USB & DAISY CHAIN

4 x SPDT Solid-State Switch Module **USB-4SP2T-852H**

50Ω 10 to 8500 MHz SMA female

THE BIG DEAL

- 4 x solid-state SPDT absorptive switches
- High-speed switch transition, 5 µs
- Very high isolation, 60 dB
- High power handling, +30 dBm max
- Daisy-chain control of up to 35 modules

APPLICATIONS

- High volume production testing / ATE
- 5G FR1, WiFi 6E, Bluetooth testing
- Design verification testing
- RF signal routing / switch matrices

Generic photo used for illustration purposes only

PRODUCT OVERVIEW

Mini-Circuits' USB-4SP2T-852H is a low cost, USB controlled, solid state matrix, containing four independent SPDT RF switches. Each fast switching, absorptive switch operates from 10 MHz to 8500 MHz with 5 µs typical switch transition speed. High linearity (+50 dBm typ IP3), and high isolation (60 dB typical) allow the model to be used for a wide variety of RF applications.

The USB-4SP2T-852H is housed in a compact, low profile, rugged metal case (8.4" x 2.00" x 0.475") with 12 SMA (F) connectors (COM, 1 & 2 for each switch), a USB Mini-B port for power and control, and two data bus connectors for Master / Slave connections to other modules.

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
Four RF SPDT absorptive switches	Wideband (10 to 8500 MHz) with low insertion loss (3 dB typ.), high isolation (60 dB typ), and high power rating (+30 dBm through path).
High Linearity (IP3 +50 dBm typ.)	Excellent intermodulation performance, meeting requirements for digital communications signals.
Internal DC Blocking capacitors	No need for external DC blocking circuitry
Dynamic daisy-chain control	Simplify control software and interconnections by cascading up to 35 modules of multiple switch types into a Master / Slave chain with a single USB interface.
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.

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4 x SPDT Solid-State Switch Module USB-4SP2T-852H

50Ω 10 to 8500 MHz SMA female

ELECTRICAL SPECIFICATIONS AT -10 TO 60°C

Parameter	Ports	Condition (MHz)	Min.	Typ.	Max.	Unit
Frequency range	-	-	10		8500	MHz
Insertion loss	COM to any active port	10 - 700	-	1.6	2.8	dB
		700 - 2500	-	2.0	3.2	
		2500 - 5000	-	2.8	4.0	
		5000 - 6000	-	3.0	4.2	
		6000 - 7200	-	3.0	4.5	
		7200 - 8000	-	3.4	4.8	
		8000 - 8500	-	3.6	5.0	
Isolation	Between ports 1 to 2 (of any given switch)	10 - 700	82	100	-	dB
		700 - 2500	67	82	-	
		2500 - 5000	55	65	-	
		5000 - 6000	50	61	-	
		6000 - 8500	45	52	-	
	COM to any terminated port (of any given switch)	10 - 700	85	100	-	
		700 - 2500	70	85	-	
		2500 - 5000	58	70	-	
		5000 - 6000	52	63	-	
		6000 - 8500	45	54	-	
	Crosstalk between switches	10 - 8500	65	100	-	
Return loss	COM port	10 - 6000	-	19.0	-	dB
		6000 - 7200	-	18.0	-	
		7200 - 8000	-	15.0	-	
		8000 - 8500	-	12.5	-	
	Any port connected to COM	10 - 6000	-	19.0	-	
		6000 - 7200	-	18.0	-	
		7200 - 8000	-	15.0	-	
		8000 - 8500	-	12.5	-	
	Any terminated port	10 - 2500	-	23.0	-	
		2500 - 5000	-	21.0	-	
		5000 - 6000	-	18.0	-	
		6000 - 7200	-	18.0	-	
		7200 - 8000	-	17.0	-	
		8000 - 8500	-	13.0	-	

ELECTRICAL SPECIFICATIONS AT -10 TO 60°C (CONTINUED)

Parameter	Ports	Condition (MHz)		Min.	Typ.	Max.	Unit
Power input @1 dB compression [1, 2]	COM to any active port	100 - 8500		-	+38	-	dBm
IP3 [2, 3]	COM to any active port	100 - 8500		-	+50	-	dBm
Transition time [4]	-	-		-	200	300	ns
Minimum dwell time [5]	High-speed mode	-		-	25	-	µs
Switching time (USB) [6]	-	-		-	2	-	ms
Supply voltage (Vcc)	USB port	-		4.75	5	5.25	V_{DC}
Supply current (Icc)		-		-	55	85	mA
Operating RF input power [7]	Per port (COM & 1 - 2)	Hot switching	10 - 8500	-	-	+24	dBm
	Total on any through path (bi-directional)	Cold switching	10 - 40	-	-	Note 1	
			40 - 6000	-	-	+30	
			6000-8500	-	-	+29	
	Per terminated port (1 - 2)	Into internal termination	10 - 8500	-	-	+24	

