



## Output Compare / Wave Generation (Chp 15)



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Modified by Prof Kohn

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## Topics

- Wave characteristics
- Timer0 review
- Wave generating using Timer0
- Wave generating using Timer2
- Wave generating using Timer1
- Music and frequencies

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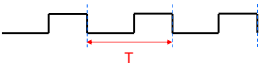
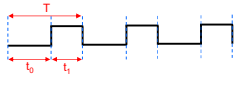
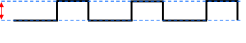
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## Wave characteristics

- Period
  - Frequency
$$f = \frac{1}{T}$$

- Duty cycle
$$\text{duty cycle} = \frac{t_0}{T} \times 100 = \frac{t_0}{t_0 + t_1} \times 100$$

- Amplitude

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WGM02	WGM01	WGM00	Comment
0	0	0	Normal
0	0	1	Phase correct PWM
0	1	0	CTC (Clear Timer on Compare Match)
0	1	1	Fast PWM
1	0	0	Reserved
1	0	1	Phase correct PWM
1	1	0	Reserved
1	1	1	Fast PWM

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### Normal mode

TCNT0

0xFF

0

TOV TOV TOV

time

TOV0: 1

TOV0 = 1

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### CTC (Clear Timer on Compare match) mode

TCNT0

0xFF

OCF0A

0

OCF0A OCF0A OCF0A

time

TOV0: 0

OCF0A: 1

TOV0 = no change

OCF0A = 1

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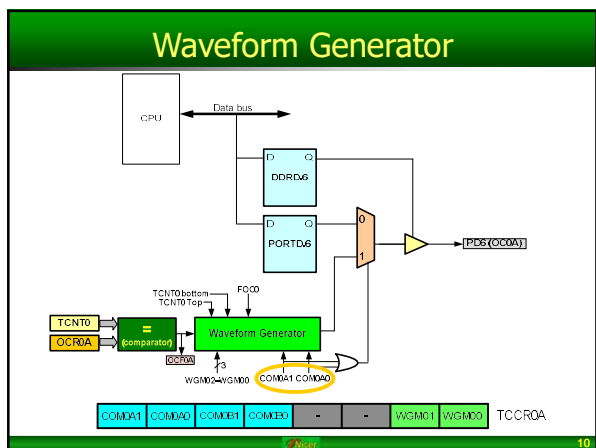
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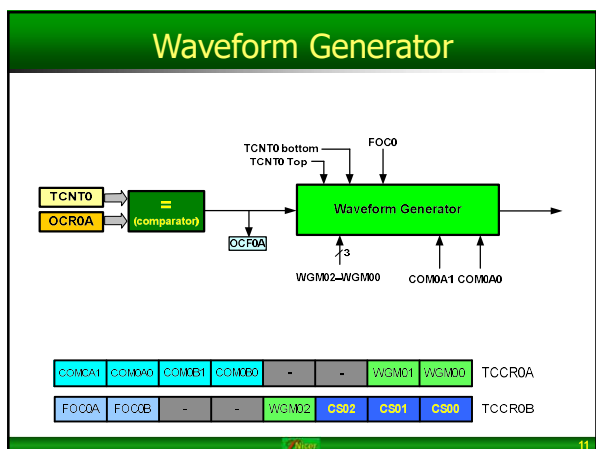
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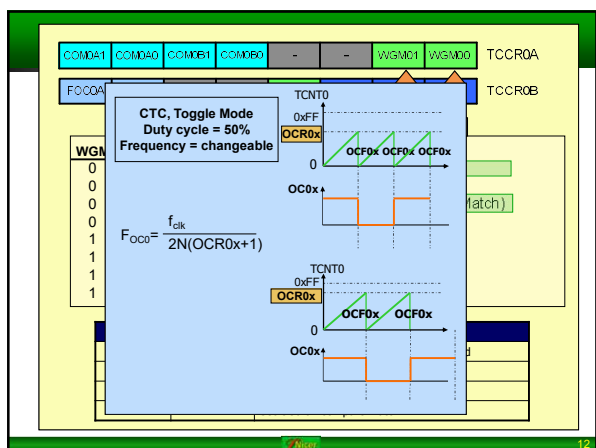
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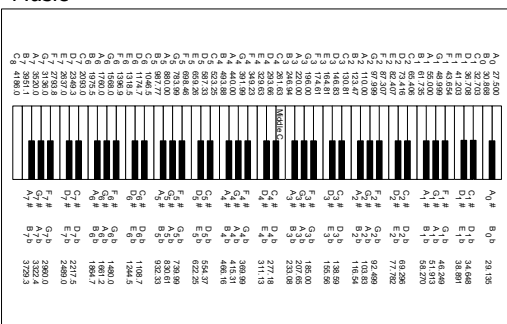




# Music and Frequencies

## Music

Figure 13.5: Piano Note Frequencies




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