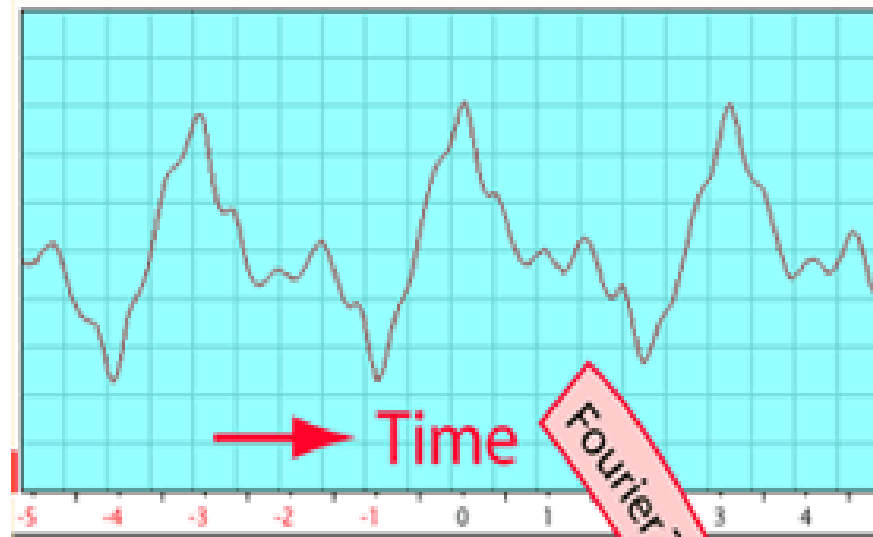


VALUE	1	2	3	4	5	6	7	8
WAVEFORM								
INSTRUMENT FAMILY	1 Brass, strings, and analog synthesizers	2 Clarinet and analog synthesizers (harmonics components are the same with "□")	3 Acoustic piano	4 Electric piano	5 Electric piano (hard)	6 Clavi	7 Organ	8 Brass
VALUE	9	10	11	12	13	14	15	16
WAVEFORM								
INSTRUMENT FAMILY	9 Saxophone	10 Violin	11 Acoustic guitar	12 Guitar (distorted)	13 Electric bass	14 Digital bass	15 Bell	16 Organ and whistle

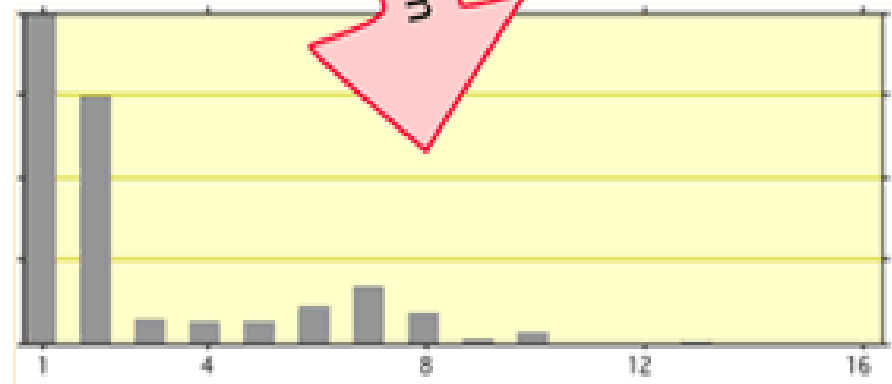
Korg DW-/EX-8000 Waveforms

Harmonic content determines the waveform of the sound signal when displayed as a function of time.



Switching from a time to a frequency plot can make the harmonic content more evident.

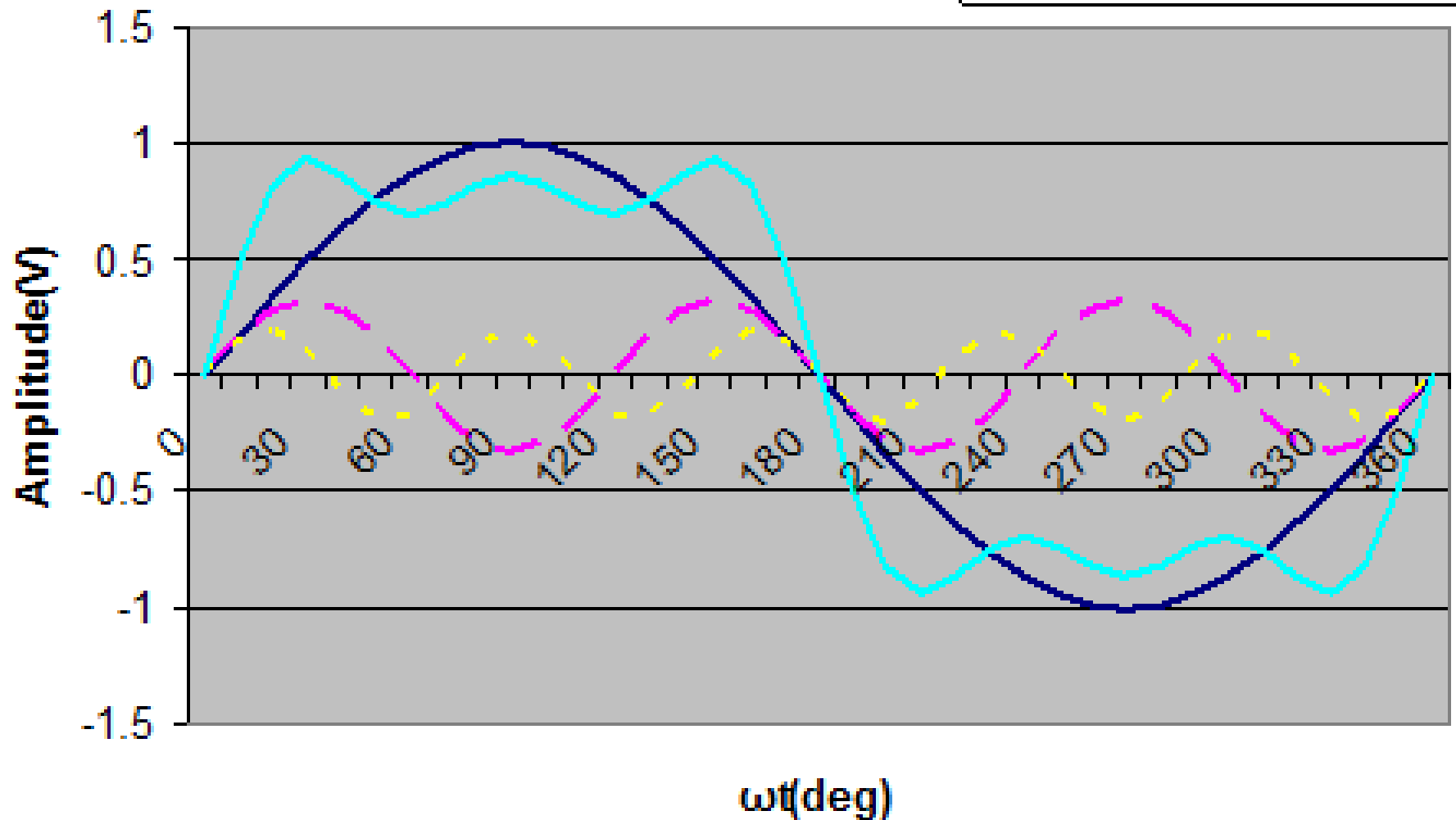
The amplitudes of the individual harmonics can be determined by Fourier analysis and displayed as a function of frequency.

