Dual in-line Package Raspberry Pi PICO

For Battery, USB and Extended Powered IoT WiFi Applications

with Embedded UPS Functionality

DiP-Pi PloT

Supported Models PIoT: Full, Power Master and WiFi Master



No Solder – No cables – No Lost Time



Especially designed for the Raspberry Pi[®] PICO

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Designed and Manufactured by www.pimodules.com

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System Overview

Introduction

Dual in-Line Package Raspberry Pi PICO (DiP-Pi PICO) is a family of self-containing, stackable add-ons to the Raspberry Pi PICO[®] that decrease to the minimum user involvement for hardware development of application/idea testing based on Raspberry Pi PICO. DiP-Pi PICO takes care to support with all basic functionalities possible required by under development user application. User can easy stack-up (if used Stack headers) 2, 3 or more separated DiP-Pi PICO, possible add own PCB and rapidly run their application or use as a standalone self-containing device together with Raspberry Pi PICO[®] (if used Top-End headers). If designed application fulfills required needs; after successfully testing, user has 3 solutions:

- It is possible to use selected and tested DiP-Pi set and use them as it is for the application,
- User design the hardware by himself based on selected and tested DiP-Pi,
- And finally, ask Designer and Manufacturer company (<u>www.pimodules.com</u>) to design a single PCB (and if needed manufacture) based on tested **DiP-Pi** set. Pi Modules has signed agreement with Raspberry Pi and currently is "Raspberry Pi Approved Design Partner"

The list of available **DiP-Pi** is long and continuously updated with new **DiP-Pi**. Each **DiP-Pi** is supported with a simple code supporting its features (written in micro-Python or C).

The **DiP-Pi PICO PloT** (named also DiP-Pi PloT) is an advanced powering system, with **UPS functionality**, that cover all possible powering needs for application build-up based on Raspberry Pi PICO. It is supplying the system with up to 1.5A@5V from 6-18 VDC on various powering sources like Cars, Solar Panels industrial plant etc. It supports LiPo or Li-Ion Battery charger as also simply switching from cable powering to battery powering or reverse (**UPS functionality**). The EPR power source is protected with PPTC Resettable fuse, Reverse Polarity, as also ESD. The **DiP-Pi PloT** contains Raspberry Pi PICO embedded RESET button and ON/OFF switch on all powering sources (USB, EPR or Battery). User can monitor (via A/D) battery level and External Powering Level with PICO's A/D converters. Both A/Ds are protected also from ESD spikes with additional protection TVS. If for any reason user needs to use those PICO pins for their own application a simple 0402 resistors (0 OHM) need to be easy removed.

The charger is automatically charging connected battery (if used) but in addition user can switch it ON/OFF if their application needs it.

Each powering source or battery charger status is indicated by separate informative LEDs (VBUS, VSYS, VEPR, 3V3, CHGR).

User can use any capacity of LiPo or Li-Ion type, however, must take care to use PCB protected batteries. The charger is set to charge battery with 240 mA current. This current is set by resistor so if user need can himself change it to higher or lower value adjusting current to application exact needs. It can be done also by Manufacturer on customer request.

Available DiP-Pi PloT Models

The **DiP-Pi PICO PloT** is assembled around of a single PCB and is offering 3 different devices. There are:

DiP-Pi PICO PIoT Full

This model is equipped with all available features, including extended powering, Battery Charger, UPS Functionality, micro–SD Card, WiFi Module, Interfaces and ON/OFF features.

A detailed list of features is provided below on Table 1 DiP-Pi PIoT Technical Specifications

DiP-Pi PICO Power Master

This model is equipped with reduced set of features, and including extended powering, Battery Charger, UPS Functionality, Interfaces and ON/OFF features.

A detailed list of features is provided below on Table 2 DiP-Pi PIoT Technical Specifications

DiP-Pi PICO WiFi Master

This model is equipped with reduced set of features including micro–SD Card, WiFi Module, Interfaces and ON/OFF features.

A detailed list of features is provided below on Table 3 DiP-Pi PIoT Technical Specifications

DiP-Pi PloT Technical Specifications

Mechanical		PIoT	WiFi	Power
			Master	Master
DiP-Pi PCB dimensions	21mm x 51mm	YES	YES	YES
Raspberry Pi PICO Footprint	Yes, size and pinout	YES	YES	YES
compliance				
Raspberry Pi PICO headers	Male, female, or female-male	YES	YES	YES
	(pass thru)			
External Cable Powering				
EPR Power Input	6-18V DC	YES	NO	YES
Current/Voltage Supply	1.5A@4.8V	YES	NO	YES
EPR Power Input Protections	ower Input Protections Reverse Polarity, PPTC FUSE,		NO	YES
	ESD			
Recommended EPR Power Input	Plug; DC supply; female;	YES	NO	YES
Plug	3.4/1.4mm			
EPR Power Input Socket	Socket, DC Supply, male,	YES	NO	YES
	Contact size 3.4/1.3mm or			
	3.5/1.3mm			
EPR Level monitoring	Yes, via ADC1 (GP27), pass	YES	NO	YES
	thru OR 0402 resistor, easy to			
	be removed if this specific GP			
	is needed for other application			
External Powering and USB	Supported by ON/OFF Slide	YES	YES	YES
Powering ON/OFF	Switch			
Raspberry Pi PICO USB Powering	Compliant	YES	YES	YES

