SURFACE MOUNT top hat

Bi-Directional Coupler TCD-10-23BDX+

50Ω 5 to 2250 MHz 10 dB Coupling

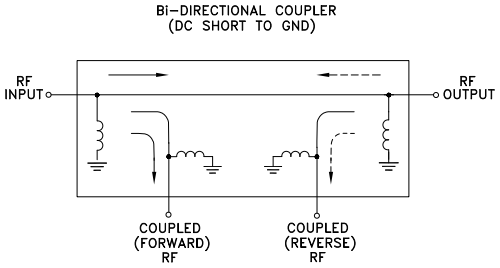
KEY FEATURES

- Wideband, 5 to 2250 MHz
- Low Mainline Loss, 2.0 dB typ.
- Excellent Return Loss; 18 dB typ.
- Aqueous Washable
- Leads for excellent solderability



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

- VHF/UHF
- CATV
- Cellular

PRODUCT OVERVIEW

Mini-Circuits' TCD-10-23BDX+ surface mount bi-directional coupler provides 10 dB nominal coupling with excellent flatness from 5 to 2250 MHz, supporting a wide variety of applications including VHF/UHF, CATV, Cellular and more. This model provides low mainline loss, high directivity and excellent return loss. The coupler is built with core and wire construction mounted on a 6-leadplastic base (0.16 x 0.15 x 0.22'') and includes Mini-Circuits' Tophat® feature for faster, and more accurate pick-and-place assembly.

ELECTRICAL SPECIFICATIONS AT +25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Units
Frequency Range		5		2250	MHz
Mainline Loss[1]	5 – 950		1.3	1.8	dB
	950 - 2250		2.2	2.6	
Coupling Nominal	5 – 2250		10 ±0.8	-	dB
Coupling Flatness (±)	5 - 2250		0.6	1.0	dB
Directivity	5 – 400	17	21		dB
	400 – 950	15	18		
	950 - 2250	9	14		
Return Loss (Input)	5 – 950		18		dB
	950 - 2250		16		
Return Loss (Output)	5 - 950		24		dB
	950 - 2250		20		
Return Loss (Coupled)	5 – 950		18		dB
	950 - 2250		16		

1. Mainline Loss includes coupling loss.

ABSOLUTE MAXIMUM RATINGS[2]

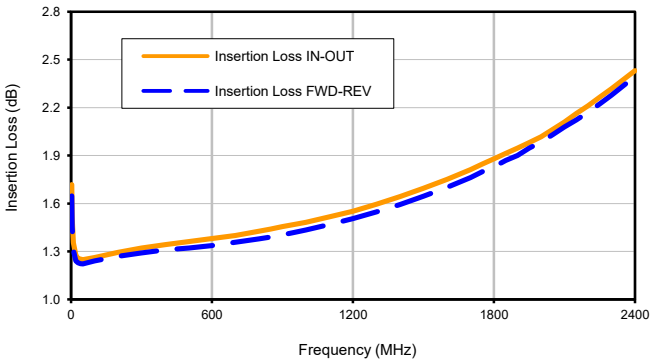
Operating Case Temperature	-40°C to +85°C
Storage Temperature	-55°C to +100°C
Input Power	0.5 W

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

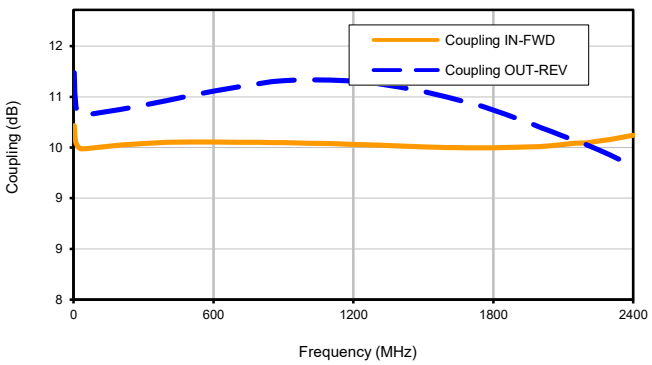
REV. OR
ECO-025837
TCD-10-23BDX+
MCL NY
250611