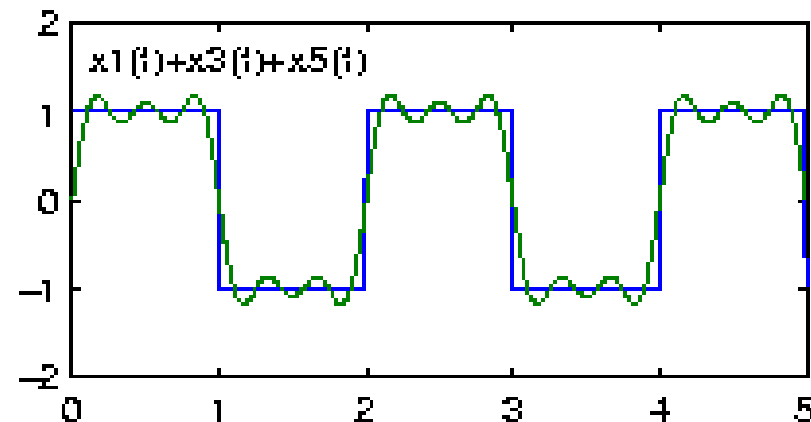
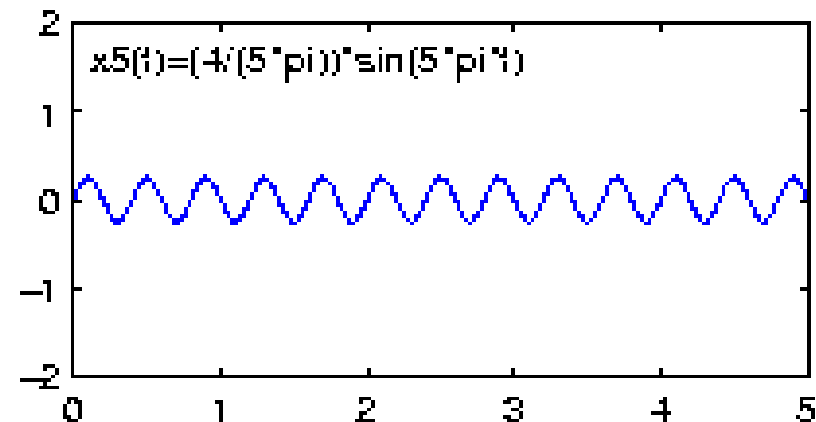
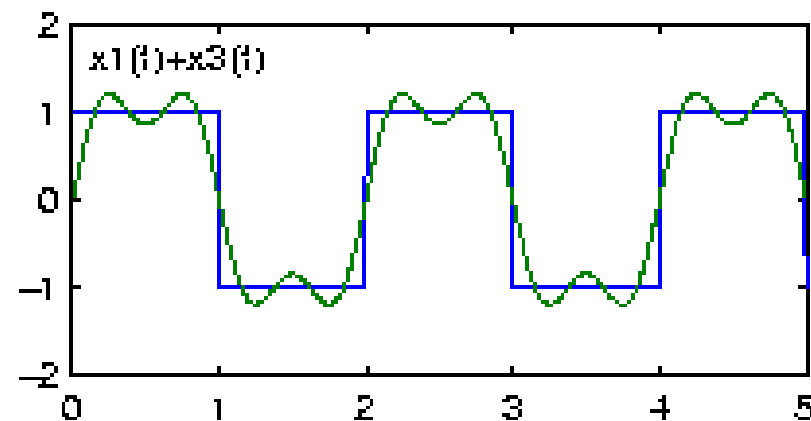
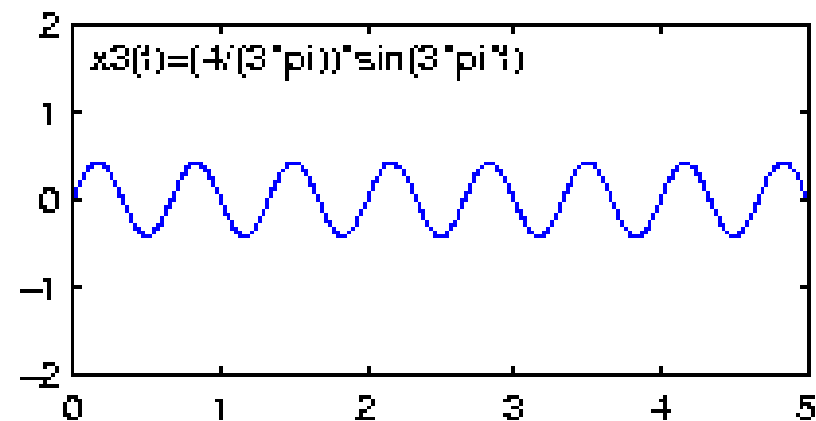
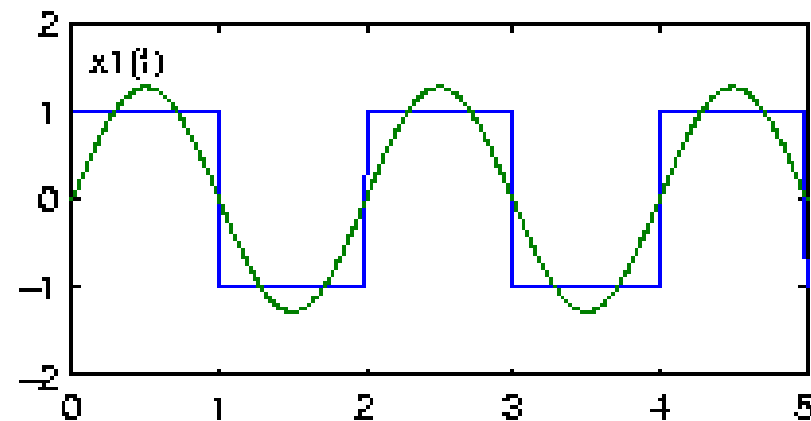
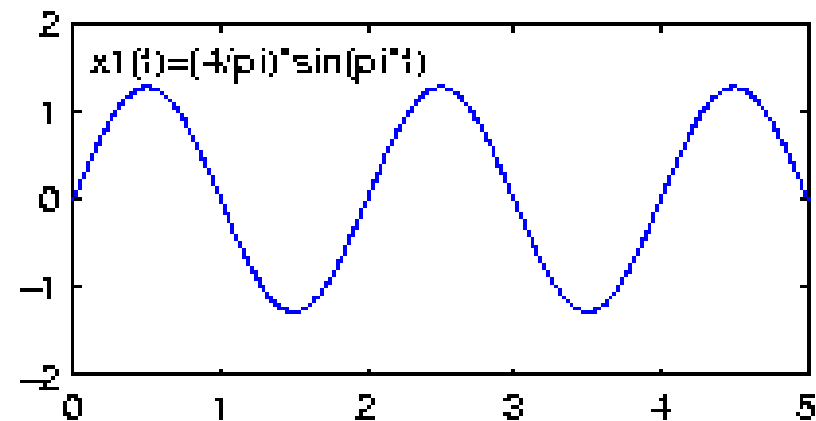


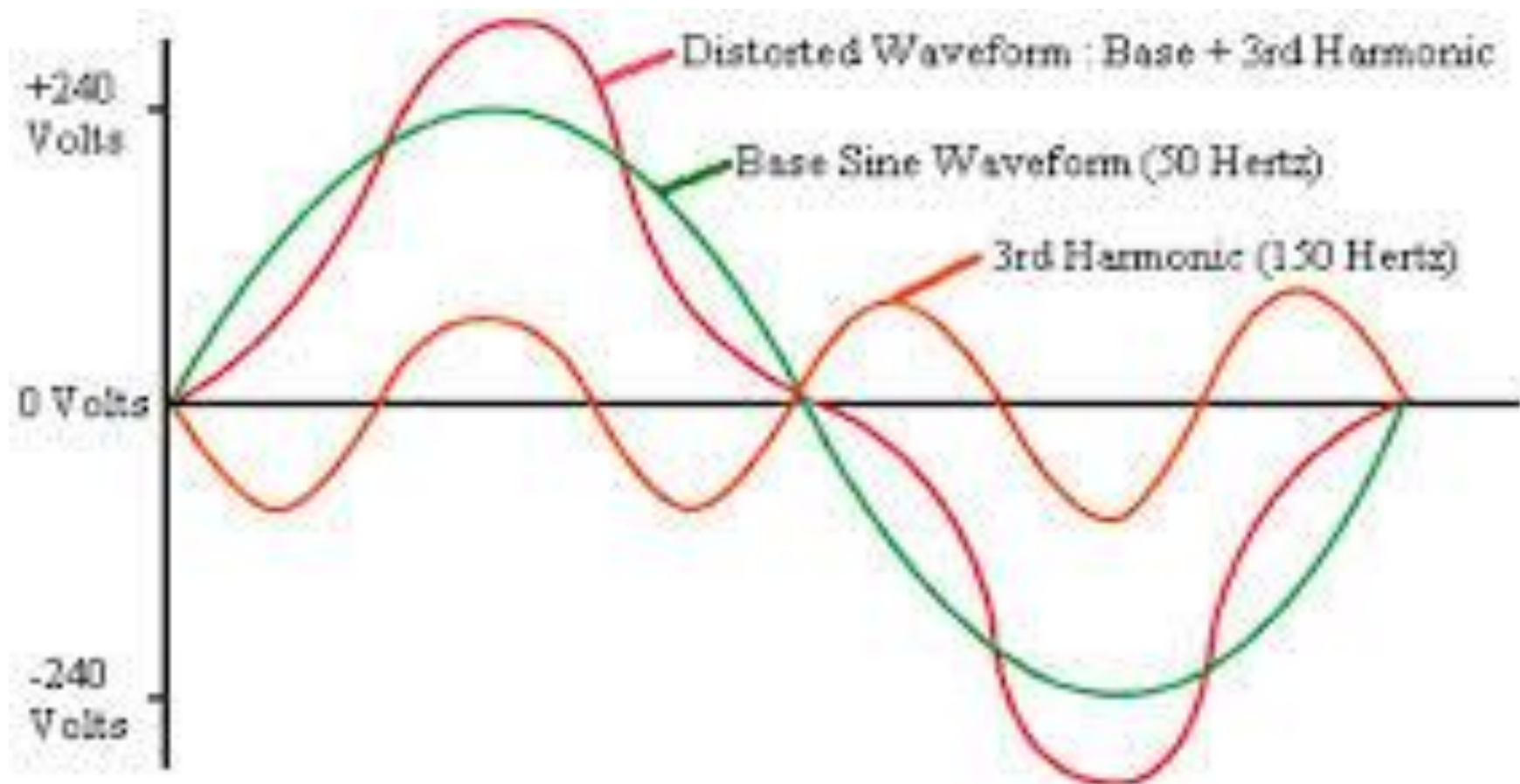
→ Frequency

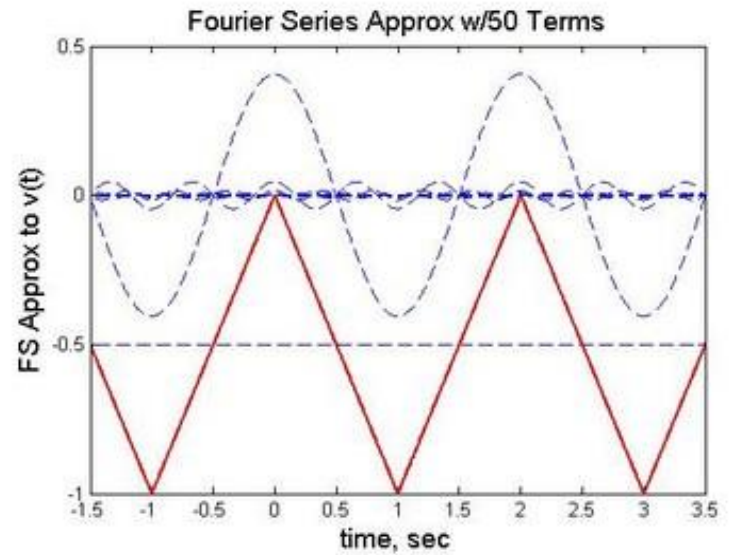
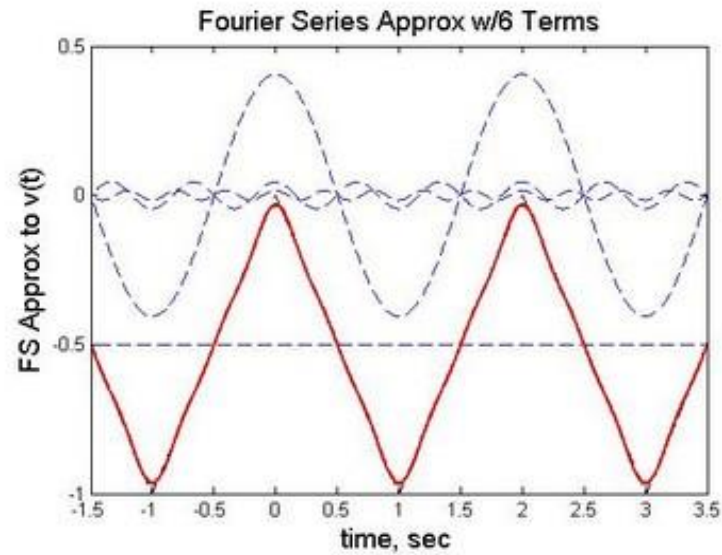
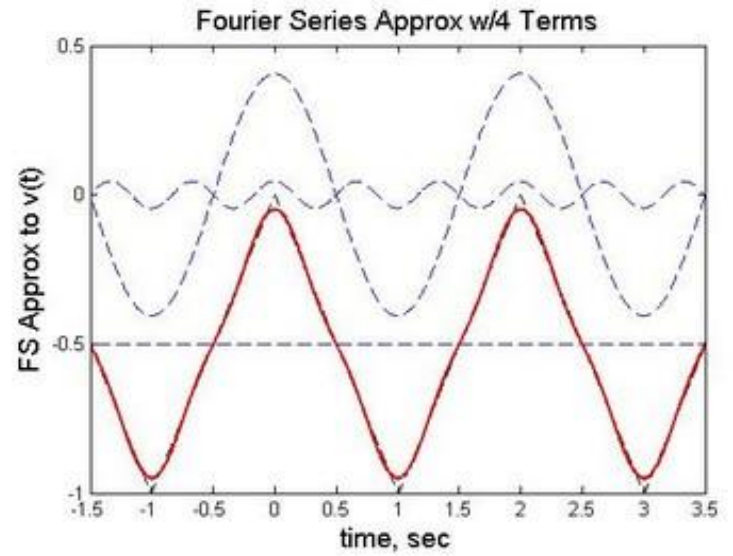
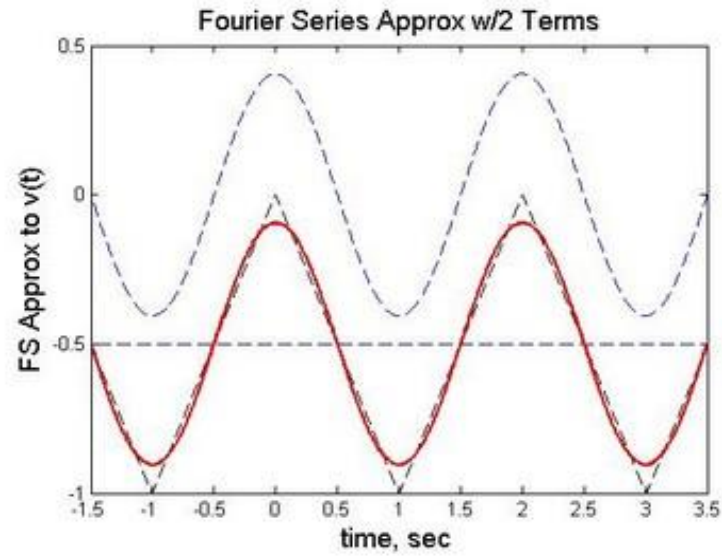
Sqaure wave formed with sum of fundamental 3rd and 5th Harmonics

