mm × 20.5mm LGA                                                                       | 17.5mm × 20.5mm LGA                                                                       | 17.5mm × 20.5mm LGA                                                                       |
| Operating Temperature Range                            | – 40° to 85°C                                                                             | – 40° to 85°C                                                                             | – 40° to 85°C                                                                             |
| Classification                                         | Wi-Fi Network Processor                                                                   | Wireless Microcontroller                                                                  | Wireless Microcontroller                                                                  |
| Standard                                               | 802.11 b/g/n                                                                              | 802.11 b/g/n                                                                              | 802.11 b/g/n                                                                              |
| Frequency                                              | 2.4GHz                                                                                    | 2.4GHz                                                                                    | 2.4GHz                                                                                    |
| TCP / IP Stack                                         | IPv4, IPv6                                                                                | IPv4, IPv6                                                                                | IPv4, IPv6                                                                                |
| Sockets                                                | 16                                                                                        | 16                                                                                        | 16                                                                                        |
| Integrated MCU                                         | -                                                                                         | Arm® Cortex®-M4 at 80 MHz                                                                 | Arm® Cortex®-M4 at 80 MHz                                                                 |
| <b>On Chip Memory</b>                                  |                                                                                           |                                                                                           |                                                                                           |
| RAM                                                    | -                                                                                         | 256KB                                                                                     | 256KB                                                                                     |
| Flash                                                  | -                                                                                         | -                                                                                         | 1MB                                                                                       |
| <b>Peripherals and Interfaces</b>                      |                                                                                           |                                                                                           |                                                                                           |
| Universal Asynchronous Receiver and Transmitter (UART) | 1                                                                                         | 2                                                                                         | 2                                                                                         |
| Serial Port Interface (SPI)                            | 1                                                                                         | 1                                                                                         | 1                                                                                         |
| Multi-Channel Audio Serial Port (McASP) — I2S or PCM   | -                                                                                         | 2-ch                                                                                      | 2-ch                                                                                      |
| Inter-Integrated Circuit (I <sup>2</sup> C)            | -                                                                                         | 1                                                                                         | 1                                                                                         |
| Analog to Digital Converter (ADC)                      | -                                                                                         | 4-ch, 12-bit                                                                              | 4-ch, 12-bit                                                                              |
| Parallel Interface (8-bit PI)                          | -                                                                                         | 1                                                                                         | 1                                                                                         |
| General-Purpose Timers                                 | -                                                                                         | 4                                                                                         | 4                                                                                         |
| Multimedia Card (MMC / SD)                             | -                                                                                         | 1                                                                                         | 1                                                                                         |
| <b>Security Features</b>                               |                                                                                           |                                                                                           |                                                                                           |
| Wi-Fi Level of Security                                | WEP, WPS, WPA / WPA2, PSK WPA2 (802.1x)                                                   | WEP, WPS, WPA / WPA2, PSK WPA2 (802.1x)                                                   | WEP, WPS, WPA / WPA2, PSK WPA2 (802.1x)                                                   |
| Secure Sockets (SSL v3 or TLS 1.0 / 1.1 / 1.2)         | 6                                                                                         | 6                                                                                         | 6                                                                                         |
| Additional Networking Security                         | Unique Device Identity<br>Trusted Root-Certificate Catalog<br>TI Root-of-Trust Public key | Unique Device Identity<br>Trusted Root-Certificate Catalog<br>TI Root-of-Trust Public key | Unique Device Identity<br>Trusted Root-Certificate Catalog<br>TI Root-of-Trust Public key |
| Hardware Acceleration                                  | Hardware Crypto Engines                                                                   | Hardware Crypto Engines                                                                   | Hardware Crypto Engines                                                                   |
| Secure Boot                                            | -                                                                                         | Yes                                                                                       | Yes                                                                                       |

**表 5-1. Device Features Comparison ( 续 )**

| FEATURE                             | DEVICE    |                                                                                                                             |                                                                                                                             |
|-------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
|                                     | CC3120MOD | CC3220MODS                                                                                                                  | CC3220MODSF                                                                                                                 |
| Enhanced Application Level Security | -         | File system security<br>Secure key storage<br>Software tamper detection<br>Cloning protection<br>Initial secure programming | File system security<br>Secure key storage<br>Software tamper detection<br>Cloning protection<br>Initial secure programming |

## 5.1 Related Products

For information about other devices in this family of products or related products see the links below.

|                                                        |                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#">SimpleLink™ MCUs Overview</a>              | The broadest portfolio of wired and wireless Arm® MCUs                                                                                                                                                                                                                                                                                 |
| <a href="#">SimpleLink wireless network processors</a> | Our SimpleLink™ MCU platform sets a new standard for developers with the broadest portfolio of wired and wireless Arm® MCUs in a single software development environment. Delivering flexible hardware, software and tool options for your Internet of Things applications, the SimpleLink platform enables unprecedented scalability. |
| <a href="#">Reference designs</a>                      | Find reference designs leveraging the best in TI technology – from analog and power management to embedded processors. All designs include a schematic, test data and design files.                                                                                                                                                    |
| <a href="#">CC3120 SDK Plug-In</a>                     | The CC3120 SDK plug-in contains drivers, many sample applications for Wi-Fi features and Internet, and documentation needed to use the CC3120 solution.                                                                                                                                                                                |

## 6 Terminal Configuration and Functions

### 6.1 CC3120MOD Pin Diagram

图 6-1 shows the pin diagram for the CC3120MOD module.

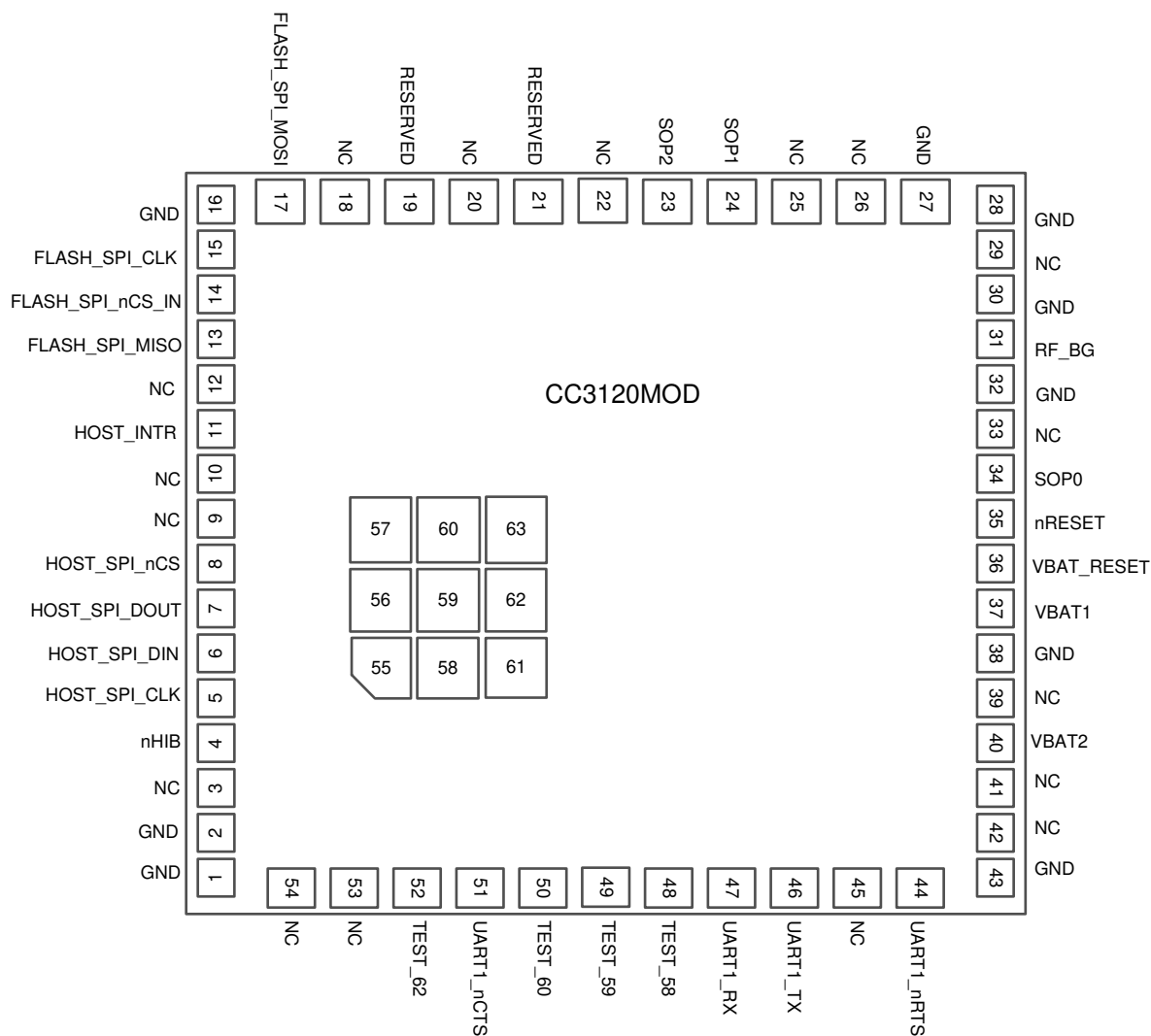


图 6-1 shows the approximate location of pins on the module. For the actual mechanical diagram, refer to 节 13.

图 6-1. CC3120MOD Pin Diagram Bottom View

## 6.2 Pin Attributes

表 6-1 lists the pin descriptions of the CC3120MOD module.

### 备注

If an external device drives a positive voltage to signal pads when the CC3120MOD is not powered, DC current is drawn from the other device. If the drive strength of the external device is adequate, an unintentional wake up and boot of the CC3120MOD can occur. To prevent current draw, TI recommends one of the following:

- All devices interfaced to the CC3120MOD must be powered from the same power rail as the CC3120MOD.
- Use level-shifters between the CC3120MOD and any external devices fed from other independent rails.
- The nRESET pin of the CC3120MOD must be held low until the  $V_{BAT}$  supply to the module is driven and stable.

**表 6-1. Module Pin Attributes**

| PIN <sup>(1)</sup> | DEFAULT FUNCTION | STATE AT RESET AND HIBERNATE | I/O TYPE <sup>(2)</sup> | DESCRIPTION                                                                         |
|--------------------|------------------|------------------------------|-------------------------|-------------------------------------------------------------------------------------|
| 1                  | GND              | N/A                          | –                       | Ground                                                                              |
| 2                  | GND              | N/A                          | –                       | Ground                                                                              |
| 4                  | nHIB             | Hi-Z                         | I                       | Hibernate signal, active low. Ensure that the nHIB line does not float at any time. |
| 5                  | HOST_SPI_CLK     | Hi-Z                         | I                       | Host interface SPI clock                                                            |
| 6                  | HOST_SPI_DIN     | Hi-Z                         | I                       | Host interface SPI data input                                                       |
| 7                  | HOST_SPI_DOUT    | Hi-Z                         | O                       | Host interface SPI data output                                                      |
| 8                  | HOST_SPI_nCS     | Hi-Z                         | I                       | Host interface SPI chip select (active low)                                         |
| 11                 | HOST_INTR        | Hi-Z                         | O                       | Interrupt output                                                                    |
| 13                 | FLASH_SPI_MISO   | Hi-Z                         | I                       | External serial Flash interface: SPI data in                                        |
| 14                 | FLASH_SPI_nCS_IN | Hi-Z                         | O                       | External serial Flash interface: SPI chip select (active low)                       |
| 15                 | FLASH_SPI_CLK    | Hi-Z                         | O                       | External serial Flash interface: SPI clock                                          |
| 16                 | GND              | N/A                          | –                       | Ground                                                                              |
| 17                 | FLASH_SPI_MOSI   | Hi-Z                         | O                       | External serial Flash interface: SPI data out                                       |
| 23                 | SOP2             | Hi-Z                         | –                       | SOP[2:0] used for factory restore. See 节 8.5.                                       |
| 24                 | SOP1             | Hi-Z                         | –                       | SOP[2:0] used for factory restore. See 节 8.5.                                       |
| 27                 | GND              | N/A                          | –                       | Ground                                                                              |
| 28                 | GND              | N/A                          | –                       | Ground                                                                              |
| 30                 | GND              | N/A                          | –                       | Ground. Reference for RF signal                                                     |
| 31                 | RF_BG            | Hi-Z                         | I/O                     | 2.4-GHz RF input/output                                                             |
| 32                 | GND              | N/A                          | –                       | Ground. Reference for RF signal                                                     |
| 34                 | SOP0             | Hi-Z                         | –                       | SOP[2:0] used for factory restore. See 节 8.5.                                       |

表 6-1. Module Pin Attributes ( 续 )

| PIN <sup>(1)</sup> | DEFAULT FUNCTION | STATE AT RESET AND HIBERNATE | I/O TYPE <sup>(2)</sup> | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|------------------|------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 35                 | nRESET           | Hi-Z                         | I                       | <p>There is an internal 100 k<math>\Omega</math> pull-up resistor option from the nRESET pin to VBAT_RESET. Note: VBAT_RESET is not connected to VBAT1 or VBAT2 within the module. The following connection schemes are recommended:</p> <ul style="list-style-type: none"> <li>Connect nRESET to a GPIO from the host only if nRESET will be in a defined state under all operating conditions. Leave VBAT_RESET unconnected to save power.</li> <li>If nRESET cannot be in a defined state under all operating conditions, connect VBAT_RESET to the main module power supply (VBAT1 and VBAT2). Due to the internal pull-up resistor, a leakage current of 3.3 V / 100 k<math>\Omega</math> is expected.</li> </ul> |
| 36                 | VBAT_RESET       | Hi-Z                         | –                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 37                 | VBAT1            | Hi-Z                         | –                       | Power supply for the module, must be connected to battery (2.3 V to 3.6 V)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 38                 | GND              | N/A                          | –                       | Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 40                 | VBAT2            | Hi-Z                         | –                       | Power supply for the module, must be connected to battery (2.3 V to 3.6 V)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 43                 | GND              | N/A                          | –                       | Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 44                 | UART1_nRTS       | Hi-Z                         | O                       | UART interface to host (request to send)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 46                 | UART1_TX         | Hi-Z                         | O                       | UART interface to host (transmit)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 47                 | UART1_RX         | Hi-Z                         | I                       | UART interface to host (receive)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 50                 | TEST_60          | Hi-Z                         | O                       | Connect to external test point.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 51                 | UART1_nCTS       | Hi-Z                         | I                       | UART interface to host (clear to send)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 52                 | TEST_62          | Hi-Z                         | O                       | Connect to external test point.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 55                 | GND              | N/A                          | –                       | Thermal Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 56                 | GND              | N/A                          | –                       | Thermal Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 57                 | GND              | N/A                          | –                       | Thermal Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 58                 | GND              | N/A                          | –                       | Thermal Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 59                 | GND              | N/A                          | –                       | Thermal Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 60                 | GND              | N/A                          | –                       | Thermal Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 61                 | GND              | N/A                          | –                       | Thermal Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 62                 | GND              | N/A                          | –                       | Thermal Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 63                 | GND              | N/A                          | –                       | Thermal Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

(1) Using a configuration file stored on Flash, the vendor can optionally block any possibility of bringing up AP using the FORCE\_AP pin.

(2) I = Input, O = Output, RF = Radio frequency, I/O = Bidirectional

## 6.3 Connections for Unused Pins

All unused pins must be left as no connect (NC) pins. 表 6-2 provides a list of NC pins.

表 6-2. Connections for Unused Pins

| PIN | DEFAULT FUNCTION | STATE AT RESET AND HIBERNATE | I/O TYPE | DESCRIPTION               |
|-----|------------------|------------------------------|----------|---------------------------|
| 3   | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 9   | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 10  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 12  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 18  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 19  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 20  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 21  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 25  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 26  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 29  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 33  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 39  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 41  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 42  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 45  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 48  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 49  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 53  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |
| 54  | NC               | WLAN analog                  | –        | Reserved. Do not connect. |

## 7 Specifications

All measurements are references of the module pins, unless otherwise indicated. All specifications are over process and voltage, unless otherwise indicated.

