

# FHX04LG, 05LG, 06LG

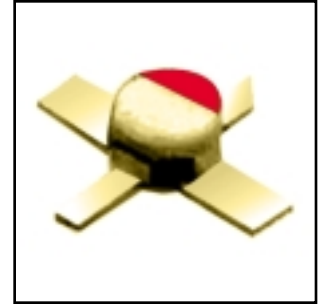
Super Low Noise HEMT

## FEATURES

- Low Noise Figure: 0.75dB (Typ.)@f=12GHz (FHX04)
- High Associated Gain: 10.5dB (Typ.)@f=12GHz
- $L_g \leq 0.25\mu\text{m}$ ,  $W_g = 200\mu\text{m}$
- Gold Gate Metallization for High Reliability
- Cost Effective Ceramic Microstrip (SMT) Package
- Tape and Reel Packaging Available

## DESCRIPTION

The FHX04LG, FHX05LG, FHX06LG is a High Electron Mobility Transistor(HEMT) intended for general purpose, low noise and high gain amplifiers in the 2-18GHz frequency range. The devices are packaged in cost effective, low parasitic, hermetically sealed metal-ceramic package for high volume telecommunication, 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  $\text{Al}_2\text{O}_3$  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 -0.05 mA 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           | Condition                                                     | Limit |      |      | Unit |
|-------------------------------|---------|------------------|---------------------------------------------------------------|-------|------|------|------|
|                               |         |                  |                                                               | Min.  | Typ. | Max. |      |
| Saturated Drain Current       |         | I <sub>DSS</sub> | V <sub>DS</sub> = 2V, V <sub>GS</sub> = 0V                    | 15    | 30   | 60   | mA   |
| Transconductance              |         | g <sub>m</sub>   | V <sub>DS</sub> = 2V, I <sub>DS</sub> =10mA                   | 35    | 45   | -    | mS   |
| Pinch-off Voltage             |         | V <sub>p</sub>   | V <sub>DS</sub> = 2V, I <sub>DS</sub> =1mA                    | -0.2  | -0.7 | -1.5 | V    |
| Gate Source Breakdown Voltage |         | V <sub>GSO</sub> | I <sub>GS</sub> = -10μA                                       | -3.0  | -    | -    | V    |
| Noise Figure                  | FHX04LG | NF               | V <sub>DS</sub> = 2V,<br>I <sub>DS</sub> = 10mA,<br>f = 12GHz | -     | 0.75 | 0.85 | dB   |
| Associated Gain               |         | G <sub>as</sub>  |                                                               | 9.5   | 10.5 | -    | dB   |
| Noise Figure                  | FHX05LG | NF               |                                                               | -     | 0.9  | 1.1  | dB   |
| Associated Gain               |         | G <sub>as</sub>  |                                                               | 9.5   | 10.5 | -    | dB   |
| Noise Figure                  | FHX06LG | NF               |                                                               | -     | 1.1  | 1.35 | dB   |
| Associated Gain               |         | G <sub>as</sub>  |                                                               | 9.5   | 10.5 | -    | dB   |
| Thermal Resistance            |         | R <sub>th</sub>  | Channel to Case                                               | -     | 300  | 400  | °C/W |

## AVAILABLE CASE STYLES: LG

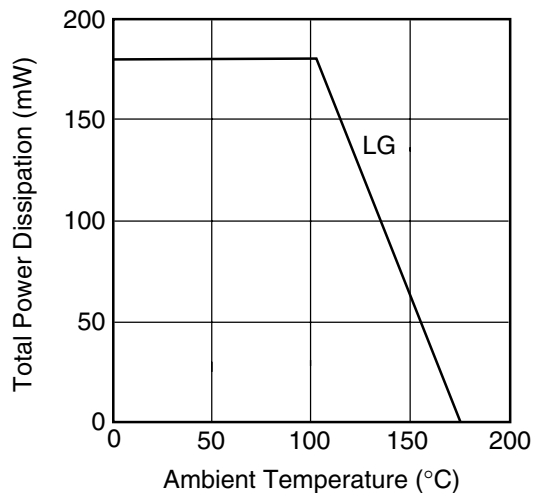
Note: RF parameters are measured on a sample basis as follows:

| Lot qty. |    |       | Sample qty. | Accept/Reject |
|----------|----|-------|-------------|---------------|
| 1200     | or | less  | 125         | (0,1)         |
| 1201     | to | 3200  | 200         | (0,1)         |
| 3201     | to | 10000 | 315         | (1,2)         |
| 10001    | or | over  | 500         | (1,2)         |

