

NCV8842PWGEVB

NCV8842 Buck Regulator 7.0 V-16 V to 5.0 V, 3.3 V and 2.5 V @ 1.0 A Evaluation Board User's Manual



ON Semiconductor®

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EVAL BOARD USER'S MANUAL

Description

The NCV8842 Evaluation Boards provide a convenient way to implement and evaluate a complete practical buck regulator design. No additional components are required other than the DC input source and load. Separate boards are available for the SOIC-16 and DFN-18 versions of the device. The SOIC-16 board has an input voltage range of 7 V – 16 V and includes jumpers to set the DC output voltage to 2.5 V, 3.3 V or 5.0 V. The DFN-18 board has an input voltage range of 6 V – 16 V and is preset for a nominal output voltage of 3.3 V.

Both boards include SHDNB and SYNC terminals for logic on-off control of the regulator and synchronization of the internal controller to a external frequency source instead of the internal 170 kHz oscillator.

Features

- V2 Control Method for Uncomplicated Loop Compensation, Fast Transient Response, and Reduced Board Area
- A Total of 12 Components, Including the IC, to Realize a Complete Buck Regulator
- Shutdown Terminal to Disable the Output and Provide a Low Current Drain Standby Mode
- Sync Terminal to Permit Controller Synchronization to an External Source
- 1.5 A Peak Inductor Current
- Cycle-by-Cycle Frequency-Foldback Current Limiter
- Soft Start Function to Reduce Inrush Current
- 87% Efficiency at 1 A Load Current (5 V Output)
- Line Regulation Better Than 0.02%
- Load Regulation Better Than 0.2%

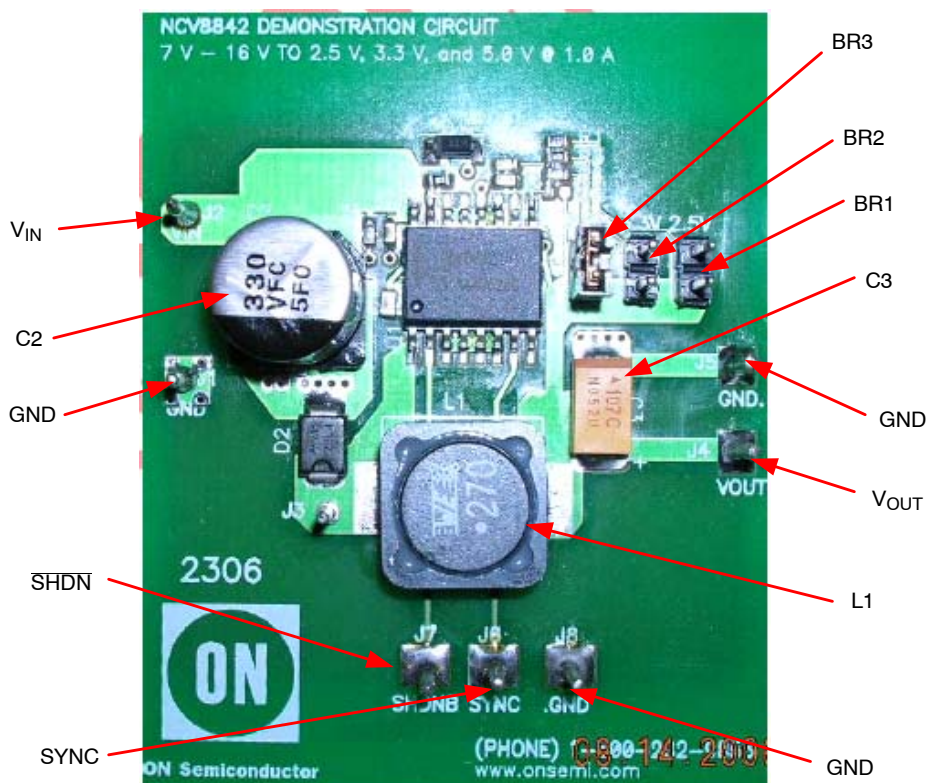


Figure 1. NCV8842 Evaluation Board (SOIC Package)

NCV8842PWGEVB

Table 1. ABSOLUTE MAXIMUM RATINGS

| Pin Name | Maximum Voltage | Maximum Current |
|------------------|-----------------|-----------------|
| V _{IN} | 16 V | 2.0 A |
| V _{OUT} | 10 V | 2.0 A |
| SHDNB | 7.0 V | 1.0 mA |
| SYNC | 7.0 V | 1.0 mA |

Stresses exceeding Maximum Ratings may damage the board. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied.

