MICROWAVE PRECISION

Fixed Attenuator

KAT-9+

50Ω 1.1 W 9 dB DC to 43.5 GHz

THE BIG DEAL

- Super-Wide Bandwidth, DC to 43.5 GHz
- High Power Handling, 1.1 W
- Small Package, 2x2 mm MCLP™
- Excellent VSWR, 1.11:1 Typ.



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

- 5G
- Test and Measurement
- Radar
- Communication
- Defense

PRODUCT OVERVIEW

KAT-9+ is an absorptive fixed attenuator fabricated using highly reliable and repeatable GaAs MMIC process. The model operates from DC to 43.5 GHz. It achieves outstanding attenuation accuracy and flatness while maintaining excellent VSWR throughout the entire band. The model can also handle input power up to 1.1 W, which makes this model an ideal choice for a wide range of applications.

KEY FEATURES

Feature	Advantages
Wideband Operation, From DC to 43.5 GHz	Supports a wide array of applications including 5G, wireless infrastructure, microwave communications, satellite, defense and aerospace, medical, broadband and optical applications.
Small Size and Simple to Use (2x2 mm)	As a single chip solution, the KAT series occupies less board space than a lumped element approach, minimizes component count and ensures repeatable performance over wide frequency range.
Wide Range of Nominal Attenuation Values (0,1,2,3,4,5,6,7,8,9,10,12,15,20 & 30)	KAT Series' identical package and footprint enables circuit designers to swap small incremental attenuation values, without board layout redesigns.
MCLP™ Package	Low Inductance, repeatable transitions, excellent thermal path make the KAT series an ideal solution as an alternative to "do it yourself" lumped element-based approach.

REV. B
ECO-014625
KAT-9+
MCL NY
250904

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50Ω 1.1 W 9 dB DC to 43.5 GHz

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

Parameter	Condition (GHz)	Min.	Typ.	Max.	Unit
Frequency Range		DC		43.5	GHz
Attenuation	0.01-5	8.6	8.9	9.4	dB
	5-10	8.6	8.9	9.4	
	10-20	8.6	8.9	9.5	
	20-30	8.6	9.1	9.9	
	30-40		9.3		
	40-43.5		8.8		
VSWR	0.01-5		1.06	1.3	:1
	5-10		1.09	1.4	
	10-20		1.11	1.9	
	20-30		1.26		
	30-40		1.58		
	40-43.5		1.60		

1. Tested on Mini-Circuits test board TB-934-9C+. See Characterization/Application Circuit in Fig. 1.

ABSOLUTE MAXIMUM RATINGS[2]

Parameter	Ratings
Operating Case Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
RF Input Power	1.1 W[3]

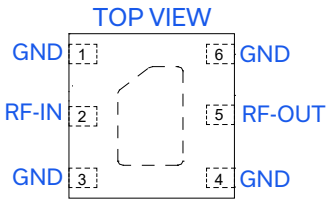
2. Permanent damage may occur if any of these limits are exceeded.
3. Power rating derated to 0.8 W at +85°C.

Fixed Attenuator

KAT-9+

50Ω 1.1 W 9 dB DC to 43.5 GHz

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

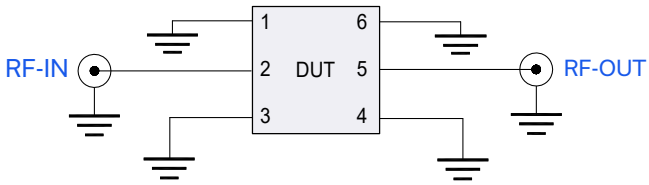
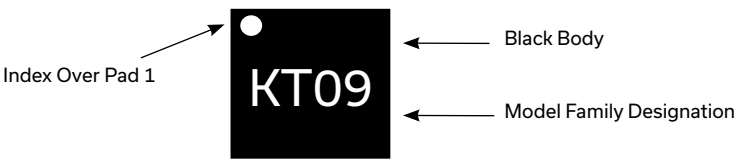


