Switches

HP 8761A

HP 8762/63/64 Family

HP 8765 Family

HP offers a broad line of coaxial switches, covering up to 40 GHz, for use in test and measurement applications. All switches use magnetically-latched solenoids and are primarily designed with break-before-make RF contacts for test simplicity. The Selection Guide on page 89 describes the product families and their features.

SPDT - Configurable Connectors

HP 8761A,B SPDT switches operate up to 18 GHz. Each port features six connector options plus 50-ohm termination for design flexibility.

SPDT - High Performance

HP 8762A,B,C switches operate up to 26.5 GHz. They provide exceptional isolation of 90 dB to 18 GHz and switched terminations, so that all ports maintain a 50-ohm match. Internal loads are rated at 1 watt average (100 W peak, 10 µsec pulse width). Control voltage Options T15 and T24 are compatible with TTL/5V CMOS drive circuitry. Another model, HP 8762F, is designed for 75-ohm transmission lines, making it valuable for communication applications up to 4 GHz.

SPDT - High Reliability

HP 8765A,B,C,D,F are SPDT switches that offer outstanding performance and a life of 5 million cycles. This switch family is available in four models up to 40 GHz, as well as a 75-ohm model to 4 GHz. Unlike the HP 8762 switches, they do not have internal, switched RF loads or dc current interrupts. Coil voltage options cover the complete range from 5 Vdc to 24 Vdc. Since the switches are magnetically latched, the coil voltage may be switched off after 15 ms.

The standard HP 8765 switch comes with ribbon cables and standard printed circuit board with a 0.025-inch connector for convenient assembly. Optional solder terminals are available.

Transfer - High Performance

HP 8763A,B,C switches operate up to 26.5 GHz. They are preferred for transfer applications because of their compact design. Transfer switches are used to automatically insert or remove a test component from a signal path. Because of their excellent isolation, they can also be used as the intersection (crosspoint) switch in full-access matrix switching applications. One port is internally terminated. Options T15 and T24 are available for TTL/5V CMOS compatibility.

HP 8764A,B,C switches operate up to 26.5 GHz, similar to the HP 8763, but with the internal termination replaced by a fifth port. The fifth port can be utilized for signal path reversal or as a calibration port. Options T15 and T24 offer TTL/5V CMOS compatibility.

Multiport - Low Profile

HP 8766/67/68/69K series switches are modified versions of the HP 8494/95/96/97 series step attenuators (dc to 26.5 GHz) for applications requiring a single-pole, 3-throw, 4-throw, 5-throw or 6-throw coaxial switch. The switch ports are unterminated. These switches offer warranted repeatability of 0.03 dB maximum over 5 million switching cycles.

The switches are available with several optional cables and connectors to make them compatible with standard 14-pin DIP sockets. Isolation and insertion loss vary with frequency, and depend upon the port selected.

