

**MACOM**<sup>TM</sup>

*Partners from RF to Light*



## RF High Power GaN Portfolio



## GaN RF Power Products

### Next generation high power 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 and communications customers.

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 3.5 GHz.

MACOM's high power GaN in space-saving plastic is setting the standard for applications where SMT manufacturing, small size and light weight are required. 3 x 6 mm DFN packaged transistors are available in 10, 15, 50, and 90 W power levels. These DFN transistors are also offered in fully matched, high gain, power modules which provide highly integrated, compact solutions.

### Why choose GaN?

MACOM GaN RF transistors improve upon the high power handling and voltage operation of LDMOS with the high frequency performance of GaAs. Improved efficiency, power, density and bandwidth give your applications enhanced performance in a smaller footprint.

GaN advantages include:

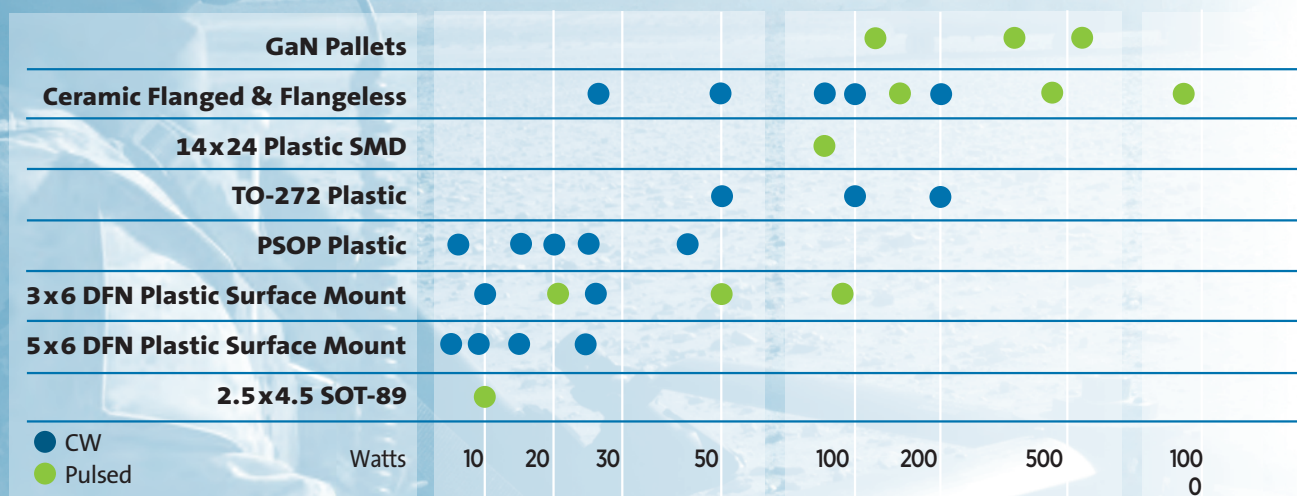
- High breakdown voltage
- Superior power density
- High RF gain and efficiency
- Superior broadband capability
- High frequency operation
- Excellent thermal conductivity

Leveraging deep experience in RF, MACOM engineers are expanding our power transistor family to fuel the future of military and commercial radars. These rugged devices deliver greater flexibility and multi-function capability in your radar communications.

Our growing GaN portfolio includes 5 W-90 W transistors in SOT-89 or DFN plastic packaging, 1000 W ceramic packages and L-, S-band fully matched modules.

Turn to MACOM today and in the future for superior performance, high power GaN solutions.

Learn more at [www.macom.com](http://www.macom.com)





## Radar

### GaN in plastic surface mount modules enable SWAP improvements and speed time-to-market for next generation AESA radar systems

#### Features and Benefits

- Fully matched over wide bandwidths enables new multifunction system capability with broad frequency operation and complex waveforms
- Small size, SMT enables system SWAP and faster time-to-market through standard surface mount assembly
- High gain and 50 V operation significantly reduces the size of energy storage capacitors and current draw
- Engineered for SMT assembly with low thermals and low pulse droop

