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 模块概述

1.1 特性

- CC3120MOD 是一款 Wi-Fi®模块，其包含 CC3120RNMARGK Wi-Fi 网络处理器 (NWP)。该完全集成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 承担的 Wi-Fi 和互联网协议压力
- 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 个人和企业安全性：WEP、WPA/WPA2 PSK、WPA2 企业版 (802.1x)
- IPv4 和 IPv6 TCP/IP 堆栈
  - 业界标准的 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
- 借助以下特性，实现灵活的 Wi-Fi 配置：SmartConfig™技术、AP 模式和 WPS2 选项
- RESTful API 支持（使用内部 HTTP 服务器）
- 广泛的安全 功能
  - 硬件 特性
    - 独立执行环境
    - 器件标识
  - 网络安全性
    - 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
    - 受信任的根证书目录
    - TI 信任根公钥
  - 软件 IP 保护
    - 安全密钥存储
    - 文件系统安全
    - 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
- 应用数据吞吐量
  - 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_{BAT} 宽电压模式：2.3V 至 3.6V
  - 高级低功耗模式
    - 关断：1µA
    - 休眠：5µA
    - 低功耗深度睡眠 (LPDS)：115µA
    - 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 690µA
- 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)
  - 32 兆位串行闪存
  - 射频滤波器和无源组件
- LGA 封装
  - 1.27mm 间距、63 引脚、20.5mm × 17.5mm LGA 封装，便于实现轻松组装和低成本 PCB 设计
- 工作温度
  - 环境温度范围： –40°C 至 +85°C
- 模块支持 SimpleLink 开发人员生态系统

1.2 应用

- 适用于物联网 (IoT) 应用，例如：
  - 云连接
  - 互联网网关
  - 家庭和楼宇自动化
  - 电器
  - 访问控制
  - 安防系统
  - 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

1.3 说明

向适用于物联网应用的低成本、低功耗 MCU 中添加了 Wi-Fi® 功能而设计的单片集成电路。CC3120MOD 是一款 FCC、IC、CE、MIC、SRRC 和 Wi-Fi CERTIFIED™ 模块，是全新 SimpleLink™ Wi-Fi® 系列中的一部分，可极大简化互联网连接的实施。CC3120MOD 集成了适用于 Wi-Fi® 和互联网的所有协议，可最大限度降低对主机 MCU 软件的要求。借助内置安全协议，CC3120MOD 解决方案可提供强大且简单的安全体验。此外，CC3120MOD 还是一款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、参考设计和 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、晶体和全集成无源组件。

Wi-Fi® 网络处理器子系统 具有 Wi-Fi® Internet-on-a chip™，并且包含额外的专用 Arm®MCU，可减少主机 MCU 的很多联网活动。该子系统包含 802.11 b/g/n 无线电、基带和 MAC，具有强大加密引擎，可实现快速安全且带有 256 位加密功能的互联网连接。CC3120MOD 模块支持基站、接入点和 Wi-Fi® Direct 模式。此模块支持 WPA2 个人和企业安全性。该子系统包含嵌入式 TCP/IP、TLS/SSL 堆栈、HTTP 服务器和多个互联网协议。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。

作为 TI 的第二代 SimpleLink™ Wi-Fi® 系列的一部分，CC3120MOD 模块引进了如下所示的全新 特性 和增强功能：

- 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 套接字和多达 16 个 BSD 套接字（其中 6 个支持安全型
- HTTPS）
- 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直流/直流转换器。该子系统支持低功耗模式，例如 RTC 休眠和关断模式，这两种模式分别消耗大约 5μA 和 1μA 的电流。CC3120MOD 模块随附一个低占用空间的用户友好型主机驱动程序，可简化网络应用的集成和 开发而设计的单片集成电路。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，需要极小的平台适配层（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。该器件驱动程序最大程度地减少了主机内存占用要求，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，其中包括 Wi-Fi、低功耗 *Bluetooth*®、低于 1GHz 和主机 MCU，它们均共用一个通用、简单易用的开发环境，其中包含单核软件开发套件 (SDK) 和丰富的工具集。一次性集成 SimpleLink 平台后，用户可以将产品组合中器件的任何组合添加至您的设计中，从而在设计要求变更时实现代码的完全重复使用。

CC3120MOD 模块采用易于布局的 LGA 封装，以一款完整的平台解决方案的形式呈现，包括各种工具和软件、示例 应用、用户和编程指南、参考设计和 TI E2E™ 支持社区。该模块系列还是 SimpleLink™ MCU 产品系列的一部分，并且支持 SimpleLink™ 开发人员生态系统。有关更多信息，请访问 www.ti.com/SimpleLink。

表 **1-1.** 模块信息(1)

器件型号	封装	封装尺寸
CC3120MODRNMMOBR	MOB (63)	20.5mm × 17.5mm

(1) 有关详细信息，请参阅节 10。

1.4 功能方框图

图 1-1 显示了 CC3120MOD 模块的功能方框图。

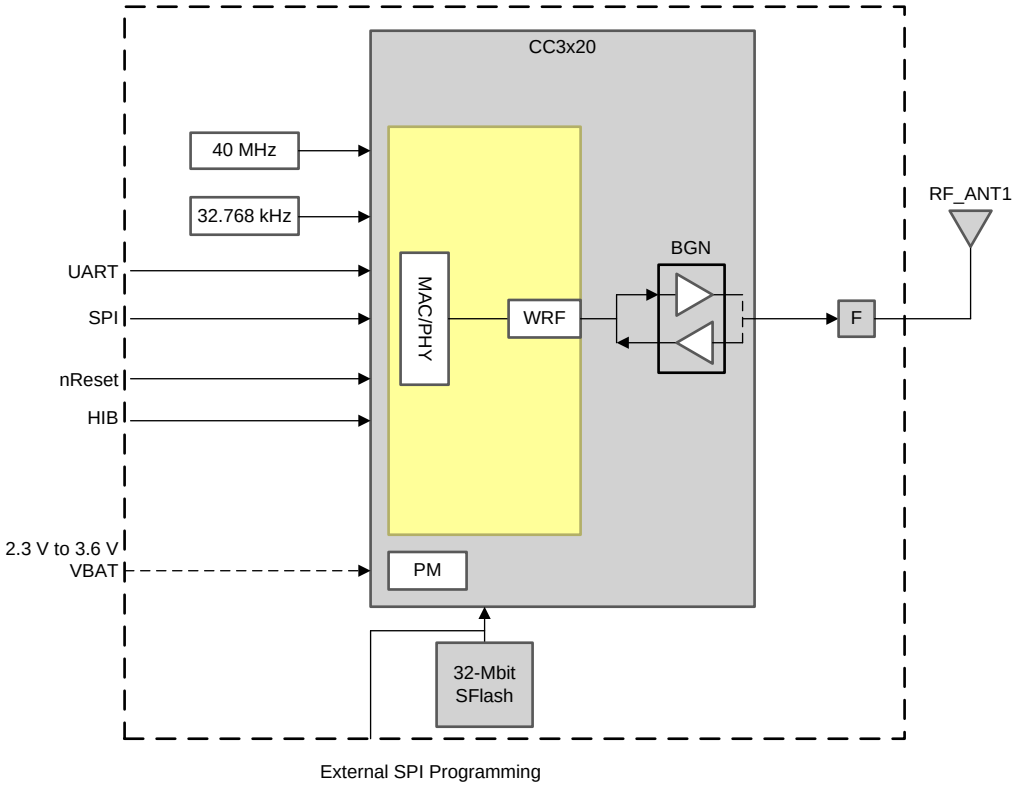


图 **1-1. CC3120MOD** 模块功能方框图

图 1-2 显示了 CC3120 硬件概览。

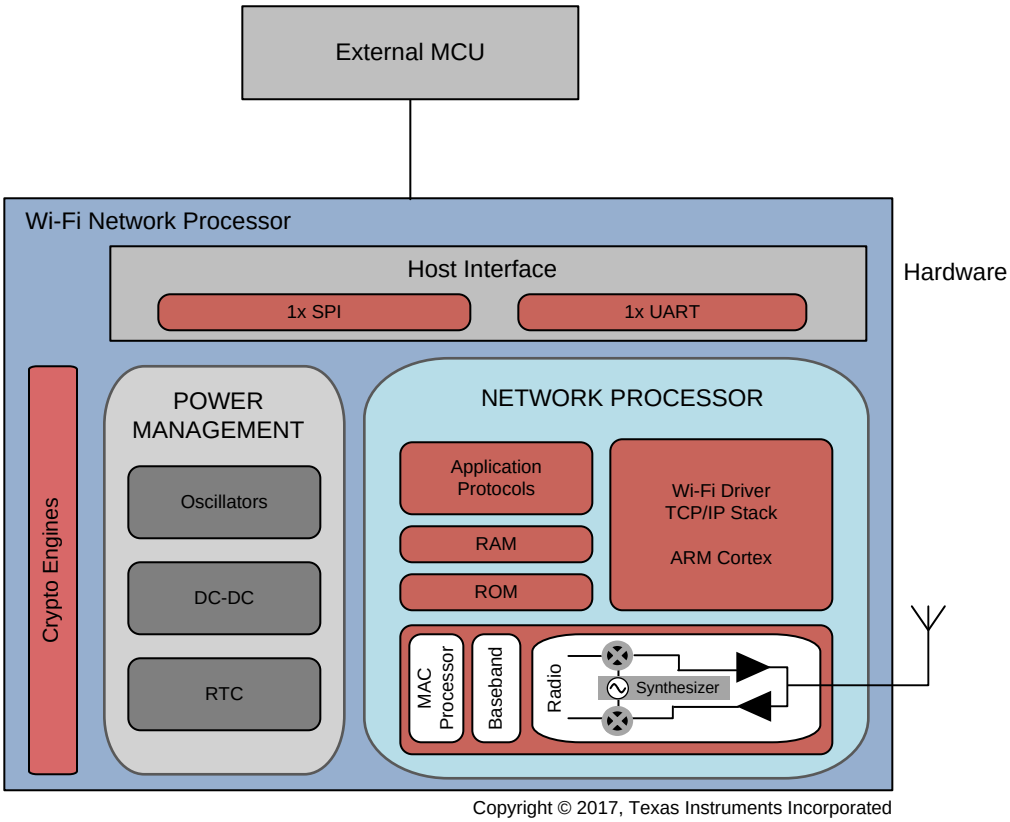


图 **1-2. CC3120** 硬件概览

图 1-3 显示了 CC3120 嵌入式软件概览。

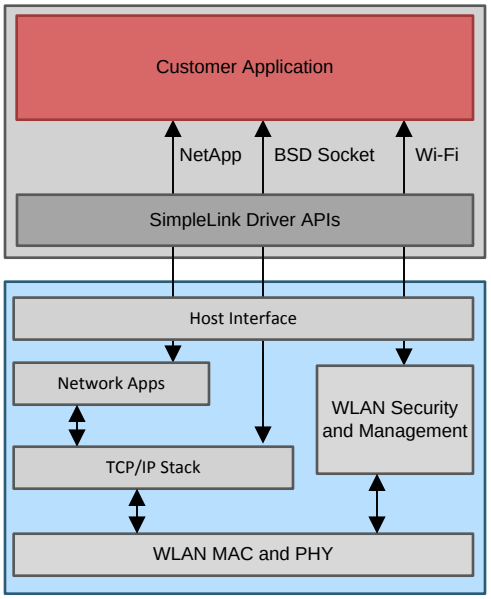


图 **1-3. CC3120** 嵌入式软件概览

内容

2 修订历史记录

Changes from June 20, 2017 to December 7, 2018 **Page**

- Changed ID for Japan MIC in Table 6-2 31
- Changed Figure 6-1 33
- Changed MARKING for MIC ID: modular MIC grant ID in Table 6-3 34

3 Device Comparison

Table 3-1 shows the features supported across different CC3x20 modules.

