POWER

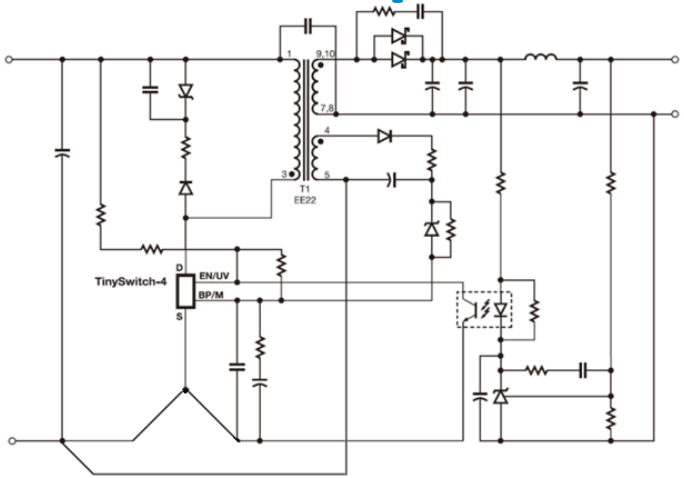
Tiny switch Series layout

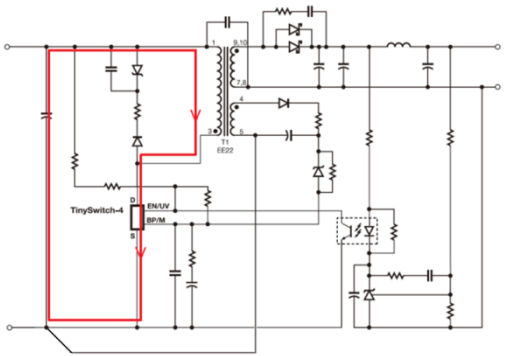
July/2019 Romeo Fan

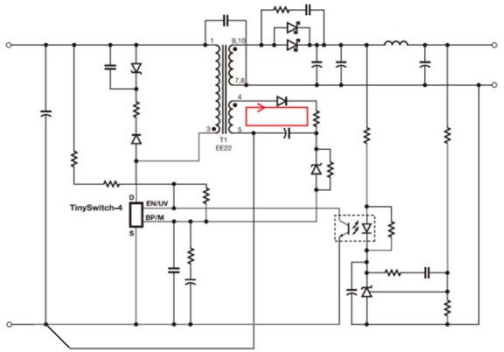
How to know it’s a good layout

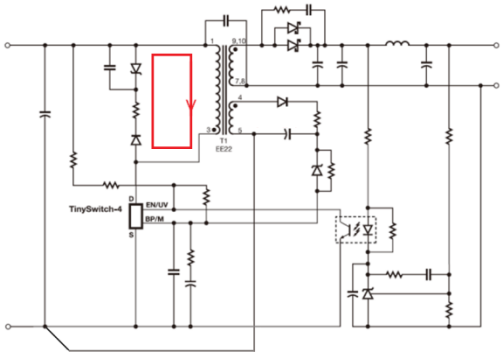
- **3 Steps and five explain in a standard schematic for Tiny switch.**
- **How can we check this is a good layout**
  - Three check points
    - Step 1
      - Switch loop: Try to find the power device
        - **MOSFET**
        - **Diode**
      - Reduce the switch loop circle area in the layout; Keep switching loops as small as possible;
      - Can’t put any signal components inside or around the switch loop.
    - Step 2
      - Power and signal loop: Try to find the power path;
        - **MOSFET**
        - **Diode**
      - Mostly is related with switch loop ,B+ and B-; Kelvin connection
      - Power path is needed to be separated with signal path; Switching loops need totally separated with signal loops
    - Step 3
      - Small Signal components as close as possible the device’s pin

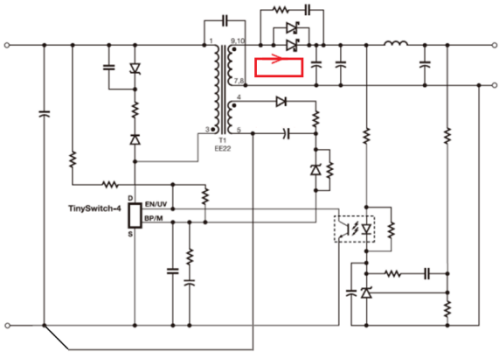
Switch loop of Standard schematic for Tiny switch







