

GaAs N-channel Dual-Gate MES FET

Description

3SK166 is a GaAs N-channel Dual-Gate MES FET for low noise UHF amplifiers. Low noise and high gain characteristics are accomplished by optimum mask pattern design. Easier high frequency circuits adjustments are made possible by the miniaturized plastic molded package which contributes to reduce parasitic elements of the device.

Features

- Low NF NF = 1.2 dB (Typ.) at 800 MHz
- High PG PG = 2.0 dB (Typ.) at 800 MHz
- High Stability

Structure

GaAs N-channel Dual-Gate MES (Metal Semiconductor) type FET.

Applications

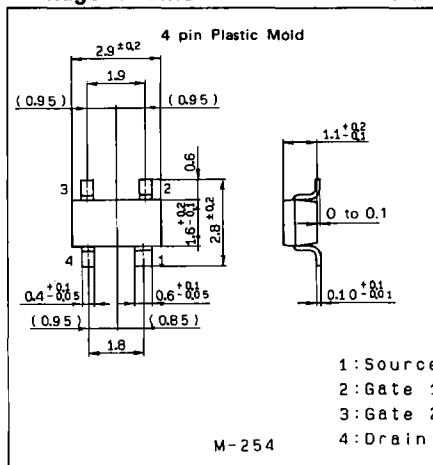
- UHF Amplifier, oscillator.

Absolute Maximum Ratings (Ta=25°C)

• Drain to source voltage	V _{DSX}	8	V
• Gate 1 to source voltage	V _{G1S}	-6	V
• Gate 2 to source voltage	V _{G2S}	-6	V
• Drain current	I _D	80	mA
• Channel temperature	T _{ch}	150	°C
• Storage temperature	T _{stg}	-55 to +150	°C
• Allowable power dissipation	P _D	150	mW

Package Outline

Unit: mm



Electrical Characteristics

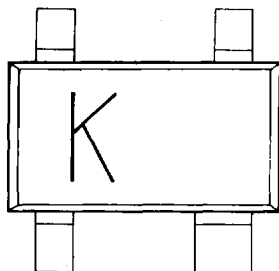
Ta=25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain to source voltage	V _{DSX}	I _D = 200 μA V _{G1S} = 0V V _{G2S} = -5V	8			V
Gate 1 cutoff current	I _{G1SS}	V _{G1S} = -5V V _{G2S} = 0V V _{DS} = 0V			-20	μA
Gate 2 cutoff current	I _{G2SS}	V _{G2S} = -5V V _{G1S} = 0V V _{DS} = 0V			-20	μA
Drain saturation current	I _{DSS} *	V _{DS} = 5V V _{G1S} = 0V V _{G2S} = 0V	20		80	mA
Gate 1 cutoff voltage	V _{G1S} (OFF)	V _{DS} = 5V I _D = 100 μA V _{G2S} = 0V	-1		-4	V
Gate 2 cutoff voltage	V _{G2S} (OFF)	V _{DS} = 5V I _D = 100 μA V _{G1S} = 0V	-1		-4	V
Forward transfer admittance	g _m	V _{DS} = 5V I _D = 10mA V _{G2S} = 1.5V f = 1KHz	25	40		mS
Input capacitance	C _{iss}	V _{DS} = 5V I _D = 10mA V _{G2S} = 1.5V f = 1MHz		1.3	2.0	pF
Reverse transfer capacitance	C _{rss}	V _{DS} = 5V I _D = 10mA V _{G2S} = 1.5V f = 1MHz		25	40	fF
Power gain	PG	V _{DS} = 5V I _D = 10mA V _{G2S} = 1.5V	18	20		dB
Noise figure	NF	V _{DS} = 5V I _D = 10mA V _{G2S} = 1.5V f = 800MHz		1.2	2.5	dB

