Surface Mount

Power Splitter/Combiner

QCC-20+

2 Way-90° 50Ω 1200 to 2200 MHz

Generic photo used for illustration purposes only

CASE STYLE: GF981

+RoHS Compliant

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

Maximum Ratings

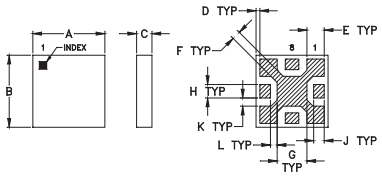
Operating Temperature	-55°C to 100°C
Storage Temperature	-55°C to 100°C
Power Input (as a splitter)	17.5W* max.

* Derate linearly to 3.5W at 100°C ambient.
Permanent damage may occur if any of these limits are exceeded.

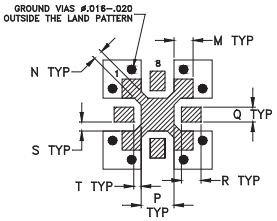
Pin Connections

SUM PORT	2
PORT 1 (0°)	8
PORT 2 (+90°)	4
GROUND	1,3,5,7
50 OHM TERM EXTERNAL	6

Outline Drawing



PCB Land Pattern



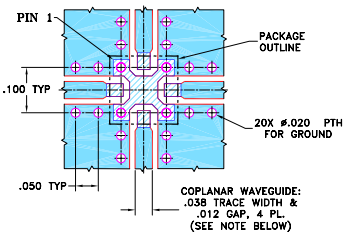
Suggested Layout,
Tolerance to be within ±.002

Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	H	J
.150	.150	.032	.008	.036	.018	.062	.028	.022
3.81	3.81	0.81	0.20	0.91	0.46	1.57	0.71	0.56

K	L	M	N	P	Q	R	S	T	wt
.017	.014	.036	.018	.062	.028	.037	.017	.014	grams
0.43	0.36	0.91	0.46	1.57	0.71	0.94	0.43	0.36	0.05

Demo Board MCL P/N: TB-302+
Suggested PCB Layout (PL-128)



NOTES: 1.COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & GAP 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

Features

- low insertion loss, 0.4 dB typ.
- high isolation, 25 dB typ.
- LTCC construction
- excellent temperature stability
- small size, 0.15" X 0.15"
- aqueous washable
- protected by U.S. Patent 7,030,713

Applications

- WCDMA
- defense
- PCS
- radar
- DECT
- PHS

Electrical Specifications

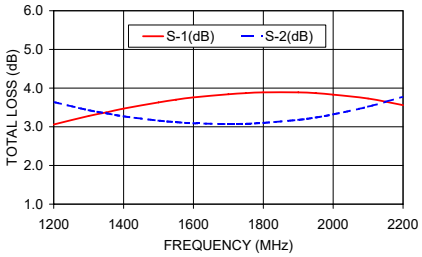
FREQ. RANGE (MHz)	ISOLATION (dB)		INSERTION LOSS (dB) Avg. of Coupled Outputs ABOVE 3 dB		PHASE UNBALANCE (Degrees)		AMPLITUDE UNBALANCE (dB)	
f_L-f_U	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.
1200-2200								
1200-1400	32	24	0.4	0.6	1	3	0.4	1.0
1400-1800	35	20	0.4	0.7	1	3	0.5	0.85
1800-2200	23	16	0.6	0.9	1	5	0.5	0.9

Typical Performance Data

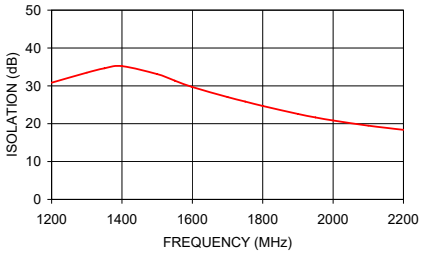
Frequency (MHz)	Total Loss[1] (dB)		Amplitude Unbalance (dB)	Isolation (dB)	Phase Unbalance (deg.)	VSWR S	VSWR 1	VSWR 2
	S-1	S-2						
1200.00	3.06	3.64	0.58	30.83	90.74	1.03	1.16	1.19
1300.00	3.28	3.43	0.16	33.49	91.05	1.01	1.18	1.20
1350.00	3.37	3.35	0.03	34.64	91.20	1.02	1.19	1.20
1400.00	3.47	3.27	0.20	35.21	91.33	1.04	1.19	1.20
1500.00	3.63	3.16	0.47	33.11	91.51	1.08	1.21	1.21
1550.00	3.70	3.12	0.58	31.38	91.57	1.10	1.22	1.21
1600.00	3.76	3.09	0.67	29.70	91.60	1.12	1.24	1.22
1700.00	3.84	3.07	0.77	27.04	91.58	1.15	1.27	1.23
1750.00	3.87	3.08	0.79	25.86	91.55	1.17	1.28	1.24
1800.00	3.89	3.10	0.79	24.69	91.48	1.18	1.29	1.25
1900.00	3.89	3.18	0.71	22.58	91.25	1.23	1.31	1.28
1950.00	3.87	3.24	0.63	21.66	91.11	1.25	1.32	1.30
2000.00	3.83	3.32	0.52	20.85	90.94	1.27	1.33	1.32
2100.00	3.73	3.52	0.21	19.49	90.53	1.31	1.35	1.35
2200.00	3.56	3.78	0.22	18.38	90.13	1.33	1.37	1.40

