ESP32-S2-SOLO-2 User Manual

2.4GHz Wi-Fi IoT Module
Built around ESP32-S2 series of SoC, Xtensa[®] single-core 32-bit LX7 microprocessor
Flash up to 16 MB, optional 2 MB PSRAM in chip package
36 GPIOs, rich set of peripherals
On-board PCB antenna



ESP32-S2-SOLO-2



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1 Module Overview

ESP32-S2-SOLO-2 is a general-purpose Wi-Fi module. The rich set of peripherals and a small size make this module an ideal choice for smart homes, industrial automation, health care, consumer electronics, etc.

Categories	Parameters	Specifications
Wi-Fi	Protocols	802.11 b/g/n (up to 150 Mbps)
VVI-I I	Frequency range	2412 ~ 2462 MHz
		GPIO, SPI, I2S, UART, I2C, LED PWM, TWAI [®] , LCD,
	Module interfaces	Camera interface, ADC, DAC, touch sensor, temper-
		ature sensor, USB OTG
	Integrated crystal	40 MHz crystal
	Integrated SPI flash	4 MB
Hardware	Operating voltage/Power supply	3.0 V ~ 3.6 V
Taluwale	Operating current	Average: 80 mA
	Minimum current delivered by power	500 mA
	supply	500 MA
	Ambient temperature	−40 °C ~ +85 °C/105 °C
	Moisture sensitivity level (MSL)	Level 3

Table 1: ESP32-S2-SOLO-2 Specifications

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2 Pin Definitions

2.1 Pin Layout

The pin diagram below shows the approximate location of pins on the module.

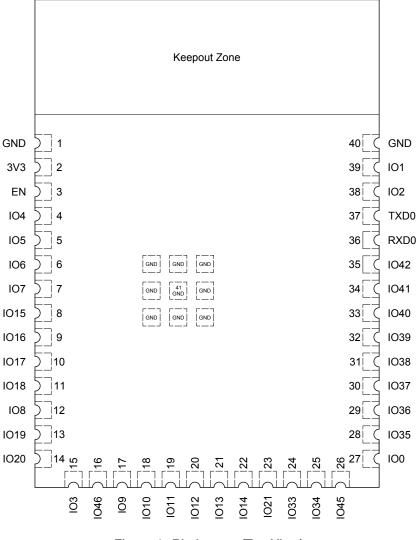


Figure 1: Pin Layout (Top View)

2.2 Pin Description

The module has 41 pins. See pin definitions in Table 2.

For peripheral pin configurations, please refer to <u>ESP32-S2 Series Datasheet</u>.