Fig 1. Block diagram of Test Circuit used for characterization, Test board TB-934-9C+
Conditions: Attenuation, VSWR: P_{IN} = 0 dBm

PRODUCT MARKING



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

MICROWAVE PRECISION

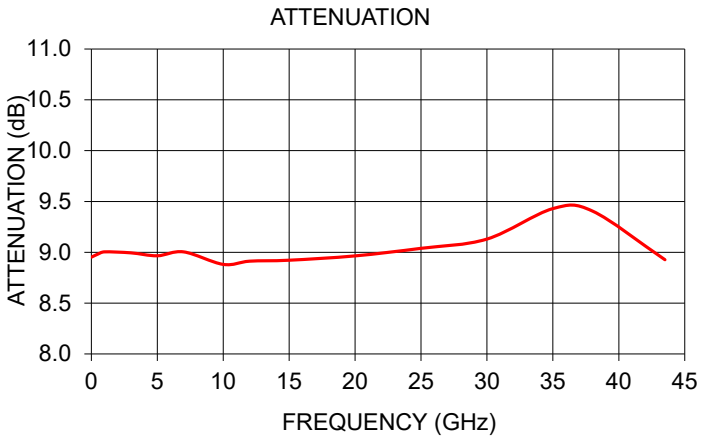
Fixed Attenuator

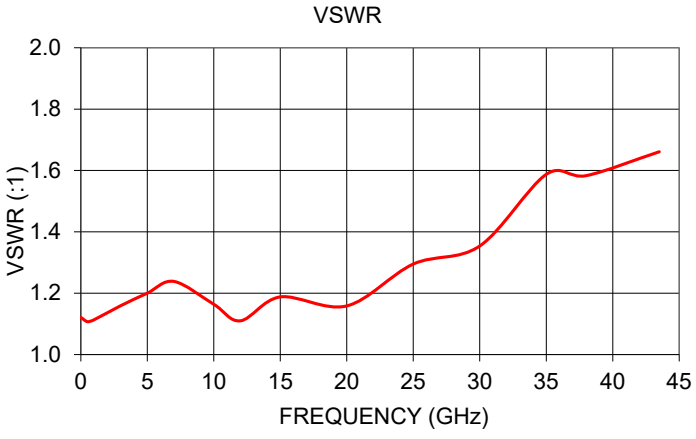
KAT-9+

50Ω 1.1 W 9 dB DC to 43.5 GHz

TYPICAL PERFORMANCE DATA AT +25°C

Frequency (GHz)	Attenuation (dB)	VSWR (:1)
0.01	8.95	1.12
0.5	8.98	1.11
1.0	8.92	1.08
3.0	8.99	1.16
5.0	8.97	1.20
7.0	9.00	1.24
10.0	8.87	1.23
12.0	8.91	1.11
15.0	8.92	1.19
20.0	8.91	1.11
25.0	9.04	1.30
30.0	8.99	1.29
35.0	9.43	1.59
38.0	9.41	1.58
43.5	8.93	1.66





Fixed Attenuator

KAT-9+

50Ω 1.1 W 9 dB DC to 43.5 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, Terminal 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-586
Evaluation Board	TB-934-9C+
Environmental Ratings	ENV08T1

ESD RATING

Human Body Model (HBM): Class 2 (Pass 2000 V) per ANSI/ESD STM 5.1 - 2001

NOTES

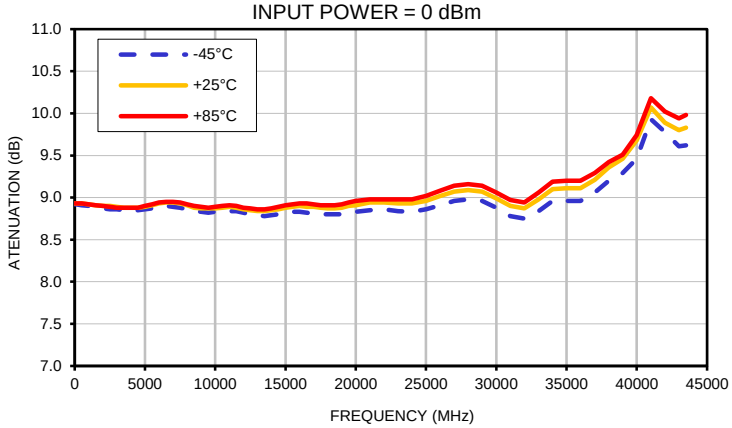
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B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
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Typical Performance Data

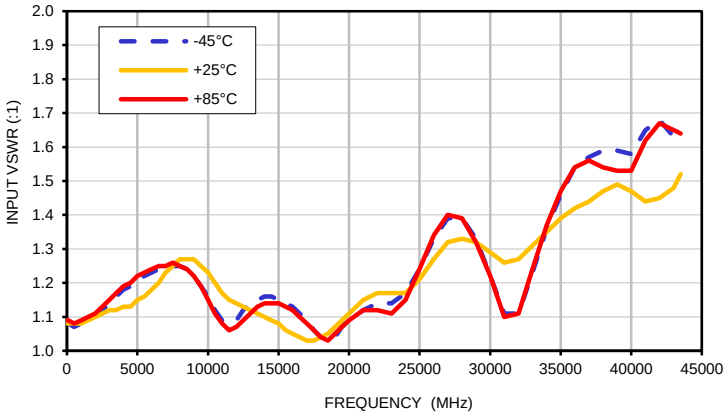
FREQ.	ATTENUATION			INPUT VSWR			OUTPUT VSWR		
(MHz)	(dB)			(:1)			(:1)		
	@-45˚C	@25°C	@+85°C	@-45˚C	@25°C	@+85°C	@-45˚C	@25°C	@+85°C
10	8.92	8.93	8.93	1.08	1.09	1.09	1.08	1.09	1.09
50	8.92	8.93	8.93	1.08	1.08	1.09	1.08	1.08	1.09
100	8.92	8.93	8.93	1.08	1.08	1.09	1.08	1.08	1.09
500	8.91	8.93	8.93	1.07	1.08	1.08	1.07	1.08	1.08
1000	8.90	8.92	8.92	1.08	1.08	1.09	1.08	1.08	1.09
1500	8.89	8.91	8.91	1.09	1.09	1.10	1.08	1.09	1.09
2000	8.87	8.90	8.90	1.10	1.10	1.11	1.09	1.11	1.10
2500	8.86	8.90	8.89	1.12	1.11	1.13	1.10	1.13	1.11
3000	8.86	8.89	8.88	1.14	1.12	1.15	1.11	1.15	1.12
3500	8.85	8.88	8.88	1.16	1.12	1.17	1.11	1.17	1.13
4000	8.84	8.88	8.88	1.18	1.13	1.19	1.12	1.18	1.14
4500	8.85	8.88	8.88	1.19	1.13	1.20	1.13	1.20	1.14
5000	8.86	8.89	8.90	1.21	1.15	1.22	1.14	1.21	1.15
5500	8.87	8.91	8.92	1.22	1.16	1.23	1.15	1.22	1.17
6000	8.89	8.93	8.94	1.23	1.18	1.24	1.17	1.23	1.18
6500	8.90	8.94	8.95	1.24	1.20	1.25	1.19	1.24	1.20
7000	8.89	8.94	8.95	1.25	1.23	1.25	1.22	1.25	1.23
7500	8.88	8.93	8.94	1.25	1.25	1.26	1.24	1.25	1.25
8000	8.86	8.91	8.92	1.25	1.27	1.25	1.26	1.25	1.27
8500	8.84	8.88	8.90	1.24	1.27	1.24	1.27	1.24	1.27
9000	8.83	8.87	8.89	1.22	1.27	1.22	1.26	1.22	1.27
9500	8.82	8.87	8.88	1.19	1.25	1.19	1.25	1.19	1.26
10000	8.83	8.87	8.89	1.16	1.23	1.15	1.23	1.16	1.23
10500	8.84	8.88	8.90	1.12	1.20	1.11	1.20	1.12	1.20
11000	8.84	8.89	8.91	1.09	1.17	1.08	1.18	1.09	1.18
11500	8.84	8.88	8.90	1.08	1.15	1.06	1.16	1.07	1.15
12000	8.82	8.86	8.88	1.09	1.14	1.07	1.15	1.08	1.14
12500	8.80	8.85	8.87	1.12	1.13	1.09	1.14	1.10	1.13
13000	8.79	8.84	8.86	1.14	1.12	1.11	1.14	1.12	1.12
