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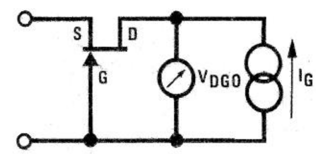
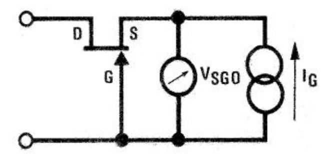
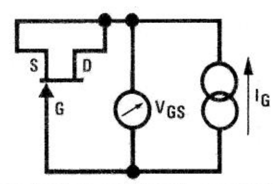
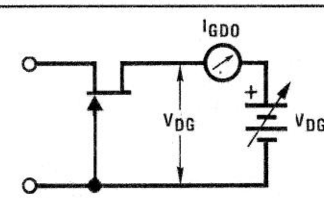
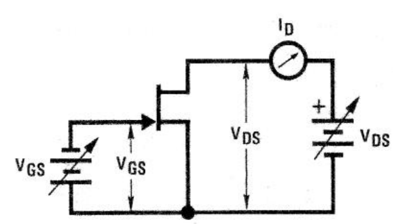
AN-6608
Glossary of JFET Measurement Parameters

Summary

The Glossary provides details on how to measure, and refer to, various JFET parameters to assure that the JFET meets its specifications and will function correctly in an application. It also provides test circuits and a system of names, terms and rules to refer to, or define, each parameter.

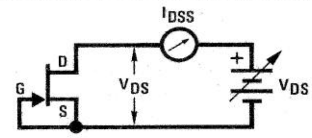
DC PARAMETERS		
BV_{DGO} (V) or BV_{GDO}	**Drain-Gate Breakdown Voltage with Source Open-Circuited** The breakdown voltage of the drain-gate junction, measured at a specified current with the source open-circuited.	
BV_{SGO} (V) or BV_{GSO}	**Source-Gate Breakdown Voltage with Drain Open-Circuited** The breakdown voltage of the source-gate junction, measured at a specified current, with the drain open-circuited.	
BV_{GSS} (V) or BV, $V_{(BR)GSS}$	**Source-Gate Breakdown Voltage with Drain-Source Shorted** The breakdown voltage of the source-gate and drain-gate junctions, measured at a specified current with the drain-source shorted.	
I_{DGO} (pA) or I_{GDO}	**Drain-Gate Leakage Current, Source Open-Circuited** The leakage current of the drain-gate junction, measured at a specified voltage, with the source open-circuited.	
I_D (μA) or $I_{D(ON)}$	**Drain ON Current** The drain current, measured at a specified drain-source voltage and gate-source voltage.	
$I_{D(OFF)}$ (pA)	**Drain Cutoff Current** The drain cutoff current, measured at a specified drain-source voltage and gate-source voltage.	

DC PARAMETERS

I_{DSS} (mA)

Drain Saturation Current

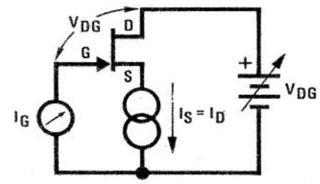
The drain current, measured at a specified drain-source voltage with the source shorted to the gate ($V_{GS} = 0$)



I_G (pA) or $I_{G(ON)}$

Gate Leakage Current with Drain Current Flowing

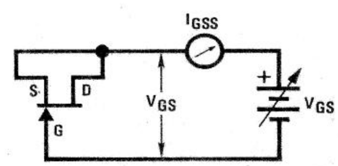
The gate leakage current, measured at a specified drain current and drain-gate voltage.



I_{GSS} (pA)

Gate-Source Reverse Leakage Current with Drain-Source Shorted

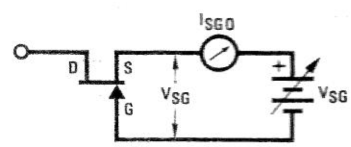
The gate-source reverse leakage current measured at a specified gate-source voltage.



I_{SGO} (pA) or I_{GSO}

Source-Gate Reverse Leakage Current with Drain Open-Circuited

The leakage current of the source-gate junction, measured at a specified voltage, with the drain open-circuited.



r_{DS} (Ω) or r_{ds}, R_{DS}, $r_{DS(ON)}$

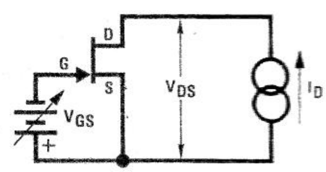
Drain-Source ON Resistance

The drain-source ON resistance, measured at a specified gate-source voltage and drain current.

