



LTCC SURFACE MOUNT

Power Splitter/Combiner

QCS-502+

2 Way-90° 50Ω 2500 to 5000 MHz

THE BIG DEAL

- Compact 0805 Form Factor
- Broadband Quadrature Performance
- Wideband Accuracy and Isolation

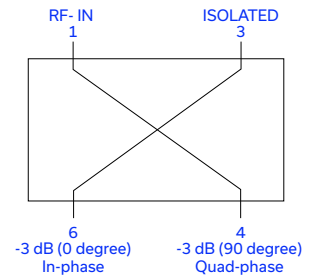


Generic photo used for illustration purposes only

APPLICATIONS

- 5G / Sub-6 GHz Infrastructure
- I/Q and Image Reject Architectures
- Balanced Amplifiers
- Phased Array Radars

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' new 90° Power Splitter, model QCS-502+, offers an industry leading combination of operating bandwidth and size by supporting a full octave band in a miniature EIA-0805 form factor. The outstanding phase and amplitude unbalance make this component a versatile building block for use in a variety of systems and sub-system designs.

KEY FEATURES

Features	Advantages
Small Size	Offered in the EIA-0805 package size, the QCS-502+ offers an industry leading combination of size, bandwidth and frequency. The small footprint (2.0mm x1.25mm) allows for reduced parasitics in systems with improved performance and simplified layout
Low Phase and Amplitude Unbalance	Supporting 1.5 deg. and 0.7 dB unbalance make this 90° hybrid applicable for use in higher level integrated components such as image reject mixers, single sideband modulators, phase shifters, variable attenuators, and balanced amplifiers.
High Power Handling	Capable of operating up to 8W, the LTCC construction of the QCS-502+ makes this 90° hybrid a robust, rugged product that can be used effectively in either the transmit or receive path

REV. OR
ECO-029654
QCS-502+
MCL NY
260521





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ELECTRICAL SPECIFICATIONS^{1,2} AT +25 °C, Z₀ = 50Ω

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		2500	-	5000	MHz
Average Insertion Loss, above 3.0 dB ³	2500 - 3300	-	0.5	0.6	dB
	3300 - 3800	-	0.5	0.6	
	3800 - 4200	-	0.4	0.5	
	4200 - 5000	-	0.5	0.6	
Isolation	2500 - 3300	15	17	-	dB
	3300 - 3800	15	17	-	
	3800 - 4200	16	18	-	
	4200 - 5000	17	20	-	
Phase Unbalance (±)	2500 - 3300	-	1.8	3.5	Degree
	3300 - 3800	-	1.5	3.5	
	3800 - 4200	-	2	3.5	
	4200 - 5000	-	3.2	4.5	
Amplitude Unbalance (±)	2500 - 3300	-	1	1.3	dB
	3300 - 3800	-	0.7	1	
	3800 - 4200	-	0.7	1	
	4200 - 5000	-	0.7	1	
Return Loss (Input, -3 dB (0°), -3 dB (-90°), Isolated)	2500 - 3300	12.7	15.5	-	dB
	3300 - 3800	14	17.7	-	
	3800 - 4200	17.7	20.8	-	
	4200 - 5000	15.5	17.7	-	

1. Tested on Evaluation Board P/N TB-QCS-502C+ with the connector and feedline effects de-embedded using the 2X Thru IEEE P370 method
2. Symmetrical, all ports are interchangeable. See Pad Description table and S-parameters for actual performance.
3. See Page 3 for average insertion loss data vs. frequency

ABSOLUTE MAXIMUM RATINGS⁴

Parameter	Ratings
Operating Temperature	-55 °C to +125 °C
Storage Temperature	-55 °C to +125 °C
Power Input (as a splitter) ⁵	8 W at +25 °C

