HOLE1 HOLE3 HOLE5
3mm 3mm 3mm
HOLE2 HOLE4 HOLE6
3mm 3mm 3mm

DA5
RO-1224
+10V
+24V
TEST24
P1

DA3
RO-1205
C19 1u
TEST5
P2

Power sources:
36V – 300mA
10V – 7.5A
5V – 0.5A

XP1
GPRM1-61
Stepper
PWR_FLAG
+36V
+10V
Power ground
5V out
Signal ground
End point switches
EP0
EP1
EP2
EP3
Hall0
Hall1
Hall2
Hall3
Hall4
Hall5
Hall6
Hall7
Hall8
Hall9
Hall sensors
1-wire
5V ext
VD1
B120-E3
Power load (top switch)
POW_LOAD

To thermoresistors
XP2 TRD
T1_0
T1_1
T1_2
T1_3
T1_4
T1_5
T1_6
T1_7

STM32F103 module
+5V
GND
1-WIRE
ADC[0..7]
T1_[0..7]
AGND
Hall[0..9]
EP[0..3]
TIM1
TIM2
CLK_1
CLK_2
CLK_3
CLK_4
CLK_5
EN[1..5]
EN_[1..5]
EN_1
EN_2
EN_3
EN_4
EN_5
DIR[1..5]
DIR_[1..5]
DIR_1
DIR_2
DIR_3
DIR_4
DIR_5
POW[0..3]
SHTR
SHTR_FB
POW3_FEEDBACK
MCU_module.sch
U10
U36
+10V
12k R43
4.7k R44

Turret slits
CLK_1
DIR_1
EN_1
SM_5V
SM_CLK
SM_DIR
SM_EN
+24V
+10V
PWR_GND
A
A*
B*
B
1A
1B
1C
1D
motors.sch

Filters slit #1
CLK_2
DIR_2
EN_2
2A
2B
2C
2D
motors.sch

Filters slit #2
CLK_3
DIR_3
EN_3
3A
3B
3C
3D
motors.sch

Long stage
CLK_4
DIR_4
EN_4
4A
4B
4C
4D
motors.sch

Short stage
CLK_5
DIR_5
EN_5
5A
5B
5C
5D
motors.sch

Shutter control
Shutter1
Shutter2
XP7 Power
POW_GND1
+10V
+10V
POW_GND2
Power load (bottom switches)

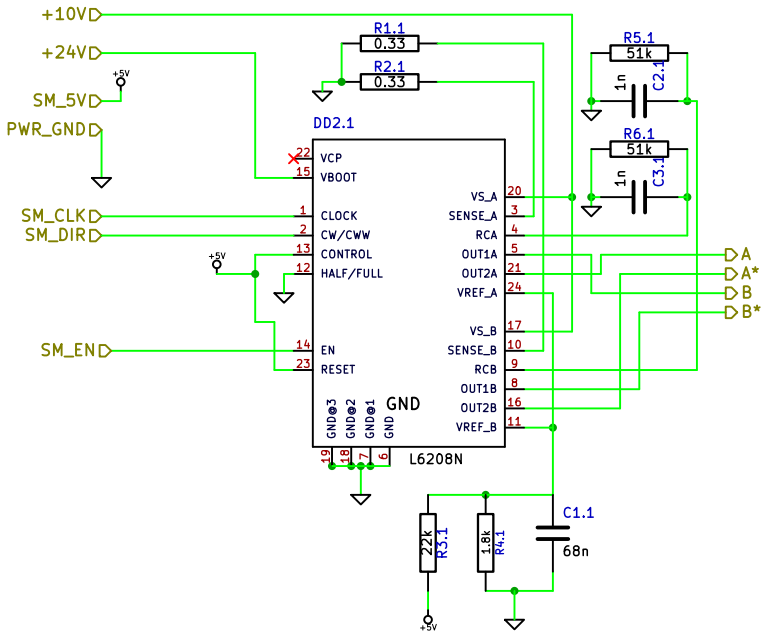
IPS5451
VCC
DG
VOUT
GND
IN
DA1
R19 4.7k
POW_LOAD
POW3

