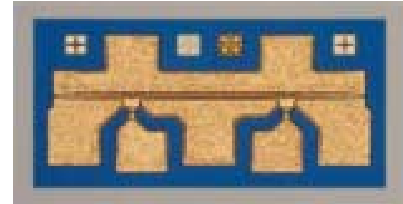
Low Noise and Medium Power GaAs FETs

FEATURES

- Low Noise Figure: NF = 0.5 dB Typical at 12 GHz
- High Associated Gain: Ga = 12 dB Typical at 12 GHz
- High Dynamic Range: 1 dB Compression Power P_{-1} = 21.5 dBm at 12 GHz
- Breakdown Voltage: $BV_{DGO} \geq 9$ V
- Lg = 0.25 µm, Wg = 300 µm
- All-Gold Metallization for High Reliability
- Tight Vp ranges control
- High RF input power handling capability
- 100 % DC Tested

PHOTO ENLARGEMENT



DESCRIPTION

The TC1201 is a GaAs Pseudomorphic High Electron Mobility Transistor (PHEMT) chip, which has very low noise figure, high associated gain and high dynamic range. The device can be used in circuits up to 30 GHz and suitable for low noise and medium power amplifier applications including a wide range of commercial and military applications. All devices are 100% DC tested to assure consistent quality. All bond pads are gold plated for either thermo-compression or thermo-sonic wire bonding.

ELECTRICAL SPECIFICATIONS (T_A=25 °C)

Symbol	Conditions	MIN	TYP	MAX	UNIT
NF	Noise Figure at V_{DS} = 4 V, I_{DS} = 25 mA, f = 12GHz		0.5	0.7	dB
G_a	Associated Gain at V_{DS} = 4 V, I_{DS} = 25 mA, f = 12GHz	10	12		dB
P_{1dB}	Output Power at 1dB Gain Compression Point , f = 12GHz V_{DS} = 6 V, I_{DS} = 40 mA	20.5	21.5		dBm
G_L	Linear Power Gain, f = 12GHz V_{DS} = 6 V, I_{DS} = 40 mA	11	12		dB
I_{DSS}	Saturated Drain-Source Current at V_{DS} = 2 V, V_{GS} = 0 V		90		mA
g_m	Transconductance at V_{DS} = 2 V, V_{GS} = 0 V		100		mS
V_P	Pinch-off Voltage at V_{DS} = 2 V, I_D = 0.6 mA		-1.0*		Volts
BV_{DGO}	Drain-Gate Breakdown Voltage at I_{DGO} =0.15 mA	9	12		Volts
R_{th}	Thermal Resistance		120		°C/W

Note: * For the tight control of the pinch-off voltage . TC1201's are divided into 3 groups:
(1) **TC1201P0710** : Vp = -0.7V to -1.0V (2) **TC1201P0811** : Vp = -0.8V to -1.1V (3) **TC1201P0912** : Vp = -0.9V to -1.2V
In addition, the customers may specify their requirements.

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ABSOLUTE MAXIMUM RATINGS (T_A=25 °C)

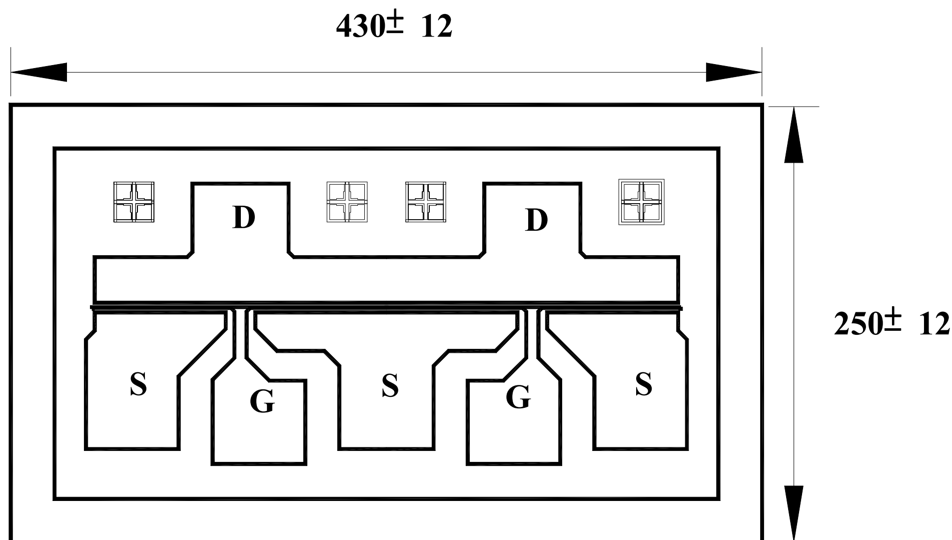
Symbol	Parameter	Rating
V_{DS}	Drain-Source Voltage	7.0 V
V_{GS}	Gate-Source Voltage	-3.0 V
I_{DS}	Drain Current	I_{DSS}
I_{GS}	Gate Current	300 µA
P_{in}	RF Input Power, CW	21 dBm
P_T	Continuous Dissipation	400 mW
T_{CH}	Channel Temperature	175 °C
T_{STG}	Storage Temperature	- 65 °C to +175 °C

