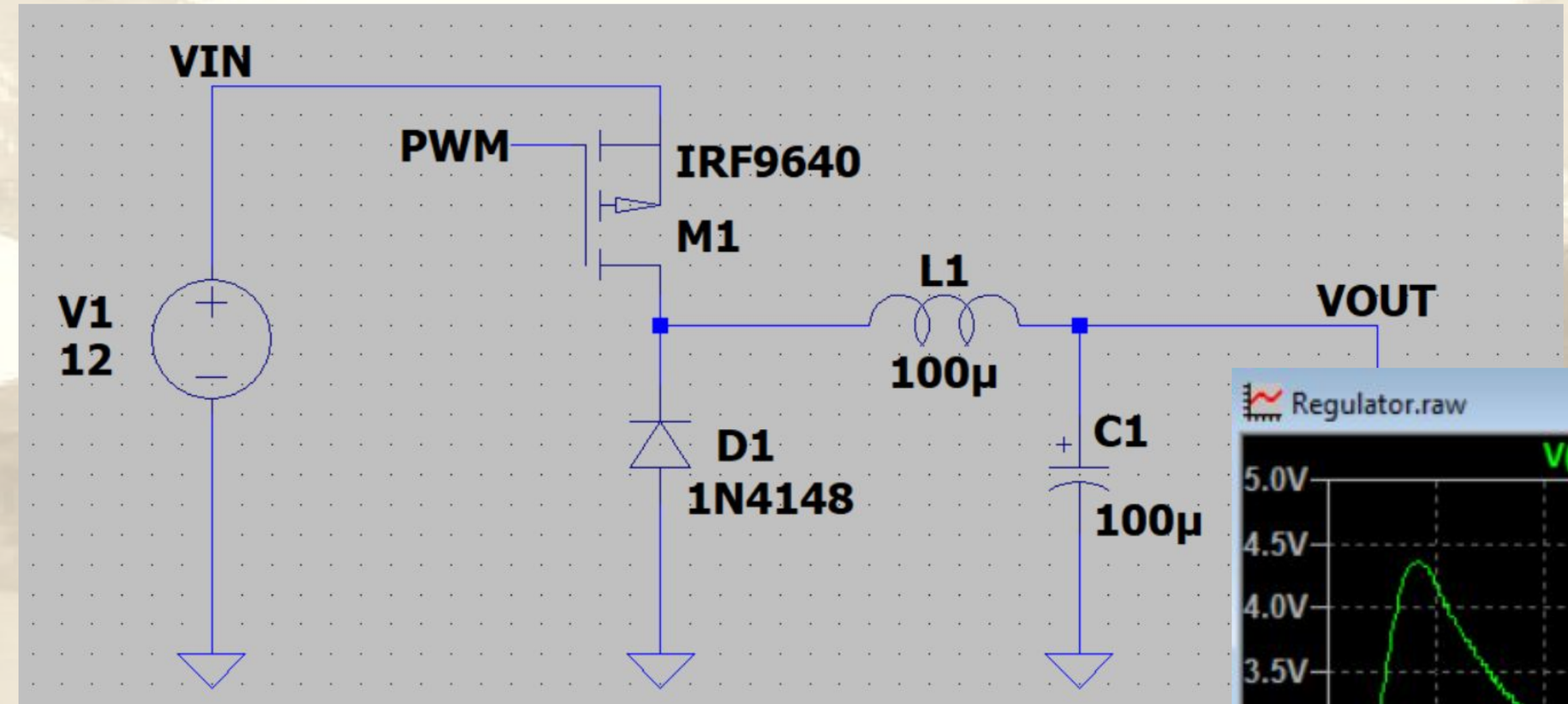
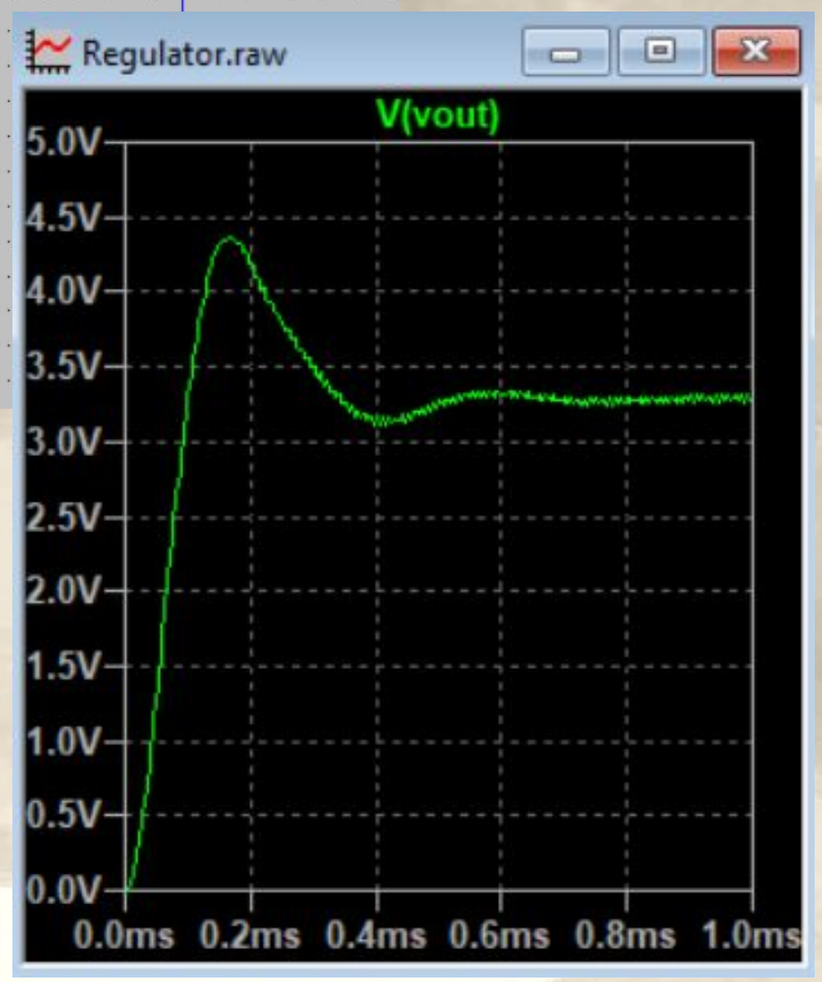
Drops of LTSpice

