ESP32-PICO-V3-ZERO

Datasheet

Alexa Connect Kit (ACK) module with an Espressif chipset
2.4 GHz Wi-Fi + Bluetooth® + Bluetooth LE support
Built around ESP32 series of SiP, Xtensa® dual-core 32-bit LX6 microprocessor
4 MB flash available
On-board PCB antenna with an RF test connector

ESP32-PICO-V3-ZERO

Version 1.3
Espressif Systems

1 Module Overview

Note:

Check the link or the QR code to make sure that you use the latest version of this document:
https://espressif.com/sites/default/files/documentation/esp32-pico-v3-zero_datasheet_en.pdf

1.1 Features

CPU and On-Chip Memory

- ESP32 embedded, Xtensa dual-core 32-bit LX6 microprocessor, up to 240 MHz
- 448 KB ROM
- 520 KB SRAM
- 16 KB SRAM in RTC

Wi-Fi

- 802.11b/g/n
- Bit rate: 802.11n up to 150 Mbps
- A-MPDU and A-MSDU aggregation
- 0.4 μs guard interval support
- Center frequency range of operating channel: 2412 ~ 2484 MHz

Bluetooth

- Bluetooth V4.2 BR/EDR and Bluetooth LE specification
- Class-1, class-2 and class-3 transmitter
- AFH
- CVSD and SBC

Peripherals

- 2 × UART (one for connection to the host and the other for debugging), EN pin, and interrupt pin

Integrated Components on Module

- 40 MHz crystal oscillator
- 4 MB SPI flash

Antenna Options

- On board PCB antenna with an RF test connector

Note:
This connector is for test only, and must not be used for connecting an external antenna.

Operating Conditions

- Operating voltage/Power supply: 3.0 ~ 3.6 V
- Operating temperature range: –40 ~ 85 °C

Certification

- Bluetooth certification: BQB (ID: D050108)
- RF certification:
  - FCC (ID: 2AC7Z-ESP32PICOZERO)
  - SRRC (CMIIT ID: 2020DP3148)
  - IC (ID: 21098-ESP32PICOV3)
  - RCM
  - CE-RED
- Green certification: REACH/RoHS

1.2 Description

The ESP32-PICO-V3-ZERO is a module that is based on ESP32-PICO-V3, a System-in-Package (SiP) device. It provides complete Wi-Fi and Bluetooth functionalities with embedded Xtensa dual-core 32-bit LX6 microprocessor. The module integrates a 4 MB SPI flash.

At the core of this module is the ESP32 chip, which is a single 2.4 GHz Wi-Fi and Bluetooth combo chip designed with TSMC's 40 nm low-power technology. ESP32-PICO-V3-ZERO integrates all peripheral components seamlessly, including a crystal oscillator, flash, filter capacitors and RF matching links in one single package. Module assembly and testing are already done at SiP level. As such, ESP32-PICO-V3-ZERO reduces the complexity of supply chain and improves control efficiency. It is ultra-small in size, with robust performance and low energy consumption.

ESP32-PICO-V3-ZERO is a module for Alexa Connect Kit (ACK), a managed service that makes it easy to integrate Alexa into your products. With ESP32-PICO-V3-ZERO and its default firmware, you can connect your devices or system to Alexa and the Internet without worrying about managing cloud services, writing an Alexa Skill, or developing complex networking and security firmware. If you add ESP32-PICO-V3-ZERO to your device, you can easily, quickly and economically create products that customers love.

Note:

- For more information on ESP32, please refer to *ESP32 Series Datasheet*.
- For more information on ESP32-PICO-V3, please refer to *ESP32-PICO-V3 Datasheet*.

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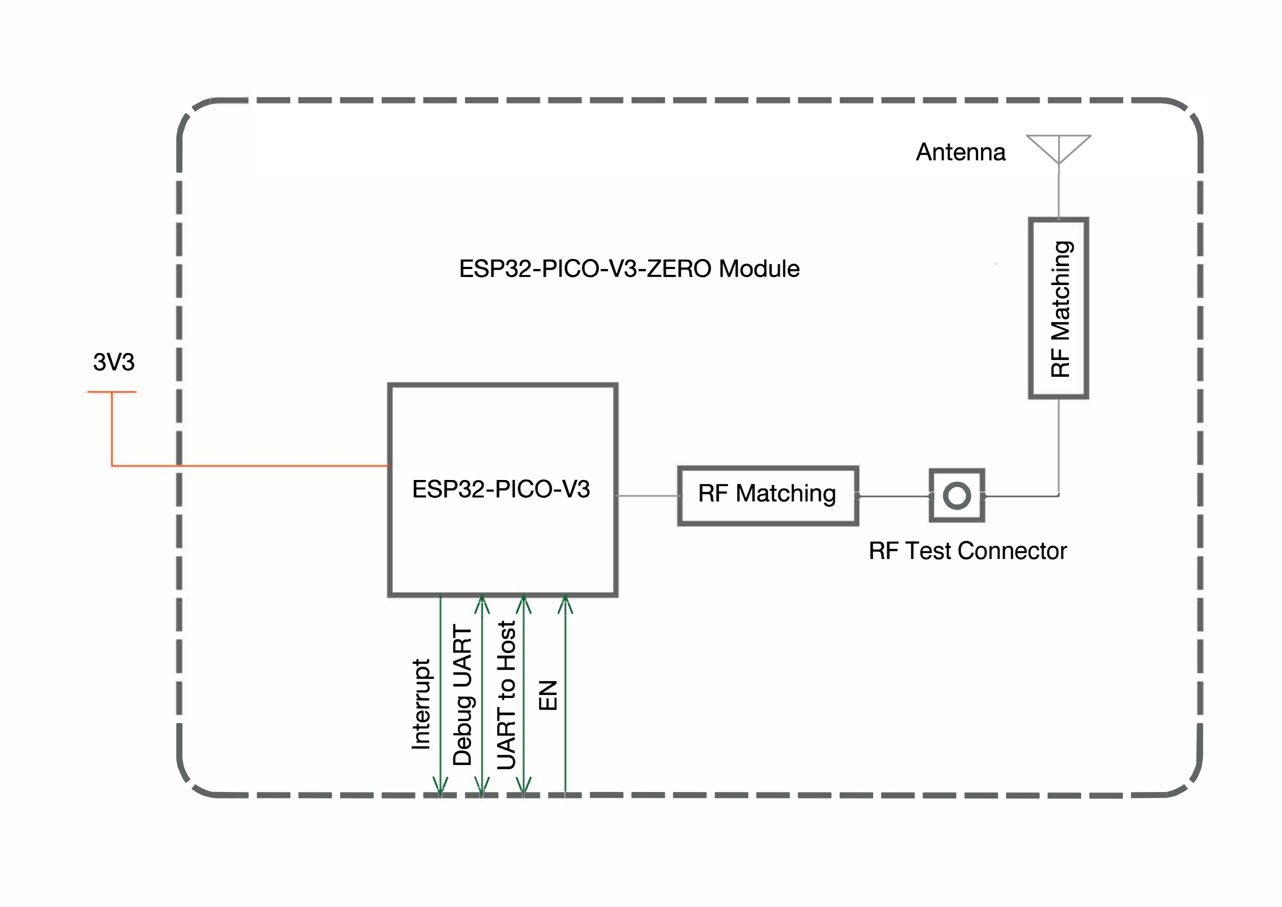