TYPICAL PERFORMANCE GRAPHS

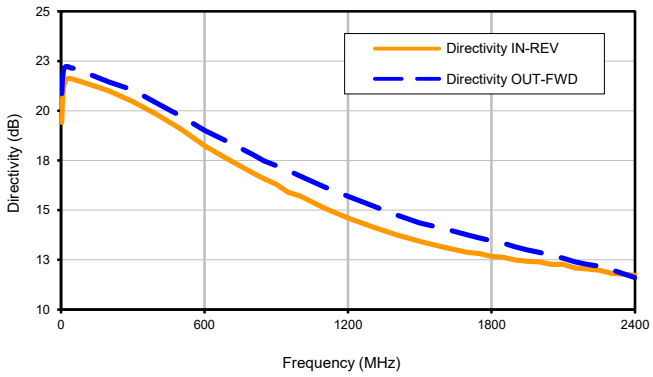
Insertion Loss



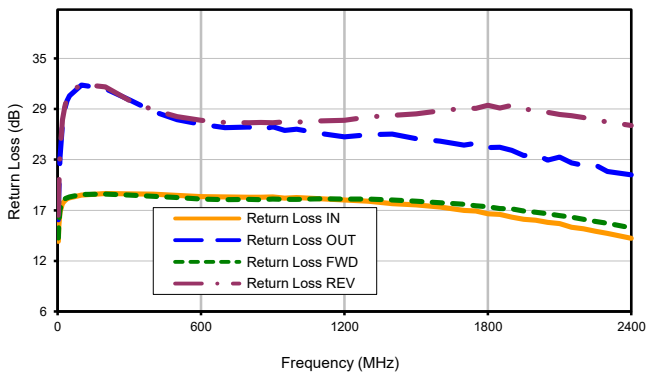
Coupling



Directivity



Return Loss



SURFACE MOUNT top hat

Bi-Directional Coupler TCD-10-23BDX+

50Ω 5 to 2250 MHz 10 dB Coupling

FUNCTIONAL DIAGRAM

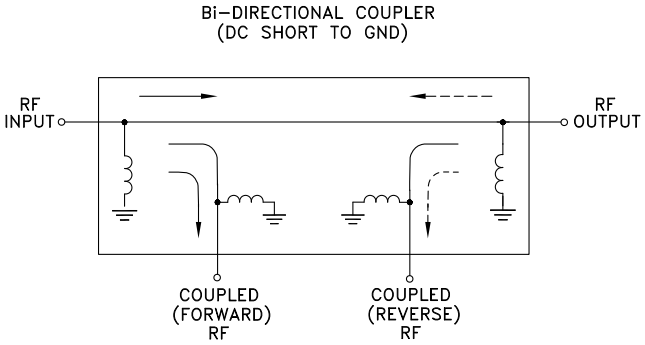
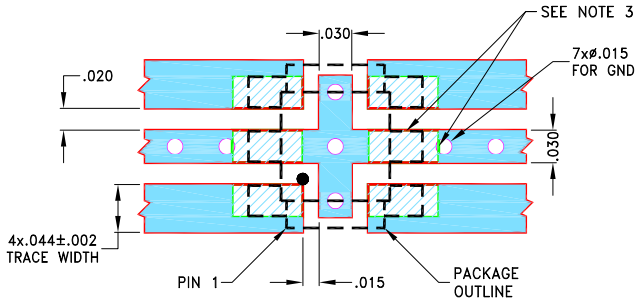


Figure 1. TCD-10-23BDX+ Functional Diagram

PAD DESCRIPTION/CONFIGURATION

Function	Pad Number	Description
Input	3	Connects to RF Input Port
Output	4	Connects to RF Output Port
Coupled FWD	1	Connects to Coupled FWD Port
Coupled REV	6	Connects to Coupled REV Port
Ground	2	Connects to Ground
Not Used	5	Not Used

SUGGESTED PCB LAYOUT (PL-821)



