



Mini-Circuits®

MMIC MICROWAVE

Gain Equalizer

EQY-12-123+

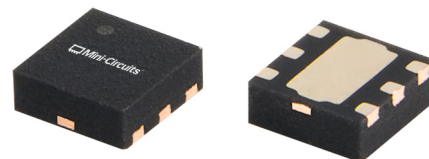
50Ω 12 dB DC to 12 GHz

THE BIG DEAL

- Wideband, DC to 12 GHz
- Linear Positive Slope Across Operating Band
- Excellent Return Loss, 16 dB Typ.
- 1.5x1.5 mm, 6-Lead QFN-Style Package

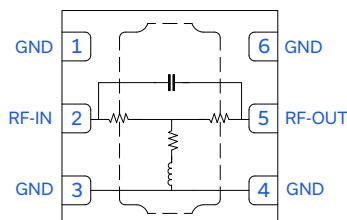
APPLICATIONS

- Test & Measurement Equipment
- Satellite Communications
- Radar, EW, and ECM Defense Systems



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM (TOP VIEW)



PRODUCT OVERVIEW

EQY-12-123+ is a wideband, absorptive gain slope equalizer fabricated using a highly reliable and repeatable GaAs MMIC IPD process. Operating from DC to 12 GHz, this model achieves outstanding linear slope while maintaining excellent return loss throughout the entire band due to its absorptive design. This model is packaged in a compact 1.5x1.5 mm package, making it an ideal choice for dense circuit layouts across a wide range of applications such as Test & Measurement, Satellite Communications, Radar, EW, and ECM Defense Systems.

KEY FEATURES

Feature	Advantages
Wideband Operation, DC to 12 GHz	Broadband positive gain slope equalization can effectively compensate for negative gain slope of amplifiers, receivers, transmitters and transmission lines to achieve flat gain across frequency in wideband systems.
Excellent Return Loss, 16 dB Typ.	Excellent return loss across the full frequency range minimizes unwanted reflections and enables this model to be seamlessly cascaded within wideband signal chains.
1.5x1.5 mm 6-Lead QFN-Style Package	Small footprint saves space in dense layouts while providing low inductance and excellent thermal contact to the PCB. Industry-standard packaging allows for ease of assembly in high-volume manufacturing processes.



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EQY-12-123+

50Ω 12 dB DC to 12 GHz

ELECTRICAL SPECIFICATIONS^{1,2} AT +25°C AND $Z_0 = 50\Omega$, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		DC		12	GHz
Insertion Loss	0.01	13.3	13.8	14.2	dB
	2	11.5	12.0	12.5	
	5	7.2	8.0	8.8	
	10	1.7	2.3	2.9	
	12	0.9	1.5	2.2	
Input Return Loss	0.01		20		dB
	2		20		
	5		16		
	10		20		
	12		20		
Output Return Loss	0.01		20		dB
	2		20		
	5		16		
	10		20		
	12		20		

1. Tested on Mini-Circuits Characterization Test Board TB-EQY-12-123C+. See Figure 2. Board loss de-embedded to the device.

2. Bi-directional RF-IN and RF-OUT ports can be interchanged.





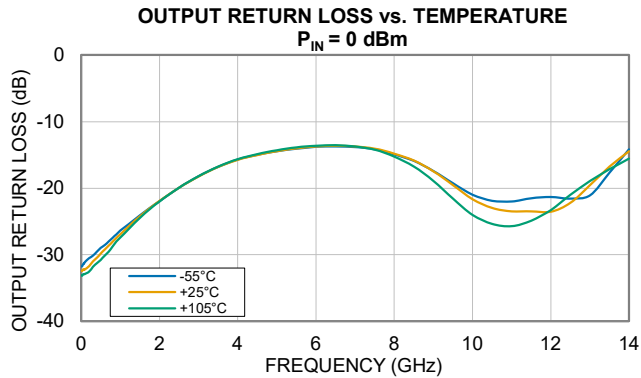
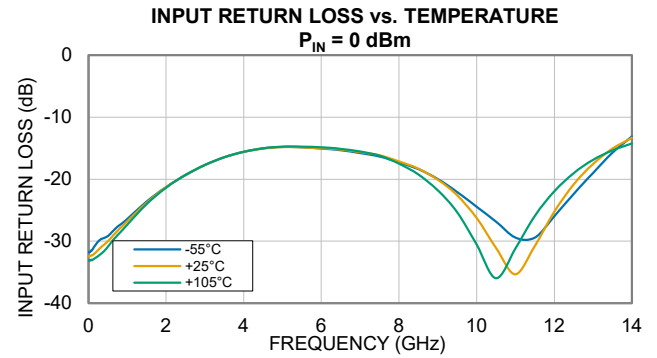
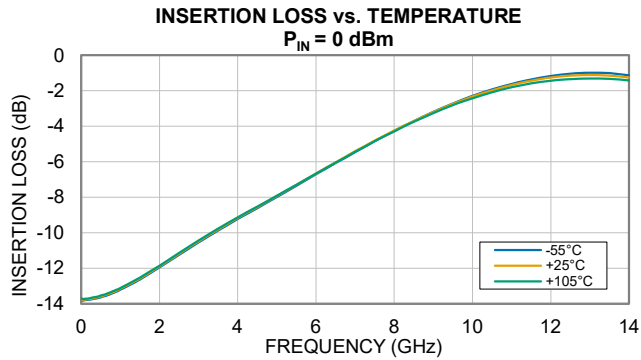
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EQY-12-123+

