

EVM User's Guide: AWR2188EVM

AWR2188EVM 用户指南



说明

AWR2188EVM 是一款高性能前端毫米波传感器器件，采用 2 器件级联 AWR2188 毫米波传感器阵列。在这一级联雷达配置中，初级器件将 20GHz LO 信号分配给两个器件，使这两个器件能够作为单个射频收发器运行。这最多可以支持 16 个 TX 和 16 个 RX 天线元件，从而在 MIMO 虚拟阵列中提供总共 256 个虚拟通道。在 TX 波束成形、波束控制和 MIMO/SIMO 应用场景中，与单器件系统相比，更多的天线单元可以实现更高的 SNR 和更高的角度分辨率。

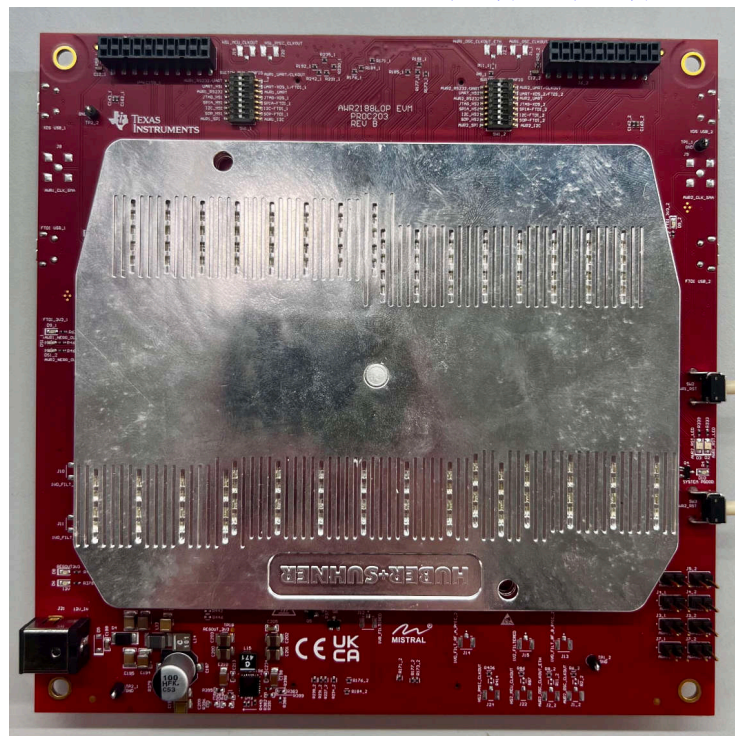
AWR2188EVM 连接至配套的 TI [DCA2000EVM](#) 采集板，该采集板负责控制毫米波器件并接收采集的 IF ADC 样本。[DCA2000EVM](#) 具有 SSD 存储，支持长期数据采集场景；还具有 1Gb 以太网连接，可控制采集的数据并将其传输至主机 PC。

特性

- 集成 VCO、LO 分配以及 PA、LNA、ADC、8TX 和 8RX、ARM Cortex-R5F 与 M4 控制器的 2 级级联 AWR2188 76-81GHz 雷达 SoC
- Huber+Suhner 16x16 3D 波导天线，81GHz 下增益为 15dBi
- 支持 CSI2.0，每通道 824Mbps，每个器件可实现 6.6Gbps ADC IF 数据速率
- 支持 SPI、JTAG、I2C UART 和 GPIO 的板载 FTDI 和 XDS110
- 10 个用于功率测量的板载 INA228 电流传感器
- 板载 TMP112 温度传感器
- 支持 ASIL-B 的 LP8772x-Q1 PMIC

应用

- [成像雷达](#)
- [远程雷达](#)
- [卫星雷达](#)
- [中距雷达或短距雷达](#)



1 评估模块概述

1.1 简介

AWR2188EVM 是一款适用于 AWR2188 毫米波传感器件的易用型评估板，可直接连接到 [DCA2000EVM](#)。该评估板集成 16x16 3D 波导天线，可构建 256 通道虚拟阵列，以提升探测距离与分辨率。AWR2188EVM 与 DCA2000EVM 采集卡和 TI 的 [mmWave Studio IDE](#) 相结合，为轻松评估新一代高性能前端传感器提供了完整的解决方案。

备注

AWR2188EVM 设计用于安装到配套的 [DCA2000EVM](#) 主机/采集板上。AWR2188EVM + DCA2000EVM 的组合可通过以太网和 USB 接口，由主机 PC 运行 TI 的 [mmWave Studio IDE](#) 进行控制。

有关组装、供电和配置双板 AWR2188EVM + DCA2000EVM 系统的详细信息，请参阅 [DCA2000EVM 用户指南](#)。

1.2 套件内容

AWR2188EVM 附带以下物品：

- AWR2188EVM
- Huber+Suhner 3D 波导天线
- 2 条 Micro USB 电缆
- 快速入门指南
- 保修卡 (免责声明)
- 安装硬件

1.3 规格

AWR2188 是一款 FMCW 收发器，其主要规格如下。

表 1-1. 主要系统规格

参数	规格
FMCW 收发器	集成 PLL、发送器、接收器、基带和 ADC
带宽	工作频率范围为 76-81GHz，具有高达 4.5GHz 的连续线性调频脉冲带宽
发送器数量 (每个器件)	8
接收器数量 (每个器件)	8
TX 功率	13.5dBm
噪声系数	11dB
相位噪声 (1MHz 时)	-96dBc/Hz (76GHz 至 81GHz)

1.4 器件信息

AWR2188 器件是一款能够在 76GHz 至 81GHz 频带内运行的集成式 FMCW 收发器。该器件采用非常小的外形尺寸实现了出色的集成度。

AWR2188 器件是一种自包含 FMCW 收发器单芯片器件，简化了汽车雷达传感器在 76GHz 至 81GHz 频带范围内的实施。该器件基于 TI 低功耗 45nm RFCMOS 工艺构建，从而实现了一个具有内置 PLL 和 ADC 转换器的单片实施 8TX、8RX 系统。简单编程模型更改可支持各种传感器实施 (近距离、中距离和远距离)，并且能够进行动态重新配置，从而实现多模式传感器。此外，该器件作为完整的平台器件进行提供，该包括硬件参考设计、软件驱动程序、样例配置、API 指南以及用户文档。

