

DEMONSTRATION
on
CIRCUITS SIMULATION & ANALYSIS USING PSPICE LAB

By

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Assistant Professor

**DEPT. OF E.E.E, VEMU IT
CHITTOOR**

Vision of the institute

To be a premier institute for professional education producing dynamic and vibrant force of technocrat with competent skills, innovative ideas and leadership qualities to serve the society with ethical and benevolent approach.

Mission of the institute

Mission_1: To create a learning environment with state-of-the-art infrastructure, well equipped laboratories, research facilities and qualified senior faculty to impart high quality technical education.

Mission_2: To facilitate the learners to foster innovative ideas, inculcate competent research and consultancy skills through Industry-Institute Interaction.

Mission_3: To develop hard work, honesty, leadership qualities and sense of direction in rural youth by providing value based education.

Vision of the Department

To produce professionally deft and intellectually adept Electrical and Electronics Engineers and equip them with the latest technological skills, research & consultancy competencies along with social responsibility, ethics, Lifelong Learning and leadership qualities.

Mission of the Department

Mission_1: To produce competent Electrical and Electronics Engineers with strong core knowledge, design experience & exposure to research by providing quality teaching and learning environment..

Mission_2: To train the students in emerging technologies through state - of - the art laboratories and thus bridge the gap between Industry and academia.

Mission_3: To inculcate learners with interpersonal skills, team work, social values, leadership qualities and professional ethics for a holistic engineering professional practice through value based education

Programme Educational Objectives (PEOs)

PEO_1: Provide sound foundation in mathematics, science and engineering fundamentals to analyze, formulate and solve complex engineering problems.

PEO_2: Have multi-disciplinary Knowledge and innovative skills to design and develop Electrical & Electronics products and allied systems.

PEO_3: Acquire the latest technological skills and motivation to pursue higher studies leading to research.

PEO_4: Possess good communication skills, team spirit, ethics, modern tools usage and the life-long learning needed for a successful professional career.

- PO_1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO_2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO_3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO_4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO_5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO_6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO_7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO_8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO_9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO_10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO_11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO_12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Programme Specific Outcome(PSOs)

PSO_1: Higher Education: Apply the fundamental knowledge of Mathematics, Science, Electrical and Electronics Engineering to pursue higher education in the areas of Electrical Circuits, Electrical Machines, Electrical Drives, Power Electronics, Control Systems and Power Systems.

PSO_2: Employment: Get employed in Public/Private sectors by applying the knowledge in the domains of design and operation of Electronic Systems, Microprocessor based control systems, Power systems, Energy auditing etc.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
III B.Tech. II-Sem (ECE)
(19A02601P) DIGITAL COMPUTER PLATFORMS LABORATORY
DEPT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Outcomes:

CO1. Simulation of various circuits using PSPICE software.

CO2. Simulation of single-phase half & fully-controlled converters, and inverters

CO3. Simulation of single-phase AC Voltage controllers with different loads.

List of Experiments:

I Simulation of Electrical Circuits

- a) DC & AC Circuits
- b) Mesh Analysis
- c) Nodal Analysis
- d) Transient Response

II Simulation of Power Electronic Circuits

- a) Single-phase half wave, Semi and full converters with RLE loads.
- b) Three-phase half wave, Semi and full converters with RLE loads.

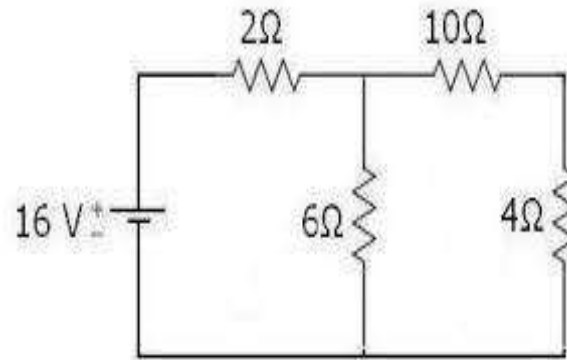
c) Buck, Boost and Buck-Boost Converters

d) Single-phase AC voltage controller

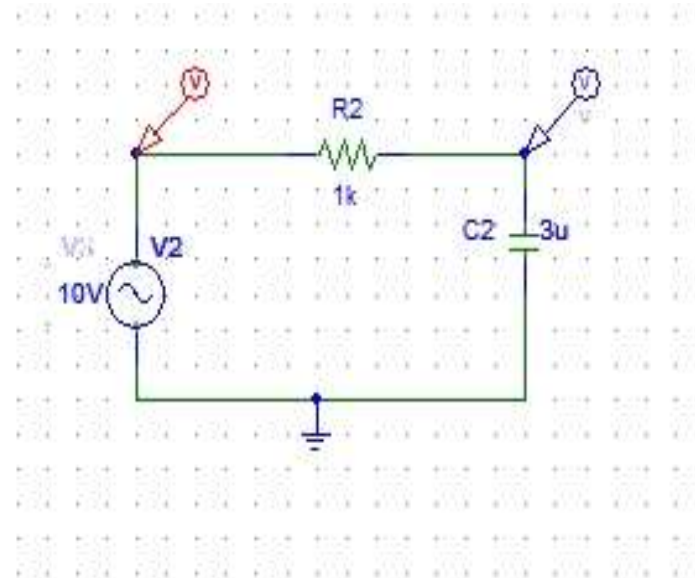
e) Single and Three phase Quasi Square wave and PWM Inverters

SIMULATION OF DC&AC CIRCUITS

DC CIRCUIT:



AC CIRCUIT:



PROCEDURE:

- 1) 1. Open PSPICE A/D windows
2. Create a new circuit file
3. Enter the program representing the nodal interconnections of various components
4. Run the program
5. Observe the response through all the elements in the output file
6. Observe the voltage, current graph of any in probe window

2) 1. Open the PSPICE design manager in search bar from the design manager click on the run **Schematic** button to open a new blank schematic.

2. Save the file and the search the components and connect the circuit as shown in figure.
3. Place the voltage marker at resistor and capacitor.
4. In analysis we can simulate the program.

PROGRAM

THEVENINS THEOREM:

V_{IN} 1 0 dc 16V

R₁ 1 2 2

R₂ 2 3 10

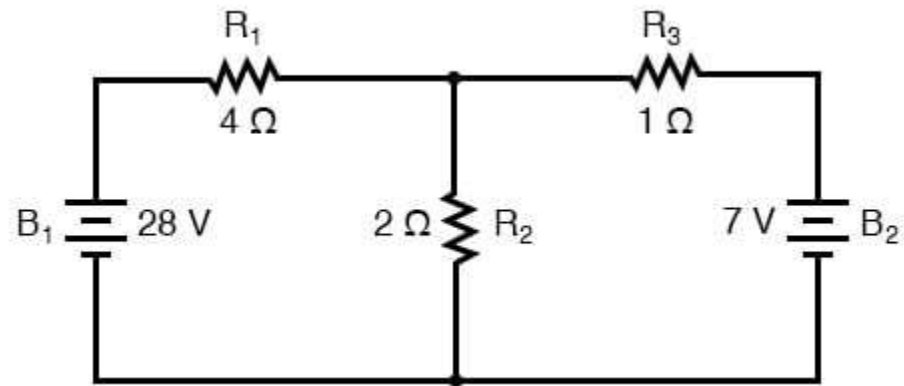
R₃ 2 0 6

R₄ 3 0 4

.TF V (3, 0) V_{IN}

.END

MESH ANALYSIS



PROGRAM

V1 1 0 DC 28V

V2 3 0 DC 7V

R1 1 2 4

R2 2 0 2

R3 2 3 1

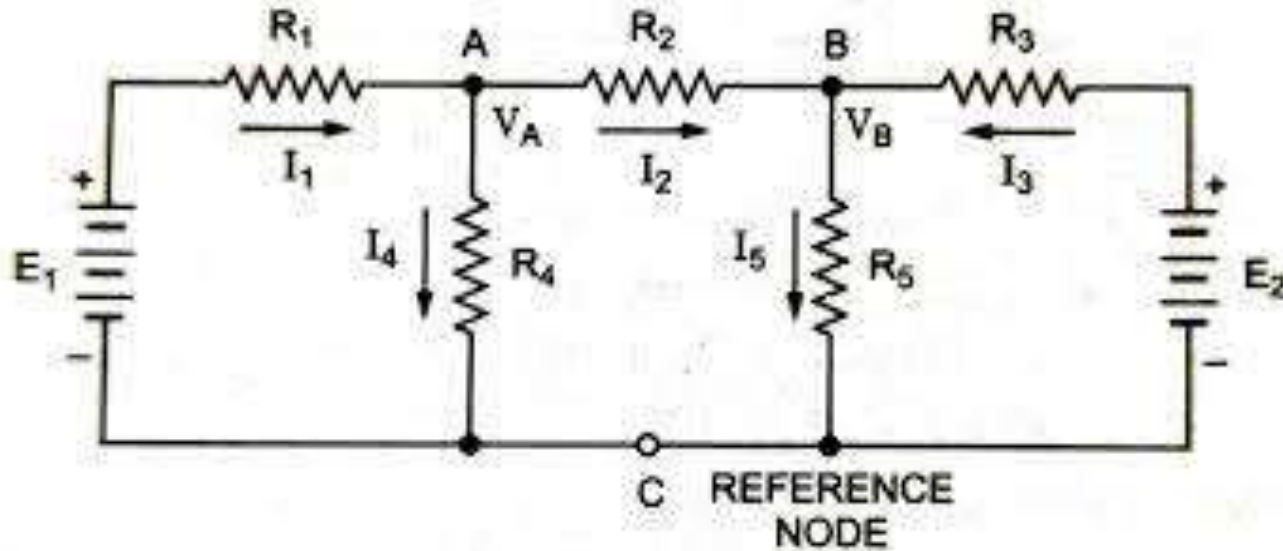
.OP

.OP

.print DC I(R1) I(R2) I(R3)

