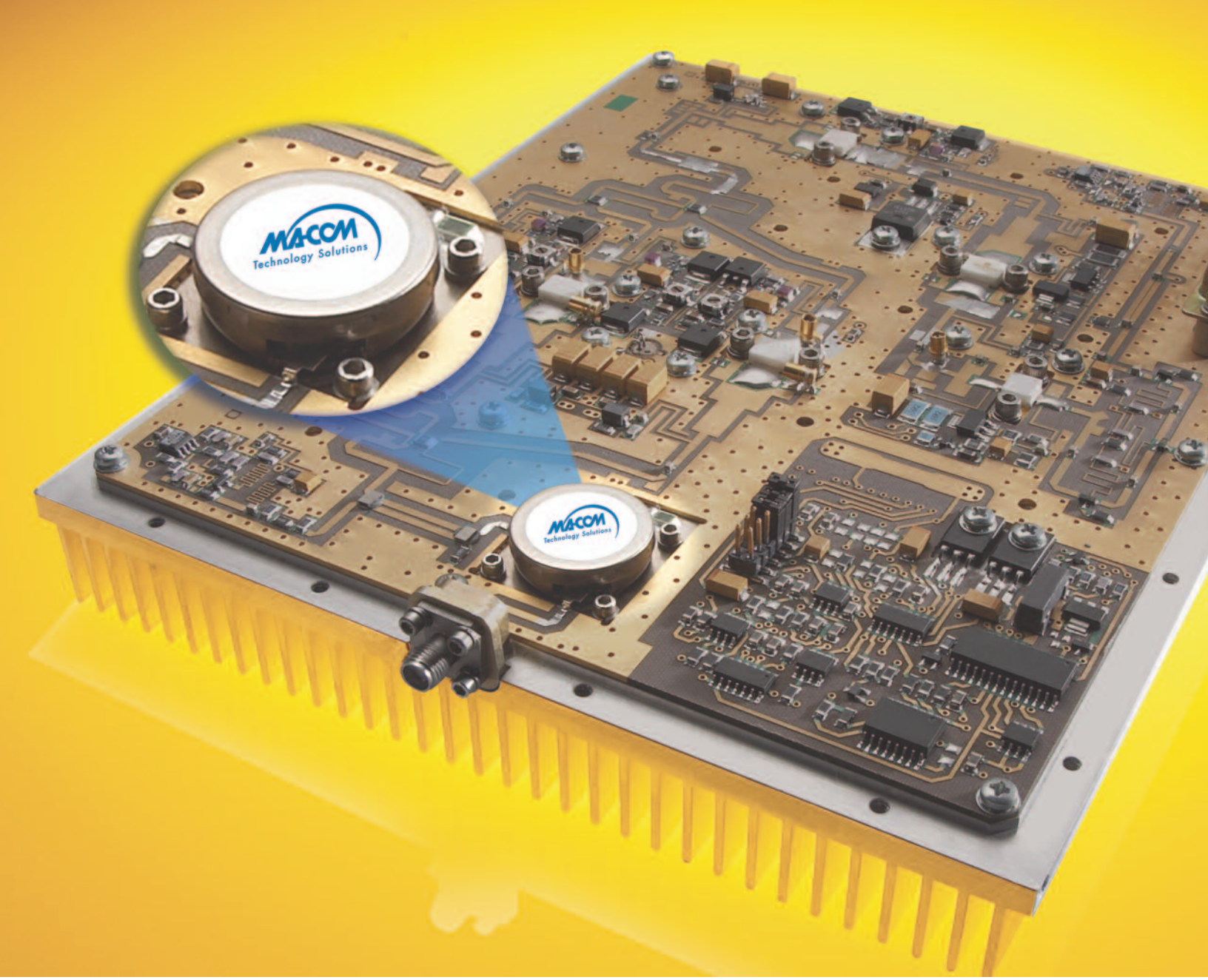


M/A-COM Technology Solutions... delivering high performance in circulators & isolators

MACOM
Technology Solutions

Circulators & Isolators

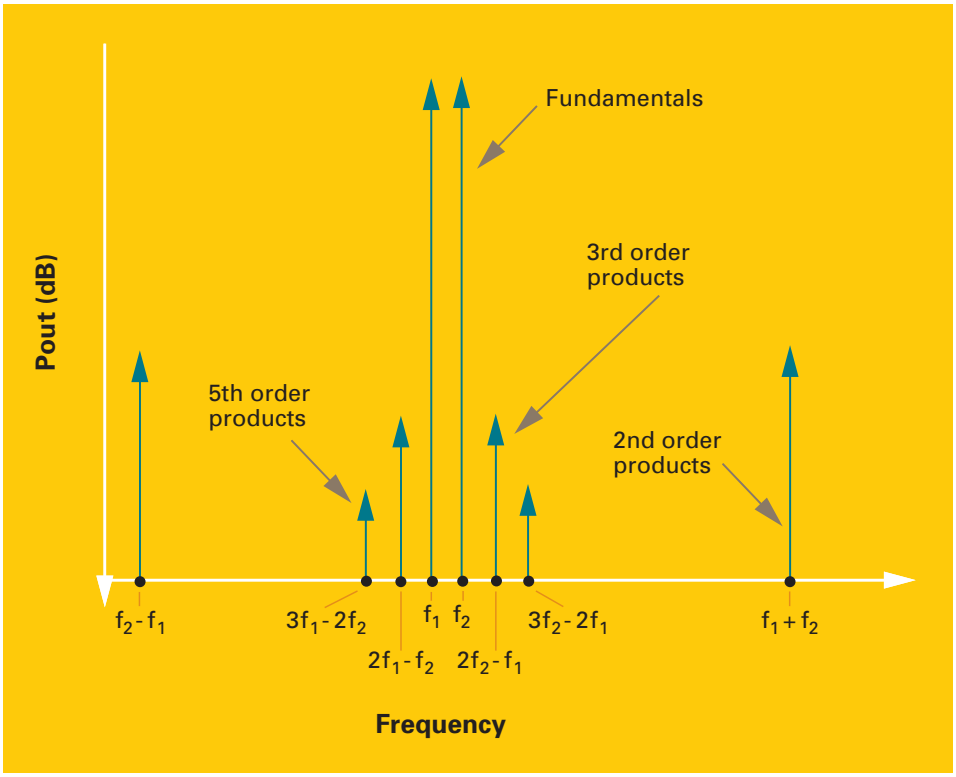
M/A-COM Technology Solutions circulators and isolators have been used extensively in the RF and telecommunications industries for more than 30 years. Our industry leading products can be found in systems ranging from wireless infrastructure power amplifiers for the cellular market to higher frequency WiMAX signal distribution equipment.

Our innovative line of circulators and isolators has excellent RF performance in frequency ranges from 380 MHz to 3.6 GHz.

- M/A-COM Technology Solutions high performance circulators and isolators assure clean transmit signals by offering low insertion loss and superior IMD performance down to -75 dBc.

- Ferrite performance in transmit applications is critical because the ferrite is located in the high power path after the power amplifier and is the last component before the filter/diplexer. Any degradation to the transmit signal is not correctable before transmission at the antenna. The ferrite must handle the high power transmit signal without breakdown or degradation over time.

- Insertion loss of the ferrite is a critical parameter and needs to be as low as possible to minimize the power loss after the high power amplifier. At 40 Watt tone power transmission, each 0.1 dB of insertion loss results in 250 mW of lost transmit power.

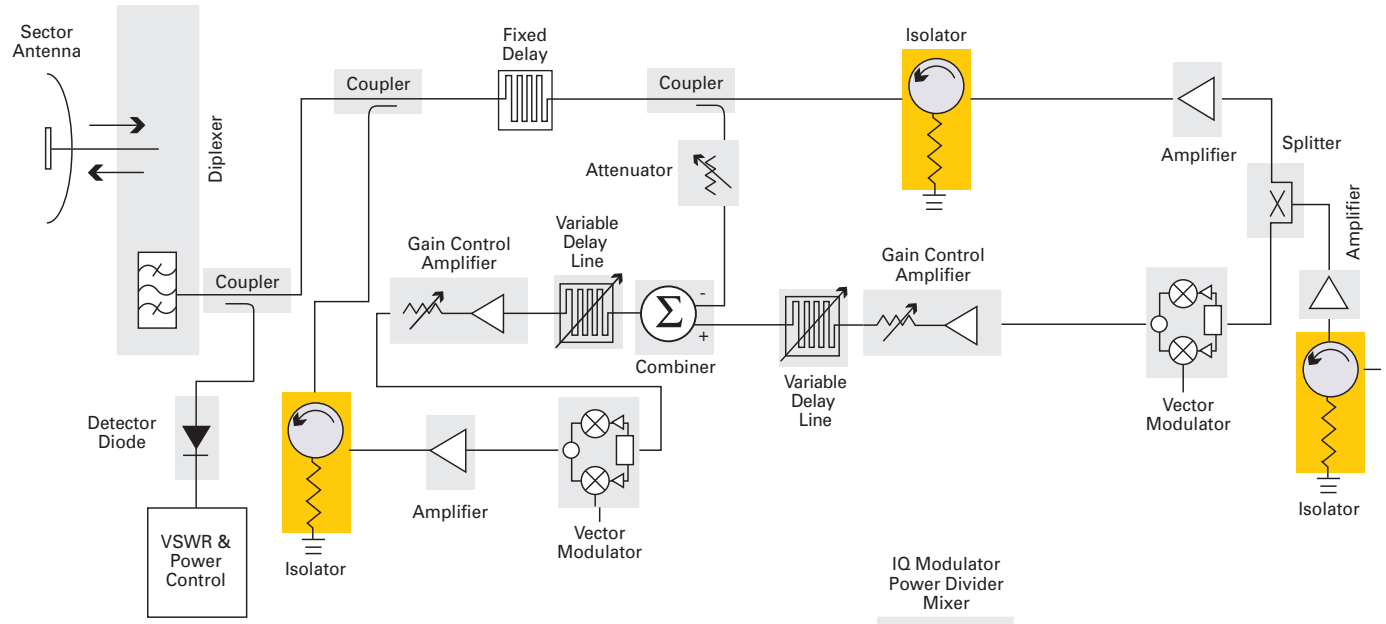


Low third order, and sometimes fifth order, IMD products are a critical parameter when choosing a circulator or isolator.

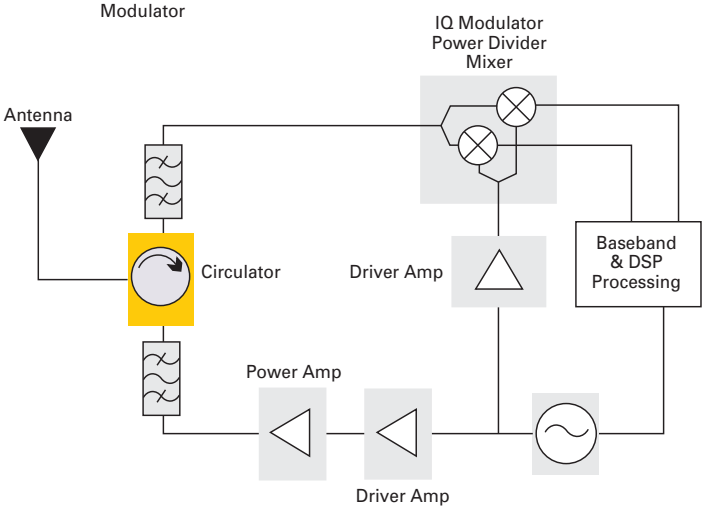
Two CW tones (f1 and f2) are combined and fed into the Device Under Test (DUT). The resulting output is measured on a spectrum analyzer. The third order, and occasionally the fifth order, products are the critical unwanted frequency IMD products that are measured.

For additional information, reference Application Note ANI-001 on our Web site: **www.macomtech.com**

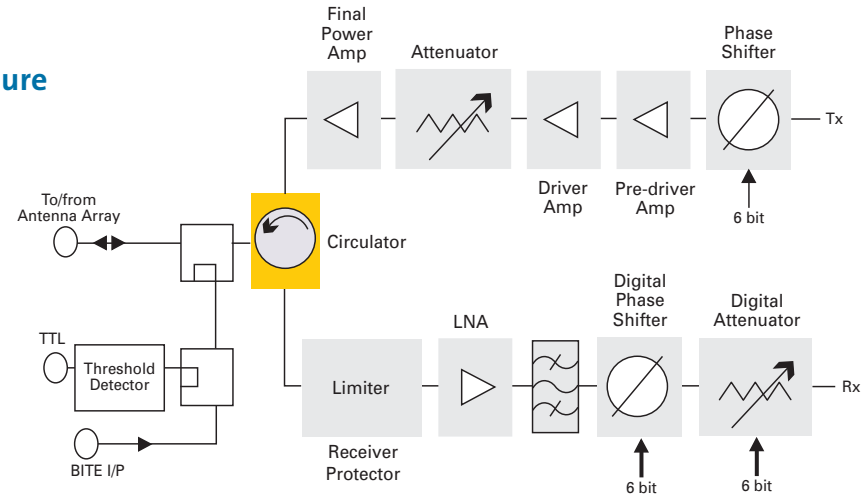
Typical Cellular/WiMAX BTS Architecture



EPCglobal UHF Architecture



Typical Radar Architecture



High Performance

Circulators

Frequency (MHz)	Part Number	Outline Drawing #	Fwd Pwr (Watts)	Rvs Pwr (Watts)	Loss (dB)	Isolation (dB)	IMD (dBc)	Tab Hgt (mm/in)	Temp: C° (min/max)
	Drop-in								
869 - 894	MAFRIN0536 ✔	**5**	200	200	0.25	20	-75	3.18 / 0.125	-30 / +85
925 - 960	MAFRIN0512 ✔	**5**	200	200	0.25	20	-75	3.18 / 0.125	-30 / +85
1805 - 1880	MAFRIN0532 ✔	**5**	200	200	0.25	20	-75	3.18 / 0.125	-30 / +85
1930 - 1990	MAFRIN0540 ✔	**5**	200	200	0.25	20	-75	3.18 / 0.125	-30 / +85
2090 - 2190	MAFR-000276-000001 ✔	**11**	250	250	0.25	22	-70	1.57 / 0.062	-30 / +85

Isolators

Frequency (MHz)	Part Number	Outline Drawing #	Fwd Pwr (Watts)	Rvs Pwr (Watts)	Loss (dB)	Isolation (dB)	IMD (dBc)	Tab Hgt (mm/in)	Temp: C° (min/max)
	Drop-in								
869 - 894	MAFRIN0537 ✔	**6**	200	100	0.25	20	-75	3.18 / 0.125	-30 / +85
925 - 960	MAFRIN0513 ✔	**6**	200	100	0.25	20	-75	3.18 / 0.125	-30 / +85
1805 - 1880	MAFRIN0533 ✔	**6**	200	100	0.25	20	-75	3.18 / 0.125	-30 / +85
1930 - 1990	MAFRIN0541 ✔	**6**	200	100	0.25	20	-75	3.18 / 0.125	-30 / +85

Standard

Circulators

Frequency (MHz)	Part Number	Outline Drawing #	Fwd Pwr (Watts)	Rvs Pwr (Watts)	Loss (dB)	Isolation (dB)	Tab Hgt (mm/in)	Temp: C° (min/max)
	Drop-in							
869 - 894	FR11-0001	**2**	250	250	0.35	20	1.57 / 0.062	-30 / +85
869 - 894	MAFR-000083-AS1C1T ✔	**2**	250	250	0.35	20	1.57 / 0.062	-30 / +85
925 - 960	FR11-0002	**2**	250	250	0.35	20	1.57 / 0.062	-30 / +85
925 - 960	MAFR-000084-GS1C1T ✔	**2**	250	250	0.35	20	1.57 / 0.062	-30 / +85
1805 - 1880	FR11-0003	**2**	250	250	0.35	20	1.57 / 0.062	-30 / +85
1805 - 1880	MAFR-000085-DS1C1T ✔	**2**	250	250	0.35	20	1.57 / 0.062	-30 / +85
1930 - 1990	FR11-0004	**2**	250	250	0.35	20	1.57 / 0.062	-30 / +85
1930 - 1990	MAFR-000086-PS1C1T ✔	**2**	250	250	0.35	20	1.57 / 0.062	-30 / +85
2110 - 2170	FR11-0009	**2**	250	250	0.35	20	1.57 / 0.062	-30 / +85
2110 - 2170	MAFR-000087-US1C1T ✔	**2**	250	250	0.35	20	1.57 / 0.062	-30 / +85
	Surface Mount							
869 - 894	MAFR-000070-AS1C1R ✔	**3**	200	200	0.35	20		-30 / +85
925 - 960	MAFR-000071-GS1C1R ✔	**3**	200	200	0.35	20		-30 / +85
1805 - 1880	MAFR-000072-DS1C1R ✔	**3**	200	200	0.35	20		-30 / +85
1930 - 1990	MAFR-000073-PS1C1R ✔	**3**	200	200	0.35	20		-30 / +85
2110 - 2170	MAFR-000076-US1C1R ✔	**3**	200	200	0.35	20		-30 / +85

✔ indicates RoHS compliant. All other part numbers are RoHS5.