Shutter MOSFET
Shutter out
+36V
Shutter1
Shutter2
+36V
OUT1
OUT2
EF
Sense
IN2
IN1
GND
POW0
Shutter_MOSFET.sch

Power MOSFET module 1
Power load (bottom switches)
POW_GND1
GND_OUT
ON
GND
POW1
power_MOSFET.sch

Power MOSFET module 2
POW_GND2
GND_OUT
ON
GND
POW2
power_MOSFET.sch

SAO RAS		
File: ALL.sch		
Sheet: /		
Title: IR-spectrometer Control System		
Size: A3	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 1/12



SAO RAS		
File: motors.sch		
Sheet: /Turret slits/		
Title: Stepper motor module		
Size: A4	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 2/12

SPI/CAN/I2C

CONN_7 XP3

+3.3V

7 I2C_SDA/CANTX
6 I2C_SCL/CANRX
5 SPI1_MOSI
4 SPI1_MISO
3 SPI1_SCK
2
1

Power

+5V
GND

DA6 LM1117MPX-3.3 (IN, OUT, GND)

C5 10u
C6 100u
VD2 PWR
R10 510
L1 BMB2A0300AN1
PWR_FLAG
C13 10u
C14 100n

VDDA
VSSA

RST

R26 10k
SB1 RESET
C7 100n

BOOT

C8 100n
SB2 BOOT
R17 10k

U10 U10_ADC
U36 U36_ADC

SHTR SHTR
SHTR_FB SHTR_FB

POW[0..3] POW[0..3]
POW3_FEEDBACK

R20 15k
R21 15k
DG_FEEDBACK

AGND VSSA
ADC[0..7] ADC_[0..7]

1-WIRE 1-WIRE

TIM1 TIM1
TIM2 TIM2
DIR[1..5] DIR_[1..5]
DIR_1
DIR_2
DIR_3
DIR_4
DIR_5

EN[1..5] EN_[1..5]
EN_1
EN_2
EN_3
EN_4
EN_5

Hall[0..9] Hall[0..9]
Hall0 Tur1_0
Hall1 Tur1_1
Hall2 Tur1_2
Hall3 Tur1_3
Hall4 Tur2_0
Hall5 Tur2_1
Hall6 Tur2_2
Hall7 Tur3_0
Hall8 Tur3_1
Hall9 Tur3_2

EP[0..3] EP[0..3]
EP0 LS1_down
EP1 LS1_up
EP2 LS2_down
EP3 LS2_up

Additional SPI

CONN_4 XP4

1 SPI2_MOSI
2 SPI2_MISO
3 SPI2_SCK
4

Additional IO

CONN_7 XP5

7 EXT4/BOOT_TX
6 EXT5/BOOT_RX
5 EXT3
4 EXT2
3 EXT1
2 EXT0
1

POW[0..3]
POW0
POW1
POW2
POW3

+3.3V

R22 10k
R23 10k
R24 10k

POW0
SHTR
SHTR_FB

POW1
POW2
POW3

R37 10k
R38 10k
R39 10k

R13 10k
R14 10k
R15 20k
R16 10k

USB input circuit

+5V
USB_+5V
GND
USB_inp.sch

USB_POWER
USB_DISC
USB_DP
USB_DM

RS-232 level converter

+5V
GND
ST3232.sch

UART_RX
UART_TX
EXT5/BOOT_RX
EXT4/BOOT_TX

STM32F103

DD3

DIR_3 1 PE2/TRACECK
DIR_4 2 PE3/TRACED0
DIR_5 3 PE4/TRACED1
POW3 4 PE5/TRACED2
DG_FEEDBACK 5 PE6/TRACED3
6 VBAT
7 PC13/TAMPER-RTC
8 PC14/OSC32IN
9 PC15/OSC32OUT
10 VSS5
11 VDD5
12 OSC_IN
13 OSC_OUT
RST 14 NRST
SHTR 15 PC0/ADC12_IN10
SHTR_FB 16 PC1/ADC12_IN11
POW0 17 PC2/ADC12_IN12
18 PC3/ADC12_IN13
VSSA 19 VSSA
20 VREF-
21 VREF+
VDDA 22 VDDA
U10_ADC 23 PA0/WKUP/USART2_CTS/ADC12_IN0/TIM2_CH1_ETR
U36_ADC 24 PA1/USART2_RTS/ADC12_IN1/TIM2_CH2
25 PA2/USART2_TX/ADC12_IN2/TIM2_CH3

