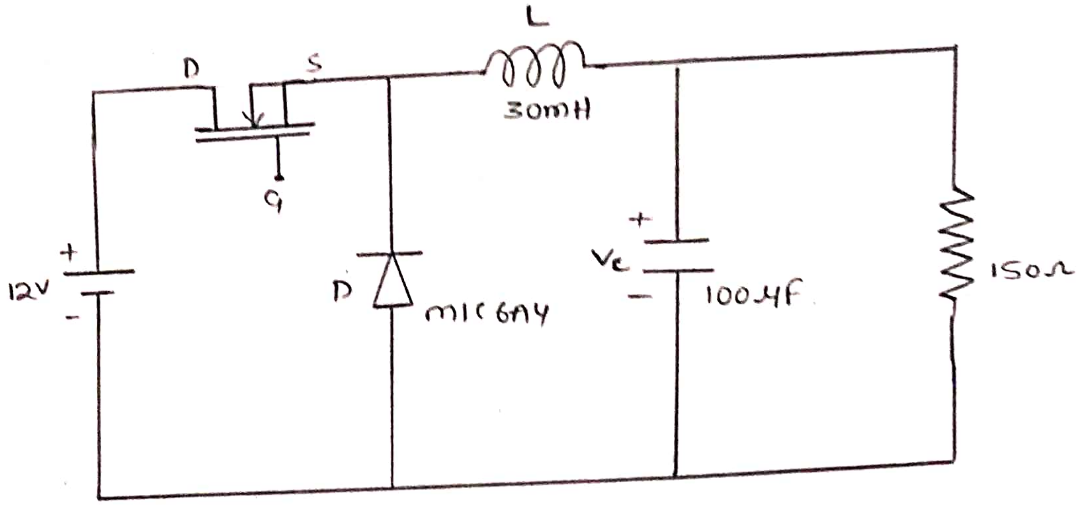
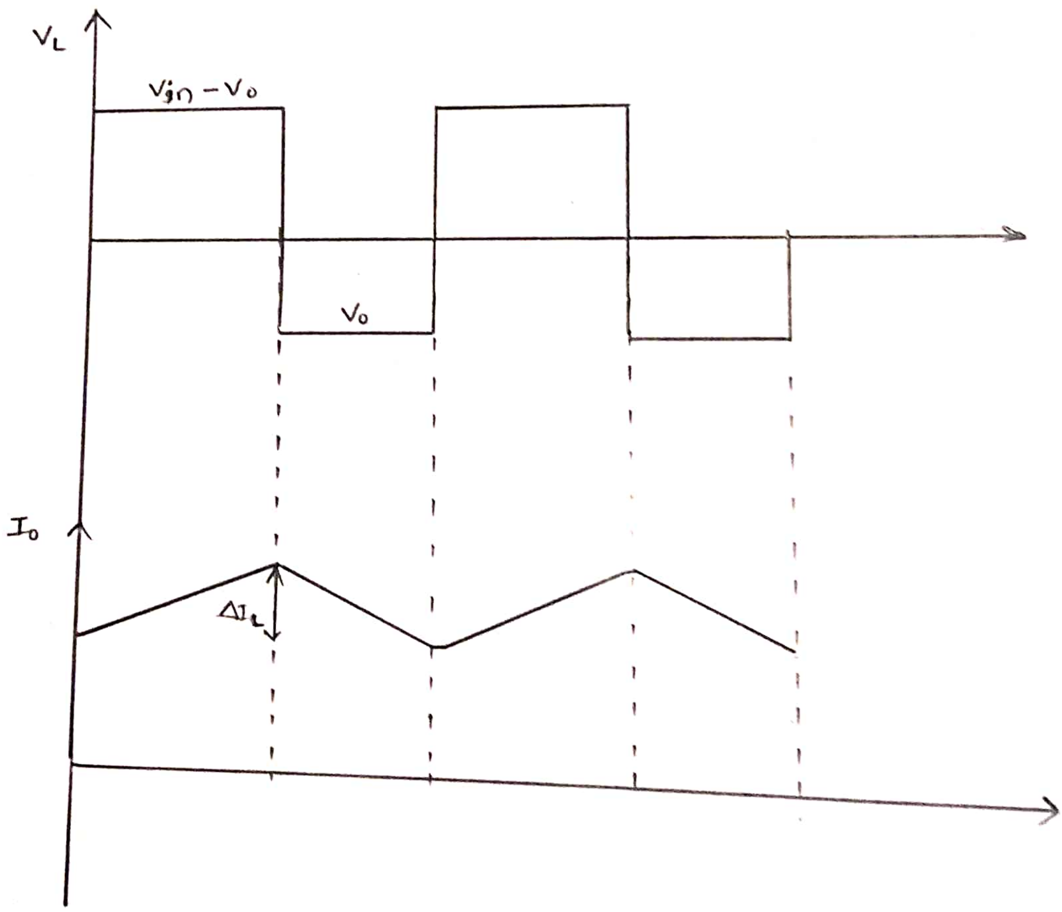


