NCV891234, NCV891334

NCV891234, NCV891334 Evaluation Board User's Manual

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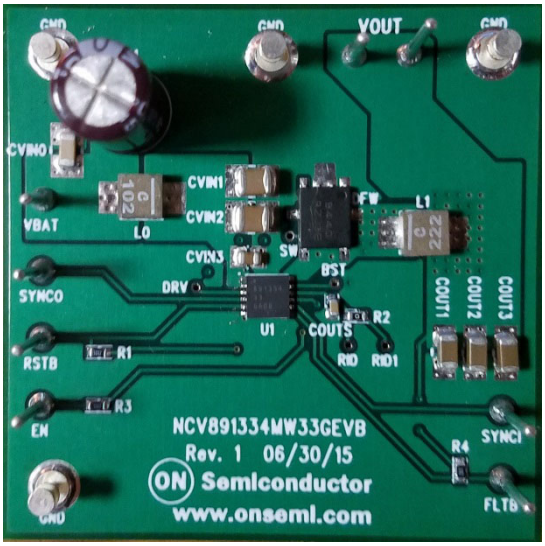
EVAL BOARD USER'S MANUAL

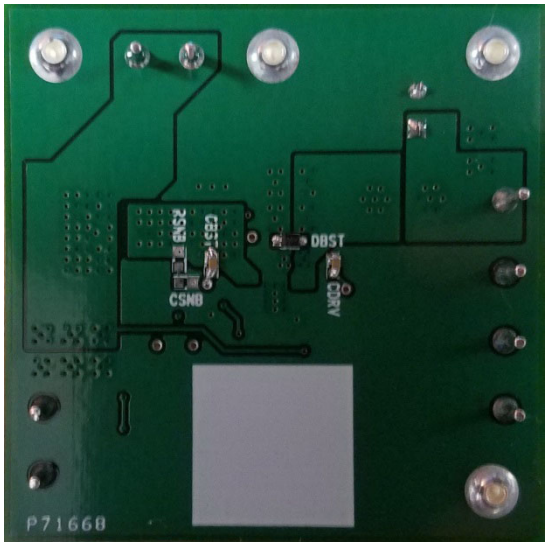
Description

The NCV891x34 is a Dual Mode regulator intended for Automotive, battery−connected applications. The output is fixed to either 3.3 V or 5.0 V, capable of delivering 2.0 A (NCV891234) or 3.0 A (NCV891334). At low output currents (≤ 50 mA), the device will operate in LDO mode, switching to PWM mode as current increases beyond 50 mA. The device is equipped with SYNCI and SYNCO pins to synchronize to an external clock and/or another NCV891x34. A reset (with fixed delay) and a fault pin (flagging low input voltage and high temperature warnings) simplify interfacing with a microcontroller.

This document will help the user to set up the hardware and to make demonstration kit running. All evaluation kit components will be described (evaluation board, connections, jumper's configuration). A quick test procedure will be also described to guide the user.



Top Side



Bottom Side

Figure 1. Evaluation Board Photo

Features and Benefits

- 40 μA Iq in Light Load Condition
- 2.0 A Maximum Output Current in PWM Mode in NCV891234
- 3.0 A Maximum Output Current in PWM Mode in NCV891334
- Internal N−channel Power Switch
- V_{IN} Operating Range 3.7 V to 36 V, Withstands Load Dump to 45 V
- Logic Level Enable Pin can be Tied to Battery
- Fixed Output Voltage of 5.0 V or 3.3 V with ±2% Accuracy
- 2 MHz Free−running Switching Frequency
- Input and Output Synchronization Pins

