

NCP4306 Synchronous Rectification Evaluation Board User's Manual



ON Semiconductor®

www.onsemi.com

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. NCP4306 can be used in application working in DCM and CCM without any additional circuits thanks to very low propagation delays and strong driver output.

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
- Small Size

EVAl BOARD USER'S MANUAL

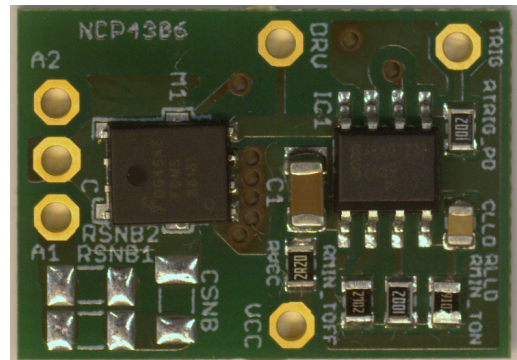


Figure 1. Evaluation Board Photo

Table 1.

| SMPS Type | Supply Voltage | Reverse Voltage | Effective Resistance |
|-------------|----------------|-----------------|----------------------|
| Flyback, QR | 4 – 35 V | 100 V | 3.3 mΩ |

CONNECTION DIAGRAM

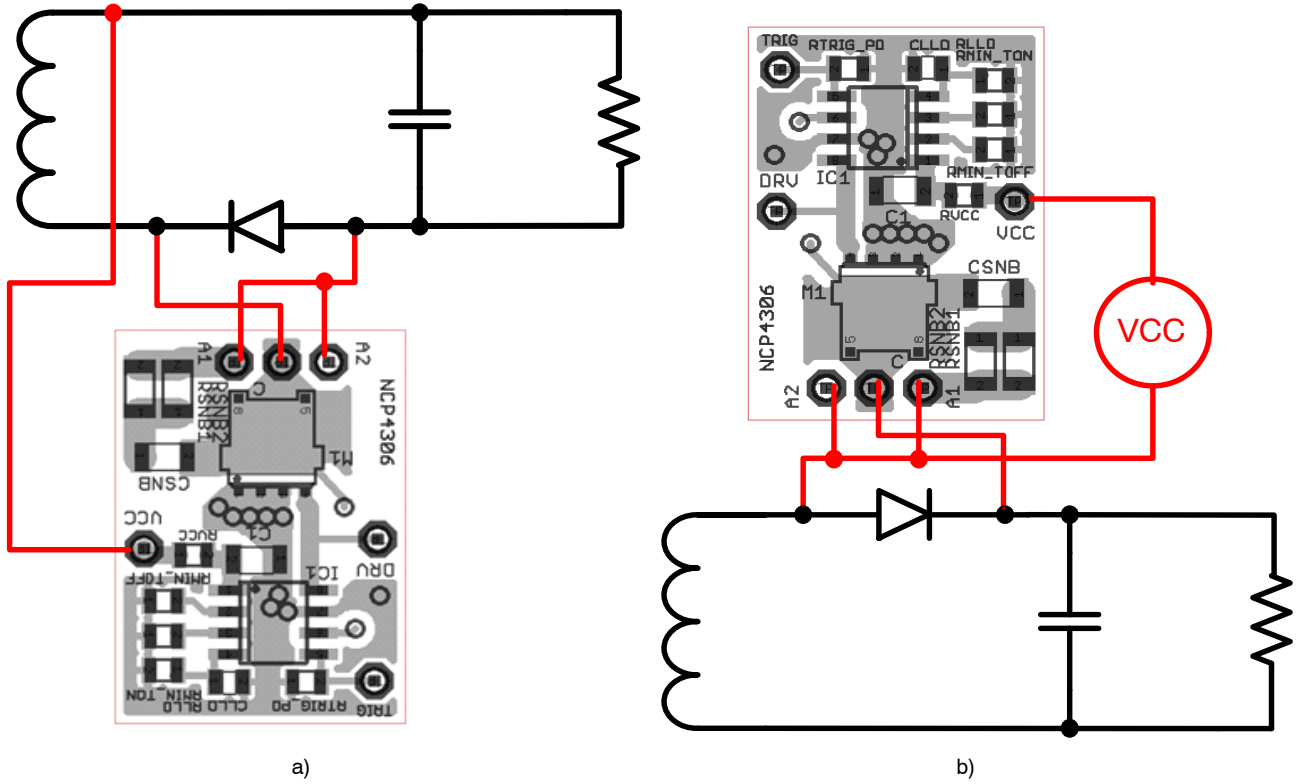


Figure 2. Possible Connections into Circuit

The evaluation board can be connected in circuit where the rectification diode is in the positive (Figure 2b) or negative (Figure 2a) branch. Connection to negative branch is simpler, VCC can be taken from SMPS VOUT if VOUT is in range of NCP4306 supply requirements. If connection

