# LAMPIRAN A

ΓERIAN PENDIDIKAN DAN KEBUDAYAAN
<NIK NEGERI SRIWIJAYA
ıya Negara, Palembang 30139
l-353414 fax. 0711-355918
**Website :** www.polisriwijaya.ac.id **E-mail :** info@polsri.ac.id

**REKOMENDASI UJIAN TUGAS AKHIR (TA)**

Pembimbing Tugas Akhir memberikan rekomendasi kepada,

| | | |
|---|---|---|
| Nama | : | Renhard Halim |
| NIM | : | 061940342307 |
| Jurusan/Program Studi | : | Teknik Elektro/Mekatronika |
| Judul Tugas Akhir | : | Analisa Sistem Pemantauan Tanaman Tomat Menggunakan Fuzzy Logic Berbasis Panel Surya |

Mahasiswa tersebut telah memenuhi persyaratan dan dapat mengikuti Ujian Tugas Akhir (TA) pada Tahun Akademik 2023

Palembang, 15 Agustus 2023.

Pembimbing I,

(Yunni Oktarina,S.T.,M.T)
NIP 197710162008122001.

Pembimbing II,

(Niksen Alfarizal,S.T.,M.Kom)
NIP 197508162001121001

No. Dok. : F-PBM-16 | Tgl. Berlaku : 13 Desember 2010 | No. Rev. : 00

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## KESEPAKATAN BIMBINGAN LAPORAN TUGAS AKHIR (TA)

Kami yang bertanda tangan di bawah ini,

**Pihak Pertama**

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| Nama | : Renhard Halim |
| NIM | : 061940342307 |
| Jurusan | : Teknik Elektro |
| Program Studi | : Mekatronika |

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| NIP | : 197710162008122001 |
| Jurusan | : Teknik Elektro |
| Program Studi | : Mekatronika |

Pada hari ini Jum'at ..... tanggal 17 Maret 2023 telah sepakat untuk melakukan konsultasi bimbingan Laporan Tugas Akhir.

Konsultasi bimbingan sekurang-kurangnya 1 (satu) kali dalam satu minggu. Pelaksanaan bimbingan pada setiap hari ..Senin..... pukul ..10.00...., tempat di Politeknik Negeri Sriwijaya.

Demikianlah kesepakatan ini dibuat dengan penuh kesadaran guna kelancaran penyelesaian Laporan Tugas Akhir.

Palembang, Maret 2023

Pihak Pertama,

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| Program Studi | : Mekatronika |

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| Program Studi | : Mekatronika |

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Palembang, .....Maret 2023.....

Pihak Pertama,

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NIM 061940342307

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No. Dok. : F-PBM-17 | Tgl. Berlaku : 13 Desember 2010 | No. Rev. : 00

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## LEMBAR BIMBINGAN LAPORAN TUGAS AKHIR (TA)

Lembar : 1

Nama : Renhard Halim
NIM : 061940342307
Jurusan/Program Studi : Teknik Elektro/Mekatronika
Judul Laporan Akhir : Analisa Sistem Pemantauan Tanaman Tomat Menggunakan Fuzzy Logic Berbasis Panel Surya
Pembimbing I : Yurni Oktarina,S.T.,M.T.

| No. | Tanggal | Uraian Bimbingan | Tanda Tangan Pembimbing |
|---|---|---|---|
| 1. | 20 Maret 2023 | Pengajuan Judul Tugas Akhir | |
| 2. | 26 Maret 2023 | Revisi Bab I Proposal | |
| 3. | 28 Maret 2023 | Revisi Bab I-II Proposal | |
| 4. | 29 Maret 2023 | ACC Bab I Proposal, Revisi Bab II | |
| 5. | 3 April 2023 | Revisi Bab II, Pengajuan Bab III | |
| 6. | 2 Mei 2023 | ACC Bab II, Revisi BAb III | |

Lembar : 2

| No. | Tanggal | Uraian Bimbingan | Tanda Tangan Pembimbing |
|---|---|---|---|
| 7. | 26/5 2023 | Mengumpulkan Jurnal | |
| 8. | 9/6 2023 | ACC Proposal | |
| 9. | 26/6 2023 | Bimbingan Bab IV dan V | |
| 10. | 28/7 2023 | Revisi Bab IV dan V | |
| 11. | 31/7 2023 | ACC Bab IV dan Revisi Bab V | |
| 12. | 15/8 2023 | Acc Bab V, ujian (TA | |

Palembang, 28/8/2023

Ketua Jurusan/KPS

(Masayu Anisah, S.T., M.T.)
NIP 197012281993032001

**Catatan:**
*) melingkari angka yang sesuai.
Ketua Jurusan/Ketua Program Studi harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini.
Lembar pembimbingan LA ini harus dilampirkan dalam Laporan Akhir.

