MCU Car Kit, Ver.5.1

Motor Drive Board, Ver.5 Assembly Manual

Version 1.01 [ANDTR100]

March 2014

Renesas MCU Car Rally Secretariat

Important Notice (Revision 1.2)

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Contents

1. Outline

This is the Motor Drive Board Ver.5 Assembly Manual for MCU Car Kit Ver.5.1.
This board is mounted in the MCU car kit and has the following features:

- It can drive two motors in forward, reverse, or brake mode.
- It can control one servo.
- It can control the on/off states of two LEDs.
- It can detect the state of a single pushbutton switch.
- It can increase the number of batteries added to the motor drive board ver.5 up to eight by adding the part "LM350 Add-On Set (sold separately) ." The standard configuration of the MCU car kit supplies four batteries to the motor drive board. Motor rotation speed is proportional to the voltage, so if the motor drive board is supplied the voltage of eight batteries in series by adding this add-on set, the motor rotation speed will be two times faster.

Motor Drive Board Ver.5 has two kinds of sets. The following table shows descriptions of the sets:

Set Name	Description	Reference Page for Assembly
Motor Drive Board Set Ver.5	The basic board set	Board Assembly
1. LM350 Add-On Set	The standard power configuration of the MCU car kit has four batteries in the control system (MCU board) and four batteries in the drive system (motor drive board ver.5). If you want faster motor rotation speed, make the voltage applied to motor drive board ver.5 7.2 – 9.6 V supplied from six to eight batteries in series. Since the maximum voltage of the MCU board is 5.5 V and that of the servo is 6 V, it will break if these voltages are applied directly. Therefore, use a three-terminal regulator to keep 5 V applied to the control system (including the MCU board) and 6 V applied to the servo. This set provides the circuit for implementing the above.	LM350 Add-On Set (Using 6 or more Batteries in Series)

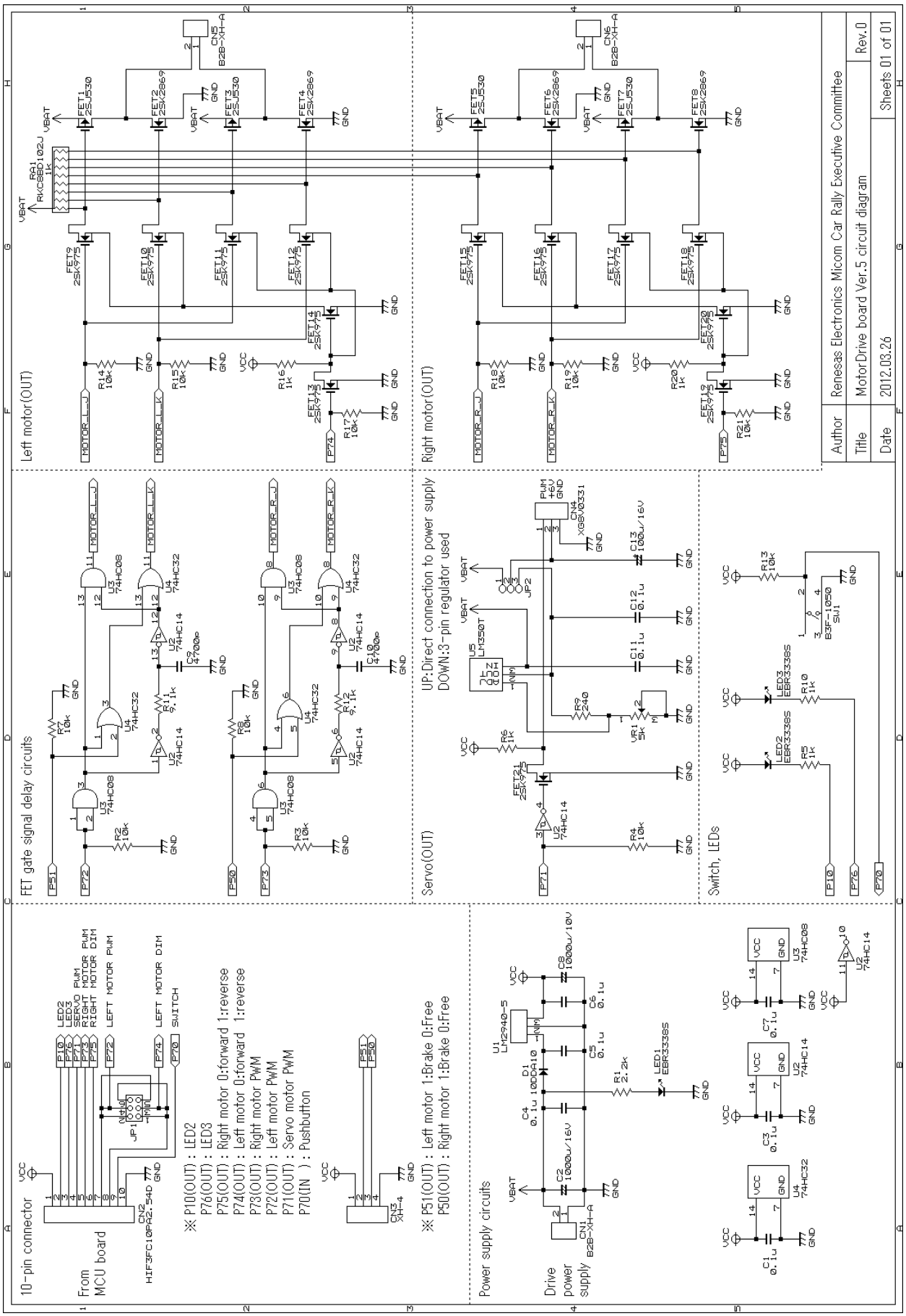
2. Specifications

2.1. Specifications

The following shows specifications of motor drive board ver.5.

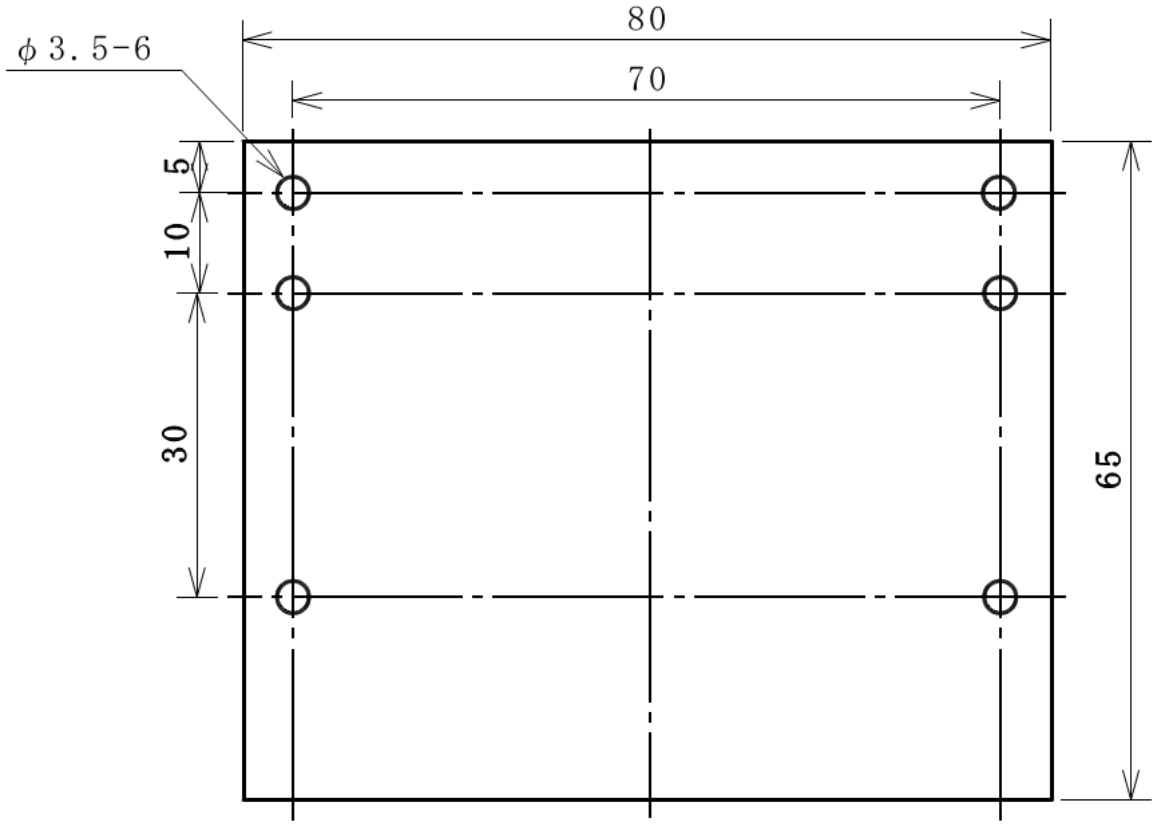
	Motor Drive Board Ver.5
Abbreviated	Drive Board 5
Number of Parts	Parts with lead wire: Approximate 66 The interval between the pins of the parts is more than 2.54 mm.
Controllable Motors	2 （Left motor and right motor）
Controllable Servo	1
LEDs that can be turned on/off by program	2
Pushbutton Switch	1
Control System Voltage (Voltage that can be added to the CN2)	DC5.0V±10%
Drive System Voltage (Voltage that can be added to the CN1)	4.5 - 5.5 V or 7 - 15 V If over 7 V, need to use the LM350 Add-On Set to make the voltage applied to the servo 6 V and the voltage applied to the MCU board 5 V.
Servo, Motor Control Period	Motor: 16 ms Servo: 16 ms Unable to set individually
Board dimensions	W80 × D65 × T1.6 mm
Completed dimensions (Actual measured dimensions)	W80 × D65 × H20 mm
Weight	Approximate 35 g *Varies depending on amount of solder and lead wire length

2.2. Circuit Diagram



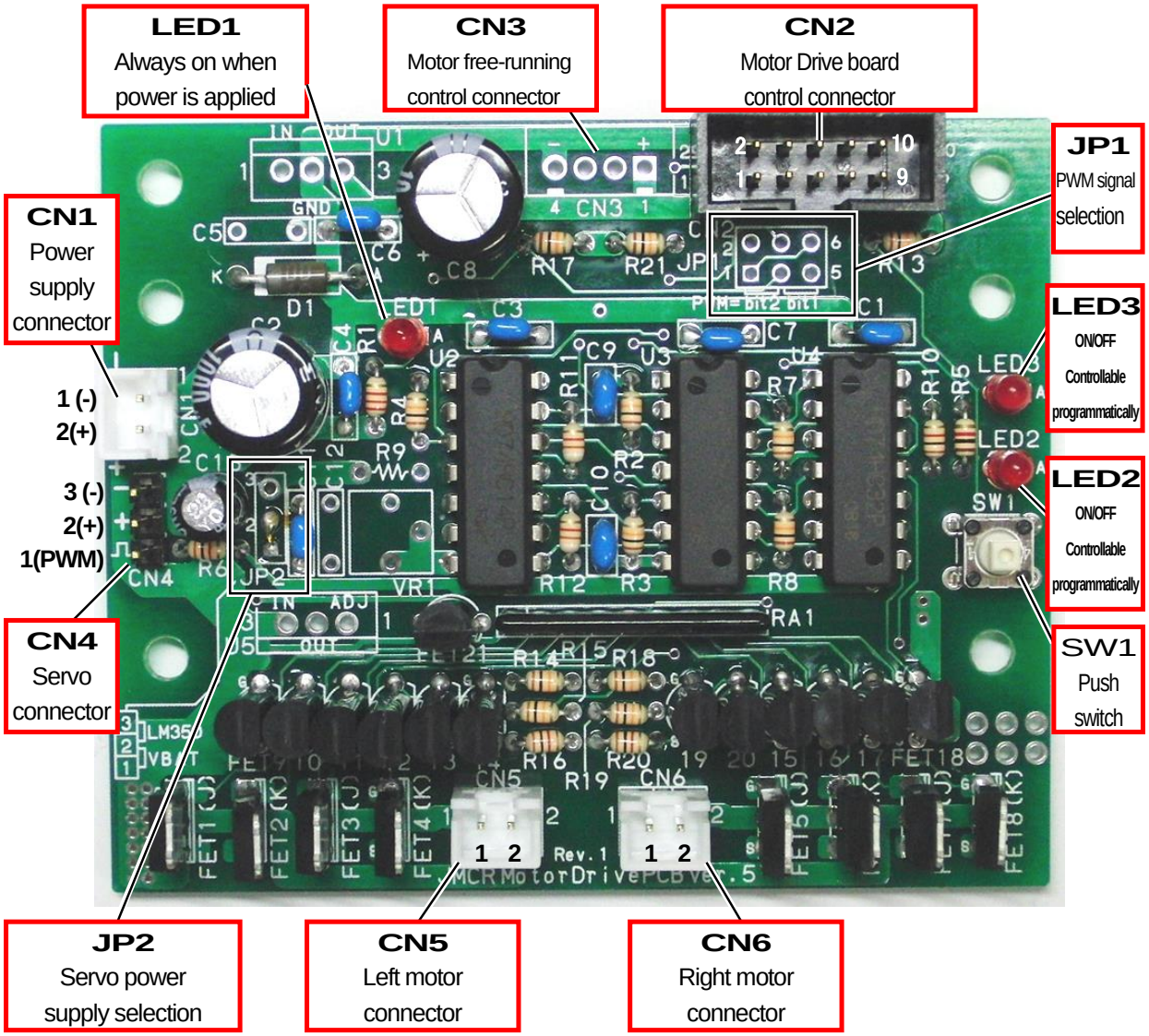
2.3. Board Dimensions

There are 6 mounting holes on the board. Use these mounting holes to mount Motor Drive Board Ver.5 to the MCU Car Kit.



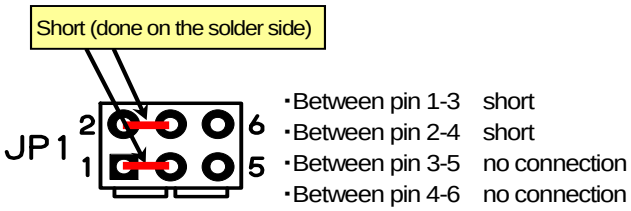
2.4. Appearance

The figure below shows the visual appearance of the board.

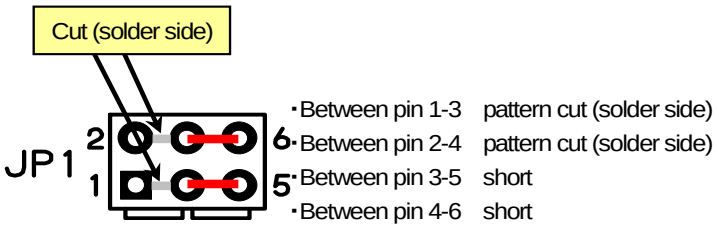


The following table lists the connector connections and the contents carried by these signals.

<table>
<tr><th>Part No.</th><th>Connection</th><th>Pin</th><th>Description</th></tr>
<tr><td rowspan="2">CN1</td><td rowspan="2">Power supply input</td><td>1</td><td>GND</td></tr>
<tr><td>2</td><td>The + power supply connection (4.5 - 5.5 V or 7 V - 15 V)
If over 7 V, need to insert “LM350 Add-On Set.”</td></tr>
<tr><td>CN2</td><td>Connected to the microcontroller board</td><td>1-10</td><td>See next item</td></tr>
<tr><td rowspan="4">CN3</td><td rowspan="4">Connected to the microcontroller board</td><td>1</td><td>+5V</td></tr>
<tr><td>2</td><td>Left motor stop state selection. 1: Free, 0: Brake</td></tr>
<tr><td>3</td><td>Right motor stop state selection. 1: Free, 0: Brake</td></tr>
<tr><td>4</td><td>GND</td></tr>
<tr><td rowspan="3">CN4</td><td rowspan="3">Servo</td><td>1</td><td>Servo PWM signal output</td></tr>
<tr><td>2</td><td>Servo power supply (6 V output)</td></tr>
<tr><td>3</td><td>GND</td></tr>
<tr><td>CN5</td><td>Left motor</td><td>1,2</td><td>Left motor output</td></tr>
<tr><td>CN6</td><td>Right motor</td><td>1,2</td><td>Right motor output</td></tr>
<tr><td>JP1</td><td>PWM signal selection of left motor</td><td>1-6</td><td>This jumper switches PWM output terminal and direction selection terminal.

●RY_R8C38 Board
 

Note: It has been short-circuited on the solder side.
No need to do in anything in particular.

●RY3048FoneBoard
 
</td></tr>
</table>

JP2	Servo power supply switching	1-3	This jumper switches the source for power supply to the servo power supply pin (pin 2 on CN2). ●If the supply voltage supplied to CN1 is less than 6 V Short between pins 1 – 2. CN1 power is connected to pin2 of CN2 directly. ●If the supply voltage supplied to CN1 is more than 6 V Install the parts from the “LM350 Add-On Set” (sold separately) and short between pins 2 – 3 because this exceeds the voltage that can be applied to the servo. Voltage of 6 V will be supplied to pin2 of CN2 through LM350 (three-terminal regulator).