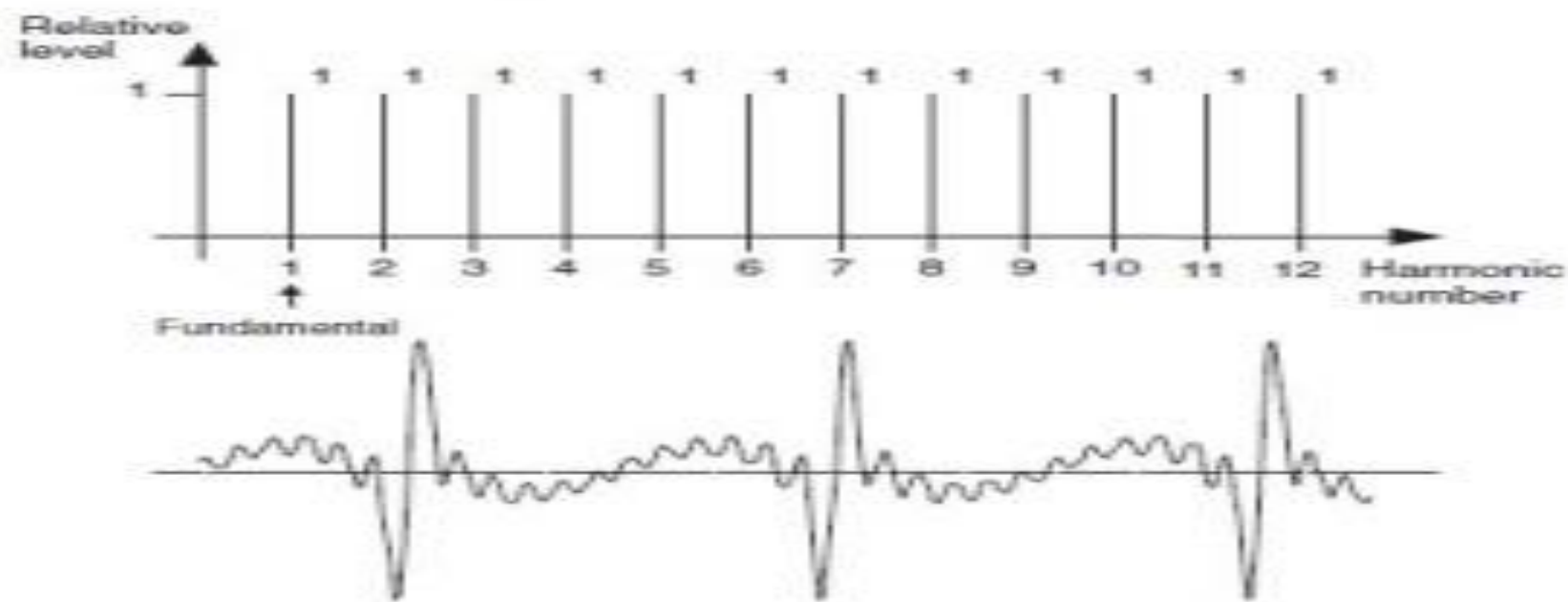
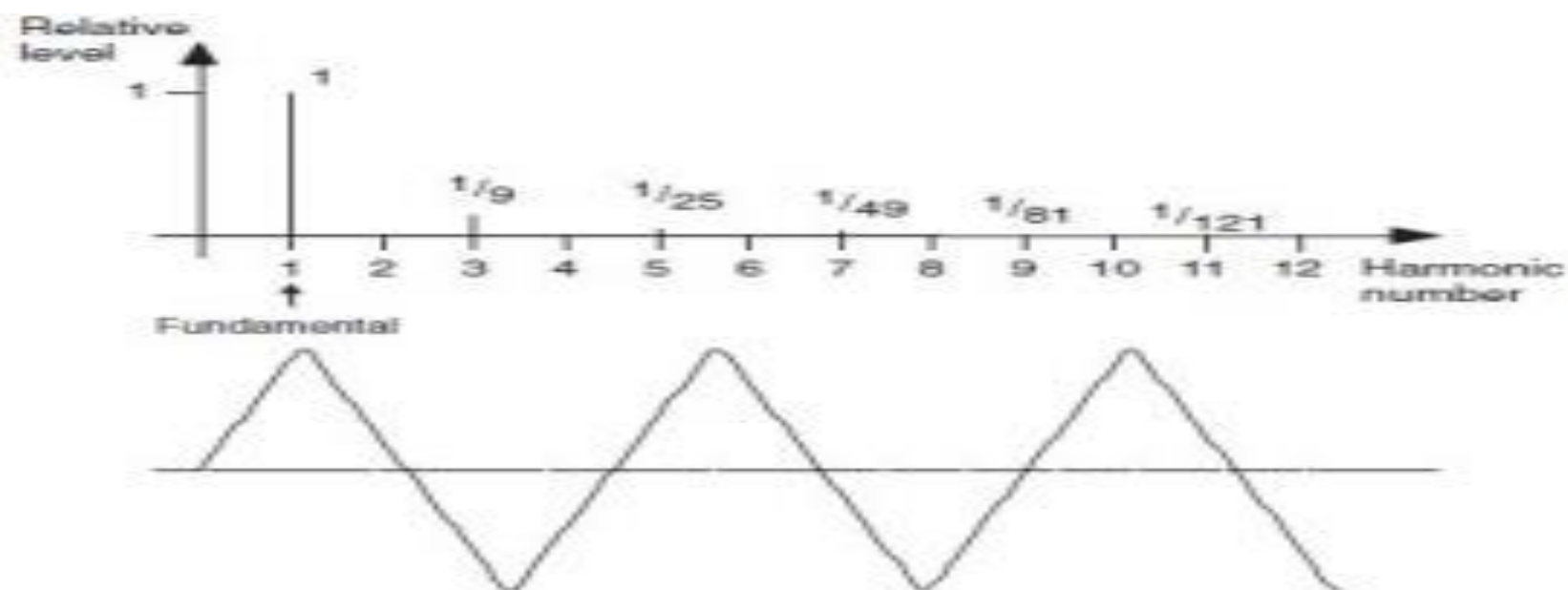
- fundamental
- third harmonics
- - - fifth harmonics
- wave

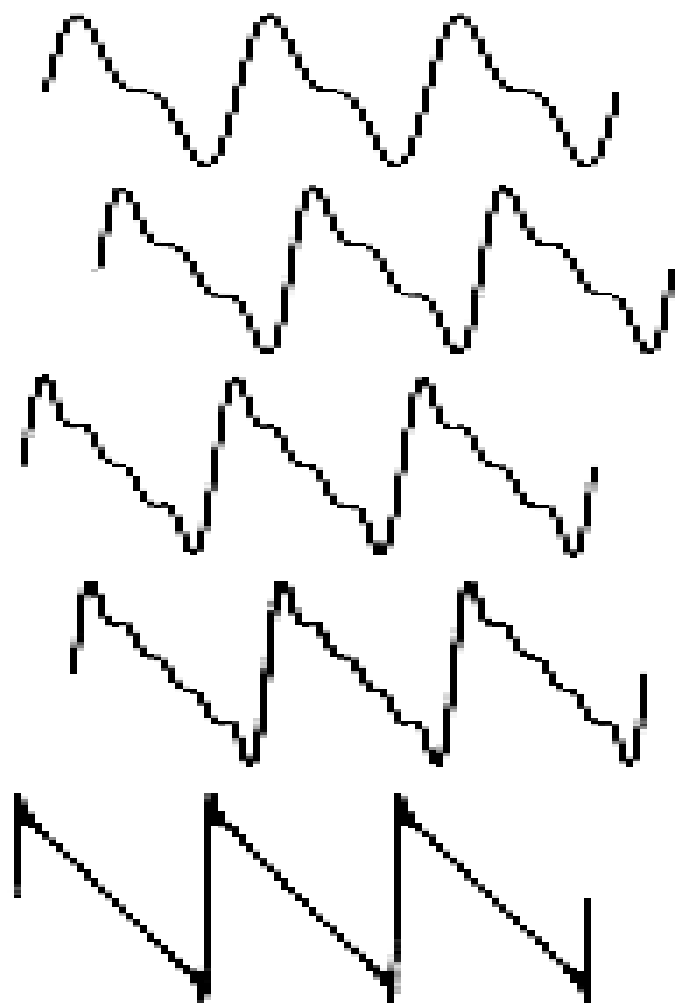
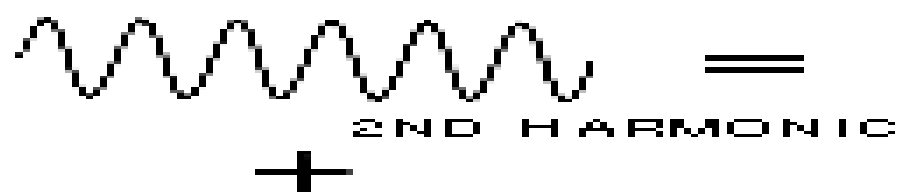
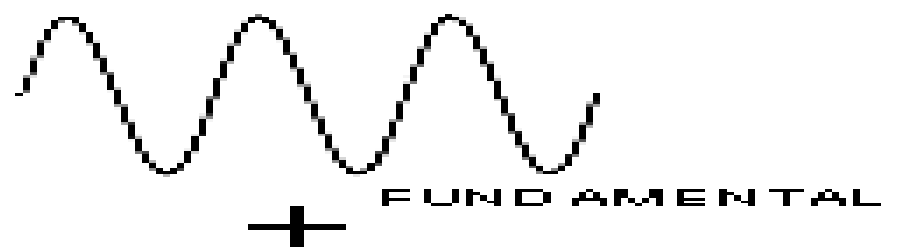




