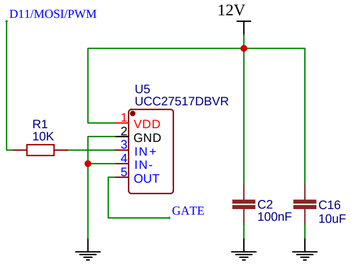
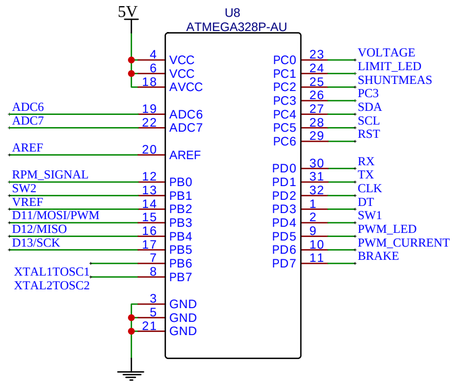
DC Motor Controller

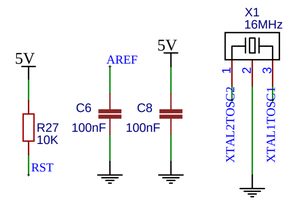
- 13.5(12)-40V, 20A
- Current limit sensing
- 10W LED driver
- Support for RPM measurement
- PID controller for constant RPM

MOSFET driver 4A
R9/10 limit the current to 4A @ 12V
31.25kHz PWM

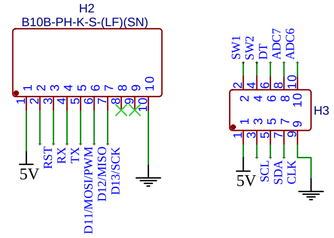


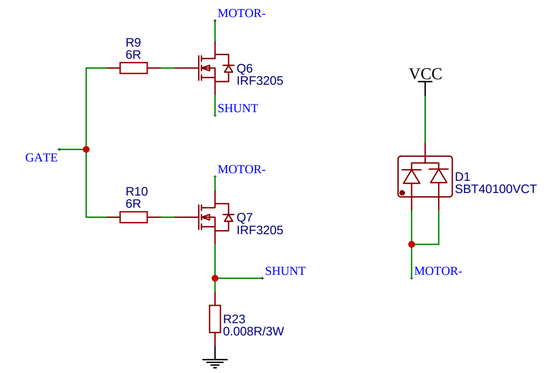
Remote Control Panel (OLED display, rotary encoder and buttons)
https://oshwlab.com/sascha23095123423/dc-motor-controller-panel





Programming and panel header

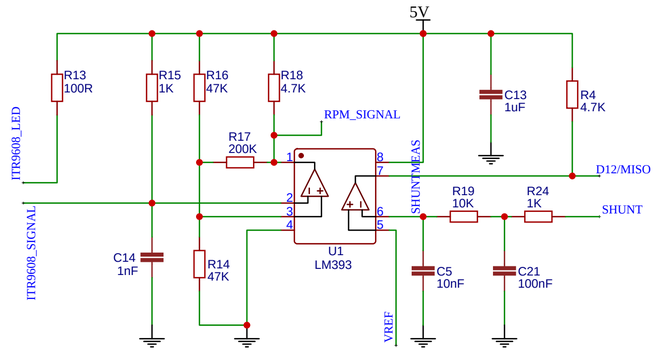




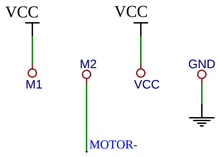
Schmitt trigger for ITR9608 with 2.24/2.76V and current limit sensing

The original current limiter has been replaced and the LM393 sends a signal to the MCU.
The rise time is <0.5ms

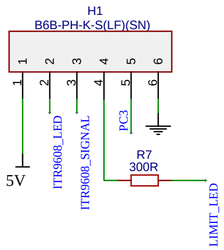
The current limit is supposed to signal over current to the MCU, not limit the actual current.



