

# Surface Mount Power Splitter/Combiner

2 Way-90° 50Ω 65 to 75 MHz

LRPQ-70



CASE STYLE: QQQ130

## Maximum Ratings

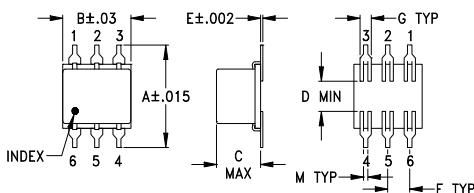
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
Power Input (as a splitter)	1W max.

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

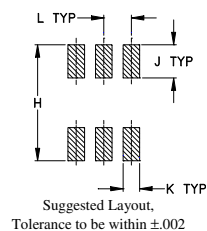
## Pin Connections

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

## Outline Drawing



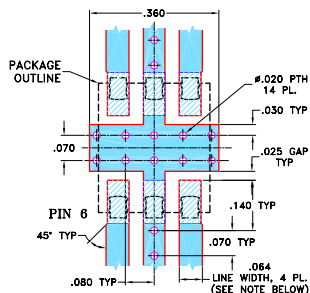
## PCB Land Pattern



## 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	

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



**NOTE:**

- 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.
- 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**

## Features

- low insertion loss, 0.1 dB typ.
- high isolation, 30 dB typ.
- excellent phase unbalance 1 deg. typ.
- excellent return loss, VSWR 1.12:1 typ.

## Applications

- VHF
- instrumentation
- modulators
- balanced amplifiers

## Electrical Specifications

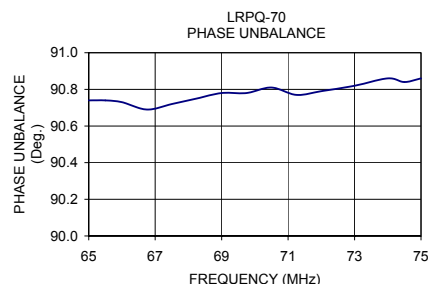
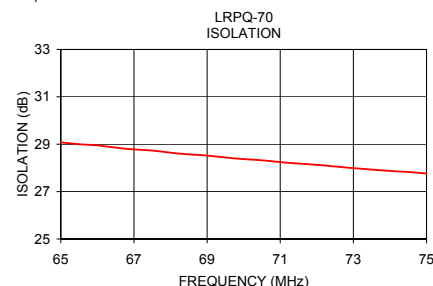
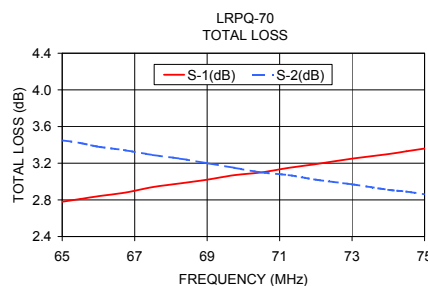
FREQ. RANGE (MHz)	ISOLATION (dB)	INSERTION LOSS (dB) Avg. of Coupled Outputs ABOVE 3 dB	PHASE UNBALANCE (Degrees)	AMPLITUDE UNBALANCE (dB)
$f_L$ - $f_U$	Typ. Min.	Typ. Max.	Max.	Max.
65-75	30 20	0.1 0.5	3	1.0

