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 AV4
20 AV5
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 B5819W
JP3 Voltage selector 5V 3V3
VDD 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

AT1 AT2 AT3 AT4
AV1 AV2 AV3 AV4 AV5 AV6 AV7 AV8 AV9 AV10
CAM_SENSOR
12V_MREL
5V

Sheet: ADC
AT1 AT2 AT3 AT4 AV1 AV2 AV3 AV4 AV5 AV6 AV7 AV8 AV9 AV10 CAM 12V 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 AGND
TP1
File: adc.sch

GP OUT 5 AND 6 ARE HIGH SIDE DRIVEN
Sheet: MCU
VDD GND
VDD GND PA0 PA1 PA2 PA3 PC0 PA6 PA7 PC2 PC3 PC4 PC5 PB0 PB1 PA4 PA5 PC1 USB_VBUS USB_D- USB_D+ VSSA
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 AGND
D7 AV4
USB_D-
USB_D+
Analog Ground Net Tie NT3
GND

6A H-BRIDGE
E-THROTTLE+
E-THROTTLE-
12V_MREL
VDD
GND
Sheet: H-BRIDGE
OUT1 OUT2 12V VDD GND
DIR PWM DIS SO SI SCK CS
PA8 PC7 PC8 PC9
GND
File: TLE9201SG.sch

Sheet: FlashMemory
VDD
SO SI SCK CS HOLD WP
PB14 PB15 PB13 PE15 PC13 PE0
File: FlashMemory.sch

U3O J12 PB11
U3P J13 PB10
PE2
U3H J6 PE0
PE4 PE3 PB8
NT2 Net-Tie_2
PB11 PB10 PE2 PE0 PE4 PE3 PB8 PB2-BOOT1

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

PC10 PC11 PA15 PA13
File: stm32.sch

Sheet: TLE8888-1QK
PD12 PD13 PD14 PD15 PE14 PE13 PE12 PE11 PE10 PE9 PE8 PE7 PB6 PB12 PB4 PD5 PB5 PB3 PC6 NRST PE1 PD8 PD9 PD10 PD11 PD4 PD3 PD2 PD1 PD7 PD6 PB9 PB7 PC12 PD0 PC13 PE6 PE5 PA14
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 SO SDO CS_TLE CSN SI SIP SCK FCLP CRNK CRNK_IN GND V5V 5V1 5V2 RST 12V_KEY 12V_SAFE 5V_STBY LIN_TX LIN_RX IGN_EN INJ_EN
D28 LED-RED
R29 1k
R2 0R DNP
U7 XC6206 3.3V
VO VI GND
5V
GND
File: TLE8888-1QK.sch

Sheet: hi-lo
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

U3F
IGN_OUT_1 IGN_OUT_2 IGN_OUT_3 IGN_OUT_4
J51 J52 J53 J54
R21 R33 R80 R81 0R
Ign1 Ign2 Ign3 Ign4
INJ_1 INJ_2 INJ_3 INJ_4
OUT_5 OUT_6 OUT_7
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 D15 12V_MREL
OUT_14 OUT_15 OUT_16 OUT_17 OUT_18 OUT_19 OUT_20 OUT_21 OUT_22 OUT_23 OUT_24
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
CRNK+ CRNK- LIN_IO CAN_L CAN_H MAIN_RELAY VDD
CRNK+ CRNK- LINBUS CANL CANH MAIN_RELAY VDD
CANH J22
CANL J23 U3R
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

5V
D30 D32 D34
D31 D33 D35
LED-RED
22
1k
R36 R49 R51
LS2 INJECTOR-1 GP5

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

12V_SAFE
D43
1k
R10
LINBUS
LIN bus termination

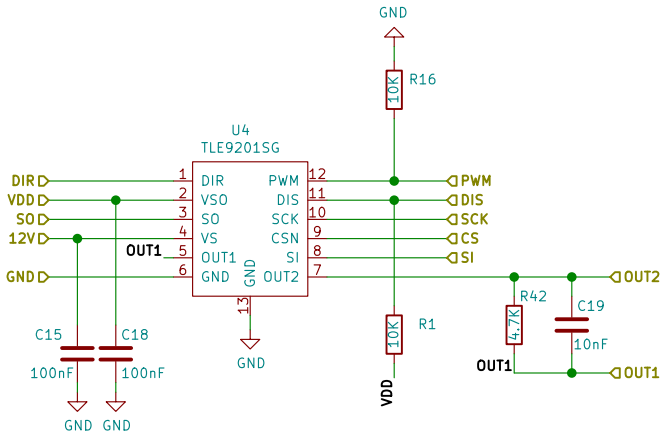
TLE_DFB10
AV9_MCU AV8_MCU
0R R30 R84
TLE_OUT10_PRE TLE_OUT11_PRE
Sheet: LowSides 3-4
IN2 IN1 OUT2 OUT1
AV9 AV8
File: pair.sch
TLE_DFB11