4. Permanent damage may occur if any of these limits are exceeded.
5. At +25 °C derate linearly to 2.25 W at +125 °C.





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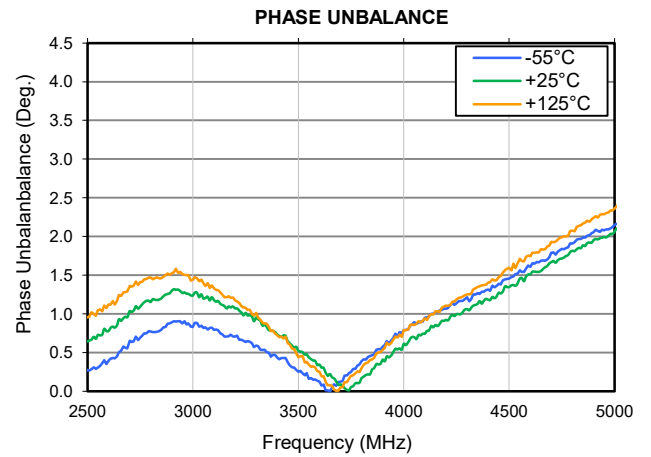
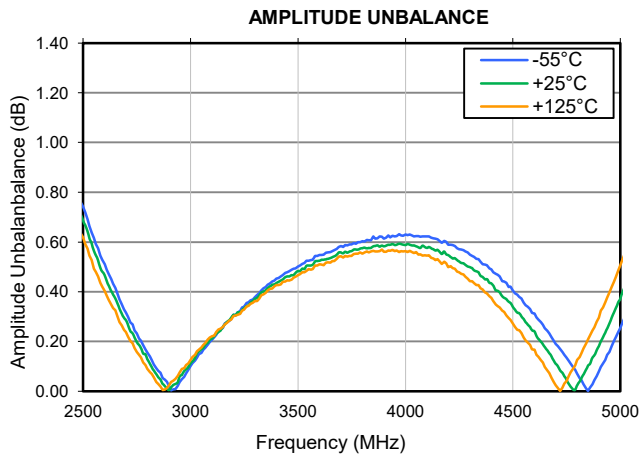
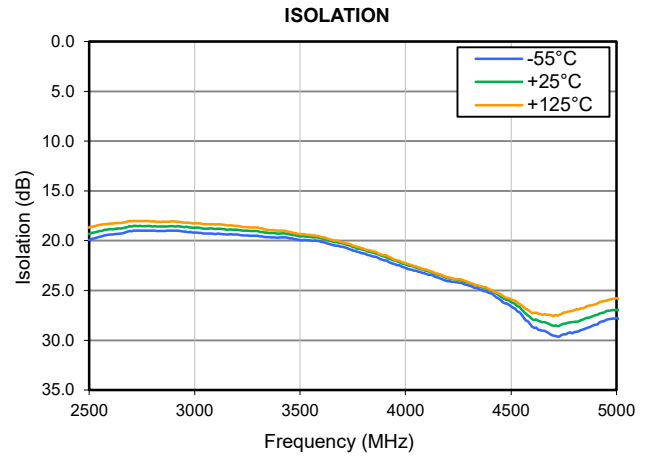
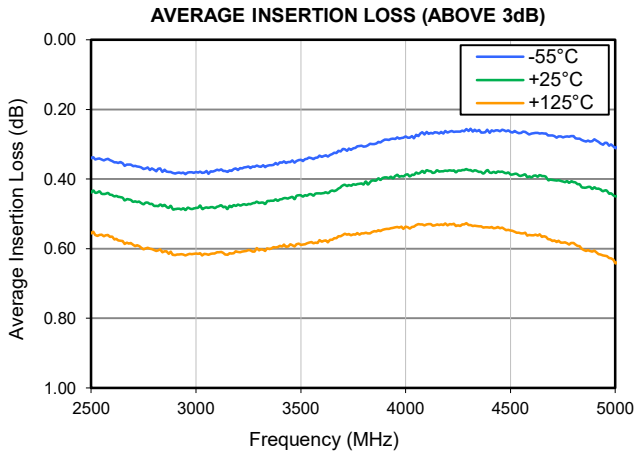
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TYPICAL PERFORMANCE GRAPHS





