

NCL30125 Daughter Board User's Manual



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The NCL30125 daughter board has been designed to replace a forward controller in an existing two-switch forward converter. This user's manual describes the procedure to make this test.

The NCL30125 is a fixed-frequency current-mode controller featuring the Dynamic Self-Supply (DSS). The controller hosts an adjustable switching frequency with jittering function operated in peak current mode control. When the power on the secondary side drops drastically, the part enters skip cycle while limiting the peak current that insures the output voltage regulation and excellent efficiency in light load condition. It features a timer-based fault detection that ensures the detection of overload and a brown-out protection against low input voltages.

Features

- Integrated High-side Driver
- Adjustable Switching Frequency up to 1 MHz with Frequency Jittering

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- Peak Current-mode Control
- Skip Mode to Maximize Performance in Light Load Conditions
- High-voltage Current Source with DSS
- Brown-out (BO) Detection
- Adjustable Soft-start Duration
- 15-ms Timer-based Short-circuit Protection with Auto-recovery or Latched Operation
- Latched OVP/OTP Input for Improved Robustness
- +0.9 A / -1.2 A Peak Source / Sink Drive Capability

The evaluation board needs to be plugged into an existing application. Below is a schematic example of a 120-W/12-V application with the NCP1252. The floating high-side MOSFET is driven thanks to a pulse transformer.

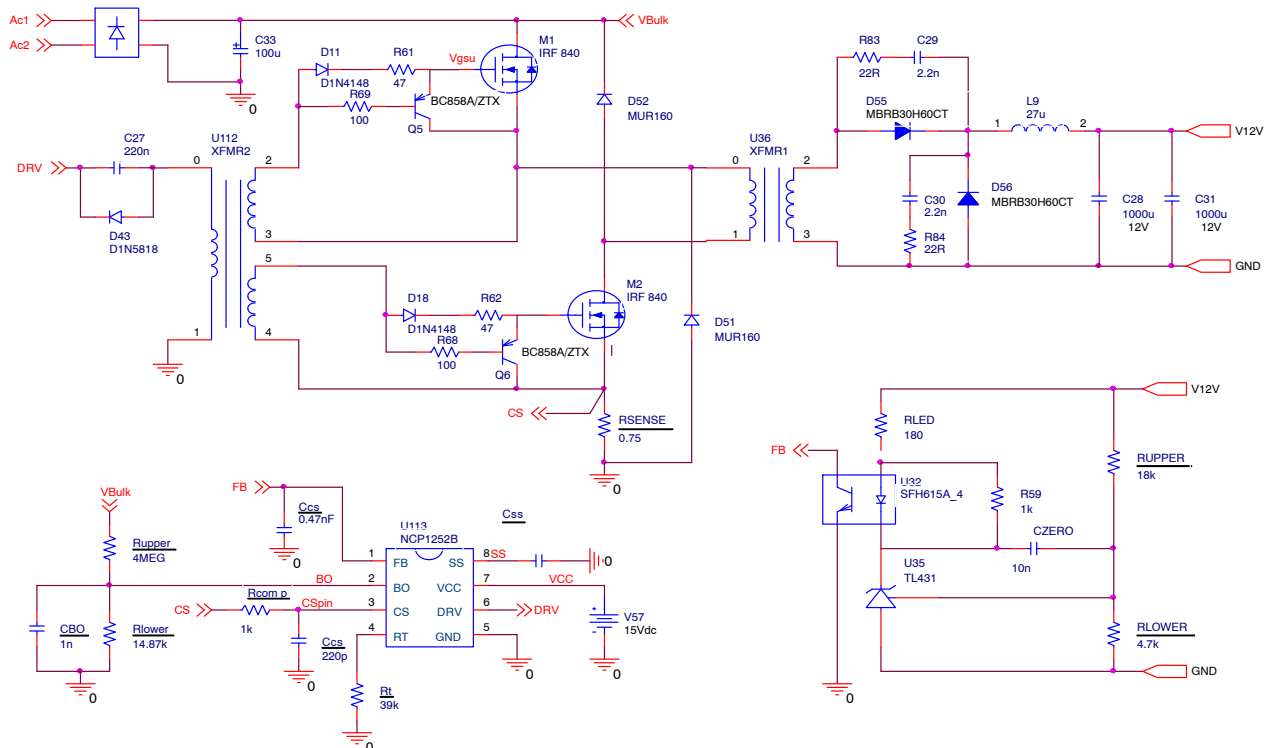


Figure 1. Application Schematic of the 120-W Adapter

Connection Diagram

In order to connect the daughter board, the old controller needs to be unsolder with the pulse transformer. Then the all tests points have to be connected to the main board with short connection. Of course, the ground (GND) node like the current sense (CS) and feedback (FB) connections have to be optimized first.

