

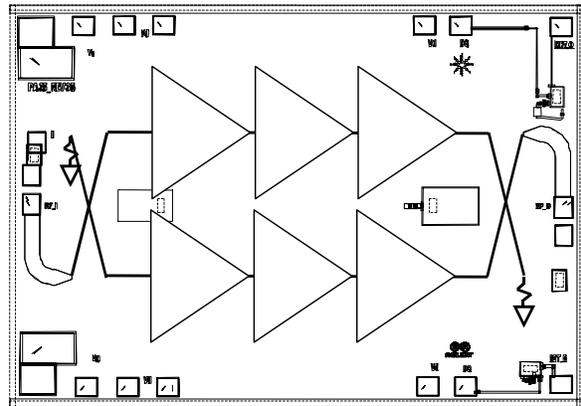
Preliminary Information
Agilent AMMC-6430
26 – 34 GHz 1W Power Amplifier
Data Sheet

Features

- Wide frequency range: 26 - 34 GHz
- High gain: 18 dB
- 50 Ω Input and Output
- High Power: 29 dBm at P-1dB
- Integrated RF Power Detector

Applications

- Microwave Radio Systems
- LMDS & Pt-Pt mmW Long Haul Platforms
- Satellite VSAT, DBS Up/Down Link
- 802.16 Broadband Wireless Access
- Commercial Grade Military



Chip Size: 2500 x 1750 μm (100 x 69 mils)
 Chip Size Tolerance: $\pm 10\mu\text{m}$ (± 0.4 mils)
 Chip Thickness: 100 $\pm 10\mu\text{m}$ (4 ± 0.4 mils)
 DC Pad Dimensions: 100 x 100 μm ($4 \times 4 \pm 0.4$ mils)
 RF I/O Pad Dimensions: 120 x 80 μm ($4.7 \times 3.15 \pm 0.4$ mils)

Description

The AMMC-6430 MMIC is a broadband 1W power amplifier designed for use in transmitters that operate in various frequency bands between 26GHz and 34GHz. It can be attached to the output of the AMMC-5040 (20-40 GHz) MMIC amplifier, increasing the power handling capability of transmitters requiring linear operation. At 30GHz, it provides 29dBm of output power (P-1dB) and 20dB of small-signal gain from a small easy-to-use device. The device has input and output matching circuitry for use in 50 Ω environments. The AMMC-6430 also integrates a temperature compensated RF power detection circuit that enables power detection of 0.3V/W at 30GHz. DC bias is simple and the device operates on widely available 5V for current supply (negative voltage only needed for Vg). It is fabricated in a PHEMT process for exceptional power and gain performance.

AMMC-6430: DC & RF Specifications ^[1]

Sym	Parameters/Conditions	Typ.	Min/Max
V _d	Drain Supply Voltage	V	5
V _g	Gate Supply Voltage	V	-0.8
I _d	Drain Supply Current	mA	850 1000
Gain	Small-signal Gain	dB	18 17
IP3	Third Order Intercept	dBm	38
RL _{in}	Input Return Loss	dB	-15 -10
RL _{out}	Output Return Loss	dB	-13 -10
P-1dB	Power @ 1dB Gain Comp	dBm	29 27
Psat	Power @ 3dB Gain Comp	dBm	30
Isol	Reverse Isolation	dB	40

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AMMC-6430 Typical Performances ($T_A = 25^\circ\text{C}$, $V_d = 5\text{ V}$, $I_d = 850\text{ mA}$, $Z_{in} = Z_{out} = 50\ \Omega$)

