



Mini-Circuits®

SURFACE MOUNT 

Directional Coupler

TCD-20-4X+

50Ω

5 to 1000 MHz

FEATURES

- Wideband, 5 to 1000 MHz
- Low mainline loss, 0.4 dB typ.
- Aqueous washable
- Leads for excellent solderability
- Protected by US Patent 6,140,887

APPLICATIONS

- VHF/UHF
- Communications
- Cellular
- Signal processing



Generic photo used for illustration purposes only

CASE STYLE: DB1627

+RoHS Compliant

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

ELECTRICAL SPECIFICATIONS AT 25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Frequency Range	—	5	—	1000	MHz
Mainline Loss ¹	5-50	—	0.3	0.9	dB
	50-500	—	0.4	0.8	
	500-1000	—	0.7	1.1	
Coupling	5-1000	—	20±0.5	—	dB
Coupling Flatness (±)	5-1000	—	±0.8	—	dB
Directivity	5-50	11	20	—	dB
	50-500	15	21	—	
	500-1000	—	15	—	
VSWR	5-1000	—	1.2	—	:1
Input Power	5-1000	—	—	1.0	W

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

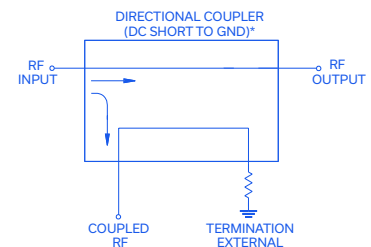
MAXIMUM RATINGS

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.

* Case temperature is defined as temperature on ground leads.

ELECTRICAL SCHEMATIC



*Electrical schematic is for Directional coupler with internal transformer(s) and external termination

Mini-Circuits®

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

REV. B
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TCD-20-4X+
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220627
PAGE 1 OF 3



Directional Coupler

TCD-20-4X+

5 to 1000 MHz

OUTLINE DRAWING

ORIENTATION DOT ON TOP HAT

MODEL MARKING (ORIENTATION)

COMPONENT AREA

A

B

1 2 3

6 5 4

G TYP

C MAX

D TYP

E TYP

4 5 6

F TYP

TOP-HAT / PICK & PLACE SURFACE AREA (.10X.10) MIN

TOP-HAT TOTAL THICKNESS: .013 inches MAX.

PCB Land Pattern

Orientation dot on Top-Hat & orientation feature on substrate corresponds to pin #1.

PCB Land Pattern

The diagram illustrates a three-row staggered joint for D and K type blocks. The top row consists of three blocks labeled 'D TYP'. The middle row consists of three blocks labeled 'K TYP'. The bottom row consists of three blocks labeled 'H TYP'. The vertical distance between the top and middle rows is labeled 'J'. The vertical distance between the middle and bottom rows is labeled 'H'. The horizontal distance between the center of a block in the top row and the center of a block in the middle row is labeled 'D TYP'. The horizontal distance between the center of a block in the middle row and the center of a block in the bottom row is labeled 'K TYP'.

Detailed drawing of the bottom view of the package. The drawing shows a central rectangular area labeled "PIN 1" with a circular feature labeled "R1". Dimensions include .047, .023, .024, .017, .052, .031, .090, .014, .035, .015, .030, .035 TYP, .064 TYP TRACE WIDTH (SEE NOTE BELOW), .018, .025, .030 X 45° CHAMFER, TYP, 6X #.015 PTH FOR GROUND, and .015 TYP. A dashed line indicates the "PACKAGE OUTLINE".

NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.030" $\pm$ 0.002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

