WPS-252724-02

2.5 – 2.7 GHz Linear Power Amplifier
Data Sheet

Features

- **15.0 dB Gain**
- **36 dBm P1dB**
- **48 dBm IP3**
- **EVM < 2.5% at 29 dBm Pout**
- **Prematch for Easy Cascade**
- **Pb Free Surface Mount Pkg**
- **MTTF > 100 yrs @ T_C 150°C**

Applications

- **802.16 WiMax**
- **802.11 WLAN**
- **Wireless Communications**
- **Telecomm Infrastructure**

Description:

The WPS-252724-02 is a 4 watt amplifier pre-matched to 50 ohm operating over frequency range 2.5 GHz to 2.7 GHz. The RF gain is 15 dB. The typical output IP3 is 48 dBm and P_{1dB} is 36 dBm. The WPS-252724-02 amplifier has excellent performance for 802.11 WLAN and 802.16 WiMax applications. At 2.5% error vector magnitude (EVM), the amplifier can achieve an average output power of 29 dBm. The WPS-252724-02 is packaged in a flange with a proprietary copper alloy for excellent thermal conductance. The package construction is environmentally 'lead free' and 'cadmium free'.

Electrical Specifications:

- ***@ 25°C, Vds = 8.5 V, Zo = 50 ohms***

SYMBOL	PARAMETERS	Min	Typical	Max	Unit
Freq.	Frequency Range	2.5		2.7	GHz
SSG	Small Signal Gain	14	15		dB
VSWR	Input/ Output VSWR		2.0:1/2.0:1		-
P1dB	Pout at 1 dB Compression Point		+36		dBm
EVM	Error Vector Magnitude (see note 1)		2.5		%
OIP3	Output Third Order Intercept (see note 2)		48		dBm
Ids	DC Current		1200		mA
Vgs	Gate Voltage		-0.7		Volt
Rth	Thermal Resistance Junction to Case		6		°C/W

Notes:

1. The output power is 29 dBm for 2.5% EVM and the test signal is 802.16, 256 carriers, 64 QAM with 3/4 coding factor and 10 MHz channel bandwidth. 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 2.7 GHz.

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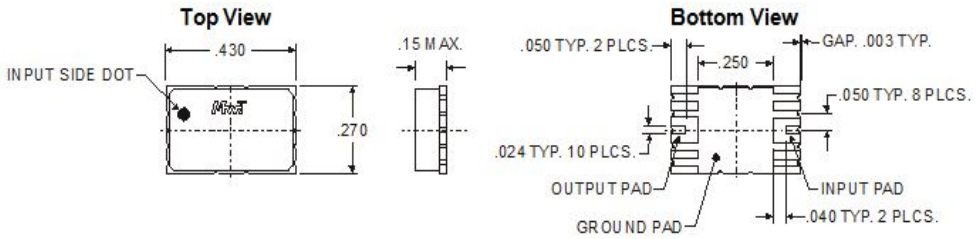
Absolute Maximum Ratings

Max Bias Voltage	10.0 V
Max Continuous RF Input Power	+33 dBm
Max Peak Input Power	+36 dBm
Case Operating Temp	+70 °C
Max Storage Temp	*65 to +150 °C

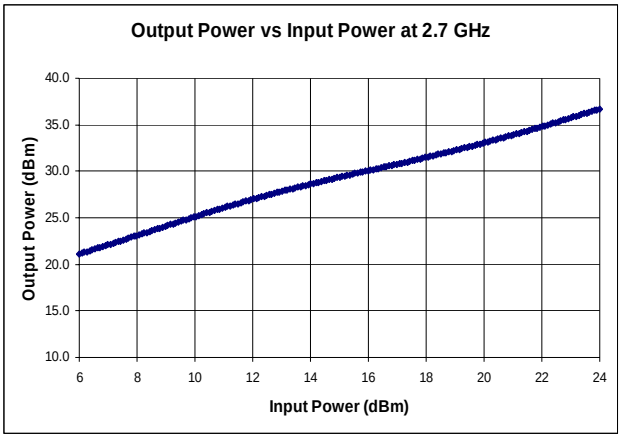
Package Outline Diagram (Package 02)

