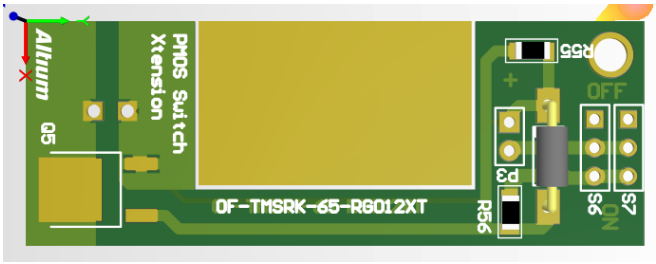
OF-TMSRK-64-RG012

Error Report ! (January 2022)

Switch usage (S1, S2)

The dip switch is not suitable in a high-current circuit board. While the selected dip switch is enabled for 3A current, the maximum current might happen on this circuit at 40+ A. OF's designer has realized this fact after the RG012 board has been published and sent to the factory.

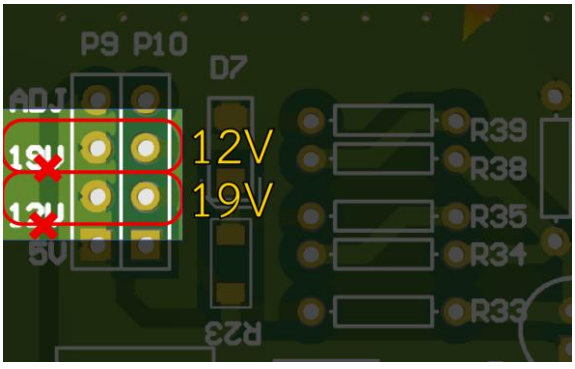
To solve this problem, PMOS Switch will be integrated into the next version of the RG012 board. Or add RG012XT which has PMOS Switch and fit dimension onto the RG012 board.



LM1501 Module Shuffle Label

At the voltage selector pin of every LM1501 Module. Some mistakes happened during the wire routing – Labeling process. 12V and 19V Selector – Label is accidentally shuffled. So, to regulate 12V from LM1501 Module, pick a mini Jumper on the pin which labeled 19V instead. On the other hand, pick a mini jumper on 12V labeled to regulate 19V.

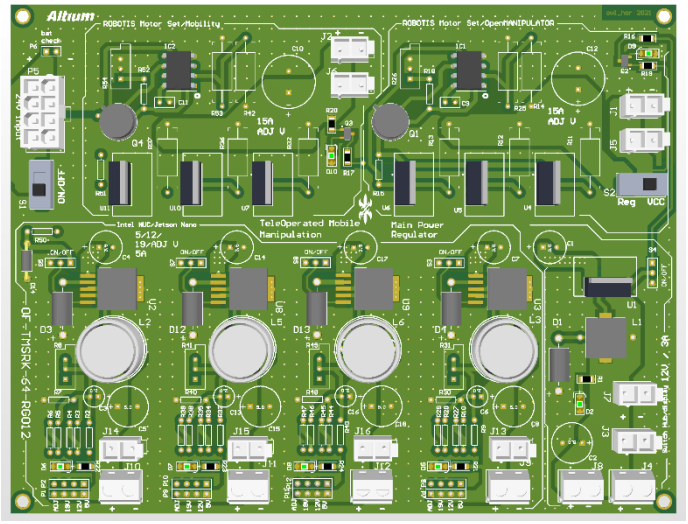
However, ADJ and 5V are correctly labeled and can be used normally.



This Error report is added on the first page of OF-TMSRK-64-RG012 Datasheet, December 2021 ver.

OF-TMSRK-64-RG012

Power Regulator Board



This is a voltage regulator, distributor circuit board. Designed to distribute power from 24V Li-po Battery. Regulate to the variety of voltage and distribute to the devices. For instance, NVIDIA Jetson Nano, Intel NUC, ROBOTIS Power hub, OpenMANIPULATOR P.

This board is designed to be a part of the "Teleoperated Mobile Manipulation" Project ("Smart Rod Khen"). Single usage is acceptable. However, recommend using with Switch Control circuit board [OF-TMSRK-64-CT011].

Please read all the general information in this datasheet before use.

Contents

Features

- 24V Battery Input.
- Variety selectable of standard Voltage Output.
- Enable to handle multiple devices.
- ON/OFF for each (switching) regulator.