L
D
S
30mH
G
12V
D
MIC6A4
Vc
100μF
150Ω



VL
Vin - Vo
Vo
Io
ΔIL

BUCK CONVERTER

Aim: To study the BUCK CONVERTER output Voltage which has a duty ratio of 0.75

Apparatus:

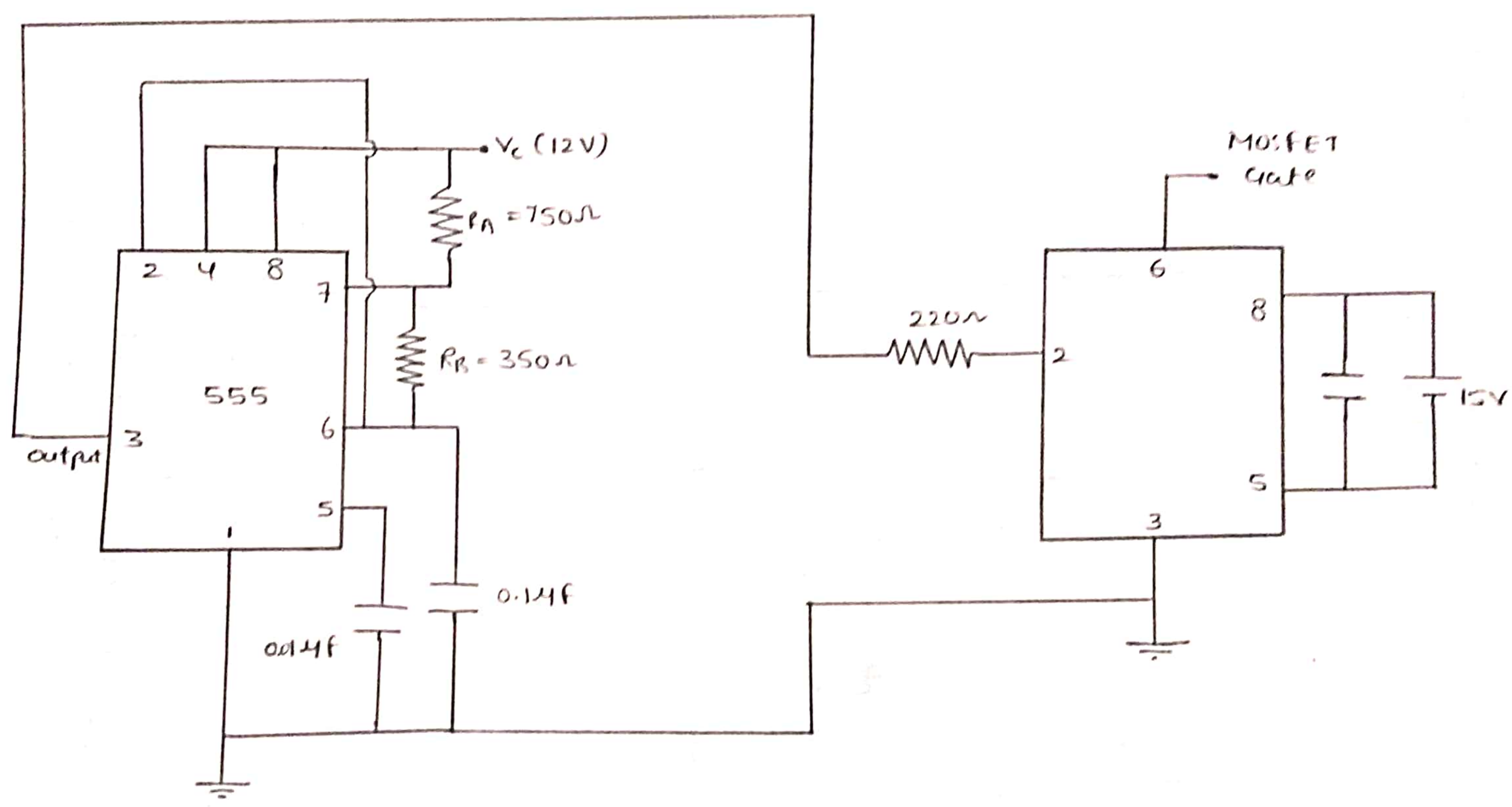
Sl.No	Components	Range	Quantity
1.	MOSFET	IRF540	1
2.	Inductor	30 mH	1
3.	Capacitor	100 µF	1
4.	Diode	MIC6A4	1
5.	Rheostat	300Ω/1.2A	1
6.	Power Supply	0-30V	3
7.	555 Timer	-	1
8.	optocoupler	TCP2504	1
9.	Capacitor	0.1µF	1
		0.01µF	1
		0.1 µF	1
10.	Resistor	750Ω	1
		350Ω	1
11.	CRO	digital	1

