SNS COLLEGE OF ENGINEERING

Coimbatore
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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

19EET501 / POWER ELECTRONICS AND DRIVES

V SEM EEE

UNIT 3 –AC CONVERTERS

THREE PHASE INVERTER (180 degree)

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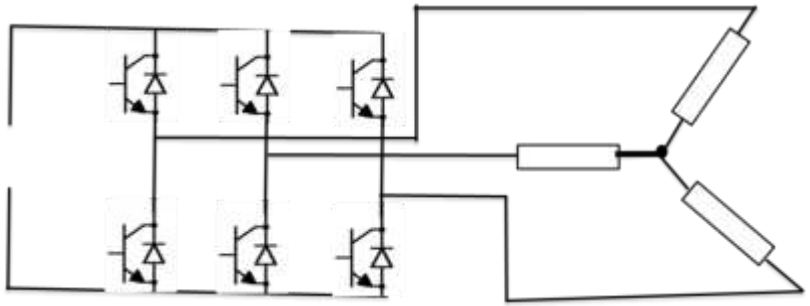
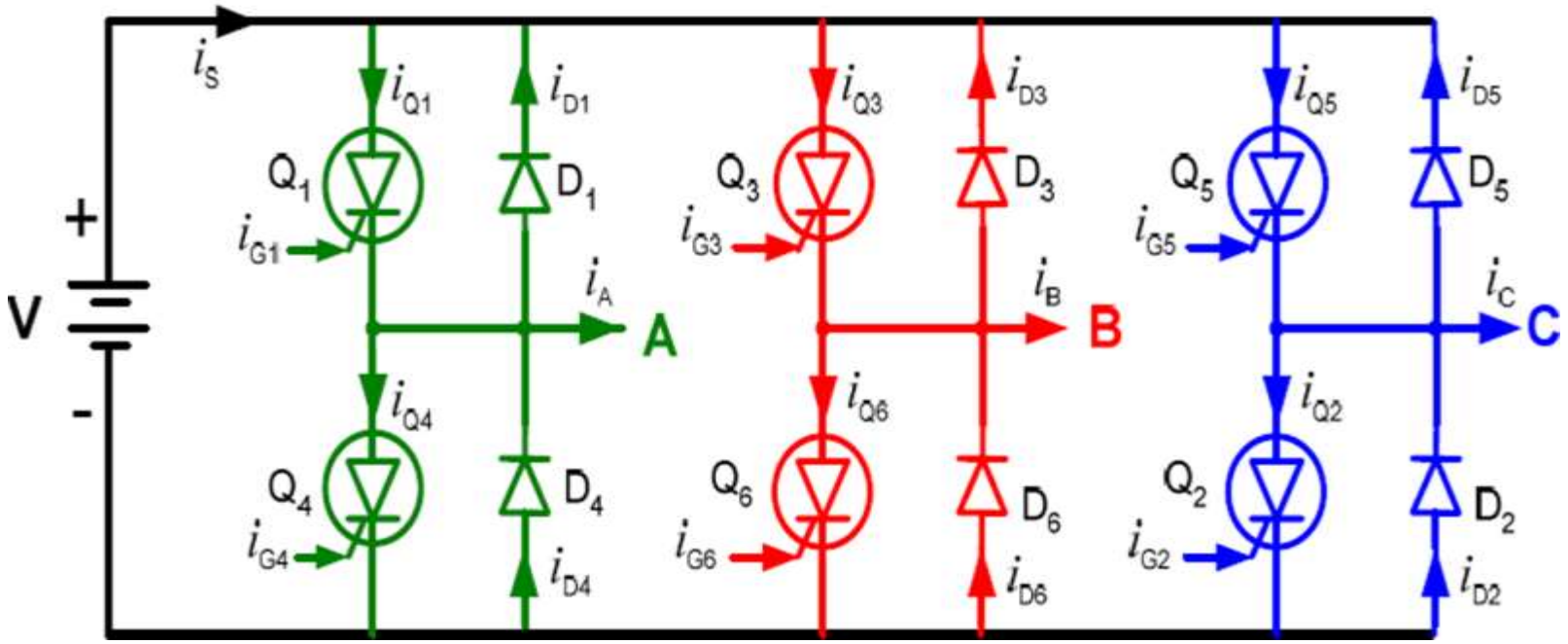
A 3-phase Inverter

