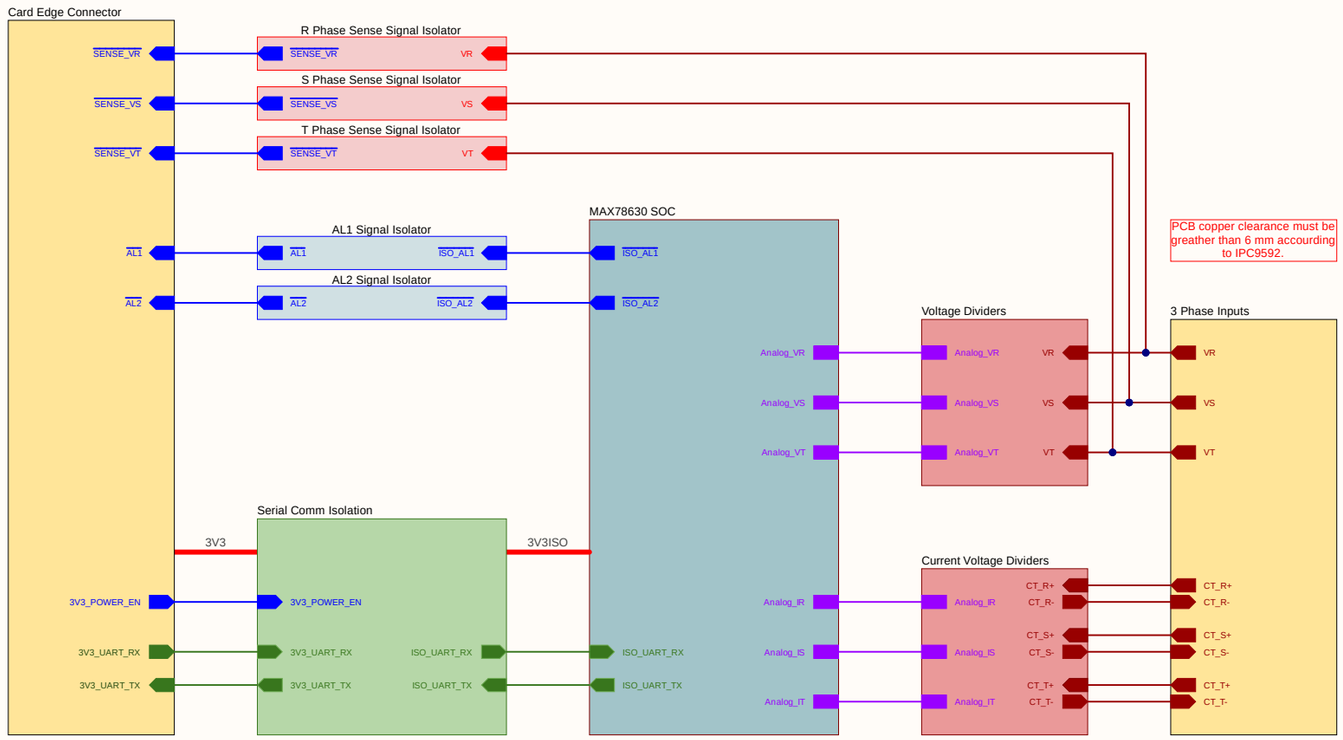
Property of -

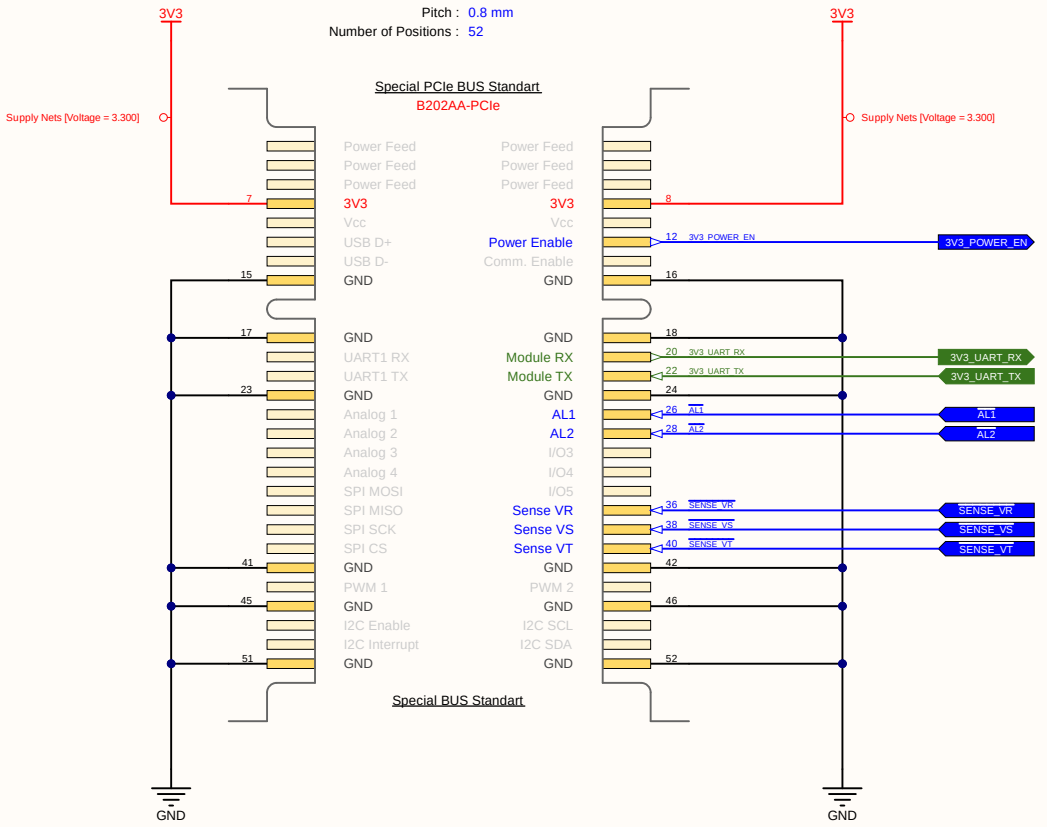



www.github.com/akkoyun/B202AA-PCIe

| | | | |
|---|---|---|---|
| B202AA Block Diagram | | Engineer : Gunce Akkoyun | - |
| | | Customer : - | |
| Size : A4 | Project : PollyPhase Energy Analyzer | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB |
| | | Module ID : B202AA-PCIe | 103. Cad. No : 12 |
| Date : 6.11.2025 | Time : 14:20:48 Page : 1 / 12 | Version : R1 | Selcuklu / Konya Türkiye |
| File : Block Diagram.SchDoc | | Revision : 00.00.01 | |