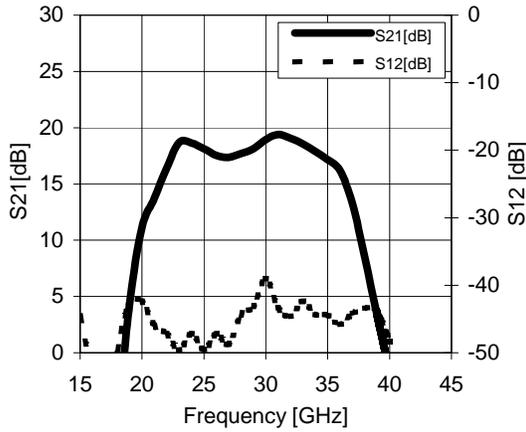


Figure 1. Typical Gain and Reverse Isolation

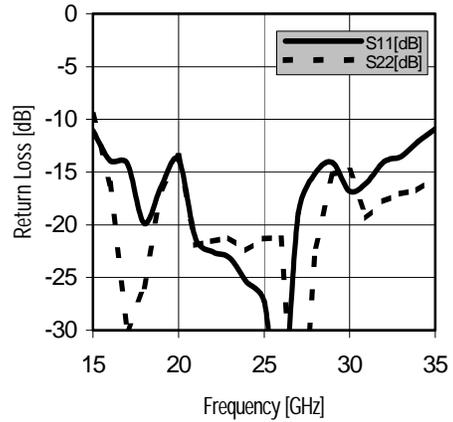


Figure 2. Typical Return Loss (Input & Output)

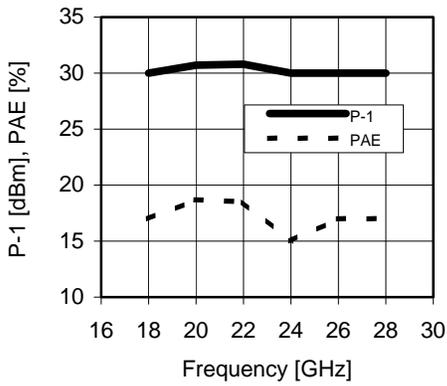


Figure 3. Typical Output Power (P-1dB)

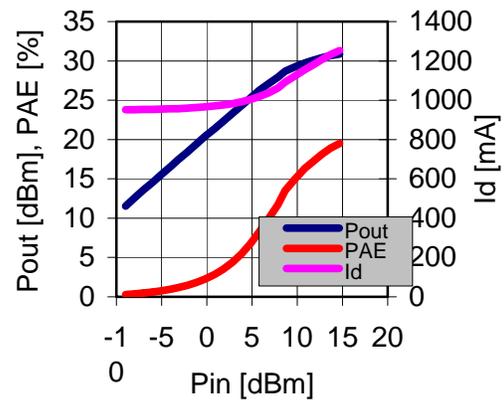


Figure 4. Typical Output Power, PAE, and Drain Current vs. Input Power at 24 GHz

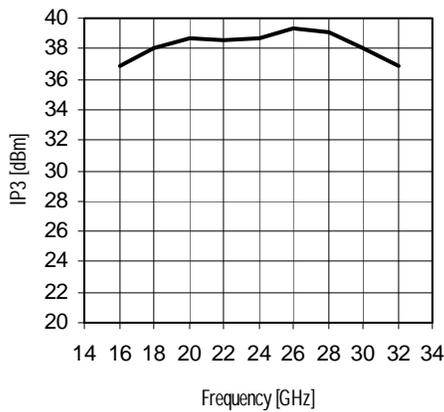


Figure 5. Typical Third Order Intercept

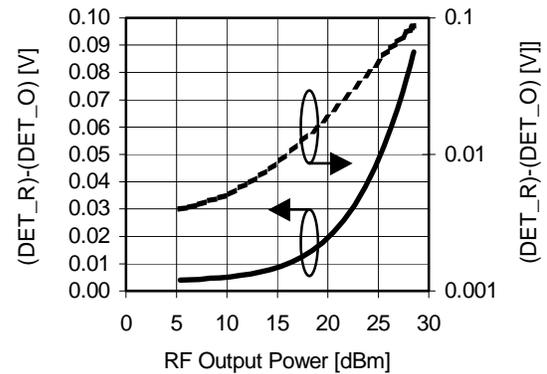


Figure 6. Typical Detector voltage vs. Output Power

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Typical Scattering Parameters^[1], ($T_A = 25^\circ\text{C}$, $V_d = 5\text{ V}$, $I_D = 850\text{ mA}$, $Z_{in} = Z_{out} = 50\ \Omega$)

