

Surface Mount Power Splitter/Combiner

**HPQ-05+
HPQ-05**

2 Way-90° 50Ω 410 to 455 MHz



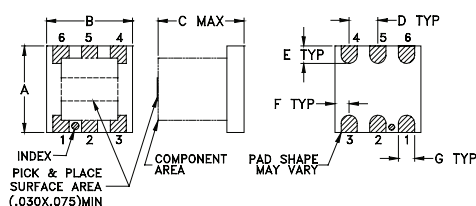
Maximum Ratings

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.	

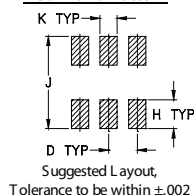
Pin Connections

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

Outline Drawing



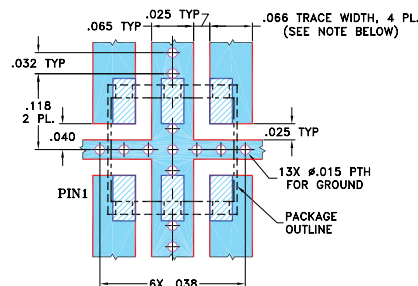
PCB Land Pattern



Outline Dimensions (inch/mm)

A	B	C	D	E	F
.200	.200	.200	.075	.050	.025
5.08	5.08	5.08	1.91	1.27	0.64
G	H	J	K		wt
.026	.070	.220	.035		grams
0.66	1.78	5.59	0.89		0.15

Demo Board MCL P/N: TB-43 Suggested PCB Layout (PL-114)



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B 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.
3. DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
4. DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Features

- low insertion loss, 0.17 dB typ.
- good isolation, 25 dB typ.
- excellent input & output VSWR, 1.12 typ.
- aqueous washable

Applications

- UHF
- image reject mixer
- balanced amplifiers
- modulators

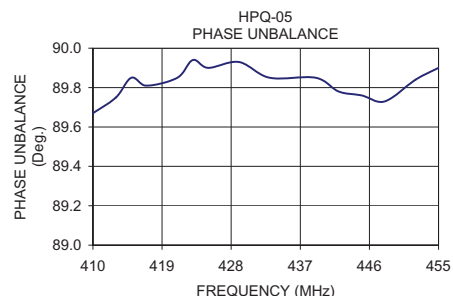
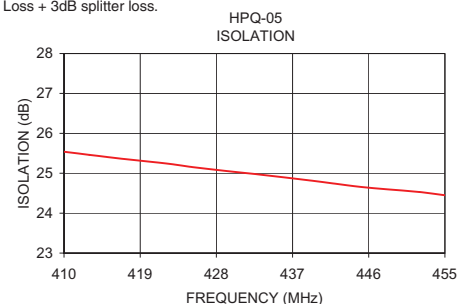
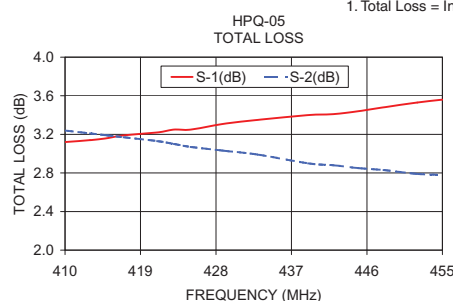
Electrical Specifications

FREQ. RANGE (MHz)	ISOLATION (dB)	INSERTION LOSS (dB) Avg. of Coupled Outputs ABOVE 3 dB	PHASE UNBALANCE (Degrees)	AMPLITUDE UNBALANCE (dB)	VSWR (:1)
f _L -f _U	Typ. Min.	Typ. Max.	Typ. Max.	Typ. Max.	S-Port Typ. Output Typ.
410-455	25 20	0.17 0.35	0.5 3.0	0.5 1.0	1.12 1.12

