Silicon N-Channel Junction FET

Description

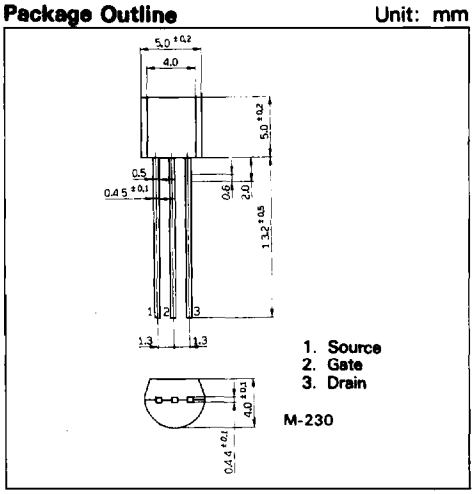
The 2SK125 is an N-Channel silicon junction type field effect transistor developed for low-noise amplification at frequencies up to UHF. It is especially suitable for when a wide dynamic range is required.

Features

- High power gain
  12.5 dB (Typ.)
  (f = 100 MHz Gate grounded)
- Low noise figure
  1.5 dB (Typ.)
  (f = 100 MHz Gate grounded)
- Wide dynamic range
  3rd intermodulation distortion
  −52 dB (Typ.)
  (f = 100 MHz at 100 dBμ input)
- Small inverse transfer coefficient
  $|S_{12}| = 0.035$ (Typ.)
  (f = 500 MHz Gate grounded)

Package Outline

Unit: mm



Structure

Silicon N-Channel junction FET.

Application

UHF band amplification, mixing, oscillation, analog switches.

Absolute Maximum Ratings (Ta = 25°C)

• Drain to gate voltage	V_{DGO}	35	V
• Source to gate voltage	V_{SGO}	35	V
• Drain current	I_D	100	mA
• Gate current	I_G	10	mA
• Channel temperature	Tj	120	°C
• Storage temperature	Tstg	−50 to +120	°C
• Allowable power dissipation	P_D	300	mW

51044A-TO

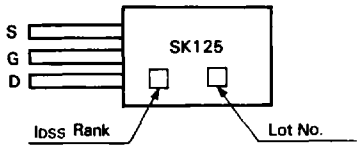
Electrical Characteristics

Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Gate cutoff current	I_{GSS}	$V_{GS} = -15V$, $V_{DS} = 0$			−10	nA
Gate to source voltage	V_{GSS}	$I_G = 10\mu A$, $V_{DS} = 0$	−35			V
Drain current	I_{DSS}	$V_{DS} = 10V$, $V_{GS} = 0$ P.W = 300μs	40		75	mA
Gate to source cutoff voltage	$V_{GS(OFF)}$	$V_{DS} = 10V$, $I_D = 100\mu A$	−2		−6	V
Forward transfer conductance	$\|Y_{fs}\|$	$V_{DS} = 10V$, $I_D = 10mA$ f = 1 kHz	10	14		mS
Reverse transfer capacitance	Crss	$V_{DG} = 10V$, $I_S = 0mA$ f = 1 MHz, source grounded		2.6	3	pF
Power gain	PG	$V_{DG} = 10V$, $I_D = 10mA$ *1 f = 100 MHz, BW = 2.8 MHz	10	12.5		dB
Noise figure	NF	$V_{DG} = 10V$, $I_D = 10mA$ *1 f = 100 MHz, BW = 2.8 MHz At the NF of the amplifier in the next stage is 4.2 dB		1.8	2.5	dB
Intermodulation distortion	IMD	$V_{DG} = 10V$, $I_D = 10mA$, *2 $f_1 = 100$ MHz, $f_2 = 100.1$ MHz, at 100 dBμ input	−45	−52		dB
Junction to ambient thermal resistance	θj-a				190	°C/W

Note) *1. See the 100 MHz, PG, NF, test circuit.
*2. See the 100 MHz IMD test circuit.

