X4 Frequency Multiplier

RKK-4-442+

50Ω Output 3600 to 4400 MHz

The Big Deal

- Broadband, output from 3600 to 4400 MHz
- Wide input power range, +19 to +23 dBm
- Low conversion loss, 24.5 dB
- Good harmonic suppression: - F3, 23 dBc; F5, 31 dBc

CASE STYLE: CK1246

Product Overview

Mini-Circuits' RKK-4-442+ frequency multiplier provides a multiplication factor of 4, converting input frequencies from 900 to 1100 MHz into output frequencies from 3600 to 4400 MHz, supporting applications including synthesizers, local oscillators, satellite up and down converters and more. This model provides an input power range from +19 to +23 dBm, low conversion loss and good harmonic suppression. The multiplier comes housed in a miniature, shielded surface-mount package (0.50 x 0.50 x 0.18") with wraparound terminations for excellent solderability.

Feature	Advantages
Low conversion loss, 24.5 dB typ.	With a low conversion loss, RKK-4-442+ produces higher output power, reducing the need for amplification.
Very good harmonic suppression • F3, 23 dBc • F5, 31 dBc	Reduces spurious signals and the need for additional filtering.
Broadband, 3600 to 4400 MHz output	With an output frequency range spanning 3600 to 4400 MHz, this multiplier covers a wide range of applications.
Wide input power range, +19 to +23 dBm	Wide input power signal range accommodates different input signal levels while still maintaining a low conversion loss.
Low cost	Provides an easy, cost-effective solution for generating high-frequency signals from a lower frequency signal source.
Small size, 0.50 x 0.50 x 0.18"	Saves space in crowded PCB layouts.

X4 Frequency Multiplier

RKK-4-442+

50Ω Output 3600 to 4400 MHz

Generic photo used for illustration purposes only

CASE STYLE: CK1246

+RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Input Power	24dBm

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

Pin Connections

INPUT	2
OUTPUT	10
GROUND	1,3,4,5,6,7,8,9,11,12,13,14,15,16

Features

- broadband
- high rejection F1, 27 dBc typ; F2, 35 dBc typ; F3, 23 dBc typ; F5, 31 dBc typ.
- aqueous washable

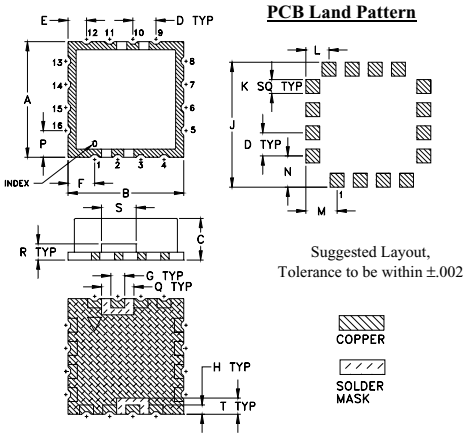
Applications

- synthesizers
- local oscillators
- satellite up and down converters

Available Tape and Reel at no extra cost

Reel Size	Devices/Reel
7"	10, 20, 50, 100
13"	200, 500

Outline Drawing

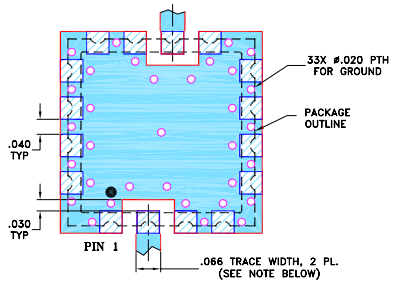


Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	H	J	K
.500	.500	.180	.100	.080	.115	.060	.040	.540	.060
12.70	12.70	4.57	2.54	2.03	2.92	1.52	1.02	13.72	1.52

L	M	N	P	Q	R	S	T	wt.
.100	.135	.135	.115	.140	.070	.150	.070	grams
2.54	3.43	3.43	2.92	3.56	1.78	3.81	1.78	1.0

Demo Board MCL P/N: TB-435+
Suggested PCB Layout (PL-267)



NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH 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

Electrical Specifications at 25°C

Parameter		Min.	Typ.	Max.	Unit
Multiplier Factor			4		
Frequency Range, Input (F1)		900	—	1100	MHz
Frequency Range, Output (F4)		3600	—	4400	MHz
Input Power		19	—	23	dBm
Conversion Loss		—	24.5	29	dB
Harmonic Ouput*	F1	23	27	—	dBc
	F2	21	35	—	
	F3	18	23		
	F5	18	31	—	