* Classification

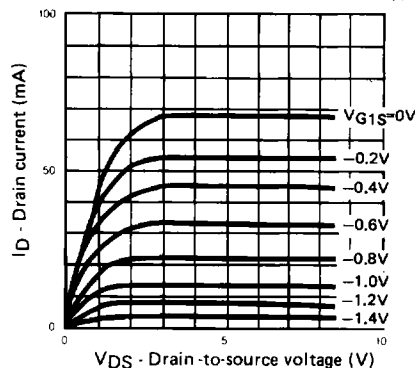
Rank	I _{DSS}	Unit
3SK166-0	20-80	mA
3SK166-1	30-55	mA
3SK166-2	45-80	mA

Mark



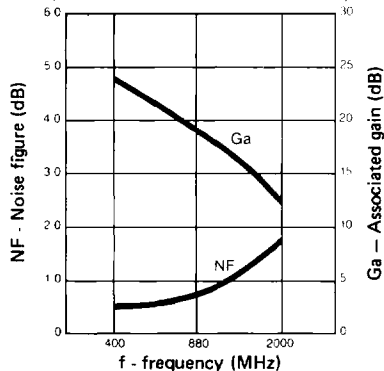
Output characteristics

($T_a=25^\circ\text{C}$, $V_{G2S}=1.5\text{V}$, $V_{G1S}=-0.2\text{V/step}$)



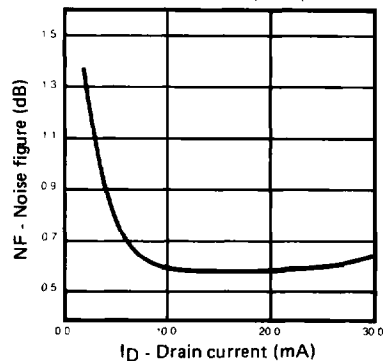
NF, Ga frequency dependence

($V_{DS}=10\text{V}$, $V_{G2S}=1.5\text{V}$, $I_D=10\text{mA}$)

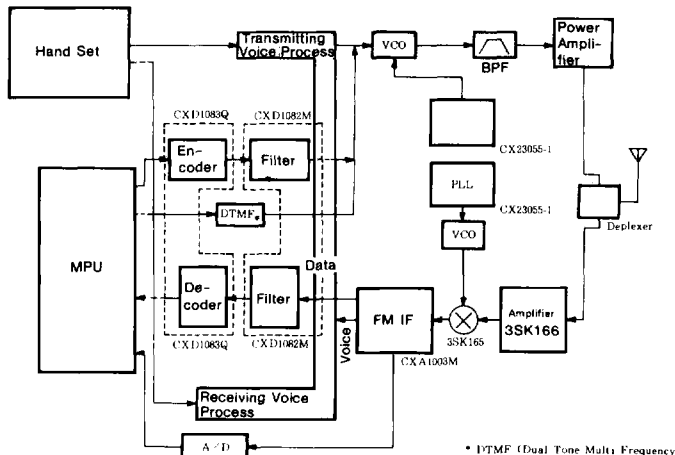


NF- I_D characteristics

($V_{DS}=5.0\text{V}$, $V_{G2S}=1.5\text{V}$, Frequency at 450MHz)