.end

NODAL ANALYSIS



$$E_1=30V, E_2=10V$$

$$R_1=1000\Omega,$$

$$R_2=4000\Omega, R_3=6000\Omega, R_4=2000\Omega, R_5=8000\Omega$$

PROGRAM

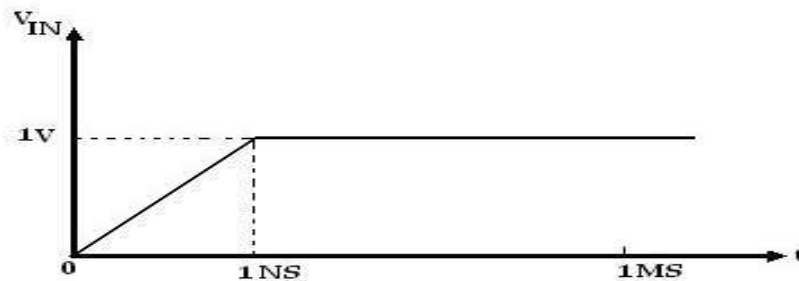
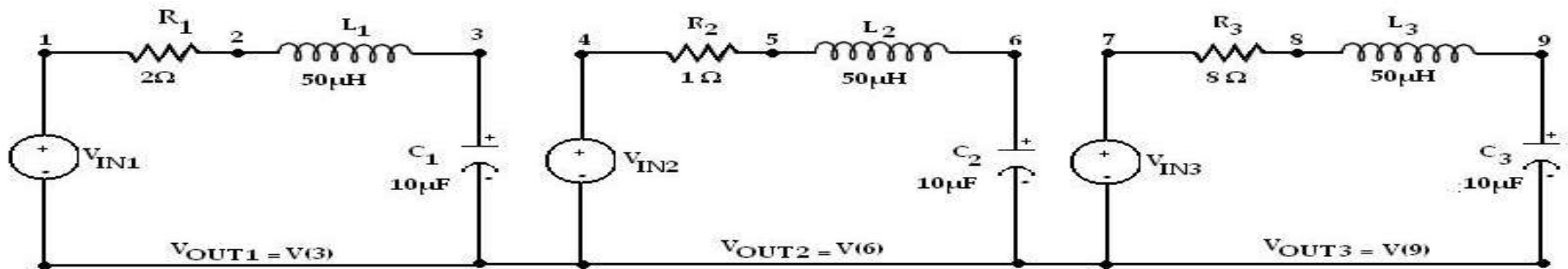
E1 1 0 DC 30V : DC Voltage source of 30V between 1 & 0 nodes
E2 4 0 DC 10V : DC Voltage source of 10V between 4 & 0 nodes
R1 1 2 1000 : Resistance of 1000ohms between 1 & 2 nodes
R2 2 3 4000 : Resistance of 800ohms between 5 & 2 nodes
R3 3 4 6000 : Resistance of 6000ohms between 2 & 3 nodes
R4 2 0 2000 : Resistance of 200ohms between 4 & 0 nodes
R5 3 0 8000 : Resistance of 200ohms between 3 & 0 nodes
.OP : Directs the bias point to the output file
.END : End of the program

DC TRANSIENT RESPONSE

S.NO	TYPE OF SOURCE	REPRESENTATION OF SOURCE	DECLARATION FORMAT
1	STEP RESPONSE	PWL	STEP (Time at a Point) (Voltage at a Point)
2	TRANSIENT ANALYSIS	.TRAN	.TRAN TStep Tstop [TStart TMax] [UIC]
3	PROBE STATEMENT	.PROBE	It is a wave form analyzer
4	PLOT STATEMENT	.PLOT	.PLOT (Output Variables) {(Lower limit

DATA REQUIRED FOR DRAWING THE CIRCUIT DIAGRAM:

For example, Three RLC circuits with $R=2\Omega$, 1Ω , and 8Ω respectively, with L having the values of $50\mu\text{H}$ each, with C having the values of $10\mu\text{F}$ each. The inputs are identical Step Response. The Step having the Time at points as 1nsec and 1msec respectively and Voltage at a point as 1V respectively. Use PSpICE to plot and calculate the transient response from 0 to $400\mu\text{seconds}$ with an increment of $1\mu\text{second}$. Plot the voltages across the capacitors.



PROGRAM

VIN1 1 0 PWL(0 0 1NS 1V 1MS 1V)

VIN2 4 0 PWL(0 0 1NS 1V 1MS 1V)

VIN3 7 0 PWL(0 0 1NS 1V 1MS 1V)

R1 1 2 2

R2 4 5 1

R3 7 8 8

L1 2 3 50UH

L2 5 6 50UH

L3 8 9 50UH

C1 3 0 10UF

C2 6 0 10UF

C3 9 0 10UF

.TRAN 1US 400US

.PLOT TRAN V(3) V(6) V(9)

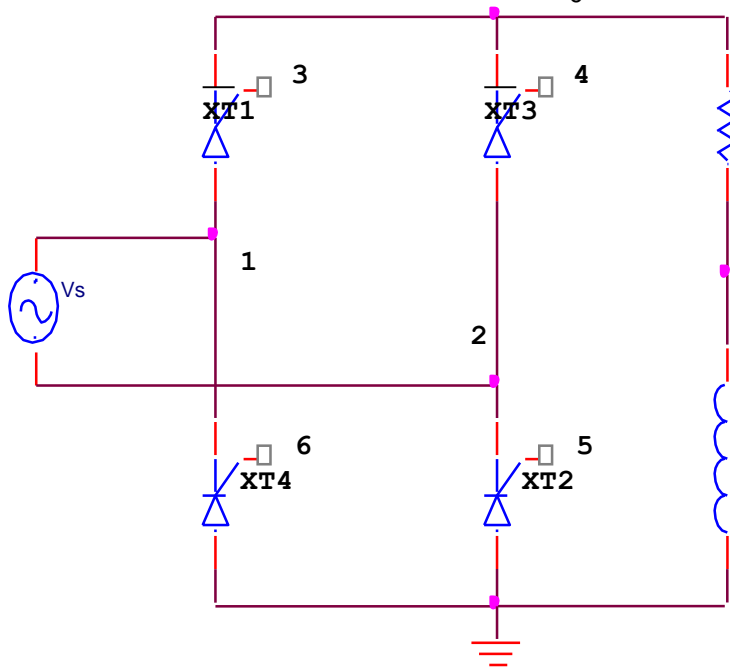
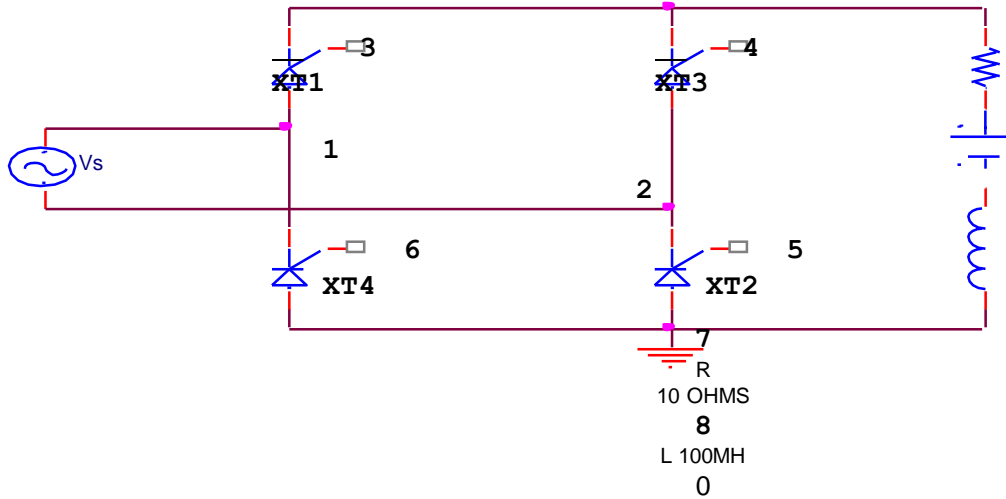
.PROBE