1. Total Loss = Insertion Loss + 3dB splitter loss.

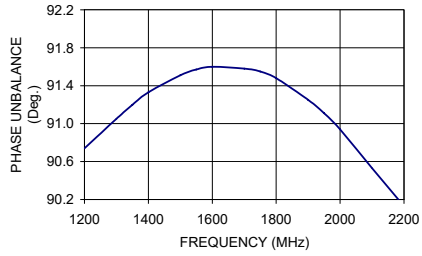
QCC-20+
TOTAL LOSS



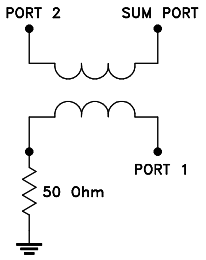
QCC-20+
ISOLATION



QCC-20+
PHASE UNBALANCE



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

2 Way-90° Power Splitter/Combiner QCC-20+

Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS[1] (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. From 90° (deg.)	ISOLATION (dB)	VSWR (:1)		
	S-1	S-2			1-2	S	1	2
400	9.72	0.68	9.05	0.98	26.45	1.06	1.12	1.06
500	8.16	0.94	7.22	0.91	25.43	1.07	1.14	1.07
600	6.99	1.22	5.76	0.77	24.92	1.07	1.15	1.07
700	6.08	1.52	4.57	0.64	24.82	1.08	1.16	1.07
800	5.38	1.81	3.56	0.46	25.02	1.08	1.16	1.07
900	4.80	2.10	2.71	0.33	25.47	1.08	1.15	1.06
1000	4.35	2.37	1.97	0.21	26.03	1.08	1.14	1.05
1050	4.17	2.50	1.66	0.18	26.36	1.08	1.14	1.05
1100	3.99	2.63	1.37	0.13	26.75	1.08	1.13	1.04
1150	3.84	2.74	1.10	0.12	27.06	1.09	1.13	1.04
1200	3.71	2.86	0.85	0.09	27.32	1.09	1.13	1.03
1250	3.59	2.97	0.62	0.10	27.53	1.09	1.12	1.03
1300	3.48	3.06	0.42	0.09	27.68	1.10	1.12	1.03
1350	3.39	3.16	0.23	0.13	27.72	1.11	1.12	1.04
1400	3.31	3.24	0.07	0.15	27.59	1.11	1.12	1.04
1450	3.25	3.32	0.08	0.18	27.32	1.12	1.12	1.05
1500	3.19	3.39	0.20	0.26	27.01	1.13	1.12	1.05
1550	3.15	3.45	0.30	0.31	26.51	1.14	1.12	1.06
1600	3.12	3.51	0.39	0.43	25.94	1.15	1.13	1.07
1700	3.09	3.58	0.49	0.64	24.79	1.17	1.14	1.09
1800	3.10	3.62	0.52	0.92	23.51	1.20	1.16	1.11
1850	3.12	3.63	0.51	1.09	22.91	1.22	1.17	1.13
1900	3.15	3.62	0.47	1.24	22.28	1.23	1.18	1.14
2000	3.26	3.58	0.32	1.67	21.13	1.26	1.20	1.17
2050	3.32	3.55	0.22	1.87	20.57	1.28	1.21	1.19
2100	3.41	3.50	0.10	2.10	20.03	1.30	1.23	1.21
2150	3.50	3.45	0.05	2.37	19.49	1.32	1.24	1.24
2200	3.62	3.39	0.23	2.57	19.00	1.34	1.26	1.26
2250	3.76	3.32	0.44	2.83	18.54	1.36	1.28	1.28
2300	3.91	3.24	0.67	3.12	18.07	1.39	1.30	1.31
2350	4.07	3.15	0.92	3.39	17.62	1.42	1.32	1.34
2400	4.27	3.06	1.21	3.73	17.23	1.45	1.35	1.38
2450	4.50	2.96	1.53	4.03	16.85	1.48	1.38	1.41
2500	4.75	2.86	1.89	4.32	16.48	1.52	1.41	1.45
2550	5.02	2.76	2.26	4.64	16.16	1.56	1.45	1.49
2600	5.34	2.66	2.68	4.99	15.88	1.60	1.50	1.54