13500	8.78	8.84	8.86	1.15	1.11	1.13	1.13	1.14	1.11
14000	8.79	8.85	8.87	1.16	1.10	1.14	1.12	1.15	1.10
14500	8.80	8.86	8.89	1.16	1.09	1.14	1.10	1.15	1.08
15000	8.82	8.88	8.91	1.15	1.08	1.14	1.09	1.15	1.07
15500	8.83	8.89	8.92	1.14	1.06	1.13	1.07	1.14	1.05
16000	8.83	8.90	8.93	1.13	1.05	1.12	1.05	1.12	1.04
16500	8.82	8.89	8.93	1.11	1.04	1.10	1.04	1.11	1.03
17000	8.81	8.89	8.92	1.09	1.03	1.08	1.03	1.09	1.03
17500	8.80	8.88	8.91	1.06	1.03	1.06	1.03	1.06	1.03
18000	8.80	8.87	8.91	1.04	1.04	1.04	1.04	1.04	1.04
18500	8.80	8.87	8.91	1.03	1.05	1.03	1.06	1.03	1.06
19000	8.80	8.88	8.92	1.04	1.07	1.05	1.08	1.05	1.07
19500	8.82	8.90	8.94	1.07	1.09	1.07	1.10	1.07	1.09
20000	8.83	8.91	8.96	1.09	1.11	1.09	1.12	1.09	1.11
21000	8.85	8.94	8.98	1.12	1.15	1.12	1.16	1.11	1.13
22000	8.86	8.94	8.98	1.14	1.17	1.12	1.17	1.12	1.15
23000	8.84	8.93	8.98	1.14	1.17	1.11	1.17	1.12	1.15
24000	8.83	8.93	8.98	1.17	1.17	1.15	1.18	1.17	1.17
25000	8.86	8.96	9.02	1.24	1.21	1.24	1.21	1.25	1.21
26000	8.91	9.02	9.08	1.33	1.27	1.34	1.27	1.33	1.28
27000	8.96	9.07	9.14	1.39	1.32	1.40	1.31	1.38	1.32
28000	8.98	9.09	9.16	1.39	1.33	1.39	1.33	1.37	1.33
29000	8.96	9.07	9.14	1.33	1.32	1.32	1.32	1.31	1.32
30000	8.88	8.99	9.06	1.22	1.29	1.22	1.30	1.22	1.29
31000	8.78	8.90	8.97	1.11	1.26	1.10	1.28	1.12	1.26
32000	8.75	8.87	8.94	1.11	1.27	1.11	1.28	1.11	1.26
33000	8.84	8.98	9.06	1.23	1.31	1.24	1.32	1.22	1.30
34000	8.96	9.10	9.19	1.36	1.35	1.37	1.35	1.35	1.35
35000	8.96	9.11	9.20	1.46	1.39	1.47	1.38	1.45	1.40
36000	8.96	9.11	9.20	1.54	1.42	1.54	1.42	1.53	1.44
37000	9.06	9.21	9.29	1.57	1.44	1.56	1.45	1.57	1.45
38000	9.20	9.36	9.42	1.59	1.47	1.54	1.48	1.57	1.46
39000	9.29	9.46	9.51	1.59	1.49	1.53	1.50	1.56	1.45
40000	9.46	9.68	9.74	1.58	1.47	1.53	1.49	1.56	1.44
41000	9.93	10.07	10.18	1.65	1.44	1.62	1.45	1.65	1.44
42000	9.78	9.89	10.02	1.68	1.45	1.67	1.45	1.69	1.47
43000	9.61	9.80	9.94	1.63	1.48	1.65	1.48	1.65	1.51
43500	9.62	9.83	9.98	1.60	1.52	1.64	1.51	1.63	1.53

Typical Performance Curves

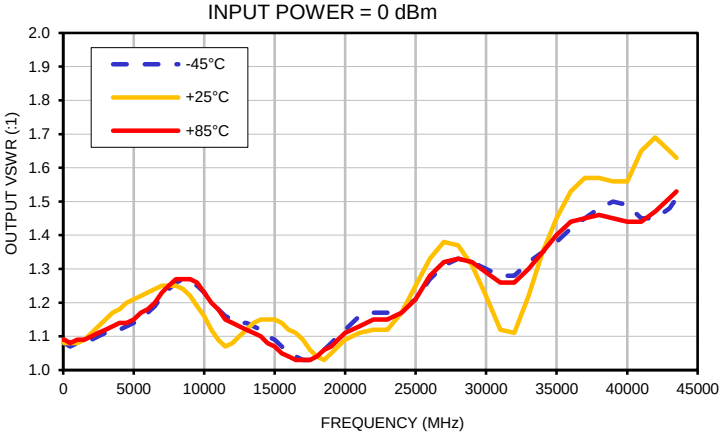
ATTENUATION vs. TEMPERATURE
INPUT POWER = 0 dBm



INPUT VSWR vs. TEMPERATURE
INPUT POWER = 0 dBm



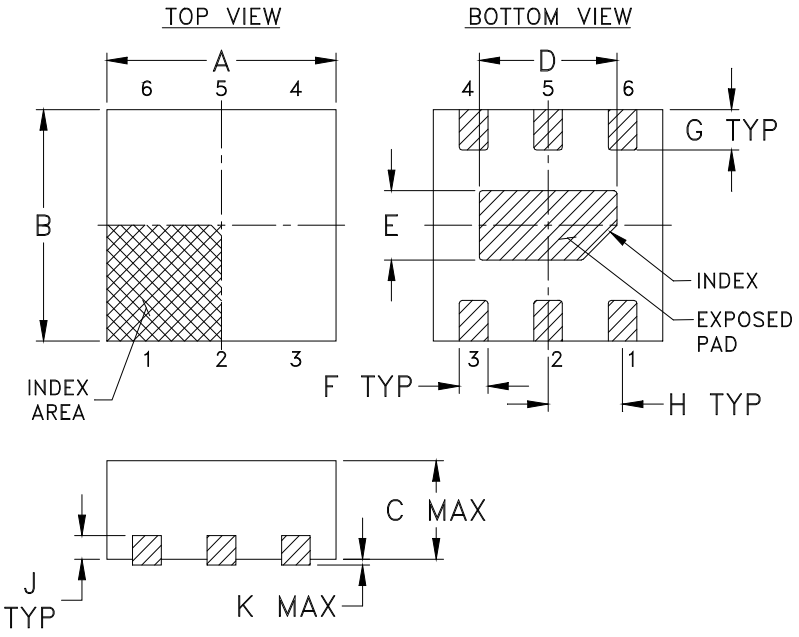
OUTPUT VSWR vs. TEMPERATURE
INPUT POWER = 0 dBm