Raspberry Pi PICO Power Entry	VSYS Pin	YES	NO	YES
Point				
Battery Powering				·
Supported Battery Types	PCM Protected (2A Max	YES	NO	YES
	allowed Current – 2A) LiPo and			
	Li-Ion Batteries			
Battery Socket	Male JST 2.5mm	YES	NO	YES
Battery Charger Current	240 mA	YES	NO	YES
Battery Fuel Gauge	Software - provided by	YES	NO	YES
	Manufacturer			
(optional) Charger ON/OFF.	Yes, via GP21, pass thru OR	YES	NO	YES
Normally charger is working	0402 resistor, easy to be			
automatically, and not need any	removed if this specific GP is			
user intervention	needed for other application			
BAT Level monitoring	Yes, via ADC1 (GP26), pass	YES	NO	YES
Divi Level monitoring	thru 0B 0402 resistor easy to	123		123
	he removed if this specific GP			
	is needed for other application			
	Supported by ON/OEE Slide	VES	NO	VES
ONYOFF Functionality	Switch on All Power Sources	TLJ	NO	TLS
	Yos, automatic if Cable nower	VEC	NO	VEC
OFS Functionality	missing (EDP, LISP) both	TES	NO	TES
	directions (from missing coble			
	to bettony powering and vice			
	vorsa)			
Indicators Switches	versaj			
		VEC	VEC	VEC
Informative LEDS		YES	YES	YES
C. Thebas		VEC	VEC	N/FC
Switches	PICO Reset, ON/OFF on all	YES	YES	YES
	Powering Sources (EPR, USB			
	and BAT), WIFI LD-NO (Normal			
	usage, Loading ESP new			
	firmware – usually not			
	needed)			
	_			
WIFI Module	Based on clone ESP8266 Clone	YES	YES	NO
	– WT8266			
Connectivity with Raspberry Pi	UARTORX(GP13),	YES	YES	NO
PICO	UARTOTX(GP12), WiFi Reset			
	(GP15), WiFi ENABLE(GP11)			
	used when ultra-low power is			
	needed. Examples provided			
	contains simple WEB server			
	set up. Interaction with WiFi is			
	done via AT commands.			
Micro SD Card Socket			1	1
Interface Type	Standard micro–SD Cards	YES	YES	NO
	Interface recommended by			
	Raspberry Pi (single bit			
	interface - SPI). Raspberry Pi			
	PICO can store/read data or			