Figure 1: ESP32-PICO-V3-ZERO Block Diagram

3 Pin Definitions

3.1 Pin Layout

The pin diagram below shows the approximate location of pins on the module. For the actual diagram drawn to scale, please refer to Figure 6.1 *Physical Dimensions*.

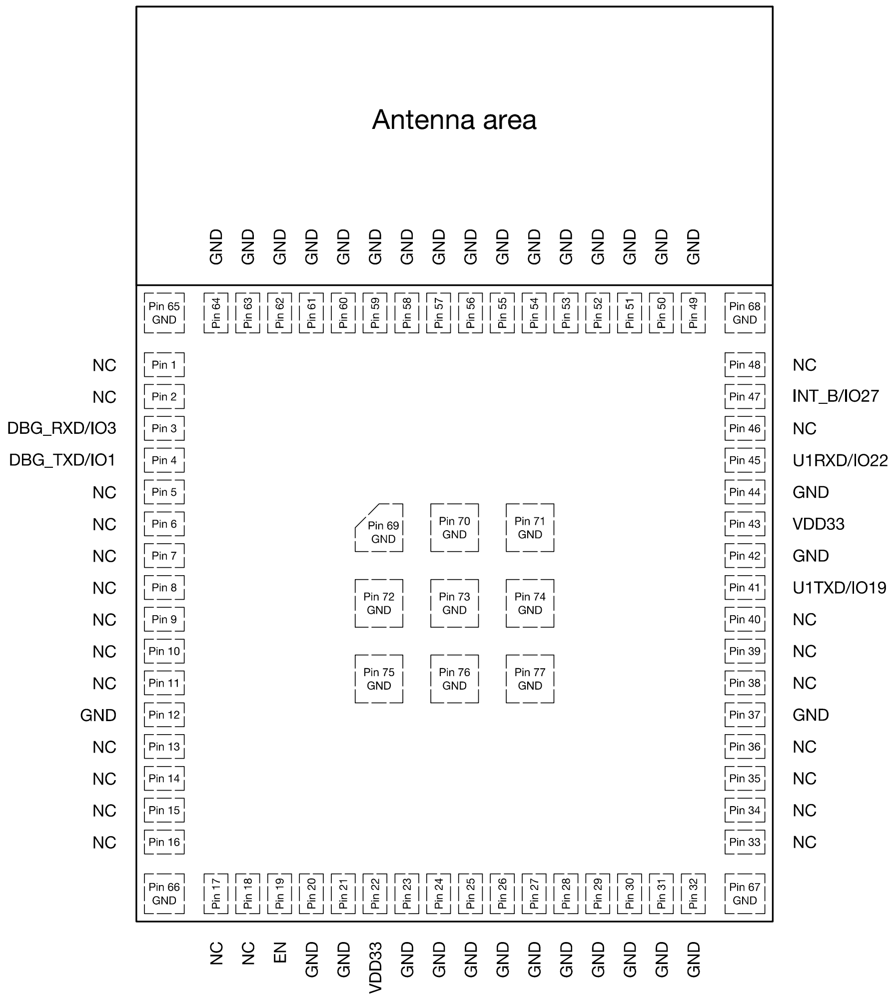

Figure 2: Pin Layout (Top View)

3.2 Pin Description

The module has 77 pins. See pin definitions in Table 1.

For peripheral pin configurations, please refer to *ESP32 Series Datasheet*.

Table 1: Pin Definitions

Name	No.	Type[1]	Function
NC	1, 2, 5 ~ 11, 13 ~ 18, 33 ~ 36, 38 ~ 40, 46, 48	NA	Do not connect. These pins must be left floating.
DBG_RXD/IO3	3	I	GPIO3, Debugging UART RX, GPIO3
DBG_TXD/IO1	4	O	GPIO1, Debugging UART TX, GPIO1
EN	19	I	High: On; enables the module Low: Off; the module powers off Note: Do not leave this pin floating.
VDD33	22	P	Power supply (3.0 V ~ 3.6 V)
U1TXD/IO19	41	O	UART TX, connected to host RX, GPIO19
VDD33	43	P	Power supply (3.0 V ~ 3.6 V)
U1RXD/IO22	45	I	UART RX, connected to host TX, GPIO22
INT_B/IO27	47	O	Host interrupt, connected to host GPIO, GPIO27
GND	12, 20, 21, 23 ~ 32, 37, 42, 44, 49 ~ 77	P	Ground

[1] P: power supply; I: input; O: output.

[2] IO7/IO8/IO9/IO10/IO20 belong to VDD_SDIO power domain and can not work when VDD_SDIO power shuts down.

4 Electrical Characteristics

4.1 Absolute Maximum Ratings

Stresses above those listed in *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.

Table 2: Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Unit
VDD33	Power supply voltage	–0.3	3.6	V
T_{STORE}	Storage temperature	–40	85	°C

* Please see Appendix IO MUX of *ESP32 Series Datasheet* for IO's power domain.