### 7.1 Absolute Maximum Ratings

These specifications indicate levels where permanent damage to the module can occur. Functional operation is not ensured under these conditions. Operation at absolute maximum conditions for extended periods can adversely affect long-term reliability of the module <sup>(1)</sup> <sup>(2)</sup>.

|                                                     | MIN   | MAX                    | UNIT |
|-----------------------------------------------------|-------|------------------------|------|
| V <sub>BAT</sub>                                    | – 0.5 | 3.8                    | V    |
| Digital I/O                                         | – 0.5 | V <sub>BAT</sub> + 0.5 | V    |
| RF pin                                              | – 0.5 | 2.1                    | V    |
| Analog pins                                         | – 0.5 | 2.1                    | V    |
| Operating temperature, T <sub>A</sub>               | – 40  | 85                     | °C   |
| Storage temperature, T <sub>stg</sub>               | – 40  | 85                     | °C   |
| Junction temperature, T <sub>j</sub> <sup>(3)</sup> |       | 120                    | °C   |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values are with respect to V<sub>SS</sub>, unless otherwise noted.
- (3) Junction temperature is for the CC3120RNMARGK device that is contained within the module.

### 7.2 ESD Ratings

|                  |                                           |                                                                  | VALUE | UNIT |
|------------------|-------------------------------------------|------------------------------------------------------------------|-------|------|
| V <sub>ESD</sub> | Electrostatic discharge (ESD) performance | Human body model (HBM), per ANSI/ESDA/JEDEC JS001 <sup>(1)</sup> | ±2000 | V    |
|                  |                                           | Charged device model (CDM), per JESD22-C101 <sup>(2)</sup>       | ±500  |      |
|                  |                                           | All pins                                                         |       |      |

- (1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

### 7.3 Recommended Operating Conditions

Function operation is not ensured outside this limit, and operation outside this limit for extended periods can adversely affect long-term reliability of the module <sup>(1)</sup> <sup>(2)</sup> <sup>(3)</sup>.

|                       | MIN  | TYP | MAX | UNIT      |
|-----------------------|------|-----|-----|-----------|
| V <sub>BAT</sub>      | 2.3  | 3.3 | 3.6 | V         |
| Operating temperature | – 40 | 25  | 85  | °C        |
| Ambient thermal slew  | – 20 |     | 20  | °C/minute |

- (1) When operating at an ambient temperature of over 75°C, the transmit duty cycle must remain below 50% to avoid the auto-protect feature of the power amplifier. If the auto-protect feature triggers, the device takes a maximum of 60 seconds to restart the transmission.
- (2) To ensure WLAN performance, ripple on the 2.3-V to 3.6-V supply must be less than ±300 mV.
- (3) The minimum voltage specified includes the ripple on the supply voltage and all other transient dips. The brownout condition is 2.1 V, and care must be taken when operating at the minimum specified voltage.

## 7.4 Current Consumption Summary

$T_A = 25^\circ\text{C}$ ,  $V_{BAT} = 3.6\text{V}$

| PARAMETER                               | TEST CONDITIONS <sup>(1)</sup> <sup>(2)</sup> |                    | MIN | TYP | MAX | UNIT          |
|-----------------------------------------|-----------------------------------------------|--------------------|-----|-----|-----|---------------|
| TX                                      | 1 DSSS                                        | TX power level = 0 |     | 272 |     | mA            |
|                                         |                                               | TX power level = 4 |     | 188 |     |               |
|                                         | 6 OFDM                                        | TX power level = 0 |     | 248 |     |               |
|                                         |                                               | TX power level = 4 |     | 179 |     |               |
|                                         | 54 OFDM                                       | TX power level = 0 |     | 223 |     |               |
|                                         |                                               | TX power level = 4 |     | 160 |     |               |
| RX <sup>(3)</sup>                       | 1 DSSS                                        |                    |     | 53  |     | mA            |
|                                         | 54 OFDM                                       |                    |     | 53  |     |               |
| Idle connected <sup>(4)</sup>           |                                               |                    |     | 690 |     | $\mu\text{A}$ |
| LPDS                                    |                                               |                    |     | 115 |     | $\mu\text{A}$ |
| Hibernate                               |                                               |                    |     | 5   |     | $\mu\text{A}$ |
| Shutdown                                |                                               |                    |     | 1   |     | $\mu\text{A}$ |
| Peak calibration current <sup>(5)</sup> | $V_{BAT} = 3.6\text{ V}$                      |                    |     | 420 |     | mA            |
|                                         | $V_{BAT} = 3.3\text{ V}$                      |                    |     | 450 |     |               |
|                                         | $V_{BAT} = 2.3\text{ V}$                      |                    |     | 620 |     |               |

- (1) TX power level = 0 implies maximum power (see 图 7-1, 图 7-2, and 图 7-3). TX power level = 4 implies output power backed off approximately 4dB.
- (2) The CC3120MOD system is a constant power-source system. The active current numbers scale inversely on the  $V_{BAT}$  voltage supplied.
- (3) The RX current is measured with a 1Mbps throughput rate.
- (4) DTIM = 1
- (5) The complete calibration can take up to 17mJ of energy from the battery over a time of 24ms. In default mode, calibration is performed sparingly, typically when re-enabling the NWP and when the temperature has changed by more than  $20^\circ\text{C}$ . There are two additional calibration modes that may be used to reduced or completely eliminate the calibration event. For further details, see the [CC3120](#), [CC3220 SimpleLink™ Wi-Fi® and IoT Network Processor Programmer's Guide](#).

## 7.5 TX Power and IBAT versus TX Power Level Settings

图 7-1, 图 7-2, and 图 7-3 show TX Power and IBAT versus TX power level settings for modulations of 1 DSSS, 6 OFDM, and 54 OFDM, respectively.

In 图 7-1, the area enclosed in the circle represents a significant reduction in current during transition from TX power level 3 to level 4. In the case of lower range requirements (14-dBm output power), TI recommends using TX power level 4 to reduce the current.

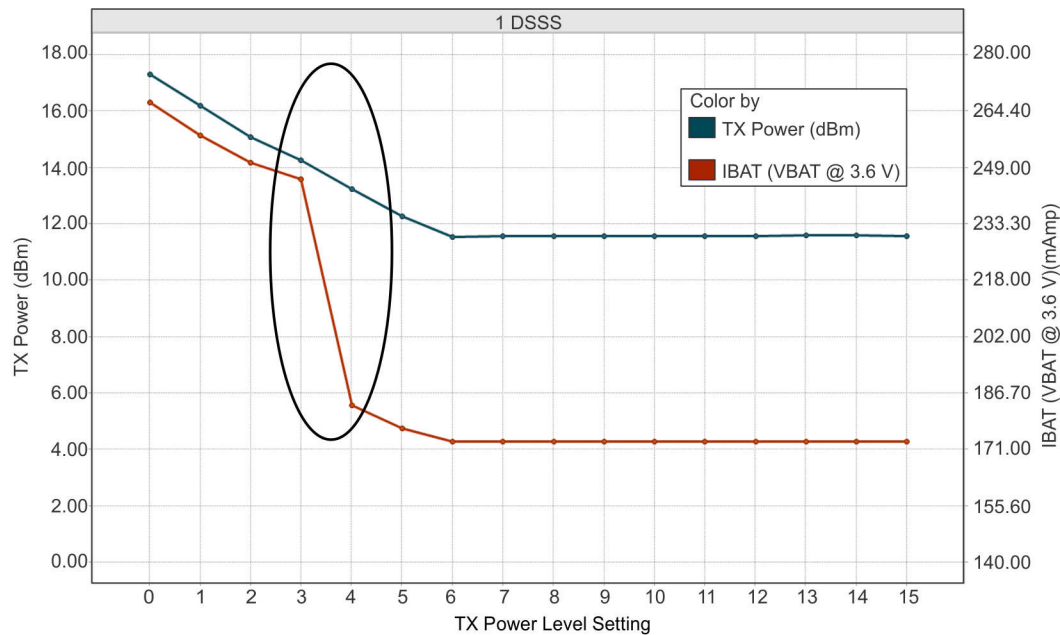


图 7-1. TX Power and IBAT vs TX Power Level Settings (1 DSSS)

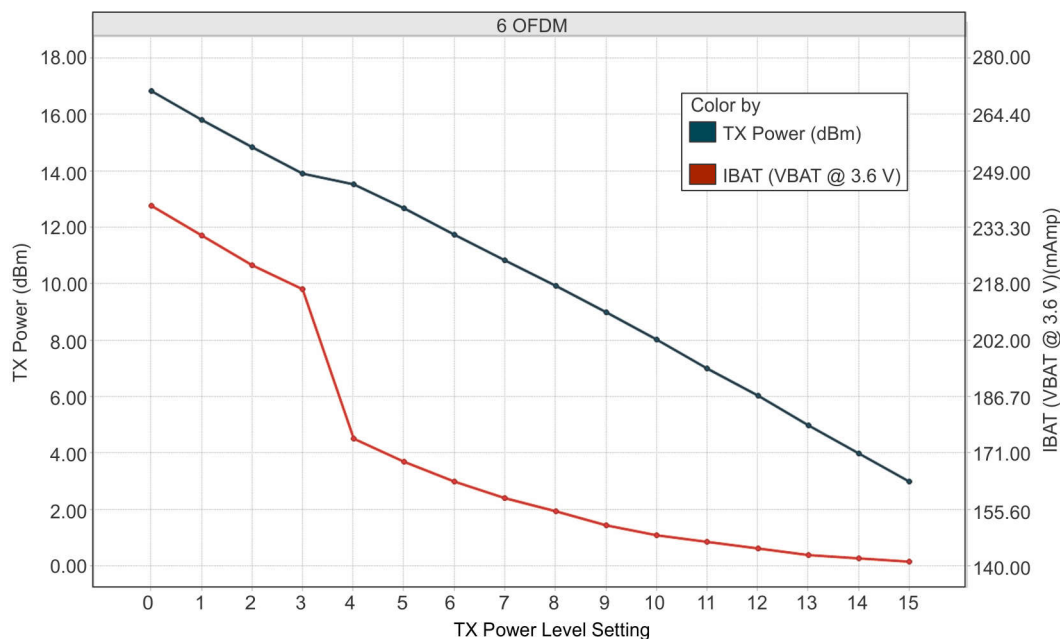
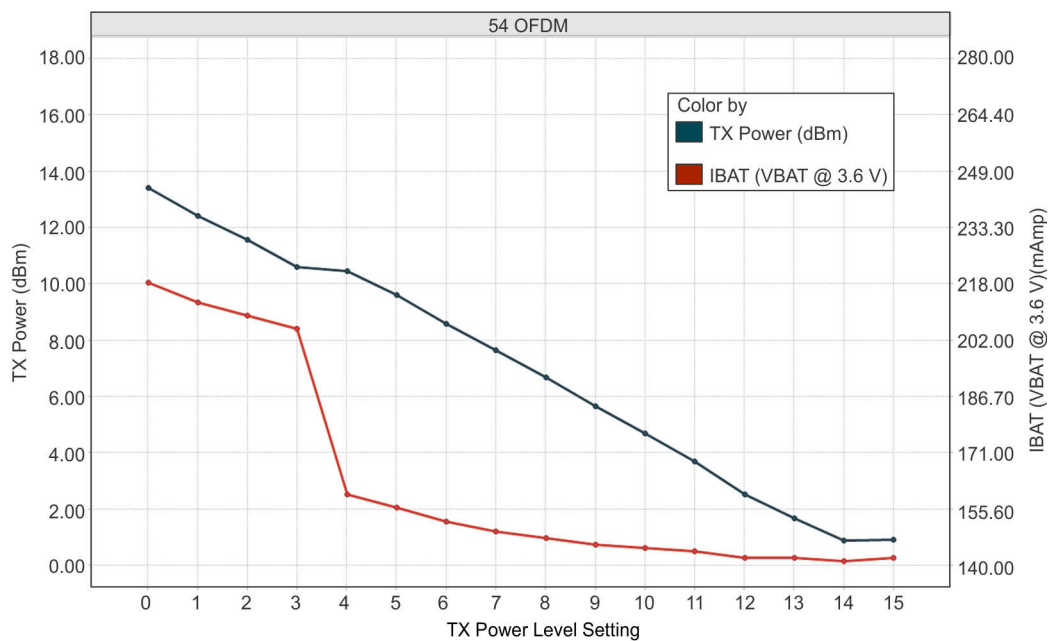


图 7-2. TX Power and IBAT vs TX Power Level Settings (6 OFDM)



**图 7-3. TX Power and IBAT vs TX Power Level Settings (54 OFDM)**

## 7.6 Brownout and Blackout Conditions

The device enters a brownout condition when the input voltage dips below  $V_{\text{BROWNOUT}}$  (see 图 7-4 and 图 7-5). This condition must be considered during design of the power supply routing, especially if operating from a battery. High-current operations, such as a TX packet or any external activity (not necessarily related directly to networking) can cause a drop in the supply voltage, potentially triggering a brownout condition. The resistance includes the internal resistance of the battery, contact resistance of the battery holder (four contacts for a 2× AA battery), and the wiring and PCB routing resistance.

### 备注

When the device is in the Hibernate state, brownout is not detected; only blackout is in effect during the Hibernate state.

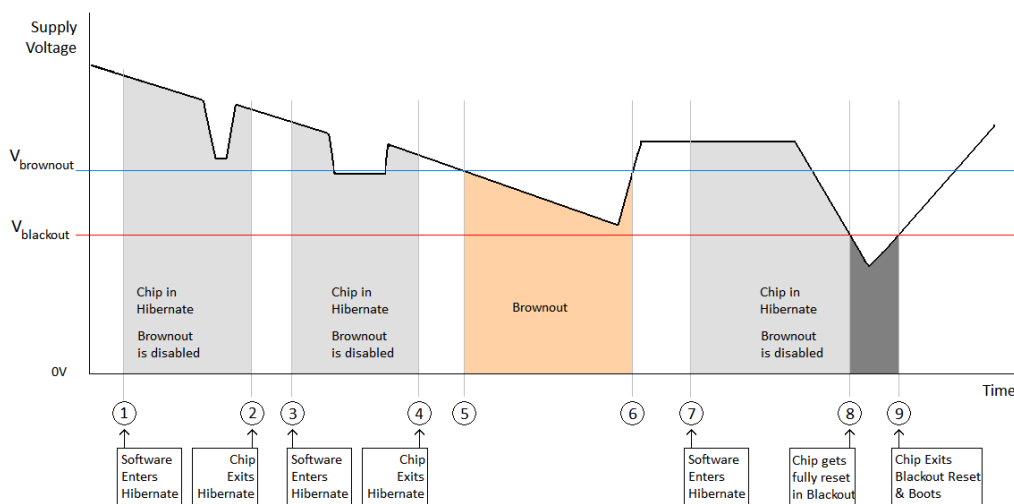


图 7-4. Brownout and Blackout Levels (1 of 2)

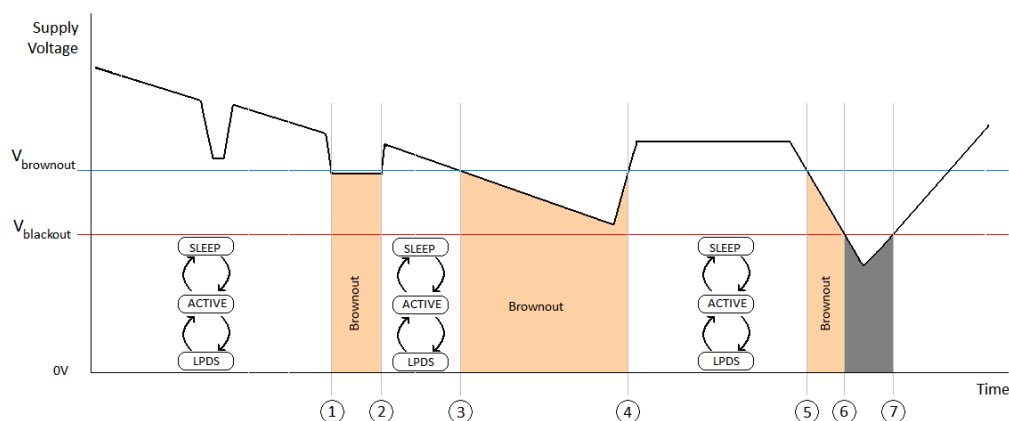


图 7-5. Brownout and Blackout Levels (2 of 2)

In the brownout condition, all sections of the CC3120MOD (including the 32kHz RTC) shut down except for the Hibernate module, which remains on. The current in this state can reach approximately 400μA. The blackout condition is equivalent to a hardware reset event in which all states within the device are lost.

表 7-1 lists the brownout and blackout voltage levels.

