EVBUM2670

NCL30125 Daughter Board User's Manual

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EVAL BOARD USER'S MANUAL

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
- 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.

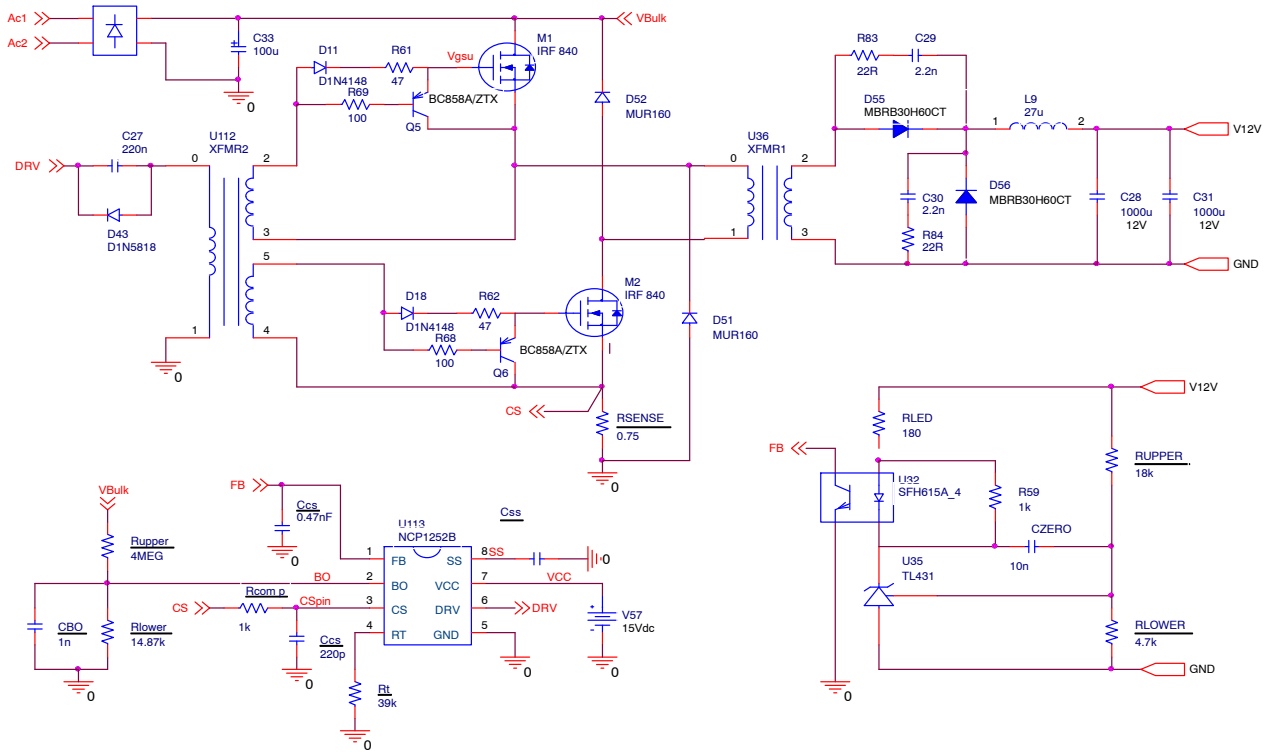

Figure 1. Application Schematic of the 120−W Adapter

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.

