



Mini-Circuits

SURFACE MOUNT

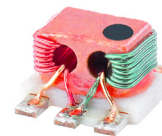
Bi-Directional Coupler

TCD-20-23BD+

50Ω 500 to 2000 MHz 20 dB 2 W

KEY FEATURES

- Wideband 500 to 2000 MHz, Multi-Octave
- Low Mainline Loss, 0.2 dB typ.
- Power Handling, 2 Watts
- Robust and Reliable

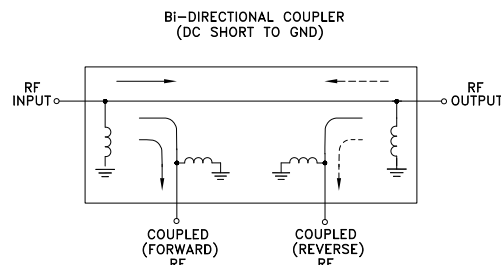


Generic photo used for illustration purposes only

APPLICATIONS

- UHF, GSM,
- ISM, GPS & PCN
- Cellular

ELECTRICAL SCHEMATIC



PRODUCT OVERVIEW

Mini-Circuits' TCD-20-23BD+ surface mount bi-directional coupler provides 20 dB nominal coupling with low mainline loss from 500 to 2000 MHz, supporting a wide variety of applications including UHF, GSM, ISM, GPS & PCN, Cellular and more. This coupler is built with core and wire construction mounted on a 5-lead base (0.162 x 0.150 x 0.022").

ELECTRICAL SPECIFICATIONS AT +25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Units
Frequency Range	-	500		2000	MHz
Mainline Loss (In -Out) ¹	500 - 1200	-	0.25	0.45	dB
	1200 - 2000	-	0.15	0.50	
Coupling Nominal	500 - 1200	-	22 ± 1.0	-	dB
	1200 - 2000	-	19 ± 1.0	-	
Coupling Flatness (±)	500 - 1200	-	±1.2	±1.9	dB
	1200 - 2000	-	±1.3	±1.9	
Directivity	500-800	13	17	-	dB
	800 - 1200	12	16	-	
	1200 - 2000	10	14	-	
Return Loss (Input)	500 - 2000	-	17	-	dB
Return Loss (Output)	500 - 2000	-	17	-	dB
Return Loss (Coupled)	500 - 2000	-	17	-	dB

1. Mainline Loss includes coupling loss.

ABSOLUTE MAXIMUM RATINGS²

Operating Case Temperature	-40°C to +85°C
Storage Temperature	-55°C to +100°C
Input Power	2 W

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

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www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

REV. OR
ECO-025921
TCD-20-23BD+
MCL NY
250619

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Bi-Directional Coupler

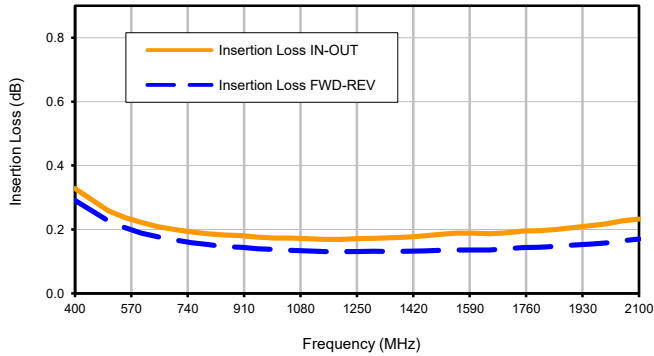
TCD-20-23BD+

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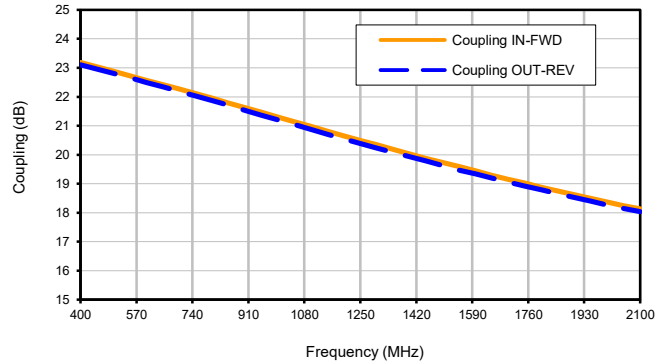
50Ω 500 to 2000 MHz 20 dB 2 W

