



## MICROWAVE

# Gain Equalizer

## EQY-0-24+

50Ω 0 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
- 0 dB Nominal



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-0-24+ is a 0 dB attenuator fabricated using highly repetitive GaAs MMIC process. EQY-0-24+ has a nominal attenuation slope of 0 dB and is packaged in a tiny 2x2 mm 8-lead QFN-style package. If gain equalization is no longer needed, EQY-0-24+ can be used as a short without changing PCB layout.

### 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-0-24+  
MCL NY  
250805





MICROWAVE

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## EQY-0-24+

50Ω 0 dB DC to 20 GHz

### ELECTRICAL SPECIFICATIONS<sup>1</sup> AT +25°C, 50Ω, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		DC		20	GHz
Insertion Loss	0.01		0.03	0.4	dB
	5		0.10		
	10		0.05		
	18		0.17		
	20		0.11		
VSWR	0.01 - 5		1.03		:1
	5 - 10		1.10		
	10 - 18		1.19		
	18 - 20		1.17		

1. Measured on Mini-Circuits Characterization Test Board TB-EQY-0-24+. See Characterization Test Circuit (Fig. 1).

### ABSOLUTE MAXIMUM RATINGS<sup>2</sup>

Parameter	Ratings
Operating Case Temperature	-55°C to +105°C
Storage Temperature	-65°C to +150°C
RF Input Power <sup>3</sup>	+33 dBm

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

3. Derates linearly to +30 dBm at +105°C.



MICROWAVE

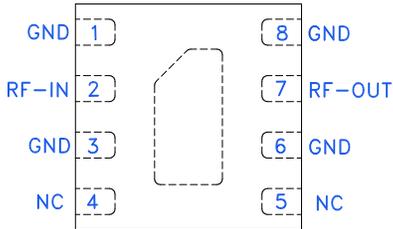
# Gain Equalizer

## EQY-0-24+

50Ω 0 dB DC to 20 GHz

### PAD DESCRIPTION

TOP VIEW



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

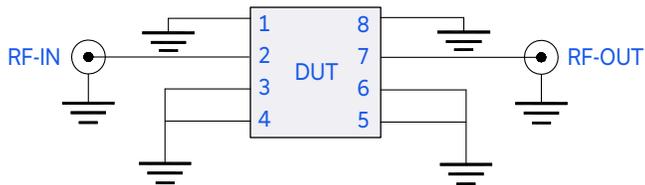
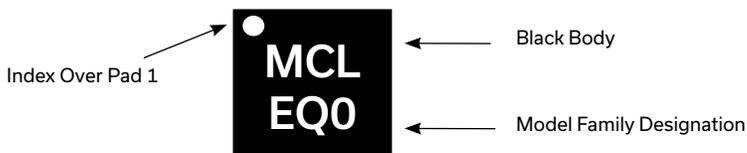


Fig 1. Block Diagram of Test Circuit used for characterization. Test Board TB-EQY-0-24+  
 Conditions: Attenuation & Return Loss  $P_{IN}$  = 0 dBm

### PRODUCT MARKING



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





MICROWAVE

# Gain Equalizer

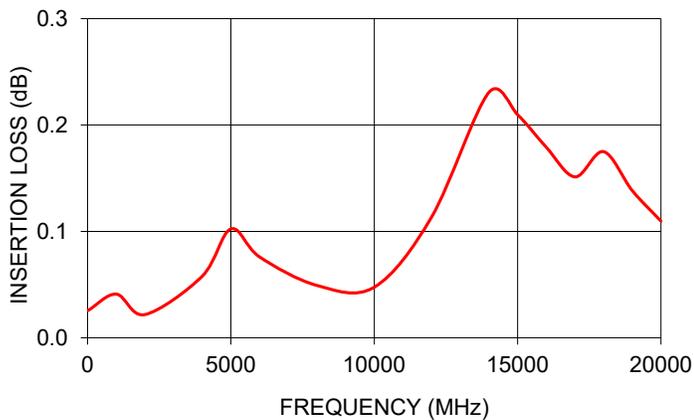
## EQY-0-24+

50Ω 0 dB DC to 20 GHz

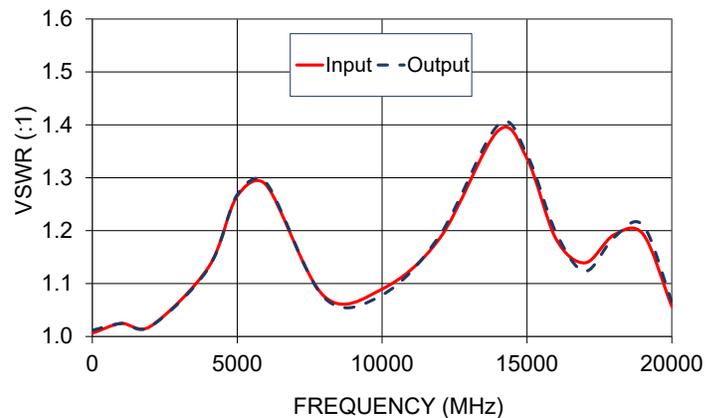
### TYPICAL PERFORMANCE DATA AT +25°C

Frequency (MHz)	Insertion Loss (dB)	Input VSWR (:1)	Output VSWR (:1)
10	0.03	1.01	1.01
1000	0.04	1.02	1.02
2000	0.02	1.02	1.02
4000	0.06	1.13	1.13
5000	0.10	1.27	1.27
6000	0.08	1.29	1.29
8000	0.05	1.08	1.07
10000	0.05	1.09	1.08
12000	0.11	1.19	1.19
14000	0.23	1.39	1.40
15000	0.21	1.34	1.34
16000	0.18	1.18	1.20
17000	0.15	1.14	1.12
18000	0.17	1.19	1.19
19000	0.14	1.19	1.21
20000	0.11	1.06	1.07

EQY-0-24+  
INSERTION LOSS



EQY-0-24+  
VSWR





MICROWAVE

# Gain Equalizer

**EQY-0-24+**

50Ω 0 dB DC to 20 GHz

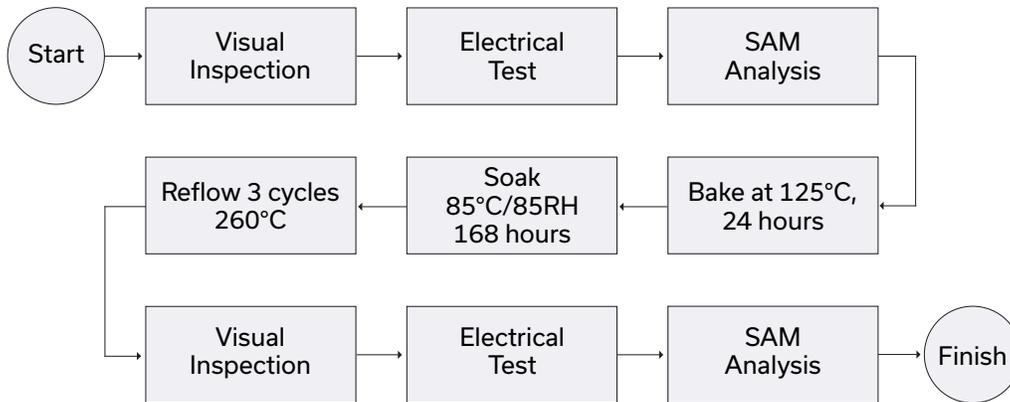
ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD. TO ACCESS [CLICK HERE](#)

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-0-24+
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

- 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/terms/viewterm.html](http://www.minicircuits.com/terms/viewterm.html)