**表 7-1. Brownout and Blackout Voltage Levels**

| CONDITION             | VOLTAGE LEVEL | UNIT |
|-----------------------|---------------|------|
| $V_{\text{brownout}}$ | 2.1           | V    |
| $V_{\text{blackout}}$ | 1.67          | V    |

## 7.7 Electrical Characteristics

$T_A = 25^\circ\text{C}$ ,  $V_{\text{BAT}} = 3.3\text{ V}$

| PARAMETER       |                           | TEST CONDITIONS <sup>(2)</sup>                                                                       | MIN                         | NOM | MAX                            | UNIT |
|-----------------|---------------------------|------------------------------------------------------------------------------------------------------|-----------------------------|-----|--------------------------------|------|
| $C_{\text{IN}}$ | Pin capacitance           |                                                                                                      |                             | 4   |                                | pF   |
| $V_{\text{IH}}$ | High-level input voltage  |                                                                                                      | $0.65 \times V_{\text{DD}}$ |     | $V_{\text{DD}} + 0.5\text{ V}$ | V    |
| $V_{\text{IL}}$ | Low-level input voltage   |                                                                                                      | - 0.5                       |     | $0.35 \times V_{\text{DD}}$    | V    |
| $I_{\text{IH}}$ | High-level input current  |                                                                                                      |                             | 5   |                                | nA   |
| $I_{\text{IL}}$ | Low-level input current   |                                                                                                      |                             | 5   |                                | nA   |
| $V_{\text{OH}}$ | High-level output voltage | IL = 2 mA; configured I/O drive strength = 2 mA;<br>$2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$ |                             |     | $V_{\text{DD}} \times 0.8$     | V    |
|                 |                           | IL = 4 mA; configured I/O drive strength = 4 mA;<br>$2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$ |                             |     | $V_{\text{DD}} \times 0.7$     | V    |
|                 |                           | IL = 8 mA; configured I/O drive strength = 8 mA;<br>$2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$ |                             |     | $V_{\text{DD}} \times 0.7$     | V    |
|                 |                           | IL = 2 mA; configured I/O drive strength = 2 mA;<br>$2.3\text{ V} \leq V_{\text{DD}} < 2.4\text{ V}$ |                             |     | $V_{\text{DD}} \times 0.75$    | V    |
| $V_{\text{OL}}$ | Low-level output voltage  | IL = 2 mA; configured I/O drive strength = 2 mA;<br>$2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$ | $V_{\text{DD}} \times 0.2$  |     |                                | V    |
|                 |                           | IL = 4 mA; configured I/O drive strength = 4 mA;<br>$2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$ | $V_{\text{DD}} \times 0.2$  |     |                                | V    |
|                 |                           | IL = 8 mA; configured I/O drive strength = 8 mA;<br>$2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$ | $V_{\text{DD}} \times 0.2$  |     |                                | V    |
|                 |                           | IL = 2 mA; configured I/O drive strength = 2 mA;<br>$2.3\text{ V} \leq V_{\text{DD}} < 2.4\text{ V}$ | $V_{\text{DD}} \times 0.25$ |     |                                | V    |
| $I_{\text{OH}}$ | High-level source current | 2-mA drive                                                                                           |                             | 2   |                                | mA   |
|                 |                           | 4-mA drive                                                                                           |                             | 4   |                                |      |
|                 |                           | 6-mA drive                                                                                           |                             | 6   |                                |      |
| $I_{\text{OL}}$ | Low-level sink current    | 2-mA drive                                                                                           |                             | 2   |                                | mA   |
|                 |                           | 4-mA drive                                                                                           |                             | 4   |                                |      |
|                 |                           | 6-mA drive                                                                                           |                             | 6   |                                |      |
| $V_{\text{IL}}$ | nRESET <sup>(1)</sup>     |                                                                                                      |                             | 0.6 |                                | V    |

(1) The nRESET pin must be held below 0.6 V for the device to register a reset.

(2) TI recommends using the lowest possible drive strength that is adequate for the applications. This recommendation minimizes the risk of interference to the WLAN radio and reduces any potential degradation of RF sensitivity and performance. The default drive strength setting is 6 mA.

## 7.8 WLAN Receiver Characteristics

$T_A = 25^\circ\text{C}$ ,  $V_{BAT} = 2.3$  to  $3.6$  V. Parameters measured at module pin on channel 6 (2437 MHz).

| PARAMETER                                                                                       | RATE              | MIN | TYP    | MAX | UNIT |
|-------------------------------------------------------------------------------------------------|-------------------|-----|--------|-----|------|
| Sensitivity<br>(8% PER for 11b rates, 10% PER for 11g or 11n rates)<br>(10% PER) <sup>(1)</sup> | 1 DSSS            |     | - 95.0 |     | dBm  |
|                                                                                                 | 2 DSSS            |     | - 93.0 |     |      |
|                                                                                                 | 11 CCK            |     | - 87.0 |     |      |
|                                                                                                 | 6 OFDM            |     | - 89.5 |     |      |
|                                                                                                 | 9 OFDM            |     | - 89.0 |     |      |
|                                                                                                 | 18 OFDM           |     | - 85.5 |     |      |
|                                                                                                 | 36 OFDM           |     | - 79.5 |     |      |
|                                                                                                 | 54 OFDM           |     | - 73.5 |     |      |
|                                                                                                 | MCS7 (Mixed Mode) |     | - 69.5 |     |      |
| Maximum input level<br>(10% PER)                                                                | 802.11b           |     | - 3.0  |     | dBm  |
|                                                                                                 | 802.11g           |     | - 9.0  |     |      |

(1) Sensitivity is 1-dB worse on channel 13 (2472 MHz).

## 7.9 WLAN Transmitter Characteristics

$T_A = 25^\circ\text{C}$ ,  $V_{BAT} = 2.3$  to  $3.6$  V. Parameters measured at module pin on 6 (2437 MHz)<sup>(1) (2)</sup>.

| PARAMETER                                                               | RATE              | MIN  | TYP  | MAX | UNIT |
|-------------------------------------------------------------------------|-------------------|------|------|-----|------|
| Max RMS Output Power measured at 1 dB<br>from IEEE spectral mask or EVM | 1 DSSS            |      | 17.0 |     | dBm  |
|                                                                         | 2 DSSS            |      | 17.0 |     |      |
|                                                                         | 11 CCK            |      | 17.3 |     |      |
|                                                                         | 6 OFDM            |      | 16.3 |     |      |
|                                                                         | 9 OFDM            |      | 16.3 |     |      |
|                                                                         | 18 OFDM           |      | 16.0 |     |      |
|                                                                         | 36 OFDM           |      | 15.0 |     |      |
|                                                                         | 54 OFDM           |      | 13.5 |     |      |
|                                                                         | MCS7 (Mixed Mode) |      | 12   |     |      |
| Transmit center frequency accuracy                                      |                   | - 20 |      | 20  | ppm  |

(1) The edge channels (2412 MHz and 2462 MHz) have reduced TX power to meet FCC emission limits.

(2) Power of 802.11b rates are reduced to meet ETSI requirements.

## 7.10 Reset Requirement

| PARAMETER                                            | MIN | TYP                   | MAX | UNIT          |
|------------------------------------------------------|-----|-----------------------|-----|---------------|
| $V_{IH}$ Operation mode level                        |     | $0.65 \times V_{BAT}$ |     | V             |
| $V_{IL}$ Shutdown mode level <sup>(1)</sup>          | 0   | 0.6                   |     | V             |
| Minimum time for nReset low for resetting the module | 5   |                       |     | ms            |
| $T_r$ and $T_f$ Rise and fall times                  |     | 20                    |     | $\mu\text{s}$ |

(1) The nRESET pin must be held below 0.6 V for the module to register a reset.

## 7.11 Thermal Resistance Characteristics for MOB Package

| NAME            | DESCRIPTION             | °C/W | AIR FLOW (m/s) |
|-----------------|-------------------------|------|----------------|
| $R_{\theta JC}$ | Junction-to-case        | 11.4 | 0.00           |
| $R_{\theta JB}$ | Junction-to-board       | 8.0  | 0.00           |
| $R_{\theta JA}$ | Junction-to-free air    | 18.7 | 0.00           |
| $\Psi_{JT}$     | Junction-to-package top | 5.3  | 0.00           |
| $\Psi_{JB}$     | Junction-to-board       | 7.7  | 0.00           |

## 7.12 Timing and Switching Characteristics

### 7.12.1 Power-Up Sequencing

For proper start-up of the CC3120MOD module, perform the recommended power-up sequencing as follows:

1. Tie  $V_{BAT1}$  (pin 37) and  $V_{BAT2}$  (pin 40) together on the board.
2. Hold the nRESET pin low while the supplies are ramping up.

图 7-6 shows the reset timing diagram for the first-time power-up and reset removal.

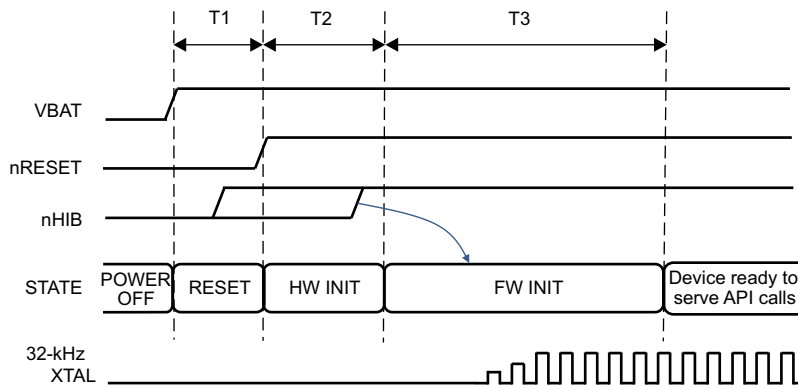


图 7-6. First-Time Power-Up and Reset Removal Timing Diagram

表 7-2 describes the timing requirements for the first-time power-up and reset removal.

表 7-2. First-Time Power-Up and Reset Removal Timing Requirements

| ITEM | NAME                  | DESCRIPTION                                                                            | MIN | TYP  | MAX | UNIT |
|------|-----------------------|----------------------------------------------------------------------------------------|-----|------|-----|------|
| T1   | Supply settling time  | Depends on application board power supply, decoupling capacitor, and so on             |     | 3    |     | ms   |
| T2   | Hardware wake-up time |                                                                                        |     | 25   |     | ms   |
| T3   | Initialization time   | Internal 32-kHz XTAL settling plus firmware initialization time plus radio calibration |     | 1.35 |     | s    |

### 7.12.2 Power-Down Sequencing

For proper power down of the CC3120MOD module, ensure that the nRESET (pin 35) and nHIB (pin 4) pins have remained in a known state for a minimum of 200 ms before removing power from the module.

### 7.12.3 Device Reset

When a device restart is required, the user may issue a negative pulse on either the nHIB pin (pin 4) or on the nRESET pin (pin 35), keeping the other pulled high, depending on the configuration of the platform. If the nRESET pin is used, the user must insure the following:

- A high-to-low reset pulse (on pin 35) of at least 200-ms duration

To ensure a proper reset sequence, the user must call the sl\_stop function prior to toggling the reset.

### 7.12.4 Wakeup From HIBERNATE Mode Timing

图 7-7 shows the timing diagram for wakeup from HIBERNATE mode.

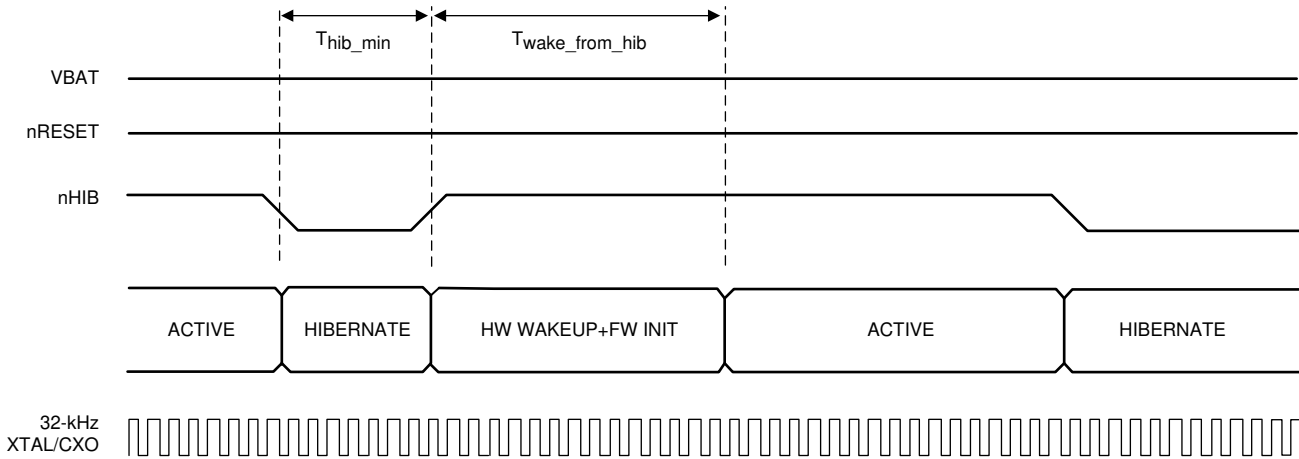


图 7-7. nHIB Timing Diagram

#### 备注

The internal 32.768-kHz XTAL is kept enabled by default when the chip goes into HIBERNATE mode in response to nHIB being pulled low.

表 7-3 describes the timing requirements for nHIB.

表 7-3. nHIB Timing Requirements

| ITEM                       | NAME                                                   | DESCRIPTION                                          | MIN | TYP | MAX | UNIT |
|----------------------------|--------------------------------------------------------|------------------------------------------------------|-----|-----|-----|------|
| T <sub>hib_min</sub>       | Minimum hibernate time                                 | Minimum pulse width of nHIB being low <sup>(1)</sup> | 10  |     |     | ms   |
| T <sub>wake_from_hib</sub> | Hardware wakeup time plus firmware initialization time | See <sup>(2)</sup>                                   |     | 50  |     | ms   |

(1) If temperature changes by more than 20°C, initialization time from HIB can increase by 200 ms due to radio calibration.

(2) Ensure that the nHIB pulse width is kept above the minimum requirement under all conditions (such as power up, MCU reset, and so on).

## 7.13 External Interfaces

This section describes the external interfaces supported by the CC3120MOD module, as follows:

- SPI Host
- Host UART
- External Flash

### 7.13.1 SPI Host Interface

The device interfaces to an external host using the SPI. The CC3120MOD module can interrupt the host using the HOST\_INTR line to initiate the data transfer over the interface. The SPI host interface can work up to a speed of 20 MHz.

图 7-8 shows the SPI host interface.

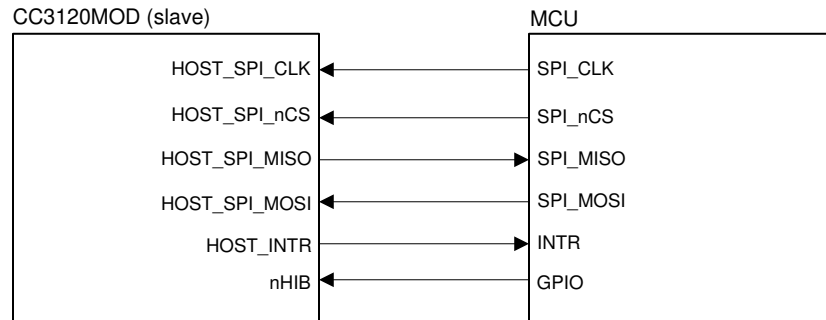


图 7-8. SPI Host Interface

表 7-4 lists the SPI host interface pins.

表 7-4. SPI Host Interface

| PIN NAME      | DESCRIPTION                                                                                       |
|---------------|---------------------------------------------------------------------------------------------------|
| HOST_SPI_CLK  | Clock (up to 20 MHz) from MCU host to CC3120MOD module                                            |
| HOST_SPI_nCS  | CS (active low) signal from MCU host to CC3120MOD module                                          |
| HOST_SPI_MOSI | Data from MCU host to CC3120MOD module                                                            |
| HOST_INTR     | Interrupt from CC3120MOD module to MCU host                                                       |
| HOST_SPI_MISO | Data from CC3120MOD module to MCU host                                                            |
| nHIB          | Active-low signal that commands the CC3120MOD module to enter hibernate mode (lowest power state) |

图 7-9 shows the host SPI timing diagram.

