HEWLETT hp PACKARD

COMPONENTS

FOR CONTROL AND CONVERSION OF RF AND MICROWAVE SIGNALS

1973-74

INTRODUCTION

INTRODUCTION. Hewlett Packard has a variety of high frequency control and conversion components which are primarily designed for the OEM market. Heretofore, information about these products has been available mostly in individual data sheets. Now, details on all high frequency control and conversion components have been compiled in a single document.

We have attempted to include enough specifications to allow the designer to determine the suitability of these components to his system. However, data sheets are available for all of these products which include much more detailed information. A call to your local HP sales office will get the appropriate data sheets to you immediately.

Some of these components were designed to fulfill exacting measurement requirements; others were designed specifically for aerospace applications and similar rugged environments. They all share certain common features: HP's reputation for excellent design, careful manufacturing, conservative specification, and thorough testing.

HIGH RELIABILITY. All of these products have been designed to operate in some level of extreme environments. An indication of this is the operating temperature which is shown for each product.

In addition, they all have been fully characterized for other environmental characteristics, and their ratings for vibration, shock, altitude, moisture and so on are listed in the individual data sheets. Wherever appropriate, the components are rated per MIL-E-5400, MIL-E-16400, and similar documents.

Furthermore, most of these products have an extensive Hi-rel history. HP switching modules went to the moon on all of the Apollo missions, and these components have been included in most of the recent major aerospace programs. The Hi-rel programs necessary for such critical applications were carried out by HP's well staffed and fully equipped high reliability department.

If your application requires high reliability, HP can tailor a program to fit your needs. Many of the past programs have been documented, and the results are available for your inspection. Your local HP component sales engineer has the details.

APPLICATIONS. A new application note discussing some of these products is now available: AN-932, Selection And Use Of Microwave Diode Switches And Limiters. A practical how-to-do-it approach is used throughout; some of the thoroughly covered topics are:

- The effects of system mismatches, and how to minimize these effects.
- How to select the proper switch for switching, attenuating, or modulating.
- How to change the threshold and slope of a limiter.
- The tradeoffs involving selection of coaxial modules, stripline modules, or complete switches.
- How to design bias networks.
- Multi-throw circuits.
- Driver circuits.
- How to test switches and limiters.
- How to construct module test fixtures.

If you are using diode switches or limiters, or are considering their use in your system, AN-932 is a must. For your copy contact your local HP sales office.

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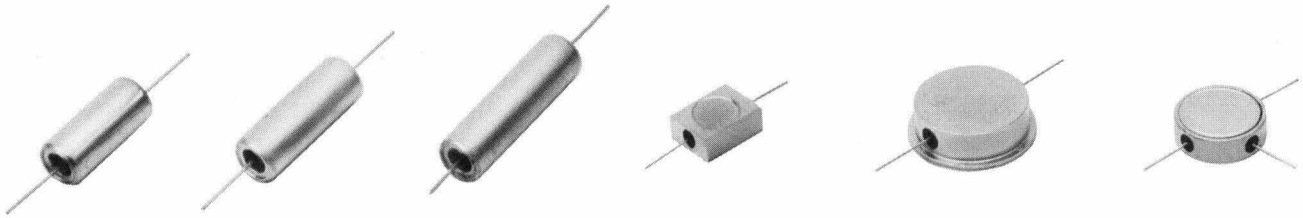
SWITCHING MODULES



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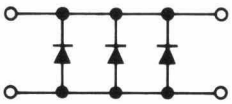
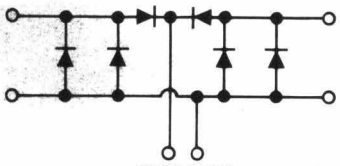


TYPICAL OF
33600 SERIES
33500 SERIES



TYPICAL OF
33007 A/B

DESCRIPTION. The 33500/33600 series consists of two, three, or four passivated PIN diode chips integrated as shunt elements in a hermetically sealed 50 ohm module. When the diodes are forward biased incident power is reflected back to the source. The amount of power reflected is a function of the bias level, so the module can be used as a variable attenuator or a modulator, in addition to its use as a switch.

The 33007 SPDT module uses six passivated pin diodes, four mounted in shunt and two in series. The series diodes provide the broad bandwidth double throw circuit; the shunt diodes contribute high isolation at higher frequencies. As with the SPST modules, the 33007 package is a hermetically sealed 50 ohm transmission line.

GUARANTEED

hp	DESCRIPTION	PACKAGE	FREQUENCY RANGE GHz	SWITCHING SPEED	BIAS POLARITY FOR OFF	POWER HANDLING		BIAS mA
						CW	PEAK	
33602A	2 High Isolation Diodes, Coax Pkg.	A	DC to 18	50 ns	Neg	2W	80W	-100
33603A	3 High Isolation Diodes, Coax Pkg.	B	DC to 18	50 ns	Neg	2W	80W	-150
33604A	4 High Isolation Diodes, Coax Pkg.	C	DC to 12.4	50 ns	Neg	2W	80W	-200
33622A	2 Fast Switching Diodes, Coax Pkg.	A	DC to 15	10 ns	Pos	2W	4W	+100
33623A	3 Fast Switching Diodes, Coax Pkg.	B	DC to 15	10 ns	Pos	2W	4W	+150
33624A	4 Fast Switching Diodes, Coax Pkg.	C	DC to 12.4	10 ns	Pos	2W	4W	+200
33530A	2 High Isolation Diodes, Disc Stripline Pkg.	D	DC to 18	50 ns	Neg	2W	80W	-100
33535A	2 High Isolation Diodes, Rectangular Stripline Pkg.	E	DC to 18	50 ns	Neg	2W	80 W	-100
33540A	2 Fast Switching Diodes, Disc Stripline Pkg.	D	DC to 12.4	10 ns	Pos	2W	4W	+100
33007A	Single Pole Double Throw, Stripline Pkg.	F	DC to 18	100 ns	Neg (Off Arm) Pos (On Arm)	1W	50W	+50 -50
33007B	Single Pole Double Throw, Stripline Pkg.	F	DC to 12.4	100 ns	Neg (Off Arm) Pos (On Arm)	1W	50W	+50 -50

SWITCHING MODULES

APPLICATIONS. Switching modules are used as the heart of microwave control circuits. Combined with the appropriate biasing and blocking circuits these modules will perform most of the switching, attenuating, and modulating functions encountered in modern microwave systems. A choice of number of diodes, type of diodes, and module package styles mean that there is some member of the 33500/33600 family to satisfy most SPST control requirements. The 33007 can be used as the essential part of almost any multi-throw switching circuit.

BROAD BANDWIDTH. Integration of diode chips directly into a sealed transmission line means that package parasitics, the bane of broadband circuits, has been eliminated. These modules function from DC to frequencies up to 18 GHz, and the practical circuits are limited only by the bias circuitry. Some switches, such as the HP 33100 series and the 33016 SPDT, operate over more than two decades in the microwave region.

CHOICE OF PACKAGES. Available are coaxial modules, in varying lengths to accomodate different numbers of diodes; two varieties of stripline modules; and a three port stripline module for the SPDT switch.

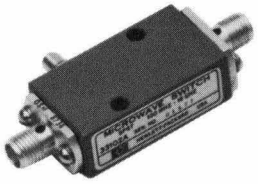
CHOICE OF DIODES. In the SPST modules, two types of PIN Diodes are available: the high isolation series, for general purpose applications; and the fast switching series, for those applications requiring very fast rise and fall times or high frequency modulation rates. Two, three, or four diodes are available; tradeoffs can be made between isolation and insertion loss, package size, and cost.

