Series 91 and 92 Miniature Broadband SP2T Switches

Application Notes for RF Switch

- **Frequency range (Series 91): 1 to 18 GHz**
- **Frequency range (Series 92): 0.2 to 4 GHz**
- **Rise and fall times as fast as 10 nsec**
- **Reflective and Non-reflective models**
- **Low VSWR and insertion loss**
- **Miniature size, light weight**

9120-500
(DRIVERLESS)

F9120
(WITH INTEGRATED DRIVER)

MODELS 9120-500 AND 9220-500

These switches provide high-performance characteristics over a multi-octave frequency range. Model 9120-500 covers the frequency range of 1 to 18 GHz; Model 9220-500 covers the frequency range of 0.2 to 4 GHz. Both models use an integrated circuit assembly of a series-shunt configuration of PIN diodes mounted in a microstrip transmission line as shown below.
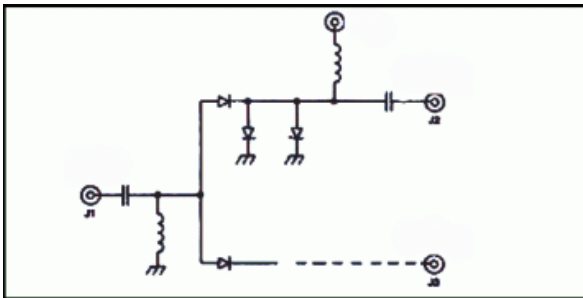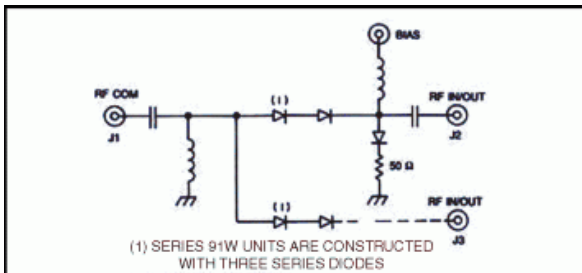

Series 91 and 92 schematic diagram

Port Control

By applying positive current to a bias terminal, the associated port is OFF since the corresponding shunt diodes are biased to a low resistance and the series diode to a high resistance. With negative current at the bias terminal, the converse conditions are established and the port is ON. Since bias terminals are individually available for both ports, the user has the option of any combination of ports ON or OFF.

MODELS 9120T-500, 9120W-500 AND 9220T-500

These switches are non-reflective versions of the switches described to the left. They are constructed in the configuration shown below.

Series 91T, 92T and 91W schematic diagram

When positive current is applied, the port is OFF since the associated series diodes are back-biased to a high resistance. At the same time, the corresponding shunt diode is biased to a low resistance, and the impedance at the port is then effectively that of the 50 ohm resistor in series with the shunt diode. When applying negative current, the converse conditions are established and the port is ON.
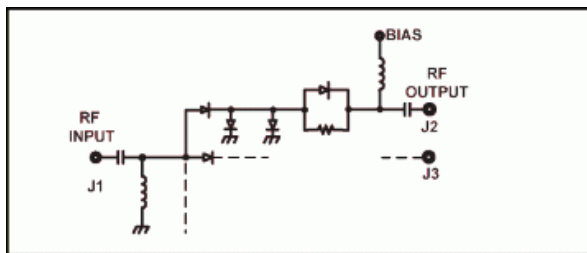
Note that when all output ports are OFF, a high VSWR will be present at the common port.

MODEL 9120AH-500

This switch has the same circuit topology as the 9120-500 except it is equipped with high-speed diodes to achieve rise and fall times of 10 nsec.

MODEL 9120AHT-500
This switch is similar to the 9120AH-500 except it includes a terminating network as shown below.

Model 9120AHT-500 schematic diagram

SERIES F91/F92
The Series F91/F92 units are the same as the Series 91/92 units except they are equipped with integrated drivers that are powered by +5 and -12 to -15V supplies. The proper currents required to switch the ports ON or OFF are provided by the drivers, which are controlled by external control signals. Standard units are wired so that a port is ON with the application of a logic "0" control signal.
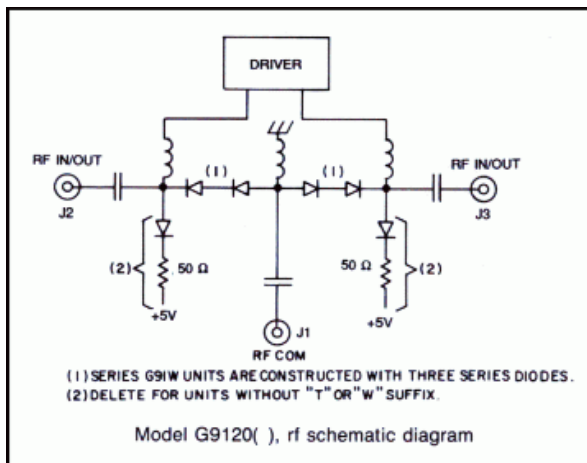
SERIES G91 and G92

- **Frequency range (Series G91): 1 to 18 GHz**
- **Frequency range (Series G92): 0.2 to 4 GHz**
- **Reflective and non-reflective models**
- **Low VSWR and insertion loss**
- **Up to 60 dB isolation**
- **Positive DC supplies only**
- **Miniature size, light weight**

MODEL G9120

SERIES G91 and G92
Operating from +5 and +15V power supplies only, the G-series switches provide high performance characteristics at relatively high speeds over multi-octave frequency ranges. The series includes low insertion loss and high isolation models in both reflective and non-reflective configurations. Series G91 units cover the frequency range of 1 to 18 GHz; Series G92 units cover the frequency range of 0.2 to 4 GHz. The design is based on an integrated circuit assembly of PIN diodes mounted in a microstrip transmission line as shown below. The currents required to switch the ports ON or OFF are provided by the integrated driver, which is controlled by external TTL logic signals.

(1) SERIES G91W UNITS ARE CONSTRUCTED WITH THREE SERIES DIODES.
(2) DELETE FOR UNITS WITHOUT "T" OR "W" SUFFIX.

Model G9120( ), rf schematic diagram

SERIES G91T/G92T and G91W

These switches are non-reflective versions of the switches described above.

MODEL NO.[1]	CHARACTERISTIC	FREQUENCY (GHz)					
		0.2-1	1-2	2-4	4-8	8-12.4	12.4-18
9120-500* F9120	Min. Isolation (dB) Max. Insertion Loss (dB) Max. VSWR (ON)	— — —	60 1.1 1.75	60 1.1 1.75	60 1.4 1.75	60 2.0 1.75	50 2.5 2.0
G9120*	Min. Isolation (dB) Max. Insertion Loss (dB) Max. VSWR (ON)	— — —	60 1.8 1.5	60 1.8 1.5	60 1.8 1.7	60 2.2 1.7	50 2.5 2.0
9220-500* F9220*	Min. Isolation (dB) Max. Insertion Loss (dB) Max. VSWR (ON)	60 1.5 1.5	60 1.5 1.5	60 1.5 1.5	— — —	— — —	— — —
G9220*	Min. Isolation (dB) Max. Insertion Loss (dB) Max. VSWR (ON)	60 1.8 1.5	60 1.8 1.5	60 1.8 1.5	— — —	— — —	— — —
9120T-500* F9120T G9120T*	Min. Isolation (dB) Max. Insertion Loss (dB) Max. VSWR (ON or OFF)	— — —	50 1.2 1.5	50 1.2 1.5	50 1.5 1.7	45 1.5 1.7	40 2.2 2.0
9220T-500* F9220T* G9220T*	Min. Isolation (dB) Max. Insertion Loss (dB) Max. VSWR (ON)	60 1.3 1.5	60 1.3 1.5	60 1.3 1.5	— — —	— — —	— — —
9120W-500* F9120W G9120W*	Min. Isolation (dB) Max. Insertion Loss (dB) Max. VSWR (ON or OFF)	— — —	60 1.8 1.5	60 1.8 1.7	60 1.8 1.7	60 2.2 2.0	55 2.5 2.0
9120AH-500* F9120AH	Min. Isolation (dB) Max. Insertion Loss (dB) Max. VSWR (ON)	— — —	60 1.1 1.75	60 1.1 1.75	60 1.4 1.75	60 2.0 1.75	50 2.5 2.0
9120AHT-500* F9120AHT	Min. Isolation (dB) Max. Insertion Loss (dB) Max. VSWR (ON) Max. VSWR (OFF)	— — — —	60 1.3 1.75 1.75	60 1.3 1.75 1.75	60 1.7 1.9 2.0	60 2.5 2.0 2.2	50 3.0 2.0 2.3

*Special-order product. Consult factory before ordering.

PERFORMANCE CHARACTERISTICS

Power Handling Capability
Without Performance Degradation
 Units without "T" or "W" suffix: 1W cw or peak
 Units with "T" or "W" suffix
  Input to any "OFF" port: 100 mW cw or peak
  Input to any "ON" port: 1W cw or peak
  Input to common port: 1W cw or peak

Survival Power
 Units without "T" or "W" suffix: 1W average,
  75W peak (1 µsec max. pulse width)
 Units with "T" or "W" suffix
  Input to any "OFF" port: 1W average
   10W peak (1 µsec max. pulse width)
  Input to any "ON" port: 1W average
   75W peak (1 µsec max. pulse width)
  Input to common port: 1W average
   75W peak (1 µsec max. pulse width)

(1) Models prefixed with "F" or "G" are equipped with integrated TTL-compatible drivers; models without the "F" or "G" prefix are current-controlled units and are furnished without drivers; models suffixed with "T" or "W" are non-reflective except a high VSWR will be present at the common port if all other ports are OFF; models suffixed with "H" are high-speed units.

Switching Characteristics[1]
SERIES 91/F91/G91
 Units without "H" suffix
  ON time .... 250 nsec max.
  OFF time .... 250 nsec max.
 Units with "H" suffix
  Rise time .... 10 nsec max.
  Fall time .... 10 nsec max.
  ON time .... 25 nsec max.
  OFF
  time .... 20 nsec max.
  Repetition rate .... 20 MHz max.
SERIES 92/F92/G92
  ON   500 nsec max.

time ....
 OFF
time ....   500 nsec max.

Power Supply Requirements
SERIES 91/92/F91/F92
Driverless Units
Bias current required at each port for rated isolation and insertion loss.

   PORT OFF
   Units without "H" suffix .... +50 mA
   Units with "H"
   suffix ....   +30 mA

   PORT ON
   Units without "H" suffix .... -50 mA
   Units with "H"
   suffix ....   -35 mA

Units With Integrated Drivers

(For one port ON)	+5V ±5%	-12 to -15V
Units Without "H" Suffix	65 mA	65 mA
Units With "H" Suffix	60 mA	50 mA
Units With "HT" Suffix	80 mA	50 mA

SERIES G91/G92
(For one Port ON)
 +5V ±5%, 100 mA
 +15V ±5%, 30 mA

Control Characteristics
SERIES 91/92/F91/F92
Units With Integrated Drivers
Control Input Impedance
 Units without
 "H"
 suffix...................... TTL, low power Schottky, one unit load. (A unit load is 0.8 mA sink current and 40 µA source current.)

 Units with
 "H"
 suffix...................... TTL, advanced Schottky, one unit load. (A unit load is 0.6 mA sink current and 20 µA source current.)

