



Mini-Circuits

LTCC SURFACE MOUNT

90° Hybrid

HPCJ-03-422+

50Ω 3.2 to 4.2 GHz 3 dB

THE BIG DEAL

- High Input Power Handling, Max, 50W
- Low Insertion Loss, 0.14 dB typ.
- High Isolation, 26 dB typ.
- Miniature Size, 2012 package
- LTCC Construction

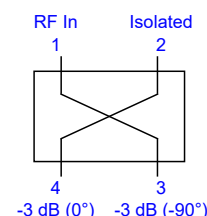


Generic photo used for illustration purposes only

APPLICATIONS

- Wireless Infrastructure
- 5G Base Stations in NR mid-band
- Satellite Communications for C-band uplink/downlink
- Test and Measurement
- Radar Systems

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' Model HPCJ-03-422+ is an LTCC 3 dB, 90° hybrid splitter/combiner operating from 3200 to 4200 MHz and supporting a variety of applications. This model provides 0.14 dB typical average insertion loss above 3 dB, 26 dB typical isolation and handles up to 50W RF input power when used as a splitter. Featuring optimized phase and amplitude unbalance, this quadrature hybrid enables operation over a wide temperature range of -55 to +125 °C. Housed in a small 0.2" x 0.125" x 0.079" form factor, the unit is ideal for dense PCB layouts and exhibits minimal performance variation due to parasitics.

KEY FEATURES

Features	Advantages
High Power Handling, 50 W Maximum	Capable of operating with up to 50 W RF input power as a splitter, the construction of the HPCJ-03-422+ makes this quadrature hybrid robust and rugged enough to be used effectively in medium power amplifier architectures with multiple devices per stage.
Low Phase Unbalance, $\pm 2^\circ$ from 90°	Improved combining efficiency and higher cancellation of odd-order harmonic distortion products.
Low Amplitude Unbalance, ± 0.8 dB	Ensures consistent signal integrity, superior power distribution and optimized efficiency for next-generation networks.
High Operating Temperature Range, -55 to +125 °C	Operation up to +125 °C allows the quadrature hybrid to be used in power amplifiers with minimal change in performance with temperature.

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ELECTRICAL SPECIFICATIONS^{1,2} AT +25°C, $Z_0 = 50\Omega$

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Units
Frequency Range		3200	-	4200	MHz
Average Insertion Loss (above 3 dB) ³	3300 - 3800	-	0.14	0.20	dB
	3200 - 4200	-	0.16	0.25	
Isolation	3300 - 3800	23	26	-	dB
	3200 - 4200	20	26	-	
Phase Unbalance (±) (Relative to 90°)	3300 - 3800	-	2	4	Degree
	3200 - 4200	-	2	5	
Amplitude Unbalance (±)	3300 - 3800	-	0.65	1	dB
	3200 - 4200	-	0.8	1.2	
Return Loss (Input, , -3 dB/_0, -3 dB/_-90, Isolated)	3300 - 3800	23	24.5	-	dB
	3200 - 4200	18	24.5	-	

1. Tested on Evaluation Board TB-HPCJ-03422C+. De-embedded to the device reference plane using TRL.

2. Symmetrical, all ports are interchangeable. See Pad Configuration Table and S-Parameters for actual performance.

3. See Page 3 for insertion loss data vs. frequency

ABSOLUTE MAXIMUM RATINGS⁴

Parameter	Ratings
Operating Temperature	-55 °C to +125 °C
Storage Temperature	-55 °C to +125 °C
Input Power ⁵	50 W at +25 °C