WANT MORE DETAILS? The 33500/33600 Data Sheet gives full technical and applications information on the SPST modules; for details on the SPDT modules, ask for the 33016/33007 Data Sheet.

SPECIFICATIONS

ISOLATION, dB FREQUENCY, GHz							BIAS VOLTS	INSERTION LOSS, dB FREQUENCY, GHz							BIAS VOLTS	VSWR FREQUENCY, GHz							OPERATING TEMPERATURE	hp
0-1	1-2	2-4	4-8	8-12	12-15	15-18		0-1	1-2	2-4	4-8	8-12	12-15	15-18		0-1	1-2	2-4	4-8	8-12	12-15	15-18		
30	35	40	45	45	45	45	0	0.5	0.5	0.7	1.2	1.5	2.0	2.0	0	1.5	1.5	1.5	2.0	2.0	2.2	2.2	−65° to +150°C	33602A
35	55	60	60	60	60	60	0	0.3	0.8	0.8	1.5	1.5	2.3	2.3	0	1.5	1.7	2.0	2.0	2.0	2.4	2.4	−65° to +150°C	33603A
43	65	80	80	80			0	0.4	0.8	1.0	1.3	1.5			0	1.5	1.6	1.7	1.7	1.7			−65° to +150°C	33604A
25	28	33	39	45	45		-10	0.5	0.5	0.7	1.2	1.5	2.0		-10	1.5	1.5	2.0	2.0	2.0	2.2		−65° to +150°C	33622A
28	35	45	55	60	60		-10	0.3	0.5	0.7	0.9	1.5	2.0		-10	1.5	1.5	1.5	1.7	2.0	2.0		−65° to +150°C	33623A
30	45	60	75	80			-10	0.3	0.5	0.6	1.1	2.0			-10	1.5	1.5	1.5	1.7	2.3			−65° to +150°C	33624A
25	35	40	45	45	45	45	0	0.7	0.7	1.0	1.0	1.5	1.8	1.8	0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	−65° to +150°C	33530A
25	35	40	45	45	45	45	0	0.7	0.7	1.0	1.0	1.5	1.8	1.8	0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	−65° to +150°C	33535A
20	30	35	45	45			-10	0.7	0.7	1.0	1.5	2.0			-10	2.0	2.0	2.0	2.0	2.0			−65° to +125°C	33540A
70	70	70	60	55	50	50	+50 mA -50 mA	1.0	1.0	1.0	1.5	2.0	2.5	2.5	+50 mA -50 mA	1.3	1.4	1.4	1.4	1.6	1.8	1.8	−65° to +125°C	33007A
70	70	70	60	55			+50 mA -50 mA	1.0	1.0	1.0	1.5	2.0			+50 mA -50 mA	1.3	1.5	1.5	1.6	1.8			−65° to +125°C	33007B

SWITCHES



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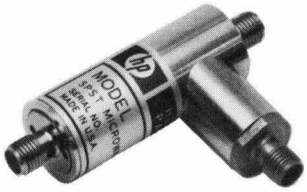

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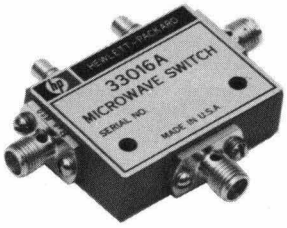

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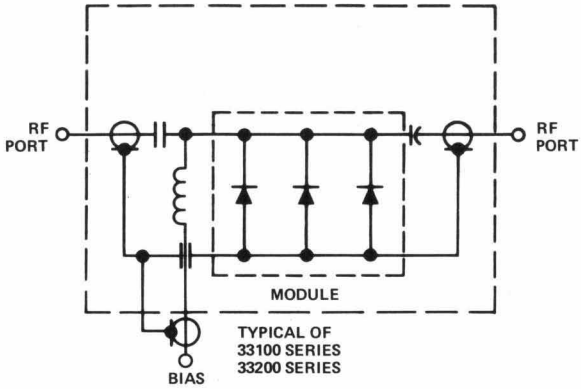
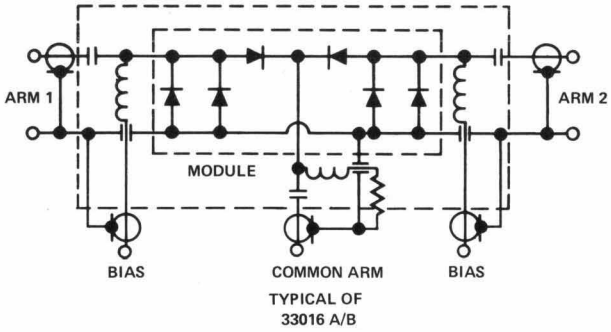




DESCRIPTION. The 33100 and 33200 series are complete SPST switches, combining the 33600 series coaxial switching modules with biasing and blocking networks and connectors. All of the flexibility of the 33600 series is incorporated in these components; in addition, the two series offer the user further choice. The 33100 series offers small size, light weight, and an exceptionally wide bandwidth. The 33200 series offers a wide variety of connectors, bias networks optimized for lowest insertion loss over octave bandwidths, slightly faster switching speed, and a greater operating temperature range.

The 33016 is a complete SPDT switch, combining wideband bias networks with a version of the 33007 module optimized for coaxial interface. Like the 33007, two bandwidths are available: 0.1 to 18 GHz and 0.1 to 12.4 GHz at a lower price.

GUARANTEED

	DESCRIPTION	PACKAGE	FREQUENCY RANGE	SWITCHING SPEED	BIAS POLARITY FOR OFF	POWER HANDLING		BIAS mA
						CW	PEAK	
33102A	2 High Isolation Diodes, Broadband	G	0.1 to 18 GHz	50 ns	Neg	2W	80W	-100
33103A	3 High Isolation Diodes, Broadband	H	0.1 to 18 GHz	50 ns	Neg	2W	80W	-150
33104A	4 High Isolation Diodes, Broadband	J	0.1 to 12.4 GHz	50 ns	Neg	2W	80W	-200
33122A	2 Fast Switching Diodes, Broadband	G	0.1 to 15 GHz	15 ns	Pos	2W	4W	+100
33123A	3 Fast Switching Diodes, Broadband	H	0.1 to 15 GHz	15 ns	Pos	2W	4W	+150
33124A	4 Fast Switching Diodes, Broadband	J	0.1 to 12.4 GHz	15 ns	Pos	2W	4W	+200
33202A/B	2 High Isolation Diodes, Octave B.W.	K	1 to 18 GHz in Octaves	50 ns	Neg	2W	80W	-100
33203A/B	3 High Isolation Diodes, Octave B.W.	L	1 to 18 GHz in Octaves	50 ns	Neg	2W	80W	-150
33204A/B	4 High Isolation Diodes, Octave B.W.	M	1 to 12.4 GHz in Octaves	50 ns	Neg	2W	80W	-200
33222A/B	2 Fast Switching Diodes, Octave B.W.	K	1 to 15 GHz in Octaves	10 ns	Pos	2W	4W	+100
33223A/B	3 Fast Switching Diodes, Octave B.W.	L	1 to 15 GHz in Octaves	10 ns	Pos	2W	4W	+150
33224A/B	4 Fast Switching Diodes, Octave B.W.	M	1 to 12.4 GHz in Octaves	10 ns	Pos	2W	4W	+200
33016A	Single Pole Double Throw, Broadband	N	0.1 to 18 GHz	100 ns	Neg (Off Arm) Pos (On Arm)	1W	50W	+50 -50
33016B	Single Pole Double Throw, Broadband	N	0.1 to 12.4 GHz	100 ns	Neg (Off Arm) Pos (On Arm)	1W	50W	+50 -50

APPLICATIONS. The 33100 series, 33200 series, and 33016 are complete components, ready to plug into a microwave system. Only the appropriate video pulse or signal is needed to control the switch.

