

# Layout Guidelines for Switching Power Supplies

(from National Semiconductor AN-1149)

When laying out a circuit (of any kind) parts placement is important. This is especially important for switching power supplies.

Problems associated with layout are most often evident with:

- High current levels
- Large differentials in input/output voltage

Problems show up in the following forms:

- Loss of regulation
- Excessive noise on the supply line
- Instability

Here are some guidelines to keep in mind regarding the selection of parts and the positioning of parts on the circuit board:

## **Inductors**

- The inductor is the primary source of power supply noise, so take care in selection and positioning this device.
- Best choice is a closed core (torroidal) ferrite core.
- Worst choice is an open ended stick core.
- Open core inductors should be positioned so that poles are perpendicular to the circuit board traces (or wires).

## **Feedback**

- Position the feedback wires as far from the inductor as possible.
- Make the feedback conductor large (for pc boards).
- For proto boards, make the feedback connection to the 723 as direct as possible.
- On a pc board, its often a good idea to separate the feedback conductor from the inductor with a ground plane.

## **Filter Capacitors**

- Place the input filter capacitor close to the switching transistor collector.
- Many bypass capacitors for this project are suggested on the schematic. Use bypass capacitors liberally!
- Keep capacitor lead lengths as short as possible.

## **Compensation**

- If external compensation components are needed, place them close to the IC.

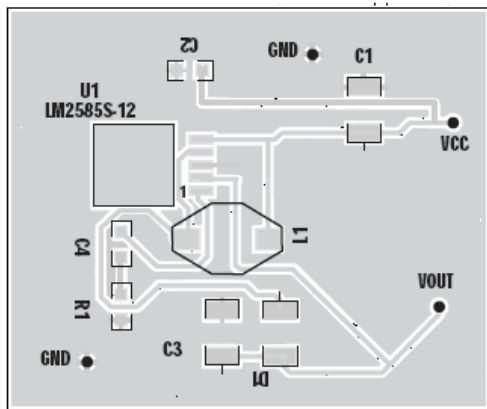
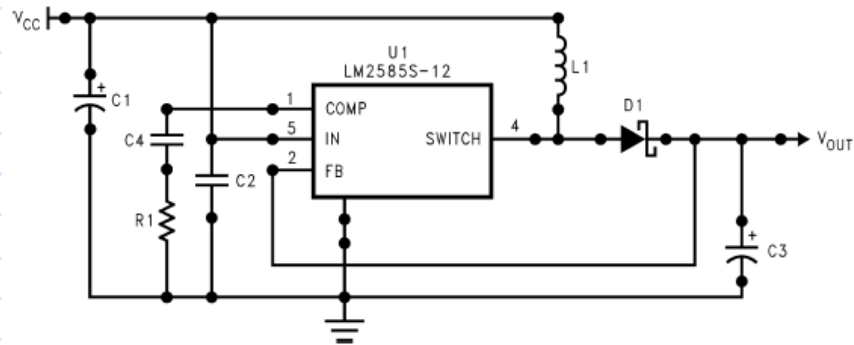
## **Traces and Ground Plane**

- Make all of the power (high current) traces as short, direct and thick as possible.
- Minimum trace size on a pc board is 15 mils (0.381 mm) per Ampere.
- The inductor, output diode and output capacitor should be located as close together as possible.
- The grounds of the IC, input capacitors and output capacitors should be connected as directly as possible to the ground plane.

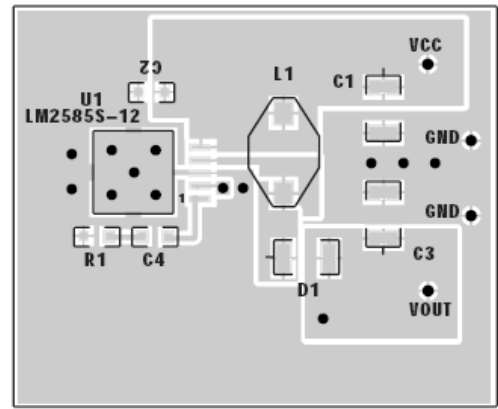
## Heat Sinking

- Use the pcb as a heat sink when possible

Here is a pcb example:



Bad layout



Good layout

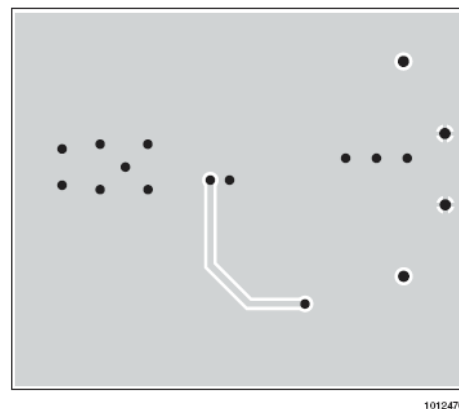


FIGURE 4. Good Layout Example, Bottom Layer