

75Ω 5 to 600 MHz

Maximum Ratings

Operating Temperature -40°C to 85°C

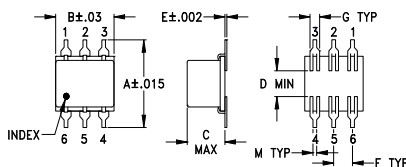
Storage Temperature -55°C to 100°C

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

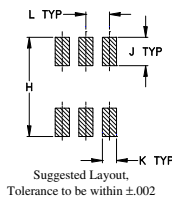
Pin Connections

INPUT	6
OUTPUT	1
COUPLED	4
GROUND	2,5
ISOLATE (DO NOT USE)	3

Outline Drawing

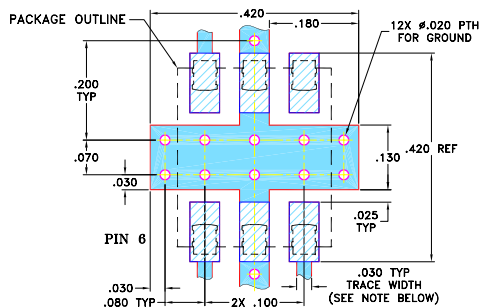


PCB Land Pattern



Outline Dimensions (inch)

A	B	C	D	E	F	G
.400	.31	.200	.10	.010	.100	.050
10.16	7.87	5.08	2.54	0.25	2.54	1.27
H	J	K	L	M	wt	
.420	.120	.060	.100	.020	grams	
10.67	3.05	1.52	2.54	0.51	0.55	

Demo Board MCL P/N: TB-34
Suggested PCB Layout (PL-043)

NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.030" ± 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

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/MCLStore/terms.jsp

Features

- low mainline loss, 0.5 dB typ.
- high directivity, 21 dB typ.

Applications

- VHF/UHF
- signal sampling
- communications
- cable tv



CASE STYLE: QQQ130

PRICE: Contact Sales Dept.

Directional Coupler Electrical Specifications

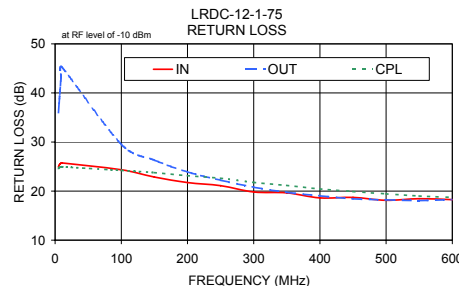
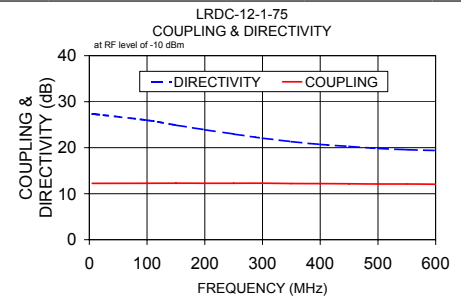
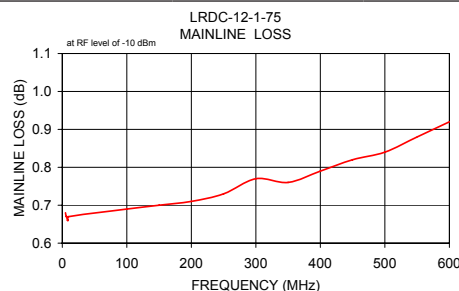
FREQ. (MHz)	COUPLING (dB)		MAINLINE LOSS ¹ (dB)						DIRECTIVITY (dB)						VSWR (:1)	POWER INPUT, W	
			L		M		U		L		M		U				
			Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.			
f _L -f _U	Nom.	Flatness															
5-600	12.2±0.5	±0.6	0.4	0.8	0.5	1.0	0.8	1.5	20	17	21	18	20	12	1.3	1.0	1.0

L = low range [f_L to 10 f_L] M = mid range [10 f_L to $f_U/2$] U = upper range [$f_U/2$ to f_U]

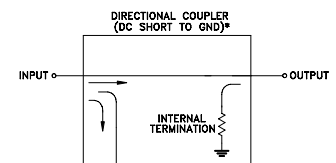
1. Mainline loss includes theoretical power loss at coupled port.

