

1-Phase Sinus Filter

Differential LC output filter for PWM power converters and motor-drive applications.

NOMINAL
VOLTAGE

**230
V**

NOMINAL
CURRENT

20 A

PWM
FREQUENCY

**> 4
kHz**





1-Phase Sinus Filter

Compact differential output filter for power-conversion equipment, intended for attenuation of high-frequency components while preserving low-frequency power transfer.

Differential output filter

LC network

Damped response

Power electronics



Key Highlights

- Two-line differential LC topology with 1 mH series inductors in each conductor.
- Damped capacitive branch for resonance control and predictable high-frequency roll-off.
- Designed for straightforward four-terminal connection: IN_A, IN_B, OUT_A, OUT_B.
- Calculated small-signal attenuation reaches approximately 40 dB near 11.3 kHz under ideal-element assumptions.
- Mechanical package and ratings to be defined from the production design.

Nominal Voltage

230 V

Preliminary rating

Nominal Current

20 A

Preliminary rating

Calculated -3 dB Frequency

1.56 kHz

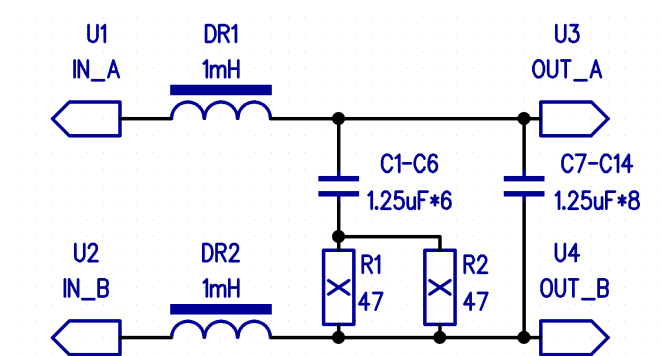
Ideal AC model



Electrical Characteristics

Parameter	Symbol	Value	Conditions / Notes
Series inductance, line A	DR1	1 mH	Ideal value used for preliminary AC model.
Series inductance, line B	DR2	1 mH	Ideal value used for preliminary AC model.
Output shunt capacitance	C7-C14	$1.25 \mu\text{F} \times 8 = 10 \mu\text{F}$	Capacitor bank connected directly between OUT_A and OUT_B.
Damping branch capacitance	C1-C6	$1.25 \mu\text{F} \times 6 = 7.5 \mu\text{F}$	Capacitor bank in series with damping resistance.
Damping resistance	R1 R2	23.5 Ω	Two 47 Ω resistors in parallel.
Rated operating voltage	V _R	230 V AC, 1-phase	Nominal operating voltage.
Dielectric test voltage	V _{TEST}	2500 V AC, 1 min	Between heatsink/enclosure and any terminal.
Rated current	I _R	20 A RMS	Peak current 40 A for 1 minute.

Connection Diagram



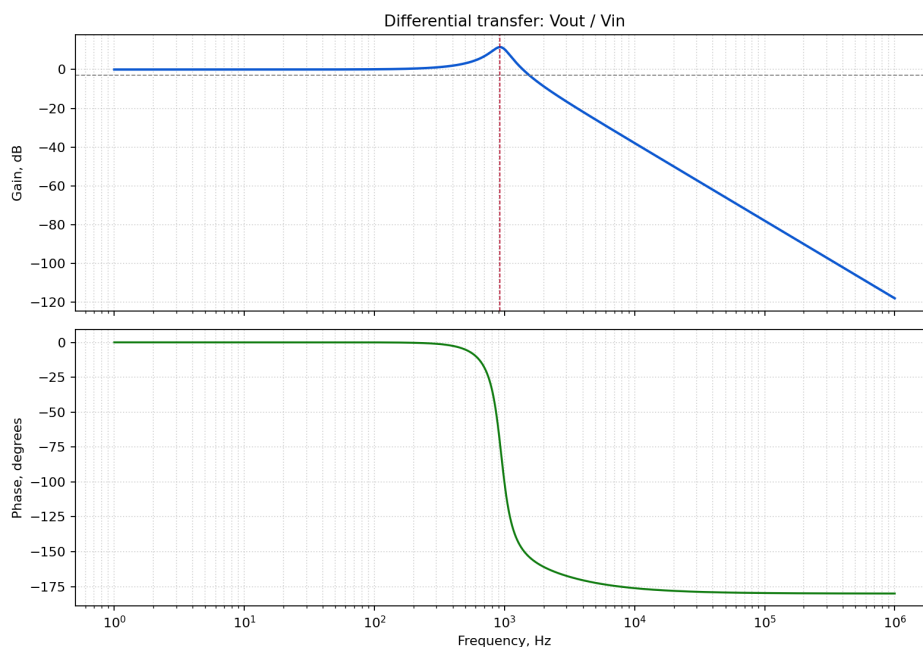
Connection schematic with equivalent capacitor banks.
Physical implementation uses four external terminals.