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Lembar : 1

| | | |
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| Nama | : | Renhard Halim |
| NIM | : | 061940342307 |
| Jurusan/Program Studi | : | Teknik Elektro/Mekatronika |
| Judul Laporan Akhir | : | Analisa Sistem Pemantauan Tanaman Tomat Menggunakan Fuzzy Logic Berbasis Panel Surya |
| Pembimbing II | : | Niksen Alfarizal, S.T., M.Kom |

| No. | Tanggal | Uraian Bimbingan | Tanda Tangan Pembimbing |
|---|---|---|---|
| 1. | 15/3 23 | Konsultasi Judul<br>Judul yang spesifik | |
| 2. | | Seleksi konsultasi dgn pembimbing II | |
| 3. | 26/3 23 | Silahkan ikut Ujian / Seminar TA | |
| 4. | | | |
| 5. | 10/4 23 | Perbaiki / kinerja Alat / Harus sesuai rencana | |
| 6. | 20/5 23 | Tata letak komponen / untuk rangkaian dsb bekerja | |

Lembar : 2

| No. | Tanggal | Uraian Bimbingan | Tanda Tangan Pembimbing |
|---|---|---|---|
| 7. | 14/6 '23 | Konsultasi dgn pembimbing I Tingkatkan kinerja Blat / | |
| 8. | | Perhatikan Uji Data Rancang Tabel Pengukuran Untuk Data dan Pembahasan | |
| 9. | | | |
| 10. | 1/8 '23 | Lengkapi berkas Laporan Aktifitas / Tabel / Capaian | |
| 11. | | Siap publikasi | |
| 12. | 8/8 '23 | Acc ikut Ujian TA | |

Palembang, 28/8/2023

Ketua Jurusan/KPS

(Masayu Anisah, S.T., M.T.)
NIP 197012281993032001

**Catatan:**
*) melingkari angka yang sesuai.
Ketua Jurusan/Ketua Program Studi harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini.
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No. Dok. : F-PBM-23 | Tgl. Berlaku : 13 Desember 2010 | No. Rev. : 00

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## PELAKSANAAN REVISI LAPORAN AKHIR

Mahasiswa berikut,

| | | |
|---|---|---|
| Nama | : | Renhard Halim |
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| Jurusan/Program Studi | : | Teknik Elektro/Sarjana Terapan Teknik Elektro |
| Judul Laporan Akhir | : | Analisa Sistem Pemantauan Tomat Menggunakan *Fuzzy Logic* Berbasis Panel Surya |

Telah melaksanakan revisi terhadap Laporan Akhir yang diujikan pada hari Senin tanggal 28 bulan Agustus tahun 2023 Pelaksanaan revisi terhadap Laporan Akhir tersebut telah disetujui oleh Dosen Penguji yang memberikan revisi:

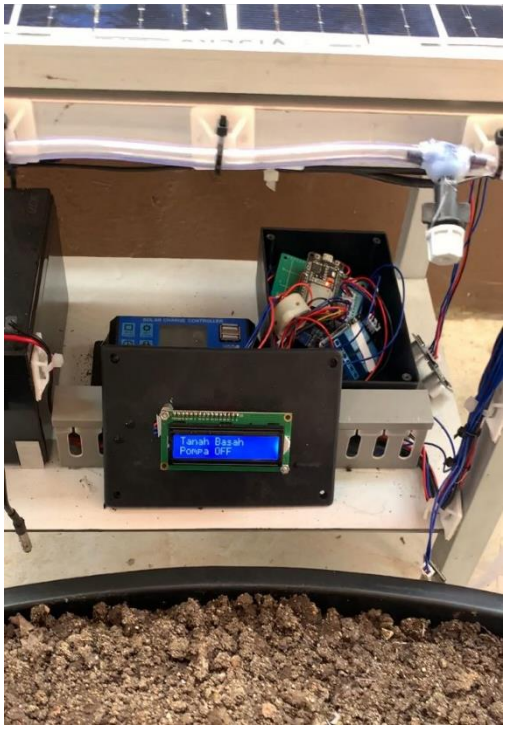
| No. | Komentar | Nama Dosen Penguji *) | Tanggal | Tanda Tangan |
|---|---|---|---|---|
| 1 | | Ir. Pola Risma, M.T. | | |
| 2 | | Yudi Wijanarko, S.T., M.T. | 1/9-23 | |
| 3 | ACC | Yeni Irdayanti, S.T., M.Kom. | 6/9-2023 | |
| 4 | | Yurni Oktarina, S.T., M.T. | 6/9 2023 | |