Freq [GHz]	S11		S21		S12		S22					
	dB	Mag	Phase	dB	Mag	Phase	dB	Mag	Phase	dB	Mag	Phase
10	-3.680	0.655	179.940	-49.398	0.003	-91.631	-48.136	3.92E-03	-174.890	-2.705	0.732	174.710
11	-4.231	0.614	166.550	-38.666	0.012	-171.090	-47.844	4.05E-03	150.480	-3.193	0.692	160.620
12	-4.889	0.570	153.400	-40.878	0.009	156.630	-45.043	5.60E-03	151.690	-3.337	0.681	145.450
13	-5.641	0.522	140.480	-39.660	0.010	135.620	-42.633	7.39E-03	116.720	-3.616	0.659	129.210
14	-6.491	0.474	127.870	-39.816	0.010	109.210	-43.867	6.41E-03	83.684	-4.017	0.630	112.010
15	-7.614	0.416	115.580	-38.576	0.012	29.305	-44.508	5.95E-03	36.587	-4.705	0.582	92.998
16	-9.039	0.353	106.490	-29.119	0.035	-57.260	-53.153	2.20E-03	20.788	-5.801	0.513	73.017
17	-10.232	0.308	101.070	-17.722	0.130	-108.010	-63.594	6.61E-04	131.340	-7.439	0.425	51.354
18	-10.220	0.308	97.878	-6.574	0.469	-153.380	-49.848	3.22E-03	142.460	-10.075	0.314	29.329
19	-8.969	0.356	78.433	4.331	1.647	141.200	-42.617	7.40E-03	108.400	-13.348	0.215	10.282
20	-13.141	0.220	52.792	11.103	3.590	54.724	-42.367	7.62E-03	68.594	-18.692	0.116	-24.003
21	-14.281	0.193	64.430	13.734	4.861	-20.215	-45.935	5.05E-03	36.771	-36.779	0.014	-17.681
22	-13.463	0.212	53.322	16.418	6.620	-83.299	-47.188	4.37E-03	34.834	-32.147	0.025	118.000
23	-14.352	0.192	31.350	18.691	8.601	-151.490	-49.642	3.30E-03	49.707	-22.596	0.074	131.760
24	-15.953	0.159	14.845	18.643	8.553	141.050	-47.131	4.40E-03	53.825	-18.835	0.114	94.022
25	-18.776	0.115	-8.289	18.111	8.046	86.286	-49.589	3.32E-03	47.182	-20.941	0.090	70.179
26	-22.520	0.075	-25.326	17.529	7.524	37.520	-47.171	4.38E-03	53.320	-25.226	0.055	67.138
27	-25.427	0.054	-44.419	17.354	7.374	-6.990	-48.727	3.66E-03	67.416	-30.365	0.030	84.491
28	-32.419	0.024	-85.668	17.698	7.671	-51.735	-44.383	6.04E-03	76.331	-23.544	0.066	127.800
29	-31.769	0.026	61.479	18.131	8.064	-97.311	-43.152	6.96E-03	59.340	-18.957	0.113	105.290
30	-33.802	0.020	-19.899	18.941	8.852	-146.290	-38.954	1.13E-02	33.132	-22.642	0.074	87.744
31	-32.036	0.025	-127.190	19.386	9.317	161.790	-43.372	6.78E-03	13.791	-22.496	0.075	122.170
32	-27.364	0.043	134.600	19.055	8.969	107.820	-44.622	5.87E-03	9.175	-18.219	0.123	115.710
33	-28.596	0.037	101.230	18.556	8.468	55.328	-42.377	7.61E-03	20.727	-16.596	0.148	115.730
34	-24.705	0.058	69.963	17.906	7.858	3.213	-44.368	6.05E-03	0.907	-14.603	0.186	95.564
35	-30.152	0.031	27.163	17.161	7.212	-51.242	-44.370	6.05E-03	-13.080	-14.467	0.189	83.784
36	-25.505	0.053	152.520	16.193	6.452	-112.580	-45.800	5.13E-03	19.160	-14.368	0.191	80.033
37	-21.126	0.088	99.771	13.272	4.609	-178.660	-44.194	6.17E-03	5.622	-14.339	0.192	75.768
38	-20.155	0.098	92.997	8.442	2.643	123.150	-43.394	6.77E-03	-16.641	-13.622	0.208	70.075
39	-18.690	0.116	85.240	3.268	1.457	76.263	-43.789	6.46E-03	-16.265	-13.518	0.211	64.711
40	-15.988	0.159	76.561	-1.687	0.823	37.742	-48.297	3.85E-03	-15.050	-13.287	0.217	59.085

Note:

1. Data obtained from on-wafer measurements.

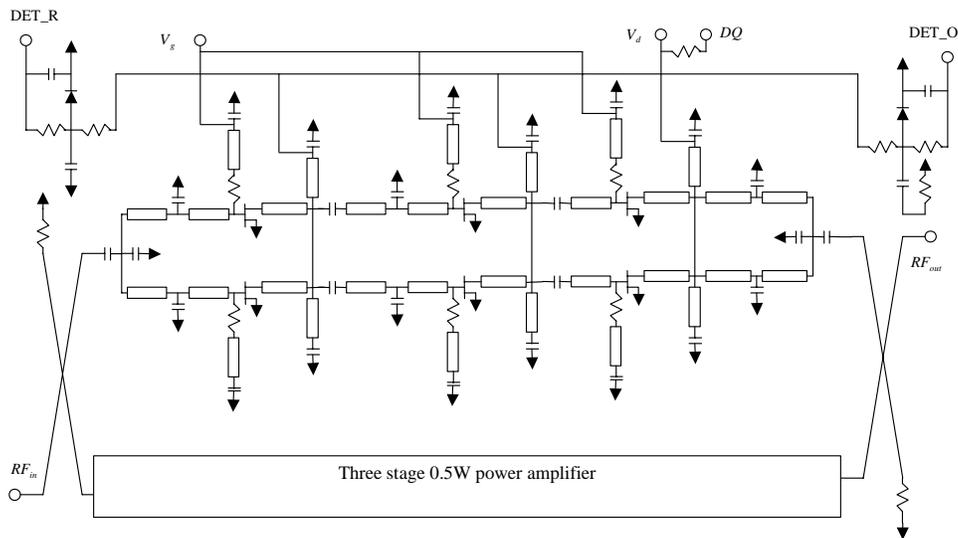


Figure 7. AMMC-6430 Schematic

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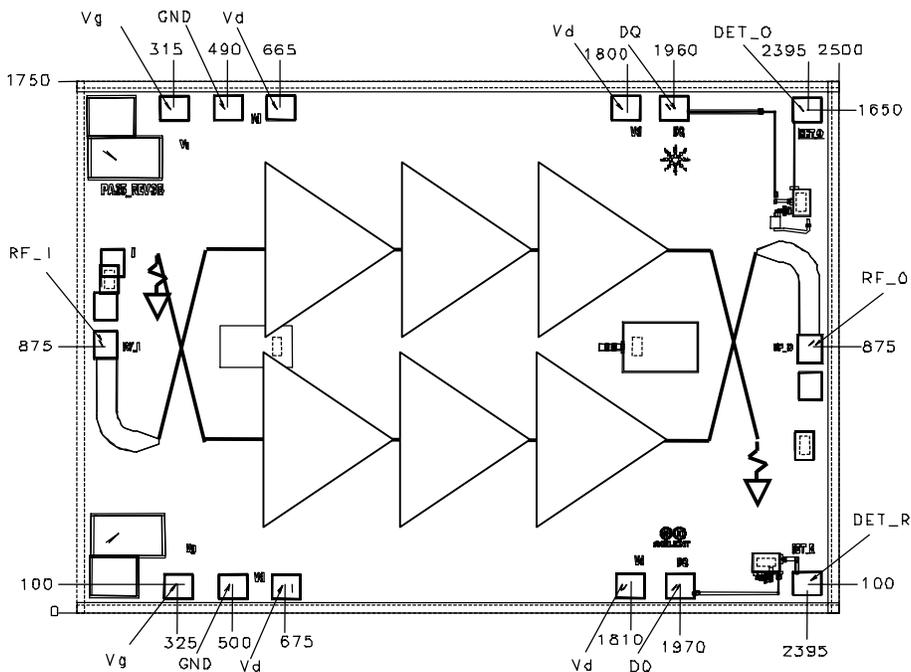


