SURFACE MOUNT

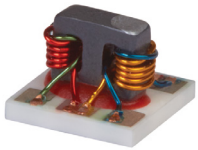
Directional Coupler

DBTC-20-4+

50Ω 20 dB 20 to 1000 MHz

FEATURES

- Very Flat Coupling
- Very Broadband, Multi Octave
- Temperature Stable, LTCC Base
- All Welded Construction
- Leads Attached for Better Solderability
- Micro Miniature Coupler
- Aqueous Washable
- Protected by US Patents 6,140,887 & 6,784,521



Generic photo used for illustration purposes only

CASE STYLE: AT790-1

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

APPLICATIONS

- VHF/UHF Receivers/Transmitters
- Cellular

ELECTRICAL SPECIFICATIONS AT +25°C

Parameter	Condition (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		20		1000	MHz
Mainline Loss[1]	20-200 200-500 500-1000		0.3 0.4 0.7	1.0 1.0 1.3	dB
Nominal Coupling	20-1000		20.4±0.5		dB
Coupling Flatness	20-1000			±0.8	dB
Directivity	20-200 200-500 500-1000	13 14	21 21 16		dB
VSWR[2]	20-1000		1.2		:1
Input Power	20-200 200-500 500-1000			1.0 1.0 1.0	W

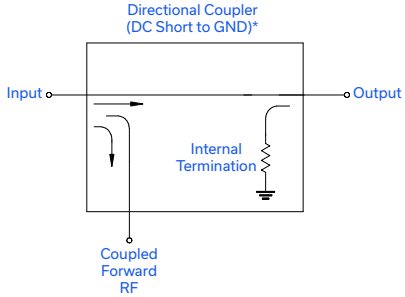
1. Includes theoretical coupled power loss of 0.04 dB at 20 dB coupling.
2. For coupled port VSWR above 500 MHz, 1.6:1 typ.

ABSOLUTE 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.

ELECTRICAL SCHEMATIC



* Electrical schematic is for directional coupler with internal transformer(s) that routes DC from RF ports to ground.

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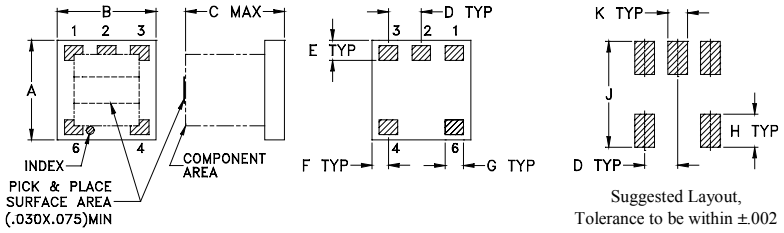
50Ω 20 dB 20 to 1000 MHz

PIN CONNECTIONS

INPUT	3
OUTPUT	4
COUPLED	1
GROUND	2
ISOLATE (DO NOT USE)	6

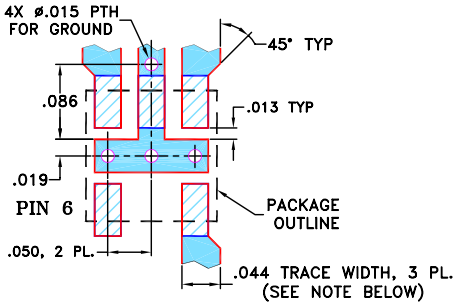
OUTLINE DRAWING



PRODUCT MARKING: N/A

DEMO BOARD MCL P/N: TB-DBTC-20-4+

SUGGESTED PCB LAYOUT (PL-150)



NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015"; 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

OUTLINE DIMENSIONS (Inches / mm)

A	B	C	D	E	F	G	H	J	K	wt
.150	.150	.150	.050	.030	.025	.028	.050	.160	.030	grams
3.81	3.81	3.81	1.27	0.76	0.64	0.71	1.27	4.06	0.76	0.10