Palembang, .....
Ketua Penguji **),

( Ir. Pola Risma, M.T.)
NIP 196303281990032001

**Catatan:**
*) Dosen penguji yang memberikan revisi saat ujian laporan akhir.
**) Dosen penguji yang ditugaskan sebagai Ketua Penguji saat ujian LA.
Lembaran pelaksanaan revisi ini harus dilampirkan dalam Laporan Akhir.

# LAMPIRAN B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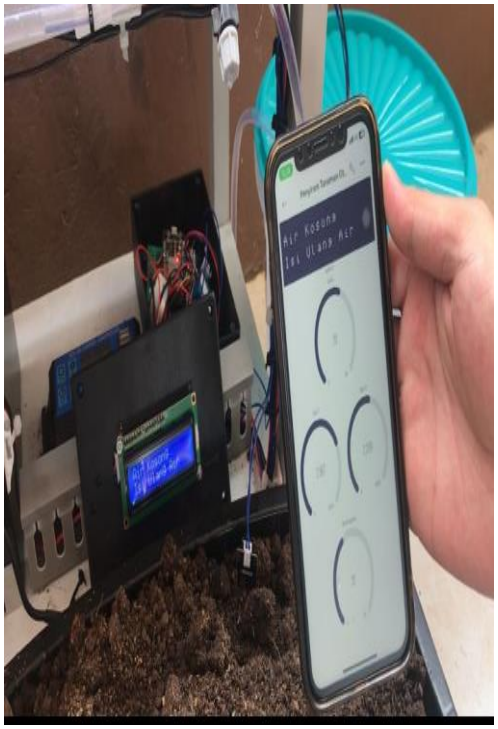


# LAMPIRAN C

***Data Sheet***

1. DHT21 atau AM2301

**AiT Semiconductor Inc.**
www.ait-ic.com

# AM2301
MOSFET
P-CHANNEL ENHANCEMENT MODE

## DESCRIPTION

The AM2301 is the P-Channel logic enhancement mode power field effect transistor is produced using high cell density. advanced trench technology to provide excellent $R_{DS(ON)}$. .low gate charge and operation gate as 2.5V.

This device is suitable for use as a load switch or other general applications.

The AM2301 is available in SOT-23S Package

## FEATURES

- -20V/-3.0A, $R_{DS(ON)}$ =80mΩ(typ.)@$V_{GS}$ =-4.5V
- -20V/-2.0A, $R_{DS(ON)}$ =105mΩ(typ.)@$V_{GS}$ =-2.5V
- Super high density cell design for extremely low Gate Charge
- Exceptional on-resistance and Maximum DC current capability
- Available in SOT-23S Package

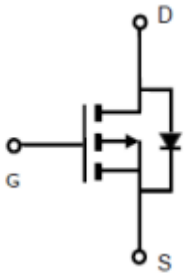
## ORDERING INFORMATION

| Package Type | Part Number | |
|---|---|---|
| SOT-23S<br>SPQ: 3,000pcs/Reel | E3S | AM2301E3SR |
| | | AM2301E3SVR |
| Note | V: Halogen free Package<br>R: Tape & Reel | |
| AiT provides all RoHS products | | |

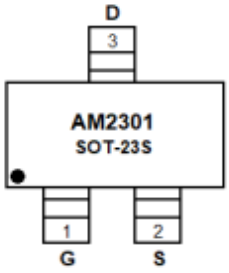
## APPLICATIONS

- Power Management in Note book
- Portable Equipment
- Networking DC-DC Power System
- Load Switch

## PIN DESCRIPTION



## PIN DESCRIPTION




Top View

| Pin # | Symbol | Function |
|---|---|---|
| 1 | G | Gate |
| 2 | S | Source |
| 3 | D | Drain |

