Notes:

Jumpers labeled JP3, JP4, JP5 and JP6 are crossover wires, nothing more. This was done to ease single sided PCB Prototype testing.

J2 is the TE Connectivity Automotive Grade water resistant connector. The 35 positions will allow for modifications to the board for additional inputs/outputs as this design only uses 27 positions. My samples to test have arrived, http://www.te.com Part #'s:
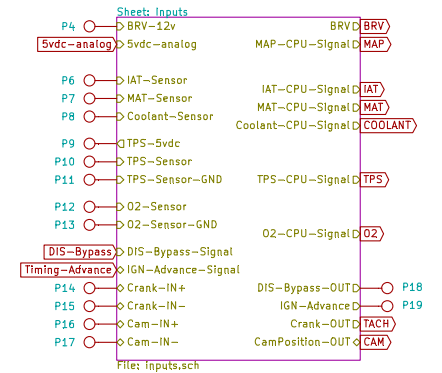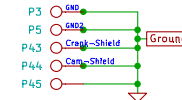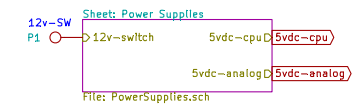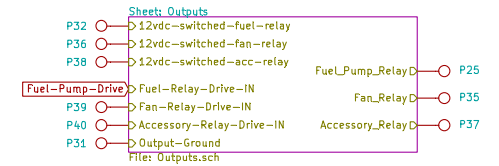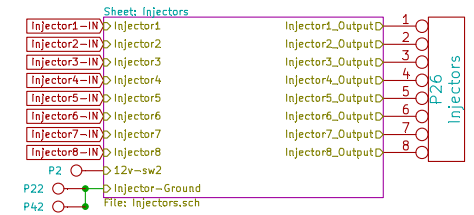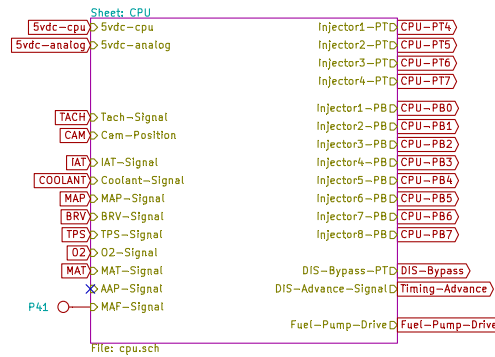
1-776163-2 Right Angle 35 Position Header (Natural Color)
OR
1-776231-2 Vertical 35 Position Header (Natural Color)
1-776231-2 Vertical 35 Position Header (Natural Color)
776164-2 35 Position AMP SEAL Plug Assembly (Natural Color)

Make sure that the PCB grounds do not touch the inside of the case and isolate the TO-220 voltage regulators from the end panels of the case with mica insulators and use plastic screws.

5vdc-cpu = VDD

5vdc-analog = VCC

INJ-GND and INJ-GND2 are isolated to only be used by the Injector FETs

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Sheet: CPU
File: cpu.sch

5vdc-cpu — 5vdc-cpu
5vdc-analog — 5vdc-analog
TACH — Tach-Signal
CAM — Cam-Position
IAT — IAT-Signal
COOLANT — Coolant-Signal
MAP — MAP-Signal
BRV — BRV-Signal
TPS — TPS-Signal
O2 — O2-Signal
MAT — MAT-Signal
AAP-Signal
P41 — MAF-Signal

Injector1-PTD — CPU-PT4
Injector2-PTD — CPU-PT5
Injector3-PTD — CPU-PT6
Injector4-PTD — CPU-PT7
Injector1-PBD — CPU-PB0
Injector2-PBD — CPU-PB1
Injector3-PBD — CPU-PB2
Injector4-PBD — CPU-PB3
Injector5-PBD — CPU-PB4
Injector6-PBD — CPU-PB5
Injector7-PBD — CPU-PB6
Injector8-PBD — CPU-PB7
DIS-Bypass-PTD — DIS-Bypass
DIS-Advance-SignalD — Timing-Advance
Fuel-Pump-Drive — Fuel-Pump-Drive

Sheet: Injectors
File: Injectors.sch

Injector1-IN — Injector1 — Injector1_OutputD — 1
Injector2-IN — Injector2 — Injector2_OutputD — 2
Injector3-IN — Injector3 — Injector3_OutputD — 3
Injector4-IN — Injector4 — Injector4_OutputD — 4
Injector5-IN — Injector5 — Injector5_OutputD — 5
Injector6-IN — Injector6 — Injector6_OutputD — 6
Injector7-IN — Injector7 — Injector7_OutputD — 7
Injector8-IN — Injector8 — Injector8_OutputD — 8
P2 — 12v-sw2
P22 — Injector-Ground
P42

P26 Injectors

Sheet: Outputs
File: Outputs.sch

P32 — 12vdc-switched-fuel-relay
P36 — 12vdc-switched-fan-relay
P38 — 12vdc-switched-acc-relay
Fuel-Pump-Drive — Fuel-Relay-Drive-IN — Fuel_Pump_RelayD — P25
P39 — Fan-Relay-Drive-IN — Fan_RelayD — P35
P40 — Accessory-Relay-Drive-IN — Accessory_RelayD — P37
P31 — Output-Ground