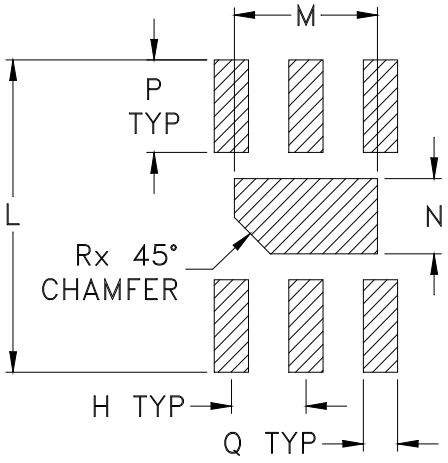
Case Style MC

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*

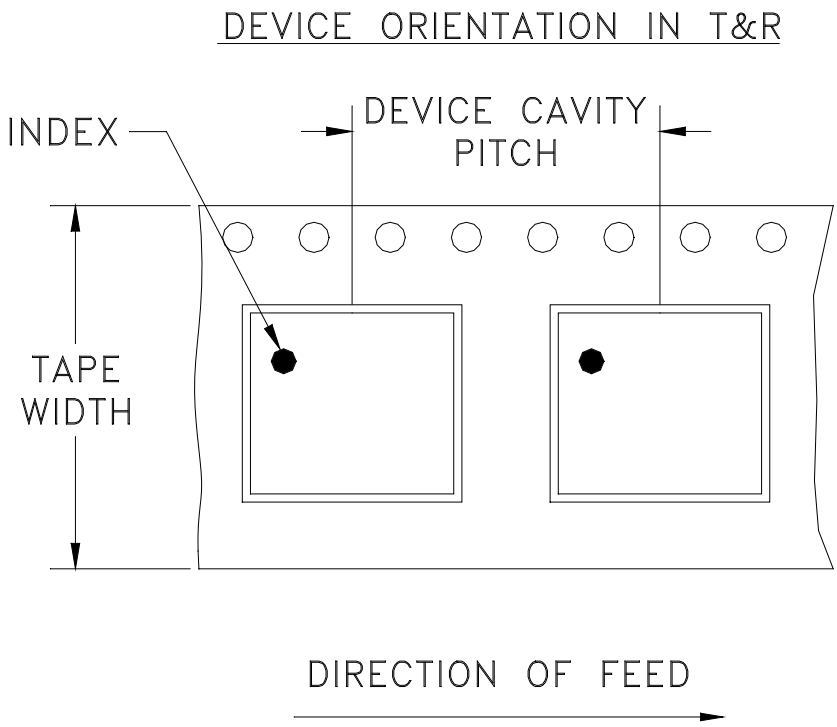
Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3 Pl. ± .005

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.