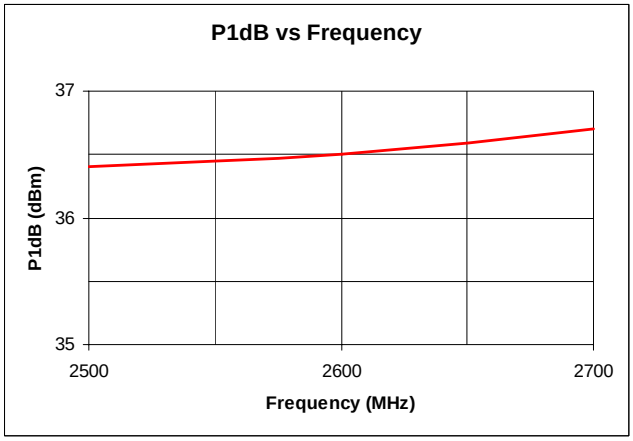


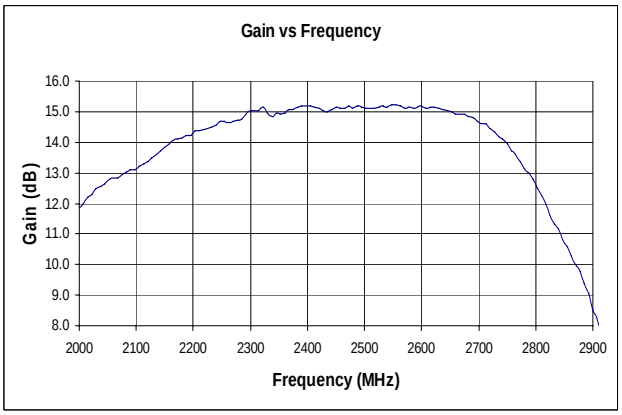
All dimensions are in inches

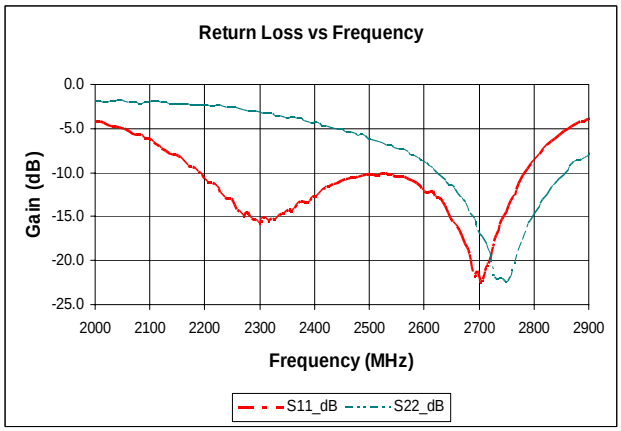
Pin Designation (Top View)			
Pin 1 (DOT Top Left)	GND	Pin 10	GND
Pin 2	GND	Pin 9	GND
Pin 3	RF In/Vg	Pin 8	RF Out/Vdd
Pin 4	GND	Pin 7	GND
Pin 5	GND	Pin 6	GND

Typical Test Data @ 25°C Vdd=8.5V and Vgs=-0.7V









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S-parameters are measured in MWT's test fixture[3].
Bias settings are Vdd=8.5 and Vg=-0.7 @ 25°C