2 硬件

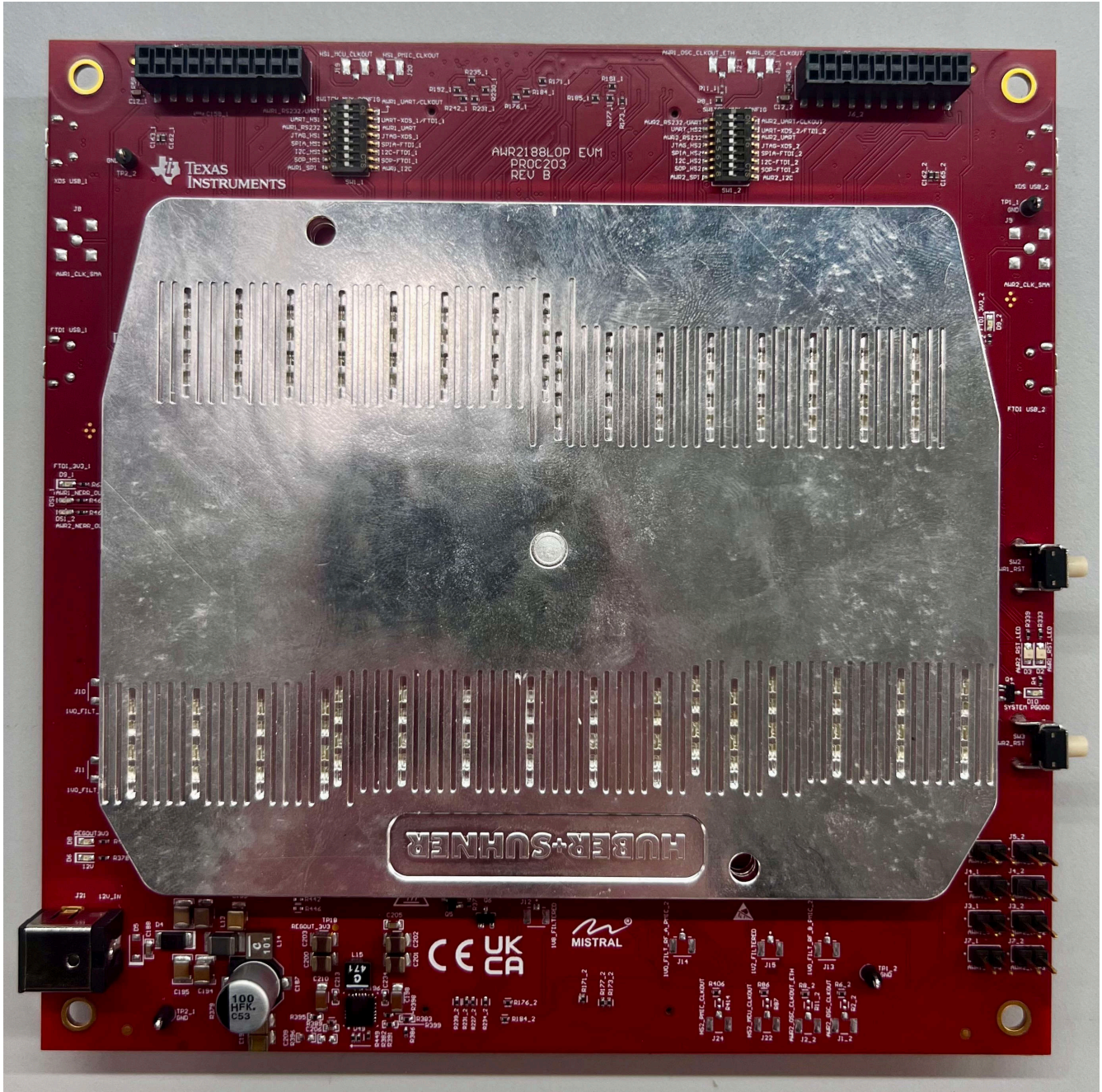


图 2-1. 板顶层

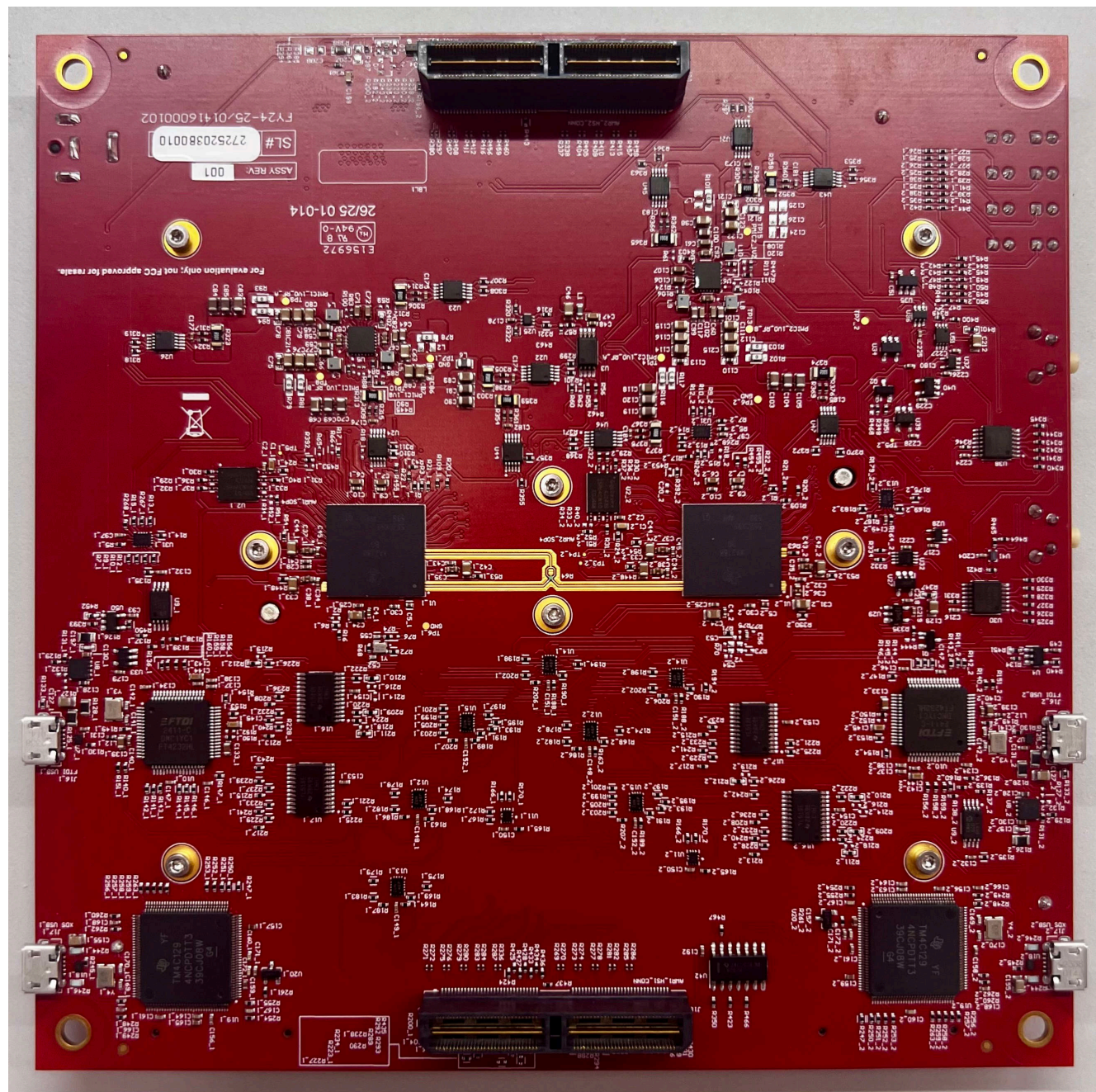


图 2-2. 板底层

2.1 方框图

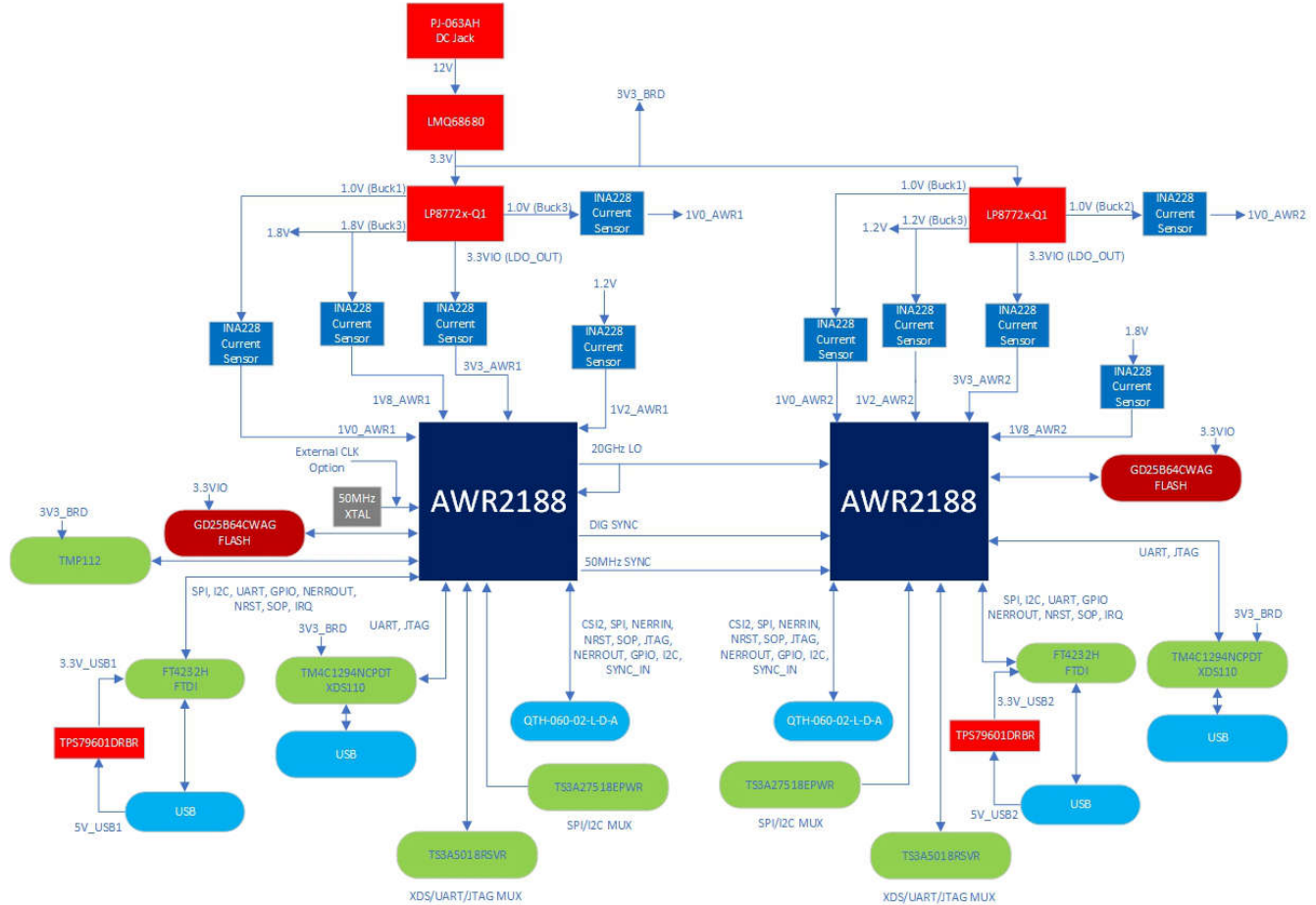


图 2-3. 方框图

2.2 PCB 处理建议

此 EVM 包含可能因静电放电而受损的元件。不使用时，请务必将 EVM 置于随附的 ESD 袋中进行运输和贮存。使用防静电腕带处理。在防静电工作台上操作。有关正确搬运的更多信息，请参阅 [SSYA010A](#)。

2.3 电源连接

AWR2188EVM 由 12V 电源插孔 (>2.5A 的电流能力) 供电。接通 12V 电源后, REGOUT_3V3 和 SYS_PGOOD LED 会点亮, 表明电路板已加电。

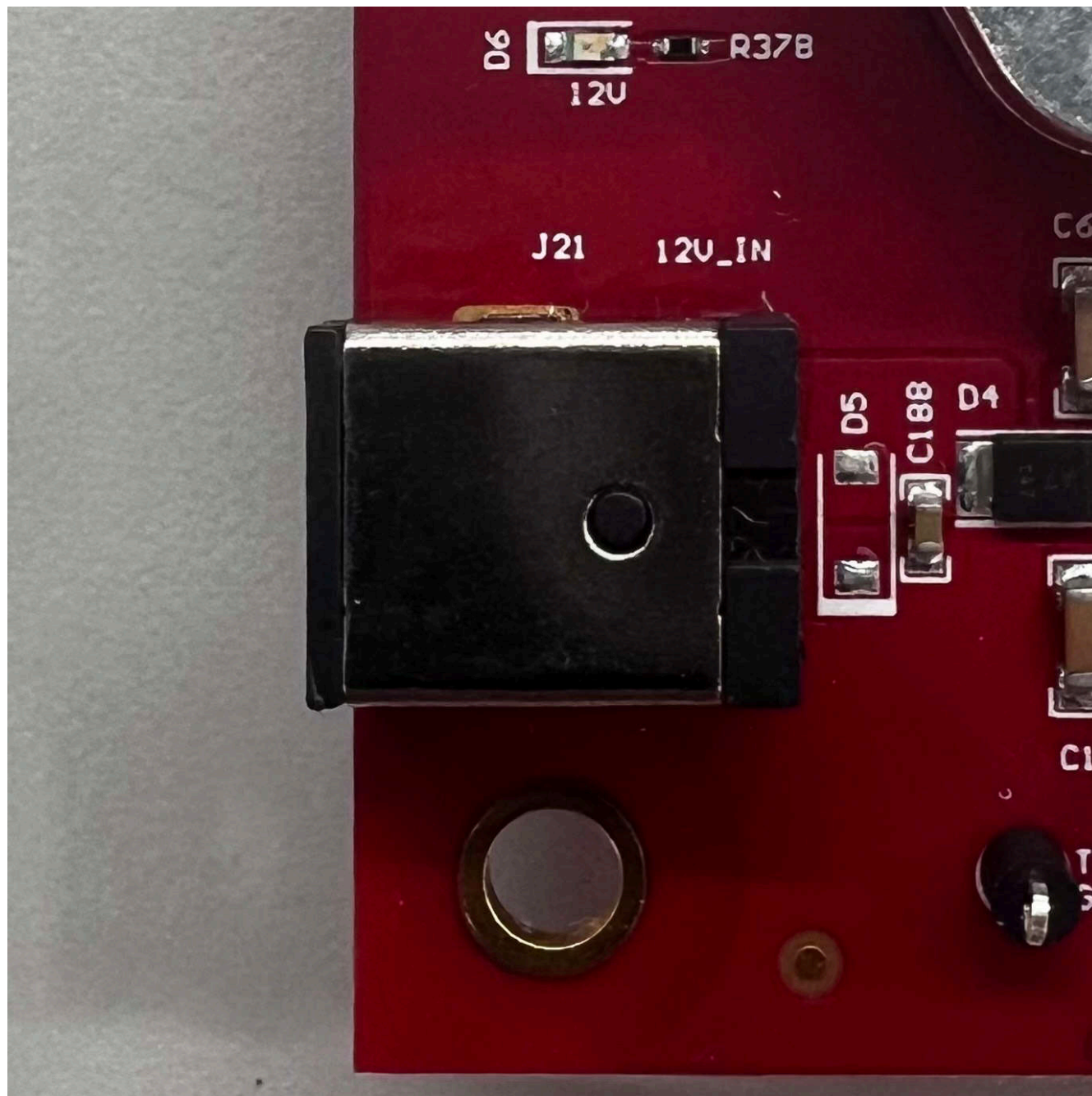


图 2-4. 电源连接器 (J21)

