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Design a flyback converter in LT spice of 100 watts. The output voltage should be (+ 15, -15, and 5) volt current ripple and the voltage ripple should be less than 2%. The input of the flyback converter comes from the AC main. calculate the losses and efficency.

CALCULATIONS:

$$\frac{Vout}{Vin} = \frac{D}{(1-D)} * \frac{N2}{N1}$$

For primary winding-

$$L_p = \frac{(Vin\,(\min) * Dmax)\text{^}2}{2 * Pin * Fs}$$

For Secondary Winding-

$$\frac{N2}{N1} = \frac{Vout}{Vin(\min)} * \frac{(1-Dmax)}{Dmax}$$

$$Ls = \left(\frac{N2}{N1}\right)^2 * Lp$$

$$C = \frac{I_o * D}{\Delta Vo * Fs}$$

SYSTEM PARAMETERS

$F_{sw} = 100$ KHz

Time Period = 10 msec

$D_{max} = 0.5$

$V_{in} = 230$ V (RMS)

$(I_{in})_{max} = \frac{100\,(W)}{230 \times \sqrt{2}\,(V)} = 0.307$ Amp

$I = \frac{\Delta Q}{\Delta T}$

$Q = I \times \frac{T}{2} = 3.07$ mC.

Ripple = 1%

$\Delta V = 325 \times \frac{1}{100} = 3.25$

$C = \frac{Q}{V} = \frac{3.07}{3.25} = 944\ \mu F \approx 1000\ \mu F$

$L_p = \frac{(325 \times 0.5)^2}{2 \times 10^5 \times 100} = 1.32$ mH.

For ±15 volts output

$\frac{V_o}{V_{in}} = \left(\frac{D}{1-D}\right)\frac{N_2}{N_1} \quad (D = 0.5)$.

$\frac{15}{325} = (1)\frac{N_2}{N_1}$

$\frac{L_p}{(L_1)_s} = \left(\frac{N_1}{N_2}\right)^2$.