TAPE & REEL INFORMATION: F17

SURFACE MOUNT

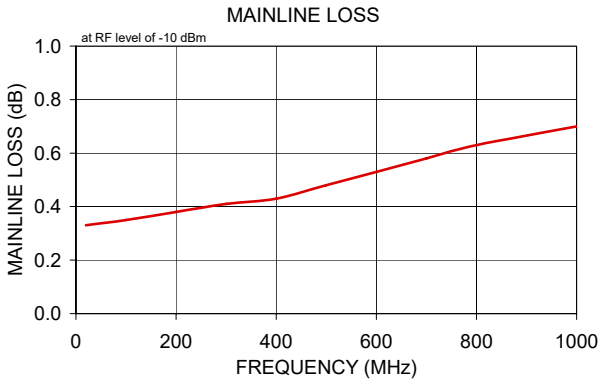
Directional Coupler

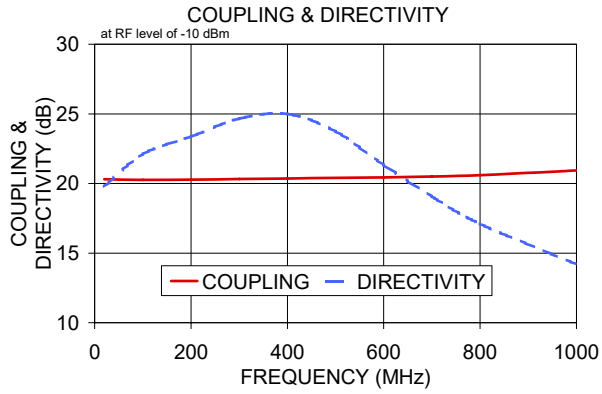
DBTC-20-4+

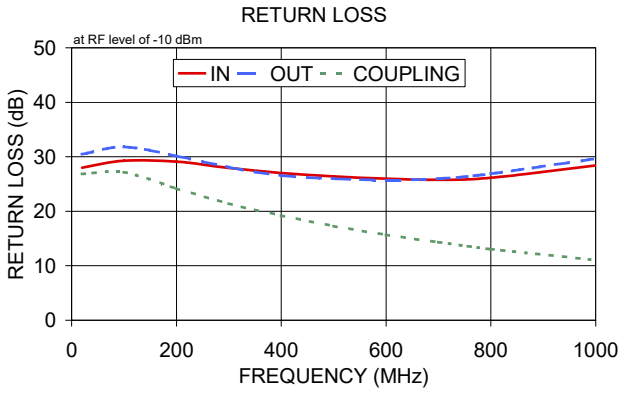
50Ω 20 dB 20 to 1000 MHz

TYPICAL PERFORMANCE DATA

Frequency (MHz)	Mainline Loss (dB) In-Out	Coupling (dB) In-Cpl	Directivity (dB)	Return Loss (dB) In	Out	Cpl
20	0.33	20.30	19.79	28.00	30.48	26.85
100	0.35	20.25	22.11	29.28	31.80	27.18
200	0.38	20.28	23.36	29.12	30.13	24.16
300	0.41	20.32	24.66	27.95	28.09	21.44
400	0.43	20.36	25.00	27.01	26.54	19.23
500	0.48	20.40	23.74	26.41	25.97	17.30
600	0.53	20.43	21.33	25.99	25.74	15.69
700	0.58	20.50	19.06	25.78	26.00	14.31
800	0.63	20.59	17.10	26.16	26.88	13.07
1000	0.70	20.94	14.20	28.41	29.64	11.03







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 DBTC-20-4+

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	0.30	20.07	23.25	28.99	31.76	26.24
10.0	0.30	20.06	23.40	29.76	33.03	26.98
15.0	0.29	20.04	23.51	30.37	34.03	27.55
20.0	0.29	20.04	23.52	30.51	34.28	27.67
50.0	0.31	20.06	23.55	31.05	34.92	27.78
100.0	0.32	20.09	23.93	31.49	35.94	27.30
150.0	0.33	20.11	24.54	31.85	37.09	26.31
200.0	0.34	20.12	25.40	32.12	38.45	25.08
250.0	0.35	20.14	26.45	32.43	40.40	23.86
300.0	0.36	20.15	27.94	32.77	42.98	22.67
350.0	0.38	20.16	29.79	32.79	44.62	21.55
400.0	0.39	20.17	32.01	33.31	44.59	20.56
450.0	0.40	20.17	33.80	33.45	41.62	19.66
500.0	0.42	20.19	33.34	33.88	38.03	18.84
525.0	0.43	20.19	32.12	34.06	36.47	18.45
550.0	0.44	20.20	30.78	34.13	35.18	18.09
600.0	0.46	20.21	28.18	34.48	33.16	17.39
650.0	0.48	20.24	25.97	34.52	31.25	16.75
700.0	0.51	20.27	24.12	34.24	29.47	16.18
750.0	0.53	20.30	22.51	33.98	28.12	15.65
800.0	0.56	20.35	21.14	33.52	26.93	15.14
850.0	0.59	20.39	19.99	32.80	25.82	14.66
900.0	0.62	20.45	18.98	31.67	24.73	14.22
950.0	0.65	20.52	18.10	30.72	23.66	13.80
1000.0	0.68	20.59	17.36	29.83	22.89	13.41
1050.0	0.71	20.66	16.67	28.93	22.13	13.05
1100.0	0.74	20.75	16.06	27.99	21.34	12.70
1150.0	0.78	20.85	15.57	27.01	20.62	12.37
1200.0	0.82	20.95	15.05	26.24	19.94	12.06
1250.0	0.86	21.06	14.61	25.41	19.31	11.78
1300.0	0.89	21.18	14.23	24.58	18.69	11.51
1400.0	0.97	21.45	13.54	23.08	17.62	11.00
1500.0	1.06	21.76	12.89	21.69	16.55	10.55
1600.0	1.15	22.12	12.24	20.53	15.69	10.16
1700.0	1.26	22.54	11.43	19.36	14.77	9.79
1800.0	1.37	23.01	10.48	18.42	14.02	9.48
1900.0	1.50	23.57	9.15	17.45	13.25	9.20
2000.0	1.64	24.19	7.57	16.64	12.59	8.95
2100.0	1.79	24.92	5.58	15.83	11.98	8.72
2200.0	1.97	25.80	3.35	15.02	11.35	8.52
2300.0	2.17	26.81	0.88	14.33	10.81	8.33
2400.0	2.41	27.93	1.74	13.59	10.25	8.18
2500.0	2.69	29.20	4.46	12.95	9.74	8.01
2600.0	3.01	30.53	7.20	12.33	9.24	7.86
2700.0	3.38	31.09	9.11	11.71	8.80	7.72
2800.0	3.83	30.58	9.87	11.16	8.35	7.55
2900.0	4.36	29.06	9.55	10.63	7.95	7.43
3000.0	4.96	27.14	8.74	10.14	7.61	7.24
3100.0	5.67	25.21	7.84	9.70	7.30	7.08
3200.0	6.47	23.52	7.08	9.25	7.02	6.88
3300.0	7.35	21.98	6.37	8.88	6.84	6.65
3400.0	8.27	20.69	5.80	8.53	6.69	6.45
3500.0	9.09	19.57	5.29	8.23	6.61	6.19

