



**GaN**

**MACOM™**  
*Partners from RF to Light*

## GaN RF Power Products

### Next generation high power RF semiconductor technology

MACOM continues to develop industry-leading gallium nitride (GaN) RF power products. Our product portfolio leverages MACOM’s more than 60-year heritage of providing best-in-class standard, application specific and custom solutions for our radar, EW, ISM, and communications customers.



As a member of the RF Energy Alliance, MACOM brings GaN technology into mainstream applications such as RF ignition systems, solid-state cooking, and high-lumen plasma lighting.

MACOM GaN products are offered as unmatched transistors, internally matched power transistors, and fully matched power pallets and modules. Using high performance GaN HEMT processes and leveraging our proprietary die layout and assembly techniques, these products exhibit robust thermal properties and excellent RF performance with respect to power, gain, gain-flatness, efficiency, and ruggedness for applications up to 6 GHz.

MACOM’s industry-leading portfolio of cost-effective RF power products uses our unique GaN on Silicon technology to deliver the cost, bandwidth, power density, and efficiency advantages of GaN in a variety of form factors— including 2 W to 600 W P1db CW power transistors in ceramic and overmolded plastic DFN and TO-272 packages, as well as HF through S-band modules and 50 Ω matched pallets. Our GaN on Silicon transistors and amplifiers improve upon the high power and efficiency performance of LDMOS while at the at the same time providing the high frequency performance of GaAs. Only MACOM delivers GaN performance at silicon cost structures to drive adoption.

### Why choose GaN?

GaN advantages include:

- > High breakdown voltage
- > Superior power density
- > High RF gain and efficiency
- > GaN performance at silicon cost structures
- > Multi-octave bandwidth
- > High frequency operation
- > Excellent thermal conductivity

For over 45 years, MACOM engineers have been redefining RF power and are now applying their GaN expertise to an array of commercial, industrial, scientific, medical and wireless applications.

Turn to MACOM for superior performance, high power GaN solutions.

	LDMOS	MACOM GaN on Silicon	Benefits
<b>Power Efficiency “&gt;2GHz”</b>	–	>10% Improvement	Lower Operating Costs, Simpler Cooling
<b>Power Density</b>	1-1.5 W/mm	4-6 W/mm	Smaller Footprint and Lower Costs
<b>Easy Matching</b>	difficult	easy	Time-to-Market and Smaller Footprint
<b>Supply Chain</b>	8"	6" and 8"	Capacity and Surge Capability
<b>Cost</b>	Silicon	Silicon	Competitive Bill of Materials
<b>Linearity</b>	DPD friendly	DPD friendly	Competitive Bill of Materials
<b>Support all ISM Brands</b>	Limited to 2.45 GHz	Can be used at >2.45 GHz	Broader Choice for Your Applications

## RF Energy

### MACOM GaN enables RF Energy applications with exceptional efficiency and gain

#### Features and Benefits

MACOM GaN delivers cost, bandwidth, power density, and efficiency advantages in an array of form factors:

- > Higher efficiency and reliability
- > Higher linearity
- > Increased precision and control
- > Excellent gain, low power, and lower cost structure
- > Power levels from 2–1000 W
- > Frequencies from 890 MHz to 2.45 GHz
- > Packages from QFN to TO-272 to ceramic

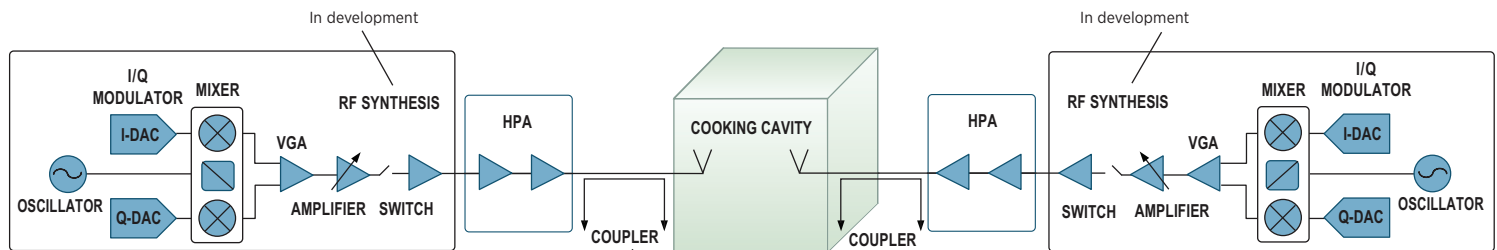
#### Description

Radio frequency (RF) energy applications use controlled electromagnetic radiation to heat items or to power all kinds of processes. Today, magnetron tubes commonly generate this energy. Tomorrow, it will be generated by an all solid-state semiconductor chain.