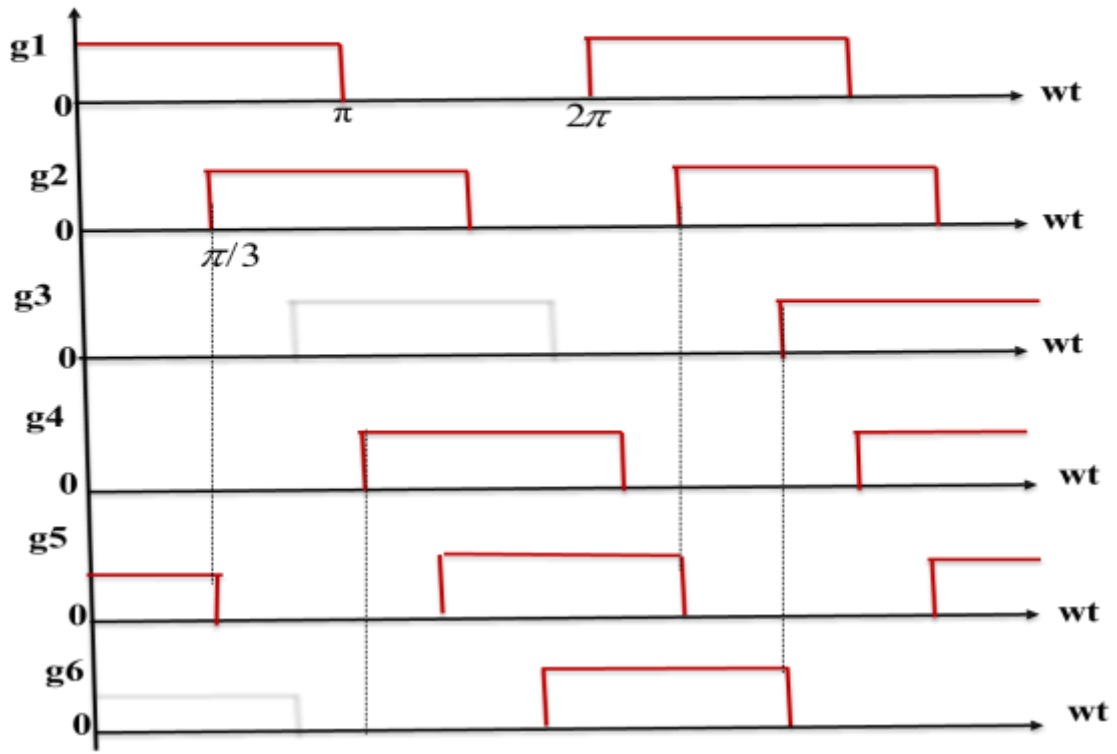




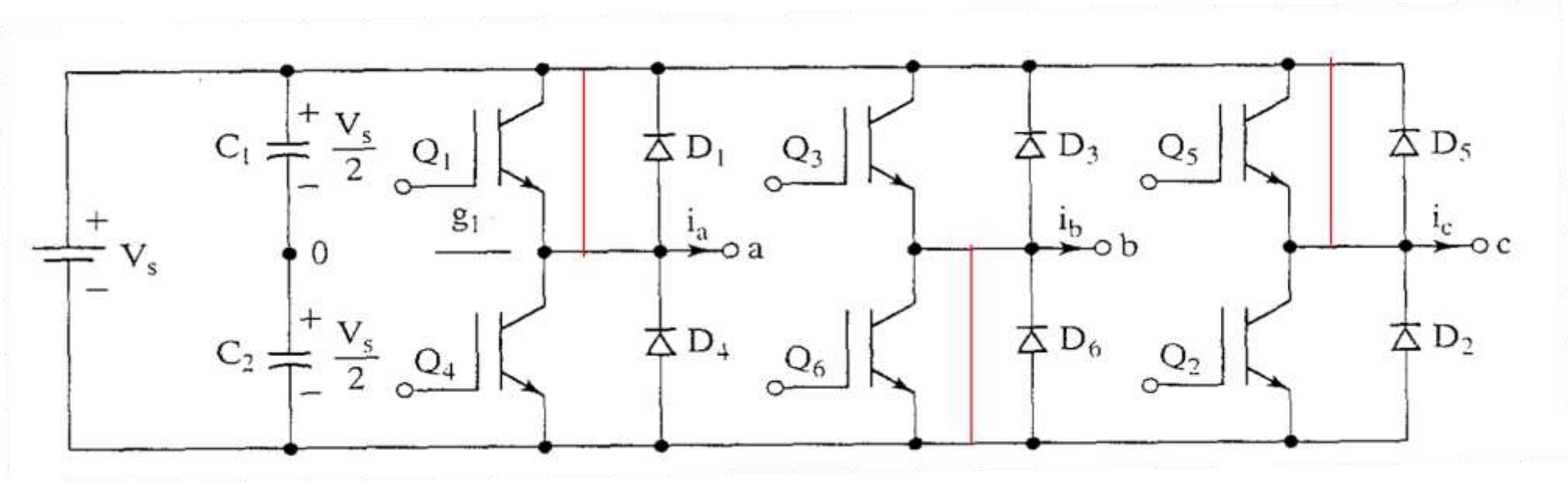
- This is a controlling scheme for 3-phase inverter.
- Each switch conduct for period of 180 degree.
- Switches are triggered in sequence of their numbers with an interval of 60º.
- At a time, three switches(one from each leg) conduct.
- Two switches of same leg are prevented from conducting.
- Switch pair in each leg, i.e. S1 , S4,S3 , S6 and S5 , S2.
- One complete cycle is divide into 6 modes.

S.NO	INTERVAL	DEVICE CONDUCTING	INCOMING DEVICE	OUTGOING DEVICE
1	I	5, 6, 1	1	4
2	II	6, 1, 2	2	5
3	III	1, 2, 3	3	6
4	IV	2, 3, 4	4	1
5	V	3, 4, 5	5	2
6	VI	4, 5, 6	6	3