For the input voltage, it can be connected on the ac mains before the bridge diode or directly on the bulk capacitor.

If the previous schematic with the NCP1252 is modified, it will lead to the following arrangement shown in the Figure 2.

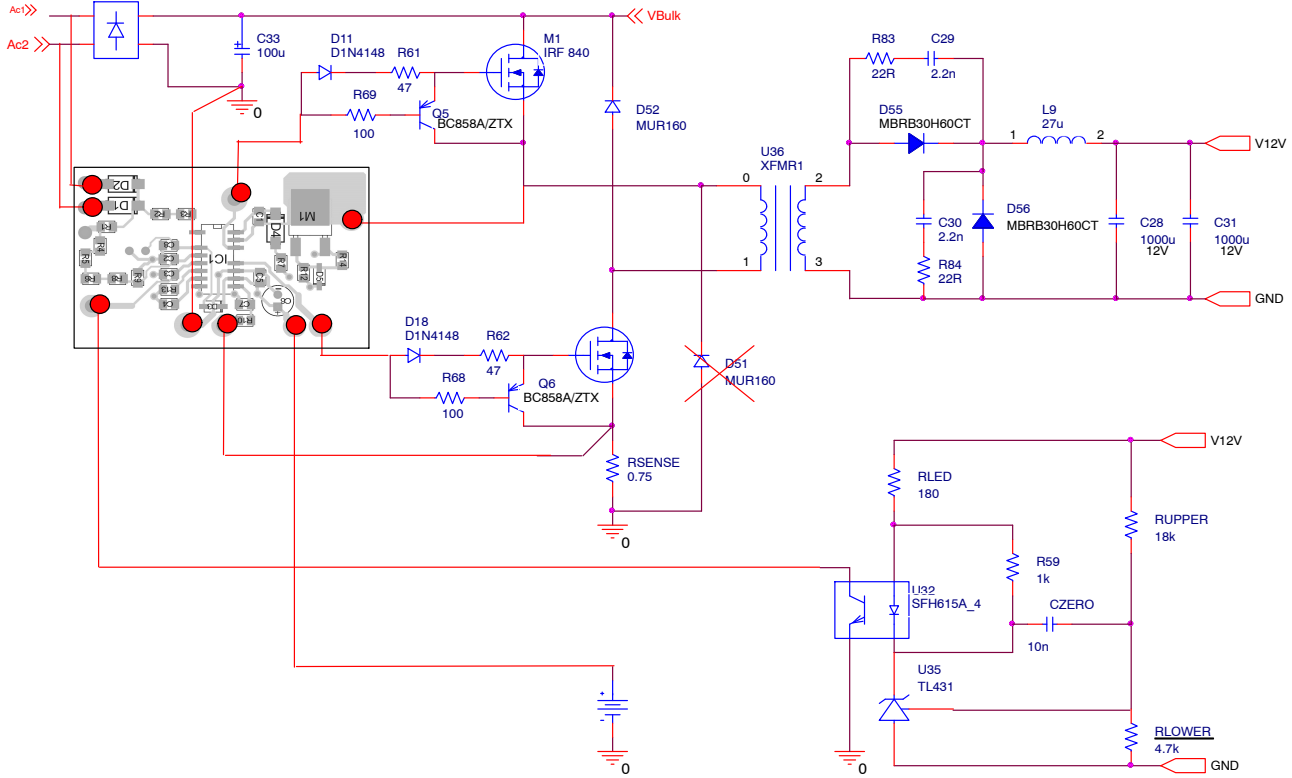


Figure 2. NCL30125 Daughter Board Inserted in the 120-W Application

Evaluation Board Schematic

The evaluation board has been designed to limit the external components. All needed parts are embedded into this daughter board. The BO thresholds can be adjusted with the resistors R₄, R₅, R₆, R₈ and R₉. The switching frequency can be changed thanks to the resistor R₁₃ and the soft-start duration via the capacitor C₄. Finally, the ramp compensation will be affected by the resistor R₁₀.

Please note that a 1-nF capacitor is placed close to the FB pin so the capacitor soldered on the power board needs to be removed to avoid compensation issue.

Finally, thanks to the MOSFET M₁ on the daughter board, the freewheel diode connected between the ground and the HB node can be removed on the mother board.

Layout

The PCB consists of a two layers FR4 board with 35 μm copper cladding. All components are soldered on the top side (only two through-hole components – NTC and V_{CC} capacitor).

