

IDP903-35PA Touch Display Datasheet



1 Introduction

The IDP903-35PA is a smart display module featuring a 3.5" TFT LCD panel with a 320x480 resolution, supporting up to 262K colors with a capacitive touch interface. It integrates Bridgetek's proprietary Embedded Video Engine (EVE) Graphics Controller, the FT811, to deliver rich, interactive, multi-touch user experiences. The module is powered by Bridgetek's FT903 System-On-Chip microcontroller, known for its high integration and low power consumption.

Designed for intuitive control and monitoring, the IDP903-35PA Touch Display allows users to trigger events effortlessly. Unlike mobile devices that require frequent recharging, it can be installed in accessible locations and continuously powered via a CAT5e cable.

1.1 Features

- Integrated FT903 32-bit RISC microcontroller (MCU) with 100MHz system clock
- Built-in advanced FT811 graphics controller with display, touch and audio functionality
- 3.5-inch high-brightness 320x480 resolution TFT LCD with capacitive touch (5 touches supported)
- Integrated buzzer for audio notifications
- Two RJ45 Ports supporting RS485 Interface for data communication, allowing daisy chain to another IDP903 module
- Powered by a 9V-24VDC source via an RJ45 port

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1.2 Typical Applications

- Home Automation Systems: Smart Thermostats, Lighting Control.
- Audio Equipment: Mixing Consoles, Hi-Fi Systems.
- Medical Devices: Portable Medical Monitors, Patient Monitoring Devices.
- Industrial Applications: Control Panels, Measurement Instrument.
- Automotive Interfaces: Infotainment Systems, Dashboards
- Consumer Electronics: Smart Speakers and Media Players, portable Gaming Consoles.
- Test and Measurement Equipment such as Oscilloscopes and Multimeters.
- and many more.

2 Part Number/Ordering Information/Package Content

Part No.	Description
IDP903-35PA	Intelligent Display Product 3.5 inch Portrait with Enclosure

Table 1 - Part Number/Ordering Information

Description	
Hardware components	IDP903-35PA Display Module
	Self-Tapping Screws (3.5mm x 15mm)-For Arlington LV1 Wall Mounting x2

Table 2 - Package Content

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3 Hardware Features

3.1 Module Overview

The IDP903-35PA module features a 3.5-inch TFT LCD and Capacitive Touch Panel (CTP) with dimensions of 116mm (L) X 86mm (W) X 17mm (T) and weighing 146g.



Figure 1 - Front View of IDP903-35PA Module



Figure 2 - Back View of IDP903-35PA Module

3.2 PCBA Profile

Dimensions of main board: 97mm (L) X 75mm (W) X 1mm (T) with maximum component height of approximately 13mm.

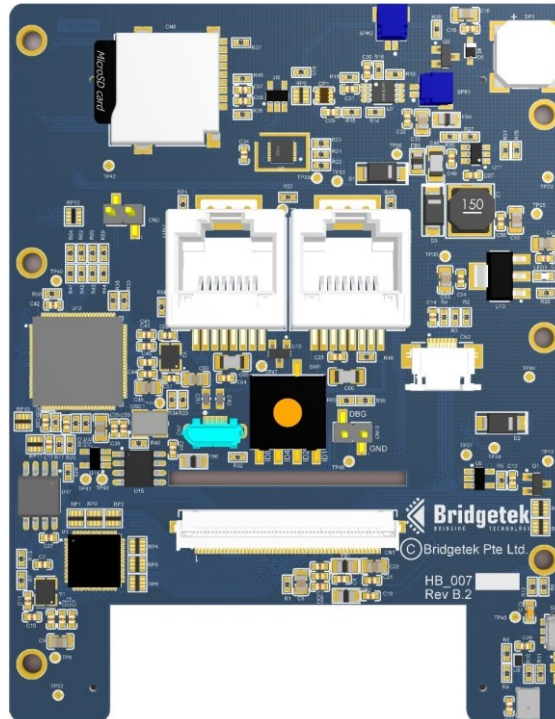


Figure 3 - Mainboard PCBA Front View

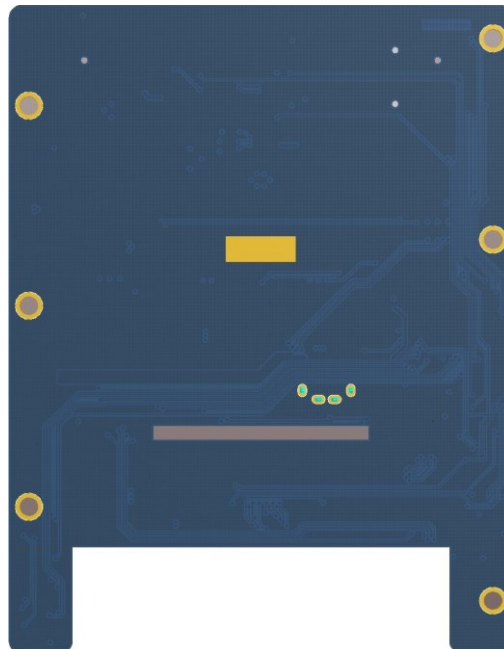


Figure 4 - Mainboard PCBA Back View

3.2.1 Key Features

- ❖ 3.5-inch 320 x 480 TFT-LCD panel with capacitive touch panel
- ❖ Bridgetek FT811 EVE chip for graphics, touch, and audio control
- ❖ LED backlight driver integrated
- ❖ Bridgetek FT903 microcontroller
- ❖ 8Mbyte NOR Flash for FT903 data storage
- ❖ Micro-SD card socket
- ❖ Micro USB port for communication to FT903 MCU
- ❖ Two RJ45 ports for I/O supply and RS485 communication
- ❖ Built-in audio buzzer for sound notifications
- ❖ Built-in smart LED indicator
- ❖ ID switch for unique ID setting
- ❖ Hardware reset button

3.3 PCB Profile

Both printed circuit boards (PCBs) in the IDP903-35PA module are designed with four layers, stacked as follows:

1. Layer 1: Routing & Component placement (Top)
2. Layer 2: Ground Plane
3. Layer 3: Power Plane
4. Layer 4: Routing & Component placement (Bottom)