Waveform of gating signals

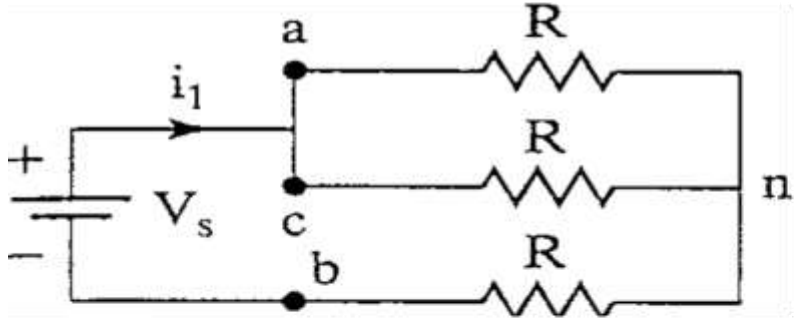


Mode 1 Operation



Mode 1 Operation

$$0 \le \omega t \le \frac{\pi}{3}$$



Q_1, Q_5, Q_6 conduct

$$R_{eq} = R + \frac{R}{2} = \frac{3R}{2}$$

$$i_1 = \frac{V_s}{R_{eq}} = \frac{2V_s}{3R}$$

$$v_{an} = v_{cn} = \frac{i_1 R}{2} = \frac{V_s}{3}$$

$$v_{bn} = -i_1 R = \frac{-2V_s}{3}$$

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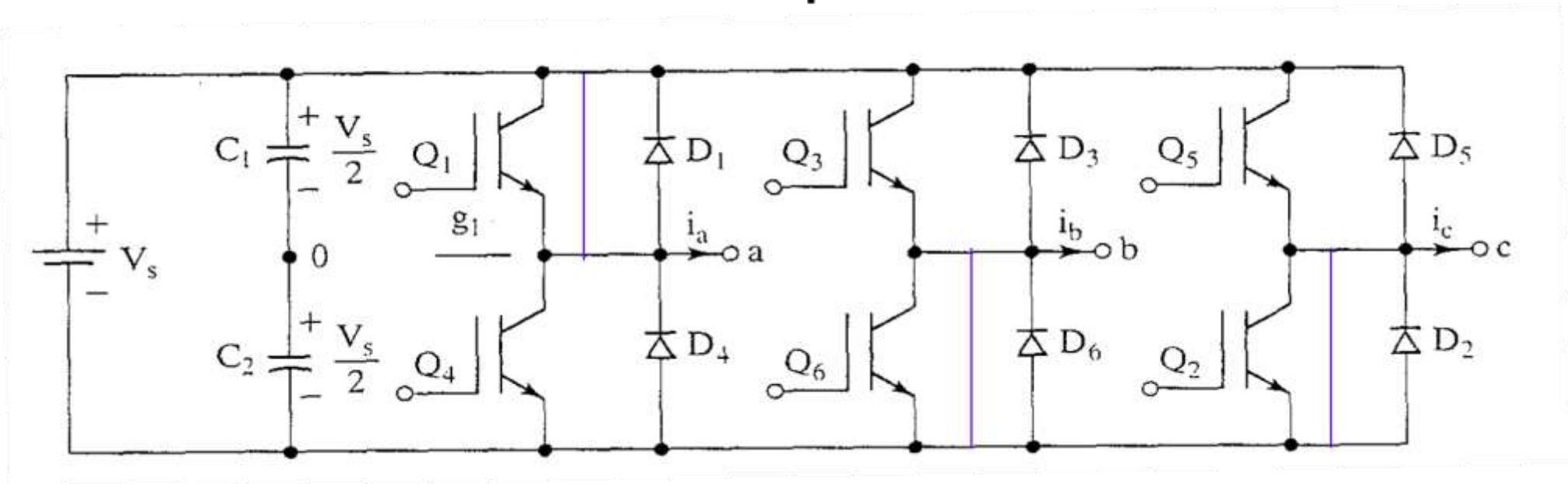
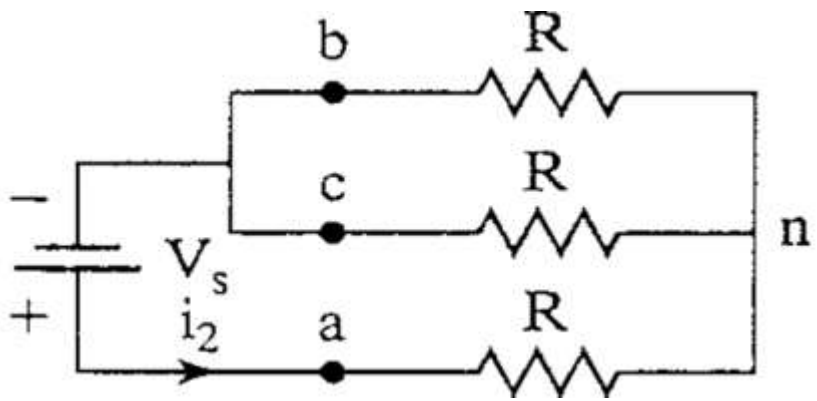
Mode 2 Operation