备注

向 EVM 提供 12V 电源后, TI 建议手动拨动 NRST 一次, 以使其进入可靠的启动状态。

2.4 连接器

2.4.1 初级雷达连接器 (J18)

初级雷达连接器将初级雷达器件的所有复位、引导、数字控制和 CSI2 信号提供给主机 (DCA2000EVM)。此连接器可直接与 DCA2000EVM 上的初级雷达连接器对接。如果用户希望使用电缆连接 AWR2188EVM 与 DCA2000EVM，建议使用的部件型号是 Samtec 生产的 HDR-241659-03-HQCD 电缆。

表 2-1. 初级雷达连接器引脚分配

引脚编号	定义	引脚编号	定义
1	GND	2	AWR_SOP3_DBG_1
3	AWR_CSI2A_TX3_1_P	4	AWR_SOP2_DBG_1
5	AWR_CSI2A_TX3_1_N	6	AWR_SOP1_DBG_1
7	GND	8	AWR_SOP0_DBG_1
9	AWR_CSI2A_TX2_1_P	10	GND
11	AWR_CSI2A_TX2_1_N	12	AWR_MSS_GPIO0_DGB_SPI_B USY_1
13	GND	14	AWR_MSS_HOST_IRQ_AE_INT R_DBG_1
15	AWR_CSI2A_CLK_1_P	16	AWR_MSS_GPIO1_LPMODE_D BG_1
17	AWR_CSI2A_CLK_1_N	18	GND
19	GND	20	AWR_DBGMcSPIA_MOSI_1
21	AWR_CSI2A_TX1_1_P	22	AWR_DBGMcSPIA_MISO_1
23	AWR_CSI2A_TX1_1_N	24	AWR_DBGMcSPIA_CLK_1
25	GND	26	AWR_DBGMcSPIA_CS0_1
27	AWR_CSI2A_TX0_1_P	28	GND
29	AWR_CSI2A_TX0_1_N	30	AWR_MSS_GPIO2_DBG_I2C_A DDR_0_1
31	GND	32	AWR_MSS_GPIO4_DBG_I2C_A DDR_1_1
33	NC	34	AWR_MSS_GPIO5_DBG_I2C_A DDR_2_1
35	NC	36	AWR_MSS_I2CA_SDA_DBG_1
37	NC	38	AWR_MSS_I2CA_SCL_DBG_1
39	NC	40	GND
41	PMIC_NERROUT_1	42	GND
43	PMIC_NERROUT_2	44	AWR_DBG_BSS_UARTA_TX_1
45	PMIC1_RSTOUT	46	AWR_DBG_MSS_UARTB_TX_1
47	PMIC2_RSTOUT	48	AWR_RS232_DBG_TX_1
49	PMIC_INT_1	50	AWR_RS232_DBG_RX_1
51	PMIC_INT_2	52	GND
53	SOC_GPIO_RST_CTRL_BUF_1	54	AWR_ADC_VALID_1
55	SOC_PREG_DIS	56	NC
57	SOC_PMIC1_DIS	58	GND
59	SOC_PMIC2_DIS	60	AWR_EXT_DIG_SYNCOUT
61	GND	62	GND

表 2-1. 初级雷达连接器引脚分配 (续)

引脚编号	定义	引脚编号	定义
63	AWR_CSI2B_TX3_1_P	64	AWR_OSC_DBG_CLKOUT_1
65	AWR_CSI2B_TX3_1_N	66	GND
67	GND	68	AWR_DBG_MCU_CLKOUT_1
69	AWR_CSI2B_TX2_1_P	70	GND
71	AWR_CSI2B_TX2_1_N	72	AWR_OSC_DBG_CLKOUT_ETH_1
73	GND	74	GND
75	AWR_CSI2B_CLK_1_P	76	AWR_DBG_PMIC__CLKOUT_1
77	AWR_CSI2B_CLK_1_N	78	AWR_DBG_MSS_UARTA_TX_1
79	GND	80	AWR_DBG_MSS_UARTA_RX_1
81	AWR_CSI2B_TX1_1_P	82	GND
83	AWR_CSI2B_TX1_1_N	84	AWR_DBG_TDO_1
85	GND	86	AWR_DBG_TDI_1
87	AWR_CSI2B_TX0_1_P	88	AWR_DBG_TMS_1
89	AWR_CSI2B_TX0_1_N	90	AWR_DBG_TCK_1
91	GND	92	GND
93	NC	94	NC
95	NC	96	NC
97	NC	98	NC
99	NC	100	NC
101	NC	102	GND
103	NC	104	AWR_NERROROUT_BUF_1
105	NC	106	DCA_GPIO_RST_CTRL_BUF_1
107	NC	108	GND
109	NC	110	DCA_FTDI_RST_CTRL_BUF_1
111	NC	112	GND
113	NC	114	DCA_XDS_RST_CTRL_BUF_1
115	NC	116	GND
117	NC	118	SYS_PGOOD
119	NC	120	NC



2.4.2 次级雷达连接器 (J23)

表 2-2. 次级雷达连接器引脚分配

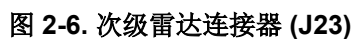
引脚编号	定义	引脚编号	定义
1	AWR_SOP3_DBG_2	2	GND
3	AWR_SOP2_DBG_2	4	AWR_CSI2A_TX3_2_P

表 2-2. 次级雷达连接器引脚分配 (续)

引脚编号	定义	引脚编号	定义
5	AWR_SOP1_DBG_2	6	AWR_CSI2A_TX3_2_N
7	AWR_SOP0_DBG_2	8	GND
9	GND	10	AWR_CSI2A_TX2_2_P
11	AWR_MSS_GPIO0_DBG_SPI_B USY_2	12	AWR_CSI2A_TX2_2_N
13	AWR_MSS_HOST_IRQ_AE_INT R_DBG_2	14	GND
15	AWR_MSS_GPIO1_LPMODE_D BG_2	16	AWR_CSI2A_CLK_2_P
17	GND	18	AWR_CSI2A_CLK_2_N
19	AWR_DBG_McSPIA_MOSI_2	20	GND
21	AWR_DBG_McSPIA_MISO_2	22	AWR_CSI2A_TX1_2_P
23	AWR_DBG_McSPIA_CLK_2	24	AWR_CSI2A_TX1_2_N
25	AWR_DBG_McSPIA_CS0_2	26	GND
27	GND	28	AWR_CSI2A_TX0_2_P
29	AWR_MSS_GPIO2_DBG_I2C_A DDR_0_2	30	AWR_CSI2A_TX0_2_N
31	AWR_MSS_GPIO4_DBG_I2C_A DDR_1_2	32	GND
33	AWR_MSS_GPIO5_DBG_I2C_A DDR_2_2	34	NC
35	AWR_MSS_I2CA_SDA_DBG_2	36	NC
37	AWR_MSS_I2CA_SCL_DBG_2	38	NC
39	GND	40	NC
41	GND	42	NC
43	AWR_DBG_BSS_UARTA_TX_2	44	NC
45	AWR_DBG_MSS_UARTB_TX_2	46	NC
47	AWR_RS232_DBG_TX_2	48	NC
49	AWR_RS232_DBG_RX_2	50	NC
51	GND	52	NC
53	AWR_ADC_VALID_2	54	SOC_GPIO_RST_CTRL_BUF_2
55	NC	56	NC
57	GND	58	NC
59	NC	60	NC
61	GND	62	GND
63	AWR_OSC_DBG_CLKTOUT_2	64	AWR_CSI2B_TX3_2_P
65	GND	66	AWR_CSI2B_TX3_2_N
67	AWR_DBG_MCU_CLKOUT_2	68	GND
69	GND	70	AWR_CSI2B_TX2_2_P
71	AWR_OSC_DBG_CLKOUT_ETH _2	72	AWR_CSI2B_TX2_2_N

表 2-2. 次级雷达连接器引脚分配 (续)

引脚编号	定义	引脚编号	定义
73	GND	74	GND
75	AWR_DBG_PMIC__CLKOUT_2	76	AWR_CSI2B_CLK_2_P
77	AWR_DBG_MSS_UARTA_TX_2	78	AWR_CSI2B_CLK_2_N
79	AWR_DBG_MSS_UARTA_RX_2	80	GND
81	GND	82	AWR_CSI2B_TX1_2_P
83	AWR_DBG_TDO_2	84	AWR_CSI2B_TX1_2_N
85	AWR_DBG_TDI_2	86	GND
87	AWR_DBG_TMS_2	88	AWR_CSI2B_TX0_2_P
89	AWR_DBG_TCK_2	90	AWR_CSI2B_TX0_2_N
91	GND	92	GND
93	NC	94	NC
95	NC	96	NC
97	NC	98	NC
99	NC	100	NC
101	GND	102	NC
103	AWR_NERROROUT_BUF_2	104	NC
105	DCA_GPIO_RST_CTRL_BUF_2	106	NC
107	GND	108	NC
109	DCA_FTDI_RST_CTRL_BUF_2	110	
111	GND	112	NC
113	DCA_XDS_RST_CTRL_BUF_2	114	NC
115	GND	116	NC
117	NC	118	NC
119	NC	120	NC



AWR2188EVM 具有四个标准 Micro USB 连接器，两个用于初级雷达 FTDI 和 XDS110 端口，两个用于次级雷达 FTDI 和 XDS110 端口。

表 2-3. 初级雷达 FTDI 引脚分配

引脚编号	说明	引脚编号	说明
1	FTDI_VBUS	2	FTDI_USBD_N
3	FTDI_USBD_P	4	FTDI_USBID

表 2-3. 初级雷达 FTDI 引脚分配 (续)