$(L_1)_s = \left(\frac{15}{325}\right)^2 \times 1.32 = 2.811\ \mu H. = (L_2)_s$

Fos 5 volts output

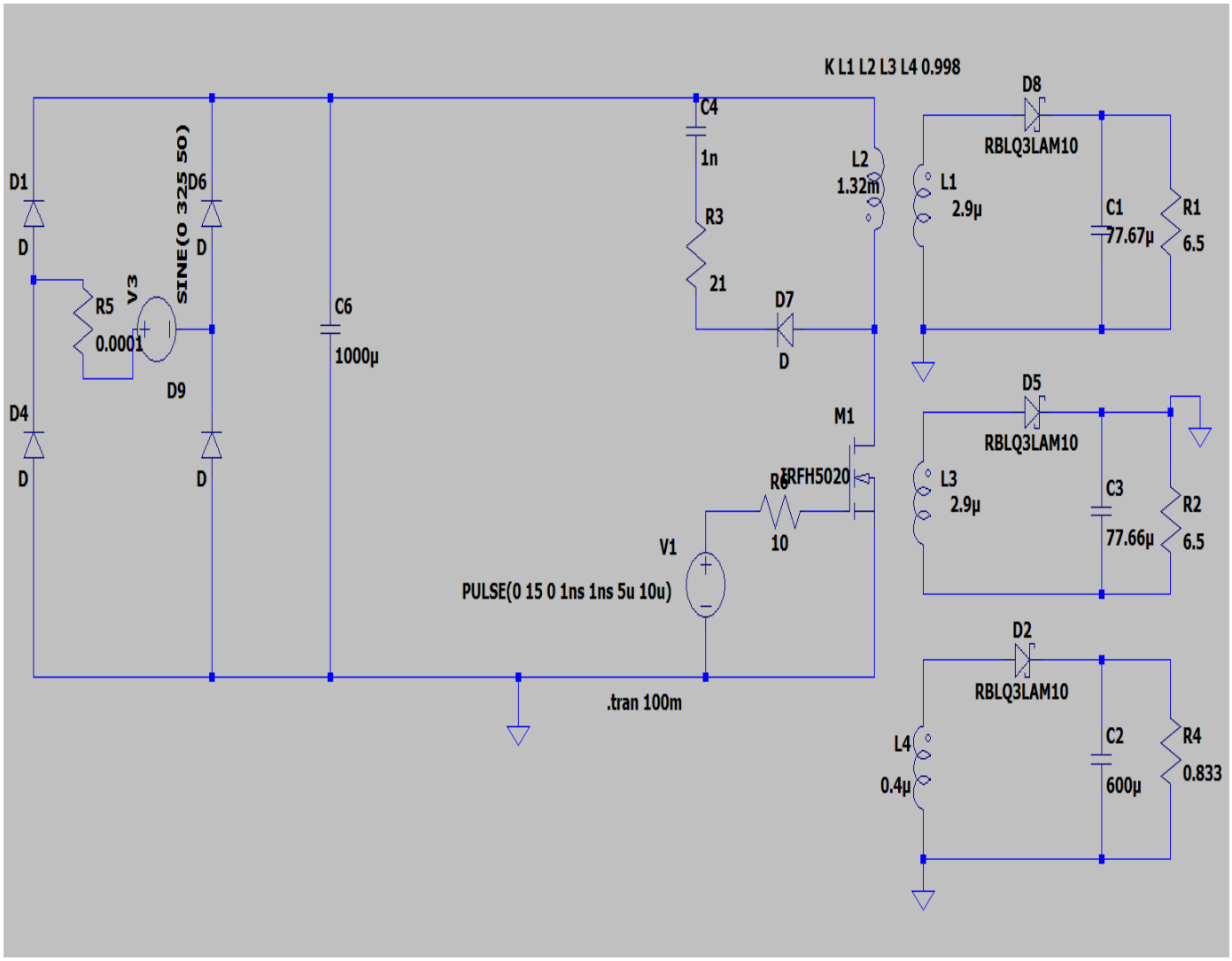
$$\frac{5}{325} = \frac{N_2}{N_1}$$

$$\frac{L_p}{(L_3)_s} = \left(\frac{N_1}{N_2}\right)^2$$

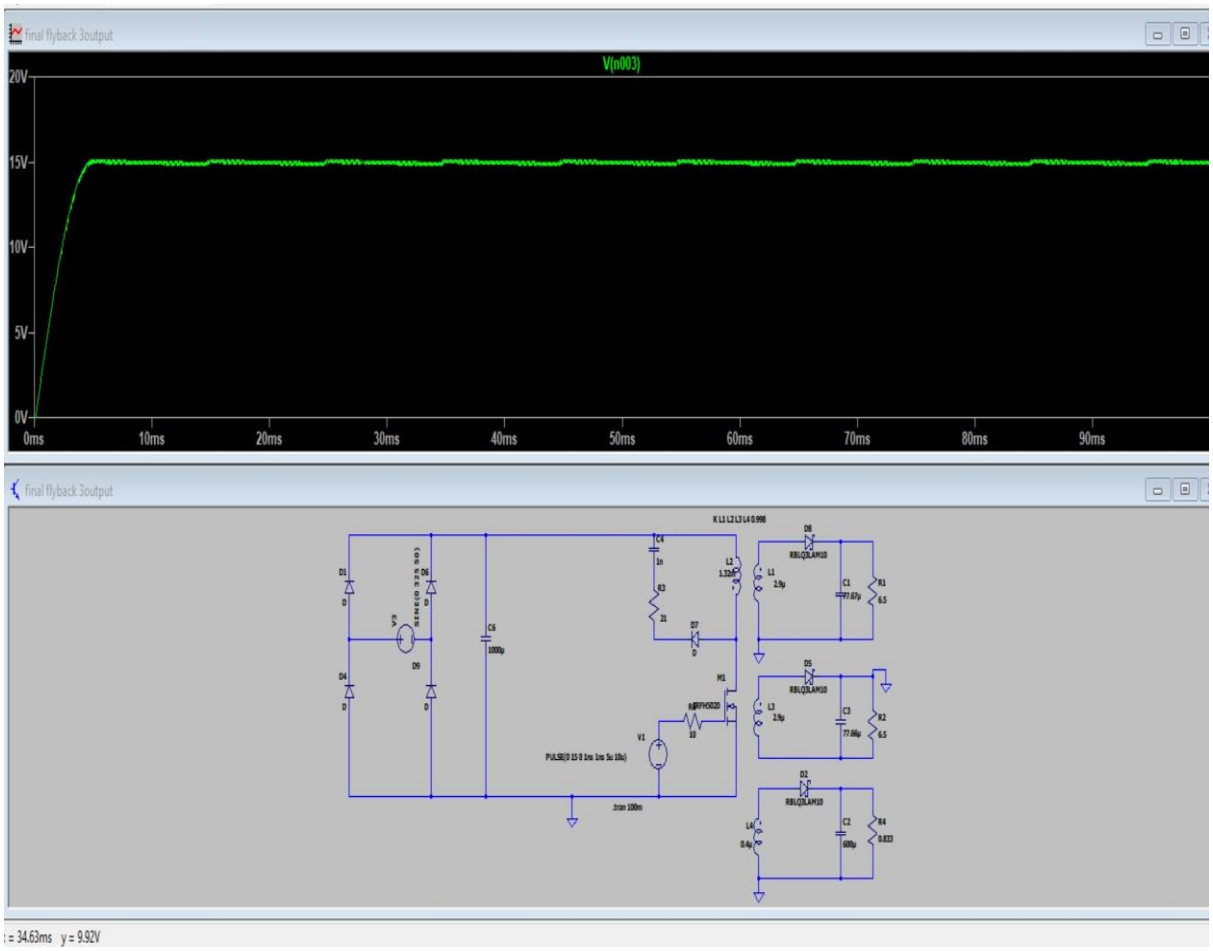
$$(L_3)_s = 1.32 \times \left(\frac{5}{325}\right)^2 = 0.312\ \mu H.$$