Mark



Classification

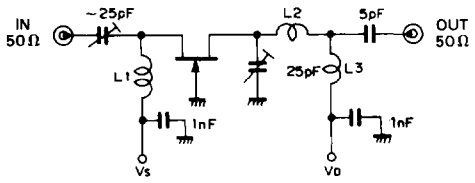
Rank	I_{DSS} (mA) V_{DS} = 10V V_{GS} = 0V
2	40 to 75
3	40 to 52
4	48 to 63
5	57 to 75

Standard Circuit Design Data

Ta = 25°C

Item	Symbol	Condition	Typ.	Unit
Input resistance	r_{ig}	V_{DG} = 10V, I_D = 10 mA f = 100 MHz	70	Ω
Input capacitance	C_{ig}		3.0	pF
Output resistance	r_{og}		5	kΩ
Output capacitance	C_{og}		3.0	pF
Power gain	PG	V_{DG} = 10V, I_D = 10 mA f = 500 MHz, BW = 12 MHz	7.0	dB
Noise figure	NF		4.0	dB
Reverse transfer coefficient	$\|S_{12}\|$	V_{DG} = 10V, I_D = 10 mA f = 500 MHz	0.035	
Equivalent input noise voltage	$\overline{e}_n$	V_{DS} = 10V, I_D = 10 mA f = 1 kHz	3	nV/√Hz
Drain source ON resistance	$R_{(ON)}$	I_D = 10 mA, V_{GS} = 0V	35	Ω
Drain cutoff current	$I_{D(OFF)}$	V_{DS} = 10V, V_{GS} = −10V	0.1	nA

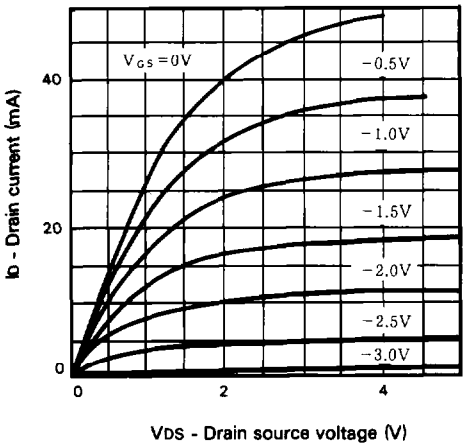
100 MHz PG, NF Test Circuit



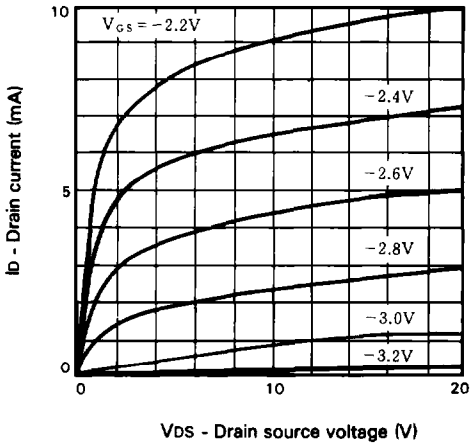
L1 : 0.45 φmm polyurethane wire φ3 mm 10.5 t
L2, L3 : 0.45 φmm polyurethane wire φ3 mm 5.5 t