.END

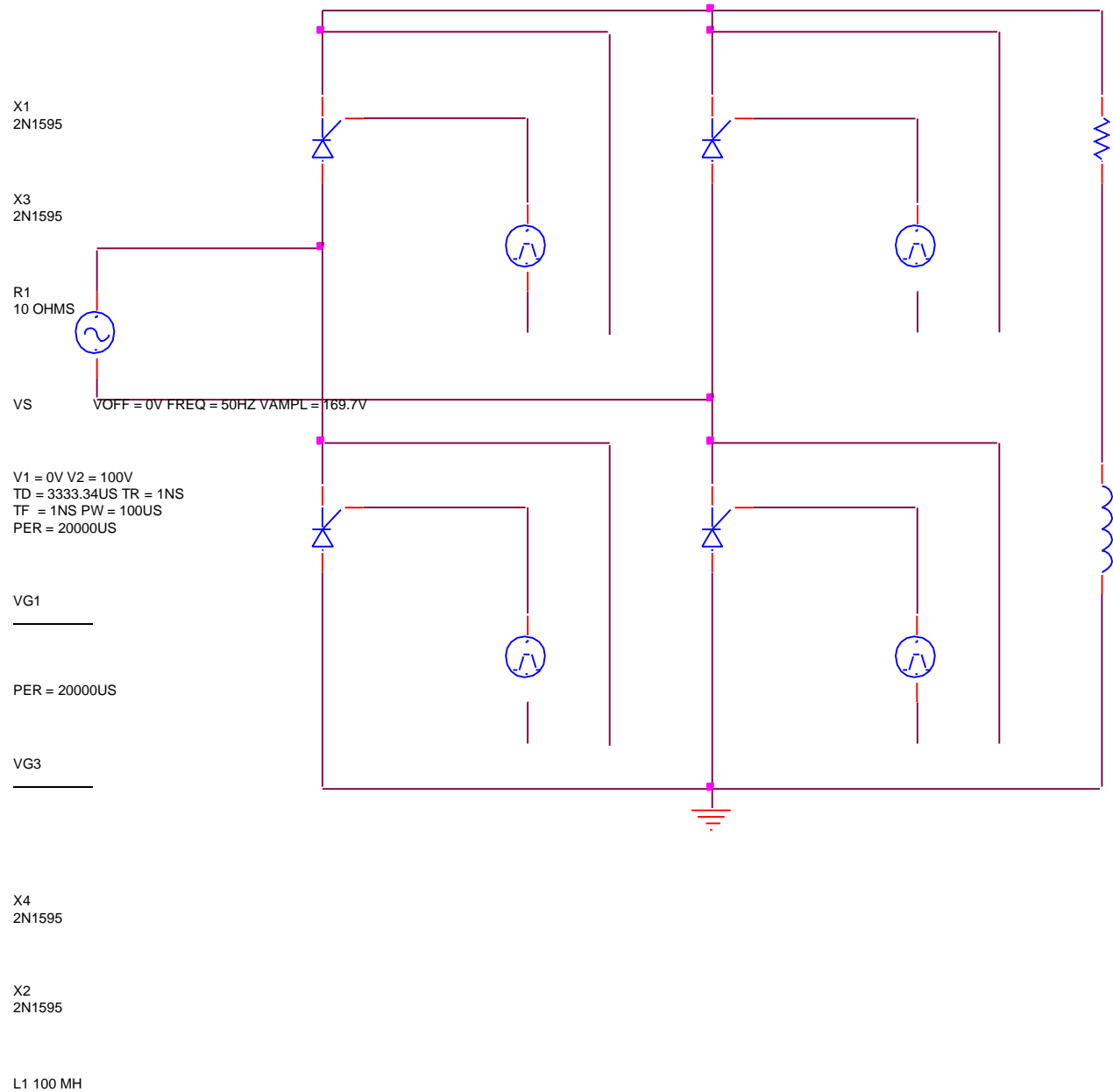
PSPICE ANALYSIS OF SINGLE PHASE FULL CONVERTER WITH RL & RLE LOADS

Single Phase full converter with RL load

Single Phase full converter with RLE load



Single Phase full converter with RL load



PER = 20000US

Single Phase full converter with RLE load

VG3
E

100 V

X4
2N1595

X2
2N1595

L1 100 MH

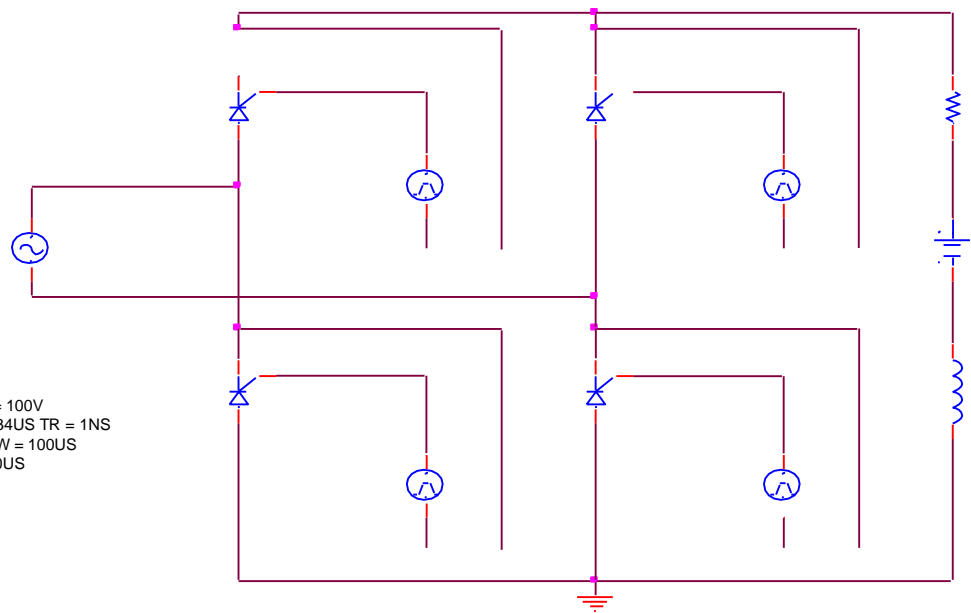
V1 = 0V V2 = 100V
TD = 13333.34US TR = 1NS
TF = 1NS PW = 100US
PER = 20000US

VG4

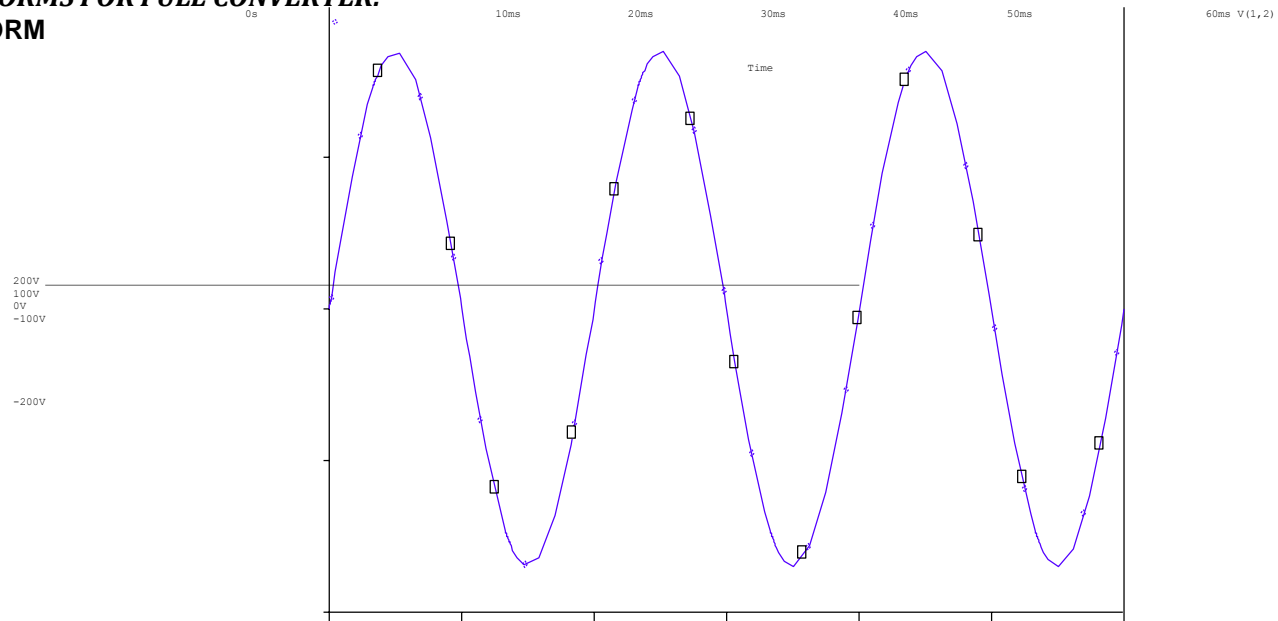
V1 = 0V V2 = 100V
TD = 3333.34US TR = 1NS
TF = 1NS PW = 100US
PER = 20000US

