PV AND BATTERY CHARGE CONTROL

SOLAR PANEL INPUT
<30V OC VOLTAGE

J1.4 PST1,0/4-3,5 — D1 SQ4 — PV_RAW — BLOCK BATTERY DISCHARGE

J1.3 — 0V

MPP IDEAL:ACTUAL
13.8:14.5V-15.2k@70ºC
15.8:15.7V-50.7k@40ºC
17:16.8V-100k@25ºC
19:18.7V-357k@0ºC

J1.2 — * 100k = B 4250 NTC THERMISTOR

J1.1

IO5 SHUTDOWN — R4 10k — Q3 K1N

IO7 OPEN COLLECTOR FAULT

R1 10k — PV_IN

R2 205k — R7 121k — R9 20k — R6 10k — R8 49.9k — R5 10k — C8 10uF — C9 .1uF — C10 1uF — 0V

U1 LT3652
VIN, TIMER, CHRG, FAULT, V_INREG, SHDN, BOOST, SW, SENSE, BAT, V_FB, NTC, SNK6, SNK5, SNK4, SNK3, SNK1, SNK0, SNK7

C1 1uF — L1 15uH 2A2 — R10 0R068 — TP4

D2 T4 — D3 T4 — SQ4 D4

C11 10uF — C12 10uF — 0V

PWR — R3 100k — C2 10nF — VIN LATCH — Q1 DMB

VIN-DISCON

ONCE Q1 IS ON IT IS HELD BY Q2 K38

Q2 RELEASES WHEN TPS3700 B-SIDE OPENS

VIN/2.6E — MURATA PS,OKI-78SR-5.0 SMPS 5V 1500MA SIP3 WITH MP2467 FROM Monolithic Power Solutions

U2 I50115 — VIN VOUT GND — +5V — C3 106A — 0V

BAT_I — R11 0R068 — Q4 DMB — BAT — J2.2 — BATTERY 12V SLA

BATTERY DISCONNECT — R13 100k — BAT-DISCON

J2.1 — BATTERY REVERSE PROTECTION — Q5 34N — -BAT

SHUTDOWN IF BATTERY WRONG 10k — R12 — D5 T4

LATCH VIN WHEN PWR IS > 13.1V — R21 100k — Q9 K38

PWR — R17 316k — 13.1V SENSOR — R18 10k — C13 .1uF

R19 280k — 11.76V SENSOR — R20 10k — C14 .1uF — C15 .1uF

U5 TPS3700 — A — B — D6 T4

R22 5.62k — DISCONNECT BATTERY AND OPEN VIN LATCH WHEN PWR IS < 11.58V E.G. 1.5% HYSTERESIS

CONNECT BATTERY WHEN PWR > 11.76V

J22 — PBC03SAA

**10K B = 3380 NTC THERMISTOR 0603 ON 0805 PAD — J21 — **10k — R23

DISABLE CHARGING ABOVE 40ºC OR BELOW 0ºC

R25 182k — R26 45.3k — R24 200k — R27 68.1k — 0V

TC+ — 13.278V:50.7k@40ºC 13.63V:100k@25ºC 14.068V:357k@0ºC — J2.3

100K B = 4250 NTC THERMISTOR — J2.4 — PST1,0/4-3,5 — TEMPERATURE COMPENSATION — TC-

DISCONNECT BATTERY — IO6 — R33 10k — Q15 K1N

NOTE: PV POWER WILL CONNECT THE BATTERY BUT THE MCU WILL EXPERIENCE A BROWN OUT SO DO NOT DISCONNECT DURING THE DAY.