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

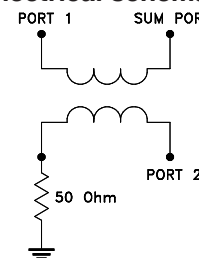
## Typical Performance Data

Frequency (MHz)	Total Loss <sup>1</sup> (dB)		Amplitude Unbalance (dB)	Isolation (dB)	Phase Unbalance (deg.)	VSWR S	VSWR 1	VSWR 2
	S-1	S-2						
65.00	2.78	3.45	0.68	29.08	90.74	1.12	1.11	1.06
65.50	2.81	3.42	0.61	29.00	90.74	1.12	1.11	1.06
66.00	2.84	3.38	0.54	28.95	90.73	1.12	1.11	1.06
66.75	2.88	3.34	0.45	28.81	90.69	1.12	1.11	1.06
67.50	2.94	3.29	0.35	28.73	90.72	1.12	1.11	1.06
68.25	2.98	3.25	0.27	28.60	90.75	1.12	1.11	1.06
69.00	3.02	3.20	0.18	28.52	90.78	1.12	1.11	1.06
69.75	3.07	3.15	0.09	28.40	90.78	1.12	1.11	1.06
70.50	3.10	3.10	0.00	28.32	90.81	1.12	1.11	1.06
71.25	3.15	3.07	0.08	28.21	90.77	1.12	1.11	1.06
72.00	3.19	3.02	0.17	28.13	90.79	1.12	1.11	1.06
73.00	3.25	2.97	0.29	27.99	90.82	1.12	1.11	1.06
74.00	3.30	2.91	0.39	27.87	90.86	1.12	1.11	1.06
74.50	3.33	2.89	0.45	27.83	90.84	1.12	1.11	1.06
75.00	3.36	2.86	0.50	27.76	90.86	1.12	1.11	1.06

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



## electrical schematic



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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.

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# 2 Way-90° Power Splitter/Combiner

# LRPQ-70

## Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS <sup>1</sup> (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. From 90° (deg.)	ISOLATION (dB) 1-2	VSWR (:1)		
	S-1	S-2				S	1	2
40	1.39	5.86	4.47	0.37	34.53	1.10	1.08	1.06
45	1.68	5.15	3.47	0.46	33.44	1.10	1.08	1.06
50	1.99	4.56	2.57	0.53	32.42	1.10	1.09	1.06
55	2.30	4.07	1.76	0.62	31.59	1.10	1.09	1.06
60	2.62	3.64	1.03	0.71	30.82	1.10	1.09	1.06
65	2.93	3.29	0.36	0.81	30.10	1.10	1.09	1.05
66	2.99	3.23	0.23	0.82	29.97	1.10	1.09	1.05
68	3.12	3.10	0.03	0.85	29.69	1.10	1.09	1.05
70	3.25	2.98	0.26	0.87	29.47	1.10	1.09	1.05
72	3.37	2.88	0.49	0.92	29.25	1.10	1.09	1.05
74	3.50	2.76	0.73	0.93	29.05	1.10	1.09	1.05
75	3.56	2.72	0.84	0.94	28.91	1.10	1.09	1.05
80	3.86	2.49	1.37	1.02	28.42	1.11	1.09	1.05
85	4.16	2.30	1.86	1.12	27.97	1.11	1.09	1.05
90	4.45	2.12	2.33	1.21	27.54	1.11	1.09	1.05
95	4.73	1.98	2.75	1.29	27.11	1.11	1.09	1.04
100	5.01	1.85	3.17	1.40	26.71	1.11	1.09	1.04
105	5.27	1.73	3.55	1.51	26.33	1.11	1.09	1.04
110	5.53	1.63	3.90	1.60	25.95	1.11	1.09	1.04
115	5.78	1.53	4.24	1.71	25.58	1.11	1.09	1.04
120	6.02	1.45	4.57	1.84	25.21	1.11	1.09	1.04
125	6.25	1.39	4.87	1.95	24.89	1.12	1.09	1.04
130	6.48	1.33	5.15	2.08	24.56	1.12	1.10	1.04
135	6.69	1.27	5.41	2.23	24.24	1.12	1.10	1.04
140	6.89	1.22	5.67	2.36	23.95	1.12	1.10	1.04
145	7.09	1.18	5.91	2.52	23.65	1.13	1.10	1.05
150	7.27	1.14	6.13	2.68	23.34	1.13	1.11	1.05

<sup>1</sup>Total Loss = Insertion Loss + 3dB Splitter Loss

REV. X2  
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# 2 Way-90° Power Splitter/Combiner

# LRPQ-70

## Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS <sup>1</sup> (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. From 90° (deg.)	ISOLATION (dB) 1-2	VSWR (:1)		
	S-1	S-2				S	1	2
40	1.38	5.85	4.47	0.31	33.85	1.10	1.09	1.07
45	1.67	5.14	3.47	0.41	32.62	1.11	1.10	1.07
50	1.97	4.55	2.58	0.49	31.53	1.12	1.11	1.08
55	2.28	4.06	1.77	0.56	30.63	1.12	1.11	1.07
60	2.60	3.63	1.04	0.67	29.84	1.13	1.12	1.07
65	2.91	3.28	0.37	0.76	29.17	1.13	1.12	1.07
66	2.97	3.21	0.24	0.78	29.04	1.13	1.12	1.07
68	3.10	3.09	0.02	0.81	28.79	1.13	1.12	1.06
70	3.22	2.96	0.26	0.85	28.60	1.13	1.12	1.06
72	3.34	2.86	0.48	0.88	28.40	1.13	1.12	1.06
74	3.47	2.75	0.71	0.91	28.24	1.12	1.12	1.06
75	3.53	2.70	0.83	0.91	28.12	1.12	1.12	1.06
80	3.83	2.47	1.36	1.01	27.73	1.12	1.12	1.05
85	4.13	2.27	1.86	1.09	27.40	1.12	1.11	1.05
90	4.41	2.10	2.32	1.19	27.12	1.12	1.11	1.05
95	4.70	1.95	2.75	1.26	26.83	1.12	1.11	1.04
100	4.97	1.81	3.16	1.38	26.57	1.11	1.10	1.04
105	5.23	1.70	3.54	1.47	26.32	1.11	1.10	1.04
110	5.49	1.59	3.91	1.56	26.04	1.11	1.10	1.04
115	5.74	1.50	4.24	1.66	25.74	1.11	1.10	1.04
120	5.98	1.41	4.56	1.78	25.40	1.11	1.10	1.03
125	6.21	1.34	4.87	1.87	25.07	1.11	1.10	1.03
130	6.44	1.28	5.16	1.99	24.70	1.11	1.10	1.03
135	6.64	1.22	5.42	2.13	24.33	1.12	1.11	1.03
140	6.85	1.17	5.68	2.25	23.97	1.12	1.11	1.04
145	7.04	1.13	5.91	2.40	23.60	1.13	1.12	1.04
150	7.22	1.09	6.13	2.58	23.23	1.13	1.13	1.04

<sup>1</sup>Total Loss = Insertion Loss + 3dB Splitter Loss

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# 2 Way-90° Power Splitter/Combiner

# LRPQ-70

## Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS <sup>1</sup> (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. From 90° (deg.)	ISOLATION (dB) 1-2	VSWR (:1)		
	S-1	S-2				S	1	2
40	1.40	5.85	4.45	0.37	35.23	1.09	1.07	1.05
45	1.69	5.14	3.45	0.47	34.35	1.09	1.07	1.05
50	2.00	4.55	2.55	0.55	33.53	1.08	1.07	1.05
55	2.31	4.06	1.74	0.62	32.84	1.08	1.06	1.04
60	2.63	3.63	1.01	0.74	32.18	1.08	1.06	1.04
65	2.94	3.28	0.33	0.80	31.49	1.08	1.06	1.04
66	3.00	3.21	0.21	0.83	31.36	1.08	1.06	1.04
68	3.13	3.09	0.05	0.86	31.07	1.08	1.06	1.04
70	3.26	2.97	0.29	0.88	30.84	1.08	1.06	1.04
72	3.38	2.86	0.52	0.91	30.57	1.08	1.06	1.04
74	3.51	2.76	0.75	0.94	30.34	1.08	1.06	1.04
75	3.57	2.71	0.86	0.95	30.17	1.08	1.06	1.04
80	3.88	2.48	1.40	1.03	29.53	1.09	1.06	1.04
85	4.18	2.29	1.89	1.11	28.91	1.09	1.07	1.04
90	4.47	2.12	2.35	1.20	28.28	1.09	1.07	1.05
95	4.75	1.97	2.78	1.29	27.68	1.10	1.08	1.04
100	5.02	1.85	3.18	1.41	27.13	1.10	1.08	1.04
105	5.29	1.73	3.56	1.51	26.62	1.10	1.09	1.04
110	5.55	1.63	3.92	1.61	26.14	1.11	1.09	1.04
115	5.80	1.54	4.26	1.75	25.70	1.11	1.09	1.04
120	6.04	1.46	4.57	1.88	25.28	1.11	1.10	1.04
125	6.27	1.39	4.88	1.99	24.91	1.11	1.10	1.04
130	6.50	1.33	5.17	2.14	24.57	1.12	1.10	1.04
135	6.71	1.27	5.43	2.30	24.25	1.12	1.10	1.05
140	6.91	1.23	5.69	2.44	23.98	1.13	1.10	1.05
145	7.11	1.18	5.93	2.61	23.71	1.13	1.10	1.06
150	7.29	1.14	6.15	2.78	23.44	1.14	1.10	1.06

<sup>1</sup>Total Loss = Insertion Loss + 3dB Splitter Loss

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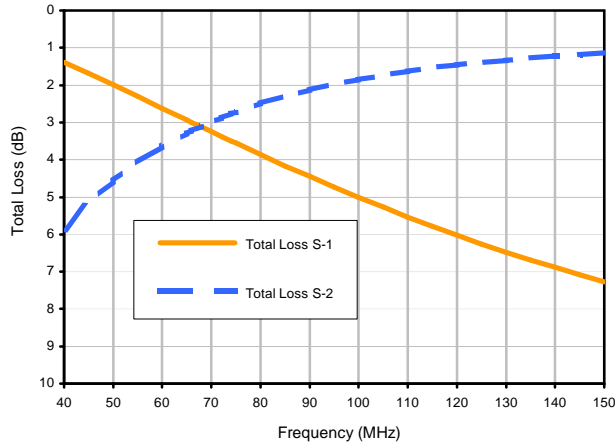


# 2 Way-0° Power Splitter/Combiner

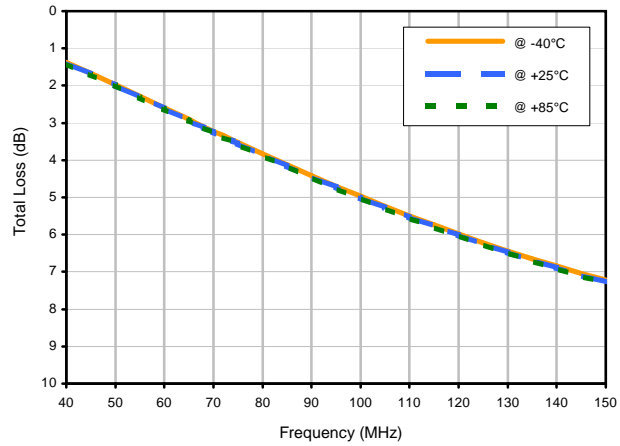
# LRPQ-70

## Typical Performance Curves

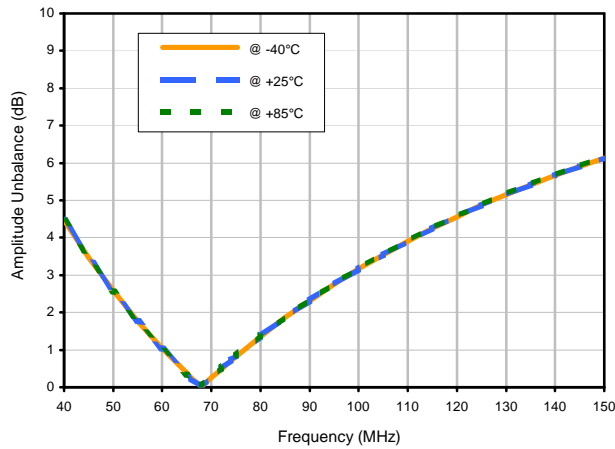
### Total Loss



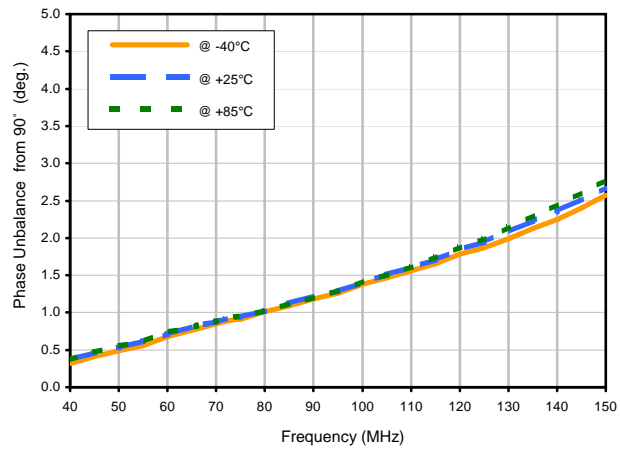
### Total Loss S-1 vs. TEMPERATURE



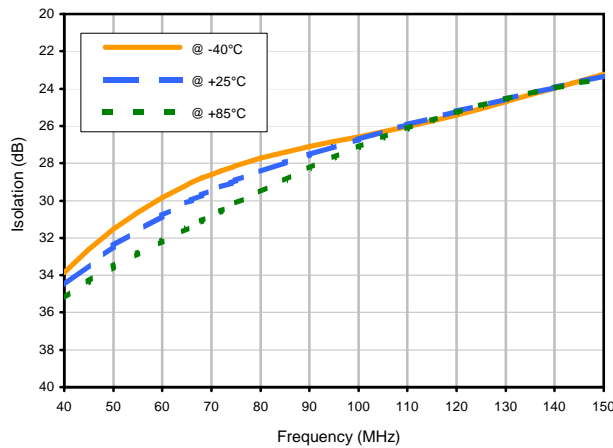
### Amplitude Unbalance vs. TEMPERATURE



### Phase Unbalance vs. TEMPERATURE



### Isolation 1-2 vs. TEMPERATURE



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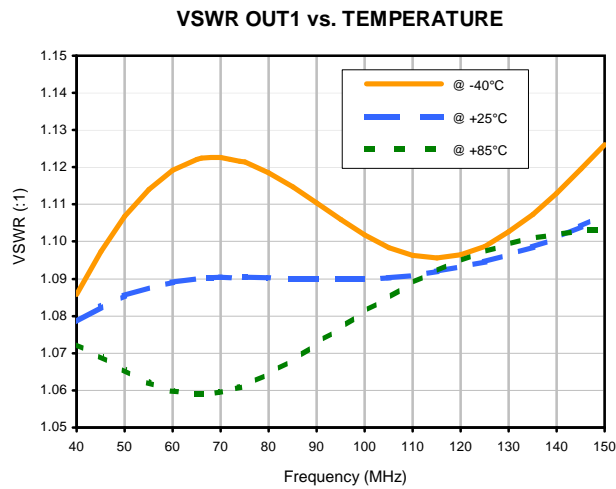
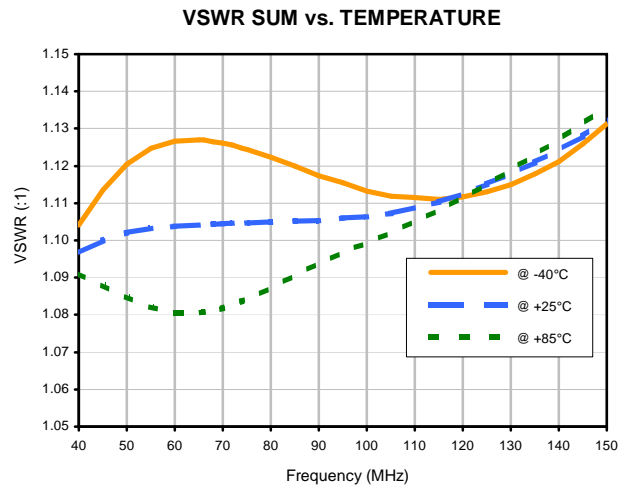
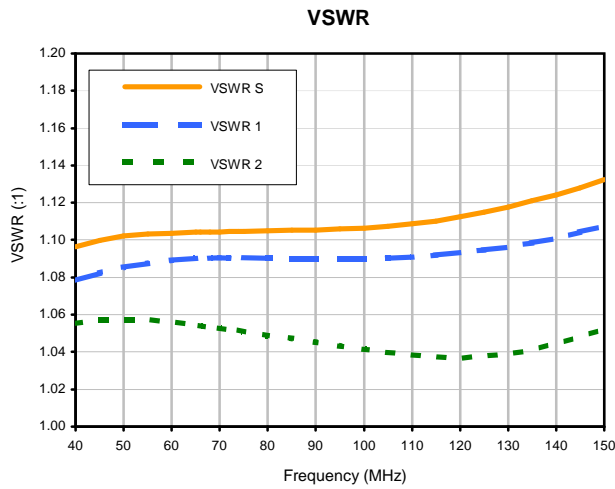
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# 2 Way-0° Power Splitter/Combiner

# LRPQ-70

## Typical Performance Curves



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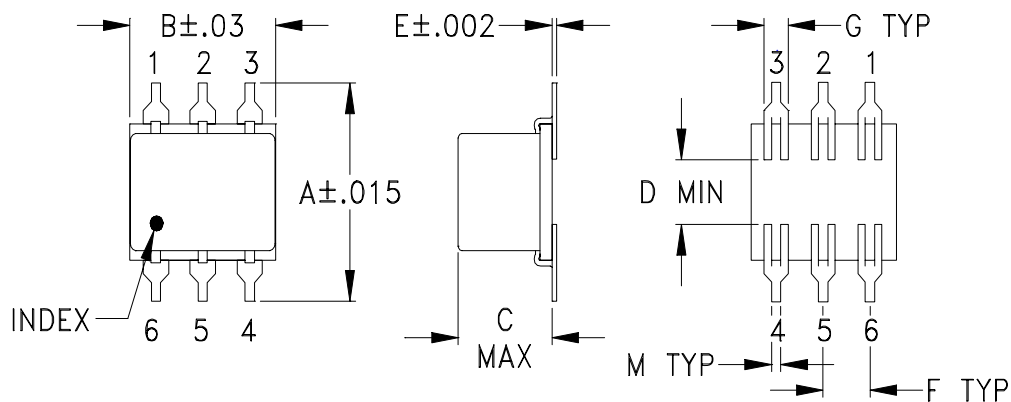


# Case Style

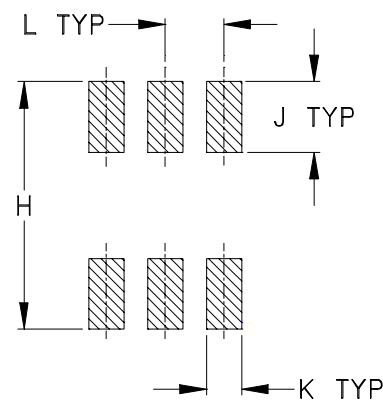
# QQQ

QQQ130 (non-waterproof)  
 QQQ828 (washable)

## 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
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.



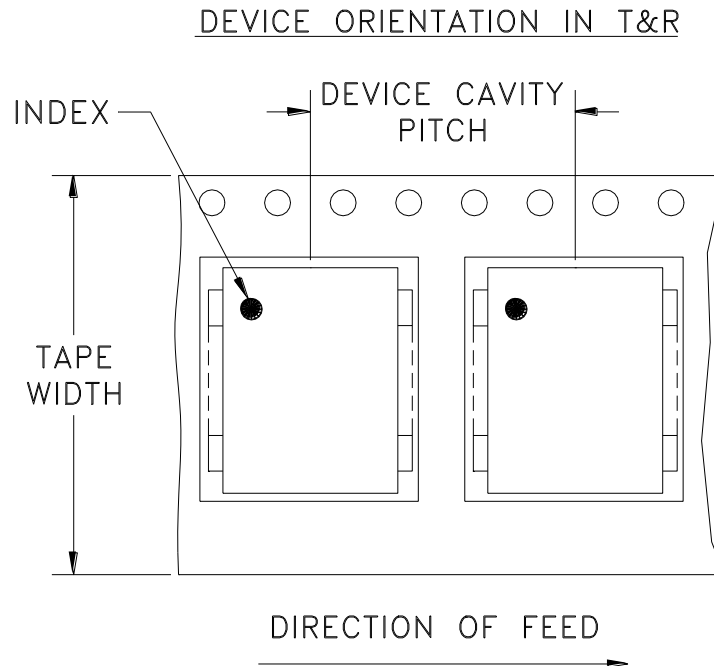
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# Tape & Reel Packaging TR-F10



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
24	16	7	10,20,50,100,200
		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](http://www.minicircuits.com/pages/pdfs/tape.pdf)

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



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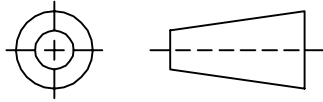
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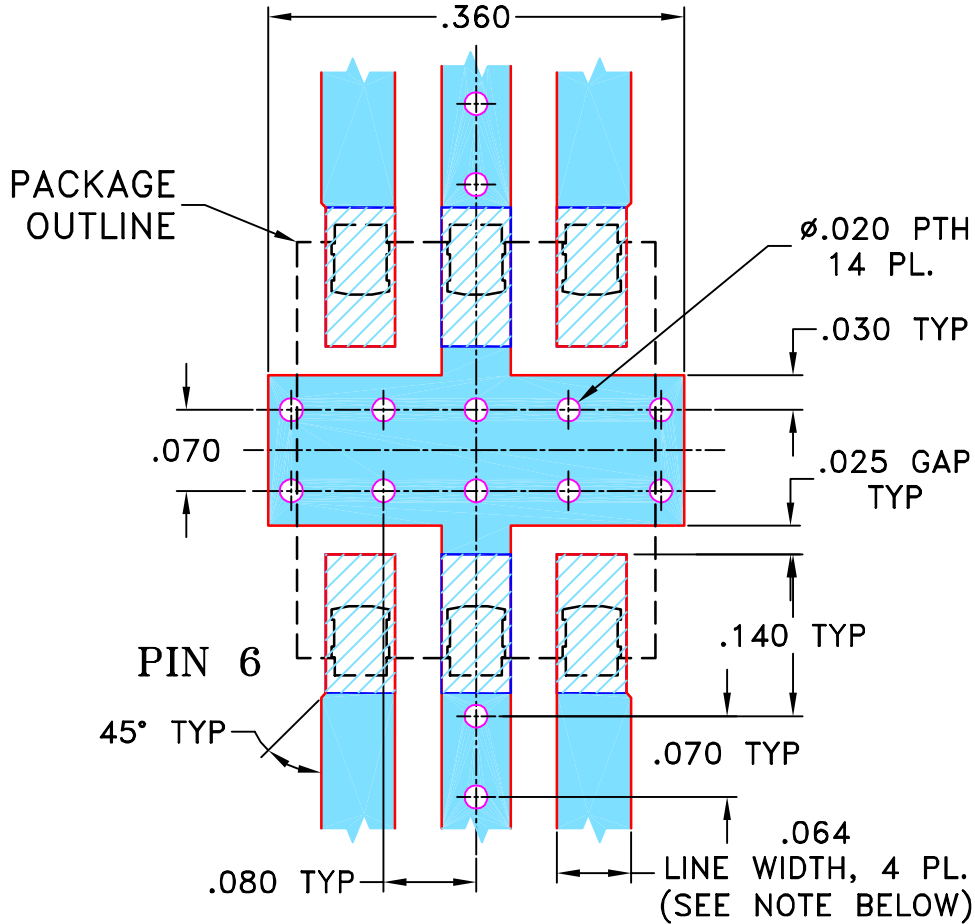
THIRD ANGLE PROJECTION



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

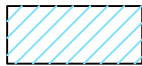
**SUGGESTED MOUNTING CONFIGURATION  
FOR QQQ569 CASE STYLE, "ay/lr" PIN CONNECTION.**



- 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

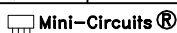
HY

10/20/03

3 PL DECIMALS  $\pm$  .005

ANGLES  $\pm$  1°

FRACTIONS  $\pm$



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



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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:

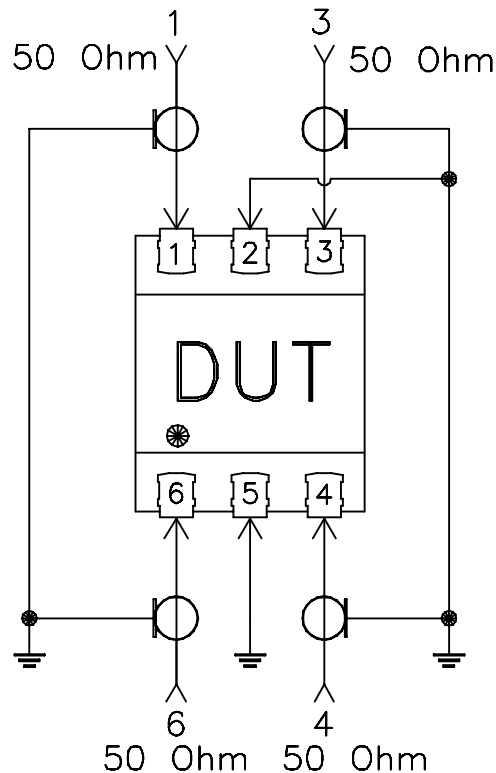
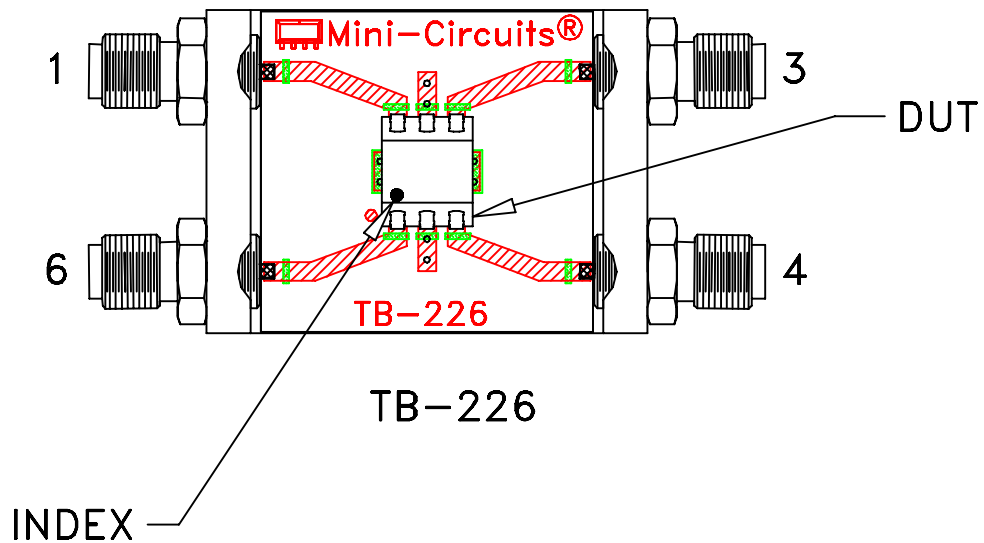
6:1

SHEET:

1 OF 1

# Evaluation Board and Circuit


For Pin Connections refer to Data Sheet of the DUT



Schematic Diagram

## Notes:

1. SMA 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