Table 2. NCV8842 SOIC EVALUATION BOARD USER TERMINALS

| | | | |
|------------------|--|------------------|--|
| V _{IN} | Positive DC input voltage, 7 V to 16 V | | |
| GND | Common power negative / signal return | | |
| V _{OUT} | Regulated DC output voltage | | |
| SHDNB | Shutdown–bar signal. Leave open or drive high for normal operation, drive low to force the regulator into sleep/shutdown mode. | | |
| SYNC | Input signal to synchronize to converter oscillator to a higher external frequency source. Leave open if unused. | | |
| BR1, BR2, BR3 | Bridges (jumpers) for programming the regulated output voltage to one of three levels. Always bridge one pair of terminals. | | |
| | Terminals bridged | V _{OUT} | |
| | BR1 | 2.5 V | |
| | BR2 | 3.3 V | |
| | BR3 | 5.0 V | |

Table 3. ELECTRICAL CHARACTERISTICS

(T_A = 25°C, 7.0 V ≤ V_{IN} ≤ 16 V, 0.1 A ≤ I_{OUT} ≤ 1.0 A, unless otherwise specified.)

| Characteristic | Test Conditions | Typ | Unit |
|------------------------------------|---|------------|--------|
| Output Voltage | | | |
| Voltage Accuracy | – | 4.0 | % |
| Line Regulation | No Load | 0.02 | % |
| Load Regulation | V _{IN} = 7.0 V | 0.15 | % |
| Transient Response | – | 3.0 | % |
| Transient Response Time | Load toggle between 0.1 A and 1.0 A | 10 | μs |
| Startup Time | – | 5.0 | ms |
| Input Voltage | | | |
| Start Threshold | – | 3.3 | V |
| Sync and Shutdown | | | |
| Sync Frequency | – | 190 to 355 | kHz |
| Minimum Sync Threshold Voltage | – | 1.0 | V |
| Minimum Shutdown Threshold Voltage | – | 0.3 | V |
| Maximum Shutdown Bias Current | – | 12 | μA |
| General | | | |
| Switching Frequency | – | 170 | kHz |
| Efficiency | I _{LOAD} = 100 mA I _{LOAD} = 1.0 A | 77.5 83 | % % |
| Shutdown Current* | – | 1.0 | μA |

*If a pull-up resistor is employed, the shutdown current is increased drastically (V_{in}/R).

