MICROWAVE

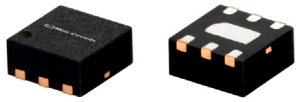
Gain Equalizer

EQY-4-453+

50Ω 4 dB DC to 45 GHz

THE BIG DEAL

- 4.5 dB Slope from DC to 45 GHz
- Small Size, 2x2 mm 6-Lead QFN-Style Package
- Excellent Return Loss, 20 dB Typ.
- Protected by US Patent US11784146B1



Generic photo used for illustration purposes only

CASE STYLE: MC1630-1

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

APPLICATIONS

- Cellular Infrastructure
- 5G
- Wideband Communications
- Test Instrumentation
- Defense

PRODUCT OVERVIEW

EQY-4-453+ is an absorptive Gain Equalizer fabricated using highly repetitive GaAs MMIC process incorporating resistors, capacitors, and inductors having negative insertion loss slope. EQY-4-453+ has a nominal attenuation slope of 4.5 dB and is packaged in a tiny 2x2 mm 6-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 3,4,5,6,7,8,9,10 dB	EQY-XX-453+ Series' identical package and footprint enables circuit designers to swap nominal insertion loss slopes, without board layout redesigns.
Wideband Operation, DC to 45 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 6-Lead QFN-Style Package)	As a single chip solution, the EQY series occupies less board space than a lumped or distributed element approach, minimizes component count, and ensures repeatable performance over a wide frequency range.

REV. B
ECO-026455
EQY-4-453+
MCL NY
250805

Gain Equalizer

EQY-4-453+

50Ω 4 dB DC to 45 GHz

ELECTRICAL SPECIFICATIONS[1] AT +25°C, 50Ω, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		DC		45	GHz
Insertion Loss	0.01	5.4	5.6	5.9	dB
	10	5.0	5.3	5.6	
	20		4.3		
	30	2.3	2.8	3.3	
	40		1.6		
	45		1.2		
VSWR	0.01 - 10		1.16		:1
	10 - 20		1.16		
	20 -30		1.24		
	30 - 40		1.34		
	40 - 45		1.46		

1. Measured on Mini-Circuits Characterization Test Board TB-EQY-4-453+. See Characterization Test Circuit (Fig. 1).

ABSOLUTE MAXIMUM RATINGS[2]

Parameter	Ratings
Operating Case Temperature	-55°C to +105°C
Storage Temperature	-65°C to +150°C
RF Input Power[3]	+29 dBm

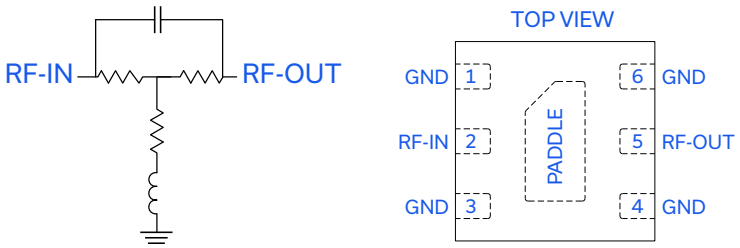
2. Permanent damage may occur if any of these limits are exceeded.
3. Derates linearly to +25 dBm at +105°C.

Gain Equalizer

EQY-4-453+

50Ω 4 dB DC to 45 GHz

SIMPLIFIED SCHEMATIC & PAD DESCRIPTION



Function	Pad Number	Description
RF-IN	2	RF-Input pad
RF-OUT	5	RF-Output pad
GND	1,3,4,6, & Paddle	Ground

CHARACTERIZATION TEST CIRCUIT

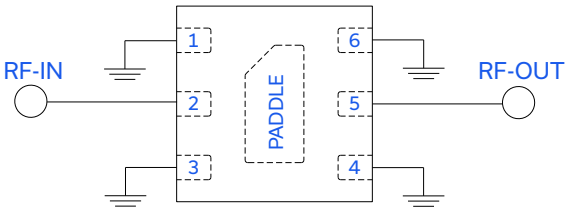
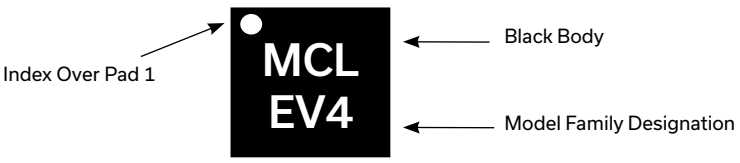


