



Mini-Circuits

SURFACE MOUNT

Bi-Directional Coupler SYBDC-10-13HP+

50 Ω 10 dB Coupling 50 to 1000 MHz 10 Watt

THE BIG DEAL

- High Power Handling, 10 W
- Full Decade Bandwidth
- Low Mainline Loss, 0.95 dB
- High Directivity, 20 dB
- Excellent VSWR, 1.20:1

APPLICATIONS

- VHF/UHF
- Signal Monitoring
- Communications
- Military Mobile
- Cellular

PRODUCT OVERVIEW

Mini-Circuits' SYBDC-10-13HP+ surface mount bi-directional coupler provides high power handling up to 10 W and low mainline loss of 0.95 dB typically for applications from 50 to 1000 MHz. The coupler features core and wire construction mounted on an 8-lead printed laminate base with wraparound terminations for excellent solderability. The unit measures 0.38x0.50x0.25", accommodating dense circuit board layouts.



Generic photo used for illustration purposes only

CASE STYLE: AH202-1

+RoHS Compliant

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

KEY FEATURES

Feature	Advantages
High Power Handling, 10 W	Usable in many systems with high-power requirements.
Low Mainline Loss, 0.95 dB	Provides excellent through-path signal power transmission.
Good Directivity, 20 dB	High directivity allows accurate signal sampling through the coupled port with minimal measurement error.
Excellent VSWR, 1.20:1 (Input/Output/Coupling)	Provides excellent matching in 50 Ω systems with minimal signal reflection.
Small Size, 0.38x0.50x0.25"	Provides high power capability while saving space in systems with tight layouts.





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ELECTRICAL SPECIFICATIONS AT +25°C¹

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency Range		50		1000	MHz
Mainline Loss ²	50		0.80	1.1	dB
	100		0.90	1.2	
	500		0.95	1.2	
	1000		1.20	1.6	
Coupling	50-1000		10±0.5		dB
Coupling Flatness(±)	50-1000		±0.2	±0.5	dB
Directivity	50-100	14	20		dB
	100-500	15	22		
	500-1000	16	20		
Return Loss (Input)	50-100		18		dB
	100-1000		20		
Return Loss (Output)	50-1000		20		dB
Return Loss (Coupling)	50-1000		18		dB
Input Power ³	100-1000			10	W

1. Tested on Evaluation Board TB-SYBDC1013HP+.

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

3. The user must provide adequate means of heat removal to limit the temperature of ground connections 2,3,6,7 to +85°C, in order to ensure proper performance.

At +25°C ambient temperature this requires thermal resistance of the user's PC board heat sink to be 27°C/W or less when the unit is driven at maximum specified RF input power, 10 W.

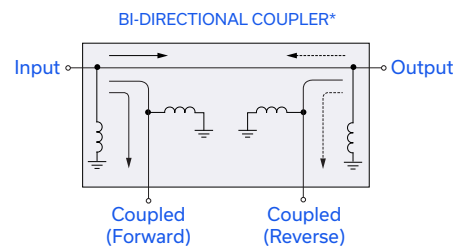
At higher ambient temperature, with the same heat sink. Input power in watts must not exceed $10 \text{ W} \times (+85^\circ\text{C} - T_{\text{ambient}}) \div +60^\circ\text{C}$.

ABSOLUTE MAXIMUM RATINGS

Parameter	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.

ELECTRICAL SCHEMATIC



*Electrical schematic is for Bi-Directional coupler with internal transformer(s) that routes DC from all ports to ground.

