

MMG-446040-S5 10 Watt, 4.4 – 6.0 GHz GaN Power Amplifier

Features

- Psat: +40 dBm
- PAE: 40 %
- Power Gain @ Psat: 27 dB
- Small Signal Gain: 30 dB
- QFN Package: 5.0 mm x 5.0 mm

Testing conditions: Pulsed RF signal with 1ms pulse width and 20% duty cycle

Applications

- Wireless Mesh Networks
- Point-to-Point Microwave Data Links
- Military Wireless Communications
- Telemetry
- Avionics

Description

The MMG-446040-S5 is a high-performance Gallium Nitride (GaN) power amplifier. The MMG-446040-S5 provides >10W of saturated output power, 40 % power-added efficiency and 27 dB of large-signal gain between 4.4 GHz and 6.0 GHz. The RF input and RF output are matched to 50Ω. Ideal applications include wireless mesh networks, point-to-point microwave data links, military wireless communications, telemetry, and avionics.

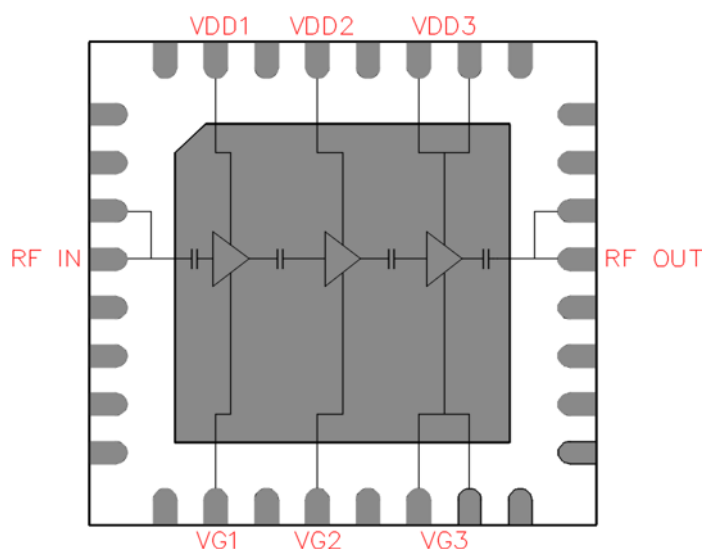
Absolute Maximum Ratings

Ta = 25 °C

SYMBOL	PARAMETERS	UNITS	MAX
Vds	Drain to Source Voltage	V	50
Vgs	Gate to Source Voltage	V	10
Idd1	Drain Current of 1st Stage	mA	200
Idd2	Drain Current of 2nd Stage	mA	400
Idd3	Drain Current of 3rd Stage	mA	800
Ig1	Gate Current of 1st Stage	mA	0.8
Ig2	Gate Current of 2nd Stage	mA	1.5
Ig3	Gate Current of 3rd Stage	mA	3
Pdiss	DC Power Dissipation	W	50
Pin max	Max RF Input Power	dBm	+15
Tch	Channel Temperature	°C	210
Tstg	Storage Temperature	°C	-55 to 150

Exceeding any of these limits may cause permanent damage.

Functional Diagram



MMG-446040-S5

10 Watt, 4.4 – 6.0 GHz GaN Power Amplifier

Typical RF Performance

$VDD1 = 15\text{ V}$, $VDD2 = 15\text{ V}$, $VDD3 = 28\text{ V}$, $IDQ1 = 15\text{ mA}$, $IDQ2 = 30\text{ mA}$, $IDQ3 = 58\text{ mA}$,
 $VG1 = -2.4\text{ V}$, $VG2 = -2.41\text{ V}$, $VG3 = -2.43\text{ V}$, $Ta = 25\text{ }^{\circ}\text{C}$, $Z0 = 50\text{ }\Omega$

