NCV898031SEPGEVB

NCV898031 Automotive Grade High-Frequency SEPIC Controller Evaluation Board User's Manual

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EVAL BOARD USER'S MANUAL

Description

This NCV898031 evaluation board provides a convenient way to evaluate a high-frequency current-mode control SEPIC converter design. The topology uses two inductors. No additional components are required, other than dc supplies for the input and enable voltages. The output is rated 7 V/8.5 W with a 2 MHz switching frequency over the typical 6 V to 18 V automotive input voltage range.

Key Features

- 7 V/1.22 A Output
- 2 MHz Switching Frequency
- Input Undervoltage Lockout
- Internal Soft-Start
- Wide Input Voltage of 6 V to 40 V
- Regulates through Load Dump Conditions
- Automotive Grade

Figure 1. NCV898031 SEPIC Evaluation Board

Table 1. EVALUATION BOARD TERMINALS

Terminal	Function
V_{IN}	Positive DC Input Voltage
GND	Common DC Return
V_{OUT}	Regulated DC Output Voltage
EN	Enable Input

Table 2. ABSOLUTE MAXIMUM RATINGS (Voltages are with respect to GND)

Rating	Value	Unit
DC Supply Voltage (V_{IN})	−0.3 to 40	V
DC Supply Voltage (EN)	−0.3 to 6	V
Junction Temperature	−40 to 150	°C
Ambient Temperature (Evaluation Board)	−40 to 105	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Table 3. ELECTRICAL CHARACTERISTICS

(T_A = 25°C, 4.5 V ≤ V_{IN} ≤ 40 V, V_{EN} = 2 V, V_{OUT} = 3.3 V, 0 ≤ I_{OUT} ≤ 1.2 A, unless otherwise specified)

Characteristic	Condition	Typical Value	Unit
Switching			
Switching Frequency	–	2	MHz
Soft-Start Time	–	650	μs
Current Limit			
Cycle-by-Cycle Current Limit (FET)	–	4	A
Protections			
Input Undervoltage Lockout (UVLO)	V_{IN} Decreasing	< 6 (Note 1)	V
Input Undervoltage Lockout (UVLO)	V_{IN} Increasing	6.7	V
Thermal Shutdown	T_A Increasing	170	°C

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. NCV898031 IC UVLO is 3.05 V (V_{IN} falling). The demo board current limit resistor was selected to limit power when V_{IN} is reduced below 6 V. See Point 3 from Test Procedure.

