Ethernet to Wi-Fi® Bridge Hardware User Guide

EV49N51A

Introduction

The Ethernet to Wi-Fi® Bridge Board is a low-cost, compact and easy-to-use development board that enables an Ethernet connection on the WFI32E01PE module, a highly-integrated Wi-Fi MCU module that supports smart Wi-Fi functionalities and premium MCU features. Out of the box, the WFI32E01PE module comes preloaded with a firmware image that enables you to quickly connect and send data over Ethernet to Wi-Fi.

Features

- WFI32E01PE Wi-Fi® RF Module
- Microchip SST26VF032B 32 Mb External SPI Flash
- On-Board Ethernet-PHY Using LAN8720A with Integrated Magnetic RJ45 with LED
- USB or External Powered at 3.3V Power Supply
- Red Power LED
- Two User LEDs
- One Power Switch
- One User Configurable Switch
- One Reset Switch

Table of Contents

1. Quick References

1.1 Reference Documentation

For further details, refer to the following:

- *MCP1727 1.5A, Low Voltage, Low Quiescent Current LDO Regulator Data Sheet* (DS21999)
- *PIC32MZ W1 MCU and WFI32 Module with Wi-Fi® and Hardware-Based Security Accelerator Data Sheet* (DS70005425)
- *SST26VF032B/SST26VF032BA 2.5V/3.0V 32-Mbit Serial Quad I/O™ (SQI™) Flash Memory* (DS20005218)
- *LAN8720A/LAN8720AI Small Footprint RMII 10/100 Ethernet Transceiver with HP Auto-MDIX Support* (DS00002165)

1.2 Hardware Prerequisites

- Ethernet to Wi-Fi® Bridge Board
- USB Type-C® cable
- USB-to-UART converter
- RJ45 cable

1.3 Software Prerequisites

- MPLAB® Integrated Development Environment (MPLAB X IDE) tool
- Out-of-Box (OOB) demo

1.4 Acronyms and Abbreviations

Table 1-1. Acronyms and Abbreviations

Acronyms and Abbreviations	Description
DNP	Do Not Populate
GPIO	General Purpose Input Output
ICSP™	In-Circuit Serial Programming™
LED	Light Emitting Diode
MCU	Microcontroller
NC	Not Connected
OOB	Out-of-Box
PCB	Printed Circuit Board
PPS	Peripheral Pin Select
RMII	Reduced Media Independent Interface
RX	Receiver
SPI	Serial Peripheral Interface
TX	Transmitter
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

2. Kit Overview

The Ethernet to Wi-Fi® Bridge Board contains an WFI32E01PE module. The RMII signals from the WFI32E01PE module interface with the LAN8720A, 10/100 Base-T/TX Ethernet Transceiver. In addition, control and status indicators are integrated with the on-board switches and LEDs for monitoring and interaction purposes.