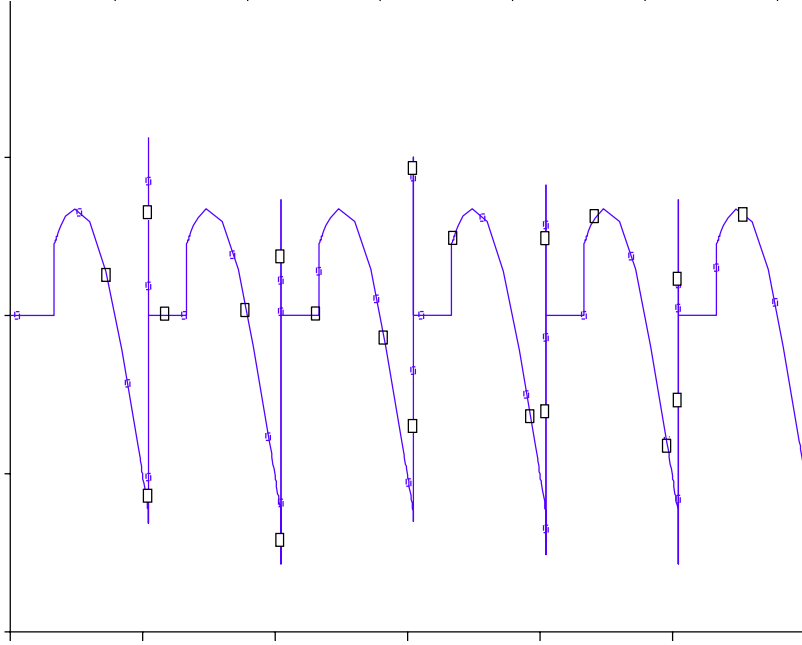
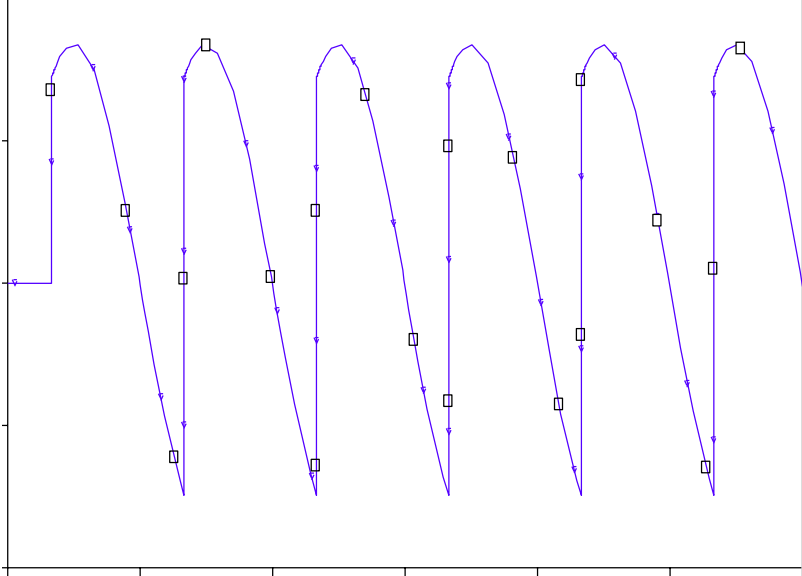
VG2