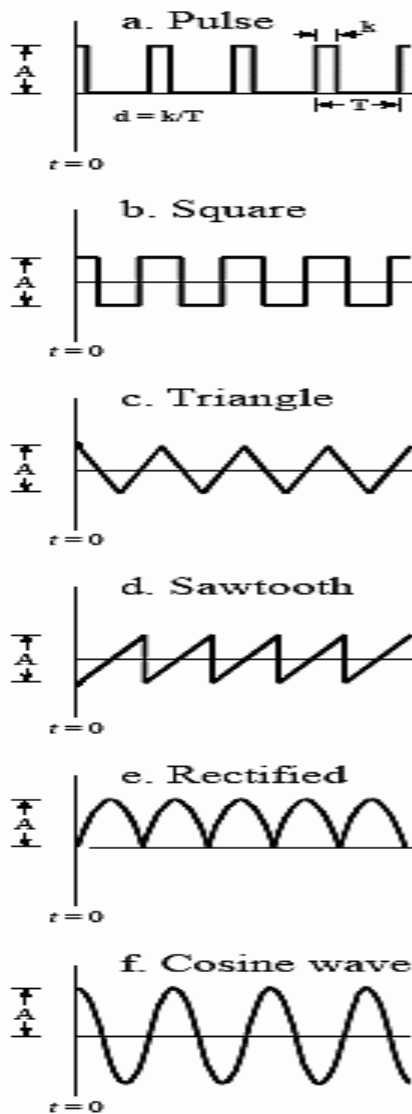




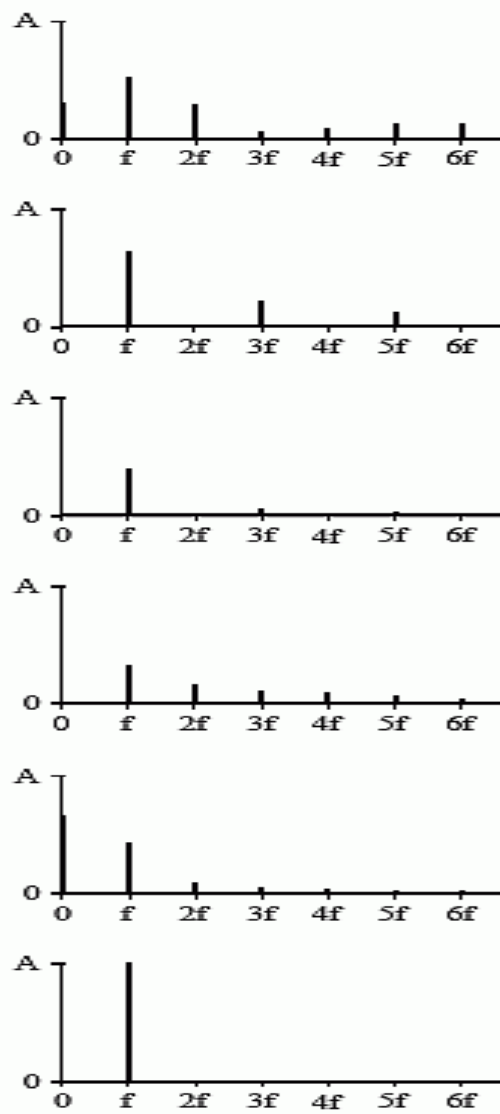




Time Domain



Frequency Domain



$$a_0 = A d$$

$$a_n = \frac{2A}{n\pi} \sin(n\pi d)$$

$$b_n = 0$$

($d = 0.27$ in this example)

$$a_0 = 0$$

$$a_n = \frac{2A}{n\pi} \sin\left(\frac{n\pi}{2}\right)$$

$$b_n = 0$$

(all even harmonics are zero)

$$a_0 = 0$$

$$a_n = \frac{4A}{(n\pi)^2}$$

$$b_n = 0$$

(all even harmonics are zero)

$$a_0 = 0$$

$$a_n = 0$$

$$b_n = \frac{A}{n\pi}$$

$$a_0 = 2A/\pi$$

$$a_n = \frac{-4A}{\pi(4n^2 - 1)}$$

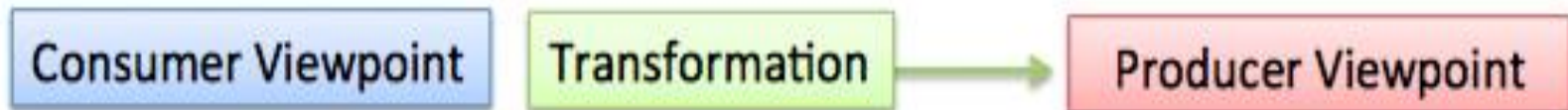
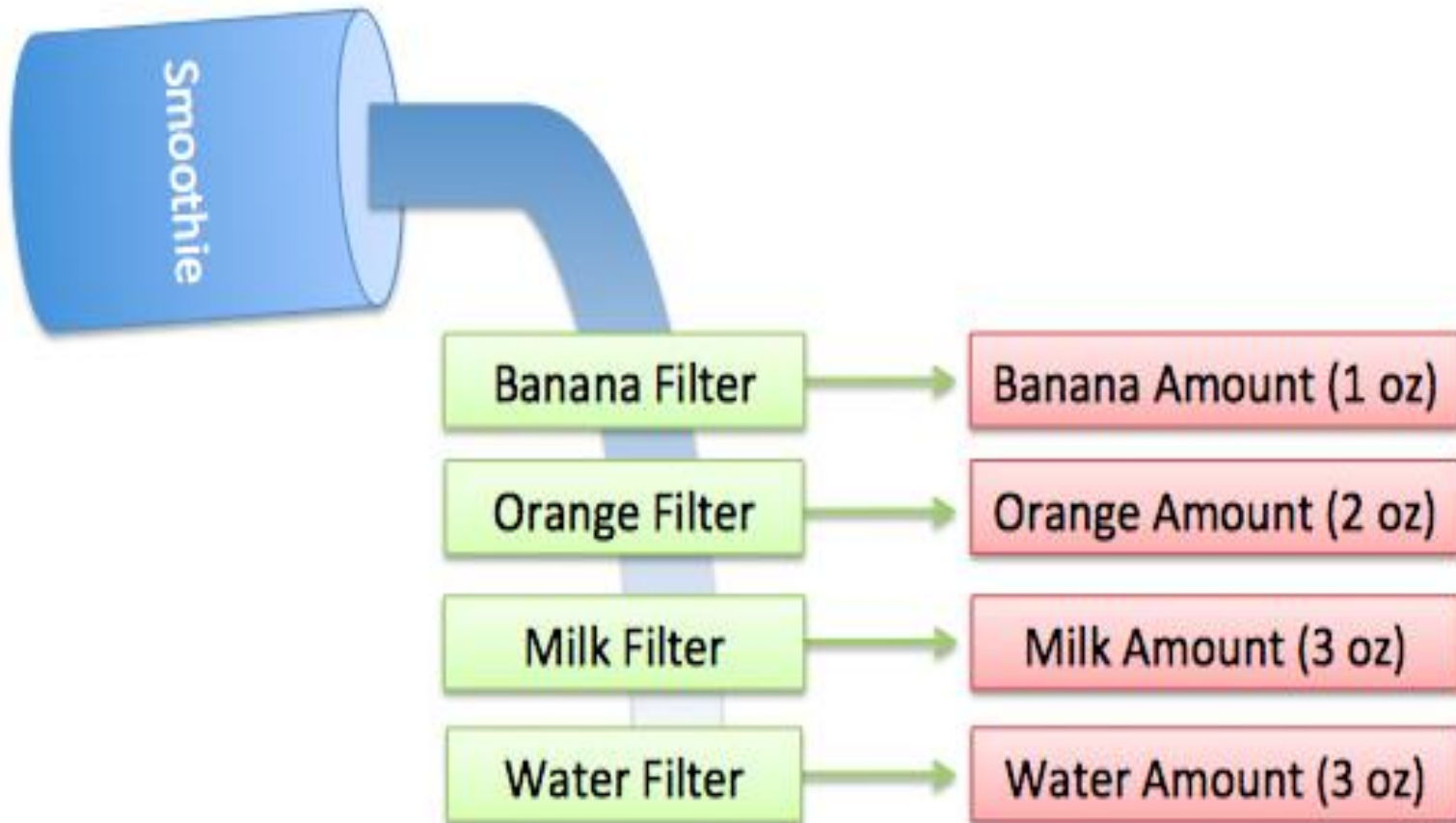
$$b_n = 0$$