Typical Performance Data

Frequency (MHz)	Mainline Loss (dB) In-Out	Coupling (dB) In-Cpl	Directivity (dB)	Return Loss (dB)		
				In	Out	Cpl
5.00	0.68	12.25	27.30	24.93	36.02	24.62
6.00	0.67	12.24	27.29	25.25	37.90	24.76
8.00	0.66	12.24	27.30	25.59	41.55	24.92
10.00	0.67	12.24	27.29	25.75	45.26	24.96
100.00	0.69	12.26	25.97	24.35	29.52	24.21
200.00	0.71	12.27	23.92	21.73	23.91	23.15
300.00	0.77	12.28	22.07	19.81	20.80	21.77
400.00	0.79	12.20	20.71	18.62	19.03	20.45
500.00	0.84	12.11	19.85	18.13	18.22	19.44
600.00	0.92	12.05	19.38	18.26	18.28	18.73



Electrical Schematic



* ELECTRICAL SCHEMATIC IS FOR DIRECTIONAL COUPLER WITH INTERNAL TRANSFORMER(S) THAT ROUTES DC FROM RF PORTS TO GROUND.

Directional Coupler

LRDC-12-1-75

Typical Performance Data

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

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS		
				IN	OUT	CPL
1	0.86	12.81	18.80	22.00	19.24	17.29
2	0.72	12.54	19.90	25.74	21.44	19.50
5	0.58	12.29	20.97	32.66	24.20	22.35
6	0.57	12.27	21.21	34.20	24.49	22.61
7	0.57	12.26	21.15	35.50	24.73	22.77
8	0.57	12.26	21.19	36.66	24.85	22.93
9	0.57	12.25	21.28	37.73	24.93	23.01
10	0.57	12.24	21.33	38.54	25.00	23.04
20	0.58	12.27	21.38	41.20	25.09	23.04
30	0.59	12.30	21.01	40.25	25.04	22.86
40	0.61	12.31	21.19	38.77	24.85	22.61
50	0.61	12.32	21.12	37.13	24.66	22.39
75	0.64	12.35	21.42	33.05	24.34	21.78
100	0.66	12.38	21.49	30.70	24.20	21.26
125	0.68	12.38	21.81	28.92	23.93	20.65
150	0.70	12.38	22.06	27.56	23.73	20.05
175	0.71	12.38	22.69	26.57	23.39	19.41
200	0.73	12.36	23.19	25.28	23.00	18.81
225	0.75	12.36	24.17	24.50	22.70	18.28
250	0.77	12.36	24.38	23.72	22.36	17.67
275	0.79	12.34	25.71	23.18	22.08	17.17
300	0.81	12.34	26.17	22.71	21.71	16.62
325	0.84	12.32	26.78	22.32	21.38	16.19
350	0.86	12.31	26.53	21.91	21.08	15.72
375	0.90	12.29	26.31	21.69	20.81	15.30
400	0.93	12.28	24.82	21.63	20.71	14.94
425	0.96	12.27	23.39	21.54	20.54	14.53
450	1.00	12.26	21.93	21.51	20.39	14.21
475	1.04	12.25	20.89	21.58	20.24	13.82
500	1.07	12.24	19.00	21.61	20.00	13.49
525	1.12	12.23	18.30	21.95	19.88	13.21
550	1.17	12.24	16.68	22.02	19.69	12.87
575	1.22	12.24	15.94	22.65	19.76	12.61
600	1.27	12.24	14.67	23.24	19.60	12.29
625	1.32	12.26	14.03	23.93	19.72	12.00
650	1.38	12.28	12.89	24.77	19.61	11.79
700	1.50	12.33	11.38	26.99	19.55	11.22
750	1.62	12.43	9.88	30.84	19.59	10.64
800	1.77	12.57	8.58	39.44	19.54	10.10
850	1.90	12.72	7.42	40.02	19.81	9.64
900	2.04	12.95	6.11	29.29	20.24	9.15
950	2.19	13.25	4.77	25.06	20.68	8.67
1000	2.35	13.60	3.60	22.44	21.11	8.20
1050	2.52	14.01	2.52	20.32	21.98	7.77
1100	2.68	14.47	1.39	18.85	23.24	7.45
1200	2.93	15.54	0.76	16.32	27.14	6.86
1300	3.13	16.64	2.32	15.03	33.34	6.40
1400	3.30	17.77	4.09	14.02	32.37	6.13
1500	3.47	18.64	4.75	13.54	28.84	5.95
1600	3.63	19.00	5.02	13.10	25.11	6.02
1700	3.97	18.48	4.85	12.93	23.06	6.13
1800	4.42	17.62	3.42	12.75	20.81	6.60
1900	5.00	16.50	3.26	12.77	18.78	7.23
2000	5.59	15.68	2.05	12.48	17.10	7.98