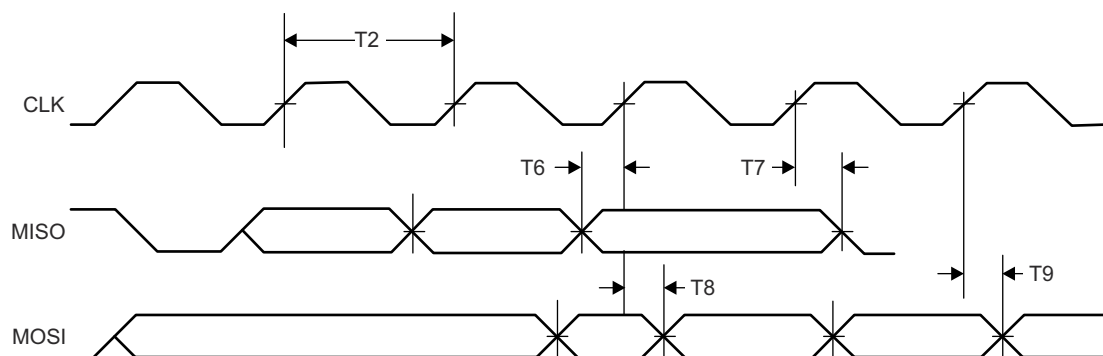


图 7-9. Host SPI Timing

表 7-5 lists the host SPI timing parameters.

表 7-5. Host SPI Timing Parameters

| PARAMETER NUMBER | DESCRIPTION                                                  | MIN | MAX | UNIT |
|------------------|--------------------------------------------------------------|-----|-----|------|
| T1               | F <sup>(1)</sup> Clock frequency at V <sub>BAT</sub> = 3.3 V |     | 20  | MHz  |
|                  | Clock frequency at V <sub>BAT</sub> = 2.3 V                  |     | 12  |      |

表 7-5. Host SPI Timing Parameters (续)

| PARAMETER NUMBER |                                     | DESCRIPTION          | MIN | MAX | UNIT |
|------------------|-------------------------------------|----------------------|-----|-----|------|
| T2               | $t_{\text{clk}}$ <sup>(1) (2)</sup> | Clock period         | 50  |     | ns   |
| T3               | $t_{\text{LP}}$ <sup>(1)</sup>      | Clock low period     |     | 25  | ns   |
| T4               | $t_{\text{HT}}$ <sup>(1)</sup>      | Clock high period    |     | 25  | ns   |
| T5               | D <sup>(1)</sup>                    | Duty cycle           | 45% | 55% |      |
| T6               | $t_{\text{IS}}$ <sup>(1)</sup>      | RX data setup time   | 4   |     | ns   |
| T7               | $t_{\text{IH}}$ <sup>(1)</sup>      | RX data hold time    | 4   |     | ns   |
| T8               | $t_{\text{OD}}$ <sup>(1)</sup>      | TX data output delay |     | 20  | ns   |
| T9               | $t_{\text{OH}}$ <sup>(1)</sup>      | TX data hold time    |     | 24  | ns   |

(1) The timing parameter has a maximum load of 20 pF at 3.3 V.

(2) Ensure that nCS (active-low signal) is asserted 10 ns before the clock is toggled. The nCS signal can be deasserted 10 ns after the clock edge.

### 7.13.2 Host UART Interface

The SimpleLink™ device requires the UART configuration described in 表 7-6.

表 7-6. SimpleLink™ UART Configuration

| PROPERTY                | SUPPORTED CC3120 CONFIGURATION                                                                           |
|-------------------------|----------------------------------------------------------------------------------------------------------|
| Baud rate               | 115200 bps, no auto-baud rate detection, can be changed by the host up to 3 Mbps using a special command |
| Data bits               | 8 bits                                                                                                   |
| Flow control            | CTS/RTS                                                                                                  |
| Parity                  | None                                                                                                     |
| Stop bits               | 1                                                                                                        |
| Bit order               | Least significant bit (LSB) first                                                                        |
| Host interrupt polarity | Active high                                                                                              |
| Host interrupt mode     | Rising edge or level 1                                                                                   |
| Endianness              | Little-endian only <sup>(1)</sup>                                                                        |

(1) The SimpleLink device does not support automatic detection of the host length while using the UART interface.

#### 7.13.2.1 5-Wire UART Topology

图 7-10 shows the typical 5-wire UART topology comprised of four standard UART lines plus one IRQ line from the device to the host controller to allow efficient low power mode.

图 7-10 shows the typical and recommended UART topology because it offers the maximum communication reliability and flexibility between the host and the SimpleLink device.

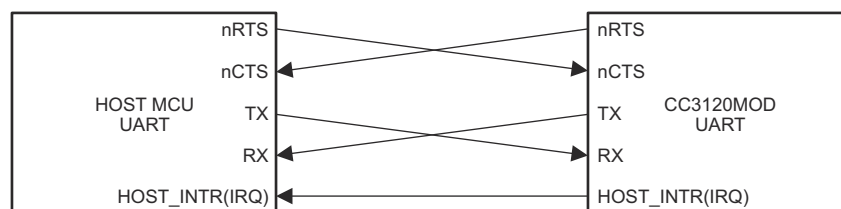


图 7-10. Typical 5-Wire UART Topology

### 7.13.2.2 4-Wire UART Topology

The 4-wire UART topology eliminates the host IRQ line (see 图 7-11). Using this topology requires one of the following conditions to be met:

- Host is always awake or active.
- Host goes to sleep, but the UART module has receiver start-edge detection for automatic wake up and does not lose data.

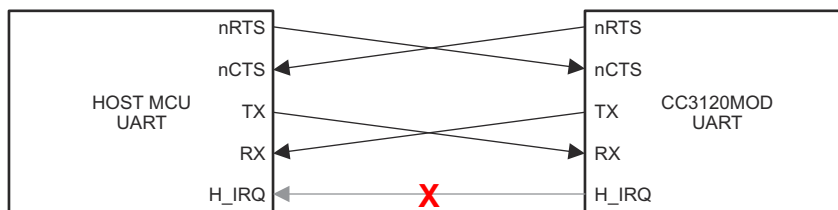


图 7-11. 4-Wire UART Configuration

### 7.13.2.3 3-Wire UART Topology

The 3-wire UART topology requires only the following lines (see 图 7-12).

- RX
- TX
- nCTS

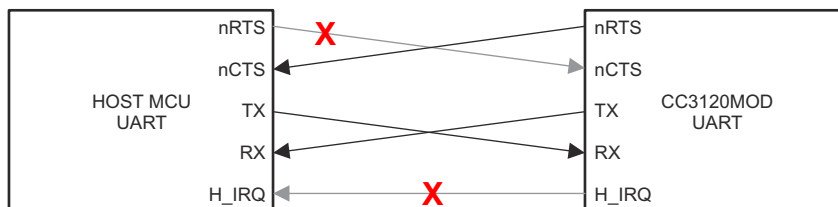


图 7-12. 3-Wire UART Topology

Using 3-wire topology requires one of the following conditions to be met:

- Host always stays awake or active.
- Host goes to sleep, but the UART module has receiver start-edge detection for auto wake up and does not lose data.
- Host can always receive any amount of data transmitted by the SimpleLink device because there is no flow control in this direction.

Because there is no full flow control, the host cannot stop the SimpleLink device to send its data; thus, the following parameters must be carefully considered:

- Maximum baud rate
- RX character interrupt latency and low-level driver jitter buffer
- Time consumed by the user's application

### 7.13.3 External Flash Interface

The CC3120MOD module includes the Macronix 32-Mbit serial Flash. The serial Flash can be programmed directly via the external Flash interface (pins 13, 14, 15, and 17). Note that during normal operation, the external Flash interface should remain unconnected.

For timing details of the 32-Mbit Macronix serial Flash, see the [MX25R3235F](#) data sheet.

## 8 Detailed Description

### 8.1 Overview

The CC3120MOD Wi-Fi module contains a dedicated Arm® MCU that offloads many of the networking activities from the host MCU. Including an 802.11 b/g/n radio, baseband, and MAC with a powerful crypto engine for a fast, secure WLAN and Internet connections with 256-bit encryption. The CC3120MOD module supports station, AP, and Wi-Fi Direct modes. The module also supports WPA2 personal and enterprise security, WPS 2.0, and WPA3 personal and enterprise security. The Wi-Fi network processor includes an embedded IPv6 and IPv4 TCP/IP stack.

### 8.2 Module Features

#### 8.2.1 WLAN

The WLAN features are as follows:

- 802.11 b/g/n integrated radio, modem, and MAC supporting WLAN communication as a BSS station, AP, and Wi-Fi Direct client and group owner with CCK and OFDM rates in the 2.4GHz ISM band, channels 1 to 13.

---

#### 备注

802.11n is supported only in Wi-Fi station, Wi-Fi direct, and P2P client modes.

- Autocalibrated radio with a single-ended 50  $\Omega$  interface enables easy connection to the antenna without requiring expertise in radio circuit design.
- Advanced connection manager with multiple user-configurable profiles stored in a serial Flash allows automatic, fast connection to an access point without user or host intervention.
- Supports all common Wi-Fi security modes for personal and enterprise networks, with on-chip security accelerators, including WEP, WPA/WPA2 PSK, and WPA2 Enterprise (802.1x), WPA3 Personal, and WPA3 Enterprise.

---

#### 备注

When using WPA Enterprise security modes, the TLS socket used to communicate with the Radius server is limited to TLSv1.0.

- Smart provisioning options deeply integrated within the device provide a comprehensive end-to-end solution. Elaborate event notifications to the host enable the application to control the provisioning decision flow. The wide variety of Wi-Fi provisioning methods include:
  - Access Point using HTTPS
  - SmartConfig Technology: a 1-step, 1-time process to connect a CC3120MOD-enabled module to the home wireless network, removing dependency on the I/O capabilities of the host MCU; thus, the device is usable by deeply embedded applications.
- 802.11 transceiver mode transmits and receives proprietary data through a socket without adding MAC or PHY headers, and provides the option to select the working channel, rate, and transmitted power. The receiver mode works together with the filtering options.

#### 8.2.2 Network Stack

The network stack features are as follows:

- Integrated IPv4, IPv6, and TCP/IP stack with BSD socket APIs for simple Internet connectivity with any MCU, microprocessor, or ASIC

---

#### 备注

Not all APIs are 100% BSD compliant. Not all BSD APIs are supported.

- Support of 16 simultaneous TCP, UDP, or RAW sockets
- Support of 6 simultaneous SSL/TLS sockets
- Built-in network protocols:

- Static IP, LLA, DHCPv4, DHCPv6 (Stateful) with DAD and Stateless auto configuration
- ARP, ICMPv4, IGMP, ICMPv6, MLD, ND
- DNS client for easy connection to the local network and the Internet
- Built-in network application and utilities:
  - HTTP/HTTPS
    - Web page content stored on serial Flash
    - RESTful APIs for setting and configuring application content
    - Dynamic user callbacks
- Service discovery: Multicast DNS service discovery allows a client to advertise its service without a centralized server. After connecting to the access point, the CC3120 device provides critical information, such as device name, IP, vendor, and port number.
- DHCP server
- Ping

表 8-1 summarizes the NWP features.

**表 8-1. NWP Features**

| FEATURES                           | DESCRIPTION                                                                                                                                 |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Wi-Fi standards                    | 802.11b/g/n station<br>802.11b/g AP supporting up to four stations<br>Wi-Fi Direct client and group owner                                   |
| Wi-Fi                              | Channels 1 to 13                                                                                                                            |
| Wi-Fi security                     | WEP, WPA/WPA2 PSK, WPA2 enterprise (802.1x), WPA3 personal and enterprise                                                                   |
| Wi-Fi provisioning                 | SmartConfig technology, Wi-Fi protected setup (WPS2), AP mode with internal HTTP/HTTPS web server                                           |
| IP protocols                       | IPv4 and IPv6                                                                                                                               |
| IP addressing                      | Static IP, LLA, DHCPv4, DHCPv6 (Stateful) with DAD and stateless auto configuration                                                         |
| Cross layer                        | ARP, ICMPv4, IGMP, ICMPv6, MLD, NDP                                                                                                         |
| Transport                          | UDP, TCP<br>SSLv3.0/TLSv1.0/TLSv1.1/TLSv1.2<br>RAW IP                                                                                       |
| Network applications and utilities | Ping<br>HTTP/HTTPS web server<br>mDNS<br>DNS-SD<br>DHCP server                                                                              |
| Host interface                     | UART/SPI                                                                                                                                    |
| Security                           | Secure file system<br>Unique ID and private key for device authentication<br>Crypto utilities<br>Secure content delivery                    |
| Power management                   | Enhanced power policy management uses 802.11 power save and deep sleep power modes                                                          |
| Other                              | RF Transceiver<br>Programmable RX Filters with Events trigger mechanism including WoWLAN<br>Recovery mechanism – Restore to factory default |

### 8.2.2.1 Security

The SimpleLink Wi-Fi CC3120MOD internet-on-a-chip module enhances the security capabilities available for development of IoT devices, while completely offloading these activities from the MCU to the networking subsystem. The security capabilities include the following key features:

#### Wi-Fi and Internet security

- Personal and enterprise Wi-Fi security
  - Personal standards
    - AES (WPA2-PSK)
    - TKIP (WPA-PSK)
    - WEP
- **Enterprise standards**
  - EAP Fast
  - EAP PEAPv0 MSCHAPv2
  - EAP PEAPv0 TLS
  - EAP PEAPv1 TLS EAP LS
  - EAP TTLS TLS
  - EAP TTLS MSCHAPv2
- **Secure sockets**
  - Protocol versions: SSL v3/TLS 1.0/TLS 1.1/TLS 1.2
  - On-chip powerful crypto engine for fast, secure Wi-Fi and internet connections with 256-bit AES encryption for TLS and SSL connections
  - Ciphers suites
    - SL\_SEC\_MASK\_SSL\_RSA\_WITH\_RC4\_128\_SHA
    - SL\_SEC\_MASK\_SSL\_RSA\_WITH\_RC4\_128\_MD5
    - SL\_SEC\_MASK\_TLS\_RSA\_WITH\_AES\_256\_CBC\_SHA
    - SL\_SEC\_MASK\_TLS\_DHE\_RSA\_WITH\_AES\_256\_CBC\_SHA
    - SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_AES\_256\_CBC\_SHA
    - SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_RC4\_128\_SHA
    - SL\_SEC\_MASK\_TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA256
    - SL\_SEC\_MASK\_TLS\_RSA\_WITH\_AES\_256\_CBC\_SHA256
    - SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_AES\_128\_CBC\_SHA256
    - SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_AES\_128\_CBC\_SHA256
    - SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_AES\_128\_CBC\_SHA
    - SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_AES\_256\_CBC\_SHA
    - SL\_SEC\_MASK\_TLS\_RSA\_WITH\_AES\_128\_GCM\_SHA256
    - SL\_SEC\_MASK\_TLS\_RSA\_WITH\_AES\_256\_GCM\_SHA384
    - SL\_SEC\_MASK\_TLS\_DHE\_RSA\_WITH\_AES\_128\_GCM\_SHA256
    - SL\_SEC\_MASK\_TLS\_DHE\_RSA\_WITH\_AES\_256\_GCM\_SHA384
    - SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_AES\_128\_GCM\_SHA256
    - SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_AES\_256\_GCM\_SHA384
    - SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_AES\_128\_GCM\_SHA256
    - SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_AES\_256\_GCM\_SHA384
    - SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_CHACHA20\_POLY1305\_SHA256
    - SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_CHACHA20\_POLY1305\_SHA256
    - SL\_SEC\_MASK\_TLS\_DHE\_RSA\_WITH\_CHACHA20\_POLY1305\_SHA256
  - Server authentication
  - Client authentication

- Domain name verification
- Socket upgrade to secure socket – STARTTLS
- Secure HTTP server (HTTPS)
- The trusted root-certificate catalog verifies that the CA used by the application is trusted and known secure content delivery.
- The TI root-of-trust public key is a hardware-based mechanism that allows authenticating TI as the genuine origin of a given content using asymmetric keys.
- Secure content delivery allows file transfer to the system in a secure way on any unsecured tunnel.
- **Code and data security**
  - Secured network information: Network passwords and certificates are encrypted
  - Secured and authenticated service pack: SP is signed based on TI certificate

### 8.2.3 Host Interface and Driver

- Interfaces over a 4-wire SPI with any MCU or a processor at a clock speed of 20MHz
- Interfaces over UART with any MCU with a baud rate up to 3Mbps. A low footprint driver is provided for TI MCUs and is easily ported to any processor or ASIC.
- Simple APIs enable easy integration with any single-threaded or multithreaded application.

### 8.2.4 System

- Connects directly to a battery
- Ultra-low leakage when disabled (hibernate mode) with a current of less than 5  $\mu$ A with the RTC running and 1 $\mu$ A when in shutdown mode.
- Integrated clock sources

## 8.3 Power-Management Subsystem

The CC3120MOD power-management subsystem contains DC-DC converters to accommodate the differing voltage or current requirements of the system.