Power Ratings

Input : -> DC 24V (Power supply, Li-PO Battery), 40V Maximum

Output : -> DC 24V* 15A

-> DC 12V* 15A

-> DC 12V 3A

-> DC 5/12/19/ADJ V 5A

* Adjustable voltage

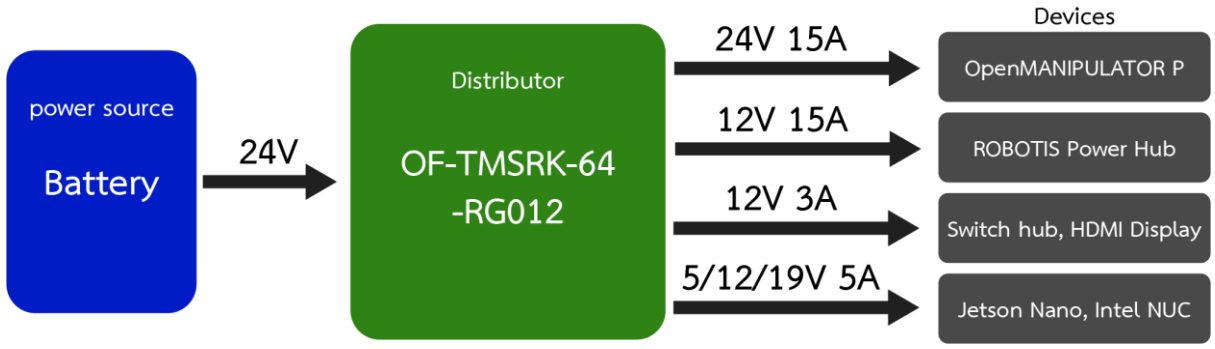
Connectable Device

Almost the regulator in this circuit board is adjustable. So, any voltage lower than the input (24V) can be regulated. However, this circuit is designed to handle these devices specifically. The simple voltage adjust are available.

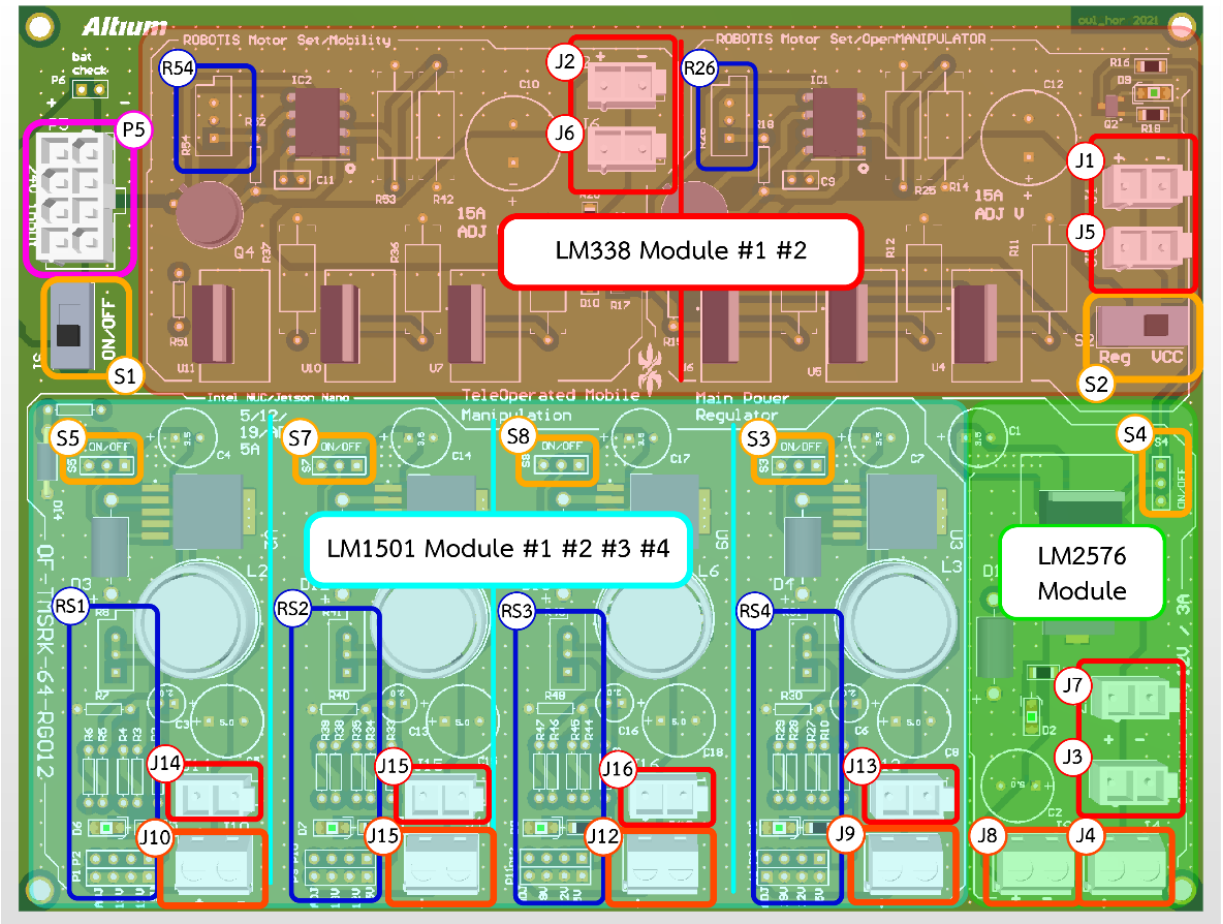
These following are the list of supported device.