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Bi-Directional Coupler **SYBDC-10-13HP+**

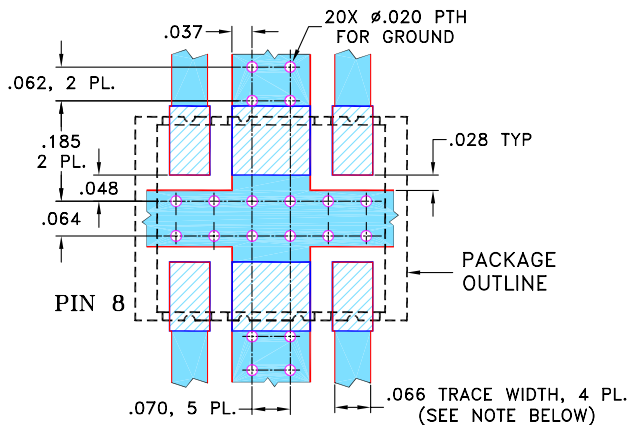
50Ω 10 dB Coupling 50 to 1000 MHz 10 Watt

PAD CONNECTIONS

INPUT	8
OUTPUT	1
COUPLED (FORWARD)	5
COUPLED (REVERSE)	4
GROUND	2, 3, 6, 7

***PRODUCT MARKING:** SYBDC-6-62HP

*Marking may contain other features or characters for internal lot control.

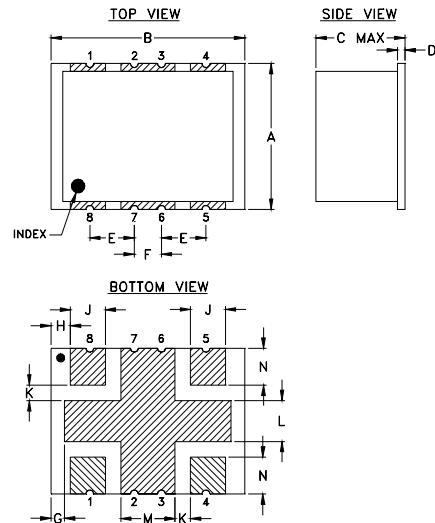
EVAL BOARD MCL P/N: TB-SYBDC1013HP+
SUGGESTED PCB LAYOUT (PL-246)

NOTES:

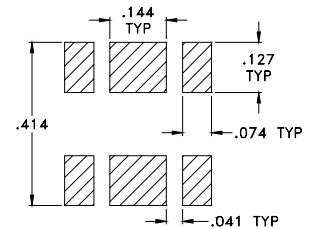
1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" $\pm$.002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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

OUTLINE DRAWING



PCB Land Pattern

Suggested Layout,
Tolerance to be within $\pm .002$ OUTLINE DIMENSIONS (Inches
mm)

A	B	C	D	E	F	G
.38	.50	.25	.020	.115	.070	.035
9.65	12.70	6.35	0.51	2.92	1.78	0.89
H	J	K	L	M	N	wt
.050	.090	.040	.105	.140	.095	grams
1.27	2.29	1.02	2.67	3.56	2.41	0.80

TAPE & REEL INFORMATION: F61



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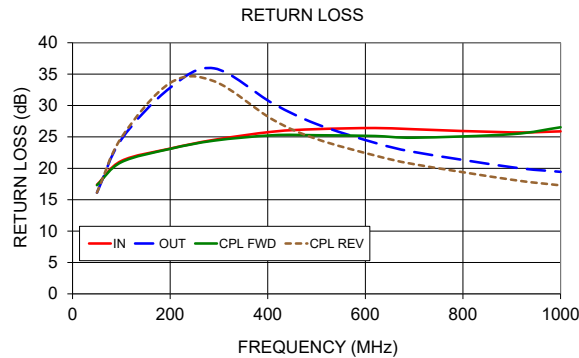
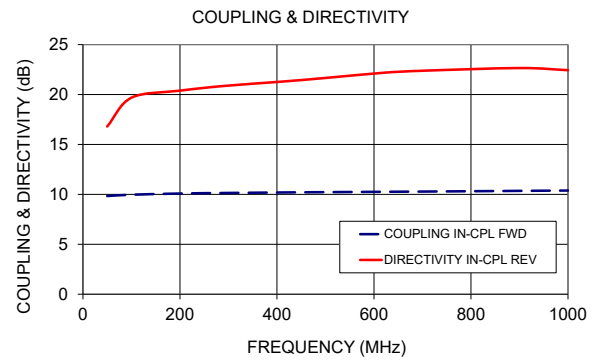
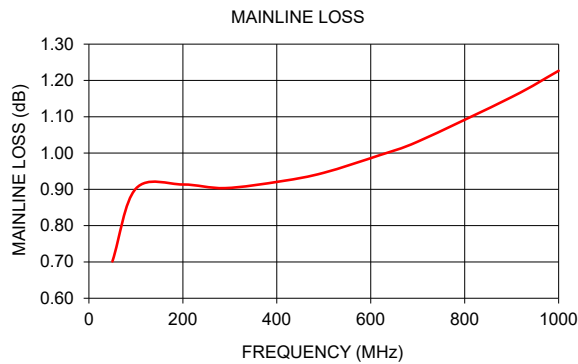
Bi-Directional Coupler

