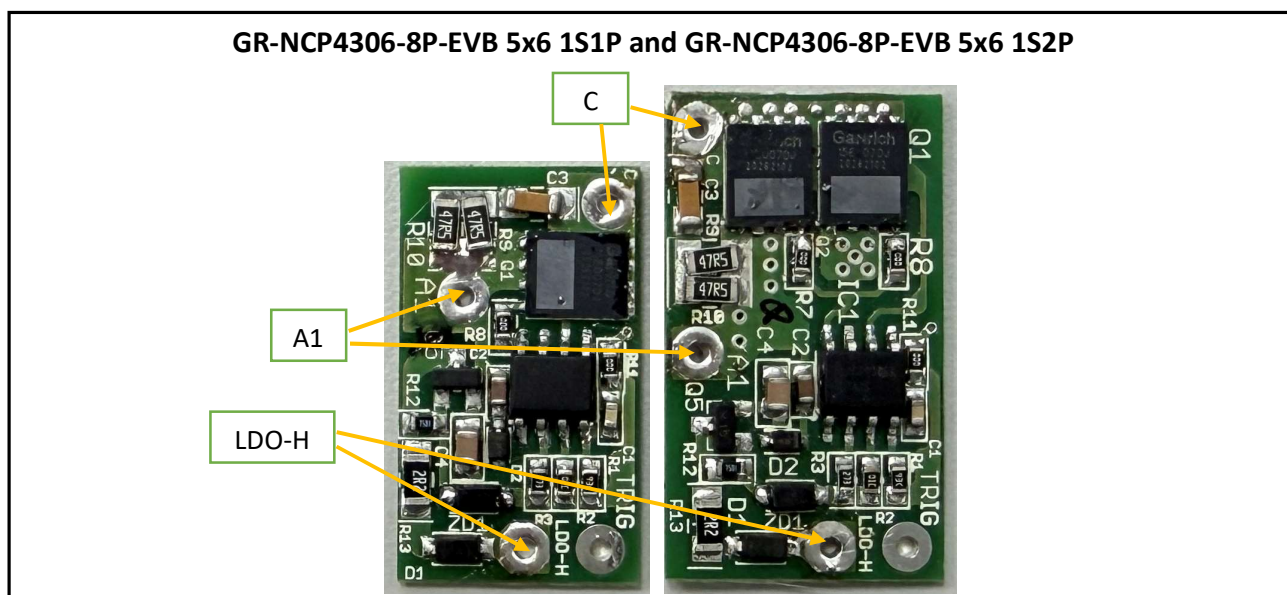


GR-NCP4306-8P-EVB 5x6 1S1P,1S2P application note

Description

The **GR-NCP4306-8P-EVB** is a compact, easy-to-use secondary side synchronous rectification switching controller integrated with GaNFETs. It is assembled based on an onsemi controller and GaNrich power devices. The EVB-module can be configured in LLC-SR, Flyback-SR, or other resonant topologies. The EVB-module features a highly integrated power module with two **GR-15E007DJ 150V 7mΩ** GaN FETs driven by a high-frequency gate driver. The module can deliver up to 3A (1S1P configuration) of current under adequate thermal management (such as forced air cooling or an external heat sink).



Key Specifications

Part Number	GR-NCP4306-8P-EVB 5x6 1S1P / GR-NCP4306-8P-EVB 5x6 1S2P
LDO-H	Under 35V
$V_{(TR)DSS}$	150V
$R_{DS(ON)}$, typ.	7mΩ(single)
Q_G , typ.	1nC
Package	14.5 x 25 x 1.2 (mm) / 16.5 x 29 x 1.2 (mm)

Features

- **GaN FET Driving Capability:**

Integrated 5V gate clamp tailored specifically to safely drive enhancement-mode Gallium Nitride (GaN) FETs. Ultra-Low R_{DS(on)}: Typ. 7mΩ for single GaN-FETs to minimize conduction losses.

- **Ultra-Fast Turn-Off Delay:**

Typ. 15ns propagation delay from current sense input to driver output to protect against shoot-through in CCM.

- **Adjustable Blanking Periods:**

Independently programmable Minimum ON-Time and Minimum OFF-Time to suppress PCB layout ringing.

Applications

- High-Power-Density AC/DC Adapters (USB-PD / Type-C Chargers).
- Notebook and Gaming Console Power Supplies.
- Resonant LLC Half-Bridge and Forward Converters.
- Flyback (CCM, DCM, QR) Switch-Mode Power Supplies.
- High-Efficiency Server and Telecom Power Modules.

1- Evaluation Module Overview

1.1 Introduction

Module Description: The NCP4306-GAN-EVB is a high-efficiency secondary-side synchronous rectification (SR) evaluation module designed to seamlessly replace standard lossy rectification diodes in switch-mode power supplies (SMPS). The EVM features the [onsemi NCP4306](#) high-performance SR controller paired with an ultra-low R_{DS(on)} 150V 7mΩ GaN FET. This manual details the technical layout, component list, and standard procedures required to power up, optimize, and safely evaluate the high-frequency switching performance of this module.

