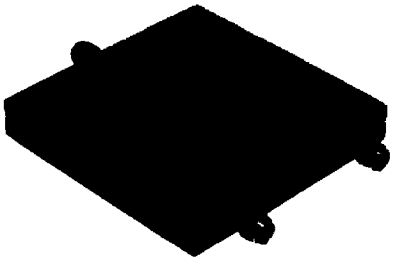
Anaren

Microwave Modulators

Balanced Modulators (up converters)



Features

Good carrier suppression and low VSWR
Low conversion loss
Good intermodulation performance
Good bi-phase tracking
Broadband modulation input

Applications

Up-convertors
Double-sideband modulators
Amplitude modulators
Pulse modulators
Current controlled attenuators
Suppressed carrier systems
Bi-phase modulators
Digital PSK systems

Description

A series of balanced modulators specifically designed to provide excellent carrier suppression and low VSWR. These modulators are a companion line to the ORTHO-QUAD® series of high isolation, low VSWR balanced mixers.

In a typical double-sideband, balanced modulator application an RF (carrier) input and an IF (modulation) input are applied. The RF output consists of the upper (RF + IF) and lower (RF - IF) sidebands. The original RF input (carrier) is suppressed at the output.

The good match of these balanced modulators is independent of the power level at any port. This minimizes the effects of reactive port terminations on intermodulation performance.

In addition to their use as up-convertors, these units provide outstanding performance as bi-phase modulators for high data-rate and digital PSK systems, AM and pulse modulators, and current-controlled attenuators.

Electrical Specifications

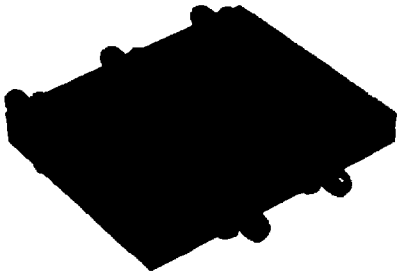
Balanced Modulators

Model No.	Frequency		Carrier* Suppression Min/Typ (dB)	RF VSWR Max/Typ	Conversion Loss** Max/Typ (dB)
	RF Input (GHz)	IF Input (MHz)			
70664	0.5-1.0	DC-150	16/21	1.50/1.20	8.0/6.5
70665	1.0-2.0	DC-250	16/21	1.50/1.20	8.0/6.5
70666	2.0-4.0	DC-250	16/21	1.60/1.20	8.0/6.5
70667	4.0-8.0	DC-400	15/20	1.70/1.25	8.5/7.5
70668	8.0-12.4	DC-400	15/20	1.80/1.35	9.5/8.5
70669	12.4-18.0	DC-600	12/18	2.20/1.50	10.5/9.0

*Relative to desired output **Approximately .5 dB degradation @ +95°C.
RF Input: -5 dBm typ.
IF (Modulation Input): +10 dBm nom. (±10 mA when used as a bi-phase modulator)

Specifications subject to change without notice.

Quadraphase Modulators



Features

Wide modulation bandwidth
Low conversion loss
Excellent Phase accuracy

Applications

High data-rate systems
QPSK modulation
BPSK modulation
Single sideband modulation

Description

These modulators are designed for high data-rate digital communication systems. For quadraphase modulation (QPSK) the modulation input is a pair of bipolar video (IF) pulses of equal amplitude. These pulses digitally modulate the carrier phase to four discrete values: 0, 90, 180 and 270 degrees. The carrier phase state depends on the polarity of the video pulses (i.e., + +, −+, —, +−). The information bandwidth can be as great as 2 GHz depending on the carrier frequency.

If biphase modulation (BPSK) is desired only one modulation drive is used feeding both IF ports simultaneously. A bipolar video pulse train will modulate the carrier to two discrete values: 0 and 180 degrees. The pulse polarities are +, −.

Electrical Specifications

Quadraphase Modulators

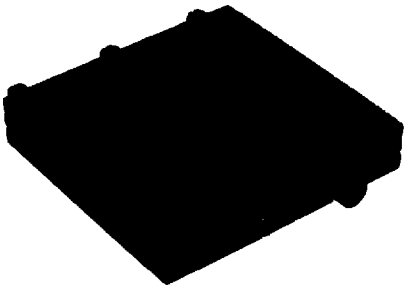
Model No.	Carrier Frequency (GHz)	RF VSWR Max/Typ	Conversion Loss* Max/Typ (dB)	Phase Accuracy (deg)	Modulator Bandwidth (GHz)
260015	1.0-2.0	2.0/1.6	9/7	±10	DC-0.25
260016	2.0-4.0	2.0/1.6	9/7	±10	DC-0.50
260017	4.0-8.0	2.0/1.7	9.5/7.5	±10	DC-0.50
260270	7.5-18.0	3.0/1.8	12/10	±15	DC-1.00
260018	8.0-12.4	2.5/1.7	11/9	±12	DC-0.80
260019	12.0-18.0	3.0/1.8	12/10	±15	DC-1.00

Modulation power: +10 dBm or ±15 mA, typ.
Carrier input power: 0 dBm max.
U.S. Patent No. 3517309 applies.