Understanding and using the MEASURE Statement

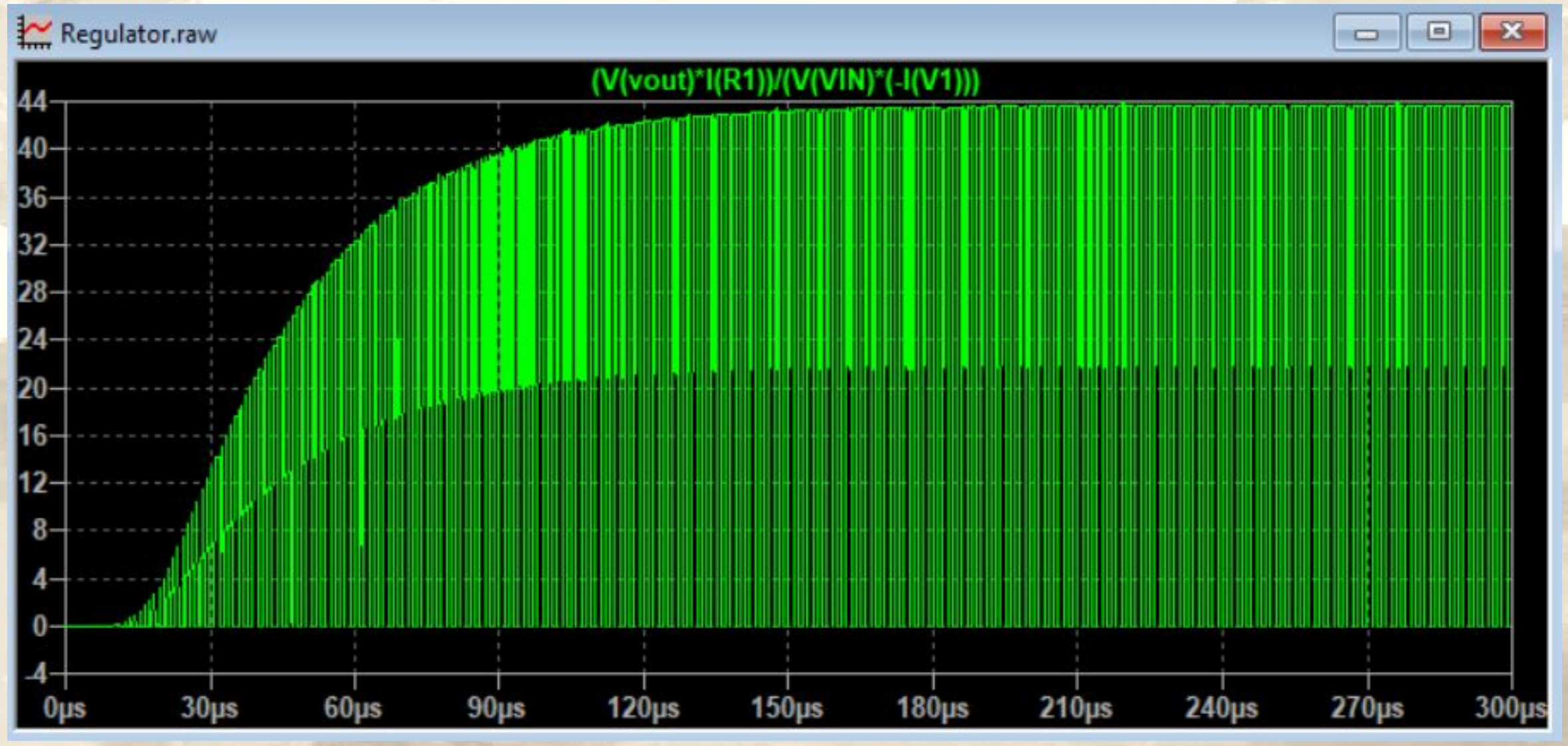
So, you created a really cool regulator, and it is working fine.