All decoupling components as well as other small low-current devices (timing capacitors, feedback decoupling...) have been placed as close as possible to the control IC. The 3rd MOSFET M₁ used to refresh the bootstrap capacitor during the start-up and skip mode has to be placed as closed as possible to the high side driver in order to avoid large noise peak current. Short connections must be used between the HB pin and the drain and also between IC GND and source pin.

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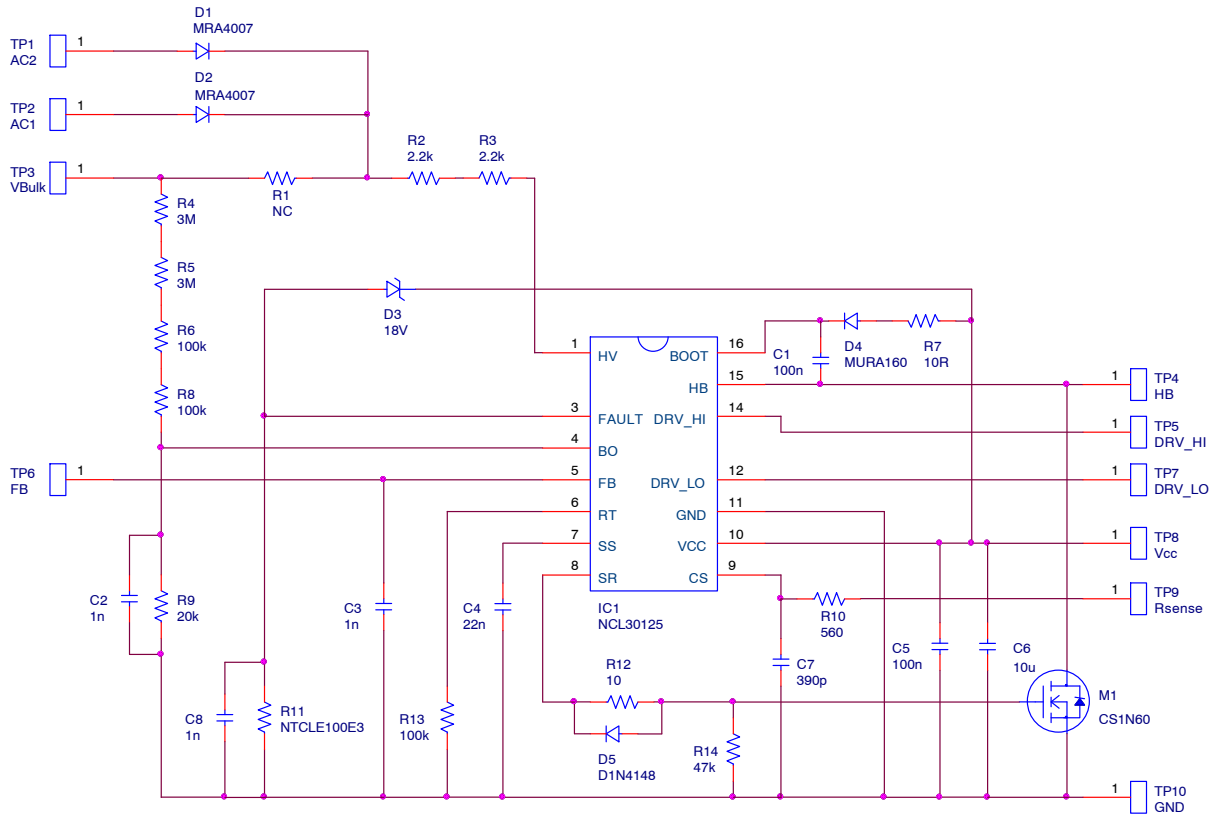


