NCV890101 Automotive Grade High-Frequency Buck Regulator Evaluation Board User's Manual

Description

The NCV890101 demonstration board provides a convenient way to evaluate a high-frequency buck converter design. 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; and the board also provides a synchronization output, enabling it to be used as a master. It is configured for a 3.3 V output with a 2 MHz switching frequency and a 1.2 A maximum output current, over the typical 4.5 V to 18 V automotive input voltage range. In addition, the board regulates up to 36 V thanks to switching frequency foldback.

Key Features

- 3.3 V Output Voltage
- 2 MHz Switching Frequency
- 1.2 A Current Limit
- Wide Input Voltage of 4.5 V to 36 V
- Regulates through Load Dump Conditions
- External Clock Synchronization up to 2.5 MHz
- Synchronization Output
- Automotive Grade



Figure 1. NCV890101GEVB Board Picture



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EVAL BOARD USER'S MANUAL

Table 1. DEMONSTRATION BOARD TERMINALS

Terminal	Function		
VIN	Positive dc input voltage		
GND	Common dc return		
VOUT	Regulated dc output voltage		
EN	Enable input		
SYNCI	Input for external clock synchronization		
SYNCO	Output for synchronizing other boards		

Table 2. ABSOLUTE MAXIMUM RATINGS

(Voltages are with respect to GND)

Rating	Value	Units
Dc supply voltage (VIN, EN)	-0.3 to 36 V	V
Dc supply voltage (SYNCI)	-0.3 to 6 V	V
Junction Temperature (NCV890101)	-40 to 150	°C
Ambient temperature (Demo Board)	-40 to 85	°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 \leq V_{IN} \leq 40 V, V_{EN} = 2 V, V_{OUT} = 3.3 V, 0 \leq I_{OUT} \leq 1.2 A, unless otherwise specified)

Characteristics	Conditions	Typical Value	Units			
Regulation						
Output Voltage		3.30	V			
Voltage Accuracy		4	%			
Line Regulation	I _{OUT} = 1.0 A	0.12	%			
Load Regulation	V _{IN} = 13.2 V	0.03	%			
Switching						
Switching Frequency		2.0	MHz			
Soft-start Time		1.4	ms			
SYNCI Frequency range		1.8 to 2.5	MHz			
Current Limit						
Average Current Limit	V _{IN} = 6 to 18 V	1.2	А			
Cycle-by-cycle Current Limit		1.55	А			
Protections						
Input Undervoltage Lockout (UVLO)	V _{IN} decreasing	4.2	V			
Thermal Shutdown	T _A increasing	170	°C			



Figure 2. NCV890101GEVB Board Schematic

Operational Guidelines

- 1. Connect a dc input voltage, within the 4.5 V to 36 V range, between VIN and GND
- 2. Connect a load between VOUT and GND
- 3. Connect a dc enable voltage, within the 4.5 V to 36 V range, between EN and GND
- 4. Optionally, for external clock synchronization, connect a pulse source between SYNCI and GND. The high state level should be within the 2 to 6 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 1.8 to 2.5 MHz range.



Figure 3. NCV890101GEVB Board Connections

TYPICAL PERFORMANCE







Figure 5. Efficiency at 2 MHz for a 5 V output

Efficiency



Figure 6. Load Regulation at 2 MHz for a 3.3 V and a 5 V output



Figure 7. Line Regulation at 2 MHz for $\,$ a 3.3 V and a 5 V output $\,$

Regulation





Figure 12. Load transient 0.1 A to 1.2 A, with V_{OUT} = 3.3 V and V_IN = 4.6 V

Figure 13. Load transient 0.1 A to 1.2 A, with V_{OUT} = 3.3 V and V_{IN} = 36 V

Synchronization



Figure 14. Starting synchronization at 2.5 MHz (from free-running)



Minimum on time

Figure 15. Minimum on time seen during a load transient

Schematic



PCB LAYOUT



Figure 16. Top View



Figure 17. Bottom View

Table 4. BILL OF MATERIALS

Reference	Value	Part #	Manufacturer	Description	Package
U1		NCV890101	ON Semiconductor	Integrated circuit	3x3 DFN10
L1	4.7 μΗ	7447785004	Wurth	Inductor	WE-PD-XS
DFW		MBRS1540	ON Semiconductor	Diode, Schottky, 1.5A, 40V	SMB
DBST		BAS16HT1	ON Semiconductor	Diode, Switching, 200mA, 75V	SOD-323
CVIN1	4.7 μF		Murata	Capacitor, Ceramic, 50V, X7R	1210
CVIN2	1 μF		Murata	Capacitor, Ceramic, 50V, X5R	0805
CDRV, CBST	0.1 μF		Kemet	Capacitor, Ceramic, 10V, X7R	0603
ZFB1	4.7 nF		Murata	Capacitor, Ceramic, 50V, X7R	0603
COUT1, COUT2	10 μF		Murata	Capacitor, Ceramic, 10V, X7R	1206
CCOMP	330 pF		Murata	Capacitor, Ceramic, 50V, C0G	0603
RCOMP	6.81 KΩ		Vishay	Resistor, 1%	0603
RFB1	100 Ω		Vishay	Resistor, 1%	0603
RFB2	31.6 Ω		Vishay	Resistor, 1%	0603

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