MGA-333840-02

3.3 – 3.8 GHz 10W High Efficiency Linear Power Amplifier
New Product Data Sheet
December 2008

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**
- **Point-To-Point Radio Applications**

Description:

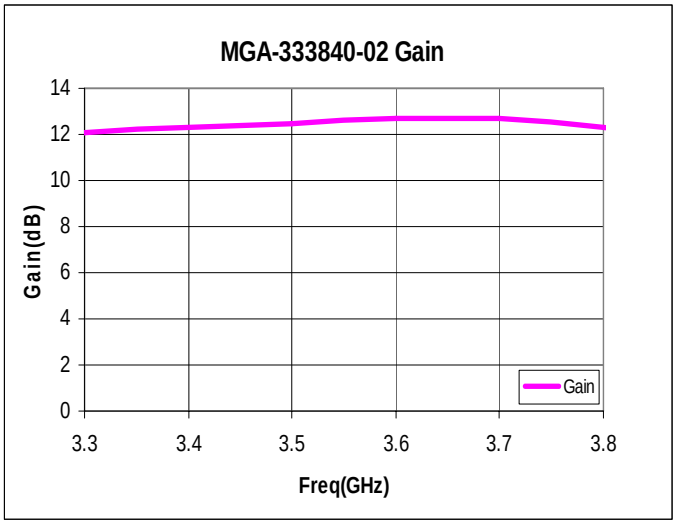
The MGA-333840-02 is a power amplifier with the State-of-the-Art linear power-added-efficiency between 3.3 GHz and 3.8 GHz frequency band. Based on advanced robust GaN device technology, the power-added-efficiency of this power amplifier is as high as 25% when it outputs 2W linear burst power with 2.5% 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 infrastructures and access points. It also can be used for PTP (Point-To-Point) radio applications for this band.

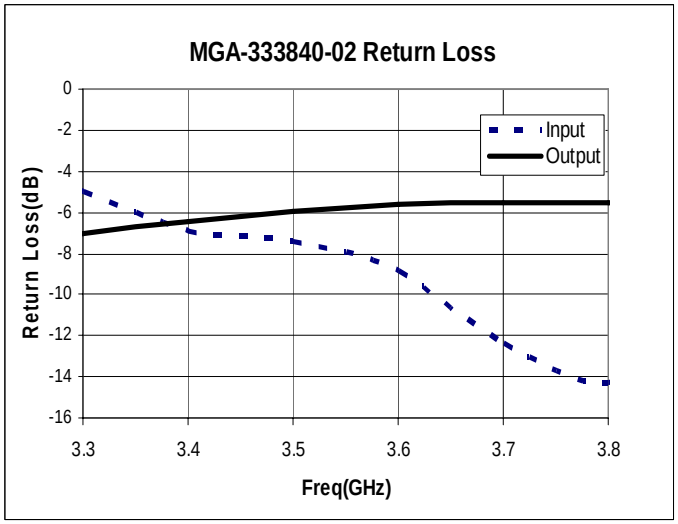
Typical RF Performance: *Vds=28V,, Icq=80mA, Ta=25 ºC, Z0=50 ohm*

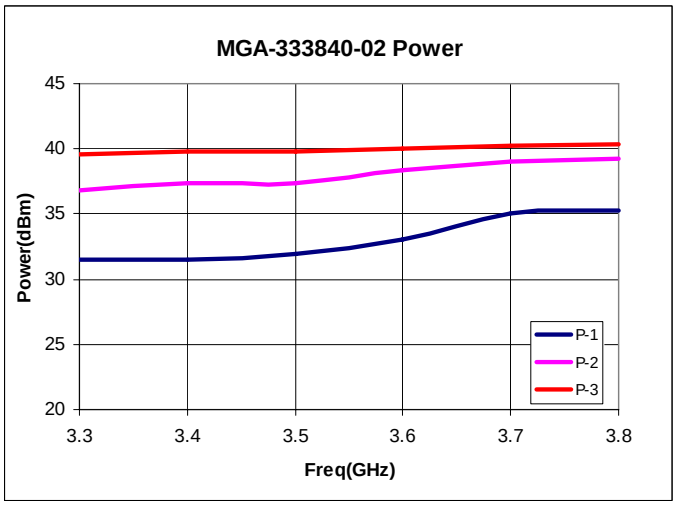
Parameter	Units	Typical Data
Frequency Range	MHz	3300-3800
Gain (Typ / Min)	dB	12 / 10
Gain Flatness (Typ / Max)	+/-dB	1.0 / 1.5
Input Return Loss	dB	8
Output Return Loss	dB	8
Output P_{-3dB}	dBm	40
Pout @ 2.5% EVM	dBm	33
Operating Current Range	mA	100-400
Thermal Resistance	°C /W	5