Fig 1. Block Diagram of Test Circuit used for characterization. Test Board TB-EQY-4-453+
Conditions: Attenuation & Return Loss P_{IN}= 0 dBm

PRODUCT MARKING



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

MICROWAVE

Gain Equalizer

EQY-4-453+

50Ω 4 dB DC to 45 GHz

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD. TO ACCESS CLICK HERE

Performance Data	Data Table Swept Graphs
Case Style	MC1630-1 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-663
Evaluation Board	TB-EQY-4-453+ & TB-EQY-4-453C+
Environmental Ratings	ENV08T1

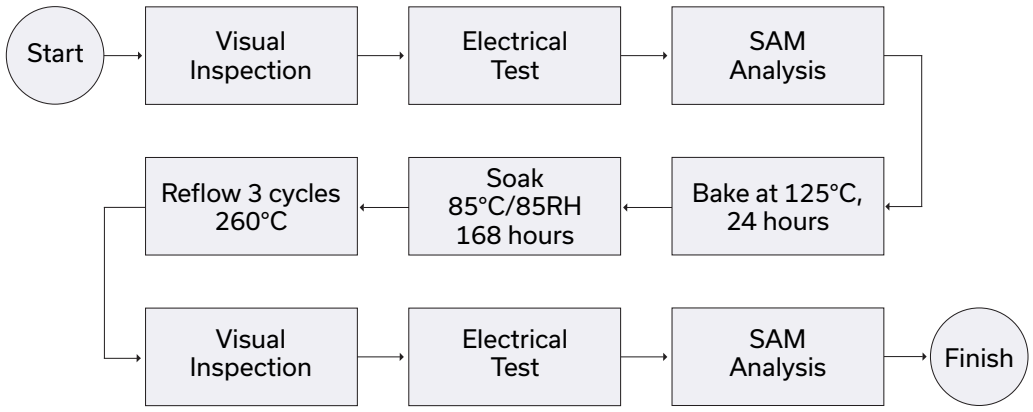
ESD RATING

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

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D.