[1] Total Loss = Insertion Loss + 3dB Splitter Loss

2 Way-90° Power Splitter/Combiner QCC-20+

Typical Performance Data

TEST CONDITIONS: INPUT POWER = 0dBm @Temperature = -55°C

FREQ. (MHz)	TOTAL LOSS[1] (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. From 90° (deg.)	ISOLATION (dB)	VSWR (:1)		
	S-1	S-2			1-2	S	1	2
400	9.68	0.60	9.08	1.53	26.75	1.05	1.12	1.05
500	8.10	0.85	7.25	1.65	25.67	1.06	1.13	1.06
600	6.90	1.12	5.78	1.72	25.10	1.07	1.14	1.06
700	5.98	1.41	4.58	1.79	24.92	1.08	1.15	1.06
800	5.26	1.69	3.56	1.82	25.13	1.08	1.15	1.06
900	4.67	1.97	2.71	1.88	25.55	1.08	1.14	1.05
1000	4.21	2.23	1.97	1.98	26.05	1.09	1.14	1.05
1050	4.01	2.36	1.65	2.03	26.45	1.08	1.13	1.04
1100	3.83	2.48	1.35	2.12	26.96	1.08	1.13	1.04
1150	3.67	2.60	1.07	2.20	27.37	1.09	1.12	1.03
1200	3.53	2.71	0.83	2.26	27.66	1.09	1.12	1.03
1250	3.41	2.81	0.61	2.37	27.85	1.09	1.12	1.03
1300	3.30	2.90	0.40	2.47	28.07	1.10	1.11	1.03
1350	3.19	3.00	0.20	2.60	28.20	1.10	1.11	1.03
1400	3.11	3.08	0.03	2.74	27.91	1.11	1.12	1.03
1450	3.05	3.16	0.11	2.87	27.44	1.12	1.12	1.04
1500	2.98	3.23	0.25	3.06	27.00	1.13	1.12	1.04
1550	2.94	3.28	0.34	3.22	26.32	1.15	1.12	1.05
1600	2.90	3.34	0.44	3.42	25.62	1.16	1.13	1.06
1700	2.86	3.41	0.55	3.85	24.35	1.18	1.14	1.08
1800	2.86	3.45	0.59	4.33	22.85	1.22	1.16	1.11
1850	2.87	3.45	0.58	4.61	22.20	1.23	1.17	1.13
1900	2.90	3.45	0.55	4.85	21.55	1.25	1.18	1.14
2000	2.99	3.41	0.42	5.47	20.35	1.29	1.19	1.18
2050	3.04	3.37	0.33	5.78	19.90	1.30	1.20	1.19
2100	3.12	3.33	0.22	6.10	19.46	1.31	1.22	1.21
2150	3.21	3.28	0.07	6.47	18.90	1.34	1.23	1.24
2200	3.31	3.22	0.09	6.76	18.45	1.35	1.24	1.26
2250	3.43	3.14	0.29	7.13	18.09	1.37	1.25	1.28
2300	3.57	3.07	0.50	7.54	17.68	1.40	1.28	1.31
2350	3.72	2.97	0.75	7.93	17.27	1.43	1.31	1.34
2400	3.91	2.88	1.03	8.35	16.91	1.45	1.34	1.37
2450	4.12	2.77	1.34	8.70	16.58	1.48	1.37	1.40
2500	4.34	2.68	1.66	9.07	16.29	1.52	1.39	1.44
2550	4.59	2.57	2.03	9.61	15.99	1.56	1.44	1.48
2600	4.89	2.45	2.44	9.97	15.76	1.58	1.51	1.51

[1] Total Loss = Insertion Loss + 3dB Splitter Loss

2 Way-90° Power Splitter/Combiner QCC-20+

Typical Performance Data

TEST CONDITIONS: INPUT POWER = 0dBm @Temperature = +100°C

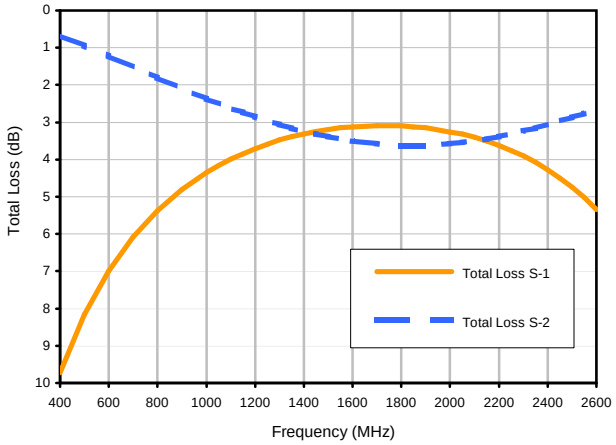
FREQ. (MHz)	TOTAL LOSS[1] (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. From 90° (deg.)	ISOLATION (dB)	VSWR (:1)		
	S-1	S-2			1-2	S	1	2
400	9.72	0.74	8.99	0.96	26.28	1.07	1.13	1.08
500	8.17	1.00	7.17	0.85	25.32	1.07	1.15	1.08
600	7.01	1.29	5.72	0.67	24.94	1.07	1.16	1.08
700	6.12	1.59	4.53	0.49	24.90	1.07	1.17	1.08
800	5.42	1.89	3.53	0.23	25.15	1.07	1.16	1.07
900	4.86	2.18	2.69	0.04	25.59	1.07	1.16	1.06
1000	4.43	2.46	1.96	0.11	26.06	1.08	1.15	1.05
1050	4.24	2.59	1.65	0.19	26.31	1.08	1.15	1.04
1100	4.07	2.72	1.35	0.26	26.55	1.09	1.14	1.04
1150	3.92	2.84	1.08	0.30	26.75	1.09	1.14	1.04
1200	3.80	2.96	0.83	0.36	26.90	1.10	1.13	1.04
1250	3.68	3.07	0.62	0.38	27.02	1.10	1.13	1.04
1300	3.59	3.17	0.42	0.40	27.05	1.11	1.12	1.04
1350	3.49	3.27	0.23	0.39	27.03	1.12	1.12	1.05
1400	3.43	3.36	0.07	0.40	26.94	1.12	1.12	1.05
1450	3.37	3.43	0.07	0.38	26.75	1.13	1.11	1.06
1500	3.31	3.50	0.19	0.33	26.54	1.14	1.11	1.06
1550	3.28	3.56	0.28	0.31	26.20	1.14	1.12	1.07
1600	3.25	3.62	0.37	0.23	25.82	1.15	1.12	1.08
1700	3.23	3.69	0.46	0.06	24.97	1.16	1.13	1.09
1800	3.25	3.73	0.48	0.18	23.91	1.18	1.15	1.11
1850	3.28	3.74	0.46	0.30	23.37	1.20	1.17	1.13
1900	3.31	3.73	0.42	0.43	22.78	1.21	1.18	1.14
2000	3.43	3.69	0.26	0.80	21.61	1.24	1.21	1.17
2050	3.50	3.66	0.15	0.97	21.01	1.26	1.22	1.19
2100	3.59	3.61	0.02	1.16	20.44	1.28	1.23	1.21
2150	3.70	3.56	0.14	1.42	19.88	1.30	1.25	1.23
2200	3.83	3.51	0.32	1.58	19.34	1.33	1.27	1.26
2250	3.97	3.43	0.54	1.84	18.82	1.35	1.29	1.29
2300	4.14	3.36	0.78	2.07	18.31	1.38	1.31	1.32
2350	4.32	3.28	1.05	2.33	17.80	1.42	1.32	1.35
2400	4.53	3.19	1.34	2.63	17.37	1.45	1.35	1.38
2450	4.77	3.09	1.67	2.93	16.96	1.49	1.38	1.42
2500	5.04	3.00	2.04	3.18	16.55	1.53	1.41	1.47
2550	5.33	2.90	2.43	3.48	16.22	1.57	1.45	1.51
2600	5.67	2.80	2.86	3.82	15.92	1.62	1.49	1.56

[1] Total Loss = Insertion Loss + 3dB Splitter Loss

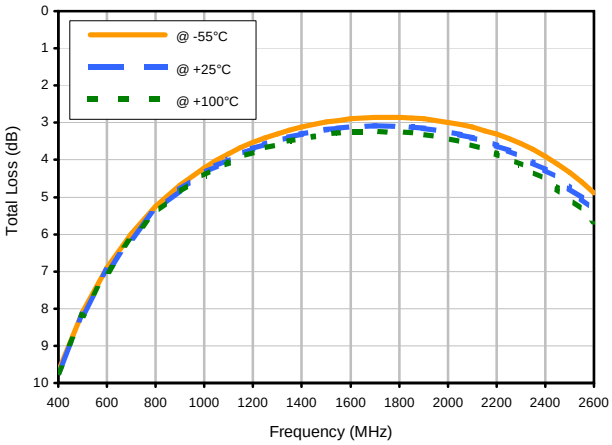
2 Way-90° Power Splitter/Combiner QCC-20+

Typical Performance Curves

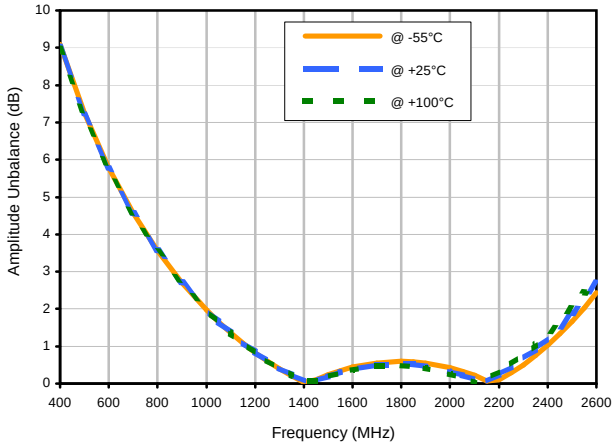
Total Loss



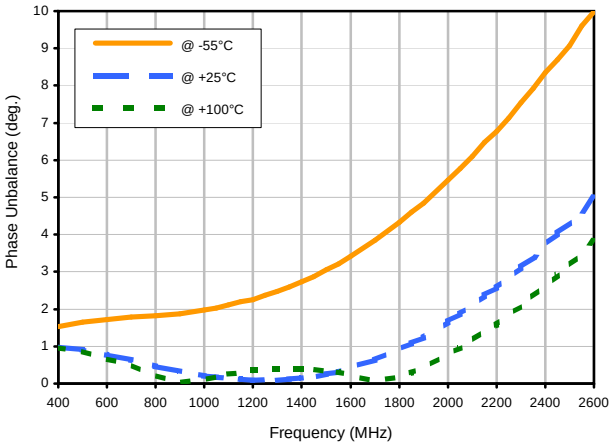
Total Loss S-1 vs. TEMPERATURE



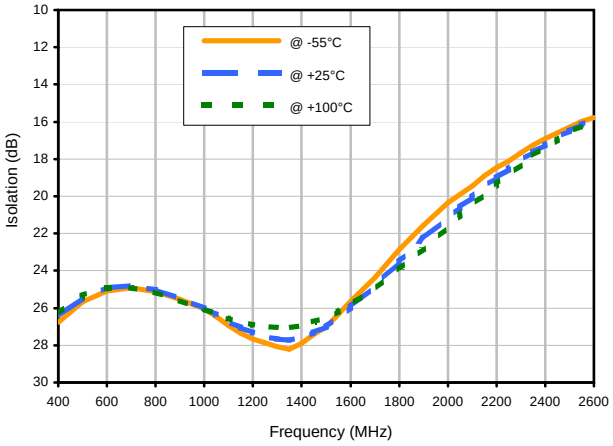
Amplitude Unbalance vs. TEMPERATURE



Phase Unbalance vs. TEMPERATURE



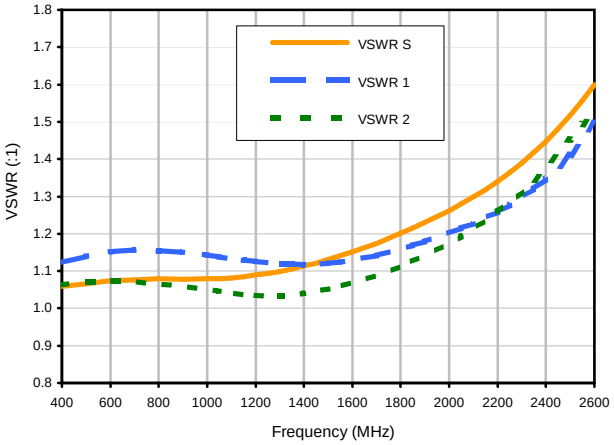
Isolation 1-2 vs. TEMPERATURE



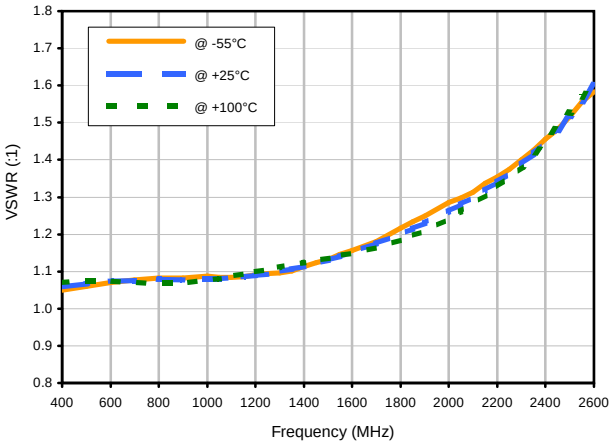
2 Way-90° Power Splitter/Combiner QCC-20+