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

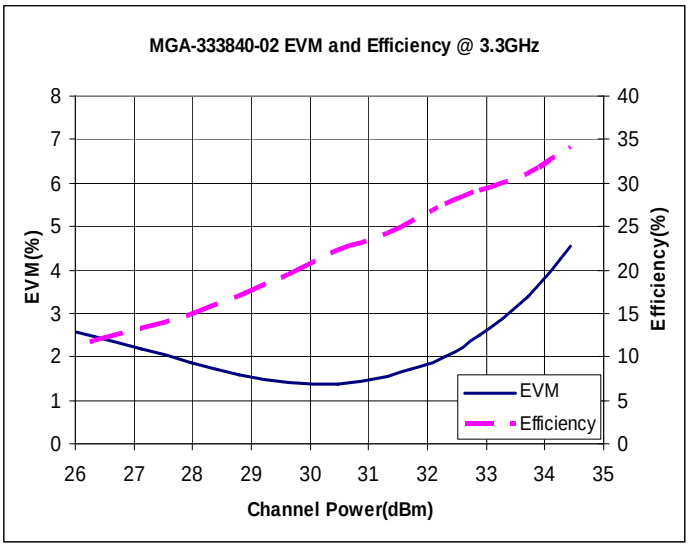
Typical RF Performance: *Vds=28.0V, Icq=80mA, Z0=50 ohm, Ta=25 ºC*

