

# 3SK321

Silicon N-Channel Dual Gate MOS FET

# HITACHI

ADE-208-711B (Z)  
3rd. Edition  
Mar. 2001

## Application

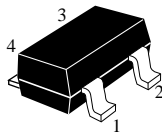
UHF RF amplifier

## Features

- Low noise figure.  
NF = 2.0 dB typ. at f = 900 MHz
- Capable of low voltage operation
- Provide mini mold packages; MPAK-4R(SOT-143 var.)

## Outline

MPAK-4R



1. Source
2. Drain
3. Gate2
4. Gate1

Note: Marking is "ZX-"

Attention: This device is very sensitive to electro static discharge.

It is recommended to adopt appropriate cautions when handling this transistor.

## Absolute Maximum Ratings (Ta = 25°C)

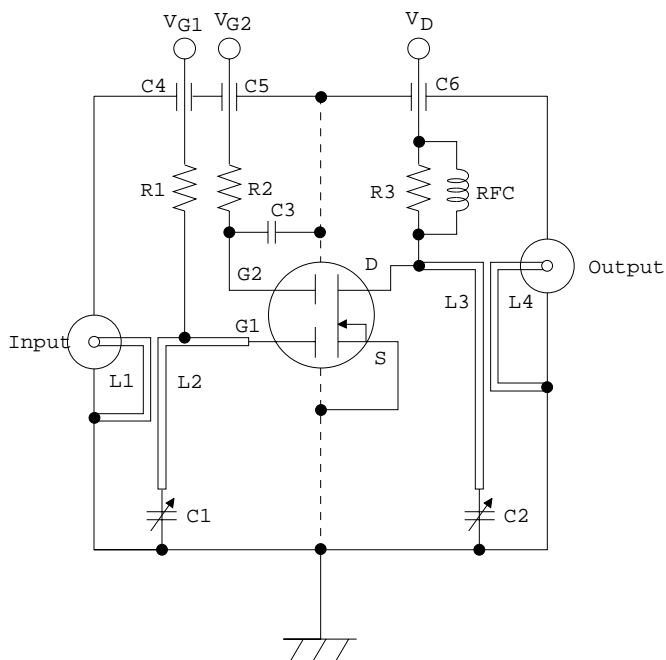
Item	Symbol	Ratings	Unit
Drain to source voltage	$V_{DS}$	12	V
Gate 1 to source voltage	$V_{G1S}$	$\pm 8$	V
Gate 2 to source voltage	$V_{G2S}$	$\pm 8$	V
Drain current	$I_D$	25	mA
Channel power dissipation	Pch	150	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	-55 to +150	°C

## Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	12	—	—	V	$I_D = 200 \mu A$ , $V_{G1S} = -3 V$ , $V_{G2S} = -3 V$
Gate 1 to source breakdown voltage	$V_{(BR)G1SS}$	$\pm 8$	—	—	V	$I_{G1} = \pm 10 \mu A$ , $V_{G2S} = V_{DS} = 0$
Gate 2 to source breakdown voltage	$V_{(BR)G2SS}$	$\pm 8$	—	—	V	$I_{G2} = \pm 10 \mu A$ , $V_{G1S} = V_{DS} = 0$
Gate 1 cutoff current	$I_{G1SS}$	—	—	$\pm 100$	nA	$V_{G1S} = \pm 6 V$ , $V_{G2S} = V_{DS} = 0$
Gate 2 cutoff current	$I_{G2SS}$	—	—	$\pm 100$	nA	$V_{G2S} = \pm 6 V$ , $V_{G1S} = V_{DS} = 0$
Drain current	$I_{DS(on)}$	0.5	—	10	mA	$V_{DS} = 6 V$ , $V_{G1S} = 0.5 V$ , $V_{G2S} = 3 V$
Gate 1 to source cutoff voltage	$V_{G1S(off)}$	-0.5	—	+0.5	V	$V_{DS} = 10 V$ , $V_{G2S} = 3 V$ , $I_D = 100 \mu A$
Gate 2 to source cutoff voltage	$V_{G2S(off)}$	0	—	+1.0	V	$V_{DS} = 10 V$ , $V_{G1S} = 3 V$ , $I_D = 100 \mu A$
Forward transfer admittance	$ y_{fs} $	16	20.8	—	mS	$V_{DS} = 6 V$ , $V_{G2S} = 3 V$ , $I_D = 10 mA$ , $f = 1 kHz$
Input capacitance	Ciss	1.2	1.5	2.2	pF	$V_{DS} = 6 V$ , $V_{G2S} = 3 V$ , $I_D = 10 mA$ , $f = 1 MHz$
Output capacitance	Coss	0.6	0.9	1.2	pF	
Reverse transfer capacitance	Crss	—	0.01	0.03	pF	
Power gain	PG	16	19.5	—	dB	$V_{DS} = 4 V$ , $V_{G2S} = 3 V$ , $I_D = 10 mA$ , $f = 900 MHz$
Noise figure	NF	—	2.0	3	dB	

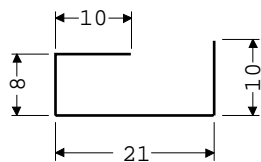
Main Characteristics

900MHz Power Gain, Noise Test Circuit

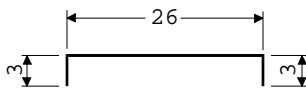


- C1, C2 F Variable Capacitor i10pF MAX)
- C3 F Disk Capacitor i1000pF)
- C4 'C6 F Air Capacitor i1000pF)
- R1 F 47 k  $\Omega$
- R2 F 47 k  $\Omega$
- R3 F 4.7 k  $\Omega$

L1 F

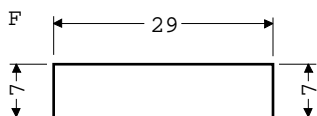


L2 F

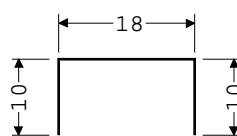


i 1mm Copper wire :  
Unit Fmm

L3 F

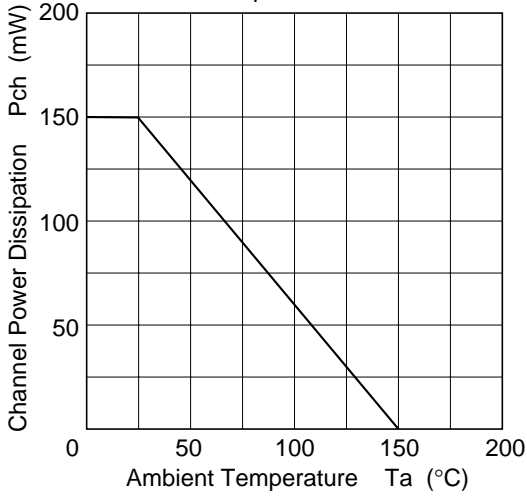


L4 F

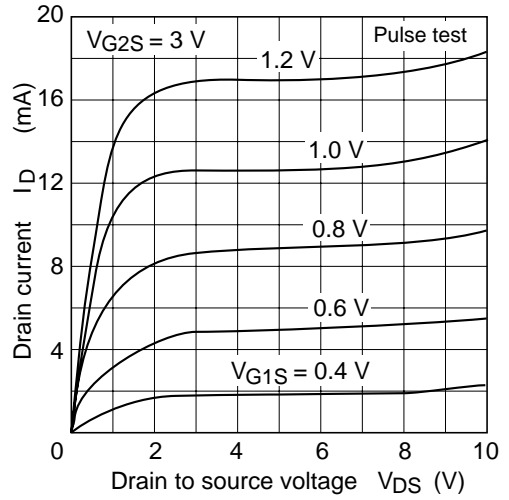


RFC F 1mm Copper wire with enamel 4turns inside di

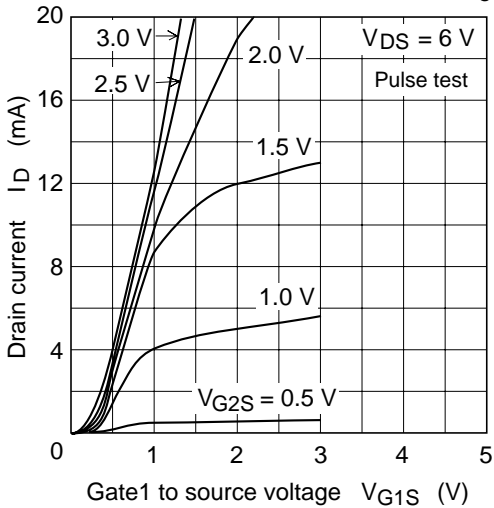
Maximum Channel Power Dissipation Curve



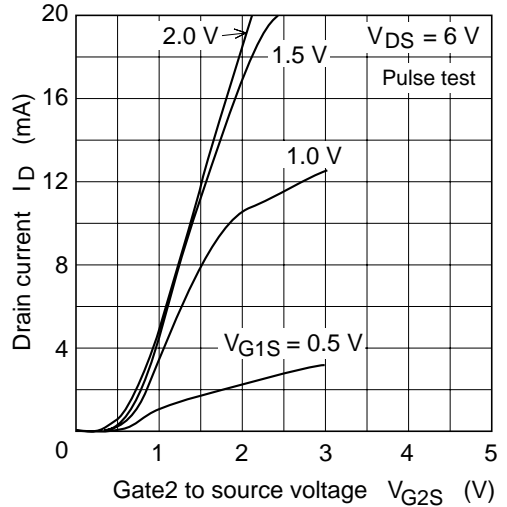
Typical Output Characteristics



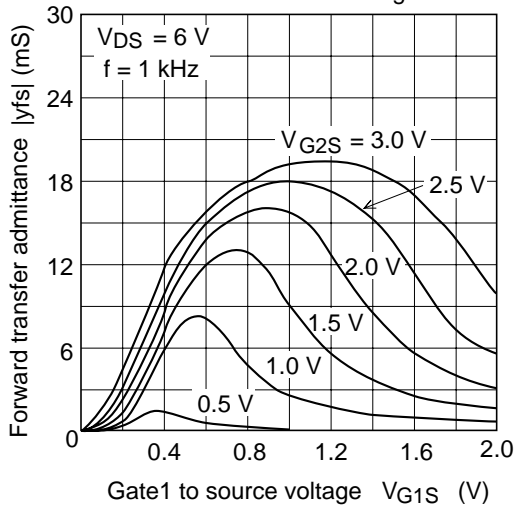
Drain Current vs. Gate1 to Source Voltage



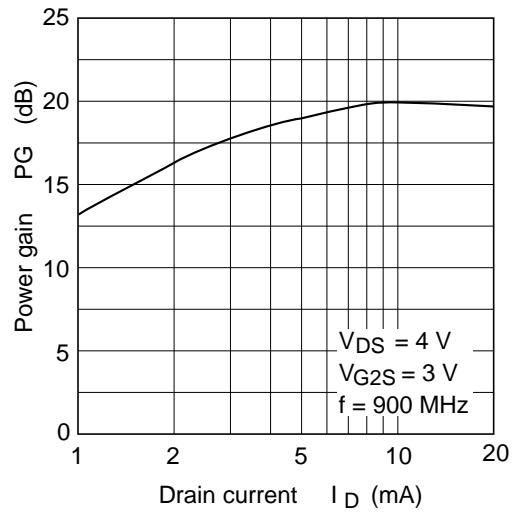
Drain Current vs. Gate2 to Source Voltage



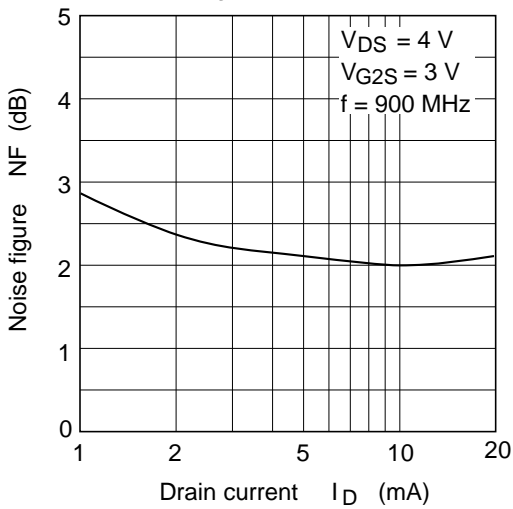
Forward Transfer Admittance vs. Gate1 to Source Voltage