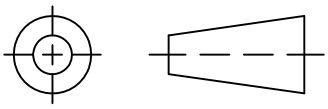
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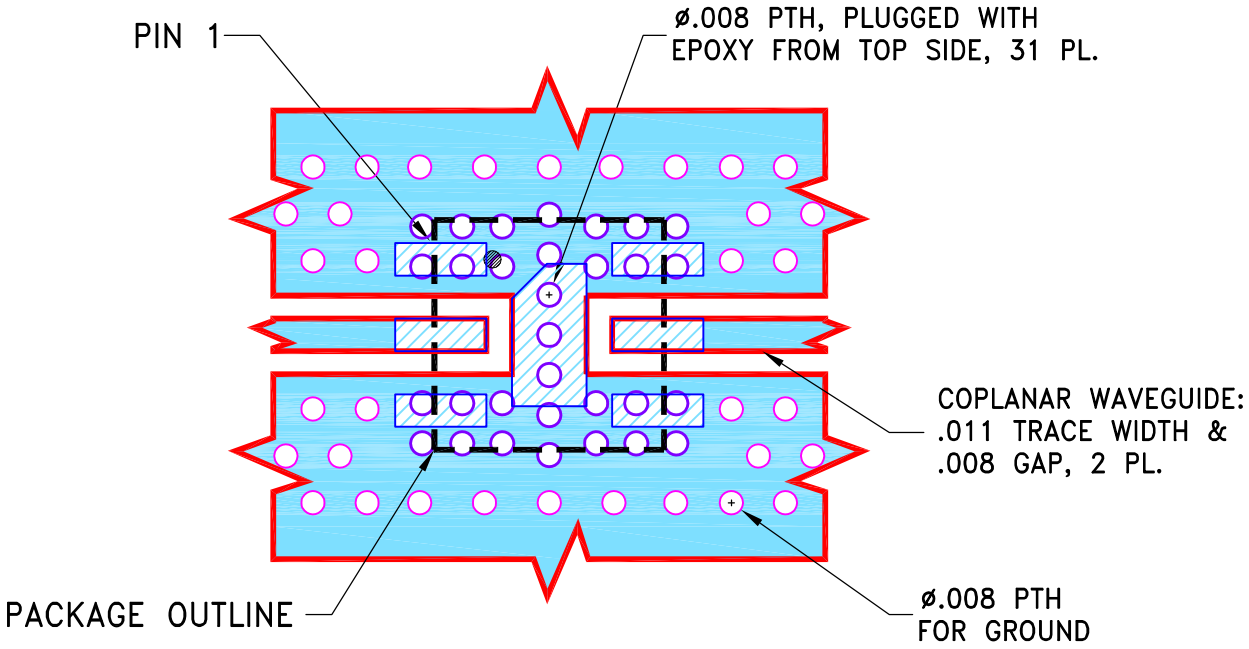
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
0R	M167874	NEW RELEASE	05/17/18	ITG	RS

SUGGESTED MOUNTING CONFIGURATION
FOR MC1630-1 CASE STYLE, "06AF04" PIN CODE



NOTES:

1. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .0066±.0007. COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & 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.

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	ITG	05/11/18
TOLERANCES ON:	CHECKED	GF	05/17/18
2 PL DECIMALS ±	APPROVED	RS	05/17/18
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