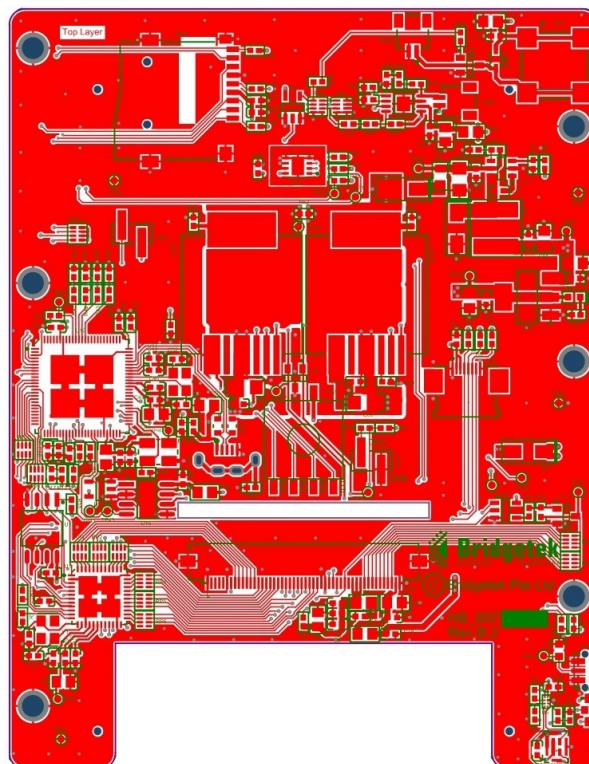


Figure 5 - Main PCB Top Layer

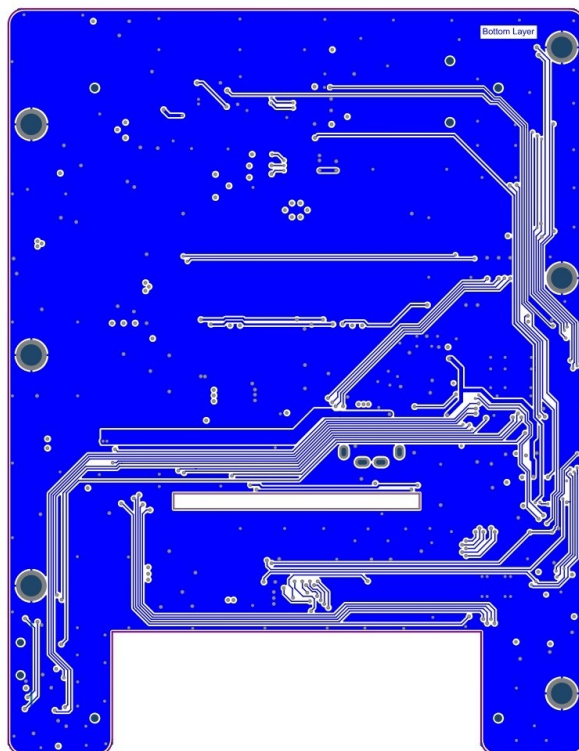


Figure 6 - Main PCB Bottom Layer

3.4 Connectors, Switches and Buttons

The following section provide details about the connectors, their pin configurations and the functions of the switches and buttons on the boards. Refer Figure 3 for connector locations.

• CN1 – LCD Panel Interface

This 50-position, 0.5mm pitch bottom-contact FPC connector is used for inter-connection to the 3.5-inch LCD panel. The manufacturer's part number for this connector is " 5051105091."

Pin No.	Name	Type	Description
1	GND	P	Ground
2	NC	NA	No Connection
3	NC	NA	No Connection
4	NC	NA	No Connection
5	NC	NA	No Connection
6	GND	P	Ground
7	LCD_3V3	P	3.3V output power supply
8	LCD_R7	O	Red channel intensity bit 7
9	LCD_R6	O	Red channel intensity bit 6
10	LCD_R5	O	Red channel intensity bit 5
11	LCD_R4	O	Red channel intensity bit 4
12	LCD_R3	O	Red channel intensity bit 3
13	LCD_R2	O	Red channel intensity bit 2

14	LCD_G7	O	Green channel intensity bit 7
15	LCD_G6	O	Green channel intensity bit 6
16	LCD_G5	O	Green channel intensity bit 5
17	LCD_G4	O	Green channel intensity bit 4
18	LCD_G3	O	Green channel intensity bit 3
19	LCD_G2	O	Green channel intensity bit 2
20	LCD_B7	O	Blue channel intensity bit 7
21	LCD_B6	O	Blue channel intensity bit 6
22	LCD_B5	O	Blue channel intensity bit 5
23	LCD_B4	O	Blue channel intensity bit 4
24	LCD_B3	O	Blue channel intensity bit 3
25	LCD_B2	O	Blue channel intensity bit 2
26	LCD_DE	O	Enable valid pixel data being sent to LCD
27	LCD_PCLK	O	Pixel clock line to LCD
28	LCD_HC	O	Horizontal sync signal line to LCD
29	LCD_VC	O	Vertical sync signal line to LCD
30	GND	P	Ground
31	GND	P	Ground
32	SPIM_SCK	O	SPI Master clock signal line
33	SPIM_SS _n 1	O	Vertical sync signal line to LCD
34	SPIM_MOSI	O	SPI Master data signal line
35	NC	NA	No Connection
36	LCD_RST	O	Reset output to CTP
37	NC	NA	No Connection
38	LCD_3V3	P	3.3V Input power supply
39	LCD_3V3	P	3.3V Input power supply
40	LCD_3V3	P	3.3V Input power supply
41	LEDK8	P	LED Cathode 8
42	LEDK7	P	LED Cathode 7
43	LEDK6	P	LED Cathode 6
44	LEDK5	P	LED Cathode 5
45	LEDK4	P	LED Cathode 4
46	LEDK3	P	LED Cathode 3
47	LEDK2	P	LED Cathode 2
48	LEDK1	P	LED Cathode 1
49	LEDA	P	LED Anode
50	GND	P	Ground

Table 3 - CN1 Pinout

• CN2 – Capacitive Touch Panel Interface

The 8-postion 0.5mm pitch top-contact FFC connector provides support to LCD panels with capacitive touch function.

Pin No.	Name	Type	Description
1	GND	P	Ground
2	VDD_3V3	P	3V3 output power supply
3	VDD_3V3	P	3V3 output power supply
4	CTP_SCL	O	I2C serial bus, clock line
5	CTP_SDA	I/O	I2C serial bus, data line
6	CTP_INT#	I	Interrupt input from CTP
7	CTP_RST#	O	Reset output to CTP
8	GND	P	Ground

Table 4 - CN2 Pinout

• CN7 – Micro-USB Receptacle

The micro-USB receptacle enables PC communication with FT903 MCU and device firmware debug and updates.

• CN8 - Micro SD Card Connector

Supports SPI communication mode with auto card detection.

• CN10 – RJ45 Interface In

The 8-position, 1.5mm pitch right-angle RJ45 connector supports an RS485 interface for communication with external host devices and accepts a 24V power input from an external source.

Pin No.	Name	Type	Description
1	RS485_B/Z	I/O	Inverting receiver input and inverting driver output. Pin is an input if DE = 0; pin is an output if DE = 1
2	RS485_A/Y	I/O	Non-inverting receiver input and inverting driver output. Pin is an input if DE = 0; pin is an output if DE = 1
3	NA	I	Pull-low with 470ohm resistor
4	DC_IN	P	24V Input power supply
5	DC_IN	P	24V Input power supply
6	NC	NA	No Connection
7	GND	P	Ground
8	GND	P	Ground

Table 5 - CN6 Pinout

- **CN11 – RJ45 Connector Out**

The 8-position right-angle RJ45 connector supports an RS485 interface for communication and supplies power to connected external devices.