J1

Bus Type : Mini PCI Express
Mating Connector : TE 2041262-1
Pitch : 0.8 mm
Number of Positions : 52




www.github.com/akkoyun/B202AA-PCIe

| | | | |
|---|---|---|---|
| Card Edge Connector | | Engineer : Gunce Akkoyun | - |
| | | Customer : - | |
| Size : A4 | Project : PollyPhase Energy Analyzer | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB |
| | | Module ID : B202AA-PCIe | 103. Cad. No : 12 |
| Date : 6.11.2025 | Time : 14:20:48 Page : 2 / 12 | Version : R1 | Selcuklu / Konya Türkiye |
| File : Card Edge Connecgtor.SchDoc | | Revision : 00.00.01 | |

Nominal: 230 Vac (phase–neutral)
Worst-case: 400 Vac (phase–phase)

Total resistance: 720 kΩ (4 × 180 kΩ / 0.5 W – 0805)

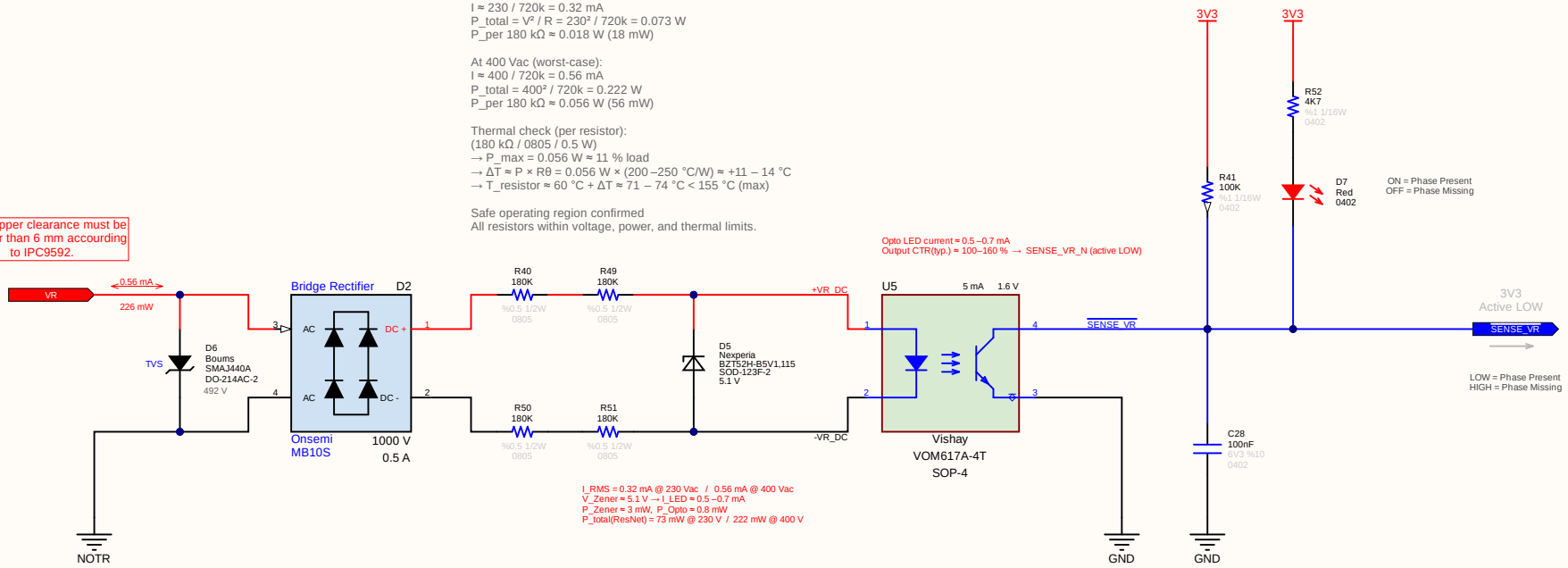
At 230 Vac:
I ≈ 230 / 720k = 0.32 mA
P_total = V² / R = 230² / 720k = 0.073 W
P_per 180 kΩ ≈ 0.018 W (18 mW)

At 400 Vac (worst-case):
I ≈ 400 / 720k = 0.56 mA
P_total = 400² / 720k = 0.222 W
P_per 180 kΩ ≈ 0.056 W (56 mW)

Thermal check (per resistor):
(180 kΩ / 0805 / 0.5 W)
→ P_max = 0.056 W ≈ 11 % load
→ ΔT ≈ P × Rθ = 0.056 W × (200–250 °C/W) ≈ +11 – 14 °C
→ T_resistor ≈ 60 °C + ΔT ≈ 71 – 74 °C < 155 °C (max)

Safe operating region confirmed
All resistors within voltage, power, and thermal limits.

