



Mini-Circuits

MICROWAVE

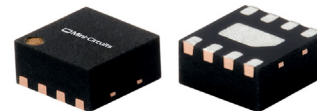
Gain Equalizer

EQY-5-24+

50Ω 5 dB DC to 20 GHz

THE BIG DEAL

- Excellent Return Loss, 20 dB Typ.
- Wide Bandwidth, DC to 20 GHz
- Small Size, 2x2 mm 8-Lead QFN-Style Package
- 5.1 dB Slope



Generic photo used for illustration purposes only

CASE STYLE: MC1631-1

APPLICATIONS

- Fixed Satellite
- Mobile
- Radio Location
- Space Research

+RoHS Compliant

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

PRODUCT OVERVIEW

EQY-5-24+ is an absorptive Gain Equalizer fabricated using highly repetitive GaAs MMIC process incorporating resistors, capacitors, and inductors having negative insertion loss slope. EQY-5-24+ has a nominal attenuation slope of 5.1 dB and is packaged in a tiny 2x2 mm 8-lead QFN-style package.

KEY FEATURES

Feature	Advantages
Negative Insertion Loss Slope vs. Frequency	Useful for compensating negative gain slope of amplifiers, receivers, and transmitters to achieve flat gain versus frequency.
Wide Range of Values 0,2,3,5,6,8,10,12 dB	EQY-XX-24+ Series' identical package and footprint enables circuit designers to swap nominal insertion loss slopes, without board layout redesigns.
Wideband Operation, DC to 20 GHz	Supports a wide array of applications including wireless cellular, microwave communications, satellite, defense and aerospace, medical, and optical applications.
Excellent Power Handling Capability	Enables its use at the output of a variety of amplifiers.
Small Size and Simple to Use (2x2 mm 8-Lead QFN-Style Package)	As a single chip solution, the EQY-XX-24+ Series occupies less board space than a lumped element approach, minimizes component count, and ensures repeatable performance over a wide frequency range.

REV. B
ECO-026456
EQY-5-24+
MCL NY
250805



**ELECTRICAL SPECIFICATIONS¹ AT +25°C, 50Ω, UNLESS NOTED OTHERWISE**

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		DC		20	GHz
Insertion Loss	0.01	5.5	5.7	6.1	dB
	5		5.0		
	10		3.2		
	18	0.7	1.0	1.3	
	20		0.7		
VSWR	0.01 - 5		1.13		:1
	5 - 10		1.24		
	10 - 18		1.29		
	18 - 20		1.06		

1. Measured on Mini-Circuits Characterization Test Board TB-EQY-5-24+. See Characterization Test Circuit (Fig. 1).

ABSOLUTE MAXIMUM RATINGS²

Parameter	Ratings
Operating Case Temperature	-55°C to +105°C
Storage Temperature	-65°C to +150°C
RF Input Power ³	+34 dBm

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

3. Derates linearly to +32 dBm at +105°C.



Mini-Circuits

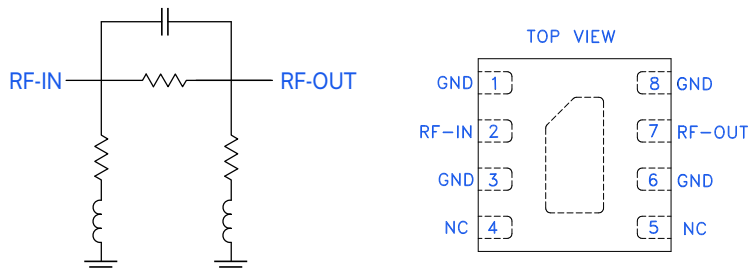
MICROWAVE

Gain Equalizer

EQY-5-24+

50Ω 5 dB DC to 20 GHz

SIMPLIFIED SCHEMATIC & PAD DESCRIPTION



Function	Pad Number	Description
RF-IN	2	RF-Input pad
RF-OUT	7	RF-Output pad
GND	1,3,6,8, & Paddle	Ground
NC	4,5	No connection, connected to ground externally on test board.

