

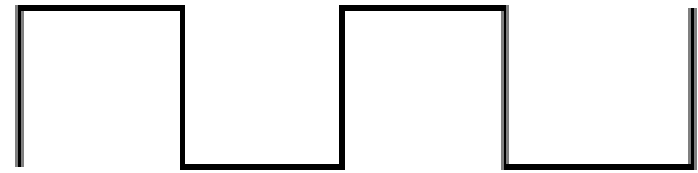
Wave shaping

AET 11

**Given formulas, identify operating principles about
integrating / differentiating wave shaping
circuits.**

An RC wave shaping circuit

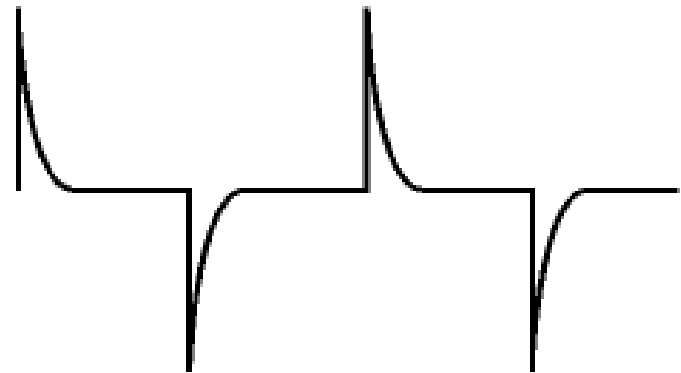
changes a **square wave** or **rectangular wave** into a triangular or peaked wave, depending on which component the output is taken across.