Sheet: Power Supplies
File: PowerSupplies.sch

12v-SW
P1 — 12v-switch
5vdc-cpuD — 5vdc-cpu
5vdc-analogD — 5vdc-analog

P3 — GND
P5 — GND
P43 — Crank-Shield
P44 — Cam-Shield — Ground
P45

For 6/8 cylinder using Port T with current code, run jumper wires from:
P20 pin 1 to P21 pin 1 = Bank 1
P20 pin 2 to P21 pin 2 = Bank 2
P20 pin 3 to P21 pin 3 = Bank 3
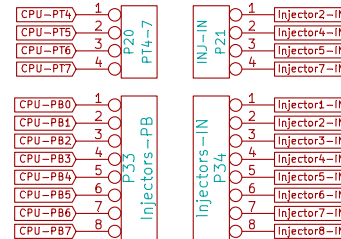P20 pin 4 to P21 pin 4 = Bank 4

AND DO THE FOLLOWING

For 6/8 cylinder using Port T with current code jumper from:
(can be tie-bar shorting jumper if you installed a 0.100" pin header for P34)
P34 pin 1 to P34 pin 2
P34 pin 3 to P34 pin 4
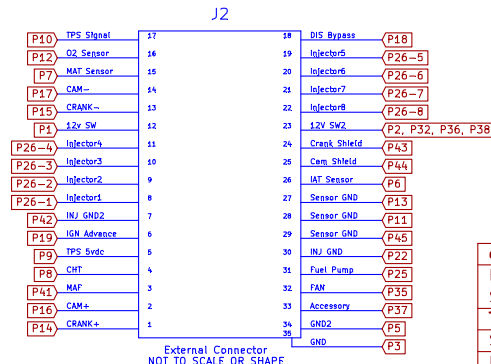P34 pin 5 to P34 pin 6
P34 pin 7 to P34 pin 8

To use Port B with future XGATE code, run jumper wires from:
P33 to P34 pin for pin and do not connect anything to P21.
ie:
P33 pin 1 to P34 pin 1
P33 pin 2 to P34 pin 2
P33 pin 3 to P34 pin 3
P33 pin 4 to P34 pin 4
P33 pin 5 to P34 pin 5
P33 pin 6 to P34 pin 6
P33 pin 7 to P34 pin 7
P33 pin 8 to P34 pin 8

P21 Pin 1 has a trace to P34 Pin 2 on the PCB
P21 Pin 2 has a trace to P34 Pin 4 on the PCB
P21 Pin 3 has a trace to P34 Pin 5 on the PCB
P21 Pin 4 has a trace to P34 Pin 7 on the PCB

CPU-PT4 — 1 — P20 PT4-7 — Injector2-IN — 1 — INJ-IN P21
CPU-PT5 — 2 — Injector4-IN — 2
CPU-PT6 — 3 — Injector5-IN — 3
CPU-PT7 — 4 — Injector7-IN — 4

CPU-PB0 — 1 — P33 Injectors-PB — Injector1-IN — 1 — Injectors-IN P34
CPU-PB1 — 2 — Injector2-IN — 2
CPU-PB2 — 3 — Injector3-IN — 3
CPU-PB3 — 4 — Injector4-IN — 4
CPU-PB4 — 5 — Injector5-IN — 5
CPU-PB5 — 6 — Injector6-IN — 6
CPU-PB6 — 7 — Injector7-IN — 7
CPU-PB7 — 8 — Injector8-IN — 8

P21 and P34 allow for selection to use either Port T (4 cpu outputs MAXIMUM: current code) or Port B (8 cpu outputs: future XGATE code)

Sheet: Inputs
File: inputs.sch

P4 — BRV-12v — BRVD — BRV
5vdc-analog — 5vdc-analog — MAP-CPU-SignalD — MAP
P6 — IAT-Sensor — IAT-CPU-SignalD — IAT
P7 — MAT-Sensor — MAT-CPU-SignalD — MAT
P8 — Coolant-Sensor — Coolant-CPU-SignalD — COOLANT
P9 — TPS-5vdc
P10 — TPS-Sensor
P11 — TPS-Sensor-GND — TPS-CPU-SignalD — TPS
P12 — O2-Sensor
P13 — O2-Sensor-GND — O2-CPU-SignalD — O2
DIS-Bypass — DIS-Bypass-Signal
Timing-Advance — IGN-Advance-Signal
P14 — Crank-IN+ — DIS-Bypass-OUTD — P18
P15 — Crank-IN- — IGN-AdvanceD — P19
P16 — Cam-IN+ — Crank-OUTD — TACH
P17 — Cam-IN- — CamPosition-OUTD — CAM

J2 — External Connector — NOT TO SCALE OR SHAPE

Left			Right	
P10	TPS Signal	17	18	DIS Bypass	P18
P12	O2 Sensor	16	19	Injector5	P26-5
P7	MAT Sensor	15	20	Injector6	P26-6
P17	CAM-	14	21	Injector7	P26-7
P15	CRANK-	13	22	Injector8	P26-8
P1	12v SW	12	23	12v SW2	P2, P32, P36, P38
P26-4	Injector4	11	24	Crank Shield	P43
P26-3	Injector3	10	25	Cam Shield	P44
P26-2	Injector2	9	26	IAT Sensor	P6
P26-1	Injector1	8	27	Sensor GND	P13
P42	INJ GND2	7	28	Sensor GND	P11
P19	IGN Advance	6	29	Sensor GND	P45
P9	TPS 5vdc	5	30	INJ GND	P22
P8	CHT	4	31	Fuel Pump	P25
P41	MAP	3	32	FAN	P35
P16	CAM+	2	33	Accessory	P37
P14	CRANK+	1	34	GND2	P5
			35	GND	P3