$V_{DS(ON)}$ (mV)

Drain-Source ON Voltage

The drain-source ON voltage, measured at a specified gate-source voltage and drain current.

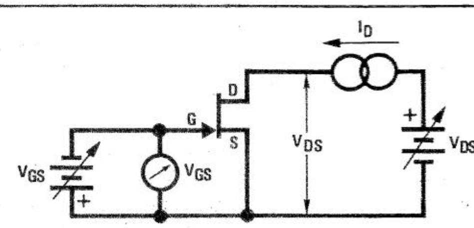


$$r_{DS} = \frac{V_{DS}}{I_D}$$

V_{GS} (V) or $V_{GS(ON)}$, V_G

Operating Gate-Source Voltage

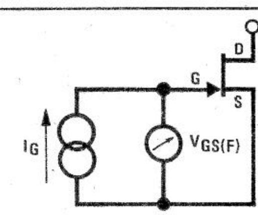
The gate-source voltage, measured at a specified drain current and drain-source voltage.



$V_{GS(F)}$ (V)

Forward Gate-Source Voltage

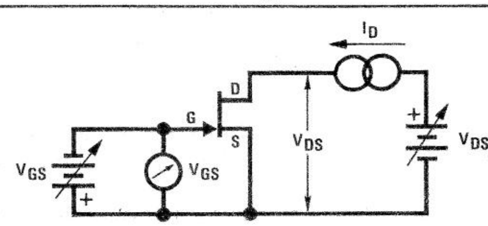
The forward gate-source voltage, measured at specified current.



$V_{GS(OFF)}$ (V) or V_P

Gate-Source Cutoff (Pinch-Off) Voltage

The gate-source cutoff voltage, measured at a specified drain current and drain-source voltage.

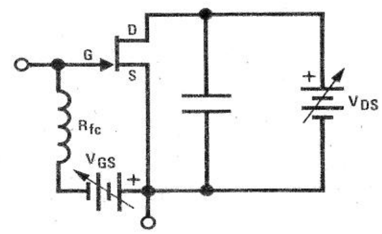


SMALL SIGNAL PARAMETERS

C_{iss} (pF)
or C_{iss}, C_{gss}

Common-Source Input Capacitance

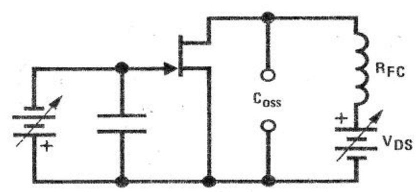
The common-source input capacitance measured between the gate and source with the drain A–C shorted to the source at specified drain-source and gate-source voltages.



C_{oss} (pF)
or C_{os}, C_{dss}

Common-Source Output Capacitance

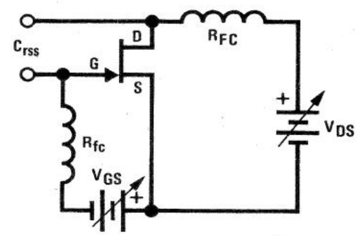
The common-source output capacitance, measured between the drain and source with the source A–C shorted to the gate at specified drain-source and gate-source voltages.



C_{rss} (pF)
or C_{rs}, C_{dg}

Common-Source Reverse Transfer Capacitance

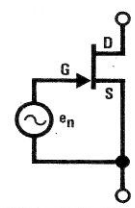
The common-source reverse transfer capacitance, measured between the drain and gate at specified drain-source and gate source voltages.



e_n (nV/$\sqrt{Hz}$)
or e_n, V_n, E_n

Equivalent Input Noise Voltage

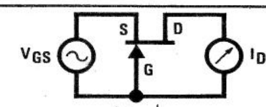
The equivalent input noise voltage per unit bandwidth, measured with the input A–C shorted to the source at a specified operating condition.



g_{fg} (mV)
or y_{fg}

Common- Gate Forward Transconductance

The common-gate forward transconductance with the output A–C shorted. This is a complex quantity ($g_{fg} + jb_{fg}$).



