

## NCP4306 Synchronous Rectification Evaluation Board User's Manual

### Description

This evaluation board user's manual describes a high efficiency synchronous rectification evaluation board that can easily replace a secondary side rectification diode in an SMPS.

The NCP4306 is used as synchronous rectification controller. The evaluation board has very few external components and illustrates how small and effective such a design can be.

The NCP4306 features a very precise 0 mV turn-off comparator that supports even very low current flowing through the MOSFET even when very low R<sub>DS(on)</sub> synchronous MOSFETs is used.

### Key Features

- Precise Turn-off Comparator
- Wide Input Voltage Range
- High Operation Frequency
- Strong MOSFET Driver
- High Efficiency
- Adjustable Minimum On and Off Times
- Adjustable Light Load Detection Feature
- Capable to Operate in Positive and Negative Branch
- Small Size

Table 1.

SMPS Type	Supply Voltage	Reverse Voltage	Effective Resistance
LLC	4 – 35 V	60 V	3.8 mΩ



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## EVAl BOARD USER'S MANUAL

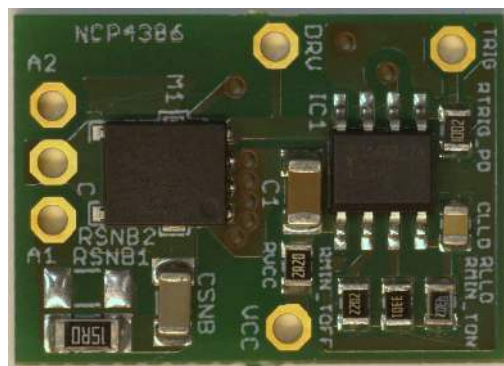


Figure 1. Evaluation Board Photo

CONNECTION DIAGRAM

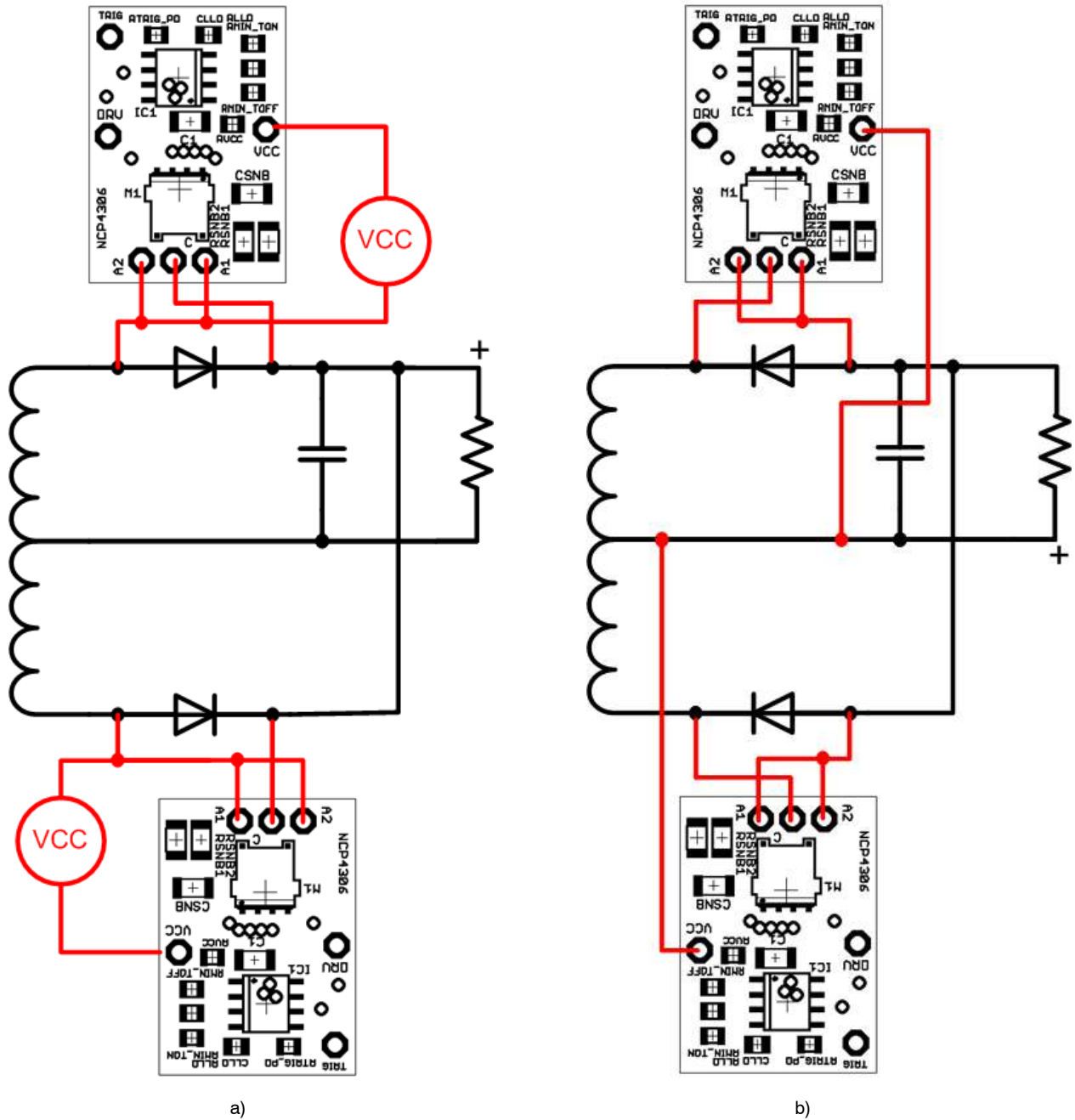


Figure 2. Possible Connections into Circuit

The evaluation board can be connected in circuit where the rectification diode is in the positive or negative branch. If connection to a positive branch is used, it is necessary to

use an external power supply (or auxiliary winding with rectification) to provide power to the evaluation board. VCC should be referenced to A1 or A2 points.

EVALUATION BOARD SCHEMATIC

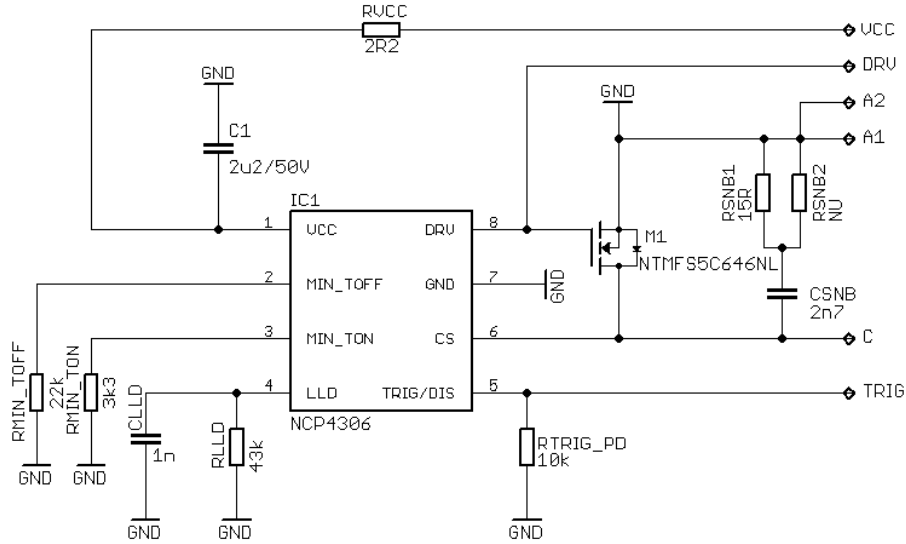


Figure 3. Schematic of the NCP4306

The evaluation board was designed to support a minimal external component count implementation. C1 is decoupling capacitor that should be placed as close as possible to the VCC and GND pins. Resistors RMIN\_TON and RMIN\_TOFF are used to set the protection interval when the synchronous MOSFET is turned on and off. It may be needed to adjust them according to used SMPS. Actual