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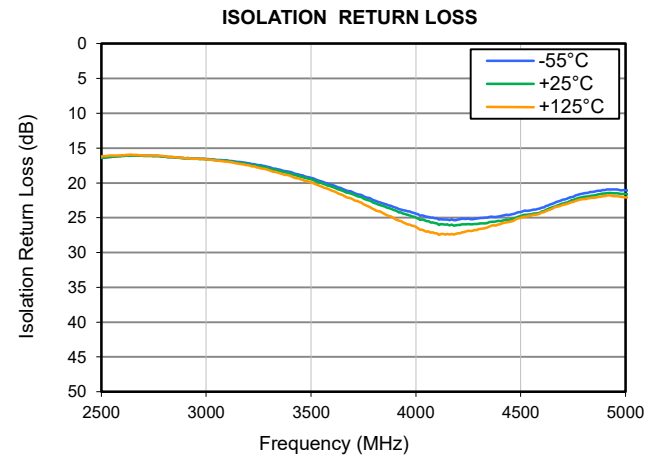
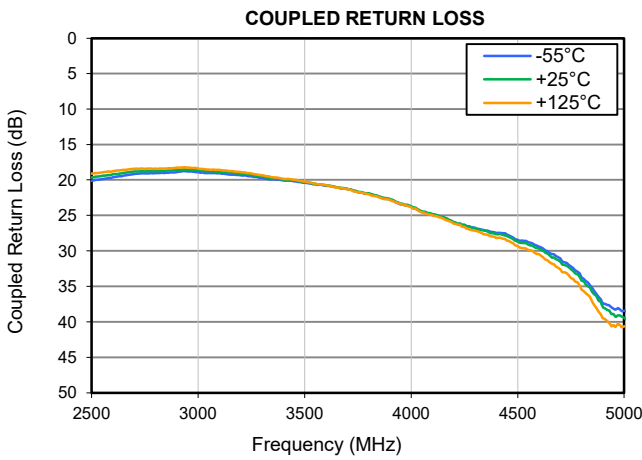
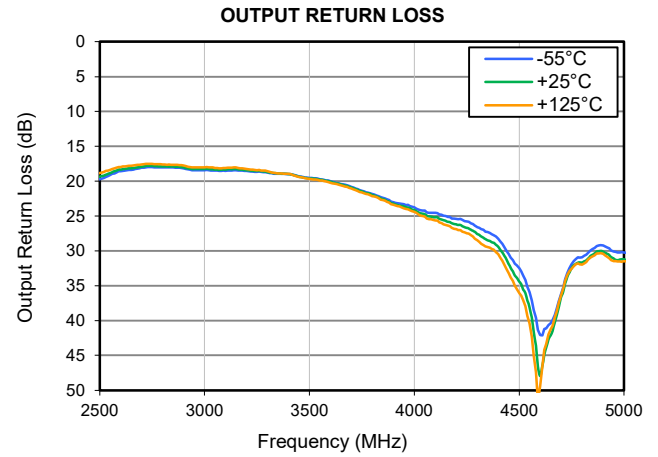
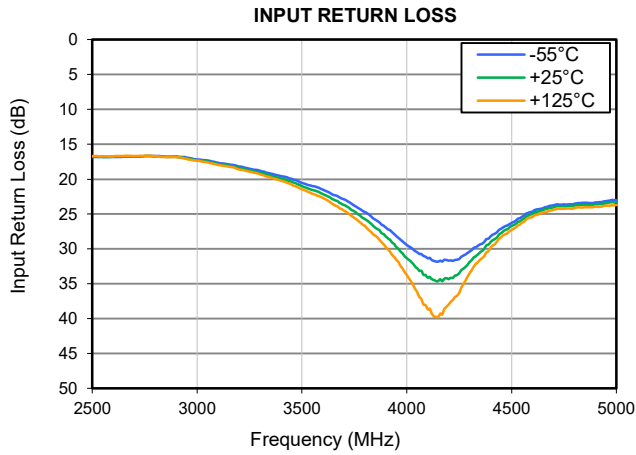
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FUNCTIONAL DIAGRAM

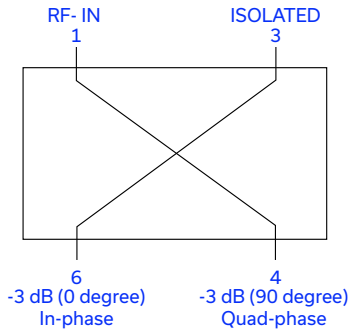
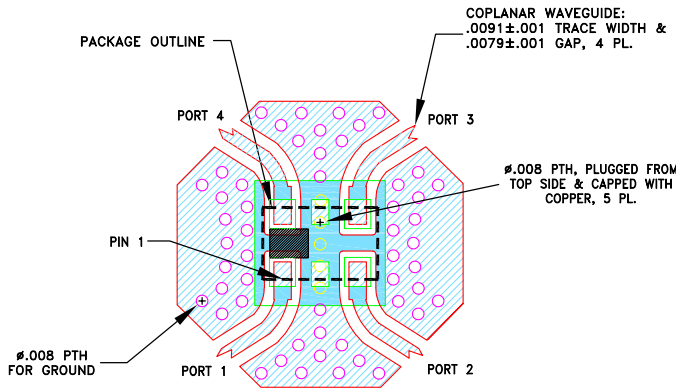