INPUT SQUARE WAVE



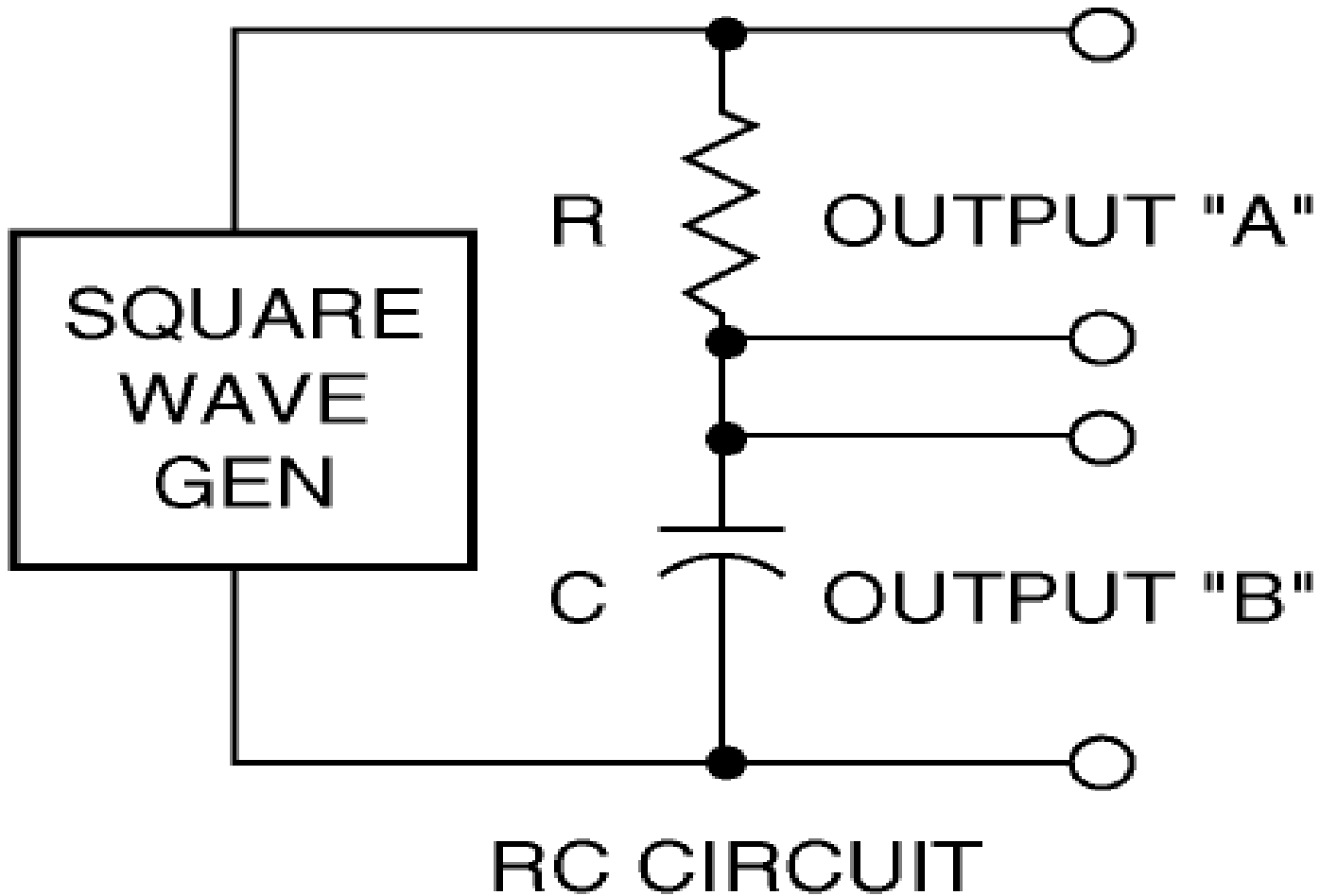
INTEGRATED WAVE



DIFFERENTIATED WAVE

Differentiating circuits produce an output that is proportional to the rate of change of the input, or how fast the input is changing. This is the process of changing a square wave input to a differentiated wave (peaked output)

Integrating circuits produce an output voltage that is proportional to the amplitude and duration of the input waveform. This is the process of changing a square wave input to an integrated wave (triangular output)



AIGR2E 020010-9704-1112B

CIDR

C

I

D

R

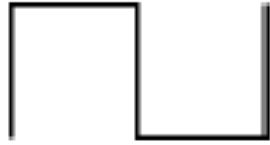
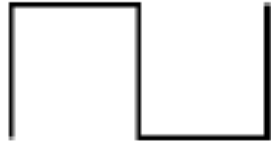






(Capacitor)

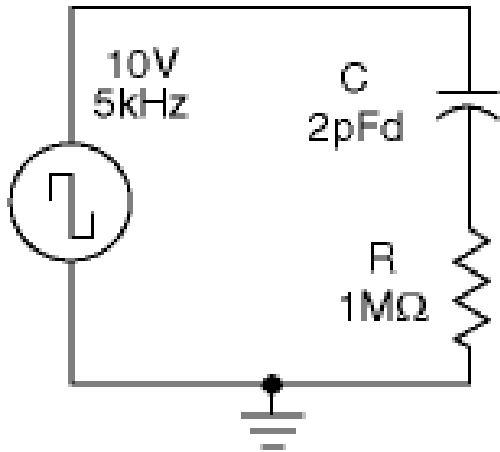
(Integration)

(Differentiation)

