MGA-495940-02

4.9 – 5.9 GHz 10W High Efficiency Linear Power Amplifier
Product Data Sheet

Features:

- **12 dB Gain**
- **40 dBm P_{-3dB}**
- **33 dBm Linear Pout @ 2.5% EVM (802.11 64QAM)**
- **25% Efficiency at 33 dBm Linear Output Power**
- **Fully Matched Input and Output for Easy Cascade**
- **+ 28V Bias Voltage**
- **Surface Mount Package with RoHS Compliance**
- **MTTF > 100 years @ 85ºC ambient temperature**

Applications:

- **802.16d/e WiMax**
- **802.11a WLAN**
- **Point-To-Point Radio Applications**

Description:

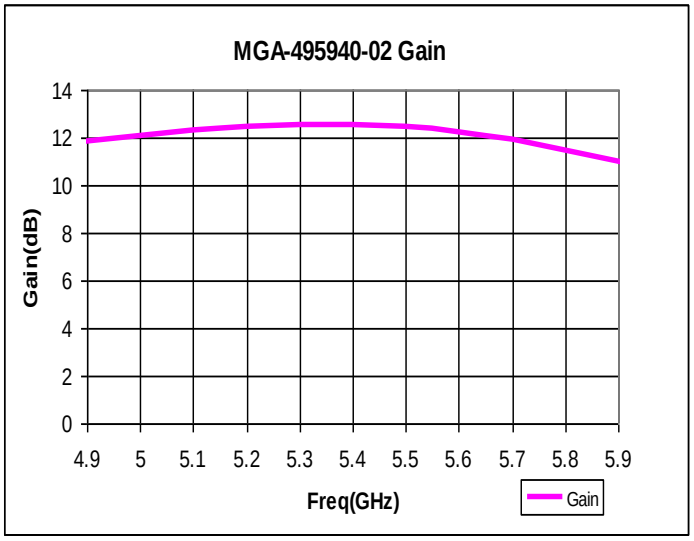
The MGA-495940-02 is a power amplifier with the State-of-the-Art linear power-added-efficiency between 4.9 GHz and 5.9 GHz frequency band. Based on advanced robust GaN device technology, the power-added-efficiency of this power amplifier is as high as 25% when it outputs 2W linear burst power with 2.5% EVM under the 802.16d/e 64QAM modulation schemes. The high efficiency linear power amplifier also has excellent reliability. Ideal applications include the driver and the output power stage of WiMax and WLAN infrastructures and access points. It also can be used for PTP (Point-To-Point) radio applications for this band.

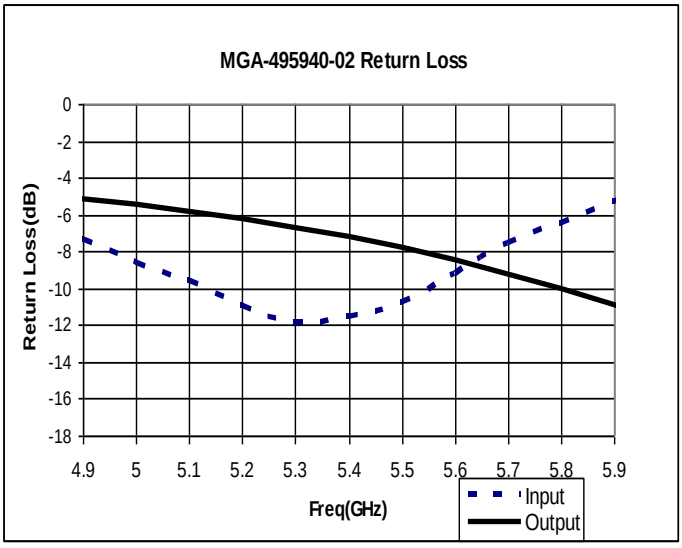
Typical RF Performance: *Vds=28V,, Icq=80mA, Ta=25 ºC, Z0=50 ohm*

