WERBEL MICROWAVE

R.F. WIRELESS COMPONENTS MADE IN U.S.A.

PRODUCT CATALOG

2014

Werbel Microwave, LLC
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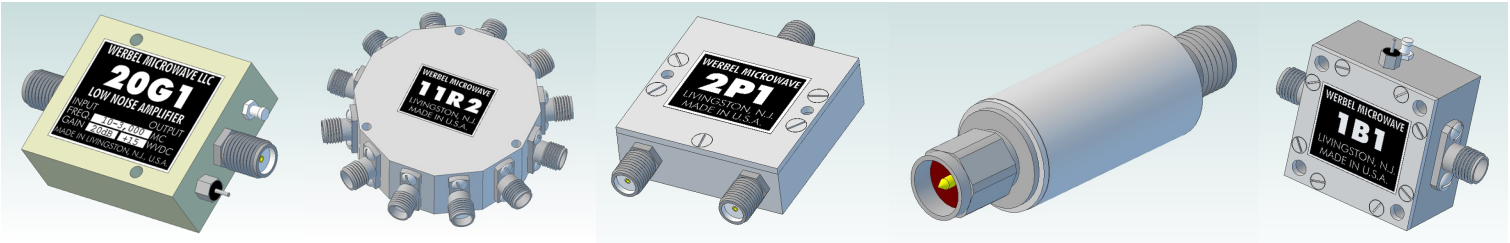

Specification details contained herein are subject to change without notice, and shall not be binding to any part of any contract. Please contact Werbel Microwave for updated specification drawings.

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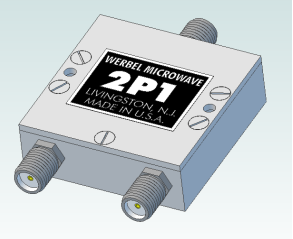
Wilkinson structure power dividers are used to combine or split multiple signals of equal phase and amplitude, where branch port isolation is an important requirement.

Standard power dividers are offered in 2, 3, 4, 6, 8, 9, 12 and 16-split configurations.

As always, custom units can be made to your electrical and mechanical specifications.



2-Split Dividers and Combiners

Frequency Range (MC)		Part No.	Insertion Loss (dB)	VSWR (:1)	Isolation (dB)	Phase Balance (deg.)	Loss Balance (dB)	Interface	Length (in)	Width (in)	Depth (in)
2	500	2P16	1.0	1.35	25	2	0.3	SMA	1.750	1.700	0.940
2	500	2PA21	1.0	1.35	25	2	0.3	N	1.750	1.670	0.930
10	1,000	2PB21	1.5	1.50	20	2	0.3	N	1.750	1.670	0.930
500	1,000	2P11	0.2	1.20	22	2	0.5	SMA	1.500	2.500	0.500
500	1,000	2P25	0.3	1.20	25	2	0.5	N	1.500	2.500	0.800
500	2,000	2P12	0.5	1.25	20	2	0.2	SMA	2.130	1.100	0.390
690	2,700	2P15	0.5	1.25	22	3	0.2	SMA	2.000	2.000	0.750
690	2,700	2P2	0.5	1.25	22	3	0.2	N	2.000	2.000	0.830
800	2,500	2P26	0.4	1.25	20	2	0.5	N	2.200	3.800	1.000
1,000	2,000	2P1	0.3	1.25	22	3	0.2	SMA	1.500	1.500	0.500
1,000	2,000	2P21	0.3	1.25	20	4	0.5	N	1.750	1.670	0.930
2,000	4,000	2PA1	0.3	1.30	20	4	0.5	SMA	1.500	1.500	0.500
2,000	4,000	2P24	0.4	1.45	18	4	0.2	N	1.500	2.000	0.800
2,000	8,000	2P4	0.4	1.35	20	4	0.5	SMA	2.000	1.500	0.500
2,000	18,000	2P14	1.0	1.50	20	5	0.4	SMA	2.000	1.500	0.380
4,000	8,000	2P13	0.4	1.30	20	4	0.5	SMA	1.000	1.000	0.500
4,000	8,000	2PB3	0.4	1.30	20	4	0.5	SMA-M	1.000	1.000	0.500
4,000	8,000	2P22	0.7	1.30	20	4	0.5	N	1.000	2.000	1.000
7,000	12,400	2P3	0.4	1.35	20	4	0.5	SMA	1.000	1.000	0.500
7,000	12,400	2PC3	0.4	1.35	20	4	0.5	SMA-M	1.000	1.000	0.500
8,000	12,400	2P23	1.0	1.60	16	5	0.5	N	1.000	2.000	1.000
8,000	18,000	2PA3	0.6	1.40	20	5	0.3	SMA	1.000	1.000	0.500
12,000	18,000	2PD3	0.6	1.35	20	5	0.3	SMA	1.000	1.000	0.500
12,000	18,000	2PA22	1.0	1.60	20	5	0.3	N	1.000	2.000	1.000

Dimensions exclude connectors.

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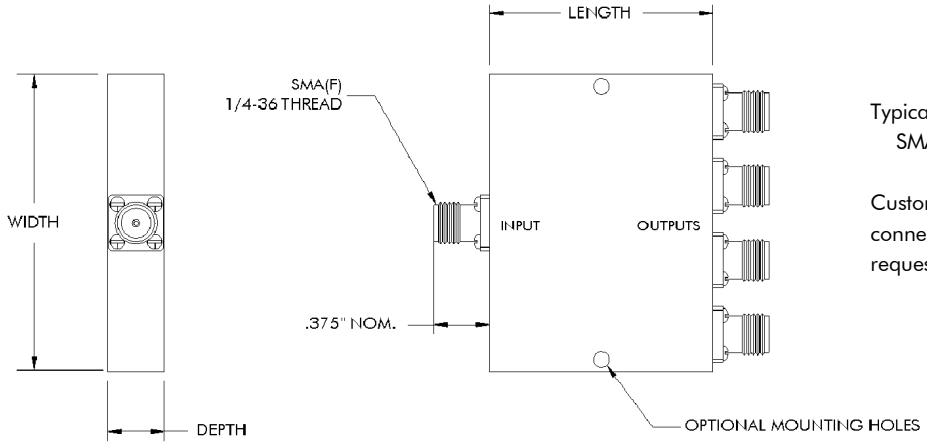
3-Split Dividers and Combiners

Frequency Range (MC)		Part No.	Insertion Loss (dB)	VSWR (:1)	Isolation (dB)	Phase Balance (deg.)	Loss Balance (dB)	Interface	Length (in)	Width (in)	Depth (in)
690	2,700	3P1	0.8	1.40	22	6	0.4	SMA	3.350	3.000	0.750
690	2,700	3P2	0.8	1.40	22	6	0.4	N	3.350	3.000	0.830
800	2,500	3P3	0.6	1.30	20	3	0.4	N	3.000	3.700	0.880

Dimensions exclude connectors.

4-split model shown for illustrative purposes.



Typical split port center spacing:
SMA: 0.500" N: 1.000."

Custom configurations and other connector types are available upon request.

4-Split Dividers and Combiners

Frequency Range (MC)		Part No.	Insertion Loss (dB)	VSWR (:1)	Isolation (dB)	Phase Balance (deg.)	Loss Balance (dB)	Interface	Length (in)	Width (in)	Depth (in)
500	1,000	4P1	0.4	1.30	20	4	0.5	SMA	3.000	2.500	0.380
500	2,000	4P9	1.0	1.30	20	3	0.3	SMA	3.000	2.210	0.390
690	2,700	4P10	1.0	1.35	22	4	0.2	SMA	3.740	4.000	0.750
800	2,500	4P8	0.7	1.30	20	6	0.3	SMA	1.990	2.240	0.390
1,000	2,000	4P2	0.6	1.60	20	4	0.5	SMA	2.500	2.750	0.380
2,000	4,000	4P3	0.6	1.50	18	6	0.5	SMA	2.200	2.650	0.500
2,000	8,000	4P7	1.0	1.50	18	8	0.5	SMA	2.750	3.500	0.500
2,000	18,000	4P6	2.0	1.60	15	10	0.7	SMA	2.850	2.000	0.380
4,000	8,000	4P4	0.4	1.40	20	4	0.5	SMA	2.000	2.000	0.380
7,000	12,400	4P5	1.0	1.50	16	4	0.5	SMA	1.280	2.750	0.500
8,000	18,000	4PB4	1.5	1.50	18	8	0.5	SMA	2.000	2.000	0.380
12,000	18,000	4PA4	1.5	1.50	18	8	0.5	SMA	2.000	2.000	0.380

Dimensions exclude connectors.