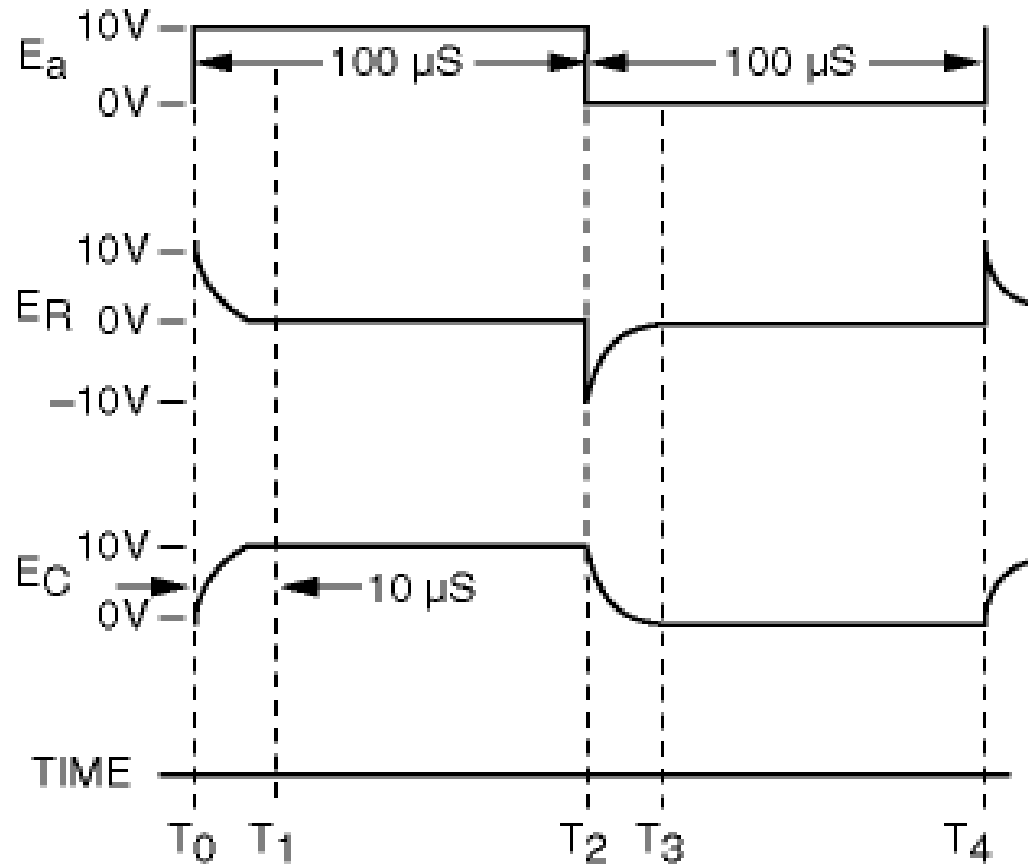
(Resistor)

OUTPUT CLASSIFICATIONS

		OUTPUT "A" E_R IN RC CIRCUIT	OUTPUT "B" E_C IN RC CIRCUIT
	INPUT WAVE		
EXAMPLE 1	LONG TIME CONSTANT $\frac{t_a}{RC}$ or $\frac{R \times t_a}{L}$ 0.1 or less		
EXAMPLE 2	MEDIUM TIME CONSTANT		
EXAMPLE 3	SHORT TIME CONSTANT $\frac{t_a}{RC}$ or $\frac{R \times t_a}{L}$ 10 or more		



Short Relative Time Constant



ADR2E020010-0704-1108

$$t_a = \frac{1}{2F}$$

$$t_a = 1, 10,000$$

$$t_a = 100 \text{ msec}$$

$$TC = RC = (1 \times 10^6) (2 \times 10^{-12}) = 2 \text{ msec}$$

$$5 \times TC = 10 \text{ msec}$$

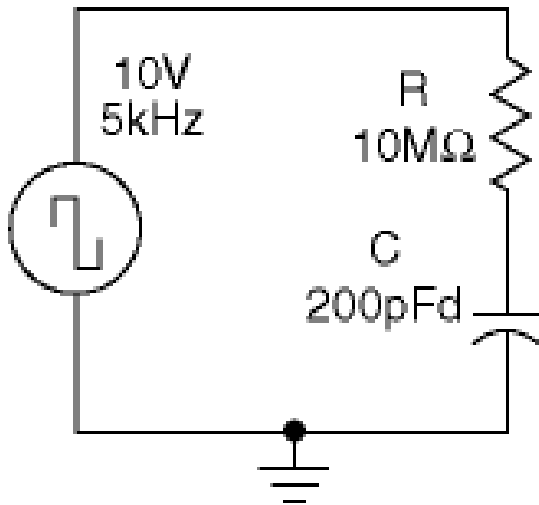
$$\#TC = 100 \text{ msec} / 2 \text{ msec} = 50$$