TYPICAL NOISE PARAMETERS (T_A=25 °C)

V_{DS} = 4 V, I_{DS} = 25 mA

Frequency (GHz)	NF_{opt} (dB)	G_A (dB)	Γ_{opt}		Rn/50
			MAG	ANG	
2	0.33	20.4	0.89	9	0.66
4	0.41	17.0	0.80	20	0.46
6	0.45	14.7	0.74	37	0.36
8	0.49	13.0	0.68	57	0.29
10	0.55	12.0	0.63	77	0.25
12	0.60	11.3	0.58	95	0.20
14	0.73	10.7	0.55	112	0.16
16	0.85	10.3	0.51	129	0.11
18	0.97	9.8	0.50	149	0.09

CHIP DIMENSIONS



Units: Micrometers

Chip Thickness: 100

Gate Pad: 55 x 50

Drain Pad: 55 x 50

Source Pad: 55 x 65

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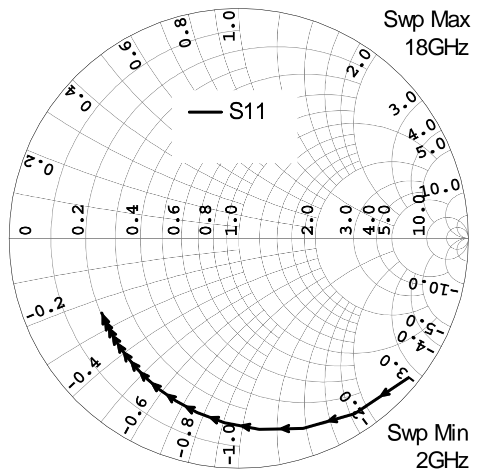
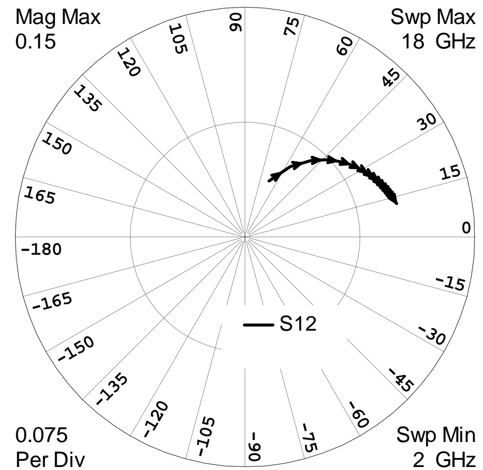
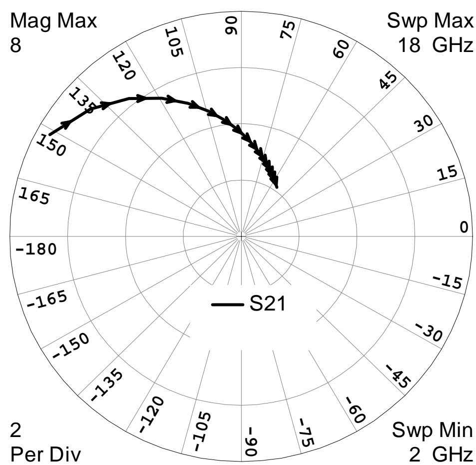
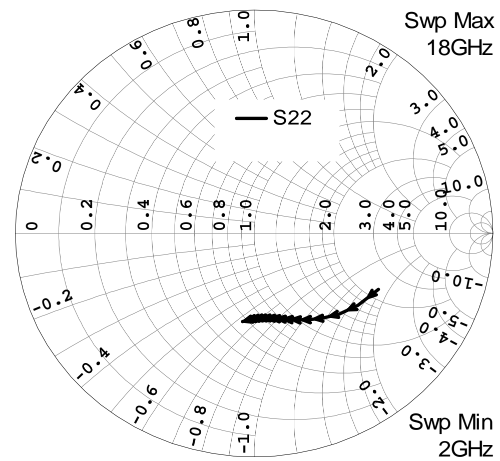
TYPICAL SCATTERING PARAMETERS (T_A=25 °C) V_{DS} = 4 V, I_{DS} = 25 mA









