

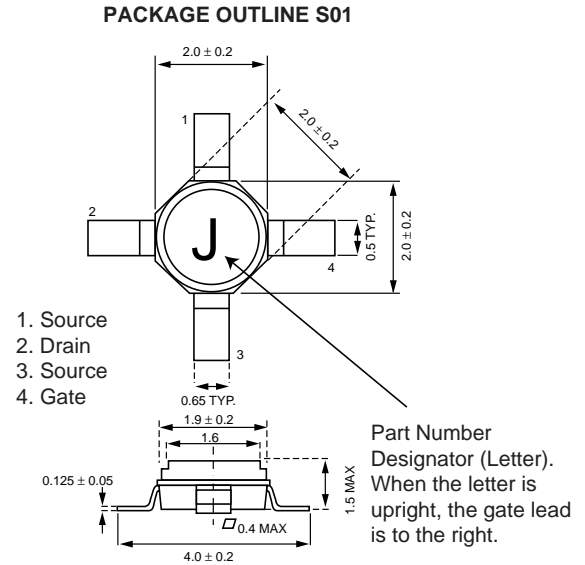
FEATURES

- **HIGH POWER GAIN:**
7 dB TYP at 12 GHz
- **HIGH OUTPUT POWER:**
15 dBm TYP at 12 GHz
- **L_G = 0.8 μm, W_G = 330 μm**
- **LOW PHASE NOISE:**
-110 dBc/Hz TYP at 100 KHz offset at f = 12 GHz
- **LOW COST PLASTIC PACKAGE**

DESCRIPTION

The NE721S01 is a low cost 0.8 μm recessed gate GaAs MESFET, suitable for both amplifier and oscillator applications. Larger gate geometry make this device ideal for second and third stages of low noise amplifiers operating in the 1-12 GHz frequency range. The NE721S01 is fabricated with an epitaxial process resulting in excellent phase noise in oscillator applications up to 14 GHz. NEC's latest high performance/low cost plastic packaging technology make the NE721S01 suitable for GPS, TVRO, DBS, PRD and other commercial applications.

OUTLINE DIMENSIONS (Units in mm)



ORDERING INFORMATION

PART NUMBER	QTY	PACKAGE	LEAD LENGTH
NE721S01-T1	1K/Reel	S01	1.0 mm
NE721S01	Bulk up to 4K	S01	1.0 mm
NE721S01-T1B	4K/Reel	S01	1.0 mm

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE			NE721S01 S01		
SYMBOL	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
PN	Phase Noise at V _{DS} = 3 V, I _D = 30 mA, f = 12 GHz, 100 KHz offset	dBc/Hz		-110	
G _S	Power Gain at V _{DS} = 3 V, I _D = 30 mA, f = 12 GHz	dB		7.0	
P _{1dB}	Output Power at 1 dB Gain Compression Point, f = 12 GHz V _{DS} = 3 V, I _{DS} = 30 mA	dBm		15.0	
I _{DSS}	Saturated Drain Current at V _{DS} = 3 V, V _{GS} = 0	mA	30	60	100
V _P	Pinch Off Voltage at V _{DS} = 3 V, I _D = 100 μA	V	-4.0	-2.0	-0.5
g _m	Transconductance at V _{DS} = 3 V, I _D = 10 mA	mS	20	40	
I _{GSO}	Gate to Source Leak Current at V _{GS} = -5 V	μA		1.0	10
R _{TH}	Thermal Resistance	°C/W			300

ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

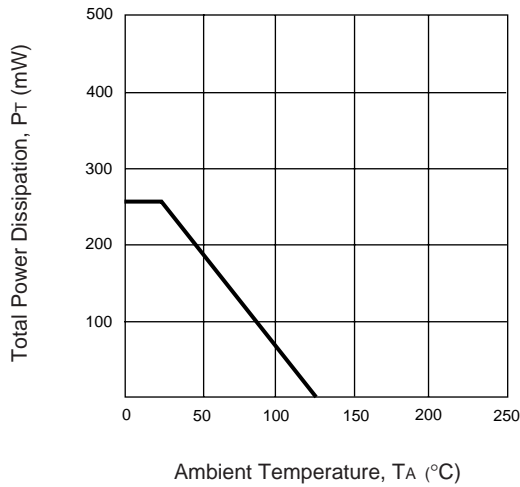
SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{DS}	Drain to Source Voltage	V	5
V _{GDO}	Gate to Drain Voltage	V	-6
V _{GSO}	Gate to Source Voltage	V	-6
I _{DS}	Drain Current	mA	I _{DSS}
T _{CH}	Channel Temperature	°C	125
T _{STG}	Storage Temperature	°C	-65 to +125
P _T	Total Power Dissipation	mW	250

Note:

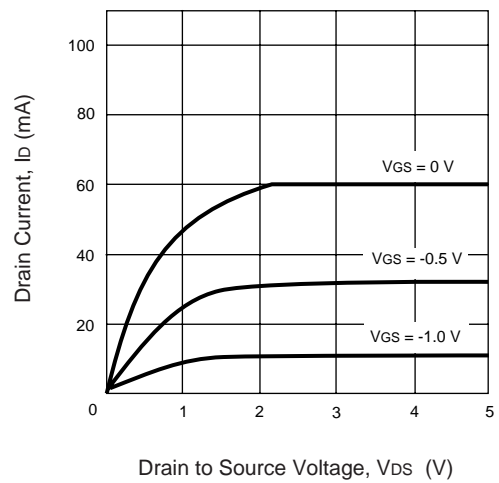
1. Operation in excess of any one of these parameters may result in permanent damage.

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

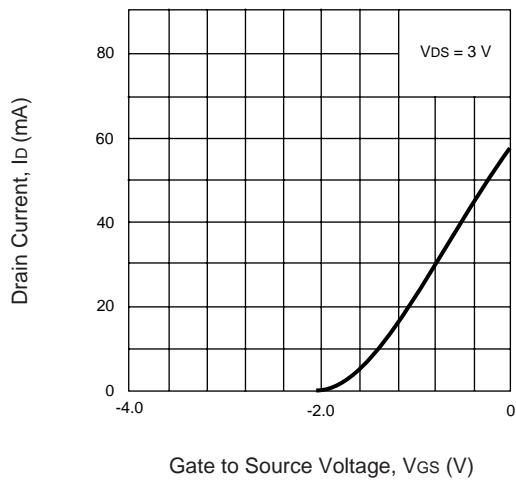
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



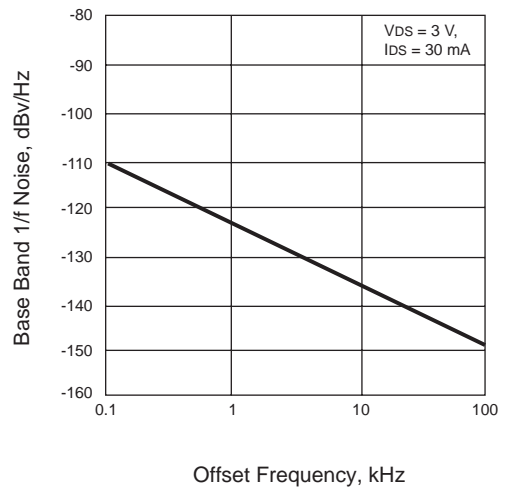
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



BASE BAND 1/f NOISE vs. OFFSET FREQUENCY



TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

V_{DS} = 3 V, I_D = 10 mA

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2.0	.936	-48.8	2.501	135.8	.070	57.1	.700	-26.5
3.0	.877	-71.9	2.387	115.2	.096	41.9	.662	-40.8
4.0	.813	-95.7	2.271	95.2	.115	26.4	.619	-53.4
5.0	.743	-119.4	2.153	75.6	.127	12.5	.568	-66.2
6.0	.691	-144.7	2.063	56.5	.135	-1.1	.518	-77.4
7.0	.649	-174.6	1.931	36.8	.136	-14.2	.448	-86.4
8.0	.639	158.2	1.765	18.4	.129	-24.8	.370	-95.5
9.0	.659	136.5	1.609	1.2	.122	-33.4	.305	-111.4
10.0	.683	115.8	1.480	-15.7	.117	-39.8	.257	-132.8
11.0	.710	95.8	1.351	-32.9	.113	-46.8	.234	-159.5
12.0	.748	78.1	1.215	-49.8	.107	-52.8	.226	-173.4
13.0	.776	64.2	1.073	-65.3	.102	-54.7	.235	143.9
14.0	.805	53.9	.954	-79.8	.101	-59.5	.288	113.0
15.0	.839	45.8	.837	-93.9	.103	-61.9	.388	89.1
16.0	.859	36.4	.722	-106.6	.104	-67.1	.485	75.7
17.0	.858	25.5	.614	-118.9	.100	-70.8	.576	66.0
18.0	.877	18.5	.522	-130.0	.100	-77.8	.628	55.5
19.0	.874	13.8	.449	-140.1	.101	-82.2	.675	45.9
20.0	.875	10.1	.392	-148.3	.098	-85.0	.724	36.4

V_{DS} = 3 V, I_{DS} = 20 mA

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2.0	.925	-51.4	2.988	134.5	.064	56.9	.676	-26.8
3.0	.858	-75.6	2.819	113.5	.087	41.3	.636	-40.9
4.0	.786	-100.2	2.641	93.4	.102	26.7	.591	-53.1
5.0	.715	-124.5	2.472	73.9	.112	13.6	.540	-65.4
6.0	.662	-150.4	2.335	55.0	.118	1.7	.493	-75.9
7.0	.625	179.8	2.155	35.8	.117	-10.9	.425	-84.3
8.0	.622	153.4	1.950	17.9	.111	-19.1	.352	-92.9
9.0	.647	132.5	1.773	1.4	.109	-26.1	.286	-107.5
10.0	.675	112.7	1.625	-15.1	.106	-30.7	.236	-128.9
11.0	.703	93.2	1.480	-31.8	.107	-36.3	.212	-156.0
12.0	.742	76.3	1.332	-48.4	.105	-41.6	.204	175.1
13.0	.776	62.7	1.178	-63.7	.105	-45.5	.212	143.6
14.0	.806	52.7	1.051	-77.6	.108	-50.7	.266	111.8
15.0	.833	44.8	.925	-91.5	.108	-54.8	.360	88.4
16.0	.859	35.4	.804	-104.2	.112	-59.3	.458	75.1
17.0	.855	24.7	.686	-116.6	.109	-65.3	.553	65.9
18.0	.876	17.9	.586	-127.6	.108	-74.0	.610	55.5
19.0	.871	12.7	.509	-138.1	.108	-77.0	.655	46.0
20.0	.866	9.2	.446	-147.2	.102	-81.9	.703	36.8

NE721S01**TYPICAL SCATTERING PARAMETERS** ($T_A = 25^\circ\text{C}$)**V_{DS} = 3 V, I_{DS} = 30 mA**

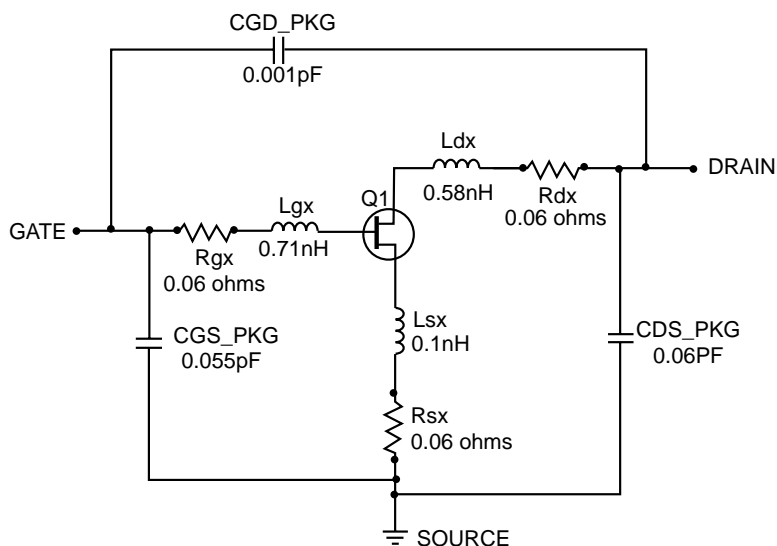
FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2.0	.922	-52.5	3.250	134.0	.060	56.7	.672	-26.7
3.0	.853	-77.0	3.048	112.9	.082	41.7	.632	-40.6
4.0	.780	-102.0	2.842	92.9	.097	27.8	.586	-52.6
5.0	.706	-126.7	2.645	73.4	.105	14.8	.538	-64.6
6.0	.652	-152.7	2.483	54.6	.110	2.9	.488	-74.8
7.0	.618	177.5	2.283	35.6	.110	-8.2	.426	-82.8
8.0	.618	151.5	2.057	18.1	.102	-16.3	.354	-90.8
9.0	.648	131.0	1.871	1.8	.100	-20.7	.288	-105.1
10.0	.676	111.6	1.713	-14.5	.102	-26.3	.239	-126.2
11.0	.707	92.3	1.559	-31.1	.104	-31.1	.214	-153.1
12.0	.747	75.5	1.403	-47.5	.104	-35.9	.204	178.3
13.0	.779	62.3	1.241	-62.7	.106	-40.8	.209	146.7
14.0	.814	52.3	1.109	-76.6	.109	-44.5	.260	113.7
15.0	.845	44.3	.980	-90.6	.114	-49.5	.356	89.5
16.0	.868	35.3	.855	-103.2	.116	-54.7	.457	76.4
17.0	.866	24.3	.727	-115.4	.114	-63.3	.547	66.7
18.0	.888	17.6	.621	-127.2	.112	-67.9	.610	56.1
19.0	.882	12.8	.539	-137.3	.111	-76.8	.656	46.7
20.0	.874	8.8	.473	-146.1	.110	-81.7	.706	37.3