Short Relative Time Constant

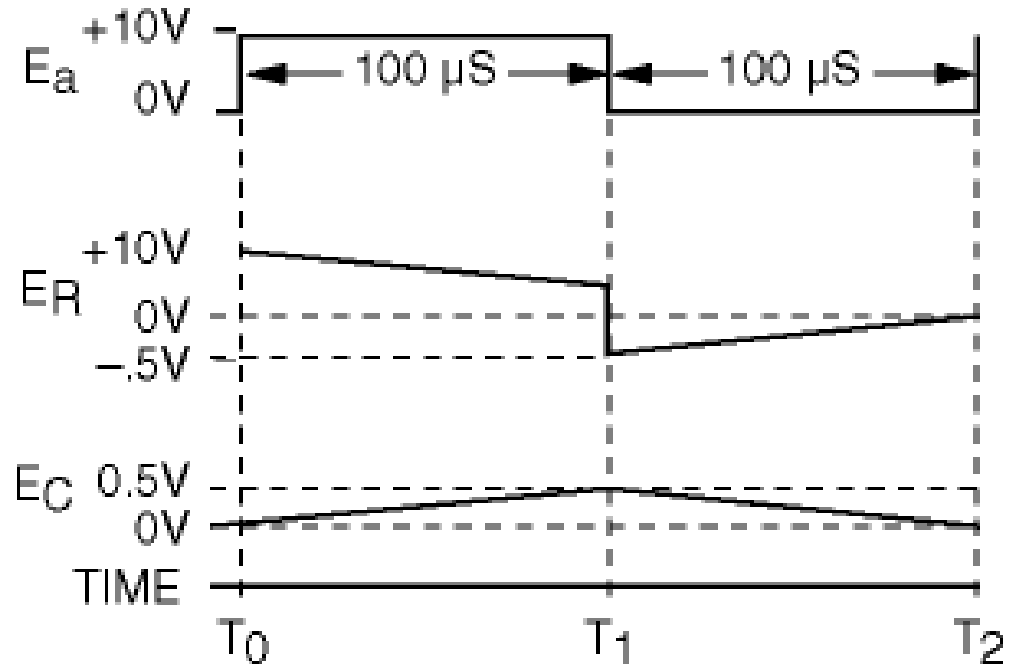
#TC's equal 10 or more,

a single time constant is shorter than the time
allowed

T_a (100 msec) vs. 1TC (2 msec)



A



B

Long Relative Time Constant

ACR2E030010-0704-1108

$$t_a = \frac{1}{2F}$$

$$t_a = 1, 10,000$$

$$t_a = 100 \text{ msec}$$

$$TC = RC = (10 \times 10^6) (200 \times 10^{-12}) = 2000 \text{ msec} \quad 5 \times TC = 10,000 \text{ msec}$$

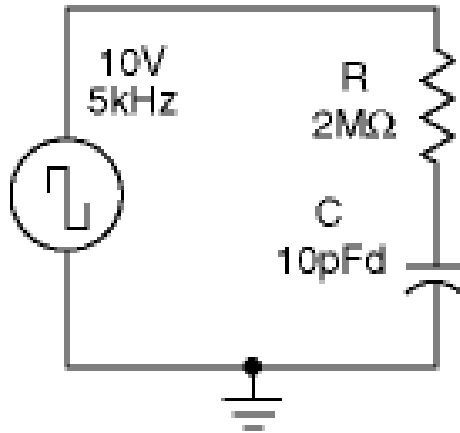
$$\#TC = 100 \text{ msec}, 2000 \text{ msec} = .05$$

