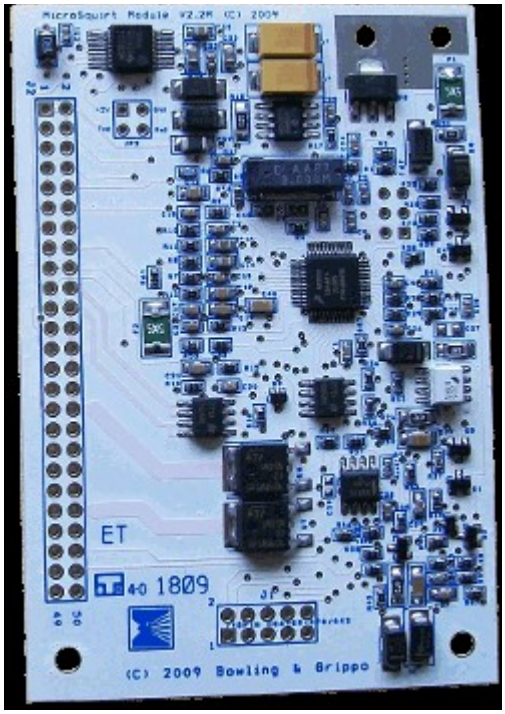
Microsquirt-Module Developers Guide

Megasquirt-2 Product Range

MS2/Extra 3.4

Dated: 2015-07-09



This version of the documentation applies to:

- MicroSquirt-module V2.2M as shown above running firmware MS2/Extra 3.4.x

  (See the Setting Up manual for more detail on version numbers.)

Does not apply to other Megasquirt products.

Contents

1: Introduction....3
1.1 Emissions and disclaimer....3
1.2 Licensing....3
1.3 Software download....3
2: Pinout....4
3: Mounting....5
4: Interfacing....5
5: Silkscreen....6
6: Schematics....6
7: Revision history....17

1: Introduction

The Microsquirt-module is a single board version of the Microsquirt ECU based on Megasquirt-2 technology. It is designed to be used as the basis for an ECU that you design.

The version 2.2 module was designed specifically to take advantage of the additional inputs, outputs and features that MS2/Extra offers so that is the firmware of choice.

As the module is intended as the heart of an ECU, it is up to the user to provide interface circuits and suitable connections to "the outside world". If you require a packaged ECU then consider one of the other products in the Megasquirt portfolio.

The documention in this manual is brief as the developer is expected to have a greater level of knowledge than a typical end-user. The Microsquirt-module is not intended for beginner users or those unskilled in electronics.

Other Megasquirt manuals and resources will need to be referenced to full utilise this product.

For additional help and support, visit the website **www.msextra.com**

1.1 Emissions and disclaimer

All parts are sold for OFF ROAD RACE-ONLY ground-vehicle use only, or vehicles that pre-date any federal and state emissions control requirements. Aftermarket EFI/EMS systems are not for sale or use on pollution controlled vehicles. Alteration of emission related components constitutes tampering under the US EPA guidelines and can lead to substantial fines and penalties. Your country/state/district may also have specific rules restricting your tampering with your vehicle’s emissions system.

Race parts are inherently dangerous and may cause injury or damage if improperly modified or altered before use. The publishers of this manual will not be held liable for and will not pay you for any injuries or damage caused by misuse, modification, redesign, or alternation of any of our products. The publishers of this manual will not be held in any way responsible for any incidental or consequential damages including direct or indirect labor, towing, lodging, garage, repair, medical, or legal expense in any way attributable to the use of any item in our catalog or to the delay or inconvenience caused by the necessity of replacing or repairing any such item.

1.2 Licensing

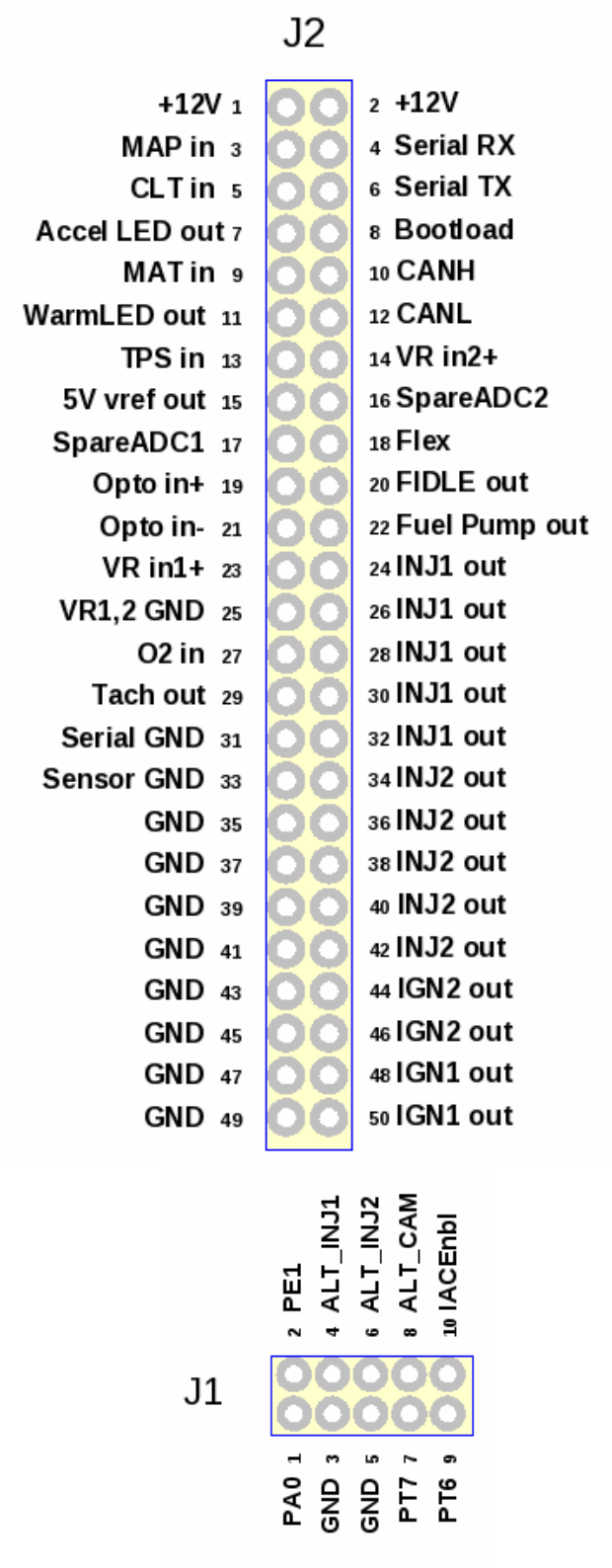
Purchase of the Microsquirt-module gives you license to use any of the Megasquirt 2 firmwares on it.

You can create your own ECU around the Microsquirt-module using whatever board(s) or components you see fit.