TLE_DFB13
AV10_MCU AV6_MCU
0R R85 R86
TLE_OUT13_PRE TLE_OUT12_PRE
Sheet: LowSides 1-2
IN1 IN2 OUT1 OUT2
AV10 AV6
File: pair.sch
TLE_DFB12

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

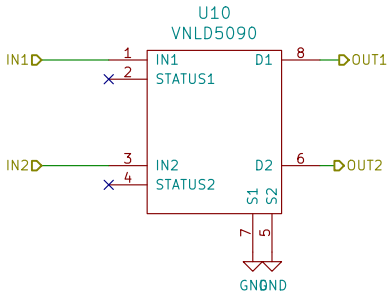
FOR OFF ROAD PURPOSES ONLY
This is not for applications with emissions or safety regulations (AKA not for street use). This is for closed stages, track and equipment.

AI6OD
Donald Becker
rusEFI.com
Sheet: /
File: micro_rusEFI.sch
Title: microRusEFI-2L
Size: B | Date: 2021-11-11 | Rev: R0.5.5rc
KiCad E.D.A. eeschema 5.1.5+dfsg1-2build2 | Id: 1/10



AI6OD
Donald Becker

rusEFI.com		
Sheet: /H-BRIDGE/ File: TLE9201SG.sch		
Title: microRusEFI-2L		
Size: A	Date: 2020-05-24	**Rev: R0.5.2**
KiCad E.D.A. eeschema 5.1.5+dfsg1-2build2		Id: 2/10



rusEFI.com		
Sheet: /LowSides_3-4/ File: pair.sch		
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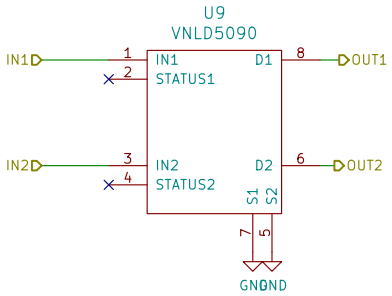
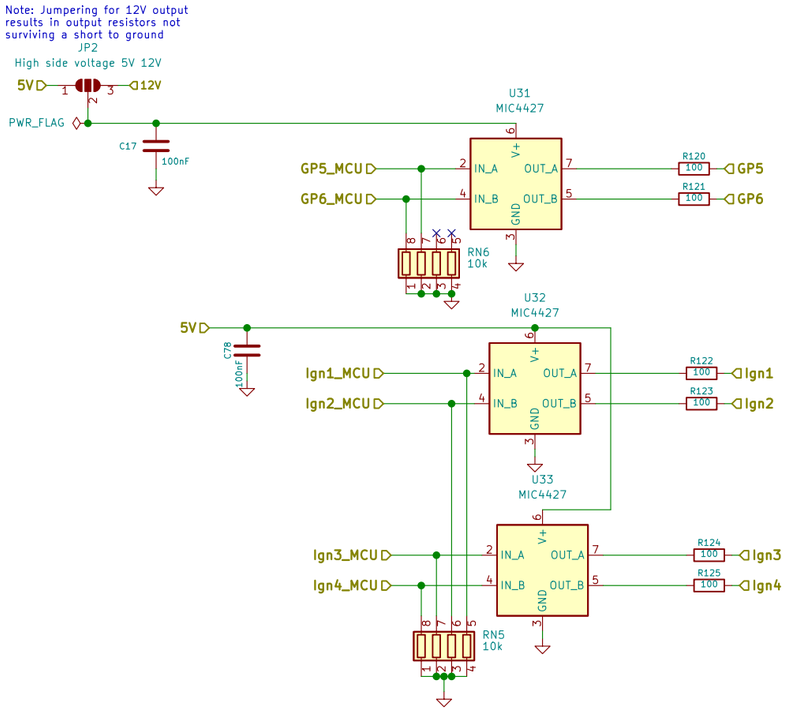
Size: A4	Date: 2020-05-24	**Rev: R0.5.2**
KiCad E.D.A. eeschema 5.1.5+dfsg1-2build2		Id: 3/10



rusEFI.com		
Sheet: /LowSides_1-2/ File: pair.sch		
Title: microRusEFI-2L		
Size: A4	Date: 2020-05-24	**Rev: R0.5.2**
KiCad E.D.A. eeschema 5.1.5+dfsg1-2build2		Id: 4/10

