



Mini-Circuits

MICROWAVE PRECISION

Fixed Attenuator

KAT-20+

50Ω 0.8 W 20 dB DC to 43.5 GHz

THE BIG DEAL

- Super-Wide Bandwidth, DC to 43.5 GHz
- High Power Handling, 0.8 W
- Small Package, 2x2 mm MCLP™
- Excellent VSWR, 1.1:1 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-20+ 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 0.8 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.

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

Parameter	Condition (GHz)	Min.	Typ.	Max.	Unit
Frequency Range		DC		43.5	GHz
Attenuation	0.01-5	19.6	20.0	20.8	dB
	5-10	19.7	20.0	21.2	
	10-20	19.7	20.0	21.9	
	20-30	19.8	19.9	23.1	
	30-40		19.9		
	40-43.5		19.4		
VSWR	0.01-5		1.07	1.4	:1
	5-10		1.09	1.4	
	10-20		1.10	1.9	
	20-30		1.30		
	30-40		1.55		
	40-43.5		1.32		

1. Tested on Mini-Circuits test board TB-934-20C+. See Characterization/Application Circuit in Fig. 1.

ABSOLUTE MAXIMUM RATINGS²

Parameter	Ratings
Operating Case Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
RF Input Power	0.8 W ³

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

3. Power rating derated to 0.6 W at +85°C.





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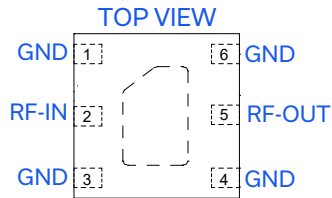
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PAD DESCRIPTION



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

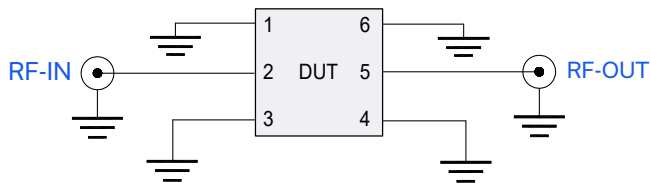
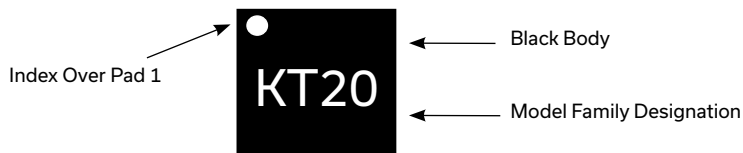


Fig 1. Block diagram of Test Circuit used for characterization, Test board TB-934-20C+
Conditions: Attenuation, VSWR: $P_{IN} = 0$ dBm

PRODUCT MARKING



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





MICROWAVE PRECISION

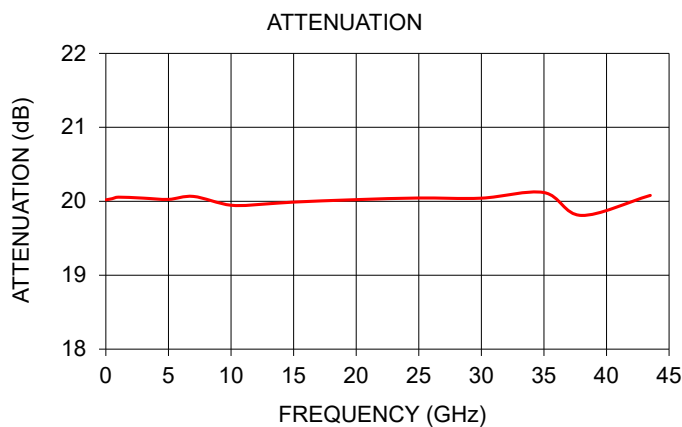
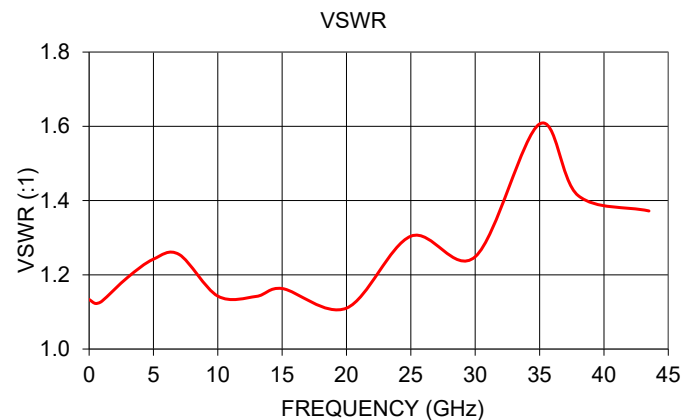
Fixed Attenuator