Table 2: Pin Definitions

Name	No.	Type ¹	Function
GND	1	Р	Ground
3V3	2	Р	Power supply

Cont'd on next page

Name No. Type Function EN 3 1 High: on, enables the chip. Low: off, the chip powers off. Note: Do not leave the EN pin floating. 104 4 1/O/T RTC_GPI04, GPI04, TOUCH4, ADC1_CH3 105 5 1/O/T RTC_GPI06, GPI06, TOUCH5, ADC1_CH4 106 6 1/O/T RTC_GPI015, GPI015, UORTS, ADC2_CH4, XTAL_32K_P 1016 9 1/O/T RTC_GPI015, GPI015, UORTS, ADC2_CH5, XTAL_32K_N 1017 10 1/O/T RTC_GPI018, GPI018, UTRXD, ADC2_CH7, DAC_2, CLK_OUT3 108 11 1/O/T RTC_GPI019, GPI019, UTRTS, ADC2_CH4, CLK_OUT2, USB_D- 1018 11 1/O/T RTC_GPI03, GPI03, TOUCH3, ADC1_CH2 108 12 1/O/T RTC_GPI03, GPI03, TOUCH3, ADC1_CH2 108 12 1/O/T RTC_GPI03, GPI03, TOUCH3, ADC1_CH2 109 13 1/O/T RTC_GPI019, GPI019, UTRTS, ADC2_CH4, SPIHD 1010 18 1/O/T RTC_GPI03, GPI03, TOUCH3, ADC1_CH2, FSPINC 1014 10 I/O/T RTC_GPI011, GPI011, TOUCH11, ADC2_CH0, FSPINC 1011	Table 2 – cont'd from previous page			
EN 3 1 Low: off, the chip powers off. Note: Do not leave the EN pin floating. 104 4 I/O/T RTC_GPI04, GPI04, TOUCH4, ADC1_CH3 105 5 I/O/T RTC_GPI05, GPI06, TOUCH6, ADC1_CH4 107 7 I/O/T RTC_GPI06, GPI06, TOUCH6, ADC1_CH5 107 7 I/O/T RTC_GPI016, GPI015, UORTS, ADC2_CH4, XTAL_32K_P 1016 9 I/O/T RTC_GPI016, GPI016, UOCTS, ADC2_CH4, XTAL_32K_P 1017 10 I/O/T RTC_GPI016, GPI016, UOCTS, ADC2_CH4, XTAL_32K_P 1018 11 I/O/T RTC_GPI016, GPI016, UOCTS, ADC2_CH4, DAC_2, CLK_OUT3 108 12 I/O/T RTC_GPI018, GPI03, UTRS, ADC2_CH7, DAC_2, CLK_OUT3 108 12 I/O/T RTC_GPI019, GPI019, UTRTS, ADC2_CH3, CLK_OUT1, USB_D+ 103 15 I/O/T RTC_GPI020, GPI020, UTCTS, ADC2_CH3, CLK_OUT1, USB_D+ 103 15 I/O/T RTC_GPI010, GPI010, TOUCH13, ADC1_CH3, FSPIHD 104 14 I/O/T RTC_GPI011, GPI011, TOUCH11, ADC2_CH0, FSPILO, FSPILO5 1011 19 I/O/T RTC_GPI013, GPI013, TOUCH12, ADC2	Name	No.	Type ¹	Function
Low: off, the chip powers off. Note: Do not leave the EN pin floating. 104 4 105 5 106 6 107 7 107 7 107 7 108 107 109 8 1017 10 1018 107 1017 10 1018 10 1017 10 1018 11 1017 10 1018 11 1017 10 1018 11 1017 10 1018 11 1017 10 1018 11 11 10/07 RTC_GPIO18, GPIO19, UTXD, ADC2_CH4, EDC4 1019 13 10/07 RTC_GPIO20, GPIO20, UTXD, ADC2_CH4, EDC4 1020 14 10/07 RTC_GPIO13, GPIO14, TOUCH13, ADC2_CH3, ESPIHD 103 15 10/07 RTC_GPIO12, GPIO12, TOUCH10, ADC1_CH4, ESPIC50, ESPIC4	FN	Q		High: on, enables the chip.
IO4 4 I/O/T RTC_GPIO4, GPIO4, TOUCH4, ADC1_CH3 IO5 5 I/O/T RTC_GPIO5, GPIO5, TOUCH5, ADC1_CH4 IO6 6 I/O/T RTC_GPIO6, GPIO5, TOUCH6, ADC1_CH5 IO7 7 I/O/T RTC_GPIO16, GPIO15, UOCH5, ADC2_CH4, XTAL_32K_P IO15 8 I/O/T RTC_GPIO16, GPIO15, UOCTS, ADC2_CH5, XTAL_32K_N IO17 10 I/O/T RTC_GPIO18, GPIO18, UDCTS, ADC2_CH5, XTAL_32K_N IO18 11 I/O/T RTC_GPIO18, GPIO18, UDCTS, ADC2_CH5, CLK_OUT3 IO8 12 I/O/T RTC_GPIO19, GPIO19, UTRTS, ADC2_CH6, CLK_OUT2, USB_D- IO20 14 I/O/T RTC_GPIO3, GPIO3, TOUCH3, ADC1_CH2 IO46 16 I GPIO46 IO9 17 I/O/T RTC_GPIO10, GPIO10, TOUCH10, ADC1_CH8, FSPIHD IO10 18 I/O/T RTC_GPIO10, GPIO17, TOUCH11, ADC2_CH0, FSPIC, FSPIIO4 IO11 19 I/O/T RTC_GPIO13, GPIO17, TOUCH11, ADC2_CH1, FSPICK, FSPIIO5 IO12 20 I/O/T RTC_GPIO14, GPIO14, TOUCH11, ADC2_CH1, FSPICK, FSPIIO6 IO13 2		0		Low: off, the chip powers off.
IO5 5 I/O/T RTC_GPIO5, GPIO5, TOUCH5, ADC1_CH4 I06 6 I/O/T RTC_GPIO6, GPIO6, TOUCH6, ADC1_CH5 I07 7 I/O/T RTC_GPIO15, GPIO15, UDRTS, ADC2_CH4, XTAL_32K_P I016 9 I/O/T RTC_GPIO16, GPIO16, UOCTS, ADC2_CH5, XTAL_32K_N I017 10 I/O/T RTC_GPIO17, GPIO17, U1TXD, ADC2_CH6, DAC_1 I018 11 I/O/T RTC_GPIO18, GPIO18, U1RXD, ADC2_CH7, DAC_2, CLK_OUT3 I08 12 I/O/T RTC_GPIO18, GPIO3, U1RXD, ADC2_CH8, CLK_OUT2, USB_D- I020 14 I/O/T RTC_GPIO20, GPIO20, U1CTS, ADC2_CH8, CLK_OUT1, USB_D+ I03 15 I/O/T RTC_GPIO3, GPIO3, TOUCH3, ADC1_CH2 I046 16 I GPIO46 I05 I/O/T RTC_GPIO10, GPIO10, TOUCH10, ADC1_CH8, FSPIID I011 19 I/O/T RTC_GPIO13, GPIO3, TOUCH3, ADC2_CH2, FSPIO, FSPIIO5 I012 20 I/O/T RTC_GPIO13, GPIO14, TOUCH11, ADC2_CH0, FSPIO, FSPIIO5 I013 17 I/O/T RTC_GPIO13, GPIO3, TOUCH3, ADC2_CH2, FSPIO, FSPIIO5 I014 20 <td></td> <td></td> <td></td> <td>Note: Do not leave the EN pin floating.</td>				Note: Do not leave the EN pin floating.
IO6 6 I/O/T RTC_GPIO6, GPIO6, TOUCH6, ADC1_CH5 IO7 7 I/O/T RTC_GPIO7, GPIO7, TOUCH7, ADC1_CH6 IO15 8 I/O/T RTC_GPIO16, GPIO16, UORTS, ADC2_CH4, XTAL_32K_P IO16 9 I/O/T RTC_GPIO16, GPIO17, U1TXD, ADC2_CH6, DAC_1 IO17 10 I/O/T RTC_GPIO16, GPIO18, U1RXD, ADC2_CH7, DAC_2, CLK_OUT3 IO8 12 I/O/T RTC_GPIO36, GPIO3, TOUCH8, ADC1_CH7 IO19 13 I/O/T RTC_GPIO30, GPIO3, TOUCH3, ADC2_CH7, DAC_2, CLK_OUT3, USB_D- IO20 14 I/O/T RTC_GPIO30, GPIO3, TOUCH3, ADC1_CH2 IO46 16 I GPIO46 IO9 IO3 15 I/O/T RTC_GPIO3, GPIO3, TOUCH3, ADC1_CH2, FSPID IO10 18 I/O/T RTC_GPIO10, GPIO1, TOUCH10, ADC1_CH3, FSPID0 IO11 19 I/O/T RTC_GPIO14, GPIO11, TOUCH11, ADC2_CH3, FSPID, FSPIIO5 IO12 20 I/O/T RTC_GPIO14, GPIO14, TOUCH12, ADC2_CH3, FSPID, FSPIIO5 IO12 10/T RTC_GPIO14, GPIO14, TOUCH14, ADC2_CH3, FSPIDO5 IO12 20<	IO4	4	I/O/T	RTC_GPIO4, GPIO4, TOUCH4, ADC1_CH3
