

Designing SCA

1. Desired behaviour

$$0\text{ V to }2.5\text{ V} \rightarrow -10\text{ V to }10\text{ V}$$

2. SCA Transfer Equation

$$V_{out} = mx + b = \frac{(10\text{ V}) - (-10\text{ V})}{(2.5\text{ V}) - (0\text{ V})} \cdot V_{in} + b = 8 \cdot V_{in} + b$$

$$(0\text{ V}, -10\text{ V}): -10\text{ V} = 8(0\text{ V}) + b \quad \therefore b = -10\text{ V}$$

$$V_{out} = 8 \cdot V_{in} + (-10\text{ V})$$

3. Implementation

$$V_{out} = \frac{R_f}{R_i} \cdot V_{in} - \frac{R_f}{R_b} \cdot (2.5006\text{ V}^*)$$

*I will be using $V_{ref} = V_{max} + V_{LSB} = 2.5006103515625\text{ V}$ for V_{bias}

$$\text{Let } R_f = 100\text{ k}\Omega$$

$$\frac{100\text{ k}\Omega}{R_i} = 8 \quad \therefore R_i = 12.5\text{ k}\Omega$$

$$-\frac{100\text{ k}\Omega}{R_b} \cdot (2.5006\text{ V}) = -10\text{ V} \quad \therefore R_b = 25.006\text{ k}\Omega$$