$$a_1 = A$$

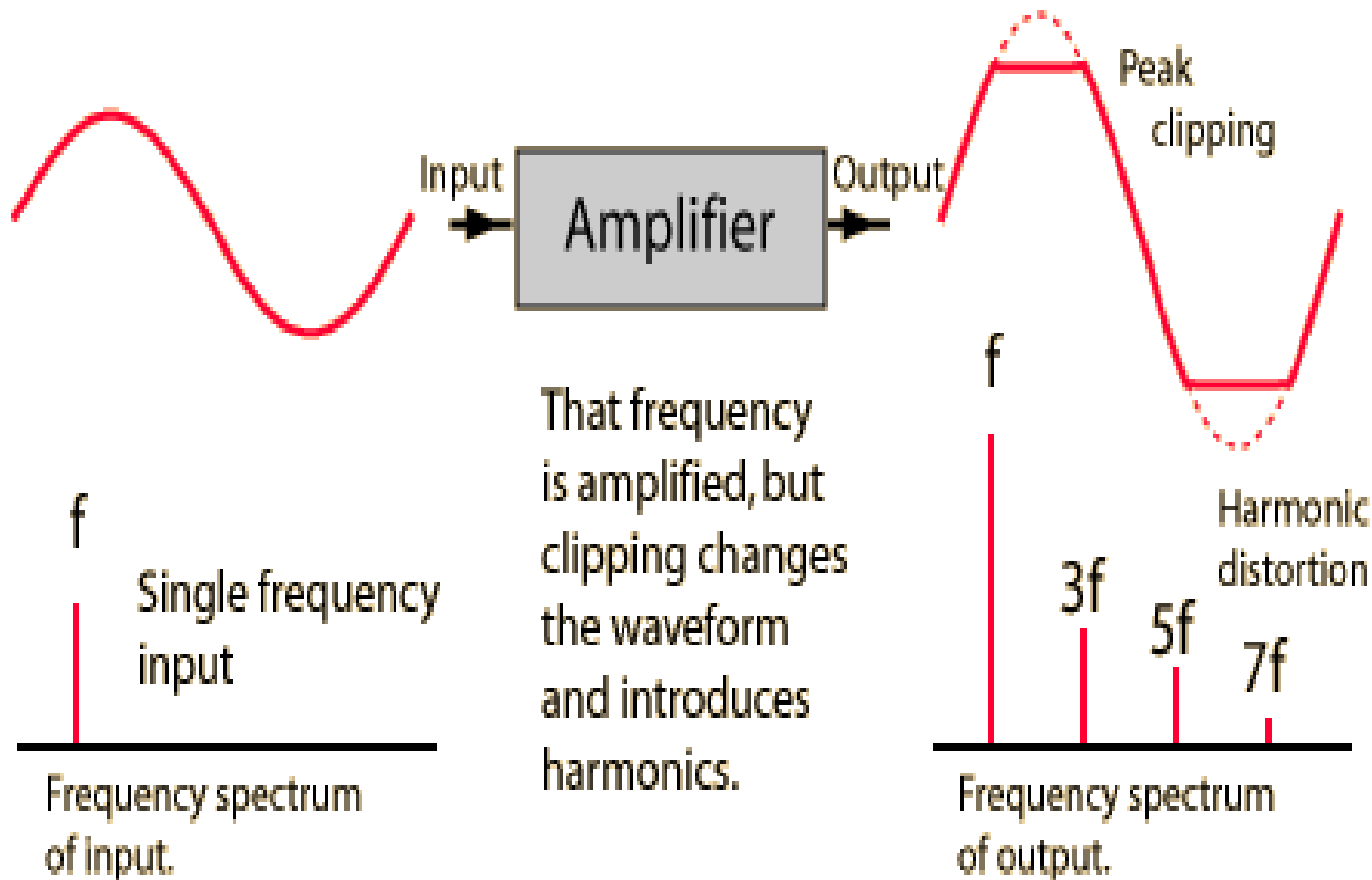
(all other coefficients are zero)

FIGURE 13-10 Examples of the Fourier series. Six common time domain waveforms are shown, along with the equations to calculate their "a" and "b" coefficients.

