NCV8871SEPGEVB

NCV8871 Automotive Grade High-Frequency SEPIC Controller Evaluation Board User's Manual

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EVAL BOARD USER'S MANUAL

Description

This NCV8871 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. An external clock can be used to synchronize the switching frequency. The output is rated 12 V / 2 A with a 170 KHz switching frequency over the typical 6 V to 18 V automotive input voltage range.

Key Features

- 12 V / 2 A Output
- 170 KHz Switching Frequency (NCV887100)
- Input Undervoltage Lockout
- Internal Soft-Start
- Wide Input Voltage of 6 V to 40 V
- Regulates through 45 V Load Dump Conditions
- External Clock Synchronization up to 1.1 MHz
- Automotive Grade

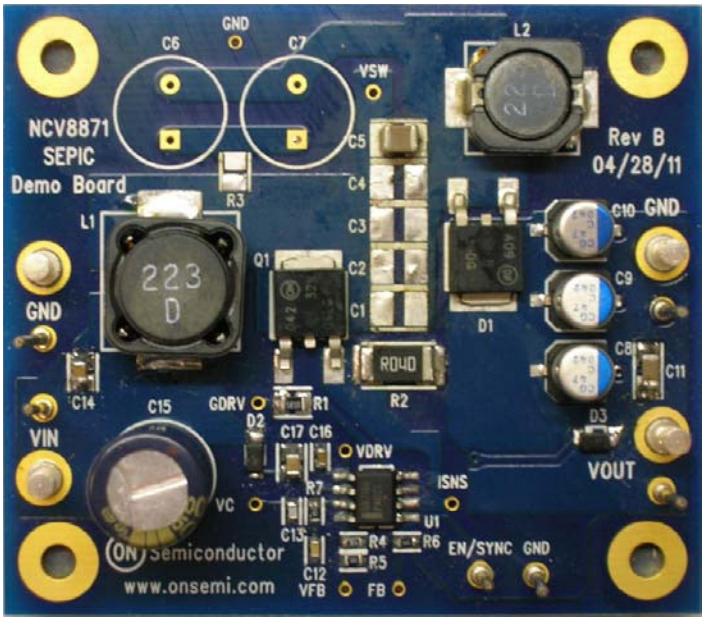

Figure 1. NCV887100 SEPIC Evaluation Board

Table 1. EVALUATION BOARD TERMINALS

Terminal	Function
VIN	Positive DC input voltage.
GND	Common DC return.
VOUT	Regulated DC output voltage.
EN/SYNC	Enable and synchronization input.

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

Rating	Value	Unit
DC Supply Voltage (VIN)	−0.3 to 40	V
DC Supply Voltage (EN/SYNC)	−0.3 to 6	V
Peak Transient Voltage (Load Dump on VIN)	45	V
Junction Temperature	−40 to 150	°C
Ambient Temperature (evaluation board)	−40 to 105	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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	Conditions	Typical Value	Unit
Switching			
Switching Frequency		170	KHz
Soft−start Time		7.4	ms
SYNC Frequency Range		170 − 1025	KHz
Current Limit			
Cycle-by-cycle Current Limit (FET)		10	A
Protections			
Input Undervoltage Lockout (UVLO)	V_{IN} decreasing	< 6*	V
Input Undervoltage Lockout (UVLO)	V_{IN} increasing	6.7	V
Thermal Shutdown	T_A increasing	170	°C

*See Note 3 from Operational Guidelines (on next page)

OPERATIONAL GUIDELINES

1. Connect a DC input voltage, within the 6 V to 40 V range, between VIN 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 12 V / 2 A output power at a minimum input voltage of 6 V. The NCV887100 V_{IN} has its operational voltage diode-ored between the converter output (12 V) and input voltages. The converter turns-on typically at 6.7 V. Once energized, the output voltage supplies power to the IC when the battery voltage is below (approximately) 11.5 V. 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.
4. Optionally for external clock synchronization, connect a pulse source between EN/SYNC and GND. The high state level should be within the 2 to 5 V range, and the low state level within the −0.3 V to 0.8 V range, with a minimum pulse width of 40 ns and a frequency within the 170 and 1100 KHz range.

NOTE: The converter was designed for 170 KHz 12 V / 2 A continuous mode operation. Operation beyond 170 KHz and/or at a different output voltage may require modifications of feedback loop component and inductor values.