REV. X1

LRDC-12-1-75

090708

Page 1 of 3



IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED RoHS compliant

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661



Patent Pending

The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs & shopping online see



Directional Coupler

LRDC-12-1-75

Typical Performance Data

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

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS		
				IN	(dB) OUT	CPL
1	0.87	12.78	17.73	22.35	19.46	18.21
2	0.84	12.74	18.45	25.60	20.52	19.12
5	0.71	12.53	19.78	29.94	22.31	20.55
6	0.68	12.45	20.12	31.08	22.78	21.00
7	0.65	12.42	20.45	32.33	23.24	21.38
8	0.63	12.37	20.72	33.61	23.67	21.76
9	0.61	12.34	20.92	34.87	23.98	22.05
10	0.60	12.32	21.03	36.05	24.20	22.27
20	0.57	12.26	21.40	38.66	25.53	23.13
30	0.57	12.29	21.34	35.10	26.29	23.16
40	0.57	12.28	21.29	32.83	26.97	23.11
50	0.57	12.28	21.35	31.87	27.67	23.06
75	0.58	12.29	21.57	32.18	28.14	22.72
100	0.59	12.30	21.85	34.46	26.76	22.32
125	0.61	12.29	22.27	31.80	25.28	21.80
150	0.61	12.29	22.30	28.40	24.92	21.27
175	0.62	12.28	23.09	27.51	25.20	20.67
200	0.64	12.26	23.40	27.65	25.38	20.05
225	0.65	12.24	24.40	27.53	24.61	19.40
250	0.67	12.24	24.49	25.78	23.39	18.65
275	0.69	12.22	25.91	24.36	22.69	17.97
300	0.70	12.19	26.24	23.55	22.33	17.27
325	0.72	12.18	27.33	23.35	22.19	16.66
350	0.74	12.16	26.85	22.79	21.69	16.06
375	0.77	12.14	26.69	22.10	21.10	15.50
400	0.80	12.11	25.44	21.67	20.74	15.04
425	0.83	12.08	23.95	21.25	20.49	14.57
450	0.86	12.07	22.69	20.92	20.23	14.20
475	0.90	12.05	21.27	20.71	19.89	13.79
500	0.93	12.03	19.57	20.60	19.47	13.43
525	0.97	12.01	18.77	20.94	19.24	13.14
550	1.01	12.00	17.08	20.96	19.04	12.76
575	1.06	11.99	16.38	21.08	18.97	12.49
600	1.11	11.99	15.08	20.98	18.58	12.13
625	1.16	11.98	14.49	21.31	18.56	11.82
650	1.21	12.00	13.28	22.25	18.48	11.57
700	1.33	12.01	11.68	24.87	18.49	10.99
750	1.45	12.07	10.12	27.54	18.34	10.42
800	1.59	12.20	8.77	33.69	18.50	9.91
850	1.73	12.37	7.51	31.75	18.97	9.50
900	1.88	12.59	6.07	25.07	19.73	9.09
950	2.02	12.91	4.66	21.52	20.85	8.65
1000	2.19	13.30	3.38	18.71	21.94	8.23
1050	2.36	13.79	2.14	16.98	24.16	7.84
1100	2.53	14.35	0.87	15.96	27.91	7.55
1200	2.74	15.56	1.42	14.22	44.33	6.96
1300	2.89	16.83	3.08	13.96	30.33	6.29
1400	3.02	18.15	4.93	13.98	28.34	5.73
1500	3.12	18.98	5.43	14.65	32.88	5.32
1600	3.27	19.24	5.46	15.21	42.52	5.33
1700	3.60	18.41	4.90	13.62	30.53	5.54
1800	4.11	17.57	3.40	12.86	22.99	6.26
1900	4.67	16.19	3.07	10.91	17.50	7.16
2000	5.28	15.40	1.80	9.89	13.59	8.08