Pin No.	Name	Type	Description
1	RS485_B/Z	I/O	Inverting receiver input and inverting driver output. Pin is an input if DE = 0; pin is an output if DE = 1
2	RS485_A/Y	I/O	Non-inverting receiver input and inverting driver output. Pin is an input if DE = 0; pin is an output if DE = 1
3	NA	I	Pull-low with 470ohm resistor
4	DC_OUT	P	Output power supply from DC_IN
5	DC_OUT	P	Output power supply from DC_IN
6	NC	NA	No Connection
7	GND	P	Ground
8	GND	P	Ground

Table 6 - CN8 Pinout

- **CN9 – One Wire Debugger Interface**

The 2-postion 2.54mm pitch header is used for debugging the onboard FT903 microcontroller.

Pin No.	Name	Type	Description
1	GND	P	Ground
2	DBG	I/O	For in-circuit debugging

Table 7 - CN9 Pinout

- **SW1** - is a 4-position rotary switch use for configuring a unique ID for the device.
- **SW2** - is hardware reset button to reset FT903 MCU.

4 Board Schematics

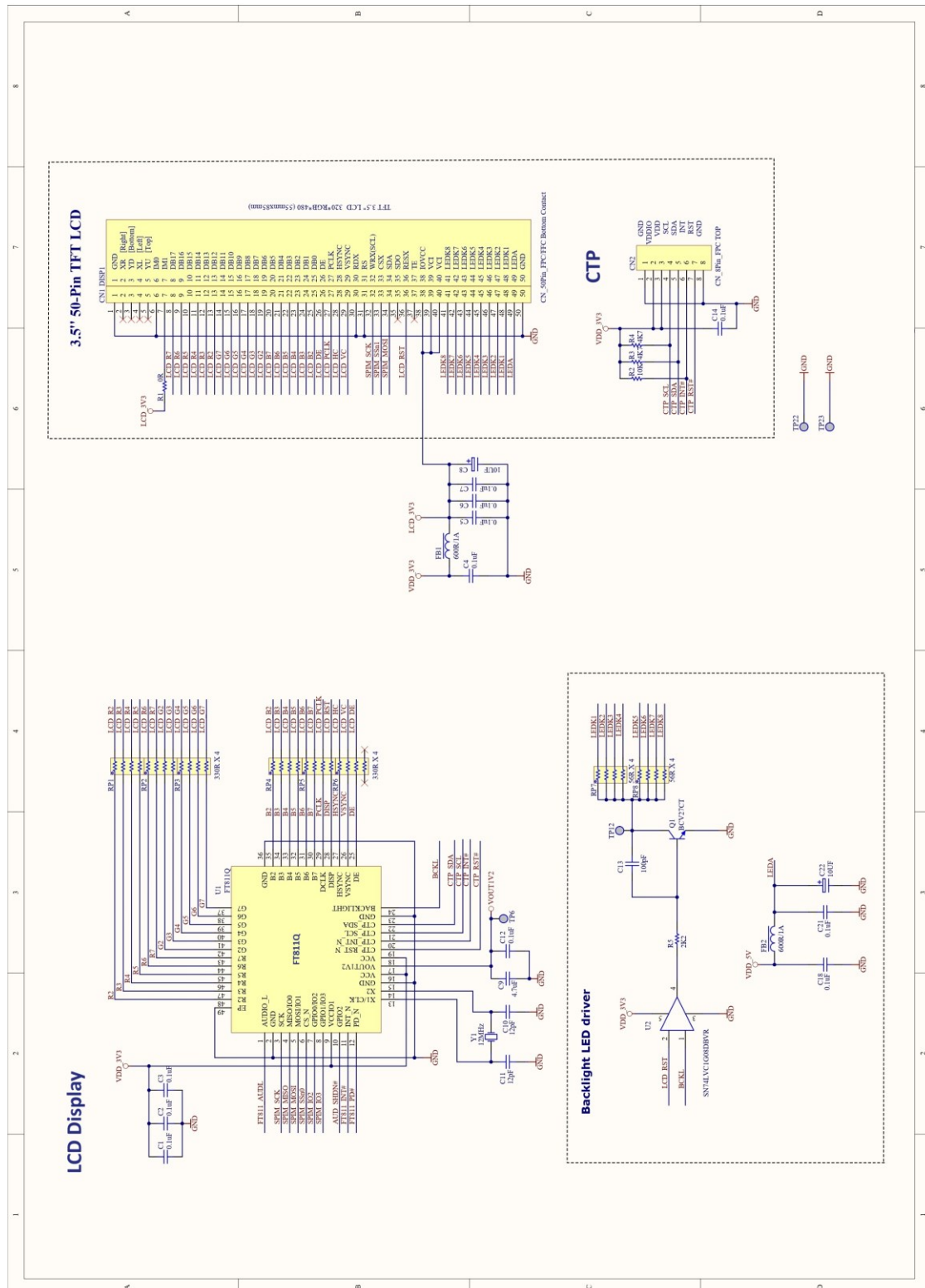


Figure 7 - 3.5-inch TFT LCD Display

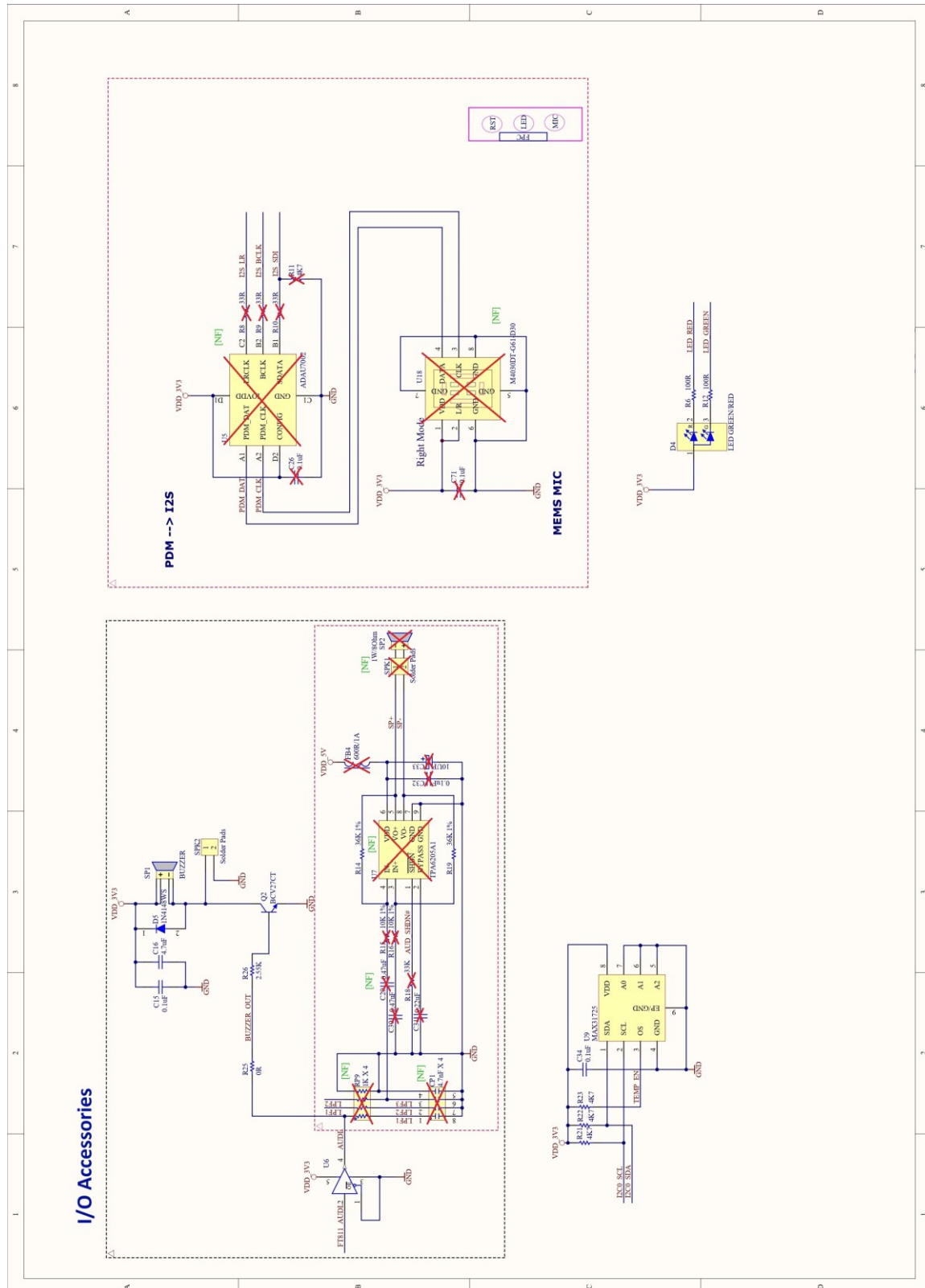


Figure 8 - I/O Accessories

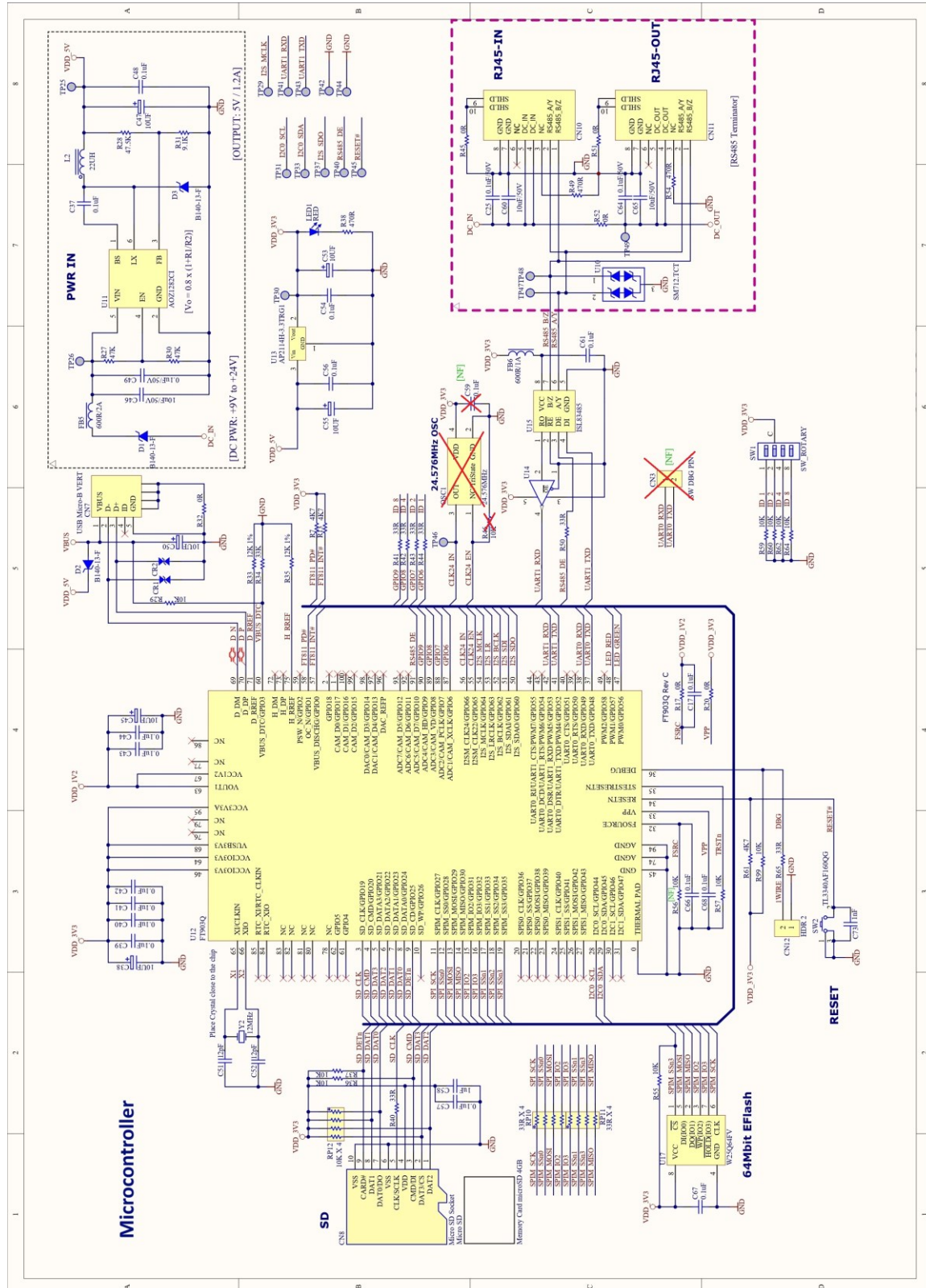


Figure 9 - MCU Controller

5 Device Description and Configuration

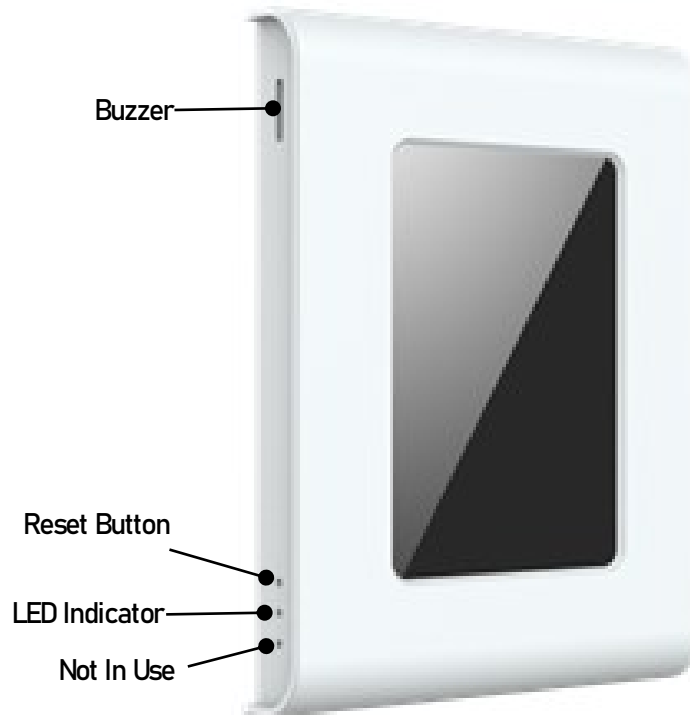


Figure 10 - IDP903-35PA Touch Display Front View

