

# Surface Mount Directional Coupler

## ADC-6-13+

50Ω 200 to 1300 MHz

### Maximum Ratings

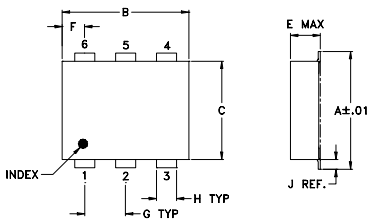
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C

Permanent damage may occur if any of these limits are exceeded.

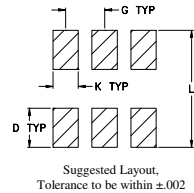
### Pin Connections

INPUT	1
OUTPUT	6
COUPLED	3
GROUND	2
50Ω TERM EXTERNAL	4
GROUND or NO CONNECTION	5

### Outline Drawing



### PCB Land Pattern



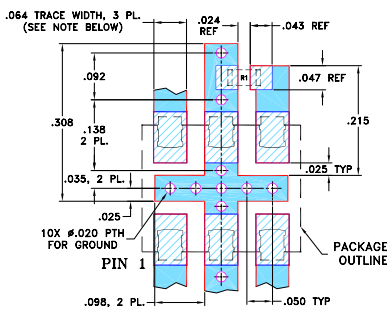
### Outline Dimensions (inch/mm)

A	B	C	D	E	F	G
.272	.310	.220	.100	.112	.055	.100
6.91	7.87	5.59	2.54	2.84	1.40	2.54

H	J	K	L	wt
.030	.026	.065	.300	grams
0.76	0.66	1.65	7.62	0.20

### Demo Board MCL P/N: TB-05 Suggested PCB Layout (PL-041)



- NOTES:
- TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
  - BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
- DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

### Notes

- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuit's standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuit's website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)

### Features

- wideband, 200-1300 MHz
- excellent VSWR: 1.3:1 typ.
- excellent coupling flatness, ±0.5 typ.
- aqueous washable
- protected by U.S. Patents 6,133,525 & 6,140,887

### Applications

- cellular
- VHF/UHF receivers



Generic photo used for illustration purposes only  
CASE STYLE: CD542

### +RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Available Tape and Reel at no extra cost

Reel Size	Devices/Reel
7"	20, 50, 100, 200
13"	500, 1000

### Directional Coupler Electrical Specifications

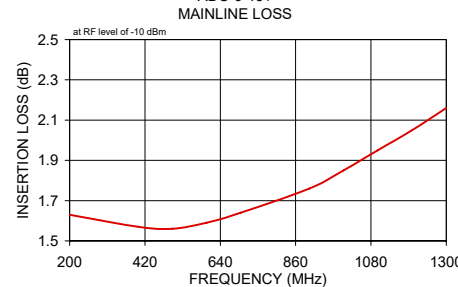
FREQ. (MHz)	COUPLING (dB)		MAINLINE LOSS <sup>1</sup> (dB)		DIRECTIVITY (dB)		VSWR (:1)	POWER INPUT, W	
	Nom.	Flatness	Typ.	Max.	Typ.	Min.		Typ.	L Max.
f <sub>c</sub> -f <sub>u</sub>									
200-1300	6.2±0.5	±0.9	1.8	2.5	17	10	1.3	0.5	0.5

1. Mainline loss includes theoretical power loss at coupled port.

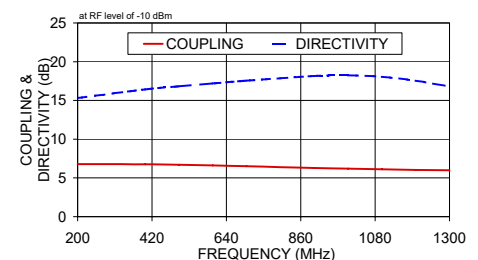
### Typical Performance Data

Frequency (MHz)	Mainline Loss (dB) In-Out	Coupling (dB) In-Cpl	Directivity (dB)	Return Loss (dB)		
				In	Out	Cpl
200.00	1.63	6.78	15.32	16.16	16.80	16.37
400.00	1.57	6.77	16.43	19.27	20.03	18.22
500.00	1.56	6.70	16.81	20.80	20.81	18.74
600.00	1.59	6.61	17.19	22.02	21.37	18.95
700.00	1.64	6.52	17.56	22.08	21.46	19.14
900.00	1.76	6.29	18.16	20.57	20.96	20.03
1000.00	1.85	6.20	18.24	19.80	21.45	20.54
1100.00	1.95	6.11	18.05	18.83	19.86	21.08
1200.00	2.05	6.04	17.55	17.57	19.28	21.80
1300.00	2.16	5.98	16.79	16.32	18.80	22.81

