



# FHF1

## High Dynamic Range FET

### The Communications Edge™

### Advanced Product Information

## Product Features

- 3000-6000 MHz Bandwidth
- +39 dBm Output IP3
- 2.4 dB Noise Figure
- +21 dBm P1dB
- Single or Dual Supply Operation
- MTBF >100 Years
- SOT-89 SMT Package



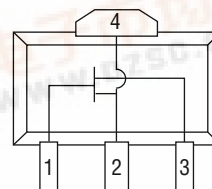
Actual Size

## Product Description

The FHF1 is a high dynamic range FET packaged in a low cost surface mount package. The combination of low noise figure and high output IP3 at the same bias point makes it ideal for receiver and transmitter applications. The FHF1 achieves +39 dBm OIP3 at a mounting temperature of 85°C with an associated MTBF of >100 years<sup>6</sup>. The package is a SOT-89. All devices are 100% RF and DC tested.

The product is targeted for applications where high linearity is required.

## Functional Diagram



| Function | Pin No. |
|----------|---------|
| Gate     | 1       |
| Source   | 2       |
| Drain    | 3       |
| Source   | 4       |

## Specifications

| DC Electrical Parameter       | Units | Minimum | Typical | Maximum | Condition    |
|-------------------------------|-------|---------|---------|---------|--------------|
| Saturated Drain Current, Idss | mA    | 100     | 140     | 170     | Vgs = 0 V    |
| Transconductance, Gm          | mS    |         | 120     |         |              |
| Pinch Off Voltage, Vp         | V     | -3.0    | -1.5    |         | Ids = 0.6 mA |

| RF Parameter                       | Units | Minimum | Typical | Maximum | Condition |
|------------------------------------|-------|---------|---------|---------|-----------|
| Small Signal Gain, Gss             | dB    | 10      | 12      |         |           |
| Maximum Stable Gain, Gmsg          | dB    |         | 17      |         |           |
| Third Order Output Intercept, OIP3 | dBm   | +37     | +39     |         |           |
| 1 dB Compression Point, P1dB       | dBm   |         | +21     |         |           |
| Noise Figure, NF                   | dB    |         | 2.4     |         |           |

### Notes:

1. DC and RF parameters measured under the following conditions unless otherwise noted.  
25°C with Vds = 5.0 V, Vgs = 0 V, test frequency = 3000 MHz, 50 Ω system.
2. OIP3 measured with two tones at an output power of 5 dBm/tone separated by 10 MHz. The suppression on the largest IM3 product is used to calculate the OIP3 using a 2:1 slope rule.
3. Degradation of OIP3 occurs at low temperatures. Minimum typical OIP3 at -40°C is +36 dBm.
4. Idss is measured with Vgs = 0 V.
5. Pinch off voltage is measured when Ids = 0.6 mA.
6. MTBF calculated with channel temperature at 155°C.

## Absolute Maximum Ratings

| Parameter                   | Rating        |
|-----------------------------|---------------|
| Drain to Source Voltage     | 8.0 V         |
| Gate to Source Voltage      | -6.0 V        |
| Gate Current                | 4.5 mA        |
| Storage Temperature         | -55 to +125°C |
| RF Input Power (continuous) | +10 dBm       |

Operation of this device above any of these parameters may cause permanent damage.

