

## Features

- **Output Power:**  $P_{1dB}=30$  dBm (typ.)
- **High Gain:**  $G_L=16$  Db (typ.)
- **High Efficiency:**  $PAE=45\%$  (typ.)
- **High Linearity:**  $IP_3=45$  dBm (typ.)
- **Low Cost**

## Description

The HWF1686RA 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            | 2 mA          |
| $T_{CH}$       | Channel Temperature     | 175°C         |
| $T_{STG}$      | Storage Temperature     | -65 to +175°C |
| $P_T^{[2]}$    | Power Dissipation       | 3.5 W         |

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

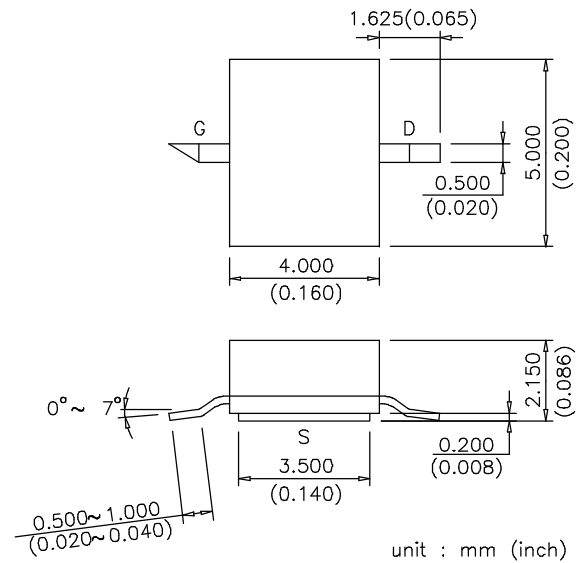
[2] Mounted on an infinite heat sink.

## Electrical Specification at 25°C

| Symbol    | Parameters                                     | Conditions                                         | Units | Min. | Typ. | Max. |
|-----------|------------------------------------------------|----------------------------------------------------|-------|------|------|------|
| $I_{DSS}$ | Saturated Drain Current                        | $V_{DS}=3V, V_{GS}=0V$                             | mA    | 300  | 400  | 600  |
| $V_P$     | Pinch-off Voltage                              | $V_{DS}=3V, I_{DS}=20$ mA                          | V     | -3.5 | -2.0 | -1.5 |
| $g_m$     | Transconductance                               | $V_{DS}=3V, I_{DS}=200$ mA                         | mS    | -    | 200  | -    |
| $R_{th}$  | Thermal Resistance                             | Channel to Case                                    | °C/W  | -    | 30   | 40   |
| $P_{1dB}$ | Output Power @1dB Gain                         | $V_{DS}=10V$<br>$I_{DS}=0.5I_{DSS}$<br>$f=2.4$ GHz | dBm   | 29.0 | 30.0 | -    |
| $G_L$     | Linear Power Gain                              |                                                    | dB    | 15   | 16   | -    |
| $PAE$     | Power-added Efficiency ( $P_{out} = P_{1dB}$ ) |                                                    | %     | -    | 45   | -    |
| $IP_3$    | Third-order Intercept Point <sup>[3]</sup>     |                                                    | dBm   | -    | 45   | -    |

