MAIN

J1
VAC_IN
2
1

Sheet: Power
[24VAC_in]
[AGND]
[+5VDC] → +5V
[+3V3DC] → +3V3
[GND_out]
File: Fuente.sch

[24VAC_main]
[AGND_main]

Sheet: monitor
[AGND_in]   [AGND]
[current_sen_out]
File: monitor.sch

Sheet: Core
[ADC_uC]

[SDA2_uC]
[SCL2_uC]

[RX_uC]
[TX_uC]

[SDA3_uC]
[SCL3_uC]

[SDA1_uC]
[SCL1_uC]

[RED_ALERT_uC]
[YELLOW_ALERT_uC]
[GREEN_ALERT_uC]

[SOUND_ALERT_uC]

File: Core.sch

Sheet: Outputs
[AGND_main]
[24VAC_main]
[24VAC_outputs]
[AGND_outputs]
[SDA_outputs]
[SCL_outputs]
File: Outputs.sch

Sheet: GPS&RTC
[TX_gps]
[RX_gps]
[SDA_rtc]
[SCL_rtc]
File: GPS&RTC.sch

Sheet: Alerts
[AGND_main]
[24VAC_main]
[24VAC_alerts]
[AGND_alerts]
[RED_ALERT_in]
[YELLOW_ALERT_in]
[GREEN_ALERT_in]
[SOUND_ALERT_in]
File: Alerts.sch

Sheet: inputs
[SDA_inputs]
[SCL_inputs]
File: inputs.sch

Sheet: miscleaneous
File: miscleaneous.sch

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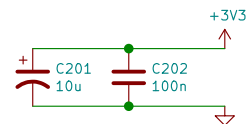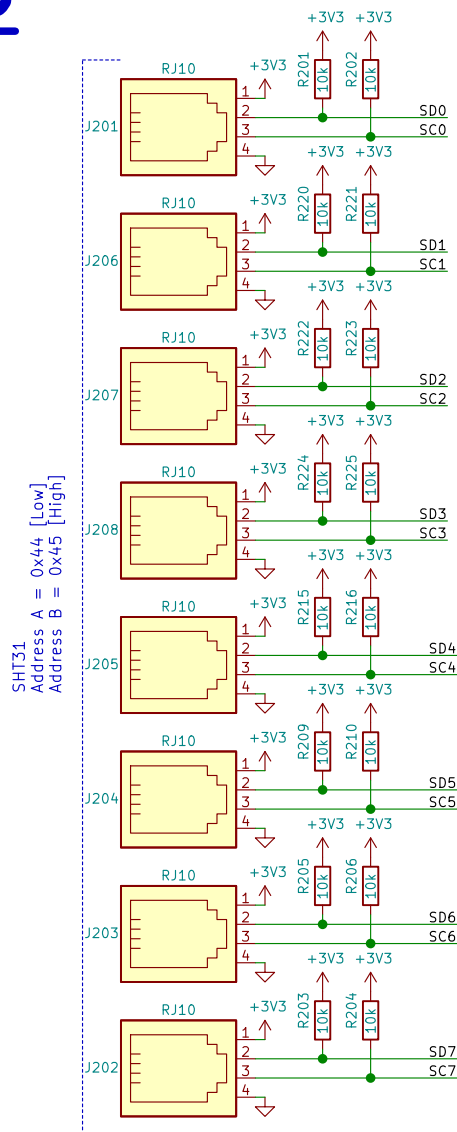Title: Monitoreo de variables de suelo para control fungico en campos de azafran