REV. X1

LRDC-12-1-75

090708

Page 2 of 3



IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED RoHS compliant

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661



Patent Pending

The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs & shopping online see



Directional Coupler

LRDC-12-1-75

Typical Performance Data

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

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS		
				IN	OUT	CPL
1	1.08	13.21	17.25	19.30	17.36	15.46
2	0.86	12.81	18.65	22.80	19.82	17.89
5	0.66	12.43	20.24	29.41	23.24	21.30
6	0.64	12.42	20.51	30.89	23.73	21.71
7	0.63	12.40	20.51	32.24	23.98	21.94
8	0.63	12.39	20.62	33.38	24.15	22.14
9	0.63	12.38	20.71	34.37	24.26	22.27
10	0.63	12.37	20.72	35.20	24.34	22.34
20	0.64	12.38	20.89	42.86	24.30	22.53
30	0.65	12.41	20.82	51.10	23.95	22.38
40	0.67	12.43	20.93	42.60	23.30	22.10
50	0.68	12.44	20.73	37.28	22.83	21.83
75	0.71	12.48	20.94	30.20	22.31	21.25
100	0.74	12.49	21.04	27.82	22.50	20.69
125	0.76	12.50	21.46	27.15	23.07	20.06
150	0.78	12.52	21.85	27.30	23.21	19.49
175	0.80	12.51	22.30	26.50	22.58	18.88
200	0.82	12.51	22.90	24.68	21.89	18.37
225	0.85	12.51	24.02	23.45	21.62	17.85
250	0.87	12.51	24.46	22.94	21.64	17.36
275	0.89	12.52	25.96	22.98	21.85	16.91
300	0.92	12.50	26.66	22.89	21.71	16.49
325	0.95	12.51	27.39	22.54	21.27	16.10
350	0.98	12.51	26.84	21.98	20.85	15.74
375	1.02	12.50	26.57	21.78	20.66	15.37
400	1.05	12.50	24.82	22.03	20.82	15.05
425	1.09	12.49	23.50	22.38	20.95	14.73
450	1.13	12.50	21.93	22.66	20.91	14.43
475	1.18	12.51	20.44	22.82	20.88	14.11
500	1.22	12.52	18.72	22.78	20.58	13.80
525	1.27	12.51	18.03	23.10	20.46	13.51
550	1.32	12.55	16.30	23.43	20.40	13.18
575	1.37	12.55	15.58	24.39	20.54	12.90
600	1.43	12.58	14.36	25.27	20.52	12.57
625	1.48	12.60	13.72	25.92	20.63	12.26
650	1.54	12.62	12.65	26.55	20.41	12.01
700	1.66	12.70	11.18	28.15	20.20	11.40
750	1.78	12.80	9.90	31.58	20.27	10.76
800	1.92	12.92	8.67	35.53	20.04	10.17
850	2.05	13.09	7.62	47.83	19.93	9.66
900	2.19	13.28	6.49	36.66	20.15	9.15
950	2.33	13.51	5.31	30.49	20.13	8.67
1000	2.48	13.76	4.34	27.00	20.12	8.23
1050	2.64	14.05	3.43	23.83	20.53	7.84
1100	2.83	14.40	2.43	21.51	21.10	7.55
1200	3.10	15.10	0.59	18.12	22.71	7.11
1300	3.35	15.86	0.78	15.98	24.77	6.85
1400	3.57	16.62	2.39	14.39	26.25	6.77
1500	3.78	17.23	3.02	13.54	25.79	6.75
1600	3.95	17.64	3.52	13.06	23.95	6.88
1700	4.28	17.67	3.98	13.18	22.88	6.86
1800	4.67	17.45	3.11	13.47	22.72	7.06
1900	5.19	16.81	3.39	14.24	22.82	7.40
2000	5.72	16.25	2.42	14.55	23.01	7.97