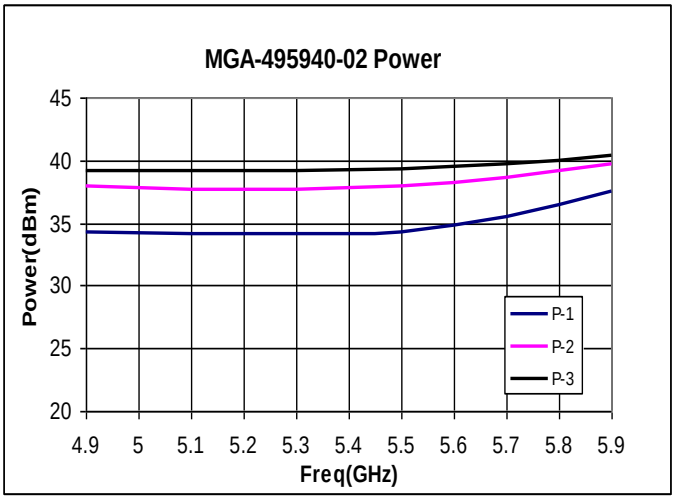
Parameter	Units	Typical Data
Frequency Range	MHz	4900-5900
Gain (Typ / Min)	dB	12 / 10
Gain Flatness (Typ / Max)	+/-dB	1.0 / 1.5
Input Return Loss	dB	8
Output Return Loss	dB	8
Output P3dB	dBm	40
Pout @ 2.5% EVM	dBm	33
Operating Current Range	mA	100-400
Thermal Resistance	°C /W	5

(1) Output IP3 is measured with two tones at output power of 13 dBm/tone separated by 10 MHz.

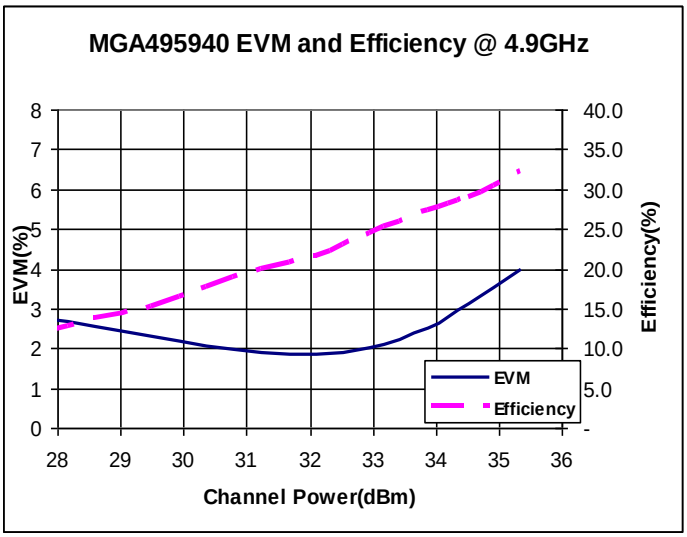
Typical RF Performance: *Vds=28.0V, Icq=80mA, Z0=50 ohm, Ta=25 ºC*