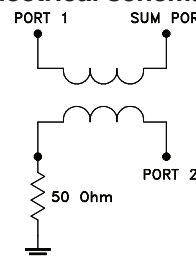
Typical Performance Data

Frequency (MHz)	Total Loss ¹ (dB)	Amplitude Unbalance (dB)	Isolation (dB)	Phase Unbalance (deg.)	VSWR S	VSWR 1	VSWR 2
	S-1	S-2					
410.00	3.12	3.24	0.13	25.54	89.67	1.14	1.13
413.00	3.14	3.21	0.07	25.46	89.75	1.14	1.13
415.00	3.16	3.19	0.03	25.41	89.85	1.14	1.13
417.00	3.19	3.17	0.02	25.36	89.81	1.14	1.13
421.00	3.22	3.13	0.08	25.27	89.85	1.14	1.14
423.00	3.25	3.10	0.15	25.22	89.94	1.14	1.14
425.00	3.25	3.07	0.18	25.16	89.90	1.14	1.14
429.00	3.31	3.03	0.28	25.06	89.93	1.14	1.14
433.00	3.35	2.99	0.36	24.97	89.85	1.14	1.14
439.00	3.40	2.90	0.50	24.82	89.85	1.14	1.14
442.00	3.41	2.88	0.54	24.74	89.78	1.14	1.14
445.00	3.44	2.85	0.60	24.66	89.76	1.14	1.14
448.00	3.48	2.83	0.65	24.60	89.73	1.15	1.14
452.00	3.53	2.79	0.73	24.53	89.84	1.15	1.14
455.00	3.56	2.78	0.78	24.45	89.90	1.15	1.14

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



electrical schematic



For detailed performance specs & shopping online see web site

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Notes: 1. Performance and quality attributes and conditions not expressly stated in this specification sheet are intended to be excluded and do not form a part of this specification sheet. 2. Electrical specifications and performance data contained herein are based on Mini-Circuits' applicable established test performance criteria and measurement instructions. 3. The parts covered by this specification sheet 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.

REV. B
M127604
HPQ-05
ED-7075
RVN/TD/CP
130313

2 Way-90° Power Splitter/Combiner

HPQ-05+

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) 1-2	VSWR (:1)		
	S-1	S-2				S	1	2
200	0.97	7.70	6.73	0.36	35.51	1.05	1.05	1.06
250	1.39	6.20	4.81	0.28	33.31	1.06	1.06	1.07
300	1.86	5.09	3.23	0.17	31.76	1.07	1.07	1.09
350	2.34	4.26	1.92	0.09	30.29	1.08	1.08	1.10
360	2.45	4.11	1.66	0.05	29.99	1.08	1.08	1.10
370	2.55	3.98	1.43	0.04	29.68	1.08	1.08	1.10
380	2.64	3.85	1.21	0.01	29.42	1.09	1.09	1.11
390	2.74	3.73	0.99	0.02	29.16	1.09	1.09	1.11
400	2.84	3.61	0.77	0.02	28.94	1.09	1.09	1.11
410	2.94	3.50	0.56	0.04	28.70	1.09	1.09	1.11
420	3.04	3.40	0.35	0.07	28.46	1.09	1.09	1.11
430	3.14	3.30	0.16	0.10	28.22	1.09	1.10	1.11
440	3.25	3.20	0.05	0.14	27.91	1.10	1.10	1.12
445	3.29	3.15	0.14	0.11	27.81	1.10	1.10	1.12
450	3.34	3.11	0.24	0.16	27.68	1.10	1.10	1.12
455	3.39	3.06	0.33	0.14	27.57	1.10	1.10	1.12
460	3.44	3.02	0.43	0.15	27.41	1.10	1.10	1.12
465	3.50	2.98	0.52	0.17	27.30	1.10	1.10	1.12
470	3.54	2.94	0.61	0.17	27.19	1.10	1.10	1.12
475	3.59	2.90	0.70	0.20	27.07	1.10	1.11	1.13
500	3.84	2.71	1.13	0.26	26.48	1.11	1.11	1.13
525	4.09	2.53	1.55	0.31	25.95	1.11	1.11	1.14
550	4.32	2.39	1.93	0.39	25.39	1.11	1.12	1.14
575	4.56	2.25	2.31	0.48	24.85	1.12	1.12	1.14
600	4.80	2.13	2.67	0.55	24.33	1.12	1.13	1.15
650	5.26	1.92	3.34	0.72	23.38	1.13	1.14	1.16
700	5.71	1.75	3.96	0.90	22.49	1.14	1.15	1.17
750	6.13	1.61	4.52	1.15	21.69	1.15	1.16	1.18
800	6.53	1.50	5.03	1.32	20.92	1.15	1.17	1.18
850	6.93	1.40	5.53	1.66	20.22	1.16	1.18	1.19
900	7.31	1.33	5.98	1.95	19.56	1.17	1.19	1.20
950	7.66	1.27	6.39	2.33	18.94	1.18	1.20	1.21
1000	8.00	1.22	6.78	2.76	18.37	1.19	1.22	1.22