1. Max power at through path derates linearly from +30 dBm @ 40 MHz to +25 dBm @ 10 MHz.
2. Compression and IP3 may degrade below 100 MHz.
3. IP3 tested with 1 MHz span between signals, +5 dBm per tone.
4. Transition time spec represents the time that the RF signal paths are interrupted during switching and thus is specified without communication delays.
5. Minimum dwell time is the shortest time that can be achieved between 2 switch transitions when programming an automated switch sequence.
6. 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.
7. The switch can tolerate the max cold switching power on the active path simultaneously with the max internal termination power on every terminated port.

ABSOLUTE MAXIMUM RATINGS [8]

Operating temperature	-10°C to 60°C
Storage temperature	-20°C to 85°C
DC supply voltage max @ USB and pin #4 of D-sub	6V
DC voltage @ RF ports	16V

8. 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.

4 x SPDT Solid-State Switch Module **USB-4SP2T-852H**

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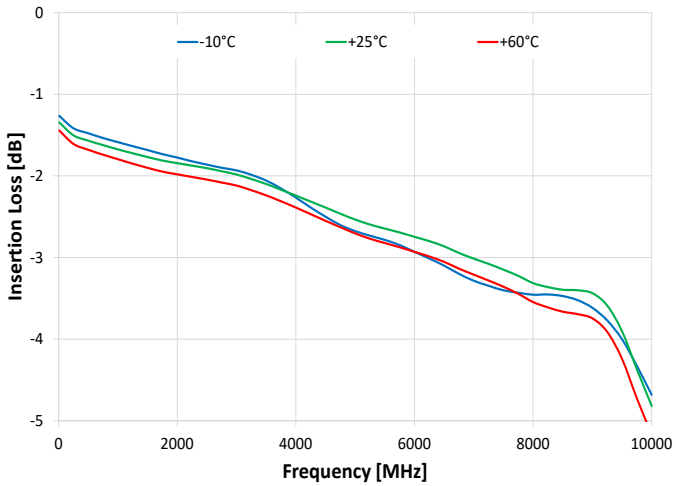
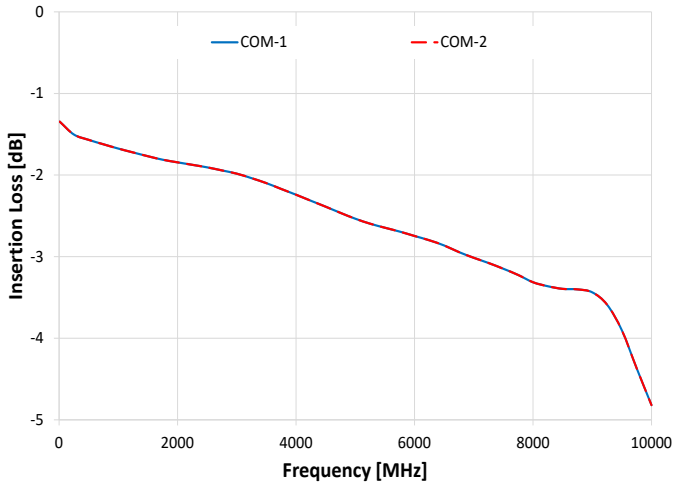
TYPICAL PERFORMANCE GRAPHS

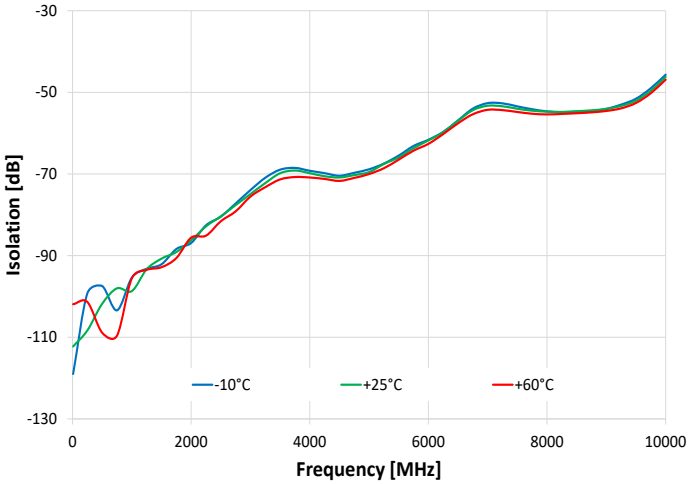
Insertion Loss over Temperature (1 Active)