PARAMETER	UNITS	TYPICAL DATA
Frequency Range	GHz	4.4 – 6.0
Gain (Typ / Min)	dB	30
Gain Flatness (Typ /Max)	$\pm$ dB	0.8
Input Return Loss	dB	7.0
Output Return Loss	dB	15
Output Psat	dBm	40
PAE	%	> 37
EVM @ Pout of 32 dBm or below	%	< 6
Operating Current Range	mA	See plot on page 3
Thermal Resistance	$^{\circ}\text{C} / \text{W}$	3.5

ESD Caution



High-performance RF integrated circuits are highly sensitive to electrostatic discharge (ESD) and may contain unprotected inputs and outputs. Handling and assembly should be conducted in an ESD-controlled environment. It is recommended that ESD precautions and protocols are adopted to minimise the risk of electrostatic discharge and protect product integrity.

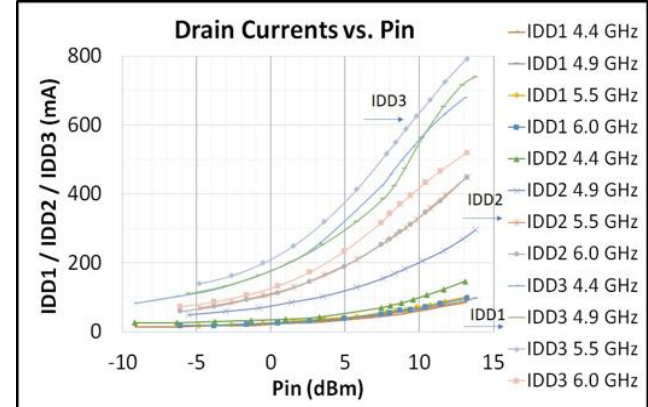
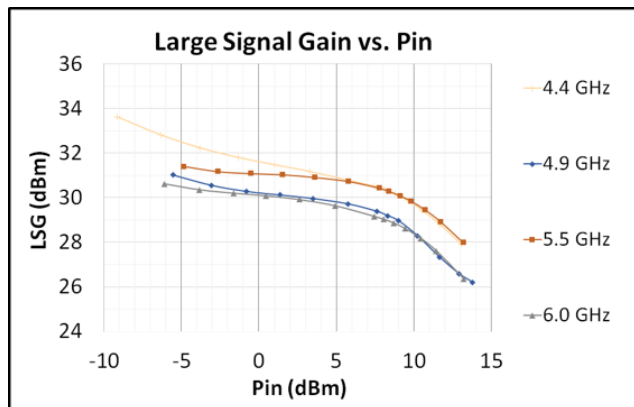
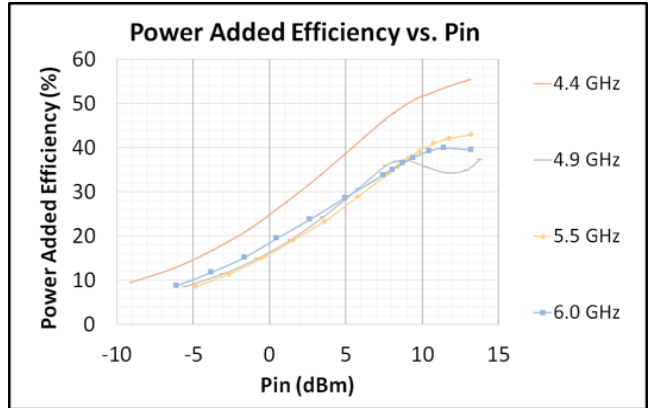
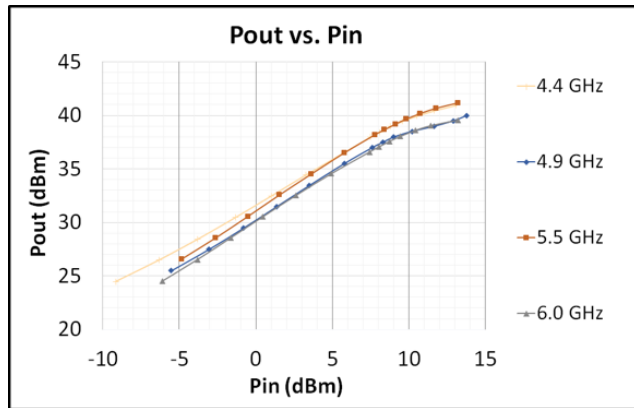
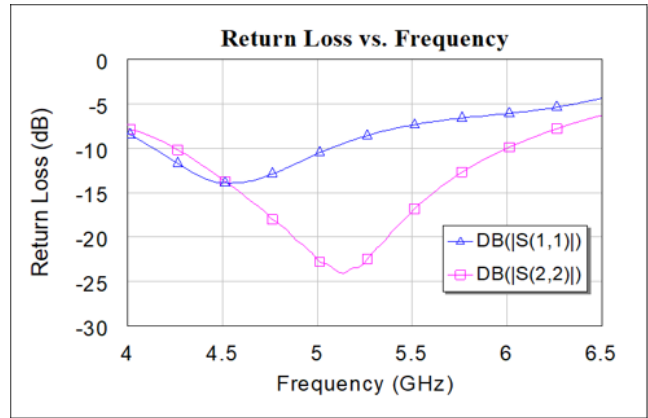
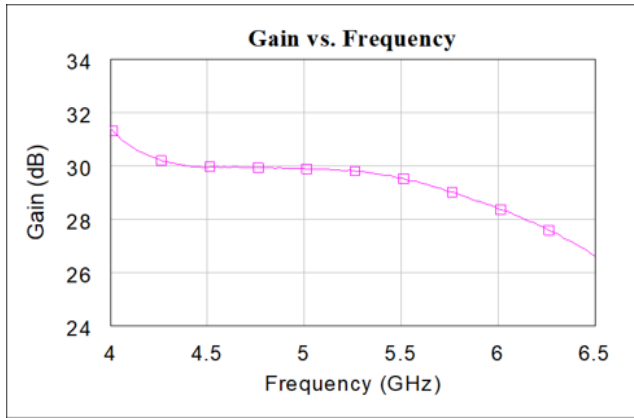
MMG-446040-S5