6 channel high / low side driver



AI60D
Donald Becker
rusEFI.com
Sheet: /hi-lo/
File: hi-lo.sch

Title: microRusEFI-2L

Size: B	Date: 2020-05-24	**Rev: R0.5.2**
KiCad E.D.A. eeschema 5.1.5+dfsg1-2build2		Id: 5/10

FID5
Fiducial
FID6
Fiducial

5V 5V 5V 5V
R14 27K
R23 27K
R25 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

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

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

CN4
100nF

AV9
AV8
AV7
AV6

R7 DNP
RN2
10k

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

D13
SRV05-4
5V

U8B MCP6004
U8A MCP6004
U8D MCP6004
U8C MCP6004

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

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

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

CN2
100nF

5V
LED-RED D29
R28 2.2K

AV5
AV4
CAM

RN13
10k

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

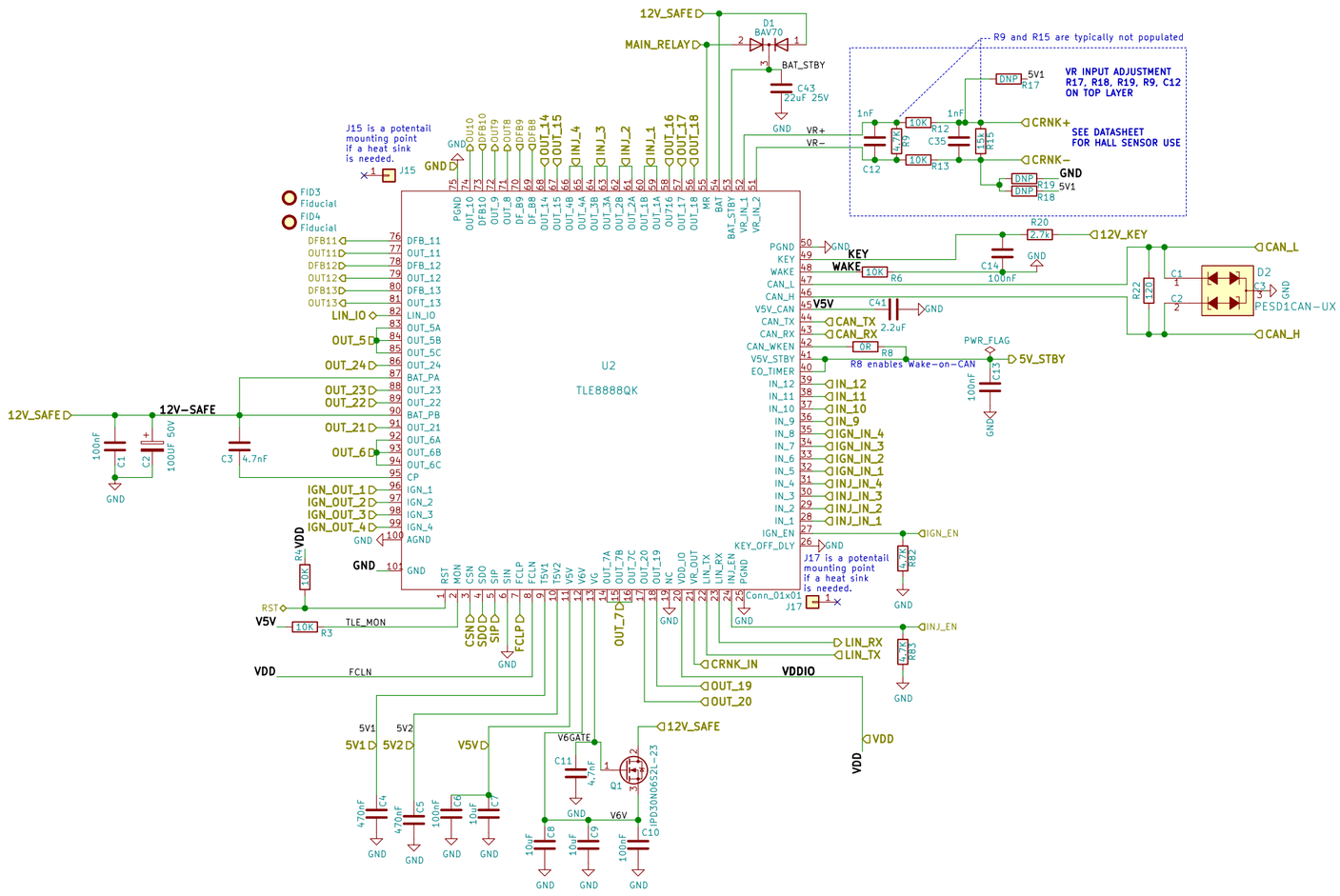
5V
SRV05-4
D40

CN1
100nF

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

AI6OD
Donald Becker
rusEFI.com
Sheet: /ADC/
File: adc.sch
Title: microRusEFI-2L
Size: B
Date: 2020-05-24
Rev: R0.5.2
KiCad E.D.A. eeschema 5.1.5+dfsg1-2build2
Id: 6/10