¹Total Loss = Insertion Loss + 3dB Splitter Loss

REV. X2

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2 Way-90° Power Splitter/Combiner

HPQ-05+

Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS ¹ (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. From 90° (deg.)	ISOLATION (dB) 1-2	VSWR (:1)		
	S-1	S-2				S	1	2
200	0.97	7.70	6.73	0.36	35.51	1.05	1.05	1.06
250	1.39	6.20	4.81	0.28	33.31	1.06	1.06	1.07
300	1.86	5.09	3.23	0.17	31.76	1.07	1.07	1.09
350	2.34	4.26	1.92	0.09	30.29	1.08	1.08	1.10
360	2.45	4.11	1.66	0.05	29.99	1.08	1.08	1.10
370	2.55	3.98	1.43	0.04	29.68	1.08	1.08	1.10
380	2.64	3.85	1.21	0.01	29.42	1.09	1.09	1.11
390	2.74	3.73	0.99	0.02	29.16	1.09	1.09	1.11
400	2.84	3.61	0.77	0.02	28.94	1.09	1.09	1.11
410	2.94	3.50	0.56	0.04	28.70	1.09	1.09	1.11
420	3.04	3.40	0.35	0.07	28.46	1.09	1.09	1.11
430	3.14	3.30	0.16	0.10	28.22	1.09	1.10	1.11
440	3.25	3.20	0.05	0.14	27.91	1.10	1.10	1.12
445	3.29	3.15	0.14	0.11	27.81	1.10	1.10	1.12
450	3.34	3.11	0.24	0.16	27.68	1.10	1.10	1.12
455	3.39	3.06	0.33	0.14	27.57	1.10	1.10	1.12
460	3.44	3.02	0.43	0.15	27.41	1.10	1.10	1.12
465	3.50	2.98	0.52	0.17	27.30	1.10	1.10	1.12
470	3.54	2.94	0.61	0.17	27.19	1.10	1.10	1.12
475	3.59	2.90	0.70	0.20	27.07	1.10	1.11	1.13
500	3.84	2.71	1.13	0.26	26.48	1.11	1.11	1.13
525	4.09	2.53	1.55	0.31	25.95	1.11	1.11	1.14
550	4.32	2.39	1.93	0.39	25.39	1.11	1.12	1.14
575	4.56	2.25	2.31	0.48	24.85	1.12	1.12	1.14
600	4.80	2.13	2.67	0.55	24.33	1.12	1.13	1.15
650	5.26	1.92	3.34	0.72	23.38	1.13	1.14	1.16
700	5.71	1.75	3.96	0.90	22.49	1.14	1.15	1.17
750	6.13	1.61	4.52	1.15	21.69	1.15	1.16	1.18
800	6.53	1.50	5.03	1.32	20.92	1.15	1.17	1.18
850	6.93	1.40	5.53	1.66	20.22	1.16	1.18	1.19
900	7.31	1.33	5.98	1.95	19.56	1.17	1.19	1.20
950	7.66	1.27	6.39	2.33	18.94	1.18	1.20	1.21
1000	8.00	1.22	6.78	2.76	18.37	1.19	1.22	1.22

¹Total Loss = Insertion Loss + 3dB Splitter Loss

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2 Way-90° Power Splitter/Combiner