**Control
Logic** .... Logic "0" (-0.3 to +0.8V) for port ON and logic "1" (+2.0 to +5.0V) for port OFF.

SERIES G91/G92
Control Input

Impedance .... Schottky TTL, one unit load. (A unit load is 2.0 mA sink current and 50 µA source current.)

**Control
Logic** .... Logic "0" (-0.3 to +0.8V) for port ON and logic "1" (+2.0 to +5.0V) for port OFF.

 (1) For driverless units, shaped current pulses must be provided by user.

ENVIRONMENTAL RATINGS

Temperature Range
 Units With Integrated Drivers
   Operating ....   -54°C to +110°C
   Non-Operating ....   -65°C to +125°C
 Driverless Units
   Operating and Non-Operating ....   -65°C to +125°C
Humidity ....   MIL-STD-202F, Method 103B, Cond. B (96 hrs. at 95%)
Shock ....   MIL-STD-202F, Method 213B, Cond. B (75G, 6 msec)
Vibration ....   MIL-STD-202F, Method 204D, Cond. B (.06" double amplitude or 15G, whichever

is less)

Altitude	....	MIL-STD-202F, Method 105C, Cond. B (50,000 ft.)
Temp. Cycling	....	MIL-STD-202F, Method 107D, Cond. A, 5 cycles

AVAILABLE OPTIONS

Option No.	Description
3	SMA female bias/control connectors
7	J1, J2 and J3 SMA male
7A	J1 SMA male; J2 and J3 SMA female
7B	J1 SMA female; J2 and J3 SMA male
9	Inverse control logic; logic "0" for port OFF and logic "1" for port ON (Not applicable to Series 91/92)
27	Single-port toggle control; logic "0" connects J1 to J2 (Not applicable to the Driverless Units, Series 91/92)
33	EMI filter solder-type bias/control terminals
41[1]	Internal video filter, common port only
42[1]	Internal video filter, output ports only
43[1]	Internal video filter, all ports
55[2]	Frequency range 0.5 to 18 GHz.
64A	SMB male bias/control connectors
Z02	70 dB min. Isolation (2 to 18 GHz)

[1] Not applicable to Series 92/F92/G92.*See Video Filter Options at Switches Applications Notes

[2] Applicable only to 1 to 18 GHz switches. See impact of Option 55 on specifications

DIMENSIONS AND WEIGHT

(1) USED ONLY ON UNITS WITH INTEGRATED DRIVERS
(2) +15V FOR G91/G92 SERIES
(3) NOT USED ON DRIVERLESS UNITS EXCEPT WITH OPTION 33
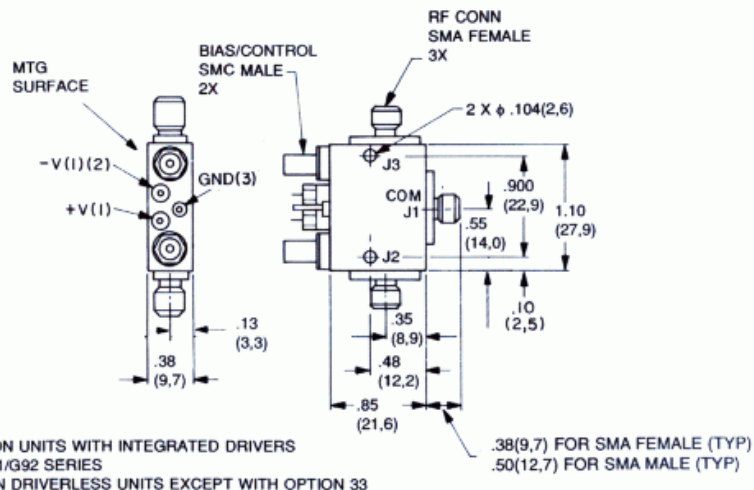
SERIES 91/92/F91/F92/G91/G92
Wt: .75 oz. (21 gm) approx.

Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.005

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