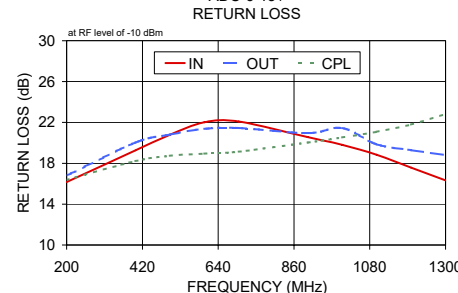
ADC-6-13+ MAINLINE LOSS



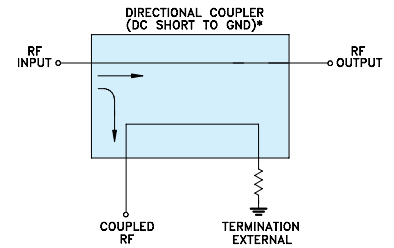
ADC-6-13+ COUPLING & DIRECTIVITY



ADC-6-13+ RETURN LOSS



### Electrical Schematic



\* ELECTRICAL SCHEMATIC IS FOR DIRECTIONAL COUPLER WITH INTERNAL TRANSFORMER(S) AND EXTERNAL TERMINATION.



# Directional Coupler

# ADC-6-13+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = +25°C

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
				IN	OUT	CPL
10	8.00	9.27	6.79	1.77	1.06	1.82
25	3.84	6.60	8.01	5.50	3.63	5.65
50	2.35	6.48	10.37	9.71	7.46	9.89
75	1.95	6.59	12.05	12.31	10.33	12.45
100	1.80	6.66	13.09	14.03	12.45	14.11
125	1.72	6.69	13.74	15.24	14.09	15.28
150	1.67	6.72	14.17	16.20	15.42	16.17
175	1.64	6.73	14.45	16.96	16.53	16.88
200	1.62	6.74	14.64	17.61	17.48	17.48
225	1.61	6.74	14.78	18.15	18.30	17.99
250	1.60	6.74	14.88	18.64	19.03	18.45
275	1.59	6.75	14.93	19.08	19.69	18.87
300	1.58	6.73	14.97	19.47	20.28	19.27
350	1.58	6.71	15.01	20.15	21.35	19.98
400	1.58	6.68	15.01	20.76	22.35	20.67
450	1.59	6.64	14.99	21.25	23.26	21.29
500	1.60	6.60	15.01	21.62	24.25	21.88
550	1.62	6.55	15.00	21.95	25.28	22.47
600	1.65	6.50	15.00	22.21	26.45	23.06
650	1.68	6.45	15.01	22.49	27.68	23.69
700	1.71	6.39	15.08	22.70	29.29	24.34
750	1.74	6.33	15.24	23.03	31.29	25.09
800	1.77	6.27	15.36	23.37	33.78	26.00
850	1.80	6.21	15.52	23.82	37.93	27.09
900	1.84	6.15	15.76	24.42	45.03	28.48
950	1.87	6.09	16.10	25.18	47.44	30.23
1000	1.90	6.05	16.51	26.19	38.38	32.36
1050	1.94	6.01	17.09	27.24	33.54	34.26
1100	1.98	5.97	17.65	28.53	30.52	32.83
1150	2.01	5.94	18.54	28.98	27.92	29.58
1200	2.04	5.93	19.62	27.66	25.85	26.12
1250	2.08	5.94	21.05	25.35	24.12	23.15
1300	2.12	5.98	22.87	22.71	22.53	20.60
1350	2.16	6.03	24.85	20.10	21.13	18.34
1400	2.21	6.15	25.95	17.85	19.89	16.28
1450	2.27	6.30	24.08	15.72	18.72	14.46
1500	2.35	6.51	20.59	13.85	17.64	12.81
1600	2.58	7.18	14.42	10.65	15.73	9.95
1700	2.96	8.32	9.36	8.14	14.20	7.65
1800	3.50	10.06	4.84	6.25	13.01	5.91
1900	4.16	12.49	0.48	4.97	12.09	4.74
2000	4.82	15.63	4.04	4.22	11.43	4.08
2100	5.35	18.09	7.35	3.94	10.76	3.88
2200	5.59	17.49	7.19	4.03	10.03	4.06
2300	5.57	14.38	3.90	4.50	9.24	4.62
2400	5.63	11.27	0.89	4.98	8.68	5.17
2500	6.36	9.21	7.73	4.65	9.10	4.67
2600	7.80	8.55	13.24	3.89	10.41	3.73
2700	9.02	8.57	8.09	3.48	11.70	3.24
2800	9.72	8.88	4.53	3.45	12.41	3.19
2900	9.87	9.03	2.47	3.59	12.37	3.28
3000	9.79	9.47	0.74	3.84	11.82	3.46