But how do you calculate how efficient your regulator is?

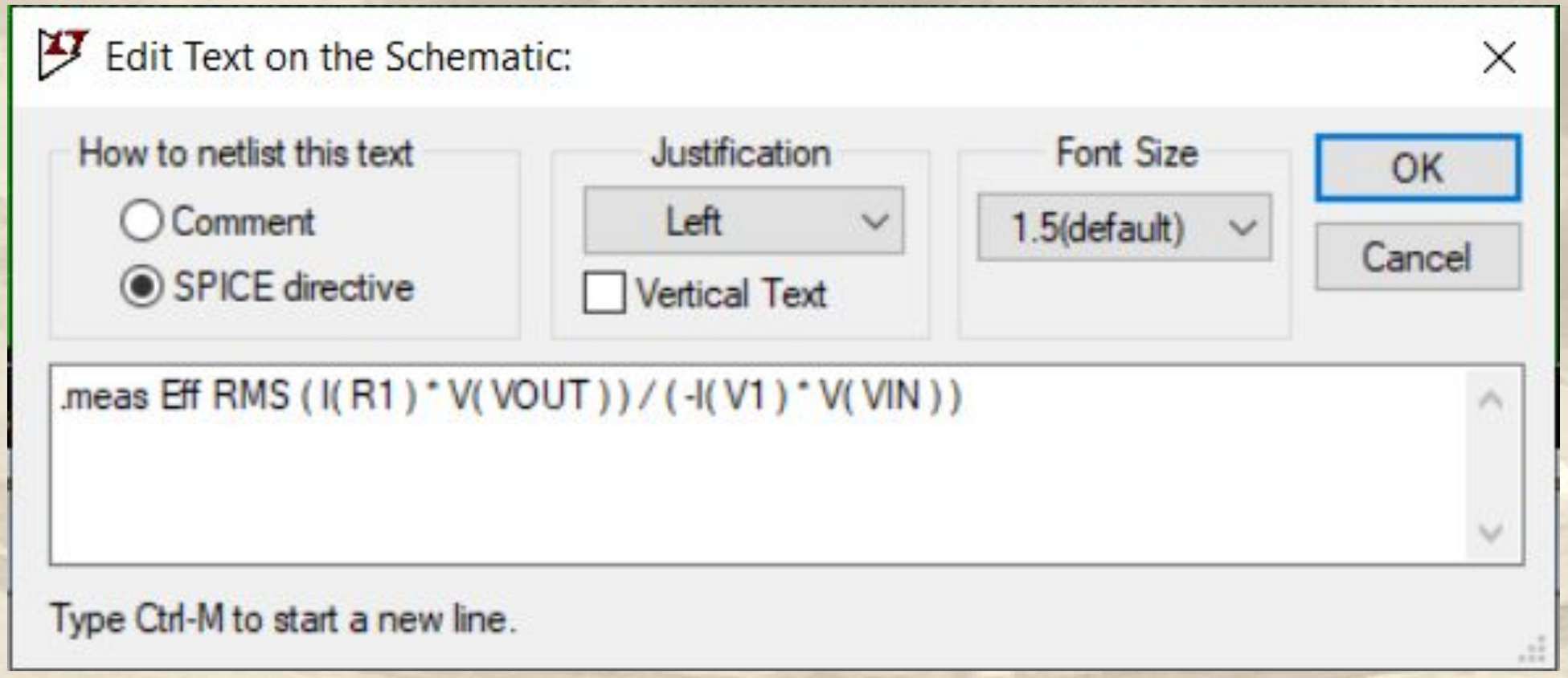
Yes, you can put that on the graph...