Output Characteristics

Drain current vs. Drain source voltage

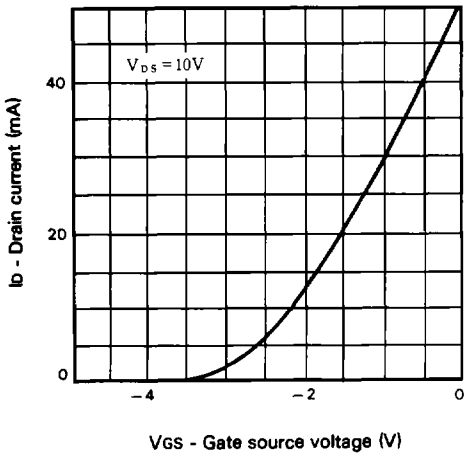


Drain current vs. Drain source voltage

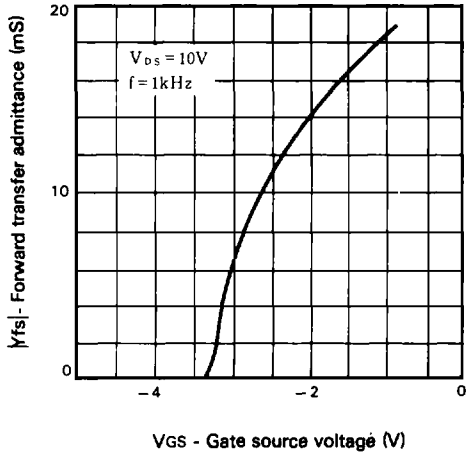


Transfer Characteristics

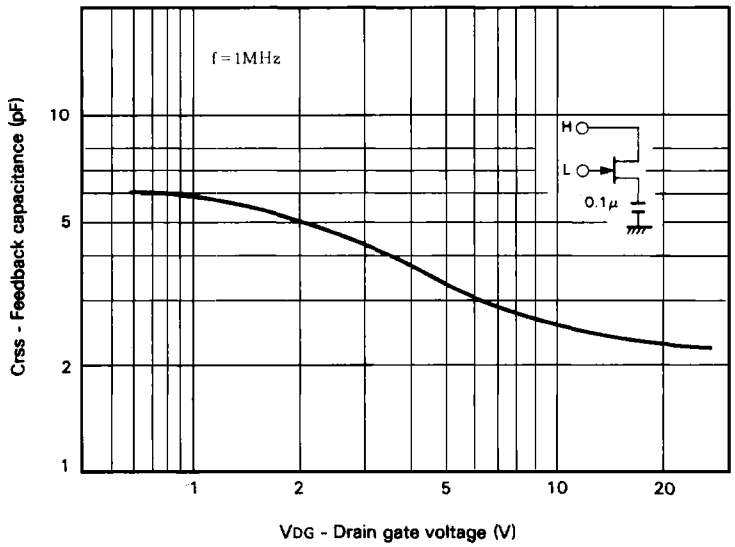
Drain current vs. Gate source voltage



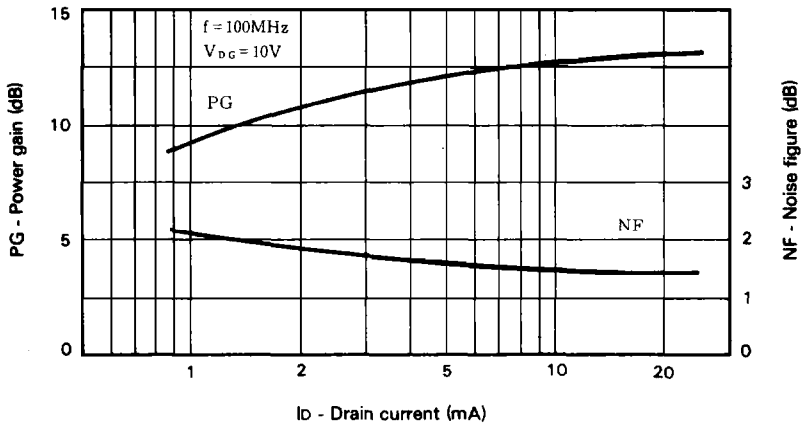
Forward transfer admittance vs. Gate source voltage



Feedback capacitance vs. Drain gate voltage



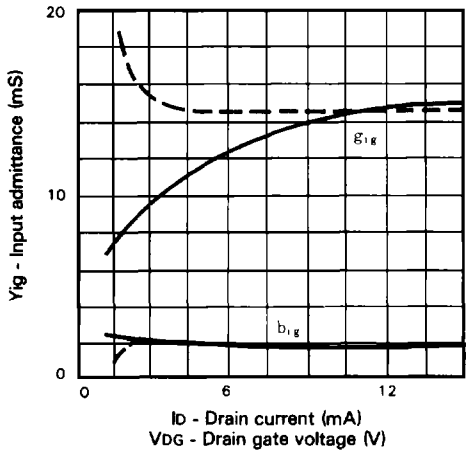
Common-gate power gain noise figure vs. Drain current