The CC3120MOD is a fully integrated module-based WLAN radio solution used on an embedded system with a wide-voltage supply range. The internal power management, including DC-DC converters and LDOs, generates all of the voltages required for the module to operate from a wide variety of input sources. For maximum flexibility, the module can operate in the modes described in the following sections.

### 8.3.1 $V_{BAT}$ Wide-Voltage Connection

In the wide-voltage battery connection, the module can be directly connected to two AA alkaline batteries. All other voltages required to operate the device are generated internally by the DC-DC converters. This scheme is the most common mode for the device because it supports wide-voltage operation from 2.3 to 3.6V.

## 8.4 Low-Power Operating Modes

This section describes the low-power modes supported by the module to optimize battery life.

### 8.4.1 Low-Power Deep Sleep

The low-power deep-sleep (LPDS) mode is an energy-efficient and transparent sleep mode that is entered automatically during periods of inactivity based on internal power optimization algorithms. The module can wake up in less than 3ms from the internal timer or from any incoming host command. The typical battery drain in this mode is 115 $\mu$ A. During LPDS mode, the module retains the software state and certain configuration information. The operation is transparent to the external host; thus, no additional handshake is required to enter or exit this sleep mode.

### 8.4.2 Hibernate

The hibernate mode is the lowest power mode in which all of the digital logic is power-gated. Only a small section of the logic powered directly by the main input supply is retained. The real-time clock (RTC) is kept

running and the module wakes up when the n\_HIB line is asserted by the host driver. The typical battery drain in this mode is 5µA. The wake-up time is longer than LPDS mode at about 50ms.

#### 8.4.3 Shutdown

Shutdown mode is the lowest power-mode system-wise. All device logics are off, including the realtime clock (RTC). The typical battery drain in this mode is 1µA. The wake-up time in this mode is longer than Hibernate at approximately 1.1 seconds.

### 8.5 Restoring Factory Default Configuration

The device has an internal recovery mechanism that allows rolling back the file system to its predefined factory image or restoring the factory default parameters of the device. The factory image is kept in a separate sector on the sFLASH in a secure manner and cannot be accessed from the host processor. The following restore modes are supported:

- None—no factory restore settings
- Enable restore of factory default parameters
- Enable restore of factory image and factory default parameters

The restore process is performed by pulling or forcing SOP[2:0] = 110 pins and toggling the nRESET pin from low to high.

The process is fail-safe and resumes operation if a power failure occurs before the restore is finished. The restore process typically takes about 8 seconds, depending on the attributes of the serial Flash vendor.

### 8.6 Device Certification and Qualification

The TI CC3120MOD module is certified for FCC, IC, ETSI/CE, Japan MIC, and SRRC. Moreover, the module is also Wi-Fi certified with the ability to request a certificate transfer for Wi-Fi alliance members. TI customers that build products based on the TI CC3120MOD can save in testing cost and time per product family.

The CC3120MOD module is certified to the standards listed in 表 8-2 (with IDs where applicable).

**表 8-2. CC3120MOD List of Certifications**

| REGULATORY BODY  | SPECIFICATION                                    | ID (IF APPLICABLE) |
|------------------|--------------------------------------------------|--------------------|
| FCC (USA)        | Part 15C + MPE FCC RF Exposure                   | Z64-CC3120MOD      |
| IC (Canada)      | RSS-102 (MPE) and RSS-247 (Wi-Fi)                | 451I-CC3120MOD     |
| ETSI/CE (Europe) | EN300328 v2.1.1 (2.4 GHz Wi-Fi)                  | —                  |
|                  | EN62311:2008 (MPE)                               | —                  |
|                  | EN301489-1 v2.1.1 (EMC General)                  | —                  |
|                  | EN301489-17 v3.1.1 (EMC Wi-Fi)                   | —                  |
|                  | EN60950-1:2006/A11:2009/A1:2010/A12:2011/A2:2013 | —                  |
| Japan MIC        | Article 49-20 of ORRE                            | 201-170387         |
| SRRC (China)     | EN300328 v1.7.1                                  | 2017DJ2946(M)      |

### 8.6.1 FCC Certification and Statement

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#### **FCC RF Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure limits. This transmitter must not be co-located or operating with any other antenna or transmitter.

The TI CC3120MOD module is certified for FCC as a single-modular transmitter. The module is an FCC-certified radio module that carries a modular grant.

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

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

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation of the device.

### 8.6.2 Industry Canada (IC) Certification and Statement

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#### **IC RF Radiation Exposure Statement:**

To comply with IC RF exposure requirements, this device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter.

Pour se conformer aux exigences de conformité RF canadienne l'exposition, cet appareil et son antenne ne doivent pas être co-localisés ou fonctionnant en conjonction avec une autre antenne ou transmetteur.

The TI CC3120MOD module is certified for IC as a single-modular transmitter. The TI CC3120MOD module meets IC modular approval and labeling requirements. The IC follows the same testing and rules as the FCC regarding certified modules in authorized equipment.

This device complies with Industry Canada licence-exempt RSS standards.

Operation is subject to the following two conditions:

- This device may not cause interference.
- This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes:

- L'appareil ne doit pas produire de brouillage
- L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

### 8.6.3 ETSI/CE Certification

The TI CC3120MOD module is CE certified with certifications to the appropriate EU radio and EMC directives summarized in the Declaration of Conformity, evidenced by the CE mark. The module is tested against the new Radio Equipment Directive (RE-D). [See the full text of the EU Declaration of Conformity.](#)

#### 8.6.4 Japan MIC Certification

The TI CC3120MOD module is MIC certified against article 49-20 and the relevant articles of the Ordinance Regulating Radio Equipment.

Operation is subject to the following condition:

- The HOST system does not contain a wireless wide area network (WWAN) device.

#### 8.6.5 SRRC Certification and Statement

The TI CC3120MOD module complies with the SRRC's rules and regulations for a limited module approval (LMA).

Operation is subject to the following condition:

- The host system does not contain a WWAN device.

In addition, the host system using an approved LMA radio requires the following:

- New CMIIT ID
- Requires radiated-related testing only
- The host system's new SRRC certificate contains the LMA's CMIIT ID information
- The host system must be affixed with the new MIIT ID (not the LMA's CMIIT ID), following the SRRC labeling requirements.

#### 备注

When an LMA radio is embedded into a host system, it does not mean the host system complies with SRRC rules and regulations. The manufacturer of the host system is responsible for ensuring that the combined system complies with SRRC rules and regulations.

### 8.7 Module Markings

图 8-1 shows the markings for the SimpleLink CC3120 Module.<sup>1</sup>

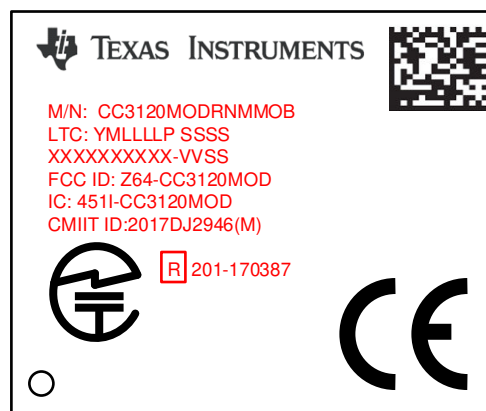


图 8-1. SimpleLink™ CC3120 Module Markings

<sup>1</sup> Drawings are representative. Content or placement may vary from what is illustrated.

表 8-3 lists the SimpleLink module markings.

**表 8-3. Marking Descriptions**

| MARKING                                                                                      | DESCRIPTION                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CC3120MODRNMMOB                                                                              | Model                                                                                                                                                                                                      |
| YMLLLLP SSSS                                                                                 | LTC (lot trace code): <ul style="list-style-type: none"> <li>Y = Year</li> <li>M = Month</li> <li>LLLL = Assembly lot code</li> <li>P = Reserved for internal use</li> <li>SSSS = Serial number</li> </ul> |
| XXXXXXXXXX-VVSS                                                                              | TI internal use only                                                                                                                                                                                       |
| Z64-CC3120MOD                                                                                | FCC ID: single modular FCC grant ID                                                                                                                                                                        |
| 451I-CC3120MOD                                                                               | IC: single modular IC grant ID                                                                                                                                                                             |
| 2017DJ2946(M)                                                                                | CMIIT: limited modular SRRC grant ID                                                                                                                                                                       |
|             | MIC compliance mark                                                                                                                                                                                        |
|  201-170387 | MIC ID: modular MIC grant ID                                                                                                                                                                               |
| CE                                                                                           | CE compliance mark                                                                                                                                                                                         |

## 8.8 End Product Labeling

This module is designed to comply with the FCC single modular FCC grant, FCC ID: Z64-CC3120MOD. The host system using this module must display a visible label indicating the following text:

Contains FCC ID: Z64-CC3120MOD

This module is designed to comply with the IC single modular IC grant, IC: 451I-CC3120MOD. The host system using this module must display a visible label indicating the following text:

Contains IC: 451I-CC3120MOD

This module is designed to comply with the JP statement, 201-170387. The host system using this module must display a visible label indicating the following text:

Contains transmitter module with certificate number: 201-170387.

## 8.9 Manual Information to the End User

The OEM integrator must be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual must include all required regulatory information/warning as shown in this manual.

## 9 Applications, Implementation, and Layout

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### 备注

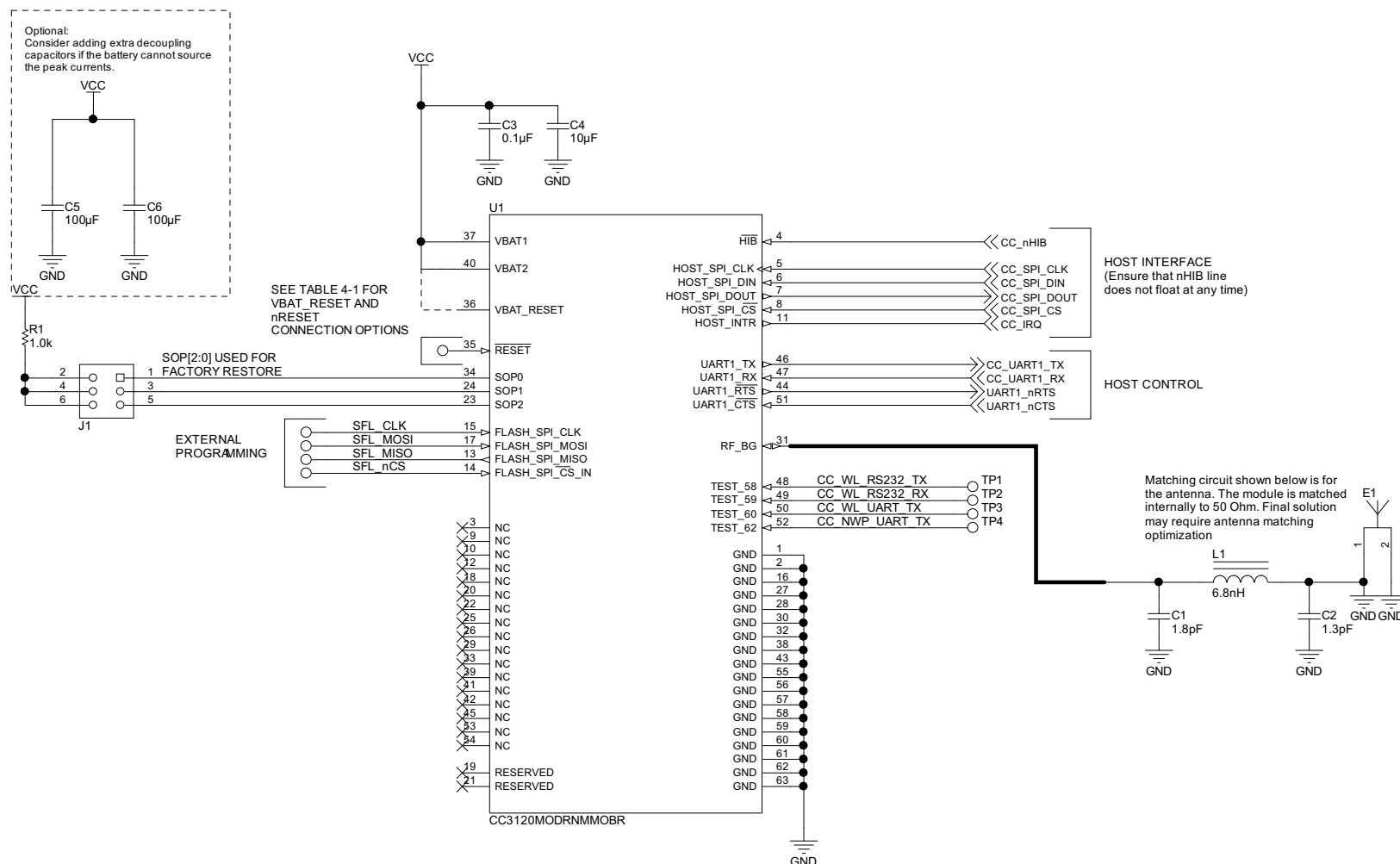
以下应用部分中的信息不属于 TI 器件规格的范围，TI 不担保其准确性和完整性。TI 的客户应负责确定器件是否适用于其应用。客户应验证并测试其设计，以确保系统功能。

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## 9.1 Application Information

### 9.1.1 Typical Application

图 9-1 shows the typical application schematic using the CC3120MOD module. For a full operation reference design, see the [BoosterPack](#) that uses the CC3120MOD module.



This is the reference schematic and not an actual board design. For the board files and BOM, refer to the CC3120MODBOOST in the [CC3120MOD Tools Folder](#).

**图 9-1. CC3120MOD Module Reference Schematic**

表 9-1 lists the bill of materials for a typical application using the CC3120MOD module shown in 图 9-1.

**表 9-1. Bill of Materials**

| QUANTITY | DESIGNATOR | VALUE        | MANUFACTURER      | PART NUMBER        | DESCRIPTION                                                                                                                    |
|----------|------------|--------------|-------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 1        | C1         | 1.8 pF       | MuRata            | GCM1555C1H1R8BA16  | CAP, CERM, 1.8 pF, 50 V, ±0.1 pF, C0G/NP0, 0402                                                                                |
| 1        | C2         | 1.3 pF       | MuRata            | GCM1555C1H1R3BA16  | CAP, CERM, 1.3 pF, 50 V, ±5%, C0G/NP0, 0402                                                                                    |
| 1        | C3         | 0.1 µF       | MuRata            | GRM155R60J104KA01D | CAP, CERM, 0.1 µF, 6.3 V, ±10%, X5R, 0402                                                                                      |
| 1        | C4         | 10 µF        | MuRata            | GRM21BR61A106KE19L | CAP, CERM, 10 µF, 10 V, ±10%, X5R, 0805                                                                                        |
| 2        | C5, C6     | 100 µF       | MuRata            | GRM31CR60J107ME39L | CAP, CERM, 100 µF, 6.3 V, ±20%, X5R, 1206                                                                                      |
| 1        | E1         | 2.45-GHz Ant | Taiyo Yuden       | AH316M245001-T     | ANT BLUETOOTH W-LAN ZIGBEE WIMAX, SMD                                                                                          |
| 1        | L1         | 6.8 nH       | MuRata            | LQP15MN6N8B02      | 6.8 nH Unshielded Thin Film Inductor 130 mA 900 mΩ Max 0402                                                                    |
| 1        | R1         | 1.0 k        | Vishay-Dale       | CRCW04021K00JNED   | RES, 1.0 k, 5%, 0.063 W, 0402                                                                                                  |
| 1        | U1         | CC3120MOD    | Texas Instruments | CC3120MODRNMMOBR   | SimpleLink Certified Wi-Fi Network Processor Internet-of-Things Module Solution for MCU Applications, MOB0063A (SIP MODULE-63) |

### 9.1.2 Power Supply Decoupling and Bulk Capacitors

Depending upon routing resistors and battery type, TI recommends adding two 100- $\mu$ F ceramic capacitors to help provide the peak current drawn by the CC3120MOD module.

---

#### 备注

The module enters a brown-out condition whenever the input voltage dips below  $V_{BROWN}$  (see 图 7-4 and 图 7-5). This condition must be considered during design of the power supply routing specifically if operating from a battery. For more details on brown-out consideration, see 节 7.6.

---

### 9.1.3 Reset

The module features an internal RC circuit to reset the device during power ON. The nRESET pin must be held below 0.6 V for at least 5 ms for the device to successfully reset.

### 9.1.4 Unused Pins

All unused pins can be left unconnected without any concern to leakage current.