Typical Applications

- Safety – Vision Systems
- Audio, Infotainment
- Instrumentation
- Telematics

BLOCK DIAGRAM

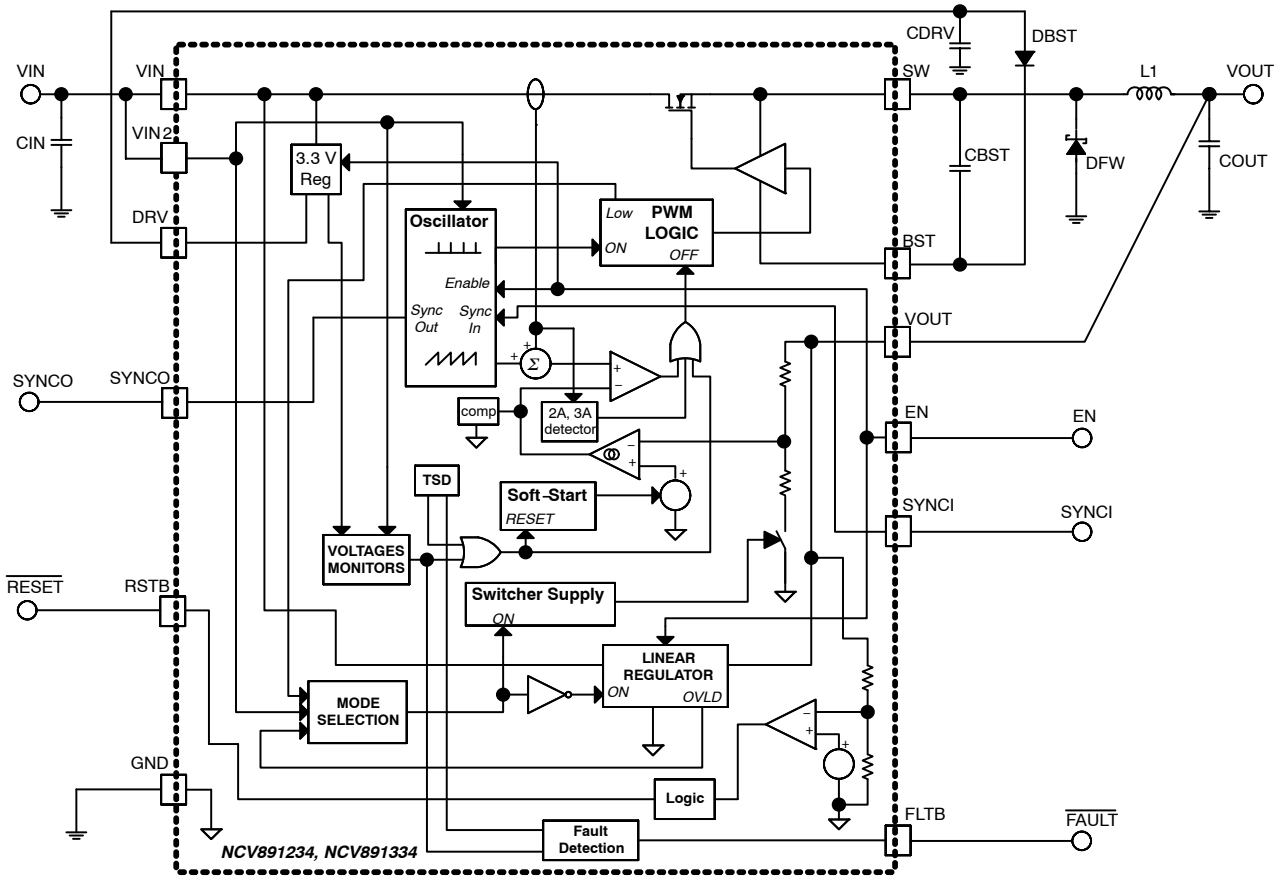


Figure 2. NCV891x34 Simplified Block Diagram

TYPICAL APPLICATION

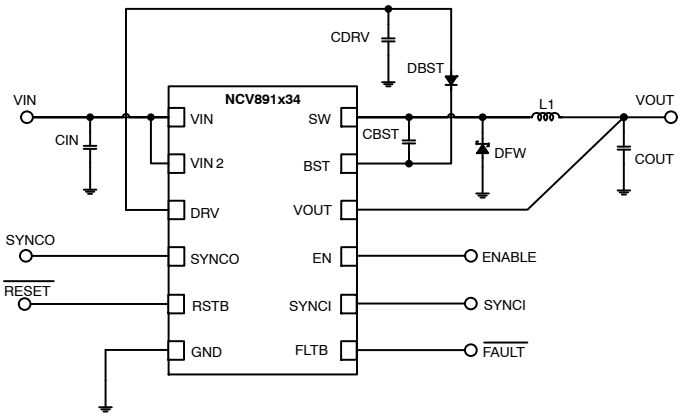


Figure 3. NCV891x34 Typical Application Diagram

Table 1. EVALUATION BOARD TERMINALS

Pin Number	Pin Name	Function
1	VBAT	Input voltage from battery. Place an input filter capacitor in close proximity to this pin.
4	SYNCO	Out−of−phase synchronization output. Turn−on of the Power Switch causes the SYNCO signal to fall (and rise half a switching period later).
5	RSTB	Reset function. Open drain output, pulling down to ground when output voltage is out of regulation.
6	GND	Battery return and output voltage ground reference.
7	FLTB	Fault flag indicating various fault conditions for the part.
8	SYNCI	Synchronization input. Connecting an external clock to this pin synchronizes switching to the rising edge of the SYNCI signal.
9	EN	This TTL compatible Enable input allows the direct connection of Battery as the enable signal. Grounding this signal stops switching and reduces quiescent current draw to a minimum.
10	VOUT	Output voltage feedback and LDO output. Feedback of output voltage used for regulation, as well as LDO output in LDO mode.

Table 2. ABSOLUTE MAXIMUM RATINGS

(Voltages are with respect to GND)

Rating	Value	Units
DC supply voltage (VBAT)	−0.3 to 45	V
DC supply voltage (EN)	−0.3 to 40	V
DC supply voltage (VOUT)	−0.3 to 18	V
DC supply voltage (SYNCI, RSTB, and FLTB)	−0.3 to 6	V
DC supply voltage (SYNCO)	−0.3 to 3.6	V
Storage Temperature Range	−55 to +150	°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

Characteristics	Conditions	Typical Value	Units
Regulation			
Output Voltage (NCV891x34MW33GEVB)		3.3	V
Output Voltage (NCV891x34MW50GEVB)		5.0	V
Switching			
Switching Frequency		2.0	MHz
Soft−start Time		1.4	ms
Synchronization Frequency Range		1.8 to 2.5	MHz
Current Limit			
Peak Current Limit (NCV891234MWxxGEVB)		3.25	A
Peak Current Limit (NCV891334MWxxGEVB)		4.4	A
Protections			