Common Gate Y-Parameter

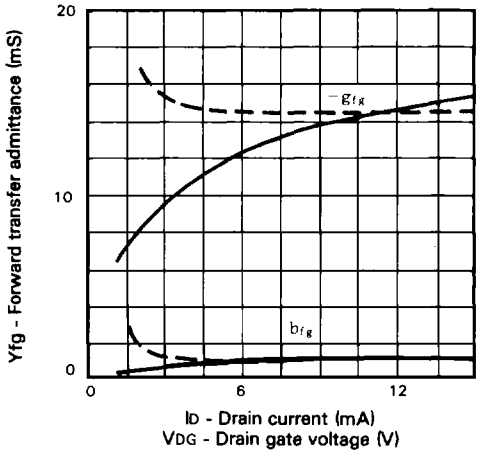
——— Drain current characteristics (V_{DG} = 10V, f = 100 MHz)
— — — Drain gate voltage characteristics (I_D = 10mA, f = 100 MHz)

Input admittance



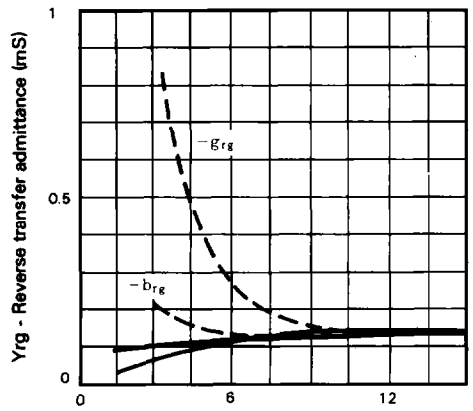
ID - Drain current (mA)
VDG - Drain gate voltage (V)

Forward transfer admittance



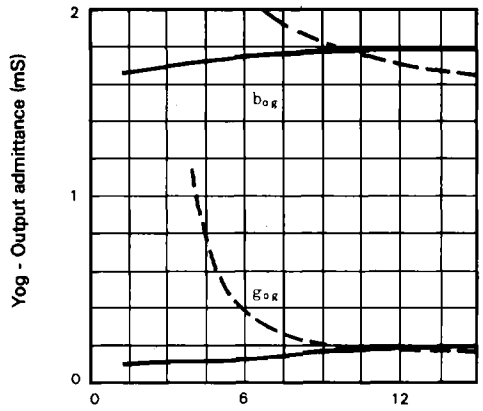
ID - Drain current (mA)
VDG - Drain gate voltage (V)

Reverse transfer admittance



ID - Drain current (mA)
VDG - Drain gate voltage (V)

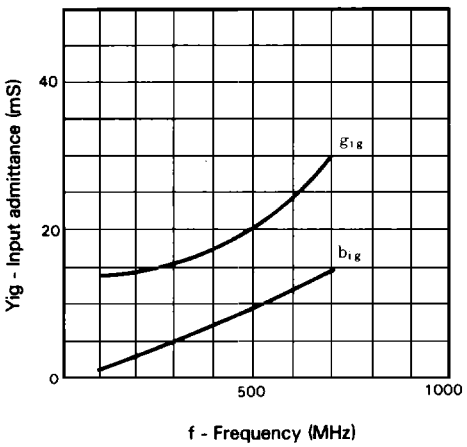
Output admittance



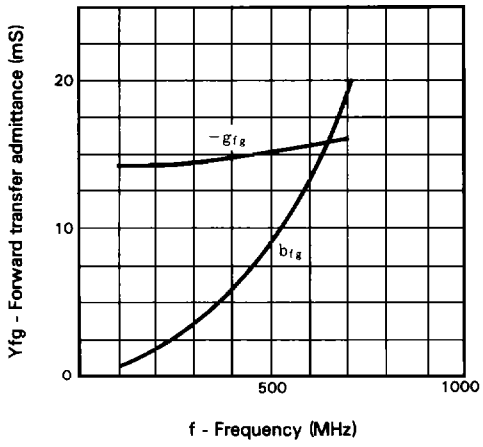
ID - Drain current (mA)
VDG - Drain gate voltage (V)

Common Gate Y-Parameter vs. Frequency (V_{DG} = 10V, I_D = 10mA)