HPQ-05+

Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS ¹ (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. From 90° (deg.)	ISOLATION (dB) 1-2	VSWR (:1)		
	S-1	S-2				S	1	2
200	0.97	7.70	6.73	0.36	35.51	1.05	1.05	1.06
250	1.39	6.20	4.81	0.28	33.31	1.06	1.06	1.07
300	1.86	5.09	3.23	0.17	31.76	1.07	1.07	1.09
350	2.34	4.26	1.92	0.09	30.29	1.08	1.08	1.10
360	2.45	4.11	1.66	0.05	29.99	1.08	1.08	1.10
370	2.55	3.98	1.43	0.04	29.68	1.08	1.08	1.10
380	2.64	3.85	1.21	0.01	29.42	1.09	1.09	1.11
390	2.74	3.73	0.99	0.02	29.16	1.09	1.09	1.11
400	2.84	3.61	0.77	0.02	28.94	1.09	1.09	1.11
410	2.94	3.50	0.56	0.04	28.70	1.09	1.09	1.11
420	3.04	3.40	0.35	0.07	28.46	1.09	1.09	1.11
430	3.14	3.30	0.16	0.10	28.22	1.09	1.10	1.11
440	3.25	3.20	0.05	0.14	27.91	1.10	1.10	1.12
445	3.29	3.15	0.14	0.11	27.81	1.10	1.10	1.12
450	3.34	3.11	0.24	0.16	27.68	1.10	1.10	1.12
455	3.39	3.06	0.33	0.14	27.57	1.10	1.10	1.12
460	3.44	3.02	0.43	0.15	27.41	1.10	1.10	1.12
465	3.50	2.98	0.52	0.17	27.30	1.10	1.10	1.12
470	3.54	2.94	0.61	0.17	27.19	1.10	1.10	1.12
475	3.59	2.90	0.70	0.20	27.07	1.10	1.11	1.13
500	3.84	2.71	1.13	0.26	26.48	1.11	1.11	1.13
525	4.09	2.53	1.55	0.31	25.95	1.11	1.11	1.14
550	4.32	2.39	1.93	0.39	25.39	1.11	1.12	1.14
575	4.56	2.25	2.31	0.48	24.85	1.12	1.12	1.14
600	4.80	2.13	2.67	0.55	24.33	1.12	1.13	1.15
650	5.26	1.92	3.34	0.72	23.38	1.13	1.14	1.16
700	5.71	1.75	3.96	0.90	22.49	1.14	1.15	1.17
750	6.13	1.61	4.52	1.15	21.69	1.15	1.16	1.18
800	6.53	1.50	5.03	1.32	20.92	1.15	1.17	1.18
850	6.93	1.40	5.53	1.66	20.22	1.16	1.18	1.19
900	7.31	1.33	5.98	1.95	19.56	1.17	1.19	1.20
950	7.66	1.27	6.39	2.33	18.94	1.18	1.20	1.21
1000	8.00	1.22	6.78	2.76	18.37	1.19	1.22	1.22

¹Total Loss = Insertion Loss + 3dB Splitter Loss

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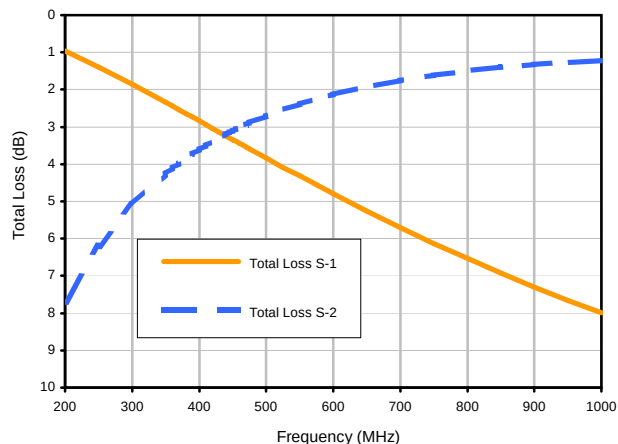


