Measuring Preamp Input Resistance in the Few to 50Ω Range

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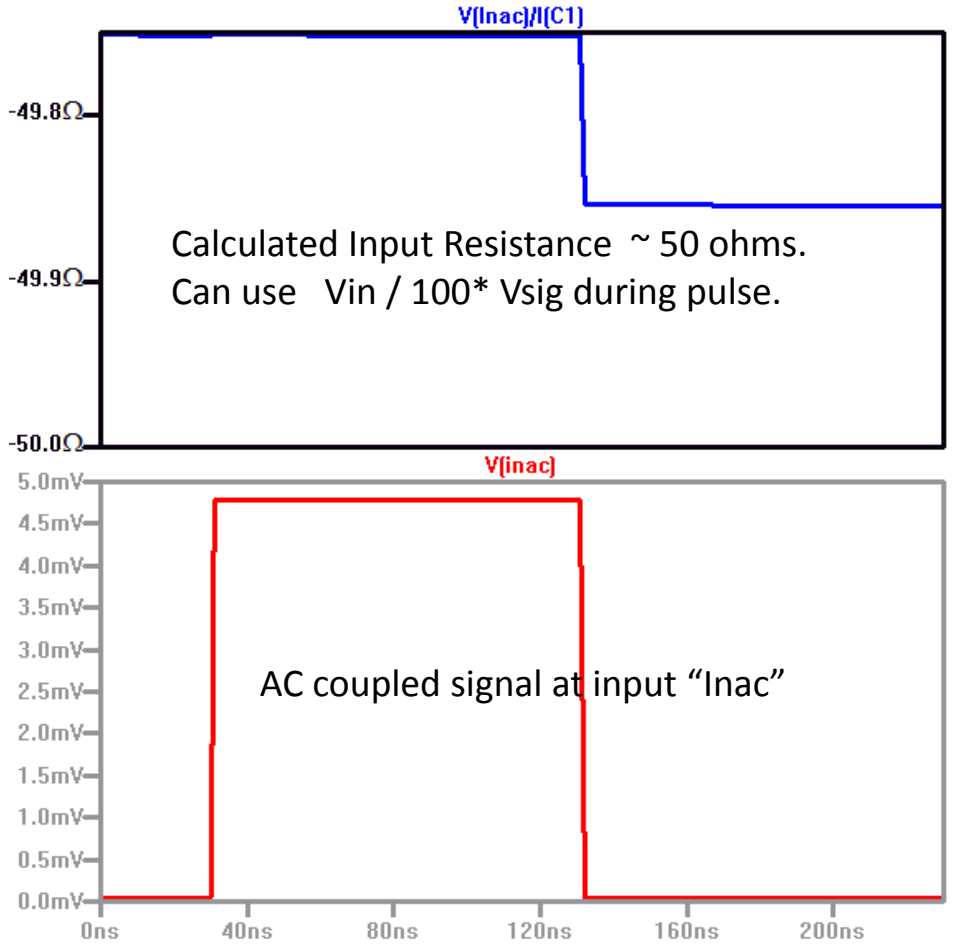
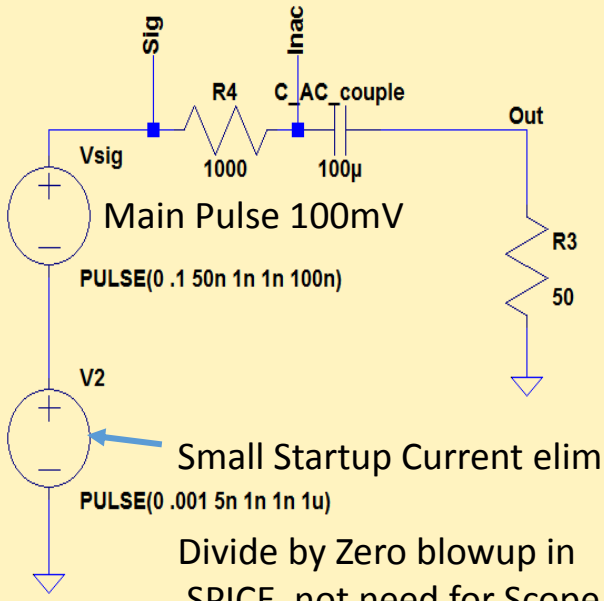
Limits and Technique of the Measurement