- NVIDIA Jetson Nano
- Intel NUC
- ROBOTIS power hub board
- ROBOTIS OpenMANIPULATOR P
- 12V Switch Hub
- 12V 15" HDMI Display

Functional Diagram



General Information



Components	Description
P5	24V Input (visit: Terminal & wire, connector information)
S1 (ON/OFF)	Turn ON/OFF all of power in this circuit.
S2 (Reg/VCC)	Switch voltage between VCC-Regulated for #2 module only.
S3, S4, S5, S7, S8	Turn ON/OFF each LM1501, LM2576-12 regulate module.
RS1, RS2, RS3, RS4	Voltage adjust set for LM1501 module.
R26, R54	Voltage adjust knob for LM338 module.
J1, J5	24V 15A Output (Molex wafer)
J2, J6	12V 15A Output (Molex wafer)
J3, J7	12V 3A Output (Molex wafer)
J13, J14, J15, J16	5/12/19/Adj. V 5A Output (Molex wafer)
J4, J8	12V 3A Output (Screw Terminal)
J9, J10, J12, J15	5/12/19/Adj. V 5A Output (Screw Terminal)

Voltage Adjust

There're 3 main regulate module types in this circuit.

1- module: LM338 High Current

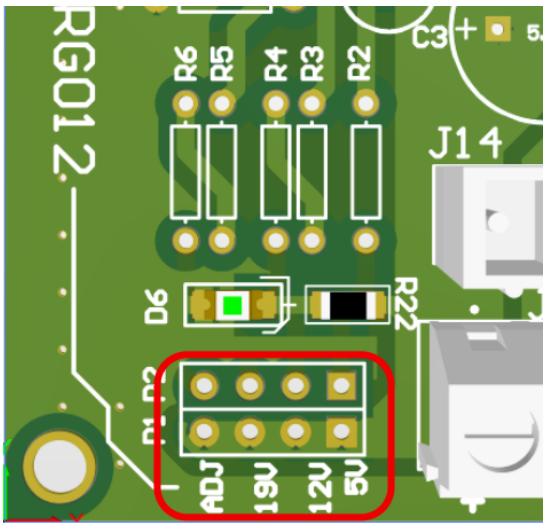
2- module: LM2576 12V fix

3- module: LM1501 module

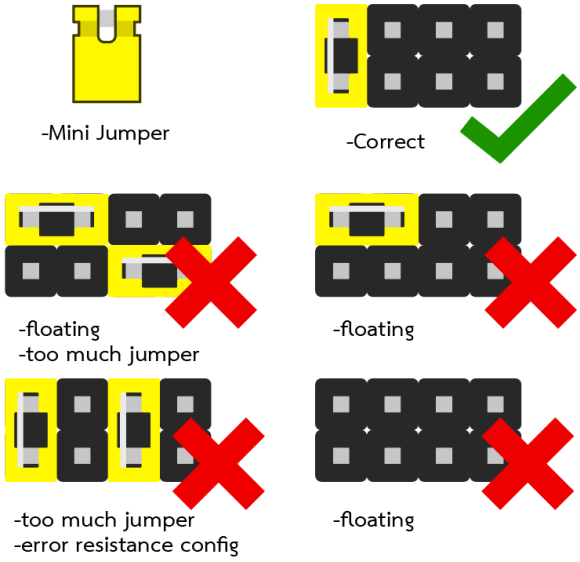
LM1501 module

Using switch **S3, S5, S7, S8** to shut down (Turn ON/OFF) the switching regulator circuit using logic level signals.