Figure 2-1. Ethernet to Wi-Fi® Bridge Board (EV49N51A) – Top View

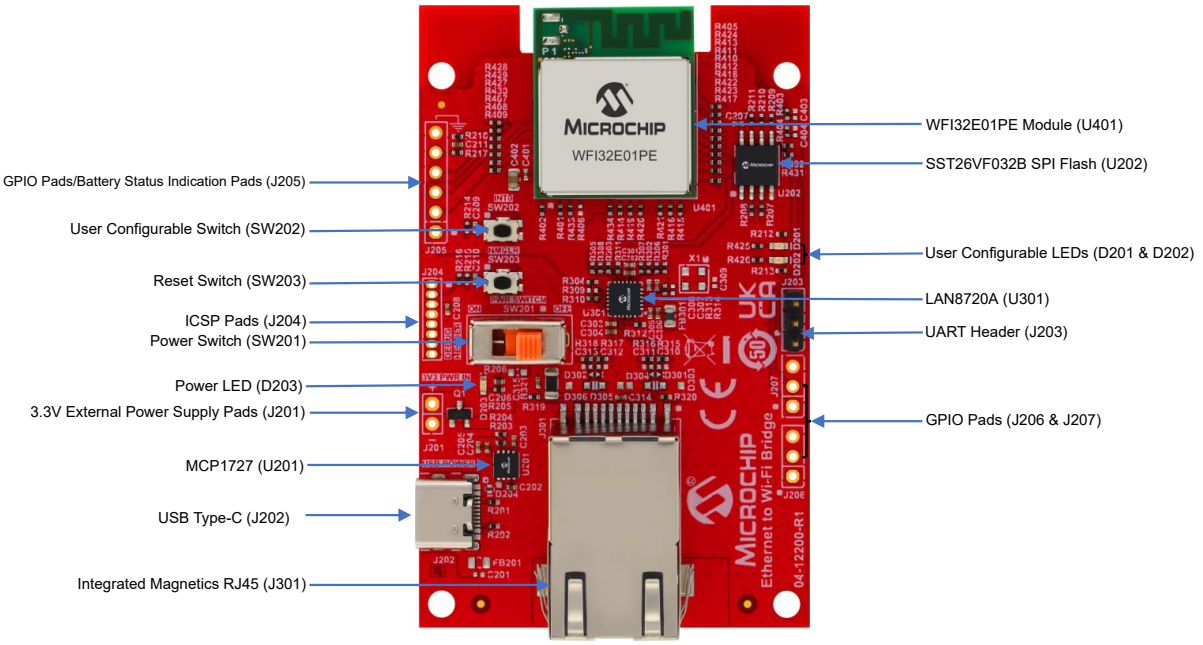
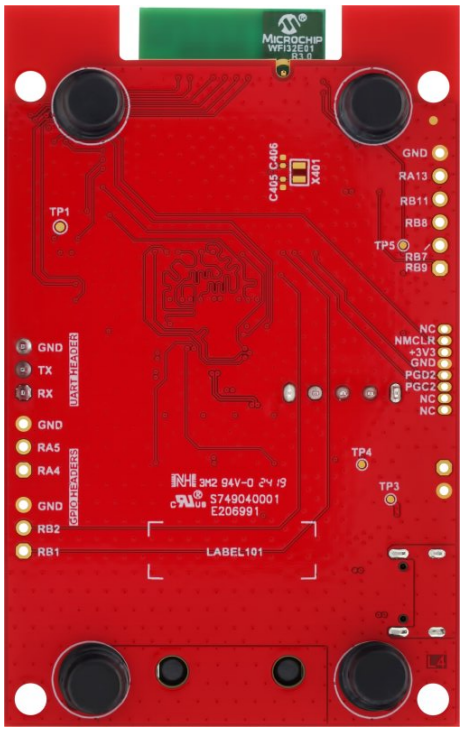


Figure 2-2. Ethernet to Wi-Fi® Bridge Board (EV49N51A) – Bottom View



Note: The pad labeled as RB11 is a misprint; it must be RA11.

2.1 Kit Contents

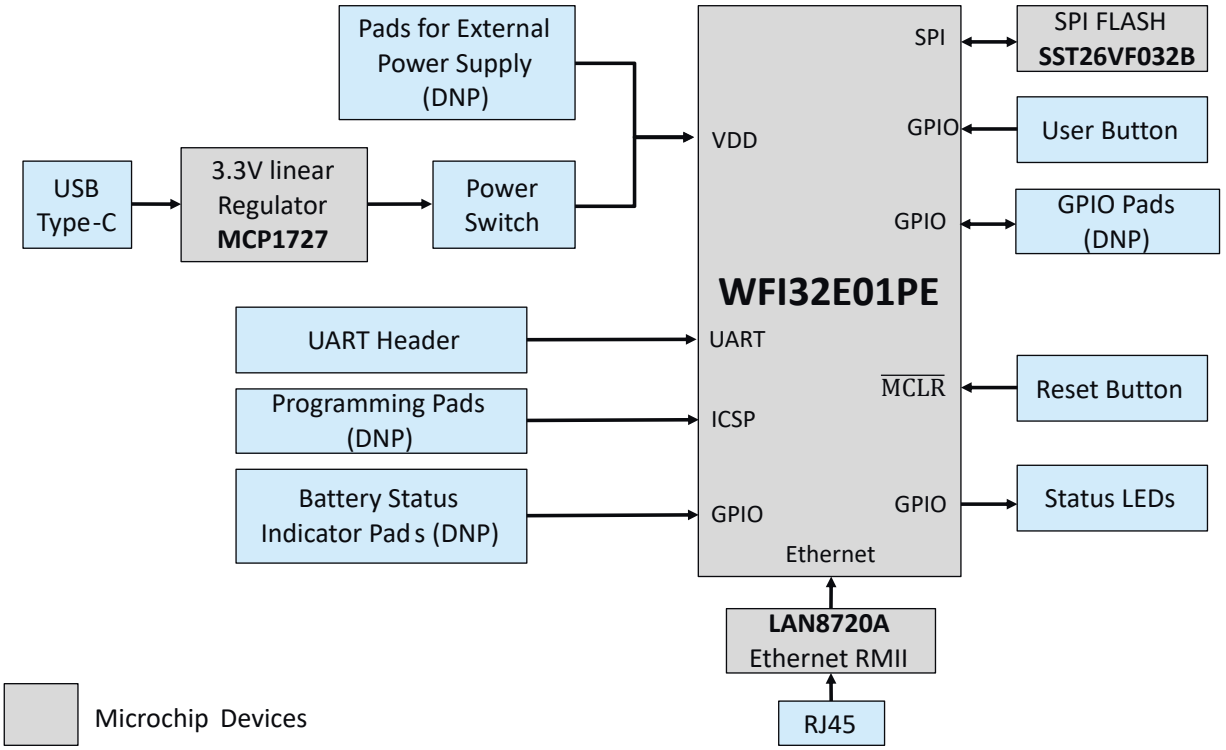
The EV49N51A (Ethernet to Wi-Fi® Bridge Board) kit contains the following:

- A WFI32E01PE module mounted on the Ethernet to Wi-Fi board

3. Hardware

This chapter describes the hardware features of the Ethernet to Wi-Fi® Bridge Board.

Figure 3-1. Ethernet to Wi-Fi® Bridge Board Block Diagram



Note:

1. Using Microchip's total system solution, which includes complementary devices, software drivers and reference designs, is highly recommended to ensure the proven performance of the Ethernet to Wi-Fi® Bridge Board. For more details, go to support.microchip.com or contact your local Microchip Sales office.

Table 3-1. Microchip Components used in Ethernet to Wi-Fi® Bridge Board

SL. No	Designator	Manufacturer Part Number	Description
1	U201	MCP1727T-ADJE/MF	Linear voltage regulator IC positive adjustable 1 output 1.5A 8-DFN (3x3)
2	U202	SST26VF032BT-104I/SM	IC Flash 32-MBIT SPI/QUAD 8SOIJ
3	U301	LAN8720AI-CP-TR-ABC	IC Ethernet physical layer transceiver
4	U401	WFI32E01PE-I	Global regulatory certified RF ready Wi-Fi® MCU Module with PCB antenna

3.1 Power Supply

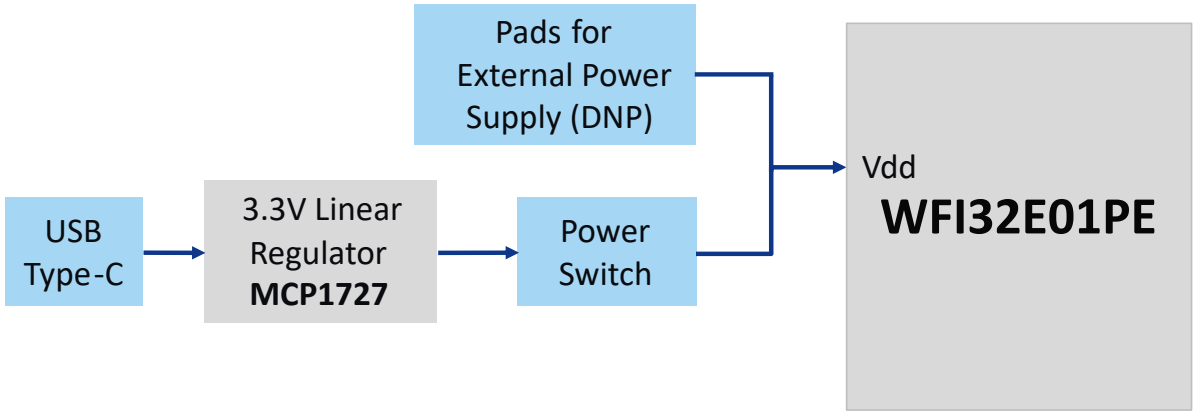
The Ethernet to Wi-Fi® Bridge Board can be powered using any of the following sources, depending on the use case scenario:

1. USB supplies power to the Ethernet to Wi-Fi® Bridge Board using a USB Type-C® cable connected to the USB Type-C Connector (J202). The module and the peripherals are powered by 3.3V

generated from the on-board 3.3V linear regulator. A power switch (SW201) is provided for turning the power on or off for the board while using USB.

2. The WFI32E01PE Module and the peripherals can also be powered by 3.3V at the 3V3 PWR IN pads (J201) using external power supply/battery.

Figure 3-2. Ethernet to Wi-Fi® Bridge Board Power Supply



3.2 Switches

The following switches are available on the Ethernet to Wi-Fi® Bridge Board:

- User-configurable switch (SW202)
- Reset switch (SW203) – Connected with the $\overline{\text{MCLR}}$ signal of the WFI32E01PE Module

In the Idle state, the level of the user-configurable switch is pulled high (+3.3V). After pressing the switch, it drives the I/O line to low (GND).