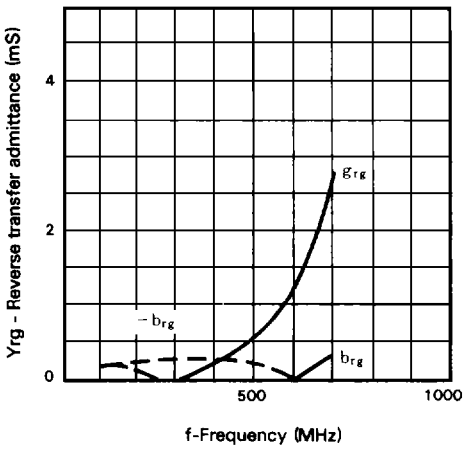
Input admittance



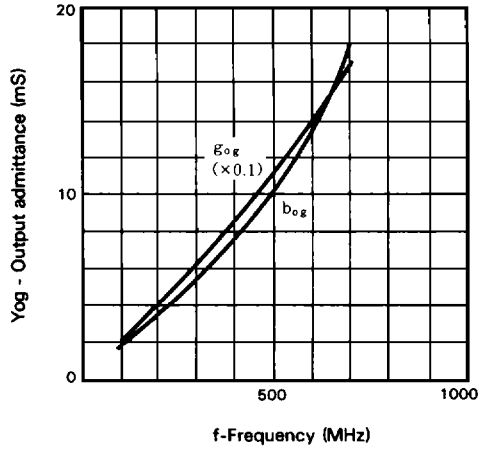
Forward transfer admittance



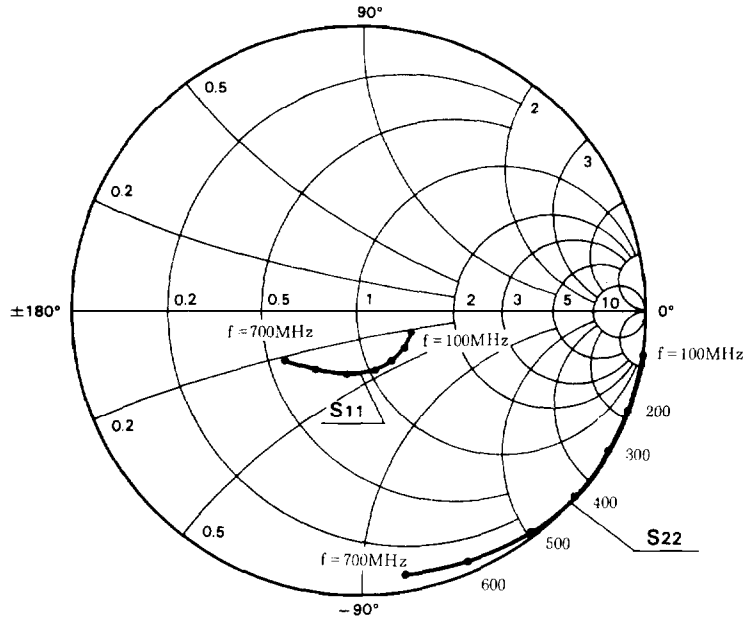
Reverse transfer admittance

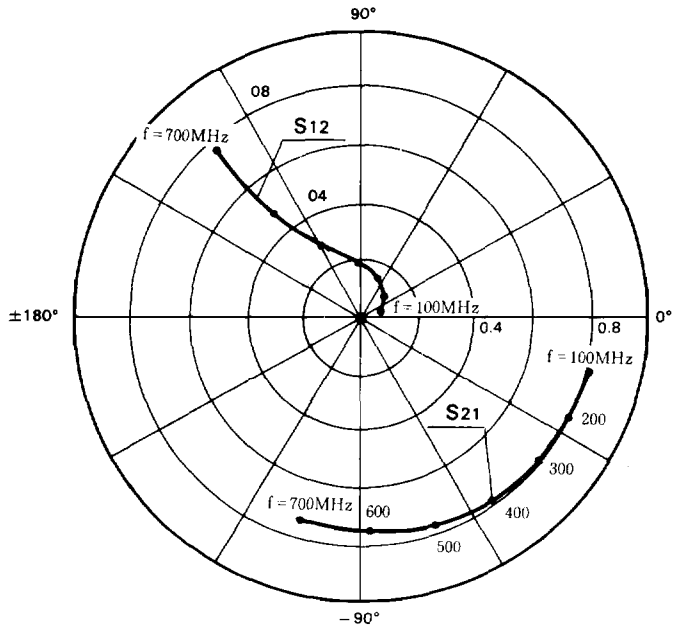


Output admittance

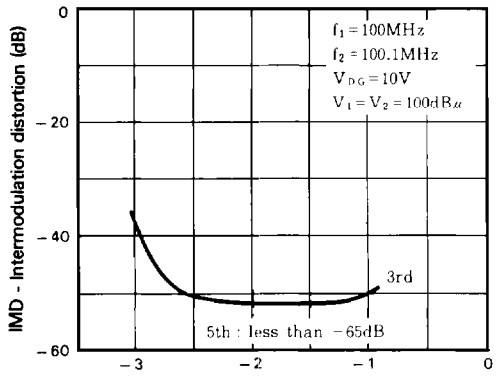


Common Gate S-Parameter vs. Frequency (V_{DG} = 10V, I_D = 10 mA)

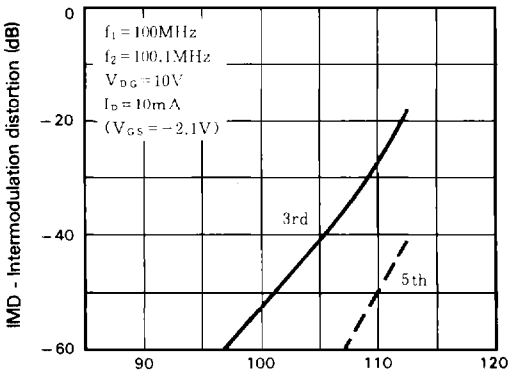




Intermodulation distortion characteristics