Voltage.	15 V	15 V	5 V
Power.	35 W	35 W	30 W
Current = $\frac{P}{V}$	2.33 A	2.33 A	6 A.
Resistance = $\frac{V^2}{P}$	6.428 Ω	6.428 Ω	0.833 Ω
Capacitor = $\frac{ID}{\Delta V_o f_s}$	77.66 μF	77.66 μF	600 μF.

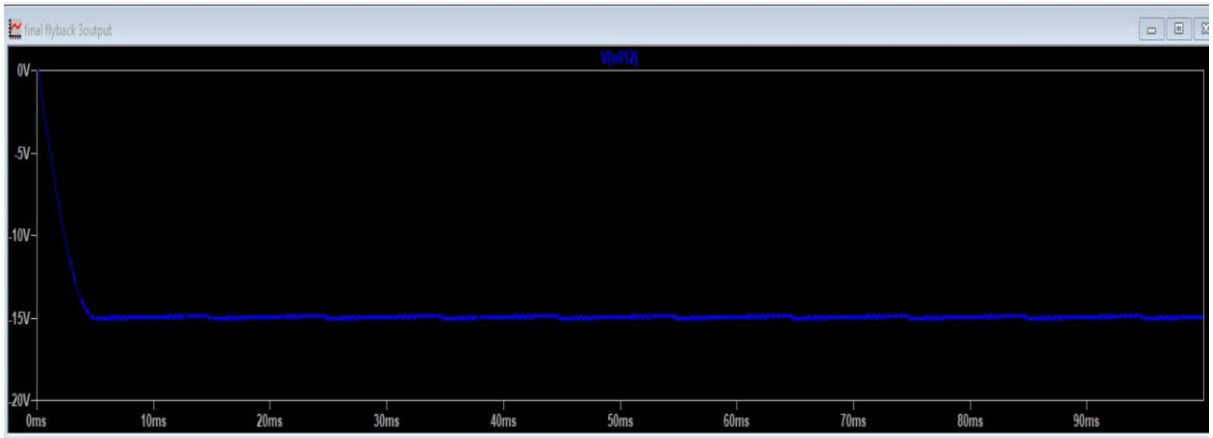
FLYBACK CONVERTER MODEL IN LT SPICE.