Connectivity with Raspberry Pi PICOSPI0 SD_MISO(GP16), SD_CS(GP17), SD_CLK(GP18), SD_DET(GP20), - if SD card is not used the GPXX can be used in other applicationsYESYESNOEmbedded ESD protected 1-wire interface </th <th></th> <th>run software from the SD card.</th> <th></th> <th></th> <th></th>		run software from the SD card.			
PICO SD_MISO(GP16), SD_CS(GP17), SD_CLK(GP18), SD_MOS(GP19), SD_DET(GP20), - if SD card is not used the GPXX can be used in other applications Image: Comparison of the	Connectivity with Raspberry Pi	SPIO	YES	YES	NO
SD_CLK(GP18), SD_MOSI(GP19), SD_DETG(P20), -if SD card is not used the GPXX can be used in other applications Image: SD_CLK(GP18), SD_DETG(P20), -if SD card is not used the GPXX can be used in other applications Embedded ESD protected 1-wire interface VES VES YES Type 1-Wire Interface Direct independent Interface (separated 3V3 and GND independent) with ESD protection and 4K7 resistor YES YES Connectivity with Raspberry PI 1-Wire (GP10) routed to independent DD YES YES YES I-Wire powering Independent LDD YES YES YES YES 1-Wire powering Independent form Pico 3V3 Powering, Current Limit and Short Circuit Protection, Thermal Shutdown Protection YES YES YES DHT22 and DHT11 interface Direct independent Interface (separated 3V3 and GND independent) with 10K resistor YES YES YES DHT11 Supported YES YES YES YES DHT22 Supported YES YES YES YES Additional User Application 3V3 LDO Independent Interface YES YES YES Type of Powering Independent LDO independent Noth Circuit YES YES YES Vie and DHT11/22, separa	PICO	SD_MISO(GP16), SD_CS(GP17),			
SD_MOSI(GP19), SD_DET(GP20), - if SD card is not used the GPXX can be used in other applicationsEmbedded ESD protected 1-wire Interface (separated 3V3 and GND independent) with ESD protection and 4K7 resistorYESYESConnectivity with Raspberry Pi PICO1-Wire (GP10) routed to independent 2 pins interface (3V3, 1-Wire, GND)YESYESYES1-Wire poweringIndependent DO independent 1202, independent from Pico 3V3 Powering, Current Limit and Short Circuit Protection, Thermal Shutdown ProtectionYESYESYES1-Wire Connectivity3 pins (holes) independent (separated 3V3 and GND independent from Pico 3V3 Powering, Current Limit and Short Circuit Protection, Thermal Shutdown ProtectionYESYESYES1-Wire Connectivity3 pins (holes) independent (separated 3V3 and GND independent) with 10K resistorYESYESYESDHT22 and DHT11 interface (separated 3V3 and GND independent) with 10K resistorYESYESYESDHT11SupportedYESYESYESDHT12SupportedYESYESYESAdditional User Application 3V3 LDOYESYESYESType of Poweringindependent LDO independent CD any user application. 3V3 is sourced from YSVS.YESYESWeather Station CapabilitiesDHT12, or DHT11 (only one can be used at the time)YESYESYESUsed/Free Raspberry PI PICO PinsUsed/Free Raspberry PI PICO PinsYESYESYESUSED PINSFREE PINSYESYESYES		SD_CLK(GP18),			
SD_DET(GP20), if SD card is not used the GPXX can be used in other applicationsEmbedded ESD protected 1-wire interface (separated 3V3 and GND independent) with ESD protection and 4K7 resistorYESYESConnectivity with Raspberry PI PICO1-Wire (GP10) routed to independent 3 pins interface (3V3, 1-Wire, GND)YESYES1-Wire poweringIndependent LDO 3V3@600mA used for WiFi, 1- Wire and DHT11/22, independent from PIco 3V3 Powering, Current Limit and Shont Circuit Protection, Thermal Shutdown ProtectionYESYES1-Wire Connectivity3 pins (holes) independent (separated 3V3 and GND independent thereface (separated 3V3 and GND independent 10hterfaceYESYES1-Wire Connectivity3 pins (holes) independent (separated 3V3 and GND independent) with 10K resistorYESYESDHT22 and DHT11 interfaceDirect independent Interface (separated 3V3 and GND independent) with 10K resistorYESYESDHT12SupportedYESYESYESAdditional User Application 3V3 LDOYESYESYESType of Poweringindependent LDO 3V3@600mA used for WiFi, 1- Wire and DHT11/22, separated from Pico 3V3 Powering, Current Limit and Short Circuit Protection, Thermal Shutdown Protection. SW3 is sourced from YSYS.YESYESWeather Station CapabilitiesDHT22, or DHT11 (only one rany user application. 3V3 is sourced from YSYS.YESYESWeather Station CapabilitiesDHT22, or DHT11 (only one can be used at the time)YESYESYESUsed/Free Raspberry PI PICO Pins US		SD MOSI(GP19),			
not used the GPXX can be used in other applicationsEmbedded ESD protected 1-wire interfaceType 1-Wire InterfaceDirect independent Interface (separated 3V3 and GND) independent) with ESD protection and 4K7 resistorYESYESYESConnectivity with Raspberry Pi PICO1-Wire (GP10) routed to independent 3 mis interface (3V3, 1-Wire, GND)YESYESYES1-Wire poweringIndependent 3 mis interface (3V3, 4600m A used for WiFi, 1- Wire and DHT11/22, independent from PIco 3V3 Powering, Current Limit and Short Circuit Protection, Thermal Shutdown ProtectionYESYESYES0HT22 and DHT11 interface (separated 3V3 and GND independent) with 10K resistorYESYESYESDHT22 Additional User Application 3V3 LDODirect independent Interface (separated 3V3 and GND independent 1With 10K resistorYESYESYESDHT22 Additional User Application 3V3 LDOSupportedYESYESYESYESType of Powering Current Limit and Short Circuit Protection, Thermal Shutdown Protection, Charber Station any user application. 3V3 Is sourced from VSYS.YESYESYESYESWeather Station Capabilities GP10 (if used for the 1-wire) - all OUSED PINSDHT22, or DHT11 (only one can be used for any user application. 3V3 Is sourced from VSYS.YESYESYESYESWeather Station Capabilities GP10 (if used for the 1-wire) - all GP00FREE PINSYESYESYESYESUSED PINSFREE PINSYESYESYESYESYESYES <td></td> <td>SD_DET(GP20). – if SD card is</td> <td></td> <td></td> <td></td>		SD_DET(GP20). – if SD card is			