Circulators & Isolators

Standard

Isolators

Frequency (MHz)	Part Number	Outline Drawing #	Fwd Pwr (Watts)	Rvs Pwr (Watts)	Loss (dB)	Isolation (dB)	Tab Hgt (mm/in)	Temp: C° (min/max)
	Drop-in							
869 - 894	FR12-0001	**1**	250	20	0.35	20	1.57 / 0.062	-30 / +85
869 - 894	MAFR-000088-AS1S1T ✔	**1**	250	20	0.35	20	1.57 / 0.062	-30 / +85
925 - 960	FR12-0002	**1**	250	20	0.35	20	1.57 / 0.062	-30 / +85
925 - 960	MAFR-000089-GS1S1T ✔	**1**	250	20	0.35	20	1.57 / 0.062	-30 / +85
1805 - 1880	FR12-0003	**1**	250	20	0.35	20	1.57 / 0.062	-30 / +85
1805 - 1880	MAFR-000090-DS1S1T ✔	**1**	250	20	0.35	20	1.57 / 0.062	-30 / +85
1930 - 1990	FR12-0004	**1**	250	20	0.35	20	1.57 / 0.062	-30 / +85
1930 - 1990	MAFR-000091-PS1S1T ✔	**1**	250	20	0.35	20	1.57 / 0.062	-30 / +85
2110 - 2170	FR12-0009	**1**	250	20	0.35	20	1.57 / 0.062	-30 / +85
2110 - 2170	MAFR-000092-US1S1T ✔	**1**	250	20	0.35	20	1.57 / 0.062	-30 / +85
	Surface Mount							
869 - 894	MAFR-000053-AS1S1R ✔	**12**	200	10	0.35	20		-30 / +85
925 - 960	MAFR-000054-GS1S1T ✔	**12**	200	10	0.35	20		-30 / +85
1805 - 1880	MAFR-000055-DS1S1T ✔	**12**	200	10	0.35	20		-30 / +85
1930 - 1990	MAFR-000056-PS1S1T ✔	**12**	200	10	0.35	20		-30 / +85

Radar

Circulators

Frequency (GHz)	Part Number	Outline Drawing #	Fwd Pwr (Watts)	Rvs Pwr (Watts)	Loss (dB)	Isolation (dB)	Tab Hgt (mm/in)	Temp: C° (min/max)
	Drop-in							
960 - 1200	MAFR-000409-000001 ✔	**16**	200	200	0.50	20	3.81 / 0.15	-10 / +85
960 - 1200	MAFR-000428-000001 ✔	**16**	200	200	0.50	20	3.81 / 0.15	-10 / +85
1200 - 1400	MAFR-000406-000001 ✔	**15**	100	100	0.30	20	2.0 / 0.078	-60 / +85
1450 - 1500	MAFR-000399-000001 ✔	**16**	200	200	0.30	20	3.81 / 0.15	-10 / +85
2700 - 2900	MAFR-000405-000001 ✔	**14**	100	100	0.30	20	2.0 / 0.078	-60 / +85
2700 - 2900	MAFR-000407-000001 ✔	**15**	200	200	0.30	20	2.0 / 0.078	-60 / +85
2700 - 3100	MAFR-000403-000001 ✔	**10**	250	250	0.30	20	3.12 / 0.123	-40 / +85
2700 - 3100	MAFR-000430-000001 ✔	**17**	250	25	0.30	20	3.12 / 0.123	-40 / +85

This brochure contains a broad range of our standard product offerings.
For the full line of circulator and isolator products visit our Web site at **www.macomtech.com**

✔ indicates RoHS compliant. All other part numbers are RoHS5.

Circulators & Isolators

WiMAX

Circulators

Frequency (GHz)	Part Number	Outline Drawing #	Fwd Pwr (Watts)	Rvs Pwr (Watts)	Loss (dB)	Isolation (dB)	IMD (dBc)	Tab Hgt (mm/in)	Temp: C° (min/max)
	Surface Mount								
2.3 - 2.5	MAFR-000229-000001 ✔	**8**	200	200	0.25	20	-65		-40 / +85
2.5 - 2.7	MAFR-000050-5S4C1T ✔	**8**	200	200	0.25	20	-70		-40 / +85
3.3 - 3.4	MAFR-000200-5S4C1T ✔	**8**	200	200	0.25	20	-60		-40 / +85
3.4 - 3.6	MAFR-000159-5S4C1T ✔	**8**	200	200	0.25	20	-60		-40 / +85
	Drop-in								
2.3 - 2.5	MAFR-000230-000001 ✔	**10**	200	200	0.25	20	-65	3.12 / 0.12	-40 / +85
2.5 - 2.7	MAFR-000226-000001 ✔	**10**	200	200	0.25	20	-70	3.12 / 0.12	-40 / +85
3.3 - 3.4	MAFR-000231-000001 ✔	**10**	200	200	0.25	20	-60	3.12 / 0.12	-40 / +85
3.4 - 3.6	MAFRIN0520 ✔	**10**	200	200	0.25	20	-60	3.12 / 0.12	-40 / +85

