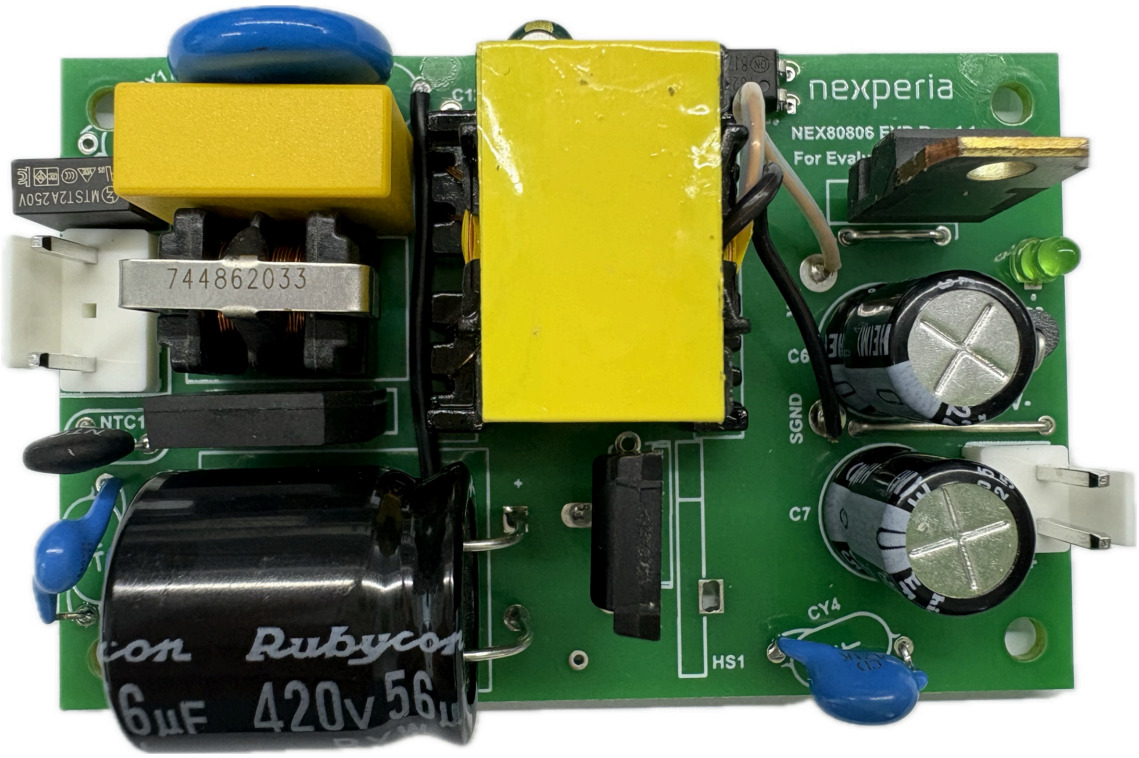
UM90078

Rev. 1 — 16 October 2025

user manual

NEVB-NEX80806DA Evaluation board



Abstract: This user guide describes the NEX80806 evaluation board (EVB), an AC-DC offline power supply platform for evaluating the NEX80806 device. The document includes the EVB schematics, test data, bill of materials (BOM), and board layout drawings.

Keywords: NEX80806, Multimode flyback

nexperia

1. Introduction

This evaluation board (EVB) is an offline power supply solution that evaluates the NEX80806.

The NEX80806 is an intelligent, multi-mode PWM controller that uses peak current mode control. It automatically switches between Continuous Conduction Mode (CCM), Quasi-Resonant (QR) mode, Discontinuous Conduction Mode (DCM), and Pulse Frequency Modulation (PFM) mode as the load changes. This maintains high efficiency across the entire load range.

Warning:

This evaluation board is designed to demonstrate the performance of a high-frequency QR-mode flyback converter. It operates at high voltage without an enclosure. Observe the following warnings during operation:

1. Use an isolated AC source for the input.
2. Ensure the bench table is properly insulated.
3. Do not manually probe the waveforms when the demo board is running. Set up probing before powering on the demo board.
4. Do not touch any part of the demo board while it is operating.
5. After powering down, use a multimeter in diode measurement mode to discharge the input HV bulk capacitor. Verify that the HV bulk capacitor voltage is below 36 V before touching the evaluation board to prevent electric shock.

2. EVB overview

Table 1. Basic information

Input	90 V ~ 264 V AC/50 ~ 60 Hz
Output	24 V/1 A
Controller part number	NEX80806
Application	Auxiliary power supply for industrial and home equipment

Table 2. Performance

Performance	Specification	Input voltage	Test result
Efficiency (24W)	-	230 V AC	• Full load: 90.54% • 10% load: 84.43%
		115 V AC	• Full load: 88.42% • 10% load: 88.14%
Ripple and noise	< 240 mV	-	85 - 264 V AC, V_{PP} < 90 mV
Standby loss	< 0.2 W	230 V AC	95 mW
		264 V AC	115 mW
Startup delay	< 1 s	85 V AC	0.753 s
Voltage stress	< 600 V (620V MOS)	264 V AC steady state	541.2 V
	< 110 V (120 V diode)		104.9 V
Size	-	-	79 mm × 50 mm × 24.5 mm

