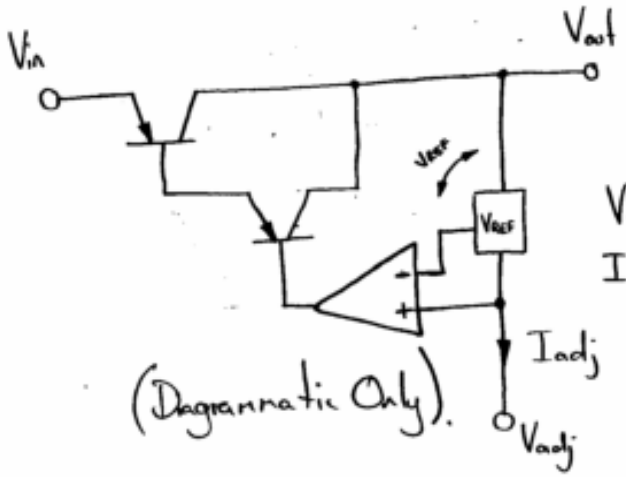
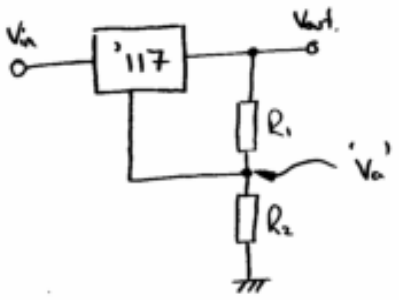
NX1117, LM1117 - Three terminal adjustable regulator. ①

$V = IR \quad \frac{V}{I} = R \quad \frac{V}{R} = I$



$V_{REF} = 1.25v$

$I_{adj} = 52\mu A_{(max)}$



$$I_{R1} = \frac{V_{REF}}{R_1}$$

$$I_{R2} = I_{R1} + I_{adj}$$

$$V_a = V_{out} - V_{REF}$$

$$V_{out} = V_a + V_{REF}$$

$$V_a = I_{R2} \cdot R_2$$

$$V_a = (I_{R1} + I_{adj}) \cdot R_2$$

$$V_a = \left(\frac{V_{REF}}{R_1} + I_{adj}\right) R_2$$

$$V_{out} = \left(\frac{V_{REF}}{R_1} + I_{adj}\right) R_2 + V_{REF}$$

$$V_{out} = \left(\frac{V_{REF}}{R_1} + I_{adj}\right) R_2 + V_{REF}.$$

$$= \frac{V_{REF} R_2}{R_1} + R_2 I_{adj} + V_{REF}.$$

$$= V_{REF} + \frac{V_{REF} R_2}{R_1} + R_2 I_{adj}$$

$$\boxed{V_{out} = V_{REF}\left(1 + \frac{R_2}{R_1}\right) + R_2 I_{adj}}$$

$V_{R1} = 1.25v$: SET $I_{R1} \gg I_{adj}$

$I_{R1} > 5_0 . I_{adj}$

$$\frac{V_{R1}}{5_0 . I_{adj}} = R_1 < \frac{1.25V}{2.6mA} = 480\Omega$$

$$V_{out} = V_{REF}\left(1 + \frac{R_2}{R_1}\right) + I_{adj} R_2$$

$$\frac{V_{out} - I_{adj} R_2}{V_{ref}} = 1 + \frac{R_2}{R_1}$$

$$\frac{V_{out} - I_{adj} R_2}{V_{ref}} - 1 = \frac{R_2}{R_1}$$

$$\frac{V_{out} - I_{adj} R_2 - V_{ref}}{V_{ref}} = \frac{R_2}{R_1}$$

$$\frac{V_{ref}}{V_{out} - I_{adj} R_2 - V_{ref}} = \frac{R_1}{R_2}.$$

$$\boxed{\frac{V_{ref} R_2}{V_{out} - I_{adj} R_2 - V_{ref}} = R_1}$$

$$\frac{V_{out}}{V_{ref}} = 1 + \frac{R_2}{R_1} + \frac{I_{adj} R_2}{V_{ref}}$$

$$\frac{V_{out}}{V_{ref}} - 1 = \frac{R_2}{R_1} + \frac{I_{adj} R_2}{V_{ref}}$$

$$= \frac{R_2 V_{ref} + I_{adj} R_1 R_2}{V_{ref} R_1}$$

$$= \frac{R_2 (V_{ref} + I_{adj} R_1)}{V_{ref} R_1}$$

$$\frac{V_{out} \cancel{V_{ref}}}{\cancel{V_{ref}}} - V_{ref} = \frac{R_2 (V_{ref} + I_{adj} R_1)}{R_1}$$

$$V_{out} - V_{ref} = \frac{R_2 (V_{ref} + I_{adj} R_1)}{R_1}$$

$$\frac{V_{out} - V_{ref}}{V_{ref} + I_{adj} R_1} = \frac{R_2}{R_1}$$

$$\boxed{\frac{R_1 (V_{out} - V_{ref})}{V_{ref} + I_{adj} R_1} = R_2.}$$

N.B; Sadly, can never exceed a ratio of $R_1 \sim R_2$ because of the I_{adj} term. Recommend set $R_1 < 480\,\Omega$ and calculate R_2

Andy Ad.