SMART SAFFRON

Autor: Castro, Franco
         Cussa, Mayco
         Navarro, Facundo
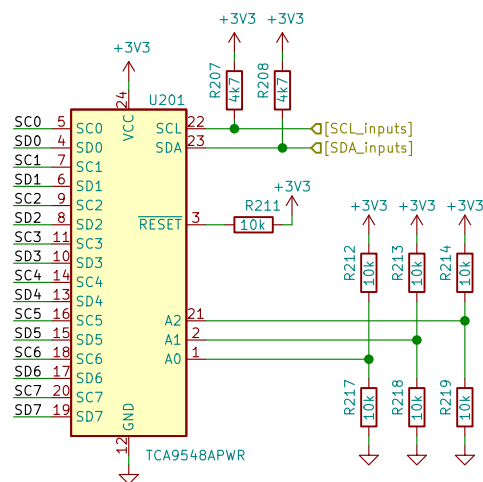   Nobile, Jonathan
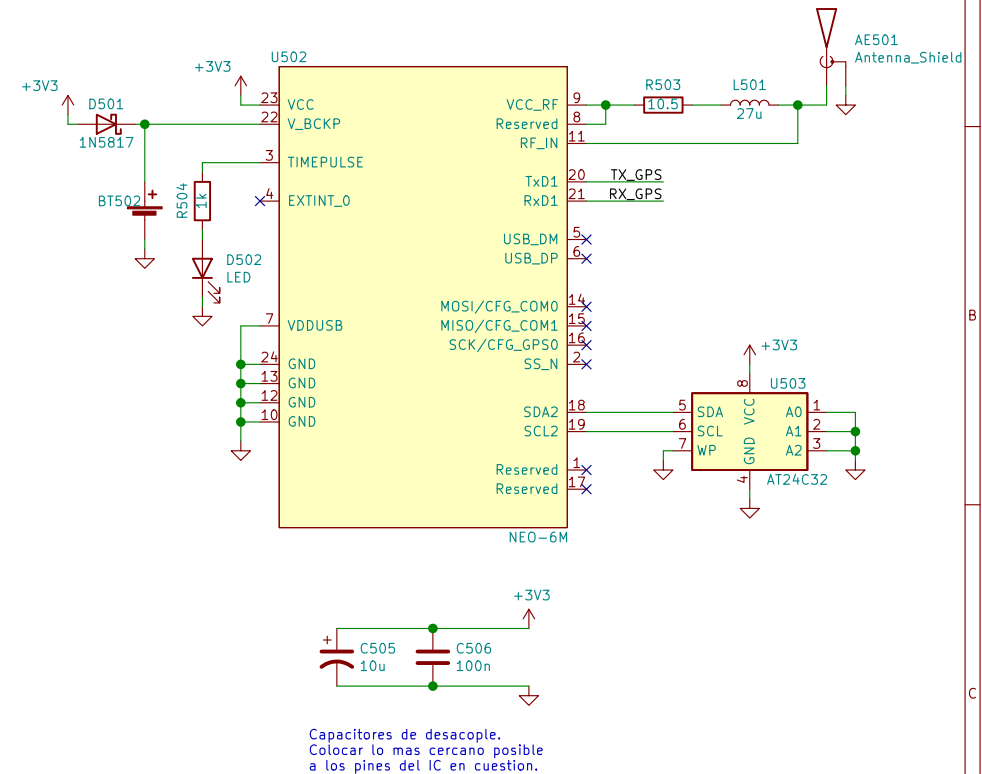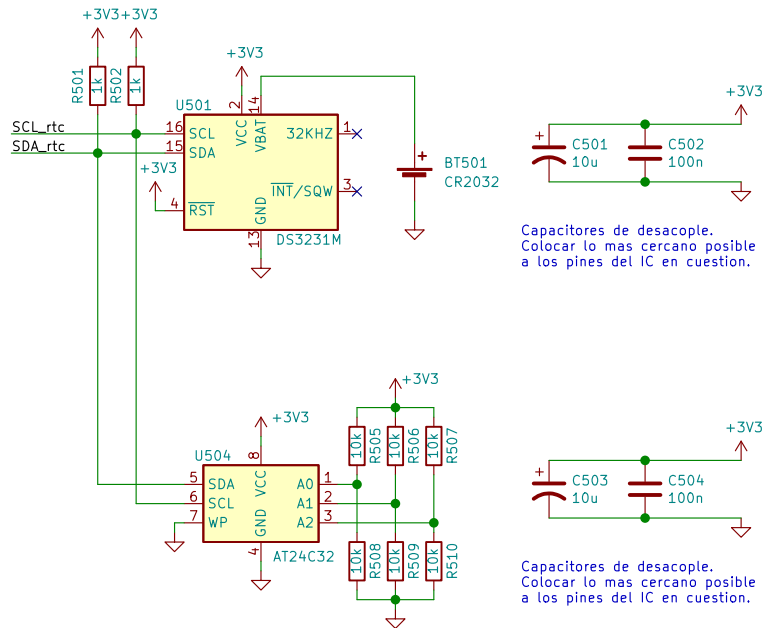
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File: tesis.sch

Size: A4   Date: 2021−10−17   Rev: v1.0
KiCad E.D.A. kicad 5.1.10   Id: 1/9

INPUTS

SHT31
Address A = 0x44 [Low]
Address B = 0x45 [High]

RJ10
J201
1
2 SD0
3 SC0
4
+3V3 R201 10k R202 10k +3V3 +3V3

RJ10
J206
1
2 SD1
3 SC1
4
+3V3 R220 10k R221 10k +3V3 +3V3

RJ10
J207
1
2 SD2
3 SC2
4
+3V3 R222 10k R223 10k +3V3 +3V3

RJ10
J208
1
2 SD3
3 SC3
4
+3V3 R224 10k R225 10k +3V3 +3V3

RJ10
J205
1
2 SD4
3 SC4
4
+3V3 R215 10k R216 10k +3V3 +3V3

RJ10
J204
1
2 SD5
3 SC5
4
+3V3 R209 10k R210 10k +3V3 +3V3

RJ10
J203
1
2 SD6
3 SC6
4
+3V3 R205 10k R206 10k +3V3 +3V3

RJ10
J202
1
2 SD7
3 SC7
4
+3V3 R203 10k R204 10k +3V3 +3V3

C201 10u   C202 100n   +3V3

Capacitores de desacople.
Colocar lo mas cercano posible
a los pines del IC en cuestion.

