Solid state, true DC

USB RF SPDT Switch Matrix

USB-2SP2T-DCH

50Ω   DC to 8000 MHz

The Big Deal

- DC passing & ultra-wide bandwidth, DC to 8 GHz
- Dual SPDT switch with single USB interface
- High isolation, 50 dB typ up to 4 GHz
- High power handling, +35 dBm max

Software Package

Case Style: QM2468

Model No.	Description	Qty.
USB-2SP2T-DCH	**Switch Matrix**	**1**
	Included Accessories	
MUSB-CBL-3+	2.6 ft USB cable	1

Typical Applications

- Satcom / GNSS antenna switching (RF & DC paths)
- Signal routing / switch matrices
- High volume production testing / ATE
- Design verification testing

RoHS Compliant

See our web site for RoHS Compliance methodologies and qualifications

Product Overview

Mini-Circuits' USB-2SP2T-DCH is a low cost, USB controlled, solid state matrix, containing two independent SPDT RF switches. Each fast switching, absorptive SPDT switch operates from true DC all the way to 8 GHz with 10 µs typical switch transition speed. High linearity (+50 dBm typ IP3), low insertion loss (1.5 dB typ) and high isolation (50 dB typical) allow the model to be used for a wide variety of RF applications.

Full software support is provided for USB control, 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). The latest version of the full software package can be downloaded from **https://www.minicircuits.com/softwaredownload/solidstate.html** at any time.

The USB-2SP2T-DCH is housed in a compact, low profile, rugged metal case (4.58" x 2.00" x 0.475") with 6 SMA (F) connectors (COM, 1 and 2 for each switch), and a USB Mini-B port for power control .

Key Features

Feature	Advantages
High speed switch transition (10 µsec typ)	High speed switching reduces the time the signal paths are interrupted and allows the switch to be used in a wider range of applications.
High Linearity (IP3 50 dBm typ.)	Results in little or negligible inter-modulation generation, meeting requirements for digital communications signals
Low insertion loss (1.5 dB typ)	Results in reduced system loss and heat build up
Full software support included	Mini-Circuits' full software package, programming and user manual are available for down load from **https://www.minicircuits.com/softwaredownload/solidstate.html** at no extra cost.

Mini-Circuits®

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Electrical Specifications @ 0 to 50°C

Parameter	Port	Conditions	Min.	Typ.	Max.	Units
Operating Frequency			DC		8000	MHz
Insertion Loss	COM to any active port	DC to 300 MHz	–	0.75	1.2	dB
		300 - 3000 MHz	–	1.0	1.5	
		3000 - 6000 MHz	–	1.3	2.5	
		6000 - 8000 MHz	–	1.7	3.0	
Isolation	Between ports 1 and 2 of each switch	DC to 300 MHz	70	90	–	dB
		300 - 3000 MHz	46	57	–	
		3000 - 6000 MHz	33	44	–	
		6000 - 8000 MHz	28	37	–	
	COM to any terminated port	DC to 300 MHz	62	81	–	
		300 - 3000 MHz	40	51	–	
		3000 - 6000 MHz	31	41	–	
		6000 - 8000 MHz	26	36	–	
	Switch A to Switch B	DC to 8000 MHz	71	103	–	
VSWR	COM or any active port	DC to 3000 MHz	–	1.20	–	:1
		3000 - 6000 MHz	–	1.25	–	
		6000 - 8000 MHz	–	1.40	–	
	Any terminated port	DC to 3000 MHz	–	1.15	–	
		3000 - 6000 MHz	–	1.30	–	
		6000 - 8000 MHz	–	1.35	–	
Power Input @1 dB Compression [1,2,3]	COM to any active port	40 to 8000 MHz	–	38	–	dBm
IP3 [3,4]	COM to any active port	40 to 8000 MHz	–	50	–	dBm
Transition Time [5]	–		–	10	14	µs
Minimum dwell time [6]	High Speed Mode		–	20	–	µs
Switching Time (USB) [7]	–	–	–	2	–	ms
Rated voltage	USB port	–	4.75	5	5.25	V
Rated Current		–	–	150	200	mA
Operating RF Input Power	COM to any active port	Hot Switching [1]	–	–	+23	dBm
	Any terminated port	Note 1	–	–	+23	
	COM to any active port	Through path [2]	–	–	+35	
DC bias voltage	Any RF port	–	-7	–	7	V
DC pass-through current	COM to any active port		-60	–	60	mA