PCB copper clearance must be greather than 6 mm accourding to IPC9592.




www.github.com/akkoyun/B202AA-PCIe

| | | | | | |
|---|---|---|---|---|---|
| R Phase Sense Signal Isolation | | | Engineer : Gunce Akkoyun | - | |
| | | | Customer : - | | |
| Size : A4 | Project : PollyPhase Energy Analyzer | | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB | stf |
| | | | Module ID : B202AA-PCIe | 103. Cad. No : 12 | |
| Date : 6.11.2025 | Time : 14:20:48 | Page : 3 / 12 | Version : R1 | Selcuklu / Konya Türkiye | |
| File : R Phase Sense Signal Isolation.SchDoc | | | Revision : 00.00.01 | | |

Nominal: 230 Vac (phase–neutral)
Worst-case: 400 Vac (phase–phase)

Total resistance: 720 kΩ (4 × 180 kΩ / 0.5 W – 0805)

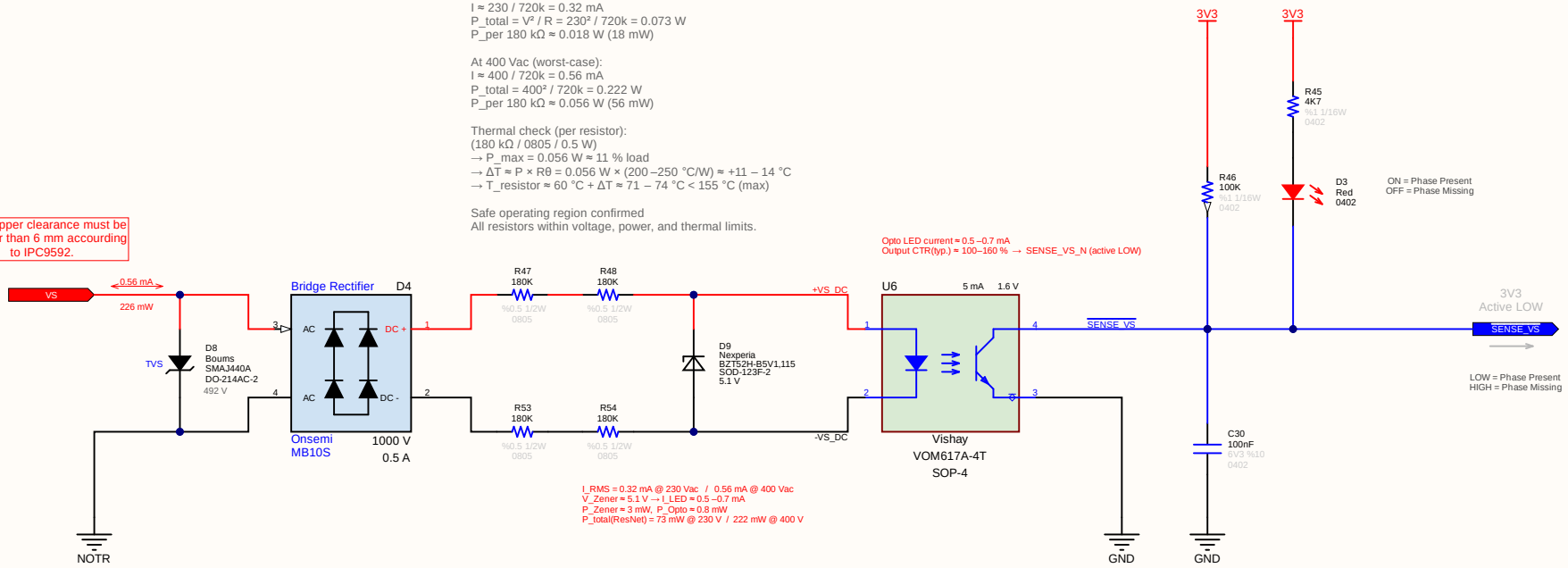
At 230 Vac:
I ≈ 230 / 720k = 0.32 mA
P_total = V² / R = 230² / 720k = 0.073 W
P_per 180 kΩ ≈ 0.018 W (18 mW)

At 400 Vac (worst-case):
I ≈ 400 / 720k = 0.56 mA
P_total = 400² / 720k = 0.222 W
P_per 180 kΩ ≈ 0.056 W (56 mW)

Thermal check (per resistor):
(180 kΩ / 0805 / 0.5 W)
→ P_max = 0.056 W ≈ 11 % load
→ ΔT ≈ P × Rθ = 0.056 W × (200–250 °C/W) ≈ +11 – 14 °C
→ T_resistor ≈ 60 °C + ΔT ≈ 71 – 74 °C < 155 °C (max)

Safe operating region confirmed
All resistors within voltage, power, and thermal limits.

PCB copper clearance must be greather than 6 mm accourding to IPC9592.




www.github.com/akkoyun/B202AA-PCIe

| | | | | | |
|---|---|---|---|---|---|
| S Phase Sense Signal Isolation | | | Engineer : Gunce Akkoyun | - | |
| | | | Customer : - | | |
| Size : A4 | Project : PollyPhase Energy Analyzer | | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB | stf |
| | | | Module ID : B202AA-PCIe | 103. Cad. No : 12 | |
| Date : 6.11.2025 | Time : 14:20:48 | Page : 4 / 12 | Version : R1 | Selcuklu / Konya Türkiye | |
| File : S Phase Sense Signal Isolation.SchDoc | | | Revision : 00.00.01 | | |

Nominal: 230 Vac (phase–neutral)
Worst-case: 400 Vac (phase–phase)

Total resistance: 720 kΩ (4 × 180 kΩ / 0.5 W – 0805)

