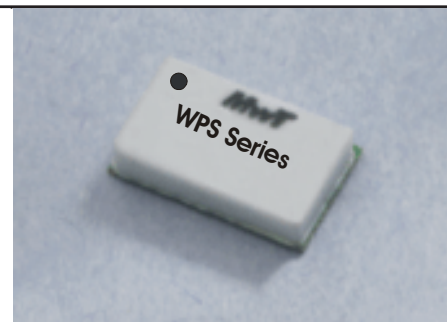


## FEATURES

- 10.0 dB Gain
- 36 dBm P1dB
- 49 dBm OIP3
- EVM < 2.0% at 29.5 dBm Pout
- Prematch for Easy Cascade
- Pb Free Surface Mount Package
- MTTF > 100 yrs @ Tc 150C

## APPLICATIONS

- Telemetry
- Private Microwave Network
- Military Wireless Communications



## DESCRIPTION

The WPS-445124-02 is a 4 watt amplifier pre-matched to 50 ohm operating over frequency range from 4.4 to 5.1 GHz. The RF gain is 10 dB. The typical output IP3 is 49 dBm and  $P_{1dB}$  is 36 dBm. The WPS-445124-02 amplifier has excellent linearity and low spectral regrowth properties for applications that have similar digital modulation schemes as those for 802.11 WLAN and 802.16 WiMax. At 2.0% error vector magnitude (EVM), the amplifier can achieve an average output power of 29.5 dBm. The WPS-445124-02 package is MwT '02' for surface mount applications and offers excellent thermal conductance. The package construction is 'lead free' and 'cadmium free'.

## TYPICAL RF PERFORMANCE:

@ 25C, Vds=8.5V, ZO=50ohm

| PARAMETER                             | UNITS | TYPICAL DATA  |
|---------------------------------------|-------|---------------|
| Frequency Range                       | MHz   | 4400-5100     |
| Small Signal Gain (Typ / Min)         | dB    | 9 / 10        |
| Input/Output VSWR                     | --    | 2.5:1 / 3.0:1 |
| Pout at 1dB Compression Point         | dBm   | +36           |
| Error Vector Magnitude (note 1)       | %     | 2.0           |
| Output Third Order Intercept (note 2) | dBm   | 49            |
| DC Current                            | mA    | 1200          |
| Gate Voltage                          | Volt  | -1.0          |
| Thermal Resistance Junction to Case   | °C/W  | 7             |

Notes:

1. The output power is 29.5 dBm for 2.0% EVM and the test signal is 802.16, 256 carriers, 64 QAM with 3/4 coding factor. The measured EVM includes the accumulated errors (0.9%) from the modulator and driver stages.

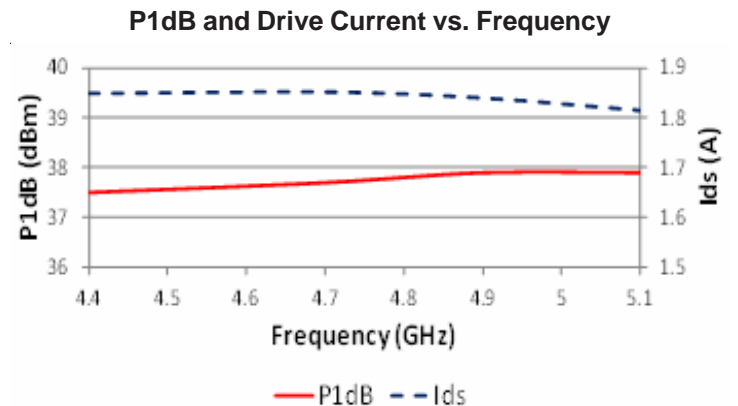
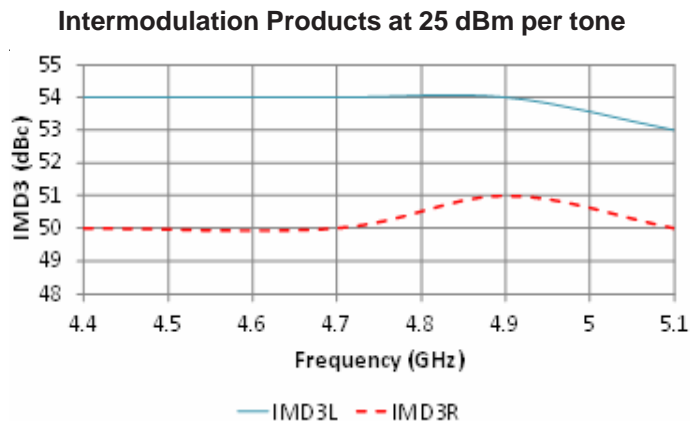
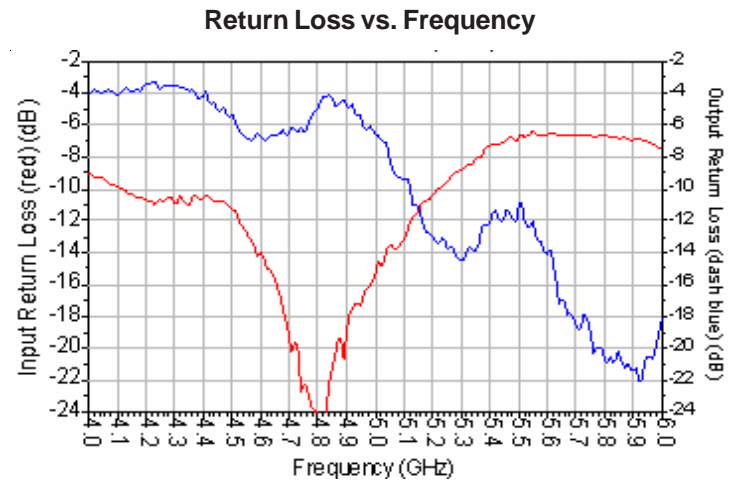
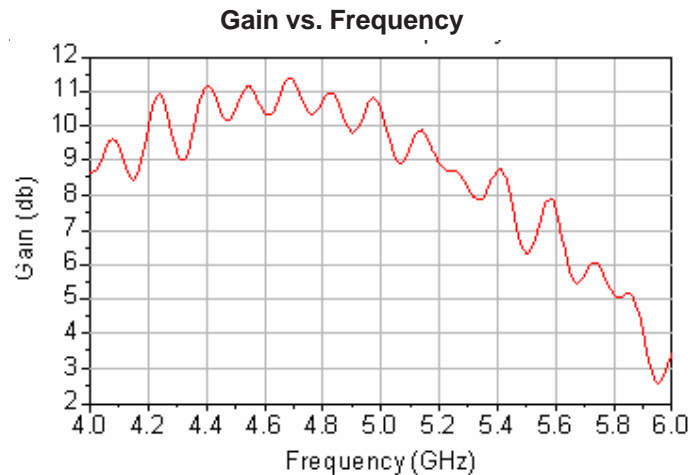
2. The output power per tone is 25 dBm and the tone separation is 20 MHz center at 4.5 GHz.

## ABSOLUTE MAXIMUM RATINGS:

Ta=25C \*

| PARAMETERS                 | UNITS | MAX         |
|----------------------------|-------|-------------|
| Bias Voltage               | V     | 10          |
| Continuous RF Input Power  | dBm   | +33         |
| Peak Input Power           | dBm   | +36         |
| Case Operating Temperature | °C    | +85         |
| Storage Temperature        | °C    | -60 to +150 |

**TYPICAL RF PERFORMANCE: @ 25C, Vdd=8.5, Vgs=-1.0V**



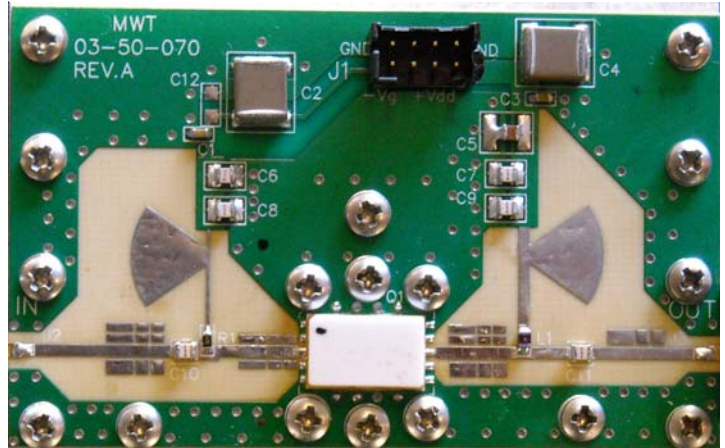
**TYPICAL SCATTERING PARAMETERS measured in MwT's test fixture:**

Vdd=8.5, Vgs=-1.0, Idq=1200mA

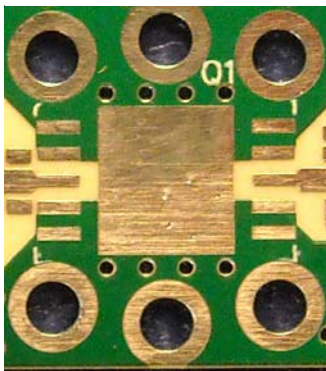
| freq     | magS11 | AngS11  | dBS21 | AngS21  | magS12 | AngS12  | magS22 | AngS22  |
|----------|--------|---------|-------|---------|--------|---------|--------|---------|
| 4.00 GHz | 0.61   | 29.26   | 8.65  | -51.69  | 0.06   | -99.98  | 0.50   | 69.12   |
| 4.10 GHz | 0.56   | 17.05   | 9.39  | -63.06  | 0.07   | -114.45 | 0.51   | 63.10   |
| 4.20 GHz | 0.48   | 2.42    | 9.94  | -60.05  | 0.08   | -131.61 | 0.49   | 54.71   |
| 4.30 GHz | 0.41   | -16.37  | 9.19  | -81.70  | 0.07   | -136.81 | 0.49   | 45.30   |
| 4.40 GHz | 0.35   | -38.36  | 11.15 | -85.46  | 0.07   | -156.13 | 0.47   | 37.17   |
| 4.50 GHz | 0.29   | -67.64  | 10.48 | -95.65  | 0.07   | -162.07 | 0.44   | 25.05   |
| 4.60 GHz | 0.27   | -101.58 | 10.34 | -111.57 | 0.07   | -167.97 | 0.41   | 12.18   |
| 4.70 GHz | 0.28   | -135.60 | 11.29 | -123.61 | 0.07   | -173.06 | 0.38   | -2.82   |
| 4.80 GHz | 0.31   | -163.73 | 10.73 | -132.24 | 0.07   | 173.13  | 0.36   | -18.94  |
| 4.90 GHz | 0.35   | 172.89  | 9.81  | -146.58 | 0.08   | 157.64  | 0.34   | -33.06  |
| 5.00 GHz | 0.37   | 152.40  | 10.48 | -162.46 | 0.09   | 146.64  | 0.31   | -50.29  |
| 5.10 GHz | 0.40   | 133.33  | 9.38  | -165.71 | 0.07   | 130.17  | 0.32   | -66.41  |
| 5.20 GHz | 0.41   | 115.75  | 8.91  | 176.10  | 0.07   | 112.11  | 0.33   | -79.41  |
| 5.30 GHz | 0.41   | 96.11   | 8.22  | 165.83  | 0.06   | 100.79  | 0.34   | -94.54  |
| 5.40 GHz | 0.41   | 73.82   | 8.71  | 157.81  | 0.06   | 98.16   | 0.36   | -106.37 |
| 5.50 GHz | 0.41   | 49.51   | 6.29  | 145.39  | 0.05   | 89.53   | 0.38   | -118.31 |
| 5.60 GHz | 0.42   | 24.10   | 7.61  | 129.75  | 0.06   | 76.30   | 0.40   | -130.13 |
| 5.70 GHz | 0.45   | -2.47   | 5.71  | 124.41  | 0.06   | 74.36   | 0.43   | -140.48 |
| 5.80 GHz | 0.48   | -28.89  | 5.12  | 108.59  | 0.05   | 58.86   | 0.45   | -150.37 |
| 5.90 GHz | 0.52   | -55.03  | 4.07  | 90.49   | 0.05   | 42.69   | 0.48   | -160.19 |
| 6.00 GHz | 0.56   | -79.95  | 3.48  | 90.85   | 0.05   | 14.97   | 0.50   | -168.29 |

## APPLICATION NOTE

The evaluation board, shown in Figure 1, is fabricated with Rogers's 4003 material which is 20 mil thick, and has 2 oz copper weight. The WPS445124-02 shown in the center of the board is a 4 watt amplifier with high linearity. The amplifier chip assembly is attached to the '02' package. The '02' package offers good thermal conductivity and excellent RF performance. External bias tees are required to bring the operating voltages for Vdd and Vgate to the device.



**FIGURE 1 Evaluation Board**



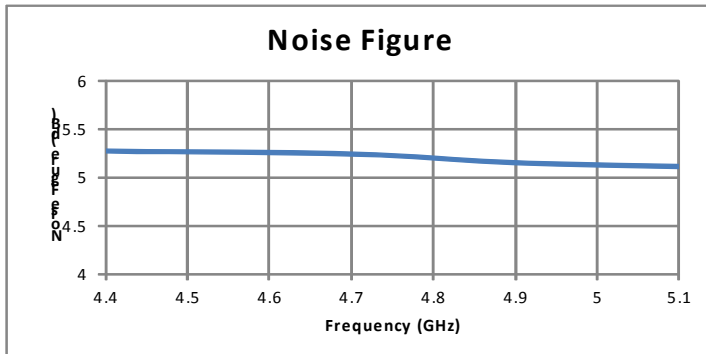
**FIGURE 2 Via Hole Array  
(Ag Back Filled)**

It is recommended that via holes be placed near the DC bias connector to maintain ground continuity between the top layer and bottom ground planes. Mounting holes near the unit will help secure the board to the chassis, minimize ground current loops and improve thermal conductivity in case the board is not soldered to the chassis. Quarter-wave stubs at the gate and drain for biasing are shown in Figure 1. A 56 ohm resistor is added in series to the gate bias. The effective impedance is increased which reduces the risk of oscillations. A 2.6 nH high Q coil from coil-craft is used on the drain line. This inductor increases the effective impedance of the bias line and improves power and linearity performance.

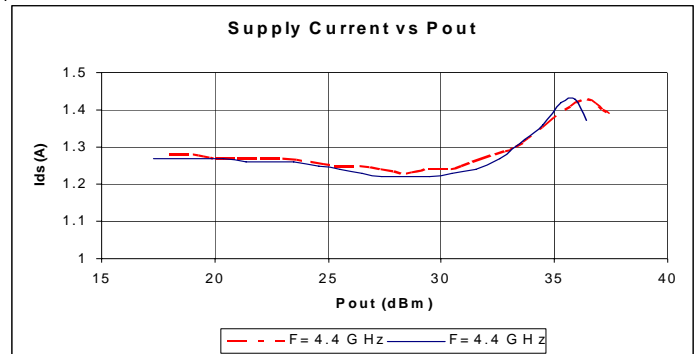
Through holes underneath the package is required to connect the top and bottom grounds and to improve thermal conductivity. Back filled copper vias are used underneath the package in Figure 2. The noise figure shown in Figure 3 was measured at room temperature. The noise figure is less than 6 dB. The supply current shown in Figure 4 is less than 1.5 A in small signal and increases to 1.85 A in large signal as the output power is increased to 37 dBm. The output IP3 response shown in Figure 5 uses a two tone separation of 20 MHz and 25 dBm per tone at 4.4, 4.7, and 5.1 GHz.

