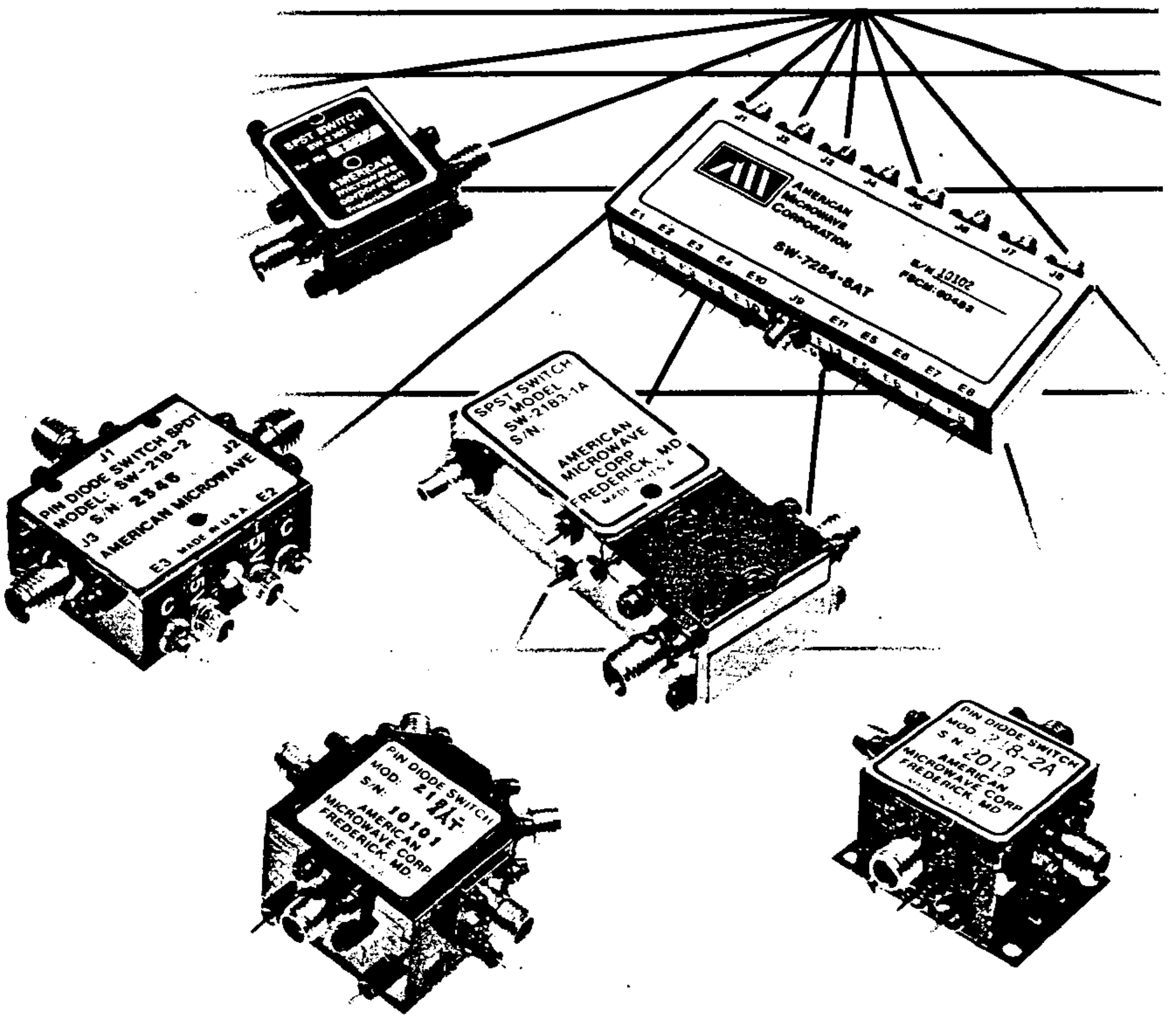
AMERICAN MICROWAVE CORPORATION

PIN Diode Switches



7311G GROVE ROAD, FREDERICK, MARYLAND 21701 • Tel. (301) 662-4700 • Fax (301) 662-4938

Introduction to American Microwave Corporation

Since its founding in 1978, American Microwave Corporation has become a leader in the design and manufacture of solid state control components. At American Microwave, we are dedicated to providing state-of-the-art technology and uniformly high quality microwave components and subsystems that meet or exceed your specifications and are delivered on schedule at fair prices. AMC's vertically integrated manufacturing plant makes it possible to design, machine and manufacture microwave hardware which means total technology, quality and schedule control on all prototype or production orders.

American Microwave's product line has grown steadily since the company's inception. From the line of ferrite products and SW-2000 switches introduced in 1978, to the introduction of microwave switches in 1981, linearized reflectionless attenuators in 1986 to present day work on microwave integrated circuits, the company has produced hundreds of custom and catalog product types. AMC is dedicated to solving customer problems and meeting promised delivery dates with the lowest return rate in the industry.

This catalog contains a sampling of the most popular products in general use today. If you have a requirement that is not listed in the catalog, call us. We may have already made it or something close to it for someone else.

RAYMOND L. SICOTTE
Chairman

ASH K. GORWARA
President and CEO

AMERICAN
MICROWAVE
CORPORATION

General Information

ORDERING INFORMATION

Please order by model or part number and product name with any options clearly specified. Please specify any modifications or special testing requirements on the order.

Telephone orders are acceptable and processed immediately. Shipments can only be made upon receipt of a confirming written order either by mail or facsimile.

Your order may be placed directly to the factory or through your local representative.

AMERICAN MICROWAVE CORPORATION
7311 G Grove Road
Frederick, Maryland 21701
Phone: 301-662-4700 Fax: 301-662-4938

All prices are FOB factory, Frederick, Maryland 21701.

DOMESTIC TERMS

Net 30 days if credit has been established. Otherwise, unless payment is received before shipment, shipment will be made C.O.D.

INTERNATIONAL TERMS

Add 30% for international pricing. Irrevocable sight letter credit engaged and accepted by Maryland National Bank, payable to the account of American Microwave Corporation, Frederick, Maryland.

SPECIFICATION AND PRICE CHANGES

The right to discontinue any item or change specifications and/or prices on any item without notice is reserved.

WARRANTY/SERVICE

American Microwave Corporation warranties all parts of equipment of its manufacture to be free from defects in material and workmanship for one year after the delivery of the equipment to the original purchaser.

Liability under the warranty is limited to repair or replacement of the equipment or parts at the discretion of American Microwave Corporation without charge for any part found to be defective under normal use and service within the warranty time period.

All equipment returned under warranty must have a Return Material Authorization number obtainable from the factory. Original parts or equipment must be returned to American Microwave Corporation, transportation charges prepaid FOB factory. If warranty repair is applicable, the unit will be returned freight prepaid, FOB destination. If warranty is not applicable, the customer will be advised of the repair charges and his authorization to proceed awaited before any costs are incurred. Non-warranty repairs will be returned FOB factory, Frederick, Maryland 21701.

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SERIES SWN-218 WIDEBAND SPST PIN DIODE SWITCHES WITH INTEGRAL DRIVERS

FEATURES

- 0.5 to 18 GHz Frequency Range
- Low Insertion Loss
- Up to 85 dB Isolation
- High Speed - 10 nsec
- Small Size
- Light Weight
- Rugged Chip and Microstrip Construction

DESCRIPTION

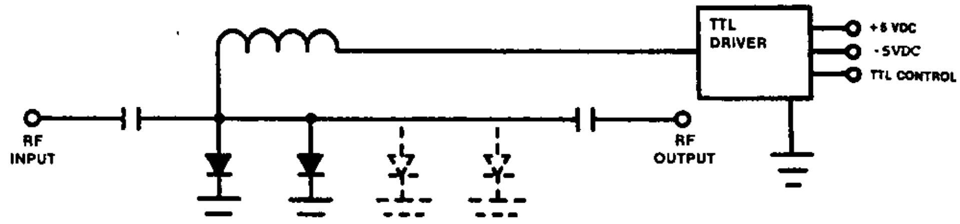
The series SWN-218 switches are broadband, high speed, low loss SPST switches with integral drivers. They are powered by +5 and -5 volt supplies and are available powered by ±15 volts. They are available in three models that operate over the entire 0.5 to 18 GHz band. Each features rugged integrated circuit assemblies of chip PIN on a microstrip transmission line and proprietary wideband bias decoupling circuitry.

Switching is accomplished by a TTL compatible driver which is controlled by the user.

SPECIFICATIONS

- Control Impedance -
  TTL Compatible, Two Load. (A Load is 1.6 mA Sink Current and 40 μA Source Current.)
- Control Logic -
  Logic "0" (−0.3 to +0.7 Volt) for Switch OFF.
  Logic "1" (+2.5 to +5.0 Volts) for Switch ON.
- Temperature -
  Operating: −65°C to +85°C
  Non-operating: −65°C to +125°C
- Humidity, Shock, Etc. -
  Per MIL-STD 202C

FUNCTIONAL SCHEMATIC



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SPECIFICATIONS, Cont'd.

MODEL NO.	CHARACTERISTICS	FREQUENCY (GHz) 0.5 to 1.0	1.0 to 2.0	2.0 to 4.0	4.0 to 8.0	8.0 to 12.4	12.4 to 18.0	RISE/FALL * TIME ON-to-OFF and OFF-to-ON	POWER HANDLING CAPABILITY AVG (WATTS)	Peak 1 μsec, max, pw (WATTS)	POWER SUPPLY	+5 VDC	-5 VDC
SWN-2182-1A	Min Isolation (dB)	30	40	45	45	45	45	10 ns	2	10		100 mA	45 mA
	Max Ins Loss (dB)	1.0	1.0	1.0	1.1	1.6	2.0						
	Max VSWR (ON Pos)	1.3	1.3	1.4	1.6	1.9	1.9						
SWN-2183-1A	Min Isolation (dB)	40	60	70	70	70	70	10	2	10		100 mA	45 mA
	Max Ins Loss (dB)	1.0	1.0	1.1	1.4	1.8	2.3						
	Max VSWR (ON Pos)	1.4	1.4	1.4	1.6	1.9	1.9						
SWN-2184-1A	Min Isolation (dB)	45	70	85	85	85	80	10	2	10		100 mA	45 mA
	Max Ins Loss (dB)	1.0	1.0	1.2	1.5	2.0	2.5						
	Max VSWR (ON Pos)	1.4	1.4	1.4	1.6	1.9	1.9						

*Rise/Fall times are 10% to 90% RF and 90% to 10% RF.

*TTL Delay is 60 nsec, Max from 50% TTL to 90% RF for turn-off or 50% TTL to 10% RF for turn-on.

ENVIRONMENTAL RATINGS

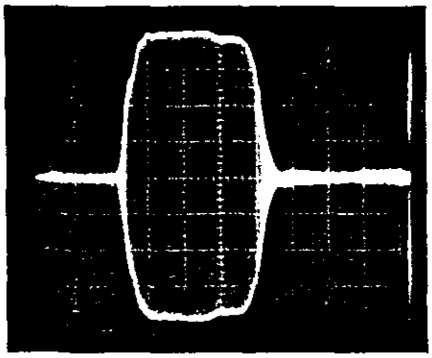
Operating Temperature −65° C to 110° C
Non-Operating Temperature −65° C to 125° C
Humidity MIL-STD-202F, METHOD 103B
Shock MIL-STD-202F, METHOD 213B
Vibration MIL-STD-202F, METHOD 204D
Altitude MIL-STD-202F, METHOD 105C
Temp Cycling MIL-STD-202F, METHOD 107D

AVAILABLE OPTIONS

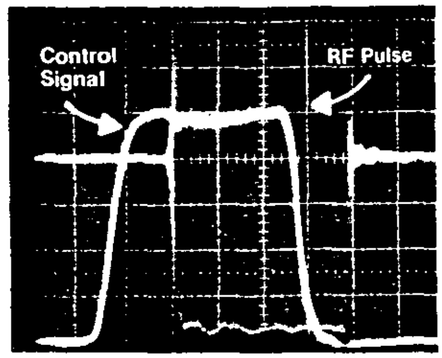
Option No.	Description
001	Two SMA Male RF Connectors
002	One SMA Male and One SMA Female RF Connector
003	SMC Control Connector (Solder Type is Standard)
004	±15 Volt Power Supply Requirement (±5 Volt is Standard)
005	50 Ohm Control Impedance
006	Cannon Multipin MDM9SSP
007	Inverted Logic
008	Extended Frequency to 100 MHz
010	50 ns, Maximum Switching Speed (5 watts cw, maximum)
012	2 ns, Maximum Switching Speed (100 mw, cw maximum)
013	-12 VDC Power Supply Requirement (+5V, -5V is Standard)
103	Integral Video Filters (2-18 GHz Frequency Band) Insertion loss Increase of 0.75 Db maximum
HS	High Speed Version - 20 nsec. Delay
AT	Off Arm Termination

TYPICAL PERFORMANCE (SWN-2184-1A)