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6-Split Dividers and Combiners

Frequency Range (MC)		Part No.	Insertion Loss (dB)	VSWR (:1)	Isolation (dB)	Phase Balance (deg.)	Loss Balance (dB)	Interface	Length (in)	Width (in)	Depth (in)
700	2,700	6P1	1.1	1.35	22	6	0.4	SMA	3.500	3.000	0.400
700	2,700	6P2	1.1	1.35	22	6	0.4	N	6.000	3.000	0.750

8-Split Dividers and Combiners

Frequency Range (MC)		Part No.	Insertion Loss (dB)	VSWR (:1)	Isolation (dB)	Phase Balance (deg.)	Loss Balance (dB)	Interface	Length (in)	Width (in)	Depth (in)
700	2,700	8P1	1.3	1.40	22	6	0.5	SMA	4.500	3.000	0.400
700	2,700	8P2	1.3	1.40	22	6	0.5	N	8.000	3.000	0.750

9-Split Dividers and Combiners

Frequency Range (MC)		Part No.	Insertion Loss (dB)	VSWR (:1)	Isolation (dB)	Phase Balance (deg.)	Loss Balance (dB)	Interface	Length (in)	Width (in)	Depth (in)
700	2,700	9P1	1.8	1.50	18	8	0.5	SMA	5.000	3.500	0.400
700	2,700	9P2	1.8	1.50	18	8	0.5	N	9.000	3.500	0.750

12-Split Dividers and Combiners

Frequency Range (MC)		Part No.	Insertion Loss (dB)	VSWR (:1)	Isolation (dB)	Phase Balance (deg.)	Loss Balance (dB)	Interface	Length (in)	Width (in)	Depth (in)
700	2,700	12P1	1.5	1.45	18	8	0.5	SMA	6.500	3.500	0.400
700	2,700	12P2	1.5	1.45	18	8	0.5	N	12.000	3.500	0.750

16-Split Dividers and Combiners

Frequency Range (MC)		Part No.	Insertion Loss (dB)	VSWR (:1)	Isolation (dB)	Phase Balance (deg.)	Loss Balance (dB)	Interface	Length (in)	Width (in)	Depth (in)
700	2,700	16P1	1.8	1.50	20	10	0.6	SMA	8.500	3.500	0.400
700	2,700	16P2	1.8	1.50	20	10	0.6	N	16.000	3.500	0.750

Dimensions exclude connectors.

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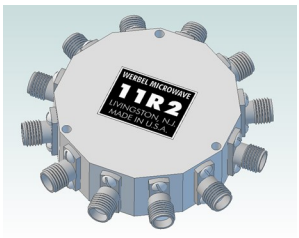
Resistive power dividers offer the advantages of symmetry and operation down to D.C. These are typically used as nodal junctions.



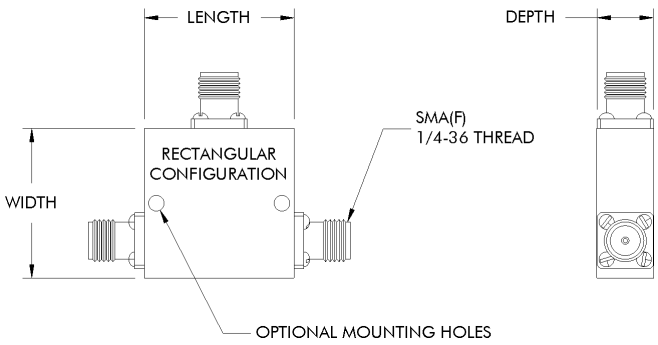
The disadvantages of resistive dividers are higher loss and lack of isolation. However, these products offer an economical solution when the isolation and loss are not critical.

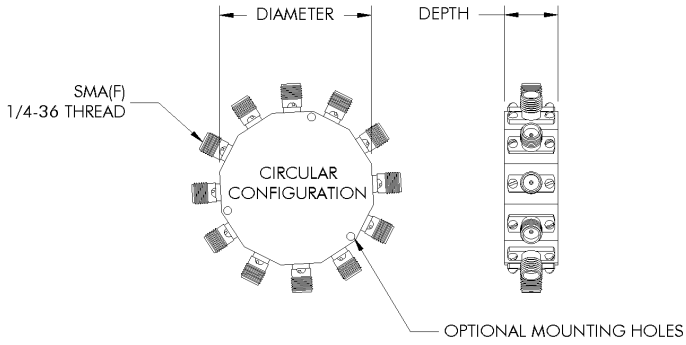
Werbel Microwave's standard line of resistive dividers are rated at an operating power level of 1/2-watt, but requirements of higher power can be met. Contact our sales department.

Resistive

Number of Ports	Frequency Range (MC)		Part No.	Insertion Loss (dB)	VSWR (:1)	Phase Balance (deg.)	Loss Balance (dB)	Interface	Length (in)	Width (in)	Depth (in)
2	DC	4,000	2R1	6.5	1.5	3	0.4	SMA	1.000	1.000	0.380
2	DC	10,000	2RA1	7.0	1.5	5	0.4	SMA	1.000	1.000	0.380
2	DC	18,000	2RB1	7.5	1.5	8	0.5	SMA	1.000	1.000	0.380
2	DC	4,000	2RC1	10	1.5	3	0.4	SMA	1.000	1.000	0.380
2	DC	4,000	2R2	7.5	1.5	3	0.4	SMA	2.000	Circular	0.800
3	DC	4,000	3R1	10	1.5	6	0.5	SMA	1.000	1.000	0.380
3	DC	4,000	3R2	10	1.5	6	0.5	SMA	2.000	Circular	0.800
4	DC	4,000	4R1	12.5	1.5	6	0.5	SMA	1.000	1.000	0.380
4	DC	4,000	4R2	12.5	1.5	6	0.5	SMA	2.000	Circular	0.700
5	DC	4,000	5R2	15	1.5	8	1	SMA	2.000	Circular	0.700
6	DC	4,000	6R2	16	1.8	8	1	SMA	2.000	Circular	0.700
6	DC	4,000	6RA2	20	1.8	8	0.5	SMA	2.000	Circular	0.700
7	DC	4,000	7R2	17	1.8	8	1	SMA	2.000	Circular	0.700
8	DC	4,000	8R2	18.5	1.8	8	1	SMA	2.000	Circular	0.700
8	DC	4,000	8RA2	20	1.8	8	0.5	SMA	2.000	Circular	0.700
9	DC	4,000	9R2	19.5	1.8	8	1	SMA	2.000	Circular	0.700
10	DC	4,000	10R2	20	1.8	8	1	SMA	2.000	Circular	0.700
11	DC	4,000	11R2	21	1.8	8	1	SMA	2.000	Circular	0.700

Dimensions exclude connectors.





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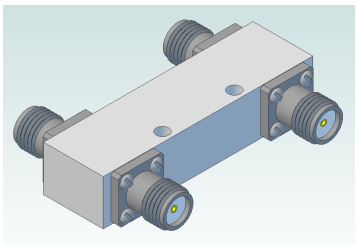
QUADRATURE (90° HYBRID) COUPLERS

Quadrature couplers are often referred to as “hybrids” because they use a structure similar to a directional coupler to fit the applications of a divider/combiner.