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

5. At +25°C derate linearly to 13 W at +125 °C.





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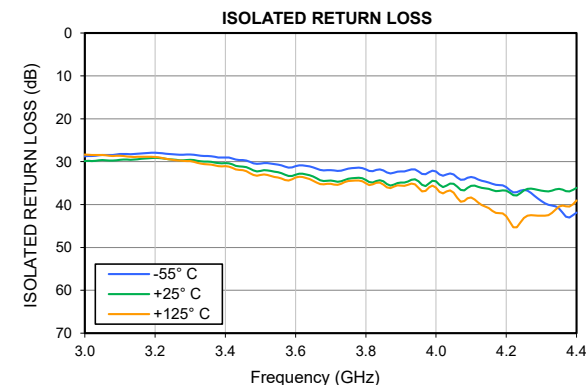
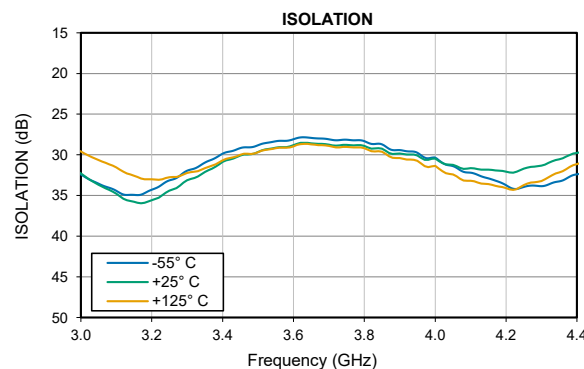
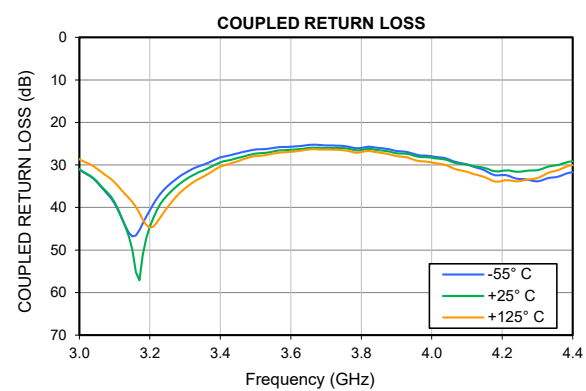
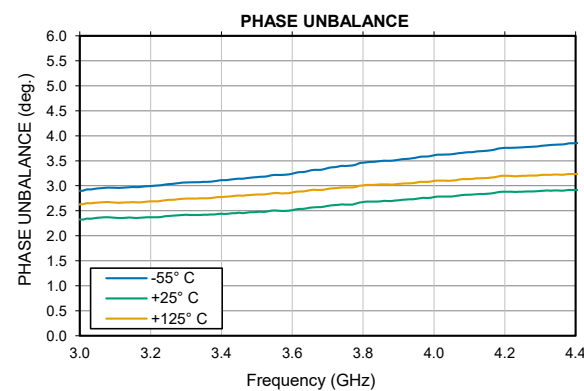
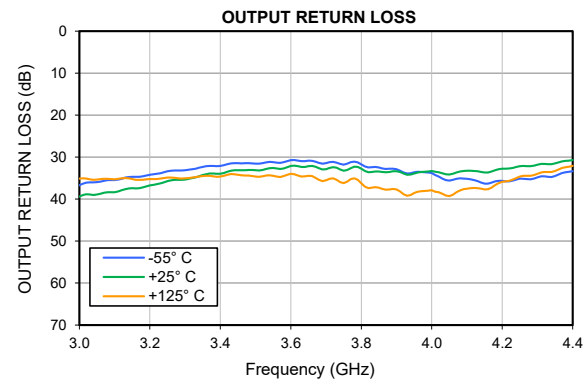
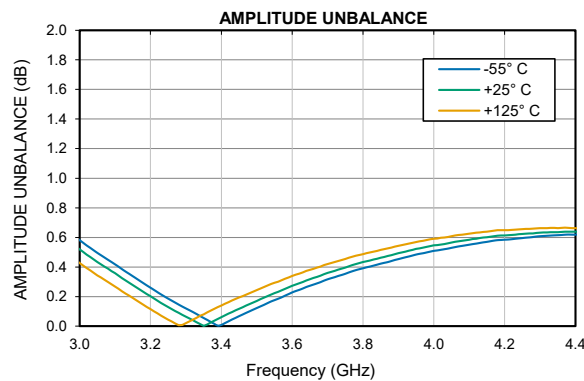
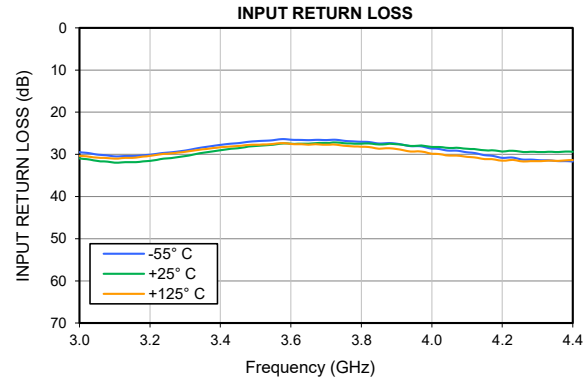
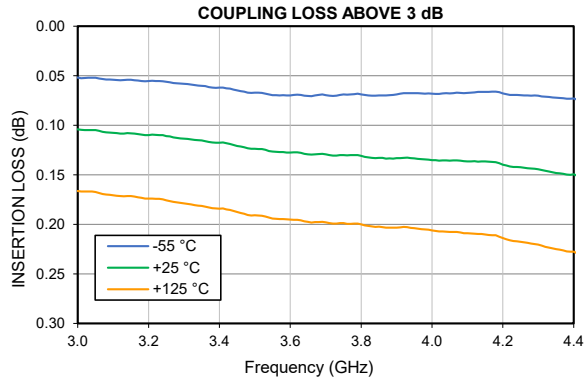
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TYPICAL PERFORMANCE GRAPHS