PCB LAYERS

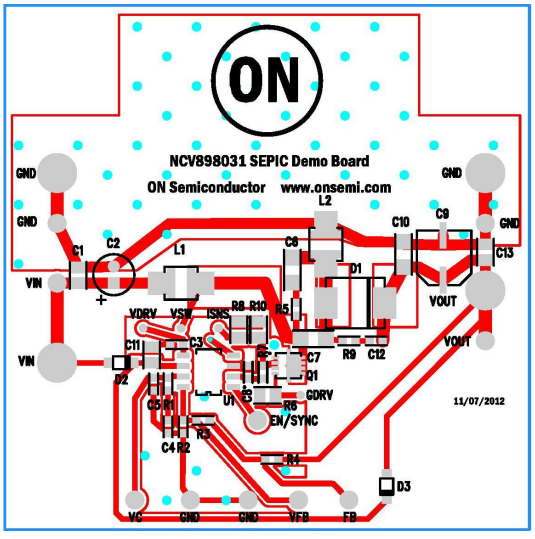

Figure 2. Top View

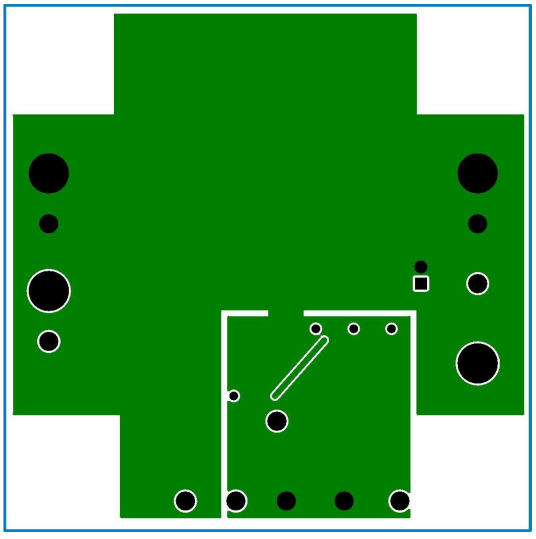

Figure 3. Bottom View

TYPICAL PERFORMANCE

Start-up

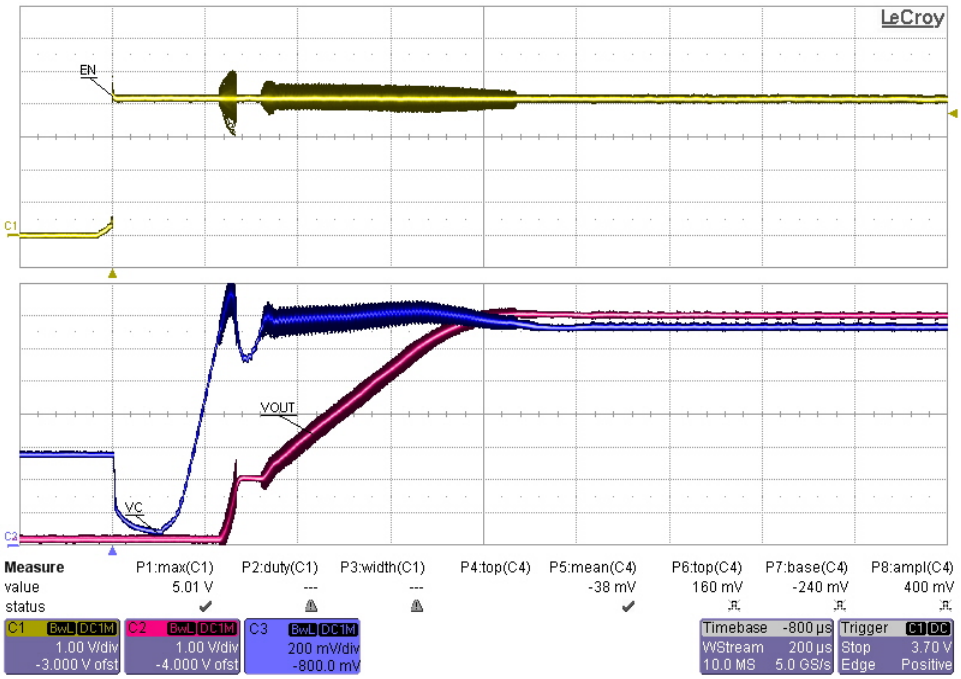

Figure 4. Typical Start-up with V_{IN} = 12 V, I_{OUT} = 1.22 A

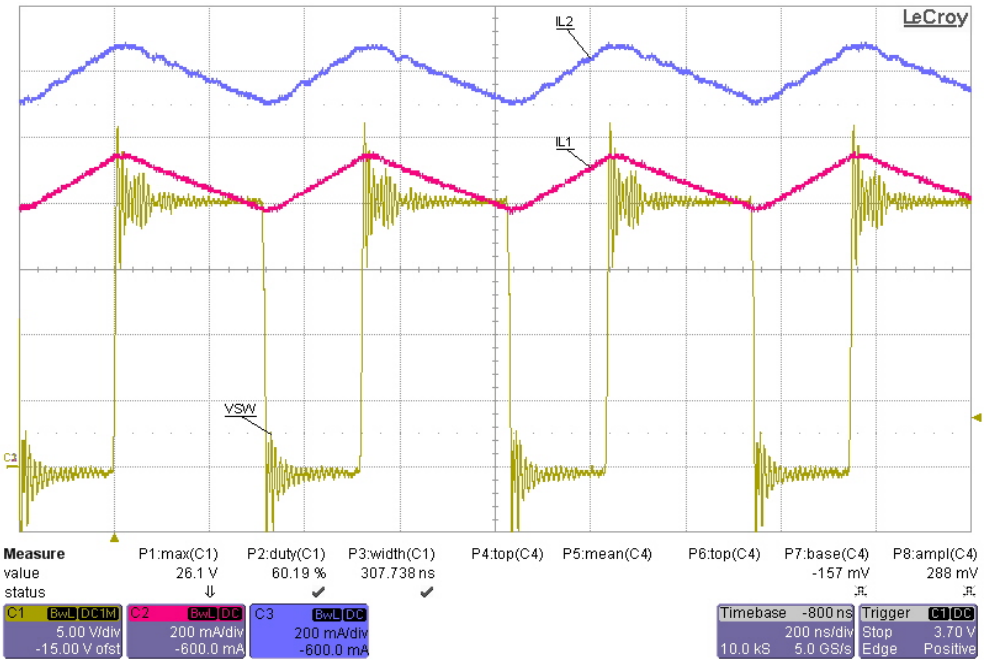

Figure 5. Operational Waveforms, V_{IN} = 12 V, RI$_{OUT}$ = 1.22 A

SCHEMATIC

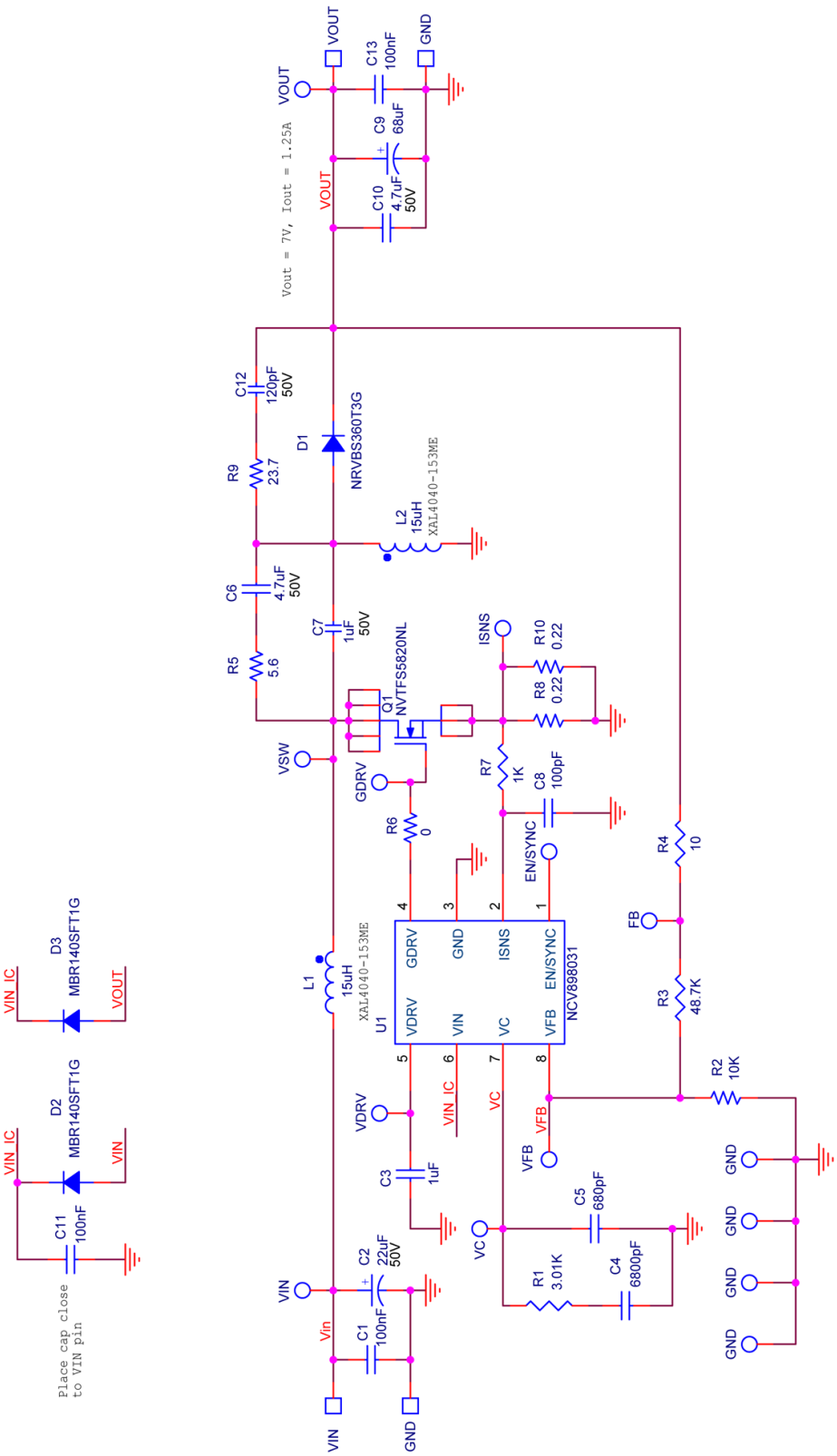

Figure 6. NCV898031 SEPIC Evaluation Board Schematic

Table 4. BILL OF MATERIALS

Reference Designator(s)	Quantity	Description	Footprint	Manufacturer's Part Number	Vendor Part #
C1, C11, C13	3	CAP CER 0.1 μF 50 V 10% X7R 0805	805	GRM21BR71H104KA01L	490-1666-1-ND
C2	1	CAP ALUM 10 μF 50 V 20% RADIAL	CAP_RAD_5X11	EKZE500ELL100ME07D	565-1702-ND
C3	1	CAP CER 1 μF 16 V 10% X7R 0603	603	GCM188R71C105KA64D	490-5241-1-ND
C4	1	CAP CER 6800PF 50 V 10% X7R 0603	603	GRM188R71H682KA01D	490-1508-1-ND