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TYPICAL PERFORMANCE DATA AT +25°C

Frequency (GHz)	Attenuation (dB)	VSWR (:1)
0.01	20.02	1.13
0.5	20.03	1.12
1.0	20.06	1.13
3.0	20.04	1.19
5.0	20.03	1.24
7.0	20.07	1.25
10.0	19.95	1.14
13.0	19.97	1.14
15.0	19.99	1.16
20.0	20.02	1.11
25.0	20.04	1.30
30.0	20.04	1.25
35.0	20.12	1.61
38.0	19.81	1.41
43.5	20.08	1.37





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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	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-586
Evaluation Board	TB-934-20C+
Environmental Ratings	ENV08T1

ESD RATING

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

NOTES

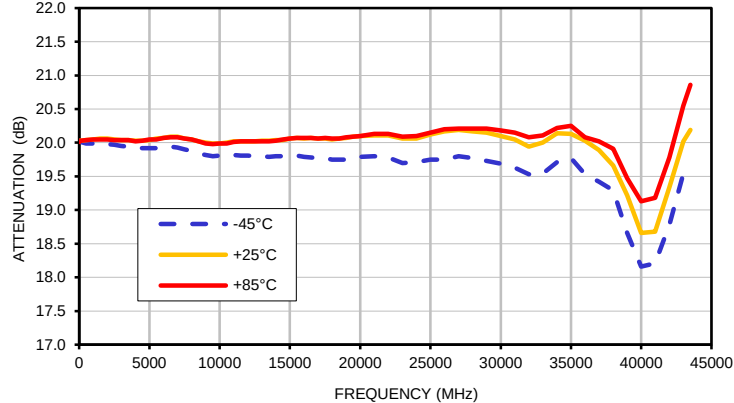
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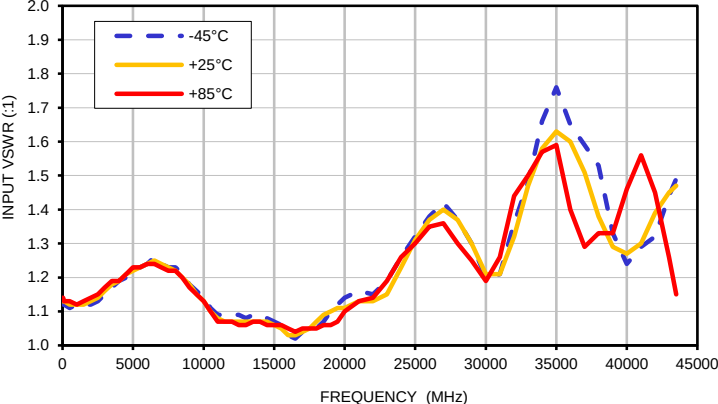
Typical Performance Data