Theory:

A Buck Converter is a DC to DC power Converter that stepdown voltage with stepping up current from its supply to its load. The key principle of Buck Converter is charging & dischargeing of Inductor and Capacitor.

Applications of Buck Converter:

1) solar chargers
2) Battery chargers
3) Quad Copters & Robotics etc..


V_c (12V)
R_A = 750Ω
R_B = 350Ω
555
2
4
8
7
6
5
3
1
output
0.1μf
0.01μf
220Ω
MOSFET Gate
6
8
2
5
3
15V

procedure:

1) Connect the circuit as shown in the fig (a)
2) Given 12V to 555 timer the square wave generated not upto good magnitude to drive MOSFET Hence, we given it to the optocouple.
3) The output of optocoupler is given to fig (b)
4) The output waveform are observed in to CRO

Design & Calculations:

$$(V_{in}-V_o)\,DT_s = V_o(1-D)T_s$$

$$V_o = \frac{DT_s}{T_s}\cdot V_{in} = DV_{in}$$

$$I_s = \alpha I_o$$

$$I_L = I_o + I_c \ \& \ I_c = I_L - I_o$$

Inductor ripple Current (Peak-Peak), $\Delta I_L = \dfrac{V_{in}\,D(1-D)}{f_s L}$

Capacitor ripple Voltage (Peak-Peak), $\Delta V_c = \dfrac{V_{in}\,D(1-D)}{8 f_s^2 LC}$

from IC555 Timer;

$$f_s = \frac{1.44}{[R_A+(R_B\times 2)]C}$$

$$T_s = 0.6933\,(R_A+2R_B)C \cong 10\ \text{KHz}$$

$$P_W = 0.693\,(R_A+R_B)\,C \cong 7.5\ \text{KHz}$$

$$\text{Duty Cycle, } D = \frac{P.W}{T_s}\times 100$$

$$= \frac{R_A+R_B}{R_A+2R_B}$$

Based on R_A & R_B values, $D = 0.75$

($\because R_A = 750\,\Omega$, $R_B = 350\,\Omega$)