4.2 Recommended Operating Conditions

Table 3: Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Unit
VDD33	Power supply voltage	3.0	3.3	3.6	V
I_{VDD}	Current delivered by external power supply	0.5	—	—	A
T	Operating ambient temperature	–40	—	85	°C

4.3 DC Characteristics (3.3 V, 25 °C)

Table 4: DC Characteristics (3.3 V, 25 °C)

Symbol	Parameter	Min	Typ	Max	Unit
C_{IN}	Pin capacitance	—	2	—	pF
V_{IH}	High-level input voltage	0.75 × VDD[1]	—	VDD[1]+ 0.3	V
V_{IL}	Low-level input voltage	–0.3	—	0.25 × VDD[1]	V
I_{IH}	High-level input current	—	—	50	nA
I_{IL}	Low-level input current	—	—	50	nA
V_{OH}	High-level output voltage	0.8 × VDD[1]	—	—	V
V_{OL}	Low-level output voltage	—	—	0.1 × VDD[1]	V

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Table 4 – cont'd from previous page

Symbol	Parameter		Min	Typ	Max	Unit
I_{OH}	High-level source current (VDD[1]= 3.3 V, V_{OH} >= 2.64 V, output drive strength set to the maximum)	VDD3P3_CPU power domain [1, 2]	—	40	—	mA
		VDD3P3_RTC power domain [1, 2]	—	40	—	mA
		VDD_SDIO power domain [1, 3]	—	20	—	mA
I_{OL}	Low-level sink current (VDD[1]= 3.3 V, V_{OL} = 0.495 V, output drive strength set to the maximum)		—	28	—	mA
R_{PU}	Resistance of internal pull-up resistor		—	45	—	kΩ
R_{PD}	Resistance of internal pull-down resistor		—	45	—	kΩ
V_{IL_nRST}	Low-level input voltage of CHIP_PU to power off the chip		—	—	0.6	V

[1] Please see Appendix IO MUX of ESP32 Series Datasheet for IO's power domain. VDD is the I/O voltage for a particular power domain of pins.

[2] For VDD3P3_CPU and VDD3P3_RTC power domain, per-pin current sourced in the same domain is gradually reduced from around 40 mA to around 29 mA, V_{OH}>=2.64 V, as the number of current-source pins increases.

[3] Pins occupied by flash and/or PSRAM in the VDD_SDIO power domain were excluded from the test.

4.4 Current Consumption Characteristics

Owing to the use of advanced power-management technologies, the module can switch between different power modes. For details on different power modes, please refer to Section *RTC and Low-Power Management* in ESP32 Series Datasheet.

Table 5: Current Consumption Depending on RF Modes

Work mode	Description		Average (mA)	Peak (mA)
Active (RF working)	TX	802.11b, 20 MHz, 1 Mbps, @19.5 dBm	233	368
		802.11g, 20 MHz, 54 Mbps, @14 dBm	181	258
		802.11n, 20 MHz, MCS7, @13 dBm	178	248
		802.11n, 40 MHz, MCS7, @13 dBm	162	205
	RX[2]	802.11b/g/n, 20 MHz	110	111
		802.11n, 40 MHz	116	117

[1] The current consumption measurements are taken with a 3.3 V supply at 25 °C of ambient temperature at the RF port. All transmitters' measurements are based on a 50% duty cycle.

[2] The current consumption figures in RX mode are for cases when the peripherals are disabled and the CPU idle.

Table 6: Current Consumption Depending on Work Modes

Work mode	Description		Current consumption (Typ)
Modem-sleep [1, 2]	The CPU is powered on [3]	240 MHz	30 ~ 68 mA
		160 MHz	27 ~ 44 mA
		Normal speed: 80 MHz	20 ~ 31 mA
Light-sleep	—		0.8 mA
Deep-sleep	The ULP coprocessor is powered on [4]		150 μA
	ULP sensor-monitored pattern [5]		100 μA @1% duty
	RTC timer + RTC memory		10 μA
	RTC timer only		5 μA
Power off	CHIP_PU is set to low level, the chip is powered off		1 μA

[1] The current consumption figures in Modem-sleep mode are for cases where the CPU is powered on and the cache idle.

[2] When Wi-Fi is enabled, the chip switches between Active and Modem-sleep modes. Therefore, current consumption changes accordingly.

[3] In Modem-sleep mode, the CPU frequency changes automatically. The frequency depends on the CPU load and the peripherals used.

[4] During Deep-sleep, when the ULP coprocessor is powered on, peripherals such as GPIO and RTC I2C are able to operate.

[5] The "ULP sensor-monitored pattern" refers to the mode where the ULP coprocessor or the sensor works periodically. When ADC works with a duty cycle of 1%, the typical current consumption is 100 μA.

4.5 Wi-Fi RF Characteristics

4.5.1 Wi-Fi RF Standards

Table 7: Wi-Fi RF Standards

Name		Description
Center frequency range of operating channel *		2412 ~ 2484 MHz
Wi-Fi wireless standard		IEEE 802.11b/g/n
Data rate	20 MHz	11b: 1, 2, 5.5, 11 Mbps 11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 11n: MCS0-7, 72.2 Mbps (Max)
	40 MHz	11n: MCS0-7, 150 Mbps (Max)
Antenna type		PCB antenna

* Device should operate in the center frequency range allocated by regional regulatory authorities. Target center frequency range is configurable by software.

4.5.2 Transmitter Characteristics

Target TX power is configurable based on device or certification requirements. The default characteristics are provided in Table 8.

Table 8: TX Power Characteristics

Rate	Typ (dBm)
11b, 1 Mbps	19.5
11b, 11 Mbps	19.5
11g, 6 Mbps	18
11g, 54 Mbps	14
11n, HT20, MCS0	18
11n, HT20, MCS7	13
11n, HT40, MCS0	18
11n, HT40, MCS7	13

4.5.3 Receiver Characteristics

Table 9: RX Sensitivity Characteristics

Rate	Typ (dBm)
1 Mbps	–97
2 Mbps	–94
5.5 Mbps	–91
11 Mbps	–88
6 Mbps	–92
9 Mbps	–91
12 Mbps	–89
18 Mbps	–87
24 Mbps	–84
36 Mbps	–80
48 Mbps	–76
54 Mbps	–75
11n, HT20, MCS0	–91
11n, HT20, MCS1	–88
11n, HT20, MCS2	–85
11n, HT20, MCS3	–83
11n, HT20, MCS4	–80
11n, HT20, MCS5	–75
11n, HT20, MCS6	–74
11n, HT20, MCS7	–72
11n, HT40, MCS0	–88
11n, HT40, MCS1	–85
11n, HT40, MCS2	–82
11n, HT40, MCS3	–80
11n, HT40, MCS4	–76
11n, HT40, MCS5	–72
11n, HT40, MCS6	–71

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Table 9 – cont'd from previous page

Rate	Typ (dBm)
11n, HT40, MCS7	–69

Table 10: RX Maximum Input Level

Rate	Typ (dBm)
11b, 1 Mbps	5
11b, 11 Mbps	5
11g, 6 Mbps	0
11g, 54 Mbps	–8
11n, HT20, MCS0	0
11n, HT20, MCS7	–8
11n, HT40, MCS0	0
11n, HT40, MCS7	–8

Table 11: Adjacent Channel Rejection

Rate	Typ (dB)
11b, 11 Mbps	35
11g, 6 Mbps	27
11g, 54 Mbps	13
11n, HT20, MCS0	27
11n, HT20, MCS7	12
11n, HT40, MCS0	16
11n, HT40, MCS7	7