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	20.02	20.02	20.01	1.13	1.13	1.14	1.13	1.13	1.14
50	20.02	20.03	20.03	1.12	1.13	1.14	1.12	1.13	1.14
100	20.01	20.03	20.03	1.12	1.13	1.13	1.12	1.13	1.13
500	19.99	20.04	20.04	1.11	1.12	1.13	1.11	1.12	1.13
1000	19.99	20.05	20.05	1.12	1.12	1.12	1.13	1.13	1.13
1500	19.99	20.06	20.05	1.12	1.12	1.13	1.14	1.14	1.15
2000	19.98	20.06	20.05	1.12	1.13	1.14	1.14	1.16	1.17
2500	19.97	20.05	20.04	1.13	1.14	1.15	1.17	1.17	1.18
3000	19.95	20.04	20.04	1.15	1.16	1.17	1.18	1.20	1.21
3500	19.94	20.04	20.04	1.17	1.18	1.19	1.20	1.21	1.23
4000	19.93	20.03	20.02	1.19	1.19	1.19	1.21	1.21	1.22
4500	19.92	20.03	20.03	1.20	1.21	1.21	1.22	1.23	1.24
5000	19.92	20.04	20.05	1.22	1.22	1.23	1.23	1.24	1.25
5500	19.92	20.06	20.05	1.23	1.23	1.23	1.25	1.25	1.25
6000	19.93	20.07	20.07	1.24	1.24	1.24	1.24	1.24	1.25
6500	19.94	20.09	20.08	1.26	1.25	1.24	1.23	1.25	1.26
7000	19.93	20.09	20.08	1.24	1.24	1.23	1.26	1.25	1.25
7500	19.90	20.06	20.06	1.23	1.23	1.22	1.24	1.24	1.23
8000	19.88	20.05	20.05	1.23	1.22	1.22	1.24	1.24	1.25
8500	19.84	20.02	20.02	1.21	1.20	1.20	1.22	1.22	1.23
9000	19.82	20.00	19.99	1.18	1.18	1.17	1.21	1.20	1.21
9500	19.80	19.99	19.98	1.16	1.15	1.15	1.19	1.18	1.18
10000	19.81	19.99	19.99	1.14	1.13	1.13	1.17	1.15	1.15
10500	19.80	20.00	19.99	1.11	1.10	1.10	1.15	1.14	1.14
11000	19.82	20.02	20.01	1.09	1.08	1.07	1.12	1.11	1.11
11500	19.81	20.02	20.02	1.09	1.07	1.07	1.11	1.10	1.09
12000	19.81	20.02	20.02	1.09	1.07	1.07	1.12	1.11	1.10
12500	19.80	20.02	20.02	1.09	1.07	1.06	1.14	1.12	1.12
13000	19.80	20.03	20.02	1.08	1.07	1.06	1.17	1.15	1.14
13500	19.79	20.03	20.02	1.09	1.07	1.07	1.17	1.16	1.16
14000	19.80	20.04	20.03	1.09	1.07	1.07	1.20	1.17	1.17
14500	19.80	20.04	20.05	1.08	1.07	1.06	1.20	1.17	1.17
15000	19.80	20.06	20.06	1.07	1.06	1.06	1.17	1.17	1.16
15500	19.81	20.07	20.07	1.06	1.05	1.06	1.18	1.16	1.15
16000	19.79	20.06	20.07	1.03	1.03	1.05	1.13	1.13	1.14
16500	19.78	20.07	20.07	1.02	1.03	1.04	1.10	1.12	1.12
17000	19.77	20.06	20.06	1.04	1.04	1.05	1.09	1.10	1.09
17500	19.77	20.06	20.07	1.05	1.05	1.05	1.09	1.06	1.06
18000	19.75	20.05	20.06	1.05	1.07	1.05	1.05	1.06	1.05
18500	19.75	20.06	20.06	1.07	1.09	1.06	1.07	1.06	1.05
19000	19.75	20.07	20.08	1.10	1.10	1.06	1.04	1.07	1.06
19500	19.76	20.09	20.09	1.12	1.11	1.07	1.07	1.08	1.07
20000	19.79	20.10	20.10	1.14	1.11	1.10	1.15	1.11	1.10
21000	19.80	20.11	20.13	1.16	1.13	1.13	1.15	1.13	1.14
22000	19.78	20.11	20.13	1.15	1.13	1.14	1.20	1.17	1.17
23000	19.70	20.06	20.09	1.19	1.15	1.19	1.22	1.21	1.19
24000	19.71	20.06	20.10	1.26	1.23	1.26	1.25	1.22	1.22
25000	19.75	20.12	20.15	1.32	1.31	1.30	1.27	1.25	1.25
26000	19.75	20.17	20.20	1.38	1.37	1.35	1.27	1.27	1.26
27000	19.80	20.19	20.21	1.42	1.40	1.36	1.32	1.30	1.31
28000	19.77	20.17	20.21	1.37	1.37	1.30	1.36	1.34	1.34
29000	19.73	20.15	20.21	1.30	1.30	1.25	1.35	1.33	1.33
30000	19.69	20.10	20.18	1.20	1.21	1.19	1.31	1.29	1.27
31000	19.63	20.05	20.15	1.21	1.21	1.26	1.23	1.22	1.19
32000	19.53	19.94	20.08	1.36	1.32	1.44	1.23	1.22	1.22
33000	19.54	20.00	20.11	1.48	1.47	1.50	1.30	1.31	1.34
34000	19.71	20.14	20.22	1.66	1.58	1.57	1.51	1.45	1.48
35000	19.77	20.13	20.25	1.76	1.63	1.59	1.63	1.54	1.58
36000	19.53	20.03	20.08	1.65	1.60	1.40	1.52	1.56	1.55
37000	19.42	19.89	20.02	1.59	1.51	1.29	1.52	1.49	1.47
38000	19.29	19.66	19.91	1.53	1.38	1.33	1.50	1.39	1.38
39000	18.66	19.22	19.47	1.33	1.29	1.33	1.38	1.35	1.32
40000	18.16	18.66	19.13	1.24	1.27	1.46	1.37	1.33	1.30
41000	18.21	18.68	19.18	1.29	1.30	1.56	1.32	1.29	1.29
42000	18.78	19.34	19.78	1.32	1.39	1.45	1.25	1.26	1.28
43000	19.54	20.02	20.55	1.44	1.45	1.26	1.26	1.28	1.29
43500	19.63	20.19	20.86	1.49	1.47	1.15	1.30	1.29	1.30