* Harmonics of input frequency below the power level of F4, at RF in +21dBm

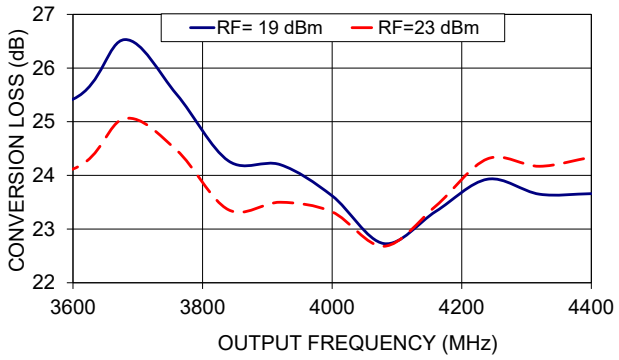
Typical Performance Data

Input Frequency (MHz)	INPUT RF= 19dBm Conversion Loss (dB)	Harmonic Output Below F4 (-dBc)				INPUT RF= 23dBm Conversion Loss (dB)	Harmonic Output Below F4 (-dBc)			
	F4	F1	F2	F3	F5	F4	F1	F2	F3	F5
900.00	25.42	44.24	33.33	40.00	37.92	24.12	45.30	37.19	41.19	37.14
920.00	26.53	43.34	32.95	35.93	35.59	25.06	44.50	37.09	37.51	44.00
940.00	25.51	44.72	34.72	32.65	35.02	24.47	45.46	38.69	34.73	45.01
960.00	24.27	45.95	36.60	30.37	35.81	23.36	46.45	40.82	33.05	43.60
980.00	24.20	45.99	37.40	27.91	35.89	23.50	46.31	41.92	30.55	40.78
1000.00	23.62	46.28	38.81	25.99	36.40	23.32	46.29	43.48	28.27	38.04
1020.00	22.73	46.33	40.37	25.15	38.35	22.68	46.14	45.07	27.18	38.46
1040.00	23.33	46.12	39.83	24.09	40.34	23.43	45.83	43.29	26.05	42.36
1060.00	23.93	45.71	38.96	23.47	36.57	24.31	45.17	41.06	25.56	40.15
1080.00	23.65	45.37	38.34	24.32	36.11	24.17	44.68	39.92	27.34	36.70
1100.00	23.66	45.39	38.51	25.99	36.04	24.34	44.55	40.35	30.35	33.89