4.6 Bluetooth Radio

4.6.1 Receiver – Basic Data Rate

Table 12: Receiver Characteristics – Basic Data Rate

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity @0.1% BER	—	–90	–89	–88	dBm
Maximum received signal @0.1% BER	—	0	—	—	dBm
Co-channel C/I	—	—	+7	—	dB
Adjacent channel selectivity C/I	F = F0 + 1 MHz	—	—	–6	dB
	F = F0 – 1 MHz	—	—	–6	dB
	F = F0 + 2 MHz	—	—	–25	dB
	F = F0 – 2 MHz	—	—	–33	dB
	F = F0 + 3 MHz	—	—	–25	dB
	F = F0 – 3 MHz	—	—	–45	dB
Out-of-band blocking performance	30 MHz ~ 2000 MHz	–10	—	—	dBm

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Table 12 – cont'd from previous page

Parameter	Conditions	Min	Typ	Max	Unit
	2000 MHz ~ 2400 MHz	–27	—	—	dBm
	2500 MHz ~ 3000 MHz	–27	—	—	dBm
	3000 MHz ~ 12.5 GHz	–10	—	—	dBm
Intermodulation	—	–36	—	—	dBm

4.6.2 Transmitter – Basic Data Rate

Table 13: Transmitter Characteristics – Basic Data Rate

Parameter	Conditions	Min	Typ	Max	Unit
RF transmit power*	—	—	0	—	dBm
Gain control step	—	—	3	—	dB
RF power control range	—	–12	—	+9	dBm
+20 dB bandwidth	—	—	0.9	—	MHz
Adjacent channel transmit power	F = F0 ± 2 MHz	—	–55	—	dBm
	F = F0 ± 3 MHz	—	–55	—	dBm
	F = F0 ± > 3 MHz	—	–59	—	dBm
$\Delta\ f1_{\text{avg}}$	—	—	—	155	kHz
$\Delta\ f2_{\text{max}}$	—	127	—	—	kHz
$\Delta\ f2_{\text{avg}}/\Delta\ f1_{\text{avg}}$	—	—	0.92	—	—
ICFT	—	—	–7	—	kHz
Drift rate	—	—	0.7	—	kHz/50 μs
Drift (DH1)	—	—	6	—	kHz
Drift (DH5)	—	—	6	—	kHz

* There are a total of eight power levels from 0 to 7, and the transmit power ranges from –12 dBm to 9 dBm. When the power level rises by 1, the transmit power increases by 3 dB. Power level 4 is used by default and the corresponding transmit power is 0 dBm.

4.6.3 Receiver – Enhanced Data Rate

Table 14: Receiver Characteristics – Enhanced Data Rate

Parameter	Conditions	Min	Typ	Max	Unit
	$\pi/4$ DQPSK				
Sensitivity @0.01% BER	—	–90	–89	–88	dBm
Maximum received signal @0.01% BER	—	—	0	—	dBm
Co-channel C/I	—	—	11	—	dB
Adjacent channel selectivity C/I	F = F0 + 1 MHz	—	–7	—	dB
	F = F0 – 1 MHz	—	–7	—	dB
	F = F0 + 2 MHz	—	–25	—	dB
	F = F0 – 2 MHz	—	–35	—	dB
	F = F0 + 3 MHz	—	–25	—	dB
	F = F0 – 3 MHz	—	–45	—	dB

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Table 14 – cont'd from previous page

Parameter	Conditions	Min	Typ	Max	Unit
8DPSK					
Sensitivity @0.01% BER	—	–84	–83	–82	dBm
Maximum received signal @0.01% BER	—	—	–5	—	dBm
C/I c-channel	—	—	18	—	dB
Adjacent channel selectivity C/I	F = F0 + 1 MHz	—	2	—	dB
	F = F0 – 1 MHz	—	2	—	dB
	F = F0 + 2 MHz	—	–25	—	dB
	F = F0 – 2 MHz	—	–25	—	dB
	F = F0 + 3 MHz	—	–25	—	dB
	F = F0 – 3 MHz	—	–38	—	dB

4.6.4 Transmitter – Enhanced Data Rate

Table 15: Transmitter Characteristics – Enhanced Data Rate

Parameter	Conditions	Min	Typ	Max	Unit
RF transmit power (see note under Table 13)	—	—	0	—	dBm
Gain control step	—	—	3	—	dB
RF power control range	—	–12	—	+9	dBm
$\pi/4$ DQPSK max w0	—	—	–0.72	—	kHz
$\pi/4$ DQPSK max wi	—	—	–6	—	kHz
$\pi/4$ DQPSK max |wi + w0|	—	—	–7.42	—	kHz
8DPSK max w0	—	—	0.7	—	kHz
8DPSK max wi	—	—	–9.6	—	kHz
8DPSK max |wi + w0|	—	—	–10	—	kHz
$\pi/4$ DQPSK modulation accuracy	RMS DEVM	—	4.28	—	%
	99% DEVM	—	100	—	%
	Peak DEVM	—	13.3	—	%
8 DPSK modulation accuracy	RMS DEVM	—	5.8	—	%
	99% DEVM	—	100	—	%
	Peak DEVM	—	14	—	%
In-band spurious emissions	F = F0 ± 1 MHz	—	–46	—	dBm
	F = F0 ± 2 MHz	—	–44	—	dBm
	F = F0 ± 3 MHz	—	–49	—	dBm
	F = F0 +/– > 3 MHz	—	—	–53	dBm
EDR differential phase coding	—	—	100	—	%

4.7 Bluetooth LE Radio

4.7.1 Receiver

Table 16: Receiver Characteristics – Bluetooth LE

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity @30.8% PER	—	–94	–93	–92	dBm
Maximum received signal @30.8% PER	—	0	—	—	dBm
Co-channel C/I	—	—	+10	—	dB
Adjacent channel selectivity C/I	F = F0 + 1 MHz	—	–5	—	dB
	F = F0 – 1 MHz	—	–5	—	dB
	F = F0 + 2 MHz	—	–25	—	dB
	F = F0 – 2 MHz	—	–35	—	dB
	F = F0 + 3 MHz	—	–25	—	dB
	F = F0 – 3 MHz	—	–45	—	dB
Out-of-band blocking performance	30 MHz ~ 2000 MHz	–10	—	—	dBm
	2000 MHz ~ 2400 MHz	–27	—	—	dBm
	2500 MHz ~ 3000 MHz	–27	—	—	dBm
	3000 MHz ~ 12.5 GHz	–10	—	—	dBm
Intermodulation	—	–36	—	—	dBm

