



Mini-Circuits

SURFACE MOUNT HIGH POWER

Bi-Directional Coupler **SYBDC-15-52VHP+**

50Ω 15 dB Coupling 10 to 520 MHz 30 Watt

THE BIG DEAL

- High power handling, 30W
- Very low mainline loss, 0.5 dB typ.
- Excellent VSWR, 1.06:1 typ.



Generic photo used for illustration purposes only

CASE STYLE: PD1647-1**

**This model is not intended for pick & place use. Please contact Applications Dept. for assistance

APPLICATIONS

- Military mobile

+RoHS Compliant

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

PRODUCT OVERVIEW

Mini-Circuits' SYBDC-15-52VHP+ surface mount bi-directional coupler provides exceptionally high power handling up to 30W and low mainline loss of 0.5 dB for applications from 10 to 520 MHz. This model features a unique heat sinking design that enables reliable operation at high power without overheating, making it an ideal choice for systems where high power capability and small size are desired. The coupler features core and wire construction mounted on an 8 -lead printed laminate base with wraparound terminations for excellent solderability. The unit measures 0.75 x 0.52 x 0.49", accommodating dense circuit board layouts.

Feature	Advantages
High power handling, 30W	Usable in many systems with high-power requirements
Low mainline loss, 0.5 dB	Provides excellent through-path signal power transmission.
Good directivity, 19 dB typ.	High directivity allows accurate signal sampling through the coupled port with minimal measurement error.
Excellent return loss, 30 dB typ. (input/output/coupling)	Provides excellent matching in 50Ω systems with minimal signal reflection.
Small size, 0.75 x 0.52 x 0.43"	Provides high power capability while saving space in systems with tight layouts.





Mini-Circuits®

SURFACE MOUNT HIGH POWER

Bi-Directional Coupler SYBDC-15-52VHP+

50Ω 15 dB Coupling 10 to 520 MHz 30 Watt

ELECTRICAL SPECIFICATIONS AT 25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		10	—	520	MHz
Mainline Loss (include theoretical 0.14 dB)	10-520	—	0.5	0.7	
Coupling	10-520	—	15±0.4	—	dB
Coupling Flatness(±)	10-520	—	0.2	0.5	dB
Directivity (Out-Cpl Fwd)	10-350	17	23	—	dB
	350-520	14	20	—	
Directivity (In-Cpl Rev)	10-350	14	18	—	dB
	350-520	11	15	—	
Return Loss (Input)	10-520	20	28	—	dB
Return Loss (Output)	10-520	20	28	—	dB
Return Loss (Coupling)	10-520	20	30	—	dB
Input Power ^{1,2}	10-520	—	—	30	W

1. The user must provide adequate means of heat removal to limit the temperature of ground connections under the PCB to 65°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 3.5°C/W.

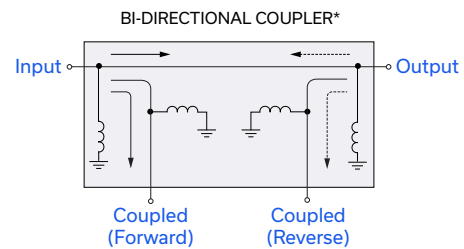
2. At 25°C. Derate to 20W linearly at 65°C case temperature.

MAXIMUM RATINGS

Parameter	Ratings
Operating temperature	-40°C to 85°C Case*
Storage temperature	-55°C to 100°C

*Case temperature is defined as temperature on ground leads.
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



