Ground Wiring in DC/DC Converters (1)

■ Background Knowledge

Everyone has to stop and think very carefully about the copper trace pattern and placement of components when designing a printed wiring board. If these two points are given insufficient consideration, the efficiency, maximum output current, output ripple, and other characteristics of a printed wiring board can be seriously affected. The causes substantially affecting these characteristics are ground (GND, VSS) wiring and power supply (+B, VCC, VDD) wiring. If the pattern of ground and power supply wiring is good, the circuits will be free of problems; if it is poor, the circuits will be problematic.

Performance problems are caused mostly by the copper trace pattern and placement of components. In this regard, there are fundamental principles and precautions, as shown below.

■ Five Fundamental Principles

1. Use a planar pattern for grounding.
2. Use also a planar pattern for power supply lines.
3. Place components in correct sequence in line with the signal current flow illustrated on the circuit diagram.
4. Data gained from experiments shall be incorporated as-is.
   (Replicate data even if constraints are placed due to board size or other factors.)

Precautions

In addition to the fundamental principles shown above, keep in mind the following when designing a copper trace pattern and placement of components

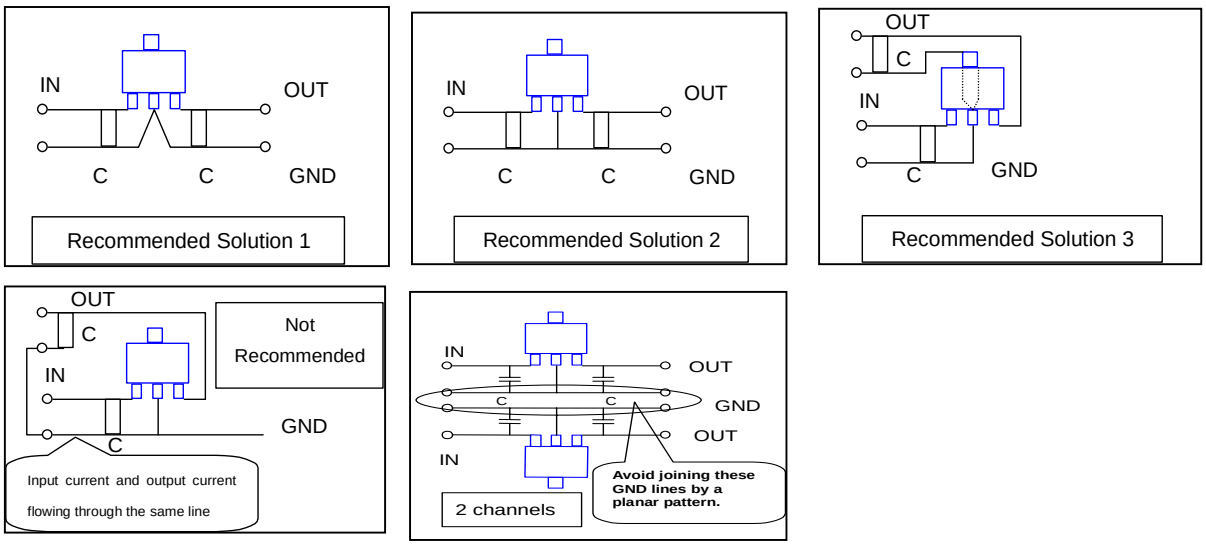
1. Stray capacitances are produced in the copper trace pattern.
2. The length of a copper trace has a resistance

It is, however, possible to make use of these factors for the removal of noise, or equivalently, unwanted radiation. Planar patterns are used incorporating these precautions 1 and 2.

■ Patterns Based on the Fundamental Principles

1: Place components in line with the flow of signals as shown on the circuit diagram. The input current line should differ from the output current line.
2: Place components so that copper traces connecting them are as short as possible. (Noise prevention)
3: Consideration should be given to positions where the signal voltage varies substantially in amplitude and portions that a high current flows through. (Noise prevention)
4: Care should be taken for the connection of a coil or transformer, if included.
5: Design the placement of components to arrange them in one direction allowing for flow soldering.
6: Provide 0.5-mm clearances among components (or component pads and solder pads). (Solder bridge prevention)

Example 1:



*1: Planar pattern

In general, lines are used to connect components. The planar pattern connects components by planes rather than lines. Imagine coloring in the line drawing of a circle. Before it is colored, you see a line (forming a circle). In general, components are placed on a line like this. The planar pattern is like the circle after it is colored in (the colored portion corresponding to a plane of copper foil). Connections in the planar pattern are made by a wide contact area.

*2: Common names of printed boards

PCB: Printed Circuit Board
PWB: Printed Wiring Board