SYBDC-10-13HP+

50Ω 10 dB Coupling 50 to 1000 MHz 10 Watt

TYPICAL PERFORMANCE DATA

Frequency (MHz)	Mainline Loss (dB)	Coupling (dB)		Directivity (dB)		Return Loss (dB)			
	In-Out	In-Cpl Fwd	Out-Cpl Rev	In-Cpl Rev	Out-Cpl Fwd	In	Out	Cpl Fwd	Cpl Rev
50	0.70	9.84	10.24	17.14	16.80	17.38	16.11	17.31	16.12
100	0.90	9.96	10.54	20.14	19.68	21.17	24.59	20.98	24.89
200	0.91	10.09	10.59	20.83	20.39	23.14	32.83	23.09	33.60
290	0.90	10.14	10.56	21.55	20.86	24.53	35.92	24.41	33.87
410	0.92	10.19	10.54	22.05	21.29	25.83	30.35	25.27	27.76
500	0.95	10.22	10.53	22.52	21.66	26.24	27.04	25.27	24.67
620	0.99	10.26	10.51	23.27	22.18	26.42	24.05	25.15	22.03
700	1.03	10.28	10.50	23.74	22.38	26.22	22.59	24.87	20.65
900	1.15	10.35	10.44	24.47	22.65	25.72	20.17	25.44	18.18
1000	1.23	10.38	10.41	24.18	22.44	25.88	19.43	26.53	17.28



- 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-Circuits 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-Circuits' website at www.minicircuits.com/terms/viewterm.html