...but for a switching regulator, this is not an easy job.

The best way is to take a measurement. To do this, LTSpice has a very useful statement.

This is the .MEASURE, or .MEAS for short.



The structure of the most basic MEASURE directive is...

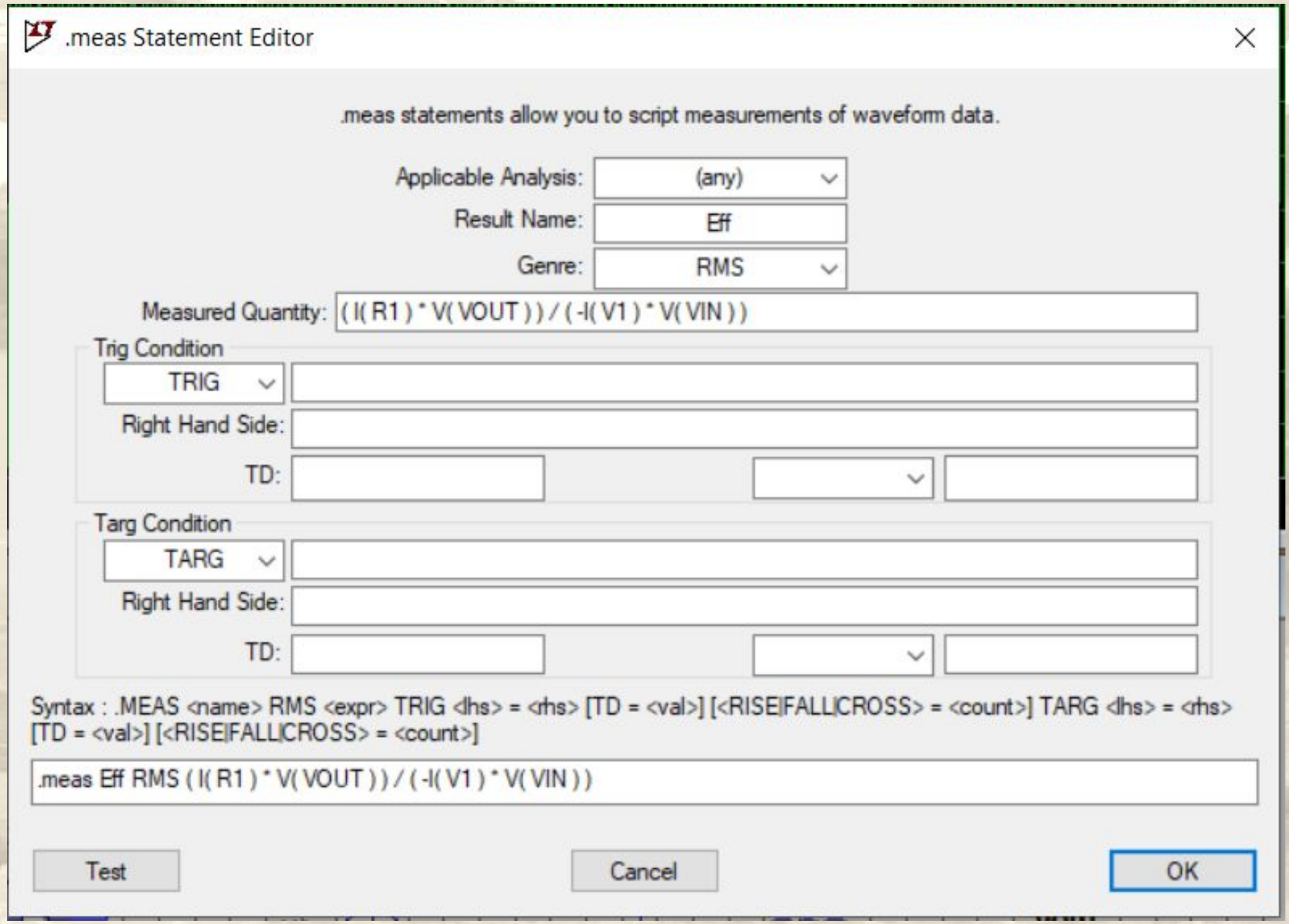
.MEAS Pout RMS V(vout) * I(R1)