Input Undervoltage Lockout (UVLO)	V_{BAT} decreasing	3.1	V
Input Overvoltage Protection	V_{BAT} increasing	37.7	V
Thermal Shutdown	T_J rising	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.

Quick−Start Guide

The following steps will get you familiar with the setup of inputs and outputs of the NCV891x34.

Required Equipment

1 DC Source – ≥ 40 V, ≥ 2 A capable	VBAT
1 Oscilloscope – 2 Channel minimum	VOUT and SW
1 Multi−meter	VOUT
1 DC Electronic Load – 4 A capable	ILOAD
1 Clip to Clip Lead or equivalent	

1. Connect DC source set to 13.2 V DC between the VBAT and GND terminals in the upper left of the evaluation board.
2. Connect a multi−meter or oscilloscope probe between the VOUT and GND terminals located in the upper right of the evaluation board.
3. Connect an oscilloscope probe between the SW and GND terminals located in the center of the evaluation board.
4. Connect a jumper wire between VBAT to the EN input.
   Verify that VOUT is:
   a.) 3.3 V for NCV891x34MW33GEVB
   b.) 5.0 V for NCV891x34MW50GEVB
5. Apply a 40 mA load to VOUT.
   Verify that VOUT is at the necessary regulated voltage and the SW signal shows that DC level (LDO mode).
6. Increase the load on VOUT to 1.5 A.
   Verify that VOUT is at the necessary regulated voltage and the SW signal shows a stable 2 MHz pulsed waveform with amplitude approximately between VBAT and GND (PWM mode).
7. While at load, increase VBAT to 21 V.
   Verify that the SW signal now shows a stable 1 MHz pulsed waveform with amplitude approximately between VBAT and GND.
8. Increase VBAT to 39.5 V.
   Verify the switching regulator turns off and there is 0 V at VOUT.
9. Reduce VBAT to 13.2 V.
   Verify that VOUT is restored to its previous value and that the SW signal returns to a 2 MHz pulsed waveform with amplitude approximately between VBAT and GND.
10. Remove the load on VOUT.
    Verify that VOUT is at the necessary regulated voltage and the SW signal shows that DC level (LDO mode).
11. Remove the jumper between VBAT the EN input.
    Verify the switching regulator turns off and there is 0 V at VOUT.
12. Disconnect VBAT from the board.

