

## Outline Dimensions

### Features

- **Output Power:**  $P_{1dB}=31.5$  dBm (typ.)
- **High Gain:**  $G_L=16$  dB (typ.)
- **High Efficiency:** PAE =45% (typ.)
- **High Linearity:**  $IP_3=46$  dBm (typ.)
- **Class A or Class AB Operation**
- **Low Cost**

### Description

The HWF1687RA is a medium power GaAs MESFET designed for various RF and Microwave applications. It is presently offered in a low cost, surface-mountable ceramic package.

### Absolute Maximum Ratings

|                |                         |               |
|----------------|-------------------------|---------------|
| $V_{DS}^{[1]}$ | Drain to Source Voltage | +15V          |
| $V_{GS}$       | Gate to Source Voltage  | -5V           |
| $I_D$          | Drain Current           | $I_{DSS}$     |
| $I_G$          | Gate Current            | 3 mA          |
| $T_{CH}$       | Channel Temperature     | 175°C         |
| $T_{STG}$      | Storage Temperature     | -65 to +175°C |
| $P_T^{[2]}$    | Power Dissipation       | 6 W           |

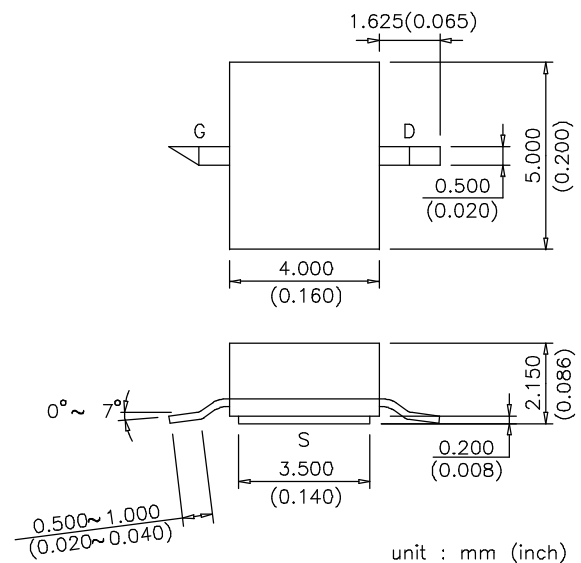
[1] Hexawave recommends that the quiescent drain-source operating voltage ( $V_{DS}$ ) should not exceed 10 Volts.

[2] Mounted on an infinite heat sink.

### Electrical Specification at 25°C

| Symbol    | Parameters                                     | Conditions                         | Units | Min. | Typ. | Max. |
|-----------|--|------------------------------------|-------|------|------|------|
| $I_{DSS}$ | Saturated Drain Current                        | $V_{DS}=3V, V_{GS}=0V$             | mA    | 500  | 600  | 900  |
| $V_P$     | Pinch-off Voltage                              | $V_{DS}=3V, I_{DS}=30$ mA          | V     | -3.5 | -2.0 | -1.5 |
| $g_m$     | Transconductance                               | $V_{DS}=3V, I_{DS}=300$ mA         | mS    | -    | 300  | -    |
| $R_{th}$  | Thermal Resistance                             | Channel to Case                    | °C/W  | -    | 15   | 25   |
| $P_{1dB}$ | Output Power @1dB Gain                         | $V_{DS}=10V$                       | dBm   | 30.5 | 31.5 | -    |
| $G_L$     | Linear Power Gain                              | $I_{DS}=0.5I_{DSS}$<br>$f=2.4$ GHz | dB    | 15   | 16   | -    |
| PAE       | Power-added Efficiency ( $P_{out} = P_{1dB}$ ) |                                    | %     | -    | 45   | -    |
| $IP_3$    | Third-order Intercept Point <sup>[3]</sup>     |                                    | dBm   | -    | 46   | -    |

[3] Single carrier level 15dBm, 1 MHz apart between 2 tones, current adjusted for best  $IP_3$



