→ Derivation

i) $V_{triangular}$ (peak-peak):

KCL at node V_A

$$\frac{V_{tri} - V_A}{R_3} = \frac{V_A - V_{o1}}{R_2}$$

• If $V_{o1} = V_{sat}$ ⇒

at $V_A = 0$ (before switching)

$$\frac{V_{tri}}{R_3} = -\frac{V_{sat}}{R_2}$$

$$\boxed{V_{tri} = -\frac{R_3}{R_2} \cdot V_{sat}} \rightarrow ①$$

• If $V_{o1} = -V_{sat}$

at $V_A = 0$

$$\frac{V_{tri}}{R_3} = -\frac{(-V_{sat})}{R_2}$$

$$\boxed{V_{tri} = \frac{R_3}{R_2} V_{sat}} \rightarrow ②$$

For V_{tria} (peak-peak) Subtract ② − ①

$$V_{tri\,(p-p)} = \frac{R_3}{R_2} V_{sat} - \left(-\frac{R_3}{R_2} V_{sat}\right)$$

$$\boxed{V_{tri(p-p)} = 2\frac{R_3}{R_2} \cdot V_{sat}} \rightarrow (I)$$

(ii) Frequency:

→ $$V_{tri} = -\frac{1}{RC}\int_0^t V_i\,dt$$

Let $V_{in} = -V_{sat}$ $[0, T/2]$

$$= -\frac{1}{RC}\int_0^{T/2} (-V_{sat})\,dt$$

$$V_{tri} = \frac{V_{sat}}{RC}\left[\frac{T}{2}\right] \rightarrow (II)$$

From (I) + (II)

$$\frac{2R_3}{R_2} V_{sat} = \frac{V_{sat}\,T}{2R_1C}$$

→

$$T = \frac{4R_1R_3C}{R_2}$$

$$\boxed{f = \frac{R_2}{4R_1R_3C}}$$