[1] Max operating power at terminated port degrades linearly below 20 MHz to +17 dBm at 2 MHz and remains constant from 2 MHz to DC

[2] Max operating power at through path degrades linearly below 30 MHz to +25 dBm at 2 MHz and remains constant from 2 MHz to DC

[3] Compression and IP3 degrade below 40 MHz

[4] IP3 Tested with 1 MHz span between signals.

[5] Transition time spec represents the time that the RF signal paths are interrupted during switching and thus is specified without communication delays.

[6] Minimum dwell time is the shortest time that can be achieved between 2 switch transitions when programming an automated switch sequence.

[7] Switching time(USB) is the time from issuing a single software command via USB to the switch state changing. The most significant factor is the host PC, influenced by CPU load and USB protocol. The time shown is an estimate for a medium CPU load and USB 2.0 connection.

USB RF SPDT Switch Matrix

Absolute Maximum Ratings

Operating Temperature		0°C to 50°C
Storage Temperature		-20°C to 60°C
DC supply voltage max.		6V
RF power into termination	DC - 20 MHz	Derate linearly from +24 dBm@20 Mhz to +18 dBm@ 2MHz and remains constant from 2 MHz to DC
	20 - 8000 MHz	+24 dBm
RF power @ Through Path	DC - 30 MHz	Derate linearly from +38 dBm@30 MHz to +28 dBm at 2 MHz and remains constant from 2 MHz to DC
	30 - 8000 MHz	38 dBm
DC voltage @ RF Ports		±7V
DC pass-through current		80mA

Permanent damage may occur if any of these limits are exceeded. Operating in the range between operating power limits and absolute maximum ratings for extended periods of time may result in reduced life and reliability.

Connections

RF SPDT Switch A (1, 2, COM)	(SMA female)
RF SPDT Switch B (1, 2, COM)	(SMA female)
USB	(USB type Mini-B receptacle)

Simplified Diagram

Mini-Circuits®

Outline Drawing (QM2468)