BROAD BANDWIDTH. Both the 33100 series SPST and the 33016 SPDT are fully specified over the frequency range of 100 MHz to 18 GHz.

VERSATILE. The 33200 series switches are designed for maximum flexibility. Combinations of diode types, number of diodes, frequency bands, connectors, and filters add up to 1152 possible versions.

SPECIAL ORDERING INFORMATION.

33016: Order 33016A for 0.1 to 18 GHz
33016B for 0.1 to 12.4 GHz

33100:
Any member of the 33100 series can be ordered with Option 001; this replaces the Conhex (SMC) Jack with an SMA Jack.

33200:
Must be ordered with a three digit option number as follows:

Typical Part Number: 33202 A - 010

Basic part number defines number and type of diodes

Letter suffix defines if bias port lowpass filter is used

	Frequency	RF Connectors	Bias Connector
0	1-2	N Plug	BNC Jack
1	2-4	N Jack	SMA Jack
2	4-8	N Plug/Jack	TNC Jack
3	8-12.4	SMA Plug	
4	12-18*	SMA Jack	
5	8-18*	SMA Plug/Jack	
6	12-15†	TNC Jack	
7	8-15†		

Letter	Filter Used?	Typical Bias Port Isolation
A	No	> 30 DB
B	Yes	> 70 DB

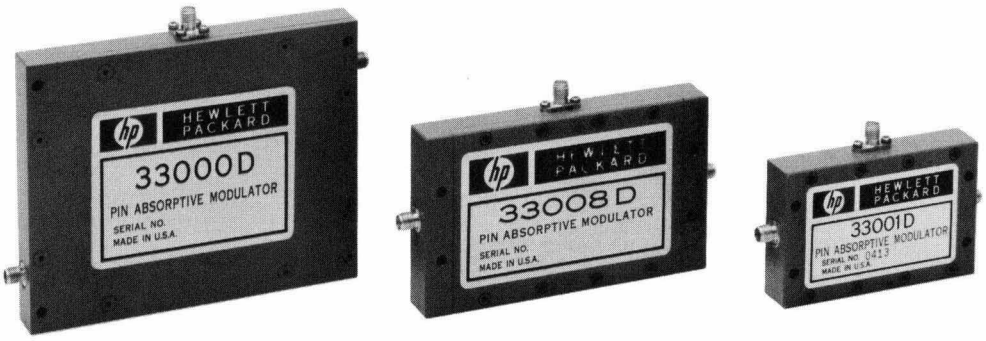
* Only available with 33202, 33203 and SMA RF Connectors
† Only available with 33222, 33223 and SMA RF Connectors

WANT MORE DETAILS? For information on Broadband Miniature Switches, ask for the 33100 Series Data Sheet. To investigate the versatility of the Octave Modular Switches, ask for the 33200 Series Data Sheet. If you are interested in Multi-Throw Switching, ask for the 33016/33007 Data Sheet.

SPECIFICATIONS

ISOLATION, dB FREQUENCY, GHz							BIAS VOLTS	INSERTION LOSS, dB FREQUENCY, GHz							BIAS VOLTS	VSWR FREQUENCY, GHz							OPERATING TEMPERATURE	
0.1–1	1–2	2–4	4–8	8–12	12–15	15–18		0.1–1	1–2	2–4	4–8	8–12	12–15	15–18		0.1–1	1–2	2–4	4–8	8–12	12–15	15–18		
33	35	40	45	45	45	45	0	1.0	1.0	1.3	2.0	2.0	2.5	2.5	0	1.7	1.7	1.8	2.0	2.0	2.5	2.5	−54° to +71°C	33102A
38	55	60	60	60	60	60	0	1.0	1.0	1.4	2.0	2.0	2.7	2.7	0	1.7	1.7	2.0	2.0	2.0	2.5	2.5	−54° to +71°C	33103A
42	65	80	80	80			0	1.0	1.0	1.5	2.1	2.2			0	1.7	1.8	2.0	2.0	2.0			−54° to +71°C	33104A
26	28	33	39	45	45		-10	1.0	1.0	1.2	1.8	2.1	3.0		-10	1.7	1.7	2.0	2.0	2.2	2.5		−54° to +71°C	33122A
30	35	45	55	60	60		-10	1.0	1.0	1.2	1.7	2.1	3.0		-10	1.7	1.7	2.0	2.2	2.5	2.5		−54° to +71°C	33123A
32	45	60	75	80			-10	1.0	1.0	1.3	1.9	2.7			-10	1.7	1.7	2.0	2.2	2.7			−54° to +71°C	33124A
	35	40	45	45	45	45	0		0.7	1.0	1.6	2.0	2.5	2.5	0		2.0	2.0	2.0	2.0	2.5	2.5	−55° to +125°C	33202A/B
	55	60	60	60	60	60	0		1.0	1.1	1.9	2.0	2.8	2.8	0		2.0	2.0	2.0	2.0	2.5	2.5	−55° to +125°C	33203A/B
	65	80	80	80			0		1.0	1.3	1.7	2.0			0		2.0	2.0	2.0	2.0			−55° to +125°C	33204A/B
	28	33	39	45	45		-10		0.7	1.0	1.6	2.0	2.5		-10		2.0	2.0	2.0	2.0	2.5		−55° to +125°C	33222A/B
	35	45	55	60	60		-10		0.7	1.0	1.3	2.0	2.5		-10		2.0	2.0	2.0	2.0	2.5		−55° to +125°C	33223A/B
	45	60	75	80			-10		0.7	1.0	1.5	2.5			-10		2.0	2.0	2.0	2.0			−55° to +125°C	33224A/B
70	70	70	60	55	50	50	+50 mA -50 mA	1.0	1.5	1.5	1.5	2.5	3	3	+50 mA -50 mA	1.4	1.4	1.4	1.6	1.8	2.0	2.0	−55° to +125°C	33016A
70	70	70	60	55			+50 mA -50 mA	1.0	1.5	1.5	1.5	2.5			+50 mA -50 mA	1.4	1.4	1.5	1.8	2.0			−55° to +125°C	33016B

ABSORPTIVE MODULATORS



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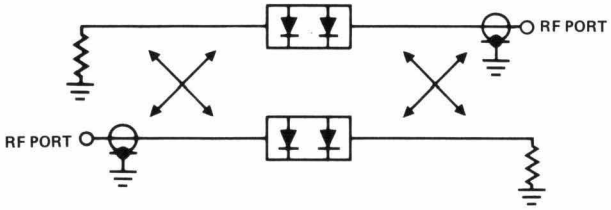


DESCRIPTION. The 33000 series Absorptive Modulators combine 33600 coaxial switching modules, quadrature hybrid couplers, and internal loads to form non-reflective control elements. When the unit is biased to attenuate some or all of the input signal, this unwanted power is absorbed in one of the internal loads, rather than reflected to the source.