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FUNCTIONAL DIAGRAM

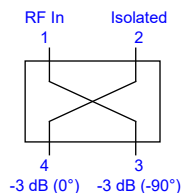
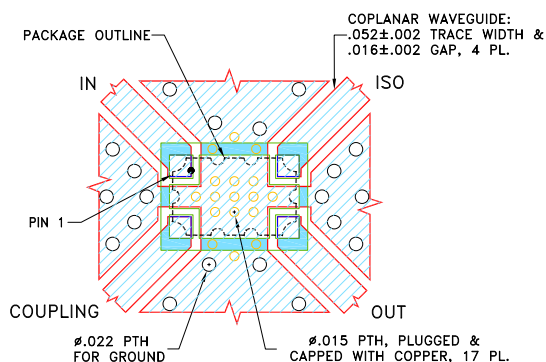


Figure 1. HPCJ-03-422+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
Input	1	Connects to RF Input Port
Isolated	2	Connects to Isolated Port
-3 dB /_-90	3	Connects to Quadrature Port
-3 dB/_0	4	Connects to In-Phase Port

SUGGESTED PCB LAYOUT (PL-846)



NOTES:

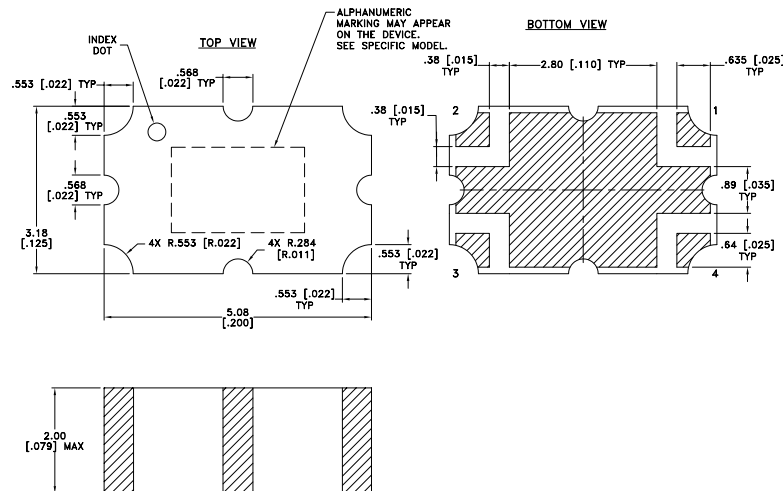
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DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

Figure 2. Suggested PCB Layout PL-846

CASE STYLE DRAWING



DENOTES METALLIZATION

Weight: 0.124 grams

Dimensions are in inches [mm]. Tolerances: 2 Pl.±.025; 3 Pl. ±.0.127 mm

PRODUCT MARKING*: Z1

*Marking may contain other features or characters for internal lot control.



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ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD.

[CLICK HERE](#)

Performance Data & Graphs	Data Graphs S-Parameter (S4P Files) Data Set (.zip file) De-embedded to device pads
Case Style	AAE3610 Lead Finish: Tin over Nickel Plating
RoHS Status	Compliant
Tape and Reel	F110
Suggested Layout for PCB Design	PL-846
Evaluation Board	TB-HPCJ-03422C+ Gerber File
Environmental Rating	ENV06T10