PULSE CHARACTERISTICS

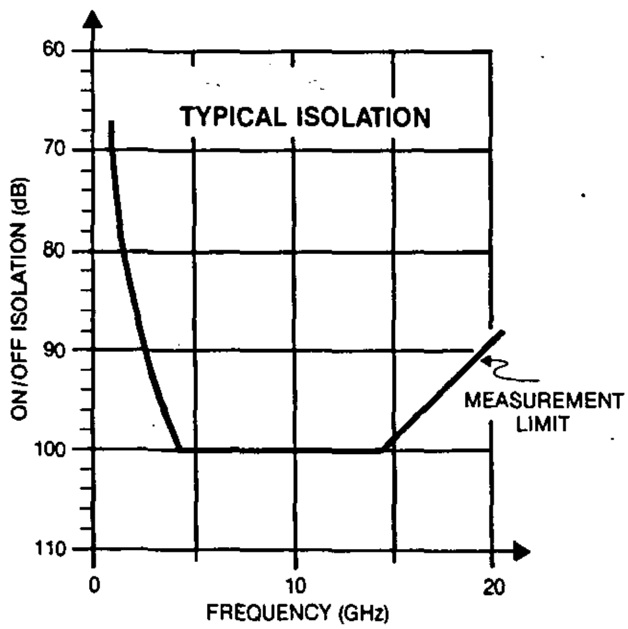


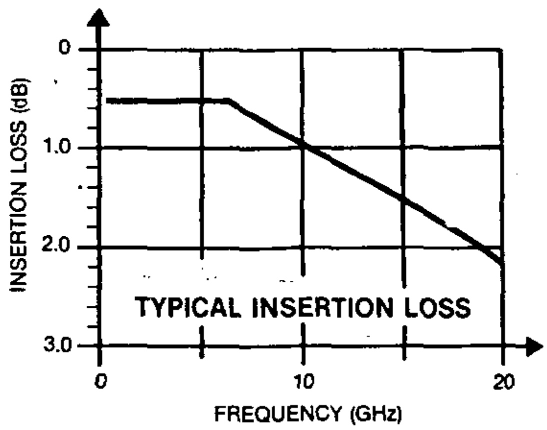
TYPICAL
15 ns Pulse Modulated
Signal at 2.3 GHz
(5 ns/Division)
SWN-2184-1A, Option 012, 103, HS

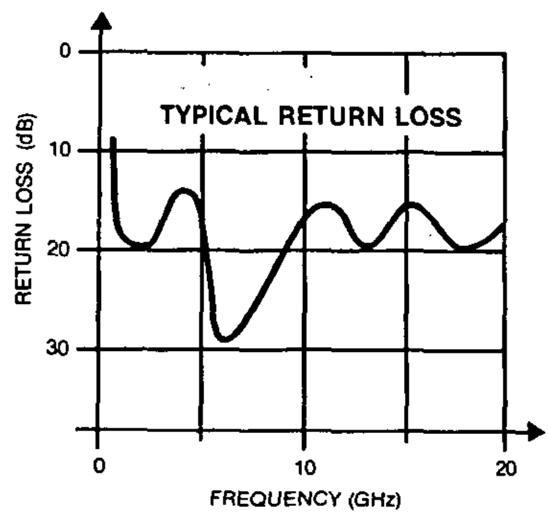


TYPICAL
40 ns Pulse Modulated Signal
at 7 GHz with Control
Pulse Super-imposed
(10 ns/Division)
SWN-2184-1A, Option 012, 103, HS

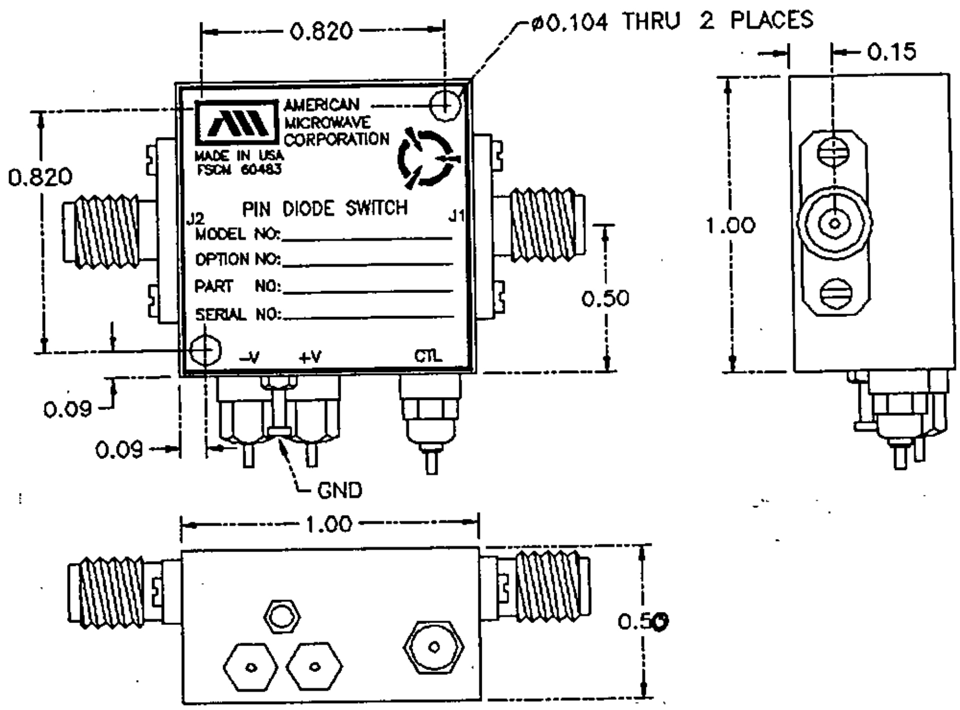
STATIC RESPONSE







MECHANICAL DATA



LOGIC TABLE

LOGIC	RF
0	OFF
1	ON

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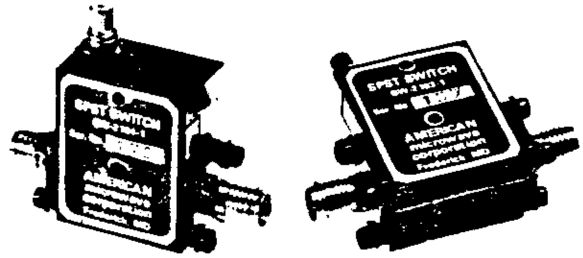
SERIES SW-218 WIDEBAND SPST PIN DIODE SWITCHES



FEATURES

- 0.3 to 18 GHz Frequency Range
- Low Insertion Loss
- Up to 85 dB Isolation
- High Speed - 10 nsec
- Small Size
- Light Weight
- Rugged Chip and Microstrip Construction

SPECIFICATIONS

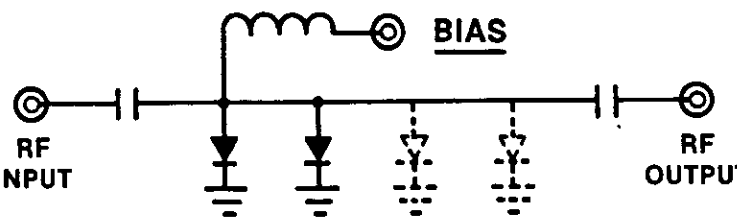
- Temperature -
  Operating: −65°C to +85°C
  Non-operating: −65°C to +125°C
- Humidity, Shock, Etc. -
  Per MIL-STD 202F

DESCRIPTION

The series SW-218 switches are broadband, high speed, low loss SPST switches. They are available in three models that operate over the 0.3 to 18 GHz band and are usable to 22 GHz. Each features rugged integrated circuit assemblies of chip PIN diodes on a microstrip transmission line and proprietary wideband bias decoupling circuitry.

Switching is accomplished by applying positive current to the bias terminal which biases the diodes to low resistance and the switch OFF. A negative voltage applied to the bias terminal biases the diodes to a high resistance and the switch ON.

FUNCTIONAL SCHEMATIC



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SPECIFICATIONS

MODEL NO.	CHARACTERISTICS	FREQUENCY (GHz) 0.3 to 1.0	1.0 to 2.0	2.0 to 4.0	4.0 to 8.0	8.0 to 12.4	12.4 to 18.0	SWITCHING SPEED ON-to-OFF and OFF-to-ON	POWER HANDLING CAPABILITY AVG (WATTS)	Peak 1 µsec, max, pw (WATTS)	BIAS REQUIREMENTS Rated Insertion Loss	Rated Isolation
SW-2182-1	Min Isolation (dB) Max Ins Loss (dB) Max VSWR (ON Pos)	30 1.0 1.3	40 1.0 1.3	45 1.0 1.4	45 1.1 1.6	45 1.6 1.9	45 2.0 1.9	10 ns	2	10	−10v	+35ma
SW-2183-1	Min Isolation (dB) Max Ins Loss (dB) Max VSWR (ON Pos)	40 1.0 1.4	60 1.0 1.4	70 1.1 1.4	70 1.4 1.6	70 1.8 1.9	70 2.3 1.9	10	2	10	−10v	+35ma
SW-2184-1	Min Isolation (dB) Max Ins Loss (dB) Max VSWR (ON Pos)	45 1.0 1.4	70 1.0 1.4	85 1.2 1.4	85 1.5 1.6	85 2.0 1.9	80 2.5 1.9	10	2	10	−10v	+35ma

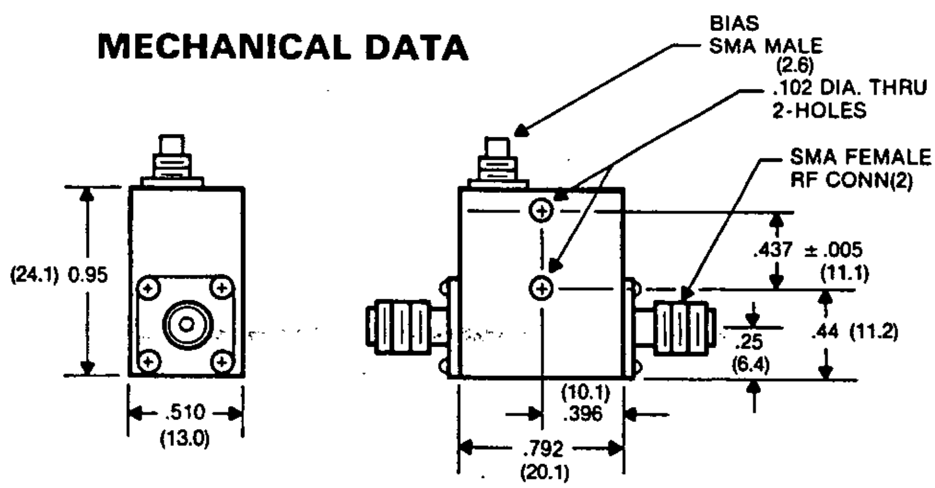
AVAILABLE OPTIONS

Option No.	Description
001	Two SMA Male RF Connectors
002	One SMA Male and One SMA Female RF Connector
003	Solder Type Control Terminals
008	Extend Frequency to 100 MHz
010	100 ns, Max Switching Speed (5w, cw, max)
012	2 ns, Max Switching Speed (100mw, cw, max)
103	Integral Video Filters (2-18 GHz Frequency Band)

ENVIRONMENTAL RATINGS

Operating Temperature −65° C to 110° C
Non-Operating Temperature −65° C to 125° C
Humidity MIL-STD-202F, METHOD 103B
Shock MIL-STD-202F, METHOD 213B
Vibration MIL-STD-202F, METHOD 204D
Altitude MIL-STD-202F, METHOD 105C
Temp Cycling MIL-STD-202F, METHOD 107D

MECHANICAL DATA



DIMENSIONS: INCHES (MILLIMETERS)

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SPST SWITCH
0.3 - 18 GHz
NON - REFLECTIVE
WITH INTEGRAL DRIVER
SWN-2183-1AT

FEATURES

- 0.3 to 18 GHz Frequency Band
- 70 dB, Minimum On/Off Isolation
- 10 ns, Maximum Rise/Fall Time
- Small Size
- Light Weight
- Integral TTL Driver

DESCRIPTION

The *SWN-2183-1AT* is a broadband, high speed, low loss SPST unit with off arm terminations and integral TTL compatible driver. It is powered by +5V and -5 volt supplies. It features rugged integrated circuit assemblies of chip pin diodes on a *microstrip transmission* line and TTL *driver* that is electrically as well as mechanically integral for smooth pulse modulation with no overshoot or ringing.

APPLICATIONS

- Radar Simulators
- Radar Cross Section Transmitters
- Pulse Modulators

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SPECIFICATIONS

CHARACTERISTIC					
	0.2 to 0.5	0.5 to 2.0	2.0 to 8.0	8.0 to 12.4	12.4 to 18.0
MIN. ISOLATION (dB)	45	80	80	80	70
MAX. INSERTION LOSS (dB)	2.0	2.0	2.5	3.0	3.5
VSWR (On and Off)	1.5	1.5	1.75	2.0	2.0

SWITCHING SPEED

RISE TIME (10 - 90% RF)	10 ns Max.
FALL TIME (90 - 10% RF)	10 ns Max.
ON TIME (50% COMMAND TO 90% RF)	70 ns Max.
OFF TIME (50% COMMAND TO 10% RF)	70 ns Max.