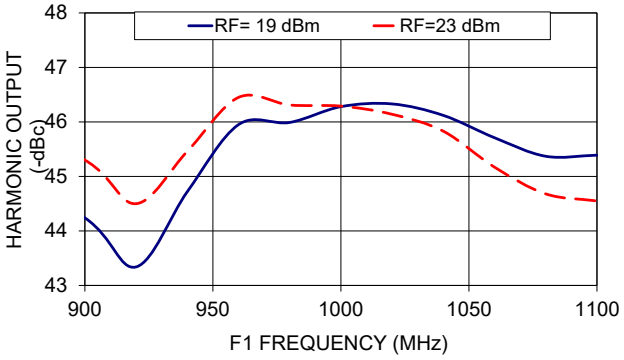
Notes

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/MCLStore/terms.jsp

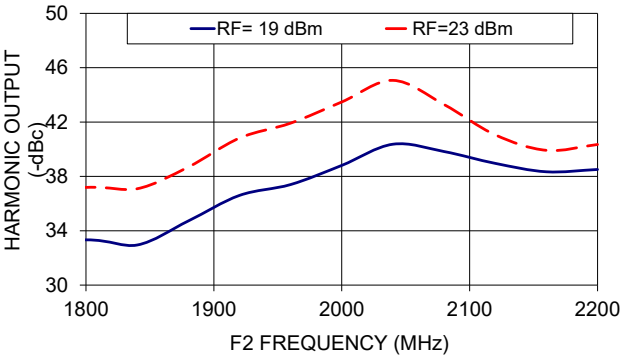
RKK-4-442+
CONVERSION LOSS



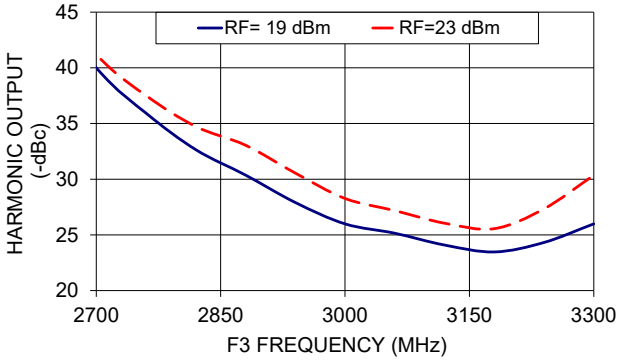
RKK-4-442+
HARMONIC OUTPUT F1



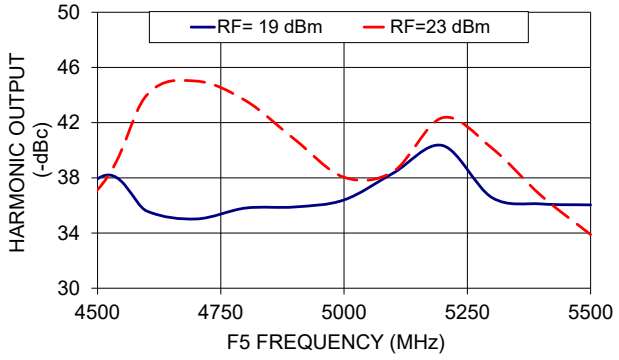
RKK-4-442+
HARMONIC OUTPUT F2



RKK-4-442+
HARMONIC OUTPUT F3



RKK-4-442+
HARMONIC OUTPUT F5



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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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Frequency Multiplier (X4) RKK-4-442+

Typical Performance Data

FREQUENCY (MHz)					CONVERSION LOSS (dB)	RF IN = +19 dBm HARMONIC OUTPUT* (-dBc)			
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X4 OUTPUT	X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X5 OUTPUT
800	1600	2400	3200	4000	25.59	47.50	31.93	54.83	30.52
850	1700	2550	3400	4250	24.99	45.58	32.89	53.97	26.60
900	1800	2700	3600	4500	25.42	44.24	33.33	40.00	37.92
920	1840	2760	3680	4600	26.53	43.34	32.95	35.93	35.59
940	1880	2820	3760	4700	25.51	44.72	34.72	32.65	35.02
960	1920	2880	3840	4800	24.27	45.95	36.60	30.37	35.81
980	1960	2940	3920	4900	24.20	45.99	37.40	27.91	35.89
1000	2000	3000	4000	5000	23.62	46.28	38.81	25.99	36.40
1020	2040	3060	4080	5100	22.73	46.33	40.37	25.15	38.35
1040	2080	3120	4160	5200	23.33	46.12	39.83	24.09	40.34
1060	2120	3180	4240	5300	23.93	45.71	38.96	23.47	36.57
1080	2160	3240	4320	5400	23.65	45.37	38.34	24.32	36.11
1100	2200	3300	4400	5500	23.66	45.39	38.51	25.99	36.04

* Harmonic Output below power level of X4 Output.

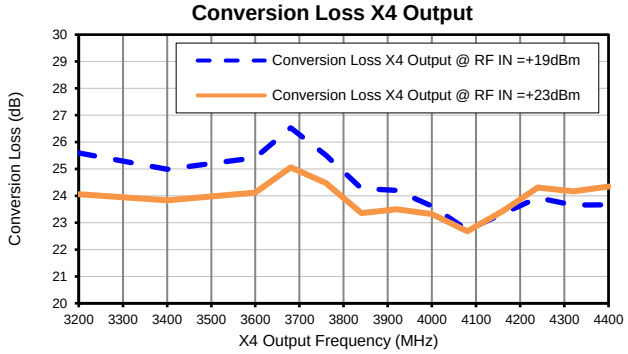
FREQUENCY (MHz)					CONVERSION LOSS (dB)	RF IN = +23 dBm HARMONIC OUTPUT* (-dBc)			
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X4 OUTPUT	X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X5 OUTPUT
800	1600	2400	3200	4000	24.06	47.23	36.06	60.32	44.59
850	1700	2550	3400	4250	23.83	46.39	36.50	54.01	30.19
900	1800	2700	3600	4500	24.12	45.30	37.19	41.19	37.14
920	1840	2760	3680	4600	25.06	44.50	37.09	37.51	44.00
940	1880	2820	3760	4700	24.47	45.46	38.69	34.73	45.01
960	1920	2880	3840	4800	23.36	46.45	40.82	33.05	43.60
980	1960	2940	3920	4900	23.50	46.31	41.92	30.55	40.78
1000	2000	3000	4000	5000	23.32	46.29	43.48	28.27	38.04
1020	2040	3060	4080	5100	22.68	46.14	45.07	27.18	38.46
1040	2080	3120	4160	5200	23.43	45.83	43.29	26.05	42.36
1060	2120	3180	4240	5300	24.31	45.17	41.06	25.56	40.15
1080	2160	3240	4320	5400	24.17	44.68	39.92	27.34	36.70
1100	2200	3300	4400	5500	24.34	44.55	40.35	30.35	33.89