C10 27p
C11 27p
G1 8MHz
R12 1M
C12 100n

1-WIRE
R11 4.7k

100n C16
VDD3 100
VSS3 99
PE1 98
PE0/TIM4_ETR 97
PB9/TIM4_CH4(I2C1_SDA/CANTX) 96
PB8/TIM4_CH3(I2C1_SCL/CANRX) 95
BOOT0 94
PB7/I2C1_SDA/TIM4_CH2(USART1_RX) 93
PB6/I2C1_SCL/TIM4_CH1(USART1_TX) 92
PB5/I2C1_SMBA(TIM3_CH2/SPI1_MOSI) 91
JNTRST(TIM3_CH1/PB4/SPI1_MISO) 90
JTDO(TIM2_CH2/PB3/TRACESWO/SPI1_SCK) 89
PD7(USART2_CK) 88
PD6(USART2_RX) 87
PD5(USART2_TX) 86
PD4(USART2_RTS) 85
PD3(USART2_CTS) 84
PD2/TIM3_ETR 83
PD1/OSC_OUT(CANTX) 82
PD0/OSC_IN(CANRX) 81
PC12(USART3_CK) 80
PC11(USART3_RX) 79
PC10(USART3_TX) 78
JTCK/SWCLK(PA14) 77
JTDI(TIM2_CH1_ETR/PA15/SPI1_NSS) 76

DIR_2
DIR_1
I2C_SDA/CANTX
I2C_SCL/CANRX
BOOT
Tur3_2
Tur3_1
SPI1_MOSI
SPI1_MISO
SPI1_SCK
Tur3_0
Tur2_2
Tur2_1
Tur2_0
Tur1_3
Tur1_2
Tur1_1
Tur1_0
USB_DISC
USB_POWER

PA3/USART2_RX/ADC12_IN3/TIM2_CH4 26
VSS4 27
VDD4 28
PA4/SPI1_NSS/USART2_CK/ADC12_IN4 29
PA5/SPI1_SCK/ADC12_IN5 30
PA6/SPI1_MISO/ADC12_IN6/TIM3_CH1(TIM1_BKIN) 31
PA7/SPI1_MOSI/ADC12_IN7/TIM3_CH2(TIM1_CH1N) 32
PC4/ADC12_IN14 33
PC5/ADC12_IN15 34
PB0/ADC12_IN8/TIM3_CH3(TIM1_CH2N) 35
PB1/ADC12_IN9/TIM3_CH4(TIM1_CH3N) 36
PB2/BOOT1 37
PE7(TIM1_ETR) 38
PE8(TIM1_CH1N) 39
PE9(TIM1_CH1) 40
PE10(TIM1_CH2N) 41
PE11(TIM1_CH2) 42
PE12(TIM1_CH3N) 43
PE13(TIM1_CH3) 44
PE14(TIM1_CH4) 45
PE15(TIM1_BKIN) 46
PB10/I2C2_SCL/USART3_TX(TIM2_CH3) 47
PB11/I2C2_SDA/USART3_RX(TIM2_CH4) 48
VSS1 49
VDD1 50

ADC_7
ADC_6
ADC_5
ADC_4
ADC_3
ADC_2
ADC_1
ADC_0
UART_TX
UART_RX

C9 100n
C17 100n

EN_1
EN_2
EN_3
EN_4
EN_5
POW2
POW1

R18 100n

Resistors with LOW |dR/dT|

VDDA
R27
R28 RT0805BRB071KL
R29 RT0805BRB071KL
R30 RT0805BRB071KL
R31 RT0805BRB071KL
R32 RT0805BRB071KL
R33 RT0805BRB071KL
R34 RT0805BRB071KL
R35 RT0805BRB071KL