Mini-Circuits

SURFACE MOUNT HIGH POWER

Bi-Directional Coupler **SYBDC-15-52VHP+**

50Ω 15 dB Coupling 10 to 520 MHz 30 Watt

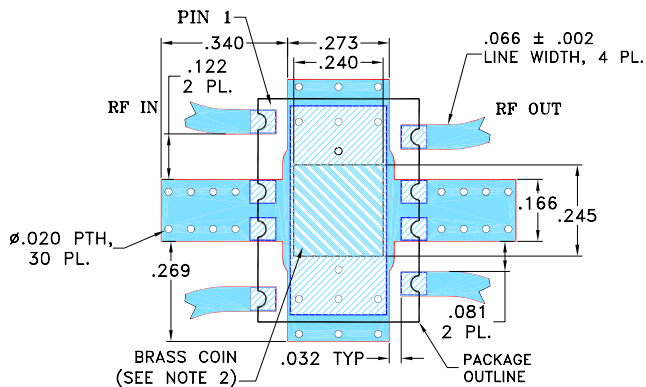
PAD CONNECTIONS

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

***PRODUCT MARKING:** SYBDC-15-52VHP

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

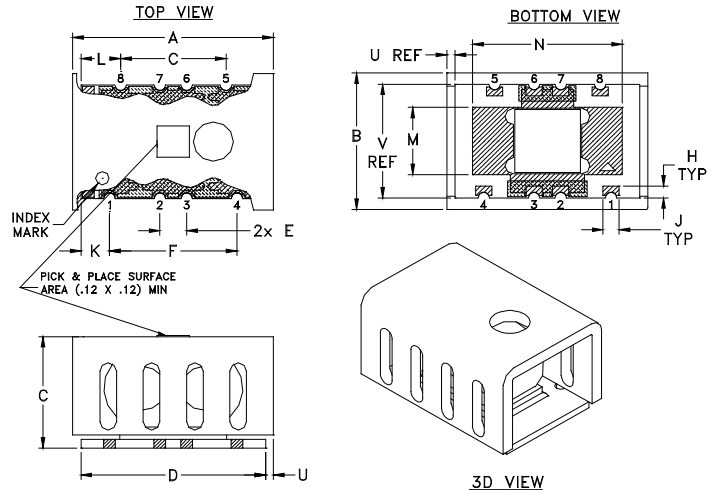
DEMO BOARD MCL P/N: TB-630+
SUGGESTED PCB LAYOUT (PL-351)
 REFER TO APPLICATION NOTE: [AN-00-017](#)



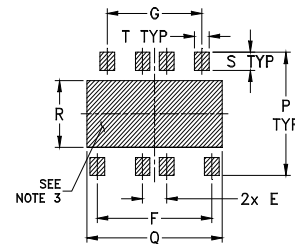
- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS $.030" \pm .002"$; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
 2. SUGGEST TO PROVIDE BRASS COIN FOR BETTER HEAT TRANSFER FROM THE UNIT. OTHERWISE PROVIDE ARRAY OF THERMAL VIAS ADEQUATE TO LIMIT TEMPERATURE OF GROUND CONNECTIONS UNDER THE UNIT TO 65°C.
 3. 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
 DENOTES BRASS COIN.

OUTLINE DRAWING



PCB Land Pattern



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

OUTLINE DIMENSIONS (Inches/mm)

A	B	C	D	E	F	G	H	J	K	L
.750	.520	.43	.690	.100	.476	.394	.045	.060	.276	.194
19.05	13.21	10.92	17.53	2.54	12.09	10.01	1.14	1.52	7.01	4.93
M	N	P	Q	R	S	T	U	V	wt	
.257	.560	.475	.561	.258	.069	.061	.03	.433	grams	
6.53	14.22	12.07	14.25	6.55	1.75	1.55	0.76	11.00	2.80	

TAPE & REEL INFORMATION: F115





Mini-Circuits

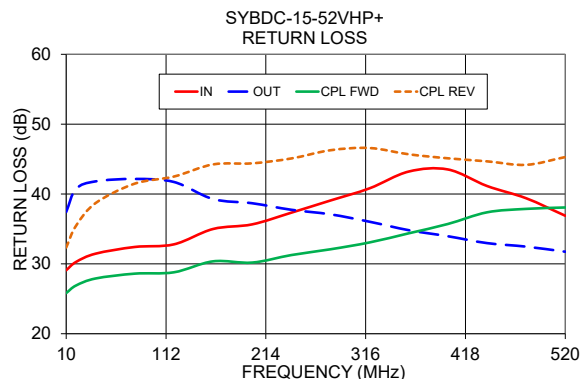
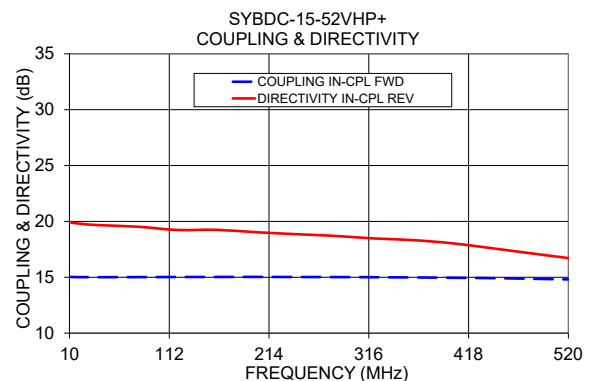
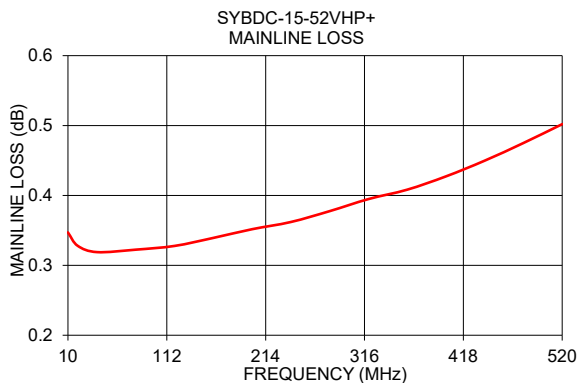
SURFACE MOUNT HIGH POWER