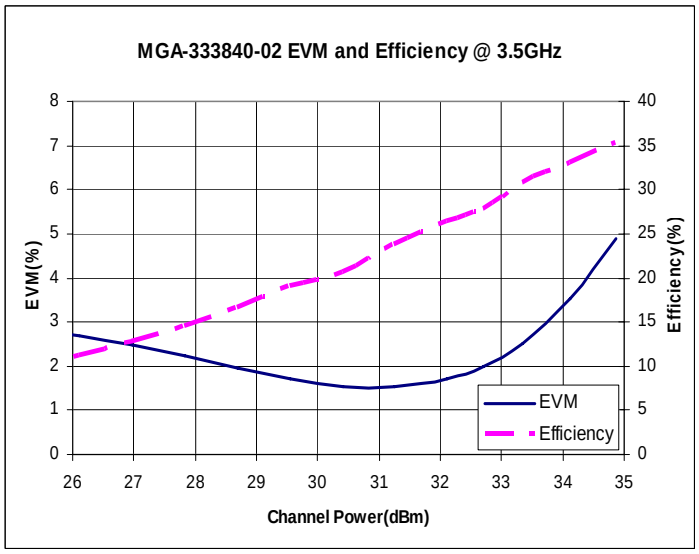


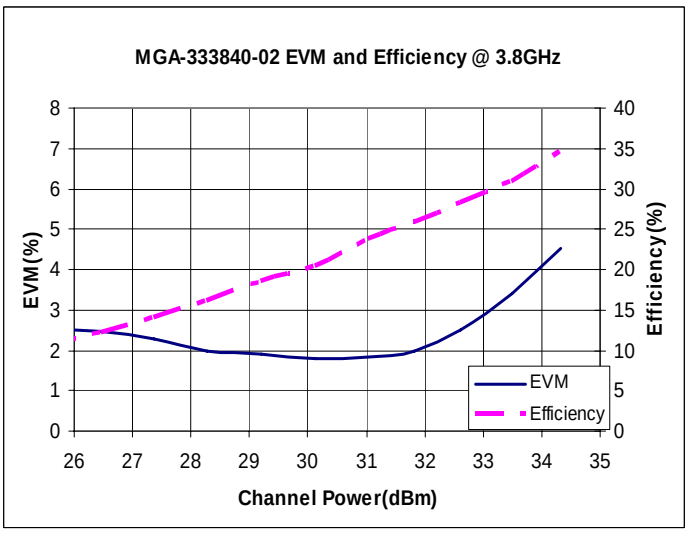




Typical RF Performance (Cont): *Vds=28.0V, Icq=80mA, Z0=50 ohm, Ta=25 ºC*







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

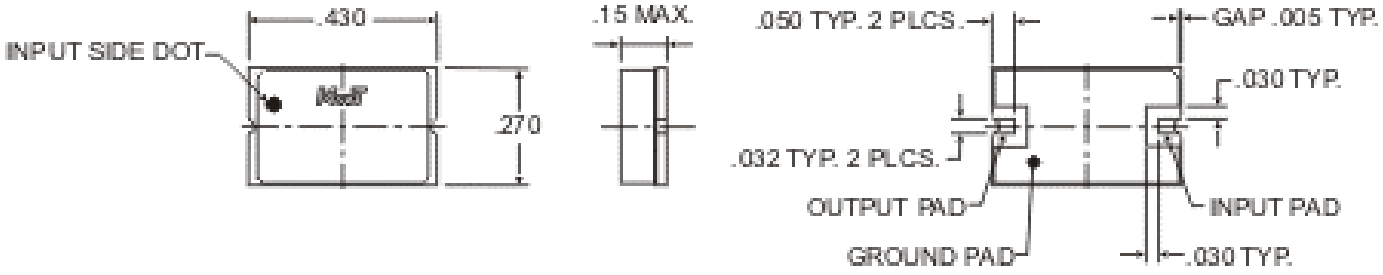
SYMBOL	PARAMETERS	UNITS	ABSOLUTE MAXIMUM
Vds	Drain-Source Voltage	V	50
Id	Drain Current	mA	1000
Ig	Gate Current	mA	100
Pdiss	DC Power Dissipation	W	50
Pin max	RF Input Power	dBm	+33
Tch	Channel Temperature	ºC	175
Tstg	Storage Temperature	ºC	-55 to 150

*****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)
2.50	-2.12	-125.00	11.20	-102.00	-33.30	-167.00	-7.92	-32.00
2.60	-2.21	-156.00	11.40	-132.00	-33.00	164.00	-7.98	-65.30
2.70	-2.27	173.00	11.50	-162.00	-32.90	136.00	-8.08	-97.50
2.80	-2.36	142.00	11.60	168.00	-33.00	108.00	-8.14	-129.00
2.90	-3.00	112.00	11.60	139.00	-32.90	79.20	-8.15	-160.00
3.00	-3.71	82.40	11.70	110.00	-32.90	50.90	-8.10	169.00
3.10	-4.00	53.50	11.70	80.70	-32.70	22.50	-7.86	139.00
3.20	-4.42	24.70	11.90	51.40	-32.60	-6.25	-7.53	108.00
3.30	-5.03	-4.61	12.10	21.50	-32.40	-34.70	-7.07	78.90
3.40	-6.97	-35.00	12.30	-8.44	-31.90	-65.00	-6.49	50.10
3.50	-7.45	-68.30	12.50	-40.20	-31.50	-96.60	-5.97	21.90
3.60	-8.85	-107.00	12.70	-73.50	-31.30	-130.00	-5.63	-5.10
3.70	-12.40	-160.00	12.70	-107.00	-31.20	-164.00	-5.50	-30.30
3.80	-14.30	120.00	12.30	-142.00	-31.40	160.00	-5.55	-53.70
3.90	-11.30	49.60	11.60	-176.00	-31.90	126.00	-5.68	-74.80
4.00	-8.38	3.82	10.70	151.00	-32.70	93.10	-5.77	-94.50
4.10	-6.55	-32.90	9.67	120.00	-33.50	61.70	-5.79	-113.00
4.20	-5.55	-66.00	8.73	89.90	-34.10	32.90	-5.79	-132.00
4.30	-4.99	-97.60	7.87	61.30	-34.60	3.91	-5.78	-150.00
4.40	-4.71	-130.00	7.07	32.70	-34.90	-24.60	-5.78	-169.00
4.50	-4.64	-164.00	6.38	4.02	-35.20	-53.70	-5.78	172.00

Mechanical Information: *This Package is RoHS compliant*



All dimensions are in mm

Application Circuit:

The evaluation board material, shown in Figure A, is Rogers 4003 material, 20 mil thick. The RF trace weight is 2 oz. Through holes with a diameter of 20 mils are spread uniformly over the center paddle for thermal relief and ground. Via holes underneath the paddle are back filled with conductive epoxy. It is recommended that via holes be placed nearby 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 the absence of sweat soldering the board to the chassis.

