

Line Following Robot

Design and instructions for a DIY line-following robot kit.

This kit is designed as a “**Learn to Solder**” kit.

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Date: 27th March 2017

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Overview



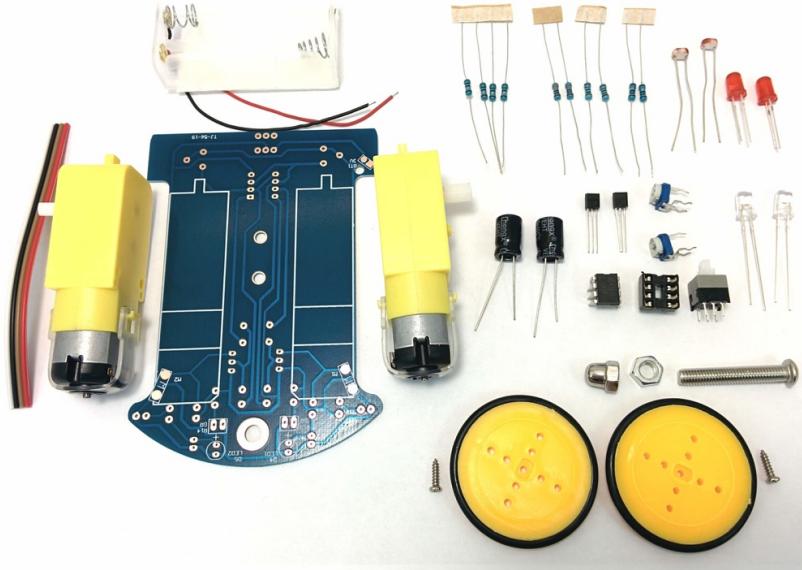
This robot will follow a black line on a light coloured background.

The sensors at the front of the robot detect the change in light and control two motors to follow the line.

The circuit uses two comparator circuits and two light dependent resistor sensors to measure the reflected light.

This kit is fully analog and requires no programming.

Kit Contents



This kit contains the following parts:

Electronics:

| REF | Description | Details |
|-----|------------------------------------|--------------------|
| C1 | Capacitor | 100uf Electrolytic |
| C2 | Capacitor | 100uf Electrolytic |
| D1 | LED Red | |
| D2 | LED Red | |
| D4 | LED Bright Red | |
| D5 | LED Bright Red | |
| IC1 | Voltage comparator IC IC socket | LM393 8 Pin |
| R1 | Adjustable Resistor | 10k |
| R2 | Adjustable Resistor | 10k |
| R3 | Resistor | 3.3k Ohm |
| R4 | Resistor | 3.3k Ohm |
| R5 | Resistor | 51 Ohm |
| R6 | Resistor | 51 Ohm |
| R7 | Resistor | 1k Ohm |
| R8 | Resistor | 1k Ohm |
| R9 | Resistor | 10 Ohm |
| R10 | Resistor | 10 Ohm |
| R11 | Resistor | 51 Ohm |
| R12 | Resistor | 51 Ohm |
| R13 | LDR Resistor | CDS5 |
| R14 | LDR Resistor | CDS5 |
| Q1 | Transistor | 8550 |
| Q2 | Transistor | 8550 |
| SW1 | Switch | |
| PCB | Circuit board | |

Hardware:

| Quantity | Description | Details |
|----------|-------------------|-------------|
| 2 | Geared motor | JD3-100 |
| 2 | Wheel piece 1 | |
| 2 | Wheel piece 2 | |
| 2 | Wheel piece 3 | |
| 2 | Silicone Tyre | 25x25mm |
| 4 | Wheel screw | M3x10 |
| 4 | Wheel nut | M3 |
| 2 | Wheel shell screw | |
| 1 | Castor screw | M5x30 |
| 1 | Nut | M5 |
| 1 | Caster nut | M5 Ball nut |

Tools Required

The following tools will be required:

| Tool | Description |
|----------------|--------------------------|
| Soldering Iron | 25W+ is best |
| Solder | I use lead-free solder |
| Side-cutter | For cutting excess leads |



A useful guide for learning to solder is available here:

<https://cdn.shopify.com/s/files/1/0943/8168/files/soldercomic.pdf>

And a more detailed guide is available here:

https://cdn.shopify.com/s/files/1/0943/8168/files/FullSolderComic_EN.pdf

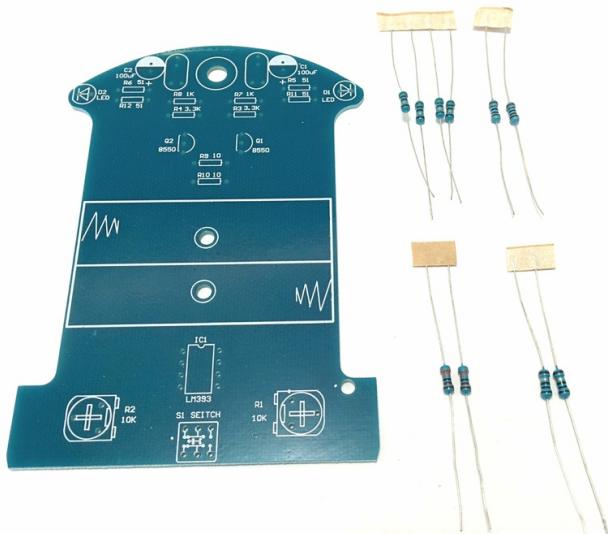
Step 1: Solder Fixed-Value Resistors

There are 10 fixed value resistors used in this circuit. These are labelled R3-R12.

Solder these into the respective marked places on the PCB.

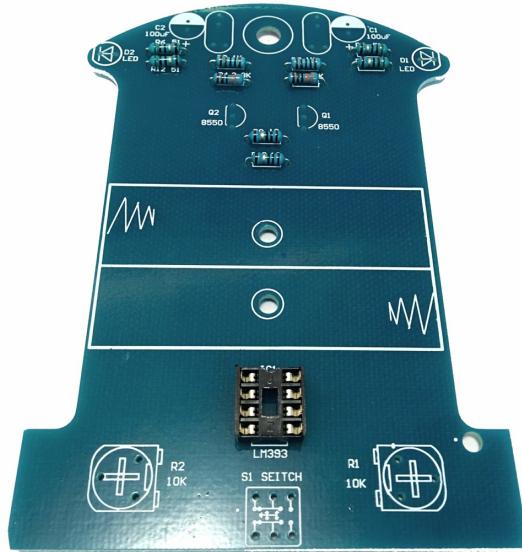
| REF | Value | Details |
|-----|----------|---------------------------------|
| R3 | 3.3k Ohm | Orange-Orange-Black-Brown-Brown |

| REF | Value | Details |
|-----|----------|---------------------------------|
| R4 | 3.3k Ohm | Orange-Orange-Black-Brown-Brown |
| R5 | 51 Ohm | Green-Brown-Black-Gold-Brown |
| R6 | 51 Ohm | Green-Brown-Black-Gold-Brown |
| R7 | 1k Ohm | Brown-Black-Black-Brown-Brown |
| R8 | 1k Ohm | Brown-Black-Black-Brown-Brown |
| R9 | 10 Ohm | Brown-Black-Black-Gold-Brown |
| R10 | 10 Ohm | Brown-Black-Black-Gold-Brown |
| R11 | 51 Ohm | Green-Brown-Black-Gold-Brown |
| R12 | 51 Ohm | Green-Brown-Black-Gold-Brown |



Step 2: Solder IC Socket

Solder the IC socket into the holes marked IC1. Ensure the notch on the IC socket aligns with the notch on the silk-screen.



Info: The data sheet for the IC is here: <https://www.onsemi.com/pub/Collateral/LM393-D.PDF>

Step 3: Solder the Red LEDs

There are two RED LEDs to solder in locations D1 and D2. You must ensure correct polarity of these LEDs.

The positive lead will be the longer lead. The negative lead has a slightly flat side to the LED case. These should align with the markings "+" on the PCB.

Please see photos for clarification.



Step 4: Solder Adjustable Resistors

There are two 10k adjustable resistors to solder into holes marked R1 and R2.



Step 5: Solder Switch

There is one on/off switch to be soldered into the holes marked S1.



Step 6: Solder Capacitors

The capacitors are 100uf capacitors and are soldered into holes marked C1 and C2.

These are electrolytic capacitors and you **must ensure the correct polarity**.

There is a white line marked on the capacitor which indicate the negative pin. This pin must align with the large white area of C1 on the PCB silk screen.

Another way to find the pin polarity is that the positive (+) pin is on the bottom of the capacitor and the negative is on the top. Please see photos for clarification.