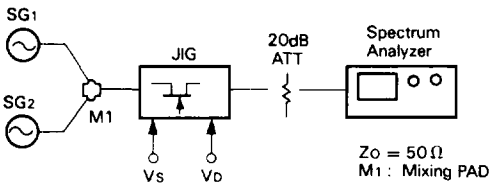


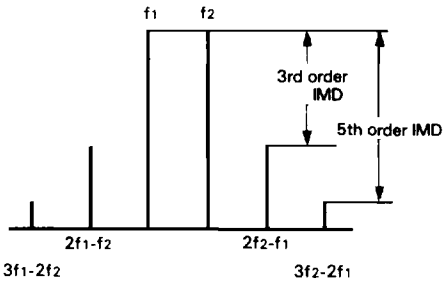
VGS - Gate source voltage (V)



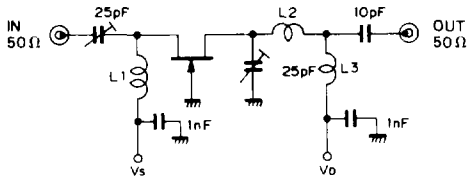
V1, V2 - Input signal level (dBμ)

Block Diagram for IMD Measurement



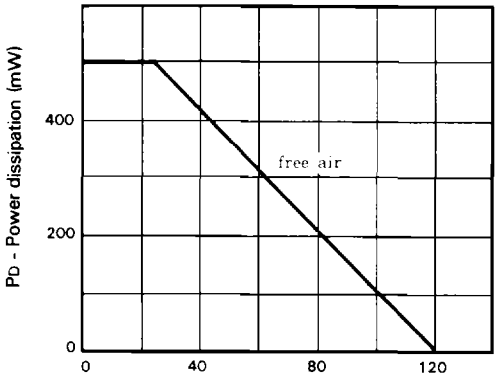


100 MHz IMD Test Circuit



L1 : 0.45 φmm polyurethane wire 3φ mm 10.5 t
L2, L3 : 0.45 φmm polyurethane wire 3φ mm 5.5 t

Derating curve



Ta - Ambient temperature (°C)