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# Directional Coupler

# ADC-6-13+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = -40°C

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
				IN	OUT	CPL
10	8.08	9.36	6.78	1.74	1.05	1.78
25	3.91	6.66	7.98	5.44	3.62	5.56
50	2.39	6.50	10.31	9.60	7.41	9.70
75	1.98	6.61	12.02	12.08	10.18	12.23
100	1.82	6.67	13.08	13.67	12.16	13.91
125	1.73	6.70	13.69	14.84	13.75	15.12
150	1.67	6.72	14.11	15.84	15.16	16.03
175	1.63	6.72	14.45	16.66	16.33	16.73
200	1.60	6.73	14.69	17.28	17.23	17.30
225	1.58	6.73	14.87	17.76	17.93	17.79
250	1.57	6.73	14.95	18.18	18.57	18.24
275	1.56	6.73	14.99	18.65	19.26	18.65
300	1.54	6.71	15.04	19.11	19.91	19.03
350	1.53	6.69	15.12	19.76	20.86	19.76
400	1.53	6.66	15.06	20.29	21.72	20.52
450	1.53	6.62	15.04	20.92	22.72	21.21
500	1.53	6.57	15.09	21.49	23.58	21.86
550	1.54	6.53	15.06	21.95	24.53	22.52
600	1.56	6.47	15.06	22.34	25.60	23.18
650	1.58	6.41	15.05	22.70	26.66	23.95
700	1.61	6.35	15.11	23.03	28.20	24.74
750	1.63	6.29	15.24	23.49	29.90	25.67
800	1.66	6.23	15.36	24.03	32.07	26.79
850	1.68	6.16	15.58	24.82	34.92	28.19
900	1.71	6.10	15.81	25.56	37.11	30.03
950	1.74	6.04	16.05	26.27	40.35	32.27
1000	1.76	6.00	16.42	27.42	38.30	35.31
1050	1.80	5.95	16.93	28.69	34.03	37.44
1100	1.83	5.91	17.50	30.24	30.55	34.15
1150	1.85	5.87	18.43	30.84	27.88	29.73
1200	1.88	5.86	19.40	29.11	26.02	26.05
1250	1.91	5.86	20.60	25.88	24.07	23.22
1300	1.95	5.89	22.29	22.45	22.01	20.71
1350	1.98	5.94	24.52	19.65	20.44	18.36
1400	2.03	6.05	26.16	17.48	19.27	16.27
1450	2.09	6.18	24.90	15.46	18.17	14.41
1500	2.15	6.38	21.42	13.69	17.11	12.77
1600	2.37	7.02	15.01	10.58	15.29	9.90
1700	2.73	8.11	9.81	8.03	13.73	7.58
1800	3.28	9.83	5.14	6.01	12.43	5.78
1900	3.92	12.21	0.80	4.73	11.56	4.56
2000	4.65	15.47	3.94	3.86	10.75	3.85
2100	5.20	18.28	7.61	3.52	10.09	3.56
2200	5.47	18.02	7.88	3.54	9.39	3.64
2300	5.49	14.97	4.85	3.90	8.55	4.08
2400	5.44	11.68	0.41	4.44	7.76	4.67
2500	6.02	9.36	5.84	4.24	7.82	4.46
2600	7.45	8.41	14.48	3.54	9.04	3.53
2700	8.84	8.30	10.24	3.07	10.49	2.97
2800	9.75	8.57	5.78	2.95	11.47	2.87
2900	10.03	8.63	3.48	3.08	11.87	2.94
3000	9.98	8.99	1.60	3.24	11.57	3.11