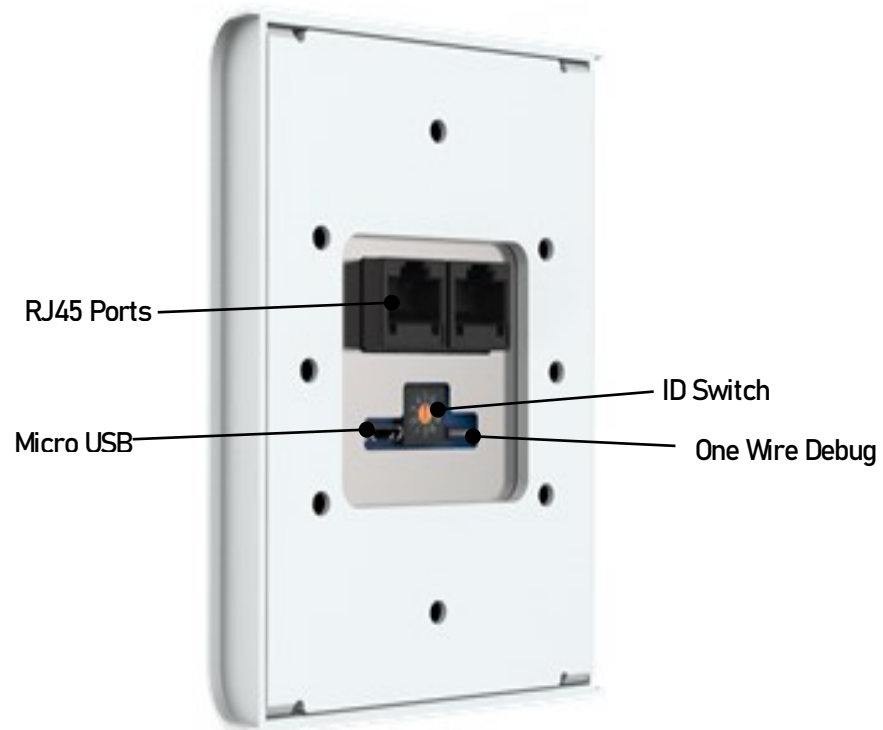


Figure 11 - IDP903-35PA Touch Display Rear View

5.1 Power Supply

The IDP903-35PA display module is powered through the RJ45 port on its back and can also output power directly from the input source. It supports an input voltage range of 9VDC to 24VDC, with a recommended power source of at least 6W.

5.2 Microcontroller

The display module is powered by the [FT903](#), a 32-bit RISC microcontroller from Bridgetek's System-On-Chip series, featuring:

- 32-bit FT32 core processor running at 100MHz
- 256kB on-chip flash memory
- 256kB on-chip shadow program memory
- 64kB of on-chip data memory
- OTP memory for security configuration
- USB 2.0 EHCI-compatible host controller supporting high-speed (480 Mbit/s), full-speed (12 Mbit/s), and low-speed (1.5 Mbit/s)
- USB 2.0 device controller supporting high-speed (480 Mbit/s) and full-speed (12 Mbit/s)

Bridgetek provides a free software toolchain to streamline the creation and downloading of .bin files. The [FT9xx-Toolchain](#) is available for download on the Bridgetek website.

5.3 Graphic Controller

