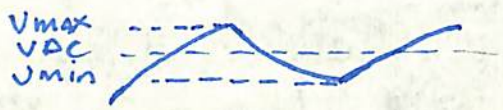
RC Circuit Response, Deriving the Vmax formula Tim L

$$V_c = V_{fin} - (V_{fin} - V_{in})\,e^{\frac{-t}{RC}}$$

* $V_c = V_{max}$
* $V_{fin} = V_{gen}$
* $V_{min} = V_{gen} - V_{max}$



$$V_c = V_{fin} - (V_{fin} - V_{in})\,e^{\frac{-t}{RC}}$$

- Substitute

$$V_{max} = V_{gen} - (V_{gen} - [V_{gen} - V_{max}])\,e^{\frac{-t}{RC}}$$

$$V_{max} = V_{gen} - (V_{gen} - V_{gen} - V_{max})\,e^{\frac{-t}{RC}}$$

$$V_{max} = V_{gen} - (-V_{max})\,e^{\frac{-t}{RC}}$$

$$V_{max} = V_{gen} + V_{max}\,e^{\frac{-t}{RC}}$$

$$V_{max} - V_{max}\,e^{\frac{-t}{RC}} = V_{gen}$$

$$V_{max}\left(1 - 1e^{\frac{-t}{RC}}\right) = V_{gen}$$

$$* \quad V_{max} = \frac{V_{gen}}{1 - e^{\frac{-t}{RC}}}$$

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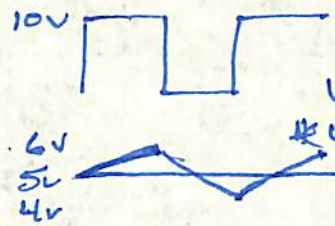
- V_c with the Charge formula = V_{max}
- V_{min}, we know if the signal is 50% duty cycle, that the signal will vary equally above and below the center. Therefore $V_{max} + V_{min} = V_{gen}$ & $V_{min} = V_{gen} - V_{max}$

* Example



$V_{min} = 10V - 6V$

* $V_{min} = 4V$