Basic Idea -

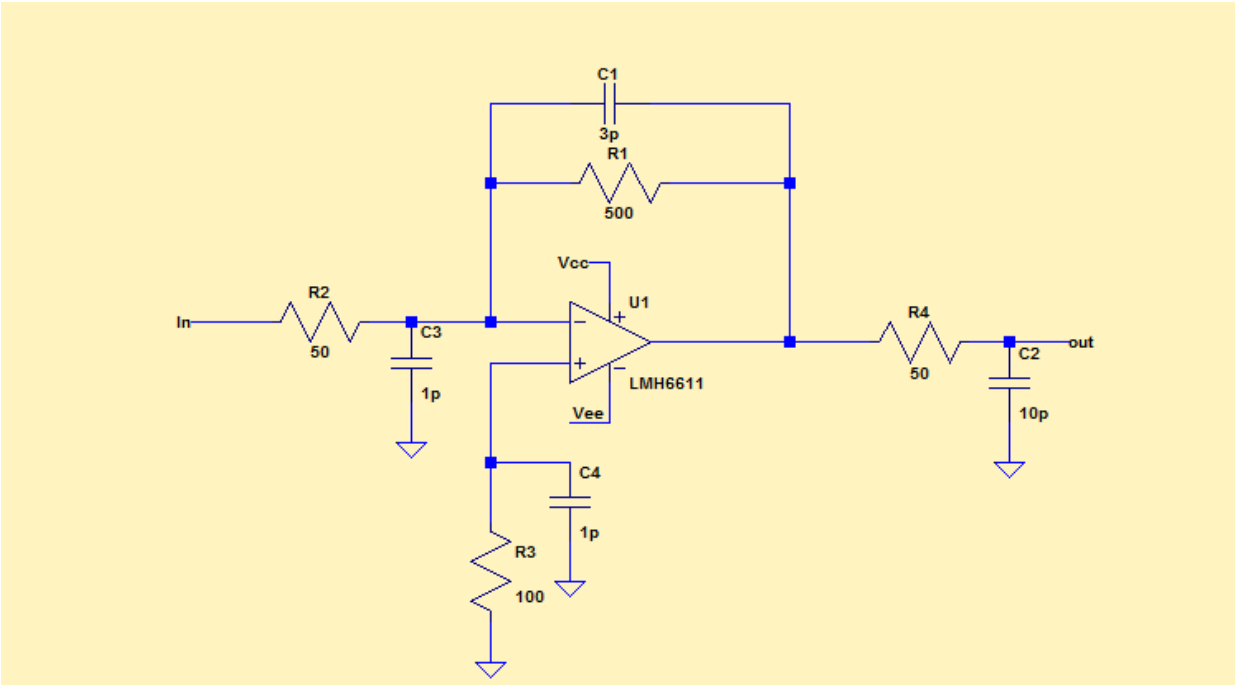
- Create a step current using a resistor in series between a voltage pulser and the input of the preamp that is large compared to the expected preamp input resistance. The resistor should be very close to the amplifier input to avoid pickup. The input current is easy to calculate, easier to estimate as V step. (Measure dV caused by the current pulse at the input not the absolute V.)
- Use as large of a voltage step as feasible to avoid output saturation. I use 100mV across a 1K ohm resistor here. It could easily be 1V across 10K or even better 5V if the amplifer output isn't near saturation.
- Measure the signal at the input with a scope probe. The signal at the input will be fairly small, mV or smaller. So use the averaging on the scope with a 1mV scale if possible. The bandwidth will be somewhat limited so larger is better but still not likely to be more than 10mV while the output is in its linear range. The objective is to get dVin/I = Zin
- This method is fine for a 50 Ω input impedance and the technique can be proven by simply using it on a 50 Ω. Resistor. Obviously if you can measure the input voltage on a 50 Ω resistor but it's too small to measure on the amplifier input, the Amp input is a lot smaller than 50Ω which may be good enough.