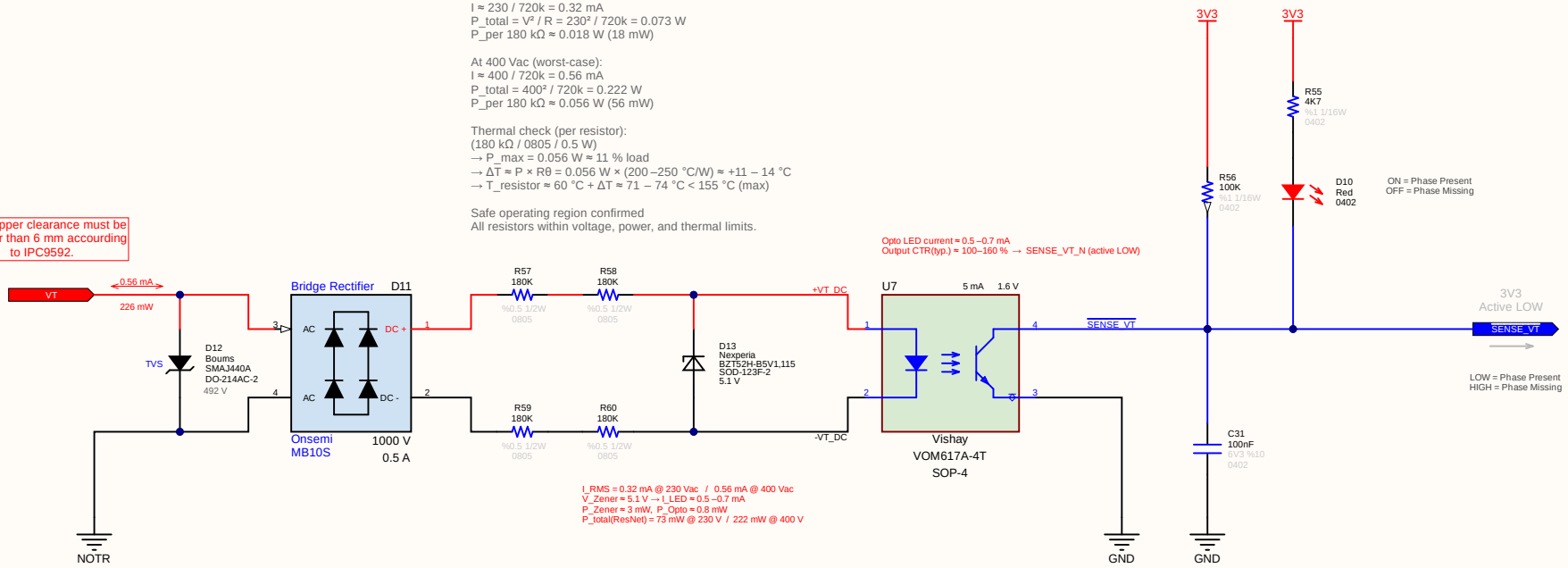
At 230 Vac:
I ≈ 230 / 720k = 0.32 mA
P_total = V² / R = 230² / 720k = 0.073 W
P_per 180 kΩ ≈ 0.018 W (18 mW)

At 400 Vac (worst-case):
I ≈ 400 / 720k = 0.56 mA
P_total = 400² / 720k = 0.222 W
P_per 180 kΩ ≈ 0.056 W (56 mW)

Thermal check (per resistor):
(180 kΩ / 0805 / 0.5 W)
→ P_max = 0.056 W ≈ 11 % load
→ ΔT ≈ P × Rθ = 0.056 W × (200–250 °C/W) ≈ +11 – 14 °C
→ T_resistor ≈ 60 °C + ΔT ≈ 71 – 74 °C < 155 °C (max)

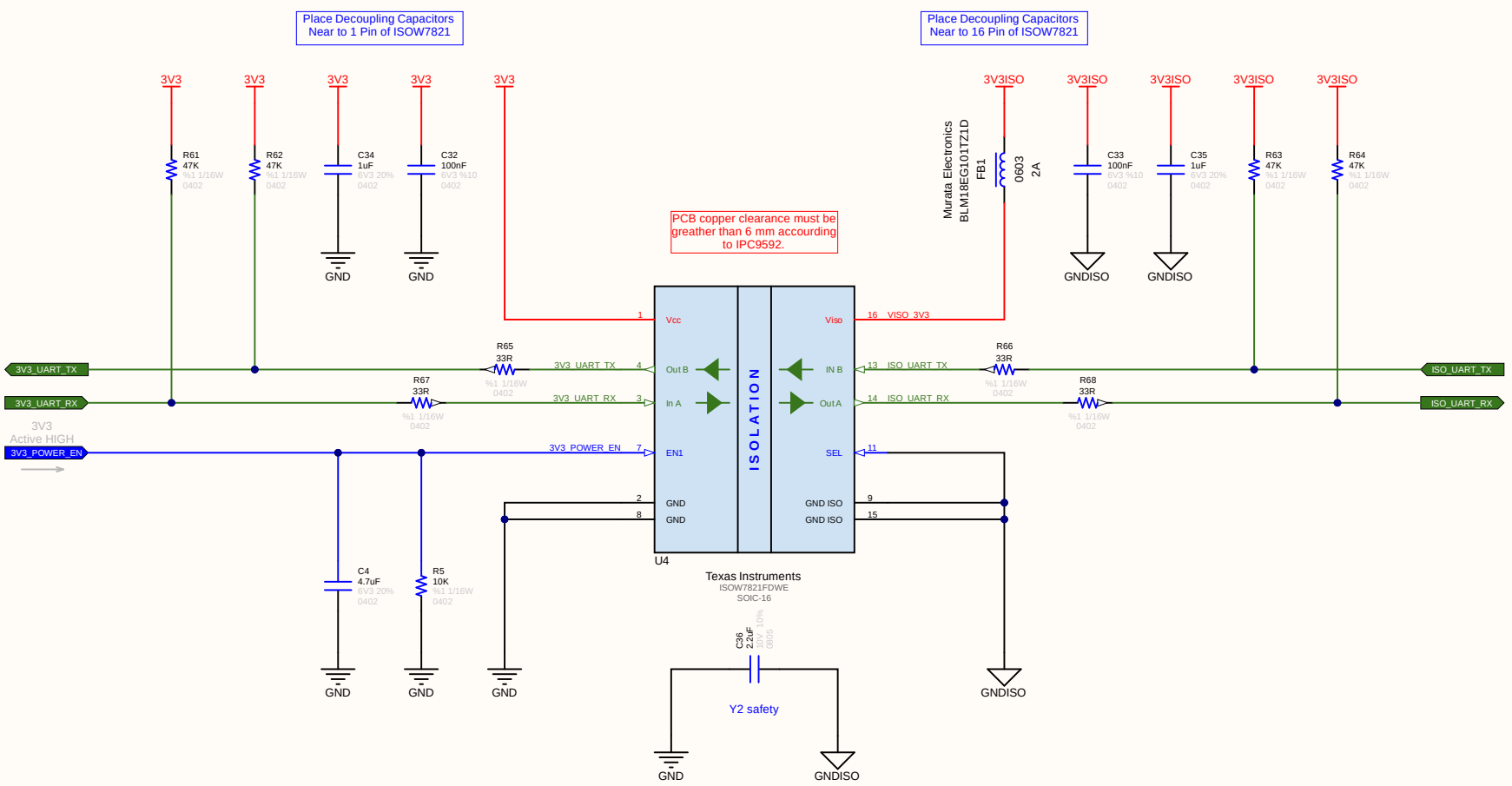
Safe operating region confirmed
All resistors within voltage, power, and thermal limits.