Freq	S11		S21		S12		S22	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2	0.62	83.45	3.92	-94.32	0.031	-147.3	.79	145.95
2.1	0.49	61.62	4.54	-115.86	0.032	-177.65	0.79	138.04
2.2	0.29	24.80	5.20	-140.27	0.035	154.71	0.76	128.75
2.3	0.16	-48.88	5.63	-166.57	0.039	125.36	0.69	119.86
2.4	0.23	-123.71	5.75	163.6	0.038	108.91	0.60	110.57
2.5	0.31	-166.42	5.71	133.65	0.052	75.81	0.49	100.57
2.6	0.25	154.84	5.74	100.97	0.049	41.71	0.36	83.07
2.7	0.08	49.43	5.40	60.62	0.048	1.96	0.14	48.18
2.8	0.37	-72.96	4.27	15.54	0.039	-44.25	0.18	-105.82
2.9	0.64	-110.23	2.66	-25.27	0.022	-80.37	0.39	-140.88
3.0	0.77	-133.62	1.56	-55.93	0.015	-123.3	0.53	-158.55
3.1	0.83	-148.70	0.915	-81.287	0.009	-140.96	0.61	-168.70
3.2	0.87	-159.11	0.52	-101.42	0.006	178.29	0.70	-175.55
3.3	0.90	-167.22	0.30	-119.81	0.008	-148.35	0.77	177.37
3.4	0.91	-174.15	0.171	-139.06	0.006	-148.78	0.83	171.75
3.5	0.91	-179.60	0.10	-151.92	0.002	-138.38	0.86	164.97
3.6	0.81	-172.53	0.01	86.80	0.048	-81.06	0.81	153.95
3.7	0.70	-165.45	0.12	145.52	0.097	156.26	0.75	142.94
3.8	0.59	-158.37	0.23	-155.76	0.146	33.578	0.70	131.92
3.9	0.49	-151.29	0.34	--97.04	0.195	-89.10	0.65	120.91
4.0	0.38	-144.21	0.46	-38.32	0.245	148.22	0.59	109.89

Notes:

3. S-parameter data is taken using the '02' package.

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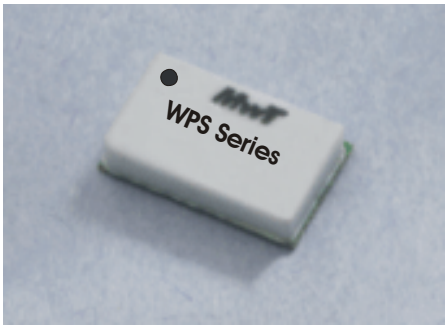
Application Note



A carbon copy of the WPS-252724-02 had been assembled in the '02' package shown in Figure 1 for ease of testing. The '02' package is dropped into an engineering test fixture that provides SMA connections to both input and output interfaces. Two external bias tees for the gate and drain voltages are required. The 4 watt device in the '02' package has a limited temperature range of approximately 60°C. An earless flange or flange package (02- package) is offered for better Tjc. Please consult the factory for your specific application.

Figure 1 Evaluation Unit in '02' package

The WPS252724-02 has a noise figure less 5.5 dB shown in Figure 2 and the supply current shown in Figure 3 is less than 1.3 A in small signal and increases to 1.4 A for an output power of 36 dBm. The RF drive level is increased incrementally and stopped when the gate leakage current of 11 mA is reached. The large signal gain response, shown in Figure 4, varies from 14 to 15 dB over the frequency range 2.5 to 2.7 GHz. The output IP3 response shown in Figure 5 uses a two tone separation of 20 MHz and 25 dBm per tone at 2.5, 2.6 and 2.7 GHz. The WPS252724-02 residual error vector magnitude shown in Figure 6 is 2.2% at output power of 29 dBm. The WiMAX power distribution curve (PDF) and complimentary cumulative distribution curve (CCDF) is shown in Figure 6. The channel bandwidth is 5 MHz.