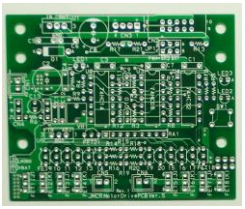
3. Assembling the Board

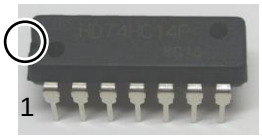
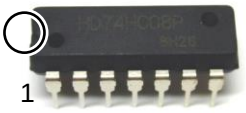
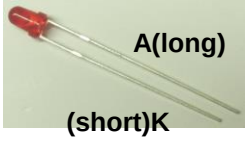
The items required to assemble the sensor board Ver.5 are listed below.

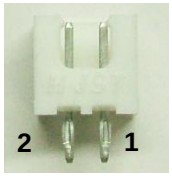
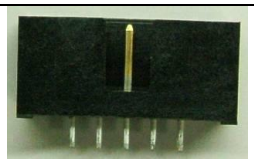
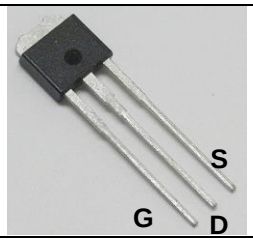
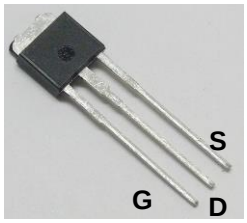
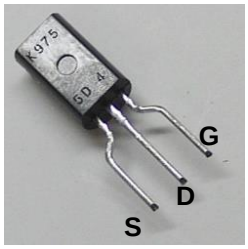
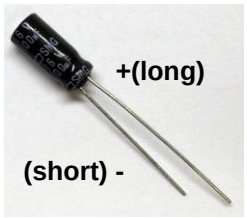
Miniature nippers		Used to cut lead wires.
Miniature cutting pliers		Used to bend lead wires and hold parts in place.
Wire stripper		Used to peel the covering of the wires.
Crimping pliers		Used to crimp of the contact pin of the connector.
Tweezers		Used to hold parts.

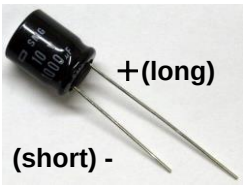
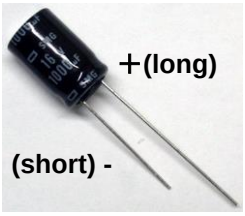
Soldering iron	 	Used to solder parts to the board. A soldering iron rated at about 50～100 watts should be sufficient.
Scissors		Used to cut the bag of the set.
Tester		Used to adjust the servo voltage when added the LM350 additional set.

3.1. Table of Parts

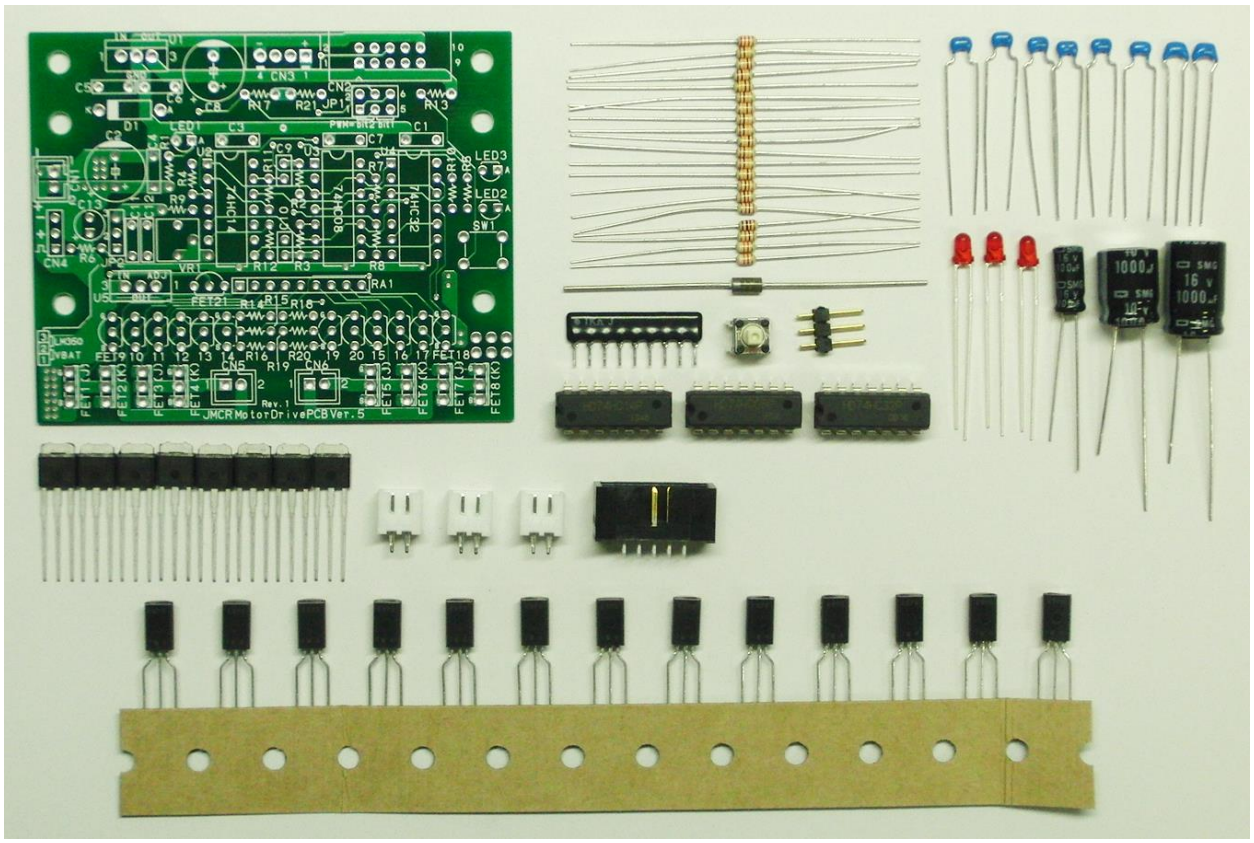
Part No.	Name	Model	Photo	Manufacturer	Q'ty
	Main Board	80×65×1.6t			1
R1	Resistor	CFS1/4C 2.2kΩ (red-red-red-gold)		KOA Corporation	1
R2,3,4,7,8, 13,14,15,17, 18,19,21	Resistor	CFS1/4C 10kΩ (red-black-orange-gold)		KOA Corporation	12
R5,6,10,16, 20	Resistor	CFS1/4C 1kΩ (brown-black-red-gold)		KOA Corporation	5

R11,12	Resistor	CFS1/4C 9.1kΩ (white-brown-red-gold)		KOA Corporation	2
U2	IC (DIP)	74HC14AF	 The pin in front of the indentation (marked ○) is 1pin	Renesas Electronics Corporation	1
U3	IC (DIP type)	74HC08AF	 The pin in front of the indentation (marked ○) is pin 1	Renesas Electronics Corporation	1
U4	IC (DIP type)	74HC32AF	 The pin in front of the indentation (marked ○) is pin 1	Renesas Electronics Corporation	1
D1	Diode	10DDA10	 The marked end is K	Nihon Inter Electronics Corporation	1
C1,3,4, 6,7,11	Laminated ceramic capacitor	RPEF11H104Z2K1A01B 0.1 μF (104) 5.08 mm pitch		Murata Manufacturing Co., Ltd.	6
C9,10	Ceramic capacitor	4700 pF (472) 2.54 mm pitch		Available from various manufacturer	2
RA1	Resistor array	RKC8BD102J 1 kΩ (102) 8 elements, 1 common	 The● mark at the 1pin	KOA Corporation	1
LED1,2,3	LED	EBR3338S 3 mm diameter, red		Stanley Electric Co.	3

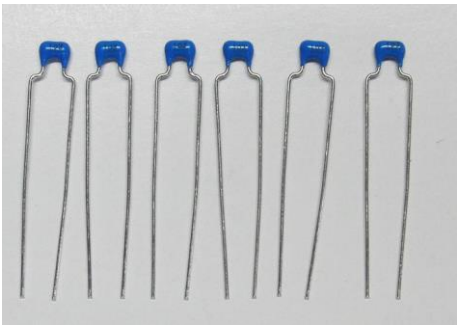
SW1	Pushbutton switch Note: This switch is also called a tactile switch. This manual uses the term push button switch.	B3F-1050		Omron Corporation	1
CN1,5,6	XH connector (2 pins); straight convex	B2B-XH-A		J.S.T. Mfg., Ltd.	3
CN4	3-pin connector	XG8V-0331		Omron Corporation	1
CN2	10-pin connector straight convex	HIF3FC10PA2.54DSA	 Pin 1 is indicated by a mark ▼	Hirose Electric Co., Ltd.	1
FET1,3,5,7	FET	2SJ530(L)		Renesas Electronics Corporation	4
FET2,4,6,8	FET	2SK2869(L)		Renesas Electronics Corporation	4
FET9,10,11, 12,13,14,15, 16,17,18,19, 20,21	FET	2SK975		Renesas Electronics Corporation	13
C13	Electrolytic capacitor	ESMG160E101ME11D 100uF/16V		Nippon Chemi-Con Corporation	1

C8	Electrolytic capacitor	ESMG100ELL102MJC5S 1000μF/10V		Nippon Chemi-Con Corporation	1
C2	Electrolytic capacitor	SMG160E102MJ16S 1000μF/16V		Nippon Chemi-Con Corporation	1
For mounting on the motor (These capacitors are not mounted on the board)	Ceramic capacitor	0.01 μF (103) 5.08 mm pitch		Available from various manufacturer	6

●Parts list



Attach six ceramic capacitors 0.01μF(103) to a motor directly, not to a board. Refer to "MCU Car Kit Body Assembly Manual" for how to attach it to the motor.



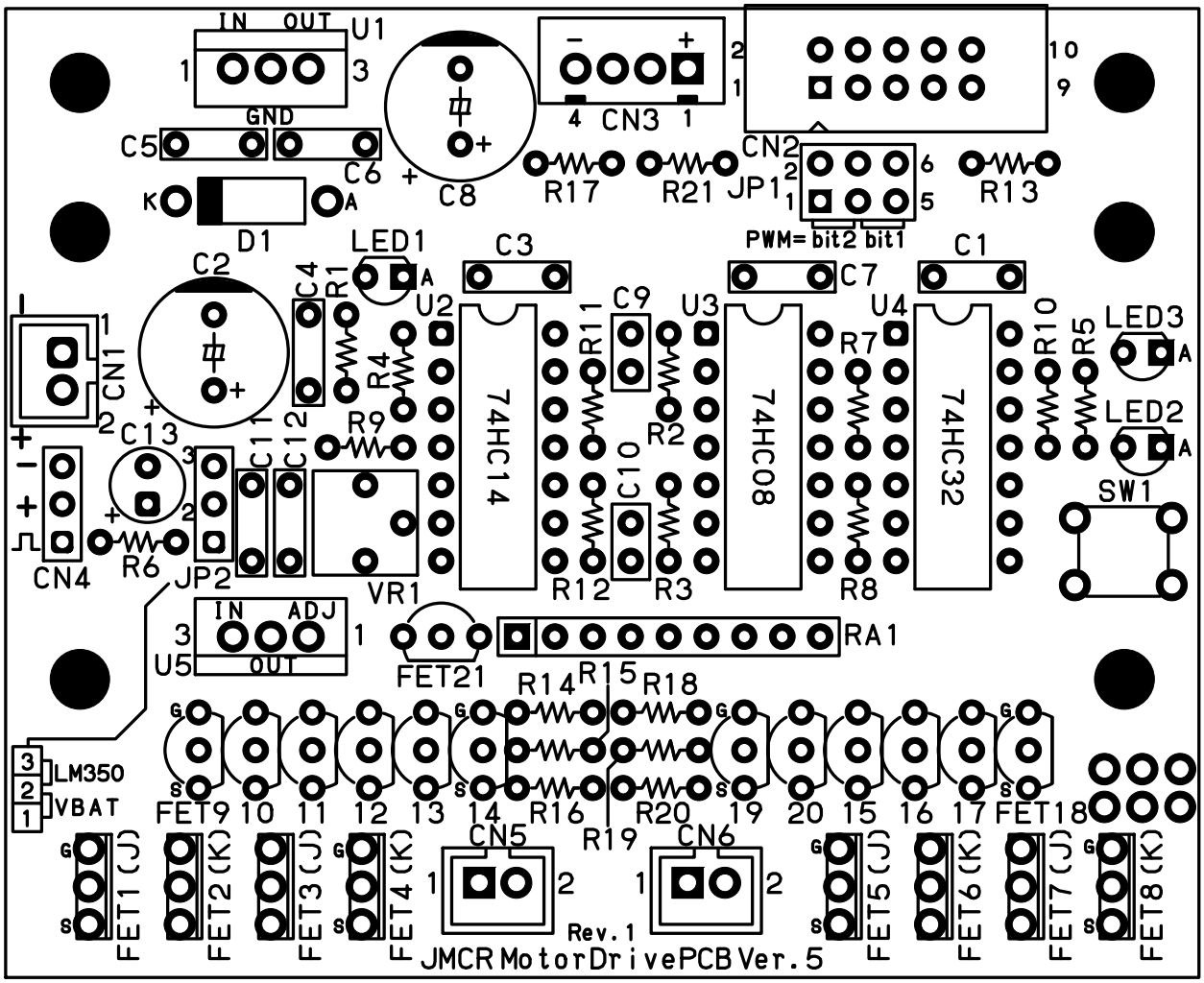
Note: The capacitors may vary in appearance from the above picture so be sure to check the numbers printed on the capacitor heads. Always refer to the written values rather than differentiating by visual appearance.

3.2. Other Necessary Parts Besides the Set

Name	Model	Specifics
Solder		The necessary length varies depending on the thickness; if the diameter is 0.6 mm a length of 5 m should be sufficient.

3.3. Part Side

The parts side has white characters on it. Attach the parts from this side.

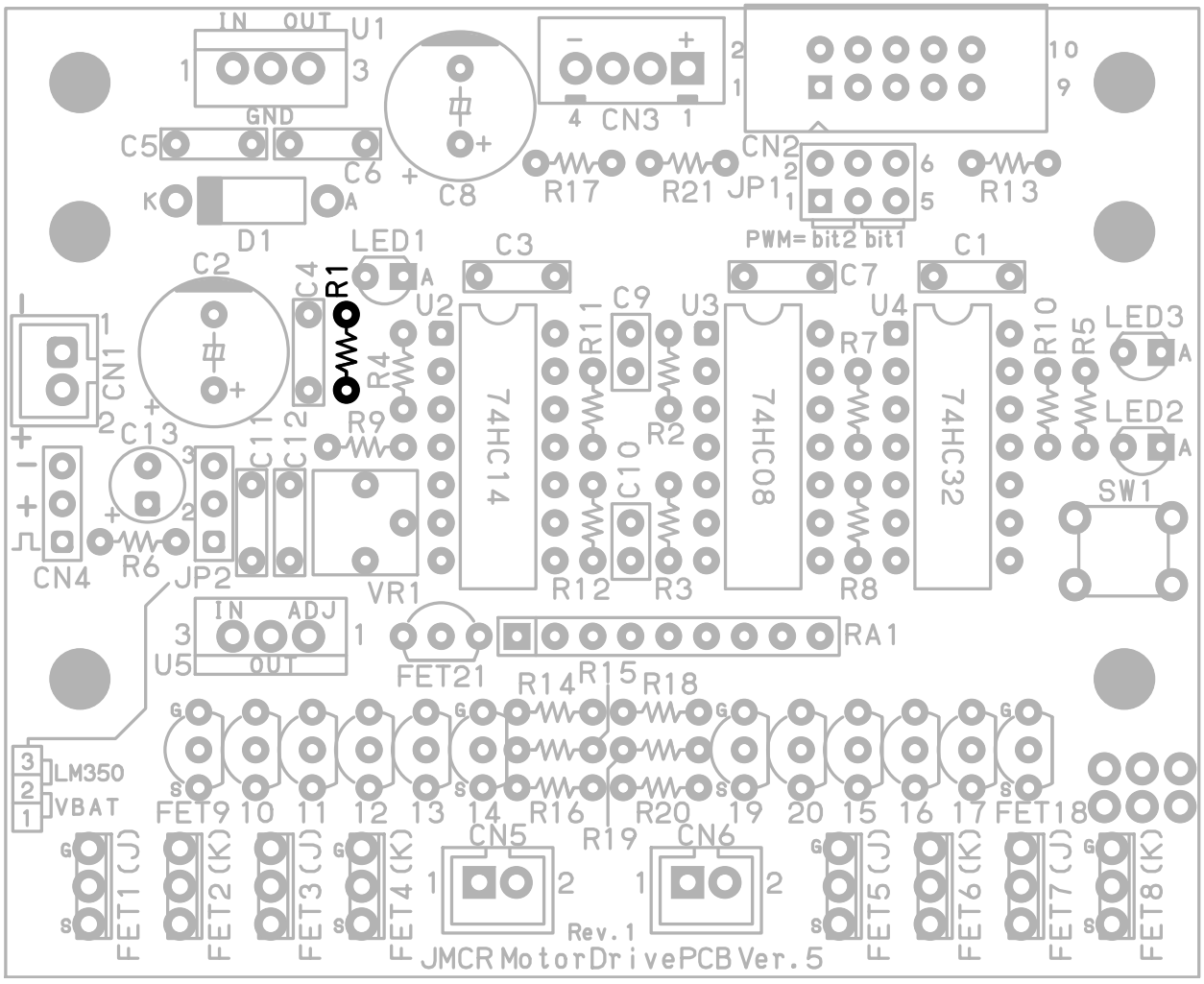


▲completed part

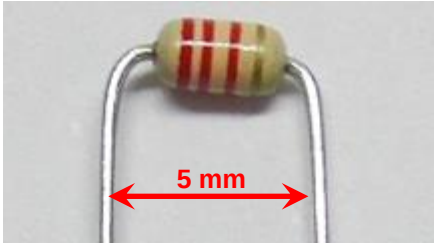
3.4. Mounting the Resistor(2.2kΩ)