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

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

TAPE & REEL INFORMATION: F47



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SURFACE MOUNT 

Directional Coupler

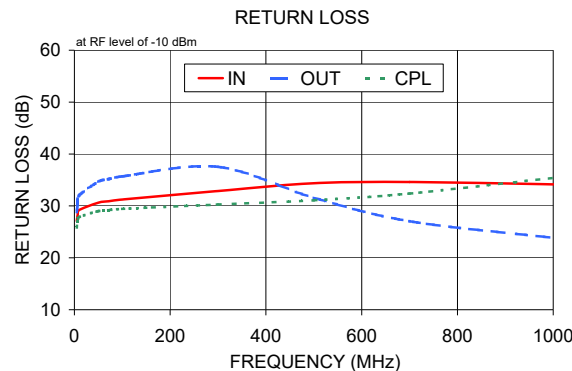
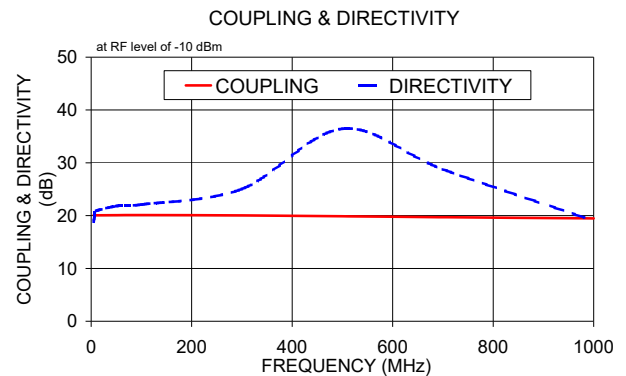
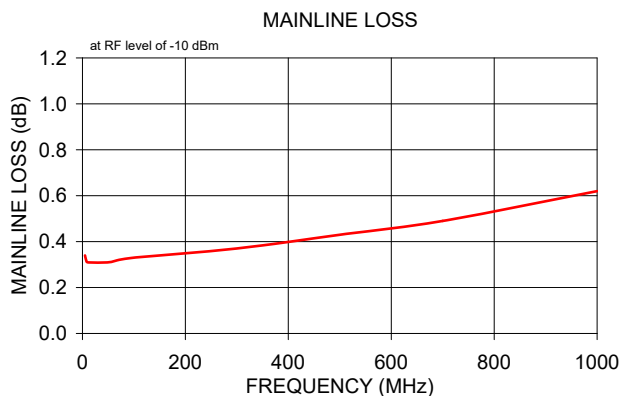
TCD-20-4X+

50Ω

5 to 1000 MHz

TYPICAL PERFORMANCE DATA

Frequency (MHz)	Mainline Loss (dB)	Coupling (dB)	Directivity (dB)	Return Loss (dB)		
	In-Out	In-Cpl		In	Out	Cpl
5.00	0.34	20.10	18.84	27.09	28.80	25.84
7.00	0.32	20.07	20.01	28.28	30.52	26.99
10.00	0.31	20.06	20.88	29.20	32.01	27.84
50.00	0.31	20.09	21.80	30.62	34.67	28.98
70.00	0.32	20.10	21.88	30.88	35.14	29.17
100.00	0.33	20.10	22.10	31.23	35.70	29.43
300.00	0.37	20.04	25.05	32.86	37.54	30.26
500.00	0.43	19.88	36.45	34.37	31.56	31.08
700.00	0.49	19.70	28.77	34.61	27.04	32.38
1000.00	0.62	19.48	19.03	34.14	23.85	35.39



- 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



Directional Coupler

TCD-20-4X+

Typical Performance Data

TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = +25°C

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
				IN	OUT	CPL
5	0.32	20.07	22.79	28.19	30.76	26.86
10	0.31	20.06	22.87	29.19	32.43	27.71
20	0.31	20.06	22.93	30.04	33.66	28.32
25	0.31	20.06	22.90	30.16	33.77	28.34
30	0.32	20.06	22.89	30.23	33.82	28.35
40	0.32	20.07	22.90	30.33	33.82	28.36
45	0.32	20.08	22.91	30.38	33.85	28.38
50	0.33	20.08	22.94	30.42	33.90	28.39
100	0.34	20.10	23.35	30.68	33.75	28.52
125	0.35	20.11	23.64	30.74	33.67	28.51
150	0.35	20.11	24.07	30.77	33.41	28.44
200	0.37	20.11	25.17	30.79	32.94	28.26
225	0.38	20.11	25.91	30.73	32.61	28.13
250	0.38	20.10	26.77	30.79	32.33	27.99
275	0.39	20.09	27.79	30.69	32.01	27.81
300	0.40	20.09	29.06	30.72	31.80	27.64
325	0.41	20.08	30.60	30.60	31.63	27.47
350	0.42	20.07	32.39	30.56	31.41	27.34
375	0.43	20.06	34.72	30.45	31.20	27.15
400	0.44	20.04	37.33	30.39	30.92	27.00
425	0.45	20.03	38.85	30.36	30.67	26.82
450	0.46	20.01	37.38	30.34	30.51	26.64
475	0.47	20.00	34.32	30.44	30.22	26.48
500	0.48	19.98	31.83	30.44	30.08	26.32
550	0.50	19.94	27.72	30.23	29.69	26.01
600	0.53	19.91	24.71	30.17	29.44	25.73
650	0.56	19.87	22.33	30.24	28.90	25.47
700	0.58	19.84	20.37	30.40	28.57	25.27
750	0.61	19.81	18.75	30.39	28.34	25.09
800	0.64	19.77	17.29	30.52	28.15	24.95
850	0.67	19.73	16.07	30.53	27.85	24.86
900	0.70	19.69	15.02	30.72	27.58	24.78
950	0.73	19.64	14.06	30.88	27.42	24.71
1000	0.75	19.60	13.18	30.92	27.21	24.66
1100	0.81	19.50	11.68	31.38	26.76	24.60
1200	0.88	19.40	10.44	31.88	26.46	24.61
1300	0.93	19.26	9.42	32.73	26.05	24.67
1400	1.00	19.15	8.53	33.91	25.56	24.81
1500	1.08	19.01	7.77	35.17	24.97	25.06
1600	1.15	18.88	7.02	37.53	24.39	25.39
1700	1.22	18.74	6.44	40.47	23.89	25.61
1800	1.31	18.59	5.87	44.81	23.32	26.06
1900	1.40	18.43	5.48	49.66	22.75	26.43
2000	1.50	18.29	5.05	44.76	22.18	26.86
2100	1.62	18.14	4.78	38.92	21.60	27.09
2200	1.74	18.01	4.47	34.44	20.99	27.40
2300	1.87	17.94	3.97	31.24	20.03	27.60
2400	2.03	17.83	3.81	28.36	19.44	27.66
2500	2.21	17.76	3.51	26.17	18.44	26.68
2600	2.41	17.64	3.34	23.86	17.48	25.19
2700	2.64	17.61	3.18	21.91	16.46	23.37
2800	2.91	17.57	3.10	20.00	15.30	21.56
2900	3.26	17.54	3.19	18.26	14.28	19.81
3000	3.64	17.50	3.13	16.51	12.96	17.87