POWER HANDLING CAPABILITY

NO DEGRADATION
100 MW CW or PEAK
SURVIVAL POWER
1 W AVERAGE, 10 W PEAK
(1μ SEC MAX PULSE WIDTH)

ENVIRONMENTAL RATINGS

OPERATING TEMPERATURE −65° C to 110° C
NON-OPERATING TEMPERATURE −65° C to 125° C

HUMIDITY	MIL-STD-202F, METHOD 103B
SHOCK	MIL-STD-202F, METHOD 213B
VIBRATION	MIL-STD-202F, METHOD 204D
ALTITUDE	MIL-STD-202F, METHOD 105C
TEMP CYCLING	MIL-STD-202F, METHOD 107D

POWER REQUIREMENTS

+5V ± 2%, 90 mA
-5V ± 5%, 75 mA

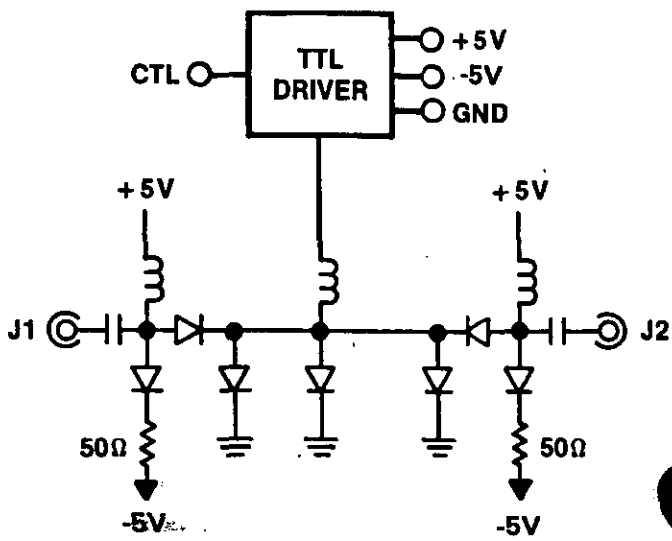
CONTROL CHARACTERISTICS

CTL INPUT - 1 UNIT LOAD
LOGIC SENSE......
0 SWITCH "ON"
1 SWITCH "OFF"

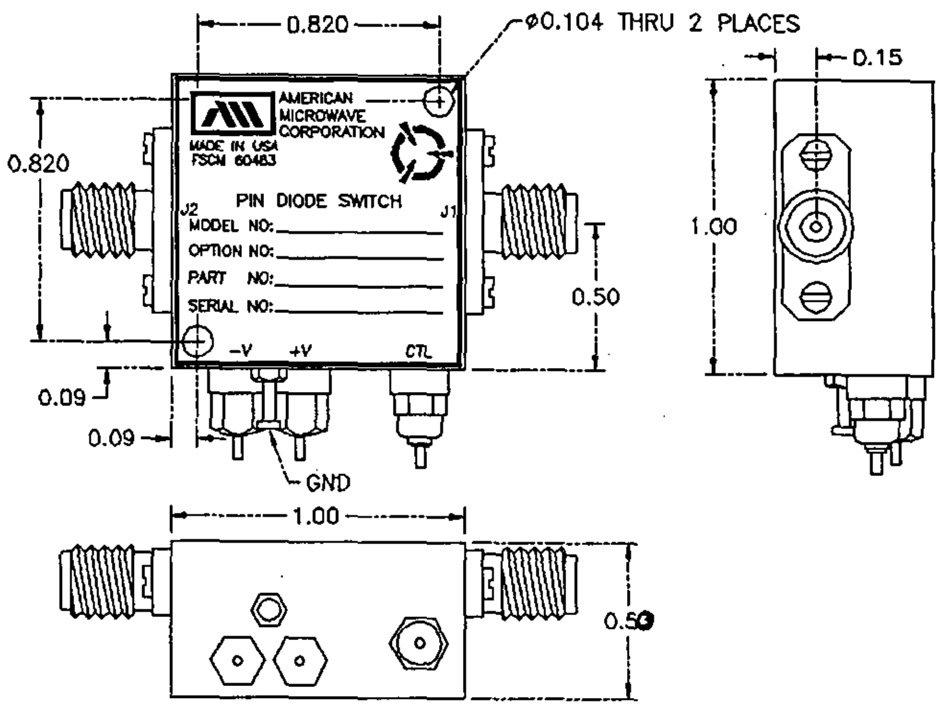
AVAILABLE OPTIONS

Option No.	Description
001	Two SMA Male RF Connectors
002	One SMA Male and One SMA Female RF Connector
003	SMC Control Connector (Solder Type is Standard)
005	50 Ohm Control Impedance
103	Integral Video Filters (2-18 GHz Frequency Band) Insertion loss Increase of 0.75 Db maximum
HS	High Speed Version (20 nsec. Delay)
R	Reflective
006	+5V, -15V

FUNCTIONAL SCHEMATIC



MECHANICAL DATA



LOGIC TABLE

LOGIC	RF
0	ON
1	OFF

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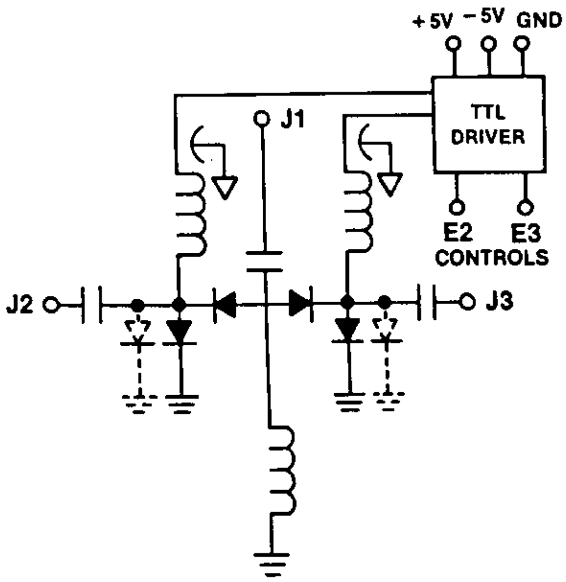
BROADBAND PIN SWITCH SPDT WITH INTEGRAL DRIVER
SWN-218-2A
0.3 To 18 GHz

FEATURES

- 0.3 to 18 GHz Frequency Range
- Low Insertion Loss
- Small Size
- Light Weight
- Rugged Chip and Microstrip Construction
- Integral TTL Compatible Driver

FUNCTIONAL SCHEMATIC



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SPECIFICATIONS

- Frequency Range: 0.3 to 18 GHz
- Insertion Loss: 2.5 dB, Max.
- Isolation: 55 dB, Min.
- VSWR: 2.0 to 1
- Rise/Fall Time: 50 ns Max.
- Power Handling: +20 dBm, CW, Max.
- Operating Temp.: −65° C to + 85° C
- DC Power: +5V DC @ 65 mA, Max.
  −5V DC @ 50 mA, Max.

DESCRIPTION

The SWN-218-2A is a SPDT Pin Switch intended for wide band switching applications in commercial and military environments. It has an instantaneous frequency coverage from 0.3 to 18 GHz and features all solid state chip diode and microstrip construction for rugged, reliable operation. Hybrid driver circuitry features reverse voltage and over-voltage protection.

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STANDARD UNIT

FREQUENCY (GHz)	0.3	2.0	4.0	8.0	12.4	18.0
MAX. INSERTION LOSS (dB)	1.2	1.2	1.3	1.3	2.0	2.5
MIN. ISOLATION (dB)	85	80	75	70	65	55
MAX. VSWR	1.7	1.5	1.5	2.0	2.0	2.0

HUMIDITY, SHOCK, ETC., PER MIL-STD 202C

OPTIONS:

001 35 dB MIN ISOLATION
002 INDEPENDENT CONTROLS
003 SMA MALE CONNECTORS
004 +15 VOLT SUPPLY
005 REVERSE LOGIC
006 −15 VOLT SUPPLY
007 10 NS, MAX SWITCHING SPEED
008 EXTEND FREQUENCY TO 100 MHz
009 30 NS, MAX DELAY
010 −12 VOLT SUPPLY
011 Off ARM TERMINATION
INSERTION LOSS OF 3.5 dB MAXIMUM
103 INTEGRAL VIDEO FILTERS (FREQUENCY 2-18 GHz)
INSERTION LOSS INCREASE OF 0.75 dB MAXIMUM

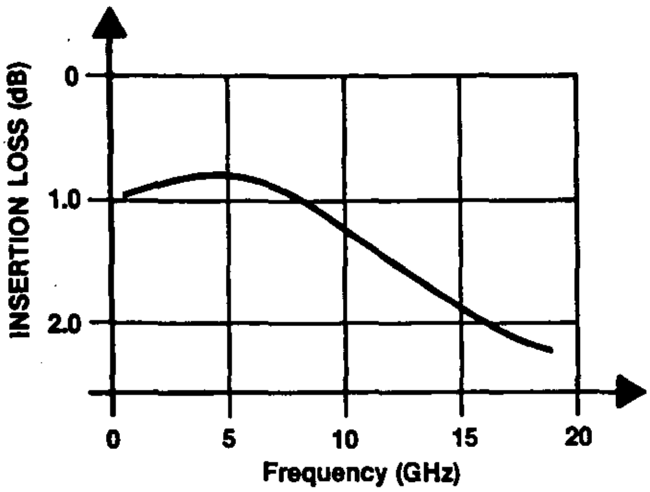
NOTES:

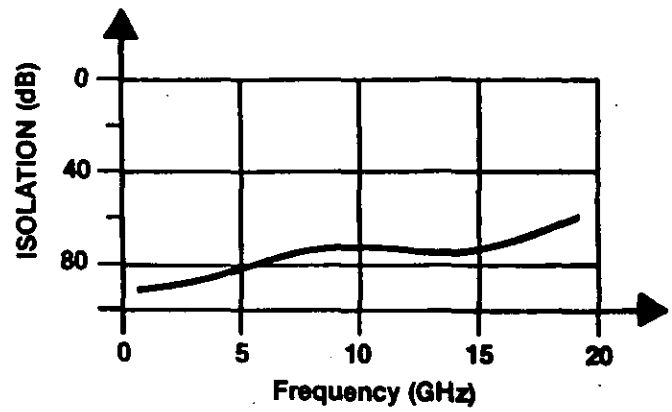
1. Switching Speeds are:
10%-90% RF and 90%-10% RF

ENVIRONMENTAL RATINGS

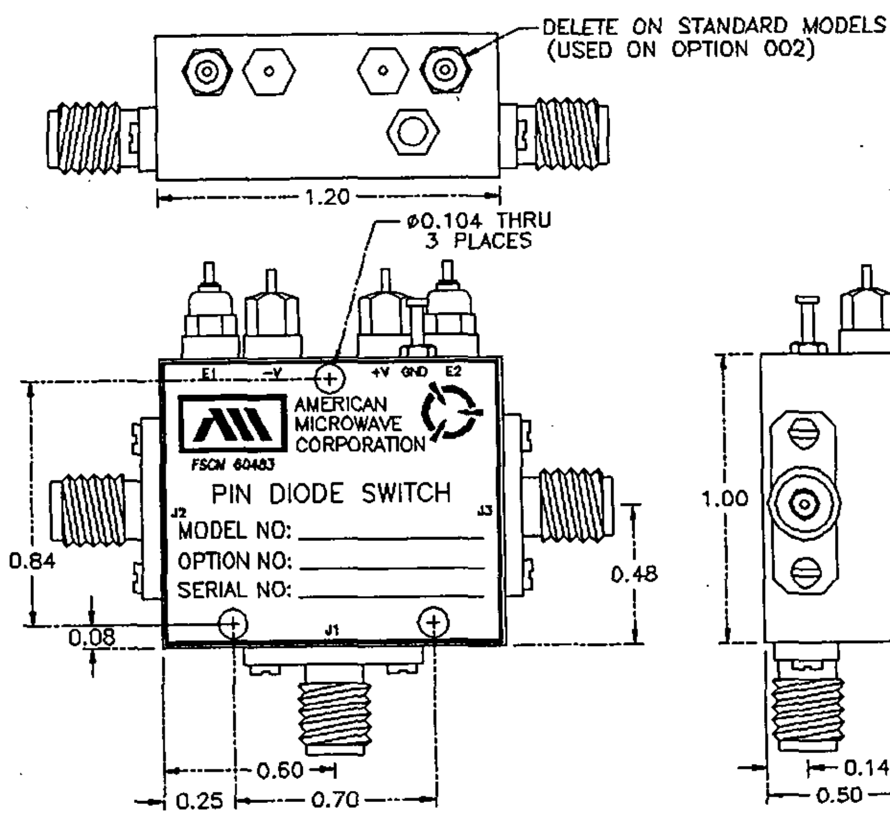
Operating Temperature −65° C to 110° C
Non-Operating Temperature −65° C to 125° C
Humidity MIL-STD-202F, METHOD 103B
Shock MIL-STD-202F, METHOD 213B
Vibration MIL-STD-202F, METHOD 204D
Altitude MIL-STD-202F, METHOD 105C
Temp Cycling MIL-STD-202F, METHOD 107D

TYPICAL PERFORMANCE





MECHANICAL DATA



LOGIC TABLE

LOGIC	RF ON	RF OFF
0	J1−J2	J1−J3
1	J1−J3	J1−J2

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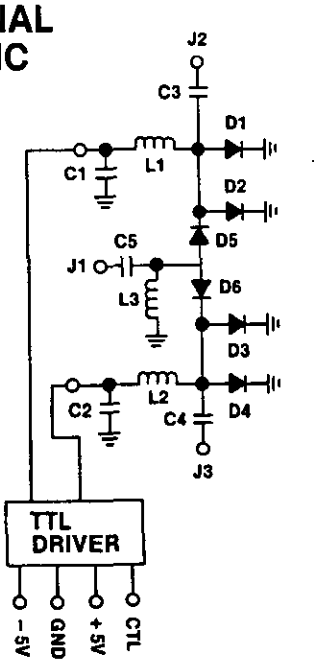
MINIATURE SP2T SWITCH
0.3 - 18 GHz WITH INTEGRAL DRIVER
SWN-2181-2A

FEATURES

- 0.3 to 18 GHz Frequency Band
- 55 dB, Minimum Isolation
- High Speed - 10 ns Optional
- Integral TTL Driver

FUNCTIONAL SCHEMATIC



SPECIFICATIONS

- Frequency Range: 0.3 to 18 GHz
- Insertion Loss: 3.0 dB, Max.
- Isolation: 55 dB, Min.
- VSWR: 2.0:1, Max.
- Switching Speed: 50 ns, Max.
  Rise/Fall Time
- Power Handling: +23 dBm, CW, Max.
- Operating Temp.: −65° C to +85° C
- DC Power: +5V @ 65 mA, Max.
  −5V @ 50 mA, Max.