USB Mini-B Receptacle

LED Indicator

6X Conn SMA Female
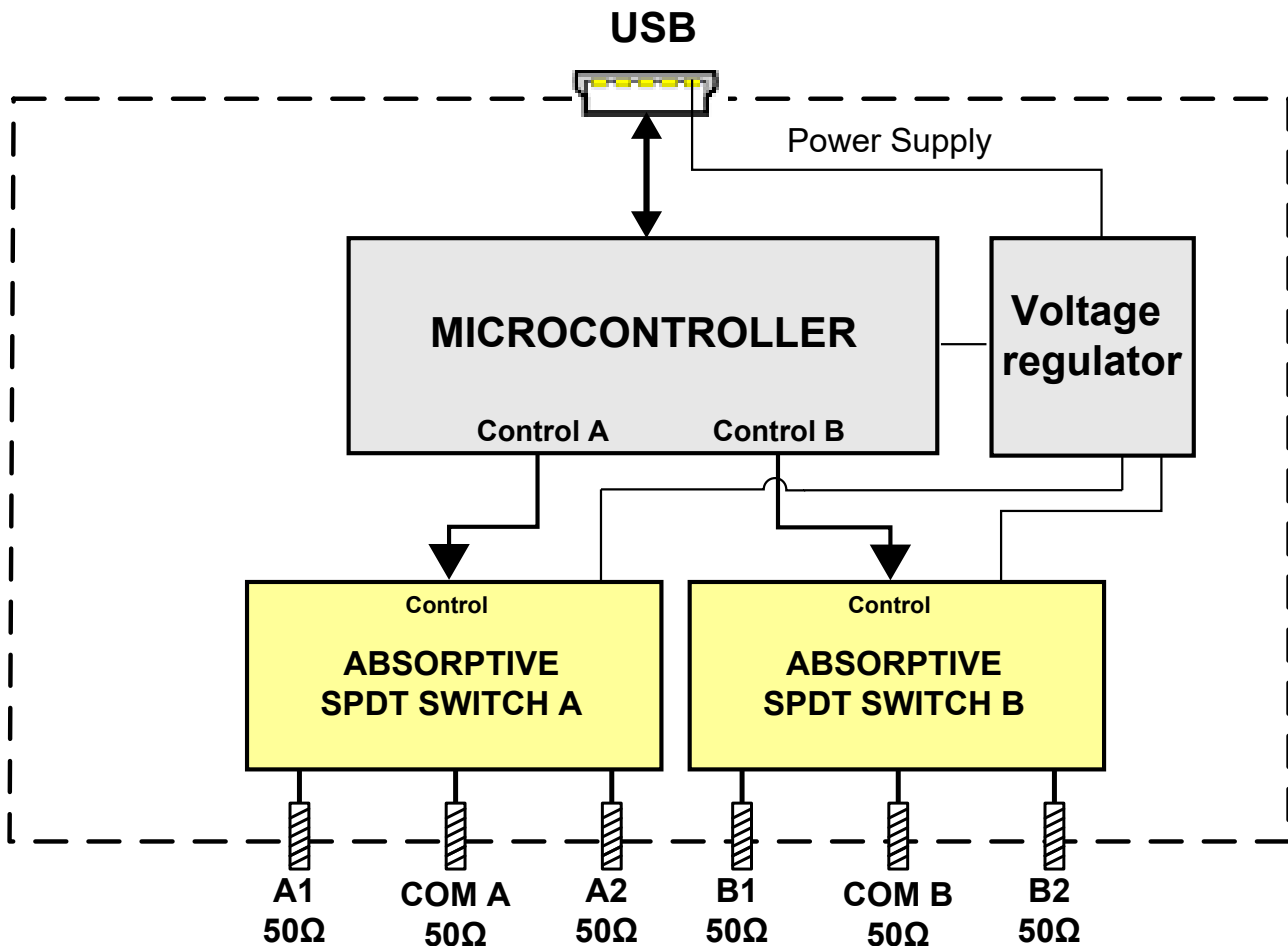