*Surface Mount*

# Voltage Controlled Oscillator

# ROS-2160W+

## Wide Band 1160 to 2160 MHz



CASE STYLE: CK605

### Features

- wide band, 1160 to 2160 MHz
- low phase noise, -98 dBc/Hz typ. @ 10kHz offset
- high power output, +5.5 dBm typ
- low pushing, 1.5 MHz/V typ.
- aqueous washable

### Applications

- PCN
- GPS

***+RoHS Compliant***

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

### Electrical Specifications

| MODEL NO. | FREQ. (MHz) | | POWER OUTPUT (dBm) | PHASE NOISE dBc/Hz SSB at offset frequencies,kHz Typ. | | | | TUNING VOLTAGE RANGE (V) | | SENSI-TIVITY (MHz/V) | PORT CAP (pF) | 3 dB MODULATION BANDWIDTH (MHz) | NON HARMONIC SPURIOUS (dBc) | HARMONICS (dBc) | | PULLING pk-pk @12 dBr (MHz) | PUSHING (MHz/V) | DC OPERATING POWER Vcc (volts) | DC OPERATING POWER Current (mA) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min. | Max. | Typ. | 1 | 10 | 100 | 1000 | Min. | Max. | Typ. | Typ. | Typ. | Typ. | Typ. | Max. | Typ. | Typ. | | Max. |
| ROS-2160W+ | 1160 | 2160 | +5.5 | -69 | -98 | -119 | -140 | 0.5 | 20 | 40 - 94 | 93 | 25 | -90 | -17 | - | 10 | 1.5 | 10 | 30 |

### Pin Connections

| | |
|---|---|
| RF OUT | 10 |
| VCC | 14 |
| V-TUNE | 2 |
| GROUND | 1,3,4,5,6,7,8,9,11,12,13,15,16 |

### Maximum Ratings

| | |
|---|---|
| Operating Temperature | -55°C to 85°C |
| Storage Temperature | -55°C to 100°C |
| Absolute Max. Supply Voltage (Vcc) | 12V |
| Absolute Max. Tuning Voltage (Vtune) | 22V |
| All specifications | 50 ohm system |

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

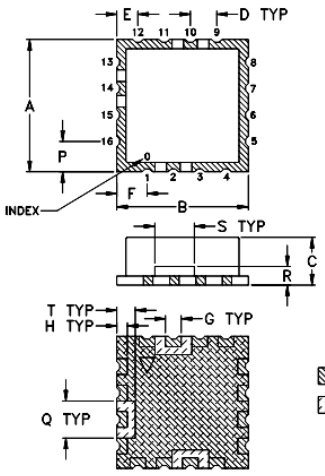
**Tape & Reel:** F37

7" Reels with 10, 20, 50, 100 devices

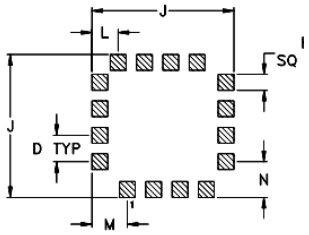
13" Reels with 200, 500 devices

**Environmental Ratings:** ENV65

### Outline Drawing




PCB Land Pattern

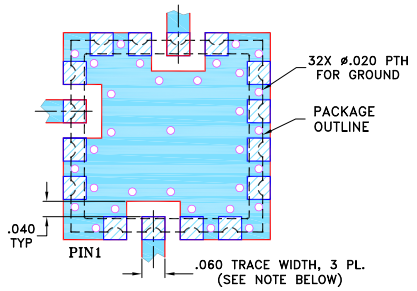



Suggested Layout,
Tolerance to be within ±.002

METALLIZATION

SOLDER RESIST

***Demo Board MCL P/N: TB-10***
***Suggested PCB Layout (PL-012)***




NOTES:

1. TRACE WIDTH IS SHOWN FOR FR4 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 BOTTOM IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

### Outline Dimensions (inch / mm)

| A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | wt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .500 | .500 | .180 | .100 | .080 | .115 | .060 | .040 | .540 | .060 | .100 | .135 | .135 | .115 | .140 | .070 | .150 | .070 | grams |
| 12.70 | 12.70 | 4.57 | 2.54 | 2.03 | 2.92 | 1.52 | 1.02 | 13.72 | 1.52 | 2.54 | 3.43 | 3.43 | 2.92 | 3.56 | 1.78 | 3.81 | 1.78 | 1.0 |

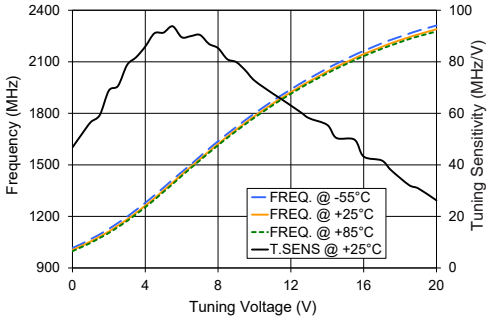
# Performance Data & Curves*

# ROS-2160W+

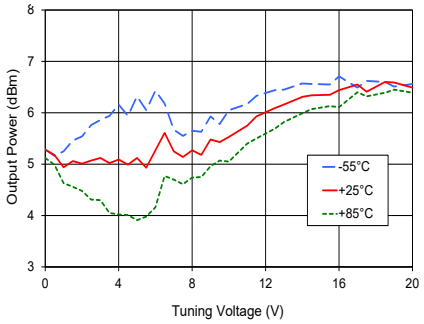
| V TUNE | TUNE SENS (MHz/V) | FREQUENCY (MHz) | | | POWER OUTPUT (dBm) | | | Icc (mA) | HARMONICS (dBc) | | | FREQ. PUSH (MHz/V) | FREQ. PULL (MHz) | PHASE NOISE (dBc/Hz) at offsets | | | | FREQ OFFSET (kHz) | PHASE NOISE at 1660 MHz (dBc/Hz) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | -55°C | +25°C | +85°C | -55°C | +25°C | +85°C | | F2 | F3 | F4 | | | 1kHz | 10kHz | 100kHz | 1MHz | | |
| 0.00 | 46.81 | 1016.8 | 1005.3 | 997.6 | 5.29 | 5.28 | 5.12 | 23.52 | -11.9 | -33.1 | -46.1 | 1.47 | 3.08 | -67.35 | -91.9 | -112.3 | -132.3 | 1.0 | -69.44 |
| 0.50 | 51.82 | 1040.5 | 1028.7 | 1021.3 | 5.16 | 5.18 | 4.99 | 23.47 | -12.1 | -41.5 | -39.1 | 1.38 | 6.92 | -69.81 | -93.2 | -113.5 | -133.5 | 2.0 | -80.21 |
| 1.00 | 56.58 | 1068.0 | 1054.6 | 1046.0 | 5.25 | 4.94 | 4.63 | 23.45 | -12.3 | -39.3 | -36.5 | 1.44 | 4.73 | -68.73 | -92.7 | -113.5 | -133.5 | 3.5 | -85.88 |
| 2.00 | 68.88 | 1127.9 | 1112.6 | 1103.7 | 5.54 | 5.01 | 4.48 | 23.50 | -12.1 | -31.4 | -35.0 | 1.30 | 5.80 | -69.30 | -94.7 | -114.9 | -135.0 | 6.0 | -93.42 |
| 3.00 | 78.78 | 1198.6 | 1182.4 | 1173.3 | 5.86 | 5.12 | 4.30 | 23.59 | -12.3 | -27.2 | -33.5 | 1.16 | 4.45 | -70.07 | -96.8 | -117.7 | -137.7 | 8.5 | -95.90 |
| 4.00 | 85.93 | 1279.6 | 1262.7 | 1253.6 | 6.16 | 5.09 | 4.02 | 23.66 | -13.0 | -24.3 | -32.1 | 1.12 | 2.12 | -69.21 | -97.1 | -118.6 | -138.7 | 10.0 | -98.40 |
| 5.00 | 91.33 | 1367.5 | 1351.2 | 1342.5 | 6.32 | 5.12 | 3.91 | 23.76 | -14.6 | -22.3 | -30.1 | 0.97 | 1.01 | -69.77 | -98.1 | -119.7 | -140.0 | 20.8 | -105.97 |
| 6.00 | 89.54 | 1458.4 | 1443.7 | 1435.3 | 6.43 | 5.27 | 4.16 | 23.86 | -15.6 | -22.1 | -27.2 | 0.66 | 2.36 | -69.55 | -97.7 | -119.7 | -140.2 | 35.5 | -110.82 |
| 7.00 | 90.45 | 1548.7 | 1533.5 | 1525.8 | 5.67 | 5.25 | 4.70 | 23.96 | -21.3 | -23.0 | -28.3 | 0.30 | 1.51 | -69.02 | -97.5 | -119.2 | -140.0 | 60.7 | -116.47 |
| 8.00 | 85.31 | 1637.9 | 1622.2 | 1614.0 | 5.65 | 5.27 | 4.74 | 24.06 | -30.1 | -21.5 | -26.6 | 0.23 | 1.76 | -70.45 | -98.2 | -120.4 | -141.4 | 86.7 | -118.62 |
| 9.00 | 79.89 | 1721.0 | 1705.4 | 1697.0 | 5.93 | 5.48 | 4.96 | 24.20 | -22.1 | -21.5 | -25.8 | 0.11 | 0.68 | -70.51 | -98.4 | -120.8 | -141.9 | 100.0 | -120.39 |
| 10.00 | 72.72 | 1799.2 | 1783.7 | 1774.9 | 6.05 | 5.53 | 5.05 | 24.31 | -18.1 | -21.5 | -26.1 | 0.05 | 0.43 | -69.37 | -98.1 | -121.0 | -142.3 | 148.1 | -123.96 |
| 11.00 | 67.71 | 1872.6 | 1856.4 | 1846.7 | 6.17 | 5.75 | 5.40 | 24.35 | -15.7 | -21.7 | -27.4 | 0.04 | 1.59 | -68.28 | -98.3 | -120.7 | -142.1 | 177.0 | -125.68 |
| 12.50 | 60.61 | 1972.4 | 1955.5 | 1945.6 | 6.44 | 6.09 | 5.69 | 24.46 | -14.3 | -22.0 | -31.9 | 0.09 | 5.63 | -69.46 | -97.9 | -121.0 | -142.3 | 211.6 | -127.39 |
| 14.50 | 50.45 | 2088.7 | 2070.8 | 2059.8 | 6.56 | 6.34 | 6.07 | 24.46 | -13.1 | -22.0 | -29.7 | 0.23 | 3.72 | -68.43 | -97.3 | -120.5 | -141.6 | 302.4 | -130.62 |
| 15.50 | 49.77 | 2140.0 | 2120.0 | 2109.1 | 6.55 | 6.35 | 6.13 | 24.41 | -12.7 | -21.9 | -29.2 | 0.33 | 6.60 | -68.36 | -97.6 | -120.1 | -141.0 | 361.5 | -132.04 |
| 16.00 | 43.23 | 2163.4 | 2144.9 | 2133.0 | 6.71 | 6.44 | 6.11 | 24.42 | -13.0 | -22.1 | -29.1 | 0.38 | 2.81 | -68.52 | -97.6 | -120.3 | -140.8 | 507.5 | -135.39 |
| 17.50 | 37.98 | 2228.0 | 2207.9 | 2195.3 | 6.62 | 6.41 | 6.32 | 24.34 | -13.0 | -22.4 | -29.9 | 0.64 | 5.38 | -67.23 | -95.8 | -118.6 | -139.4 | 606.7 | -136.92 |
| 18.50 | 32.13 | 2264.1 | 2243.6 | 2232.2 | 6.60 | 6.60 | 6.39 | 24.34 | -13.4 | -22.7 | -30.0 | 0.75 | 7.14 | -69.07 | -96.9 | -119.4 | -140.0 | 851.6 | -140.16 |
| 19.00 | 30.88 | 2281.4 | 2259.6 | 2247.6 | 6.51 | 6.59 | 6.45 | 24.30 | -13.2 | -22.8 | -30.6 | 0.86 | 8.87 | -67.07 | -96.6 | -118.8 | -139.4 | 1000.0 | -141.32 |