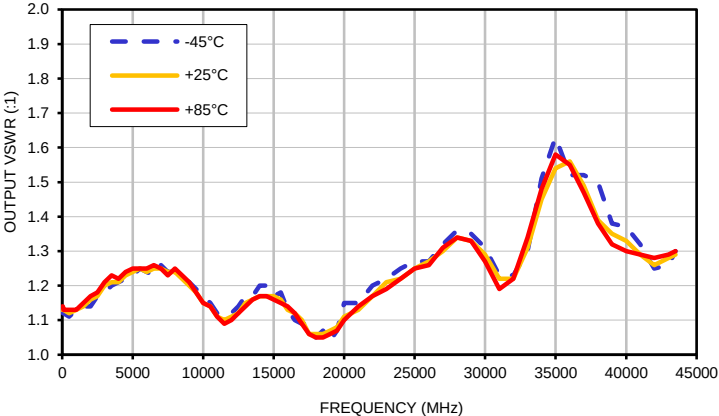
ATTENUATION vs. TEMPERATURE
INPUT POWER = 0 dBm



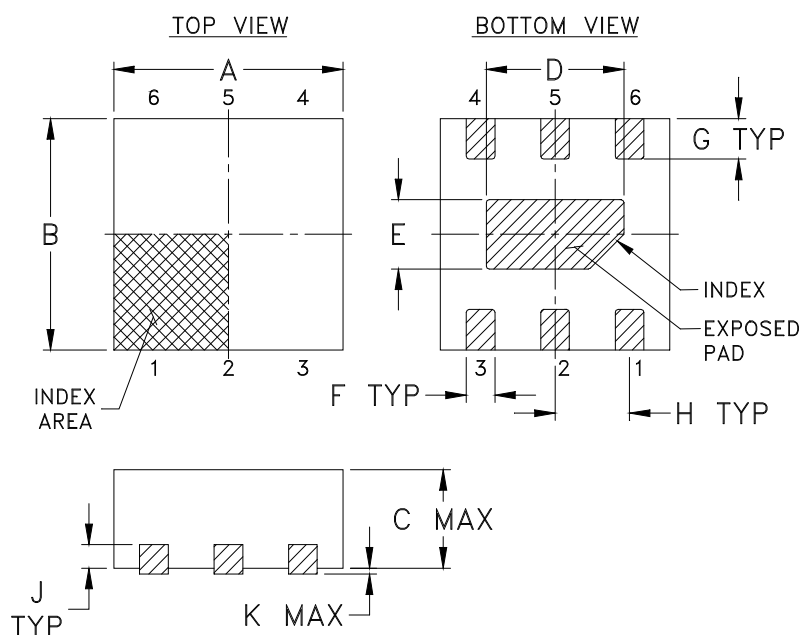
INPUT VSWR vs. TEMPERATURE
INPUT POWER = 0 dBm