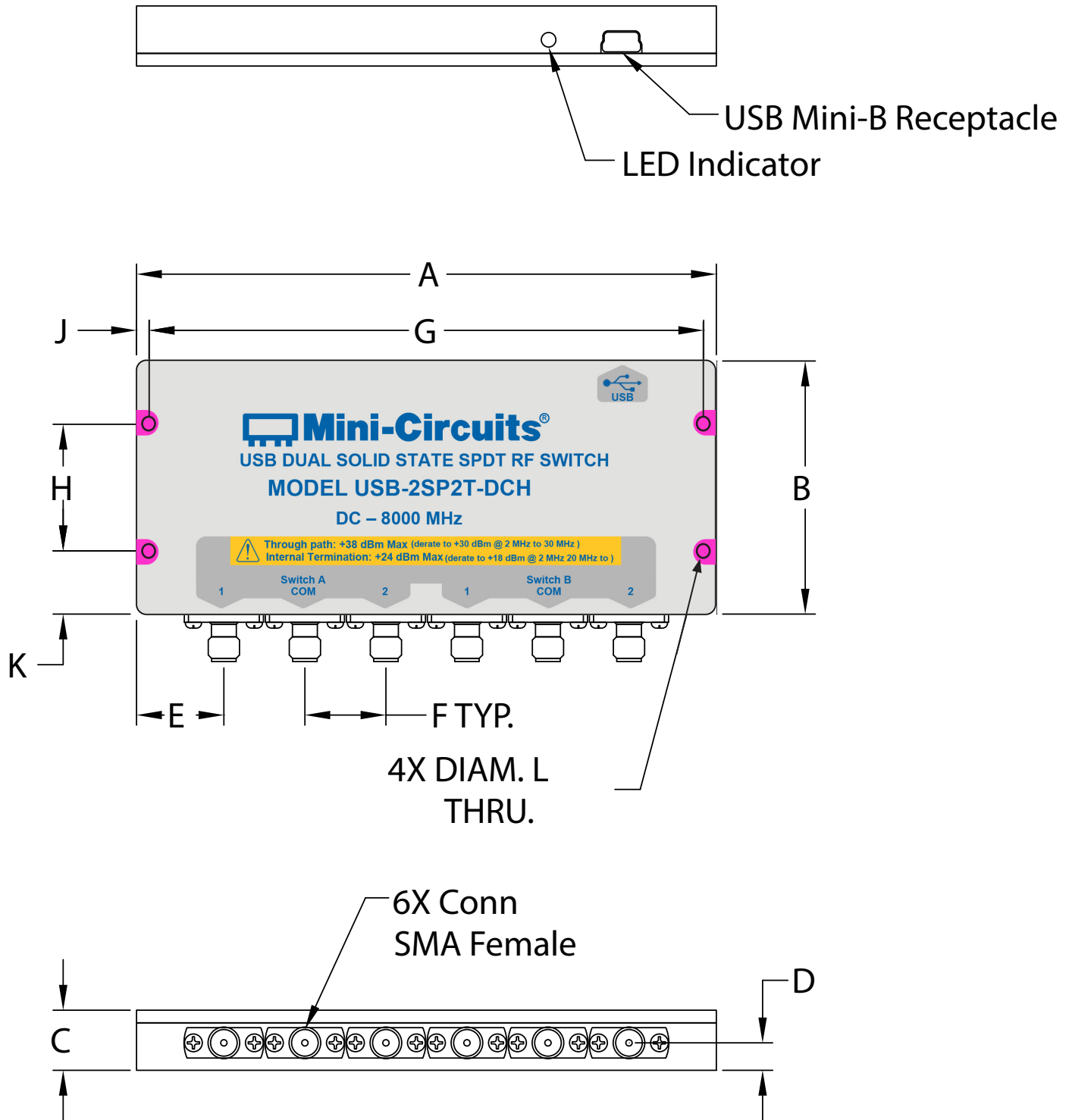
Outline Dimensions ($\frac{inch}{mm}$)