Directional Coupler DBTC-20-4+

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	0.38	20.23	21.33	24.93	26.29	21.97
10.0	0.30	20.06	23.61	27.75	29.98	24.56
15.0	0.25	19.92	25.43	30.06	33.19	26.71
20.0	0.24	19.90	25.86	30.87	35.00	27.56
50.0	0.24	19.89	26.22	32.12	40.15	29.42
100.0	0.24	19.91	26.32	34.00	38.68	28.80
150.0	0.24	19.92	26.76	35.52	39.39	26.99
200.0	0.25	19.92	27.72	34.20	41.03	25.92
250.0	0.26	19.93	28.94	34.68	40.14	24.41
300.0	0.27	19.94	30.71	34.52	42.44	23.08
350.0	0.28	19.95	32.84	34.28	40.99	22.04
400.0	0.29	19.96	35.09	35.12	40.95	20.94
450.0	0.30	19.97	36.38	34.88	38.48	20.08
500.0	0.31	19.99	34.53	35.61	36.63	19.26
525.0	0.32	20.00	32.77	35.57	35.41	18.85
550.0	0.33	20.01	31.19	35.28	34.03	18.50
600.0	0.34	20.04	28.32	35.98	32.76	17.80
650.0	0.36	20.07	26.22	37.42	31.82	17.14
700.0	0.38	20.11	24.44	37.62	30.23	16.62
750.0	0.40	20.15	22.88	38.00	29.04	16.10
800.0	0.42	20.20	21.48	37.38	27.59	15.64
850.0	0.45	20.25	20.21	37.36	26.63	15.21
900.0	0.48	20.32	19.16	36.36	25.67	14.77
950.0	0.50	20.40	18.20	35.47	24.61	14.39
1000.0	0.53	20.48	17.42	34.74	24.02	13.98
1050.0	0.55	20.58	16.65	33.18	23.08	13.61
1100.0	0.59	20.68	15.95	32.16	22.26	13.32
1150.0	0.62	20.80	15.31	30.46	21.41	12.99
1200.0	0.66	20.93	14.67	29.33	20.52	12.68
1250.0	0.69	21.07	14.13	28.70	20.11	12.42
1300.0	0.73	21.22	13.62	27.28	19.34	12.16
1400.0	0.81	21.56	12.62	25.77	18.06	11.67
1500.0	0.90	21.94	11.56	24.43	17.19	11.32
1600.0	1.00	22.42	10.44	22.28	15.73	10.96
1700.0	1.10	22.94	9.13	21.28	14.97	10.66
1800.0	1.22	23.55	7.61	20.09	14.06	10.39
1900.0	1.36	24.28	5.81	18.87	13.10	10.13
2000.0	1.50	25.09	3.81	18.14	12.49	9.92
2100.0	1.67	26.06	1.55	17.05	11.64	9.73
2200.0	1.83	27.04	0.82	16.73	11.45	9.59
2300.0	2.07	28.28	3.44	15.67	10.56	9.44
2400.0	2.29	29.36	5.87	15.22	10.20	9.27
2500.0	2.59	30.19	8.02	14.45	9.59	9.09
2600.0	2.90	30.02	9.19	13.94	9.22	9.01
2700.0	3.27	28.92	9.32	13.32	8.80	8.87
2800.0	3.75	27.24	8.81	12.61	8.20	8.69
2900.0	4.27	25.31	8.01	11.92	7.85	8.49
3000.0	4.87	23.64	7.36	11.31	7.53	8.21
3100.0	5.57	21.92	6.56	10.96	7.14	7.92
3200.0	6.32	20.54	6.07	10.49	6.95	7.71
3300.0	7.13	19.26	5.54	10.16	6.76	7.38
3400.0	7.95	18.14	5.08	9.82	6.63	7.04
3500.0	8.70	17.22	4.70	9.36	6.58	6.63