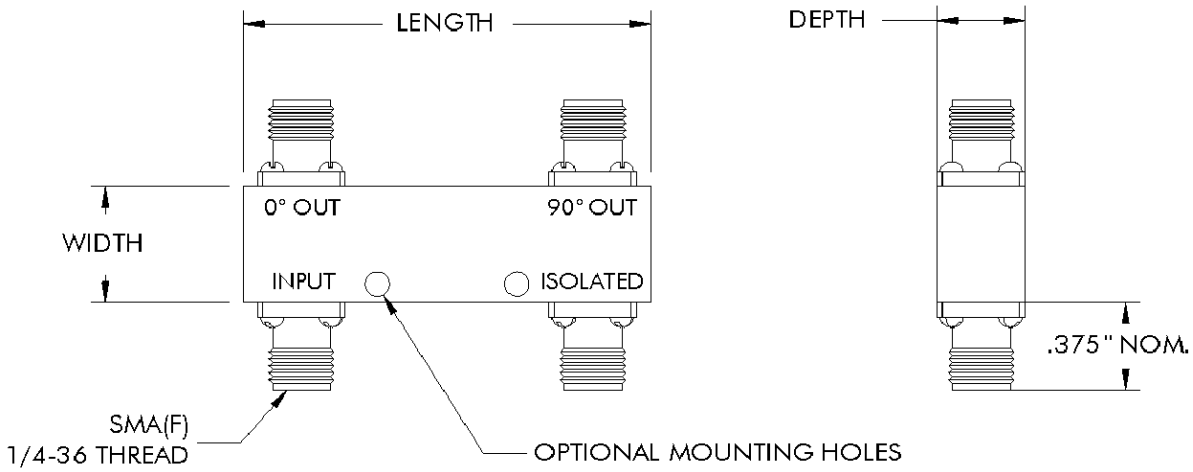
The branches achieve a split equal in amplitude but are 90 degrees apart in phase. These devices have no internal resistors and may be connected to a high-power load at the isolated port. This makes them preferred for combining power amplifiers.



90° Quadrature

Frequency Range (MC)		Part No.	Insertion Loss (dB)	VSWR (:1)	Isolation (dB)	Frequency Sensitivity dB)	Interface	Length (in)	Width (in)	Depth (in)
500	1,000	3Q1	0.1	1.10	18	0.5	SMA	3.060	0.500	0.380
800	2,500	3Q8	0.2	1.30	18	0.8	N	5.000	2.500	1.000
1,000	2,000	3Q2	0.2	1.15	28	0.5	SMA	1.780	0.500	0.380
2,000	4,000	3Q3	0.1	1.20	22	0.5	SMA	1.150	0.500	0.380
2,000	8,000	3Q6	0.3	1.30	17	0.4	SMA	2.600	0.750	0.440
2,600	5,200	3Q4	0.1	1.25	20	0.5	SMA	1.000	0.500	0.380
4,000	8,000	3QA4	0.2	1.25	18	0.5	SMA	1.000	0.500	0.380
4,000	12,400	3Q7	0.5	1.50	15	0.4	SMA	1.720	0.600	0.500
6,000	12,400	3QB4	0.4	1.40	17	0.5	SMA	1.000	0.500	0.380
7,000	18,000	3QA7	0.5	1.50	13	0.7	SMA	1.720	0.600	0.500
7,500	16,000	3Q5	0.4	1.45	15	0.6	SMA	1.000	0.580	0.380
12,000	18,000	3QA5	0.4	1.50	15	0.7	SMA	1.000	0.580	0.380

Dimensions exclude connectors.



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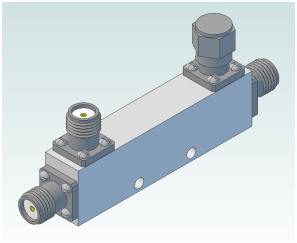
Directional couplers are used in power monitoring applications, feedback loops and low-noise attenuation. The requirement of a directional coupler is to sample a signal at reduced power with minimal insertion loss to the network when connected in one direction.

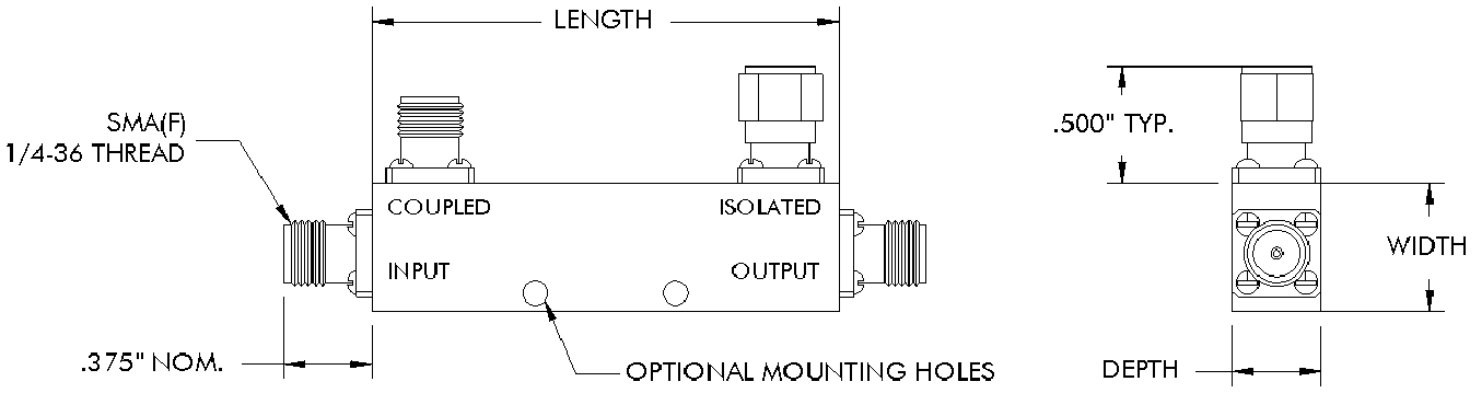


Standard directional couplers are offered in 6, 10, 20 and 30-dB configurations at 50W power handling (at load rated minimum 1.2:1 VSWR). Custom units can be made to fit your electrical and mechanical requirements.

6-dB Directional Couplers

Frequency Range (MC)		Part No.	Coupling Tolerance (±dB)	Insertion Loss (dB)	Directivity (dB)	VSWR (:1)	Interface	Length (in)	Width (in)	Depth (in)
500	1,000	6C13	1.0	1.8	25	1.15	SMA	3.100	0.500	0.380
500	2,000	6C19	1.0	2.0	23	1.20	SMA	3.600	0.530	0.380
800	2,500	6C7	1.0	1.7	20	1.25	SMA	5.240	0.590	0.440
800	2,500	6C20	1.0	1.7	20	1.25	N	4.135	1.190	0.825
1,000	2,000	6C12	1.0	1.8	25	1.15	SMA	1.780	0.500	0.380
1,000	4,000	6C9	1.0	2.0	23	1.20	SMA	2.900	0.680	0.380
2,000	4,000	6C11	1.0	1.8	22	1.15	SMA	1.160	0.500	0.380
2,600	5,200	6C5	1.0	1.4	18	1.25	SMA	1.000	0.500	0.400
4,000	8,000	6CB5	1.0	1.9	20	1.25	SMA	1.000	0.500	0.400
7,000	12,400	6CA5	1.0	1.5	17	1.30	SMA	1.000	0.500	0.400

Dimensions exclude connectors.



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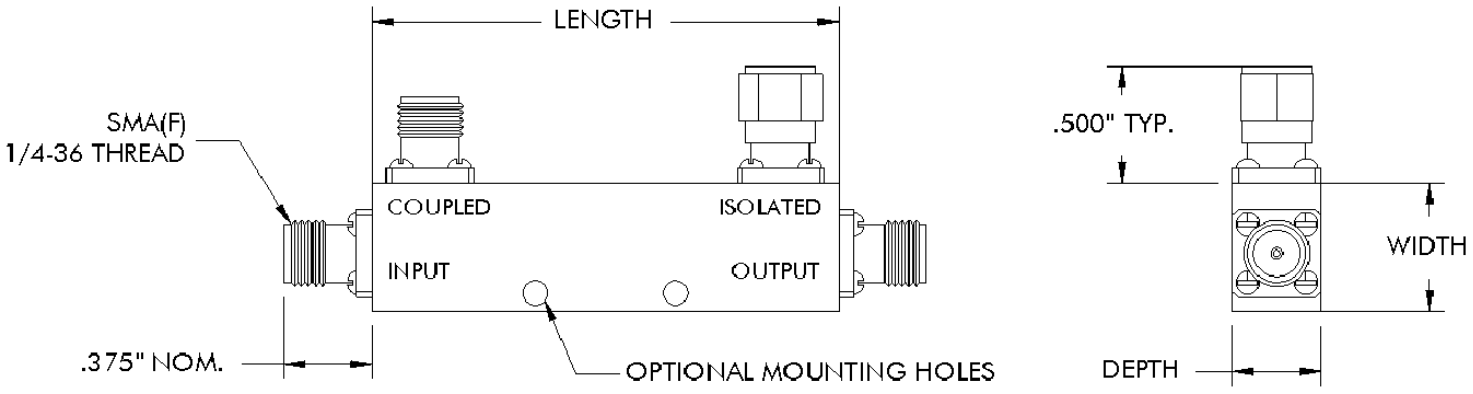
10-dB Directional Couplers

Frequency Range (MC)		Part No.	Coupling Tolerance (±dB)	Insertion Loss (dB)	Directivity (dB)	VSWR (:1)	Interface	Length (in)	Width (in)	Depth (in)
500	1,000	10C13	1.25	0.8	25	1.10	SMA	3.100	0.500	0.380
500	2,000	10C18	1.00	0.9	23	1.20	SMA	3.600	0.550	0.410
600	4,000	10C17	1.25	0.9	18	1.25	SMA	4.400	0.600	0.380
800	2,500	10C7	1.00	0.8	20	1.20	SMA	5.240	0.590	0.440
800	2,500	10C16	1.25	0.8	20	1.25	SMA	3.350	0.590	0.430
1,000	2,000	10C12	1.25	0.8	25	1.10	SMA	1.780	0.500	0.380
1,000	4,000	10C9	1.00	0.9	23	1.20	SMA	2.900	0.680	0.380
2,000	4,000	10C11	1.25	0.7	22	1.15	SMA	1.160	0.500	0.380
2,000	8,000	10C10	1.00	0.9	20	1.25	SMA	1.780	0.680	0.380
2,600	5,200	10C5	1.25	0.8	20	1.25	SMA	1.000	0.500	0.400
4,000	8,000	10CA5	1.25	0.9	20	1.25	SMA	1.000	0.500	0.400
4,000	12,400	10C15	1.00	0.8	17	1.00	SMA	1.220	0.600	0.380
7,000	12,400	10CB5	1.00	0.8	17	1.30	SMA	1.000	0.500	0.400
7,000	18,000	10CE5	1.25	1.1	15	1.35	SMA	1.000	0.500	0.400
7,500	16,000	10CC5	1.25	1.0	12	1.35	SMA	1.000	0.500	0.400
12,400	18,000	10CD5	1.00	1.2	15	1.30	SMA	1.000	0.500	0.400

Dimensions exclude connectors.



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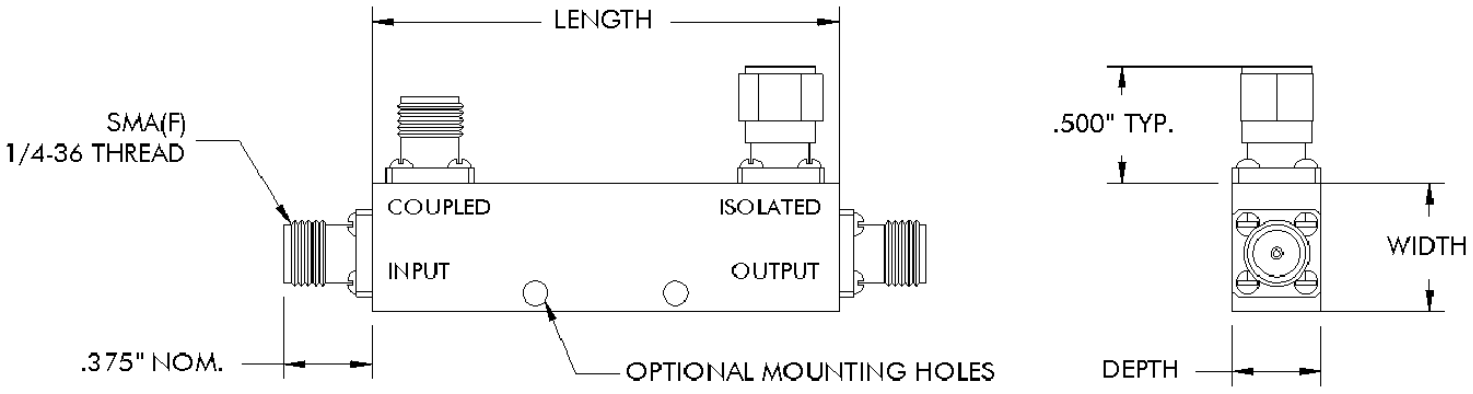
20-dB Directional Couplers

Frequency Range (MC)		Part No.	Coupling Tolerance (±dB)	Insertion Loss (dB)	Directivity (dB)	VSWR (:1)	Interface	Length (in)	Width (in)	Depth (in)
500	1,000	20C13	1.25	0.2	25	1.10	SMA	3.100	0.500	0.380
500	2,000	20C8	1.00	0.4	23	1.20	SMA	3.600	0.600	0.380
800	2,500	20C7	1.00	0.4	20	1.25	SMA	5.240	0.590	0.440
800	2,500	20C16	1.25	0.4	20	1.30	SMA	3.350	0.590	0.430
1,000	2,000	20C12	1.25	0.2	25	1.10	SMA	1.780	0.500	0.380
2,000	4,000	20C11	1.25	0.2	22	1.15	SMA	1.160	0.500	0.380
2,000	8,000	20C14	1.00	0.5	20	1.25	SMA	1.880	0.600	0.380
2,600	5,200	20C5	1.25	0.3	20	1.25	SMA	1.000	0.500	0.400
4,000	8,000	20CA5	1.25	0.3	20	1.25	SMA	1.000	0.500	0.400
4,000	12,400	20C15	1.00	0.5	17	1.30	SMA	1.220	0.600	0.380
7,000	12,400	20C4	1.00	0.4	17	1.30	SMA	1.000	0.550	0.380
7,500	16,000	20C6	1.00	0.5	15	1.40	SMA	1.000	0.600	0.380
12,400	18,000	20CA6	1.25	0.5	15	1.40	SMA	1.000	0.600	0.380

Dimensions exclude connectors.



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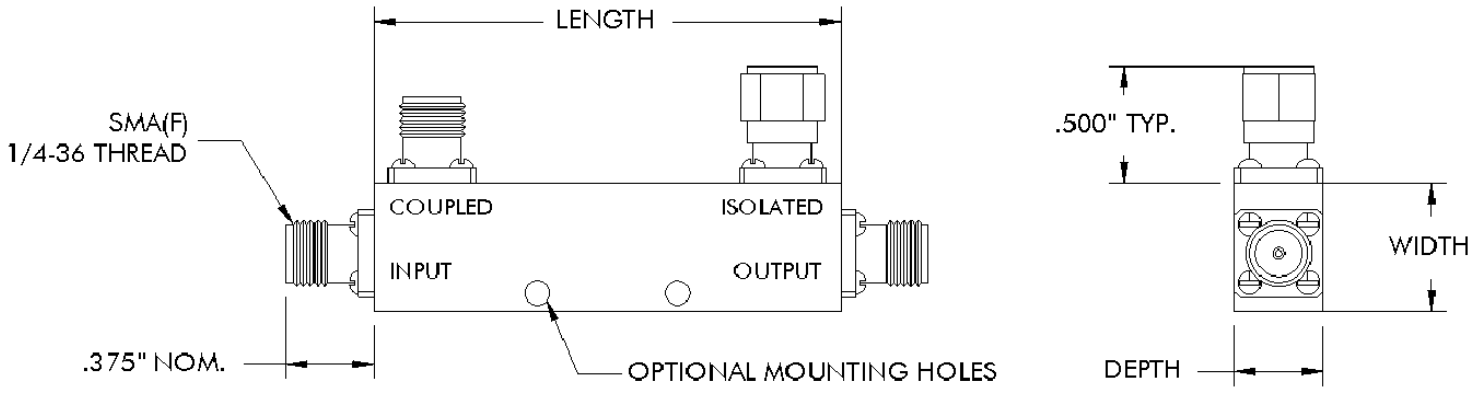
30-dB Directional Couplers

Frequency Range (MC)		Part No.	Coupling Tolerance (±dB)	Insertion Loss (dB)	Directivity (dB)	VSWR (:1)	Interface	Length (in)	Width (in)	Depth (in)
500	1,000	30C3	1.25	0.2	25	1.10	SMA	3.100	0.550	0.380
800	2,500	30C7	1.00	0.4	20	1.25	SMA	5.240	0.590	0.440
1,000	2,000	30C2	1.25	0.2	25	1.10	SMA	1.840	0.590	0.380
2,000	4,000	30C1	1.25	0.2	25	1.10	SMA	1.160	0.550	0.380
2,600	5,200	30C4	1.25	0.2	20	1.25	SMA	1.000	0.550	0.380
4,000	8,000	30C5	1.25	0.3	20	1.25	SMA	1.000	0.500	0.400
7,000	12,400	30CA4	1.00	0.3	17	1.30	SMA	1.000	0.550	0.380
7,500	16,000	30C6	1.25	0.5	15	1.40	SMA	1.000	0.600	0.380
12,400	18,000	30CA6	1.00	0.5	15	1.30	SMA	1.000	0.600	0.380

Dimensions exclude connectors.

