

G5111 PCB Layout Guide

Description

G5111 is a step-up (boost) DC/DC converter, using constant peak inductor current and minimum OFF time PFM topology. It could output up to 28V and drive 30mA from a 2.5V ~ 5.5V input power source, such as a Li-Ion battery. G5111 is suitable for series 2~8 white LED driver application because its maximum 28V output capability. But a bad PCB layout will make G5111 unstable. A good design engineer should understand the PCB layout guide to make G5111 could work its best performance.

Signal Path Analysis

To make a good PCB layout, understanding the circuit signal path is necessary. The following discussion will base on G5111 typical application circuit show as Fig.1.

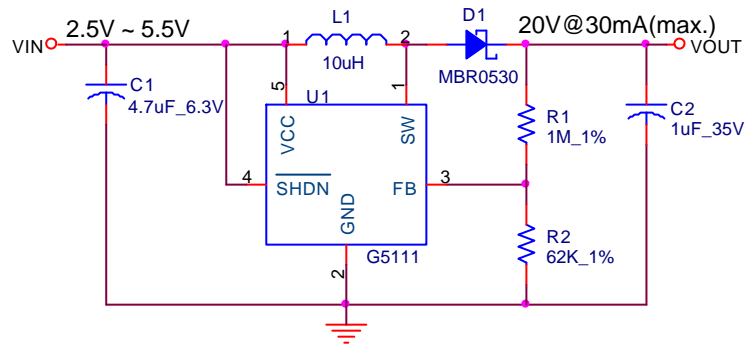


Fig.1

At the switch on time, the inductor current will increase to about 350mA and the current flow path show as Fig.2. The large current flow from C1 → L1 → SW pin of G5111 → GND pin of G5111 → C1, become a close loop.

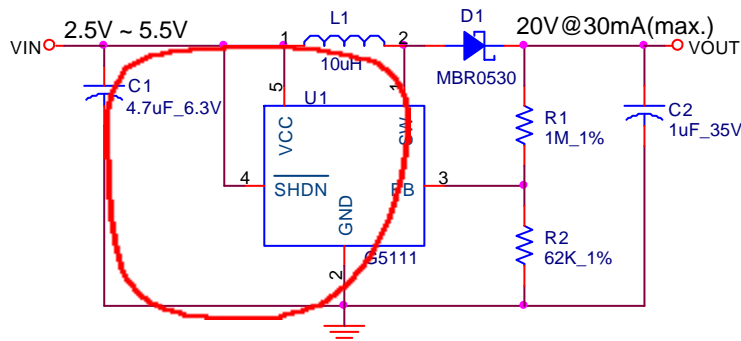


Fig.2

At the switch off time, the inductor current will decrease to zero and the current flow path show as Fig.3. The current flow from C1 → L1 → D1 → C2 → GND → C1, become a close loop.

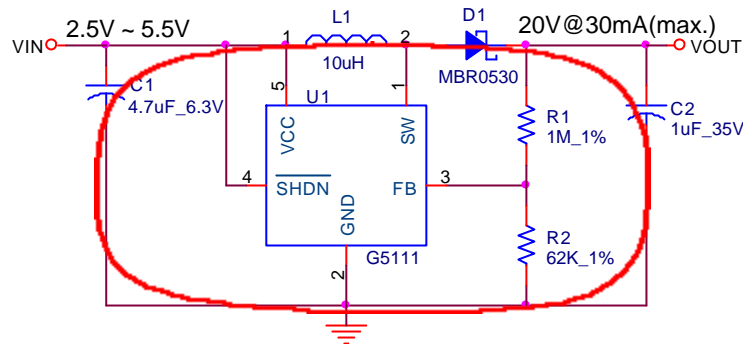


Fig.3

From the large current signal analysis above, the circuit could be redraw as Fig.4. The blue thick lines mean the large current path that should be careful when PCB layout.