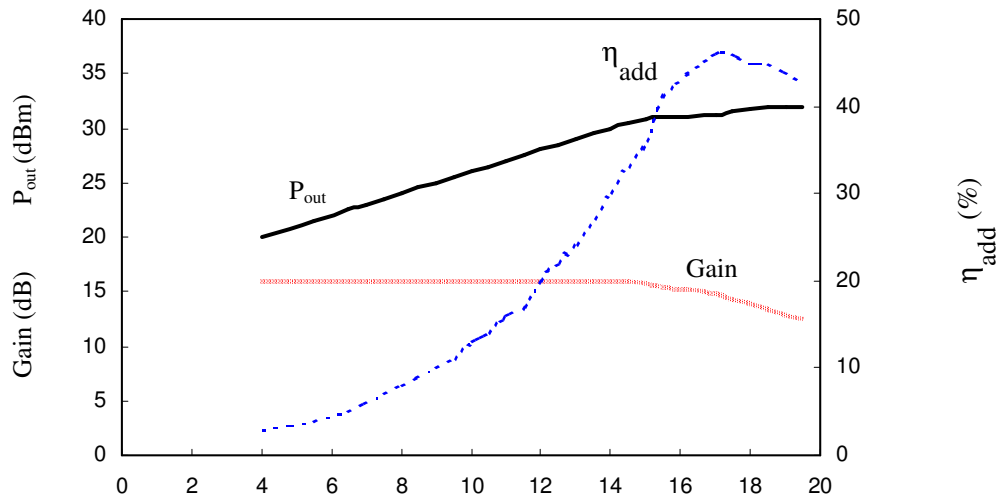
### RA Package (Ceramic)

**Typical Performance at 25°C**

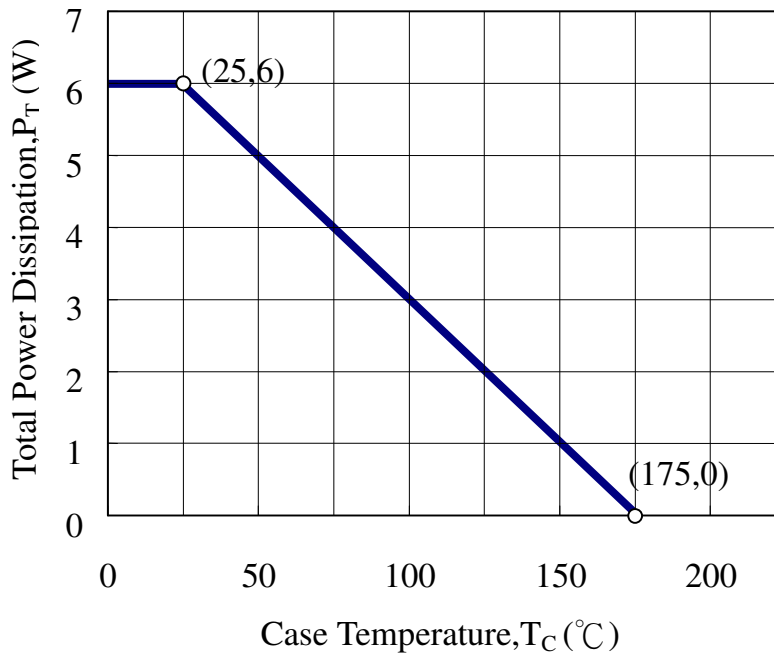
**Output Power, Efficiency & Gain vs. Input Power**