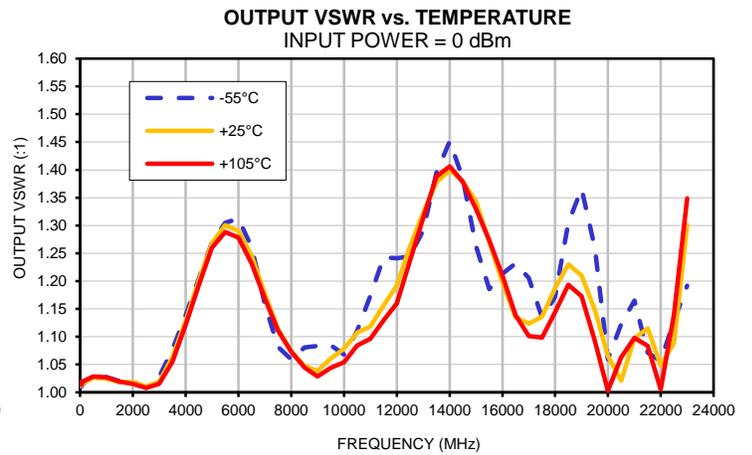
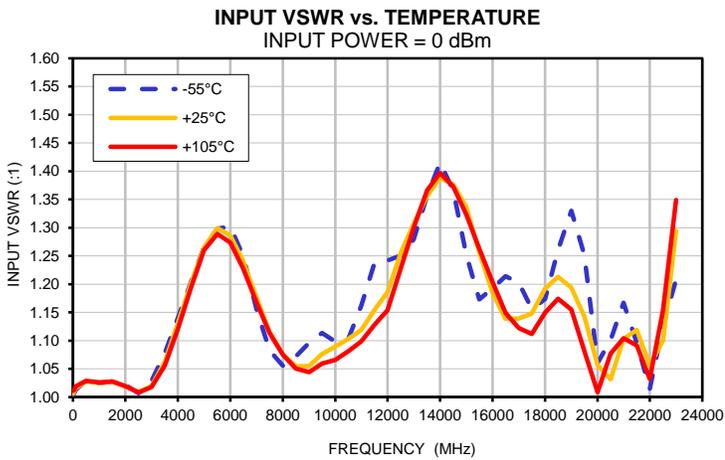
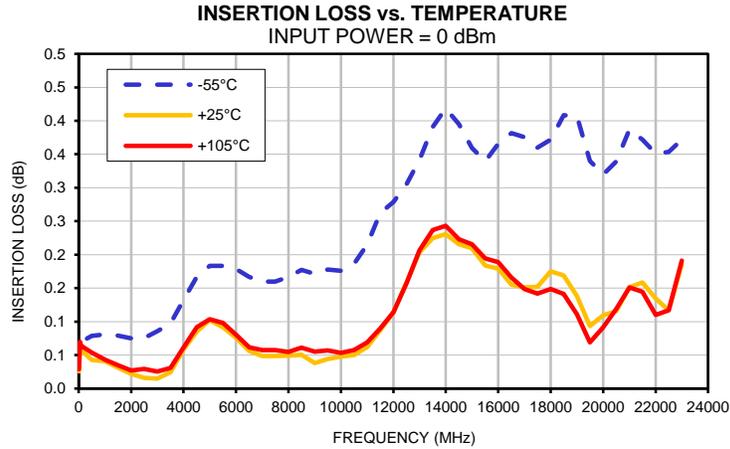


