

Surface Mount Power Splitter/Combiner

2 Way-90° 50Ω 270 to 320 MHz

LRPQ-320J



Generic photo used for illustration purposes only

CASE STYLE: QQQ569

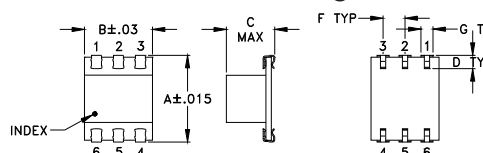
Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
Power Input (as a splitter)	1W max.
Permanent damage may occur if any of these limits are exceeded.	

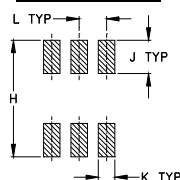
Pin Connections

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

Outline Drawing



PCB Land Pattern

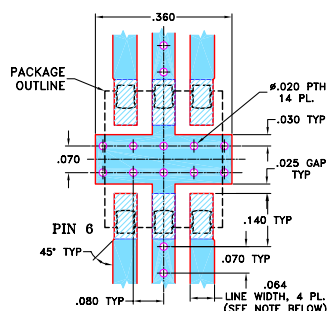


Suggested Layout,
Tolerance to be within ±.002

Outline Dimensions (inch)

A	B	C	D	E	F	G	
.390	.31	.225	.060	--	.100	.045	
9.91	7.87	5.72	1.52	--	2.54	1.14	
H	J	K	L	M			wt
.420	.120	.060	.100	--			grams
10.67	3.05	1.52	2.54	--			0.50

Demo Board MCL P/N: TB-226 Suggested PCB Layout (PL-140)



- NOTE: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .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 insertion loss, 0.3 dB typ.
- good isolation, 21 dB typ.
- excellent phase unbalance 1 deg. typ.
- good return loss, VSWR 1.20:1 typ.
- aqueous washable

Applications

- UHF
- modulators
- balanced amplifiers
- image rejection mixers

Electrical Specifications

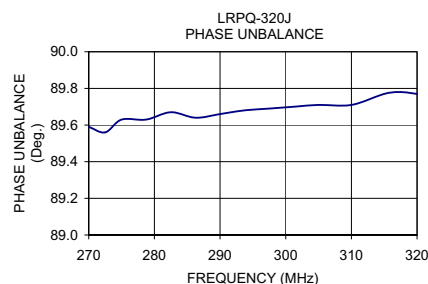
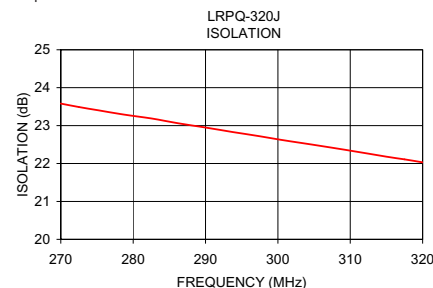
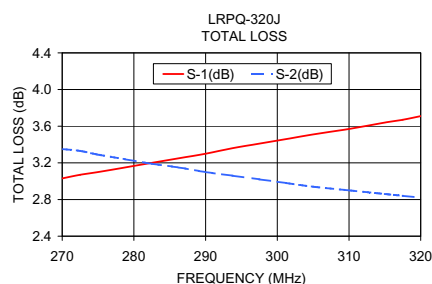
FREQ. RANGE (MHz)	ISOLATION (dB)	INSERTION LOSS (dB) Avg. of Coupled Outputs ABOVE 3 dB	PHASE UNBALANCE (Degrees)	AMPLITUDE UNBALANCE (dB)
f_L - f_U	Typ. Min.	Typ. Max.	Max.	Max.
270-320	21 18	0.3 0.6	3	1.2

LRPQ units have bottom barrier ground plane insulated with glass barrier.

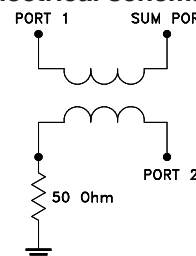
Typical Performance Data

Frequency (MHz)	Total Loss ¹ (dB)	Amplitude Unbalance (dB)	Isolation (dB)	Phase Unbalance (deg.)	VSWR S	VSWR 1	VSWR 2
	S-1 S-2						
270.00	3.03 3.35	0.32	23.58	89.59	1.15	1.11	1.15
272.50	3.07 3.33	0.26	23.49	89.56	1.15	1.12	1.15
275.00	3.10 3.29	0.19	23.41	89.63	1.15	1.12	1.15
278.75	3.15 3.24	0.09	23.29	89.63	1.16	1.12	1.16
282.50	3.20 3.19	0.01	23.19	89.67	1.16	1.12	1.16
286.25	3.25 3.15	0.10	23.06	89.64	1.16	1.12	1.16
290.00	3.30 3.10	0.20	22.95	89.66	1.17	1.13	1.17
293.75	3.36 3.06	0.30	22.83	89.68	1.17	1.13	1.17
297.50	3.41 3.02	0.39	22.72	89.69	1.17	1.13	1.17
301.25	3.46 2.98	0.47	22.60	89.70	1.18	1.13	1.18
305.00	3.51 2.94	0.57	22.49	89.71	1.18	1.14	1.18
310.00	3.57 2.90	0.67	22.34	89.71	1.19	1.14	1.18
315.00	3.64 2.86	0.79	22.18	89.77	1.19	1.14	1.19
317.50	3.67 2.84	0.84	22.11	89.78	1.19	1.14	1.19
320.00	3.71 2.82	0.89	22.03	89.77	1.20	1.15	1.19

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



electrical schematic



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2 Way-90° Power Splitter/Combiner

LRPQ-320J

Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS ¹			AMP. UNBAL. (dB)	PHASE UNBAL. From 90° (deg.)	ISOLATION (dB) 1-2	VSWR		
	S-1	S-2	AVG.				S	1	2
170	1.44	6.07	3.76	4.63	0.17	24.98	1.07	1.05	1.06
180	1.58	5.73	3.65	4.16	0.15	24.65	1.08	1.06	1.07
200	1.84	5.14	3.49	3.30	0.13	24.08	1.09	1.07	1.09
210	1.97	4.88	3.43	2.91	0.10	23.82	1.10	1.08	1.09
220	2.10	4.65	3.38	2.55	0.08	23.57	1.11	1.08	1.10
225	2.18	4.54	3.36	2.36	0.08	23.45	1.11	1.09	1.11
230	2.24	4.44	3.34	2.20	0.06	23.34	1.12	1.09	1.11
235	2.31	4.33	3.32	2.03	0.07	23.24	1.12	1.09	1.12
240	2.37	4.23	3.30	1.86	0.03	23.13	1.13	1.10	1.12
245	2.43	4.14	3.29	1.71	0.02	23.01	1.13	1.10	1.12
250	2.51	4.05	3.28	1.55	0.00	22.88	1.13	1.11	1.13
255	2.57	3.97	3.27	1.40	0.01	22.77	1.14	1.11	1.13
260	2.64	3.89	3.27	1.24	0.01	22.66	1.14	1.11	1.14
265	2.71	3.81	3.26	1.10	0.03	22.54	1.15	1.12	1.14
270	2.77	3.74	3.25	0.97	0.08	22.43	1.15	1.12	1.15
275	2.83	3.67	3.25	0.83	0.09	22.31	1.16	1.12	1.15
280	2.90	3.59	3.25	0.70	0.10	22.19	1.16	1.13	1.16
285	2.96	3.52	3.24	0.56	0.12	22.08	1.17	1.13	1.16
290	3.01	3.46	3.24	0.44	0.14	21.96	1.17	1.13	1.17
295	3.08	3.39	3.24	0.32	0.17	21.84	1.17	1.14	1.17
300	3.15	3.34	3.24	0.19	0.19	21.73	1.18	1.14	1.18
305	3.20	3.29	3.25	0.08	0.20	21.62	1.18	1.15	1.18
310	3.27	3.23	3.25	0.04	0.23	21.50	1.19	1.15	1.19
315	3.33	3.18	3.26	0.15	0.26	21.39	1.19	1.15	1.19
320	3.38	3.13	3.26	0.26	0.30	21.27	1.20	1.16	1.20
340	3.62	2.95	3.28	0.67	0.43	20.82	1.22	1.17	1.22
360	3.83	2.80	3.32	1.03	0.56	20.31	1.24	1.19	1.24
380	4.04	2.69	3.36	1.35	0.76	19.78	1.26	1.21	1.26
400	4.23	2.59	3.41	1.64	0.97	19.23	1.29	1.22	1.29
420	4.41	2.51	3.46	1.89	1.23	18.66	1.31	1.24	1.32
440	4.57	2.46	3.51	2.11	1.51	18.09	1.34	1.26	1.34
460	4.71	2.43	3.57	2.28	1.86	17.49	1.37	1.28	1.38
480	4.85	2.42	3.63	2.43	2.30	16.88	1.41	1.31	1.41
500	4.96	2.43	3.69	2.53	2.85	16.26	1.44	1.33	1.45
520	5.05	2.46	3.76	2.59	3.44	15.63	1.49	1.36	1.49
540	5.13	2.52	3.82	2.61	4.17	14.99	1.53	1.39	1.54
560	5.20	2.61	3.90	2.59	5.04	14.34	1.58	1.43	1.59
580	5.24	2.72	3.98	2.52	6.09	13.67	1.64	1.47	1.65
600	5.27	2.88	4.08	2.39	7.41	13.00	1.71	1.51	1.72