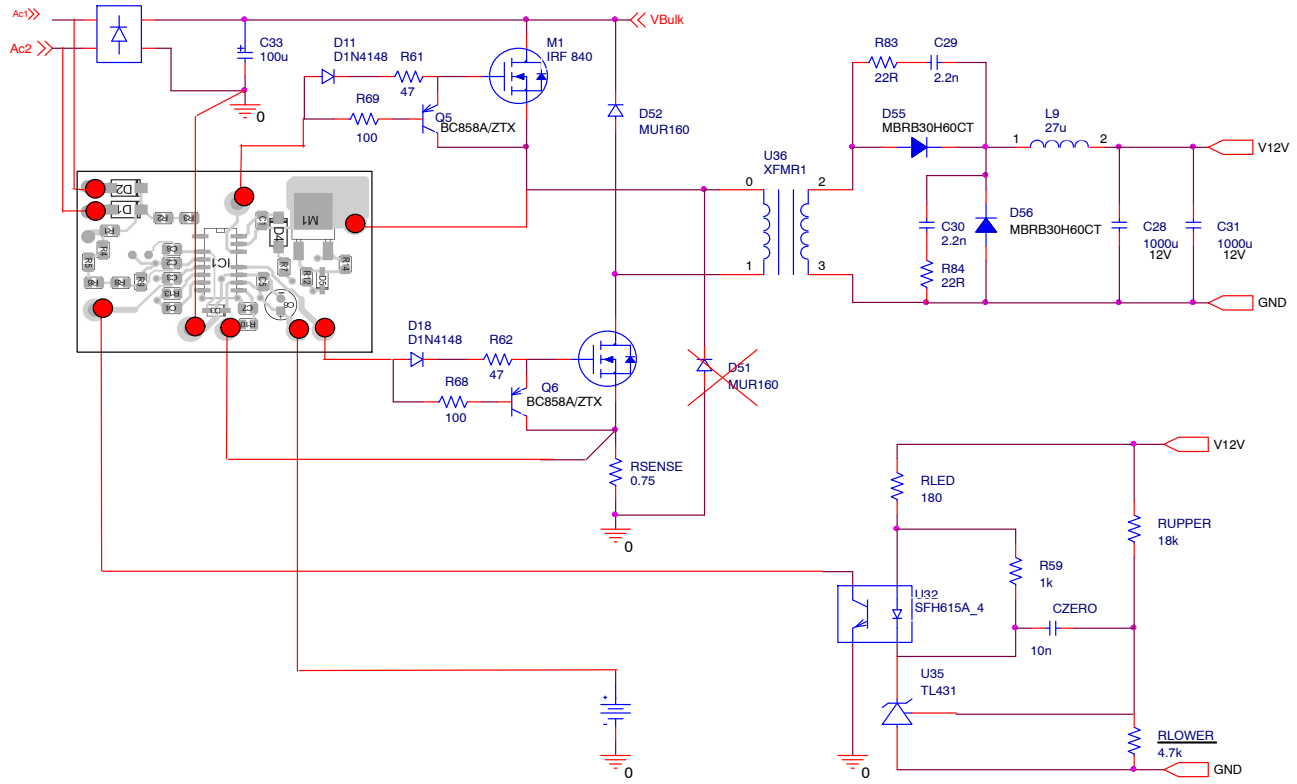

Figure 2. NCL30125 Daughter Board Inserted in the 120−W Application

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 R_4, R_5, R_6, R_8 and R_9. The switching frequency can be changed thanks to the resistor R_{13} and the soft−start duration via the capacitor C_4. Finally, the ramp compensation will be affected by the resistor R_{10}.

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 M_1 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 M_1 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.