1.3 Software download

The latest software and firmware versions can be downloaded from www.msextra.com/downloads

2: Pinout

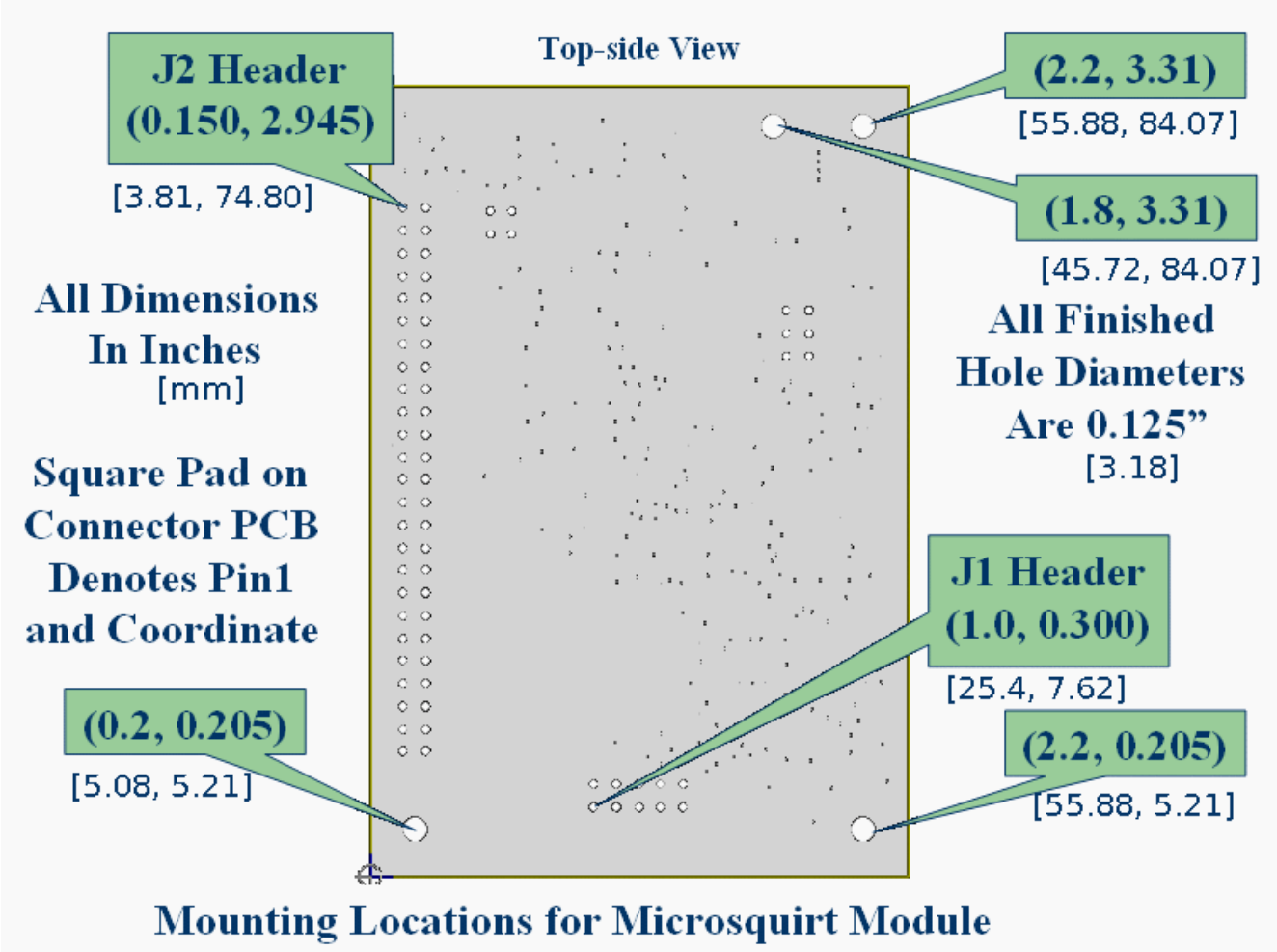


The main 50 pin header connector is J2:
1,2: +12V fused power input
3: 0-5V MAP sensor input
4: Serial RX comms to tuning computer
5: Coolant temperature sensor
6: Serial TX comms to tuning computer
7: Accel LED "D16" mid current ground out, SparkD
8: Bootload, the "boot jumper" rarely used
9: Manifold Air Temp sensor
10: CAN communications H
11: Warmup LED "D15" mid current ground out, SparkC
12: CAN communications L
13: 0-5V Throttle position sensor input
14: VR tach signal no.2 (+) input
15: 5V vref out (for TPS) MAX 25mA
16: SpareADC2 0-5V analogue input or digital output
17: SpareADC1 0-5V analogue input or digital output
18: 0-5V Flex fuel input
19: Opto tacho in(+)
20: FIDLE mid current ground out
21: Opto tacho in(-)
22: Fuel Pump mid current ground out
23: VR tach signal no.1 (+) input
24,26,28,30,32: INJ1 out. Use all the INJ1 pins in parallel
25: VR1,2 GND
27: 0-5V Oxygen sensor input
29: Tach "D14" low current ground out
31: Serial GND
33: Sensor GND
34,36,38,40,42: INJ2 out. Use all the INJ2 pins in parallel
35,37,39,41,43,45,47,49: Power GND. Use all Power Grounds in parallel
44,46: IGN2 low current output, SparkB
48,50: IGN1 low current output, SparkA

The secondary 10 pin header is J1:

1: PA0 Generic output (raw CPU pin)
2: PE1 Input only Tableswitching (raw CPU pin)
3,5: GND
4: ALT_INJ1, digital injector 1 signal
6: ALT_INJ2, digital injector 2 signal
7: PT7 Stepper idle channel (IAC) or additional injector
8: ALT_CAM zero crossing setpoint for VR2
9: PT6 Stepper idle channel (IAC) or additional injector
10: IACEnbl Stepper idle chip enable

3: Mounting



The two bolt holes on the top/right of the board are ideally used as additional heatsinking for the 5V voltage regulator.

Overall the card is 2.40 x 3.50 inches (61.0 x 88.9mm)

4: Interfacing

Electrically, the module is similar to the Microsquirt for most sensor inputs and outputs. Details are provided within the Microsquirt Hardware.

The key differences are:

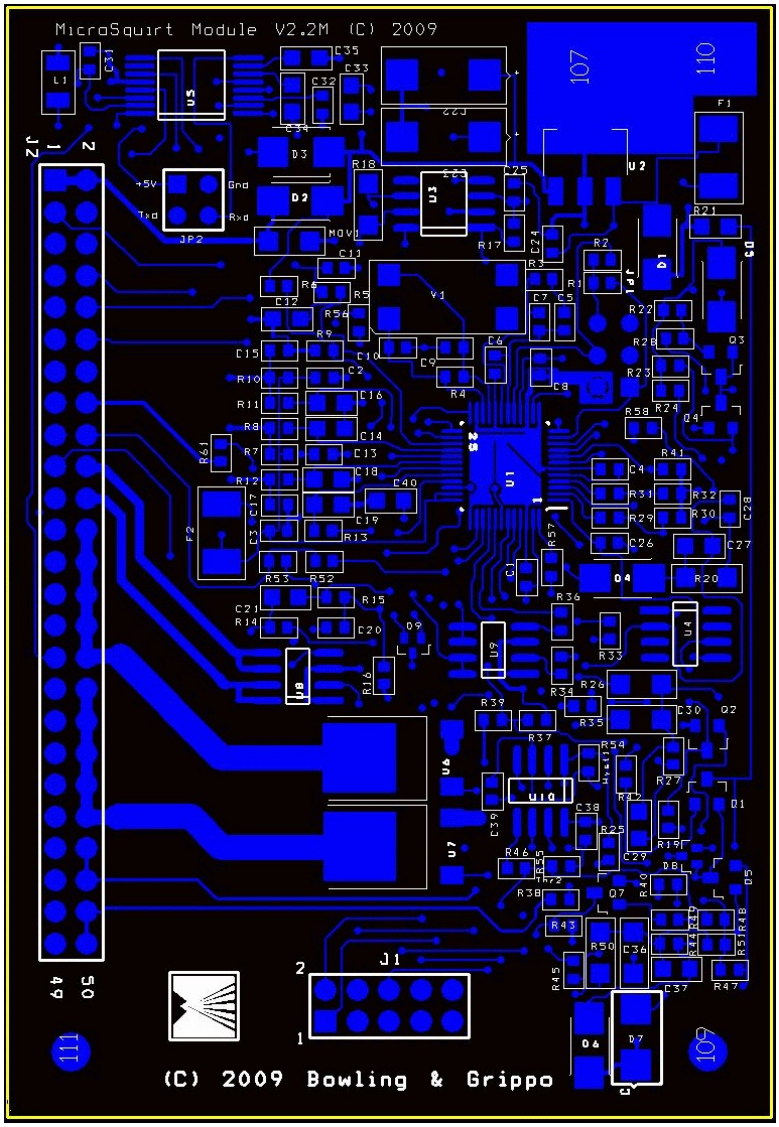
- Microsquirt-module uses single ended tach circuits - similar to the V3.0 mainboard circuit, but non-adjustable.