¹Total Loss = Insertion Loss + 3dB Splitter Loss

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2 Way-90° Power Splitter/Combiner

LRPQ-320J

Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS ¹			AMP. UNBAL. (dB)	PHASE UNBAL. From 90° (deg.)	ISOLATION (dB) 1-2	VSWR		
	S-1	S-2	AVG.				S	1	2
170	1.40	6.03	3.72	4.63	0.14	25.14	1.09	1.07	1.06
180	1.53	5.69	3.61	4.17	0.13	24.65	1.10	1.08	1.07
200	1.79	5.09	3.44	3.30	0.13	23.88	1.11	1.09	1.10
210	1.92	4.83	3.37	2.91	0.12	23.60	1.11	1.09	1.10
220	2.05	4.60	3.33	2.54	0.11	23.41	1.12	1.10	1.11
225	2.12	4.48	3.30	2.36	0.11	23.33	1.12	1.10	1.11
230	2.18	4.38	3.28	2.19	0.11	23.28	1.12	1.10	1.11
235	2.25	4.27	3.26	2.03	0.11	23.21	1.12	1.10	1.12
240	2.31	4.17	3.24	1.86	0.07	23.15	1.13	1.11	1.12
245	2.37	4.08	3.23	1.71	0.08	23.04	1.13	1.11	1.12
250	2.44	3.99	3.22	1.55	0.05	22.93	1.14	1.11	1.13
255	2.51	3.91	3.21	1.40	0.04	22.80	1.14	1.12	1.13
260	2.57	3.83	3.20	1.25	0.02	22.67	1.15	1.12	1.14
265	2.65	3.75	3.20	1.10	0.01	22.52	1.16	1.13	1.14
270	2.71	3.68	3.19	0.97	0.04	22.37	1.16	1.14	1.15
275	2.77	3.60	3.18	0.82	0.07	22.21	1.17	1.14	1.16
280	2.84	3.52	3.18	0.69	0.08	22.04	1.18	1.15	1.16
285	2.89	3.46	3.18	0.57	0.10	21.89	1.18	1.15	1.17
290	2.96	3.40	3.18	0.44	0.14	21.74	1.19	1.15	1.18
295	3.02	3.33	3.17	0.32	0.14	21.60	1.19	1.16	1.18
300	3.09	3.27	3.18	0.19	0.17	21.46	1.20	1.16	1.19
305	3.15	3.22	3.18	0.06	0.19	21.33	1.20	1.17	1.20
310	3.21	3.16	3.19	0.05	0.20	21.20	1.21	1.17	1.20
315	3.27	3.11	3.19	0.16	0.21	21.11	1.21	1.17	1.21
320	3.33	3.07	3.20	0.26	0.24	21.00	1.22	1.17	1.21
340	3.55	2.88	3.21	0.67	0.35	20.65	1.23	1.18	1.23
360	3.76	2.73	3.25	1.03	0.46	20.19	1.25	1.19	1.25
380	3.97	2.61	3.29	1.36	0.67	19.67	1.28	1.21	1.28
400	4.16	2.51	3.34	1.65	0.89	19.11	1.31	1.23	1.31
420	4.34	2.43	3.39	1.91	1.13	18.57	1.34	1.25	1.34
440	4.50	2.37	3.44	2.13	1.41	18.04	1.36	1.27	1.37
460	4.64	2.33	3.49	2.31	1.72	17.48	1.39	1.29	1.40
480	4.78	2.32	3.55	2.46	2.16	16.89	1.42	1.31	1.44
500	4.89	2.32	3.60	2.57	2.65	16.29	1.46	1.34	1.48
520	4.98	2.34	3.66	2.64	3.21	15.70	1.50	1.37	1.52
540	5.06	2.39	3.72	2.67	3.89	15.06	1.54	1.40	1.56
560	5.11	2.47	3.79	2.64	4.69	14.41	1.59	1.43	1.61
580	5.16	2.58	3.87	2.58	5.67	13.72	1.65	1.47	1.67
600	5.18	2.73	3.95	2.45	6.88	13.05	1.72	1.51	1.73

¹Total Loss = Insertion Loss + 3dB Splitter Loss

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2 Way-90° Power Splitter/Combiner