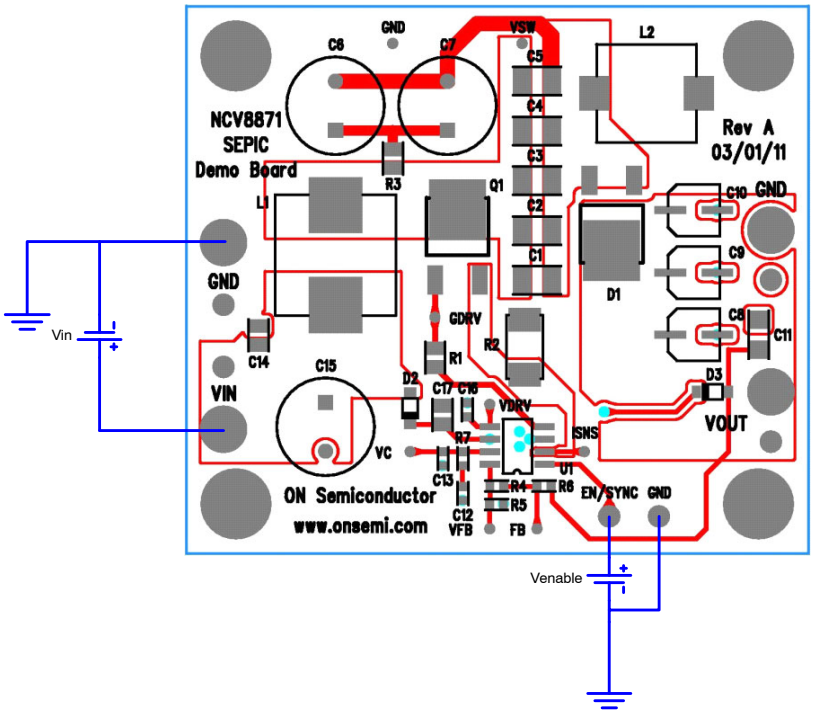

Figure 2. Evaluation Board Connections

TYPICAL PERFORMANCE

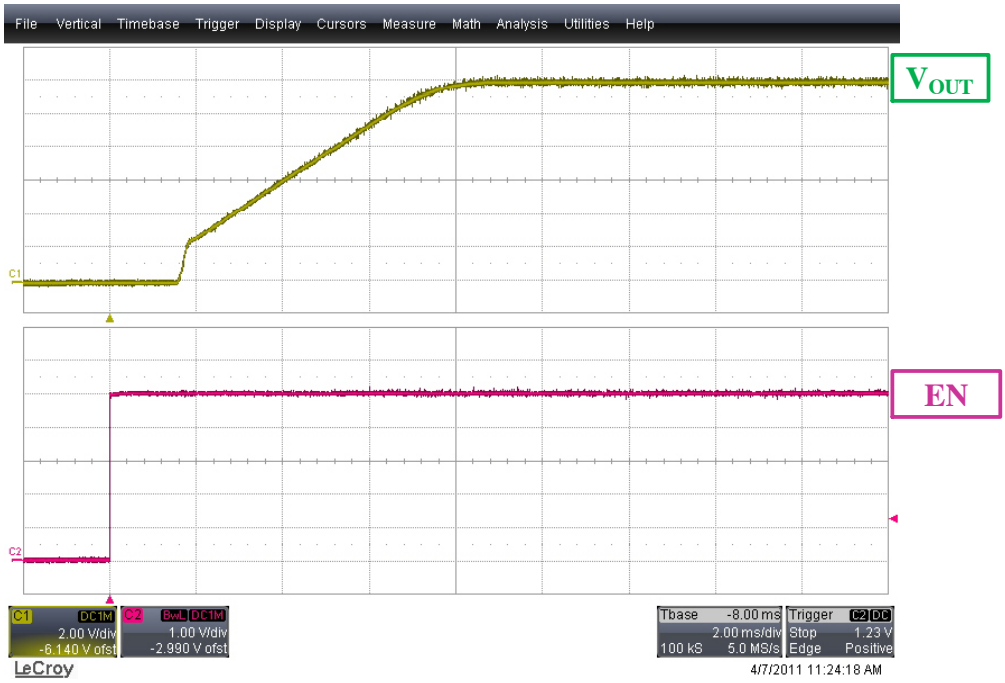

Figure 3. Typical Start−up with V_{IN} = 12 V, R_{OUT} = 6 Ω

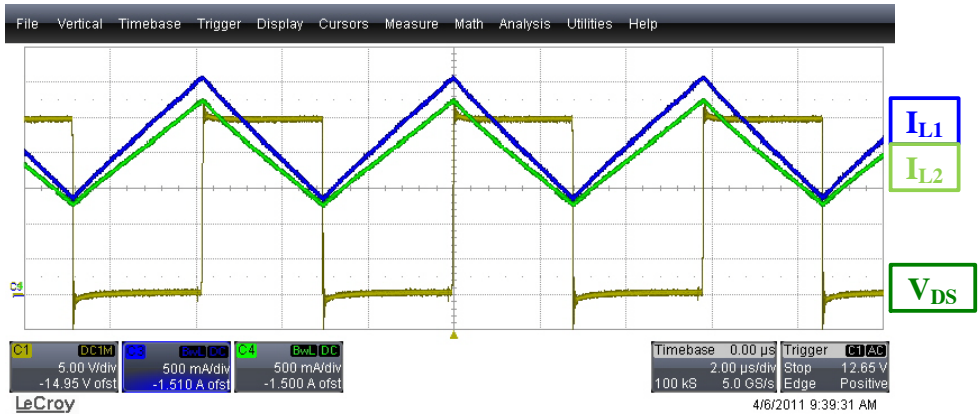

Figure 4. Operational Waveforms, V_{IN} = 12 V, R_{OUT} = 6 Ω

SCHEMATIC

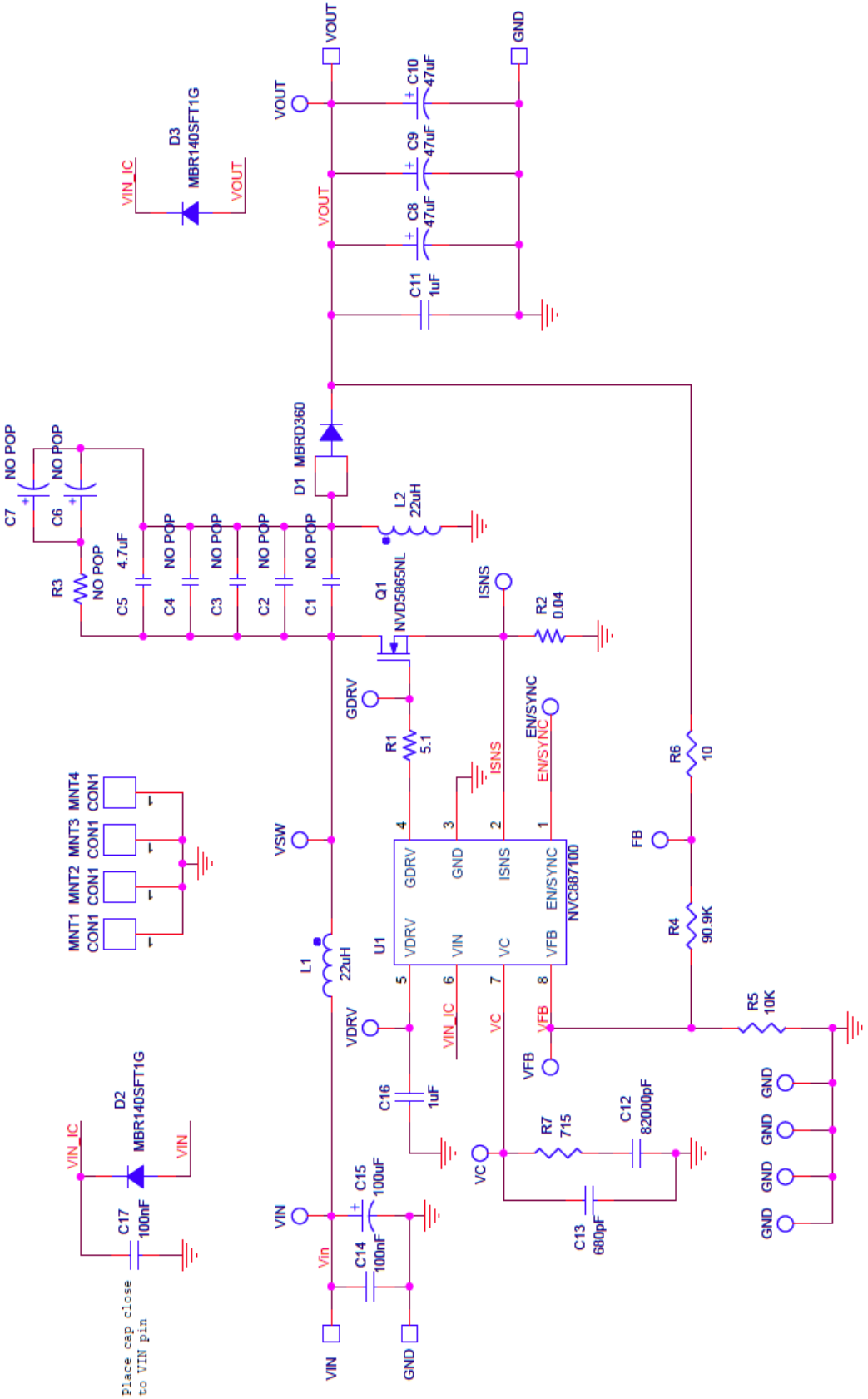

Figure 5. NCV887100 SEPIC Evaluation Board Schematic

Table 4. BILL OF MATERIALS

Component	Description	Manufacturer P/N	Vendor P/N
C1	DO NOT POPULATE		
C2	DO NOT POPULATE		
C3	DO NOT POPULATE		
C4	DO NOT POPULATE		
C5	CAP CER 4.7UF 50V 10% X7R 1210	GRM32ER71H475KA88L	490−1864−1−ND
C6	DO NOT POPULATE		
C7	DO NOT POPULATE		
C8	CAP POLY ALUM 47UF 16V SMD	PCG1C470MCL1GS	493−3095−1−ND