Assuming (P-P) load current = ΔI_L = 0.0075 A

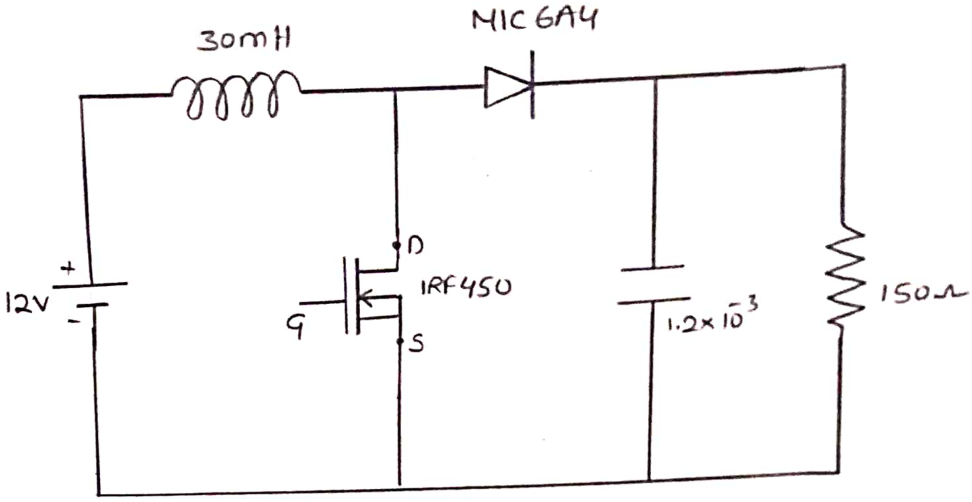
$$\Delta I_L = \frac{V_{in} D(1-D)}{f_s L} = \frac{12 \times 0.75(1-0.75)}{10\times10^3 \times 30\times10^{-3}}$$

$$L = 30\times10^{-3} H = 30 mH$$

Assuming (P-P) load voltage, ΔV_L = 0.937 mV

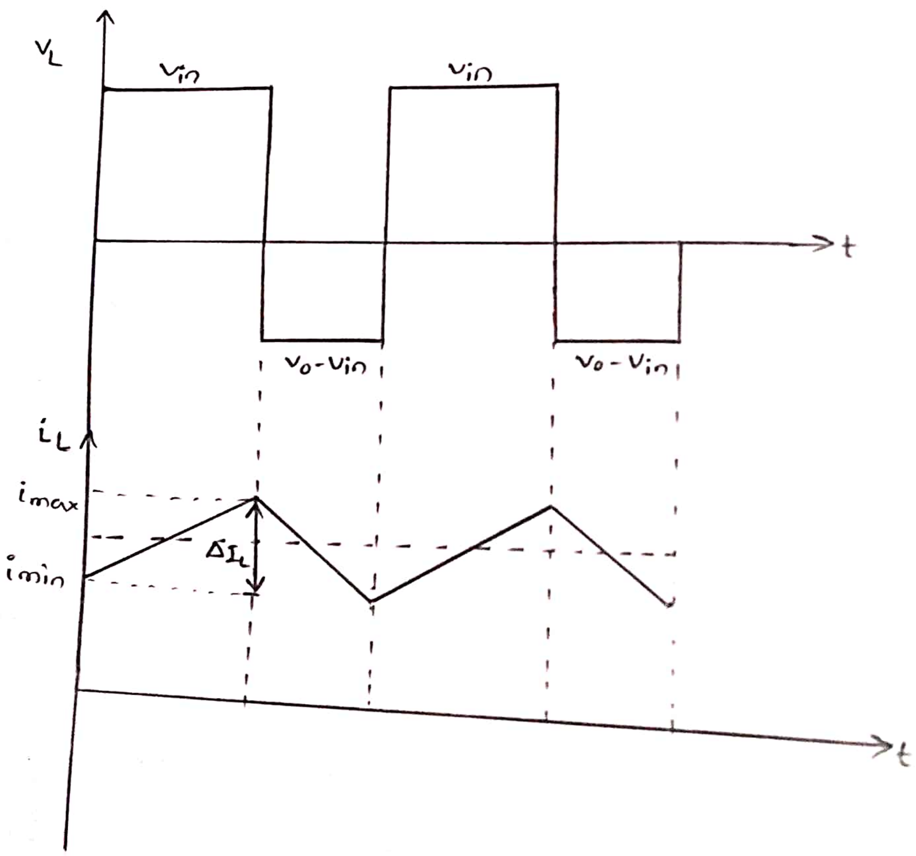
$$\Delta V_C = \frac{V_{in}(1-D)D}{8f^2LC} = \frac{12\times(0.75)(0.25)}{8\times(10\times10^3)^2\, 30\times10^{-3}\times100\times10^{-6}}$$