DESCRIPTION

The SWN-2181-2A is a SPDT Pin Switch intended for use in commercial and military environments. It features all solid state chip diode and microstrip construction for rugged, reliable operation. Hybrid driver circuitry features reverse voltage and over voltage protection.

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SPECIFICATIONS

STANDARD UNIT

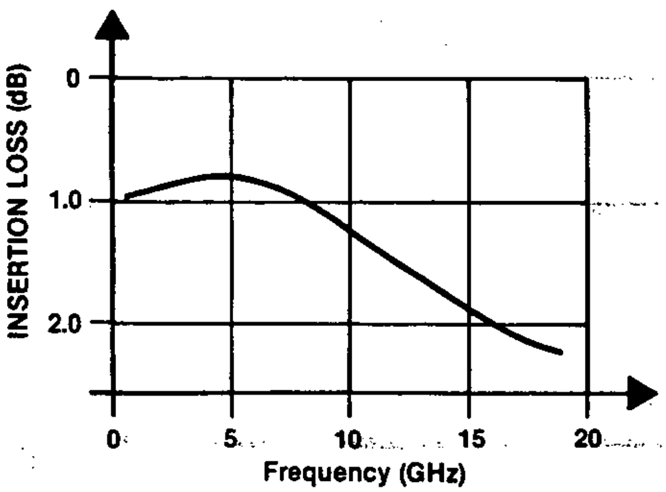
FREQUENCY (GHz)	0.3	2.0	4.0	8.0	12.0	18.0
MAX. INSERTION LOSS (dB)	1.2	1.2	1.1	1.0	1.8	3.0
MIN. ISOLATION (dB)	85	80	75	70	65	55
MAX. VSWR	1.7	1.5	1.5	1.9	2.0	2.0

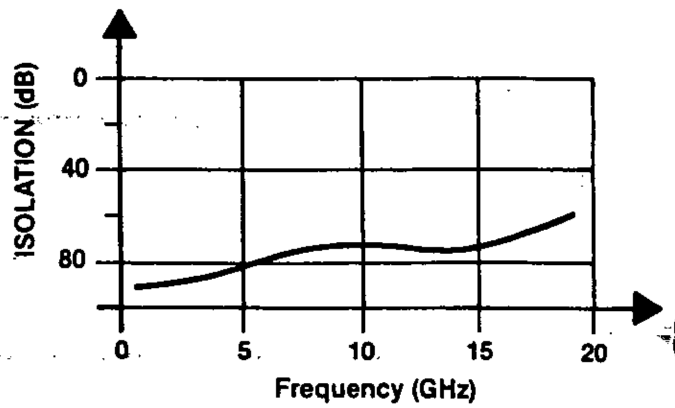
HUMIDITY, SHOCK, ETC. PER MIL-STD 202C

OPTIONS:

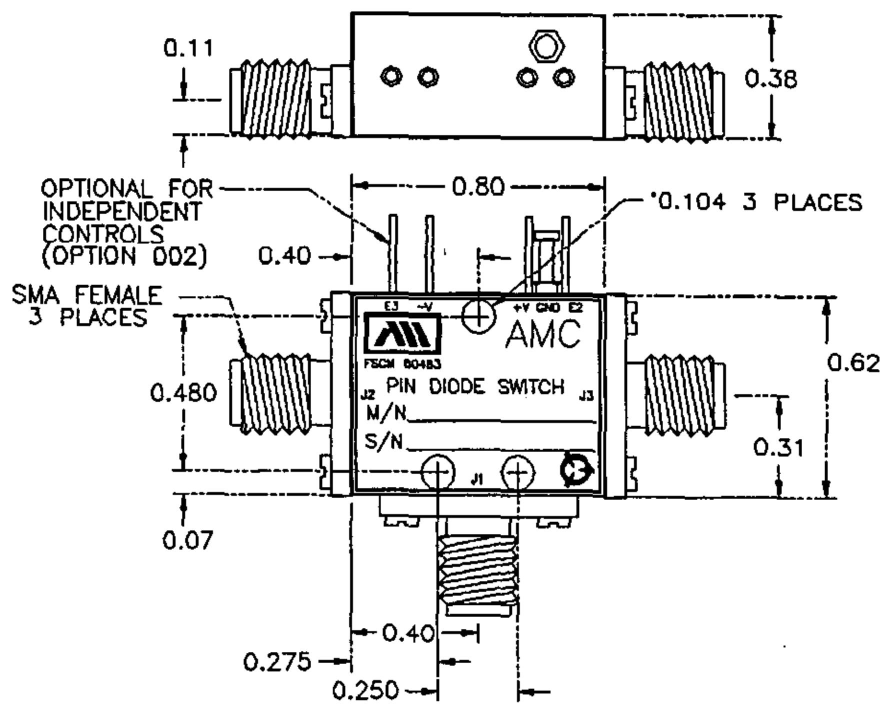
001	35 dB MINIMUM ISOLATION
002	INDEPENDANT CONTROLS
003	SMA MALE CONNECTORS
005	REVERSE LOGIC
006	-15 VOLT SUPPLY
007	10 NS, MAXIMUM RISE/FALL TIME
008	EXTENDED FREQUENCY TO 100 MHz
009	30 NS, MAXIMUM DELAY
010	OFF ARM TERMINATION INSERTION LOSS OF 3.5 dB MAXIMUM
103	INTEGRAL VIDEO FILTERS (2 - 18 GHz) INSERTION LOSS INCREASE OF 0.75 dB MAXIMUM

TYPICAL PERFORMANCE





MECHANICAL DATA

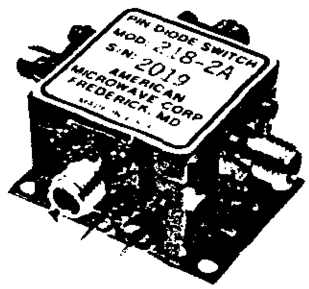


LOGIC TABLE

LOGIC	RF ON	RF OFF
0	J1-J2	J1-J3
1	J1-J3	J1-J2

AMERICAN Microwave corporation

2 - 18 GHz SP3T SWITCHES WITH DRIVERS



FEATURES

- 10 MHz to 18 GHz
- Low Insertion Loss
- High Isolation
- Small Size

DESCRIPTION

SP3T PIN diode switches that cover the frequency range from 2 to 18 GHz are available in octave to multi-decade bandwidths.

All feature rugged, bonded diode chip and micro-strip construction that meet MIL-STD-202C environmental requirements. TTL drivers feature ultra reliable discrete component construction. Drivers, in addition, will withstand up to 300% overload and reverse polarity connection for up to 30 seconds without damage.

Optional control port connectors, power supply voltages, male RF connectors and truth tables are available.

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7311G GROVE ROAD, FREDERICK, MARYLAND 21701 (301) 662-4700

SPECIFICATIONS

MODEL NUMBER	SWITCH TYPE	FREQUENCY RANGE (GHz)	MAXIMUM INSERTION LOSS (dB)	MINIMUM ISOLATION (dB)	MAXIMUM VSWR
SW-2040-3A	SP3T	2–4	1.6	45	1.5
SW-4080-3A	SP3T	4–8	1.7	40	1.6
SW-8012-3A	SP3T	8–12	1.8	35	1.7
SW-1218-3A	SP3T	12–18	2.6	30	1.9
SW-218-3A	SP3T	2–18	2.8	30	2.5

RISE/FALL TIME: (10% RF to 90% RF) 50 ns, Max
(90% RF to 10% RF) 50 ns, Max

POWER HANDLING: +23 dBm, Max

TTL DELAY: 50 ns, typical

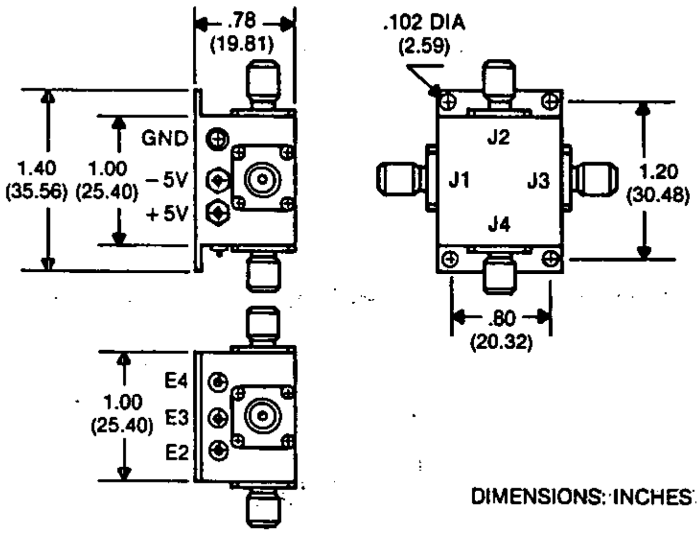
POWER SUPPLY: +5VDC @100 mA, Max
−5VDC @ 50 mA, Max

OPTIONS:
- 001 −55 dB, Min Isolation
- 002 Independent Controls (SPDT)
- 003 SMA Male Connectors
- 004 Solder Pin Control Terminal
- 005 Reverse Logic
- 006 −15V Supply
- 007 −12V Supply

ENVIRONMENTAL RATINGS

Operating Temperature −65° C to 110° C
Non-Operating Temperature −65° C to 125° C
Humidity MIL-STD-202F, METHOD 103B
Shock MIL-STD-202F, METHOD 213B
Vibration MIL-STD-202F, METHOD 204D
Altitude MIL-STD-202F, METHOD 105C
Temp Cycling MIL-STD-202F, METHOD 107D

MECHANICAL DATA



STANDARD LOGIC TABLE

LOGIC-H	RF-ON
E2	J1–J2
E3	J1–J3
E4	J1–J4

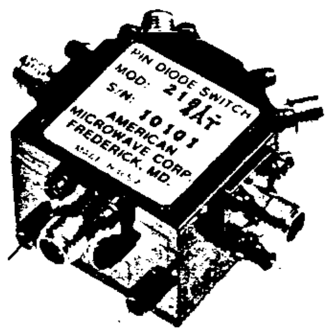
INVERTED LOGIC

LOGIC-L	RF-ON
E2	J1–J2
E3	J1–J3
E4	J1–J4

DIMENSIONS: INCHES (MILLIMETERS)

AMERICAN Microwave corporation

PIN DIODE SWITCH SP4T
MODEL SW-2181-4AT
NON-REFLECTIVE
2-18 GHz

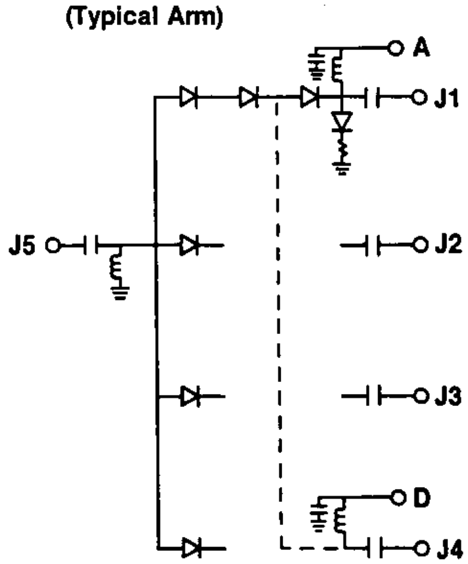


FEATURES

- Integral TTL Driver
- Rugged Microstrip Construction
- Reverse Polarity Protection on +5V and −5V Lines
- Off-Arm Terminations

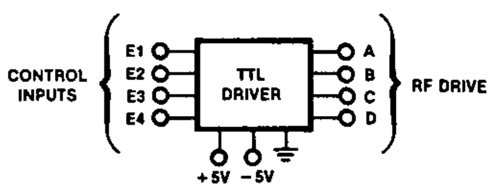
FUNCTIONAL SCHEMATIC

(Typical Arm)



DESCRIPTION

Model SW-2181-4AT is a broadband SP4T switch covering the 2-18 GHz band. It features Off-Arm terminations that provide reflectionless performance when arm is switched "on" or "off". Integral TTL Driver is "unit load" TTL compatible, one control per arm.



