



Delivering Dependable Performance... A Spectrum of **Radar Solutions**

Integrated Modules and Discrete Components

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Integrated Modules and Discrete Components for Radar Applications

Radar applications require a diverse suite of RF components that support a broad range of architectures. Ground or airborne radar systems that are detecting, transmitting and managing power need robust, reliable and clean RF power. Diverse applications, for example, such as over-the-horizon volume search, identification friend or foe (IFF) or automotive autonomous cruise control, operate across frequency ranges from UHF to millimeter wave. Their power levels also span from milliwatts to megawatts. M/A-COM Technology Solutions offers a broad range of products and technical capabilities that meet these requirements. We are here to support designers with standard and custom solutions.

M/A-COM Technology Solutions uses high volume, dual use processes to create compelling components for radar applications:

- Si bipolar and LDMOS power transistors
- GaAs MESFET and pHEMT-based MMICs
- Si, GaAs and AlGaAs diodes
- Ferrite-based circulators and isolators

Our extensive module and pallet design experience, coupled with our assembly and automated test capability, makes M/A-COM Technology Solutions uniquely qualified to address the most demanding radar specifications.



Our Quality Policy

The goal of M/A-COM Technology Solutions is to continually deliver effective, high quality products and services that meet our customers' and internal operations' needs in terms of delivery, performance, safety and value.

Process controls shall be implemented such that the tasks are performed properly the first time, so that products and services meet established, agreed-to requirements.

It is the personal responsibility of every employee to ensure quality, customer satisfaction, continual improvement, maintenance of our quality management system and compliance with customer and regulatory requirements.





dual junction
isolator



SMT isolator



drop-in
isolator



drop-in circulator
* MAFR-000493

Delivering low insertion loss...ferrite products for military and commercial radar applications

M/A-COM Technology Solutions has been designing and manufacturing ferrite circulators and isolators for more than 30 years. In the beginning, we focused on custom products for military applications. This knowledge led to innovative, low-cost, technical leadership in the commercial wireless markets. Our company now offers technical leadership and cost-competitive products for radar applications in both military and commercial markets.

M/A-COM Tech's ferrite circulators have industry-leading insertion loss performance. Insertion loss is a critical parameter in radar design. For a 100 W tone, every 0.1 dB of loss thru the circulator results in 2.3 W of lost transmit power. M/A-COM Tech circulators, using an optimized design approach, have a typical insertion loss of < 0.25 db.

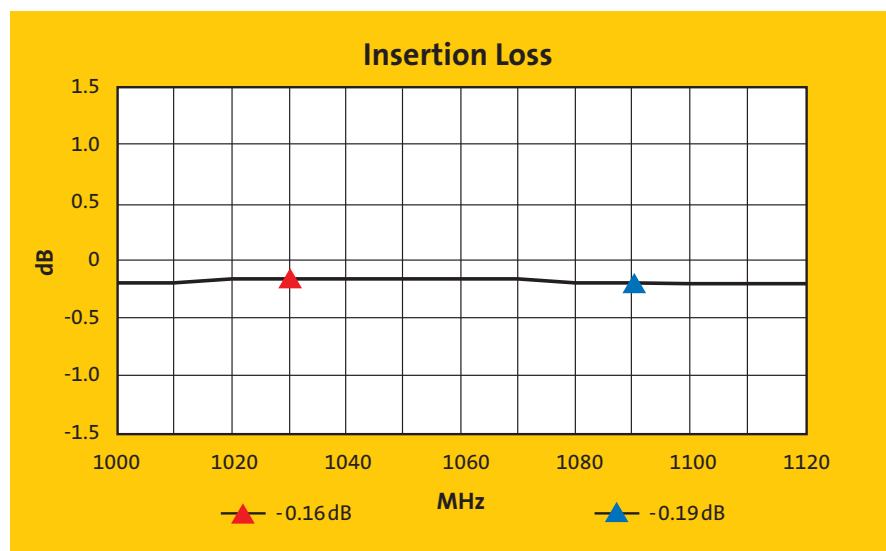
M/A-COM Tech's MAFR-000493-000001*, for instance, is designed to operate in the L-band. It has a typical insertion loss of just 0.16 dB at 1030 MHz. And our MAFR-000403 S-Band circulator, optimized from 2.7 GHz to 3.1 GHz, has a typical insertion loss of only 0.25 dB. These are only a couple of examples of our many product offerings.

M/A-COM Tech achieves best-in-class performance through a systematic approach, which includes Six Sigma tools and methodologies. This ensures quality and reliability from product development through volume production.