NCV8842PWGEVB

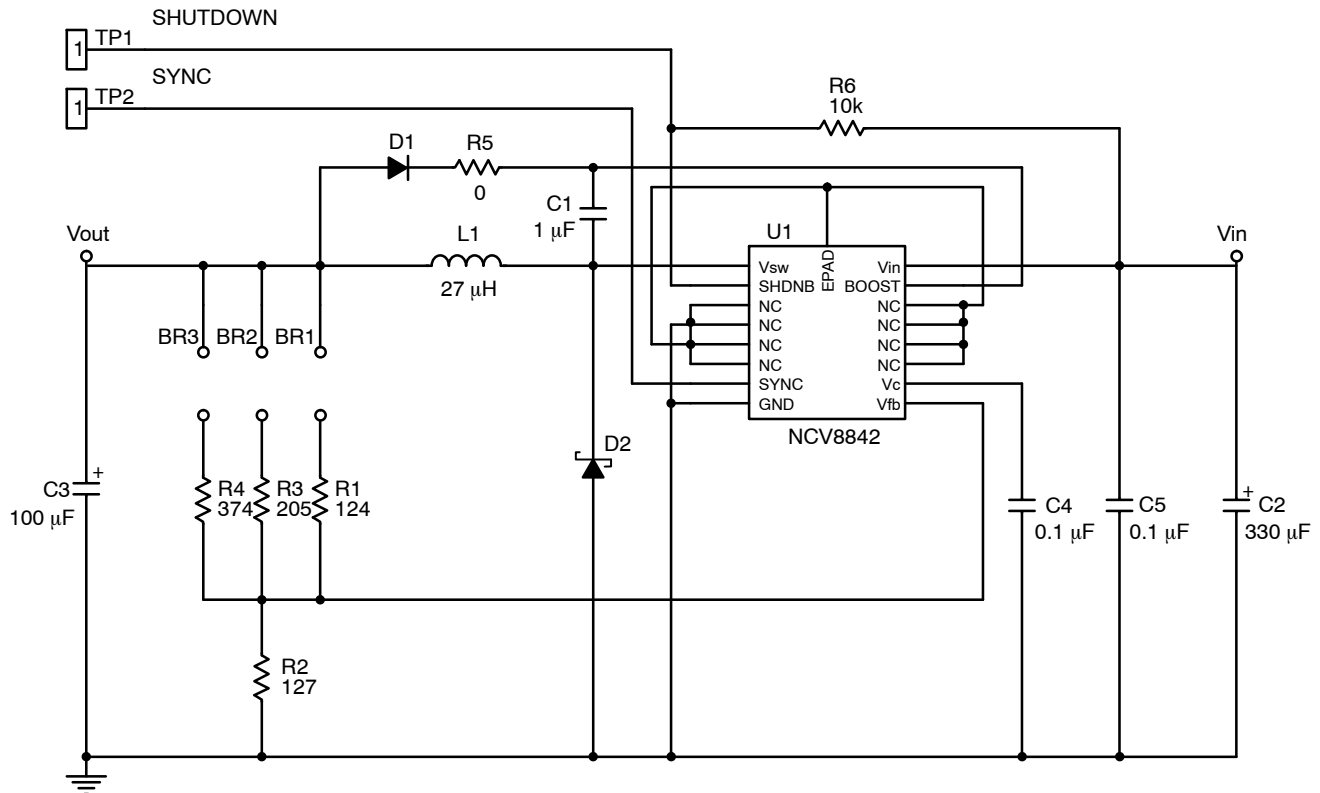


Figure 2. Application Diagram

Operation Guidelines

1. Connect a DC input voltage, within the range of 7.0 V to 16 V, between the board terminals “V_{IN}” (+) and “GND” (-).
2. Connect a load impedance between terminals “V_{OUT}” (+) and “GND” (-).
3. To force the regulator into Shutdown/sleep mode, connect the “SHDNB” terminal to a positive DC voltage of 0.3 V or less, or connect it directly to GND.
4. If synchronization to an external frequency source is desired, connect the SYNC terminal to a pulse source with positive amplitude 1 V to 7 V relative to GND. Sync pulse duty cycle may vary from 10% to 90%.

Theory Of Operation

1. **Boost Circuit:** The Boost circuit, comprised of D1 and C1, generates a voltage higher than the output voltage to drive the base of the internal NPN power switch. When the internal power switch is Off, pin Vsw of the NCV8842 goes negative to sustain the current in L1 through Schottky diode D2. Diode D1 is forward biased, and charges C1 to approximately the output voltage. When the internal power switch turns on, Vsw is driven high, forcing the voltage at BOOST to be the sum of the instantaneous voltage at Vsw plus the

charge across C1. D1 is now reverse-biased, and the energy stored in C1 is used to bias the output stage.

2. **Soft Start:** The soft-start is implemented on the V_C pin. During the startup, the limited source current (25 µA) of the error amplifier charges the V_C pin capacitor. The rising slope of the V_C pin voltage clamps the duty cycle through the PWM comparator. The V_C pin voltage eventually settles down to a voltage roughly equal to the reference voltage 1.27 V. Therefore, the startup time can be easily calculated.
3. **Feedback Network:** V² control relies on the output ripple to provide pulse width modulation. When the output ripple is inadequate, pulse skipping or instability may be observed. Adding a capacitor C6 in parallel with R1 provides a low impedance pass for the output ripple. Therefore, the output ripple is not attenuated by the resistor divider. The use of this capacitor is optional.

Please see data sheet for more description on regulator operation and component selection (document number NCV8842/D available through the Literature Distribution Center or via our website at <http://www.onsemi.com>).