50Ω 12 dB DC to 12 GHz

TYPICAL PERFORMANCE GRAPHS



ABSOLUTE MAXIMUM RATINGS³

Parameter	Ratings
Operating Temperature	-55°C to +105°C
Storage Temperature	-65°C to +150°C
RF Input Power	+30 dBm

3. Permanent damage may occur if any of these limits are exceeded. Maximum ratings are not intended for continuous normal operation.

THERMAL RESISTANCE

Parameter	Ratings
Thermal Resistance (Θ_{JC}) ⁴	117.6°C/W

4. Θ_{JC} = (Hot Spot Temperature on Die - Temperature at Ground Lead) / Dissipated Power

ESD RATING

	Class	Voltage Range	Reference Standard
HBM	1C	> 1000 V	ANSI/ESDA/JEDEC JS-001-2023
CDM	C3	> 1000 V	ANSI/ESDA/JEDEC JS-002-2022



ESD HANDLING PRECAUTION: This device is designed to be Class 1C for HBM. Static charges may easily produce potentials higher than this with improper handling and can discharge into DUT and damage it. As a preventive measure Industry standard ESD handling precautions should be used at all times to protect the device from ESD damage.

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020E /JEDEC J-STD-033C



Gain Equalizer

EQY-12-123+

50Ω 12 dB DC to 12 GHz

FUNCTIONAL DIAGRAM (TOP VIEW)

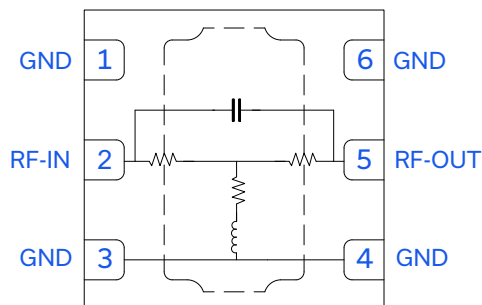


Figure 1. EQY-12-123+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Figure 2)
RF-IN	2	RF-IN Pad connects to RF Input port.
RF-OUT	5	RF-OUT Pad connects to RF Output port.
GND	1, 3, 4, 6, & Paddle	Connects to ground.

CHARACTERIZATION TEST BOARD

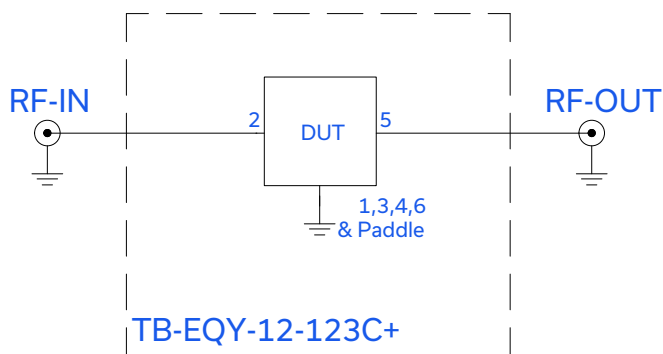


Figure 2. EQY-12-123C+ Evaluation and Application Circuit

Electrical Parameters and Conditions

Insertion Loss and Return Loss are measured using N5242B PNA-X Microwave Network Analyzer.