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Independent) with ESD protection and 4K7 resistorConnectivity with Raspberry Pi PICO1-Wire (GP10) routed to and dependent 3 pins interface (3V3, 1-Wire, GND)YESYESYES1-Wire poweringIndependent LDO 3V3@600MA used for WiFi, 1- Wire and DHT11/22, independent from PIco 3V3 Powering, Current Limit and Short Circuit Protection, Thermal Shutdown ProtectionYESYESYES01-Wire Connectivity3 pins (holes) independent sont Circuit Protection, Thermal Shutdown ProtectionYESYESYES0DHT22 and DHT11 interface (separated 3V3 and GND independent) with 10K resistorYESYESYES0DHT21SupportedYESYESYES0SupportedYESYESYES0SupportedYESYESYES0SupportedYESYESYES0SupportedYESYESYES0YESYESYESYES0YESYESYESYES0YESYESYESYES0YESYESYESYES0YESYESYESYES0YESYESYESYES0YESYESYESYES0YESYESYESYES0YESYESYESYES0YESYESYESYES0YESYESYESYES1Wire and DHT11/22, separated fro	Type I whe mendee	(separated 3V3 and GND	125	123	123
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Connectivity with Naspuerry III 1 Write (of 10) rotice to find the spin interface (3V3, 1-Wire, GND) 110	Connectivity with Basnherry Pi	1-Wire (GP10) routed to	VES	VES	VES
Independent S pins interface Independent S pins interface I-Wire powering Independent LDO YES YES YES 3V3@600mA used for WiFi, 1- Wire and DHT11/22, independent from Pico 3V3 YES YES YES I-Wire Connectivity 3 pins (holes) independent YES YES YES 1-Wire Connectivity 3 pins (holes) independent YES YES YES DHT22 and DHT11 interface Thermal Shutdown Protection YES YES YES Humidity/Temperature Sensor Interface Direct independent Interface (separated 3V3 and GND independent) with 10K resistor YES YES YES DHT22 Supported YES YES YES YES Additional User Application 3V3 LDO Type of Powering independent LDO 3V3@600mA used for WiFi, 1- Wire and DHT11/22, separated from Pico 3V3 Powering, Current Limit and Short Circuit Protection, Thermal Shutdown Protection. Can be used for any user application. 3V3 is sourced from VSYS. YES YES YES Weather Station Capabilities DHT22, or DHT11 (only one can be used at the time) YES YES YES Used/Free Raspberry Pi PICO Pins Used/Free Raspberry Pi PICO Pins YES YES YES YES <t< td=""><td></td><td>independent 3 pins interface</td><td>TLJ</td><td>TLJ</td><td>TL5</td></t<>		independent 3 pins interface	TLJ	TLJ	TL5
1-Wire poweringIndependent LDO 3V3@600mA used for WiFi, 1- Wire and DHT11/22, independent from Pico 3V3 Powering, Current Limit and Short Circuit Protection, Thermal Shutdown ProtectionYESYESYES1-Wire Connectivity3 pins (holes) independent connectivityYESYESYESYESDHT22 and DHT11 interfaceDirect independent Interface (separated 3V3 and GND independent) with 10K resistorYESYESYESDHT21SupportedYESYESYESYESDHT22SupportedYESYESYESDHT22SupportedYESYESYESDHT22SupportedYESYESYESDHT22SupportedYESYESYESAdditional User Application 3V3 LDOIndependent LDO 3V3@600mA used for WiFi, 1- Wire and DHT11/22, separated from Plco 3V3 Powering, Current Limit and Short Circuit Protection. Can be used for any user application. 3V3 is sourced from VSVS.YESYESWeather Station CapabilitiesDHT22, or DHT11 (only one can be used at the time)YESYESYESUSED PINSFREE PINSYESYESYESYESUSED PINSFREE PINSYESYESYESYESUSED PINSFREE PINSYESYESYESYESUSED PINSFREE PINSYESYESYESYESUSED PINSFREE PINSYESYESYESYESUSED PINSGP00GP01 GP01GP01 GP01GP02YESYESYES <td></td> <td>(2)/2 1 Wire GND</td> <td></td> <td></td> <td></td>		(2)/2 1 Wire GND			
1-Write powering Interpretent EDO TES TES TES 3V3@600mA used for WiFi, 1- Wire and DHT11/22, independent from Pico 3V3 Powering, Current Limit and Short Circuit Protection, Thermal Shutdown Protection YES YES YES 1-Wire Connectivity 3 pins (holes) independent connectivity YES YES YES YES DHT22 and DHT11 interface Direct independent Interface (separated 3V3 and GND independent) with 10K resistor YES YES YES DHT11 Supported YES YES YES YES DHT22 Supported YES YES YES YES Additional User Application 3V3 LDO Independent LDO 3V3@600mA used for WiFi, 1- Wire and DHT11/22, separated from Pico 3V3 Powering, Current Limit and Short Circuit Protection. Can be used for any user application. 3V3 is sourced from VSYS. YES YES YES Weather Station Capabilities DHT22, or DHT11 (only one can be used at the time) YES YES YES Used/Free Raspberry Pi PICO Pins Used/Free Raspberry Pi PICO Pins YES YES YES YES Used/Free Raspberry Pi PICO Pins GP00 GP10 (if wief for the 1-wire) – all GP00 GP11 (if WiFi is assembled) – GP01 GP11 (if WiFi is assembled) – GP02 YES YES YES <td>1 Wire new oring</td> <td>(3V3, 1-Wile, GND)</td> <td>VEC</td> <td>VEC</td> <td>VEC</td>	1 Wire new oring	(3V3, 1-Wile, GND)	VEC	VEC	VEC
Sysgebolina User for Wiri, 1- Wire and DHT11/22, independent from Pico 3V3 Powering, Current Limit and Short Circuit Protection, Thermal Shutdown Protection1-Wire Connectivity3 pins (holes) independent connectivityYESYESYESDHT22 and DHT11 interfaceDirect independent Interface (separated 3V3 and GND independent) with 10K resistorYESYESYESDHT11SupportedYESYESYESYESDHT11SupportedYESYESYESYESDHT22SupportedYESYESYESYESAdditional User Application 3V3 LDOindependent LDO 3V3@600mA used for WiFi, 1- Wire and DHT11/22, separated from Pico 3V3 Powering, Current Limit and Short Circuit Protection. Can be used for any user application. 3V3 is sourced from VSYS.YESYESYESWeather Station CapabilitiesDHT22, or DHT11 (only one can be used at the time)YESYESYESYESUSED PINSFREE PINSYESYESYESYESYESYESUSED PINSFREE PINSYESYESYESYESYESUSED PINSFREE PINSYESYESYESYESYESUSED PINSFREE PINSYESYESYESYESYESUSED PINSFREE PINSYESYESYESYESYESUSED PINSGP01 GP02GP02GP01 GP03GP01GP02GP02GP01GP02	1-wire powering	Independent LDO	YES	YES	YES
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WiFi and PloT GP03	GP11 (if WiFi is assembled) –	GP02			
	WiFi and PloT	GP03			