Directional Coupler

TCD-20-4X+

Typical Performance Data

TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = -40°C

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
				IN	OUT	CPL
5	0.40	20.14	21.22	24.37	25.70	22.95
10	0.32	19.98	23.64	27.22	29.14	25.75
20	0.26	19.87	25.40	30.48	33.00	28.79
25	0.26	19.87	25.34	31.16	33.65	29.34
30	0.26	19.86	25.24	31.70	34.09	29.79
40	0.26	19.87	25.02	32.49	34.49	30.41
45	0.26	19.87	24.96	32.79	34.61	30.64
50	0.26	19.87	24.95	33.02	34.70	30.82
100	0.26	19.88	25.46	32.12	35.35	30.29
125	0.26	19.88	25.88	31.57	35.70	29.93
150	0.27	19.88	26.10	31.75	35.33	30.11
200	0.28	19.87	26.73	31.67	32.95	29.95
225	0.28	19.87	27.48	31.09	32.12	29.38
250	0.29	19.86	28.24	30.95	31.78	28.95
275	0.30	19.85	28.92	30.94	31.56	28.70
300	0.30	19.84	29.58	31.01	31.26	28.42
325	0.31	19.84	30.51	30.68	30.89	28.02
350	0.32	19.82	31.41	30.35	30.52	27.68
375	0.32	19.81	32.16	30.06	30.29	27.41
400	0.33	19.80	32.36	29.87	29.96	27.20
425	0.34	19.79	32.41	29.66	29.53	26.89
450	0.34	19.78	31.95	29.35	29.19	26.52
475	0.35	19.76	31.03	29.15	28.74	26.24
500	0.36	19.75	29.68	29.08	28.58	26.03
550	0.38	19.72	27.21	28.62	28.11	25.56
600	0.40	19.69	24.88	28.29	27.83	24.99
650	0.42	19.66	22.89	28.22	27.42	24.67
700	0.45	19.63	21.17	28.01	26.99	24.30
750	0.47	19.60	19.72	27.84	26.74	24.03
800	0.50	19.56	18.39	27.56	26.57	23.75
850	0.52	19.52	17.20	27.24	26.27	23.52
900	0.55	19.48	16.14	27.13	25.93	23.53
950	0.57	19.44	15.16	27.04	25.66	23.29
1000	0.61	19.40	14.27	26.83	25.54	23.06
1100	0.67	19.32	12.65	26.52	24.92	22.78
1200	0.74	19.24	11.34	26.26	24.98	23.11
1300	0.81	19.14	10.17	26.24	24.78	22.50
1400	0.90	19.08	9.11	26.76	24.43	22.81
1500	0.99	19.00	8.23	26.77	24.17	22.53
1600	1.07	18.93	7.29	28.07	23.71	22.69
1700	1.17	18.88	6.57	28.07	23.51	22.99
1800	1.28	18.82	5.89	28.60	23.22	23.32
1900	1.39	18.76	5.32	28.98	22.73	22.85
2000	1.51	18.71	4.78	28.65	22.71	24.28
2100	1.66	18.67	4.29	28.95	21.88	23.60
2200	1.81	18.63	3.91	30.82	21.23	24.58
2300	1.96	18.67	3.27	29.78	20.55	25.01
2400	2.14	18.61	2.99	28.32	20.13	26.55
2500	2.33	18.64	2.57	28.01	19.17	27.82
2600	2.54	18.53	2.38	27.42	18.27	29.72
2700	2.77	18.49	2.17	25.92	17.22	28.49
2800	3.03	18.36	2.08	24.06	16.26	26.30
2900	3.35	18.12	2.15	22.41	15.49	24.39
3000	3.69	17.85	2.14	20.44	14.12	20.60