Bi-Directional Coupler

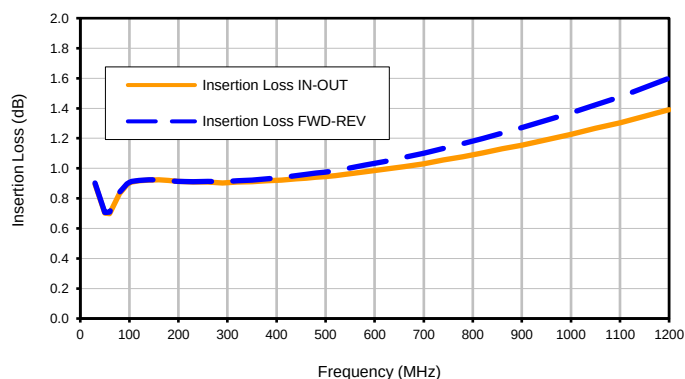
SYBDC-10-13HP+

Typical Performance Data

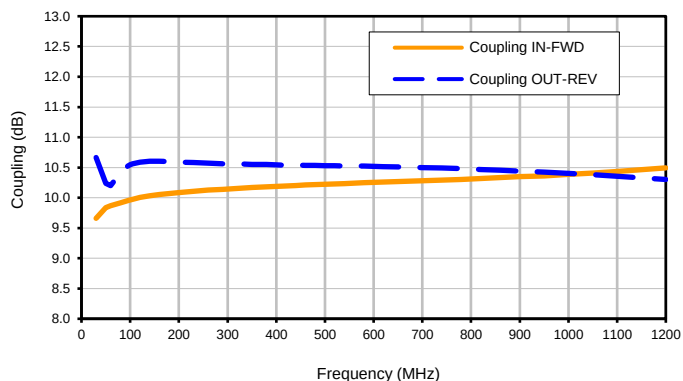
FREQ. (MHz)	INSERTION LOSS		COUPLING		DIRECTIVITY		RETURN LOSS			
	(dB)		(dB)		(dB)		(dB)			
	IN-OUT	FWD-REV	IN-FWD	OUT-REV	IN-REV	OUT-FWD	IN	OUT	FWD	REV
30	0.90	0.90	9.66	10.67	12.25	13.15	12.76	11.34	12.66	11.28
50	0.70	0.71	9.84	10.24	16.80	17.14	17.38	16.11	17.31	16.12
60	0.70	0.71	9.87	10.20	18.49	18.73	19.26	18.39	19.18	18.46
80	0.83	0.84	9.92	10.42	19.57	19.81	20.83	22.66	20.63	22.60
95	0.89	0.90	9.95	10.52	19.62	20.04	21.07	24.24	20.91	24.41
100	0.90	0.91	9.96	10.54	19.68	20.14	21.17	24.59	20.98	24.89
105	0.91	0.91	9.97	10.56	19.72	20.18	21.24	24.94	21.05	25.35
120	0.92	0.92	10.00	10.59	19.67	20.10	21.49	26.52	21.22	26.76
140	0.92	0.92	10.03	10.60	19.77	20.27	21.98	28.24	21.82	28.46
160	0.92	0.92	10.05	10.61	19.97	20.56	22.43	29.62	22.42	30.14
180	0.92	0.92	10.07	10.60	20.18	20.71	22.74	31.14	22.68	31.88
200	0.91	0.91	10.09	10.59	20.39	20.83	23.14	32.83	23.09	33.60
230	0.91	0.91	10.11	10.58	20.59	21.08	23.64	34.81	23.63	35.44
260	0.91	0.91	10.13	10.57	20.72	21.32	24.08	36.17	24.00	35.55
290	0.90	0.91	10.14	10.56	20.86	21.55	24.53	35.92	24.41	33.87
320	0.91	0.92	10.16	10.56	20.99	21.68	24.87	34.91	24.65	32.16
350	0.91	0.92	10.17	10.55	21.14	21.83	25.22	33.10	24.92	30.43
380	0.92	0.93	10.18	10.55	21.28	21.96	25.52	31.66	25.11	29.01
410	0.92	0.94	10.19	10.54	21.29	22.05	25.83	30.35	25.27	27.76
440	0.93	0.95	10.20	10.54	21.40	22.21	26.00	29.05	25.27	26.52
460	0.94	0.96	10.21	10.54	21.47	22.27	26.13	28.44	25.26	25.92
480	0.94	0.97	10.22	10.54	21.57	22.41	26.15	27.72	25.22	25.26
500	0.95	0.98	10.22	10.53	21.66	22.52	26.24	27.04	25.27	24.67
520	0.95	0.99	10.23	10.53	21.79	22.63	26.33	26.46	25.22	24.18
540	0.96	1.00	10.23	10.53	21.91	22.78	26.34	25.82	25.17	23.69
580	0.98	1.02	10.25	10.52	22.05	23.01	26.40	24.86	25.15	22.81
620	0.99	1.05	10.26	10.51	22.18	23.27	26.42	24.05	25.15	22.03
660	1.01	1.07	10.27	10.51	22.25	23.52	26.30	23.21	25.04	21.32
700	1.03	1.10	10.28	10.50	22.38	23.74	26.22	22.59	24.87	20.65
740	1.06	1.13	10.29	10.49	22.60	24.08	26.10	21.91	24.81	20.01
780	1.08	1.16	10.30	10.48	22.68	24.24	25.94	21.41	24.81	19.50
820	1.10	1.20	10.32	10.47	22.65	24.34	25.94	20.98	25.01	19.02
860	1.13	1.24	10.34	10.45	22.71	24.39	25.83	20.53	25.25	18.60
900	1.15	1.27	10.35	10.44	22.65	24.47	25.72	20.17	25.44	18.18
950	1.19	1.32	10.36	10.43	22.59	24.52	25.76	19.73	25.89	17.72
1000	1.23	1.37	10.38	10.41	22.44	24.18	25.88	19.43	26.53	17.28
1050	1.27	1.42	10.41	10.38	22.16	23.80	26.02	19.13	27.52	16.93
1100	1.30	1.48	10.43	10.35	21.78	23.19	26.30	18.91	28.71	16.53
1200	1.39	1.60	10.49	10.30	20.82	21.78	27.43	18.58	32.11	15.82