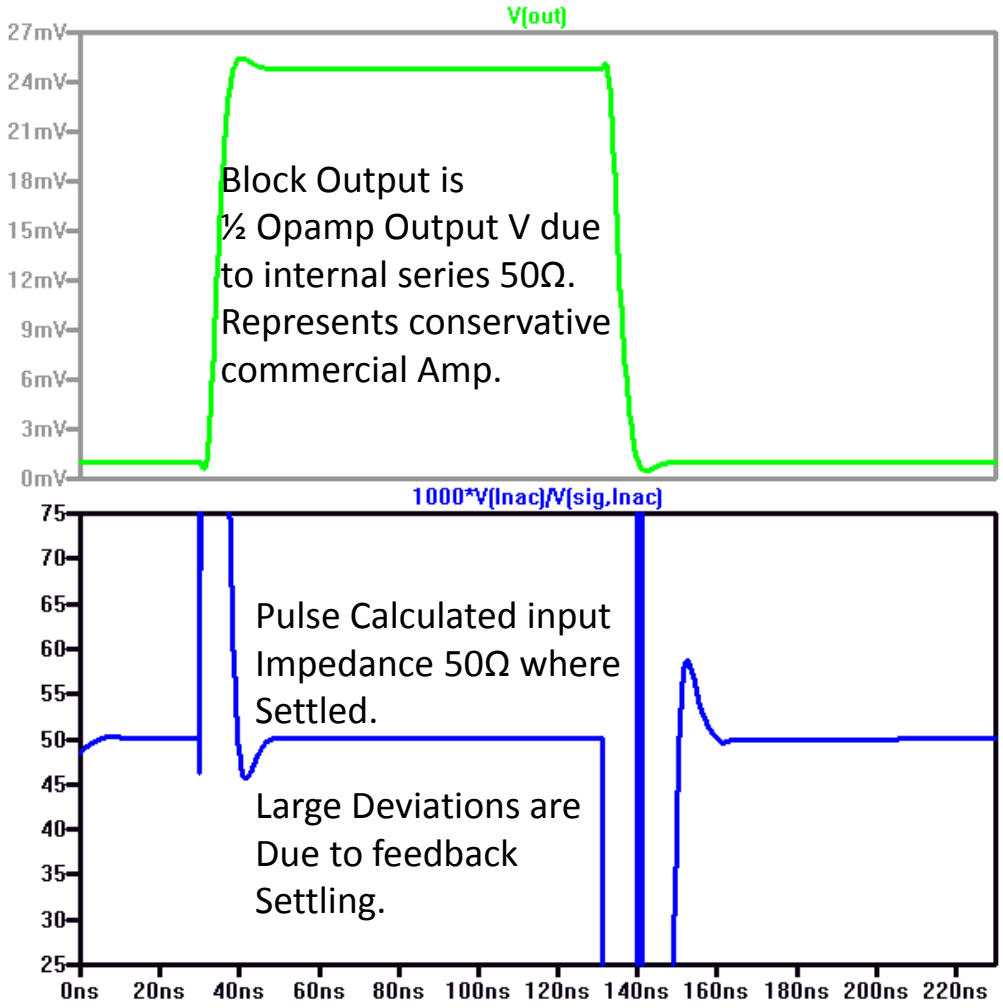
Pulse Technique to measure a 50Ω Resistor