IO7 7 I/O/T RTC_GPI07, GPI07, TOUCH7, ADC1_CH6 IO15 8 I/O/T RTC_GPI015, GPI015, UORTS, ADC2_CH4, XTAL_32K_P IO16 9 I/O/T RTC_GPI016, GPI017, U1TXD, ADC2_CH6, DAC_1 IO18 11 I/O/T RTC_GPI017, GPI017, U1TXD, ADC2_CH6, DAC_1 IO18 11 I/O/T RTC_GPI018, GPI018, U1RXD, ADC2_CH7, DAC_2, CLK_OUT3 IO8 12 I/O/T RTC_GPI03, GPI03, TOUCH8, ADC1_CH7 IO19 13 I/O/T RTC_GPI03, GPI03, TOUCH3, ADC1_CH8, CLK_OUT1, USB_D+ IO20 14 I/O/T RTC_GPI03, GPI03, TOUCH3, ADC1_CH8, FSPIHD IO3 15 I/O/T RTC_GPI010, GPI010, TOUCH10, ADC1_CH8, FSPIHD IO11 18 I/O/T RTC_GPI010, GPI010, TOUCH10, ADC2_CH1, FSPICS0, FSPIIO4 IO11 19 I/O/T RTC_GPI010, GPI011, TOUCH11, ADC2_CH1, FSPICSN, FSPIIO5 IO12 20 I/O/T RTC_GPI013, GPI013, TOUCH13, ADC2_CH3, FSPICSN, FSPIIO5 IO12 21 I/O/T RTC_GPI013, GPI01, TOUCH14, ADC2_CH3, FSPICSN, FSPIIO5 IO12 20 I/O/T RTC_GPI013, GPI01, TOUCH14, A	IO5	5	I/O/T	RTC_GPIO5, GPIO5, TOUCH5, ADC1_CH4
IO15 8 I/O/T RTC_GPI015, GPI015, UORTS, ADC2_CH4, XTAL_32K_P IO16 9 I/O/T RTC_GPI016, GPI016, UOCTS, ADC2_CH5, XTAL_32K_N IO17 10 I/O/T RTC_GPI017, GPI017, U1TXD, ADC2_CH6, DAC_1 IO18 11 I/O/T RTC_GPI018, GPI018, U1RXD, ADC2_CH7, DAC_2, CLK_OUT3 IO8 12 I/O/T RTC_GPI019, GPI019, U1RTS, ADC2_CH8, CLK_OUT2, USB_D- IO19 13 I/O/T RTC_GPI019, GPI019, U1RTS, ADC2_CH8, CLK_OUT1, USB_D+ IO3 15 I/O/T RTC_GPI020, GPI020, U1CTS, ADC2_CH9, CLK_OUT1, USB_D+ IO3 15 I/O/T RTC_GPI010, GPI010, TOUCH3, ADC1_CH2 IO46 16 I GPI046 IO9 17 I/O/T RTC_GPI01, GPI011, TOUCH10, ADC1_CH8, FSPIID IO10 18 I/O/T RTC_GPI013, GPI013, TOUCH12, ADC2_CH1, FSPICK, FSPIIO5 IO12 20 I/O/T RTC_GPI014, GPI014, TOUCH11, ADC2_CH0, FSPIIO IO11 19 I/O/T RTC_GPI021, GPI021 IO21 23 I/O/T RTC_GPI021, GPI021 IO33 24	IO6	6	I/O/T	RTC_GPIO6, GPIO6, TOUCH6, ADC1_CH5
IO16 9 I/O/T RTC_GPIO16, GPIO16, U0CTS, ADC2_CH5, XTAL_32K_N IO17 10 I/O/T RTC_GPIO17, GPIO17, U1TXD, ADC2_CH6, DAC_1 IO18 11 I/O/T RTC_GPIO18, GPIO18, U1RXD, ADC2_CH7, DAC_2, CLK_OUT3 IO8 12 I/O/T RTC_GPIO28, GPIO8, TOUCH8, ADC1_CH7 IO19 13 I/O/T RTC_GPIO20, GPIO20, U1CTS, ADC2_CH9, CLK_OUT1, USB_D- IO20 14 I/O/T RTC_GPIO3, GPIO3, TOUCH3, ADC1_CH2 IO3 15 I/O/T RTC_GPIO3, GPIO3, TOUCH3, ADC1_CH2, FSPID IO10 18 I/O/T RTC_GPIO10, GPIO10, TOUCH10, ADC1_CH3, FSPID IO11 19 I/O/T RTC_GPIO12, GPIO12, TOUCH12, ADC2_CH1, FSPIC16, FSPIIO5 IO12 20 I/O/T RTC_GPIO12, GPIO14, TOUCH11, ADC2_CH3, FSPIND IO11 19 I/O/T RTC_GPIO13, GPIO13, TOUCH12, ADC2_CH2, FSPIQ, FSPIIO7 IO14 22 I/O/T RTC_GPIO14, GPIO3, FIO2 IO1 IO14 22 I/O/T RTC_GPIO14, GPIO3, FIO2 IO1 IO33 24 I/O/T RTC_GPIO2, GPIO21 IO2	107	7	I/O/T	RTC_GPIO7, GPIO7, TOUCH7, ADC1_CH6
IO17 10 I/O/T RTC_GPIO17, GPIO17, U1TXD, ADC2_CH6, DAC_1 IO18 11 I/O/T RTC_GPIO18, GPIO18, U1RXD, ADC2_CH7, DAC_2, CLK_OUT3 IO8 12 I/O/T RTC_GPIO18, GPIO8, TOUCH8, ADC1_CH7 IO19 13 I/O/T RTC_GPIO20, GPIO20, U1CTS, ADC2_CH8, CLK_OUT2, USB_D- IO20 14 I/O/T RTC_GPIO3, GPIO3, TOUCH3, ADC1_CH2 IO3 15 I/O/T RTC_GPIO9, GPIO9, TOUCH9, ADC1_CH8, FSPIHD IO3 15 I/O/T RTC_GPIO10, GPIO10, TOUCH10, ADC1_CH9, FSPICS0, FSPIIO4 IO11 18 I/O/T RTC_GPIO12, GPIO12, TOUCH10, ADC1_CH9, FSPIC50, FSPIIO4 IO11 19 I/O/T RTC_GPIO12, GPIO12, TOUCH12, ADC2_CH1, FSPIC4K, FSPIIO5 IO12 20 I/O/T RTC_GPIO13, GPIO13, TOUCH13, ADC2_CH2, FSPIQ, FSPIIO7 IO14 22 I/O/T RTC_GPIO14, GPIO33, FSPIHD IO33 24 I/O/T SPIIO5, GPIO34, FSPIC50 IO44 25 I/O/T SPIIO5, GPIO34, FSPIC50 IO33 24 I/O/T SPIIO5, GPIO36, FSPIC14 IO34 25 <td>IO15</td> <td>8</td> <td>I/O/T</td> <td>RTC_GPIO15, GPIO15, U0RTS, ADC2_CH4, XTAL_32K_P</td>	IO15	8	I/O/T	RTC_GPIO15, GPIO15, U0RTS, ADC2_CH4, XTAL_32K_P
IO18 11 I/O/T RTC_GPIO18, GPIO18, U1RXD, ADC2_CH7, DAC_2, CLK_OUT3 IO8 12 I/O/T RTC_GPIO8, GPIO8, TOUCH8, ADC1_CH7 IO19 13 I/O/T RTC_GPIO9, GPIO9, GPIO9, U1RTS, ADC2_CH8, CLK_OUT2, USB_D- IO20 14 I/O/T RTC_GPIO20, GPIO20, U1CTS, ADC2_CH9, CLK_OUT1, USB_D+ IO3 15 I/O/T RTC_GPIO3, GPIO3, TOUCH3, ADC1_CH2 IO46 16 1 GPIO46 IO9 17 I/O/T RTC_GPIO10, GPIO10, TOUCH10, ADC1_CH8, FSPIHD IO10 18 I/O/T RTC_GPIO12, GPIO12, TOUCH12, ADC2_CH1, FSPICSO, FSPIIO4 IO11 19 I/O/T RTC_GPIO13, GPIO11, TOUCH11, ADC2_CH0, FSPID, FSPIIO5 IO12 20 I/O/T RTC_GPIO12, GPIO12, TOUCH12, ADC2_CH1, FSPICJK, FSPIIO6 IO13 21 I/O/T RTC_GPIO13, GPIO14, TOUCH11, ADC2_CH3, FSPILO, FSPIIO7 IO14 22 I/O/T RTC_GPIO13, GPIO21 IO33 24 I/O/T SPIC6, GPIO33, FSPIHD IO34 25 I/O/T SPIO6, GPIO3 IO35 28 I/O/T	IO16	9	1/0/T	RTC_GPIO16, GPIO16, U0CTS, ADC2_CH5, XTAL_32K_N
