U3
Molex_48_pin

12V_MREL 1 | GND 2 | LS2 3 | E-THROTTLE+ 4 | 12V_KEY 5 | GND 6 | LS1 7 | E-THROTTLE- 8 | Ign1 9 | Ign2 10 | Ign3 11 | Ign4 12 | GP6 13 | GP5 14 | USB_D- 15 | USB_D+ 16 | GND 17 | AT1 18 | AV4 19 | AV5 20 | GND 21 | AT4 22 | AT2 23 | AT3 24 | CAM_SENSOR 25 | AV2 26 | AV1 27 | AV10 28 | MAIN_RELAY 29 | AV7 30 | AV3 31 | AV6 32 | GP3 33 | GP2 34 | GP1 35 | AV8 36 | INJECTOR-1 37 | INJECTOR-2 38 | 5V2 39 | AV9 40 | INJECTOR-3 41 | INJECTOR-4 42 | GP4 43 | 5V1 44 | CRNK+ 45 | CRNK- 46 | CANL 47 | CANH 48

D36 SS54
12V_MREL
D37 SS54
12V_KEY
12V_SAFE
D41 SM15T33C
GND

J4
Conn_02x05_Counter_Clockwise
5V 1 | 2 12V_MREL
PB8 3 | 4 VDD
PC11 5 | 6 PD0
PA15 7 | 8 PC10
GND 9 | 10 PC12

5V TP1
GND TP2
CAM_MCU TP3
CRANK TP4
12V_MREL TP5
GND TP6

GP OUT 5 AND 6 ARE HIGH SIDE DRIVEN

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 VSense_ref AGND
File: adc.sch

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
File: TLE9201SG.sch

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

Sheet: MCU
VDD GND
PA0 PA1 PA2 PA3 PC0 PA6 PA7 PC2 PC3 PC4 PC5 PB0 PB1 PA4 PA5 PC1 VRef_IN USB_D- USB_D+ VSSA
PB14 PB15 PB13 PE15 PB11 PB10 PD15 PE2 PE0 PE4 PE3 PB8 PB2-BOOT1 PC10 PC11 PA15 PA13
PE14 PE13 PE12 PE11 PE10 PE9 PE8 PE7 PB6 PB12 PB4 PD5 PB5 PB3 PC6 PE1 PD8 PD9 PD4 PD3 PD2 PD1 PD7 PD6 PD12 PD13 PD14 PB9 PB7 PC12 PD10 PD0 PC13 PE6 PE5 PA14 PD11
PC12 PD0
PE2 PE4 PE3 PB8
PC10 PC11 PA15
File: stm32.sch

Sheet: TLE8888-1QK
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 5V V5V 5V2 5V1 5V1 5V_STBY 12V_KEY 12V_SAFE LIN_TX LIN_RX
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 DFB11 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
IGN1 IGN2 IGN3 IGN4 OUT14 OUT15 OUT16 OUT17 OUT18 LIN1
GND
D28 LED-RED
R29 1k
PE1
12V_KEY 12V_SAFE
U7 XC6206 3.3V
VBAT 5V
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
5V 12V_MREL
File: hi-lo.sch

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

CAN BE USED AS LOW-SIDE OR HIGH-SIDE
GP1 GP2 GP3 GP4 0.6A

HIGH-SIDE OUTPUTS

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

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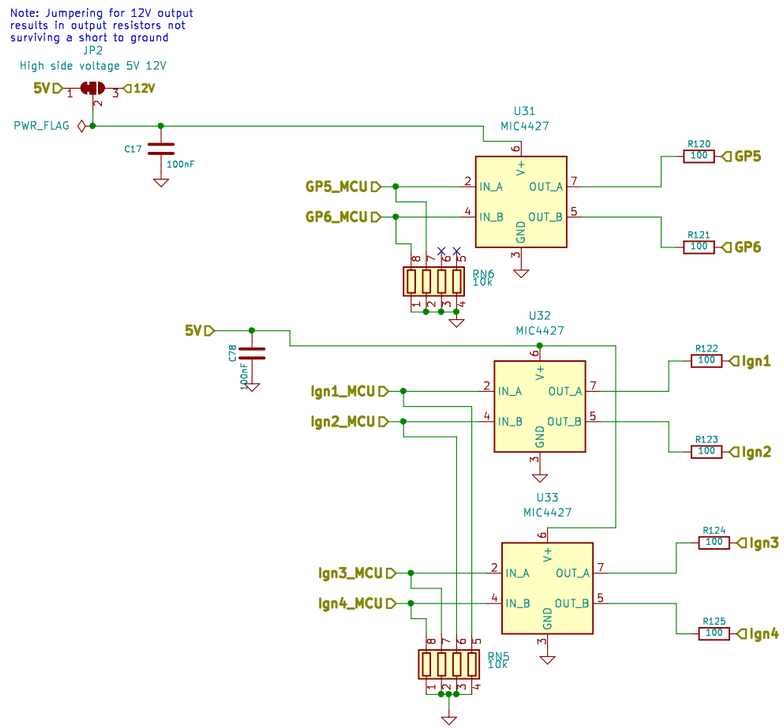
Sheet: /
File: microRusEfi.sch
Title: microRusEfi-2L
Size: B | Date: 2019-10-08 | Rev: R0.4.5
KiCad E.D.A. kicad (5.1.2)-2 | Id: 1/7

