U3E
LIN1 LINBUS

U3A
molex_48pin_MRE
M13 M12 M11 M3 M23 M22 M21
M73 12V_SAFE M63
M72 12V_SAFE M62
M71 12V_SAFE M61
M53 M52 M51 M4
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

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

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

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

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

CAN ALSO BE USED
AS DIGITAL INPUTS

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 AGND
TP1
File: adc.kicad_sch

GP OUT 5 AND 6 ARE HIGH SIDE DRIVEN
MCU
VDD GND
PA0 PA1 PA2 PA3 PC0 PA6 PA7 PC2 PC3 PC4 PC5 PB0 PB1 PA4 PA5 PC1 PA8 PC7 PC8 PC9 PB14 PB15 PB13 PE15 PB11 PB10 PE2 PE0 PE4 PE3 PB8 PB2-BOOT1 PC10 PC11 PA15 PA13
AV4
D7
USB_D-
USB_D+
USB_VBUS
USB_D-
USB_D+
VSSA
Analog Ground Net Tie
NT3
GND
File: stm32.kicad_sch

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

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

U30 J12 PB11
U3P J13 PB10
PE2
U3H J6 PE0
PE4 PE3 PB8
NT2
GND
Net-Tie_2

PC10 PC11 PA15

TLE8888-1QK
PD12 PD13 PD14 PD15 PE14 PE13 PE12 PE11 PE10 PE9 PE8 PE7 PB6 PB12 PB4 PD5 PB5 PB3 PC6 PD8 PD9 PD10 PD11
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 SIP FCLP CRNK_IN GND V5V 5V1 5V2 RST 12V_KEY 12V_SAFE 5V_STBY LIN_TX LIN_RX IGN_EN INJ_EN
SO SI SCK CS_TLE CRANK GND 5V1 5V2
D28 LED-RED
R29 1k
R2 0R DNP
U7 XC6206 3.3V
VBAT 5V
File: TLE8888-1QK.kicad_sch

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.kicad_sch

PB9 PB7 PC12 PD0 PC13 PE6 PE5 PA14
J18 U3I
PC12
J16 U3M
PC13 J9 U3J
J10 U3K
J11 U3L

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
INJECTOR-1 INJECTOR-2 INJECTOR-3 INJECTOR-4
2.2A
Populate for freewheeling.
Bypasses internal clamps.
OUT_5 OUT_6 OUT_7
J14 U3N
LS2 LS1
4.5A
D20 D15
12V_MREL
LOW SIDE OUTPUTS

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_LO CAN_HI MAIN_RELAY VDD
CRNK+ CRNK- LINBUS CANL CANH 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

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
1k RN1 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
LowSides_3-4
AV9_MCU AV8_MCU
0R R30 R84
TLE_OUT10_PRE TLE_OUT11_PRE
IN2 IN1 OUT2D OUT1D
AV9 AV8
TLE_DFB11
File: pair.kicad_sch

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

AI6OD
Donald Becker
rusEFI.com
Sheet: /
File: micro_rusEFI.kicad_sch
Title: microRusEFI-2L
Size: B | Date: 2022-04-09 | Rev: R0.5.5
KiCad E.D.A. kicad (6.0.0) | Id: 1/9

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_MCUD
AT3_MCUD
AT2_MCUD
AT1_MCUD

D38
SRV05-4
5V

100nF C52
100nF C53
100nF C54
100nF C55

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

RN4
10k
AV3
AV2
AV10
AV1

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

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_MCUD
AV10_MCUD
AV2_MCUD
AV3_MCUD

5V
SRV05-4
D39

100nF C48
100nF C49
100nF C50
100nF C51

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

5V
LED-RED D29
R28 2.2K

RN13
10k
AV5
AV4
CAMD

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

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_MCUD
Vbat_MCUD
AV4_MCUD
AV5_MCUD

5V
SRV05-4
D40

100nF C56
100nF C57
100nF C58
100nF C59

CAM_MCUD

Comparator with histeresis for CAM input?
Usign this OpAmp.