Directional Coupler

TCD-20-4X+

Typical Performance Data

TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = +85°C

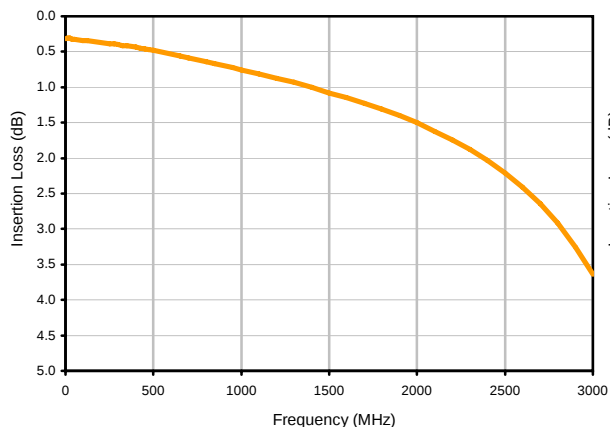
FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
				IN	OUT	CPL
5	0.40	20.30	20.93	26.75	29.14	25.53
10	0.40	20.28	21.13	27.32	30.06	26.00
20	0.40	20.28	21.32	27.72	30.73	26.26
25	0.41	20.29	21.37	27.73	30.84	26.21
30	0.41	20.29	21.41	27.71	30.92	26.15
40	0.42	20.30	21.51	27.64	31.04	26.04
45	0.42	20.31	21.57	27.63	31.13	26.00
50	0.43	20.31	21.63	27.61	31.22	25.96
100	0.44	20.34	22.09	28.29	31.06	26.33
125	0.45	20.35	22.41	28.75	30.81	26.62
150	0.45	20.35	22.97	28.91	30.73	26.66
200	0.47	20.36	24.56	28.89	31.43	26.48
225	0.48	20.36	25.43	29.08	31.65	26.56
250	0.48	20.36	26.39	29.42	31.72	26.65
275	0.50	20.35	27.60	29.53	31.64	26.65
300	0.50	20.35	29.23	29.62	31.70	26.57
325	0.52	20.35	31.27	29.55	31.85	26.47
350	0.52	20.34	34.06	29.63	31.97	26.46
375	0.53	20.34	38.21	29.74	32.04	26.41
400	0.54	20.33	44.21	29.85	31.95	26.39
425	0.56	20.33	41.07	29.99	31.82	26.31
450	0.57	20.32	35.50	30.10	31.89	26.21
475	0.58	20.32	31.50	30.30	31.72	26.14
500	0.59	20.31	28.89	30.53	31.83	26.06
550	0.62	20.30	24.96	30.71	31.79	25.96
600	0.65	20.29	22.15	31.00	31.85	25.90
650	0.67	20.28	19.97	31.50	31.49	25.87
700	0.70	20.26	18.17	32.07	31.21	25.79
750	0.73	20.25	16.68	32.46	30.97	25.70
800	0.75	20.23	15.39	33.27	30.76	25.74
850	0.77	20.20	14.31	33.87	30.39	25.80
900	0.79	20.16	13.38	34.74	30.10	25.84
950	0.82	20.12	12.55	35.45	29.93	25.91
1000	0.84	20.07	11.79	35.95	29.65	25.98
1100	0.90	19.96	10.51	36.89	29.10	26.02
1200	0.95	19.83	9.44	38.58	28.41	26.07
1300	1.00	19.67	8.57	41.55	27.72	26.44
1400	1.06	19.51	7.84	45.71	27.14	26.62
1500	1.13	19.33	7.24	47.46	26.62	27.20
1600	1.19	19.16	6.60	50.02	26.15	27.64
1700	1.25	18.97	6.12	48.93	25.67	28.07
1800	1.33	18.78	5.61	42.64	25.05	29.03
1900	1.41	18.57	5.31	38.61	24.47	29.66
2000	1.50	18.41	4.92	34.45	23.75	29.87
2100	1.61	18.21	4.75	33.26	23.19	31.31
2200	1.72	18.05	4.43	30.50	22.75	31.14
2300	1.84	17.95	3.98	28.28	21.57	30.98
2400	1.98	17.82	3.82	26.13	20.78	29.65
2500	2.14	17.73	3.56	24.29	19.59	27.85
2600	2.33	17.60	3.42	22.35	18.58	25.72
2700	2.54	17.56	3.21	20.67	17.36	23.83
2800	2.79	17.52	3.12	18.92	16.07	21.66
2900	3.09	17.56	3.14	17.39	14.87	19.98
3000	3.45	17.57	3.05	15.76	13.49	18.45