Soft Start

The NCV891x34 contains a battery−connectable EN pin for the primary buck regulator. A common setup includes the following connections:

EN → VIN

When the EN connection on the board are as shown above, the following startup profile can be seen on an oscilloscope:

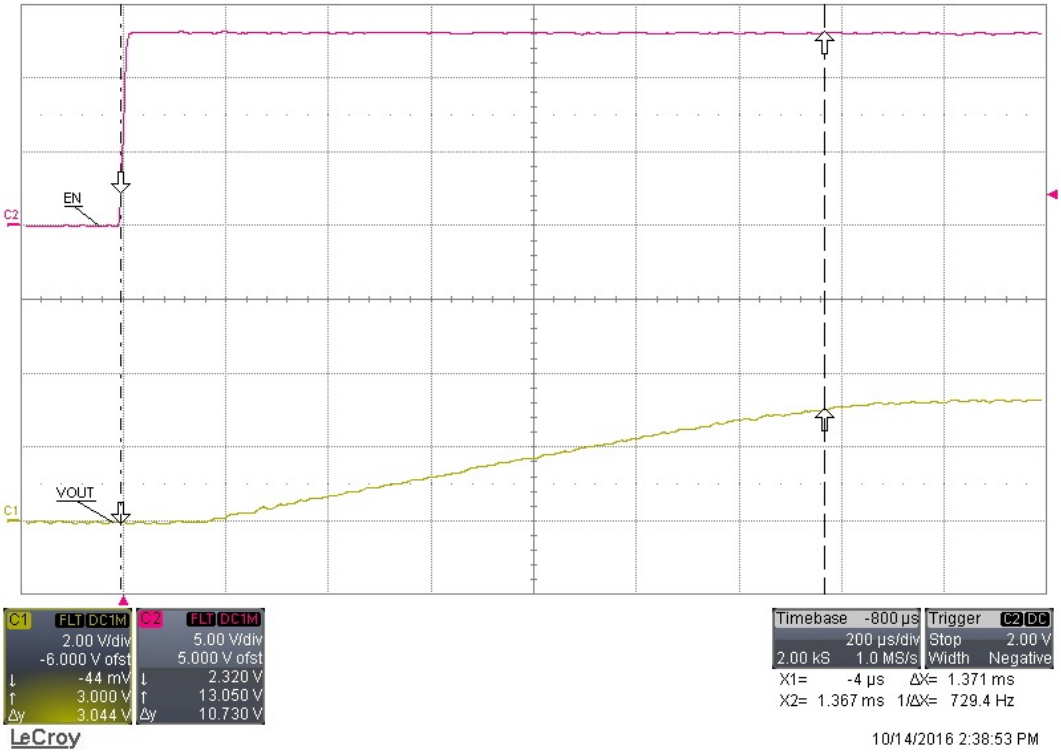


Figure 4. Typical NCV891x34 Startup Profile

EMI Filter

In a typical application, an LC filter is used on the input line of a buck regulator to filter EMI from the device. On this evaluation board, an LC filter is pre−populated to allow you to perform EMI testing directly with this evaluation board.

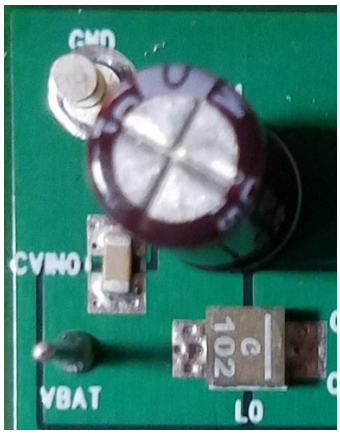


Figure 5. LC Filter on VIN Line

L0: 1.0 μH
CVIN0: 4.7 μF
CB1: 100 μF

An input filter can drastically reduce the emissions from a switching regulator.