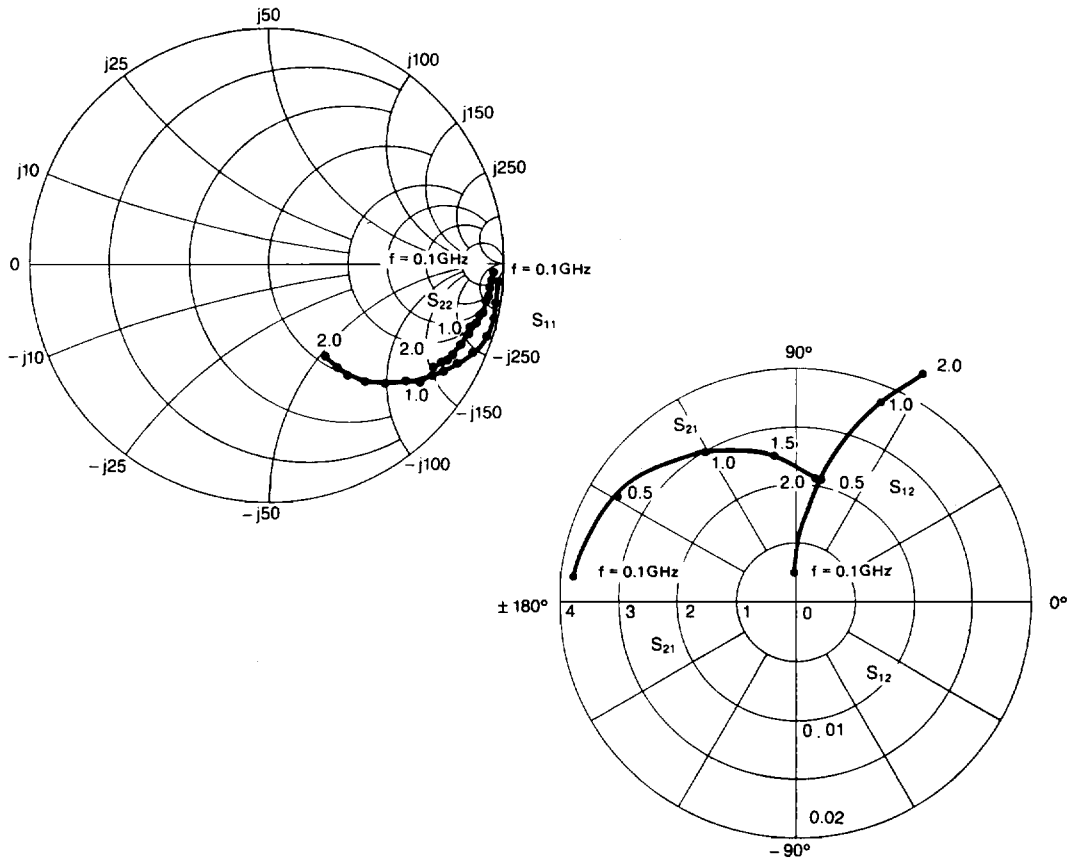
Application Example for Cellular System



* DTMF (Dual Tone Multi Frequency)

S-Parameter vs. Frequency characteristics

($V_{DS}=5.0V$, $V_{GS}=1.5V$, $I_D=10mA$)