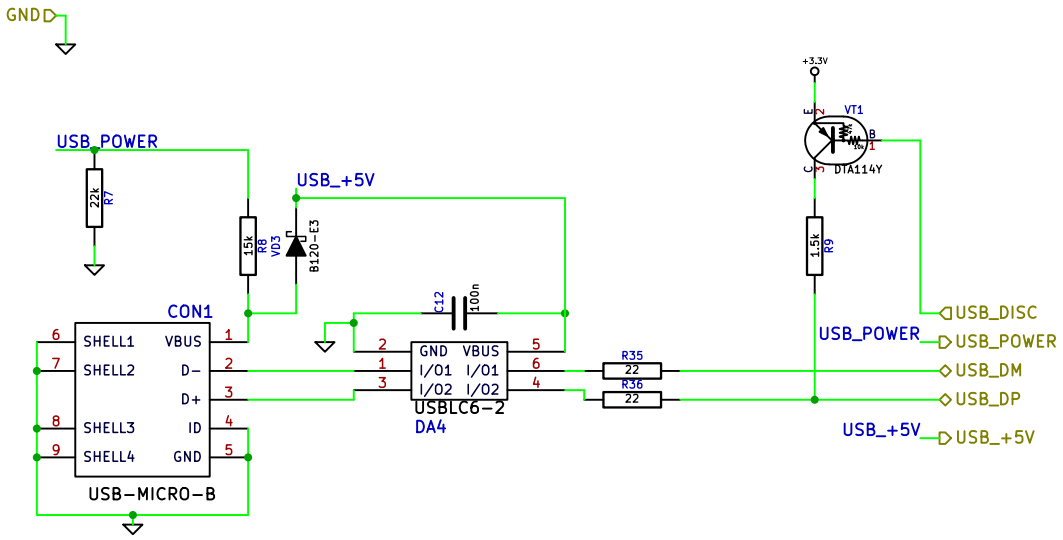
ADC[0..7]

C18 100n

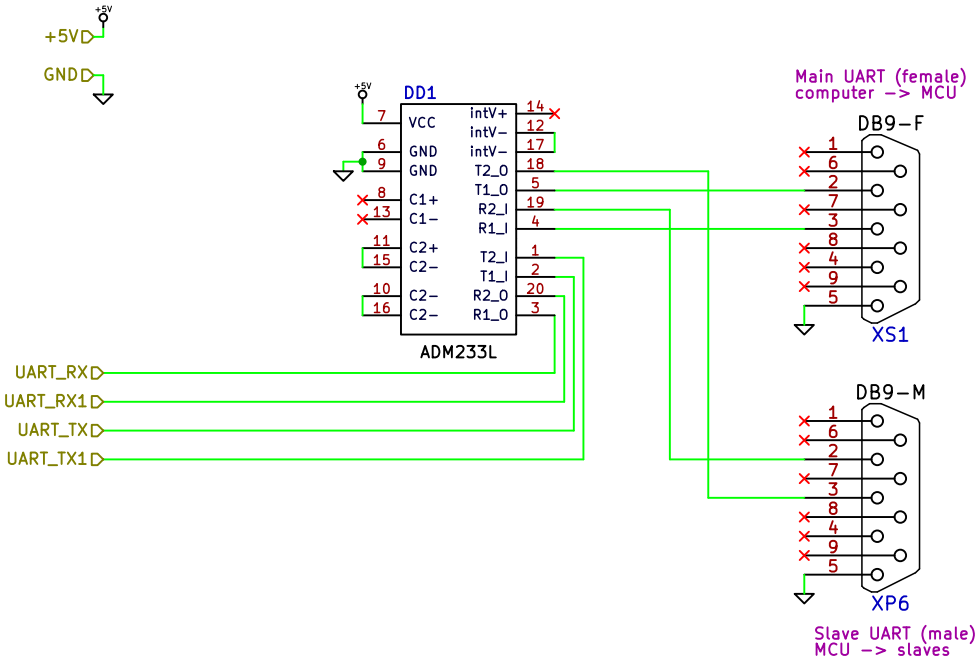
VDD2 75
VSS2 74
NC 73
JTMS/SWDIO(PA13) 72
PA12/USART1_RTS/CANTX/USBDP/TIM1_ETR 71 USB_DP
PA11/USART1_CTS/CANRX/USBDM/TIM1_CH4 70 USB_DM
PA10/USART1_RX/TIM1_CH3 69 EXT5/BOOT_RX
PA9/USART1_TX/TIM1_CH2 68 EXT4/BOOT_TX
PA8/USART1_CK/TIM1_CH1/MCO 67 LS2_up
PC9(TIM3_CH4) 66 LS2_down
PC8(TIM3_CH3) 65 LS1_up
PC7(TIM3_CH2) 64 LS1_down
PC6(TIM3_CH1) 63 TIM1
PD15(TIM4_CH4) 62 TIM2
PD14(TIM4_CH3) 61
PD13(TIM4_CH2) 60 EXT3
PD12(TIM4_CH1/USART3_RTS) 59 EXT2
PD11(USART3_CTS) 58 EXT1
PD10(USART3_CK) 57 EXT0
PD9(USART3_RX) 56
PD8(USART3_TX) 55
PB15/SPI2_MOSI/TIM1_CH3N 54 SPI2_MOSI
PB14/SPI2_MISO/USART3_RTS/TIM1_CH2N 53 SPI2_MISO
PB13/SPI2_SCK/USART3_CTS/TIM1_CH1N 52 SPI2_SCK
PB12/SPI2_NSS/I2C2_SMBAI/USART3_CK/TIM1_BKIN 51