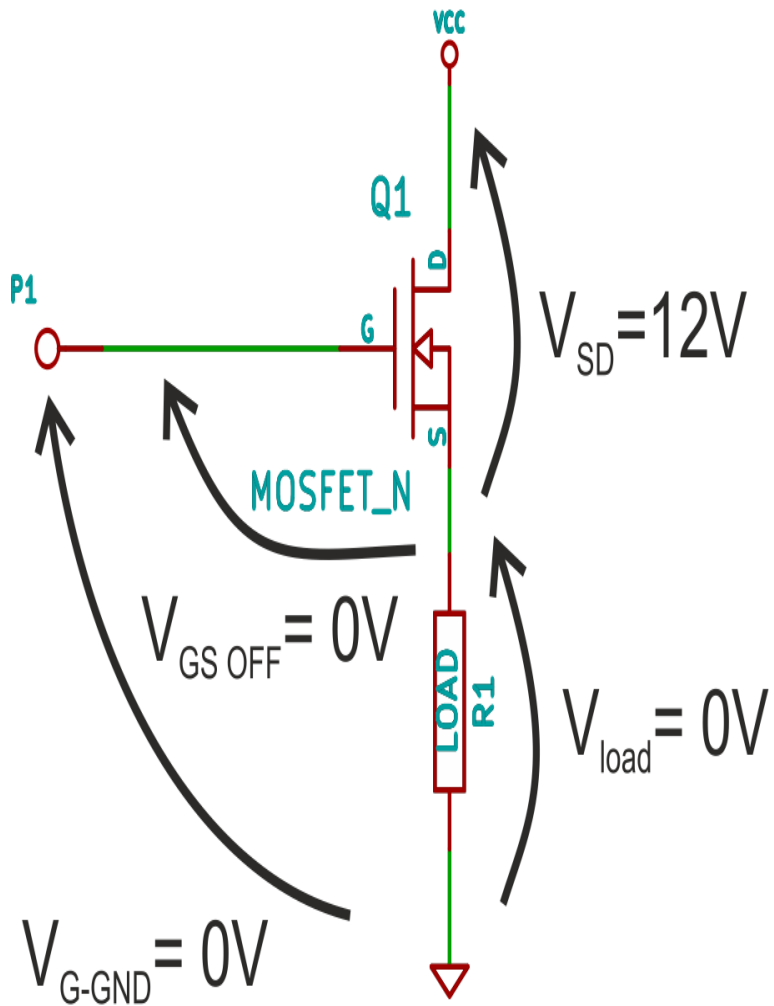
Smoothie to Recipe





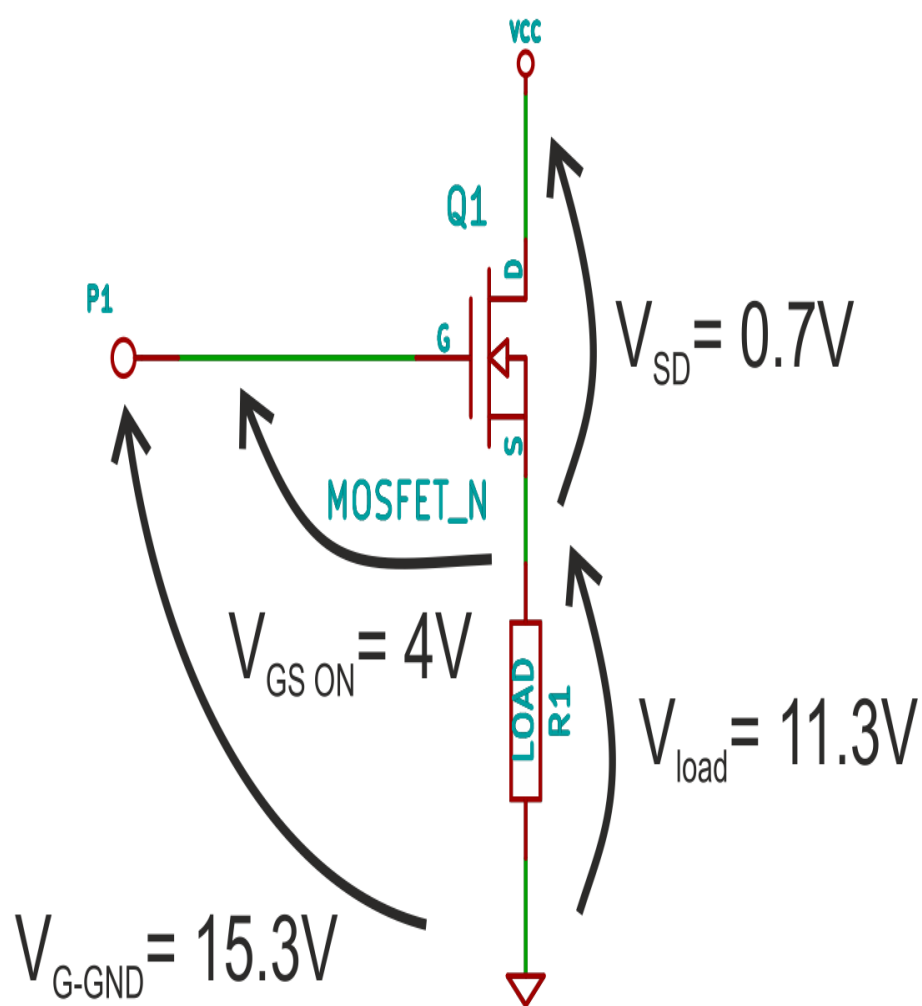


$V_{CC} = 12V$

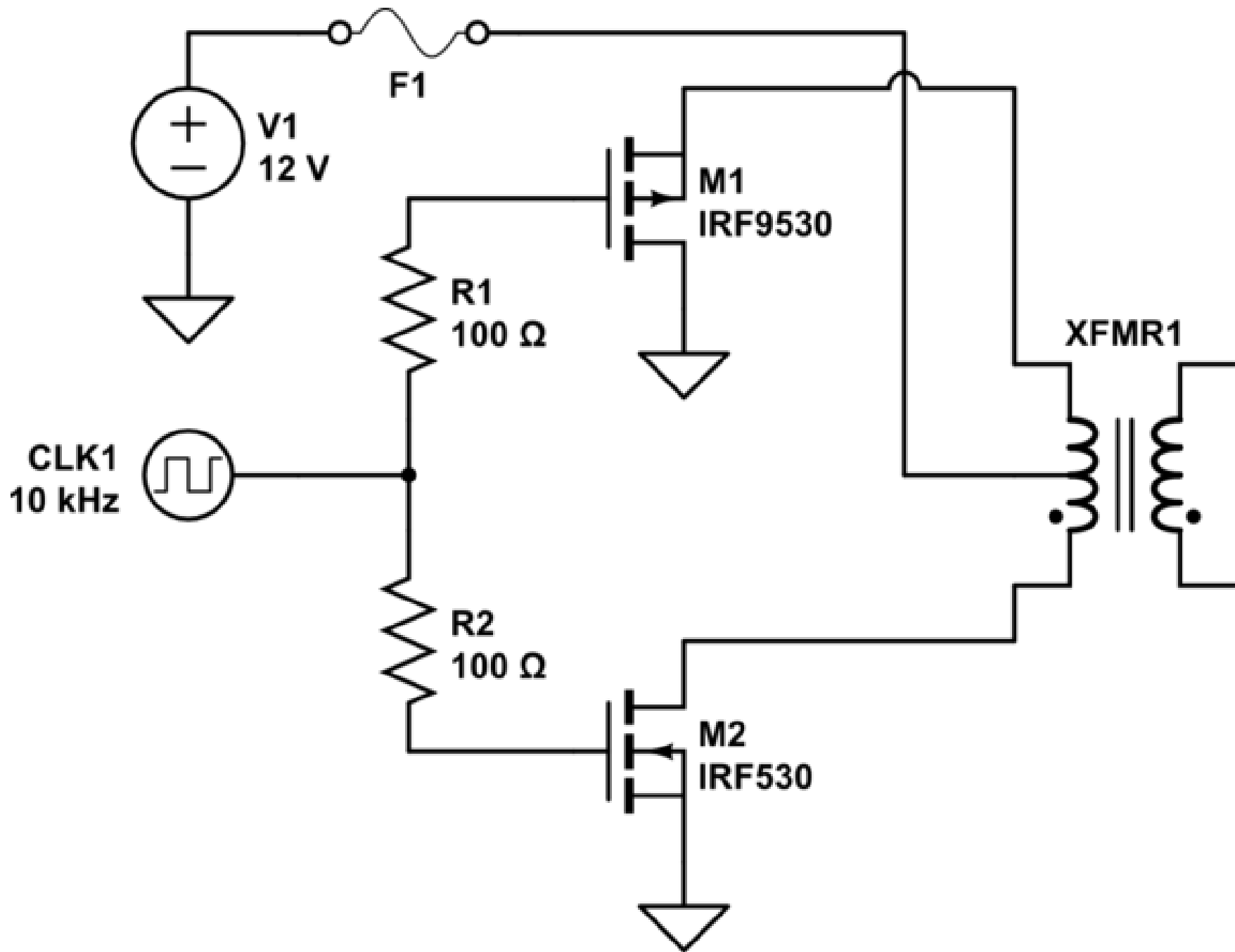


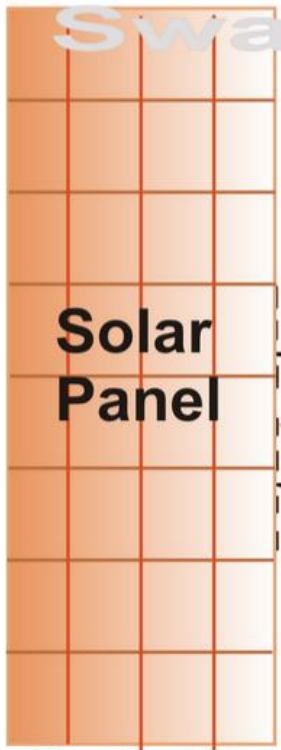
MOSFET OFF

$V_{CC} = 12V$



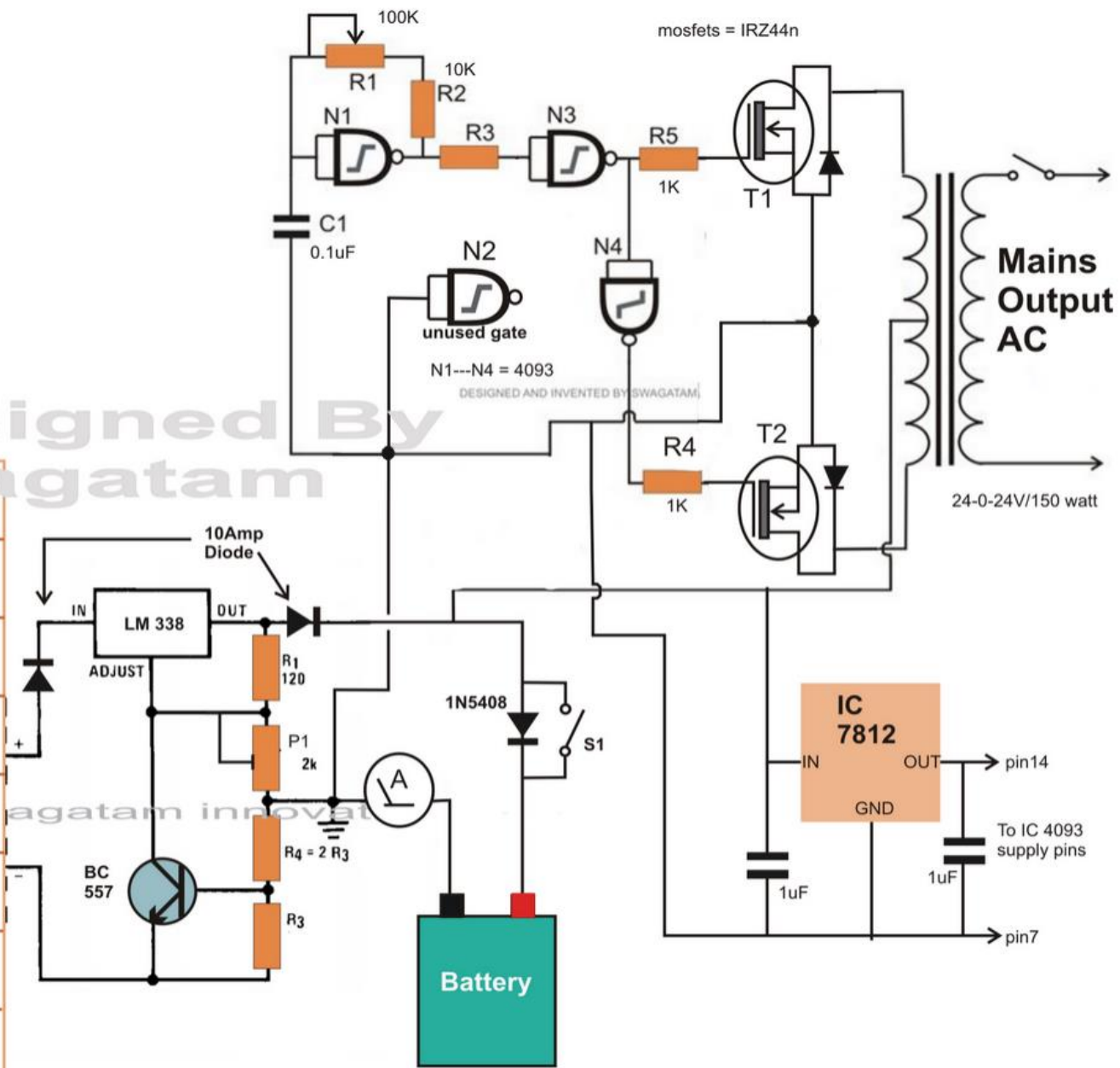
MOSFET ON





Solar Panel

Designed By Swagatam



Swagatam innovat

Battery

Mains Output AC