Custom Values

Directional couplers of values 6 to 50-dB can be achieved. Contact our sales department today with your requirements.



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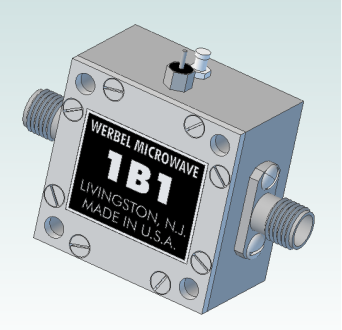
Bias tees are used in systems to merge or separate the analog signal from power supply or logic control voltages.

Bias tee networks are usually integrated into active devices. However, it is often necessary to use them externally in existing systems.

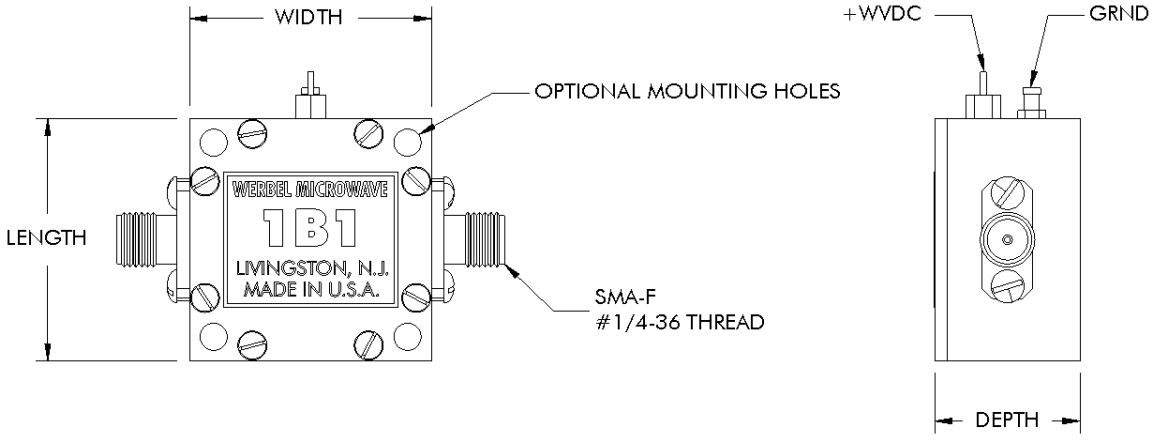
Werbel Microwave can customize packages to your specific connector and mounting requirements.



Bias Tees

Frequency Range (MC)		Part No.	Insertion Loss (dB)	VSWR (:1)	Isolation (dB)	Voltage (WVDC)	Current (mA)	Interface	Length (in)	Width (in)	Depth (in)
10	3,000	1BA1	1.8	1.50	25	50	3,000	SMA	1.250	1.250	0.750
10	4,200	1B3	1.2	1.25	25	75	1,500	N	1.260	1.180	0.790
100	6,000	1BB1	1.5	1.50	30	50	500	SMA	1.250	1.250	0.750
400	10,000	1B1	1.5	1.50	25	50	200	SMA	1.250	1.250	0.750
700	2,700	1BD1	1.0	1.25	30	50	200	SMA	1.250	1.250	0.750
1,000	2,000	1BC1	1.0	1.25	30	50	200	SMA	1.250	1.250	0.750
2,000	4,000	1BE1	1.0	1.25	25	50	200	SMA	1.250	1.250	0.750
4,000	8,000	1BF1	1.2	1.35	25	50	200	SMA	1.250	1.250	0.750

Dimensions exclude connectors.



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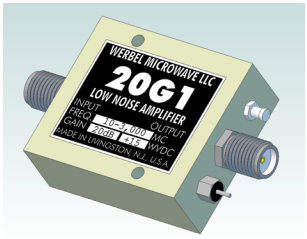
Werbel Microwave's line of small signal amplifiers cover general-purpose cellular applications up to 0.5W power output.



General purpose gain blocks are suitable for broadband applications to add gain to a system. When narrow-band, low noise figure is critical, please select from our list of low-noise amplifier designs. Amplifiers can be tuned and optimized to your operating frequency.

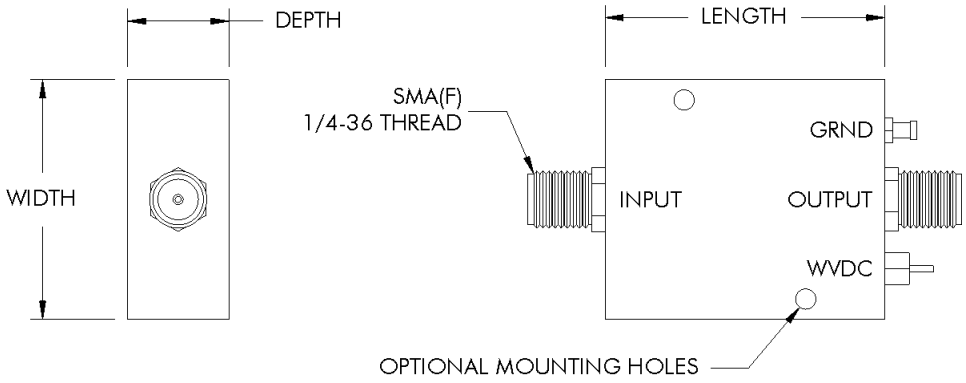
Below is a sample of Werbel Microwave's capabilities. Custom requirements of frequency bands, connector types, monitoring and control loops, and shutoff features are within our design expertise.

General-Purpose Gain Blocks (Broadband)

Frequency Range (MC)		Part No.	Signal Gain (±dB)	Noise Figure (dB)	Input VSWR (:1)	Output P-1dB (+dBm)	Output I.P.3 (+dBm)	Power Source (V / mA)		Interface	Length (in)	Width (in)	Depth (in)
100	3,000	12G1	12	7.0	1.80	10	33	9-15	140	SMA	1.380	1.180	0.500
100	3,000	14G1	14	3.4	1.50	10	33	12-18	140	SMA	1.380	1.180	0.500
100	3,000	18G1	18	7.0	1.50	16	30	9-15	120	SMA	1.380	1.180	0.500
100	3,000	20G1	20	5.0	1.50	13	27	9-15	150	SMA	1.380	1.180	0.500
200	2,500	19G1	19	7.0	1.80	15	29	9-15	120	SMA	1.380	1.180	0.500

Dimensions exclude connectors.

Housing style No.1 shown for illustration purposes. Custom configurations available.



Low-Noise Amplifiers (Narrowband)

Frequency Range (MC)		Part No.	Signal Gain (±dB)	Noise Figure (dB)	Input VSWR (:1)	Output P-1dB (+dBm)	Output I.P.3 (+dBm)	Power Source (V / mA)		Interface	Length (in)	Width (in)	Depth (in)
800	960	15L1	15	1.0	1.50	18	33	9-15	150	SMA	1.380	1.180	0.500
800	960	19L1	19	0.8	1.50	16	30	9-15	150	SMA	1.380	1.180	0.500
800	960	45L1	45	2.1	1.50	20	35	9-15	300	SMA	1.380	1.180	0.500

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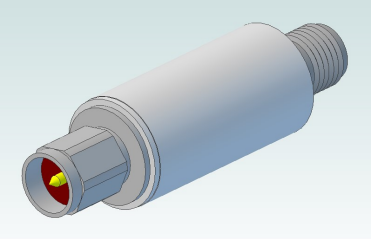
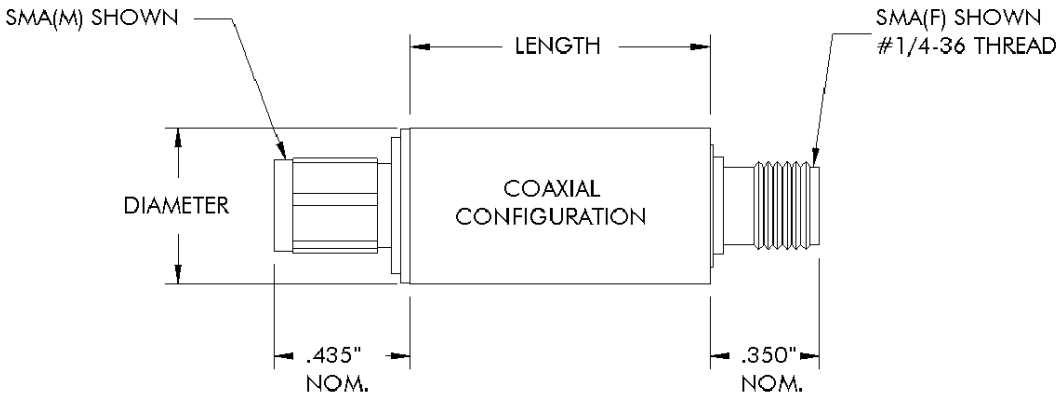
Fixed attenuators reduce the signal power level by an amount determined by its construction. These are used to protect sensitive devices and to provide VSWR matching between active stages.

