X4

Frequency Multiplier RKK-4-112+

50Ω Output 800 to 1100 MHz

The Big Deal

- Broadband, output from 800 to 1100 MHz
- Wide input power range, +17 to +23 dBm
- Low conversion loss, 22.5 dB
- Good harmonic suppression:
  F3, 30 dBc; F5, 23 dBc

CASE STYLE: CK1246

Product Overview

Mini-Circuits' RKK-4-112+ frequency multiplier provides a multiplication factor of 4, converting input frequencies from 200 to 275 MHz into output frequencies from 800 to 1100 MHz, supporting applications including synthesizers, local oscillators, satellite up and down converters and more. This model provides an input power range from +17 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 wrap-around terminations for excellent solderability.

Key Features

Feature	Advantages
Low conversion loss, 22.5 dB typ	With a low conversion loss, RKK-4-112+ produces higher output power, reducing the need for amplification.
Very good harmonic suppression • F3, 30 dBc • F5, 23 dBc	Reduces spurious signals and the need for additional filtering.
Broadband, 800 to 1100 MHz output	With an output frequency range spanning 800 to 1100 MHz, this multiplier covers a wide range of applications.
Wide input power range, +17 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-4-112+

50Ω Output 800 to 1100 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	25dBm

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, 36 dBc typ; F2, 30 dBc typ; F3, 30 dBc typ; F5, 23 dBc typ.
- aqueous washable

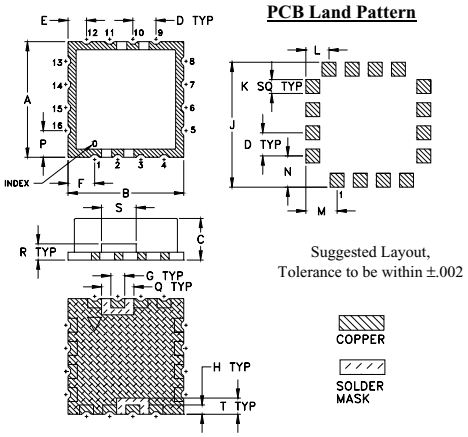
Applications

- 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

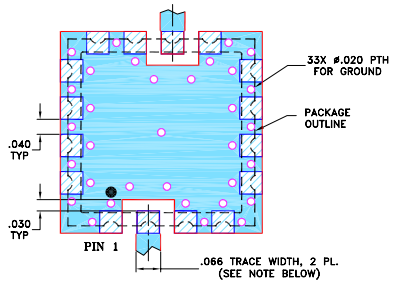


Outline Dimensions (inch / mm)

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)		200	—	275	MHz
Frequency Range, Output (F4)		800	—	1100	MHz
Input Power		17	—	23	dBm
Conversion Loss		—	22.5	29	dB
Harmonic Ouput*	F1	25	36	—	dBc
	F2	20	30	—	
	F3	20	30		
	F5	18	23	—	

* Harmonics of input frequency below the power level of F4.