Efficiency

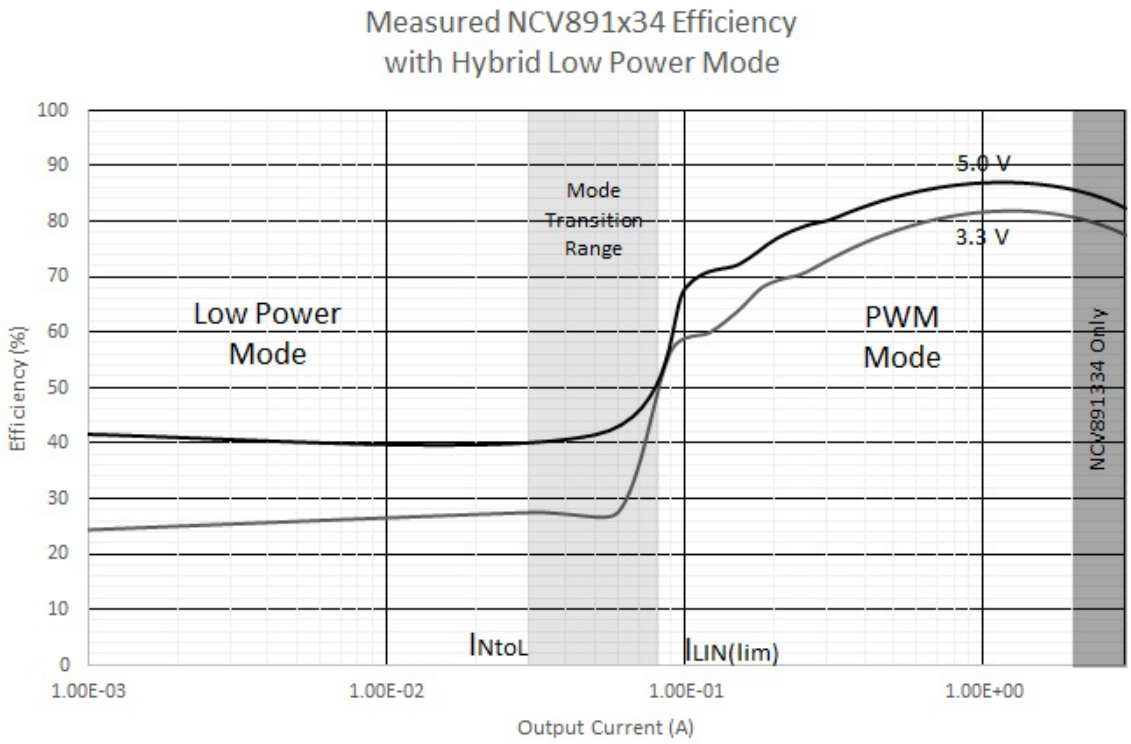


Figure 6. NCV891x34 Efficiency Curves

SCHEMATIC

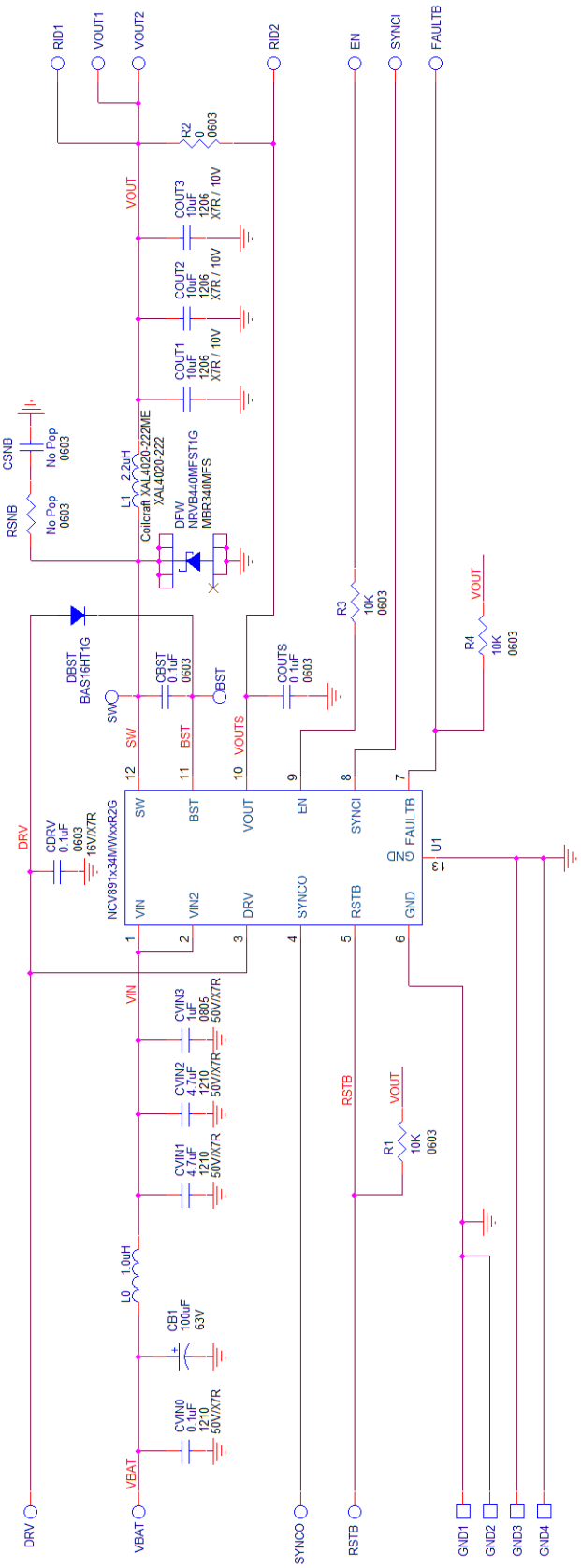


Figure 7. NCV891x34MWxxGEVB Evaluation Board Schematic − Rev.1

PCB LAYOUT

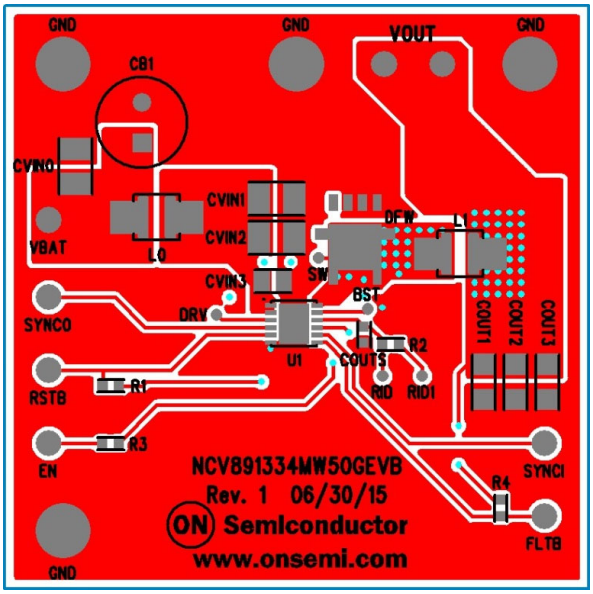