REV. X1

LRDC-12-1-75

090708

Page 3 of 3



IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED RoHS compliant

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661



The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs & shopping online see

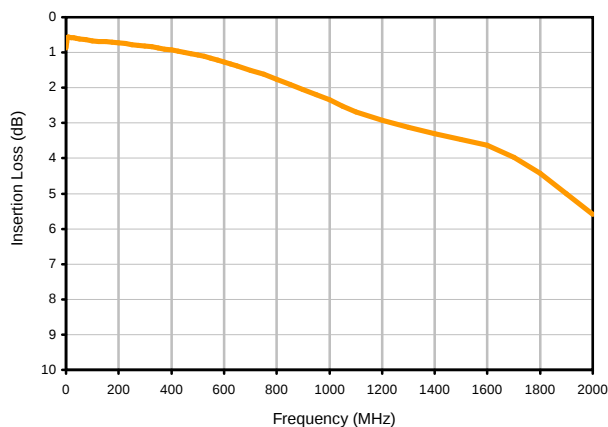


Directional Coupler

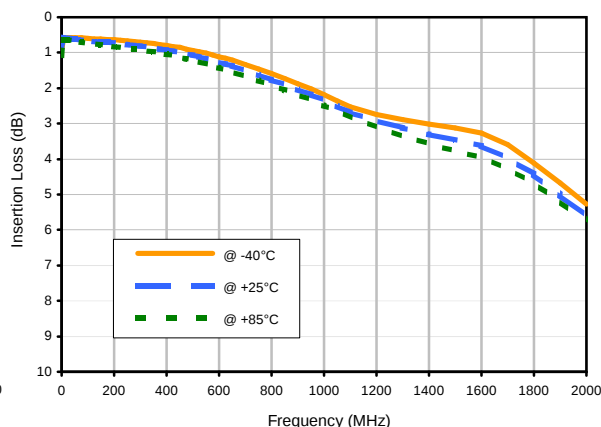
Typical Performance Curves

LRDC-12-1-75

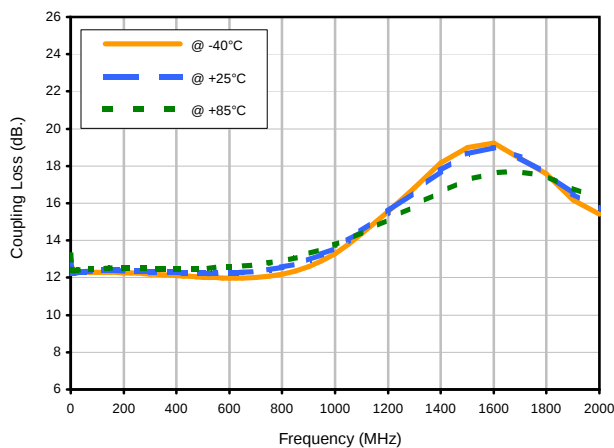
Insertion Loss



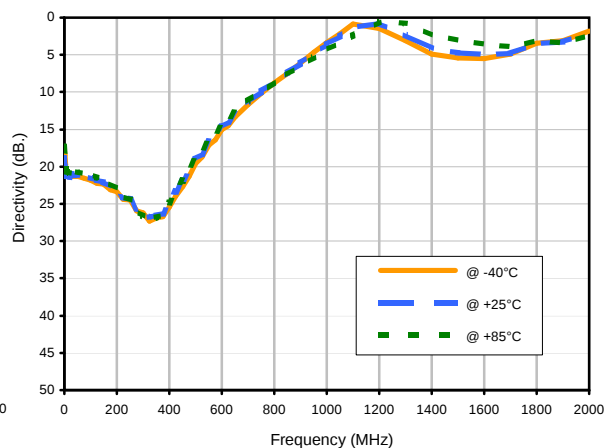
Insertion Loss vs. TEMPERATURE



Coupling Loss vs. TEMPERATURE



Directivity vs. TEMPERATURE



REV. X1
LRDC-12-1-75
090708
Page 1 of 2

Mini-Circuits®

IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS 9100 CERTIFIED RoHS compliant
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661



The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs & shopping online see

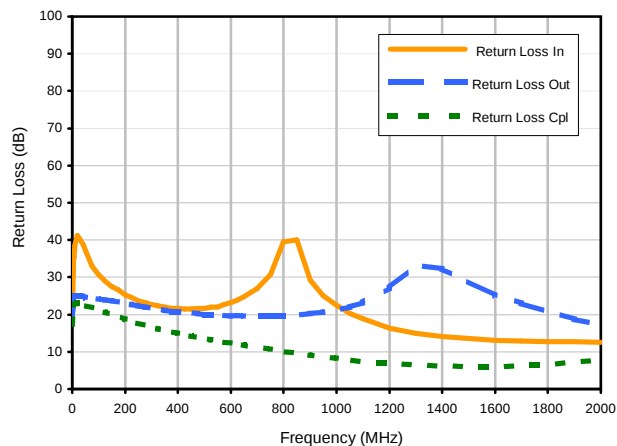


Directional Coupler

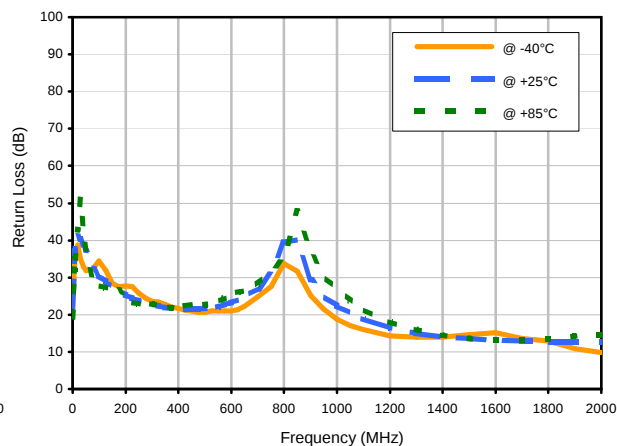
LRDC-12-1-75

Typical Performance Curves

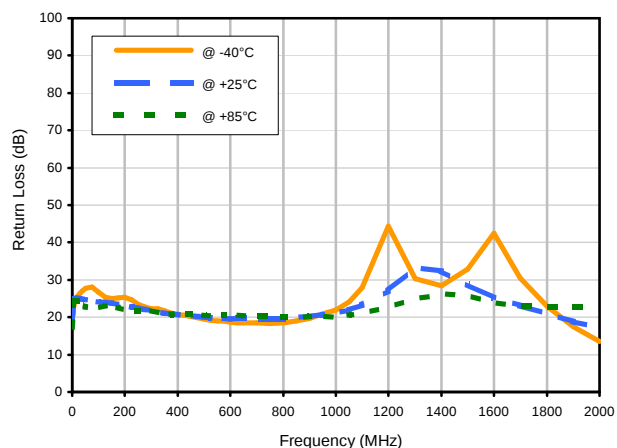
Return Loss



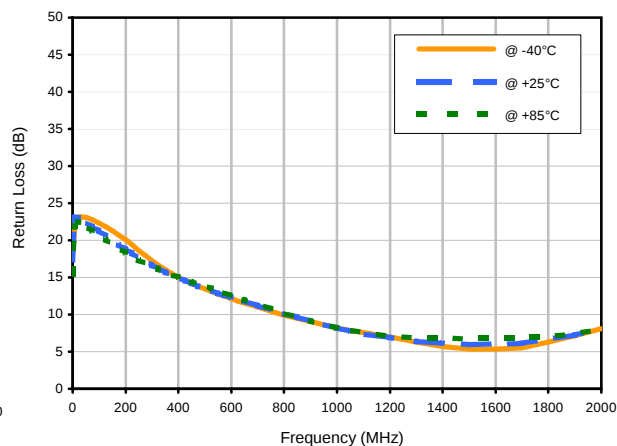
Return Loss In vs. TEMPERATURE



Return Loss Out vs. TEMPERATURE



Return Loss Cpl vs. TEMPERATURE



REV. X1
LRDC-12-1-75
090708
Page 2 of 2



Mini-Circuits®
IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED • RoHS compliant
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs & shopping online see

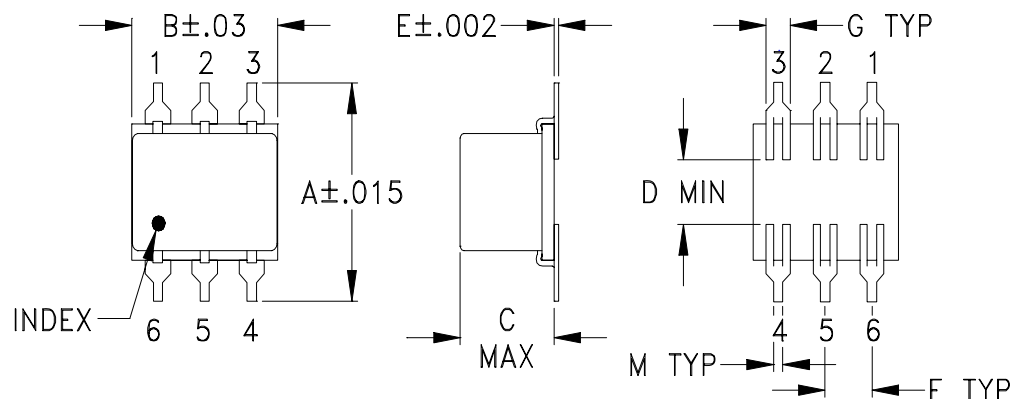


Case Style

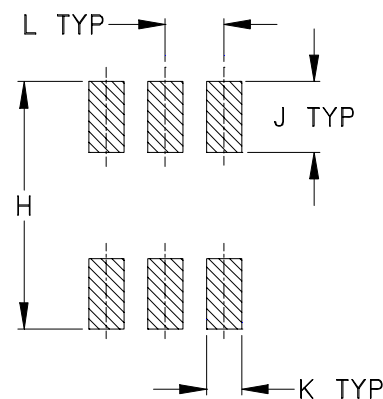
QQQ

Outline Dimensions

QQQ130 (non-waterproof)
QQQ828 (washable)



PCB Land Pattern



Suggested Layout,
Tolerance to be within $\pm.002$

CASE#	A	B	C	D	E	F	G	H	J	K	L	M	WT, GRAM
QQQ130	.400 (10.16)	.31 (7.87)	.200 (5.08)	.10 (2.54)	.010 (.25)	.100 (2.54)	.050 (1.27)	.420 (10.67)	.120 (3.05)	.060 (1.52)	.100 (2.54)	.020 (.51)	.55
QQQ828			.050 (1.27)										.20

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

Notes:

- Case material: Ceramic.
- Termination finish:
For RoHS Case Styles: Tin plate over Nickel plate.
For RoHS-5 Case Styles: Tin-Lead plate.