PCB copper clearance must be greather than 6 mm accourding to IPC9592.




www.github.com/akkoyun/B202AA-PCIe

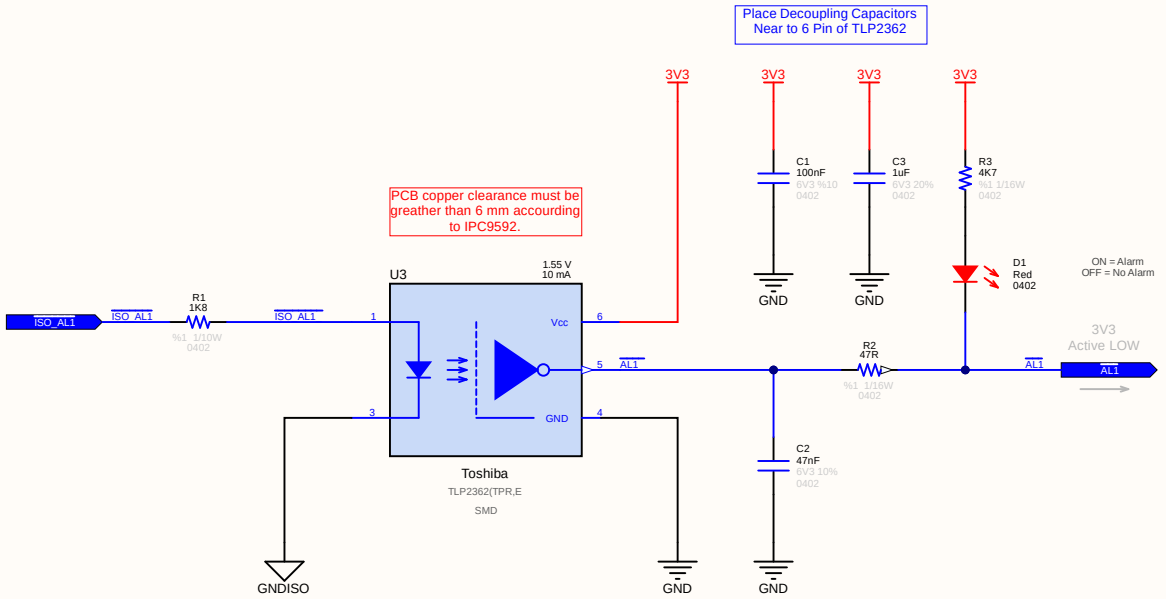
| | | | | | |
|---|---|---|---|---|---|
| T Phase Sense Signal Isolation | | | Engineer : Gunce Akkoyun | - | stf |
| | | | Customer : - | | |
| Size : A4 | Project : PollyPhase Energy Analyzer | | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB<br>103. Cad. No : 12<br>Selcuklu / Konya Türkiye | |
| | | | Module ID : B202AA-PCIe | | |
| Date : 6.11.2025 | Time : 14:20:48 | Page : 5 / 12 | Version : R1 | | |
| File : T Phase Sense Signal Isolation.SchDoc | | | Revision : 00.00.01 | | |






www.github.com/akkoyun/B202AA-PCIe

| | | | | | |
|---|---|---|---|---|---|
| UART Isolation | | | Engineer : Gunce Akkoyun | - | stf |
| | | | Customer : - | | |
| Size : A4 | Project : PollyPhase Energy Analyzer | | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB | |
| | | | Module ID : B202AA-PCIe | 103. Cad. No : 12 | |
| Date : 6.11.2025 | Time : 14:20:48 | Page : 6 / 12 | Version : R1 | Selcuklu / Konya Türkiye | |
| File : UART Comm Isolation.SchDoc | | | Revision : 00.00.01 | | |