MCU

+5V — L2 MH2029-300Y — T4 D7 — R32 10K — RESET

U6 ATMEGA1284P-AU

AVCC, VCC, VCC, RESET, AREF, XTAL1, XTAL2, GND, GND, GND, GND

(ADC0)PA0 — ADC0/2.3E
(ADC1)PA1 — ADC1/2.3F
(ADC2)PA2 — CHRG_ADC2
(ADC3)PA3 — DISCHRG_ADC3
(ADC4)PA4 — ADC4/2.5E
(ADC5)PA5 — ADC5/2.5F
(ADC6)PA6 — PV_ADC6
(ADC7)PA7 — PWR_ADC7

(PCINT8/T0)PB0 — IO4
(PCINT9/T1)PB1 — IO23/2.5A
(PCINT10/INT2)PB2 — IO22
(OC0A)PB3 — IO6
(OC0B/SS)PB4 — IO5
(ICP3/MOSI)PB5 — IO14/2.9E
(OC3A/MISO)PB6 — IO12/2.8A
(OC3B/SCK)PB7 — IO13/2.8A

(SCL)PC0 — SCL
(SDA)PC1 — SDA
(TCK)PC2 — IO19/2.5A
(TMS)PC3 — IO18/2.5A
(TDO)PC4 — IO17/2.5A
(TDI)PC5 — IO16/2.5A
PC6 — IO15/2.5D
PC7 — IO7

PD0(RXD0) — RX
PD1(TXD0) — TX
PD2(INT0/RXD1) — IO2
PD3(INT1/TXD1) — IO3
PD4(OC1B) — IO10/2.8B
PD5(OC1A) — IO9/2.6E
(OC2A)PD7 — IO11/2.8B
(OC2B/ICP1)PD6 — IO8/2.9C

C19 .1uF — C21 15pF — C18 .1uF — C20 .1uF — C22 15pF — Y1 16MHz

ECS-160-20-3X-TR
16MHZ +/- 30PPM
STABILITY AND TOLERANCE
CRYSTAL CAPACITORS:
15PF = 5PF +
(20PF*20PF)/(20PF+20PF)

NOTE: A CRYSTAL IS USED SO THE AVR TIMERS HAVE CRYSTAL ACCURACY.

J17 ISP-SPI — MISO, SCK, RESET, VCC, MOSI, GND — IO12/2.8A, IO13/2.8A, RESET, IO14/2.9E — +5V

PV AND BATTERY VOLTAGE

PV_RAW — R34 432k — PV * .188 — PV_ADC6 — C16 .01uF — R35 100k — 0V

VIN/2.6E — R36 200k — PWR * .667 — PWR_ADC7 — C17 .01uF — R37 100k — 0V

CL8 INTERFACE

K7 AND CL8 USE:
A0 = IO19
A1 = IO18
A2 = IO17

K[1:3]:
E3 = IO15
nE2 = IO16
nE1 = IO23

K[4:7]:
E3 = IO16
nE2 = IO15
nE1 = IO23

CL8:
E3 = IO23
nE2 = IO15
nE1 = IO16

J9 — IO19/2.5A, IO18/2.5A, IO17/2.5A, IO23/2.5A, IO15/2.5D, A0, A1, A2, E3, E2, E1, IO16/2.5A, +5V, 0V

R43 10k — R44 10k — R45 10k — 0V

K7 SHCEMATIC IS ON NEXT SHEET

A0 A1 A2 E3 E2 E1 : DESC	A0 A1 A2 E3 E2 E1 : DESC
X X X 0V X X : ALL DISABLED	X X X 0V X X : ALL DISABLED
X X X X 5V X : ALL DISABLED	X X X X 5V X : ALL DISABLED
X X X X X 5V : ALL DISABLED	X X X X X 5V : ALL DISABLED
X X X 5V X X : ENABLE 17mA	0V 0V 0V 5V 0V 0V : SET K4
5V 0V 0V 5V 0V 0V : BOOST	5V 0V 0V 5V 0V 0V : RESET K4
0V 5V 0V 5V 0V 0V : SET K1	0V 5V 0V 5V 0V 0V : SET K5
5V 5V 0V 5V 0V 0V : RESET K1	5V 5V 0V 5V 0V 0V : RESET K5
0V 0V 5V 5V 0V 0V : SET K2	0V 0V 5V 5V 0V 0V : SET K6
5V 0V 5V 5V 0V 0V : RESET K2	5V 0V 5V 5V 0V 0V : RESET K6
0V 5V 5V 5V 0V 0V : SET K3	0V 5V 5V 5V 0V 0V : SET K7
5V 5V 5V 5V 0V 0V : RESET K3	5V 5V 5V 5V 0V 0V : RESET K7

map for pins_arduino.h
PA0 (D 24) AI 0
PA1 (D 25) AI 1
PA2 (D 26) AI 2
PA3 (D 27) AI 3
PA4 (D 28) AI 4
PA5 (D 29) AI 5
PA6 (D 30) AI 6
PA7 (D 31) AI 7