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diyefi.org
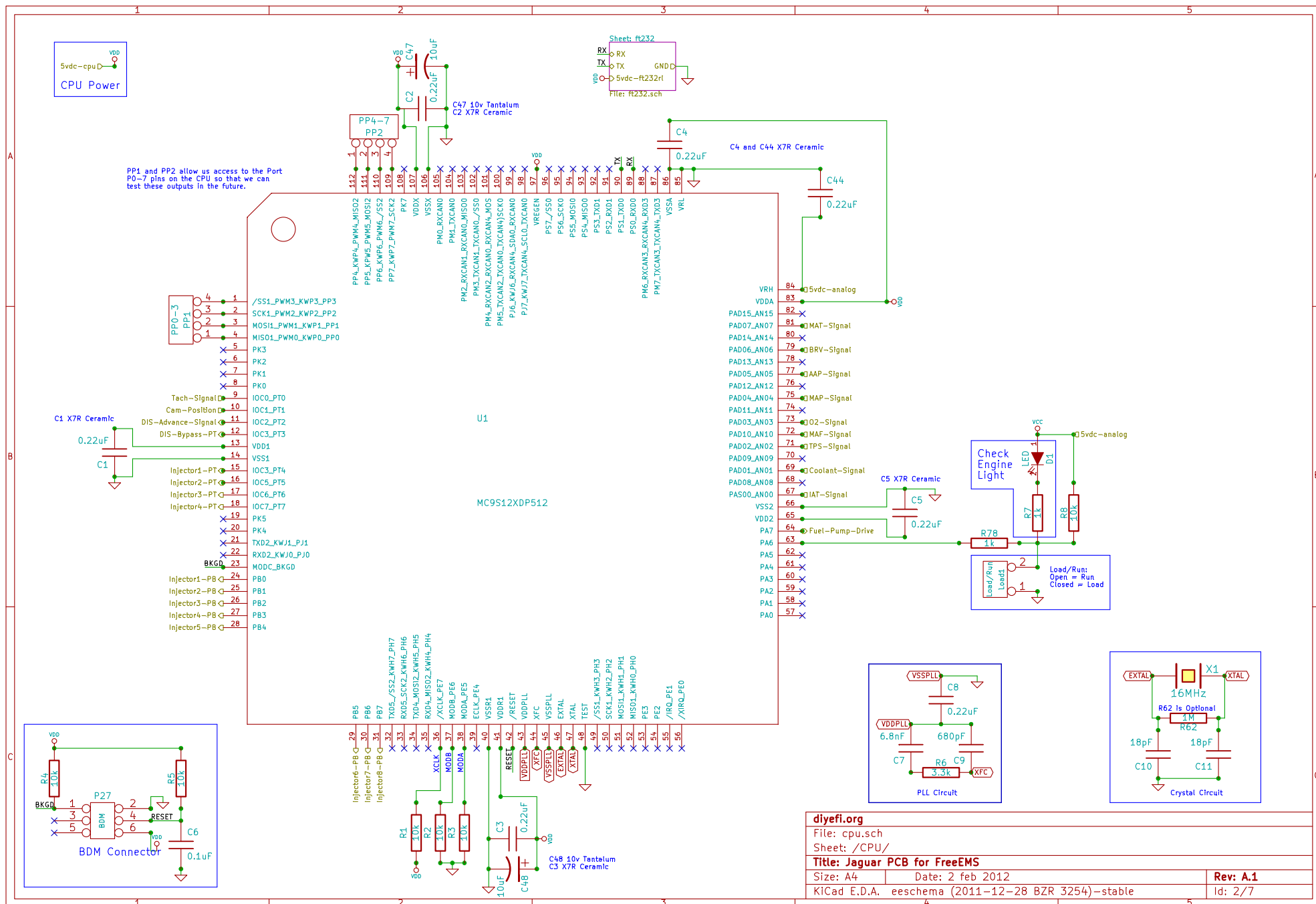File: Jaguar.sch
Sheet: /
Title: Jaguar PCB for FreeEMS
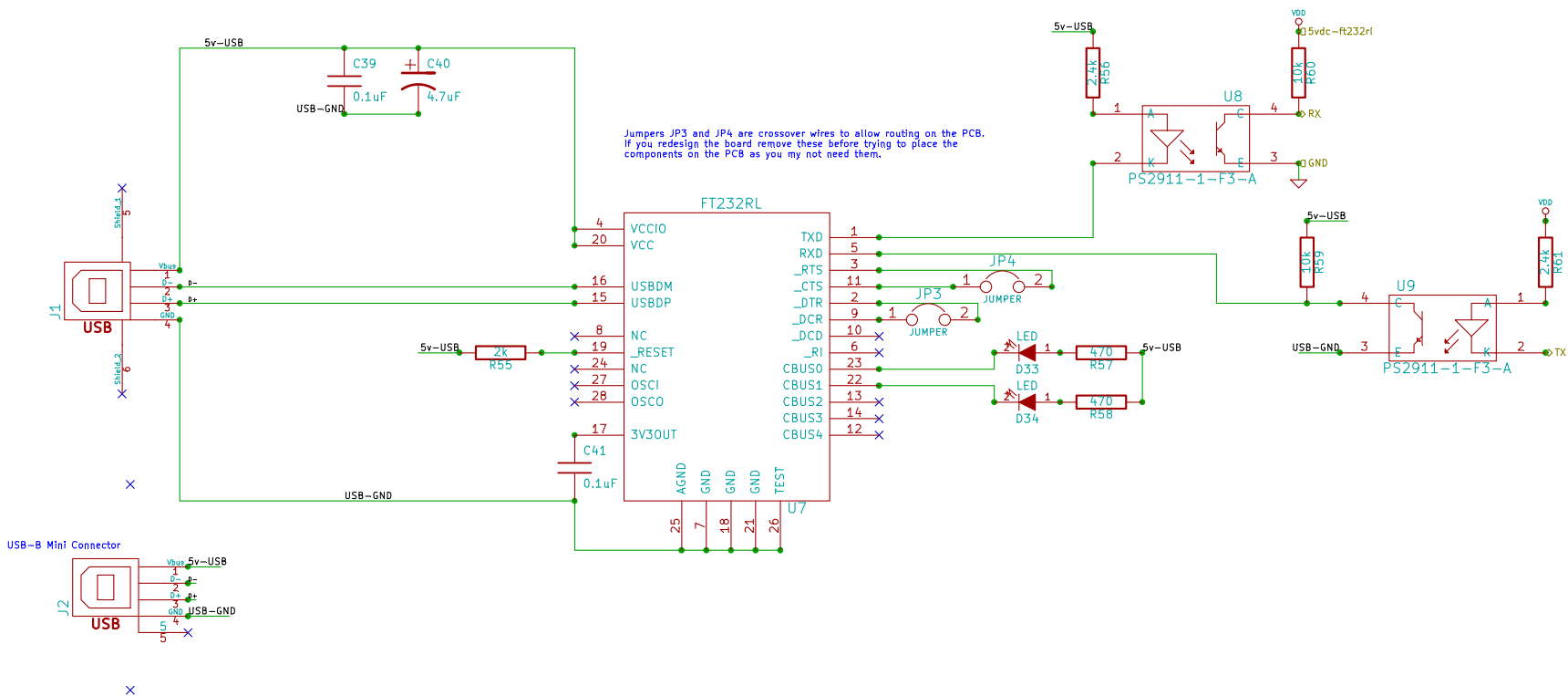Size: A4   Date: 2 feb 2012
KiCad E.D.A. eeschema (2011-12-28 BZR 3254)-stable
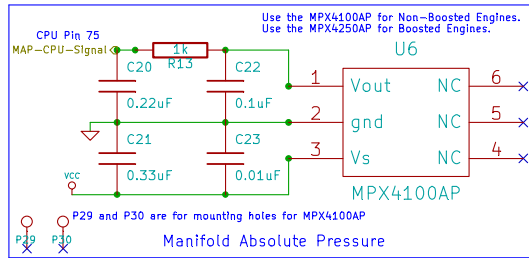Rev: A.1
Id: 1/7