GP12 (if WiFi is assembled) –	GP04		
WiFi and PloT	GP05		
GP13 (if WiFi is assembled) –	GP06		
WiFi and PloT	GP07		
GP14 used for User LEDs	GP08		
(optional)	GP09		
GP15 (if WiFi is assembled) –	GP10 (if not used for the 1-		
WiFi and PIoT	wire)		
<u>Right Side</u>	<u>Right Side</u>		
GP27 (if used for EPR	GP28		
monitoring)	GP27 (if not used for EPR		
GP26 (if used for BAT	monitoring)		
monitoring)	GP26 (if not used for BAT		
GP22 (if used for DHT11/22	monitoring)		
monitoring)	GP22 (if not used for		
GP21 (if used for Charger	DHT11/22 monitoring)		
Control)	GP21 (if not used for Charger		
GP20 (if SD Card is used) – PIoT	Control)		
only			
GP19 (if SD Card is used) – PIoT	GP20 (if SD Card is not used)		
only	GP19 (if SD Card is not used)		
GP18 (if SD Card is used) – PIoT	GP18 (if SD Card is not used)		
only	GP17 (if SD Card is not used)		
GP17 (if SD Card is used) – PIoT	GP16 (if SD Card is not used)		
only			
GP16 (if SD Card is used) – PIoT			
only			