Table 3-2. Switches Pin Description

Switch Name	Pin on WFI32E01PE Module	Description
SW202	INT0/RPA10	User-configurable switch
SW203	$\overline{\text{MCLR}}$	Reset switch

3.3 LEDs

The on-board LEDs are categorized into two types:

- Power LED
- User-configurable LEDs

3.3.1 Power LED

Use the power LED (D203) to signal the activation of the device's power via USB Type-C® (J202) or 3V3 PWR IN header (J201).

3.3.2 User-Configurable LEDs

Two user-configurable LEDs are provided in this board. The following table provides details about the list of LEDs that the user can turn ON or OFF while using the connected GPIO pins.

Table 3-3. LEDs Pin Description

Pin on WFI32E01PE Module	Description	Function
RPK1/RK1	PORTK digital I/O	Red LED (D201)

.....continued		
Pin on WFI32E01PE Module	**Description**	**Function**
RPK3/RK3	PORTK digital I/O	Green LED (D202)

3.4 ICSP Pads (J204)

ICSP pads on the Ethernet to Wi-Fi® Bridge Board allow an MPLAB® programmer or debugger, such as PICkit 5, Mplab ICD 5, etc., to connect for external programming and debugging.

Refer to the following table for ICSP pinout details.

Table 3-4. ICSP Pin Description

Pin Number	Pin on ICSP™ Mini Programming Header	Pin Description of ICSP Mini Programming Header	Pin on WFI32E01PE Module
J204-1	NC	Not connected	—
J204-2	$\overline{MCLR}$	Reset pin	$\overline{MCLR}$
J204-3	3V3	3.3V power supply	—
J204-4	GND	Ground	GND
J204-5	PGD	ICSP programming data	PGD2/RPB5
J204-6	PGC	ICSP programming clock	PGC2/RPB4
J204-7	NC	Not connected	—
J204-8	NC	Not connected	—

3.5 Serial Flash (SST26VF032B) (U202)

The Ethernet to Wi-Fi® Bridge Board has an on-board 32 Mb, 2.3-3.6V Serial Flash (SST26VF032B) (U202) memory for data storage. For more details, refer to the *SST26VF032B/SST26VF032BA 2.5V/3.0V 32-Mbit Serial Quad I/O™ (SQI™) Flash Memory* (DS20005218).

Note: Ethernet to Wi-Fi® Bridge Board does not use the SST26VF032B's SQI feature but supports traditional Serial Peripheral Interface (SPI) protocol.

Table 3-5. SPI Flash (SST26VF032B) Pin Details

Pin Number on SPI Flash SST26VF032B (U202)	Standard Pin on SPI Flash	Pin on WFI32E01PE	Description
1	CE#	$\overline{SPI1CS}$/RPA1	SPI Flash SST26VF032B Chip Select ($\overline{CS}$)
2	SO/SIO1	SDI1/RPC7	SPI Flash SST26VF032B serial data output for SPI mode
3	WP#/SIO2	—	—
4	VSS	GND	Ground
5	SI/SIO0	SDO1/RPC8	SPI Flash SST26VF032B serial data input for SPI mode
6	SCK	SCK1/RPC6	SPI Flash SST26VF032B serial clock
7	HOLD#/SIO3	—	—
8	VDD	VDD	3.3V power supply

3.6 Ethernet PHY interface

The Ethernet to Wi-Fi® Bridge Board includes an Ethernet PHY device and integrated magnetic RJ45.

Table 3-6. Ethernet Pin Details

Pin No. on LAN8720A	Pin No. on WFI32E01PE	Pin on WFI32E01PE	Description
16	8	ETXEN/RPC13	Ethernet transmit enable
17	14	ETXD0/RPC15	Ethernet transmit data 0
18	13	ETXD1/RPC14	Ethernet transmit data 1
11	15	ERXDV/RPK12	Ethernet receive data valid
10	18	ERXERR/RPC9	Ethernet receive error
8	9	ERXD0/RPC11	Ethernet receive data 0
7	10	ERXD1/RPC10	Ethernet receive data 1
5	12	ETH_CLK_OUT/RPC12	Ethernet clock output (50 MHz)
13	17	EMDC/RPK14	Ethernet management data clock
12	16	EMDIO/RPK13	Ethernet management data
14	25	INT2/RPK6	Ethernet interrupt output
15	44	RA14/RPA14	Ethernet Reset

3.7 UART Header (J203)

The Ethernet to Wi-Fi® Bridge Board provides a UART header (J203) for the UART serial interface to the host.