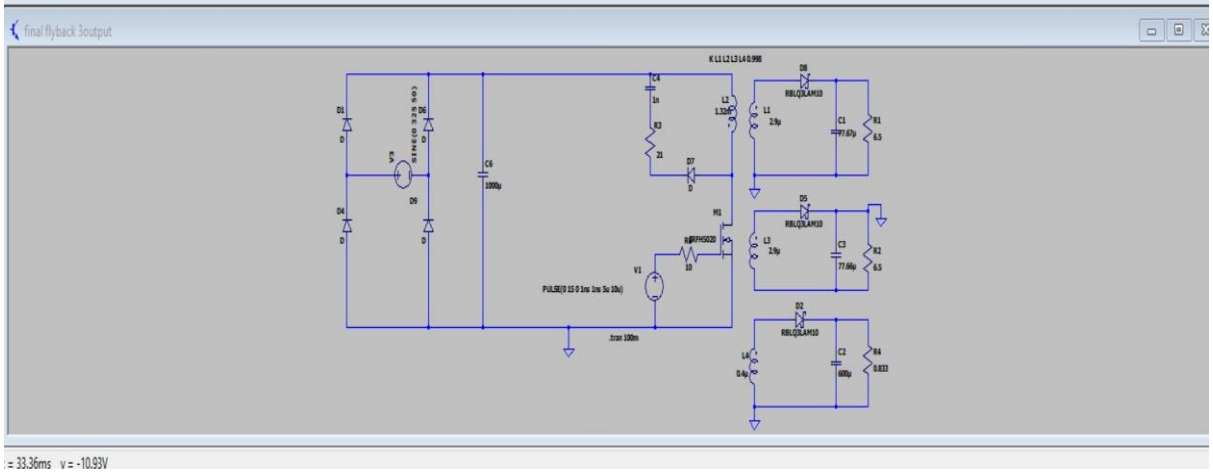


OUTPUT VOLTAGE OF +15 VOLTS AT ONE NODE.



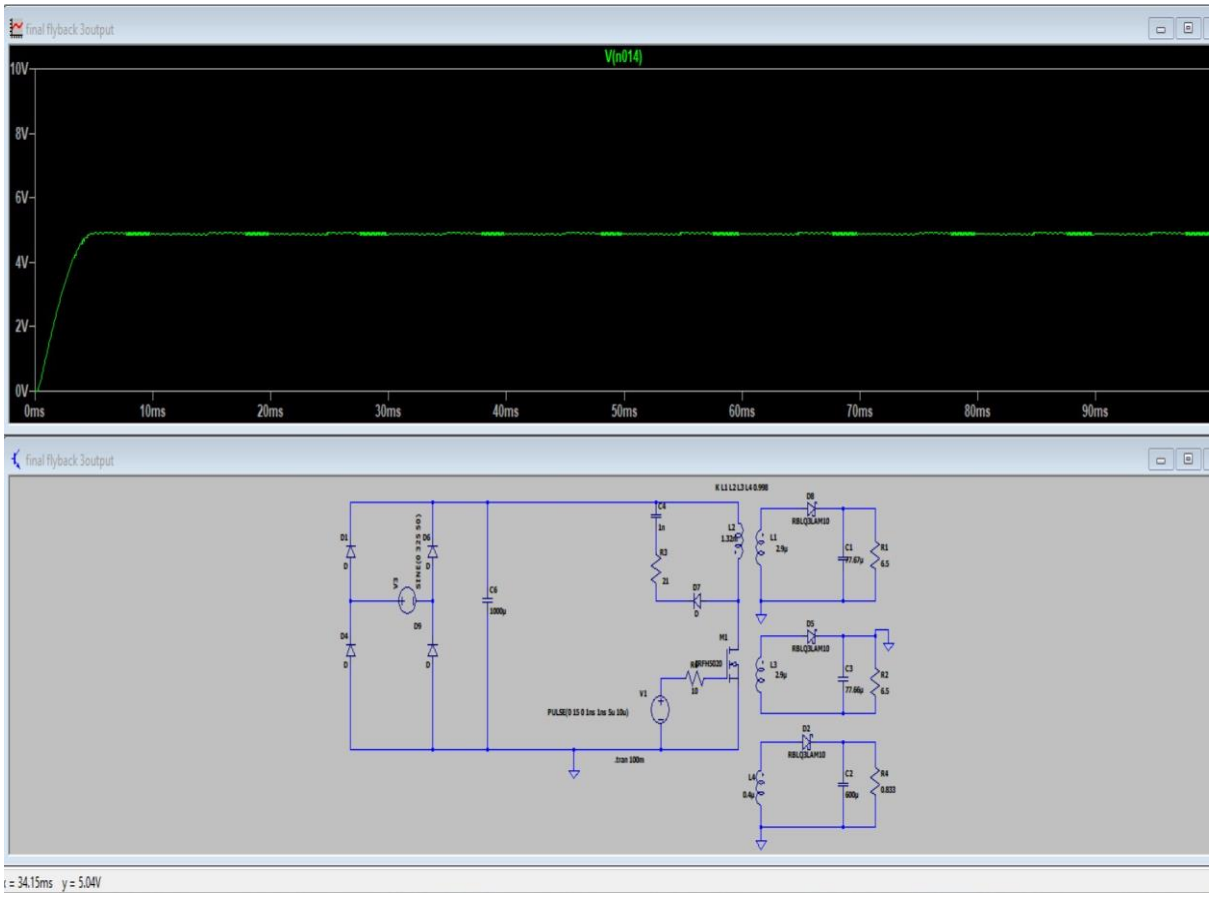
OUTPUT VOLTAGE OF -15 VOLTS AT ONE NODE.