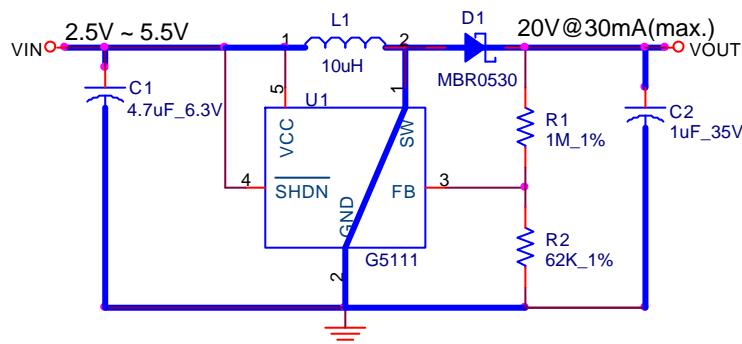


Fig.4

Noise Source and Noise Sensitive Node

The major noise source of a step-up DC/DC converter is the SW pin of G5111. It called as switching node (LX). In generally, 3 components are connected at this node, inductor(L1)、 diode(D1) and switch(G5111). When normal operating, LX will switch at full swing from 0V to $V_{OUT} + V_{F,DIODE}$. In the typical application of G5111 show as Fig.1, the full swing is from 0V to 20V, and switching 0mA ~ 350mA. The LX node is a related very large EMI noise source.

In the other hand, FB is a related sensitive node. Because efficiency consideration, the feedback network R1 and R2 flow only about 10 ~ 20uA. R1 need a mega ohm order resistor.

On PCB layout, feedback network must be far away the LX node.

G5111 PCB Layout Guide Lines

After the analysis above, the circuit could be redraw as Fig.5.

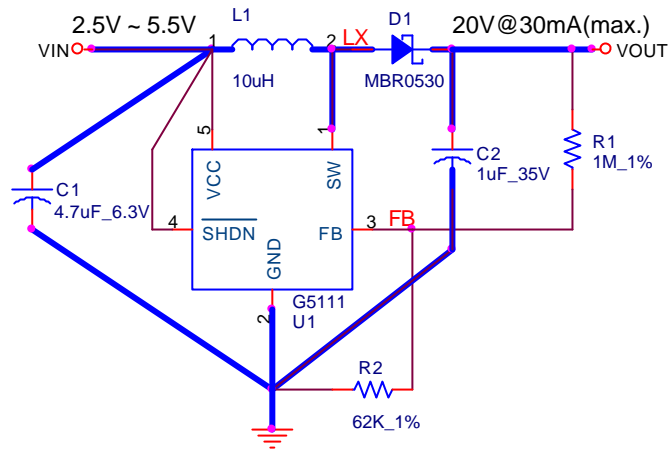


Fig.5

1. Use polygon plane or internal split plane as could as possible for all large current path.
2. C1 should be close L1 and GND pin of G5111.
3. C2 should be close GND pin of G5111.
4. L1 should be place at a suitable position and close to G5111.
5. Do not route LX track through below the body of G5111.
6. R1, R2 should be far away LX node.
7. R2 should be close to GND pin of G5111.

A Good PCB Layout Example

“A good PCB layout need good placement”. Fig.6 is a good PCB layout example of G5111 typical application. This example uses only single layer to make a good layout. The placement of all components is very suitable and smooth, and follows the layout guide lines.

1. VCC、SW、VOUT use polygon plane.
2. GND use 20mil wide track (as wide as possible), and all GND nodes are close as possible.
3. C1 place close to L1 and GND pin of G5111
4. C2 place close to GND pin of G5111, and close to K of D1.
5. R1、R2 place faraway from SW node, and be separated by ground track.
6. R2 place close to GND and FB of G5111.