* Harmonic Output below power level of X4 Output.

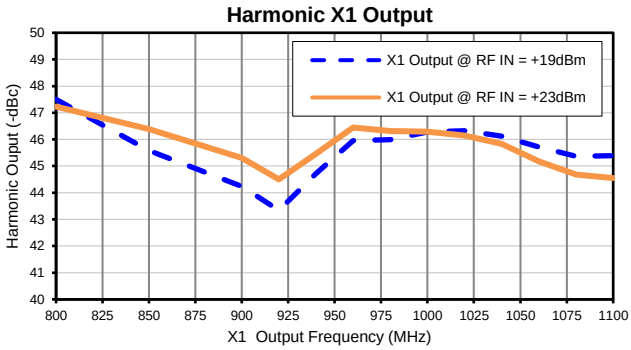
Frequency Multiplier (X4) RKK-4-442+

Typical Performance Curves

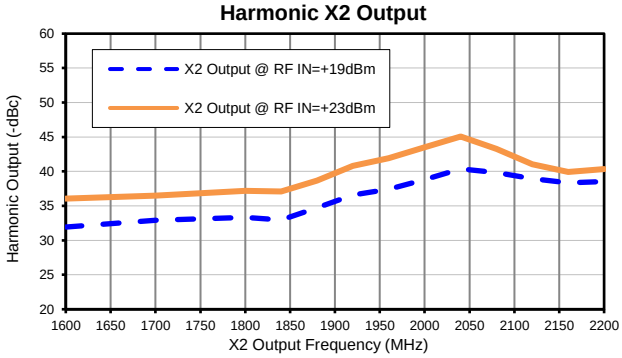
Conversion Loss X4 Output



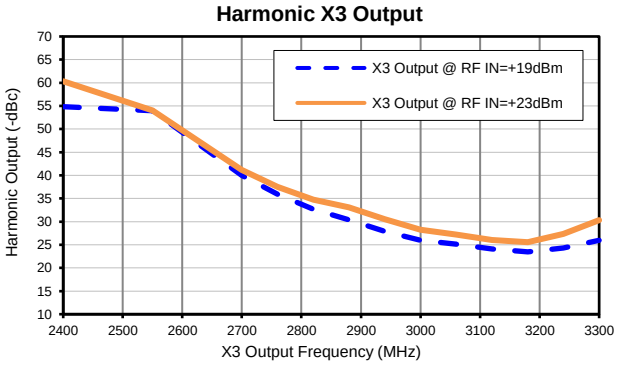
Harmonic X1 Output



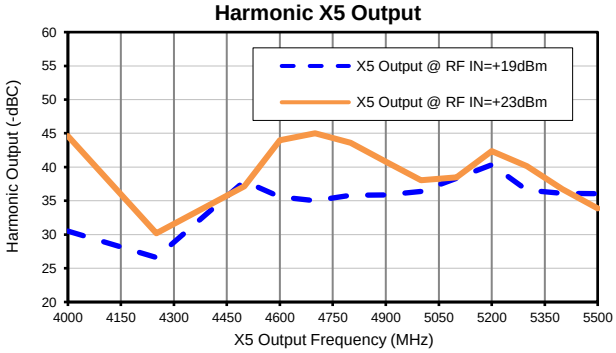
Harmonic X2 Output



Harmonic X3 Output



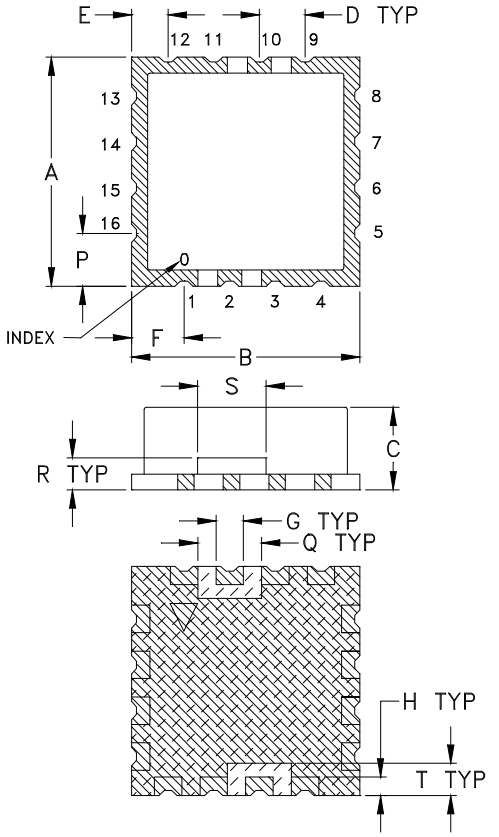
Harmonic X5 Output



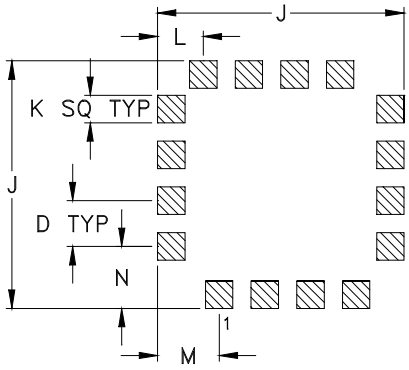