Figure 3. Daughter Board Schematic

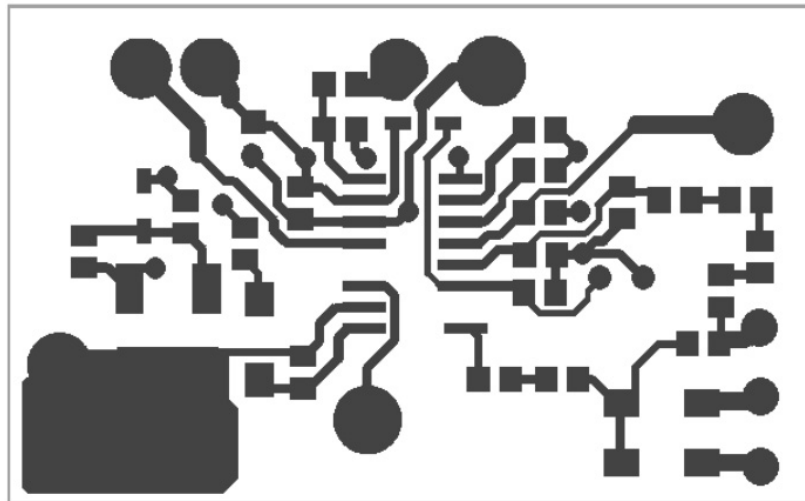


Figure 4. Top Layer

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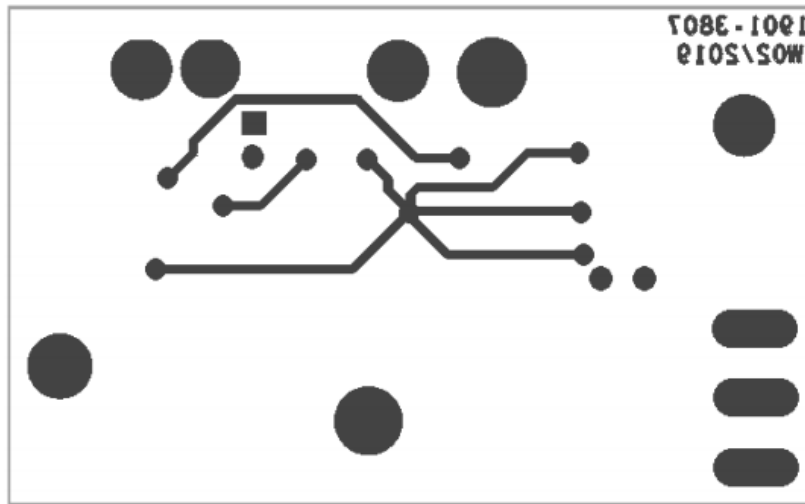