rusEFI MRE was measured to consume 235mA from the 12V battery, for 2.9 watts

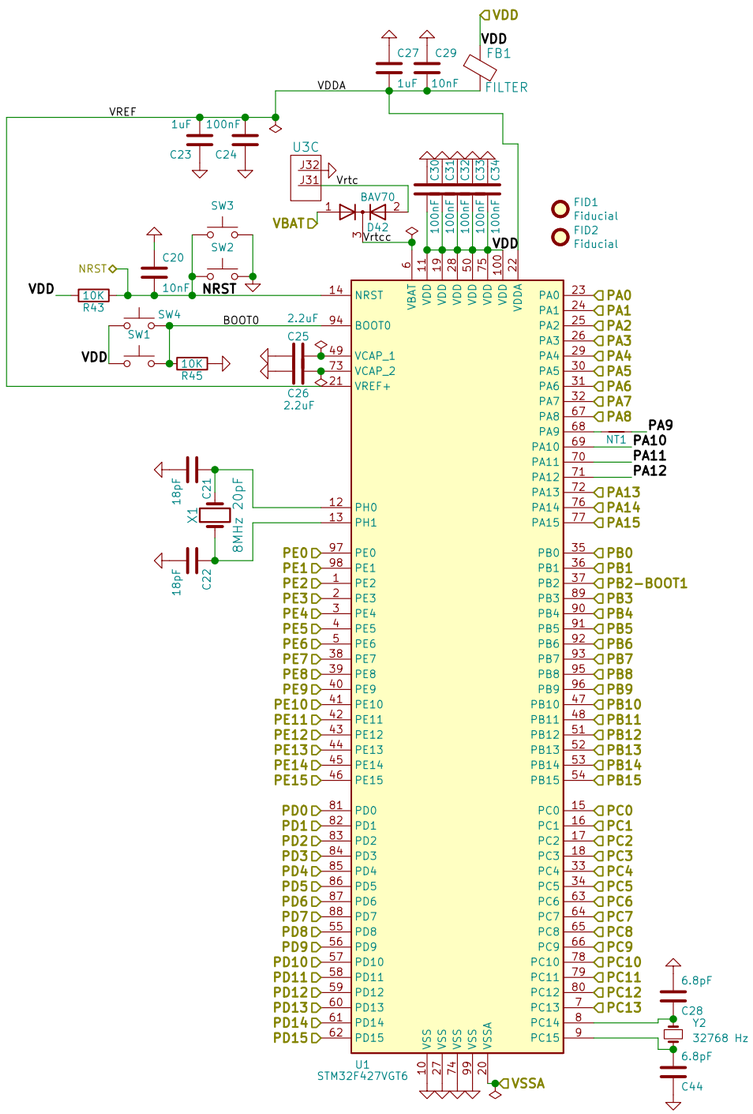


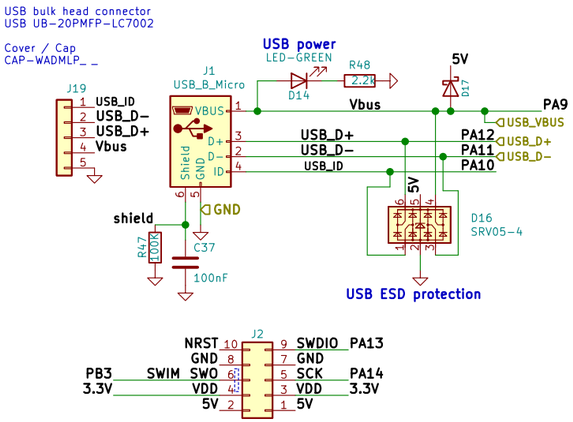
AI6OD
Donald Becker
rusEFI.com

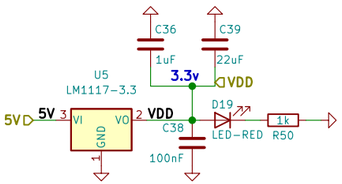
Sheet: /TLE8888−1QK/
File: TLE8888−1QK.sch

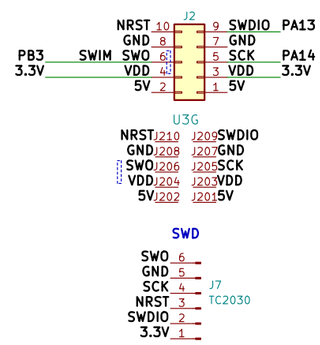
Title: microRusEFI−2L

Size: User	Date: 2020−05−24	Rev: R0.5.2
KiCad E.D.A. eeschema 5.1.5+dfsg1−2build2		Id: 7/10





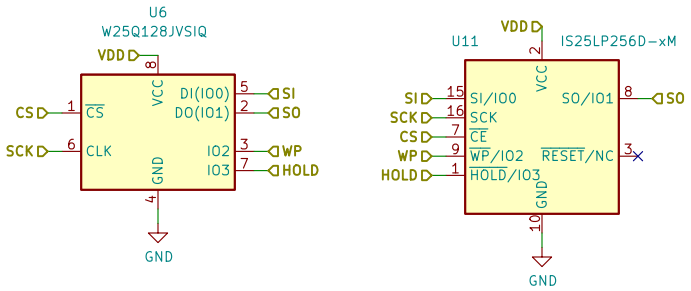




http://www.crystek.com/documents/appnotes/Pierce-GateIntroduction.pdf
PCB per predictions with SaturnPCB has less then 3.5pF traces,
STM32 pins assumed 5pF
ESR = 80ohms max???
Rf = 2meg could be between 1meg and 10meg.