+3V3   R207 4k7   R208 4k7   +3V3 +3V3

U201
+3V3
24 VCC
SC0 5 SC0   SCL 22 [SCL_inputs]
SD0 4 SD0   SDA 23 [SDA_inputs]
SC1 7 SC1
SD1 6 SD1   RESET 3   R211 10k   +3V3
SC2 9 SC2
SD2 8 SD2
SC3 11 SC3
SD3 10 SD3
SC4 14 SC4
SD4 13 SD4   R212 10k R213 10k R214 10k   +3V3 +3V3 +3V3
SC5 16 SC5   A2 21
SD5 15 SD5   A1
SC6 18 SC6   A0 1
SD6 17 SD6
SC7 20 SC7   R217 10k R218 10k R219 10k
SD7 19 SD7
12 GND
TCA9548APWR

A2	A1	A0	Address
L	L	L	0x70
L	L	H	0x71
L	H	L	0x72
L	H	H	0x73
H	L	L	0x74
H	L	H	0x75
H	H	L	0x76
H	H	H	0x77

OUTPUTS

A2	A1	A0	Address
L	L	L	0x20
L	L	H	0x21
L	H	L	0x22
L	H	H	0x23
H	L	L	0x24
H	L	H	0x25
H	H	L	0x26
H	H	H	0x27

+3V3 +3V3 +3V3

R411 10k
R412 10k
R413 10k

R414 10k
R415 10k
R416 10k

+3V3 +3V3

R409 47
R410 47

SCL
SCA

U403

14	SCL	VDD	16
15	SDA	P0	4	P0
1	A0	P1	5	P1
2	A1	P2	6	P2
3	A2	P3	7	P3
		P4	9	P4
		P5	10	P5
		P6	11	P6
12	INT	P7	12	P7
8	VSS		

+3V3

R441 10k

PCF8574

+3V3

C405 10u   C406 100n

+3V3

Capacitores de desacople.
Colocar lo mas cercano posible
a los pines del IC en cuestion.

OUT_1 1
OUT_2 2
OUT_3 3
OUT_4 4
OUT_5 5
OUT_6 6
OUT_7 7
OUT_8 8

J401
OUTPUT_SW

AGND 1
2

J402
COMMON

+5V P0 Q401 U401 R401 1k OUT_1 R403 470 Q403 mac97a8 C401 100n R405 1k R406 470 MOC3043 24VAC AGND

+5V P1 Q402 U402 R402 1k OUT_2 R404 470 Q404 mac97a8 C402 100n R407 1k R408 470 MOC3043 24VAC AGND

+5V P2 Q405 U404 R417 1k OUT_3 R419 470 Q407 mac97a8 C403 100n R421 1k R422 470 MOC3043 24VAC AGND

+5V P3 Q406 U405 R418 1k OUT_4 R420 470 Q408 mac97a8 C404 100n R423 1k R424 470 MOC3043 24VAC AGND

+5V P7 Q409 U406 R425 1k OUT_5 R427 470 Q411 mac97a8 C407 100n R429 1k R430 470 MOC3043 24VAC AGND

+5V P6 Q410 U407 R426 1k OUT_6 R428 470 Q412 mac97a8 C408 100n R431 1k R432 470 MOC3043 24VAC AGND

+5V P5 Q413 U408 R433 1k OUT_7 R435 470 Q415 mac97a8 C409 100n R437 1k R438 470 MOC3043 24VAC AGND

+5V P4 Q414 U409 R434 1k OUT_8 R436 470 Q416 mac97a8 C410 100n R439 1k R440 470 MOC3043 24VAC AGND