6 channel high / low side driver



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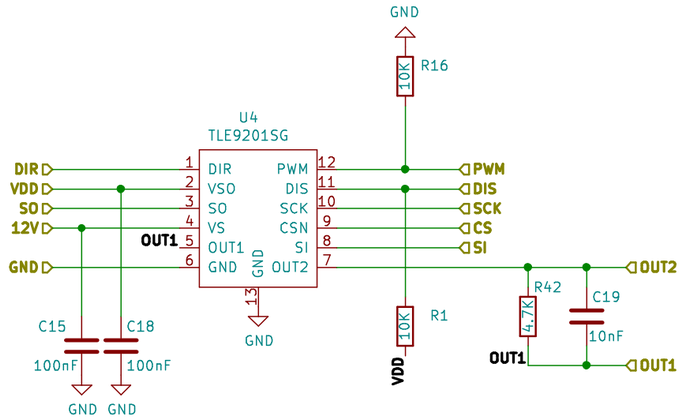
Sheet: /hi-lo/
File: hi-lo.sch

Title: microRusEfi-2L

Size: B	Date: 2019-10-08	**Rev: R0.4.5**
KiCad E.D.A. kicad (5.1.2)-2		Id: 2/7



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Sheet: /H-BRIDGE/
File: TLE9201SG.sch

