U3E
LIN1 LINBUS

U3A
molex_48pin_MRE
M13 M12 M11 M3 M23 M22 M21 M4 M53 M52 M51
M73 12V_SAFE M63
M72 12V_SAFE M62
M71 12V_SAFE M61
1 12V_MREL
2 GND
3 LS2
4 E-THROTTLE+
5 12V_KEY
6 GND
7 LS1
8 E-THROTTLE-
9 Ign1
10 Ign2
11 Ign3
12 Ign4
13 GP6
14 GP5
15 USB_D-
16 USB_D+
17 GND
18 AT1
19 AT4
20 AT5
21 GND
22 AT4
23 AT2
24 AT3
25 CAM_SENSOR
26 AV2
27 AV1
28 AV10
29 MAIN_RELAY
30 AV7
31 AV3
32 AV6
33 GP3
34 GP2
35 GP1
36 AV8
37 INJECTOR-1
38 INJECTOR-2
39 5V2
40 AV9
41 INJECTOR-3
42 INJECTOR-4
43 GP4
44 5V1
45 CRNK+
46 CRNK-
47 CANL
48 CANH

U3D
5V J801 J802 12V_MREL
PB8 J803 J804 VDD
PC11 J805 J806 PB9
PA15 J807 J808 PC10
GND J809 J810 PC12

Communication Header
J4
Conn_02x05_Counter_Clockwise
5V 1 2 12V_MREL
PB8 3 4 VDD
PC11 5 6 PB9
PA15 7 8 PC10
GND 9 10 PC12

12V_MREL D36 SS54 12V_SAFE
12V_KEY D37 SS54
D41 SM15T33C Load Dump TVS
GND

5V TP5
GND TP0
CAM_MCU TP2
CRANK TP4
12V_MREL TP12
VDD TP3

D44 1N4148WS
VDD
JP3 Voltage selector 5V 3V3
1 2 3 5V
J21
GND J20 U3Q

ANALOG INPUTS.
ADC 1-4 HAVE
BIAS RESISTORS
FOR TEMP SENSORS

CAN ALSO BE USED
AS DIGITAL INPUTS

Sheet: ADC
AT1 AT2 AT3 AT4
AV1 AV2 AV3 AV4 AV5 AV6 AV7 AV8 AV9 AV10
CAM_SENSOR
12V_MREL
5V
AT1_MCU AT2_MCU AT3_MCU AT4_MCU
AV1_MCU AV2_MCU AV3_MCU AV4_MCU AV5_MCU AV6_MCU AV7_MCU AV8_MCU AV9_MCU AV10_MCU
CAM_MCU
Vbat_MCU
AV11_MCU TP1
AGND
File: adc.sch

GP OUT 5 AND 6 ARE HIGH SIDE DRIVEN
Sheet: MCU
VDD GND
AT1_MCU AT2_MCU AT3_MCU AT4_MCU
AV1_MCU AV2_MCU AV3_MCU AV4_MCU AV5_MCU AV6_MCU AV7_MCU AV8_MCU AV9_MCU AV10_MCU
CAM_MCU
Vbat_MCU
AV4 D7 USB_VBUS
USB_D- USB_D-
USB_D+ USB_D+
Analog Ground Net Tie NT3
VSSA
GND
PA0 PA1 PA2 PA3 PC0 PA6 PA7 PC2 PC3 PC4 PC5 PB0 PB1 PA4 PA5 PC1
PD12 PD13 PD14 PD15 PE14 PE13 PE12 PE11 PE10 PE9 PE8 PE7 PB6 PB12 PB4 PD5 PB5 PB3 PC6
PB9 PB7 PC12 PD0 PC13 PE6 PE5 PA14
PA8 PC7 PC8 PC9
PB14 PB15 PB13 PE15 PB11 PB10 PE2 PE0 PE4 PE3 PB8 PB2-BOOT1 PC10 PC11 PA15 PA13
NRST PE1
RST R29 1k
RST R2 0R DNP
D28 LED-RED
12V_KEY 12V_SAFE
U7 XC6206 3.3V
VBAT 5V
5V_STBY
LIN_TX LIN_RX IGN_EN INJ_EN
SO SI SCK CRANK CS
PB9 J18 U3I
PC12 J16 U3M
PC13 J9 U3J
J10 U3K
J11 U3L
File: stm32.sch