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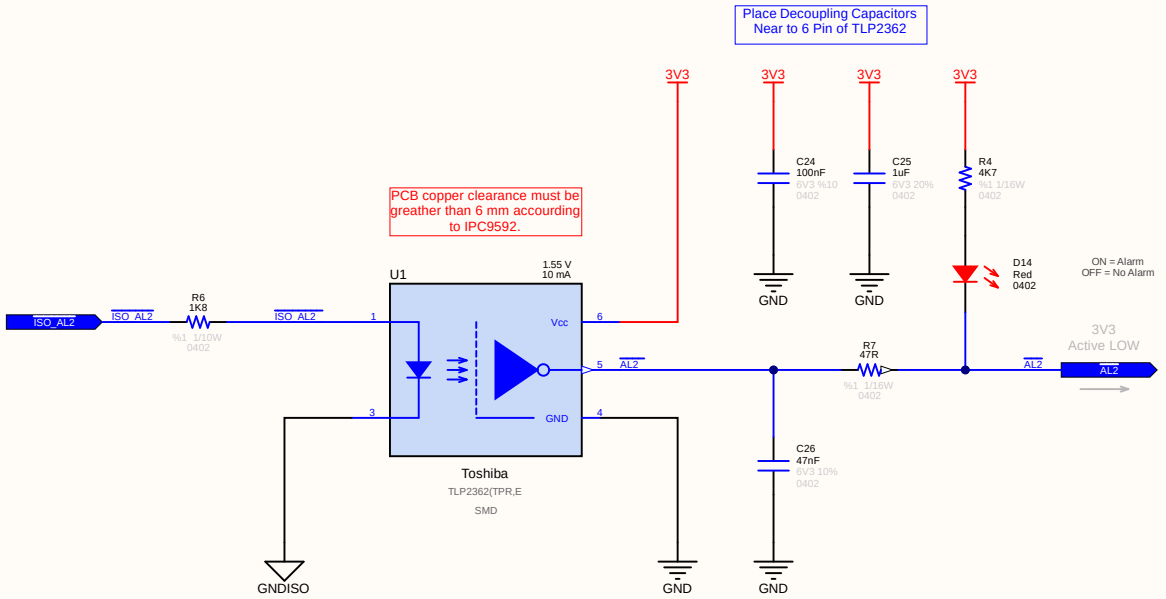
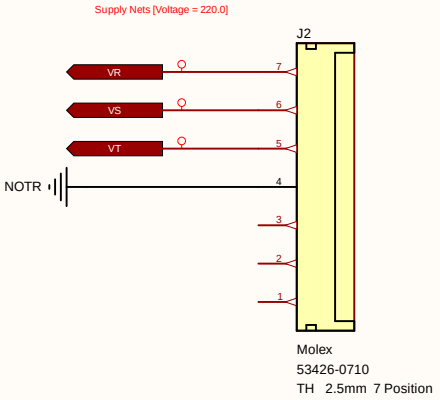
| | | | | | |
|---|---|---|---|---|---|
| AL1 Signal Isolation | | | Engineer : Gunce Akkoyun | - | stf |
| | | | Customer : - | | |
| Size : A4 | Project : PollyPhase Energy Analyzer | | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB<br>103. Cad. No : 12<br>Selcuklu / Konya Türkiye | |
| | | | Module ID : B202AA-PCIe | | |
| Date : 6.11.2025 | Time : 14:20:48 | Page : 7 / 12 | Version : R1 | | |
| File : AL1 Signal Isolation.SchDoc | | | Revision : 00.00.01 | | |

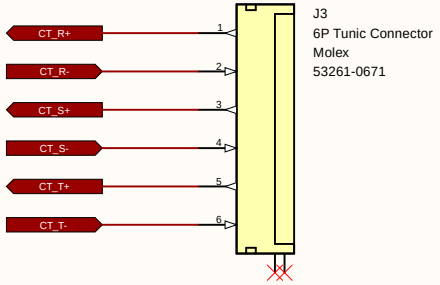



www.github.com/akkoyun/B202AA-PCIe

| | | | |
|---|---|---|---|
| AL2 Signal Isolation | | Engineer : Gunce Akkoyun | - |
| | | Customer : - | |
| Size : A4 | Project : PollyPhase Energy Analyzer | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB |
| | | Module ID : B202AA-PCIe | 103. Cad. No : 12 |
| Date : 6.11.2025 | Time : 14:20:48 Page : 8 / 12 | Version : R1 | Selcuklu / Konya Türkiye |
| File : AL2 Signal Isolation.SchDoc | | Revision : 00.00.01 | |

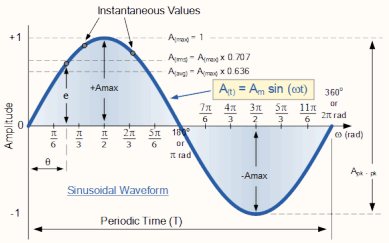
Property of -




www.github.com/akkoyun/B202AA-PCIe

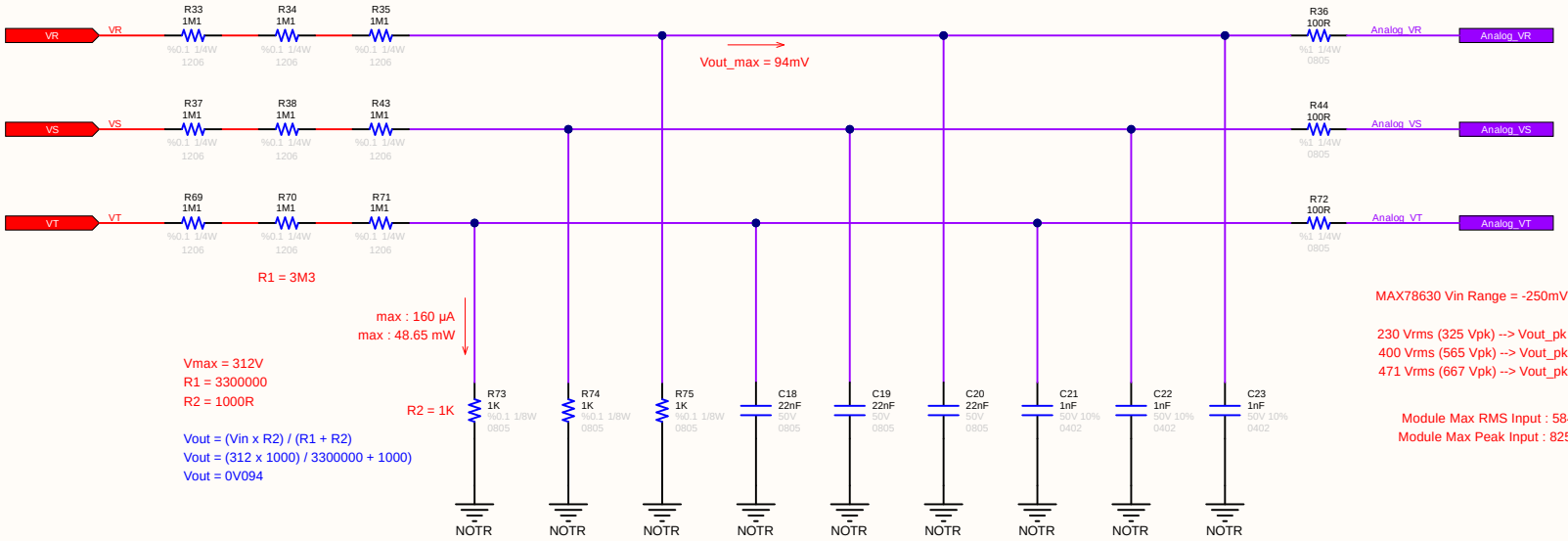
| | | | | |
|---|---|---|---|---|
| Energy Inputs | | | Engineer : Gunce Akkoyun | - |
| | | | Customer : - | |
| Size : A4 | Project : PollyPhase Energy Analyzer | | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB |
| | | | Module ID : B202AA-PCIe | 103. Cad. No : 12 |
| Date : 6.11.2025 | Time : 14:20:49 | Page : 9 / 12 | Version : R1 | Selcuklu / Konya Türkiye |
| File : Energy Inputs.SchDoc | | | Revision : 00.00.01 | |




