01 POWER / 5 V TO 3.3 V

J2 regulated 5 V only. Buck + local reservoirs. Not battery charging.

J2
REGULATED 5V INPUT
BGND
LOGIC_5V_IN

SJ-6P2L-SMD-HF 1.5A
LOGIC_5V_IN
LOGIC_5V_FUSED

U3
AP63203WU-7
IN
EN
SW
BST
FB
GND
BUCK_SW
BUCK_BST
VCC
LOGIC_5V_FUSED

6.8uH SRP5020TA-6R8M
BUCK_SW
VCC

C1 10uF 10V X7R
C6 100nF 10V X7R
C2 100nF 25V X7R
C7 22uF 10V X7R
C8 22uF 10V X7R
C4 100nF 10V
C20 100nF 16V X7R
C21 10uF 16V X7R
C22 100nF 16V X7R

#FLG01 PWR_FLAG
#FLG02 PWR_FLAG
#FLG03 PWR_FLAG
#FLG05 PWR_FLAG

J6
CAM USB 5V OUT
VBUS
D+
D-
GND
SHIELD
LOGIC_5V_FUSED

J6 USB-A: camera 5V POWER OUT, D-/D+/GND, GND and shell to BGND.
USB-A to micro-USB cable powers external ESP32-CAM-MB base. Wi-Fi image transfer requires firmware.
Shared F1 1.5A fuse; camera/base budget 0.5A, total target <=1.1A at 25C; verify at temperature.

02 USB / UART PROGRAMMING

USB is data only; J2 powers the board. Hold BOOT, pulse RESET.

R1 22
R2 47
USB_VBUS_SENSE

J4
USB_C_Receptacle_USB2.0_14P
VBUS
CC1
CC2
D-
D+
SHIELD
GND
USB_VBUS
USB_CC1
USB_CC2
USB_D-
USB_D+

U2
CP2102N-A02-GQFN28
VDD
VIO
RST
VBUS
D-
D+
TXD
RXD
RTS
CTS
DSR
DTR
DCD
RI/CLK
SUSPEND
SUSPEND
TXT/GPIO.0
RXT/GPIO.1
RS485/GPIO.2
WAKEUP/GPIO.3
GPIO.4
GPIO.5
GPIO.6
CHREN
CHR0
CHR1
USB_RESET
USB_VBUS_SENSE
USB_D-
USB_D+
TX
RX

R2 1
USB_RESET

C19 100nF

R2 5.1k
CC1
R2 5.1k
CC2

J7
5V_DONGHANTG

C18 4.7uF
C17 100nF
C16 4.7uF

03 ESP32-S3 / BOOT / RESET

ESP32-S3-WROOM-1-N16R8. Module RF keepout on every copper layer.

D4 SS34
VCC
MCU_3V3

C9 10uF
C10 100nF
C23 22uF 10V X7R
R15 10k

U4
ESP32-S3-WROOM-1-N16R8
3V3
GND
EN
BOOT
SCL
CTL
BUZZER_DRIVE
LED_R
LED_G
LED_B
SDA
TXD0
RXD0
IO17
IO18
USB_D-
USB_D+
IO21
IO35
IO36
IO37
IO38
IO39
IO40
IO41
IO42
IO45
IO46
IO47
IO48
TX
RX

C11 1uF
SW3
RESET
R16 10k
SW2
BOOT

04 CT / ADC ANALOG FRONT END

AC current transformer only. Differential AIN0–AIN1, address 0x48.

J1
SCT-013-000 ONLY
CT_BIAS
CT_HI

R23 18 ohm 1% 0.25W
CT_BIAS

U1
ADS1115IDGS
ADDR
ALERT/RDY
AIN0
AIN1
AIN2
AIN3
GND
VDD
SCL
SDA
ADC_AIN0
ADC_AIN1
BGND
ADC_3V3
SCL
SDA

#FLG04 PWR_FLAG
ADC_3V3

1k 0.1%
CT_HI
ADC_AIN0
1k 0.1%
CT_BIAS
ADC_AIN1

C5 220nF
ADC_AIN0

R3 10k 1%
CT_HI
R4 10k 1%
CT_BIAS

D9
BAT54S
D10
BAT54S
ADC_3V3

C12 1uF
100R 1%
VCC
ADC_3V3
C13 10uF
C14 100nF 10V X7R

05 RELAY / TEST LOAD

Normally-open dry contact loop. 5–24 V DC / 1 A resistive bench target.

K1
SRD-05VDC-SL-C
LOGIC_5V_FUSED
LOAD_IN
RELAY_COM
RELAY_NO

100R
CTL
RELAY_GATE

Q1
AO3400A
RELAY_GATE
RELAY_LOW

J5
TEST_LOAD
LOAD_IN
LOAD_OUT

R21 10k
R22 10k
RELAY_GATE

D1
W7 (1N4007 SMD)
LOGIC_5V_FUSED
RELAY_LOW

C15 100nF 10V X7R
C20 100nF 10V X7R
C2 100nF 10V

06 INDICATORS / EXTERNAL I2C

3.3 V logic only. Buzzer part selection and bench measurements pending.

J3
THERMAL_I2C
SDA
SCL
BGND
MCU_3V3

R7 4.7k
SCL
R8 4.7k
SDA

D6
WS2812B-2020V1
LED_R_A
LED_G_A
LED_B_A
BGND

330Ω
VCC
USB_LED_A

BZ1
Buzzer (3V3 type TBD)
MCU_3V3
BUZZER_LOW

330Ω
LED_R
LED_R_A
330Ω
LED_G
LED_G_A
330Ω
LED_B
LED_B_A

100R
BUZZ_R_DRIVE
Net-(Q2-G)
R 330Ω
Net-(D5-A)
R9 1k
ADC_LED_A

Q2
AO3400A
BUZZER_LOW
Net-(Q2-G)

D2
ADC POWER
BGND
ADC_LED_A

R24 100k
GND

D5
POWER
BGND
Net-(D5-A)

D8
USB BRIDGE POWER
BGND
USB_LED_A

MECHANICAL + MEASUREMENT POINTS

H1 M3 mounting
H2 M3 mounting
H3 M3 mounting
H4 M3 mounting
TP1 LOGIC_5V_FUSED
TP2 VCC
TP3 MCU_3V3
TP4 ADC_3V3
TP5 BGND

COMPACT BENCH PROTOTYPE — NO MAINS — hardware validation required

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Title: SmartDB v2 — low-voltage bench revision

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