ULTRA-SMALL CERAMIC

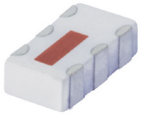
Power Splitter/Combiner

QCN-45+

2 Way-90° 50Ω 2500 to 4500 MHz

FEATURES

- Low insertion loss, 0.4 dB typ.
- Wide band, 2500-4500 MHz
- Wrap-around terminal for excellent solderability
- Ultra small, 0.12"X0.06"X0.035"
- Patent pending



Generic photo used for illustration purposes only

CASE STYLE: FV1206-1

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

APPLICATIONS

- Balanced amplifiers
- Modulators
- MMDS
- Defense communications

ELECTRICAL SPECIFICATIONS AT +25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		2500		4500	MHz
Average Insertion Loss, above 3.0 dB	2500-3500 3500-4500		0.4 0.5	0.7 0.8	dB
Isolation	2500-3500 3500-4500	16 15	22 19		dB
Phase Unbalance	2500-3500 3500-4500		1 3	4 6	Degree
Amplitude Unbalance	2500-3500 3500-4500		0.5 1.0	1.7 2.1	dB
VSWR	2500-3500 3500-4500		1.2 1.2		(:1)

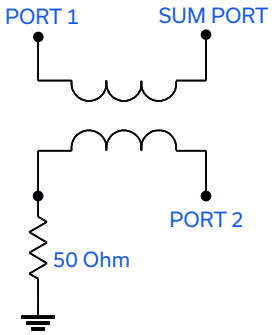
1. For applications requiring DC voltage to be applied to the RF ports, add suffix letter "D" to part no.
   DC resistance to ground is 100 Mohms min.

ABSOLUTE MAXIMUM RATINGS

Parameter	Ratings
Operating Temperature	-55°C to +100°C
Storage Temperature	-55°C to +100°C
Power Input (as a splitter)	15 W* max.

* Derate linearly to 7 W at +100°C ambient.
Permanent damage may occur if any of these limits are exceeded.

ELECTRICAL SCHEMATIC (NOTE 1)



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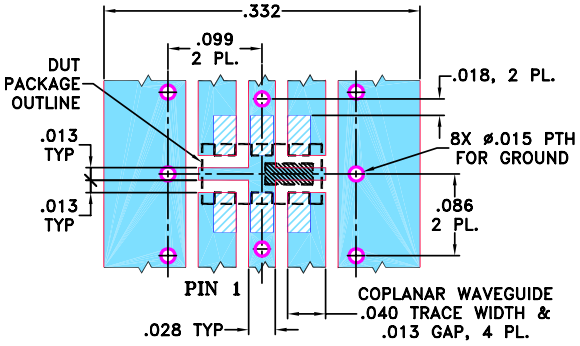
PIN CONNECTIONS

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

PRODUCT MARKING: SA

DEMO BOARD MCL P/N: TB-QCN-45+
SUGGESTED PCB LAYOUT (PL-250)

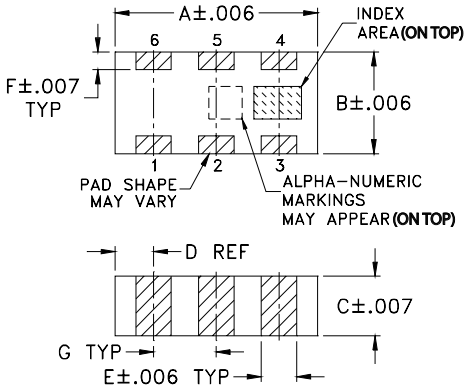


NOTES: 1.TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2.BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

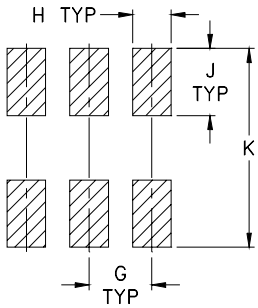
DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

OUTLINE DRAWING



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

OUTLINE DIMENSIONS (Inches / mm)

A	B	C	D	E	F
.126	.063	.035	.024	.022	.011
3.20	1.60	0.89	0.61	0.56	0.28

G	H	J	K		wt
.039	.024	.042	.123		grams
0.99	0.61	1.07	3.12		.020

TAPE & REEL INFORMATION: F75

Power Splitter/Combiner

QCN-45+

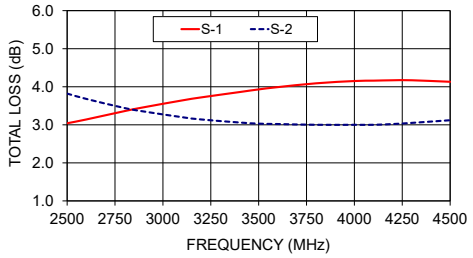
2 Way-90° 50Ω 2500 to 4500 MHz

TYPICAL PERFORMANCE DATA

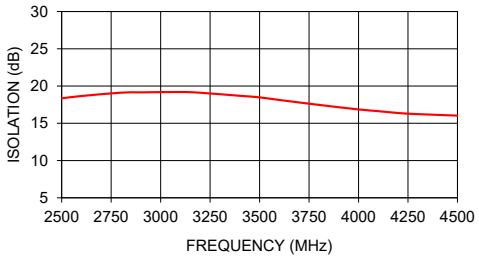
Frequency (MHz)	Total Loss[2] (dB)		Amplitude Unbalance (dB)	Isolation (dB)	Phase Unbalance (deg.)	VSWR (:1)		
	S-1	S-2				S	1	2
2500	3.04	3.82	0.78	18.35	88.41	1.20	1.21	1.26
2600	3.14	3.68	0.54	18.66	88.69	1.19	1.18	1.24
2800	3.36	3.44	0.09	19.11	89.21	1.18	1.13	1.20
2900	3.46	3.35	0.11	19.15	89.40	1.19	1.11	1.18
3100	3.64	3.20	0.44	19.20	89.79	1.22	1.08	1.17
3200	3.72	3.14	0.57	19.10	89.97	1.22	1.08	1.16
3400	3.86	3.06	0.80	18.69	90.28	1.25	1.08	1.12
3500	3.93	3.03	0.90	18.48	90.38	1.27	1.09	1.11
3600	3.99	3.02	0.97	18.13	90.47	1.29	1.10	1.12
3800	4.09	3.00	1.09	17.47	90.65	1.32	1.11	1.12
4000	4.15	3.00	1.15	16.86	90.87	1.33	1.12	1.12
4100	4.16	3.00	1.16	16.63	90.98	1.34	1.12	1.13
4200	4.17	3.02	1.15	16.38	91.08	1.35	1.12	1.13
4300	4.17	3.05	1.13	16.23	91.21	1.35	1.13	1.14
4500	4.13	3.12	1.01	16.03	91.48	1.36	1.13	1.13

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

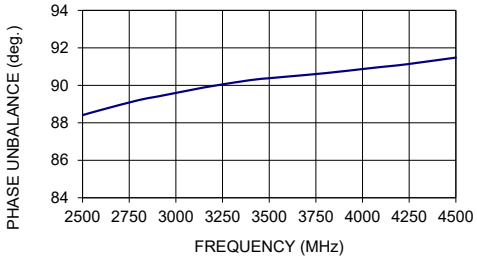
TOTAL LOSS[2]



ISOLATION



PHASE UNBALANCE



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

2 Way-90° Power Splitter/Combiner QCN-45+

Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS[1] (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. (deg.)	ISOLATION (dB)	VSWR (:1)		
	S-1	S-2			1-2	S	1	2
2000	2.47	4.78	2.30	86.91	16.76	1.33	1.37	1.39
2100	2.59	4.55	1.97	87.26	17.03	1.30	1.34	1.36
2200	2.70	4.34	1.65	87.62	17.30	1.27	1.31	1.33
2300	2.81	4.15	1.34	87.88	17.64	1.24	1.27	1.30
2400	2.93	3.98	1.05	88.14	17.98	1.22	1.24	1.28
2450	2.98	3.90	0.92	88.29	18.15	1.21	1.22	1.27
2500	3.04	3.82	0.78	88.41	18.35	1.20	1.21	1.26
2550	3.09	3.75	0.66	88.53	18.50	1.19	1.19	1.25
2600	3.14	3.68	0.54	88.69	18.66	1.19	1.18	1.24
2650	3.19	3.61	0.42	88.83	18.80	1.18	1.17	1.23
2700	3.25	3.55	0.30	88.96	18.90	1.18	1.15	1.22
2750	3.30	3.49	0.19	89.10	19.01	1.18	1.14	1.21
2800	3.36	3.44	0.09	89.21	19.11	1.18	1.13	1.20
2900	3.46	3.35	0.11	89.40	19.15	1.19	1.11	1.18
3000	3.55	3.27	0.28	89.60	19.20	1.20	1.09	1.18
3100	3.64	3.20	0.44	89.79	19.20	1.22	1.08	1.17
3200	3.72	3.14	0.57	89.97	19.10	1.22	1.08	1.16
3250	3.75	3.12	0.63	90.06	19.01	1.23	1.07	1.14
3300	3.79	3.09	0.70	90.14	18.93	1.24	1.08	1.13
3350	3.83	3.08	0.75	90.22	18.85	1.24	1.08	1.13
3400	3.86	3.06	0.80	90.28	18.69	1.25	1.08	1.12
3450	3.90	3.05	0.85	90.33	18.60	1.26	1.09	1.12
3500	3.93	3.03	0.90	90.38	18.48	1.27	1.09	1.11
3550	3.96	3.02	0.94	90.43	18.29	1.28	1.09	1.11
3600	3.99	3.02	0.97	90.47	18.13	1.29	1.10	1.12
3650	4.02	3.01	1.01	90.50	17.99	1.30	1.10	1.12
3700	4.04	3.01	1.04	90.55	17.78	1.31	1.10	1.12
3750	4.06	3.00	1.06	90.60	17.63	1.32	1.10	1.12
3800	4.09	3.00	1.09	90.65	17.47	1.32	1.11	1.12
3900	4.12	3.00	1.13	90.75	17.11	1.33	1.11	1.12
4000	4.15	3.00	1.15	90.87	16.86	1.33	1.12	1.12
4100	4.16	3.00	1.16	90.98	16.63	1.34	1.12	1.13
4200	4.17	3.02	1.15	91.08	16.38	1.35	1.12	1.13
4250	4.17	3.03	1.14	91.14	16.31	1.35	1.13	1.14
4300	4.17	3.05	1.13	91.21	16.23	1.35	1.13	1.14
4450	4.14	3.10	1.04	91.41	16.04	1.36	1.13	1.14
4500	4.13	3.12	1.01	91.48	16.03	1.36	1.13	1.13
4550	4.11	3.14	0.97	91.54	16.01	1.36	1.13	1.13
4600	4.10	3.17	0.92	91.64	16.02	1.35	1.12	1.13
4700	4.06	3.22	0.83	91.73	16.13	1.35	1.13	1.13
4800	3.99	3.29	0.71	91.82	16.22	1.33	1.13	1.12
4900	3.91	3.35	0.56	91.88	16.30	1.31	1.13	1.10
5000	3.82	3.44	0.38	92.09	16.43	1.30	1.12	1.08

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

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2 Way-90° Power Splitter/Combiner QCN-45+

Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS[1] (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. (deg.)	ISOLATION (dB)	VSWR (:1)		
	S-1	S-2			1-2	S	1	2
2000	2.35	4.69	2.34	86.75	16.63	1.34	1.37	1.39
2100	2.46	4.47	2.00	87.05	16.91	1.31	1.35	1.36
2200	2.57	4.25	1.68	87.37	17.24	1.28	1.33	1.33
2300	2.68	4.05	1.38	87.59	17.64	1.25	1.29	1.31
2400	2.79	3.88	1.09	87.85	17.95	1.23	1.25	1.29
2450	2.84	3.80	0.96	88.00	18.09	1.22	1.23	1.28
2500	2.89	3.72	0.83	88.12	18.27	1.21	1.22	1.27
2550	2.94	3.64	0.70	88.24	18.42	1.20	1.20	1.27
2600	2.99	3.57	0.58	88.41	18.61	1.19	1.18	1.25
2650	3.04	3.50	0.46	88.55	18.77	1.18	1.17	1.24
2700	3.10	3.43	0.34	88.67	18.90	1.17	1.16	1.23
2750	3.14	3.37	0.23	88.82	19.03	1.17	1.14	1.22
2800	3.20	3.31	0.11	88.91	19.14	1.17	1.14	1.20
2900	3.30	3.22	0.09	89.06	19.20	1.18	1.12	1.19
3000	3.39	3.14	0.26	89.22	19.19	1.20	1.10	1.19
3100	3.48	3.06	0.42	89.38	19.08	1.22	1.09	1.18
3200	3.56	3.00	0.55	89.56	19.03	1.23	1.08	1.16
3250	3.59	2.98	0.62	89.64	18.97	1.23	1.07	1.15
3300	3.63	2.95	0.68	89.71	18.88	1.25	1.07	1.14
3350	3.67	2.94	0.73	89.80	18.76	1.26	1.07	1.14
3400	3.70	2.91	0.79	89.86	18.55	1.27	1.07	1.13
3450	3.74	2.90	0.84	89.90	18.45	1.28	1.07	1.13
3500	3.77	2.88	0.89	89.95	18.34	1.29	1.08	1.12
3550	3.80	2.87	0.93	89.98	18.19	1.29	1.08	1.12
3600	3.83	2.86	0.97	90.02	18.06	1.30	1.09	1.13
3650	3.86	2.85	1.00	90.04	17.94	1.31	1.09	1.13
3700	3.88	2.84	1.04	90.08	17.73	1.32	1.09	1.13
3750	3.90	2.84	1.06	90.13	17.55	1.33	1.10	1.13
3800	3.92	2.83	1.09	90.18	17.36	1.33	1.10	1.13
3900	3.96	2.83	1.13	90.28	16.95	1.35	1.10	1.13
4000	3.99	2.82	1.17	90.37	16.70	1.35	1.12	1.13
4100	4.00	2.82	1.18	90.45	16.49	1.35	1.12	1.14
4200	4.02	2.83	1.18	90.54	16.20	1.36	1.13	1.15
4250	4.02	2.84	1.18	90.58	16.11	1.37	1.13	1.15
4300	4.02	2.85	1.17	90.60	16.00	1.37	1.13	1.15
4450	3.99	2.89	1.10	90.74	15.70	1.38	1.14	1.15
4500	3.98	2.91	1.07	90.78	15.68	1.38	1.14	1.15
4550	3.96	2.93	1.03	90.84	15.65	1.38	1.14	1.15
4600	3.95	2.96	0.99	90.90	15.67	1.38	1.14	1.14
4700	3.91	3.00	0.91	90.96	15.79	1.37	1.14	1.14
4800	3.84	3.05	0.78	91.00	15.89	1.35	1.14	1.13
4900	3.76	3.11	0.64	91.04	15.94	1.33	1.14	1.11
5000	3.66	3.20	0.47	91.23	16.05	1.32	1.14	1.09

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

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2 Way-90° Power Splitter/Combiner QCN-45+

Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS[1] (dB) S-1	TOTAL LOSS[1] (dB) S-2	AMP. UNBAL. (dB)	PHASE UNBAL. (deg.)	ISOLATION (dB) 1-2	VSWR (:1) S	VSWR (:1) 1	VSWR (:1) 2
2000	2.57	4.82	2.25	86.89	16.73	1.31	1.35	1.38
2100	2.69	4.60	1.91	87.23	16.96	1.28	1.32	1.35
2200	2.81	4.39	1.59	87.59	17.18	1.26	1.29	1.32
2300	2.93	4.21	1.28	87.85	17.46	1.24	1.26	1.29
2400	3.04	4.04	1.00	88.09	17.77	1.22	1.24	1.26
2450	3.10	3.97	0.86	88.24	17.92	1.21	1.22	1.26
2500	3.16	3.89	0.73	88.35	18.11	1.20	1.21	1.25
2550	3.21	3.83	0.61	88.46	18.25	1.19	1.19	1.25
2600	3.26	3.76	0.50	88.63	18.39	1.19	1.18	1.24
2650	3.32	3.70	0.38	88.76	18.50	1.18	1.17	1.23
2700	3.38	3.64	0.26	88.89	18.59	1.18	1.15	1.22
2750	3.42	3.59	0.16	89.03	18.70	1.18	1.14	1.21
2800	3.48	3.54	0.06	89.15	18.79	1.19	1.13	1.20
2900	3.58	3.45	0.13	89.35	18.86	1.20	1.11	1.19
3000	3.67	3.38	0.30	89.60	18.97	1.21	1.09	1.18
3100	3.76	3.31	0.45	89.81	19.04	1.22	1.08	1.17
3200	3.84	3.26	0.59	89.99	19.00	1.23	1.08	1.16
3250	3.88	3.23	0.64	90.07	18.94	1.23	1.08	1.15
3300	3.92	3.21	0.70	90.16	18.89	1.24	1.08	1.14
3350	3.95	3.20	0.75	90.24	18.83	1.25	1.08	1.13
3400	3.98	3.18	0.80	90.31	18.72	1.25	1.08	1.13
3450	4.02	3.17	0.85	90.36	18.67	1.26	1.08	1.12
3500	4.05	3.16	0.89	90.43	18.57	1.27	1.09	1.12
3550	4.08	3.15	0.93	90.49	18.42	1.28	1.09	1.11
3600	4.10	3.14	0.96	90.55	18.28	1.28	1.09	1.11
3650	4.13	3.14	0.99	90.61	18.16	1.29	1.09	1.11
3700	4.16	3.14	1.02	90.67	17.97	1.30	1.09	1.11
3750	4.18	3.14	1.04	90.74	17.82	1.31	1.09	1.11
3800	4.20	3.14	1.07	90.80	17.65	1.32	1.10	1.11
3900	4.24	3.14	1.10	90.92	17.29	1.33	1.10	1.12
4000	4.26	3.14	1.12	91.05	17.03	1.33	1.11	1.12
4100	4.28	3.16	1.13	91.17	16.79	1.34	1.12	1.12
4200	4.28	3.18	1.11	91.32	16.58	1.34	1.12	1.12
4250	4.29	3.19	1.09	91.40	16.54	1.34	1.12	1.13
4300	4.28	3.21	1.08	91.47	16.50	1.34	1.12	1.13
4450	4.25	3.26	0.98	91.69	16.42	1.34	1.12	1.13
4500	4.24	3.29	0.95	91.78	16.43	1.33	1.12	1.12
4550	4.22	3.31	0.91	91.87	16.41	1.33	1.12	1.12
4600	4.20	3.35	0.86	91.97	16.41	1.33	1.12	1.12
4700	4.16	3.40	0.76	92.08	16.53	1.32	1.12	1.11
4800	4.10	3.47	0.63	92.21	16.66	1.30	1.12	1.10
4900	4.02	3.55	0.47	92.33	16.75	1.28	1.12	1.08
5000	3.94	3.65	0.29	92.55	16.88	1.27	1.11	1.07

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

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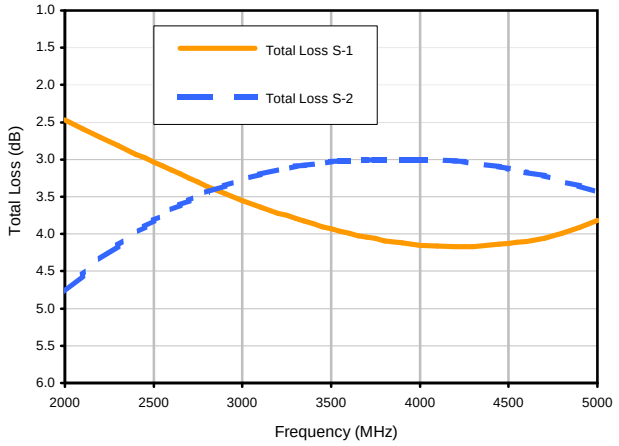
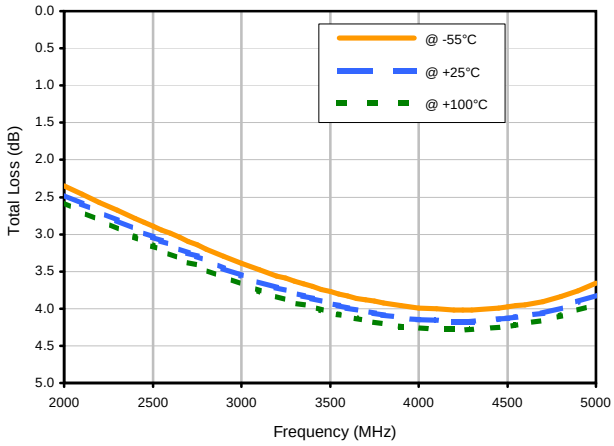
2 Way-90° Power Splitter/Combiner QCN-45+

Typical Performance Curves

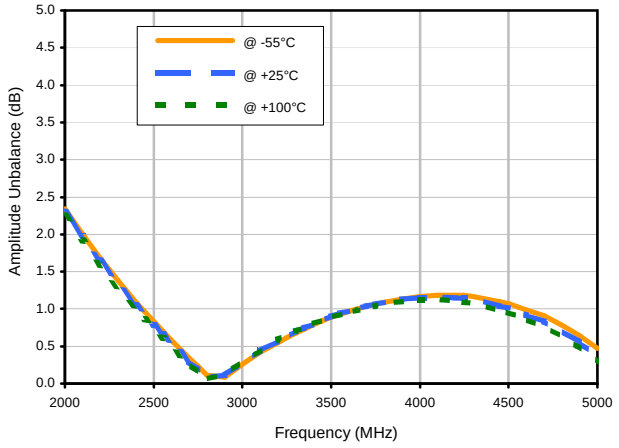
Total Loss



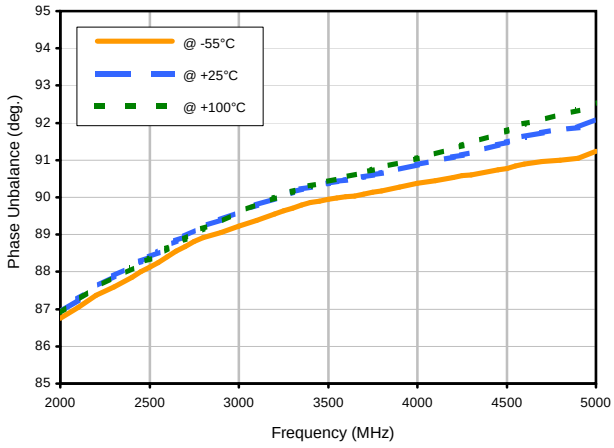
Total Loss S-1 vs. TEMPERATURE



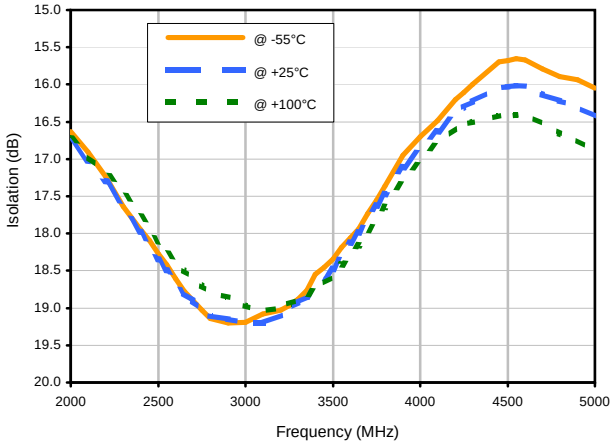
Amplitude Unbalance vs. TEMPERATURE



Phase Unbalance vs. TEMPERATURE



Isolation 1-2 vs. TEMPERATURE



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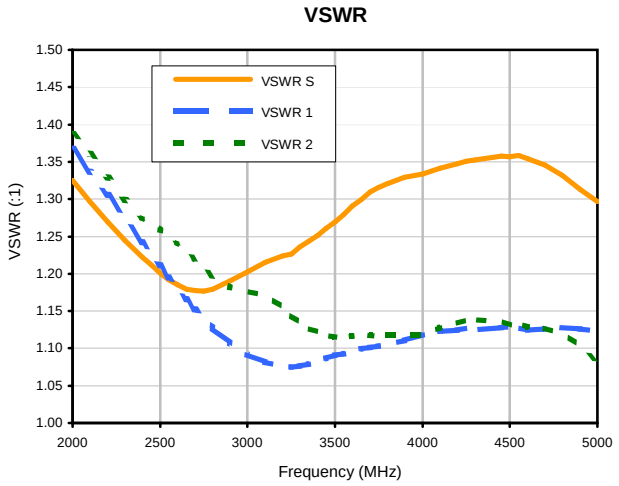
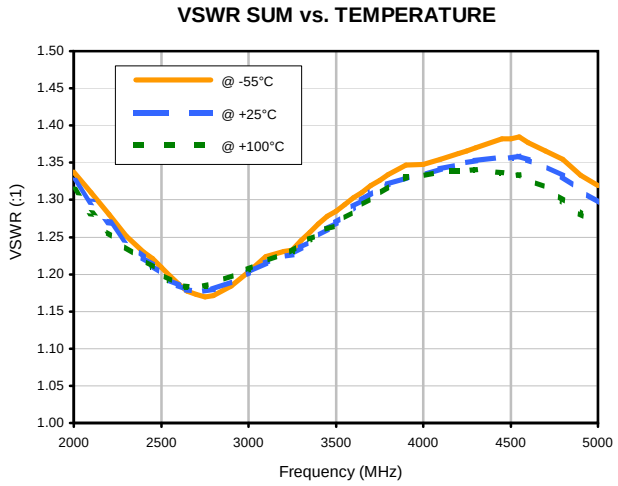
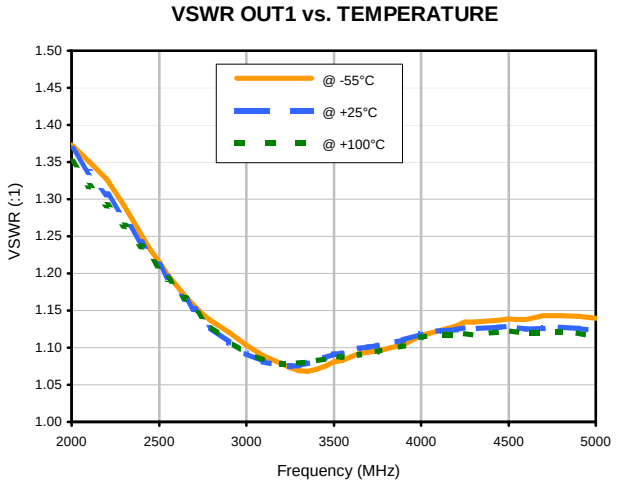
Typical Performance Curves







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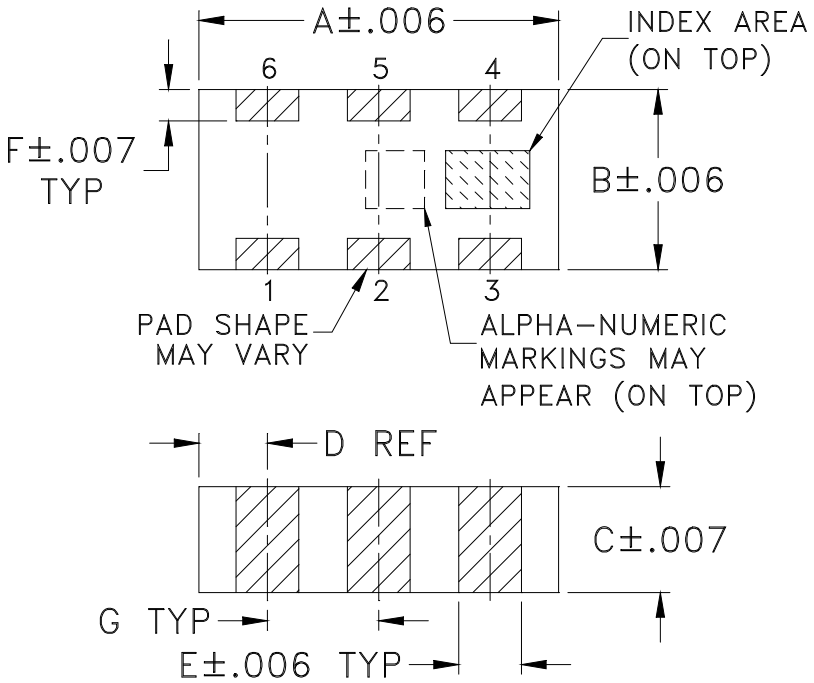
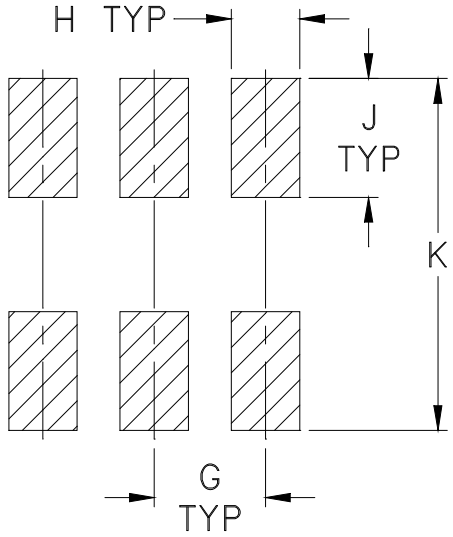
Case Style FV

FV1206-1

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	N	P	WT. GRAM
FV1206-1	.126 (3.20)	.063 (1.60)	.035 (0.89)	.024 (0.61)	.022 (0.56)	.011 (0.28)	.039 (0.99)	.024 (0.61)	.042 (1.07)	.123 (3.12)	-- --	-- --	-- --	-- --	.020

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

Notes:

1. Open style, ceramic base.
2. Termination finish: **as shown below or indicated on Data Sheet.**
   For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
   For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

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Tape & Reel Packaging TR-F75