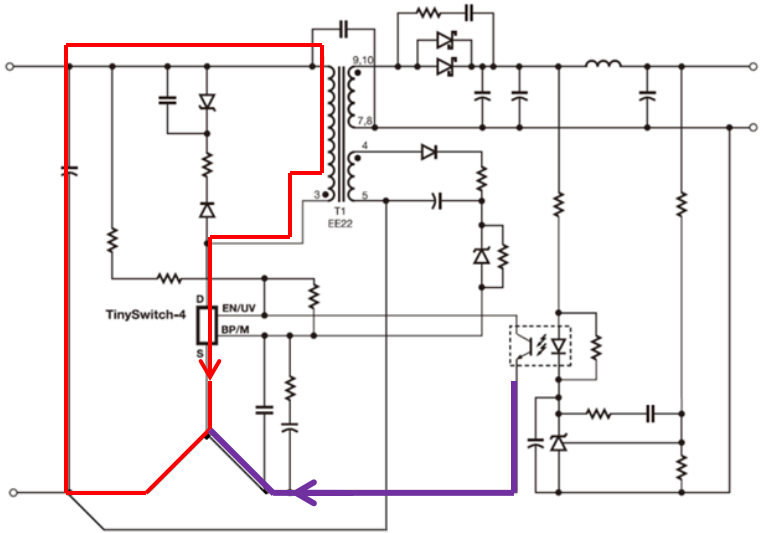




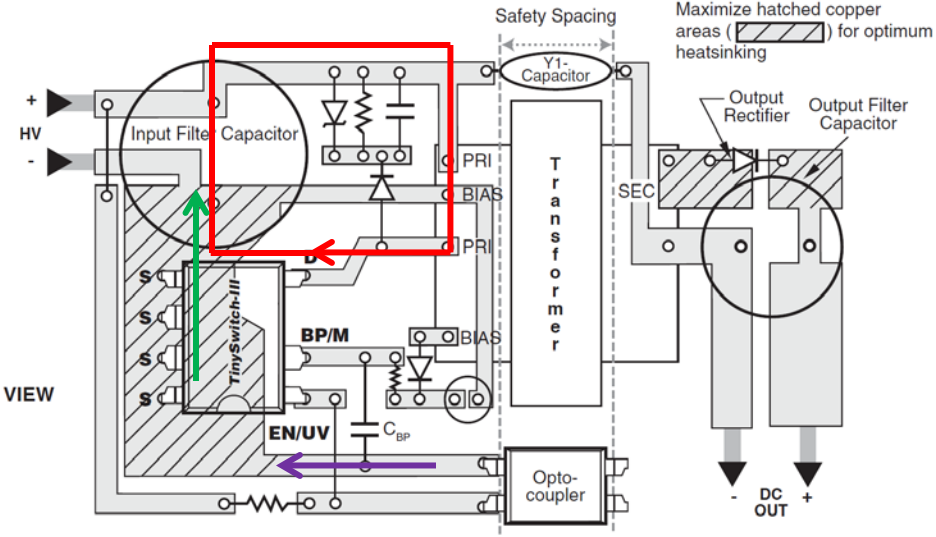
- **Normal we will separate to 4 switch loops in a standard circuit**
  - Main loop
  - Primary snubber circuit loop
  - Primary bias winding loop
  - Secondary power winding loop
    - Snubber should be noted too

1.Main Mosfet switch loop

- **B+(Buck cap or decoupling cap)➔Main transformer➔Drain pin of Tiny➔Source pin of Tiny➔ B-(Buck cap or decoupling cap)**
- **Switching loops as small as possible**
- **Power path**
  - The **Green** line, **MOSFET currents flow** into Bulk cap directly; the Signal loops need to pass through Source pin, can't connect with high current path between Source pin to Bulk cap(Green line).
  - The purple line, it's the Signal ground. High current will flow in Bulk cap(Green line), purple path has no switch current.