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

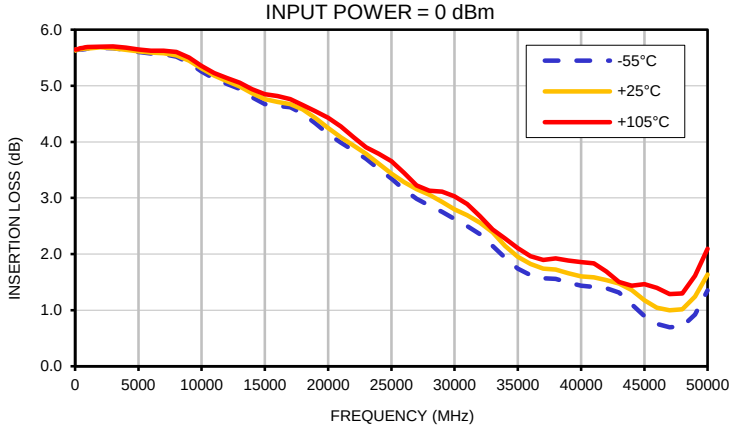
MMIC Gain Equalizer EQY-4-453+

Typical Performance Data

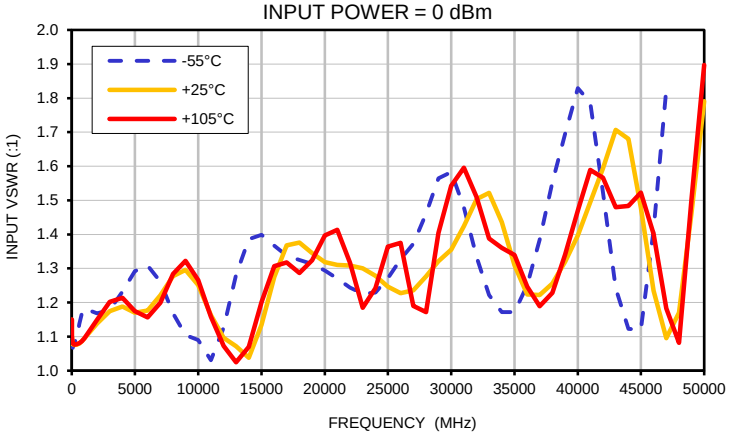
FREQ.	INSERTION LOSS			INPUT VSWR			OUTPUT VSWR		
(MHz)	(dB)			(:1)			(:1)		
	@-55˚C	@25°C	@+105°C	@-55˚C	@25°C	@+105°C	@-55˚C	@25°C	@+105°C
10	5.64	5.64	5.65	1.14	1.15	1.15	1.15	1.15	1.16
20	5.63	5.63	5.65	1.10	1.10	1.10	1.10	1.11	1.11
30	5.64	5.64	5.65	1.08	1.09	1.09	1.09	1.09	1.09
40	5.64	5.64	5.65	1.08	1.08	1.09	1.08	1.09	1.09
50	5.63	5.64	5.65	1.08	1.08	1.08	1.08	1.08	1.09
60	5.64	5.64	5.65	1.07	1.08	1.08	1.08	1.08	1.09
70	5.64	5.64	5.65	1.07	1.08	1.08	1.08	1.08	1.08
80	5.64	5.64	5.65	1.07	1.08	1.08	1.07	1.08	1.08
90	5.64	5.64	5.65	1.07	1.08	1.08	1.07	1.08	1.08
100	5.64	5.64	5.65	1.07	1.08	1.08	1.07	1.08	1.08
200	5.64	5.65	5.65	1.07	1.08	1.08	1.07	1.08	1.08
400	5.64	5.65	5.67	1.07	1.08	1.08	1.07	1.08	1.08
600	5.65	5.66	5.68	1.08	1.08	1.08	1.07	1.08	1.08
800	5.65	5.66	5.68	1.08	1.09	1.09	1.08	1.08	1.09
1000	5.66	5.66	5.69	1.09	1.09	1.09	1.09	1.09	1.09
2000	5.67	5.69	5.70	1.14	1.14	1.15	1.13	1.13	1.13
3000	5.67	5.67	5.70	1.17	1.17	1.20	1.16	1.16	1.17
4000	5.64	5.64	5.68	1.18	1.19	1.21	1.19	1.19	1.19
5000	5.60	5.61	5.65	1.17	1.17	1.17	1.21	1.20	1.21
6000	5.57	5.59	5.63	1.18	1.18	1.16	1.24	1.24	1.24
7000	5.57	5.58	5.63	1.23	1.22	1.20	1.30	1.29	1.29
8000	5.52	5.54	5.60	1.29	1.28	1.28	1.35	1.34	1.34
9000	5.41	5.45	5.50	1.31	1.30	1.32	1.35	1.34	1.35
10000	5.26	5.31	5.35	1.26	1.25	1.27	1.29	1.29	1.26
11000	5.13	5.18	5.23	1.17	1.16	1.16	1.19	1.18	1.16
12000	5.03	5.08	5.14	1.10	1.10	1.07	1.12	1.11	1.10
13000	4.94	4.99	5.06	1.09	1.07	1.02	1.11	1.08	1.06
14000	4.80	4.86	4.94	1.03	1.04	1.07	1.08	1.05	1.03
15000	4.68	4.76	4.85	1.13	1.13	1.20	1.16	1.14	1.16