Table 3-1. Device Features Comparison

FEATURE	DEVICE		
	CC3120MOD	**CC3220MODS**	**CC3220MODSF**
Onboard Chip	CC3120	CC3220S	CC3220SF
Onboard ANT	No	No	No
sFlash	32-Mbit	32-Mbit	32-Mbit
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	2.3 V to 3.6 V	2.3 V to 3.6 V	2.3 V to 3.6 V
Package	17.5 mm × 20.5 mm LGA	17.5 mm × 20.5 mm LGA	17.5 mm × 20.5 mm 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	2.4 GHz	2.4 GHz	2.4 GHz
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
On Chip Memory			
RAM	-	256KB	256KB
Flash	-	-	1MB
Peripherals and Interfaces			
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^2C)	-	1	1
Analog to Digital Converter (ADC)	-	4-ch, 12-bit	4-ch, 12-bit
Parallel Interface (8-bit PI)	-	1	1
General Purposes Timers	-	4	4
Multimedia Card (MMC / SD)	-	1	1
Security Features			
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 Trusted Root-Certificate Catalog TI Root-of-Trust Public key	Unique Device Identity Trusted Root-Certificate Catalog TI Root-of-Trust Public key	Unique Device Identity Trusted Root-Certificate Catalog TI Root-of-Trust Public key
Hardware Acceleration	Hardware Crypto Engines	Hardware Crypto Engines	Hardware Crypto Engines
Secure Boot	-	Yes	Yes
Enhanced Application Level Security	-	File system security Secure key storage Software tamper detection Cloning protection Initial secure programming	File system security Secure key storage Software tamper detection Cloning protection Initial secure programming

3.1 Related Products

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

The SimpleLink™ MCU Portfolio Offers a single development environment that delivers flexible hardware, software, and tool options for customers developing wired and wireless applications. With 100% code reuse across host MCUs, Wi-Fi, Bluetooth low energy, Sub-1 GHz devices and more, choose the MCU or connectivity standard that fits your design. A one-time investment with the SimpleLink software development kit (SDK) allows you to reuse often, opening the door to create unlimited applications. For more information, visit www.ti.com/simplelink.

SimpleLink™ Wi-Fi® Family Offers several Internet-on-a chip solutions, which address the need of battery operated, security enabled products. Texas Instruments offers a single chip wireless microcontroller and a wireless network processor which can be paired with any MCU, to allow developers to design new Wi-Fi products, or upgrade existing products with Wi-Fi capabilities. For more information, visit www.ti.com/simplelinkwifi.

MSP432™ Host MCU The MSP432P401R MCU features the Arm® Cortex®-M4 processor offering ample processing capability with floating point unit and memory footprint for advanced processing algorithm, communication protocols as well as application needs, while incorporating a 14-bit 1-msps ADC14 that provides a flexible and low-power analog with best-in-class performance to enable developers to add differentiated sensing and measurement capabilities to their Wi-Fi applications. For more information, visit www.ti.com/product/MSP432P401R.

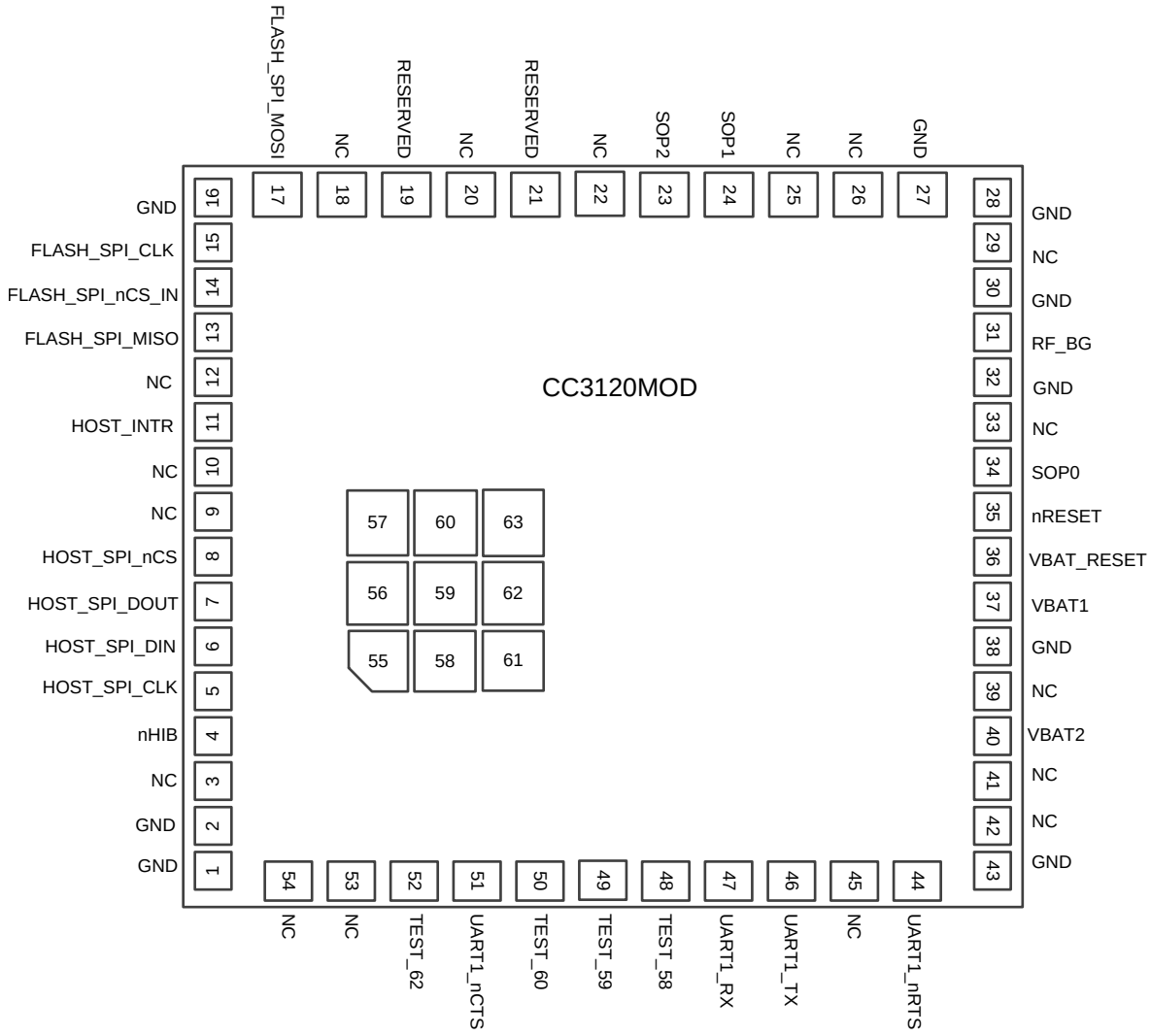
Reference Designs for CC3120 and CC3220 Modules The TI Designs Reference Design Library is a robust reference design library spanning analog, embedded processor, and connectivity. Created by TI experts to help you jump start your system design, all TI Designs include schematic or block diagrams, BOMs, and design files to speed your time to market. Search and download designs at www.ti.com/tidesigns.

CC3120 SDK Plug In The CC3120 SDK Plug In contains drivers, many sample applications for Wi-Fi features and Internet, and documentation needed to use the CC3120 solution. Learn more at http://www.ti.com/cc3120sdk.

4 Terminal Configuration and Functions

4.1 CC3120MOD Pin Diagram

Figure 4-1 shows the pin diagram for the CC3120MOD module.



NOTE: Figure 4-1 shows the approximate location of pins on the module. For the actual mechanical diagram, refer to 节 10.

Figure 4-1. CC3120MOD Pin Diagram Bottom View

4.2 Pin Attributes

Table 4-1 lists the pin descriptions of the CC3120MOD module.

NOTE

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.

Table 4-1. Module Pin Attributes(1)

PIN	DEFAULT FUNCTION	STATE AT RESET AND HIBERNATE	I/O TYPE(2)	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 Section 6.5.
24	SOP1	Hi-Z	–	SOP[2:0] used for factory restore. See Section 6.5.
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 Section 6.5.

(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

Table 4-1. Module Pin Attributes[1] (continued)

PIN	DEFAULT FUNCTION	STATE AT RESET AND HIBERNATE	I/O TYPE[2]	DESCRIPTION
35	nRESET	Hi-Z	I	There is an internal 100 kΩ 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: • 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. • 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 kΩ is expected.
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

4.3 Connections for Unused Pins

All unused pins must be left as no connect (NC) pins. Table 4-2 provides a list of NC pins.

Table 4-2. 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.

5 Specifications

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

5.1 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 (1)(2).

	MIN	MAX	UNIT
V_{BAT}	–0.5	3.8	V
Digital I/O	–0.5	V_{BAT} + 0.5	V
RF pin	–0.5	2.1	V
Analog pins	–0.5	2.1	V
Operating temperature, T_A	–40	85	°C
Storage temperature, T_{stg}	–40	85	°C
Junction temperature, T_j (3)		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_{SS}, unless otherwise noted.
(3) Junction temperature is for the CC3120RNMARGK device that is contained within the module.

5.2 ESD Ratings

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

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

5.3 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 (1)(2)(3).

	MIN	TYP	MAX	UNIT
V_{BAT}	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.

5.4 Current Consumption Summary

T_A = 25°C, V_{BAT} = 3.6 V

PARAMETER	TEST CONDITIONS (1) (2)		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 (3)	1 DSSS			53		mA
	54 OFDM			53		
Idle connected (4)				690		µA
LPDS				115		µA
Hibernate				5		µA
Shutdown				1		µA
Peak calibration current (5)	V_{BAT} = 3.6 V			420		mA
	V_{BAT} = 3.3 V			450		
	V_{BAT} = 2.3 V			620		

(1) TX power level = 0 implies maximum power (see Figure 5-1, Figure 5-2, and Figure 5-3). TX power level = 4 implies output power backed off approximately 4 dB.
(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 1-Mbps throughput rate.
(4) DTIM = 1
(5) The complete calibration can take up to 17 mJ of energy from the battery over a time of 24 ms. In default mode, calibration is performed sparingly, typically when re-enabling the NWP and when the temperature has changed by more than 20°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*.

5.5 TX Power and IBAT versus TX Power Level Settings

Figure 5-1, Figure 5-2, and Figure 5-3 show TX Power and IBAT versus TX power level settings for modulations of 1 DSSS, 6 OFDM, and 54 OFDM, respectively.

In Figure 5-1, 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.