## Typical Performance Data

FREQ.  (MHz)	INSERTION LOSS			INPUT VSWR			OUTPUT VSWR		
	(dB)			(:1)			(:1)		
	@-55°C	@25°C	@+105°C	@-55°C	@25°C	@+105°C	@-55°C	@25°C	@+105°C
10	0.04	0.03	0.03	1.00	1.01	1.01	1.01	1.01	1.02
50	0.07	0.06	0.07	1.01	1.01	1.01	1.01	1.01	1.01
100	0.07	0.06	0.06	1.01	1.02	1.02	1.01	1.02	1.02
500	0.08	0.04	0.05	1.03	1.03	1.03	1.03	1.03	1.03
1000	0.08	0.04	0.04	1.02	1.02	1.03	1.03	1.02	1.03
1500	0.08	0.03	0.04	1.03	1.03	1.03	1.02	1.02	1.02
2000	0.08	0.02	0.03	1.02	1.02	1.02	1.02	1.02	1.02
2500	0.08	0.02	0.03	1.01	1.01	1.01	1.01	1.01	1.01
3000	0.09	0.01	0.03	1.03	1.02	1.02	1.03	1.02	1.02
3500	0.10	0.02	0.03	1.08	1.06	1.06	1.08	1.06	1.05
4000	0.13	0.06	0.06	1.14	1.13	1.12	1.14	1.13	1.12
4500	0.17	0.08	0.09	1.20	1.20	1.19	1.21	1.20	1.19
5000	0.18	0.10	0.10	1.27	1.27	1.26	1.27	1.27	1.26
5500	0.18	0.09	0.10	1.30	1.30	1.29	1.30	1.30	1.29
6000	0.18	0.08	0.08	1.30	1.29	1.27	1.31	1.29	1.28
6500	0.17	0.06	0.06	1.25	1.24	1.23	1.26	1.24	1.23
7000	0.16	0.05	0.06	1.15	1.18	1.17	1.16	1.18	1.17
7500	0.16	0.05	0.06	1.08	1.12	1.11	1.08	1.11	1.11
8000	0.17	0.05	0.05	1.06	1.08	1.08	1.06	1.07	1.07
8500	0.18	0.05	0.06	1.07	1.05	1.05	1.08	1.05	1.04
9000	0.17	0.04	0.05	1.10	1.05	1.04	1.08	1.04	1.03
9500	0.18	0.04	0.06	1.11	1.08	1.06	1.08	1.06	1.04
10000	0.18	0.05	0.05	1.10	1.09	1.07	1.07	1.08	1.05
10500	0.19	0.05	0.06	1.10	1.10	1.08	1.11	1.11	1.08
11000	0.22	0.06	0.07	1.16	1.12	1.10	1.17	1.12	1.10
11500	0.26	0.09	0.09	1.24	1.15	1.13	1.24	1.16	1.13
12000	0.28	0.11	0.11	1.24	1.19	1.15	1.24	1.19	1.16
12500	0.31	0.16	0.16	1.25	1.26	1.23	1.24	1.26	1.24
13000	0.34	0.20	0.21	1.28	1.31	1.30	1.29	1.32	1.31
13500	0.39	0.22	0.24	1.36	1.36	1.37	1.39	1.38	1.39
14000	0.42	0.23	0.24	1.42	1.39	1.40	1.45	1.40	1.41
14500	0.39	0.22	0.22	1.37	1.38	1.37	1.39	1.38	1.38
15000	0.36	0.21	0.22	1.25	1.34	1.32	1.26	1.34	1.33
15500	0.34	0.18	0.19	1.17	1.26	1.26	1.19	1.27	1.27
16000	0.37	0.18	0.19	1.19	1.18	1.20	1.21	1.20	1.21
16500	0.38	0.16	0.17	1.21	1.14	1.15	1.23	1.14	1.14
17000	0.38	0.15	0.15	1.20	1.14	1.12	1.21	1.12	1.10
17500	0.36	0.15	0.14	1.16	1.15	1.11	1.13	1.14	1.10
18000	0.37	0.17	0.15	1.17	1.19	1.15	1.17	1.19	1.14
18500	0.41	0.17	0.14	1.26	1.21	1.17	1.30	1.23	1.19
19000	0.41	0.14	0.11	1.33	1.19	1.16	1.37	1.21	1.17
19500	0.34	0.09	0.07	1.25	1.14	1.08	1.26	1.15	1.09
20000	0.32	0.11	0.09	1.06	1.06	1.01	1.06	1.07	1.00
20500	0.34	0.12	0.12	1.10	1.03	1.08	1.12	1.02	1.06
21000	0.39	0.15	0.15	1.17	1.10	1.10	1.17	1.10	1.10
21500	0.37	0.16	0.14	1.10	1.12	1.09	1.07	1.12	1.08
22000	0.35	0.13	0.11	1.01	1.06	1.03	1.06	1.05	1.01
22500	0.35	0.12	0.12	1.13	1.10	1.15	1.13	1.09	1.14
23000	0.37	0.19	0.19	1.21	1.29	1.35	1.19	1.30	1.35