*at 25°C unless mentioned otherwise

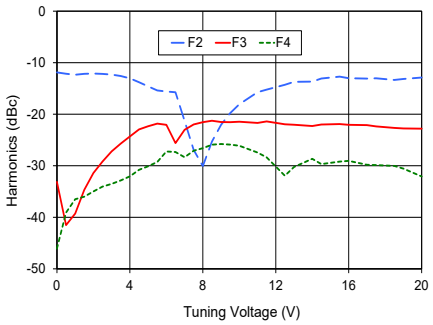
ROS-2160W+
Frequency and Tuning Sensitivity



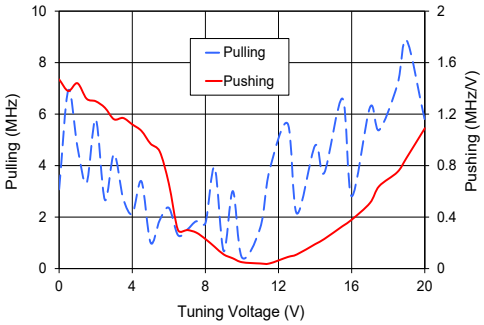

ROS-2160W+
Power Output



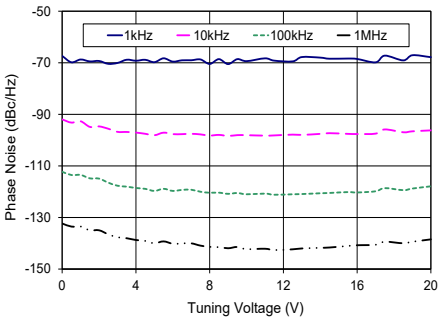

ROS-2160W+
Harmonics Level



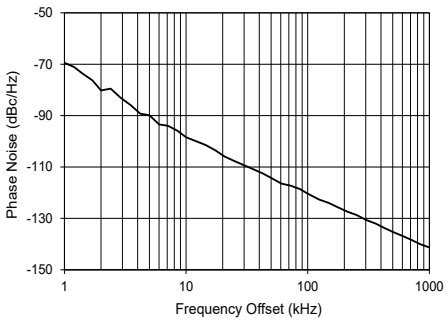

ROS-2160W+
Frequency Pulling & Pushing (Vcc ± 5%)




ROS-2160W+
Phase Noise Vs. Tuning Voltage




ROS-2160W+
Phase Noise




## Additional 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

# Voltage Controlled Oscillator ROS-2160W+

## *Typical Performance Data*

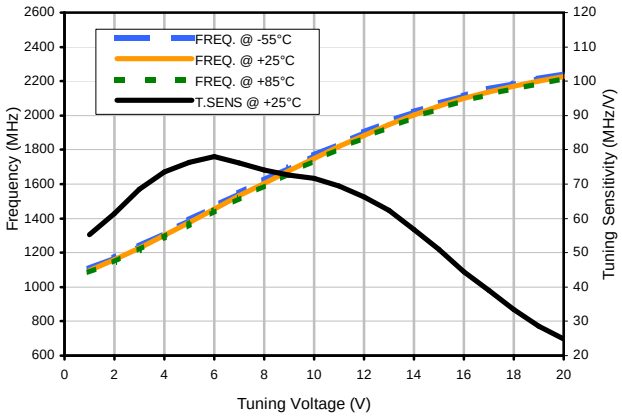
| V TUNE | TUNE SENS (MHz/V) | FREQUENCY (MHz) | | | POWER OUTPUT (dBm) | | | HARMONICS (dBc) | | | FREQ. PUSH (MHz/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | -55ºC | +25ºC | +85ºC | -55ºC | +25ºC | +85ºC | F2 | F3 | F4 | |
| 1.0 | 55.26 | 1107.6 | 1097.1 | 1085.4 | 5.10 | 5.37 | 5.20 | -11.4 | -36.4 | -36.9 | 1.31 |
| 2.0 | 61.50 | 1170.5 | 1158.6 | 1146.4 | 5.73 | 5.81 | 5.53 | -10.2 | -32.6 | -36.4 | 1.07 |
| 3.0 | 68.54 | 1239.8 | 1227.1 | 1214.8 | 6.13 | 6.11 | 5.69 | -9.4 | -30.0 | -32.9 | 0.84 |
| 4.0 | 73.50 | 1313.5 | 1300.6 | 1288.5 | 6.14 | 6.04 | 5.60 | -10.0 | -26.9 | -31.1 | 0.62 |
| 5.0 | 76.41 | 1390.8 | 1377.0 | 1364.7 | 5.51 | 5.59 | 5.29 | -12.4 | -23.9 | -32.6 | 0.29 |
| 6.0 | 78.06 | 1471.2 | 1455.1 | 1441.6 | 4.89 | 5.17 | 4.98 | -17.3 | -22.3 | -31.4 | 0.23 |
| 7.0 | 76.10 | 1548.3 | 1531.2 | 1516.9 | 4.89 | 5.12 | 4.97 | -22.9 | -21.5 | -28.6 | 0.38 |
| 8.0 | 74.11 | 1622.9 | 1605.3 | 1590.6 | 5.06 | 5.23 | 5.04 | -26.5 | -21.5 | -27.2 | 0.56 |
| 9.0 | 72.54 | 1695.4 | 1677.8 | 1663.1 | 5.29 | 5.38 | 5.11 | -26.2 | -21.0 | -27.5 | 0.61 |
| 10.0 | 71.59 | 1766.5 | 1749.4 | 1734.8 | 5.43 | 5.48 | 5.19 | -21.8 | -21.4 | -27.2 | 0.50 |
| 11.0 | 69.46 | 1835.7 | 1818.9 | 1804.2 | 5.52 | 5.66 | 5.38 | -19.4 | -22.1 | -27.7 | 0.31 |
| 12.0 | 66.29 | 1901.8 | 1885.2 | 1870.7 | 5.68 | 5.82 | 5.52 | -17.6 | -22.9 | -30.4 | 0.12 |
| 13.0 | 62.35 | 1963.9 | 1947.5 | 1933.0 | 5.69 | 5.89 | 5.64 | -16.6 | -23.3 | -34.7 | 0.02 |
| 14.0 | 56.70 | 2020.6 | 2004.2 | 1989.5 | 5.76 | 6.01 | 5.74 | -16.1 | -23.7 | -37.3 | 0.16 |
| 15.0 | 50.92 | 2071.2 | 2055.2 | 2040.3 | 5.67 | 5.98 | 5.82 | -16.0 | -23.7 | -37.9 | 0.37 |
| 16.0 | 44.38 | 2115.5 | 2099.5 | 2084.6 | 5.63 | 5.93 | 5.82 | -16.3 | -23.7 | -33.6 | 0.69 |
| 17.0 | 39.00 | 2154.2 | 2138.5 | 2123.3 | 5.48 | 5.91 | 5.88 | -16.1 | -24.1 | -34.6 | 1.05 |
| 18.0 | 33.49 | 2187.2 | 2172.0 | 2156.9 | 5.42 | 5.81 | 5.79 | -16.1 | -24.7 | -34.2 | 1.30 |
| 19.0 | 28.60 | 2215.6 | 2200.6 | 2185.6 | 5.37 | 5.80 | 5.75 | -16.0 | -25.0 | -34.7 | 1.54 |
| 20.0 | 24.82 | 2240.2 | 2225.4 | 2210.2 | 5.31 | 5.75 | 5.72 | -16.3 | -25.6 | -42.3 | 1.76 |