24-0-24V/150 watt

IC 7812

IN

OUT

GND

pin14

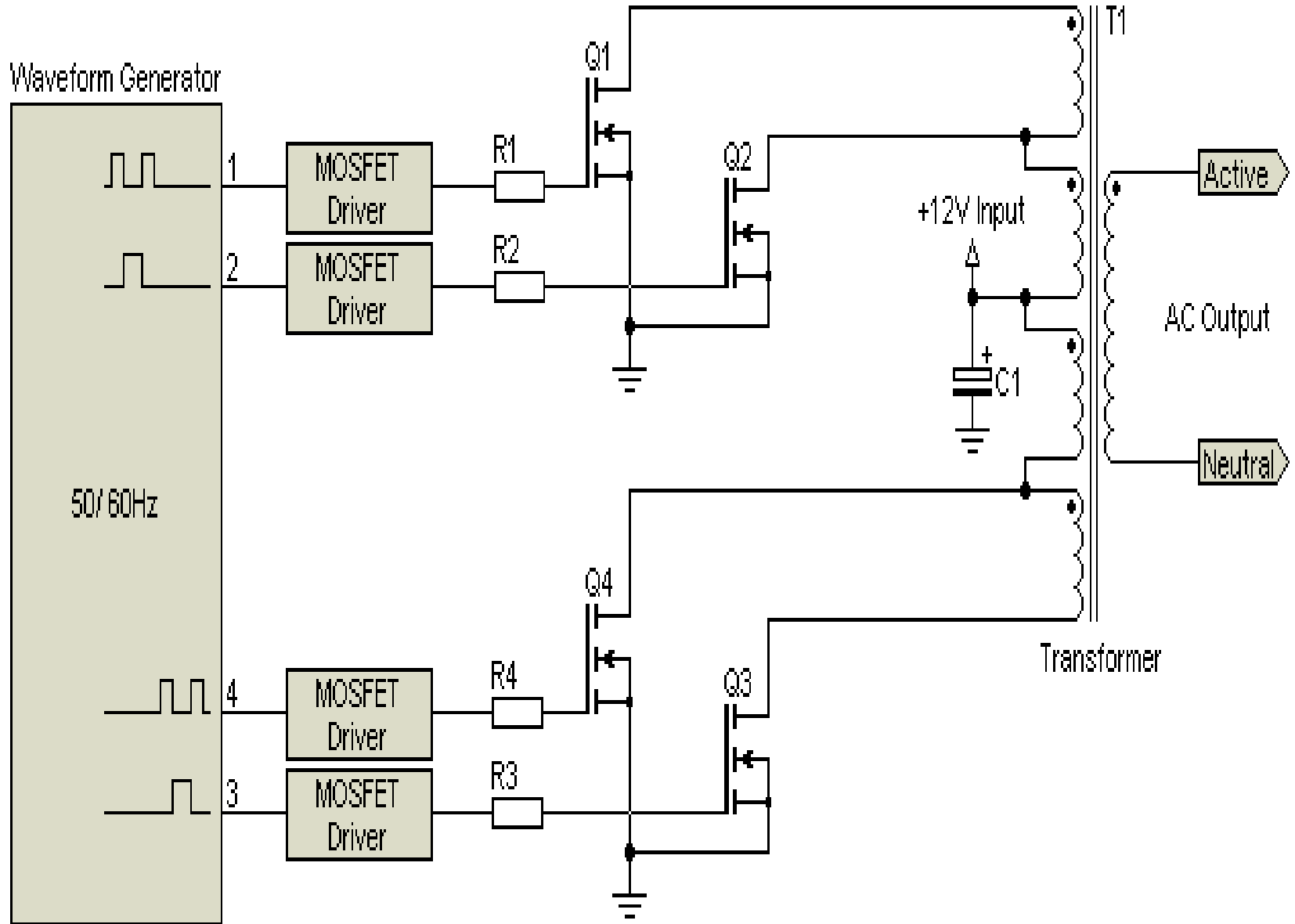
pin7

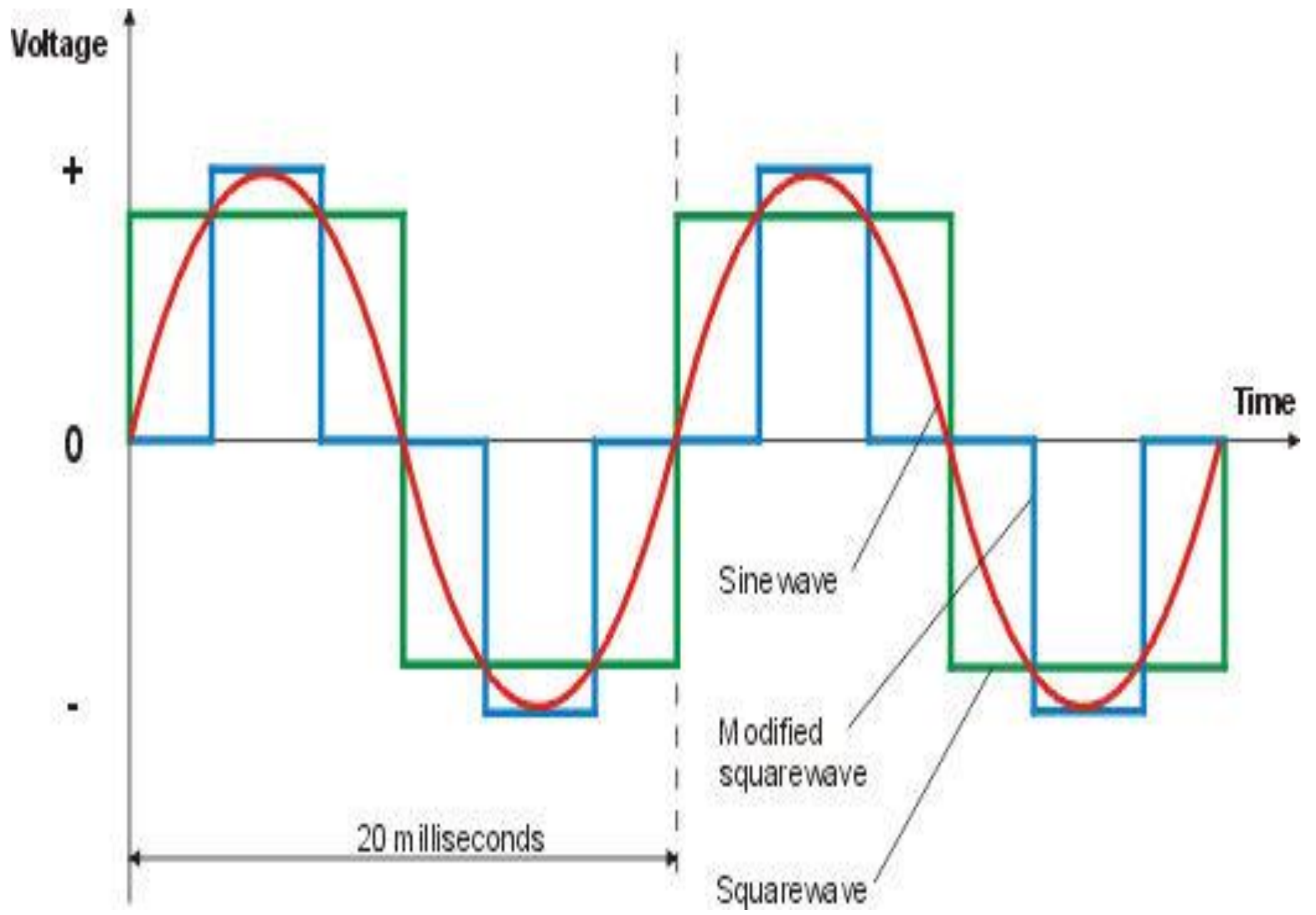
To IC 4093 supply pins

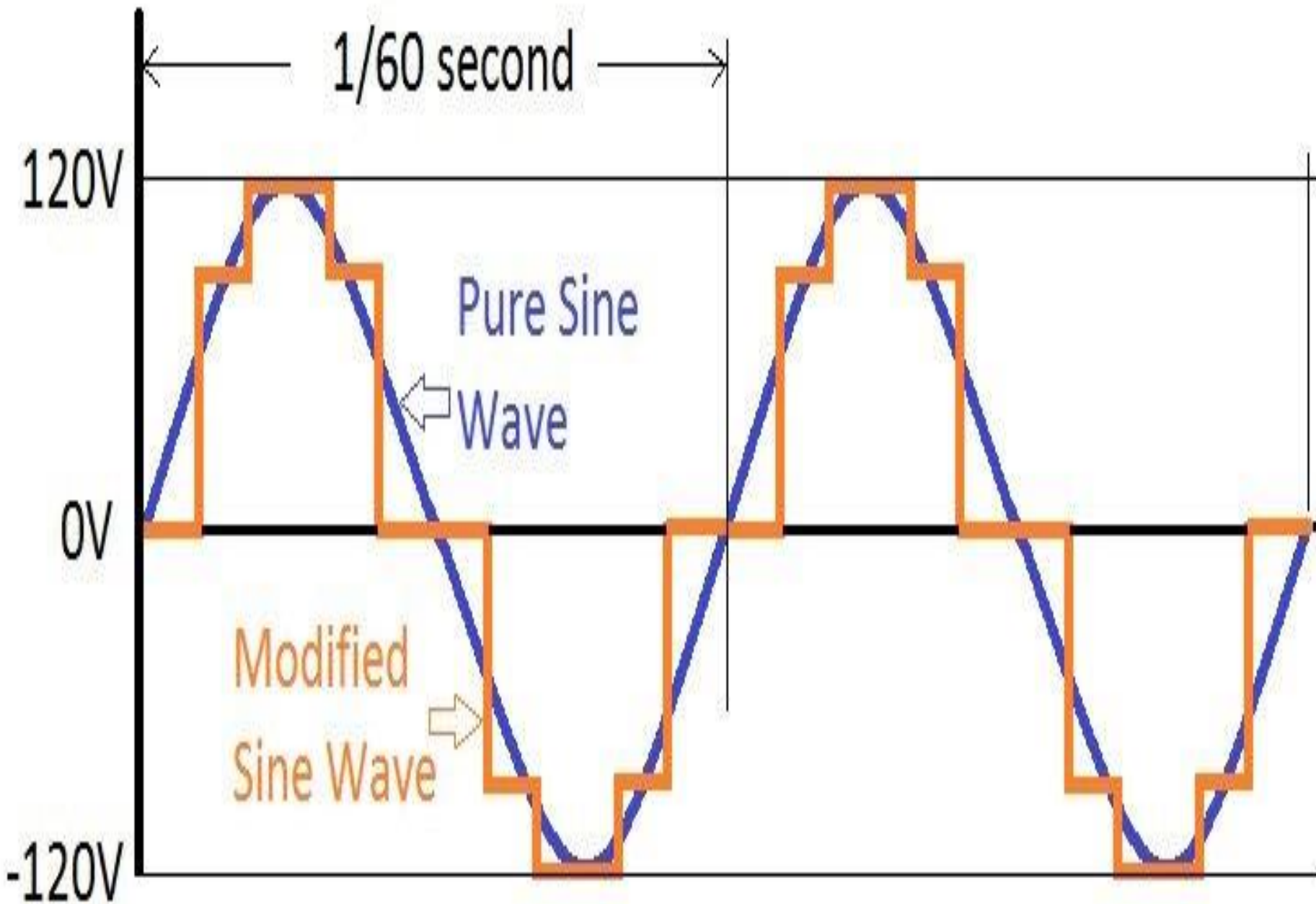
1uF

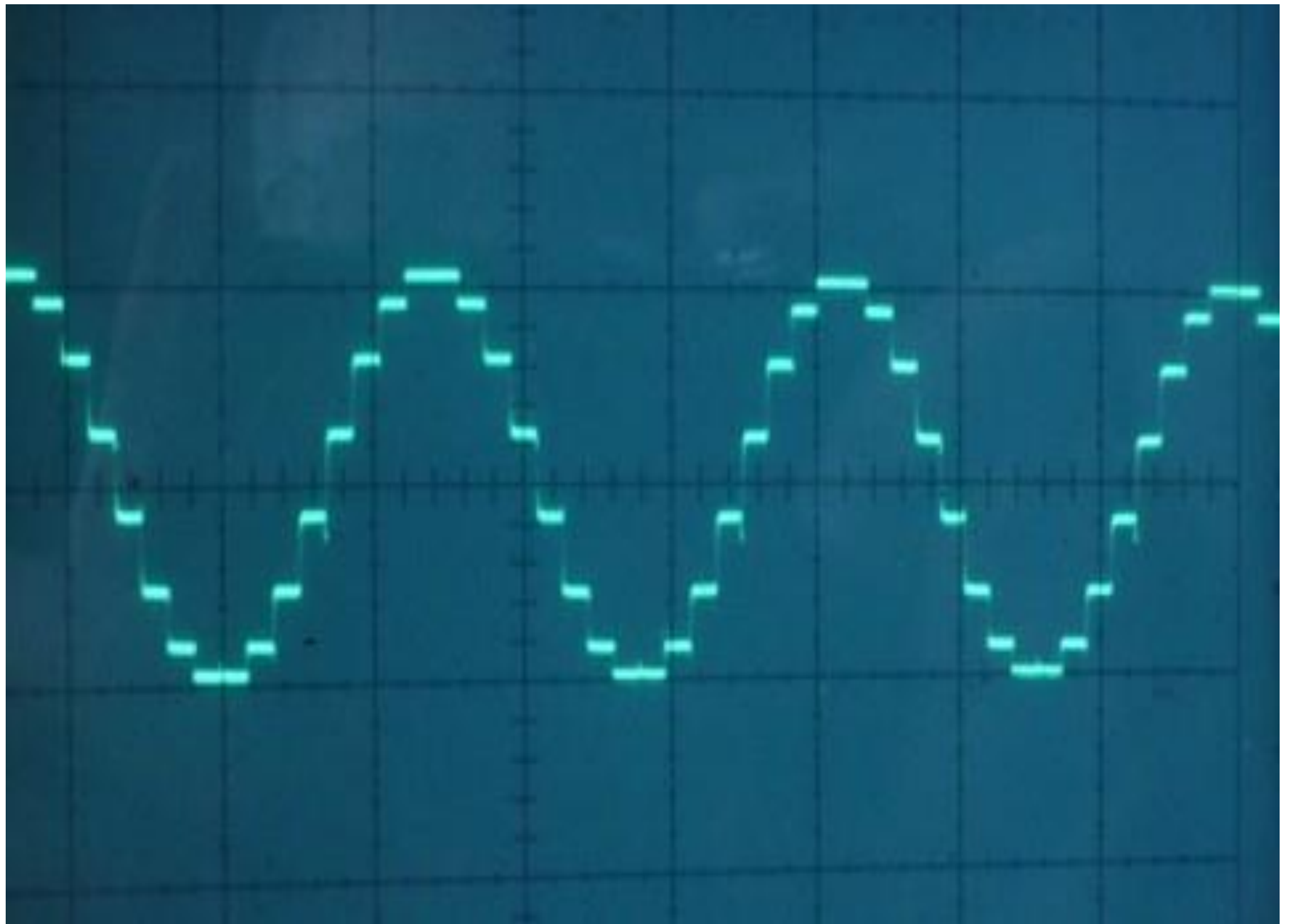
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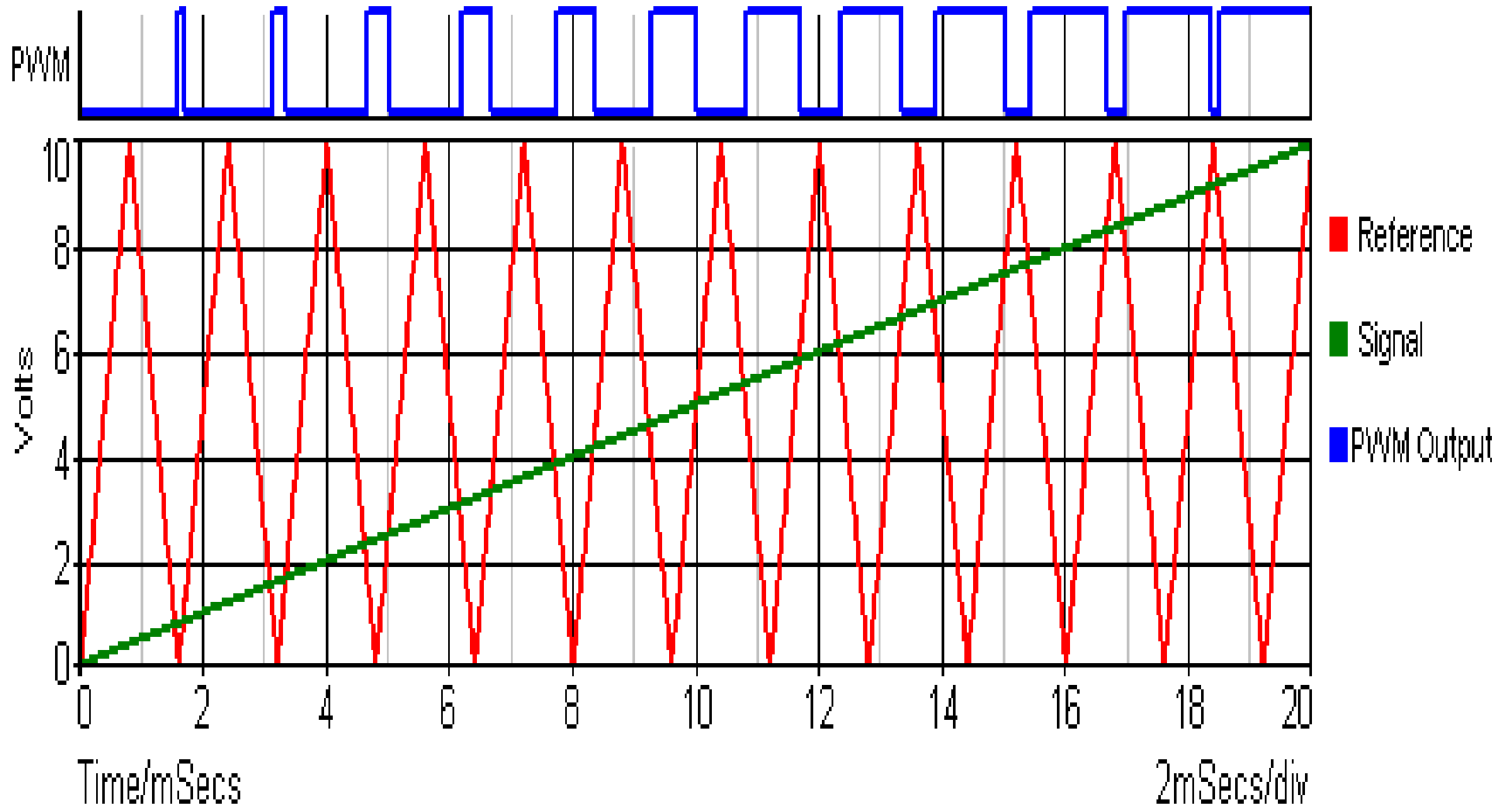
mosfets = IRZ44n