-

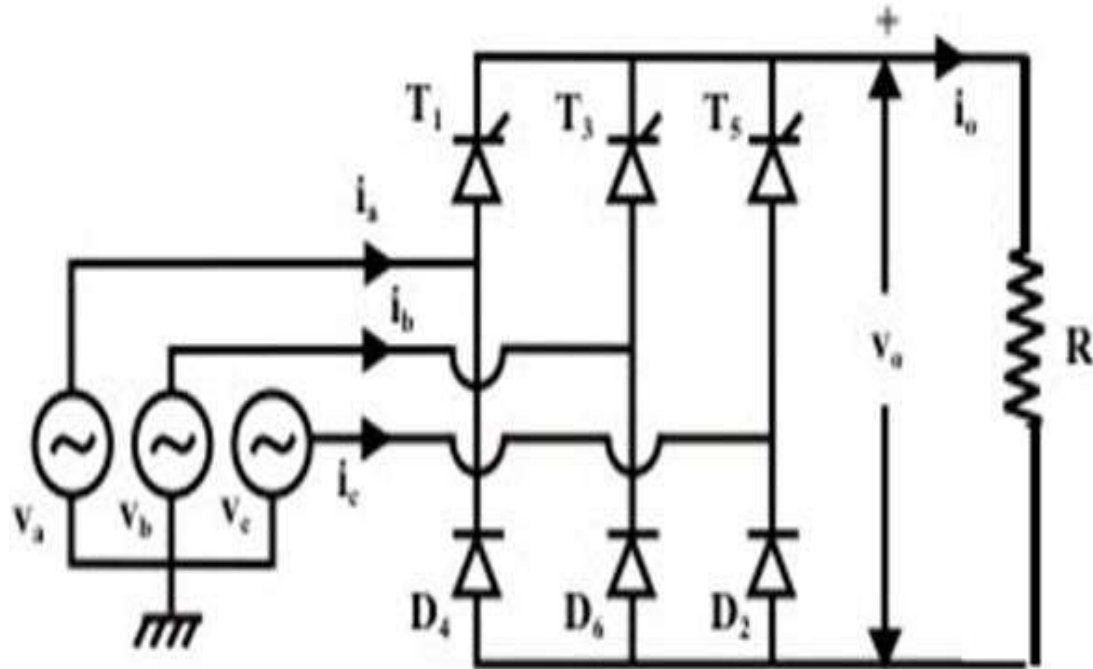


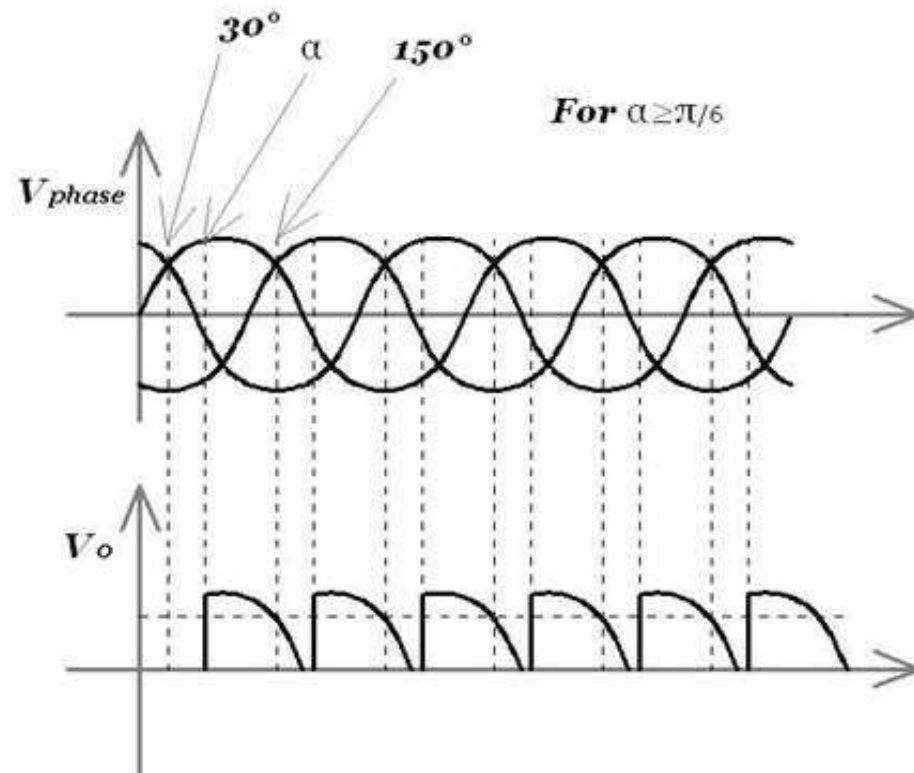
**MODEL WAVEFORMS FOR FULL CONVERTER:
INPUT WAVEFORM**



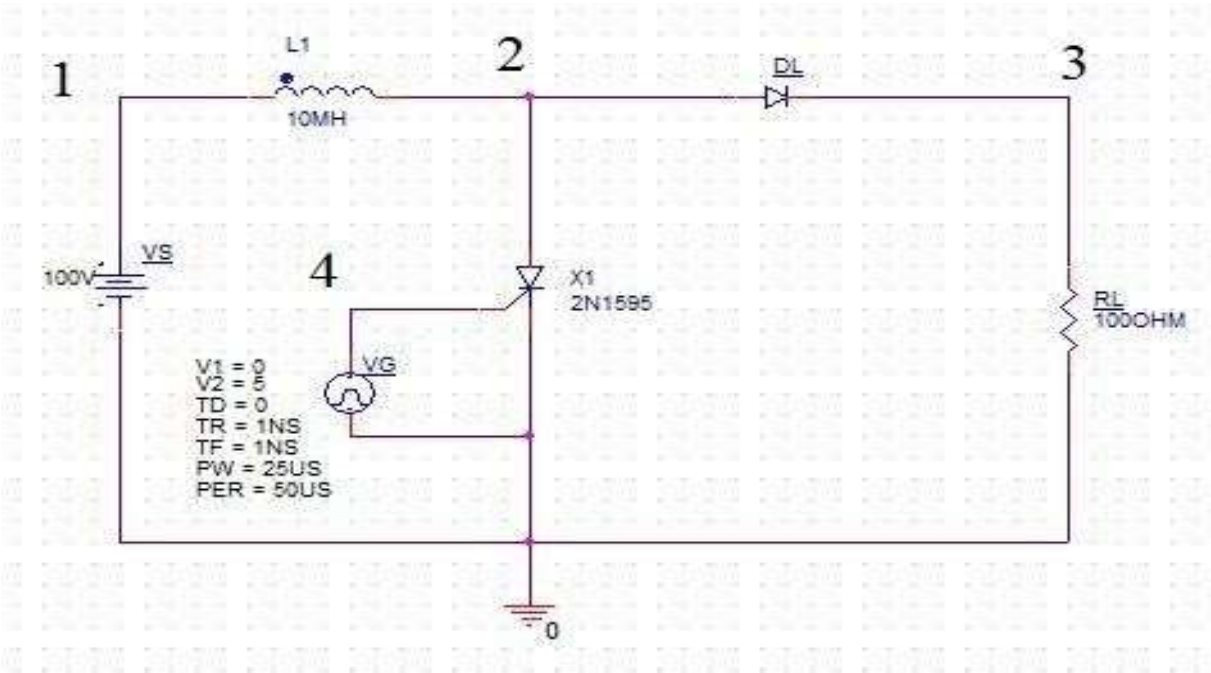


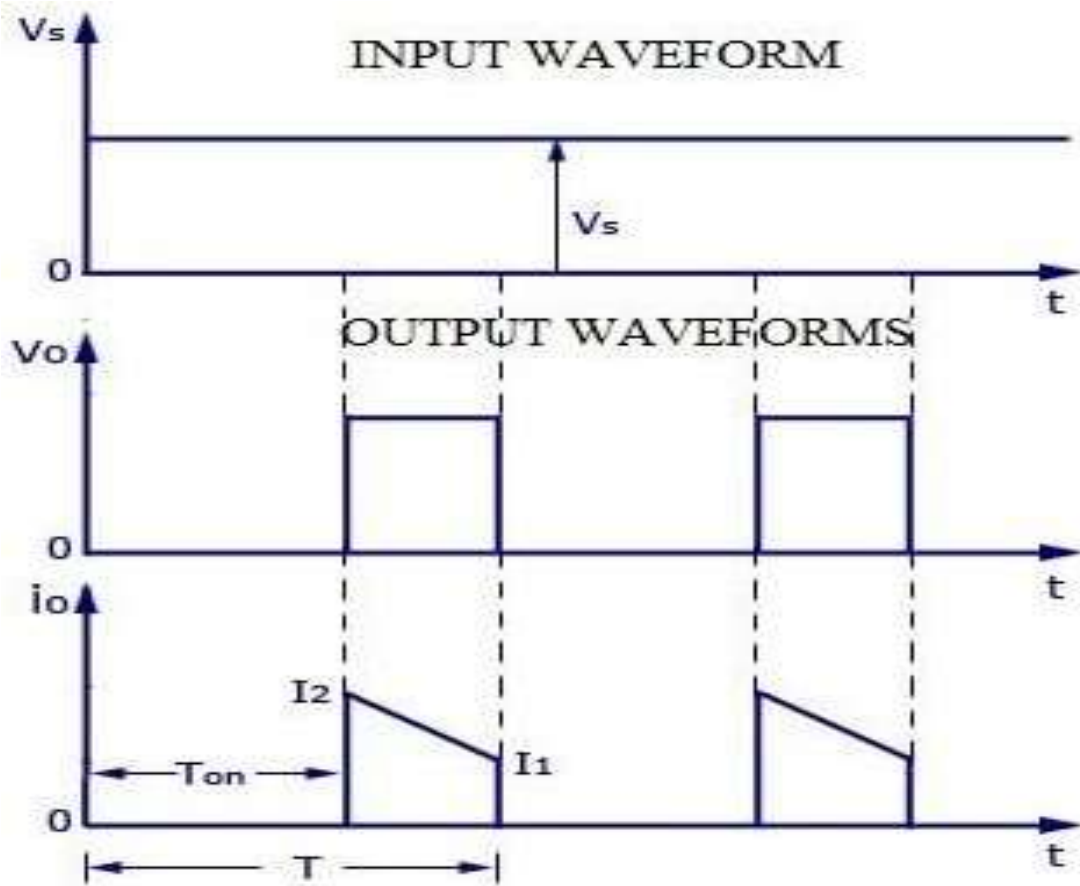
THREE PHASE HALF CONTROLLED BRIDGE CONVERTER WITH R LOAD