Solid-state RF energy offers numerous benefits unavailable via alternate solutions: low-voltage drive, semiconductor-type reliability, smaller form factor, and an “all-solid-state electronics” footprint. Perhaps its most compelling attributes are fast frequency, phase- and power-agility complemented by hyper-precision. Collectively, the technology’s attributes yield an unprecedented process control range, even energy distribution, and fast adaption to changing load conditions. Ideal for applications including: automotive ignition, industrial cooking, industrial drying, medical ablation, plasma street lighting.

#### Block Diagram

##### RF Energy Cooking System



##### High Power Amplifiers

- MAGe-100809-600\*
- MAGe-100809-1K0\*
- MAGe-100825-002\*
- MAGe-100825-005\*
- MAGe-100825-010\*
- MAGe-102425-015\*
- MAGe-102425-030\*
- MAGe-102425-050\*
- MAGe-102425-100\*
- MAGe-102425-300\*

\* In development

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- MAGe-102425-050\*
- MAGe-102425-100\*
- MAGe-102425-300\*

\* In development

## Basestation

### MACOM GaN transforms the network with ease of use and cost effectiveness

#### Features and Benefits

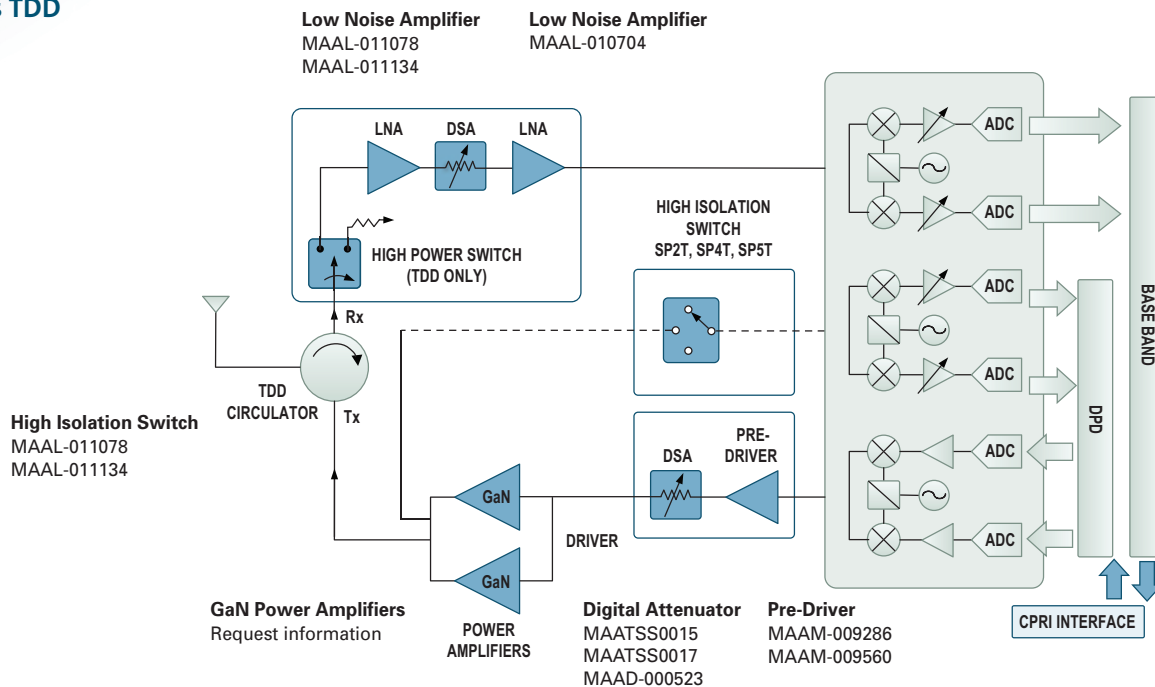
- > Optimized to meet the most demanding bandwidth, performance, and efficiency needs
- > Multi-band system: single radio supporting > 100 MHz of bandwidth
- > High frequency: enables 1.8 GHz to 6 GHz
- > Compact and lightweight: higher power density with smaller package, higher efficiency with smaller heat sink
- > Easy to linearize and correct with standard digital pre-distortion (DPD) systems
- > CapEx savings: smaller PCBs, lower heat sink cost, single GaN device replaces multiple LDMOS devices
- > OpEx Savings: high efficiency reduces utility bill
- > Massive MIMO pre-5G sets new standard for integration with high efficiency and high power density
- > Faster time to market: simpler devices lead to shorter development times, broadband means fewer PAs to deal with when covering all bands, excellent applications support