to a positive branch is used, it is necessary to use an external power supply, auxiliary winding with rectification or regulator supplied from transformer forward voltage (Figure 3) to provide power to the evaluation board. VCC should be referenced to A1 or A2 points.

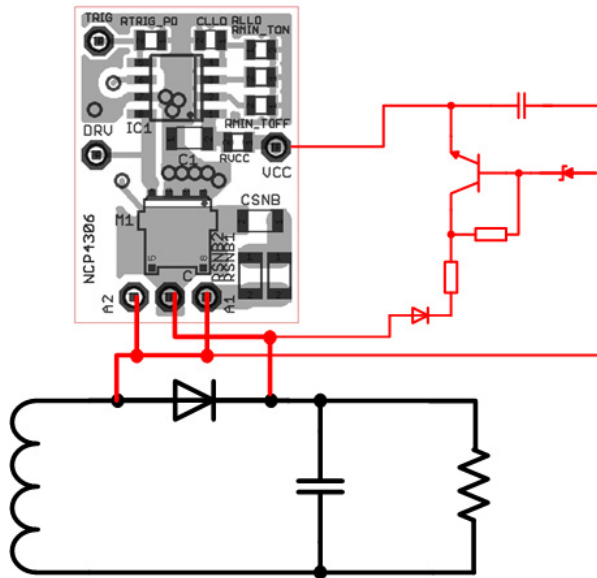


Figure 3. External Voltage Regulator for SR Supply

EVALUATION BOARD SCHEMATIC

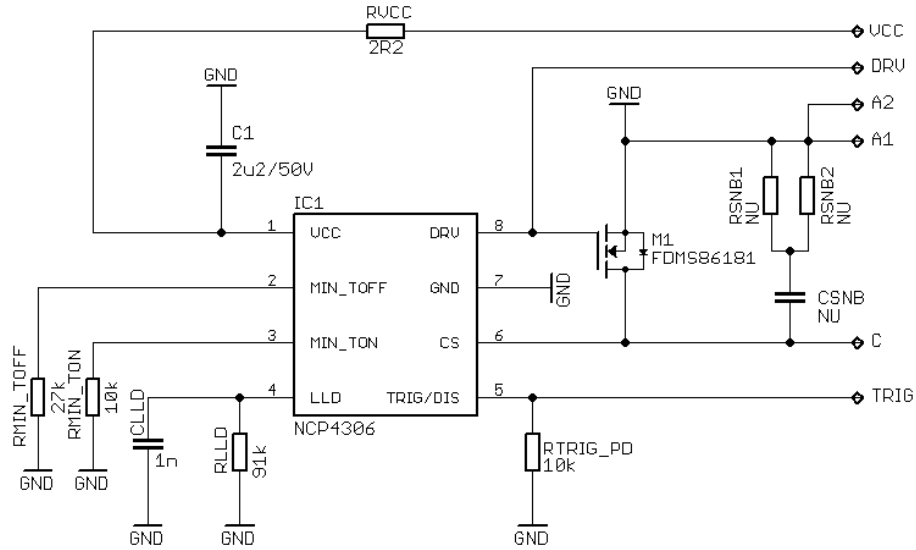


Figure 4. Schematic of the NCP4306

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. 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 100 V V_{DS} capable, $R_{DS(on)}$ of 3.3 m Ω typ@10 V with soft recovery body diode that allows to omit snubber circuit without ringing and overshoots at SR transistor drain.

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.