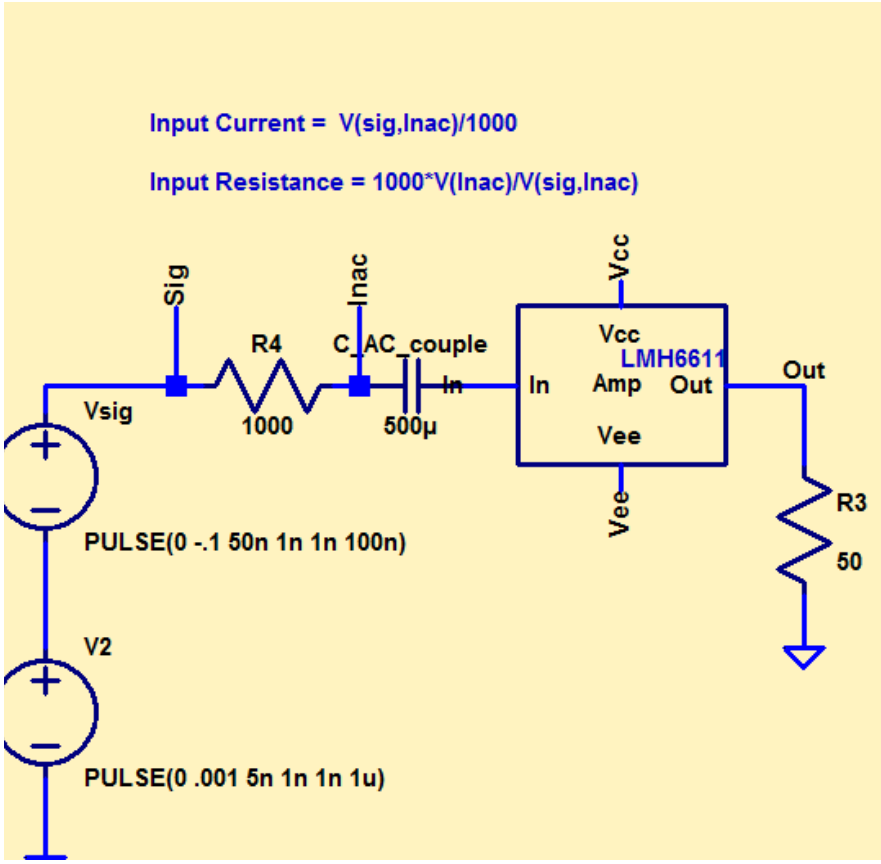




400MHz LMH Op Amp Gain ~10 input 50Ω to compare with 50Ω resistor.