16000	4.64	4.71	4.82	1.28	1.28	1.31	1.30	1.27	1.28
17000	4.62	4.67	4.76	1.39	1.37	1.32	1.38	1.34	1.32
18000	4.50	4.58	4.65	1.40	1.38	1.29	1.36	1.34	1.30
19000	4.33	4.42	4.54	1.37	1.35	1.32	1.29	1.28	1.26
20000	4.14	4.25	4.43	1.34	1.32	1.40	1.22	1.22	1.21
21000	3.99	4.08	4.28	1.33	1.31	1.41	1.18	1.18	1.18
22000	3.85	3.94	4.09	1.31	1.31	1.32	1.15	1.16	1.18
23000	3.70	3.79	3.91	1.29	1.30	1.18	1.14	1.15	1.19
24000	3.52	3.61	3.79	1.27	1.28	1.24	1.13	1.15	1.18
25000	3.35	3.43	3.66	1.24	1.25	1.36	1.11	1.13	1.14
26000	3.15	3.28	3.45	1.23	1.23	1.37	1.08	1.09	1.13
27000	2.98	3.16	3.22	1.23	1.24	1.19	1.07	1.07	1.06
28000	2.86	3.06	3.13	1.27	1.28	1.17	1.13	1.11	1.17
29000	2.75	2.93	3.12	1.33	1.32	1.40	1.17	1.15	1.22
30000	2.62	2.80	3.03	1.37	1.36	1.54	1.20	1.19	1.17
31000	2.50	2.69	2.89	1.46	1.42	1.60	1.29	1.27	1.31
32000	2.35	2.56	2.67	1.56	1.50	1.51	1.43	1.38	1.42
33000	2.14	2.39	2.44	1.58	1.52	1.39	1.49	1.45	1.42
34000	1.93	2.15	2.28	1.48	1.44	1.36	1.42	1.40	1.38
35000	1.74	1.95	2.11	1.33	1.31	1.34	1.30	1.29	1.29
36000	1.63	1.82	1.96	1.22	1.22	1.25	1.20	1.19	1.16
37000	1.57	1.74	1.90	1.17	1.22	1.19	1.13	1.14	1.13
38000	1.56	1.72	1.92	1.17	1.26	1.23	1.11	1.15	1.18
39000	1.49	1.66	1.89	1.25	1.32	1.34	1.16	1.20	1.25
40000	1.44	1.60	1.86	1.38	1.40	1.47	1.28	1.26	1.30
41000	1.42	1.58	1.83	1.55	1.49	1.59	1.46	1.39	1.45
42000	1.39	1.54	1.69	1.69	1.59	1.57	1.62	1.53	1.54
43000	1.31	1.47	1.50	1.83	1.71	1.48	1.75	1.67	1.52
44000	1.11	1.36	1.43	1.79	1.68	1.48	1.72	1.65	1.49
45000	0.90	1.18	1.47	1.52	1.48	1.52	1.44	1.41	1.43
46000	0.75	1.04	1.40	1.24	1.23	1.40	1.15	1.16	1.28
47000	0.69	1.00	1.29	1.12	1.10	1.18	1.06	1.10	1.14
48000	0.71	1.01	1.30	1.12	1.17	1.08	1.23	1.25	1.21
49000	0.92	1.24	1.61	1.41	1.46	1.50	1.50	1.49	1.51
50000	1.36	1.63	2.09	1.82	1.79	1.90	1.83	1.76	1.77

