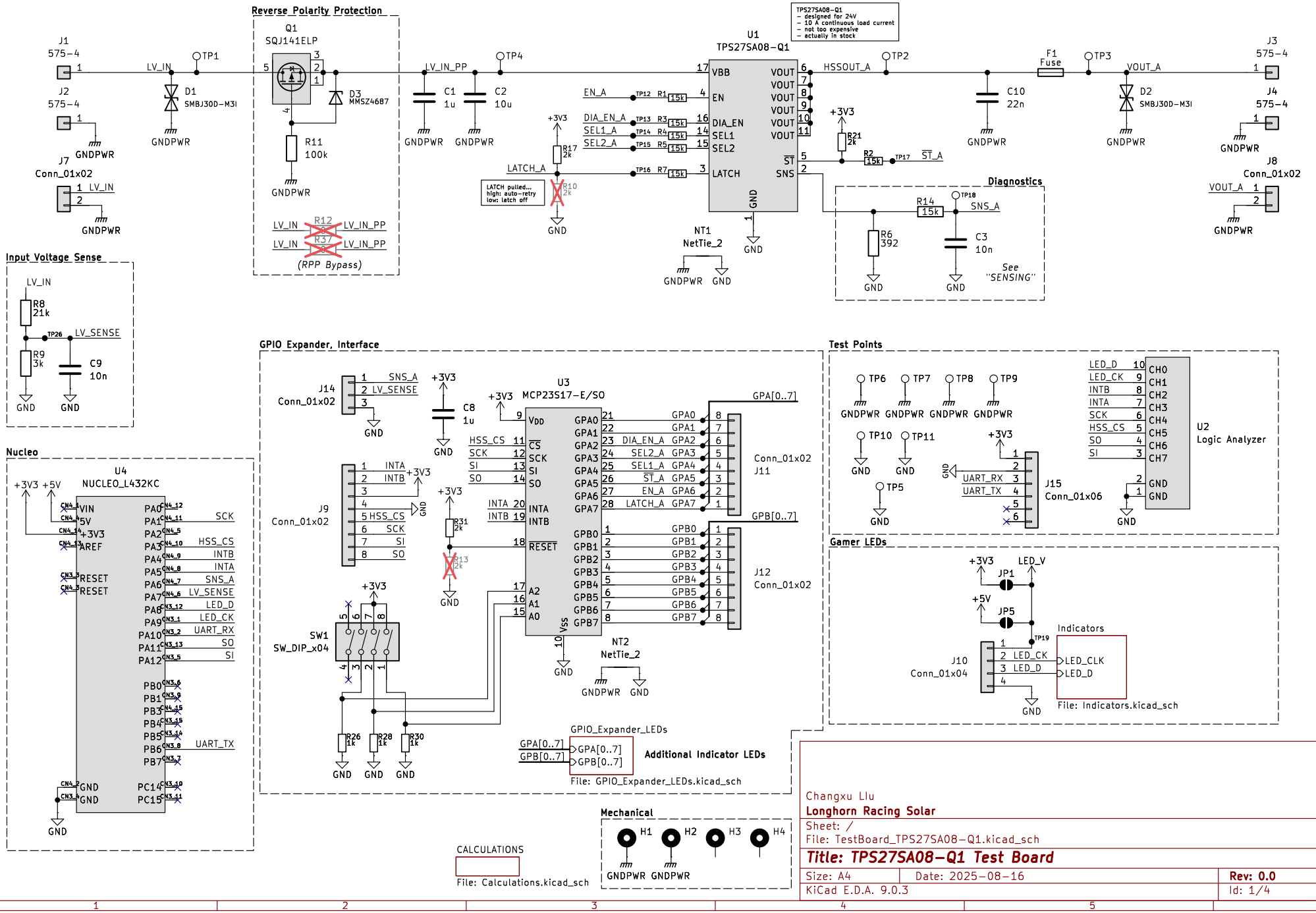
Reverse Polarity Protection
Q1
SQJ141ELP
D1
SMBJ30D-M3I
D3
MMSZ4687
R11
100k
LV_IN
LV_IN_PP
R12
R37
(RPP Bypass)
J1
575-4
J2
575-4
J7
Conn_01x02
GNDPWR
TP1
TP4
C1
1u
C2
10u
U1
TPS27SA08-Q1
TPS27SA08-Q1
- designed for 24V
- 10 A continuous load current
- not too expensive
- actually in stock
VBB
EN
DIA_EN
SEL1
SEL2
LATCH
VOUT
ST
SNS
GND
EN_A
DIA_EN_A
SEL1_A
SEL2_A
LATCH_A
R13 15k
R14 15k
R15 15k
R16 15k
R17 2k
R10 2k
LATCH pulled...
high: auto-retry
low: latch off
NT1
NetTie_2
HSSOUT_A
TP2
F1
Fuse
TP3
VOUT_A
C10
22n
D2
SMBJ30D-M3I
J3
575-4
J4
575-4
J8
Conn_01x02
R21
2k
R2
15k
ST_A
Diagnostics
R14
15k
SNS_A
R6
392
C3
10n
See
"SENSING"
Input Voltage Sense
R8
21k
R9
3k
C9
10n
LV_SENSE
Nucleo
U4
NUCLEO_L432KC
+3V3
+5V
GND
SCK
HSS_CS
INTB
INTA
SNS_A
LV_SENSE
LED_D
LED_CK
UART_RX
SO
SI
UART_TX
RESET
GPIO Expander, Interface
U3
MCP23S17-E/SO
J14
Conn_01x02
SNS_A
LV_SENSE
C8
1u
J9
Conn_01x02
INTA
INTB
HSS_CS
SCK
SI
SO
R31
2k
R13
2k
SW1
SW_DIP_x04
R26
1k
R28
1k
R30
1k
GPA0
GPA1
GPA2
GPA3
GPA4
GPA5
GPA6
GPA7
GPB0
GPB1
GPB2
GPB3
GPB4
GPB5
GPB6
GPB7
DIA_EN_A
SEL2_A
SEL1_A
ST_A
EN_A
LATCH_A
GPA[0..7]
GPB[0..7]
Conn_01x02
J11
J12
NT2
NetTie_2
GPIO_Expander_LEDs
Additional Indicator LEDs
File: GPIO_Expander_LEDs.kicad_sch
Test Points
TP6
TP7
TP8
TP9
TP10
TP11
TP5
U2
Logic Analyzer
LED_D
LED_CK
INTB
INTA
SCK
HSS_CS
SO
SI
CH0
CH1
CH2
CH3
CH4
CH5
CH6
CH7
J15
Conn_01x06
UART_RX
UART_TX
Gamer LEDs
JP1
JP5
LED_V
J10
Conn_01x04
Indicators
LED_CLK
LED_D
File: Indicators.kicad_sch
Mechanical
H1
H2
H3
H4
CALCULATIONS
File: Calculations.kicad_sch
Changxu Liu
Longhorn Racing Solar
Sheet: /
File: TestBoard_TPS27SA08-Q1.kicad_sch
Title: TPS27SA08-Q1 Test Board
Size: A4
Date: 2025-08-16
Rev: 0.0
KiCad E.D.A. 9.0.3
Id: 1/4