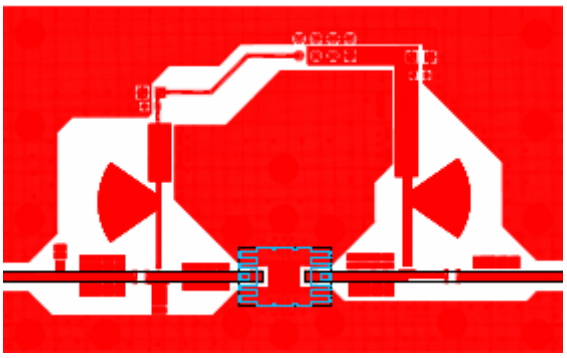


Figure A Evaluation Board

Biasing with quarter-wave stubs at the gate and drain are shown in Figure A. The impedance of the quarter wave structures is cyclical with frequency. A RF short is observed at frequencies that are even multiples of a quarter-wavelength and an open-impedance is observed at frequencies that are odd multiples of a quarter-wavelength. A 56 Ohm resistor is added in series to the gate bias. The effective impedance is increased which reduces the risk of oscillations. The 56 ohm resistor is not shown in Figure A. Through holes underneath the package is required to connect the top and bottom grounds and to improve thermal conductivity.

Application Notes:

802.16 256 carriers, 64 QAM @ 3.3GHz, Pavg=32.89dBm @ EVM=2.5%

IEEE 802.16-2004 OFDM					
Frequency:	3.3 GHz	Signal Level Setting:	14.7 dBm	Ref. Level / Ext. Att:	24.7 dBm / 17.3 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	7					
	Min	Mean	Limit	Max	Limit	Unit
EVM All Carriers	**2.51**	**2.57**	2.82	**2.70**	2.82	%
EVM Data Carriers	**2.52**	**2.58**		**2.70**		%
EVM Pilot Carriers	**2.35**	**2.43**		**2.59**		%
IQ Offset	**0.09**	**0.12**	17.78	**0.15**	17.78	%
Gain Imbalance	**0.18**	**0.13**		**0.04**		%
Quadrature Error	**- 0.036**	**- 0.002**		**0.021**		°
Center Frequency Error	**107.25**	**107.99**	± 26400	**108.66**	± 26400	Hz
Clock Error	**0.08**	**0.12**	± 8	**0.94**	± 8	ppm
Burst Power	**32.87**	**32.89**		**32.90**		dBm
Crest Factor	**9.02**	**9.24**		**9.42**		dB
RSSI	**35.68**	**35.72**		**35.74**		dBm
RSSI Standard Deviation		**7.25**				dB
CINR	**15.29**	**15.33**		**15.41**		dB
CINR Standard Deviation		**16.81**				dB

Running ...

Date: 26.NOV.2008 16:28:14

Application Notes (Cont):

802.16 256 carriers, 64 QAM @ 3.5GHz, Pavg=33.24dBm @ EVM=2.5%

IEEE 802.16-2004 OFDM					
Frequency: 3.5 GHz	Signal Level Setting:	16.9 dBm	Ref. Level / Ext. Att:	26.9 dBm / 17.3 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	7					
	Min	Mean	Limit	Max	Limit	Unit
EVM All Carriers	**2.41**	**2.49**	2.82	**2.68**	2.82	%
EVM Data Carriers	**2.41**	**2.49**		**2.68**		%
EVM Pilot Carriers	**2.29**	**2.36**		**2.58**		%
IQ Offset	**0.03**	**0.06**	17.78	**0.08**	17.78	%
Gain Imbalance	**0.22**	**0.15**		**0.05**		%
Quadrature Error	**- 0.024**	**0.003**		**0.027**		°
Center Frequency Error	**114.46**	**114.96**	± 28000	**115.62**	± 28000	Hz
Clock Error	**0.09**	**0.19**	± 8	**0.92**	± 8	ppm
Burst Power	**33.22**	**33.24**		**33.26**		dBm
Crest Factor	**9.17**	**9.30**		**9.41**		dB
RSSI	**36.04**	**36.11**		**36.14**		dBm
RSSI Standard Deviation		**10.23**				dB
CINR	**15.50**	**15.54**		**15.69**		dB
CINR Standard Deviation		**21.24**				dB

Running ...

