

NCP4306 Synchronous Rectification Evaluation Board User's Manual



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EVAl 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_{DS(on)} 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

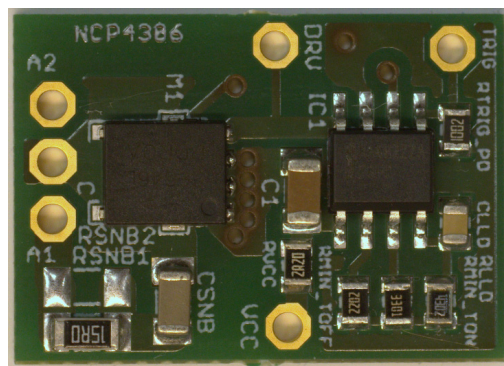


Figure 1. Evaluation Board Photo

Table 1.

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

CONNECTION DIAGRAM

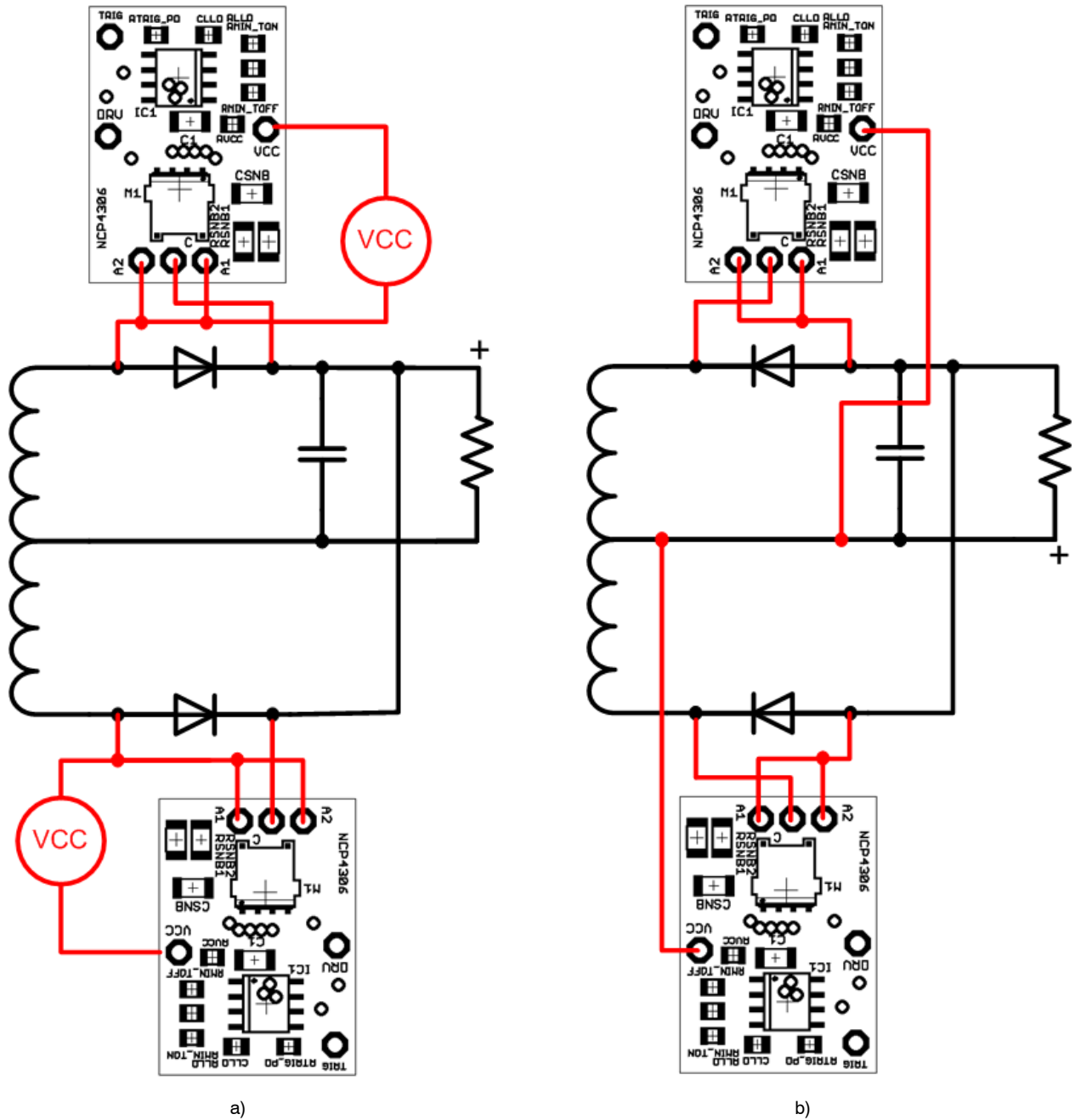


Figure 2. Possible Connections into Circuit

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

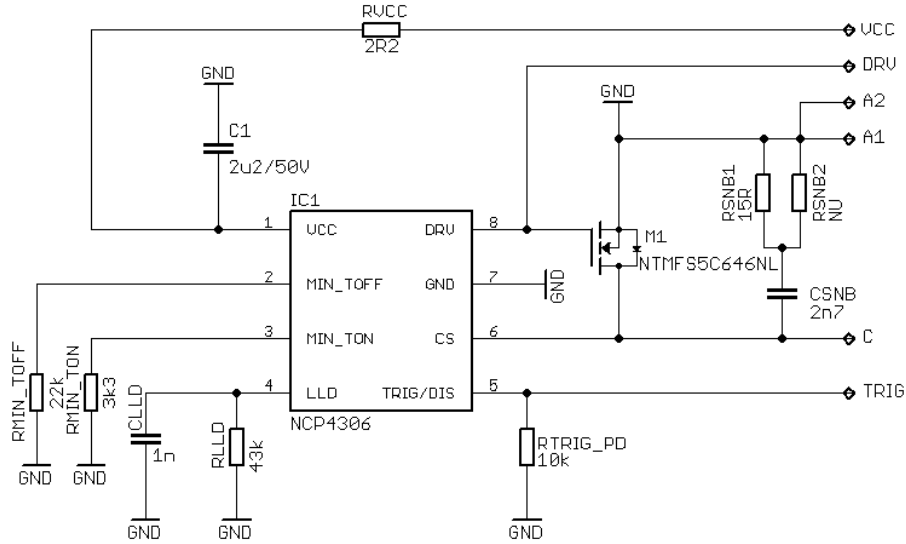


Figure 3. Schematic of the NCP4306

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 μ 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 Ω 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 μm 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.