Operating Setup: This evaluation module can be implemented in either the positive or negative branch of Flyback, QR, or LLC topologies. It utilizes an internal Kelvin connection method to sense the GaN FET's drain-to-source voltage drops with high precision. An external input voltage (LDO-H: 4.0V to 35V) is required to power the controller, while the output stage can easily handle high-current rectification up to 100W+ when provided with appropriate cooling.

1.2 Specification

Parameter	Specifications
V _{DS} : Input voltage (C-A1)	0V to 100V (recommended)
LDO-H: Input supply voltage	0 V to 35 V
Maximum power	Single (140W) ; Dual (300W)
Switching frequency	Base on Primary Side controller
Board dimensions	14.5 mm × 25 mm × 1.2 mm (single) 16.5 mm × 29 mm × 1.2 mm (Dual)

1.3 Device Information

The NCP4306 is an advanced, self-contained secondary-side controller specifically designed to maximize SMPS efficiency. By substituting a Silicon MOSFET or Schottky diode with a GaN FET, the driver utilizes its internal 5V clamp to prevent gate overvoltage. The system features an ultra-fast 15ns trigger/disable interface for deep Continuous Conduction Mode (CCM) topologies, allowing it to instantly turn off the GaN switch before primary-side turn-on.

2- Hardware

2.1 EVM External Interface Pin Definition

Pin	Description
LDO-H	The high-voltage input terminal. It is connected to the secondary or auxiliary winding V+ to power the LDO of NCP4306.
C	GaN FET Drain.
A1	GaN FET Source.
TRIG	Test Pin for Debug.

2.2 Power-Up Procedure

2.2.1 Step 1: VCC Initialization

Provide a bias supply voltage (recommended 5V to 35V) to the LDO-H pin relative to the A1 source pin. The internal LDO will then initialize a stable VCC for NCP4306. Ensure the voltage on LDO-H does not exceed the 35V absolute maximum rating of NCP4306. Once VCC is stable, the controller will stand by for primary-side switching detection.

2.2.2 Step 2: Main Transformer/Secondary Energization

Slowly energize the primary-side controller or main AC input to introduce switching waveforms to the secondary-side transformer winding. The NCP4306 will utilize its self-synchronization capability to automatically lock onto the primary frequency, starting SR operation safely without requiring an explicit primary-to-secondary synchronization link.

2.2.3 Step 3: Probing the DS

To verify synchronous rectification action, hook up an oscilloscope probe across the GaN FET's drain and source terminals. Crucial: Use a rigid, ultra-short spring pigtail ground ring for your probe instead of standard long alligator ground wires. Because GaN transitions have a high $dv/dt > 100V/ns$, long ground paths generate fake ringing artifacts on your scope that don't match the true performance of the module.

2.3 Power-Down Procedure

To safely turn off the evaluation system, execute the setup steps in reverse order:

1. Turn off the output load connected to the module.
2. Disable the main primary-side AC input supply.

3- Hardware Design Files

3.1 Schematic

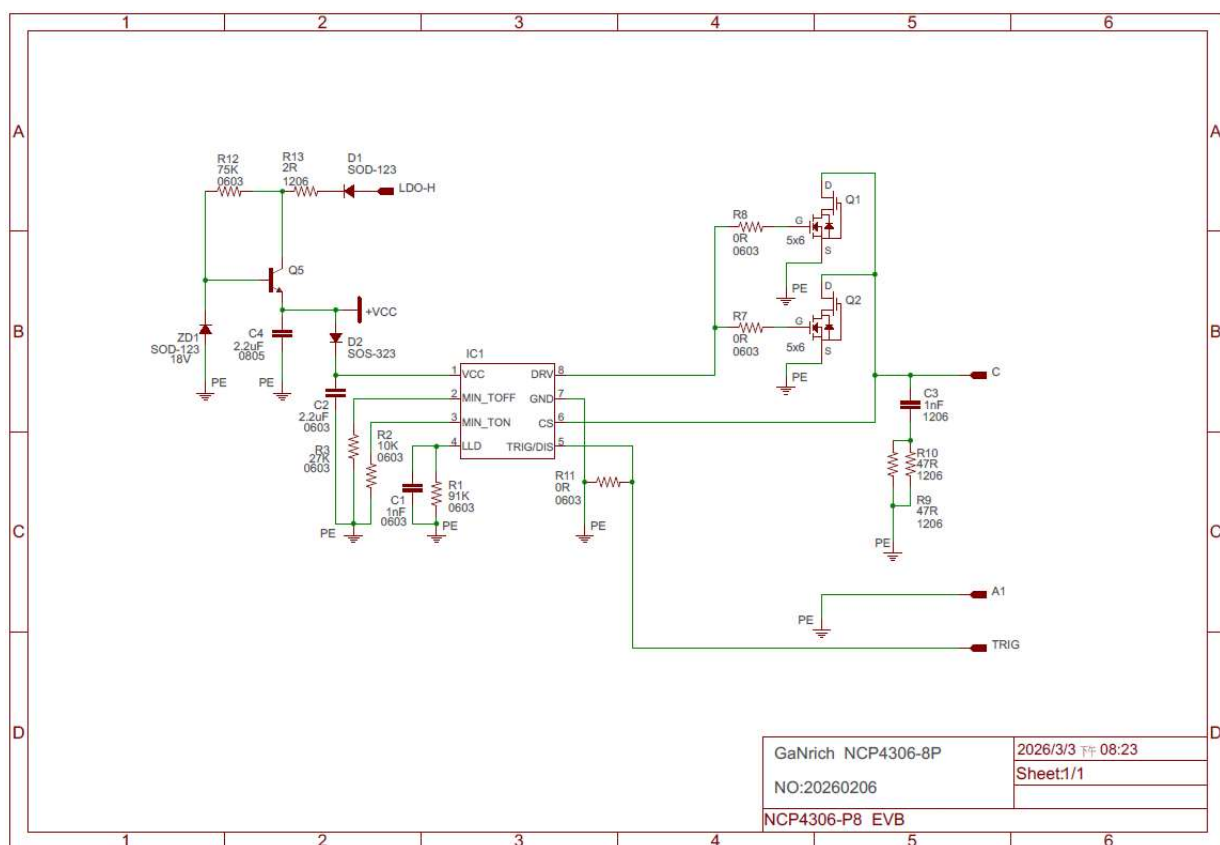


Figure 3.1 GR-NCP4306-8P-EVB 1S2P Schematic

3.2 PCB



Figure 3.2.1 GR-NCP4306-8P-EVB 1S1P

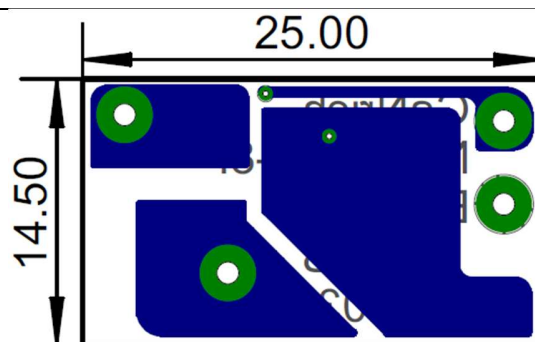
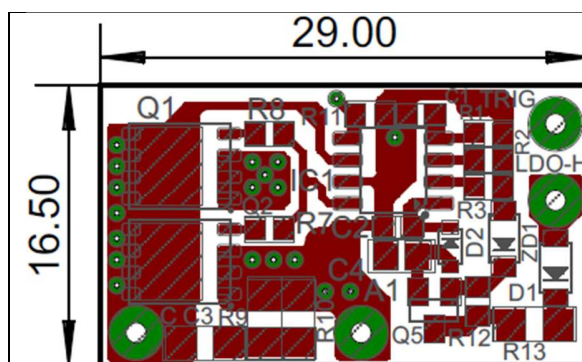


Figure 3.2.2 GR-NCP4306-8P-EVB 1S1P



4.3 Bill of Materials (1S1P) (Add Q2 for 1S2P)

Designator	Value	Package	Qty	Manu
R1	91K	0603	1	Yageo
R2	10k	0603	1	Yageo
R3	27k	0603	1	Yageo
R7	0	0603	1 (For 1S2P only)	Yageo
R8	0	0603	1	Yageo
R9	47R	1206	1	Yageo
R10	47R	1206	1	Yageo
R11	0	0603	1	Yageo
R12	75k	0603	1	Yageo
R13	2R	1206	1	Yageo
ZD1	18V	SOD-123	1	Diodes Inc
D1	60V 1A Diode	SOD-123	1	Diodes Inc
D2	30V 1A Diode	SOD-323	1	Diodes Inc
C1	1nF 50V	0603	1	Yageo
C2	2.2uF 50V	0603	1	Yageo
C3	1nF 200V	1206	1	Yageo
C4	2.2uF 50V	0805	1	Yageo
Q1	GrNrich GR-15E007DJ	5x6	1	GaNrich
Q2	GrNrich GR-15E007DJ	5x6	1 (For 1S2P only)	GaNrich

4- Additional Information

5.1 Trademarks

All trademarks are the property of their respective owners.

WARNING

These evaluation kits are designed exclusively for trained engineering professionals who possess a thorough understanding of the hazards and technical risks involved in working with electro-mechanical hardware and systems.

Users must operate the Evaluation Kit in accordance with GaNrich's specifications, standard safety precautions, and all relevant legal and environmental regulations. Proper setup—including strict adherence to GaNrich's guidelines for electrical ratings on inputs, outputs, and loads—is mandatory. Neglecting these operating parameters or setup instructions can lead to severe property damage, serious injury, or death.