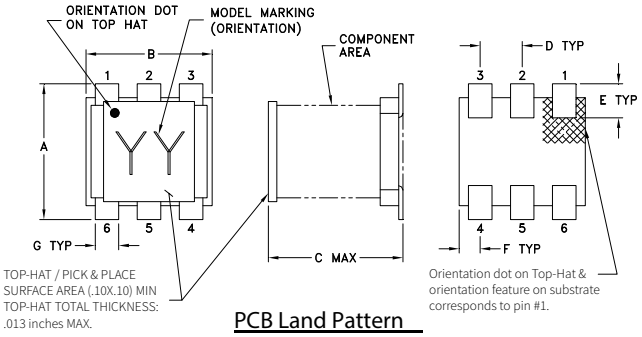
NOTES:
1. TRACE WIDTH IS SHOWN FOR ROGERS (RO4350B) WITH DIELECTRIC THICKNESS .020±.0015
   COPPER: 1/2 Oz ON EACH SIDE.
   FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
3. THIS PAD/PIN IS NOT AVAILABLE/REQUIRED FOR FIVE PIN CASE STYLES (AT SERIES).

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

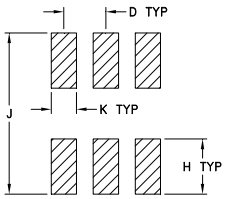
DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK.

Figure 2. Suggested PCB Layout PL-821

CASE STYLE DRAWING



PCB Land Pattern



SUGGESTED LAYOUT
TOLERANCE TO BE WITHIN ±.002

OUTLINE DIMENSIONS (inches / mm)

A	B	C	D	E	F
.160	.150	.160	.050	.040	.025
4.06	3.81	4.06	1.27	1.02	0.64

G	H	J	K		wt
.028	.065	.190	.030		grams
0.71	1.65	4.83	0.76		0.15

PRODUCT MARKING*: BN

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

SURFACE MOUNT top hat

Bi-Directional Coupler TCD-10-23BDX+

50Ω 5 to 2250 MHz 10 dB Coupling

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD. CLICK HERE

Performance Data & Graphs	Data Graphs S-Parameter (S4P Files) Data Set (.zip file) De-embedded to device pads
Case Style	DB1627
RoHS Status	Compliant
Tape and Reel	F47
Suggested Layout for PCB Design	PL-821
Evaluation Board	TB-TCD-1023BDX+ 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-10-23BDX+