Conditions:

1. Insertion Loss and Return Loss: $P_{IN} = 0$ dBm



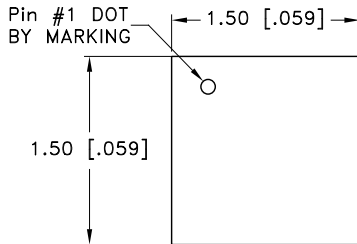
MMIC MICROWAVE

Gain Equalizer

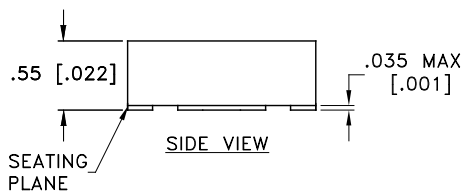
EQY-12-123+

50Ω 12 dB DC to 12 GHz

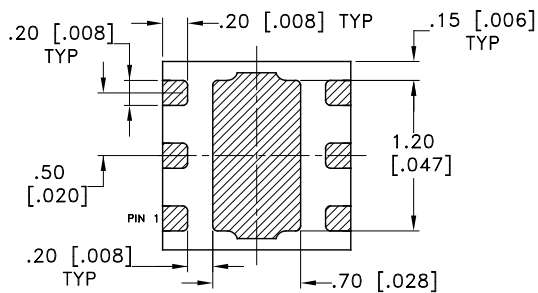
CASE STYLE DRAWING



TOP VIEW

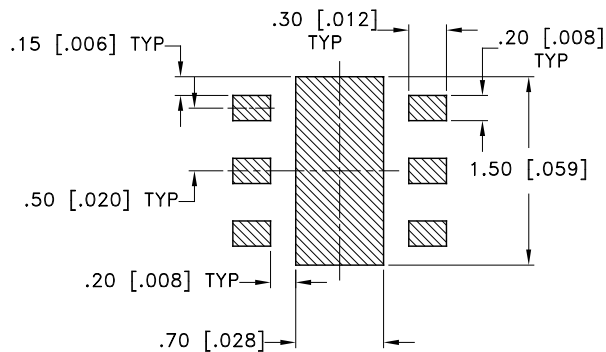


SIDE VIEW



BOTTOM VIEW

PCB Land Pattern



Suggested Layout,
Tolerance to be within ± 0.050 mm

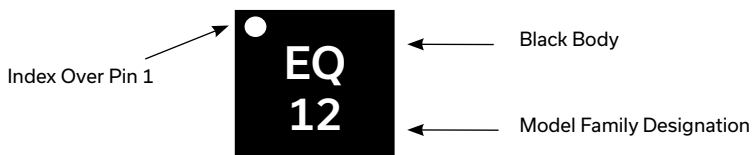
NOTES:

1.  DENOTES METALLIZATION

Weight: 0.0036 grams

Dimensions are in mm [inches]. Tolerances: 2Pl. ± 0.05 mm [0.002 inches].

PRODUCT MARKING



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





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ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD

[CLICK HERE](#)

Performance Data	Data
	Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
Case Style	KC3011 Plastic package, exposed paddle, Lead Finish: Nickel Palladium Gold
RoHS Status	Compliant
Tape & Reel	F66
Standard Quantities Available on Reel	7" Reels with 20, 50, 100, 200, 500, 1000, 2000, or 3000 devices
Suggested Layout for PCB Design	PL-835
Evaluation Board	TB-EQY-12-123C+
	Gerber File
Environmental Ratings	ENV08T1

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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www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

*Typical Performance Data***NOTE: Use PDF Bookmarks to view DATA at required conditions**TEST CONDITIONS: $P_{IN} = 0$ dBm Temperature = +25°C