Date: 26.NOV.2008 16:26:32

Application Notes (Cont):

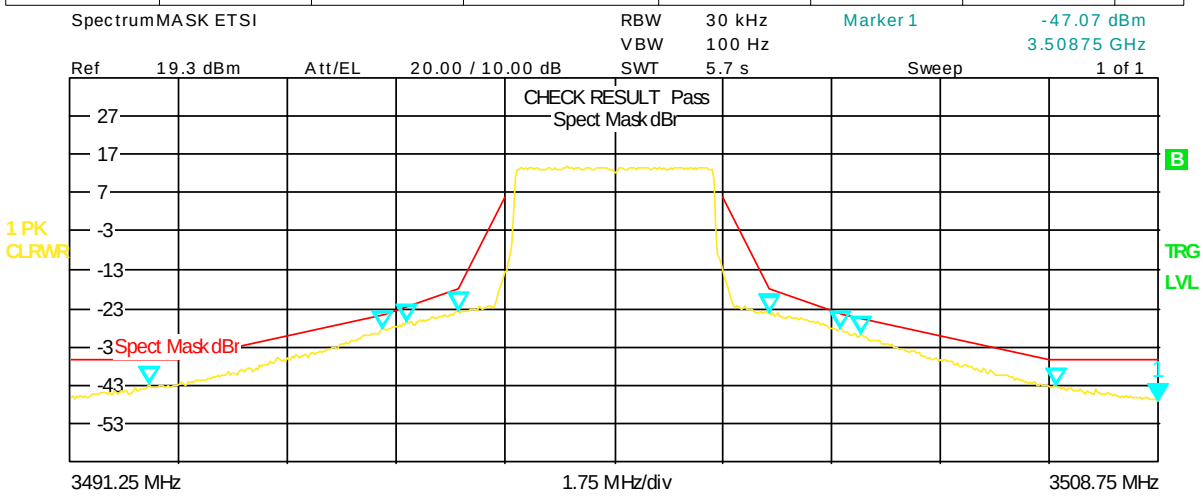
Typical ACPR response for 802.16 Pavg=33.24dBm @ 2.5% EVM, 3.5GHz

IEEE 802.16-2004 OFDM		
Frequency: 3.5 GHz	Signal Level Setting: 17.8 dBm	Ref. Level / Ext. Att: 19.3 dBm / 17.3 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 13.73 dBm

Start Freq. Rel.	Stop Freq. Rel.	RBW	Freq. at ? to Limit	Pwr Abs	Pwr Rel	? to Limit
-8.750 MHz	-7.000 MHz	30 kHz	3.492540064 GHz	-42.83 dBm	-56.56 dB	-6.45 dB
-7.000 MHz	-3.700 MHz	30 kHz	3.496298077 GHz	-28.43 dBm	-42.16 dB	-4.15 dB
-3.700 MHz	-2.500 MHz	30 kHz	3.496662660 GHz	-26.56 dBm	-40.30 dB	-4.11 dB
-2.500 MHz	-1.750 MHz	30 kHz	3.497504007 GHz	-23.73 dBm	-37.46 dB	-5.59 dB
1.750 MHz	2.500 MHz	30 kHz	3.502495993 GHz	-24.17 dBm	-37.90 dB	-6.03 dB
2.500 MHz	3.700 MHz	30 kHz	3.503617789 GHz	-28.16 dBm	-41.89 dB	-4.30 dB
3.700 MHz	7.000 MHz	30 kHz	3.503954327 GHz	-29.44 dBm	-43.17 dB	-4.24 dB
7.000 MHz	8.750 MHz	30 kHz	3.507123398 GHz	-43.24 dBm	-56.97 dB	-6.97 dB



Running ...

Date: 26.NOV.2008 16:27:02

Application Notes (Cont):

Typical constellation response for 802.16 Pavg=32.6dBm @ 2.5% EVM, 3.8GHz

Running ...

Date: 26.NOV.2008 16:25:47