setup is 2.2  $\mu$ s  $t_{MIN\_TOFF}$  and 330 ns  $t_{MIN\_TON}$ . RLLD sets light load detection time and CLLD is optional for LLD voltage decoupling. Components CSNB, RSNB1 and RSNB2 form a snubber circuit.

Transistor M1 is 60 V  $V_{DS}$  capable,  $R_{DS(on)}$  of 3.8 m $\Omega$  typ@10 V that should be enough for LLC with  $V_{OUT}$  up to 24 V.

CIRCUIT LAYOUT

The PCB consists of a 2 layer FR4 board with 35  $\mu\text{m}$  copper cladding. All components are surface mount and use 0805 and 1206 size for easy rework. Critical component such as blocking capacitor C1 has to be placed carefully near the IC. The synchronous driver path to the MOSFETs was done with very low resistance and parasitic inductance to

minimize emissions and minimize turn-on and turn-off times. The same is true for the CS pin. For the CS pin, a kelvin contact was done to be able to sense the voltage directly at the drain. Improper connection of the GND and CS connects can impact the turn-off process especially when a very low  $R_{\text{DS(on)}}$  MOSFETs are used.

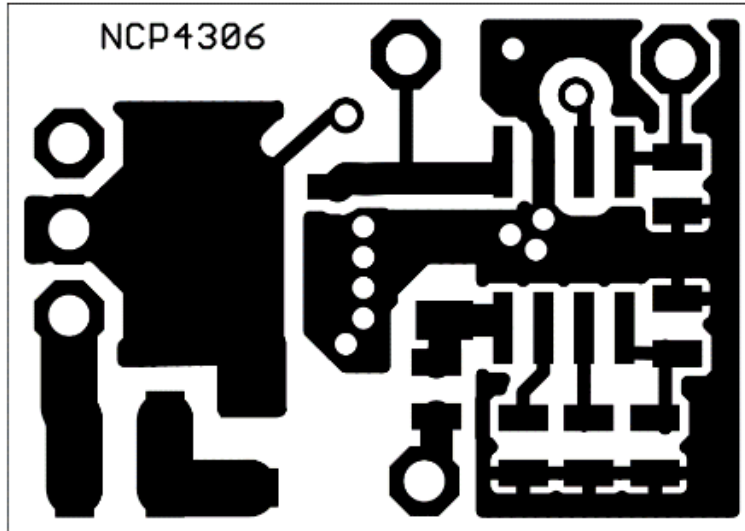


Figure 4. Top Layer

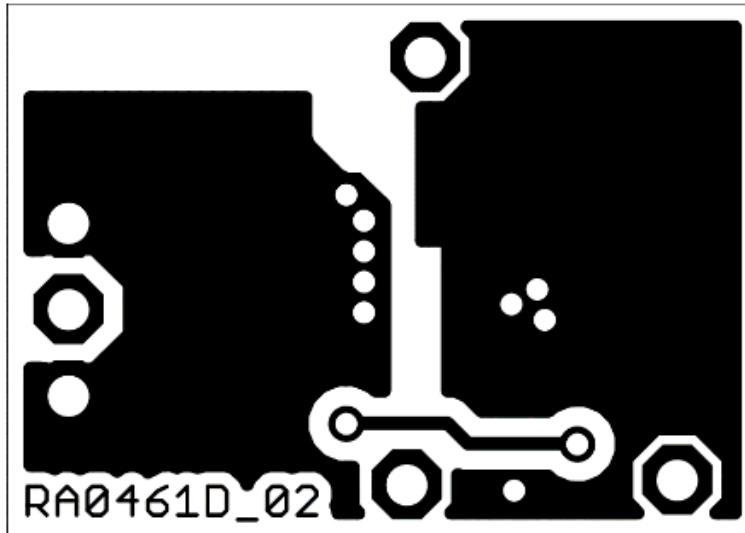


Figure 5. Bottom Layer

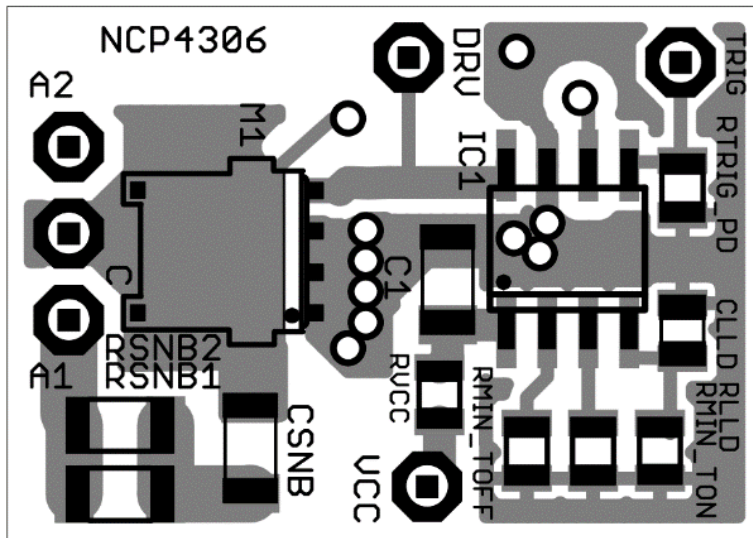


Figure 6. Top Side Components

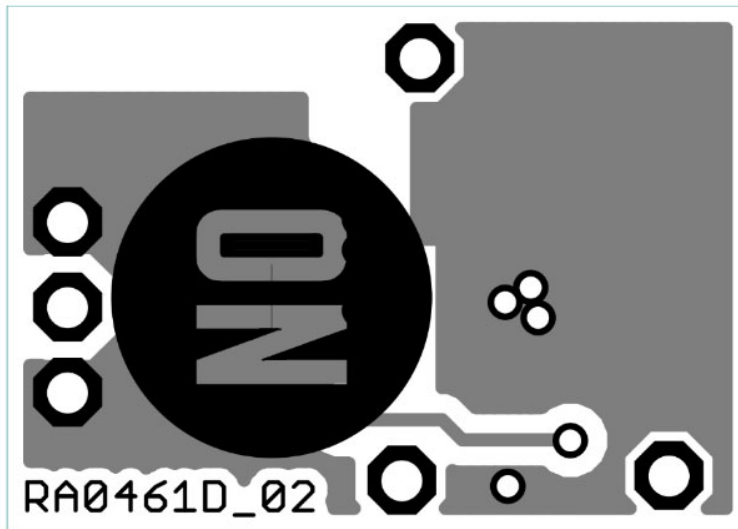


Figure 7. Bottom Side Components

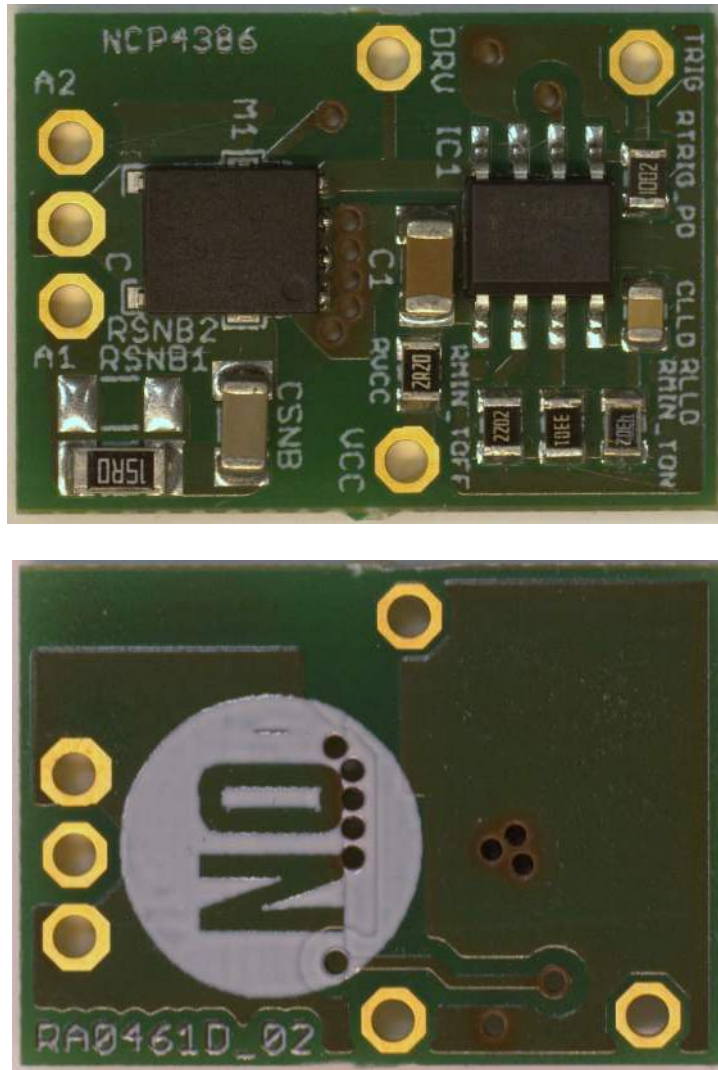


Figure 8. Evaluation Board Photos

# EVBUM2521/D

## BILL OF MATERIAL

**Table 2. BILL OF MATERIAL FOR THE NCP4306 PUT-IN BOARD SO8FL 60 V**

Designator	Qty	Description	Value	Tolerance	Footprint	Manufacturer	Manufacturer Part Number	Substitution Allowed
C1	1	Ceramic Capacitor	2.2 $\mu$ F / 50 V	10%	1206	KEMET	C1206C225K5RACTU	Yes
CLLD	1	Ceramic Capacitor	1 nF	20%	0805	KEMET	C0805C102M5RACTU	Yes