Typical Performance Curves

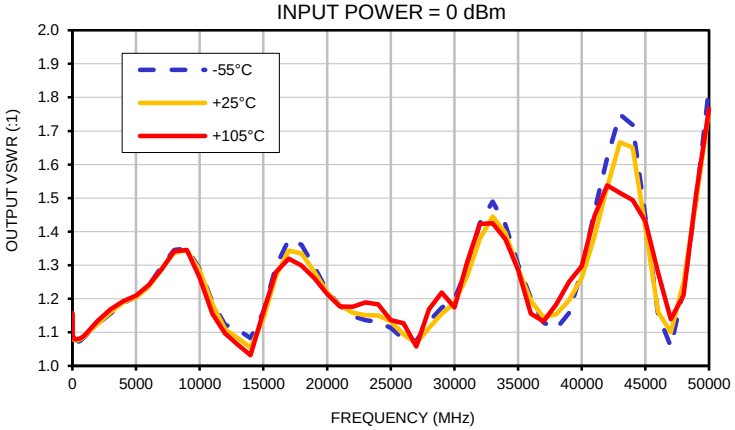
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



INPUT VSWR vs. TEMPERATURE
INPUT POWER = 0 dBm



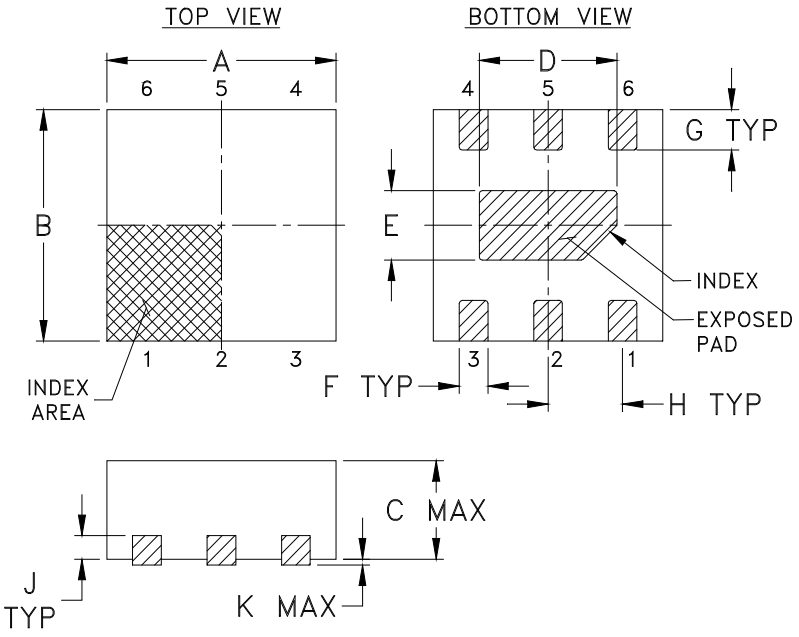
OUTPUT VSWR vs. TEMPERATURE
INPUT POWER = 0 dBm



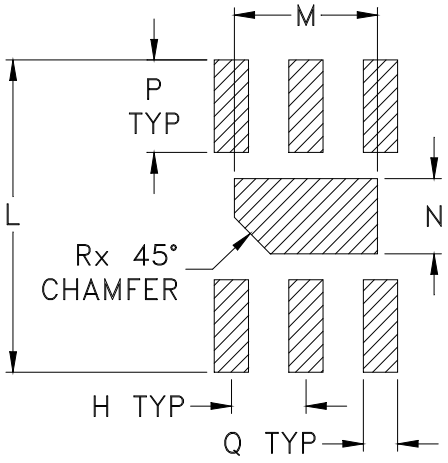
Case Style MC

MC1630-1

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #.	A	B	C	D	E	F	G	H	J	K	L	M	N	P
MC1630-1	.079 (2.00)	.079 (2.00)	.039 (1.00)	.047 (1.20)	.024 (.60)	.010 (.25)	.014 (.35)	.026 (.65)	.008 (.20)	.002 (.05)	.106 (2.70)	.049 (1.25)	.026 (.65)	.031 (.80)

CASE #.	Q	R	WT, GRAM
MC1630-1	.012 (.30)	.012 (.30)	.010*

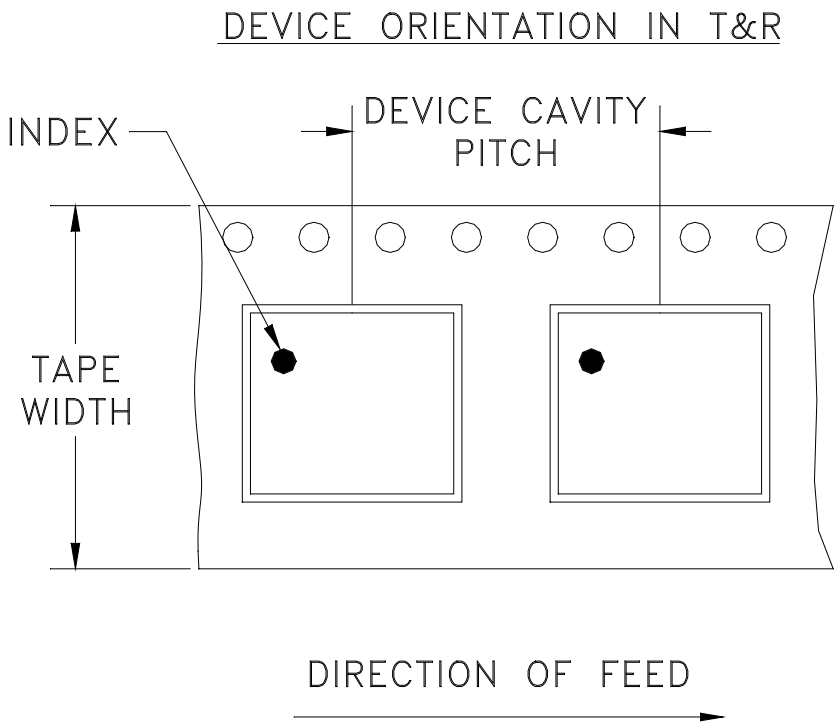
Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3 Pl. ± .005