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

## Outline Dimensions



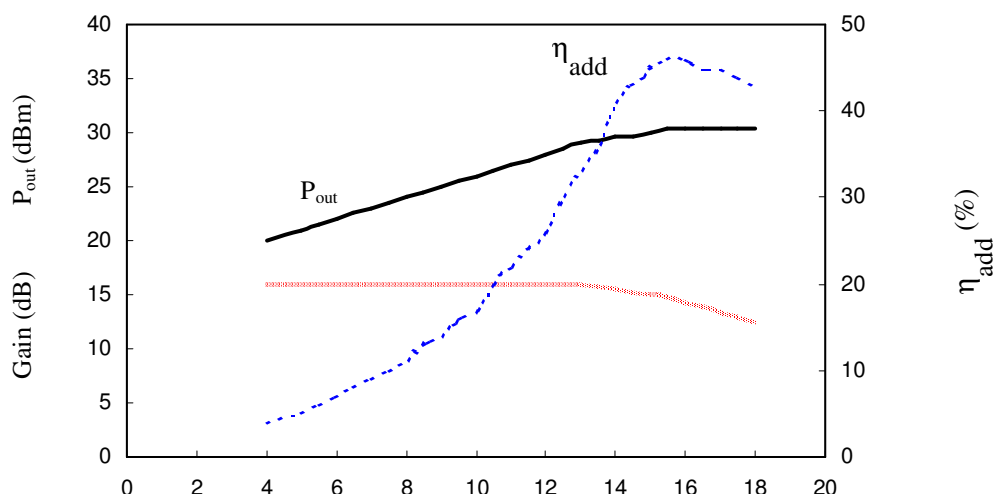
## RA Package (Ceramic)

**Typical Performance at 25°C**

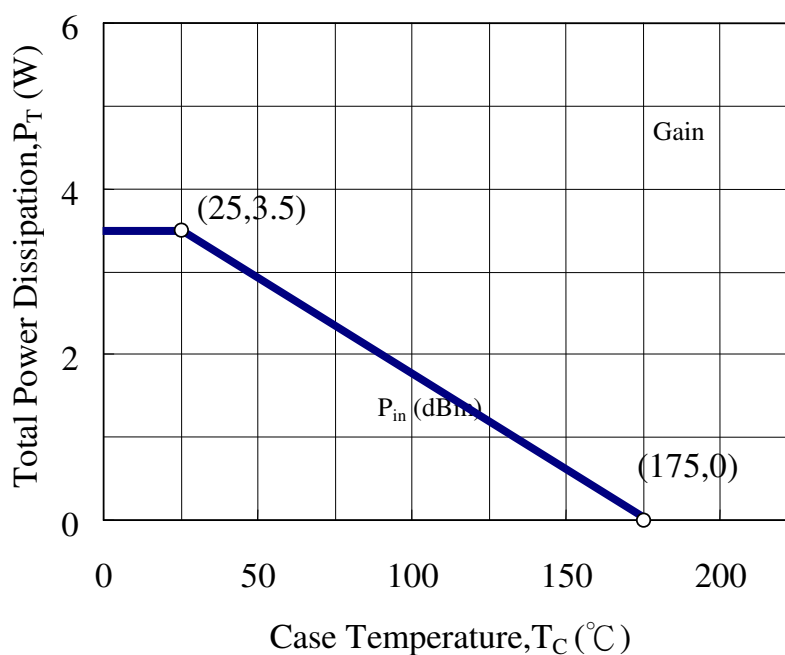
**Output Power, Efficiency & Gain vs. Input Power**