Switches

Selection Guide

HP Model	Frequency Range	Features	Product Category: SPDT Configurable Connectors	SPDT High Performance	SPDT High Reliability	Transfer High Performance 4-port	Transfer High Performance 5-port	Multiport Low-profile SP3T	Multiport Low-profile SP4T	Multiport Low-profile SP5T	Multiport Low-profile SP6T	Multiport High Performance SP4T	Multiport High Performance SP6T
8761A	dc to 18 GHz	• 1 million cycles	X										
8761B	dc to 18 GHz	• Selectable connector configuration	X										
8762A	dc to 4 GHz	• 1 million cycles		X									
8762B	dc to 18 GHz	• High repeatability		X									
8762C	dc to 26.5 GHz	• All-ports terminated		X									
8762F (75 Ω)	dc to 4 GHz	• Current interrupts and position indication capability • TTL/5V CMOS option		X									
8763A	dc to 4 GHz	• 1 million cycles				X							
8763B	dc to 18 GHz	• High repeatability				X							
8763C	dc to 26.5 GHz	• 1-port terminated • Current interrupts and position indication capability • TTL/5V CMOS option				X							
8764A	dc to 4 GHz	• 1 million cycles					X						
8764B	dc to 18 GHz	• High repeatability					X						
8764C	dc to 26.5 Ghz	• Unterminated • Current interrupts and position indication capability • TTL/5V CMOS option					X						
8765A	dc to 4 GHz	• Highest frequency range			X								
8765B	dc to 20 GHz	• 5 million cycles			X								
8765C	dc to 26.5 GHz	• High repeatability			X								
8765D	dc to 40 GHz	• Unterminated			X								
8765F (75 Ω)	dc to 4 GHz				X								
8766K	dc to 26.5 GHz	• 5 million cycles						X					
8767K	dc to 26.5 GHz	• High repeatability							X				
8768K	dc to 26.5 GHz	• Unterminated								X			
8769K	dc to 26.5 GHz	• Current interrupts and position indication capability									X		
87104A	dc to 4 GHz	• 5 million cycles										X	
87104B	dc to 20 GHz	• High repeatability										X	
87104C	dc to 26.5 GHz	• All-ports terminated										X	
87106A	dc to 4 GHz	• Optoelectronic interrupts and position indicators • TTL/5V CMOS option											X
87106B	dc to 20 GHz												X
87106C	dc to 26.5 GHz												X
87204A	dc to 4 GHz	• 5 million cycles										X	
87204B	dc to 20 GHz	• High repeatability										X	
87204C	dc to 26.5 GHz	• All-ports terminated										X	
87206A	dc to 4 GHz	• Optoelectronic interrupts and position indication capability											X
87206B	dc to 20 GHz												X
87206C	dc to 26.5 GHz												X

Switches

Low Profile Multiport

Specifications

HP Model	8766K	8767K	8768K	8769K
Configuration	SP3T	SP4T	SP5T	SP6T
Features	Unterminated Break-before-make Current interrupts Position indication capability [1]			
Impedance	50 Ω			
Frequency Range	dc to 26.5 GHz			
Insertion Loss (dB)	**Signal Path** Common to Port 1: 0.2 dB + 0.05 dB x f (GHz) Common to Port 2: 0.2 dB + 0.06 dB x f (GHz) Common to Port 3: 0.2 dB + 0.08 dB x f (GHz) Common to Port 4: 0.25 dB + 0.095 dB x f (GHz) Common to Port 5: 0.25 dB + 0.108 dB x f (GHz) Common to Port 6: 0.25 dB + 0.12 dB x f (GHz)			
SWR (Through Line)	<1.3 to 8 GHz <1.5 to 12.4 GHz <1.6 to 18 GHz <1.8 to 26.5 GHz			<1.3 to 8 GHz <1.55 to 12.4 GHz <1.8 to 18 GHz <2.05 to 26.5 GHz
Isolation (dB)	See chart on page 102			
Input Power Average Peak [2]	1 W 100 W (10 µs max)			
Switching Time (max)	30 ms			
Repeatability (max)[3]	0.01 dB to 18 GHz 0.05 dB to 26.5 GHz			
Life (min)	5,000,000 cycles			
RF Connectors	3.5 mm (f)			
DC Connectors	Viking cable connector			

Options

Supply Voltage, Current, and Impedance	Std.	Opt. 011	Opt. 015
Supply Voltage Range	20 to 30 Vdc	4.5 to 7 Vdc	13 to 22 Vdc
Supply Voltage (nom)	24 Vdc	5 Vdc	15 Vdc
Current (nom)	130 mA	332 mA	187 mA
Impedance (nom)	185 Ω, 65 mH	17 Ω, 5.5 mH	80 Ω, 30 mH
RF Connectors	**Opt. 002:** SMA (f) [4]		
DC Connectors	**Opt. 008:** 8-inch ribbon cable		
	Opt. 016: 16-inch ribbon cable		
Calibration Documentation	See ordering information		

Indicates QuickShip availability. Standard models only.
Contact HP Direct or your local HP sales representative to confirm QuickShip.