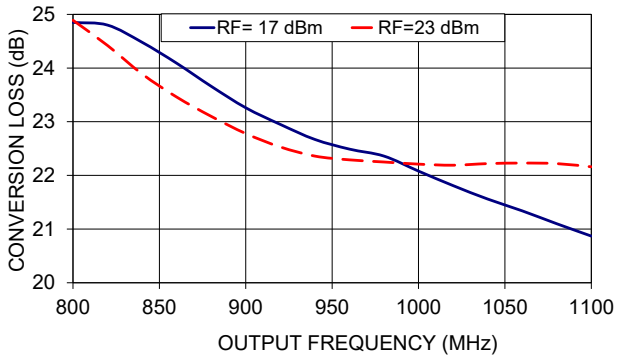
Typical Performance Data

Input Frequency (MHz)	INPUT RF= 17dBm 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
200	24.85	38.38	37.98	41.62	25.90	24.89	38.23	38.34	39.01	27.01
205	24.80	38.04	38.23	40.30	25.87	24.42	38.28	38.93	38.41	27.63
210	24.48	37.97	38.63	37.95	25.38	23.89	38.40	39.56	38.71	27.38
215	24.09	38.01	38.93	35.62	24.76	23.46	38.44	39.82	39.62	26.86
220	23.66	38.12	39.05	33.91	24.37	23.10	38.48	39.85	40.80	26.43
225	23.26	38.24	39.11	32.83	24.15	22.78	38.51	39.61	41.62	26.10
230	22.95	38.26	38.91	32.29	24.01	22.53	38.47	39.04	42.23	25.98
235	22.67	38.22	38.49	32.29	23.95	22.36	38.33	37.96	42.00	25.90
240	22.49	38.04	37.86	33.21	23.90	22.29	38.05	36.51	40.82	25.54
245	22.36	37.80	36.99	35.39	23.82	22.25	37.73	35.09	39.16	24.92
250	22.08	37.72	35.60	39.28	23.93	22.21	37.44	33.68	37.50	24.11
255	21.81	37.67	33.79	36.64	23.85	22.19	37.16	32.13	35.50	23.40
260	21.56	37.66	32.01	32.25	23.75	22.22	36.89	30.42	33.27	22.81
265	21.34	37.63	30.49	29.61	23.87	22.23	36.66	28.77	31.00	22.39
270	21.10	37.59	29.14	27.97	24.34	22.22	36.45	27.20	28.89	22.30
275	20.87	37.51	27.82	27.01	25.11	22.16	36.23	25.65	27.29	22.56