CHARACTERIZATION TEST CIRCUIT

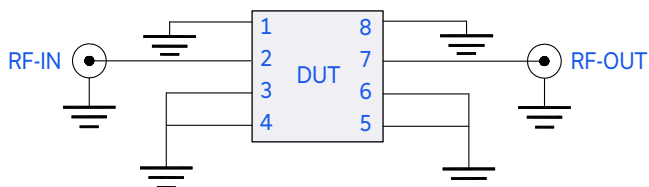
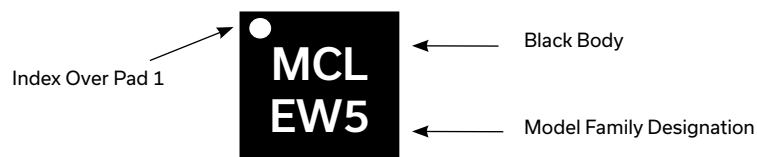


Fig 1. Block Diagram of Test Circuit used for characterization. Test Board TB-EQY-5-24+
Conditions: Attenuation & Return Loss $P_{IN} = 0$ dBm

PRODUCT MARKING



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



MICROWAVE

Gain Equalizer

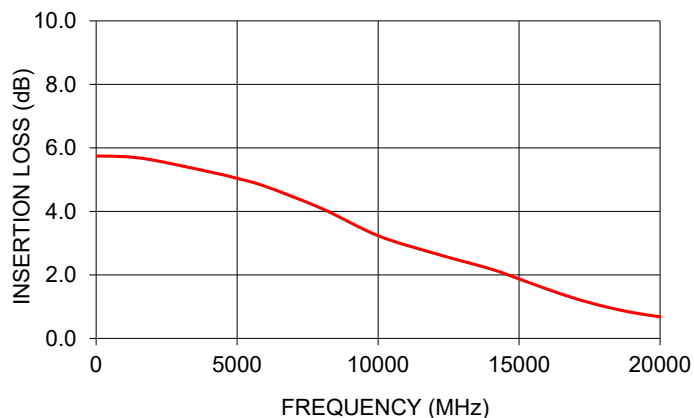
EQY-5-24+

50Ω 5 dB DC to 20 GHz

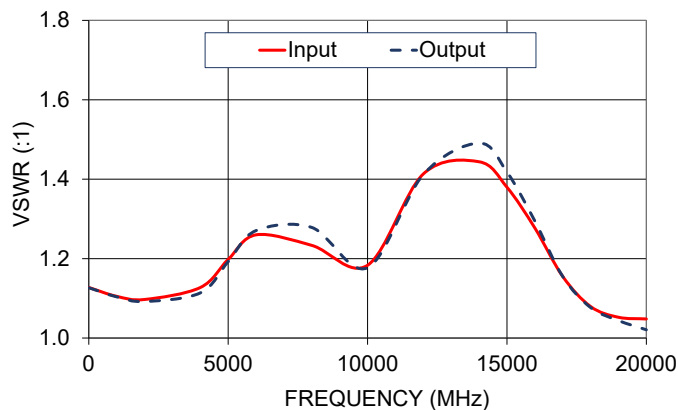
TYPICAL PERFORMANCE DATA AT +25°C

Frequency (MHz)	Insertion Loss (dB)	Input VSWR (:1)	Output VSWR (:1)
10	5.74	1.13	1.13
1000	5.72	1.11	1.10
2000	5.62	1.10	1.09
4000	5.25	1.13	1.11
5000	5.04	1.20	1.19
6000	4.79	1.26	1.27
8000	4.09	1.23	1.28
10000	3.23	1.18	1.18
12000	2.68	1.41	1.41
14000	2.18	1.44	1.49
15000	1.87	1.38	1.42
16000	1.55	1.28	1.29
17000	1.25	1.16	1.16
18000	1.01	1.08	1.08
19000	0.82	1.05	1.04
20000	0.68	1.05	1.02

EQY-5-24+
INSERTION LOSS



EQY-5-24+
VSWR





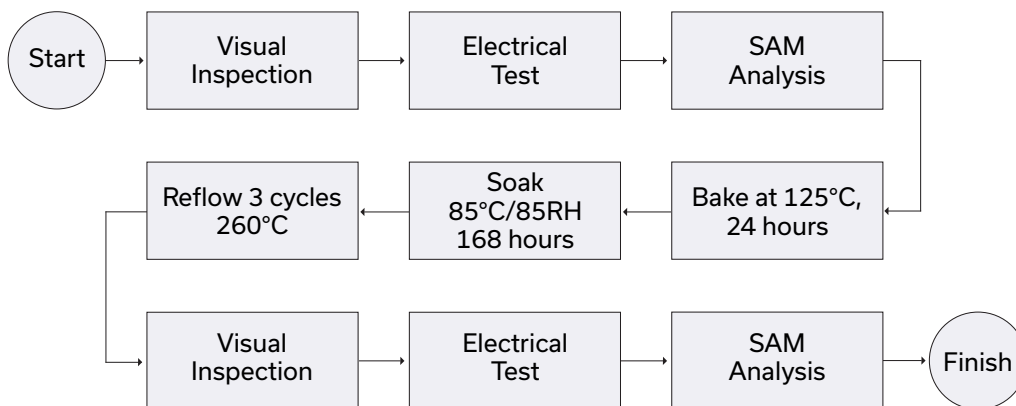
ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD. TO ACCESS [CLICK HERE](#)

Performance Data	Data Table
	Swept Graphs
Case Style	MC1631-1 Plastic package, Lead finish: Matte-tin
Tape & Reel Standard Quantities Available on Reel	F66 7" Reels with 20, 50, 100, 200, 500, 1000, 2000, or 3000 devices
Suggested Layout for PCB Design	PL-618
Evaluation Board	TB-EQY-5-24+
Environmental Ratings	ENV08T1

ESD RATING

Human Body Model (HBM): Class 2 (Pass 2000 V) in accordance with ANSI/ESD STM 5.1 - 2001 Machine.

MSL TEST FLOW CHART

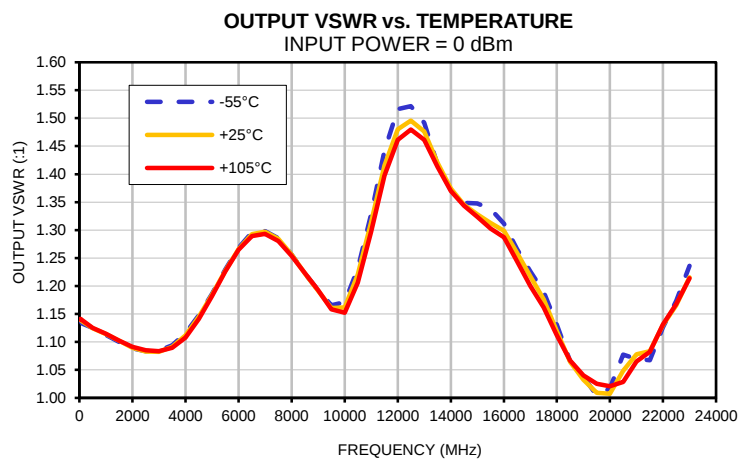
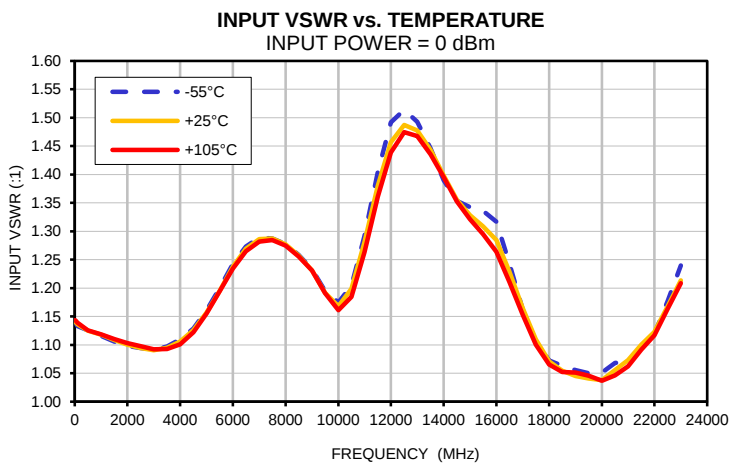
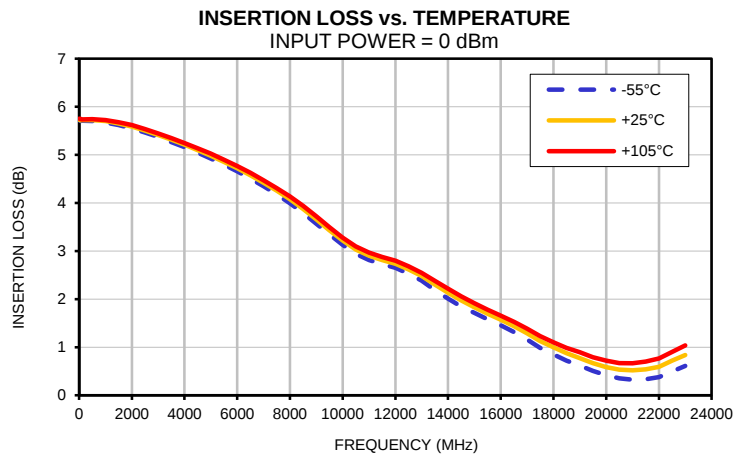


NOTES

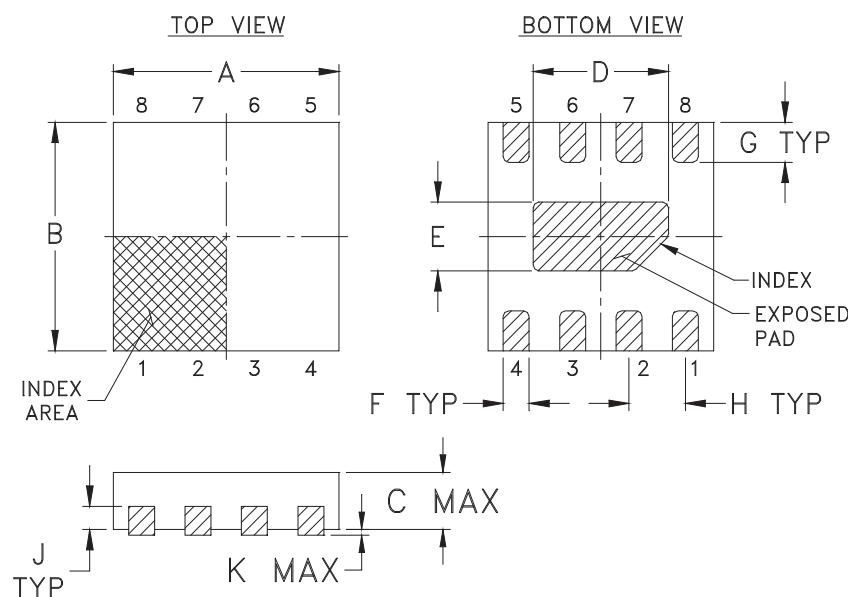
- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
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Typical Performance Data

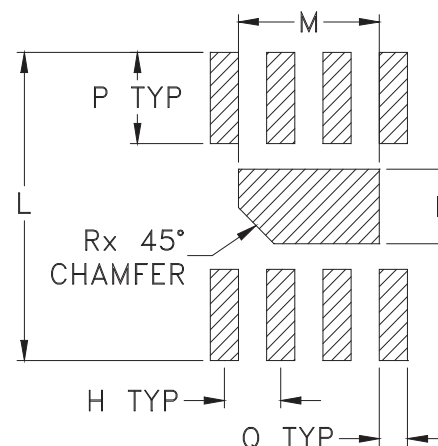
FREQ.	INSERTION LOSS			INPUT VSWR			OUTPUT VSWR		
(MHz)	(dB)			(:1)			(:1)		
	@-55°C	@25°C	@+105°C	@-55°C	@25°C	@+105°C	@-55°C	@25°C	@+105°C
10	5.72	5.73	5.75	1.14	1.14	1.14	1.14	1.14	1.14
50	5.70	5.72	5.75	1.14	1.14	1.14	1.14	1.14	1.14
100	5.71	5.73	5.74	1.13	1.14	1.14	1.13	1.14	1.14
500	5.70	5.72	5.74	1.13	1.12	1.13	1.12	1.12	1.13
1000	5.67	5.70	5.72	1.12	1.12	1.12	1.11	1.11	1.11
1500	5.62	5.65	5.68	1.11	1.11	1.11	1.10	1.10	1.10
2000	5.55	5.59	5.62	1.10	1.10	1.10	1.09	1.09	1.09
2500	5.47	5.51	5.54	1.09	1.09	1.10	1.08	1.08	1.09
3000	5.37	5.42	5.45	1.09	1.09	1.09	1.08	1.08	1.08
3500	5.27	5.31	5.35	1.10	1.09	1.09	1.09	1.09	1.09
4000	5.16	5.21	5.24	1.11	1.11	1.10	1.12	1.11	1.11
4500	5.04	5.10	5.14	1.13	1.13	1.12	1.15	1.14	1.14
5000	4.92	4.98	5.02	1.16	1.16	1.16	1.19	1.18	1.18
5500	4.79	4.85	4.90	1.20	1.20	1.19	1.23	1.23	1.23
6000	4.65	4.72	4.77	1.24	1.24	1.23	1.27	1.27	1.27
6500	4.51	4.58	4.62	1.27	1.27	1.26	1.30	1.29	1.29
7000	4.35	4.42	4.47	1.29	1.29	1.28	1.30	1.30	1.29
7500	4.18	4.26	4.31	1.29	1.29	1.28	1.29	1.28	1.28
8000	3.99	4.08	4.13	1.28	1.28	1.28	1.26	1.26	1.25
8500	3.79	3.88	3.94	1.26	1.26	1.26	1.22	1.22	1.22
9000	3.57	3.66	3.72	1.23	1.23	1.23	1.19	1.19	1.19
9500	3.35	3.43	3.50	1.19	1.19	1.19	1.17	1.16	1.16
10000	3.13	3.22	3.28	1.17	1.17	1.16	1.17	1.16	1.15
10500	2.94	3.03	3.09	1.20	1.20	1.18	1.23	1.22	1.21
11000	2.81	2.90	2.96	1.29	1.28	1.26	1.33	1.31	1.30
11500	2.73	2.81	2.88	1.40	1.38	1.36	1.44	1.42	1.40
12000	2.65	2.73	2.80	1.49	1.46	1.44	1.52	1.48	1.46
12500	2.53	2.62	2.68	1.51	1.49	1.47	1.52	1.50	1.48
13000	2.38	2.48	2.55	1.49	1.48	1.47	1.49	1.48	1.46
13500	2.19	2.30	2.38	1.45	1.44	1.44	1.42	1.42	1.41
14000	2.01	2.14	2.22	1.39	1.40	1.40	1.37	1.37	1.37
14500	1.84	1.97	2.06	1.35	1.36	1.35	1.35	1.35	1.34
15000	1.71	1.83	1.92	1.34	1.33	1.32	1.35	1.33	1.32
15500	1.58	1.69	1.78	1.34	1.31	1.29	1.34	1.31	1.30
16000	1.45	1.57	1.66	1.32	1.28	1.26	1.31	1.30	1.29
16500	1.31	1.44	1.53	1.24	1.23	1.21	1.27	1.26	1.24
17000	1.16	1.29	1.39	1.16	1.16	1.15	1.23	1.22	1.20
17500	0.98	1.13	1.23	1.11	1.11	1.10	1.19	1.18	1.16
18000	0.85	0.99	1.10	1.07	1.07	1.07	1.13	1.12	1.11
18500	0.72	0.87	0.99	1.06	1.05	1.05	1.07	1.06	1.07
19000	0.62	0.77	0.89	1.06	1.05	1.05	1.04	1.03	1.04
19500	0.51	0.67	0.79	1.05	1.04	1.05	1.00	1.01	1.02
20000	0.42	0.59	0.72	1.05	1.04	1.04	1.02	1.01	1.02
20500	0.35	0.53	0.67	1.07	1.06	1.05	1.08	1.05	1.03
21000	0.32	0.52	0.67	1.07	1.07	1.06	1.07	1.08	1.07
21500	0.33	0.54	0.70	1.10	1.10	1.09	1.07	1.08	1.08
22000	0.38	0.59	0.77	1.12	1.12	1.12	1.13	1.13	1.13
22500	0.50	0.72	0.90	1.18	1.17	1.16	1.17	1.17	1.17
23000	0.61	0.84	1.04	1.24	1.21	1.21	1.24	1.22	1.21



Outline Dimensions



PCB Land Pattern



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

SE #.	A	B	C	D	E	F	G	H	J	K	L	M	N	P
MC1631-1	.079 (2.00)	.079 (2.00)	.039 (1.00)	.047 (1.20)	.024 (.60)	.009 (.23)	.014 (.35)	.020 (.50)	.008 (.20)	.002 (.05)	.106 (2.70)	.049 (1.25)	.026 (.65)	.031 (.80)