## 9.2 PCB Layout Guidelines

This section details the PCB guidelines to speed up the PCB design using the CC3120MOD Module. The integrator of the CC3120MOD module must comply with the PCB layout recommendations described in the following subsections to preserve/minimize the risk with regulatory certifications for FCC, IC, CE, MIC, and SRRC. Moreover, TI recommends customers follow the guidelines described in this section to achieve similar performance to that obtained with the TI reference design.

### 9.2.1 General Layout Recommendations

Ensure that the following general layout recommendations are followed:

- Have a solid ground plane and ground vias under the module for stable system and thermal dissipation.
- Do **not** run signal traces underneath the module on a layer where the module is mounted.
- RF traces must have 50- $\Omega$  impedance.
- RF trace bends must be made with gradual curves, and 90 degree bends must be avoided.
- RF traces must **not** have sharp corners.
- There must be no traces or ground under the antenna section.
- RF traces must have via stitching on the ground plane beside the RF trace on both sides.
- RF traces must be as short as possible. The antenna, RF traces, and the module must be on the edge of the PCB product in consideration of the product enclosure material and proximity.

### 9.2.2 RF Layout Recommendations

The RF section of this wireless device gets top priority in terms of layout. It is very important for the RF section to be laid out correctly to ensure optimum performance from the device. A poor layout can cause low-output power, EVM degradation, sensitivity degradation, and mask violations.

图 9-2 shows the RF placement and routing of the CC3120MOD module.

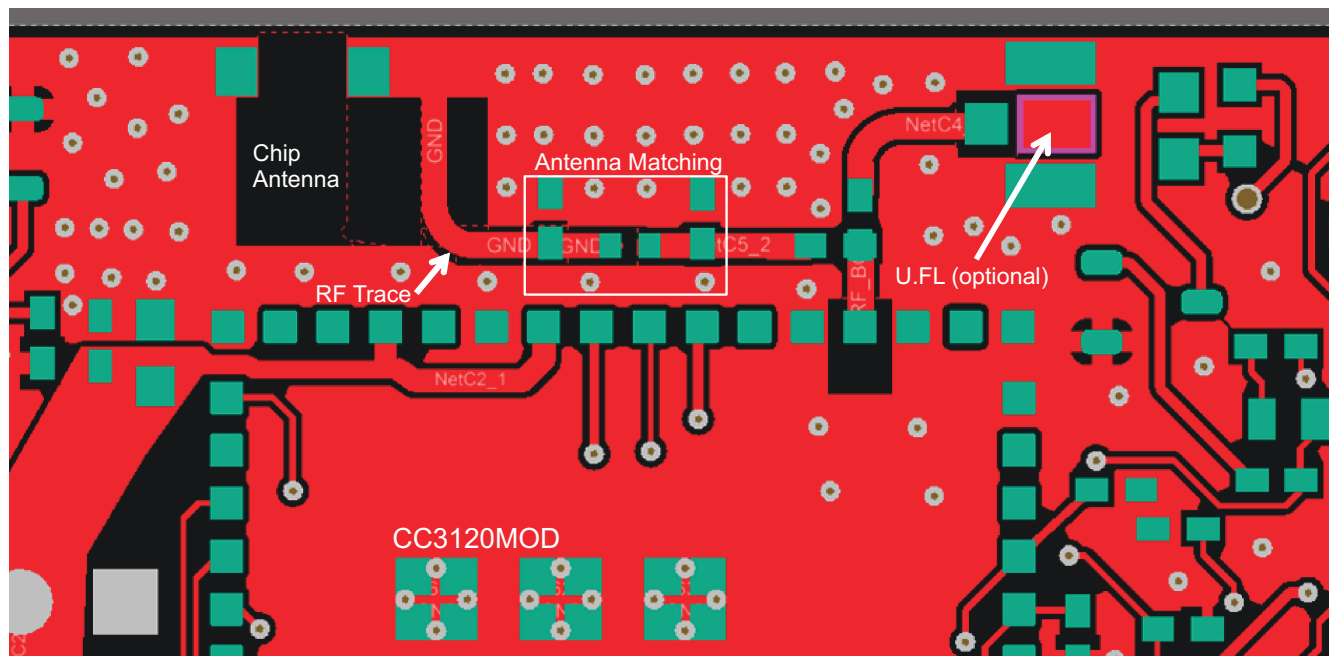


图 9-2. RF Section Layout

For optimal RF performance, ensure the copper cut out on the top layer under the RF-BG pin, (pin 31), is as shown in 图 9-3.

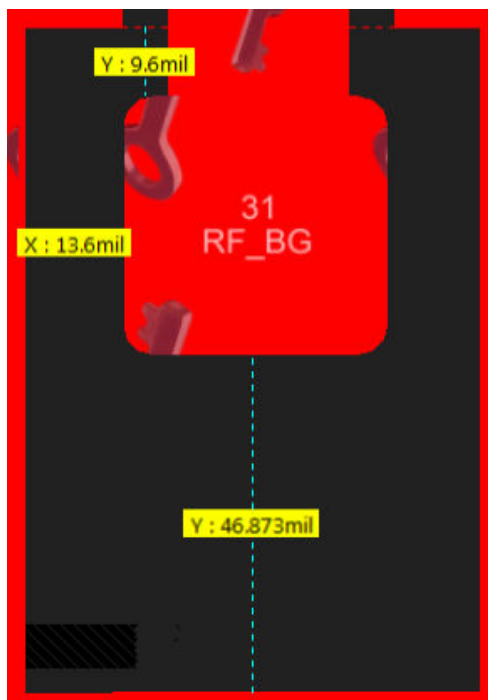


图 9-3. Top Layer Copper Pull Back on RF Pads

### 9.2.3 Antenna Placement and Routing

The antenna is the element used to convert the guided waves on the PCB traces to the free space electromagnetic radiation. The placement and layout of the antenna are the keys to increased range and data rates. 表 9-2 provides a summary of the recommended antennas to use with the CC3120MOD module.

表 9-2. Antenna Guidelines

| SR NO. | GUIDELINES                                                                                                                                                                                                                                                              |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | Place the antenna on an edge or corner of the PCB.                                                                                                                                                                                                                      |
| 2      | Ensure that no signals are routed across the antenna elements on all the layers of the PCB.                                                                                                                                                                             |
| 3      | Most antennas, including the chip antenna used on the booster pack, require ground clearance on all the layers of the PCB. Ensure that the ground is cleared on inner layers as well.                                                                                   |
| 4      | Ensure that there is provision to place matching components for the antenna. These must be tuned for best return loss when the complete board is assembled. Any plastics or casing must also be mounted while tuning the antenna because this can impact the impedance. |
| 5      | Ensure that the antenna impedance is 50 $\Omega$ because the device is rated to work only with a 50- $\Omega$ system.                                                                                                                                                   |
| 6      | In case of printed antenna, ensure that the simulation is performed with the solder mask in consideration.                                                                                                                                                              |
| 7      | Ensure that the antenna has a near omni-directional pattern.                                                                                                                                                                                                            |
| 8      | The feed point of the antenna is required to be grounded. This is only for the antenna type used on the CC3120MOD BoosterPack. Refer to the specific antenna data sheets for the recommendations.                                                                       |
| 9      | To use the FCC certification of the module, see the <a href="#">CC3120 and CC3220 Radio Certifications</a> wiki page on CC3120 Radio certification                                                                                                                      |

表 9-3 lists the recommended antennas to use with the CC3120MOD module. Other antennas may be available for use with the CC3120MOD module. See the [CC3120 and CC3220 Radio Certifications](#) wiki page.

表 9-3. Recommended Components

| CHOICE | PART NUMBER    | MANUFACTURER | NOTES                                                                    |
|--------|----------------|--------------|--------------------------------------------------------------------------|
| 1      | AH316M245001-T | Taiyo Yuden  | Can be placed at the edge of the PCB using the least amount of PCB area. |

### 9.2.4 Transmission Line Considerations

The RF signal from the device is routed to the antenna using a Coplanar Waveguide with ground (CPW-G) structure. CPW-G structure offers the maximum amount of isolation and the best possible shielding to the RF lines. In addition to the ground on the L1 layer, placing GND vias along the line also provides additional shielding. 图 9-4 shows a cross section of the coplanar waveguide with the critical dimensions.

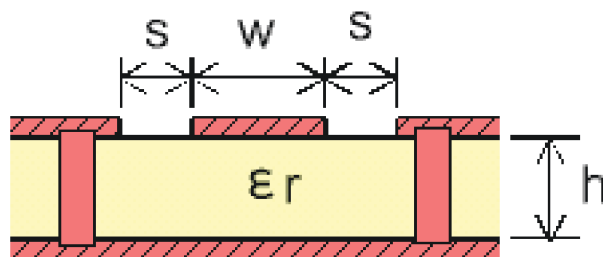


图 9-4. Coplanar Waveguide (Cross Section)

图 9-5 shows the top view of the coplanar waveguide with GND and via stitching.

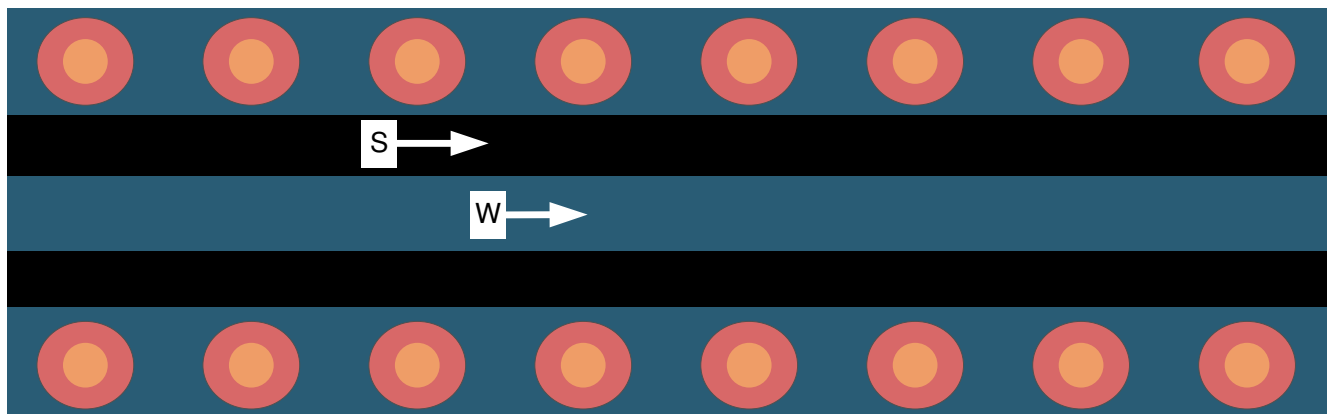


图 9-5. CPW With GND and Via Stitching (Top View)

The recommended values for the PCB are provided for 2-layer boards in 表 9-4 and 4-layer boards in 表 9-5.

表 9-4. Recommended PCB Values for 2-Layer Board  
(L1 to L2 = 42.1 mils)

| PARAMETER           | VALUE | UNIT |
|---------------------|-------|------|
| W                   | 24.5  | mils |
| S                   | 6.5   | mils |
| H                   | 42.1  | mils |
| Er (FR-4 substrate) | 4.8   |      |

表 9-5. Recommended PCB Values for 4-Layer Board  
(L1 to L2 = 16 mils)

| PARAMETER           | VALUE | UNITS |
|---------------------|-------|-------|
| W                   | 21    | mils  |
| S                   | 10    | mils  |
| H                   | 16    | mils  |
| Er (FR-4 substrate) | 4.5   |       |

## 10 Environmental Requirements and Specifications

### 10.1 Temperature

#### 10.1.1 PCB Bending

The PCB bending specification will maintain planeness at a thickness of less than 0.1 mm.

### 10.2 Handling Environment

#### 10.2.1 Terminals

The product is mounted with motherboard through land-grid array (LGA). To prevent poor soldering, do not touch the LGA portion by hand.

#### 10.2.2 Falling

The mounted components will be damaged if the product falls or is dropped. Such damage may cause the product to malfunction.

### 10.3 Storage Condition

#### 10.3.1 Moisture Barrier Bag Before Opened

A moisture barrier bag must be stored in a temperature of less than 30°C with humidity under 85% RH. The calculated shelf life for the dry-packed product will be 12 months from the date the bag is sealed.

#### 10.3.2 Moisture Barrier Bag Open

Humidity indicator cards must be blue, < 30%.

### 10.4 Baking Conditions

Products require baking before mounting if:

- Humidity indicator cards read > 30%
- Temp < 30°C, humidity < 70% RH, over 96 hours

Baking condition: 90°C, 12 – 24 hours

Baking times: 1 time

### 10.5 Soldering and Reflow Condition

- Heating method: Conventional convection or IR convection
- Temperature measurement: Thermocouple d = 0.1 mm to 0.2 mm CA (K) or CC (T) at soldering portion or equivalent method
- Solder paste composition: Sn/3.0 Ag/0.5 Cu
- Allowable reflow soldering times: 2 times based on the reflow soldering profile (see [图 10-1](#))
- Temperature profile: Reflow soldering will be done according to the temperature profile (see [图 10-1](#))
- Peak temp: 245°C

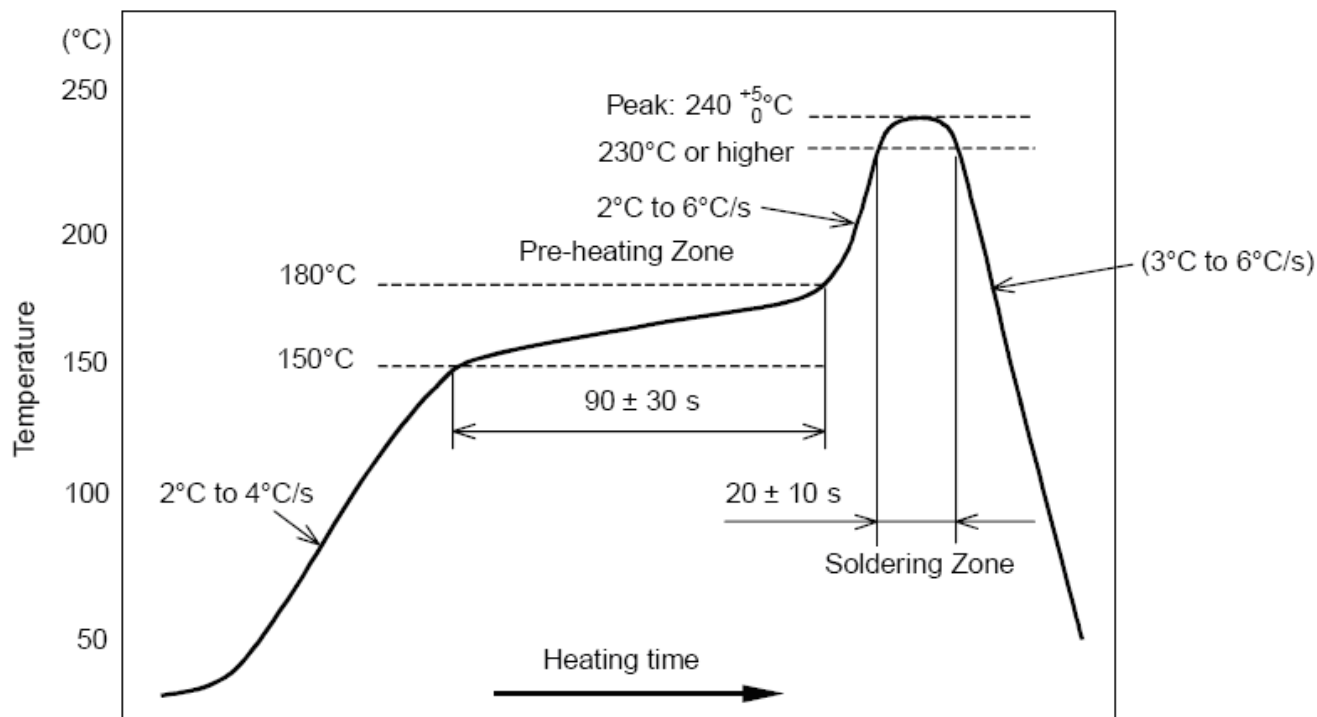


图 10-1. Temperature Profile for Evaluation of Solder Heat Resistance of a Component (at Solder Joint)

#### 备注

TI does not recommend the use of conformal coating or similar material on the SimpleLink module. This coating can lead to localized stress on the WCSP solder connections inside the module and impact the device reliability. Use caution during the module assembly process to the final PCB to avoid the presence of foreign material inside the module.

## 11 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed in this section.

### 11.1 Device Nomenclature

To designate the stages in the product development cycle, TI assigns prefixes to the part numbers of the CC3120MOD and support tools (see 图 11-1).