C5	1	CAP CER 680PF 50 V 5% NP0 0603	603	GRM1885C1H681JA01D	490-1447-1-ND
C6, C10	2	CAP CER 4.7 μF 50 V 10% X7R 1206	1206	C3216X7R1H475K	445-8032-1-ND
C7	1	CAP CER 1 μF 50 V 10% X7R 1206	1206	GCM31MR71H105KA55L	490-4795-1-ND
C8	1	CAP CER 100 pF 50 V 5% NP0 0603	603	GCM1885C1H101JA16D	490-4767-1-ND
C9	1	CAP HYBRID CONDUCTIVE POLYMER 68 μF 10 V 20%	SUNCON_6p6CAP	10HVA68M	SUNCON
C12	1	CAP CER 120 pF 50 V 5% NP0 0603	603	GRM1885C1H121JA01D	490-1429-1-ND
D1	1	60 V, 3.0 A Schottky Rectifier	SMC_DIODE	NRVBS360T3G	ON Semiconductor
D2, D3	2	DIODE SCHOTTKY 40 V 1 A SOD123FL	SOD_123	MBR140SFT1G	ON Semiconductor
L1, L2	2	High Temp SMT Power Inductor 15 μH 2.8 A	XAL4040	XAL4040-153ME	XAL4040-153ME
Q1	1	N-CHANNEL MOSFET, LL, 60 V 11.5 mΩ	WDFN8	NVTFS5820NL	ON Semiconductor
R1	1	RES 3.01 kΩ 1/10 W 1% 0603 SMD	603	CRCW06033K01FKEA	541-3.01KHCT-ND
R2	1	RES 10.0 kΩ 1/10 W 1% 0603 SMD	603	CRCW060310K0FKEA	541-10.0KHCT-ND