Step 7: Solder the Transistors

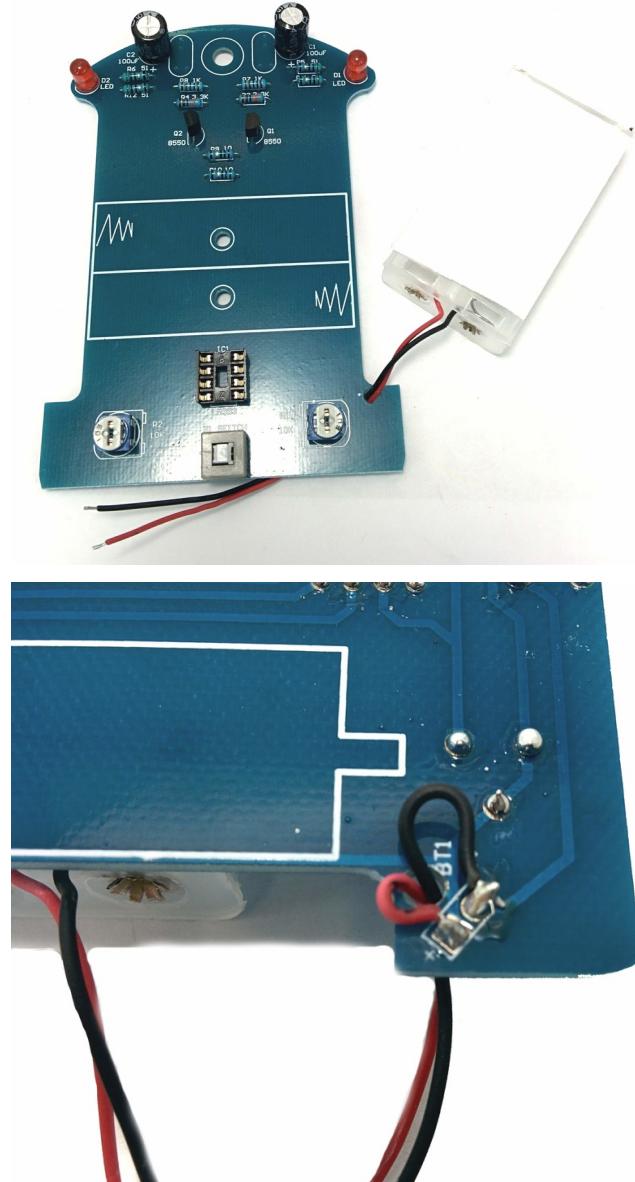
There are two transistors to solder in to the holes marked Q1 and Q2.

The transistors have three pins and must be placed into the holes so that the flat side on the transistor aligns with the flat side on the silk screen.



Step 8: Attach Battery Holder

The battery holder is stuck onto the top of the PCB. The wires from the holder go through the hole at the back edge of the PCB and are soldered on the underside of the PCB. You must ensure correct polarity with the RED lead going to the BT1 pad marked + and the BLACK wire going to the other pad.

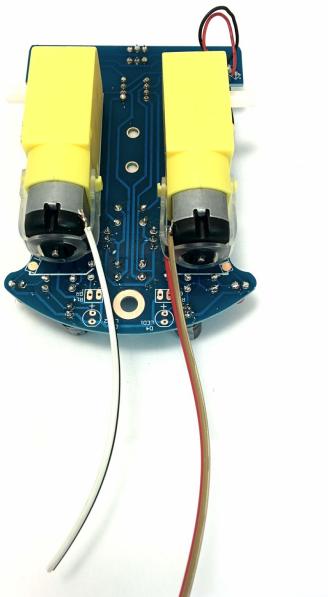
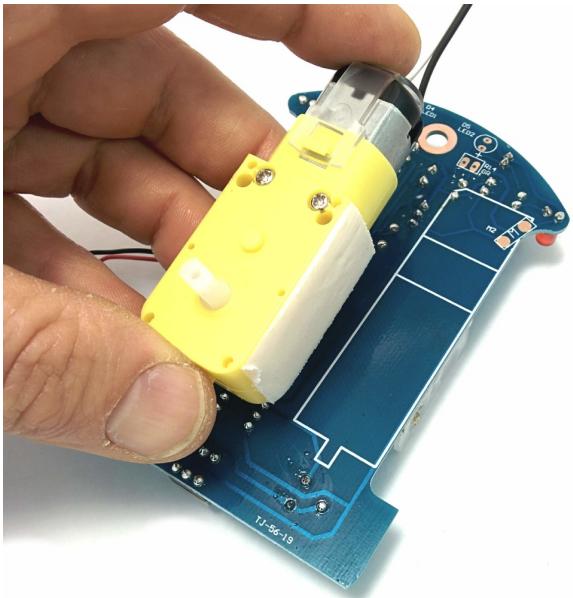