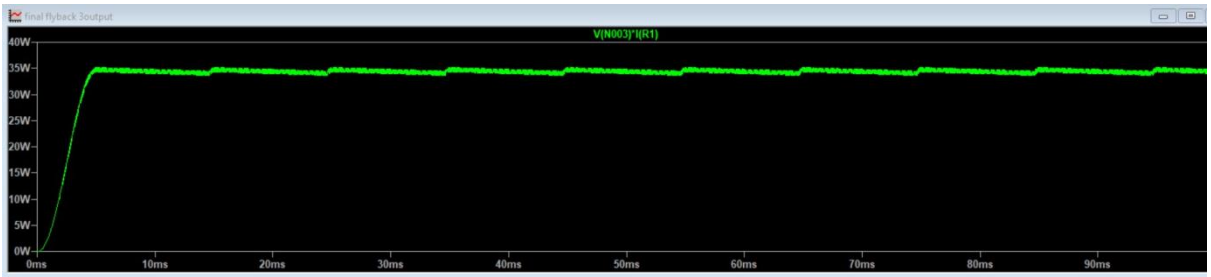


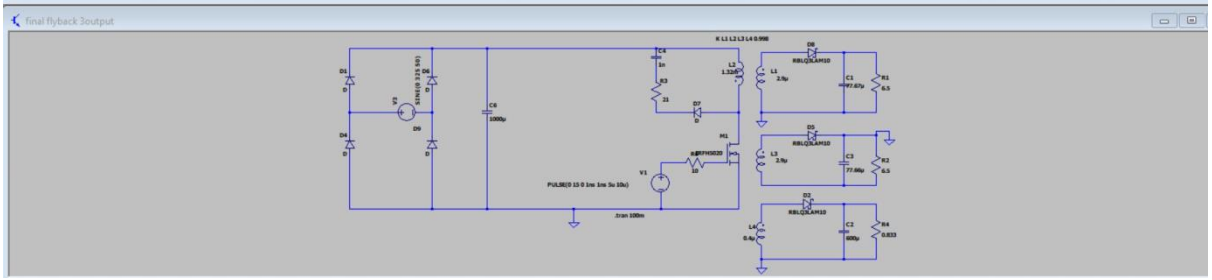
: = 33.36ms v = -10.93V

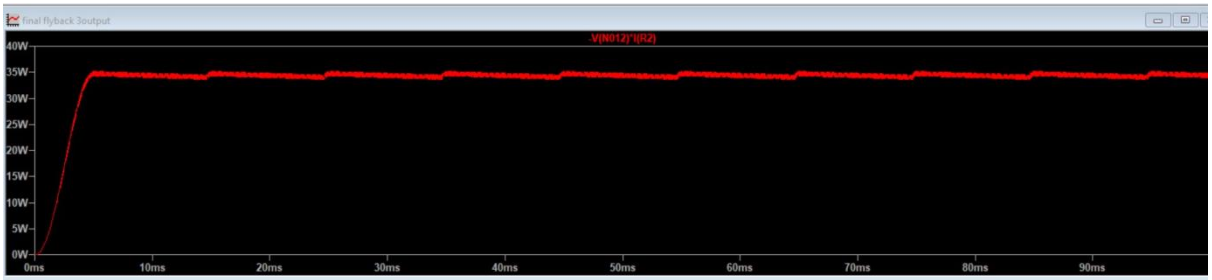
OUTPUT VOLTAGE OF +5 VOLTS AT ONE NODE.

