

707B 708B

Semiconductor Switch Matrix Mainframes Six-slot and Single-slot Versions



The six-slot Model 707B and single-slot Model 708B Semiconductor Switch Matrix Mainframes extend Keithley's decades-long commitment to innovation in switch systems optimized for semiconductor test applications. These mainframes build upon the strengths of their popular predecessors, the Models 707/707A and 708/708A, adding new features and capabilities designed to speed and simplify system integration and test development. New control options and interfaces offer system builders even greater flexibility when configuring high performance switching systems for use in both lab and production environments. Just as important, both new mainframes are compatible with the popular switch cards developed for the Models 707A and 708A, simplifying and minimizing the cost of switch system migration.

- Significantly faster command-to-connect speeds than earlier Series 700 mainframes
- 708B mainframe controls a single 8×12 matrix card
- 707B mainframe controls up to six 8×12 matrix cards
- Compatible with the popular plug-in cards designed for the 707A/708A mainframes
- Support for both remote (via LXI, USB, and GPIB interfaces) and manual (via front panel) programming
- Integrates seamlessly with the Model 4200-SCS for semiconductor I-V and C-V characterization via GPIB interface
- Stores hundreds of switching configurations and channel patterns in non-volatile memory for reuse
- LXI Class C interface supports remote programming and control
- Embedded TSP® processor and TSP-Link® interface make it easy to integrate Series 2600A System SourceMeter instruments into a high speed, self-contained tester
- 14 bits of digital I/O

Faster Command-to-Connect

High performance Model 707B and 708B semiconductor switch matrix mainframes slash the time from command to connection, offering significantly faster test sequences and overall system throughput than Keithley's earlier 707A and 708A mainframes.

Optimized for Easy Integration with Existing Test Systems

To minimize migration issues for current users of Model 707A and 708A mainframes, the Model 707B and 708B are designed for command emulation with Models 707A and 708A. The 707B and 708B also support the popular switch matrix cards developed for the Model 707A and 708A, so there's no need to purchase new cards to take advantage of the new mainframes:

- **Model 7174A Low Current Matrix Card:** This 8×12 card is designed for semiconductor research, development, and production applications that demand high quality switching of I-V and C-V signals. Its low leakage and minimal dielectric absorption ensure that key device measurements can be performed many times faster than with earlier switching technologies. Its superior low current performance makes it ideal for use with both Models 2635A and 2636A System SourceMeter Instruments for adding high speed I-V source and measurement capabilities and for accessing the I-V and C-V measurement capabilities of the Model 4200-SCS parametric analyzer.
- **Model 7072 Semiconductor Matrix Card:** This 8×12 switch supports the low level and high impedance measurements encountered in semiconductor parametric tests on wafers and devices. It provides two low current paths with just 1pA maximum offset current for sensitive sub-picoamp measurements, and two other paths optimized for measuring C-V characteristics from DC to 1MHz. Four more high quality signal paths with <20pA offset current provide for general-purpose signal switching up to 100nA or 200V.
- **Model 7072-HV High Voltage Semiconductor Matrix Card:** Like the Model 7072, the 7072-HV is designed to handle low level, high voltage, and high impedance signals. It provides two signal paths capable of switching 1300V with less than 1pA of offset current, so it's ideal for switching the high voltage signals encountered in breakdown measurements or oxide integrity testing. Two paths are optimized for C-V measurements from DC to 1MHz or for switching low currents with a common ground. Four additional high quality signal paths with less than 20pA offset current provide for signal switching to 200V.
- **Model 7173-50 High Frequency, 2-pole, 4×12 Matrix Card:** The Model 7173-50 provides 200MHz bandwidth and a rise time of <2ns. Offset voltage is <15μV per crosspoint, and offset current is <200pA. Its combined AC and DC capabilities make it ideal for mixed-signal applications, such as testing ADCs or DACs, which involve measuring both digital and analog signals.

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Ordering Information

707B	Six-slot semiconductor switch mainframe
708B	Single-slot semiconductor switch mainframe

Extended warranty, service, and calibration contracts are available.