Notes:

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

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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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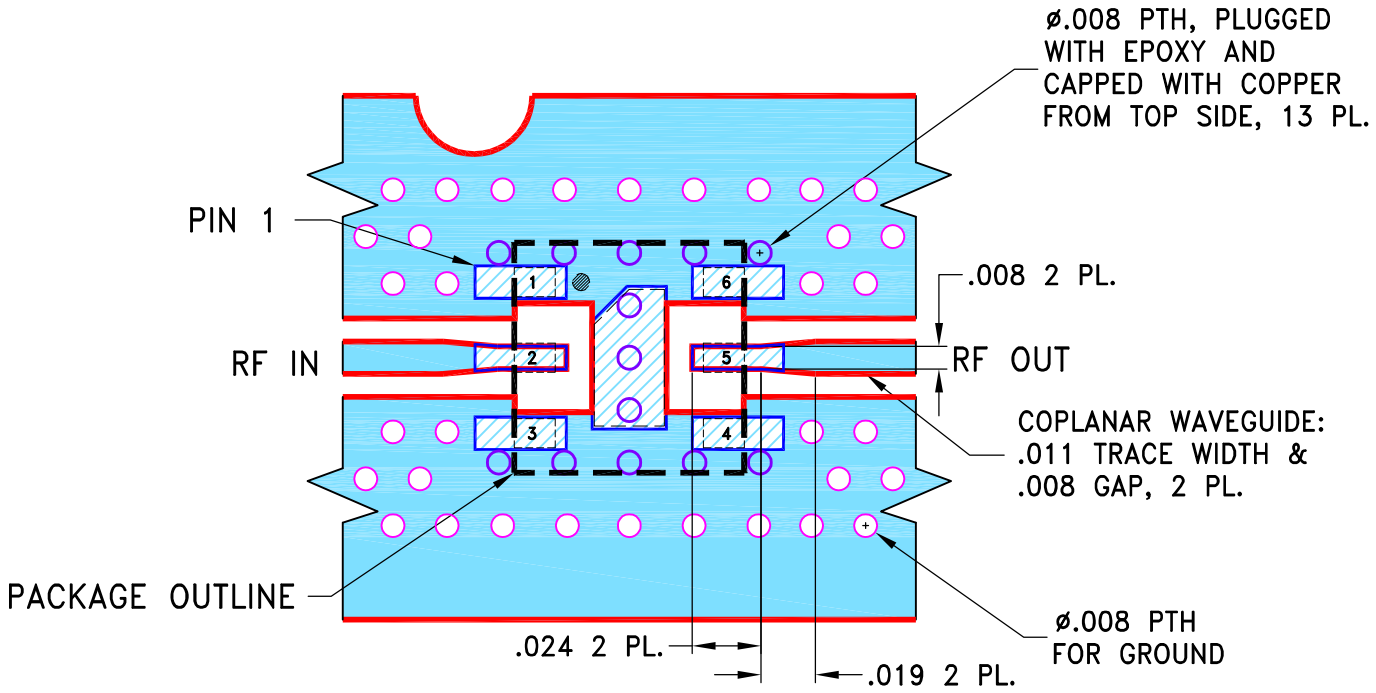
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THIRD ANGLE PROJECTION

REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
0R	ECO-001053	NEW RELEASE	12/18/19	GF	IL

SUGGESTED MOUNTING CONFIGURATION FOR MC1630-1 CASE STYLE,



NOTES:

1. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .0066±.001. COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
2. UNIT FOOT PRINT IS OPTIMIZED FOR PERFORMANCE AND IS DIFFERENT FROM CASE STYLE MC1630-1 RECOMMENDATIONS.
3. 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.