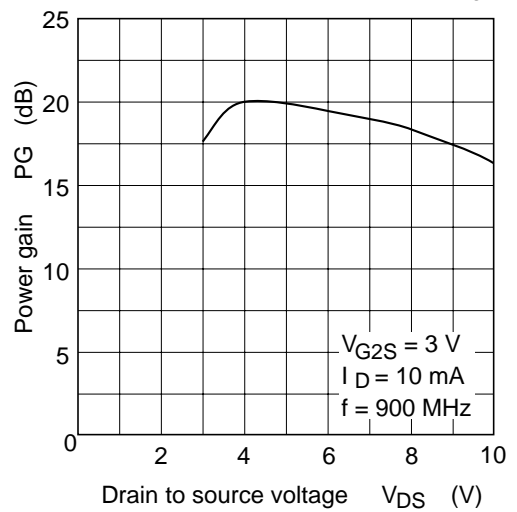
Power Gain vs. Drain Current

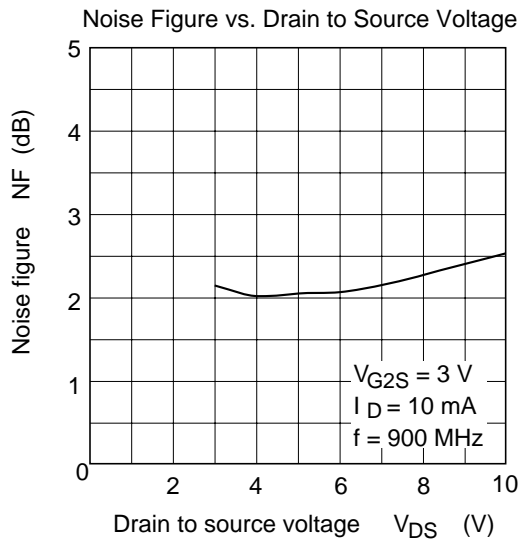


Noise Figure vs. Drain Current

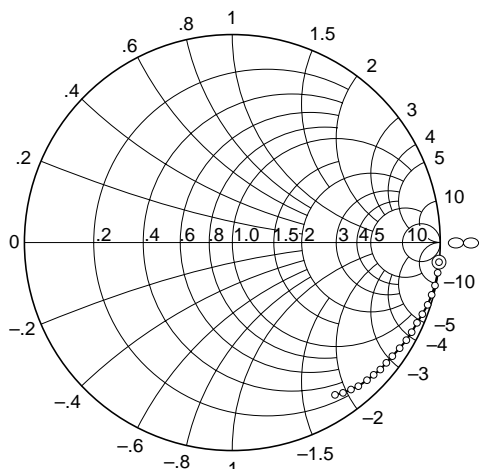


Power Gain vs. Drain to Source Voltage





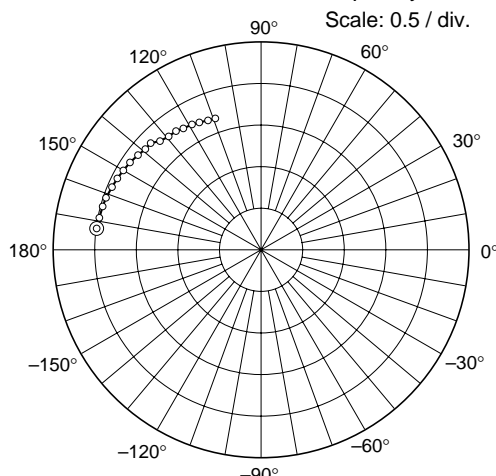
S11 Parameter vs. Frequency



Condition:  $V_{DS} = 4\text{ V}$ ,  $V_{G2S} = 3\text{ V}$   
 $I_D = 10\text{ mA}$ ,  $Z_0 = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)



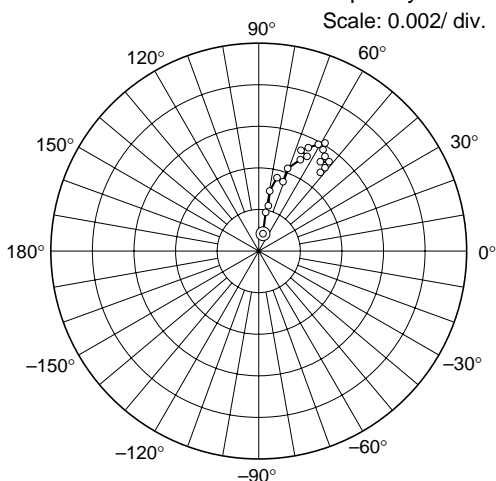
S21 Parameter vs. Frequency



Condition:  $V_{DS} = 4\text{ V}$ ,  $V_{G2S} = 3\text{ V}$   
 $I_D = 10\text{ mA}$ ,  $Z_0 = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)



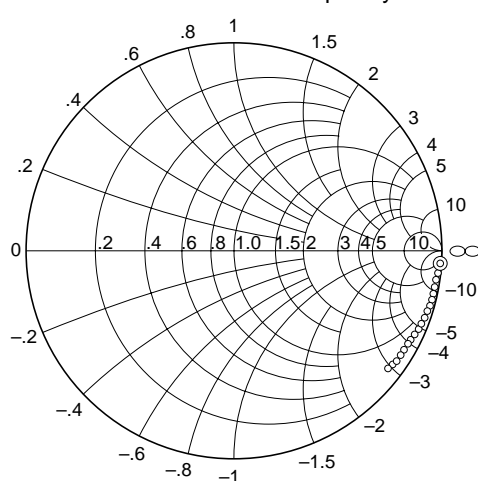
S12 Parameter vs. Frequency



Condition:  $V_{DS} = 4\text{ V}$ ,  $V_{G2S} = 3\text{ V}$   
 $I_D = 10\text{ mA}$ ,  $Z_0 = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)