Use Mini Jumper to select the voltage. 5V, 12V, 19V is the default value. And Adjustable is another choice. The selector pins have 2 rows and 4 columns. Put "Only One" Mini Jumper on each regulated unit. Connect between row-1 & row-2 at any column in which the preferred voltage label is written.



The Selector pin



Warnings:

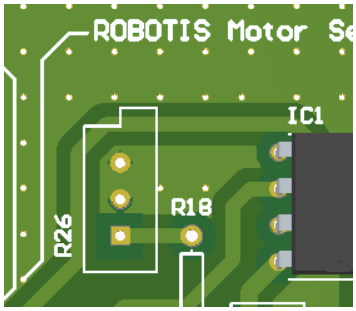
- Error voltage can occur when using more than one mini jumper. Because of uncorrectable resistance in the bulk-regulator circuit.
- Don't let the selector pin without one mini jumper. Also, don't put the jumper connect between columns (Not dangerous but errors happen). It causes a floating circuit in which errors can occur.

LM2576-12 module

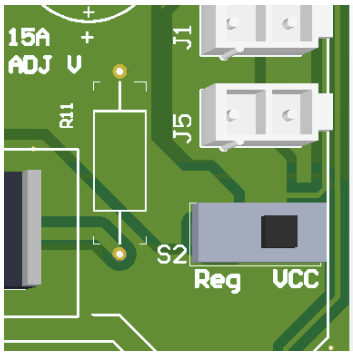
This module uses LM2576-12 as the regulator which regulates the fixed voltage at 12V 3A. No configuration has to do in this module.

Using switch **S4** to shut down (Turn ON/OFF) the switching regulator circuit using logic level signals.

LM338 module



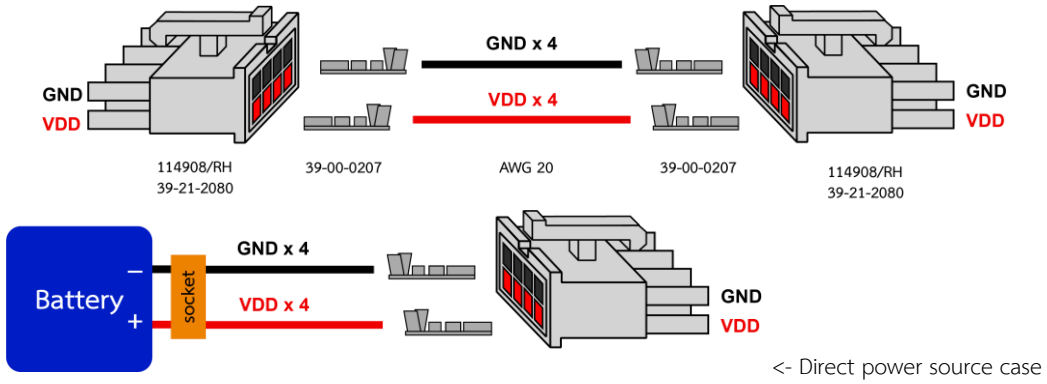
Adjustable voltage for each module can be adjusted by **R26, R54**. However, this part is designed to gain power for OpenMANIPULATOR P and ROBOTIS Power hub. So, 12V on the left and 24V on the right is the default parameter recommended.