Isolators

Frequency (GHz)	Part Number	Outline Drawing #	Fwd Pwr (Watts)	Rvs Pwr (Watts)	Loss (dB)	Isolation (dB)	IMD (dBc)	Tab Hgt (mm/in)	Temp: C° (min/max)
	Drop-in								
2.3 - 2.4	MAFR-000128-WD3S1T ✔	**13**	200	60	0.50	46	-65	2.16 / 0.085	-40 / +85
2.3 - 2.5	MAFR-000247-000001 ✔	**9**	200	60	0.25	20	-65	3.12 / 0.12	-40 / +85
2.5 - 2.7	MAFR-000161-5S3S1T ✔	**9**	200	60	0.25	20	-70	3.12 / 0.12	-40 / +85
3.3 - 3.4	MAFR-000232-000001 ✔	**17**	200	60	0.25	20	-60	8.89 / 0.35	-40 / +85
3.4 - 3.6	MAFR-000171-5S3S1T ✔	**17**	200	60	0.25	20	-60	8.89 / 0.35	-40 / +85
3.4 - 3.6	MAFR-000127-WD3S1T ✔	**13**	200	60	0.50	46	-65	2.16 / 0.085	-40 / +85
2496 - 2690 MHz	MAFR-000121-5D4S1T ✔	**13**	200	60	0.50	46	-65	2.16 / 0.085	-40 / +85

RFID

Circulators

Frequency (MHz)	Part Number	Outline Drawing #	Fwd Pwr (Watts)	Rvs Pwr (Watts)	Loss (dB)	Isolation (dB)		Temp: C° (min/max)
	Surface Mount							
860 - 872	MAFRIN0495 ✔	**7**	100	100	0.25	23		-10 / +85
902 - 928	MAFRIN0332 ✔	**3**	100	100	0.35	22		-10 / +85
902 - 928	MAFRIN0497 ✔	**7**	100	100	0.30	22		-10 / +85
902 - 928	MAFRIN0493 ✔	**3**	100	100	0.35	22		-10 / +85
950 - 956	MAFRIN0496 ✔	**7**	100	100	0.25	23		-10 / +85
860 - 960	MAFRIN0494 ✔	**7**	100	100	0.40	18		-10 / +85

✔ indicates RoHS compliant

LTE

Circulator/Isolators

Frequency (MHz)	Part Number	Outline Drawing #	Fwd Pwr (Watts)	Rvs Pwr (Watts)	Loss (dB)	Isolation (dB)	IMD (dBc)	Tab Hgt (mm/in)	Temp: C° (min/max)
	Surface Mount								
728 - 768	MAFR-000358-000001 ✔	**19**	1000	85	0.25	23	-60	3.0 / 0.118	-40 / +90
1460.9 - 1515.9	MAFR-000398-000001 ✔	**19**	1000	85	0.25	23	-74	3.0 / 0.118	-10 / +95
2110 - 2170	MAFR-000355-000001 ✔	**18**	200	200	0.25	20	-70	3.12 / 0.123	-40 / +85
2605 - 2705	MAFR-000359-000001 ✔	**19**	676	85	0.25	23	-74	3.0 / 0.118	-10 / +95

TETRA

Circulator/Isolators

Frequency (MHz)	Part Number	Outline Drawing #	Fwd Pwr (Watts)	Rvs Pwr (Watts)	Loss (dB)	Isolation (dB)	IMD (dBc)	Tab Hgt (mm/in)	Temp: C° (min/max)
	Surface Mount								
380 - 400	MAFR-000335-000001 ✔	**20**	100	100	0.30	24	-77	3.5 / 0.138	-30 / +75

TDSCDMA

Circulator/Isolators

Frequency (MHz)	Part Number	Outline Drawing #	Fwd Pwr (Watts)	Rvs Pwr (Watts)	Loss (dB)	Isolation (dB)	IMD (dBc)	Tab Hgt (mm/in)	Temp: C° (min/max)
	Surface Mount								
2010 - 2025	MAFR-000164-4S3C1T ✔	**21**	200	200	0.15	25	-75	3.12 / 0.123	-40 / +85
2010 - 2025	MAFR-000291-000001 ✔	**22**	200	200	0.25	25	-70		-40 / +85
2010 - 2025	MAFR-000326-000001 ✔	**23**	20	20	0.30	25	-55		-40 / +85

This brochure contains a broad range of our standard product offerings.
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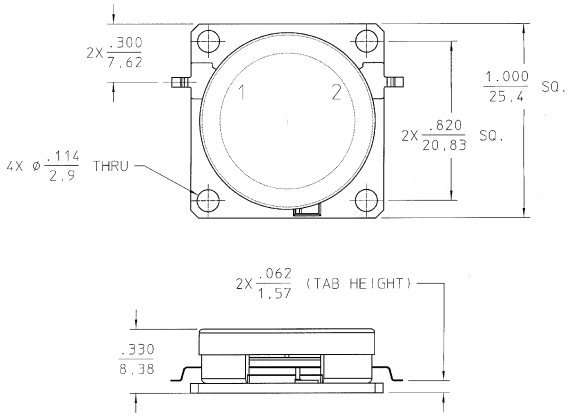
✔ indicates RoHS compliant

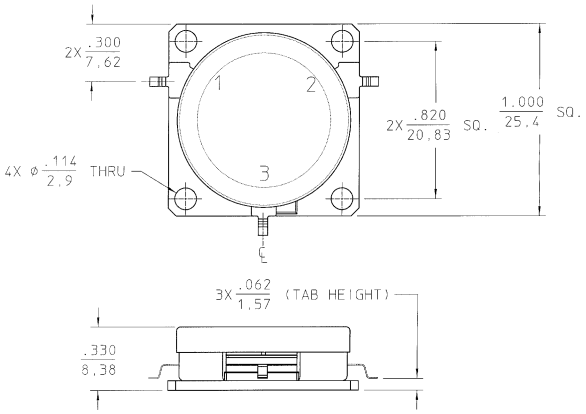
Circulators & Isolators

M/A-COM Technology Solutions innovative packaging technology offers a wide variety of package styles and lead attachment options—from high power, drop-in isolators with industry leading intermodulation performance, to miniature surface mount, low cost single piece housing.

