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NCV887720BSTGEVB

NCV887720 Automotive Grade High-Frequency Start-Stop Boost Controller Evaluation Board User's Manual

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EVAL BOARD USER'S MANUAL

Description

This NCV887720 evaluation board provides a convenient way to evaluate a high frequency boost controller designed to supply a minimum output voltage during Start-Stop vehicle battery voltage sags. The unit is in low I_q sleep-mode under normal battery operating condition and wakes-up when the monitored voltage drops below 10.65 V and begin regulating once 10.0 V is reached. Switching frequency is set to 440 kHz with a user selectable ROSC resistor. The evaluation board is rated 10.0 V / 2.5 A at a 3.75 V input voltage. Operation below 3.75 V is possible if output current is reduced.

Key Features

- Automatic Enable below 10.65 V
- Disable Override Function
- Boost Operation at 10.0 V
- 440 kHz Switching Frequency
- Input Undervoltage Lockout
- Wide Input Voltage of 3.75 V to 45 V
- Low Quiescent Current in Sleep Mode (< 12 μA Typical)
- Cycle-by-Cycle Current Limit Protection
- Automotive Grade

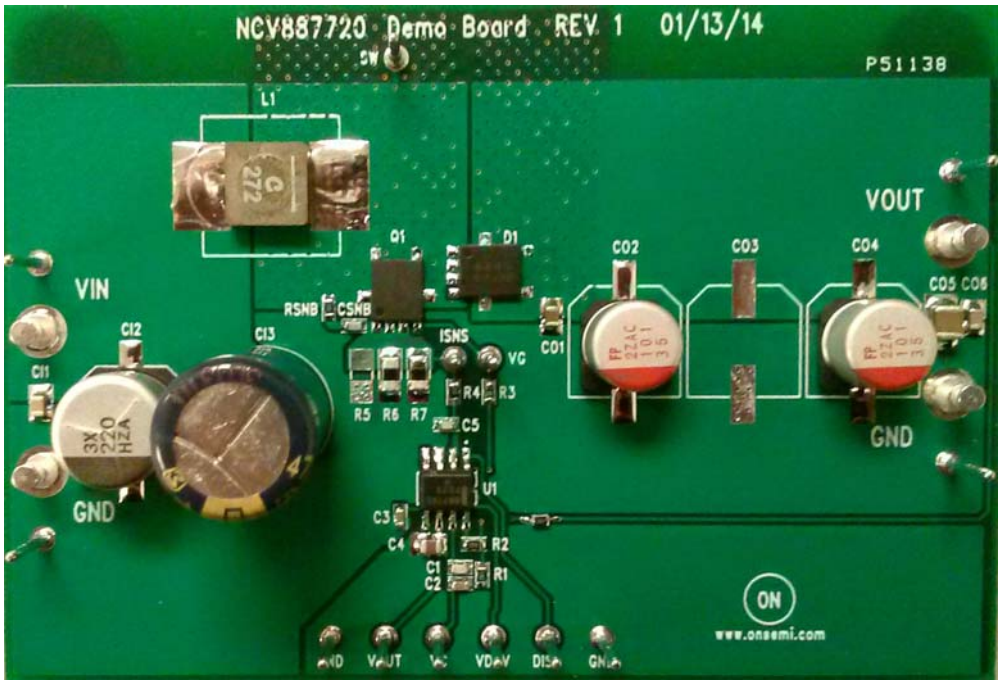

Figure 1. NCV887720 Start–Stop Evaluation Board

Table 1. EVALUATION BOARD TERMINALS

Terminal	Function
VIN (large post)	Positive DC input voltage (power)
GND (large post)	Common DC return (power)
VOUT (large post)	Regulated DC output voltage (power)
GND (small post)	Common DC return, monitoring point
VC (small post)	Voltage compensation, monitoring point
VOUT (small post)	Regulated DC output voltage, monitoring point
VDRV (small post)	Driving voltage, monitoring point
DISB (small post)	Disable override input, monitoring point
ISNS (small post)	Current sense resistor voltage, monitoring point
VG (small post)	MOSFET gate voltage, monitoring point
SW (small post)	MOSFET drain voltage, monitoring point