Typical Performance Curves

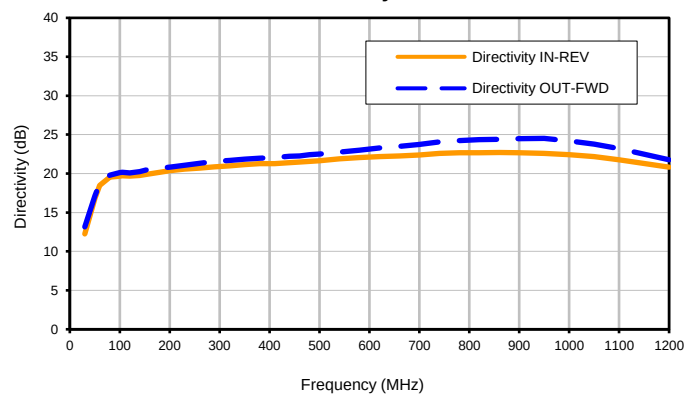
Insertion Loss



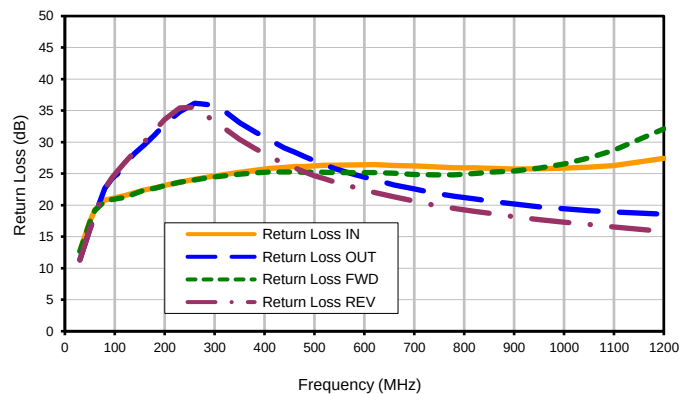
Coupling



Directivity

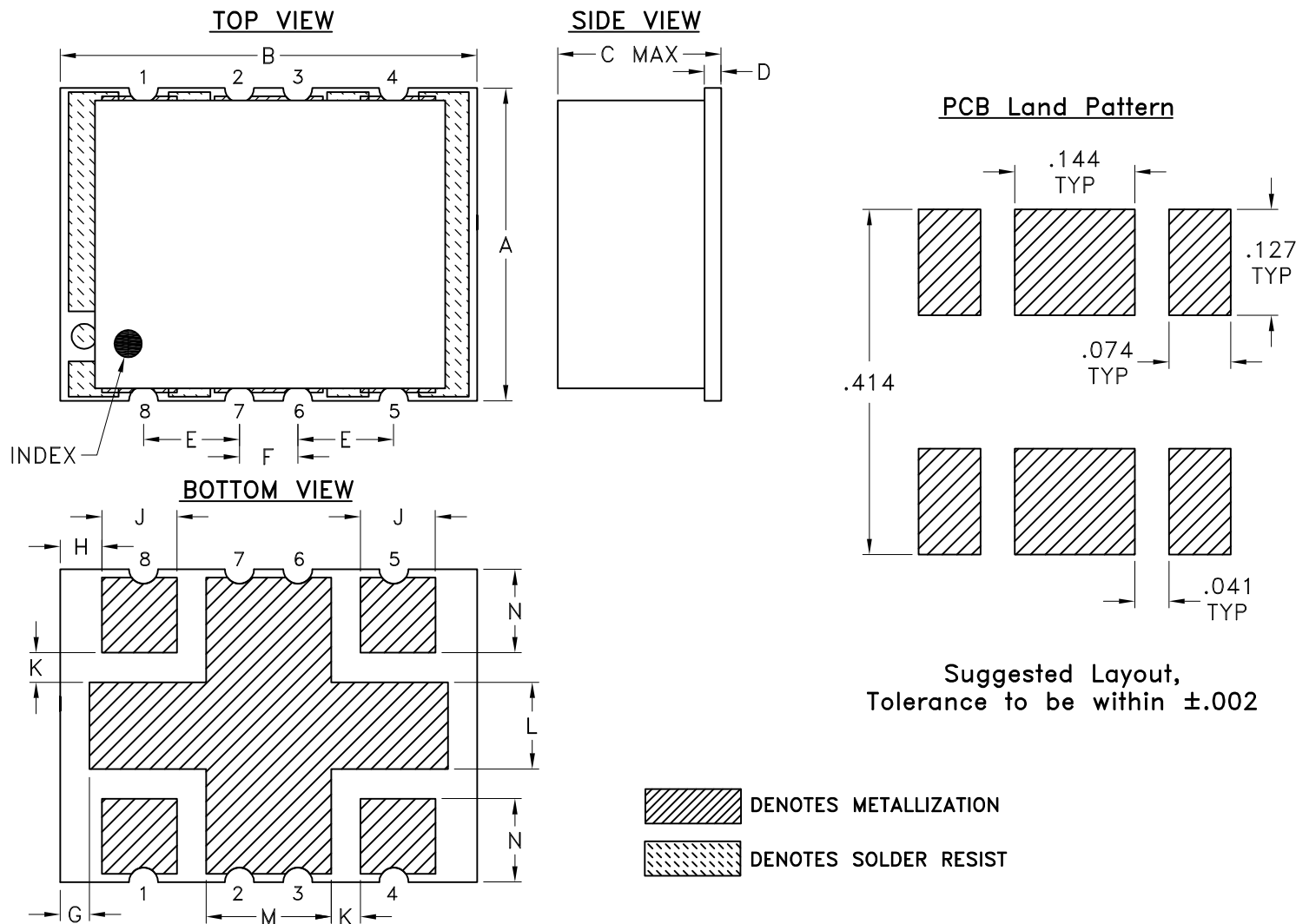


Return Loss



Outline Dimensions

AH202-1



CASE#	A	B	C	D	E	F	G	H	J	K	L	M	N	WT, GRAM
AH202-1	.38 (9.65)	.50 (12.70)	.25 (6.35)	.020 (0.51)	.115 (2.92)	.070 (1.78)	.035 (0.89)	.050 (1.27)	.090 (2.29)	.040 (1.02)	.105 (2.67)	.140 (3.56)	.095 (2.41)	.80

Dimensions are in inches (mm). Tolerances: 2 Pl. ± 0.01 ; 3 Pl. ± 0.005

Notes:

- Case material: Nickel Silver alloy.
- Base material: Printed wiring laminate.
- Termination finish:

For RoHS 3-5 μ inch (.08-.13 microns) Gold over 120-240 μ inch (3.05-6.10 microns) Nickel plate.

All models, (+) suffix.

For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

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ISO 9001 ISO 14001 CERTIFIED