Case Style CK

CK1246

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

METALLIZATION

SOLDER RESIST

CASE #	A	B	C	D	E	F	G	H	J	K
CK1246	.500 (12.70)	.500 (12.70)	.180 (4.57)	.100 (2.54)	.080 (2.03)	.115 (2.92)	.060 (1.52)	.040 (1.02)	.540 (13.72)	.060 (1.52)

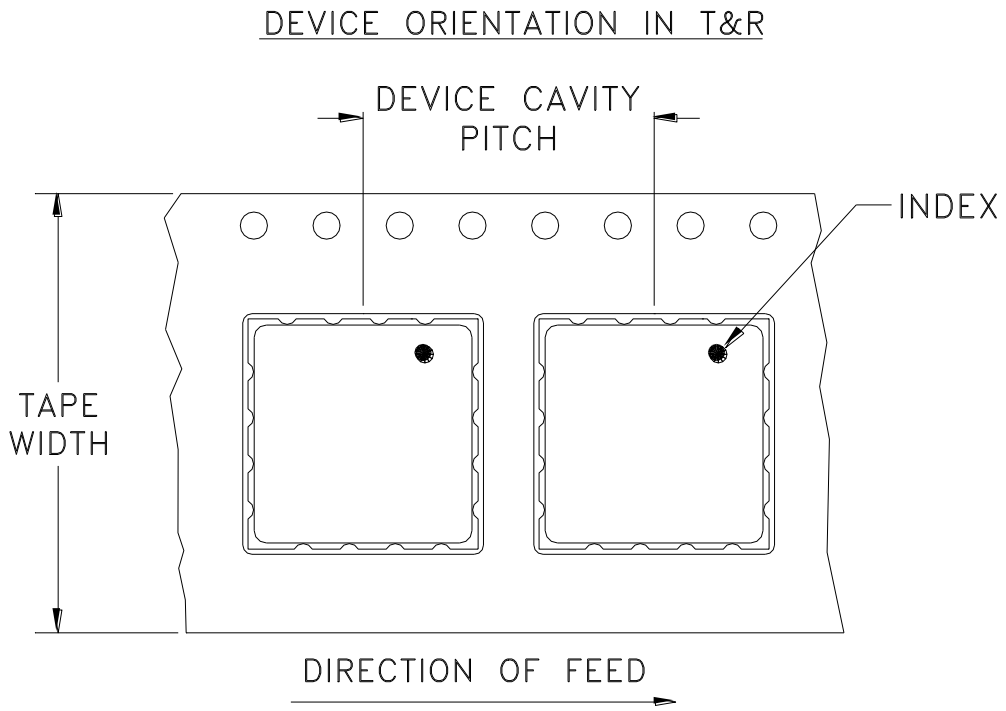
CASE #	L	M	N	P	Q	R	S	T	WT. GRAM
CK1246	.100 (2.54)	.135 (3.43)	.135 (3.43)	.115 (2.92)	.140 (3.56)	.070 (1.78)	.150 (3.81)	.070 (1.78)	1.0

