



USB & ETHERNET CONTROLLED

Millimeter Wave Switch Matrix **RC-3MTS-50**

50Ω DC to 50 GHz 2.4mm-Female

THE BIG DEAL

- Millimeter wave switching (up to 50 GHz)
- 3 x mechanical transfer / DPDT switches
- Ethernet & USB control
- High reliability, 2 million switch cycles

APPLICATIONS

- 5G FR1 & FR2 node / device testing
- Automated test equipment
- Fail-safe / redundancy switching
- Switch matrices



CASE STYLE: SH3143

[DOWNLOAD](#)

SOFTWARE PACKAGE

RoHS Compliant

See our website for RoHS Compliance methodologies and qualifications

PRODUCT OVERVIEW

Mini-Circuits' RC-3MTS-50 comprises of three independently controlled, electro-mechanical transfer switches. Each switch operates over a wide bandwidth, from DC to 50 GHz with high isolation (65 dB typical), low insertion loss (0.8 dB typical) and high input power rating. The switches are of a fail-safe and break-before-make-configuration, with a life time of 2 million switching cycles when used within the noted specifications.

The switch box is constructed in a compact, rugged metal case (4.5 x 6.0 x 2.25") with all 2.4 mm connectors on the front panel. The switches are controlled via USB or Ethernet, allowing control directly from a PC, or remotely over a network. Full software support is provided, including our user-friendly GUI application for Windows and a full API with programming instructions for Windows and Linux environments (both 32-bit and 64-bit systems).

KEY FEATURES

| Feature | Advantages |
|---------------------------------|--|
| Three transfer switches | Transfer switches provide a simple DPDT switch application (2 input to 2 output switch matrix) and are a useful building block in much larger switch matrices |
| Fail-safe design | The switches revert to a known default state when the DC supply is removed, allowing their use in systems that must continue to operate safely in the event of power failure |
| Break-before-make configuration | Prevents a momentary connection of the old and new signal paths, reducing the inconsistent transient effects that could otherwise be observed during switching |
| USB & Ethernet control | USB HID and Ethernet (HTTP / Telnet) interfaces provide easy compatibility with a wide range of software setups and programming environments |
| Full software support | User friendly Windows GUI (graphical user interface) allows manual control straight out of the box, while the comprehensive API (application programming interface) with examples and instructions allows easy automation in most programming environments |

REV. B
ECO-028391
RC-3MTS-40
MCL NY
260202





USB & ETHERNET CONTROLLED

Millimeter Wave Switch Matrix **RC-3MTS-50**

Mini-Circuits

50Ω DC to 50 GHz 2.4mm-Female

ELECTRICAL SPECIFICATIONS AT +25°C

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|-----------------|---|------|------|------|----------------|
| Frequency | | DC | | 50 | GHz |
| Path Loss | DC - 12 GHz | | 0.15 | 0.40 | dB |
| | 12 - 26 GHz | | 0.25 | 0.70 | |
| | 26 - 40 GHz | | 0.50 | 0.80 | |
| | 40 - 50 GHz | | 0.80 | 1.10 | |
| Isolation | DC - 12 GHz | 60 | 90 | | dB |
| | 12 - 26 GHz | 55 | 85 | | |
| | 26 - 40 GHz | 50 | 70 | | |
| | 40 - 50 GHz | 50 | 65 | | |
| Return Loss | DC - 12 GHz | | 32 | | dB |
| | 12 - 26 GHz | | 21 | | |
| | 26 - 40 GHz | | 14 | | |
| | 40 - 50 GHz | | 11 | | |
| Switching Time | | | 25 | | ms |
| RF Input Power | Cold switching ¹ , DC - 12 GHz | | | 20 | W |
| | Cold switching ¹ , 12 - 26 GHz | | | 10 | |
| | Cold switching ¹ , 26 - 40 GHz | | | 5 | |
| | Cold switching ¹ , 40 - 50 GHz | | | 3 | |
| | Hot switching ² | | | 0.1 | |
| Switch Lifetime | | | 2 | | million cycles |

1. Maximum power per path with all ports terminated into 50Ω

2. Hot switching power above this level will degrade the switch lifetime

SWITCH CONTROL LOGIC

| Switch Command | Switch x State | LED x Color |
|----------------|-------------------|-------------|
| SETx = 0 | 1 to 2 and 3 to 4 | Green |
| SETx = 1 | 1 to 3 and 2 to 4 | Red |

x = switch address

POWER-UP OPTIONS

| Mode | Initial Switch Paths |
|------------|--|
| Default | Switches power-up in the default state (ports 1 to 2 and 3 to 4 connected) |
| Last State | Switches resume the previous state from the point of last power supply disconnection |

