

Wiring the Road Rippers Monster Truck for externally triggered motor power

The *Road Rippers Monster Truck* was \$6.99 from my local Walgreens. Versions sell on ebay for \$14.99. It has two AA batteries supplying 3V, two LED headlights, a 3Ω DC motor, and an 8Ω speaker. The wires are all stranded, and smaller than 22 AWG – maybe 24 or 28 – I started stripping wires with a sharp edge and then used my fingernails after otherwise pulling the entire end of the wire off multiple times.



After cutting out the printed circuit board inside, the wiring in the monster truck I had was:

- Red / Red + Black Stripe = 3VDC / Ground
- White / White + Black Stripe = Motor in / Ground
- White / White + Yellow Stripe = Speaker in / Ground
- Red / Black / White = LED high / LED low / LED low

Shopping list

People (at least in the U.S.) with time to order parts in advance will save a lot of money buying in bulk from [DigiKey](#) / [Mouser](#) / [Jameco](#) instead of Radio Shack.



× 2

RadioShack® 2N4401 Switching
Transistor
1.49



RadioShack® **220K** ohm 1/2W 5%
Carbon Film **Resistor** (5-Pack)
1.49

It is probably better to buy a circuit board to solder to, and one of the stands to hold the parts, so you don't burn your fingers like I did:



RadioShack® Helping Hands with
Magnifier
16.99



RadioShack® LED Helping Hands
with **Magnifier**
39.99

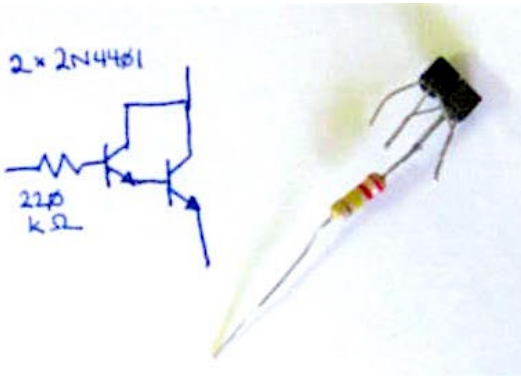


RadioShack® Dual Mini **Board**
2.49

Wiring details

Use a pair of transistors to switch the motor on / off using the micro::bit board. The RadioShack 2N4401 Switching Transistor has about a 200× current gain from the base to the emitter (the Radio Shack specs say 100 to 300 times), and a maximum base current of 600 mA. The photo shows two transistors in a Darlington Pair – so that the emitter of the first one feeds into the base of the second one – making the current gain something like 40,000 (up to the maximum 600 mA).

The transistor has three ports: a Base (where the main current flows in), a Collector (where the signal current flows in), and an Emitter (where the main + signal current flow out). There is something inside physically blocking current flow (a region of extra positive charge) that opens when you flow electrons in through the Collector, allowing the main current to go through.



Input from micro::bit = 3 Volts

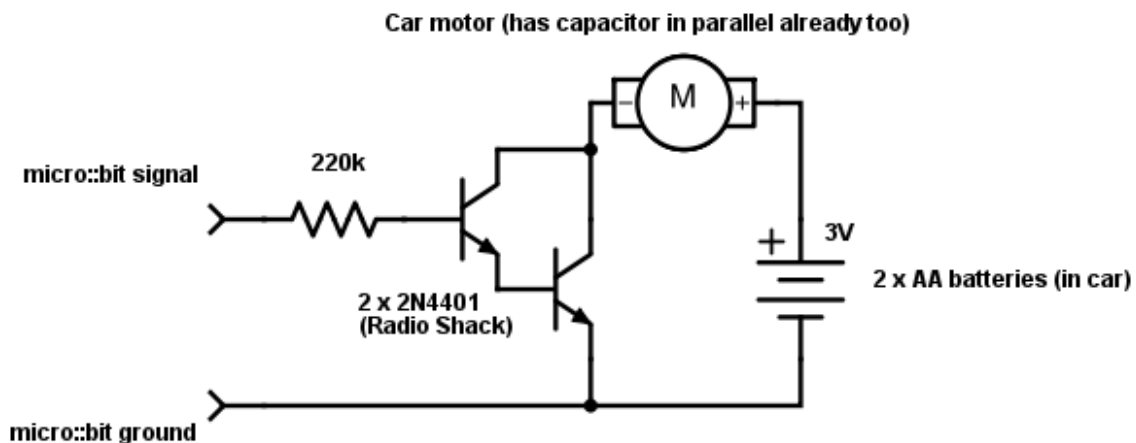
2 × collector → emitter diodes (inside)
= 2 × 0.7 = 1.4 Volts

Current through resistor =
 $(3\text{ V} - 1.4\text{ V}) / 220\text{ k}\Omega = .0073\text{ mA}$

Transistor gain = 200 (well 100-300)
 $200 \times 200 = 40,000$

$40,000 \times 0.0073\text{ mA} = 290\text{ mA}$

This is the whole circuit diagram. The drawing was made in DigiKey's free web-based SchemIt tool: <http://www.digikey.com/schemeit/>.



[Page linking to 2N4401 transistor datasheet from Fairchild Semiconductor](#)

Audio Amplifier

The datasheet for the IC chip in this section lists supply voltages from 4-18V. This probably means the 3V from the two AA batteries in the *Road Ripper Monster Truck* won't be enough. But I didn't try...

There are integrated circuit (IC) chips that can amplify an input sound signal. This is much easier than do-it-yourself (although if you care to try it [this is the easiest one I found online](#)). Don't solder directly to an IC or you'll cook it. Instead use a retention contact and just push the chip in after everything is cool. You can melt the plastic on the retention contact too if you take too long so be quick and careful. This is like a middle-school or above task for sure.

There's a small divot in the top of the IC chip and a similar small divot in one end of the retention contact to get the orientation correct. The chip fits both ways so all you have to go by is the little divot.

Radio Shack shopping list



RadioShack® 8-Pin **Retention Contact**
0.99



RadioShack® **Audio Power Amp**
1.99



RadioShack® General-Purpose IC **PC Board**
2.49



RadioShack® 1.0 ohm **10W 10%** Wirewound **Resistor** (2-Pack)
2.49



RadioShack® 10K-Ohm **Horizontal-Style Trimmer**
1.99



RadioShack® 0.047uF 50V 10% PC-Mount **Capacitor**
1.99



RadioShack® **220uF** 35V 20% Radial-lead Electrolytic **Capacitor**
1.49

Wiring details

Use the recommended “minimum wiring” option from the chip manufacturer, Texas Instruments (actually National is the one that makes the Radio Shack LM386 chip but it’s the same specifications)

V_s stands for the supply voltage – which can be from 4V to 18V. The extra pins are for better control over the amplification if you want to use them but they’re fine the way they are.

You need to use a power resistor at the output W resistor, which will receive

$$P = V^2 / R = 25 \text{ Volts}^2 / 10 \text{ Ohms} = 2.5 \text{ Watts}$$

[Link to the whole datasheet](#) – wiring examples are at the end – and other details and ideas come before that...