#### Description

MACOM's new **MAGb** series is the industry's first commercial basestation-optimized family of GaN transistors to achieve leadership efficiency, bandwidth and power gain with the linearity and cost structure like LDMOS, with a path to better than LDMOS cost. Leveraging MACOM's Gen4 GaN technology, this new series enables wireless carriers to deploy the latest LTE releases and significantly reduce operating expenses at highly competitive price points, with robust and scalable CMOS-like supply chain combined with MACOM's best in class applications and design support team with decades of experience.

#### Block Diagram

##### Wireless Access TDD



## ISM, Communications & Instrumentation

MACOM—the first choice for GaN in communications, multi-market and ISM applications

### Features and Benefits

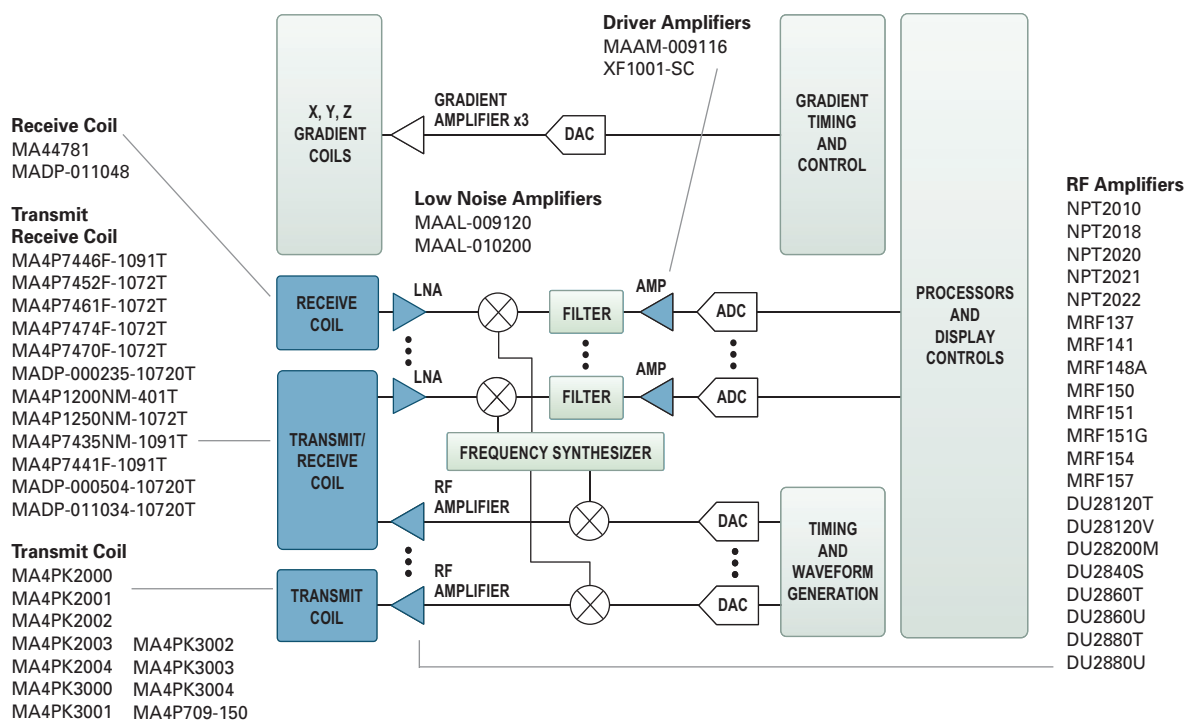
- > Broadband, unmatched transistors can be used for a variety of applications including communications, instrumentation and industrial, scientific and medical (ISM)
- > Very rugged: allows GaN transistors to withstand high VSWR mismatches during power on/start up and during operation without damaging the transistor
- > High voltage: reduces bias current load on power supply allowing for reduced cost power supplies
- > Excellent thermal performance: allows reduced heat sink costs for easier PCB designs
- > High RF gain and efficiency
- > MTTF of 100 year+ (channel temperature < 200°C)
- > Non-magnetic parts available
- > EAR99 export classification

### Description

As gallium nitride grows from its initial role in military and radar applications to expand into commercial markets, MACOM is uniquely positioned to enable those demanding applications. Leveraging our GaN experience and supply chain, MACOM satisfies many of the commercial requirements that have limited GaN penetration in broader markets. Packaging choices range from ceramic flanged and earless, to discrete plastic, including plastic laminate modules that enable traditional SMT PCB production techniques. The portfolio of 5-300 W devices allows customers a wide set of options to build line-ups for their ISM applications.