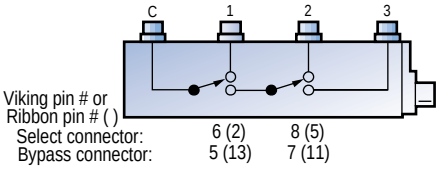
[1] Provides position sensing when used with HP 87130A/70611A switch driver or customer supplied external circuitry.
[2] Not to exceed 1 W average (non-switching).
[3] Measured at 25 °C.
[4] Use to 18 GHz only.

Switches

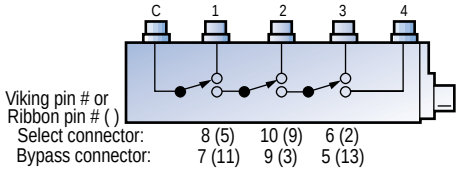
Low Profile Multiport

Simplified Schematics

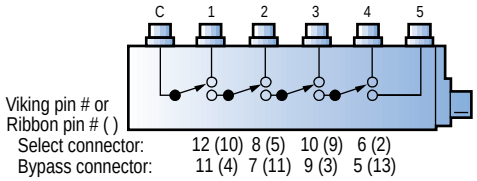
HP 8766K



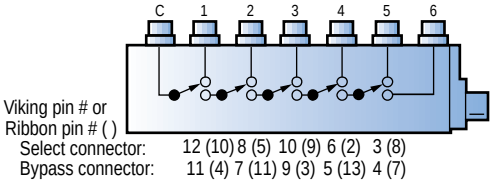
HP 8767K



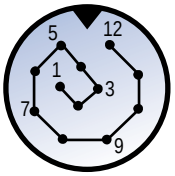
HP 8768K



HP 8769K

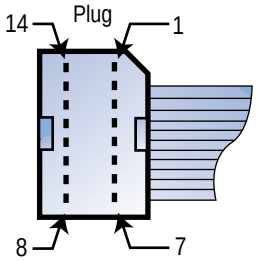


Viking Plug Detail [1, 2]



STD

DIP Plug [3]



Option 008, 016

[1] DC drive interface cable has color coded tinned leads at opposite end.

[2] Supply voltage is Pin 1 (red wire).

[3] Supply voltage is Pin 6.

Dimensions are in millimeters (inches) nominal, unless otherwise specified.

Switches

Low Profile Multiport

Signal Path Control Data

The tables below can be used to better understand how to select a signal path for each switch. The standard drive connector for each switch is a Viking connector with a 5 ft. cable. Alternately, a flat ribbon cable with a 14-pin DIP plug is available as an option. As an example, to connect the path from port C to port 2 of the standard HP 8767K, it is required that the supply voltage be applied to pin 1 (red lead) and that pin 10 (blue lead) and pin 7 (black lead) are grounded. This will "bypass" port 1 and "select" port 2. Note that section 3 can be selected or bypassed; however, isolation performance will be affected (see next page for further information). Additional information related to signal path control can be found in the product data

HP 8766K SP3T Switch

Switching Section	1		2	
Section State	Select	Bypass	Select	Bypass
Std. Viking Pin	6	5	8	7
Std. Viking Wire Color	Yellow	Violet	Green	Black
Opt. 008/016 Dual Inline Pin Connector	2	13	5	11
Common to Port 1	X			
Common to Port 2		X	X	
Common to Port 3		X		X

HP 8767K SP4T Switch

Switching Section	1		2		3	
Section State	Select	Bypass	Select	Bypass	Select	Bypass
Std. Viking Pin	8	7	10	9	6	5
Std. Viking Wire Color	Green	Black	Blue	Orange	Yellow	Violet
Opt. 008/016 Dual Inline Pin Connector	5	11	9	3	2	13
Common to Port 1	X					
Common to Port 2		X	X			
Common to Port 3		X		X	X	
Common to Port 4		X		X		X