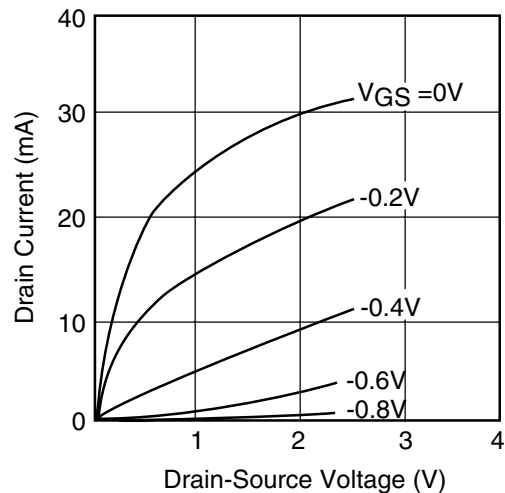
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POWER DERATING CURVE

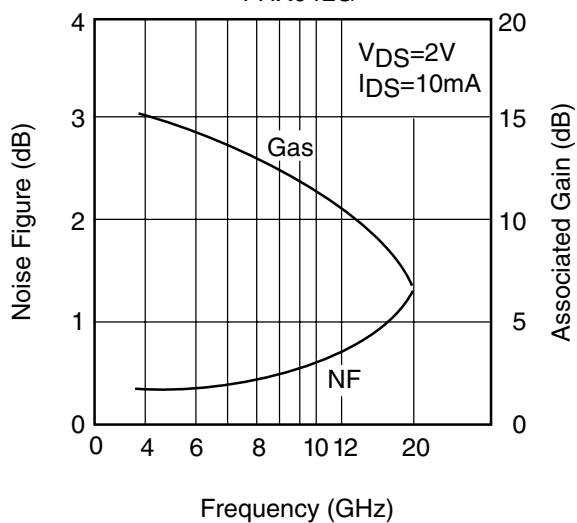


DRAIN CURRENT vs. DRAIN-SOURCE VOLTAGE



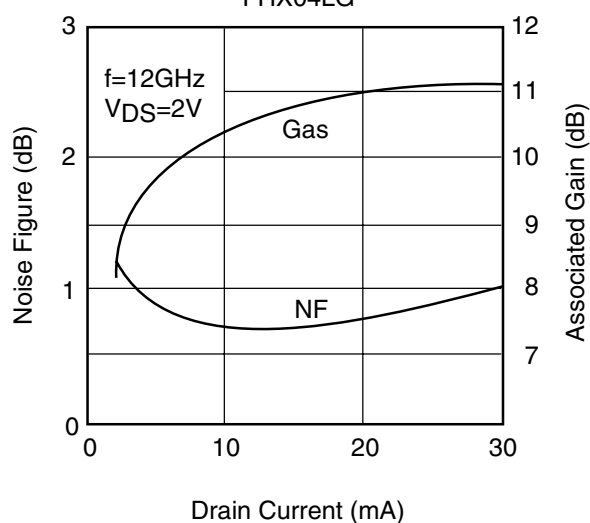
NF & Gas vs. FREQUENCY

FHX04LG



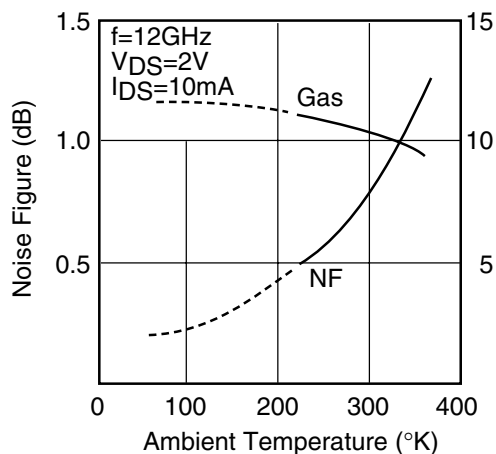
NF & Gas vs.  $I_{DS}$

FHX04LG

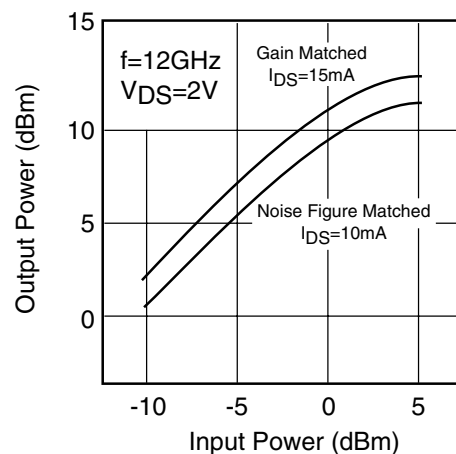


NF & Gas vs. TEMPERATURE

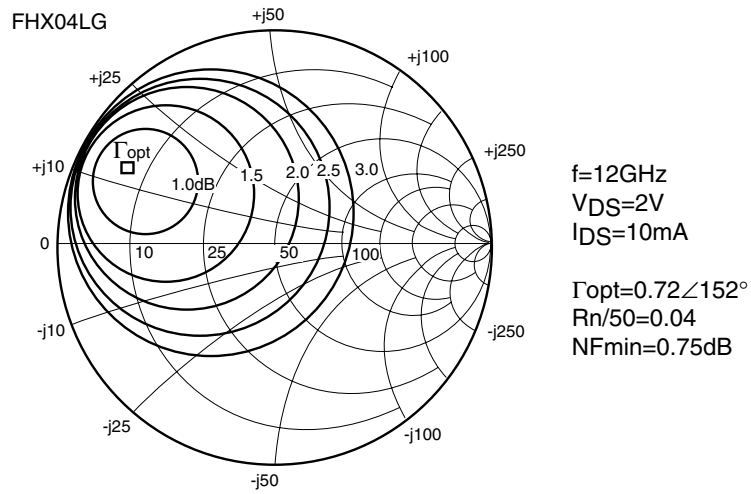
FHX04LG



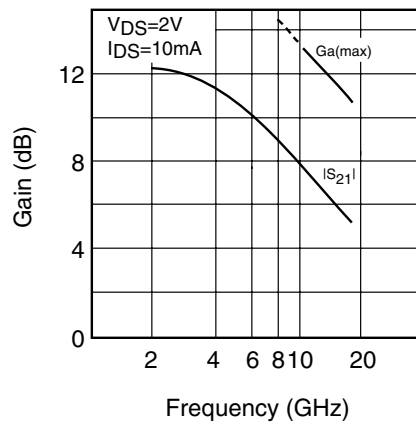
OUTPUT POWER vs. INPUT POWER



### TYPICAL NOISE FIGURE CIRCLE



### Ga(max) AND $|S_{21}|$ vs. FREQUENCY FHX04LG



### NOISE PARAMETERS

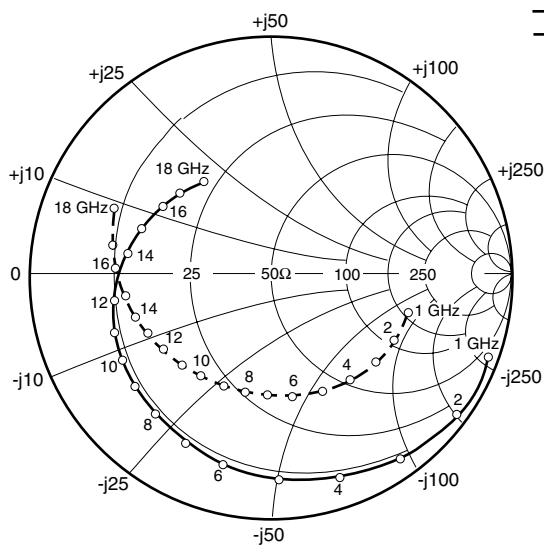
FHX04LG

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

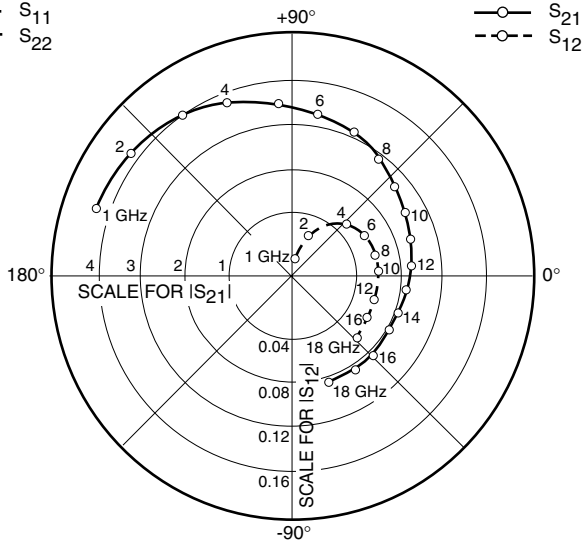
| Freq.<br>(GHz) | $\Gamma_{opt}$ |        | NFmin<br>(dB) | Rn/50 |
|----------------|----------------|--------|---------------|-------|
|                | (MAG)          | (ANG)  |               |       |
| 2.0            | 0.99           | 29.0   | 0.33          | 0.43  |
| 4.0            | 0.97           | 53.0   | 0.35          | 0.30  |
| 6.0            | 0.93           | 77.0   | 0.45          | 0.20  |
| 8.0            | 0.87           | 101.0  | 0.55          | 0.12  |
| 10.0           | 0.80           | 127.0  | 0.66          | 0.07  |
| 12.0           | 0.72           | 152.0  | 0.75          | 0.04  |
| 14.0           | 0.63           | 178.0  | 0.88          | 0.03  |
| 16.0           | 0.53           | -156.0 | 1.05          | 0.05  |
| 18.0           | 0.42           | -129.0 | 1.30          | 0.09  |