NOTES

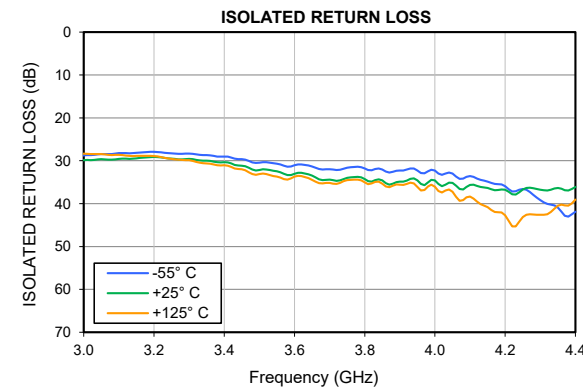
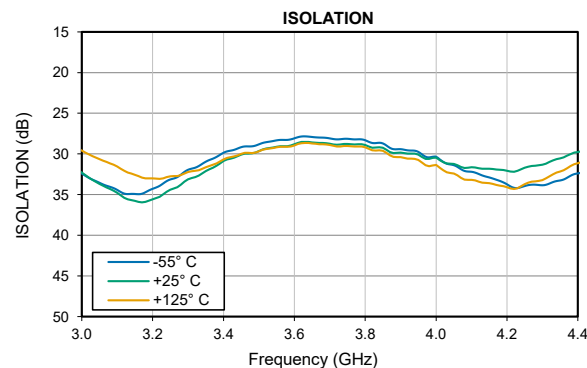
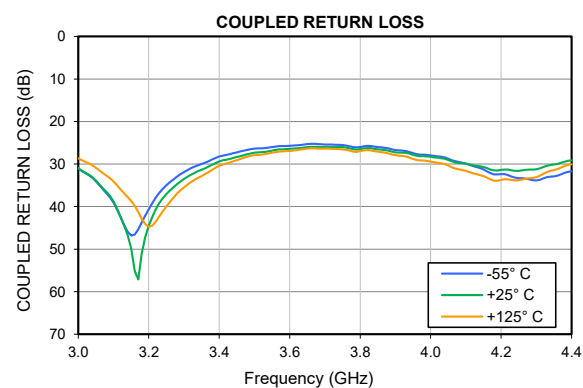
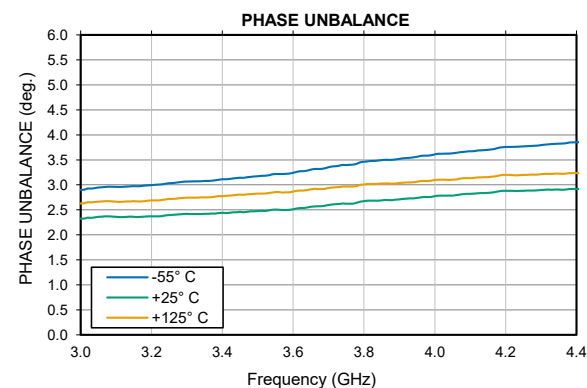
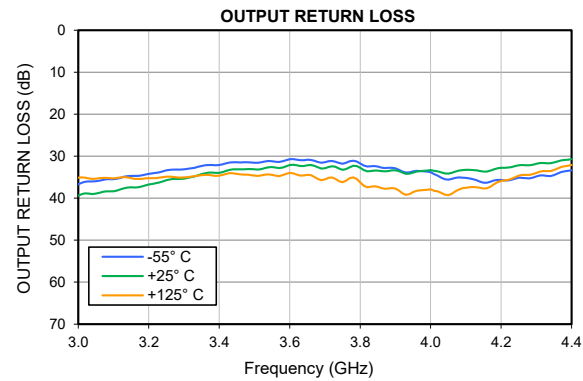