Switches revert to the default state when the power supply is turned off or disconnected

ABSOLUTE MAXIMUM RATINGS

| Parameters | Ratings |
|-----------------------|-----------------|
| Operating Temperature | 0 °C to 40 °C |
| Storage Temperature | -15 °C to 85 °C |
| Supply Voltage | 26 V |





USB & ETHERNET CONTROLLED

Millimeter Wave Switch Matrix **RC-3MTS-50**

50Ω DC to 50 GHz 2.4mm-Female

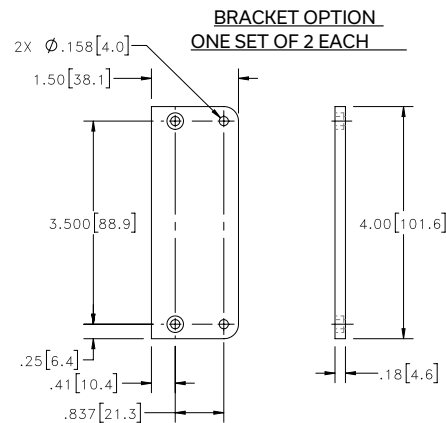
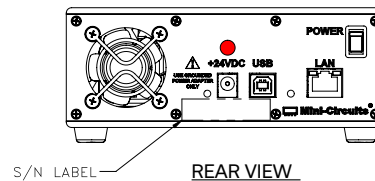
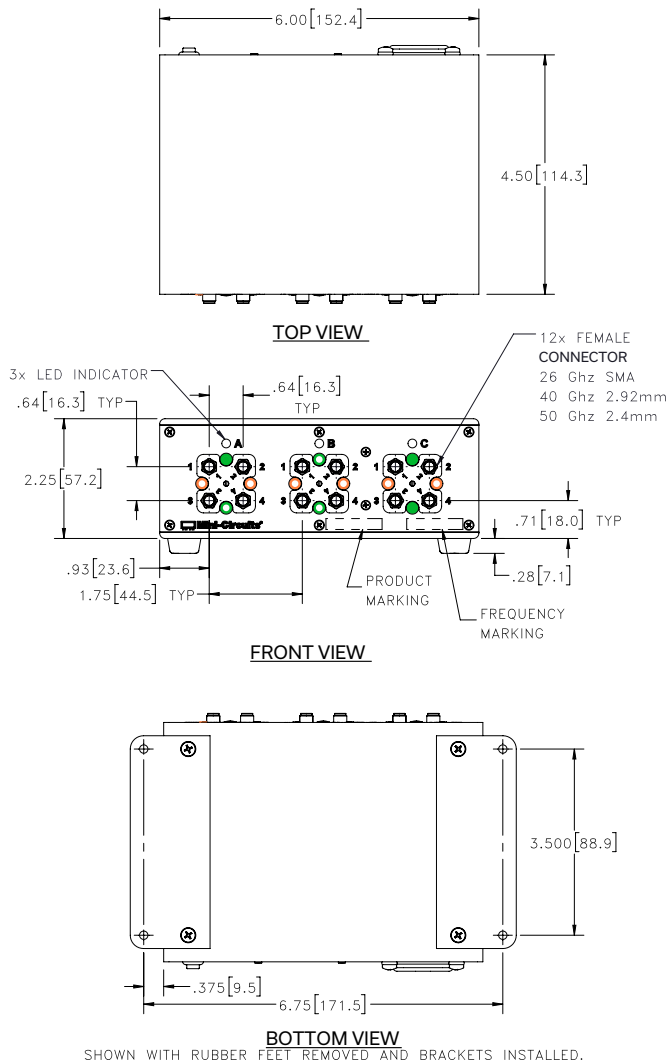
SWITCHING STATES (PER SWITCH)



CONNECTIONS

| Port Name | Connector Type |
|-------------------------------|---------------------------------|
| RF Switch A (J1, J2, J3 & J4) | 2.4mm female |
| RF Switch B (J1, J2, J3 & J4) | 2.4mm female |
| RF Switch C (J1, J2, J3 & J4) | 2.4mm female |
| USB | USB type-B |
| Ethernet / LAN | RJ45 |
| 24V _{DC} Input | 2.1mm center positive DC socket |

OUTLINE DRAWING (SH3143)



TOLERANCE: ±.005

INSTRUCTIONS FOR MOUNTING BRACKETS:

TOOL REQUIRED: PHILLIPS HEAD SCREWDRIVER

STEP 1: REMOVE RUBBER FEET FROM THE BOTTOM OF THE UNIT. DO NOT DISCARD THE FASTENERS.