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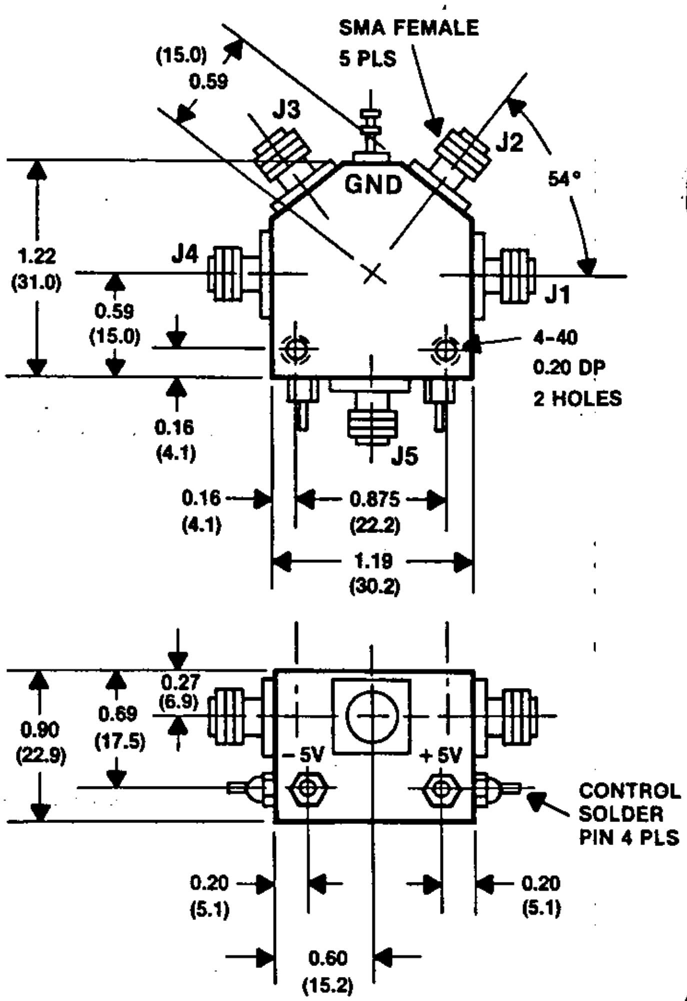
SPECIFICATIONS

	FREQUENCY (GHz)			
CHARACTERISTICS	2-4	4-8	8-12.4	12.4-18
MAX. INS LOSS (dB)	2.0	2.2	2.7	3.5
MIN. ISOLATION (dB)	60	60	60	55
MAX. VSWR (on)	1.8	1.8	2.0	2.0
MAX. VSWR (off)	1.8	1.8	2.0	2.0

Switching Speed: (10% to 90% RF) 50 ns, Max.
(90% to 10% RF) 50 ns, Max.
RF Power: +20 dBm, Max.
Control: TTL compatible, one "unit load"
4 individual controls. Logic "1" - RF On;
Logic "0" - RF Off
Power Requirements: +5V @ 200 mA, Max.

Connectors: RF: SMA Female
Power: RFI Solder Pin
Control: Solder Pin
Options:
- 001 RF Male SMA Connectors
- 002 35 dB, Min. Isolation
- 003 −12V Supply
- 004 +15 Volt Supply
- 005 Reverse Logic
- 006 −15 Volt Supply
- 007 Decoder
- 008 SMC Male CTL Connector
- 009 10 ns, Max Rise/Fall Time
- 010 Extend Frequency Range to 500 MHz

MECHANICAL DATA



DIMENSIONS: INCHES (MILLIMETERS)

ENVIRONMENTAL RATINGS

Operating Temperature −65° C to 110° C
Non-Operating Temperature −65° C to 125° C

Humidity	MIL-STD-202F, METHOD 103B
Shock	MIL-STD-202F, METHOD 213B
Vibration	MIL-STD-202F, METHOD 204D
Altitude	MIL-STD-202F, METHOD 105C
Temp Cycling	MIL-STD-202F, METHOD 107D

AMERICAN Microwave corporation

PIN DIODE SWITCH SP5T WITH TTL DRIVER MODEL SW-2181-5A 2-18 GHz

FEATURES

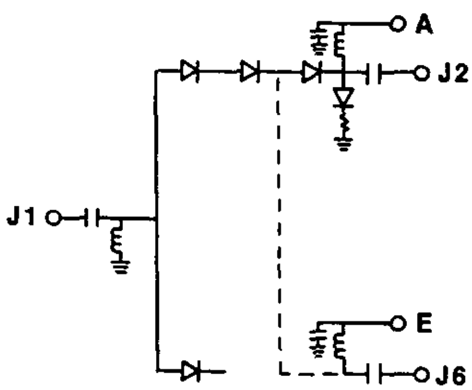
- Integral TTL Driver
- Rugged Microstrip Construction
- Reverse Polarity Protection on +5V and −15V Lines
- Available with Off-Arm Terminations

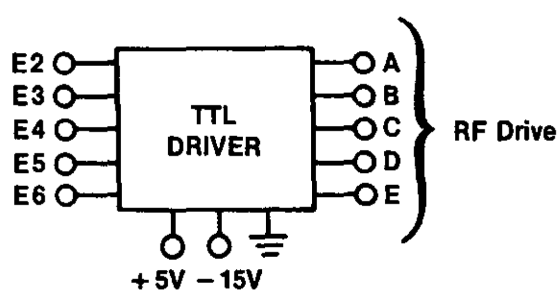
DESCRIPTION

Model SW-2181-5A is a Broadband SP5T Switch covering the 2-18 GHz Band. Integral TTL Driver is "unit load" TTL compatible, one control per arm.

FUNCTIONAL SCHEMATIC

(Typical Arm)





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7311G GROVE ROAD, FREDERICK, MARYLAND 21701 (301) 662-4700

SPECIFICATIONS

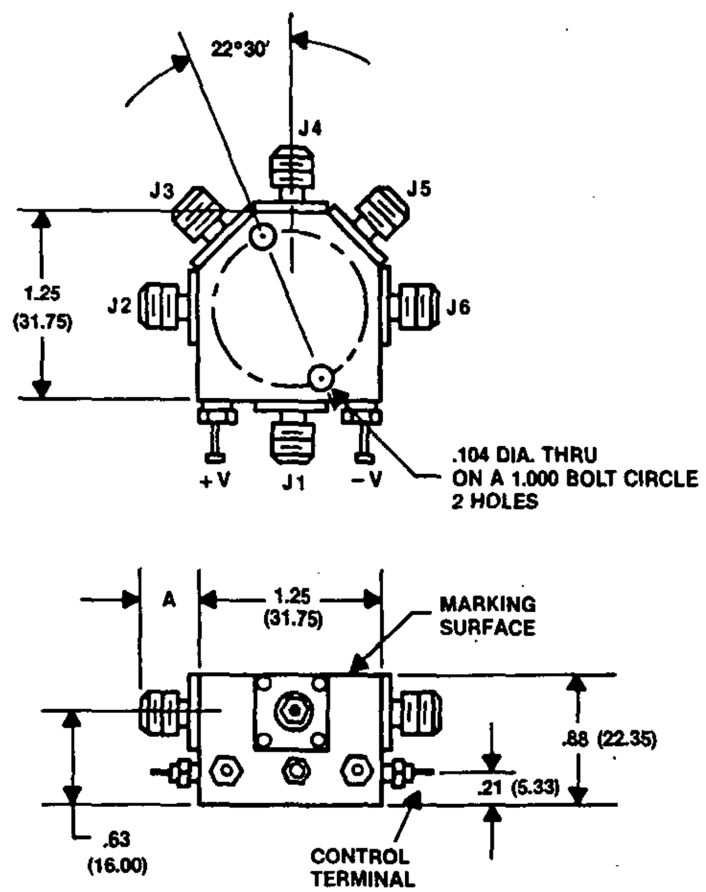
CHARACTERISTICS	FREQUENCY (GHz)				
	.5-2 (Option 010)	2-4	4-8	8-12.4	12.4-18
MAX. INS. LOSS (dB)	2.7	2.7	2.7	3.3	3.6
MIN. ISOLATION (dB)	75	65	65	60	60
MAX. VSWR (On)	1.8	1.8	1.8	2.0	2.0
MAX. VSWR (Off) (Option 011)	1.8	1.8	1.8	1.8	2.0

Switching Speed: (10% to 90% RF) 50 ns, Max.
(90% to 10% RF) 50 ns, Max.
RF Power: +20 dBm, Max.
Control: TTL compatible, one "unit load"
5 individual controls.
Control Logic: Logic "1" (−0.3 to +0.7V) Port On
Logic "0" (+2.0 to +5.0V) Port Off
Power Requirements: +5 VDC @ 250 mA, Max.
−15 VDC @ 100 mA, Max.
Connectors: RF: SMA Female
Power: RFI Solder Pin
Control: Solder Pin
Options:
001 RF SMA Male Connectors
002 35 dB, Min. Isolation
003 −12 VDC Power Supply
004 +15 VDC Power Supply
005 Reverse Logic
006 −5 VDC Power Supply
007 Decoder
008 SMC - Male Control Connector
009 10 ns, Max. Rise/Fall Time
010 Extend Frequency Range to 500 MHz
011 Off-Arm Terminations
103 Video Filters

ENVIRONMENTAL RATINGS

Operating Temperature −50° C to 85° C
Non-Operating Temperature −65° C to 125° C
Humidity MIL-STD-202F, METHOD 103B
Shock MIL-STD-202F, METHOD 213B
Vibration MIL-STD-202F, METHOD 204D
Altitude MIL-STD-202F, METHOD 105C
Temp Cycling MIL-STD-202F, METHOD 107D

MECHANICAL DATA



DIMENSIONS: INCHES (MILLIMETERS)

AMERICAN Microwave corporation

PIN DIODE SWITCH SP8T NON-REFLECTIVE WITH TTL DRIVER
SW-2000-8AT .01-2.0 GHz
SW-2181-8AT 2-18 GHz

FEATURES

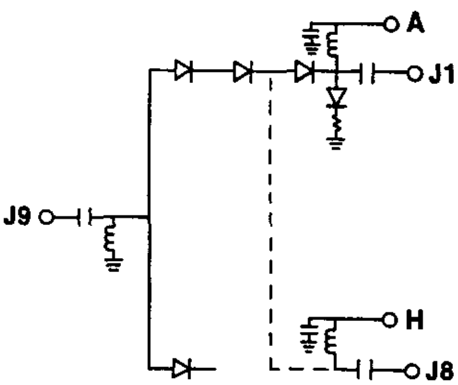
- Integral TTL Driver
- Rugged Microstrip Construction
- Reverse Polarity Protection
- 300% Overload for up to 2 Minutes
- Off-Arm Terminations

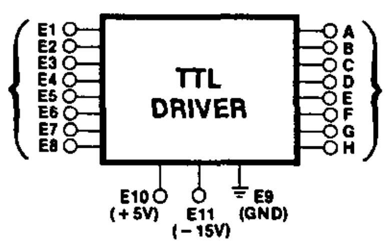
DESCRIPTION

SP8T switch is available in two models, SW-2000-8AT covers .01-2.0 GHz and SW-2181-8AT covers 2-18 GHz. Both models feature Off-Arm terminations that provide reflectionless performance when the arm is switched "on" or "off". Integral TTL Driver is one "unit load" compatible, one control per arm.