| FREQ OFFSET (KHz) | PHASE NOISE (dBc/Hz) |
|---|---|
| 1 | -70 |
| 10 | -97 |
| 100 | -117 |
| 1000 | -137 |

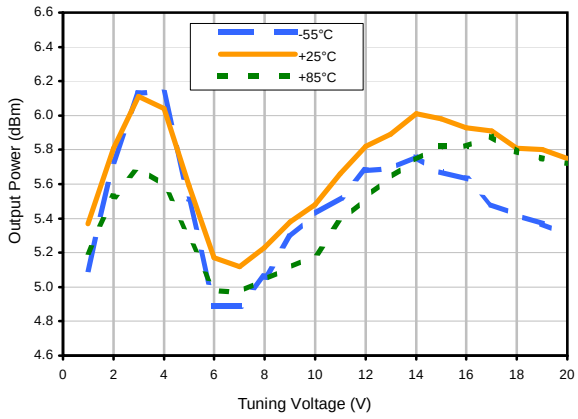
# Voltage Controlled Oscillator ROS-2160W+

## *Typical Performance Data*

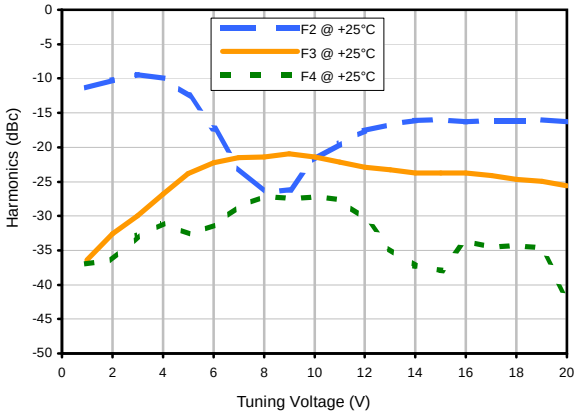
**Frequency and Tuning Sensitivity**



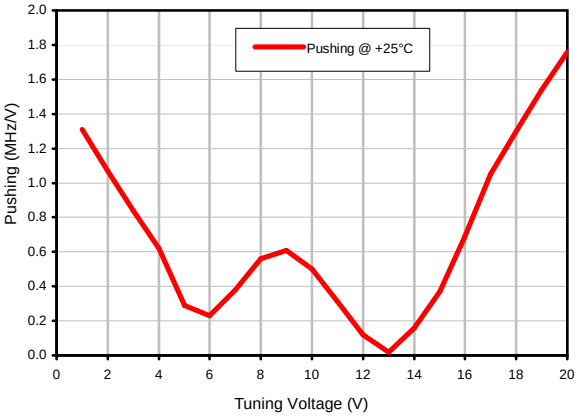

**Power Output**



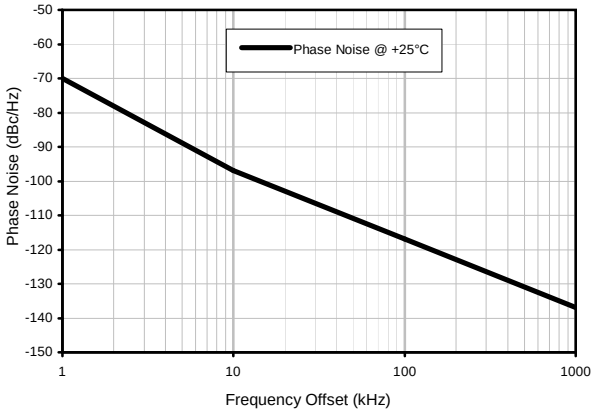

**Harmonics Level**




**Frequency Pushing**



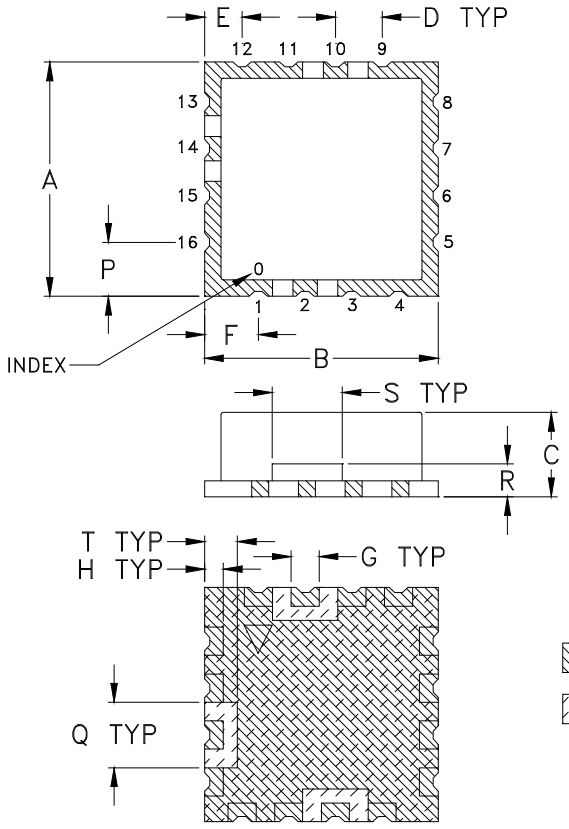

**Phase Noise**



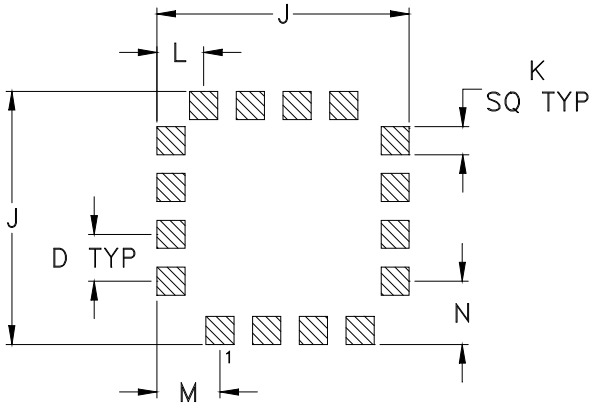