10 Watt, 4.4 – 6.0 GHz GaN Power Amplifier

Typical RF Performance

Test conditions unless otherwise noted:

$VDD1 = 15\text{ V}$, $VDD2 = 15\text{ V}$, $VDD3 = 28\text{ V}$, $IDQ1 = 15\text{ mA}$, $IDQ2 = 30\text{ mA}$, $IDQ3 = 58\text{ mA}$, $VG1 = -2.4\text{ V}$, $VG2 = -2.41\text{ V}$, $VG3 = -2.43\text{ V}$,
 $T_a = 25\text{ }^{\circ}\text{C}$, $Z_0 = 50\text{ }\Omega$, Pulse Width = 1 ms, Duty Cycle = 20 %



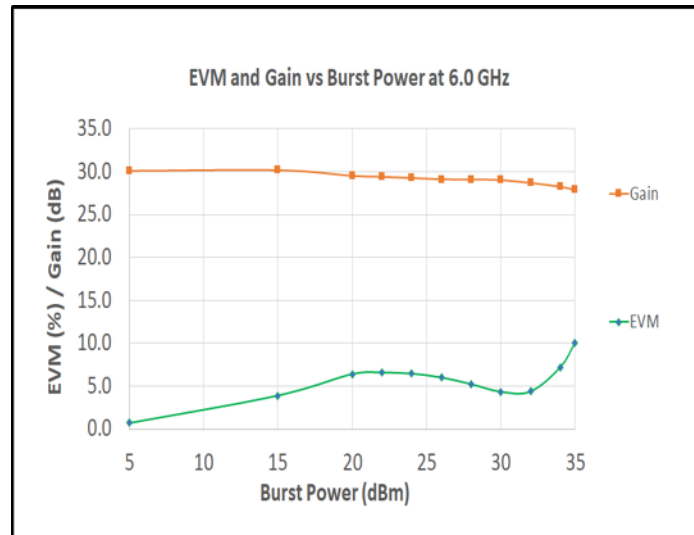
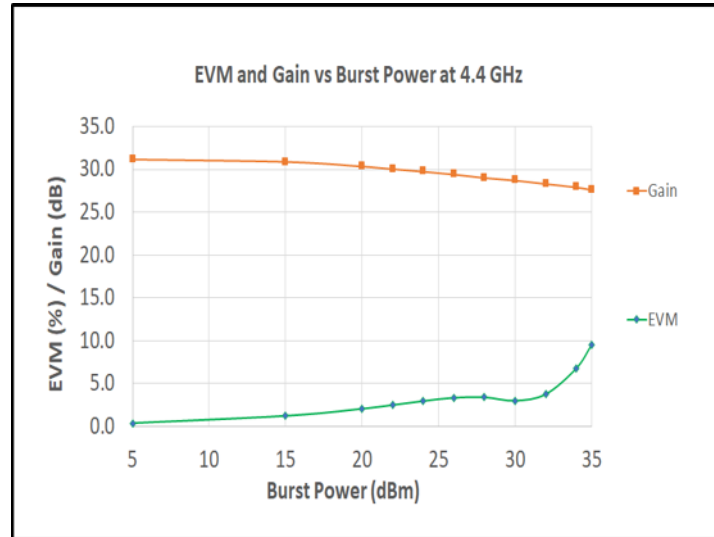
MMG-446040-S5

10 Watt, 4.4 – 6.0 GHz GaN Power Amplifier

Typical RF Performance

Test conditions unless otherwise noted:

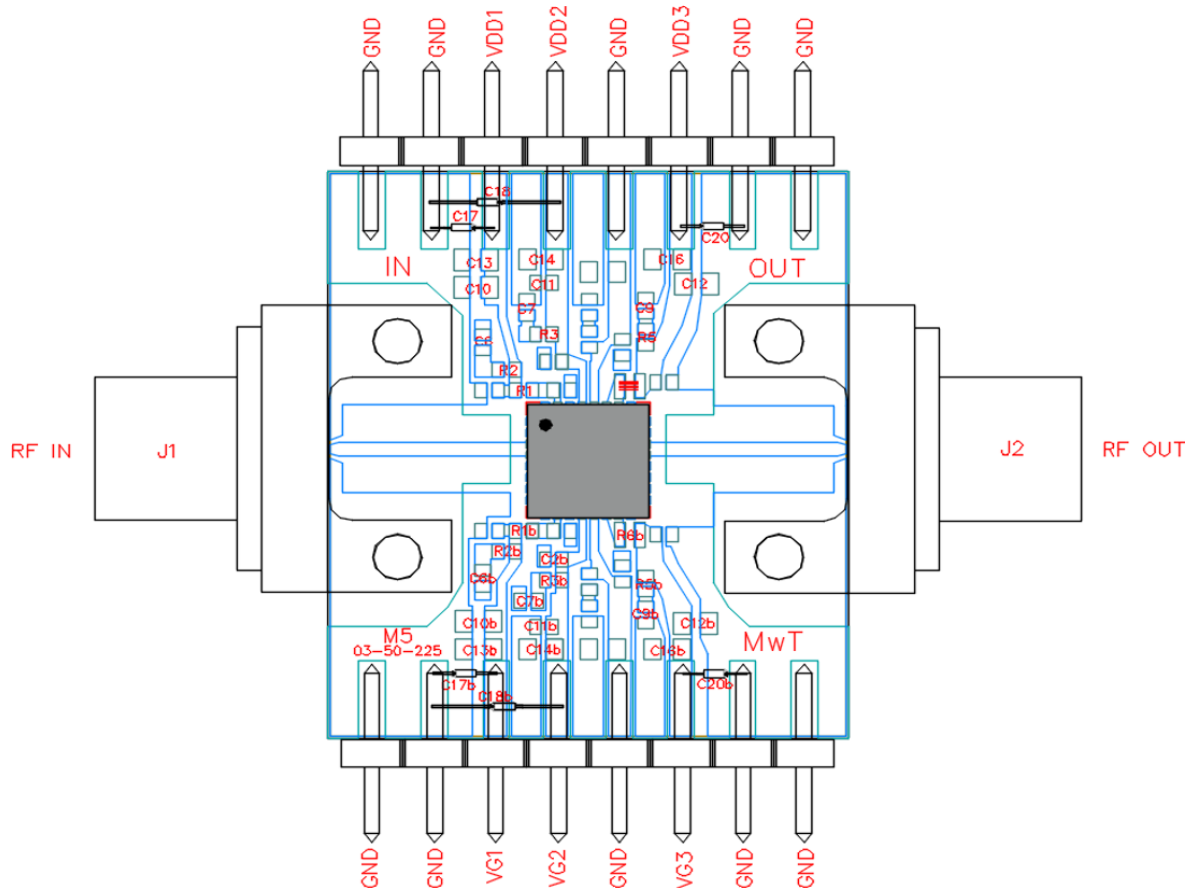
VDD1 = 15 V, VDD2 = 15 V, VDD3 = 28 V, IDQ1 = 15 mA, IDQ2 = 30 mA, IDQ3 = 58 mA, VG1 = -2.4 V,
VG2 = -2.41V, VG3 = -2.43V, Wi-Fi source: 802.11 64-QAM3/4