**Voltage Divider Performance Summary**

- Maximum Input Voltage (RMS): 584 V
- Maximum ADC Input (Full Scale): ±250 mV
- Gain Error (Initial): ±0.14 %
- Gain Drift (0–70 °C): ±0.18 %
- Phase Shift @ 50 Hz: −0.40°
- Power Error (PF = 0.9, uncompensated): −0.34 %
- Power Error (PF = 0.5, uncompensated): −1.21 %
- Power Error (after compensation): < 0.05 %
- Long-Term Gain Stability: ±0.2 %
- Safety Margin (vs 400 V RMS system): ≈ 45 %

Vrms = 220V
Vmax = Vrms / 0.707 = 312V
Vpk-pk = 624V




MAX78630 Vin Range = -250mV - + 250mV

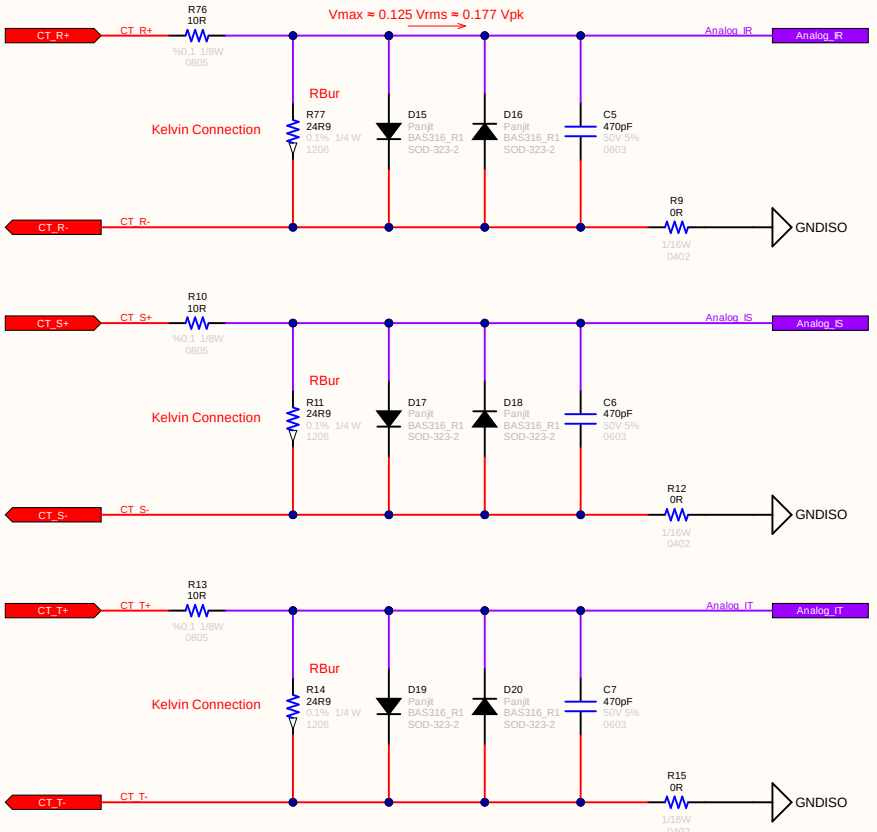
230 Vrms (325 Vpk) --> Vout_pk = 98.5 mV
400 Vrms (565 Vpk) --> Vout_pk = 171 mV
471 Vrms (667 Vpk) --> Vout_pk = 202 mV

Module Max RMS Input : 584 Vrms
Module Max Peak Input : 825 Vpeak

www.github.com/akkoyun/B202AA-PCIe

| | | | |
|---|---|---|---|
| 3 Phase Voltage Dividers | | Engineer : Gunce Akkoyun | - |
| | | Customer : - | |
| Size : A4 | Project : PollyPhase Energy Analyzer | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB |
| | | Module ID : B202AA-PCIe | 103. Cad. No : 12 |
| Date : 6.11.2025 | Time : 14:20:49 Page : 10 / 12 | Version : R1 | Selcuklu / Konya Türkiye |
| File : Phase Voltage Dividers.SchDoc | | Revision : 00.00.01 | |

Operating Range
- Nominal current (5 A rms): 0.125 V rms = 0.177 V pk
- Max current (7 A rms): 0.174 V rms = 0.246 V pk
- MAX78630 input limit: ±250 mV pk
- Utilization: ≈ 98 % of full-scale (ideal range)
- Burden dissipation: < 2 mW, no thermal drift concern