#### Description

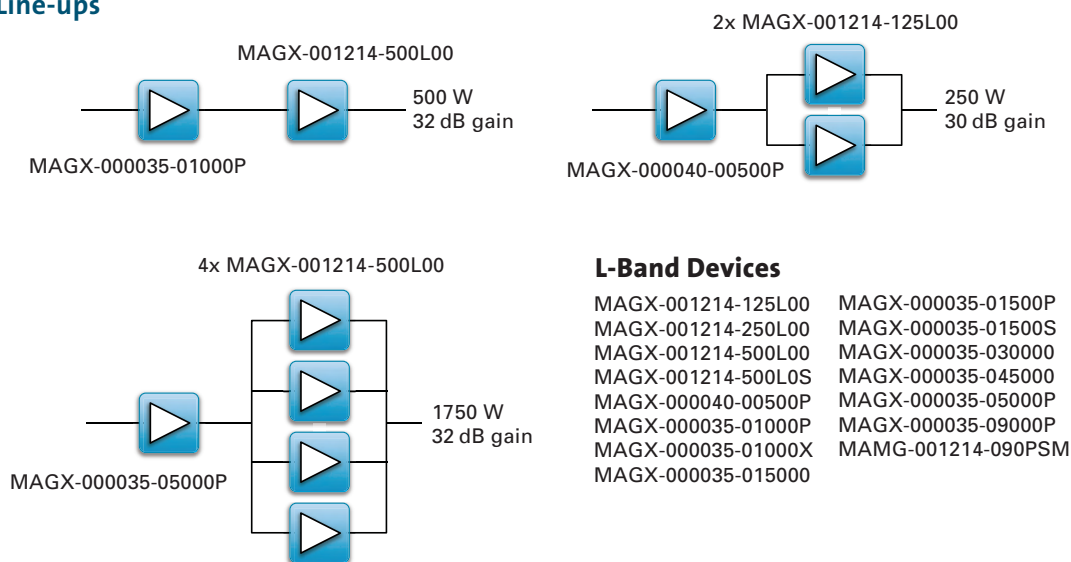
MACOM's portfolio of surface mount, GaN in plastic power modules affords radar system designers a common platform and pin-out architecture to leverage across a growing range of frequency bands. These fully matched, 2-stage GaN power modules deliver 90 W typical output power in a lightweight, 14 x 24 mm package, and deliver breakthrough power performance.

Optimized for commercial air traffic control and military radar applications, the new SMT laminate packaged modules deliver GaN power performance while enabling significant application and manufacturing efficiencies. Supporting standard surface mount assembly, the module leverages commercial best practices for high-volume manufacturing, ensuring additional benefits including improved assembly yield, lower component count, and reduced touch labor. The 2-stage module is internally matched to 50 ohms, which requires no external matching components, and allows reduction in overall part count, further streamlining assembly processes.

Supporting voltage operation from 28 to 50 V with high gain to reduce input power requirements, the module maximizes power and cooling efficiency and provides robust performance over a wide range of input voltages. Flexible voltage operation equips system operators to optimize the module for different power requirements and dynamically manage their total system power budget.

#### Block Diagrams

##### 1.2 - 1.4 GHz Line-ups



## Avionics and Air Traffic Control

MACOM's high power GaN is leading the future of next generation power in Avionics systems.

### Features and Benefits

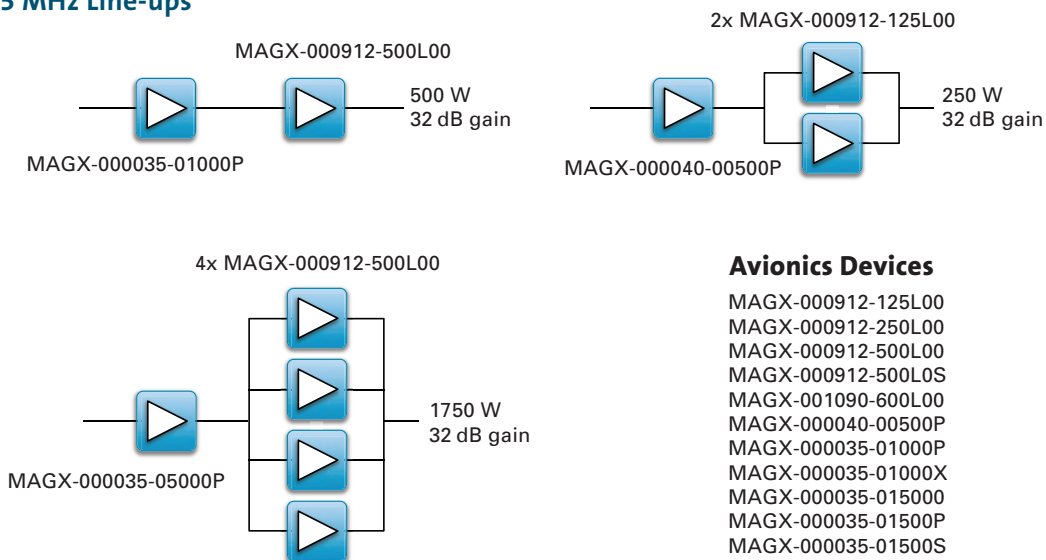
- High *power* allows customer to upgrade systems for increased range and performance
- High *efficiency* reduces the power consumption and cooling requirements of systems
- Increased *ruggedness* provides greater tolerance under demanding operating conditions and improves the reliability of the system
- High *voltage* operation enhances the system performance and reduces the bias current load of power supplies and distribution network