Our Design Center is certified to ISO9001:2008 standard. Furthermore, all production facilities are certified to ISO9000 and ISO14000 standards. Our isolator and circulator products are also compliant to the EU RoHS directive 2002/95/EC.



See tables on reverse side. ►



M/A-COM Technology Solutions Inc.

Lowell, Massachusetts 01851
 • North America 800.366.2266
 • Europe +353.21.244.6400
 • India +91.80.43537383
 • China +86.21.2407.1588

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Radar Circulators

Frequency (MHz)	Insertion Loss Typ / Max(dB)	Isolation Min / Typ(dB)	Return Loss Min / Typ(dB)	Input Power Avg / Peak (W)	Reverse Power Avg / Peak (W)	Rotation Direction	Part Number
960 - 1200	— / 0.5	18 / NA	18 / NA	200 / 1000	200 / 1000	CCW	MAFR-000409-000001
960 - 1200	— / 0.5	18 / NA	18 / NA	200 / 1200	200 / 1200	CCW	MAFR-000428-000001
960 - 1200	— / 0.5	16 / NA	16 / NA	200 / 1000	200 / 1000	CCW	MAFR-000455-000001
1030 - 1090	— / 0.3	18 / —	18 / —	200 / 1200	200 / 1200	CW	MAFR-000493-000001
1450 - 1500	0.23 / 0.3	20 / 25	20 / 25	200 / 1000	200 / 1000	CW	MAFR-000399-000001
2700 - 3100	0.26 / 0.35	20 / —	20 / —	250 / 1300	250 / 1300	CW	MAFR-000403-000001
3100 - 3500	— / 0.3	23 / —	20.8 / —	150 / 1500	150 / 1500	CW	MAFR-000436-000001
3100 - 3500	— / 0.3	23 / —	20.8 / —	250 / 2500	250 / 2500	CW	MAFR-000438-000001

Radar Isolators

Frequency (MHz)	Insertion Loss Max (dB)	Isolation Min (dB)	Return Loss Min (dB)	Input Power Avg / Peak (W)	Reverse Power Avg / Peak (W)	Rotation Direction	Part Number
2700 - 3100	0.3	20	20	250 / 1300	25 / 75	CW	MAFR-000430-000001
3100 - 3500	0.3	23	20.8	150 / 1500	60 / —	CW	MAFR-000437-000001

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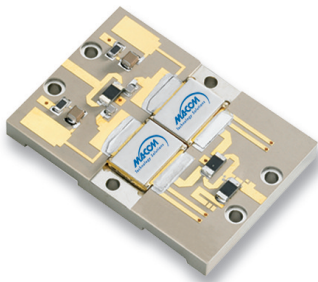
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pulsed and CW high power
RF transistors for radar applications
worldwide

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Delivering build-to-print services... plus standard components

M/A-COM Technology Solutions can create custom devices, modules and pallets to your specifications in addition to standard components:

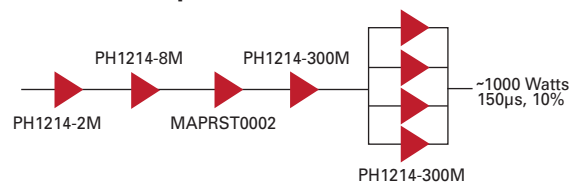
- Discrete diodes and diode-based MMICs utilizing silicon, GaAs, and AlGaAs technologies
- Tested performance
- Consistent quality and minimal unit-to-unit variation
- Amplifier pallets include input and output matching to 50 ohms, streamlining amplifier development
- Phase gain and additional RF parameters can be matched to your specification

Test Capabilities

- Bond strength
- Radiography
- Internal visual inspection
- Internal visual and mechanical
- Resistance to solvents
- Physical dimensions
- Particle impact noise detect
- Bond pull
- Lid torque
- Adhesion of lead finish
- Stud pull strength
- Package lead pull test
- Steady state life test
- Stabilization bake
- Temperature cycling
- Seal – gross, fine leak
- Burn-in
- Constant acceleration
- Vibration, variable
- Visual inspection

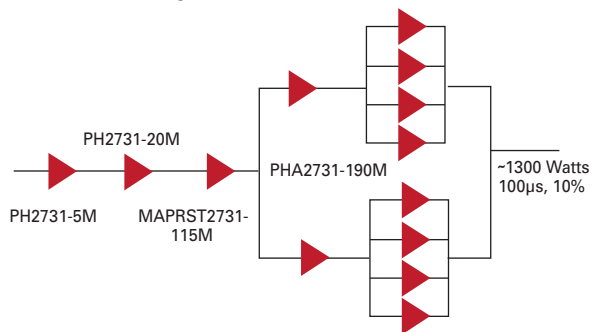


L-Band Lineup

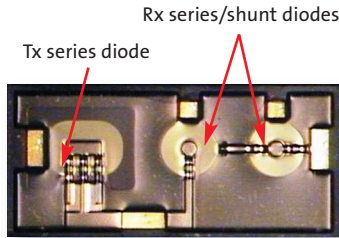


Part Number	Freq (GHz)	Vcc (V)	Pout (W)	Gain (dB)
PH1214-2M	1.2 - 1.4	28	2	7.0
PH1214-8M	1.2 - 1.4	28	8	7.0
MAPRST0002	1.2 - 1.4	36	50	9.5
PH1214-300M	1.2 - 1.4	36	300	8.75

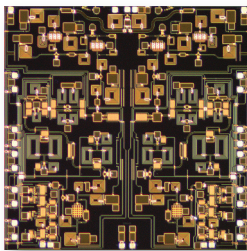
S-Band Lineup



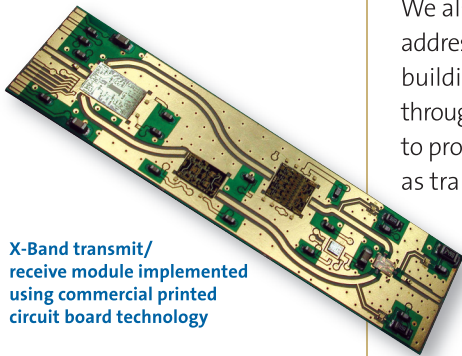
Part Number	Freq (GHz)	Vcc (V)	Pout (W)	Gain (dB)
PH2731-5M	2.7 - 3.1	36	5	7.0
PH2731-20M	2.7 - 3.1	36	20	8.2
MAPRST2731-115M	2.7 - 3.1	36	115	7.6
PHA2731-190M	2.7 - 3.1	36	190	7.0



50 MHz to 6 GHz SPDT switch capable of handling 50 W CW (>1500 W pulsed) fabricated in M/A-COM Technology Solutions' MMIC process



multi-function transmit integrated circuit for S-Band radar containing multiple gain stages, two 6-bit phase shifters and two 4-bit constant phase digital attenuators



X-Band transmit/receive module implemented using commercial printed circuit board technology

Delivering volume manufacturing processes... MMICs and modules in radar applications

M/A-COM Technology Solutions has a broad set of products, technologies and capabilities that make possible high performance, cost effective solutions for radar applications.

Our semiconductor processes include:

- Discrete diodes and diode-based MMICs utilizing silicon, GaAs, and AlGaAs technologies
- MMIC processes in GaAs-based MESFET and pHEMT with GaN processes in development
- Discrete power transistors and pallets based on silicon bipolar, DMOS, TMOS and LDMOS processes

This array of capabilities allows for the creation of industry leading products such as high power, broadband switches (>50 CW), limiters, digital attenuators, phase shifters, low noise amplifiers. We also supply high power amplifiers that address all major radar frequency bands. These building block functions can be combined through either on-chip or board level integration to provide higher functionality solutions such as transmit/receive modules.

All of our manufacturing areas are “dual use.” We employ the high volumes associated with commercial markets such as cellular infrastructure or broadband and CATV to drive down cost and drive up cycles of learning. This commercial volume provides a direct technical and cost benefit to our customers requiring radar solutions where the volumes are significantly lower.

M/A-COM Technology Solutions can support a diverse set of requirements with either standard or custom solutions. Our capabilities range from discrete semiconductor functions to multi-function integrated circuits to highly integrated modules with both digital and RF functionality. We are ready to support your requirements.



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We work with you

M/A-COM Technology Solutions is an industry leader in the design, development, and manufacture of radio frequency (RF), microwave and millimeter wave semiconductors, components and technologies. Holding hundreds of patents in the field, M/A-COM Technology Solutions is internationally known as an innovator and integrator whose technologies are found in major markets such as wireless telecommunications, broadband communications, industrial and commercial electronics.

Headquartered in Lowell, Massachusetts, M/A-COM Technology Solutions has offices and manufacturing facilities worldwide.

M/A-COM Technology Solutions currently has many new products in development. We are happy to work with you on any customized products or standard product variations. Visit M/A-COM Technology Solutions on the Web at www.macomtech.com or contact your local M/A-COM Technology Solutions sales office for assistance.

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