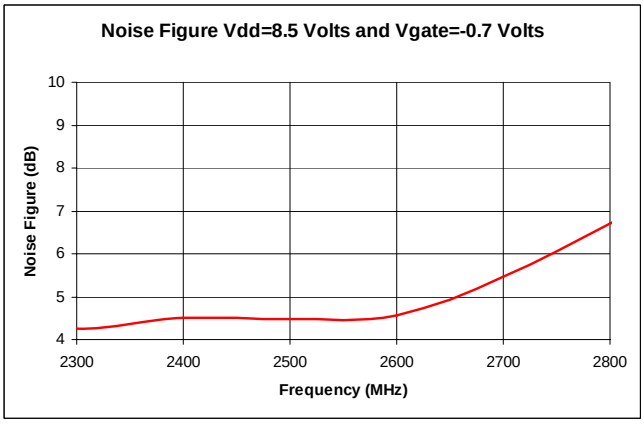


Figure 2 Noise Figure

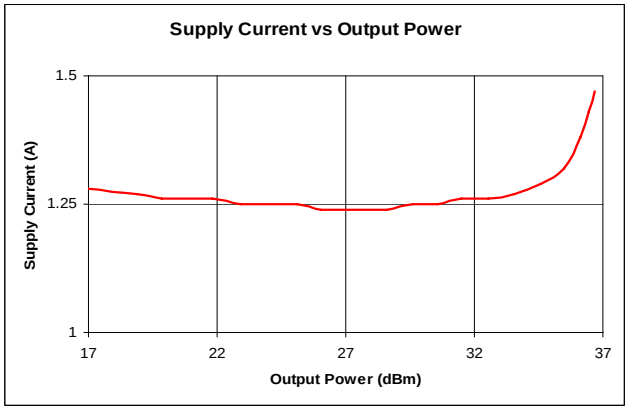


Figure 3 Supply Current

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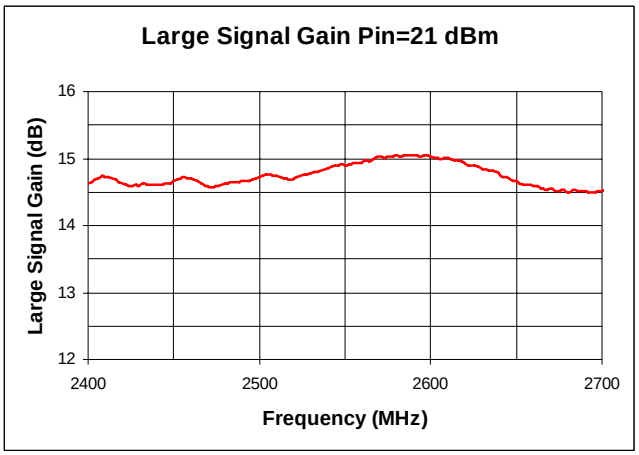

Figure 4 Gain Response

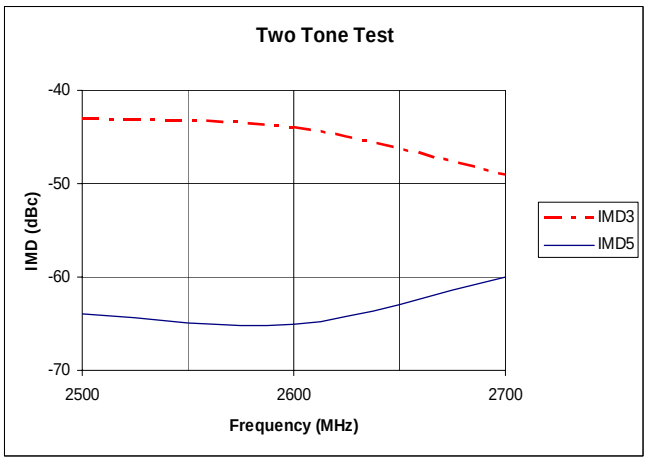

Figure 5 OIP3

One of most stringent modulations for a linear amplifier is WiMAX 256 carriers, 64 QAM ¾ loading factor. The WiMAX test signals were generated using Agilent's E4406A VSA transmitter and VSA signal studio suite. Agilent distortion test suite software 89604A is used to analyze signal integrity. An output power of 29.6 dBm is achieved for a residual error vector magnitude of 2.2% as shown in Figure 6. The amplifier's output power is 17.2 dB higher than the response power levels. Because of high linearity of this amplifier, a 2 dB peak reduction in the crest factor does not degrade the quality of WiMAX signal. In Figure 7 the Rhode/Schwarz SMU200A and FSQ26 are used to demodulate the WiMAX signal. The amplifier's output power is 10 dB higher than the measured power levels. The amplifier's output power for an EVM of 2.7% is 30 dBm.