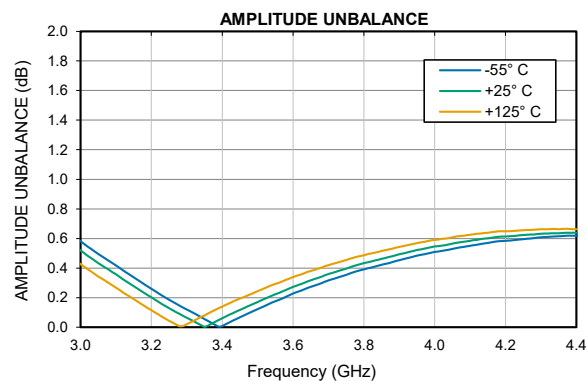
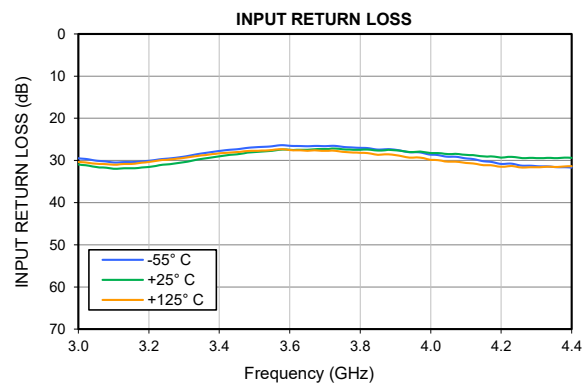
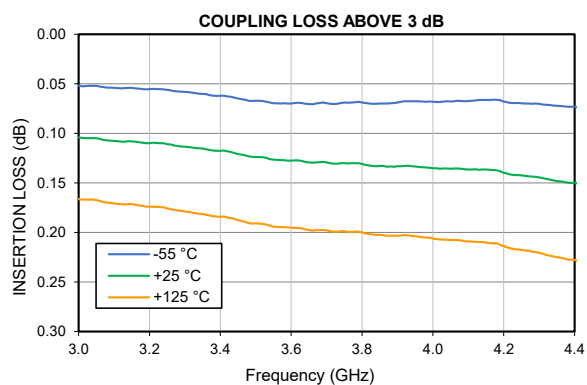
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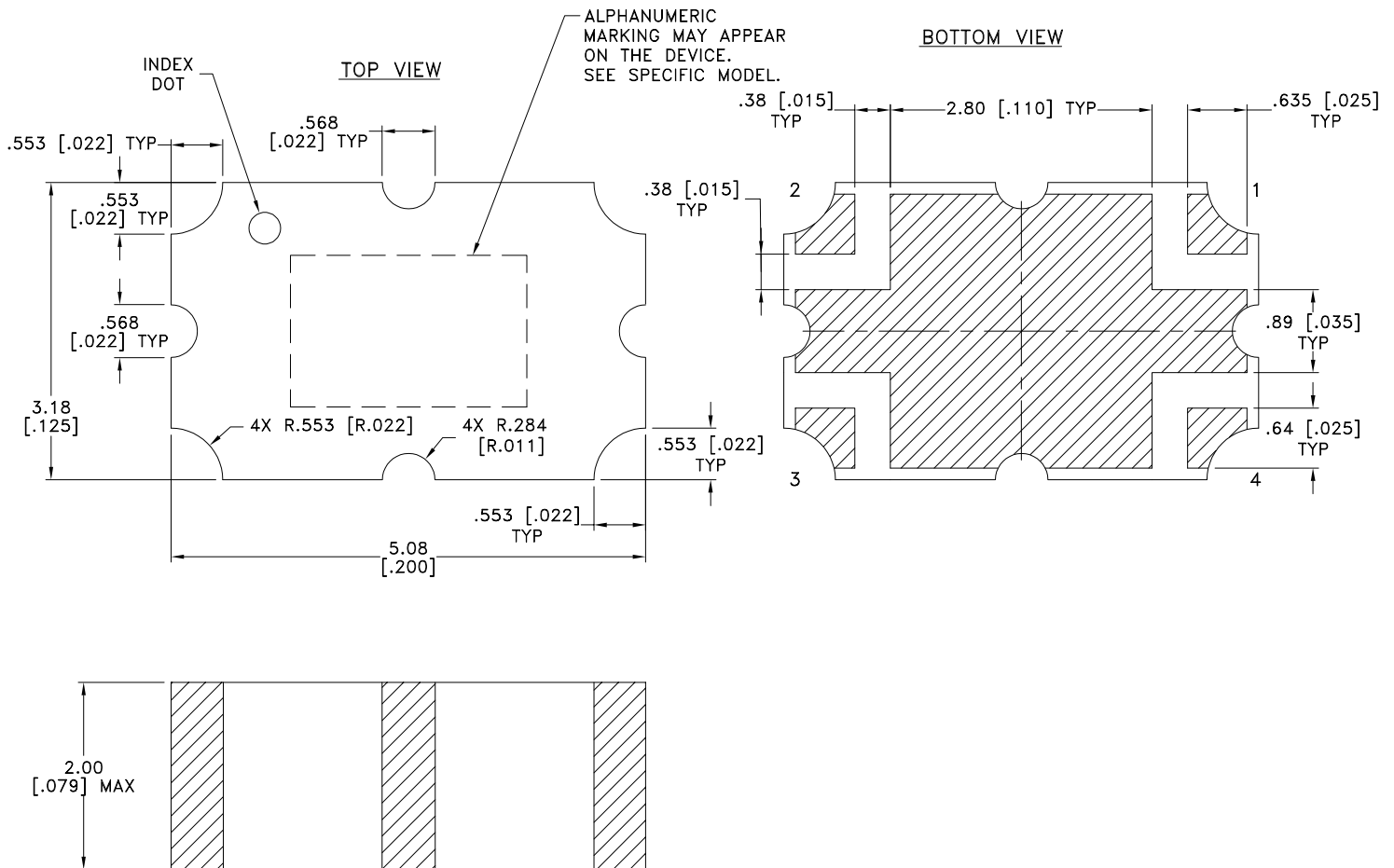