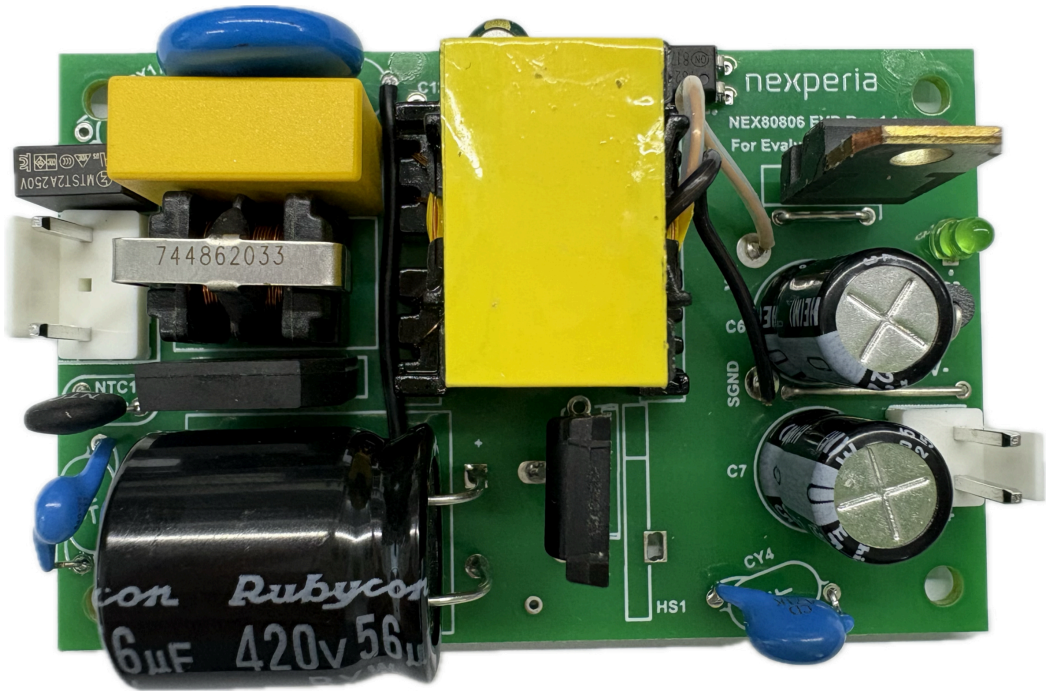


Fig. 1. Top view

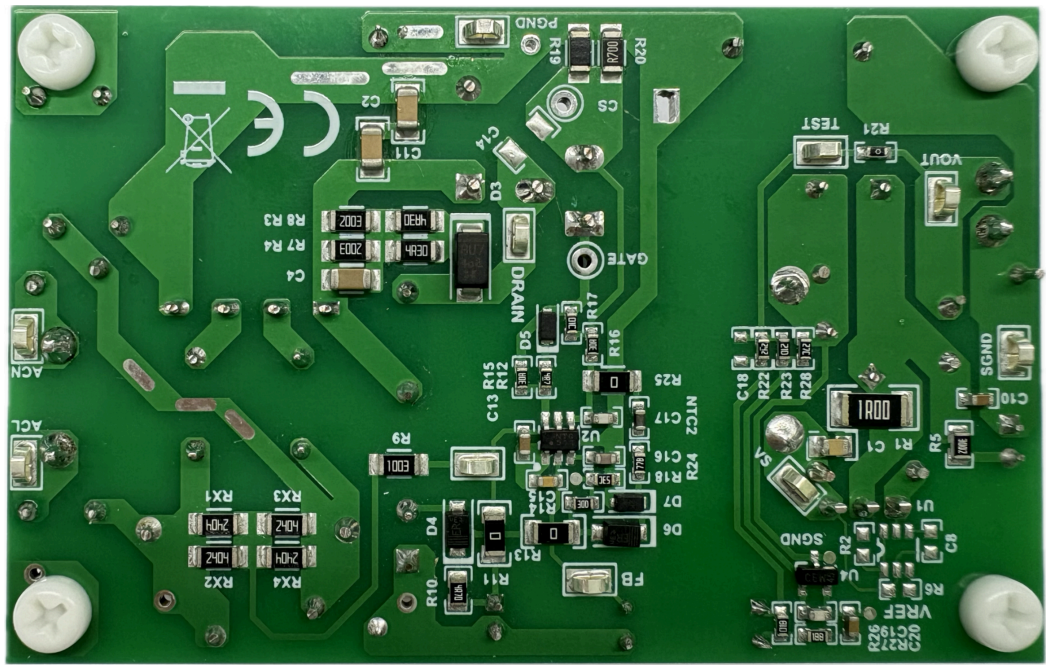


Fig. 2. Bottom view

3. Setting up the EVB

As shown in Fig. 3

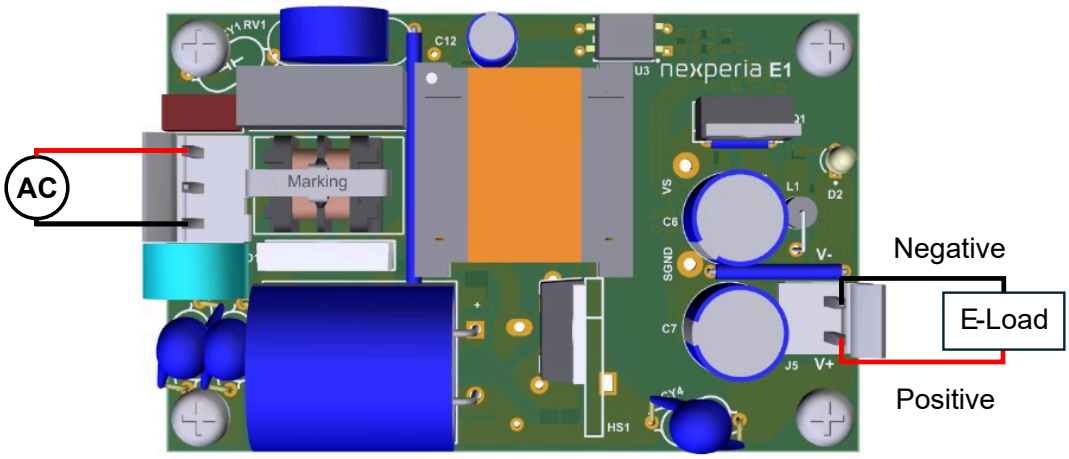


Fig. 3. EVB connection diagram

1. Connect the L and N terminals of the EVB to the output of the AC source.
2. Connect the load to the output of the EVB.