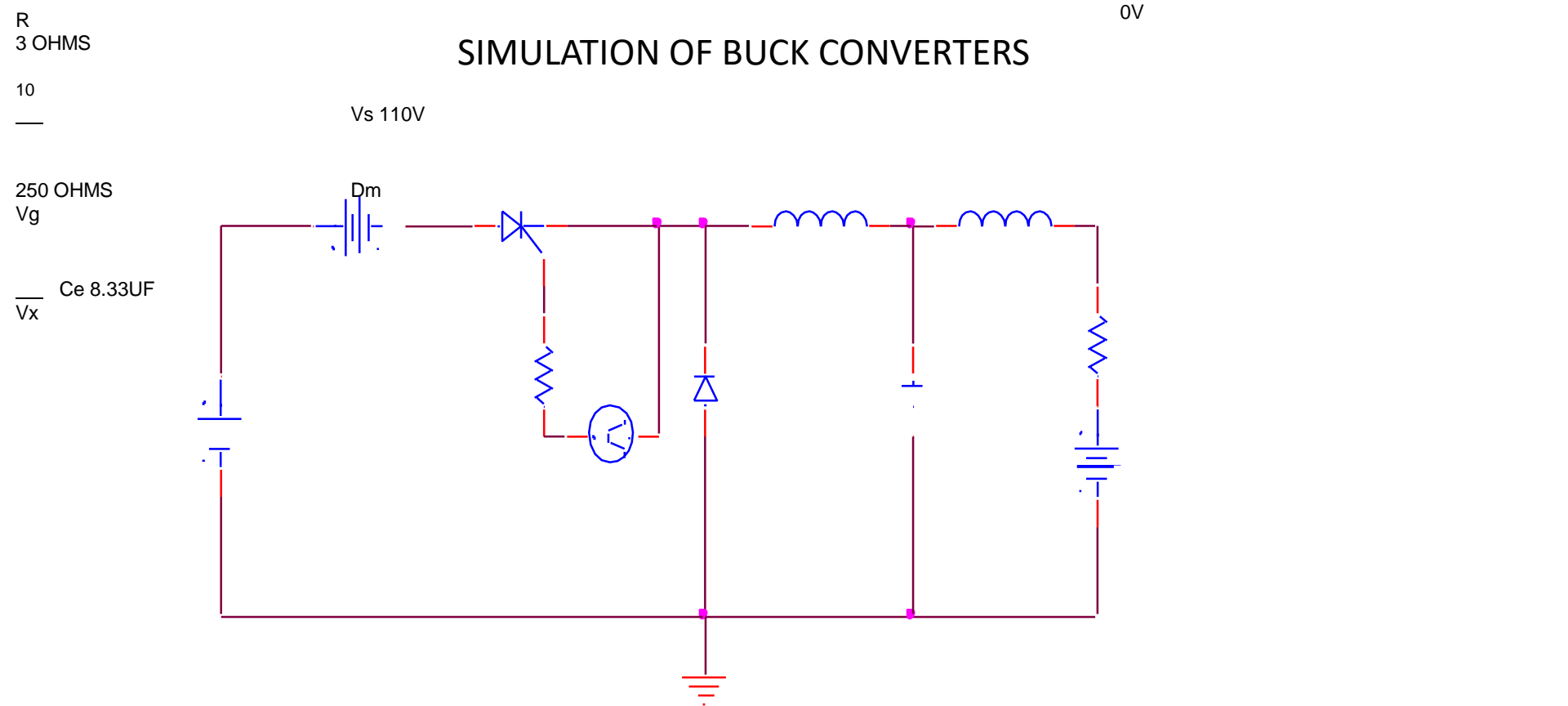


SIMULATION OF BOOST CONVERTERS





SIMULATION OF BUCK CONVERTERS



3 OHMS

10

—

V_s 110V

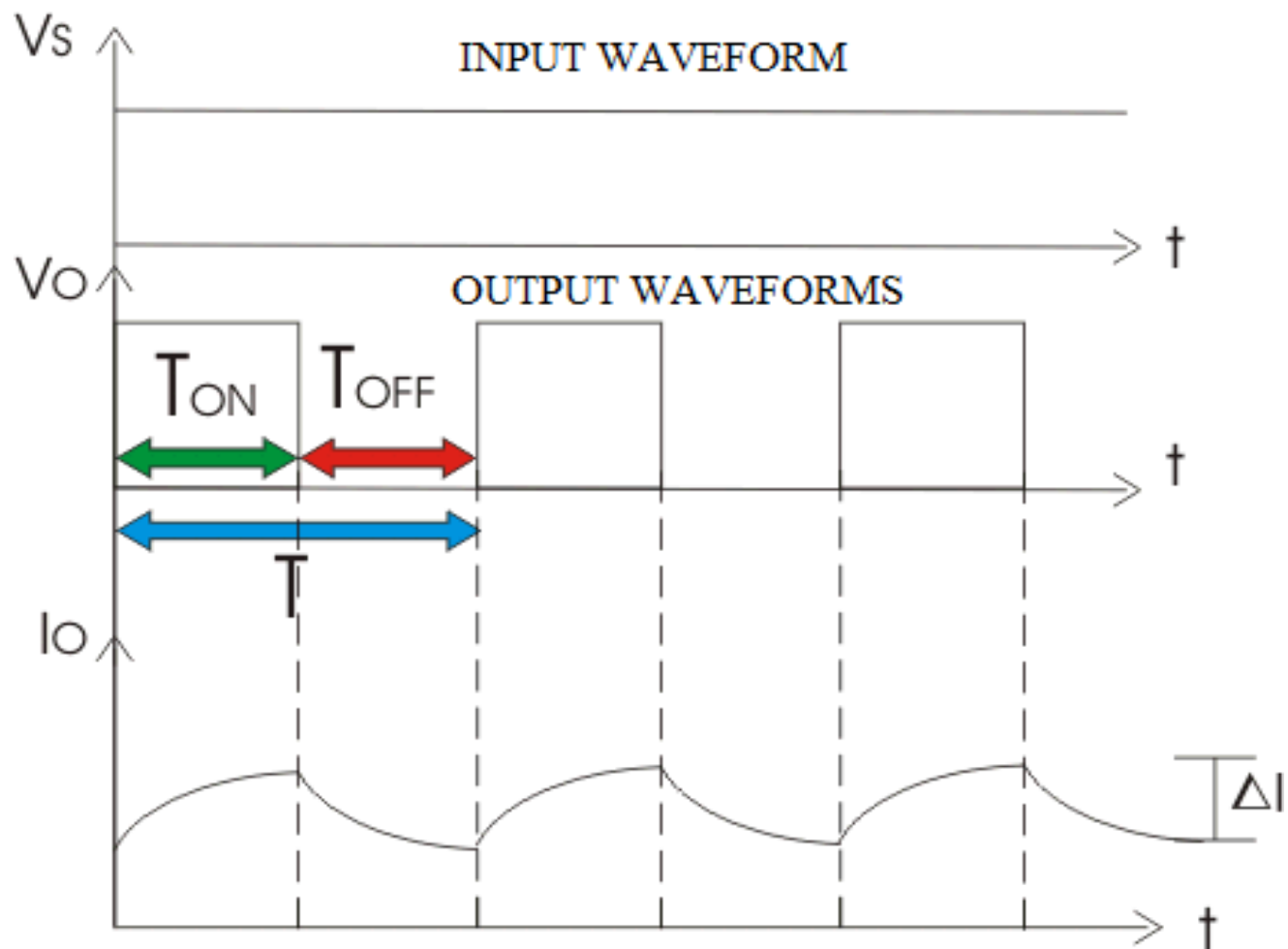
250 OHMS

V_g

8.33UF

V_x

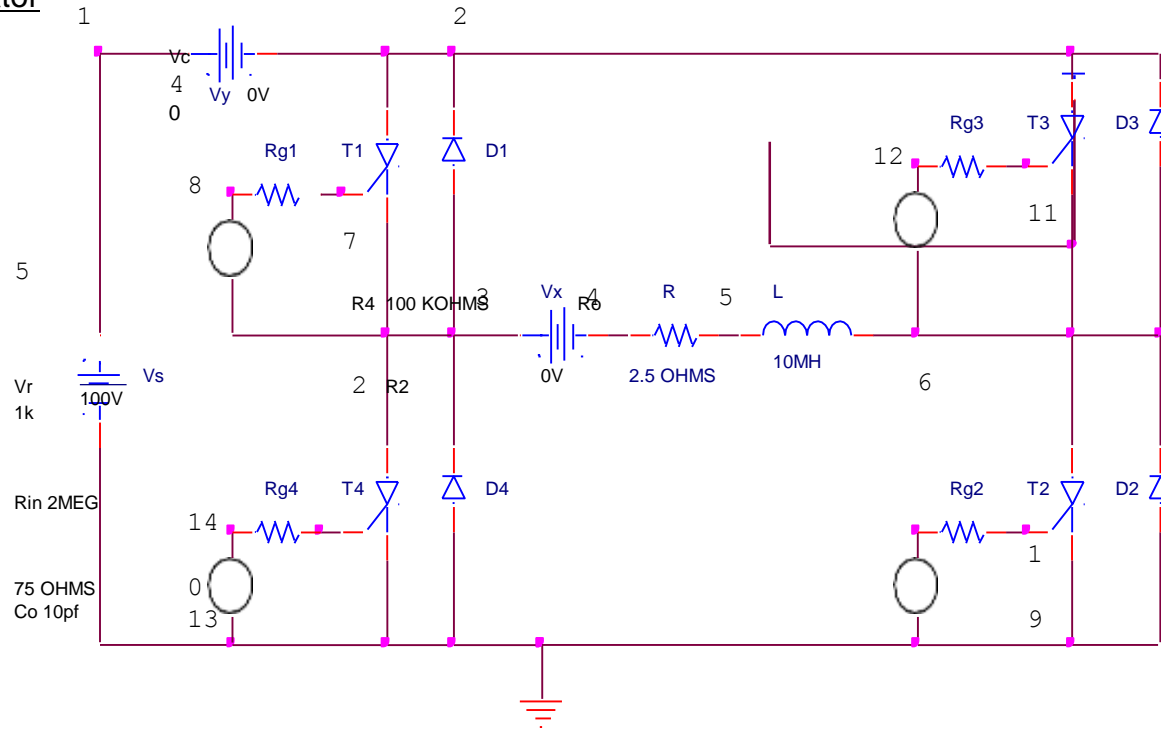
0V



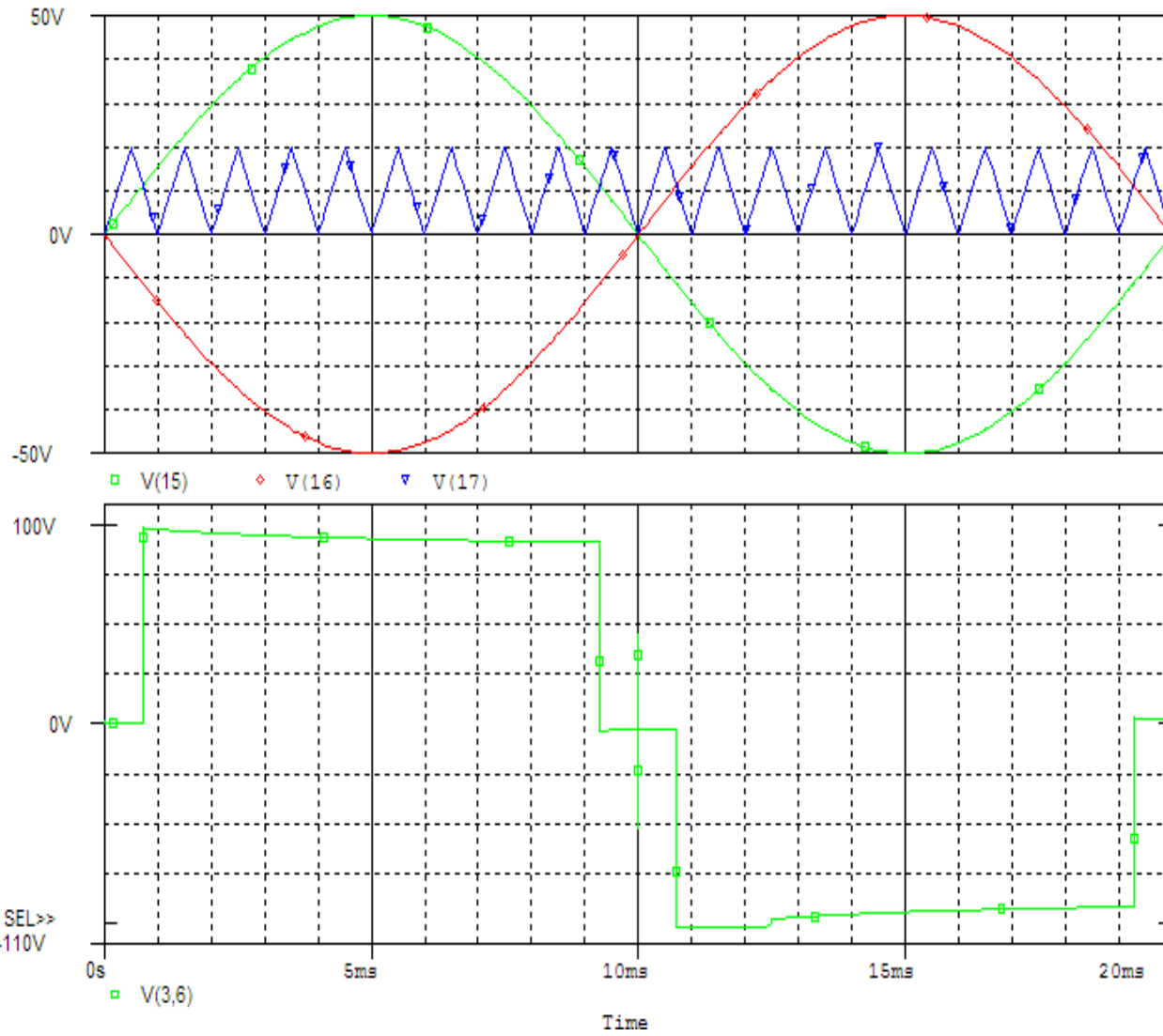