FUNCTIONAL SCHEMATIC

(Typical Arm)





5/89

7311G GROVE ROAD, FREDERICK, MARYLAND 21701 (301) 662-4700

SPECIFICATIONS

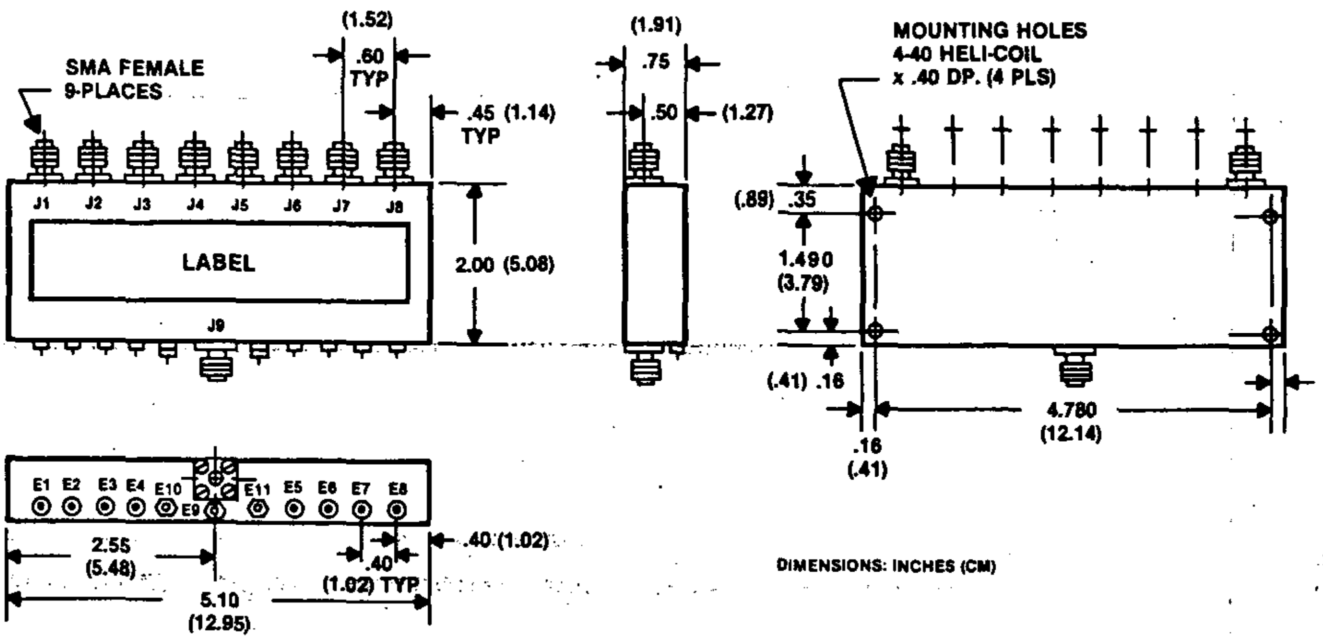
MODEL	CHARACTERISTICS	FREQUENCY (GHz) .01-2	2-4	4-8	8-12.4	12.4-18
SW-2000-8AT	MAX. INS LOSS (dB)	2.0	—	—	—	—
	MIN. ISOLATION (dB)	80	—	—	—	—
	MAX. VSWR (on)	1.5:1	—	—	—	—
	MAX. VSWR (off)	1.45:1	—	—	—	—
SW-2181-8AT	MAX. INS LOSS (dB)	—	2.8	3.0	3.8	4.5
	MIN. ISOLATION (dB)	—	80	75	60	60
	MAX. VSWR (on)	—	1.9:1	1.9:1	1.9:1	1.9:1
	MAX. VSWR (off)	—	1.9:1	1.9:1	1.9:1	1.9:1

Switching Speed: (10% to 90% RF) 50 ns, Max.
(90% to 10% RF) 50 ns, Max.
RF Power: +20 dBM, Max.
Control: TTL compatible, one "unit load"
8 individual controls
TTL "Hi" - RF on
TTL "Lo" - RF off
Power Requirements: +5VDC @ 350 mA, Max.
−15VDC @ 100 mA, Max.
Connectors: RF: SMA Female
Power: RFI Solder Pin
Control: Solder Pin
Options: 001 RF Male Connectors
002 Inverted Logic
003 +15VDC Supply
004 Decoder
005 10 ns, Max. Rise/Fall Time (not available on SW-2000-8AT)
103 Video Filters (not available on SW-2000-8AT)

ENVIRONMENTAL RATINGS

Operating Temperature −65° C to 110° C
Non-Operating Temperature −65° C to 125° C
Humidity MIL-STD-202F, METHOD 103B
Shock MIL-STD-202F, METHOD 213B
Vibration MIL-STD-202F, METHOD 204D
Altitude MIL-STD-202F, METHOD 105C
Temp Cycling MIL-STD-202F, METHOD 107D

MECHANICAL DATA



DIMENSIONS: INCHES (CM)

How to Specify PIN Diode Switches

I. INTRODUCTION

When purchasing PIN diode switches, it is important that they are completely specified to assure system performance. It is also important that the specifications be achievable. This paper is designed to help a systems designer specify realizable PIN diode switches.

There are six key parameters essential to specify PIN diode switches. These are:

1) Type, i.e., SPST, SPDT, SP3T, DPDT, etc.

2) Operating frequency band

3) Insertion loss

4) Isolation

5) Switching speed

6) Power handling

There are five secondary parameters that may require specification. These are:

1) Logic compatible driver type and speed

2) Phase tracking arm to arm and/or unit to unit

3) Off arm terminations

4) Intercept point or compression point

5) Video transients

II. SWITCH TYPE

Most PIN diode switches are of the single pole multiple throw type. They range from single throw up through 8-12 throws. The most popular type is the SPST or pulse modulator type. In general, the greater the number of throws, the less popular the switch, and, hence, the less readily available it is. American Microwave has standard switch designs up through 5 throws in the three popular bands of interest: HF, UHF/VHF, and Microwave. We also have designs for 8 and 10 throws at HF and Microwave.

The most popular multi-pole switch is the DPDT type, commonly known as the *Transfer Switch.* These units are available in UHF/VHF and Microwave bands. High order multi-pole switches are generally referred to as switch matrices, which is a whole subject matter by itself.

III. OPERATING FREQUENCY BANDS

American Microwave classifies PIN switches into five operating frequency bands. They are:

a) Video, which covers from 10MHz to 2MHz, not manufactured at AMC.

b) HF, which covers 2MHz to 32MHz, AMC series SW-0230 switches.

c) UHF/VHF, covering 10MHz to 2000MHz, AMC series SW-2000 switches.

d) Microwave, covering 10MHz to 20GHz and above, AMC series SW-218 switches.

e) Millimeter wave switches, 20 GHz and up

The above bands have loosely defined boundaries which overlap. They are more indicative of the five different technologies available to the switch manufacturer as well as distinct application areas of switch requirements.

There are some special application bands and technologies such as the high speed, low transient IF switching technology which is reflected in the SWB-0070 series of switches in the AMC catalog.

IV. THE PIN DIODE

A simplified equivalent circuit of the PIN diode is shown in figure 1. The forward biased diode is a current controlled resistor. The resistance vs current behavior of a typical PIN diode is shown in figure 2. The reversed biased diode is a voltage-controlled capacitor. The capacitance vs voltage of a typical PIN diode is shown in figure 3.

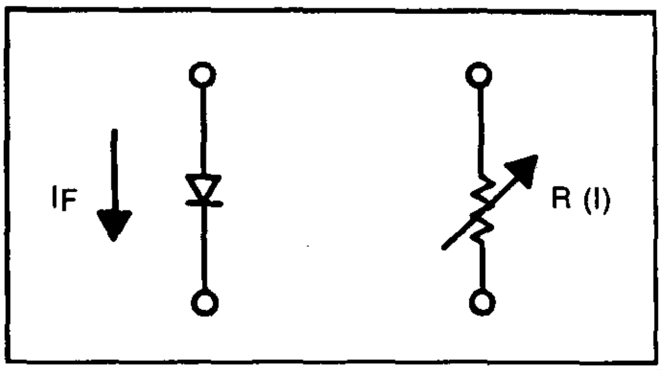


Figure 1. The forward biased PIN diode.

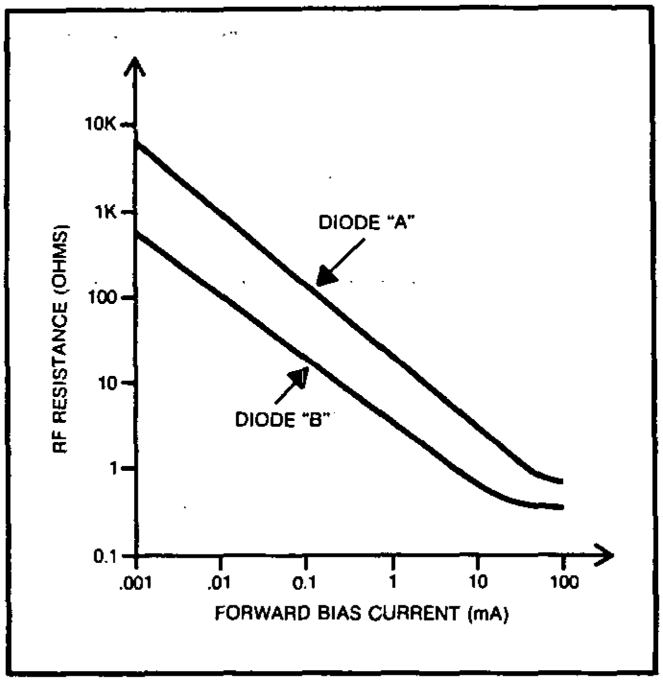


Figure 2. RF resistance vs. forward bias current.

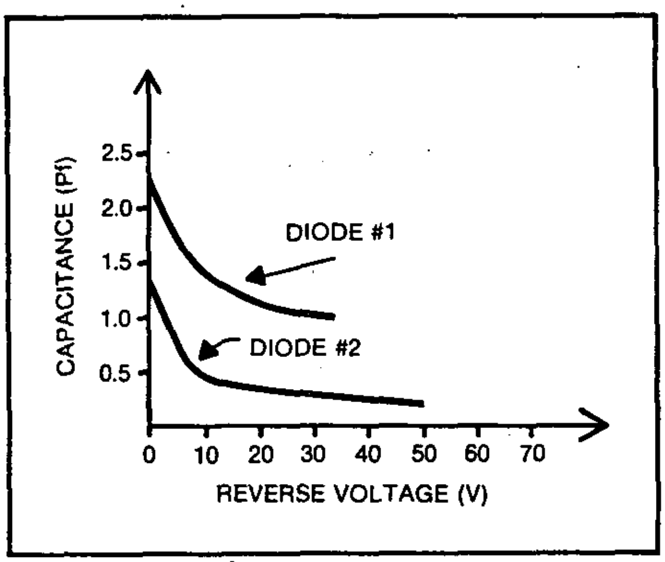


Figure 3. PIN diode capacitance vs. voltage.

V. INSERTION LOSS

Simple, most basic switches have the lowest loss for any given operating band. For a given technology or operating band, insertion loss increases with increasing frequency proportional to the square root of frequency in a well-designed PIN switch. Insertion loss originates in four basic areas.

a) Conductor or transmission line loss within the switch itself due to the presence of microstrip, coaxial line, or waveguide inter-connecting lines.

b) Resistance losses due to finite resistance of series connected components such as PIN diodes and/or finite "Q" capacitors.

c) VSWR losses due to mismatch of components within the switch or at the terminals of the switch. VSWR losses at the terminals of the switch can be tuned out externally to improve losses; those within the switch must be minimized in design. These actually are the cause for ripples in the insertion loss *vs* frequency characteristic.

Assuming a switch is well designed, i.e., lowest loss transmission media, lowest resistance diodes and other series components are employed and all internal VSWRs are minimized, the loss of the switch is then dependent on the complexity of the design. In general, multi-throw units are more lossy as the number of throws increases. The addition of off-arm terminations and video filters increases the loss of the switch for a given technology. Also, increased on/off isolation will contribute slightly to the loss. The insertion loss is lowest in the least complex switch configurations. For low loss switches, keep the specification simple.

VI. ISOLATION

PIN diodes are connected to the transmission line in series or in shunt. Isolation is achieved by reverse biasing series connected diodes for forward biasing shunt connected diodes. The shunt mounted diode provides the most effective means for achieving broadband, relatively frequency independent isolation. It is ideally frequency independent, but, practically, small parasitic reactances generally affect broadband performance. Isolation is also achieved by reverse biasing series mounted diodes. Isolation for the series mounted diode decreases with increasing frequency.

Series-shunt diode configurations are frequently employed in multi-throw broadband switches to achieve relatively high isolation in a simple structure. An example of the performance of a series-shunt connection is shown in figure 4 for the AMC model SW-218-2 switch. Note how the isolation decreases with increasing frequency. Multiple diodes connected in series or in shunt are frequently employed in PIN switches to achieve relatively high isolation over a broad band of frequencies. The isolation *vs* frequency characteristic of a shunt connected array of forward biased diodes is shown in figure 5. An example of a shunt mounted switch is the AMC model SW-2184-1A SPST unit, shown in figure 6, which achieves 85 dB isolation over the 2-18 GHz band by judiciously spacing four shunt connected diodes. An example of a switch employing an array of reverse biased series connected diodes is the AMC model SW-2000-1, shown in figure 7, which achieves 70 dB minimum isolation over the 10-2000 MHz band. It is interesting to note that the SW-2000-1 unit has more insertion loss at the low end of the band than that of the SW-218-1A unit. This, of course, is due to the finite resistance of the forward biased series diodes in the SW-2000-1 unit.

For narrowband applications, the possibilities are endless for combining and tuning diodes for excellent tradeoffs between insertion loss and isolation. Many designers have employed series and shunt inductors to resonate the capacitance of reverse biased PIN diodes to achieve excellent isolation-insertion loss performance over limited frequency bands. (See reference 1.)