### Description

MACOM's high power GaN power transistors optimized for avionics applications offer customers greater performance, flexibility and functionality through the benefits of GaN on SiC technology. A growing family of leading power GaN transistors offer high pulsed power operation of up to 600 W for Avionics applications in the 960-1215 MHz and 1030-1090 MHz bands. The GaN technology offers the customer higher power and efficiency operation in a similar size and footprint compared to LDMOS or Si Bipolar technologies. Furthermore, the inherent higher thermal performance and higher breakdown voltage of GaN benefit the customer with great flexibility in wider-band operation, increased power handling leading to longer pulse lengths and duty cycles and increased ruggedness under load mismatch conditions.

### Block Diagrams

#### 960-1215 MHz Line-ups



#### Avionics Devices

MAGX-000912-125L00  
MAGX-000912-250L00  
MAGX-000912-500L00  
MAGX-000912-500L0S  
MAGX-001090-600L00  
MAGX-000040-00500P  
MAGX-000035-01000P  
MAGX-000035-01000X  
MAGX-000035-015000  
MAGX-000035-01500P  
MAGX-000035-01500S  
MAGX-000035-030000  
MAGX-000035-045000  
MAGX-000035-05000P  
MAGX-000035-09000P



## ISM / Multi-Market

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

## Features and Benefits

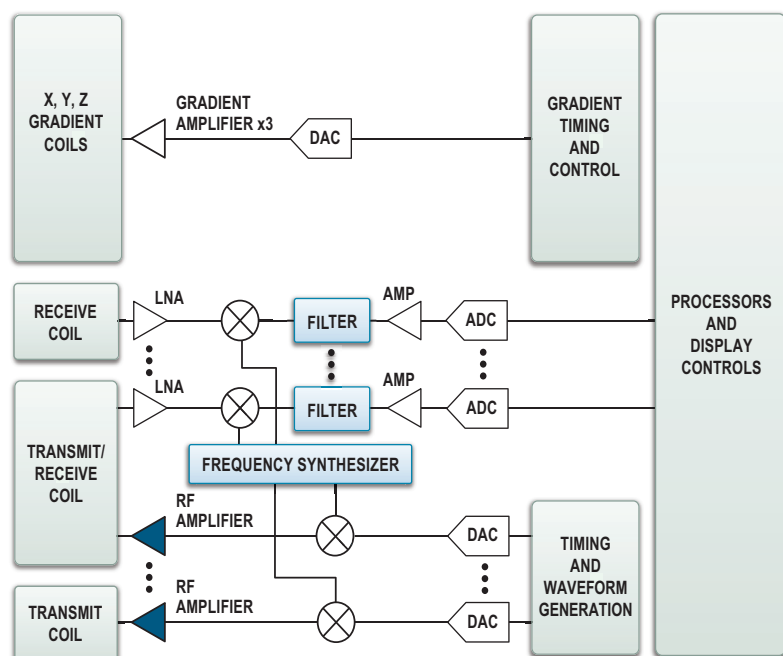
- Broadband, unmatched transistors can be used for a variety of applications including communications, instrumentation and industrial, scientific and medical (ISM)
- Very rugged—allows GaN transistors to withstand high VSWR mismatches during power on/start up and during operation without damaging the 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 600 years (channel temperature < 200°C)
- EAR99 export classification