Dimensions are in inches (mm). Tolerances: 2 Pl. ± .03; 3Pl. ± .015

Notes:

1. Case material: Nickel-Silver alloy.
2. Base: Printed wiring laminate.
3. Termination finish:
   For RoHS Case Styles: 3-5 µ inch (.08-.13 microns) Gold over 120-240 µ inch (3.05-6.10 microns) Nickel plate. All models, (+) suffix.

Tape & Reel Packaging TR-F37



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
24	16	7	Small quantity standards (see note)	10
				20
				50
				100
		13	Standard	200
				500

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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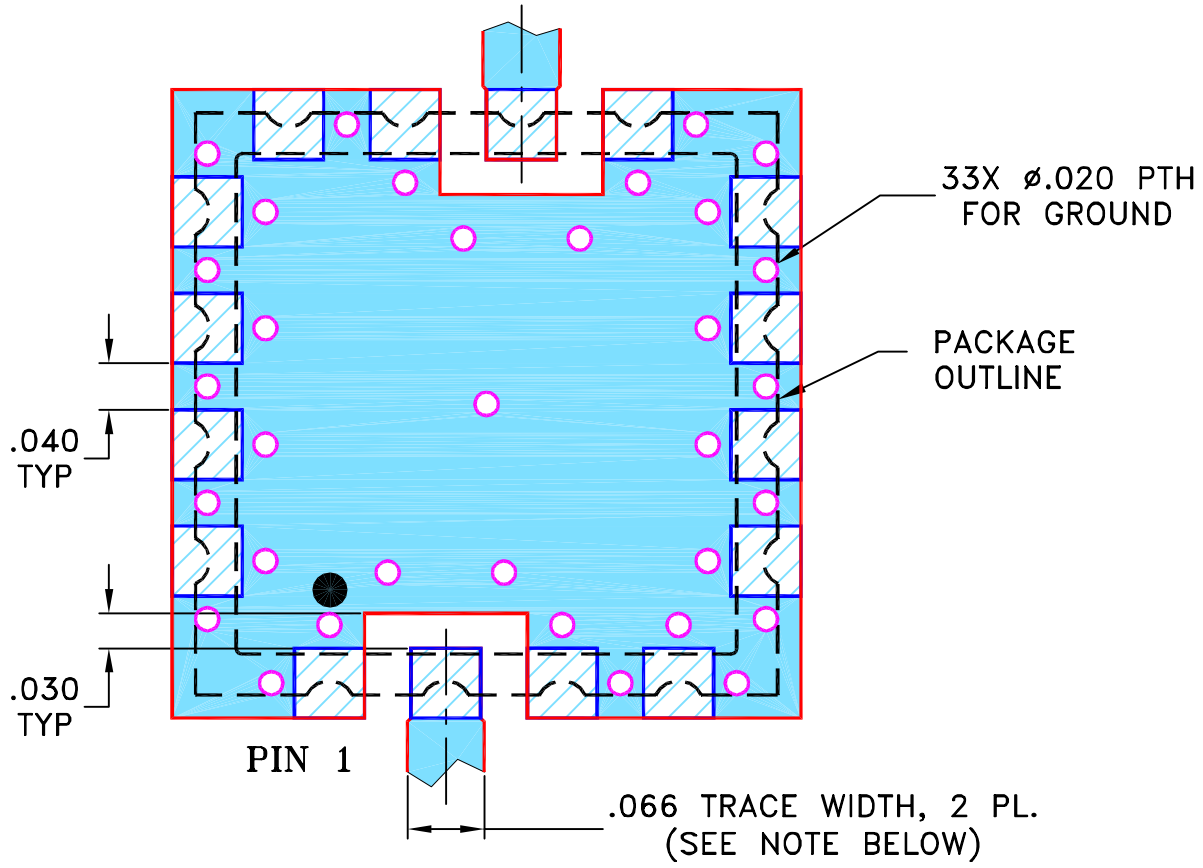
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M109402	NEW RELEASE	01/24/07	PW	DJ