4.7.2 Transmitter

Table 17: Transmitter Characteristics – Bluetooth LE

Parameter	Conditions	Min	Typ	Max	Unit
RF transmit power (see note under Table 13)	—	—	0	—	dBm
Gain control step	—	—	3	—	dB
RF power control range	—	–12	—	+9	dBm
Adjacent channel transmit power	F = F0 ± 2 MHz	—	–55	—	dBm
	F = F0 ± 3 MHz	—	–57	—	dBm
	F = F0 ± > 3 MHz	—	–59	—	dBm
$\Delta f1_{avg}$	—	—	—	265	kHz
$\Delta f2_{max}$	—	210	—	—	kHz
$\Delta f2_{avg}/\Delta f1_{avg}$	—	—	+0.92	—	—
ICFT	—	—	–10	—	kHz
Drift rate	—	—	0.7	—	kHz/50 μs
Drift	—	—	2	—	kHz

5 Peripheral Schematics

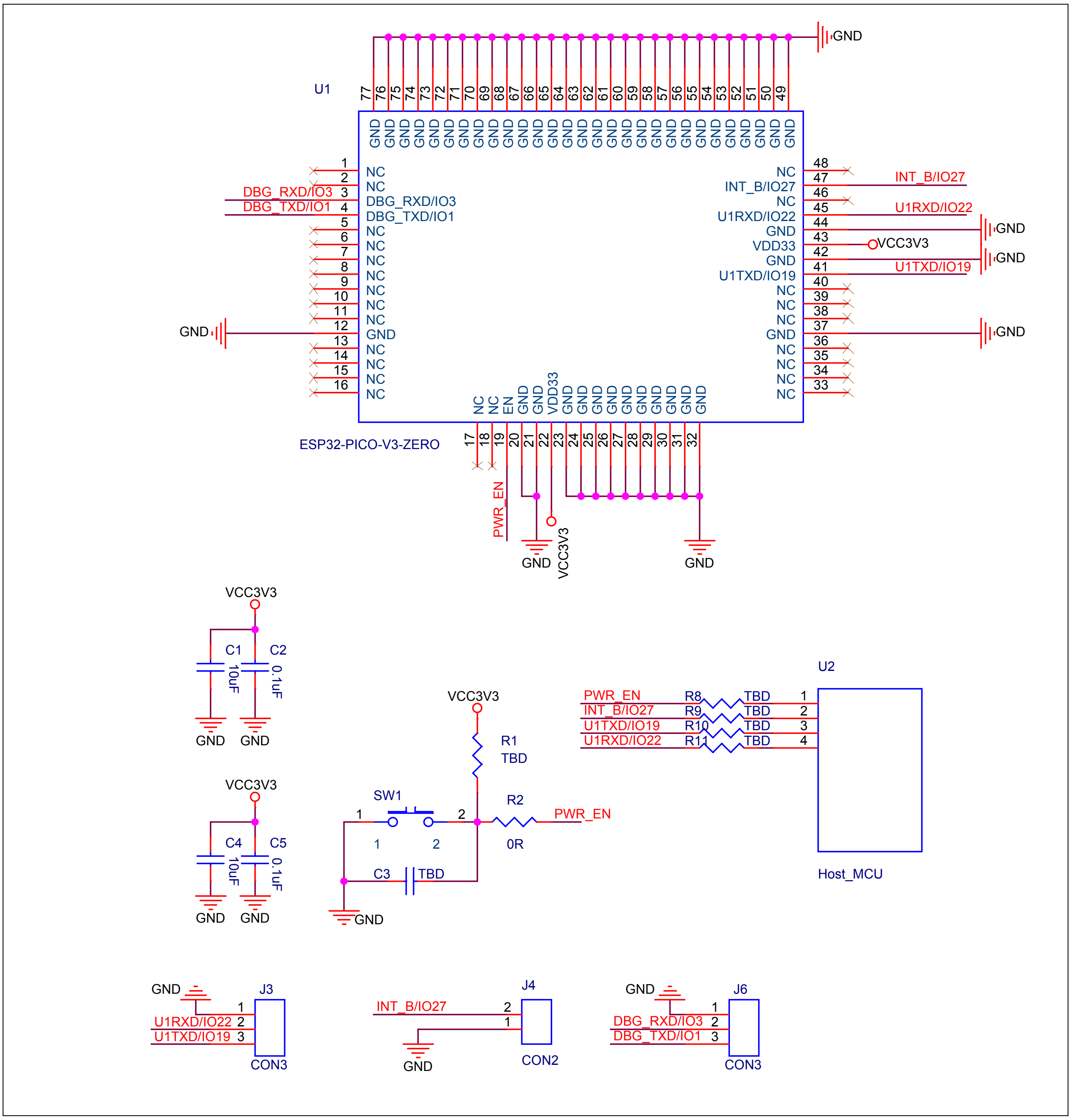


Figure 3: Peripheral Schematics

- To ensure that the power supply to the ESP32 chip is stable during power-up, it is advised to add an RC delay circuit at the EN pin. The recommended setting for the RC delay circuit is usually R = 10 kΩ and C = 1 μF. However, specific parameters should be adjusted based on the power-up timing of the module and the power-up and reset sequence timing of the chip. For ESP32's power-up and reset sequence timing diagram, please refer to Section *Power Scheme* in [ESP32 Series Datasheet].