## Description

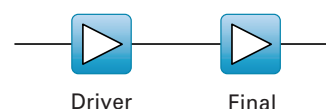
As Gallium Nitride moves from its initial uses in Military and Radar applications to broader classes of products, MACOM is uniquely positioned to enable those markets. With more than a decade of GaN experience and the industry's only dual source wafer fabrication agreement in place for GaN, MACOM satisfies many of the commercial requirements that have limited GaN penetration in broader markets. Packaging choices from ceramic flanged and flangeless to discrete plastic, including plastic laminate modules that enable traditional SMT PCB production techniques. The portfolio of 10, 14, 25, 30, 50, 100 W CW devices allows customers a wide set of options to build line ups for their ISM applications.

## Block Diagrams

## MRI



## Small Cell



Pout	Driver	Final
1-5 W	MMIC	MAGX-000035-01000X
10-20 W	MAGX-000040-00500P	MAGX-000035-030000
10-20 W	MAGX-000035-01000X	MAGX-000035-030000

## ISM Devices

MAGX-000025-150000  
MAGX-000035-01000X  
MAGX-000035-015000  
MAGX-000035-01500S  
MAGX-000035-030000  
MAGX-000035-045000  
MAGX-000040-00500P  
MAGX-000245-014000  
MAGX-000245-025000

## GaN on SiC RF Power Transistors: Pulsed

Part Number	Min Freq (MHz)	Max Freq (MHz)	Operating Voltage (V)	Output Power (W)	Min. Gain (dB)	Pulse Width (µs)	Duty Cycle (%)	Test Freq (MHz)	Package Size (mm)
MATR-GCHJ04-022050	1	4000	50	15	15	3000	10	1200-1400	Die (0.75 x 0.90 x 0.10)
MATR-GCHJ04-066050	1	4000	50	50 60	11.3 18	1000	10	2700 - 3500 1030 - 1090	Die (0.75 x 1.70 x 0.10)
MAGX-000025-150000	1	2500	50	150	18	300	20	1200-1400	29.0 x 17.8 x 4.8
MAGX-000040-00500P	1	4000	50	5	13 11	1000 3000	10 20	1600	4.5 x 4.0 x 1.5
MAGX-000035-01000P	1	3500	50	10	14.8 14	1000 3000	10 20	1600	6.0 x 3.0 x 0.9
MAGX-000035-01500P	1	3500	50	15	19.5 14.2	1000 3000	10 20	1600 2600	6.0 x 3.0 x 0.9
MAGX-000035-05000P	1	3500	50	50	18 17	1000 3000	10	1600	6.0 x 3.0 x 0.9
MAGX-000035-09000P	1	3500	50	90	17.5 16.6	1000 3000	10	1600 1300	6.0 x 3.0 x 0.9
MAGX-000035-015000	1	3500	50	15	15.5 15	1000 3000	10 20	1200 - 1400	14.0 x 8.1 x 3.3
MAGX-000035-01500S	1	3500	50	15	15.5 15	1000 3000	10 20	1200 - 1400	5.6 x 8.1 x 2.4
MAGX-000035-045000	1	3500	50	50 60	11.3 18	1000	10	2700 - 3500 1030 - 1090	20.3 x 10.9 x 4.0
MAGX-000912-125L00	960	1215	50	125	20	128	10		20.3 x 15.0 x 4.1
MAGX-000912-250L00	960	1215	50	250	19	128	10		20.3 x 15.0 x 4.1
MAGX-000912-500L00	960	1215	50	500	19.8	128	10		34.0 x 19.4 x 3.7
MAGX-000912-500LOS	960	1215	50	500	19.8	128	10		20.6 x 19.4 x 3.7
MAGX-001090-600L00	1030	1090	50	600	21.4	32	2		34.0 x 19.4 x 3.7
MAGX-001090-600LOS	1030	1090	50	600	21.4	32	2		20.6 x 19.4 x 3.7
MAGX-001214-125L00	1200	1400	50	125	19	300	10		20.3 x 15.0 x 4.1
MAGX-001214-250L00	1200	1400	50	250	19	300	10		20.3 x 15.0 x 4.1
MAGX-001214-500L00	1200	1400	50	500	19.2	300	10		34.0 x 19.4 x 3.7
MAGX-001214-500LOS	1200	1400	50	500	19.2	300	10		20.6 x 19.4 x 3.7
MAGX-001214-650L00	1200	1400	50	650	19	300	10		20.6 x 19.4 x 3.7
MAGX-001220-100L00	1200	2000	50	100	14	300	10		20.3 x 10.9 x 4.0
MAGX-002731-100L00	2700	3100	50	100	12	500	10		20.3 x 10.9 x 4.0
MAGX-002731-180L00	2700	3100	50	180	11	300	10		20.3 x 10.9 x 4.0
MAGX-002731-180LOS	2700	3100	50	180	11	300	10		9.7 x 10.9 x 3.5
MAGX-003135-120L00	3100	3500	50	120	11.8	300	10		20.3 x 10.9 x 4.0