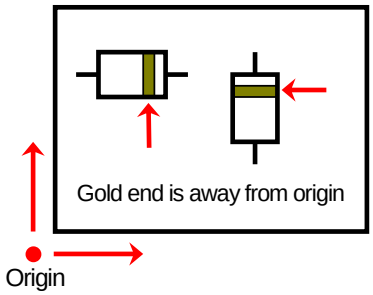
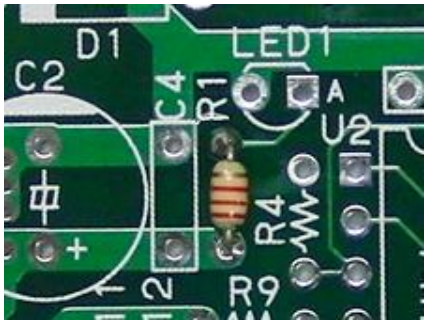
Part No.	Name	Model	Photo	Manufacturer	Q'ty
R1	Resistor	CFS1/4C 2.2 kΩ (red-red-red-gold)		KOA Corporation	1

Solder one resistor (2.2kΩ).



1		The resistors will be bent. Place a resistor with the leads pointing left and right.

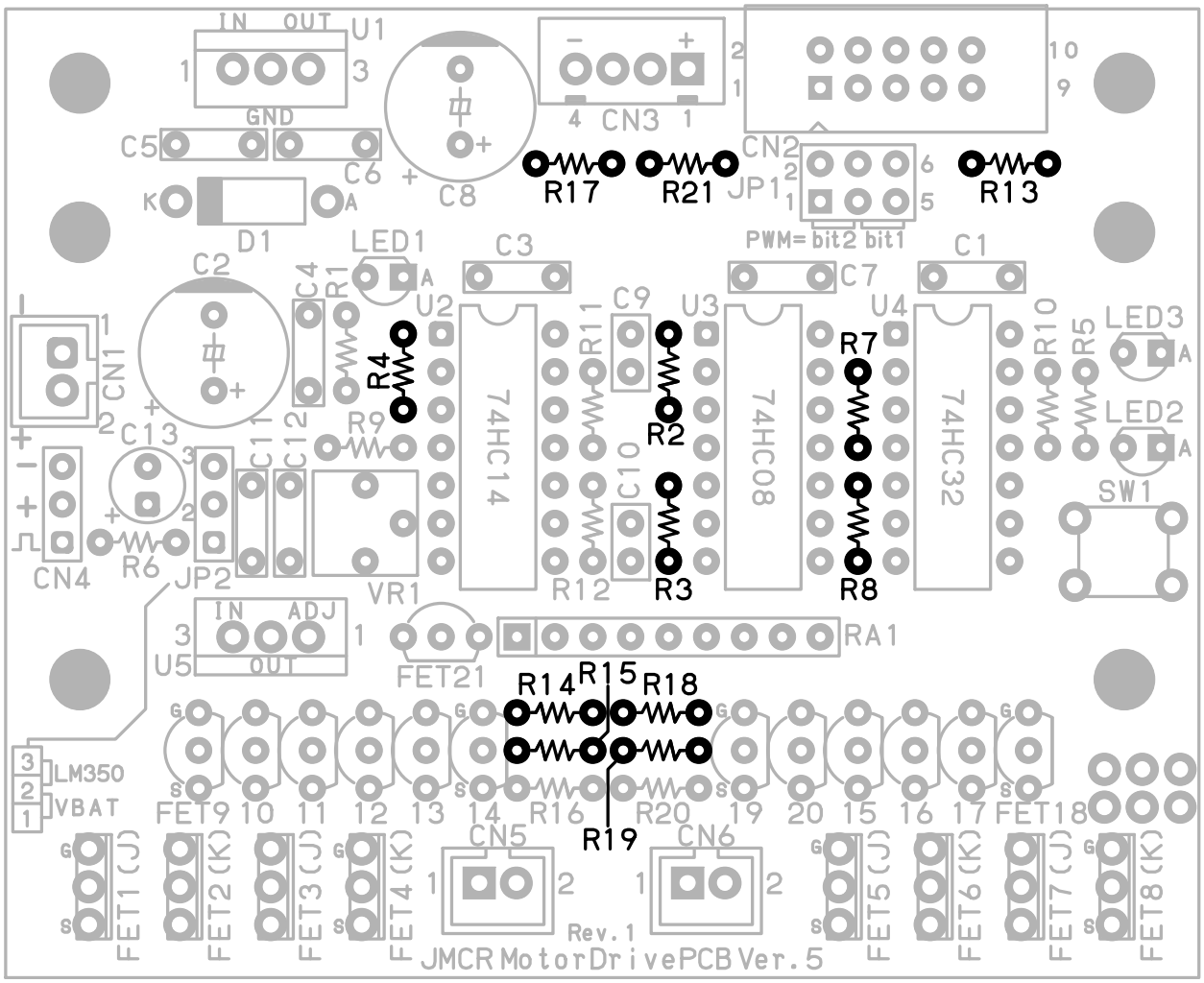
2		Bend the resistor into a U shape as shown in the photo. The gap between the leads should be 5 mm. (Do this for all resistors R1 to R21.)

3		Mounting the resistors: let the lower left corner of the board be the origin. Mount the resistors with the end that has the gold colour code away from the origin.
4		In the case of R1, the gold end is pointed up, away from the origin, as shown in the photo.

3.5. Mounting the Resistor(10kΩ)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
R2,3,4,7,8, 13,14,15,17, 18,19,21	Resistor	CFS1/4C 10kΩ (brown-black-orange-gold)		KOA Corporation	12

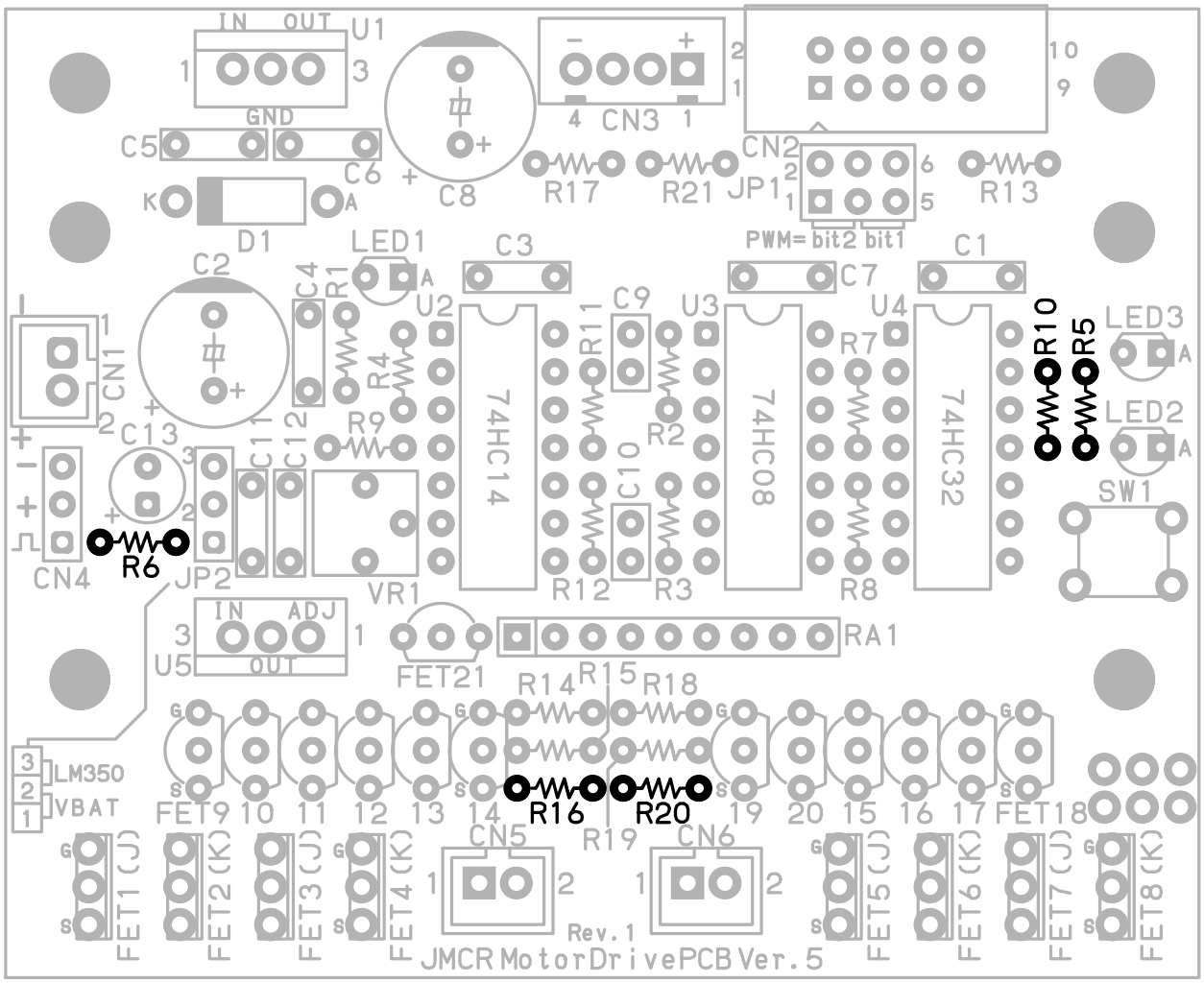
Solder the resistors (10 kΩ).



3.6. Mounting the Resistor(1kΩ)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
R5,6,10,16, 20	Resistor	CFS1/4C 1kΩ (brown-black-red-gold)		KOA Corporation	5

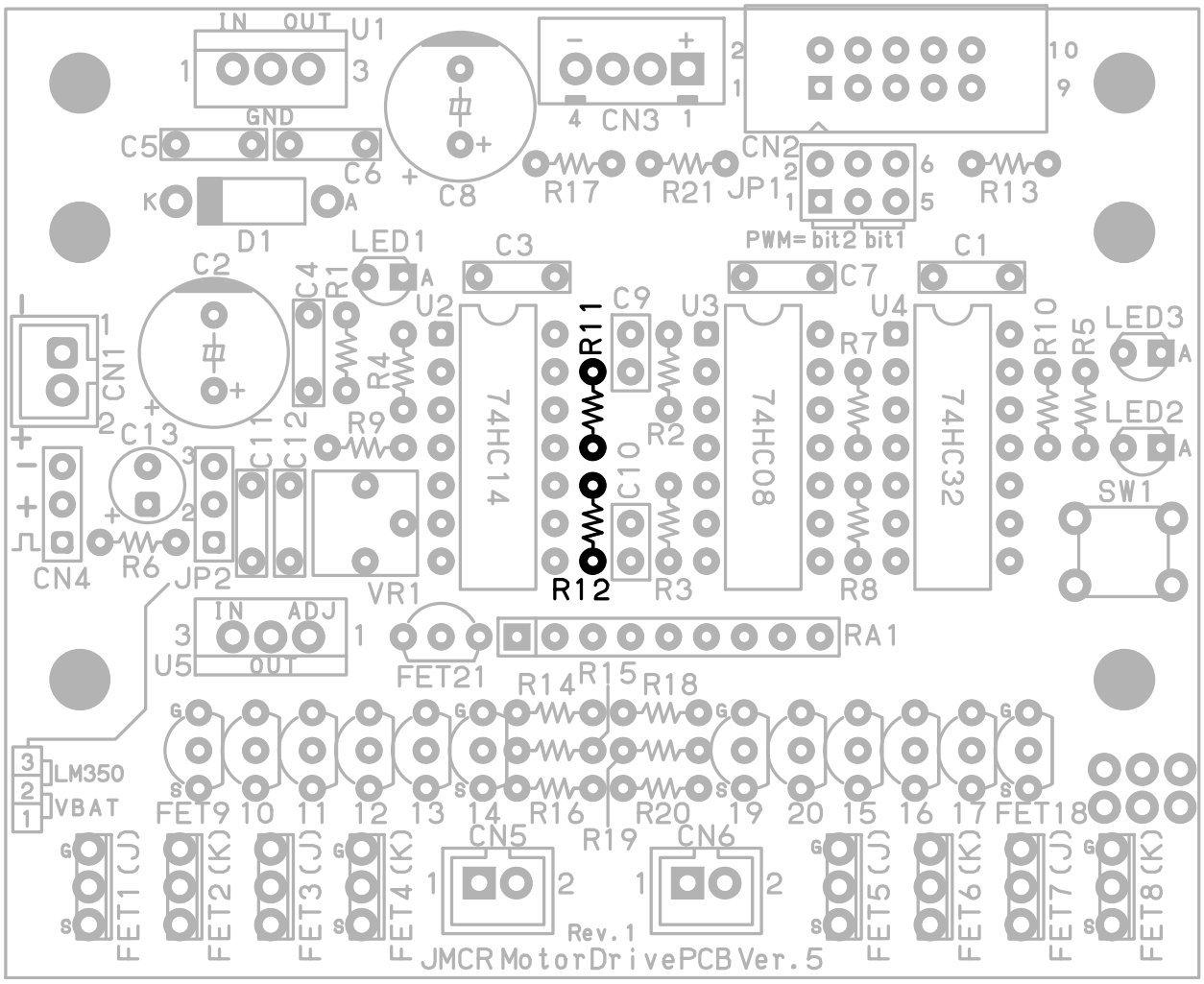
Solder the resistors (1 kΩ).



3.7. Mounting the Resistor (9.1kΩ)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
R11,12	Resistor	CFS1/4C 9.1kΩ (white-brown-red-gold)		KOA Corporation	2

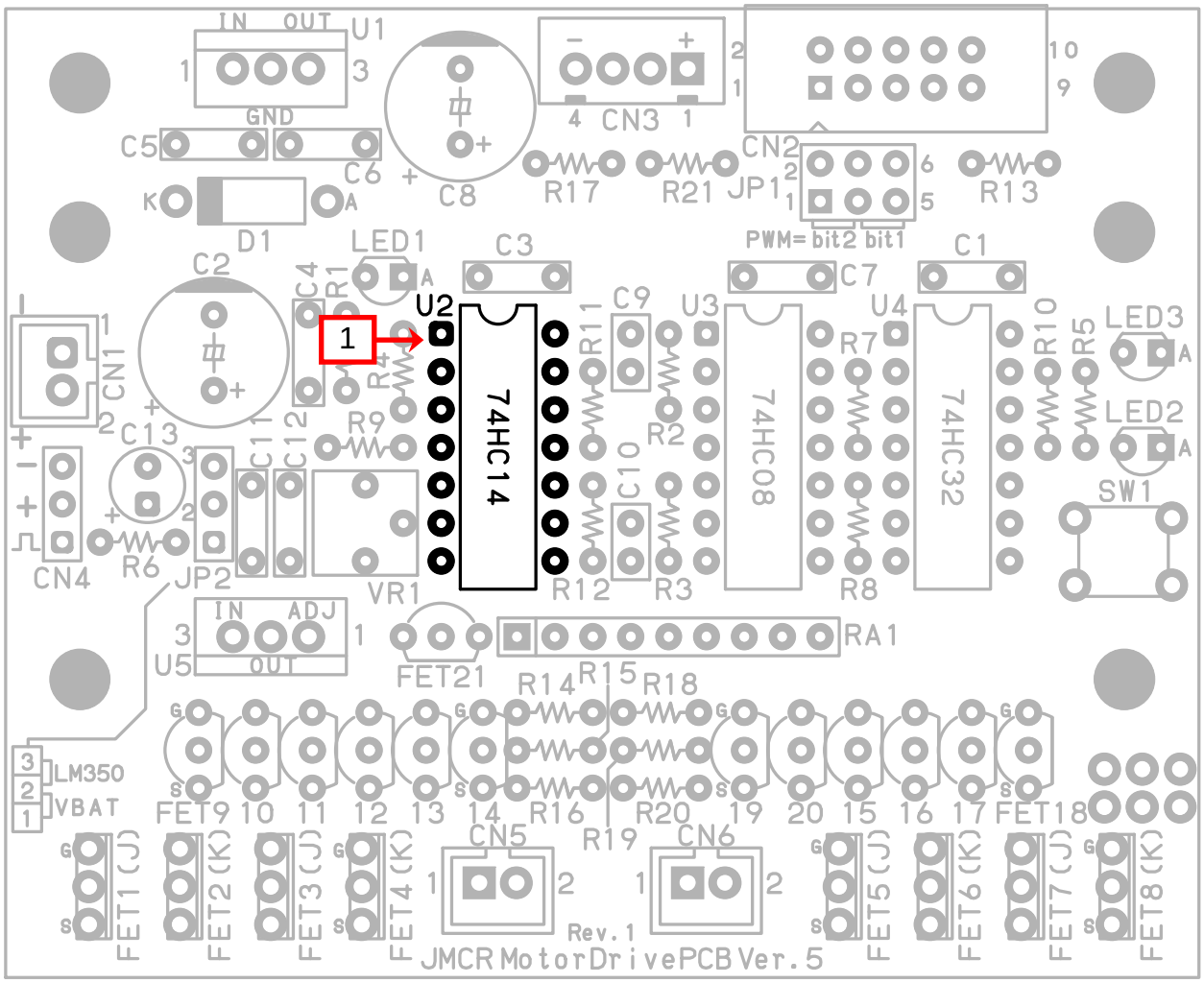
Solder the resistors (9.1 kΩ).