# Case Style CK

CK605

## Outline Dimensions




## PCB Land Pattern




Suggested Layout,
Tolerance to be within ±.002

| CASE # | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| CK605 | .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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| CK605 | .100 (2.54) | .135 (3.43) | .135 (3.43) | .115 (2.92) | .140 (3.56) | .070 (1.78) | .150 (3.81) | .070 (1.78) | 1.2 | +0.5 -0.0 |

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

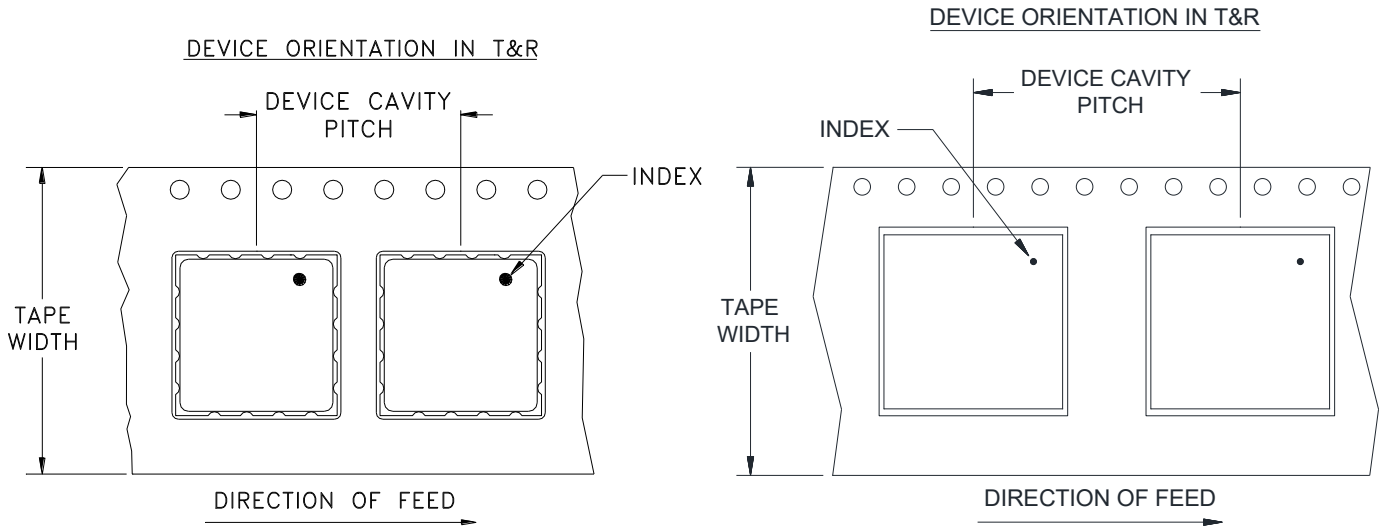
### Notes:

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.



This document and its contents are the property of Mini-Circuits

# 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

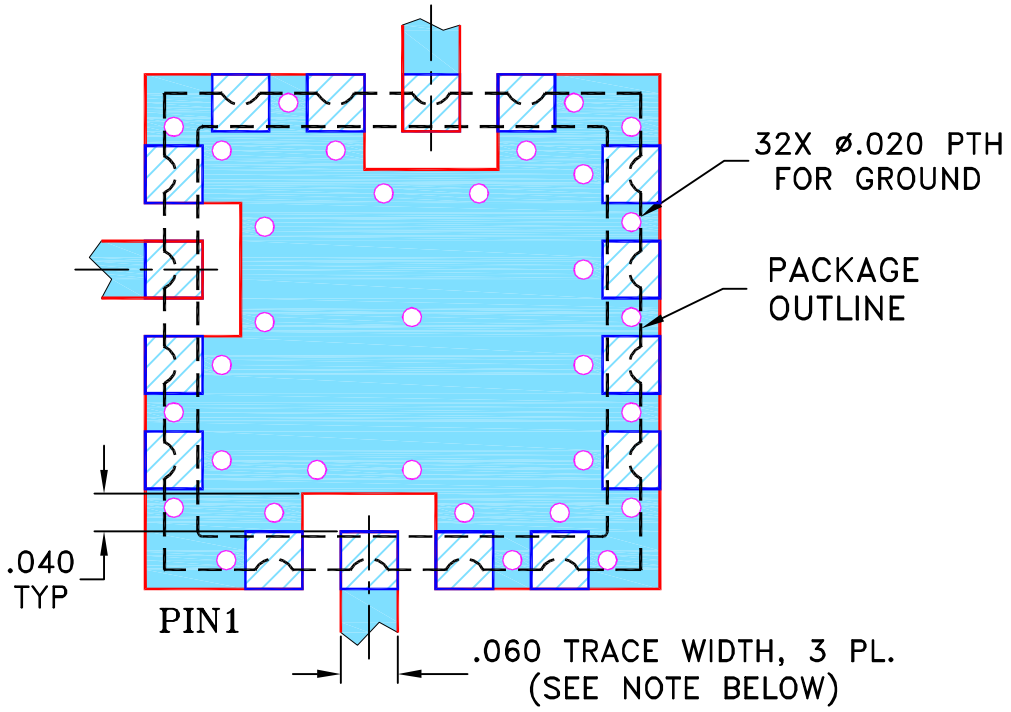
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010
Mini-Circuits ISO 9001 & ISO 14001 Certified


This document and its contents are the property of Mini-Circuits.

THIRD ANGLE PROJECTION

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| REV | ECN No. | DESCRIPTION | DATE | DR | AUTH |
| E | M105563 | ADDED "rl" PIN CONNECTION | 06/02/06 | MMG | DJ |
| F | M105640 | CORRECTED NOTE 2 | 06/08/06 | MMG | MM |
| G | M124395 | ADDED "RAMP" | 09/09 | EM | HH |
| G | R77589 | ADDED "RAMP" | 09/09 | EM | HH |

## SUGGESTED MOUNTING CONFIGURATION FOR CK605 CASE STYLE, "kg/rl/16AM01" PIN CONNECTION




NOTES:

1. TRACE WIDTH IS SHOWN FOR FR4 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 BOTTOM 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 | AV | 08/07/00 |
| TOLERANCES ON: | CHECKED | SK | 08/08/00 |
| 2 PL DECIMALS ± | APPROVED | DB | 08/08/00 |
| 3 PL DECIMALS ± .005 | | | |
| ANGLES ± | | | |
| FRACTIONS ± | | | |

Mini-Circuits®

THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS. EXCEPT FOR USE EXPRESSLY GRANTED, IN WRITING, TO ITS VENDORS, VENDEE AND THE UNITED STATES GOVERNMENT, MINI-CIRCUITS RESERVES ALL PROPRIETARY DESIGN, USE , MANUFACTURING AND REPRODUCTION RIGHTS THERETO. THESE CONTENTS SHALL NOT BE USED, DUPLICATED OR DISCLOSED TO ANY OUTSIDE PARTY, IN WHOLE OR IN PART, WITHOUT WRITTEN PERMISSION OF MINI-CIRCUITS.