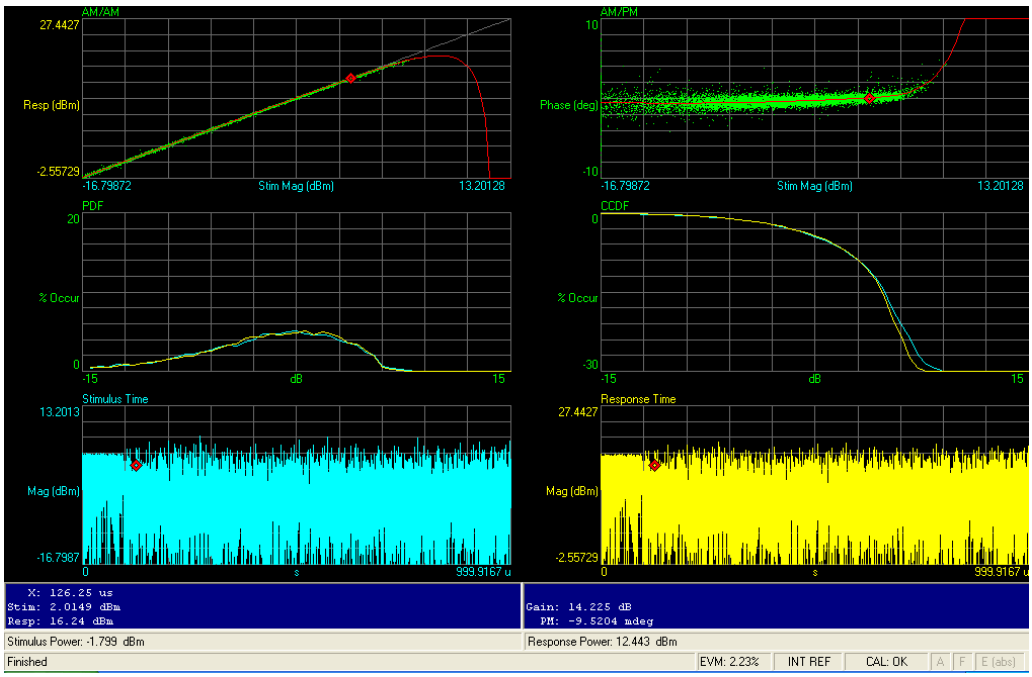

Figure 6 802.16, 256 carriers, 64QAM at 2.6 GHz, EVM=2.2% @ Pavg=29.6 dBm.

Application Note (Con't)

IEEE 802.16 - 2004					
Frequency:	2.5 GHz	Signal Level:	17.9 dBm	External Att:	0 dB
Sweep Mode:	Continuous	Trigger Mode:	Power	Trigger Offset:	-10 µs
Burst Type:	OFDM DL Burst	Modulation:	64QAM3/4	No Of Data Symbols:	1/2425

Result Summary						
No. of Bursts	2					*
	Min	Mean	Limit	Max	Limit	Unit
EVM All Carriers	**2.72**	**2.73**	2.82	**2.73**	2.82	%
EVM Data Carriers	**2.72**	**2.73**	2.82	**2.74**	2.82	%
EVM Pilot Carriers	**2.56**	**2.57**		**2.57**		%
IQ Offset	**0.24**	**0.24**		**0.24**		%
Gain Imbalance	**0.04**	**0.04**		**0.04**		%
Quadrature Error	**- 0.081**	**- 0.078**		**- 0.076**		°
Center Frequency Error	**5.64**	**6.05**	± 20000	**6.45**	± 20000	Hz
Symbol Clock Error	**- 0.04**	**- 0.05**	± 8	**- 0.06**	± 8	ppm
Burst Power	**17.76**	**17.76**		**17.76**		dBm
Crest Factor	**8.17**	**8.20**		**8.22**		dB
RSSI	**20.10**	**20.10**		**20.10**		dBm
RSSI Standard Deviation		**- 6.03**				dB
CINR	**40.25**	**40.25**		**40.25**		dB
CINR Standard Deviation		**14.86**				dB