引脚编号	说明	引脚编号	说明
5	GND	6	GND
7	GND	8	GND
9	GND	10	GND
11	GND		

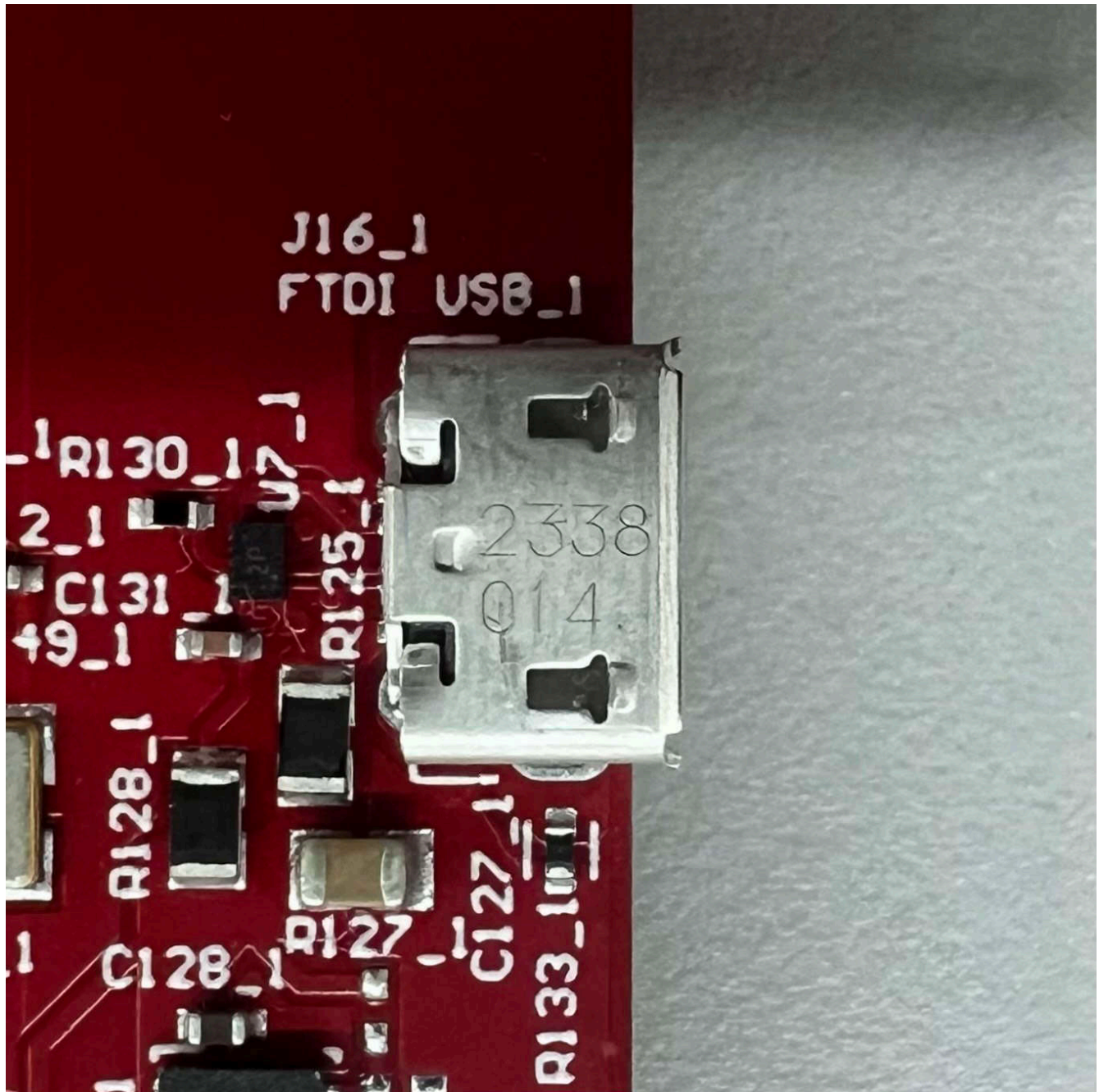


图 2-7. 初级雷达 FTDI 端口 (J16_1)

Micro USB 连接器 J17_1 支持通过板载 XDS110 仿真器访问初级雷达 UART 和 JTAG 接口。

表 2-4. 初级雷达 XDS110 引脚分配

引脚编号	说明	引脚编号	说明
1	XDSET_VBUS	2	XDSET_D_N
3	XDSET_D_P	4	XDSET_ID
5	GND	6	GND
7	NC	8	NC
9	GND	10	GND
11	GND		

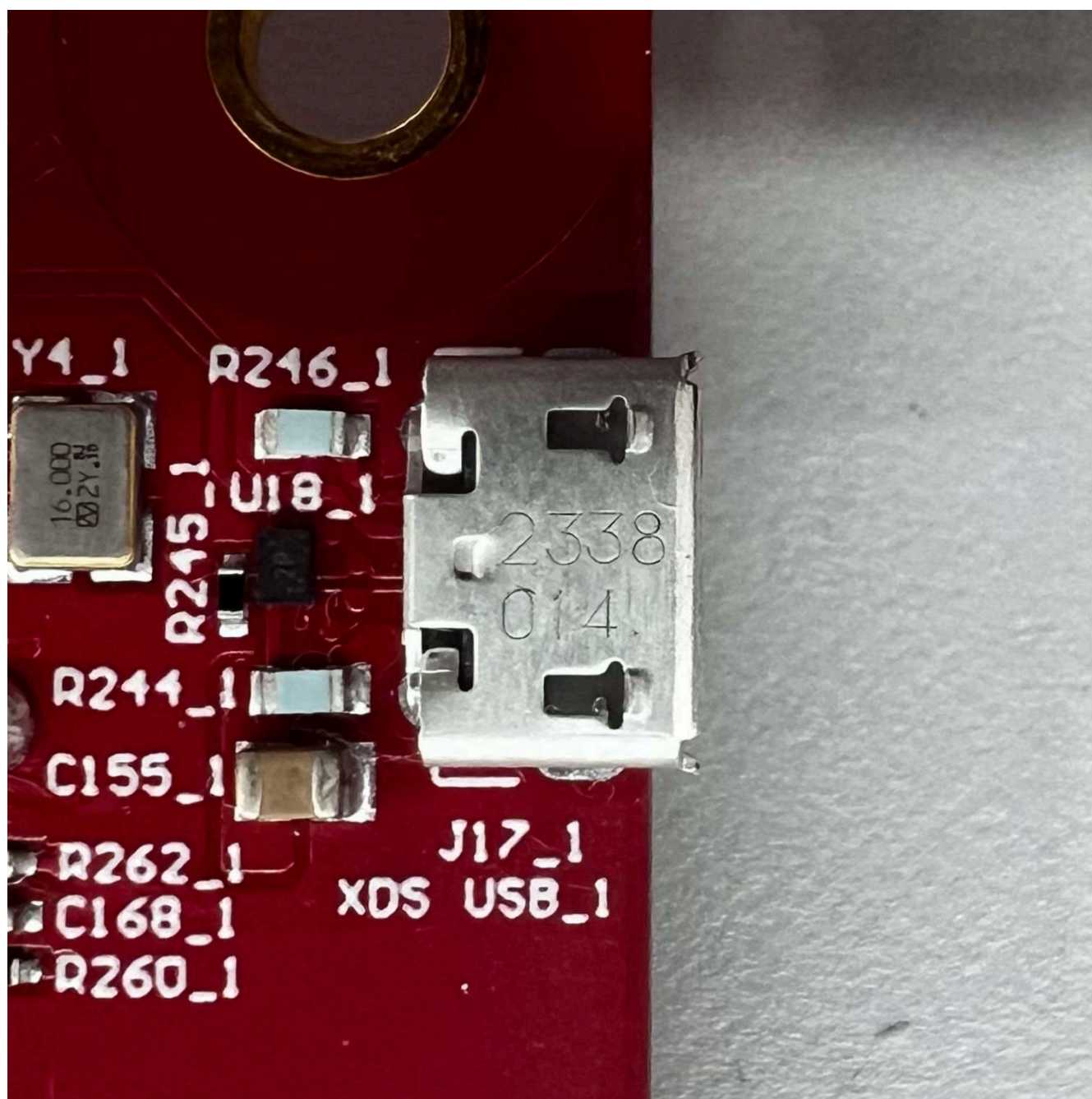


图 2-8. 初级雷达 XDS110 端口 (J17_1)

Micro USB 连接器 J16_2 支持通过 FTDI 芯片访问次级雷达 UART、SPI、I2C、RS232 和 SOP 接口。

表 2-5. 次级雷达 FTDI 引脚分配

引脚编号	说明	引脚编号	说明
1	FTDI_VBUS	2	FTDI_USBD_N
3	FTDI_USBD_P	4	FTDI_USBDID
5	GND	6	GND
7	GND	8	GND
9	GND	10	GND
11	GND		

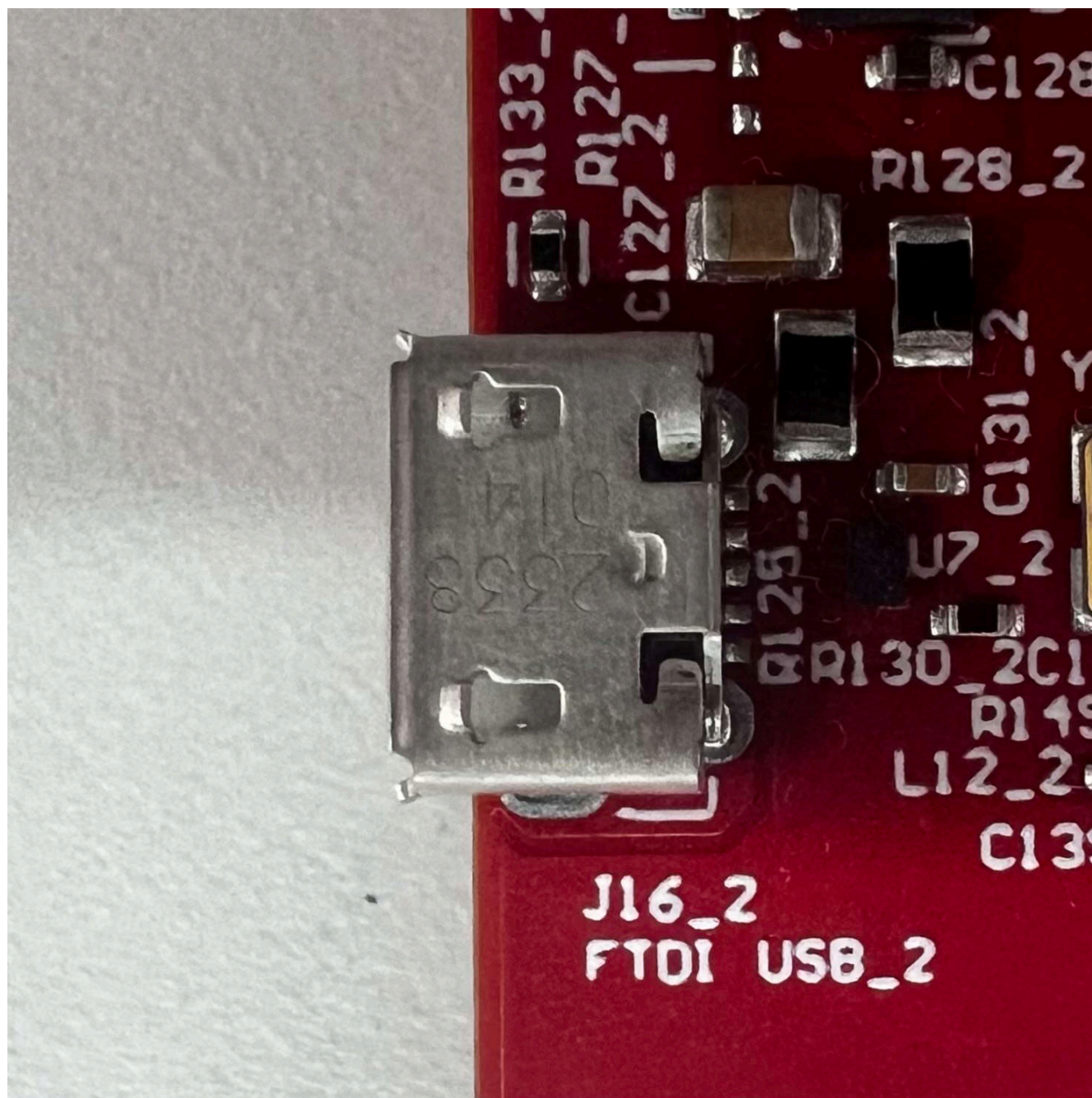


图 2-9. 次级雷达 FTDI 端口 (J16_2)