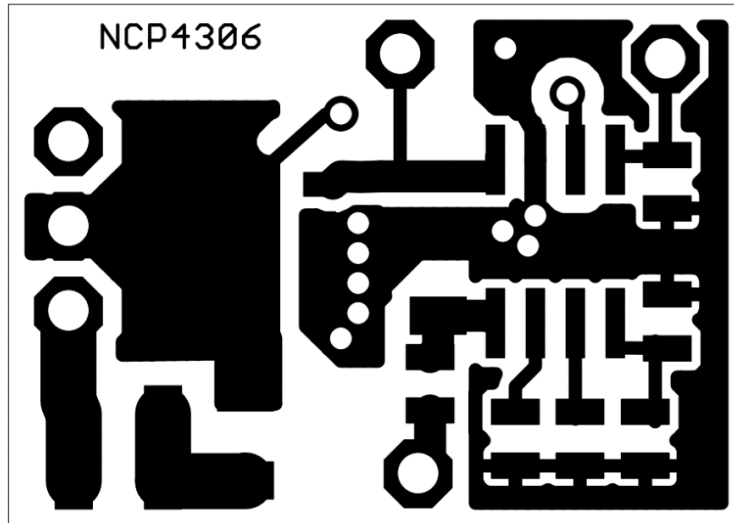


Figure 5. Top Layer

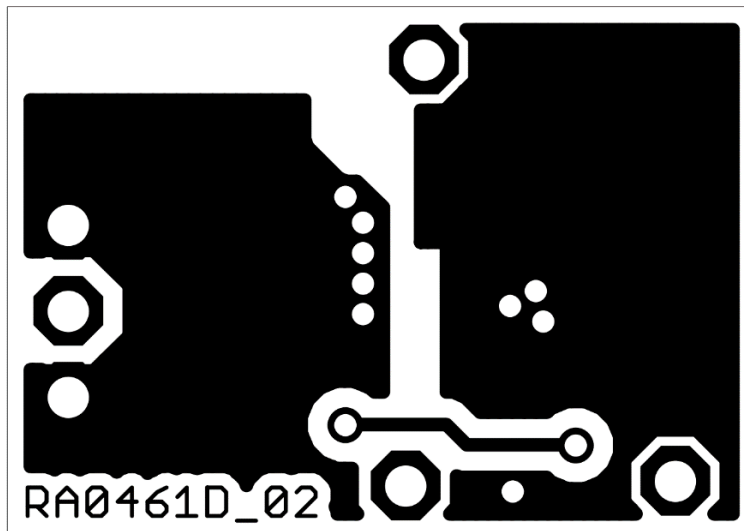


Figure 6. Bottom Layer

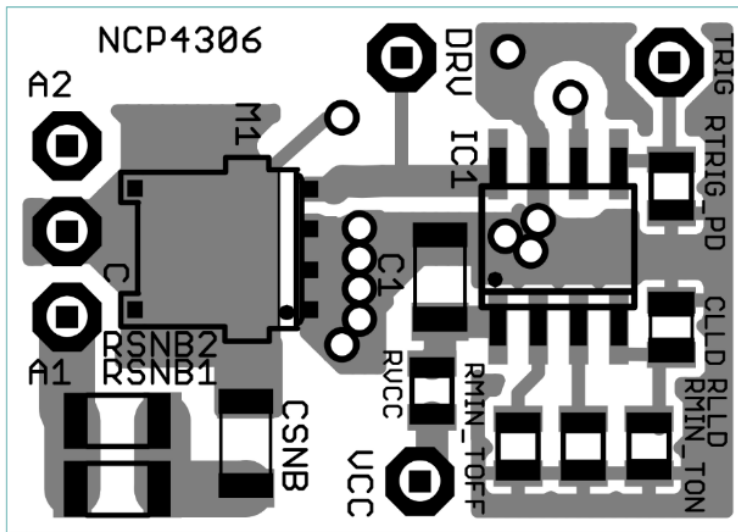


Figure 7. Top Side Components

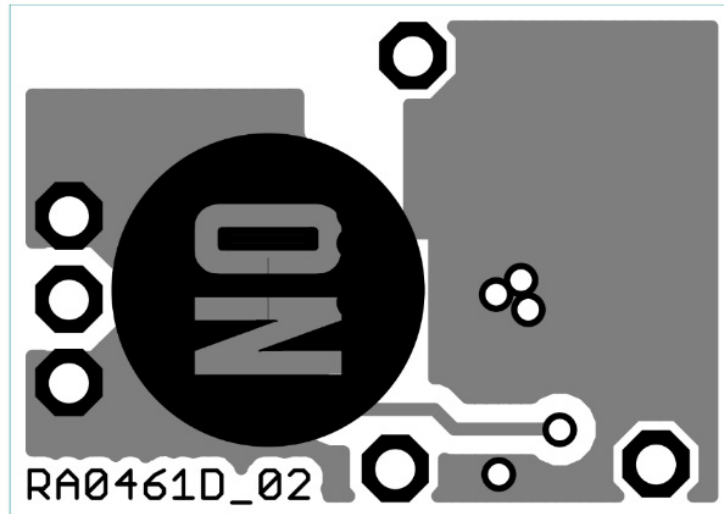


Figure 8. Bottom Side Components

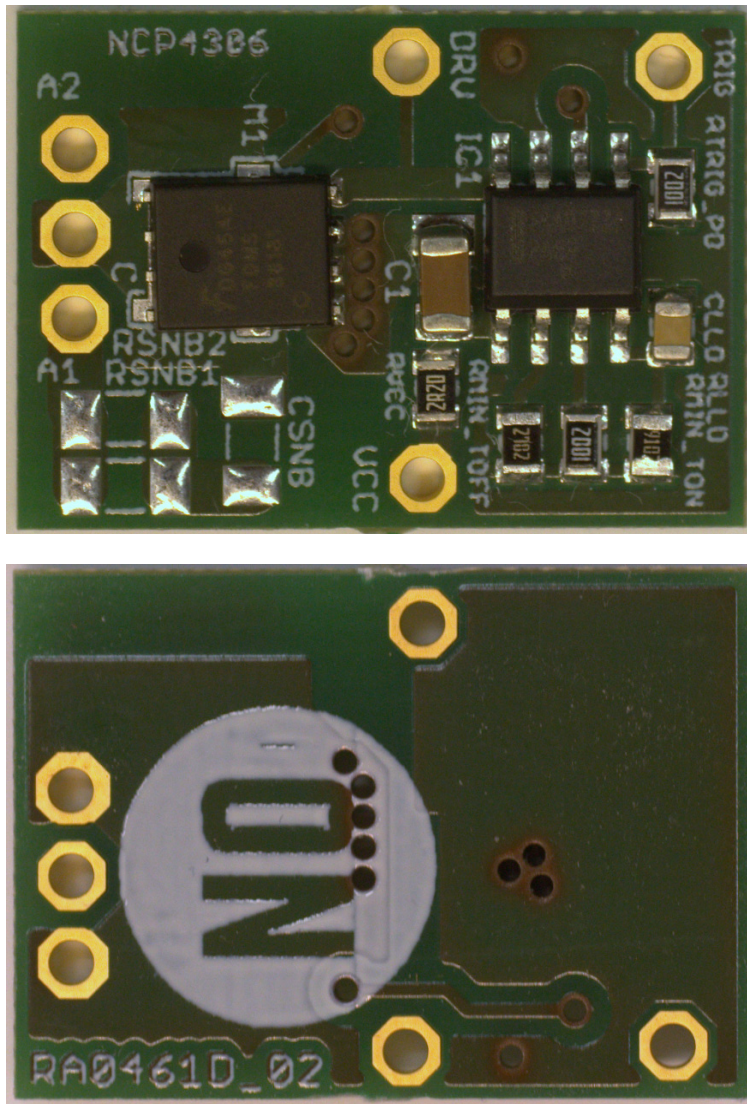


Figure 9. Evaluation Board Photos


EVBUM2522/D

BILL OF MATERIAL

Table 2. BILL OF MATERIAL FOR THE NCP4306 PUT-IN BOARD SO8FL 100 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 | NU | - | 1206 | - | - | Yes |
| IC1 | 1 | Secondary Side Synchronous Rectification Controller | NCP4306AADZZA | - | SOIC-08 | ON Semiconductor | NCP4306AADZZAD R2G | No |
| M1 | 1 | N-Channel Power MOSFET | FDMS86181 | - | Power 56 | ON Semiconductor | FDMS86181 | 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} , R _{TRIG_PD} | 2 | Resistor SMD | 10 k Ω | 1% | 0805 | YAGEO | RC0805FR-0710KL | Yes |
| RSNB1, RSNB2 | 2 | Resistor SMD | NU | - | 1206 | - | - | Yes |

NOTE: All components are Pb-Free.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative