Surface Mount

Attenuator/Switch

75Ω Bi-Phase 10 to 1000 MHz

LRAS-2-75

Generic photo used for illustration purposes only

CASE STYLE: QQQ130

Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
Control Current	30mA

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

Pin Connections

INPUT	4
OUTPUT	1
CONTROL	5
GROUND	2,3,6

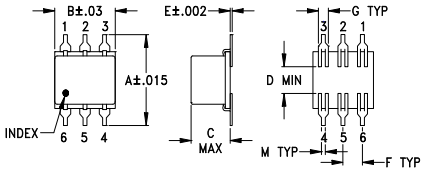
Features

- wideband, 10 to 1000 MHz
- excellent phase and amplitude unbalance

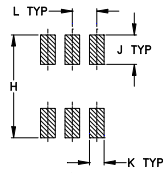
Applications

- bi-phase modulator

Outline Drawing



PCB Land Pattern



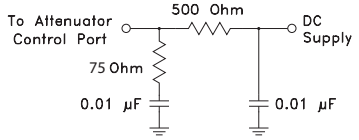
Suggested Layout,
Tolerance to be within ±.002

Outline Dimensions (inch / mm)

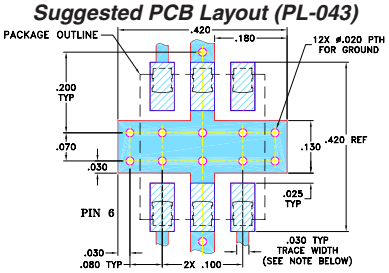
A	B	C	D	E	F	G
.400	.31	.200	.10	.010	.100	.050
10.16	7.87	5.08	2.54	0.25	2.54	1.27

H	J	K	L	M		wt
.420	.120	.060	.100	.020		grams
10.67	3.05	1.52	2.54	0.51		0.55

suggested control port biasing configuration



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

Attenuator/Switch Electrical Specifications

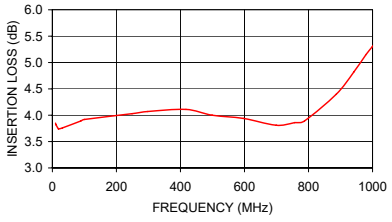
FREQUENCY (MHz)		INSERTION LOSS (dB) ±20 mA				MAX. INPUT PWR (dBm) ±20 mA		IN-OUT ISOLATION (dB) 0 mA						BI-PHASE $\overline{X}$ (±20 mA) Typ.			
		Mid-Band m		Total Range				L		M		U		Δ AMP (dB)		Phase (deg.) deviation from 180°	
IN f_L-f_U	CON	Typ.	Max.	Typ.	Max.	1 dB compr.	no damage	Typ.	Min.	Typ.	Min.	Typ.	Min.	m	Total Range	m	Total Range
10-1000	DC-0.05	4.1	6.0	4.5	7.5	20	25	58	40	42	28	39	20	0.15	0.3	1.5	3.0

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] m = [2 f_L to f_U/2]
Performance specifications apply for input power up to 10 dB below stated 1 dB compression.

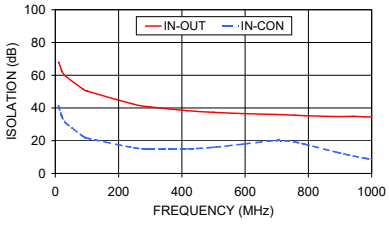
Typical Performance Data

Freq. (MHz)	I. Loss (dB) at 20mA		±Control ΔΔAMP (dB)	20mA ΔΔPhase (deg.)	Isolation (dB) (in-out)	(in-con)	Input R. Loss (dB)	Control Current (mA)	Attenuation (dB) 10 MHz	500 MHz	1000 MHz	Phase Δ ref at 15mA Ctrl 10 MHz deg.	500 MHz deg.	1000 MHz deg.	Input VSWR 10 MHz	500 MHz	1000 MHz
	$\overline{x}$	σ	$\overline{x}$	$\overline{x}$	$\overline{x}$	$\overline{x}$	$\overline{x}$										
10.0	3.85	0.03	0.02	179.9	68	41	10.1	0.0000	72.9	42.4	27.4	77.0	123.7	-103.5	2.1	3.1	3.1
11.1	3.82	0.03	0.02	179.9	68	40	10.2	0.0003	55.2	42.7	27.4	11.3	120.0	-102.9	2.1	3.1	3.1
18.9	3.74	0.03	0.02	179.9	63	36	10.6	0.0005	53.2	42.9	27.5	7.8	118.9	-102.6	2.1	3.1	3.1
20.0	3.74	0.03	0.02	180.0	63	35	10.7	0.0012	51.4	43.0	27.5	3.9	117.5	-102.4	2.1	3.1	3.1
31.6	3.76	0.02	0.02	180.0	60	31	10.7	0.0020	48.6	43.5	27.5	-0.2	112.3	-101.5	2.1	3.1	3.1
88.8	3.89	0.03	0.02	179.9	51	23	10.3	0.0057	43.1	45.3	27.5	1.3	90.0	-98.1	2.1	3.1	3.0
100.0	3.92	0.03	0.02	179.9	50	22	10.2	0.0100	39.5	44.9	27.5	3.7	57.7	-94.3	2.0	3.1	3.0
249.1	4.03	0.04	0.03	179.8	42	16	8.9	0.0159	36.4	42.4	27.5	5.1	30.2	-89.7	2.0	3.1	3.0
297.8	4.07	0.05	0.03	179.8	41	15	8.5	0.0285	31.8	36.4	27.2	6.5	7.1	-79.2	2.0	3.0	2.9
417.3	4.11	0.07	0.05	179.6	38	15	7.9	0.0446	28.2	32.0	26.8	7.2	-1.1	-68.6	1.9	2.9	2.8
498.9	4.00	0.08	0.06	179.2	37	16	7.9	0.0715	24.6	27.7	25.4	7.4	-5.8	-54.2	1.8	2.8	2.7
596.4	3.94	0.09	0.08	178.5	37	18	8.5	0.1020	21.8	24.5	23.6	7.5	-7.7	-43.6	1.7	2.7	2.6
699.0	3.81	0.10	0.11	177.8	36	20	10.0	0.1879	17.4	19.7	20.0	7.0	-9.0	-27.2	1.5	2.5	2.4
756.8	3.86	0.12	0.11	177.5	36	19	11.1	0.3050	14.2	16.2	16.9	6.3	-8.9	-17.7	1.4	2.3	2.2
787.4	3.89	0.14	0.15	177.4	35	18	12.0	0.4255	12.2	14.0	14.9	5.7	-8.5	-12.5	1.2	2.1	2.0
887.0	4.40	0.24	0.24	176.4	35	13	13.7	0.7057	9.7	11.2	12.3	4.5	-7.4	-6.6	1.1	2.0	1.8
941.4	4.82	0.31	0.39	175.6	35	11	15.6	0.9950	8.3	9.6	10.9	3.7	-6.6	-3.4	1.2	1.9	1.6
979.5	5.15	0.36	0.39	175.1	35	9	15.2	1.7446	6.5	7.4	9.2	2.5	-4.9	0.2	1.4	1.8	1.5
999.1	5.30	0.38	0.40	175.0	35	9	14.5	5.6985	4.4	4.8	7.6	0.6	-1.6	1.8	1.8	1.8	1.2
1019.2	5.47	0.41	0.45	175.1	35	8	13.8	15.0090	3.7	3.9	7.3	0.0	0.0	0.1	2.1	1.9	1.1

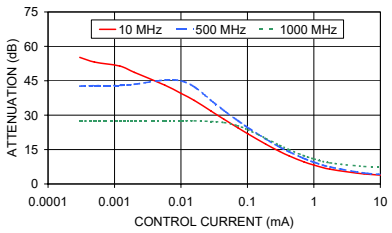
LRAS-2-75
INSERTION LOSS



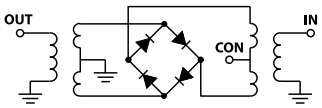
LRAS-2-75
ISOLATION



LRAS-2-75
ATTENUATION



electrical schematic



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

Attenuator/Switch LRAS-2-75

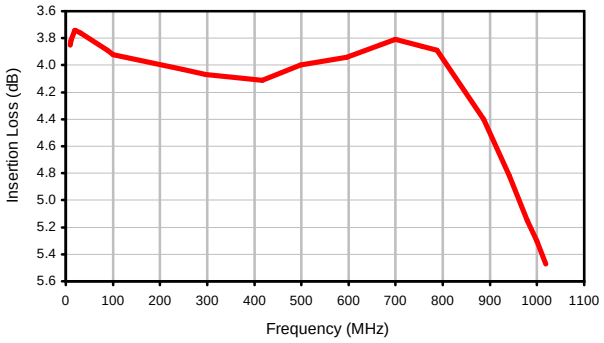
Typical Performance Data

FREQ. (MHz)	INSERTION LOSS (dB) at 20mA Control Current	AMP. UNBAL. (dB) at ± 20mA Control Current	PHASE UNBAL. (deg.) at ± 20mA Control Current	ISOLATION at 0 mA Control Current (dB)		RETURN LOSS (dB)
				In-Out	In-Con	Input
10.0	3.85	0.02	179.9	68	41	10.1
11.1	3.82	0.02	179.9	68	40	10.2
18.9	3.74	0.02	179.9	63	36	10.6
20.0	3.74	0.02	180.0	63	35	10.7
31.6	3.76	0.02	180.0	60	31	10.7
88.8	3.89	0.02	179.9	51	23	10.3
100.0	3.92	0.02	179.9	50	22	10.2
249.1	4.03	0.03	179.8	42	16	8.9
297.8	4.07	0.03	179.8	41	15	8.5
417.3	4.11	0.05	179.6	38	15	7.9
498.9	4.00	0.06	179.2	37	16	7.9
596.4	3.94	0.08	178.5	37	18	8.5
699.0	3.81	0.11	177.8	36	20	10.0
756.8	3.86	0.11	177.5	36	19	11.1
787.4	3.89	0.15	177.4	35	18	12.0
887.0	4.40	0.24	176.4	35	13	13.7
941.4	4.82	0.39	175.6	35	11	15.6
979.5	5.15	0.39	175.1	35	9	15.2
999.1	5.30	0.40	175.0	35	9	14.5
1019.2	5.47	0.45	175.1	35	8	13.8

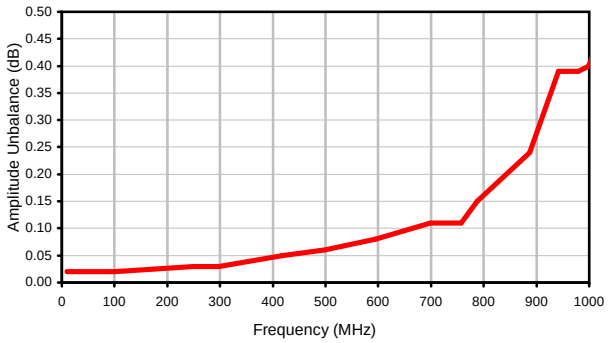
CONTROL CURRENT (mA)	ATTENUATION (dB)			PHASE UNBALANCE REF AT 15 mA CONTROL (deg.)			INPUT VSWR (:1)		
	10 MHz	500 MHz	1000 MHz	10 MHz	500 MHz	1000 MHz	10 MHz	500 MHz	1000 MHz
0.0000	72.9	42.4	27.4	77.0	123.7	-103.5	2.1	3.1	3.1
0.0003	55.2	42.7	27.4	11.3	120.0	-102.9	2.1	3.1	3.1
0.0005	53.2	42.9	27.5	7.8	118.9	-102.6	2.1	3.1	3.1
0.0012	51.4	43.0	27.5	3.9	117.5	-102.4	2.1	3.1	3.1
0.0020	48.6	43.5	27.5	-0.2	112.3	-101.5	2.1	3.1	3.1
0.0057	43.1	45.3	27.5	1.3	90.0	-98.1	2.1	3.1	3.0
0.0100	39.5	44.9	27.5	3.7	57.7	-94.3	2.0	3.1	3.0
0.0159	36.4	42.4	27.5	5.1	30.2	-89.7	2.0	3.1	3.0
0.0285	31.8	36.4	27.2	6.5	7.1	-79.2	2.0	3.0	2.9
0.0446	28.2	32.0	26.8	7.2	-1.1	-68.6	1.9	2.9	2.8
0.0715	24.6	27.7	25.4	7.4	-5.8	-54.2	1.8	2.8	2.7
0.1020	21.8	24.5	23.6	7.5	-7.7	-43.6	1.7	2.7	2.6
0.1879	17.4	19.7	20.0	7.0	-9.0	-27.2	1.5	2.5	2.4
0.3050	14.2	16.2	16.9	6.3	-8.9	-17.7	1.4	2.3	2.2
0.4255	12.2	14.0	14.9	5.7	-8.5	-12.5	1.2	2.1	2.0
0.7057	9.7	11.2	12.3	4.5	-7.4	-6.6	1.1	2.0	1.8
0.9950	8.3	9.6	10.9	3.7	-6.6	-3.4	1.2	1.9	1.6
1.7446	6.5	7.4	9.2	2.5	-4.9	0.2	1.4	1.8	1.5
5.6985	4.4	4.8	7.6	0.6	-1.6	1.8	1.8	1.8	1.2
15.0090	3.7	3.9	7.3	0.0	0.0	0.1	2.1	1.9	1.1

Typical Performance Curves

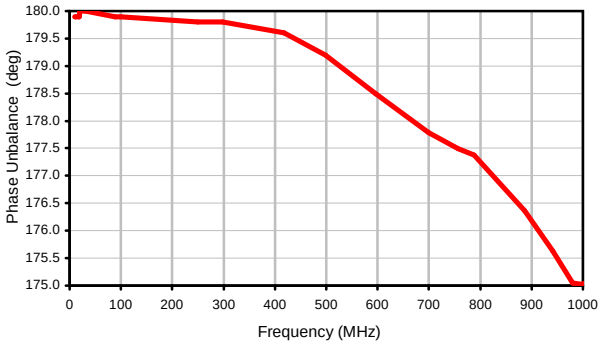
Insertion Loss @ 20 mA



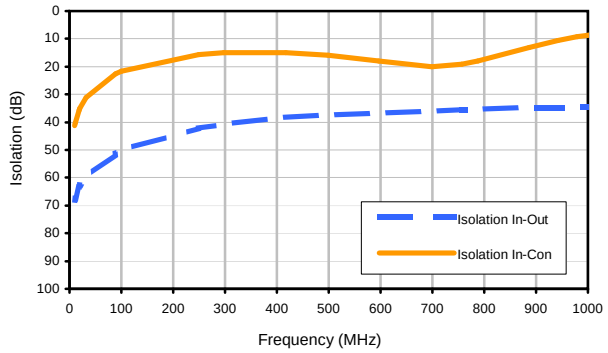
Amplitude Unbalance @ ± 20mA



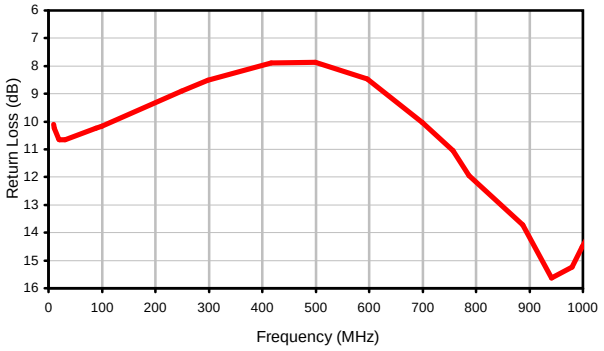
Phase Unbalance @ ± 20mA



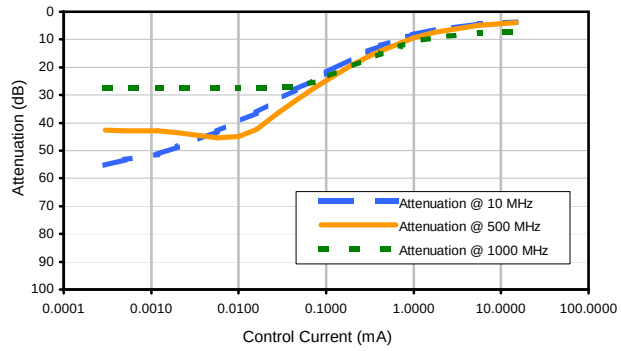
Isolation @ 0 mA



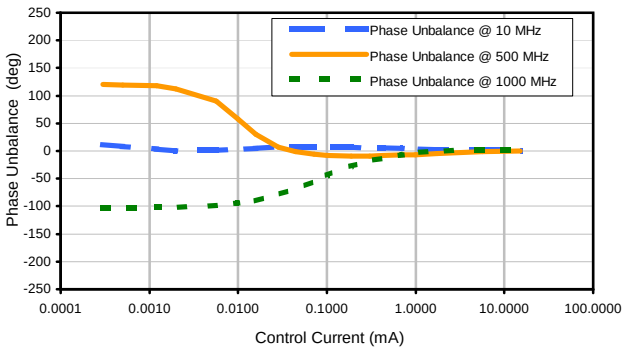
Return Loss Input



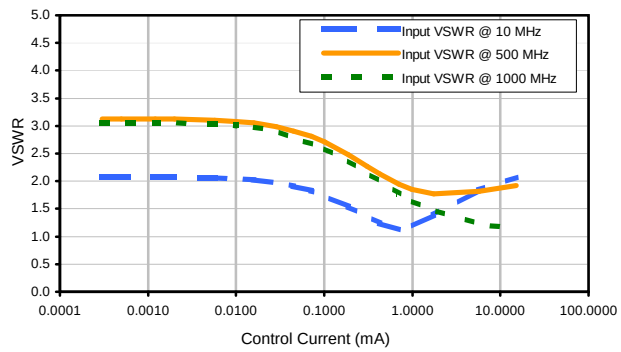
Attenuation



Phase Unbalance ref @ 15 mA



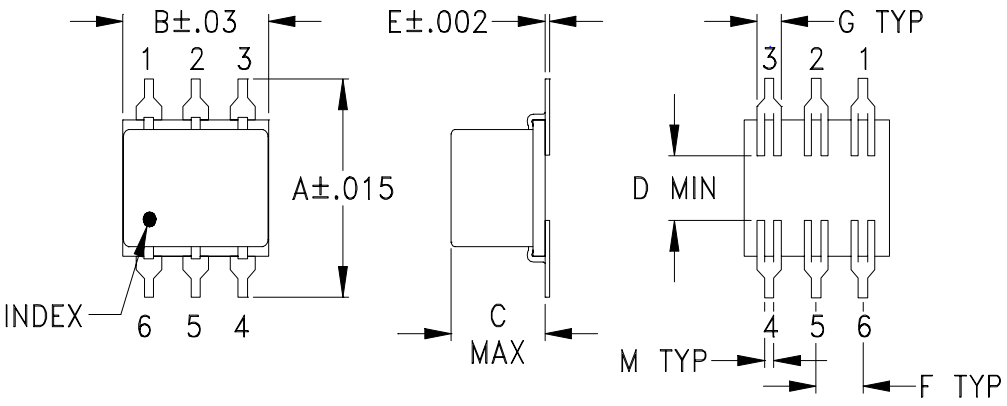
Input VSWR



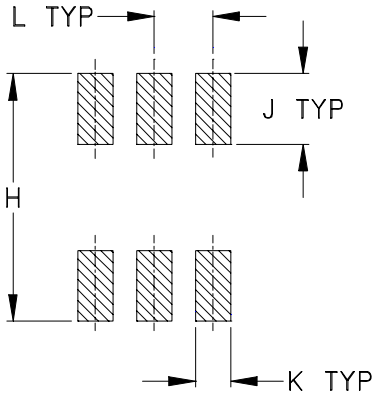
Case Style QQQ

QQQ130 (non-waterproof)
QQQ828 (washable)

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.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. ± .01; 3 Pl. ± .005

Notes:

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

Mini-Circuits®
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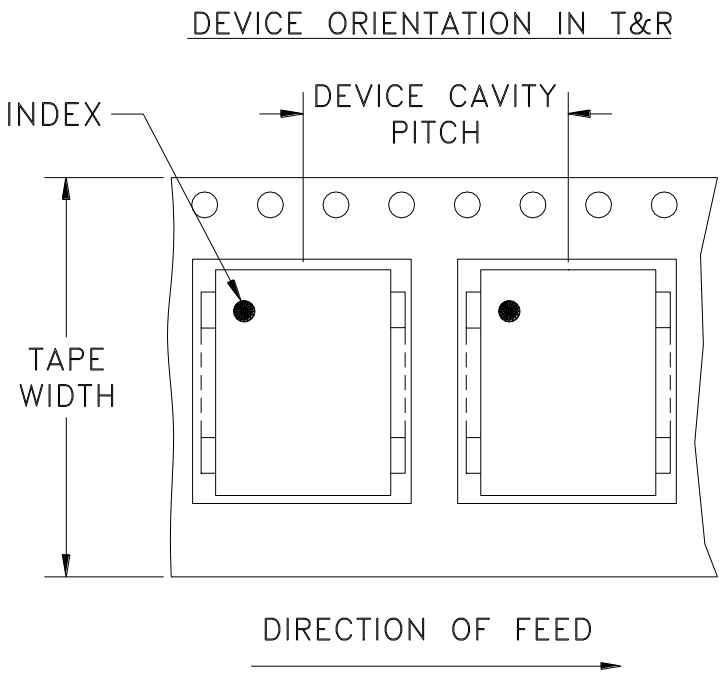
Tape & Reel Packaging TR-F10



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

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.

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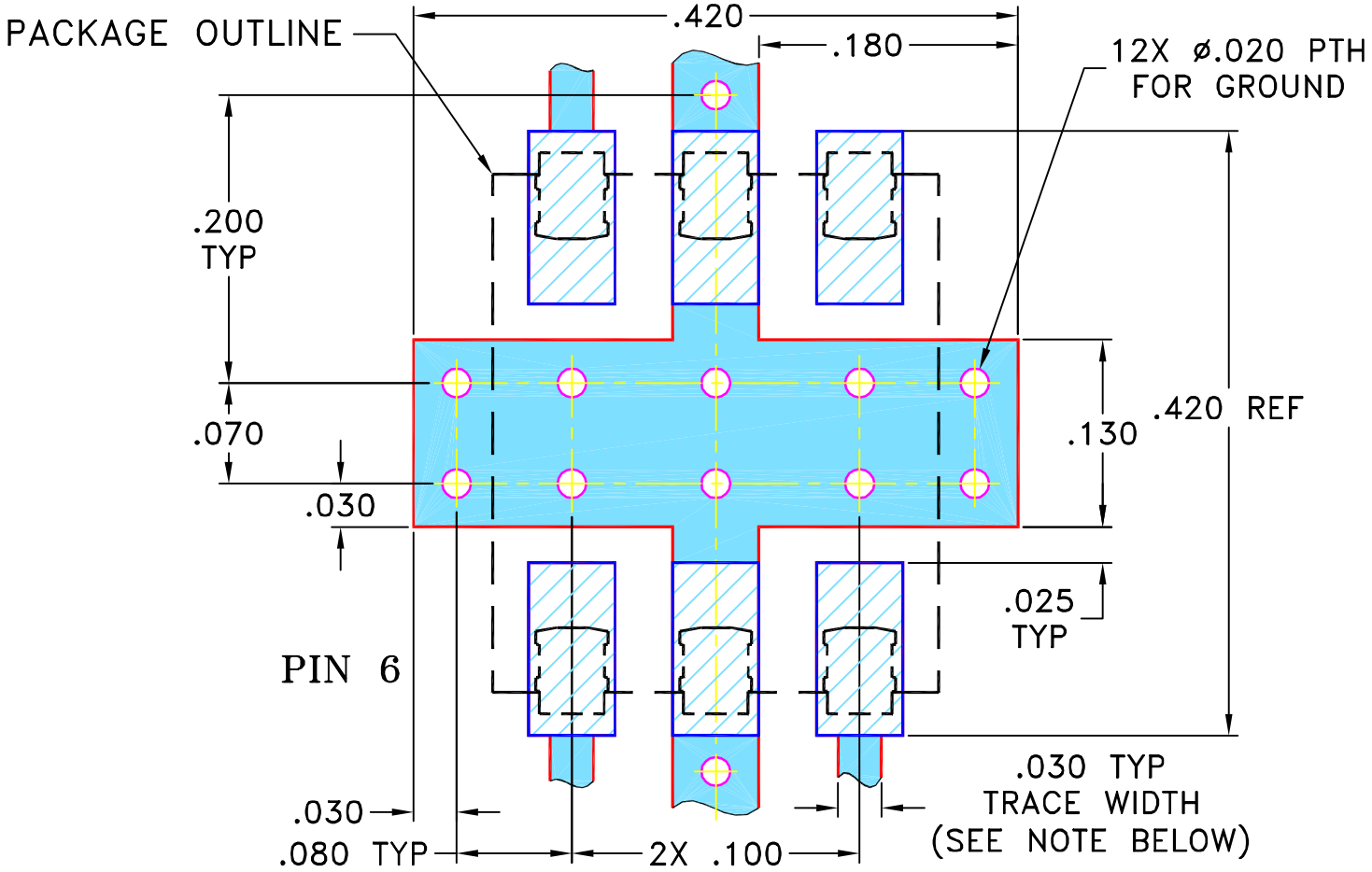
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M79561	NEW RELEASE	07/23/02	MMG	LC
A	M102713	UPDATED NOTES	01/12/06	GF	IL

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



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

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	MMG	06/17/02
TOLERANCES ON:	CHECKED	AV	07/23/02
2 PL DECIMALS ±	APPROVED	LC	07/23/02
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

Mini-Circuits®

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

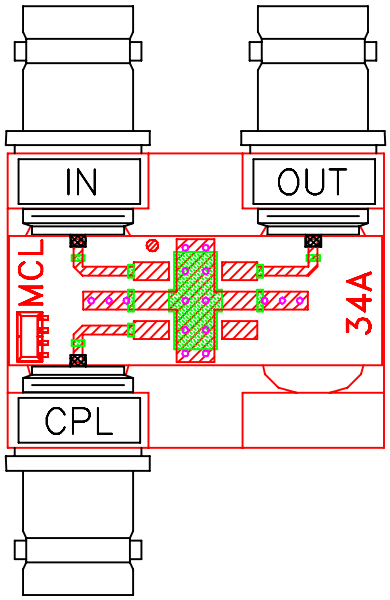
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

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

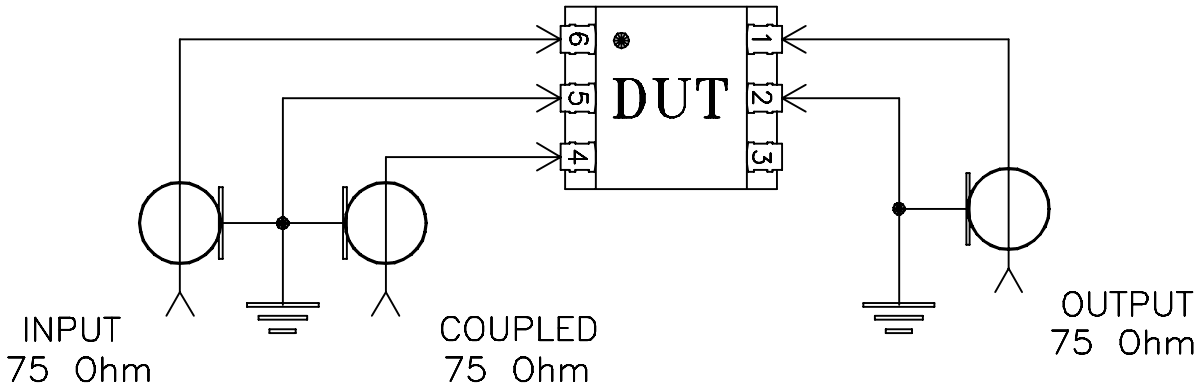
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-043	A

FILE:	SCALE:	SHEET:
98PL043	8:1	1 OF 1

Evaluation Board and Circuit



TB-34



Schematic Diagram

Notes:

1. 75 Ohm BNC Female connectors.
2. PCB Material: Rogers RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.030 inch.

Mini-Circuits®

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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