[SCL_outputs] SCL
[SDA_outputs] SCA
[24VAC_outputs] 24VAC
[AGND_outputs] AGND

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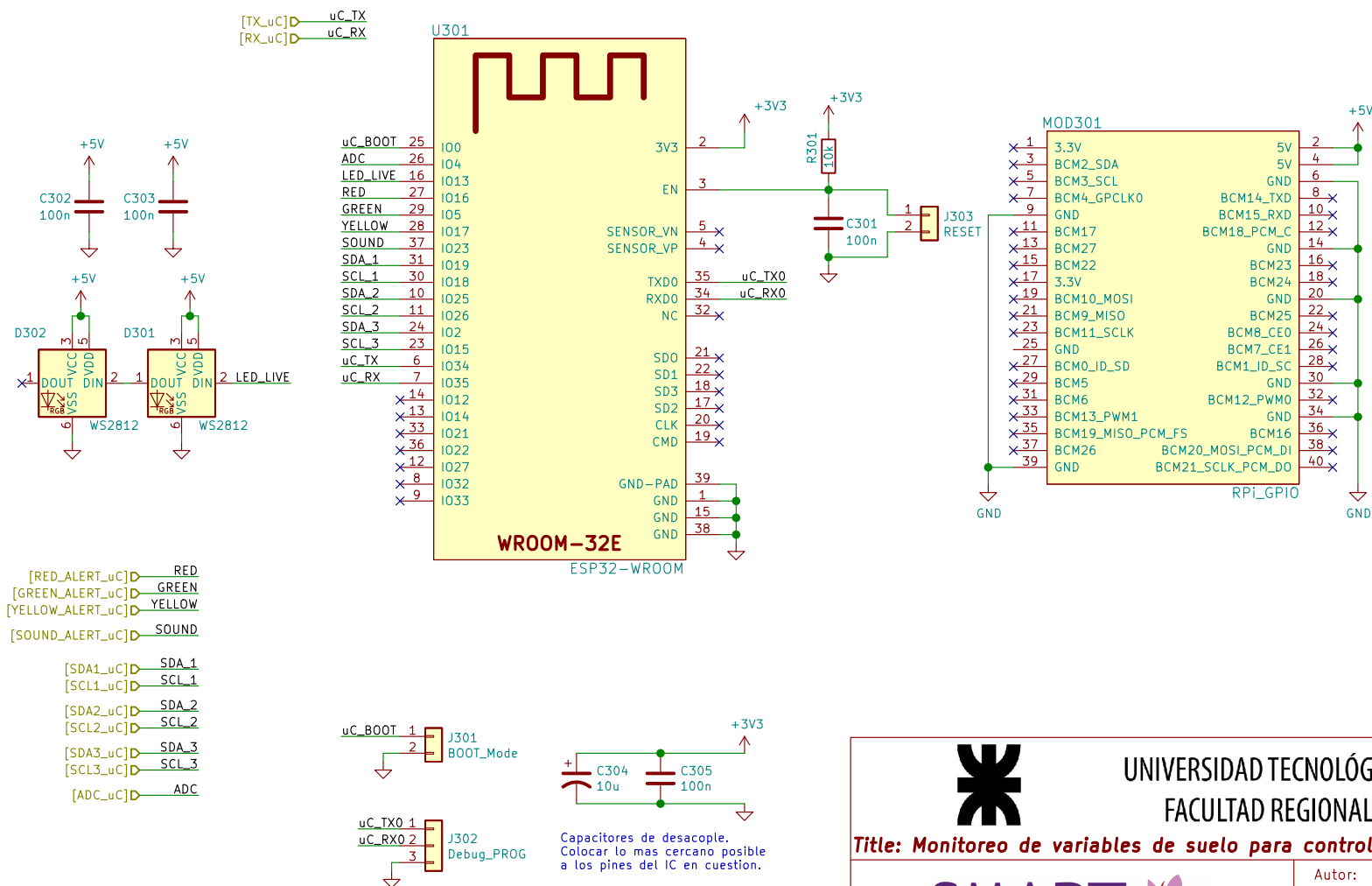Title: Monitoreo de variables de suelo para control fungico en campos de azafran
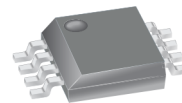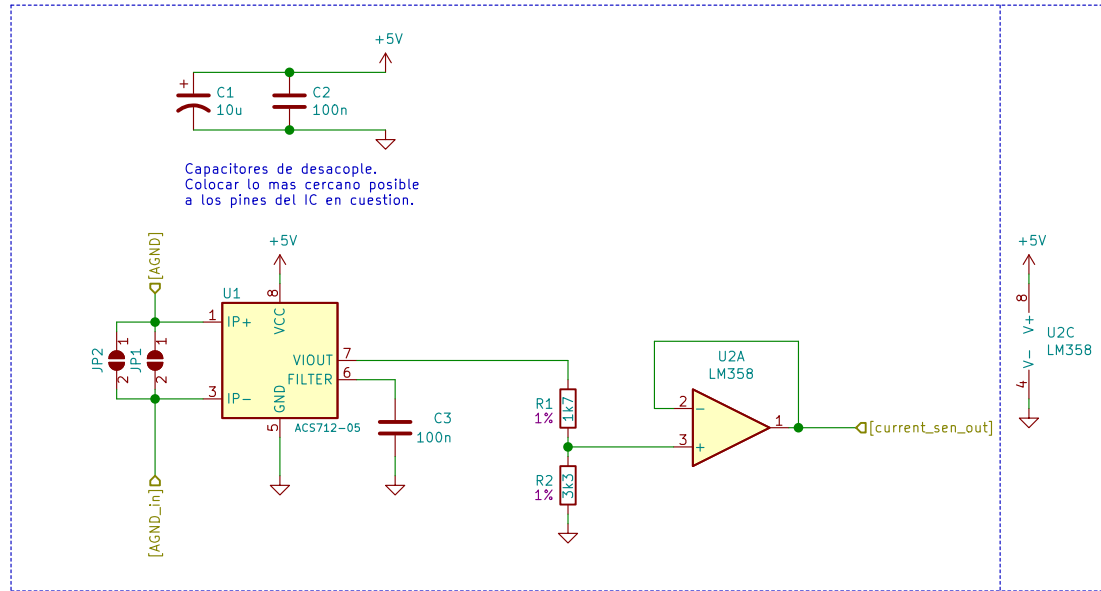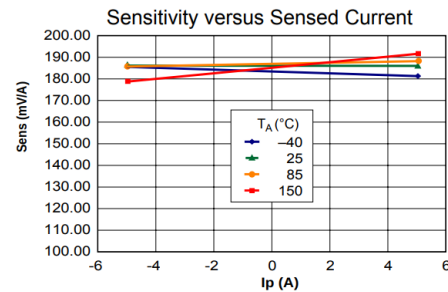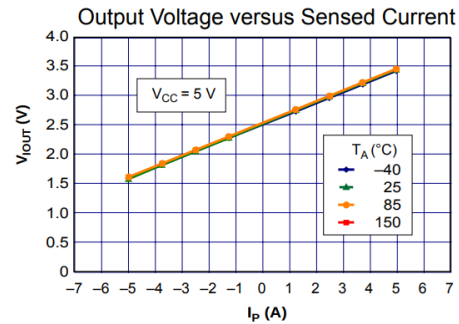
SMART SAFFRON

Autor:
Castro, Franco
Cussa, Mayco
Navarro, Facundo
Nobile, Jonathan

Responsable: Grupo6/21   Sheet: /Outputs/
File: Outputs.sch
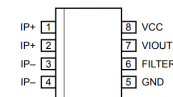
Size: A3   Date: 2021-10-17   Rev: v1.0
KiCad E.D.A. kicad 5.1.10   Id: 3/9

GPS&RTC

U501 DS3231M
- SCL (16)
- SDA (15)
- RST
- VCC (2)
- VBAT (14)
- 32KHZ (1)
- INT/SQW (3)
- GND (13)

SCL_rtc
SDA_rtc

R501 1k
R502 1k

BT501 CR2032

C501 10u
C502 100n

Capacitores de desacople.
Colocar lo mas cercano posible
a los pines del IC en cuestion.