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

$$f=2.4GHz$$



**Power Derating Curve**



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

| Freq<br>(GHz) | $S_{11}$ |          | $S_{21}$ |          | $S_{12}$ |          | $S_{22}$ |          |
|---------------|----------|----------|----------|----------|----------|----------|----------|----------|
|               | Mag.     | Ang.     | Mag.     | Ang.     | Mag.     | Ang.     | Mag.     | Ang.     |
| 0.5           | 0.966    | -60.600  | 7.901    | 137.750  | 0.014    | 53.040   | 0.455    | -44.490  |
| 0.6           | 0.954    | -71.580  | 7.488    | 129.900  | 0.015    | 46.780   | 0.453    | -49.140  |
| 0.7           | 0.954    | -79.740  | 7.065    | 122.830  | 0.017    | 40.360   | 0.444    | -55.370  |
| 0.8           | 0.955    | -88.330  | 6.693    | 116.180  | 0.018    | 36.440   | 0.447    | -60.860  |
| 0.9           | 0.951    | -95.930  | 6.327    | 109.940  | 0.019    | 30.700   | 0.450    | -66.130  |
| 1.0           | 0.943    | -102.980 | 5.953    | 103.930  | 0.020    | 26.080   | 0.454    | -71.560  |
| 1.1           | 0.943    | -109.520 | 5.612    | 98.390   | 0.021    | 21.660   | 0.457    | -76.340  |
| 1.2           | 0.943    | -115.520 | 5.283    | 92.970   | 0.021    | 17.640   | 0.465    | -81.450  |
| 1.3           | 0.947    | -120.920 | 4.979    | 88.080   | 0.021    | 14.800   | 0.468    | -85.610  |
| 1.4           | 0.947    | -125.900 | 4.700    | 83.310   | 0.022    | 10.930   | 0.478    | -89.680  |
| 1.5           | 0.949    | -130.650 | 4.434    | 78.720   | 0.022    | 7.860    | 0.485    | -93.630  |
| 1.6           | 0.946    | -134.810 | 4.199    | 74.510   | 0.022    | 4.280    | 0.494    | -97.440  |
| 1.7           | 0.949    | -139.040 | 3.970    | 70.220   | 0.021    | 2.480    | 0.502    | -101.200 |
| 1.8           | 0.950    | -142.830 | 3.771    | 66.290   | 0.021    | -0.240   | 0.512    | -104.460 |
| 1.9           | 0.949    | -146.280 | 3.579    | 62.310   | 0.021    | -2.920   | 0.524    | -107.740 |
| 2.0           | 0.948    | -149.330 | 3.402    | 59.030   | 0.021    | -4.520   | 0.533    | -110.660 |
| 2.1           | 0.951    | -152.720 | 3.245    | 55.200   | 0.020    | -6.500   | 0.545    | -113.700 |
| 2.2           | 0.947    | -155.590 | 3.081    | 51.910   | 0.020    | -7.550   | 0.558    | -116.610 |
| 2.3           | 0.946    | -158.550 | 2.942    | 48.650   | 0.020    | -10.380  | 0.569    | -119.360 |
| 2.4           | 0.944    | -161.160 | 2.811    | 45.510   | 0.020    | -13.150  | 0.579    | -121.760 |
| 2.5           | 0.940    | -163.570 | 2.691    | 42.540   | 0.019    | -13.840  | 0.591    | -124.120 |
| 2.6           | 0.939    | -166.360 | 2.577    | 39.490   | 0.019    | -15.830  | 0.601    | -126.170 |
| 2.7           | 0.940    | -168.460 | 2.473    | 36.680   | 0.019    | -14.660  | 0.613    | -128.150 |
| 2.8           | 0.936    | -170.910 | 2.374    | 33.920   | 0.018    | -17.220  | 0.625    | -130.160 |
| 2.9           | 0.932    | -172.740 | 2.290    | 31.330   | 0.018    | -20.380  | 0.636    | -131.900 |
| 3.0           | 0.931    | -175.220 | 2.198    | 28.650   | 0.018    | -20.140  | 0.646    | -133.870 |
| 4.0           | 0.900    | 166.850  | 1.664    | 5.030    | 0.016    | -31.630  | 0.733    | -148.980 |
| 5.0           | 0.897    | 148.860  | 1.431    | -18.490  | 0.016    | -38.100  | 0.774    | -164.480 |
| 6.0           | 0.882    | 130.020  | 1.301    | -43.500  | 0.008    | -46.420  | 0.792    | 178.130  |
| 7.0           | 0.846    | 109.390  | 1.206    | -69.890  | 0.015    | -52.210  | 0.837    | 160.780  |
| 8.0           | 0.781    | 91.190   | 1.210    | -93.950  | 0.022    | -71.340  | 0.841    | 148.940  |
| 9.0           | 0.626    | 65.480   | 1.414    | -121.200 | 0.026    | -78.610  | 0.833    | 141.520  |
| 10.0          | 0.265    | -11.550  | 1.774    | -164.010 | 0.051    | -114.740 | 0.839    | 129.890  |