Note:

Insert a power meter between the AC source and the EVB for accurate efficiency measurement. Measure the output voltage between the V_{OUT} and second ground (SGND) terminals of the EVB.

4. Schematic

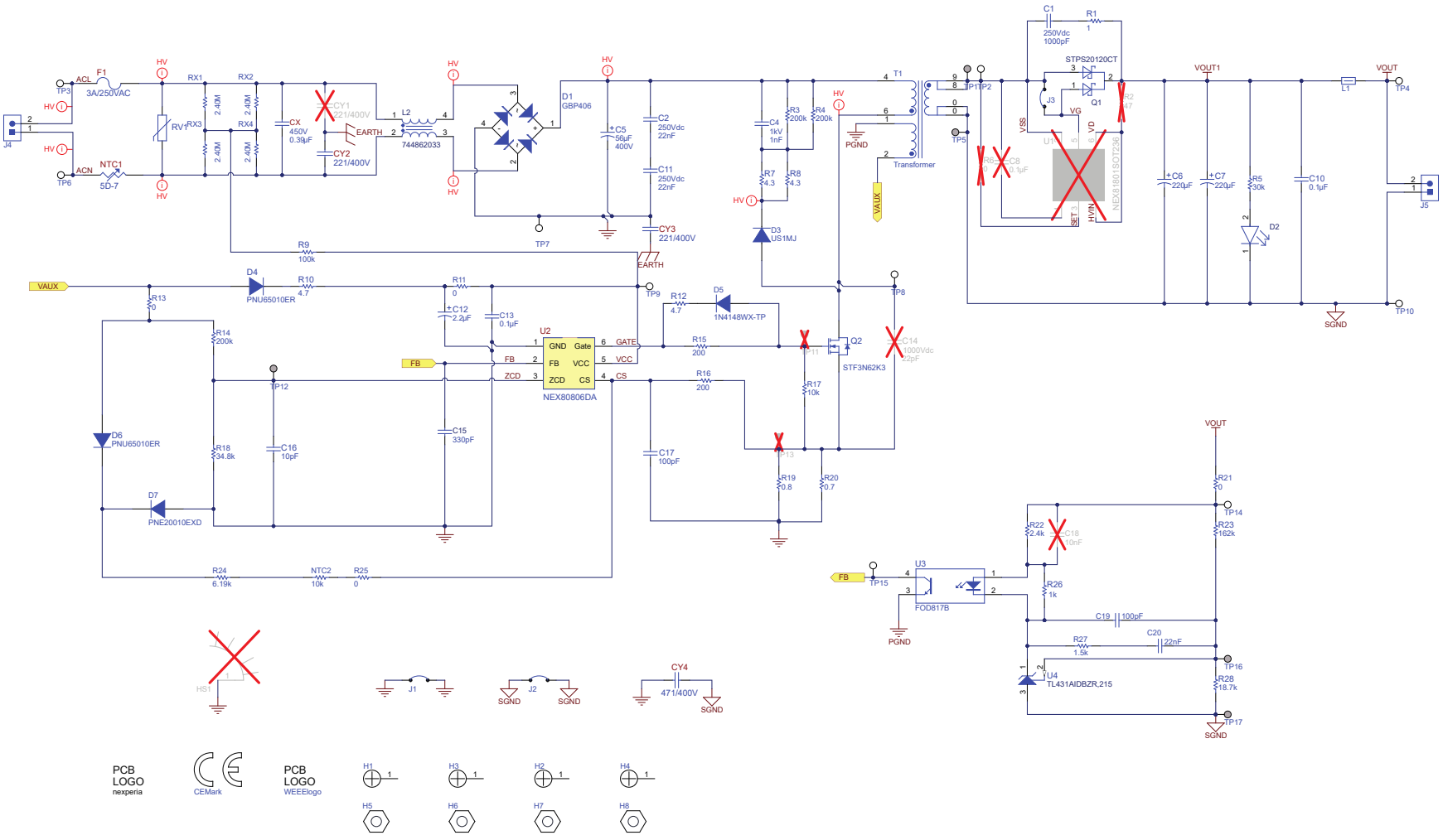


Fig. 4. Schematic

5. PCB layout

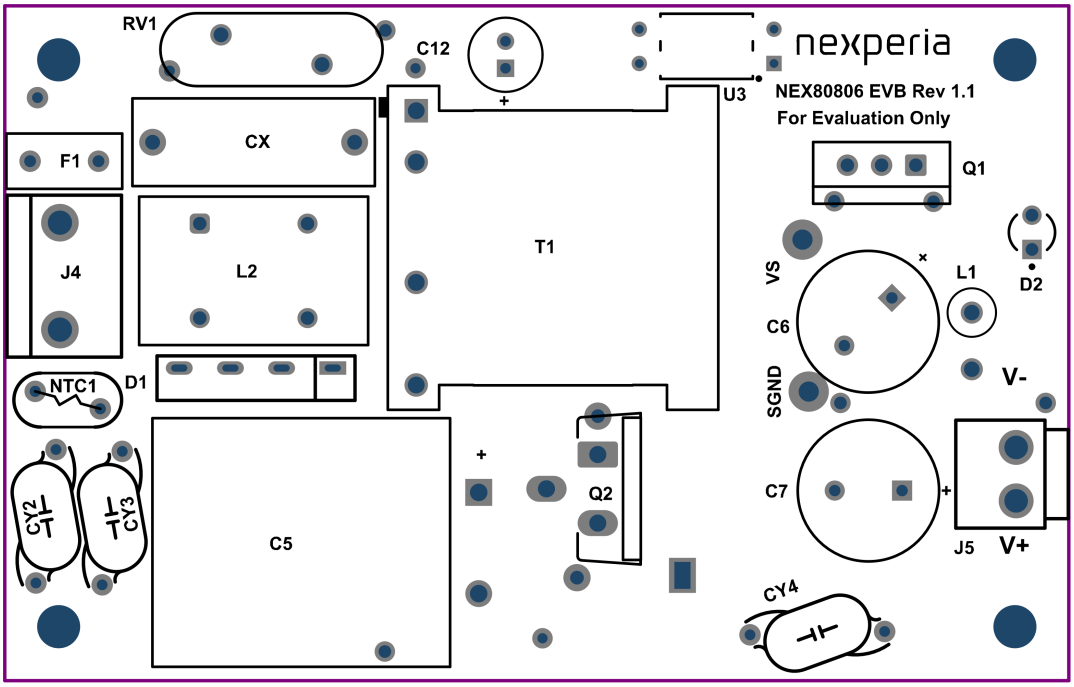


Fig. 5. Top layer

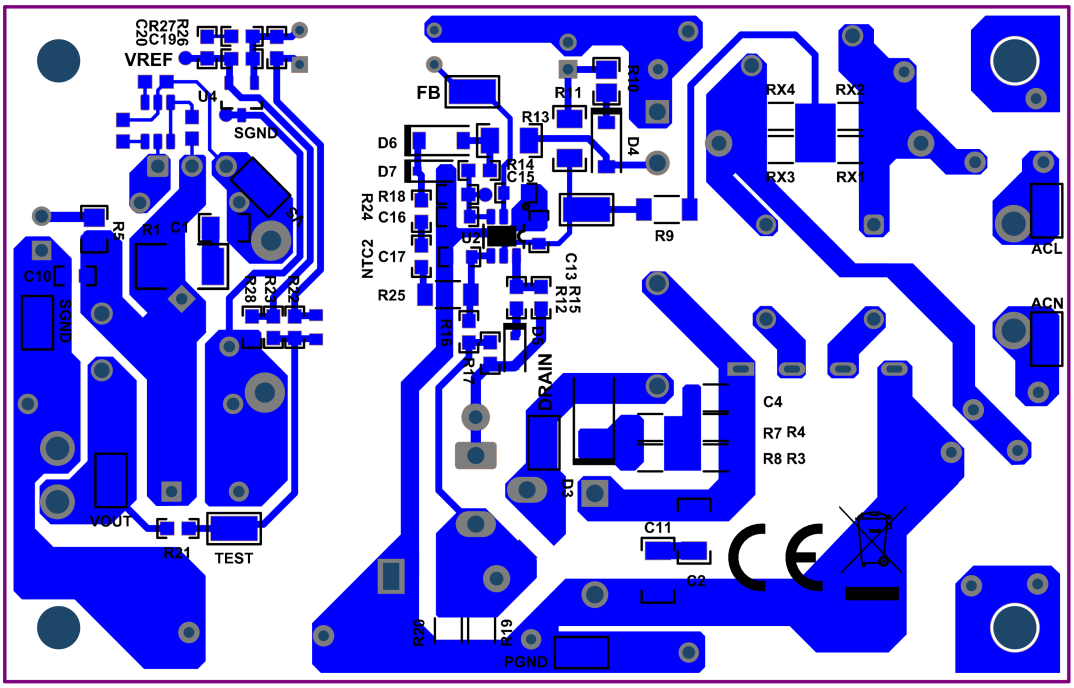
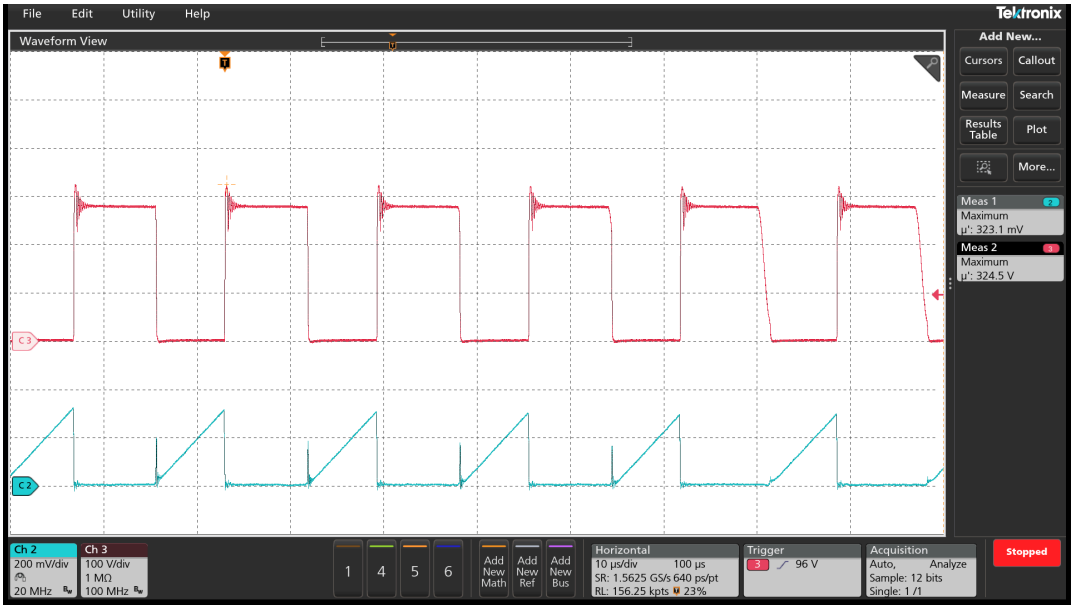