U504 AT24C32
- SDA (5)
- SCL (6)
- WP (7)
- GND (4)
- VCC (8)
- A0 (1)
- A1 (2)
- A2 (3)

R505 10k
R506 10k
R507 10k
R508 10k
R509 10k
R510 10k

C503 10u
C504 100n

Capacitores de desacople.
Colocar lo mas cercano posible
a los pines del IC en cuestion.

U502 NEO-6M
- VCC (23)
- V_BCKP (22)
- TIMEPULSE (3)
- EXTINT_0 (4)
- VDDUSB (7)
- GND (24)
- GND (13)
- GND (12)
- GND (10)
- VCC_RF (9)
- Reserved (8)
- RF_IN (11)
- TxD1 (20)
- RxD1 (21)
- USB_DM (5)
- USB_DP (6)
- MOSI/CFG_COM0 (14)
- MISO/CFG_COM1 (15)
- SCK/CFG_GPS0 (16)
- SS_N (2)
- SDA2 (18)
- SCL2 (19)
- Reserved (1)
- Reserved (17)

D501 1N5817
BT502
R504 1k
D502 LED

R503 10.5
L501 27u
AE501 Antenna_Shield

TX_GPS
RX_GPS

U503 AT24C32
- SDA (5)
- SCL (6)
- WP (7)
- GND (4)
- VCC (8)
- A0 (1)
- A1 (2)
- A2 (3)

C505 10u
C506 100n

Capacitores de desacople.
Colocar lo mas cercano posible
a los pines del IC en cuestion.

[SDA_rtc] SDA_rtc
[SCL_rtc] SCL_rtc

[TX_gps] TX_GPS
[RX_gps] RX_GPS

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SMART SAFFRON

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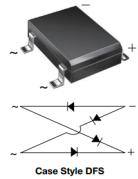
Autor: Castro, Franco
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Nobile, Jonathan

Responsable: Grupo6/21   Sheet: /GPS&RTC/
File: GPS&RTC.sch

Size: A4   Date: 2021-10-17   Rev: v1.0
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CORE

U301

WROOM-32E
ESP32-WROOM

uC_BOOT	25	IO0
ADC	26	IO4
LED_LIVE	16	IO13
RED	27	IO16
GREEN	29	IO5
YELLOW	28	IO17
SOUND	37	IO23
SDA_1	31	IO19
SCL_1	30	IO18
SDA_2	10	IO25
SCL_2	11	IO26
SDA_3	24	IO2
SCL_3	23	IO15
uC_TX	6	IO34
uC_RX	7	IO35

3V3 — 2
EN — 3
SENSOR_VN — 5
SENSOR_VP — 4
TXD0 — 35 — uC_TX0
RXD0 — 34 — uC_RX0
NC — 32
SD0 — 21
SD1 — 22
SD3 — 18
SD2 — 17
CLK — 20
CMD — 19
GND-PAD — 39
GND — 1
GND — 15
GND — 38

[TX_uC] uC_TX
[RX_uC] uC_RX

C302 100n
C303 100n

D302 WS2812
D301 WS2812
LED_LIVE

+5V +5V

R301 10k
+3V3

C301 100n
J303 RESET

MOD301

1	3.3V	5V	2
3	BCM2_SDA	5V	4
5	BCM3_SCL	GND	6
7	BCM4_GPCLK0	BCM14_TXD	8
9	GND	BCM15_RXD	10
11	BCM17	BCM18_PCM_C	12
13	BCM27	GND	14
15	BCM22	BCM23	16
17	3.3V	BCM24	18
19	BCM10_MOSI	GND	20
21	BCM9_MISO	BCM25	22
23	BCM11_SCLK	BCM8_CE0	24
25	GND	BCM7_CE1	26
27	BCM0_ID_SD	BCM1_ID_SC	28
29	BCM5	GND	30
31	BCM6	BCM12_PWM0	32
33	BCM13_PWM1	GND	34
35	BCM19_MISO_PCM_FS	BCM16	36
37	BCM26	BCM20_MOSI_PCM_DI	38
39	GND	BCM21_SCLK_PCM_DO	40

RPi_GPIO

+5V
GND

[RED_ALERT_uC] RED
[GREEN_ALERT_uC] GREEN
[YELLOW_ALERT_uC] YELLOW

[SOUND_ALERT_uC] SOUND

[SDA1_uC] SDA_1
[SCL1_uC] SCL_1

[SDA2_uC] SDA_2
[SCL2_uC] SCL_2

[SDA3_uC] SDA_3
[SCL3_uC] SCL_3

[ADC_uC] ADC

uC_BOOT 1
2
J301 BOOT_Mode

uC_TX0 1
uC_RX0 2
3
J302 Debug_PROG

C304 10u
C305 100n
+3V3

Capacitores de desacople.
Colocar lo mas cercano posible
a los pines del IC en cuestion.

MONITOR

Output Voltage versus Sensed Current

V_{CC} = 5 V

T_A (°C)
- −40
- 25
- 85
- 150

Sensitivity versus Sensed Current

T_A (°C)
- −40
- 25
- 85
- 150

Capacitores de desacople.
Colocar lo mas cercano posible
a los pines del IC en cuestion.