Micro USB 连接器 J17_2 支持通过板载 XDS110 仿真器访问次级雷达 UART 和 JTAG 接口。

表 2-6. 次级雷达 XDS110 引脚分配

引脚编号	说明	引脚编号	说明
1	XDSET_VBUS	2	XDSET_D_N
3	XDSET_D_P	4	XDSET_ID
5	GND	6	GND
7	NC	8	NC
9	GND	10	GND

表 2-6. 次级雷达 XDS110 引脚分配 (续)

引脚编号	说明	引脚编号	说明
11	GND		

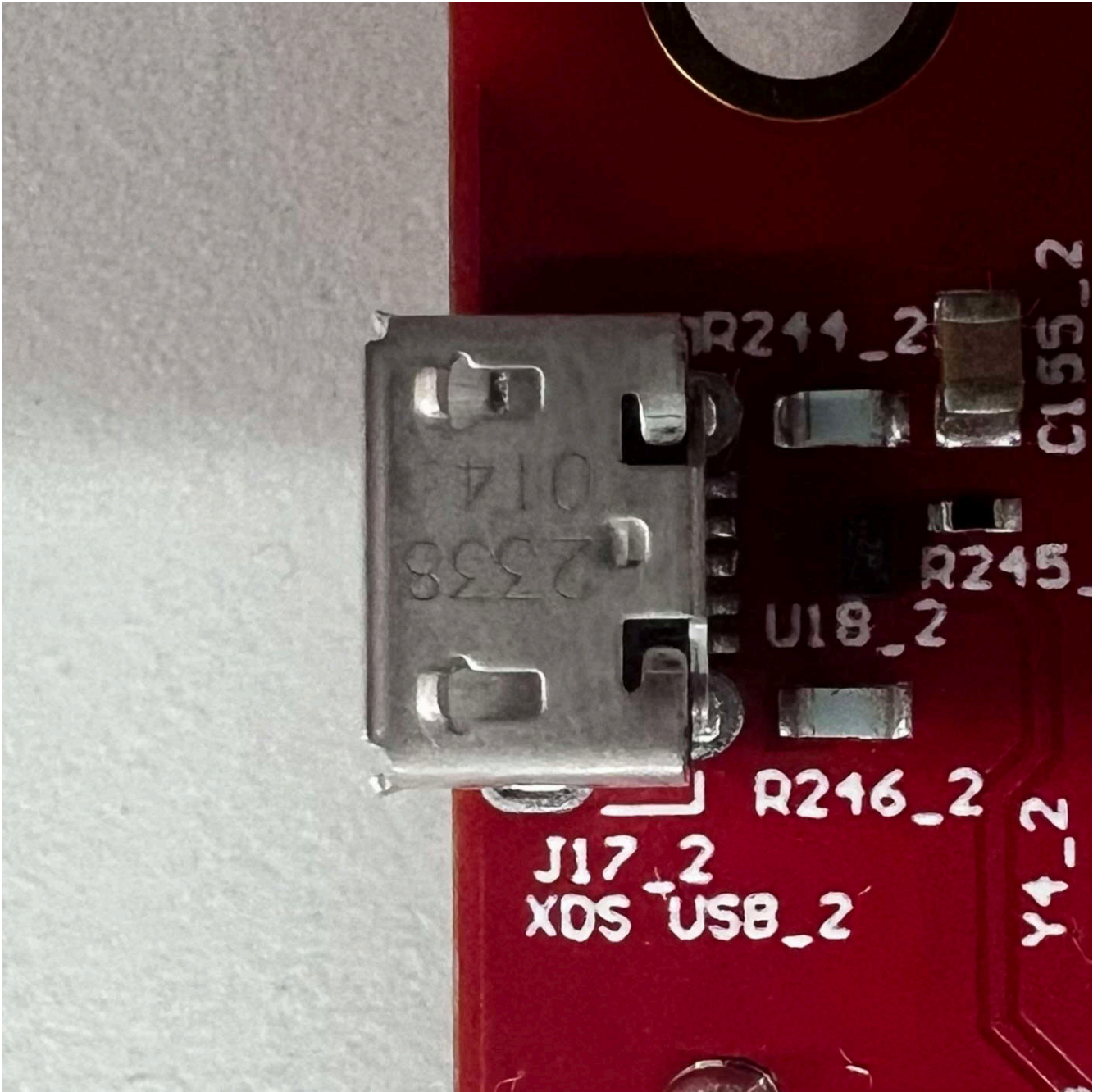


图 2-10. 次级雷达 XDS110 端口 (J17_2)

2.4.4 调试连接器 (J6_1、J6_2)

AWR2188EVM 集成两个调试连接器，一个用于初级雷达，一个用于次级雷达。

表 2-7. 初级雷达调试连接器引脚分配

引脚编号	说明	引脚编号	说明
1	3V3_VIO_PMIC_1	2	GND

表 2-7. 初级雷达调试连接器引脚分配 (续)

引脚编号	说明	引脚编号	说明
3	3V3_VIO_PMIC_1	4	GND
5	3V3_VIO_PMIC_1	6	GND
7	AWR_NERROUT_1	8	AWR_MSS_GPIO2_I2C_ADDR_0_1
9	AWR_DBG_BSS_UARTA_TX_1	10	AWR_MSS_GPIO4_I2C_ADDR_1_1
11	AWR_DBG_MSS_UARTA_RX_1	12	AWR_MSS_GPIO5_I2C_ADDR_2_1
13	AWR_MSS_GPIO1_LP_MODE_1	14	AWR_MSS_HOST_IRQ_AE_INT_R_1
15	AWR_MSS_GPIO0_SPI_BUSY_1	16	AWR_RS232_TX_1
17	AWR_ADC_VALID_1	18	AWR_RS232_RX_1
19	NRST_AWR1	20	VPP_1P7_1

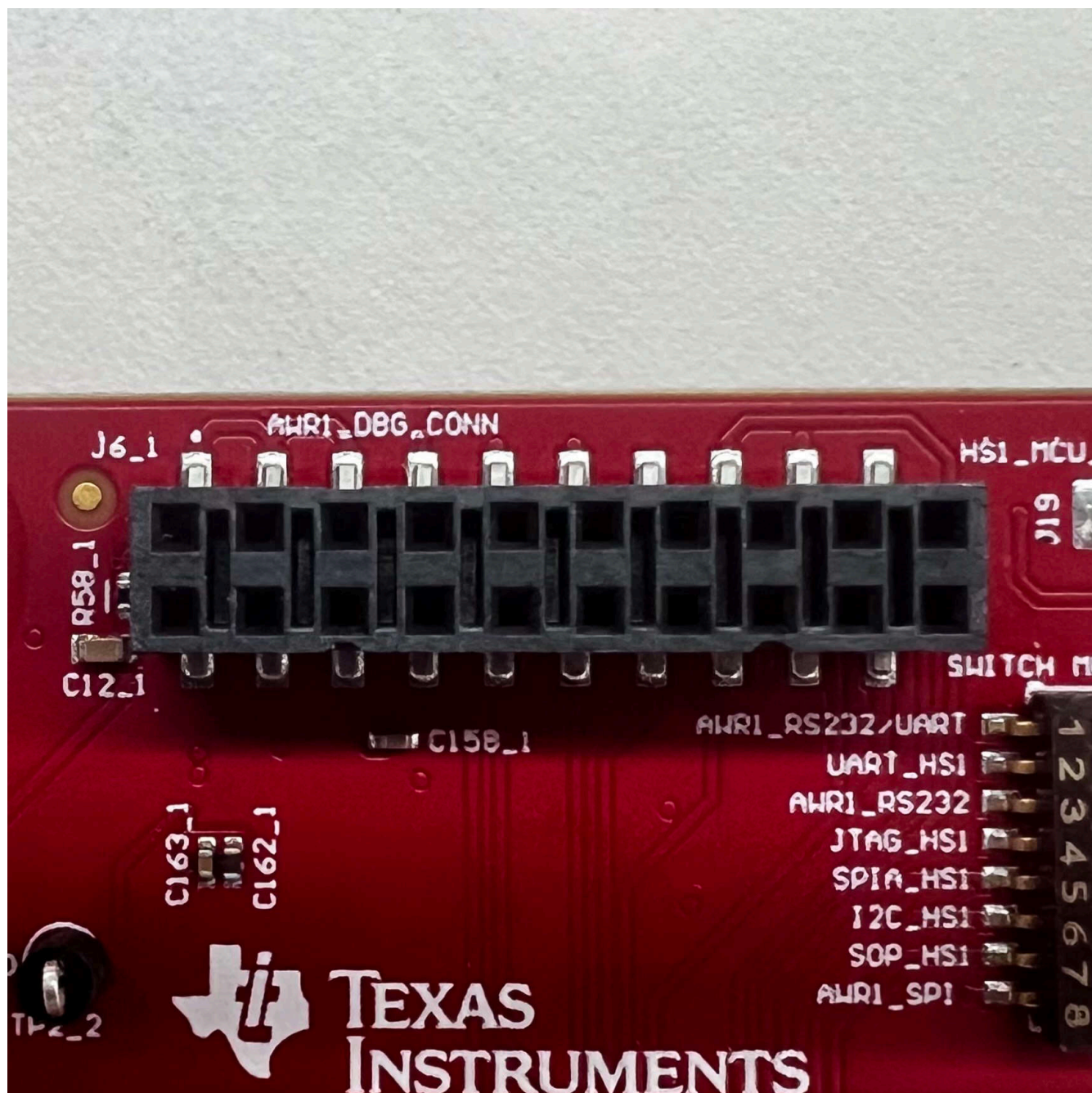


图 2-11. 初级雷达调试连接器 (J6_1)