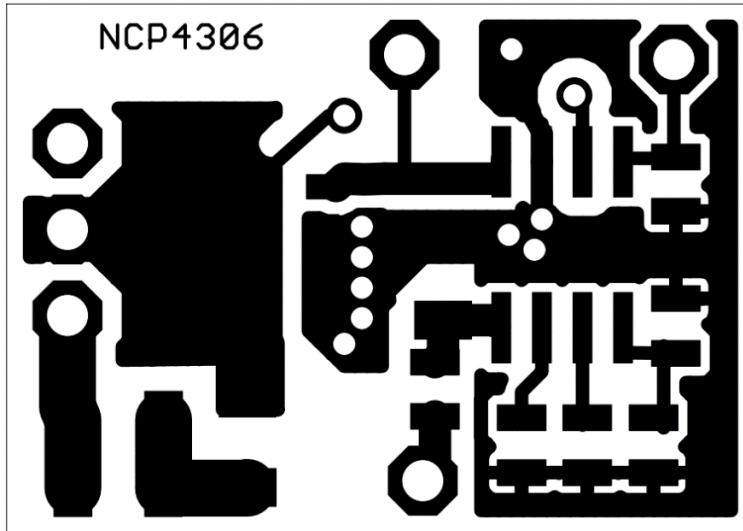


Figure 4. Top Layer

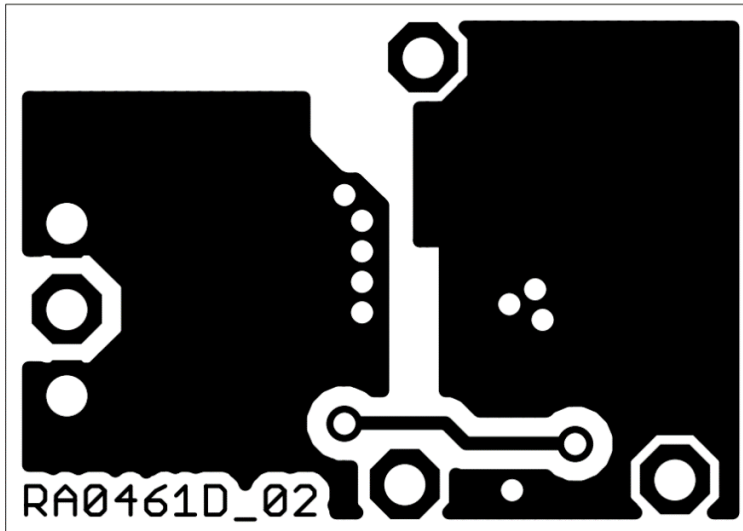


Figure 5. Bottom Layer

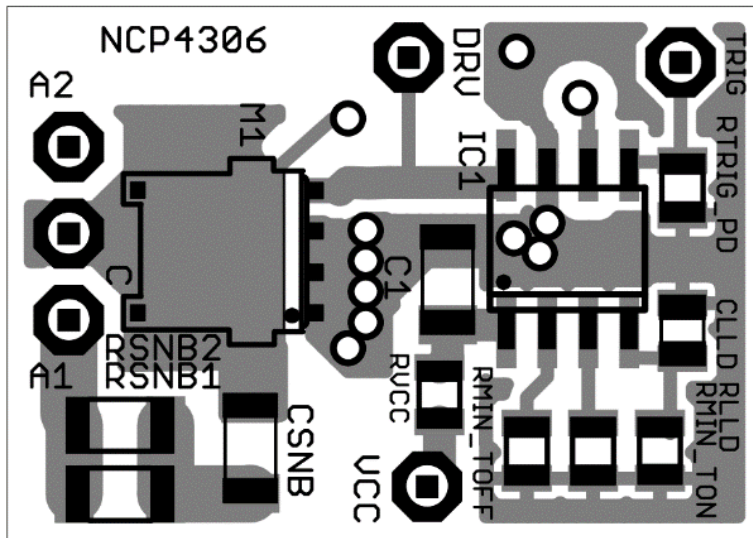


Figure 6. Top Side Components

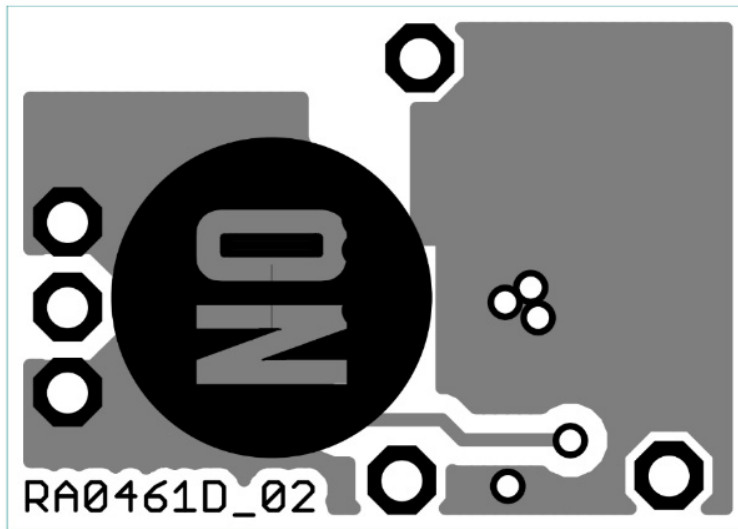


Figure 7. Bottom Side Components

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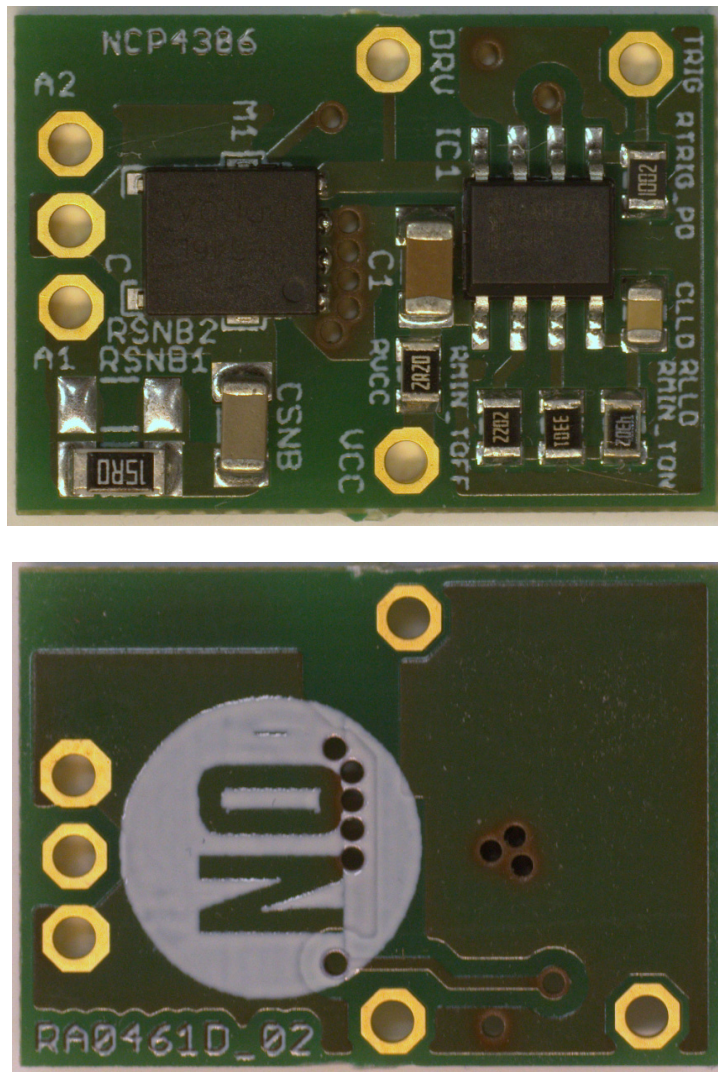


Figure 8. Evaluation Board Photos


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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 μ 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 | NCP4306AAHZZZAD R2G | No |
| M1 | 1 | N-Channel Power MOSFET | FDB110N15A | - | SO-8FL | ON Semiconductor | NTMFS5C646NLT1 | Yes |
| RVCC | 1 | Resistor SMD | 2.2 Ω | 1% | 0805 | YAGEO | RC0805FR-072R2L | Yes |
| RLLD | 1 | Resistor SMD | 43 k Ω | 1% | 0805 | YAGEO | RC0805FR-0743KL | Yes |
| R _{MIN_TOFF} | 1 | Resistor SMD | 22 k Ω | 1% | 0805 | YAGEO | RC0805FR-0722KL | Yes |
| R _{MIN_TON} | 1 | Resistor SMD | 3.3 k Ω | 1% | 0805 | YAGEO | RC0805FR-073K3L | Yes |
| R _{TRIG_PD} | 1 | Resistor SMD | 10 k Ω | 1% | 0805 | YAGEO | RC0805FR-0710KL | Yes |
| RSNB1 | 1 | Resistor SMD | 15 Ω | 1% | 1206 | YAGEO | RC1206FR-0715RL | Yes |
| RSNB2 | 1 | Resistor SMD | NU | - | 1206 | - | - | Yes |

NOTE: All components are Pb-Free.

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