- more I/O is connected on the Microsquirt-module

- PT6/7 can be used for stepper idle or 4 cyl sequential fuel

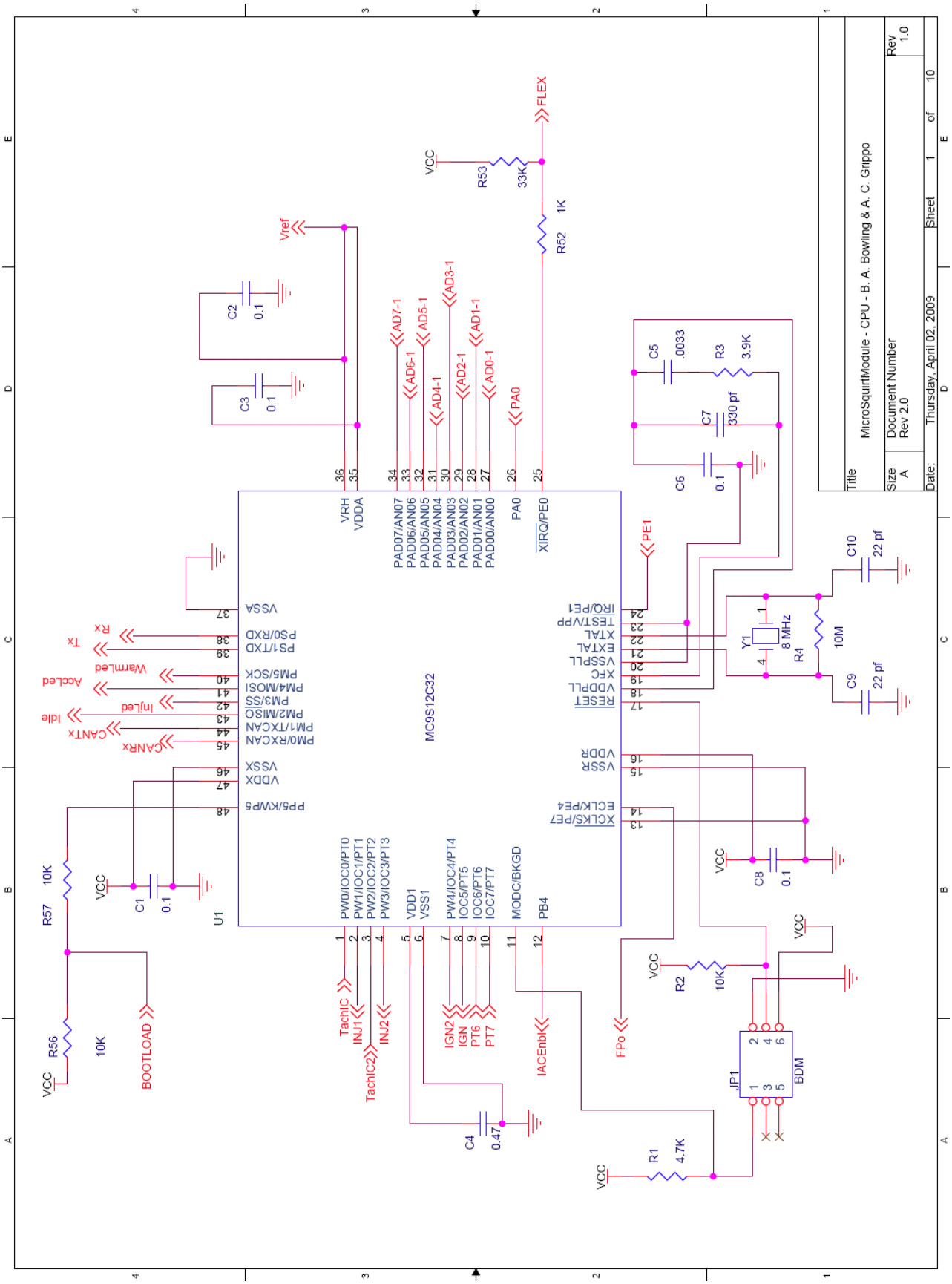
Be aware that the 5V supply should not be used to supply more than 25mA to any external circuits.