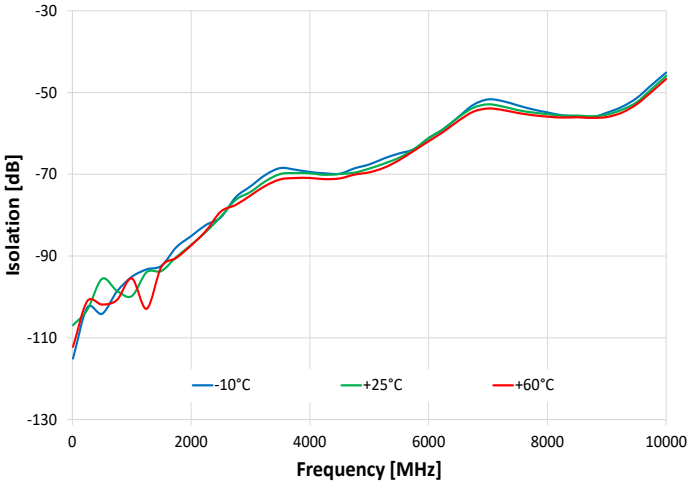
Insertion Loss 1 - 2 Active



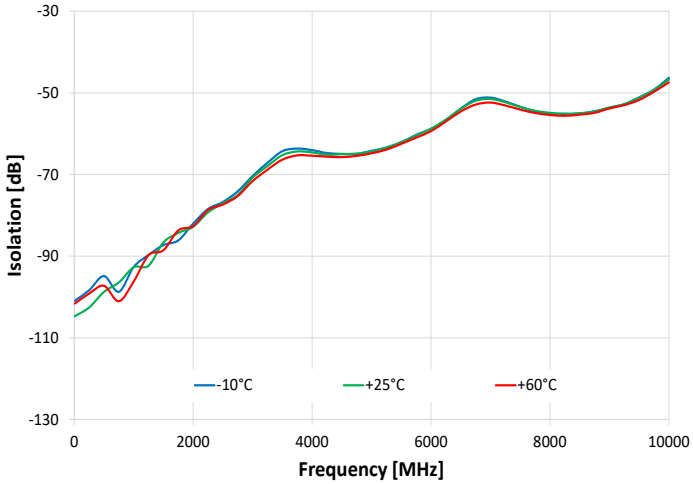
Isolation Com to 1 (2 Active)



Isolation Com to 2 (1 Active)



Isolation 1 to 2 (1 Active)

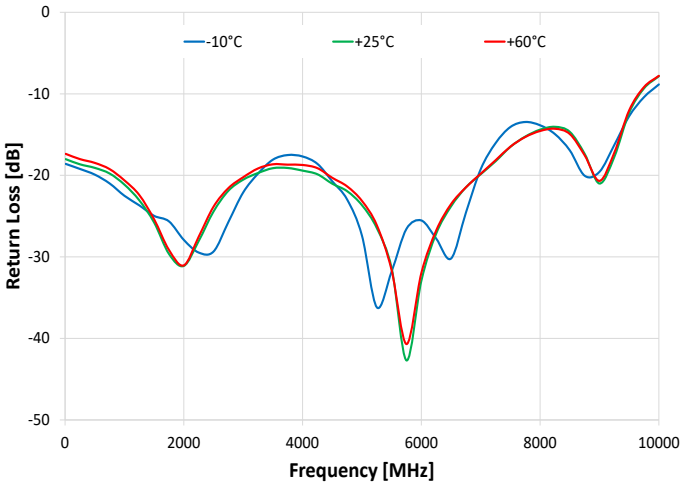


4 x SPDT Solid-State Switch Module **USB-4SP2T-852H**

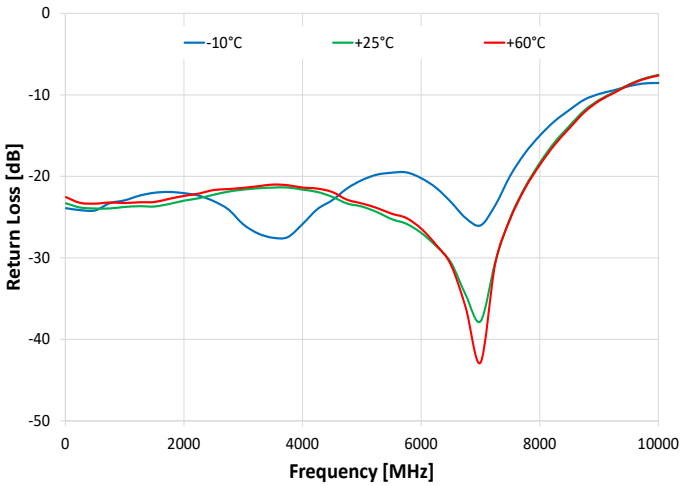
50Ω 10 to 8500 MHz SMA female

TYPICAL PERFORMANCE GRAPHS (CONTINUED)