Table 3-7. UART Pin Details

Pin Number	Pin on UART Header	Pin Description of UART Header	Pin on WFI32E01PE
1	RX	UART receive input	U1RX
2	TX	UART transmit output	U1TX
3	GND	Ground	GND

3.8 GPIO Pads/Battery Status Indication Pads (J205)

The Ethernet to Wi-Fi® Bridge Board features GPIO pads (J205) that provide access to the GPIO pins of the WFI32E01PE. These pads enable users to interface with the WFI32E01PE for custom applications, such as monitoring battery voltage and status indications, tailored to specific user requirements.

Table 3-8. J205 Pin Details

Pin Number	Pin on J205	Pin Definition of Battery Status Indication Pads (J205)	Pin on WFI32E01PE
1	RB9	nPowerGood	INT3/RPB9
2	RB7	STAT1/LBO	INT1/RPB7
3	RB8	STAT2	INT4/RPB8
4	RA11	VBAT_SENSE_EN	RA11/RPA11
5	RA13	VBAT_SENSE	ANN1/RPA13
6	GND	GND	GND

A voltage divider circuit is provided to the VBAT_SENSE pin for sensing the battery voltage level of 3.7V.

3.9 GPIO Pads (J206 and J207)

The Ethernet to Wi-Fi® Bridge Board provides GPIO pads (J206 and J207) to access the unused WFI32E01PE GPIO pins.

Table 3-9. J206 GPIO Pin Details

Pin Number	Pin on J206	Pin on WFI32E01PE
1	RB1	RB1/RPB1
2	RB2	RB2/RPB2
3	GND	GND

Table 3-10. J207 GPIO Pin Details

Pin Number	Pin on J207	Pin on WFI32E01PE
1	RA4	RA4/RPA4
2	RA5	RA5/RPA5
3	GND	GND

4. Ethernet to Wi-Fi® Bridge Board Out-of-Box Demo

The Ethernet to Wi-Fi® Bridge Board allows Ethernet devices to connect through an RJ45 cable and extend their network by linking to a Wireless LAN. The bridge board features a command line interface-over-UART to configure operating modes like STA/SoftAP modes, TCP/IP stack settings and more. For more information on the Ethernet to Wi-Fi® Bridge Board demo, go to GitHub - MicrochipTech/WFI32_Ethernet_Wi-Fi_Bridge_OOB.