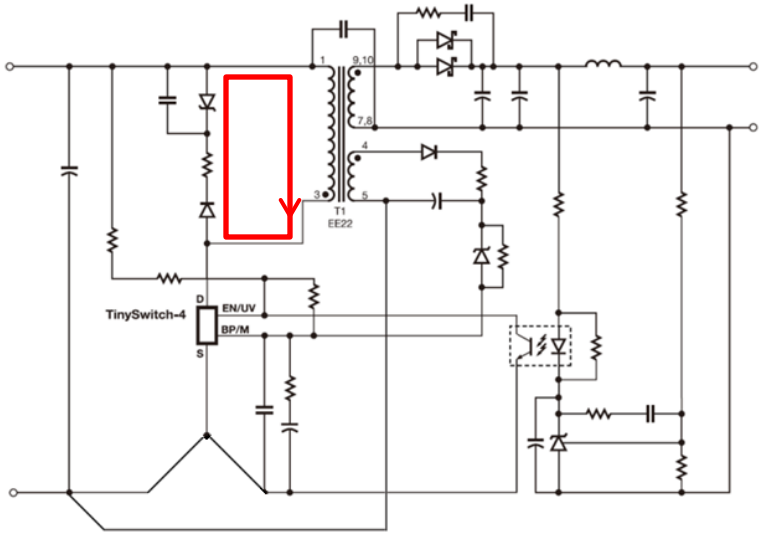


TOP VIEW



2. Primary snubber loop

- **Switch loop**
  - B+ of Main transformer ➔ Clamp diode ➔ TVS or RC ➔ B+
- **Switching loops as small as possible**



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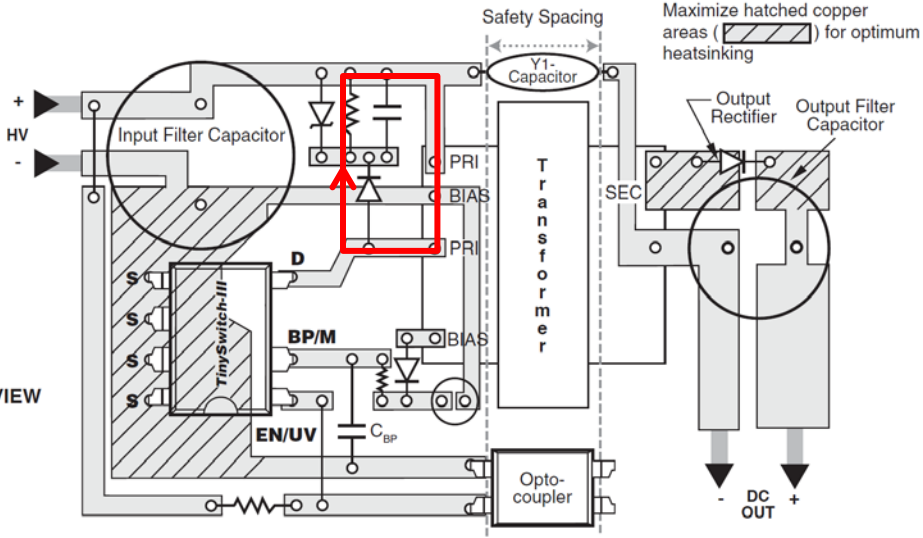
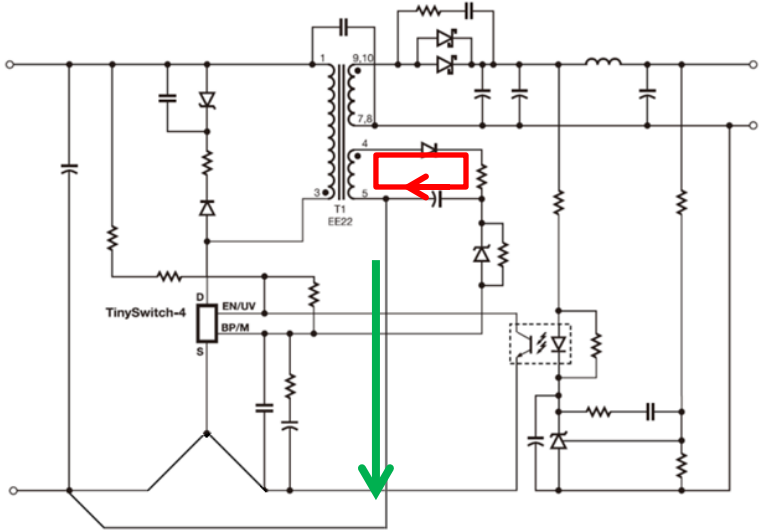
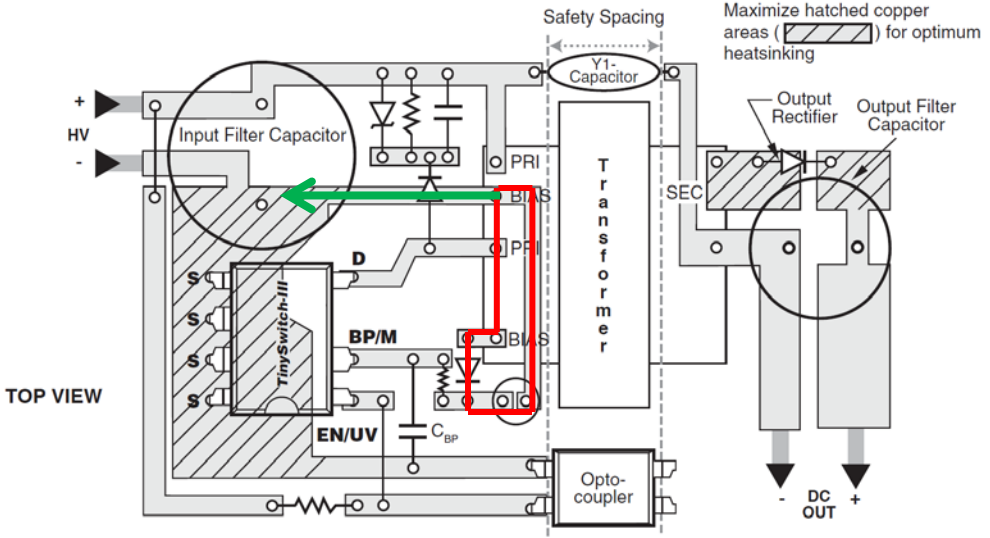