HP 8768K SP5T Switch

Switching Section	1		2		3		4	
Section State	Select	Bypass	Select	Bypass	Select	Bypass	Select	Bypass
Std. Viking Pin	12	11	8	7	10	9	6	5
Std. Viking Wire Color	White	Brown	Green	Black	Blue	Orange	Yellow	Violet
Opt. 008/016 Dual Inline Pin Connector	10	4	5	11	9	3	2	13
Common to Port 1	X							
Common to Port 2		X	X					
Common to Port 3		X		X	X			
Common to Port 4		X		X		X	X	
Common to Port 5		X		X		X		X

HP 8769K SP6T Switch

Switching Section	1		2		3		4		5	
Section State	Select	Bypass	Select	Bypass	Select	Bypass	Select	Bypass	Select	Bypass
Std. Viking Pin	12	11	8	7	10	9	6	5	3	4
Std. Viking Wire Color	White	Brown	Green	Black	Blue	Orange	Yellow	Violet	Gray	White/Red
Opt. 008/016 Dual Inline Pin Connector	10	4	5	11	9	3	2	13	8	7
Common to Port 1	X									
Common to Port 2		X	X							
Common to Port 3		X		X	X					
Common to Port 4		X		X		X	X			
Common to Port 5		X		X		X		X	X	
Common to Port 6		X		X		X		X		X

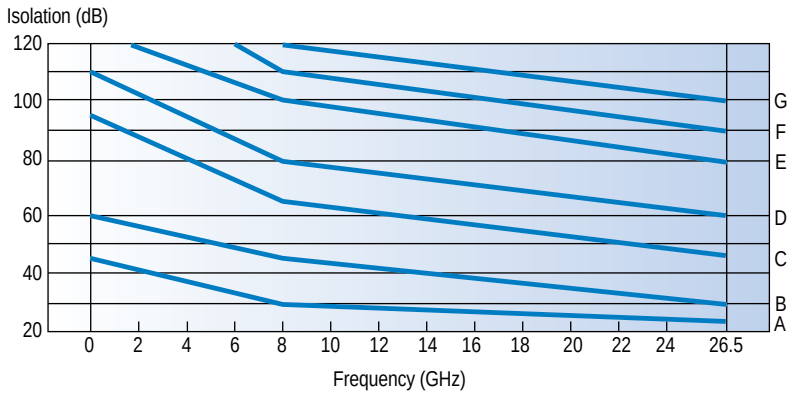
Sections identified by this cross-hatch symbol can be selected or bypassed; however, isolation performance will be affected (see next page for further information).

Switches

Low Profile Multiport

Isolation Calculation Characteristics

Isolation and insertion loss vary with frequency and depend on the port selected as shown in the chart and tables below. The input connector "C" is always defined as the connector at the end of the switch opposite the dc drive cable. The output ports are numbered sequentially from the input connector. For example, if an HP 8768K is being used, use the HP 8768K table to determine the isolation to each port. If port three (the third connector from the input) is selected, the isolation to ports 1 and 2 will follow curve A. Isolation to port 4 will follow curve B and isolation to port 5 will follow curve C. At 8 GHz, the worst case isolation to ports 1 and 2 will be 30 dB; to port 4, 45 dB, and to port 5, 65 dB. Note: in selecting ports 1 or 2, isolation to disconnected ports can be varied by choosing the position of each section to "bypass" or "select". Depending on the user's application, port assignments can be critical for optimizing performance at higher frequencies.



HP 8766K SP3T Switch

Section	Section Status 1	Section Status 2	Isolation Curve for Port ( ) 1	Isolation Curve for Port ( ) 2	Isolation Curve for Port ( ) 3
Common to Port 1	Select	Select	-	B	D
Common to Port 1	Select	Bypass	-	C	B
Common to Port 2	Bypass	Select	A	-	B
Common to Port 3	Bypass	Bypass	A	A	-