The modulators are available in six versions, covering three frequency ranges (1-4 GHz, 3.7-8 GHz, and 8-18 GHz) and two attenuation ranges (40 and 80 dB). The 33602A modules are used in the 40 dB version, the 33604A in the 80 dB version; and the characteristics of the modules are reproduced in the modulators.

Video blocking filters and bias networks are integrated into the modulator.

GUARANTEED

	DESCRIPTION	PACKAGE	FREQUENCY RANGE	SWITCHING SPEED	BIAS POLARITY FOR OFF	POWER HANDLING		BIAS mA
						CW	PEAK	
33000C	Medium Isolation, L-S Band	P	1 to 4 GHz	50 ns	Neg	2W	100W	100
33000D	High Isolation, L-S Band	P	1 to 4 GHz	50 ns	Neg	2W	100W	400
33008C	Medium Isolation, C Band	Q	3.7 to 8 GHz	50 ns	Neg	2W	100W	100
33008D	High Isolation, C Band	Q	3.7 to 8 GHz	50 ns	Neg	2W	100W	200
33001C	Medium Isolation, X-P Band	R	8 to 18 GHz	50 ns	Neg	2W	100W	75
33001D	High Isolation, X-P Band	R	8 to 18 GHz	50 ns	Neg	2W	100W	75

ABSORPTIVE MODULATORS

APPLICATIONS. The absorptive modulars can be used for any switching, attenuating, or modulating application where diode control elements are appropriate. They are particularly suited to measurement systems, oscillator leveling, and other applications where reflective components cause measurement errors, frequency pulling, or other unwanted effects.

BROAD BANDWIDTH. The 33000 series Modulators cover 1 to 18 GHz in 3 bands which range from over an octave to two octaves. All of these modulators can be used at frequencies outside of their specified range; in some cases with little or no degradation of specifications. Check with your HP Components Sales Engineer for details.

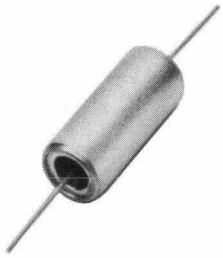
MINIMUM VIDEO FEEDTHROUGH. Each modulator incorporates a bandpass or highpass filter at each RF port, resulting in a minimum leakage of the switching pulse or video control signal at the RF input and output.

WANT MORE DETAILS? Ask for the 33000 Series Absorptive Modulator Data Sheet.

SPECIFICATIONS

ISOLATION dB FREQUENCY, GHz					BIAS VOLTS	INSERTION LOSS dB FREQUENCY, GHz						VSWR at ANY BIAS FREQUENCY, GHz				OPERATING TEMPERATURE	
1-2	2-4	3.7-8	8-12	12-18		1-2	2-4	3.7-8	8-12	12-15	15-18	1-4	3.7-7	7-8	8-18		
35	40				0	1.8	2.5					1.86				−54° to +95°C	33000C
65	80				0	2.0	3.0					1.86				−54° to +95°C	33000D
		45			0			2.3					2.0	2.2		−54° to +95°C	33008C
		80			0			2.5					2.0	2.2		−54° to +95°C	33008D
			45	45	0				3.0	3.2	4.3				2.2	−54° to +95°C	33001C
			80	70	0				3.0	3.5	4.5				2.2	−54° to +95°C	33001D

LIMITERS



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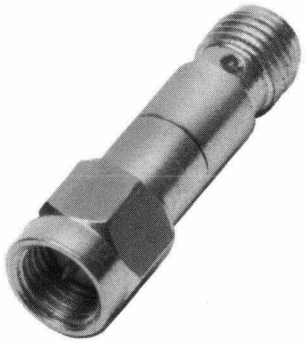

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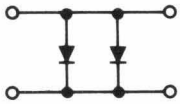


DESCRIPTION. The 33700 series consist of two special passivated PIN diode chips integrated into a hermetically sealed 50 ohm coaxial module. When combined with an external DC return, the module functions as a complete limiter circuit; no additional components are required, and no bias is necessary.

GUARANTEED

	DESCRIPTION	PACKAGE	FREQUENCY RANGE	RECOVERY TIME, MAX	POWER HANDLING		SPIKE LEAKAGE MAX	VSWR (Pin = 1mW) FREQUENCY GHz		
					CW	PEAK		0.4-4	4-8	8-12.4
33701A	Module	A	0.4 to 12.4	20 ns	1W	75W	0.1 erg	1.4	1.5	1.9
33711A	Module with Connectors	S	0.4 to 12.4	20 ns	1W	75W	0.1 erg	1.4	1.5	1.9

APPLICATIONS. Primarily designed as a protection circuit for sensitive mixers, detectors, and amplifiers, the limiter is also usable as a leveling circuit. In addition, the limiter can be biased and used as a switch, modulator, or attenuator.

WIDE FREQUENCY COVERAGE. These limiters are broadband matched from DC to 12.4 GHz; limiting is specified from 0.4 to 12.4 GHz.

LOW LIMITING THRESHOLD. Typical limiting threshold is 15 mW at 0.4 GHz, 5 mW at 12.4 GHz.

ADJUSTABLE THRESHOLD. The application of small bias voltages will raise or lower the threshold by several dB.

ADJUSTABLE LIMITING CURVE. The optimum limiting curve is attained with a DC return of one ohm or less. Changing this resistance alters the slope of this curve for tailored applications.

AVAILABLE IN TWO PACKAGE FORMS. For simple installation, the 33711A is available with SMA Connectors. For integration with other components, the 33701A is available in the modular form.

USABLE AS A SWITCH. The 33701A and 33711A limiters can be externally biased, so they can be used in dual applications as a combination limiter and switch, modulator, or attenuator.

SPECIAL ORDERING INFORMATION. Order 33701A in modular form or 33711A with SMA Connectors.

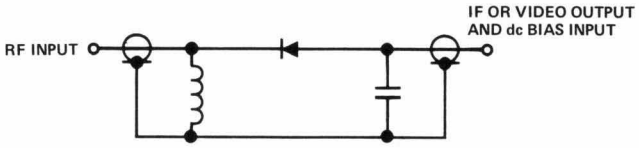
WANT MORE DETAILS? Ask for the 33701/33711 Data Sheet.

SPECIFICATIONS

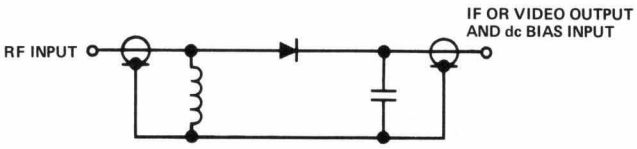
INSERTION LOSS (Pin = 1mW) FREQUENCY, GHz				CW LEAKAGE (Pin = 1W) FREQUENCY GHz					FLAT LEAKAGE (Pin = 75W) FREQUENCY GHz		OPERATING TEMPERATURE	
0.4–2	2–4	4–8	8–12.4	0.4–1	1–2	2–4	4–8	8–12.4	5.6	9.4		
0.4dB	0.8dB	1.2dB	1.9dB	80mW	70mW	60mW	40mW	30mW	150mW	120mW	−65°C to +150°C	33701A
0.4dB	0.8dB	1.2dB	1.9dB	80mW	70mW	60mW	40mW	30mW	150mW	120mW	−65°C to +150°C	33711A

MIXER/DETECTORS

T



TYPE 33801 – REQUIRES POSITIVE dc BIAS



TYPE 33802 – REQUIRES NEGATIVE dc BIAS

DESCRIPTION. The 33800 series consists of a passivated hot carrier diode chip, a bypass capacitor, and a DC return, all of which are integrated into the hermetically sealed 50 ohm coaxial module.

GUARANTEED

Note 1. Specs below guaranteed from 2 to 12.4 GHz; Device is usable to frequencies above 18 GHz.
Note 2. NF, Z_{IF} and VSWR measured with LO Power of 0 dBm and ≈0.4 volts DC Bias.

	DESCRIPTION	PACKAGE	FREQUENCY RANGE (NOTE 1)	POWER HANDLING		PULSE BURNOUT (1 dB INCREASE IN NF)
				CW	PEAK	
33801A/B	Uses Positive DC Bias	T	2 to 12.4 GHz	100mW	200mW	2 ergs
33802A/B	Uses Negative DC Bias	T	2 to 12.4 GHz	100mW	200mW	2 ergs
33803A/B	Matched Pair, 33801 and 33802	T	2 to 12.4 GHz	100mW	200mW	2 ergs

APPLICATIONS. Designed for use as a mixer or detector, the 33800 series is particularly useful where wide RF bandwidths are used.

WIDE FREQUENCY COVERAGE. Specified from 2 to 12.4 GHz, usable to frequencies above 18 GHz.

SMA INPUT AND OUTPUT CONNECTORS. Also available on special order as module without connectors (Package Style B).

COMPLETE CIRCUIT. With the diode, bypass capacitor, and DC return all internal to the module, the 33800 series is a complete mixer/detector circuit. Used as a mixer, the only external circuit needed is a coupler to combine the LO and RF signals; as a detector, nothing else is required: RF in, Video out!

CHOICE OF BYPASS CAPACITORS. Available off the shelf with 17 pF (33801/2/3A) or 10 pF (33801/2/3B) bypass capacitors. Other values are available on special order.

HIGH SENSITIVITY AS A DETECTOR. Typical TSS of 33800 series is −50 dBm with 2 MHz video bandwidth and 50 μA Bias.

CHOICE OF POLARITY. Available with positive bias (33801) or negative bias (33802) configuration.

MATCHED PAIRS FOR BALANCED MIXERS. The 33803 consists of one 33801 and one 33802 matched for noise figure and video impedance.

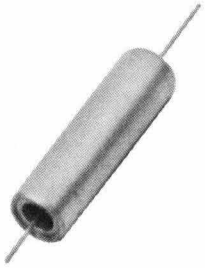
SPECIAL ORDERING INFORMATION. The basic part number defines the bias polarity (or a matched pair of each polarity); the letter suffix defines the bypass capacitor value.

WANT MORE DETAILS? Ask for the 33800 Series Mixer/Detector Module Data Sheet.

SPECIFICATIONS

SSB NOISE FIGURE AT 10 GHz (Includes 1.5dB Amplifier NF)	ΔNF, MAX.	IF IMPEDANCE Ohms (IF=30MHz)	ΔZ_{IF}, Ohms MAX	VSWR,MAX	OPERATING TEMPERATURE	hp
8.5 dB Max		80 Min, 130 Max		2.5	−65° to +125°C	33801A/B
8.5 dB Max		80 Min, 130 Max		2.5	−65° to +125°C	33802A/B
8.5 dB Max	0.3 dB	80 Min, 130 Max	25	2.5	−65° to +125°C	33803A/B

SRD MODULES



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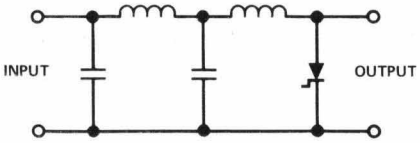
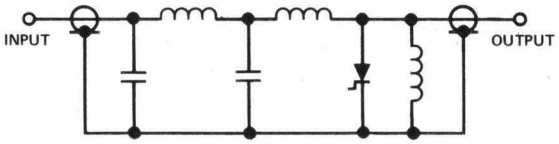


B VERSION



A VERSION

DESCRIPTION. The 33002/3/4/5 SRD Modules combine a step recovery diode, a two element drive network, and a two element matching network into a hermetically sealed 50 ohm integrated circuit. The B version (indicated by the suffix "B" on the Part Number) is the module; the A version combines the module with two SMA connectors and a broadband DC return.

The SRD modules, either A or B version, are available with four standard input frequencies: 100, 250, 500, and 1000 MHZ. The modules can be easily converted to other input frequencies by simple two element external matching.

GUARANTEED

	DESCRIPTION	PACKAGE	INPUT FREQUENCY	INPUT POWER		INPUT VSWR
				NOMINAL	USEFUL RANGE	
33002A	100 MHz Input, with Connectors	U	100 ±5 MHz	500 mW	100 mW to 750 mW	2
33002B	100 MHz Input, Module Form	C	100 ±5 MHz	500 mW	100 mW to 750 mW	2
33003A	250 MHz Input, With Connectors	U	250 ±12.5 MHz	500 mW	100 mW to 750 mW	2
33003B	250 MHz Input, Module Form	C	250 ±12.5 MHz	500 mW	100 mW to 750 mW	2
33004A	500 MHz Input, With Connectors	U	500 ±25 MHz	500 mW	100 mW to 750 mW	2
33004B	500 MHz Input, Module Form	C	500 ±25 MHz	500 mW	100 mW to 750 mW	2
33005A	1000 MHz Input, With Connectors	U	1000 ±50 MHz	500 mW	100 mW to 750 mW	2
33005B	1000 MHz Input, Module Form	C	1000 ±50 MHz	500 mW	100 mW to 750 mW	2

APPLICATIONS. When driven with a sine wave signal at a level of about 1/2 watt, the SRD module produces at the output a train of very narrow pulses (typical pulse width is 130 picoseconds) at a PRF (Pulse Repetition Frequency) equal to the input frequency.

The SRD modules have two normal modes of operation. First, as a pulse generator or comb generator, the module is operated into a broadband load, and the entire output spectrum is utilized. Second, as the vital element in a multiplier, the SRD module is terminated with a resonant network that selects a particular line of the output spectrum and, if properly designed, enhances the power available in that line.

BROADBAND OUTPUT. All SRD modules have guaranteed output power up to 12.4 GHz. The output spectrum distribution is a smooth rolloff from the fundamental to 12.4 GHz, with no "missing teeth" in the comb.

HIGH OUTPUT POWER AVAILABLE. The power generating capability of the SRD modules makes them suitable for use in LO multipliers. For example, a x100 multiplier using a 33002 (100 MHz input) develops 0.5 mW at 10 GHz; with a 33005 (1 GHz input) 10 mW can be obtained at 10 GHz.

NEEDS NO BIAS. The SRD module is self-biased when driven by RF power levels of 100 mW or greater. For unique applications the B versions can be externally biased.

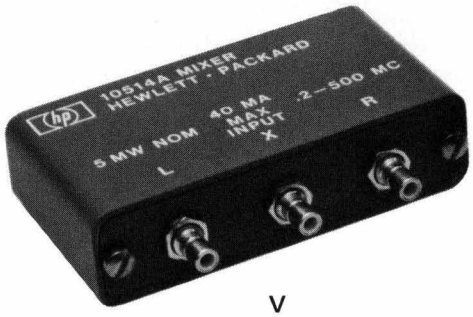
STABILITY. When operated into a broadband load, the SRD module is stable over a wide ambient temperature range (−55°C to +75°C).

WANT MORE DETAILS ? Ask for the 33002/3/4/5 Step Recovery Diode Module Data Sheet.