TYPICAL PERFORMANCE GRAPHS

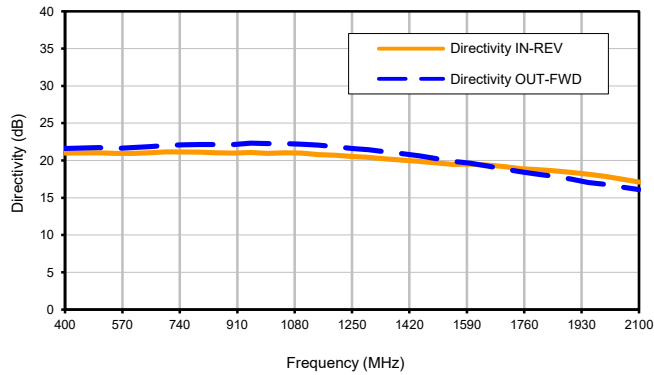
Insertion Loss



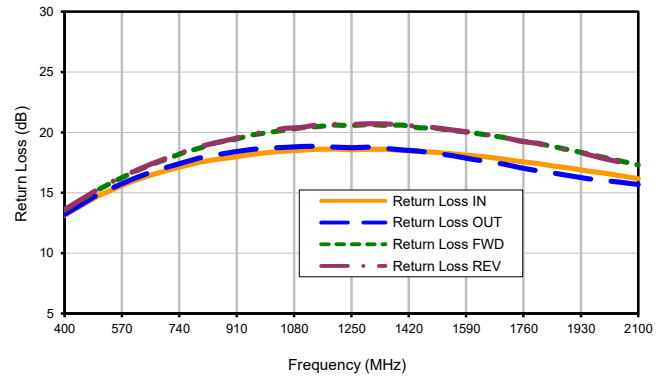
Coupling



Directivity



Return Loss





SURFACE MOUNT

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50Ω 500 to 2000 MHz 20 dB 2 W

ELECTRICAL SCHEMATIC

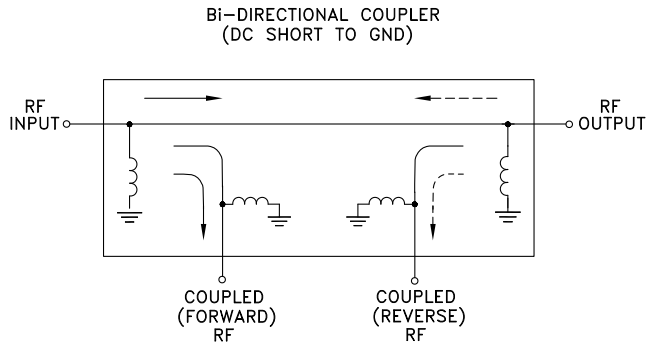
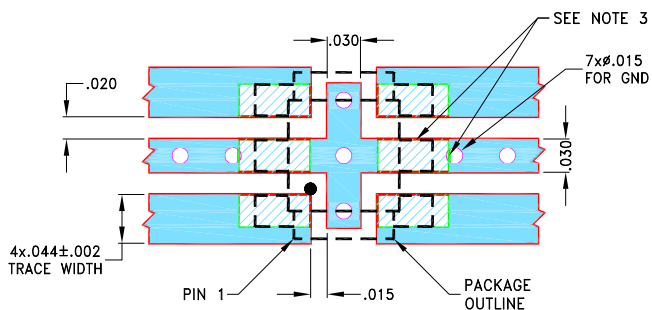


Figure 1. TCD-20-23BD+ Functional Diagram

PAD DESCRIPTION/CONFIGURATION

Function	Pad Number	Description
Input	1	Connects to RF Input Port
Output	6	Connects to RF Output Port
Coupled Forward	3	Connects to Coupled Forward Port
Coupled Reverse	4	Connects to Coupled Reverse Port
Ground	2	Connects to Ground

SUGGESTED PCB LAYOUT (PL-821)



NOTES:

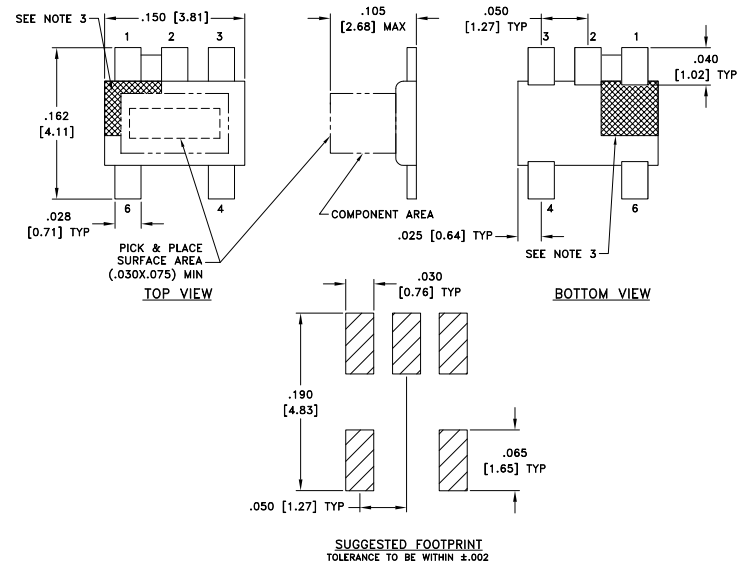
- TRACE WIDTH IS SHOWN FOR ROGERS (R04350B) WITH DIELECTRIC THICKNESS .020±.0015. COPPER: 1/2 Oz ON EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
- BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
- THIS PAD/PIN IS NOT AVAILABLE/REQUIRED FOR FIVE PIN CASE STYLES (AT SERIES).

■ DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).

■ DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK.

Figure 2. Suggested PCB Layout PL-821

CASE STYLE DRAWING



Weight: 0.11 grams

Dimensions are in inches [mm]. Tolerances: 2 Pl. ± .01; 3 Pl. ± .005

PRODUCT MARKING*: N/A

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



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Bi-Directional Coupler

TCD-20-23BD+

50Ω 500 to 2000 MHz 20 dB 2 W

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD.

[CLICK HERE](#)

Performance Data & Graphs	Data Graphs S-Parameter (SXP Files) Data Set (.zip file) De-embedded to device pads
Case Style	AT224-5
RoHS Status	Compliant
Tape and Reel	F17
Suggested Layout for PCB Design	PL-821
Evaluation Board	TB-TCD-20-23BD+ Gerber File
Environmental Rating	ENV02T1

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-Circuits' 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