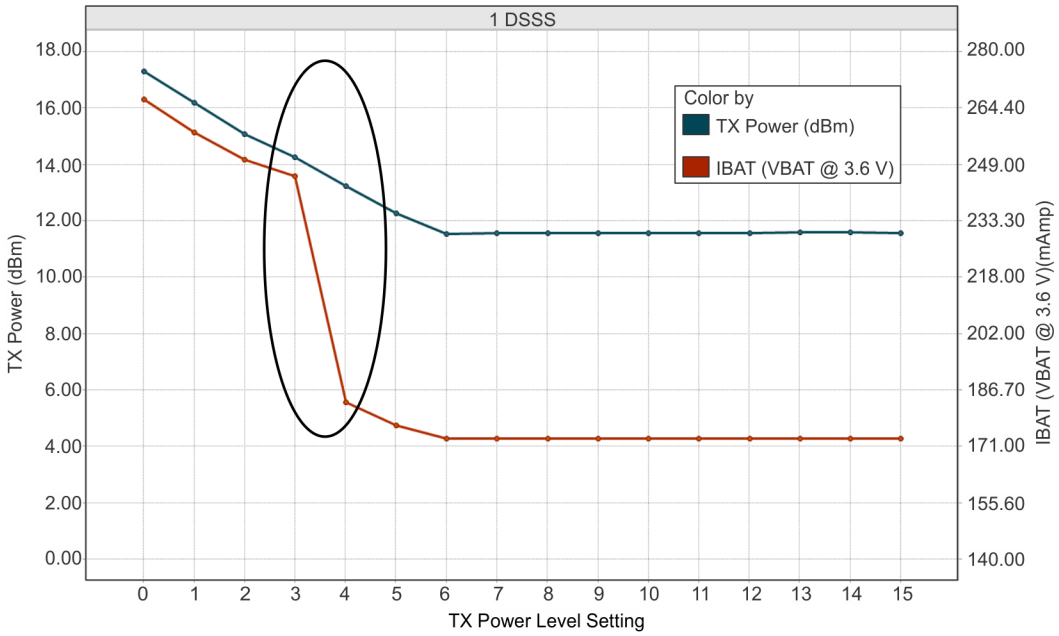


Figure 5-1. TX Power and IBAT vs TX Power Level Settings (1 DSSS)

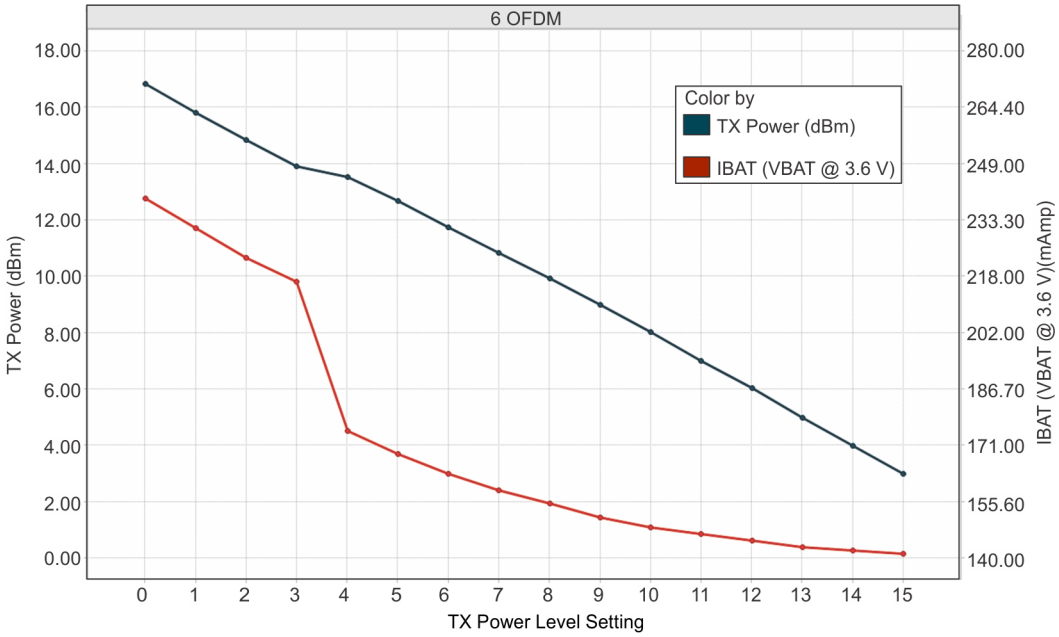


Figure 5-2. TX Power and IBAT vs TX Power Level Settings (6 OFDM)

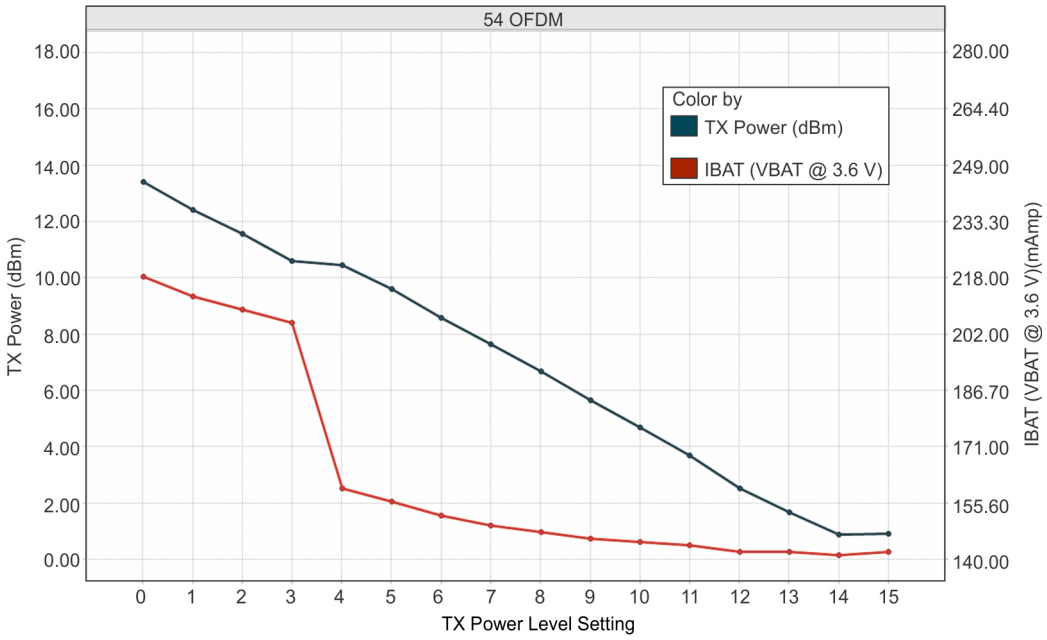


Figure 5-3. TX Power and IBAT vs TX Power Level Settings (54 OFDM)

5.6 Brownout and Blackout Conditions

The device enters a brownout condition when the input voltage dips below $V_{BROWNOUT}$ (see Figure 5-4 and Figure 5-5). 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.

NOTE

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

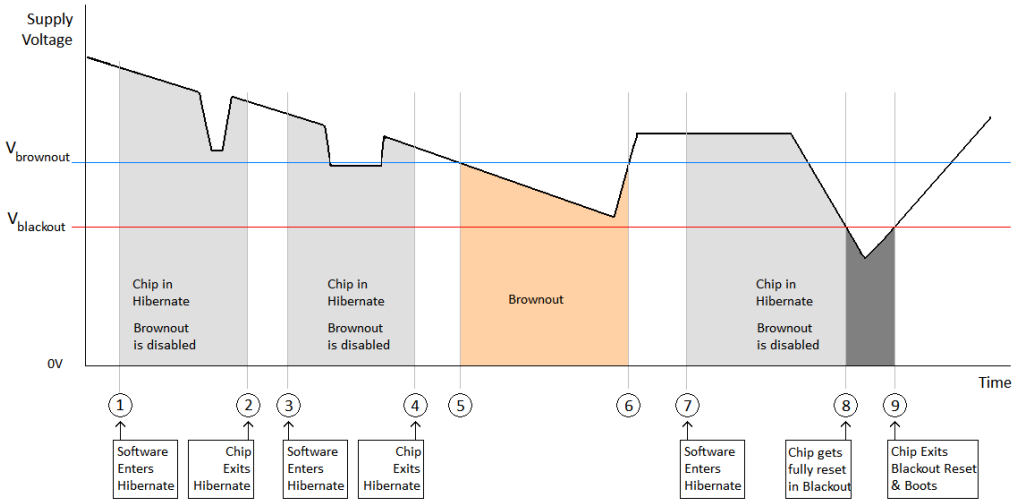


Figure 5-4. Brownout and Blackout Levels (1 of 2)

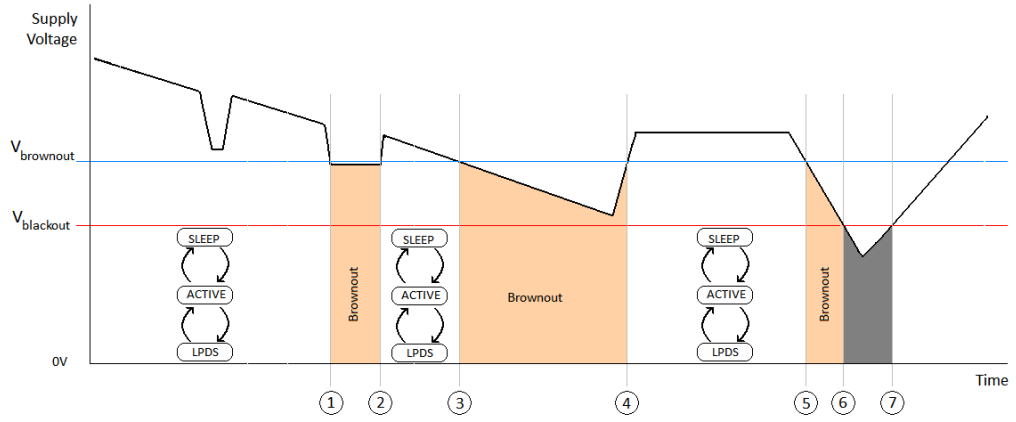


Figure 5-5. Brownout and Blackout Levels (2 of 2)

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

Table 5-1 lists the brownout and blackout voltage levels.

Table 5-1. Brownout and Blackout Voltage Levels

CONDITION	VOLTAGE LEVEL	UNIT
$V_{brownout}$	2.1	V
$V_{blackout}$	1.67	V

5.7 Electrical Characteristics

T_A = 25°C, V_{BAT} = 3.3 V

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

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

5.8 WLAN Receiver Characteristics

T_A = 25°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 (8% PER for 11b rates, 10% PER for 11g or 11n rates) (10% PER)(1)	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 (10% PER)	802.11b		–3.0		dBm
	802.11g		–9.0		

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

5.9 WLAN Transmitter Characteristics

T_A = 25°C, V_{BAT} = 2.3 to 3.6 V. Parameters measured at module pin on 6 (2437 MHz)(1)(2).

PARAMETER	RATE	MIN	TYP	MAX	UNIT
Max RMS Output Power measured at 1 dB 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.

5.10 Reset Requirement

PARAMETER		MIN	TYP	MAX	UNIT
V_{IH}	Operation mode level		0.65 × V_{BAT}		V
V_{IL}	Shutdown mode level(1)	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		µs

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

5.11 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

5.12 Timing and Switching Characteristics

5.12.1 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.

Figure 5-6 shows the reset timing diagram for the first-time power-up and reset removal.

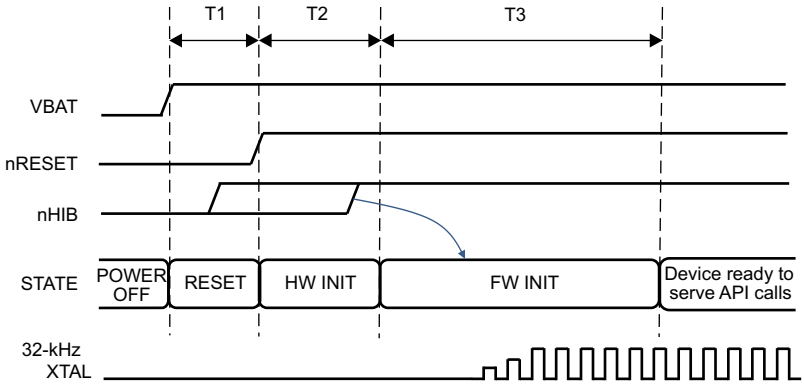


Figure 5-6. First-Time Power-Up and Reset Removal Timing Diagram

Table 5-2 describes the timing requirements for the first-time power-up and reset removal.

Table 5-2. 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

5.12.2 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.

5.12.3 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.

5.12.4 Wakeup From HIBERNATE Mode Timing

Figure 5-7 shows the timing diagram for wakeup from HIBERNATE mode.