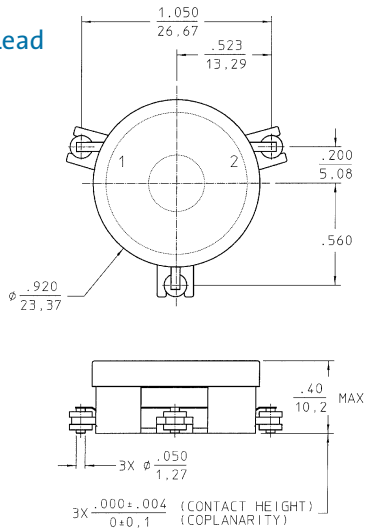
Outline 1: Drop-in Isolator



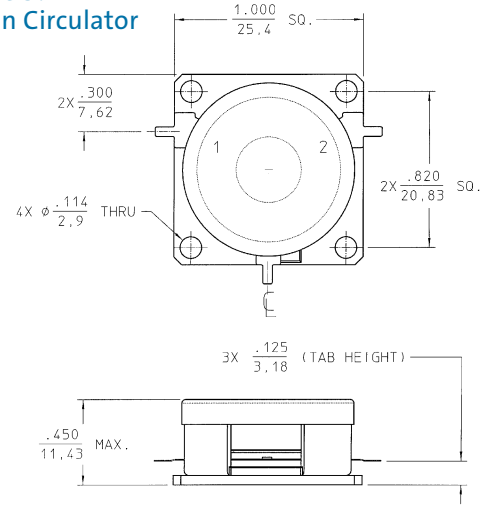
Outline 2: Drop-in Circulator



Outline 3: SMT Robust Lead Circulator



Outline 5: Drop-in Circulator

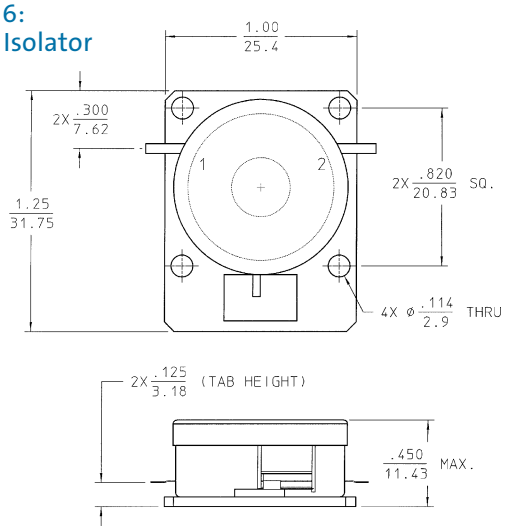


The M/A-COM Technology Solutions patented Robust Lead design offers an engineered solution for critical coplanarity requirements. Manufacturing repeatability is enhanced with simplified handling and tape and reel capability.

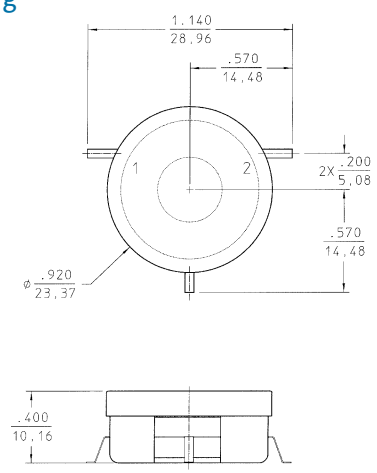
M/A-COM Technology Solutions offers several Ferrite Application Notes that contain detailed information on manufacture, test, screening, and use of these circulators and isolators.
Please visit our Web site at www.macomtech.com for:

- ANI-001 Intermodulation Distortion Measurements (IMD) of Ferrites
- ANI-003 Maximum Peak Power of Ferrite Junctions
- ANI-004 Thermal Design Considerations for Ferrite Products