### Block Diagram

#### MRI



## MILCOM

MACOM's GaN solutions offer customers the flexibility in designing systems to fit their unique requirements

### Features and Benefits

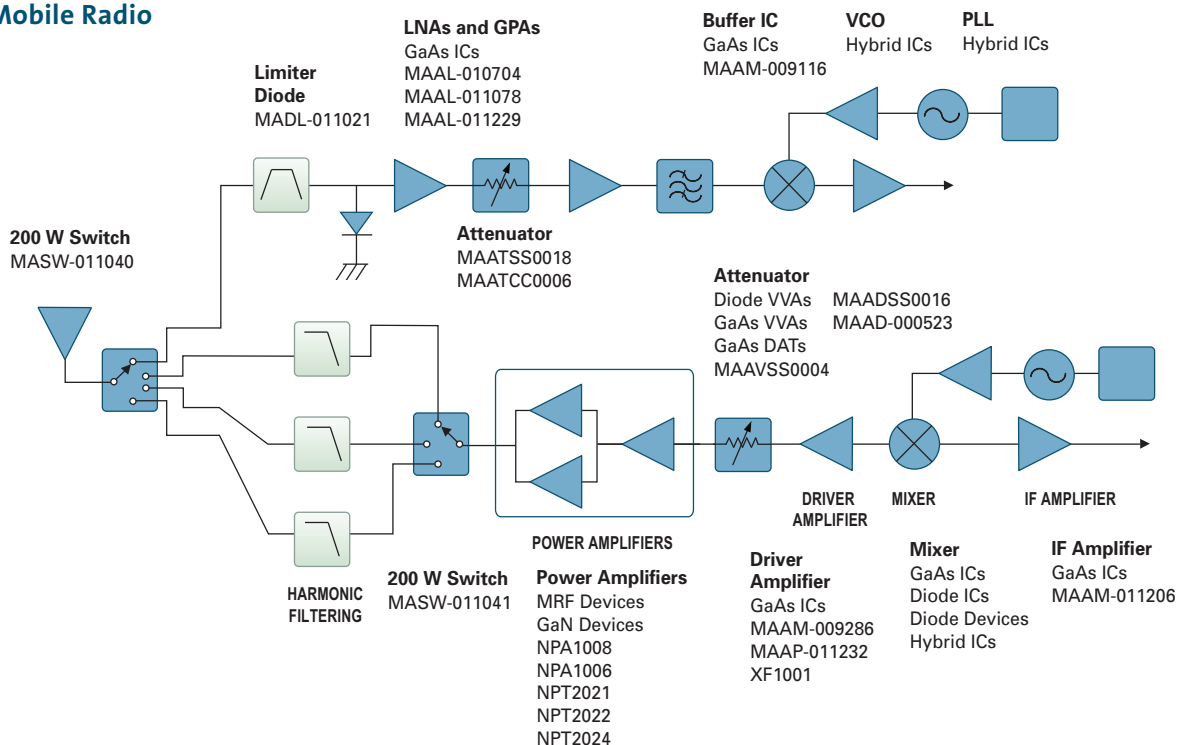
- > MACOM's rich heritage in supporting MILCOM radios for the last 50-60 years is still going strong
- > Extensive portfolio of RF Power Products enable the right system choices
- > Proven track record of high quality and reliability
- > Wideband products enable new multifunction system capability requiring complex waveforms and efficient, economical designs
- > Small size, easy to match products enable fast time-to-market
- > High gain and 50 V operation provide efficient operation and significantly reduce size of matching networks
- > MACOM GaN is mature technology, inexpensive, leverages readily available Si process services, and delivers consistent quality
- > Proven track record in non-obsolescence of the legacy Power MOSFET for the last 30-40 years, helping customers to support the A&D market

### Description

MACOM's GaN portfolio of plastic power transistors afford MILCOM system designers the most cost effective solutions across a growing range of frequency bands while not compromising performance. Supporting voltage operation at 50 V with high gain to reduce input power requirements, the transistors maximize power and cooling efficiency and provide robust performance. Engineered using leading edge power transistor packaging techniques and innovative semiconductor designs, MACOM's high power transistor products provide optimal operation for CW and pulsed applications.