Attenuators are readily available in standard values of 3, 6, 10, 20 and 30-dB. Any value between 1 to 40-dB may be ordered. Custom connector configurations are available upon request. Contact our sales department with your requirements.



SMA Attenuators

Frequency Range (MC)		Part No.	Value (dB)	Tolerance (±dB)	VSWR (:1)	CW Power (W)	Interface 1	Interface 2	Length (in)	Width (in)	Depth (in)
DC	4,000	3A1	3	0.5	1.3	2	SMA-M	SMA-F	1.000	Tubular	0.500 dia.
DC	4,000	6A1	6	0.5	1.3	2	SMA-M	SMA-F	1.000	Tubular	0.500 dia.
DC	4,000	10A1	10	1.0	1.3	2	SMA-M	SMA-F	1.000	Tubular	0.500 dia.
DC	4,000	20A1	20	1.0	1.3	2	SMA-M	SMA-F	1.000	Tubular	0.500 dia.
DC	4,000	30A1	30	1.5	1.4	2	SMA-M	SMA-F	1.000	Tubular	0.500 dia.



N Attenuators

Frequency Range (MC)		Part No.	Value (dB)	Tolerance (±dB)	VSWR (:1)	CW Power (W)	Interface 1	Interface 2	Length (in)	Width (in)	Depth (in)
DC	4,000	3A2	3	0.5	1.3	2	N-M	N-F	2.500	1.000	1.000
DC	4,000	6A2	6	0.5	1.3	2	N-M	N-F	2.500	1.000	1.000
DC	4,000	10A2	10	1.0	1.3	2	N-M	N-F	2.500	1.000	1.000
DC	4,000	20A2	20	1.0	1.3	2	N-M	N-F	2.500	1.000	1.000
DC	4,000	30A2	30	1.5	1.4	2	N-M	N-F	2.500	1.000	1.000

Dimensions exclude connectors.

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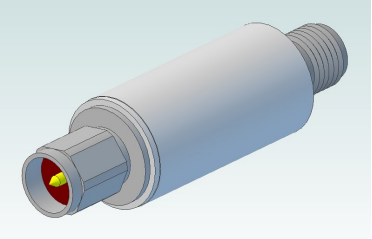
D.C. blocks prevent direct current flow while allowing uninhibited signal transmission. They are available in interior, exterior and interior/exterior blocking configurations.

The following represents a sample of what Werbel Microwave offers. Custom size and connector configurations are available.



Interior

Frequency Range (MC)		Part No.	Insertion Loss (±dB)	VSWR (:1)	CW Power (W)	Voltage (WVDC)	Interface 1	Interface 2	Length (in)	Width (in)	Depth (in)
700	2,700	1D1	1	1.5	2	50	SMA-M	SMA-F	1.000	Tubular	0.500 dia.
700	2,700	1D2	0.5	1.3	100	2.5k	N-M	N-F	2.500	1.000	1.000
700	2,700	1D3	0.5	1.3	200	2.5k	DIN-M	DIN-F	2.500	1.500	1.500

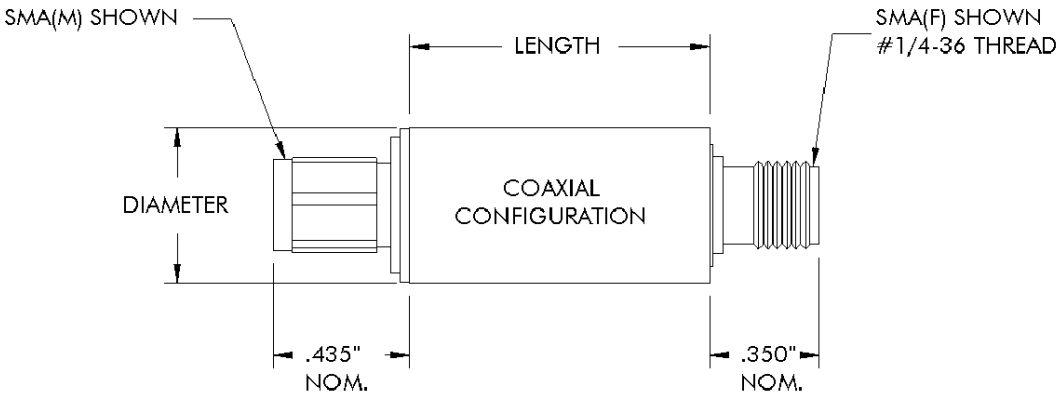
Exterior

Frequency Range (MC)		Part No.	Insertion Loss (±dB)	VSWR (:1)	CW Power (W)	Voltage (WVDC)	Interface 1	Interface 2	Length (in)	Width (in)	Depth (in)
700	2,700	2D1	1	1.5	2	50	SMA-M	SMA-F	1.000	Tubular	0.500 dia.

Interior/Exterior

Frequency Range (MC)		Part No.	Insertion Loss (±dB)	VSWR (:1)	CW Power (W)	Voltage (WVDC)	Interface 1	Interface 2	Length (in)	Width (in)	Depth (in)
700	2,700	3D1	1	1.5	2	50	SMA-M	SMA-F	1.000	Tubular	0.500 dia.

Dimensions exclude connectors.



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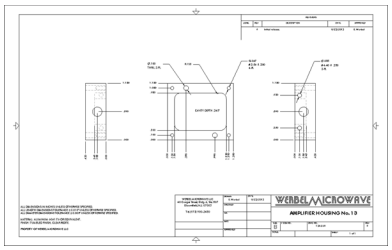
Design and Manufacturing Engineering

Consider Werbel Microwave for assistance when you require design and technical expertise without manufacturing. Werbel Microwave specializes in passive-RF to 20-GHz and active-RF to 3-GHz operation. Specialized applications including logic and analog control are within our capability.

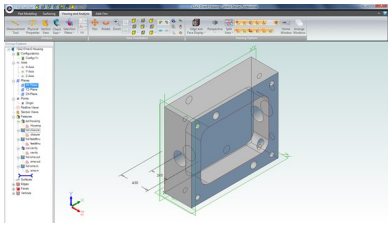
Werbel Microwave can offer any or all parts of engineering as a package, ready to hand off to your production team. Below are some of the consulting services we offer:

- Electrical Schematics
- Electrical Wiring Diagrams
- PCB Layouts
- Bill of Materials
- Part Sourcing
- Production Cost Analysis
- Contract Manufacturing
- Mechanical Enclosure Drawings
- Final and Subassembly Drawings
- Written Assembly and Test Procedures
- Compliant with ISO protocol
- Datasheets and Marketing Material
- Owner's and Operator's Manuals

A good design is only part of the effort. It must be packaged and produced in such a way that all stakeholders benefit. From employee training to project oversight, Werbel Microwave offers on-site, technical support to ensure that your team is equipped to produce, test and ship the final product.