Figure 7 802.16 256 carriers, 64 QAM at 2.5 GHz, EVM = 2.7% @ Pavg=30.0 dBm

Application Note (Con't)

Typical constellation response for 802.16 Pavg=24 dBm and 1.7% EVM

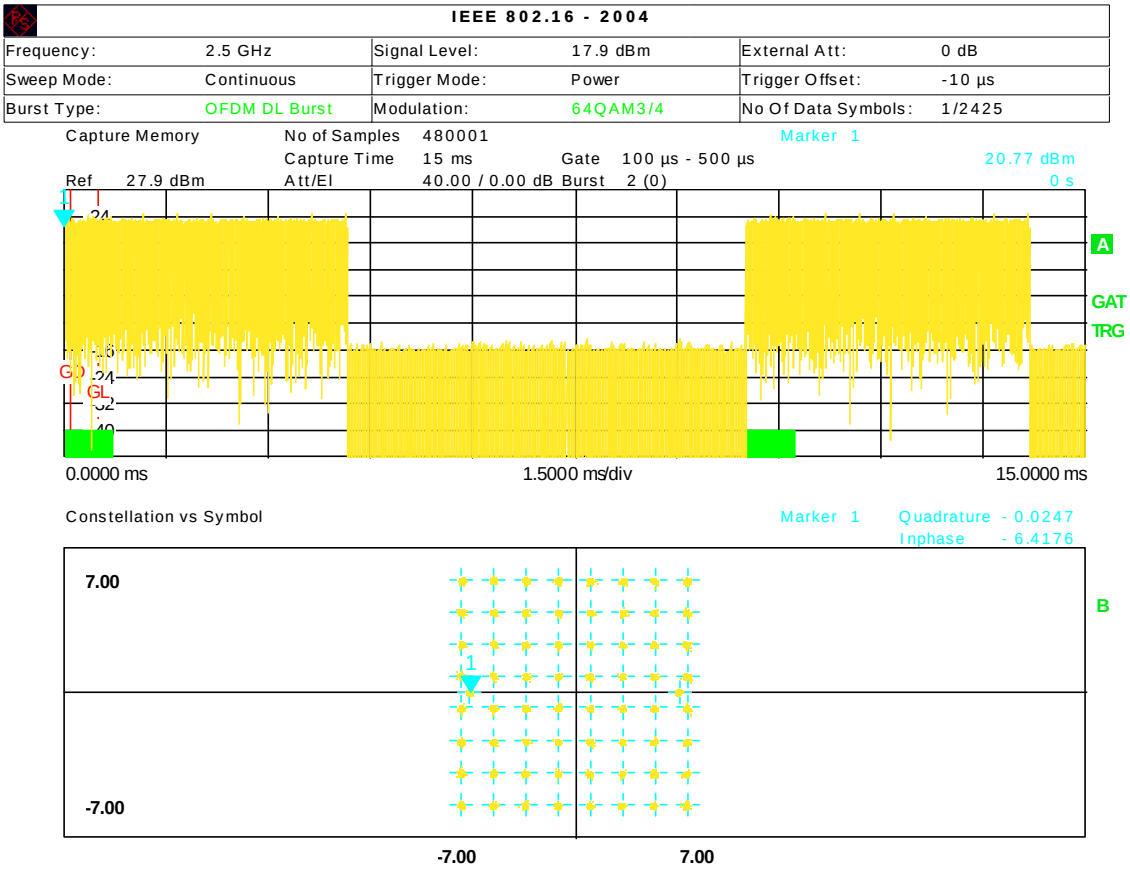

Figure 8 WiMax constellation Pavg=30 dBm at 2.5 GHz for 2.7% EVM for all carriers.

The test signal is 256 carriers, 64 QAM with 3/4 coding factor.

The signal power versus time is shown in yellow.

The constellation shown in represents 64 QAM.