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

Rating	Value	Unit
DC supply voltage (VIN)	-0.3 to 45	V
DC supply voltage (EN, SYNC)	-0.3 to 6	V
DC Voltage (DISB)	-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, 3.75 V ≤ V_{IN} ≤ Vout_LED, V_{DISB} = 5 V, unless otherwise specified)

Characteristics	Conditions	Typical Value	Unit
Switching			
Switching Frequency	ROSC = 10.7 kΩ	440	kHz
User Selectable Frequency Range	ROSC (refer to datasheet)	170-500	kHz
Current Limit			
Cycle-by-cycle Current Limit (FET)	-	11	A
Protections			
Maximum Duty Cycle	-	0.83	-
VOUT Undervoltage Lockout (UVLO)	VOUT falling	3.8	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.

Operational Guidelines

The evaluation board is rated to operate under full load for input voltage as low as 3.75 V at the input terminal under full power (less if output current is reduced). Start-Stop applications use reverse battery protection diodes in front of the boost converter (Figure 2), so the input source can operate down to 3.75 V plus a diode drop (i.e ~4.25 V).

Notes:

1. The IC UVLO (undervoltage lockout) is 4.25 V for VOUT rising, 3.8 V for VOUT falling (0.45 V hysteresis).
2. Limit time spent with the power supply operating at minimum input voltage (equivalent to VIN = 3.75 V) to avoid overheating the power semiconductors.

First Time Power-Up:

1. Connect a DC source voltage (15 A capable) set to a voltage of 13 − 14 V as shown in Figure 1.
2. Connect the DISB TTL control signal as shown in Figure 1. The initial DISB state should be set to logic −‘0’.
3. Connect a 2.5 A constant current load on the output.
4. Decrease the DC input voltage until the PCB VIN voltage is 5.5 V ±0.5 V.
5. Set the DISB control signal to a TTL high state (i.e. 5 V).
6. Verify that the unit is regulating at VOUT = 10.0 V.
7. Reduce the DC input voltage until the PCB VIN = 3.75 V. Verify that the unit is regulating at VOUT = 10.0 V.

Start-Stop Voltage Transient Test:

1. Connect both DC1 and DC2 input power supplies as illustrated in Figure 2. Adjust DC2 so that PCB VIN = 3.75 V for a 2.5 A load.
2. Connect a 2.5 A load on the output. If a load resistor is used, it is recommended to start from a DC1 input voltage of 13 − 14 V to avoid overstressing the PCB boost diode (D1, rated 4 A).
3. Monitor VOUT. Disconnect supply DC1. VOUT should have a response similar to that of Figure 3.