Typical Performance Curves

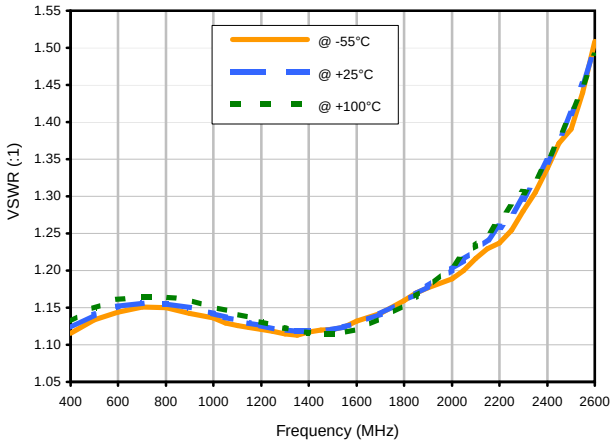
VSWR



VSWR SUM vs. TEMPERATURE



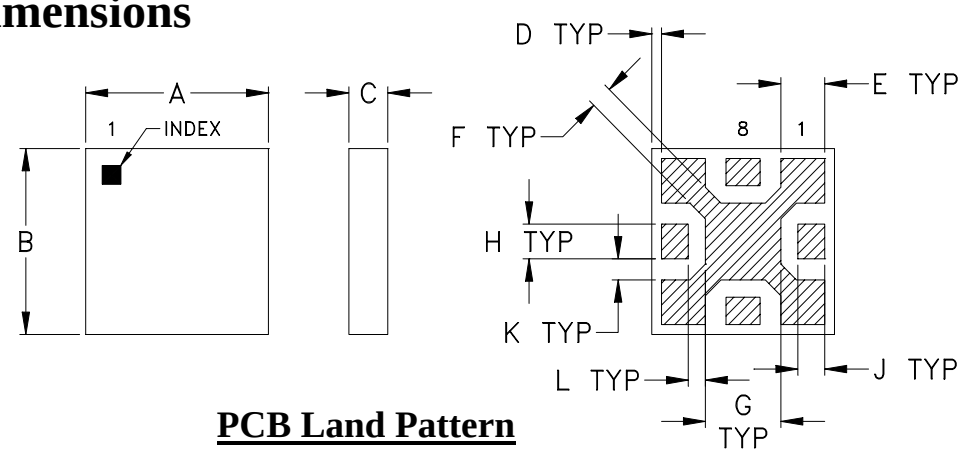
VSWR OUT1 vs. TEMPERATURE



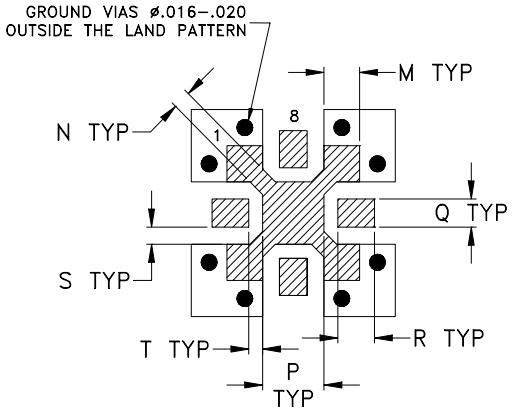
Case Style GF

GF981
GF995

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #	A	B	C	D	E	F	G	H	J	K
GF981	.150 (3.81)	.150 (3.81)	.032 (0.81)	.008 (0.20)	.036 (0.91)	.018 (0.46)	.062 (1.57)	.028 (0.71)	.022 (0.56)	.017 (0.43)
GF995			.065 MAX (1.65)							

CASE #	L	M	N	P	Q	R	S	T	WT. GRAM
GF981	.014 (0.36)	.036 (0.91)	.018 (0.46)	.062 (1.57)	.028 (0.71)	.037 (0.94)	.017 (0.43)	.014 (0.36)	.05
GF995									.06

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

Notes:

1. Open style, Ceramic Base.
2. Termination finish: Palladium Silver.

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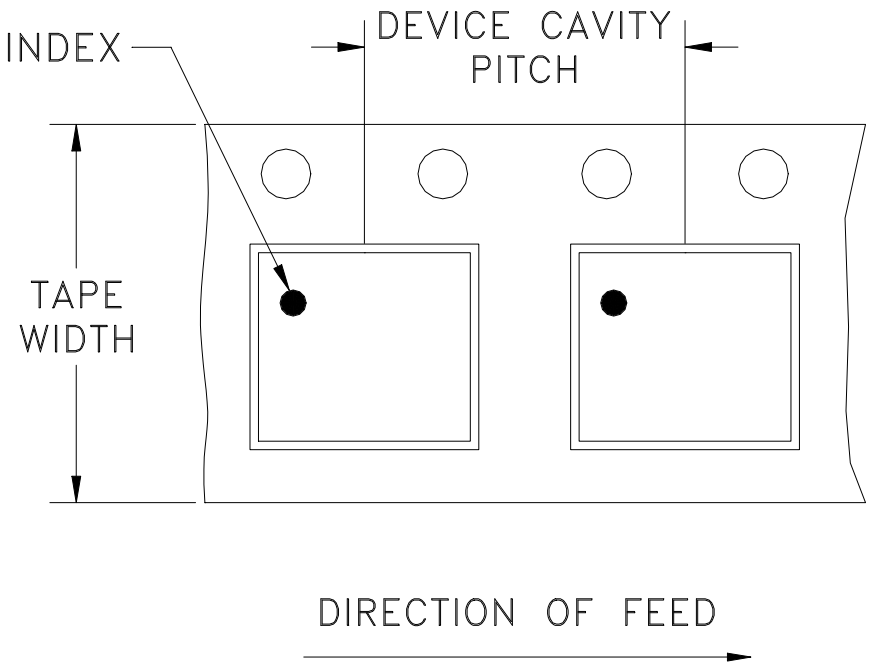
Tape & Reel Packaging TR-F68

DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
12	8	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000
		13	Standard	2000
				3000
				4000

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.

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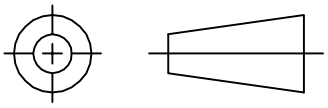
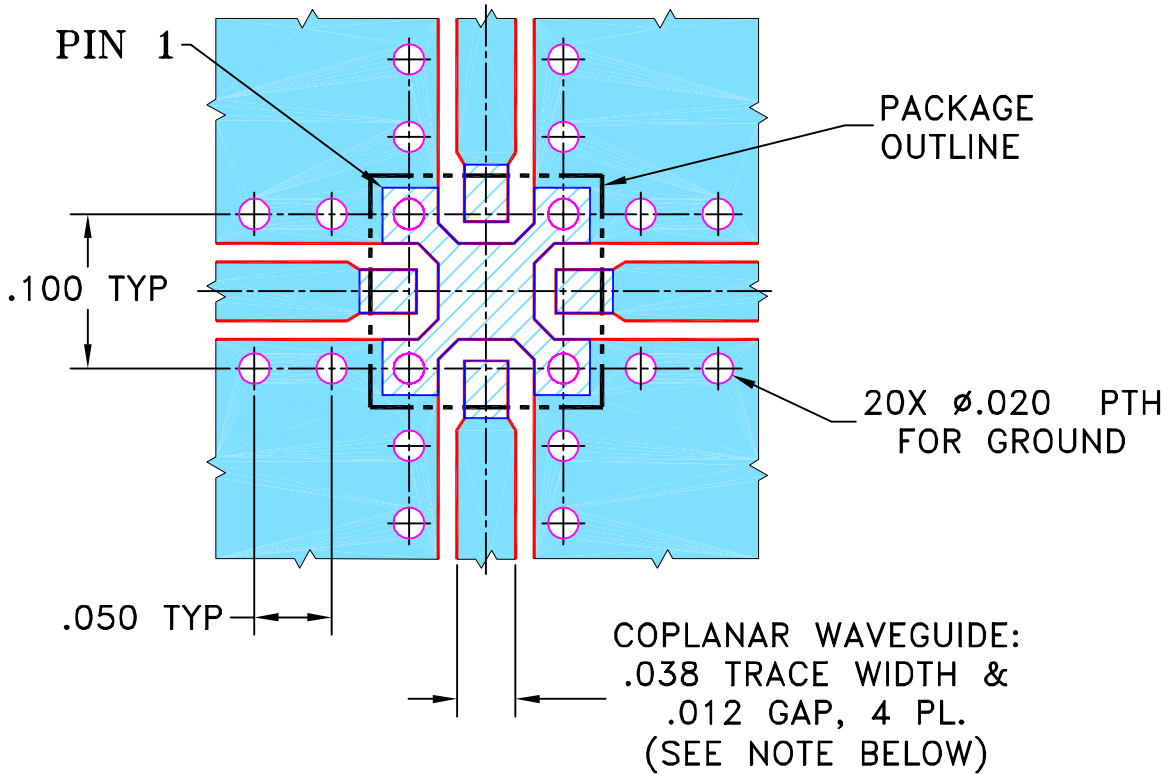
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M86087	NEW RELEASE	04/14/03	GF	ABD
A	M86801	CHG. NAME OF MODEL FROM TCQ TO QCC	05/23/03	MMG	ABD
B	M93045	TB-302 WAS TB-250	07/06/04	MMG	ABD
C	M102713	ADDED"...WITH SMOBC"	01/16/06	GF	IL

SUGGESTED MOUNTING CONFIGURATION
FOR GF981 CASE STYLE, "nz" PIN CONNECTION



NOTES: 1.COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & GAP 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	GF	03/19/03
TOLERANCES ON:	CHECKED	IL	04/12/03
2 PL DECIMALS ±	APPROVED	ABD	04/14/03
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