Directional Coupler DBTC-20-4+

Typical Performance Data

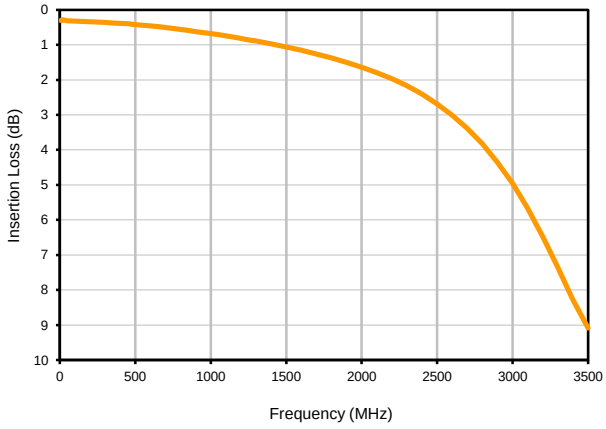
TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = +85°C

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
				IN	OUT	CPL
5.0	0.40	20.30	21.38	26.76	28.94	24.74
10.0	0.39	20.27	21.58	27.42	29.77	25.39
15.0	0.39	20.25	21.73	27.96	30.43	25.90
20.0	0.39	20.25	21.75	28.13	30.55	26.00
50.0	0.40	20.27	21.95	28.93	30.58	25.96
100.0	0.42	20.31	22.53	29.08	31.89	25.78
150.0	0.43	20.34	23.37	28.97	33.74	25.53
200.0	0.44	20.37	24.51	29.59	34.58	24.48
250.0	0.45	20.39	25.89	30.00	36.90	23.39
300.0	0.46	20.42	27.87	30.34	40.28	22.41
350.0	0.47	20.45	30.56	30.68	43.70	21.33
400.0	0.49	20.48	33.75	31.29	52.92	20.34
450.0	0.51	20.52	34.00	31.51	46.77	19.48
500.0	0.53	20.56	30.56	32.01	40.06	18.64
525.0	0.54	20.59	28.60	32.16	37.63	18.23
550.0	0.55	20.61	26.88	32.22	35.90	17.86
600.0	0.57	20.67	24.06	32.49	33.29	17.14
650.0	0.60	20.73	21.89	32.47	31.08	16.44
700.0	0.63	20.80	20.08	32.06	29.06	15.81
750.0	0.65	20.88	18.59	31.76	27.76	15.22
800.0	0.68	20.96	17.30	31.12	26.56	14.65
850.0	0.71	21.05	16.21	30.20	25.34	14.12
900.0	0.74	21.14	15.29	29.10	24.22	13.62
950.0	0.76	21.23	14.42	28.20	23.21	13.14
1000.0	0.79	21.33	13.72	27.41	22.51	12.70
1050.0	0.82	21.43	13.07	26.53	21.76	12.30
1100.0	0.85	21.55	12.49	25.70	21.01	11.91
1150.0	0.88	21.66	11.99	24.95	20.43	11.54
1200.0	0.92	21.77	11.53	24.23	19.80	11.21
1250.0	0.95	21.90	11.12	23.45	19.14	10.90
1300.0	0.98	22.02	10.76	22.83	18.66	10.61
1400.0	1.05	22.29	10.17	21.54	17.72	10.06
1500.0	1.13	22.59	9.69	20.30	16.71	9.57
1600.0	1.20	22.93	9.29	19.30	15.95	9.15
1700.0	1.30	23.33	8.95	18.14	14.98	8.73
1800.0	1.39	23.77	8.68	17.41	14.37	8.38
1900.0	1.50	24.28	8.30	16.65	13.75	8.08
2000.0	1.62	24.84	7.81	15.88	13.09	7.83
2100.0	1.75	25.56	6.88	15.21	12.55	7.58
2200.0	1.91	26.39	5.66	14.35	11.83	7.35
2300.0	2.08	27.35	3.87	13.70	11.34	7.15
2400.0	2.28	28.53	1.54	13.01	10.81	6.99
2500.0	2.51	30.09	1.36	12.42	10.30	6.80
2600.0	2.79	32.16	4.80	11.72	9.70	6.65
2700.0	3.11	34.80	8.87	11.07	9.22	6.50
2800.0	3.48	37.91	13.33	10.52	8.77	6.33
2900.0	3.91	38.88	15.62	10.06	8.36	6.25
3000.0	4.44	35.63	13.61	9.57	7.91	6.11
3100.0	5.06	31.94	11.10	9.11	7.59	6.02
3200.0	5.80	29.06	9.28	8.56	7.18	5.86
3300.0	6.67	26.69	7.89	8.08	6.84	5.72
3400.0	7.63	24.81	6.90	7.62	6.56	5.61
3500.0	8.62	23.23	6.13	7.27	6.37	5.47