PB0 (D 4)
PB1 (D 23) T1 # open IO5
PB2 (D 22) INT2
PB3 (D 6) OC0A
PB4 (D 5) OC0B/SS # jmp IO5
PB5 (D 14) ICP3/MOSI
PB6 (D 12) OC3A/MISO
PB7 (D 13) OC3B

PC0 (D 21) SCL
PC1 (D 20) SDA
PC2 (D 19) TCK
PC3 (D 18) TMS
PC4 (D 17) TDO
PC5 (D 16) TDI
PC6 (D 15)
PC7 (D 7)

PD0 (D 0) RX0
PD1 (D 1) TX0
PD2 (D 2) RX1/INT0
PD3 (D 3) TX0/INT1
PD4 (D 10) OC1B
PD5 (D 9) OC1A
PD6 (D 8) OC2B/ICP1
PD7 (D 11) OC2A

Reference Designators:
B Battery
C Capacitor
D Diode
F Fuse/Breaker
H Hardware & Outline
J Connector/Link
K Relay
L Inductor
M Motor (and Related)
P Power supply
Q Transistor
R Resistor
S Switch
T Transformer
TP Test point
U Integrated circuit/module
Y Crystal or oscillator

BATTERY CURRENT

BAT_I — PWR — U3 1087 3.4 V/A DISCHRG_ADC3 — U4 1087 3.4 V/A CHRG_ADC2 — +5V — V+ 50V/V OUT GND — C4 .1uF — C5 .01uF — C6 .1uF — C7 .01uF — 0V

DIGITAL INPUT/OUTPUT 2:4

PST1,0/5-3,5 — J4.5 IO4_ — Q6 K1N — Q7 K38 — ESD_NODE/2.8A — +5V/2.8A — R14 182 — IO4

J4.4 IO3_ — Q8 K1N — Q10 K38 — ESD_NODE/2.8A — +5V/2.8A — R28 182 — IO3

J4.3 IO2_ — Q11 K1N — Q12 K38 — ESD_NODE/2.8A — +5V/2.8A — R29 182 — IO2

J4.2 22MA_DIO2

J4.1 — 0V

VIN/2.6E — R30 32.4 — K3N Q14 — K3N Q13 — 20mA — R31 49.9k — 0V

J14

PORT BIT 328;1284
* 2568 TX3

IO14/2.9E — NC; ICP3 B5 (*)
IO22 — NC; INT2 B2
RX — RX0 D0;D0
TX — TX0 D1;D1
IO2 — INT0 D2; INT0/RX1 D2
IO3 — OC2B/INT1 D3; INT1/TX1 D3
IO4 — T0 D4;B0
T1/OC0B D5; OC0B B4
IO6 — OC0A D6;B3
IO7 — D7;C7

PPPC101LFBN

IO5 — R15 JMP — R16 OPEN — IO23/2.5A

IO8/2.9C — ICP1 B0; OC2B/ICP1 D6
IO9/2.6E — OC1A B1;D5
IO10/2.8B — OC1B B2;D4
IO11/2.8B — OC2A B3;D7
IO12/2.8A — B4; OC3A B6
IO13/2.8A — B5; OC3B B7
0V/2.1A — GND
AREF(NC)
SDA — SDA C4;C1
SCL — SCL C5;C0

PPPC101LFBN

J15

ADC0/2.3E — ADC0 C0;A0
ADC1/2.3F — ADC1 C1;A1
CHRG_ADC2 — ADC2 C2;A2
DISCHRG_ADC3 — ADC3 C3;A3
ADC4/2.5E — ADC4 C4;A4
ADC5/2.5F — ADC5 C5;A5
PV_ADC6 — NC; ADC6 A6
PWR_ADC7 — NC; ADC7 A7
0V/2.1A — NC; GND
NC; NC (**)

PPPC101LFBN
** 2568 ADC8

VIN/2.6E — R40 100k — Q16 DMB — SHLD_VIN — R42 10k — R39 10k — RPUNO IS IO2 NOT IO22 — IO22 — R38 JMP — Q17 K38 — R41 OPEN — 0V

J16

SHLD_VIN
GND
GND
+5V
+3V3
RESET
IOREF
NC
NC

PPPC081LFBN

HW2 DIN MNT — HW1 DIN MNT

ARDUINO UNO R3
PIN-COMPATIBLE

RPU BUS — RPUBUS.ORG — GITHUB.COM/EPCCS

SIZE B

BK black, BN brown, RD red, OG orange, YE yellow, GN green, BU blue, VT violet, GY gray, WH white
Symbols = RD
Names = BU
Values = GY
Label/Info = VT
Busses = Dark BU
Net/Wire = GN
Guide = YE

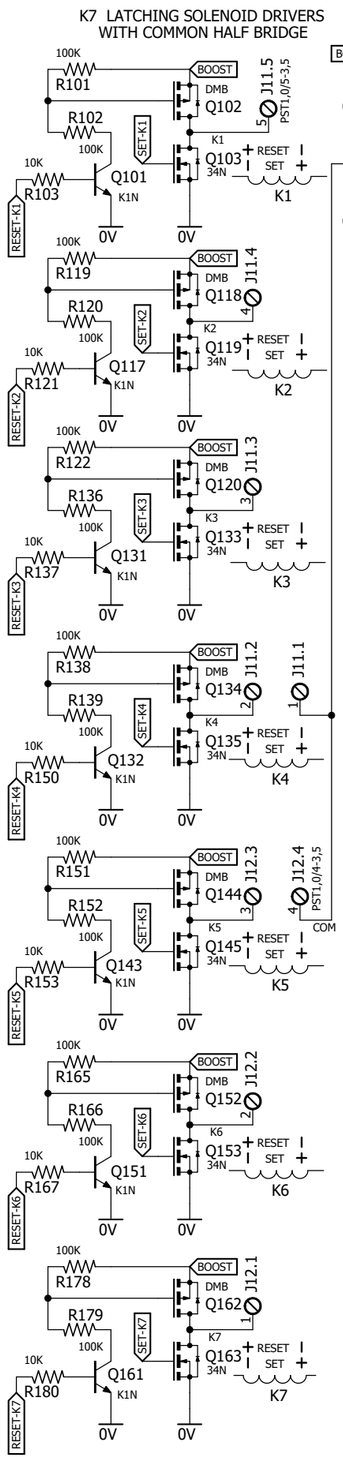
			DATE:	NAME:
Edit		4/22/17	RON S	
Chk				

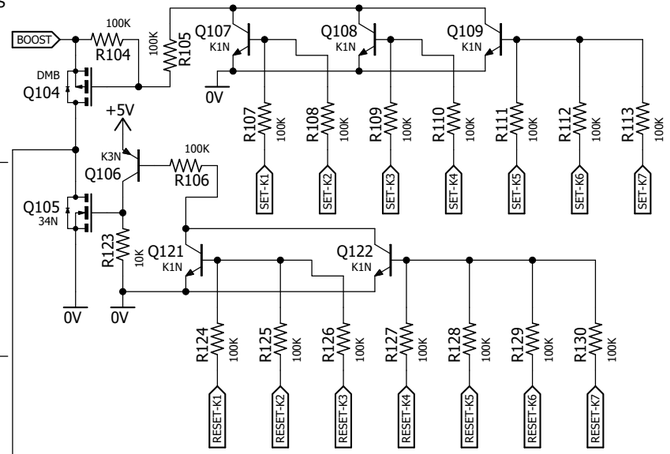
ADDR: 1627 W INVERNESS DR TEMPE AZ 85282
E-MAIL: ronald.sutherland@gmail.com
PHONE: (480) 967-2851

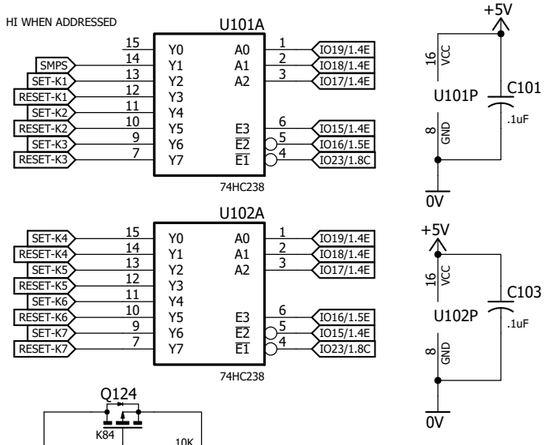
REV			
^2	RM JTAG, RM CL8 HW, ICP1 SAME AS ICP3, 12V SLA	4/22/17	
^1	ADD ^0A, CC01^4, CURRENT LOOPS	3/5/16	
REV	BUGZILLA ISSUE #	JDATE	1/2

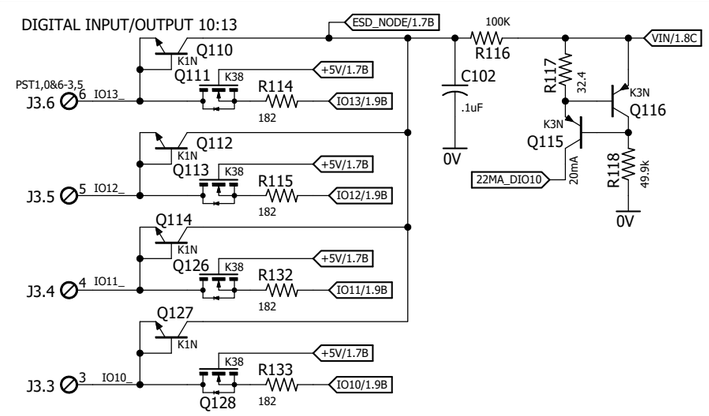
TO:
FROM:

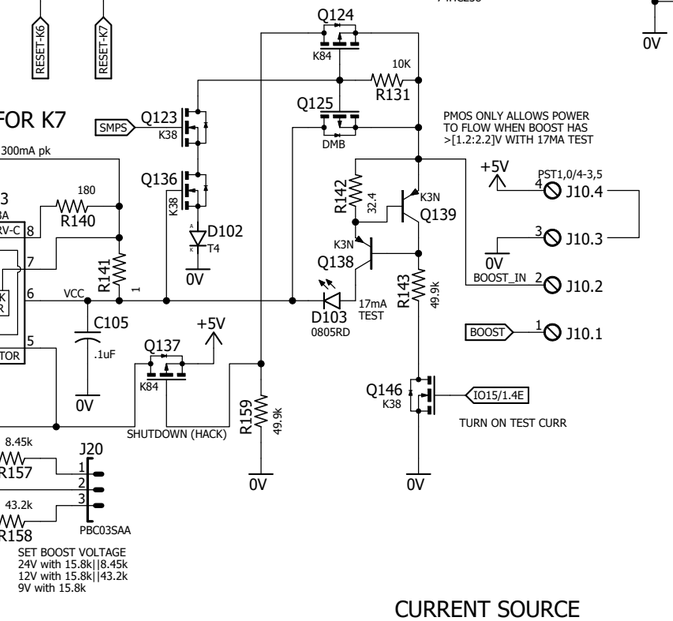
DESCRIPTION: 12V PVCC, 7 K LH, 2 ICP, 4 ADC /W LOOP, 6 D IO
MODEL: IRRIGATE7
DRAWING: 14320
5/6/2017 10:20 PM

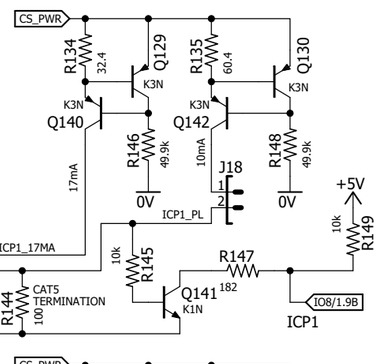


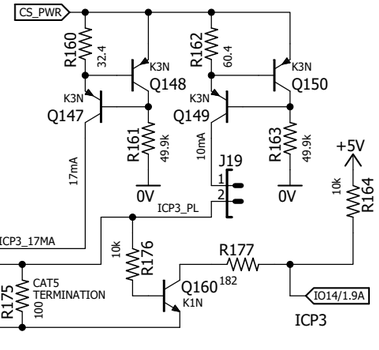


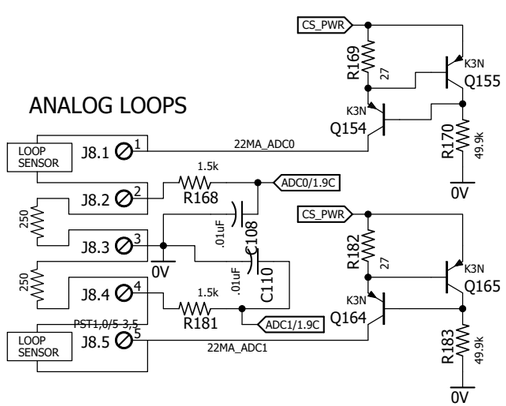


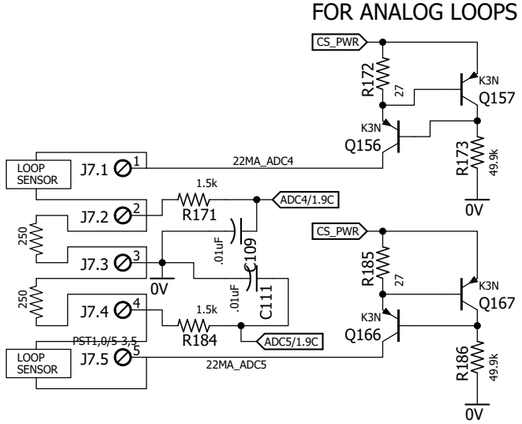


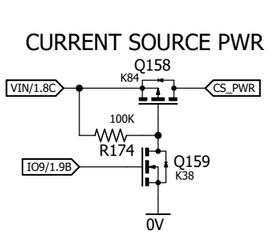












Reference Designators:
B Battery
C Capacitor
D Diode
F Fuse/Breaker
H Hardware & Outline
J Connector/Link
K Relay
L Inductor
M Motor (and Related)
P Power supply
Q Transistor
R Resistor
S Switch
T Transformer
TP Test point
U Integrated circuit/module
Y Crystal or oscillator

RPU BUS
RPUBUS.ORG
GITHUB.COM/EPCCS

SIZE B

BK black	GN green	Symbols = RD
BN brown	BU blue	Names = BU
RD red	VT violet	Values = GY
OG orange	GY gray	Label/Info = VT
YE yellow	WH white	Busses = Dark BU
		Net/Wire = GN
		Guide = YE

ADDR: 1627 W INVERNESS DR
TEMPE AZ 85282
E-MAIL: ronald.sutherland@gmail.com
PHONE: (480) 967-2851

	DATE:	NAME:
Edit	4/22/17	RON S
Chk		

^2	RM JTAG, RM CL8 HW, ICP1 SAME AS ICP3, 12V SLA	4/22/17
^1	ADD ^0A, CC01^4, CURRENT LOOPS	3/5/16
REV	BUGZILLA ISSUE #	JDATE

TO:
FROM:

DESCRIPTION: 12V PVCC, 7 K LH, 2 ICP, 4 ADC /W LOOP, 7 D IO
MODEL: IRRIGATE7
DRAWING: 14320
2/2
5/6/2017 10:20 PM