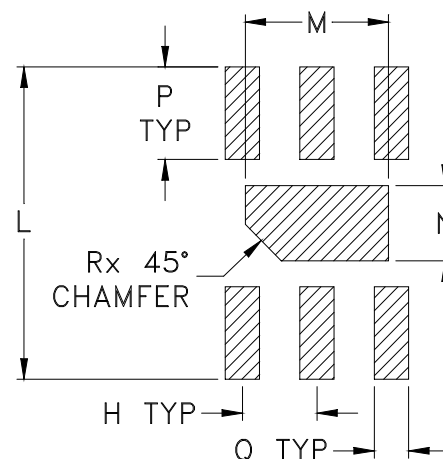
OUTPUT VSWR vs. TEMPERATURE
INPUT POWER = 0 dBm



Outline Dimensions



PCB Land Pattern



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

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)

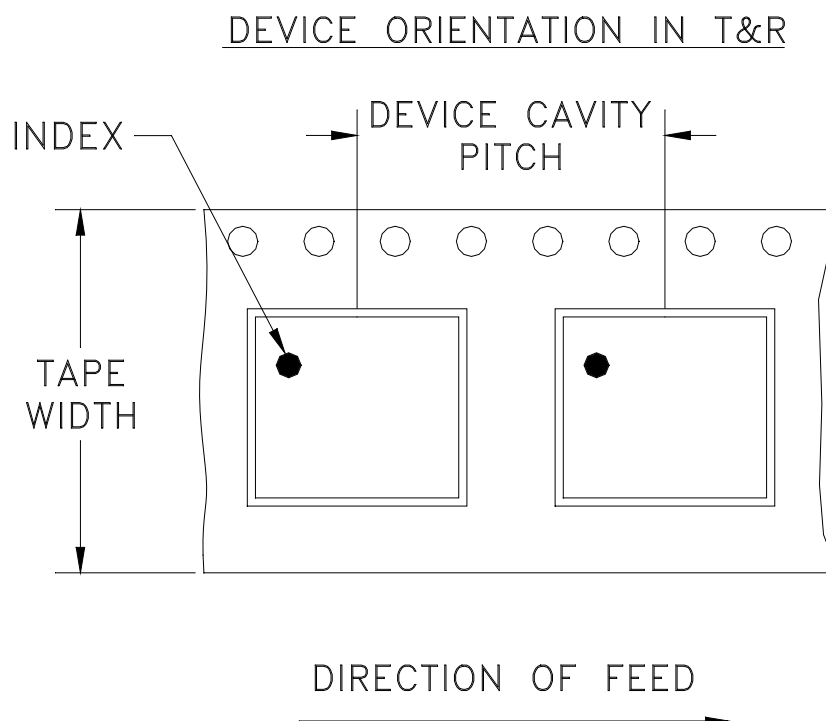
CASE #.	Q	R	WT, GRAM
MC1630-1	.012 (.30)	.012 (.30)	.010*

Dimensions are in inches (mm). Tolerances: 2 Pl. $\pm .01$; 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.
- *Approximate weight: For the accurate weight, please see the Material Declaration.

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.

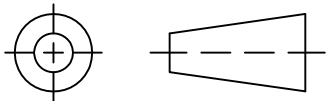
Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

