MMIC Surface Mount

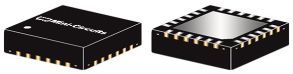
Power Splitter/Combiner

EPQ-133+

2 Way-90° 50Ω 6000 to 14000 MHz

The Big Deal

- Wideband (6-14 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-133+ is a wideband 6-14 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-133+ 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	3.4 deg. and 0.5 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-133+ makes this 90° hybrid a robust, rugged product that can be used effectively in either the transmit or receive paths.

MMIC Surface Mount

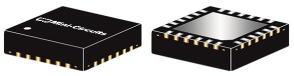
Power Splitter/Combiner

EPQ-133+

2 Way-90° 50Ω 6000 to 14000 MHz

Features

- Low insertion loss, 0.6 dB typ. at 8-10 GHz
- Good isolation, 20 dB typ. at 8-10 GHz
- Miniature size, 4x4 mm
- High Power



CASE STYLE: DG1847

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

Applications

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

Electrical Specifications at 25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		6000		14000	MHz
Insertion Loss, (Avg. of Mainline & Coupled) above 3dB	6000 - 8000	—	0.6	1.1	dB
	8000 - 10000	—	0.6	1.2	
	10000 - 12000	—	0.8	1.5	
	12000 - 14000	—	1.0	2.0	
Isolation	6000 - 8000	16	20	—	dB
	8000 - 10000	16	20	—	
	10000 - 12000	14	18	—	
	12000 - 14000	13	16	—	
Amplitude Unbalance	6000 - 8000	—	0.5	1.7	dB
	8000 - 10000	—	0.5	1.2	
	10000 - 12000	—	0.6	1.2	
	12000 - 14000	—	0.4	1.6	
Phase Unbalance (Deviation from 90°)	6000 - 8000	—	2.9	5.7	Degree
	8000 - 10000	—	3.4	7.0	
	10000 - 12000	—	4.1	8.8	
	12000 - 14000	—	4.4	—	
Input VSWR	6000 - 8000		1.2		:1
	8000 - 10000		1.2		
	10000 - 12000		1.4		
	12000 - 14000		1.6		
Output VSWR (0°&90°)	6000 - 8000		1.2		:1
	8000 - 10000		1.1		
	10000 - 12000		1.3		
	12000 - 14000		1.5		

Maximum Ratings

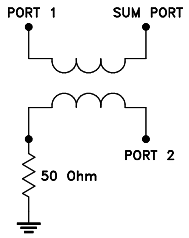
Parameter	Ratings
Operating Temperature	-45°C to 85°C
Storage Temperature	-65°C to 150°C
Power Input (as a splitter)	32 dBm
Internal Dissipation	30 dBm

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

Pad Connections

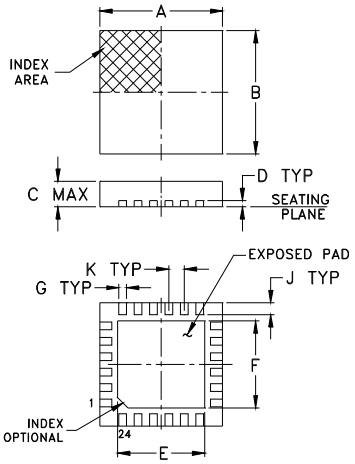
Function	Pad Number
SUM PORT	1
PORT 1 (0°)	9
PORT 2 (+90°)	22
NC	2-8, 10-21,23,24

Simplified Electrical Schematic

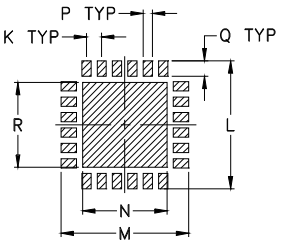


* ESD rating
Human body model (HBM): Class 1A(250 to <500 V) in accordance with ANSI/ESD 5.1-2007

Outline Drawing



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

Product Marking

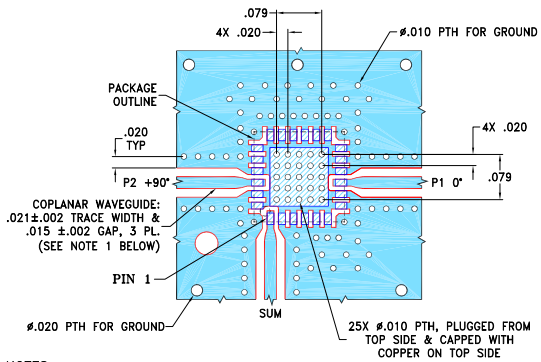
Lead Finish: Matte-Tin

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-961-133+
Suggested PCB Layout (PL-520)