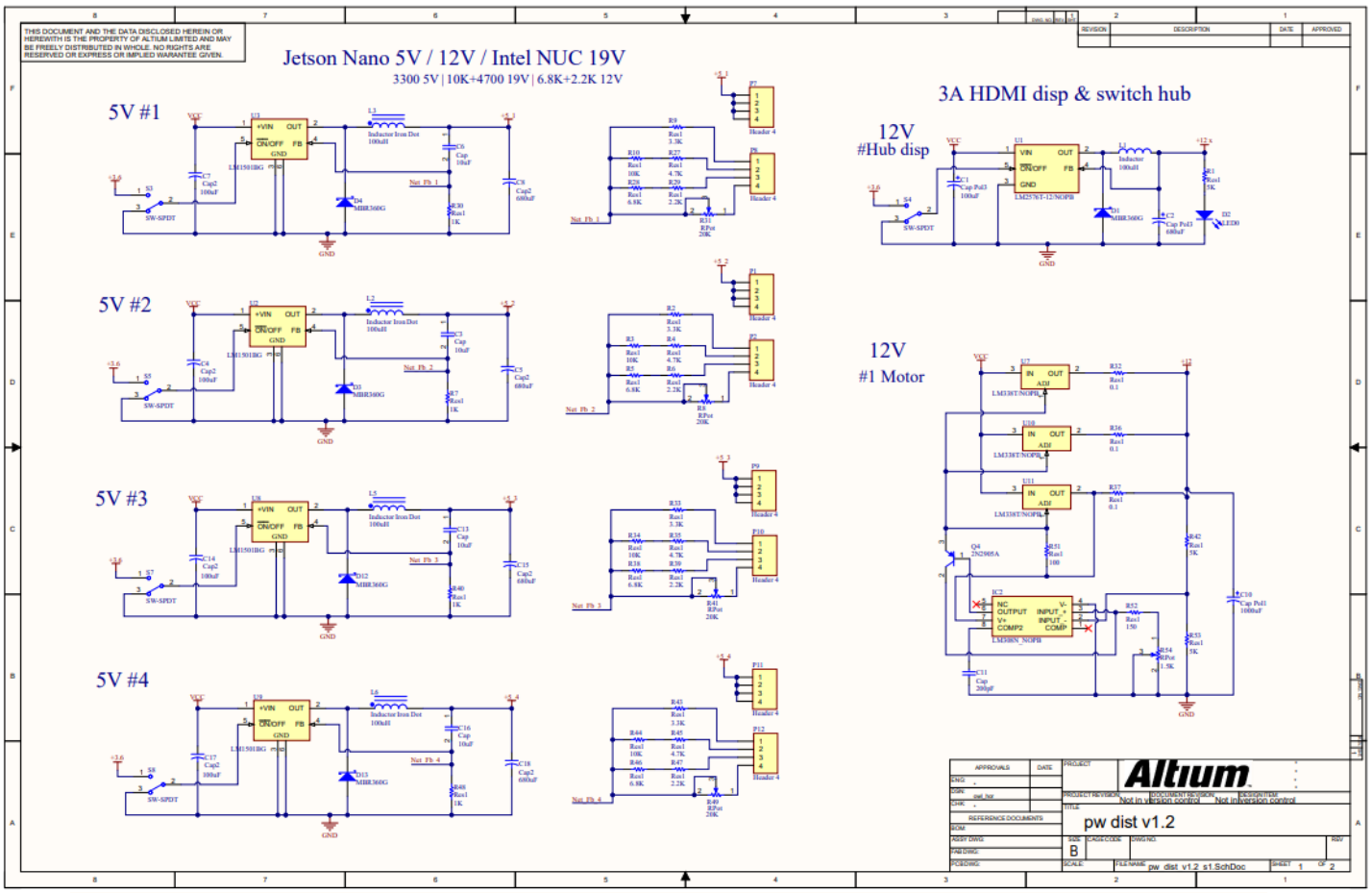
For #2 module on the right of the circuit board is designed specifically to gain power for OpenMANIPULATOR P. If voltage from the battery is too low which is nearly 24V, Use switch **S2** to change the source from this module to the battery voltage line directly instead.