The IDP903-35PA utilizes Bridgetek's second-generation Advanced Embedded Video Engine (EVE) [FT811](#) for high-quality Human Machine Interfaces (HMIs), integrating graphic control, audio, and touch interface capabilities.

Bridgetek provides the [EVE Toolchains](#), an essential suite of tools for free, enabling developers to design impressive and highly responsive graphics user interfaces (GUIs) for EVE-based solutions. The toolchain contains the following tools:

- **EVE Screen Designer**
- **EVE Screen Editor**
- **EVE Asset Builder**

5.4 RJ45 Ports

5.4.1 Pin Definition

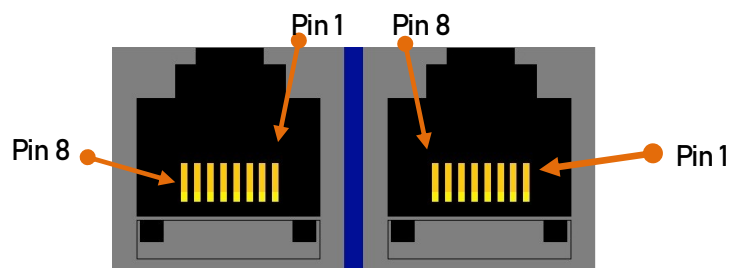


Figure 12 - RJ45 Ports Pin orientation

Pin Number	1	2	3	4,5	6	7,8
Function	RS485 B/Z	RS485 A/Y	NC	DC_IN/OUT	Pull-low to GND	GND

Table 8 - RJ45 Ports Pin Function

5.4.2 Powering and Communication

The RJ45 ports support both power and data transmission. Below are two methods for supplying power and communicating with the IDP903-35PA module.

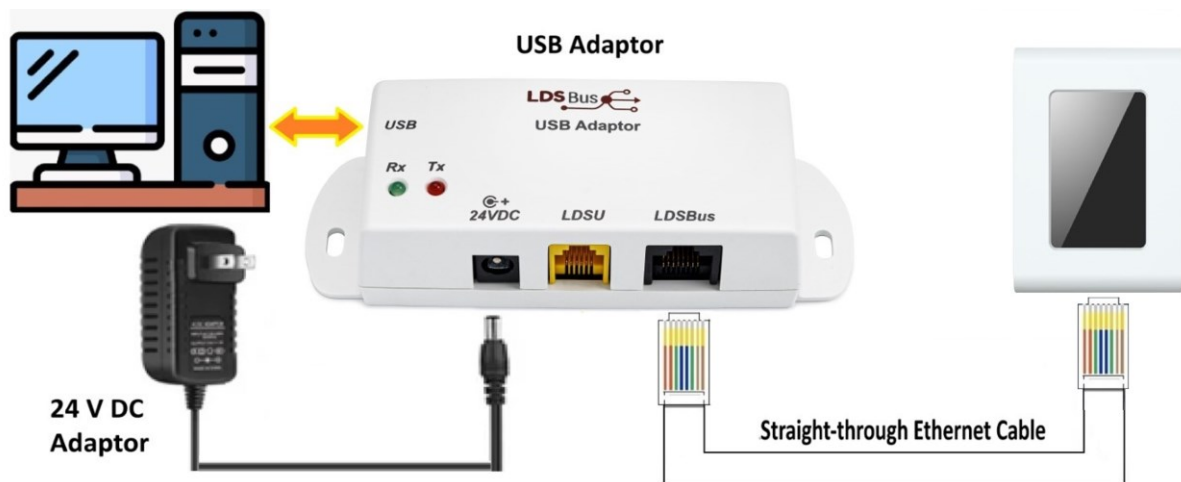
Method 1: Use of BRTSys LDSBus Adaptor

For development purposes, developers can use a BRTSys's LDSBus USB Adaptor designed for RS485 device applications. It provides a USB-to_RS485 interface with power supplied through its RJ45 port. Refer to the purchase link below for the adaptor and an illustration in Figure 13.