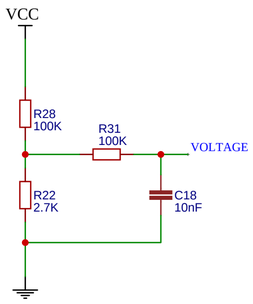
Current limit
VREF from DAC



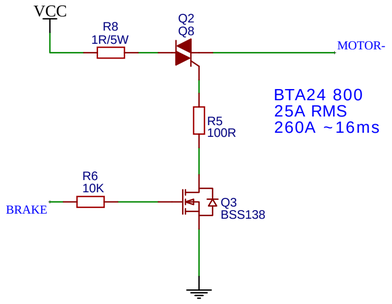
Opto interrupter



Input Voltage Detection



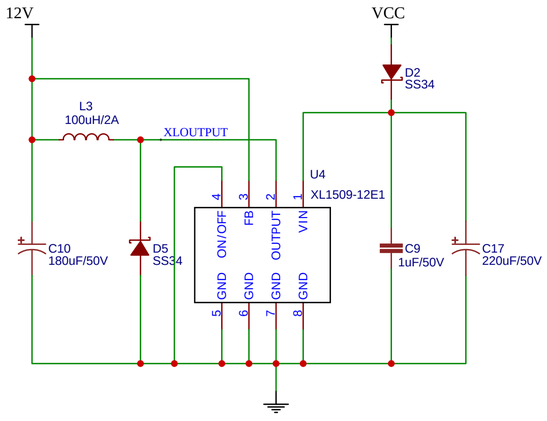
Brake / slow current decay
Adjust R8 that the current stays below the max. ratings of the TRIAC and motor

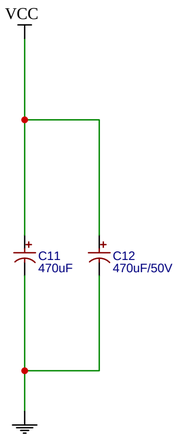


BTA24 800
25A RMS
260A ~16ms

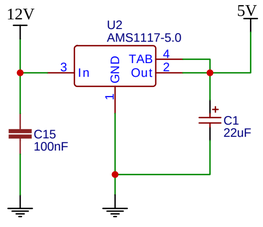
12V supply
~110mA

With 10W of LEDs it goes up to 1.3A
If the LED driver is not used, it only requires a small inductor





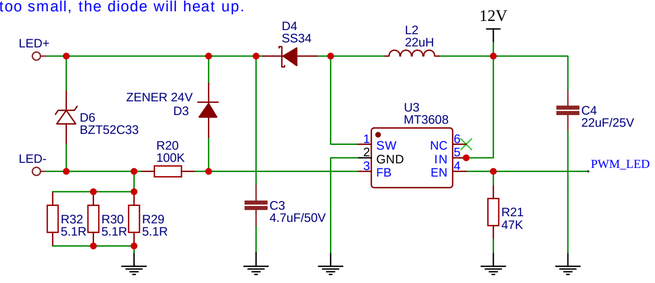
5V supply
~70mA/0.5W dissipation



Optional constant current LED driver ~15-25V, PWM up to 1kHz

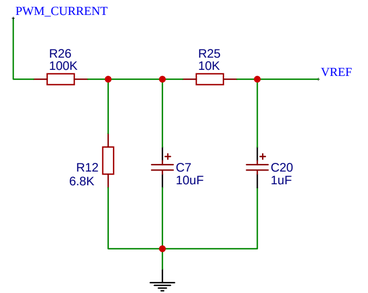
I got the best results with 4.7uF, LEDs 21.6V@250mA and 120, 180 or 240Hz. With higher frequencies the dimming curve becomes non linear and the increase from duty cycle 96-100% is pretty steep (current 70-100%). There is no visible flicker and most cameras can filter multiples of 60Hz.

Using a lower output capacitor leads to overshoot at each PWM cycle
D6 is optional to prevent damage from overshoot. If the output capacitor is too small, the diode will heat up.



NOTE: When turned off, it is still connected to 12V
Open circuit voltage is ~26V

DAC for current limit detection
0-318mV, ~30µV ripple
200-300ms to reach the max. voltage @ 980Hz



Rev 1.1 - Added voltage divider for supply voltage to PC0, changed C5 to 0805, added C17
Rev 1.2 - Some PCB layout changes, added C14 to filter the PWM signal/back EMF, added C18, increased current of MOSFET driver to 1.2A, optional pullup R11
Rev 1.3 - Low cost 4A MOSFET driver UCC27517DBVR, Replaced R7 and R8 since they could not handle the braking current, replaced zener D6 with R31,
removed current limit circuit, connected current limit detection to D12/MISO, added proper trace from shunt to LM393, moved MOSFET driver away from shunt for better cooling, added LED output to PC1
Rev 1.4 - Improved LED dimming, current limit sensing and DAC, TO-220 TRIAC, C14 to filter noise from the opto interrupter
Rev 1.5 - Different connector for the control panel, JST PH wire to board connectors, removed R11, added PC3/ADC3, PE2/ADC6, PE3/ADC7 to headers

TITLE: DC Motor Controller 12-40V, 20A		REV: 1.5
EasyEDA	Company: KFCLabs	Sheet: 1/1
	Date: 2019-10-08	Drawn By: sascha23095123423