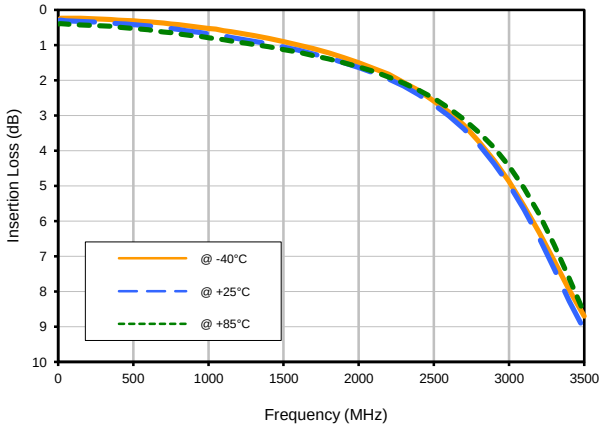
Directional Coupler DBTC-20-4+

Typical Performance Curves

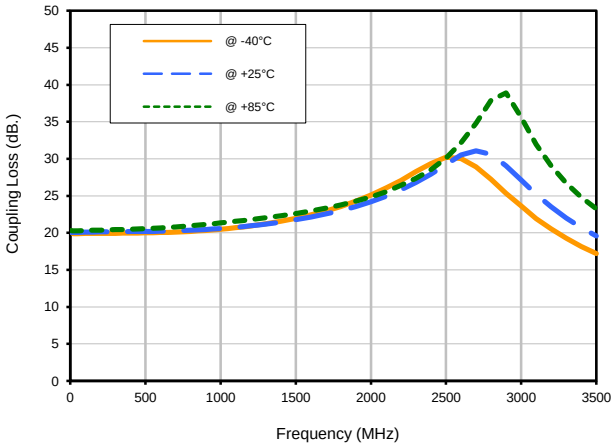
Insertion Loss



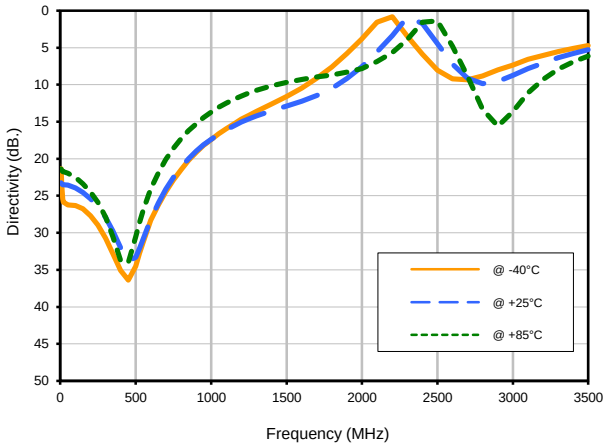
Insertion Loss vs. TEMPERATURE



Coupling Loss vs. TEMPERATURE

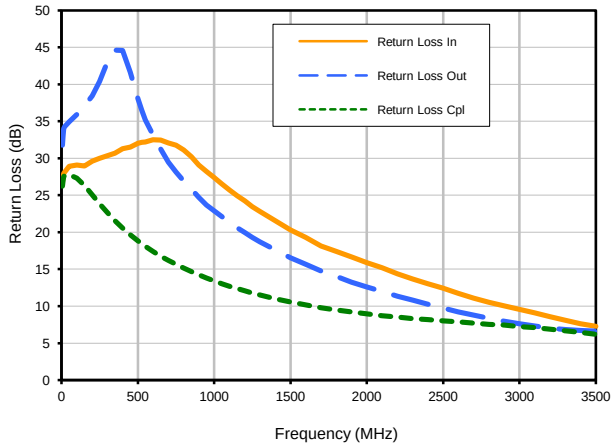


Directivity vs. TEMPERATURE

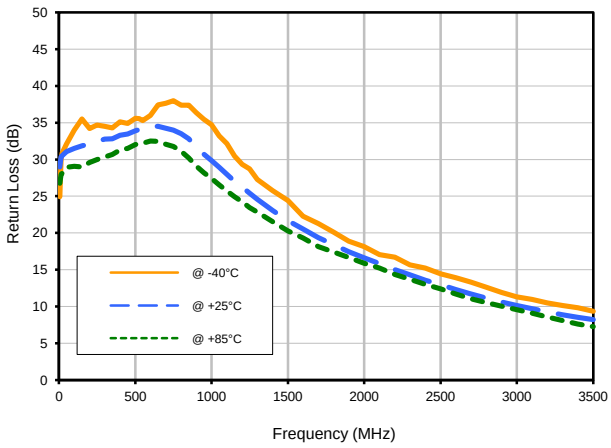


Typical Performance Curves

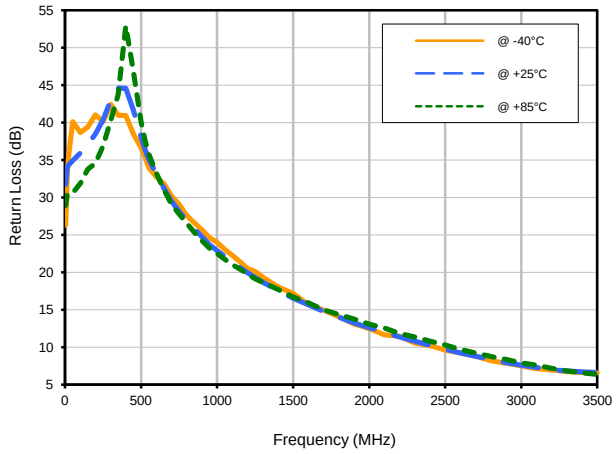
Return Loss



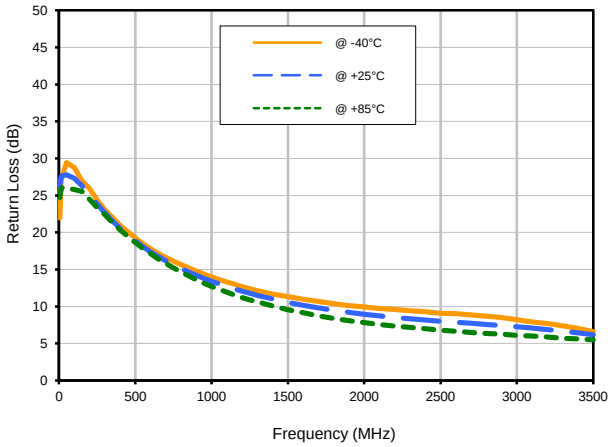