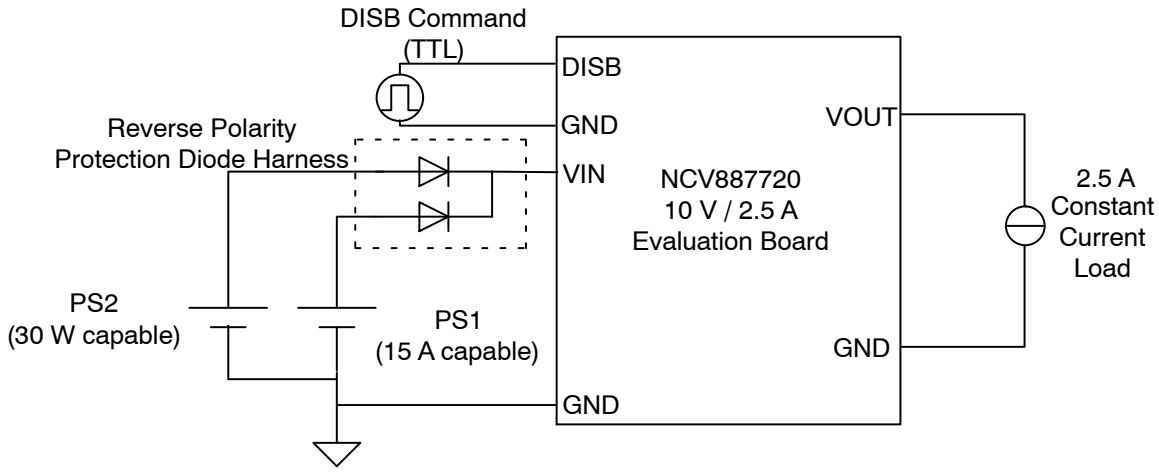

Figure 2. Evaluation Board Connections

Typical Performance

DC1 is disabled, then re-enabled

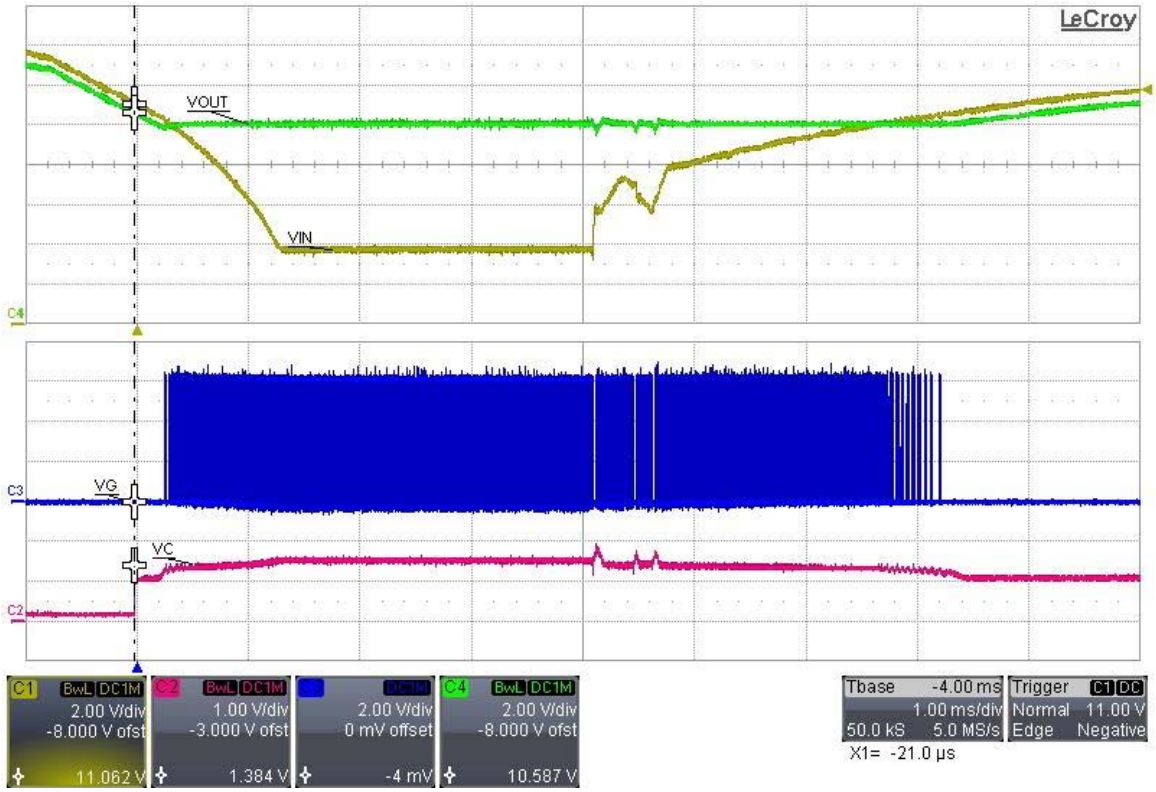

Figure 3. NCV887701 Evaluation Board Waveforms

- DC2 at VIN adjusted to 3.75 V (after reverse polarity protection diode)
- VOUT = 10.0 V, I_{OUT} = 2.5 A