CPU Power

5vdc-cpu   VDD

PP1 and PP2 allow us access to the Port
P0-7 pins on the CPU so that we can
test these outputs in the future.

Sheet: ft232
RX   RX
TX   TX
VDD   GND
5vdc-ft232rl
File: ft232.sch

VDD
C47 10uF
C2   0.22uF
C47 10v Tantalum
C2 X7R Ceramic

C4   0.22uF
C4 and C44 X7R Ceramic
C44   0.22uF

PP4-7
PP2

112 PP4_KWP4_PWM4_MISO2
111 PP5_KWP5_PWM5_MOSI2
110 PP6_KWP6_PWM6_/SS2
109 PP7_KWP7_PWM7_SCK2
108 PK7
107 VDDX
106 VSSX
105 PM0_RXCAN0
104 PM1_TXCAN0
103 PM2_RXCAN1_TXCAN0_MISO0
102 PM3_TXCAN1_TXCAN0_/SS0
101 PM4_RXCAN2_TXCAN0_RXCAN4_MOS
100 PM5_TXCAN2_TXCAN4_SDA0_RXCAN0
99 PJ6_KW6_RXCAN4_SCL0_TXCAN0
98 PJ7_KWJ7_TXCAN4_SCL0_TXCAN0
97 VREGEN
96 PS7_/SS0
95 PS6_SCK0
94 PS5_MOSI0
93 PS4_MISO0
92 PS3_TXD1
91 PS2_RXD1
90 PS1_TXD0   TX
89 PS0_RXD0   RX
88 PM6_RXCAN3_RXCAN4_RXD3
87 PM7_TXCAN3_TXCAN4_TXD3
86 VSSA
85 VRL

VDD

U1
MC9S12XDP512

PP0-3
PP1
4 1 /SS1_PWM3_KWP3_PP3
3 2 SCK1_PWM2_KWP2_PP2
2 3 MOSI1_PWM1_KWP1_PP1
1 4 MISO1_PWM0_KWP0_PP0
5 PK3
6 PK2
7 PK1
8 PK0
9 IOC0_PT0   Tach-Signal
10 IOC1_PT1   Cam-Position
11 IOC2_PT2   DIS-Advance-Signal
12 IOC3_PT3   DIS-Bypass-PT
13 VDD1
14 VSS1
15 IOC3_PT4   Injector1-PT
16 IOC5_PT5   Injector2-PT
17 IOC6_PT6   Injector3-PT
18 IOC7_PT7   Injector4-PT
19 PK5
20 PK4
21 TXD2_KWJ1_PJ1
22 RXD2_KWJ0_PJ0
23 MODC_BKGD   BKGD
24 PB0   Injector1-PB
25 PB1   Injector2-PB
26 PB2   Injector3-PB
27 PB3   Injector4-PB
28 PB4   Injector5-PB

C1 X7R Ceramic
0.22uF
C1

84 VRH   5vdc-analog
83 VDDA
82 PAD15_AN15
81 PAD07_AN07   MAT-Signal
80 PAD14_AN14
79 PAD06_AN06   BRV-Signal
78 PAD13_AN13
77 PAD05_AN05   AAP-Signal
76 PAD12_AN12
75 PAD04_AN04   MAP-Signal
74 PAD11_AN11
73 PAD03_AN03   IO2-Signal
72 PAD10_AN10   MAF-Signal
71 PAD02_AN02   TPS-Signal
70 PAD09_AN09
69 PAD01_AN01   Coolant-Signal
68 PAD08_AN08
67 PAS00_AN00   IAT-Signal
66 VSS2
65 VDD2
64 PA7   Fuel-Pump-Drive
63 PA6
62 PA5
61 PA4
60 PA3
59 PA2
58 PA1
57 PA0