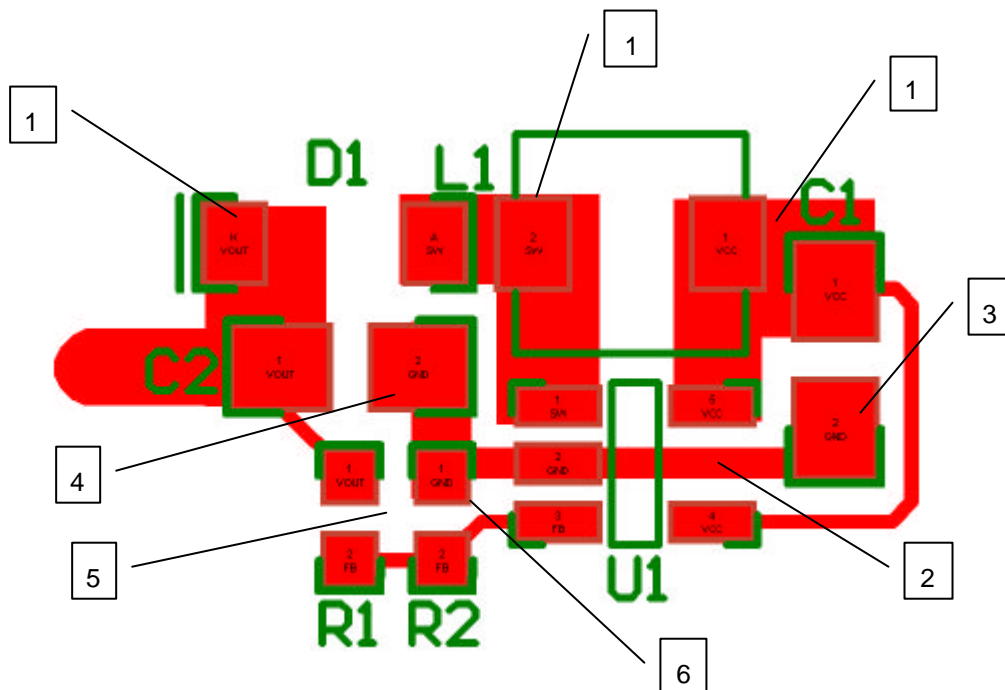


Fig.6

A Bad PCB Layout Example

“A bad placement causes bad PCB layout”. Fig.7 is a bad PCB layout example of G5111 typical application. This example also uses only single layer to make a bad layout. The placement of all components is very unsuitable, and violates the layout guide lines.

1. Node VCC、SW、VOUT use narrow track, not polygon plane or wide track.
2. All GND nodes use narrow track, and not close as possible.
3. C1 place close to L1, but GND node of C1 route a long narrow track to GND pin of G5111
4. C2 doesn't place close to GND pin of G5111, neither close to K of D1.
5. SW route from G5111 through body of G5111 to L1
6. R1、R2 place close to SW node.
7. R2 place close to GND and FB of G5111.