HP 8767K SP4T Switch

Section	Section Status 1	Section Status 2	Section Status 3	Isolation Curve for Port ( ) 1	Isolation Curve for Port ( ) 2	Isolation Curve for Port ( ) 3	Isolation Curve for Port ( ) 4
Common to Port 1	Select	Select	Select	-	B	D	E
Common to Port 1	Select	Select	Bypass	-	B	E	D
Common to Port 1	Select	Bypass	Select	-	C	B	D
Common to Port 1	Select	Bypass	Bypass	-	C	C	B
Common to Port 2	Bypass	Select	Select	A	-	B	C
Common to Port 2	Bypass	Select	Bypass	A	-	C	B
Common to Port 3	Bypass	Bypass	Select	A	A	-	A
Common to Port 4	Bypass	Bypass	Bypass	A	A	A	-

Isolation Calculation Characteristics

HP 8768K SP5T Switch

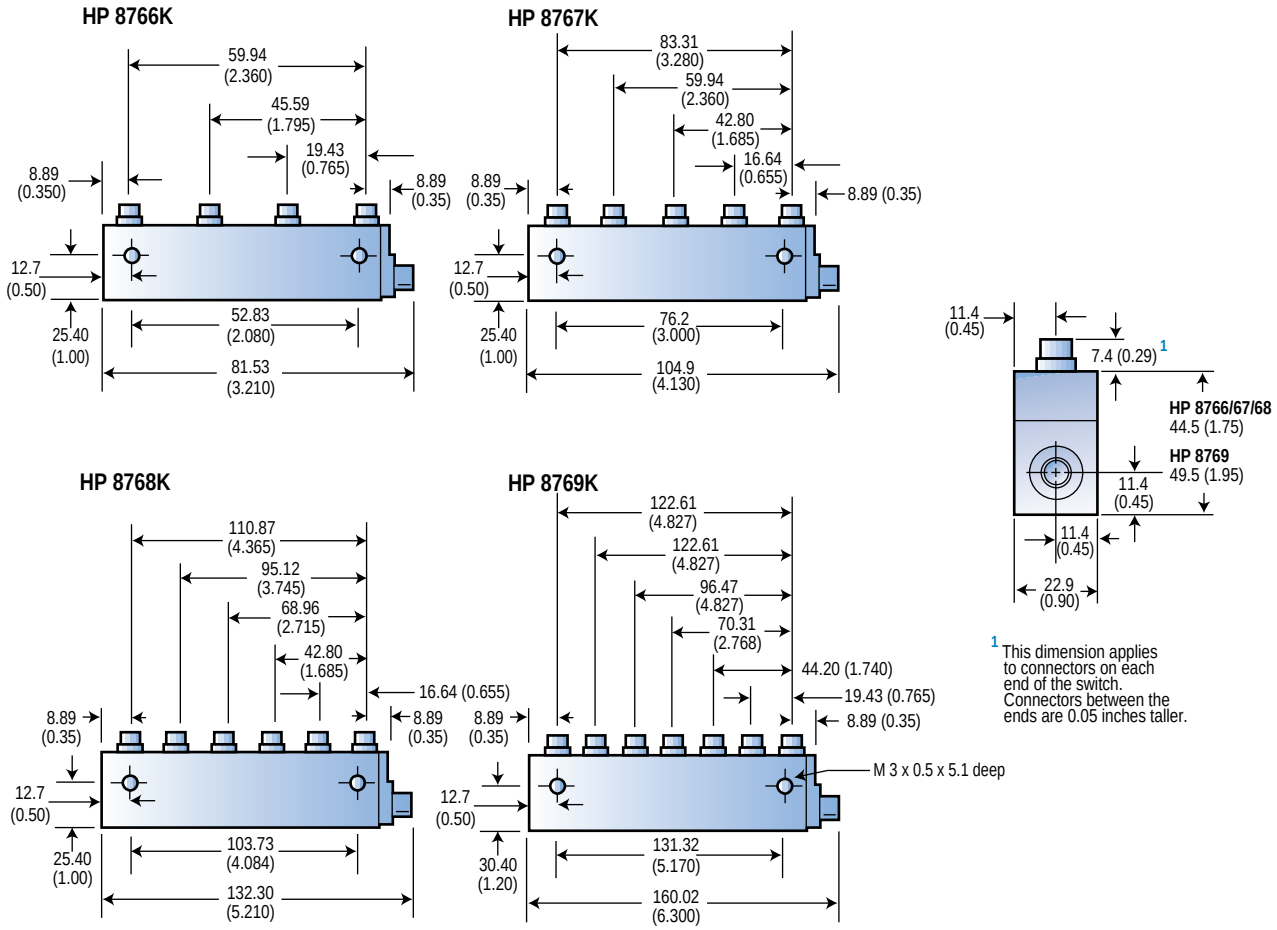
	Section Status				Isolation Curve for Port ( )				
Section	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Common to Port 1	Select	Select	Select	Select	–	B	D	E	F
Common to Port 1	Select	Select	Bypass	Select	–	B	E	D	E
Common to Port 1	Select	Bypass	Select	Select	–	C	B	D	E
Common to Port 1	Select	Bypass	Bypass	Select	–	C	C	B	C
Common to Port 2	Bypass	Select	Select	Select	A	–	B	D	E
Common to Port 2	Bypass	Select	Bypass	Select	A	–	C	B	C
Common to Port 3	Bypass	Bypass	Select	Select	A	A	–	B	C
Common to Port 4	Bypass	Bypass	Bypass	Select	A	A	A	–	A
Common to Port 5	Bypass	Bypass	Bypass	Bypass	A	A	A	A	–