Model Assumptions

- Small-signal differential AC transfer is calculated as V_{out}/V_{in} .
- No external load resistance is included in the preliminary model.
- Capacitor ESR, inductor DCR, core loss and source impedance are not included.
- One output terminal may be used as the simulation reference node.

Final frequency response must be verified with real ESR/DCR values and intended load conditions.

Calculated Frequency Response



Calculated ideal-element differential transfer function. Source: preliminary Python AC model.

Key Frequencies

Point	Frequency	Gain
Resonant peak	923.6 Hz	+11.54 dB
-3 dB	1.56 kHz	-3.06 dB
-10 dB	2.14 kHz	-10.00 dB
-20 dB	3.63 kHz	-20.01 dB
-40 dB	11.29 kHz	-40.03 dB
-60 dB	35.63 kHz	-60.02 dB

Selected Response Points

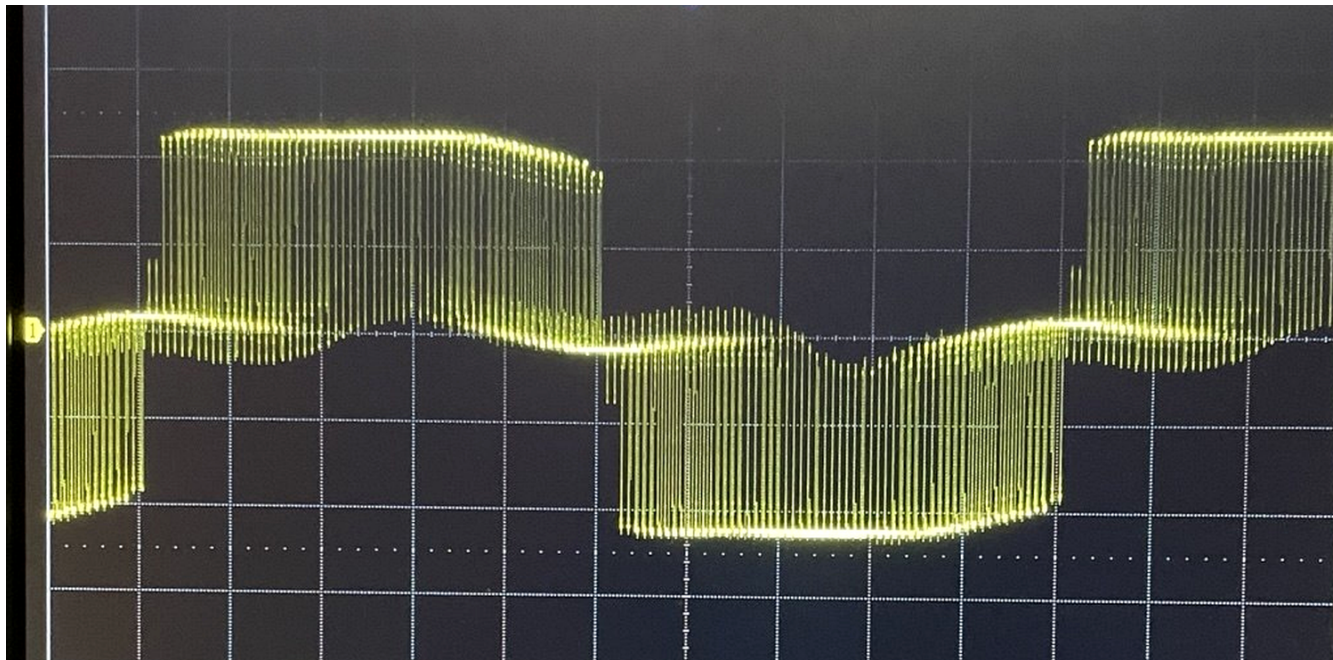
Frequency	Gain	Phase
500 Hz	+3.20 dB	-5.2°
800 Hz	+9.39 dB	-33.7°
1 kHz	+10.47 dB	-100.7°
1.5 kHz	-2.11 dB	-152.5°
2 kHz	-8.66 dB	-160.9°
10 kHz	-37.91 dB	-176.1°
100 kHz	-77.95 dB	-179.6°