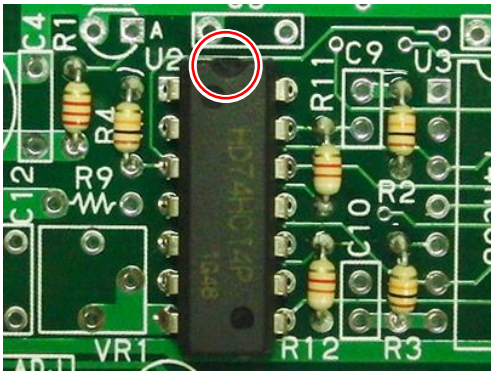


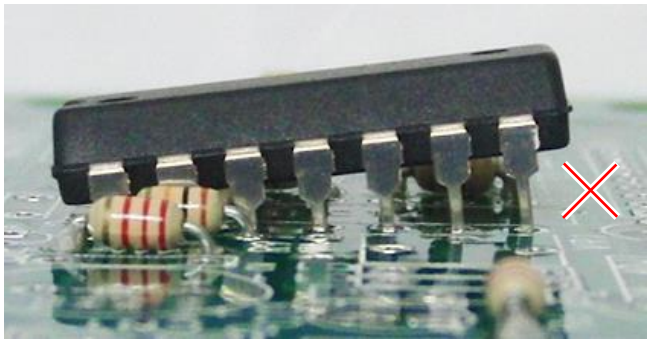
3.8. Mounting the IC(74HC14AP)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
U2	IC (DIP type)	74HC14AP	 The pin in front of the indentation (marked ○) is pin 1	Renesas Electronics Corporation	1

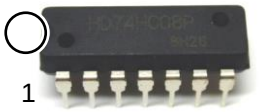
Solder the 74HC14AP. Pay attention to its orientation.



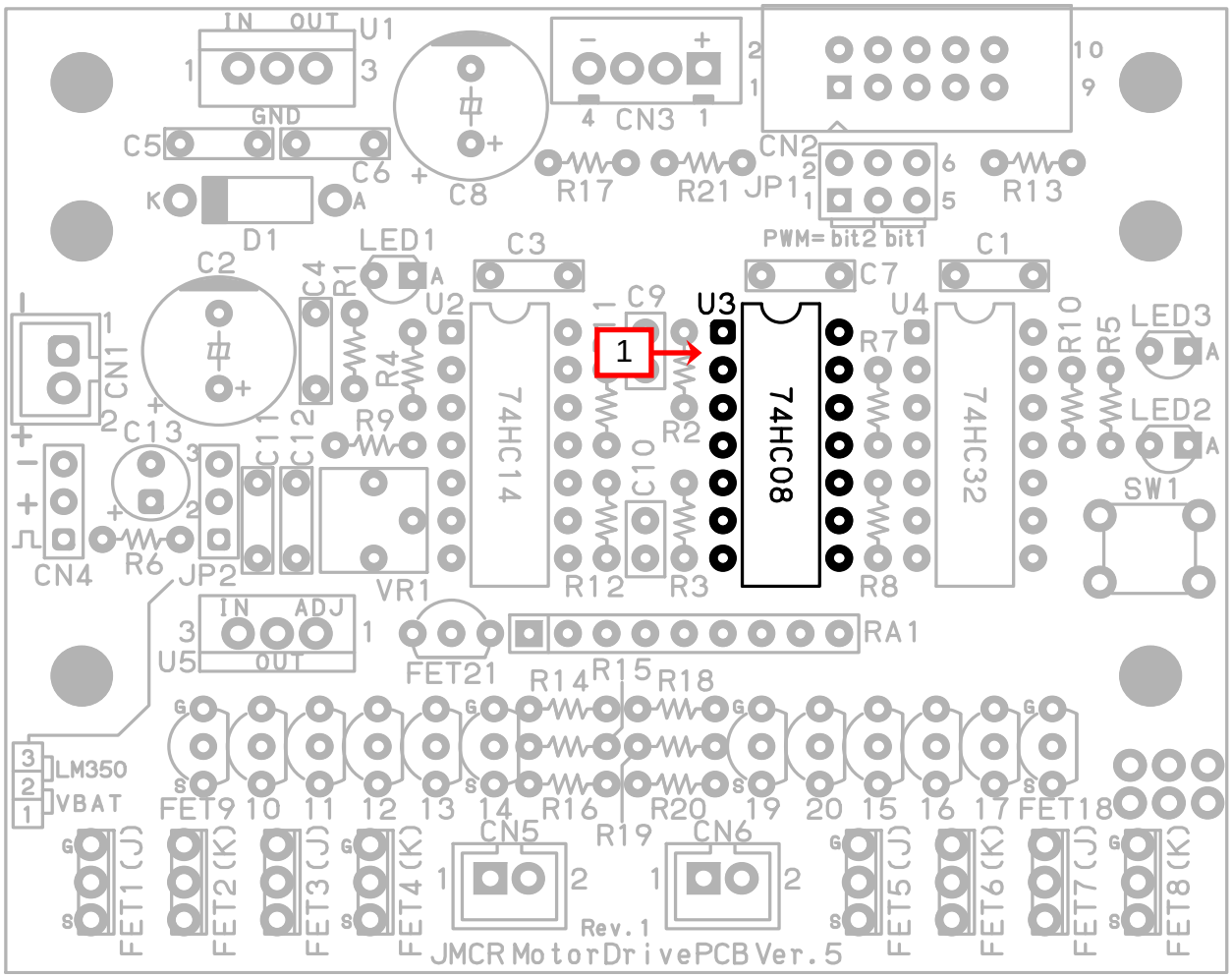
1		Implement it so that dent (○ part) of the IC matches a dent of the silk.

2		When mounting the IC, push the legs of all the pins as far down as possible. The photo is an example of INCORRECT mounting.

3.9. Mounting the IC(74HC08AP)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
U3	IC (DIP type)	74HC08AP	 1 The pin in front of the indentation (marked ○) is pin1	Renesas Electronics Corporation	1

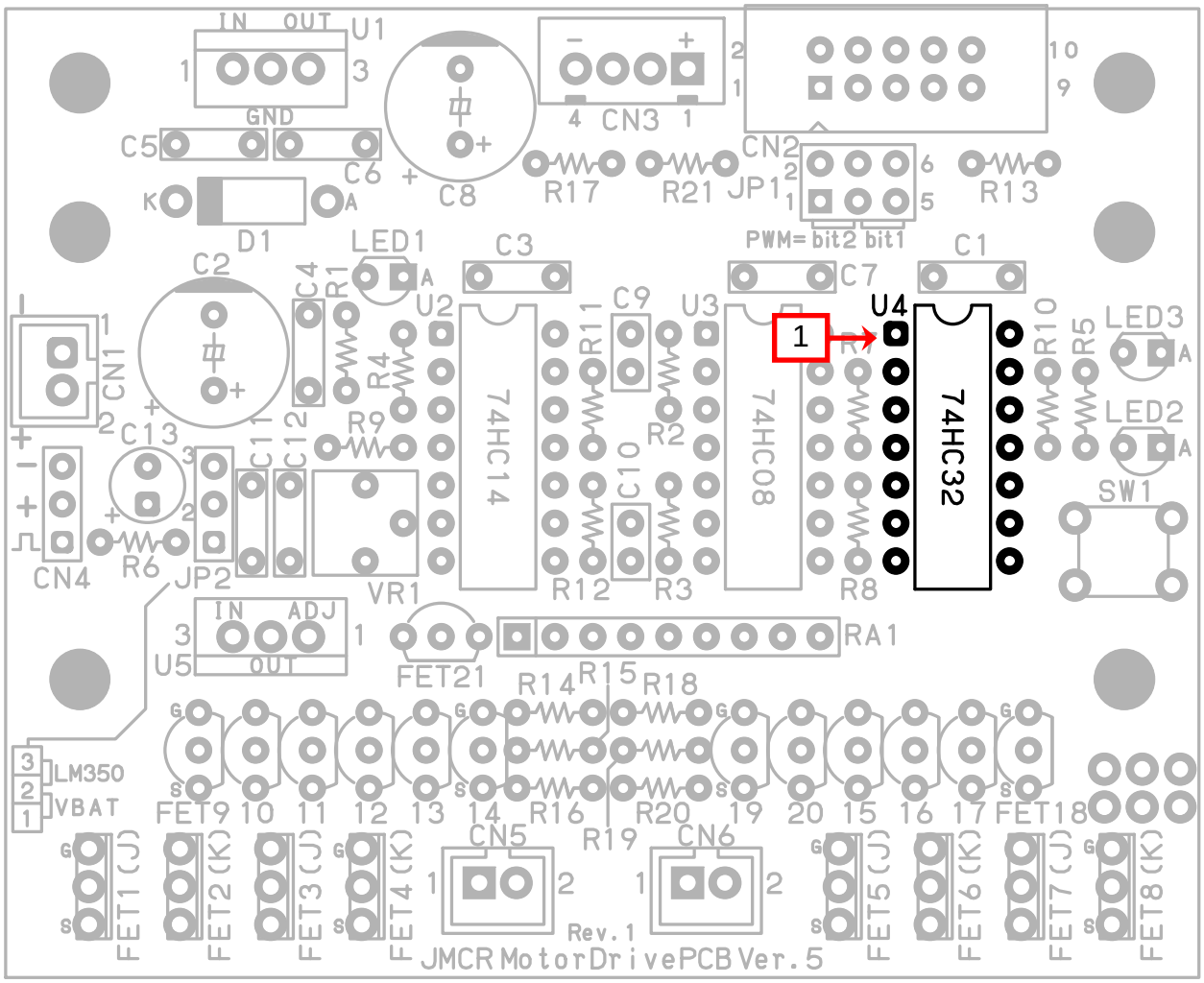
Solder the 74HC08AP. Pay attention to its orientation.



3.10. Mounting the IC(74HC32AP)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
U4	IC (DIP type)	74HC32AP	 The pin in front of the indentation (marked ○) is pin 1	Renesas Electronics Corporation	1

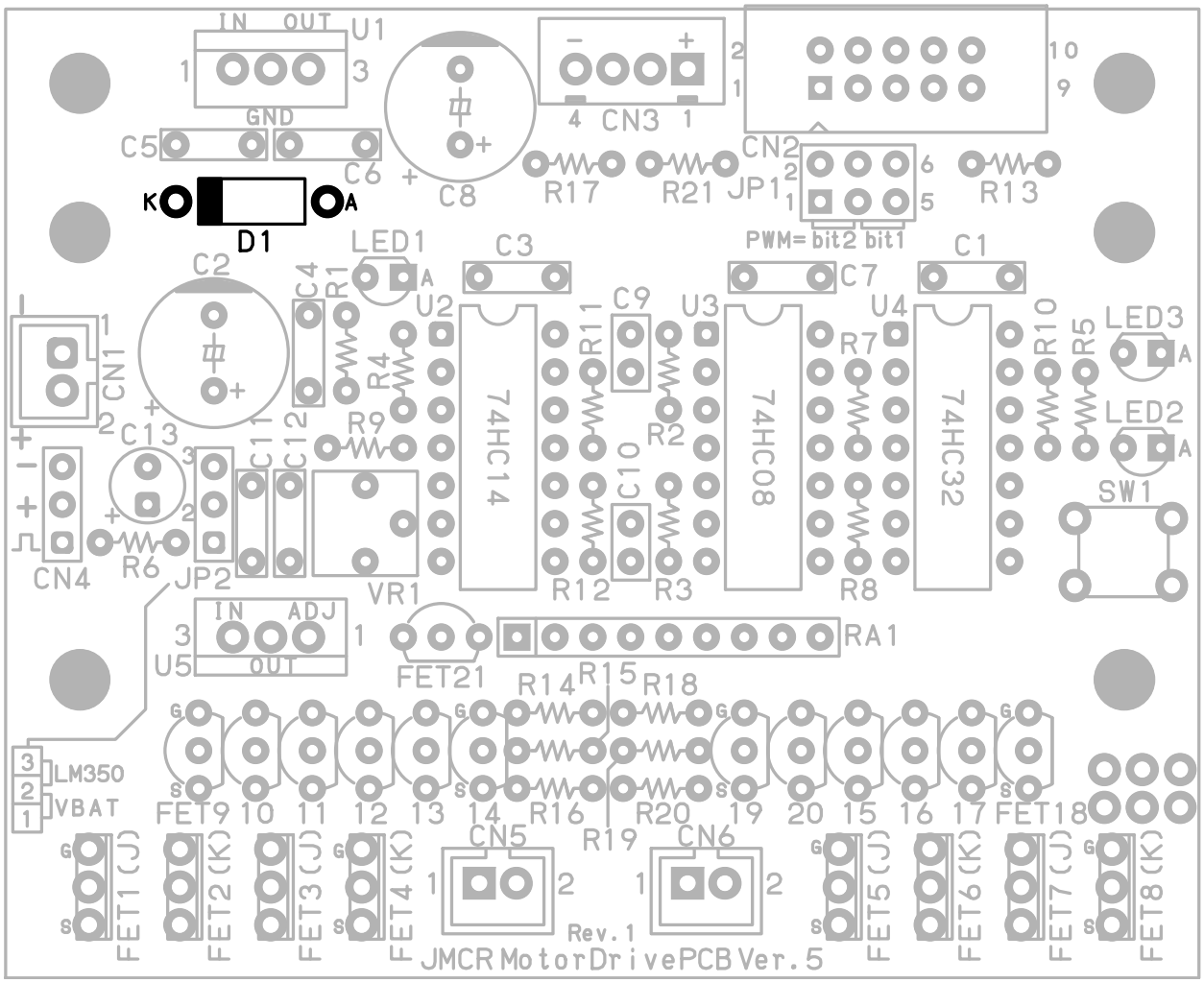
Solder the 74HC32AP. Pay attention to its orientation.

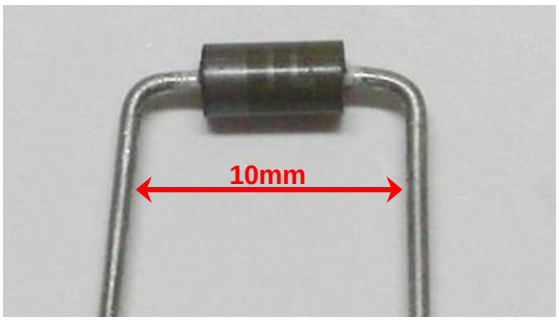


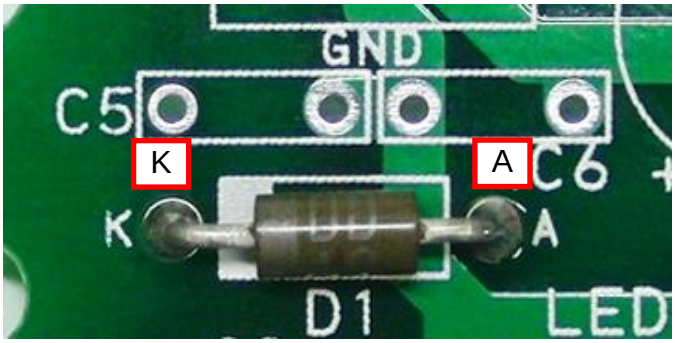
3.11. Mounting the Diode(10DDA10)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
D1	Diode	10DDA10	 The marked end is K	Nihon Inter Electronics Corporation	1

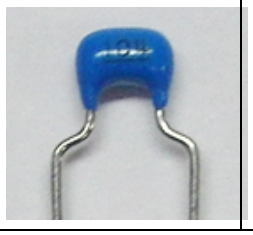
Solder the diode (10DDA10). Pay attention to its orientation.