Directional Coupler

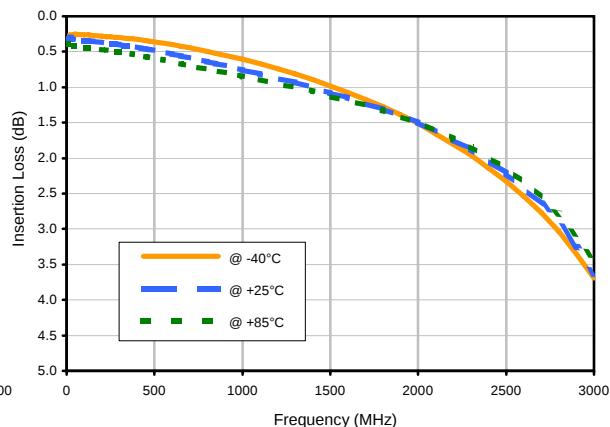
Typical Performance Curves

TCD-20-4X+

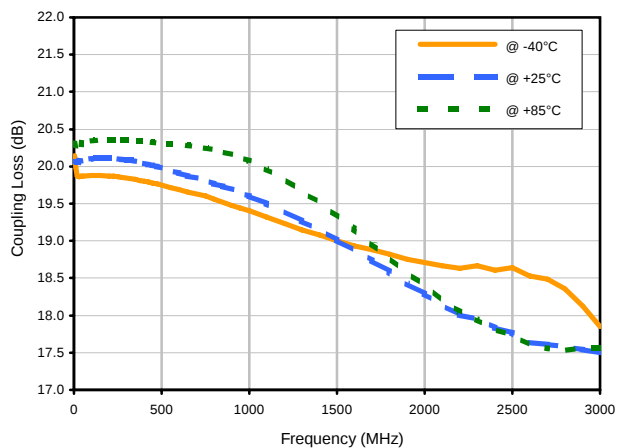
Insertion Loss



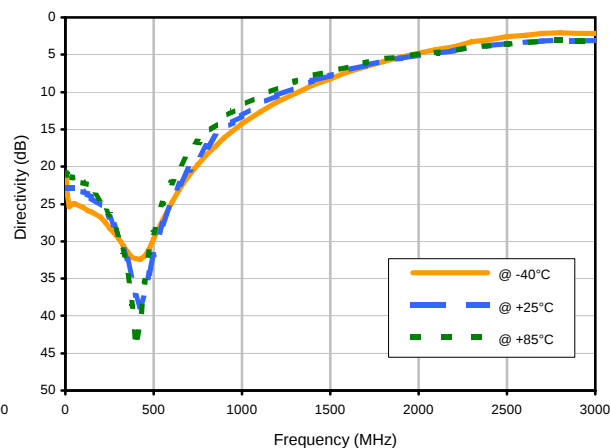
Insertion Loss vs. TEMPERATURE



Coupling Loss vs. TEMPERATURE



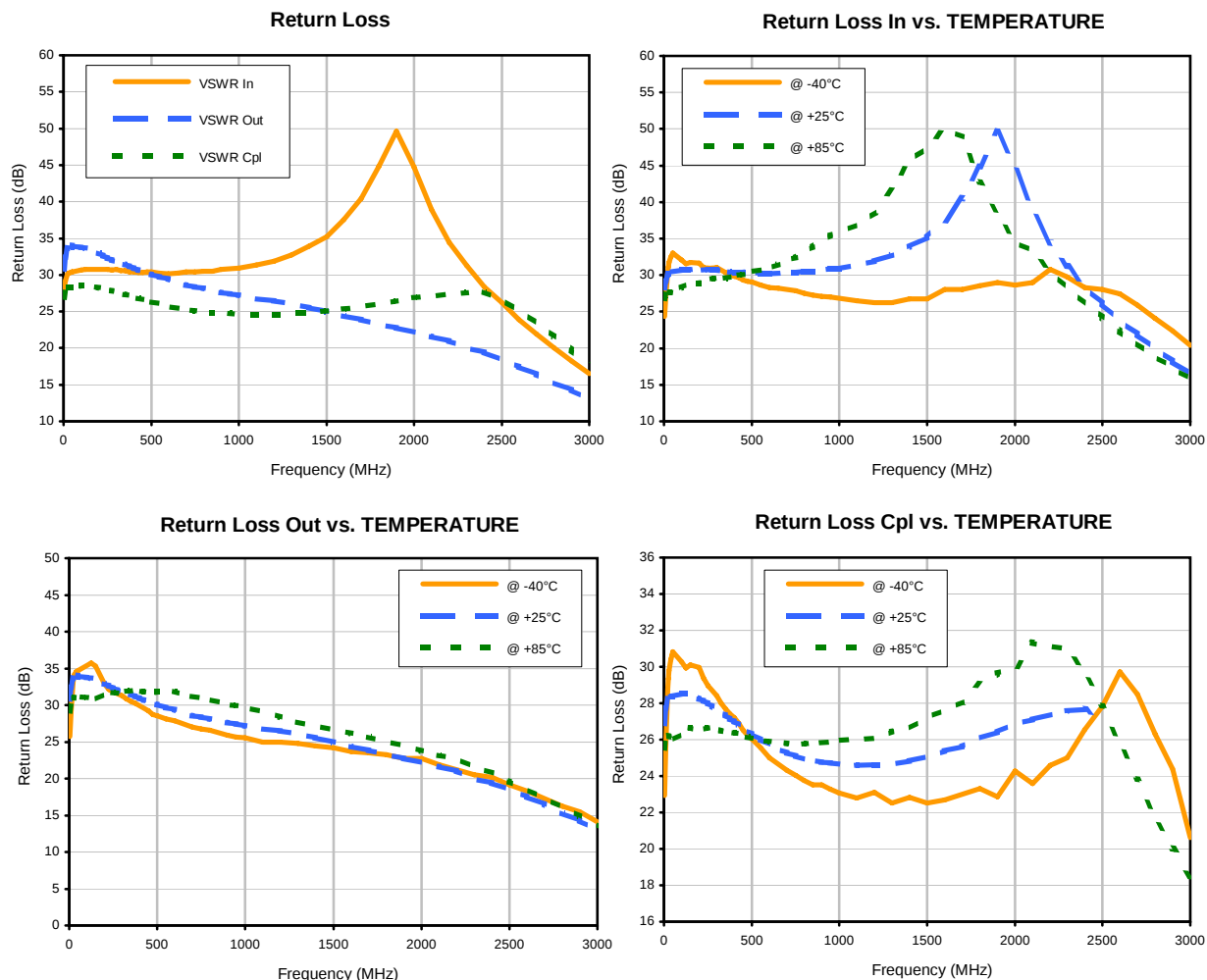
Directivity vs. TEMPERATURE



Directional Coupler