Figure 8. AMMC-6430 Bonding pad locations

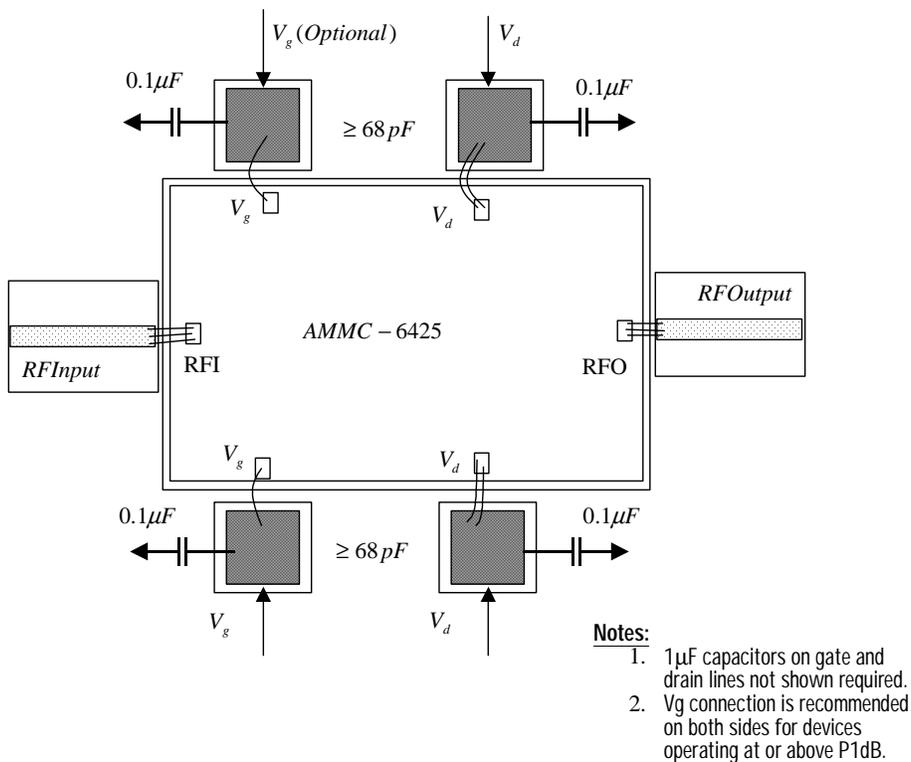


Figure 9. AMMC-6430 Assembly diagram

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Biasing and Operation

The recommended quiescent DC bias condition for optimum efficiency, performance, and reliability is $V_d=5$ volts with V_g set for $I_d=850$ mA. A single DC gate supply connected to V_g will bias all gain stages. Muting can be accomplished by setting V_g and V_d to the pinch-off voltage V_p .

An optional output power detector network is also provided. The differential voltage between the Det-Ref and Det-Out pads can be correlated with the RF power emerging from the RF output port. The detected voltage is given by :

$$V = (V_{ref} - V_{det}) - V_{ofs}$$

where V_{ref} is the voltage at the DET_R port, V_{det} is a voltage at the DET_O port, and V_{ofs} is the zero-input-power offset voltage. There are three methods to calculate V_{ofs} :

1) V_{ofs} can be measured before each detector measurement (by removing or switching off the power source and measuring $V_{ref} - V_{det}$). This method gives an error due to temperature drift of less than 0.01dB/50°C.

2) V_{ofs} can be measured at a single reference temperature.

The drift error will be less than 0.25dB.

3) V_{ofs} can either be characterized over temperature and stored in a lookup table, or it can be measured at two temperatures and a linear fit used to calculate V_{ofs} at any temperature. This method gives an error close to the method #1.

The RF ports are AC coupled at the RF input to the first stage and the RF output of the final stage. No ground wires are needed since ground connections are made with plated through-holes to the backside of the device.

Assembly Techniques

Electrically and thermally conductive epoxy die attach is the preferred assembly method. Solder die attach using flux-less gold-tin (AuSn) solder perform can also be used. The device should be attached to an electrically conductive surface to complete the DC and RF ground paths. The backside metallization on the device is gold.

It is recommended that the electrical connection to the bonding pads be made using 0.7-1.0mil diameter gold wire. The microwave/millimeter wave connection should be

kept as short as possible to minimize inductance. For assemblies requiring long bond wires, multiple wires can be attached to the RF bonding pads.

Gold thermo-sonic wedge bonding with 1-mil diameter Au wire is recommended for all bonds. Tool force should be 22 +/- 1-gram, stage temperature should be 150 +/- 2 °C, and ultra sonic power and duration should be 64 +/- 1dB and 76 +/- 8mSec respectively. Bonding pads and chip backside metallization are gold.

For more detailed information see Agilent Technologies' application note #999 "GaAs MMIC assembly and handling guideline.

For product information and a complete list of Agilent contacts and distributors, please go to our website:
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