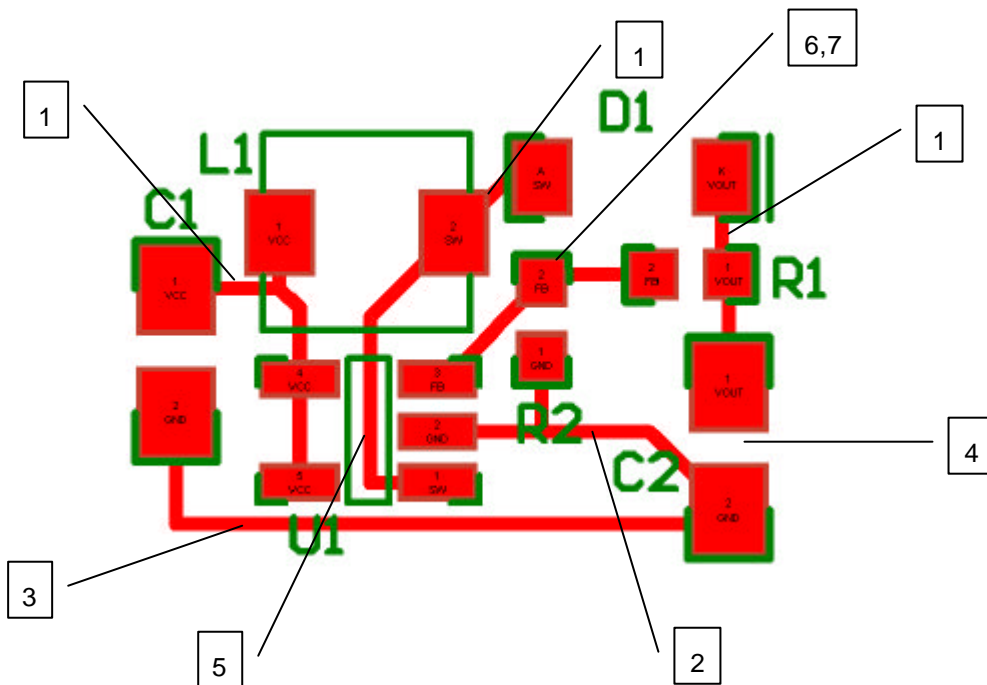
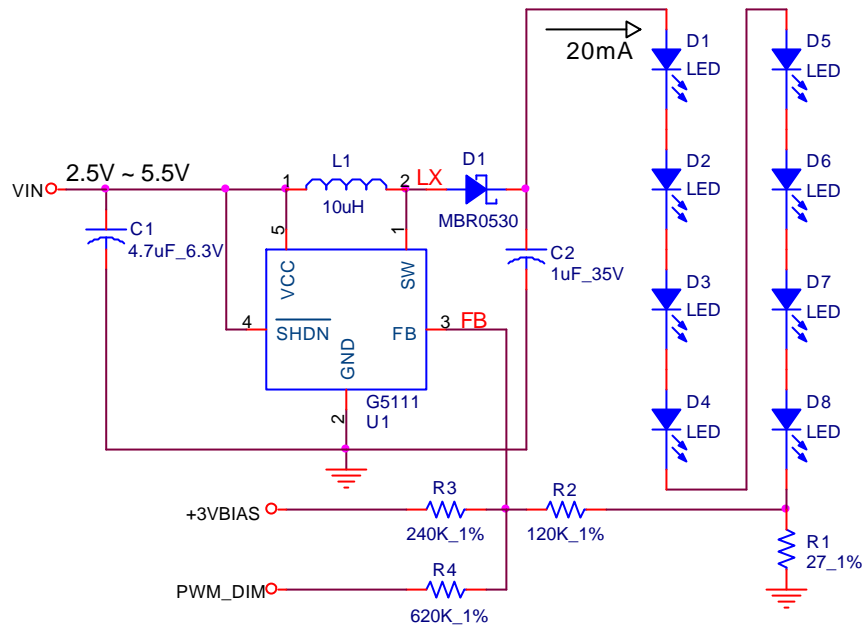


Fig.7

A Good PCB Layout Example for White LED Driver Application



2 ~ 8 White LED Driver Application Circuit

Fig.8

Fig.9 is a good PCB layout example of G5111 white LED driver application. This example uses only single layer to make a good layout. The placement of all components is very suitable and smooth, and follows the layout guide lines.

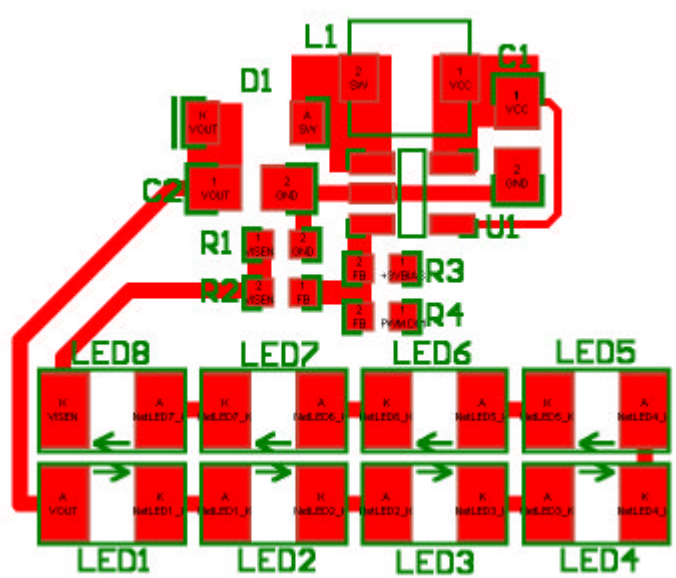


Fig.9