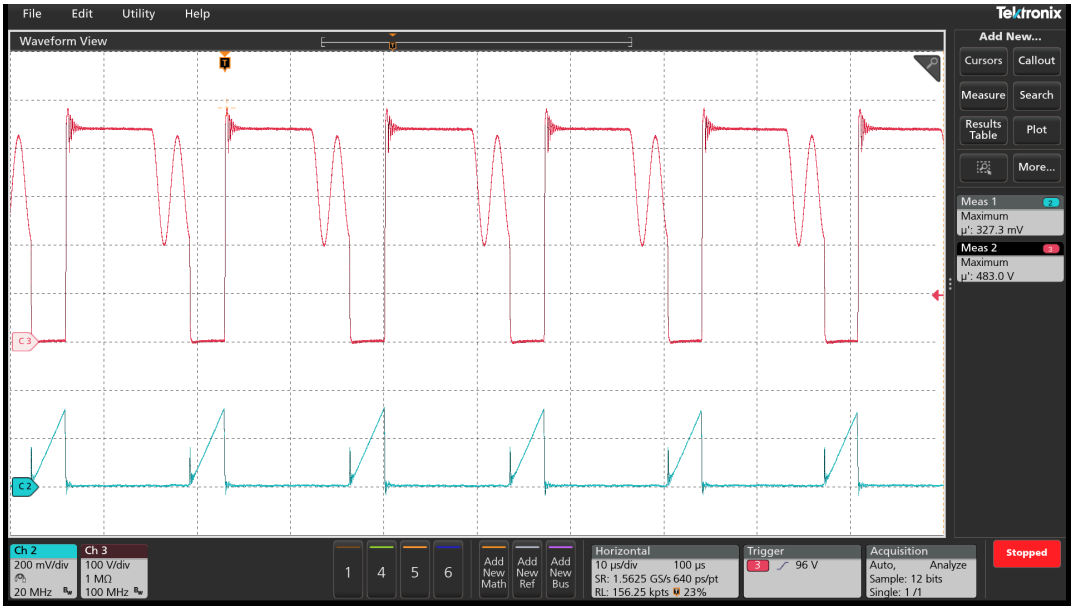
Fig. 6. Bottom layer

6. Operation waveforms



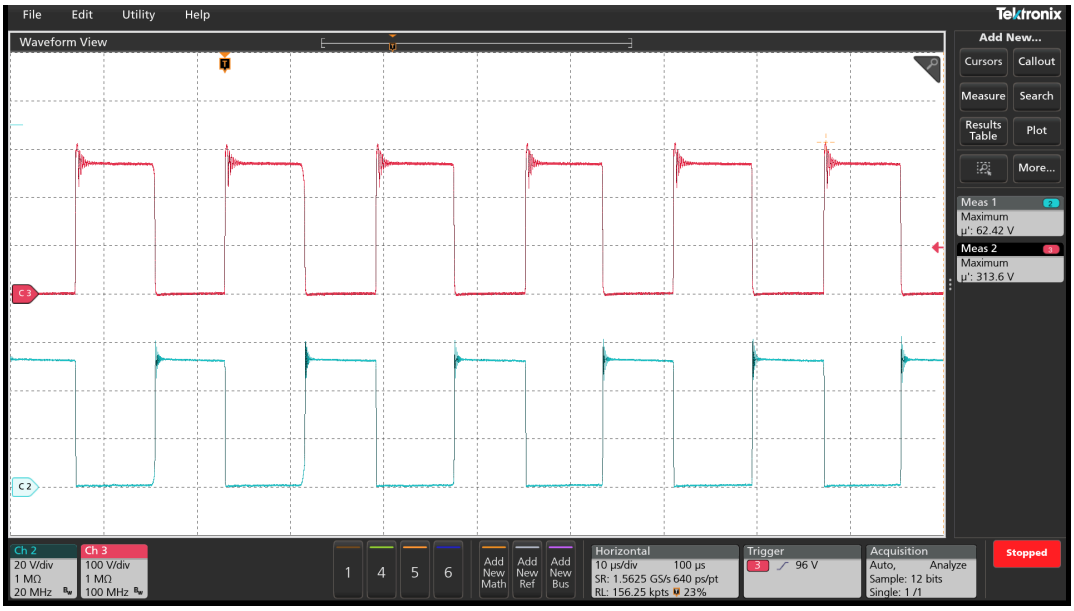
- Channel 2: VCS
- Channel 3: VDS

Fig. 7. VDS and VCS waveform of 115 V AC 24 V/1 A



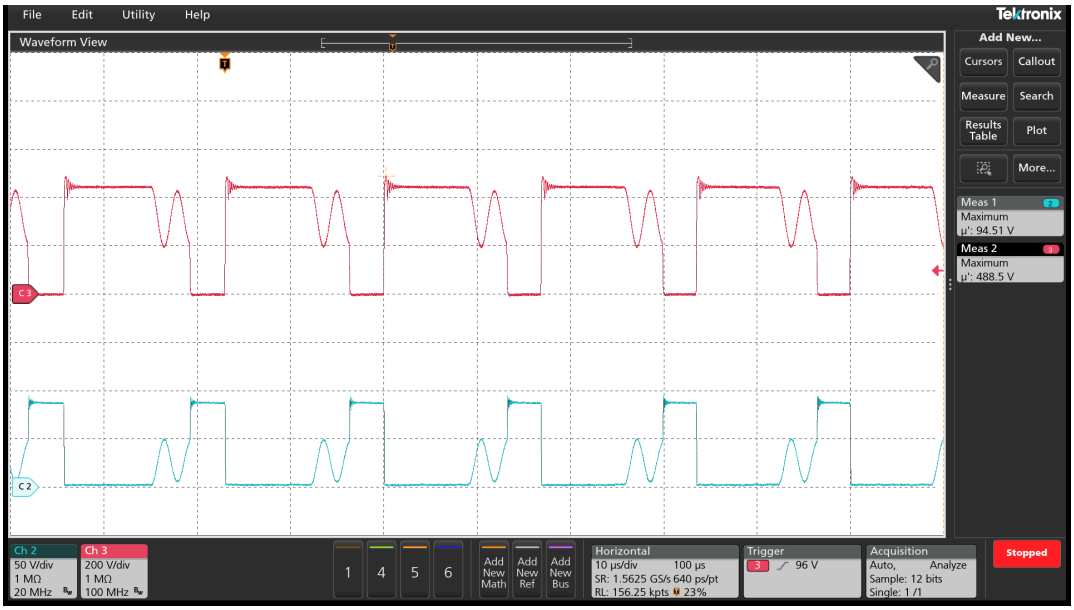
- Channel 2: VCS
- Channel 3: VDS

Fig. 8. VDS and VCS waveform of 230 V AC 24 V/1 A



- Channel 2: VR_DIODE
- Channel 3 VDS_MOS

Fig. 9. VDS_MOS and VR_DIODE waveform of 115 V AC 24 V/1 A



- Channel 2: VR_DIODE
- Channel 3 VDS_MOS

Fig. 10. VDS_MOS and VR_DIODE waveform of 230 V AC 24 V/1 A

7. Thermal performance

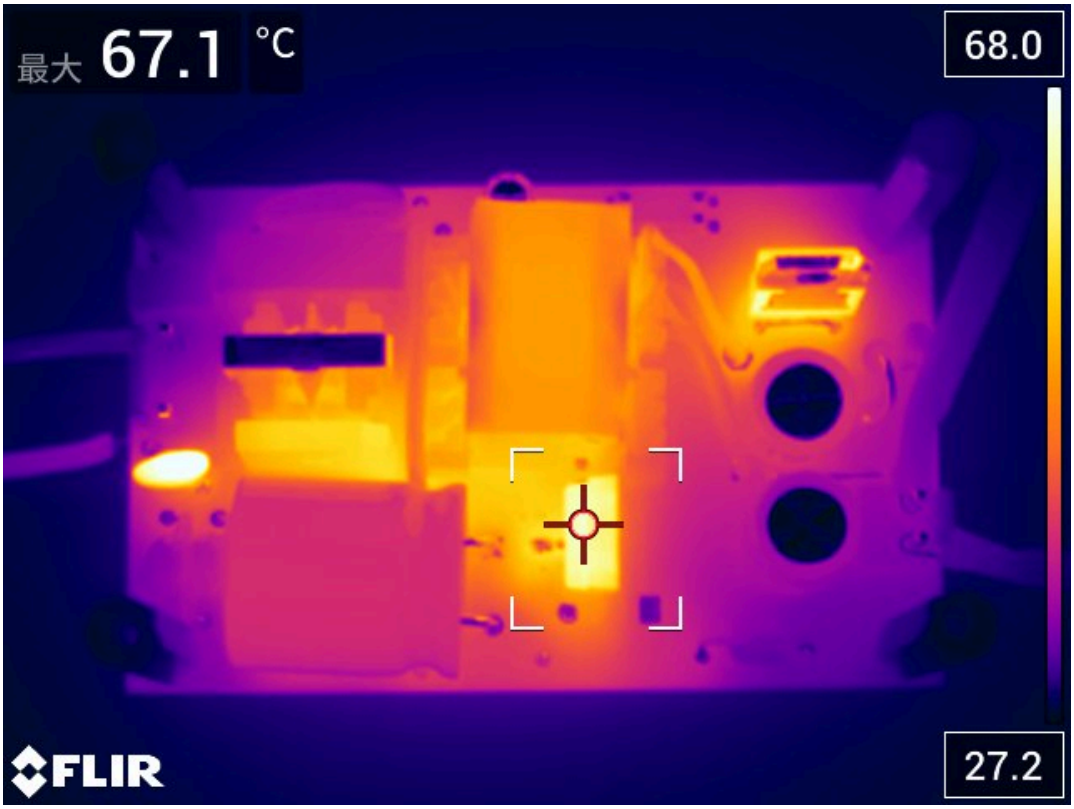


Fig. 11. Thermal performance of 115 V AC 24 V/1 A

Fig. 12. Thermal performance of 230 V AC 24 V/1 A

8. Efficiency

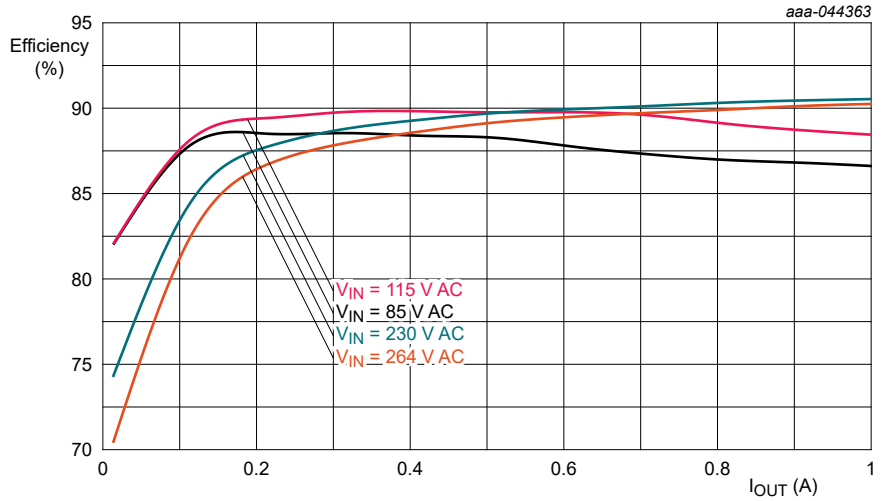


Fig. 13. Efficiency

9. Bill of materials

Reference	Quantity	Description	Part number	Manufacturer
C1	1	CAP, CERM, 1 nF, 250 V, +/- 10 %, X7R, 0805	CC0805KRX7RYBB102	YAGEO
C2, C11	2	CAP, CERM, 22 nF, 250 V, +/- 10 %, X7R, 1206	GCJ31BR72E223KXJ1L	MuRata
C4	1	CAP, CERM, 1 nF, 1 kV, +/- 10 %, X7R, 1206	GRM31BR73A102KW01	MuRata