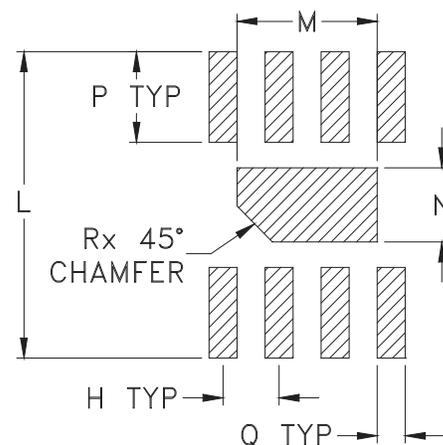
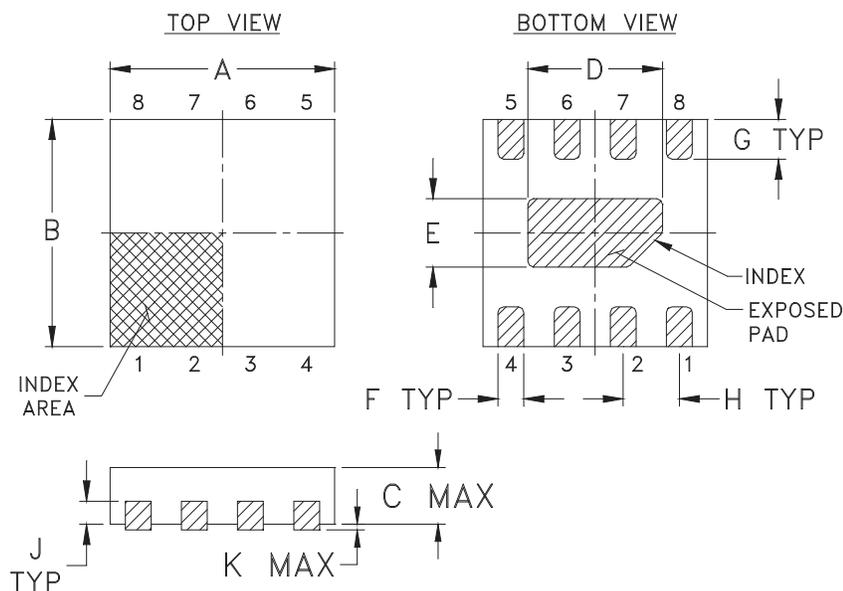


## Typical Performance Curves



### 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.



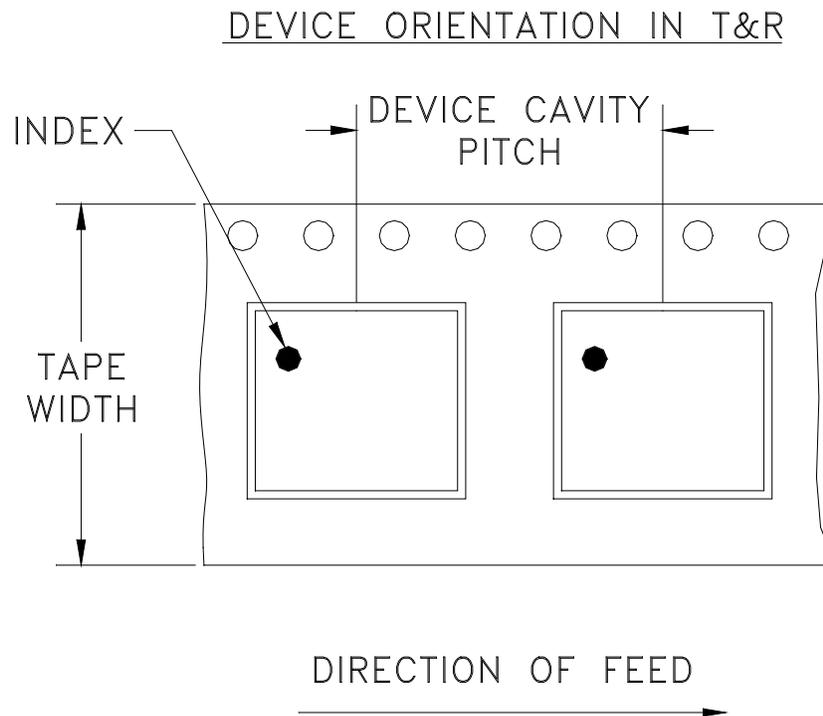
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: [www.minicircuits.com](http://www.minicircuits.com)

