

# FHX13X, FHX14X

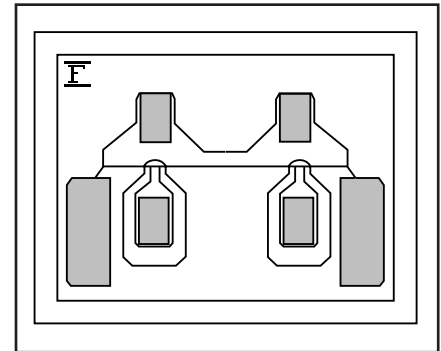
## GaAs FET & HEMT Chips

### FEATURES

- Low Noise Figure: 0.45dB (Typ.)@f=12GHz (FHX13)
- High Associated Gain: 13.0dB (Typ.)@f=12GHz
- $L_g \leq 0.15\mu\text{m}$ ,  $W_g = 200\mu\text{m}$
- Gold Gate Metallization for High Reliability

### DESCRIPTION

The FHX13X, FHX14X are Super High Electron Mobility Transistor (SuperHEMT™) intended for general purpose, ultra-low noise and high gain amplifiers in the 2-18GHz frequency range. The devices are well suited for telecommunication, DBS, TVRO, VSAT or other low noise applications.



Fujitsu's stringent Quality Assurance Program assures the highest reliability and consistent performance.

### ABSOLUTE MAXIMUM RATING (Ambient Temperature Ta=25°C)

Item	Symbol	Rating	Unit
Drain-Source Voltage	$V_{DS}$	3.5	V
Gate-Source Voltage	$V_{GS}$	-3.0	V
Total Power Dissipation	$P_{t^*}$	180	mW
Storage Temperature	$T_{stg}$	-65 to +175	°C
Channel Temperature	$T_{ch}$	175	°C

\*Note: Mounted on  $Al_2O_3$  board (30 x 30 x 0.65mm)

Fujitsu recommends the following conditions for the reliable operation of GaAs FETs:

1. The drain-source operating voltage ( $V_{DS}$ ) should not exceed 2 volts.
2. The forward and reverse gate currents should not exceed 0.2 and -0.05mA respectively with gate resistance of 4000Ω.
3. The operating channel temperature ( $T_{ch}$ ) should not exceed 80°C.

### ELECTRICAL CHARACTERISTICS (Ambient Temperature Ta=25°C)

Item	Symbol	Test Conditions	Limit			Unit
			Min.	Typ.	Max.	
Saturated Drain Current	$I_{DSS}$	$V_{DS} = 2V, V_{GS} = 0V$	10	30	60	mA
Transconductance	$g_m$	$V_{DS} = 2V, I_{DS} = 10mA$	35	50	-	mS
Pinch-off Voltage	$V_p$	$V_{DS} = 2V, I_{DS} = 1mA$	-0.1	-0.7	-1.5	V
Gate Source Breakdown Voltage	$V_{GSO}$	$I_{GS} = -10\mu A$	-3.0	-	-	V
Noise Figure	FHX13X	NF	-	0.45	0.50	dB
Associated Gain		$G_{as}$	$V_{DS} = 2V$ $I_{DS} = 10mA$	11.0	13.0	-
Noise Figure	FHX14X	NF	-	0.55	0.60	dB
Associated Gain		$G_{as}$	f = 12GHz	11.0	13.0	-
Thermal Resistance	$R_{th}$	Channel to Case	-	220	300	°C/W

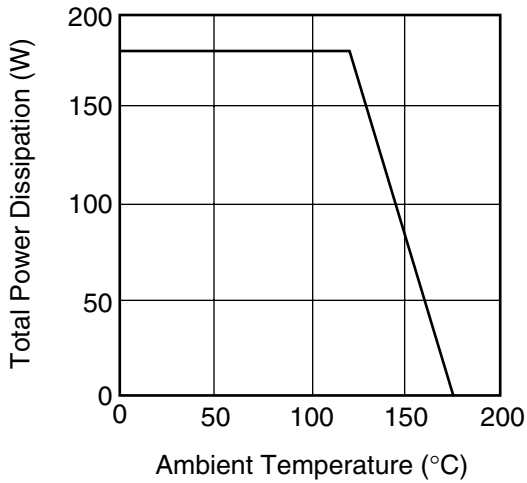
Note: RF parameter sample size 10pcs. criteria (accept/reject)=(2/3)

The chip must be enclosed in a hermetically sealed environment for optimum performance and reliability.

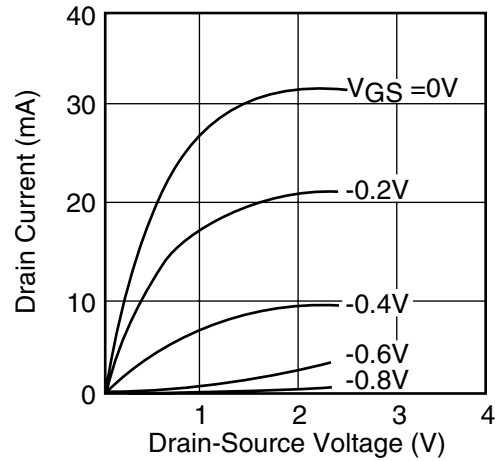
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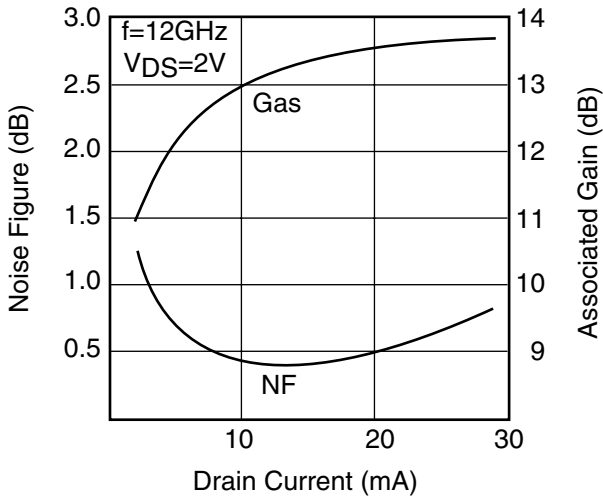
**POWER DERATING CURVE**



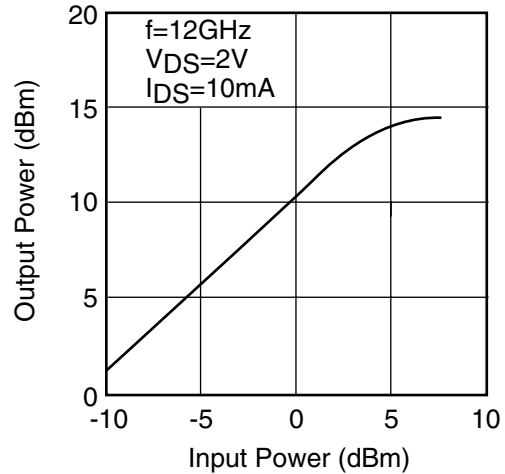
**DRAIN CURRENT vs. DRAIN-SOURCE VOLTAGE**