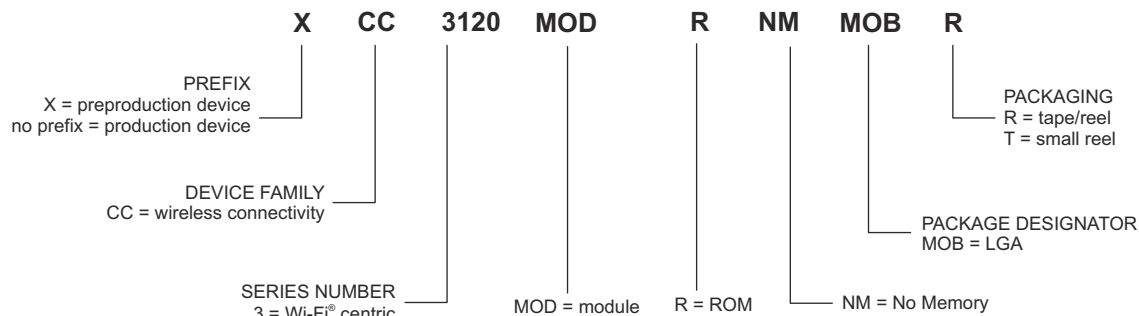


图 11-1. CC3120MOD Module Nomenclature

For orderable part numbers of CC3120MOD modules in the MOB package types, see the Package Option Addendum of this document, the TI website ([www.ti.com](http://www.ti.com)), or contact your TI sales representative.

### 11.2 Development Tools and Software

For the most up-to-date list of development tools and software, visit the [CC3120MOD tools and software](#) page. You can also click on the Alert me button in the top-right corner of the page to stay informed about updates related to the CC3120MOD.

#### SimpleLink™ Wi-Fi® Starter Pro

The SimpleLink™ Wi-Fi® Starter Pro mobile application is a new mobile app for SimpleLink provisioning. It goes with the embedded provisioning library and example that runs on the device side. The new provisioning release is TI's recommendation for Wi-Fi provisioning using SimpleLink Wi-Fi products. It implements advanced AP mode provisioning with feedback and fallback options to ensure a successful process has been accomplished. Customers can use both the embedded library and the mobile library for integration into their end products.

#### SimpleLink™ Wi-Fi® CC3120 SDK Plugin

The CC3120 SDK contains drivers, many sample applications for Wi-Fi features and internet, and documentation needed to use the CC3120 Internet-on-a chip solution. This SDK can be used with TI's MSP432P401R LaunchPad™, or SimpleLink Studio, a PC tool that allows MCU development with the CC3120. You can also use the SDK as example code for any platform. All sample applications in the SDK are supported on TI's MSP432P401R ultra-low-power MCUs with Code Composer Studio™ IDE and TI RTOS. In addition, many of the applications support IAR.

#### SimpleLink™ Studio for CC31xx

SimpleLink™ Studio for CC31xx is a Windows®-based software tool used to aid in the development of embedded networking applications and software for microcontrollers. Using SimpleLink Studio for CC31xx, embedded software developers can develop and test applications using any desktop IDE, such as Visual Studio or Eclipse, and connect their applications to the cloud using the CC31xx BoosterPack™. The application can then be easily ported to any microcontroller. With the SimpleLink Wi-Fi CC31xx solution, customers now have the flexibility to add Wi-Fi to any microcontroller (MCU). This Internet-on-a chip solution contains all you need to easily create IoT solutions – security, quick connection, cloud support and more. For more information on CC31xx devices, visit <http://www.ti.com/simplelinkwifi>.

### SimpleLink™ Wi-Fi® Radio Testing Tool

The SimpleLink™ Wi-Fi® Radio Testing Tool is a Windows-based software tool for RF evaluation and testing of SimpleLink Wi-Fi CC3120 and CC3220 designs during development and certification. The tool enables low-level radio testing capabilities by manually setting the radio into transmit or receive modes. Use of the tool requires familiarity and knowledge of radio circuit theory and radio test methods.

### Uniflash Standalone Flash Tool for TI Microcontrollers (MCU), Sitara Processors and SimpleLink™ Devices

CCS Uniflash is a standalone tool used to program onchip flash memory on TI MCUs and onboard flash memory for Sitara processors. Uniflash has a GUI, command line, and scripting interface. CCS Uniflash is available free of charge.

## 11.3 Firmware Updates

TI updates features in the service pack for this module with no published schedule. Due to the ongoing changes, TI recommends that users have the latest service pack in their module for production.

To stay informed, sign up with the SDK Alert me button in the top-right corner of the product page or visit [here](#).

## 11.4 Documentation Support

To receive notification of documentation updates — including silicon errata — go to the CC3120MOD product folder on ti.com, and click the Alert me button in the upper-right corner. This registers you to receive a weekly digest of updated product information (if any). For change details, check the revision history of any revised document. The current documentation which describes the processor, related peripherals, and other technical collateral follows. The following documents provide support for the CC3120MOD module.

### Application Reports

#### *Transfer of TI's Wi-Fi® Alliance Certifications to Products Based on SimpleLink™*

This document explains how to employ the Wi-Fi® Alliance (WFA) derivative certification transfer policy to transfer a WFA certification, already obtained by Texas Instruments, to a system you have developed.

#### *SimpleLink™ CC3x20 Wi-Fi® Internet-on-a chip™ Solution Built- In Security Features*

The SimpleLink Wi-Fi CC3120 and CC3220 Internet-on-a chip family of devices from Texas Instruments offers a wide range of built-in security features to help developers address a variety of security needs, which is achieved without any processing burden on the main MCU. This document describes these security-related features and provides recommendations for leveraging each feature in the context of practical system implementation.

#### *Using Serial Flash on SimpleLink™ CC3x20 Wi-Fi® and Internet-of- Things Devices*

This application note is divided into two parts. The first part provides important guidelines and best practice design techniques to consider when choosing and embedding a serial flash paired with the CC3120 and CC3220 (CC3x20) devices. The second part describes the file system, along with guidelines and considerations for system designers working with the CC3x20 devices.

#### *SimpleLink™ CC3x20 Wi-Fi® and Internet-of-Things Over-the-Air Update*

This document describes the OTA library for the SimpleLink™ Wi-Fi® CC3x20 family of devices from Texas Instruments and explains how to prepare a new cloud-ready update to be downloaded by the OTA library.

#### *SimpleLink™ CC3x20 Wi-Fi® Internet-on-a chip™ Solution Device Provisioning*

This guide describes the provisioning process, which provides the SimpleLink Wi-Fi device with the information (network name, password, and so forth) needed to connect to a wireless network.

#### *SimpleLink™ CC3x20 Wi-Fi® Internet-on-a chip™ Networking Subsystem Power Management*

This application report describes the best practices for power management and extended battery life for embedded low-power Wi-Fi devices such as the SimpleLink Wi-Fi Internet-on-a chip™ solution from Texas Instruments

## User's Guides

### [SimpleLink™ CC3x20 Wi-Fi® Embedded Programming](#)

This application note describes in detail additional options that leverage all the features UniFlash has to offer, but without the necessary connected PC. This option is referred to as Embedded Programming. To achieve embedded programming, bootloader protocol implemented over UART is described in detail.

### [UniFlash SimpleLink™ CC3x20 Wi-Fi® and IoC™ Solution ImageCreator and Pro](#)

This document describes the installation, operation, and usage of the SimpleLink ImageCreator tool as part of the UniFlash.

### [SimpleLink™ CC3x20 Wi-Fi® and Internet-of-Things Network Processor](#)

This document provides software (SW) programmers with all of the required knowledge for working with the networking subsystem of the SimpleLink Wi-Fi devices. This guide provides basic guidelines for writing robust, optimized networking host applications, and describes the capabilities of the networking subsystem. The guide contains some example code snapshots, to give users an idea of how to work with the host driver. More comprehensive code examples can be found in the formal software development kit (SDK). This guide does not provide a detailed description of the host driver APIs.

### [SimpleLink™ CC3x20 Wi-Fi® Provisioning for Mobile Applications](#)

This guide describes TI's SimpleLink™ Wi-Fi® provisioning solution for mobile applications, specifically on the usage of the Android™ and iOS® building blocks for UI requirements, networking, and provisioning APIs required for building the mobile application.

### [SimpleLink™ CC3120 Wi-Fi® Internet-on-a chip™ Solution SDK](#)

This guide is intended to help users in the initial setup and demonstration of the different demos in the CC3120 SDK. The guide lists the software and hardware components required to get started, and explains how to install the supported integrated development environment (IDE), SimpleLink CC3120 SDK, and the various other tools required.

### [SimpleLink™ CC3x20 Wi-Fi® and Internet-on-a chip™ Solution Radio Tool](#)

The Radio Tool serves as a control panel for direct access to the radio, and can be used for both the radio frequency (RF) evaluation and for certification purposes. This guide describes how to have the tool work seamlessly on Texas Instruments™ evaluation platforms such as the BoosterPack™ plus FTDI emulation board for CC3120 devices, and the LaunchPad™ for CC3220 devices.

### [SimpleLink™ CC3120 Wi-Fi® BoosterPack™ Plug-In Module and IoT Solution](#)

The SimpleLink Wi-Fi CC3120 wireless network processor from Texas Instruments™ provides users the flexibility to add Wi-Fi to any MCU. This user's guide explains the various configurations of the CC3120 BoosterPack™ Plug-In Module.

## More Literature

[RemoTI Manifest](#)

## Design Files

[SimpleLink™ CC3120MOD Wi-Fi® and Internet of Things CC3120 Hardware](#)

[SimpleLink™ CC3x20 Wi-Fi® and Internet of Things](#)

## 11.5 Trademarks

Wi-Fi CERTIFIED™ is a trademark of Wi-Fi Alliance.

Internet-on-a chip™, SmartConfig™, E2E™, LaunchPad™, Code Composer Studio™, and BoosterPack™ are trademarks of Texas Instruments.

SimpleLink™ is a trademark of TI.

Wi-Fi® and Wi-Fi Direct® are registered trademarks of Wi-Fi Alliance.

Arm® and Cortex® are registered trademarks of Arm Limited.

蓝牙® is a registered trademark of Bluetooth SIG Inc.

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## 11.6 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

## 11.7 术语表

**TI 术语表**      本术语表列出并解释了术语、首字母缩略词和定义。

## 12 Revision History

| Changes from Revision E (May 2021) to Revision F (December 2024)                                      | Page               |
|-------------------------------------------------------------------------------------------------------|--------------------|
| • Added the note on the TLS socket for WPA Enterprise security modes in <a href="#">节 8.2.1</a> ..... | <a href="#">24</a> |

| Changes from September 22, 2020 to May 13, 2021 (from Revision D (September 2020) to Revision E (May 2021)) | Page               |
|-------------------------------------------------------------------------------------------------------------|--------------------|
| • 新增了 WPA3 个人版和企业版至 <a href="#">节 1</a> .....                                                               | <a href="#">1</a>  |
| • 更新了整个文档中的表格、图和交叉参考的编号格式.....                                                                              | <a href="#">1</a>  |
| • 新增了 WPA3 个人版和企业版 <a href="#">节 3</a> .....                                                                | <a href="#">2</a>  |
| • Added WPA3 personal and enterprise <a href="#">节 8.1</a> .....                                            | <a href="#">24</a> |
| • Added WPA3 personal and enterprise <a href="#">节 8.2.1</a> .....                                          | <a href="#">24</a> |
| • Added WPA3 personal and enterprise to <a href="#">表 8-1</a> .....                                         | <a href="#">24</a> |

## 13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical packaging and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document.

### 13.1 Mechanical, Land, and Solder Paste Drawings

---

#### 备注

1. The total height of the module is 2.45 mm.
  2. The weight of the module is 0.00175 kg  $\pm$ 3%.
- 

---

#### 备注

1. All dimensions are in mm.
  2. Solder mask should be the same or 5% larger than the dimension of the pad
  3. Solder paste must be the same as the pin for all peripheral pads. For ground pins, make the solder paste 20% smaller than the pad.
-

## 13.2 Package Option Addendum

The CC3120MOD is only offered in a 750-unit real option.

### 13.2.1 Packaging Information

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>   | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> | Op Temp (°C) | Device Marking <sup>(4) (5)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|---------------------------|------------------|------------------------------|--------------|-----------------------------------|
| CC3120MODRNMMOBR | ACTIVE                | LGA          | MOB             | 63   | 750         | Green (RoHS and no Sb/Br) | Ni Au            | 3, 250°C                     | – 40 to 85   | CC3120MODRNMMOB                   |

- (1) The marketing status values are defined as follows:  
**ACTIVE:** Product device recommended for new designs.  
**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.  
**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.  
**PRE\_PROD** Unannounced device, not in production, not available for mass market, nor on the web, samples not available.  
**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.  
**OBSOLETE:** TI has discontinued the production of the device.
- (2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.  
**TBD:** The Pb-Free/Green conversion plan has not been defined.  
**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.  
**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.  
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)
- (3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.
- (4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device
- (5) Multiple Device markings will be inside parentheses. Only on Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.  
**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.  
 In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

### 13.3 Tape and Reel Information

Emboss tapping specification for MOC 1000 pin.

#### 13.3.1 Tape and Reel Specification

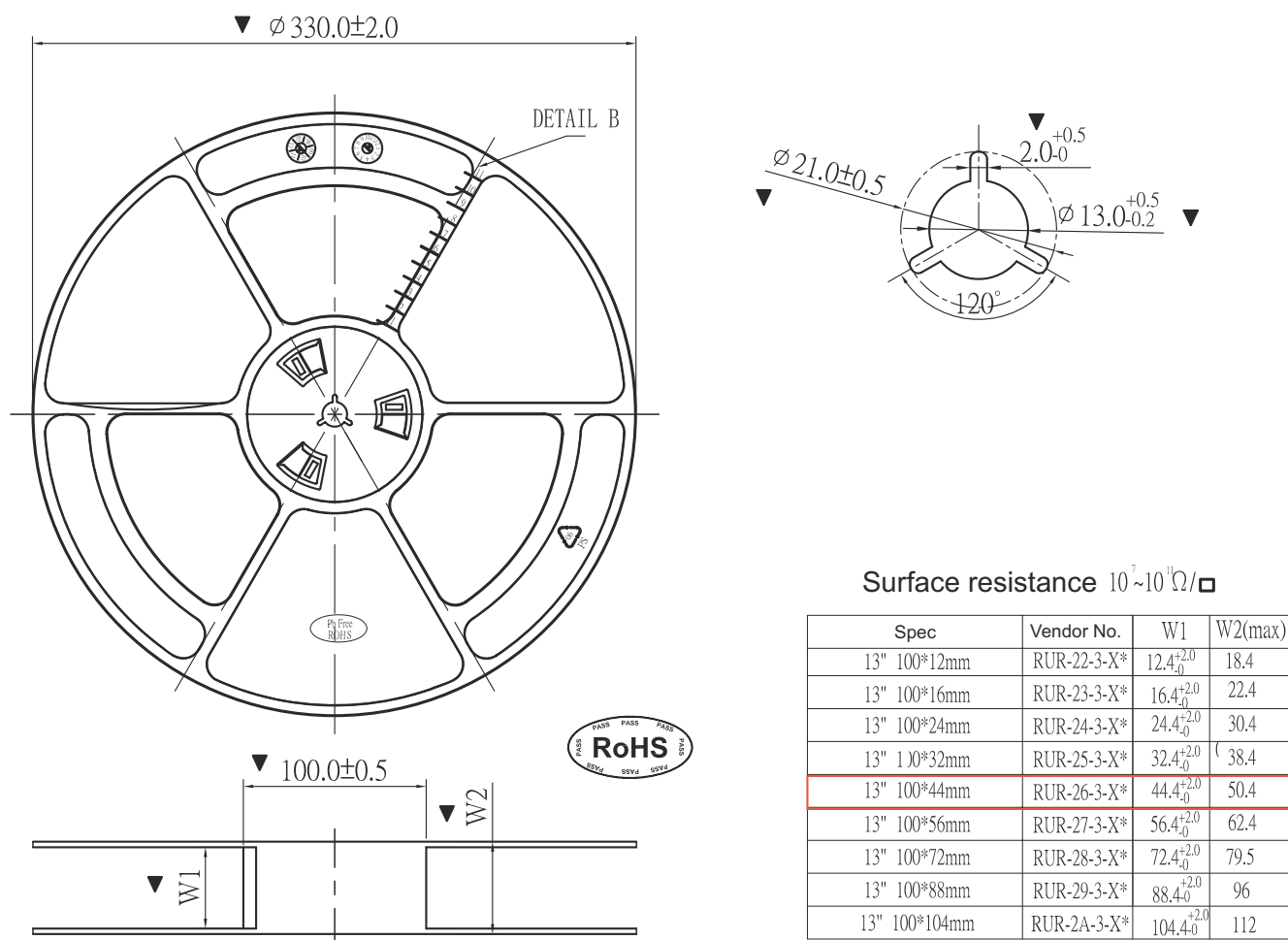
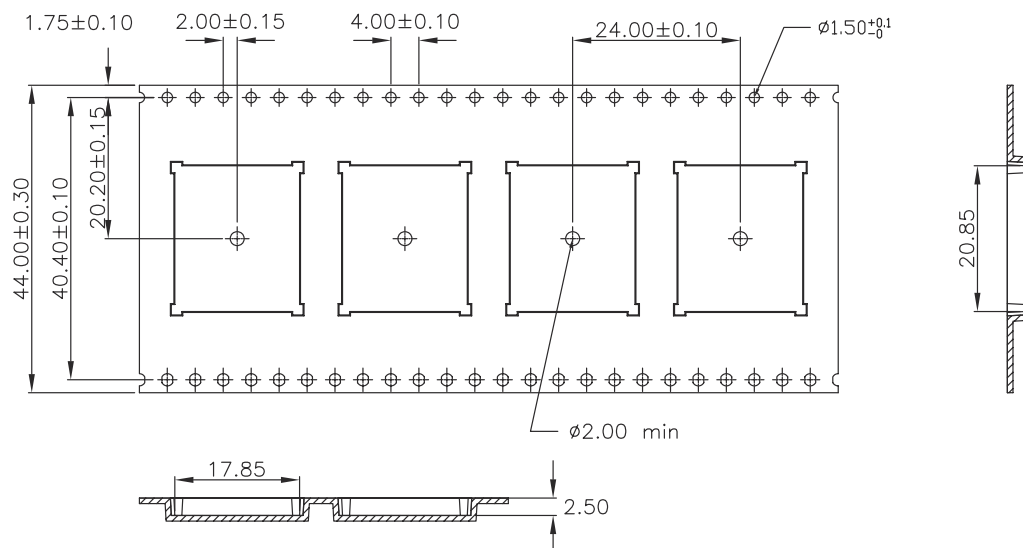