C9	CAP POLY ALUM 47UF 16V SMD	PCG1C470MCL1GS	493−3095−1−ND
C10	CAP POLY ALUM 47UF 16V SMD	PCG1C470MCL1GS	493−3095−1−ND
C11	CAP CER 1UF 50V X7R 1206	GCM31MR71H105KA55L	490−4795−1−ND
C12	CAP CER .082UF 10% 16V X7R 0603	0603YC823KAT2A	478−1238−1−ND
C13	CAP CER 680PF 50V 5% C0G 0603	GRM1885C1H681JA01D	490−1447−1−ND
C14	CAP CER .1UF 50V X7R 0603	GCM188R71H104KA57D	490−4779−1−ND
C15	CAP 100UF 50V ELECT FC RADIAL	EEU−FC1H101	P10323−ND
C16	CAP CER 1UF 16V X7R 10% 0603	GCM188R71C105KA64D	490−5241−1−ND
C17	CAP CER .1UF 50V X7R 0603	GCM188R71H104KA57D	490−4779−1−ND
D1	60 V, 3.0 A Schottky Rectifier DPAK	MBRD360G	MBRD360G
D2	DIODE SCHOTTKY 40V 1A SOD123FL	MBR140SFT1G	MBR140SFT1G
D3	DIODE SCHOTTKY 40V 1A SOD123FL	MBR140SFT1G	MBR140SFT1G
L1	High Temp SMT Power Inductor 2.3A	MSS1260T−223ML	MSS1260T−223ML
L2	High Temp SMT Power Inductor 1.9A	MSS1038T−223ML	MSS1038T−223ML
Q1	N−CHANNEL MOSFET, LOGIC LEVEL, 60V 16mOHMS	NVD5865NL	NVD5865NL
R1	RES 5.10 OHM 1/8W 1% 0805 SMD	CRCW08055R10FKEA	541−5.10CCCT−ND
R2	RES .04 OHM 3W 1% 2512 SMD	CRA2512−FZ−R040ELF	CRA2512−FZ−R040ELFCT−ND
R3	DO NOT POPULATE		
R4	RES 90.9K OHM 1/10W 1% 0603 SMD	RC0603FR−0790K9L	311−90.9KHRCT−ND
R5	RES 10.0K OHM 1/10W 1% 0603 SMD	MCR03EZPFX1002	RHM10.0KHCT−ND
R6	RES 10.0 OHM 1/10W 1% 0603 SMD	RC0603FR−0710RL	311−10.0HRCT−ND
R7	RES 715 OHM 1/10W 1% 0603 SMD	CRCW0603715RFKEA	541−715HCT−ND
U1	ON SEMI Non−Sync Boost Controller	NCV887100	NCV887100D1R2G