C18 100n

SAO RAS		
File: MCU_module.sch		
Sheet: /STM32F103 module/		
Title: MCU module on STM32F103		
Size: A3	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 3/12

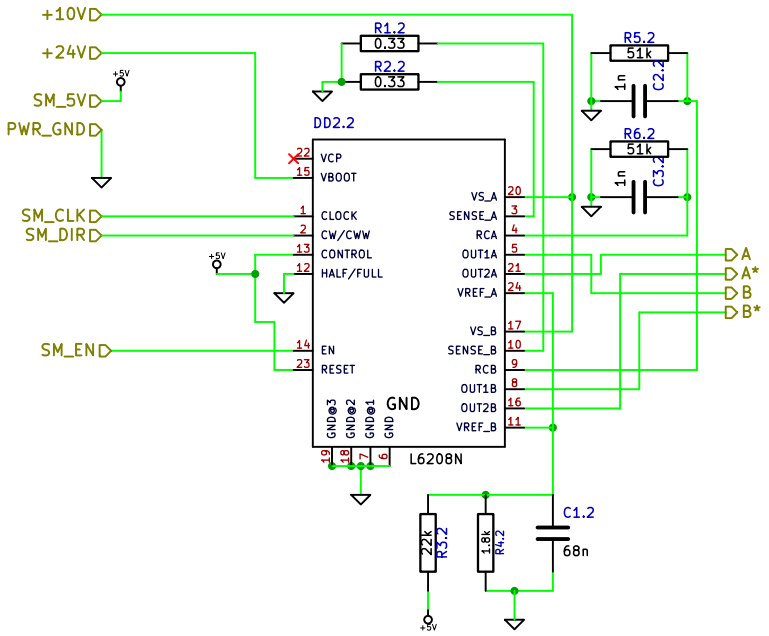


SAO RAS		
File: USB_inp.sch		
Sheet: /STM32F103 module/USB input circuit/		
Title: USB input circuit		
Size: A4	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 4/12