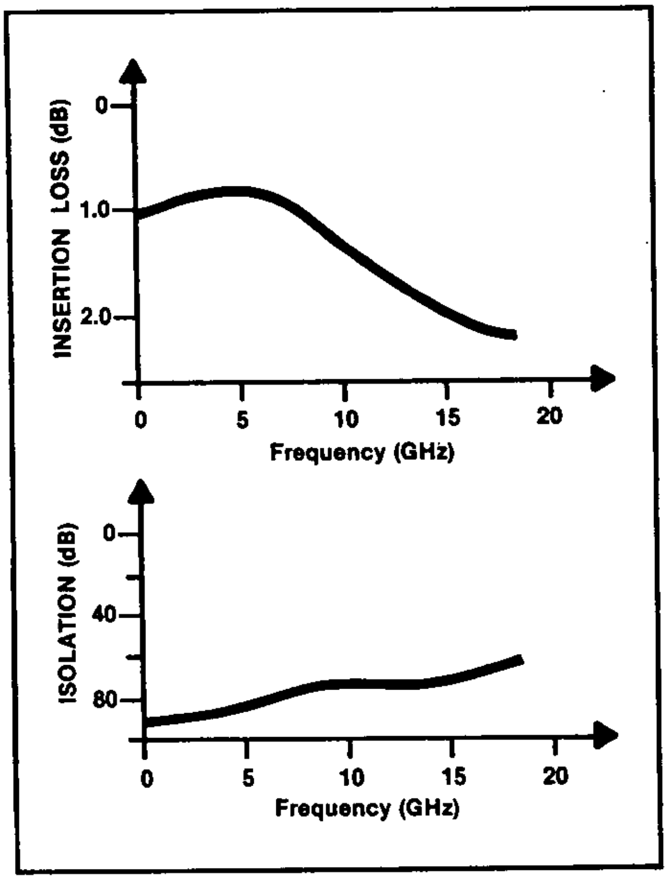


Figure 4.

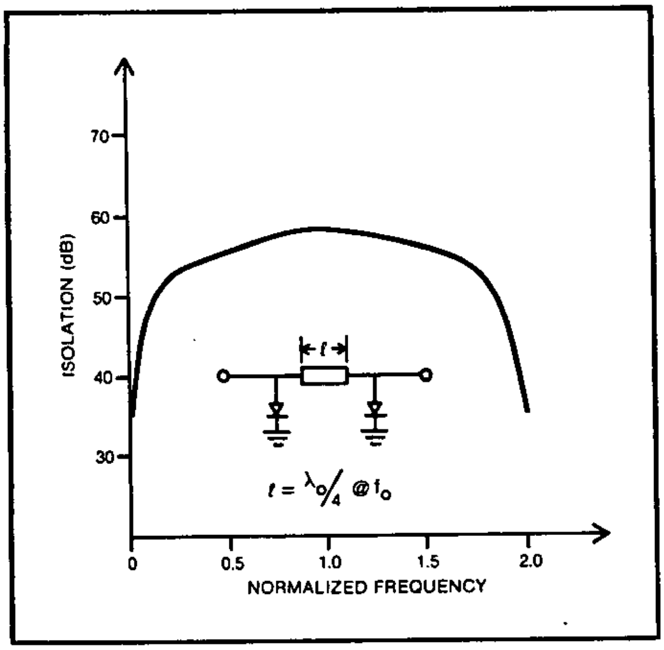


Figure 5. Isolation vs. frequency, shunt array.

MODEL NO.	CHARACTERISTICS	FREQUENCY (GHz) 0.3 to 1.0	1.0 to 2.0	2.0 to 4.0	4.0 to 8.0	8.0 to 12.4	12.4 to 18.0
SW-2182-1A	Min Isolation (dB)	30	40	45	45	45	45
	Max Ins Loss (dB)	1.0	1.0	1.0	1.1	1.6	2.0
	Max VSWR (ON Pos)	1.3	1.3	1.4	1.6	1.9	1.9
SW-2183-1A	Min Isolation (dB)	40	60	70	70	70	70
	Max Ins Loss (dB)	1.0	1.0	1.1	1.4	1.8	2.3
	Max VSWR (ON Pos)	1.4	1.4	1.4	1.6	1.9	1.9
SW-2184-1A	Min Isolation (dB)	45	70	85	85	85	80
	Max Ins Loss (dB)	1.0	1.0	1.2	1.5	2.0	2.5
	Max VSWR (ON Pos)	1.4	1.4	1.4	1.6	1.9	1.9

Figure 6.

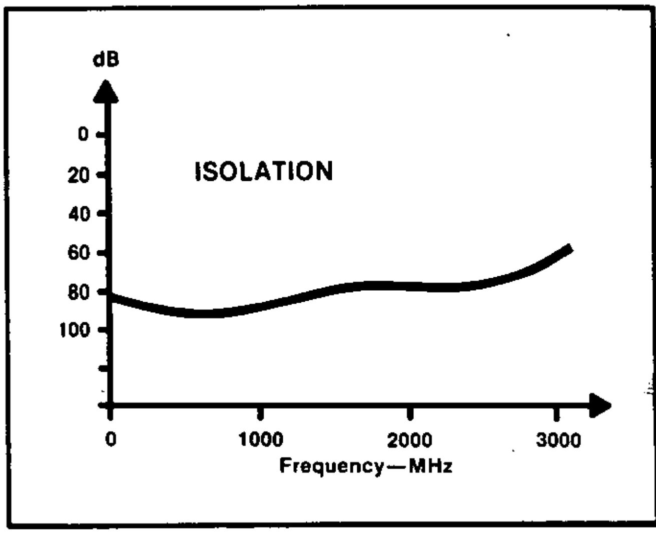


Figure 7.

VII. SWITCHING SPEED

Switching speed of a PIN diode switch is generally defined as the time for the RF to traverse 10% to 90% levels. Other definitions, such as the time from 1 dB to 60 dB levels, are occasionally employed for high isolation requirements. The switching speed is generally controlled by two factors, the time required to remove the stored charge from the diode junction and the theoretical maximum speed at which the charge can be removed from the junction. The time required to remove the stored charge from the junction is limited by the transit time of the PIN diode. The transit time given by

$$It = W1/Vs$$

where W1=the device I-region thickness (cm)
Vs=maximum saturated velocity=10^7 cm/sec
The I-region thickness is related to the breakdown voltage Vb by

$$W1 = Vb/20$$

Additionally, the stored charge in the forward biased diode junction is related to the minority carrier lifetime of the junction by

$$Qs = I^* \tau$$

Where Qs=stored charge (coulombs)
I =forward current (amperes)
τ =minority carrier lifetime (seconds)

As a minimum for operation as a PIN switch, the diode lifetime is shown vs the lowest operating frequency in figure 8. Further, the transit time as a function of breakdown voltage is shown in figure 9. (see reference 2.) For minority carrier lifetimes shorter than 10 ns, state-of-the-art PIN drivers can switch in approximately the transition time of the device. Longer lifetimes require higher currents and larger, slower switching transistors causing switching times to be longer than the transition time.

Low intermodulation and harmonic distortion PIN switches require diodes with longer than minimum minority carrier lifetimes and hence switch more slowly.

High power PIN switches require higher Vb diodes which results in slower transition times and slower switching times.

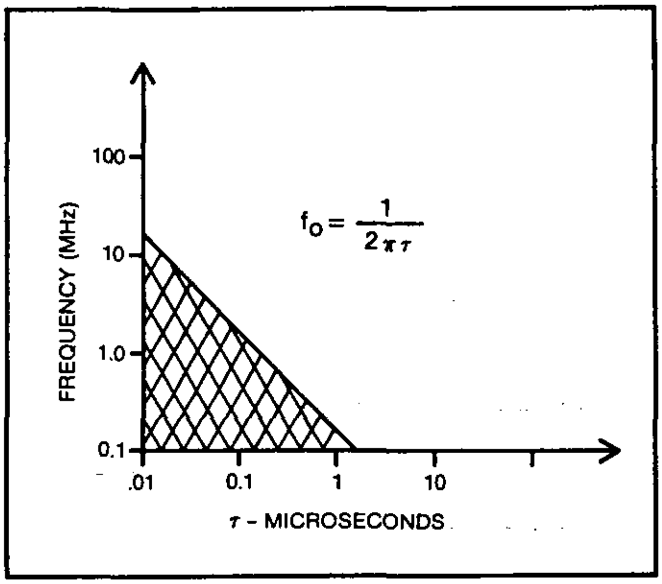


Figure 8. Minimum lifetime vs. frequency.

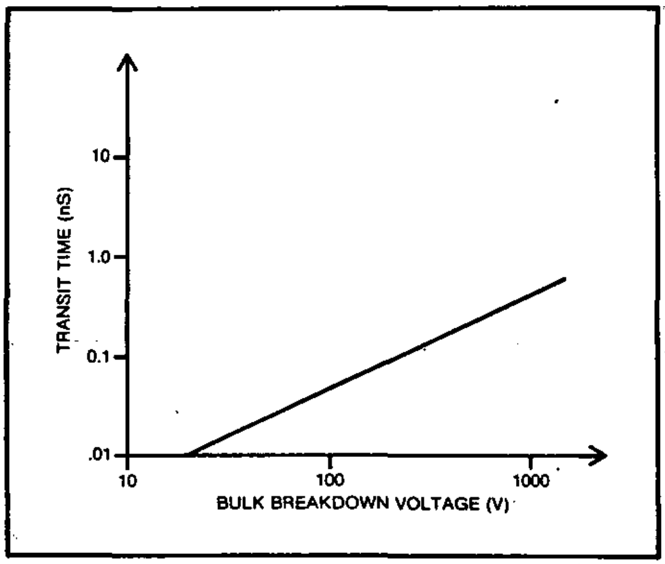


Figure 9. Transit time vs. bulk breakdown voltage.

VIII. POWER HANDLING

The power handling capability of PIN diode switches is controlled by three parameters. First is the upper operating temperature of the device. Second is the breakdown voltage and third the charge storage capability of the device. For silicon PIN diodes, best reliability is achieved by keeping junction operating temperatures below 200 degrees centigrade. Since series mounted diodes are more dissipative and have poorer heat sinking capabilities than shunt mounted configurations, switch designers tend to avoid series configurations in high power applications. Since series configurations are essential to wideband multi-throw switches, these units tend to be the lowest power handling configurations. Hence, high power broadband switches are difficult to realize. One usually ends up trading power for bandwidth.

It is necessary that the breakdown voltage be at least twice the peak RF voltage that the diode will see and that the forward charge stored in the junction be greater than the charge moved on one-half cycle of the RF current waveform. The former requirement will assure that the diode not exceed its voltage breakdown and the latter that the forward biased junction will not be depleted in operation. The elements are essential to linear non-destructive operation of the diode under high power operation.

IX. LOGIC COMPATIBLE DRIVERS

The three most popular logic families are Transitor-Translator-Logic (TTL), Emitter Coupled Logic (ECL) and Metal Oxide Semiconductor (MOS/CMOS).

Of the three, TTL logic is by far the most popular, ECL and CMOS are a distant second. Four of the most popular forms of TTL driver circuits are shown in figure 10. We will confine this discussion to TTL compatible drivers. For best performance, switch drivers must be electrically as well as mechanically integrated in the switch unit. It is possible to achieve clean, transient free switching by designing electrically compatible drivers.

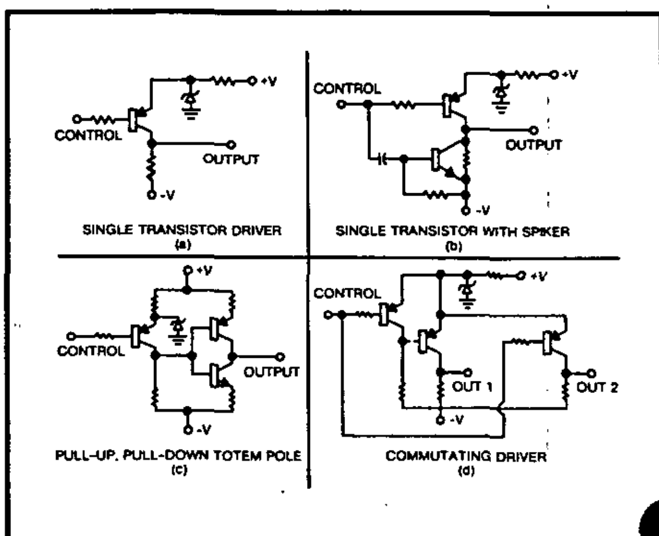


Figure 10. TTL driver circuits.

"Unit load" drivers are highly desireable because they are compatible with the widest range of TTL product line I.C.s. A "unit load" is defined as 40 microamperes maximum source current and 1.6 milliamperes maximum sink current. Drivers are available in multiples of "unit load." True TTL compatibility also requires a logic "low" to be 0-.8 volts and a logic "high" to be 2.0-5.0 volts at the input (0.8-2.0 volts is an undefined region.)

All TTL compatible drivers have delay. Generally the driver delay is defined as the time from 50% TTL level to where the RF signal changes by 10%, i.e., 0-10% for turn-on or 100-90% for turn-off. It is caused by energy storage in the driver and/or RF circuitry. The delay is a result of the time required to remove the stored energy before the switch state can be changed. The stored energy can be stored charge in the base region of a switching transistor or stored in various capacitors and inductors in the driver circuit or the bias decoupling circuit. Often this delay is different for turn-on or turn-off. This phenomenon can lead to pulse shrinkage or pulse expansion when the PIN switch is operated in a pulse mode. Since driver delay is consistent from unit to unit in a well designed PIN switch, a systems designer can often pre-trigger the switch and essentially "program-out"the driver delay. When it is not possible to anticipate the delay, it is necessary to specify delay equalization. An example of a PIN switch with equalized delay is the AMC model SW-218-1A series pulse modulator with modulation characteristics shown in figure 11. This unit has on/off delay equalization to 5 ns, maximum.