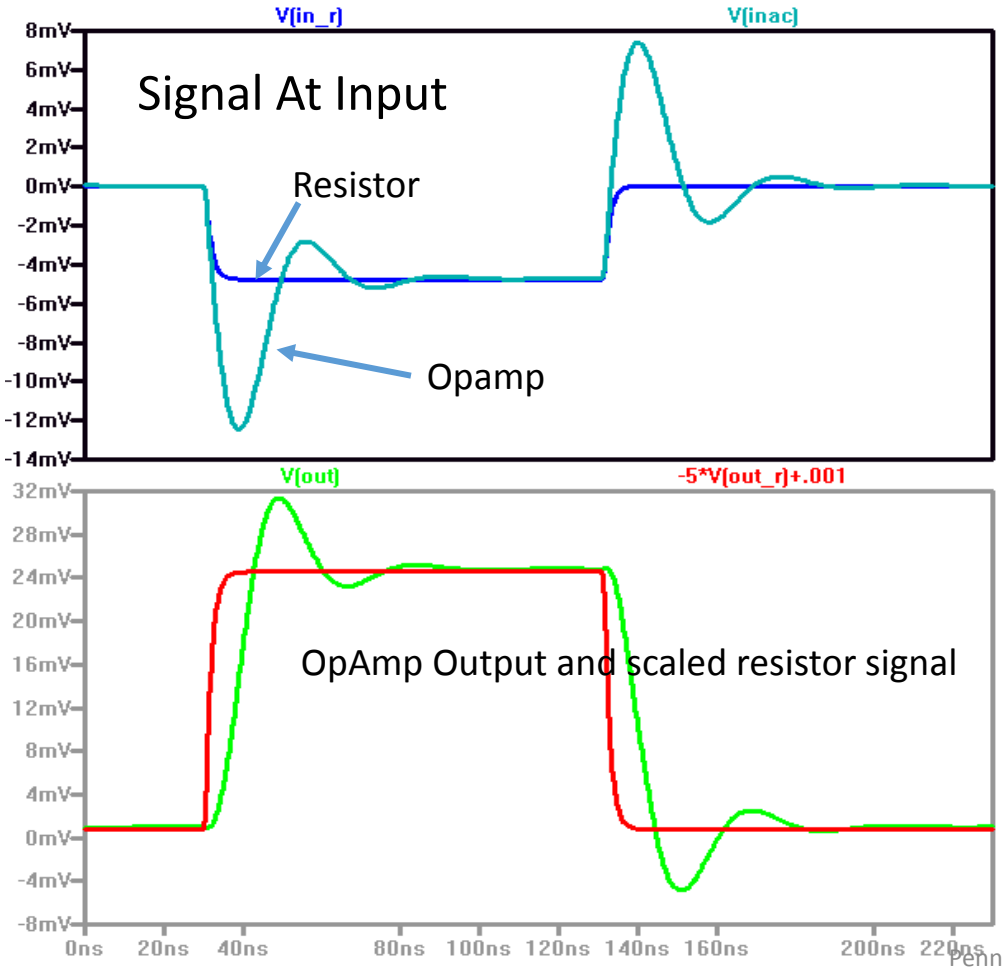


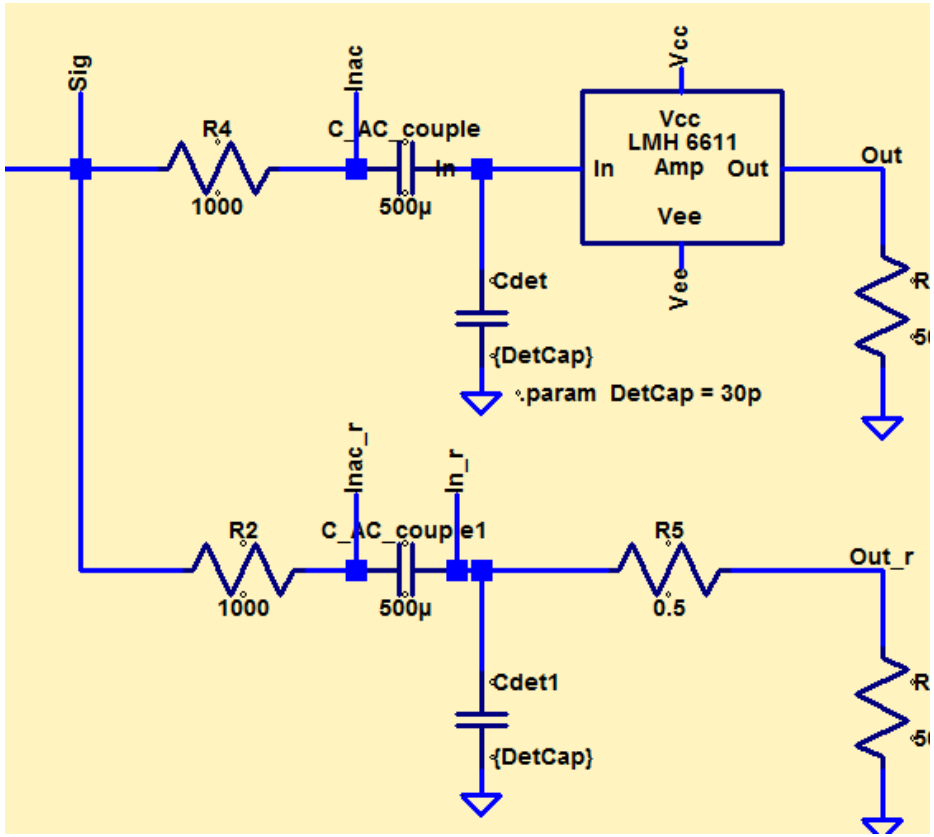

V(out)
27mV
24mV
21mV
18mV
15mV
12mV
9mV
6mV
3mV
0mV
Block Output is
½ Opamp Output V due
to internal series 50Ω.
Represents conservative
commercial Amp.
1000*V(Inac)/V(sig,Inac)
75
70
65
60
55
50
45
40
35
30
25
0ns
20ns
40ns
60ns
80ns
100ns
120ns
140ns
160ns
180ns
200ns
220ns
Pulse Calculated input
Impedance 50Ω where
Settled.
Large Deviations are
Due to feedback
Settling.


Input Current = V(sig,Inac)/1000
Input Resistance = 1000*V(Inac)/V(sig,Inac)
Sig
Inac
Vcc
R4
C_AC_couple
Vcc
LMH6611
In
Amp
Out
Out
Vsig
1000
500µ
In
Vee
R3
50
Vee
PULSE(0 -.1 50n 1n 1n 100n)
V2
PULSE(0 .001 5n 1n 1n 1u)