## ABSOLUTE MAXIMUM RATINGS

$T_A$ = 25℃, unless otherwise noted

| | | |
|---|---|---|
| $V_{DSS}$, Drain-Source Voltage | | -20V |
| $V_{GSS}$, Gate-Source Voltage | | ±12V |
| $I_D$, Continuous Drain Current , $V_{GS}$ = -4.5V | $T_A$=25℃[NOTE1] | 3.2A |
| | $T_A$=70℃[NOTE1] | 2.5A |
| $I_{DM}$, Pulsed Drain Current[NOTE2] | | -10A |
| $P_D$, Power Dissipation | $T_A$=25℃ | 1.0W |
| | $T_A$=70℃ | 0.7W |
| $T_J$, Operation Junction Temperature | | -55℃~150℃ |
| $T_{STG}$, Storage Temperature Range | | -55℃~150℃ |

Stresses above 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 in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## THERMAL INFORMATION

| Parameter | | Symbol | Limit | Unit |
|---|---|---|---|---|
| Thermal Resistance-Junction to Ambient[NOTE1] | Steady-State | $R_{\theta JA}$ | 125 | °C/W |
| Thermal Resistance Junction to Lead[NOTE1] | Steady-State | $R_{\theta JC}$ | 85 | °C/W |

2. *Soil Moisture*

# Moisture Sensor (SKU:SEN0114)

## Contents



## Introduction

This moisture sensor can read the amount of moisture present in the soil surrounding it. It's a low tech sensor, but ideal for monitoring an urban garden, or your pet plant's water level. This is a must have tool for a connected garden!

This sensor uses the two probes to pass current through the soil, and then it reads that resistance to get the moisture level. More water makes the soil conduct electricity more easily (less resistance), while dry soil conducts electricity poorly (more resistance).

It will be helpful to remind you to water your indoor plants or to monitor the soil moisture in your garden.

## Specification

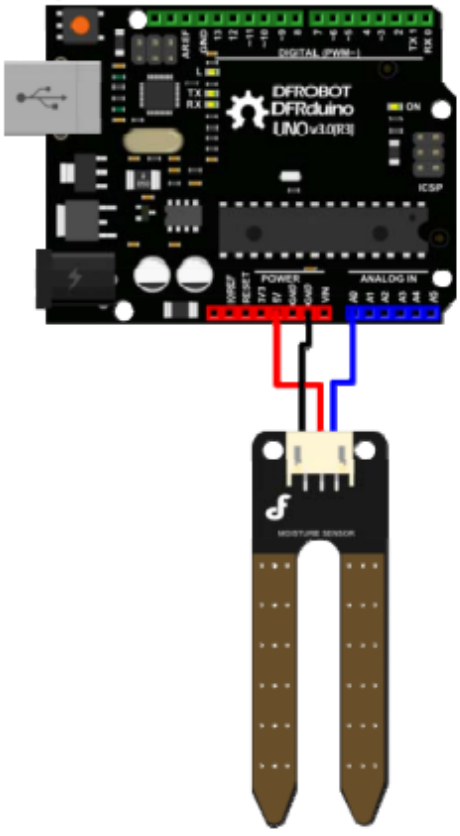
- Power supply: 3.3v or 5v
- Output voltage signal: 0~4.2v
- Current: 35mA
- Pin definition:
  Analog output(Blue wire)
  GND(Black wire)
  Power(Red wire)

- Size: 60x20x5mm
- Value range:
  0 ~300 : dry soil
  300~700 : humid soil
  700~950 : in water

## Specification

- Power supply: 3.3v or 5v
- Output voltage signal: 0~4.2v
- Current: 35mA
- Pin definition:
  Analog output(Blue wire)
  GND(Black wire)
  Power(Red wire)
- Size: 60x20x5mm
- Value range:
  0 ~300 : dry soil
  300~700 : humid soil
  70050 : in water

## Usage




Moisture sensor Connection diagram

| Pin Name | Pin No. | Description |
|---|---|---|
| VCC | 1 | The Vcc pin powers the module, typically with +5V |
| GND | 2 | Power Supply Ground |
| DO | 3 | Digital Out Pin for Digital Output |
| AO | 4 | Analog Out Pin for Analog Output |

## Specifications

- Operating Voltage: 3.3V to 5V DC
- Operating Current: 15mA
- Output Digital – 0V to 5V, Adjustable trigger level from preset
- Output Analog – 0V to 5V based on infrared radiation from fire flame falling on the sensor
- LEDs indicating output and power
- PCB Size: 3.2cm x 1.4cm
- LM393 based design