DEVICE ORIENTATION IN T&R

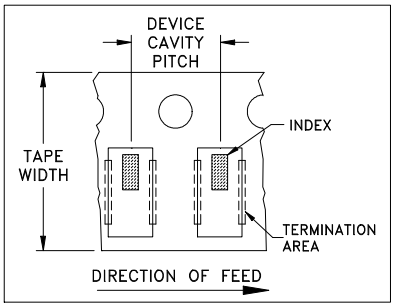

ILLUSTRATION 1

Applicable Case Styles
FV1206-1 FV1206-3

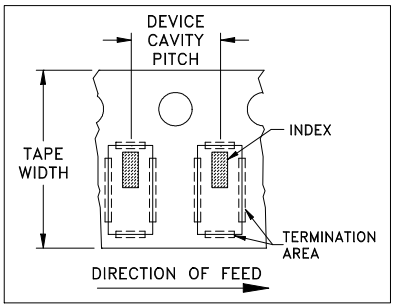

ILLUSTRATION 2

Applicable Case Styles
FV1206-4 FV1206-5 FV1206-6 FV1206-7 FV1206-9

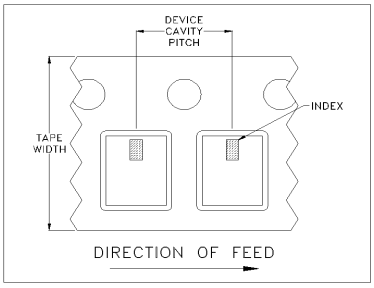

ILLUSTRATION 3

Applicable Case Styles
FV1206-11 FV1206-12 GE0805C-18 NL1008C-6 NL1008C-7 NL1008C-9 NL1008C-10 NL1008C-12

Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
8	4	7	Small quantity standards (see note)	20
				50
				100
				200
				500
				1000
			Standard	3000

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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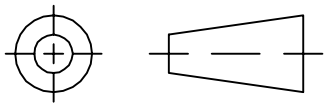
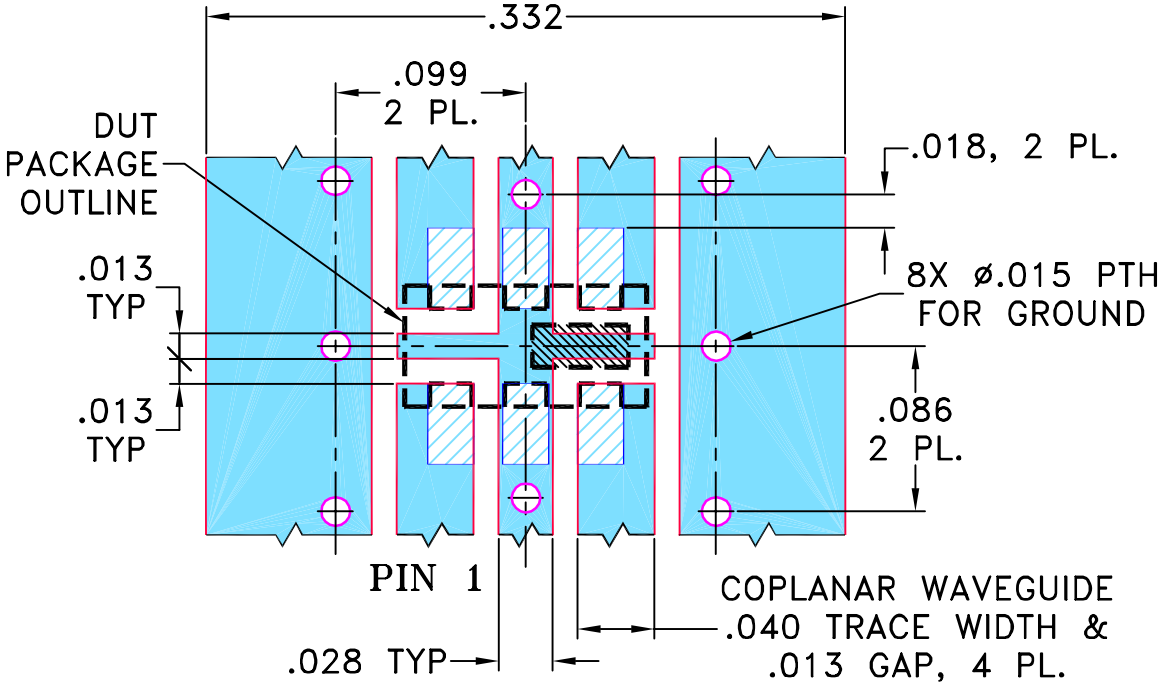
THIRD ANGLE PROJECTION



REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M107907	NEW RELEASE	11/21/06	AV	ABD

SUGGESTED MOUNTING CONFIGURATION FOR FV1206-1 CASE STYLE, "pb" PIN CONNECTIONS



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	11/20/06
TOLERANCES ON:	CHECKED	IL	11/21/06
2 PL DECIMALS ±	APPROVED	ABD	11/21/06
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