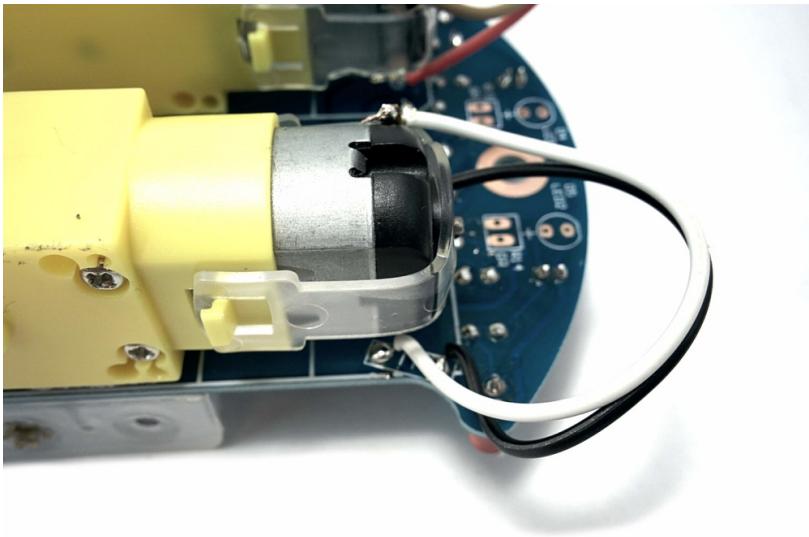
The motors are stuck onto the underside of the PCB. With the wire included make 2 cables with 2 wires in each. Solder these wires to the motor pads on the underside of the PCB (sticking out from the back of the motors).

These are soldered to the M1 and M2 pads on the underside of the PCB.

The wire attached to the motor the furthest away from the PCB will go to the pad closest to the red LED. The wire connecting to the motor closest to the PCB will go on the other pad. Please see photos for clarification.

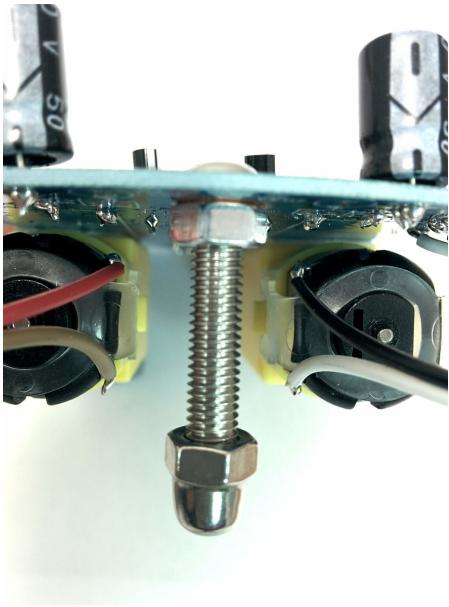






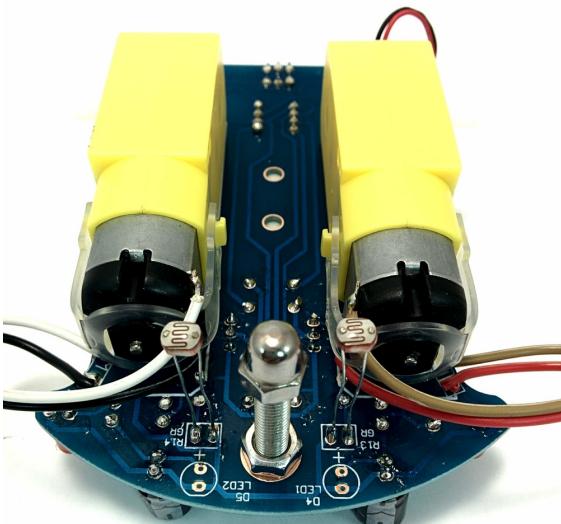
Step 10: Attach front caster

The front caster is built using an M5 bolt, along with a nut and a ball nut on the end. The bolt goes through the PCB and is held in place with the M5 nut. The M5 ball nut is screwed on to the end. As the ball nut is round it will glide along the ground.



