FET Measurements with DMM

XEN Audio

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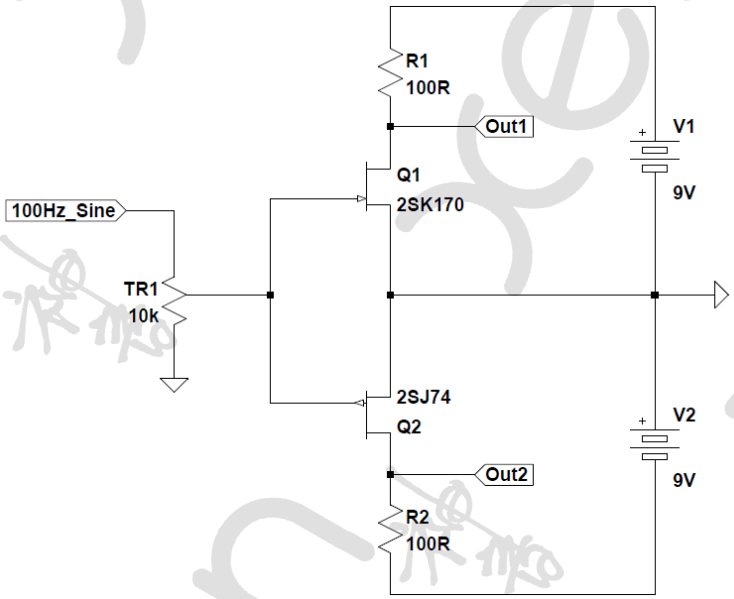
JFETs



The following is a poor men's method to do measure Idss and Yfs of JFETs (Vgs = 0)

Required :

3-pin DIL socket (for Device under Test, DUT)
Digital multimeter (DMM)
100R metal film resistor
9V battery
10k trimmer (preferably multi-turn)
Headphone output of PC / laptop

2SK170BL is used here as an example for the description below.
For 2SJ74 Polarity of PSU has to be reversed.

To measure Idss

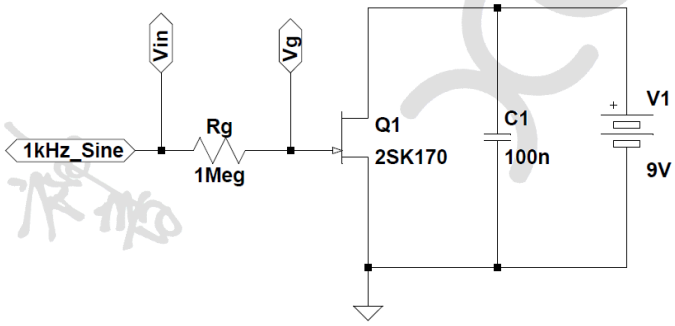
First connect JFET gate to the 10k trimmer wiper, and one of the 10k leads to the source, the third open (for now).
Can leave at any trim position.
Connect 0V to the source, and +9V to the drain via a 100R resistor.
Measure the DC voltage across the 100R resistor.
Divide by 100R, and you get Idss.

To measure Yfs at Idss

A signal source of a sine wave of 0.05Vrms 100Hz is needed.
This can be simply provided for by connecting the headphone output of the PC across the 10k pins of the trimmer. Headphone Gnd should be connected to the JFET source side. With the JFET

removed, play a 100Hz WAV file and adjust the trimmer until the G-S pins of the trimmer gives 0.05Vrms, measured by the DMM :
https://1soundfx.com/sound/57149-tec...conds-0db-loop
Then plug in the DUT, and measure the AC rms voltage across the 100R resistor via a 1µF film cap (to block off any DC).
This AC voltage divided by 5 will give you Yfs (at Idss).