FREQ	Insertion Loss	Input Return Loss	Output Return Loss
(GHz)	(dB)	(dB)	(dB)
0.01	-13.8	-32.5	-32.4
0.02	-13.8	-32.5	-32.5
0.03	-13.8	-32.4	-32.4
0.04	-13.8	-32.4	-32.3
0.05	-13.8	-32.4	-32.3
0.06	-13.8	-32.3	-32.2
0.07	-13.8	-32.3	-32.2
0.08	-13.8	-32.3	-32.2
0.09	-13.8	-32.3	-32.3
0.10	-13.8	-32.3	-32.2
0.20	-13.7	-31.7	-31.7
0.30	-13.7	-31.1	-31.0
0.40	-13.7	-30.5	-30.5
0.50	-13.6	-30.0	-29.9
0.60	-13.5	-29.3	-29.2
0.70	-13.4	-28.6	-28.7
0.80	-13.4	-28.0	-28.1
0.90	-13.3	-27.4	-27.5
1.00	-13.2	-26.8	-26.9
1.50	-12.6	-23.8	-24.2
2.00	-11.9	-21.3	-21.9
2.50	-11.2	-19.3	-20.0
3.00	-10.5	-17.7	-18.2
3.50	-9.8	-16.5	-16.8
4.00	-9.2	-15.6	-15.7
4.50	-8.6	-15.1	-15.0
5.00	-7.9	-14.8	-14.4
5.50	-7.3	-14.9	-14.0
6.00	-6.7	-15.0	-13.7
6.50	-6.0	-15.2	-13.6
7.00	-5.4	-15.6	-13.8
7.50	-4.8	-16.2	-14.1
8.00	-4.2	-17.1	-14.8
8.50	-3.7	-18.3	-15.9
9.00	-3.2	-20.1	-17.5
9.50	-2.7	-22.6	-19.5
10.00	-2.3	-26.3	-21.7
10.50	-2.0	-31.1	-23.0
11.00	-1.7	-35.3	-23.5
11.50	-1.4	-30.8	-23.5
12.00	-1.2	-25.3	-23.5
12.50	-1.1	-20.9	-22.2
13.00	-1.1	-17.5	-19.6
13.50	-1.1	-15.1	-16.8
14.00	-1.2	-13.3	-14.5

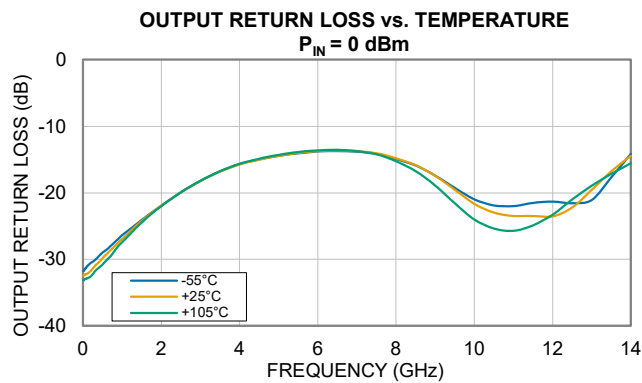
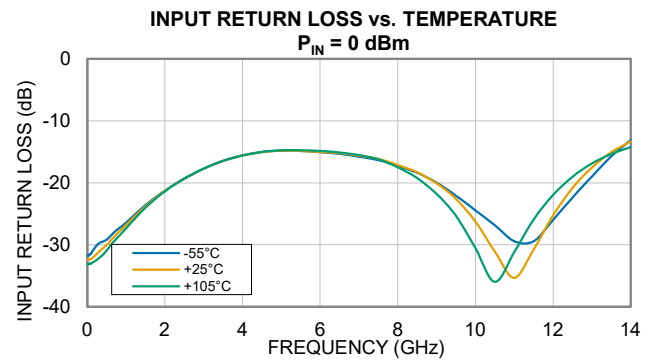
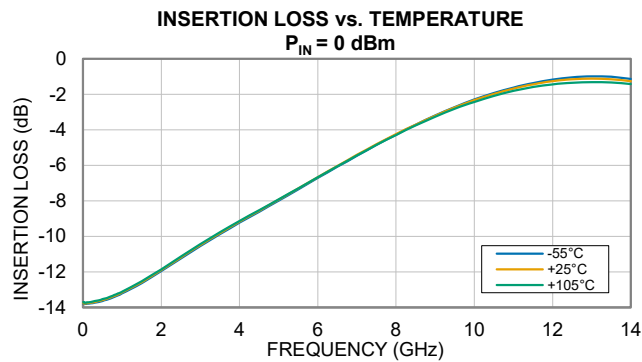
*Typical Performance Data***NOTE: Use PDF Bookmarks to view DATA at required conditions**TEST CONDITIONS: $P_{IN} = 0$ dBm Temperature = -55°C