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# Directional Coupler

# ADC-6-13+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = +85°C

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
				IN	OUT	CPL
10	7.90	9.20	6.80	1.81	1.09	1.86
25	3.78	6.59	8.05	5.57	3.67	5.74
50	2.32	6.50	10.42	9.81	7.54	10.05
75	1.93	6.62	12.04	12.48	10.49	12.60
100	1.78	6.68	13.10	14.30	12.69	14.24
125	1.71	6.72	13.78	15.52	14.33	15.38
150	1.67	6.75	14.21	16.42	15.61	16.26
175	1.64	6.76	14.46	17.15	16.67	16.99
200	1.62	6.77	14.62	17.84	17.70	17.62
225	1.61	6.78	14.76	18.45	18.64	18.15
250	1.60	6.78	14.87	18.95	19.38	18.62
275	1.60	6.79	14.95	19.34	20.01	19.06
300	1.60	6.77	14.99	19.69	20.51	19.48
350	1.60	6.76	14.99	20.34	21.69	20.20
400	1.60	6.73	15.02	20.91	22.74	20.84
450	1.62	6.70	15.02	21.28	23.59	21.41
500	1.64	6.66	15.04	21.62	24.59	21.95
550	1.67	6.62	15.04	21.85	25.63	22.48
600	1.69	6.56	15.06	22.00	26.74	23.05
650	1.73	6.51	15.07	22.21	28.03	23.67
700	1.76	6.46	15.17	22.41	29.72	24.28
750	1.80	6.40	15.34	22.71	31.75	25.06
800	1.84	6.34	15.47	23.12	34.55	25.89
850	1.87	6.28	15.67	23.56	39.54	26.93
900	1.91	6.23	15.95	24.17	49.30	28.27
950	1.95	6.17	16.32	24.87	48.37	29.98
1000	1.99	6.14	16.72	25.91	39.45	31.90
1050	2.02	6.10	17.34	27.10	34.77	33.45
1100	2.06	6.06	17.99	28.68	31.62	32.09
1150	2.10	6.03	18.92	29.73	29.04	28.90
1200	2.14	6.03	20.06	28.36	26.73	25.68
1250	2.18	6.05	21.61	25.77	24.82	22.87
1300	2.22	6.08	23.60	22.95	23.26	20.37
1350	2.27	6.15	25.74	20.29	21.81	18.20
1400	2.32	6.26	26.49	18.00	20.52	16.22
1450	2.39	6.42	23.94	15.89	19.36	14.48
1500	2.47	6.65	20.24	14.01	18.25	12.86
1600	2.72	7.35	14.11	10.83	16.28	10.04
1700	3.11	8.52	9.10	8.32	14.69	7.79
1800	3.64	10.26	4.66	6.48	13.48	6.08
1900	4.32	12.71	0.32	5.20	12.44	4.94
2000	4.97	15.87	4.19	4.48	11.72	4.31
2100	5.48	18.20	7.35	4.23	11.12	4.13
2200	5.71	17.31	6.84	4.39	10.39	4.36
2300	5.71	14.17	3.36	4.90	9.70	4.95
2400	5.86	11.18	1.59	5.31	9.32	5.40
2500	6.69	9.36	8.52	4.88	10.02	4.74
2600	8.10	8.82	11.65	4.11	11.43	3.84
2700	9.18	8.92	6.98	3.75	12.62	3.40
2800	9.78	9.27	3.83	3.77	13.10	3.37
2900	9.97	9.49	1.81	3.87	12.65	3.47
3000	9.87	9.92	0.19	4.14	11.88	3.68

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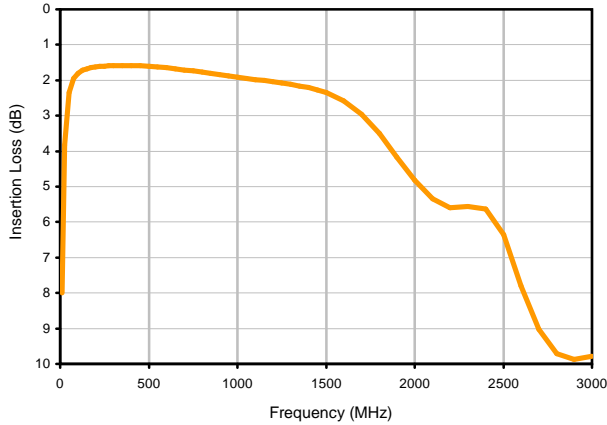


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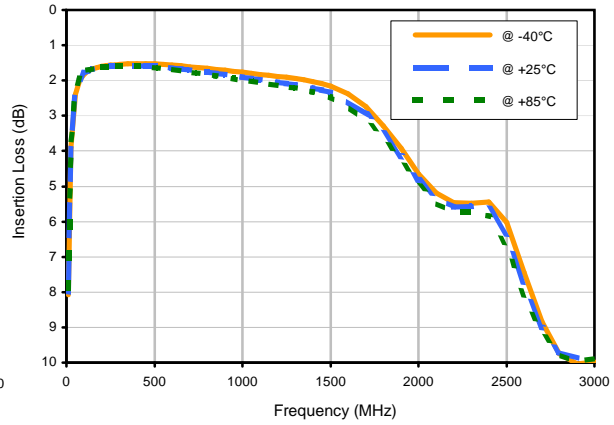