Single phase inverter with PWM control

SINGLE PHASE INVERTER WITH PWM CONTROL

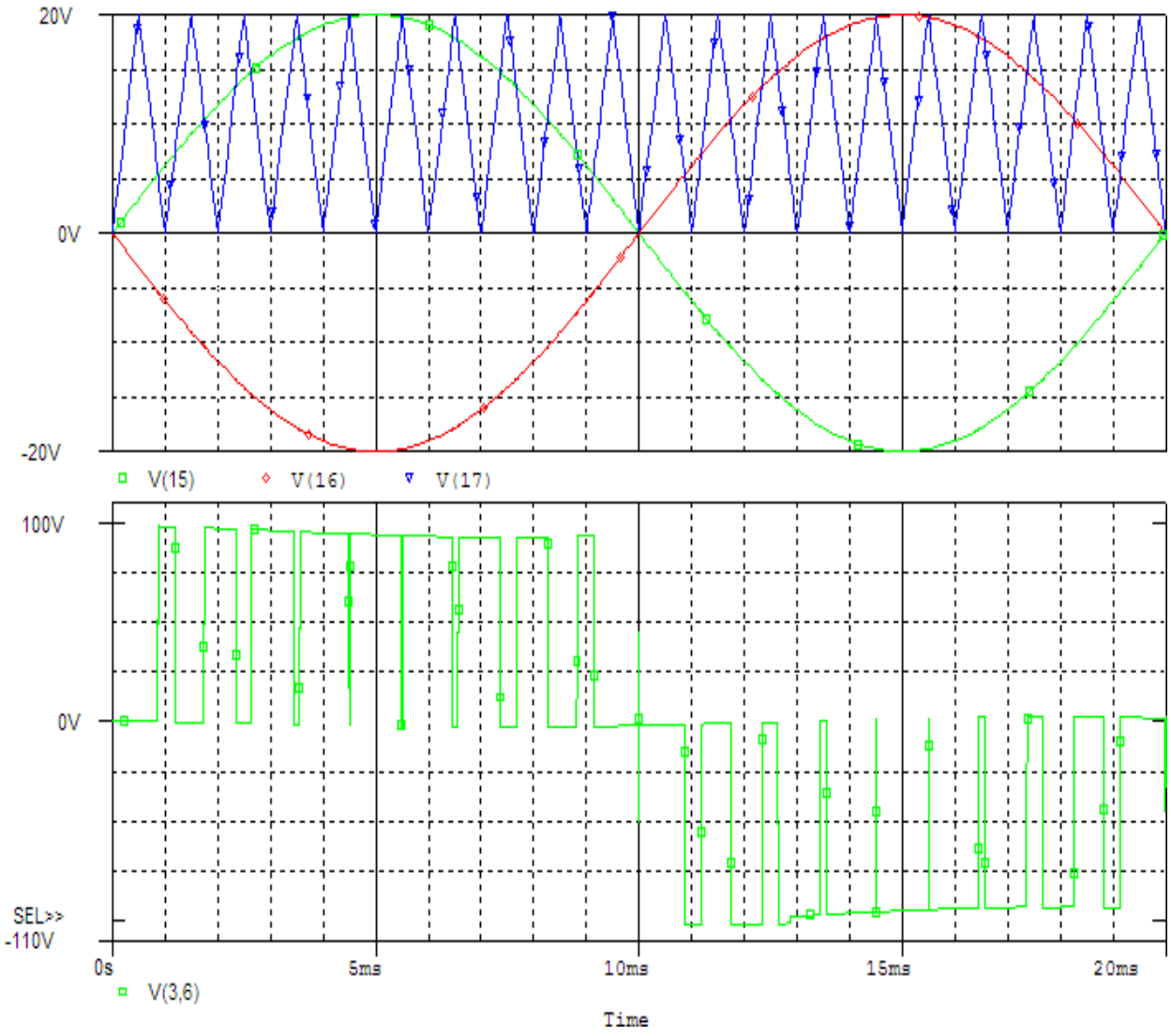
PWM Generator



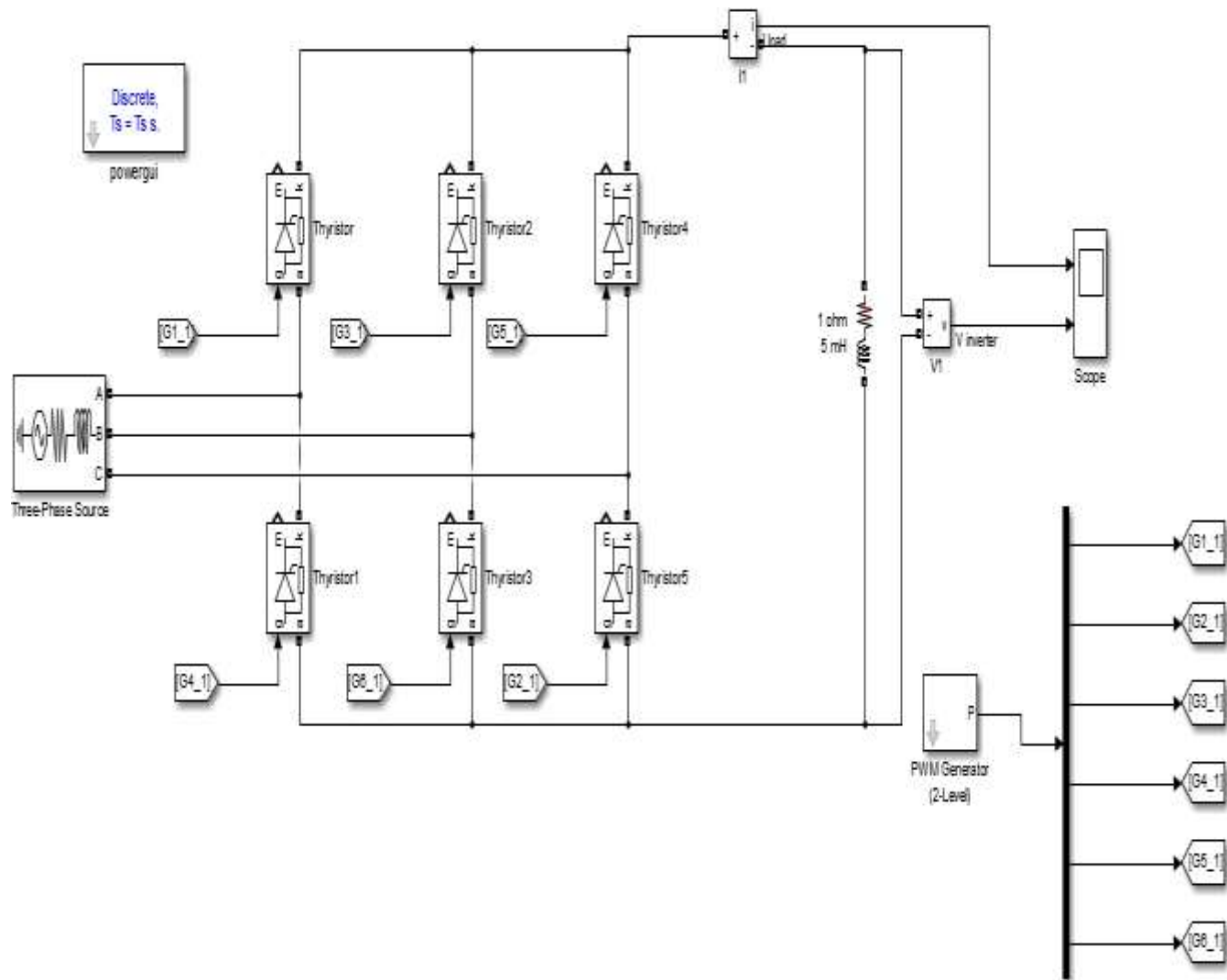
(A) inverter.dat (active)

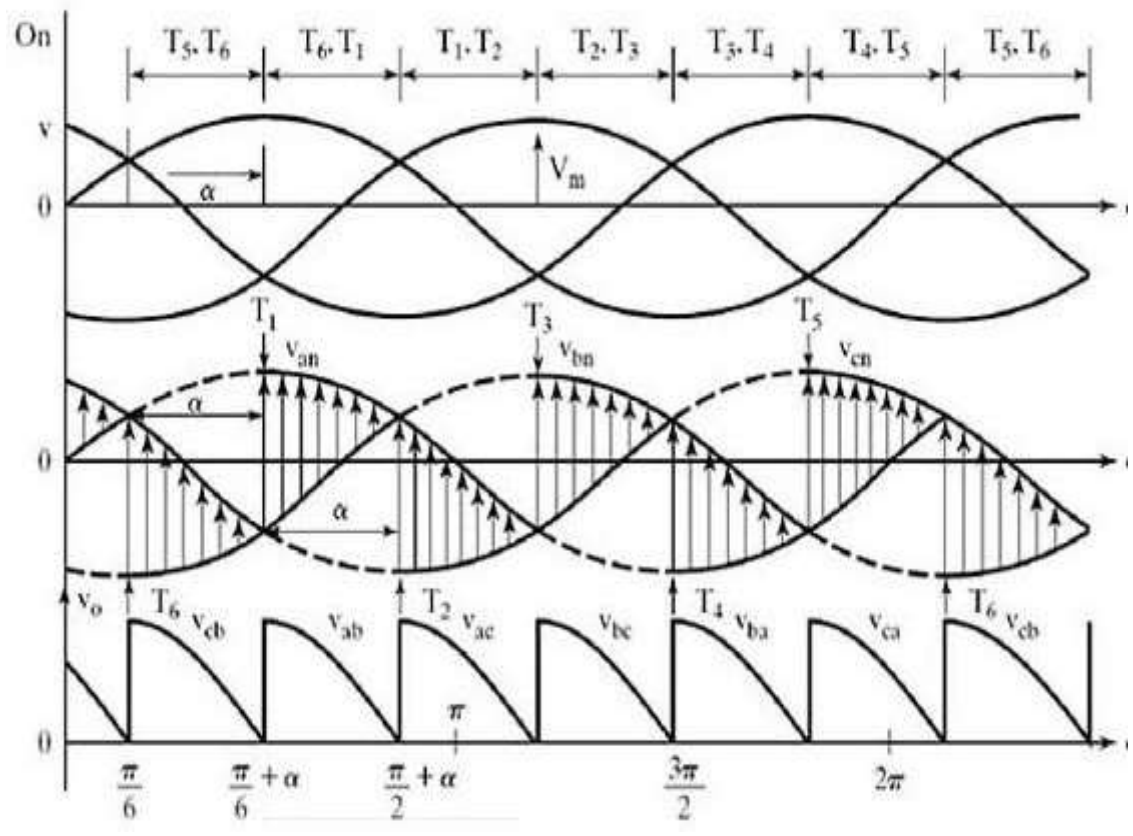


(A) inverter.dat (active)