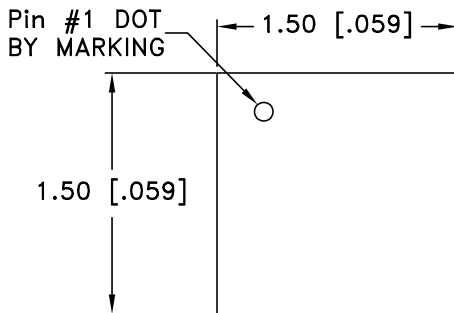
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(GHz)	(dB)	(dB)	(dB)
0.01	-13.8	-31.7	-31.8
0.02	-13.8	-31.8	-31.7
0.03	-13.8	-31.7	-31.7
0.04	-13.8	-31.7	-31.6
0.05	-13.8	-31.7	-31.5
0.06	-13.8	-31.6	-31.4
0.07	-13.8	-31.5	-31.3
0.08	-13.8	-31.5	-31.2
0.09	-13.8	-31.5	-31.2
0.10	-13.8	-31.4	-31.1
0.20	-13.8	-30.4	-30.5
0.30	-13.7	-29.8	-30.1
0.40	-13.7	-29.5	-29.6
0.50	-13.6	-29.2	-29.0
0.60	-13.6	-28.5	-28.6
0.70	-13.5	-27.9	-28.0
0.80	-13.4	-27.4	-27.5
0.90	-13.3	-27.0	-26.9
1.00	-13.2	-26.4	-26.4
1.50	-12.6	-23.6	-24.1
2.00	-12.0	-21.2	-22.0
2.50	-11.2	-19.4	-20.0
3.00	-10.5	-17.7	-18.2
3.50	-9.9	-16.5	-16.8
4.00	-9.2	-15.6	-15.7
4.50	-8.6	-15.0	-15.0
5.00	-8.0	-14.8	-14.4
5.50	-7.4	-14.9	-14.1
6.00	-6.7	-15.1	-13.8
6.50	-6.1	-15.3	-13.7
7.00	-5.5	-15.8	-13.8
7.50	-4.9	-16.3	-14.1
8.00	-4.3	-17.3	-14.9
8.50	-3.7	-18.4	-15.9
9.00	-3.2	-20.0	-17.4
9.50	-2.7	-22.1	-19.3
10.00	-2.3	-24.4	-21.0
10.50	-1.9	-26.8	-21.9
11.00	-1.6	-29.4	-22.0
11.50	-1.4	-29.4	-21.5
12.00	-1.2	-26.0	-21.3
12.50	-1.0	-22.4	-21.6
13.00	-1.0	-19.0	-21.1
13.50	-1.0	-15.7	-17.7
14.00	-1.1	-13.1	-14.2

*Typical Performance Data***NOTE: Use PDF Bookmarks to view DATA at required conditions**TEST CONDITIONS: $P_{IN} = 0$ dBm Temperature = +105°C

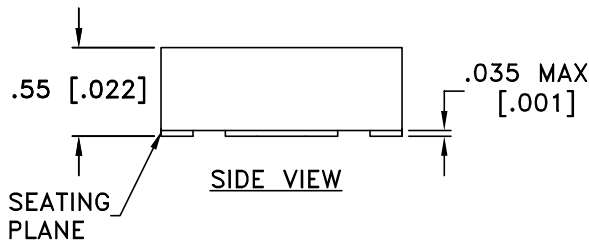
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(GHz)	(dB)	(dB)	(dB)
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0.02	-13.7	-33.2	-33.2
0.03	-13.7	-33.1	-33.1
0.04	-13.7	-33.1	-33.0
0.05	-13.7	-33.1	-33.0
0.06	-13.7	-33.0	-32.9
0.07	-13.7	-33.0	-32.9
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0.09	-13.7	-33.1	-32.9
0.10	-13.7	-33.0	-32.9
0.20	-13.7	-32.6	-32.6
0.30	-13.7	-32.2	-31.8
0.40	-13.6	-31.6	-31.3
0.50	-13.5	-30.9	-30.8
0.60	-13.5	-30.1	-30.1
0.70	-13.4	-29.4	-29.5
0.80	-13.3	-28.7	-28.8
0.90	-13.2	-28.0	-28.0
1.00	-13.1	-27.3	-27.4
1.50	-12.5	-24.0	-24.4
2.00	-11.9	-21.3	-22.0
2.50	-11.1	-19.3	-19.9
3.00	-10.4	-17.7	-18.2
3.50	-9.8	-16.5	-16.8
4.00	-9.1	-15.6	-15.7
4.50	-8.5	-15.0	-14.9
5.00	-7.9	-14.7	-14.3
5.50	-7.3	-14.7	-13.9
6.00	-6.7	-14.9	-13.6
6.50	-6.1	-15.1	-13.5
7.00	-5.4	-15.5	-13.7
7.50	-4.8	-16.2	-14.2
8.00	-4.3	-17.5	-15.3
8.50	-3.7	-19.2	-16.8
9.00	-3.3	-21.8	-18.9
9.50	-2.8	-25.3	-21.6
10.00	-2.4	-30.6	-24.0
10.50	-2.1	-36.0	-25.4
11.00	-1.8	-31.2	-25.7
11.50	-1.6	-25.9	-24.9
12.00	-1.4	-22.0	-23.3
12.50	-1.3	-19.0	-21.0
13.00	-1.3	-16.9	-18.9
13.50	-1.3	-15.4	-17.2
14.00	-1.4	-14.3	-15.6