SPECIFICATIONS

OUTPUT, TIME DOMAIN		OUTPUT, FREQUENCY DOMAIN	MINIMUM OUTPUT PER LINE			OPERATING TEMPERATURE	
PULSE HT. MIN.	PULSE WIDTH MAX.		f in to 4 GHz	4 to 8 GHz	8 to 12.4 GHz		
10 volts	140 ps	Line every 100 MHz to 12.4 GHz	−15 dBm	−25 dBm	−30 dBm	−55° to +75°C	33002A
10 volts	140 ps	Line every 100 MHz to 12.4 GHz	−15 dBm	−25 dBm	−30 dBm	−55° to +75°C	33002B
10 volts	140 ps	Line every 250 MHz to 12.4 GHz	−5 dBm	−15 dBm	−20 dBm	−55° to +75°C	33003A
10 volts	140 ps	Line every 250 MHz to 12.4 GHz	−5 dBm	−15 dBm	−20 dBm	−55° to +75°C	33003B
10 volts	140 ps	Line every 500 MHz to 12.4 GHz	+5 dBm	−5 dBm	−15 dBm	−55° to +75°C	33004A
10 volts	140 ps	Line every 500 MHz to 12.4 GHz	+5 dBm	−5 dBm	−15 dBm	−55° to +75°C	33004B
8 volts	140 ps	Line every 1000 MHz to 12.4 GHz	+5 dBm	0 dBm	−10 dBm	−55° to +75°C	33005A
8 volts	140 ps	Line every 1000 MHz to 12.4 GHz	+5 dBm	0 dBm	−10 dBm	−55° to +75°C	33005B

DOUBLE BALANCED MIXERS



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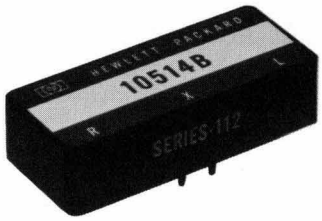

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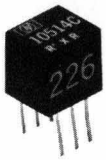

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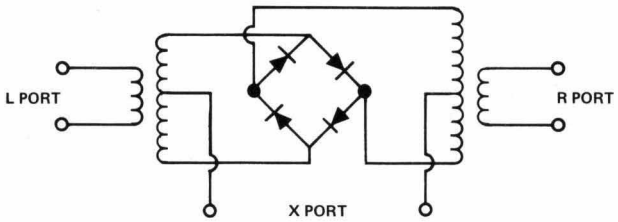


DESCRIPTION. The 10514/34 Double Balanced Mixers combine a matched set of four hot carrier mixer diodes with two transformers, forming a mixer/modulator circuit with all three ports isolated from each oth by balancing rather than filters. This feature, in conjunction with the multi-decade bandwidth, gives rise to an extremely versatile product.

The Double Balanced Mixers are available in two frequency ranges (200 KHz to 500 MHz and 50 KHz to 150 MHz), and three package styles; accessory model, with a choice of connectors; PC board model, for maximum economy; and miniature PC model, for minimum size and weight.

GUARANTEED

	DESCRIPTION	PACKAGE	OPERATING FREQUENCY		POWER HANDLING mA MAX
			RF PORTS	VIDEO PORT MHz	
10514A	500 MHz, With Connectors	V	200 kHz to 500 MHz	DC to 500	40
10514B	500 MHz, PC Board Mounting	W	200 kHz to 500 MHz	DC to 500	40
10514C	500 MHz, Miniature	X	10 MHz to 500 MHz	DC to 500	40
10534A	150 MHz With Connectors	V	50 kHz to 150 MHz	DC to 150	40
10534B	150 MHz, PC Board Mounting	W	50 kHz to 150 MHz	DC to 150	40
10534C	150 MHz, Miniature	X	50 kHz to 150 MHz	DC to 150	40

DOUBLE BALANCED MIXERS

APPLICATIONS. Almost any application involving frequency conversion can be filled with a double balanced mixer. Up-conversion, down-conversion, broadband mixing, phase detection, AM modulation, and balanced modulation (DSB suppressed carrier) are some examples of common applications. In addition, many control functions, such as pulse modulation, switching, and variable attenuation can be done with the double balanced mixer.

LOW NOISE. Guaranteed SSB noise figures range from 6 dB to 9.5 dB depending upon frequency. In addition, these mixers exhibit very low l/f noise (less than 10 nV per root cycle at 10 Hz) a must for phase detectors and low frequency IF systems.

SWITCHING APPLICATIONS. As a switch or pulse modulator, fast switching (1 ns) can be obtained with low current (10 mA). Also, the balanced isolation between ports means that the switching speed is independent of the RF frequency, and very low frequency signals can still be switched in 1 nanosecond.

HIGH ISOLATION BETWEEN PORTS. Operating as a mixer, the LO power is isolated from the RF and IF ports by a minimum of 35 or 40 dB over a 2 decade bandwidth.

SPECIAL ORDERING INFORMATION. The basic part number defines the frequency range; the letter suffix describes the package style. In addition, the A versions which use BNC Jack connectors as standard equipment can be obtained with other connectors by ordering the following options:

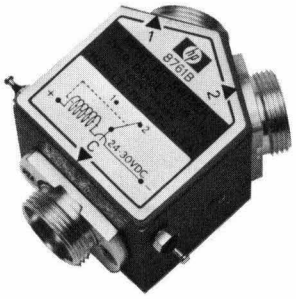
OPTION CODE	CONNECTOR TYPE
001	TNC Jack
002	SMA Jack
003	Sealectro Screw-On
004	Sealectro Snap-On

WANT MORE DETAILS? Ask for the 10514/10534 Double Balanced Mixer Data Sheet.

SPECIFICATIONS

SSB CONVERSION LOSS	SSB NOISE FIGURE	OPERATING TEMPERATURE	hp
7 dB, 0.5 to 50 MHz; 9 dB Full Range	6.5 dB, 0.5 to 60 MHz; 9 dB Full Range	−54° to +75°C	10514A
7 dB, 0.5 to 50 MHz; 9 dB Full Range	6.5 dB, 0.5 to 60 MHz; 9 dB Full Range	−54° to +75°C	10514B
7.2 dB, 15 to 250 MHz; 9 dB Full Range	6.5 dB, 15 to 250 MHz; 9.5 dB Full Range	−54° to +75°C	10514C
6.5 dB, 0.2 to 35 MHz; 8 dB Full Range	6 dB, 0.2 to 50 MHz; 8 dB Full Range	−54° to +75°C	10534A
6.5 dB, 0.2 to 35 MHz; 8 dB Full Range	6 dB, 0.2 to 50 MHz; 8 dB Full Range	−54° to +75°C	10534B
6.5 dB, 0.2 to 35 MHz; 8 dB Full Range	6 dB, 0.2 to 50 MHz; 8 dB Full Range	−54° to +75°C	10534C

COAXIAL SWITCHES



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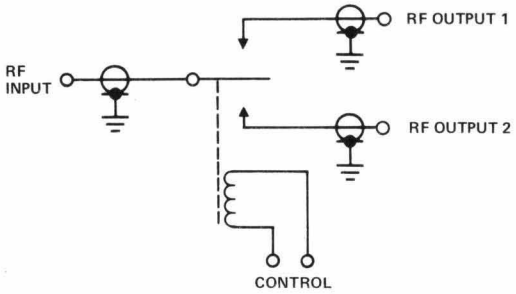


DESCRIPTION. The 8761 Coaxial Switch is a solenoid operated SPDT switch featuring very low VSWR ar insertion loss, and exceptional repeatability over a long lifetime. Available in either 12 or 24 volt versions, this switch has a large variety of connectors or connector/load combinations as standard options.