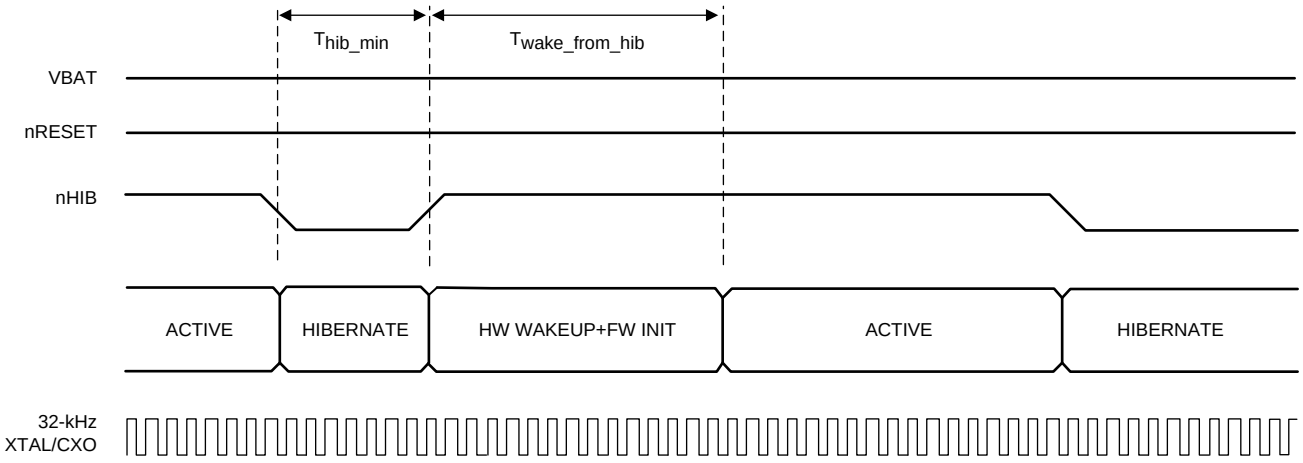


Figure 5-7. nHIB Timing Diagram

NOTE

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.

Table 5-3 describes the timing requirements for nHIB.

Table 5-3. nHIB Timing Requirements

ITEM	NAME	DESCRIPTION	MIN	TYP	MAX	UNIT
T_{hib_min}	Minimum hibernate time	Minimum pulse width of nHIB being low(1)	10			ms
$T_{wake\_from\_hib}$	Hardware wakeup time plus firmware initialization time	See(2)		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).

5.13 External Interfaces

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

- SPI Host
- Host UART
- External Flash

5.13.1 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.

Figure 5-8 shows the SPI host interface.

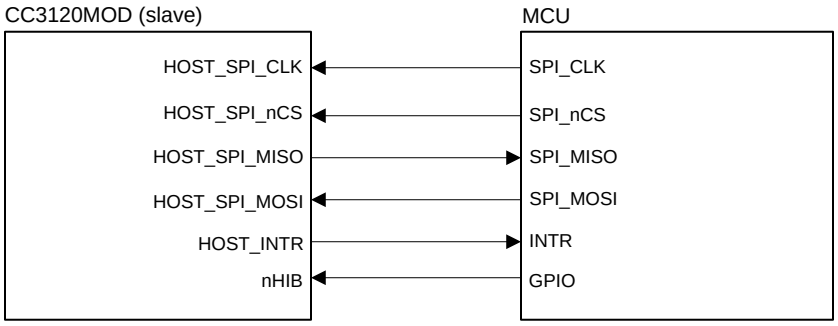


Figure 5-8. SPI Host Interface

Table 5-4 lists the SPI host interface pins.

Table 5-4. 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)

Figure 5-9 shows the host SPI timing diagram.

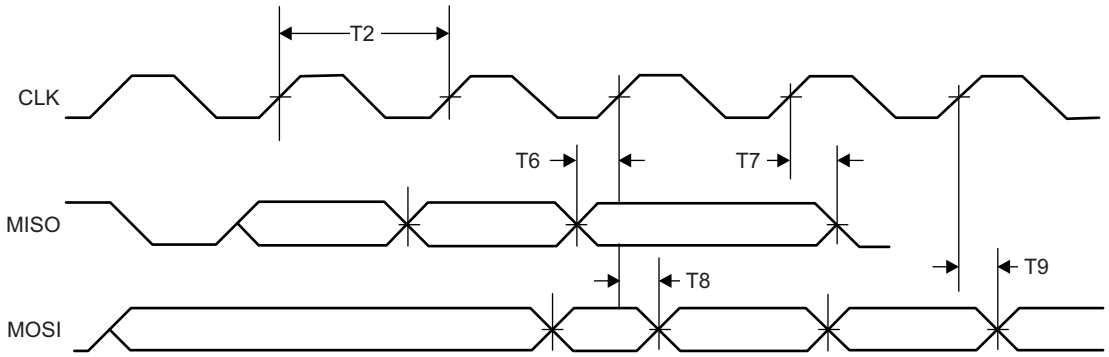


Figure 5-9. Host SPI Timing

Table 5-5 lists the host SPI timing parameters.

Table 5-5. Host SPI Timing Parameters

PARAMETER NUMBER	DESCRIPTION		MIN	MAX	UNIT
T1	$F^{(1)}$	Clock frequency at V_{BAT} = 3.3 V		20	MHz
		Clock frequency at V_{BAT} = 2.3 V		12	
T2	$t_{clk}^{(1)(2)}$	Clock period	50		ns
T3	$t_{LP}^{(1)}$	Clock low period		25	ns
T4	$t_{HT}^{(1)}$	Clock high period		25	ns
T5	$D^{(1)}$	Duty cycle	45%	55%	
T6	$t_{IS}^{(1)}$	RX data setup time	4		ns
T7	$t_{IH}^{(1)}$	RX data hold time	4		ns
T8	$t_{OD}^{(1)}$	TX data output delay		20	ns
T9	$t_{OH}^{(1)}$	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.

5.13.2 Host UART Interface

The SimpleLink™ device requires the UART configuration described in Table 5-6.

Table 5-6. 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[(1)]

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

5.13.2.1 5-Wire UART Topology

Figure 5-10 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.

Figure 5-10 shows the typical and recommended UART topology because it offers the maximum communication reliability and flexibility between the host and the SimpleLink device.

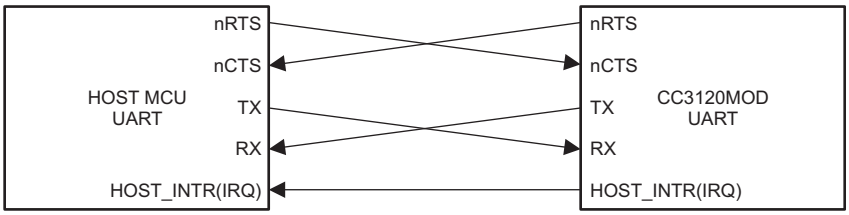


Figure 5-10. Typical 5-Wire UART Topology

5.13.2.2 4-Wire UART Topology

The 4-wire UART topology eliminates the host IRQ line (see Figure 5-11). 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.

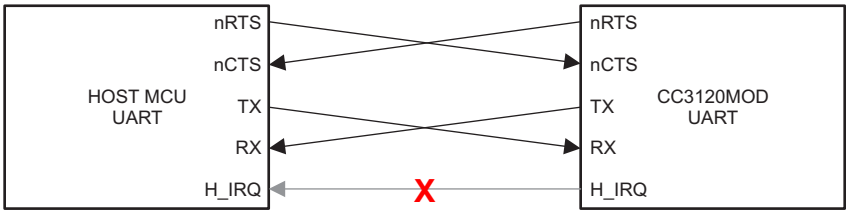


Figure 5-11. 4-Wire UART Configuration

5.13.2.3 3-Wire UART Topology

The 3-wire UART topology requires only the following lines (see Figure 5-12).

- RX
- TX
- nCTS

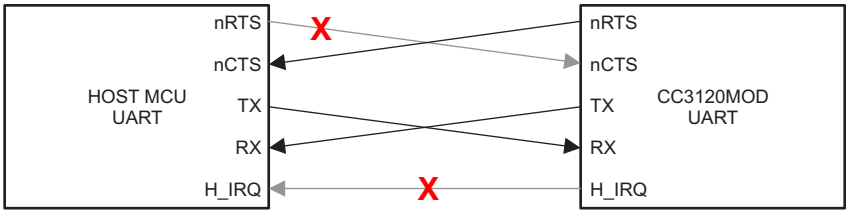


Figure 5-12. 3-Wire UART Topology

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

5.13.3 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.

6 Detailed Description

6.1 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 and WPS 2.0. The Wi-Fi network processor includes an embedded IPv6 and IPv4 TPC/IP stack.

6.2 Module Features

6.2.1 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 2.4-GHz ISM band, channels 1 to 13.

NOTE

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

- Autocalibrated radio with a single-ended 50-Ω 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).
- Smart provisioning options deeply integrated within the device provide a comprehensive end-to-end solution. Elaborate events notification 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.

6.2.2 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

NOTE

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\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

Table 6-1 summarizes the NWP features.

Table 6-1. NWP Features

FEATURES	DESCRIPTION
Wi-Fi standards	802.11b/g/n station 802.11b/g AP supporting up to four stations Wi-Fi Direct client and group owner
Wi-Fi	Channels 1 to 13
Wi-Fi security	WEP, WPA/WPA2 PSK, WPA2 enterprise (802.1x)
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 SSLv3.0/TLSv1.0/TLSv1.1/TLSv1.2 RAW IP
Network applications and utilities	Ping HTTP/HTTPS web server mDNS DNS-SD DHCP server
Host interface	UART/SPI
Security	Secure file system Unique ID and private key for device authentication Crypto utilities Secure content delivery
Power management	Enhanced power policy management uses 802.11 power save and deep sleep power modes

Table 6-1. NWP Features (continued)

FEATURES	DESCRIPTION
Other	RF Transceiver Programmable RX Filters with Events trigger mechanism including WoWLAN Recovery mechanism – Restore to factory default

6.2.2.1 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

6.2.3 Host Interface and Driver

- Interfaces over a 4-wire SPI with any MCU or a processor at a clock speed of 20 MHz
- Interfaces over UART with any MCU with a baud rate up to 3 Mbps. 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.

6.2.4 System

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

6.3 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.

6.3.1 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 3.6 V.

6.4 Low-Power Operating Modes

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

6.4.1 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 3 ms from the internal timer or from any incoming host command. Typical battery drain in this mode is 115 µA. 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.

6.4.2 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 5 µA. The wake-up time is longer than LPDS mode at about 50 ms.

6.4.3 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 1 µA. The wake-up time in this mode is longer than hibernate at approximately 1.1 seconds.

6.5 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.

6.6 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 Table 6-2 (with IDs where applicable).

Table 6-2. 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)

6.6.1 FCC Certification and Statement

CAUTION

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.

6.6.2 Industry Canada (IC) Certification and Statement

CAUTION

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 étre 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.

6.6.3 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.

6.6.4 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.

6.6.5 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.

NOTE

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.

6.7 Module Markings

Figure 6-1 shows the markings for the SimpleLink CC3120 Module.

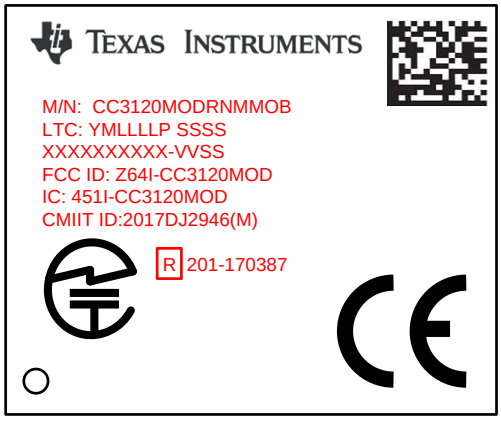


Figure 6-1. SimpleLink™ CC3120 Module Markings

Table 6-3 lists the SimpleLink module markings.