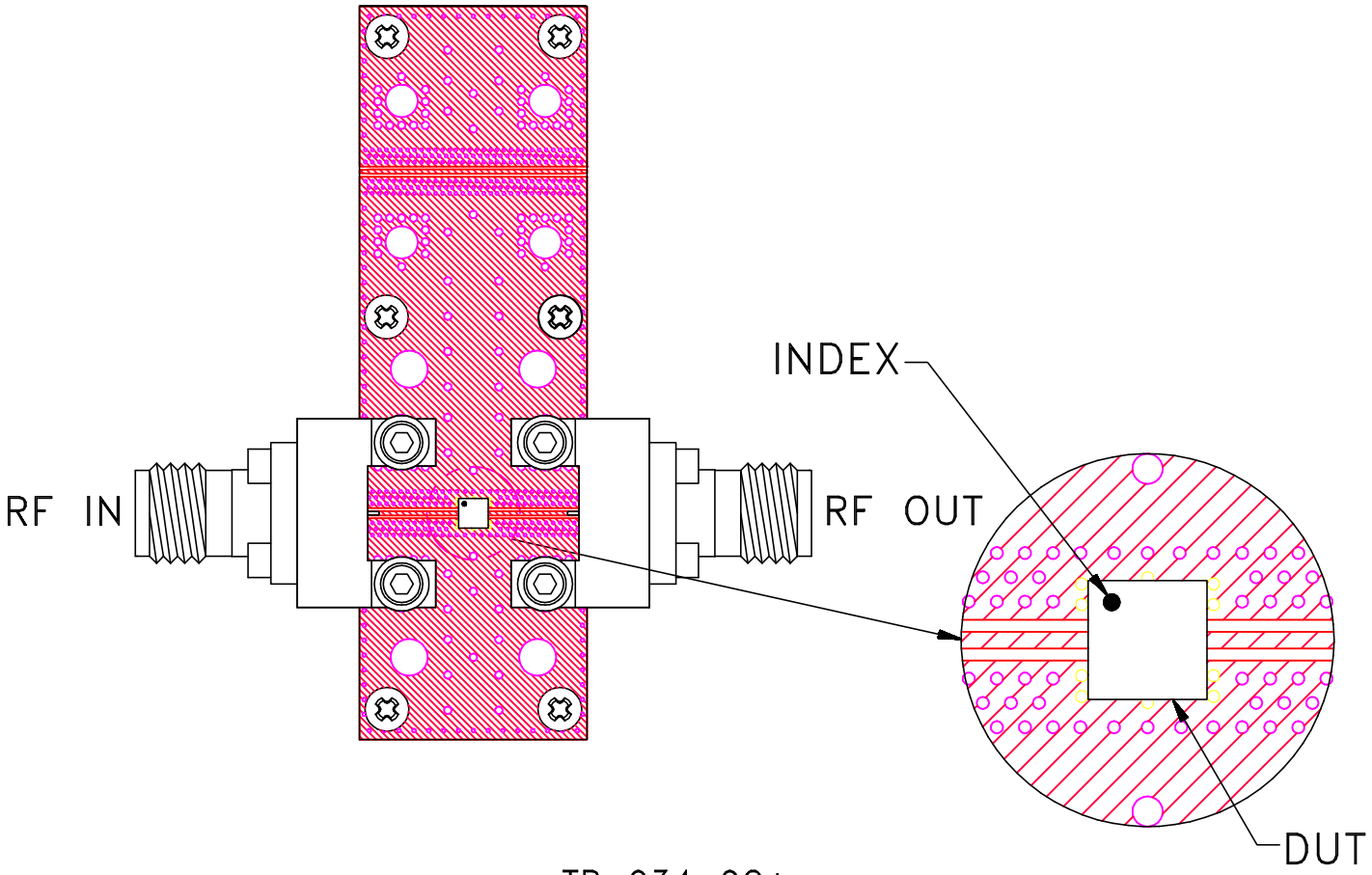
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, 06AF04, MC1630-1, TB-934-NC+

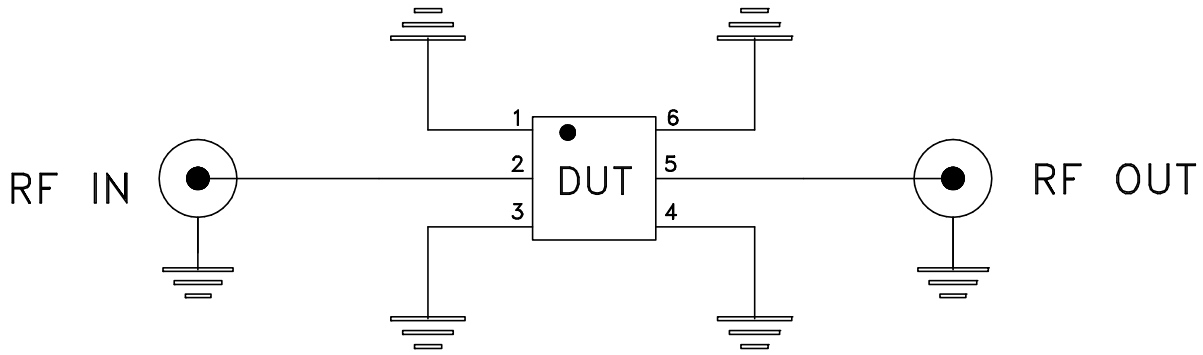
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-586	0R

FILE:	SCALE:	SHEET:
98PL586	15:1	1 OF 1

Evaluation Board and Circuit



TB-934-9C+



Schematic Diagram

Notes:

1. 50 Ohm 2.40mm Female end launch connectors.
2. PCB Material: RO4350 or equivalent,
   Dielectric Constant=3.5, Thickness=.0066 inch.

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Mini-Circuits

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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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

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