C5	1	CAP, AL, 56 µF, 420 V, +/- 20 %, TH	420BXW56MEFR18X20	Rubycon
C6, C7	2	CAP, AL, 220 µF, 35 V, +/- 20 %, TH	UHE1V221MPD6	Nichicon
C10, C13	1	CAP, CERM, 0.1 µF, 50 V, +/- 10 %, X7R, 0603	C1608X7R1H104K	TDK
C12	1	CAP, AL, 2.2 µF, 50 V, +/- 20 %, TH	CD2882251HM0511VFL	HRK
C15	1	CAP, CERM, 330 pF, 50 V, +/- 10 %, X7R, 0603	885012206080	Wurth Elektronik
C16	1	CAP, CERM, 10 pF, 50 V, +/- 5 %, C0G/NP0, 0603	885012006051	Wurth Elektronik
C17, C19	1	CAP, CERM, 100 pF, 50 V, +/- 10 %, X7R, 0603	885012006057	Wurth Elektronik
C20	1	CAP, CERM, 22 nF, 50 V, +/- 10 %, X7R, 0603	885012206091	Wurth Elektronik
CX	1	0.39 µF Film Capacitor 450 V Polypropylene (PP), Metallized Radial	MPX394K31D3KN15800	KNSCHA
CY2, CY3	2	Y1 cap, TH, 220 pF	CD45-B2GA221K	TDK
CY4	1	Y1 cap, TH, 470 pF	CD45-B2GA471K	TDK
D1	1	Diode, Switching-Bridge, 420 V, 2 A, TH	GBP406	LGE
D2	1	LED (Green)	151034GS03000	Wurth Elektronik
D3	1	Diode, Ultrafast, 1000 V, 1 A, SMA	US1MJ	Nexperia
D4, D6	2	Diode, Ultrafast, 100 V, 0.15 A, SOD-123	PNU65010ER	Nexperia
D5, D7	2	Diode, Switching, 75 V, 0.15 A, SOD-323	PNE20010EXD	Nexperia