Typical Performance Data

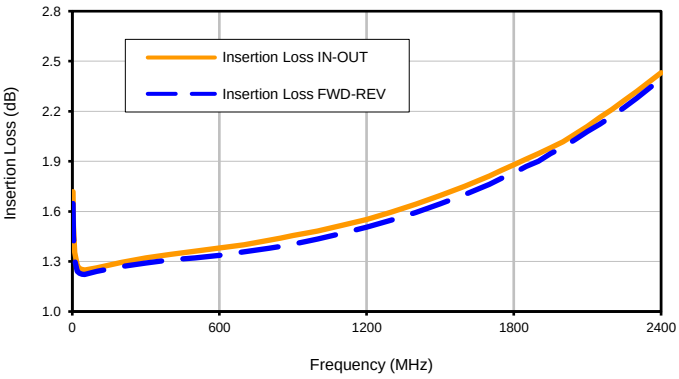
FREQ. (MHz)	INSERTION LOSS (1) (dB)		COUPLING (dB)		DIRECTIVITY (dB)		RETURN LOSS (dB)			
	IN-OUT	FWD-REV	IN-FWD	OUT-REV	IN-REV	OUT-FWD	IN	OUT	FWD	REV
3	1.72	1.65	10.40	11.13	19.41	20.86	13.89	16.33	14.27	16.84
5	1.51	1.46	10.26	10.86	20.41	21.53	15.58	19.31	15.86	19.81
10	1.35	1.31	10.16	10.66	21.24	22.12	17.20	23.40	17.44	23.83
20	1.28	1.24	10.10	10.57	21.55	22.22	18.18	27.11	18.32	27.59
30	1.26	1.23	10.08	10.56	21.62	22.22	18.48	28.87	18.70	29.12
40	1.25	1.22	10.08	10.55	21.61	22.15	18.70	29.75	18.81	30.10
50	1.25	1.22	10.08	10.55	21.59	22.14	18.81	30.31	18.89	30.64
100	1.26	1.24	10.10	10.57	21.41	21.92	19.11	31.50	19.17	31.59
200	1.29	1.27	10.13	10.62	20.99	21.45	19.28	31.10	19.22	31.29
300	1.32	1.29	10.15	10.68	20.46	21.05	19.25	29.86	19.12	29.77
400	1.34	1.31	10.17	10.75	19.81	20.38	19.20	28.54	18.96	28.71
500	1.36	1.32	10.17	10.81	19.09	19.73	19.08	27.61	18.84	27.95
600	1.38	1.34	10.18	10.88	18.24	19.01	18.95	27.07	18.68	27.55
700	1.40	1.36	10.17	10.93	17.54	18.43	18.90	26.69	18.59	27.30
800	1.43	1.38	10.17	10.99	16.89	17.81	18.86	26.77	18.63	27.26
850	1.44	1.39	10.17	11.01	16.57	17.48	18.88	26.44	18.60	27.30
900	1.46	1.40	10.17	11.02	16.30	17.24	18.90	26.79	18.65	27.26
950	1.47	1.42	10.16	11.03	15.90	16.99	18.77	26.41	18.64	27.35
1000	1.48	1.43	10.16	11.03	15.71	16.71	18.84	26.52	18.64	27.31
1100	1.52	1.47	10.15	11.03	15.12	16.17	18.69	26.03	18.68	27.48
1200	1.55	1.51	10.14	11.02	14.61	15.69	18.55	25.67	18.65	27.53
1300	1.60	1.55	10.13	10.98	14.18	15.23	18.40	25.92	18.66	27.92
1400	1.64	1.59	10.12	10.93	13.78	14.77	18.15	25.98	18.55	28.08
1500	1.69	1.65	10.11	10.87	13.43	14.36	17.99	25.48	18.42	28.26
1600	1.75	1.70	10.10	10.80	13.13	14.07	17.78	25.19	18.26	28.61
1700	1.81	1.76	10.10	10.71	12.88	13.76	17.38	24.73	18.07	28.89
1750	1.85	1.80	10.10	10.67	12.81	13.61	17.31	24.95	17.90	28.89
1800	1.88	1.83	10.10	10.62	12.68	13.47	17.01	24.48	17.81	29.22
1850	1.91	1.87	10.10	10.56	12.63	13.33	16.92	24.49	17.60	28.90
1900	1.95	1.90	10.10	10.50	12.50	13.15	16.62	24.15	17.54	29.23
1950	1.98	1.95	10.11	10.45	12.43	13.00	16.39	23.58	17.32	28.75
2000	2.02	1.98	10.11	10.38	12.39	12.88	16.29	23.70	17.17	28.75
2050	2.06	2.03	10.13	10.32	12.28	12.74	16.04	23.03	17.00	28.44
2100	2.11	2.08	10.14	10.26	12.28	12.59	15.89	23.38	16.80	28.18
2150	2.16	2.12	10.16	10.20	12.09	12.39	15.47	22.72	16.64	28.05
2200	2.21	2.17	10.17	10.14	12.05	12.28	15.30	22.47	16.39	27.86
2250	2.26	2.22	10.19	10.07	11.98	12.19	15.03	22.49	16.14	27.55
2300	2.32	2.28	10.21	10.00	11.82	12.01	14.78	21.78	15.95	27.38
2400	2.43	2.40	10.27	9.84	11.73	11.61	14.24	21.39	15.41	26.95

(1)Mainline loss includes coupling loss.