NCV8842PWGEVB

TYPICAL PERFORMANCE CHARACTERISTICS

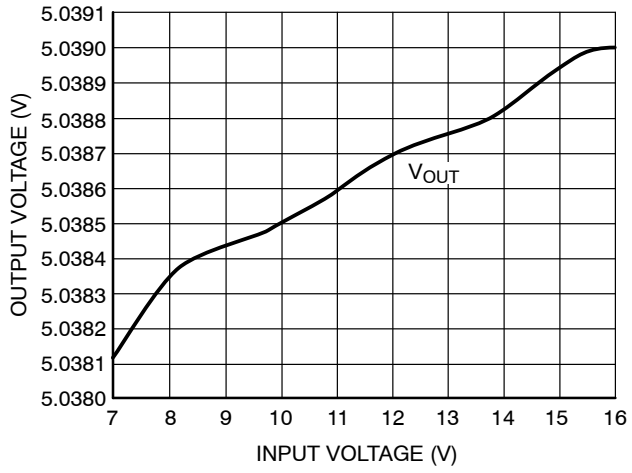


Figure 3. Line Regulation

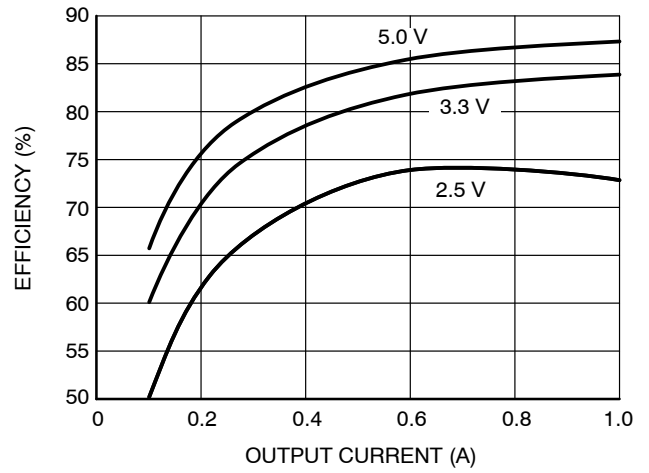


Figure 4. Efficiency vs. Output Current

NCV8842PWGEVB

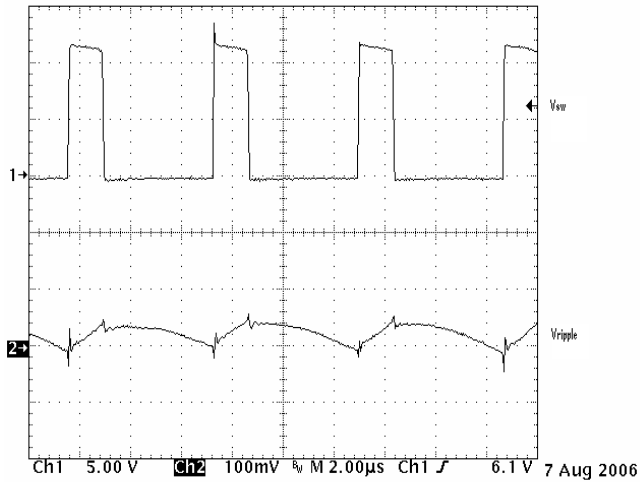


Figure 5. Continuous Mode Operation

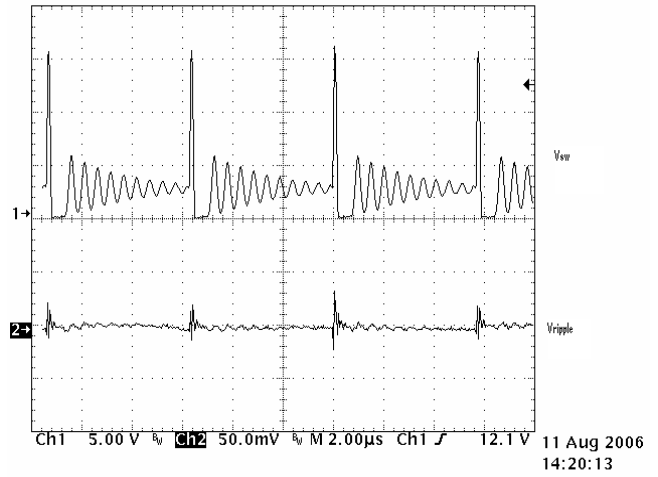


Figure 6. Discontinuous Mode Operation

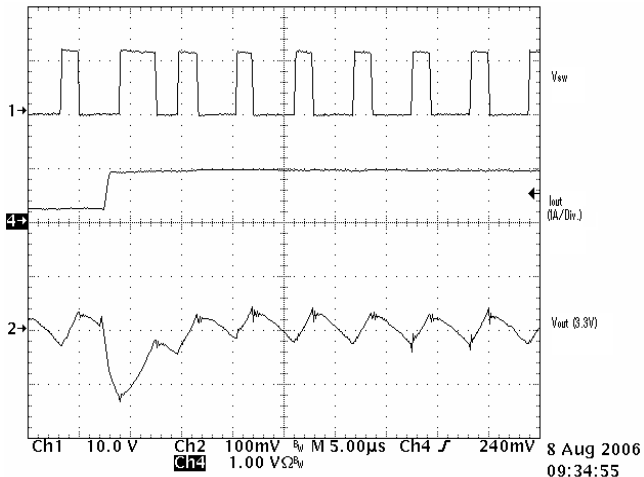


Figure 7. 300 mA to 1.0 A Load Step (3.3 V)