Step 11: Solder Light Dependent Resistors

The light dependent resistors (LDR) are soldered onto the underside of the PCB (see photo). These go into the holes marked R13 and R14 (on the underside of the PCB). They need to be inserted and solder so that the head of the LDR is around 5mm from the ground. The LDRs do not have a polarity.



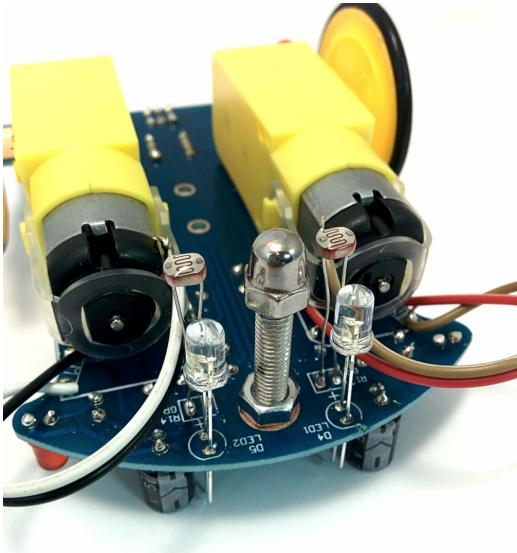
Step 12: Solder LEDs

The last two LEDs are super-bright LEDs. They provide the light which is reflected back from a white surface, but not from a black surface.

You must ensure correct polarity of these LEDs.

The positive lead will be the longer lead. The negative lead has a slightly flat side to the LED case. These should align with the markings “+” on the PCB.

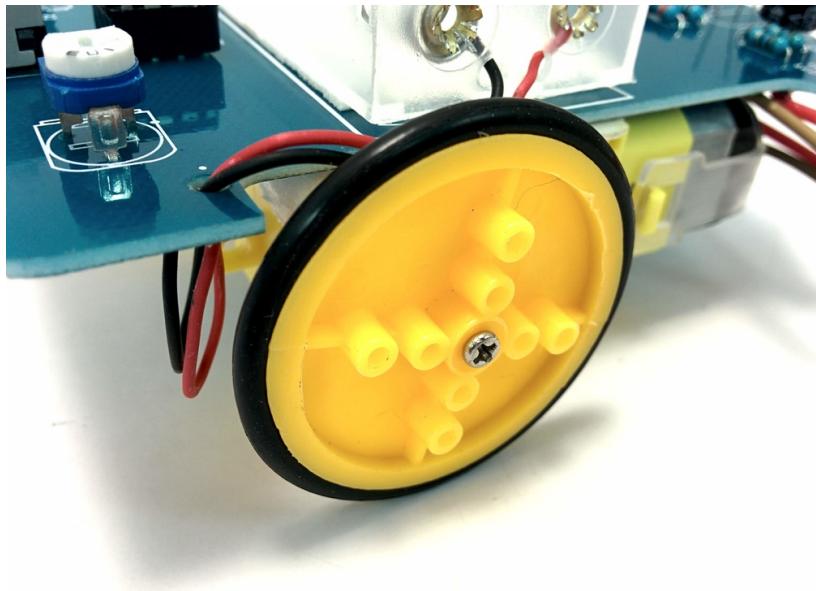
Please see photos for clarification.



Step 13: Add Wheels

The wheels fit onto the motor shaft and are held in place with the two small self-tapping screws.

The silicone tyres fit over the wheels to provide grip.

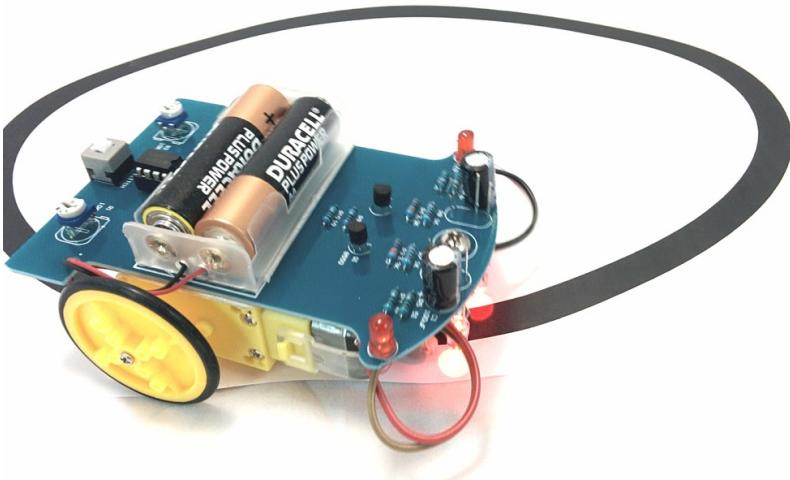


Step 14: Finished!