PCB LAYOUT

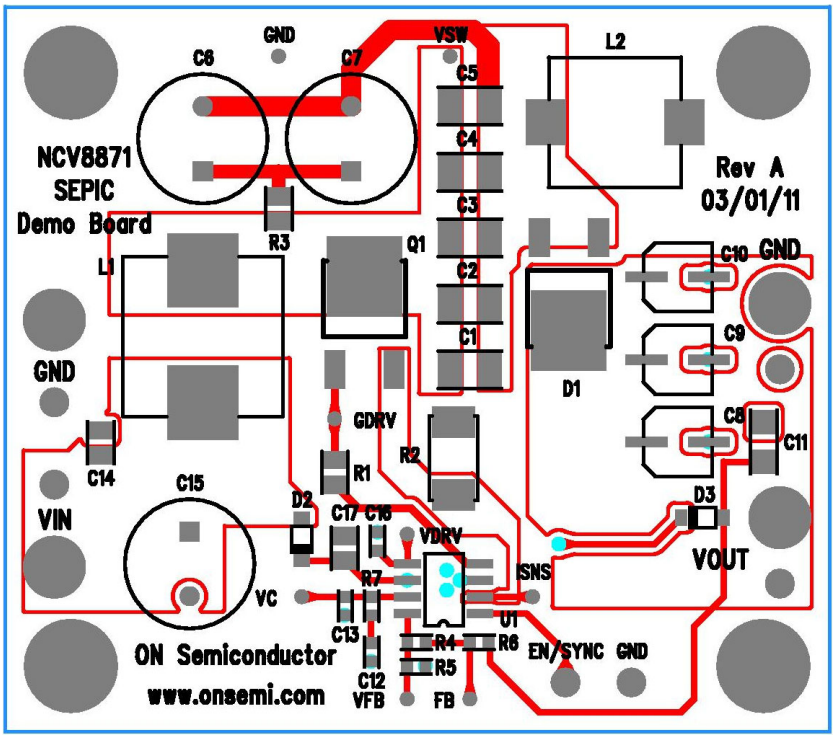

Figure 6. Top View

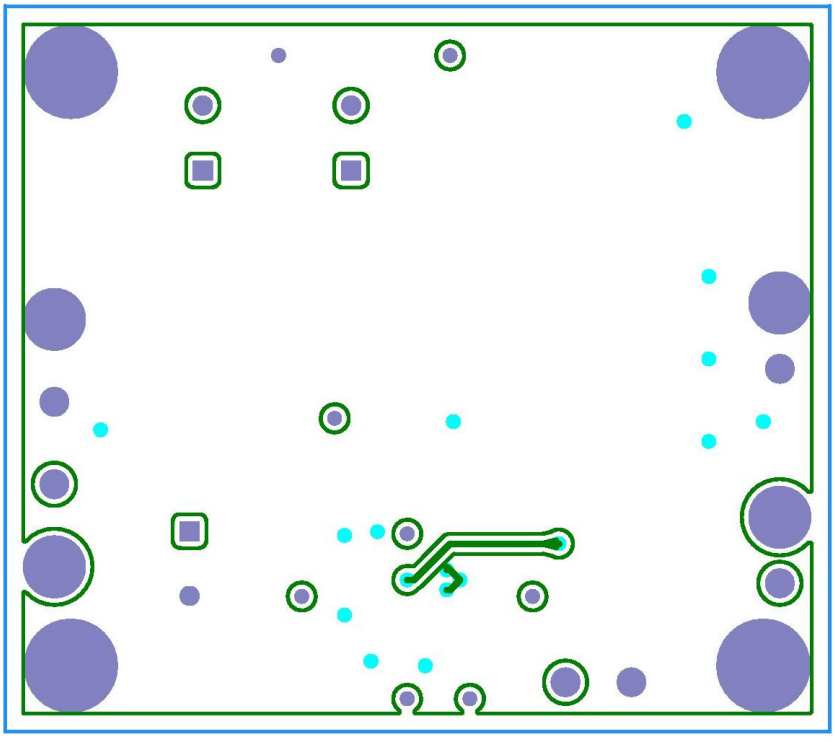

Figure 7. Bottom View

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