STEP 2: MOUNT THE BRACKETS WITH THE FASTENERS REMOVED IN STEP 1. USING THE COUNTER BORE HOLES IN THE BRACKET.

Weight: 960 grams

Dimensions are in inches [mm]. Tolerances: 2 Pl. ±.03 inch; 3Pl. ±.015 inch



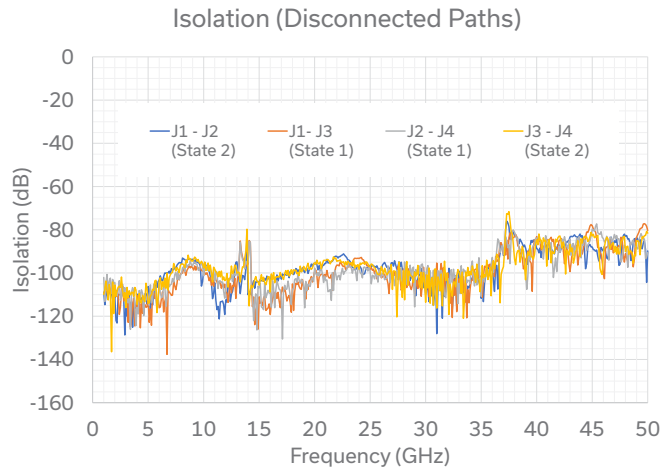
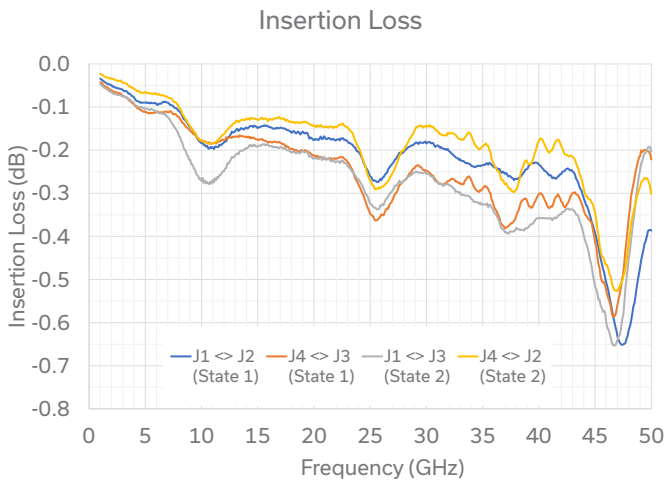


USB & ETHERNET CONTROLLED

Millimeter Wave Switch Matrix **RC-3MTS-50**

50Ω DC to 50 GHz 2.4mm-Female

TYPICAL PERFORMANCE GRAPHS (PER SWITCH)





USB & ETHERNET CONTROLLED

Millimeter Wave Switch Matrix **RC-3MTS-50**

Mini-Circuits

50Ω DC to 50 GHz 2.4mm-Female

SOFTWARE SPECIFICATIONS

SOFTWARE & DOCUMENTATION DOWNLOAD:

- Mini-Circuits' full software and support package including user guide, Windows GUI, DLL files, programming manual and examples can be downloaded free of charge from: <https://www.minicircuits.com/softwaredownload/rfswitchcontroller.html>
- Please contact testsolutions@minicircuits.com for support

MINIMUM SYSTEM REQUIREMENTS:

| Parameter | Requirements | |
|---------------------|-------------------------------------|--|
| Interface | USB HID & Ethernet (HTTP & Telnet) | |
| System Requirements | GUI | Windows 98 or later |
| | USB API DLL | Windows 98 or later and programming environment with ActiveX or .NET support |
| | USB Direct Programming | Linux, Windows 98 or later |
| | Ethernet | Windows, Linux or Mac computer with a network port and Ethernet TCP/IP support |
| Hardware | Pentium II or later with 256 MB RAM | |

APPLICATION PROGRAMMING INTERFACE (API)

ETHERNET SUPPORT:

- Simple ASCII / SCPI command set for attenuator control
- Communication via HTTP or Telnet
- Supported by most common programming environment

USB SUPPORT (WINDOWS):

- ActiveX COM DLL file for creation of 32-bit programs
- .NET library DLL file for creation of 32 / 64-bit programs
- Supported by most common programming environments (refer to application note AN-49-001 for summary of supported environments)

USB SUPPORT (LINUX):

- Direct USB programming using a series of USB interrupt codes

Full programming instructions and examples available for a wide range of programming environments / languages.