TCD-20-4X+

Typical Performance Curves



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The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com



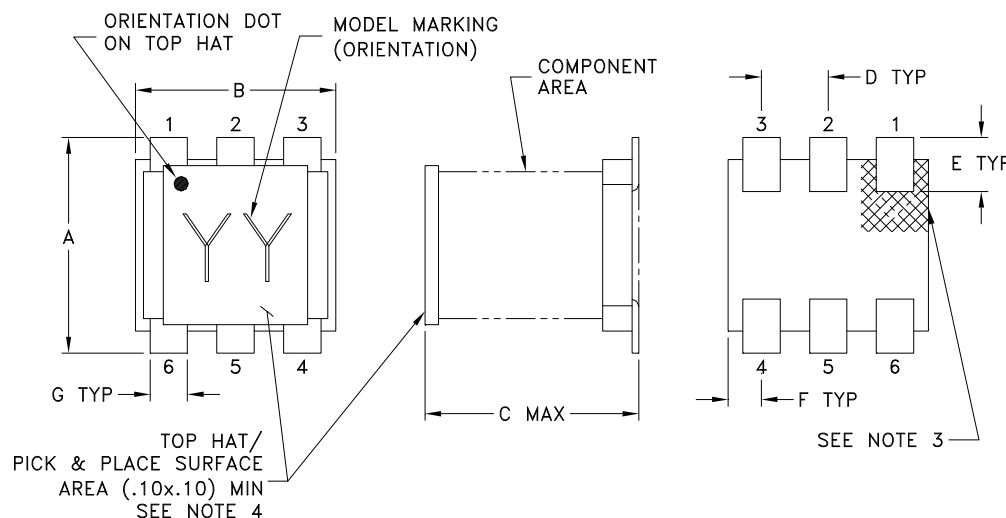
IF/RF MICROWAVE COMPONENTS



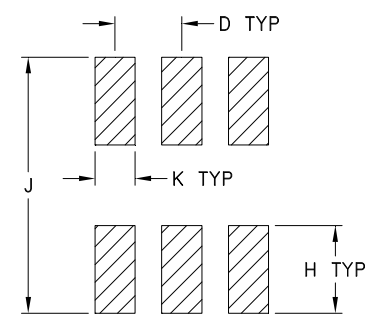
REV. X1
TCD-20-4X+
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Outline Dimensions