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Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS ¹			AMP. UNBAL. (dB)	PHASE UNBAL. From 90° (deg.)	ISOLATION (dB) 1-2	VSWR		
	S-1	S-2	AVG.				S	1	2
170	1.47	6.06	3.76	4.59	0.27	24.68	1.06	1.04	1.07
180	1.61	5.72	3.66	4.12	0.27	24.52	1.07	1.05	1.07
200	1.86	5.14	3.50	3.28	0.24	24.31	1.07	1.05	1.07
210	2.00	4.88	3.44	2.88	0.20	24.13	1.08	1.06	1.08
220	2.13	4.65	3.39	2.52	0.15	23.89	1.09	1.07	1.09
225	2.21	4.54	3.38	2.33	0.13	23.75	1.10	1.08	1.10
230	2.27	4.44	3.35	2.17	0.12	23.61	1.11	1.08	1.10
235	2.34	4.33	3.33	2.00	0.10	23.48	1.11	1.09	1.11
240	2.41	4.24	3.32	1.83	0.05	23.32	1.12	1.09	1.11
245	2.47	4.14	3.31	1.67	0.05	23.15	1.12	1.10	1.12
250	2.54	4.05	3.30	1.51	0.03	22.99	1.13	1.10	1.13
255	2.61	3.97	3.29	1.36	0.03	22.85	1.13	1.10	1.13
260	2.67	3.90	3.29	1.22	0.00	22.72	1.14	1.11	1.14
265	2.75	3.81	3.28	1.07	0.01	22.60	1.14	1.11	1.14
270	2.81	3.74	3.27	0.93	0.04	22.50	1.15	1.11	1.15
275	2.87	3.67	3.27	0.79	0.08	22.41	1.15	1.11	1.15
280	2.94	3.59	3.26	0.66	0.08	22.32	1.15	1.12	1.15
285	2.99	3.53	3.26	0.54	0.08	22.26	1.16	1.12	1.16
290	3.05	3.46	3.25	0.40	0.10	22.19	1.16	1.12	1.16
295	3.12	3.40	3.26	0.29	0.14	22.12	1.16	1.12	1.16
300	3.18	3.34	3.26	0.16	0.15	22.04	1.16	1.12	1.16
305	3.23	3.29	3.26	0.05	0.17	21.96	1.17	1.13	1.17
310	3.30	3.23	3.26	0.07	0.18	21.86	1.17	1.13	1.17
315	3.35	3.18	3.27	0.17	0.23	21.77	1.18	1.14	1.17
320	3.41	3.14	3.28	0.28	0.28	21.65	1.18	1.14	1.18
340	3.65	2.96	3.30	0.69	0.44	21.13	1.20	1.16	1.20
360	3.86	2.82	3.34	1.04	0.62	20.51	1.23	1.18	1.23
380	4.07	2.70	3.39	1.37	0.82	19.95	1.25	1.20	1.25
400	4.27	2.60	3.44	1.67	1.03	19.41	1.27	1.21	1.27
420	4.44	2.53	3.48	1.91	1.28	18.87	1.29	1.23	1.29
440	4.59	2.48	3.54	2.11	1.58	18.27	1.32	1.25	1.32
460	4.74	2.45	3.60	2.29	1.94	17.61	1.35	1.28	1.35
480	4.87	2.44	3.65	2.43	2.43	16.94	1.39	1.30	1.39
500	4.99	2.46	3.72	2.53	3.00	16.29	1.43	1.33	1.43
520	5.08	2.50	3.79	2.58	3.65	15.66	1.47	1.35	1.47
540	5.16	2.56	3.86	2.60	4.44	15.01	1.51	1.39	1.52
560	5.22	2.66	3.94	2.56	5.39	14.35	1.57	1.42	1.57
580	5.27	2.78	4.03	2.49	6.53	13.66	1.63	1.47	1.63
600	5.31	2.95	4.13	2.36	7.94	12.98	1.70	1.52	1.71

¹Total Loss = Insertion Loss + 3dB Splitter Loss

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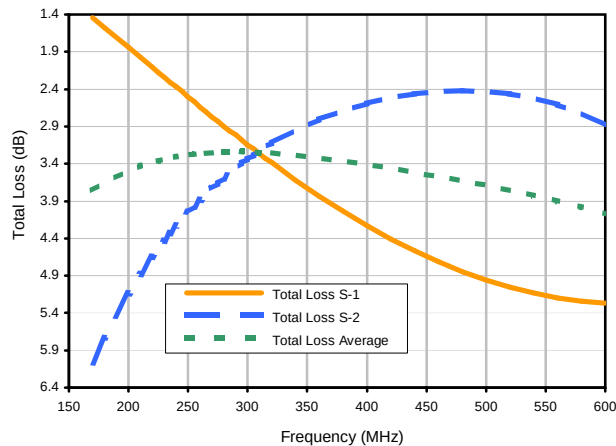


2 Way-0° Power Splitter/Combiner

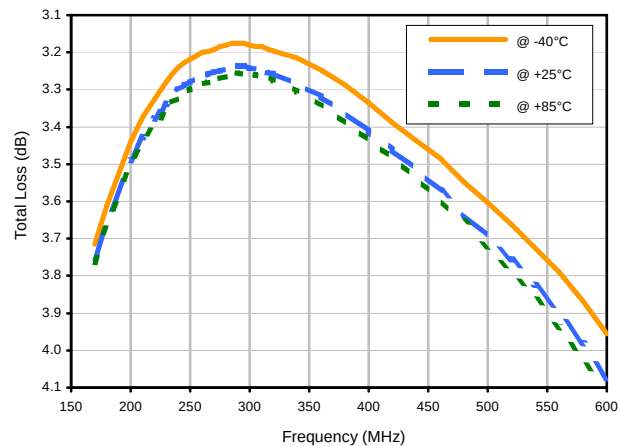
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Typical Performance Curves

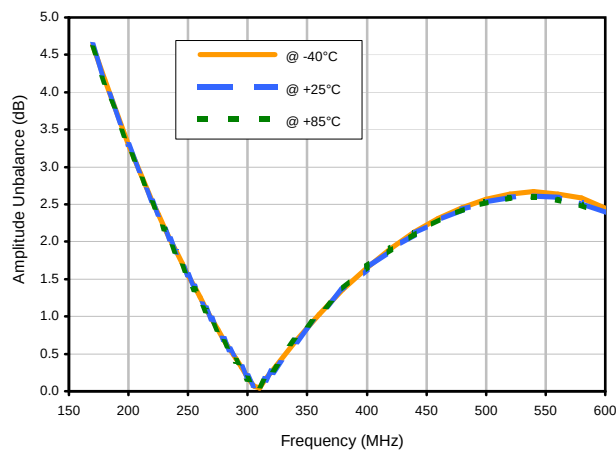
Total Loss



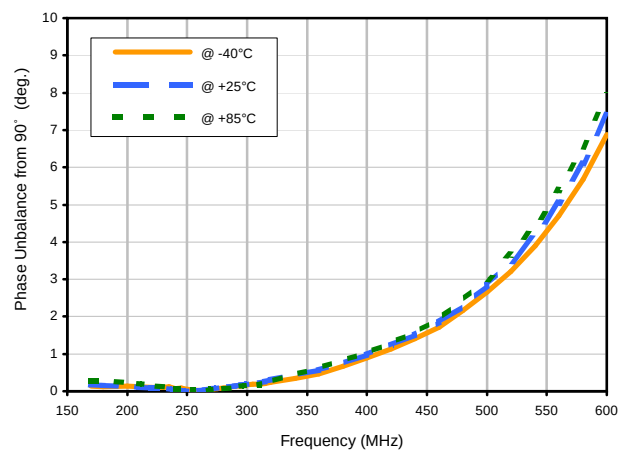
Average Total Loss vs. TEMPERATURE



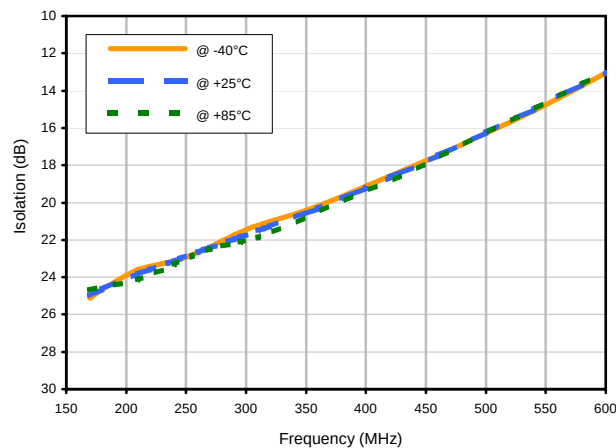
Amplitude Unbalance vs. TEMPERATURE



Phase Unbalance vs. TEMPERATURE



Isolation 1-2 vs. TEMPERATURE



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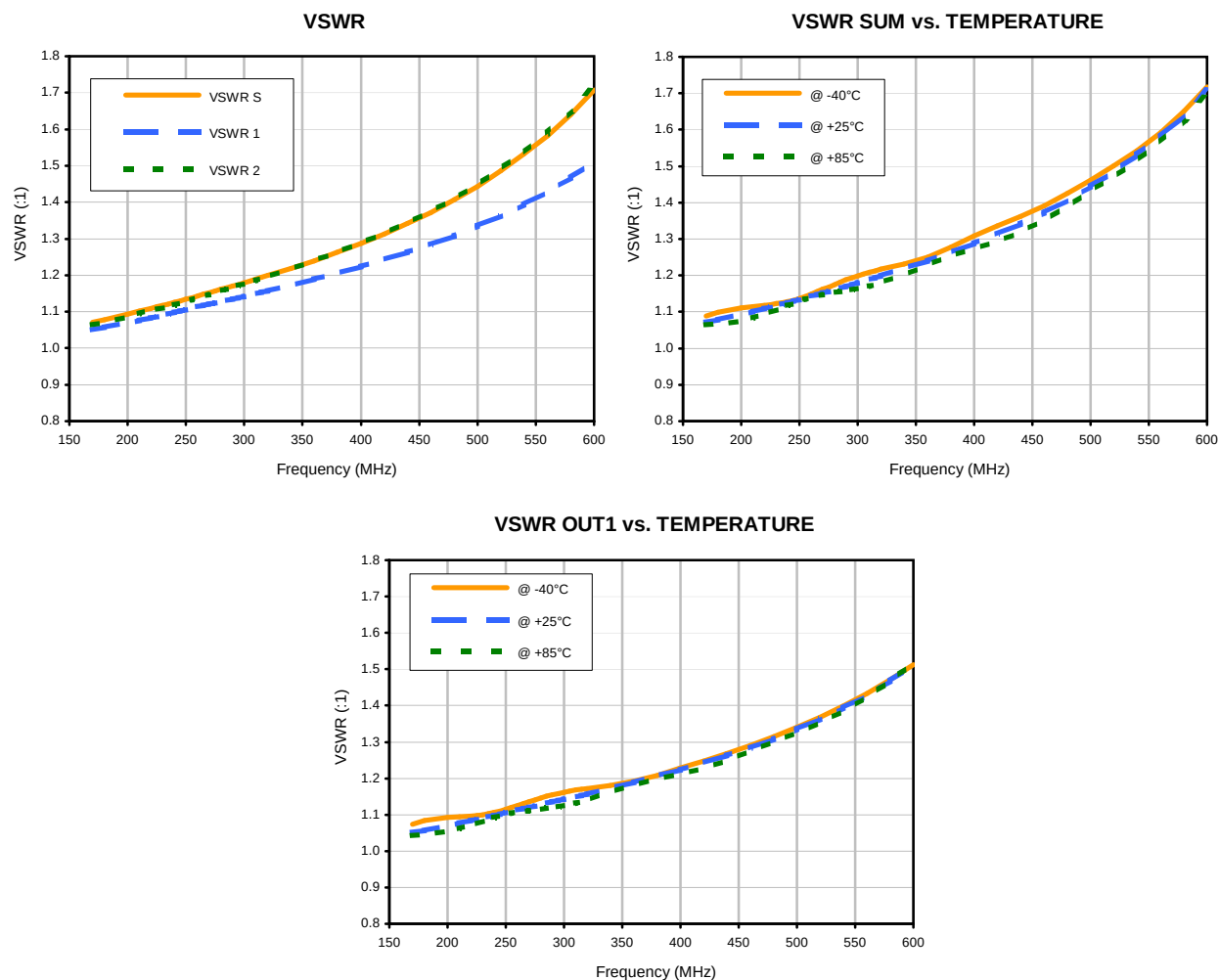


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2 Way-0° Power Splitter/Combiner

LRPQ-320J

Typical Performance Curves



REV. X2
LRPQ-320J
100623
Page 2 of 2



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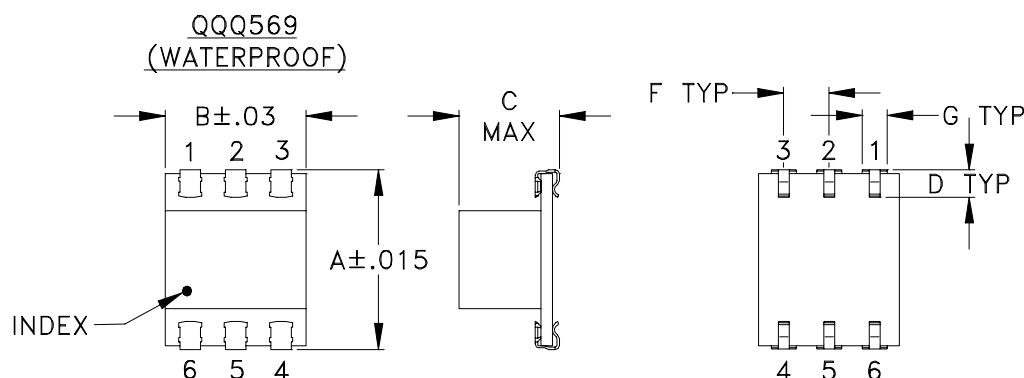


Case Style

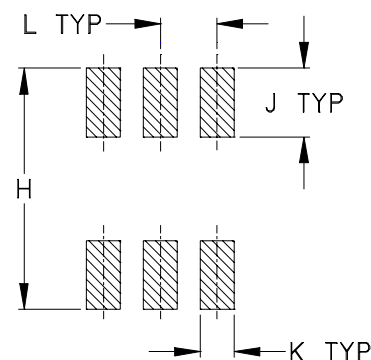
QQQ

QQQ569 (waterproof)

Outline Dimensions



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
QQQ569	.390 (9.90)	.31 (7.87)	.225 (5.72)	.060 (1.52)	-	.100 (2.54)	.045 (1.14)	.420 (10.67)	.120 (3.05)	.060 (1.52)	.100 (2.54)	-	.50

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.