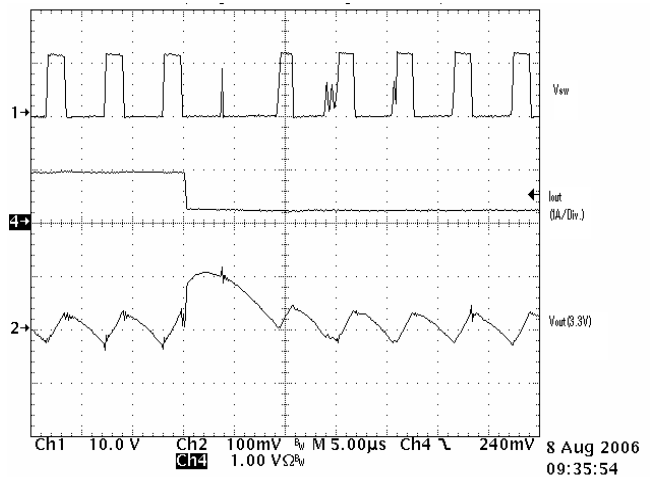


Figure 8. 1.0 A to 300 mA Load Release (3.3 V)

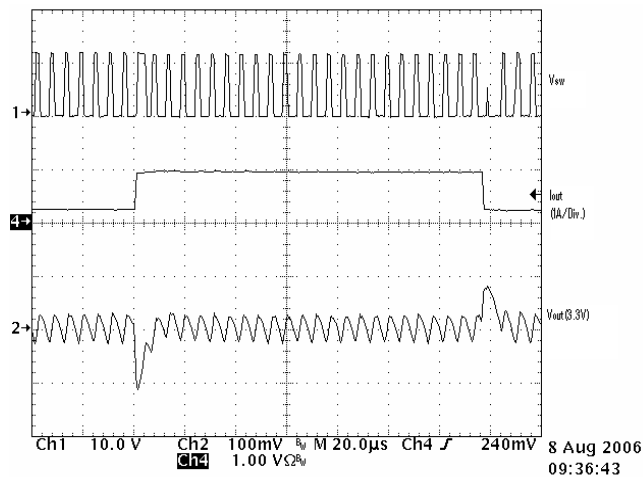


Figure 9. Overall 600 mA Load Response

NCV8842PWGEVB

Table 4. BILL OF MATERIALS

| Ref. Designator | Vendor | Part Number | Type | PC/Board |
|-----------------|------------------|---------------|--------------------------|----------|
| C1 | Panasonic | ECJ-1VB0J105K | 1 μ F Ceramic | 1 |
| C2 | Panasonic | EEVEC1V331P | 330 μ F Electrolytic | 1 |
| C3 | AVX | TAJE107K016R | 100 μ F Tantalum | 1 |
| C4, C5 | Panasonic | ECJ-1VBIC104K | 0.1 μ F Ceramic | 2 |
| D1 | ON Semiconductor | MBRM130LT3 | Diode (Fast Switching) | 1 |
| D2 | ON Semiconductor | MBRS240T3 | 2A Diode (Schottky) | 1 |
| R1 | Panasonic | ERJ-3EKF2040V | 124 Ω Resistor | 1 |
| R2 | Panasonic | ERJ-3EKF1270V | 127 Ω Resistor | 1 |
| R3 | Panasonic | ERJ-3EKF205V | 205 Ω Resistor | 1 |
| R4 | Panasonic | ERJ-3EKF3740V | 374 Ω Resistor | 1 |
| R5 | Panasonic | ERJ-2GEY100V | 10 Ω Resistor | 1 |
| R6 | Panasonic | ERJ-2GEY103V | 10 k Ω Resistor | 1 |
| L1 | Würth | 744771127 | 27 μ H Inductor | 1 |
| U1 | ON Semiconductor | NCV8842 | Controller | 1 |
| J1-J8 | Vector | K24C/M | Test Points | 8 |
| BR1, 2, 3 | Molex/Moldom | 22-28-4020 | Jumpers | 3 |