3. HCSR-04

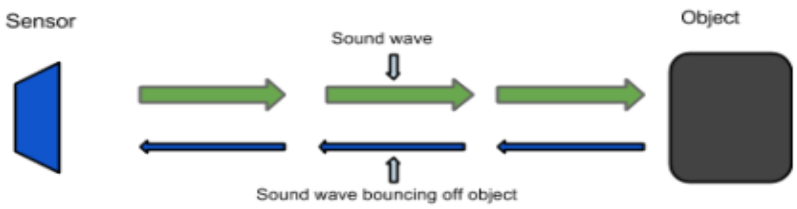
Elijah J. Morgan
Nov. 16 2014

The purpose of this file is to explain how the HC-SR04 works. It will give a brief explanation of how ultrasonic sensors work in general. It will also explain how to wire the sensor up to a microcontroller and how to take/interpret readings. It will also discuss some sources of errors and bad readings.

1. **How Ultrasonic Sensors Work**
2. **HC-SR04 Specifications**
3. **Timing chart, Pin explanations and Taking Distance Measurements**
4. **Wiring HC-SR04 with a microcontroller**
5. **Errors and Bad Readings**


**1. How Ultrasonic Sensors Work**

Ultrasonic sensors use sound to determine the distance between the sensor and the closest object in its path. How do ultrasonic sensors do this? Ultrasonic sensors are essentially sound sensors, but they operate at a frequency above human hearing.



The sensor sends out a sound wave at a specific frequency. It then listens for that specific sound wave to bounce off of an object and come back (Figure 1). The sensor keeps track of the time between sending the sound wave and the sound wave returning. If you know how fast something is going and how long it is traveling you can find the distance traveled with equation 1.

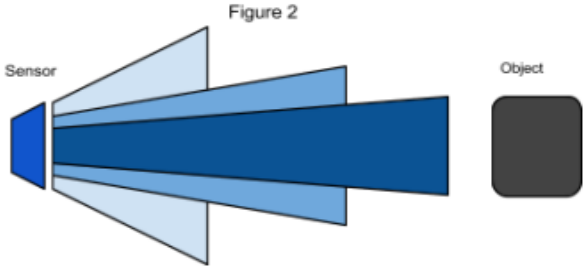
**Equation 1.** $d = v \times t$

The speed of sound can be calculated based on the a variety of atmospheric conditions, including temperature, humidity and pressure. Actually calculating the distance will be shown later on in this document.

It should be noted that ultrasonic sensors have a cone of detection, the angle of this cone varies with distance, Figure 2 show this relation. The ability of a sensor to

detect an object also depends on the objects orientation to the sensor. If an object doesn't present a flat surface to the sensor then it is possible the sound wave will bounce off the object in a way that it does not return to the sensor.

Figure 2




**2. HC-SR04 Specifications**

The sensor chosen for the Firefighting Drone Project was the HC-SR04. This section contains the specifications and why they are important to the sensor module. The sensor modules requirements are as follows.

- Cost
- Weight
- Community of hobbyists and support
- Accuracy of object detection
- Probability of working in a smoky environment
- Ease of use

The HC-SR04 Specifications are listed below. These specifications are from the Cytron Technologies HC-SR04 User's Manual (source 1).

- Power Supply: +5V DC
- Quiescent Current: <2mA
- Working current: 15mA
- Effectual Angle: <15°
- Ranging Distance: 2-400 cm
- Resolution: 0.3 cm
- Measuring Angle: 30°
- Trigger Input Pulse width: 10uS
- Dimension: 45mm x 20mm x 15mm
- Weight: approx. 10 g