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



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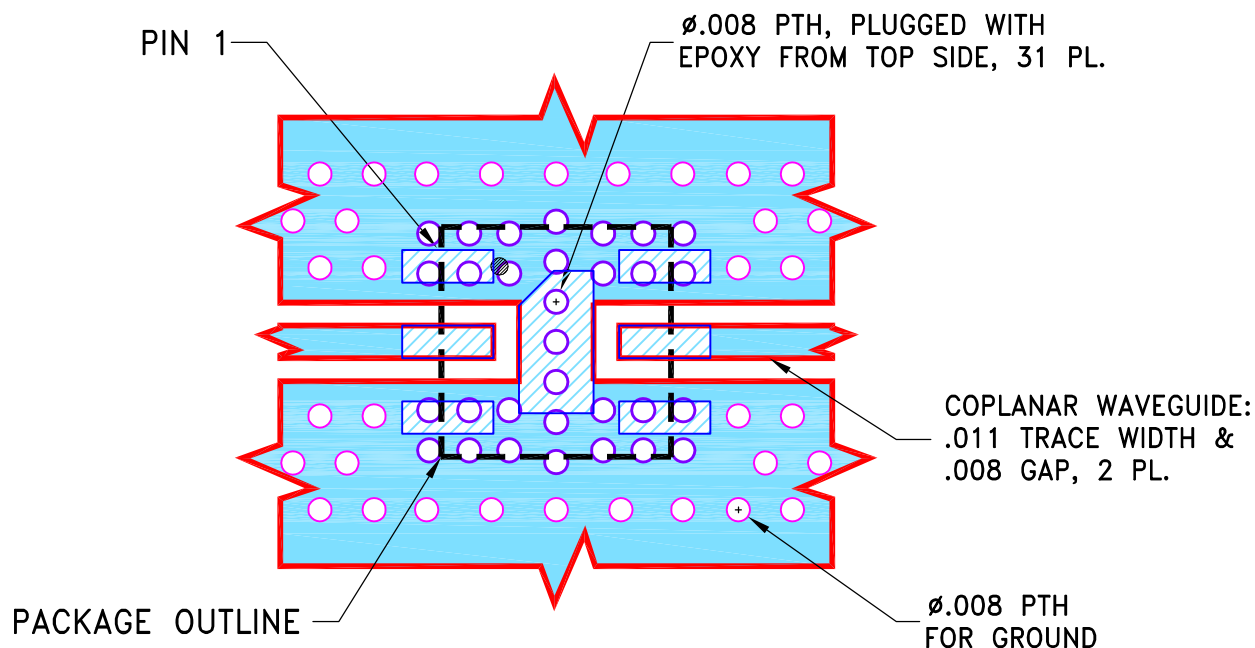
THIRD ANGLE PROJECTION



REVISIONS

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

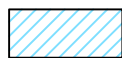
SUGGESTED MOUNTING CONFIGURATION
FOR MC1630-1 CASE STYLE, "06AF04" PIN CODE

**NOTES:**

- TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS $.0066 \pm .0007$. COPPER: 1/2 OZ. EACH SIDE.
FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
- 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

TOLERANCES ON:

2 PL DECIMALS $\pm$ 3 PL DECIMALS $\pm$.005ANGLES $\pm$ FRACTIONS $\pm$

DRAWN

ITG

05/11/18

CHECKED

GF

05/17/18

APPROVED

RS

05/17/18

**Mini-Circuits®**13 Neptune Avenue
Brooklyn NY 11235**PL, 06AF04, MC1630-1, TB-934-NC+**

SIZE

A

CODE IDENT

15542

DRAWING NO:

98-PL-586

REV:

OR

FILE:

98PL586

SCALE:

15:1

SHEET:

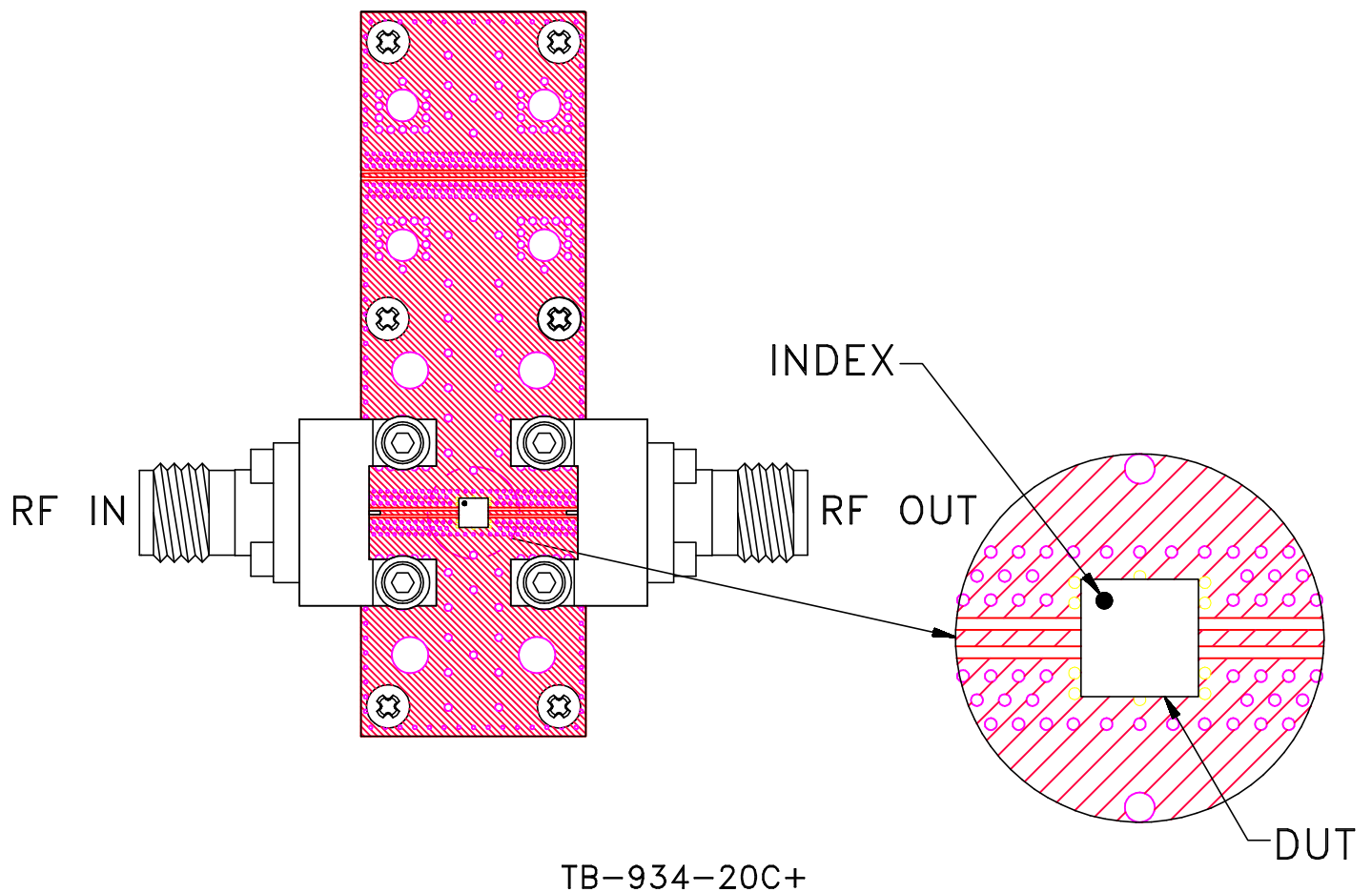
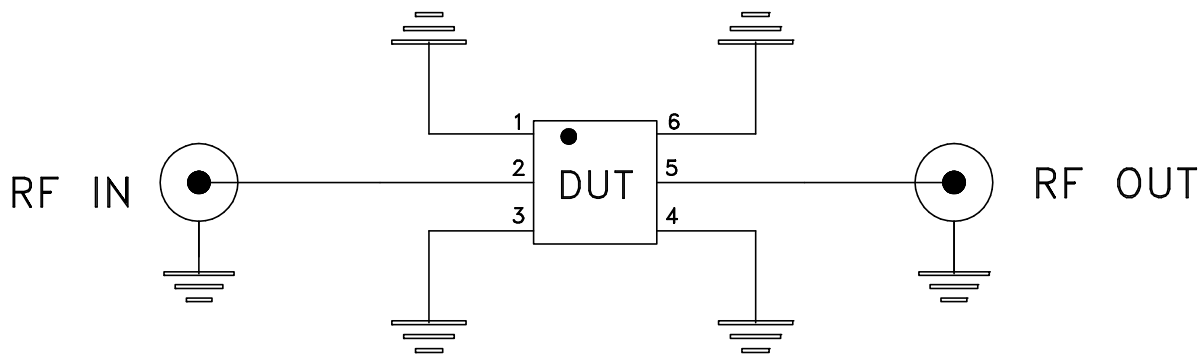
1 OF 1

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

Evaluation Board and Circuit



Schematic Diagram

Notes:

1. 50 Ohm 2.40mm Female end launch connectors.
2. PCB Material: R04350 or equivalent,
Dielectric Constant=3.5, Thickness=.0066 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