MMG-446040-S5

10 Watt, 4.4 – 6.0 GHz GaN Power Amplifier

Evaluation Board



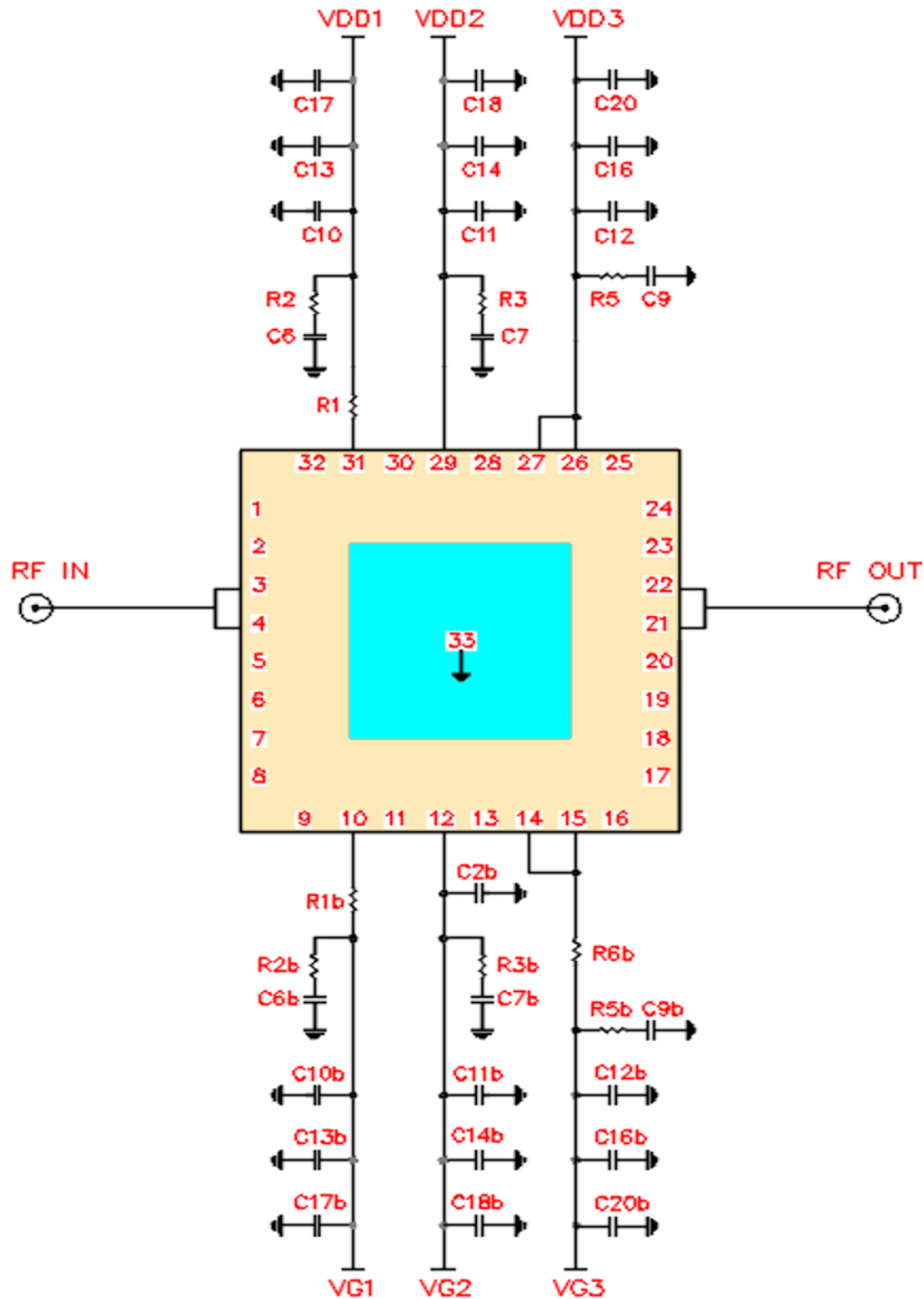
Bill of Materials

REFERENCE	VALUE	DESCRIPTION	MANUFACTURER	PART NUMBER
R1, R2, R3, R5,	10 Ω	RES, 5%, 0.2W, 0402	Various	
R1b, R2b, R3b, R5b, R6b	10 Ω	RES, 5%, 0.2W, 0402	Various	
C6, C7, C7b, C9, C9b	0.5 pF	CAP, 20%, 50V, C0H, 0402	Various	
C10, C11, C12, C10b, C11b, C12b	0.1 uF	CAP, 10%, 50V, X8L, 0402	Various	
C13, C14, C16, C13b, C14b, C16b	1 uF	CAP, 10%, 35V, X5R, 0603	Various	
C17, C18, C20, C17b, C18b, C20b	1 uF	CAP, 10%, 50V, TANT, AXIAL	Various	M39003/01-2356
C2b	100 pF	CAP, 5%, 50V, NPO, 0402	Various	
C6b	1000 pF	CAP, 10%, 50V, X7R, 0402	Various	
J1, J2 (Connector)		SMA Female End Launch	Southwest Microwave	292-06A-6
03-50-225 (PCB)		RO4350B, 0.254mm Thick	Various	