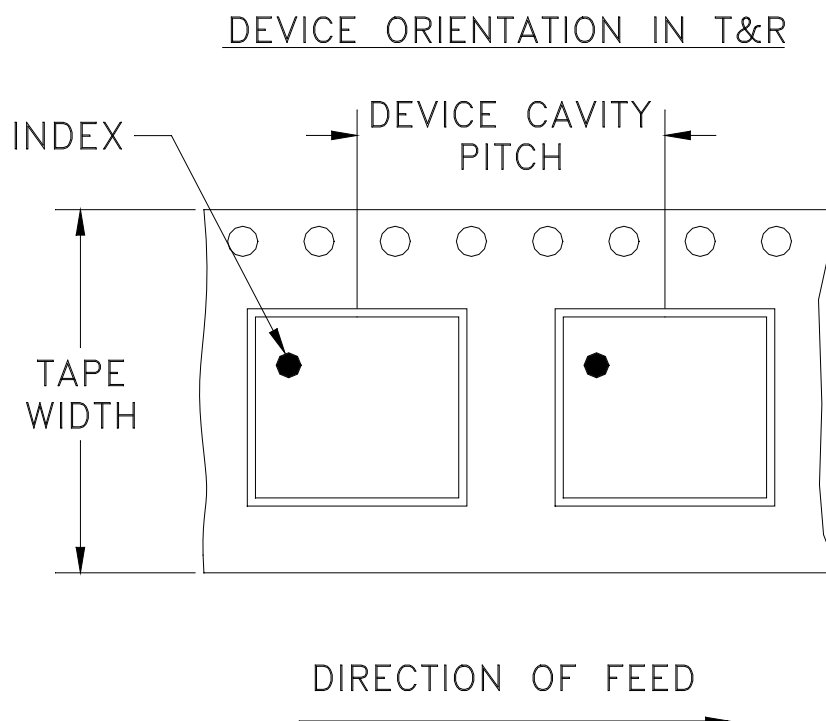
CASE #.	Q	R	WT, GRAM
MC1631-1	.010 (.25)	.012 (.30)	.006

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

Notes:

- Case material: Plastic.
- Termination finish:
For RoHS Case Styles: Tin-Silver over Nickel plated or Matte-Tin Plated (See Data sheet).
All models, (+) suffix.
- Lead #1 identifier shall be located in the cross-hatched area shown.
Identifier may be either a molded or marked feature.

Tape & Reel Packaging TR-F66



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
8	4	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000, 2000, 3000

Note: Please consult individual model data sheet to determine device per reel availability.

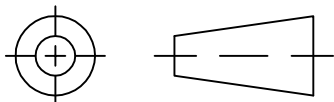
Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf



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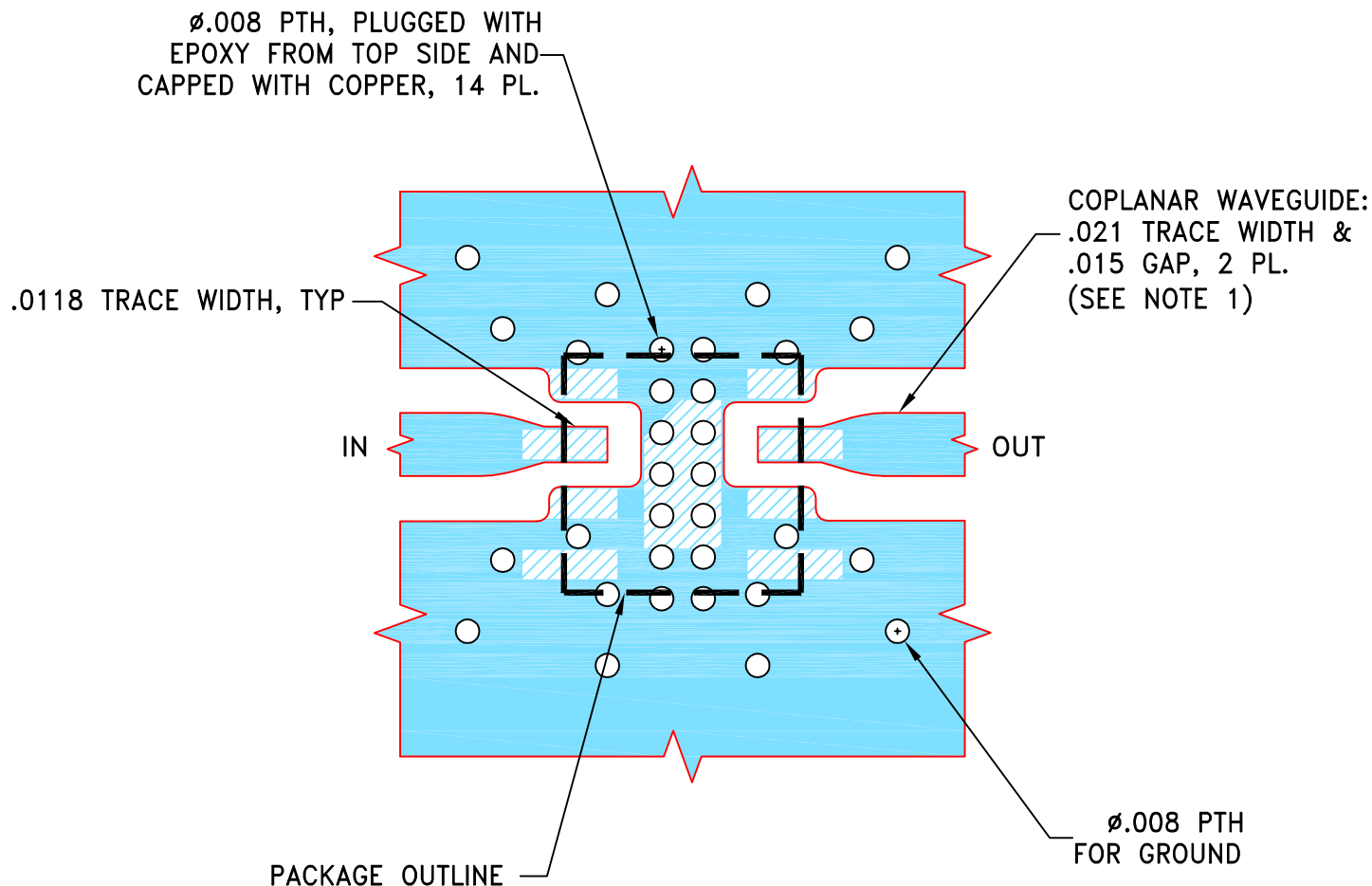
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M171992	NEW RELEASE	01/22/19	NP	GH