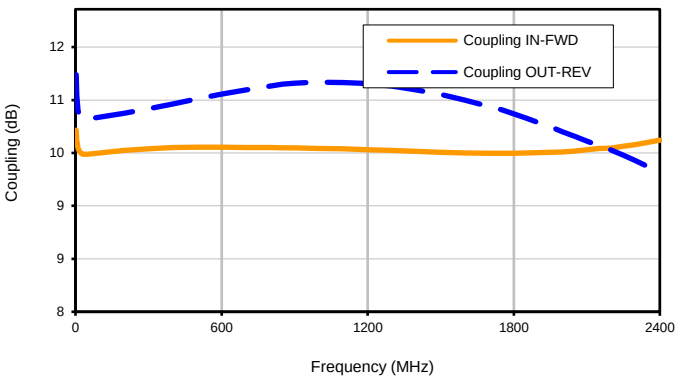
Bi-Directional Coupler TCD-10-23BDX+

Typical Performance Curves

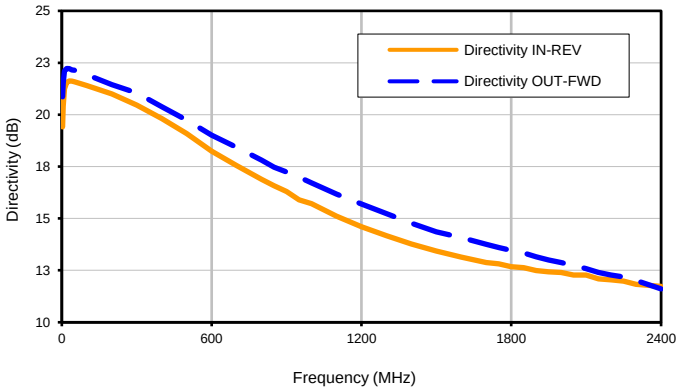
Insertion Loss



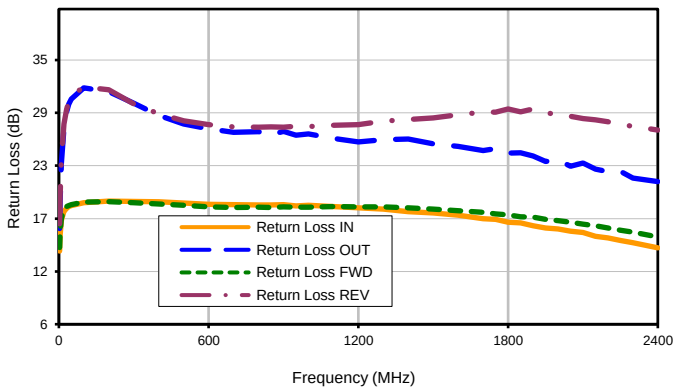
Coupling



Directivity



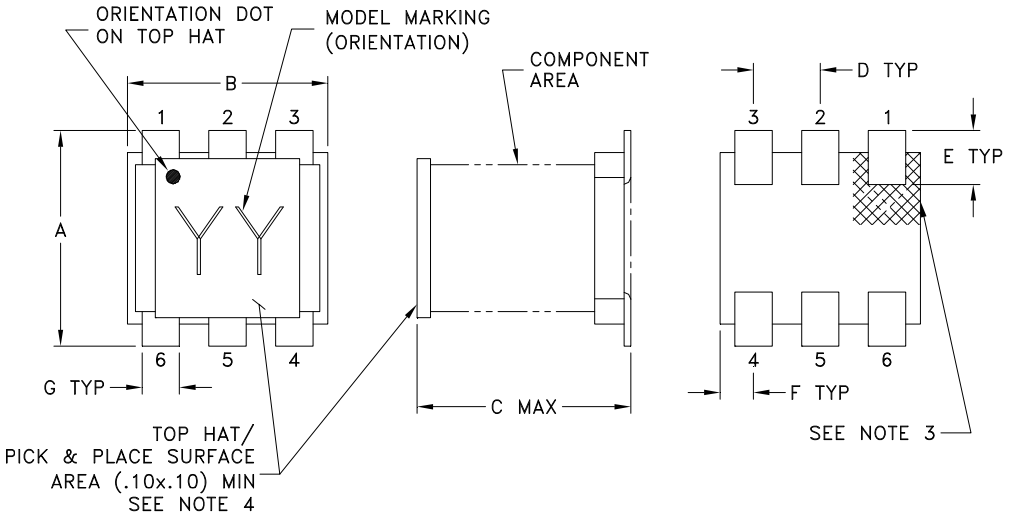
Return Loss



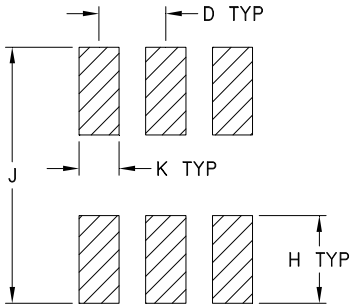
Case Style DB

DB1627

Outline Dimensions



PCB Land Pattern



SUGGESTED LAYOUT
TOLERANCE TO BE WITHIN ±.002

CASE #	A	B	C	D	E	F	G	H	J	K	WT. GRAM
DB1627	.160 (4.06)	.150 (3.81)	.160 (4.06)	.050 (1.27)	.040 (1.02)	.025 (0.64)	.028 (0.71)	.065 (1.65)	.190 (4.83)	.030 (0.76)	.15

