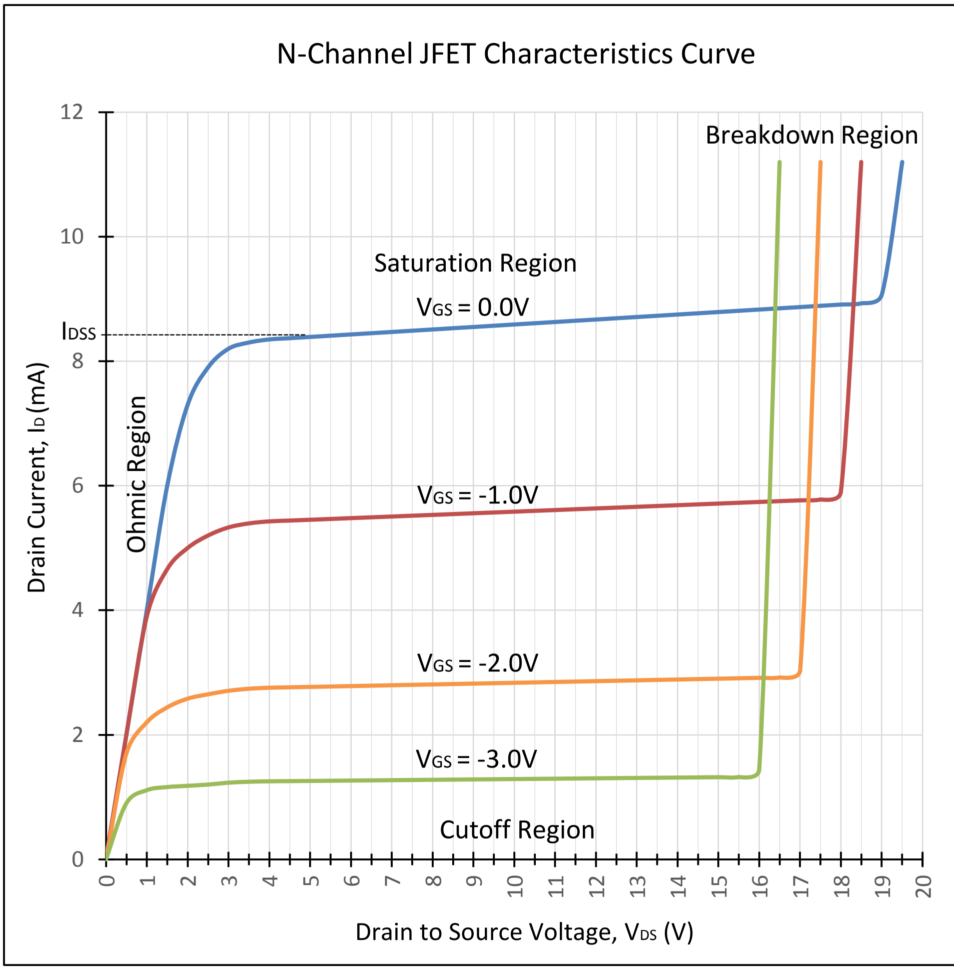
# Application Note : Common Parameters & Equations