Long Relative Time Constant

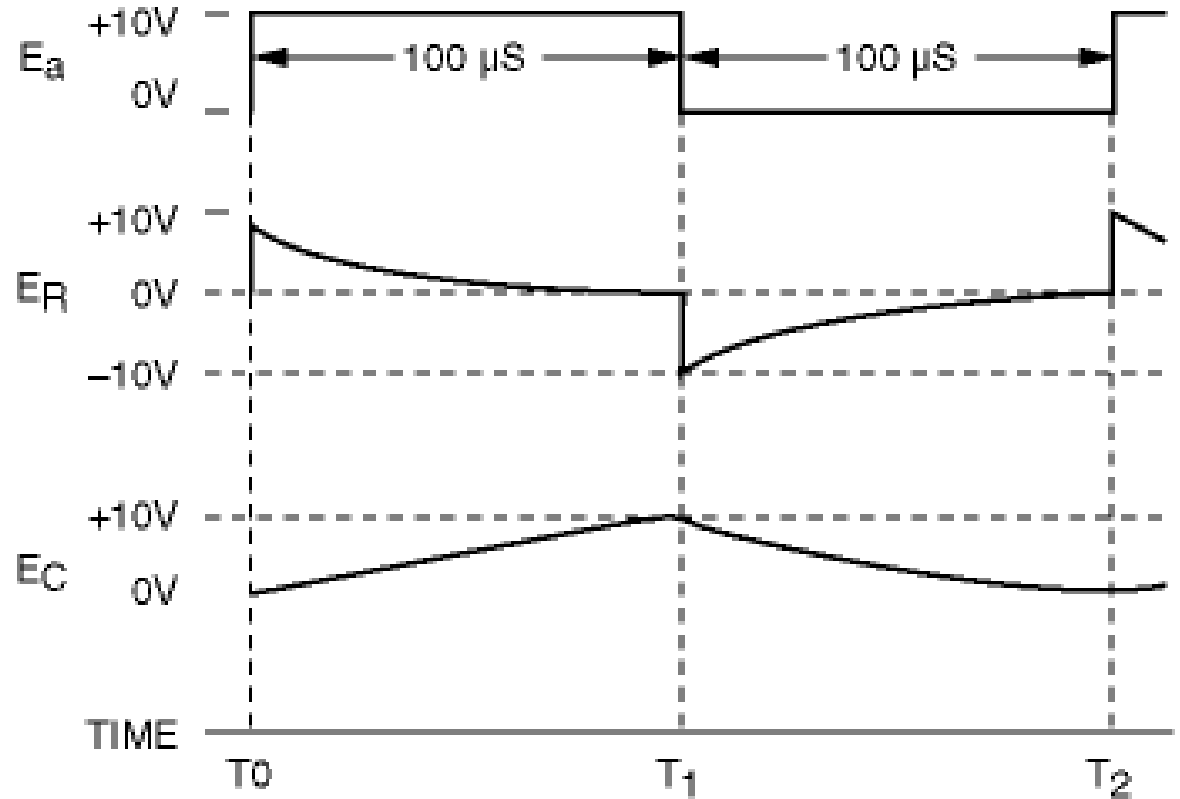
#TC's equal .1 or less,

a single time constant is longer than the time
allowed

Ta (100 msec) vs. 1TC (2,000 msec)



Medium Relative Time Constant



AQR2EC20010-0704-1111

$$t_a = \frac{1}{2F}$$

$$t_a = 1, 10,000 \quad t_a = 100 \text{ msec}$$

$$\text{TC} = \text{RC} = (2 \times 10^6) (10 \times 10^{-12}) = 20 \text{ msec} \quad 5 \times \text{TC} = 100 \text{ msec}$$

$$\# \text{TC} = 100 \text{ msec}, 20 \text{ msec} = 5$$

Medium Relative Time Constant

#TC's equal $>.1$ but <10 ,

Wave shaping

**Given formulas, identify operating principles about
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This concludes chapter 6