DB1627



PCB Land Pattern



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. $\pm .01$; 3Pl. $\pm .005$

Notes:

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



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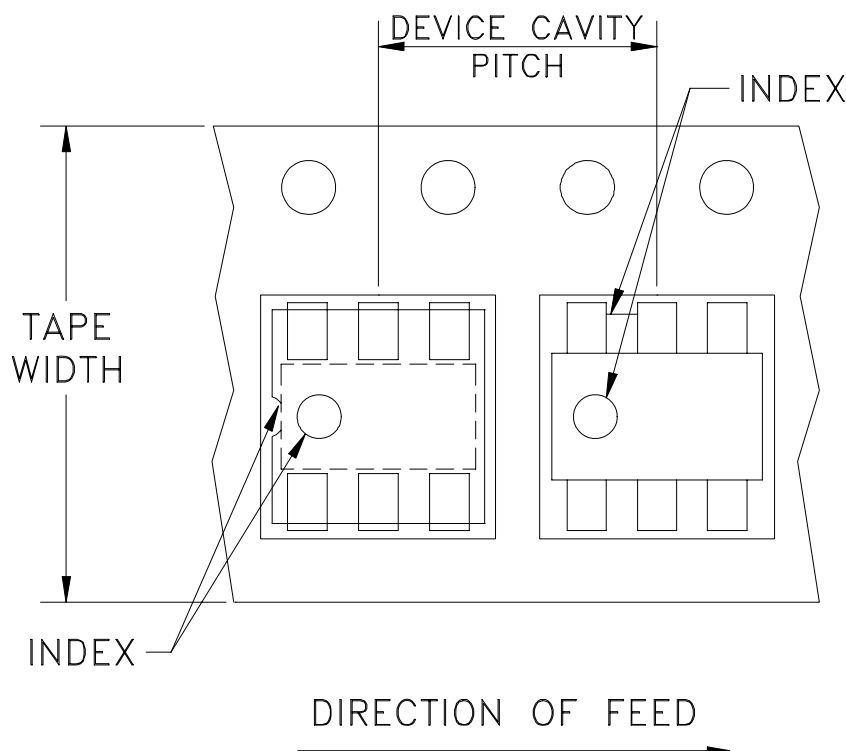
The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

RF/IF MICROWAVE COMPONENTS



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.

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



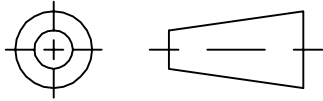
INTERNET <http://www.minicircuits.com>

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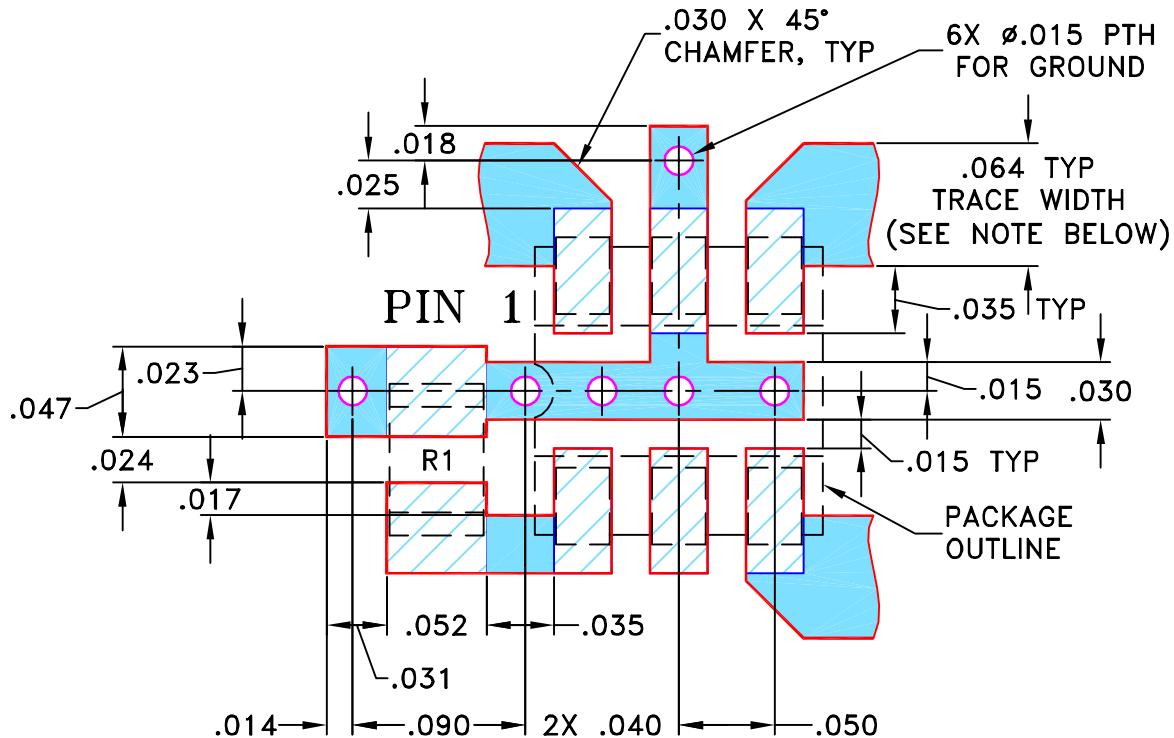
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M73159	NEW RELEASE	08/00	IL	DB
A	M82377	UPDATED DRAWING	07/21/02	AV	LC
B	M102713	UPDATED NOTES	01/12/08	GF	IL