Return Loss In vs. TEMPERATURE



Return Loss Out vs. TEMPERATURE



Return Loss Cpl vs. TEMPERATURE

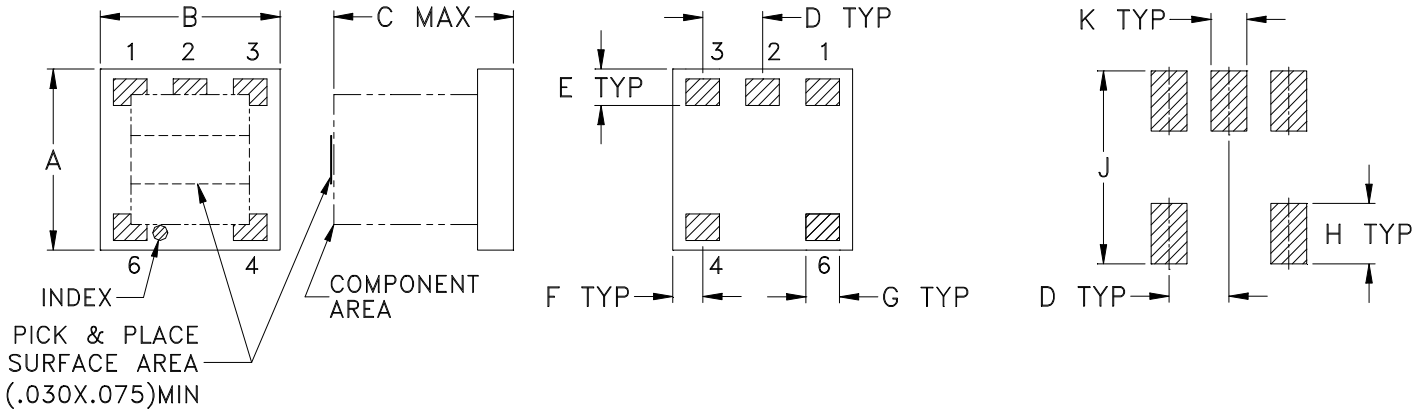


Case Style AT

Outline Dimensions

AT790-1

PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #	A	B	C	D	E	F	G	H	J	K	L	WT. GRAMS
AT790-1	.150 (3.81)	.150 (3.81)	.150 (3.81)	.050 (1.27)	.030 (0.76)	.025 (0.64)	.028 (0.71)	.050 (1.27)	.160 (4.06)	.030 (0.76)	-- --	.10

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

Notes:

1. Open style, Ceramic base.