## Pin Layout

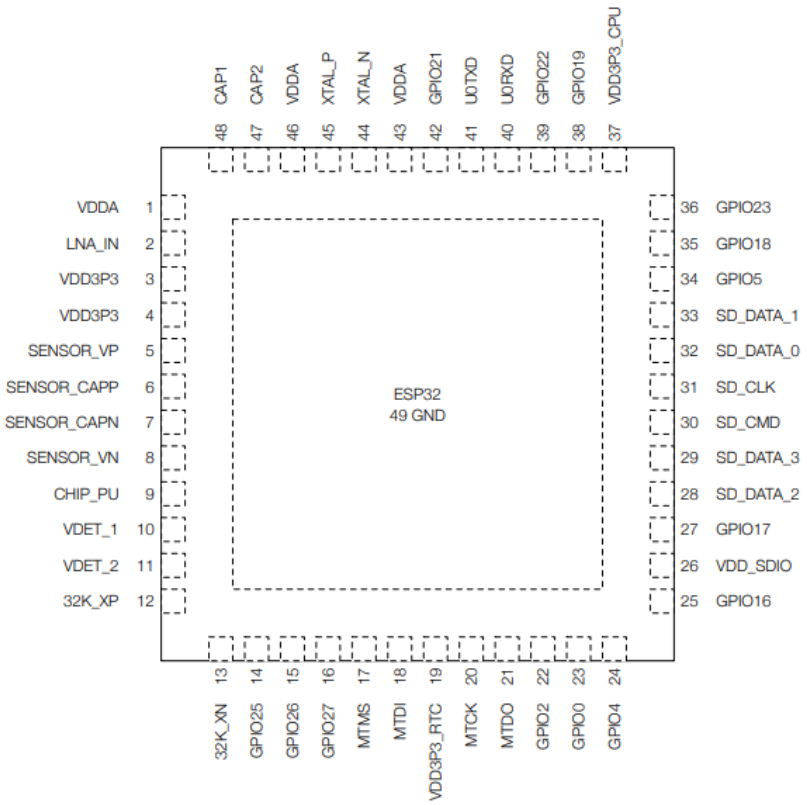



**Figure 2: ESP32 Pin Layout (QFN 6*6, Top View)**

## 2.2 Pin Description

**Table 1: Pin Description**

| Name | No. | Type | Functior |
|---|---|---|---|
| Analog | | | |
| VDDA | 1 | P | Analog power supply (2.3 V – 3.6 V) |
| LNA_IN | 2 | I/O | RF input and output |
| VDD3P3 | 3 | P | Analog power supply (2.3 V – 3.6 V) |
| VDD3P3 | 4 | P | Analog power supply (2.3 V – 3.6 V) |
| VDD3P3_RTC | | | |
| SENSOR_VP | 5 | I | GPIO36, ADC1_CH0, RTC_GPIO0 |
| SENSOR_CAPP | 6 | I | GPIO37, ADC1_CH1, RTC_GPIO1 |
| SENSOR_CAPN | 7 | I | GPIO38, ADC1_CH2, RTC_GPIO2 |
| SENSOR_VN | 8 | I | GPIO39, ADC1_CH3, RTC_GPIO3 |
| CHIP_PU | 9 | I | High: On; enables the chip<br>Low: Off; the chip powers off<br>Note: Do not leave the CHIP_PU pin floating. |

