



Mini-Circuits

SURFACE MOUNT, HIGH POWER

Bi-Directional Coupler SYDC-10-52VHP+

50Ω 10 dB Coupling 30 to 512 MHz 35 Watt

THE BIG DEAL

- High Power Handling, 35 W
- Very Low Mainline Loss, 0.5 dB
- Excellent VSWR, 1.18



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.

+RoHS Compliant

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

APPLICATIONS

- Military Mobile

PRODUCT OVERVIEW

Mini-Circuits' SYDC-10-52VHP+ surface mount bi-directional coupler provides high power handling up to 35 W and low mainline loss of 0.5 dB for applications from 30 to 512 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 0.75x0.52x0.43", accommodating dense circuit board layouts.

KEY FEATURES

Feature	Advantages
High Power Handling • 35 W, 2.0 VSWR Max. • 10 W, Output Open or Short	Usable in many systems with high-power requirements.
Low Mainline Loss, 0.5 dB	Provides excellent through-path signal power transmission.
Good Directivity, Up to 22 dB	High directivity allows accurate signal sampling through the coupled port with minimal measurement error.
Excellent Return Loss, Up to 25 dB (Input/Output/Coupling)	Provides excellent matching in 50Ω systems with minimal signal reflection.
Small Size, 0.75x0.52x0.43"	Provides high power capability while saving space in systems with tight layouts.





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ELECTRICAL SPECIFICATIONS¹ AT +25°C

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency Range		30		512	MHz
Mainline Loss (Above Theoretical Loss 0.5 dB)	30		0.3	0.5	dB
	450		0.45	0.8	
	512		0.65	0.9	
Coupling	30-512		10±0.8		dB
Coupling Flatness (±)	30-512		±0.4	±0.6	dB
Directivity	30-250	18	22		dB
	250-450	16	20		
	450-512	14	18		
Return Loss (Input)	30-250	18	20		dB
	250-450	20	25		
	450-512	17	23		
Return Loss (Output)	30-250	18	20		dB
	250-450	20	26		
	450-512	18	25		
Return Loss (Coupling)	30-250	18	20		dB
	250-450	16	20		
	450-512	15	18		
Input Power ²	30-512			35	W

1. Tested on Evaluation Board TB-SYDC1052VHP+.

2. The user must provide adequate means of heat removal to limit the temperature of ground 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 or less when the unit is driven at maximum specified RF input power, 35 W.

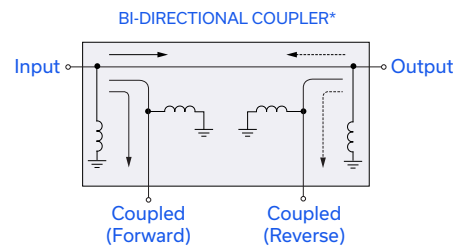
At higher ambient temperature, with the same heat sink. Input power in watts must not exceed $35 \text{ W} \times (+65^\circ\text{C} - T_{\text{ambient}}) \div +40^\circ\text{C}$.

ABSOLUTE MAXIMUM RATINGS

Parameter	Ratings
Operating Temperature	-40°C to +65°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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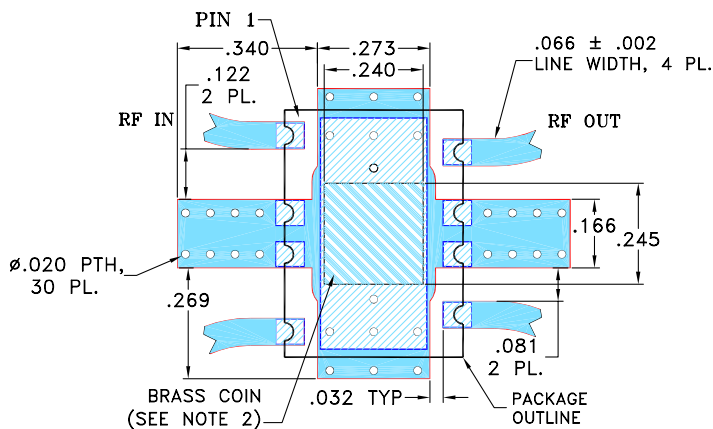
PAD CONNECTIONS

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

***PRODUCT MARKING:** SYDC-10-52VHP

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

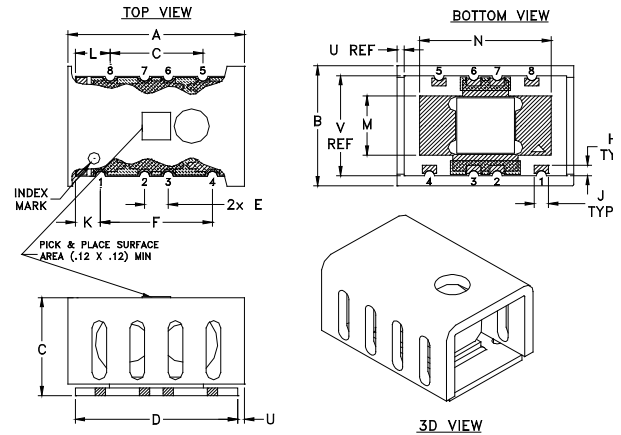
EVAL BOARD MCL P/N: TB-SYDC1052VHP+
SUGGESTED PCB LAYOUT (PL-351)
 REFER TO APPLICATION NOTE: [AN-00-017](#)



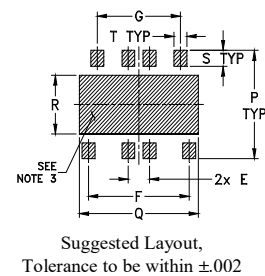
- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS $.030" \pm .002"$; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
 2. SUGGEST TO PROVIDE BRASS COIN FOR BETTER HEAT TRANSFER FROM THE UNIT. OTHERWISE PROVIDE ARRAY OF THERMAL VIAS ADEQUATE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



OUTLINE DIMENSIONS (Inches)

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

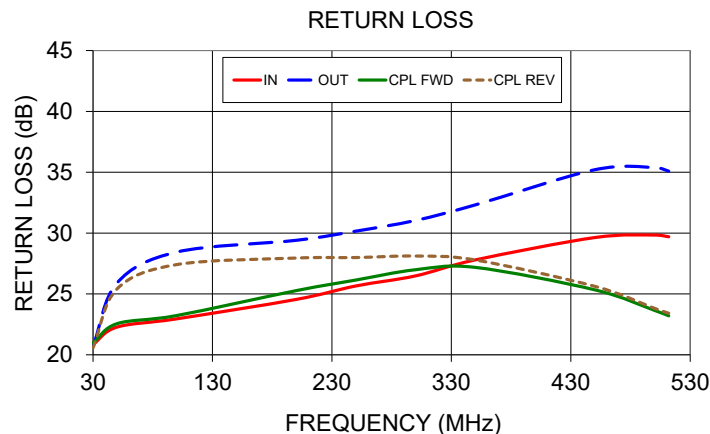
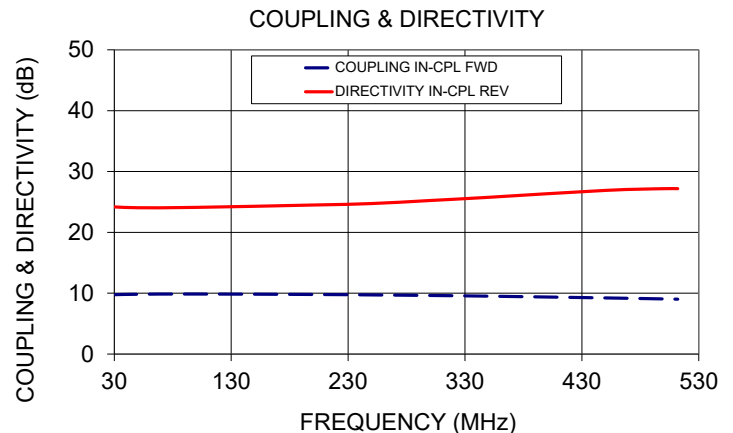
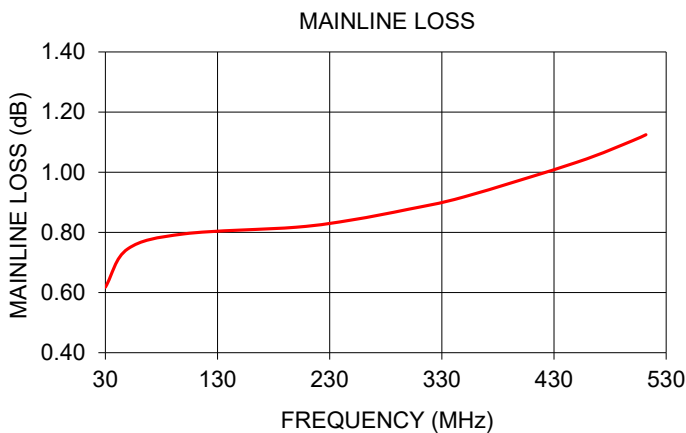
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TYPICAL PERFORMANCE DATA

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
30	0.62	9.8	9.8	22.4	24.2	20.8	20.7	21.0	20.6
50	0.75	9.8	10.0	22.7	24.0	22.3	25.9	22.5	25.4
100	0.79	9.9	10.0	22.2	24.1	22.9	28.4	23.2	27.4
200	0.82	9.8	9.9	21.5	24.5	24.5	29.4	25.3	27.9
250	0.84	9.7	9.8	21.1	24.7	25.7	30.2	26.1	28.0
300	0.88	9.6	9.7	20.8	25.2	26.5	31.0	27.0	28.1
350	0.92	9.5	9.6	20.3	25.8	27.8	32.3	27.2	27.8
450	1.03	9.2	9.3	19.6	26.9	29.6	35.2	25.3	25.6
500	1.10	9.1	9.1	19.2	27.2	29.8	35.4	23.6	23.8
512	1.12	9.0	9.1	19.1	27.2	29.7	35.1	23.2	23.4



- 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

SYDC-10-52VHP+

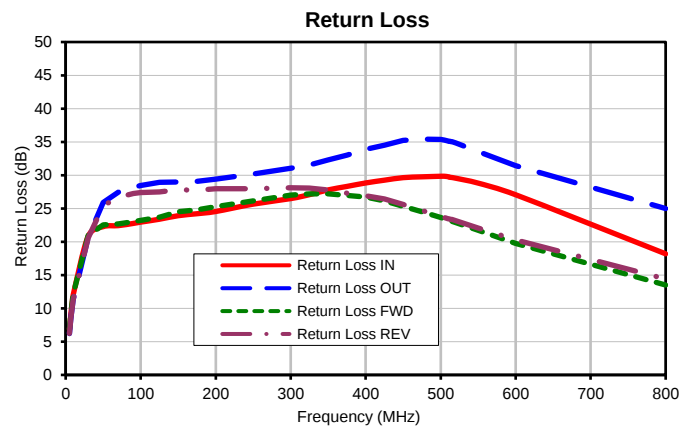
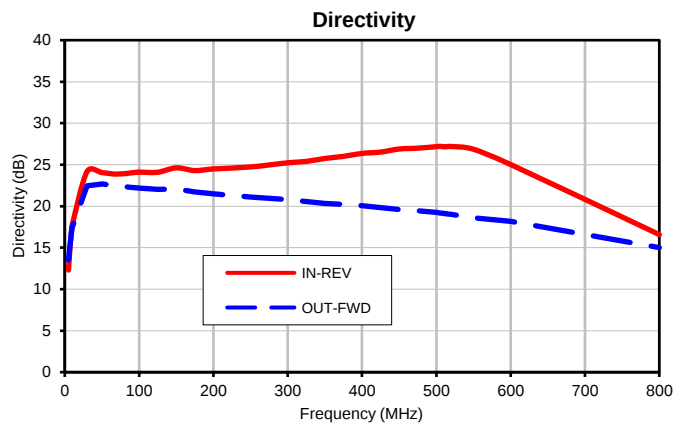
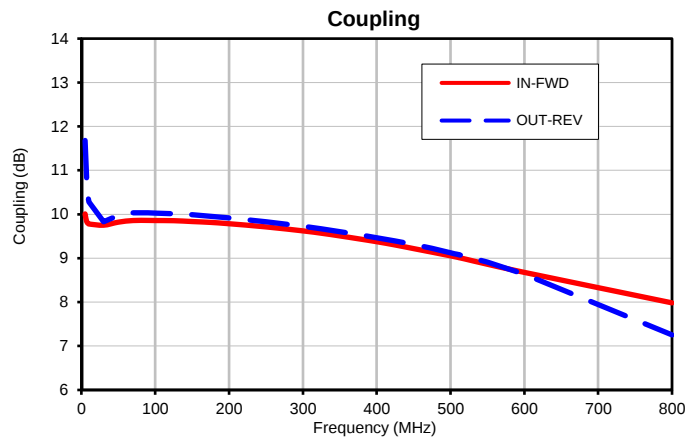
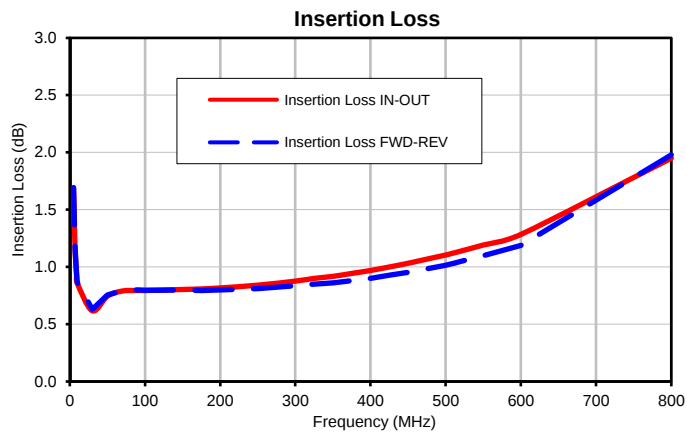
Typical Performance Data

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
5.0	1.68	1.69	10.01	11.68	12.31	13.52	6.83	6.21	6.86	6.23
7.0	1.16	1.17	9.84	10.80	14.94	15.34	9.23	8.56	9.28	8.56
9.0	0.93	0.94	9.79	10.40	16.90	16.83	11.18	10.48	11.22	10.48
10	0.86	0.87	9.78	10.28	17.73	17.47	12.02	11.31	12.06	11.31
30	0.62	0.63	9.75	9.83	24.18	22.45	20.84	20.68	20.97	20.57
50	0.75	0.75	9.82	9.97	24.04	22.68	22.27	25.89	22.55	25.40
70	0.79	0.79	9.86	10.03	23.86	22.45	22.42	27.43	22.67	26.67
90	0.79	0.80	9.86	10.04	24.02	22.24	22.75	28.14	23.03	27.25
100	0.79	0.80	9.86	10.03	24.10	22.17	22.95	28.44	23.22	27.41
125	0.80	0.80	9.85	10.01	24.09	22.01	23.38	28.92	23.68	27.50
150	0.80	0.80	9.83	9.99	24.62	22.07	23.91	28.98	24.50	27.81
175	0.81	0.80	9.82	9.95	24.29	21.71	24.21	29.09	24.82	27.72
200	0.82	0.80	9.78	9.92	24.49	21.49	24.54	29.40	25.27	27.95
250	0.84	0.81	9.71	9.83	24.73	21.11	25.65	30.16	26.14	27.99
300	0.88	0.84	9.62	9.73	25.23	20.80	26.48	31.04	26.99	28.11
325	0.90	0.85	9.57	9.67	25.40	20.57	27.07	31.55	27.19	28.05
350	0.92	0.86	9.51	9.61	25.75	20.34	27.79	32.31	27.18	27.79
375	0.94	0.88	9.44	9.54	26.00	20.23	28.31	33.03	26.97	27.30
400	0.97	0.90	9.38	9.47	26.36	20.07	28.83	33.87	26.73	26.90
425	1.00	0.93	9.30	9.39	26.52	19.84	29.25	34.50	26.13	26.43
450	1.03	0.95	9.22	9.31	26.89	19.61	29.63	35.20	25.34	25.62
475	1.07	0.98	9.14	9.22	26.99	19.44	29.75	35.42	24.51	24.69
500	1.10	1.02	9.05	9.12	27.17	19.24	29.84	35.38	23.65	23.82
505	1.11	1.02	9.04	9.10	27.21	19.19	29.84	35.25	23.45	23.66
510	1.12	1.03	9.02	9.09	27.17	19.13	29.77	35.13	23.26	23.47
511	1.12	1.03	9.01	9.08	27.14	19.12	29.69	35.07	23.22	23.43
512	1.12	1.03	9.01	9.08	27.18	19.09	29.70	35.09	23.20	23.41
513	1.13	1.04	9.01	9.07	27.16	19.10	29.68	35.08	23.16	23.38
514	1.13	1.04	9.00	9.07	27.17	19.09	29.66	35.03	23.10	23.35
515	1.13	1.04	9.00	9.07	27.18	19.07	29.65	35.02	23.08	23.33
520	1.14	1.05	8.98	9.05	27.19	19.01	29.55	34.82	22.90	23.14
550	1.19	1.10	8.86	8.92	26.86	18.61	28.81	33.54	21.73	22.08
600	1.28	1.19	8.68	8.64	25.02	18.17	27.06	31.45	19.77	20.26
800	1.95	1.98	7.98	7.25	16.58	15.00	18.19	24.98	13.48	14.40

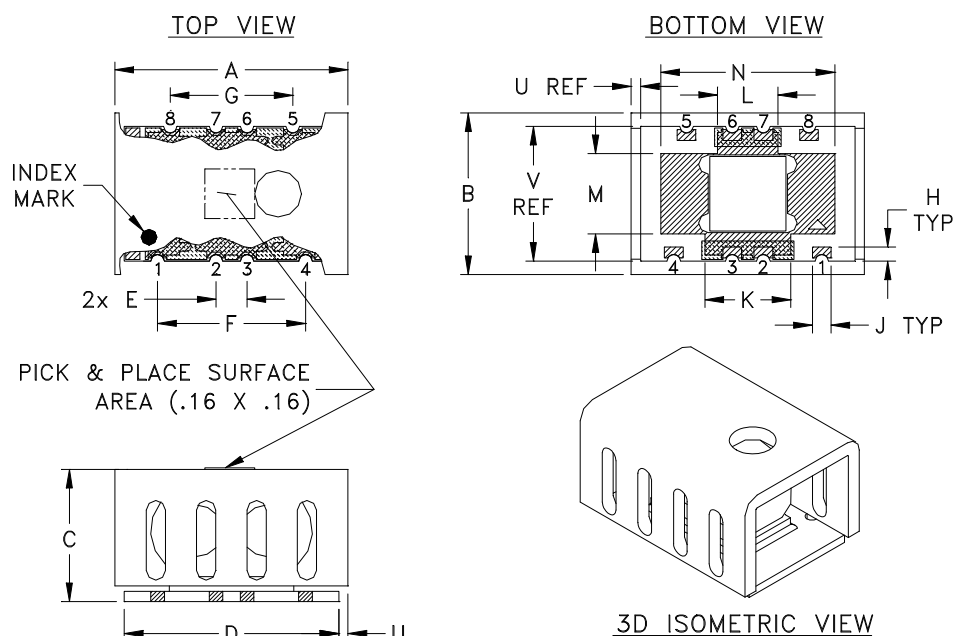
Bi-Directional Coupler

Typical Performance Curves

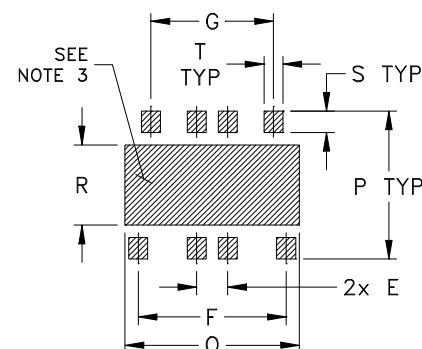
SYDC-10-52VHP+



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:

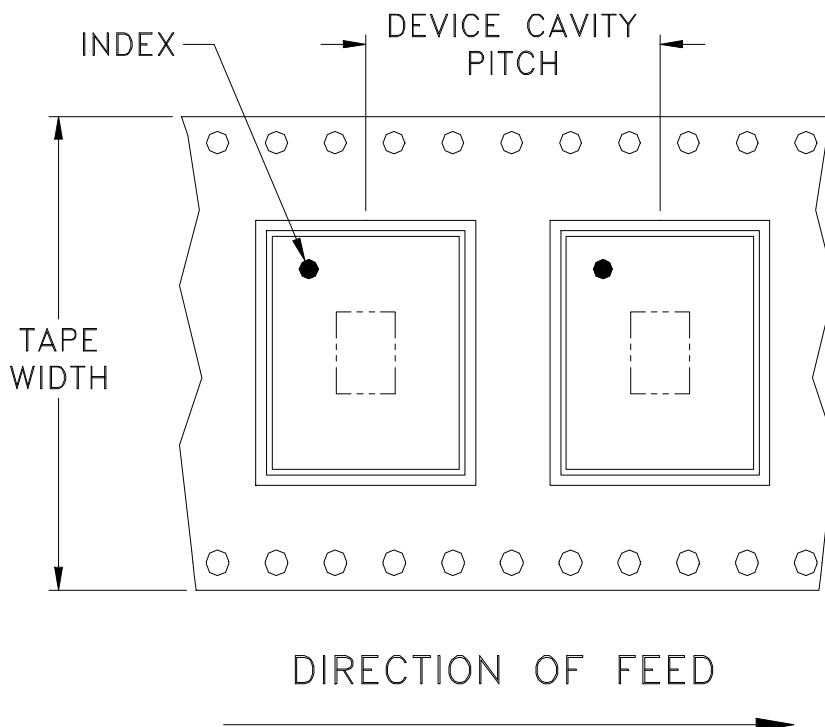
- Heat sink material: Black anodized aluminum.
- Open style, Base material: Printed wiring laminate.
- Termination finish: Tin copper solder alloy up to 0.07% Nickel. All models, (+) suffix.



INTERNET <http://www.minicircuits.com>
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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.

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

Technical drawing of a package outline showing dimensions and features:

- PIN 1**: Indicated by an arrow pointing to the top-left corner.
- .340**: Dimension across the top-left section.
- .273**: Dimension across the top-right section.
- .122 2 PL.**: Dimension across the top-left section, indicating 2 plating layers.
- .240**: Dimension across the top-right section.
- .066 ± .002 LINE WIDTH, 4 PL.**: Dimension across the top-right section, indicating 4 plating layers.
- RF IN**: Label for the input radio frequency port.
- RF OUT**: Label for the output radio frequency port.
- .166**: Dimension across the bottom-right section.
- .245**: Dimension across the bottom-right section.
- Ø.020 PTH, 30 PL.**: Dimension across the bottom-left section, indicating 30 plating layers.
- .269**: Dimension across the bottom-left section.
- .081 2 PL.**: Dimension across the bottom-right section, indicating 2 plating layers.
- BRASS COIN (SEE NOTE 2)**: Label for the central feature.
- .032 TYP**: Dimension across the bottom-right section, indicating typical thickness.
- PACKAGE OUTLINE**: Label for the overall package boundary.

- 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.

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES

TOLERANCES ON:
2 PL DECIMALS ±
3 PL DECIMALS ± .005
ANGLES ±
FRACTIONS ±

INITIALS

DATE _____

DRAWN

GF

08/22/11

CHECKED

II

08/25/11

APPROVED

442

09 / 09 / 11



Mini-Circuits® 13 Neptune Avenue
Brooklyn NY 11235

13 Neptune Avenue
Brooklyn NY 11235

PL, 08DC05, AH1647, TB-630+

SIZE
A

CODE IDENT
15542

DRAWING NO:
98-PL-351

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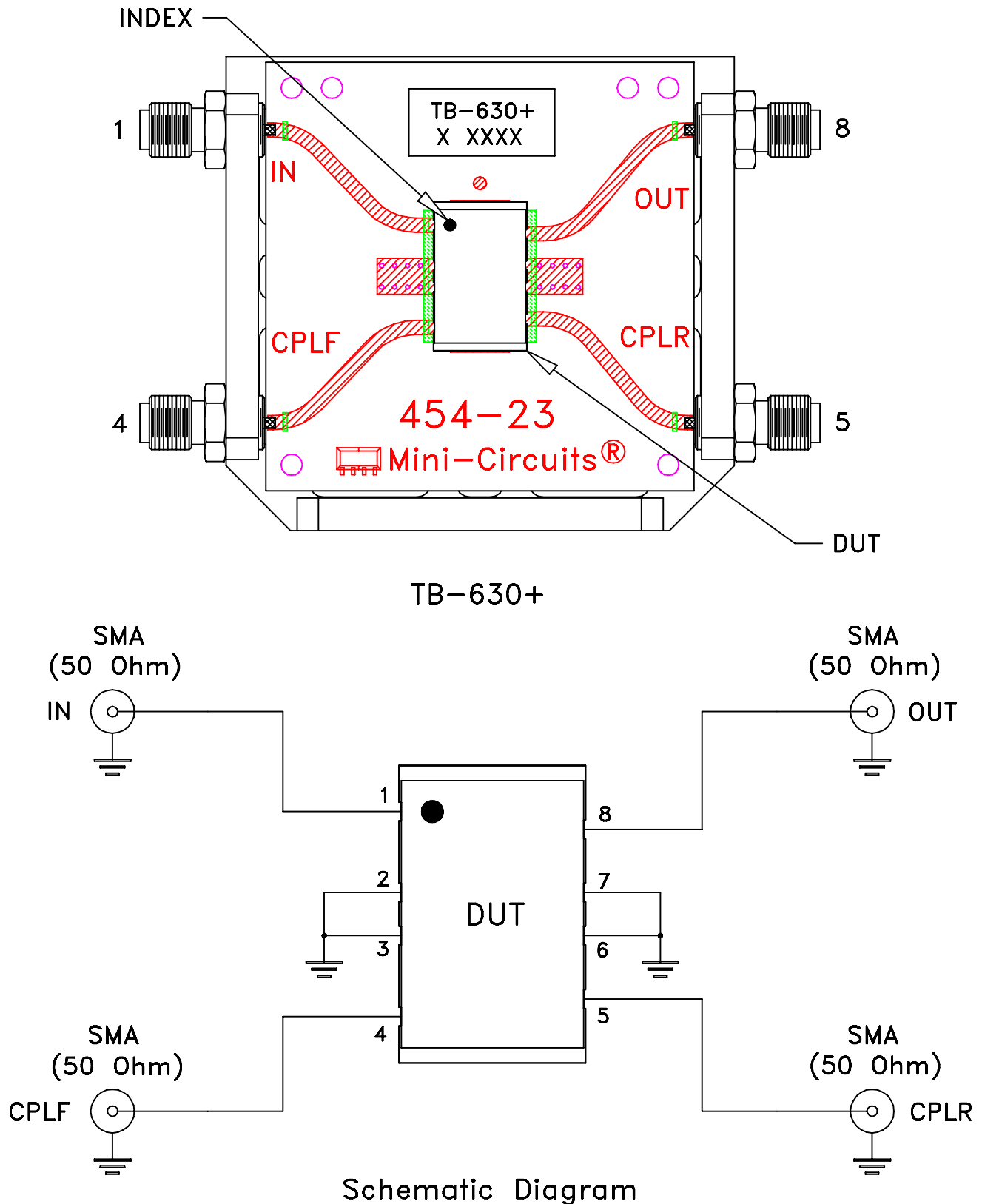
SCALE: 4:1

SHEET:	1 OF 1
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ASHEETA1.DWG REV:A DATE:01/12/95

Evaluation Board and Circuit



Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: 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 65° C Case 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, Para 4.2.5, Test S, 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