C1 10u
C2 100n
+5V

U1
IP+ 1
IP− 3
VCC 8
VIOUT 7
FILTER 6
GND 5
ACS712−05

JP2
JP1
[AGND]
[AGND_in]

C3 100n

R1 1% 1k
R2 1% 3k3

U2A LM358

U2C LM358
+5V

[current_sen_out]

Package: 8 Lead SOIC

Pin-out Diagram

IP+	1		8	VCC
IP+	2		7	VIOUT
IP−	3		6	FILTER
IP−	4		5	GND

Terminal List Table

Number	Name	Description
1 and 2	IP+	Terminals for current being sensed; fused internally
3 and 4	IP−	Terminals for current being sensed; fused internally
5	GND	Signal ground terminal
6	FILTER	Terminal for external capacitor that sets bandwidth
7	VIOUT	Analog output signal
8	VCC	Device power supply terminal

COMMON OPERATING CHARACTERISTICS[1] over full range of T_A, C_F = 1 nF, and V_{CC} = 5 V, unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
ELECTRICAL CHARACTERISTICS						
Supply Voltage	V_{CC}		4.5	5.0	5.5	V
Supply Current	I_{CC}	V_{CC} = 5.0 V, output open	–	10	13	mA
Output Capacitance Load	C_{LOAD}	VIOUT to GND	–	–	10	nF
Output Resistive Load	R_{LOAD}	VIOUT to GND	4.7	–	–	kΩ
Primary Conductor Resistance	$R_{PRIMARY}$	T_A = 25°C	–	1.2	–	mΩ
Rise Time	t_r	I_P = I_P(max), T_A = 25°C, C_{OUT} = open	–	5	–	μs
Frequency Bandwidth	f	–3 dB, T_A = 25°C; I_P is 10 A peak-to-peak	–	80	–	kHz
Nonlinearity	E_{LIN}	Over full range of I_P	–	1.5	–	%
Symmetry	E_{SYM}	Over full range of I_P	98	100	102	%
Zero Current Output Voltage	$V_{IOUT(Q)}$	Bidirectional; I_P = 0 A, T_A = 25°C	–	V_{CC} × 0.5	–	V
Power-On Time	t_{PO}	Output reaches 90% of steady-state level, T_J =25°C, 20 A present on leadframe	–	35	–	μs
Magnetic Coupling[2]			–	12	–	G/A
Internal Filter Resistance[3]	$R_{F(INT)}$			1.7		kΩ

[1]Device may be operated at higher primary current levels, I_P, and ambient, T_A, and internal leadframe temperatures, T_A, provided that the Maximum Junction Temperature, T_J(max), is not exceeded.
[2]1G = 0.1 mT.
[3]$R_{F(INT)}$ forms an RC circuit via the FILTER pin.

POWER

Rectificacion

[24V_DC]

C101
470u/50V

GND

[24VAC_in]

[AGND]

D101
DF06S

Case Style DFS

DC-DC STEP-DOWN 5V-5A

Funcion de transferencia realimentación
VOUT=0.8*(1+R2/R1)

R101 1k5
R102 0
C102 33u
R103 0

GND

R104 8k2

U101
FB
EN
VIN GND SW
XL4005E1

24V_DC

C104
470u/50V

C105
1u

GND

D102
1N5824

L101
33uH/5A

C103
470uF/50V

R105 2k2

D103

GND

GND [GND_out]

J101
USB_B_Micro

VBUS 1 [+5VDC]
D+ 3
D- 2
ID 4
Shield 6
GND 5

GND

JP101
JP102
[+5VDC]
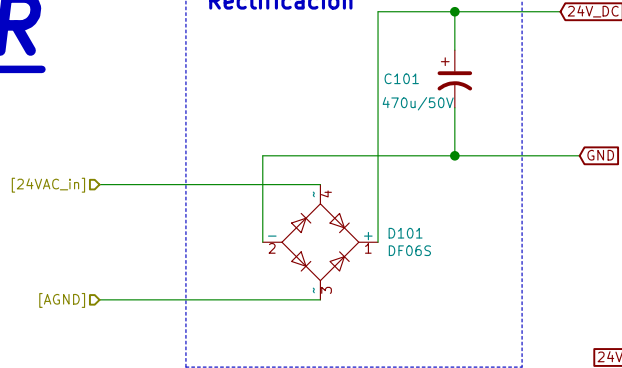
MAXIMUM RATINGS (T_A = 25 °C unless otherwise noted)

PARAMETER	SYMBOL	DF005S	DF01S	DF02S	DF04S	DF06S	DF08S	DF10S	UNIT
Device marking code		DF005S	DF01S	DF02S	DF04S	DF06S	DF08S	DF10S	
Maximum repetitive peak reverse voltage	V_{RRM}	50	100	200	400	600	800	1000	V
Maximum RMS voltage	V_{RMS}	35	70	140	280	420	560	700	V
Maximum DC blocking voltage	V_{DC}	50	100	200	400	600	800	1000	V
Maximum average forward output rectified current at T_A = 40 °C [(1)]	$I_{F(AV)}$	1.0							A
Peak forward surge current single half sine-wave superimposed on rated load	I_{FSM}	50							A
Rating for fusing (t < 8.3 ms)	I^2t	10							A^2s
Operating junction and storage temperature range	T_J, T_{STG}	-55 to +150							°C