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

5V
R7 DNP

RN2
10k
AV9
AV8
AV7
AV6

470K R52
470K R53
470K R54
470K R56

D13
SRV05-4
5V

100nF C16
100nF C45
100nF C46
100nF C47

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

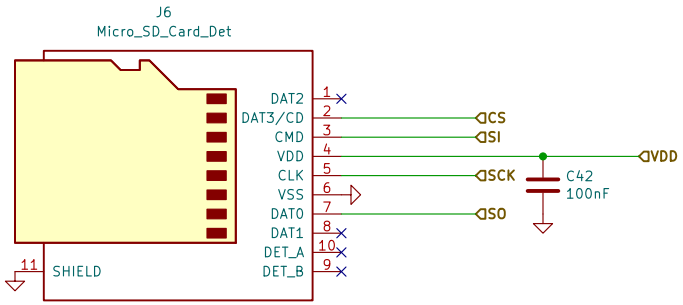
10K R60
10K R61
10K R62
10K R63

AGND

AV9_MCUD
AV8_MCUD
AV7_MCUD
AV6_MCUD

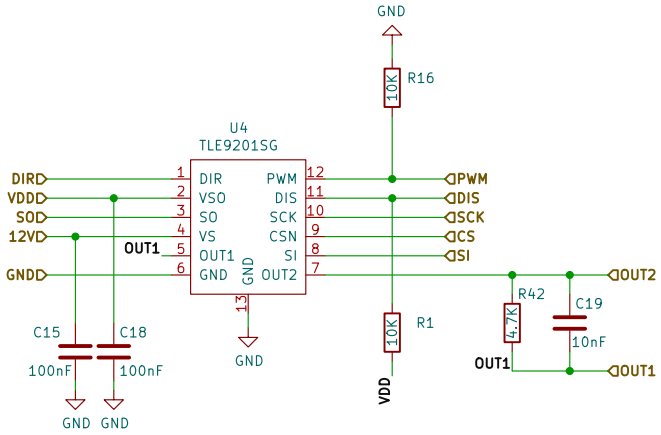
5V
C40 10nF
V+ 4
V- 11
U8E MCP6004

AI6OD
Donald Becker
rusEFI.com
Sheet: /ADC/
File: adc.kicad_sch
Title: microRusEFI-2L
Size: B | Date: 2020-05-24 | Rev: R0.5.2
KiCad E.D.A. kicad (6.0.0) | Id: 2/9



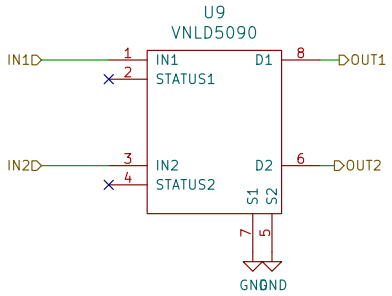
AI6OD
Donald Becker

rusEFI.com		
Sheet: /FlashMemory/ File: FlashMemory.kicad_sch		
Title: microRusEFI-2L		
Size: A	Date: 2022-04-09	**Rev: R0.5.5**
KiCad E.D.A. kicad (6.0.0)		Id: 3/9