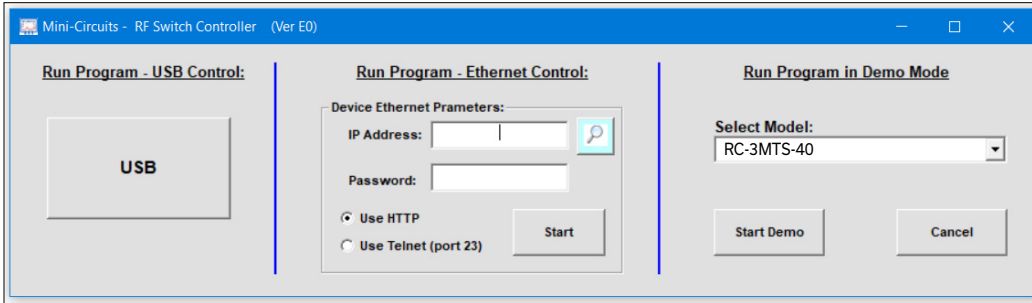
USB & ETHERNET CONTROLLED

Millimeter Wave Switch Matrix **RC-3MTS-50**

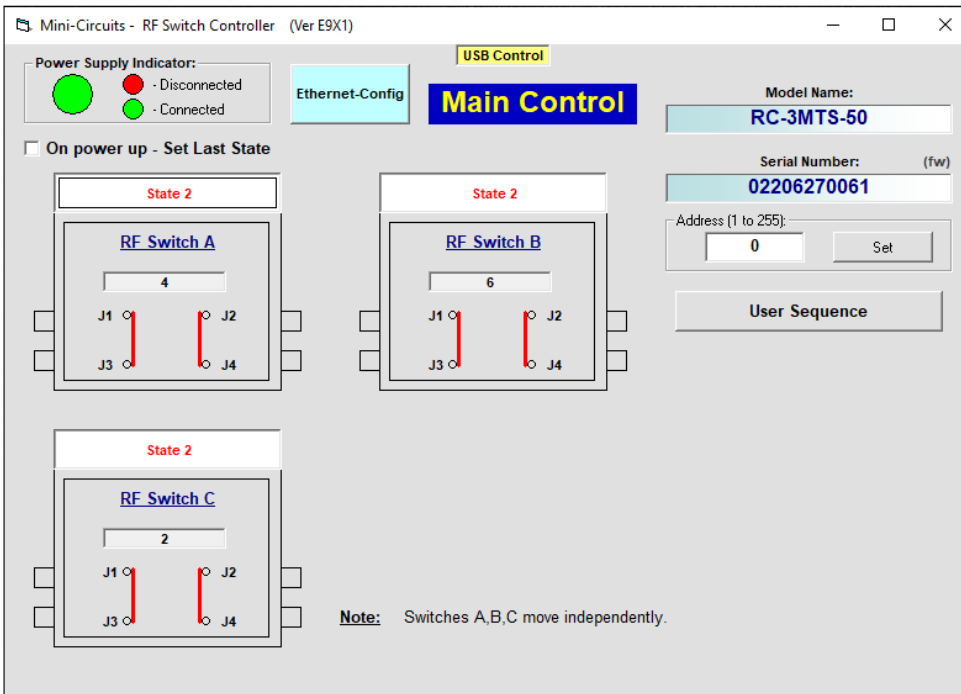
50Ω DC to 50 GHz 2.4mm-Female

GRAPHICAL USER INTERFACE (GUI) FOR WINDOWS - KEY FEATURES

- Connect via USB or Ethernet
- Run GUI in "demo mode" to evaluate software without a hardware connection



- View and set switch states at the click of a button
- Configure and run timed switching sequences
- Set start-up switch state
- Configure Ethernet IP settings





USB & ETHERNET CONTROLLED

Millimeter Wave Switch Matrix **RC-3MTS-50**



50Ω DC to 50 GHz 2.4mm-Female






ORDERING INFORMATION

Refer to Mini-Circuits' website for pricing and availability information:

<https://www.minicircuits.com/WebStore/dashboard.html?model=RC-3MTS-50>

| Model | Description |
|------------|--|
| RC-3MTS-50 | USB & Ethernet controlled transfer switch matrix |

| Included Accessories | Part No. | Description |
|---|---------------|--|
|  | AC/DC-24-3W1 | AC/DC 24V _{DC} Grounded Power Adaptor. Operating temperature: 0°C to +40°C, I _{Max} =2.5A |
| See Below | CBL-3W1-XX | AC Power Cord (Select one power cord from below with each Switch Matrix box) |
|  | USB-CBL-AB-3+ | 2.7 ft (0.8 m) USB Cable: USB type A(Male) to USB type B(Male) |

| AC Power Cords ³ | Part No. | Description |
|---|------------|------------------------------------|
|  | CBL-3W1-US | Power Cord for United States |
|  | CBL-3W1-EU | Power Cord for Europe |
|  | CBL-3W1-UK | Power Cord for United Kingdom |
|  | CBL-3W1-AU | Power Cord for Australia and China |
|  | CBL-3W1-IL | Power Cord for Israel |

3. If you need a Power cord for a country not listed please contact testsolutions@minicircuits.com

OPTIONAL ACCESSORIES

| | |
|----------------|--|
| USB-CBL-AB-3+ | 2.7 ft (0.8 m) USB Cable: USB type A(Male) to USB type B(Male) |
| USB-CBL-AB-7+ | 6.8 ft (2.1 m) USB Cable: USB type A(Male) to USB type B(Male) |
| USB-CBL-AB-11+ | 11 ft (3.4 m) USB Cable: USB type A(Male) to USB type B(Male) |
| CBL-RJ45-MM-5+ | 5 ft (1.5 m) Ethernet cable: RJ45(Male) to RJ45(Male) Cat 5E cable |
| BKT-272-08+ | Bracket (One set of 2 each) |

- 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



RF Transfer Switch Matrix

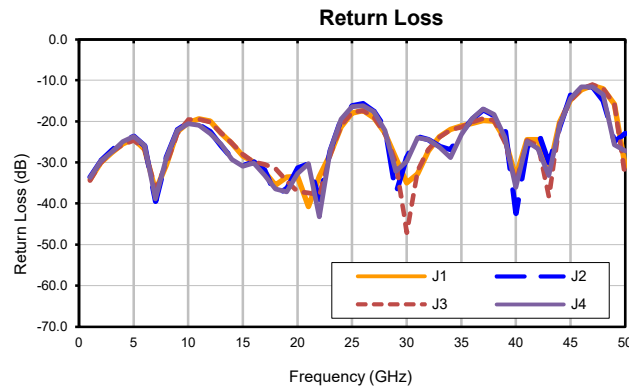
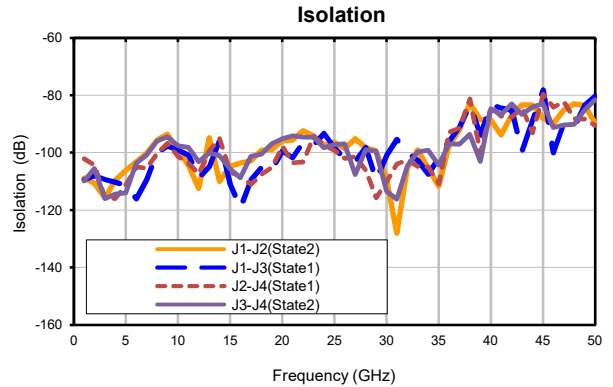
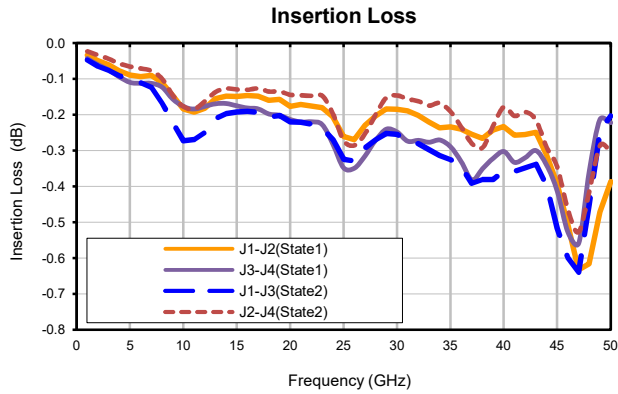
RC-3MTS-50