A	B	C	D	E	F	G	H	J	K	L	WT. GRAMS
4.58	2.00	.475	0.217	0.69	0.640	4.380	1.000	0.10	0.50	0.106	260
116.33	50.8	12.07	5.51	17.53	16.26	111.25	25.40	2.54	12.70	2.69	

Typical Performance Curves

Insertion Loss over Temp.
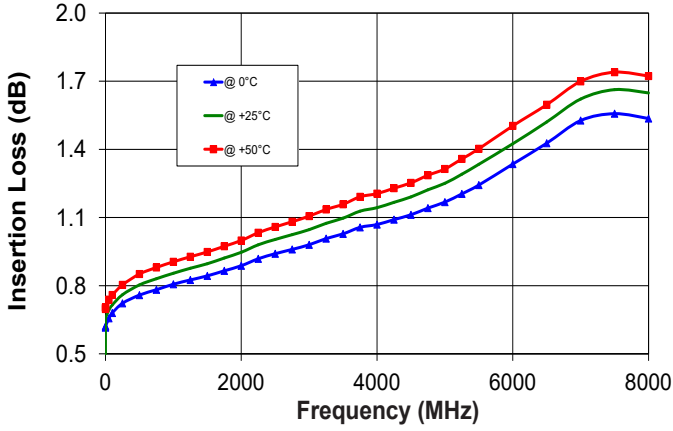
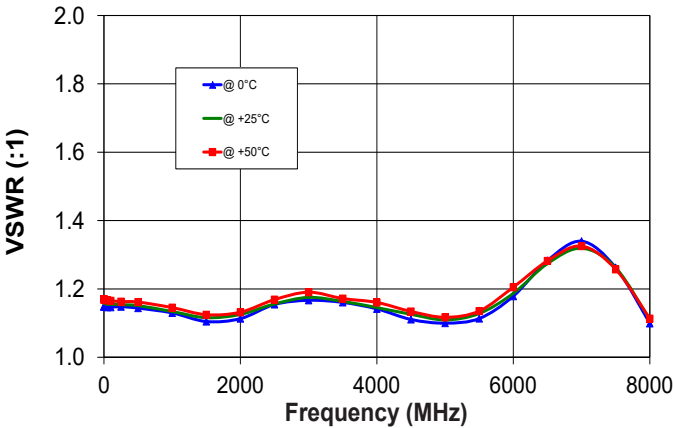### Insertion Loss of all switches in module vs. Frequency
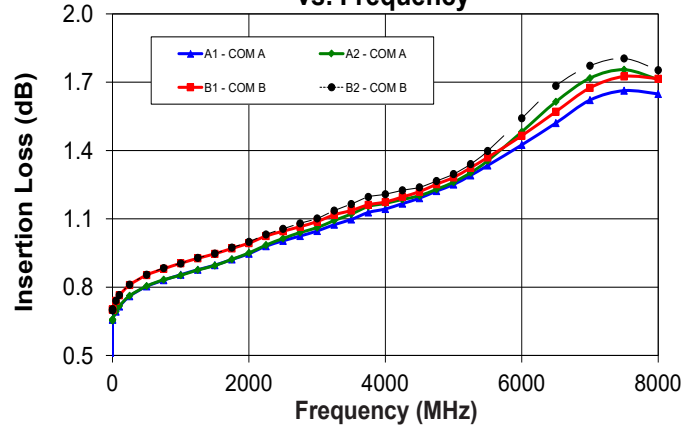
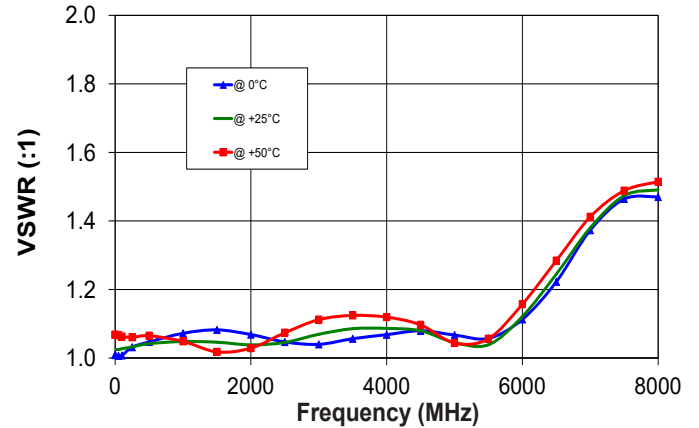### Insertion Loss with DC Bias at COM Port.
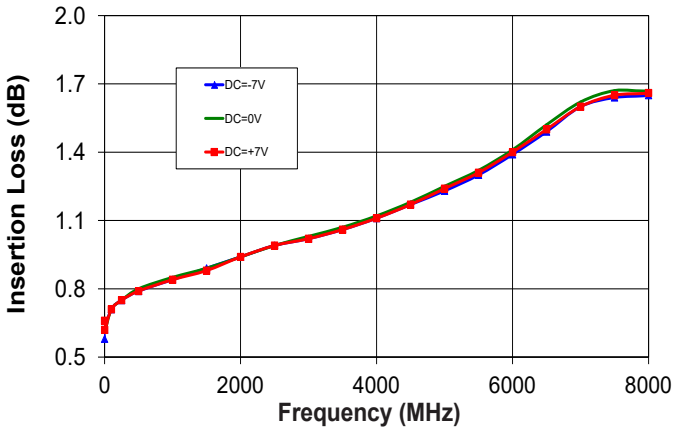
Common Port VSWR over Temp.
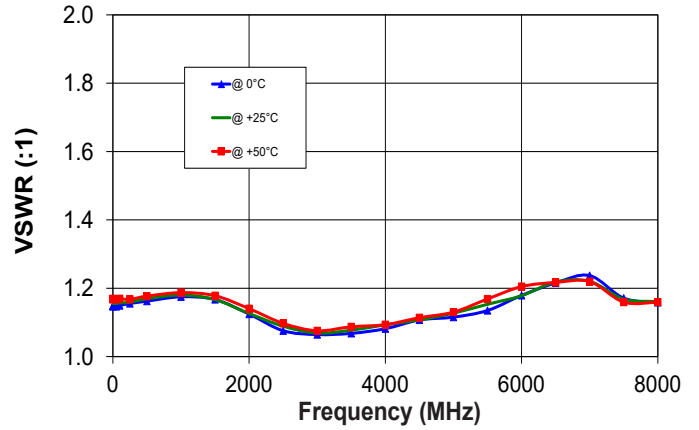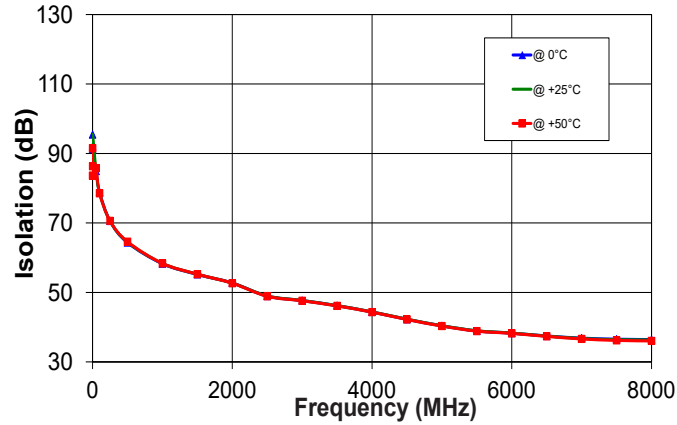