The unique design of this switch maintains the integrity of the 50 ohm transmission line over a very wic bandwidth, and is fully specified from DC to 18 GHz.

GUARANTEED

	DESCRIPTION	PACKAGE	INPUT FREQUENCY	SWITCHING SPEED, MAX	SOLENOID VOLTAGE	POWER HANDLING		LIFETIME MIN
						CW	PEAK	
8761A	SPDT, 12 volt	Y	DC to 18 GHz	50 ms	± 12 volts	10W	5kW	1 million cy
8761B	SPDT, 24 volt	Y	DC to 18 GHz	50 ms	± 24 volts	10W	5kW	1 million cy

APPLICATIONS. Primarily designed for instrumentation systems where errors cannot be tolerated, the 8761 switch is ideal for any application where low AND consistent VSWR and insertion loss are of prime importance.

OUTSTANDING REPEATABILITY. The singular characteristic of this switch is the design which eliminates sliding contacts yet exhibits almost no stray reactances. This combination leads to repeatability not encountered in other mechanical microwave switches. Typical repeatability after 1 million cycles is 0.02 dB!

SELF LATCHING. Permanent magnet latching allows pulse operation, with pulse widths of only 30 ms. The switch is a break-before-make configuration.

INTEGRAL TERMINATION AVAILABLE. In addition to six varieties of connectors and one cable adaptor, the 8761 switch can also be provided with a built-in 50 ohm termination on one switched port.

SPECIAL ORDERING INFORMATION. Must be ordered with a three digit option number as follows:

Typical Part Number: **8761 A - 056**

- Basic part number
- Letter suffix denotes solenoid voltage
- Connector on common port
- Connector on second switched port
- Connector on first switched port

OPTION CODE	CONNECTOR TYPE
0	Type N Jack
1	Type N Plug
2	7 mm Jack*
3	7 mm Plug*
4	7 mm for UT-250 Coax
5	SMA Jack
6	SMA Plug
7	50 ohm Termination†

* Mates with APC-7 Precision Sexless Connector.
† Available only on one Switched Port.

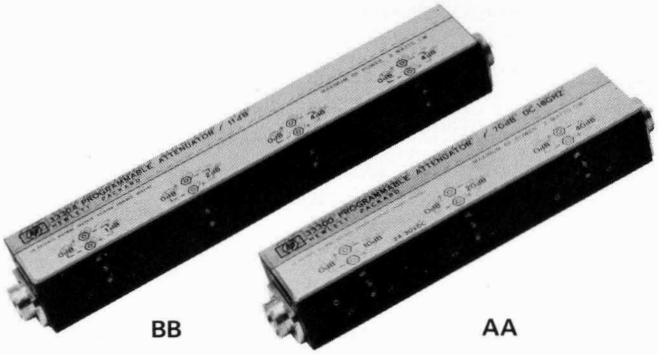
LETTER	VOLTAGE
A	12
B	24

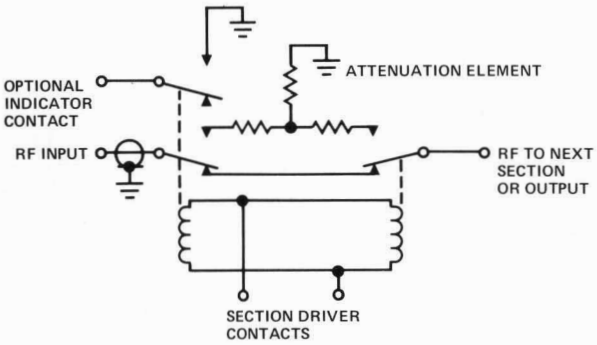
WANT MORE DETAILS? Ask for the 8761 Coaxial Switch Data Sheet.

SPECIFICATIONS

INSERTION LOSS, MAX		ISOLATION, MIN.		VSWR, DC-12.4 GHz			VSWR, 12.4-18 GHz			OPERATING TEMPERATURE	
DC-12.4 GHz	12.4-18 GHz	DC-12.4 GHz	12.4-18 GHz	7mm	Type N	SMA	7mm	Type N	SMA		
0.5 dB	0.8 dB	50 dB	45 dB	1.15	1.20	1.25	1.20	1.25	1.30	−20° to +65°C	8761A
0.5 dB	0.8 dB	50 dB	45 dB	1.15	1.20	1.25	1.20	1.25	1.30	−20° to +65°C	8761B

STEP ATTENUATORS





SECTION ELECTRICAL DIAGRAM
33300/1/4/5

DESCRIPTION. HP offers four electrically controlled programmable step attenuators: 0–70 dB in 10 dB steps, 0–42 dB in 6 dB steps, 0–11 dB in 1 dB step and 0–110 dB in 10 dB steps. The design and operation of all four varieties is the same.

Three or four attenuation sections are connected in cascade on a 50 ohm transmission line. Each section consists of: a thin film attenuation element; a lossless transmission line; and a pair of ganged SPDT switches that connect the input and output to either the attenuation element or the lossless line.

A combination of tantalum-on-sapphire attenuation elements, unique switch designs which allow center-conductor-only switching with no sliding contacts, and careful elimination of reactances results in low VSWR and insertion loss, high accuracy, and unprecedented repeatability. All of these characteristics are maintained from DC to 18 GHz.

GUARANTEED

*Tentative Specifications

	DESCRIPTION	PACKAGE	FREQUENCY RANGE	ATTENUATION		ATTENUATION SECTIONS				POWER HANDLING		SWITCHING SPEED, MAX.	SOLENOID VOLTAGE
				STEPS	TOTAL					CW	PEAK		
33300	Programmable, 70 dB	AA	DC to 18 GHz	10 dB	70 dB	10	20	40		2W	500W	50 ms	±12 or 24V
33301	Programmable, 42 dB	AA	DC to 18 GHz	6 dB	42 dB	6	12	24		2W	500W	50 ms	±12 or 24V
33304	Programmable, 11 dB	BB	DC to 18 GHz	1 dB	11 dB	1	2	4	4	2W	500W	50 ms	±12 or 24V
33305	Programmable, 110 dB	BB	DC to 18 GHz	10 dB	110 dB	10	20	40	40	2W	500W	50 ms	±12 or 24V

APPLICATIONS. The 33300 series programmable attenuators are primarily designed for measurement, checkout, or calibration systems. Their low cost allows them to be used in any application where precise and repeatable attenuation changes are required.

HIGH REPEATABILITY. Typical repeatability ranges from 0.02 dB to 0.05 dB depending upon number of sections and frequency.

INDICATOR CONTACTS AVAILABLE. The programmable version can be provided with indicator contacts for each attenuation section. When the section is in the high attenuation mode, the contacts are closed; in the zero attenuation mode, they are open.