表 2-8. 次级雷达调试连接器引脚分配

引脚编号	说明	引脚编号	说明
1	3V3_VIO_PMIC_2	2	GND
3	3V3_VIO_PMIC_2	4	GND
5	3V3_VIO_PMIC_2	6	GND
7	AWR_NERROUT_2	8	AWR_MSS_GPIO2_I2C_ADDR_0_2
9	AWR_DBG_BSS_UARTA_TX_2	10	AWR_MSS_GPIO4_I2C_ADDR_1_2

表 2-8. 次级雷达调试连接器引脚分配 (续)

引脚编号	说明	引脚编号	说明
11	AWR_DBG_MSS_UARTA_RX_2	12	AWR_MSS_GPIO5_I2C_ADDR_2_2
13	AWR_MSS_GPIO1_LP_MODE_2	14	AWR_MSS_HOST_IRQ_AE_INT_R_2
15	AWR_MSS_GPIO0_SPI_BUSY_2	16	AWR_RS232_TX_2
17	AWR_ADC_VALID_2	18	AWR_RS232_RX_2
19	NRST_AWR_2	20	VPP_1P7_2

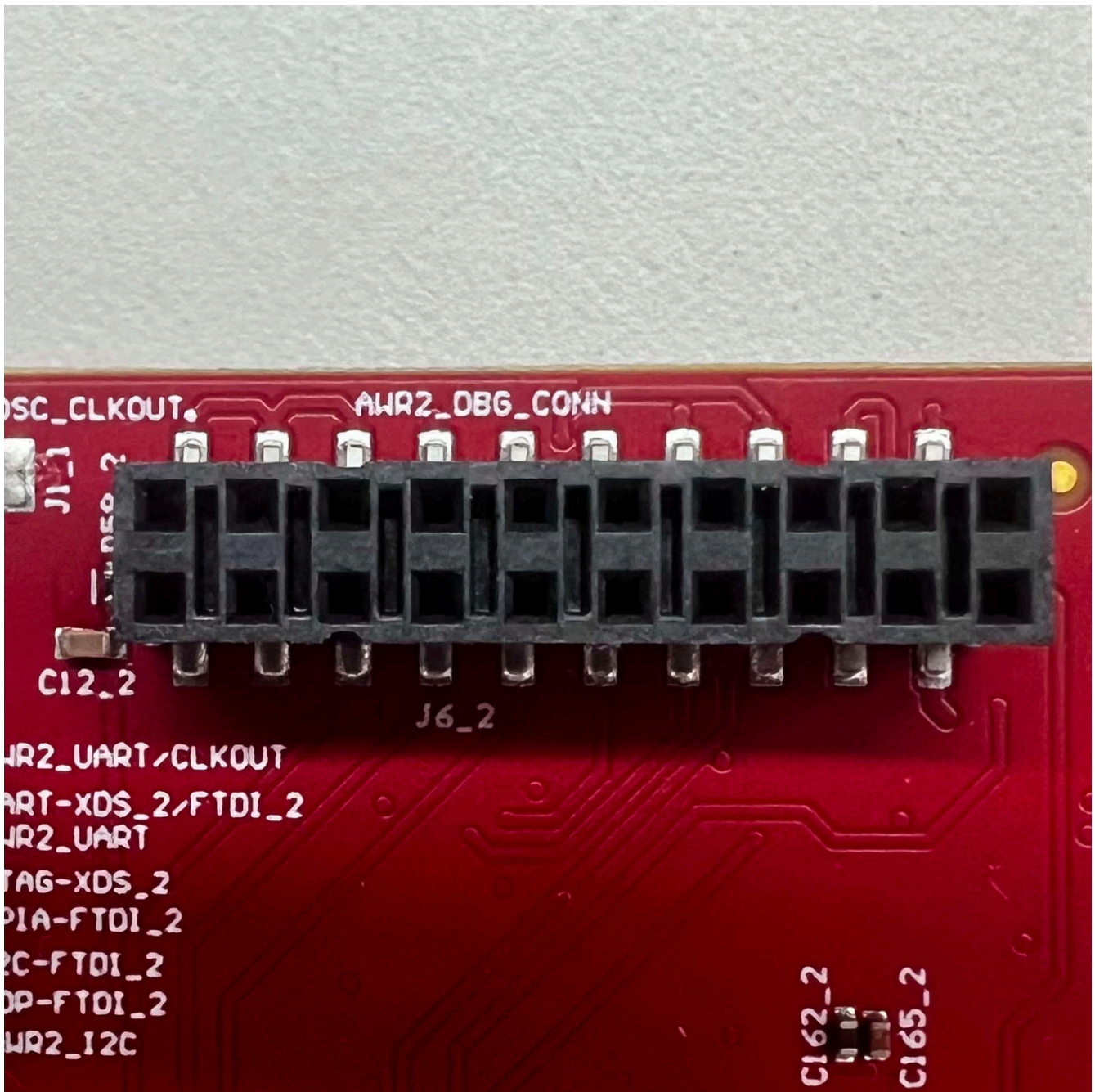


图 2-12. 次级雷达调试连接器 (J6_2)

2.5 天线

AWR2188EVM 集成由 Huber+Suhner 开发的 3D 波导天线，支持 16 个接收器和 16 个发送器。该天线采用近规则阵列设计，能够同时估算方位角与俯仰角，从而实现 3D 空间中的物体检测