VDD

VCC
Check Engine Light
LED   D1   5vdc-analog
R7 1k   R8 10k
R78 1k
Load/Run   Load/Run:
Load1   Open = Run
Closed = Load

C5 X7R Ceramic
C5   0.22uF

29 PB5   Injector6-PB
30 PB6   Injector7-PB
31 PB7   Injector8-PB
32 TXD5_/SS2_KWH7_PH7
33 RXD5_SCK2_KWH6_PH6
34 TXD4_MOSI2_KWH5_PH5
35 RXD4_MISO2_KWH4_PH4
36 /XCLK_PE7   XCLK
37 MODB_PE6   MODB
38 MODA_PE5   MODA
39 ECLK_PE4
40 VSSR1
41 VDDR1
42 /RESET   RESET
43 VDDPLL   VDDPLL
44 XFC   XFC
45 VSSPLL   VSSPLL
46 EXTAL   EXTAL
47 XTAL   XTAL
48 TEST
49 /SS1_KWH3_PH3
50 SCK1_KWH2_PH2
51 MOSI1_KWH1_PH1
52 MISO1_KWH0_PH0
53 PE3
54 PE2
55 /IRQ_PE1
56 /XIRQ_PE0

R1 10k   R2 10k   R3 10k
C3   0.22uF
VDD
C48 10v Tantalum
C3 X7R Ceramic
10uF   C48

PLL Circuit
VSSPLL
C8   0.22uF
VDDPLL
6.8nF   680pF
C7   R6 3.3k   C9   XFC

Crystal Circuit
EXTAL   X1   XTAL
16MHz
R62 is Optional
1M   R62
18pF   18pF
C10   C11

BDM Connector
VDD
R4 10k   R5 10k
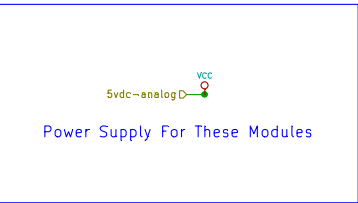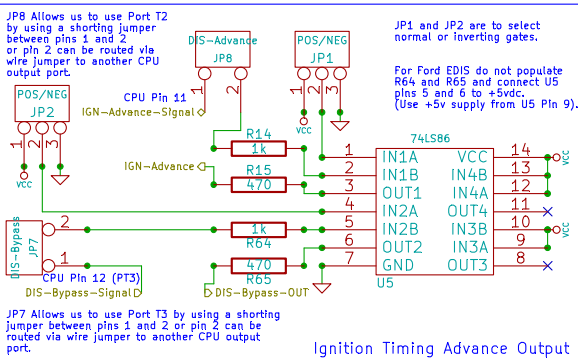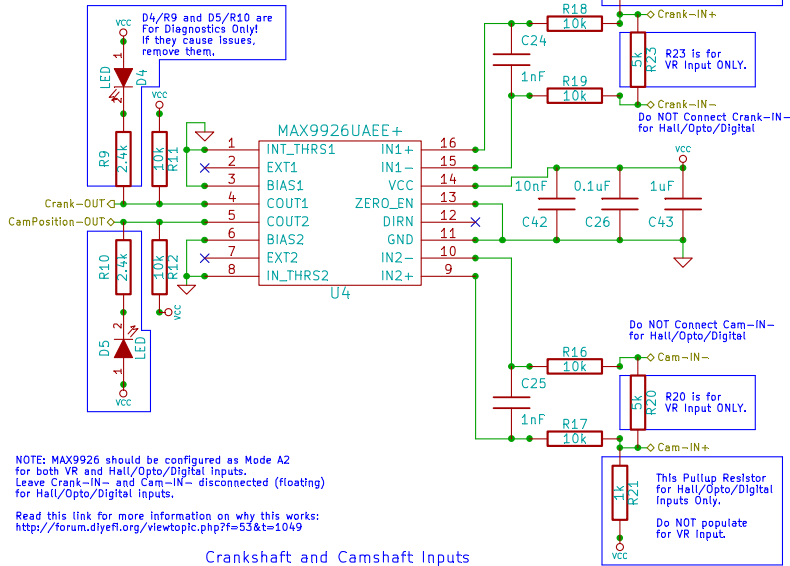BKGD
P27
1 2
3 4
5 6
BDM
BKGD
RESET
C6
0.1uF
VDD

diyefi.org
File: cpu.sch
Sheet: /CPU/
Title: Jaguar PCB for FreeEMS
Size: A4   Date: 2 feb 2012   Rev: A.1
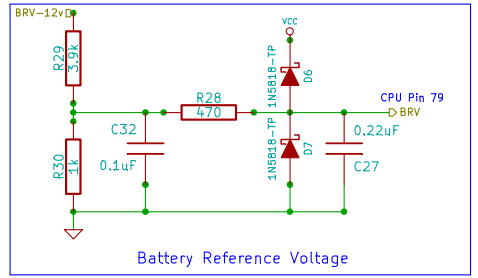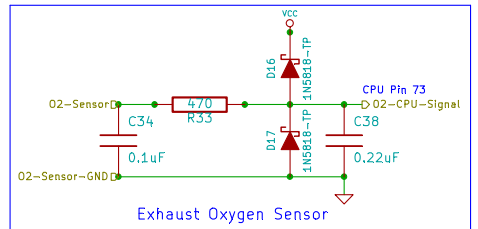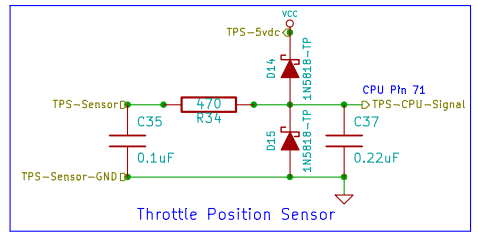KiCad E.D.A. eeschema (2011-12-28 BZR 3254)-stable   Id: 2/7

5v-USB

C39
0.1uF

C40
4.7uF

USB-GND

Jumpers JP3 and JP4 are crossover wires to allow routing on the PCB.
If you redesign the board remove these before trying to place the
components on the PCB as you my not need them.