Name Operation Expressions

Possible operations are...

Keyword	Operation performed over interval
AVG	Compute the average of <expr>
MAX	Find the maximum value of <expr>
MIN	Find the minimum value of <expr>
PP	Find the peak-to-peak of <expr>
RMS	Compute the root mean square of <expr>
INTEG	Integrate <expr>

Once you add the statement, LTSpice allows you to change it in a specific editor.



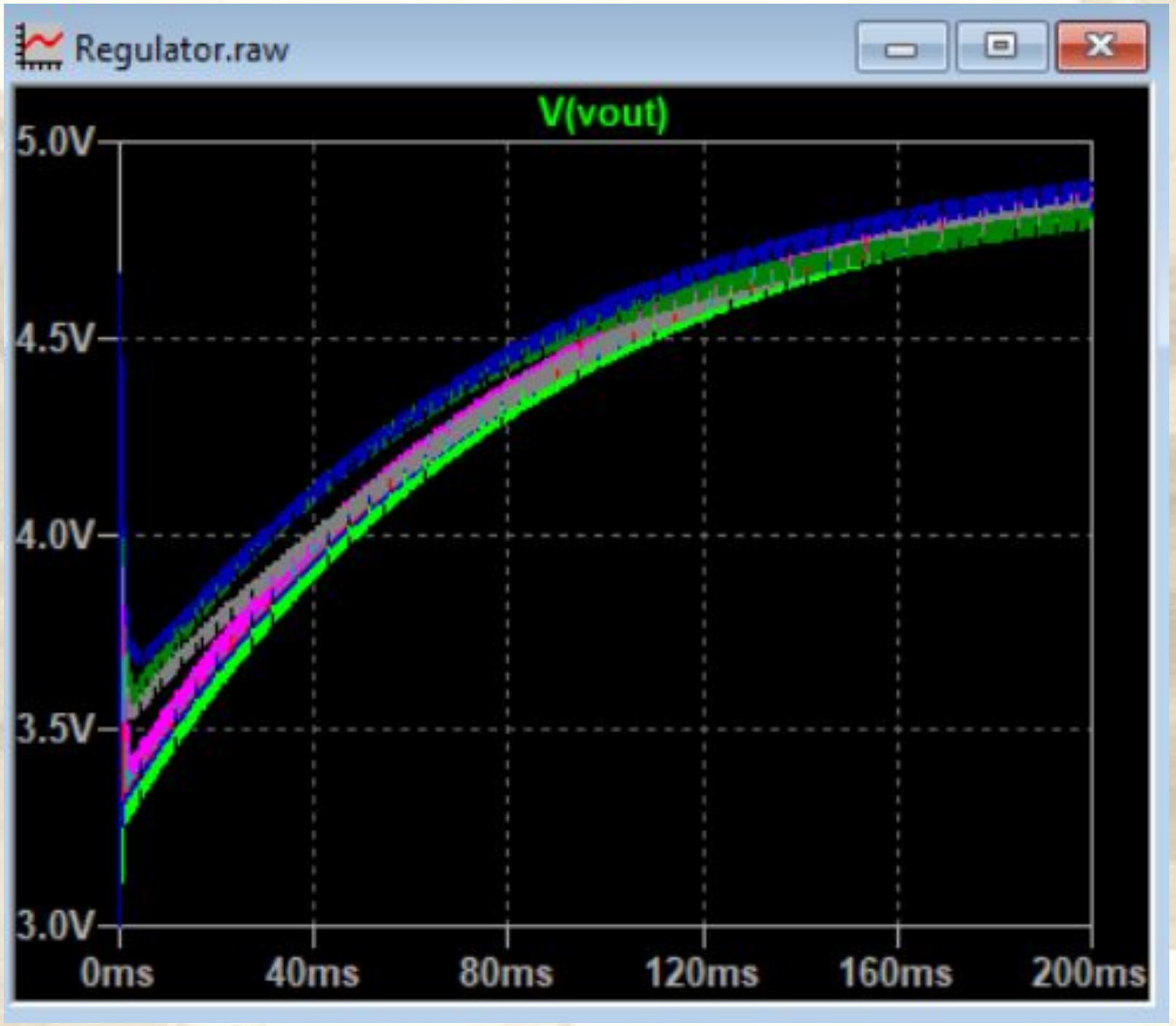
In our circuit, to calculate the efficiency we need the following expression