- [BRTSys – LDS Bus USB Adaptor](#)


Figure 13 - BRTSys LDS Bus USB Adaptor

For connection details when using the adapter, see Figure 14.


Figure 14 - Connection to PC and Supply via LDS Bus USB Adaptor

Method 2: Use of Power-over-Ethernet (PoE) Splitter

A Power-over-Ethernet (PoE) splitter can be used to separate power and data for connection to a power source and host controller. Refer to Figure 15 for an image illustration of the PoE and links for purchasing options:

- [PoE Splitter - Digikey](#)

- [PoE Splitter- AliExpress](#)



Figure 15 - PoE Splitter

Refer to Figure 16 for connection details using a PoE splitter.

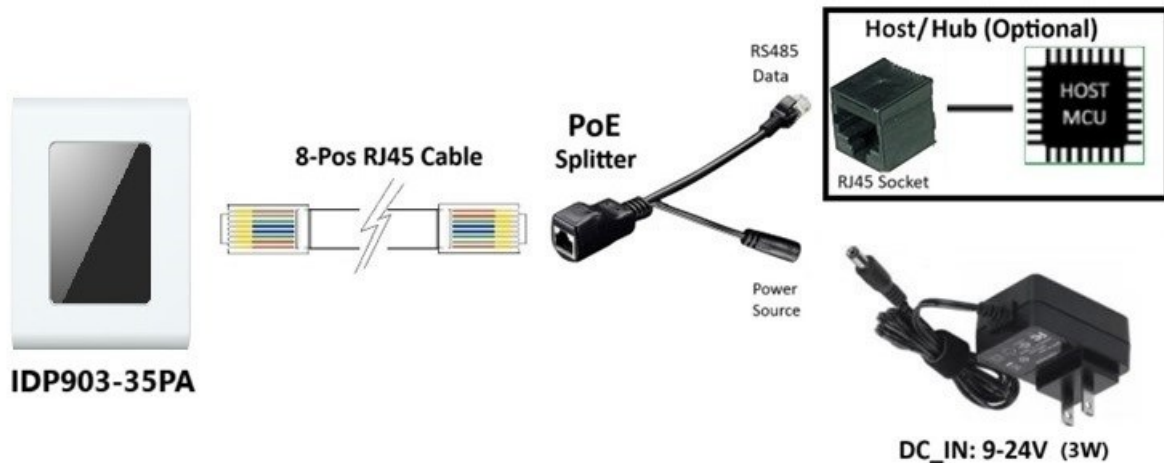


Figure 16 - Connection to Host and Supply via PoE Splitter

5.4.3 Port Connection

The RJ45 ports share identical connections, with their power lines shorted through a 0-ohm resistor and RS485 signals linked. When a power source or interface is connected to one port, it is automatically routed to the other. Refer to Figure 17 below for a simplified block diagram of the IDP903-35PA's internal RJ45 connections.

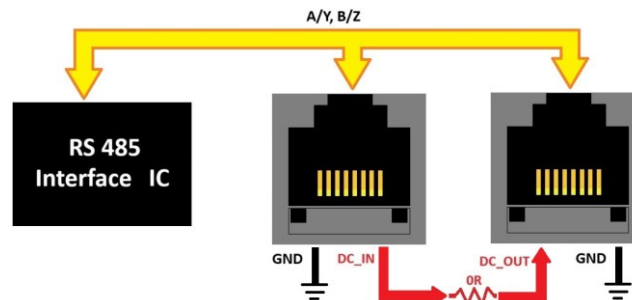


Figure 17 - PCB Connections of RJ45 Ports

Caution: Only one power source should be supplied at a time.

5.4.4 Port Termination

When using IDP903-35PA module as a standalone device or as the last unit in a Daisy Chain configuration, attach the terminator to the final RJ45 port, as illustrate in Figure 18, to enhance data transmission reliability. The port terminator should include a 120ohm resistor across the RS-485 differential signal lines (pins 1 and 2 of the RJ45 port) to ensure proper RS-485 signal termination. For RS-485 applications, it is recommended to always include the 120Ω port terminator at both ends of the RS-485 bus.

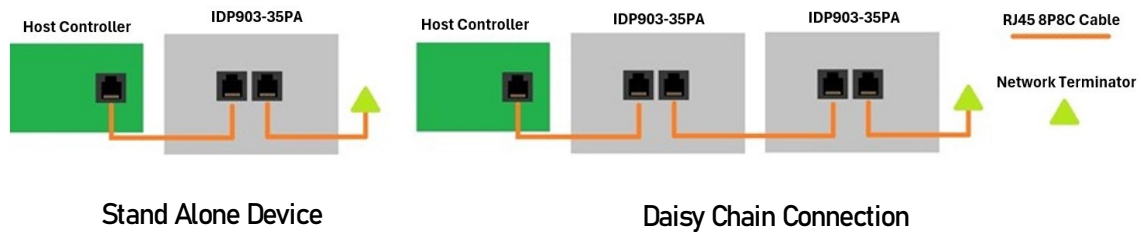


Figure 18 - Port Termination

5.5 LED Indicator

An integrated smart bi-color LED with red and green emitters offers programmable status indicators. Positioned on the side of the module (Figure 10), it can display red, green, and yellow colors, controlled by the MCU.

5.6 ID Switch

The ID switch on the module's back (Figure 11) allows custom configurations or use of the default factory setting (zero). It assists with device management in multi-device setups or boot mode configurations.

5.7 Reset Button

The module includes a reset button positioned on the side (Figure 10). The reset function can be activated by pressing through the designated hole.

5.8 Micro USB

A micro-USB connector interfaces with the FT903 microcontroller, supporting communication and firmware downloads to the integrated NOR flash. Detailed setup instructions can be found in the Section [8 Software Setup Information](#).

5.9 One Wire Debug

A one-wire debug function is accessible via the 2-position header on the module's back (Figure 11), connecting to the microcontroller. This mode supports code, firmware, and bootloader downloads to the NOR flash. Refer to the Section [8 Software Setup Information](#) for installation details.

5.10 Buzzer

The IDP903-35PA display module includes an integrated buzzer circuit for event notifications.

6 Specifications

6.1 Electrical Specifications

Parameter		Min	Typ	Max	Unit
DC_IN	Input voltage range	9	24.0	28	V
DC_OUT	Output voltage range	-	DC_IN	-	V
I _{cc_12V}	Operating current, DC_IN=12V: Normal *Note	-	200	-	mA
V _{OD1}	Driver Differential VOUT (no load)	-	-	3.3	V
V _{OD2}	Driver Differential VOUT (with load) R _L =100Ω (RS-422) (Figure 19) R _L = 54Ω (RS-485) (Figure 19) R _L = 60Ω, -7V ≤ V _{CM} ≤ 12V	2	2.7	-	V
		1.5	2.3	3.3	
		1.5	2.6	-	
ΔV _{OD}	Change in Magnitude of Driver Differential VOUT for Complementary Output States R _L = 54Ω or 100Ω (Figure 19)	-	0.01	0.2	V
V _{OC}	Driver Common-Mode VOUT R _L = 54Ω or 100Ω (Figure 19)	-	1.8	3	V
ΔV _{OC}	Change in Magnitude of Driver Common-Mode VOUT for Complementary Output States R _L = 54Ω or 100Ω (Figure 19)	-	0.01	0.2	V
Temperature	Operating temperature	0	-	55	°C
	Storage temperature	0	-	70	

Table 9 - Operating Voltage and Current

Note: Measurement taken with the screen turned on.