Mechanical Blueprints



Solid Models with 3D CAD

Bill of Materials Report

Assembly No.						13A2
Revision						0
Date						9/23/2013
Build Qty						1

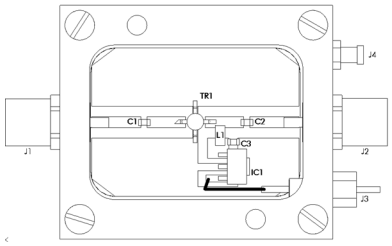
Item	Part No./Rev.	Description	Vendor	Reference	Qty Ea.	Qty. Total
1	13A2-01	Housing		HSG	1	1
2	13A2-02	Cover		CVR	1	1
3	S-0256-0250-F	#2-56x1/4 Slot Flat Machine SS		-	4	4
4	13A2-31	PC Board, Blank		PCB	1	1
5	S-0256-0125-R	#2-56x1/8 Slot Round Machine SS		-	4	4
6	OL-1207-36	SMA-female Torque-in connector	Santron	J1,J2	2	2
7	4400-041	Bias Feed-Thru #4-40	Tusonix	J3	1	1
8	1563	Turret Ground Terminal #4-40	Keystone	J4	1	1
9	SGA4586Z	MMIC	RFMD	TR1	1	1
10	MC78L05ACHX	Voltage Regulator, SOT-89	Fairchild	IC1	1	1
11	L0805101	Inductor, 100nHy, 0805	Coilcraft	L1	1	1
12	C0603101	Condenser, 100 pFd, 0603	ATC/AVX	C1,C2,C3	3	3

Bill of Materials with
Part Sourcing and Cost Analysis

PCB Prototyping

Werbel Microwave has the ability to prototype printed circuit boards, with next-day service to most areas. Our applications include microstrip, stripline and double-sided (unplated) through-hole.

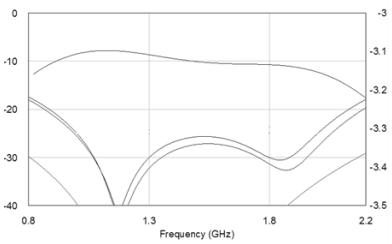
Our PCB router/engraver can handle all standard hardboard materials, and soft materials. Trace and gap widths down to .010" are possible. Drilled holes and cutouts optional.



Assembly Drawings

Contract Manufacturing

Werbel Microwave can assist during times of peak workload. We are equipped to handle most types of assembly including SMT, RF cable assembly, electrical wiring harness and through-hole.



R.F. and Analog Circuit Simulation

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V.S.W.R. versus Return Loss

$$RL(dB) = -20\log\left(\frac{VSWR+1}{VSWR-1}\right)$$

V.S.W.R.	Return Loss (dB)	V.S.W.R.	Return Loss (dB)	V.S.W.R.	Return Loss (dB)	V.S.W.R.	Return Loss (dB)	V.S.W.R.	Return Loss (dB)
1.000	-Infinite	1.110	-25.658	1.310	-17.445	1.550	-13.324	2.600	-7.044
1.001	-66.025	1.120	-24.943	1.320	-17.207	1.600	-12.736	2.700	-6.755
1.002	-60.009	1.130	-24.289	1.330	-16.977	1.650	-12.207	2.800	-6.490
1.003	-56.491	1.140	-23.686	1.340	-16.755	1.700	-11.725	2.900	-6.246
1.004	-53.997	1.150	-23.127	1.350	-16.540	1.750	-11.285	3.000	-6.021
1.005	-52.063	1.160	-22.607	1.360	-16.332	1.800	-10.881	3.500	-5.105
1.006	-50.484	1.170	-22.120	1.370	-16.131	1.850	-10.509	4.000	-4.437
1.007	-49.149	1.180	-21.664	1.380	-15.936	1.900	-10.163	4.500	-3.926
1.008	-47.993	1.190	-21.234	1.390	-15.747	1.950	-9.842	5.000	-3.522
1.009	-46.975	1.200	-20.828	1.400	-15.563	2.000	-9.542	6.000	-2.923
1.010	-46.064	1.210	-20.443	1.410	-15.385	2.050	-9.262	7.000	-2.499
1.020	-40.086	1.220	-20.079	1.420	-15.211	2.100	-8.999	8.000	-2.183
1.030	-36.607	1.230	-19.732	1.430	-15.043	2.150	-8.752	9.000	-1.938
1.040	-34.151	1.240	-19.401	1.440	-14.879	2.200	-8.519	10.000	-1.743
1.050	-32.256	1.250	-19.085	1.450	-14.719	2.250	-8.299	20.000	-0.869
1.060	-30.714	1.260	-18.783	1.460	-14.564	2.300	-8.091	30.000	-0.579
1.070	-29.417	1.270	-18.493	1.470	-14.412	2.350	-7.894	40.000	-0.434
1.080	-28.299	1.280	-18.216	1.480	-14.264	2.400	-7.707	50.000	-0.347
1.090	-27.318	1.290	-17.949	1.490	-14.120	2.450	-7.529	80.000	-0.217
1.100	-26.444	1.300	-17.692	1.500	-13.979	2.500	-7.360	100.000	-0.174

January

			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

February

						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

March

						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

April

		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

May

				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

June

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

July

		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

August

					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

September

	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

October

			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

November

						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

December

	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

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sales@werbelmicrowave.com · www.werbelmicrowave.com

Power Conversion											
dBm	mW	dBm	mW	dBm	mW	dBm	W	dBm	W	dBm	W
0	1.0	10	10	20	100	30	1.0	40	10	50	100
1	1.3	11	13	21	126	31	1.3	41	13	51	126
2	1.6	12	16	22	158	32	1.6	42	16	52	158
3	2.0	13	20	23	200	33	2.0	43	20	53	200
4	2.5	14	25	24	251	34	2.5	44	25	54	251
5	3.2	15	32	25	316	35	3.2	45	32	55	316
6	4.0	16	40	26	398	36	4.0	46	40	56	398
7	5.0	17	50	27	501	37	5.0	47	50	57	501
8	6.3	18	63	28	631	38	6.3	48	63	58	631
9	7.9	19	79	29	794	39	7.9	49	79	59	794

Insertion Loss due to Splitting	
Number of Splits	Loss (dB)
2	-3.01
3	-4.77
4	-6.02
6	-7.78
8	-9.03
9	-9.54
12	-10.79
16	-12.04

Insertion Loss due to Coupling	
Coupling Value (dB)	Coupling Loss (dB)
3	3.00
6	1.25
10	0.458
20	0.0435
30	0.00435

Power in dBm, referenced to 1mW.

$$P(dBm) = 10\log\left(\frac{P(mW)}{1mW}\right)$$

Power in mW, given dBm.

$$P(mW) = 10^{dBm/10}$$

Power in W, given dBm.

$$P(W) = {10^{dBm/10}}/{1{,}000}$$

Gain in terms of Power Ratio

Where P_{out} and P_{in} are of identical units.

$$A(dB) = 10\log\left(\frac{P_{out}}{P_{in}}\right)$$

Loss from Power Splitting

Where N = number of split ports.

$$A(dB) = 10\log\left(\frac{1}{N}\right)$$

Insertion Loss due to Coupling

Where P_{out} and P_{in} are of identical units.

$$L(dB) = -10\log\left(1 - \frac{P_{Coupled}}{P_{In}}\right)$$

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TERMS AND CONDITIONS

These terms and conditions of sale ("Terms and Conditions") relate to certain goods and services provided ("Products") by Werbel Microwave, LLC, a New Jersey limited liability company, ("Company") to the purchaser of such goods and services ("Customer"). Any additional or different terms, including but not limited to those on Customer's purchase order, are hereby objected to and specifically rejected by Company.

A. PAYMENT
All amounts payable to Company shall be in U.S. Dollars, including all applicable taxes, fees, transportation, insurance and other charges. Company will invoice Customer for each shipment. If all products in Customer's purchase order are not shipped at the same time, Company will invoice Customer at the time of shipment for the Products that are shipped. All payments in U.S. dollars, are due net 30 calendar days after the date of invoice unless otherwise mutually agreed. Any unpaid amounts will be subject to interest at 1.5% per month or the highest rate permitted by law, whichever is less. Any returned checks are subject to a $50 fee. Should any action be necessary to recover any sum due to Company from Customer, Company shall be entitled to recover costs of such action including reasonable attorneys' fees whether or not incurred in connection with issues of federal bankruptcy law. **Shipping allowances and prices are subject to change without notice.** Company cannot guarantee the pricing set forth in this catalog or on the Company website. The Company is not responsible for any typographical errors contained therein. Company retains title to all Products until Company receives full payment. Customer is responsible for any loss or damage to the Products until Company receives full payment. If Customer does not make payment in accordance with the terms of the payment specified or if the Company has any doubt as to the Customer's financial responsibility, Company may, at its option, (i) cancel the purchase order or (ii) refuse to perform any further work under the purchase order unless Customer immediately pays for all Products that have been delivered and pays in advance for all Products to be delivered. Any remedies contained in this Section 1 shall be in addition to any remedies at equity or law.