## Ordering Information

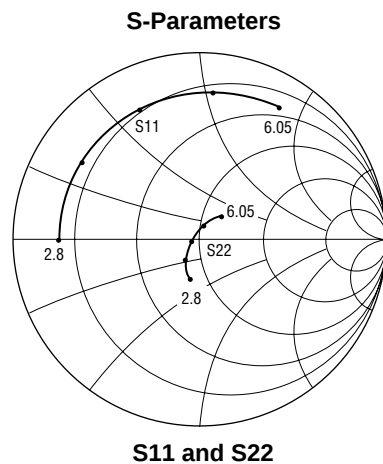
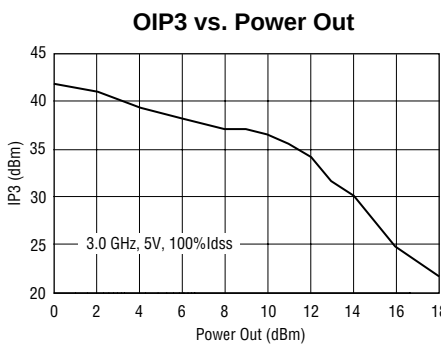
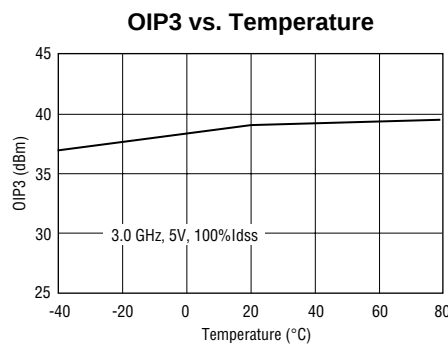
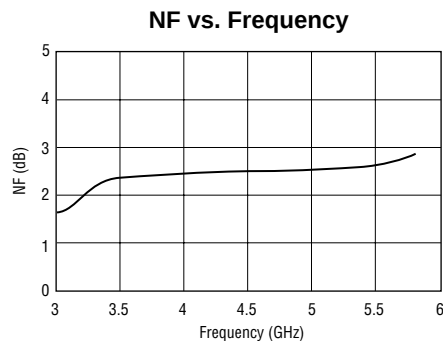
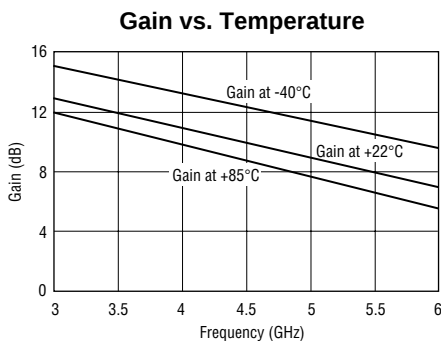
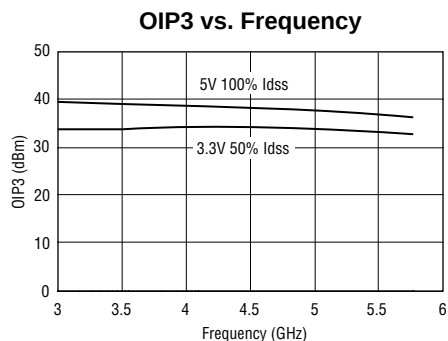
| Part No. | Description                                            |
|----------|--------------------------------------------------------|
| FHF1     | High Dynamic Range FET<br>(Available in tape and reel) |



# FHF1

## Advanced Product Information

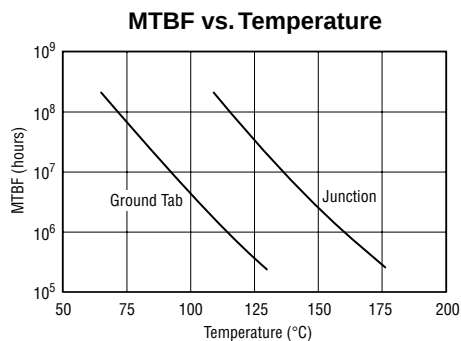
### Performance Charts ( $V_{ds} = 5.0\text{ V}$ , $I_{ds} = 150\text{ mA}$ , $T = 22^\circ\text{C}$ , 50 ohm system)



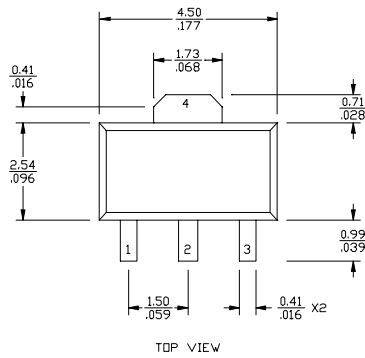
## Thermal Specifications

| Parameter                                  | Rating       |
|--------------------------------------------|--------------|
| Operating Case Temperature                 | -40 to +85°C |
| Thermal Resistance (Maximum)               | 59°C/W       |
| Junction Temperature (Recommended Maximum) | +155°C       |

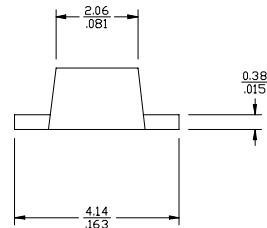
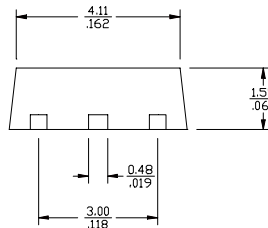
Notes:  
 1. Thermal Resistance determined at Maximum Tab Temperature and Maximum Power Dissipation.  
 2. Recommended Maximum Junction Temperature insures a MTBF of 1 million hours.