Test Circuits

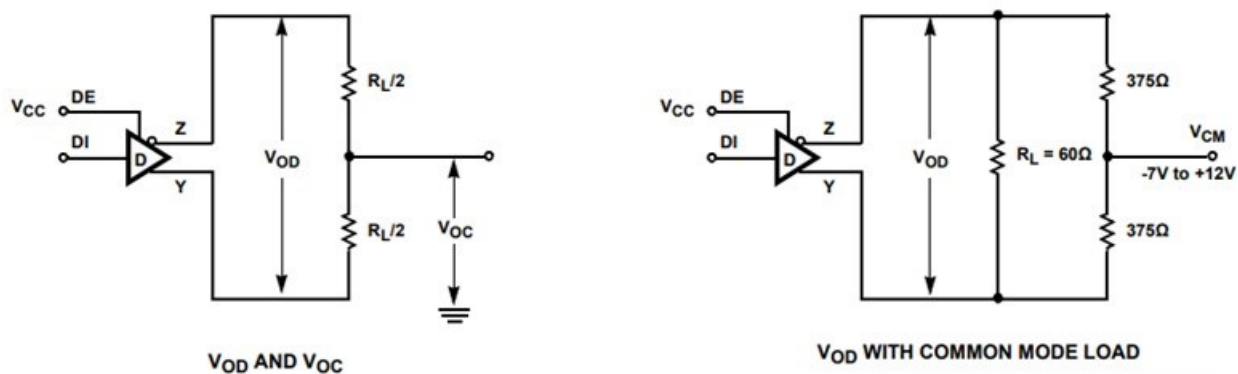


Figure 19 - DC Driver Test Circuits

6.2 Optical Specifications

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Contrast Ratio		CR	$\theta=0^{\circ}$ Normal Viewing Angle	-	500	-	-
Response Time	Rising	$T_R + T_F$		-	35	50	msec
	Falling						
Uniformity		S(%)		-	70	-	%
Color Filter Chromaticity	White	W_X		-	0.301	0.303	-
		W_Y		-	0.335	0.337	-
	Red	R_X		-	0.631	0.633	-
		R_Y		-	0.334	0.335	-
	Green	G_X		-	0.316	0.318	-
		G_Y		-	0.602	0.605	-
	Blue	B_X		-	0.151	0.152	-
		B_Y		-	0.047	0.049	-
Viewing Angle	Hor.	3:00	$Cr \geq 10$	-	80	-	Deg
		6:00		-	80	-	
	Ver.	9:00		-	80	-	
		12:00		-	80	-	
Option View Direction		Free					

Table 10 - Optical Specifications

Note: The parameter is slightly changed by temperature, driving voltage and material

7 Mechanical Dimensions and Mounting Guide

The following section provides details on the mechanical dimensions and the mounting process of the IDP903-35PA.

7.1 Mechanical Dimensions

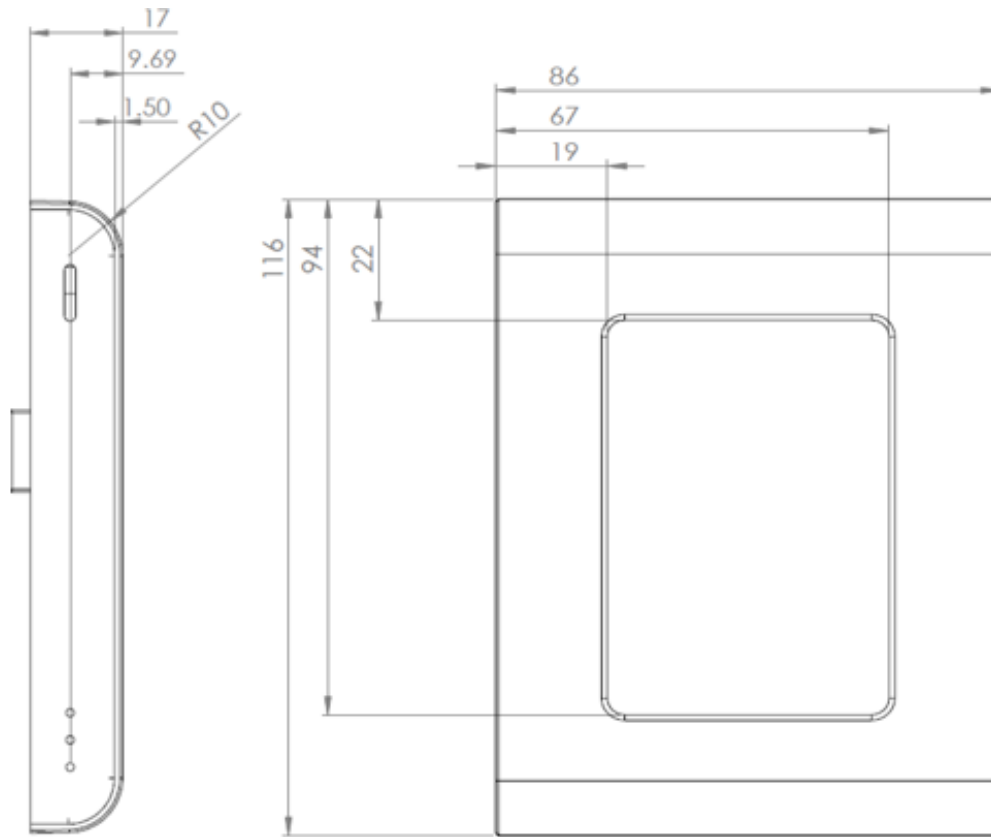


Figure 20 - IDP903-35PA Touch Display Dimensions

Note: All dimensions are in millimetres.

7.2 Mounting Guide

The IDP903-35PA package includes accessories to facilitate wall mounting of the display module. Secure the IDP903-35PA back cover to the Arlington LV1 bracket using the provided self-tapping screws, as shown in Figure 21. And install the IDP903-35PA display module on back cover and secure the panel. Then, install the IDP903-35PA display module onto the back cover and secure it.