IO8 12 I/O/T RTC_GPIO8, GPIO8, TOUCH8, ADC1_CH7 IO19 13 I/O/T RTC_GPIO19, GPIO19, U1RTS, ADC2_CH8, CLK_OUT2, USB_D- IO20 14 I/O/T RTC_GPIO20, GPIO20, U1CTS, ADC2_CH9, CLK_OUT1, USB_D+ IO3 15 I/O/T RTC_GPIO3, GPIO3, TOUCH3, ADC1_CH2 IO46 16 1 GPIO46 IO9 17 I/O/T RTC_GPIO10, GPIO10, TOUCH10, ADC1_CH8, FSPIHD IO10 18 I/O/T RTC_GPIO10, GPIO10, TOUCH10, ADC1_CH9, FSPICS0, FSPIIO4 IO11 19 I/O/T RTC_GPIO12, GPIO12, TOUCH12, ADC2_CH1, FSPICS0, FSPIIO5 IO12 20 I/O/T RTC_GPIO13, GPIO13, TOUCH13, ADC2_CH2, FSPIQ, FSPIIO7 IO14 22 I/O/T RTC_GPIO14, GPIO14, TOUCH14, ADC2_CH3, FSPIQ, FSPIDOS IO12 20 I/O/T RTC_GPIO21, GPIO21 IO3 24 I/O/T RTC_GPIO3, FSPIHD IO33 24 I/O/T SPIIO6, GPIO34, FSPICS0 IO45 26 I/O/T SPIIO6, GPIO35, FSPID IO35 28 I/O/T SPIIO3, SPISO	IO17	10	I/O/T	RTC_GPI017, GPI017, U1TXD, ADC2_CH6, DAC_1
IO19 13 I/O/T RTC_GPIO19, GPIO19, U1RTS, ADC2_CH8, CLK_OUT2, USB_D- IO20 14 I/O/T RTC_GPIO20, GPIO20, U1CTS, ADC2_CH9, CLK_OUT1, USB_D+ IO3 15 I/O/T RTC_GPIO20, GPIO20, U1CTS, ADC2_CH9, CLK_OUT1, USB_D+ IO3 16 I GPIO46 I IO46 16 I GPIO46 I IO10 18 I/O/T RTC_GPIO10, GPIO10, TOUCH10, ADC1_CH8, FSPIHD IO11 19 I/O/T RTC_GPIO12, GPIO12, TOUCH12, ADC2_CH0, FSPID, FSPIIO5 IO12 20 I/O/T RTC_GPIO13, GPIO13, TOUCH13, ADC2_CH2, FSPIQ, FSPIIO7 IO14 21 I/O/T RTC_GPIO14, GPIO14, TOUCH14, ADC2_CH3, FSPIDA, FSPIDO5 IO12 20 I/O/T RTC_GPIO21, GPIO21 IO33 21 I/O/T RTC_GPIO21, GPIO21 IO34 25 I/O/T RTC_GPIO3, FSPIHD IO33 24 I/O/T SPIIO6, GPIO34, FSPICS0 IO45 26 I/O/T RTC_GPIO36, FSPICLK IO35 28 I/O/T SPIIO6, GPIO36, FSPICLK	IO18	11	1/0/T	RTC_GPIO18, GPIO18, U1RXD, ADC2_CH7, DAC_2, CLK_OUT3
IO20 14 I/O/T RTC_GPIO20, GPIO20, U1CTS, ADC2_CH9, CLK_OUT1, USB_D+ IO3 15 I/O/T RTC_GPIO3, GPIO3, TOUCH3, ADC1_CH2 IO46 16 I GPIO46 IO9 17 I/O/T RTC_GPIO9, GPIO9, TOUCH9, ADC1_CH8, FSPIHD IO10 18 I/O/T RTC_GPIO10, GPIO10, TOUCH10, ADC1_CH9, FSPICS0, FSPIIO4 IO11 19 I/O/T RTC_GPIO12, GPIO12, TOUCH12, ADC2_CH0, FSPID, FSPIIO5 IO12 20 I/O/T RTC_GPIO13, GPIO13, TOUCH13, ADC2_CH2, FSPIQ, FSPIIO7 IO14 22 I/O/T RTC_GPIO14, GPIO14, TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS IO21 23 I/O/T RTC_GPIO21, GPIO21 IO33 24 I/O/T SPIIO5, GPIO34, FSPICS0 IO45 26 I/O/T SPIIO5, GPIO34, FSPICS0 IO35 28 I/O/T SPIIO7, GPIO36, FSPICLK IO37 30 I/O/T SPIIO36, GPIO37, FSPIQ IO38 31 I/O/T SPIDQS, GPIO37, FSPIQ IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 <	IO8	12	I/O/T	RTC_GPI08, GPI08, TOUCH8, ADC1_CH7
IO3 15 I/O/T RTC_GPI03, GPI03, TOUCH3, ADC1_CH2 IO46 16 I GPI046 IO9 17 I/O/T RTC_GPI09, GPI09, TOUCH3, ADC1_CH3, FSPIHD IO10 18 I/O/T RTC_GPI01, GPI01, TOUCH10, ADC1_CH9, FSPICS0, FSPII04 IO11 19 I/O/T RTC_GPI012, GPI012, TOUCH12, ADC2_CH0, FSPID, FSPII05 IO12 20 I/O/T RTC_GPI013, GPI013, TOUCH13, ADC2_CH2, FSPIQ, FSPII06 IO13 21 I/O/T RTC_GPI014, GPI014, TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS IO21 23 I/O/T RTC_GPI021, GPI021 IO33 24 I/O/T SPII05, GPI034, FSPICS0 IO45 26 I/O/T SPII05, GPI034, FSPICS0 IO34 25 I/O/T SPII06, GPI035, FSPID IO35 28 I/O/T SPII07, GPI036, FSPICLK IO37 30 I/O/T SPII03, GPI037, FSPIQ IO38 31 I/O/T GPI038, FSPIWP IO39 32 I/O/T MTCK, GPI039, CLK_OUT3 IO40 33 <	IO19	13	I/0/T	RTC_GPI019, GPI019, U1RTS, ADC2_CH8, CLK_OUT2, USB_D-
IO46 16 I GPI046 IO9 17 I/O/T RTC_GPI09, GPI09, TOUCH9, ADC1_CH8, FSPIHD IO10 18 I/O/T RTC_GPI010, GPI010, TOUCH10, ADC1_CH9, FSPICS0, FSPII04 IO11 19 I/O/T RTC_GPI011, GPI011, TOUCH11, ADC2_CH0, FSPID, FSPII05 IO12 20 I/O/T RTC_GPI012, GPI012, TOUCH12, ADC2_CH1, FSPICLK, FSPII06 IO13 21 I/O/T RTC_GPI014, GPI014, TOUCH13, ADC2_CH2, FSPIQ, FSPII07 IO14 22 I/O/T RTC_GPI014, GPI014, TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS IO21 23 I/O/T RTC_GPI021, GPI021 IO33 24 I/O/T SPII04, GPI033, FSPIHD IO34 25 I/O/T SPII05, GPI034, FSPICS0 IO45 26 I/O/T SPII06, GPI035, FSPID IO35 28 I/O/T SPII06, GPI035, FSPID IO36 29 I/O/T SPII03, GPI037, FSPIQ IO38 31 I/O/T GPI038, FSPIWP IO39 32 I/O/T MTD, GPI040, CLK_OUT3 IO40 <	IO20	14	I/O/T	RTC_GPIO20, GPIO20, U1CTS, ADC2_CH9, CLK_OUT1, USB_D+