Bi-Directional Coupler **SYBDC-15-52VHP+**

50Ω 15 dB Coupling 10 to 520 MHz 30 Watt

TYPICAL PERFORMANCE DATA

Frequency (MHz)	Mainline Loss (dB)	Coupling (dB)		Directivity (dB)		Return Loss (dB)			
	In-Out	In-Cpl Fwd	Out-Cpl Rev	Out-Cpl Fwd	In-Cpl Rev	In	Out	Cpl Fwd	Cpl Rev
10.0	0.35	15.03	14.99	23.17	19.93	29.09	37.43	25.82	32.35
20.0	0.33	15.01	14.97	23.18	19.80	30.27	40.73	26.90	35.45
40.0	0.32	15.00	14.97	23.21	19.66	31.46	41.81	27.91	38.70
80.0	0.32	15.01	15.00	23.30	19.52	32.42	42.16	28.60	41.49
120.0	0.33	15.02	15.02	23.54	19.23	32.79	41.73	28.79	42.50
160.0	0.34	15.03	15.05	23.28	19.24	34.99	39.28	30.36	44.24
200.0	0.35	15.03	15.08	23.64	19.04	35.65	38.68	30.19	44.39
240.0	0.36	15.02	15.11	23.67	18.86	37.33	37.75	31.26	45.09
280.0	0.38	15.02	15.14	23.63	18.71	39.07	37.09	32.09	46.27
320.0	0.39	15.00	15.16	23.67	18.48	40.82	36.03	33.07	46.58
360.0	0.41	14.98	15.18	23.58	18.33	43.22	34.82	34.38	45.69
400.0	0.43	14.96	15.21	23.47	18.05	43.52	33.96	35.71	45.11
440.0	0.45	14.92	15.23	23.35	17.62	41.15	32.97	37.38	44.68
480.0	0.48	14.87	15.26	23.49	17.16	39.39	32.47	37.87	44.18
520.0	0.50	14.81	15.29	23.47	16.72	36.89	31.74	38.07	45.29



NOTES

- A. 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.
- B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- C. 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