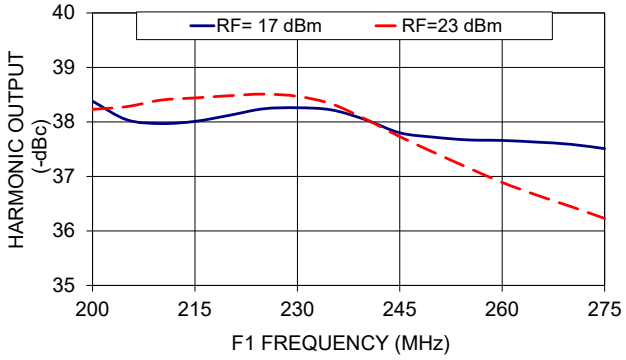
Notes

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

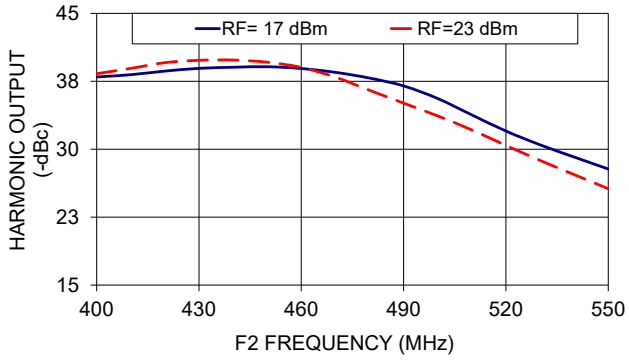
RKK-4-112+
CONVERSION LOSS



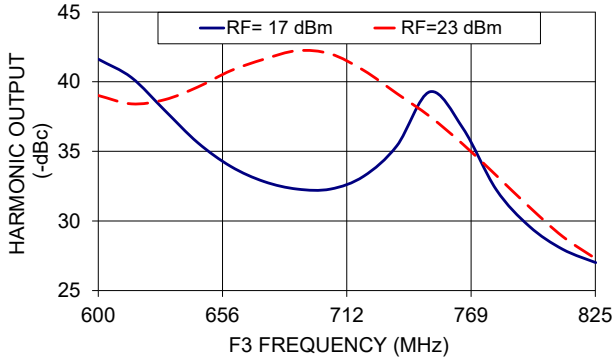
RKK-4-112+
HARMONIC OUTPUT F1



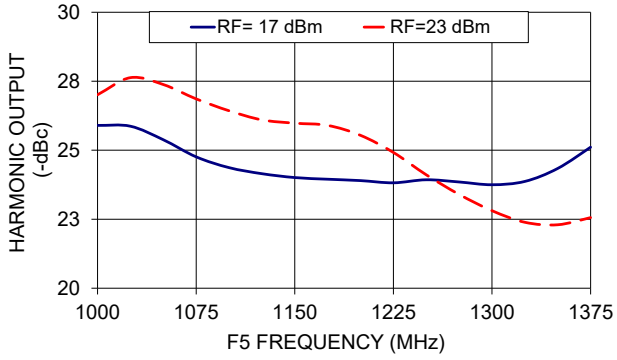
RKK-4-112+
HARMONIC OUTPUT F2



RKK-4-112+
HARMONIC OUTPUT F3



RKK-4-112+
HARMONIC OUTPUT F5



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Frequency Multiplier (X4) RKK-4-112+

Typical Performance Data

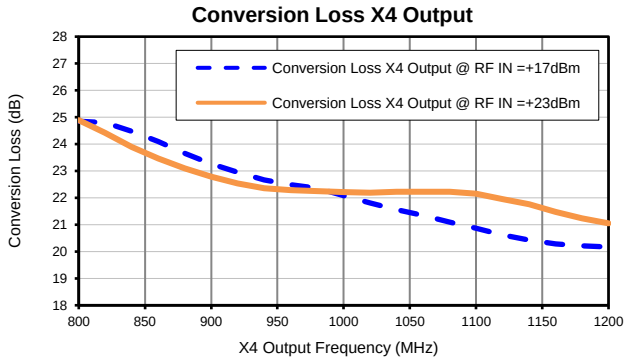
FREQUENCY (MHz)					CONVERSION LOSS (dB)	RF IN = +17 dBm HARMONIC OUTPUT* (-dBc)			
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X4 OUTPUT	X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X5 OUTPUT
200	400	600	800	1000	24.85	38.38	37.98	41.62	25.90
205	410	615	820	1025	24.80	38.04	38.23	40.30	25.87
210	420	630	840	1050	24.48	37.97	38.63	37.95	25.38
215	430	645	860	1075	24.09	38.01	38.93	35.62	24.76
220	440	660	880	1100	23.66	38.12	39.05	33.91	24.37
225	450	675	900	1125	23.26	38.24	39.11	32.83	24.15
230	460	690	920	1150	22.95	38.26	38.91	32.29	24.01
235	470	705	940	1175	22.67	38.22	38.49	32.29	23.95
240	480	720	960	1200	22.49	38.04	37.86	33.21	23.90
245	490	735	980	1225	22.36	37.80	36.99	35.39	23.82
250	500	750	1000	1250	22.08	37.72	35.60	39.28	23.93
255	510	765	1020	1275	21.81	37.67	33.79	36.64	23.85
260	520	780	1040	1300	21.56	37.66	32.01	32.25	23.75
265	530	795	1060	1325	21.34	37.63	30.49	29.61	23.87
270	540	810	1080	1350	21.10	37.59	29.14	27.97	24.34
275	550	825	1100	1375	20.87	37.51	27.82	27.01	25.11
280	560	840	1120	1400	20.62	37.41	26.57	26.60	26.14
285	570	855	1140	1425	20.43	37.25	25.42	26.55	27.25
290	580	870	1160	1450	20.29	37.06	24.21	26.72	28.37
295	590	885	1180	1475	20.21	36.85	22.96	26.68	29.42
300	600	900	1200	1500	20.17	36.61	21.83	26.21	29.89