SUGGESTED MOUNTING CONFIGURATION FOR DB714 CASE STYLE, "mm" PIN CONNECTION

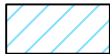


RESISTOR R1: $49.9 \pm 1\%$ Ohm, 0805 SIZE

NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS $0.030'' \pm 0.002''$; 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

UNLESS OTHERWISE SPECIFIED

INITIALS

DATE

DIMENSIONS ARE IN INCHES

DRAWN

IL

08/03/00

TOLERANCES ON:
2 PL DECIMALS $\pm .005$

CHECKED

WP

08/08/00

3 PL DECIMALS $\pm$
ANGLES $\pm$
FRACTIONS $\pm$

APPROVED

DB

08/08/00

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



Mini-Circuits® 13 Neptune Avenue
Brooklyn NY 11235

PL, mm, DB714, TCD, TB-71

SIZE
A

CODE IDENT
15542

DRAWING NO:
98-PL-009

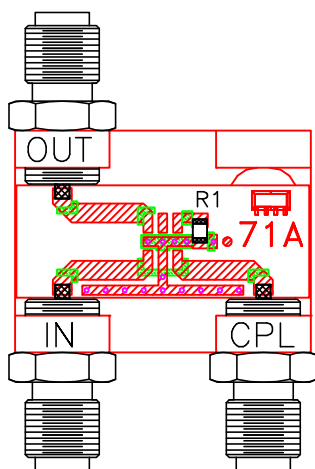
REV:
B

FILE: 98PL009

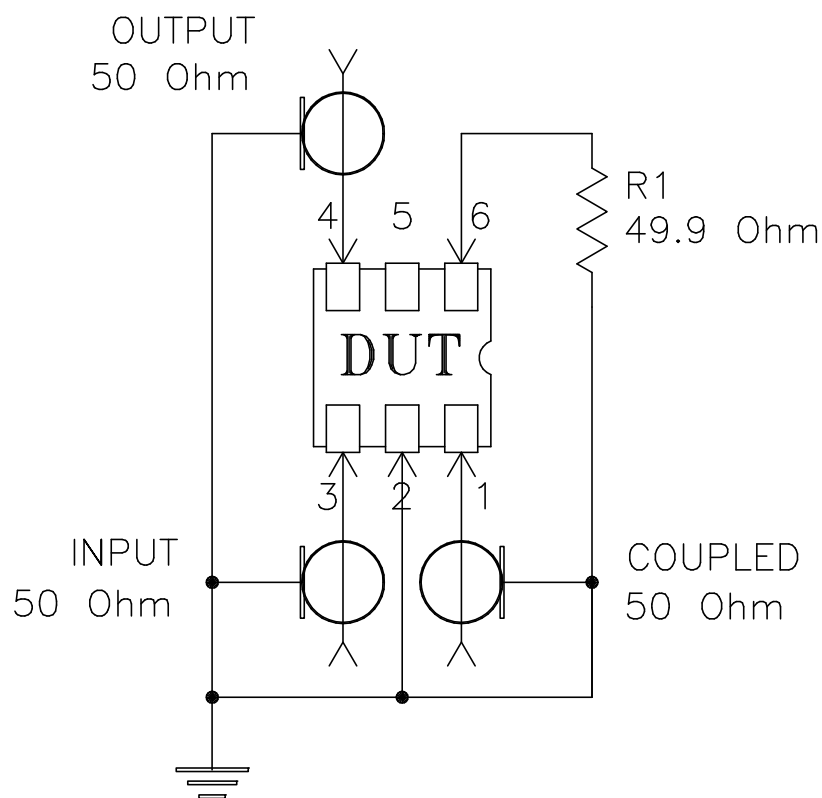
SCALE: 10:1

SHEET: 1 OF 1

Evaluation Board and Circuit



TB-71



Schematic Diagram

Notes:

1. SMA Female connectors.
2. PCB Material: Rogers 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 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