Introduction

5V Supply is needed for RGB LED-s and relays. 3,3V Regulator supply also originates from 5V supply.

Load	Current [mA]
10 RGB LED-s	10
8 relays	644
3,3V SMPS 80% efficiency	396
Total	1050

Maximum input voltage of the system is 32V. SMAJ33A has a reverse working voltage of 33V and maximum reverse voltage 53,3V at 7,5A surge current.
The regulator input should be 54 V tolerant.

Regulator selection

LM46002AQPWPRQ1 was selected from Krakul library. Vin is 60V and maximum output current is 2A. It has been used in multiple circuits earlier.

Schematic design

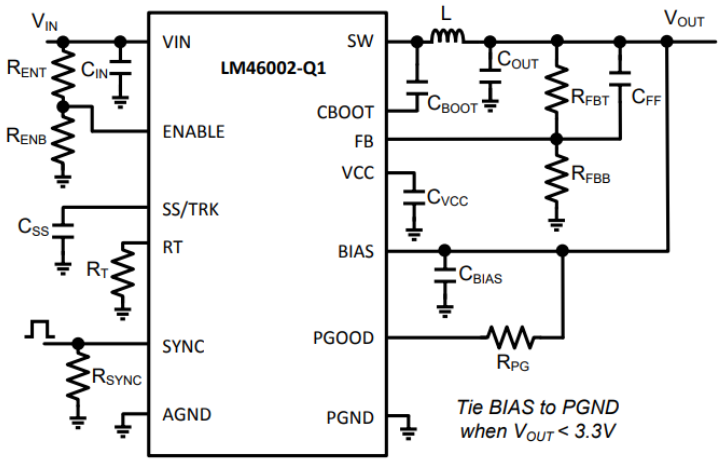

Figure 1: Typical application

Datasheet gives multiple application examples.

F_S (kHz)	L (µH)[1]	C_{OUT} (µF) [2]	C_{FF} (pF) [3][4]	R_T (kΩ)	R_{FBB} (kΩ) [3][4]
V_{OUT} = 1 V					
200	8.2	560	none	200	100
500	3.3	470	none	80.6 or open	100
1000	1.8	220	none	39.2	100
2200	0.68	150	none	17.8	100
V_{OUT} = 3.3 V					
200	27	250	56	200	432
500	10	150	47	80.6 or open	432
1000	4.7	100	33	39.2	432
2200	2.2	47	22	17.8	432
V_{OUT} = 5 V					
200	33	200	68	200	249
500	15	100	47	80.6 or open	249
1000	6.8	47	47	39.2	249
2200	3.3	33	33	17.8	249

1 MHz switching frequency is selected as a compromise between switching losses and component sizes.

Suggested bootstrap capacitor C_{BOOT} is 470nF.

VCC pin is the output of the internal LDO. C_{VCC} should be 2,2µF and at least 10V rated.

To increase light load efficiency BIAS will be connected to regulator output. BIAS is the input of the internal LDO. The smaller the input output voltage difference the better the efficiency. 1uF capacitor is suggested close to the pin as the input capacitor of the LDO.

Soft-start capacitor will not be used. When the pin is floating the soft start time is 4,1ms. This seems reasonable and the same choice has been made in other implementations.

SYNC pin will not be used, and it will be tied to GND.

Additional 100nF capacitor is added to the regulator output to suppress switching noise at higher frequencies.

For input capacitor datasheet suggests using 10uF. Three 4,7nF 100V 1210 capacitors were used. 100V helps mitigating capacitance drop due to DC bias.