Typical Performance Data per Switch

| FREQUENCY (GHz) | INSERTION LOSS (dB) | | | | ISOLATION (dB) | | | | Return Loss (dB) | | | |
|--------------------|---------------------|-------|---------|-------|----------------|-------|---------|-------|------------------|-----|-----|-----|
| | State 1 | | State 2 | | State 1 | | State 2 | | J1 | J2 | J3 | J4 |
| | J1-J2 | J4-J3 | J1-J3 | J4-J2 | J1-J3 | J4-J2 | J1-J2 | J4-J3 | | | | |
| 1 | -0.03 | -0.04 | -0.05 | -0.02 | -109 | -102 | -109 | -110 | -34 | -33 | -34 | -34 |
| 2 | -0.05 | -0.06 | -0.06 | -0.03 | -108 | -104 | -111 | -106 | -30 | -30 | -30 | -30 |
| 3 | -0.06 | -0.08 | -0.08 | -0.04 | -109 | -116 | -116 | -116 | -28 | -27 | -27 | -27 |
| 4 | -0.08 | -0.09 | -0.09 | -0.06 | -110 | -116 | -110 | -115 | -25 | -25 | -26 | -25 |
| 5 | -0.09 | -0.11 | -0.10 | -0.07 | -111 | -111 | -106 | -114 | -24 | -24 | -25 | -24 |
| 6 | -0.09 | -0.11 | -0.11 | -0.07 | -116 | -105 | -103 | -104 | -27 | -26 | -27 | -26 |
| 7 | -0.09 | -0.11 | -0.12 | -0.08 | -109 | -105 | -100 | -101 | -37 | -39 | -36 | -39 |
| 8 | -0.11 | -0.12 | -0.17 | -0.10 | -100 | -100 | -96 | -96 | -31 | -29 | -30 | -29 |
| 9 | -0.15 | -0.16 | -0.22 | -0.15 | -98 | -97 | -94 | -95 | -23 | -22 | -23 | -22 |
| 10 | -0.18 | -0.18 | -0.27 | -0.18 | -99 | -101 | -99 | -98 | -20 | -20 | -20 | -21 |
| 11 | -0.19 | -0.18 | -0.27 | -0.18 | -101 | -104 | -104 | -98 | -19 | -21 | -19 | -21 |
| 12 | -0.18 | -0.18 | -0.25 | -0.16 | -109 | -107 | -112 | -103 | -20 | -23 | -20 | -23 |
| 13 | -0.16 | -0.17 | -0.21 | -0.14 | -105 | -99 | -95 | -100 | -23 | -26 | -23 | -26 |
| 14 | -0.15 | -0.17 | -0.20 | -0.13 | -96 | -95 | -110 | -101 | -25 | -29 | -25 | -29 |
| 15 | -0.15 | -0.18 | -0.19 | -0.13 | -111 | -107 | -105 | -106 | -28 | -31 | -28 | -31 |
| 16 | -0.15 | -0.18 | -0.19 | -0.13 | -119 | -108 | -104 | -109 | -30 | -30 | -30 | -30 |
| 17 | -0.15 | -0.18 | -0.19 | -0.13 | -109 | -111 | -103 | -101 | -32 | -32 | -30 | -33 |
| 18 | -0.16 | -0.20 | -0.21 | -0.14 | -105 | -108 | -99 | -101 | -36 | -38 | -31 | -36 |
| 19 | -0.16 | -0.20 | -0.20 | -0.13 | -106 | -105 | -99 | -97 | -34 | -36 | -34 | -37 |
| 20 | -0.18 | -0.21 | -0.22 | -0.14 | -99 | -98 | -96 | -95 | -33 | -31 | -37 | -33 |
| 21 | -0.17 | -0.22 | -0.22 | -0.15 | -102 | -104 | -96 | -94 | -41 | -30 | -37 | -30 |
| 22 | -0.18 | -0.22 | -0.23 | -0.15 | -96 | -103 | -92 | -95 | -33 | -39 | -38 | -43 |
