

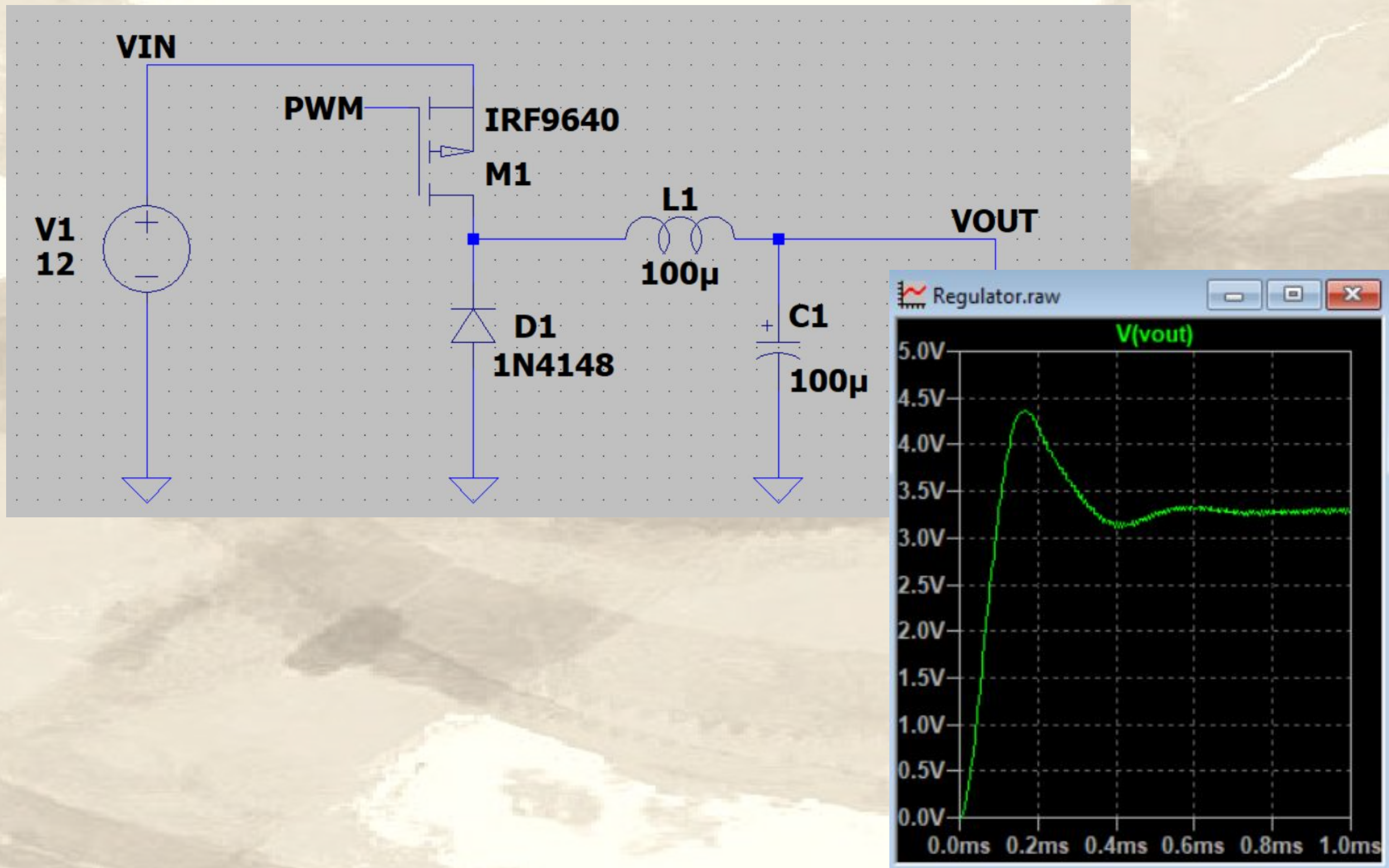
# Drops of LTSpice



Understanding and using  
the MEASURE Statement



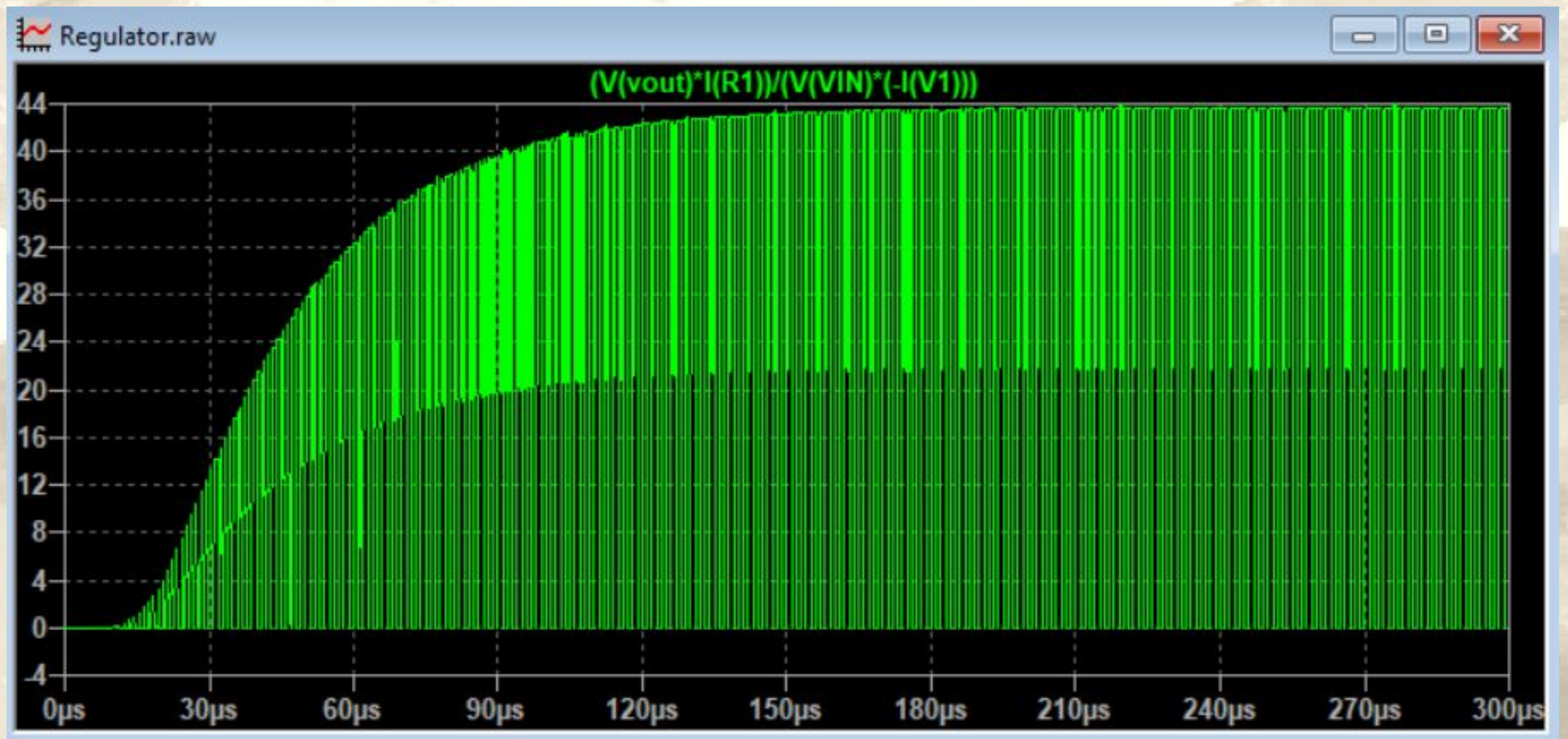
So, you created a really cool regulator, and it is working fine.



But how do you calculate how efficient your regulator is?