5v-USB

2.4k
R56

VDD

5vdc-ft232rl

10k
R60

U8

1 A   C 4
                    RX

2 K   E 3
                    GND

PS2911-1-F3-A

FT232RL

4   VCCIO
20 VCC

16 USBDM
15 USBDP

8   NC
19 _RESET
24 NC
27 OSCI
28 OSCO

17 3V3OUT

TXD   1
RXD   5
_RTS 3
_CTS 11
_DTR 2
_DCR 9
_DCD 10
_RI   6
CBUS0 23
CBUS1 22
CBUS2 13
CBUS3 14
CBUS4 12

JP4
1   2
JUMPER

JP3
1   2
JUMPER

5v-USB

10k
R59

VDD

2.4k
R61

U9

4 C   A 1
                    TX

3 E   K 2

PS2911-1-F3-A

USB-GND

LED
D33
470
R57
5v-USB

LED
D34
470
R58

AGND GND GND GND TEST
25   7   18 21 26

U7

C41
0.1uF

5v-USB
2k
R55

J1
USB

Shield_4 5

Vbus 1
D-   2   D-
D+   3   D+
GND   4

Shield_2 6

USB-GND

USB-B Mini Connector

J2
USB

Vbus 1 5v-USB
D-   2   D-
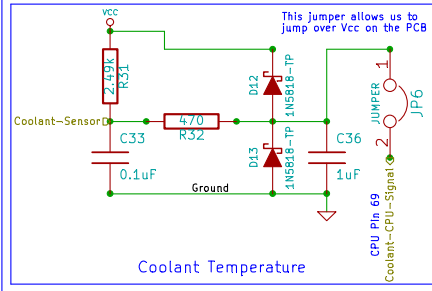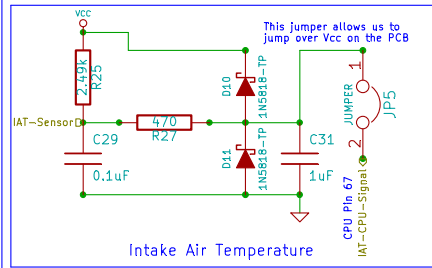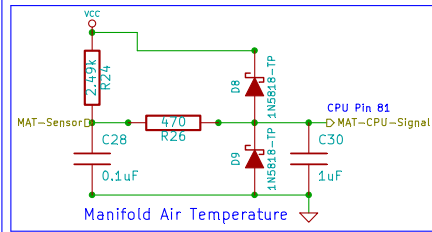D+   3   D+
GND   4 USB-GND
      5

For GM DIS and Ford EDIS leave Crank−IN~ and Cam−IN~ totally disconnected.

For Ford EDIS do not connect Cam−IN+ to anything either.
R16, R17, C25, R10, R12 and D5 are not needed for the EDIS system.
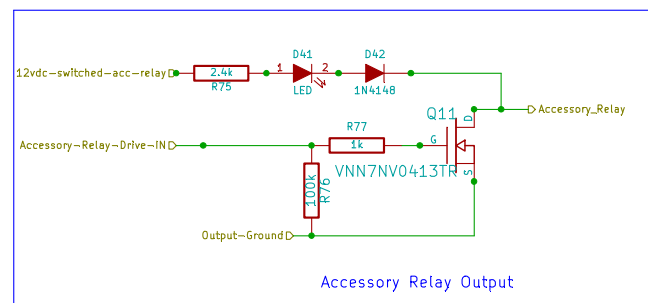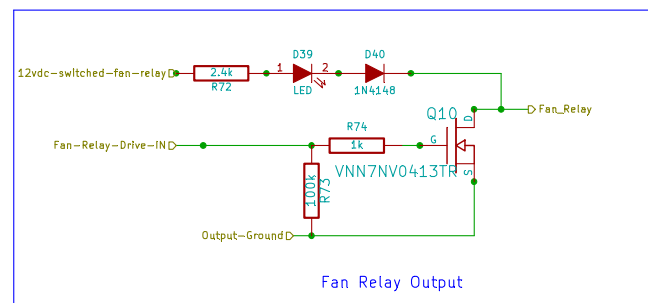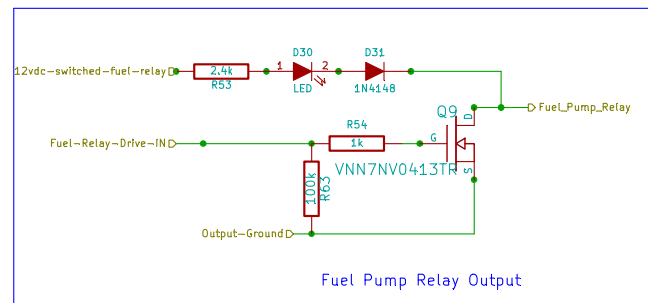
R20 and 23 are only to be used with VR inputs, do not
populate these components for GM DIS or Ford EDIS systems.

D4/R9 and D5/R10 are
For Diagnostics Only!
If they cause issues,
remove them.

VCC
R22
1k
This Pullup Resistor
for Hall/Opto/Digital
Inputs Only.
Do NOT populate
for VR Input.