$V_{DS}=10V, I_{DS}=0.5I_{DSS}$

**f=2.4GHz**



**Power Derating Curve**



**Typical S-Parameters** (Common Source,  $T_A=25^\circ\text{C}$ ,  $V_{DS}=10\text{V}$ ,  $I_{DS}=0.5I_{DSS}$ )

| f <sub>max</sub><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.    |
| 0.5                       | 0.962           | -76.42  | 9.456           | 129.85  | 0.016           | 46.86  | 0.307           | -64.76  |
| 0.6                       | 0.950           | -88.58  | 8.730           | 121.80  | 0.018           | 40.88  | 0.303           | -70.36  |
| 0.7                       | 0.945           | -97.49  | 8.066           | 114.76  | 0.019           | 35.92  | 0.301           | -77.31  |
| 0.8                       | 0.946           | -106.34 | 7.495           | 108.24  | 0.020           | 30.21  | 0.307           | -82.95  |
| 0.9                       | 0.940           | -113.98 | 6.963           | 102.31  | 0.021           | 26.13  | 0.314           | -88.10  |
| 1.0                       | 0.935           | -120.90 | 6.463           | 96.72   | 0.022           | 22.00  | 0.322           | -92.92  |
| 1.1                       | 0.935           | -127.15 | 6.016           | 91.58   | 0.022           | 18.06  | 0.330           | -97.39  |
| 1.2                       | 0.935           | -132.75 | 5.606           | 86.69   | 0.022           | 14.88  | 0.342           | -101.75 |
| 1.3                       | 0.938           | -137.60 | 5.243           | 82.22   | 0.022           | 12.46  | 0.349           | -105.27 |
| 1.4                       | 0.938           | -142.11 | 4.915           | 77.87   | 0.022           | 9.82   | 0.361           | -108.53 |
| 1.5                       | 0.941           | -146.30 | 4.609           | 73.75   | 0.022           | 7.72   | 0.371           | -111.78 |
| 1.6                       | 0.939           | -150.07 | 4.347           | 69.97   | 0.022           | 4.77   | 0.383           | -114.67 |
| 1.7                       | 0.941           | -153.83 | 4.098           | 66.10   | 0.022           | 3.83   | 0.395           | -117.70 |
| 1.8                       | 0.941           | -157.22 | 3.880           | 62.48   | 0.022           | 1.33   | 0.407           | -120.34 |
| 1.9                       | 0.941           | -160.17 | 3.675           | 58.95   | 0.022           | -0.22  | 0.420           | -122.88 |
| 2.0                       | 0.940           | -162.84 | 3.491           | 55.90   | 0.022           | -1.94  | 0.431           | -125.15 |
| 2.1                       | 0.944           | -165.81 | 3.323           | 52.48   | 0.021           | -3.24  | 0.444           | -127.46 |
| 2.2                       | 0.939           | -168.31 | 3.160           | 49.37   | 0.021           | -4.58  | 0.459           | -129.62 |
| 2.3                       | 0.939           | -170.93 | 3.006           | 46.27   | 0.021           | -4.43  | 0.474           | -131.90 |
| 2.4                       | 0.937           | -173.33 | 2.874           | 43.62   | 0.021           | -6.73  | 0.484           | -133.79 |
| 2.5                       | 0.932           | -175.41 | 2.755           | 40.86   | 0.020           | -6.91  | 0.496           | -135.56 |
| 2.6                       | 0.932           | -177.92 | 2.642           | 38.01   | 0.020           | -10.13 | 0.508           | -137.13 |
| 2.7                       | 0.932           | -179.77 | 2.539           | 35.38   | 0.020           | -9.96  | 0.520           | -138.61 |
| 2.8                       | 0.929           | 178.01  | 2.441           | 32.75   | 0.020           | -10.32 | 0.534           | -140.20 |
| 2.9                       | 0.923           | 176.42  | 2.356           | 30.28   | 0.020           | -10.44 | 0.545           | -141.56 |
| 3.0                       | 0.923           | 174.25  | 2.262           | 27.72   | 0.019           | -11.47 | 0.556           | -143.17 |
| 4.0                       | 0.893           | 157.12  | 1.726           | 4.61    | 0.019           | -17.23 | 0.647           | -156.32 |
| 5.0                       | 0.892           | 138.90  | 1.474           | -19.07  | 0.020           | -22.31 | 0.690           | -171.37 |
| 6.0                       | 0.881           | 119.59  | 1.307           | -43.89  | 0.016           | -17.90 | 0.710           | 170.90  |
| 7.0                       | 0.858           | 99.12   | 1.167           | -69.47  | 0.023           | -32.91 | 0.761           | 153.39  |
| 8.0                       | 0.823           | 81.96   | 1.107           | -91.49  | 0.030           | -47.27 | 0.767           | 141.00  |
| 9.0                       | 0.764           | 61.21   | 1.192           | -113.45 | 0.043           | -49.52 | 0.749           | 132.82  |
| 10.0                      | 0.632           | 24.25   | 1.441           | -143.52 | 0.076           | -75.80 | 0.757           | 120.64  |