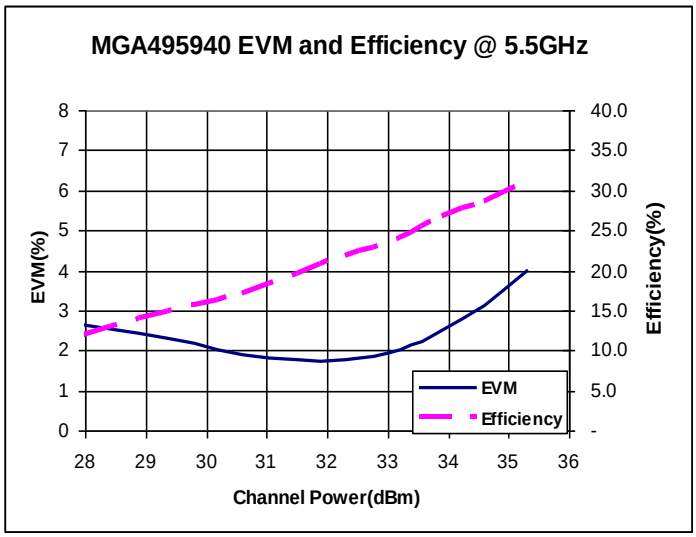


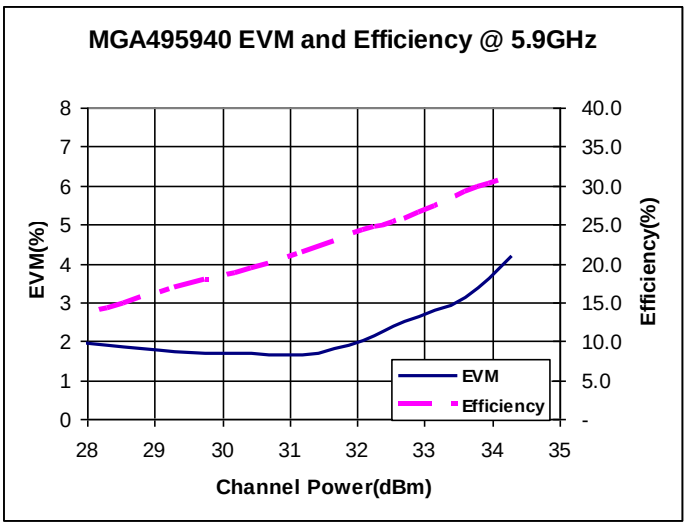




Typical RF Performance(Cont'l): *Vds=28.0V, Icq=80mA, Z0=50 ohm, Ta=25 ºC*







Absolute Maximum Ratings: *(Ta= 25 ºC)**

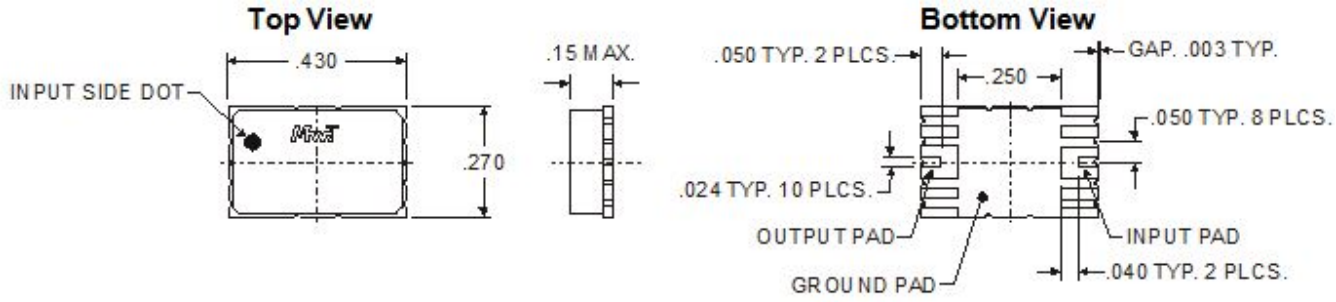
SYMBOL	PARAMETERS	UNITS	ABSOLUTE MAXIMUM
Vds	Drain-Source Voltage	V	50
Id	Drain Current	mA	1000
Ig	Gate Current	mA	100
Pdiss	DC Power Dissipation	W	50
Pin max	RF Input Power	dBm	+33
Tch	Channel Temperature	ºC	175
Tstg	Storage Temperature	ºC	-55 to 150