Accessories Supplied

Product Information CD-ROM:

707BS-950-01: Product Information CD

707B-903-01: Quick Start Guide

SWITCH-950-01: Switching and Control Product Information CD

KTS-850D01: Test Script Builder User Suite CD

CA-180-4A: CAT 5 Ethernet Crossover Cable, 1m (3.3 ft)

CA-179-2A: CAT 5 Ethernet Cable, 3m (10 ft)

CO-7: Line Cord

Front Rack Mount Kit

Rear Fixed Rack Mount Kit (707B only)

ACCESSORIES AVAILABLE

CA-126-7A	25-pin Female Digital I/O to 25-pin Male Cable, 3m (10 ft)
Model 7xxx Cards	
2600-TLINK	Digital I/O to TLINK Cable, 1m (3.3 ft)
4299-6	Universal Full Rack Mount Kit (for Model 708B)
7079	Rear Slide Rack Mount Kit (for Model 708B)
7072-TRT	Triax Hastening Tool
7007-1	Double Shielded GPIB Cable, 1m (3.3 ft)
7007-2	Double Shielded GPIB Cable, 2m (6.6 ft)
707B-3Y/5Y-EW	Extended Warranty

SOFTWARE

IVI-COM and IVI-C Driver for C#, VB.NET, Visual C++, VB6, and LabWindows/CVI

LabVIEW Driver

Example TSP Scripts

Test Script Builder

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For additional details and specifications on these cards, refer to their individual data sheets, available on www.keithley.com. A Keithley applications engineer or representative can help you choose the most appropriate card or cards for a specific application.

In addition, the Models 707B and 708B offer a number of features to ensure their compatibility with Keithley instrumentation already at work in labs and on test floors around the world. For example, these semiconductor switch matrix mainframes are compatible with the Model 4200-SCS semiconductor parametric analyzer's existing matrix driver and GPIB interface, so they can become drop-in switch matrix replacements for many applications. The new mainframes also provide electrical performance that correlates closely with that of the Model 707A and Model 7174A switch card, the previous industry-standard switching solution.

Suited for Both Lab and Fab

Like their predecessors, the Models 707B/708B are specifically designed for the requirements of both semiconductor lab and production test environments, delivering ultra low current switching performance using standard triax connectors and cables. For automating smaller test systems with a limited number of pins and instruments, the Model 708B supports a single switch card with up to 8 rows and 12 columns (8×12). For applications requiring higher switch counts, the Model 707B can accommodate up to six 8×12 cards, which can be connected via an internal backplane or jumpers to form larger matrices. Both mainframes also support mixed signal switching for both DC and RF (up to 200MHz) signals.

APPLICATIONS

- **Support for semiconductor device characterization and process control monitoring**
- **Fully automated testing of a wide range of electronic components in both lab and production environments**



The 707B or 708B can be easily used as a drop-in replacement for the 707A or 708A in a test system based on the Model 4200-SCS semiconductor parameter analyzer.

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Choice of Manual Operation or Remote Programming

Both mainframes offer a variety of manual operation and remote programming functions via either the front panel controls or a choice of interfaces. For example, for manual operation, such as when experimenting with a new switching configuration, the updated front panel interface allows labeling switch card rows (instruments) and columns (pins) alphabetically, which simplifies keeping track of what's connected to each crosspoint. An LED crosspoint display makes it easy to identify whether a specific channel is open or closed, as well as determine which slots are occupied and which cards are currently in use. A two-line display shows both error messages and user-defined messages, and displays control menus and open/closed channel messages.

An intuitive navigation/control knob allows scrolling through and opening/closing channels. Key pad controls support scrolling through menus, changing host interface settings, saving and restoring instrument setups, and loading and running factory and user-defined test scripts, etc.

Test system integrators can choose from several instrument communication interfaces and tools for remote programming and control of the Model 707B or 708B:

- TSP-Link® is a high speed system expansion and coordination interface that simplifies linking instruments and switches for faster inter-unit communication and control. It provides a high speed, low latency interface to other Test Script Processor-based hardware, enabling simple multi-box and multi-instrument software control, as well as simplified test system scaling as new requirements evolve.

With TSP-Link, there's no need to add external triggers and remote communication cables to individual units because all TSP-Link connected devices can be controlled from a single master unit. Up to 16 Model 707B/708B chassis can be linked together to form a larger switching matrix using TSP-Link. Each mainframe has two TSP-Link connectors to facilitate chaining instruments together. They can also be used to connect Model 707B/708B semiconductor switch matrix mainframes to other TSP-Link enabled instruments, such as Keithley's Series 2600A System SourceMeter instruments. Every piece of instrumentation connected via TSP-Link can be controlled by a single master unit, just as though they were all housed in the same chassis.
- Like all instruments compliant with the LXI (LAN eXtensions for Instrumentation) standard, the Models 707B and 708B have a built-in switch control Web page that is accessible via any standard Web browser. In conjunction with a 10/100M Base-T Ethernet connection and LAN-based triggering, this Web interface offers a quick and easy method to program switching patterns. Interactive schematics of each card in the mainframe support point-and-click control for opening and closing switches. A scan list builder is provided to guide users through the requirements of a scan list (such as trigger and looping definitions) for more advanced applications. The Web page's point-and-click design provides easy switch system control, as well as basic switch system troubleshooting and diagnostics capabilities.