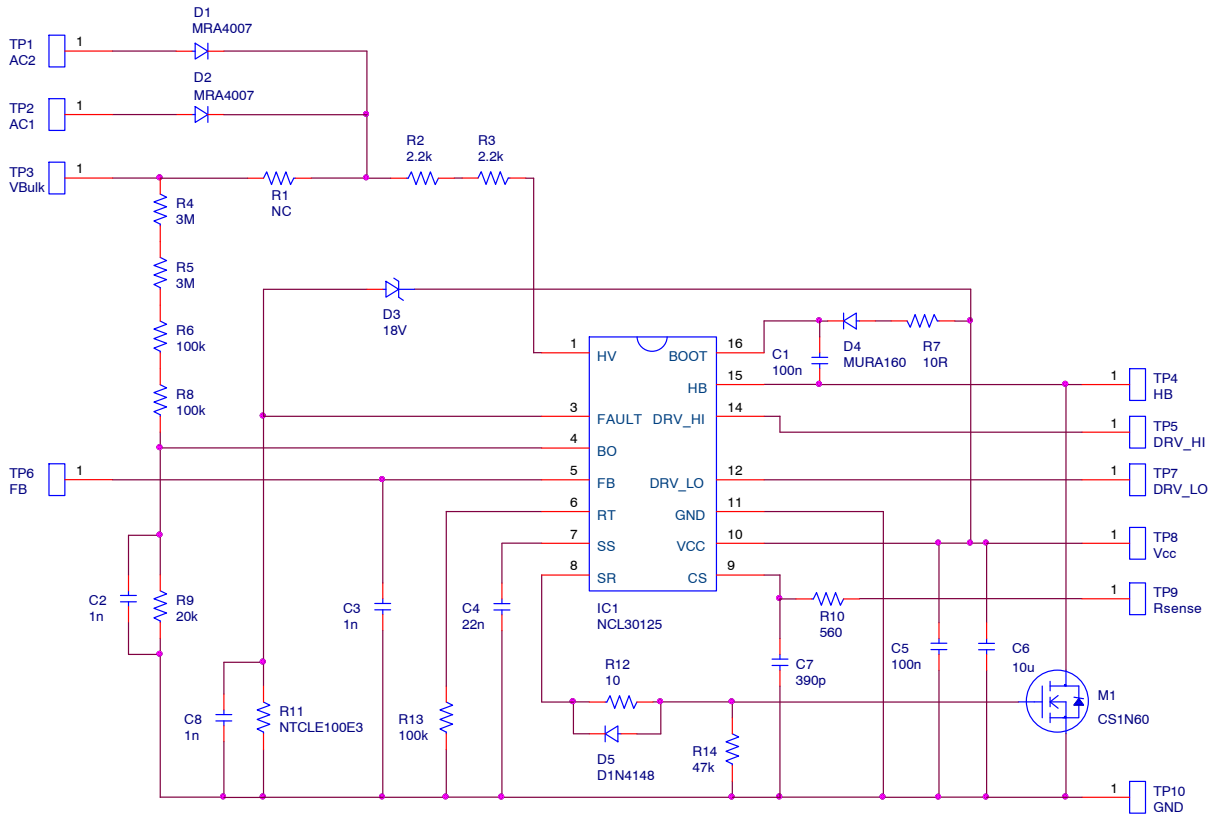

Figure 3. Daughter Board Schematic

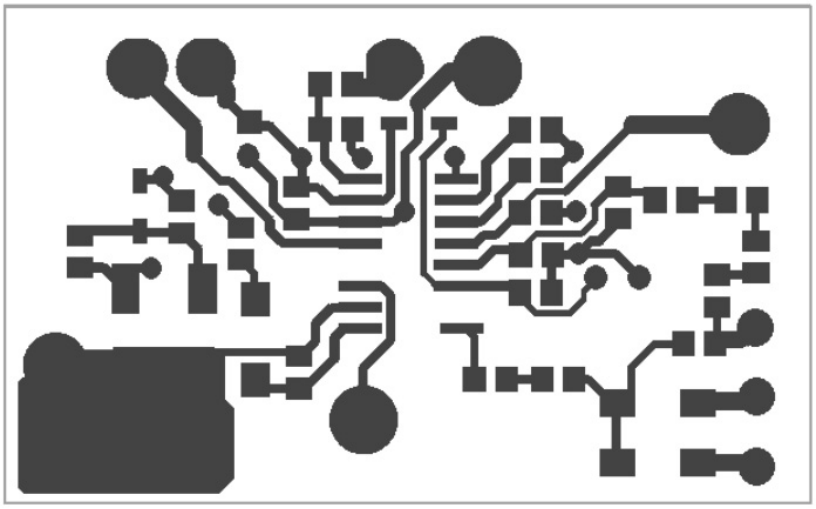

Figure 4. Top Layer

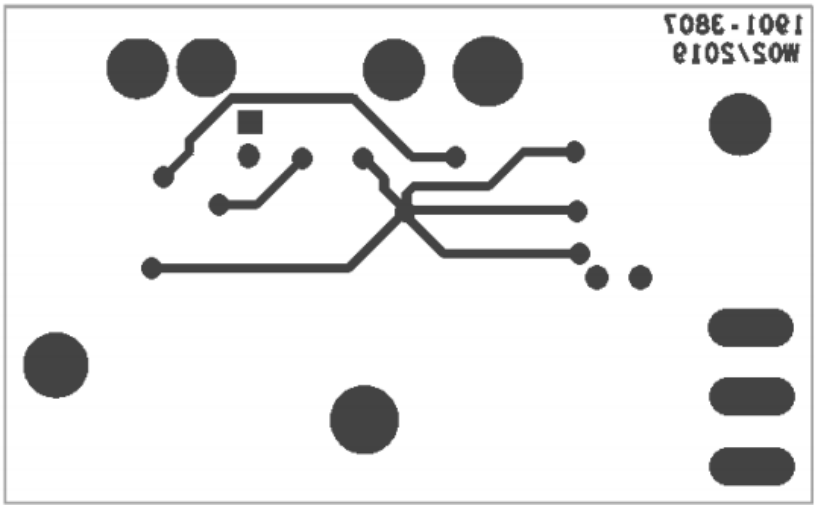

Figure 5. Bottom Layer

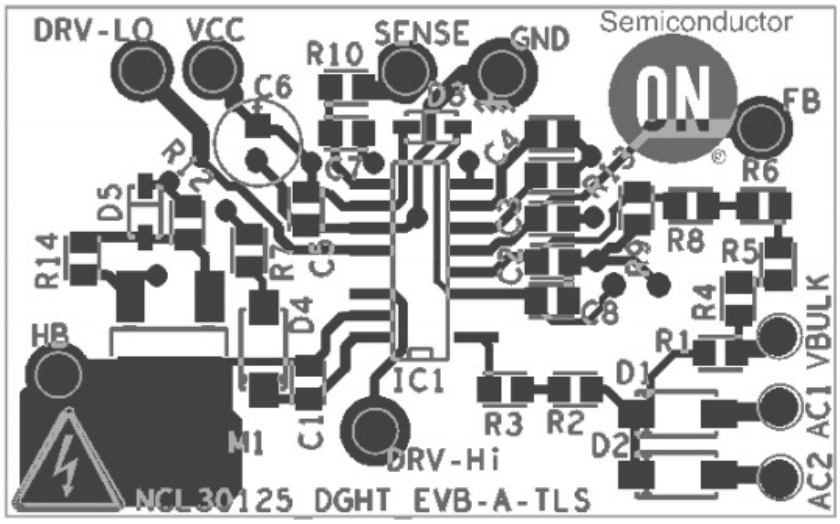

Figure 6. Top Side Components

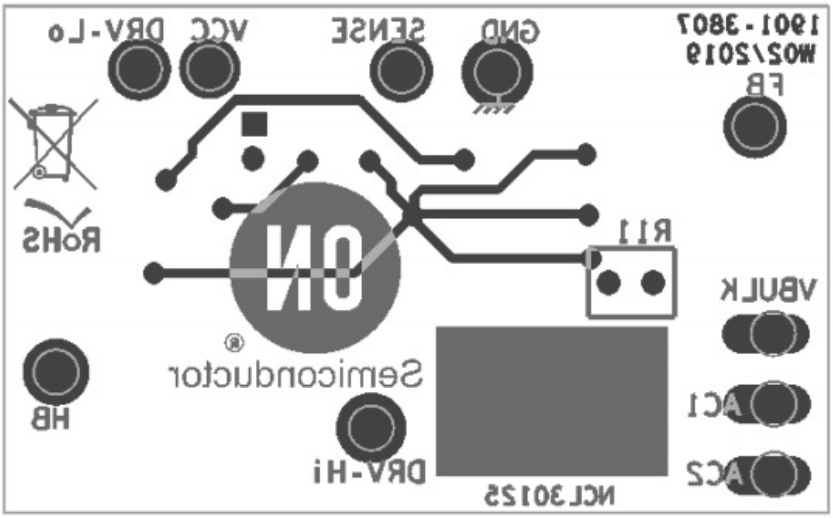

Figure 7. Bottom Side Components