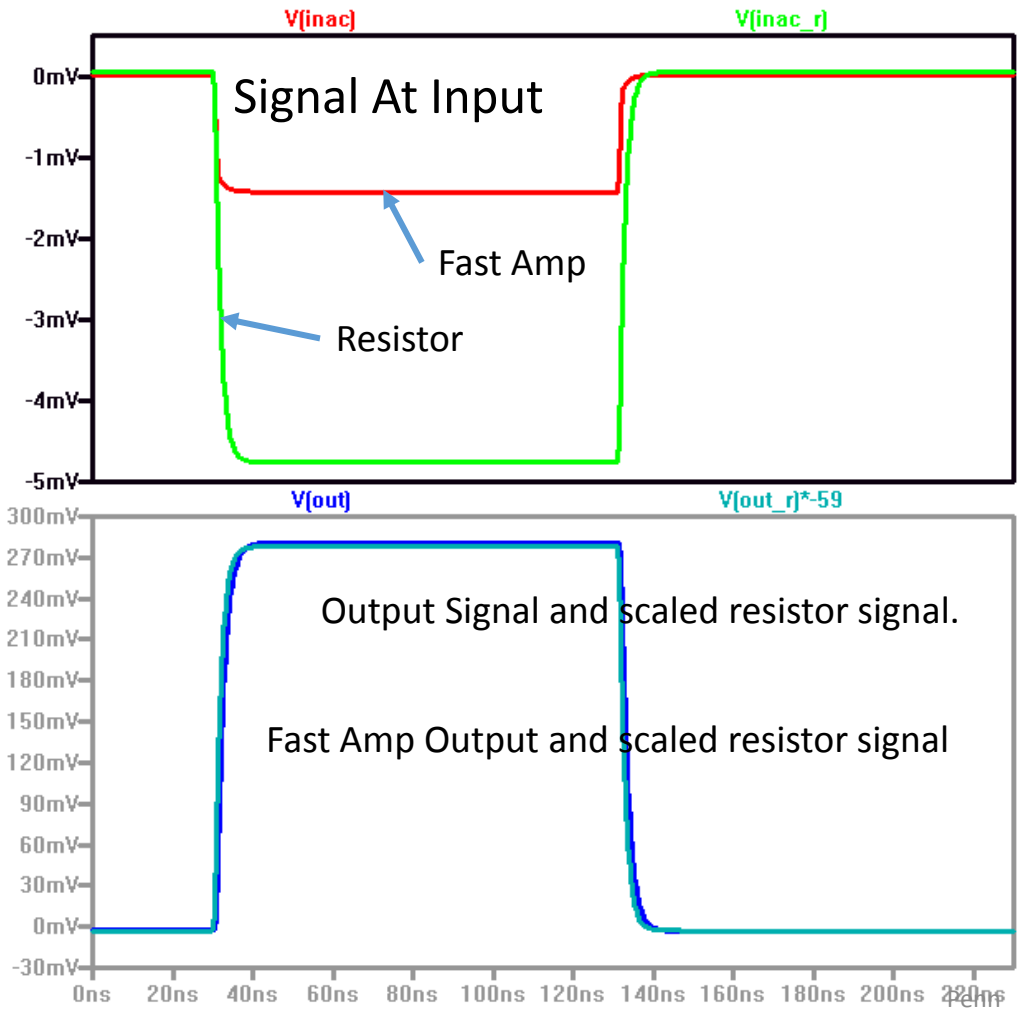
Add 30pF Capacitance

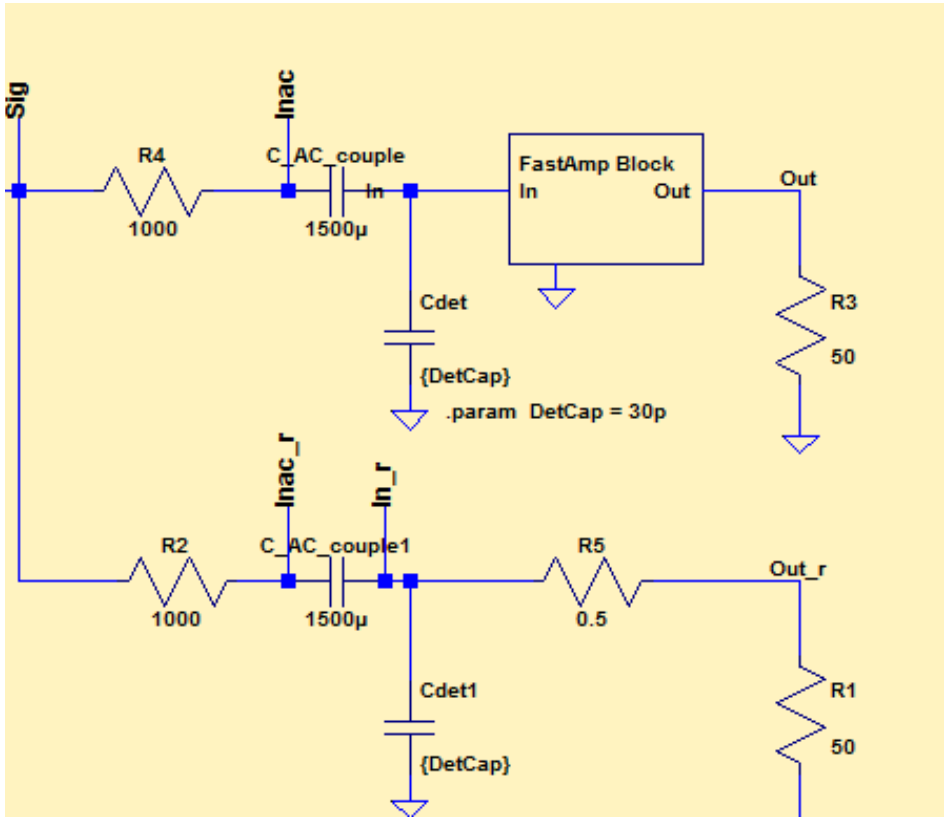
30pF Capacitance 50 Ω Resistor vs Opamp





Fast Amp and 50Ω





Pulse Calculated Input Resistance