TSB (Test Script Builder) Embedded is an application with a reduced feature set that resides in the mainframe and can be accessed through its web page. Like the full Test Script Builder programming tool, it offers script-building functions and can be used to run example scripts

Advantages of TSP® Technology for Switch Throughput

The test script processor (TSP) technology embedded in these upgraded mainframes allows for distributed processing and control rather than relying exclusively on a central PC to direct their operation, increasing test speed and lowering overall test cost. The TSP is a full-featured test sequence engine that allows unprecedented control of the test sequence. In addition to responding to individual ICL commands, it can store a user-defined test script or sequence in memory and execute it on command, which limits the set-up and configuration time for each step in the test sequence and increases throughput by decreasing communication time.

Test scripts are complete test programs based on Lua, an easy-to-use but highly efficient and compact scripting language. Because test scripts can contain any sequence of routines that are executable by conventional programming languages (including decision-making algorithms and control of the digital I/O), the mainframe can manage the operation of entire tests without sending readings back to a PC for use in decision making. The TSP can even access the mainframe's 14-bit digital I/O on the fly, increasing throughput by allowing instrument and binning equipment such as handlers to run without PC interference. This eliminates delays due to GPIB traffic congestion and greatly improves overall test times.

TSP control allows individual switches and instruments or groups of them to operate autonomously, often eliminating the need for a high-level PC system controller altogether. This same proven TSP technology has already been successfully incorporated into Keithley's innovative Series 2600A System SourceMeter® instruments and Series 3700 Multimeter/Switch System.

provided with the mainframe. It also includes a command line interface that can be used to issue single-line ICL commands.

- For those replacing Keithley's earlier 707A/708A mainframes and who prefer to minimize the levels of changes to their test systems, the Models 707B and 708B offer a GPIB interface and 707A/708A DDC command emulation capabilities to simplify the migration process. These users can incorporate the "B" models into their test systems without making any changes to their legacy code or hardware interface. However, these users will not be able to take full advantage of many of the throughput gains that TSP control provides. The GPIB interface also allows controlling additional GPIB-compatible instruments and systems through a Model 707B/708B mainframe.
- A rear panel Universal Serial Bus (USB) port allows a host computer to communicate with and control the 707B/708B over a USB interface.

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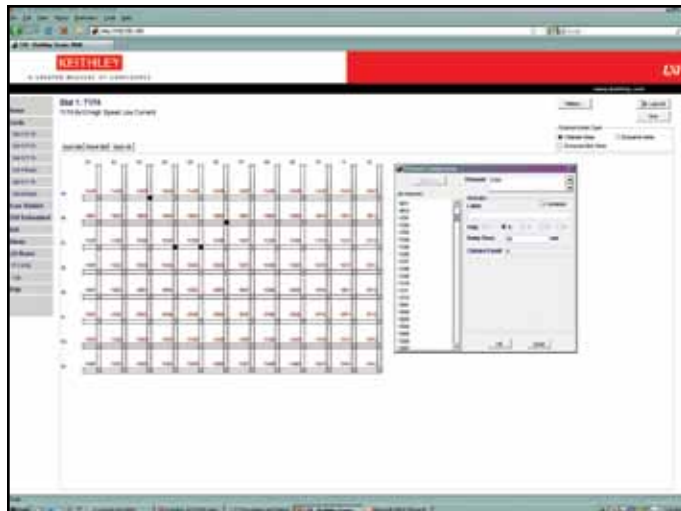
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The Models 707B and 708B include a built-in Web interface that offers a quick and easy method to control the instrument remotely. Interactive schematics of each card in the mainframe support point-and-click control for opening and closing switches.

Optimized for Easy Integration with Series 2600A-Based Systems

The Models 707B and 708B are ideal companion products for systems that incorporate Series 2600A instrumentation, such as Keithley's ACS and S530 integrated test systems. These mainframes share the same TSP, Lua scripting language, and TSP-Link interface as the Series 2600A and support an ultra low current switch matrix (the Model 7174A) that complements the Model 2636A's low current sensitivity. The Models 707B/708B offer test system builders a switch matrix that is fast, scriptable, and works seamlessly with all Series 2600A models.

In common with Series 2600A instruments, the Models 707B/708B provide system builders with the advantages of the Keithley Test Script Builder (TSB) Integrated Development Environment (IDE). TSB IDE is a programming tool provided on the CD that accompanies each mainframe. It can be used to create, modify, debug, and store TSP scripts. It provides a project/file manager window to store and organize test scripts, a text-sensitive program editor (like Visual Basic) to create and modify test TSP code, and an immediate instrument control window to send GPIB commands and receive data from the instrument. The immediate window allows viewing the output of a given test script and simplifies debugging.



