

SEPIC calculations

$$V_{inmin} := 10 \cdot V$$

$$V_{innom} := 13 \cdot V$$

$$V_{inmax} := 19 \cdot V$$

$$V_{outmax} := 13.8 \cdot V$$

$$I_{outmax} := 1 \cdot \text{amp}$$

$$F_{sw} := 350 \cdot \text{KHz}$$

outputs

$$D_{nom} := \frac{V_{outmax}}{V_{outmax} + V_{innom}} \quad D_{nom} = 0.515$$

$$D_{max} := \frac{V_{outmax}}{V_{outmax} + V_{inmin}} \quad D_{max} = 0.58$$

$$D_{min} := \frac{V_{outmax}}{V_{outmax} + V_{inmax}} \quad D_{min} = 0.421$$

$$P_{outmax} := I_{outmax} \cdot V_{outmax} \quad P_{outmax} = 13.8 \text{ W}$$

$$P_{outBDRY} := \frac{P_{outmax}}{3} \quad P_{outBDRY} = 4.6 \text{ W}$$

Inductor value and current rating

$$L_{indc} := \frac{1}{P_{outBDRY} F_{sw} \cdot \left(\frac{1}{V_{outmax}} + \frac{1}{V_{innom}} \right)^2} \quad L_{indc} = 27.832 \mu\text{H} \quad \text{Min L value}$$

Divide by 2 for coupled inductor

$$L_{ind} := 10 \cdot \mu\text{H} \quad \text{chosen L}$$

$$\text{eff} := .85 \quad \text{Approx efficiency}$$

$$I_1 := \frac{P_{outmax}}{V_{inmin} \cdot \text{eff}} \quad I_1 = 1.624 \text{ A}$$

$$I_{\text{lpk}} := I_1 + \frac{V_{\text{inmin}} \cdot D_{\text{max}}}{2 \cdot L_{\text{ind}} \cdot F_{\text{sw}}} \quad I_{\text{lpk}} = 2.452 \text{ A}$$

Peak inductor current (min sat rating)

RMS and peak MOSFET current and voltage rating

$$I_{\text{l2pp}} := V_{\text{inmin}} \cdot \frac{D_{\text{max}}}{L_{\text{ind}} \cdot F_{\text{sw}}}$$

$$I_{\text{l2pp}} = 1.657 \text{ A}$$

$$I_{\text{Qpk}} := I_{\text{lpk}} + I_{\text{outmax}} + \frac{I_{\text{l2pp}}}{2}$$

$$I_{\text{Qpk}} = 4.28 \text{ A}$$

Peak switch current

$$i_{\text{MOSon}} := I_{\text{outmax}} + I_1 \quad i_{\text{MOSon}} = 2.624 \text{ A}$$

$$i_{\text{MOSrms}} := \sqrt{\int_0^{D_{\text{max}}} i_{\text{MOSon}}^2 dt} \quad i_{\text{MOSrms}} = 1.998 \text{ A}$$

$$V_{\text{MOS}} := (V_{\text{inmax}} + V_{\text{outmax}}) \cdot 1.2 \quad V_{\text{MOS}} = 39.36 \text{ V} \quad \text{Switch min voltage rating}$$

Diode current and voltage rating

$$V_{\text{diode}} := (V_{\text{outmax}} + V_{\text{inmax}}) \cdot 1.2 \quad V_{\text{diode}} = 39.36 \text{ V} \quad \text{Diode min voltage rating}$$

$$I_{\text{diode}} := I_{\text{outmax}} \quad I_{\text{diode}} = 1 \text{ A} \quad \text{diode average current}$$

SEPIC capacitor min value

$$V_{\text{deltacap}} := V_{\text{inmin}} \cdot 0.1 \quad V_{\text{deltacap}} = 1 \text{ V} \quad \text{10\% ripple of } V_{\text{inmin}} \text{ is typical}$$

$$C_{\text{Smin}} := \frac{I_{\text{outmax}} \cdot D_{\text{max}}}{F_{\text{sw}} \cdot V_{\text{deltacap}}} \quad C_{\text{Smin}} = 1.657 \cdot \mu\text{F}$$

Output capacitor min value

$$R_d := 3 \cdot \text{ohm}$$

Total dynamic resistance of LED string

$$I_{\text{rip}} := 50 \cdot \text{mA}$$

$$C_{\text{outmin}} := \frac{I_{\text{outmax}} \cdot \frac{1}{F_{\text{sw}}} \cdot D_{\text{max}}}{R_d \cdot I_{\text{rip}}}$$

$$C_{\text{outmin}} = 11.044 \cdot \mu\text{F}$$

min Cout value

Input capacitor min value

$$V_{\text{rip}} := 500 \cdot \text{mV}$$

$$di_{\text{Lin}} := \frac{V_{\text{inmax}}}{L_{\text{ind}}} \cdot \frac{1}{350 \cdot \text{KHz}} \cdot D_{\text{min}}$$

$$di_{\text{Lin}} = 2.284 \text{ A}$$

L1 di/dt at Vin high (max ripple point, best for min value)

$$C_{\text{in}} := \frac{di_{\text{Lin}}}{4} \cdot \frac{1}{(F_{\text{sw}} \cdot 2) \cdot V_{\text{rip}}}$$

$$C_{\text{in}} = 1.631 \cdot \mu\text{F}$$

min Cin value