R3	1	RES 48.7 kΩ 1/10 W 1% 0603 SMD	603	CRCW060348K7FKEA	541-48.7KHCT-ND
R4	1	RES 10.0 Ω 1/10 W 1% 0603 SMD	603	CRCW060310R0FKEA	541-10.0HCT-ND
R5	1	RES 5.6 Ω 1/10 W 5% 0603 SMD	603	CRCW06035R60JNEA	541-5.6GCT-ND
R6	1	RES 0.0 Ω 1/8 W 0805 SMD	805	CRCW08050000Z0EA	541-0.0ACT-ND
R7	1	RES 1.00 kΩ 1/10 W 1% 0603 SMD	603	CRCW06031K00FKEA	541-1.00KHCT-ND
R8, R10	2	RES .22 Ω 1/3 W 1% 0805 SMD	805	RL1220S-R22-F	CSR1206FK25L0TR-ND
R9	1	RES 23.7 Ω 1/10 W 1% 0603 SMD	603	CRCW060323R7FKEA	541-23.7HCT-ND
TP1, TP3, TP4, TP7, TP8, TP14, TP15, TP16, TP17	9	PIN INBOARD .042″ HOLE 1000/PKG	TP	K24C/M	V1055-ND
TP2, TP5, TP6, TP9	4	CIRCUIT PIN PRNTD .020″D .425″L	SMALLTP	3128-2-00-15-00-00-08-0	ED90324-ND
TP10, TP11, TP12, TP13	4	TERM SOLDER TURRET .219″ .109″L	TURRET	2501-2-00-44-00-00-07-0	2501-200440000070-ND
U1	1	2 MHz Non-Synchronous SEPIC/Boost Controller	SOIC8_N_ADJ	NCV898031D1R2G	ON Semiconductor