$$\eta = \frac{P_{OUT}}{P_{IN}} = \frac{V_{OUT} \cdot I_{R1}}{V_{IN} \cdot I_{V1}}$$

However, we cannot use instantaneous power. So, let's separate it into 3 measures

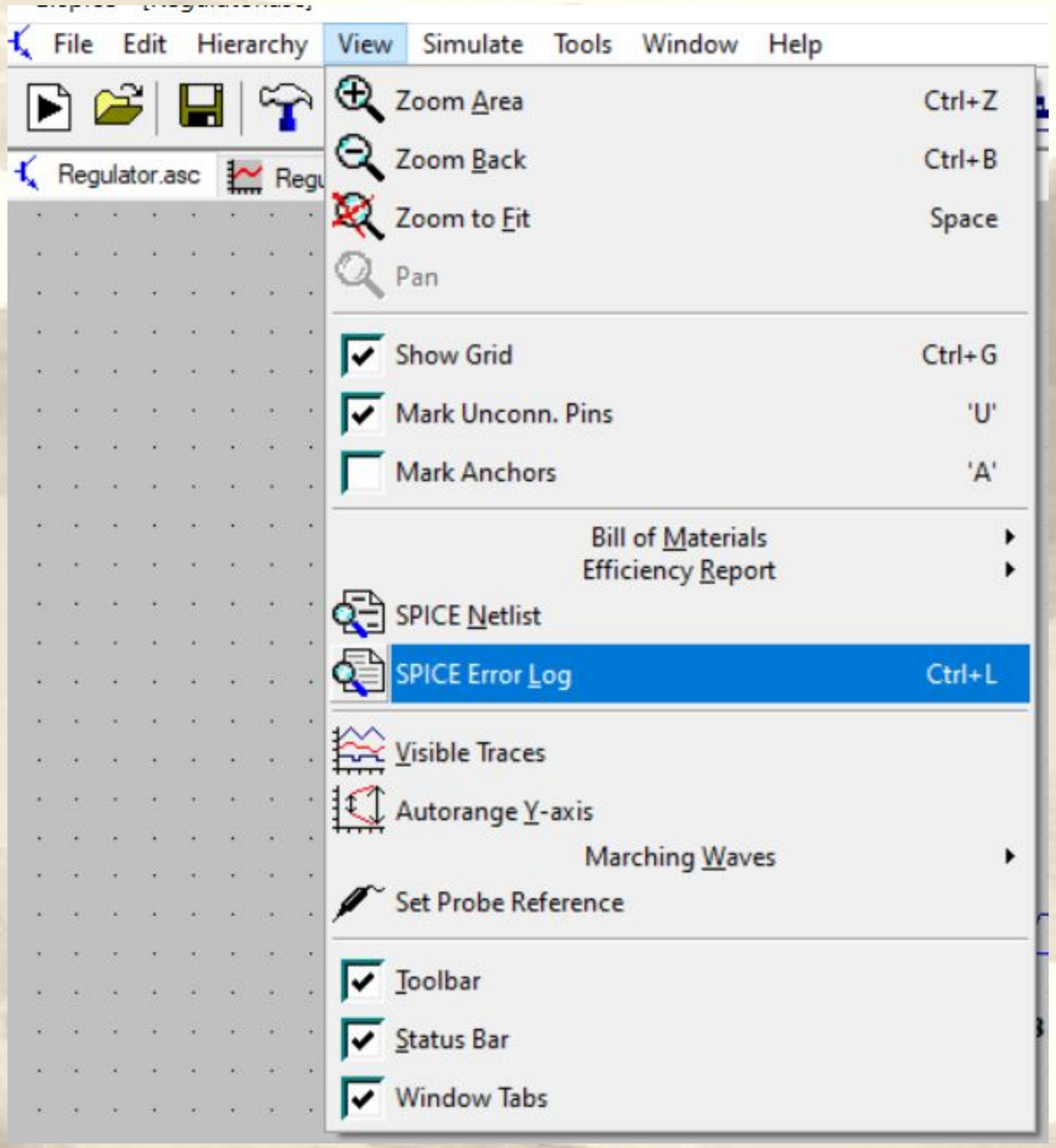
```
.MEAS Pout   RMS    I(R1)*V(VOUT)
.MEAS Pin    RMS    -I(V1)*V(VIN)
.MEAS Eff    PARAM  Pout/Pin
```