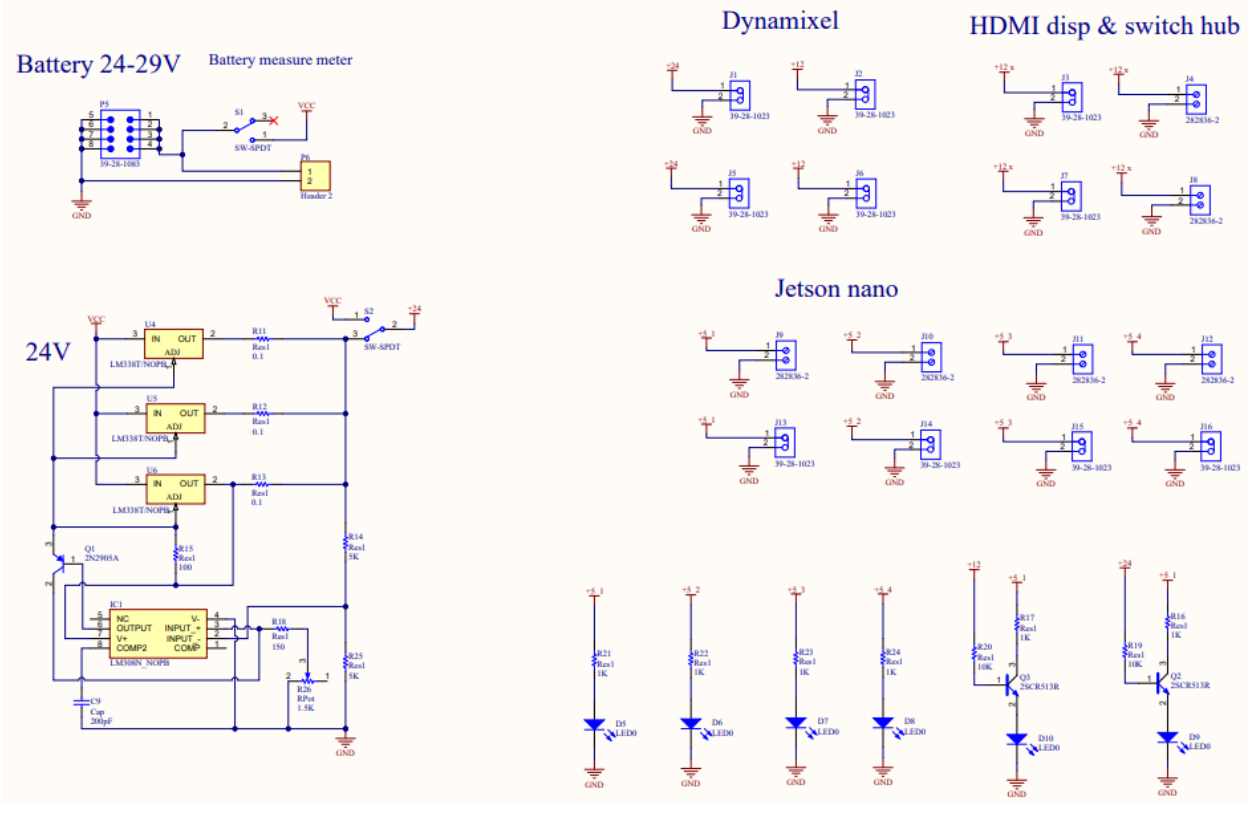
Terminal & Wire, Connector Information

Device	Wire socket In	Wire socket Out	Circuit board pin	Type	AWG
NVIDIA Jetson nano	5.5×2.1 male Jack	Molex : 39-01-2020 GTK : 114902/RH	Molex : 39-28-1023 GTK : 115102ST	W1	20
Intel NUC	5.5×2.1 male Jack	Molex : 39-01-2020 GTK : 114902/RH	Molex : 39-28-1023 GTK : 115102ST	W1	20
Switch hub	5.5×2.1 male Jack	Molex : 39-01-2020 GTK : 114902/RH	Molex : 39-28-1023 GTK : 115102ST	W1	20
15" HDMI display	3.5x1.5 male Jack	Molex : 39-01-2020 GTK : 114902/RH	Molex : 39-28-1023 GTK : 115102ST	W1	20
U2D2 Power hub	Molex : 39-01-2020 GTK : 114902/RH	Molex : 39-01-2020 GTK : 114902/RH	Molex : 39-28-1023 GTK : 115102ST	W2	20
Open MANIPULATOR P	Molex : 39-01-2020 GTK : 114902/RH	Molex : 39-01-2020 GTK : 114902/RH	Molex : 39-28-1023 GTK : 115102ST	W2	20
OF-TMSRK-64-CT011 (control), Battery	Molex : 39-01-2080 GTK : 114908/RH	Molex : 39-01-2080 GTK : 114908/RH	Molex : 39-28-1083 GTK : 115008ST/RH	W3	20