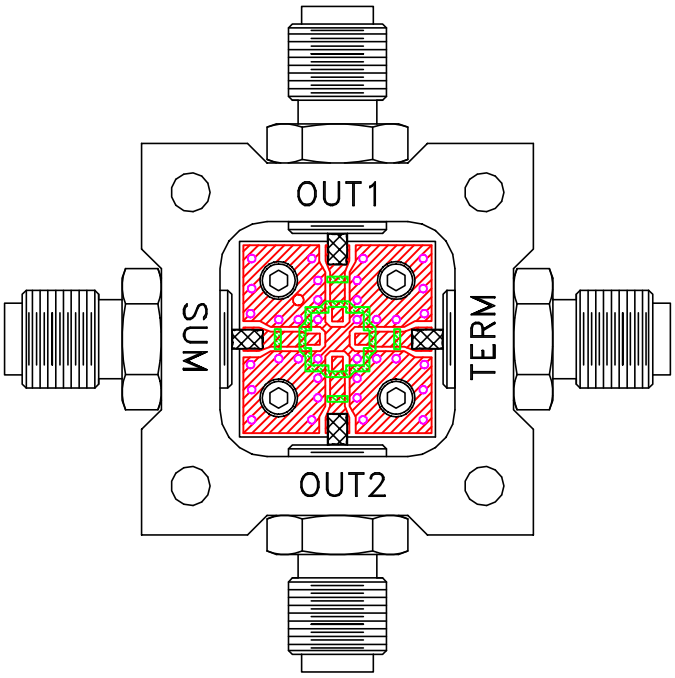
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, nz, GF981, QCC, TB-302

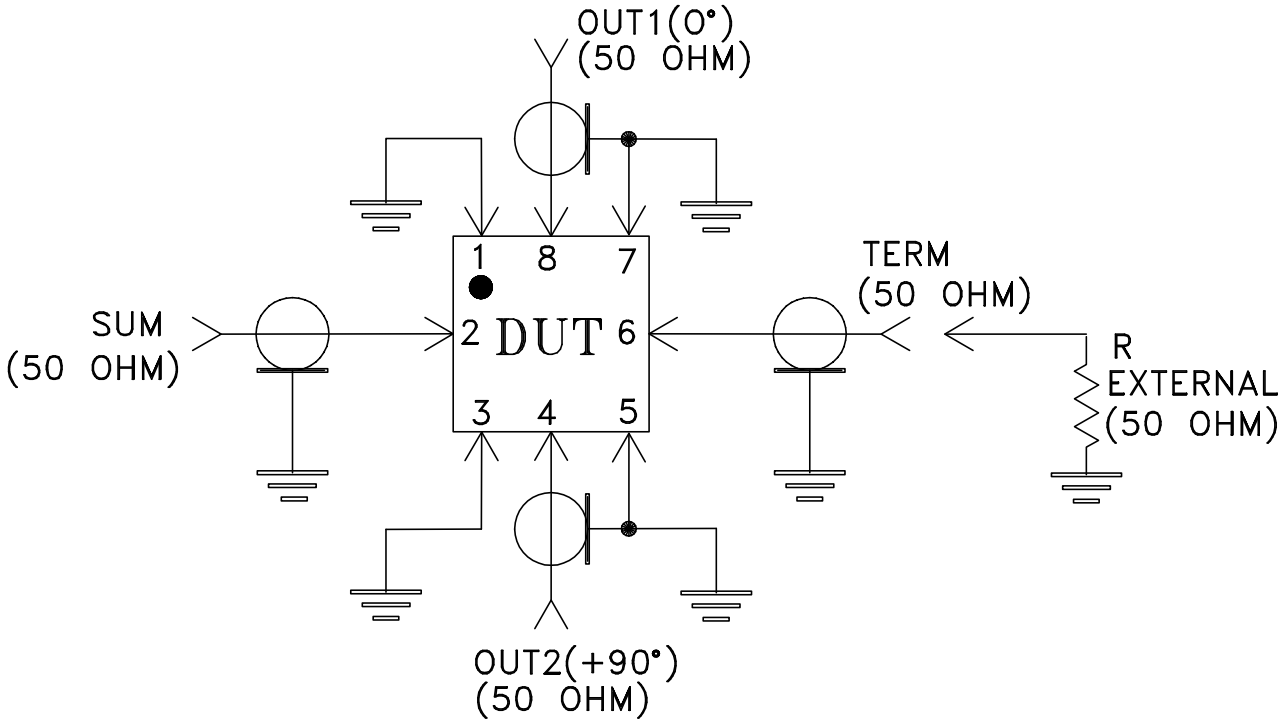
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-128	C

FILE:	SCALE:	SHEET:
98PL128	8:1	1 OF 1

Evaluation Board and Circuit



TB-302+



Schematic Diagram

Notes:

1. SMA Female connectors.
2. PCB Material: Rogers RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.020 inch.

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Environmental Specifications ENV07

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	-55° to 100°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, Para 4.2.5, Test S, 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