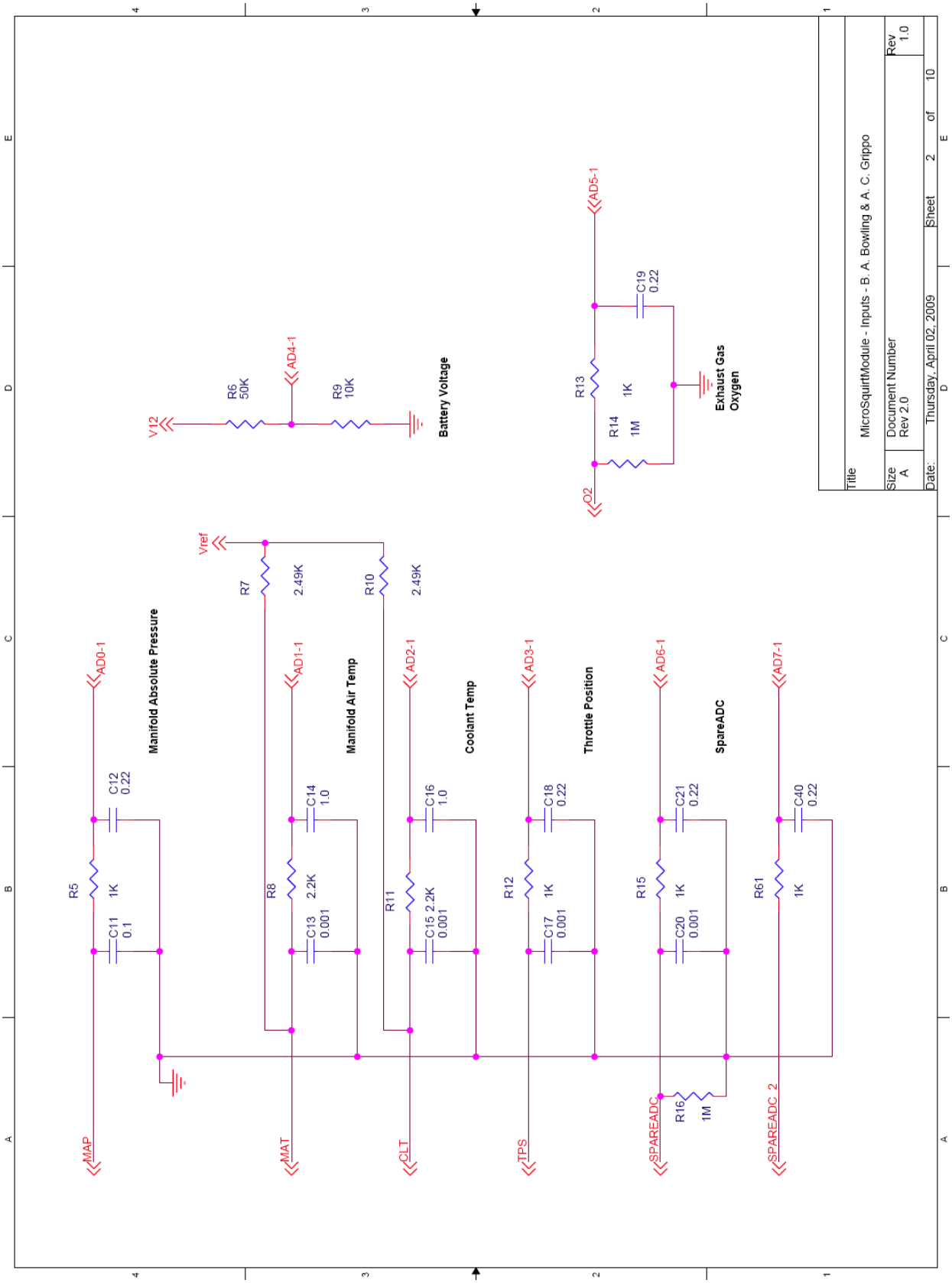
5: Silkscreen

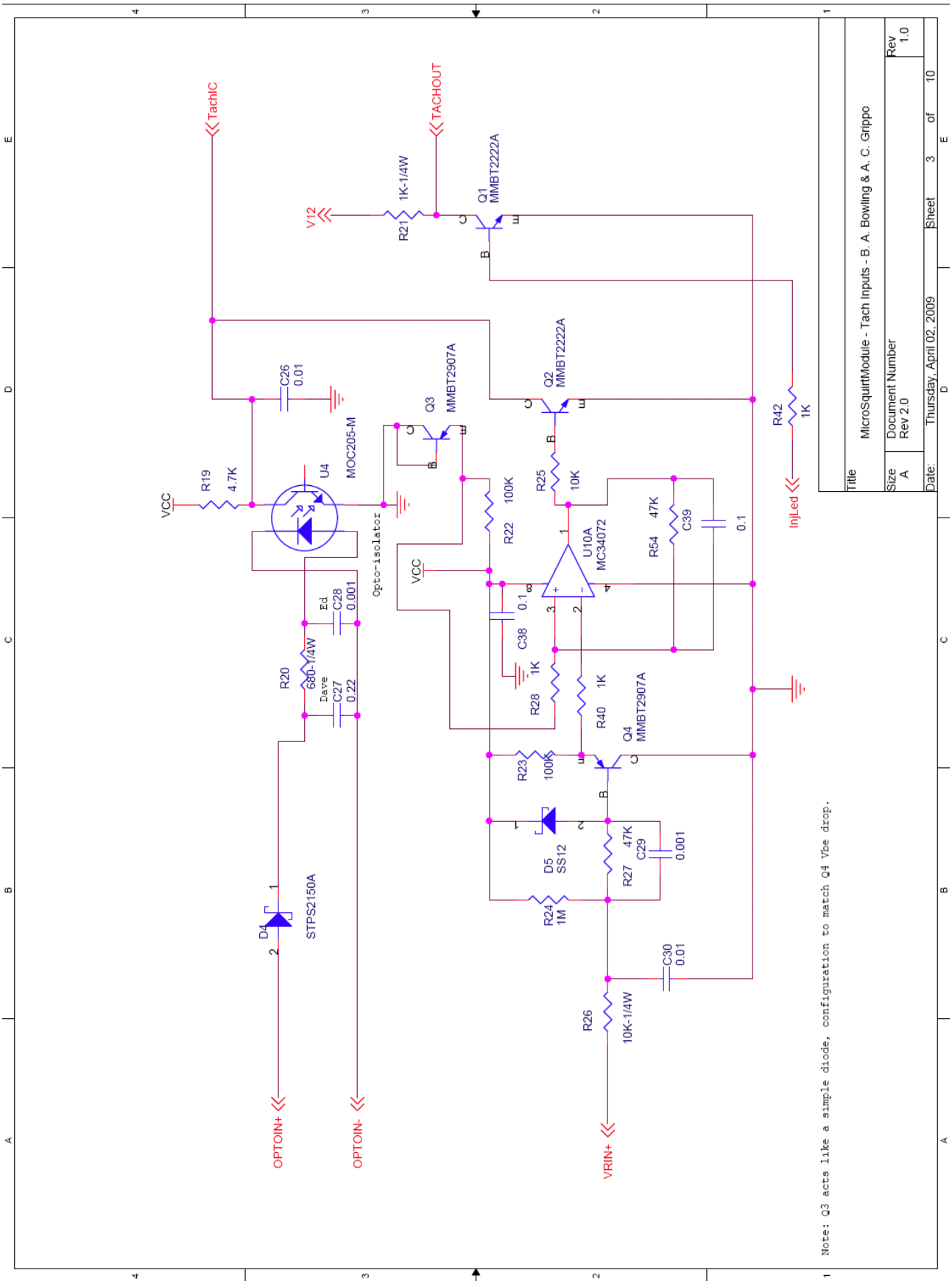


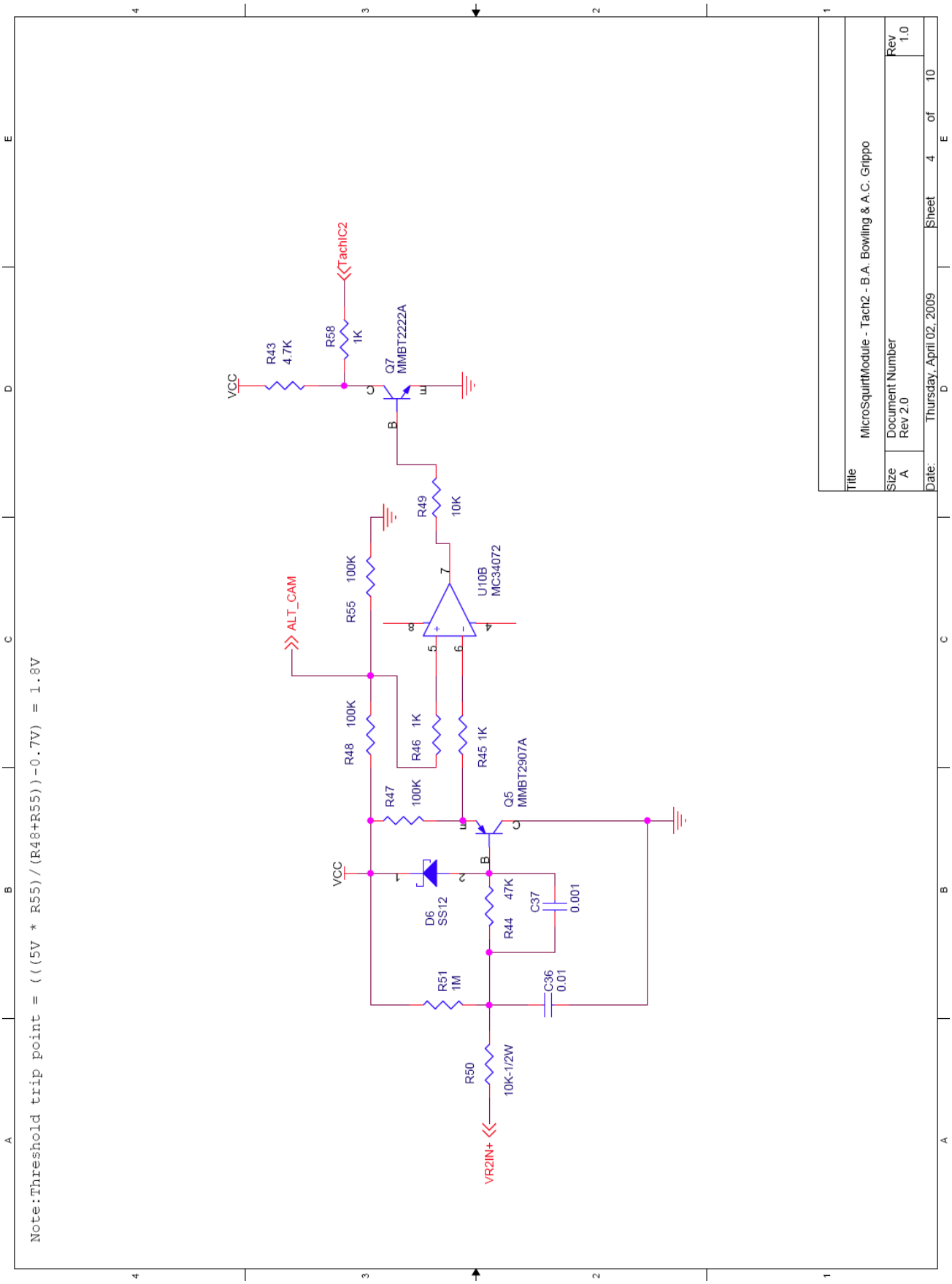