F1	1	Fuse, 2 A/250 V AC	MTS1200A	Reomax
H1, H2, H3, H4	4	Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	97790803211	Wurth Elektronik
H5, H6, H7, H8	4	Standoff, Hex, 25mm #4-40 Nylon	970250365	Wurth Elektronik
J1	1	Jumper wire, 45 mm	-	-
J2	1	Jumper wire, 5 mm	-	-
J3	1	Jumper wire, 7.5 mm	-	-
J4	1	Header (shrouded), 3.96 mm, 2x1, TH	VH-3A2	-
J5	1	Header (shrouded), 3.96 mm, 2x1, TH	VH3.96-2P	-
L1	1	Ferrite Bead, 100 Ω@100 MHz, 3 A,	7427605	Wurth Elektronik
L2	1	Common mode inductor	744862033	Wurth Elektronik
NTC1	1	NTC, 5 Ω, 2 A, TH	5D-7	RUILON
NTC2	1	NTC, 10 kΩ, 1 %, 0.1 W, 0603	NCP18XH103F03RB	MuRata
Q1	1	Schottky Barrier Rectifier 10 A/120 V	STPS20120CT	ST
Q2	1	MOSFET N-CHANNEL 620 V 2.7 A TO220	STF3N62K3	ST
R1	1	RES, 1 Ω, 5 %, 0.75 W, 2010	AC2010FK-071RL	YAGEO
R3, R4	2	RES, 200 kΩ, 1 %, 0.25 W, 1206	RC1206FR-07200KL	YAGEO
R5	1	RES, 30 kΩ, 1 %, 0.1 W, 0805	RC0805FR-0730KL	YAGEO
R7, R8	2	RES, 4.3Ω, 1 %, 0.25 W, 1206	RC1206FR-074R3L	YAGEO
R9	1	RES, 100 kΩ, 1 %, 0.25 W, 1206	RC1206FR-07100KL	YAGEO
R10	1	RES, 4.7Ω, 1 %, 0.1 W, 0805	RC0805FR-074R7L	YAGEO