V_{DS} = 3 V, I_{DS} = 40 mA

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2.0	.921	-53.1	3.386	133.7	.055	57.6	.690	-25.9
3.0	.850	-78.0	3.166	112.6	.076	41.4	.650	-39.4
4.0	.774	-103.0	2.944	92.4	.087	27.8	.606	-50.9
5.0	.701	-127.9	2.732	73.2	.094	15.7	.560	-62.5
6.0	.647	-153.9	2.556	54.5	.098	5.7	.517	-72.1
7.0	.615	176.2	2.344	35.7	.097	-5.6	.457	-79.7
8.0	.617	150.6	2.116	18.3	.092	-11.4	.393	-87.4
9.0	.645	130.4	1.926	2.1	.091	-14.8	.332	-101.3
10.0	.678	111.1	1.768	-14.1	.094	-19.4	.282	-120.5
11.0	.708	92.0	1.612	-30.7	.096	-22.1	.254	-144.2
12.0	.750	75.3	1.453	-47.1	.101	-27.1	.238	-170.8
13.0	.784	62.3	1.292	-62.2	.106	-33.1	.231	159.5
14.0	.820	52.6	1.157	-76.6	.113	-37.0	.269	125.6
15.0	.853	44.3	1.026	-90.5	.118	-43.9	.361	98.1
16.0	.875	34.9	.890	-103.7	.121	-50.7	.462	81.9
17.0	.872	24.2	.754	-116.4	.118	-58.0	.556	71.2
18.0	.893	17.5	.648	-127.8	.119	-65.5	.619	59.7
19.0	.890	12.4	.558	-138.2	.119	-72.2	.665	49.8
20.0	.882	9.0	.490	-147.8	.120	-79.8	.715	39.8

NE721S01 NONLINEAR MODEL

SCHEMATIC

FET NONLINEAR MODEL PARAMETERS ⁽¹⁾

Parameters	Q1	Parameters	Q1
VTO	-1.699	RG	7
VTOSC	0	RD	6
ALPHA	2.5	RS	4
BETA	0.0254	RGMET	0
GAMMA	0.09	KF	1.36e-10
GAMMADC	0.09	AF	1.74
Q	1.95	TNOM	27
DELTA	1.1	XTI	3
VBI	0.8	EG	1.43
IS	1e-14	VTOTC	0
N	1.2	BETATCE	0
RIS	0	FFE	1
RID	0		
TAU	6e-12		
CDS	0.18e-12		
RDB	5000		
CBS	1e-10		
CGSO	0.7e-12		
CGDO	0.055e-12		
DELTA1	1.2		
DELTA2	1		
FC	0.5		
VBR	Infinity		

(1) Series IV Libra TOM Model

Note:

This nonlinear model utilized the latest data available. See our Design Parameter Library at www.cel.com for this data.

UNITS

Parameter	Units
time	seconds
capacitance	farads
inductance	henries
resistance	ohms
voltage	volts
current	amps

MODEL RANGE

Frequency: 0.1 to 18 GHz

Bias: $V_{DS} = 2\text{ V to }4\text{ V}$, $I_D = 20\text{ mA to }40\text{ mA}$

Date: 7/97

EXCLUSIVE NORTH AMERICAN AGENT FOR **NEC** RF, MICROWAVE & OPTOELECTRONIC SEMICONDUCTORS

CEL CALIFORNIA EASTERN LABORATORIES • Headquarters • 4590 Patrick Henry Drive • Santa Clara, CA 95054-1817 • (408) 988-3500 • Telex 34-6393 • FAX (408) 988-0279
24-Hour Fax-On-Demand: 800-390-3232 (U.S. and Canada only) • Internet: <http://WWW.CEL.COM>

DATA SUBJECT TO CHANGE WITHOUT NOTICE

PRINTED IN USA ON RECYCLED PAPER -9/98