Table 6-3. Marking Descriptions

MARKING	DESCRIPTION
CC3120MODRNMMOB	Model
YMLLLLP SSSS	LTC (lot trace code): • Y = Year • M = Month • LLLL = Assembly lot code • P = Reserved for internal use • SSSS = Serial number
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
R 201-170387	MIC ID: modular MIC grant ID
CE	CE compliance mark

6.8 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.

6.9 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.

7 Applications, Implementation, and Layout

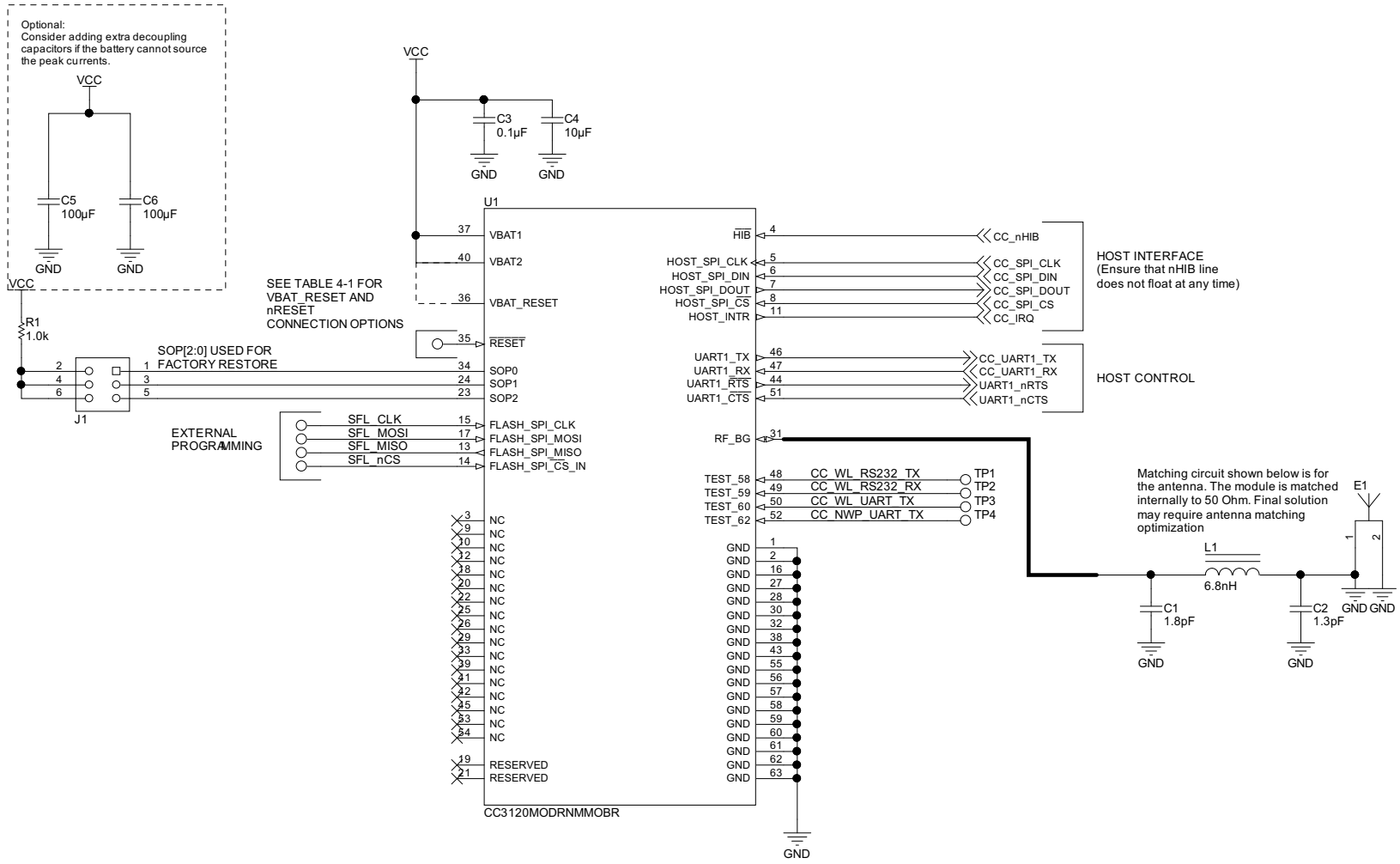
NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

7.1 Application Information

7.1.1 Typical Application

Figure 7-1 shows the typical application schematic using the CC3120MOD module. For a full operation reference design, see the BoosterPack that uses the CC3120MOD module.



Note: 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.

Figure 7-1. CC3120MOD Module Reference Schematic

Table 7-1 lists the bill of materials for a typical application using the CC3120MOD module shown in Figure 7-1.

Table 7-1. 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)

7.1.2 Power Supply Decoupling and Bulk Capacitors

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

NOTE

The module enters a brown-out condition whenever the input voltage dips below V_{BROWN} (see Figure 5-4 and Figure 5-5). 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 Section 5.6.

7.1.3 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.

7.1.4 Unused Pins

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

7.2 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.

7.2.1 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-Ω 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.

7.2.2 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.

Figure 7-2 shows the RF placement and routing of the CC3120MOD module.

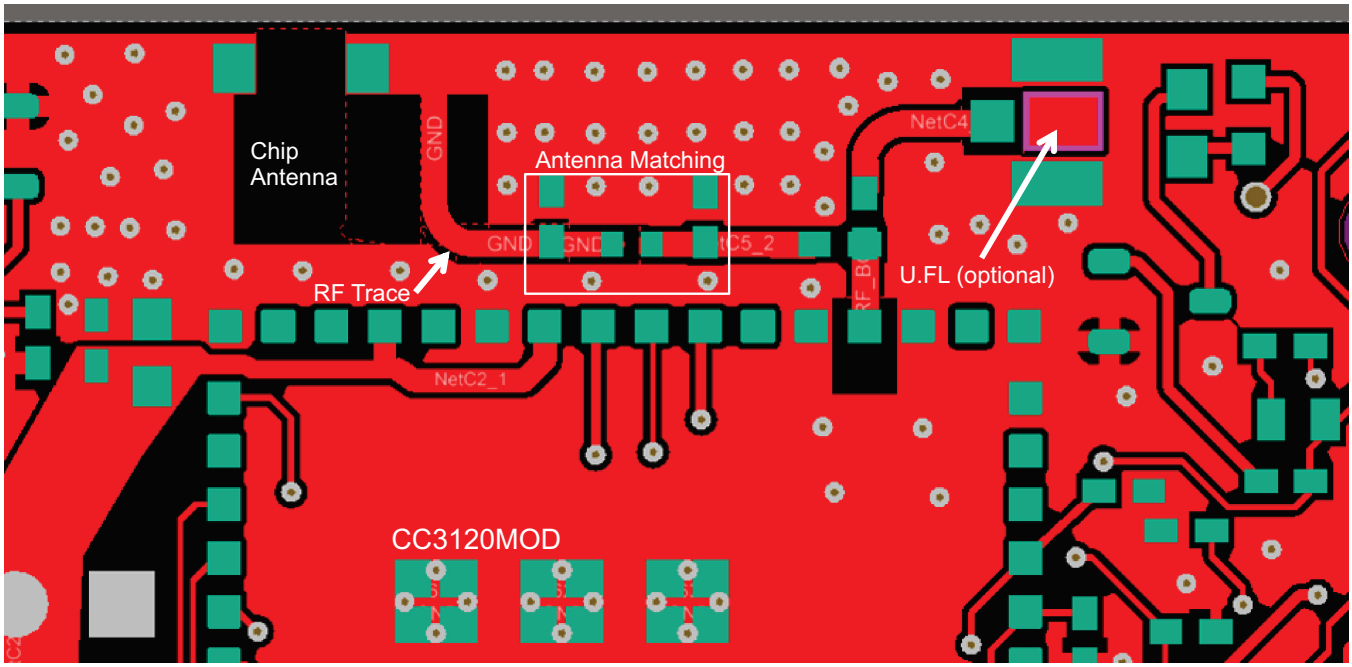


Figure 7-2. RF Section Layout

For optimal RF performance, ensure the copper cut out on the top layer under the RF-BG pin, (pin 31), is as shown in Figure 7-3.

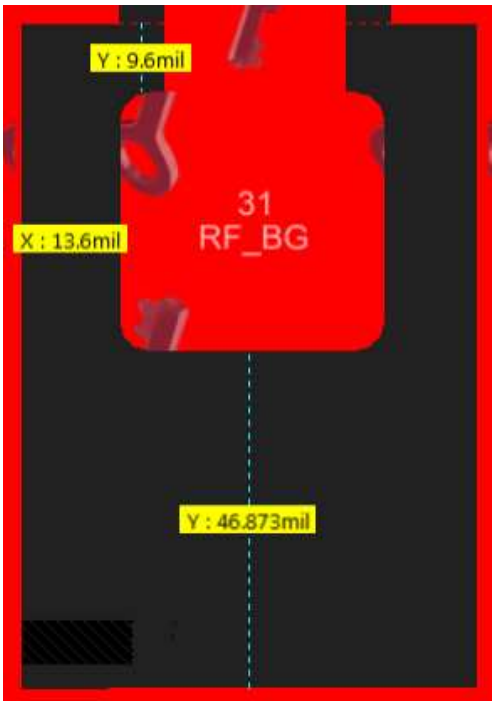


Figure 7-3. Top Layer Copper Pull Back on RF Pads

7.2.3 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. Table 7-2 provides a summary of the recommended antennas to use with the CC3120MOD module.

Table 7-2. 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 Ω because the device is rated to work only with a 50-Ω 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 *CC3120 and CC3220 Radio Certifications* wiki page on CC3120 Radio certification

Table 7-3 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.

Table 7-3. 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.

7.2.4 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. Figure 7-4 shows a cross section of the coplanar waveguide with the critical dimensions.

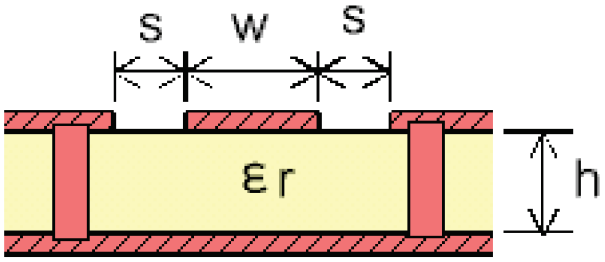


Figure 7-4. Coplanar Waveguide (Cross Section)

Figure 7-5 shows the top view of the coplanar waveguide with GND and via stitching.