**NF & Gas vs. I<sub>DS</sub>**



**OUTPUT POWER vs. INPUT POWER**

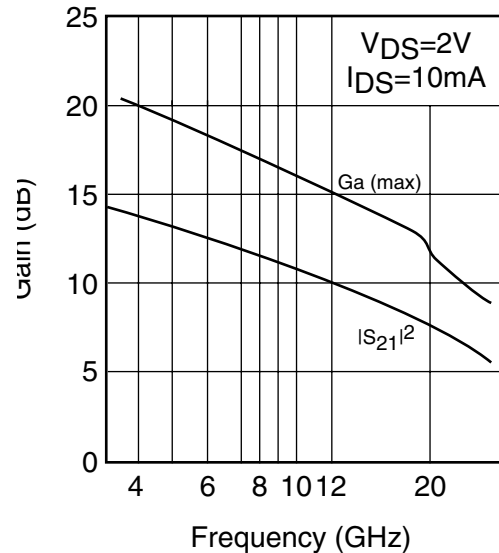


**NOISE PARAMETERS**

V<sub>DS</sub>=2V, I<sub>DS</sub>=10mA

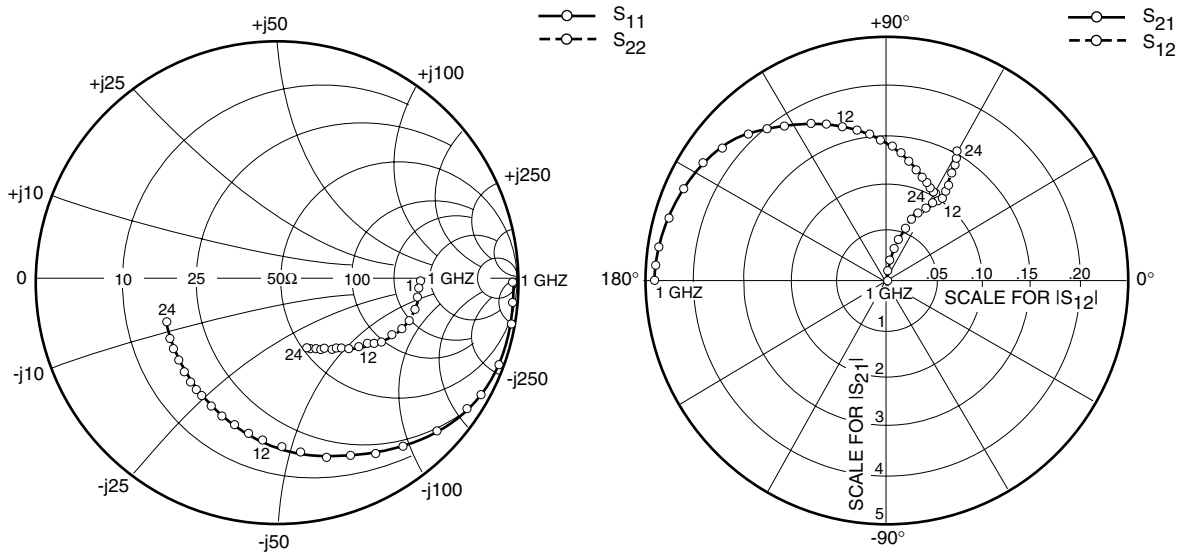
Freq. (GHz)	Γ <sub>opt</sub>		NF <sub>min</sub> (dB)	Rn/50
	(MAG)	(ANG)		
2	0.92	13	0.28	0.65
4	0.84	25	0.30	0.54
6	0.77	38	0.32	0.41
8	0.71	51	0.34	0.31
10	0.66	65	0.39	0.23
12	0.61	79	0.45	0.17
14	0.58	93	0.56	0.12
16	0.56	108	0.68	0.09
18	0.54	122	0.86	0.07
20	0.52	136	1.03	0.07
22	0.50	150	1.22	0.07
24	0.46	162	1.43	0.07