## Typical Performance Curves

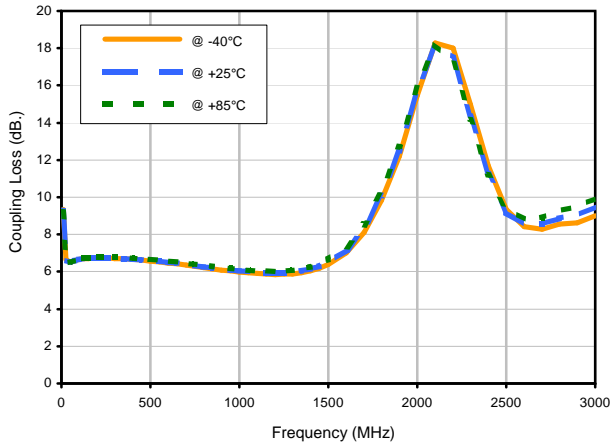
### Insertion Loss



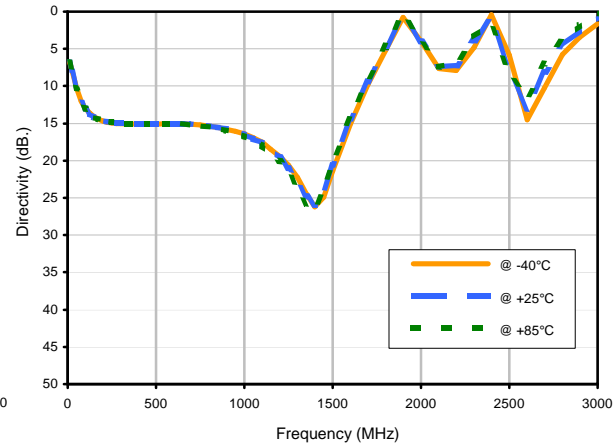
### Insertion Loss vs. TEMPERATURE



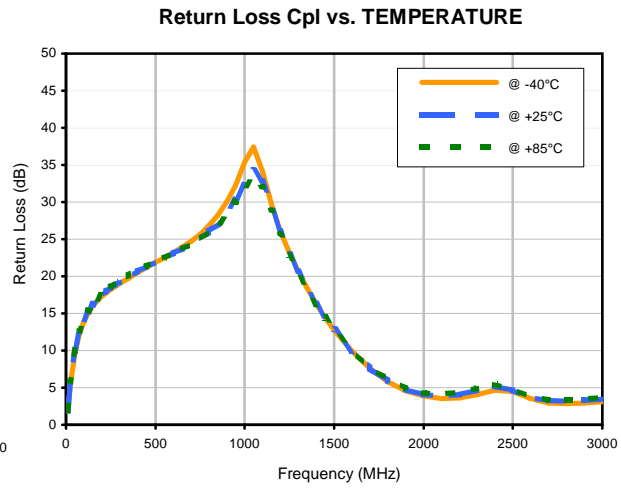
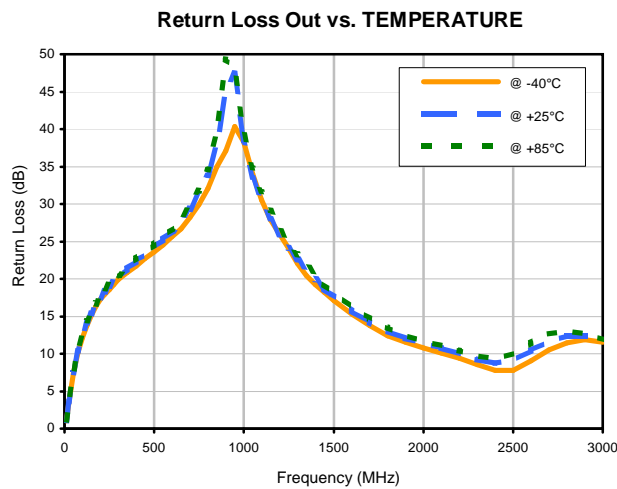
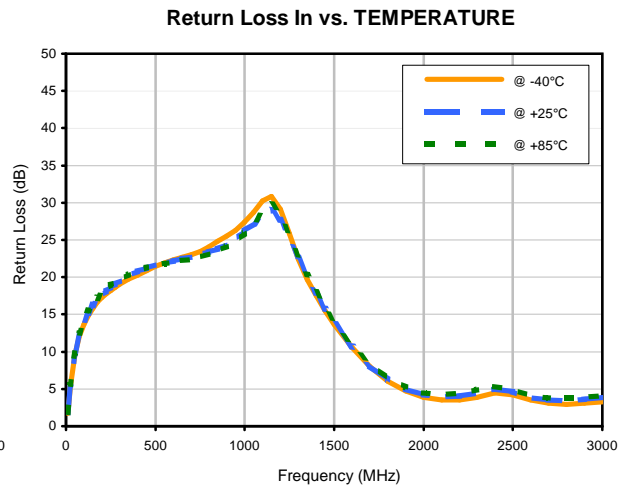
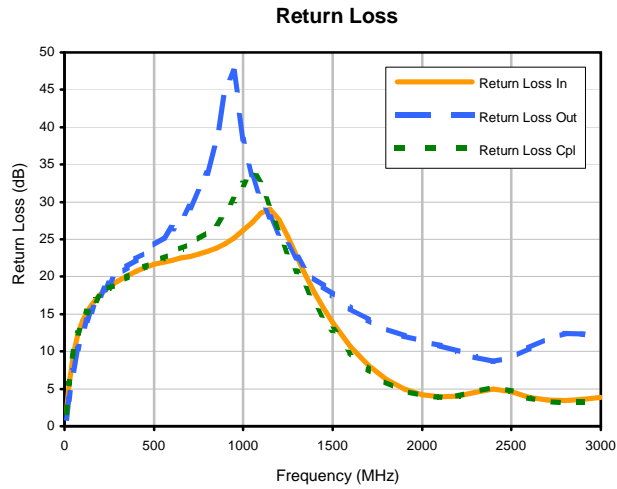
### Coupling Loss vs. TEMPERATURE