SCHEMATIC

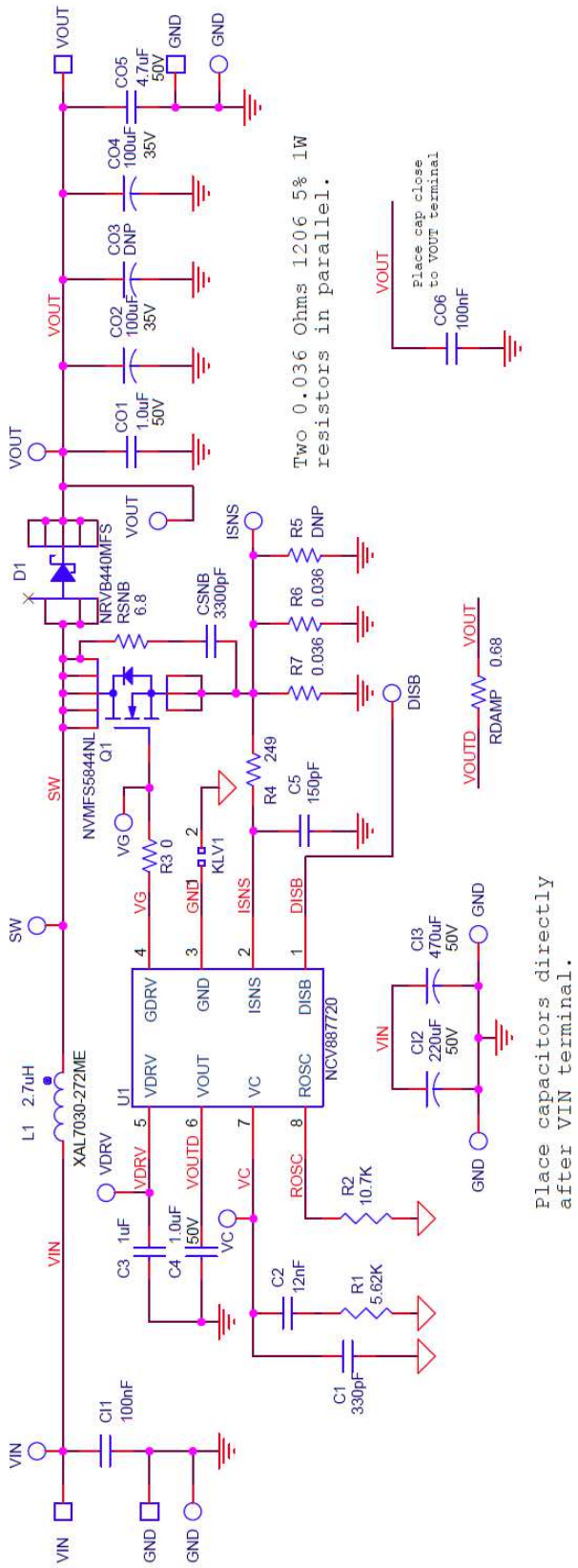

Figure 4. NCV887720 Boost 10.0 V / 2.5 A Evaluation Board Schematic

BILL OF MATERIALS

Table 4. BILL OF MATERIALS*

Reference Designator(s)	QTY	Description	Value	Tolerance	Manufacturer	Manufacturer's Part Number	Substitution Allowed
C1	1	CAP CER 330PF 50V 5% NP0 0603	330 pF	5%	Murata Electronics North America	GCM1885C1H331JA16D	Yes
C2	1	CAP CER 0.012UF 50V 10% X7R 0603	0.012 μF	10%	Murata Electronics North America	GRM188R71H123KA01D	Yes
C3	1	CAP CER 1UF 16V 10% X7R 0603	1 μF	10%	Murata Electronics North America	GCM188R71C105KA64D	Yes
C4, CO1	2	CAP CER 1UF 50V 10% X7R 0805	1.0 μF	10%	TDK Corporation	CGA4J3X7R1H105K125AB	Yes
C5	1	CAP CER 150PF 50V 5% NP0 0603	150 pF	5%	Murata Electronics North America	GCM1885C1H151JA16D	Yes
CI1, CO6	2	CAP CER 0.1UF 50V 10% X7R 0805	100 nF	10%	Murata Electronics North America	GCM21BR71H104KA37L	Yes
CI2	1	CAP ALUM 220UF 50V 20% SMD	220 μF	20%	Chemi−Con	EMZA500ADA221MJA0G	Yes
CI3	1	CAP ALUM 470UF 50V 20% RADIAL	470 μF	20%	Panasonic Electronic Components	EEU-FC1H471	Yes
CO2, CO4	2	CAP ALUM 100UF 35V 20% SMD	100 μF	20%	Nichicon	RHS1V101MCN1GS	No
CO3	DNP						