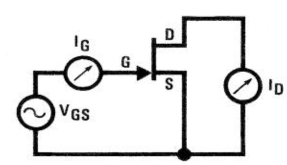
$$Y_{fg} = \left.\frac{I_D}{V_{GS}}\right|_{V_{DS}=0}$$

g_{fs} (mV)
or g_m, Y_{fs},
Re|Y_{fs}|

Common-Source Forward Transconductance

The common source forward transconductance with the output A–C shorted. This is a complex quantity ($g_{fs} + jb_{fs}$).

$$Y_{fs} = \left.\frac{I_D}{V_{GS}}\right|_{V_{DS}=0}$$



g_{iss} (μV)
or Y_{is}

Common-Source Input Conductance

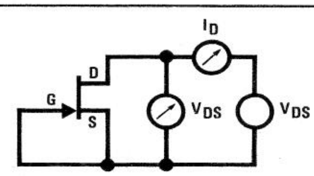
The common–source input conductance with the output A–C shorted. This is a complex quantity ($g_{is} + jb_{is}$).

$$Y_{is} = \left.\frac{I_G}{V_{GS}}\right|_{V_{DS}=0}$$

g_{oss} (μV)
or Y_{os}

Common-Source Output Conductance

The common source output conductance with the input A–C shorted. This is a complex quantity ($g_{os} + jb_{os}$).



$$Y_{os} = \left.\frac{I_D}{V_{DS}}\right|_{V_{GS}=0}$$

SMALL SIGNAL PARAMETERS

G_{pg} (dB) — **Common-Gate Power Gain**

The common-gate power gain is the ratio of output power to input power.

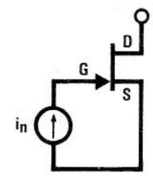
G_{PS} (dB) — **Common-Source Power Gain**

The common-source power gain is the ratio of output power to input power.

$$G_p = 10 \log_{10} \frac{P_O}{P_I},$$

i_n (pA/$\sqrt{Hz}$) — **Equivalent Input Noise Current**

The equivalent input noise current measured with the input open-circuited under specified operating conditions.



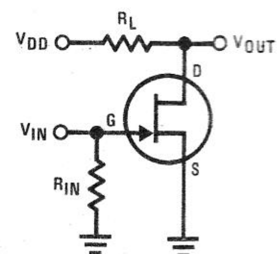
NF (dB) — **Spot Noise Figure**

Noise figure = 10 $\log_{10}$ F were F is noise factor which is the ratio of the total output noise power to the output noise power of the source. Measured at specified operating conditions and source resistance.

$$F = \frac{\text{Total Output Noise Power}}{\text{Source Output Noise Power}}$$

COMMON-SOURCE SWITCHING PARAMETERS

In the following, drive circuit conditions and drain circuit conditions must be specified. The transition times of the input must be negligible compared to the measured times.



$t_{d(ON)}$ — **Turn-On Delay Time**

The time interval during turn-on from the point when the input pulse at the gate reaches 10% of its full amplitude to the point when the drain pulse changes from 0 to 10% of its maximum amplitude.

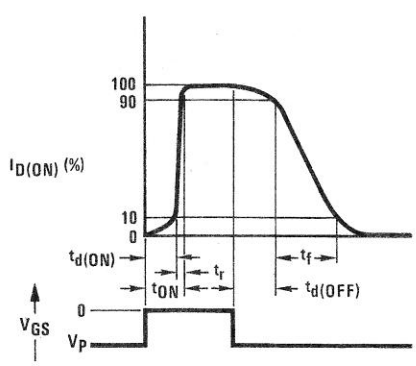
$$I_{D(ON)} = \frac{V_{DD} - V_{DS(ON)}}{R_L}$$

t_r — **Rise Time**

The time interval during turn-on in which the drain current pulse changes from 10% to 90% of its maximum amplitude.

$t_{d(OFF)}$ — **Turn-Off Delay Time**

The time interval during turn-off from the point when the turn-off pulse at the gate changes from 100% to 90% of its full amplitude to the time when the drain current has changed from 100% to 90% of its maximum amplitude.



t_f — **Fall Time**

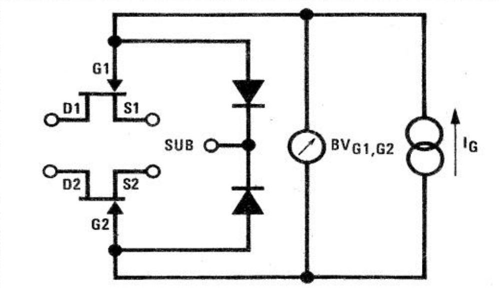
The time interval during turn-off in which the drain current pulse decreases from 90% to 10% of its maximum amplitude.