## APPLICATION NOTE CONTINUED

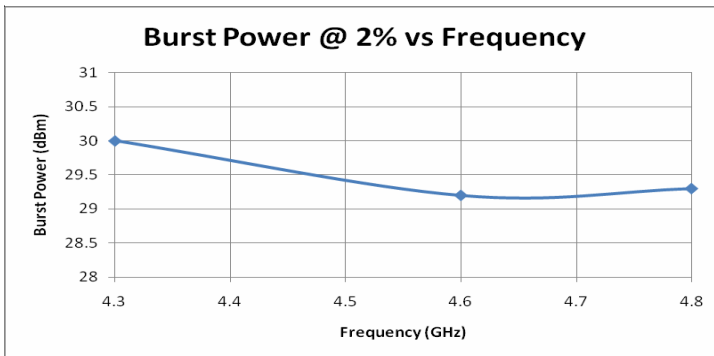
**FIGURE 3**  
**Noise Figure**



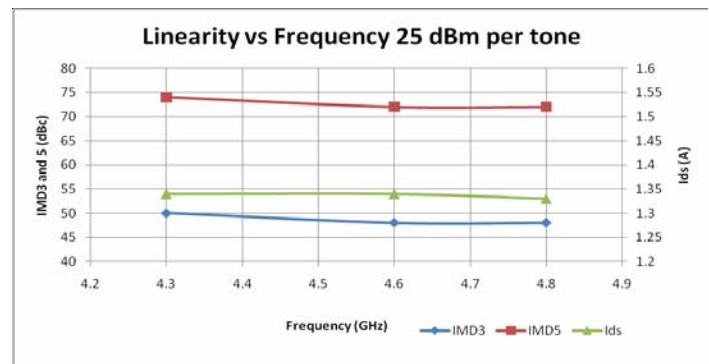
**FIGURE 4**  
**Supply Current**



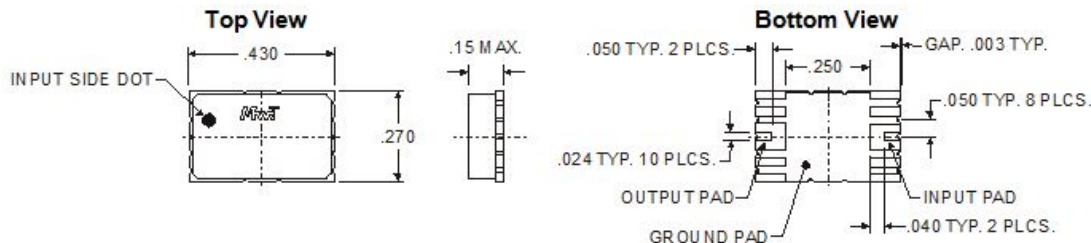
**FIGURE 5**  
**Burst Power Response**



**FIGURE 6**  
**OIP3**



## PACKAGE OUTLINE DIAGRAM (Package 02):



**All dimensions are in inches**

| Pin Designation (Top View) |          |        |            |
|----------------------------|----------|--------|------------|
| Pin 1 (DOT Top Left)       | GND      | Pin 10 | GND        |
| Pin 2                      | GND      | Pin 9  | GND        |
| Pin 3                      | RF In/Vg | Pin 8  | RF Out/Vdd |
| Pin 4                      | GND      | Pin 7  | GND        |
| Pin 5                      | GND      | Pin 6  | GND        |