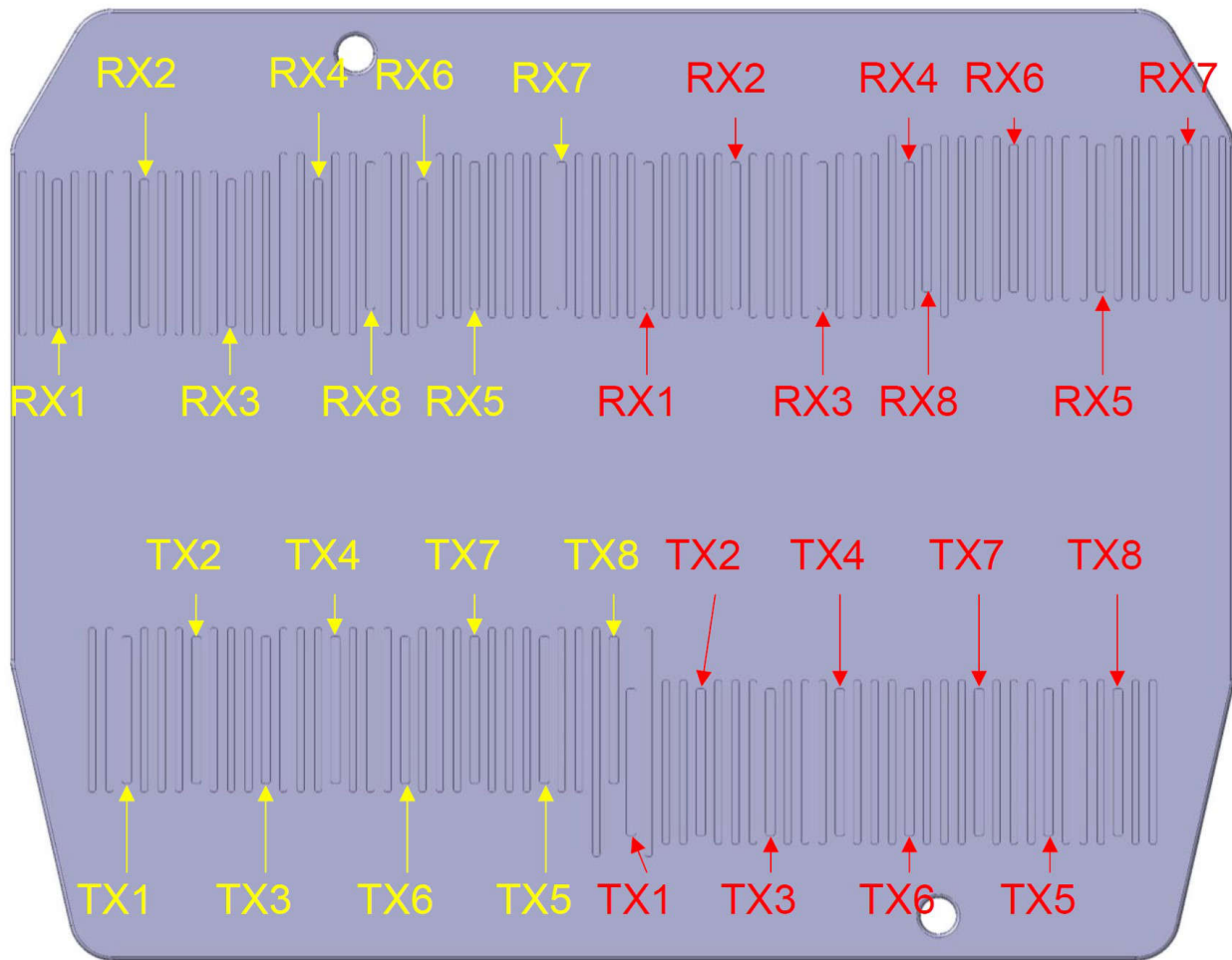


图 2-13. 天线端口分配

16 个发送器的虚拟阵列如 **TX 虚拟阵列**图所示。

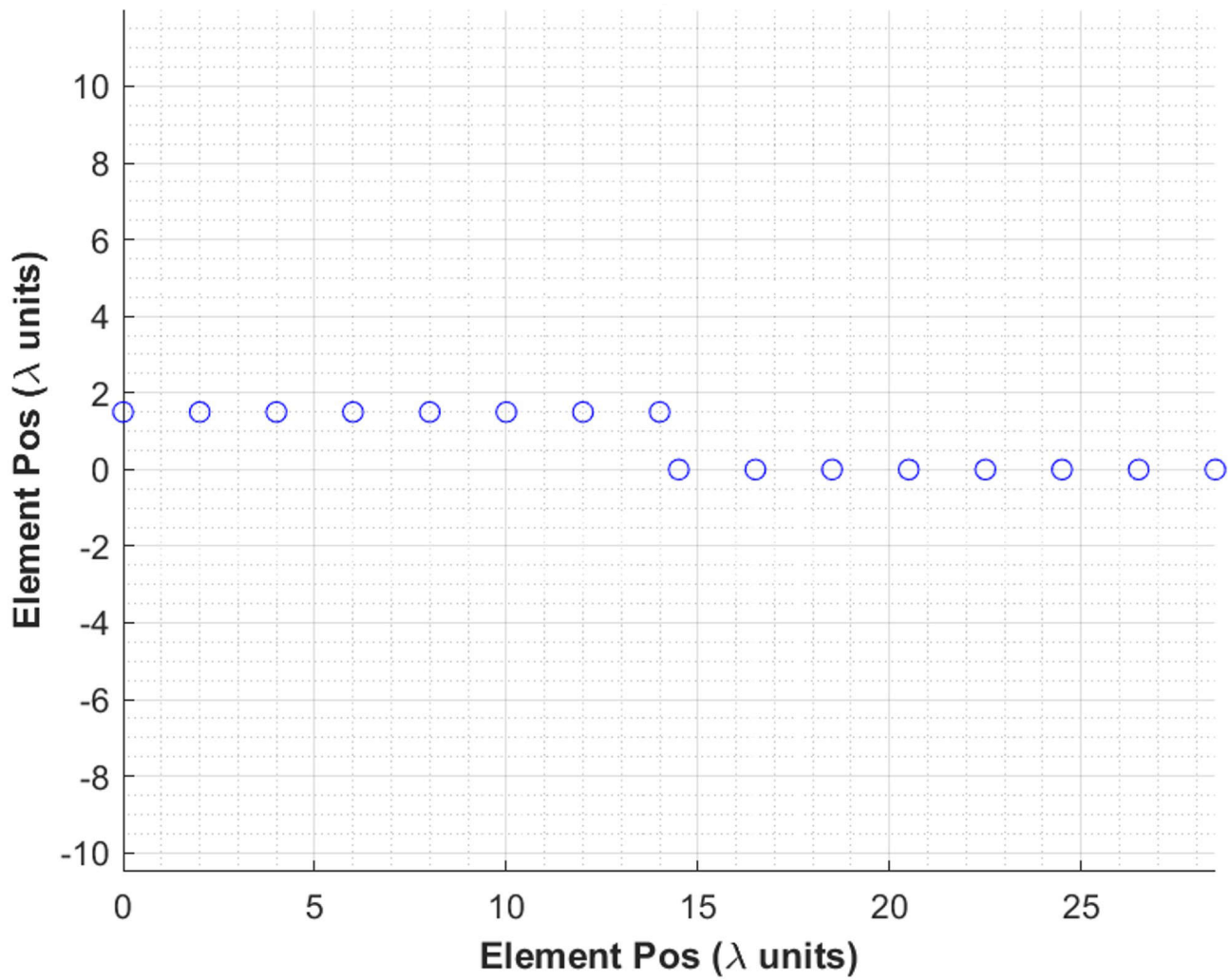


图 2-14. TX 虚拟阵列

16 个接收器的虚拟阵列如 RX 虚拟阵列图所示。

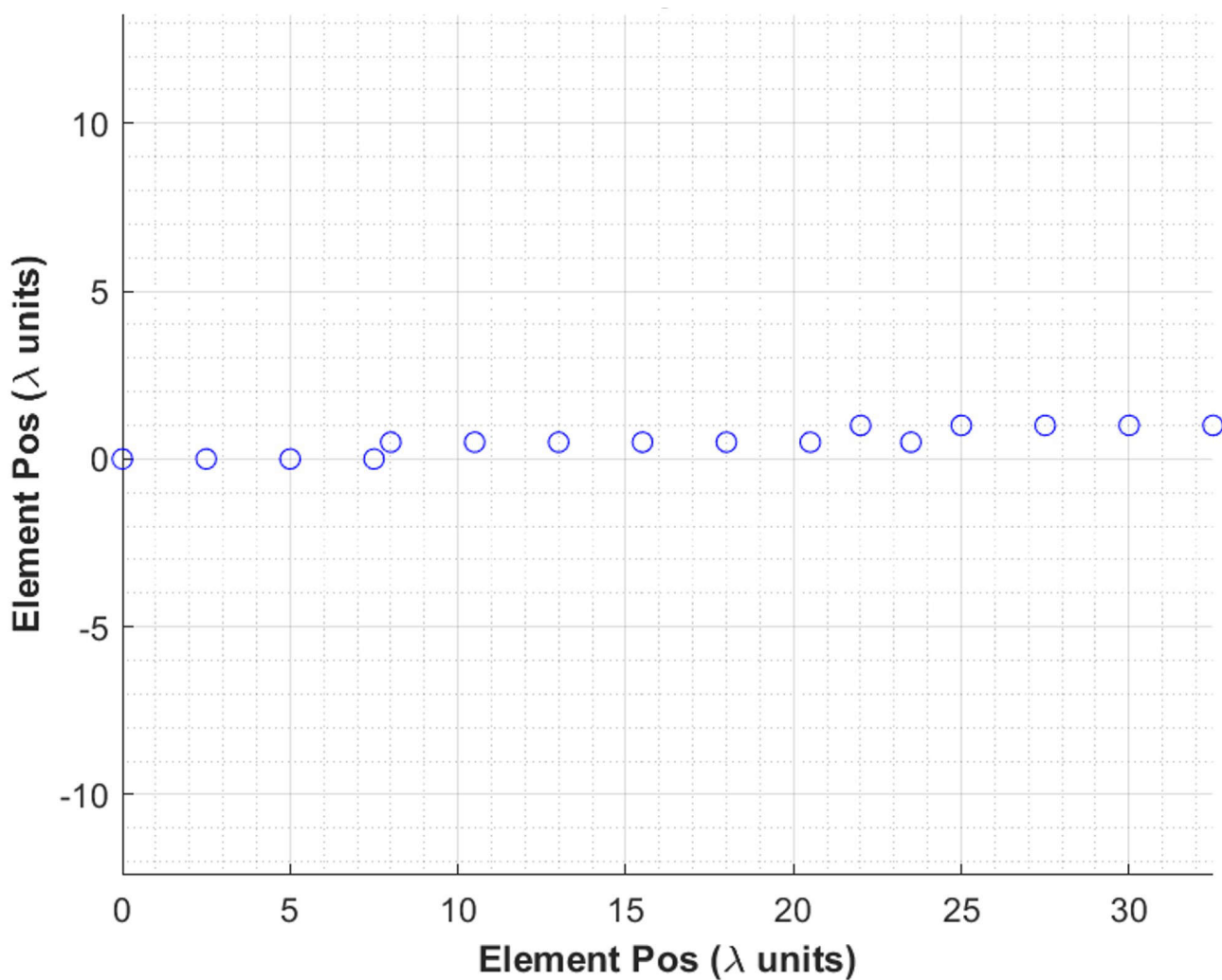


图 2-15. RX 虚拟阵列

16x16 组合元件构成的整体虚拟阵列如天线近规则阵列配置图所示。



图 2-16. 天线近规则阵列配置

在 76-81GHz 频带内，仿真天线增益为 15dBi。

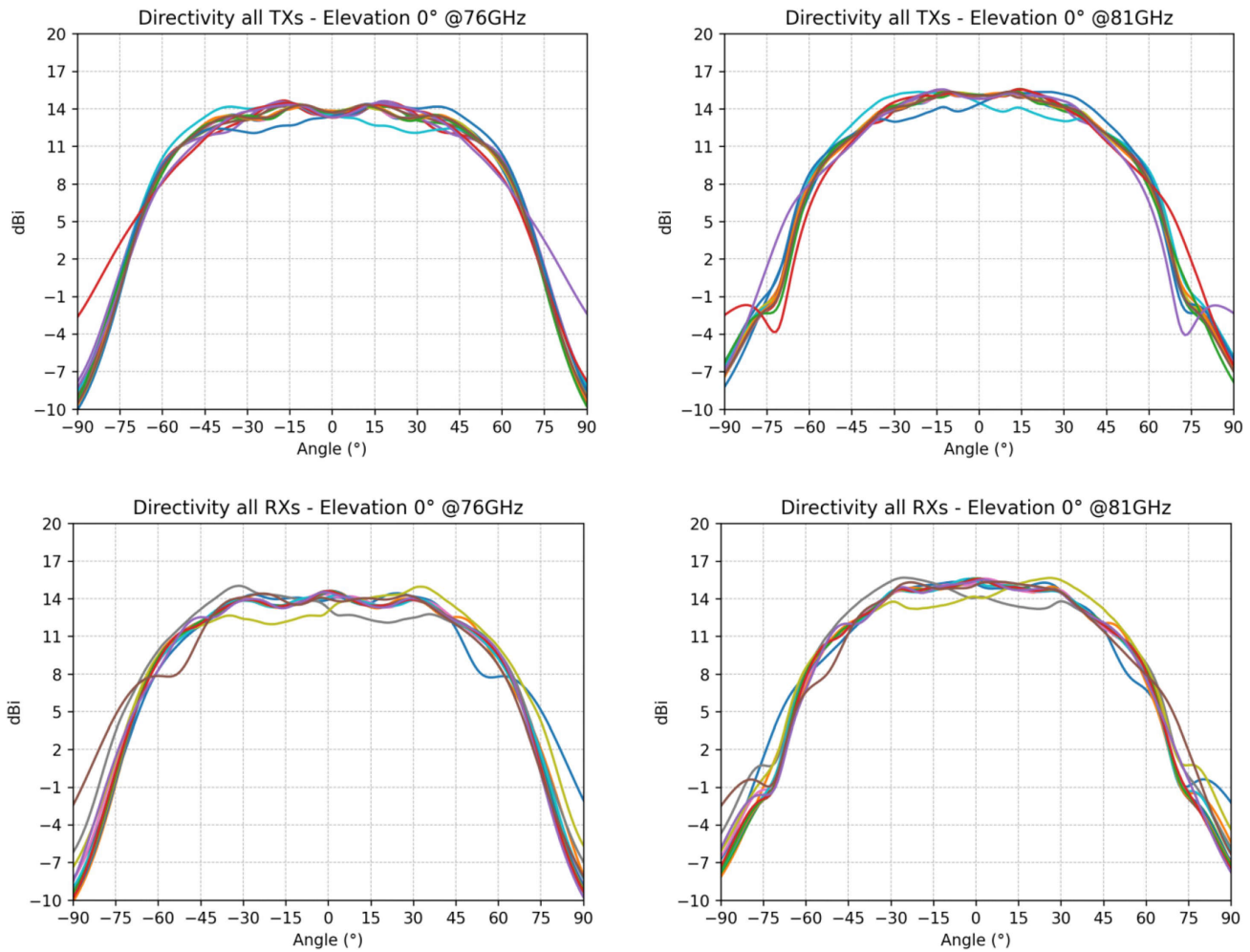


图 2-17. TX 和 RX 仿真方向性

2.6 PC 连接

AWR2188EVM 连接至配套的 TI [DCA2000EVM](#) 采集板，该采集板负责控制毫米波器件并将采集的数据传输至主机 PC。有关如何将 AWR2188EVM 和 DCA2000EVM 连接到主机 PC 的详细信息，请参阅 [DCA2000EVM 用户指南](#)。