Add some AA batteries into the battery holder (double check their polarity!). Press switch S1 and the unit should start to move.

You can adjust R1 and R2 to adjust the sensitivity of each sensor. Typically around half-way on each resistor works well.





Troubleshooting

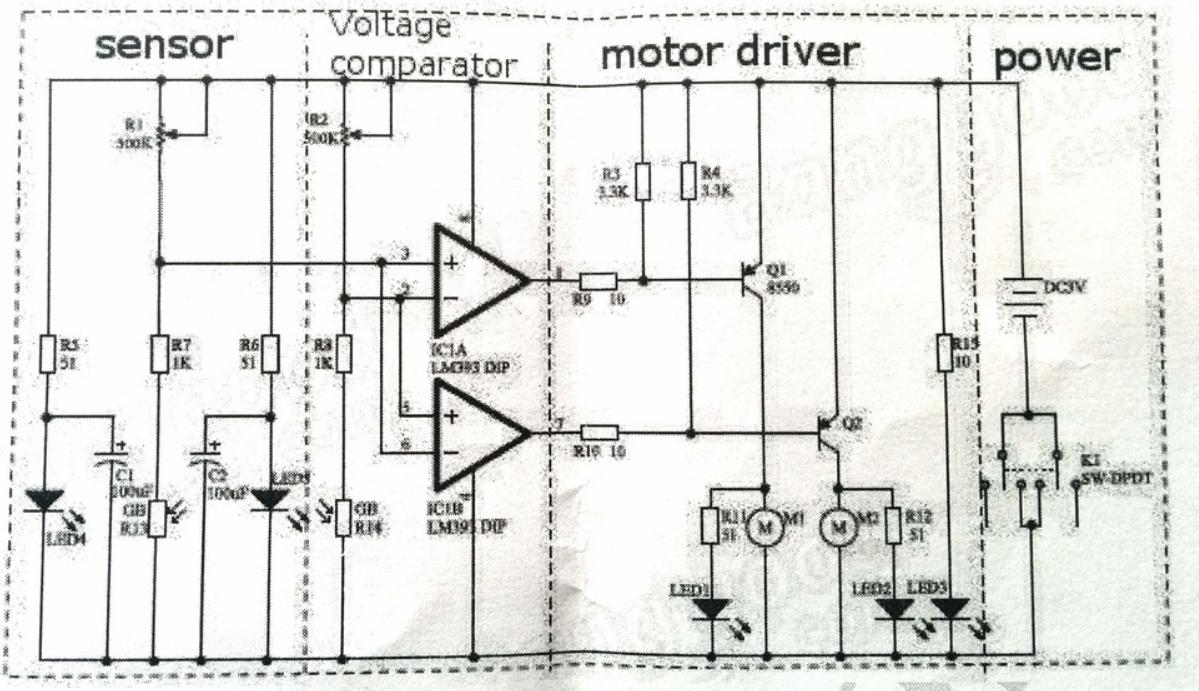
This circuit is relatively simple and designed for the beginner. There are some items which have a polarity and the circuit will not work if any of the following are placed the wrong way around: - Diodes - LEDs - Capacitors - Transistors - IC orientation

Please double check these in case of any issues.

Also it might be that one of the motors moves in the wrong direction (the robot will be going around in circles or moving away from the line). If this is the case then we need to swap around the wires to the motor. This is easiest to change by unsoldering the wires from the motor pads and swapping them around.

Please also double check the soldering to ensure that there are no short circuits (solder connecting two pads) or 'dry joints' (which do not have enough solder or are not clean).

Circuit Schematic



Suppliers Information

We would like you to be happy with this kit. If you are not happy for any reason then please contact us and we will help to sort it out.

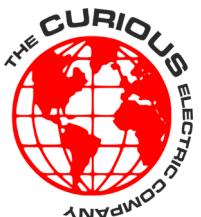
Please email hello@curioselectric.co.uk with any questions or comments or please tweet us at [@curioselectric](#)

If any parts are missing from your kit then please email hello@curioselectric.co.uk with details and, if possible, where the kit was purchased.

More technical information can be found via www.curioselectric.co.uk

The GITHUB repository for all these files is: www.github.com/curioselectric/soldersolar

This kit has been supplied by:



The Curious Electric Company

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