S22 Parameter vs. Frequency



Condition:  $V_{DS} = 4\text{ V}$ ,  $V_{G2S} = 3\text{ V}$   
 $I_D = 10\text{ mA}$ ,  $Z_0 = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)



## 3SK321

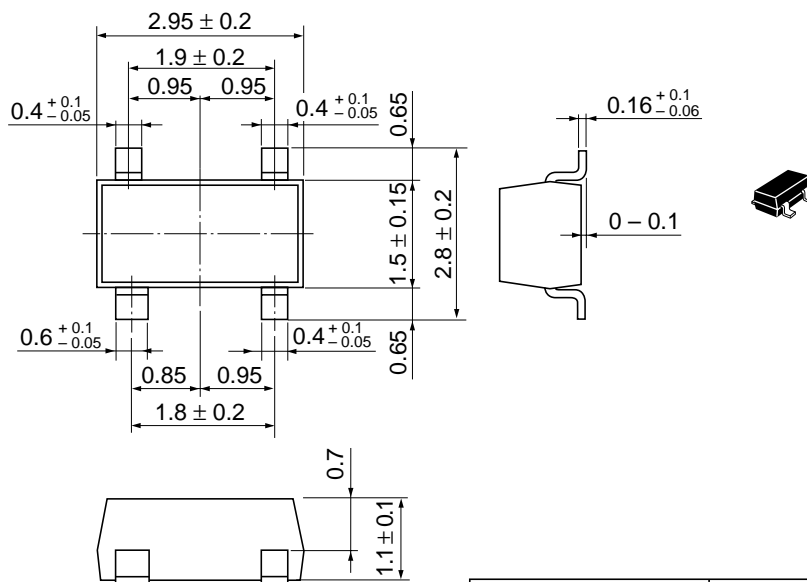
**S Parameter** ( $V_{DS} = 4 \text{ V}$ ,  $V_{G2S} = 3 \text{ V}$ ,  $I_D = 10 \text{ mA}$ ,  $Z_O = 50 \text{ } \Omega$  )

Freq. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.999	-6.1	1.98	172.2	0.00094	79.2	0.989	-4.2
150	0.998	-9.1	1.97	168.4	0.00189	80.4	0.987	-6.1
200	0.992	-11.9	1.96	165.0	0.00230	79.5	0.986	-7.9
250	0.988	-14.8	1.96	161.0	0.00286	79.9	0.984	-9.8
300	0.985	-17.9	1.94	157.1	0.00364	75.2	0.981	-11.5
350	0.976	-20.6	1.92	153.7	0.00353	71.8	0.978	-13.4
400	0.971	-23.2	1.91	149.9	0.00419	70.7	0.975	-15.2
450	0.964	-26.3	1.88	146.8	0.00495	65.5	0.972	-17.2
500	0.961	-29.1	1.87	142.8	0.00509	62.7	0.968	-19.1
550	0.951	-32.2	1.86	139.4	0.00530	66.6	0.963	-20.8
600	0.949	-35.0	1.86	136.1	0.00550	63.8	0.960	-22.8
650	0.935	-37.6	1.81	132.9	0.00601	58.2	0.956	-24.5
700	0.933	-40.5	1.78	129.4	0.00582	60.6	0.950	-26.3
750	0.923	-42.9	1.77	125.7	0.00572	58.5	0.945	-28.0
800	0.916	-45.8	1.75	122.6	0.00553	56.3	0.941	-29.9
850	0.908	-49.0	1.72	119.1	0.00514	56.3	0.936	-31.7
900	0.900	-51.2	1.70	115.8	0.00543	52.9	0.930	-33.4
950	0.890	-54.0	1.67	112.6	0.00506	52.4	0.924	-35.2
1000	0.876	-56.4	1.65	109.3	0.00469	51.9	0.919	-37.0

## Package Dimensions

As of January, 2001

Unit: mm



Hitachi Code	MPAK-4R
JEDEC	—
EIAJ	—
Mass (reference value)	0.013 g

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