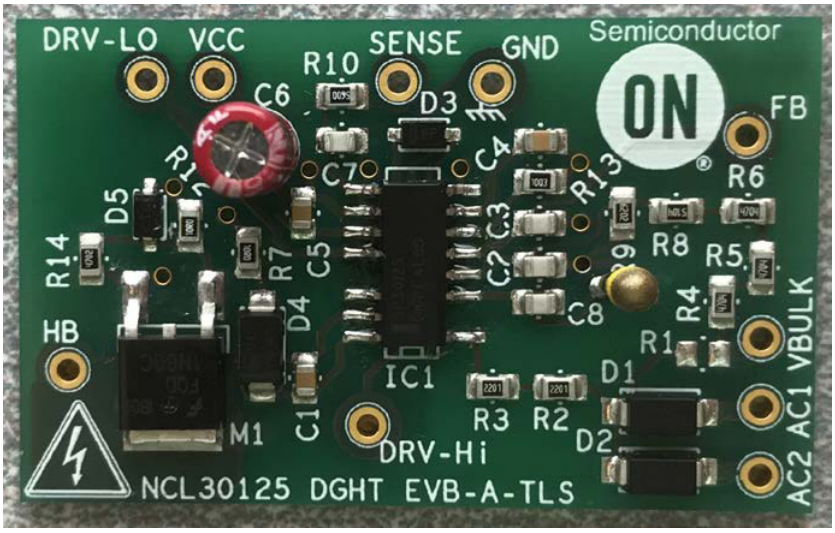

Figure 8. Top Side Daughter Board Picture

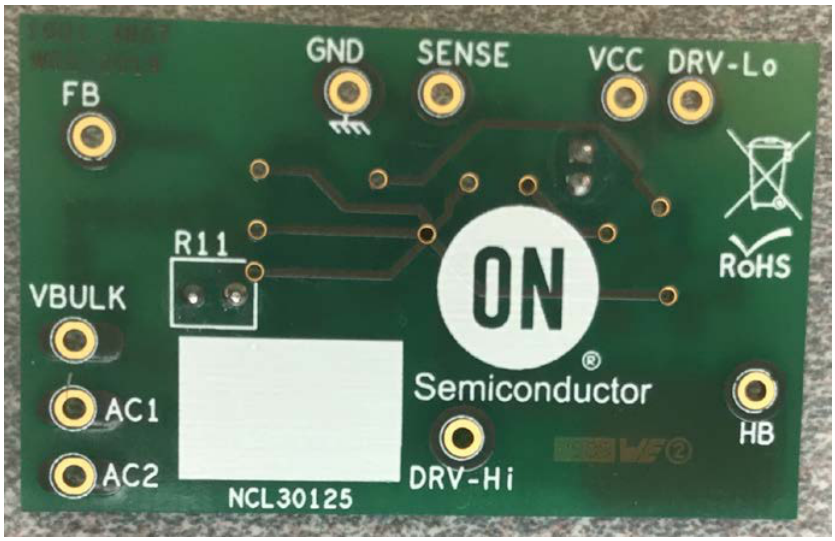

Figure 9. Bottom Side Daughter Board Picture

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 μF	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 kΩ	5%	0805	Standard	Yes
R4, R5	2	Ceramic Resistor	3 MΩ	5%	0805	Standard	Yes
R6, R8	2	Ceramic Resistor	100 kΩ	5%	0805	Standard	Yes
R7, R12	2	Ceramic Resistor	10 Ω	5%	0805	Standard	Yes
R9	1	Ceramic Resistor	20 kΩ	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 kΩ	5%	0805	Standard	Yes
R14	1	Ceramic Resistor	47 kΩ	5%	0805	Standard	Yes

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