HP 8769K SP6T Switch

	Section Status					Isolation Curve for Port ( )					
Section	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**6**
Common to Port 1	Select	Select	Select	Select	Select	–	B	D	E	F	G
Common to Port 1	Select	Select	Select	Bypass	Select	–	B	D	F	E	F
Common to Port 1	Select	Select	Bypass	Select	Select	–	B	E	D	E	F
Common to Port 1	Select	Bypass	Select	Select	Select	–	C	B	D	E	F
Common to Port 1	Select	Bypass	Bypass	Select	Select	–	C	C	B	C	F
Common to Port 1	Select	Bypass	Bypass	Bypass	Select	–	C	C	C	B	D
Common to Port 1	Select	Bypass	Bypass	Bypass	Bypass	–	C	C	C	C	B
Common to Port 2	Bypass	Select	Select	Select	Select	A	–	B	D	E	E
Common to Port 2	Bypass	Select	Bypass	Select	Select	A	–	C	B	C	F
Common to Port 2	Bypass	Select	Bypass	Bypass	Bypass	A	–	C	C	C	B
Common to Port 3	Bypass	Bypass	Select	Select	Select	A	A	–	B	C	E
Common to Port 3	Bypass	Bypass	Select	Bypass	Select	A	A	–	A	B	D
Common to Port 3	Bypass	Bypass	Select	Bypass	Bypass	A	A	–	C	C	A
Common to Port 4	Bypass	Bypass	Bypass	Select	Bypass	A	A	A	–	A	C
Common to Port 5	Bypass	Bypass	Bypass	Bypass	Select	A	A	A	A	–	B
Common to Port 6	Bypass	Bypass	Bypass	Bypass	Bypass	A	A	A	A	A	–

Low Profile Multiport

Outline Drawings



1 This dimension applies to connectors on each end of the switch. Connectors between the ends are 0.05 inches taller.

All connectors are 3.5 mm (f). Dimensions are in millimeters (inches) nominal, unless otherwise specified.

Ordering Information

HP 8766/67/68/69 Series Ordering Example

HP 8767K Option 011 Option 002 Option 008 Option UK6

Type	Supply Voltage	RF Connector	DC Connector	Calibration Documentation
6: SP3T	Std: 24 Vdc	Std: 3.5 mm (f)	Std: Viking cable connector	UK6: Commercial calibration test data with certificate
7: SP4T	011: 5 Vdc	002: SMA (f)	008: 8-inch ribbon cable	
8: SP5T	015: 15 Vdc		016: 16-inch ribbon cable	UKS: Commercial calibration certificate
9: SP6T				