R18
10k
Crank−IN+
C24
1nF
R19
10k
Crank−IN−
R23
5k
R23 is for
VR Input ONLY.
Do NOT Connect Crank−IN−
for Hall/Opto/Digital

MAX9926UAEE+

1 INT_THRS1   IN1+ 16
2 EXT1   IN1− 15
3 BIAS1   VCC   14
4 COUT1   ZERO_EN 13
5 COUT2   DIRN 12
6 BIAS2   GND   11
7 EXT2   IN2− 10
8 IN_THRS2   IN2+ 9

U4

R9 2.4k
D4 LED
VCC
D4
VCC
R11 10k

Crank−OUT
CamPosition−OUT

D5 LED
VCC
R10 2.4k
R12 10k
VCC

10nF   0.1uF   1uF
C42   C26   C43
VCC

R16
10k
Cam−IN~
C25
1nF
R17
10k
Cam−IN+

Do NOT Connect Cam−IN~
for Hall/Opto/Digital

R20
5k
R20 is for
VR Input ONLY.

VCC
R21
1k
This Pullup Resistor
for Hall/Opto/Digital
Inputs Only.
Do NOT populate
for VR Input.

NOTE: MAX9926 should be configured as Mode A2
for both VR and Hall/Opto/Digital inputs.
Leave Crank−IN~ and Cam−IN~ disconnected (floating)
for Hall/Opto/Digital inputs.

Read this link for more information on why this works:
http://forum.diyefi.org/viewtopic.php?f=53&t=1049

Crankshaft and Camshaft Inputs

JP8 Allows us to use Port T2
by using a shorting jumper
between pins 1 and 2
or pin 2 can be routed via
wire jumper to another CPU
output port.

DIS−Advance
JP8
POS/NEG
JP1
JP1 and JP2 are to select
normal or inverting gates.

For Ford EDIS do not populate
R64 and R65 and connect U5
pins 5 and 6 to +5vdc.
(Use +5v supply from U5 Pin 9).

POS/NEG
JP2
CPU Pin 11
IGN−Advance−Signal

R14 1k
VCC
R15 470
IGN−Advance

74LS86
1 IN1A   VCC   14
2 IN1B   IN4B 13
3 OUT1   IN4A 12
4 IN2A   OUT4 11
5 IN2B   IN3B 10
6 OUT2   IN3A 9
7 GND   OUT3 8
U5

DIS−Bypass
JP7
CPU Pin 12 (PT3)
DIS−Bypass−Signal

R64 1k
R65 470
DIS−Bypass−OUT

JP7 Allows us to use Port T3 by using a shorting
jumper between pins 1 and 2 or pin 2 can be
routed via wire jumper to another CPU output
port.

Ignition Timing Advance Output
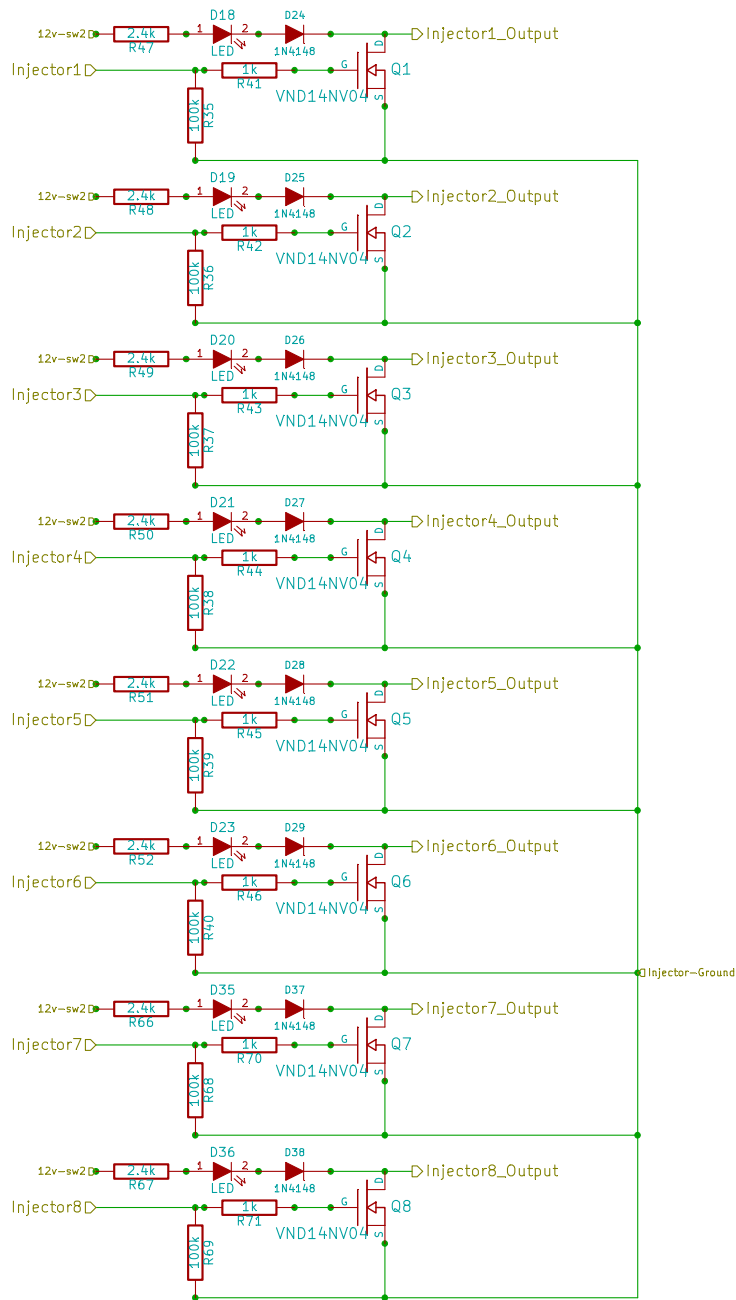
VCC
5vdc−analog
Power Supply For These Modules

R24, R25 and R31 (2.49k) can be replaced if using sensors other than
GM temperature sensors; for FORD Sensors: use 27.4k 0.1% Metal Film
resistors; for MOPAR Sensors: use 9.1k 0.1% Metal Film resistors or
use 2.43k 0.1% Metal Film resistors (best for most cases). Be sure to
use FreeTherm to adjust the values in the FreeEMS code for the best
accuracy irregardless of which value resistors you use!