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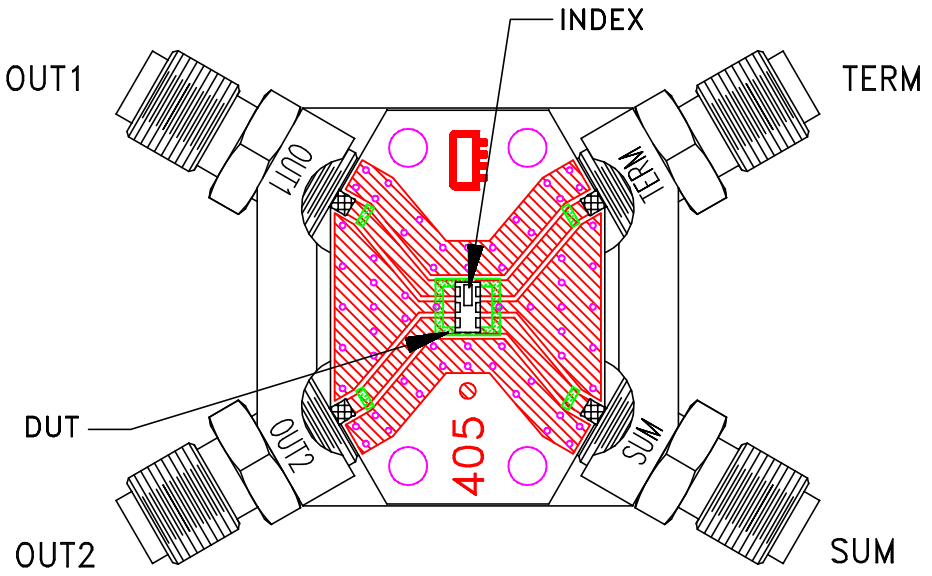
PL, pb, FV1206-1, QCN, TB-405

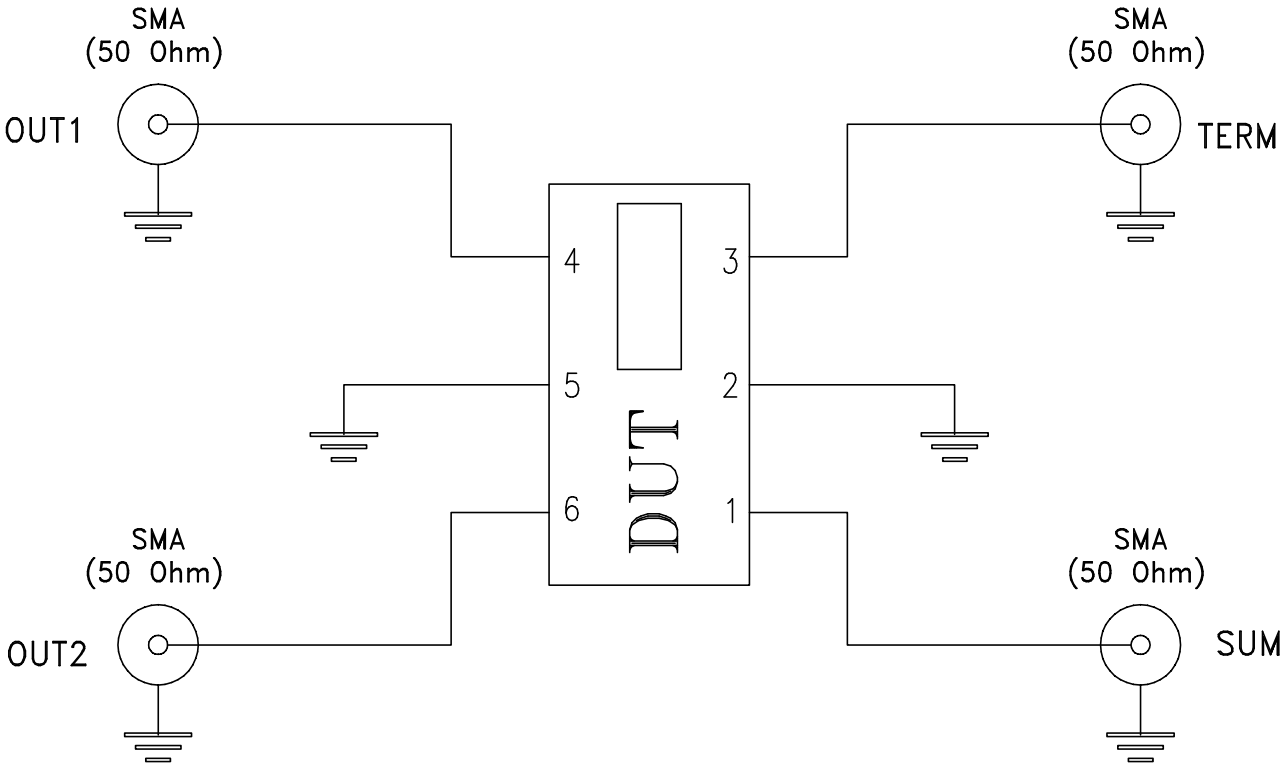
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-250	OR

FILE:	SCALE:	SHEET:
98PL250	10:1	1 OF 1

Evaluation Board and Circuit



TB-405



Schematic Diagram

Notes:

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

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Environmental Specifications ENV06

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
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

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