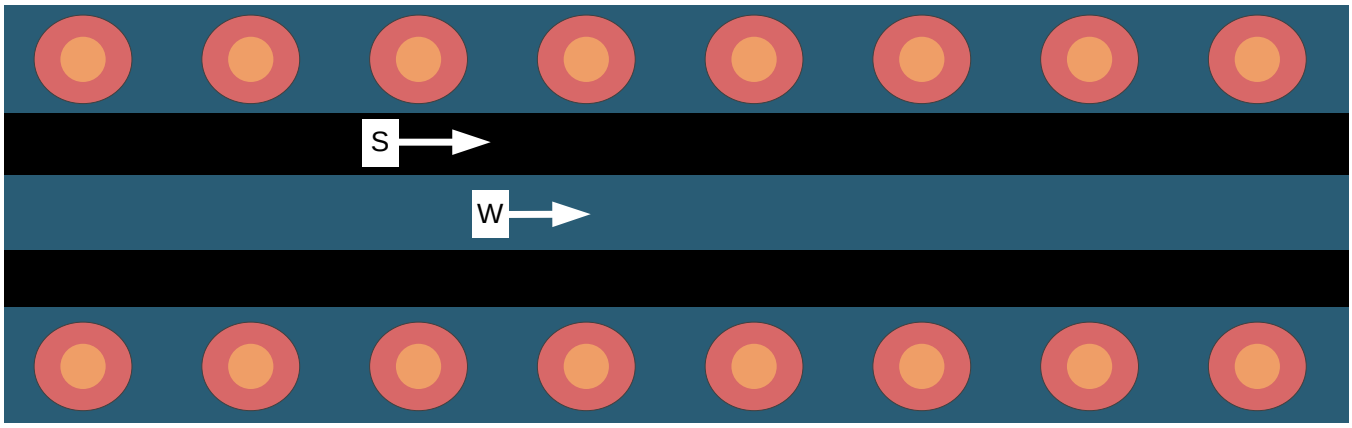


Figure 7-5. CPW With GND and Via Stitching (Top View)

The recommended values for the PCB are provided for 2-layer boards in Table 7-4 and 4-layer boards in Table 7-5.

Table 7-4. 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	

Table 7-5. 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	

8 Environmental Requirements and Specifications

8.1 Temperature

8.1.1 PCB Bending

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

8.2 Handling Environment

8.2.1 Terminals

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

8.2.2 Falling

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

8.3 Storage Condition

8.3.1 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.

8.3.2 Moisture Barrier Bag Open

Humidity indicator cards must be blue, < 30%.

8.4 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

8.5 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 Figure 8-1)
- Temperature profile: Reflow soldering will be done according to the temperature profile (see Figure 8-1)
- Peak temp: 245°C

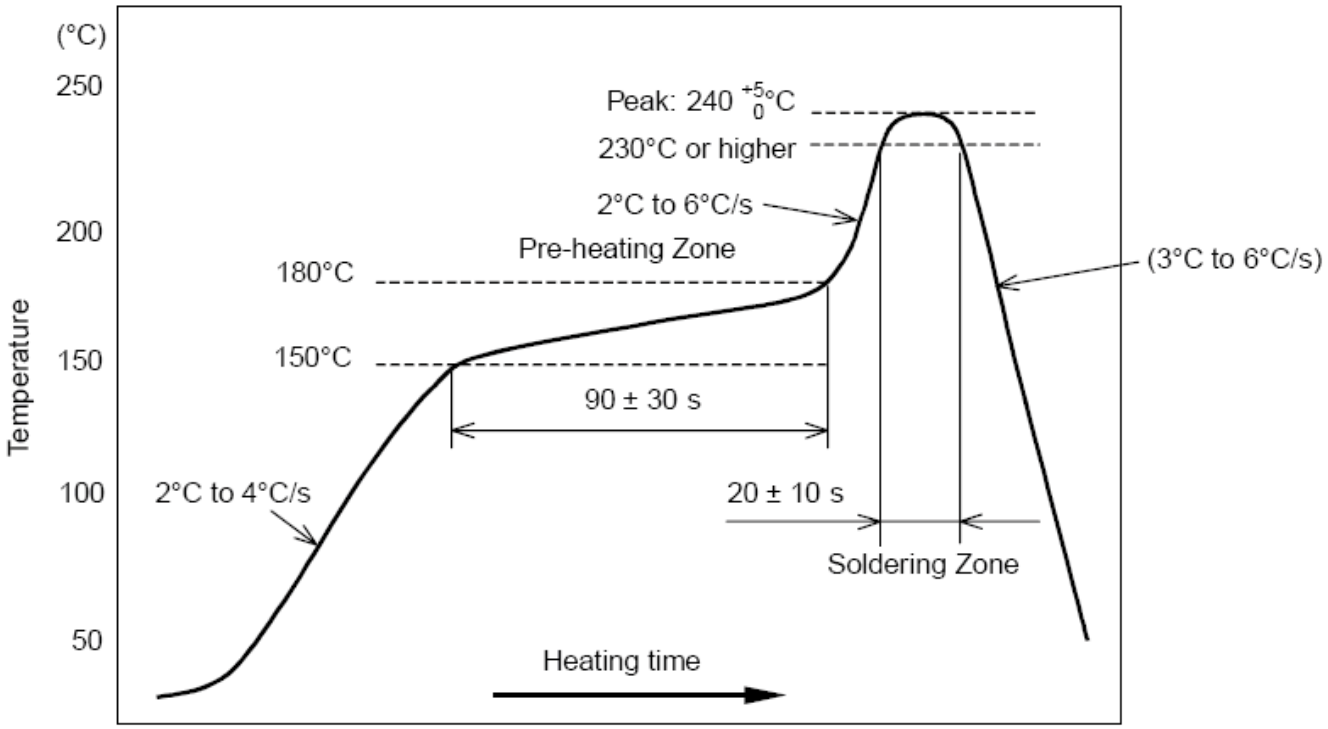


Figure 8-1. Temperature Profile for Evaluation of Solder Heat Resistance of a Component (at Solder Joint)

NOTE

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.

9 器件和文档支持

TI 提供大量的开发工具。此部分列出了用于评估器件性能、生成代码和开发解决方案的工具和软件。

9.1 器件命名规则

为了标示产品开发周期所处的阶段，TI 为 CC3120MOD 和支持工具的部件号分配了前缀（请参阅 图 9-1）。

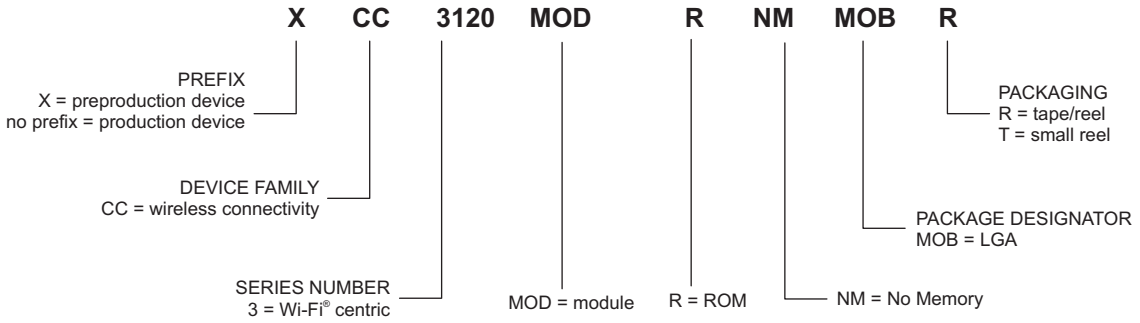


图 9-1. CC3120MOD 模块命名规则

如需采用 MOB 封装类型的 CC3120MOD 模块的可订购器件号，请参阅本文档的封装选项附录、访问 TI 网站 (www.ti.com) 或联系您的 TI 销售代表。

9.2 开发工具和软件

有关开发工具和软件的最新列表，请访问 CC3120MOD 工具和软件页面。您也可以点击页面右上角的“通知我”按钮，随时获取有关 CC3120MOD 的最新消息。

SimpleLink™ Wi-Fi® Starter Pro SimpleLink™ Wi-Fi® Starter Pro 移动应用是一款用于配置 SimpleLink 的新移动应用。其中随附嵌入式配置库以及在设备端运行的示例。如需使用 SimpleLink Wi-Fi 产品进行 Wi-Fi 配置，TI 建议使用新配置版本。它可以协同反馈和备用选项实现高级 AP 模式配置，确保成功完成处理。客户可以使用嵌入式库和移动库集成到最终产品中。

SimpleLink™ Wi-Fi® CC3120 SDK 插件 CC3120 SDK 包含驱动程序、 针对 Wi-Fi 功能 和互联网的很多示例应用以及使用 CC3120 Internet-on-a-chip 解决方案。此 SDK 可与 TI 的 MSP432P401R LaunchPad™或 SimpleLink Studio（一款允许使用 CC3120 进行 MCU 开发的 PC 工具）配合使用。您也可以将此 SDK 用作任何平台的示例代码。此 SDK 中的 所有示例应用 均支持在 TI 的 MSP432P401R 超低功耗 MCU 上运行（借助 Code Composer Studio™IDE 和 TI RTOS）。此外，许多 应用 都支持 IAR。

SimpleLink™ Studio for CC31xx SimpleLink™ Studio for CC31xx 是一款基于 Windows® 系统的软件工具，用于辅助开发微控制器的嵌入式网络 应用 和软件。利用 SimpleLink Studio for CC31xx，嵌入式软件开发人员可 使用 任何桌面 IDE（例如 Visual Studio 或 Eclipse）来开发和测试应用，并 借助 CC31xx BoosterPack™将这些应用连接到云。然后可以轻松地将该应用移植到任何微控制器。借助 SimpleLink Wi-Fi CC31xx 解决方案，客户现已可将 Wi-Fi 灵活地添加到任何微控制器 (MCU)。这款 Internet-on-a-chip 解决方案包含轻松创建物联网解决方案所需的全部资源 - 安全功能、快速连接、云支持等等。有关 CC31xx 器件的更多信息，请访问 http://www.ti.com/simplelinkwifi。

SimpleLink™ Wi-Fi® 无线电测试工具 SimpleLink™ Wi-Fi® 无线电测试工具是一款基于 Windows 的软件工具，用于在开发和认证过程中对 SimpleLink Wi-Fi CC3120 和 CC3220 设计进行射频评估和测试。通过手动将无线电设置为传输或接收模式，该工具可提供低级无线电测试功能。使用此工具需要熟悉并了解无线电电路理论和无线电测试方法的知识。

适用于 TI 微控制器 (MCU)、Sitara 处理器和 SimpleLink™ 器件的 Uniflash 独立闪存工具 CCS Uniflash 是一个独立工具，用于对 TI MCU 的片上闪存内存和 Sitara 处理器的板载闪存内存进行编程。Uniflash 具有 GUI、命令行和脚本界面。CCS UniFlash 免费提供。

9.3 固件更新

即使未发布 相关计划， TI 也会不时更新此模块相应服务包中的功能。由于更改不断发生，TI 建议用户在其用于生产的模块中使用最新服务包。

若要随时获取更新消息，请点击产品页面右上角的 SDK“通知我”按钮，或者访问此处点击此按钮。

9.4 文档支持

要接收文档更新通知（包括器件勘误表），请转至 ti.com 上的 CC3120MOD 产品文件夹，并点击右上角的“通知我”按钮。点击注册后，即可收到产品信息更改每周摘要（如有）有关更改的详细信息，请查看任意已修订文档的修订历史记录。下面列出了介绍处理器、相关外设以及其他配套技术资料的最新文档。以下文档为 CC3120MOD 模块提供支持。

应用报告

将 ***TI 的 Wi-Fi® Alliance 认证转移到基于 SimpleLink™ 的产品*** 本文档介绍如何使用 Wi-Fi® Alliance (WFA) 衍生认证策略将德州仪器 (TI) 已获得的 WFA 认证转移到您开发的系统之中。

SimpleLink™ CC3x20 Wi-Fi® Internet-on-a chip™ 解决方案内置安全性 特性 德州仪器 (TI) 的 SimpleLink Wi-Fi CC3120 和 CC3220 Internet-on-a chip 系列器件具备广泛的内置安全 功能， 帮助开发人员解决各种安全需求，同时不会增加主 MCU 的处理负担。本文档介绍这些安全相关的 功能 并就每种功能在实际系统实施中的应用提供相关建议。

在 SimpleLink™ CC3x20 Wi-Fi® 和物联网设备上使用串行闪存 本应用手册分为两个部分。第一部分提供重要指南，以及在选择和嵌入与 CC3120 和 CC3220 (CC3x20) 器件配对的串行闪存时应考虑的最佳实践设计技巧。第二部分介绍文件系统，同时为使用 CC3x20 器件的系统设计人员提供相关指南及注意事项。

