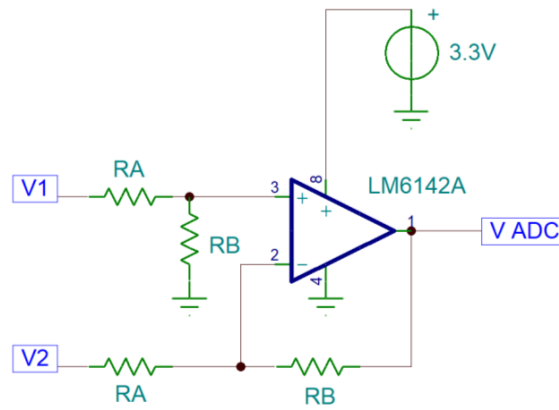


SENSING CIRCUITS

The current and voltage signals of the SEPIC must be conditioned in order to be able to read and process them with the development card to control the useful cycle of the gate of the MOSFET. The card's ADC allows an analog input range between 0V and 3.3V. Inverter voltages are in the range of 0V - 22V and currents of 0A-3A.

For the conditioning of the signals, the implementation of a non-inverting differential amplifier was chosen with the LM6142A rail-to-rail operational amplifier due to its effective slew rate (25 V / us) and output voltage limitation because it is rail- to-rail ($V_{cc} = 3.3$ V). This feature helps protect the development board. The differential amplifier topology and its equations are described below.

Sensed Voltage



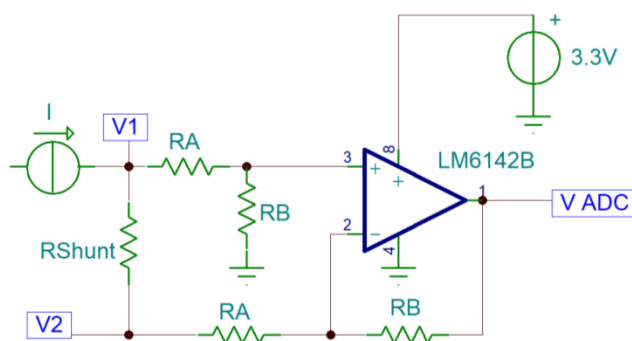
Differential amplifier to measure voltage.

The voltage entering the ADC of the development board is a function of the resistors RA, RB, V1 and V2 as follows:

$$V_{ADC} = (V1 - V2) \left(\frac{RB}{RA} \right)$$

Precision resistors of 1% tolerance will be used for greater precision in taking measurements.

Current Sensing



Differential amplifier to measure current.

Figure (4.8). Differential amplifier to measure current. The voltage that enters the ADC of the development board is a function of the resistors RA, RB, V1 and V2 but in this case V1 and V2 represent the current variable that circulates with the ohm law of the following way:

$$V_{ADC} = (V1 - V2) \left(\frac{RB}{RA} \right) = IR_{SH} \left(\frac{RB}{RA} \right)$$

Rshunt	0.1													
Max ciclo útil	0.63													
Sensado	Corr. máx	Corr. Nom?	max input	(V1-V2) nom.	RA	RB	Corr positivo	Corr negativo	Vadc máx.	Resolución medición	Potencia OPA	Pot. Shunt	Pot. Total	
Vpanel (V)	NA	NA	22.0	17.5	2.2E+04	3.3E+03	8.70E-04	0.000130435	3.3	5.37E+00	mV	1.24E-02	0.00E+00	1.24E-02
Vsalida (V)	NA	NA	16.5	14.7	1.2E+04	2.4E+03	1.15E-03	0.000229167	3.3	4.03E+00	mV	1.56E-02	0.00E+00	1.56E-02
Ipanel (A)	1.5	1.14	0.2	0.114	1.0E+03	2.2E+04	6.52E-06	0.000143478	3.3	3.66E+02	uA	2.74E-04	1.42E-01	1.42E-01
Imosfet (A)	3.003	1.86	0.3	0.186	9.1E+02	1.0E+04	2.75E-05	0.000302475	3.3	7.33E+02	uA	3.86E-04	5.68E-01	5.69E-01
Isalida (A)	1.5	1	0.2	0.1	1.0E+03	2.2E+04	6.52E-06	0.000143478	3.3	3.66E+02	uA	2.11E-04	1.42E-01	1.42E-01
														8.80E-01

Sense board

In the table above, we can see the resolution of the measurement using precision resistances of 1%, in addition to taking into account that our maximum measurement must be above the limit conditions of the converter to protect the card from spikes from voltages and currents.