6: Schematics

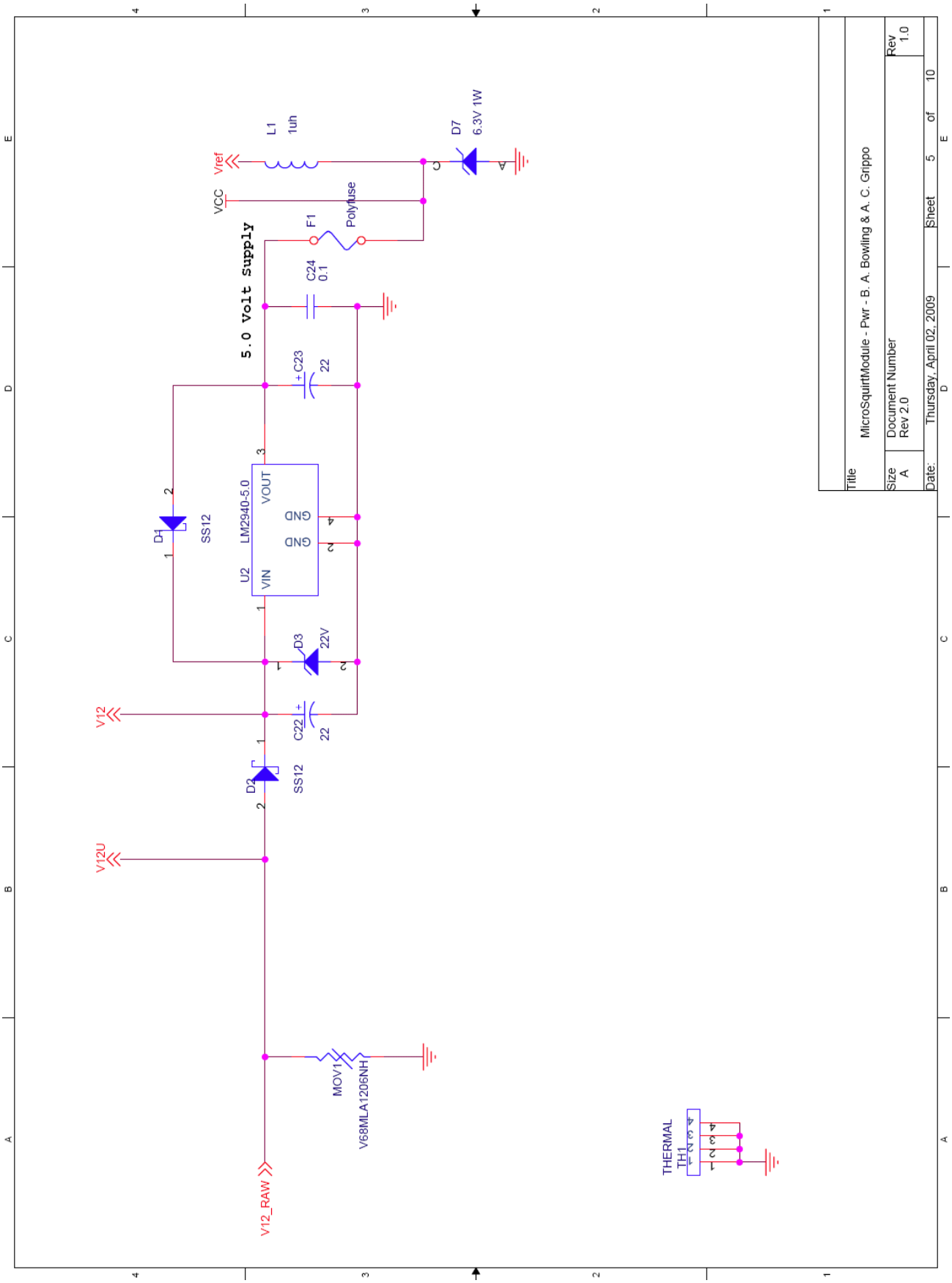
The copyrighted schematics are provided for repair, interfacing and education purposes only.