Active Port VSWR over Temp.
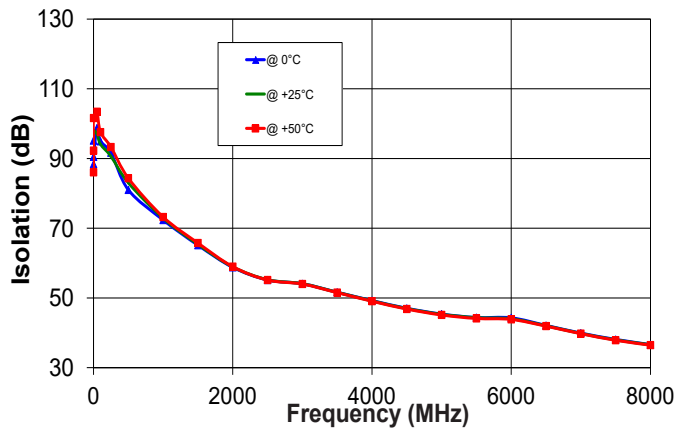

Internal Term. VSWR over Temp.
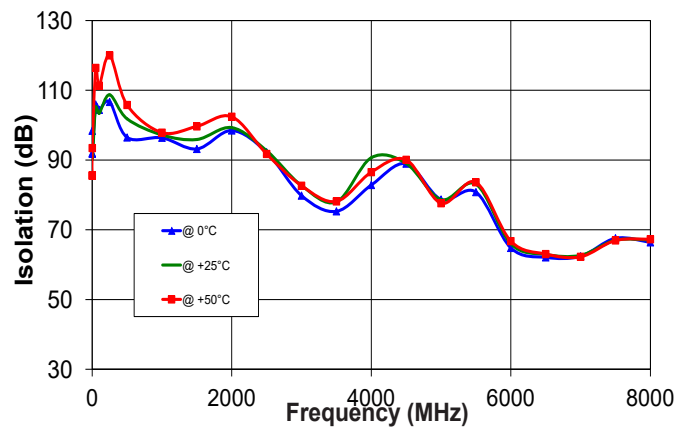
Typical Performance Curves (Continued)

Com to Port Isolation over Temp.