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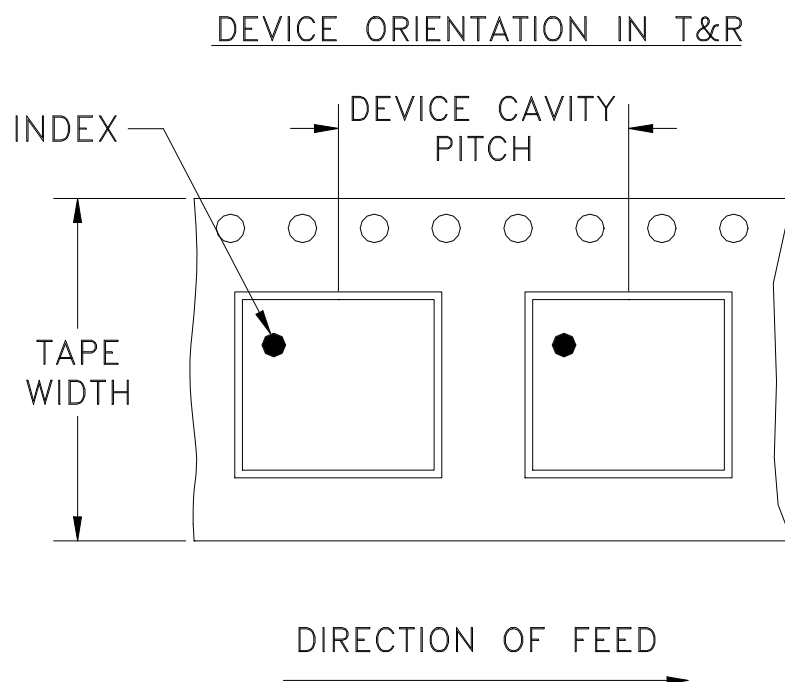
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Tape & Reel Packaging TR-F61



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
24	12	13	200

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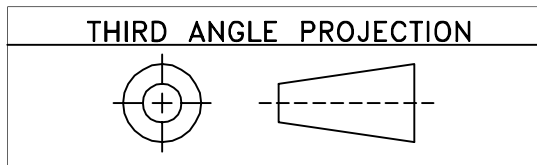


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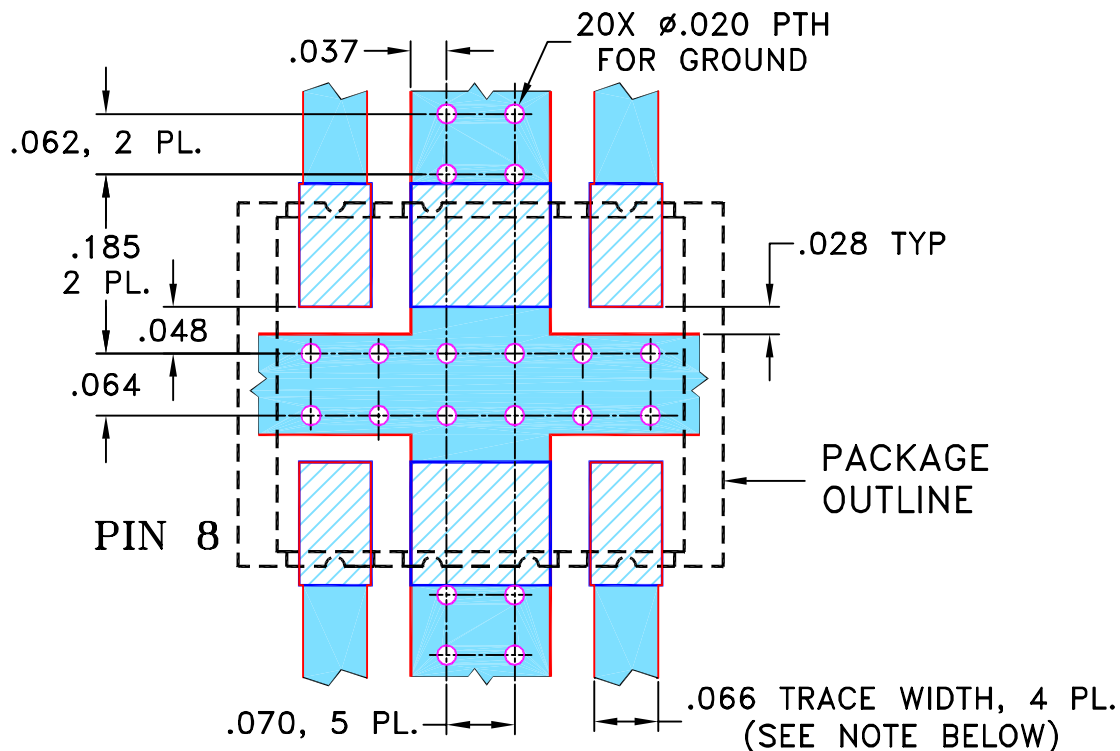
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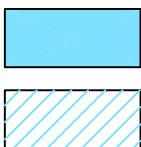
REVISIONS					
REV OR	ECN No.	DESCRIPTION	DATE	DR	AUTH
	M107473	NEW RELEASE	09/25/06	AV	DY