VCC
R24 2.49k
D8 1N5818−TP
CPU Pin 81
MAT−SensorD
C28 0.1uF
R26 470
D9 1N5818−TP
MAT−CPU−Signal
C30 1uF

Manifold Air Temperature

VCC
R25 2.49k
D10 1N5818−TP
This jumper allows us to
jump over Vcc on the PCB
JUMPER
JP5
IAT−SensorD
C29 0.1uF
R27 470
D11 1N5818−TP
C31 1uF
CPU Pin 67
IAT−CPU−Signal

Intake Air Temperature

VCC
R31 2.49k
D12 1N5818−TP
This jumper allows us to
jump over Vcc on the PCB
JUMPER
JP6
Coolant−SensorD
C33 0.1uF
R32 470
D13 1N5818−TP
C36 1uF
Ground
CPU Pin 69
Coolant−CPU−Signal

Coolant Temperature

TPS−5vdc
VCC
D14 1N5818−TP
CPU Pin 71
TPS−SensorD
C35 0.1uF
R34 470
D15 1N5818−TP
TPS−CPU−Signal
C37 0.22uF
TPS−Sensor−GND

Throttle Position Sensor

VCC
D16 1N5818−TP
CPU Pin 73
O2−SensorD
C34 0.1uF
R33 470
D17 1N5818−TP
O2−CPU−Signal
C38 0.22uF
O2−Sensor−GND

Exhaust Oxygen Sensor

BRV−12vD
R29 3.9k
VCC
D6 1N5818−TP
CPU Pin 79
R28 470
BRV
C32 0.1uF
R30 1k
D7 1N5818−TP
C27 0.22uF

Battery Reference Voltage

CPU Pin 75
MAP−CPU−Signal
C20 R13 C22
0.22uF 1k 0.1uF
Use the MPX4100AP for Non−Boosted Engines.
Use the MPX4250AP for Boosted Engines.
U6
1 Vout   NC 6
2 gnd   NC 5
3 Vs   NC 4
C21 C23
0.33uF 0.01uF
VCC
MPX4100AP

P29 and P30 are for mounting holes for MPX4100AP
P29 P30

Manifold Absolute Pressure

Fuel Pump Relay Output

12vdc-switched-fuel-relay

R53 2.4k

D30 LED

D31 1N4148

Fuel_Pump_Relay

Q9

Fuel-Relay-Drive-IN

R54 1k

R63 100k

VNN7NV0413TR

Output-Ground

Fuel Pump Relay Output

Fan Relay Output

12vdc-switched-fan-relay

R72 2.4k

D39 LED

D40 1N4148

Fan_Relay

Q10

Fan-Relay-Drive-IN

R74 1k

R73 100k

VNN7NV0413TR

Output-Ground

Fan Relay Output

Accessory Relay Output

12vdc-switched-acc-relay

R75 2.4k

D41 LED

D42 1N4148

Accessory_Relay

Q11

Accessory-Relay-Drive-IN

R77 1k

R76 100k

VNN7NV0413TR

Output-Ground

Accessory Relay Output

12v-sw2   2.4k   D18   D24   Injector1_Output
R47   LED   1N4148
Injector1   1k   Q1
R41   VND14NV04
100k
R35

12v-sw2   2.4k   D19   D25   Injector2_Output
R48   LED   1N4148
Injector2   1k   Q2
R42   VND14NV04
100k
R36

12v-sw2   2.4k   D20   D26   Injector3_Output
R49   LED   1N4148
Injector3   1k   Q3
R43   VND14NV04
100k
R37

12v-sw2   2.4k   D21   D27   Injector4_Output
R50   LED   1N4148
Injector4   1k   Q4
R44   VND14NV04
100k
R38

12v-sw2   2.4k   D22   D28   Injector5_Output
R51   LED   1N4148
Injector5   1k   Q5
R45   VND14NV04
100k
R39

12v-sw2   2.4k   D23   D29   Injector6_Output
R52   LED   1N4148
Injector6   1k   Q6
R46   VND14NV04
100k
R40

Injector-Ground

12v-sw2   2.4k   D35   D37   Injector7_Output
R66   LED   1N4148
Injector7   1k   Q7
R70   VND14NV04
100k
R68

12v-sw2   2.4k   D36   D38   Injector8_Output
R67   LED   1N4148
Injector8   1k   Q8
R71   VND14NV04
100k
R69

LM2937EM-5.0

Vin | 1 | 3 | Vo

C12
10uF

C14
0.1uF

GND | 2 | U2

Ground

C16
0.1uF

C18
47uF

D2
1N5919BG

5.6v/3w

5vdc-analog

12v-switch

ERZ-V14D220

MOV1

LM2937EM-5.0

Vin | 1 | 3 | Vo

C13
10uF

C15
0.1uF

GND | 2 | U3

Ground

C17
0.1uF

C19
22uF

D3
1N5919BG

5.6v/3w

5vdc-cpu

C14, C15, C16 and C17 are 50v X7R Ceramic capacitors.

C12 and C13 are 35v Tantalum capacitors.
C18 and C19 are 16v Tantalum capacitors.