TEST PROCEDURE

1. Connect a DC input voltage, within the 6 V to 40 V range, between V_{IN} and GND.
2. Connect a DC enable voltage, within the 2.0 V to 5.0 V range, between EN/SYNC and GND.
3. The evaluation board feedback components were selected to for continuous operation at rated 7 V/1.22 A output power at a minimum input voltage of 6 V. The NCV898031 V_{IN} has its operational voltage diode-ored between the converter output and input voltages. The converter turns-on typically at 6.7 V (V_{IN} rising). Once energized, the output voltage supplies power to the IC when the battery voltage is less than the IC V_{IN} input voltage. The decreasing V_{IN} UVLO voltage depends on load current as well as V_{IN}, and will be less than 6 V when operating below rated output current.

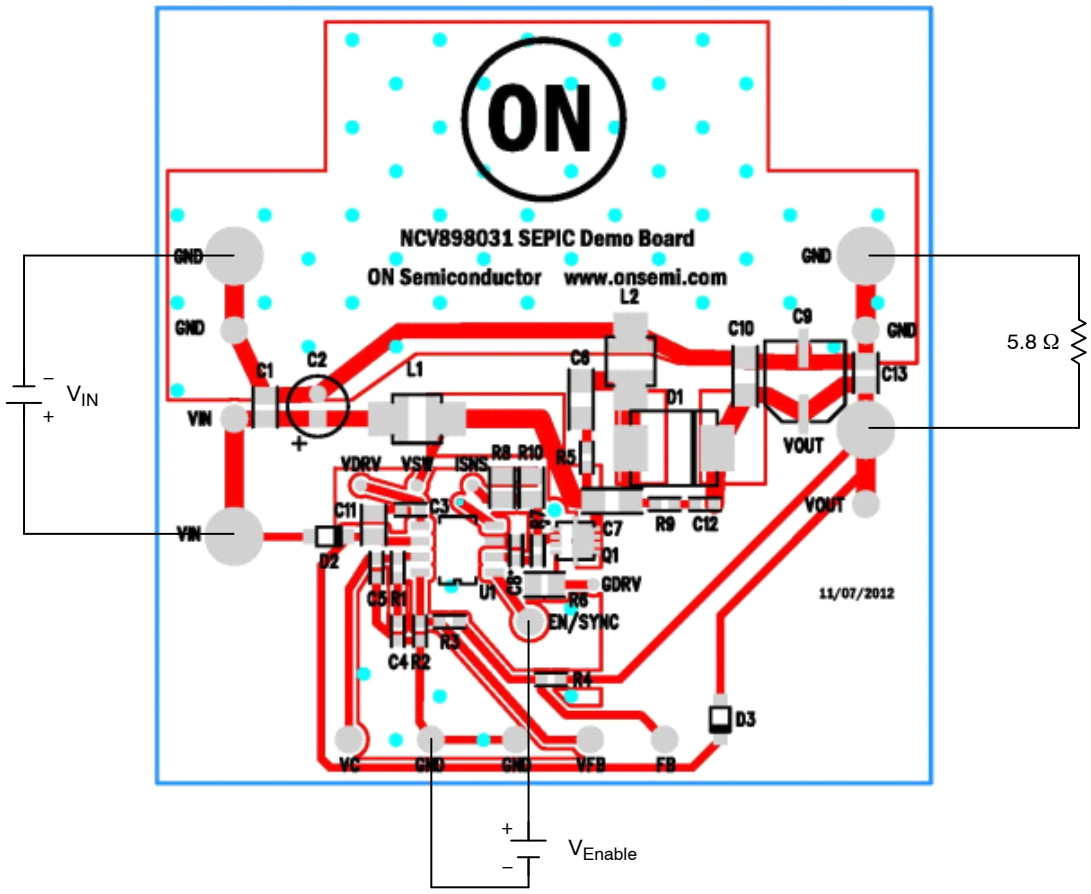

Figure 7. Evaluation Board Connections

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