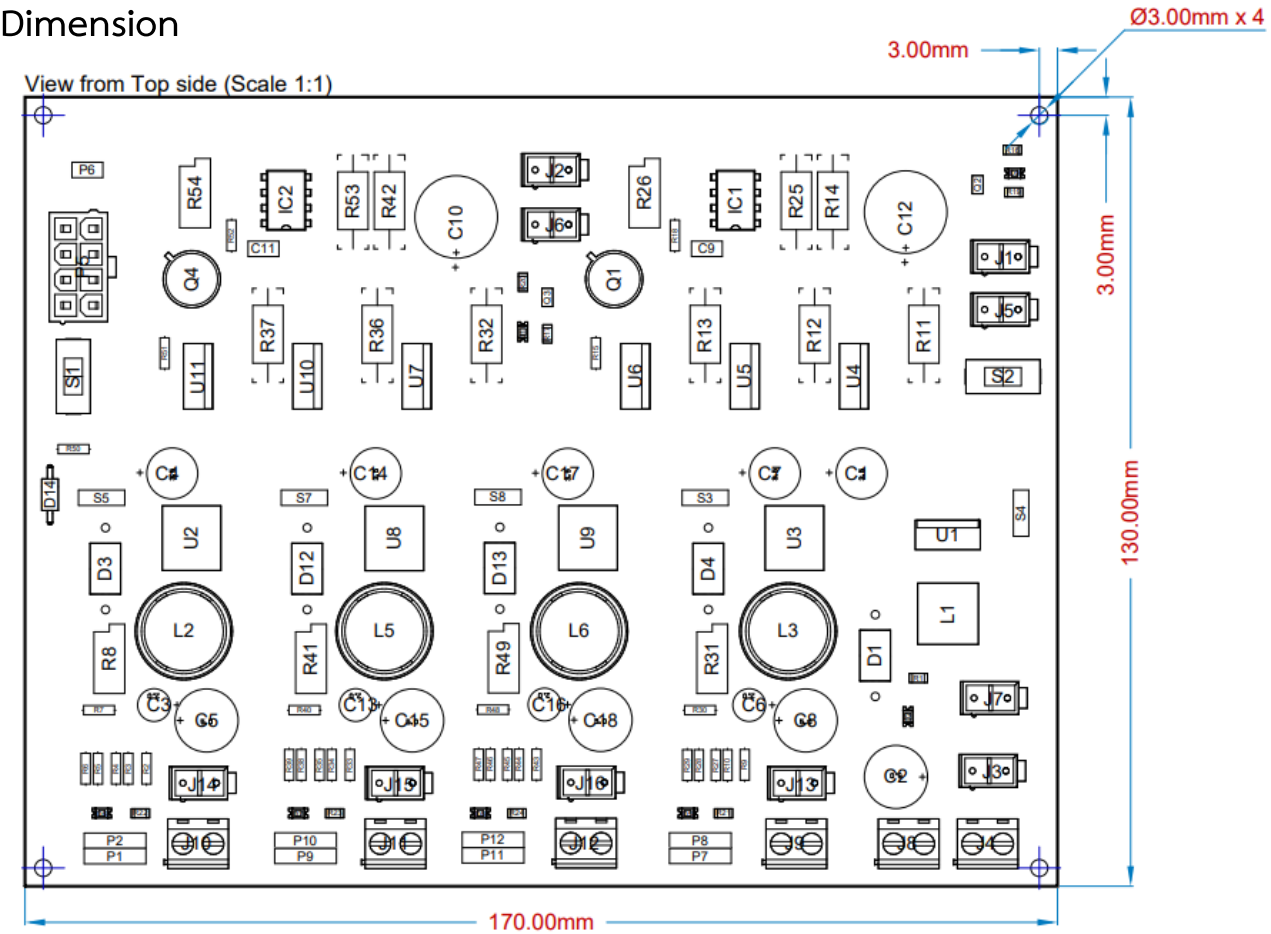
Wire Type	Picture
W1	
W2	
W3	

Schematics


Jetson Nano 5V / 12V / Intel NUC 19V
3300 5V | 10K+4700 19V | 6.8K+2.2K 12V
5V #1
5V #2
5V #3
5V #4
3A HDMI disp & switch hub
12V
#Hub disp
12V
#1 Motor
pw dist v1.2


Battery 24-29V
Battery measure meter
Dynamixel
HDMI disp & switch hub
24V
Jetson nano

