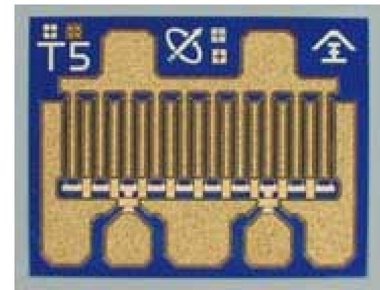
1W High Linearity and High Efficiency GaAs Power FETs

FEATURES

- 1W Typical Power at 6 GHz
- Linear Power Gain: G_L = 12 dB Typical at 6 GHz
- High Linearity: IP3 = 40 dBm Typical at 6 GHz
- High Power Added Efficiency: Nominal PAE of 43% at 6 GHz
- Non-Via Hole Source for Self-Bias Application
- Suitable for High Reliability Application
- Breakdown Voltage: $BV_{DGO} \geq 15$ V
- Lg = 0.35 μm, Wg = 2.4 mm
- Tight Vp ranges control
- High RF input power handling capability
- 100 % DC Tested

PHOTO ENLARGEMENT



DESCRIPTION

The TC1501N is a GaAs Pseudomorphic High Electron Mobility Transistor (PHEMT) which has high linearity and high Power Added Efficiency. The device is processed without via-holes for self-bias applications. The short gate length characteristic enables the device to be used in circuits up to 20GHz. All devices are 100% DC tested to assure consistent quality. Bond pads are gold plated for either thermo-compression or thermo-sonic wire bonding. Backside gold plating is compatible with standard AuSn die-attach. Typical application include commercial and military high performance power amplifiers.

ELECTRICAL SPECIFICATIONS (T_A=25 °C)

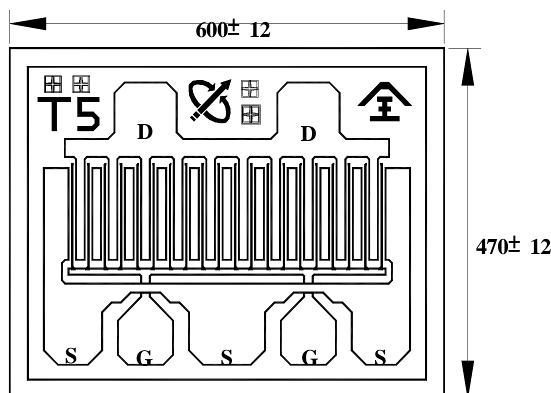
Symbol	Conditions	MIN	TYP	MAX	UNIT
P_{1dB}	Output Power at 1dB Gain Compression Point , f = 6 GHz V_{DS} = 8 V, I_{DS} = 240 mA	29.5	30		dBm
G_L	Linear Power Gain, f = 6 GHz V_{DS} = 8 V, I_{DS} = 240 mA		12		dB
IP3	Intercept Point of the 3rd-order Intermodulation, f = 6 GHz V_{DS} = 8 V, I_{DS} = 240 mA,*P_{SCL} = 17 dBm		40		dBm
PAE	Power Added Efficiency at 1dB Compression Power, f = 6 GHz		43		%
I_{DSS}	Saturated Drain-Source Current at V_{DS} = 2 V, V_{GS} = 0 V		600		mA
g_m	Transconductance at V_{DS} = 2 V, V_{GS} = 0 V		400		mS
V_P	Pinch-off Voltage at V_{DS} = 2 V, I_D = 4.8 mA		-1.7**		Volts
BV_{DGO}	Drain-Gate Breakdown Voltage at I_{DGO} =1.2 mA	15	18		Volts
R_{th}	Thermal Resistance		15		°C/W

Note:
*** P_{SCL}: Output Power of Single Carrier Level.**
* For the tight control of the pinch-off voltage . TC1501N's are divided into 3 groups:
(1)**TC1501NP1519** : Vp = -1.5V to -1.9V (2) **TC1501NP1620** : Vp = -1.6V to -2.0V
(3)**TC1501NP1721** : Vp = -1.7V to -2.1V In addition, the customers may specify their requirements.

ABSOLUTE MAXIMUM RATINGS (T_A=25 °C)

Symbol	Parameter	Rating
V_{DS}	Drain-Source Voltage	12 V
V_{GS}	Gate-Source Voltage	-5 V
I_{DS}	Drain Current	I_{DSS}
P_{in}	RF Input Power, CW	28 dBm
P_T	Continuous Dissipation	3.8 W
T_{CH}	Channel Temperature	175 °C
T_{STG}	Storage Temperature	- 65 °C to +175 °C

CHIP DIMENSIONS



Units: Micrometers
Chip Thickness: 50
Gate Pad: 79 x 59.5
Drain Pad: 86.0 x 76.0
Source Pad: 80 x 86

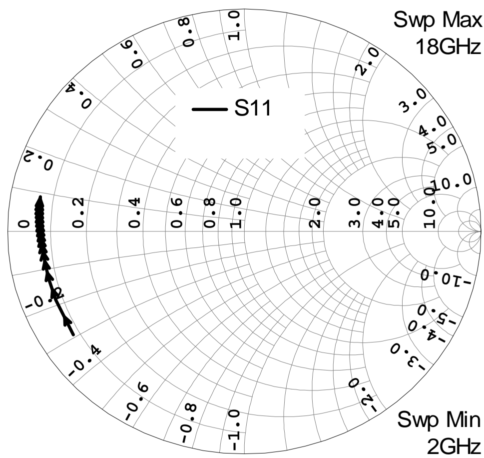
CHIP HANDLING

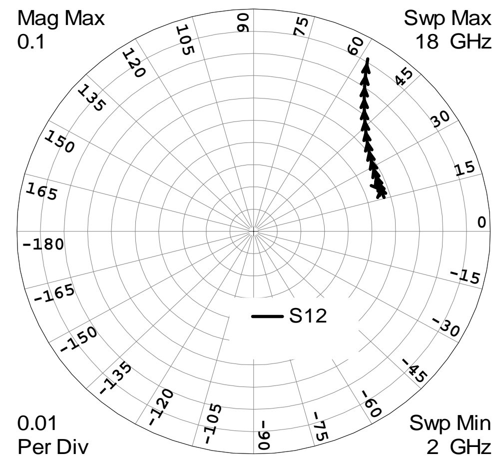
DIE ATTACHMENT: Conductive epoxy or eutectic die attach is recommended. Eutectic die attach can be accomplished with Au-Sn (80% Au-20% Sn) perform at stage temperature: 290°C ± 5°C; Handling Tool: Tweezers; Time: less than 1min.

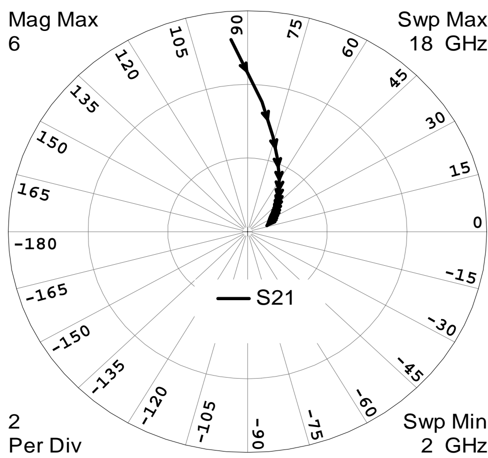
WIRE BONDING: The recommended wire bond method is thermocompression bonding with 0.7 to 1.0 mil (0.018 to 0.025 mm) gold wire. Stage temperature: 220°C to 250°C; Bond Tip Temperature: 150°C; Bond Force: 20 to 30 gms depending on size of wire and Bond Tip Temperature.

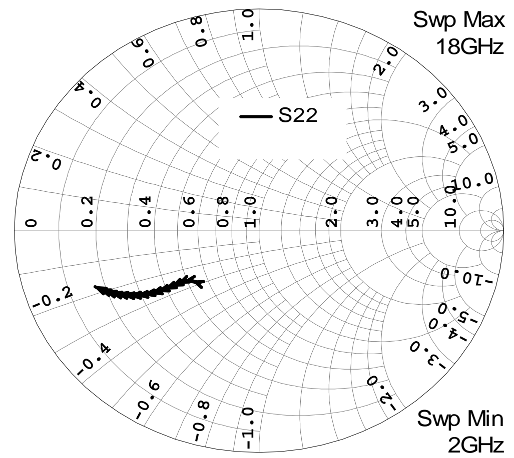
HANDLING PRECAUTIONS: The user must operate in a clean, dry environment. Care should be exercised during handling avoid damage to the devices. Electrostatic Discharge (ESD) precautions should be observed at all stages of storage, handling, assembly, and testing. The static discharge must be less than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