| 23 | -0.18 | -0.23 | -0.24 | -0.15 | -97 | -94 | -94 | -95 | -28 | -27 | -28 | -27 |
| 24 | -0.21 | -0.28 | -0.27 | -0.20 | -93 | -97 | -97 | -98 | -21 | -19 | -21 | -19 |
| 25 | -0.26 | -0.35 | -0.32 | -0.27 | -98 | -99 | -96 | -97 | -18 | -16 | -18 | -16 |
| 26 | -0.27 | -0.35 | -0.33 | -0.29 | -102 | -102 | -99 | -97 | -17 | -16 | -17 | -16 |
| 27 | -0.23 | -0.31 | -0.29 | -0.25 | -103 | -101 | -95 | -108 | -19 | -18 | -19 | -18 |
| 28 | -0.20 | -0.27 | -0.27 | -0.20 | -98 | -106 | -98 | -99 | -23 | -22 | -23 | -22 |
| 29 | -0.18 | -0.24 | -0.25 | -0.15 | -110 | -116 | -99 | -99 | -29 | -38 | -30 | -32 |
| 30 | -0.18 | -0.25 | -0.25 | -0.15 | -101 | -110 | -109 | -114 | -35 | -29 | -47 | -30 |
| 31 | -0.19 | -0.27 | -0.27 | -0.16 | -95 | -104 | -128 | -116 | -33 | -24 | -32 | -24 |
| 32 | -0.20 | -0.27 | -0.28 | -0.16 | -100 | -103 | -105 | -105 | -27 | -24 | -27 | -24 |
| 33 | -0.22 | -0.28 | -0.30 | -0.17 | -103 | -105 | -99 | -100 | -24 | -26 | -24 | -26 |
| 34 | -0.24 | -0.27 | -0.31 | -0.17 | -107 | -105 | -105 | -99 | -22 | -27 | -22 | -29 |
| 35 | -0.23 | -0.29 | -0.33 | -0.19 | -102 | -111 | -112 | -104 | -21 | -23 | -21 | -23 |
| 36 | -0.24 | -0.33 | -0.34 | -0.23 | -96 | -93 | -98 | -97 | -20 | -19 | -20 | -19 |
| 37 | -0.25 | -0.38 | -0.39 | -0.28 | -91 | -91 | -92 | -97 | -20 | -17 | -19 | -17 |
| 38 | -0.27 | -0.35 | -0.38 | -0.29 | -83 | -81 | -83 | -94 | -20 | -19 | -20 | -18 |
| 39 | -0.24 | -0.32 | -0.38 | -0.23 | -94 | -100 | -88 | -103 | -24 | -22 | -25 | -24 |
| 40 | -0.23 | -0.30 | -0.36 | -0.18 | -83 | -84 | -89 | -85 | -34 | -42 | -35 | -36 |
| 41 | -0.26 | -0.33 | -0.36 | -0.20 | -84 | -87 | -94 | -87 | -24 | -26 | -25 | -25 |
| 42 | -0.26 | -0.32 | -0.35 | -0.19 | -85 | -88 | -87 | -83 | -24 | -22 | -26 | -27 |
| 43 | -0.25 | -0.30 | -0.34 | -0.21 | -99 | -84 | -83 | -87 | -32 | -30 | -38 | -33 |
| 44 | -0.31 | -0.34 | -0.40 | -0.29 | -89 | -93 | -83 | -84 | -20 | -21 | -20 | -21 |
| 45 | -0.39 | -0.41 | -0.52 | -0.35 | -78 | -80 | -88 | -83 | -15 | -13 | -15 | -14 |
| 46 | -0.51 | -0.53 | -0.60 | -0.46 | -100 | -84 | -90 | -91 | -12 | -11 | -12 | -12 |
| 47 | -0.63 | -0.56 | -0.64 | -0.53 | -90 | -82 | -85 | -90 | -11 | -12 | -11 | -12 |
| 48 | -0.62 | -0.36 | -0.45 | -0.41 | -91 | -88 | -83 | -90 | -12 | -15 | -12 | -13 |
| 49 | -0.47 | -0.21 | -0.25 | -0.29 | -83 | -88 | -84 | -85 | -16 | -25 | -16 | -26 |
| 50 | -0.39 | -0.22 | -0.20 | -0.30 | -80 | -90 | -90 | -82 | -31 | -23 | -33 | -27 |