$$C = 100\times10^{-6} = 100 \mu F$$



MIC 6A4
30mH
12V
+
-
D
G
S
IRF450
1.2×10⁻³
150Ω

fig (b)



VL
Vin
Vin
t
Vo-Vin
Vo - Vin
iL
imax
imin
ΔIL
t

5. BOOST CONVERTER

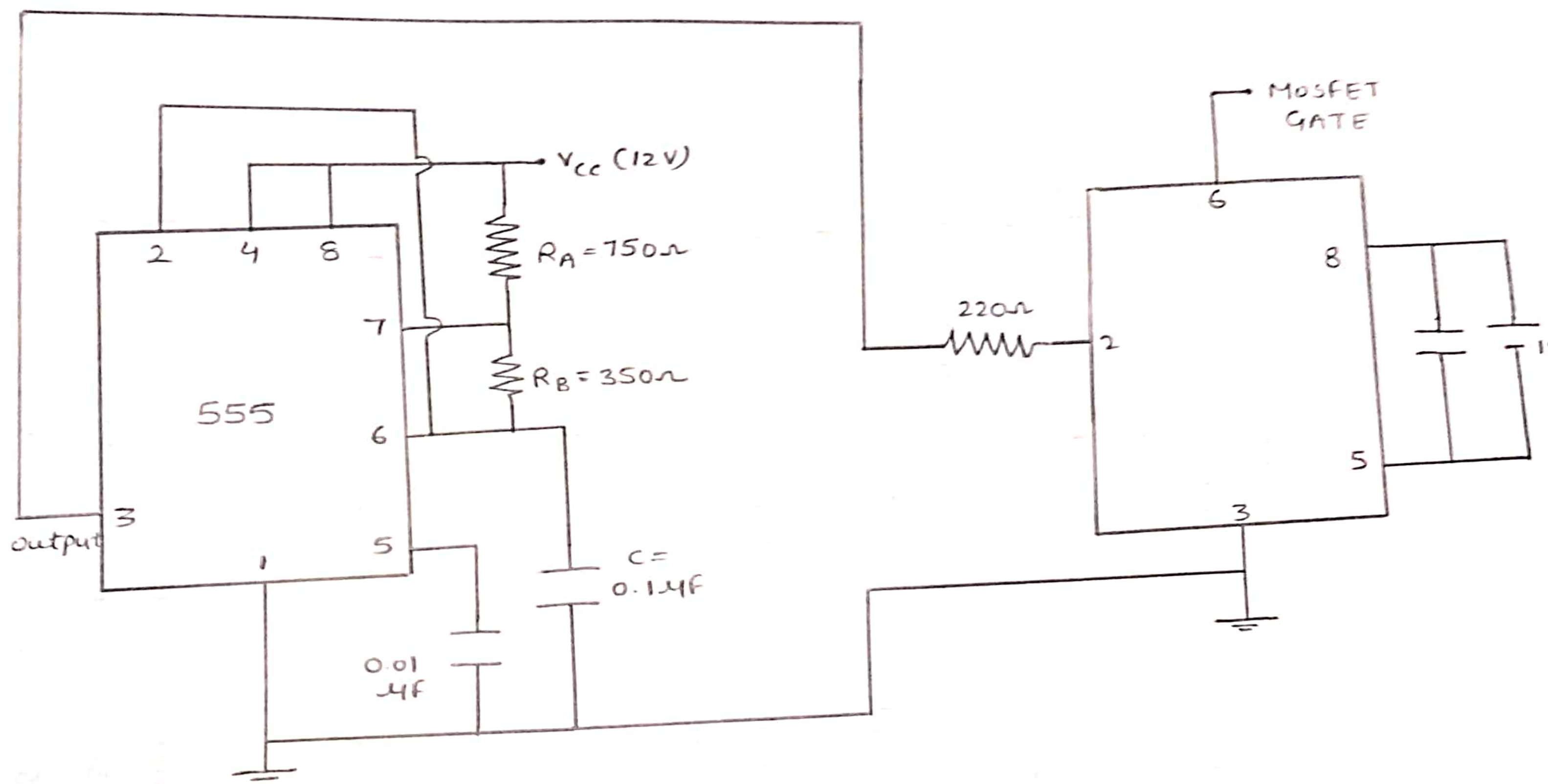
Aim: To study the boost Converter output voltage which has duty ratio of 0.75

