

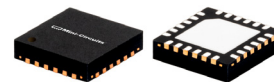
2 Way-90°

50Ω

5 to 11 GHz

The Big Deal

- Wideband (5-11 GHz)
- Good Isolation and Return Loss
- Highly repeatable performance (GaAs based design)
- No external termination required
- High power handling (>30dBm)
- Small Size MCLP 4x4mm



CASE STYLE: DG1847

Product Overview

Mini-Circuits' EPQ-113+ is a wideband 5-11 GHz, 90° hybrid. It splits an input signal into two output signals with quadrature phase shift between them. It provides low loss, wideband in a small layout size and handles high power with good VSWR.

Key Features

Feature	Advantages
Small Size	The EPQ-113+ offers an industry leading combination of size, bandwidth and frequency. The small footprint (4mm x4 mm) allows for reduced parasitics in systems with improved performance and simplified layout.
Low Phase and Amplitude Unbalance	3.7 deg. and 0.8 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 balance amplifiers.
High Power Handling	Capable of operating up to 32 dBm, MMIC structure of EPQ-113+ makes this 90° hybrid a robust, rugged product that can be used effectively in either the transmit or receive paths.

Power Splitter/Combiner

EPQ-113+

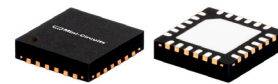
2 Way-90° 50Ω 5 to 11 GHz

Features

- Low insertion loss, 0.6 dB typ. at 7-9 GHz
- Good isolation, 19 dB typ. at 7-9 GHz
- Miniature size, 4x4 mm
- High power handling (>30 dBm)

Applications

- Balanced amplifiers
- Modulators
- Attenuator
- Point to Point
- Military



Generic photo used for illustration purposes only

CASE STYLE: DG1847

+RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Electrical Specifications at 25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		5000		11000	MHz
Insertion Loss, (Avg. of Mainline & Coupled) above 3dB	5000 - 6000	—	0.5	1.1	dB
	6000 - 7000	—	0.6	1.2	
	7000 - 9000	—	0.6	1.4	
	9000 - 10000	—	0.7	1.5	
	10000 - 11000	—	0.8	1.8	
Isolation	5000 - 6000	16	19	—	dB
	6000 - 7000	16	19	—	
	7000 - 9000	16	19	—	
	9000 - 10000	16	19	—	
	10000 - 11000	14	18	—	
Amplitude Unbalance	5000 - 6000	—	0.4	1.4	dB
	6000 - 7000	—	0.4	1.2	
	7000 - 9000	—	0.8	1.5	
	9000 - 10000	—	0.7	1.4	
	10000 - 11000	—	0.2	1.1	
Phase Unbalance (Deviation from 90°)	5000 - 6000	—	1.9	6.6	Degree
	6000 - 7000	—	2.4	7.6	
	7000 - 9000	—	3.7	8.8	
	9000 - 10000	—	4.1	9.7	
	10000 - 11000	—	4.2	—	
Input VSWR	5000 - 6000	—	1.2	—	:1
	6000 - 7000	—	1.2	—	
	7000 - 9000	—	1.2	—	
	9000 - 10000	—	1.2	—	
	10000 - 11000	—	1.3	—	
Output VSWR (0°&90°)	5000 - 6000	—	1.2	—	:1
	6000 - 7000	—	1.2	—	
	7000 - 9000	—	1.1	—	
	9000 - 10000	—	1.1	—	
	10000 - 11000	—	1.2	—	

Maximum Ratings

Parameter	Ratings
Operating Temperature	-45°C to 85°C
Storage Temperature	-65°C to 150°C
Power Input (as a splitter)	32 dBm (5 minute max.) 30 dBm (continuous)
Internal Dissipation	30 dBm

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

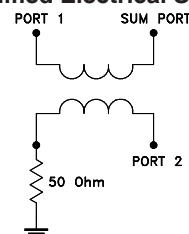
* ESD rating

Human body model (HBM): Class 1A(250 to <500 V) in accordance with ANSI/ESD 5.1-2007

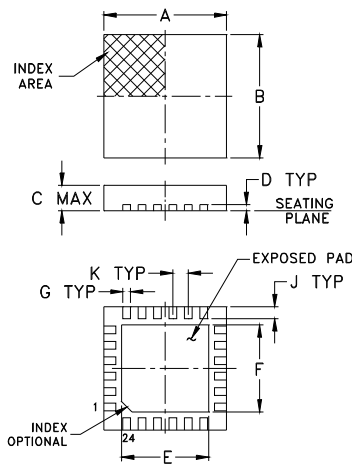
Pad Connections

Function	Pad Number
SUM PORT	1
PORT 1 (0°)	9
PORT 2 (+90°)	22
NC	2-8, 10-21,23,24

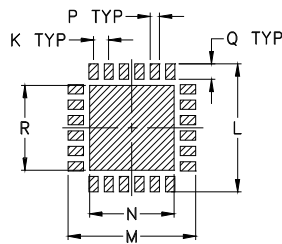
Simplified Electrical Schematic



Outline Drawing



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

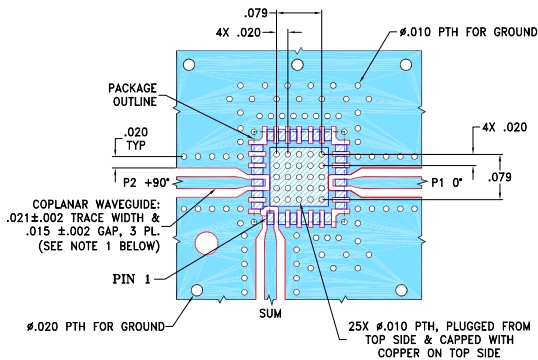
Product Marking



Outline Dimensions (inch/mm)