DC-DC STEP-DOWN 3V3-5A

Funcion de Transferencia realimentacion
VOUT=0.8*(1+R2/R1)

R106 4k7
R107 0
C106 33u
R108 0

GND

R109 15k

U102
FB
EN
VIN GND SW
XL4005E1

24V_DC

C108
470u/50V

C109
1u

GND

D104
1N5824

L102
33uH/5A

C107
470uF/50V

R110 2k2

D105

GND

JP103
JP104
[+3V3DC]

[GND_out]

Metal Tab SW
TO263-5L

Pin Configuration

GND FB SW EN VIN
1 2 3 4 5
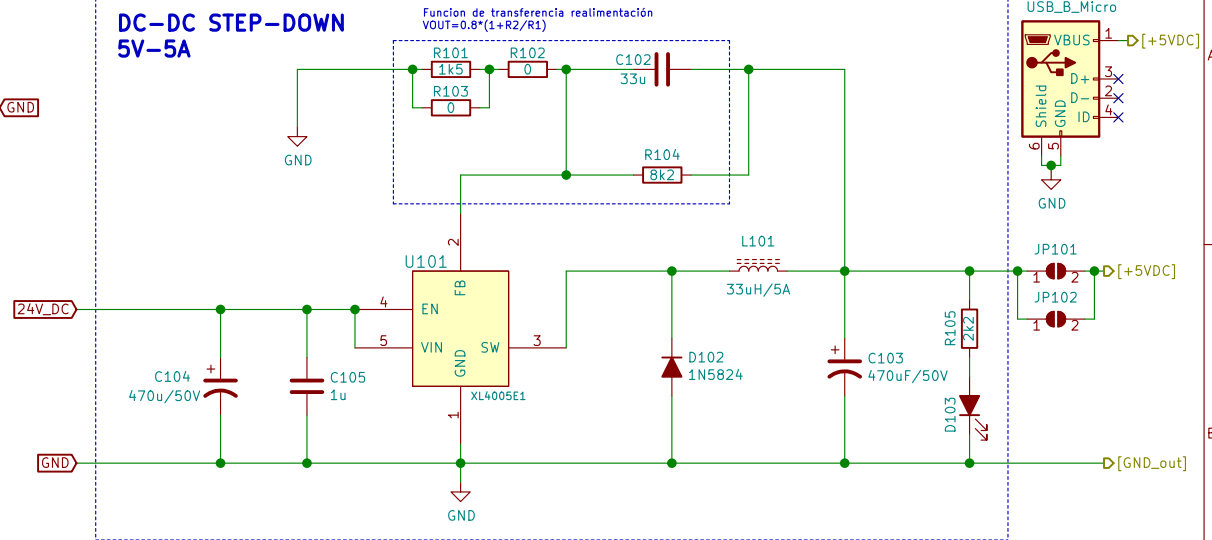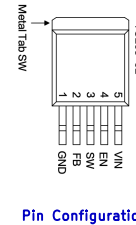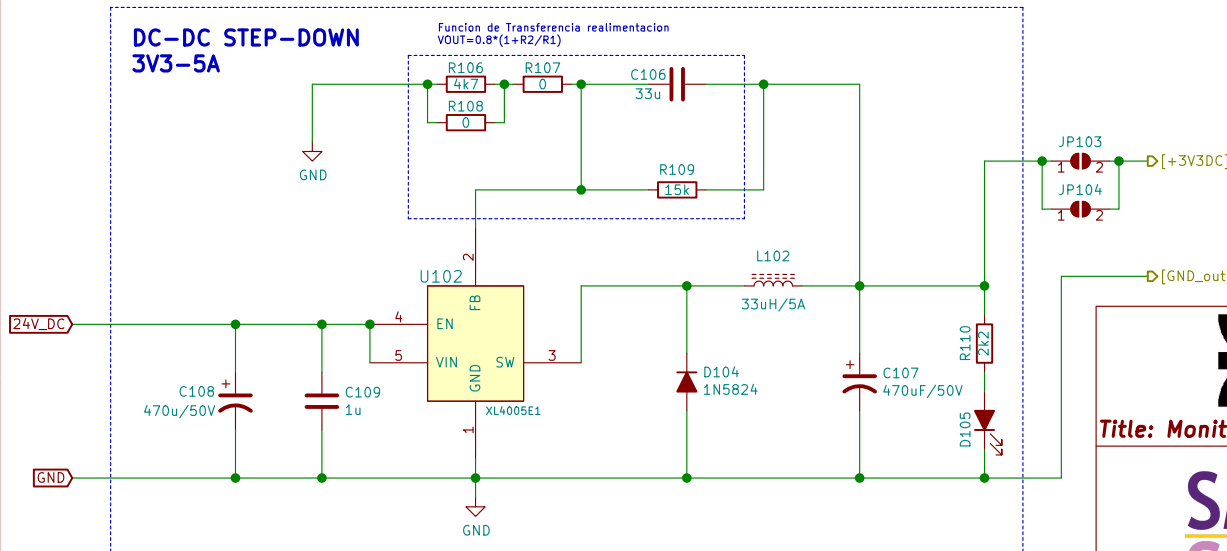
Absolute Maximum Ratings (Note1)