Apparatus:

Sl.No	Component	Range	quality
1.	MOSFET	IRF540	1
2.	Inductor	30mH	1
3.	Capacitor	100μF	1
4.	Diode	41C6A4	1
5.	Rheostat	300Ω/1.7A	1
6.	Power supply	0-30V	3
7.	555 timer		1
8.	opto Coupler	TCP 2504	1
9.	Capacitor	0.1μF	1
		0.01 μF	1
		0.1 μF	1
10.	Resistor	750Ω	1
		350Ω	1
11.	CRO	digital	1

Theory:

A Boost Converter is a DC to DC power Converter that steps up voltage with stepping down Current from it's supply to it's load. The key principle that drives the Boost Converter is the tendency of an Inductor to Reset changes in output by Creating and distroying a mag. field. Some of Applications are Communication Applications, Battery power suppliers and power Amplifier Applications



Vcc (12V)
RA=750Ω
RB=350Ω
555
2
4
8
7
6
3
output
1
5
0.01 μF
C= 0.1μF
220Ω
MOSFET GATE
6
8
2
5
3
15V

fig(a)

procedure:

1) Connect the circuit as shown in the figure
2) Given 12V to 555 timmer the square wave generated not upto good magnitude to drive MOSFET hence, we give it to the Amplifier.
3) The output of optocoupler is given to fig (b)
4) The output wave-forms are observed in the CRO

Design & Calculations:

$$V_i T_{ON} = (V_o - V_i) T_{OFF}$$

$$T_{ON} = DT_s \quad \& \quad T_{OFF} = (1-D) T_s$$

$$V_o = \frac{V_i}{1-D}$$

Inductor ripple Current (Peak-Peak), $\Delta I_L = \frac{V_i \cdot D}{f_s L}$

Capacitor ripple voltage (Peak-Peak), $\Delta V_c = \frac{I_o \cdot D}{f_s C}$

From 555 (IC) Timmer,

$$f_s = f_c = \frac{1.44}{(R_A + 2R_B)C}$$

$$T_s = T_c = \frac{1}{f_c} = 0.6933\,(R_A + 2R_B)\,C = 10\,KHz$$

Pulse width, $P.W = 0.693\,(R_A + R_B)\,C = 7.5\,KHz$

$$SW = T_c - P.W$$

Duty cycle, $D = \frac{P.W}{T_c} \times 100$

$$= \frac{R_A + R_B}{R_A + 2R_B}$$

Based on the R_A & R_B $\longrightarrow$ $D \cong 0.75$

$(\because R_A = 750\Omega,\ R_B = 350\Omega)$

Assuming (P-P) load current, $\Delta I_L = 0.03A$

$$\Delta I_L = \frac{V_{in} D}{f_s L} = \frac{12 \times 0.75}{10 \times 10^3 \times L}$$

$$L = 30 mH.$$

Assuming (P-P) load voltage, $\Delta V_L =$

$$\Delta V_L = \frac{I_o D}{f_s C} =$$

$$C =$$