2 Way-90° Power Splitter/Combiner

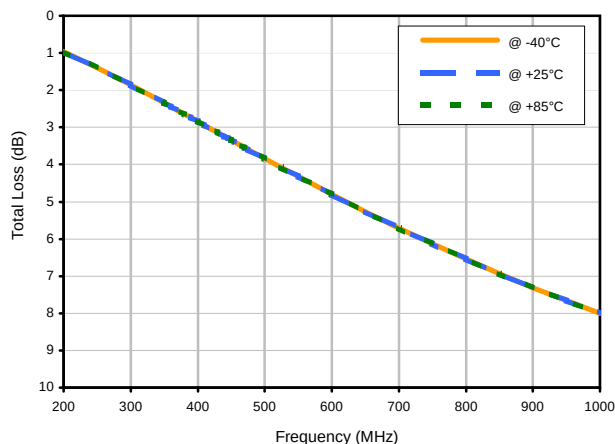
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Typical Performance Curves

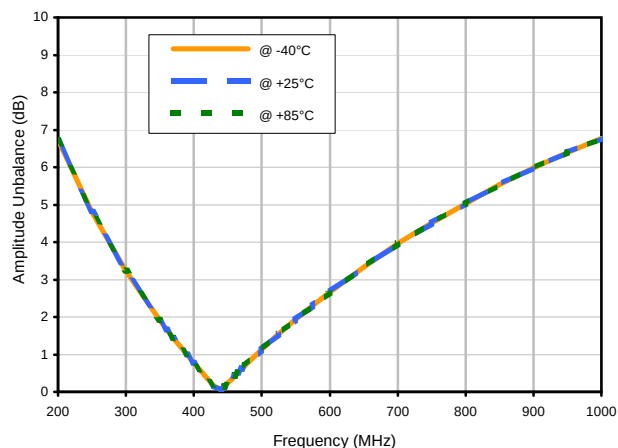
Total Loss



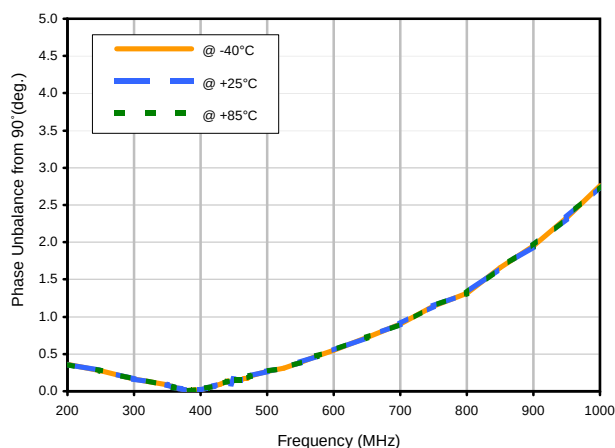
Total Loss S-1 vs. TEMPERATURE



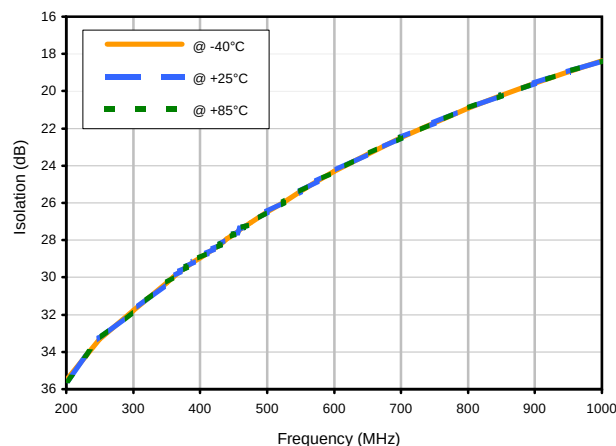
Amplitude Unbalance vs. TEMPERATURE



Phase Unbalance vs. TEMPERATURE



Isolation 1-2 vs. TEMPERATURE



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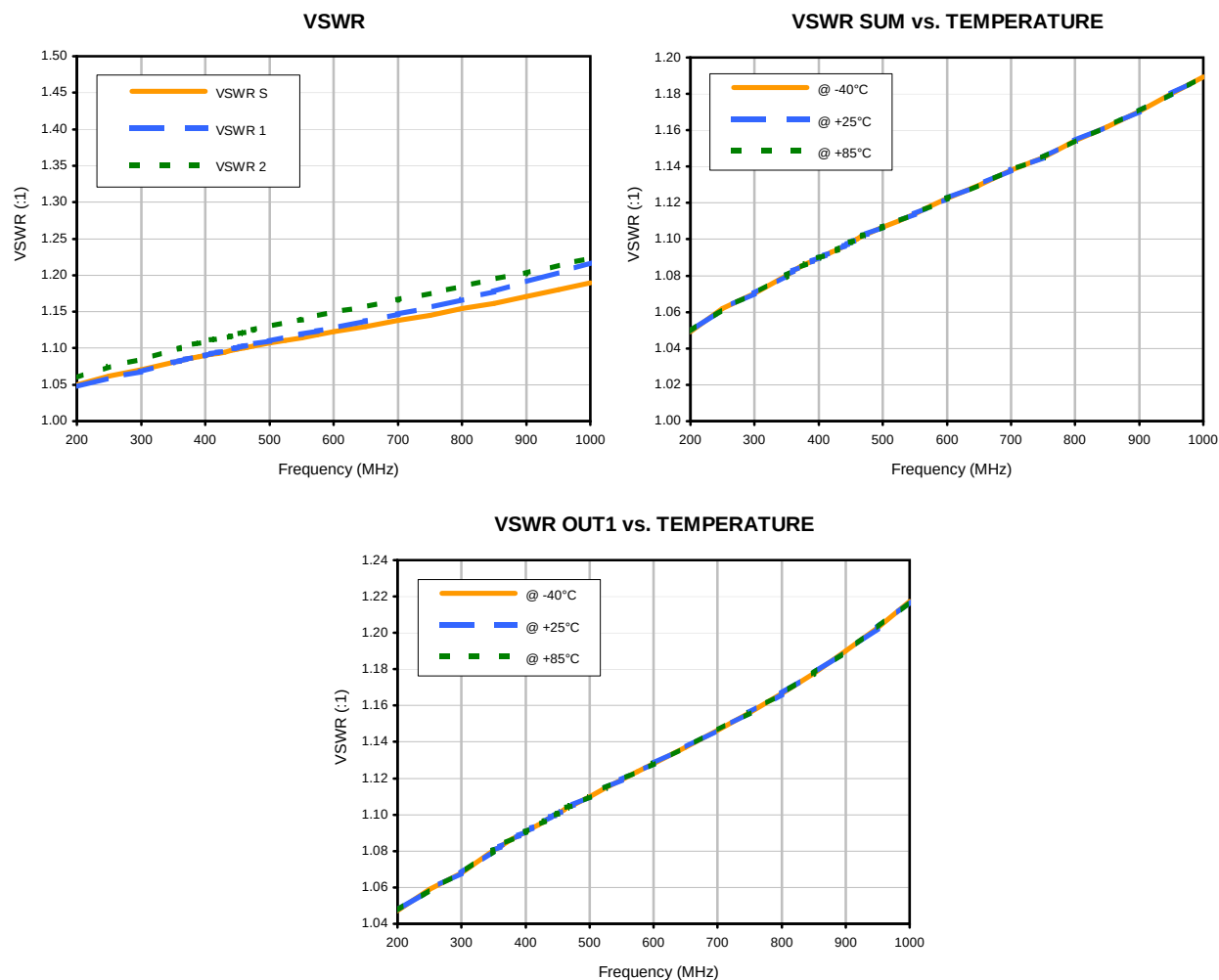


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2 Way-90° Power Splitter/Combiner

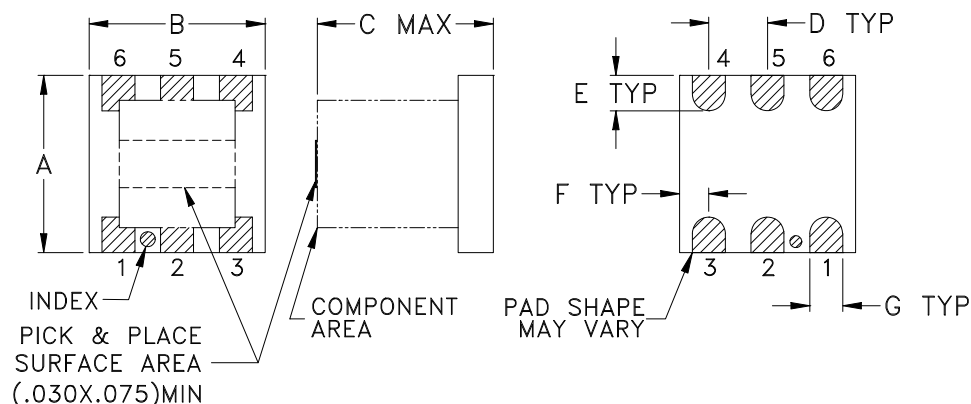
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Typical Performance Curves