Cload should be 8pF per XTAL datasheet
Cload = ([Cin+C1][C2+Cout])/(Cin+C1+C2_Cout)+PCBstray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

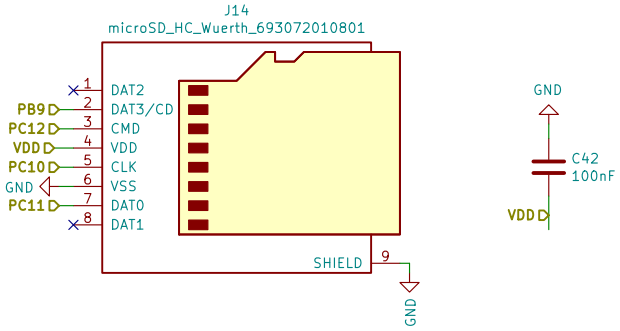
AI60D
Donald Becker

rusEFI.com		
Sheet: /MCU/		
File: stm32.sch		
Title: microRusEFI-2L		
Size: B	Date: 2020-05-24	**Rev: R0.5.2**
KiCad E.D.A. eeschema 5.1.5+dfsg1-2build2		Id: 8/10



AI6OD
Donald Becker

rusEFI.com		
Sheet: /FlashMemory/ File: FlashMemory.sch		
Title: microRusEFI-2L		
Size: A	Date: 2020-05-24	**Rev: R0.5.2**
KiCad E.D.A. eeschema 5.1.5+dfsg1-2build2		Id: 9/10



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Size: A4	Date:	**Rev:**
KiCad E.D.A. eeschema 5.1.5+dfsg1-2build2		Id: 10/10