Figure 8. NCV891334MW50GEVB PCB Layout – Top

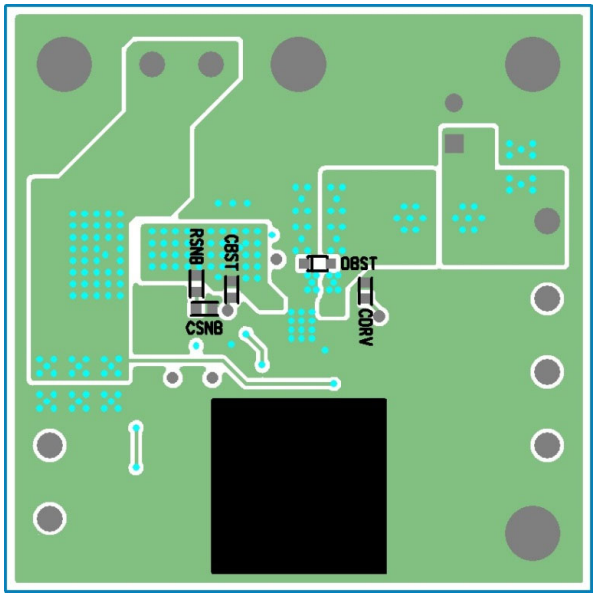


Figure 9. NCV891334MW50GEVB PCB Layout – Bottom

All evaluation board PCB layouts are identical with the exception of TOP Silkscreen and device mounted upon them.