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

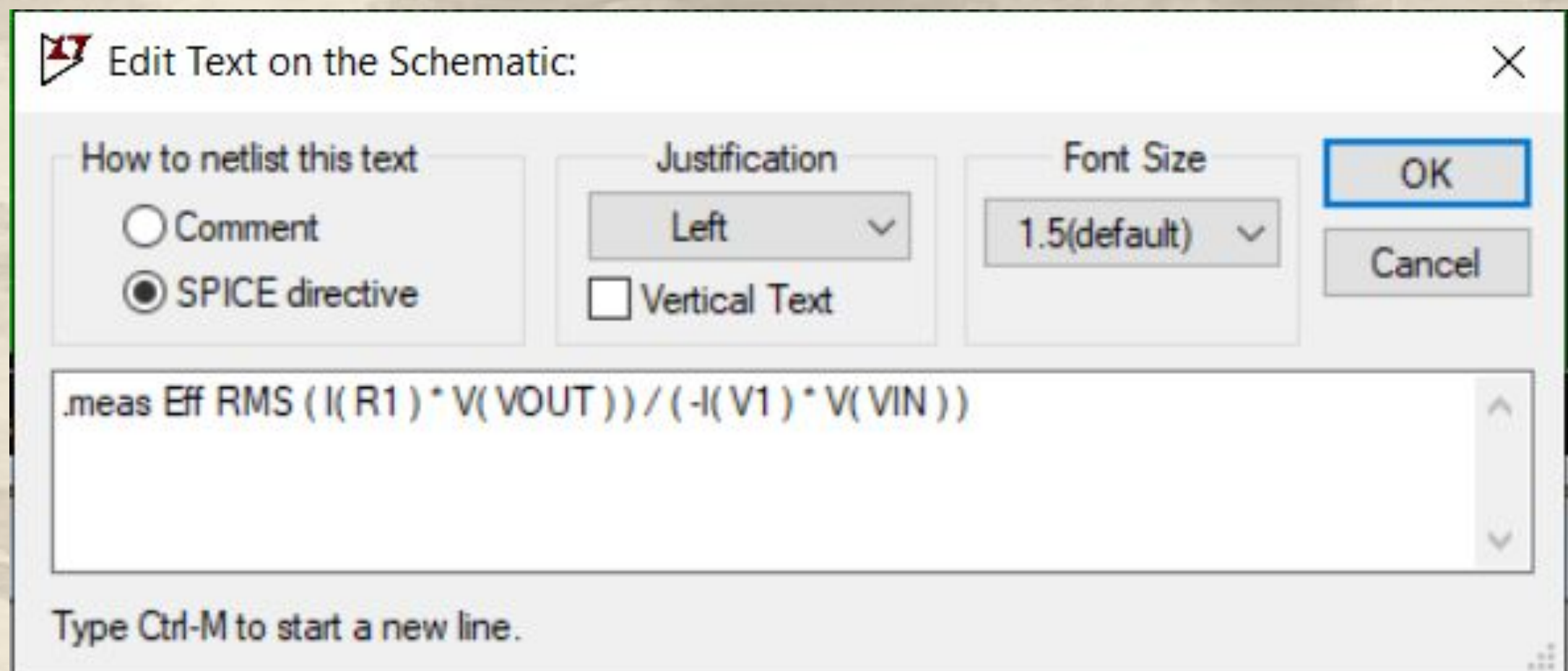


...but for a switching regulator, this is not an easy job.



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.



LTSpice Edit Text on the Schematic: [X]

How to netlist this text

☐ Comment

☒ SPICE directive

Justification

Left [v]

☐ Vertical Text

Font Size

1.5(default) [v]

OK

Cancel

.meas Eff RMS ( I( R1 ) \* V( VOUT ) ) / ( -I( V1 ) \* V( VIN ) )

Type Ctrl-M to start a new line.



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.

 .meas Statement Editor

.meas statements allow you to script measurements of waveform data.

Applicable Analysis: (any)

Result Name: Eff

Genre: RMS

Measured Quantity:  $(I(R1) * V(VOUT)) / (-I(V1) * V(VIN))$

Trig Condition

Right Hand Side:

TD:

Targ Condition

Right Hand Side:

TD:

Syntax : .MEAS <name> RMS <expr> TRIG <lhs> = <rhs> [TD = <val>] [<RISE|FALL|CROSS> = <count>] TARG <lhs> = <rhs> [TD = <val>] [<RISE|FALL|CROSS> = <count>]