Figure 1. QCS-502+ Functional Diagram

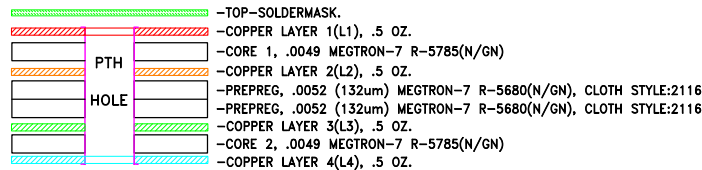
PAD DESCRIPTION

Function	Pad Number	Description
RF Input	1	Connects to RF Input Port
Ground	2	Connects to Ground
Isolated	3	Connects to Isolated Port
-3 dB (-90°)	4	Connects to Quadrature Port
Ground	5	Connects to Ground
-3 dB (0°)	6	Connects to In-Phase Port

SUGGESTED PCB LAYOUT (PL-869)



STACK-UP DIAGRAM



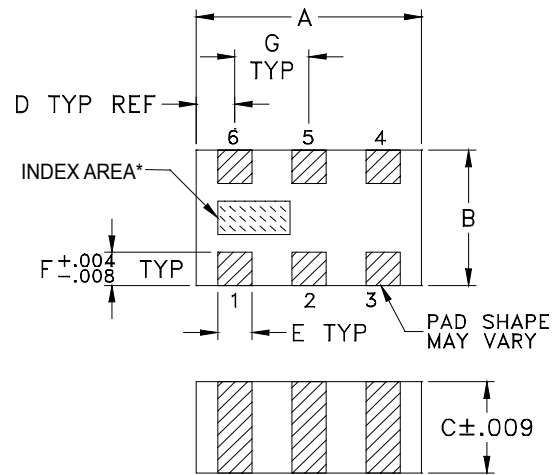
- TOTAL FINISHED THICKNESS 0.0236±.004
- PTH PRESENT FROM COPPER LAYER 1 TO COPPER LAYER 4.
- INDICATED ON TOP VIEW PTH'S ARE PLUGGED WITH EPOXY AND CAPPED WITH COPPER FROM TOP SIDE.
- L2, L3 & L4 ARE CONTINUOUS GROUND PLANE.

NOTES:

- TRACE WIDTH & GAP ARE SHOWN FOR MEGTRON-7 R-5785 WITH DIELECTRIC THICKNESS 0.0049±0.0005; 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.

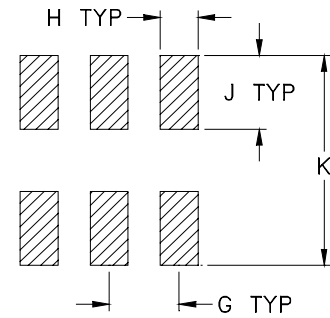
Figure 2. QCS-502+Suggested PCB Layout

OUTLINE DRAWING



*Shape of index marking may vary

PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

OUTLINE DIMENSIONS (Inches/mm)

A	B	C	D	E	F
.079	.049	.033	.014	.012	.012
2.00	1.25	0.84	0.35	0.30	0.30
G	H	J	K		wt
.026	.014	.039	.110		grams
0.65	0.35	1.00	2.80		.008

Tolerances: 2Pl. + .01; 3 Pl. + .005

PRODUCT MARKING*: CP

*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	GE0805C-1 Lead Finish: Tin over Nickel Plating
RoHS Status	Compliant
Tape and Reel	F74
Suggested Layout for PCB Design	PL-869
Evaluation Board	TB-QCS-502C+ Gerber File
Environmental Rating	ENV06

- 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-Circuits' 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