Port 1 to Port 2 Isolation over Temp.

Isolation between switches over Temp.

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/solidstate.html
- Please contact **testsolutions@minicircuits.com** for support

Minimum System Requirements

Parameter	Requirements	
Interface	USB HID	
System requirements	GUI:	Windows 32 & 64 bit systems from Windows 98 up to Windows 10
	USB API (ActiveX & .Net)	Windows 32 & 64 bit systems with ActiveX or .Net support from Windows 98 up to Windows 10
	USB direct programming support	Linux, Windows systems from Windows 98 up to Windows 10
Hardware	Pentium® II or higher, RAM 256 MB	

Graphical User Interface (GUI) for Windows
Key Features:
- Set each switch manually
- Set timed sequence of switching states
- Configure switch address and upgrade Firmware
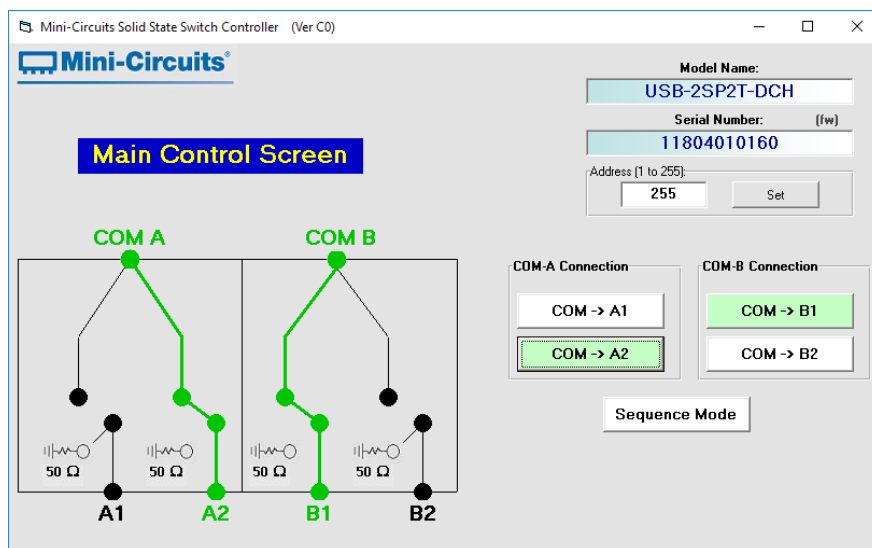
Application Programming Interface (API)
Windows Support:
- API DLL files exposing the full switch functionality See programming manual at **https://www.minicircuits.com/softwaredownload/Prog_Manual-Solid_State_Switch.pdf** for details
  - ActiveX COM DLL file for creation of 32-bit programs
  - .Net 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 tested environments)

Linux Support:
- Full switch control in a Linux environment is achieved by way of USB interrupt commands. See programming manual at **https://www.minicircuits.com/softwaredownload/Prog_Manual-H_Series_Switches.pdf** for details

Ordering, Pricing & Availability Information see our web site

Model	Description
USB-2SP2T-DCH	USB RF SPDT Switch matrix

Included Accessories	Part No.	Description
	MUSB-CBL-3+	2.6 ft (0.8 m) USB Cable: USB type A(Male) to USB type Mini-B(Male)

Optional Accessories	Description
MUSB-CBL-3+ (Spare)	2.6 ft (0.8 m) USB Cable: USB type A(Male) to USB type Mini-B(Male)
MUSB-CBL-7+	6.6 ft (2.0 m) USB Cable: USB type A(Male) to USB type Mini-B(Male)

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