6 Physical Dimensions and PCB Land Pattern

6.1 Physical Dimensions

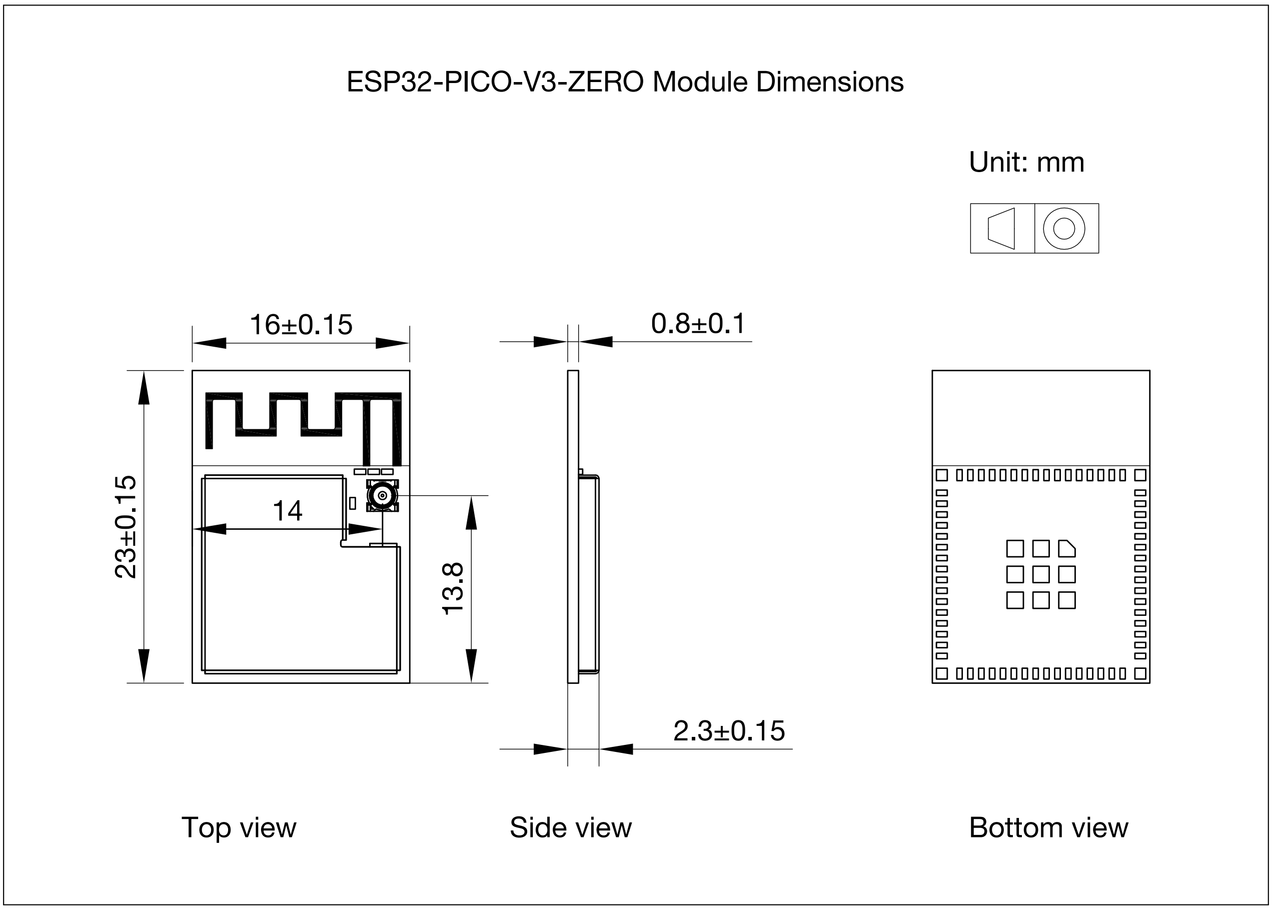


Figure 4: Physical Dimensions

> **Note:**
> For information about tape, reel, and product marking, please refer to *Espressif Module Package Information*.

6.2 PCB Layout

6.2.1 Recommended PCB Land Pattern

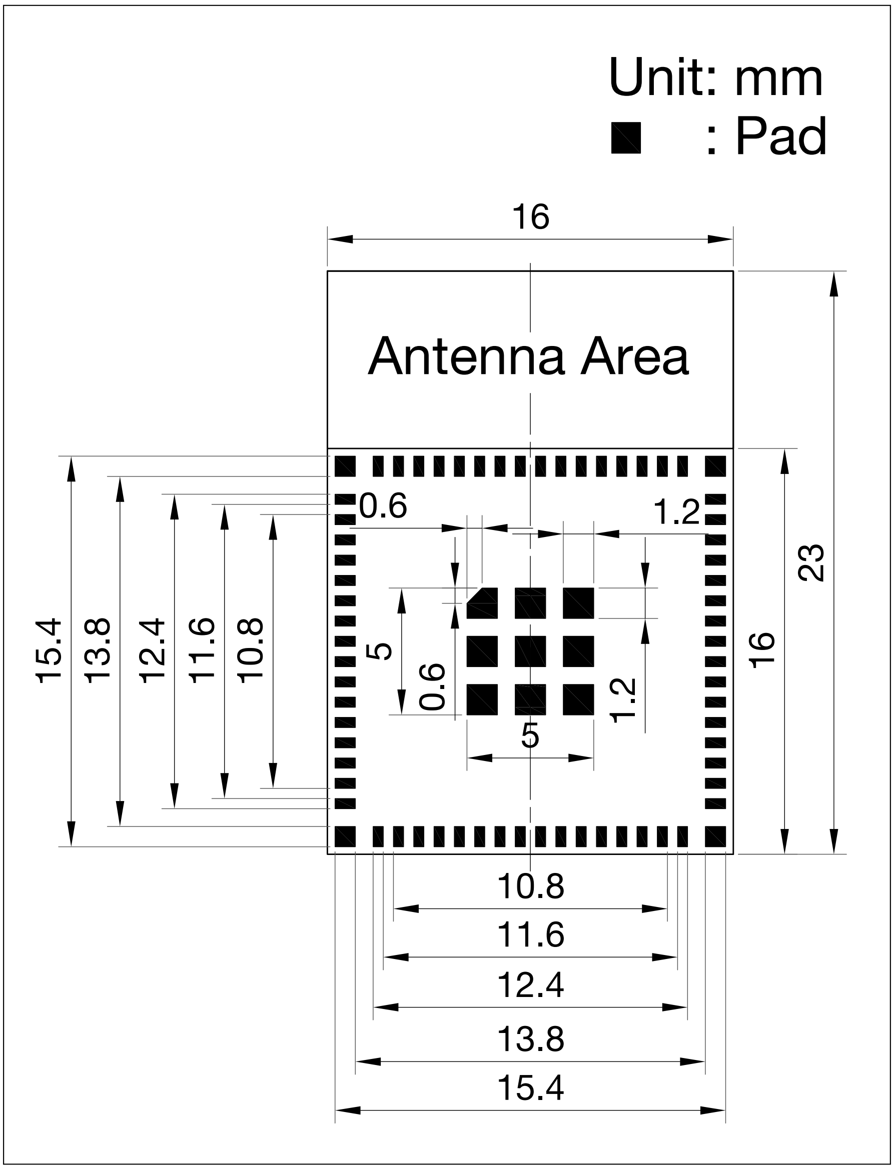


Figure 5: Recommended PCB Land Pattern

6.2.2 PCB Layout Guide

To achieve the optimum RF performance on a device with on-board antenna, please follow the guidelines below.

The module uses an inverted-F antenna design, and the antenna area of the module should have specific placement against the base board. The feed point of the antenna should be as close to the board as possible. The PCB antenna area should be placed outside the base board whenever possible while the module be put as close as possible to the edge of the base board.