Sheet: TLE8888-1QK
PD12 PD13 PD14 PD15
IGN_IN_1 IGN_IN_2 IGN_IN_3 IGN_IN_4
INJ_IN_1 INJ_IN_2 INJ_IN_3 INJ_IN_4
IN_9 IN_10 IN_11 IN_12
CAN_TX CAN_RX SDO SCK SIP FCLP CRNK_IN
GND 5V 5V1 5V2 RST 12V_KEY 12V_SAFE 5V_STBY
IGN_OUT_1 IGN_OUT_2 IGN_OUT_3 IGN_OUT_4
INJ_1 INJ_2 INJ_3 INJ_4
OUT_5 OUT_6 OUT_7
OUT_14 OUT_15 OUT_16 OUT_17 OUT_18 OUT_19 OUT_20 OUT_21 OUT_22 OUT_23 OUT_24
CRNK+ CRNK- LIN_IO CAN_L CAN_H MAIN_RELAY VDD
OUT8 DFB8 OUT9 DFB9 OUT10 DFB10 OUT11 DFB11 OUT12 DFB12 OUT13 DFB13
TLE_OUT10_PRE TLE_DFB10 TLE_OUT11_PRE TLE_DFB11 TLE_OUT12_PRE TLE_DFB12 TLE_OUT13_PRE TLE_DFB13
File: TLE8888-1QK.sch

U3F
J51 R21 0R Ign1
J52 R33 0R Ign2
J53 R80 0R Ign3
J54 R81 0R Ign4
J14 U3N
INJECTOR-1 INJECTOR-2 INJECTOR-3 INJECTOR-4 2.2A
LS2 4.5A
LS1
LOW SIDE OUTPUTS
Populate for freewheeling.
Bypasses internal clamps.
D20 12V_MREL
D15
J61 J62 J63 J64 J65 U3B
0.6A low side drivers
J3 J5 J12 J13
D4 D3 D6 D5

Push-Pull half bridge
LOW-SIDE OR HIGH-SIDE
GP1 GP2 GP3 GP4 0.6A

CANH J22
CANL J23 U3R
CANH J49
CANL J50 U3S

5V
D30 D32 D34
D31 D33 D35 LED-RED
R36 R49 R51 1k
LS2 INJECTOR-1 GP5

LED-YELLOW PE1 D27
LED-BLUE PE2 D23
LED-RED PE3 D21
LED-GREEN PE4 D22
RN1 1k
PE1 is yellow- warning
PE2 is blue - communication
PE3 is red - fatal
PE4 is green - running

12V_SAFE
D43
LINBUS R10 1k
LIN bus termination

Sheet: H-BRIDGE
6A H-BRIDGE
E-THROTTLE+ E-THROTTLE-
OUT1 OUT2
12V_MREL
VDD
GND
DIR PWM DIS SO SI SCK CS
File: TLE9201SG.sch

Sheet: FlashMemory
VDD
SO SI SCK CS HOLD WP
PC13 PE0
File: FlashMemory.sch

Sheet: SDCard
VDD
PB9 PC10 PC11 PC12
File: SDCard.sch

Sheet: hi-lo
PD4 PD3 PD2 PD1 PD7 PD6
Ign1_MCU Ign2_MCU Ign3_MCU Ign4_MCU GP5_MCU GP6_MCU
Ign1 Ign2 Ign3 Ign4 GP5 GP6
HIGH-SIDE PP OUTPUTS
5V 12V
5V 12V_MREL
File: hi-lo.sch

TLE_DFB10
AV9_MCU 0R R30 TLE_OUT10_PRE
AV8_MCU 0R R84 TLE_OUT11_PRE
TLE_DFB11
Sheet: LowSides_3-4
IN2 OUT2D
IN1 OUT1D
AV9 AV8
File: pair.sch

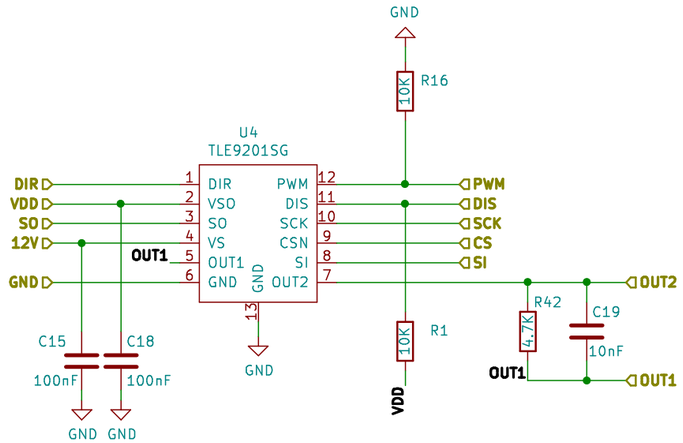
TLE_DFB13
AV10_MCU 0R R85 TLE_OUT13_PRE
AV6_MCU 0R R86 TLE_OUT12_PRE
TLE_DFB12
Sheet: LowSides_1-2
IN1 OUT1D
IN2 OUT2D
AV10 AV6
File: pair.sch