Measured Input and Output Waveforms

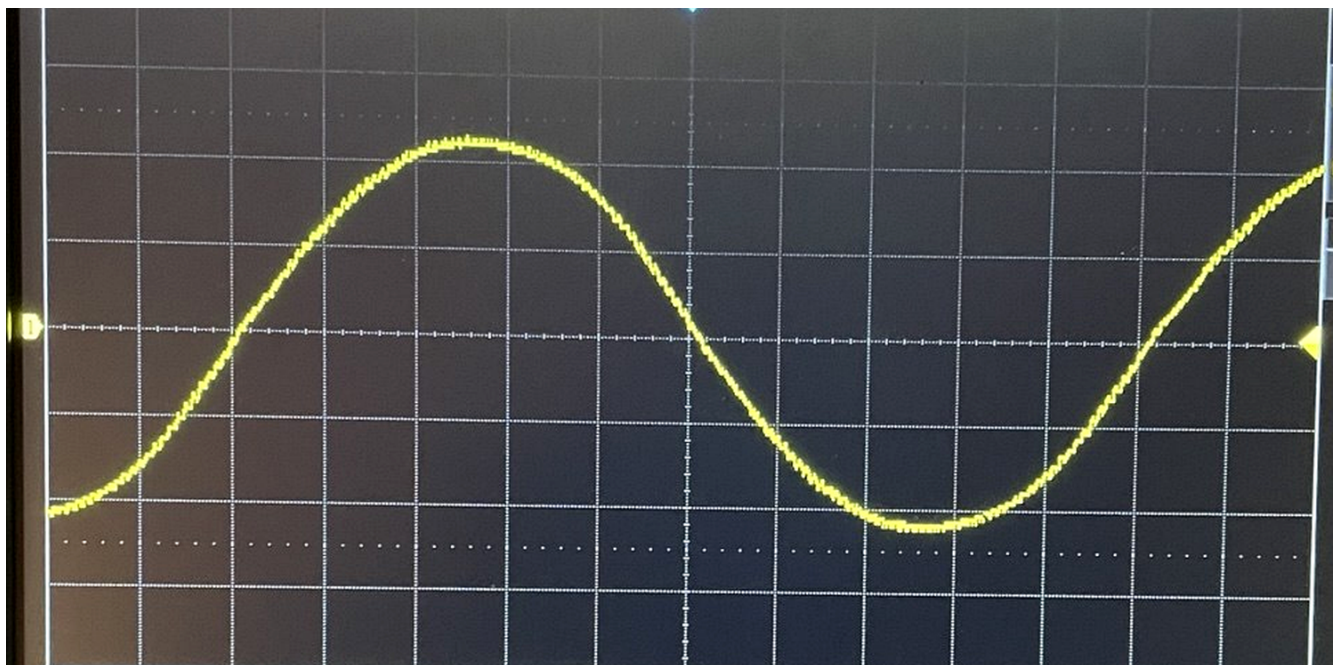
Before Filter

PWM waveform, fundamental 49 Hz, PWM 6.25 kHz



After Filter

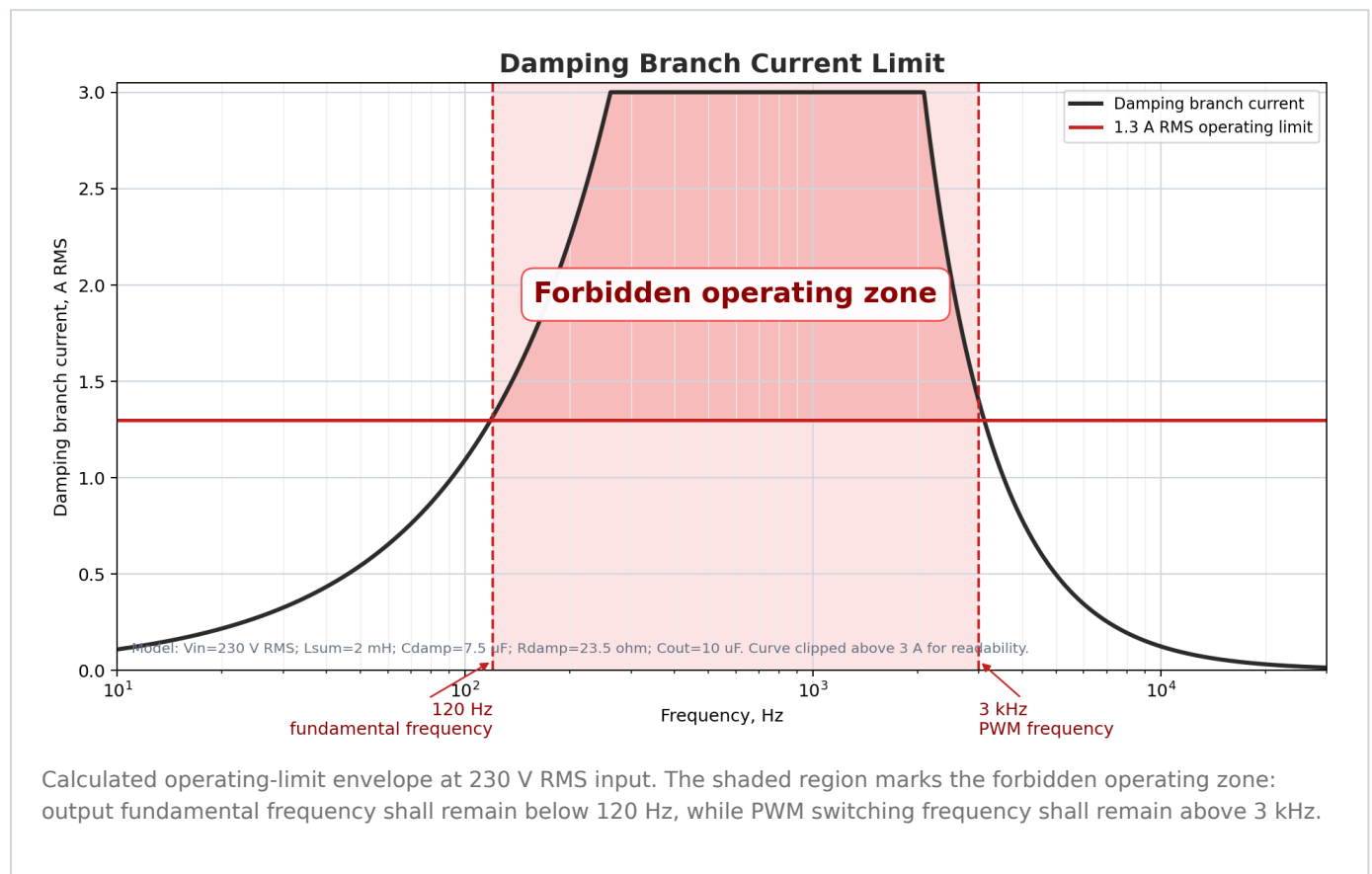
Filtered sinusoidal output, 230 V, fundamental 49 Hz



Oscilloscope screen photographs from practical verification. Measurement conditions: output voltage 230 V, fundamental frequency 49 Hz, PWM switching frequency 6.25 kHz.