**SUGGESTED MOUNTING CONFIGURATION
FOR AH202-1 CASE STYLE, "rr" PIN CONNECTION**



NOTES:

- TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" $\pm$.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

UNLESS OTHERWISE SPECIFIED	INITIALS		DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL DECIMALS $\pm$ 3 PL DECIMALS $\pm$.005 ANGLES $\pm$ FRACTIONS $\pm$	DRAWN	AV	09/19/06
	CHECKED	IL	09/25/06
	APPROVED	DY	09/25/06



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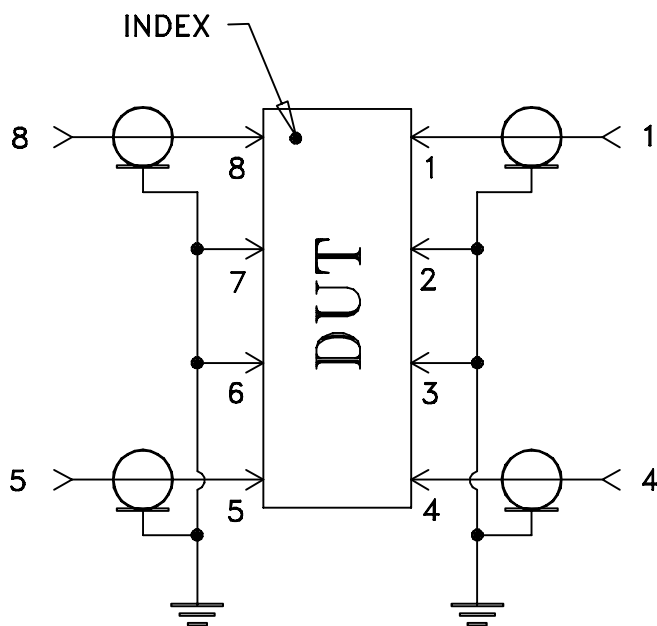
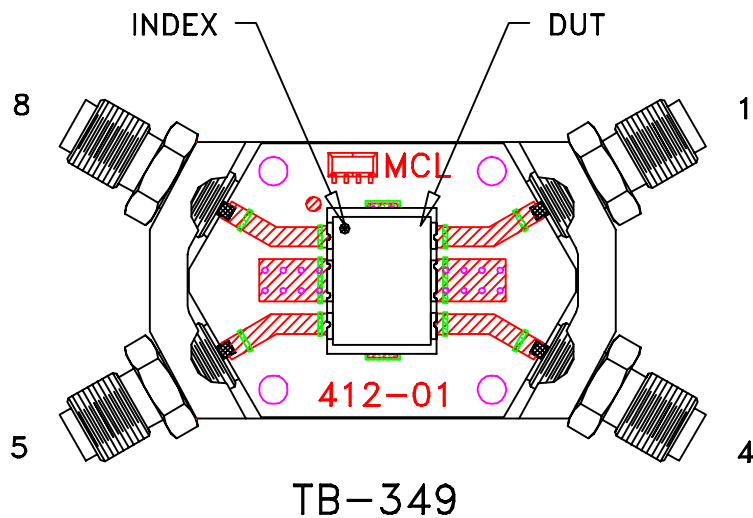
PL, rr, AH202-1, SYDC, TB-349

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

SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-246	REV: OR
FILE: 98PL246	SCALE: 5:1	SHEET: 1 OF 1	

Evaluation Board and Circuit

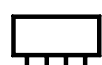
For Pin Connections refer to Data Sheet of the DUT



Schematic Diagram

Notes:

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

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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