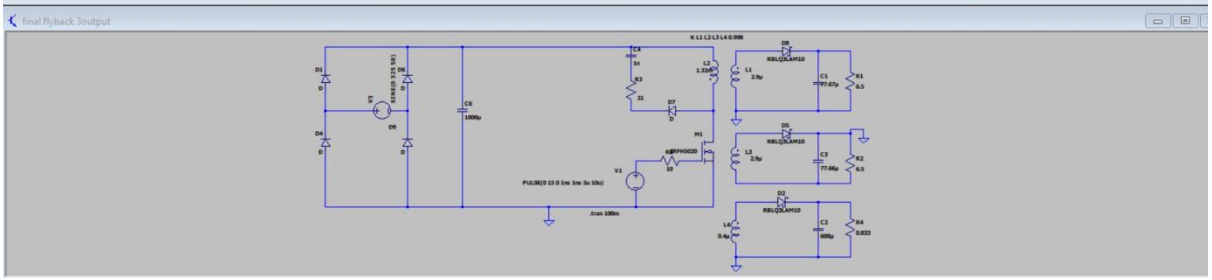


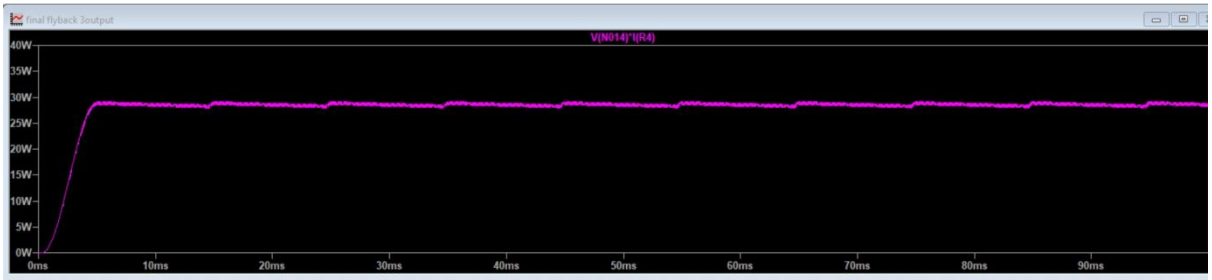
Power at individual output.

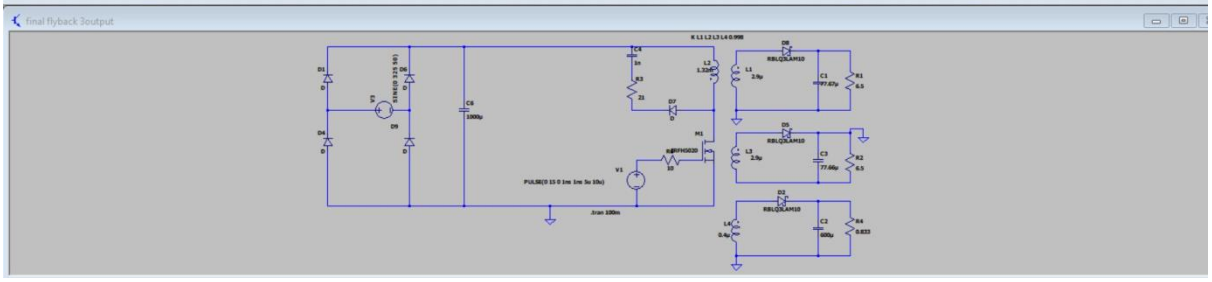

final flyback 3output
V(N003)*I(R1)
40W
35W
30W
25W
20W
15W
10W
5W
0W
0ms
10ms
20ms
30ms
40ms
50ms
60ms
70ms
80ms
90ms