IO9 17 I/O/T RTC_GPIO9, GPIO9, TOUCH9, ADC1_CH8, FSPIHD IO10 18 I/O/T RTC_GPIO10, GPIO10, TOUCH10, ADC1_CH9, FSPICS0, FSPII04 IO11 19 I/O/T RTC_GPIO11, GPIO11, TOUCH11, ADC2_CH0, FSPID, FSPII05 IO12 20 I/O/T RTC_GPIO12, GPIO12, TOUCH12, ADC2_CH1, FSPICLK, FSPII06 IO13 21 I/O/T RTC_GPIO13, GPIO13, TOUCH13, ADC2_CH2, FSPIQ, FSPII07 IO14 22 I/O/T RTC_GPIO14, GPIO14, TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS IO21 23 I/O/T RTC_GPIO21, GPIO21 IO33 24 I/O/T SPII05, GPIO34, FSPICS0 IO34 25 I/O/T SPII05, GPIO34, FSPICS0 IO45 26 I/O/T SPII06, GPIO35, FSPID IO35 28 I/O/T SPII06, GPIO35, FSPID IO36 29 I/O/T SPII07, GPIO36, FSPICLK IO37 30 I/O/T SPII03, SPINP IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTD, GPIO41, CLK_OUT1 IO40<	IO3	15	I/O/T	RTC_GPIO3, GPIO3, TOUCH3, ADC1_CH2
IO10 18 I/O/T RTC_GPI010, GPI010, TOUCH10, ADC1_CH9, FSPICS0, FSPII04 IO11 19 I/O/T RTC_GPI011, GPI011, TOUCH11, ADC2_CH0, FSPID, FSPII05 IO12 20 I/O/T RTC_GPI012, GPI012, TOUCH12, ADC2_CH1, FSPICLK, FSPII06 IO13 21 I/O/T RTC_GPI013, GPI013, TOUCH13, ADC2_CH2, FSPIQ, FSPII07 IO14 22 I/O/T RTC_GPI014, GPI014, TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS IO21 23 I/O/T RTC_GPI021, GPI021 IO33 24 I/O/T SPII05, GPI033, FSPIHD IO34 25 I/O/T SPII05, GPI034, FSPICS0 IO45 26 I/O/T GPI045 IO0 27 I/O/T RTC_GPI00, GPI00 IO35 28 I/O/T SPII07, GPI036, FSPICLK IO37 30 I/O/T SPII03, GPI037, FSPIQ IO38 31 I/O/T GPI038, FSPIWP IO39 32 I/O/T MTCK, GPI039, CLK_OUT3 IO40 33 I/O/T MTDO, GPI040, CLK_OUT2 IO41 34	IO46	16		GPIO46
IO11 19 I/O/T RTC_GPIO11, GPIO11, TOUCH11, ADC2_CH0, FSPID, FSPII05 IO12 20 I/O/T RTC_GPIO12, GPIO12, TOUCH12, ADC2_CH1, FSPICLK, FSPII06 IO13 21 I/O/T RTC_GPIO13, GPIO13, TOUCH13, ADC2_CH2, FSPIQ, FSPII07 IO14 22 I/O/T RTC_GPIO14, GPIO14, TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS IO21 23 I/O/T RTC_GPIO21, GPIO21 IO33 24 I/O/T SPII04, GPIO33, FSPIHD IO34 25 I/O/T SPII05, GPIO34, FSPICS0 IO45 26 I/O/T GPIO45 IO0 27 I/O/T RTC_GPIO0, GPIO0 IO35 28 I/O/T SPII06, GPIO35, FSPID IO36 29 I/O/T SPII07, GPIO36, FSPICLK IO37 30 I/O/T SPIDQS, GPIO37, FSPIQ IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTD0, GPIO40, CLK_OUT3 IO40 33 I/O/T MTD0, GPIO41, CLK_OUT2 IO41 34 I/O/T MTD1,	109	17	I/O/T	RTC_GPIO9, GPIO9, TOUCH9, ADC1_CH8, FSPIHD
IO12 20 I/O/T RTC_GPIO12, GPIO12, TOUCH12, ADC2_CH1, FSPICLK, FSPIIO6 IO13 21 I/O/T RTC_GPIO13, GPIO13, TOUCH13, ADC2_CH2, FSPIQ, FSPIIO7 IO14 22 I/O/T RTC_GPIO14, GPIO14, TOUCH13, ADC2_CH3, FSPIWP, FSPIDQS IO21 23 I/O/T RTC_GPIO21, GPIO21 IO33 24 I/O/T SPIIO4, GPIO33, FSPIHD IO34 25 I/O/T SPIIO5, GPIO34, FSPICS0 IO45 26 I/O/T GPIO45 IO0 27 I/O/T RTC_GPIO3, FSPID IO35 28 I/O/T SPIIO6, GPIO35, FSPID IO36 29 I/O/T SPIIO7, GPIO36, FSPICLK IO37 30 I/O/T SPIDOS, GPIO37, FSPIQ IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDO, GPIO41, CLK_OUT2 IO42 35 I/O/T MTDXD, GPIO44, CLK_OUT2 <td>IO10</td> <td>18</td> <td>I/O/T</td> <td>RTC_GPI010, GPI010, TOUCH10, ADC1_CH9, FSPICS0, FSPII04</td>	IO10	18	I/O/T	RTC_GPI010, GPI010, TOUCH10, ADC1_CH9, FSPICS0, FSPII04
IO13 21 I/O/T RTC_GPIO13, GPIO13, TOUCH13, ADC2_CH2, FSPIQ, FSPII07 IO14 22 I/O/T RTC_GPIO14, GPIO14, TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS IO21 23 I/O/T RTC_GPIO21, GPIO21 IO33 24 I/O/T SPIIO4, GPIO33, FSPIHD IO34 25 I/O/T SPIIO5, GPIO34, FSPICS0 IO45 26 I/O/T GPIO45 IO0 27 I/O/T SPIIO6, GPIO35, FSPID IO35 28 I/O/T SPIIO7, GPIO36, FSPICLK IO37 30 I/O/T SPIIO8, GPIO37, FSPIQ IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDO, GPIO40, CLK_OUT2 IO42 35 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTDO, GPIO44, CLK_OUT2 TXD0 37 I/O/T UOTXD, GPIO43, CLK_OUT1 IO2<	IO11	19	I/0/T	RTC_GPI011, GPI011, TOUCH11, ADC2_CH0, FSPID, FSPII05
IO14 22 I/O/T RTC_GPIO14, GPIO14, TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS IO21 23 I/O/T RTC_GPIO21, GPIO21 IO33 24 I/O/T SPIIO4, GPIO33, FSPIHD IO34 25 I/O/T SPIIO5, GPIO34, FSPICS0 IO45 26 I/O/T GPIO45 IO0 27 I/O/T GPIO45 IO3 28 I/O/T SPIIO6, GPIO35, FSPID IO36 29 I/O/T SPIIO3, GPIO37, FSPIQ IO37 30 I/O/T SPIIO8, GPIO37, FSPIQ IO38 31 I/O/T SPIIO8, GPIO37, FSPIQ IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UORXD, GPIO4, CLK_OUT2 TXD0 37 I/O/T UOXD, GPIO4, CLK_OUT1 IO2 38 I/O/T	IO12	20	I/O/T	RTC_GPI012, GPI012, TOUCH12, ADC2_CH1, FSPICLK, FSPII06
IO21 23 I/O/T RTC_GPIO21, GPIO21 IO33 24 I/O/T SPIIO4, GPIO33, FSPIHD IO34 25 I/O/T SPIIO5, GPIO34, FSPICS0 IO45 26 I/O/T GPIO45 IO0 27 I/O/T RTC_GPIO0, GPIO0 IO35 28 I/O/T SPIIO6, GPIO35, FSPID IO36 29 I/O/T SPIIO7, GPIO36, FSPICLK IO37 30 I/O/T SPIIO8, GPIO37, FSPIQ IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTDO, GPIO40, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO41, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UORXD, GPIO4, CLK_OUT2 TXD0 37 I/O/T UORXD, GPIO43, CLK_OUT1 IO2 38 I/O/T UORXD, GPIO44, CLK_OUT2 TXD0 37 I/O/T UORXD, GPIO43, CLK	IO13	21	I/O/T	RTC_GPI013, GPI013, TOUCH13, ADC2_CH2, FSPIQ, FSPII07