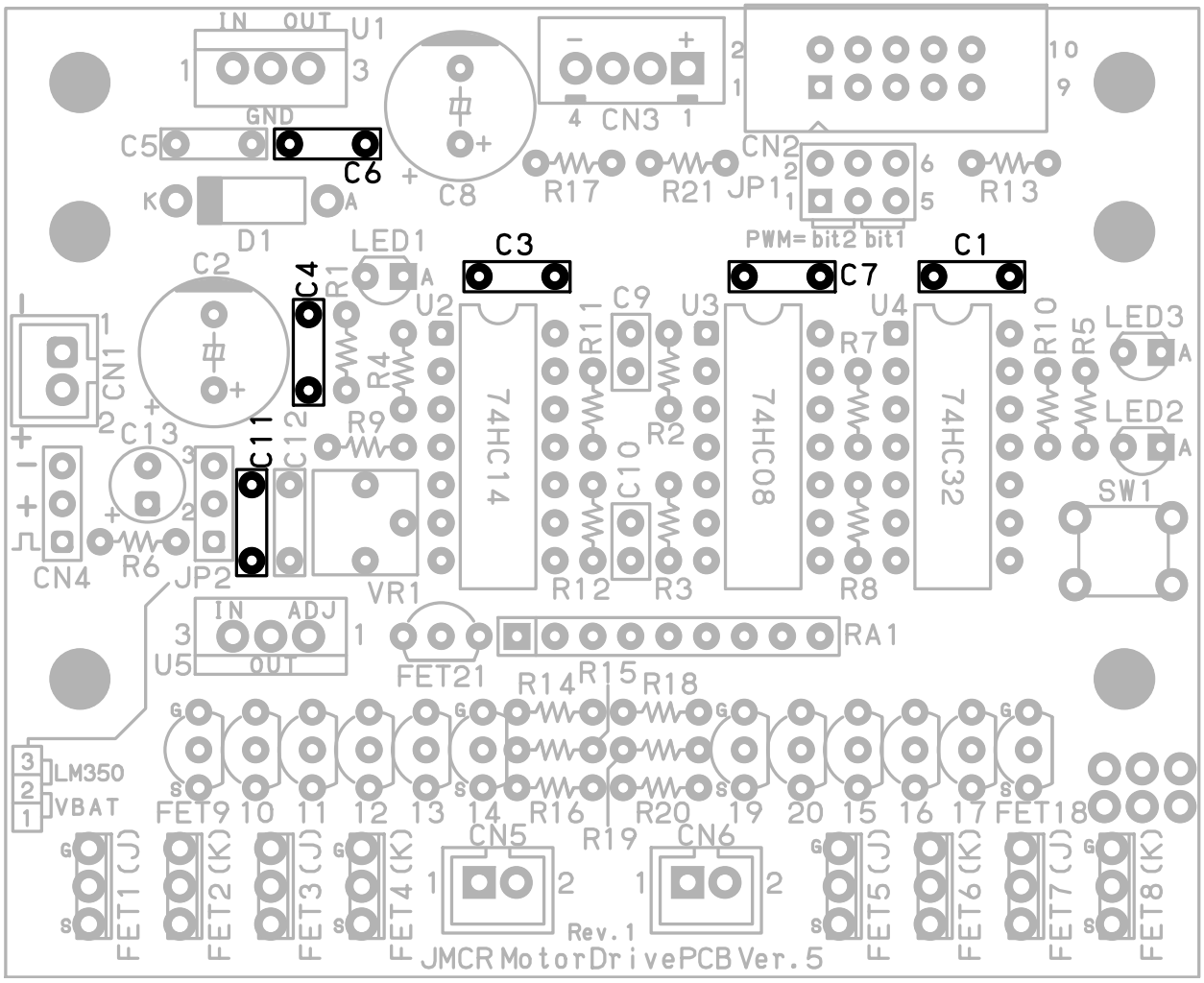
1		Bend both sides of the diode to 90 degrees so that the distance of the lead becomes 10mm.

2		Implement it with matching the direction of K and A.

3.12. Mounting the Laminated ceramic capacitor (0.1 μ F)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
C1,3,4, 6,7,11	Laminated ceramic capacitor	RPEF11H104Z2K1A01B 0.1 µF (104) 5.08 mm pitch		Murata Manufacturing Co., Ltd.	6

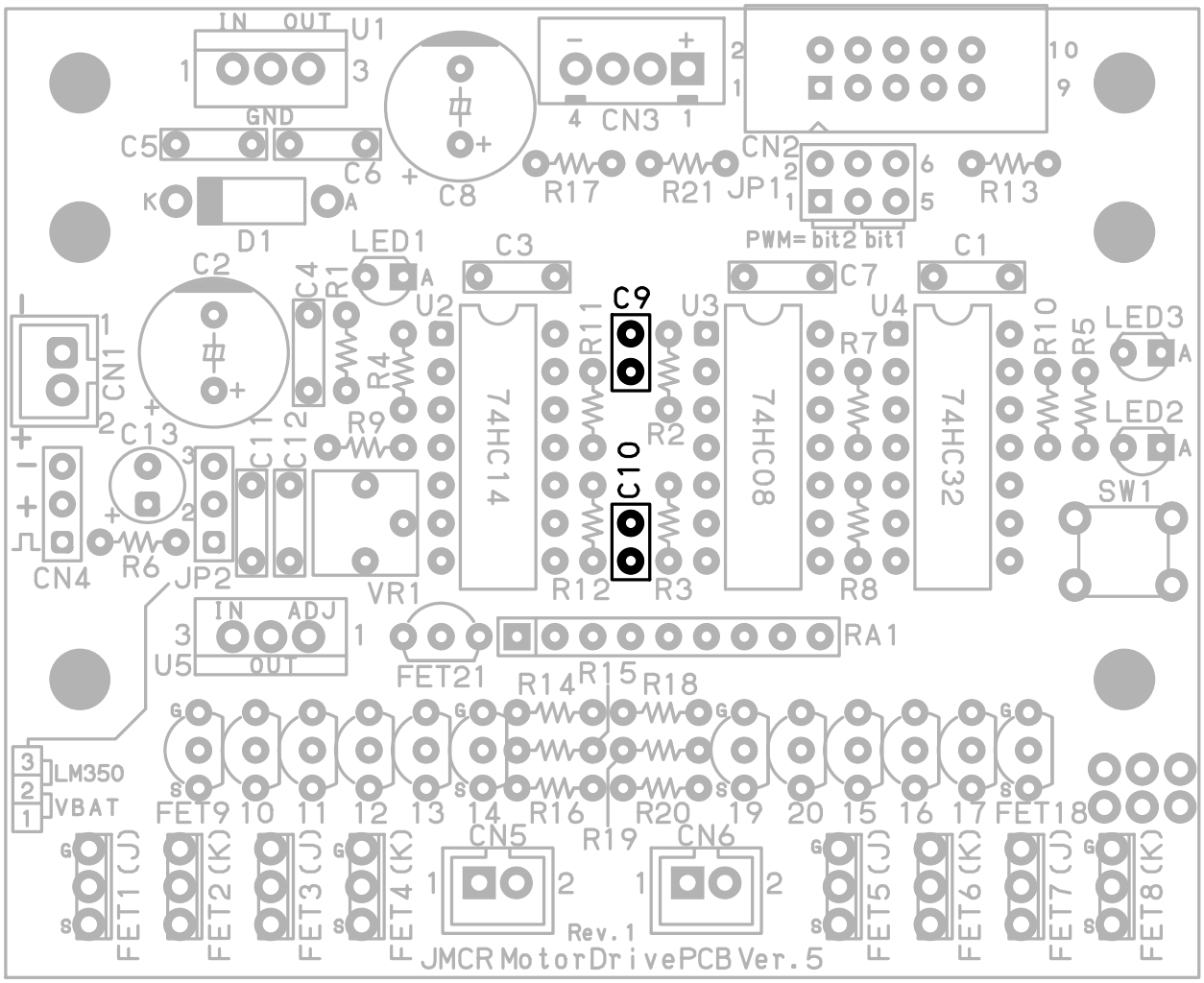
Solder the laminated ceramic capacitors (0.1 µF). There is no difference between either end. Position the capacitors so that it easy to see the marking "104".



3.13. Mounting the Ceramic capacitor(4700pF)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
C9,10	Ceramic capacitor	4700pF (472) 2.54 mm pitch		Available from various manufacturer	2

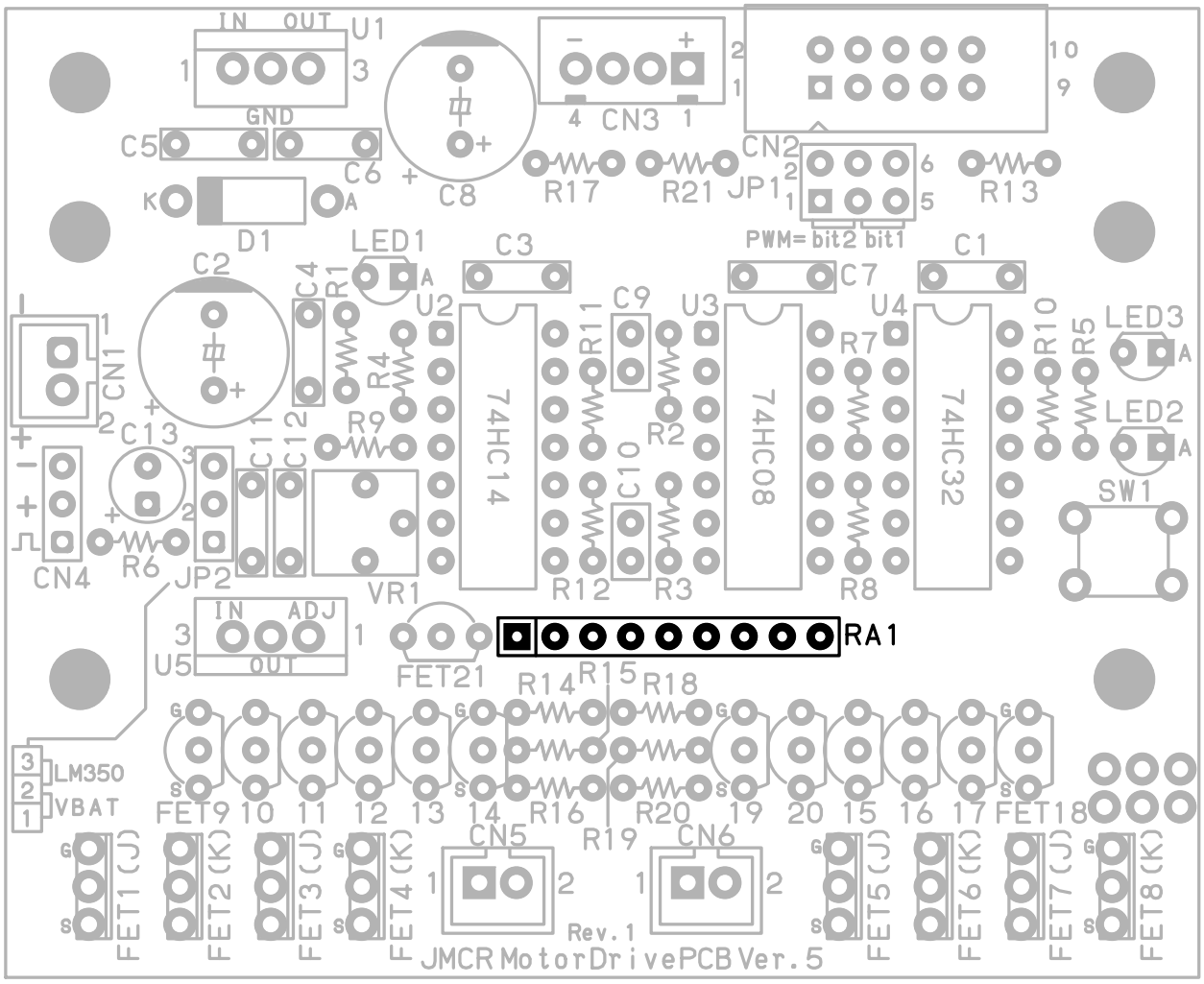
Solder the ceramic capacitors (4700 pF). There is no difference between either end. Position the capacitors so that it easy to see the marking "472".

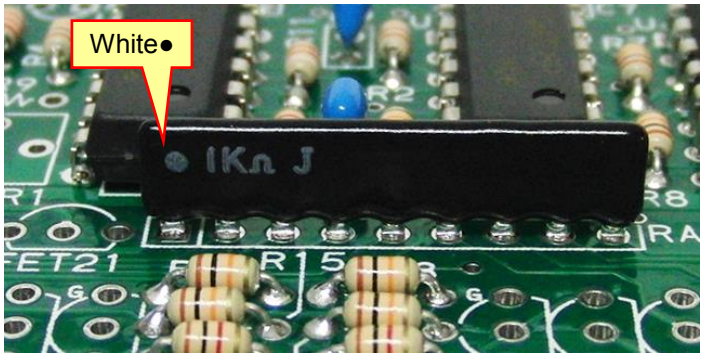


3.14. Mounting the Resistor array

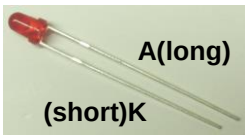
Part No.	Name	Model	Photo	Manufacturer	Q'ty
RA1	Resistor array	RKC8BD102J 1kΩ (102) 8 elements, 1 common	 ● mark at the pin 1 side	KOA Corporation	1

Solder the resistor array. Pay attention to its orientation.

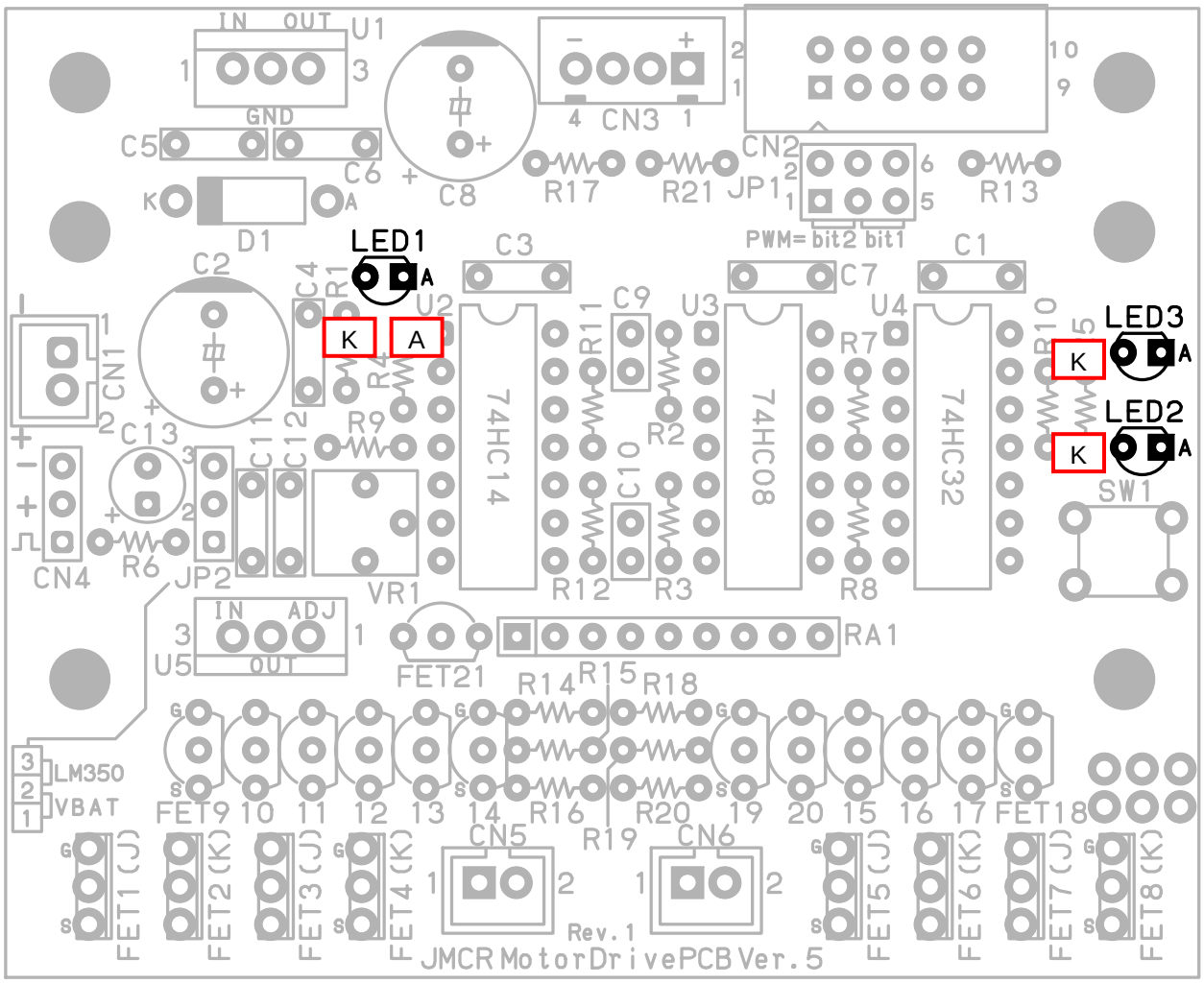


1		Attach a part so that a white ● mark of the resistor array becomes the FET21 side.

3.15. Mounting the LED (red)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
LED1,2,3	LED	EBR3338S 3 mm diameter, red		Stanley Electric Co.	3