Typical Performance Data

FREQUENCY	AVERAGE INSERTION LOSS	AMPLITUDE UNBALANCE	PHASE UNBALANCE	ISOLATION	INPUT RETURN LOSS	OUTPUT RETURN LOSS	COUPLED RETURN LOSS	ISOLATED RETURN LOSS
(GHz)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
0.20	0.023	22.220	0.493	43.094	47.034	43.085	41.264	39.379
0.40	0.035	16.242	0.596	38.073	43.246	41.632	43.454	44.007
0.60	0.045	12.769	0.712	33.993	38.188	39.725	47.945	64.173
0.80	0.057	10.321	0.856	31.069	36.026	37.715	37.108	44.432
1.00	0.066	8.452	0.994	29.439	33.988	34.406	34.400	37.366
1.20	0.077	6.954	1.191	28.304	32.634	32.037	32.677	34.167
1.40	0.084	5.722	1.352	27.188	31.096	29.875	30.089	31.351
1.60	0.091	4.691	1.561	26.672	30.130	28.399	28.735	30.168
1.80	0.096	3.804	1.653	26.777	29.177	27.658	28.263	30.347
2.00	0.099	3.045	1.833	27.349	29.212	28.261	28.513	30.683
2.20	0.099	2.383	1.869	28.498	29.366	29.875	29.880	33.797
2.40	0.102	1.804	2.026	28.302	28.538	31.379	28.150	39.879
2.60	0.108	1.314	2.110	27.521	28.027	34.178	25.485	37.290
2.80	0.107	0.884	2.231	28.405	28.749	37.182	25.884	32.167
3.00	0.104	0.519	2.323	32.298	30.965	39.410	31.043	29.847
3.10	0.108	0.358	2.360	34.782	31.954	38.338	38.769	29.552
3.20	0.110	0.202	2.372	35.575	31.535	36.750	44.565	29.102
3.30	0.113	0.064	2.419	33.131	30.412	35.337	33.527	29.579
3.40	0.118	0.061	2.440	30.870	29.029	33.933	29.376	30.348
3.50	0.124	0.171	2.476	29.634	27.997	33.138	27.344	32.169
3.60	0.128	0.273	2.511	28.805	27.488	32.110	26.434	33.044
3.70	0.129	0.359	2.596	28.741	27.311	32.871	26.001	34.398
3.80	0.131	0.433	2.675	28.909	27.470	32.754	26.493	34.266
3.90	0.133	0.493	2.711	29.838	27.565	33.354	27.236	34.873
4.00	0.135	0.545	2.774	30.450	28.259	33.291	28.288	34.577
4.10	0.136	0.584	2.821	31.638	28.679	33.269	29.952	35.640
4.20	0.140	0.613	2.882	32.073	29.305	32.771	31.385	36.787
4.30	0.144	0.632	2.894	31.337	29.443	31.799	31.247	36.751
4.40	0.150	0.638	2.918	29.766	29.368	30.696	29.159	36.091
4.60	0.168	0.620	2.890	27.106	27.730	27.758	25.859	34.400
4.80	0.186	0.567	2.881	26.606	25.805	26.002	26.462	34.039
5.00	0.200	0.461	3.003	25.955	24.554	24.350	28.873	30.485
5.20	0.220	0.292	3.097	23.779	24.032	22.289	25.091	25.500
5.40	0.255	0.076	2.854	21.188	22.895	20.824	20.535	22.713
5.60	0.297	0.159	2.588	19.934	21.112	19.278	19.384	21.155
5.80	0.341	0.441	2.256	19.337	19.514	18.319	19.456	19.820
6.00	0.388	0.808	1.999	18.447	18.173	17.243	18.046	18.052
6.20	0.464	1.243	1.408	17.092	16.677	16.075	16.122	16.766
6.40	0.557	1.690	0.353	15.898	15.033	14.751	14.633	15.802
6.60	0.666	2.159	0.771	15.075	13.512	13.554	13.768	15.197
6.80	0.794	2.669	2.026	14.449	12.325	12.655	13.347	14.627
7.00	0.924	3.261	3.490	13.828	11.456	11.856	13.019	13.749
7.20	1.036	3.908	5.521	13.229	10.652	11.191	11.975	12.603
7.40	1.192	4.568	7.759	12.485	9.908	10.601	11.138	11.876
7.60	1.340	5.222	10.568	11.917	9.319	10.170	10.829	11.801
7.80	1.438	5.850	13.262	11.559	8.964	9.719	11.195	11.758
8.00	1.501	6.504	16.217	11.301	8.810	9.409	11.553	11.337
8.20	1.533	7.291	19.198	10.925	8.859	9.336	11.186	10.780
8.40	1.596	8.214	22.441	10.524	8.966	9.335	10.871	10.651
8.60	1.615	9.207	26.422	10.194	9.191	9.462	11.125	10.975
8.80	1.592	10.321	30.105	9.937	9.752	9.681	11.769	11.408
9.00	1.542	11.695	34.477	9.775	10.546	10.129	12.182	11.930
9.20	1.473	13.625	40.801	9.696	11.512	10.798	12.603	12.569
9.40	1.401	16.118	52.674	9.747	12.490	11.744	13.296	13.482
9.60	1.314	18.710	76.594	9.955	13.584	12.930	14.848	15.222
9.80	1.240	19.376	64.630	10.345	14.522	14.347	17.610	17.863
10.00	1.166	16.368	34.440	10.843	15.115	16.236	18.650	20.845

Typical Performance Curves





DENOTES METALLIZATION

Weight: 0.124 grams

Dimensions are in mm [inches]. Tolerances: 2 PL ± 0.25 ; 3 PL ± 0.127 mm

Notes:

- Case material - Ceramic.
- Termination finish - Tin over Nickel Plating.