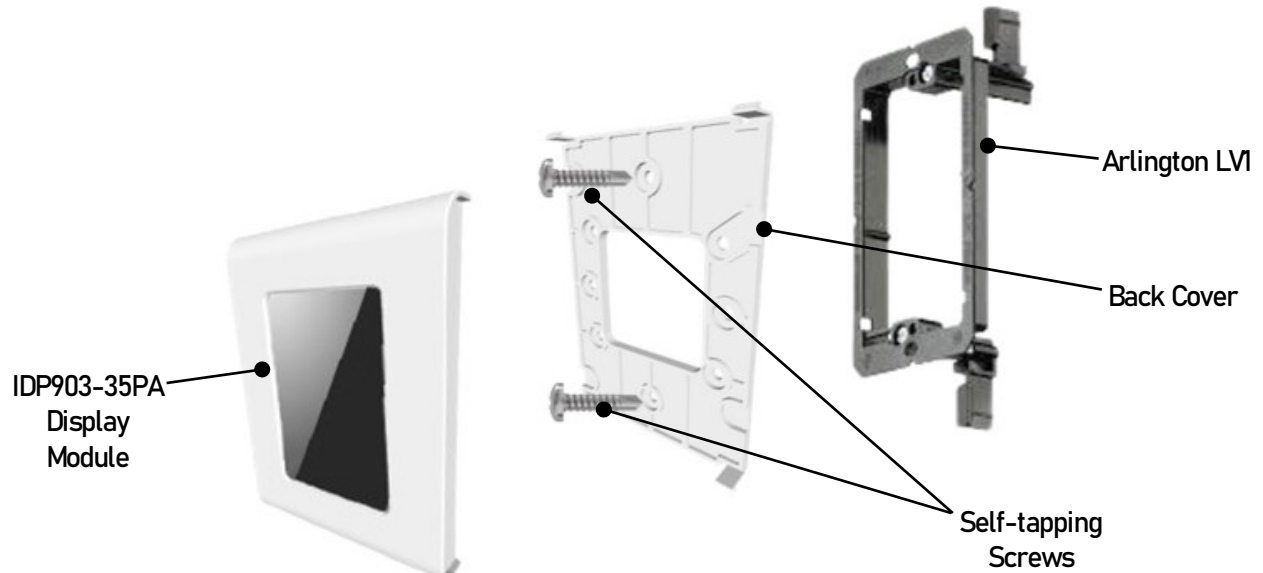


Figure 21 - Wall Mount

Note: Arlington LV1 mounting bracket is not part of the package.

8 Software Setup Information

8.1 Startup Test

The device comes preloaded with default firmware stored in the integrated NOR-Flash. Follow these steps to perform an initial test of the set before flashing developers' own code.

Step 1: Powering Up the Device

Connect the device to power source via the RJ45 connector. For details, refer to section [5.4.2 Table 8 - RJ45 Ports Pin Function](#) Powering and Communication.

Step 2 Touch calibration:

When powered on, the display module's preloaded firmware will prompt the user to perform a touch calibration test, as shown in Figure 22. During the calibration process, an audible beep tone will be activated. Complete the calibration as required for the application.



Figure 22 - Touch Calibration

Once the CTP is successfully calibrated, the Bridgetek company logo will be displayed as shown in Figure 23.

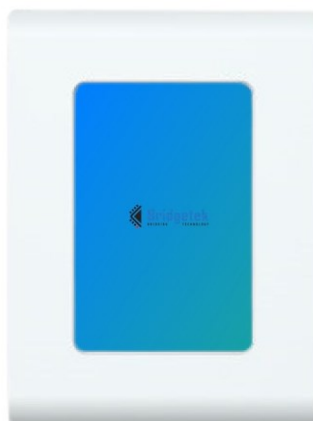


Figure 23 - Bridgetek Logo

Conducting this startup test ensures the device is fully operational before developers load their custom code.

8.2 Downloading Firmware

There are two methods for downloading firmware and debugging with the FT903 MCU:

Method 1: One Wire Programming Mode

This method requires additional hardware, specifically the UMFTPD2A programming module developed by Bridgetek, which supports downloading of firmware and debugging. For detailed information on the module and hardware pin definitions, refer to the [UMFTPD2A](#) link.

To establish the hardware connection, simply connect the **DBG** (CN2/CN3-8) and **GND** (CN2/CN3-7) pins from UMFTPD2A to the **One-Wire Debug** header pins of IDP903-35PA display module, as shown in Figure 24.

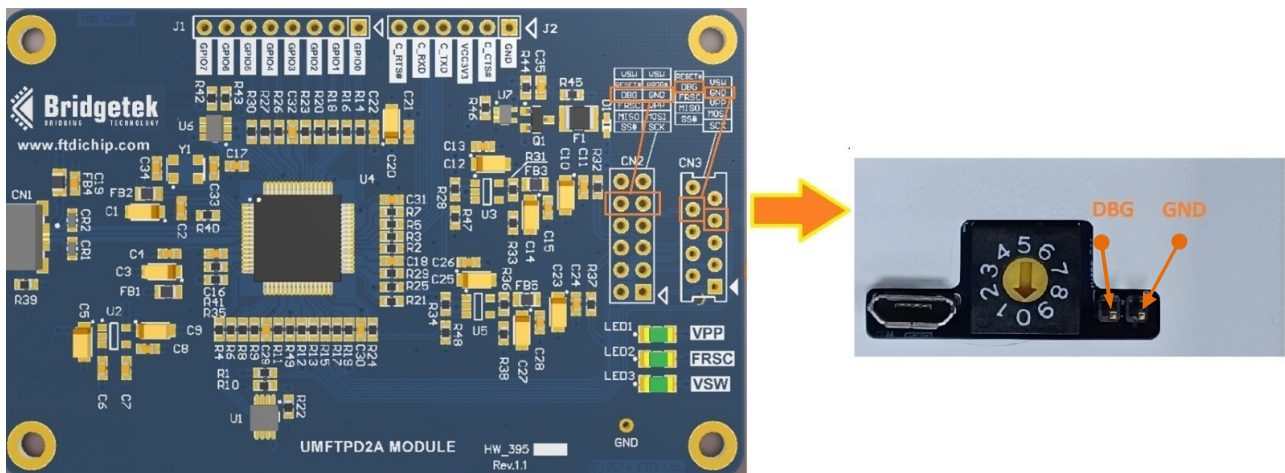


Figure 24 - One-Wire Debug Mode Hardware Connection

Method 2: Device firmware upgrade (DFU) via USB Mode

The USB-micro connector at the back of the module supports communication with the FT903 MCU, allowing the application code to configure it as either a Device Firmware Upgrade (DFU) port or a USB CDC serial port.



Figure 25 - Application Code to Define USB Port Configuration

For more details, refer to the [FT9xx Programming-Debugging-and-Troubleshooting Guide](#).

8.3 Software Development Tools and Support

Bridgetek provides free and comprehensive software tools to simplify application development:

- FT9XX Toolchain - [Download here](#)
- EVE Toolchain - [Download here](#)

For example, projects, documentation, and additional support resources, please refer to the dedicated open-source repository:

- [IDP903-35PA](#)

9 Contact Information

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Appendix A - References

Document References

[DS_FT900/1/2/3](#)

[DS_FT81x](#)

Acronyms and Abbreviations

Terms	Description
CTP	Capacitive Touch Panel
DFU	Device Firmware Upgrade
EVE	Embedded Video Engine
FCC	Federal Communications Commission
I/O	Input/Output
IC	Integrated Circuit
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MCU	Microcontroller Unit
MIC	Microphone
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
QFN	Quad Flat No Leads Package
RISC	Reduced Instruction Set Computer
RGB	Red, Green Blue
TFT	Thin Film Transistor
USB	Universal Serial Bus

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Appendix C – Revision History

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