SimpleLink™ CC3x20 Wi-Fi® 和物联网无线更新 本文档介绍德州仪器 (TI) 所提供的 SimpleLink™ Wi-Fi® CC3x20 系列器件的 OTA 库，并说明了如何准备将由 OTA 库下载的新的云就绪更新。

SimpleLink™ CC3x20 Wi-Fi® Internet-on-a chip™ 解决方案器件配置 本指南介绍了为 SimpleLink Wi-Fi 器件提供连接无线网络所需信息（网络名称、密码等）的配置过程。

SimpleLink™ CC3x20 Wi-Fi® Internet-on-a chip™ 网络子系统电源管理 该应用报告介绍了进行电源管理和延长电池寿命的最佳实践，适用于嵌入式低功耗 Wi-Fi 器件，例如德州仪器 (TI) 提供的 SimpleLink Wi-Fi Internet-on-a chip™ 解决方案。

用户指南

SimpleLink™ CC3x20 Wi-Fi® 嵌入式编程 此应用手册详细介绍了一些其他选项，这些选项 利用 UniFlash 所提供的全部功能，但没有必要连通电脑。此选项称为嵌入式编程。为实现嵌入式编程，下面将详细介绍通过 UART 实现的引导加载程序协议。

UniFlash SimpleLink™ CC3x20 Wi-Fi® 和 IoC™ 解决方案 ImageCreator 和 Pro 本文档介绍如何安装、操作和使用作为 UniFlash 一部分的 SimpleLink ImageCreator 工具。

SimpleLink™ CC3x20 Wi-Fi® 和物联网网络处理器 本文档为软件 (SW) 程序员提供了使用 SimpleLink Wi-Fi 器件网络子系统所需的全部知识。本指南提供了编写强大、优化型网络主机应用 的基本指南，并介绍了网络子系统的功能。本指南包含一些示例代码屏幕截图，以便使用户明白如何使用主机驱动程序。可在正式的软件开发套件 (SDK) 中找到更全面的代码示例。本指南未提供有关 主机驱动程序 API 的详细说明。

适用于移动应用的 ***SimpleLink™ CC3x20 Wi-Fi® 配置*** 本指南介绍适用于移动应用的 TI SimpleLink™ Wi-Fi® 配置 解决方案，特别是介绍如何使用Android™ 和 iOS® 构建块来满足 UI 要求、进行联网以及配置构建移动应用所需的 API。

SimpleLink™ CC3120 Wi-Fi® Internet-on-a chip™ 解决方案 SDK 本指南旨在帮助用户完成初始设置并展示 CC3120 SDK 中的各种演示。该指南列出了开始使用时所需的软件和硬件组件，并介绍了如何安装所支持的集成开发环境 (IDE)、SimpleLink CC3120 SDK 和所需的各种其他工具。

SimpleLink™ CC3x20 Wi-Fi® 和 Internet-on-a chip™ 解决方案无线电工具 这款无线电工具作为直接接入无线电的控制面板，可用于射频 (RF) 评估及获取认证。本指南介绍如何使该工具在德州仪器 (TI) ™ 评估平台（例如 CC3120 器件的 BoosterPack™ 和 FTDI 仿真板或 CC3220 器件的 LaunchPad™）上无缝运行。

SimpleLink™ CC3120 Wi-Fi® BoosterPack™ 插件模块和物联网解决方案 借助德州仪器 (TI) 提供的 SimpleLink Wi-Fi CC3120 无线网络处理器，用户可以灵活地将 Wi-Fi 添加到任何 MCU。本用户指南主要介绍 CC3120 BoosterPack™ 插件模块的各种配置。

更多文献

RemoTI 清单

设计文件

SimpleLink™ CC3120MOD WI-Fi® 和物联网 CC3120 硬件

SimpleLink™ CC3x20 Wi-Fi® 和物联网

9.5 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

TI E2E™ Online Community The TI engineer-to-engineer (E2E) community was created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

TI Embedded Processors Wiki Established to help developers get started with Embedded Processors from Texas Instruments and to foster innovation and growth of general knowledge about the hardware and software surrounding these devices.

9.6 商标

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Bluetooth is a registered trademark of Bluetooth SIG Inc.
Wi-Fi CERTIFIED is a trademark of Wi-Fi Alliance.
Wi-Fi, Wi-Fi Direct are registered trademarks of Wi-Fi Alliance.

9.7 静电放电警告

ESD 可能会损坏该集成电路。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措施和安装程序，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。

9.8 Export Control Notice

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9.9 Glossary

TI Glossary This glossary lists and explains terms, acronyms, and definitions.

10 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。

10.1 机械、焊盘和焊锡膏制图

注

添加了注释
添加了注释

1. 模块总高度为 2.45 mm。
2. 模块的重量为 0.00175kg ±3%。

注

1. 所有尺寸的单位皆为 mm。
2. 阻焊层应与焊盘大小相同或比焊盘大 5%
3. 焊锡膏必须采用与所有外设焊盘相同的引脚。对于接地引脚，焊锡膏量应比焊盘少 20%。

10.2 Package Option Addendum

The CC3120MOD is only offered in a 1000-unit real option.

10.2.1 Packaging Information

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4) (5)
CC3120MODRNMMOBR	ACTIVE	LGA	MOB	63	1000	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.

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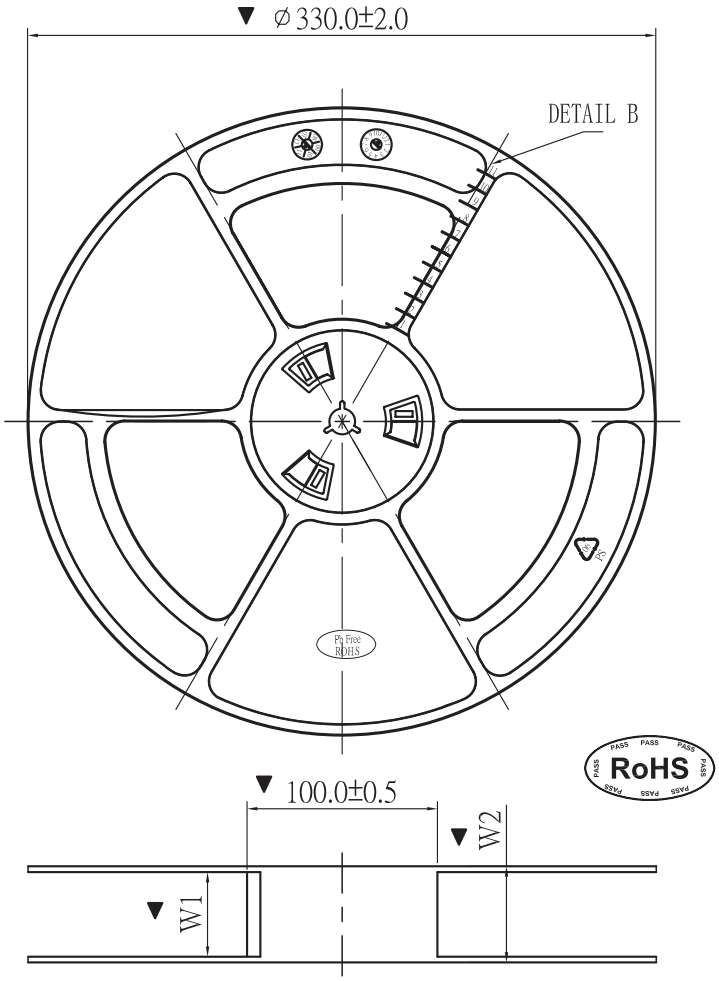
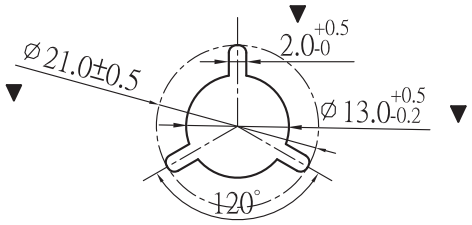
10.3 卷带封装信息

MOC 1000 引脚的压纹带规格。

10.3.1 卷带封装规格

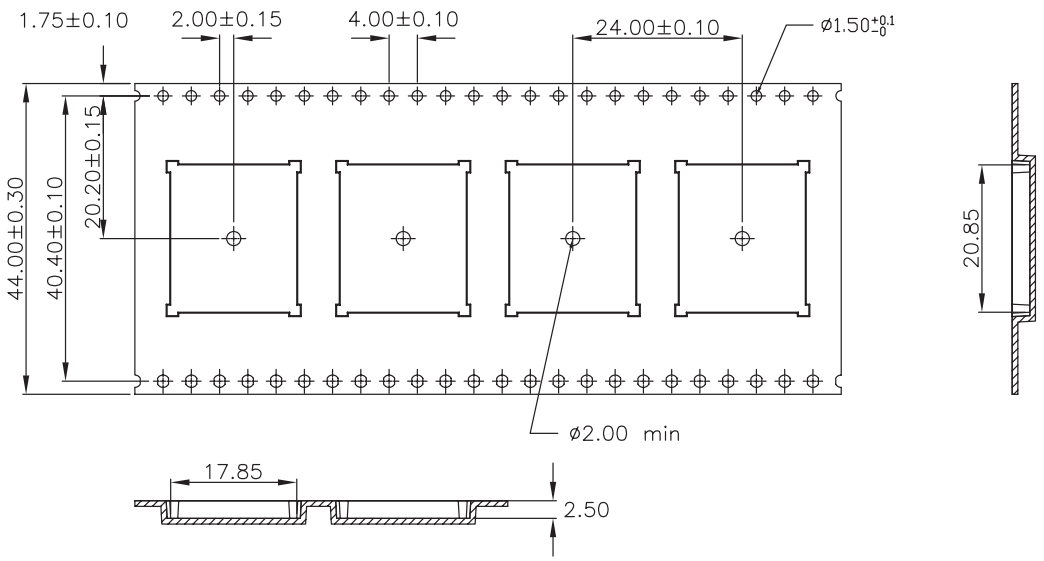




Surface resistance 10^{7}~$10^{11}\Omega/\square$

Spec	Vendor No.	W1	W2(max)
13" 100*12mm	RUR-22-3-X*	$12.4^{+2.0}_{-0}$	18.4
13" 100*16mm	RUR-23-3-X*	$16.4^{+2.0}_{-0}$	22.4
13" 100*24mm	RUR-24-3-X*	$24.4^{+2.0}_{-0}$	30.4
13" 100*32mm	RUR-25-3-X*	$32.4^{+2.0}_{-0}$	38.4
13" 100*44mm	RUR-26-3-X*	$44.4^{+2.0}_{-0}$	50.4
13" 100*56mm	RUR-27-3-X*	$56.4^{+2.0}_{-0}$	62.4
13" 100*72mm	RUR-28-3-X*	$72.4^{+2.0}_{-0}$	79.5
13" 100*88mm	RUR-29-3-X*	$88.4^{+2.0}_{-0}$	96
13" 100*104mm	RUR-2A-3-X*	$104.4^{+2.0}_{-0}$	112

图 **10-1.** 卷带规格



1. 10 sprocket hole pitch cumulative tolerance ±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±0.05mm.
6. Packing length per13" reel : 25 Meters.
7. Component load per 7" reel :1000 pcs