BILL OF MATERIALS

Table 4. BILL OF MATERIALS

Reference Designator(s)	Qty	Description	Value	Toler-ance	Foot-print	Manufacturer	Manufacturer's Part Number
CVIN0	1	CAP CER 0.1UF 250V 10% X7R 1210	0.1 μF	10%	1210	TDK Corporation	CGA6M3X7R2E104K200AA
CVIN1, CVIN2	2	CAP CER 4.7UF 50V 10% X7R 1210	4.7 μF	10%	1210	Murata Electronics North America	GCM32ER71H475KA55L
CVIN3	1	CAP CER 1.0UF 50V X7R 0805	1.0 μF	10%	805	Murata Electronics North America	GCM21BR71H105KA03L
CB1	1	CAP ALUM 100UF 63V 20% RADIAL	100 μF	20%	CAP_RAD _8X11P5	Chemi−Con	ELXZ630ELL101MH15D
CBST, CDRV, COUTS	3	CAP .10UF 16V CERAMIC X7R 0603	0.1 μF	10%	603	Murata Electronics North America	GCM188R71C104KA37D
COUT1, COUT2, COUT3	3	CAP CER 10UF 10V X7R 1206	10 μF	10%	1206	Murata Electronics North America	GCM31CR71A106KA64L
CSNB	1	CAP CER 100pF 50V 5% NP0 603	Do Not Populate	5%	603	Murata Electronics North America	GCM1885C1H101JA16D
R1, R3, R4	3	RES 10.0K OHM 1/10W 1% 0603 SMD	10.0 K	1%	603	Vishay/Dale	CRCW060310K0FKEA
R2	1	RES 0.0 OHM 1/10W 0603 SMD	0.0	N/A	603	Vishay/Dale	CRCW06030000Z0EA
RSNB	1	RES 10.0 OHM 1/10W 0603 SMD	Do Not Populate	1%	603	Vishay/Dale	CRCW060310R0FKEA
DFW	1	DIODE SCHOTTKY 4.0A 40V SMB	40 V / 4.0 A	N/A	MBR340M FS	ON Semiconductor	NRVB440MFST1G
DBST	1	DIODE SWITCH 200MA 100V SOD323	100 V / 0.2 A	N/A	SOD_323	ON Semiconductor	BAS16HT1G
L0	1	High Current Shielded Inductor 1.0uH, 8.7A SAT	1.0 μH	20%	XAL4020− 102ME	Coilcraft	XAL4020−102ME
L1	1	High Current Shielded Inductor 2.2uH, 5.6A SAT	2.2 μH	20%	XAL4020− 222ME	Coilcraft	XAL4020−222ME
GND1, GND2, GND3, GND4	4	TERM SOLDER TURRET .219", .109"L	N/A	N/A	TURRET	Mill−Max Manufacturing Corp.	2501−2−00−44−00−00−07−0
EN, FAULTB, RSTB, SYNCI, SYNCO, VBAT, VOUT1, VOUT2	8	PIN INBOARD .042" HOLE 1000/PKG	N/A	N/A	TP	Vector Electronics	K24C/M
BST, DRV, RID1, RID2, SW	5	CIRCUIT PIN PRNTD .020"D .425"L	Do Not Populate	N/A	SMALLTP	Mill−Max Manufacturing Corp.	3128−2−00−15−00−00−08−0
U1 *	1	Automotive Buck Switching Regulator	*	N/A	12PINDF N4X4P65	ON Semiconductor	NCV891x34MWxxR2G

*The Bills of Materials for all four evaluation boards covered in this user's manual are identical with the exception of the mounted device. This can be either NCV891234MW33R2G, NCV891234MW50R2G, NCV891334MW33R2G, or NCV891334MW50R2G.

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