Table 4 DiP-Pi PIoT Technical Specifications

Setting up Procedure

Installing Thonny and testing your Raspberry Pi Pico

The **DiP-Pis** are offered to user with a set ready to use interfaces as also access to WiFi network combined with extended Powering and UPS functionality, all-in-one! Some simple and more complicated examples **ready-to-use** are available <u>here</u>. This set of **ready-to-use** examples is under continuously update with new one. They have been written on **Micro Python** and suggested tool for using them is <u>Thonny</u>, as it is extremely user friendly. It is obviously that, user can use any other tool as also language i.e., C or C++. As most of the users are using their Windows PC, we provide installation instruction for Windows, however they are similar for macOS and Raspberry Pi.

Thonny is an integrated development environment for Python that is designed for beginners. It supports different ways of stepping through the code, step-by-step expression evaluation, detailed visualization of the call stack and a mode for explaining the concepts of references and heap. It is extremely user friendly fro beginner but also for experienced users.

Simple Instructions for Downloading and installing <u>Thonny</u> for Raspberry Pi Pico.

• Download and install **Thonny** from below link

https://thonny.org

General	Interpreter	Editor	Theme & Font	Run & Debug	Terminal	Shell	Assistant		
Which i MicroP	interpreter or Ython (Raspi	device s erry Pi P	hould Thonny us ico)	e for running yo	ur code?			v	$\left \right $
Conn (look If you Port < Try	ect your devi for your devi can't find it, to detect po	e to the ce name you may rt autom	computer and s , 'USB Serial'' or need to install ; natically >	elect correspond "UART"). roper USB drive	ing port be	low		×	

Figure 1 Installing Thonny

- Connect the Raspberry Pi Pico to your computer and in <u>Thonny</u> go to Tools > Options and click on the Interpreter tab. From the interpreter drop-down list select Micro Python (Raspberry Pi Pico). The port drop-down menu can be left to automatically detect the Pico. Click OK to close.
- Press the BOOT button on Pico and enter micro-USB Cable, proceed with installation. Then press Close
- You should see (if click on) the Serial Port assigned to Pico



Figure 2 Installing Thonny

• The Python Shell (called also REPL) will now update to show that the Pico is connected and working.

General	Interpreter	Editor	Theme & Font	Run & Debug	Terminal	Shell	Assistant		
Which Microl Details Conn (look If you Port < Tr	yption Tim F s H ect you for yo 1 y can't 2 3 y to de W N	e device of Install Mid lere you of . Plug in y . Wait unt . Click 'Ins /hen the j licroPytho	an install or upd our Pico while h il device informa tall'. process finishes, on. Close the dia	are for augming up are for Raspberry late MicroPython olding the BOOT ation appears. your Pico will be log and start pro	running the gramming!	in Raspl e latest	berry Pi Pico	×	•
	V T T	ersion to arget dev arget dev	be installed: v1 ice location: G3 ice model: Ra	.16 (2021-06-18) \ spberry Pi RP2				- f	irmware

Figure 3 Installing Thonny

• The Python Shell (called also REPL) will now update to show that the Pico is connected and working.



Figure 4 Installing Thonny

• To test we can write a quick print function to say, "**Hi DiP-Pi**" Point mouse on the REPL window and press some time the Enter. Then write *print('Hi DiP-Pi')* and press Enter to run the code.

>>>		
>>>		
>>>		
>>>		
>>>		
>>>		
>>>		
>>>		
>>>		
>>> print('hi DiP-Pi')		
hi DiP-Pi		
>>>		ļ

Figure 5 Installing Thonny

Simple Blinking Raspberry Pi© Pico LED Micro-Python Program

To further test that we can successfully program the Raspberry Pi Pico. We wrote a simple program that is flashing Embedded **Blinking Raspberry Pi© Pico** LED. This quick test ensures us, that our hardware is working, and it will introduce the **Micro-Python** language and syntax in the simplest form. It can be downloaded from <u>here</u>. Please download it to your PC and then open with Thonny.

www.dip-pi.com
DiP-Pi PloT Powered IoT for Raspberry Pi Pico
MicroPython Raspberry Pi PICO LED ON/OFF demo software
demo written by Ioannis A.Mourtsiadis by www.pimodules.com
-*- coding: utf-8 -*from machine import Pin, Timer
from time import sleep_ms
led = Pin(25, Pin.OUT)
LED_state = True
tim = Timer()

def tick(timer): global led, LED_state LED_state = not LED_state led.value(LED_state) Press Green Button (called: **Run Current Script**) and your program will start execution and LED blinking every second. Before you start experimenting with DiP-Pi, you need to make the last test, to have your **Blinking Raspberry Pi© Pico** fully operative. You need to make the system running without need to have loaded the Thonny. Your system must be independent from your PCB. To do that, you need to save your software to Pico, and say to the Pico "when wake-up, run this script". This is standard procedure for all demo programs we demonstrate here. To achieve this, you need your script to save to your Pico, called as "main.py".

Go to the *File->Save* as and when you see picture like this below select Raspberry Pi Pico and save with a name **main.py**.



Figure 6 Installing Thonny

Now, whenever your Raspberry Pi Pico will be powered, will run your **main.py** script.

You are ready to use **Raspberry Pi**[©] **Pico** with **DiP-Pi** and develop professional applications.

Hardware installing on Raspberry Pi PICO

The DiP-Pi PICO is designed and manufactured on the way to minimize need for hand work on the user. However, some very basic steps need to be proceeded to develop a fully operable system based on DiP-Pi PICO and Raspberry Pi PICO. On the most cases there is no need to use soldering iron. It is very important to plug in properly DiP-Pi to the Raspberry Pi PICO. Each DiP-Pi is clearly marked with **PIN 1**, that should be placed on Raspberry Pi PICO Pin 1. To avoid any misunderstanding there is glued in addition a paper label that mind the user how to plug the DiP-Pi on the Raspberry Pi PICO. Users need to remove this label before plug the DiP-Pi to Raspberry Pi PICO. Below Picture shows **PIN 1** Label as also **PIN 1** market on DiP-Pi PCB.