NCV8842PWGEVB

DRAWINGS OF LAYERS

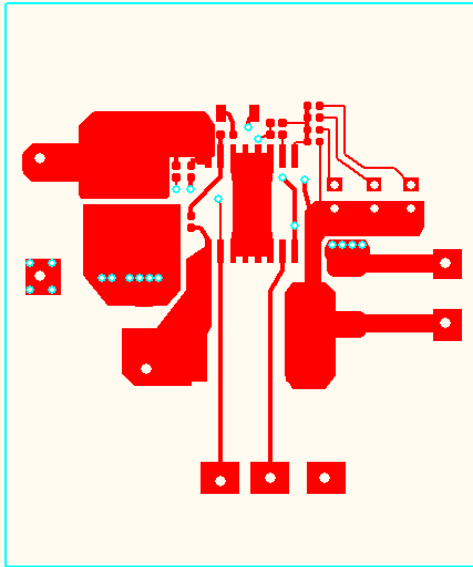


Figure 10. Top Copper

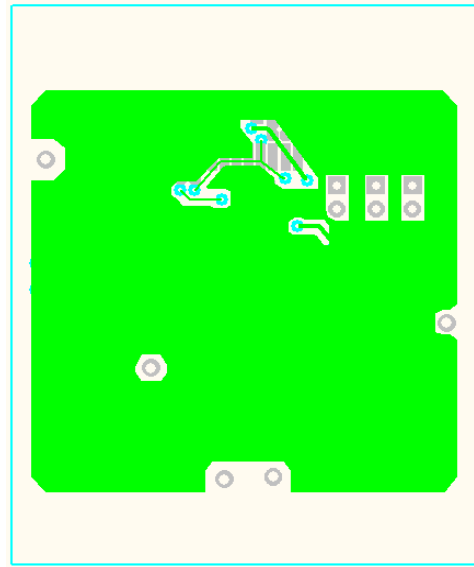


Figure 11. Bottom Copper

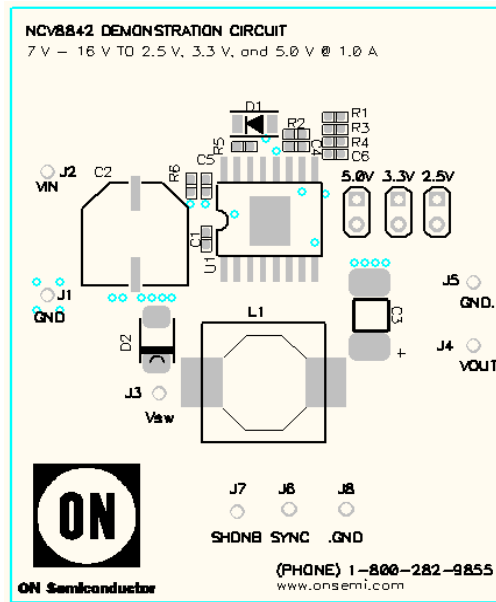


Figure 12. Top Silk

NCV8842PWGEVB

DFN EVALUATION CIRCUIT INFORMATION

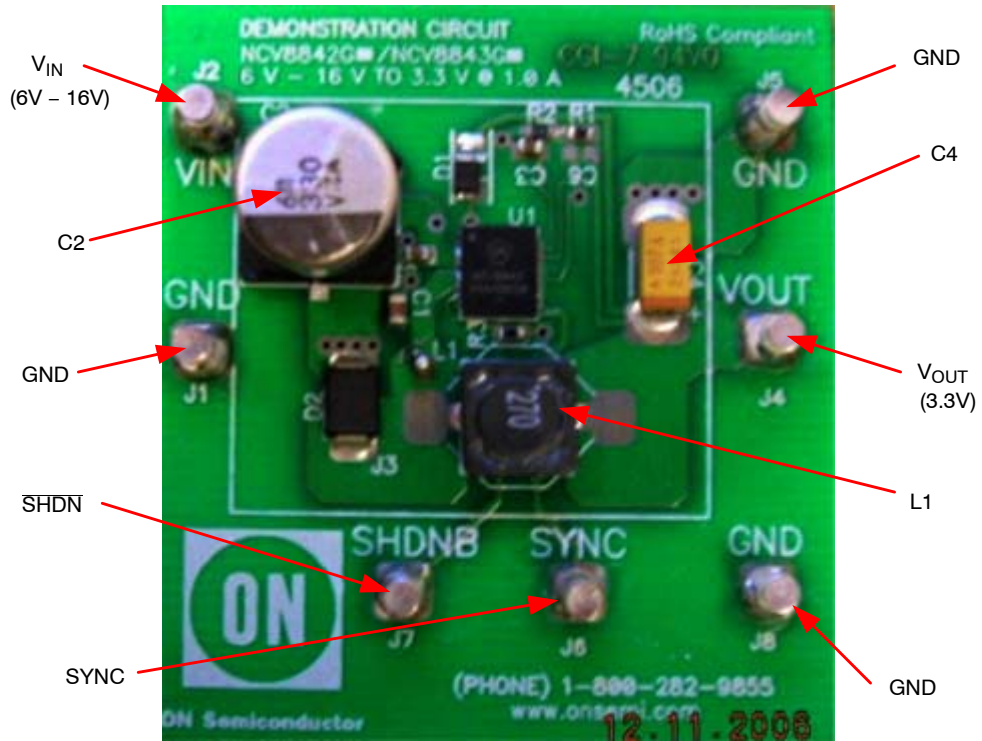


Figure 13. NCV8842 Evaluation Board (DFN Package)