## GaN on SiC RF Power Transistors: CW

Part Number	Min Freq (MHz)	Max Freq (MHz)	Operating Voltage (V)	Output Power (W)	Min. Gain (dB)	Test Freq (MHz)	Package Size (mm)
MATR-GCHJ04-022050	1	2450	50	14	15.2	2450	Die (0.75 x 0.90 x 0.10)
MATR-GCHJ04-066050	1	2450	28	25	12	2450	Die (0.75 x 1.70 x 0.10)
MAGX-000245-014000	1	2450	50	14	15.2	2450	14.0 x 8.1 x 3.3
MAGX-000245-025000	1	2450	28	25	12	2450	20.3 x 10.9 x 4.0
MAGX-000035-01000P	1	3500	50	10	14.5	1650	6.0 x 3.0 x 0.9
MAGX-000035-010000	1	3500	50	10	19	1300	14.0 x 8.1 x 3.3
MAGX-000035-01000S	1	3500	50	10	19	1300	5.6 x 8.1 x 2.4
MAGX-000040-00500P	1	4000	50	4	10	2700	4.5 x 4.0 x 1.5

Note: Part numbers are RoHS compliant ♦ indicates non-RoHS compliant

Detailed specifications can be found quickly on our website at [macom.com](http://macom.com) by typing the part number into the search box.

All specifications are subject to change.

## GaN on SiC Modules and Pallets

Part Number	Min Freq (MHz)	Max Freq (MHz)	Operating Voltage (V)	Output Power (W)	Min. Gain (dB)	Pulse Width (μs)	Duty Cycle (%)	Package Size (mm)
MAMG-000912-090PSM	960	1215	50	90	30	300	10	24.0 x 14.0 x 3.2
MAMG-001214-090PSM	1200	1400	45	90	30.5	1000	10	24.0 x 14.0 x 3.2
MAMG-002735-085PSM	2700	3500	50	85	23 23	1000 750	10 20	24.0 x 14.0 x 3.2
MAMG-002735-030PSM	2700	3500	50	30	25.5 20	1000 750	10 20	7.0 x 7.0 x 1.4
MAPG-002729-350L00	2700	2900	50	350	11.5	300	10	50.8 x 22.9 x 5.8

## GaN Bias Modules

Part Number	Positive Supply V <sub>DS1</sub> (V)	Positive Supply V <sub>DS2</sub> (V)	Negative Supply V <sub>GS</sub> (V)	Pulse Enable TTL (V)	Positive Supply I <sub>DS1</sub> (mA)	Positive Supply I <sub>DS2</sub> (mA)	Negative Supply I <sub>GS</sub> (mA)	Peak Output Gate I <sub>GC</sub> (mA)	Open Drain ON/OFF Prop Delay (ns)	Package Size (mm)
MABC-001000-000DPM	10 to 60	N/A	-8 to 0	0/3.3	2.3	N/A	-3	50	100/70	22.5 x 6.5 x 5.0
MABC-001000-00SDPM	10 to 60	4.4 to 5.6	-8 to 0	0/3.3	0	2.2	-3	50	100/70	22.5 x 6.5 x 5.0