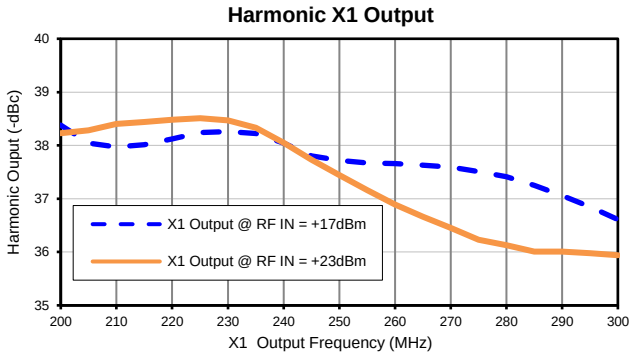
* Harmonic Output below power level of X4 Output.

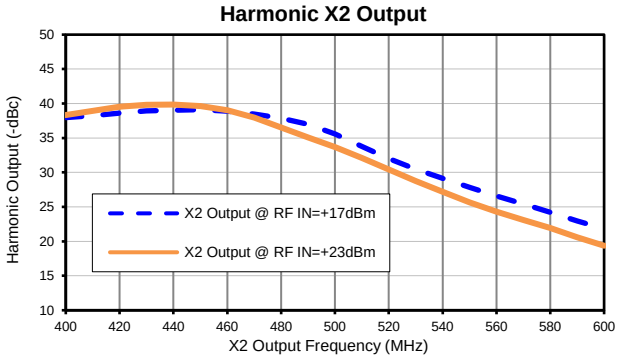
FREQUENCY (MHz)					CONVERSION LOSS	RF IN = +23 dBm HARMONIC OUTPUT*			
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X4 OUTPUT	X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X5 OUTPUT
200	400	600	800	1000	24.89	38.23	38.34	39.01	27.01
205	410	615	820	1025	24.42	38.28	38.93	38.41	27.63
210	420	630	840	1050	23.89	38.40	39.56	38.71	27.38
215	430	645	860	1075	23.46	38.44	39.82	39.62	26.86
220	440	660	880	1100	23.10	38.48	39.85	40.80	26.43
225	450	675	900	1125	22.78	38.51	39.61	41.62	26.10
230	460	690	920	1150	22.53	38.47	39.04	42.23	25.98
235	470	705	940	1175	22.36	38.33	37.96	42.00	25.90
240	480	720	960	1200	22.29	38.05	36.51	40.82	25.54
245	490	735	980	1225	22.25	37.73	35.09	39.16	24.92
250	500	750	1000	1250	22.21	37.44	33.68	37.50	24.11
255	510	765	1020	1275	22.19	37.16	32.13	35.50	23.40
260	520	780	1040	1300	22.22	36.89	30.42	33.27	22.81
265	530	795	1060	1325	22.23	36.66	28.77	31.00	22.39
270	540	810	1080	1350	22.22	36.45	27.20	28.89	22.30
275	550	825	1100	1375	22.16	36.23	25.65	27.29	22.56
280	560	840	1120	1400	21.95	36.13	24.32	26.19	23.14
285	570	855	1140	1425	21.76	36.01	23.10	25.62	23.82
290	580	870	1160	1450	21.47	36.01	21.92	25.52	24.63
295	590	885	1180	1475	21.24	35.98	20.60	25.67	25.46
300	600	900	1200	1500	21.05	35.94	19.37	25.86	26.17

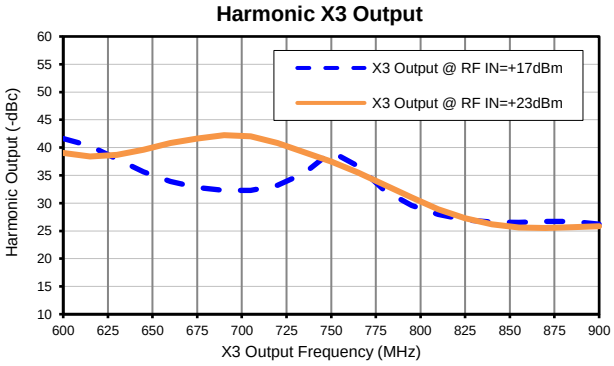
* Harmonic Output below power level of X4 Output.