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—○— S<sub>11</sub>  
- -○- - S<sub>22</sub>



—○— S<sub>21</sub>  
- -○- - S<sub>12</sub>

## S-PARAMETERS

FHX04LG

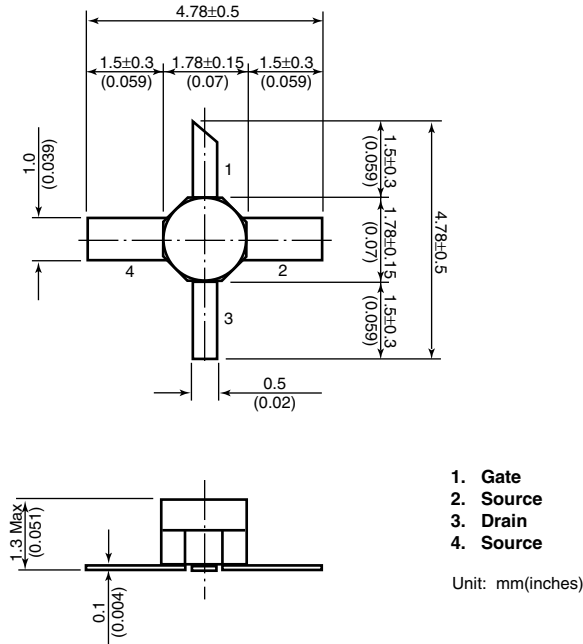
V<sub>DS</sub> = 2V, I<sub>DS</sub> = 10mA

| FREQUENCY<br>(GHZ) | S <sub>11</sub> |        | S <sub>21</sub> |       | S <sub>12</sub> |       | S <sub>22</sub> |        |
|--------------------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|--------|
|                    | MAG             | ANG    | MAG             | ANG   | MAG             | ANG   | MAG             | ANG    |
| 1.0                | 0.990           | -19.3  | 4.232           | 162.1 | 0.016           | 75.1  | 0.576           | -14.3  |
| 2.0                | 0.965           | -37.5  | 4.115           | 144.1 | 0.030           | 64.8  | 0.563           | -28.1  |
| 3.0                | 0.928           | -55.2  | 3.923           | 127.4 | 0.042           | 53.3  | 0.546           | -41.2  |
| 4.0                | 0.886           | -72.1  | 3.737           | 110.9 | 0.052           | 41.9  | 0.525           | -54.4  |
| 5.0                | 0.844           | -88.3  | 3.518           | 95.6  | 0.059           | 32.2  | 0.505           | -67.6  |
| 6.0                | 0.804           | -103.4 | 3.302           | 80.8  | 0.063           | 23.9  | 0.489           | -80.7  |
| 7.0                | 0.771           | -117.4 | 3.090           | 66.4  | 0.066           | 16.6  | 0.484           | -93.0  |
| 8.0                | 0.741           | -129.6 | 2.876           | 53.1  | 0.065           | 11.5  | 0.487           | -104.5 |
| 9.0                | 0.717           | -140.3 | 2.703           | 40.7  | 0.066           | 4.9   | 0.497           | -115.1 |
| 10.0               | 0.695           | -150.8 | 2.592           | 28.6  | 0.065           | -0.3  | 0.503           | -124.9 |
| 11.0               | 0.675           | -161.2 | 2.476           | 16.4  | 0.064           | -3.0  | 0.517           | -135.7 |
| 12.0               | 0.650           | -171.5 | 2.374           | 4.2   | 0.064           | -6.4  | 0.534           | -145.8 |
| 13.0               | 0.630           | 178.9  | 2.277           | -7.8  | 0.063           | -9.3  | 0.552           | -156.1 |
| 14.0               | 0.607           | 170.2  | 2.176           | -19.1 | 0.064           | -12.5 | 0.585           | -164.6 |
| 15.0               | 0.585           | 161.8  | 2.144           | -30.7 | 0.065           | -16.4 | 0.617           | -171.7 |
| 16.0               | 0.557           | 151.8  | 2.151           | -43.2 | 0.066           | -22.2 | 0.642           | 177.8  |
| 17.0               | 0.522           | 140.9  | 2.142           | -56.9 | 0.067           | -29.4 | 0.673           | 169.5  |
| 18.0               | 0.480           | 128.4  | 2.136           | -71.2 | 0.068           | -39.2 | 0.694           | 159.7  |

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## Case Style "LG" Metal-Ceramic Hermetic Package



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