.meas Eff RMS  $(I(R1) * V(VOUT)) / (-I(V1) * V(VIN))$

Test Cancel OK



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

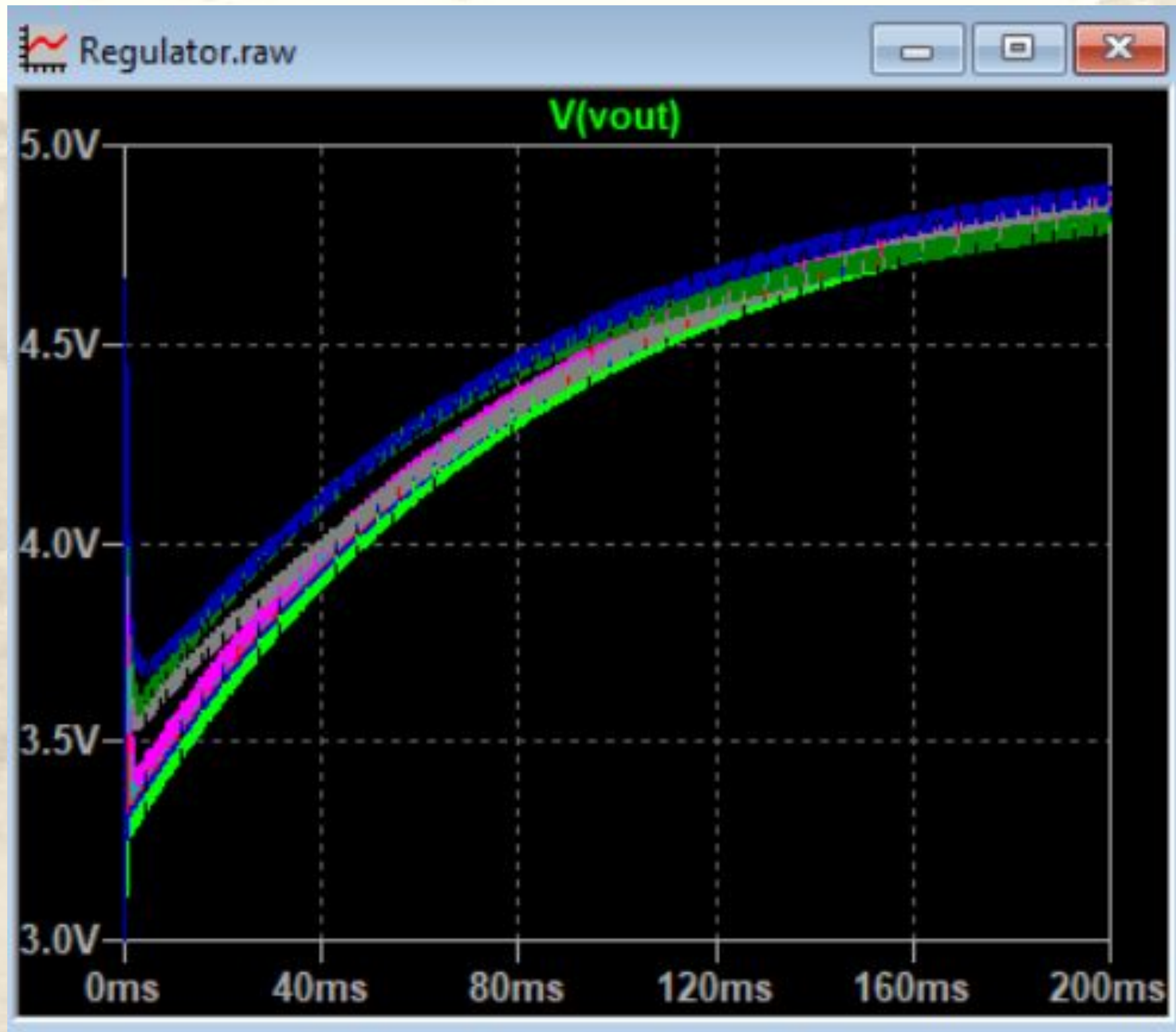
$$\eta = \frac{P_{OUT}}{P_{IN}} = \frac{V_{OUT} \cdot I_{R1}}{V_{IN} \cdot I_{V1}}$$