Damping Branch Current Limit



Limit Summary

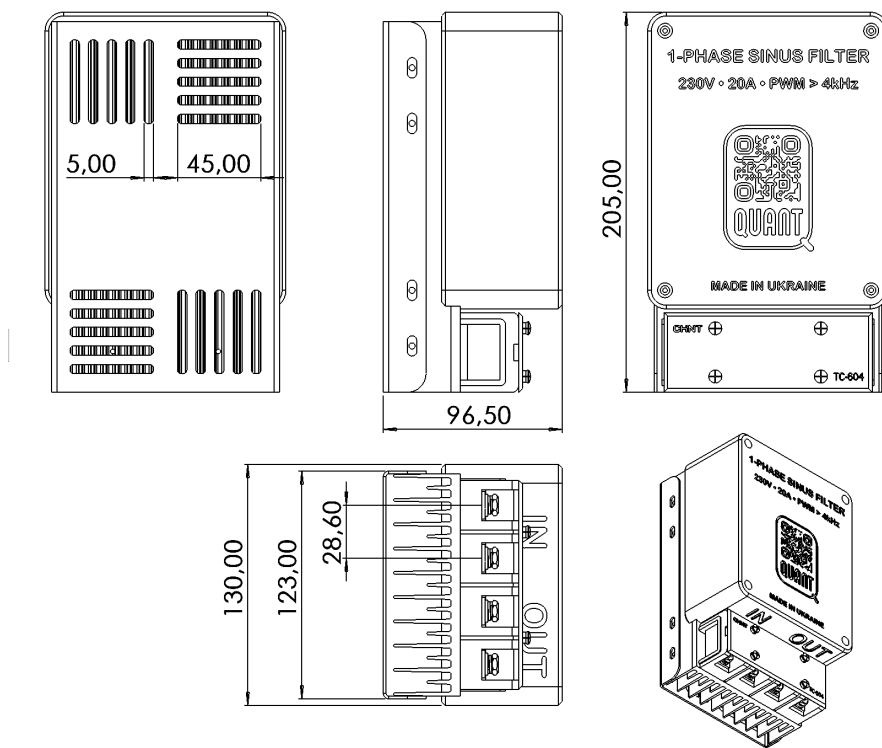
Damping current limit	1.3 A RMS
Total damping power at limit	39.7 W
Maximum fundamental frequency	120 Hz
Minimum PWM frequency	> 3 kHz

Operating Guidance

- Use carrier/PWM settings above the forbidden zone for normal operation.
- For typical VFD applications, 6-8 kHz PWM switching frequency is preferred.
- Do not operate the filter as a low-frequency power load inside the shaded band.
- Final limits must be confirmed by thermal validation in the target enclosure.



Mechanical Outline



Preliminary mechanical outline. Dimensions are shown in millimeters.

Mechanical Notes

Overall dimensions	See outline drawing.
Mass	2.8 kg net
Mounting	Side flange, hole pattern per outline.
Terminals	4-position screw terminal block, CHINT TC-604 shown.
Wire range / torque	2.5-10 mm ² wire range, D6 mm cable lugs. Tightening torque 2.0 N·m nominal, 2.5 N·m maximum.
Cooling method	Ventilated enclosure with heatsink fins.

Application Notes

- Keep input and output wiring separated to prevent bypassing the filter at high frequency.
- Connect the filter as close as practical to the noise source or protected load, according to system layout.
- Verify capacitor voltage rating and ripple current under the final operating waveform.
- Validate thermal conditions at rated current in the target enclosure.

Ordering Information

Part Number	Status
QUANT_SINF1F_20	Prototype / preliminary

Revision History

Rev.	Date	Changes
0.1	2026-06-03	Initial preliminary datasheet.



Contact and Support

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