MMG-446040-S5

10 Watt, 4.4 – 6.0 GHz GaN Power Amplifier

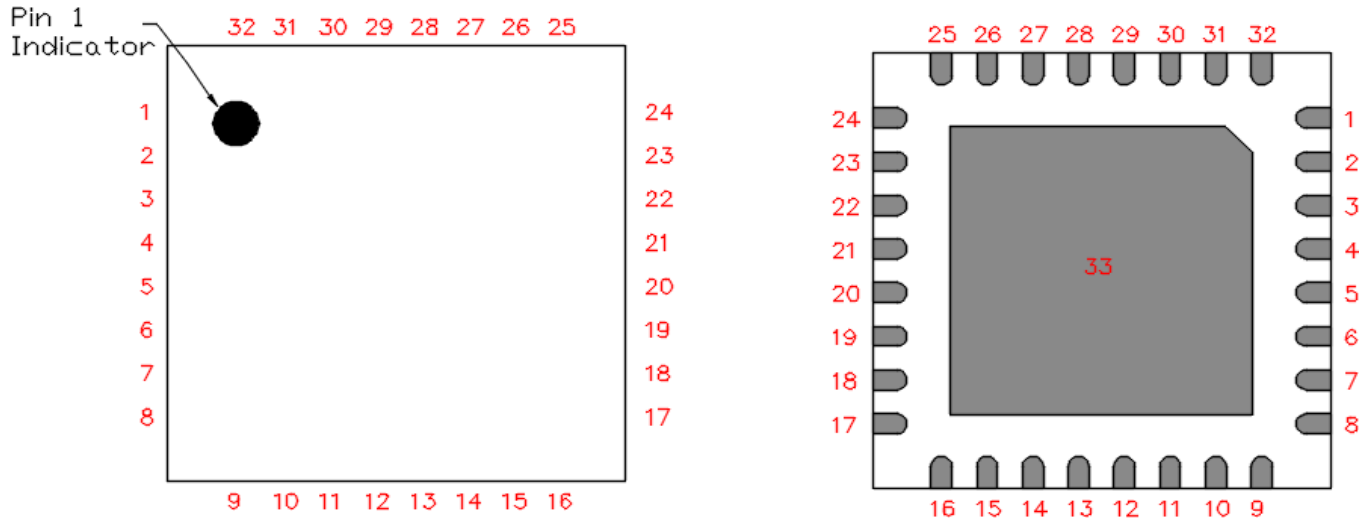
Schematic of Bias Circuit



MMG-446040-S5

10 Watt, 4.4 – 6.0 GHz GaN Power Amplifier

Pin Layout



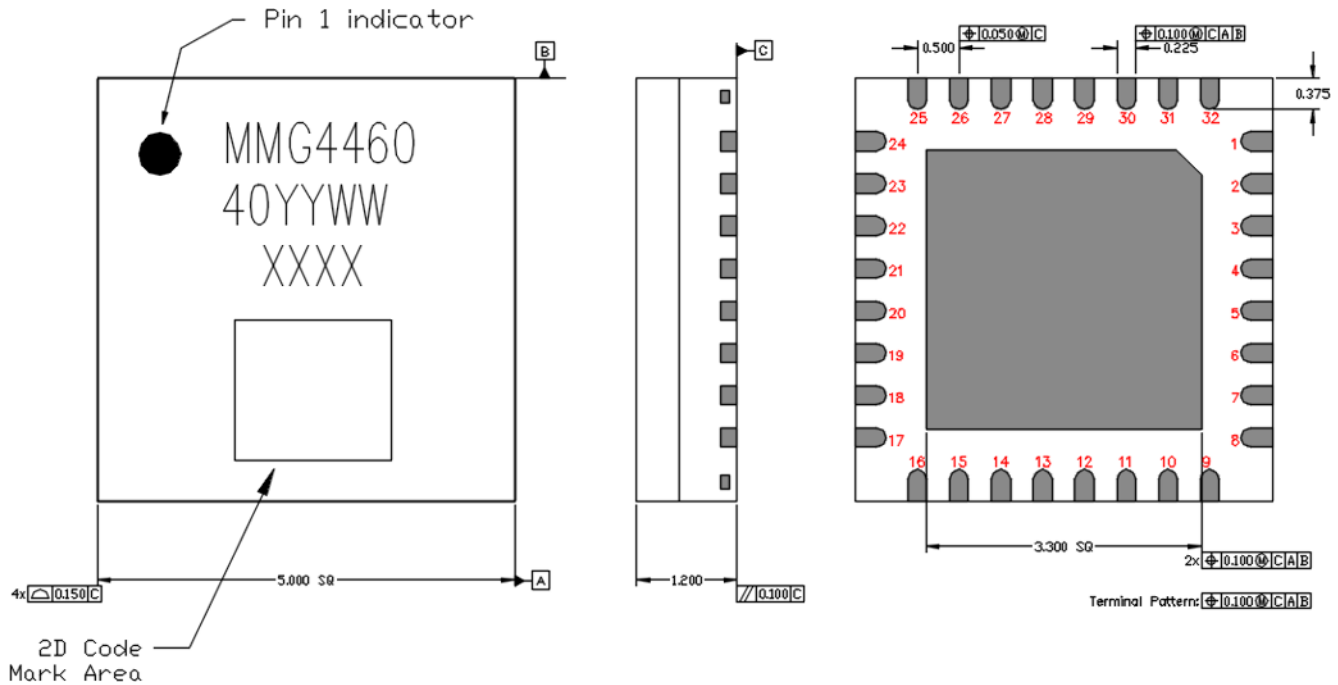
Pin Description

PIN NUMBER	SYMBOL	DESCRIPTION
1, 2, 5-9, 11, 13, 16-20, 23-25, 28, 30, 32	NC	No connection inside of package.
3, 4	RF IN	RF input, 50 Ohms, DC blocked
10	VG1	Gate voltage of 1st stage. Biasing circuitry required
12	VG2	Gate voltage of 2nd stage. Biasing circuitry required
14, 15	VG3	Gate voltage of 3rd stage. Biasing circuitry required
21, 22	RF OUT	RF output, 50 Ohms, DC blocked
26, 27	VDD3	Drain voltage of 3rd stage. Biasing circuitry required
29	VDD2	Drain voltage of 2nd stage. Biasing circuitry required
31	VDD1	Drain voltage of 1st stage. Biasing circuitry required
33	GND	Center ground

MMG-446040-S5

10 Watt, 4.4 – 6.0 GHz GaN Power Amplifier

Mechanical Information



Notes:

1. All dimensions are in millimeters
2. Markings:
 - Line 1: MMG4460
 - Line 2: 43YYWW: YY for the last two digits of the year
WW for the work week
 - Line 3: XXXX (Lot code)
 - Line 4: 2D code for XXXX (Lot code) from line 3
3. Plating of the Package:
 - Ni: 0.5µm. MIN.
 - Pd: 0.02µm. MIN.
 - Au: 0.05µm. MAX.

ROHS Compliance



CML Micro certifies, to the best of our knowledge, that its products comply with **RoHS directive (2011/65/EU)**, as amended by **Directive (EU) 2015/863**.

REACH Compliance



CML Micro certifies, to the best of our knowledge, that its products do not contain any of the banned substances specified in the SVHC list at <https://echa.europa.eu/candidate-list-table>. CML Micro are committed to ensuring the safety of products and the compliance with regulations. Publications will be updated in the event that REACH control is compromised.

Contact Information

For further information please contact your local CML sales representative.

Contact details can be found at www.cmlmicro.com

Important notice: The information provided in this document is believed to be accurate and reliable however, CML assumes no responsibility for any errors or omissions in this document. CML reserves the right to make changes to this document at any time without notice.

The product(s) referenced within this document are not designed, authorized, or warranted for use in life support, life-critical, surgical or nuclear applications, nor in any application where the failure of the product could create a situation where personal injury or death may occur. Customers using or selling the product for such applications do so entirely at their own risk and without any recourse to CML, financial or otherwise.

CML assumes no liability for applications assistance or the design of customers' products. Customers are solely responsible for the design, validation, and testing of customer products as well as compliance with all legal, regulatory, and safety-related requirements concerning their applications.

ALL SPECIFICATIONS AND DATA ARE PROVIDED "AS IS" AND WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. PRODUCTS ARE PROVIDED UNDER THE TERMS OF CML'S CONDITIONS OF SALE.

Nothing in this document or any purchase of CML products shall be construed as granting any license, whether express or implied, under any patent, copyright, trade secret, or other intellectual property right owned or controlled by CML.