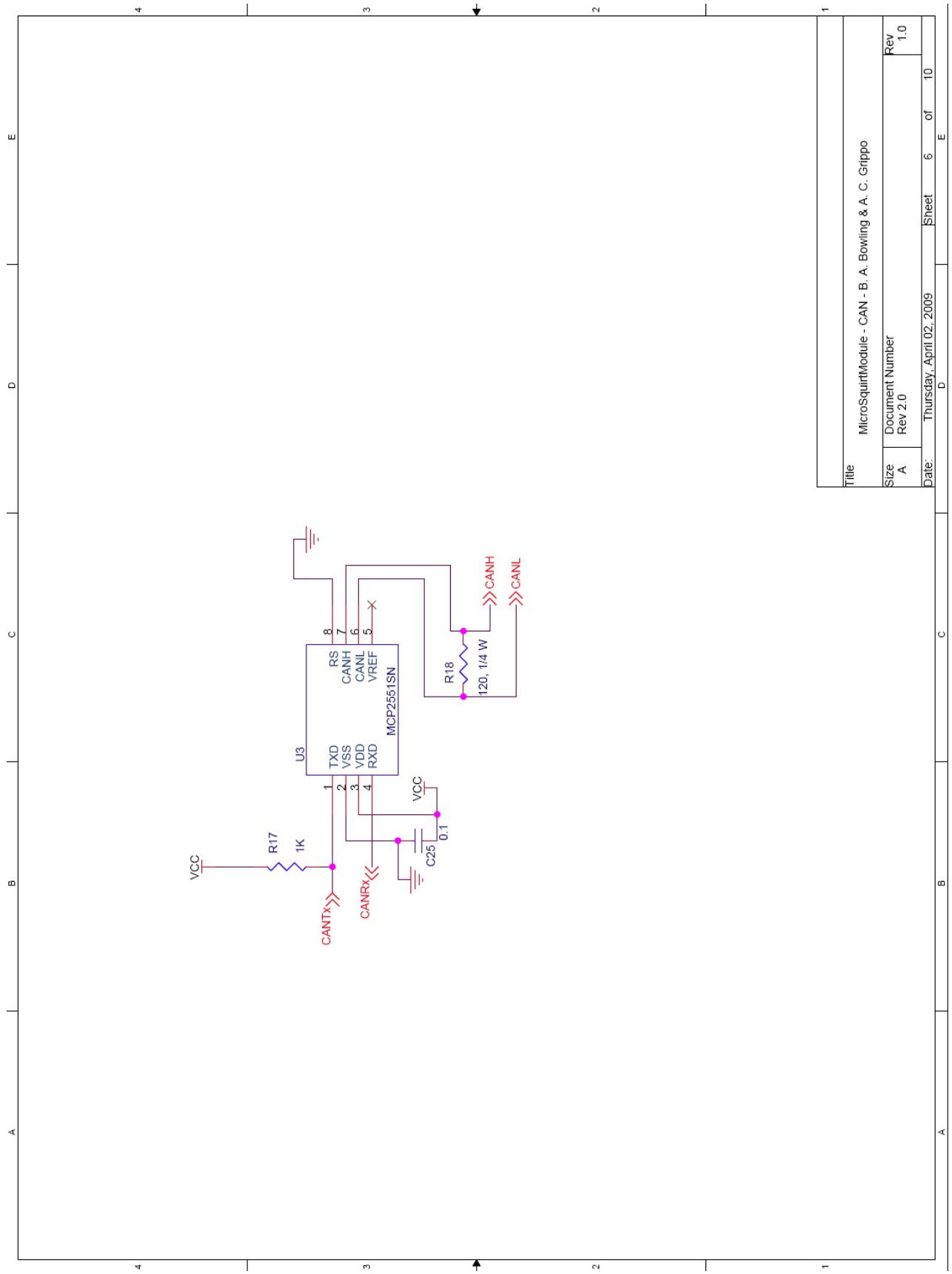

MicroSquirtModule - CPU - B. A. Bowling & A. C. Grippo
Document Number
Rev 2.0
Thursday, April 02, 2009
MC9S12C32
U1
VCC
Vref
FLEX
R53 33K
R52 1K
C2 0.1
C3 0.1
C5 .0033
R3 3.9K
C7 330 pf
C6 0.1
C10 22 pf
C9 22 pf
Y1 8 MHz
R4 10M
C8 0.1
R2 10K
R57 10K
R56 10K
C1 0.1
R1 4.7K
C4 0.47
JP1
BDM
BOOTLOAD
TachIC
INJ1
TachIC2
INJ2
IGN2
IGN
PT6
PT7
IACEnbl
FPo
PE1
PA0
AD7-1
AD6-1
AD5-1
AD4-1
AD3-1
AD2-1
AD1-1
AD0-1
Rx
Tx
WarmLed
AccLed
InjLed
Idle
CANTx
CANRx

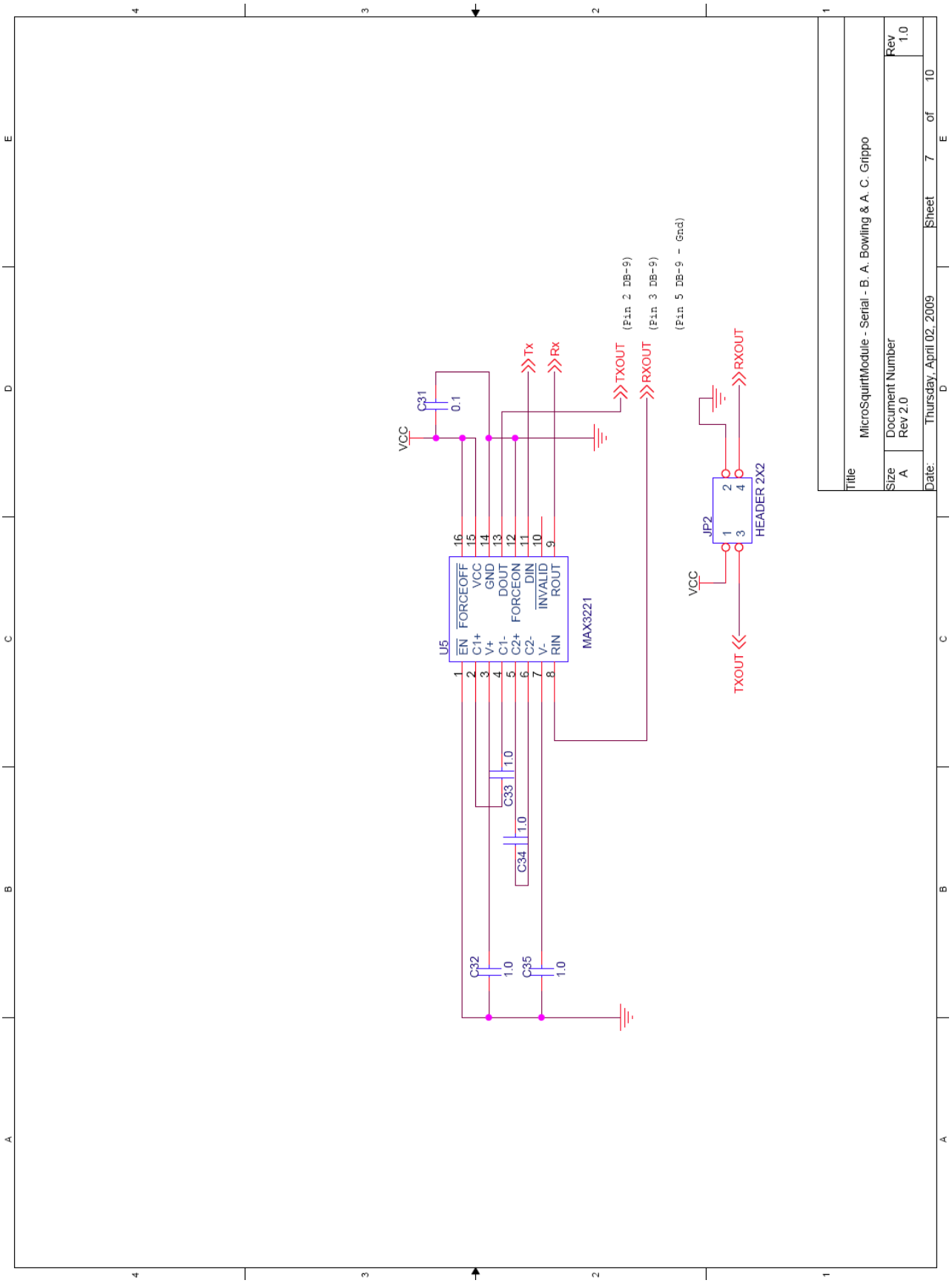

Title
MicroSquirtModule - Inputs - B. A. Bowling & A. C. Grippo
Size A
Document Number Rev 2.0
Rev 1.0
Date: Thursday, April 02, 2009
Sheet 2 of 10
Battery Voltage
Exhaust Gas Oxygen
Manifold Absolute Pressure
Manifold Air Temp
Coolant Temp
Throttle Position
SpareADC
V12
R6 50K
R9 10K
AD4-1
AD5-1
R13 1K
R14 1M
C19 0.22
O2
Vref
R7 2.49K
R10 2.49K
AD0-1
AD1-1
AD2-1
AD3-1
AD6-1
AD7-1
R5 1K
C11 0.1
C12 0.22
R8 2.2K
C13 0.001
C14 1.0
R11 2.2K
C15 0.001
C16 1.0
R12 1K
C17 0.001
C18 0.22
R15 1K
C20 0.001
C21 0.22
R61 1K
C40 0.22
R16 1M
MAP
MAT
CLT
TPS
SPAREADC
SPAREADC_2