3. Primary bias winding loop

- **Switch loop**
  - Bias winding high side➔Rectifier Diode➔Capacitor➔ Bias winding low side
- **Switching loops as small as possible**
- **Power path**
  - The **Green** line, bias winding currents flow into Bulk cap directly; the Aux Ground need totally separated with signal loops and don't pass through Tny's Source pins when it back to Bulk cap Ground.

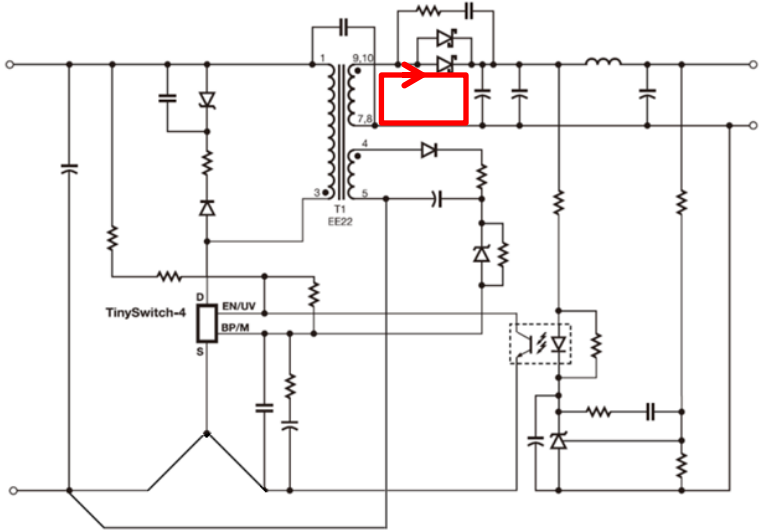


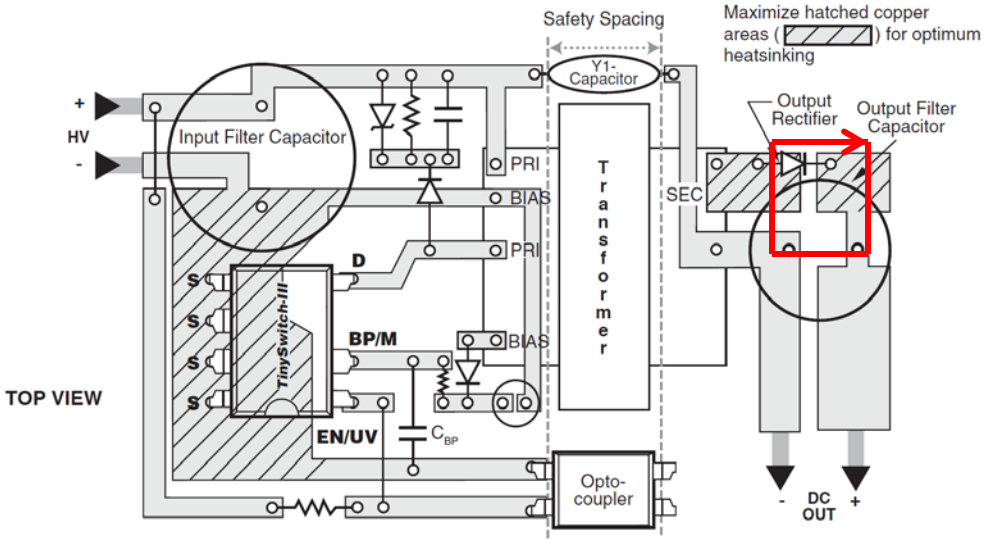


TOP VIEW

4. Secondary power winding loop

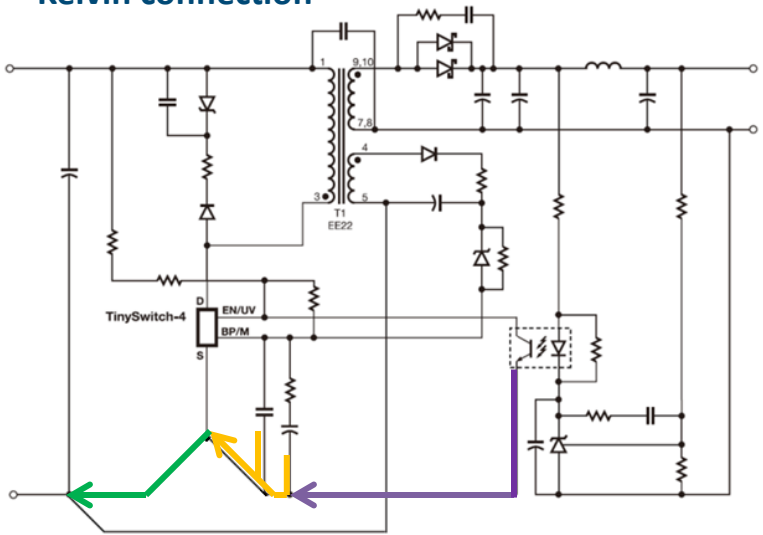
- **Switch loop**
  - Output winding high side➔Rectifier Diode➔Capacitor➔ Output winding low side
- **Switching loops as small as possible**





5.Signal loop

- **Signal loop need to be Separated with Power path**