*****Operation of this device above any one of these parameters may cause permanent damage.

Typical Scattering Parameters: *Vds=28V, Icq=80mA ,Z0=50 ohm, Ta=25 ºC*

Freq(GHz)	dB(S11)	Ang(S11)	dB(S21)	Ang(S21)	dB(S12)	Ang(S12)	dB(S22)	Ang(S22)
4.50	-4.69	-43.52	10.55	-141.90	-33.06	-144.90	-4.14	-142.40
4.60	-5.11	-50.54	10.90	-152.80	-32.87	-152.70	-4.42	-151.70
4.70	-5.87	-56.32	11.18	-164.00	-32.51	-159.70	-4.66	-161.40
4.80	-6.51	-61.08	11.51	-175.90	-32.07	-168.00	-4.93	-171.30
4.90	-7.39	-66.87	11.83	172.30	-31.71	-177.20	-5.19	178.50
5.00	-8.62	-68.72	12.08	159.90	-31.52	172.80	-5.49	167.40
5.10	-9.60	-69.53	12.34	146.80	-31.24	162.00	-5.85	156.40
5.20	-10.95	-67.66	12.50	133.80	-31.05	150.90	-6.21	144.60
5.30	-11.84	-58.77	12.52	120.10	-30.84	139.60	-6.67	132.30
5.40	-11.59	-49.87	12.57	106.30	-30.96	127.60	-7.21	120.40
5.50	-10.77	-42.44	12.48	92.66	-31.15	115.20	-7.76	107.30
5.60	-9.20	-39.10	12.20	78.48	-31.29	103.10	-8.48	94.20
5.70	-7.62	-41.41	11.90	64.56	-31.78	91.87	-9.28	81.16
5.80	-6.53	-45.95	11.48	50.88	-32.39	79.12	-10.07	67.42
5.90	-5.35	-51.14	11.01	37.53	-32.88	67.90	-10.94	53.45
6.00	-4.49	-59.01	10.45	24.92	-33.57	57.35	-11.91	38.94
6.10	-3.99	-65.82	9.80	12.18	-34.36	44.67	-12.77	24.35
6.20	-3.22	-73.37	9.23	-0.24	-35.20	33.93	-13.60	8.06
6.30	-2.90	-81.86	8.62	-11.31	-36.03	24.04	-14.51	-7.53
6.40	-2.63	-88.27	7.89	-22.43	-37.27	13.47	-14.93	-23.85
6.50	-2.15	-96.78	7.23	-33.40	-38.15	2.63	-15.33	-42.38

Mechanical Information: *This Package is RoHS compliant*



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

Application Circuit

The evaluation board, shown in Figure 3, is fabricated with Rogers's 4003 material, 20 mil thick, 2 oz copper weight. The MGA-495940-02 shown in the center of board is a 10 watt amplifier with high gain and high linearity. For best thermal performance, the PCB requires via holes with a diameter of 20 mils placed uniformly over the center pad for thermal relief and RF ground as shown in Figure 4. The via holes underneath the package are back filled with conductive epoxy as shown in Figure 4. The choice of capactir bypassing near the amplififer should have a short circuit resonance at the frequency of operation. A small capacitor 3.9 pf 0603 from AVX has a series resonance at 5.5 GHz and will make a good choice for the first bypass capacitor.

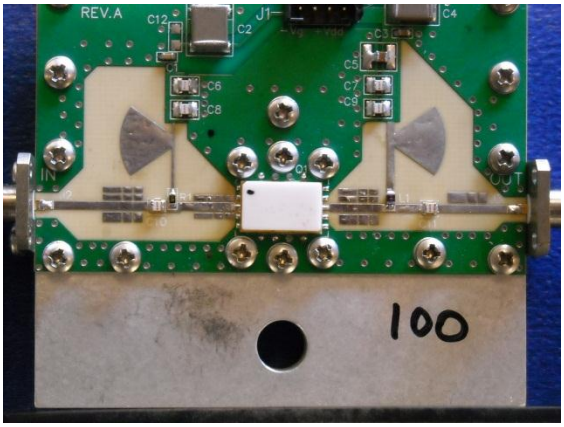


Figure 3 Evaluation board

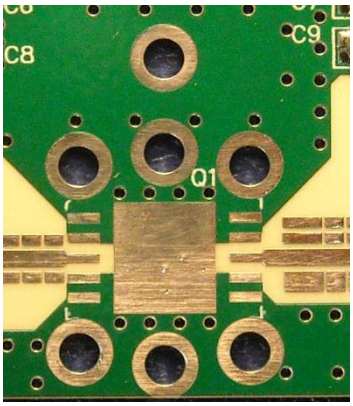


Figure 4 Hole Pattern

Followed up with larger value capacitors 100pf, 1000pf and 2.2 uF can be used to maintain voltage stability under peak current conditions. The DC ground via holes should be laid out to minimized inductive returns associated with ground loops. Use of stitch ground vias holes can help control the return current and also maintain ground continuity between the top and bottom ground layers. Biasing with quarter-wave stubs at the gate and drain are shown in Figure 3. A 56 ohm resistor is added in series to the gate bias and a 2.2 nH choke is added inseries to the drain bias. The effective impedance is increased which reduces the risk of low frequency oscillations.