IO33 24 I/O/T SPIIO4, GPIO33, FSPIHD IO34 25 I/O/T SPIIO5, GPIO34, FSPICS0 IO45 26 I/O/T GPIO45 IO0 27 I/O/T RTC_GPIO0, GPIO0 IO35 28 I/O/T SPIIO6, GPIO35, FSPID IO36 29 I/O/T SPIIO7, GPIO36, FSPICLK IO37 30 I/O/T SPIIO8, GPIO37, FSPIQ IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UORXD, GPIO44, CLK_OUT2 TXD0 37 I/O/T UOTXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T	IO14	22	I/O/T	RTC_GPI014, GPI014, TOUCH14, ADC2_CH3, FSPIWP, FSPIDQS
IO34 25 I/O/T SPIIO5, GPIO34, FSPICS0 IO45 26 I/O/T GPIO45 IO0 27 I/O/T RTC_GPIO0, GPIO0 IO35 28 I/O/T SPIIO6, GPIO35, FSPID IO36 29 I/O/T SPIIO7, GPIO36, FSPICLK IO37 30 I/O/T SPIDQS, GPIO37, FSPIQ IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UORXD, GPIO44, CLK_OUT2 TXD0 37 I/O/T UORXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P <td>IO21</td> <td>23</td> <td>I/O/T</td> <td>RTC_GPIO21, GPIO21</td>	IO21	23	I/O/T	RTC_GPIO21, GPIO21
IO45 26 I/O/T GPIO45 IO0 27 I/O/T RTC_GPIO0, GPIO0 IO35 28 I/O/T SPIIO6, GPIO35, FSPID IO36 29 I/O/T SPIIO7, GPIO36, FSPICLK IO37 30 I/O/T SPIIO28, GPIO37, FSPIQ IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UORXD, GPIO44, CLK_OUT2 TXD0 37 I/O/T UORXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO33	24	I/O/T	SPIIO4, GPIO33, FSPIHD
IO0 27 I/O/T RTC_GPIO0, GPIO0 IO35 28 I/O/T SPIIO6, GPIO35, FSPID IO36 29 I/O/T SPIIO7, GPIO36, FSPICLK IO37 30 I/O/T SPIDQS, GPIO37, FSPIQ IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UORXD, GPIO44, CLK_OUT2 TXD0 37 I/O/T UOTXD, GPIO43, CLK_OUT1 IO2 38 I/O/T UOTXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO34	25	I/O/T	SPIIO5, GPIO34, FSPICS0
IO35 28 I/O/T SPIIO6, GPIO35, FSPID IO36 29 I/O/T SPIIO7, GPIO36, FSPICLK IO37 30 I/O/T SPIDQS, GPIO37, FSPIQ IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTCO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UOXD, GPIO43, CLK_OUT2 TXD0 37 I/O/T UOXD, GPIO44, CLK_OUT2 TXD0 36 I/O/T UOXD, GPIO43, CLK_OUT1 IO2 38 I/O/T UOXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO45	26	I/O/T	GPIO45
IO36 29 I/O/T SPIIO7, GPIO36, FSPICLK IO37 30 I/O/T SPIDQS, GPIO37, FSPIQ IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UORXD, GPIO43, CLK_OUT2 IO2 38 I/O/T UOTXD, GPIO43, CLK_OUT1 IO2 36 I/O/T UORXD, GPIO43, CLK_OUT2 TXD0 37 I/O/T UOTXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO0	27	I/O/T	RTC_GPIO0, GPIO0
IO37 30 I/O/T SPIDQS, GPIO37, FSPIQ IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UORXD, GPIO43, CLK_OUT2 TXD0 37 I/O/T UORXD, GPIO43, CLK_OUT1 IO2 38 I/O/T UOTXD, GPIO43, CLK_OUT1 IO1 39 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO35	28	I/O/T	SPIIO6, GPIO35, FSPID
IO38 31 I/O/T GPIO38, FSPIWP IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTDI, GPIO42 RXD0 36 I/O/T UORXD, GPIO44, CLK_OUT2 TXD0 37 I/O/T UORXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO36	29	I/O/T	SPIIO7, GPIO36, FSPICLK
IO39 32 I/O/T MTCK, GPIO39, CLK_OUT3 IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UORXD, GPIO44, CLK_OUT2 TXD0 37 I/O/T UORXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO37	30	I/O/T	SPIDQS, GPIO37, FSPIQ
IO40 33 I/O/T MTDO, GPIO40, CLK_OUT2 IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UORXD, GPIO44, CLK_OUT2 TXD0 37 I/O/T UOTXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO38	31	I/O/T	GPIO38, FSPIWP
IO41 34 I/O/T MTDI, GPIO41, CLK_OUT1 IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T U0RXD, GPIO44, CLK_OUT2 TXD0 37 I/O/T U0TXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO39	32	I/O/T	MTCK, GPIO39, CLK_OUT3
IO42 35 I/O/T MTMS, GPIO42 RXD0 36 I/O/T UORXD, GPIO44, CLK_OUT2 TXD0 37 I/O/T UOTXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO40	33	I/O/T	MTDO, GPIO40, CLK_OUT2
RXD0 36 I/O/T U0RXD, GPIO44, CLK_OUT2 TXD0 37 I/O/T U0TXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO41	34	I/O/T	MTDI, GPIO41, CLK_OUT1
TXD0 37 I/O/T U0TXD, GPIO43, CLK_OUT1 IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	IO42	35	I/O/T	MTMS, GPIO42
IO2 38 I/O/T RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1 IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	RXD0	36	I/O/T	UORXD, GPIO44, CLK_OUT2
IO1 39 I/O/T RTC_GPIO1, GPIO1, TOUCH1, ADC1_CH0 GND 40 P Ground	TXD0	37	I/O/T	U0TXD, GPIO43, CLK_OUT1
GND 40 P Ground	102	38	I/O/T	RTC_GPIO2, GPIO2, TOUCH2, ADC1_CH1
	IO1	39	I/O/T	RTC_GPI01, GPI01, TOUCH1, ADC1_CH0
EPAD 41 P Ground	GND	40	Р	Ground
	EPAD	41	Р	Ground