FREQUENCY	S11		S21		S12		S22	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2	0.9554	-39.49	7.5329	151.36	0.0398	66.80	0.5775	-25.69
3	0.9139	-56.54	6.9061	139.05	0.0548	57.21	0.5420	-36.51
4	0.8723	-71.28	6.2454	128.40	0.0660	49.27	0.5059	-45.66
5	0.8352	-83.83	5.6234	119.22	0.0743	42.80	0.4737	-53.32
6	0.8042	-94.47	5.0697	111.25	0.0804	37.54	0.4471	-59.75
7	0.7790	-103.50	4.5894	104.26	0.0849	33.23	0.4260	-65.20
8	0.7588	-111.21	4.1772	98.02	0.0883	29.68	0.4100	-69.87
9	0.7425	-117.84	3.8241	92.37	0.0909	26.70	0.3983	-73.94
10	0.7294	-123.59	3.5208	87.18	0.0930	24.17	0.3902	-77.53
11	0.7186	-128.61	3.2590	82.37	0.0947	22.01	0.3851	-80.74
12	0.7098	-133.04	3.0317	77.86	0.0960	20.13	0.3823	-83.64
13	0.7025	-136.97	2.8331	73.59	0.0972	18.48	0.3816	-86.29
14	0.6963	-140.48	2.6586	69.52	0.0982	17.01	0.3826	-88.74
15	0.6911	-143.65	2.5043	65.62	0.0991	15.70	0.3849	-91.01
16	0.6866	-146.51	2.3671	61.87	0.0999	14.51	0.3883	-93.14
17	0.6827	-149.13	2.2444	58.23	0.1006	13.43	0.3928	-95.14
18	0.6793	-151.52	2.1341	54.70	0.1013	12.44	0.3980	-97.05

* The data does not include gate, drain and source bond wires.

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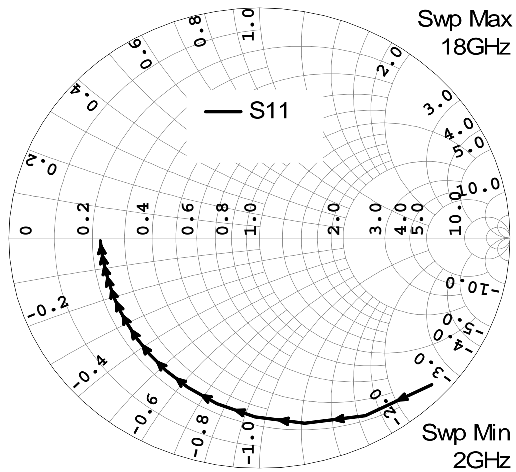
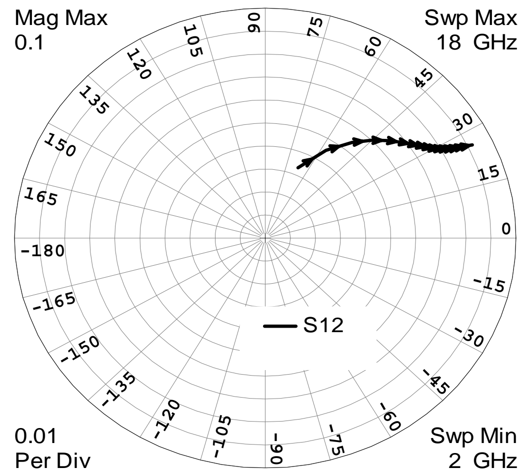
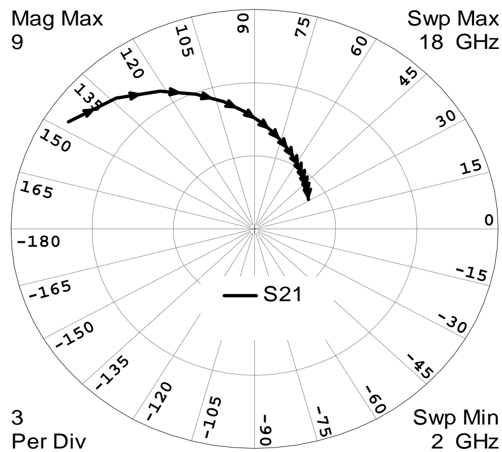
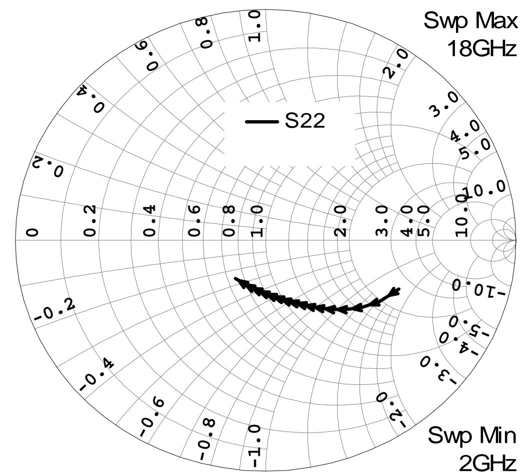
TYPICAL SCATTERING PARAMETERS (T$_A$=25 °C) V_{DS} = 6 V, I_{DS} = 40 mA