### Directivity vs. TEMPERATURE



## Typical Performance Curves

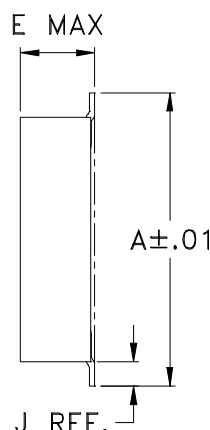
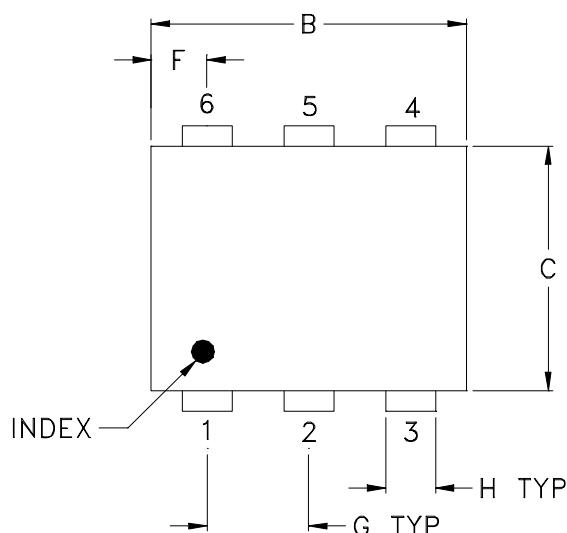


# Case Style

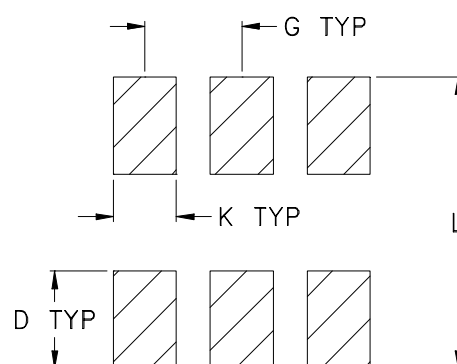
# CD

CD541  
CD542  
CD636  
CD637

## Outline Dimensions



## PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm.002$

CASE#	A	B	C	D	E	F	G	H	J	K	L	WT, GRAM
CD541					.082 (2.08)							.15
CD542	.272 (6.91)	.310 (7.87)	.220 (5.58)	.100 (2.54)	.112 (2.84)	.055 (1.40)	.100 (2.54)	.030 (0.76)	.026 (0.66)	.065 (1.65)	.300 (7.62)	.20
CD636					.162 (4.11)							.25
CD637					.206 (5.23)							.40

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .01$ ; 3 Pl.  $\pm .005$

### Notes:

- Case material: Plastic.
- Termination finish:
  - For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
  - For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

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# Tape & Reel Packaging TR-F34



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
16	12	7	Small quantity standard (see note)	20
				50
				100
				200
		13	Standard	500
1000				

Note: Availability of small reel quantity varies by model.  
Refer to pricing and availability on individual model dashboard.