**Ga (max) & |S<sub>21</sub>|<sup>2</sup> vs. FREQUENCY**



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### S-PARAMETERS

$V_{DS} = 2V, I_{DS} = 10mA$

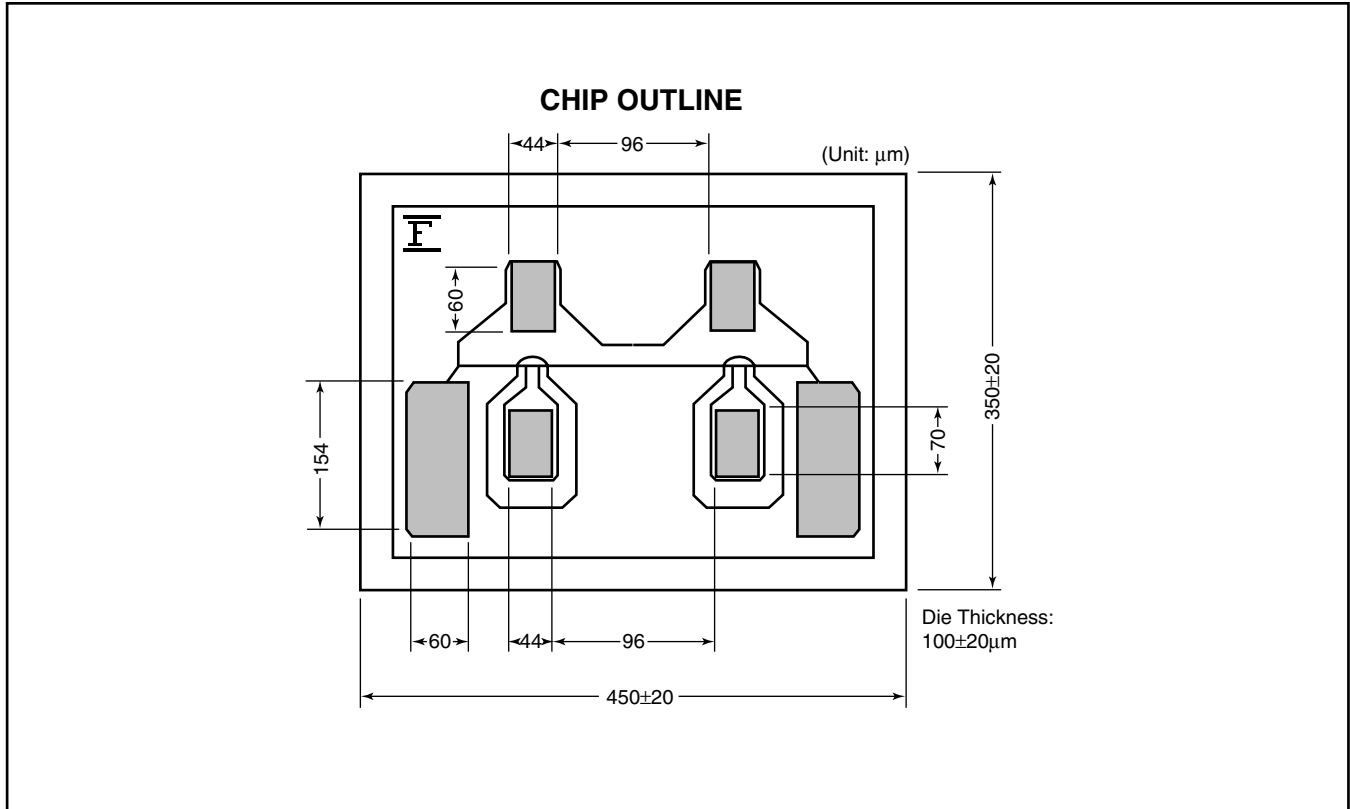
FREQUENCY (MHZ)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	1.000	-0.9	4.899	179.2	0.001	89.5	0.601	-0.5
500	0.999	-4.7	4.894	175.9	0.006	87.7	0.601	-2.3
1000	0.995	-9.4	4.876	171.9	0.013	85.5	0.599	-4.6
2000	0.981	-18.6	4.806	163.9	0.025	81.1	0.591	-9.2
3000	0.958	-27.7	4.696	156.1	0.037	77.0	0.580	-13.5
4000	0.929	-36.4	4.555	148.6	0.048	73.2	0.565	-17.7
5000	0.895	-44.9	4.392	141.5	0.057	69.8	0.548	-21.5
6000	0.860	-53.0	4.215	134.8	0.066	66.8	0.530	-25.0
7000	0.823	-60.7	4.034	128.4	0.074	64.2	0.512	-28.3
8000	0.786	-68.1	3.852	122.4	0.080	62.0	0.493	-31.3
9000	0.751	-75.3	3.675	116.8	0.086	60.2	0.475	-34.0
10000	0.718	-82.1	3.506	111.5	0.092	58.9	0.458	-36.6
11000	0.687	-88.7	3.345	106.5	0.096	57.8	0.442	-39.0
12000	0.659	-95.0	3.194	101.8	0.101	57.1	0.426	-41.3
13000	0.633	-101.2	3.054	97.3	0.105	56.6	0.412	-43.6
14000	0.610	-107.2	2.923	93.0	0.108	56.4	0.399	-45.8
15000	0.590	-113.0	2.801	88.9	0.112	56.4	0.386	-47.9
16000	0.572	-118.7	2.688	85.0	0.116	56.6	0.375	-50.1
17000	0.556	-124.2	2.584	81.3	0.120	56.9	0.364	-52.3
18000	0.543	-129.6	2.487	77.7	0.124	57.3	0.353	-54.6
19000	0.532	-134.9	2.397	74.2	0.129	57.8	0.344	-56.9
20000	0.523	-140.0	2.314	70.8	0.133	58.4	0.335	-59.4
21000	0.516	-145.0	2.236	67.5	0.138	58.9	0.326	-62.0
22000	0.511	-149.8	2.164	64.4	0.144	59.5	0.318	-64.7
23000	0.507	-154.6	2.096	61.3	0.150	60.0	0.310	-67.5
24000	0.505	-159.2	2.033	58.3	0.156	60.5	0.303	-70.5

NOTE:\* The data includes bonding wires.

n: number of wires  
 Gate n=2 (0.3mm length, 20 $\mu$ m Dia Au wire)  
 Drain n=2 (0.3mm length, 20 $\mu$ m Dia Au wire)  
 Source n=4 (0.3mm length, 20 $\mu$ m Dia Au wire)

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- Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.

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