NOT OEM POPULATED
OEM IS
AV6 AND AV10 ARE ANALOG
AV8 AND AV9 ARE DIGITAL OUTPUTS

FOR OFF ROAD PURPOSES ONLY
This is not for applications with emissions or safety regulations (AKA not for street use). This is for closed stages, track and equipment.

by JRD McLAREN
Donald Becker

rusEFI.com
Sheet: /
File: micro_rusEFI.sch
Title: microRusEFI-2L
Size: B | Date: 2022-03-16 | Rev: R0.5.5rc2
KiCad E.D.A. kicad 5.1.5+dfsg1-2build2 | Id: 1/10



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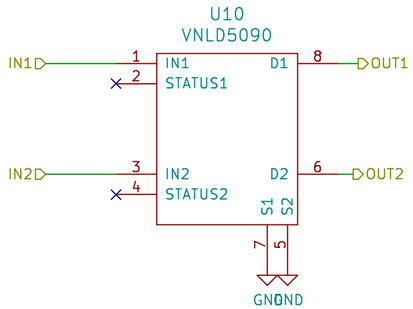
Donald Becker

rusEFI.com		
Sheet: /H-BRIDGE/ File: TLE9201SG.sch		
Title: microRusEFI-2L		
Size: A	Date: 2022-03-16	**Rev: R0.5.5rc2**
KiCad E.D.A. kicad 5.1.5+dfsg1-2build2		Id: 2/10



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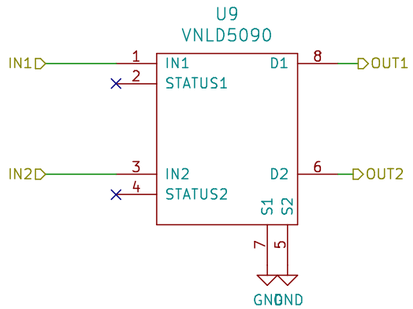
Sheet: /LowSides_3-4/
File: pair.sch

Title: microRusEFI-2L

Size: A4	Date: 2022-03-16	**Rev: R0.5.5rc2**
KiCad E.D.A. kicad 5.1.5+dfsg1-2build2		Id: 3/10



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Donald Becker

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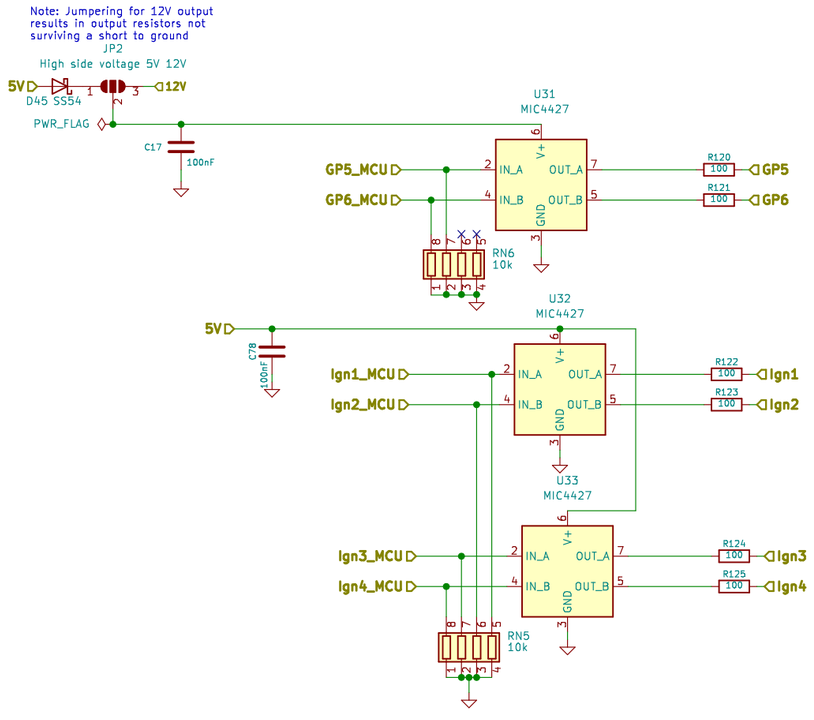
Sheet: /LowSides_1-2/
File: pair.sch