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

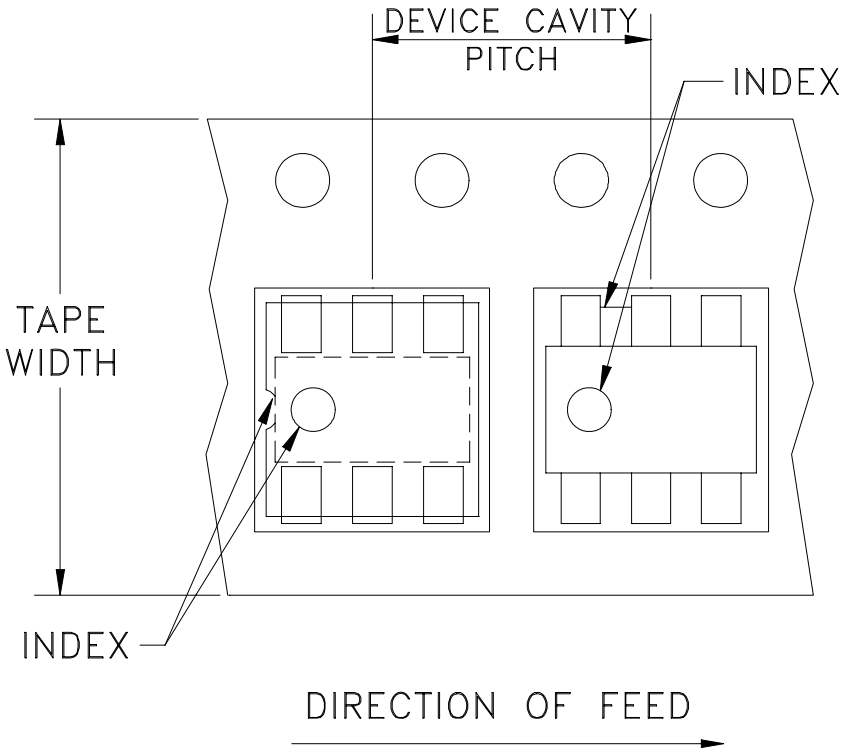
Notes:

1. Case material: Plastic.
2. 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.
3 Orientation dot on top hat & orientation feature on substrate correspondence to pin #1.
4 Top-Hat total thickness: .013 inches MAX.

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Tape & Reel Packaging TR-F47

DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note
12	8	13	1000, 2000
		7	20, 50, 100, 200, 500

Note: Please consult individual model data sheet to determine device per reel availability.