Application Notes:

802.16 256 carriers, 64 QAM @ 4.9GHz, Pavg=33.40dBm @ EVM=2.5%

IEEE 802.16-2004 OFDM					
Frequency:	4.9 GHz	Signal Level Setting:	16.1 dBm	Ref. Level / Ext. Att:	26.1 dBm / 17.9 dB
Sweep Mode:	Continuous	Trigger Mode:	External	Trigger Offset:	-10 µs
Burst Type:	OFDM DL Burst	Modulation:	ALL	No Of Data Symbols:	1/2425

Result Summary						
No. of Bursts	4					
	Min	Mean	Limit	Max	Limit	Unit
EVM All Carriers	2.45	2.48	2.82	2.55	2.82	%
EVM Data Carriers	2.46	2.48		2.55		%
EVM Pilot Carriers	2.34	2.41		2.54		%
IQ Offset	0.34	0.34	17.78	0.34	17.78	%
Gain Imbalance	0.12	0.12		0.12		%
Quadrature Error	0.013	0.013		0.013		°
Center Frequency Error	149.15	149.15	±39200	149.15	±39200	Hz
Clock Error	0.03	0.03	±8	0.03	±8	ppm
Burst Power	33.37	33.40		33.43		dBm
Crest Factor	9.15	9.18		9.21		dB
RSSI	36.31	36.31		36.31		dBm
RSSI Standard Deviation		-3.06				dB
CINR	15.98	15.98		15.98		dB
CINR Standard Deviation		2.75				dB

Application Notes(Con't):

802.16 256 carriers, 64 QAM @ 5.5GHz, Pavg=33.54dBm @ EVM=2.5%

IEEE 802.16-2004 OFDM		
Frequency: 5.5 GHz	Signal Level Setting: 16.7 dBm	Ref. Level / Ext. Att: 26.7 dBm / 17.9 dB
Sweep Mode: Continuous	Trigger Mode: External	Trigger Offset: -10 µs
Burst Type: OFDM DL Burst	Modulation: ALL	No Of Data Symbols: 1/2425