Parameter	Symbol	Value	Unit
Input Voltage	Vin	−0.3 to 35	V
Feedback Pin Voltage	V_{FB}	−0.3 to Vin	V
EN Pin Voltage	V_{EN}	−0.3 to Vin	V
Output Switch Pin Voltage	V_{Output}	−0.3 to Vin	V
Power Dissipation	P_D	Internally limited	mW
Thermal Resistance (TO263) (Junction to Ambient, No Heatsink, Free Air)	R_{JA}	30	°C/W
Operating Junction Temperature	T_J	−40 to 125	°C
Storage Temperature	T_{STG}	−65 to 150	°C
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	260	°C
ESD (HBM)		2000	V

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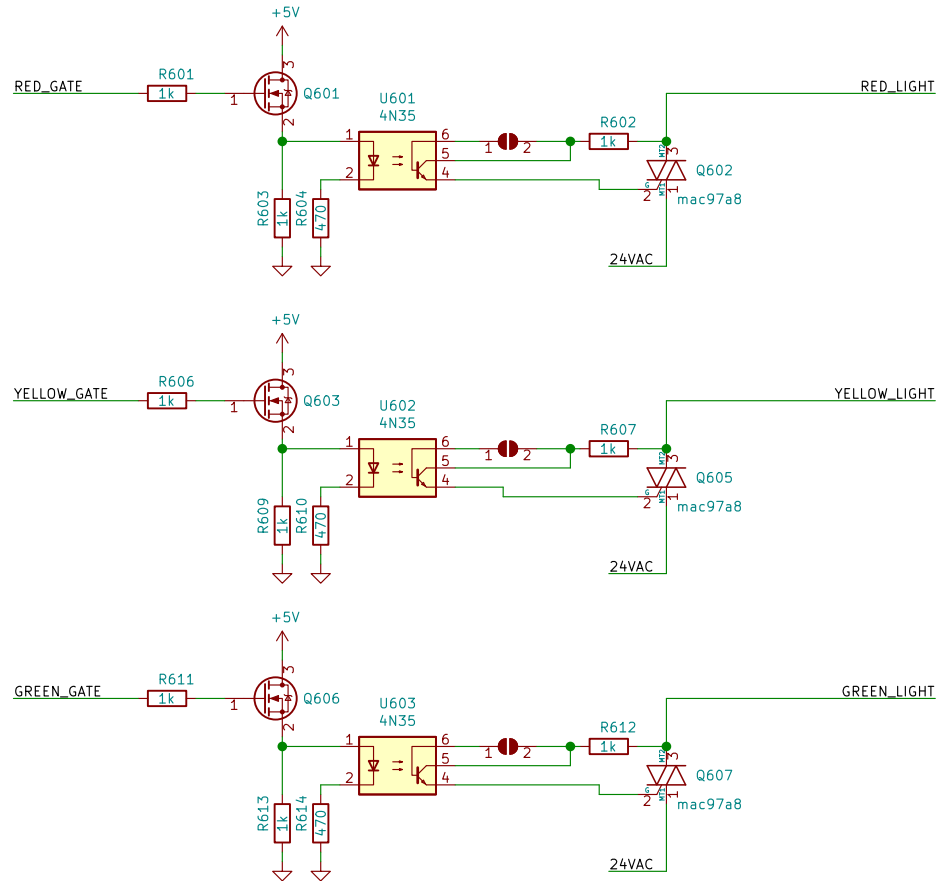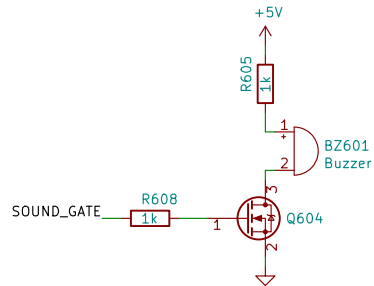## FACULTAD REGIONAL CÓRDOBA

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ALERTS

RED_GATE — R601 1k — Q601 — +5V

R603 1k — R604 470

U601 4N35

R602 1k — Q602 mac97a8 — RED_LIGHT

24VAC

+5V — R605 1k — BZ601 Buzzer

SOUND_GATE — R608 1k — Q604

YELLOW_GATE — R606 1k — Q603 — +5V

R609 1k — R610 470

U602 4N35

R607 1k — Q605 mac97a8 — YELLOW_LIGHT

24VAC

GREEN_GATE — R611 1k — Q606 — +5V

R613 1k — R614 470

U603 4N35

R612 1k — Q607 mac97a8 — GREEN_LIGHT

24VAC

	J602 Lights
RED_LIGHT	1
YELLOW_LIGHT	2
GREEN_LIGHT	3
AGND	4

[RED_ALERT_in] — RED_GATE
[YELLOW_ALERT_in] — YELLOW_GATE
[GREEN_ALERT_in] — GREEN_GATE
[SOUND_ALERT_in] — SOUND_GATE

[24VAC_alerts] — 24VAC
[AGND_alerts] — AGND

MH1
MountingHole

MH2
MountingHole

MH3
MountingHole

MH4
MountingHole

TP1
TestPoint

UNIVERSIDAD TECNOLÓGICA NACIONAL
FACULTAD REGIONAL CÓRDOBA

SMART SAFFRON

Title: Monitoreo de variables de suelo para control fungico en campos de azafran

Autor:
Castro, Franco
Cussa, Mayco
Navarro, Facundo
Nobile, Jonathan

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