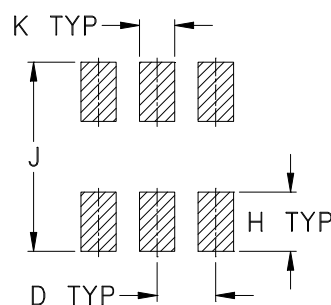


Outline Dimensions

AT577



PCB Land Pattern



Suggested Layout,
Tolerance to be within $\pm .002$

CASE #	A	B	C	D	E	F	G	H	J	K	L	WT. GRAMS
AT577	.200 (5.08)	.200 (5.08)	.200 (5.08)	.075 (1.91)	.050 (1.27)	.025 (0.64)	.026 (0.66)	.070 (1.78)	.220 (5.59)	.035 (0.89)	-- --	.15

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

Notes:

- Open style, ceramic base.
- Termination finish:
For RoHS Case Style: 2-10 μ inch (.05-.25 microns) Gold over 100-300 μ inch (2.54-7.62 microns) Nickel plate.
For RoHS-5 Case Style: Tin-Lead plate



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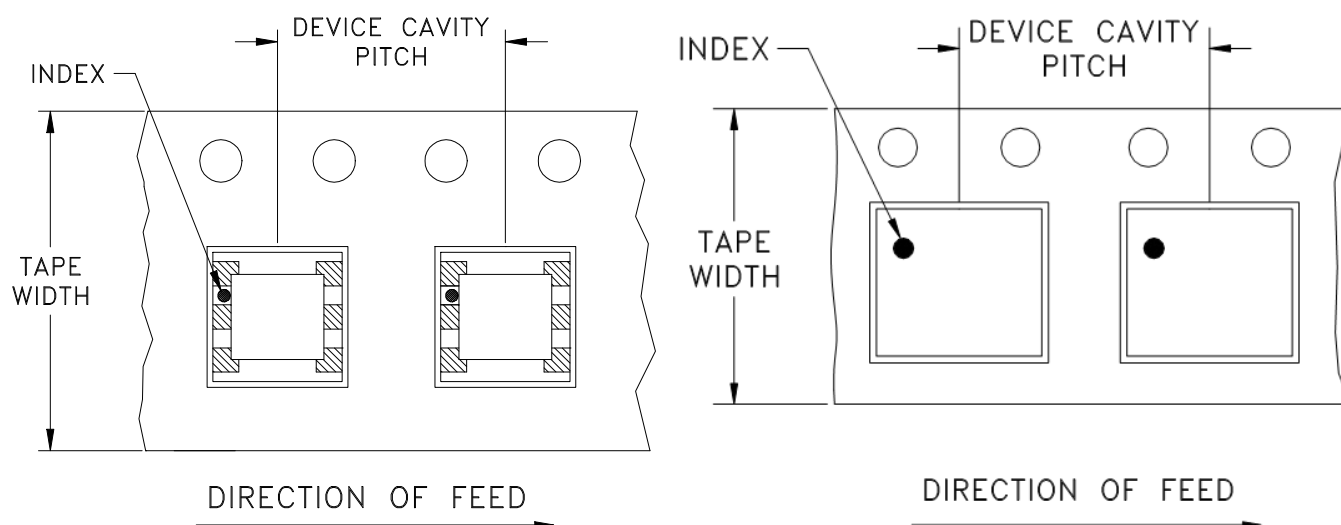


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RF/IF MICROWAVE COMPONENTS

Tape & Reel Packaging TR-F73

DEVICE ORIENTATION IN T&R



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

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

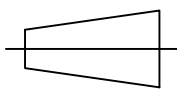


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REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M83147	NEW RELEASE	11/26/02	MMG	HY
A	M102713	ADDED "...WITH SMOBC"	01/17/06	MMG	IL

.065 TYP

.025 TYP

.066 TRACE WIDTH, 4 PL.
(SEE NOTE BELOW)

.032 TYP

.118
2 PL.