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: [www.minicircuits.com/pages/pdfs/tape.pdf](http://www.minicircuits.com/pages/pdfs/tape.pdf)



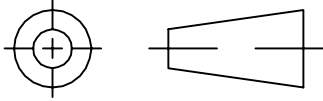
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THIRD ANGLE PROJECTION

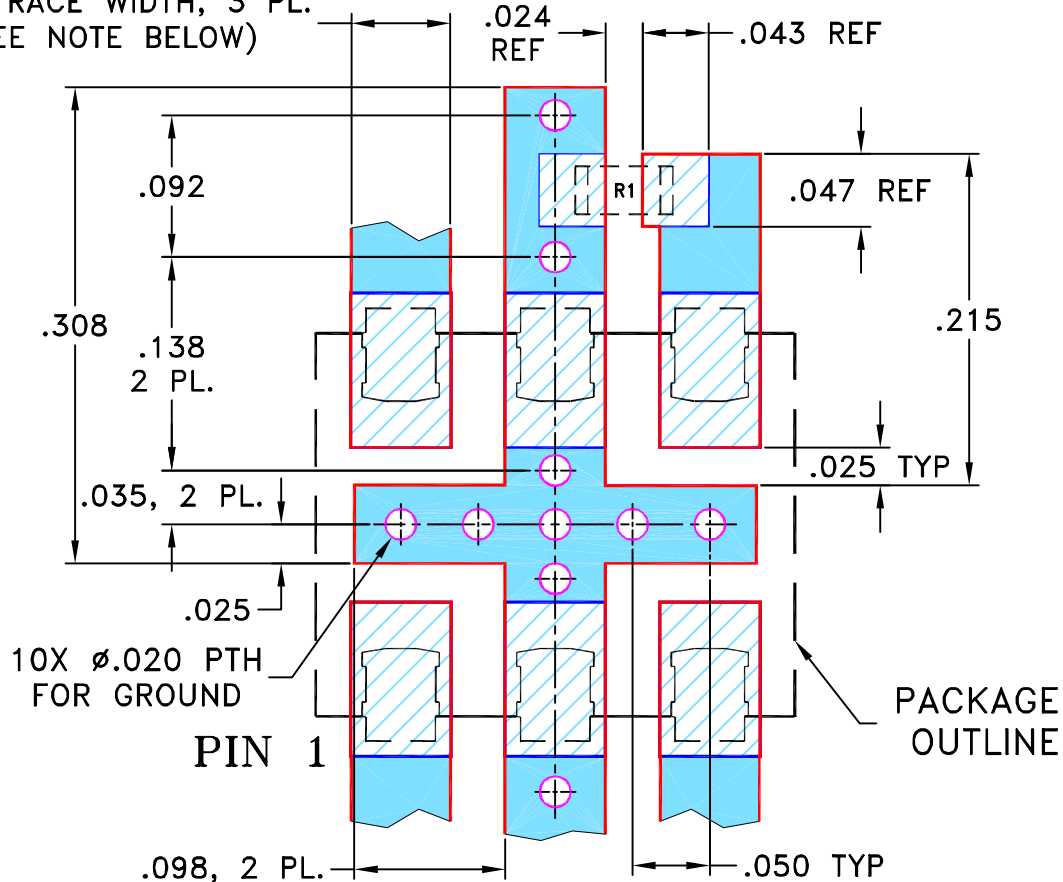


REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M81002	NEW RELEASE	08/05/02	MMG	LC
A	M102713	ADDED NOTE 2 & "...WITH SMOBC"	01/17/06	MMG	IL

**SUGGESTED MOUNTING CONFIGURATION  
FOR BH292/CD542 CASE STYLE, "It" PIN CONNECTION**

.064 TRACE WIDTH, 3 PL.  
(SEE NOTE BELOW)



RESISTOR R1: 49.9 Ohm, 0603 SIZE.

- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.  
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
- DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED	INITIALS	DATE
DRAWN	MMG	08/05/02
CHECKED	AV	08/05/02
APPROVED	LC	08/05/02

DIMENSIONS ARE IN INCHES  
TOLERANCES ON:  
2 PL DECIMALS ±  
3 PL DECIMALS ± .005  
ANGLES ±  
FRACTIONS ±

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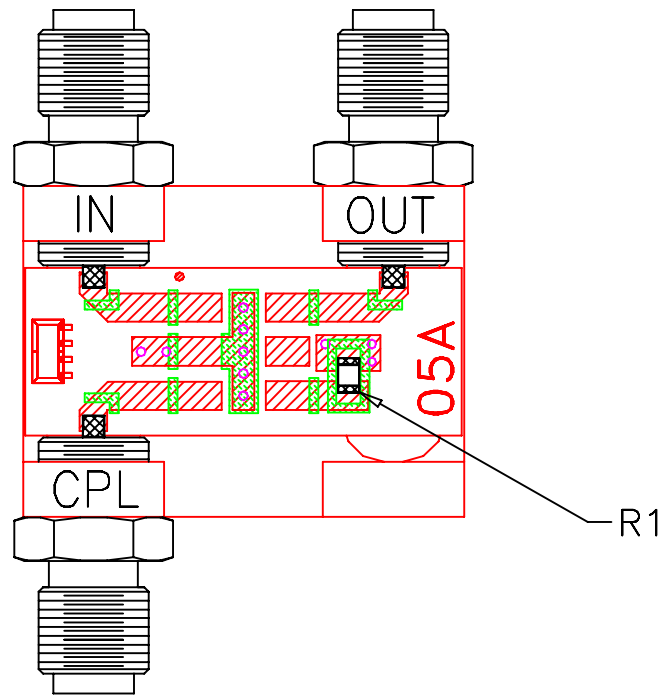
ASHEETA1.DWG REV:A DATE:01/12/95

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Brooklyn NY 11235

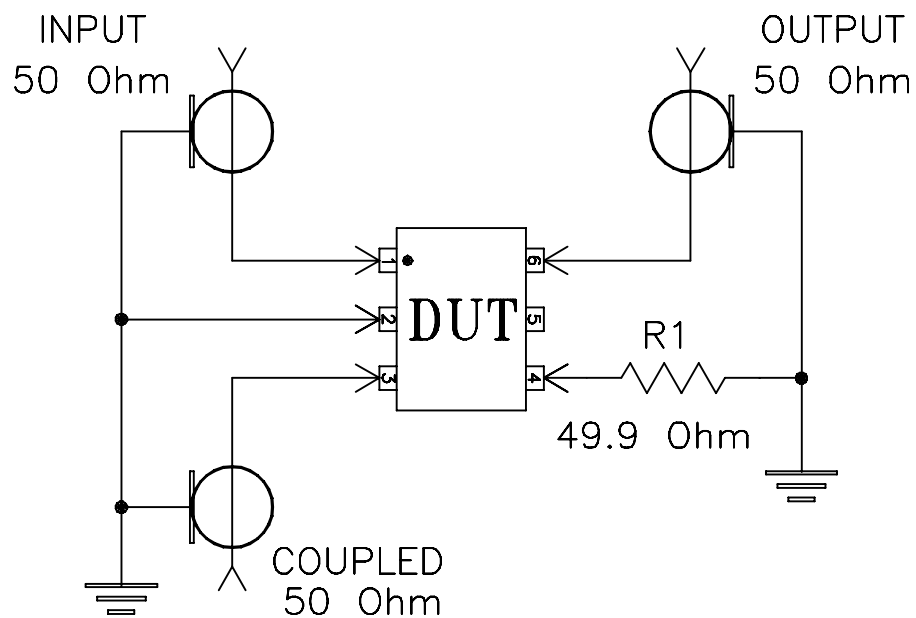
PL, It, BH292/CD542, JDC/ADC, TB-176

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-041	A
FILE:	98PL041	SCALE:	8:1
SHEET:	1	OF	1

# Evaluation Board and Circuit



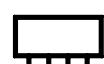
TB-05



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent, Dielectric Constant=3.5, Thickness=.030 inch.

 Mini-Circuits®

All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

Specification	Test/Inspection Condition	Reference/Spec
Operating Temperature	-40° to 85°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
Humidity	90 to 95% RH, 240 hours, 50°C	MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Solder Reflow Heat	Sn-Pb Eutetic Process: 225°C peak Pb-Free Process 245° - 250°C peak	J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1
Solderability	10X Magnification	J-STD-002, 95% Coverage
Vibration (High Frequency)	20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36)	MIL-STD-202, Method 204, Condition D
Mechanical Shock	50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes	MIL-STD-202, Method 213, Condition A
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C	MIL-STD-202, Method 215