DUAL FET PARAMETERS

$BV_{G1,\,G2}$ (V) or BV_{G1-2}

Gate to Gate Breakdown Voltage

The breakdown voltage of the gate to gate junctions, measured at a specified current.

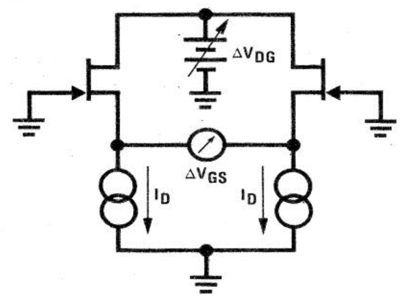


CMRR (dB) or CMR

Common-Mode Rejection Ratio

The common-mode rejection ratio is the ratio of the change in differential gate voltage with a change in the drain to gate voltage.

$$CMRR = 20 \log_{10} \frac{\Delta V_{DG}}{\Delta V_{os}}$$



g_{fs1-2} (%) or g_{fs1}/g_{fs2}

Common-Source Forward Transconductance Ratio (Match)

The transconductance ratio = $g_{fs1}/g_{fs2} \times 100$ (%) measured at specified drain-gate voltage and drain current.

$g_{oss\,1\text{-}2}$ (μV) or g_{os1-2}

Common-Source Output Conductance (Match)

Output conductance match = $|g_{os1} - g_{os2}|$ measured at specified drain-gate voltage and drain current.

I_{DSS1-2} (%) or I_{DS1-2}, I_{DSS1}/I_{DSS2}

Drain Saturation Current Ratio (Match)

The drain saturation current ratio = $I_{DSS1}/I_{DSS2} \times 100\%$ measured at specified drain-source voltages.

I_{G1-2} (pA)

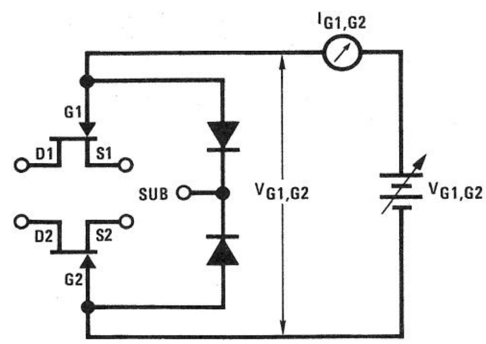
Differential Gate Leakage Current

Differential gate leakage current = $|I_{G1} - I_{G2}|$ measured at specified drain-gate voltage and drain current.

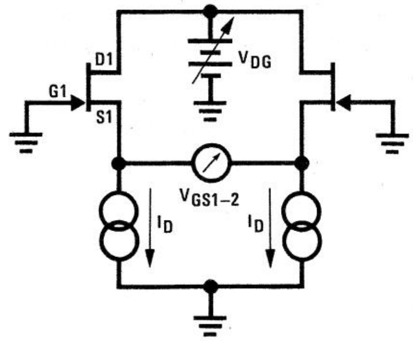
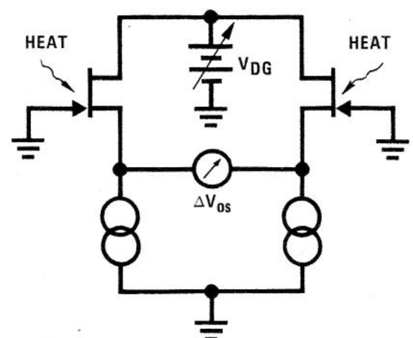
$I_{G1,\,G2}$ (pA)

Gate to Gate Reverse Leakage Current

The gate to gate reverse leakage measured at a specified voltage monolithic dual with diode isolation shown.



DUAL FET PARAMETERS

V_{GS1-2} (mV) or ΔV_{GS}, V_{os}, $\lvert V_{GS1}-V_{GS2}\rvert$	**Differential Gate-Source Voltage** The differential gate-source voltage, measured at a specified drain-gate voltage and drain current.	
ΔV_{GS1-2} (μV/°C) or $\Delta \lvert V_{GS1}-V_{GS2}\rvert/\Delta T$ $\Delta V_{os}/\Delta T$	**Differential Gate-Source Voltage Drift** The differential gate-source voltage drift is the change in the differential gate-source voltage with a change in device temperature at a specified operating condition. $$\frac{\Delta V_{os}}{\Delta T} = \left\lvert \frac{(V_{GS1}-V_{GS2})\lvert_{T1} - (V_{GS1}-V_{GS2})\lvert_{T2}}{T_1-T_2} \right\rvert$$	

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