## SENSING

| SEL1 | SEL2 | Output | Conversion |
|---|---|---|---|
| 0 | 0 | Load Current | $I_{SNSI} = I_{OUT} / K_{SNS}$ $K_{SNS} = 4600$ |
| 0 | 1 | Not Used | rgb(124, 124, 124) |
| 1 | 0 | Device Temperature | $I_{SNST} = (T_J - 25\ [°C]) * dI_{SNST}/dT + 0.85$<br>$dI_{SNST}/dT = 0.0112\ [mA/°C]$ |
| 1 | 1 | Supply Voltage | $I_{SNSV} = (V_{BB}) * dI_{SNSV}/dV$ $K_{SNSV} = 0.0867$ |

[FOR VERSION A ONLY]
> For current sensing I range 0 – 30 A, $I_{SNSI}$ current range is 0 – 6.522 mA.
  (from datasheet, worst-case current limit range is 12.8 – 27.8 A (nominally 20 A))
> For thermal sensing range −40 – 150 °C, $I_{SNST}$ current range is 0 – 2.25 mA.
  (values obtained from datasheet table, operating temp range is −40 – 125 °C)
> For voltage sensing range 0 – 40 V, $I_{SNSV}$ current range is 0 – 3.468 mA.
  (values obtained from datasheet table, operating voltage range is 8 – 36 V, with max long transient 40 V)

When the device is faulted, SNS will output $I_{SNSFH}$ (6.9 mA nom, 7.6 mA max) and the $\overline{ST}$ pin will be pulled low.