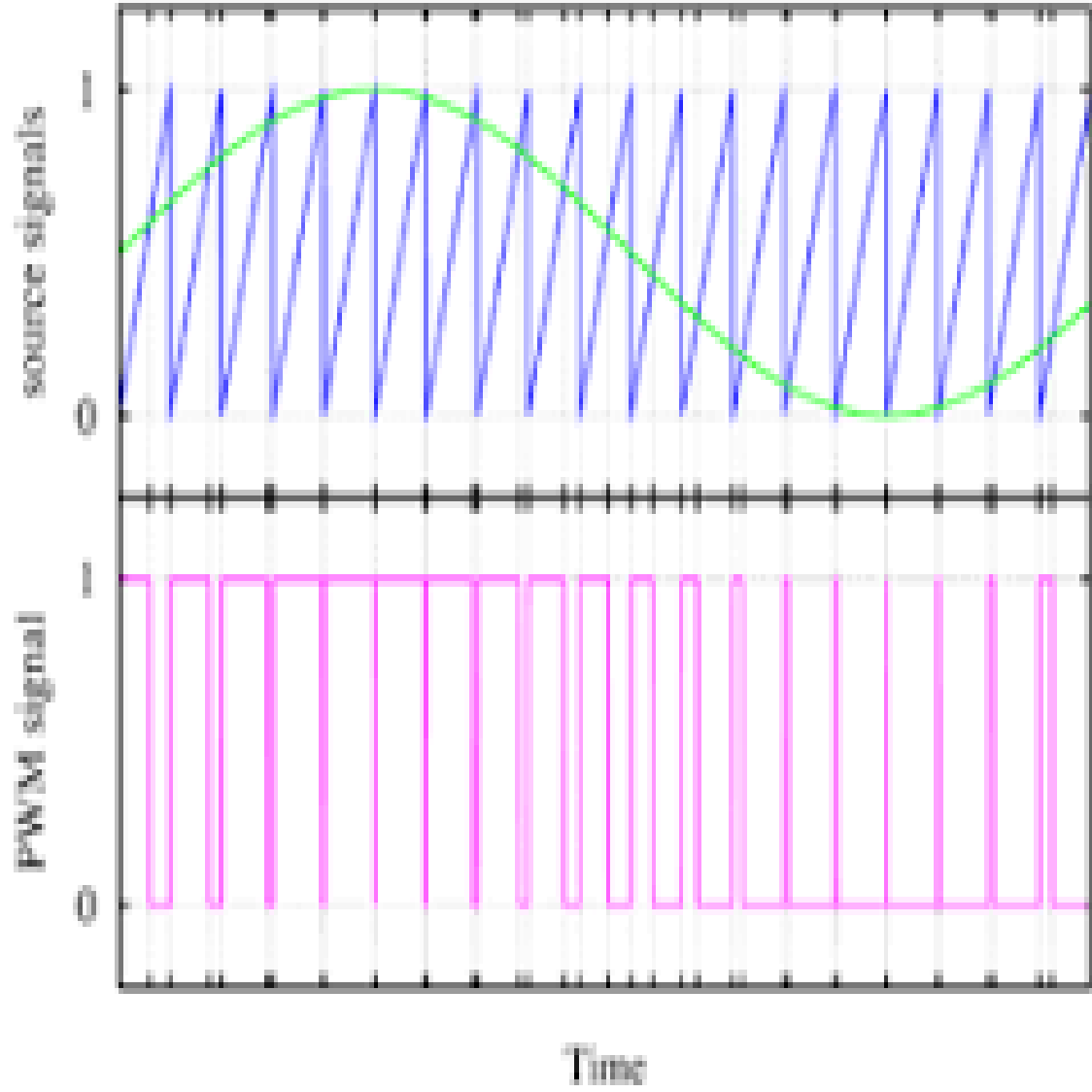


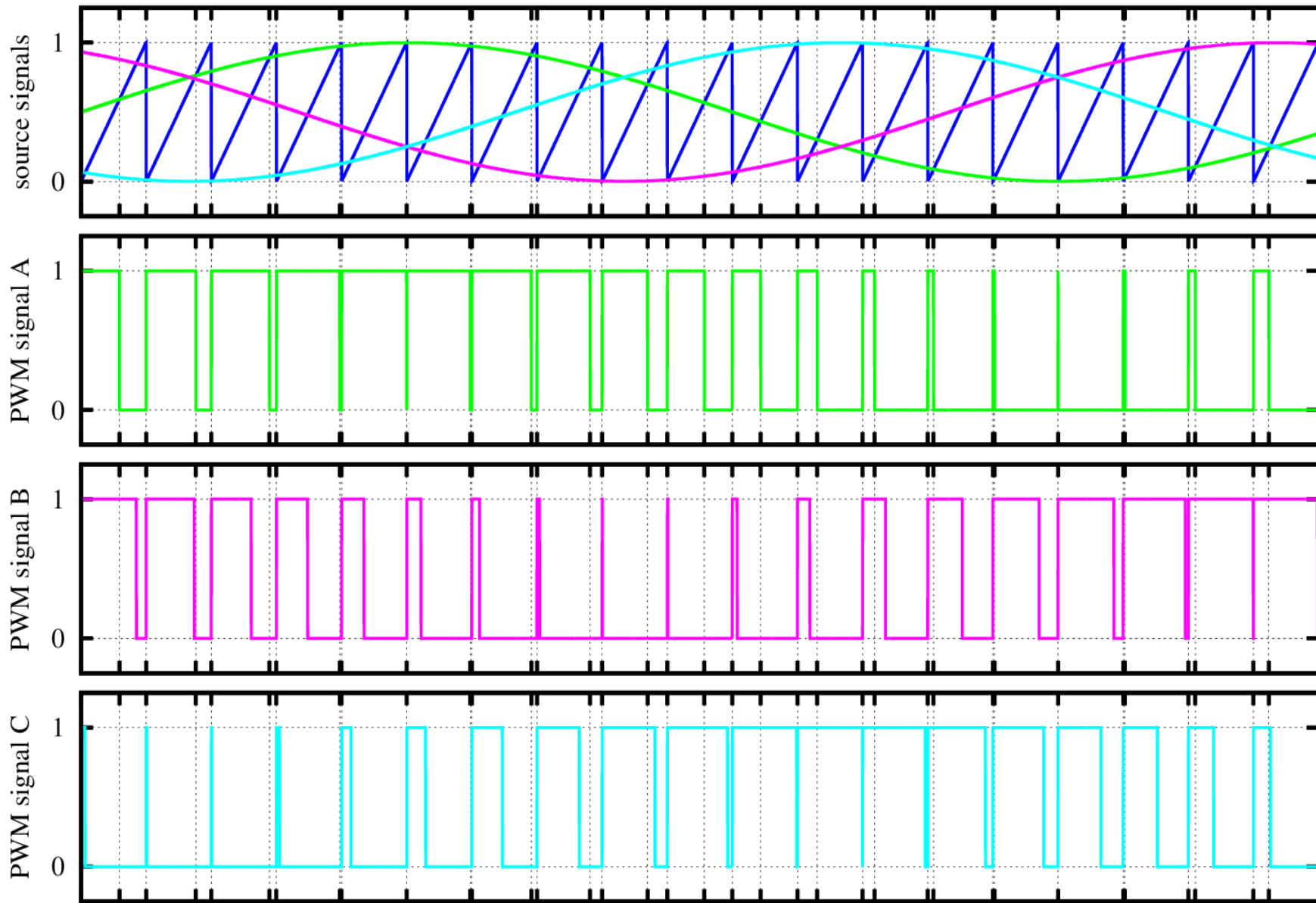












Time