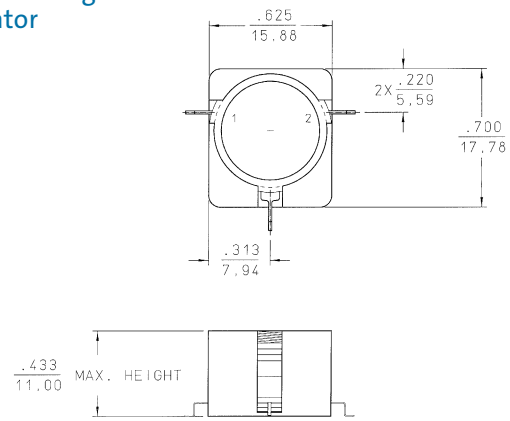
Outline 6: Drop-in Isolator



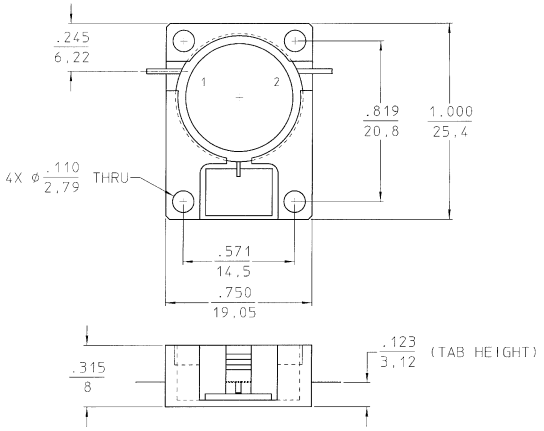
Outline 7: SMT Gull Wing Circulator



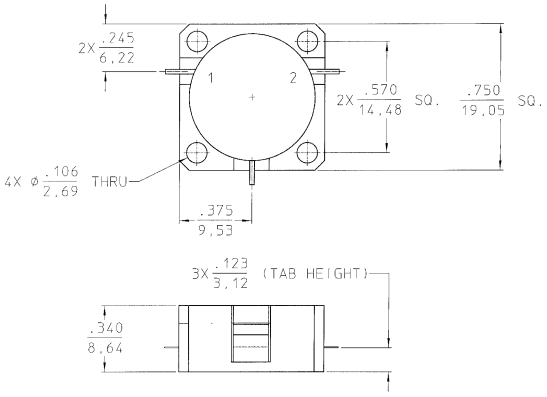
Outline 8: SMT Gull Wing Circulator



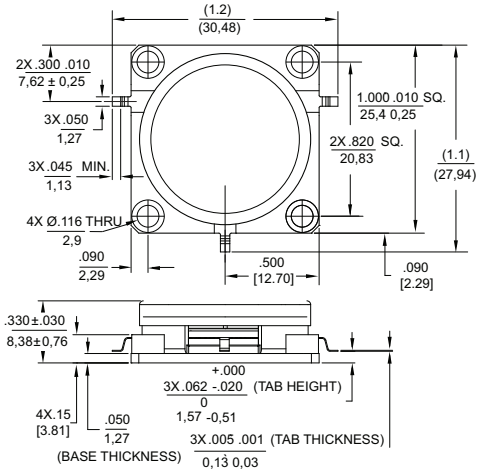
Outline 9: Drop-in Isolator



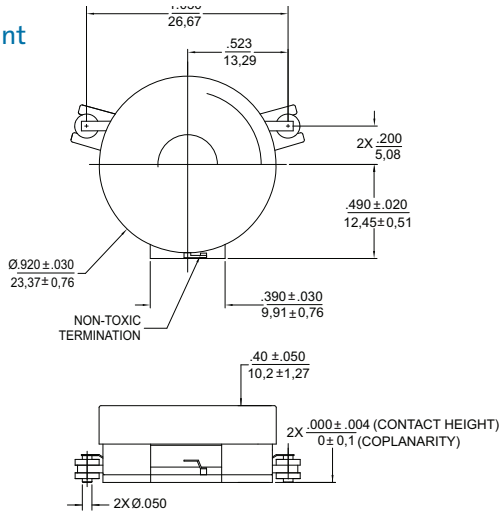
Outline 10: Drop-in Circulator



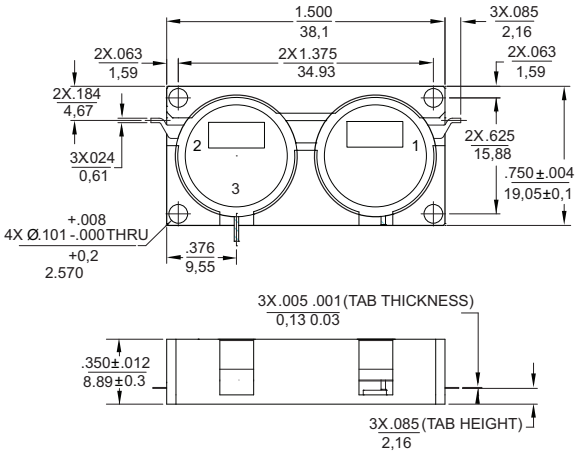
Outline 11: Drop-in Circulator



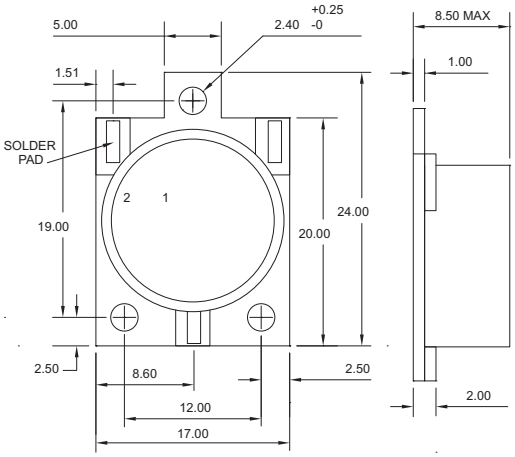
Outline 12: Surface Mount Isolator



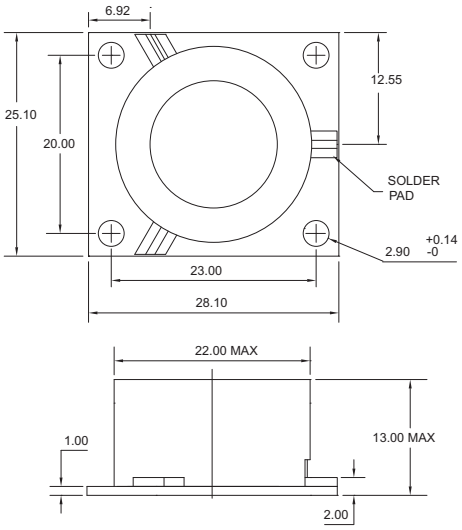
Outline 13: Drop-in Isolator



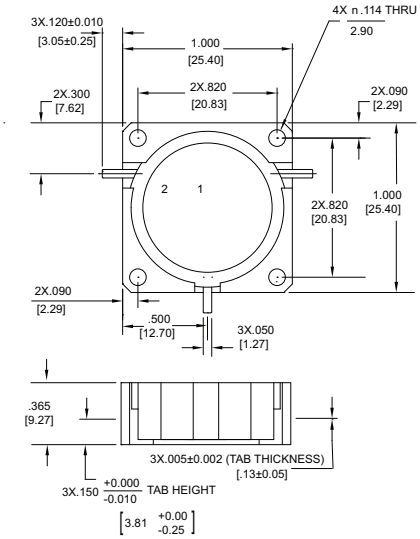
Outline 14: Drop-in Circulator