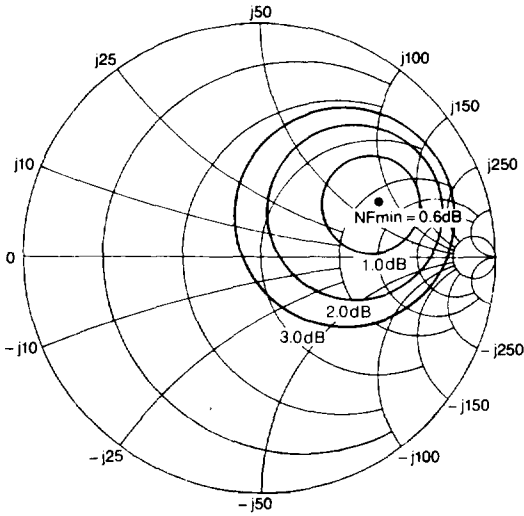
S-Parameter Data of FET 3SK166

$Z_0=50\Omega$

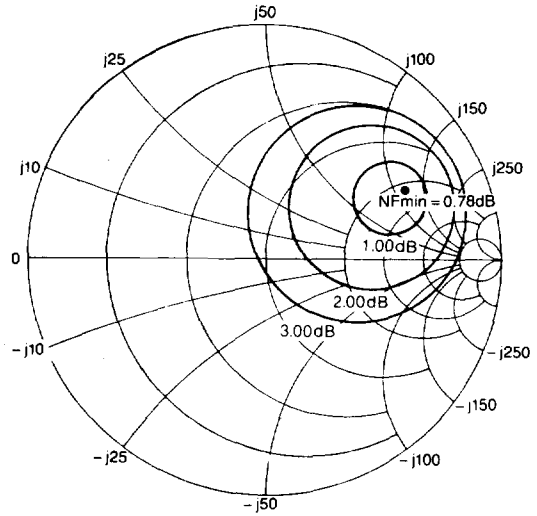
Frequency MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	.997	-4.90	3.815	173.47	0.0025	90.83	.941	-1.80
200	.991	-9.59	3.745	165.74	0.0041	86.98	.939	-4.18
300	.998	-13.04	3.672	161.43	0.0095	84.23	.979	-9.40
400	.959	-18.65	3.647	155.81	0.0105	82.44	.928	-8.23
500	.933	-22.47	3.471	149.90	0.0110	76.78	.925	-9.44
600	.904	-26.50	3.400	141.51	0.0134	76.78	.926	-11.85
700	.873	-30.25	3.311	137.92	0.0153	72.93	.913	-12.87
800	.844	-33.71	3.173	132.54	0.0160	73.56	.912	-15.33
900	.814	-36.72	3.002	125.45	0.0172	69.08	.896	-16.30
1000	.780	-39.35	3.058	120.39	0.0189	66.18	.897	-18.80
1200	.707	-44.48	2.741	112.87	0.0217	65.07	.882	-22.55
1400	.641	-49.20	2.636	103.06	0.0246	60.53	.868	-25.75
1600	.587	-52.59	2.412	95.81	0.0236	61.71	.863	-28.06
1800	.520	-54.29	2.357	88.93	0.0245	62.06	.855	-29.88
2000	.452	-57.35	2.145	80.33	0.0239	60.92	.834	-31.69

Noise figure characteristics

at 450MHz (V_{DS}=5.0V, V_{G2S}=1.5V, I_D=10mA) at 880MHz

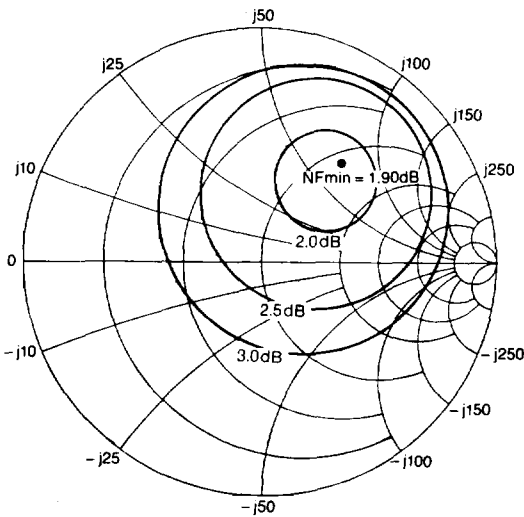


V_{DS} = 5.0V
 V_{G2S} = 1.5V
 I_D = 10mA
 Frequency 450 MHz
 NF min 0.60 dB
 Ga 23.02 dB
 Gamma (S); MAG 0.559 ANG 26.73°



V_{DS} = 5.0V
 V_{G2S} = 1.5V
 I_D = 10mA
 Frequency 880 MHz
 NF min 0.78 dB
 Ga 19.25 dB
 Gamma (S); MAG 0.616, ANG 26.89°

at 2000MHz



Frequency (MHz)	Ga (dB)	NF (dB)	Gamma- S		Gamma- L	
			MAG	ANG	MAG	ANG
400	24.31	0.51	0.689	21.39°	0.902	14.07°
450	23.02	0.60	0.559	26.73°	0.894	16.93°
500	22.43	0.66	0.690	19.49°	0.894	17.93°
880	19.25	0.78	0.616	26.87°		
2000	12.90	1.90	0.542	51.14°		

V_{DS} = 5.0V
 V_{G2S} = 1.5V
 I_D = 10mA
 Frequency 2000 MHz
 NF min 1.90 dB
 Ga 12.90 dB
 Gamma (S); MAG 0.542, ANG 51.14°