RF/IF MICROWAVE COMPONENTS

# 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](http://www.minicircuits.com/pages/pdfs/tape.pdf)

**Mini-Circuits®**

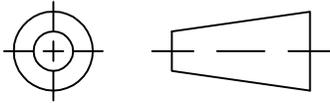
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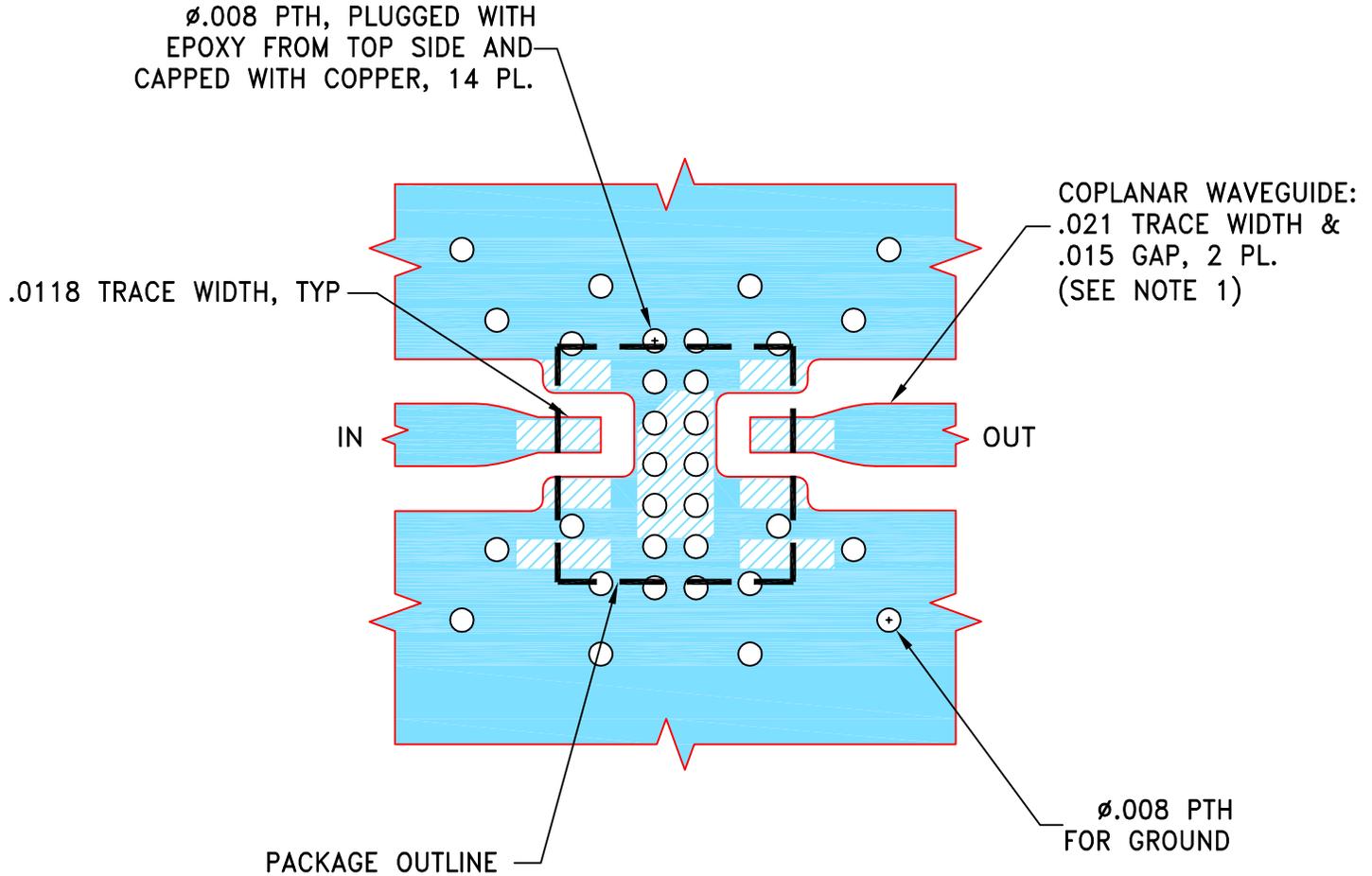
THIRD ANGLE PROJECTION



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 R04350B 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.