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
```



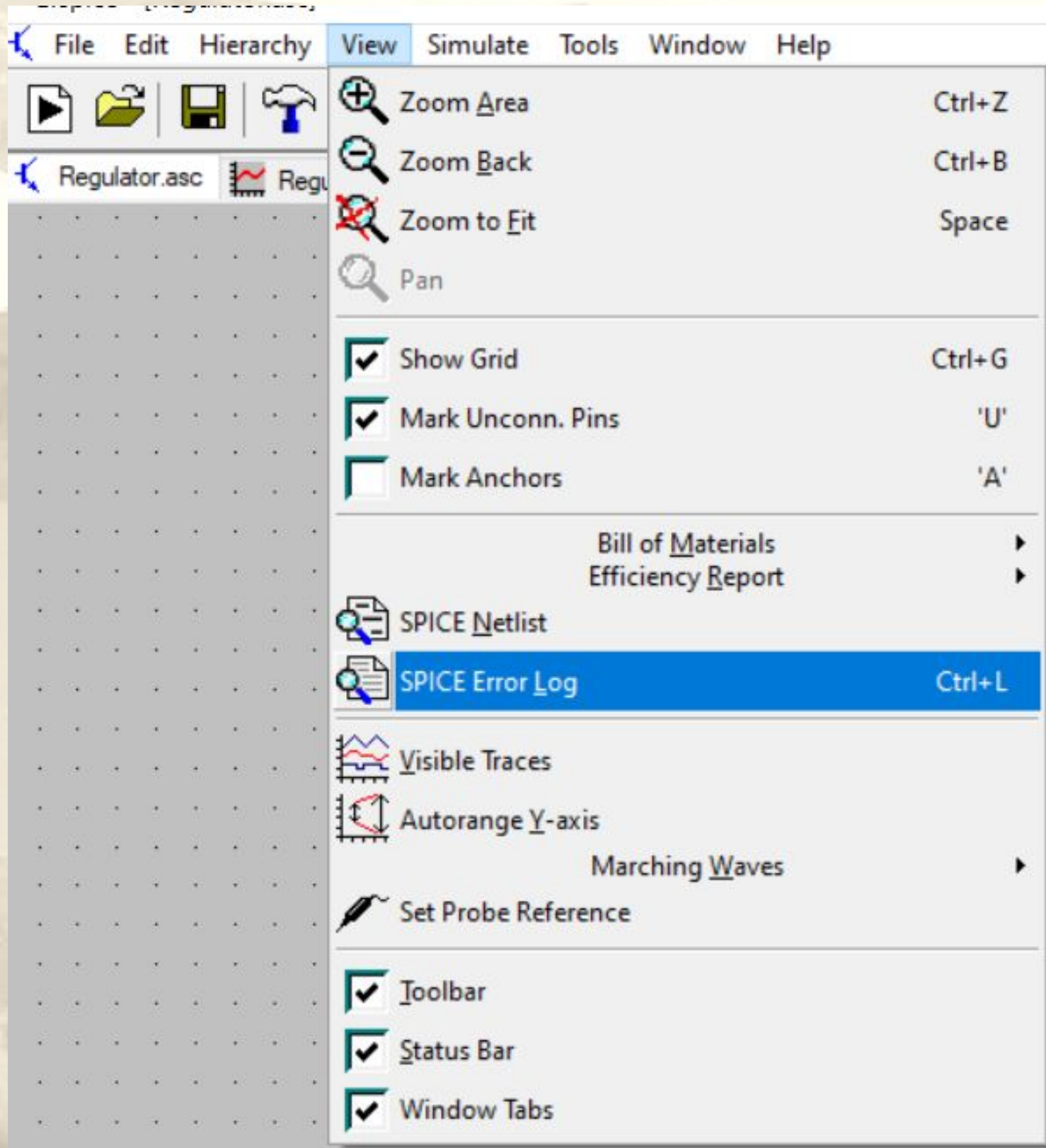
And after almost 3 hours, our simulation is ready.



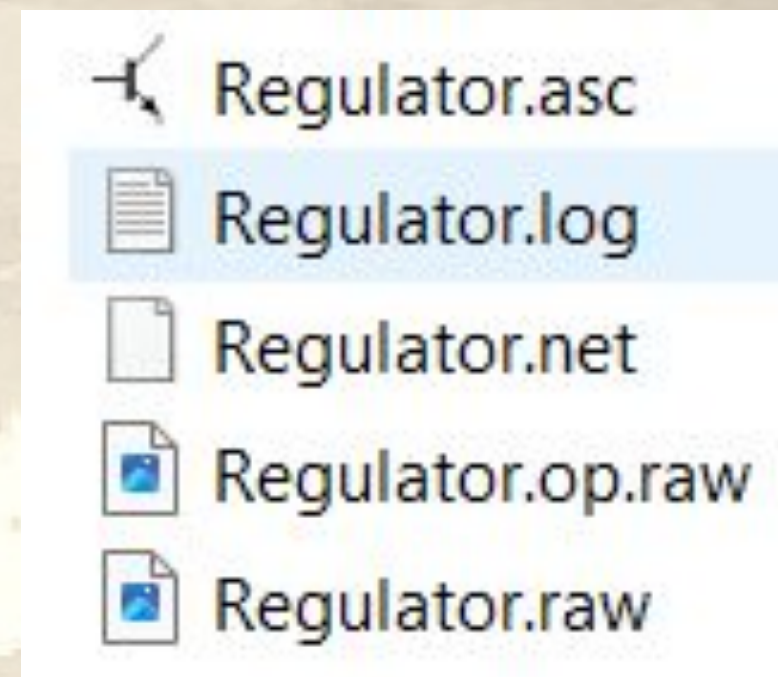
But where are the results?



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

Francesco Sacco  
[linkedin.com/in/saccofrancesco](https://www.linkedin.com/in/saccofrancesco)