Title: microRusEFI-2L

Size: A4	Date: 2022-03-16	**Rev: R0.5.5rc2**
KiCad E.D.A. kicad 5.1.5+dfsg1-2build2		Id: 4/10

6 channel high / low side driver



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Sheet: /hi-lo/
File: hi-lo.sch

Title: microRusEFI-2L

Size: B	Date: 2022-03-16	**Rev: R0.5.5rc2**
KiCad E.D.A. kicad 5.1.5+dfsg1-2build2		Id: 5/10

FID5
Fiducial
FID6
Fiducial

5V 5V 5V 5V
R14 27K
R25 27K
R26 27K
R27 27K

RN3
10k
AT4
AT3
AT2
AT1

U35B MCP6004
U35A MCP6004
U35D MCP6004
U35C MCP6004

6.8K R64
6.8K R65
6.8K R66
6.8K R67
10K R68
10K R69
10K R70
10K R71
AGND

AT4_MCU
AT3_MCU
AT2_MCU
AT1_MCU

D38
SRV05-4
5V

C79 10nF
5V
U35E MCP6004
V+ 4
V- 11

CN3
100nF

AV5
AV4
CAM

5V
LED-RED
D29
R28 2.2K

RN13
10k

5V R11 DNP
5V R40 DNP
R139 39k
12V
R131 470K
R41 470K
R141 10K

U46D MCP6004
U46C MCP6004
U46B MCP6004
U46A MCP6004

6.8K R72
6.8K R73
6.8K R74
6.8K R75
10K R76
10K R77
10K R78
10K R79
AGND

AV11_MCU
Vbat_MCU
AV4_MCU
AV5_MCU

CAM_MCU

Comparator with histeresis for CAM input?
Usign this OpAmp.