CT Clamp Protection Explanation

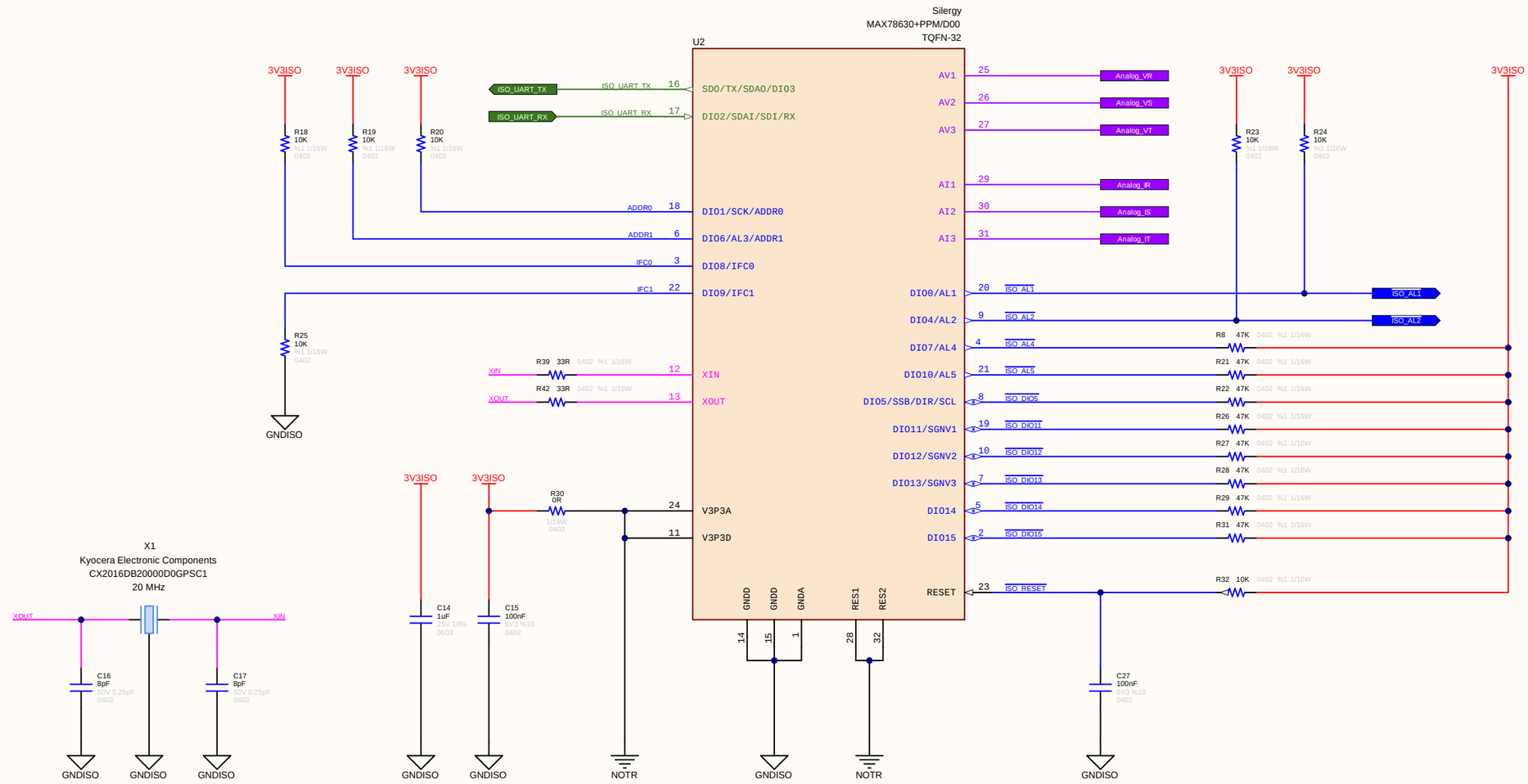
Each current transformer (CT) channel includes a pair of antiparallel signal diodes (BAS316) connected across the burden resistor. These diodes normally remain non-conductive because the operating voltage across the burden (≈ 0.25 Vpk at 7 $A_{(rms)}$) is far below the diode forward voltage (~ 0.7 V).

If the CT circuit becomes open-circuited (e.g., connector unplugged, broken wire, or burden failure), the CT behaves as a current source and its secondary voltage can rise to several hundred volts. In that case, the diodes conduct and clamp the voltage to ±0.7 V, protecting both the MAX78630 input and the surrounding circuitry.

Thus, the diodes act only as a safety clamp during abnormal conditions, without affecting normal measurement accuracy or phase angle.

www.github.com/akkoyun/B202AA-PCIe

| | | | |
|---|---|---|---|
| 3 Phase Current Voltage Dividers | | Engineer : Gunce Akkoyun | - |
| | | Customer : - | |
| Size : A4 | Project : PollyPhase Energy Analyzer | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB |
| | | Module ID : B202AA-PCIe | 103. Cad. No : 12 |
| Date : 6.11.2025 | Time : 14:20:49 Page : 11 / 12 | Version : R1 | Selcuklu / Konya Türkiye |
| File : Current Voltage Dividers.SchDoc | | Revision : 00.00.01 | |




www.github.com/akkoyun/B202AA-PCIe

| | | | |
|---|---|---|---|
| MAX78630 SOC Core | | Engineer : Gunce Akkoyun | - |
| | | Customer : - | |
| Size : A4 | Project : PollyPhase Energy Analyzer | Product ID : B202AA-PCIe | Buyuk Kayacik Mah. 4. OSB |
| | | Module ID : B202AA-PCIe | 103. Cad. No : 12 |
| Date : 6.11.2025 | Time : 14:20:49 Page : 12 / 12 | Version : R1 | Selcuklu / Konya Türkiye |
| File : MAX78630 SOC.SchDoc | | Revision : 00.00.01 | |