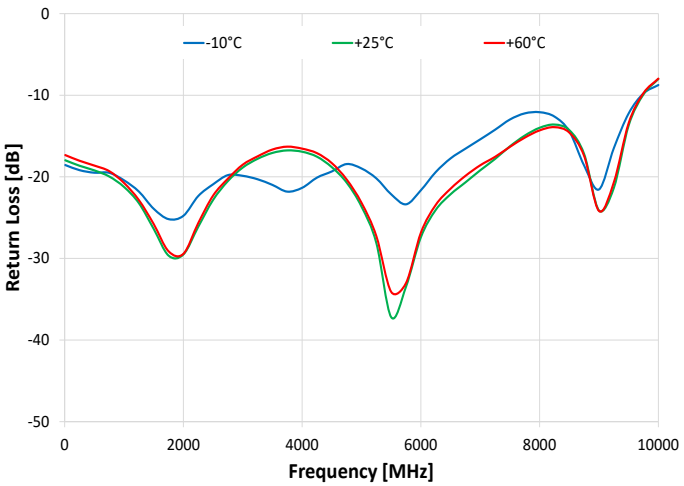
Return Loss @ COM over Temperature (1 Active)



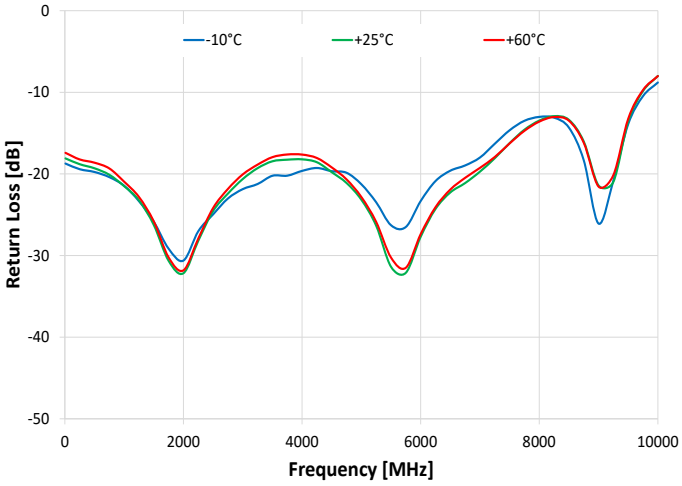
Return Loss @ 1 over Temperature (1 Terminated)



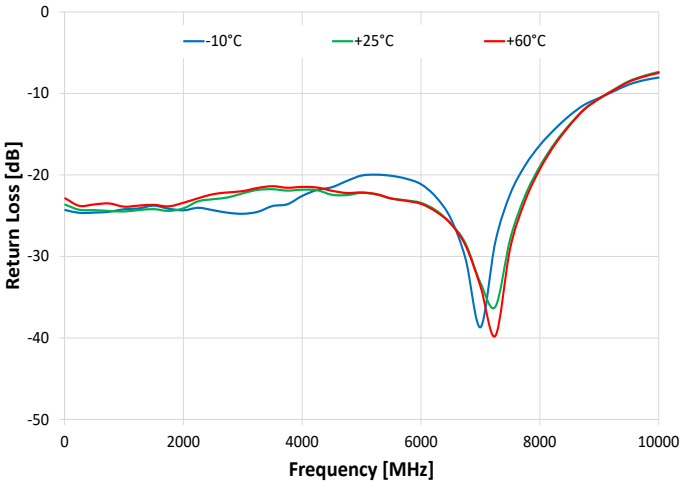
Return Loss @ 1 over Temperature (1 Active)



Return Loss @ 2 over Temperature (2 Active)



Return Loss @ 2 over Temperature (2 Terminated)



CONTROL INTERFACES

USB control	Supported protocols	HID (Human Interface Device) - Full-speed
	Min communication time [9]	3 ms typ (full transmit/receive cycle)

9. USB min communication time is based on the polling interval of the USB HID protocol (1 ms polling interval, 64 bytes per packet), medium CPU load and no other high speed USB devices using the USB bus.

SOFTWARE & DOCUMENTATION

Mini-Circuits' full software and support package including user guide, Windows GUI, API, programming manual and examples can be downloaded free of charge (refer to the last page for the download path).

A comprehensive set of software control options is provided:

- GUI for Windows – Simple software interface for control via Ethernet and USB.
- Programming / automation via USB:
  - DLL files provide a full API for Windows with a set of intuitive functions which can be implemented in any programming environment supporting .Net Framework or ActiveX.
  - Direct USB programming is possible in any other environment (not supporting .Net or ActiveX).