ISO 9001 ISO 14001 CERTIFIED

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



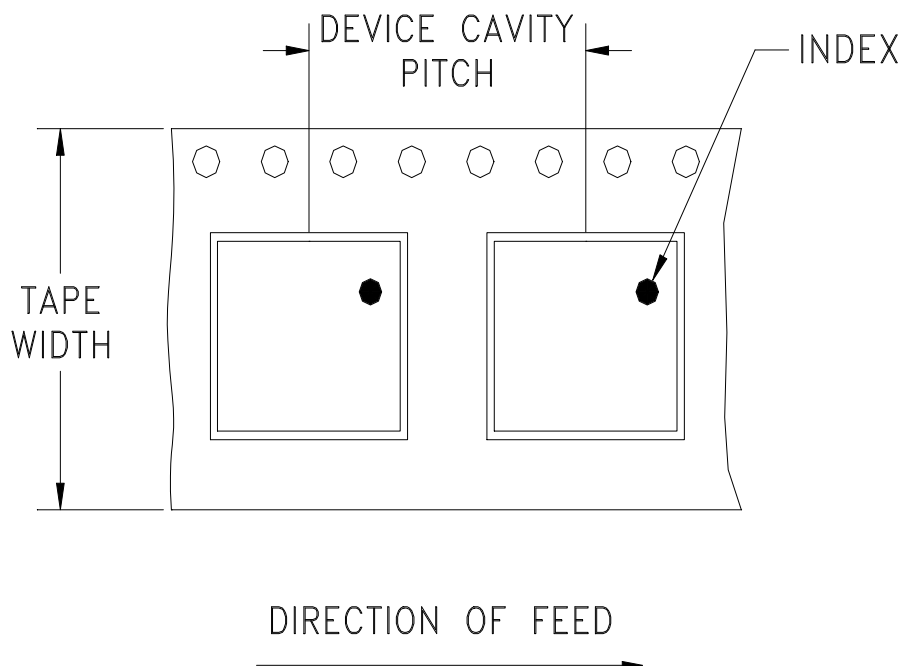
The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

RF/IF MICROWAVE COMPONENTS



Tape & Reel Packaging TR-F110

DEVICE ORIENTATION IN T&R



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

Note: Please consult individual model datasheet 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.

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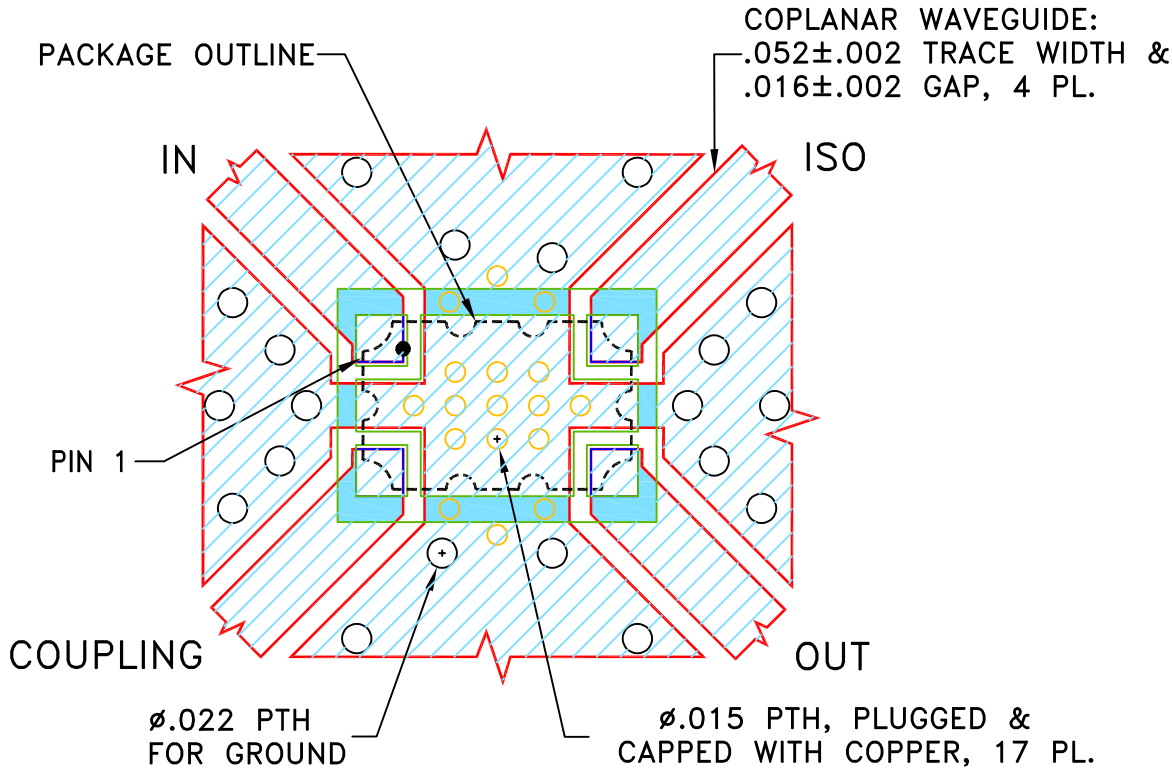
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THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-027776	NEW RELEASE	11/26/25	ITG	IL

SUGGESTED MOUNTING CONFIGURATION
FOR AAE3610 CASE STYLE



NOTES:

1. TRACE WIDTH & GAP ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS: .030±.002; COPPER: 1/2 OZ. ON EACH SIDE.
FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.