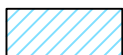
SUGGESTED MOUNTING CONFIGURATION
FOR MC1631-1 CASE STYLE, "08EQ02" PIN CODE

**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.
3. UNIT LAND PATTERN WAS OPTIMIZED FOR BETTER PERFORMANCE.



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



DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

UNLESS OTHERWISE SPECIFIED	INITIALS	DATE
DRAWN	NP	01/22/19
CHECKED	GF	01/22/19
APPROVED	GH	01/22/19

DIMENSIONS ARE IN INCHES
 TOLERANCES ON:
 2 PL DECIMALS ±
 3 PL DECIMALS ± .005
 ANGLES ±
 FRACTIONS ±

Mini-Circuits®

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



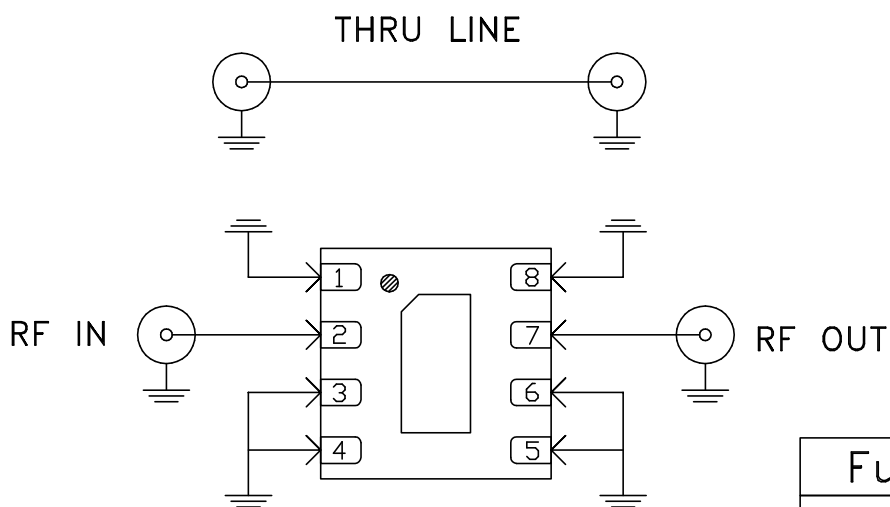
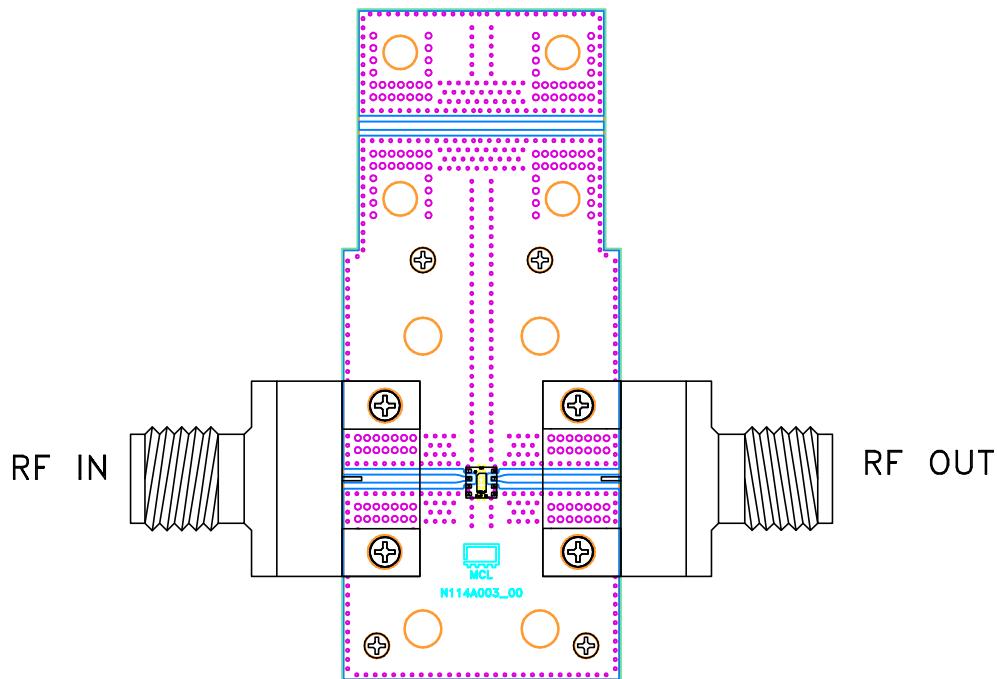
Mini-Circuits®

13 Neptune Avenue
 Brooklyn NY 11235

PL, 08EQ02, MC1631-1, TB-EQY-N-24+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-618	OR
FILE:	98PL618	SCALE: 16:1	SHEET: 1 OF 1

Evaluation Board and Circuit



Function	Pad
RF IN	2
RF OUT	7
GND	1,3,4,5,6,8

Schematic Diagram

NOTES:

1. 2.92 mm Female Connectors.
2. PCB Material: Roger R04350B or equivalent,
Dielectric constant=3.5, Thickness=0.010 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 or -45° to 85° C or -55° to 105° C or -40° to 105° C or -40° to 95° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C or -65° to 150° Ambient Environment	Individual Model Data Sheet
HTOL	1000 hours at 125°C	MIL-STD-883, Method 1005, Condition B
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Mechanical Shock	1.5Kg, 0.5 ms, 5 shock pulses, Y1 direction only	MIL-STD-883, Method 2002, Condition B, except Y1 direction only
Vibration (Variable Frequency)	50g peak	MIL-STD-883, Method 2007, Condition B
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102, Condition C
HAST	130°C, 85% RH, 96 hours	JESD22-A110
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 95% Coverage
Solder Reflow Heat	Sn-Pb Eutetic Process: 240°C peak Pb-Free Process: 260°C peak	J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1
Moisture Sensitivity: Level 1	Bake at 125°C for 24 hours Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 260°C peak	J-STD-020



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
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