5V
SRV05-4
D40

CN1
100nF

C82 10nF
5V
U46E MCP6004
V+ 4
V- 11

AV3
AV2
AV10
AV1

RN4
10k

470K R24
470K R31
470K R34
470K R37

5V
SRV05-4
D39

U36D MCP6004
U36C MCP6004
U36B MCP6004
U36A MCP6004

6.8K R5
6.8K R26
6.8K R32
6.8K R35
10K R38
10K R39
10K R44
10K R46
AGND

AV1_MCU
AV10_MCU
AV2_MCU
AV3_MCU

5V
C80 10nF
U36E MCP6004
V+ 4
V- 11

CN4
100nF

NOT OEM POPULATED
OEM IS
AV6 AND AV10 ARE ANALOG
AV8 AND AV9 ARE DIGITAL OUTPUTS

5V
R7 DNP

AV9
AV8
AV7
AV6

RN2
10k

470K R52
470K R54
470K R56
470K R58

D13
SRV05-4
5V

U8B MCP6004
U8A MCP6004
U8D MCP6004
U8C MCP6004

6.8K R53
6.8K R55
6.8K R57
6.8K R59
10K R60
10K R61
10K R62
10K R63
AGND

AV9_MCU
AV8_MCU
AV7_MCU
AV6_MCU

5V
C40 10nF
U8E MCP6004
V+ 4
V- 11

CN2
100nF

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Donald Becker

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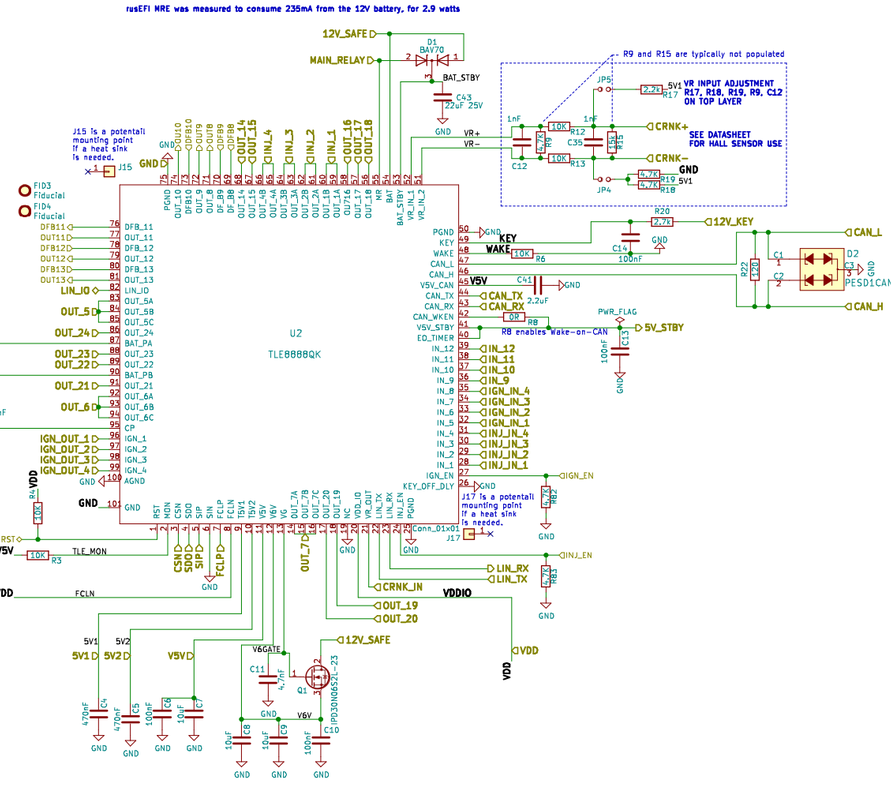
Sheet: /ADC/
File: adc.sch

Title: microRusEFI-2L

Size: B	Date: 2022-03-16	**Rev: R0.5.5rc2**
KiCad E.D.A. kicad 5.1.5+dfsg1-2build2		Id: 6/10



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Sheet: /TLE8888-1QK/	
File: TLE8888-1QK.sch	
Title: microRusEFI-2L	
Size: User	Date: 2022-03-16
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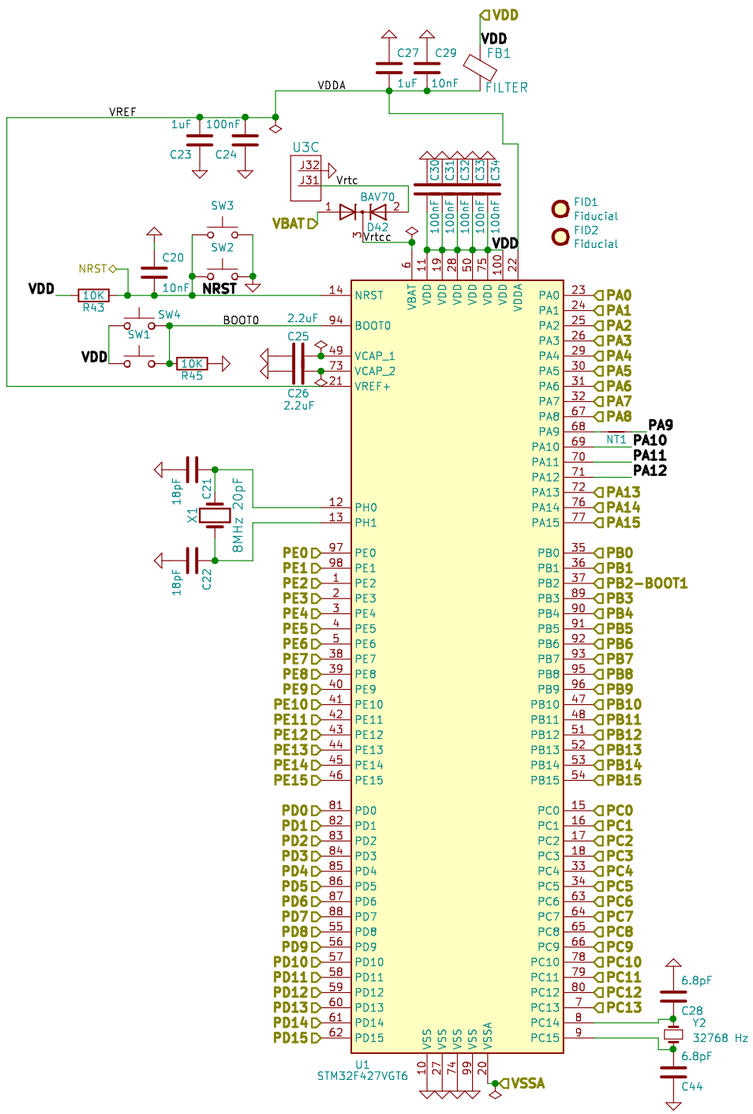
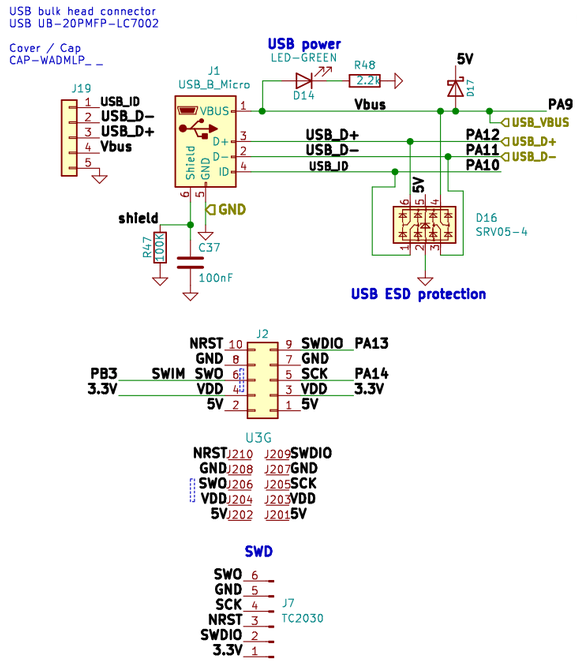
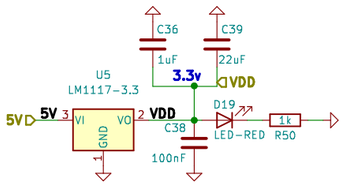
	Rev: R0.5.5rc2