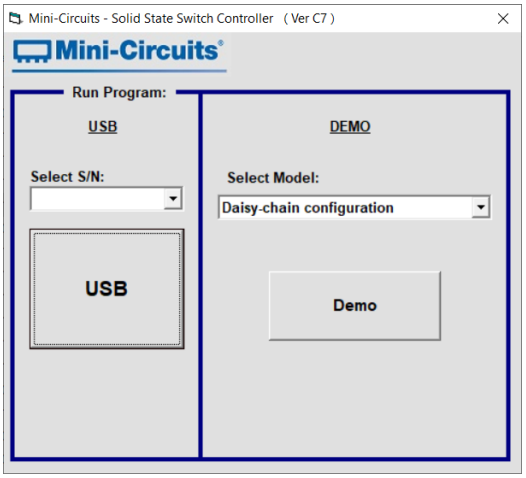
Please contact testsolutions@minicircuits.com for support.

MINIMUM SYSTEM REQUIREMENTS

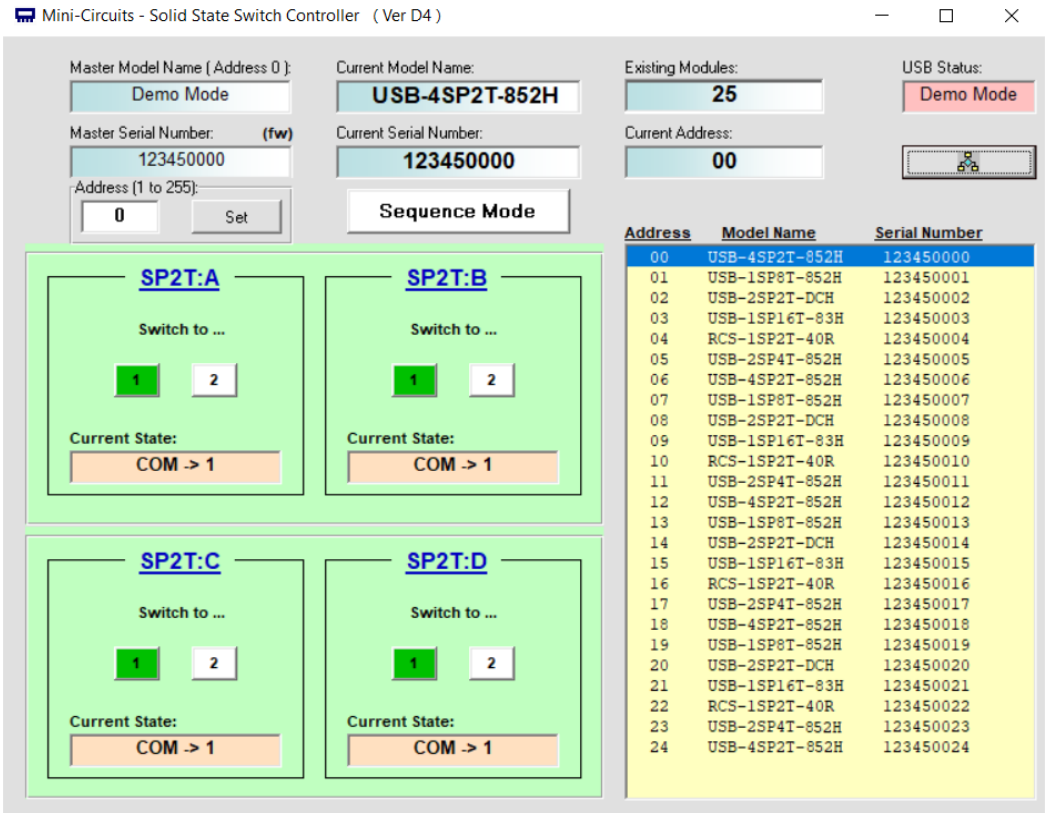
GUI	Windows 7 or later
USB API DLL	Windows 7 or later and programming environment with ActiveX or .NET support
USB Direct Programming	Linux, Windows 7 or later
Daisy-chain dynamic addressing	An additional Mini-Circuits model supporting dynamic addressing
Hardware	Intel i3 (or equivalent) or later