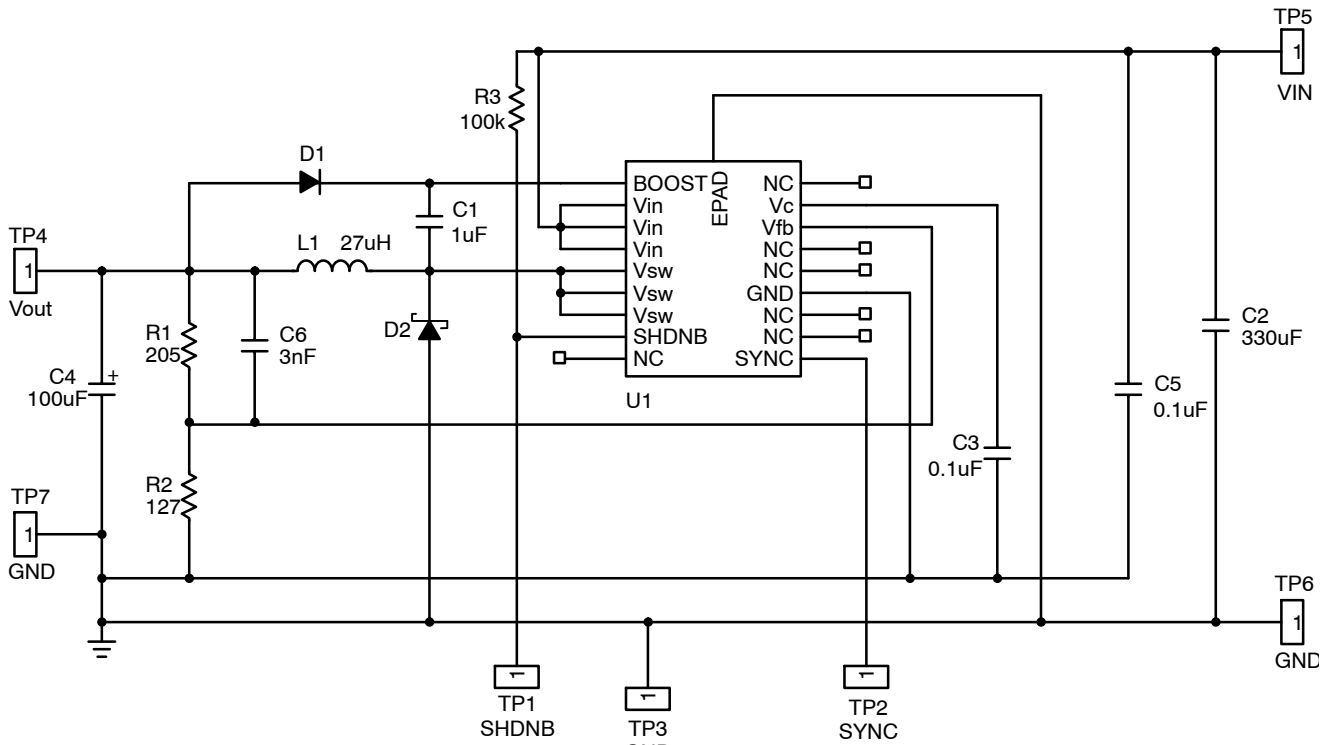


Figure 14. Application Diagram

NCV8842PWGEVB

Table 5. BILL OF MATERIALS

| Ref Des | Type | Part Number | Vender | PC/Board |
|---------------|--------------------------|-------------------------|------------------|----------|
| C3, C5 | 0.1 μ F Ceramic | PCC2398CT-ND | Panasonic | 2 |
| C1 | 1.0 μ F Ceramic | ECJ-1VBOJ105K | Panasonic | 1 |
| C2 | 330 μ F Electrolytic | MZA35VC331MJ10TP | United Chemi-Con | 1 |
| C4 | 100 μ F Tantalum | TPSC107K010R0075 | AVX | 1 |
| C6 | 3.0 nF Ceramic | Not Used | | 1 |
| D1 | Diode | MBRM130LT1G | ON Semiconductor | 1 |
| D2 | 2 A Schottky Diode | MBRS240LT3G | ON Semiconductor | 1 |