5. Appendix A: Reference Circuit

5.1 Ethernet to Wi-Fi Bridge Board Reference Schematics

Figure 5-1. Power Circuit

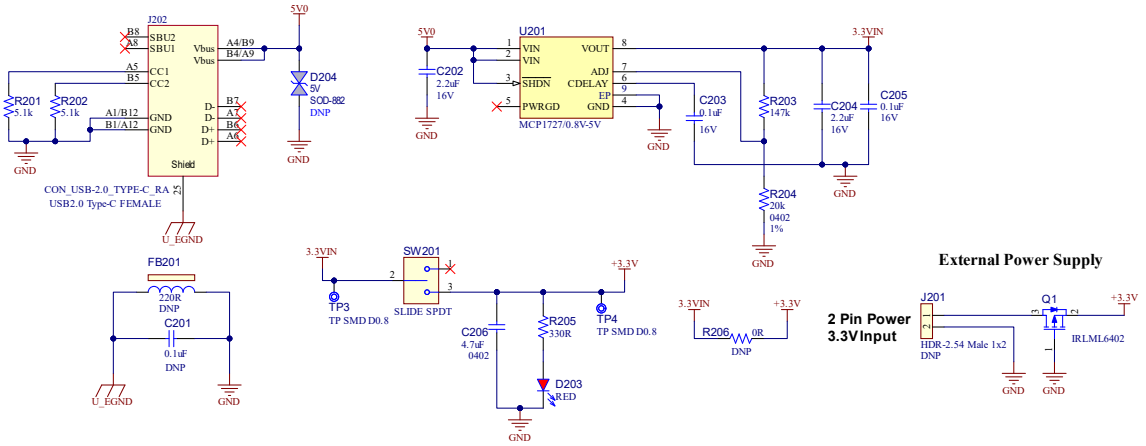


Figure 5-2. SPI Flash

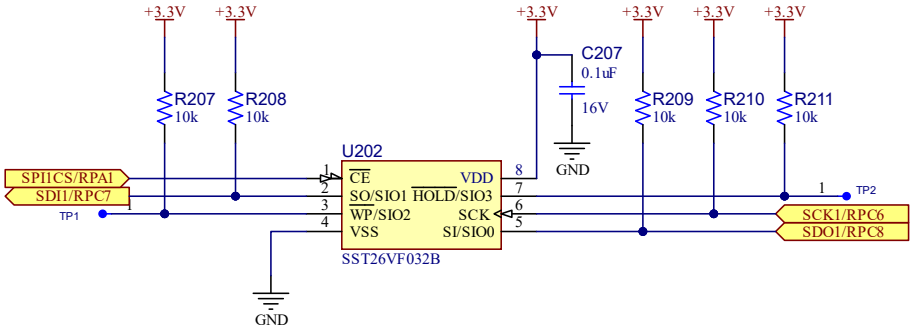


Figure 5-3. UART Header

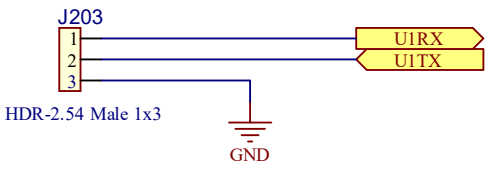


Figure 5-4. ICSP Mini Programming Pads

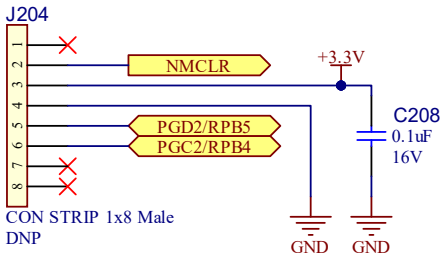


Figure 5-5. User Configurable LEDs