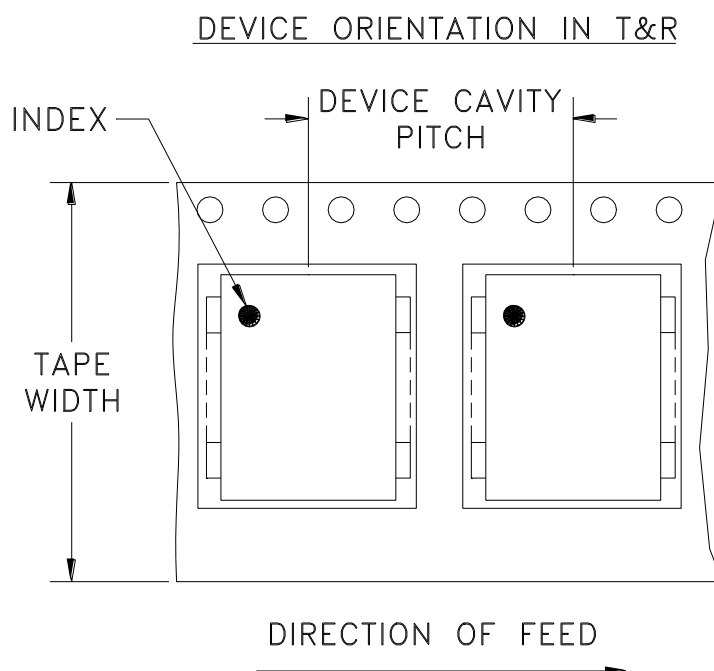
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified

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

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Tape & Reel Packaging TR-F10



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
24	16	7	10,20,50,100,200
		13	500

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

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



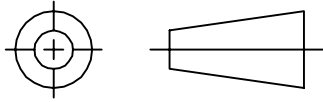
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified

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

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

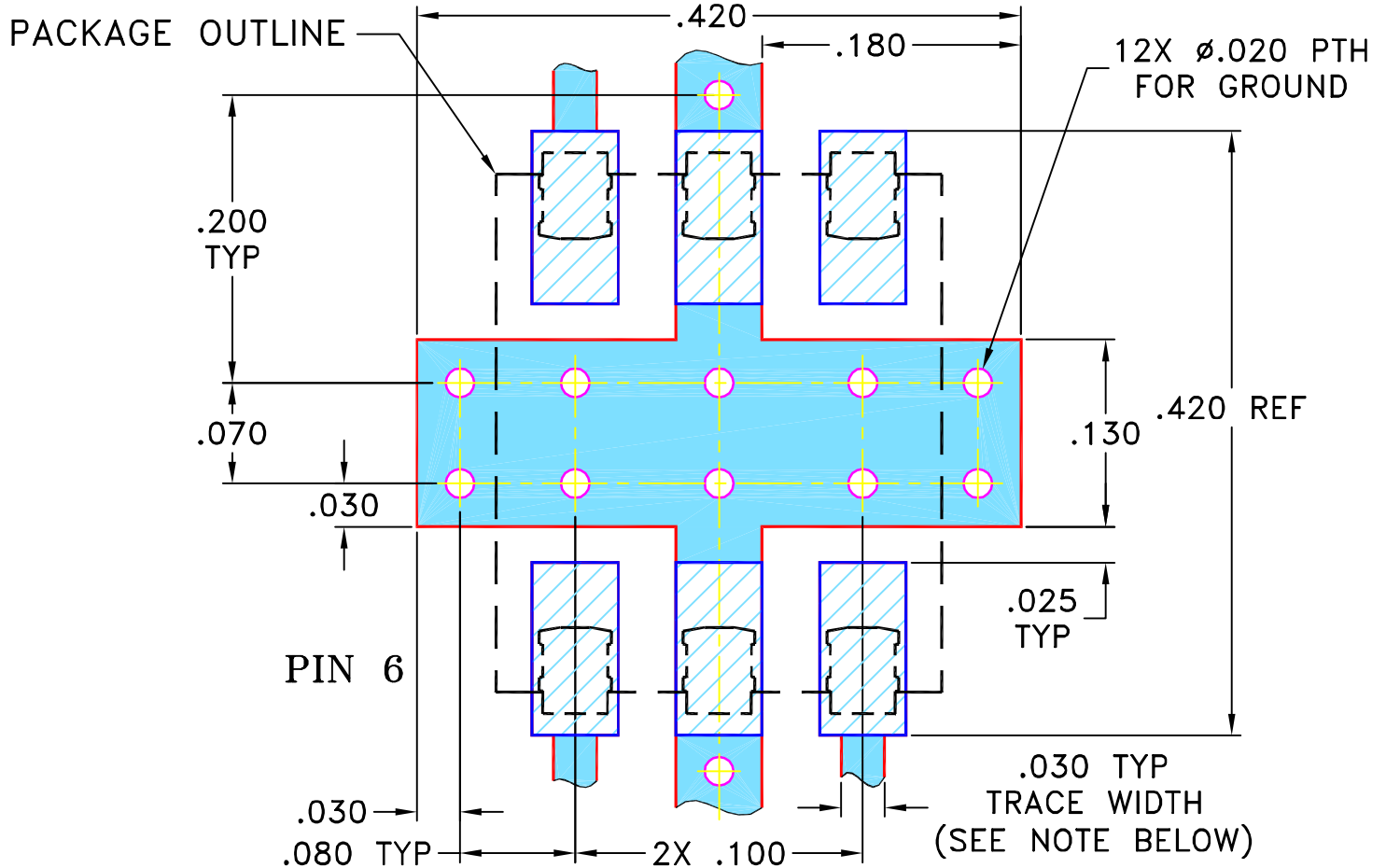
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M79561	NEW RELEASE	07/23/02	MMG	LC
A	M102713	UPDATED NOTES	01/12/08	GF	IL