Table 2 – cont'd from previous page

¹ P: power supply; I: input; O: output; T: high impedance.

3 Get Started

3.1 What You Need

To develop applications for module you need:

- 1 x ESP32-S2-SOLO-2
- 1 x Espressif RF testing board
- 1 x USB-to-Serial board
- 1 x Micro-USB cable
- 1 x PC running Linux

In this user guide, we take Linux operating system as an example. For more information about the configuration on Windows and macOS, please refer to *ESP-IDF Programming Guide*.

3.2 Hardware Connection

1. Solder the ESP32-S2-SOLO-2 module to the RF testing board as shown in Figure 2.



Figure 2: Hardware Connection

- 2. Connect the RF testing board to the USB-to-Serial board via TXD, RXD, and GND.
- 3. Connect the USB-to-Serial board to the PC.
- 4. Connect the RF testing board to the PC or a power adapter to enable 5 V power supply, via the Micro-USB cable.
- 5. During download, connect IO0 to GND via a jumper. Then, turn "ON" the testing board.
- 6. Download firmware into flash. For details, see the sections below.

- 7. After download, remove the jumper on IO0 and GND.
- 8. Power up the RF testing board again. The module will switch to working mode. The chip will read programs from flash upon initialization.

Note:

IO0 is internally logic high. If IO0 is set to pull-up, the Boot mode is selected. If this pin is pull-down or left floating, the Download mode is selected. For more information on ESP32-S2-SOLO-2, please refer to ESP32-S2 Series Datasheet.

3.3 Set up Development Environment

The Espressif IoT Development Framework (ESP-IDF for short) is a framework for developing applications based on the Espressif SoCs. Users can develop applications with ESP32-S2 in Windows/Linux/macOS based on ESP-IDF. Here we take Linux operating system as an example.

3.3.1 Install Prerequisites

To compile with ESP-IDF you need to get the following packages:

- CentOS 7 & 8:
 - sudo yum -y update && sudo yum install git wget flex bison gperf python3 python3pip
 - 2 python3-setuptools cmake ninja-build ccache dfu-util libusbx
- Ubuntu and Debian:
 - sudo apt-get install git wget flex bison gperf python3 python3-pip python3setuptools
 - 2 cmake ninja-build ccache libffi-dev libssl-dev dfu-util libusb-1.0-0
- Arch:
 - sudo pacman -S ---needed gcc git make flex bison gperf python-pip cmake ninja ccache
 - 2 dfu-util libusb

Note:

- This guide uses the directory ~/esp on Linux as an installation folder for ESP-IDF.
- Keep in mind that ESP-IDF does not support spaces in paths.

3.3.2 Get ESP-IDF

To build applications for ESP32-S2-SOLO-2 module, you need the software libraries provided by Espressif in ESP-IDF repository.

To get ESP-IDF, create an installation directory (~/esp) to download ESP-IDF to and clone the repository with 'git clone':

- ₁ mkdir -p ~/esp
- 2 cd ~/esp
- 3 git clone --recursive https://github.com/espressif/esp-idf.git

ESP-IDF will be downloaded into ~/esp/esp-idf. Consult <u>ESP-IDF Versions</u> for information about which ESP-IDF version to use in a given situation.

3.3.3 Set up Tools

Aside from the ESP-IDF, you also need to install the tools used by ESP-IDF, such as the compiler, debugger, Python packages, etc. ESP-IDF provides a script named 'install.sh' to help set up the tools in one go.

- d ~/esp/esp-idf
- 2 ./install.sh

3.3.4 Set up Environment Variables

The installed tools are not yet added to the PATH environment variable. To make the tools usable from the command line, some environment variables must be set. ESP-IDF provides another script 'export.sh' which does that. In the terminal where you are going to use ESP-IDF, run:

sHOME/esp/esp-idf/export.sh

Now everything is ready, you can build your first project on ESP32-S2-SOLO-2 module.

3.4 Create Your First Project

3.4.1 Start a Project

Now you are ready to prepare your application for ESP32-S2-SOLO-2 module. You can start with get-started/hello_world project from examples directory in ESP-IDF.

Copy get-started/hello_world to ~/esp directory:

- 1 cd ~/esp
- 2 cp -r \$IDF_PATH/examples/get-started/hello_world .

There is a range of <u>example projects</u> in the examples directory in ESP-IDF. You can copy any project in the same way as presented above and run it. It is also possible to build examples in-place, without copying them first.

3.4.2 Connect Your Device

Now connect your module to the computer and check under what serial port the module is visible. Serial ports in Linux start with '/dev/tty' in their names. Run the command below two times, first with the board unplugged, then with plugged in. The port which appears the second time is the one you need:

1 ls /dev/tty*

Note:

Keep the port name handy as you will need it in the next steps.

3.4.3 Configure

Navigate to your 'hello_world' directory from Step 3.4.1. Start a Project, set ESP32-S2 chip as the target and run the project configuration utility 'menuconfig'.

- 1 cd ~/esp/hello_world
- ² idf.py set-target esp32s2
- 3 idf.py menuconfig

Setting the target with 'idf.py set-target ESP32-S2' should be done once, after opening a new project. If the project contains some existing builds and configuration, they will be cleared and initialized. The target may be saved in environment variable to skip this step at all. See <u>Selecting the Target</u> for additional information.

If the previous steps have been done correctly, the following menu appears:

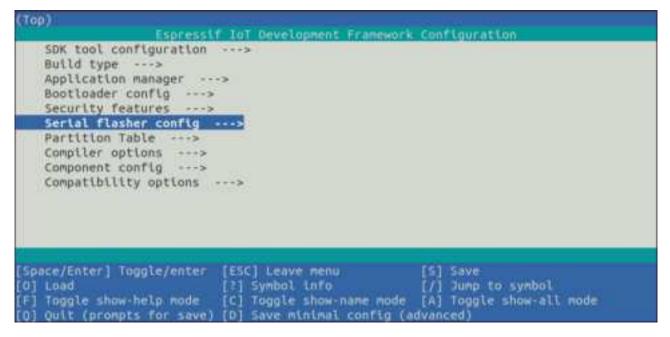


Figure 3: Project Configuration - Home Window

You are using this menu to set up project specific variables, e.g. Wi-Fi network name and password, the processor speed, etc. Setting up the project with menuconfig may be skipped for "hello_word". This example will run with default configuration

The colors of the menu could be different in your terminal. You can change the appearance with the option '--style'. Please run 'idf.py menuconfig --help' for further information.

3.4.4 Build the Project

Build the project by running:

idf.py build

This command will compile the application and all ESP-IDF components, then it will generate the bootloader, partition table, and application binaries.

- 1 \$ idf.py build
- 2 Running cmake in directory /path/to/hello_world/build
- Executing "cmake -G Ninja --warn-uninitialized /path/to/hello_world"...

```
Warn about uninitialized values.
   -- Found Git: /usr/bin/git (found version "2.17.0")
   -- Building empty aws_iot component due to configuration
   -- Component names: ...
   -- Component paths: ...
8
9
   ... (more lines of build system output)
10
11
   [527/527] Generating hello_world.bin
12
  esptool.py v2.3.1
13
14
   Project build complete. To flash, run this command:
15
   ../../components/esptool_py/esptool/esptool.py -p (PORT) -b 921600
  write_flash --flash_mode dio --flash_size detect --flash_freq 40m
17
  0x10000 build/hello_world.bin build 0x1000 build/bootloader/bootloader.bin 0x8000
18
  build/partition_table/partition-table.bin
19
  or run 'idf.py -p PORT flash'
20
```

If there are no errors, the build will finish by generating the firmware binary .bin file.

3.4.5 Flash onto the Device

Flash the binaries that you just built onto your module by running:

idf.py -p PORT [-b BAUD] flash

Replace PORT with your ESP32-S2 board's serial port name from Step: Connect Your Device.

You can also change the flasher baud rate by replacing BAUD with the baud rate you need. The default baud rate is 460800.