GRAPHICAL USER INTERFACE (GUI) FOR WINDOWS - KEY FEATURES

- Connect via USB
- 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

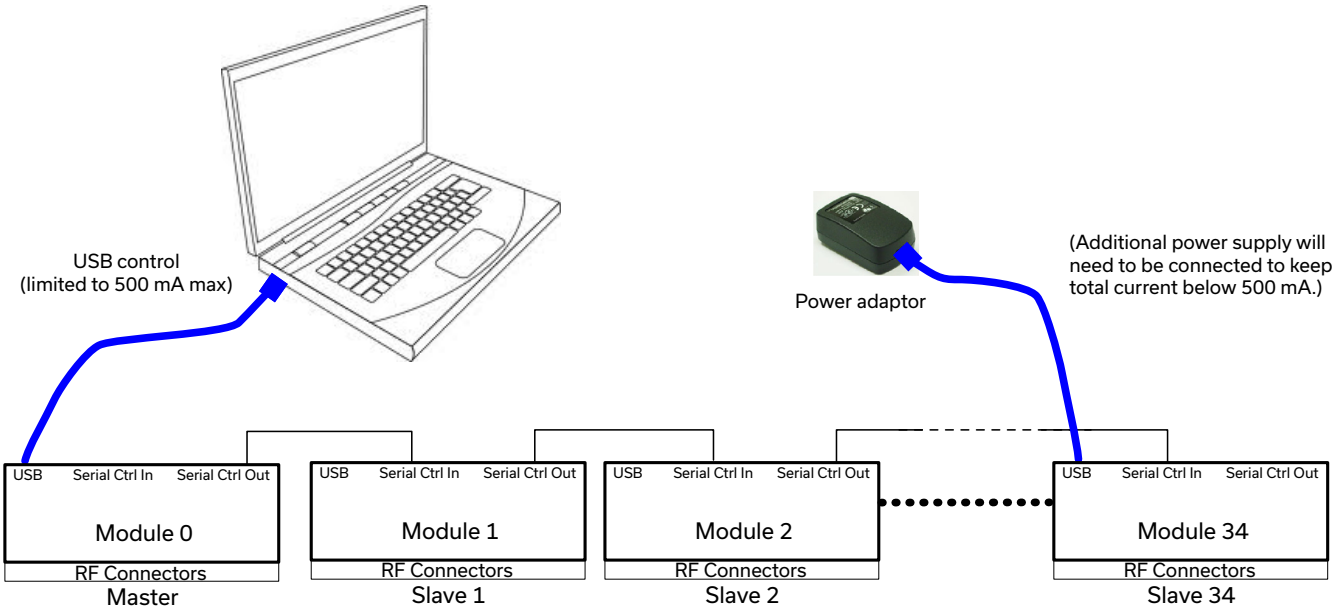


4 x SPDT Solid-State Switch Module **USB-4SP2T-852H**

50Ω 10 to 8500 MHz SMA female

CONNECTING MULTIPLE MODULES (DAISY CHAIN)

The model is designed to connect up to 35 modules in series (daisy chain) using dynamic addressing, meaning there is no need to specifically set the address of the modules. The addresses will be set automatically as part of establishing the communications with the computer. The module connected to the computer's USB port will be assigned address 0 (master), the first module connected to it will get address 1 (slave) and subsequent modules incrementing up to address 34 (slave).



Connections between modules will be made using the serial in/out ports with the module connected to the PC act as a master and all other as slave modules. All control will be through the master module (address 0) which is the only one communicating with the PC. Serial control out port of each module should be connected to the serial control in port of the next module.

Power will be supplied from the PC via the master module up to a maximum of 500 mA. Generally, additional power supply will be needed to keep total current below 500 mA. All power supplies should be connected to the module via the module's USB port. Connecting an additional power supply will automatically cut off power draw from the serial control in port for that module.

The serial master/slave bus allows connecting modules of different types to the same daisy chain as long as all support Mini-Circuits Dynamic addressing setup. To add a new module to the setup, simply connect the module and refresh the address listing, no need to reset any of the existing modules or assign addresses manually.

Note: Different module types may have different current consumption which will change the number of units which can be connected before an additional power supply is needed. For example ,if connecting units with a current consumption of 100 mA each, additional power supply is recommended every sixth module. If using units with current consumption of 50 mA additional power supply is recommended every eleventh module.