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

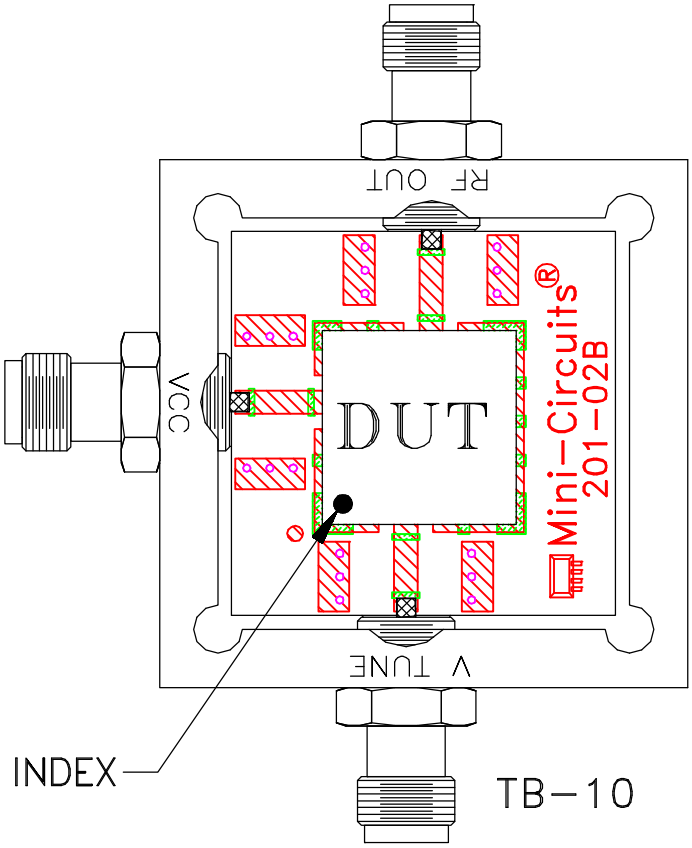
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

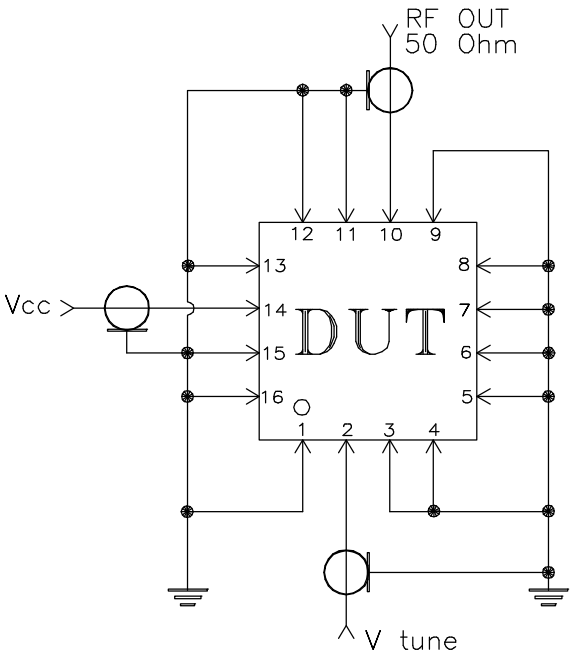
# PL,kg/rl/16AM01,CK605,ROS/LAVI/RAMP

| SIZE | CODE IDENT | DRAWING NO: | REV: |
|---|---|---|---|
| A | 15542 | 98-PL-012 | G |

| FILE: | SCALE: | SHEET: |
|---|---|---|
| 98PL012 | 5:1 | 1 OF 1 |

# Evaluation Board and Circuit




Schematic Diagram

## Notes:

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

Mini-Circuits®


THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS.

Mini-Circuits

# Environmental Specifications ENV65

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 | -55° to 85°C<br>Ambient Environment | Individual Model Data Sheet |
| Storage Temperature | -55° to 100° C<br>Ambient Environment | Individual Model Data Sheet |
| 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<br>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;<br>distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C | MIL-STD-202, Method 215 |


This document and its contents are the property of Mini-Circuits.