As the ADC full-scale voltage is 3.3 V, target a SNS voltage range of 0 – 3 V (to provide some buffer).
Resistor value is selected to be $R_{SNS}$ = 392 Ω (ideally 394.737 Ω), then...
Fault range: 0 – 2.9792 V
Current sensing range: 0 – 2.568 V
Thermal sensing range: 0 – 0.882 V (consider using PGA)
Voltage sensing range: 0 – 1.359 V (consider using PGA)

Preferably a 1% tolerance resistor. (Maximum voltage with worst-case resistor 3.009 V)
Consider measuring each resistor and populating its precise value in code to maximize sensing accuracy.

When EN is low and DIA_EN is high, the device will perform open-load detection and ouput $I_{SNSFH}$ if detected.

It is recommended for the software to take multiple samples and use a median.

Sheet: /CALCULATIONS/
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**Title:**

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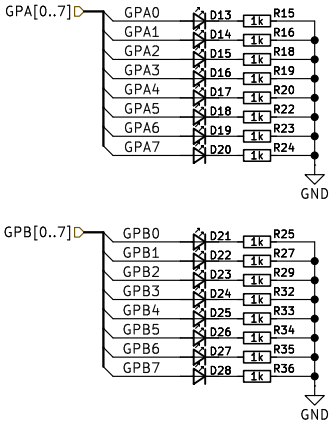


Sheet: /GPIO_Expander_LEDs/
File: GPIO_Expander_LEDs.kicad_sch

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| Size: A4 | Date: | **Rev:** |
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| KiCad E.D.A. 9.0.3 | | Id: 4/4 |

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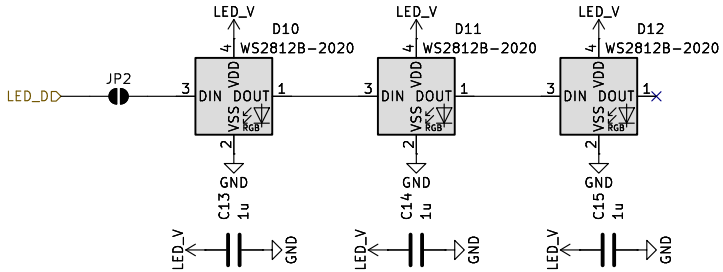


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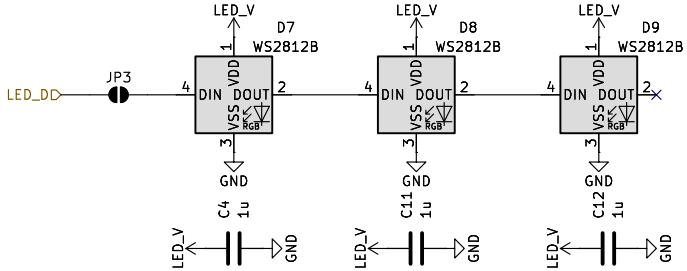


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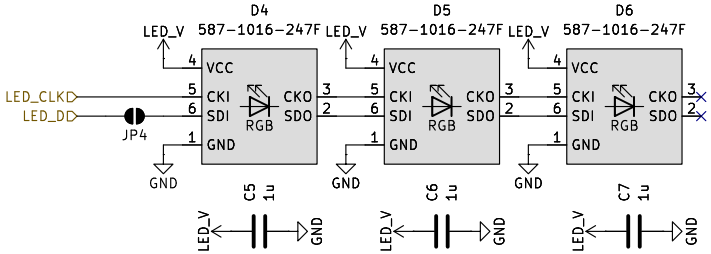


| | |
|---|---|
| Sheet: /Indicators/ | |
| File: Indicators.kicad_sch | |
| **Title:** | |
| Size: A4 | Date: |
| KiCad E.D.A. 9.0.3 | Id: 3/4 |
| | **Rev:** |