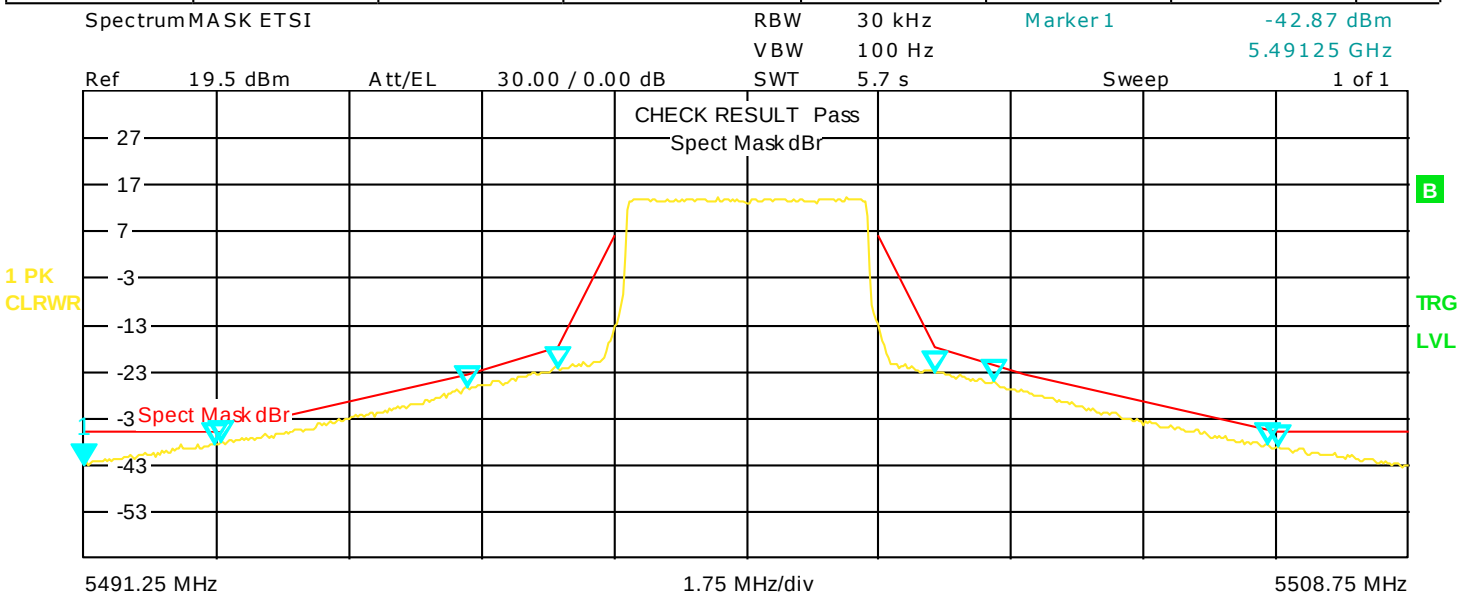
Result Summary						
No. of Bursts	4					
	Min	Mean	Limit	Max	Limit	Unit
EVM All Carriers	2.47	2.50	2.82	2.54	2.82	%
EVM Data Carriers	2.48	2.50		2.54		%
EVM Pilot Carriers	2.38	2.45		2.56		%
IQ Offset	0.21	0.21	17.78	0.21	17.78	%
Gain Imbalance	0.14	0.14		0.14		%
Quadrature Error	- 0.017	- 0.017		- 0.017		°
Center Frequency Error	166.88	166.88	±44000	166.88	±44000	Hz
Clock Error	0.02	0.02	±8	0.02	±8	ppm
Burst Power	33.50	33.54		33.57		dBm
Crest Factor	9.12	9.25		9.30		dB
RSSI	36.45	36.45		36.45		dBm
RSSI Standard Deviation		- 5.47				dB
CINR	15.94	15.94		15.94		dB
CINR Standard Deviation		2.20				dB

IEEE 802.16-2004 OFDM					
Frequency: 5.5 GHz		Signal Level Setting: 18 dBm		Ref. Level / Ext. Att: 19.5 dBm / 17.9 dB	
Sweep Mode: Continuous		Trigger Mode: External		Trigger Offset: -10 µs	
Burst Type: OFDM DL Burst		Modulation: ALL		No Of Data Symbols: 1/2425	

Spectrum Emission Mask

Tx Channel: Bandwidth 3.5 MHz Power 14.26 dBm

Start Freq. Rel.	Stop Freq. Rel.	RBW	Freq. at Δ to Limit	Pwr Abs	Pwr Rel	Δ to Limit	
-8.750 MHz	-7.000 MHz	30 kHz	5.492988782 GHz	-38.54 dBm	-52.79 dB	-2.79 dB	
-7.000 MHz	-3.700 MHz	30 kHz	5.493044872 GHz	-38.05 dBm	-52.30 dB	-2.46 dB	
-3.700 MHz	-2.500 MHz	30 kHz	5.496326122 GHz	-26.39 dBm	-40.65 dB	-2.78 dB	
-2.500 MHz	-1.750 MHz	30 kHz	5.497504007 GHz	-22.05 dBm	-36.31 dB	-4.44 dB	
1.750 MHz	2.500 MHz	30 kHz	5.502495994 GHz	-23.01 dBm	-37.27 dB	-5.39 dB	
2.500 MHz	3.700 MHz	30 kHz	5.503281250 GHz	-25.19 dBm	-39.44 dB	-3.53 dB	
3.700 MHz	7.000 MHz	30 kHz	5.506899039 GHz	-38.57 dBm	-52.83 dB	-3.20 dB	
7.000 MHz	8.750 MHz	30 kHz	5.507011218 GHz	-38.94 dBm	-53.20 dB	-3.20 dB	



Application Notes(Con't):

Typical constellation response for 802.16 Pavg=32.5dBm @ 2.5% EVM, 5.9GHz