CSNB	1	Ceramic Capacitor	2.7 nF	10%	1206	TDK Corporation	C1206C273K5RACTU	Yes
IC1	1	Secondary Side Synchronous Rectification Controller	NCP4306AAHZZZA	-	SOIC-08	ON Semiconductor	NCP4306AAHZZZADR2G	No
M1	1	N-Channel Power MOSFET	FDB110N15A	-	SO-8FL	ON Semiconductor	NTMFS5C646NLT1	Yes
RVCC	1	Resistor SMD	2.2 $\Omega$	1%	0805	YAGEO	RC0805FR-072R2L	Yes
RLLD	1	Resistor SMD	43 k $\Omega$	1%	0805	YAGEO	RC0805FR-0743KL	Yes
R <sub>MIN_TOFF</sub>	1	Resistor SMD	22 k $\Omega$	1%	0805	YAGEO	RC0805FR-0722KL	Yes
R <sub>MIN_TON</sub>	1	Resistor SMD	3.3 k $\Omega$	1%	0805	YAGEO	RC0805FR-073K3L	Yes
R <sub>TRIG_PD</sub>	1	Resistor SMD	10 k $\Omega$	1%	0805	YAGEO	RC0805FR-0710KL	Yes
RSNB1	1	Resistor SMD	15 $\Omega$	1%	1206	YAGEO	RC1206FR-0715RL	Yes
RSNB2	1	Resistor SMD	NU	-	1206	-	-	Yes

NOTE: All components are Pb-Free.

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