4 x SPDT Solid-State Switch Module USB-4SP2T-852H

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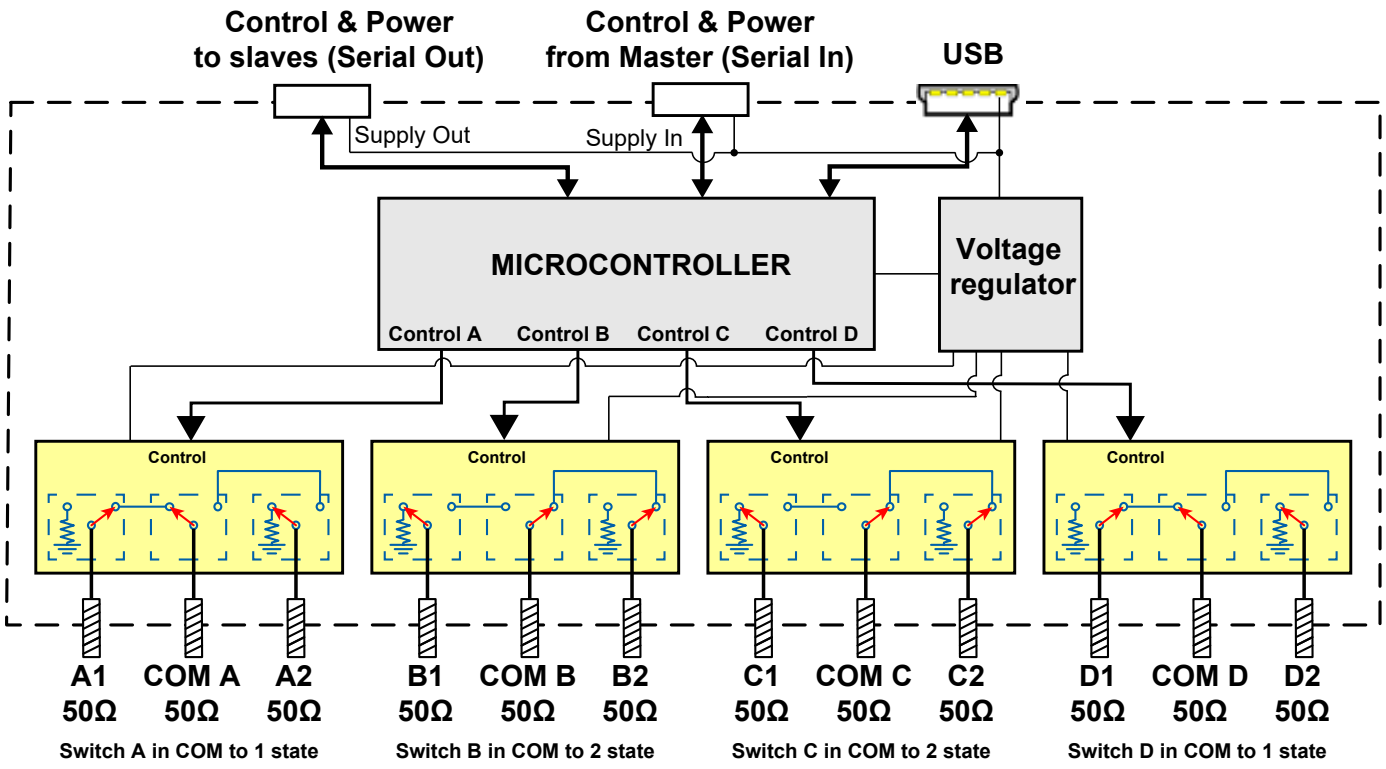
BLOCK DIAGRAM



SWITCH STATE TABLE (EACH SWITCH)

State	Switch path
1	Com to 1
2	Com to 2

CONNECTIONS

Port name	Connector type
RF ports switch A (COM, 1 & 2)	SMA female
RF ports switch B (COM, 1 & 2)	SMA female
RF ports switch C (COM, 1 & 2)	SMA female
RF ports switch D (COM, 1 & 2)	SMA female
USB	USB type Mini-B receptacle
Serial in (digital control 2 port)	Digital snap fit connector [10]
Serial out (digital control 1 port)	Digital snap fit connector [10]