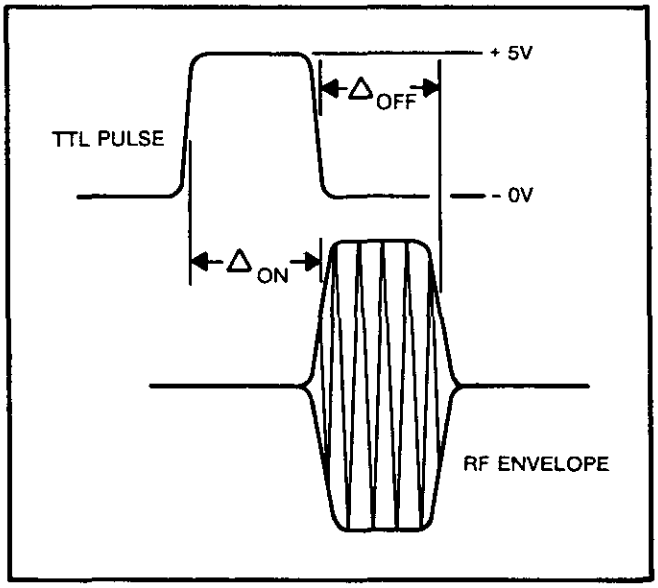


Figure 11. Driver delay equalized.

Another phenomenon of driver delay is minimum pulse width. Since delay involves charging and discharging of components within the driver circuit, it is necessary to "charge" or "discharge" the driver before any RF changes in signal level are observed. This results in minimum pulse width for any switch with integral logic drivers. The minimum pulse width is approximately equal to the delay in the driver.

X. PHASE TRACKING

Often systems require switches that are "phase tracked". A phase tracking requirement is best achieved by first equalizing the time delay between arms of a multi-throw switch (if a multi-throw is indicated) and equalizing the time delay from unit to unit within a production run or product line, if required.

Since the PIN switch is made up internally of many elements, i.e., diodes, capacitors, and chokes with their accompanying mounting parasitic reactances and losses, it is necessary to control the uniformity of parts and assembly techniques to achieve best phase tracking.

For unit-to-unit phase tracking on a lot-to-lot basis, it is necessary to build a phase standard unit that is maintained at the switch vendor's facility which has an impact on the price of the initial lot of switches.

Typical state-of-the-art phase tracking is as follows:

BAND	PHASE TRACKING
HF	1 Degree
UHF/VHF	2 Degrees
Microwave	10 Degrees

XI. OFF ARM TERMINATIONS

Often PIN switches are employed to commutate or switch VSWR sensitive components such as antenna elements in an array, oscillators or amplifiers. Normally, switches have an infinite VSWR in the OFF position. Figure 12 shows a switch with off arm terminations having an extra switching section that switch the terminal in question into a matched load when that arm is turned off. This, in effect, controls and stabilizes the VSWR in both the ON and OFF condition of the switch. You must specify off arm terminations when it is necessary to control OFF VSWR.

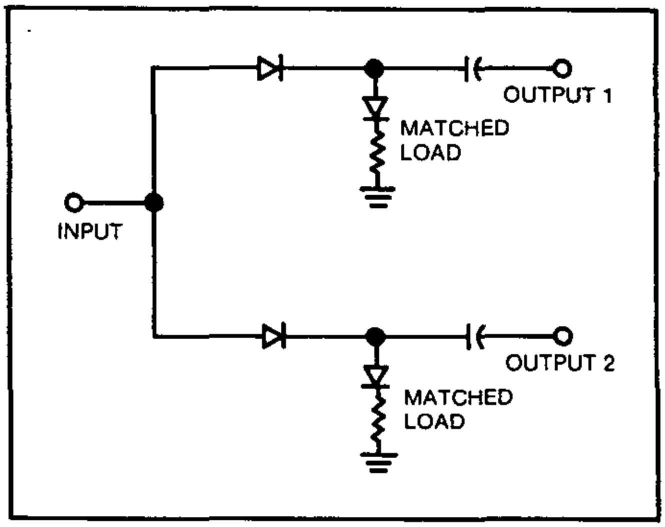


Figure 12. Off arm terminations.

Be aware that when the specified arm is commutated or switched there is a period of time when the VSWR is unspecified. This is particularly important in high power switches where momentary high reflected power levels can be troublesome.

The addition to off arm terminations adds complexity to the switch which results in additional insertion loss and poorer phase tracking.

XII. INTERCEPT POINT OR COMPRESSION POINT

Compression in a PIN switch is a less well defined parameter than in, say, an amplifier. So, we will limit our remarks in this section to intercept point. The concept of intercept point is well documented in the literature and we will not go into it here. Rather, we will examine the elements that control intercept point of PIN diode switches and their tradeoff on overall switch performance.

Intermodulation is a result of nonlinear mechanisms within the PIN diode primarily and occasionally caused by other elements such as nonlinear capacitors, resistors, and/or ferrite cores in the bias decoupling chokes. We will confine this discussion to the PIN diode only.

The primary intermod generator in a PIN switch is the forward biased series PIN diode. Intermod is generated in the diode when the stored charge becomes close to being swept out (or depleted) from the I layer region. Hence, low intermod switches employ diodes with longer than minimum minority carrier lifetimes and are biased at relatively high forward currents to store a lot of charge in the junction. The degree of linearity is controlled by the percentage of charge depleted from the junction by the RF cycle. Highly linear switches have small percentage of charge depletion. See reference 3 for a more complete discussion of Intermodulation Distortion Mechanisms.

A secondary intermod generator is the non-linear capacitance vs voltage characteristic of the reversed biased PIN diode. This phenomenon is relatively easily controlled by selecting diodes with flat capacitance vs voltage characteristics and biasing the device into that region of the curve.

XIII. VIDEO TRANSIENTS

Refer to figure 13, the equivalent circuit of a typical PIN switch. When the diodes are switched between biasing conditions, a change of voltage or current occurs at the bias decoupling element adjacent to the output terminals. This element acts to differentiate the waveform (current for the shunt inductor and voltage for the series capacitor) and cause a pulse, spike, or video transient at the output terminal. This transient occurs in all PIN switches but is controlled by various means.

The most effective means of controlling video transients are:

1) Slowing the switching waveform

2) Filtering the video spectrum

3) Balancing or cancelling two equal video transients

The first is very effective when switching speed is not important. Slowing the switching waveform will slow switching speed. The second is effective when the switch operating band is above the frequency band where the video spectrum is concentrated. The addition of high pass filters at the input and output terminals of PIN switches at frequencies above 500 MHz has proven very effective in reducing transients. Typically, the highest speed switches (1ns) have at least 90% of the video spectrum below 1 GHz. Filtering has its accompanying side effects. It will often introduce unwanted "ringing" in the switching waveform. Balancing has been employed very effectively as a means of reducing video transients without affecting switching speed or introducing "ringing". Unfortunately, present state-of-the-art technology has limited balancing technique to UHF/VHF band. An example of the balancing technique is the AMC SWB-0700 series of IF switches shown in figure 14.

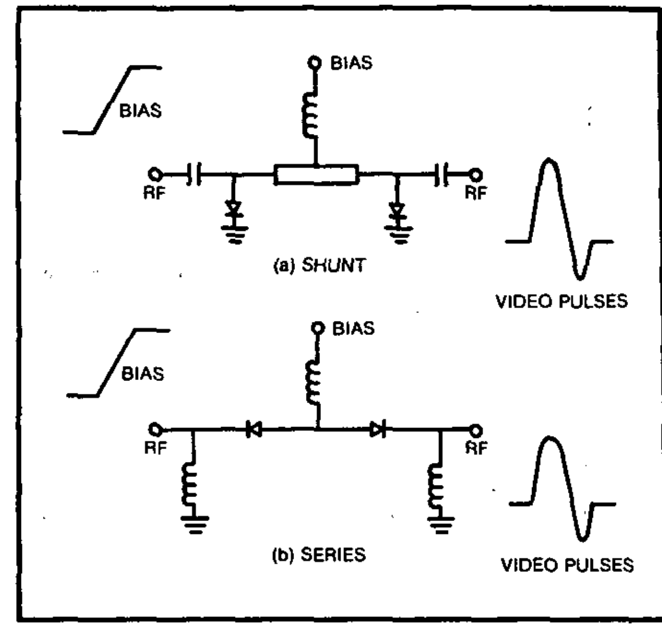


Figure 13. PIN switch equivalent circuits.

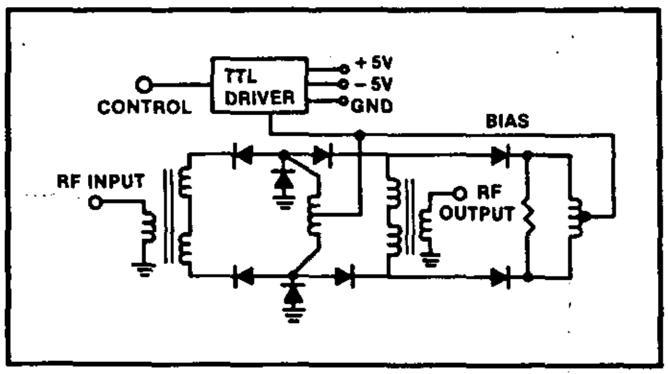


Figure 14.

XIV. CONCLUSION

Six essential and five supplementary parameters have been presented to aid in the specification of PIN diode switches. Tradeoffs between the various parameters have also been explored. It is hoped that this will help bridge the gap between switch users and switch designers.

A sample specification is presented in figure 15 to serve as a prototype switch specification to aid in bridging the gap.

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SWITCH SPECIFICATIONS DATA SHEET

CUSTOMER: ______________________________ MODEL: ____________ OPT.: ____________

1.0 CONFIGURATION:

2.0 FREQUENCY BAND (GHZ):

3.0 INSERTION LOSS:

- 3.1) MAXIMUM:
- 3.2) VARIATION:

4.0 ISOLATION:

- 4.1) MINIMUM:
- 4.2) TYPICAL:

5.0 SWITCHING SPEED:

- 5.1) 50% TTL TO 90% RF
- 5.2) 50% TTL TO 10% RF
- 5.3) 10% RF TO 90% RF
- 5.4) 90% RF TO 10% RF

6.0 VSWR:

- 6.1) INPUT
- 6.2) OUTPUT (ON)
- 6.3) OUTPUT (OFF)

7.0 RF POWER:

- 7.1) CW
- 7.2) PEAK POWER
- 7.3) PULSE DUTY RATIO

8.0 CONTROL: NO DRIVER ☐
TTL DRIVER ☐
TTL DECODER ☐

9.0 POWER SUPPLY: VOLTAGE CURRENT (mA)

VOLTAGE	CURRENT (mA)
+5	
+15	
−5	
−15	

10.0 CONNECTORS:

- 10.1) RF: SMA N BNC TNC
- 10.2) POWER: MULTI-PIN SOLDER PIN
- 10.3) CONTROL: SOLDER PIN SMC SMA

11.0 INTERCEPT POINT:

11.1 3rd ORDER
_____dBm @ _____dBM input power

11.2 2nd ORDER
_____dBm @ _____dBm input power

12.0 VIDEO TRANSIENTS:

_____MV, MAX

13.0 PHASE TRACKING:

_____DEGREES MAXIMUM DEVIATION

Figure 15.

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References:

1. R. N. Assaly, "PIN Diode Switches for Space Applications," MTT, 1967.
2. M/A COMM PIN Diode Designers' Guide, 1983.
3. R. H. Cauerly and G. Hiller, "Distortion in PIN Diode Control Circuits," IEEE Transactions on Microwave Theory and Techniques, MMT-35, p492.

NOTES

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SWITCH SPECIFICATIONS DATA SHEET

CUSTOMER: ______________________ MODEL: __________ OPT.: __________

1.0 CONFIGURATION:

2.0 FREQUENCY BAND (GHZ):

3.0 INSERTION LOSS:

3.1) MAXIMUM:
3.2) VARIATION:

4.0 ISOLATION:

4.1) MINIMUM:
4.2) TYPICAL:

5.0 SWITCHING SPEED:

5.1) 50% TTL TO 90% RF
5.2) 50% TTL TO 10% RF
5.3) 10% RF TO 90% RF
5.4) 90% RF TO 10% RF

6.0 VSWR:

6.1) INPUT
6.2) OUTPUT (ON)
6.3) OUTPUT (OFF)

7.0 RF POWER:

7.1) CW
7.2) PEAK POWER
7.3) PULSE DUTY RATIO

8.0 CONTROL: NO DRIVER ☐
TTL DRIVER ☐
TTL DECODER ☐

9.0 POWER SUPPLY:

VOLTAGE	CURRENT (mA)
+5	
+15	
−5	
−15	

10.0 CONNECTORS:

10.1) RF: SMA N BNC TNC
10.2) POWER: MULTI-PIN SOLDER PIN
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11.0 INTERCEPT POINT:

11.1 3rd ORDER
_____dBm @ _____dBM input power

11.2 2nd ORDER
_____dBm @ _____dBm input power

12.0 VIDEO TRANSIENTS:

_____MV, MAX

13.0 PHASE TRACKING:

_____DEGREES MAXIMUM DEVIATION

Figure 15.

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