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 TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± FRACTIONS ±	DRAWN	ITG	11/26/25
	CHECKED	GF	11/26/25
	APPROVED	IL	11/26/25

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Brooklyn NY 11235

PL, AAE3610, TB-HPCJ-03422C+

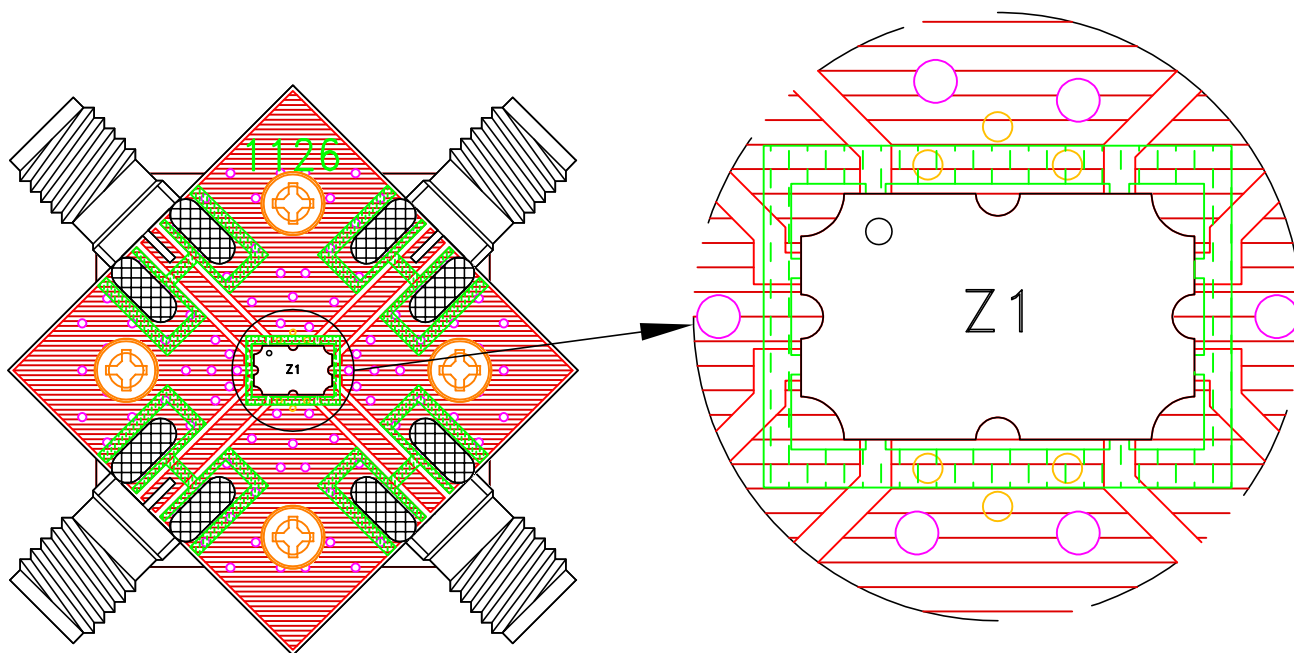
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FILE: 98PL846	SCALE: 7:1	SHEET: 1 OF 1	

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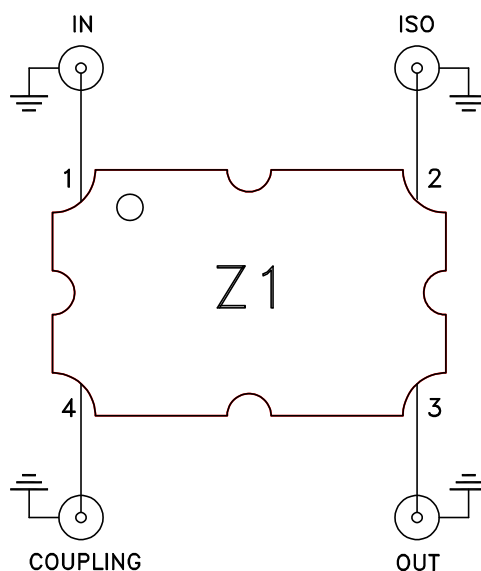
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ASHEETA1.DWG REV:A DATE:01/12/95

Evaluation Board and Circuit



TB-HPCJ-03422C+



Schematic Diagram

1. 50 Ohm SMA Female end Launch connectors.
2. PCB Material: ROGERS R04350B or equivalent,
Dielectric Constant= 3.48 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	-55° to 125° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 125° 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 Eutectic Process 225°C peak Pb-Free Process 245° - 250°C peak	J-STD-020C, Table 4-1, 4-2 and 5-2, Figure 5-1
Solderability	10X Magnification	J-STD-002, Test B,B1, 95% Coverage
Thermal Shock	-55° to +125°C, 15 min dwell, 250 cycles	MIL-STD-202, Method 107
Bend Test	1mm, deflection for 5 seconds Span of bending: 2.75"	--
High Temp Storage	125°C to 1000 Hrs	---