CO5	1	CAP CER 4.7UF 50V 10% X7R 1210	4.7 μF	10%	Murata Electronics North America	GCM32ER71H475KA55L	Yes
CSNB	1	CAP CER 3300PF 50V 5% NP0 0603	3300 pF	5%	TDK Corporation	CGA3E2C0G1H332J080AA	Yes
D1	1	40 V, 4.0 A Schottky Rectifier SO8-FL	40 V / 4 A	N/A	ON Semiconductor	NRVB440MFST1G	No
L1	1	INDUCTOR POWER 2.7UH 12.8A SMD	2.7 μH	20%	Coilcraft, Inc	XAL7030-272ME	No
Q1	1	N-Channel Power MOSFET 60V 61A SO-8FL	60 V / 61 A	N/A	ON Semiconductor	NVMFS5844NL	No
R1	1	RES 5.62K OHM 1/10W 1% 0603 SMD	5.62 KΩ	1%	Vishay Dale	CRCW06035K62FKEA	Yes
R2	1	RES 10.7K OHM 1/10W 1% 0603 SMD	10.7 KΩ	1%	Vishay Dale	CRCW060310K7FKEA	Yes
R3	1	RES 0.0 OHM 1/10W JUMP 0603 SMD	0	Jumper	Vishay Dale	CRCW06030000Z0EA	Yes
R4	1	RES 249 OHM 1/10W 1% 0603 SMD	249 Ω	1%	Vishay Dale	CRCW0603249RFKEA	Yes
R6	DNP						
R7, R8	2	RES 0.036 OHM 1W 5% 1206 SMD	0.036 Ω	5%	Panasonic Electronic Components	ERJ-8BWJR036V	No
RDAMP	1	RES 0.68 OHM 1/10W 1% 0603 SMD	0.68 Ω	1%	Panasonic Electronic Components	ERJ-3RQFR68V	Yes
RSNB	1	RES 6.80 OHM 1/10W 1% 0603 SMD	6.8 Ω	1%	Vishay Dale	CRCW06036R80FKEA	Yes
U1	1	Automotive Non-Sync Boost Controller	N/A	N/A	ON Semiconductor	NCV887720	No