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	GF	12/16/19
TOLERANCES ON:	CHECKED	IL	12/18/19
2 PL DECIMALS ±	APPROVED	IL	12/18/19
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

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Brooklyn NY 11235

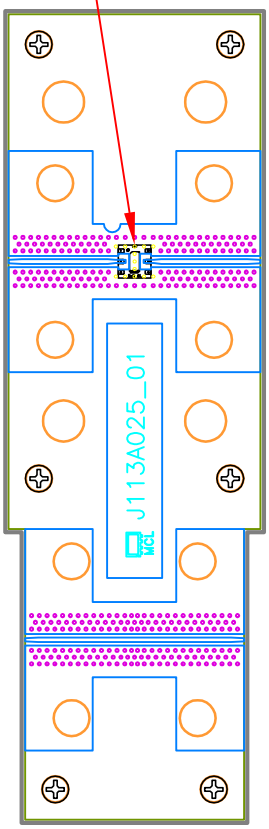
PL, MC1630-1, TB-EQY-X-453+
TB-EQY-X-453C+

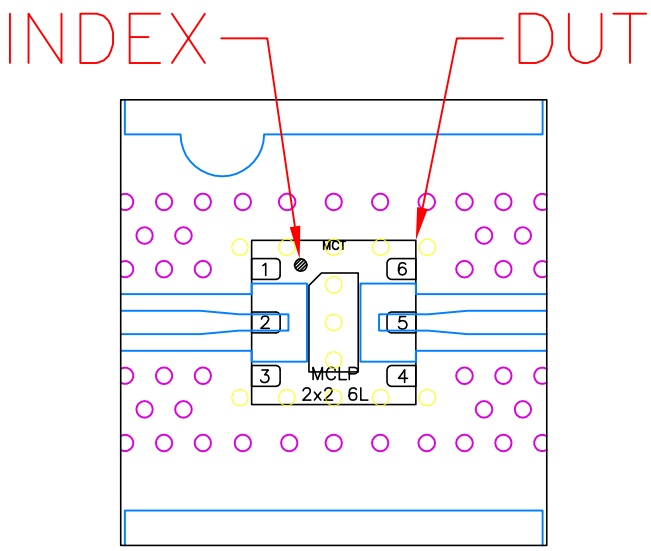
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-663	0R

FILE:	SCALE:	SHEET:
98PL663	15:1	1 OF 1

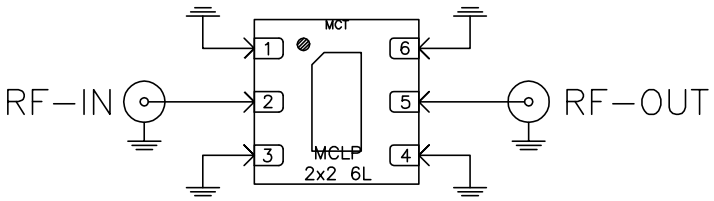
Evaluation Board and Circuit

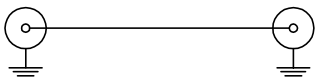
SEE DETAIL "A"





DETAIL "A"
(SCALE 5:1)