FREQUENCY	S11		S21		S12		S22	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2	0.9492	-42.63	8.1520	149.89	0.0332	65.82	0.5814	-23.13
3	0.9040	-60.64	7.3895	137.28	0.0452	56.18	0.5443	-32.47
4	0.8603	-75.94	6.6121	126.58	0.0539	48.42	0.5083	-40.13
5	0.8229	-88.76	5.9016	117.51	0.0602	42.29	0.4777	-46.43
6	0.7926	-99.48	5.2840	109.74	0.0648	37.45	0.4535	-51.70
7	0.7685	-108.48	4.7585	102.97	0.0682	33.60	0.4353	-56.23
8	0.7495	-116.10	4.3141	96.97	0.0708	30.49	0.4222	-60.23
9	0.7344	-122.61	3.9377	91.56	0.0728	27.95	0.4133	-63.85
10	0.7224	-128.23	3.6174	86.61	0.0744	25.85	0.4077	-67.19
11	0.7126	-133.13	3.3430	82.03	0.0758	24.09	0.4048	-70.31
12	0.7046	-137.43	3.1063	77.73	0.0770	22.60	0.4040	-73.25
13	0.6979	-141.24	2.9006	73.66	0.0781	21.31	0.4049	-76.05
14	0.6923	-144.65	2.7207	69.79	0.0791	20.19	0.4072	-78.73
15	0.6875	-147.73	2.5622	66.07	0.0799	19.20	0.4106	-81.30
16	0.6833	-150.51	2.4219	62.49	0.0808	18.32	0.4149	-83.76
17	0.6797	-153.06	2.2969	59.03	0.0816	17.53	0.4199	-86.13
18	0.6764	-155.39	2.1849	55.66	0.0824	16.80	0.4255	-88.42

*The data does not include gate, drain and source bond wires.

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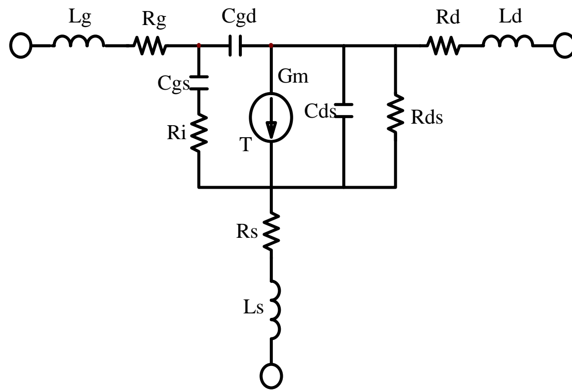
SMALL SIGNAL MODEL, V_{DS} = 4 V, I_{DS} = 25 mA