SUGGESTED MOUNTING CONFIGURATION
FOR QQQ569 CASE STYLE, "cz" PIN CONNECTION

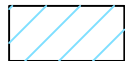


NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS $0.030'' \pm 0.002''$; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

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

MMG

06/17/02

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

CHECKED

AV

07/23/02

APPROVED

LC

07/23/02

ANGLES $\pm$
FRACTIONS $\pm$

Mini-Circuits®

THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS. EXCEPT FOR USE EXPRESSLY GRANTED, IN WRITING, TO ITS VENDORS, VENDEE AND THE UNITED STATES GOVERNMENT, MINI-CIRCUITS RESERVES ALL PROPRIETARY DESIGN, USE, MANUFACTURING AND REPRODUCTION RIGHTS THERETO. THESE CONTENTS SHALL NOT BE USED, DUPLICATED OR DISCLOSED TO ANY OUTSIDE PARTY, IN WHOLE OR IN PART, WITHOUT WRITTEN PERMISSION OF MINI-CIRCUITS.

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



Mini-Circuits®

13 Neptune Avenue
Brooklyn NY 11235

PL, cz, 75, QQQ569, LRDC, TB-34

SIZE
A

CODE IDENT
15542

DRAWING NO:
98-PL-043

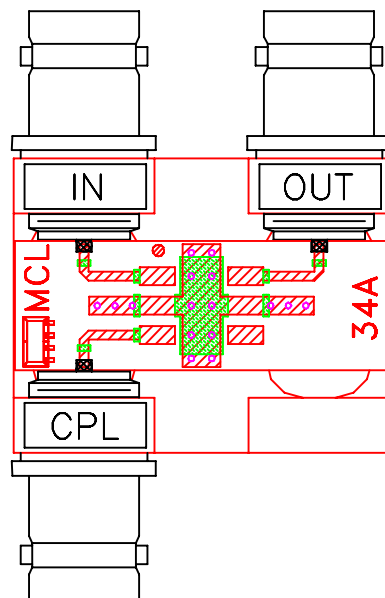
REV:
A

FILE: 98PL043

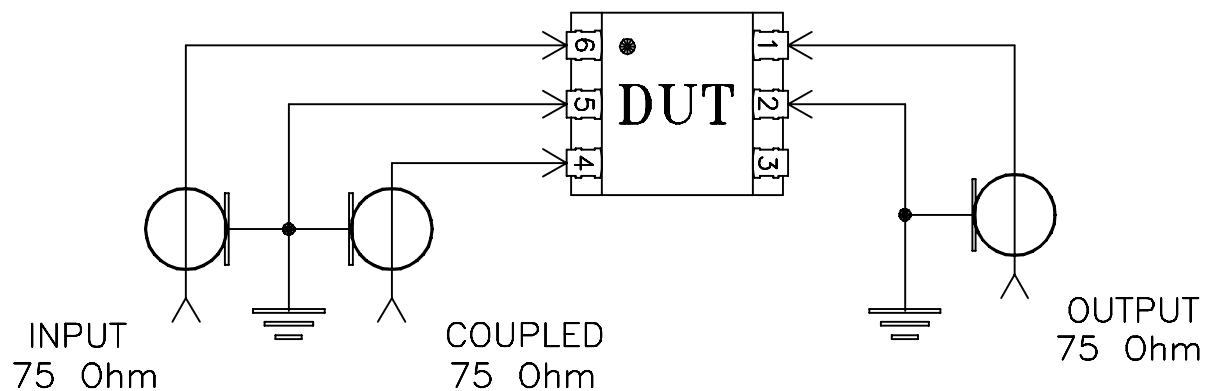
SCALE: 8:1

SHEET: 1 OF 1

Evaluation Board and Circuit



TB-34



Schematic Diagram

Notes:

1. 75 Ohm BNC 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