A	B	C	D	E	F	G	H	J
.157	.157	.039	.008	.104	.104	.009	--	.016
4.0	4.0	1.0	0.20	2.64	2.64	0.23	--	0.41
K	L	M	N	P	Q	R		wt
.020	.166	.166	.102	.012	.020	.102		grams
0.50	4.22	4.22	2.59	0.30	0.51	2.59		0.04

Demo Board MCL P/N: TB-961-113+
Suggested PCB Layout (PL-520)

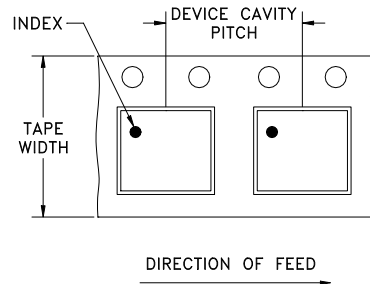


NOTES:

- TRACE WIDTH AND GAP PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .010" ±001; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP 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

Tape and Reel (F68)

DEVICE ORIENTATION IN T&R

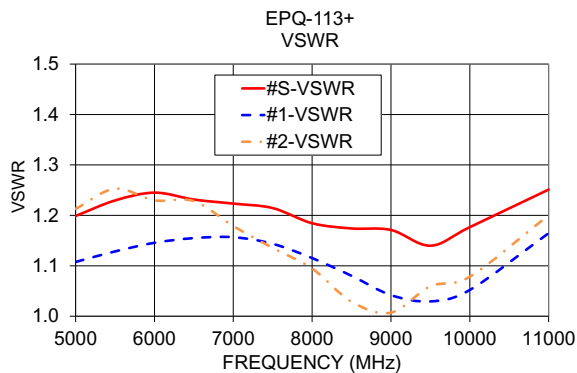
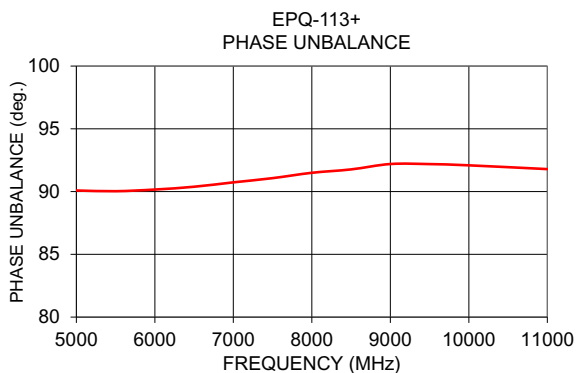
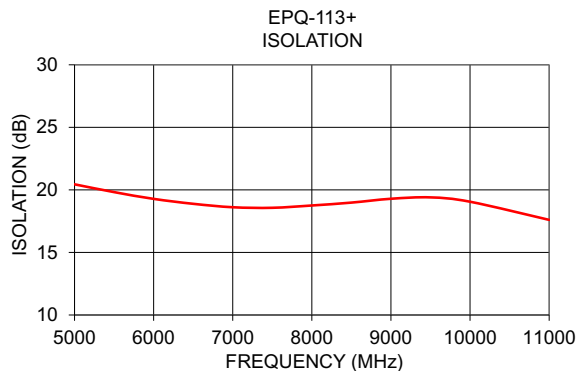
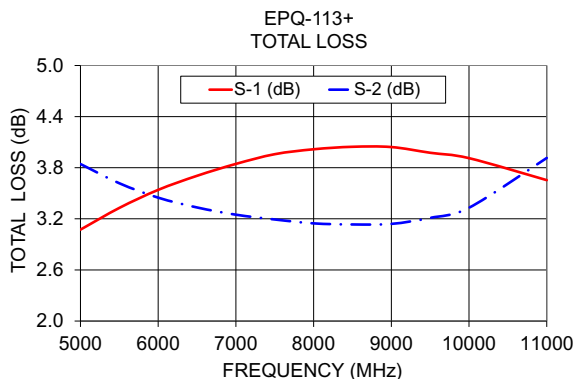


Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note
12	8	7	Small quantity standard
			20
			50
			100
		7	Standard
			1000
13	Standard	2000	
		3000	
			4000

Typical Performance Data

Frequency (MHz)	Total Loss ¹ (dB)		Amplitude Unbalance (dB)	Isolation (dB)	Phase Unbalance (deg.)	VSWR (:1) S	VSWR (:1) 1	VSWR (:1) 2
	S-1	S-2						
5000	3.07	3.84	0.8	20.45	90.1	1.20	1.11	1.21
5500	3.33	3.62	0.3	19.82	90.0	1.23	1.13	1.25
6000	3.54	3.45	0.1	19.28	90.2	1.25	1.15	1.23
6500	3.71	3.33	0.4	18.89	90.4	1.23	1.15	1.23
7000	3.84	3.25	0.6	18.61	90.7	1.22	1.16	1.18
7500	3.96	3.19	0.8	18.57	91.1	1.21	1.14	1.14
8000	4.02	3.15	0.9	18.75	91.5	1.18	1.12	1.09
8500	4.05	3.13	0.9	18.98	91.8	1.17	1.08	1.03
9000	4.04	3.14	0.9	19.29	92.2	1.17	1.04	1.01
9500	3.98	3.21	0.8	19.40	92.2	1.14	1.03	1.06
10000	3.91	3.33	0.6	19.05	92.1	1.18	1.05	1.08
11000	3.65	3.91	0.3	17.60	91.8	1.25	1.16	1.20

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



Additional 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/MCLStore/terms.jsp