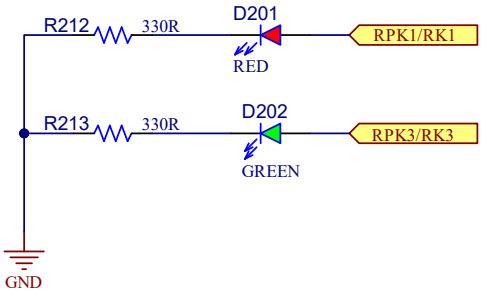


Figure 5-6. Switches

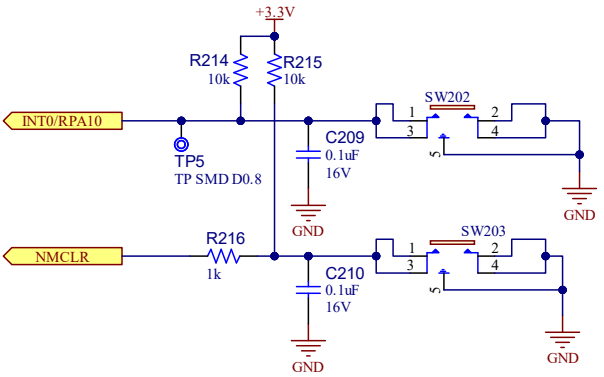


Figure 5-7. Battery Status Indication Pads

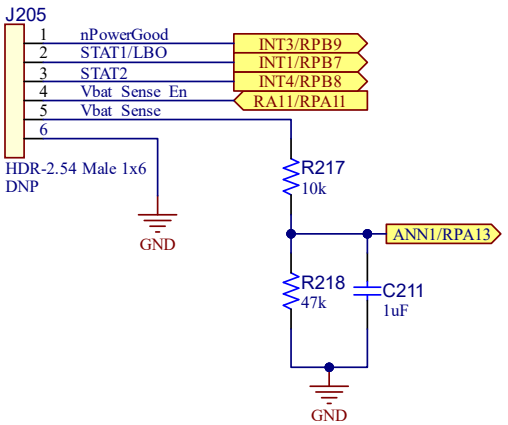


Figure 5-8. GPIO Pads

Figure 5-9. Integrated Magnetics RJ45

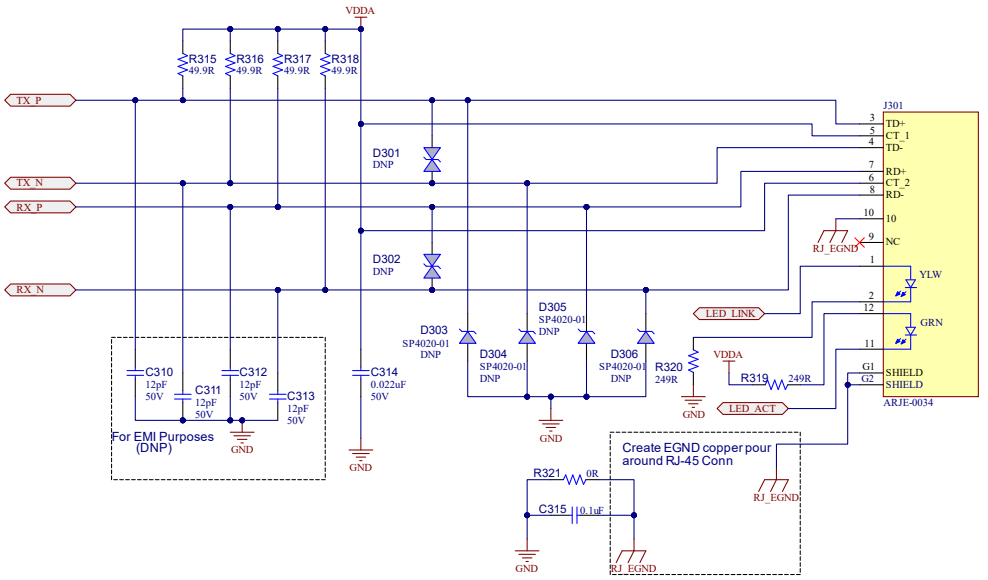


Figure 5-10. LAN8720A

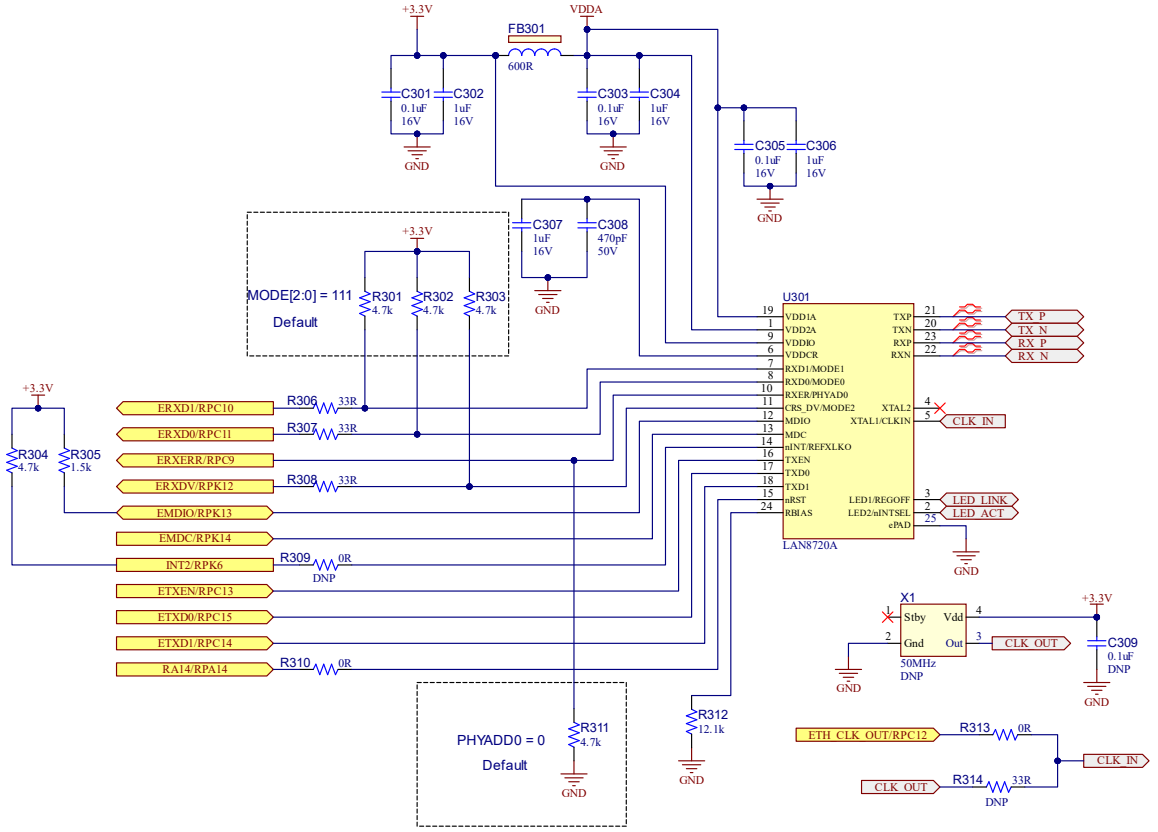
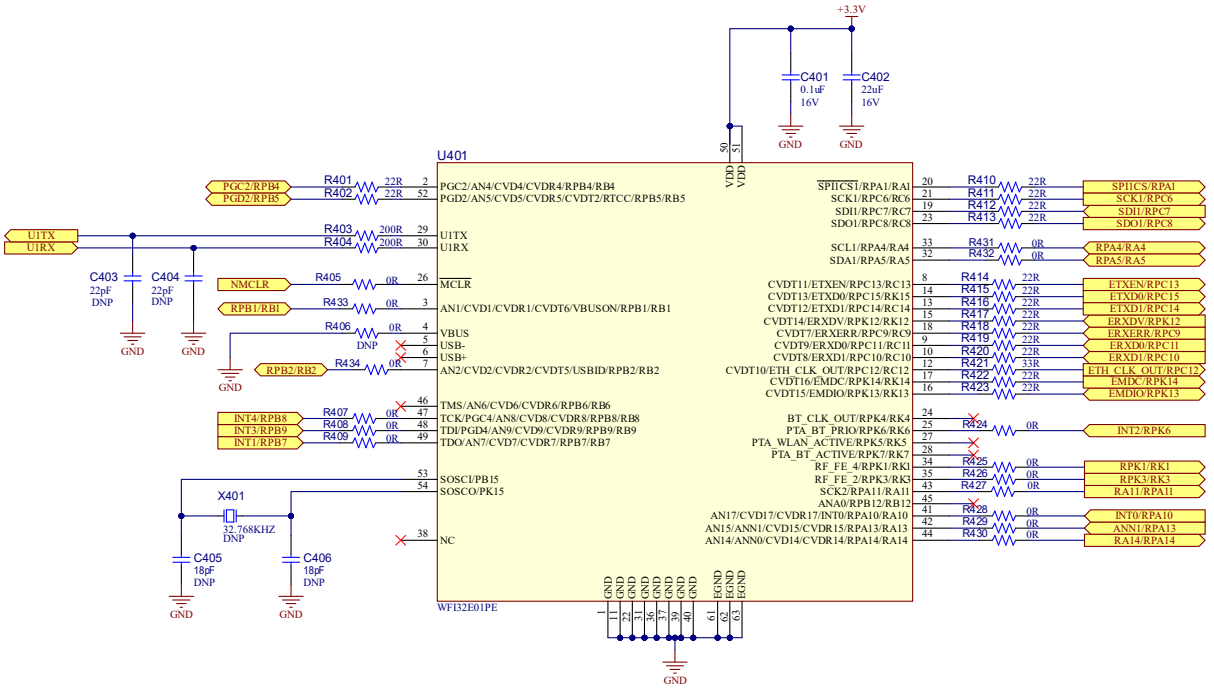