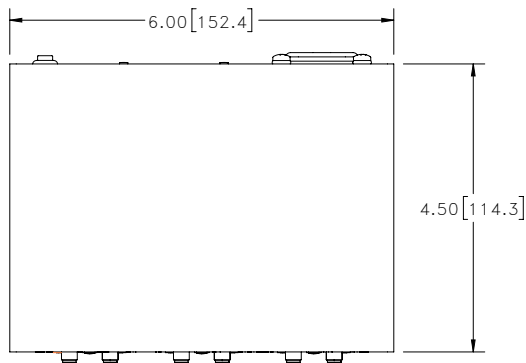


Typical Performance Curves per Switch

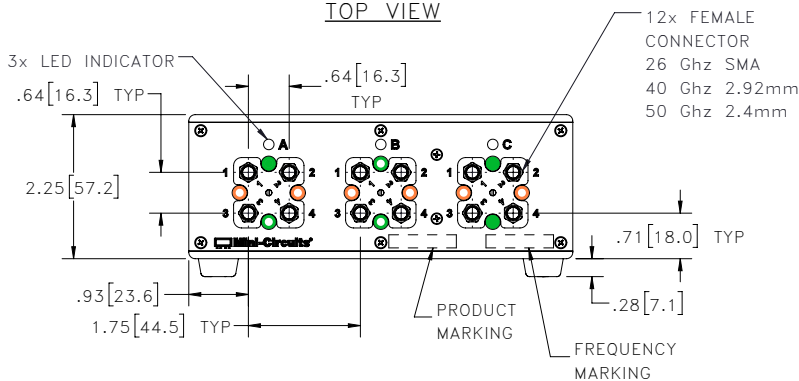


Outline Dimensions

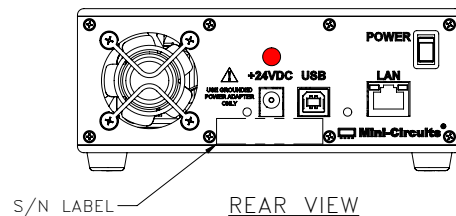
SH3143



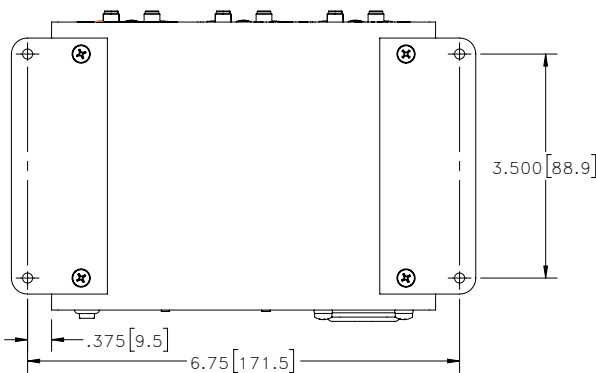
TOP VIEW



FRONT VIEW

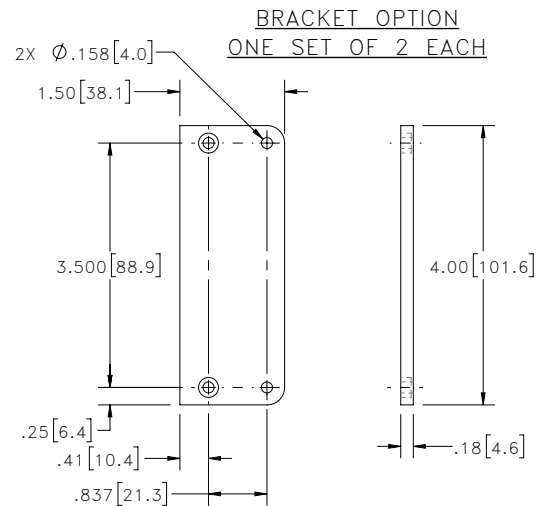


REAR VIEW



BOTTOM VIEW

SHOWN WITH RUBBER FEET REMOVED AND BRACKETS INSTALLED.



TOLERANCE: ± 0.005

INSTRUCTIONS FOR MOUNTING BRACKETS:
 TOOL REQUIRED: PHILLIPS HEAD SCREWDRIVER
 STEP 1: REMOVE RUBBER FEET FROM THE BOTTOM OF THE UNIT. DO NOT DISCARD THE FASTENERS.
 STEP 2: MOUNT THE BRACKETS WITH THE FASTENERS REMOVED IN STEP 1, USING THE COUNTER BORE HOLES IN THE BRACKET.

Notes:

1. Case material: Aluminum (with protective coating to prevent corrosion).
2. Dimensions are in inches [mm]. Tolerances: 2 Pl. ± 0.03 inch; 3 Pl. ± 0.015 inch.
3. Weight: 960 grams.
4. Marking may contain other features or characters for internal lot control.



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

RF/IF MICROWAVE COMPONENTS



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 | 0° to 40° C Ambient Environment | Individual Model Data Sheet |
| Storage Temperature | -15° to 85°C Ambient Environment | Individual Model Data Sheet |
| Operating and Storage Humidity | 5% to 85% RH (non-condensing) | Ambient |
| Bench Handling Test | Bench Top Tip 45° & Drop | MIL-PRF-28800F |
| Transit Drop Test | Free Fall Drop, 20 cm (7.9 inches) | MIL-PRF-28800F class 3 |