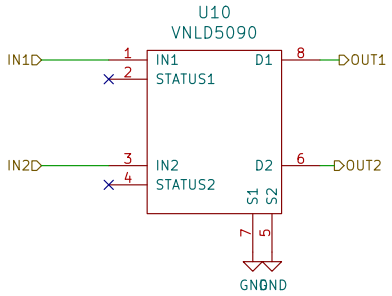


AI6OD
Donald Becker

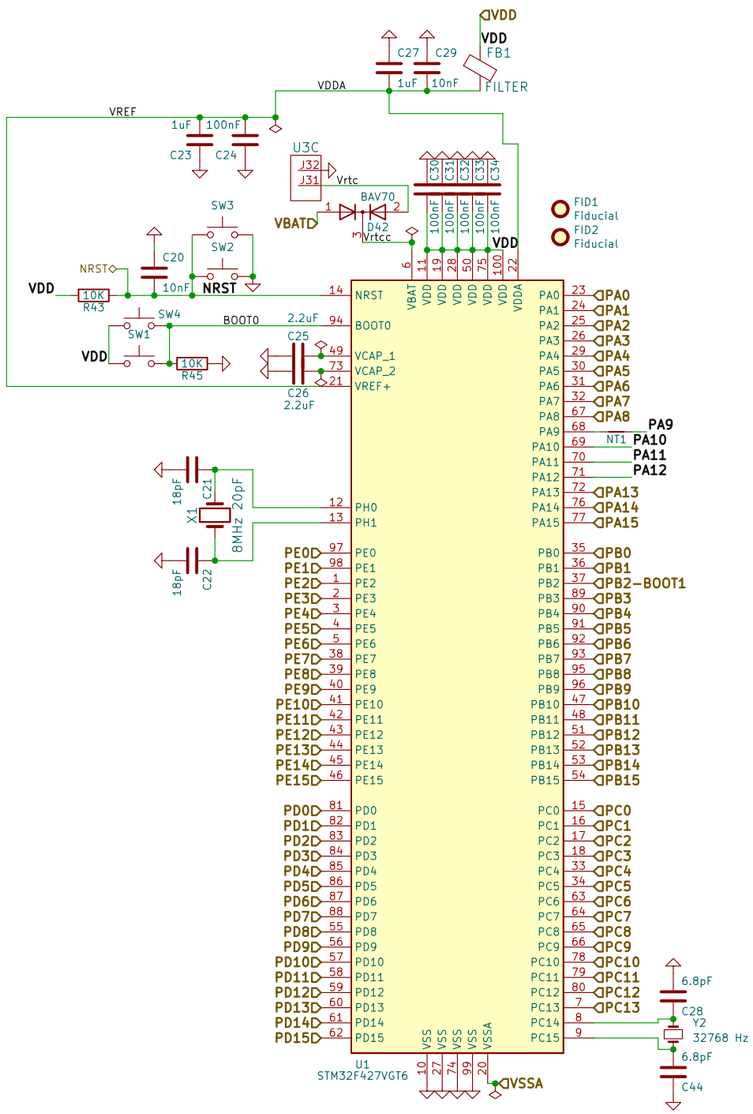
rusEFI.com		
Sheet: /H-BRIDGE/ File: TLE9201SG.kicad_sch		
Title: microRusEFI-2L		
Size: A	Date: 2020-05-24	**Rev: R0.5.2**
KiCad E.D.A. kicad (6.0.0)		Id: 4/9

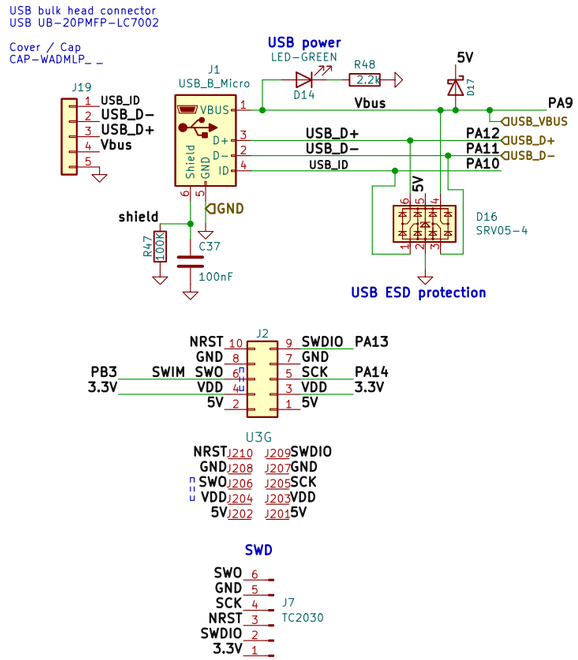


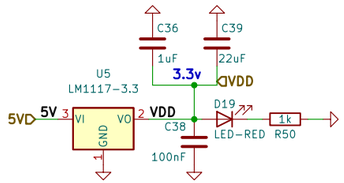
rusEFI.com		
Sheet: /LowSides_1-2/ File: pair.kicad_sch		
Title: microRusEFI-2L		
Size: A4	Date: 2020-05-24	**Rev: R0.5.2**
KiCad E.D.A. kicad (6.0.0)		Id: 5/9



rusEFI.com		
Sheet: /LowSides_3-4/ File: pair.kicad_sch		
Title: microRusEFI-2L		
Size: A4	Date: 2020-05-24	**Rev: R0.5.2**
KiCad E.D.A. kicad (6.0.0)		Id: 6/9