Figure 5-11. WFI32E01PE Module



6. Appendix B: Regulatory Approval

This equipment (Ethernet to Wi-Fi® Bridge Board/EV49N51A) is a reference design kit and not a finished product. It is intended for laboratory evaluation purposes only. It is not directly marketed or sold to the general public through retail; it is only sold through authorized distributors or through Microchip. Using this requires a significant engineering expertise towards understanding of the tools and relevant technology, which can be expected only from a person who is professionally trained in the technology.

Regulatory compliance settings have to follow the WFI32E01PE module certifications. The following regulatory notices are to cover the requirements under the regulatory approval.

6.1 United States

The Ethernet to Wi-Fi® Bridge Board (EV49N51A) contains the WFI32E01PE module, which has received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C “Intentional Radiators” single-modular approval in accordance with Part 15.212 Modular Transmitter approval.

Contains FCC ID: 2ADHKWFI32E01

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

Important: FCC Radiation Exposure Statement
This equipment complies with FCC radiation exposure limits set forth for uncontrolled environment. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 8 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. This transmitter is restricted for use with the specific antenna(s) tested in this application for certification.

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

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

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

6.2 Canada

The Ethernet to Wi-Fi® Bridge Board (EV49N51A) contains the WFI32E01PE module, which has been certified for use in Canada under Innovation, Science and Economic Development Canada (ISED, formerly Industry Canada) Radio Standards Procedure (RSP) RSP-100, Radio Standards Specification (RSS) RSS-Gen and RSS-247.

Contains IC: 20266-WFI32E01

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference;
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

⚠ WARNING

This equipment complies with radio frequency exposure limits set forth by Innovation, Science and Economic Development Canada for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the device and the user or bystanders.

Cet équipement est conforme aux limites d'exposition aux radiofréquences définies par d'Innovation, Sciences et Développement économique Canada pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre le dispositif et l'utilisateur ou des tiers.

6.3 Europe

This equipment (EV49N51A) has been assessed under the Radio Equipment Directive (RED) for use in European Union countries. The product does not exceed the specified power ratings, antenna specifications and/or installation requirements as specified in the user manual. A Declaration of Conformity is issued for each of these standards and kept on file as described in Radio Equipment Directive (RED).

Simplified EU Declaration of Conformity

Hereby, Microchip Technology Inc. declares that the radio equipment type [EV49N51A] is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at (See *Conformity Documents*).

7. Document Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Table 7-1. Document Revision History

Revision	Date	Section	Description
A	10/2024	Document	Initial Revision

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