B. SHIPPING AND DELIVERY
Shipment will be made in accordance with instructions issued by Company's shipping department. Customer assumes risk of all loss and damage resulting from any cause whatsoever when the Products are delivered to carrier, to Customer, or to Customer's agent, whichever occurs first. All required shipping costs, insurance, export/import duties, taxes (foreign and domestic) and any other related costs and risks consistent with the designated shipping method shall be borne by Customer for delivery of the Products to Customer's chosen destination. Shipping dates are approximate and not guaranteed. Partial deliveries shall be accepted by Customer and paid for at contract prices and terms.

C. WARRANTY AND PRODUCT RETURNS
All Product orders are subject to written acceptance by Company by a duly authorized agent of Company. Orders accepted and processed by Company are Non-Cancelable and Non-Refundable without exception. All sales are final. All Products are covered by a Limited Warranty for a period of 90 days from the date of purchase which applies to defective Products only. Company expressly disclaims all other warranties of any kind, whether expressed or implied, including, but not limited to, implied warranties or merchantability and fitness for a particular purpose. Company will only accept return of defective Products, and are subject to pre-approval by Company in writing with an RMA (Return Material Authorization) number must be issued by Company before Company will accept such return. Return shipments not pre-approved by Company will be refused. Company will inspect pre-approved returns to determine whether they are defective, which determination by Company is final. Products must be returned in the same or equivalent container and packaging materials in which they were originally shipped. Customer retains title to any Products returned. Return shipping or freight cost is the responsibility of Customer. In Company determines a product is defective, it may repair or replace the defective Product.

D. TOLERANCES
All dimensions displayed in the Company catalog, datasheets, web site or other technical drawings or documentation have a standard length dimension tolerance of ± .010" and a standard diameter tolerance of ± .005", whichever is applicable. All cable assemblies have a standard cable length tolerance of ± 1.5% or 3/8" whichever is greater.

E. LIMITATION OF LIABILITY
Company's liability on any claim of any kind, including negligence, for any loss or damage arising out of, connected with, or resulting from the manufacture, sale, delivery, resale repair or use of any Products covered by or Furnished hereunder shall in no case exceed the lesser of the cost of repairing or replacing Products failing to conform to the warranties connected herein, if any, or the price of Products or part thereof which gives rise to the claim. In no event will Company be liable for any direct, indirect incidental, special or contingent damages, including, but not limited to, damaged for loss of profits, goodwill, use or other intangible loss (even if Company has been advised of the possibility of such damaged), resulting from: (i) the use or inability to use Products purchased from the Company; (ii) the cost of procurement of substitute products resulting from any Products purchased or obtained from Company; or (iii) any other matter relating to products purchased from Company.

F. U.S. GOVERNMENT CONTRACTS
If Customer's order is placed under a contract with the United States Government, Company agrees to comply with those contract provisions and regulations with which, pursuant to law, it must comply anmd of which Customer has, at the time of porder placement, placed Company on notice. In no event will United States Government Cost Accounting Standards apply. No provision of Customer's contract with the government will be binding on Company except as expressly set forth in this paragraph.

G. INDEMNIFICATION
Customer agrees to defend and indemnify Company and its officers, directors, agents and employees of and from any and all claims or liabilities asserted against Company or its officers, directors, agents and employees in connection with the manufacture, sale , delivery resale or repair or use of any Products covered by or furnished hereunder arising in whole or in part out of or by reason of (i) the failure of Customer, its agents, servants, employees or customers to follow instructions, warnings or recommendations furnished by Company in connection with such Products, (ii) the failure of Customer, its agents, servants, employees or customers to comply with all federal, state and local laws applicable to such goods, or the use thereof, including the Occupational Safety and Health Act of 1970, (iii) the negligence of Customer, its agents, servants, employees or customers, or (iv) any defect, including but not limited to defects in the manufacture or design, of any Products produced, manufactured, distributed, sold, resole, repaired or used by Customer or its agents, servants, employees or customers.

H. TAXES AND DUTIES
All prices are exclusive of all taxes and import or export duties, imposed by any city, state, federal or other government authority. Liability for all taxes and import or export duties shall be assumed and paid by Customer. Customer further agrees to defend and indemnify Company against any and all liabilities for such taxes or duties and legal fees or costs incurred by Company in connection therewith. Any Customer that is located in New Jersey must remit sales tax with any purchase order unless a valid New Jersey Resale Certificate has been provided.

I. ASSISATNCE AND ADVICE
Upon request, Company in its sole and absolute discretion may furnish as an accommodation to Customer such technical advice or assistance as is available in reference to the Products. Company assumes no obligation or liability for the advice or assistance given or results obtained, all such advice or assistance being given and accepted at Customer's sole risk.

J. INTELLECTUAL PROPERTY
All designs, data, drawings, software, or other technical information supplied by Company to Customer in connection with the sale of Products shall remain Company's sole property. All specifications, drawings, designs data, information, ideas, methods, patterns, and/or inventions made, conceived, developed, or acquired by Company, incident to procuring and/or carrying out the delivery of Products to Customer will vest In and inure to Company's sole benefit. Customer agrees that it will not use in any way Company's trademarks and trade names, and it will not publish, or cause or permit to be published any statement, or encourage or approve any advertising or practice, which may be detrimental to the good name, trademarks, goodwill or reputation of Company or the Products.

K. FORCE MAJEURE
Company shall not be liable for delays in delivery or failure to manufacture or deliver due to causes beyond its reasonable control, including but not limited to acts of God, acts of Customer, acts of military or civil authorities, fires, strikes, flood, epidemic, war, riot, accident, delays in transportation, or inability to obtain necessary labor, materials, components or services through Company's usual and regular sources at usual and regular prices.

L. EXPORT COMPLIANCE
Customer shall not, directly or indirectly, export, re-export, transfer, furnish or ship Products in violation of nay applicable export control laws or regulations of any country having jurisdiction over the Products, including any and all U.S. law or U.S. Government export controls. Customer agrees, at Customer's own expense, to comply with all applicable export laws and will, in accordance with the indemnification provisions of these Terms and Conditions, indemnify, defend and hold Company harmless from any claim against Company due to Customer's violation or alleged violation of any export laws.

M. GOVERNING LAW, VENUE AND JURISDICTION
All Product purchases and these Terms and Conditions are governed by the laws of the State of New Jersey without reference to conflict of law principles. The federal and state courts within Essex County, New Jersey will have exclusive jurisdiction to adjudicate any dispute arising out of these Terms and Conditions, or the purchase, sale and usage of any Products.

N. NON-WAIVER/SEVERABILITY
Each provision of these Terms and Conditions is severable from any and all other provisions of these Terms and Conditions. In the event that any provision of these Terms and Conditions is held to be invalid, the other provisions shall continue in force and effect, and the offending provision, to the extent practicable, shall be reformed so as to achieve its intended purpose.

O. SURVIVAL
The provisions of these Terms and Conditions that, by their essence and context, are intended to survive performance by either or both parties shall also survive the completion, expiration, termination or cancellation of the purchase order.

P. ENTIRE AGREEMENT/MODIFICATION
This agreement constitutes the entire contract between Customer and Company relating to the Products identified herein. No modifications hereof shall be binding upon Company unless in writing and signed by Company's duly authorized representative, and no modification shall be effected by Company's acknowledgement or acceptance of Customer's purchase order forms containing different provisions. These Terms and Conditions shall solely and exclusively apply to all sales of Products and shall NOT be revised, modified or overridden by any terms and conditions obtained in any Customer purchase order or other documentation or communication. Trade usage shall neither be applicable nor relevant to these Terms and Conditions, nor be used in any manner whatsoever to explain, qualify or supplement any of the provisions hereof. No waiver by either party of default shall be deemed a waiver of any subsequent default.

Q. SPECIFICATIONS
Specifications on all Products are subject to change without notice.

Effective Date: 1/25/2014

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