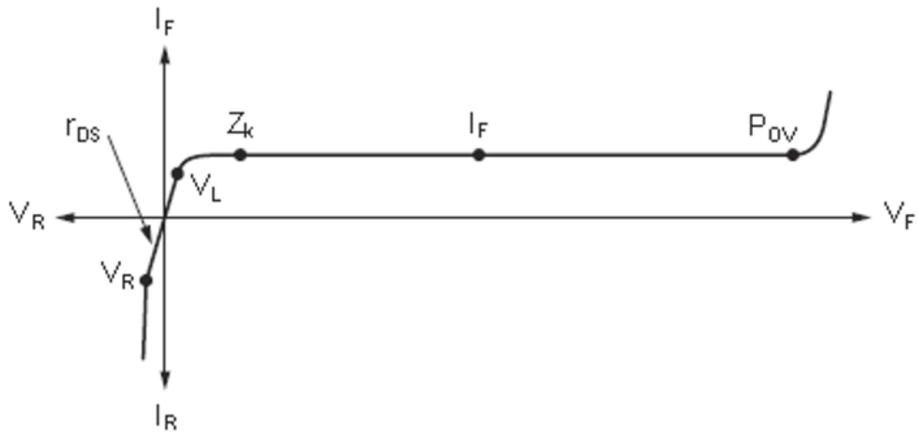

## JFET Parameters

| Equations | Description |
|---|---|
| $C_{ISS} = C_{GS} + C_{GD}$ | Common Source Input Capacitance. |
| $C_{OSS} = C_{DS} + C_{GS} + C_{BD}$ | Common Source Output Capacitance. |
| $C_{RSS} = C_{QD}$ | Reverse Feedback Capacitance. |
| $G_{FSO} = \dfrac{K\, I_{DSS}}{I_{DSS(OFF)}}$ | Forward transconductance as a function of $I_{DSS}$ and $V_{GS(OFF)}$ at zero gate-source voltage (K= 1.5 to 2.5, typically 2 for N-channel JFETs). |
| $G_{FS} = G_{FSO} \dfrac{(1 - V_{GS})}{V_{GS(OFF)}}$ | Variation of $G_{FS}$ with gate bias. Forward common source transconductance. |
| $G_{FS} = G_{FSO}\sqrt{I_D}/I_{DSS}$ | Variation of $G_{FS}$ with drain current. Forward common-source transconductance. |

## JFET Parameters (Continued)

| Equations | Description |
|---|---|
| $I_{GSS}$ | Gate-Source cutoff voltage in terms of $I_{DSS}$ and $G_{FSO}$. |
| $V_{GS(F)}$ | Gate reverse current with the Drain shorted to the Source. |
| $V_{GS(OFF)} = \frac{2\ I_{DSS}}{G_{FSO}}$ | Gate-Source Forward Voltage. |
| $V_{DS} = \frac{V_{GS(OFF)}(I_D)^2}{G_{FSO}}$ | Drain voltage at which drain current saturates. |
| $R_{DS} = 1/G_{FS}$ | Reciprocal relationship between drain-source resistance and forward transconductance. Accurate when $V_{DS} < V_{GS(OFF)}$ (in the triode region). |
| $R_{DS} = \frac{(V_{GS(OFF)})^2}{K\ I_{DSS}(V_{GSS})^2}$ | K= 1.5 to 2.5, typically 2 for N-channel JFETs. (Variation of drain resistance in the triode region) |
| $I_D = \frac{I_{DSS}(1 - V_{GSS})^2}{V_{GS(OFF)}}$ | Variation of drain current with gate-source voltage. The square law transfer characteristic. |
| $NF = 10\ Log_{10}\left(\frac{1 + {e_N}^2 + {I_N}^2{R_G}^2}{4KTR_GB}\right)$ | Noise Figure in which $R_G$ is the equivalent Gate resistance, T is absolute temperature, B is bandwidth in Hz, k is Boltzmann's constant 1.38E-23 J/˚K |
| ${e_N}^2 = \frac{(4kTB\ 0.63)^2}{V_{GS(OFF)}}$ | Equivalent Short-Circuit Input Noise Voltage. |
| $V_P = V_{GS(OFF)}$ | Pinch-off Voltage is very similar to Gate Source Cutoff Voltage – The Voltage at the transition point from the Linear Region to the Saturation Region. |
| $V_{(BR)GSS}$ | Breakdown Voltage with the Gate short circuited to the Source. The maximum Voltage the device can be operated at without damage. |
| $I_{DZ} = I_{DSS}\frac{I_{DSS}\ (0.63)^2}{V_{GS(OFF)}}$ | Drain Current at the Zero TC point. The biasing point on the $I_D$ vs. $V_{GS}$ Transfer Characteristic chart where the mobility factor and the depletion factor offset the changes in drain current relative to temperature. |
| $V_{GZ} = V_{GS(OFF)} + 0.7V$ | The Zero temperature coefficient gate voltage is about 7/10th of a Volt above the Gate Source Cutoff Voltage. |
| $I_{DSS}$ | Saturation drain current with the Gate shorted to the Source. (Max Drain Current) |
| $A_V = \frac{G_{FS}R_s}{1 + G_{FS}R_s}$ | The Voltage Gain at the Source with a resistor $R_S$ between the Source and Ground. |

## Current Regulator Diode Characteristic Curve




### Current Regulator Diode Parameters

| Equations | Description |
|---|---|
| $PoV$ | Peak Operating Voltage – Also known as the Breakdown Voltage |
| $I_{PoV}$ | Current at the Peak Operating Voltage |
| $V_K$ | Knee Voltage – Also known as the Pinch-off Voltage – The Voltage at the transition point from the Linear Region to the Saturation Region. |
| $I_K$ | Knee Current – Current at the Knee Voltage. |
| $I_F$ | Forward Current – The Current flowing through the device in the Saturation region. |
| $V_F$ | Forward Voltage – The Voltage across the device during operation. |
| $Z_D = \frac{I_{PoV} - I_K}{PoV - V_K}$ | Dynamic Impedance – The slope of the I-V curve in the saturation region. |
| $Z_K$ | Knee Impedance – The Impedance at the Knee point. |