SUGGESTED MOUNTING CONFIGURATION FOR CK1246 CASE STYLE, "rz" PIN CONNECTION



NOTES:
1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH 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	PW	01/19/07
TOLERANCES ON:	CHECKED	IL	01/24/07
2 PL DECIMALS ±	APPROVED	DJ	01/24/07
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

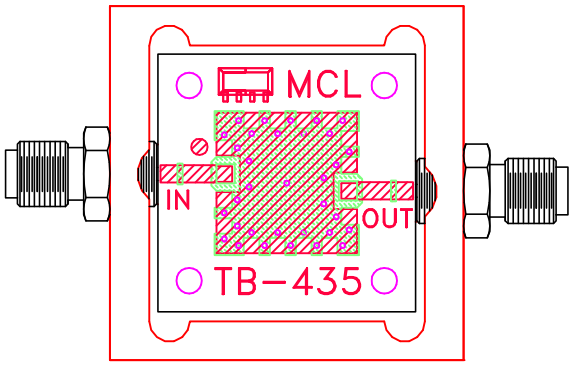
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, rz, CK1246, RKK, TB-435+

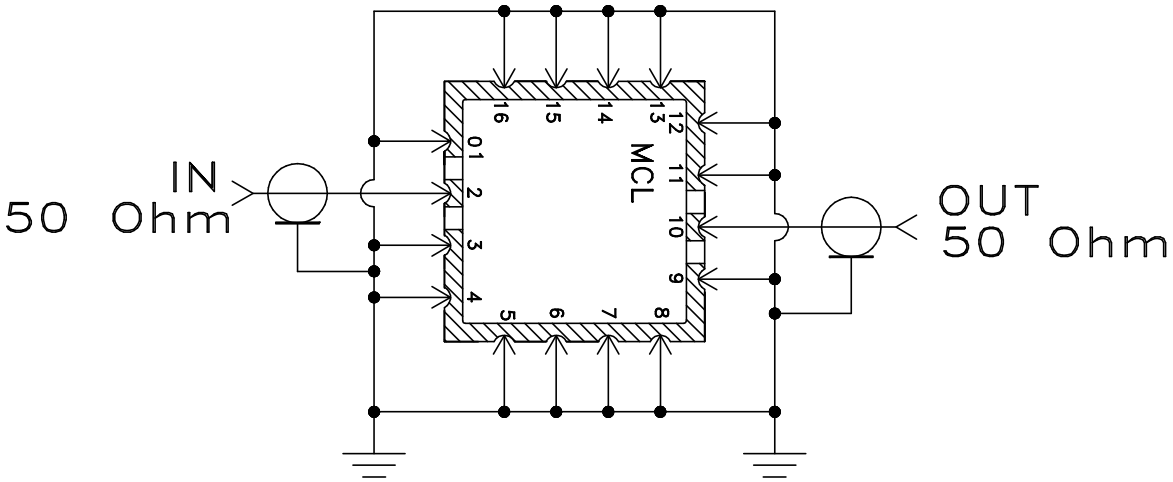
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-267	OR

FILE:	SCALE:	SHEET:
98PL267	6:1	1 OF 1

Evaluation Board and Circuit



TB-435+



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: Rogers RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.030 inch.

Mini-Circuits®

Mini-Circuits

Environmental Specifications ENV03T2

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 Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
HAST	130°C, 85% RH, 96 hours	JESD22-A110
Humidity	90 to 95% RH, 240 hours, 50°C	MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Solder Reflow Heat	Sn-Pb Eutectic Process: 225°C peak Pb-Free Process, 245°C peak	J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 95% Coverage
Vibration (High Frequency)	20g peak, 20-2000 Hz, 4 times in each of three axes (total 12)	MIL-STD-883, Method 2007.3, Condition A
Mechanical Shock	50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes	MIL-STD-202, Method 213, Condition A
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