And after almost 3 hours, our simulation is ready.

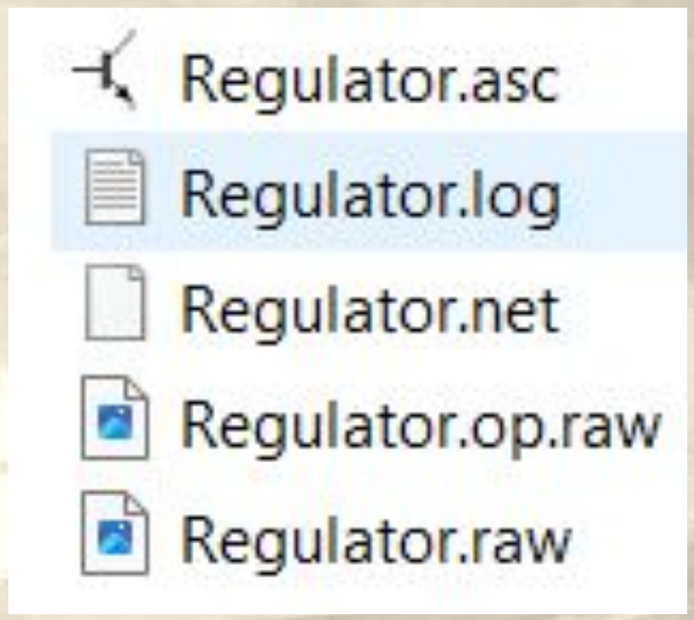


But where are the results?

To see the result, you need to open the SPICE Error Log.



The same result is also in the LOG file.



The first result is the Input and Output Power

Measurement: pout

step	RMS(i(r1)*v(vout))	FROM	TO
1	4.76401	0	1
2	2.3862	0	1
3	1.59184	0	1
4	1.1943	0	1
5	0.955645	0	1
6	0.796172	0	1
7	0.681996	0	1
8	0.600745	0	1

Measurement: pin

step	RMS(-i(v1)*v(vin))	FROM	TO
1	8.37983	0	1
2	4.24318	0	1
3	2.90619	0	1
4	2.25932	0	1
5	1.88599	0	1
6	1.64539	0	1
7	1.48095	0	1
8	1.36691	0	1

And here,
the efficiency of this circuit.

Measurement: eff

step	pout/pin
1	0.568509
2	0.562363
3	0.54774
4	0.528608
5	0.506707
6	0.483881
7	0.460511
8	0.43949

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