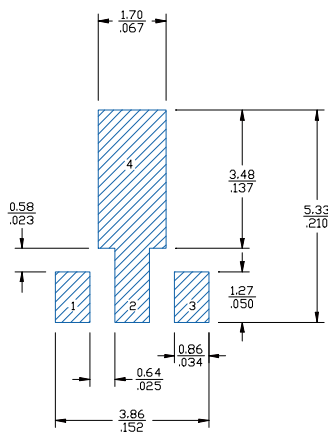
### Outline Drawing



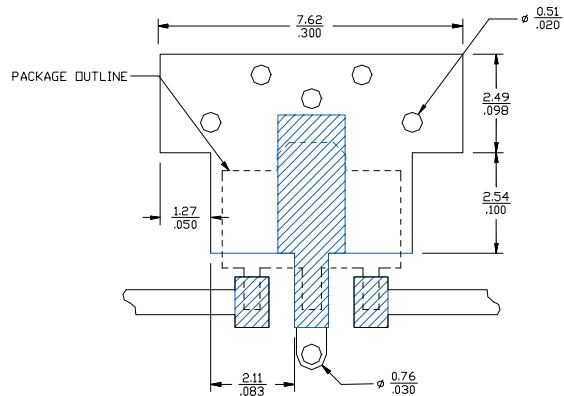
mm  
inch



### Land Pattern



### Mounting Configuration



| FUNCTION      | PIN NO. |
|---------------|---------|
| INPUT         | 1       |
| GROUND        | 2       |
| OUTPUT (BIAS) | 3       |
| GROUND        | 4       |

- Notes:
1. Ground vias are critical for thermal and RF grounding considerations.
  2. A minimum of 6 ground vias are required for 14 mil and 28 mil FR4 board.
  3. If your PCB design rules allow, ground vias should be placed under the land pattern for better RF and thermal performance. Otherwise ground vias should be placed as close to land pattern as possible.
  4. Trace width depends on PC board.

## Typical Test Data

**S-Parameters (V<sub>ds</sub> = +5 V, 100% I<sub>dss</sub>, T = 22°C, unmatched device in a 50 ohm system)**

| Freq (GHz) | S11 (Mag) | S11 (Ang) | S21 (dB) | S21 (Mag) | S21 (Ang) | S12 (Mag) | S12 (Ang) | S22 (Mag) | S22 (Ang) | K Value |
|------------|-----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|---------|
| 2.80       | 0.754     | -180.000  | 13.679   | 4.830     | 49.600    | 0.074     | -5.810    | 0.216     | -103.000  | 0.5746  |
| 3.05       | 0.748     | 169.000   | 13.103   | 4.520     | 41.200    | 0.075     | -12.300   | 0.191     | -110.000  | 0.6242  |
| 3.30       | 0.749     | 159.000   | 12.547   | 4.240     | 32.900    | 0.076     | -17.600   | 0.165     | -117.000  | 0.6725  |
| 3.55       | 0.759     | 148.000   | 12.041   | 4.000     | 24.500    | 0.075     | -23.300   | 0.139     | -123.000  | 0.7042  |
| 3.80       | 0.759     | 139.000   | 11.527   | 3.770     | 16.800    | 0.077     | -27.800   | 0.113     | -132.000  | 0.7675  |
| 4.05       | 0.757     | 129.000   | 11.053   | 3.570     | 8.940     | 0.076     | -33.100   | 0.087     | -143.000  | 0.8173  |
| 4.30       | 0.764     | 120.000   | 10.578   | 3.380     | 0.975     | 0.075     | -38.100   | 0.061     | -158.000  | 0.8469  |
| 4.55       | 0.770     | 110.000   | 10.103   | 3.200     | -6.850    | 0.074     | -42.400   | 0.043     | 172.000   | 0.8732  |
| 4.80       | 0.781     | 101.000   | 9.629    | 3.030     | -14.700   | 0.073     | -47.100   | 0.040     | 122.000   | 0.8962  |
| 5.05       | 0.785     | 91.800    | 9.097    | 2.850     | -22.700   | 0.071     | -51.600   | 0.059     | 88.700    | 0.9528  |
| 5.30       | 0.796     | 82.700    | 8.627    | 2.700     | -30.500   | 0.070     | -55.900   | 0.087     | 70.100    | 0.9914  |
| 5.55       | 0.808     | 73.900    | 8.097    | 2.540     | -38.100   | 0.068     | -59.900   | 0.120     | 60.200    | 1.0313  |
| 5.80       | 0.817     | 65.800    | 7.532    | 2.380     | -45.800   | 0.068     | -64.300   | 0.151     | 52.900    | 1.0687  |
| 6.05       | 0.825     | 59.800    | 7.082    | 2.260     | -51.800   | 0.066     | -68.000   | 0.178     | 47.500    | 1.1102  |

**S-Parameters (V<sub>ds</sub> = +3.3 V, 50% I<sub>dss</sub>, T = 22°C, unmatched device in a 50 ohm system)**

| Freq (GHz) | S11 (Mag) | S11 (Ang) | S21 (dB) | S21 (Mag) | S21 (Ang) | S12 (Mag) | S12 (Ang) | S22 (Mag) | S22 (Ang) | K Value |
|------------|-----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|---------|
| 2.80       | 0.755     | -175.000  | 13.625   | 4.800     | 52.000    | 0.089     | -6.810    | 0.169     | -138.000  | 0.6190  |
| 3.05       | 0.747     | 174.000   | 13.064   | 4.500     | 43.400    | 0.090     | -13.400   | 0.150     | -152.000  | 0.6719  |
| 3.30       | 0.745     | 163.000   | 12.527   | 4.230     | 35.100    | 0.090     | -19.500   | 0.133     | -168.000  | 0.7133  |
| 3.55       | 0.755     | 151.000   | 11.954   | 3.960     | 26.000    | 0.088     | -24.700   | 0.119     | 179.000   | 0.7456  |
| 3.80       | 0.753     | 142.000   | 11.434   | 3.730     | 18.200    | 0.088     | -30.200   | 0.102     | 156.000   | 0.7882  |
| 4.05       | 0.753     | 132.000   | 10.955   | 3.530     | 10.300    | 0.088     | -35.300   | 0.104     | 134.000   | 0.8550  |
| 4.30       | 0.757     | 123.000   | 10.501   | 3.350     | 2.490     | 0.089     | -40.900   | 0.121     | 113.000   | 0.9027  |
| 4.55       | 0.763     | 114.000   | 10.021   | 3.170     | -5.310    | 0.090     | -47.800   | 0.145     | 96.800    | 0.9433  |
| 4.80       | 0.773     | 104.000   | 9.571    | 3.010     | -13.000   | 0.090     | -53.600   | 0.174     | 83.400    | 0.9851  |
| 5.05       | 0.778     | 94.700    | 9.005    | 2.820     | -21.000   | 0.088     | -58.200   | 0.199     | 72.500    | 1.0559  |
| 5.30       | 0.788     | 85.300    | 8.498    | 2.660     | -28.900   | 0.086     | -63.000   | 0.230     | 63.300    | 1.0930  |
| 5.55       | 0.800     | 76.300    | 7.959    | 2.500     | -36.600   | 0.083     | -68.400   | 0.262     | 55.300    | 1.1350  |
| 5.80       | 0.809     | 68.000    | 7.347    | 2.330     | -44.200   | 0.081     | -73.300   | 0.293     | 48.500    | 1.1729  |
| 6.05       | 0.817     | 61.700    | 6.888    | 2.210     | -50.200   | 0.078     | -77.400   | 0.319     | 43.200    | 1.2156  |