final flyback 3output

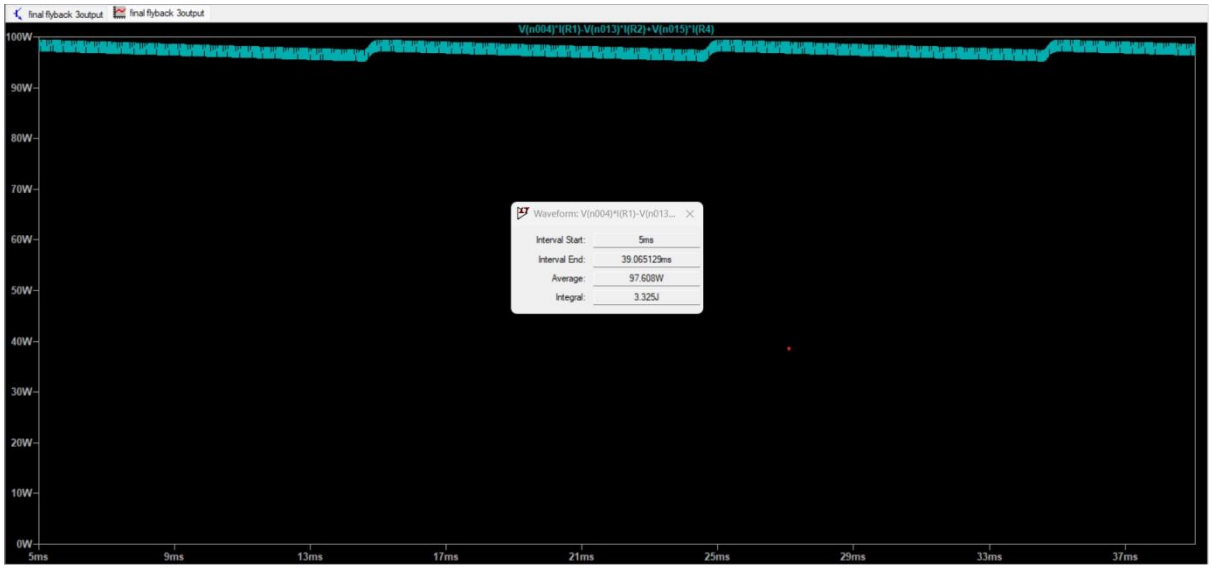

final flyback 3output
V(N012)*I(R2)
40W
35W
30W
25W
20W
15W
10W
5W
0W
0ms
10ms
20ms
30ms
40ms
50ms
60ms
70ms
80ms
90ms


final flyback 3output


final flyback 3output
V(N014)*I(R4)
40W
35W
30W
25W
20W
15W
10W
5W
0W
0ms
10ms
20ms
30ms
40ms
50ms
60ms
70ms
80ms
90ms

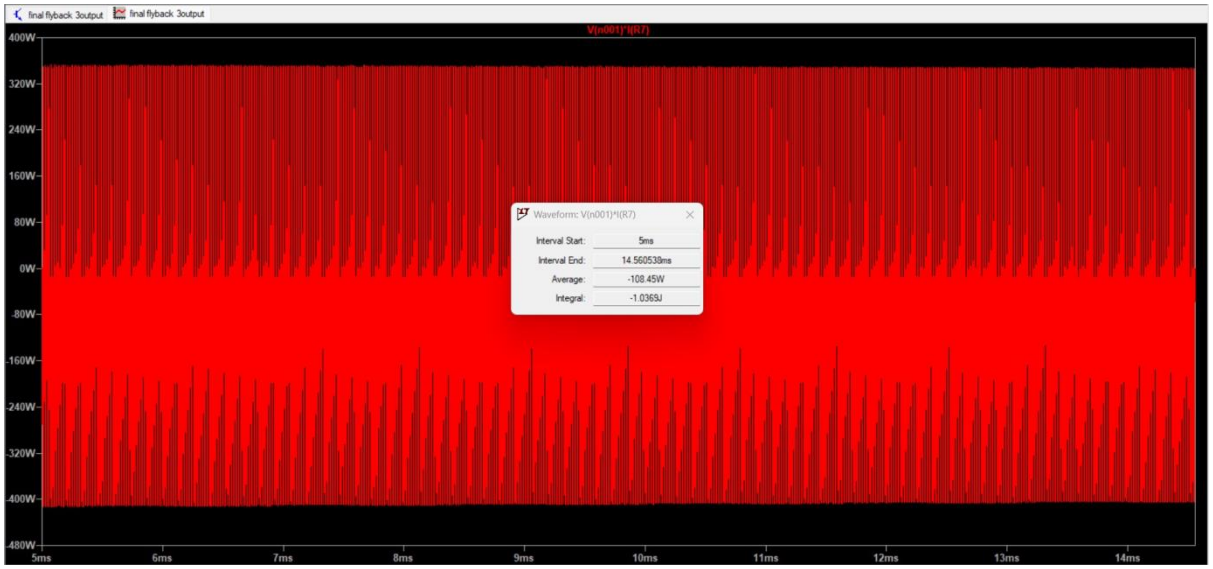

final flyback 3output

POWER MEASUREMENTS AT OUTPUT.



Pout avg =97.608W

Power Measurement at Input.



Pin avg=108.45w

LOSSES:

P loss = Pin – Pout

=108.45-97.608=10.842W

Efficiency:

$$n = \frac{\text{Pout}}{\text{Pin}} * 100\ \%$$

$$= \frac{97.608}{108.45} * 100\%$$

=90.0027%.

THANK YOU !