Figure 7 Pin 1 Placement

User should mind that Raspberry Pi PICO USB socket needs to be on the same side of the DiP-Pi PIN1 marker when plugged to the **DiP-Pi**. <u>Opposite plugging-in cause after power connection destroy of the system.</u>



Figure 8 micro USB Placement

Based on the same PCB there has been released 3 versions of **DiP-Pi PloT**:

- 1. DiP-Pi PloT Full
- 2. DiP-Pi PloT WiFi Master
- 3. DiP-Pi PloT Power Master

Depending to application user need to select the proper one. Below table shows differenced on each DiP-Pi PIoT. It is also available to download a big A3 page from <u>here</u>



Table 5 DiP-Pi PloT Moldels

Hardware Interfacing/Interaction with Raspberry Pi® PICO

The core goal of the **DiP-Pi** is to minimize pins required to be interfaced with and left them for user applications. Therefore, for WiFi interfacing has been selected Serial Port of Raspberry Pi PICO and AT Commands instead of SPI, for micro-SD Card single line SPI (not 4 bits), as also A/D Pins if not used for monitoring of are bridged by 0402 OR resistor that in a case user does not need it, can be easy removed. The 1-wire and DHT11/22 interfaces if not used for their scope, can be used by user application. A detailed usage of Raspberry Pi PICO Pins is presented for each model on **Table 6** DiP-Pi PIOT Moldels

Battery Connection

The **DiP-Pi PloT Full** and **DiP-Pi PloT Power Master** both are equipped with **UPS functionality** and allow to use connected external battery. Used Battery must be **PCM** protected, and protection must not allow current higher than 2 A. There is also needed to take a special care how to connect battery polarity to avoid miss working or destroying of the device. There are special makers on the PCB showing where should be connected "+ " and "-" of the battery. Battery can be used independently from the Cable powering and can be switched ON/OFF with the slide switch for battery powered applications as also as automatic power backup **UPS functionality**.



Figure 9 Battery fitting

Extended Powering Cable Connection

The **DiP-Pi PloT Full** and **DiP-Pi PloT Power Master** are offering to be powered also with **E**xtended **Power**ing Input (**6-18V DC**). This EPR input can be used for industrial applications powering. It is reverse polarity, ESD and PPT fuse protected.

The power input is done via Socket, DC Supply, male, Contact size 3.4/1.3mm or 3.5/1.3mm. The plug is included in the package. Polarity should follow below diagram.



Figure 10 EPR Plug Soldering

ON/OFF Slide Switch and Reset Switch

The **DiP-Pi PloT Full**, **DiP-Pi PloT WiFi Master** and **DiP-Pi PloT Power Master** are equipped with **ON/OFF Slide Switch** and **PICO RESET Button**. It switches power of the Raspberry Pi PICO ON/OFF on all power sources (USB, EPR and Battery). The position of the slide switch moved to the PIN 1 side

make the system **Powered** as shown on the below picture. If system is powered by USB can be used for firmware download instead of removing the USB cable. The **PICO RESET Button** is connected directly to the Raspberry Pi[®] PICO Reset pin, and when pressed resets the Raspberry Pi[®] PICO and can be also used as alternative for the firmware download instead of removing the USB cable. Details are shown on the picture below.



Figure 11 ON/OFF Switch Positioning

UPS Functionality

The **UPS Functionality** is an integrated part of the powered DiP-Pi PloT versions (**DiP-Pi PloT Full** and **DiP-Pi PloT Power Master**). It is automatic and whenever cable powering is missing it is automatically switching to battery and vice-versa. The UPS Functionality is working when ON/OFF Slide switch is on Position **ON**. Whenever used system can be switched OFF with their Slide ON/OFF Switch.

Embedded Li-Ion LiPo Charger

The **DiP-Pi PICO PloT Full** and **Power Master** are equipped with embedded I-lon and LiPo charger. It is working automatically and charging battery when needed. When Battery is charged then the CHG LED is ON, when battery is not connected or faulty the CHG LED is blinking.

Connectivity with Raspberry Pi PICO:

- BATLEVEL ADC0 (GP26) measures Battery Level
- CHG_ACTIVE (GP21) activate/deactivate Battery Charger

ESP8266 WiFi Embedded Module

The DiP-Pi PICO PIoT and WiFi Master are equipped with embedded Integrated ESP8266 clone (WT8266). It is handled by AT Commands, and practically can be used for all of the WiFi Applications. They include simple interactive WEBSERVER, email client, UBIdots client, data access to SD card logger etc. The default speed of the AT Commands is 115200 bps. The range of baud rates supported: 110~115200*40.