TCD-20-23BD+

Typical Performance Data

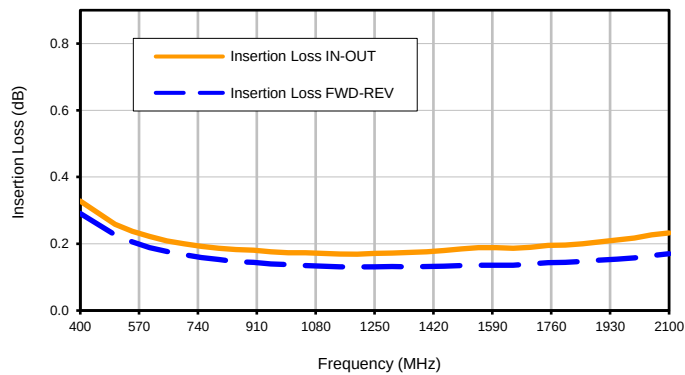
FREQ. (MHz)	INSERTION LOSS		COUPLING		DIRECTIVITY		RETURN LOSS			
	(dB)		(dB)		(dB)		(dB)			
	IN-OUT	FWD-REV	IN-FWD	OUT-REV	IN-REV	OUT-FWD	IN	OUT	FWD	REV
400.00	0.33	0.29	23.19	23.10	20.98	21.62	13.14	13.20	13.55	13.61
500.00	0.26	0.23	22.88	22.81	21.04	21.74	14.74	14.86	15.26	15.31
550.00	0.24	0.21	22.73	22.66	20.95	21.62	15.36	15.51	15.98	16.02
600.00	0.22	0.19	22.57	22.49	20.95	21.74	15.92	16.10	16.65	16.69
650.00	0.21	0.18	22.42	22.34	21.04	21.85	16.41	16.64	17.25	17.31
700.00	0.20	0.17	22.27	22.19	21.14	22.00	16.83	17.09	17.77	17.84
750.00	0.19	0.16	22.11	22.03	21.14	22.09	17.19	17.49	18.29	18.34
800.00	0.19	0.15	21.95	21.87	21.13	22.13	17.54	17.88	18.71	18.82
850.00	0.18	0.15	21.78	21.70	21.02	22.14	17.76	18.14	19.15	19.16
900.00	0.18	0.14	21.63	21.52	20.97	22.16	17.95	18.37	19.40	19.47
950.00	0.18	0.14	21.46	21.36	21.05	22.32	18.17	18.58	19.76	19.83
1000.00	0.17	0.14	21.30	21.20	20.97	22.28	18.33	18.69	19.96	20.04
1050.00	0.17	0.13	21.14	21.04	21.04	22.24	18.44	18.76	20.18	20.32
1100.00	0.17	0.13	20.97	20.87	20.98	22.16	18.53	18.82	20.39	20.40
1150.00	0.17	0.13	20.82	20.71	20.77	22.07	18.60	18.86	20.48	20.62
1200.00	0.17	0.13	20.66	20.55	20.72	21.86	18.62	18.78	20.60	20.66
1250.00	0.17	0.13	20.49	20.39	20.53	21.63	18.55	18.72	20.57	20.67
1300.00	0.17	0.13	20.34	20.23	20.40	21.44	18.60	18.77	20.65	20.72
1350.00	0.17	0.13	20.19	20.08	20.20	21.17	18.61	18.68	20.57	20.70
1400.00	0.18	0.13	20.03	19.93	20.03	20.91	18.49	18.55	20.61	20.61
1450.00	0.18	0.13	19.87	19.78	19.87	20.63	18.43	18.45	20.36	20.50
1500.00	0.18	0.13	19.73	19.62	19.69	20.25	18.35	18.28	20.36	20.37
1550.00	0.19	0.14	19.59	19.47	19.48	19.88	18.22	18.06	20.14	20.20
1600.00	0.19	0.14	19.45	19.34	19.50	19.65	18.08	17.81	20.00	20.01
1650.00	0.19	0.14	19.29	19.19	19.39	19.27	17.96	17.58	19.79	19.82
1700.00	0.19	0.14	19.15	19.05	19.19	18.87	17.78	17.37	19.60	19.59
1750.00	0.19	0.14	19.02	18.92	18.91	18.48	17.57	17.09	19.29	19.29
1800.00	0.20	0.14	18.88	18.79	18.78	18.15	17.43	16.83	19.10	19.08
1850.00	0.20	0.15	18.75	18.66	18.59	17.86	17.21	16.63	18.80	18.81
1900.00	0.21	0.15	18.62	18.53	18.41	17.50	17.03	16.39	18.51	18.48
1950.00	0.21	0.15	18.49	18.39	18.13	17.04	16.80	16.15	18.22	18.17
2000.00	0.22	0.16	18.36	18.26	17.85	16.78	16.61	16.02	17.91	17.82
2050.00	0.23	0.16	18.24	18.14	17.47	16.42	16.39	15.86	17.61	17.51
2100.00	0.23	0.17	18.13	18.04	17.10	16.10	16.15	15.67	17.31	17.17