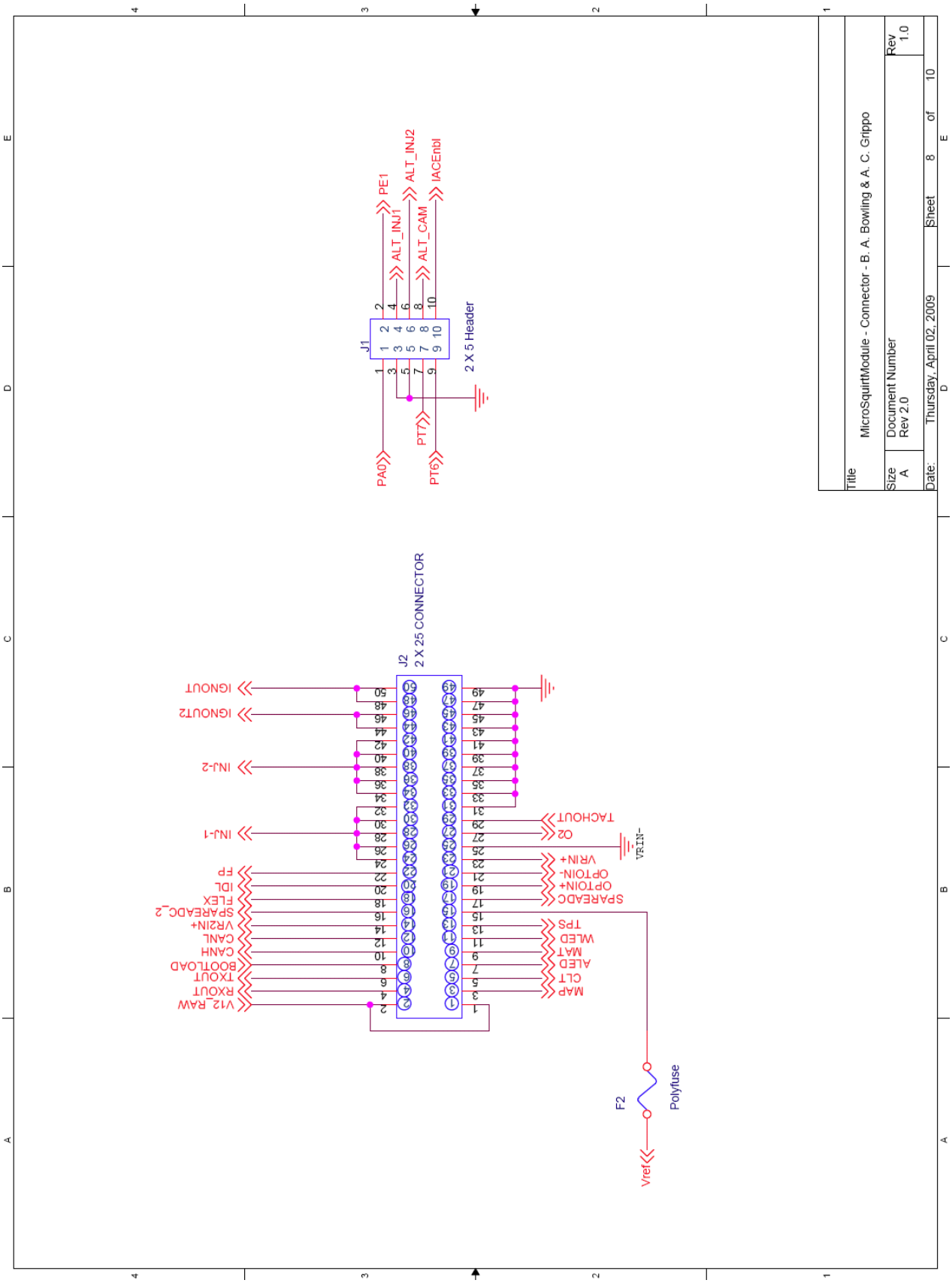

TachIC
TACHOUT
V12
R21 1K-1/4W
Q1 MMBT2222A
Q2 MMBT2222A
Q3 MMBT2907A
Q4 MMBT2907A
C26 0.01
R19 4.7K
U4 MOC205-M
Opto-isolator
VCC
R22 100K
R25 10K
R42 1K
InjLed
U10A MC34072
R54 47K
C39 0.1
C38 0.1
R28 1K
R40 1K
R20 680-1/4W
C28 0.001
C27 0.22
R23 100K
D5 SS12
R27 47K
C29 0.001
R24 1M
C30 0.01
R26 10K-1/4W
D4 STPS2150A
OPTOIN+
OPTOIN-
VRIN+
Note: Q3 acts like a simple diode, configuration to match Q4 Vbe drop.
Title MicroSquirtModule - Tach Inputs - B. A. Bowling & A. C. Grippo
Size A
Document Number Rev 2.0
Rev 1.0
Date: Thursday, April 02, 2009
Sheet 3 of 10

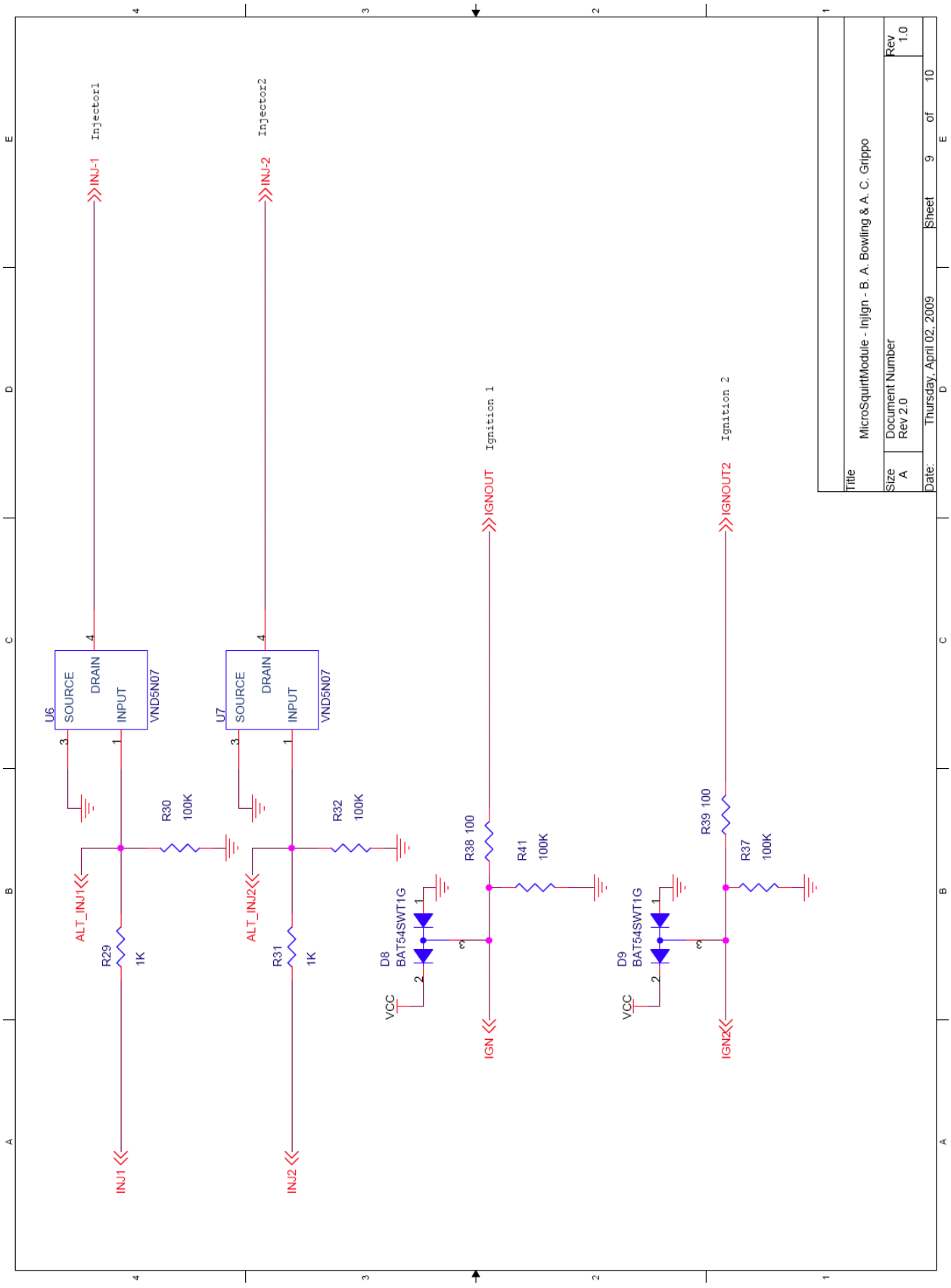

Note:Threshold trip point = (((5V * R55)/(R48+R55))-0.7V) = 1.8V
TachC2
R58 1K
R43 4.7K
VCC
Q7 MMBT2222A
R49 10K
R55 100K
ALT_CAM
U10B MC34072
R48 100K
R46 1K
R45 1K
R47 100K
Q5 MMBT2907A
D6 SS12
R44 47K
C37 0.001
R51 1M
C36 0.01
R50 10K-1/2W
VR2IN+
Title
MicroSquirtModule - Tach2 - B.A. Bowling & A.C. Grippo
Size A
Document Number Rev 2.0
Rev 1.0
Date: Thursday, April 02, 2009
Sheet 4 of 10

