

Important MESFET Characteristics Formulas PDF



Formulas Examples with Units

List of 13 Important MESFET Characteristics Formulas

1) Cut-off Frequency Formula

Formula

$$f_{co} = \frac{V_s}{4 \cdot \pi \cdot L_{gate}}$$

Example with Units

$$30.0519 \text{ Hz} = \frac{5 \text{ mm/s}}{4 \cdot 3.1416 \cdot 13.24 \mu\text{m}}$$

Evaluate Formula 

2) Cut-off Frequency given Transconductance and Capacitance Formula

Formula

$$f_{co} = \frac{g_m}{2 \cdot \pi \cdot C_{gs}}$$

Example with Units

$$30.0292 \text{ Hz} = \frac{0.05 \text{ s}}{2 \cdot 3.1416 \cdot 265 \mu\text{F}}$$

Evaluate Formula 

3) Cut-off Frequency using Maximum Frequency Formula

Formula

$$f_{co} = \frac{2 \cdot f_m}{\sqrt{\frac{R_d}{R_s + R_g + R_i}}}$$

Example with Units

$$30.0535 \text{ Hz} = \frac{2 \cdot 65 \text{ Hz}}{\sqrt{\frac{450 \Omega}{5.75 \Omega + 2.8 \Omega + 15.5 \Omega}}}$$

Evaluate Formula 

4) Drain Resistance of MESFET Formula

Formula

$$R_d = \left(\frac{4 \cdot f_m^2}{f_{co}^2} \right) \cdot (R_s + R_g + R_i)$$

Evaluate Formula 

Example with Units

$$450.104 \Omega = \left(\frac{4 \cdot 65 \text{ Hz}^2}{30.05 \text{ Hz}^2} \right) \cdot (5.75 \Omega + 2.8 \Omega + 15.5 \Omega)$$

5) Gate Length of MESFET Formula

Formula

$$L_{gate} = \frac{V_s}{4 \cdot \pi \cdot f_{co}}$$

Example with Units

$$13.2408 \mu\text{m} = \frac{5 \text{ mm/s}}{4 \cdot 3.1416 \cdot 30.05 \text{ Hz}}$$

Evaluate Formula 



6) Gate Metallization Resistance Formula

Formula

$$R_g = \left(\frac{R_d \cdot f_{co}^2}{4 \cdot f_m^2} \right) - (R_s + R_i)$$

Evaluate Formula 

Example with Units

$$2.7944 \Omega = \left(\frac{450 \Omega \cdot 30.05 \text{ Hz}^2}{4 \cdot 65 \text{ Hz}^2} \right) - (5.75 \Omega + 15.5 \Omega)$$

7) Gate Source Capacitance Formula

Formula

$$C_{gs} = \frac{g_m}{2 \cdot \pi \cdot f_{co}}$$

Example with Units

$$264.8169 \mu\text{F} = \frac{0.05 \text{ s}}{2 \cdot 3.1416 \cdot 30.05 \text{ Hz}}$$

Evaluate Formula 

8) Input Resistance Formula

Formula

$$R_i = \left(\frac{R_d \cdot f_{co}^2}{4 \cdot f_m^2} \right) - (R_g + R_s)$$

Evaluate Formula 

Example with Units

$$15.4944 \Omega = \left(\frac{450 \Omega \cdot 30.05 \text{ Hz}^2}{4 \cdot 65 \text{ Hz}^2} \right) - (2.8 \Omega + 5.75 \Omega)$$

9) Maximum Frequency of Oscillation given Transconductance Formula

Formula

$$f_m = \frac{g_m}{\pi \cdot C_{gs}}$$

Example with Units

$$60.0585 \text{ Hz} = \frac{0.05 \text{ s}}{3.1416 \cdot 265 \mu\text{F}}$$

Evaluate Formula 

10) Maximum Frequency of Oscillations in MESFET Formula

Formula

$$f_m = \left(\frac{f_t}{2} \right) \cdot \sqrt{\frac{R_d}{R_g}}$$

Example with Units

$$65.2882 \text{ Hz} = \left(\frac{10.3 \text{ Hz}}{2} \right) \cdot \sqrt{\frac{450 \Omega}{2.8 \Omega}}$$

Evaluate Formula 



11) Source Resistance Formula

Formula

$$R_s = \left(\frac{R_d \cdot f_{co}^2}{4 \cdot f_m^2} \right) - (R_g + R_i)$$

Example with Units

$$5.7444\Omega = \left(\frac{450\Omega \cdot 30.05\text{Hz}^2}{4 \cdot 65\text{Hz}^2} \right) - (2.8\Omega + 15.5\Omega)$$

Evaluate Formula 

12) Transconductance in MESFET Formula

Formula

$$g_m = 2 \cdot C_{gs} \cdot \pi \cdot f_{co}$$

Example with Units

$$0.05s = 2 \cdot 265\mu\text{F} \cdot 3.1416 \cdot 30.05\text{Hz}$$

Evaluate Formula 

13) Transconductance in Saturation Region Formula

Formula

$$g_m = G_o \cdot \left(1 - \sqrt{\frac{V_i - V_g}{V_p}} \right)$$

Example with Units

$$0.051s = 0.174s \cdot \left(1 - \sqrt{\frac{15.9v - 9.62v}{12.56v}} \right)$$

Evaluate Formula 



Variables used in list of MESFET Characteristics Formulas above

- **C_{gs}** Gate Source Capacitance (Microfarad)
- **f_{co}** Cut-off Frequency (Hertz)
- **f_m** Maximum Frequency of Oscillations (Hertz)
- **f_t** Unity Gain Frequency (Hertz)
- **g_m** Transconductance (Siemens)
- **G_o** Output Conductance (Siemens)
- **L_{gate}** Gate Length (Micrometer)
- **R_d** Drain Resistance (Ohm)
- **R_g** Gate Metallization Resistance (Ohm)
- **R_i** Input Resistance (Ohm)
- **R_s** Source Resistance (Ohm)
- **V_g** Gate Voltage (Volt)
- **V_i** Schottky Diode Potential Barrier (Volt)
- **V_p** Pinch Off Voltage (Volt)
- **V_s** Saturated Drift Velocity (Millimeter per Second)

Constants, Functions, Measurements used in list of MESFET Characteristics Formulas above

- **constant(s):** pi, 3.14159265358979323846264338327950288
Archimedes' constant
- **Functions:** sqrt, sqrt(Number)
A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- **Measurement: Length** in Micrometer (μm)
Length Unit Conversion 
- **Measurement: Speed** in Millimeter per Second (mm/s)
Speed Unit Conversion 
- **Measurement: Frequency** in Hertz (Hz)
Frequency Unit Conversion 
- **Measurement: Capacitance** in Microfarad (μF)
Capacitance Unit Conversion 
- **Measurement: Electric Resistance** in Ohm (Ω)
Electric Resistance Unit Conversion 
- **Measurement: Electric Conductance** in Siemens (S)
Electric Conductance Unit Conversion 
- **Measurement: Electric Potential** in Volt (V)
Electric Potential Unit Conversion 
- **Measurement: Transconductance** in Siemens (S)
Transconductance Unit Conversion 



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