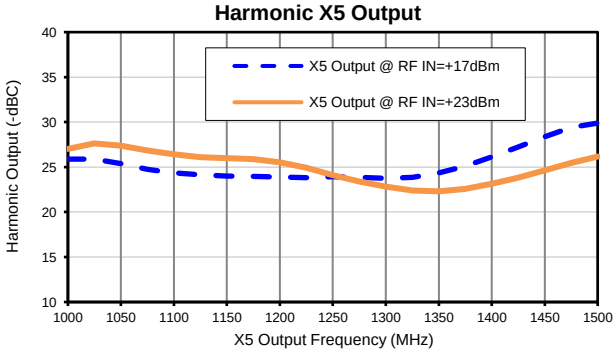
Typical Performance Curves







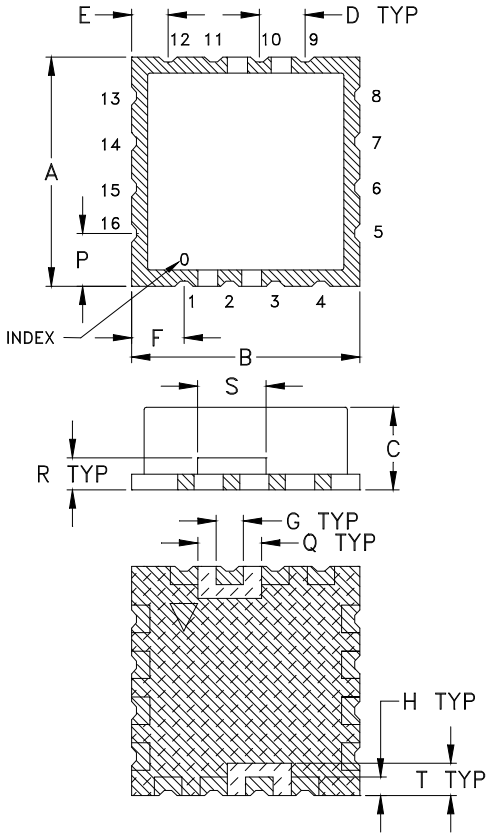




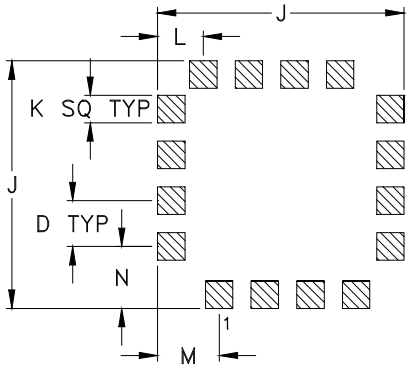
Case Style CK

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)