Dimension



Bill of Materials

Comment	Description	Designator	Value	Qtt.
Cap Pol3	Polarized Capacitor (Surface Mount)	C1	100uF	1
Cap Pol3	Polarized Capacitor (Surface Mount)	C2	680uF	1
Cap	Capacitor	C3, C6, C13, C16	10uF	4
Cap2	Capacitor	C4, C7, C14, C17	100uF	4
Cap2	Capacitor	C5, C8, C15, C18	680uF	4
Cap	Capacitor	C9, C11	200pF	2
Cap Pol1	Polarized Capacitor (Radial)	C10, C12	1000uF	2
MBR360G	Axial Lead Rectifier, 60 V, 3 A, -65 to 150 degC, 2-Pin DO-201AD, RoHS, Bag	D1, D3, D4, D12, D13		5
LED0	Typical INFRARED GaAs LED	D2, D5, D6, D7, D8, D9, D10		7
1N4729A	Zener Diode, 3.6V, 1W, 5%, -65 to 200 degC, 2-Pin DO-41, Body 2.72 x 5.2 mm, RoHS	D14		1
LM308N_NOPB	Integrated Circuit	IC1, IC2		2
39-28-1023	Female Header, Pitch 4.2 mm, 1 x 2 Position, Height 12.8 mm, Tail Length 3.5 mm, -40 to 105 degC, RoHS	J1, J2, J3, J5, J6, J7, J13, J14, J15, J16		10
282836-2	Female Header, Pitch 5 mm, 1 x 2 Position, Height 10 mm, Tail Length 3.5 mm, Rohs, Bulk	J4, J8, J9, J10, J11, J12		6
Inductor	Inductor	L1	100uH	1

Inductor Iron Dot	Magnetic-Core Inductor with Winding Polarity Marking	L2, L3, L5, L6	100uH	4
Header 4	Header, 4-Pin	P1, P2, P7, P8, P9, P10, P11, P12		8
39-28-1083	4.2 mm Pitch Mini-Fit Jr.Power Connector, Through Hole, 8 Circuits, -40 to 105 degC, RoHS	P5		1
Header 2	Header, 2-Pin	P6		1
2N2905A	Small Singal PNP Transistor, 200 MHz, -65 to 175 degC, 3-Pin TO-39, RoHS	Q1, Q4		2
2SCR513R	NPN 10A 50V Middle power Transistor	Q2, Q3		2
Res1	Resistor	R1, R21, R22, R23, R24	5KΩ	5
Res1	Resistor	R2, R9, R33, R43	3.3KΩ	4
Res1	Resistor	R3, R10, R34, R44	10KΩ	4
Res1	Resistor	R4, R27, R35, R45	4.7KΩ	4
Res1	Resistor	R5, R28, R38, R46	6.8KΩ	4
Res1	Resistor	R6, R29, R39, R47, R50	2.2KΩ	5
Res1	Resistor	R7, R30, R40, R48	1KΩ	4
RPot	Potentiometer	R8, R31, R41, R49	20KΩ	4
Res1	Resistor	R11, R12, R13, R32, R36, R37	0.1Ω	6
Res1	Resistor	R14, R25, R42, R53	5KΩ	4
Res1	Resistor	R15, R51	100Ω	2
Res1	Resistor	R16, R17	1KΩ	2
Res1	Resistor	R18, R52	150Ω	2
Res1	Resistor	R19, R20	10KΩ	2
RPot	Potentiometer	R26, R54	1.5KΩ	2
SW-SPDT	SPDT Subminiature Toggle Switch, Right Angle Mounting, Vertical Actuation	S1, S2		2
SW-SPDT	SPDT Subminiature Toggle Switch, Right Angle Mounting, Vertical Actuation	S3, S4, S5, S7, S8		5
LM2576T-12/NOPB	SIMPLE SWITCHER® 3A Step-Down Voltage Regulator, 5-pin TO-220, Pb-Free	U1		1
LM1501BG	Simple Switcher(R) Power Converter 150 kHz Step-Down Voltage Regulator, 5 A, 4.5 to 40 V, -40 to 125 degC,	U2, U3, U8, U9		4
LM338T/NOPB	5 Amp Adjustable Regulator, 3-pin TO-220, Pb-Free	U4, U5, U6, U7, U10, U11		6
Mini Jumper	For voltage select in LM1501 Module.			4

Disclaimer

This circuit board is a part of of "Teleoperated Mobile Manipulation" ("Smart Rod Khen") Project. Which is a project of the Human-Computer Interface (HCI) lab. Institute of Field Robotics, King Mongkut's University of Technology Thonburi, Thailand. This circuit is designed by Altium Designer (Student License). Academic use purpose. Commercial use is unacceptable.

This circuit board is a student project design. So, some usage problems might have occurred. Such as error concept design, transmission line length, ground plate, etc. Industrial standards are unclaimed in this model.

Using a power source which not in range of recommended rating is a risk to get dangerous, breaking components, or underrating power.

Using different components, parameters from specifying in this datasheet might cause altered voltage or unusable circuits. More Information about electrical characteristics for each IC is available on each own datasheet.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

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PCB Design Software: Altium Designer 21 (Student License)

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