*All Materials are RoHS Compliant

PCB LAYOUT

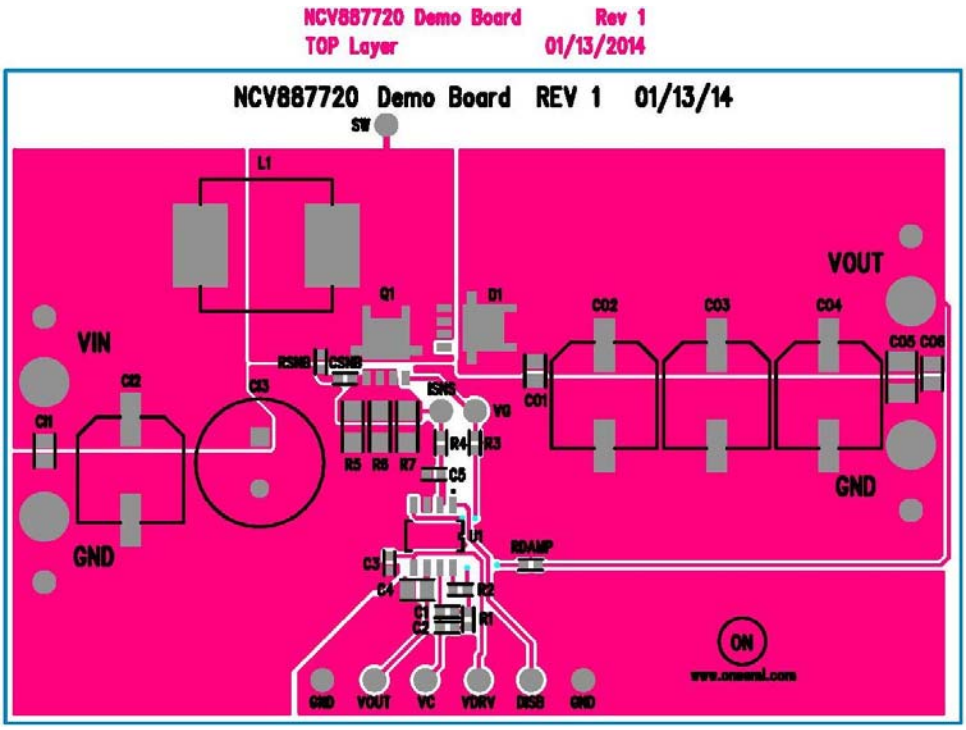

Figure 5. Top View

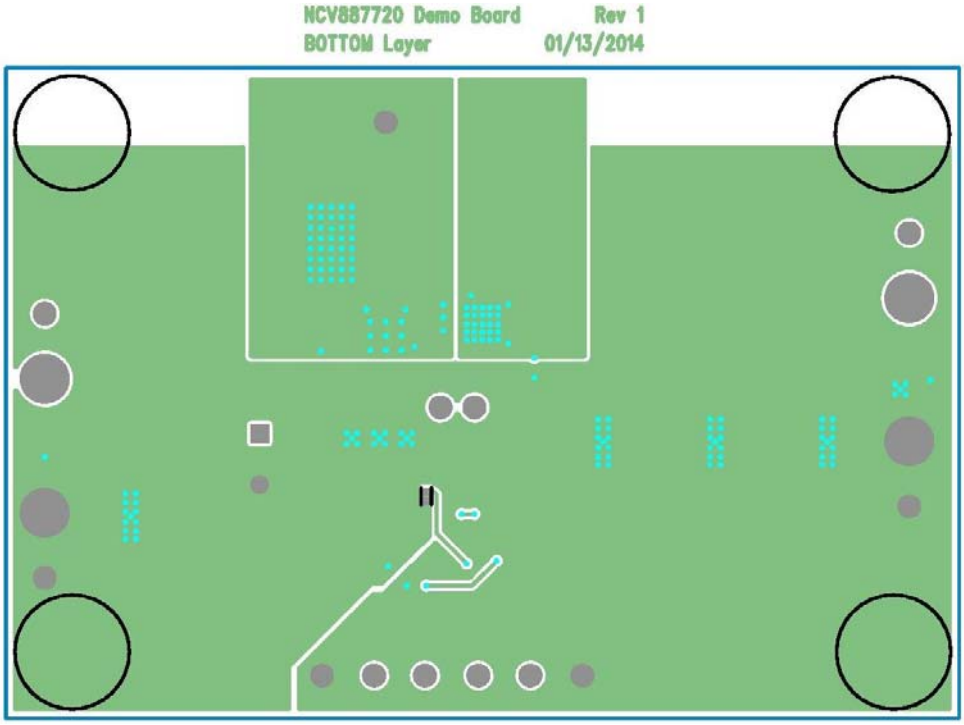

Figure 6. Bottom View

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