NOTES:

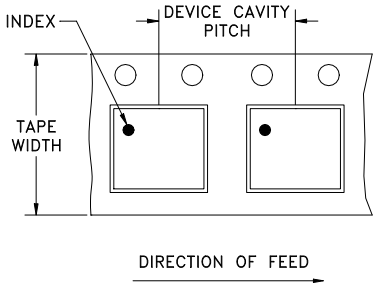
1. TRACE WIDTH AND GAP PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010" ±001; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Tape and Reel (F68)

DEVICE ORIENTATION IN T&R



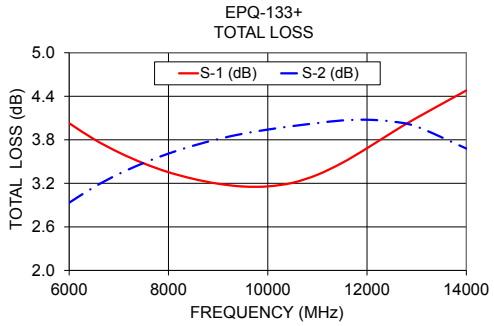
DIRECTION OF FEED

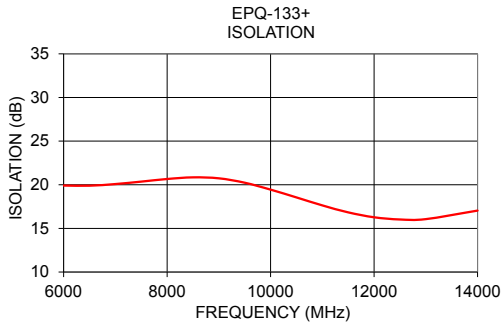
Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
12	8	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000
		13	Standard	2000
				3000
				4000

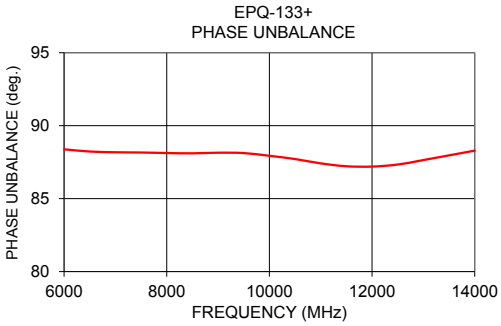
Typical Performance Data

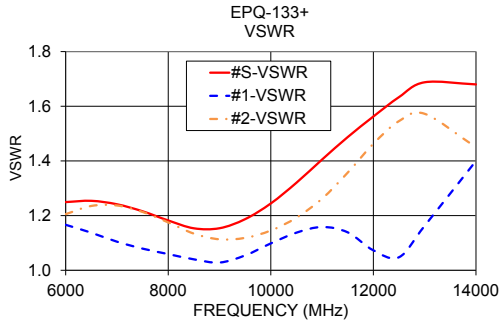
Frequency (MHz)	Total Loss[1] (dB)		Amplitude Unbalance (dB)	Isolation (dB)	Phase Unbalance (deg.)	VSWR (:1) S	VSWR (:1) 1	VSWR (:1) 2
	S-1	S-2						
6000	4.03	2.93	1.10	19.91	88.38	1.25	1.17	1.21
6500	3.81	3.15	0.66	19.89	88.23	1.25	1.14	1.24
7000	3.63	3.33	0.30	20.08	88.18	1.24	1.10	1.24
7500	3.48	3.48	0.00	20.36	88.16	1.22	1.08	1.21
8000	3.35	3.61	0.26	20.66	88.13	1.18	1.06	1.18
8500	3.26	3.72	0.46	20.85	88.11	1.15	1.04	1.13
9000	3.19	3.81	0.61	20.74	88.15	1.15	1.03	1.11
9500	3.16	3.88	0.73	20.23	88.12	1.19	1.05	1.12
10000	3.16	3.94	0.78	19.44	87.94	1.24	1.10	1.15
10500	3.21	3.99	0.78	18.55	87.71	1.32	1.14	1.19
11000	3.32	4.03	0.71	17.64	87.42	1.41	1.16	1.26
11500	3.48	4.07	0.58	16.84	87.22	1.49	1.14	1.36
12000	3.68	4.08	0.39	16.27	87.20	1.56	1.07	1.46
12500	3.90	4.05	0.15	16.02	87.34	1.63	1.05	1.55
13000	4.10	3.98	0.12	16.06	87.64	1.69	1.16	1.57
14000	4.48	3.68	0.80	17.04	88.29	1.68	1.40	1.45

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-Circuit's 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