SCHEMATIC DIAGRAM

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

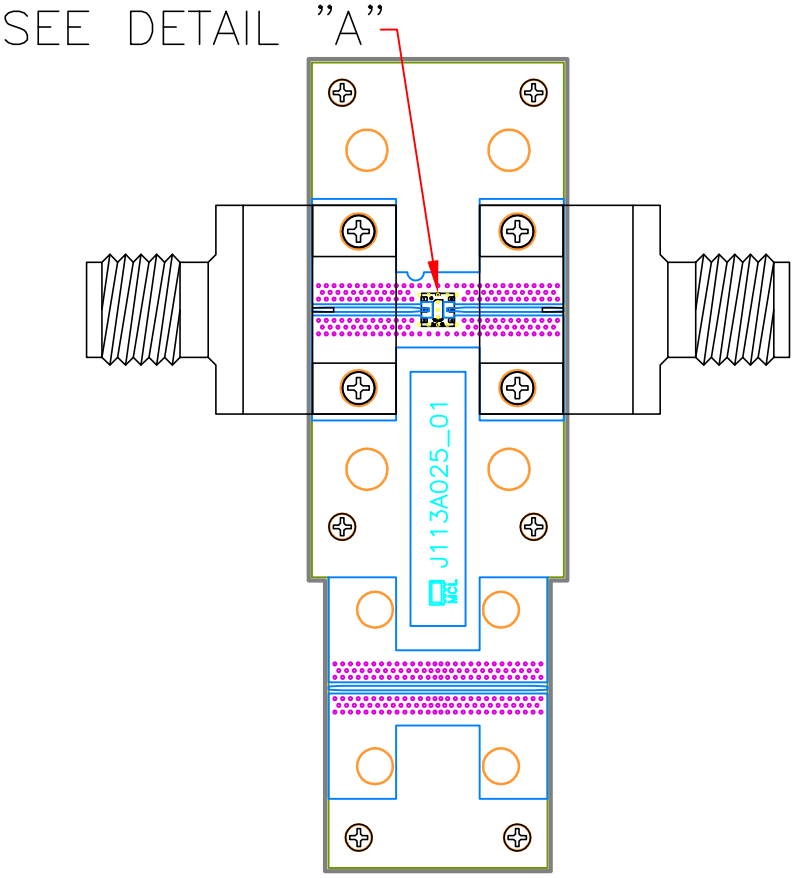
Notes:

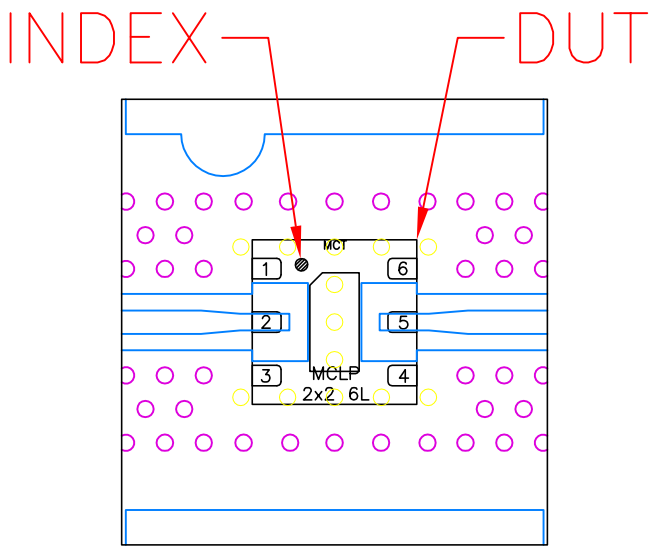
1. PCB Material: Roger RO4350B or equivalent,
   Dielectric constant=3.5, Thickness=0.0066 inch

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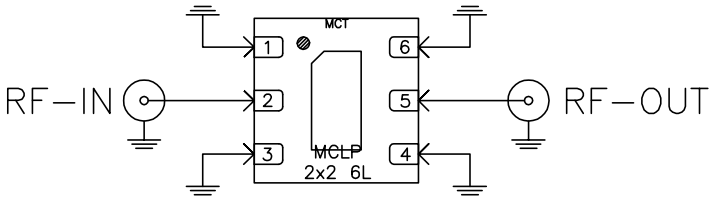
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Evaluation Board and Circuit

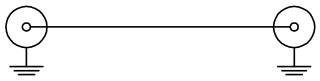




DETAIL "A"
(SCALE 5:1)



THRU LINE



SCHEMATIC DIAGRAM

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

Notes:

1. 2.4mm Female Connectors.
2. PCB Material: Roger RO4350B or equivalent, Dielectric constant=3.5, Thickness=0.0066 inch

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Environmental Specifications **ENV08T1**

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

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