2.7 跳线、开关和 LED

2.7.1 开关 (SW1_1、SW1_2)

AWR2188EVM 集成 SW1_1 和 SW1_2 两个开关，分别用于配置初级和次级雷达控制路径。对于 DCA2000EVM 的典型运行情况，需将 SW1_1 和 SW1_2 均置于 **OFF** 位置。

表 2-9. SW1_1，初级雷达多路复用开关

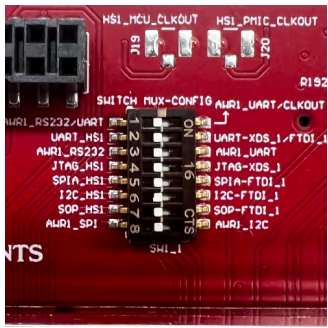
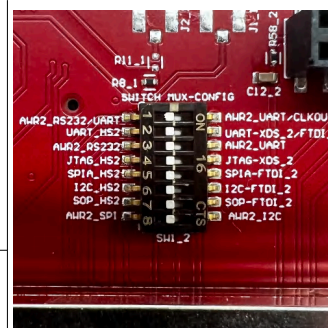
参考	用途	注释	图像
SW1_1.1	RS232、PMIC_CLKOUT 和 MCU_CLKOUT 多路复用器	置于 OFF 位置可启用 MSS_RS232、MSS_UARTB_TX 和 BSS_UARTA_TX 信号路径。 置于 ON 位置可启用 MSS_UARTB、BSS_UARTA、PMIC_CLKOUT 和 MCU_CLKOUT 信号路径。	
SW1_1.2	MSS 和 BSS UART	置于 OFF 位置可将 MSS_UARTA、MSS_UARTB_TX 和 BSS_UARTA_TX 信号传递至初级雷达连接器 (J18)。置于 ON 位置可将 MSS_UARTA、MSS_UARTB_TX 和 BSS_UARTA_TX 信号传递至板载 FTDI 和 XDS110。	
SW1_1.3	MSS_RS232 和 MSS_UARTA	置于 OFF 位置可将 RS232 信号传递至初级雷达连接器 (J18)。置于 ON 位置可将 MSS_UARTA 信号传递至多路复用器 U12 输入端 (由 SW1_1.2 控制)。	
SW1_1.4	JTAG	置于 OFF 位置可将 JTAG 连接至初级雷达连接器 (J18)。置于 ON 位置可将 JTAG 连接至板载 XDS110。	
SW1_1.5	MSS_McSPIA	置于 OFF 位置可将 MSS_McSPIA 接口连接至初级雷达连接器 (J18)。置于 ON 位置可将 MSS_McSPIA 接口连接至板载 FTDI。	
SW1_1.6	MSS_I2C	置于 OFF 位置可将 MSS_I2C 接口连接至初级雷达连接器 (J18)。置于 ON 位置可将 MSS_I2C 接口连接至板载 FTDI。	
SW1_1.7	SOP	置于 OFF 位置可将 SOP 接口连接至初级雷达连接器 (J18)。置于 ON 位置可将 SOP 接口连接至板载 FTDI。	
SW1_1.8	SPI/I2C 选择	置于 OFF 位置以进入 SPI 模式。 置于 ON 位置以进入 I2C 模式。	

表 2-10. SW1_2，次级雷达多路复用开关

参考	用途	注释	图像
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表 2-10. SW1_2，次级雷达多路复用开关（续）

SW1_2.1	RS232、PMIC_CLKOUT 和 MCU_CLKOUT 多路复用器	置于 OFF 位置可启用 MSS_RS232、MSS_UARTB_TX 和 BSS_UARTA_TX 信号路径。 置于 ON 位置可启用 MSS_UARTB、BSS_UARTA、PMIC_CLKOUT 和 MCU_CLKOUT 信号路径。
SW1_2.2	MSS 和 BSS UART	置于 OFF 位置可将 MSS_UARTA、MSS_UARTB_TX 和 BSS_UARTA_TX 信号传递至初级雷达连接器 (J18)。置于 ON 位置可将 MSS_UARTA、MSS_UARTB_TX 和 BSS_UARTA_TX 信号传递至板载 FTDI 和 XDS110。
SW1_2.3	MSS_RS232 和 MSS_UARTA	置于 OFF 位置可将 RS232 信号传递至初级雷达连接器 (J18)。置于 ON 位置可将 MSS_UARTA 信号传递至多路复用器 U12 输入端 (由 SW1_1.2 控制)。
SW1_2.4	JTAG	置于 OFF 位置可将 JTAG 连接至初级雷达连接器 (J18)。置于 ON 位置可将 JTAG 连接至板载 XDS110。
SW1_2.5	MSS_McSPIA	置于 OFF 位置可将 MSS_McSPIA 接口连接至初级雷达连接器 (J18)。置于 ON 位置可将 MSS_McSPIA 接口连接至板载 FTDI。
SW1_2.6	MSS_I2C	置于 OFF 位置可将 MSS_I2C 接口连接至初级雷达连接器 (J18)。置于 ON 位置可将 MSS_I2C 接口连接至板载 FTDI。
SW1_2.7	SOP	置于 OFF 位置可将 SOP 接口连接至初级雷达连接器 (J18)。置于 ON 位置可将 SOP 接口连接至板载 FTDI。
SW1_2.8	SPI/I2C 选择	置于 OFF 位置以进入 SPI 模式。 置于 ON 位置以进入 I2C 模式。

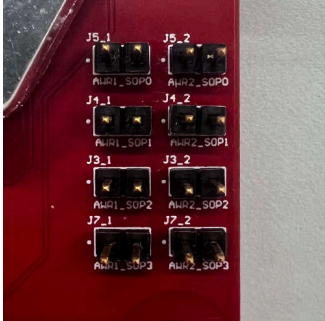


2.7.2 跳线

可以根据 SOP [4:0] 线的状态，将 AWR2188EVM 设置为在不同的模式下运行。只有在 AWR2188 器件启动过程中，才会对这些线路进行检测。本部分旨在介绍器件的状态。闭合跳线表示进入 AWR2188 器件的 SOP 信号的状态“1”，断开跳线表示状态“0”。

备注

也可通过 FTDI 控制 SOP[3:0] 引脚。在这种情况下，FTDI 设置将覆盖跳线设置。

参考	用途	注释	图像
J3(SOP2)、J4 (SOP1)、J5 (SOP0)	SOP[2:0]	101 (SOP 模式 5) = 刷写模式 001 (SOP 模式 4) = 功能模式 000 (SOP 模式 3) = 保留 011 (SOP 模式 2) = 开发模式 010 (SOP 模式 1) = 保留	
J7(SOP3)	SOP[3]	0 = 单芯片模式 1 = 级联模式	

此外，SOP4 信号根据以下配置定义 XTAL 时钟输入。

- 装上 R51，移除 R52 (默认) = 50MHz XTAL 模式
- 装上 R52，移除 R51 = 40MHz XTAL 模式

2.7.3 LED

AWR2188EVM 集成多个 LED 状态指示灯。

参考指示符	颜色	用途	注释	图像
D6	黄色	VIN	此 LED 在存在输入电源时点 亮	

参考指示符	颜色	用途	注释	图像
D8	黄色	REGOUT_3V3	此 LED 在 REGOUT 3V3 电源开启时点亮。	

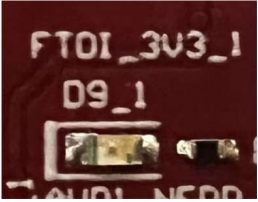
参考指示符	颜色	用途	注释	图像
D10	黄色	SYS_PGOOD	此 LED 在系统 PGOOD 开启时点亮。	

参考指示符	颜色	用途	注释	图像
D2	绿色	NRESET_1	此 LED 在初级雷达退出复位时点亮。	

参考指示符	颜色	用途	注释	图像
D3	绿色	NRESET_2	此 LED 在次级雷达退出复位时点亮。	

参考指示符	颜色	用途	注释	图像
DS1_1	红色	NERROUT_1	此 LED 在初级雷达退出复位时点亮。	

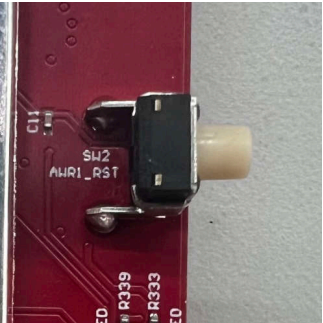
参考指示符	颜色	用途	注释	图像
DS1_2	红色	NERROUT_2	此 LED 在次级雷达退出复位时点亮。	

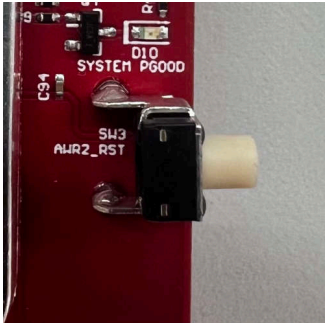
参考指示符	颜色	用途	注释	图像
D9_1	黄色	FTDI_VBUS_1	此 LED 在初级 FTDI 通电时点亮。	

参考指示符	颜色	用途	注释	图像
D9_2	黄色	FTDI_VBUS_2	此 LED 在次级 FTDI 通电时点亮。	

2.8 按钮 (SW2、SW3)

AWR2188EVM 集成两个按钮 (SW2 和 SW3)，分别用于手动复位初级雷达和次级雷达。

参考指示符	用途	注释	图像
SW2	NRESET_1	按下 SW2 时，初级雷达复位。	

参考指示符	用途	注释	图像
SW3	NRESET_2	按下 SW3 时，初级雷达复位。	

3 工具与软件

工具

[DCA2000EVM](#)

用于 AWR2188EVM 的数据采集卡

软件

[MmWave
Studio](#)

独立的 Windows® GUI，具有配置和控制毫米波传感器模块以及收集模数转换 (ADC) 数据以进行离线分析的功能。

4 硬件设计文件

要查看原理图、装配图和 BOM，请参阅 [AWR2188EVM 原理图、装配和 BOM 文件](#)。

要查看设计数据库和布局详细信息，请参阅 [AWR2188EVM 设计数据库文件](#)。

5 其他信息

5.1 商标

所有商标均为其各自所有者的财产。

6 修订历史记录

注：以前版本的页码可能与当前版本的页码不同

日期	修订版本	注释
2025 年 11 月	*	初始发行版

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

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: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/sds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

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東京都新宿区西新宿 6 丁目 2 4 番 1 号
西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/sds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 EVM Use Restrictions and Warnings:

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 Safety-Related Warnings and Restrictions:

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