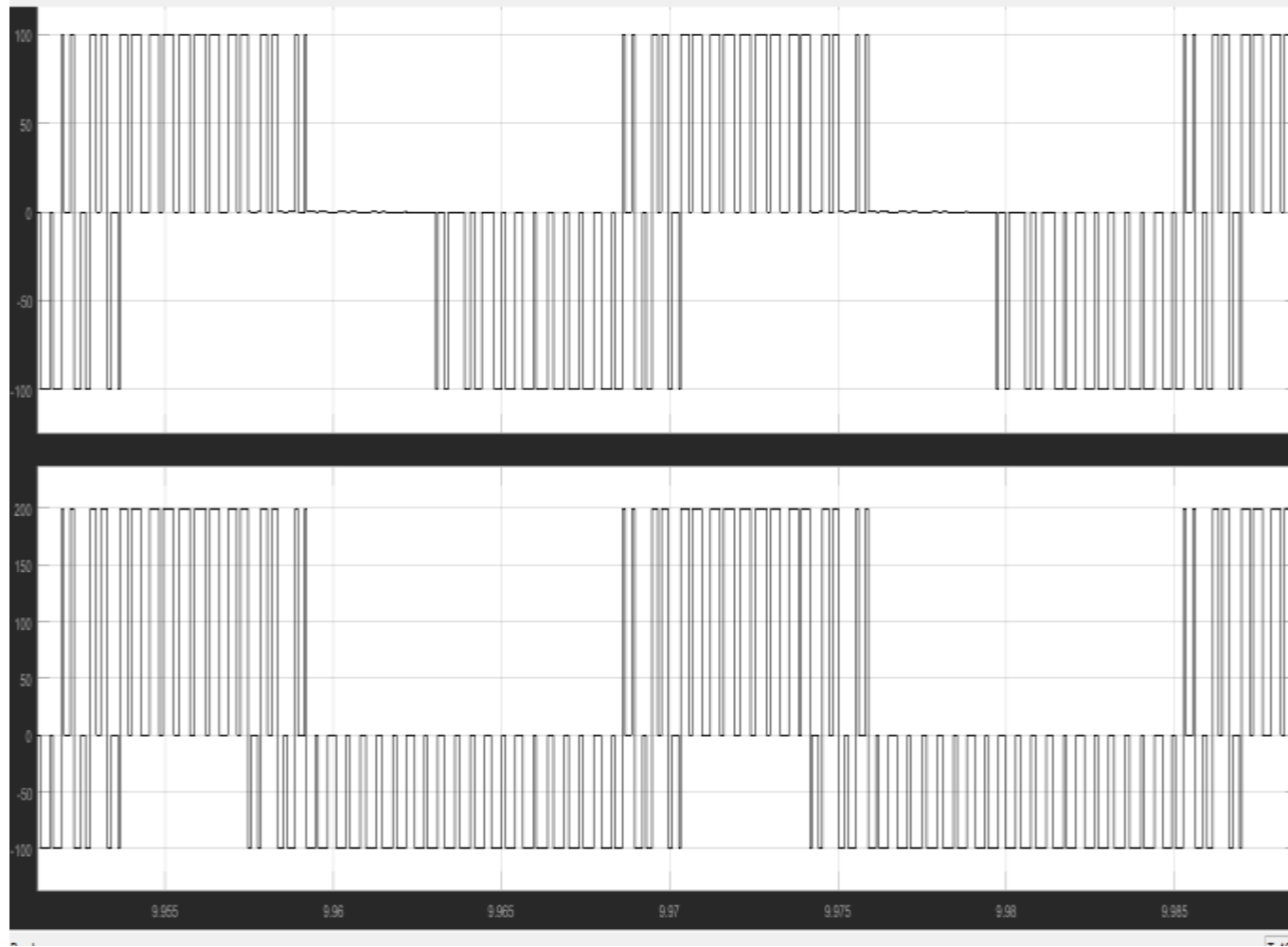


SIMULATION OF THREE PHASE FULL CONVERTER AND PWM INVERTER

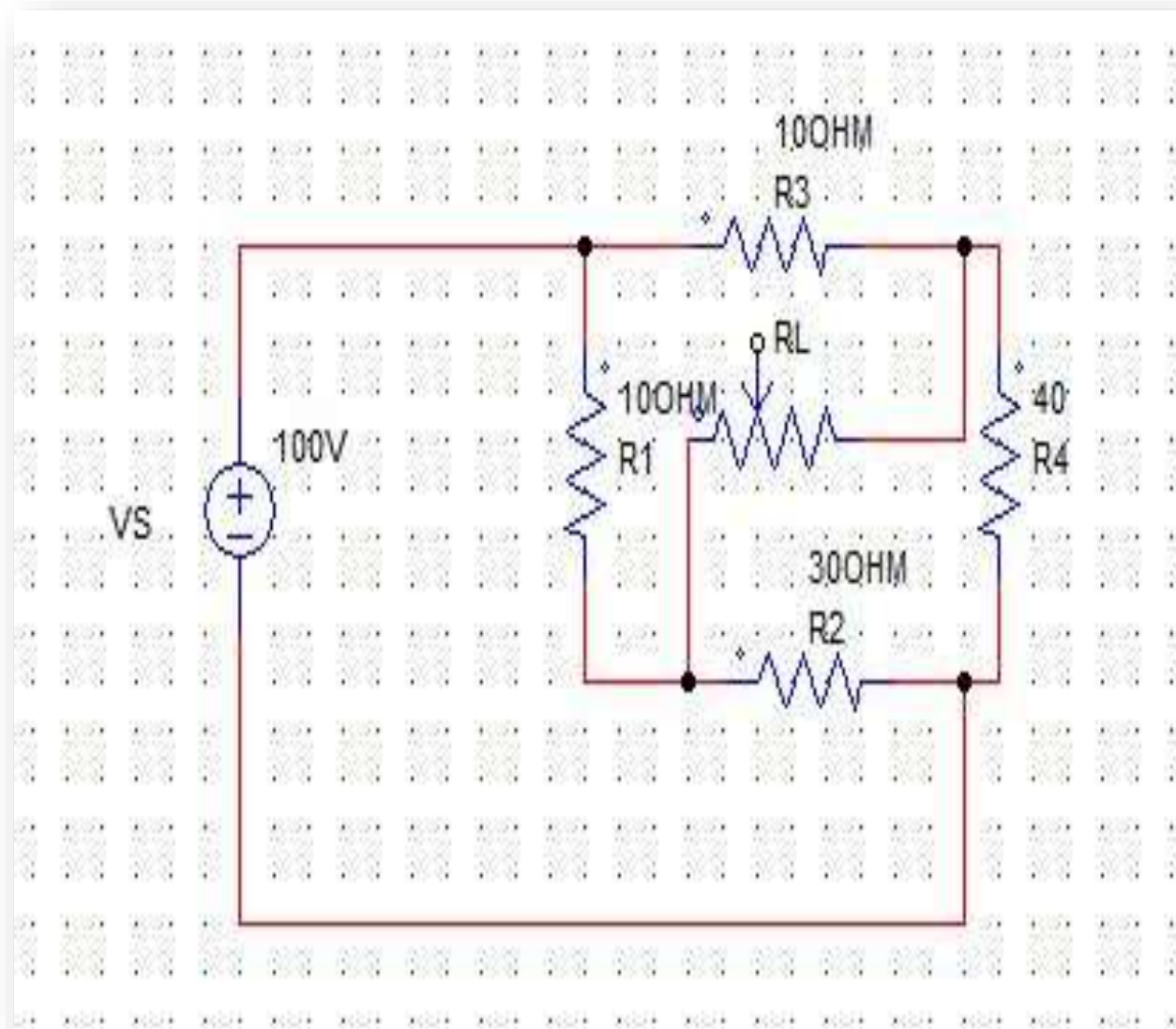




Data may be missing. Try unchecking 'Limit data points to last' from the Configuration Properties Logging tab.



VERIFICATION OF THE MAXIMUM POWER DISSIPATION



PROGRAM:

VS 1 0 DC 100

R1 1 2 10

R2 2 0 30

R3 1 3 20

R4 3 0 40

RL 2 3 RLOAD 1

.MODEL RLOAD RES(R=25)

.DC RES RLOAD(R) 0.001 40 0.01

.TF V(2,3) VS

.PROBE

.END

DOs & DON'TS

- Do not displace monitor, keyboard, mouse etc.
- Do not use personal pen drives without permission.
- Students should not attempt to repair, open, tamper or interfere with any of the computer, cabling, or other equipment in the laboratory.

Safety Precautions

- Data will be preserved using UPS Backup.
- Equipped with Fire Extinguishers.
- Students and Faculty are instructed to follow Safety Instructions Chart in the Laboratories.
- Before inserting USB Stick, the Pen drives have to be scanned for any malicious content.
- The Lab is under CC Camera surveillance.
- Keep all the Computers Updated with antivirus software.
- Make Sure the Firewalls are enabled on each and every Computer.
- Miniature Circuit Breaker's (MCB's).
- Students inserting USB Stick have to be scanned for any malicious content.
- Students should not attempt to repair, open, tamper or interfere with any of the computer, cabling, or other equipment in the laboratory.
- Do not displace monitor, keyboard, mouse etc.
- Do not use personal pen drives without permission.



Fire Extinguishers



First Aid Box



Miniature Circuit Breaker's (MCB's).



CC Camera surveillance

Table 6.4.2 Safety Measures in the Laboratories

THANK YOU