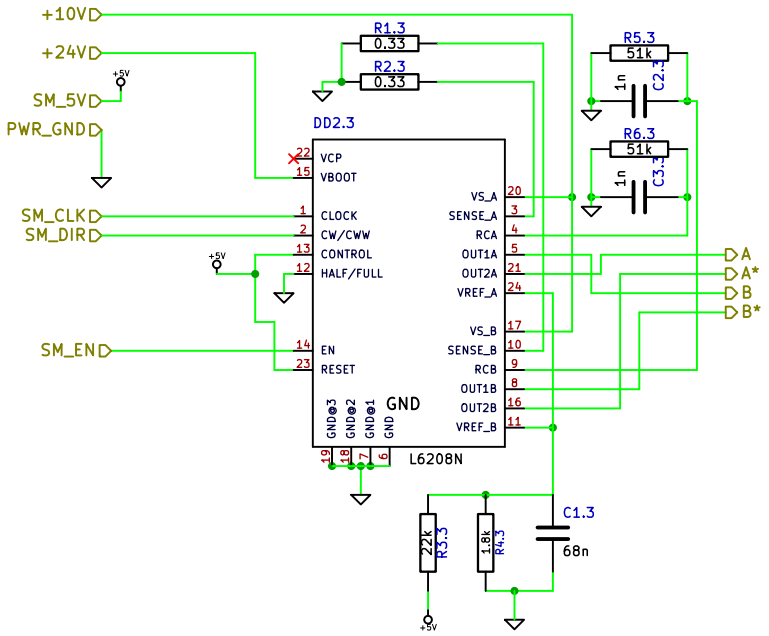


DB9 pinout:
1 – Data carrier detect
2 – Receive data
3 – Transmit data
4 – Data terminal ready
5 – Signal ground
6 – Data set ready
7 – Request to send
8 – Clear to send
9 – Ring indicator

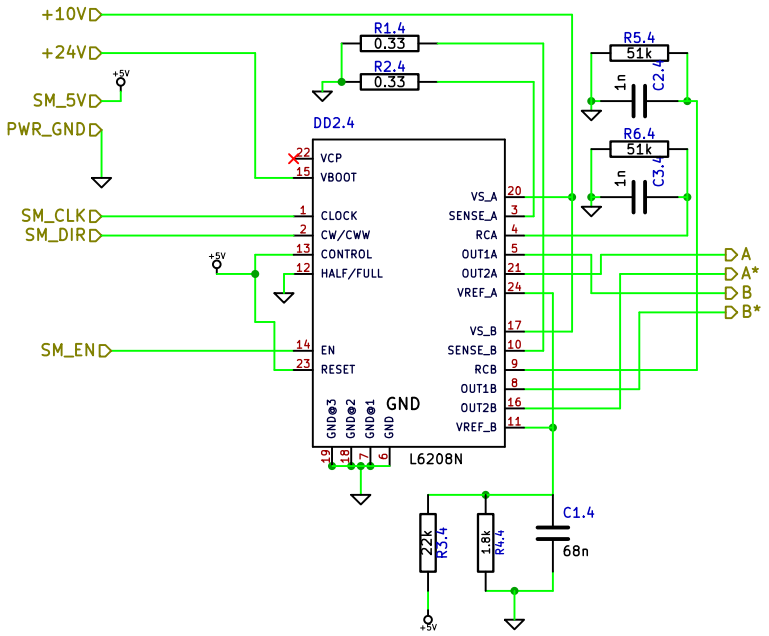
SAO RAS		
File: ST3232.sch		
Sheet: /STM32F103 module/RS−232 level converter/		
Title: RS−232 level converter		
Size: A4	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 5/12



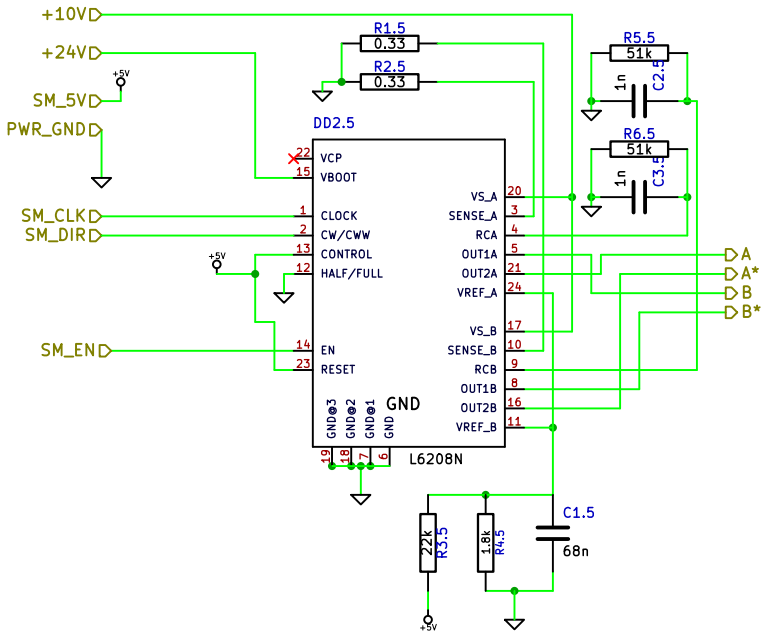
SAO RAS		
File: motors.sch		
Sheet: /Filters slit #1/		
Title: Stepper motor module		
Size: A4	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 6/12