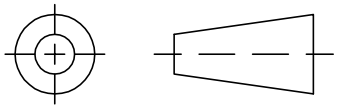
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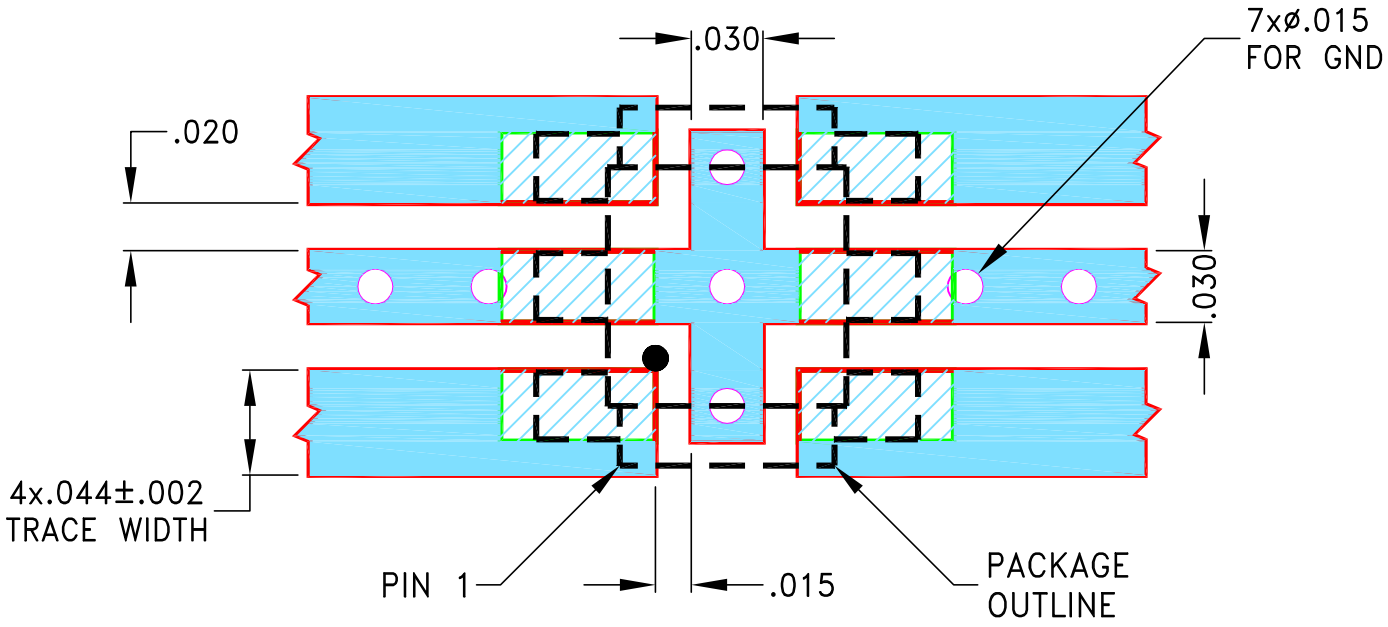
THIRD ANGLE PROJECTION



REVISIONS

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

SUGGESTED MOUNTING CONFIGURATION FOR DB1627 CASE STYLE



NOTES:

1. TRACE WIDTH IS SHOWN FOR ROGERS (RO4350B) WITH DIELECTRIC THICKNESS .020±.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	DRAWN	DDR	30 APR 25
TOLERANCES ON:	CHECKED	MKS	30 APR 25
2 PL DECIMALS ±	APPROVED	ASJ	30 APR 25
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, DB1627, TB-1241