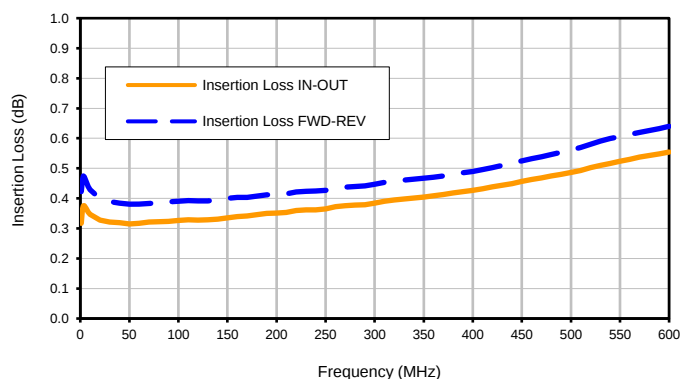
SYBDC-15-52VHP+

Typical Performance Data

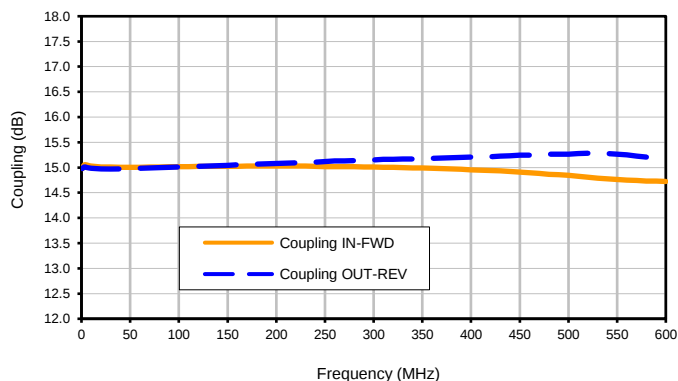
FREQ. (MHz)	INSERTION LOSS		COUPLING		DIRECTIVITY		RETURN LOSS			
	(dB)		(dB)		(dB)		(dB)			
	IN-OUT	FWD-REV	IN-FWD	OUT-REV	IN-REV	OUT-FWD	IN	OUT	FWD	REV
1	0.32	0.42	14.98	14.98	19.82	22.72	20.43	20.81	17.51	17.84
2	0.36	0.46	15.03	15.00	20.02	23.14	25.18	27.41	22.19	24.01
3	0.38	0.47	15.05	15.01	20.09	23.18	26.50	30.31	23.43	26.53
4	0.38	0.47	15.06	15.01	20.14	23.21	27.16	32.06	24.02	27.89
6	0.37	0.46	15.05	15.00	20.05	23.18	28.12	34.60	24.83	29.88
8	0.35	0.44	15.04	14.99	19.99	23.20	28.56	36.04	25.35	31.17
10	0.35	0.43	15.03	14.99	19.93	23.17	29.09	37.43	25.82	32.35
20	0.33	0.40	15.01	14.97	19.80	23.18	30.27	40.73	26.90	35.45
30	0.32	0.39	15.01	14.97	19.74	23.20	30.99	41.35	27.51	37.38
40	0.32	0.38	15.00	14.97	19.66	23.21	31.46	41.81	27.91	38.70
50	0.31	0.38	15.00	14.97	19.65	23.26	31.75	41.80	28.19	39.63
60	0.32	0.38	15.01	14.98	19.63	23.31	32.06	41.81	28.36	40.19
70	0.32	0.38	15.01	14.99	19.60	23.33	32.30	41.85	28.46	40.74
80	0.32	0.39	15.01	15.00	19.52	23.30	32.42	42.16	28.60	41.49
90	0.32	0.39	15.02	15.00	19.50	23.30	32.60	41.97	28.71	41.88
100	0.33	0.39	15.02	15.01	19.57	23.29	33.02	40.92	28.89	41.55
110	0.33	0.39	15.02	15.01	19.48	23.33	33.04	41.04	28.91	41.79
120	0.33	0.39	15.02	15.02	19.23	23.54	32.79	41.73	28.79	42.50
130	0.33	0.39	15.02	15.03	19.09	23.65	32.89	41.18	28.93	43.22
140	0.33	0.40	15.02	15.04	19.18	23.44	33.75	40.17	29.69	43.82
150	0.34	0.40	15.02	15.04	19.27	23.22	34.74	39.49	30.36	44.17
160	0.34	0.40	15.03	15.05	19.24	23.28	34.99	39.28	30.36	44.24
170	0.34	0.40	15.03	15.06	19.17	23.43	35.07	39.18	30.15	44.19
180	0.35	0.41	15.03	15.06	19.09	23.55	34.99	39.28	29.96	44.14
190	0.35	0.41	15.03	15.07	19.06	23.61	35.20	39.20	29.98	44.16
200	0.35	0.41	15.03	15.08	19.04	23.64	35.65	38.68	30.19	44.39
210	0.35	0.41	15.03	15.08	19.00	23.66	36.09	38.33	30.42	44.47
220	0.36	0.42	15.03	15.09	18.96	23.69	36.42	38.18	30.63	44.66
230	0.36	0.42	15.03	15.10	18.91	23.69	36.88	37.95	30.91	45.02
240	0.36	0.42	15.02	15.11	18.86	23.67	37.33	37.75	31.26	45.09
250	0.36	0.43	15.02	15.12	18.80	23.71	37.78	37.70	31.49	45.20