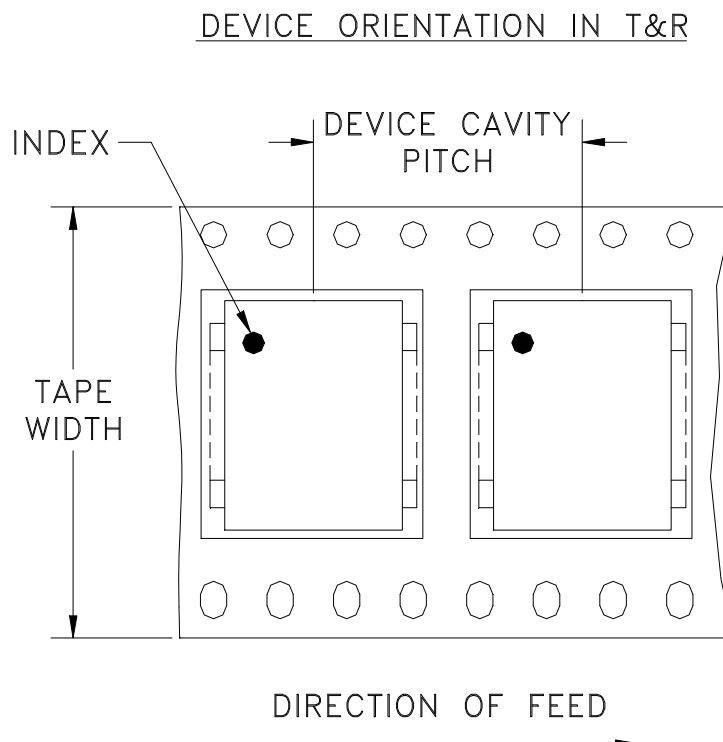
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Tape & Reel Packaging TR-F5



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
32	16	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



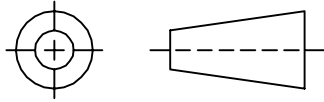
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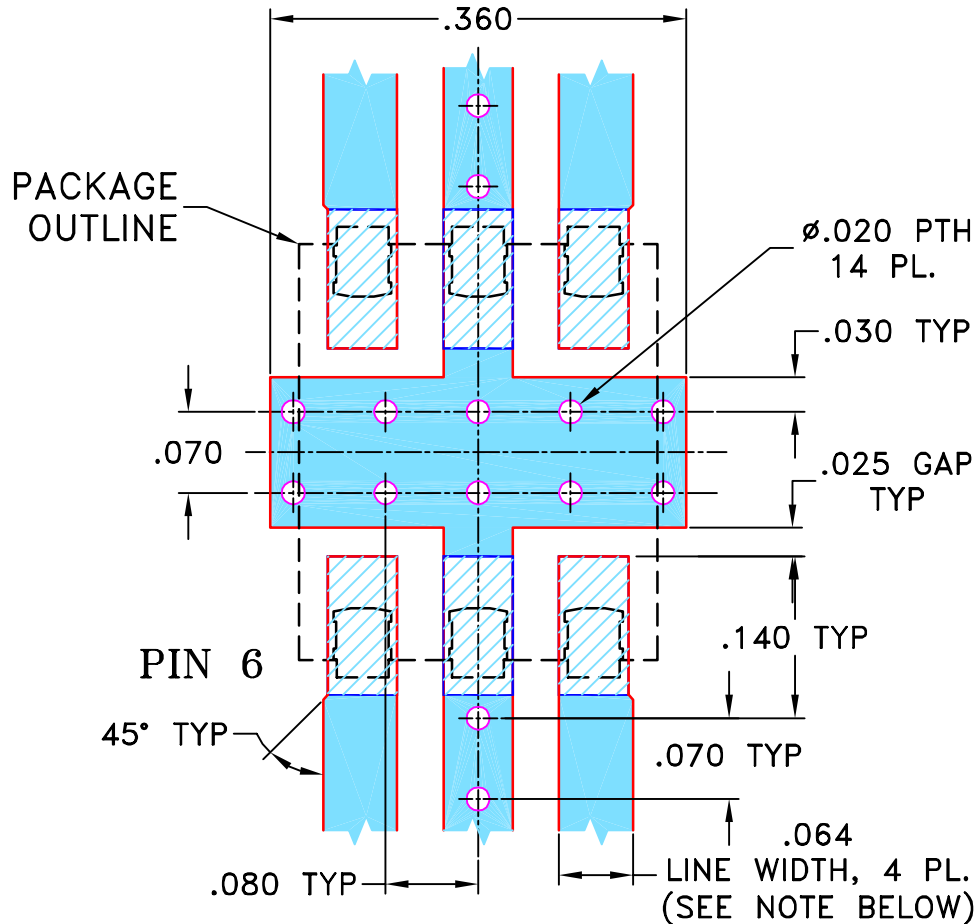
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M88792	NEW RELEASE	10/20/03	GF	HY
A	M100924	CHANGED ORIENTATION PIN 1 TO PIN 6	09/23/05	GT	HY
B	M102713	ADDED "...WITH SMOBC"	01/12/06	GF	IL