2. Termination finish: Silver palladium or gold over nickel based on stock availability

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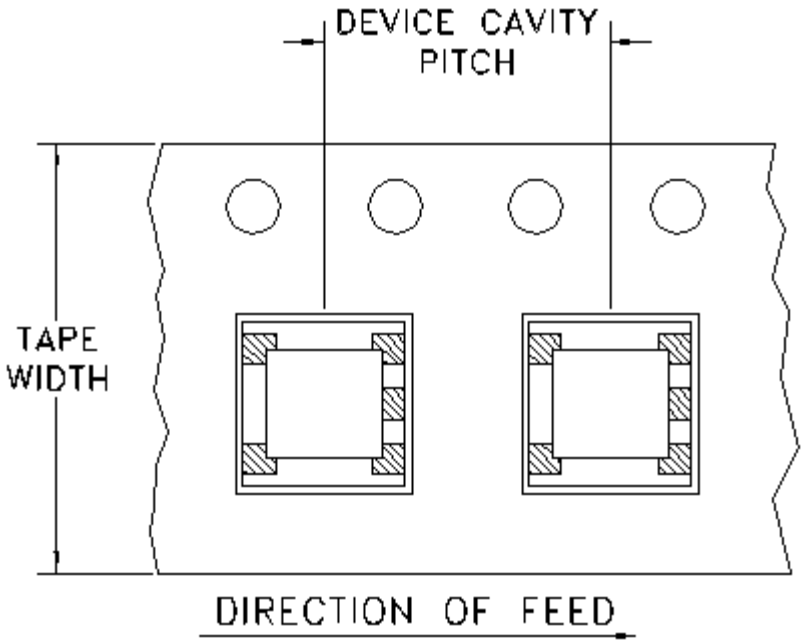
Tape & Reel Packaging TR-F17

DEVICE ORIENTATION IN T&R



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

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

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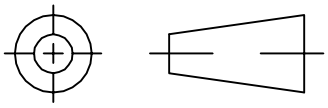
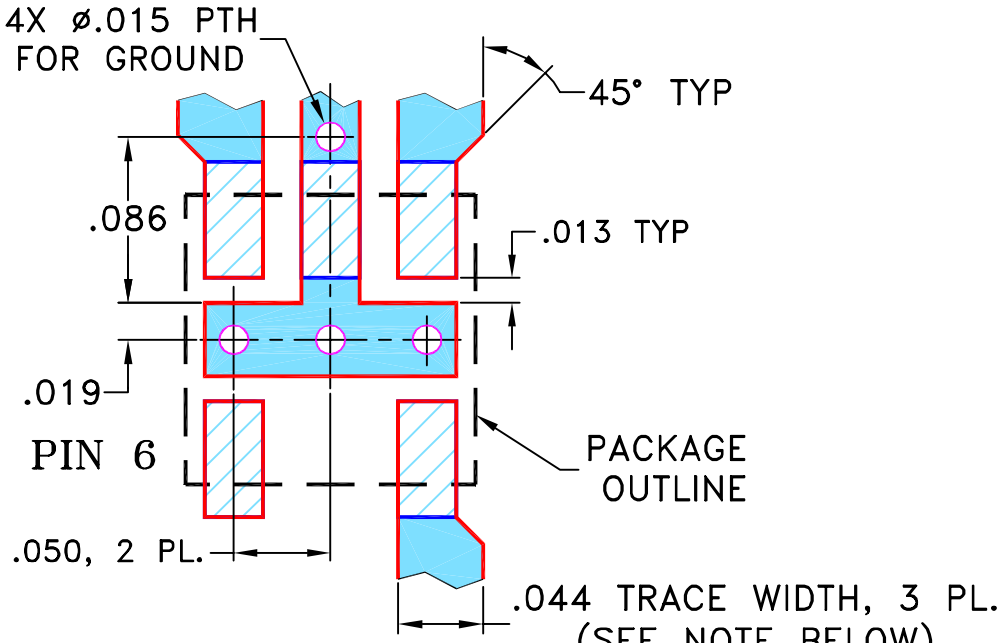
THIRD ANGLE PROJECTION



REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M90454	NEW RELEASE	01/16/04	AV	WP
A	M93049	AT1030 WAS AT1029	07/02/04	MMG	WP
B	M102713	ADDED "...WITH SMOBC"	01/17/06	MMG	IL

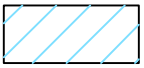
SUGGESTED MOUNTING CONFIGURATION FOR AT1030 CASE STYLE, "na" PIN CONNECTION



NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015"; 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	AV	01/08/04
TOLERANCES ON:	CHECKED	IL	01/16/04
2 PL DECIMALS ±	APPROVED	WP	01/16/04
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

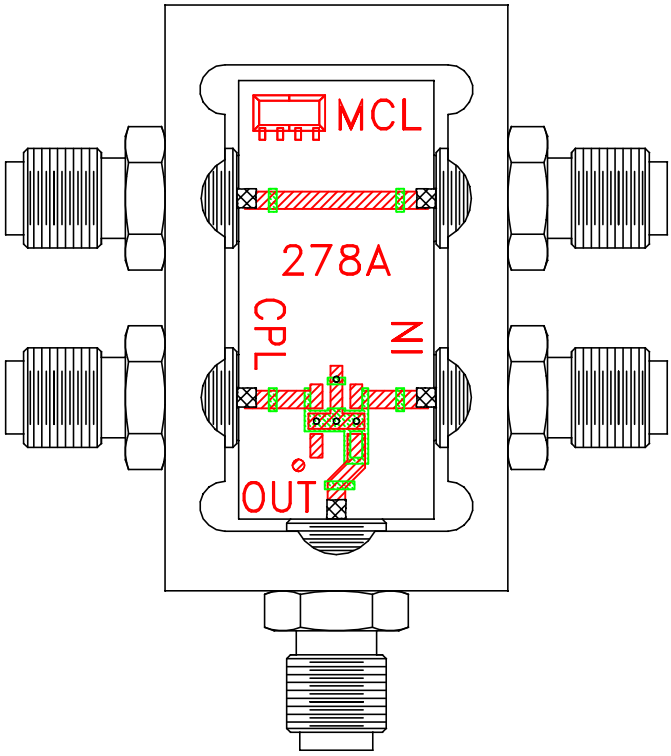
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, na, AT1030, DBTC, TB-278

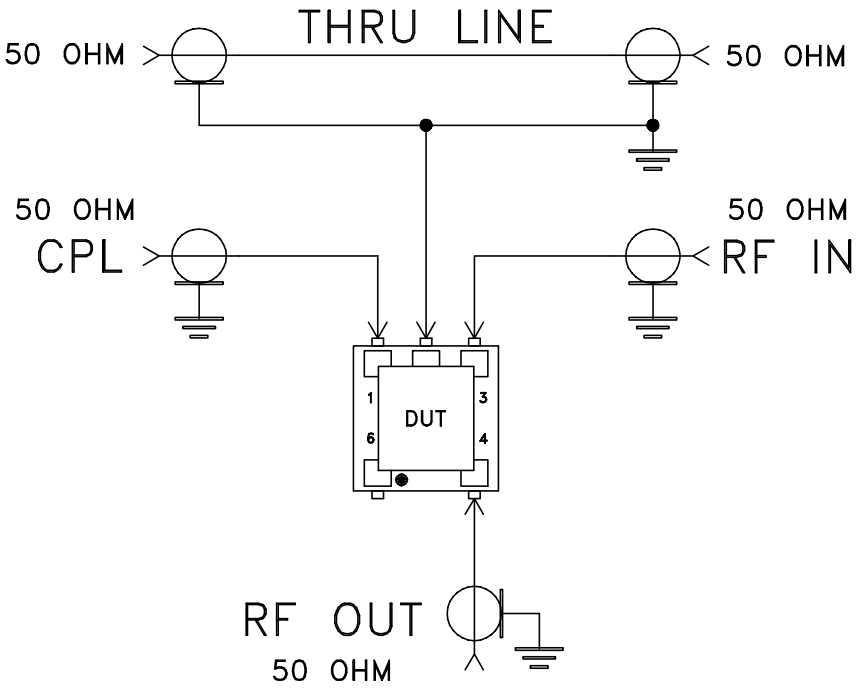
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-150	B

FILE:	SCALE:	SHEET:
98PL150	10:1	1 OF 1

Evaluation Board and Circuit



TB-278



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: Rogers RO4350B or its equivalent, Dielectric Constant=3.5, Thickness=.020"

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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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