As is shown in Figure 6, examples 3 and 4 of the module position on the base board are highly recommended, while examples 1, 2, and 5 are not recommended.

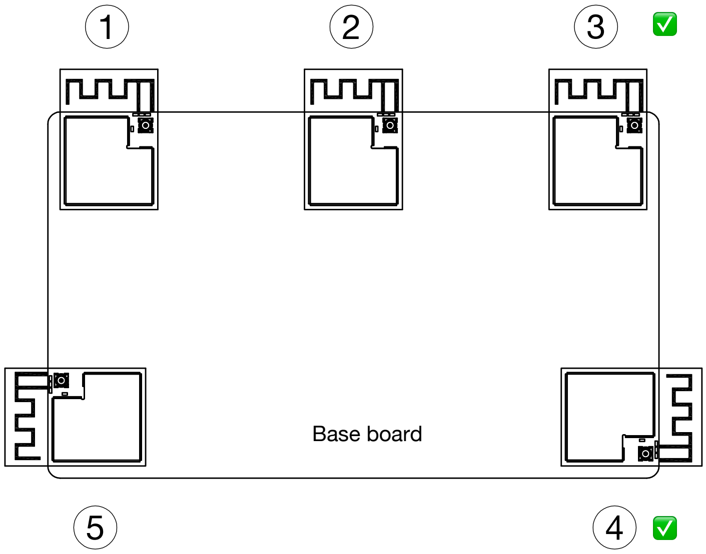


Figure 6: Module Placement on a Base Board

If the positions recommended above are not possible, then please make sure that the module is not covered by any metal shell and that a clearance area (without copper, routing, or components) outside the antenna is large enough, as shown in Figure 7. In addition, if there is base board under the antenna area, it is recommended to cut it off to minimize its impact on the antenna.

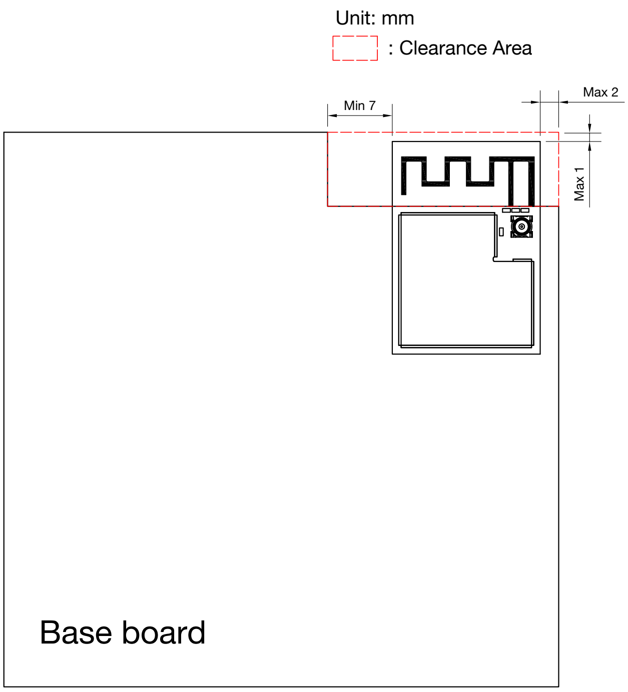


Figure 7: Keepout Zone for Module's Antenna on the Base Board

If the PCB layout does not follow the above rules, then RF throughput and RF range testing should be performed to ensure that the end product performance is satisfactory. When designing an end product, pay attention to the impact of enclosure on the antenna and verify the device performance by making RF verification.

6.3 Dimensions of RF Test Connector

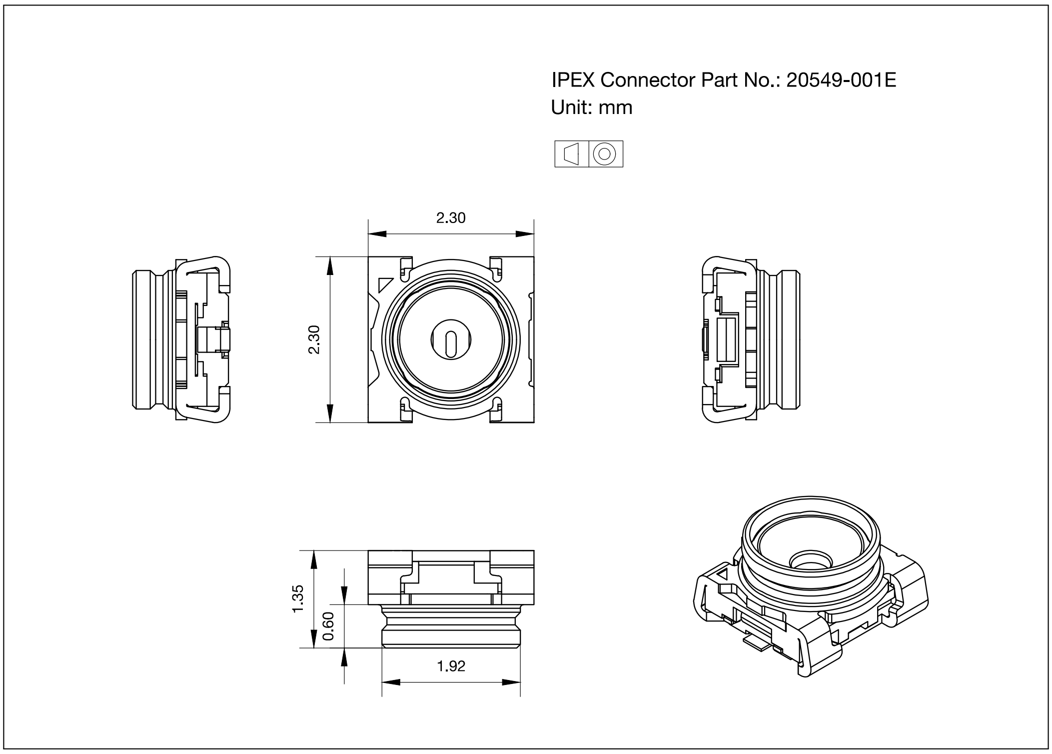


Figure 8: Dimensions of RF Test Connector

7 Product Handling

7.1 Storage Conditions

The products sealed in moisture barrier bags (MBB) should be stored in a non-condensing atmospheric environment of < 40 °C and 90%RH. The module is rated at the moisture sensitivity level (MSL) of 3.