  - **Yellow** & **purple** line is clean ground. Signal components connect to source pin directly without through power path (**Green** line is non-clean; power current flow into bulk cap)
- **Signal loop need to be Separated with Switch loop**
  - Signal components and trace can't be closed switch loop, especially Drain pin (trace) or snubber circuit (Because high dv/dt)
- **Kelvin connection**



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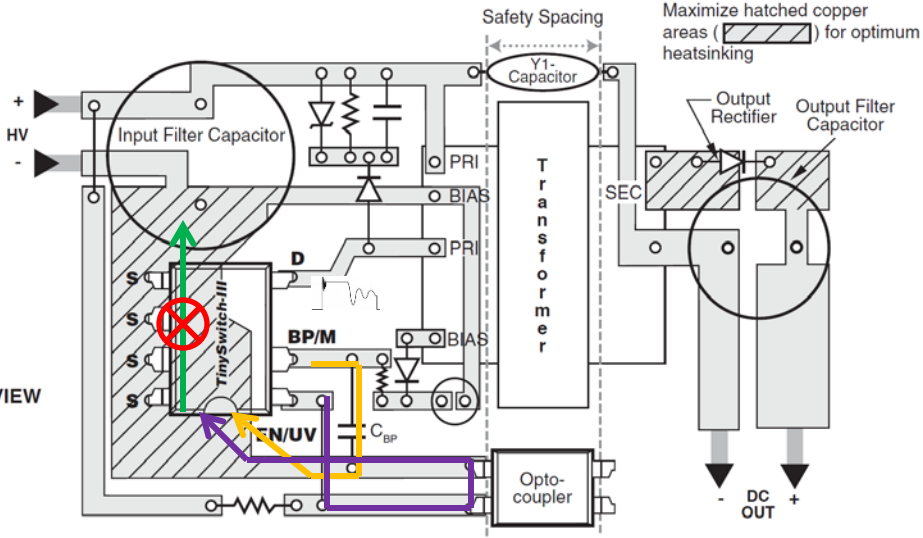

Kelvin connection

- A Kelvin connection is a means of making precision electrical potential contact with a current carrying component or reference point in such a way that eliminates or greatly reduces the effect of contact resistance.