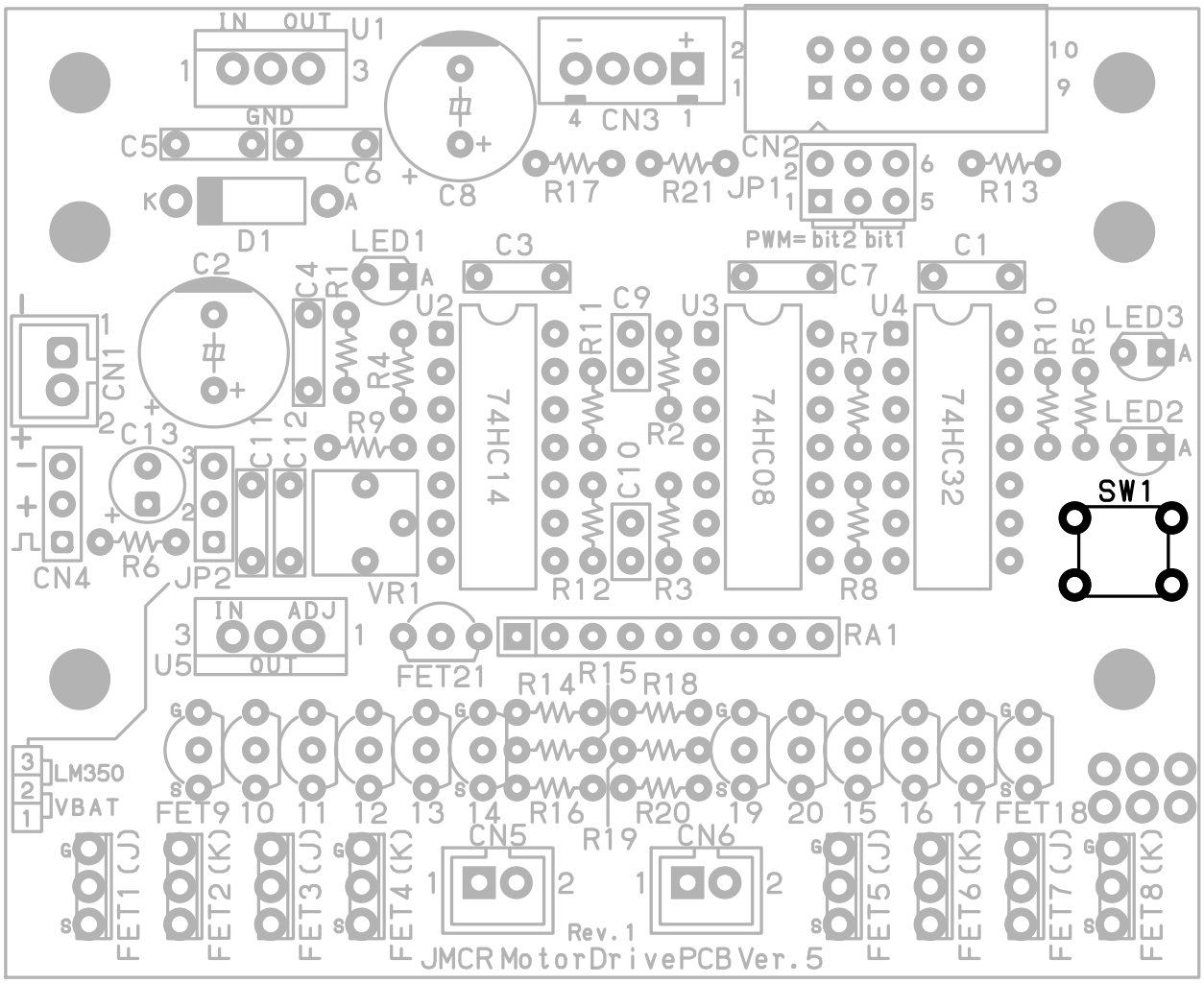
Solder the LEDs (red). Match the pins to A and K.



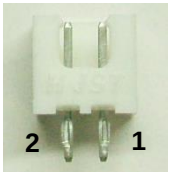
3.16. Mounting the Pushbutton switch

Part No.	Name	Model	Photo	Manufacturer	Q'ty
SW1	Pushbutton switch Note: This switch is also called a tactile switch. This manual uses the term push button switch.	B3F-1050		Omron Corporation	1

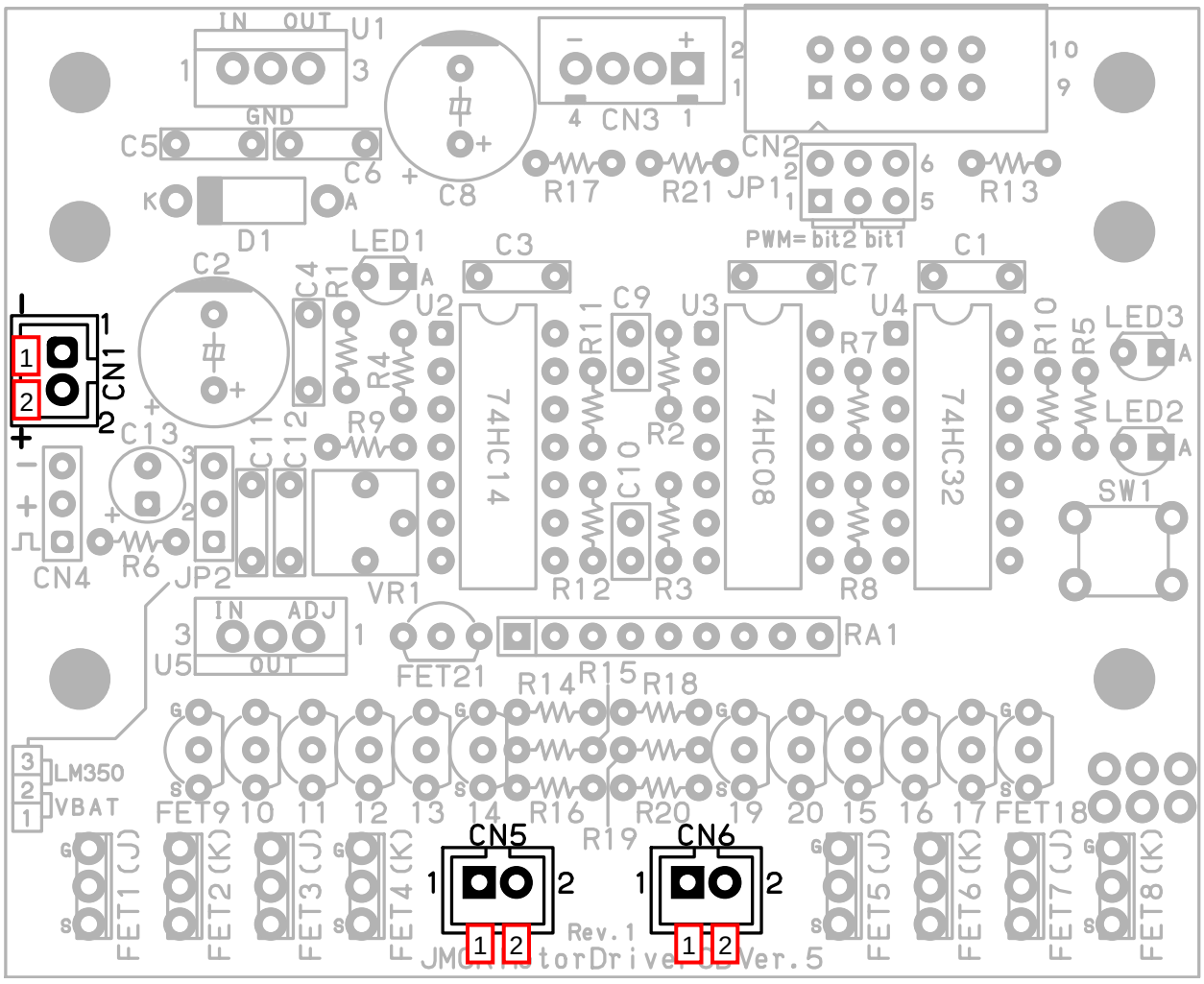
Solder the push switch. There is no difference between either end, so mount it according to the land. Make sure it remains flat while soldering.



3.17. Mounting the XH connector (2 pins)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
CN1,5,6	XH connector (2 pins); straight convex	B2B-XH-A		J.S.T. Mfg., Ltd.	3

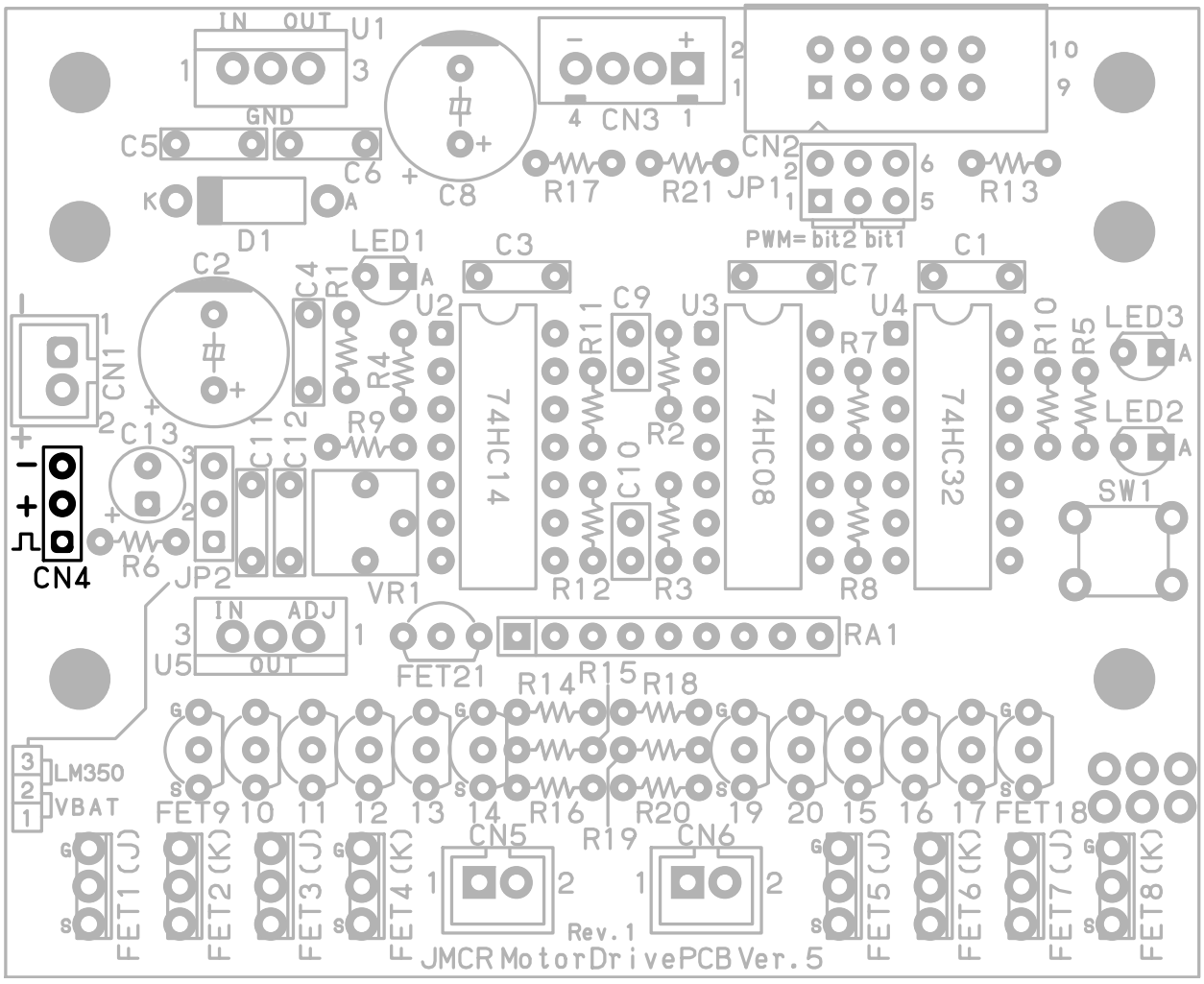
Solder the XH connectors (2-pin). Match the pins to 1 and 2.

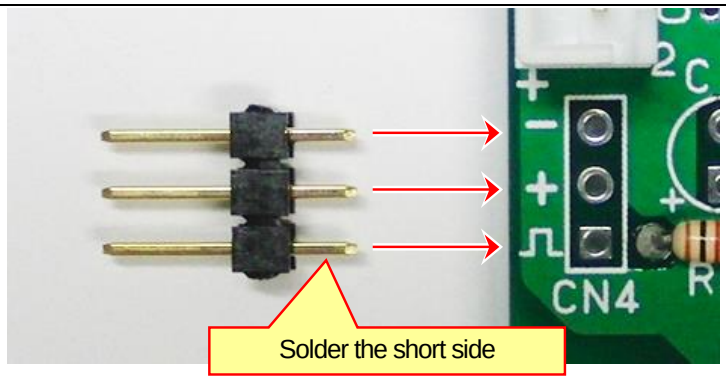


3.18. Mounting the 3-pin conector

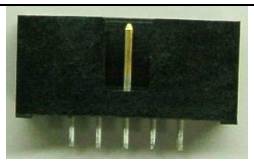
Part No.	Name	Model	Photo	Manufacturer	Q'ty
CN4	3-pin connector	XG8V-0331		Omron Corporation	1

Solder the 3-pin connector. There is no difference between either end.