Mode 2 Operation

$$\frac{\pi}{3} \le \omega t \le \frac{2\pi}{3}$$



Q_1, Q_2, Q_6 conduct

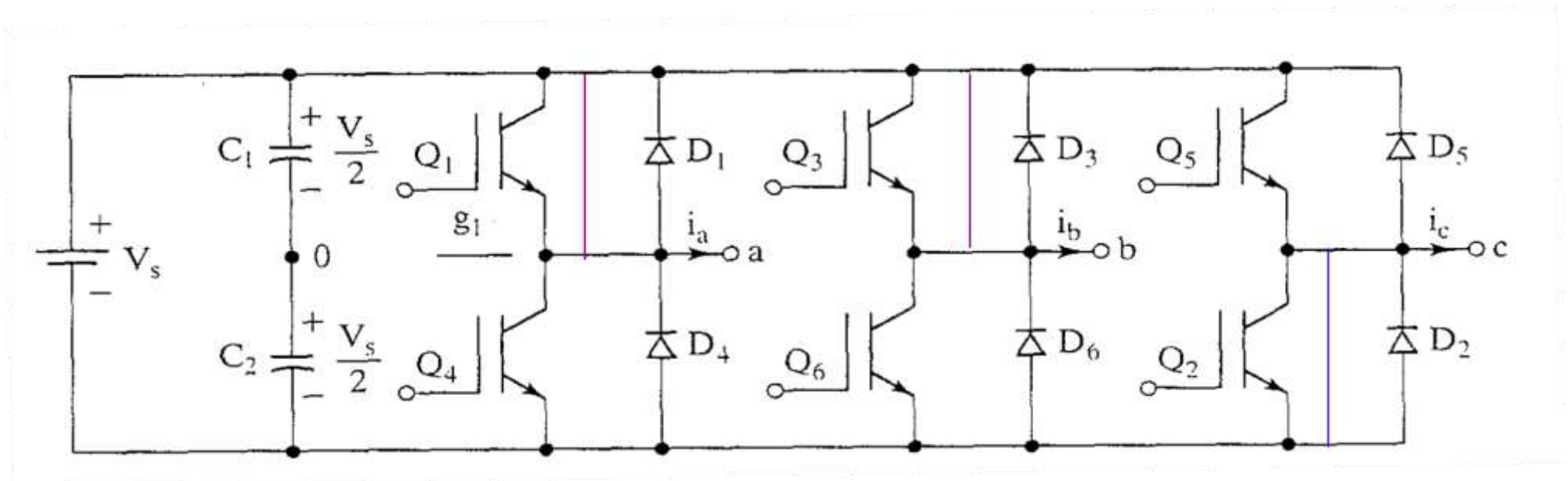
$$R_{eq} = R + \frac{R}{2} = \frac{3R}{2}$$

$$i_2 = \frac{V_s}{R_{eq}} = \frac{2V_s}{3R}$$

$$v_{an} = i_2 R = \frac{2V_s}{3}$$

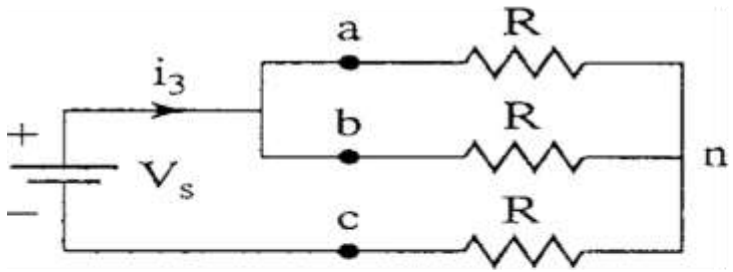
$$v_{bn} = v_{cn} = \frac{i_2 R}{2} = \frac{V_s}{3}$$

Mode 3 Operation



Mode 3 Operation

$$\frac{2\pi}{3} \leq \omega t \leq \pi$$



Q_1, Q_2, Q_3 conduct

$$R_{eq} = R + \frac{R}{2} = \frac{3R}{2}$$

$$i_3 = \frac{V_s}{R_{eq}} = \frac{2V_s}{3R}$$

$$v_{an} = v_{bn} = \frac{i_3}{2}$$

$$v_{cn} = i_3 R = \frac{-2V_s}{3}$$

Output phase voltage for star connected load

INTERVAL	I	II	III	IV	V	VI
V_{AN}	$\frac{V_s}{3}$	$\frac{2V_s}{3}$	$\frac{V_s}{3}$	$\frac{-V_s}{3}$	$\frac{-2V_s}{3}$	$\frac{-V_s}{3}$
V_{BN}	$-2\frac{V_s}{3}$	$\frac{-V_s}{3}$	$\frac{V_s}{3}$	$\frac{2V_s}{3}$	$\frac{V_s}{3}$	$\frac{-V_s}{3}$
V_{CN}	$\frac{V_s}{3}$	$\frac{-V_s}{3}$	$\frac{-2V_s}{3}$	$\frac{-V_s}{3}$	$\frac{V_s}{3}$	$\frac{2V_s}{3}$

Phase Voltages for 180° Conduction