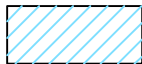
SUGGESTED MOUNTING CONFIGURATION
FOR QQQ569 CASE STYLE, "ay/lr" PIN CONNECTION.



- NOTE:**
- TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS $.030'' \pm .002''$; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
 - 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

09/18/03

TOLERANCES ON:

CHECKED

IL

10/20/03

2 PL DECIMALS $\pm$

APPROVED

HY

10/20/03

3 PL DECIMALS $\pm$.005ANGLES $\pm$ 1°FRACTIONS $\pm$

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



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13 Neptune Avenue
Brooklyn NY 11235

PL, ay/lr, QQQ569, LRPQ-J, TB-226

SIZE

CODE IDENT

DRAWING NO:

REV:

A

15542

98-PL-140

B

FILE:

98PL140

SCALE:

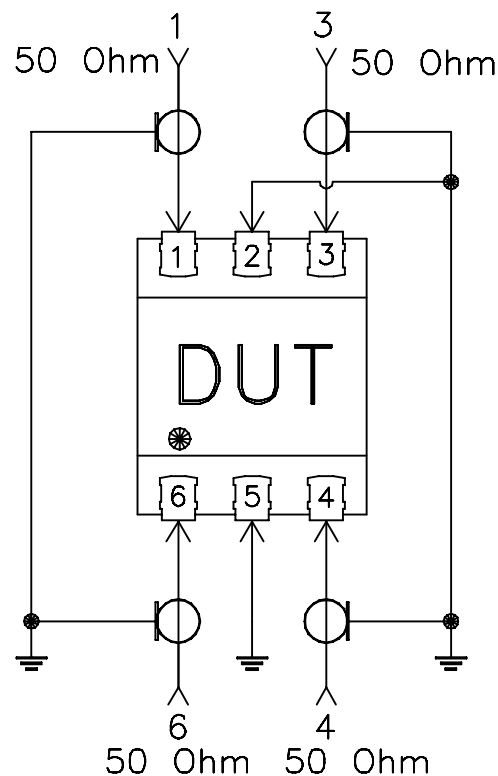
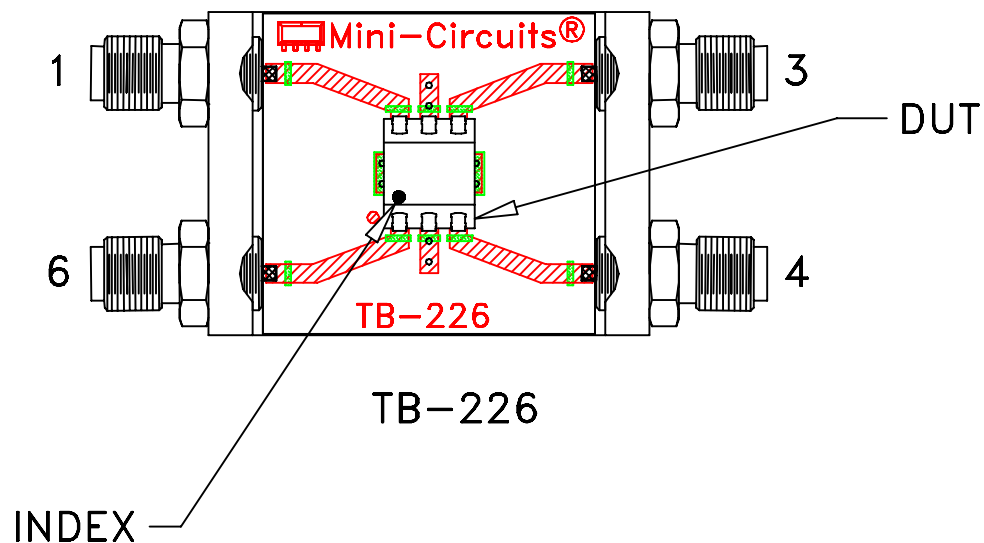
6:1

SHEET:

1 OF 1

Evaluation Board and Circuit

For Pin Connections refer to Data Sheet of the DUT



Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent,
Dielectric Constant=3.5, Thickness=.030 inch.

Schematic Diagram

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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