图 13-1. Tape Specification



|    |            |
|----|------------|
| W  | 44.00±0.30 |
| A0 | 17.85±0.10 |
| B0 | 20.85±0.10 |
| K0 | 2.50±0.10  |

1. 10 sprocket hole pitch cumulative tolerance  $\pm 0.20$ .
2. Carrier camber is within 1 mm in 250 mm.
3. Material : Black Conductive Polystyrene Alloy.
4. All dimensions meet EIA-481-C requirements.
5. Thickness :  $0.40 \pm 0.05$  mm.
6. Packing length per 13" reel : 25 Meters.
7. Component load per 7" reel : 1000 pcs.

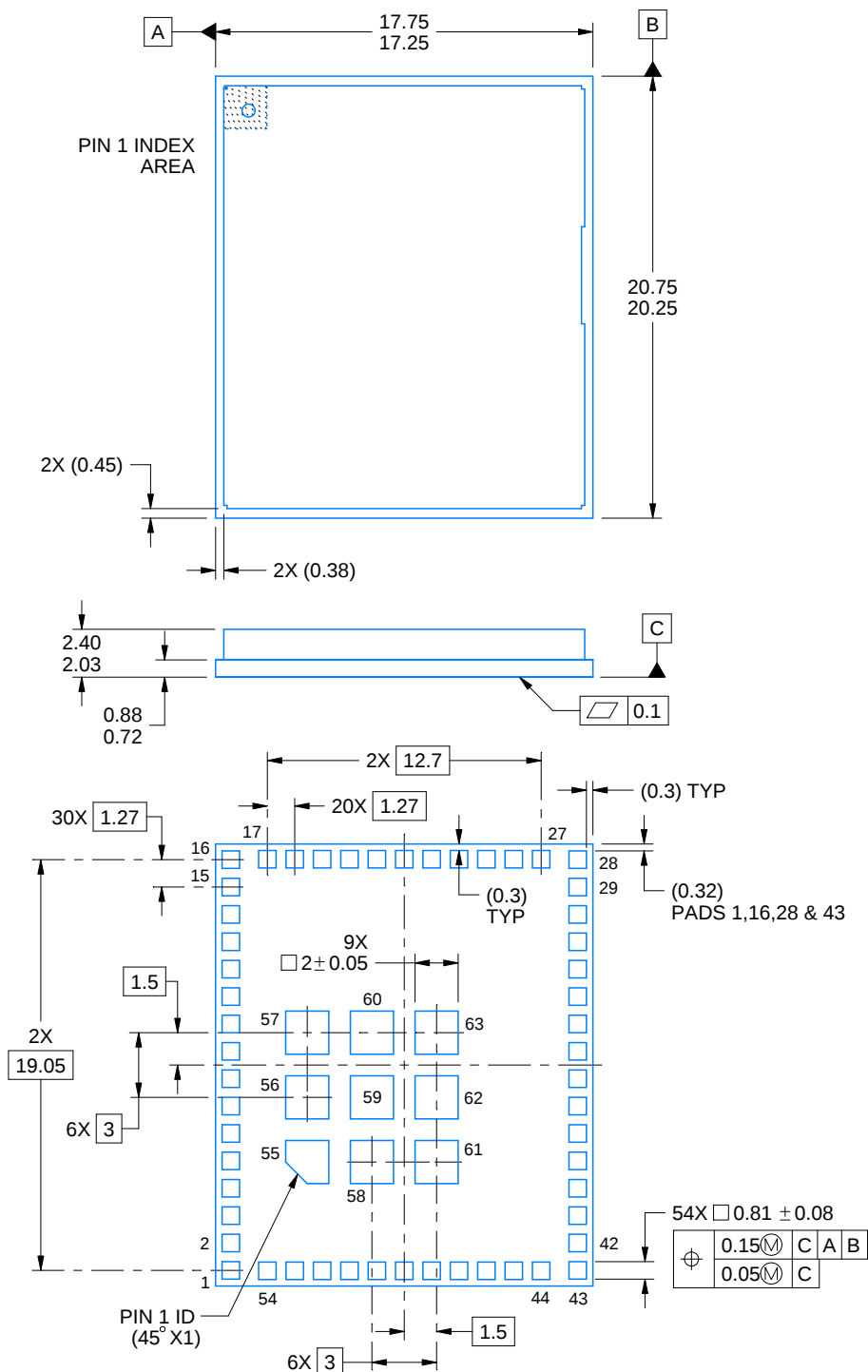
**图 13-2. Reel Specification**



## PACKAGE OUTLINE

**QFM - 2.4 mm max height**

QUAD FLAT MODULE



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NOTES:

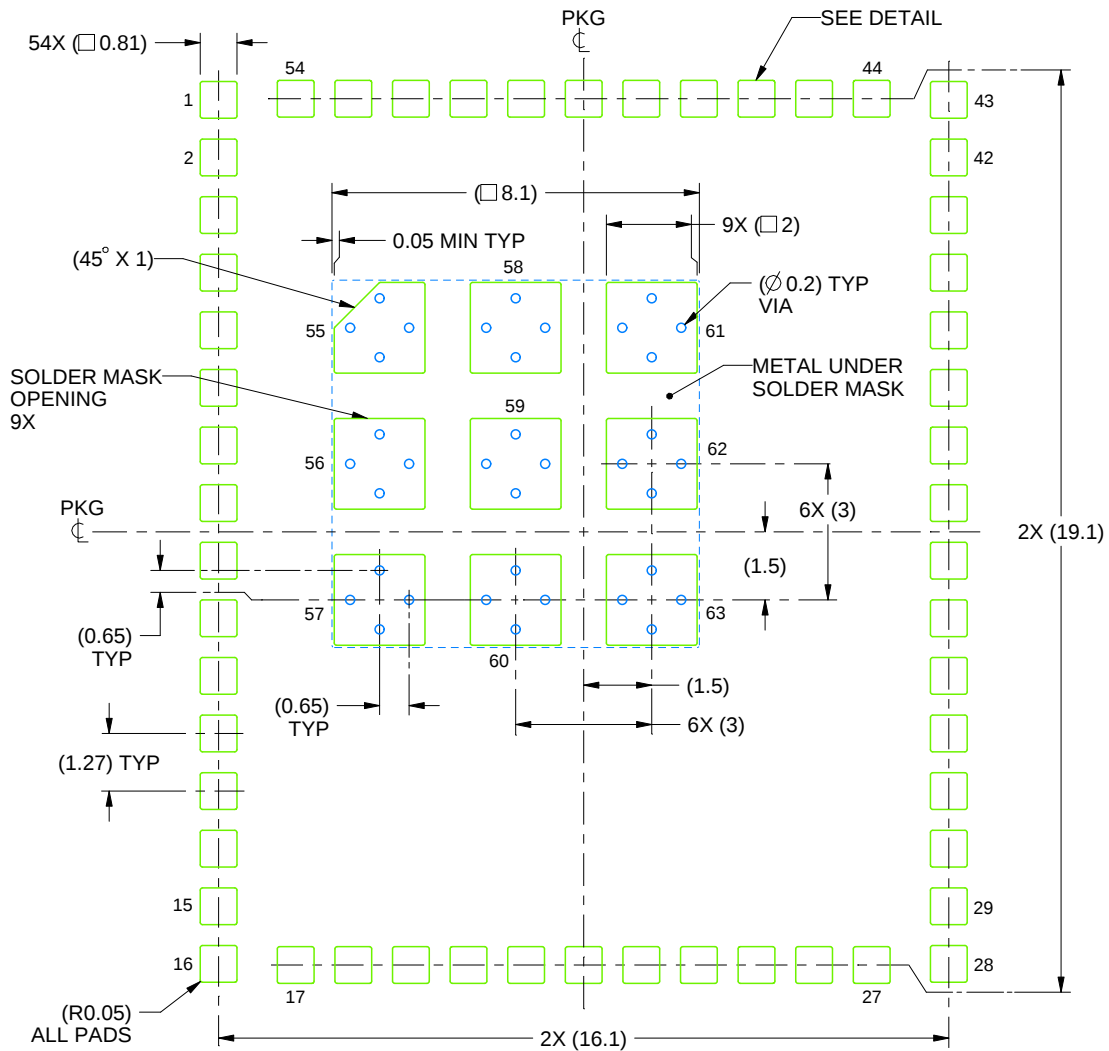
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

# EXAMPLE BOARD LAYOUT

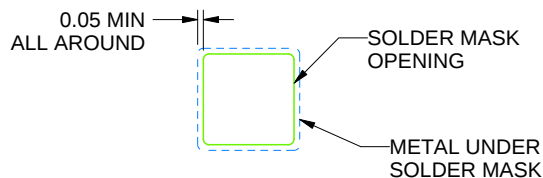
MOB0063A

QFM - 2.4 mm max height

QUAD FLAT MODULE



LAND PATTERN EXAMPLE  
SOLDER MASK DEFINED  
SCALE:6X



SIGNAL PADS DETAIL

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NOTES: (continued)

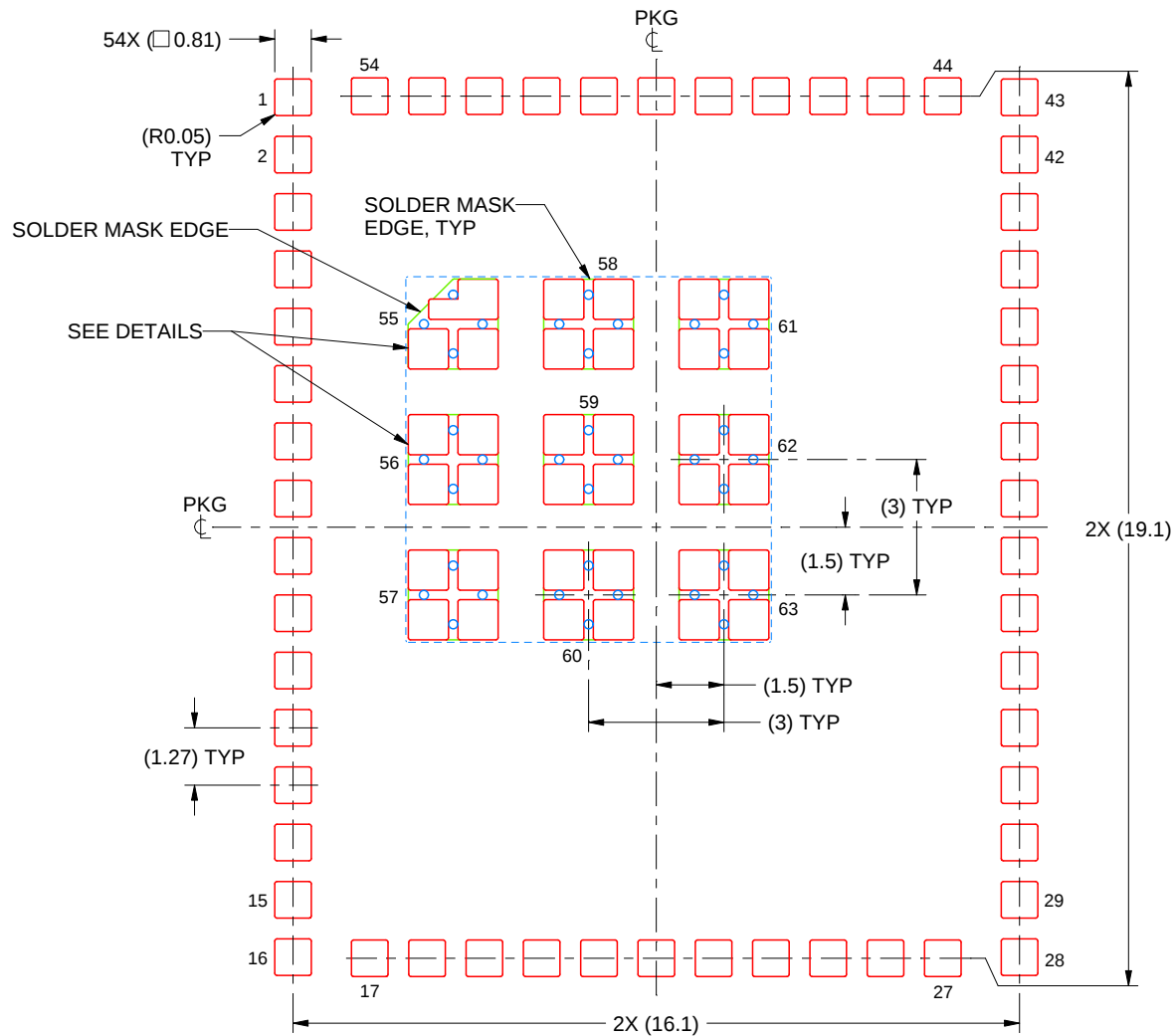
- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).

# EXAMPLE STENCIL DESIGN

MOB0063A

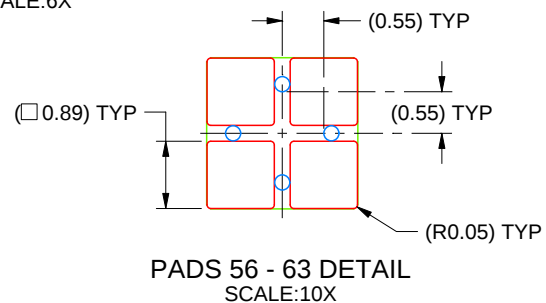
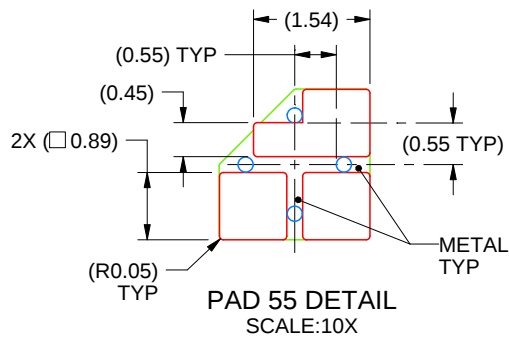
QFM - 2.4 mm max height

QUAD FLAT MODULE



**SOLDER PASTE EXAMPLE**  
BASED ON 0.125 mm THICK STENCIL

EXPOSED PADS PRINTED SOLDER COVERAGE BY AREA  
PAD 55: 77.5 %, PADS 56 - 63: 79%  
SCALE:6X



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NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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