**Design of a 20V to 12V Buck Converter**

I have designed an adjustable output buck regulator using **LM2596S-ADJ** that can regulate an input voltage of **20V** to **12V DC** output with a constant **2A** load current.

The input voltage (20 VDC) is fed through **input-side MSTB**. The **1N5822** diode ensures that if polarity is accidentally reversed, the circuit won’t be damaged;it blocks reverse current flow. The voltage after D2 (VIN) becomes the main input supply to the LM2596 converter and the indicator LED section. C1 filters the input voltage to the LM2596S-ADJ IC.

Then, LM2596 operates by rapidly switching its internal transistor to control energy delivered to the inductor. During the **ON** phase, current flows through the inductor and stores energy. During the **OFF** phase, D1 provides a path for inductor current to flow to the load. The voltage divider (R1, R2) feeds back a portion of the output voltage to the **FB pin** to regulate output. The feedback equation is:  
 V\_OUT = VREF×(1+R1/R2)  
 where VREF=1.23 V  
 Plugging in values of R1=8.66k ohm and R2=1k ohm  
 V\_OUT = 1.23×(1+8.66/1) ≈ 12 V

Hence, the output voltage is properly set to **12 V**.

The inductor **L1** and capacitor **C2** ensure low ripple voltage by acting as the output filter section.

R3 of **10k ohm** and R4 of **2k** ohm is selected so that 3.3V appears at the junction, which is perfect for the LED. Also a resistance of 220 ohm is added in series to the LED so that limited current flows through the LED.

I have used the following components:

* **MSTB connectors** of **5.08mm** pitch for input and output ports so that input and output can be easily attached to or detached from the converter.
* **1N5822 Schottky diode** for reverse polarity protection in the input side as well as for freewheeling during switching in the output side due to its current rating while also being cheap and available at the same time.
* **Surface mount electrolytic capacitors** of **150uF** for input filter and **330uF** for output filter primarily because of their smaller size than through hole capacitors while also being cheap.
* A **shielded inductor** of **68uH** for output filtering so that its electromagnetic interference is minimized and it does not affect the output power.
* **Resistors** of **0805 metric** and **<= 1% metal film** so that they can be assembled easily in-house.
* **Feedforward capacitor** of **390pF** of **0805 metric** as our output voltage is greater than 10V.
* **LM2596S-ADJ** so that we can get a freedom of adjusting output voltage.

All the values mentioned above have been taken from LM2596 datasheet tables and formulae given in the datasheet. I have also designed and simulated the circuit using **WEBENCH Power Designer** and **TINA-T**I.