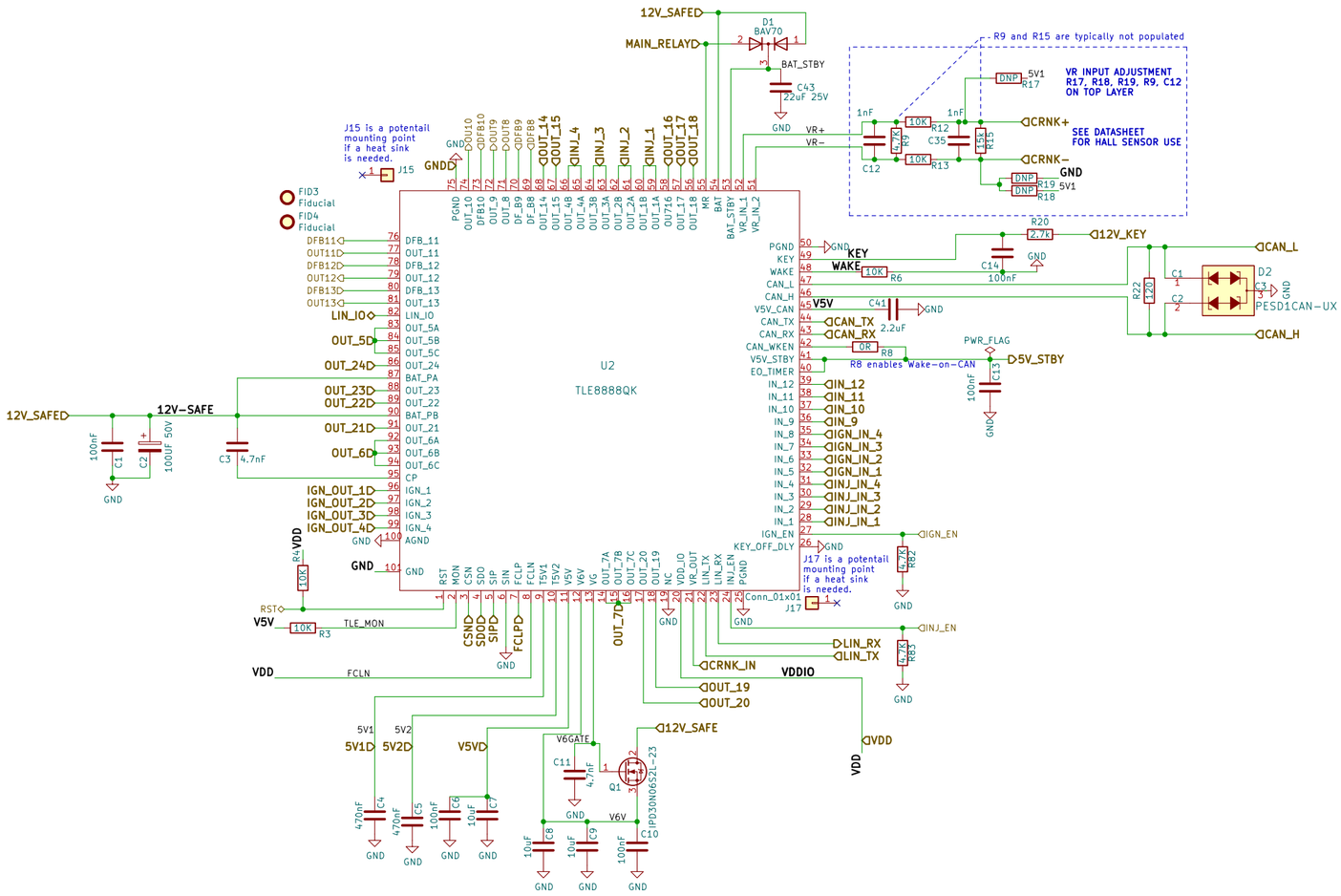


http://www.crystek.com/documents/appnotes/Pierce-GateIntroduction.pdf
PCB per predictions with SaturnPCB has less then 3.5pF traces,
STM32 pins assumed 5pF
ESR = 80ohms max???
Rf = 2meg could be between 1meg and 10meg.
Cload should be 8pF per XTAL datasheet
Cload = ([Cin+C1][C2+Cout])/(Cin+C1+C2_Cout)+PCBstray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