TYPICAL SCATTERING PARAMETERS (T_A=25 °C) V_{DS} = 8 V, I_{DS} = 240 mA







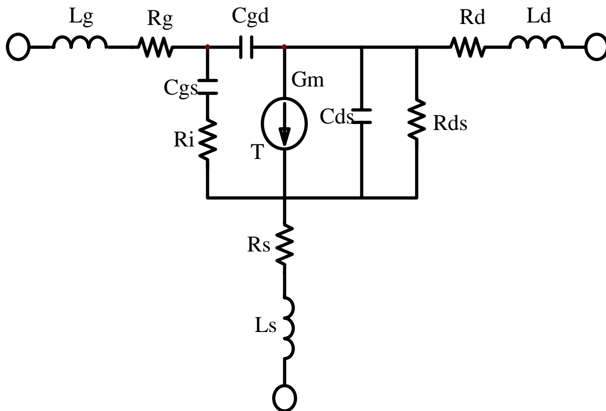


FREQUENCY	S11		S21		S12		S22	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2	0.8590	-147.25	5.2262	94.57	0.0559	21.04	0.3393	-135.53
3	0.8534	-158.90	3.5426	84.03	0.0568	18.84	0.3577	-141.51
4	0.8524	-165.26	2.6620	76.08	0.0569	19.35	0.3819	-143.44
5	0.8529	-169.41	2.1223	69.32	0.0570	21.16	0.4095	-144.26
6	0.8541	-172.46	1.7577	63.27	0.0571	23.76	0.4390	-144.88
7	0.8558	-174.86	1.4947	57.72	0.0575	26.90	0.4691	-145.59
8	0.8577	-176.88	1.2959	52.59	0.0583	30.37	0.4988	-146.47
9	0.8597	-178.64	1.1403	47.83	0.0595	34.03	0.5276	-147.50
10	0.8618	179.77	1.0153	43.40	0.0613	37.71	0.5550	-148.66
11	0.8638	178.31	0.9127	39.29	0.0636	41.27	0.5809	-149.92
12	0.8658	176.94	0.8269	35.47	0.0663	44.62	0.6050	-151.24
13	0.8677	175.63	0.7542	31.93	0.0696	47.68	0.6275	-152.59
14	0.8695	174.38	0.6918	28.67	0.0733	50.41	0.6483	-153.96
15	0.8712	173.18	0.6377	25.67	0.0773	52.81	0.6674	-155.33
16	0.8728	172.00	0.5903	22.91	0.0817	54.89	0.6850	-156.69
17	0.8743	170.86	0.5485	20.39	0.0864	56.65	0.7012	-158.02
18	0.8757	169.74	0.5113	18.11	0.0912	58.13	0.7161	-159.34

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

SMALL SIGNAL MODEL, V_{DS} = 8 V, I_{DS} = 240 mA

SCHEMATI

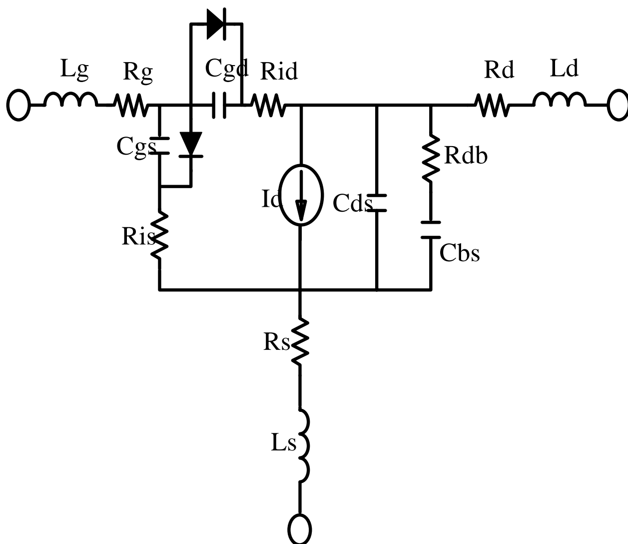


PARAMETERS

Lg	0.0377 nH	Rs	0.965 Ohm
Rg	0.69 Ohm	Ls	0.0254 nH
Cgs	3.6 pF	Cds	0.439 pF
Ri	1.18 Ohm	Rds	73.1 Ohm
Cgd	0.213 pF	Rd	0.937 Ohm
Gm	407.7 mS	Ld	0.008 nH
T	3.9 psec		

LARGE SIGNAL MODEL, V_{DS} = 8 V, I_{DS} = 240 mA

SCHEMATI



TOM2 MODEL PARAMETERS

VTO	-2.364 V	VMAX	0.5 V
ALPHA	10.67	CGD	0.213 pF
BETA	0.543	CGS	6.712 pF
GAMMA	0.0195	CDS	0.444 pF
DELTA	0.0848	RIS	1.288 Ohm
Q	0.83	RID	0.0001 Ohm
NG	0.1	VBR	15 V
ND	0.01	RDB	54.633 Ohm
TAU	3.9 ps	CBS	14.433 pF
RG	1.071 Ohm	TNOM	25 °C
RD	0.92 Ohm	LS	0.0254 nH
RS	0.965 Ohm	LG	0.0377 nH
IS	1E-11 mA	LD	0.0078 nH
N	1	AFAC	1
VBI	1 V	NFING	1
VDELTA	0.2 V		

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