http://www.crystek.com/documents/appnotes/Pierce-GateIntroduction.pdf
PCB per predictions with SaturnPCB has less then 3.5pF traces,
STM32 pins assumed 5pF
ESR = 80ohms max???
Rf = 2meg could be between 1meg and 10meg.
Cload should be 8pF per XTAL datasheet
Cload = ((Cin+C1)[C2+Cout])/(Cin+C1+C2_Cout)+PCBstray
Cload = ([5+4.7][4.7+5])/(5+4.7+4.7+5)+3.5= 8.35pF
C1=C2=C166=C167 = 4.7pF
Rs = 1/(2pIFC2) = 1/(2*pI*8MHz*4.7pF) = 4.2ohms.

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Donald Becker

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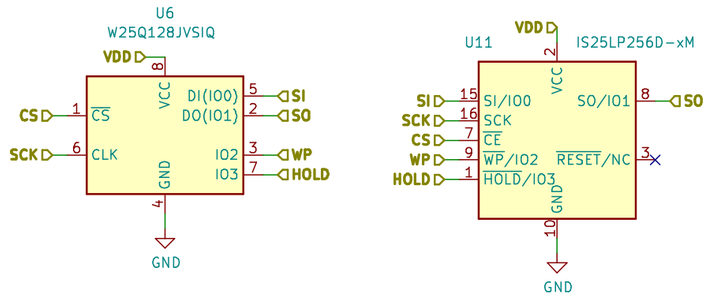
Sheet: /MCU/		
File: stm32.sch		
Title: microRusEFI-2L		
Size: B	Date: 2022-03-16	**Rev: R0.5.5rc2**
KiCad E.D.A. kicad 5.1.5+dfsg1-2build2		Id: 8/10



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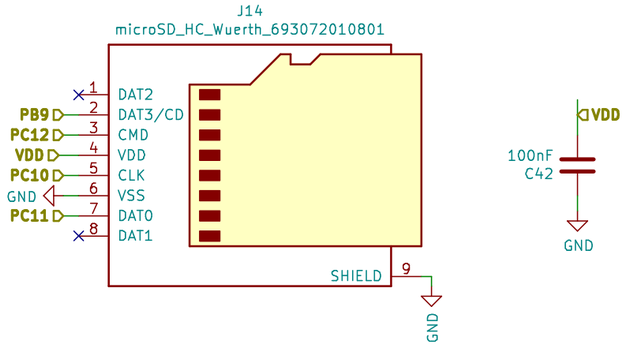
Sheet: /FlashMemory/
File: FlashMemory.sch

Title: microRusEFI-2L

Size: A	Date: 2022-03-16	**Rev: R0.5.5rc2**
KiCad E.D.A. kicad 5.1.5+dfsg1-2build2		Id: 9/10



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by JRD McLAREN
Donald Becker

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Sheet: /SDCard/
File: SDCard.sch

Title: microRusEFI-2L

Size: A4	Date: 2022-03-16	**Rev: R0.5.5rc2**
KiCad E.D.A. kicad 5.1.5+dfsg1-2build2		Id: 10/10