| L1 | 27 μ H | 7447779127 | Würth | 1 |
| R1 | 205 Ω Resistor | P205HCT-ND | Panasonic | 1 |
| R2 | 127 Ω Resistor | P127HCT-ND | Panasonic | 1 |
| R3 | 100 k Ω Resistor | P100kHCT-ND | Panasonic | 1 |
| J1, J2, J4-J8 | Test Points | 2501-2-00-44-00-00-07-0 | Mill-Max MFG | 7 |
| J3 | Test Point (Vsw) | K24C/M | Vector | 1 |
| U1 | Regulator | NCV8842G | ON Semiconductor | 1 |

NCV8842PWGEVB

DRAWING OF LAYERS (DFN)

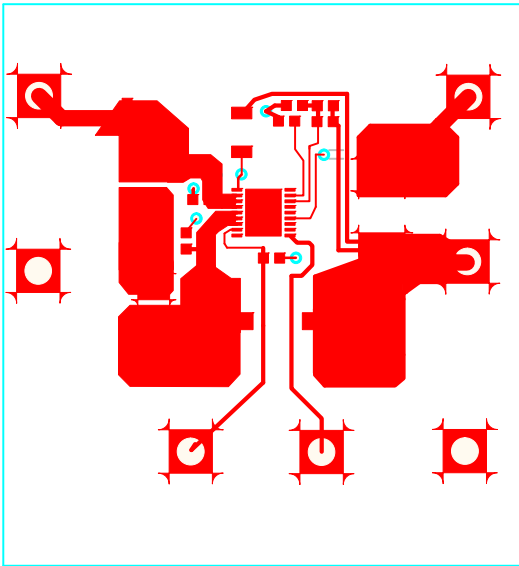


Figure 15. Top Copper

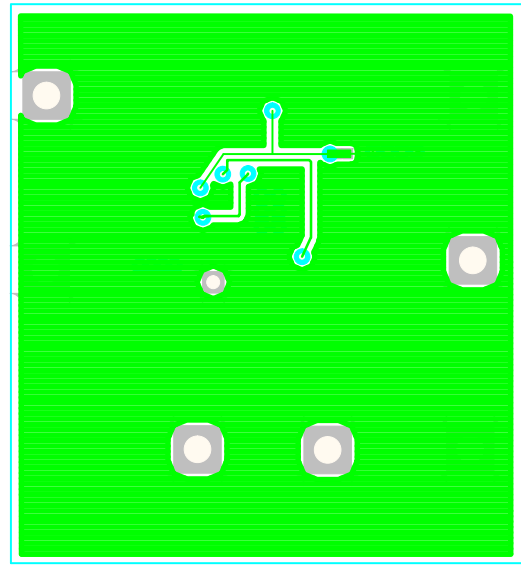


Figure 16. Bottom Copper

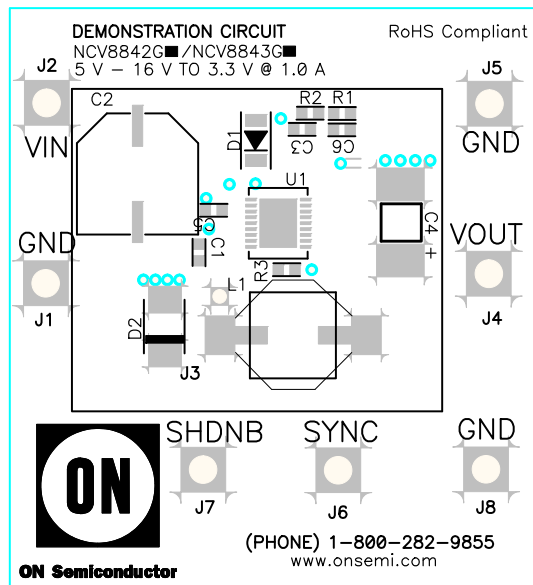


Figure 17. Top Silk

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