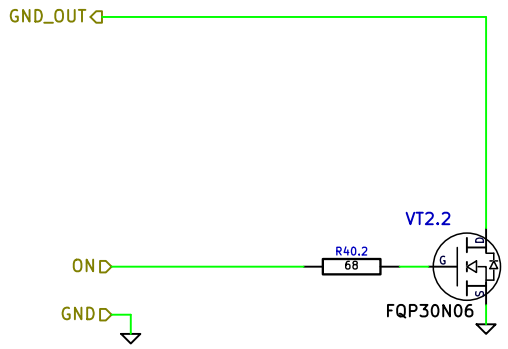
SAO RAS		
File: motors.sch		
Sheet: /Filters slit #2/		
Title: Stepper motor module		
Size: A4	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 7/12



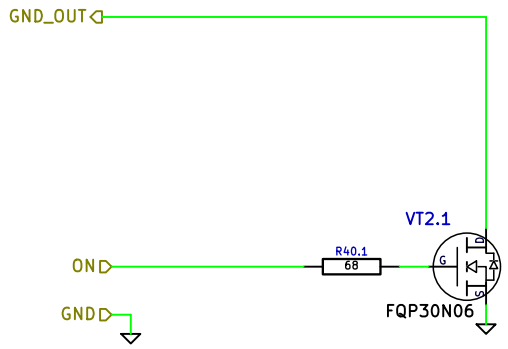
SAO RAS		
File: motors.sch		
Sheet: /Long stage/		
Title: Stepper motor module		
Size: A4	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 8/12



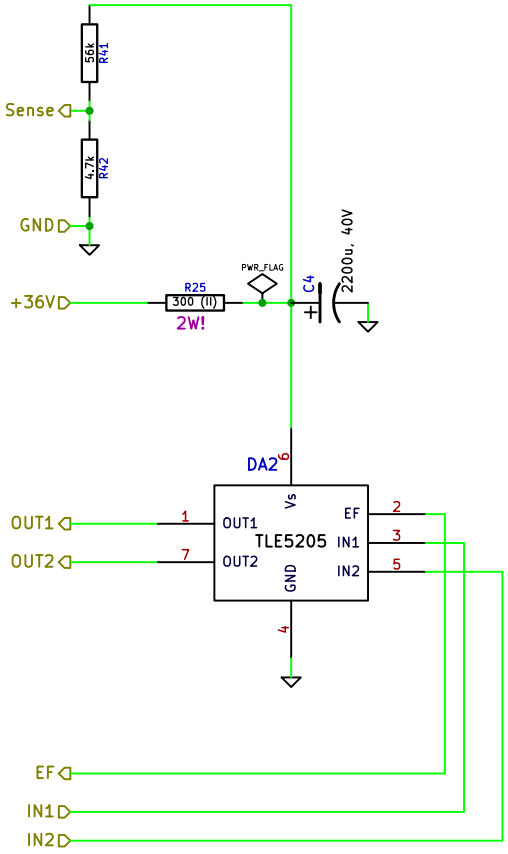
SAO RAS		
File: motors.sch		
Sheet: /Short stage/		
Title: Stepper motor module		
Size: A4	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 9/12



SAO RAS		
File: power_MOSFET.sch		
Sheet: /Power MOSFET module 1/		
Title: Power load module		
Size: A4	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 10/12



SAO RAS		
File: power_MOSFET.sch		
Sheet: /Power MOSFET module 2/		
Title: Power load module		
Size: A4	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 11/12



SAO RAS		
File: Shutter_MOSFET.sch		
Sheet: /Shutter MOSFET/		
Title: Power load module		
Size: A4	Date: 25 nov 2014	Rev:
KiCad E.D.A.		Id: 12/12