Bi-Directional Coupler

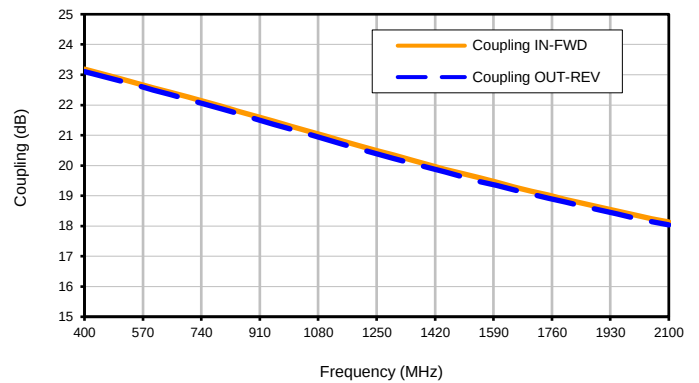
Typical Performance Curves

TCD-20-23BD+

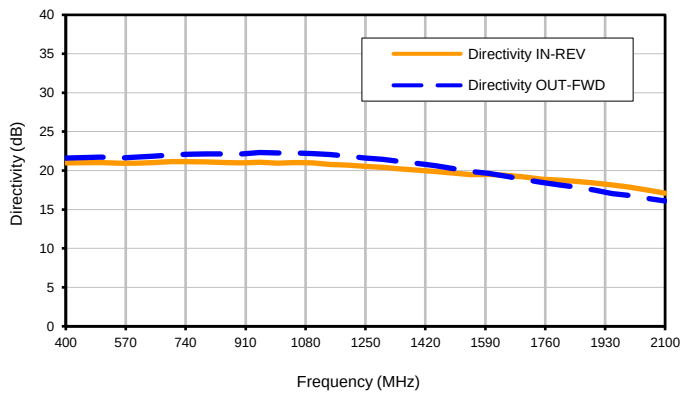
Insertion Loss



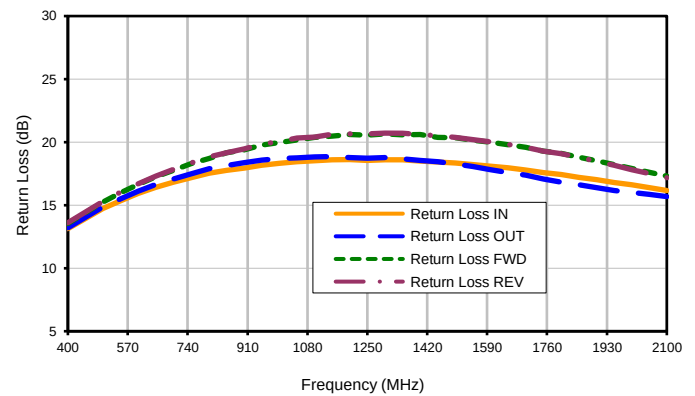
Coupling

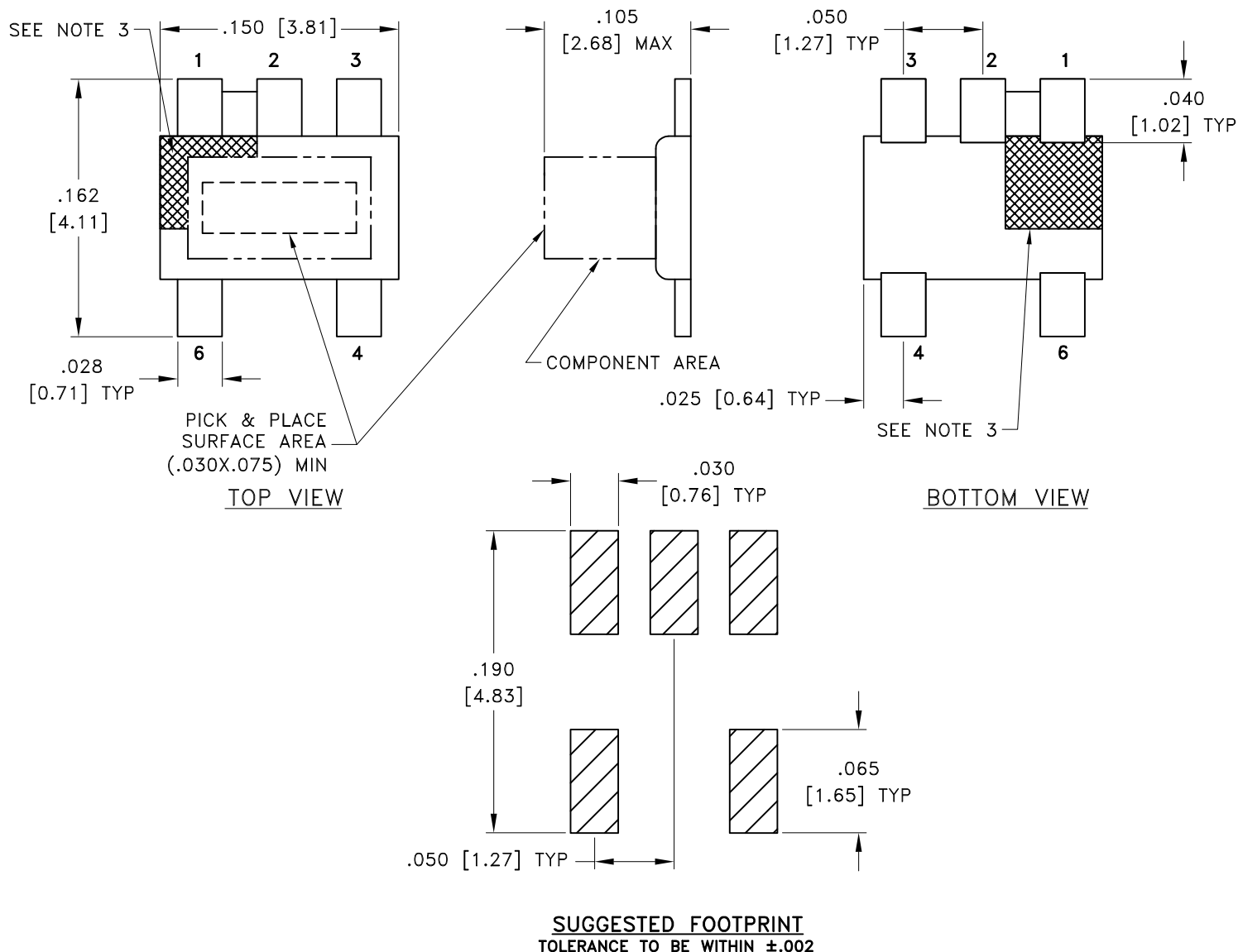


Directivity



Return Loss





Weight: 0.11 grams

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

Notes:

1. Case material: Plastic.
2. Termination finish:
For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
3. Lead #1 identifier shall be located in the cross-hatched area shown.
Identifier may be either a molded or marked feature.



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



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RF/IF MICROWAVE COMPONENTS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-025369	NEW RELEASE	APR 25	DDR	VC

1. TRACE WIDTH IS SHOWN FOR ROGERS (RO4350B) WITH DIELECTRIC THICKNESS $.020 \pm .0015$
COPPER: 1/2 Oz ON 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 SOLDERMASK.