To measure Ciss

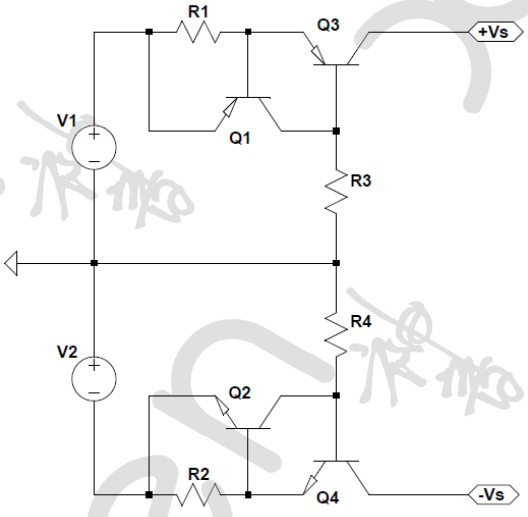


Use PC sound card to generate 1kHz 0.1Vrms sine wave, as above.
Vg needs to be measured via a high Zin buffer (OPA192 as unity gain follower).
Make sure DMM is capable of measuring AC voltage at 1kHz or above.

Ciss = vg x 1M / (Vin – Vg)

Current Limiter

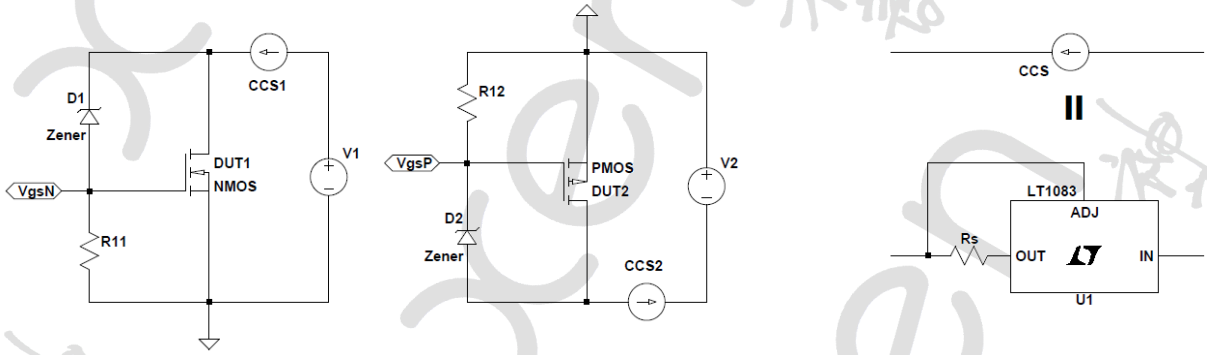
During FET testing it is useful to apply a current limit at the power supply. Most laboratory PSUs will have adjustable current limit. But in case one is needed, the following circuit can be made up with only a handful of components.



Q1, Q3 = BC560C
Q2, Q4 = BC550C
R1, R2 = 0.6V / I_limit = 22R
R3, R4 = 100k

MOSFETs

The following method allows you to measure Vgs and Yfs at bias of MOSFETs with Vds as in circuit.
It applies to any enhancement mode MOSFETs, including laterals with low Vgs voltages.



Again, note polarity differences between N & P MOS.
Make sure you use heat sinks for both DUT and CCS, the larger the better.

Before starting, you need to determine :

- Bias current
- Nominal Vgs at bias (from data sheet)
- Test Vds

Required :

- Digital Multimeter (DMM)
- Constant Current Source made from a LM317, with current at bias, 0.9x bias and 1.1x bias.
  (Use LT1083 for bias > 1A).
- Power supply capable of Test Vds + 5V, and current of 1.3x bias.
- Zener diode 0.5W, Zener voltage ≈ (Test Vds – Nominal Vgs at bias)
- 5k 0.25W metal film resistor
- Sufficient heat sinking for DUT and CCS

To measure Vgs at bias

Set CCS to bias, measure Vgs using DMM directly at the DUT leads.

To measure Yfs at bias

Set CCS to 0.9x bias, measure Vgs1 using DMM directly at the DUT leads.
Set CCS to 1.1x bias, measure Vgs2 using DMM directly at the DUT leads.
Yfs = 0.2x bias / (Vgs2 – Vgs1)

Current setting resistor Rs = 1.25V / Required Constant Current
For best stability, use a 10x over-rated, low tempco (< 50ppm/K) power resistor