Typical Performance Curves

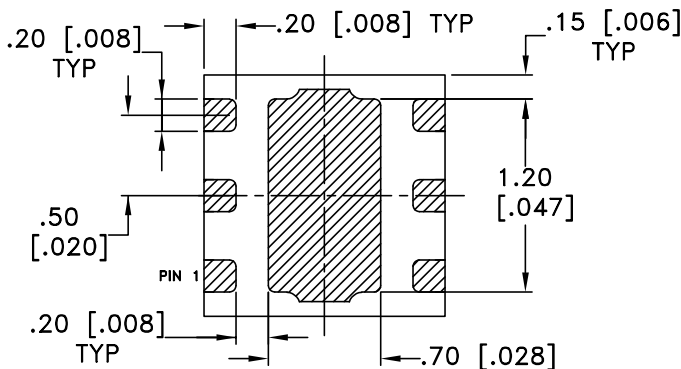




TOP VIEW

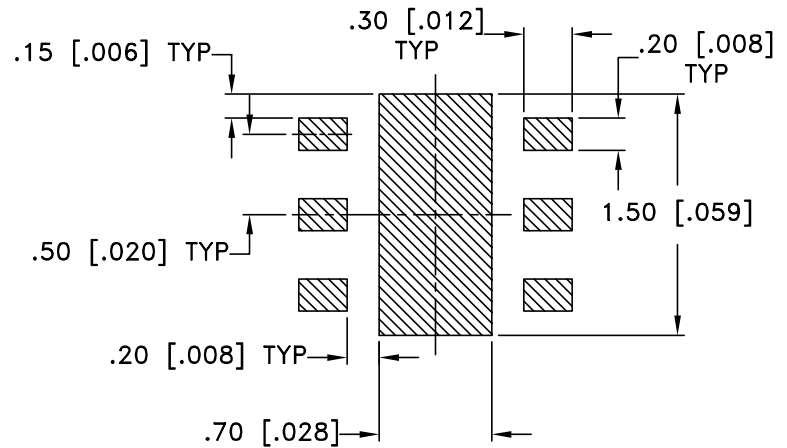


SIDE VIEW



BOTTOM VIEW

PCB Land Pattern



Suggested Layout,
Tolerance to be within ± 0.050 mm

NOTES:

1.  DENOTES METALLIZATION

Weight: .0036 grams

Dimensions are in mm [inches]. Tolerances: 2 Pl. ± 0.05 mm

Notes:

1. Case material: Plastic.
2. Termination finish: NiPdAu ($3\mu\text{m}/0.080\mu\text{m}/0.080\mu\text{m}$).



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

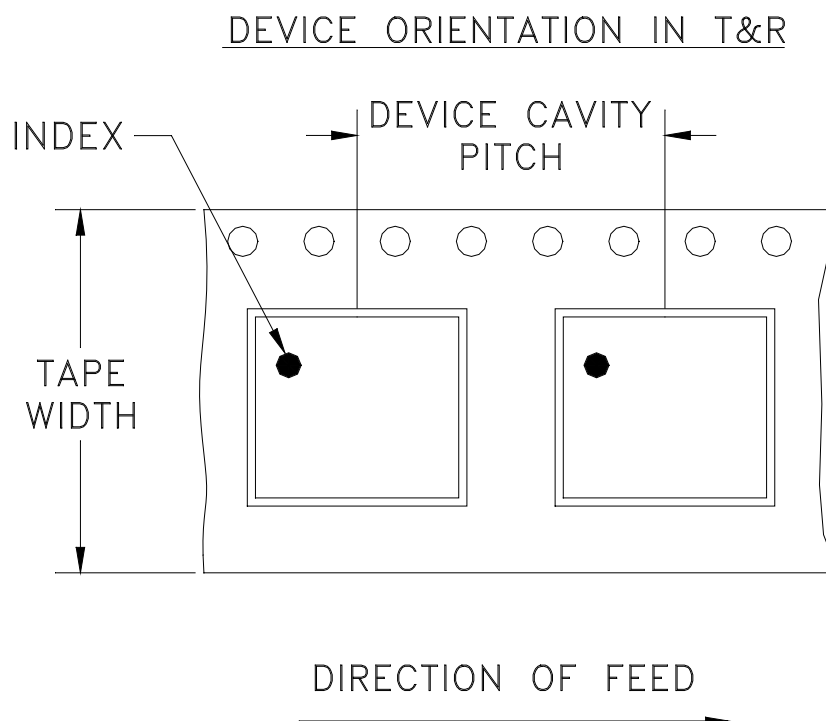


The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

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.

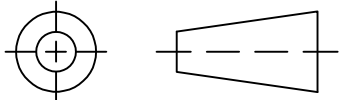
Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

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



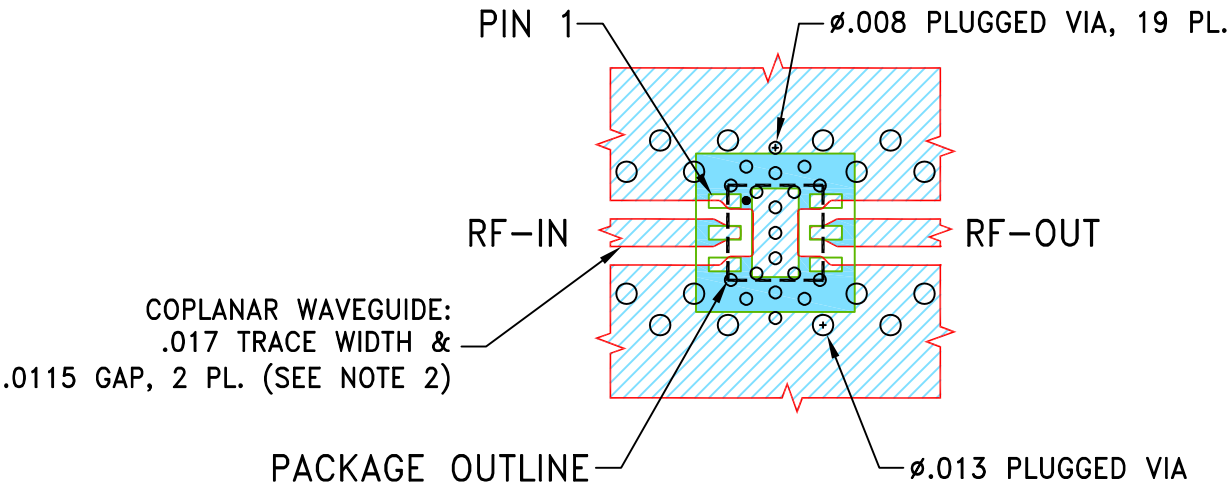
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THIRD ANGLE PROJECTION

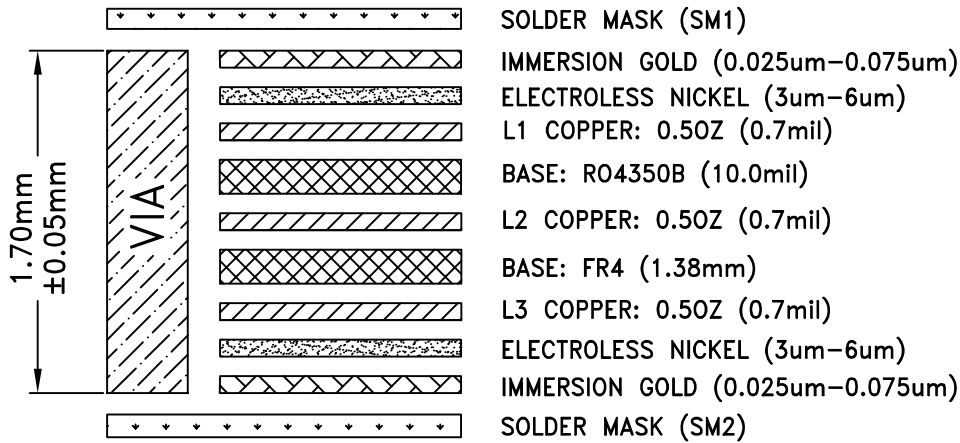


REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-026893	NEW RELEASE	09/15/25	ITG	IL

SUGGESTED MOUNTING CONFIGURATION
FOR KC3011 CASE STYLE



3 LAYER STACKUP DETAIL



NOTES:

- 1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
- 2. TRACE WIDTH & GAP ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .010", COPPER: 1 OZ. EACH LAYER. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
- 3. LAYERS L2 & L3 OF PCB ARE CONTINUOUS GROUND PLANES.