Reference	Quantity	Description	Part number	Manufacturer
R11, R13	2	RES, 0 Ω, 5 %, 0.25 W, 1206	RC1206JR-070RL	YAGEO
R12	1	RES, 4.7Ω, 1 %, 0.1 W, 0603	RC0603FR-074R7L	YAGEO
R14	1	RES, 200 kΩ, 1 %, 0.1 W, 0603	RC0603FR-07200KL	YAGEO
R15, R16	2	RES, 200 Ω, 1 %, 0.1 W, 0603	RC0603FR-07200RL	YAGEO
R17	1	RES, 10 kΩ, 1 %, 0.1 W, 0603	RC0603FR-0710KL	YAGEO
R18	1	RES, 34.8 kΩ, 1 %, 0.1 W, 0603	RC0603FR-0734K8L	YAGEO
R19	1	RES, 0.8 Ω, 1 %, 0.25 W, 1206	RL1206FR-070R8L	YAGEO
R20	1	RES, 0.7 Ω, 1 %, 0.25 W, 1206	RL1206FR-070R7L	YAGEO
R21	1	RES, 0 Ω, 1 %, 0.1 W, 0603	ERJ-3GEY0R00V	Panasonic
R22	1	RES, 2.4 kΩ, 1 %, 0.1 W, 0603	RC0603FR-072K4L	YAGEO
R23	1	RES, 162 kΩ, 1 %, 0.1 W, 0603	RC0603FR-07162KL	YAGEO
R24	1	RES, 6.19 kΩ, 1 %, 0.1 W, 0603	RC0603FR-076K19L	YAGEO
R25	1	RES, 0 Ω, 5 %, 0.25 W, 1206	RC1206JR-070RL	YAGEO
R26	1	RES, 1 kΩ, 1 %, 0.1 W, 0603	RC0603FR-071KL	YAGEO
R27	1	RES, 1.5 kΩ, 1 %, 0.1 W, 0603	RC0603FR-071K5L	YAGEO
R28	1	RES, 18.7 kΩ, 1 %, 0.1 W, 0603	RC0603FR-0718K7L	YAGEO
RV1	1	Varistor, 430 V, 3.5 kA, 7.5 mm, TH	14D471K	BOURNS
RX1, RX2, RX3, RX4	4	RES, 2.4 MΩ, 1 %, 0.25 W, 1206	RC1206FR-072M4L	YAGEO
T1	1	Transformer, PQ2020, 1.4 mH, TH	750345875	Wurth Electronic
TP2, TP3, TP4, TP6, TP7, TP8, TP9, TP10, TP14, TP15	10	Test Point, Miniature, SMT	5015	Keystone
U2	1	SSR controller, SOT23-6	NEX80806DA	Nexperia
U3	1	Optocoupler, 5 kV, 130-260 % CTR, TH	FOD817B300	Onsemi
U4	1	Adjustable Precision Shunt Regulator	TL431AIDBZR,215	Nexperia

10. Transformer design

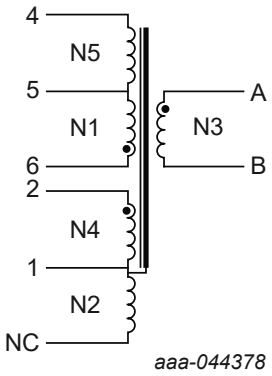


Fig. 14. Transformer diagram

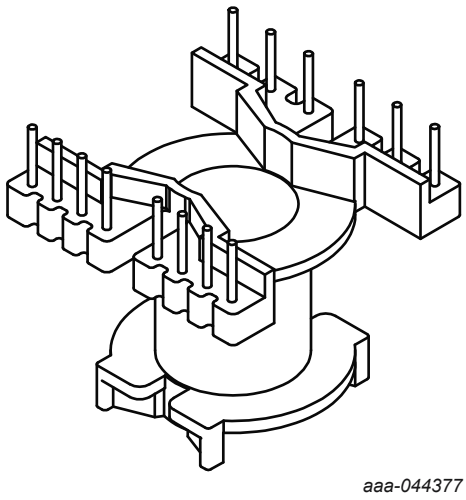


Fig. 15. Transformer design reference

Table 3. Transformer build diagram

Winding	Pins		Winding wires					
	Start	Finish	Wire type	Inner diameter / Parallels	Turns	Direction	Tape turns	Remark
N1	6	5	UEW	0.3 mm × 1p	36	clockwise	2	Wrap around a full layer
N2	1	NC	UEW	0.15 mm × 2p	12			
N3	A (white)	B (black)	Triple insulated wires	0.5 mm × 1p	14			
N4	2	1	UEW	0.15 mm × 2p	12			
N5	5	4	UEW	0.3 mm × 1p	36			

Transformer specifications:

- Core: PQ2020, PC95, A_e = 62 mm^2
- Bobbin: PQ2020, bobbin width = 11.7mm.
- Primary inductance (L_p): 1.4 mH ± 5 % (Measured at 100 kHz, 0.3 V between Pins 4-6).

Process requirements:

- Pin 1 must connect to the core, and the transformer must be fully covered with tape.
- The length of flying wire A and B must be 30 mm, tinned 5 mm, with a black sleeve added to wire B.
- The transformer must be vacuum-impregnated with oil, then dried at high temperature. After drying, the transformer must not have air bubbles.
- After drying, the transformer must pass the high voltage test at 3.6 kV 50Hz.

11. Revision history

Table 4. Revision history

Revision	Date	Description
UM90078 v.1	20251016	Initial version

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