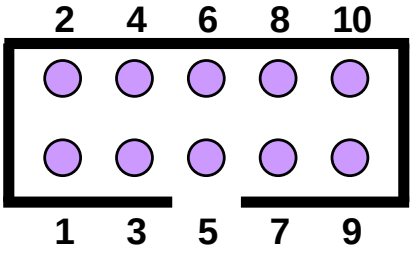


1		Solder the short side of 3 pin connectors.

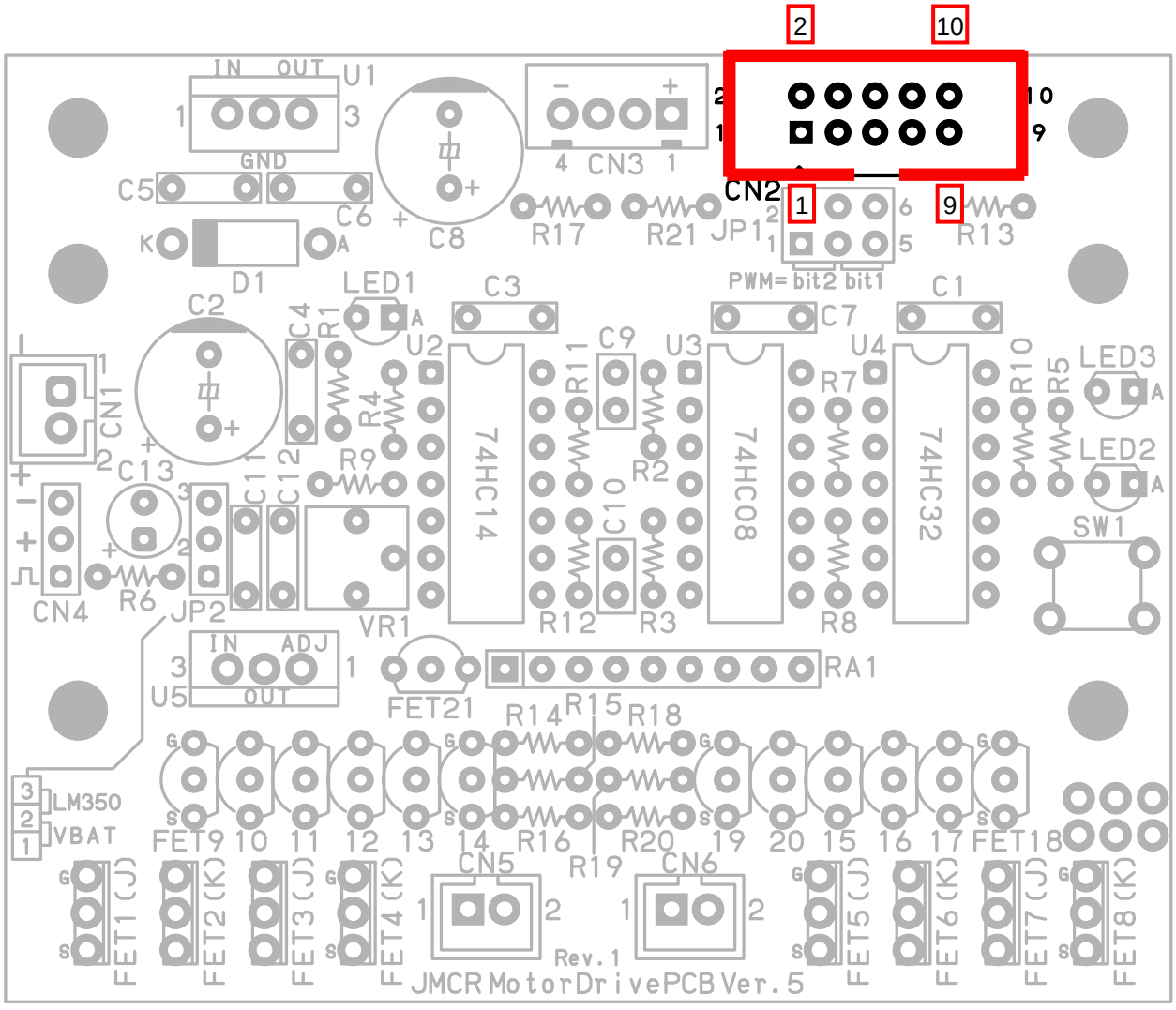
3.19. Mounting the 10-pin connector

Part No.	Name	Model	Photo	Manufacturer	Q'ty
CN2	10-pin connector straight convex	HIF3FC10PA2.54DSA	 Pin 1 is indicated by a mark ▼	Hirose Electric Co., Ltd.	1

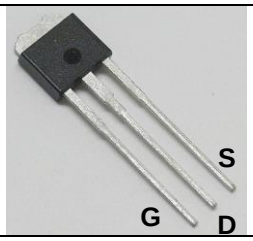
Solder the 10-pin connect (straight convex). When viewed from above, the pins are numbered as shown below. Match the pin numbers when mounting on the board.



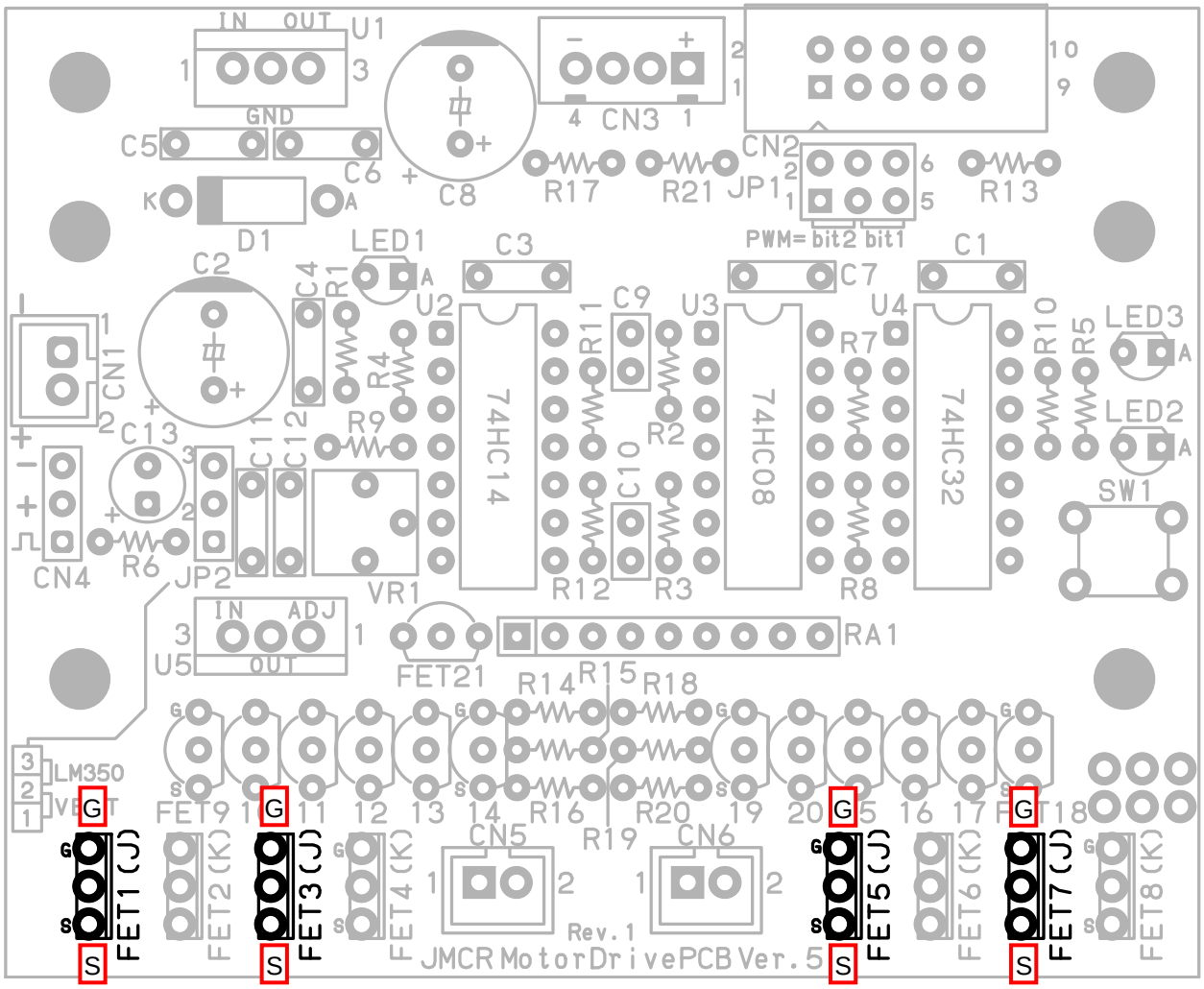
Overhead view of the connector



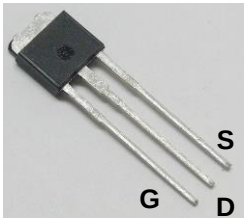
3.20. Mounting the FET(2SJ530)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
FET1,3,5,7	FET	2SJ530(L)		Renesas Electronics Corporation	4

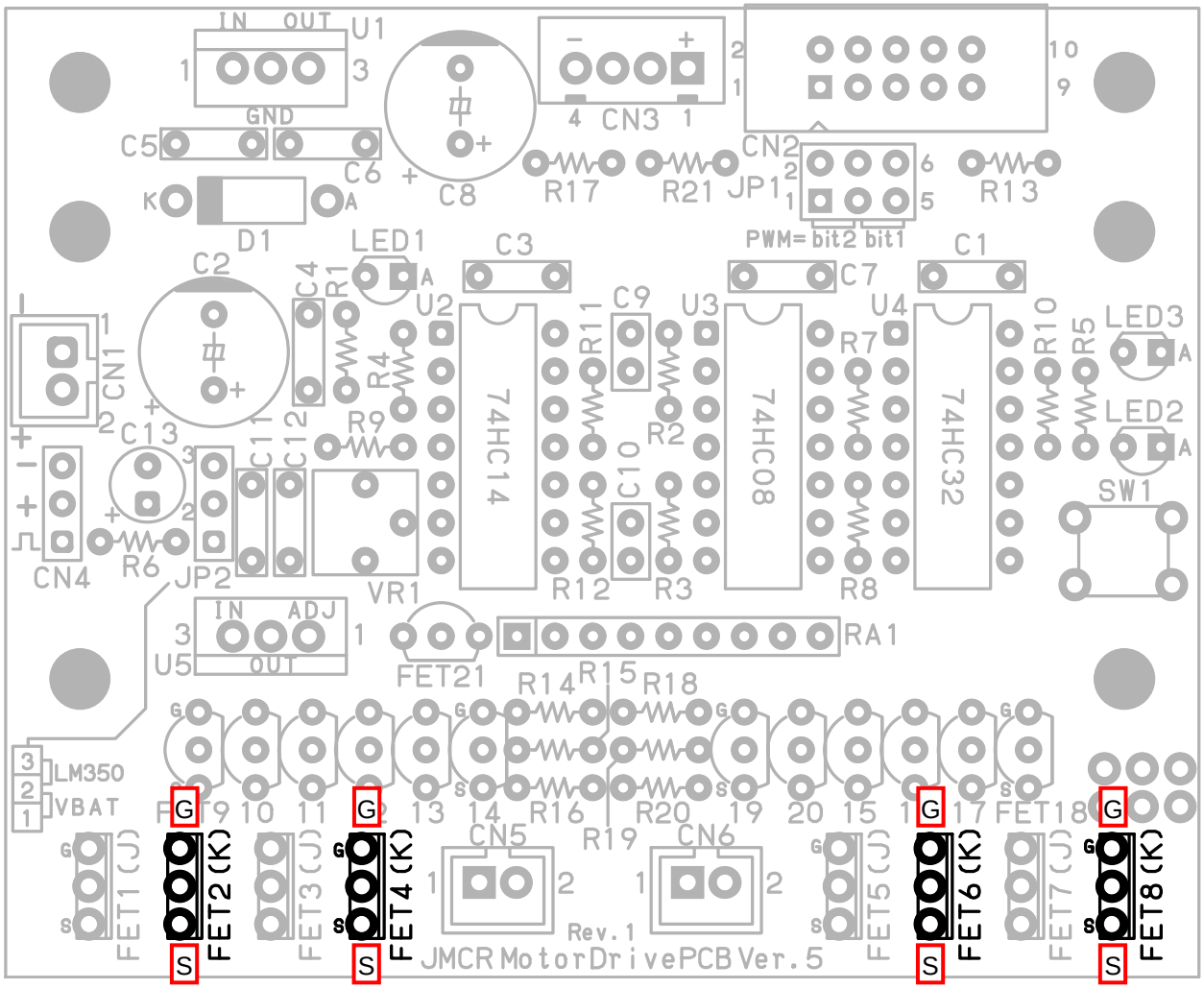
Solder the FETs (2SJ530). Match the pins to G and S. The 2SJ530(L) and 2SK2869(L) FETs are identical in appearance, so make sure to use the correct ones.



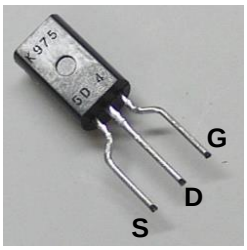
3.21. Mounting the FET(2SK2869)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
FET2,4,6,8	FET	2SK2869(L)		Renesas Electronics Corporation	4

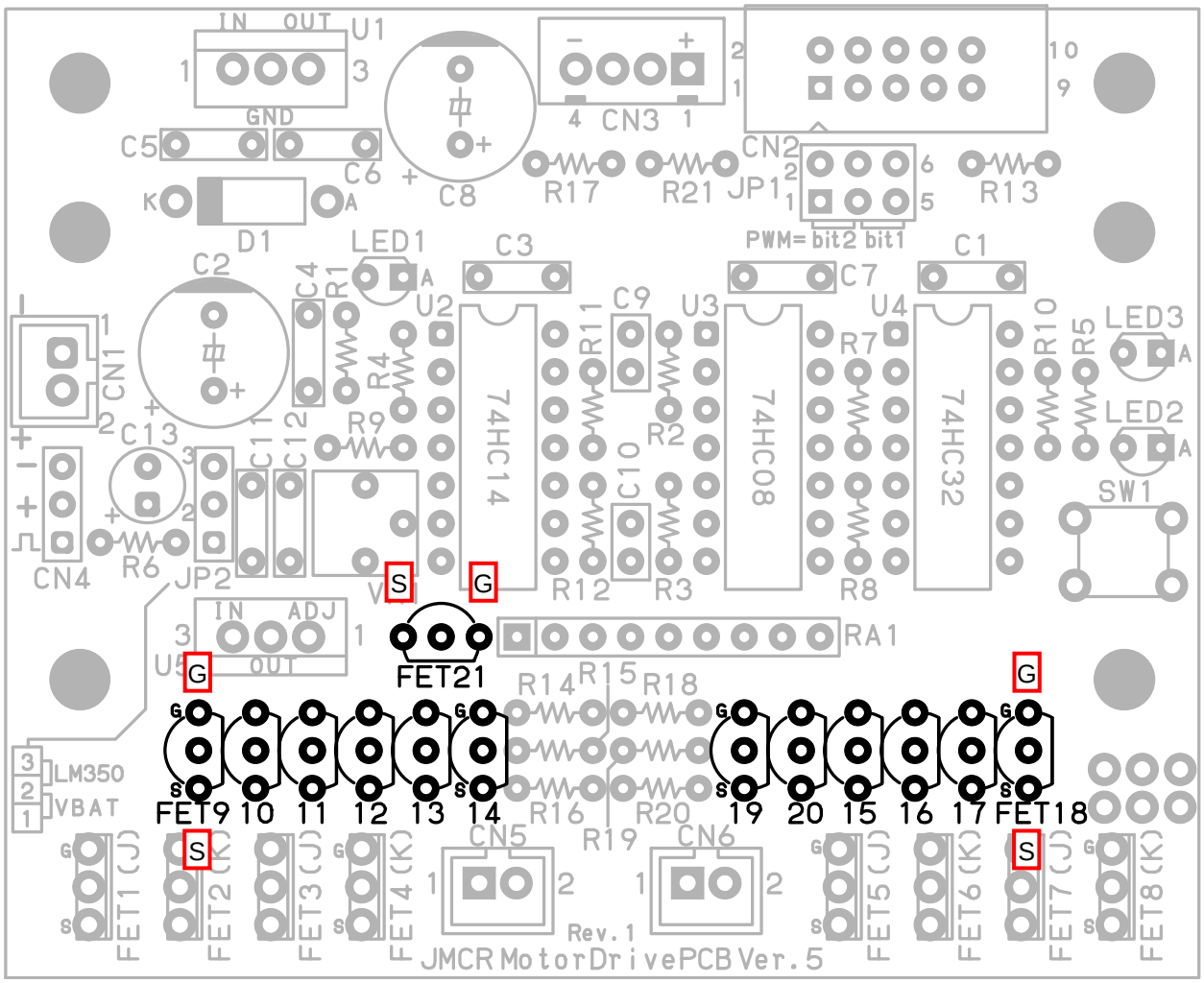
Solder the FETs (2SK2869). Match the pins to G and S. The 2SJ530(L) and 2SK2869(L) FETs are identical in appearance, so make sure to use the correct ones.

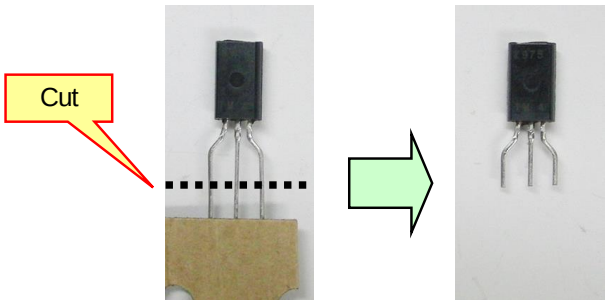


3.22. Mounting the FET(2SK975)

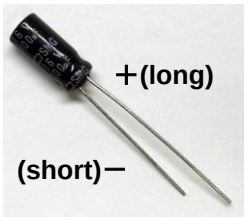
Part No.	Name	Model	Photo	Manufacturer	Q'ty
FET9,10,11, 12,13,14,15, 16,17,18,19, 20,21	FET	2SK975		Renesas Electronics Corporation	13

Solder the FETs (2SK975). Pay attention to their orientation.