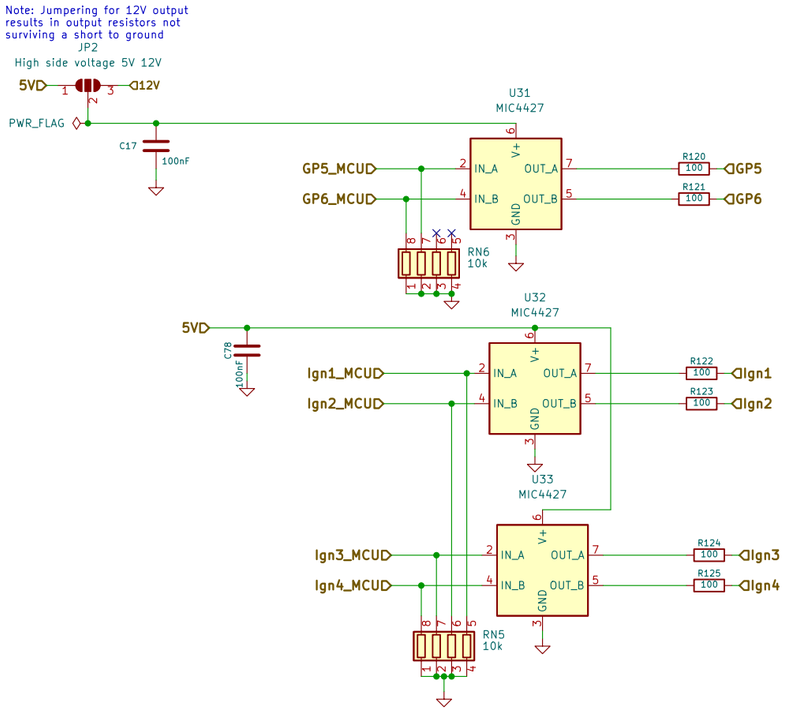
AI6OD
Donald Becker

rusEFI.com		
Sheet: /MCU/		
File: stm32.kicad_sch		
Title: microRusEFI-2L		
Size: B	Date: 2020-05-24	**Rev: R0.5.2**
KiCad E.D.A. kicad (6.0.0)		Id: 7/9

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


12V_SAFED
MAIN_RELAYD
D1
BAV70
BAT_STBY
C43
22uF 25V
GND
VR+
VR−
R9 and R15 are typically not populated
DNP
5V1
R17
VR INPUT ADJUSTMENT
R17, R18, R19, R9, C12
ON TOP LAYER
1nF
10K
R12
C35
4.7K
R15
CRNK+
SEE DATASHEET
FOR HALL SENSOR USE
4.7K
R9
C12
10K
R13
CRNK−
GND
DNP
R19
5V1
DNP
R18
J15 is a potentail
mounting point
if a heat sink
is needed.
J15
GNDD
FID3
Fiducial
FID4
Fiducial
U2
TLE8888QK
12V_SAFED
12V−SAFE
100nF
C1
100UF 50V
C2
C3
4.7nF
GND
R20
2.7K
12V_KEY
CAN_L
C14
100nF
GND
KEY
WAKE
10K
R6
C1
D2
C3
C2
PESD1CAN−UX
R22
120
CAN_H
V5V
C41
2.2uF
GND
CAN_TX
CAN_RX
0R
R8
R8 enables Wake−on−CAN
PWR_FLAG
5V_STBY
100nF
C13
GND
IGN_EN
KEY_OFF_DLY
J17 is a potentail
mounting point
if a heat sink
is needed.
Conn_01x01
J17
4.7K
R62
GND
INJ_EN
LIN_RX
LIN_TX
4.7K
R63
GND
CRNK_IN
VDDIO
OUT_19
OUT_20
VDD
VDD
R4
10K
RST
V5V
10K
R3
TLE_MON
CSND
SDOD
SIPD
FCLPD
GND
VDD
FCLN
OUT_7D
5V1
5V2
5V1D
5V2D
V5VD
V6GATE
12V_SAFE
C11
4.7nF
Q1
IPD30N06S2L−23
GND
V6V
C4
470nF
C5
470nF
C6
100nF
C7
10uF
C8
10uF
C9
10uF
C10
100nF
GND
GND
GND

6 channel high / low side driver



AI60D
Donald Becker

rusEFI.com		
Sheet: /hi-lo/ File: hi-lo.kicad_sch		
Title: microRusEFI-2L		
Size: B	Date: 2020-05-24	**Rev: R0.5.2**
KiCad E.D.A. kicad (6.0.0)		Id: 9/9