For more information on idf.py arguments, see idf.py.

```
Note:
The option 'flash' automatically builds and flashes the project, so running 'idf.py build' is not necessary.
```

When flashing, you will see the output log similar to the following:

- 11 MAC: 7c:df:a1:e0:00:64
- 12 Uploading stub...
- Running stub...

```
14 Stub running...
15 Changing baud rate to 460800
16 Changed.
17 Configuring flash size...
<sup>18</sup> Flash will be erased from 0x00000000 to 0x00004fff...
<sup>19</sup> Flash will be erased from 0x00010000 to 0x00039fff...
<sup>20</sup> Flash will be erased from 0x00008000 to 0x00008fff...
21 Compressed 18896 bytes to 11758...
22 Writing at 0x0000000... (100 %)
23 Wrote 18896 bytes (11758 compressed) at 0x00000000 in 0.5 seconds (effective 279.9 kbit/s)
       . . .
24 Hash of data verified.
<sup>25</sup> Compressed 168208 bytes to 88178...
26 Writing at 0x00010000... (16 %)
27 Writing at 0x0001a80f... (33 %)
28 Writing at 0x000201f1... (50 %)
29 Writing at 0x00025dcf... (66 %)
30 Writing at 0x0002d0be... (83 %)
31 Writing at 0x00036c07... (100 %)
32 Wrote 168208 bytes (88178 compressed) at 0x00010000 in 2.4 seconds (effective 569.2 kbit/s
       )...
33 Hash of data verified.
34 Compressed 3072 bytes to 103...
35 Writing at 0x00008000... (100 %)
36 Wrote 3072 bytes (103 compressed) at 0x00008000 in 0.1 seconds (effective 478.9 kbit/s)...
  Hash of data verified.
37
38
39 Leaving...
40 Hard resetting via RTS pin...
  Done
41
```

If there are no issues by the end of the flash process, the board will reboot and start up the "hello_world" application.

3.4.6 Monitor

To check if "hello_world" is indeed running, type 'idf.py -p PORT monitor' (Do not forget to replace PORT with your serial port name).

This command launches the IDF Monitor application:

```
1 $ idf.py -p /dev/ttyUSB0 monitor
2 Running idf_monitor in directory [...]/esp/hello_world/build
3 Executing "python [...]/esp-idf/tools/idf_monitor.py -b 115200
4 [...]/esp/hello_world/build/hello-world.elf"...
5 --- idf_monitor on /dev/ttyUSB0 115200 ---
6 --- Quit: Ctrl+] | Menu: Ctrl+T | Help: Ctrl+T followed by Ctrl+H ---
7 ets Jun 8 2016 00:22:57
8
9 rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_B00T)
10 ets Jun 8 2016 00:22:57
```

```
11 ...
```

After startup and diagnostic logs scroll up, you should see "Hello world!" printed out by the application.

```
1 ...
```

- 2 Hello world!
- 3 Restarting in 10 seconds...
- ⁴ This is esp32s2 chip with 1 CPU core, WiFi,
- 5 silicon revision 1
- ⁶ Minimum free heap size: 390684 bytes
- 7 Restarting in 9 seconds...
- 8 Restarting in 8 seconds...
- 9 Restarting in 7 seconds...

To exit IDF monitor use the shortcut Ctrl+].

That's all what you need to get started with ESP32-S2-SOLO-2 module! Now you are ready to try some other examples in ESP-IDF, or go right to developing your own applications.

4 U.S. FCC Statement

The device complies with KDB 996369 D03 OEM Manual v01. Below are integration instructions for host product manufacturers according to the KDB 996369 D03 OEM Manual v01.

List of Applicable FCC Rules

FCC Part 15 Subpart C 15.247

Specific Operational Use Conditions

The module has WiFi functions.

- Operation Frequency:
 - WiFi: 2412 ~ 2462 MHz
- Number of Channel:
 - WiFi: 11
- Modulation:
 - WiFi: DSSS; OFDM
- Type: On-board PCB antenna
- Gain: 3.26 dBi Max

The module can be used for IoT applications with a maximum 3.26 dBi antenna. The host manufacturer installing this module into their product must ensure that the final composit product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to 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 shall include all required regulatory information/warning as show in this manual.

Limited Module Procedures

Not applicable. The module is a single module and complies with the requirement of FCC Part 15.212.

Trace Antenna Designs

Not applicable. The module has its own antenna, and does not need a host's printed board microstrip trace antenna, etc.

RF Exposure Considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users' body; and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Antennas

Antenna specification are as follows:

- Type: On-board PCB antenna
- Gain: 3.26 dBi

This device is intended only for host manufacturers under the following conditions:

- The transmitter module may not be co-located with any other transmitter or antenna.
- The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.
- The antenna must be either permanently attached or employ a 'unique' antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

Label and Compliance Information

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID: 2AC7Z-ESPS2SOLO2" with their finished product.

Information on test modes and additional testing requirements

- Operation Frequency:
 - WiFi: 2412 ~ 2462 MHz
- Number of Channel:
 - WiFi: 11
- Modulation:
 - WiFi: DSSS; OFDM

Host manufacturer must perform test of radiated and conducted emission and spurious emission, etc., according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

Additional testing, Part 15 Subpart B compliant

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part15 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 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.

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.

Caution:

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

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter. The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM Integration Instructions

This device is intended only for OEM integrators under the following conditions:

- The transmitter module may not be co-located with any other transmitter or antenna.
- The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as the conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

Validity of Using the Module Certification

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2AC7Z-ESPS2SOLO2".

5 Related Documentation and Resources

Related Documentation

- ESP32-S2 Series Datasheet Specifications of the ESP32-S2 hardware.
- ESP32-S2 Technical Reference Manual Detailed information on how to use the ESP32-S2 memory and peripherals.
- ESP32-S2 Hardware Design Guidelines Guidelines on how to integrate the ESP32-S2 into your hardware product.
- <u>ESP32-S2 Series SoC Errata</u> Descriptions of errors in ESP32-S2 series of SoCs from chip revision 0 forward. *Certificates*
- https://espressif.com/en/support/documents/certificates
- ESP32-S2 Product/Process Change Notifications (PCN) https://espressif.com/en/support/documents/pcns
- *ESP32-S2 Advisories* Information on security, bugs, compatibility, component reliability. <u>https://espressif.com/en/support/documents/advisories</u>
- Documentation Updates and Update Notification Subscription
 https://espressif.com/en/support/download/documents

Developer Zone

- ESP-IDF Programming Guide for ESP32-S2 Extensive documentation for the ESP-IDF development framework.
- *ESP-IDF* and other development frameworks on GitHub. <u>https://github.com/espressif</u>
- 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. https://esp32.com/
- *The ESP Journal* Best Practices, Articles, and Notes from Espressif folks. <u>https://blog.espressif.com/</u>
- See the tabs SDKs and Demos, Apps, Tools, AT Firmware. https://espressif.com/en/support/download/sdks-demos

Products

- ESP32-S2 Series SoCs Browse through all ESP32-S2 SoCs. https://espressif.com/en/products/socs?id=ESP32-S2
- ESP32-S2 Series Modules Browse through all ESP32-S2-based modules. https://espressif.com/en/products/modules?id=ESP32-S2
- ESP32-S2 Series DevKits Browse through all ESP32-S2-based devkits. https://espressif.com/en/products/devkits?id=ESP32-S2
- *ESP Product Selector* Find an Espressif hardware product suitable for your needs by comparing or applying filters. https://products.espressif.com/#/product-selector?language=en

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Revision History

Date	Version	Release notes
2022-09-01	v0.5	Preliminary release



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