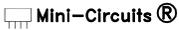
 DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).  
 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

UNLESS OTHERWISE SPECIFIED	INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN NP	01/22/19
TOLERANCES ON:	CHECKED GF	01/22/19
2 PL DECIMALS ±	APPROVED GH	01/22/19
3 PL DECIMALS ± .005		
ANGLES ±		
FRACTIONS ±		

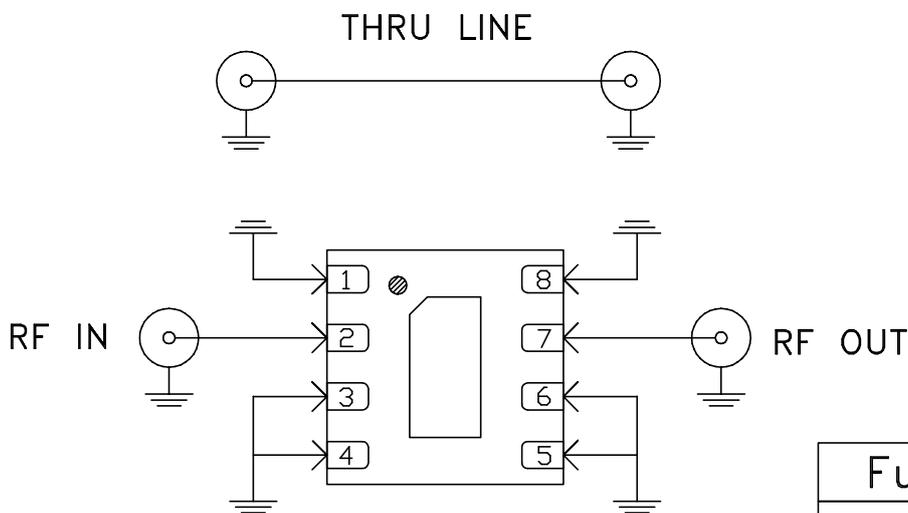
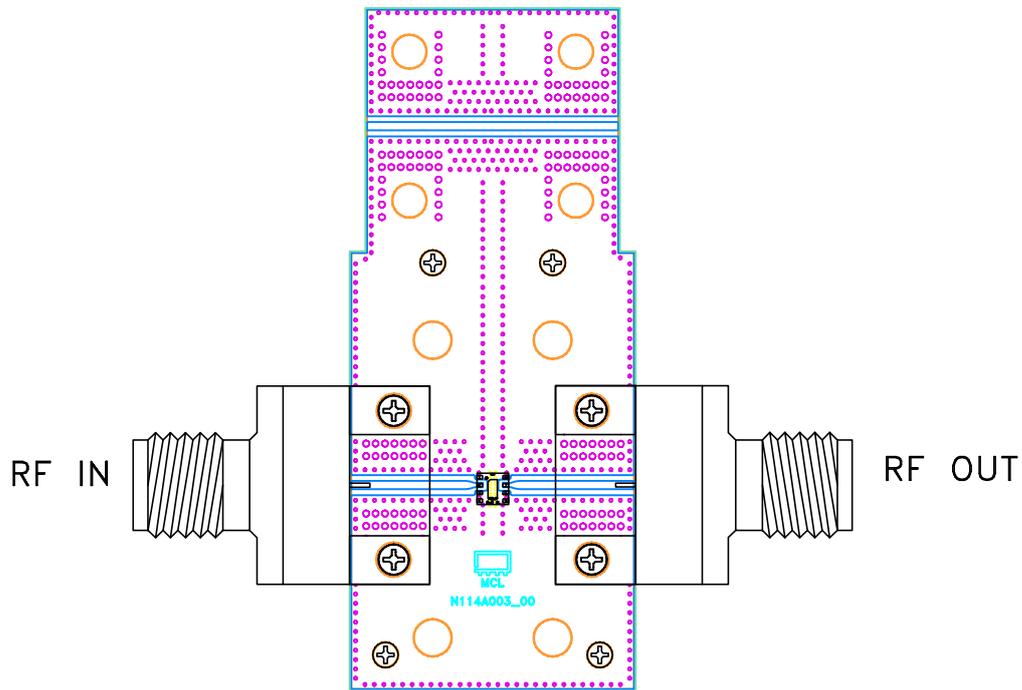
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 Brooklyn NY 11235

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

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

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# Evaluation Board and Circuit



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

Schematic Diagram

## NOTES:

- 2.92 mm Female Connectors.
- 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.

<b>Specification</b>	<b>Test/Inspection Condition</b>	<b>Reference/Spec</b>
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