1 Efficiency

Efficiency for linear regulator is given by:

$$\textbf{Efficiency}(\eta) = 1 - (Vin - Vout/Vin) = Vout/Vin \tag{1}$$

MIC29300 series: Vout+1 < Vin < 26V

$$\textbf{Typical}\eta = Vout/(Vout + 1) = Vout/24V \tag{2}$$

$$\textbf{maximum}\eta = Vout/(Vout + 1) \tag{3}$$

$$\textbf{minnimum}\eta = Vout/26 \tag{4}$$

$$\begin{bmatrix} OutputVoltage \\ 3.3 \\ 5 \\ 12 \end{bmatrix} = \begin{bmatrix} InputVoltage(Oursysten) & InputVoltage(min) & InputVoltage(max) \\ 24 & 4.3 & 26 \\ 24 & 6 & 26 \\ 24 & 13 & 26 \end{bmatrix} \tag{5}$$

$$\begin{bmatrix} \eta \\ 3.3 \\ 5 \\ 12 \end{bmatrix} = \begin{bmatrix} \eta(oursystem) & \eta(min) & \eta(max) \\ 0.1375 & 0.126 & 0.767 \\ 0.208 & 0.192 & 0.833 \\ 0.5 & 0.461 & 0.923 \end{bmatrix} \tag{6}$$

2 Input Power

Assuming Input and Output current are same for all the subsytems. Iout=Iin=1A for 3.3V regulator
Iout=Iin=1Afor 5V regulator
Iout=Iin=2A for 12V regulator
Iout=Iin=10A for motors

$$\textbf{Input Power dissipation} = Iin(Vin) \tag{7}$$

$$\begin{bmatrix} P \\ 3.3Vregulator \\ 5Vregulator \\ 12Vregulator \\ Motor \end{bmatrix} = \begin{bmatrix} Power(input) & Power(output) \\ 24 * 1 = 24V & 3.3 * 1 = 3.3W \\ 24 * 1 = 24W & 5 * 1 = 5W \\ 24 * 2 = 48W & 12 * 2 = 24W \\ 24 * 10 = 240W & 24 * 10 = 240W \end{bmatrix} \tag{8}$$

3 Total System Efficiency

$$\textbf{Efficiency}(\eta) = TotalOutputPower/TotalInputPower = Pout/Pin \tag{9}$$

$$\textbf{TotalOuputPower} = 272.3W \tag{10}$$

$$\textbf{TotalInputPower} = 336W \tag{11}$$

$$\big[\eta\big] = 272.3/336 = 0.81 \tag{12}$$