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 TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± FRACTIONS ±	DRAWN	ITG	09/15/25
	CHECKED	GF	09/15/25
	APPROVED	IL	09/15/25

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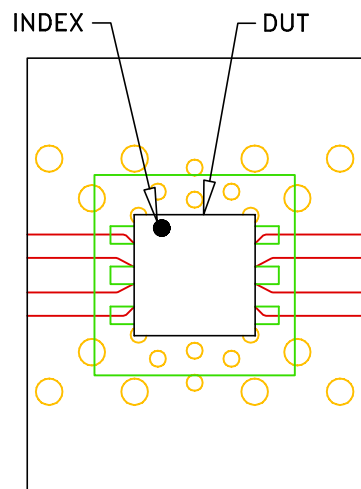
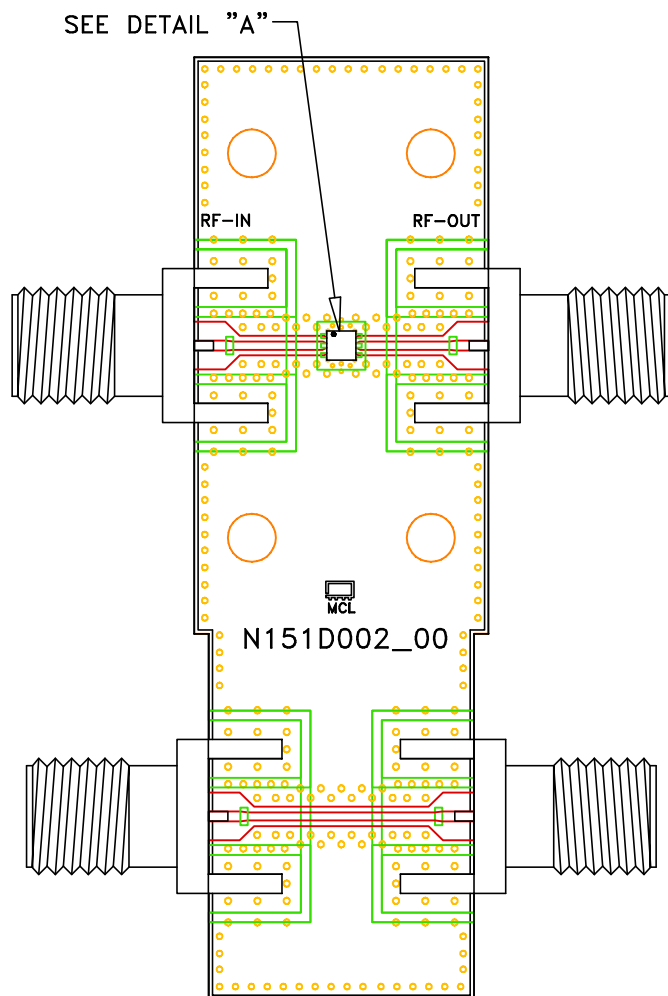
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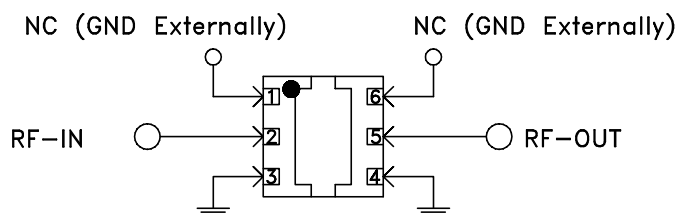
PL, KC3011, TB-EQY-X-123+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-835	OR
FILE:	98PL835	SCALE: 8:1	SHEET: 1 OF 1

Evaluation Board and Circuit



DETAIL "A"
(SCALE 6:1)



SCHEMATIC DIAGRAM
(SCALE 6:1)

Function	Pad
RF-IN	2
RF-OUT	5
GND	3,4
NC (GND Externally)	1,6

NOTES:

1. 50 Ohm SMA 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



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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