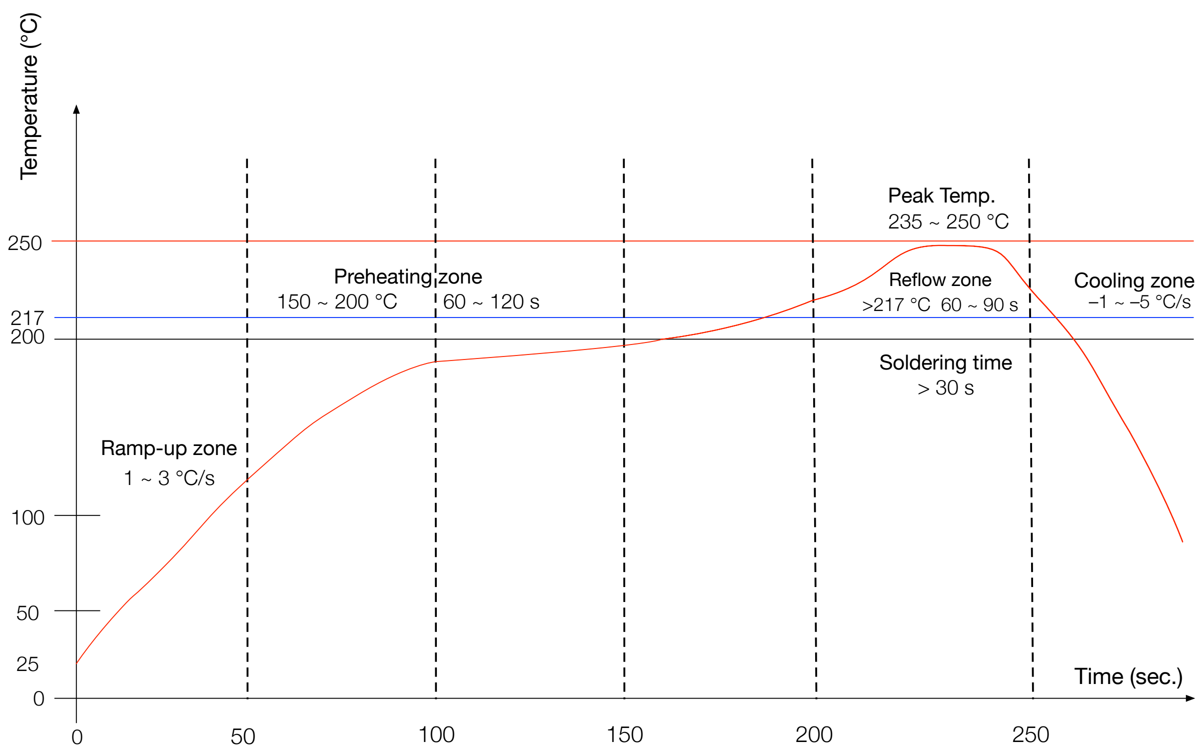
After unpacking, the module must be soldered within 168 hours with the factory conditions 25 ± 5 °C and 60 %RH. If the above conditions are not met, the module needs to be baked.

7.2 Electrostatic Discharge (ESD)

- Human body model (HBM): ±2000 V
- Charged-device model (CDM): ±500 V
- Air discharge: ±6000 V
- Contact discharge: ±4000 V

7.3 Reflow Profile

Solder the module in a single reflow.



Ramp-up zone — Temp.: 25 ~ 150 °C Time: 60 ~ 90 s Ramp-up rate: 1 ~ 3 °C/s
Preheating zone — Temp.: 150 ~ 200 °C Time: 60 ~ 120 s
Reflow zone — Temp.: >217 °C Time: 60 ~ 90 s; Peak Temp.: 235 ~ 250 °C Time: 30 ~ 70 s
Cooling zone — Peak Temp. ~ 180 °C Ramp-down rate: −1 ~ −5 °C/s
Solder — Sn-Ag-Cu (SAC305) lead-free solder alloy

Figure 9: Reflow Profile

8 Related Documentation and Resources

Related Documentation

- ESP32 Technical Reference Manual – Detailed information on how to use the ESP32 memory and peripherals.
- ESP32 Series Datasheet – Specifications of the ESP32 hardware.
- ESP32 Hardware Design Guidelines – Guidelines on how to integrate the ESP32 into your hardware product.
- ESP32 ECO and Workarounds for Bugs – Correction of ESP32 design errors.
- *Certificates*
  http://espressif.com/en/support/documents/certificates
- *ESP32 Product/Process Change Notifications (PCN)*
  http://espressif.com/en/support/documents/pcns
- *ESP32 Advisories* – Information on security, bugs, compatibility, component reliability.
  http://espressif.com/en/support/documents/advisories
- *Documentation Updates and Update Notification Subscription*
  http://espressif.com/en/support/download/documents

Developer Zone

- ESP-IDF Programming Guide for ESP32 – Extensive documentation for the ESP-IDF development framework.
- *ESP-IDF* and other development frameworks on GitHub.
  http://github.com/espressif
- *ESP32 BBS Forum* – Engineer-to-Engineer (E2E) Community for Espressif products where you can post questions, share knowledge, explore ideas, and help solve problems with fellow engineers.
  http://esp32.com/
- *The ESP Journal* – Best Practices, Articles, and Notes from Espressif folks.
  http://blog.espressif.com/
- See the tabs *SDKs and Demos*, *Apps*, *Tools*, *AT Firmware*.
  http://espressif.com/en/support/download/sdks-demos

Products

- *ESP32 Series SoCs* – Browse through all ESP32 SoCs.
  http://espressif.com/en/products/socs?id=ESP32
- *ESP32 Series Modules* – Browse through all ESP32-based modules.
  http://espressif.com/en/products/modules?id=ESP32
- *ESP32 Series DevKits* – Browse through all ESP32-based devkits.
  http://espressif.com/en/products/devkits?id=ESP32
- *ESP Product Selector* – Find an Espressif hardware product suitable for your needs by comparing or applying filters.
  http://products.espressif.com/#/product-selector?language=en

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- See the tabs *Sales Questions*, *Technical Enquiries*, *Circuit Schematic & PCB Design Review*, *Get Samples* (Online stores), *Become Our Supplier*, *Comments & Suggestions*.
  http://espressif.com/en/contact-us/sales-questions

Revision History

Date	Version	Release notes
2022-02-22	v1.3	Added a note regarding the RF test connector in Section 1.1 Updated Figure 1, Table 4, and Table 7
2021-11-08	v1.2	Added a note below Figure 4: *Physical Dimensions* Updated Table 3: *Recommended Operating Conditions* Upgraded document formatting
2021-02-09	v1.1	Deleted Reset Circuit and Discharge Circuit for VDD33 Rail in Section 5 *Peripheral Schematics* Modified the note below Figure 9 *Reflow Profile*
2020-11-03	v1.0	First release