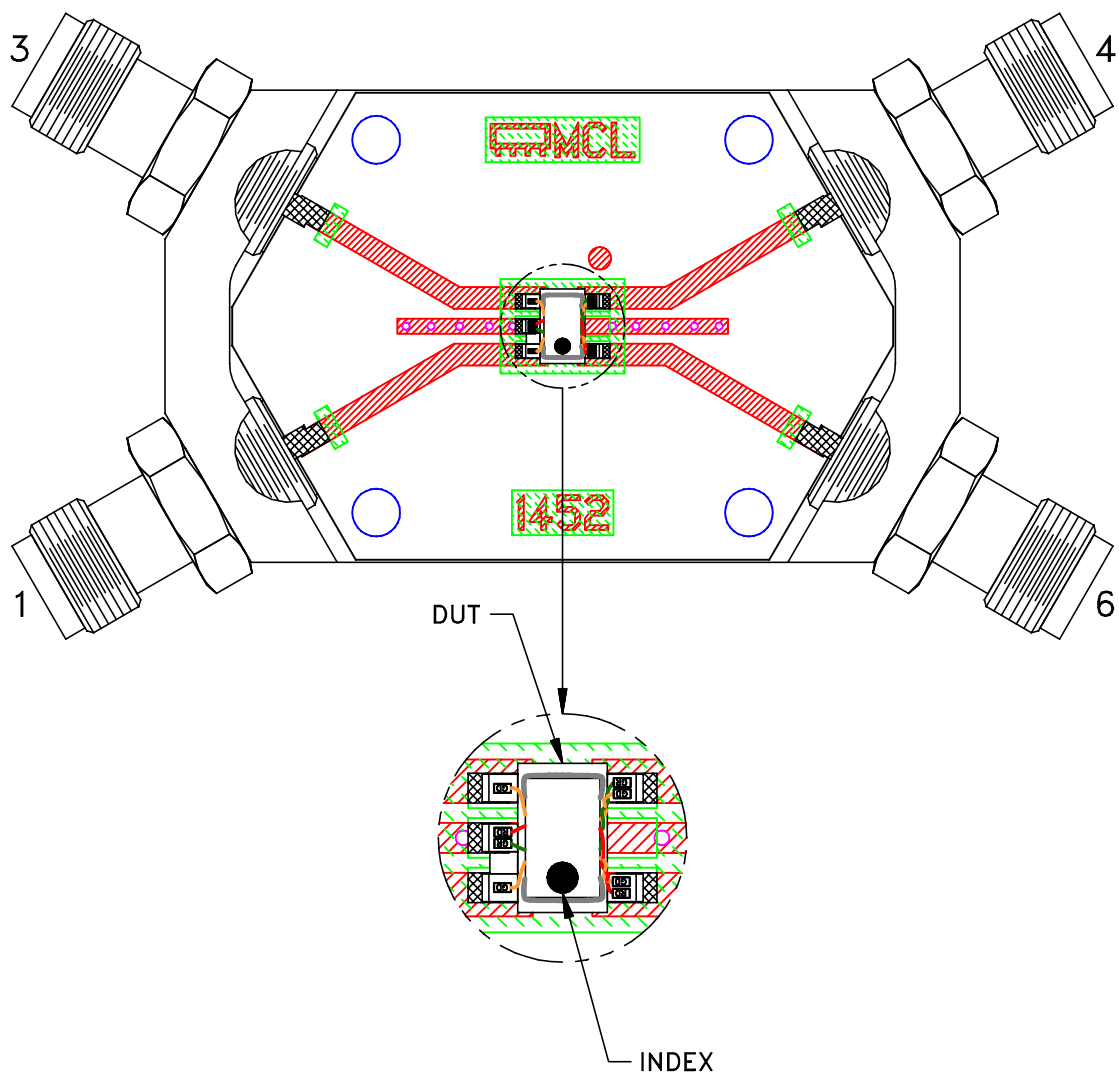
UNLESS OTHERWISE SPECIFIED		INITIALS		DATE	
DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± FRACTIONS ± 		DRAWN	DDR	30	APR 25
		CHECKED	MKS	30	APR 25
		APPROVED	ASJ	30	APR 25
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Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235					
PL, DB1627, TB-1241					
SIZE A		CODE IDENT 15542		DRAWING NO: 98-PL-821	
REV: OR					
FILE: 98-PL-821		SCALE: 12:1		SHEET: 1 OF 1	

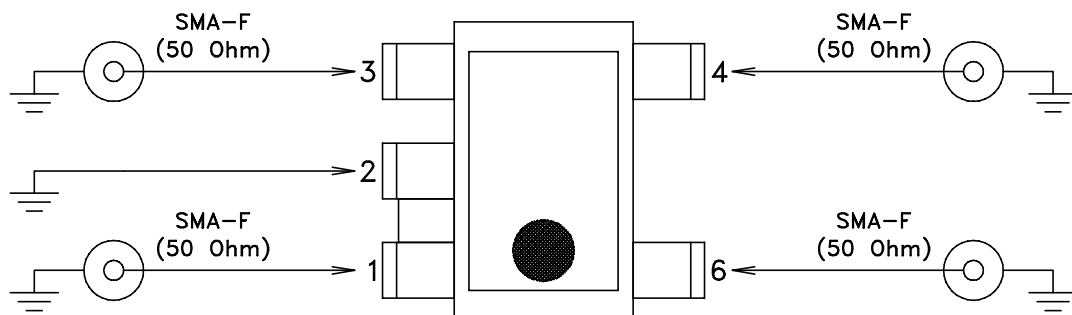
Evaluation Board and Circuit

TB-TCD-20-23BD+

Refer data sheet of the model for pin connections



Schematic diagram



Notes:

1. PCB Material: ROGERS (R04350B) OR Equivalent, Dielectric Constant=3.48
Thickness=.020±.0015 inch
2. 50 Ohm SMA Female Connectors.

 **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	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
Barometric Pressure	100,000 Feet	MIL-STD-202, Method 105, Condition D
Humidity	90% RH, 65°C Units may require bake-out after humidity to restore full performance.	MIL-STD-202, Method 103
Thermal Shock	-65° to 125°C, 5 cycles	MIL-STD-202, Method 107, Condition B
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	100g, 6ms sawtooth, 3 shocks each direction 3 axes (total 18)	MIL-STD-202, Method 213, Condition I