| Name | No. | Type | Function |
|---|---|---|---|
| VDET_1 | 10 | I | GPIO34, ADC1_CH6, RTC_GPIO4 |
| VDET_2 | 11 | I | GPIO35, ADC1_CH7, RTC_GPIO5 |
| 32K_XP | 12 | I/O | GPIO32, ADC1_CH4, RTC_GPIO9, TOUCH9, 32K_XP (32.768 kHz crystal oscillator input) |
| 32K_XN | 13 | I/O | GPIO33, ADC1_CH5, RTC_GPIO8, TOUCH8, 32K_XN (32.768 kHz crystal oscillator output) |
| GPIO25 | 14 | I/O | GPIO25, ADC2_CH8, RTC_GPIO6, DAC_1, EMAC_RXD0 |
| GPIO26 | 15 | I/O | GPIO26, ADC2_CH9, RTC_GPIO7, DAC_2, EMAC_RXD1 |
| GPIO27 | 16 | I/O | GPIO27, ADC2_CH7, RTC_GPIO17, TOUCH7, EMAC_RX_DV |
| MTMS | 17 | I/O | GPIO14, ADC2_CH6, RTC_GPIO16, TOUCH6, EMAC_TXD2, HSPICLK, HS2_CLK, SD_CLK, MTMS |
| MTDI | 18 | I/O | GPIO12, ADC2_CH5, RTC_GPIO15, TOUCH5, EMAC_TXD3, HSPIQ, HS2_DATA2, SD_DATA2, MTDI |
| VDD3P3_RTC | 19 | P | Input power supply for RTC IO (2.3 V – 3.6 V) |
| MTCK | 20 | I/O | GPIO13, ADC2_CH4, RTC_GPIO14, TOUCH4, EMAC_RX_ER, HSPID, HS2_DATA3, SD_DATA3, MTCK |
| MTDO | 21 | I/O | GPIO15, ADC2_CH3, RTC_GPIO13, TOUCH3, EMAC_RXD3, HSPICS0, HS2_CMD, SD_CMD, MTDO |
| GPIO2 | 22 | I/O | GPIO2, ADC2_CH2, RTC_GPIO12, TOUCH2, HSPIWP, HS2_DATA0, SD_DATA0 |
| GPIO0 | 23 | I/O | GPIO0, ADC2_CH1, RTC_GPIO11, TOUCH1, EMAC_TX_CLK, CLK_OUT1, |
| GPIO4 | 24 | I/O | GPIO4, ADC2_CH0, RTC_GPIO10, TOUCH0, EMAC_TX_ER, HSPIHD, HS2_DATA1, SD_DATA1 |
| VDD_SDIO | | | |
| GPIO16 | 25 | I/O | GPIO16, HS1_DATA4, U2RXD, EMAC_CLK_OUT |
| VDD_SDIO | 26 | P | Output power supply: 1.8 V or the same voltage as VDD3P3_RTC |
| GPIO17 | 27 | I/O | GPIO17, HS1_DATA5, U2TXD, EMAC_CLK_OUT_180 |
| SD_DATA_2 | 28 | I/O | GPIO9, HS1_DATA2, U1RXD, SD_DATA2, SPIHD |
| SD_DATA_3 | 29 | I/O | GPIO10, HS1_DATA3, U1TXD, SD_DATA3, SPIWP |
| SD_CMD | 30 | I/O | GPIO11, HS1_CMD, U1RTS, SD_CMD, SPICS0 |
| SD_CLK | 31 | I/O | GPIO6, HS1_CLK, U1CTS, SD_CLK, SPICLK |
| SD_DATA_0 | 32 | I/O | GPIO7, HS1_DATA0, U2RTS, SD_DATA0, SPIQ |
| SD_DATA_1 | 33 | I/O | GPIO8, HS1_DATA1, U2CTS, SD_DATA1, SPID |
| VDD3P3_CPU | | | |
| GPIO5 | 34 | I/O | GPIO5, HS1_DATA6, VSPICS0, EMAC_RX_CLK |
| GPIO18 | 35 | I/O | GPIO18, HS1_DATA7, VSPICLK |
| GPIO23 | 36 | I/O | GPIO23, HS1_STROBE, VSPID |
| VDD3P3_CPU | 37 | P | Input power supply for CPU IO (1.8 V – 3.6 V) |
| GPIO19 | 38 | I/O | GPIO19, U0CTS, VSPIQ, EMAC_TXD0 |
| GPIO22 | 39 | I/O | GPIO22, U0RTS, VSPIWP, EMAC_TXD1 |
| U0RXD | 40 | I/O | GPIO3, U0RXD, CLK_OUT2 |
| U0TXD | 41 | I/O | GPIO1, U0TXD, CLK_OUT3, EMAC_RXD2 |
| GPIO21 | 42 | I/O | GPIO21, VSPIHD, EMAC_TX_EN |
| Analog | | | |
| VDDA | 43 | P | Analog power supply (2.3 V – 3.6 V) |
| XTAL_N | 44 | O | External crystal output |
| XTAL_P | 45 | I | External crystal input |
| VDDA | 46 | P | Analog power supply (2.3 V – 3.6 V) |
| CAP2 | 47 | I | Connects to a 3 nF capacitor and 20 kΩ resistor in parallel to CAP1 |
| CAP1 | 48 | I | Connects to a 10 nF series capacitor to ground |
| GND | 49 | P | Ground |

**Note:**

- ESP32-D2WD's pins GPIO16, GPIO17, SD_CMD, SD_CLK, SD_DATA_0 and SD_DATA_1 are used for connecting the embedded flash, and are not recommended for other uses.
- For a quick reference guide to using the IO_MUX, Ethernet MAC, and GIPO Matrix pins of ESP32, please refer to Appendix ESP32 Pin Lists.
- In most cases, the data port connection between the ESP32 and external flash is as follows: SD_DATA0/SPIQ = IO1/DO, SD_DATA1/SPID = IO0/DI, SD_DATA2/SPIHD = IO3/HOLD#, SD_DATA3/SPIWP = IO2/WP#.