.040

.025 TYP

PIN1

13X $\varnothing$.015 PTH
FOR GROUND

PACKAGE
OUTLINE

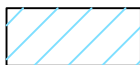
6X .038

NOTES:

1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" $\pm$.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

11/19/

TOLERANCES ON:

CHECKED

AV

11/25/

2 PL DECIMALS ±

APPROVE

HV

11 / 26 /

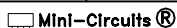
3 PL DECIMAL
ANGLES ±

--

11/30/

FRACTIONS $\pm$

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Mini-Circuits®

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Brooklyn NY 11235

PL, km, AT577, HPQ, TB-43

SIZE
A

CODE IDENT
15542

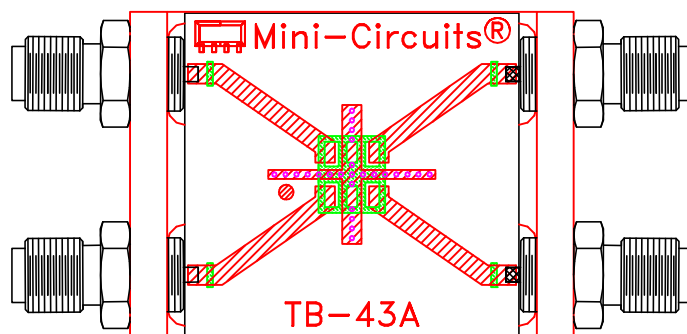
DRAWING NO:
98-PL-114

REV: A

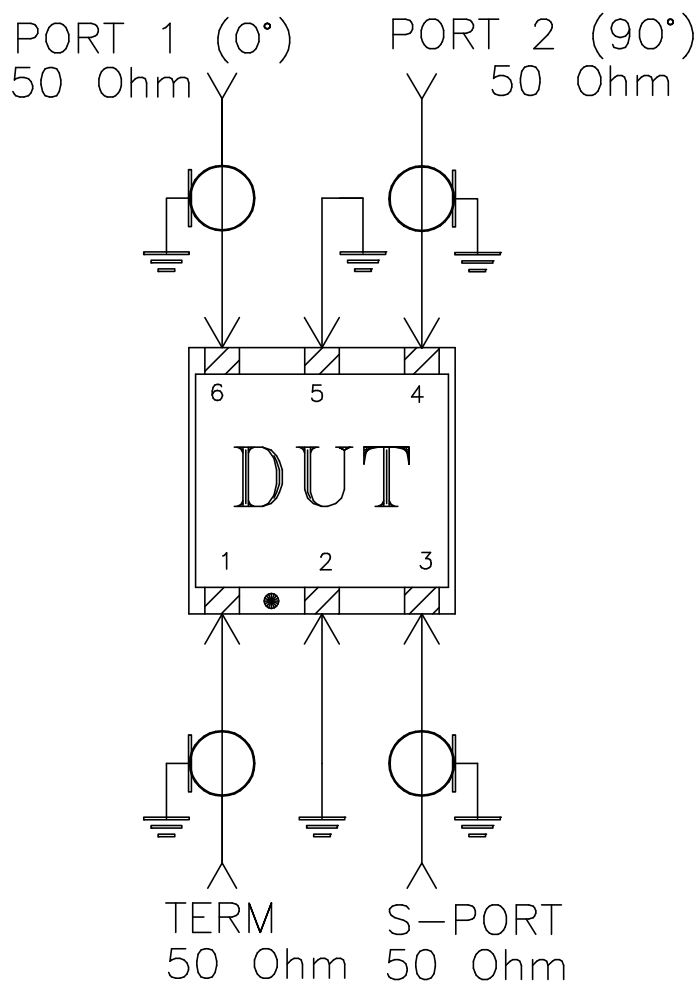
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Evaluation Board and Circuit

For Pin Connection refer to Data Sheet of the DUT



TB-43



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