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

图 **10-2.** 卷盘规格

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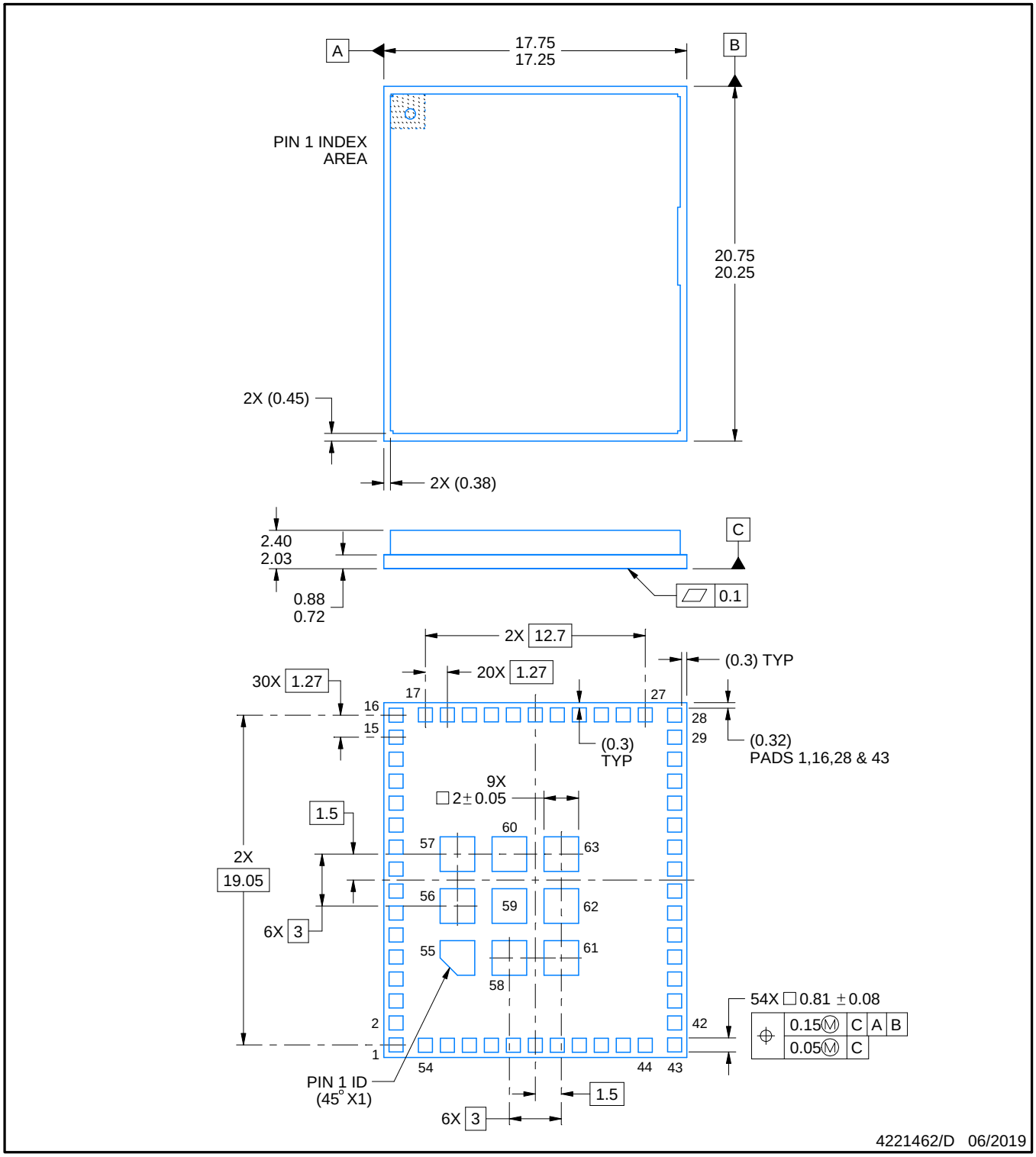
PACKAGE OUTLINE

MOB0063A

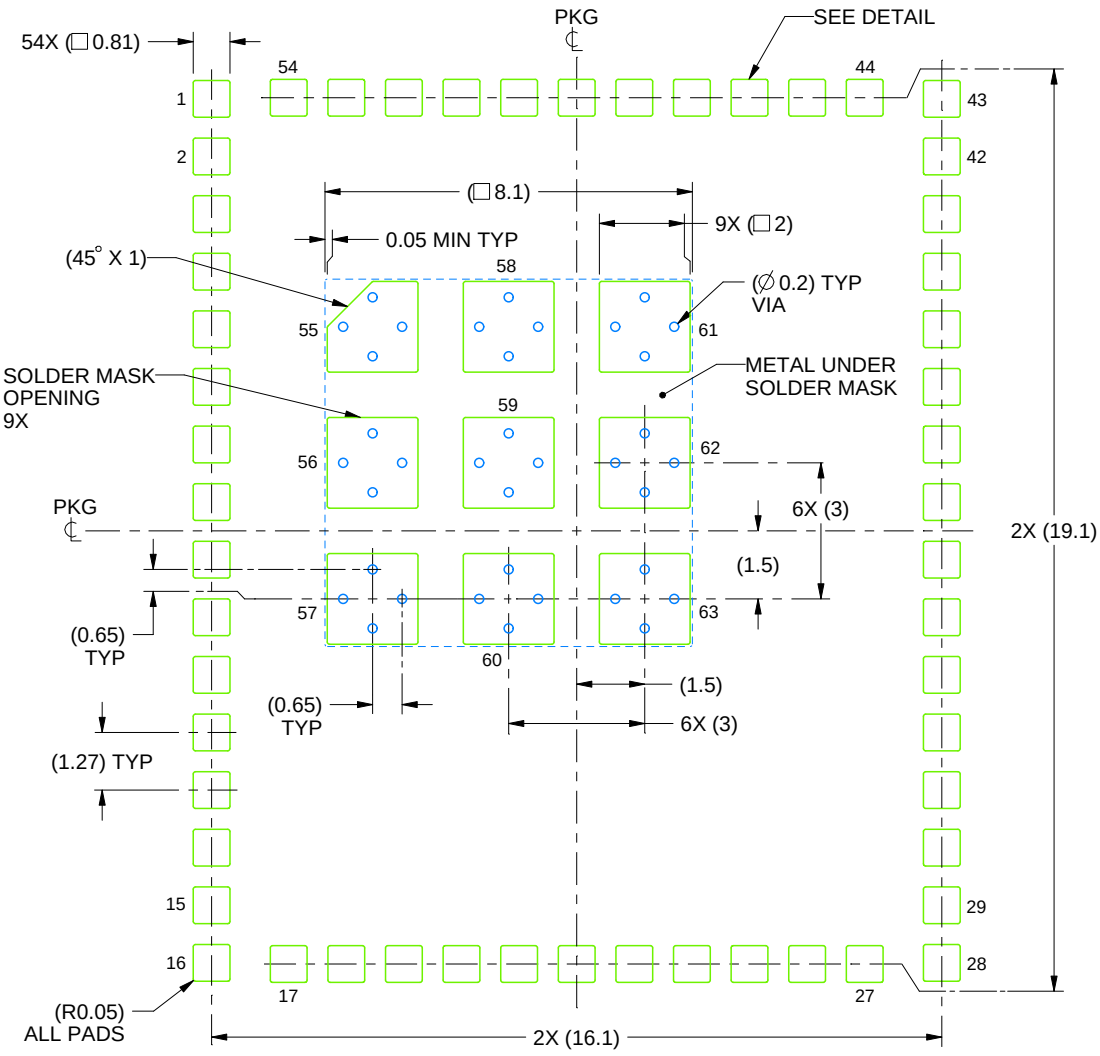
QFM - 2.4 mm max height

QUAD FLAT MODULE

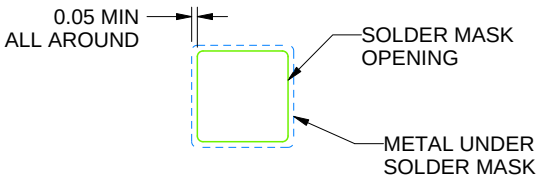


NOTES:

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.



LAND PATTERN EXAMPLE
SOLDER MASK DEFINED
SCALE:6X

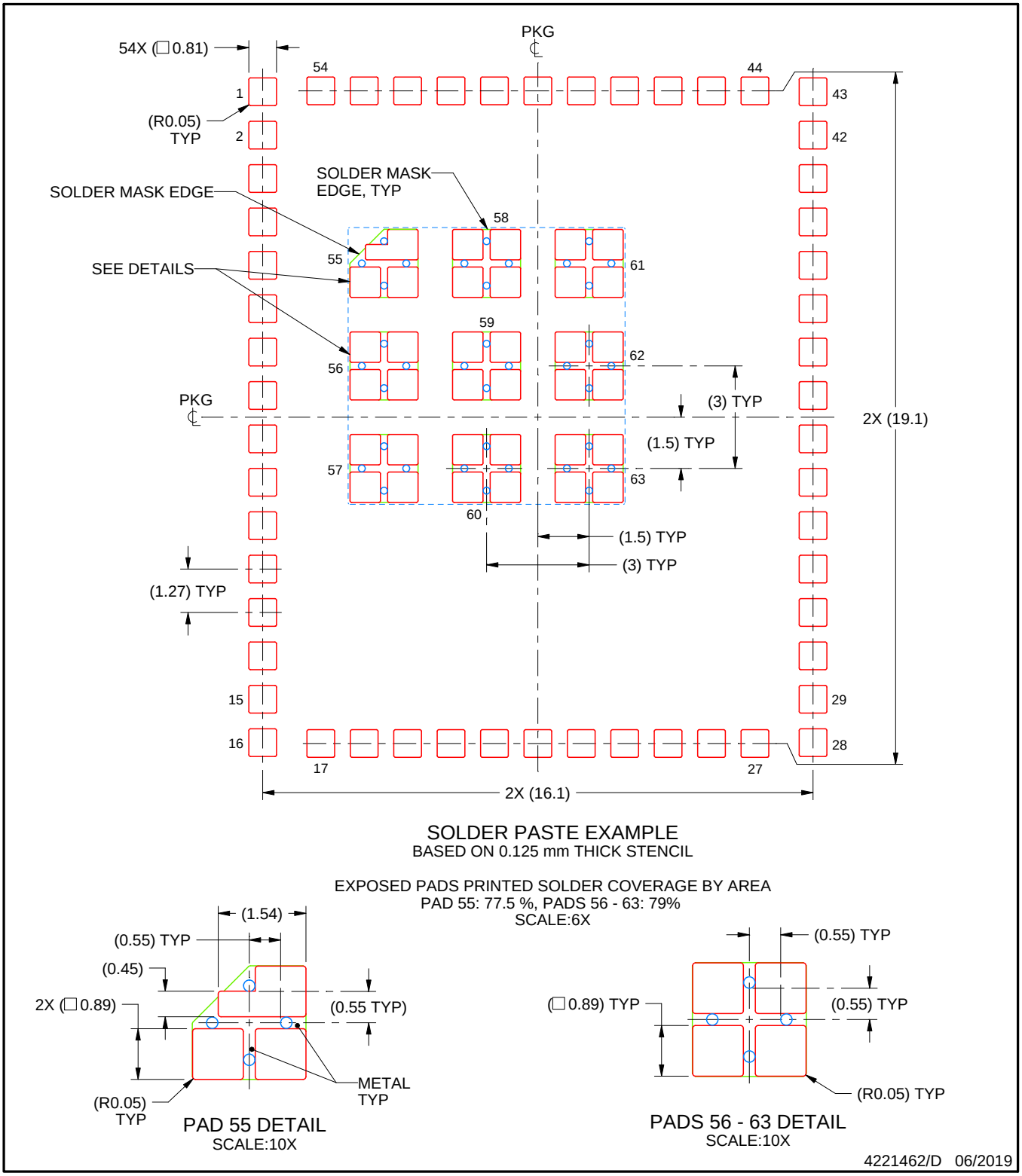


SIGNAL PADS DETAIL

4221462/D 06/2019

NOTES: (continued)

3. 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/slua271).



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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