260	0.37	0.43	15.02	15.13	18.73	23.75	38.16	37.76	31.57	45.13
270	0.38	0.44	15.02	15.13	18.73	23.69	38.64	37.49	31.80	45.70
280	0.38	0.44	15.02	15.14	18.71	23.63	39.07	37.09	32.09	46.27
290	0.38	0.44	15.01	15.14	18.67	23.65	39.60	36.67	32.41	46.29
300	0.38	0.45	15.01	15.15	18.57	23.69	39.93	36.51	32.56	46.07
310	0.39	0.45	15.01	15.16	18.51	23.71	40.36	36.36	32.73	46.20
320	0.39	0.46	15.00	15.16	18.48	23.67	40.82	36.03	33.07	46.58
330	0.40	0.46	15.00	15.17	18.45	23.65	41.41	35.65	33.42	46.61
340	0.40	0.46	14.99	15.17	18.42	23.61	41.85	35.27	33.80	46.19
350	0.40	0.47	14.99	15.18	18.38	23.59	42.42	35.08	34.13	46.09
360	0.41	0.47	14.98	15.18	18.33	23.58	43.22	34.82	34.38	45.69
370	0.41	0.48	14.98	15.19	18.27	23.54	43.56	34.65	34.65	45.70
380	0.42	0.48	14.97	15.19	18.21	23.51	43.77	34.38	34.98	45.57
390	0.42	0.49	14.96	15.20	18.13	23.47	43.63	34.19	35.34	45.39
400	0.43	0.49	14.96	15.21	18.05	23.47	43.52	33.96	35.71	45.11
410	0.43	0.50	14.95	15.21	17.94	23.49	43.27	33.72	36.09	45.24
420	0.44	0.50	14.94	15.22	17.85	23.42	42.67	33.43	36.51	45.31
430	0.44	0.51	14.93	15.22	17.75	23.37	41.98	33.16	36.99	44.77
440	0.45	0.52	14.92	15.23	17.62	23.35	41.15	32.97	37.38	44.68
450	0.46	0.53	14.91	15.24	17.50	23.41	40.66	32.81	37.53	44.66
460	0.46	0.53	14.89	15.25	17.38	23.45	40.54	32.70	37.61	44.49
470	0.47	0.54	14.88	15.25	17.27	23.47	39.94	32.58	37.64	44.31
480	0.48	0.55	14.87	15.26	17.16	23.49	39.39	32.47	37.87	44.18
490	0.48	0.55	14.86	15.26	17.08	23.45	38.69	32.28	38.06	44.25
500	0.49	0.56	14.84	15.27	17.00	23.42	37.96	32.08	38.05	44.25
510	0.49	0.57	14.83	15.27	16.85	23.41	37.40	31.92	38.15	44.62
520	0.50	0.58	14.81	15.29	16.72	23.47	36.89	31.74	38.07	45.29
530	0.51	0.59	14.79	15.29	16.65	23.60	36.43	31.56	37.82	45.30
540	0.52	0.60	14.78	15.28	16.62	23.66	35.91	31.43	37.39	45.09
550	0.52	0.61	14.76	15.26	16.59	23.70	35.51	31.31	36.76	44.14
560	0.53	0.61	14.75	15.25	16.55	23.69	35.09	31.26	36.02	43.08
570	0.54	0.62	14.74	15.23	16.51	23.62	34.85	31.21	35.45	42.17
580	0.54	0.63	14.73	15.21	16.48	23.47	34.56	31.06	34.99	41.25
590	0.55	0.63	14.73	15.18	16.45	23.26	34.12	30.94	34.54	40.46
600	0.55	0.64	14.72	15.16	16.41	23.06	33.65	30.81	34.03	39.64

Typical Performance Curves

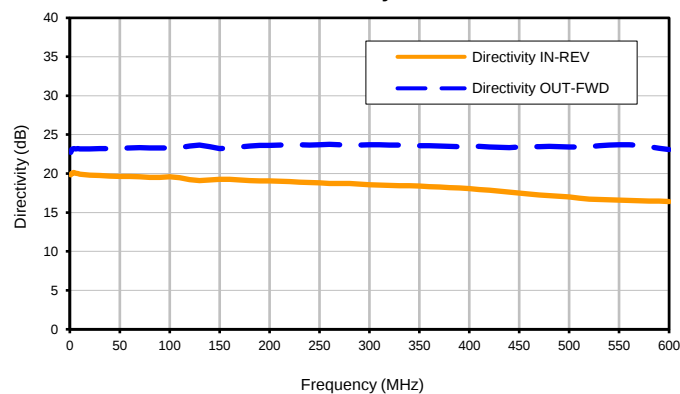
Insertion Loss



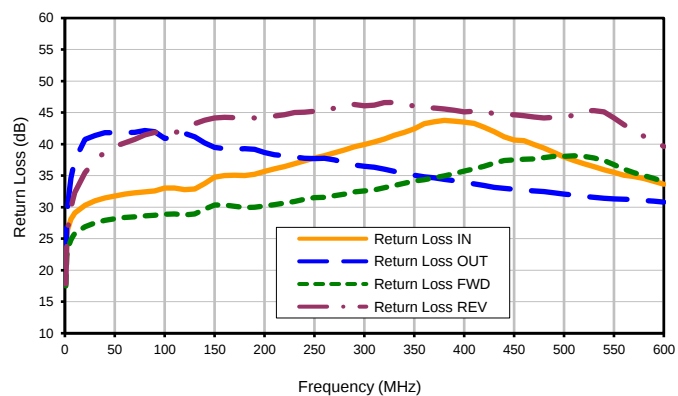
Coupling



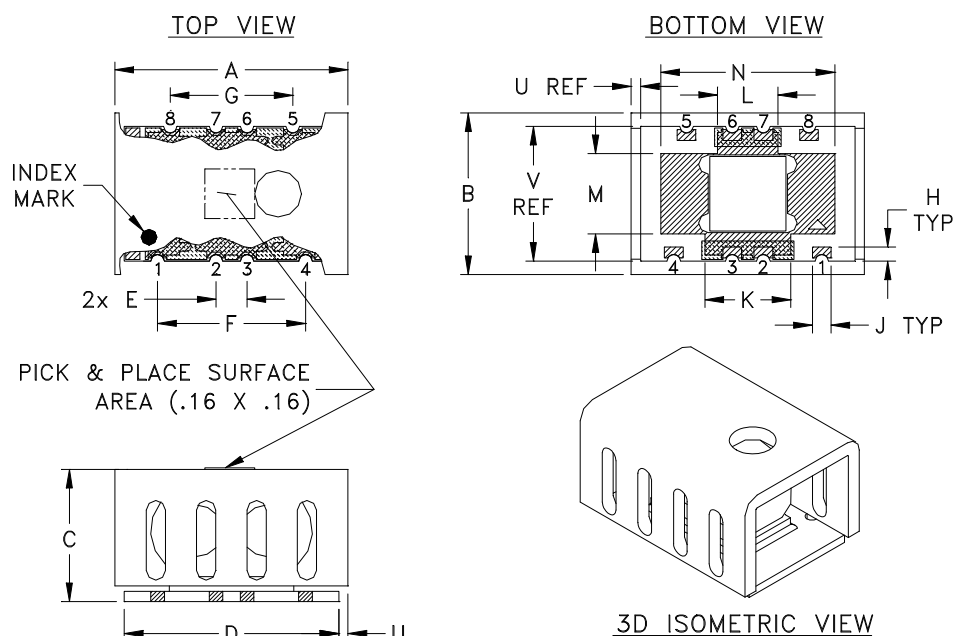
Directivity



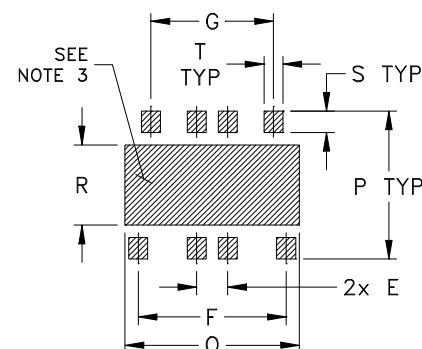
Return Loss



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	M	N
PD1647-1	.750 (19.05)	.520 (13.21)	.43 (10.92)	.690 (17.53)	.100 (2.54)	.476 (12.09)	.394 (10.01)	.045 (1.14)	.060 (1.52)	.276 (7.01)	.194 (4.93)	.257 (6.53)	.560 (14.22)

CASE #	P	Q	R	S	T	U	V	WT, GRAM
PD1647-1	.475 (12.07)	.561 (14.25)	.258 (6.55)	.069 (1.75)	.061 (1.55)	.030 (0.76)	.433 (11.00)	2.80

Dimensions are in inches (mm). Tolerances: 2 Pl. $\pm .03$; 3 Pl. $\pm .015$

Notes:

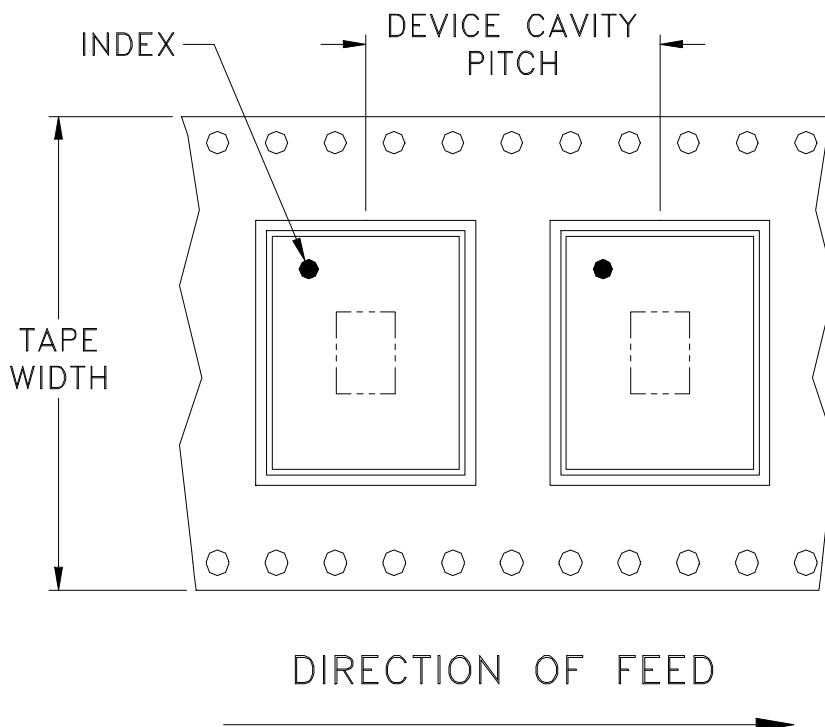
- Heat sink material: Black anodized aluminum.
- Open style, Base material: Printed wiring laminate.
- Termination finish: Tin copper solder alloy up to 0.07% Nickel. All models, (+) suffix.



INTERNET <http://www.minicircuits.com>
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010
Mini-Circuits ISO 9001 & ISO 14001 Certified

Tape & Reel Packaging TR-F115

DEVICE ORIENTATION IN T&R



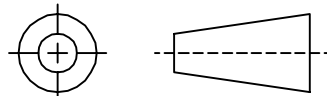
Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
32	20	7	25
		13	200

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.

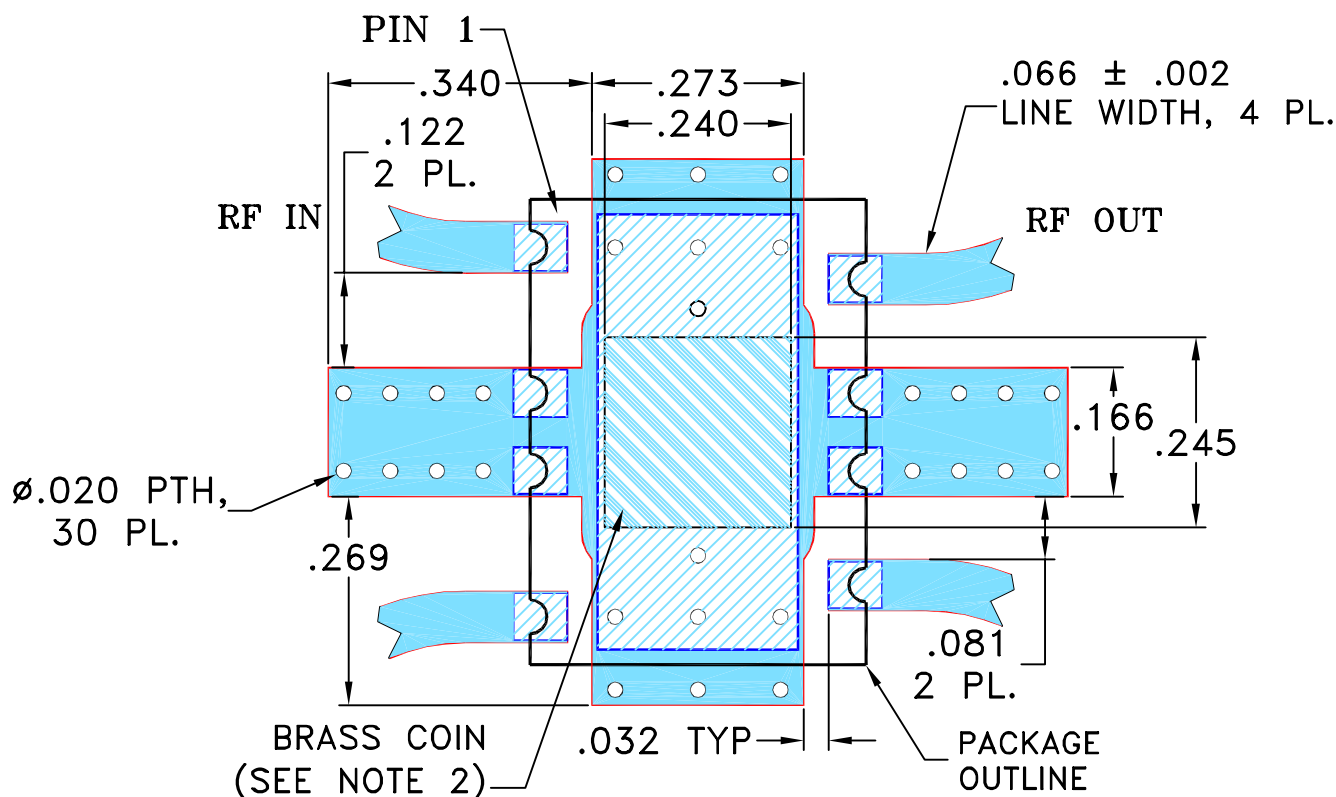
Go to: www.minicircuits.com/pages/pdfs/tape.pdf



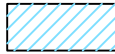
INTERNET <http://www.minicircuits.com>
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010
Mini-Circuits ISO 9001 & ISO 14001 Certified

THIRD ANGLE PROJECTION		REVISIONS					
		REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
		OR	M133287	NEW RELEASE	08/26/11	GF	WP

**SUGGESTED MOUNTING CONFIGURATION FOR
AH1647 CASE STYLE, "08DC05" PIN CODE**



- 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. SUGGEST TO PROVIDE BRASS COIN FOR BETTER HEAT TRANSFER FROM THE UNIT. OTHERWISE PROVIDE ARRAY OF THERMAL VIAS ADEQUATE TO LIMIT TEMPERATURE OF GROUND CONNECTIONS UNDER THE UNIT TO 65°C.
3. 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
-  DENOTES BRASS COIN.

UNLESS OTHERWISE SPECIFIED		INITIALS		DATE		Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235							
DIMENSIONS ARE IN INCHES		DRAWN	GF	08/22/11		PL, 08DC05, AH1647, TB-630+							
TOLERANCES ON:		CHECKED	IL	08/25/11									
2 PL DECIMALS ±		APPROVED	WP	08/26/11									
3 PL DECIMALS ± .005													
ANGLES ±													
FRACTIONS ±													
Mini-Circuits® THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS. EXCEPT FOR USE EXPRESSLY GRANTED, IN WRITING, TO ITS VENDORS, VENDEE AND THE UNITED STATES GOVERNMENT, MINI-CIRCUITS RESERVES ALL PROPRIETARY DESIGN, USE, MANUFACTURING AND REPRODUCTION RIGHTS THERETO. THESE CONTENTS SHALL NOT BE USED, DUPLICATED OR DISCLOSED TO ANY OUTSIDE PARTY, IN WHOLE OR IN PART, WITHOUT WRITTEN PERMISSION OF MINI-CIRCUITS.													
ASHEETA1.DWG REV:A DATE:01/12/95						SIZE A		CODE IDENT 15542		DRAWING NO: 98-PL-351		REV: OR	
						FILE: 98PL351		SCALE: 4:1		SHEET: 1 OF 1			



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