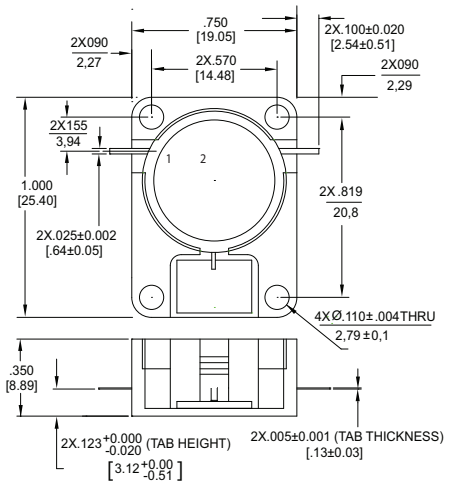
Outline 15: Drop-in Circulator



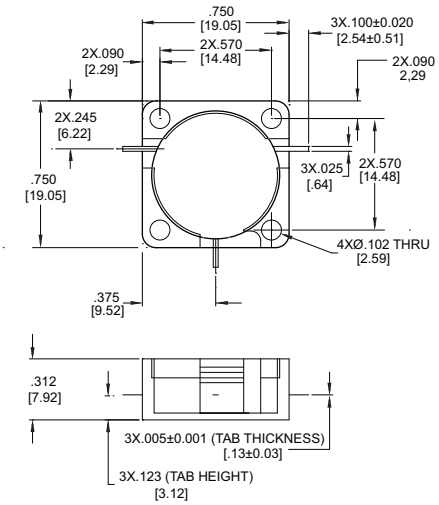
Outline 16: Drop-in Circulator



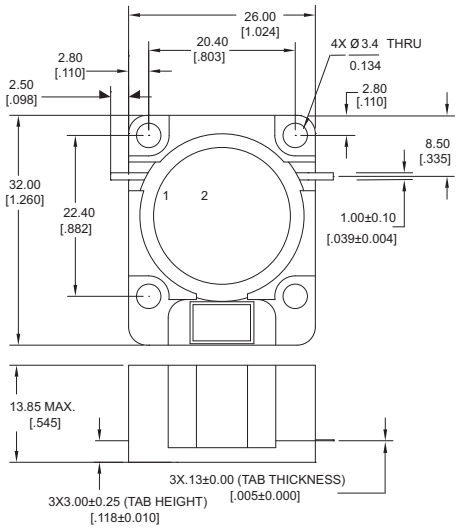
Outline 17: Drop-in Isolator



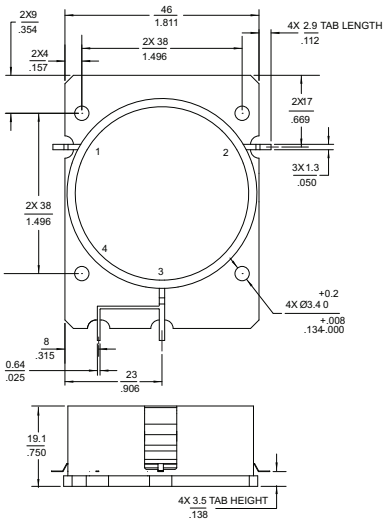
Outline 18: Drop-in Circulator



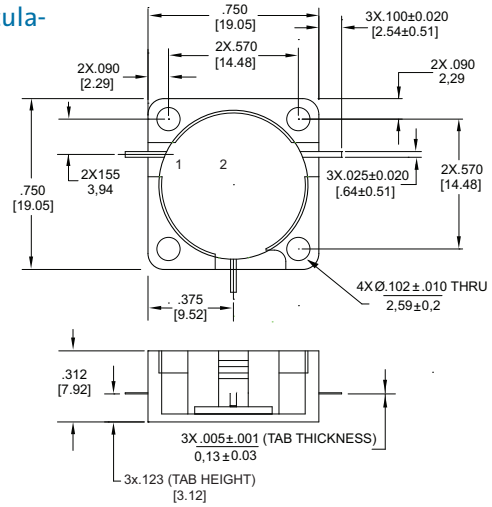
Outline 19: Drop-in Isolator



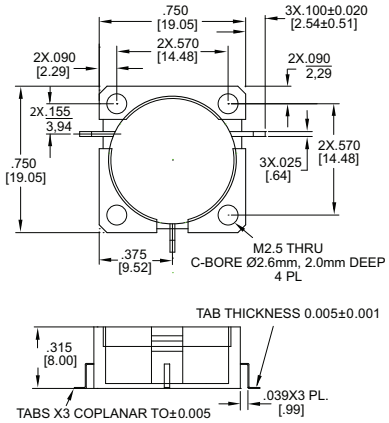
Outline 20: Drop-in Circulator



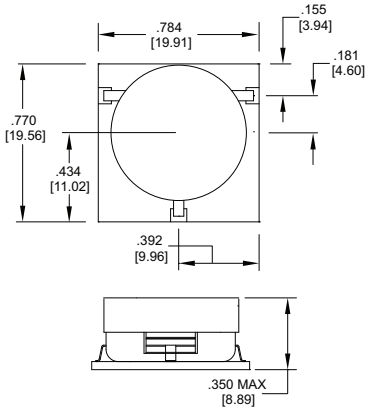
Outline 21: Drop-in Circulator



Outline 22: SMT/Drop-in Circulator



Outline 23: Surface Mount Circulator



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