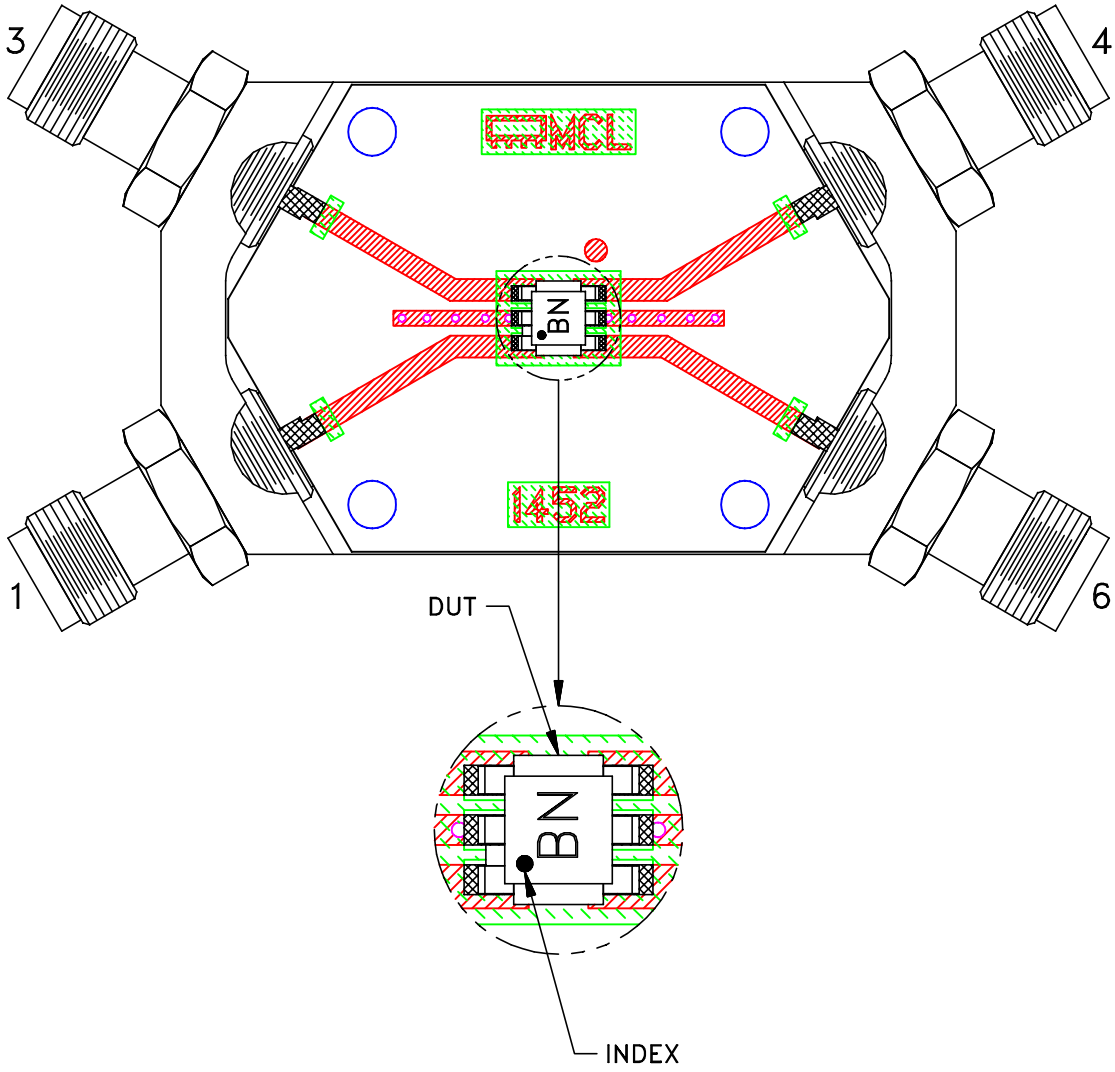
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-821	OR

FILE:	SCALE:	SHEET:
98-PL-821	12:1	1 OF 1

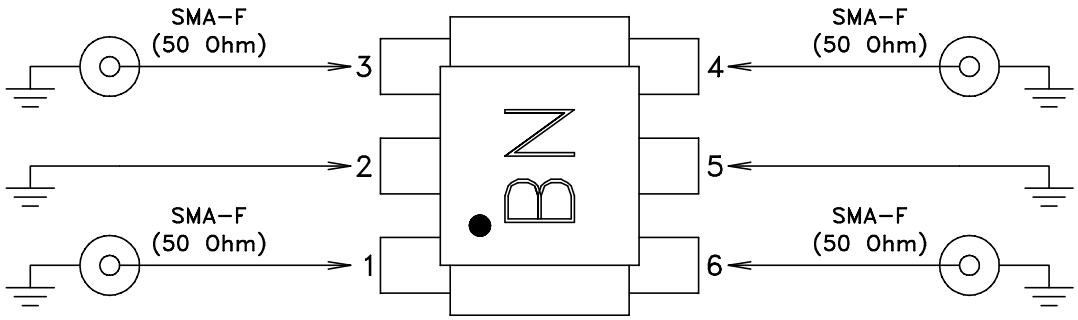
Evaluation Board and Circuit

TB-TCD-1023BDX+

Refer data sheet of the model for pin connections



Schematic diagram



Notes:

1. PCB Material: ROGERS (RO4350B) OR Equivalent, Dielectric Constant=3.48
   Thickness=.020±.0015 inch
2. 50 Ohm SMA Female Connectors.

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Mini-Circuits

Environmental Specifications ENV02T1

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

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