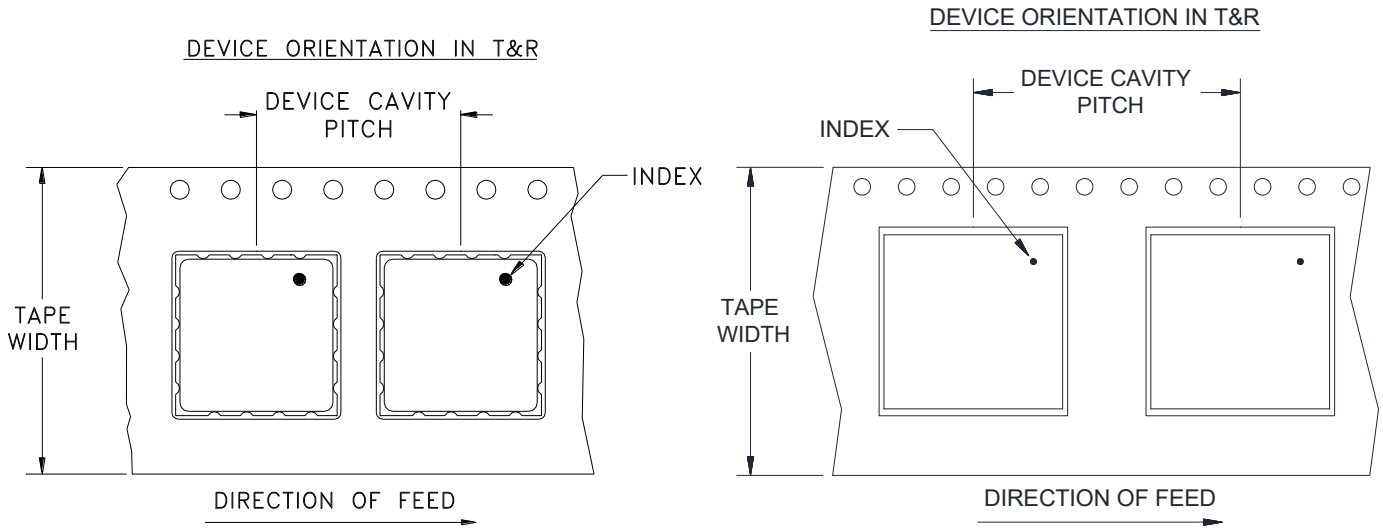
CASE #	L	M	N	P	Q	R	S	T	WT. GRAM
CK1246	.100 (2.54)	.135 (3.43)	.135 (3.43)	.115 (2.92)	.140 (3.56)	.070 (1.78)	.150 (3.81)	.070 (1.78)	1.0

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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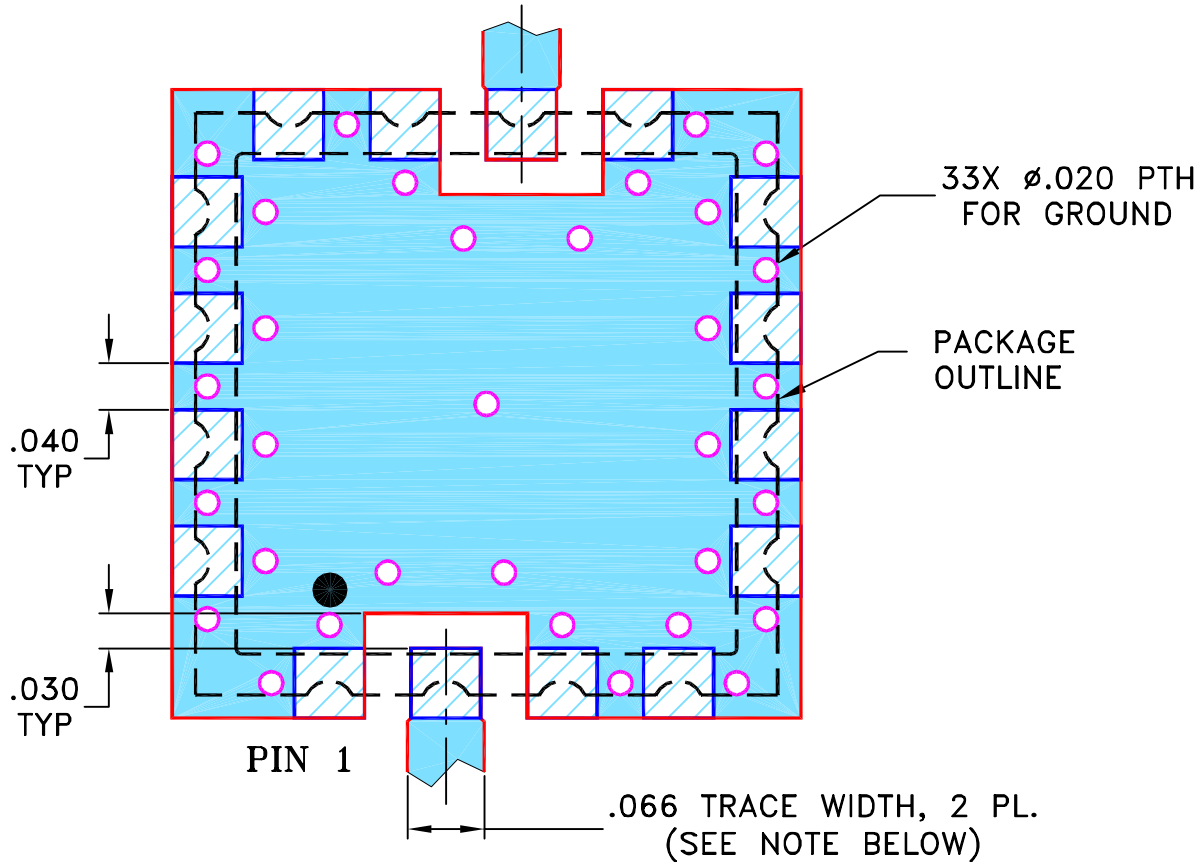
THIRD ANGLE PROJECTION