### Block Diagram

#### Land Mobile Radio



**Multipurpose / RF Power Transistors GaN on Si: CW and Pulsed**

Part Number	Min Freq (MHz)	Max Freq (MHz)	Operating Voltage (V)	Output Power Psat (W)	Gain (dB)	Efficiency (%)	Test Freq (MHz)	Package
NPA1006	20	1000	28	12.5	14	>45	900	6 x 5 mm DFN-8
NPT2022	1	2000	50	100	20	>60	900	TO-272
NPT2021	1	2500	50	4	17	>55	2500	TO-272
NPA1007	30	2500	28	10	14	>50	2000	6 x 5 mm DFN-8
NPA1008	20	2700	28	5	12	>45	1900	4 x 4 mm PQFN-24
NPT2024	1	2700	50	200	22	65	900	TO-272-4
NPT1012B	1	4000	28	25	13	>50	3000	AC360B-2
NPTB00025AB	1	4000	28	25	13	>50	3000	AC360B-2
NPTB00025B	1	4000	28	25	13	>50	3000	AC360B-2
MAGx-011086	1	6000	28	4	9	>50	5800	4 x 4 mm QFN-24
NPT2018	1	6000	50	12.5	17.5	>50	2500	6 x 3 mm PDFN-14
NPTB00004A	1	6000	28	5	17	>50	2500	SOIC-8NE
NPTB00004D	1	6000	28	5	17	>50	2500	SOIC-8NE
MAGx-100027-050*	1	2700	50	50	17	65	2700	TO-272S-2
MAGx-100027-100*	1	2700	50	100	17	65	2700	TO-272S-2
MAGx-100027-300*	1	2700	50	300	16	63	2700	TO-272S-4

\*In development

**RF Energy / RF Power Transistors GaN on Si: CW**

Part Number	Min Freq (MHz)	Max Freq (MHz)	Operating Voltage (V)	Output Power Psat (W)	Gain (dB)	Efficiency (%)	Test Freq (MHz)	Package
MAGe-100809-600*	896	928	50	600	21	73	915	P-282
MAGe-100809-1K0*	896	928	50	1000	20	72	915	P-283
MAGe-100825-002*	896	2500	50	2	19.5	73	2450	6 x 3 mm DFN-14
MAGe-100825-005*	896	2500	50	5	19.5	73	2450	6 x 3 mm DFN-14
MAGe-100825-010*	896	2500	50	10	19.5	73	2450	7 x 7 mm PQFN-20
MAGe-102425-015*	2400	2500	50	15	18.5	73	2450	7 x 7 mm PQFN-20
MAGe-102425-030*	2400	2500	50	30	18.5	73	2450	7 x 7 mm PQFN-20
MAGe-102425-050*	2400	2500	50	50	17.5	72	2450	TO-272S-2
MAGe-102425-100*	2400	2500	50	100	17.5	72	2450	TO-272S-2
MAGe-102425-300*	2400	2500	50	300	16.5	70	2450	TO-272S-4

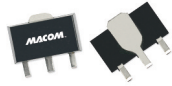
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**GaN and GaAs Device Bias Sequencer**

Part Number	Positive Supply Voltage (V)	Positive Supply Current (mA)	Negative Supply Voltage (V)	Negative Supply Current (mA)	Output Gate Voltage (V)	Output Gate Current (mA)	Pulse Enable TTL Voltage (V)	Package
MABC-001000-DP000L	50	14	-6	-3	-8 to 0	50	3.3	SMJ2307
MABC-001000-DPS00L	50	14	-6	-3	-8 to 0	50	3.3	SMJ2307

## Package Type: Plastic Packages

SOT89-3LD



SOIC-EP



3 x 6 mm PDFN-14LD



4 mm PQFN-24LD



5 x 6 mm PDFN-8LD



7 mm PQFN-20LD



TO-272-2



TO-272-4



TO-272S-2



TO-272S-2B



TO-272S-4



## Package Type: Ceramic Air Cavity

AC-200B-2



AC-200S-2



AC-360B-2



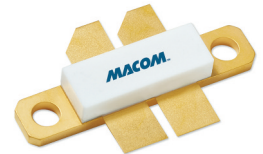
AC-360S-2



AC-400S-2



AC-650B-4



AC-780B-2



AC-780S-2



AC-780B-4



AC-780S-4



AC-1230B-4



AC-1230S-4







Additional product information can be found on our website at:

**[www.macom.com](http://www.macom.com)**

Contact our worldwide sales offices, authorized representatives, and industry-leading distributors to request samples, test boards, and application support.

All contacts are listed on our website at:

**[www.macom.com/purchases](http://www.macom.com/purchases)**

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