## GaN on Si RF Power Transistors: CW

Part Number	Min Freq (MHz)	Max Freq (MHz)	Operating Voltage (V)	Test Freq (MHz)	Output Power P <sub>SAT</sub> (W)	Small Signal Gain (dB)	R <sub>TH</sub> (°C/W)	Package
NPA1006	30	1000	28	500	15	15	4.6	6 x 5 mm DFN-8
NPT1007	0	1200	28	900	200	18	1.0	AC780B-4
NPA1003	20	1500	28	1000	5	18	12	4 x 4 mm QFN-16
NPT1010B	0	2000	28	900	100	20	1.4	AC360B-2
NPT2010	0	2200	48	2100	100	17	1.7	AC360B-2
NPT2022	0	2200	48	900	100	19	1.3	TO272-2
NPT2021	0	2500	48	2100	50	17	1.9	TO272-2
NPA1007	30	2500	28	2000	10	11	7	6 x 5 mm DFN-8
NPA1008	30	2700	28	2500	5	13	17	4 x 4 mm QFN-24
NPT25100B	0	2700	28	2500	90	16	1.8	AC780B-2
NPT1015B	0	3500	28	2500	45	14	2.1	AC360B-2
NPT2020	0	3500	48	2100	50	17	2.3	AC360B-2
NPT35050AB	3300	3800	28	3500	50	13	2.0	AC780B-2
NPT1012B	0	4000	28	3000	25	13	4.0	AC200B-2
NPTB00025B	0	4000	28	3000	25	13	5.3	AC200B-2
16NPTB00004D	0	6000	28	2500	5	17	23.0	SOIC-8
NPTB00004A	0	6000	28	2500	5	17	15.0	SOIC-8
MAGX-011086	0	6000	28	2500	5	17	17.0	4 x 4 mm QFN-24
NPT2018	0	6000	48	2500	12.5	17.5	6.5	3 x 6 mm DFN-14

## GaN on Si RF Power Transistors: Linear

Part Number	Min Freq (MHz)	Max Freq (MHz)	Operating Voltage (V)	Test Freq (MHz)	Output Power P <sub>SAT</sub> (W)	Small Signal Gain (dB)	R <sub>TH</sub> (°C/W)	Package
NPT25015D	0	3000	28	2500	23*	14	6.3	SOIC-8
NPT1004D	0	3000	28	2500	45*	13	4.3	SOIC-8
NPT35015D	3000	4000	28	3500	18*	11	6.3	SOIC-8
NPT2019	0	6000	48	2500	25*	16	3.8	3 x 6 mm DFN-14

\*Typical peak power in linear or pulse applications

# GaN Package Guide



Package by Part Number	Approximate Dimensions (mm)	
MAGX-000040-00500P	4.5 x 4.0 x 1.5	
MAGX-000035-01000P	6.0 x 3.0 x 0.9	
MAGX-000035-01500P		
MAGX-000035-05000P		
MAGX-000035-09000P		
MAMG-001214-090PSM	24.0 x 14.0 x 3.2	
MAMG-000912-090PSM		
MAMG-002735-085PSM		
MAGX-000035-01000S	24.0 x 14.0 x 3.2	
MAGX-000035-01500S		
MAGX-000035-010000	13.97 x 8.12 x 3.25	
MAGX-000245-014000		
MAGX-000035-015000		
MAGX-000035-045000	20.32 x 10.92 x 3.99	
MAGX-000245-025000		
MAGX-000245-050000		
MAGX-000245-100000		
MAGX-002731-180L00		
MAGX-000025-150000	28.96 x 17.78 x 4.78	
MAGX-000912-125L00	20.32 x 14.96 x 4.11	
MAGX-000912-250L00		
MAGX-001214-125L00		
MAGX-001214-250L00		
MAGX-001214-500L0S	20.57 x 19.44 x 3.74	
MAGX-000912-500L0S		
MAGX-001090-600L0S		
MAGX-001214-500L00	34.04 x 19.44 x 3.74	
MAGX-000912-500L00		
MAGX-001090-600L00		
MAGX-001090-1KW000	41.15 x 16.62 x 5.13	
MAGX-000245-014000		
MAGX-000035-015000		

Package Type	Approximate Dimensions (mm)	
QFN4x4-24	4.0 x 4.0 x 0.9	
SOIC-8NE	4.9 x 6.1 x 1.47	
DFN3x6-14	6.0 x 3.0 x 1.0	
TO272-2	23.62 x 11.18 x 2.59	
AC200B-2	13.97 x 8.13 x 3.1	
AC360B-2	20.32 x 10.92 x 3.86	
AC360P-2	9.65 x 10.92 x 3.86	
AC780P-2	20.57 x 19.43 x 3.6	
AC780B-2	34.04 x 19.43 x 3.6	
AC780B-4	34.04 x 19.43 x 3.6	





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