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



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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

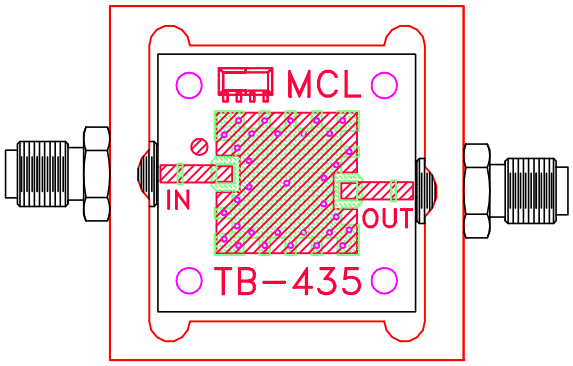
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

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

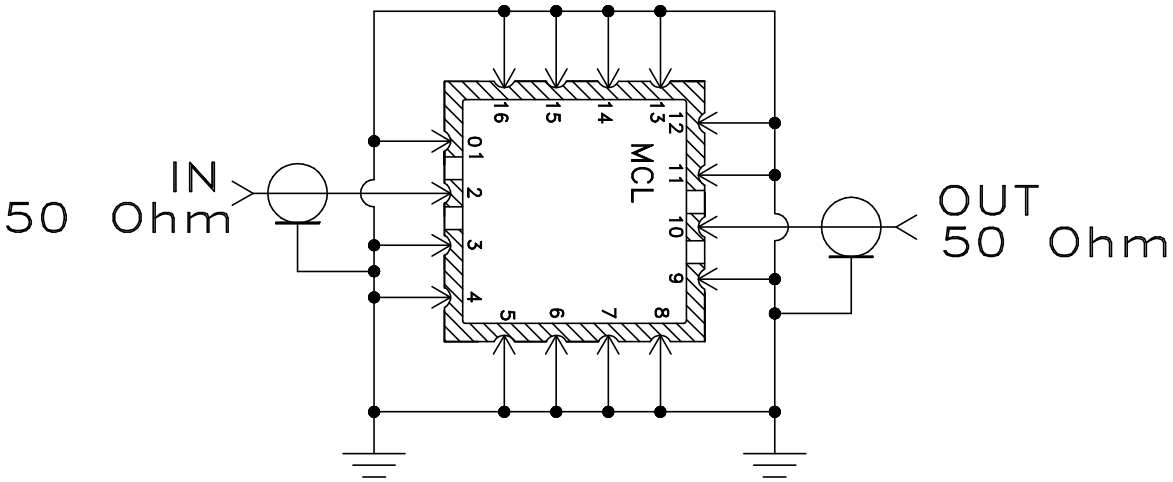
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-267	OR

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