Model 707B rear panel



Model 708B rear panel

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Supported Cards

7072	8×12 Semiconductor Matrix 200V, 1A
7072-HV	8×12 HV Semiconductor Matrix 1300V, 0.1A
7173-50	4×12, 2-pole, High-Frequency Matrix Card
7174A	8×12 Low-Current, High-Speed Matrix Card, with 3-lug Triax Row and Column connects

Execution Speed

SYSTEM PERFORMANCE¹

COMMAND: channel.close ('ch_list') or channel.open ('ch_list')

Card	Single Command Execution Time (ms)			
	Ethernet	GPIO	TSP-Link	USB
7072	15.9	15.9	20.5	15.9
7072-HV	15.9	15.9	20.5	15.9
7173-50	7.9	7.9	11.5	7.9
7174A	1.9	1.9	5.5	1.9

1. Time between the start of a single digio.writebit (1, 1), channel.close ('ch_list') or channel.open ('ch_list') (which includes relay settle time), and digio.writebit (1, 0) command.

TRIGGER RESPONSE TIME

MAXIMUM TRIGGER RATE (setups per second):

7072:	≥65.
7072-HV:	≥65.
7173-50:	≥160.
7174A:	≥815.

TRIGGER IN TO START OF MATRIX READY PULSE (DDC Mode): ≤85μs.

TRIGGER IN TO TRIGGER OUT: ≤0.5μs.

TRIGGER TIMER ACCURACY: ≤0.5μs.

1. Includes scan.scancount = 100, scan.stepcount ≥3, channel.connectrule = channel.OFF or 0, and relay settle time.

GENERAL

EMULATION: 707A/708A Device Dependent Commands (DDC). Since the architecture of the Model 707B/708B differs from the Model 707A/708A, some commands are different. Refer to notes in the 707B-901 Reference manual for additional details.

BREAK BEFORE MAKE: channel.connectrule= channel.BREAK_BEFORE_MAKE or 1.

MAKE BEFORE BREAK: channel.connectrule= channel.MAKE_BEFORE_BREAK or 2.

NONE: channel.connectrule= channel.OFF or 0, the system will close relays as it is able to without adhering to a rule.

IEEE-488: IEEE-488.1 compliant. Supports IEEE-488.2 common commands and status model topology.

USB 2.0 DEVICE (rear panel type B): Full and high speed, USBTMC compliant.

DIGITAL I/O INTERFACE

Connector: 25-pin female D.

Input/Output Pins: 14 open drain I/O bits.

Absolute Maximum Input Voltage: 5.25V.

Absolute Minimum Input Voltage: -0.25V.

Maximum Logic Low Input Voltage: 0.7V, +850μA max.

Maximum Logic High Input Voltage: 2.1V, +570μA.

Maximum Source Current (flowing out of Digital I/O bit): 960μA.

Maximum Sink Current @ Maximum Logic Low Voltage (0.7V): -5.0mA.

Absolute Maximum Sink Current (flowing into Digital I/O pin): -11mA.

5V Power Supply Pin: Limited to 600mA, solid state fuse protected.

ETHERNET: RJ-45 connector, 10/100BaseT, Auto-MDIX.

LXI COMPLIANCE: LXI Class C, Version 1.2.

POWER SUPPLY:

707B: 100V to 240VAC, 50Hz-60Hz, 210VA max.

708B: 100V to 240VAC, 50Hz-60Hz, 110VA max.

RELAY DRIVE:

707B: 30W (6V at 5.0A) max. per slot, 162W (6V at 27A) max. for all slots.

708B: 30W (6V at 5.0A) max.

SAFETY: Conforms to European Union Low Voltage Directive.

DIMENSIONS:

707B: 356mm high × 432mm wide × 574mm deep (14.0 in × 17.0 in × 22.6 in).

708B: 90mm high × 432mm wide × 574mm deep (3.5 in × 17.0 in × 22.6 in).

DIMENSIONS WITH CARD INSTALLED:

707B: 356mm high × 432mm wide × 612mm deep (14.0 in × 17.0 in × 24.1 in).

708B: 356mm high × 432mm wide × 612mm deep (14.0 in × 17.0 in × 24.1 in).

WEIGHT: 707B: 14.5kg (32 lbs). 708B: 7.3kg (16 lbs).

SHIPPING WEIGHT: 707B: 27.2kg (60 lbs). 708B: 16.4 kg (36 lbs).

ENVIRONMENT: For indoor use only.

Altitude: Maximum 2000 meters above sea level.

Operating: 0°- 50°C, 80% R.H. up to 35°C. Derate to 3% R.H./°C, 35°- 50°C.

Storage: - 25°C to 65°C.

Specifications are subject to change without notice.

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