Title: microRusEfi-2L

Size: A	Date: 2019-10-08	**Rev: R0.4.5**
KiCad E.D.A. kicad (5.1.2)-2		Id: 3/7

FID5
Fiducial
FID6
Fiducial

5V 5V 5V 5V
R24 27K
R25 27K
R26 27K
R27 27K

RN3
10k
AT4
AT3
AT2
AT1

D38
SRV05-4

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

C79 10nF
U35E
MCP6004

CN17
10nF

RN4
10k
AV3
AV2
AV10
AV1

4700 R24
4700 R31
4700 R34
4700 R37

D39
SRV05-4

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

AV1_MCU
AV10_MCU
AV2_MCU
AV3_MCU

C80 10nF
U36E
MCP6004

CN6
10nF

RN2
10k
AV9
AV8
AV7
AV6

R7 DNP
4.70K R52
4.70K R54
4.70K R56
4.70K R58

D13
SRV05-4

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

C40 10nF
U8E
MCP6004

CN5
10nF

LED-RED D29
R28 2.2K

RN13
10k
AV5
AV4
CAM

R11 DNP
R131 470K
R9 DNP
R41 470K
12V-SWITCH
R139 39K
R414 10K

BAS70-04
BAS70-04

SRV05-4
D40

CN14
10nF

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

VSense_ref
Vbat_MCU
AV4_MCU
AV5_MCU

CAM_MCU

C82 10nF
U46E
MCP6004

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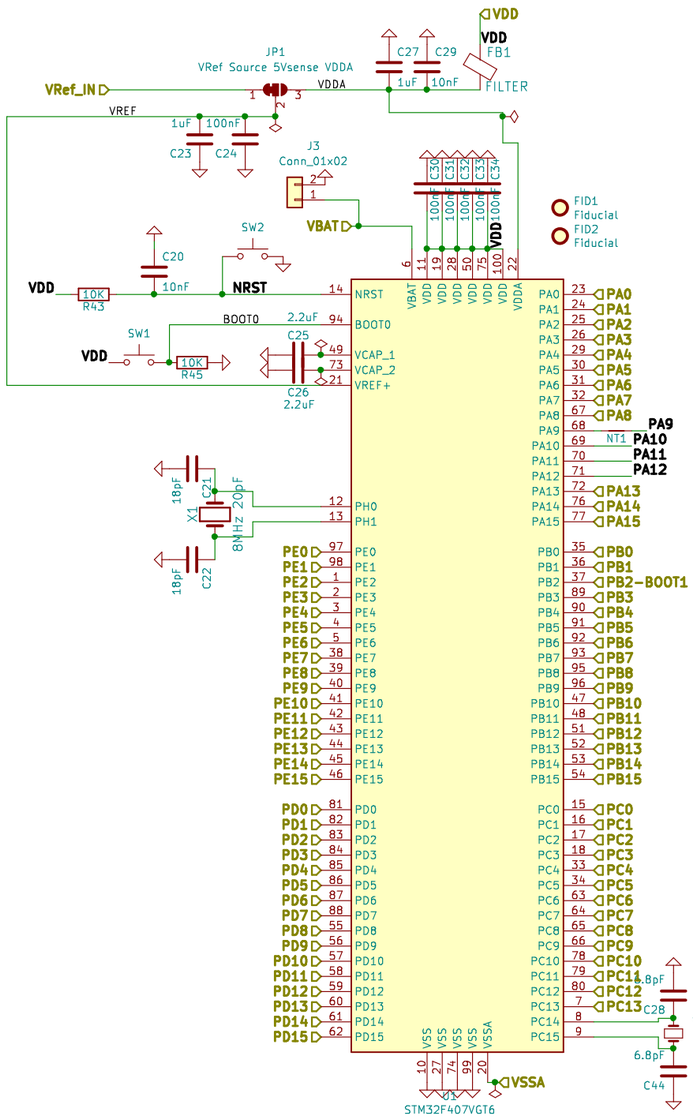
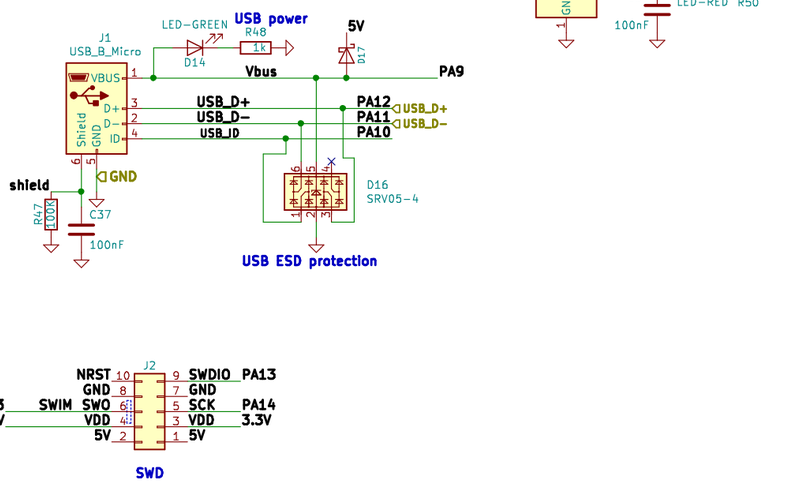
Sheet: /ADC/
File: adc.sch

Title: microRusEfi-2L

Size: B	Date: 2019-10-08	**Rev: R0.4.5**
KiCad E.D.A. kicad (5.1.2)-2		Id: 4/7





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=C165=C167 = 4.7pF
Rs = 1/(2pifC2) = 1/(2*pi*8MHz*4.7pF) = 4.2ohms.

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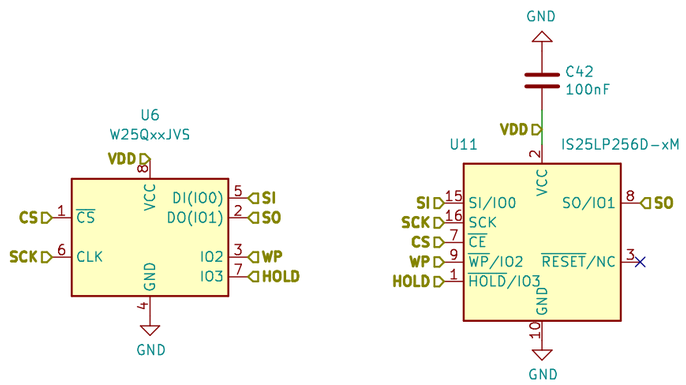
Sheet: /MCU/
File: stm32.sch
Title: microRusEfi-2L

Size: B	Date: 2019-10-08	Rev: R0.4.5
KiCad E.D.A. kicad (5.1.2)-2		Id: 5/7



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Sheet: /FlashMemory/
File: FlashMemory.sch

Title: microRusEfi-2L

Size: A	Date: 2019-10-08	**Rev: R0.4.5**
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rusEFI MRE was measured to consume 235mA from the 12V battery, for 2,9 watts

VR INPUT ADJUSTMENT
R17, R18, R19, R9, C12
ON BOTTOM LAYER

SEE DATASHEET
FOR HALL SENSOR USE

U2
TLE8888QK

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Sheet: /TLE8888-1QK/		
File: TLE8888-1QK.sch		
Title: microRusEfi-2L		
Size: User	Date: 2019-10-08	Rev: R0.4.5
KiCad E.D.A. kicad (5.1.2)-2		Id: 7/7