SPECIAL ORDERING INFORMATION. The step attenuators must be ordered with the basic part number, letter suffix, and three digit part number as follows:

33300 Series (Programmable):

Typical Part Number: **33304 C - 055**

- Basic part number defines total attenuation and steps
- Letter suffix defines solenoid voltage and if indicator contacts are used.
- Always zero
- Connector on Port 1
- Connector on Port 2

OPTION CODE	CONNECTOR TYPE
0	Type N Jack
1	Type N Plug
2	7 mm Jack*
3	7 mm Plug*
5	SMA Jack
6	SMA Plug

* Mates with APC-7 Precision Sexless Connector

A	12 volts, no contacts
B	24 volts, no contacts
C	12 volts, with contacts
D	24 volts, with contacts

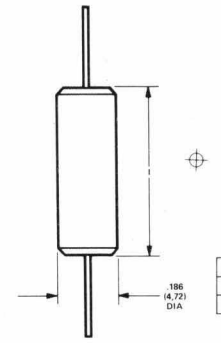
WANT MORE DETAILS? Ask for the 33300 Series Programmable Step Attenuator Data Sheet.

SPECIFICATIONS

LIFETIME, MINIMUM	INSERTION LOSS (f in GHz)	ACCURACY						OPERATING TEMPERATURE	
		DC – 4 GHz		4 – 12.4 GHz		12.4 – 18 GHz			
		MIDRANGE	MAX SETTING	MIDRANGE	MAX SETTING	MIDRANGE	MAX SETTING		
1,000,000 cy	(0.5 + 0.08f) dB	±1.2 dB	±2.1 dB	±1.2 dB	±2.1 dB	±1.6 dB	±2.8 dB	−20° to +55°C	33300
1,000,000 cy	(0.5 + 0.08f) dB	±0.8 dB	±1.2 dB	±0.8 dB	±1.2 dB	±1.0 dB	±2.0 dB	−20° to +55°C	33301
1,000,000 cy	(0.7 + 0.1f) dB	±0.3 dB	±0.5 dB	±0.4 dB	±0.6 dB	±0.8 dB	±0.9 dB	−20° to +55°C	33304
1,000,000 cy	(0.7 + 0.1f) dB	±1.8 dB	±3.3 dB	±1.8 dB	±3.3 dB	±2.4 dB	±4.4 dB	−20° to +55°C	33305

OUTLINE DRAWINGS

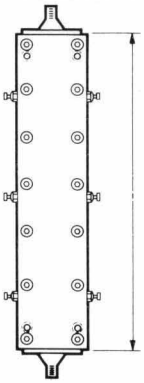
A,B,C



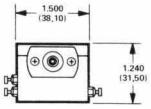
	l
A	.430 (10,92)
B	.530 (13,46)
C	.650 (16,51)

WEIGHT, MAX: 0.08 (2)

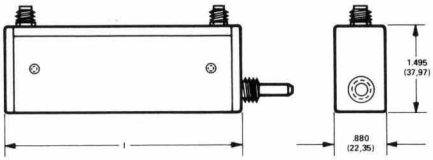
A A,B B



	l	WEIGHT, MAX
AA	6.932 (176,07)	19 (545)
BB	9.282 (235,76)	23 (652)

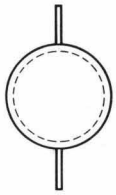


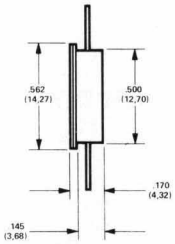
C C,D D



	l	WEIGHT, MAX
CC	3.979 (101,06)	8 (227)
DD	5.064 (128,63)	9.5 (270)

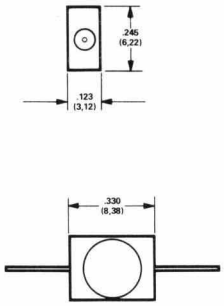
D





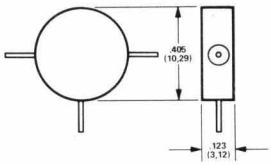
WEIGHT, MAX: 0.15 (4,3)

E



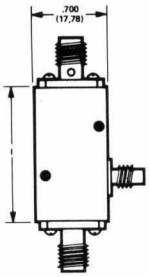
WEIGHT, MAX = 0.08 (2)

F

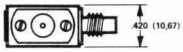


WEIGHT, MAX 0.08 (2)

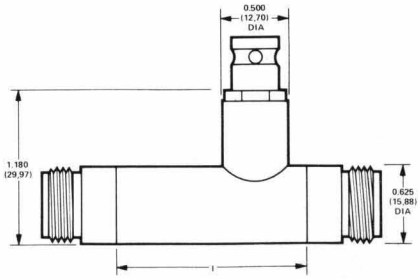
G,H,J



	l	WEIGHT, MAX
G	1.250 (31,75)	0.8 (23)
H	1.350 (34,29)	0.9 (26)
J	1.470 (37,34)	1.0 (29)



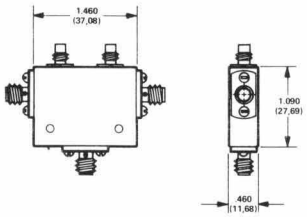
K,L,M



	l	WEIGHT, MAX
K	1.560 (39, 62)	5.1 (145)
L	1.660 (42,16)	5.3 (150)
M	1.780 (45,21)	5.5 (155)

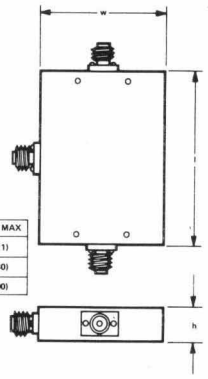
OUTLINE DRAWINGS

N



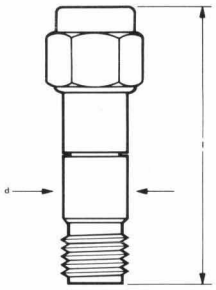
WEIGHT, MAX: 1.6 (45)

P,Q,R



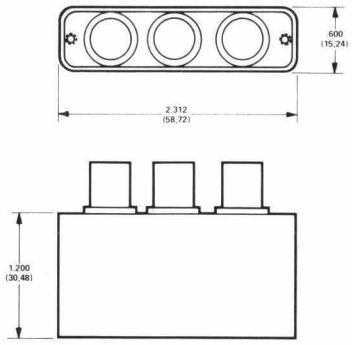
	h	w	l	WEIGHT, MAX
P	.618 (15,70)	3.850 (97,79)	4.900 (124,46)	18 (511)
Q	.625 (15,88)	2.625 (66,68)	4.500 (114,30)	12 (340)
R	.625 (15,88)	2.000 (50,80)	3.200 (81,28)	7 (200)

S,T,U



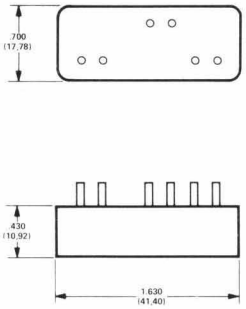
	d	l	WEIGHT, MAX
S	.247 (6,27)	1.060 (26,92)	0.2 (5.5)
T	.247 (6,27)	1.160 (29,46)	0.2 (5.5)
U	.312 (7,92)	1.423 (36,14)	0.36 (10)

V



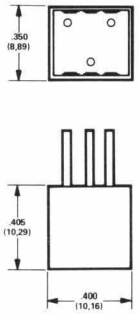
WEIGHT, MAX: 2.1 (59)

W



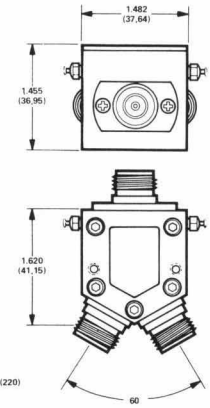
WEIGHT, MAX: 0.5 (14)

X



WEIGHT, MAX: 0.053 (1,5)

Y



WEIGHT, MAX: 8 (220)

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