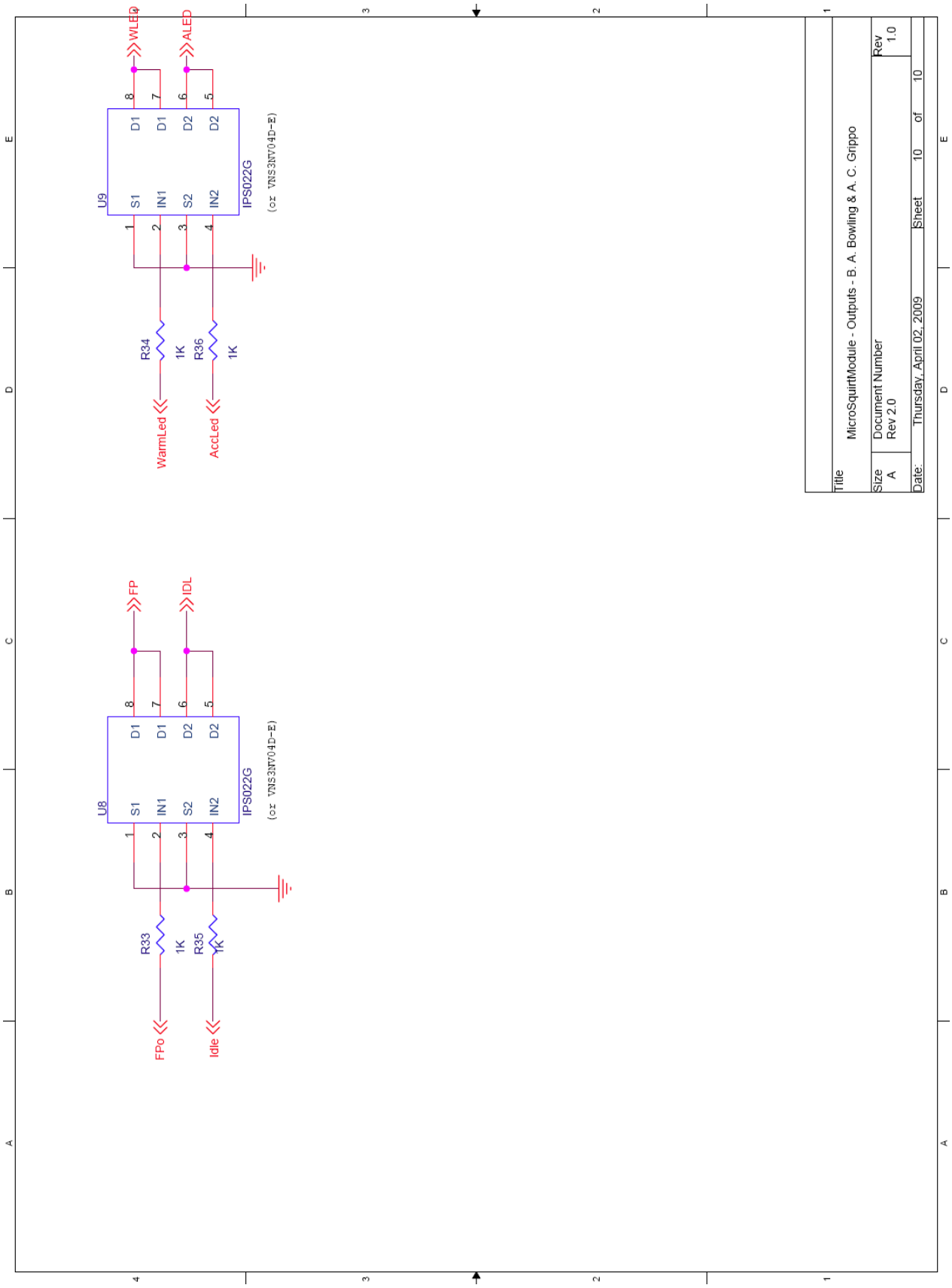

5.0 Volt Supply
L1
1uh
D7
6.3V 1W
Vref
VCC
F1
PolyFuse
C24
0.1
C23
22
U2
LM2940-5.0
VIN
VOUT
GND
GND
D1
SS12
D3
22V
C22
22
V12
D2
SS12
V12U
MOV1
V68MLA1206NH
V12_RAW
THERMAL
TH1
Title
MicroSquirtModule - Pwr - B. A. Bowling & A. C. Grippo
Size
A
Document Number
Rev 2.0
Rev
1.0
Date:
Thursday, April 02, 2009
Sheet
5
of
10


Title
MicroSquirtModule - CAN - B. A. Bowling & A. C. Grippo
Size
A
Document Number
Rev 2.0
Rev
1.0
Date:
Thursday, April 02, 2009
Sheet
6
of
10
U3
MCP2551SN
TXD
VSS
VDD
RXD
RS
CANH
CANL
VREF
1
2
3
4
8
7
6
5
R17
1K
R18
120, 1/4 W
C25
0.1
VCC
VCC
CANTx
CANRx
CANH
CANL


MicroSquirtModule - Serial - B. A. Bowling & A. C. Grippo
Document Number
Rev 2.0
Rev 1.0
Size A
Date: Thursday, April 02, 2009
Sheet 7 of 10
U5
MAX3221
FORCEOFF
VCC
GND
DOUT
FORCEON
DIN
INVALID
ROUT
EN
C1+
V+
C1-
C2+
C2-
V-
RIN
C31 0.1
C32 1.0
C33 1.0
C34 1.0
C35 1.0
VCC
Tx
Rx
TXOUT
RXOUT
(Pin 2 DB-9)
(Pin 3 DB-9)
(Pin 5 DB-9 - Gnd)
JP2
HEADER 2X2


PE1
ALT_INJ1
ALT_INJ2
ALT_CAM
IACEnbl
J1
2 X 5 Header
PA0
PT7
PT6
J2
2 X 25 CONNECTOR
IGNOUT1
IGNOUT2
INJ-2
INJ-1
FP
IDL
FLEX
SPAREADC_2
VR2IN+
CANL
CANH
BOOTLOAD
TXOUT
RXOUT
V12_RAW
TACHOUT
O2
VRIN-
VRIN+
OPTOIN-
OPTOIN+
SPAREADC
TPS
WLED
MAT
ALED
CLT
MAP
F2
Polyfuse
Vref
Title
MicroSquirtModule - Connector - B. A. Bowling & A. C. Grippo
Size
A
Document Number
Rev 2.0
Rev
1.0
Date:
Thursday, April 02, 2009
Sheet
8
of
10


Injector1
INJ-1
Injector2
INJ-2
U6
SOURCE
DRAIN
INPUT
VND5N07
U7
SOURCE
DRAIN
INPUT
VND5N07
R30 100K
R32 100K
ALT_INJ1
ALT_INJ2
R29 1K
R31 1K
INJ1
INJ2
Ignition 1
IGNOUT
R38 100
R41 100K
D8 BAT54SWT1G
VCC
IGN
Ignition 2
IGNOUT2
R39 100
R37 100K
D9 BAT54SWT1G
VCC
IGN2
Title
MicroSquirtModule - Injign - B. A. Bowling & A. C. Grippo
Size A
Document Number Rev 2.0
Rev 1.0
Date: Thursday, April 02, 2009
Sheet 9 of 10


WLED
ALED
U9
IPS022G
(or VNS3NV04D-E)
S1
IN1
S2
IN2
D1
D2
R34
1K
R36
1K
WarmLed
AccLed
FP
IDL
U8
IPS022G
(or VNS3NV04D-E)
R33
1K
R35
1K
FPo
Idle
Title
MicroSquirtModule - Outputs - B. A. Bowling & A. C. Grippo
Size
A
Document Number
Rev 2.0
Rev
1.0
Date:
Thursday, April 02, 2009
Sheet
10
of
10

7: Revision history

2014-08-29	Started.
2014-12-10	Fix GND pin typos. Add two missing schematic sheets.