10. Mating connector is Hirose ST40X-10S-CV(30).

4 x SPDT Solid-State Switch Module **USB-4SP2T-852H**

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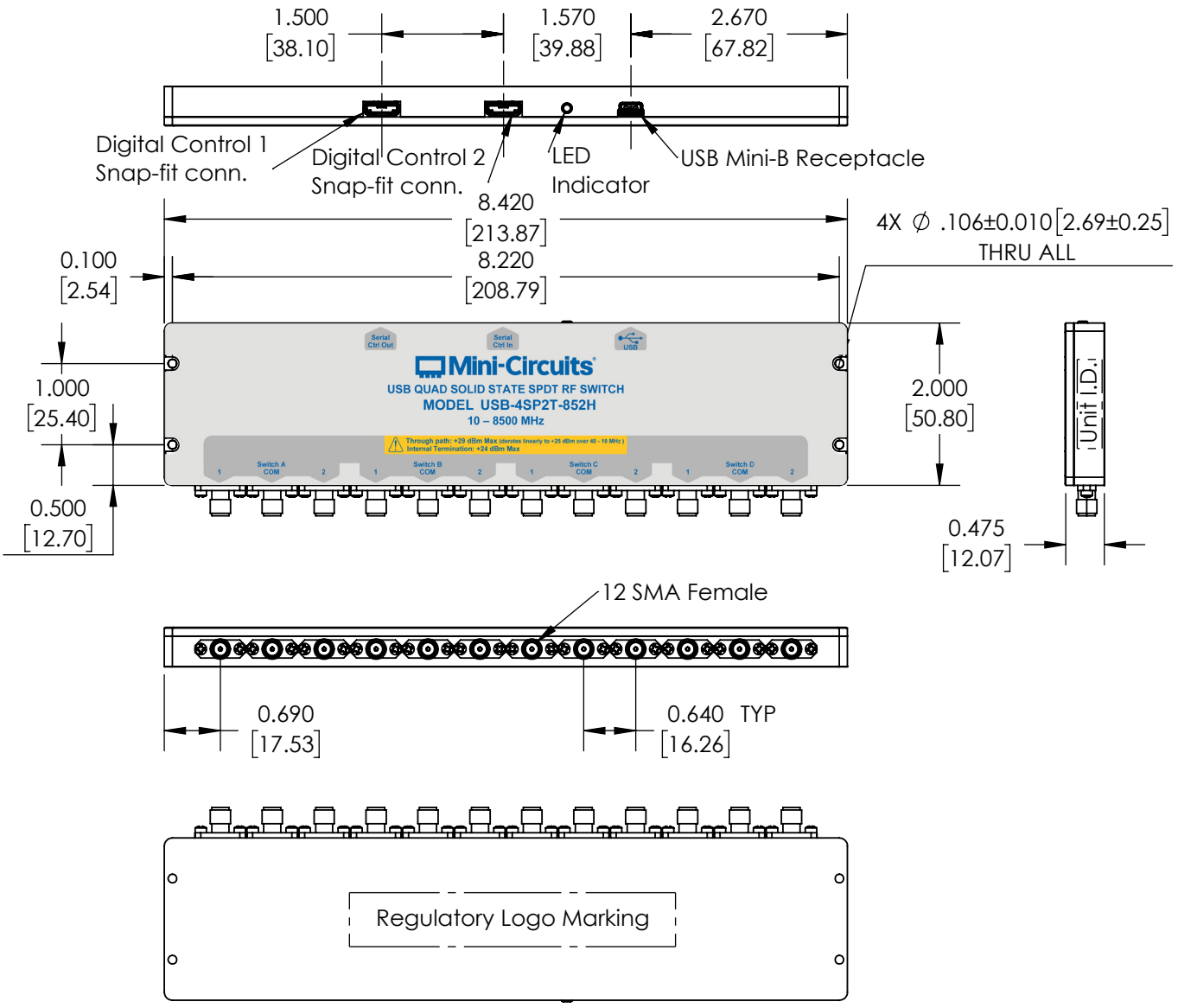
CASE STYLE DRAWING (QM2279)



NOTES:

1. Case material: Aluminum alloy.
2. Case Finish: Nickel Plate.
3. Dimensions: Inches [mm]. Tolerances 2 Pl. ±.03 inch; 3 Pl. ±.015 inch.
4. Weight: 450 grams
5. Marking may contain other features or characters for internal lot control.

4 x SPDT Solid-State Switch Module USB-4SP2T-852H

50Ω 10 to 8500 MHz SMA female

ADDITIONAL DETAILED MODEL INFORMATION IS AVAILABLE ON OUR WEBSITE

Ordering information	https://www.minicircuits.com/WebStore/dashboard.html?model=USB-4SP2T-852H
Performance data & graphs	https://www.minicircuits.com/pages/s-params/USB-4SP2T-852H_VIEW.pdf https://www.minicircuits.com/pages/s-params/USB-4SP2T-852H_GRAPHS.pdf
Case style	https://www.minicircuits.com/case_style/QM2279.pdf
Software, user guide & programming manual	https://www.minicircuits.com/softwaredownload/solidstate.html
Environmental rating	https://www.minicircuits.com/pcb/ENV55.pdf
Regulatory compliance	Refer to user guide for compliance information CE FC UKCA https://www.minicircuits.com/app/AN49-012.pdf
Support	testsolutions@minicircuits.com

INCLUDED ACCESSORIES

Photo	Part No.	Description
	MUSB-CBL-3+	3.3 ft (1.0 m) USB Cable: USB type A (Male) to USB type Mini-B (Male)

OPTIONAL ACCESSORIES

Part No.	Description
MUSB-CBL-3+ (Spare)	3.3 ft (1.0 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)
CBL-1.5FT-MMD+	1.5 ft (0.5 m) cable assembly for serial control daisy chain with snap fit connectors
USB-AC/DC-5	AC/DC +5V power adaptor with USB connector [11, 12]

11. The power adaptor may be used to provide additional power via USB port when connecting several units in daisy chain control.
12. Includes power plugs for US, UK, EU, IL, AU & China. Plugs for other countries are also available. If you need a power cord for a country not listed please contact testsolutions@minicircuits.com

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 https://www.minicircuits.com/terms/viewterm.html