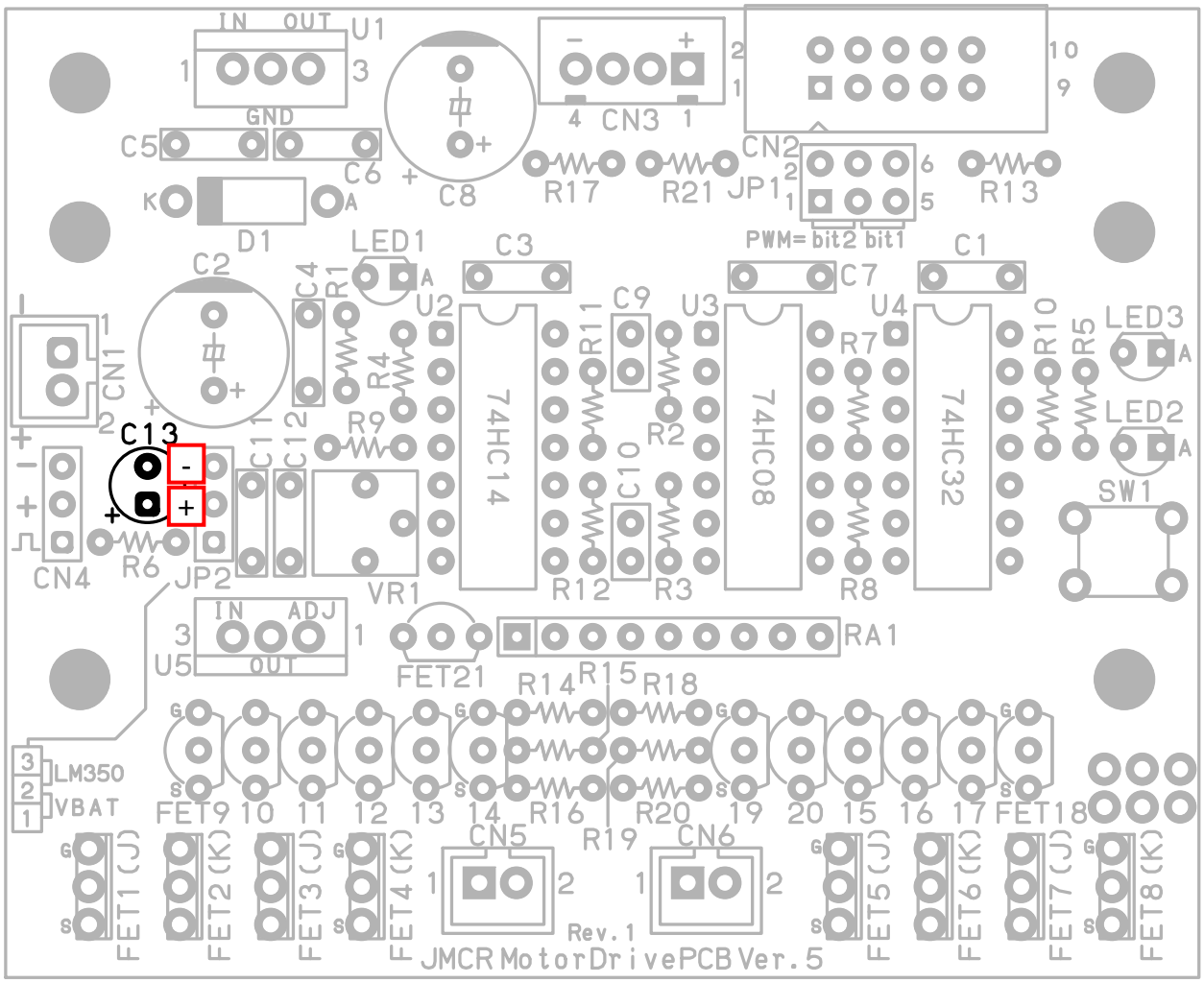


1		Cut thirteen FETs from the sheet and mount them on the board.

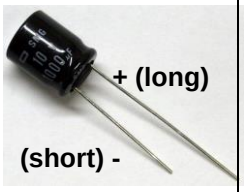
3.23. Mounting the Electrolytic capacitor(100μF/16V)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
C13	Electrolytic capacitor	ESMG160E101ME11 D 100uF/16V		Nippon Chemi-Con Corporation	1

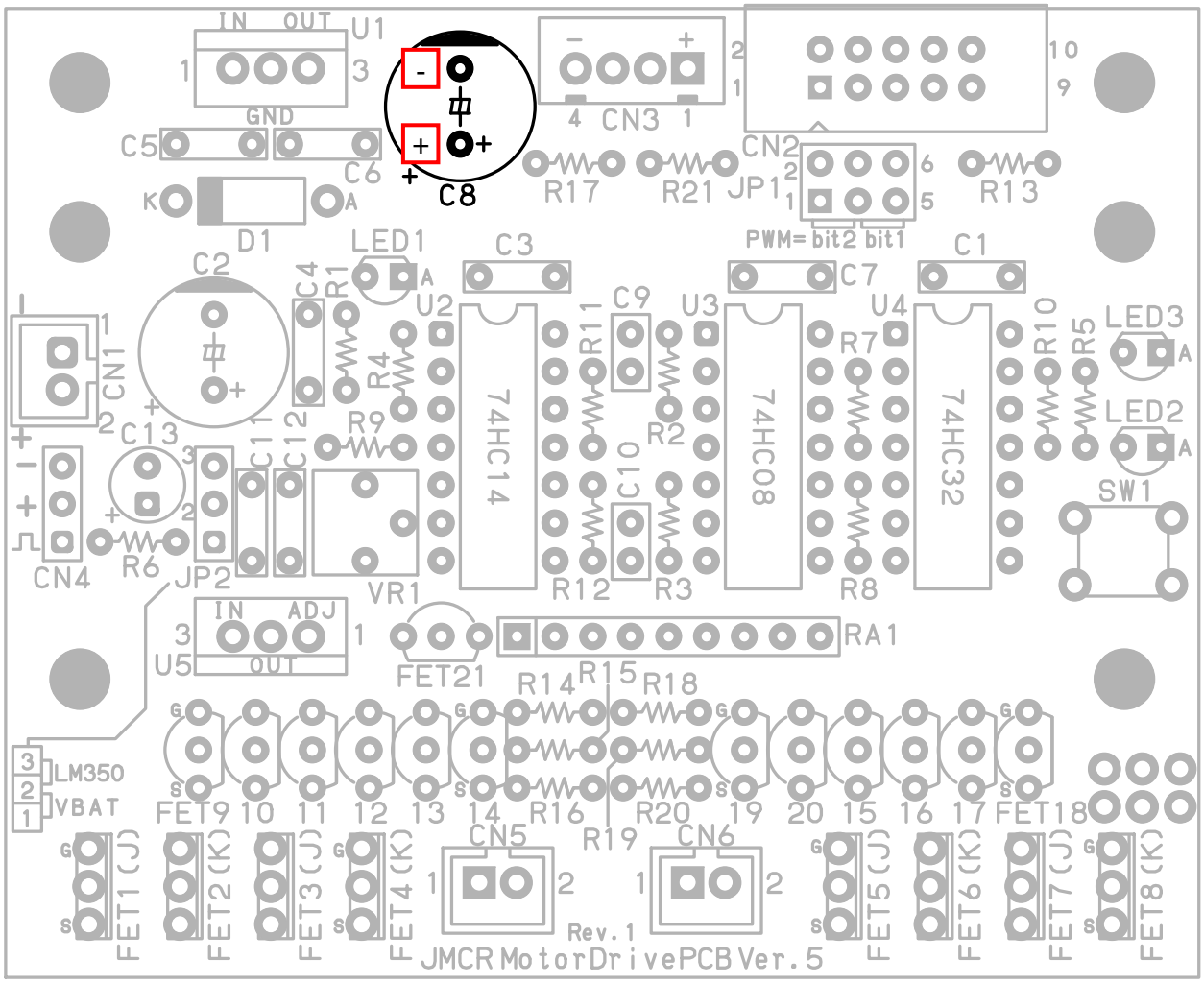
Solder the electrolytic capacitor (100 μF/16 V). Match the pins to [+] and [−].



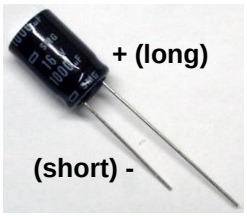
3.24. Mounting the Electrolytic capacitor(1000 μ F/10V)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
C8	Electrolytic capacitor	ESMG100ELL102MJC5S 1000μF/10V		Nippon Chemi-Con Corporation	1

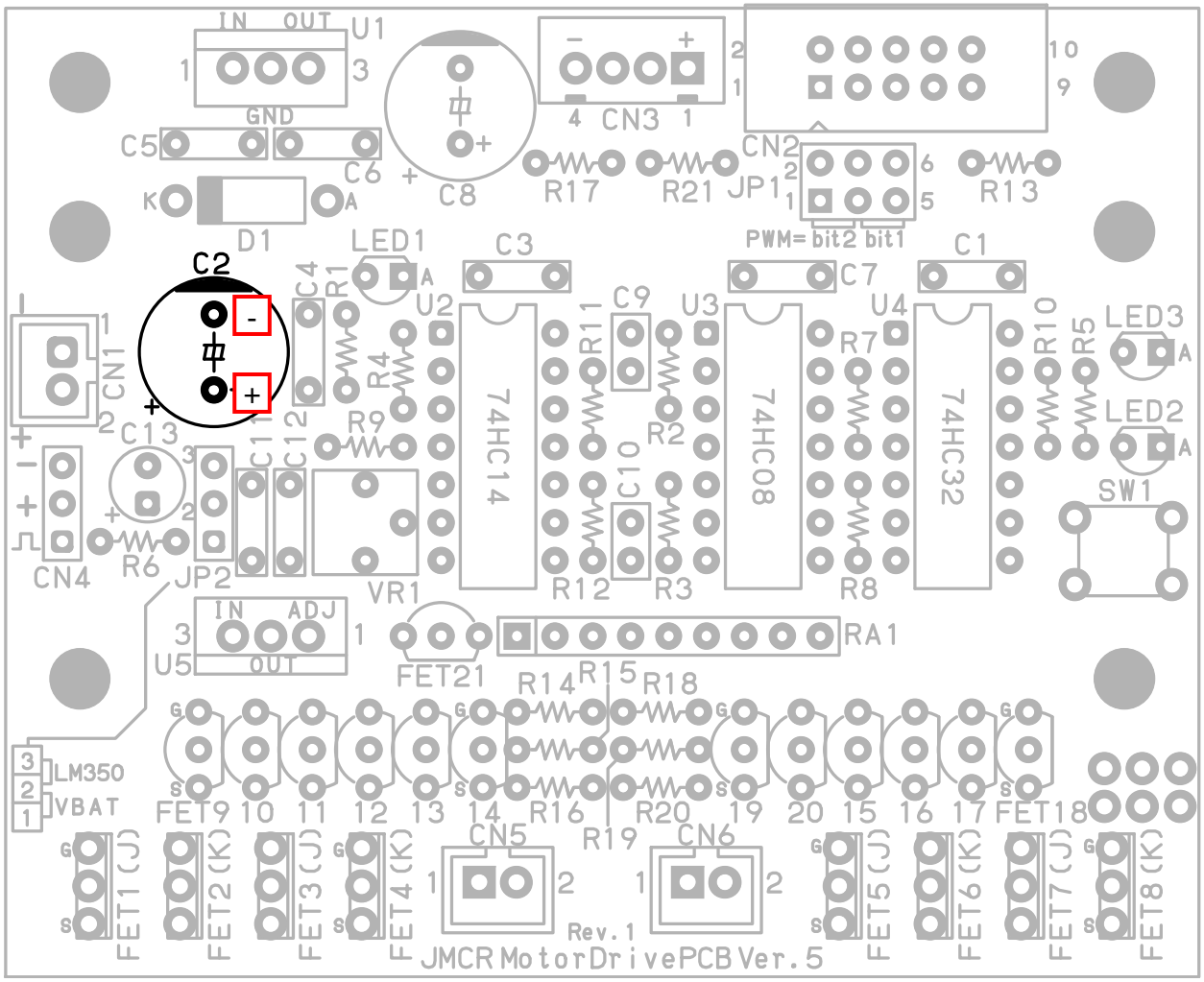
Solder the electrolytic capacitor (1000 μF/10 V). Match the pins to [+] and [−].



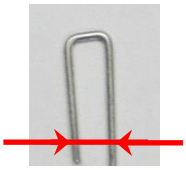
3.25. Mounting the Electrolytic capacitor(1000 μ F/16V)

Part No.	Name	Model	Photo	Manufacturer	Q'ty
C2	Electrolytic capacitor	SMG160E102MJ16S 1000μF/16V		Nippon Chemi-Con Corporation	1

Solder the electrolytic capacitor (1000 μF/16 V). Match the pins to [+] and [−].

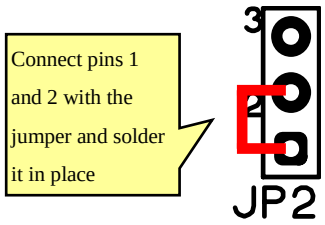


3.26. JP2 Jumper Insertion

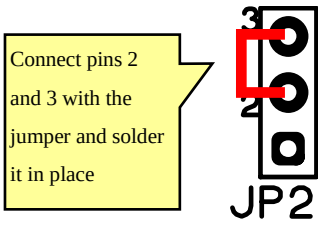
Part No.	Name	Model	Photo	Manufacturer	Q'ty
JP2	Jumper				

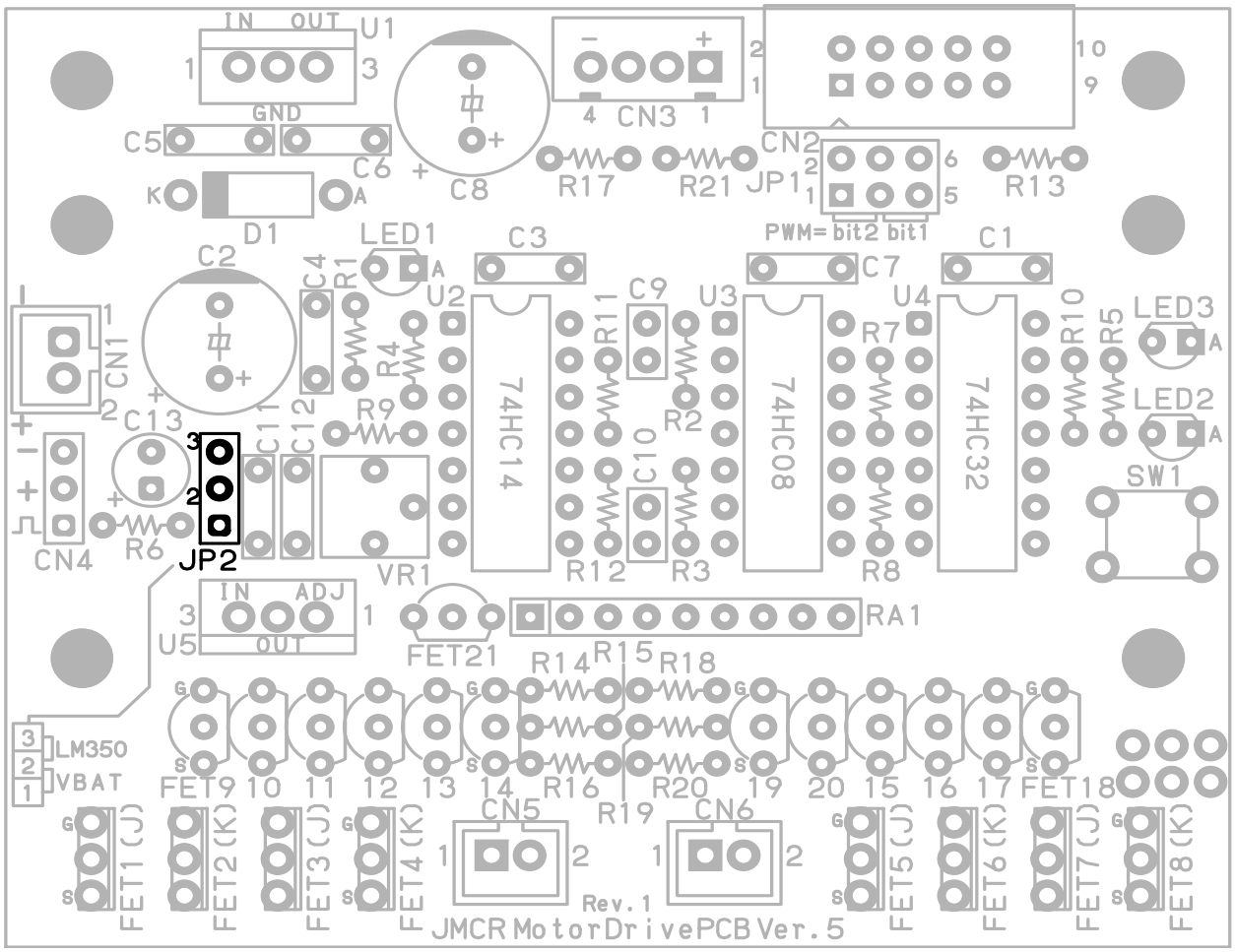
Use a section of left over lead wire to create a U-shaped jumper with a 2.5 mm lead spacing, and solder it to the JP2 jumper connector between pins 2 and 3.

●LM350 Add-On Set not used



●LM350 Add-On Set used





***If soldering is difficult due to coming in contact with another component, solder from the solder side (reverse side).**

3.27. Completed

It is completed. Visually confirm that there are no solder bridges or dry joints and that there are no mistakes with the orientation of the parts.
Refer to “Operation Test Manual MCU Car Kit, Ver.5.1” for the operation test.