SCHEMATI

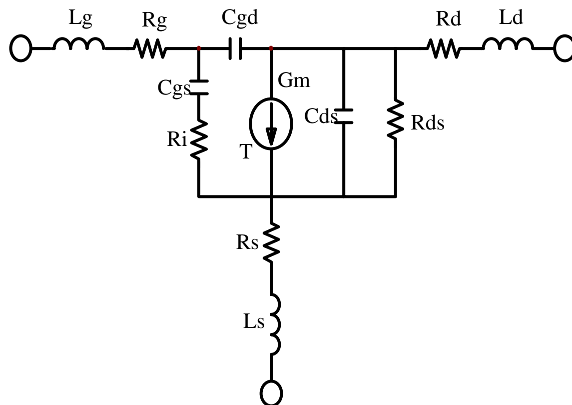


PARAMETERS

Lg	0.028 nH	Rs	1.63 Ohm
Rg	2.21 Ohm	**Ls**	0.0005 nH
Cgs	0.425 pF	**Cds**	0.104 pF
Ri	5.95 Ohm	**Rds**	172.8 Ohm
Cgd	0.039 pF	**Rd**	0.898 Ohm
Gm	123.1 mS	**Ld**	0.024 nH
T	4.58 psec		

SMALL SIGNAL MODEL, V_{DS} = 6 V, I_{DS} = 40 mA

SCHEMATI



PARAMETERS

Lg	0.028 nH	Rs	1.63 Ohm
Rg	2.21 Ohm	**Ls**	0.0005 nH
Cgs	0.52 pF	**Cds**	0.1 pF
Ri	7.12 Ohm	**Rds**	173.9 Ohm
Cgd	0.032 pF	**Rd**	0.898 Ohm
Gm	136.8 mS	**Ld**	0.024 nH
T	5.10 psec		

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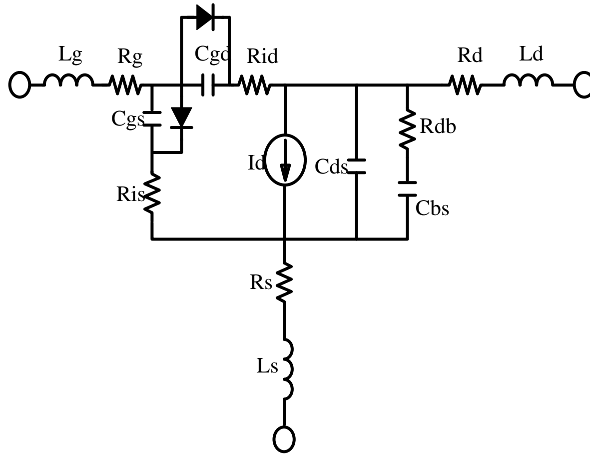
LARGE SIGNAL MODEL, V_{DS} = 6 V, I_{DS} = 40 mA

SCHEMATIC



TOM2 MODEL PARAMETERS

Parameters		Parameters	
VTO	-0.757 V	**VMAX**	0.5 V
ALPHA	3.92	**CGD**	0.032 pF
BETA	0.161	**CGS**	1.7929 pF
GAMMA	0.0509	**CDS**	0.097 pF
DELTA	0.3815	**RIS**	7.121 Ohm
Q	0.987	**RID**	0.001 Ohm
NG	0.1	**VBR**	9 V
ND	0.01	**RDB**	173.9 Ohm
TAU	5.098 ps	**CBS**	0.0266 pF
RG	2.205 Ohm	**TNOM**	25 °C
RD	0.898 Ohm	**LS**	0.0005 nH
RS	1.631 Ohm	**LG**	0.0278 nH
IS	1E-11 mA	**LD**	0.0243 nH
N	1	**AFAC**	1
VBI	1 V	**NFING**	1
VDELTA	0.2 V		

CHIP HANDLING

DIE ATTACHMENT: Conductive epoxy or eutectic die attach is recommended. Eutectic die attach can be accomplished with Au-Sn (80%Au-20%Sn) perform at stage temperature: 290°C ± 5°C; Handling Tool: Tweezers; Time: less than 1min.

WIRE BONDING: The recommended wire bond method is thermocompression bonding with 0.7 to 1.0 mil (0.018 to 0.025 mm) gold wire. Stage temperature: 220°C to 250°C; Bond Tip Temperature: 150°C; Bond Force: 20 to 30 gms depending on size of wire and Bond Tip Temperature.

HANDLING PRECAUTIONS: The user must operate in a clean, dry environment. Care should be exercised during handling avoid damage to the devices. Electrostatic Discharge (ESD) precautions should be observed at all stages of storage, handling, assembly, and testing. The static discharge must be less than 300V.

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