Figure 5. Bottom Layer

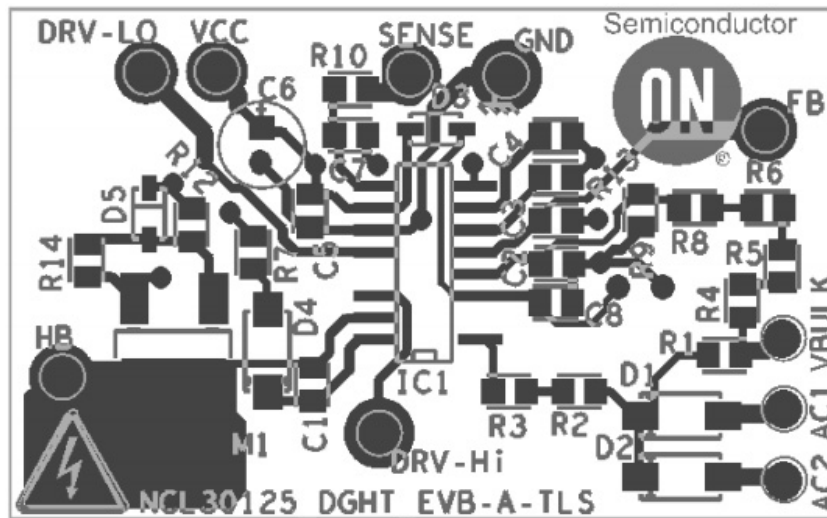


Figure 6. Top Side Components

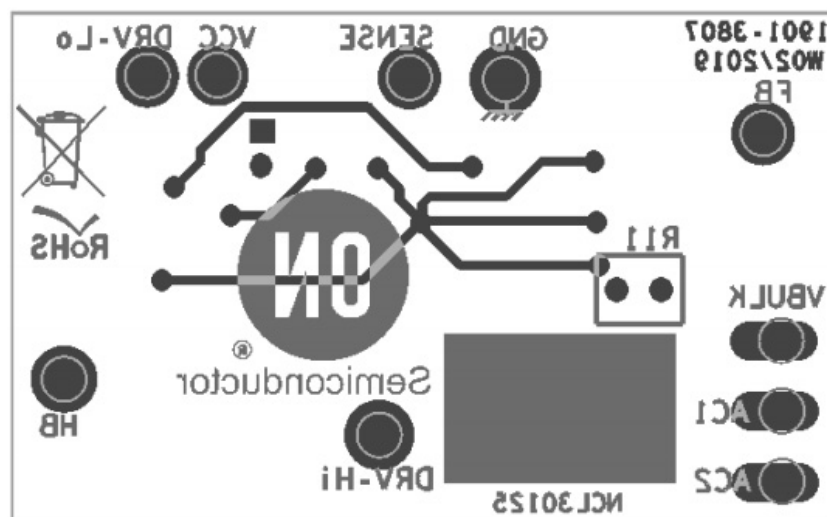


Figure 7. Bottom Side Components



Figure 8. Top Side Daughter Board Picture

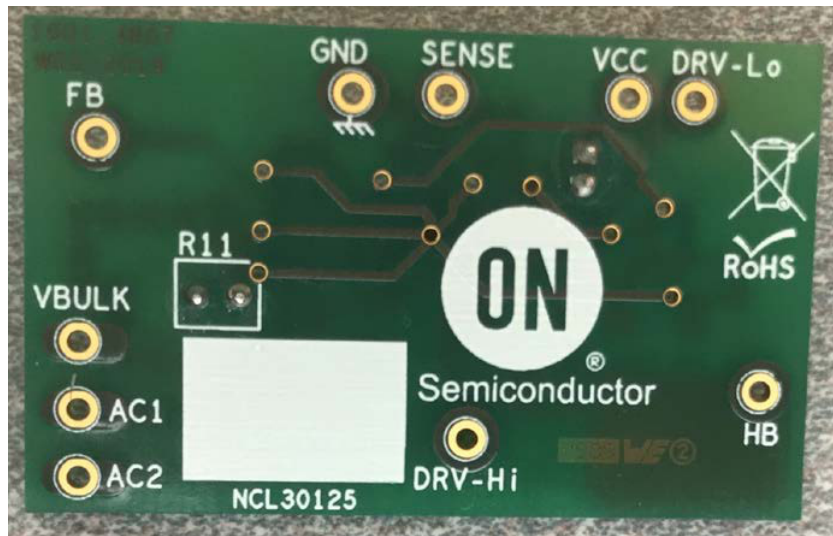


Figure 9. Bottom Side Daughter Board Picture

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Table 1. BILL OF MATERIAL

| Designator | Quantity | Description | Value | Tolerance | Footprint | Manufacturer Part Number | Substitution Allowed |
|------------|----------|------------------------|----------------|--------------|--------------|--------------------------|----------------------|
| C1,C5 | 2 | Ceramic Capacitor | 100 nF | 10%, 50 V | 0805 | Standard | Yes |
| C2, C3, C8 | 3 | Ceramic Capacitor | 1 nF | 10%, 50 V | 0805 | Standard | Yes |
| C4 | 1 | Ceramic Capacitor | 22 nF | 10%, 50 V | 0805 | Standard | Yes |
| C6 | 1 | Electrolytic Capacitor | 10 μ F | 50 V | D5_H11_P2 | 860160672009 | Yes |
| C7 | 1 | Ceramic Capacitor | 390 pF | 10%, 50 V | 805 | Standard | Yes |
| D1, D2 | 2 | Power Rectifiers | MRA4007 | 1 A, 1 kV | SMA | ON Semiconductor | Yes |
| D3 | 1 | Zener Diode | 18 V | | SOD-123 | Standard | Yes |
| D4 | 1 | Power Rectifiers | MURA160 | 1 A, 600 V | SMA | MURA160T3G | Yes |
| D5 | 1 | Switching Diode | MMSD4148 | 100 V | SOD-123 | MMSD4148 | Yes |
| IC1 | 1 | Controller | | | SO-16 | NCL30125B1 | No |
| M1 | 1 | MOSFET | CS1N60 | 0.8 A, 600 V | TO-252 | CS1N60A4H | Yes |
| R1 | 1 | Ceramic Resistor | NC | 5% | 0805 | Standard | Yes |
| R2, R3 | 2 | Ceramic Resistor | 2.2 k Ω | 5% | 0805 | Standard | Yes |
| R4, R5 | 2 | Ceramic Resistor | 3 M Ω | 5% | 0805 | Standard | Yes |
| R6, R8 | 2 | Ceramic Resistor | 100 k Ω | 5% | 0805 | Standard | Yes |
| R7, R12 | 2 | Ceramic Resistor | 10 Ω | 5% | 0805 | Standard | Yes |
| R9 | 1 | Ceramic Resistor | 20 k Ω | 5% | 0805 | Standard | Yes |
| R10 | 1 | Ceramic Resistor | 560 Ω | 5% | 0805 | Standard | Yes |
| R11 | 1 | NTC, Beta = 4190 | 100 k @ 25°C | 5% | Through-hole | NTCLE100E3104JB0 | Yes |
| R13 | 1 | Ceramic Resistor | 100 k Ω | 5% | 0805 | Standard | Yes |
| R14 | 1 | Ceramic Resistor | 47 k Ω | 5% | 0805 | Standard | Yes |

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