Connectivity with Raspberry Pi PICO:

- UARTORX(GP13)
- UARTOTX(GP12)

- WiFi Reset (GP15)
- WiFi ENABLE(GP11)



Figure 12 WiFi Module

WT8266 WiFi Embedded Module AT Commands Set

The WT8266 AT Commands detailed specification can be found in different manual listed here

WiFi Firmware Uploader switch

The Uploader Switch is used to upload the newer firmware (only if really needed – under normal conditions NOT needed) for **WT8266 WiFi Module**. Under normal usage should be on position **NO** (**NO**rmal). If it is on position **LD** (LoaD) the WiFi Module will not working properly as will be waiting for new firmware. The update switch is connected directly to the **WT8266 WiFi Module**.



Figure 13 micro-SD Card and WiFi

Micro SD Card Socket

Is used to hold data, or Raspberry Pi[®] PICO executable software. Therefore, allow user to execute micro-python directly from it. Above picture shows the micro-SD Card inserted.

Connectivity with Raspberry Pi PICO:

- SD_MISO (GP16)
- SD_CS (GP17)
- SD_CLK (GP18)
- SD_MOSI (GP19)
- SD_DET (GP20)

Informative LEDs

The **DiP-Pi PICO PloT** is equipped with multiple Colored Informative LEDs. They are:

- VE ON when VEPR 6-18VDC is applied (Green)
- VS ON when VSYS is applied (Blue)
- VB ON when VBUS is applied (GREEN)
- V3 ON when V3V3 is generated (GREEN)
- **CH** ON when VCHG is generated (**RED**)



Figure 14 Informative LEDs

DiP-Pi PloT Interfaces

Each DiP-Pi PIoT Modules is equiped with with some basic intefaces. There are:

 A/D inerface that measure Battery Level (where is implemented – Version Full and Power Master)

- A/D inerface that measure EPR Level (where is implemented Version Full and Power Master)
- 1-wire embedded Intreface ESD Protected (all versions)
- DHT11/22 embedded Intreface ESD Protected (all versions)

A/D interfaces

Two of existing Raspberry Pi PICO A/D are used by the **DiP-Pi**. They are:

- BATLEVEL ADC0 (GP26) measures Battery Level
- EPRLEVEL ADC1 (GP27) measures EPR (6-18VDC) Level

Both are equipped with serial 0402 OR Resistor that can be easy removed if this functionality is not needed. Both A/D are based on Resistor Dividers to cover PICO limited voltage inputs.



A detailed examples how to read A/D data and convert to voltages as also implementation of **Olympic Score** de-noising filtering algorithm are provided <u>here</u>.

1-wire interface

The **DiP-PloT** is equipped with 1-wire interface. It contains resistor 4K7K as also ESD protection. This interface can be used with temperature sensors and i-button (making sophisticated lock systems). Due to reduced available space the sensor needs to be soldered to **DiP-Pi PloT**. If user do not have soldering skills our company is offering the soldering service.



Figure 15 1-wire interface

Connectivity with Raspberry Pi PICO:

• 1-wire data (GP10)

The 3V3 powering for the 1-wire interface is provided by **DiP-Pi** from a separate protected LDO @600mA, therefore there is no risk if short circuit.

A detailed examples in micro-python are provided <u>here</u>.

DHT11/22 Interface

The **DiP-PloT** is equipped with DHT11 or 22 interface. It contains resistor 10K. This interface can be used with temperature/humidity environmental sensors for application like weather station. Due to reduced available space the sensor needs to be soldered to **DiP-Pi PloT**. If user do not have soldering skills our company is offering the soldering service. DiP-Pi PloT is supporting also cabled sensor co can be placed away of the system.



Figure 16 DHT11/22 Interface

Connectivity with Raspberry Pi PICO:

• DHT11/22 data (GP22)

The 3V3 powering for the DHT11/ 22 interface is provided by **DiP-Pi** from a separate protected LDO @600mA, therefore there is no risk if short circuit.

A detailed examples in micro-python are provided <u>here</u>.

Ready-To-Use Examples

Library and Ready-to-Use examples can be downloaded from here.

Common Problems & Solutions

Can I connect EPR (6-18VDC) input and Raspberry Pi PICO micro-USB at the same time?

Yes, you can. They are electrically separated and can be used at the same time. The ENTRY point for the EPR (4.8V) is the VSYS, so they are separated by diode on the Raspberry Pi PICO.

When I switch OFF with the Slide Switch and micro-USB is connected, the VUSB and is still light.

It is normal, as the VUSB (VB) LED is powered via VUSB so as far the USB is connected the LED is powered. Similar with VSYS, as is originated form the VUSB. The OFF signal (LOW) is attached to the Raspberry Pi PICO OFF pin, that cause stopping of Buck/Boost converter working. Therefore, when powered by micro-USB the ON/OFF witching will cause V3V3 voltage LED (V3) switching.

Document Revisions

Version	Date	Modified Sections	Comments
N.A.	01/09/2021	N.A.	First Preliminary Public Document Release

DiP-Pi PloT Schematic



Figure 17 Detailed Schematic