*Approximately .5 dB degradation @ +95°C.

Specifications subject to change without notice.

Single Side Band Modulators (SSBMs)



Features

High unwanted sideband suppression
Excellent carrier suppression
Low conversion loss
Wideband operation

Applications

SSB communication systems
Down-converter/up-converter systems
Precision frequency offset
Doppler simulators

Description

A single sideband modulator (SSBM) accepts an RF input and a modulation (IF) input and produces either the upper (RF + IF) or lower (RF - IF) sideband. The original RF input (carrier) and the unwanted sideband are suppressed at the output. This is accomplished by using the phase cancellation method of single sideband modulation.

The SSBM is constructed with two IF input ports. By changing the modulating signal from IF_1 to IF_2 either the upper or the lower RF sideband can be selected. Sideband selection can, therefore, be done by IF switching between IF_1 and IF_2.

Two types of Models are offered below. One type (Models having "-DC" suffix in the Model No.) is supplied with no internal IF hybrid. The user must provide a quadrature IF drive, either by using an external 90° hybrid covering covering the IF frequency of interest or by generating two equal amplitude signals differing in phase by 90°. This quadrature drive can be obtained digitally or by differential phase shift networks. Approximately +10 dBm, or ±15 mA, drive is required. The other Model type (Models having -30, -60 etc., suffixes) make use of internal hybrids covering the octave IF bandwidth listed. Units are tested only at one IF frequency (band center), but will meet specifications over the entire IF octave. A single IF input of +10 dBm to +13 dBm is required.

For most SSBM applications the RF input signal is 0 dBm or less and the IF signal is the high level (+10 dBm) switching input. These harmonics can be reduced at the expense of carrier suppression by having the RF input signal as the high level (+10 dBm) input. Consult the factory for more information on this technique. specifically designed to provide excellent carrier suppression and low VSWR. These modulators are a companion line to the ORTHO-QUAD® series of high isolation, low VSWR balanced mixers.

In a typical double-sideband, balanced modulator application an RF (carrier) input and an IF (modulation) input are applied. The RF output consists of the upper (RF + IF) and lower (RF - IF) sidebands. The original RF input (carrier) is suppressed at the output.

The good match of these balanced modulators is independent of the power level at any port. This minimizes the effects of reactive port terminations on intermodulation performance.

In addition to their use as up-convertors, these units provide outstanding performance as bi-phase modulators for high data-rate and digital PSK systems, AM and pulse modulators, and current-controlled attenuators.

Electrical Specifications

Single Sideband Modulators

Model No.	RF Input (GHz)	IF Input[1] (MHz)	Carrier Suppression[2] Min/Typ (dB)	Sideband Suppression[2] Min/Typ (dB)	Conversion Loss* Max/Typ (dB)
90334-DC	.5-1.0	DC-250	18/22	18/25	9/7.5
90334-30		20-40	18/22	18/25	9/7.5
90334-60		40-80	18/22	18/25	9/7.5
90335-DC	1.0-2.0	DC-250	18/22	18/25	9/7.5
90335-30		20-40	18/22	18/25	9/7.5
90335-60		40-80	18/22	18/25	9/7.5
90335-120		80-160	18/22	18/25	9/7.5

(1) Measurements made at 30 MHz IF for DC coupled models and at IF band center for octave units
(2) Carrier suppression is relative to desired output. *Approximately .5 dB degradation @ +95°C.

Specifications subject to change without notice.

Electrical Specifications (Continued)

Single Sideband Modulators

Model No.	RF Input (GHz)	IF Input[1] (MHz)	Carrier Suppression[2] Min/Typ (dB)	Sideband Suppression[2] Min/Typ (dB)	Conversion Loss* Max/Typ (dB)
90336-DC	2.0-4.0	DC-400	15/20	18/25	9/7.5
90336-30		20-40	15/20	18/25	9/7.5
90336-60		40-80	15/20	18/25	9/7.5
90336-120		80-160	15/20	18/25	9/7.5
90336-240		160-320	15/20	18/25	9/7.5
90450-DC	2.6-5.2	DC-50	18/22	17/22	10.5/5
9C0336-DC	3.6-4.3	DC-600	15/20	18/25	9/7.5
9C0336-30		20-40	15/20	18/25	9/7.5
9C0336-60		40-80	15/20	18/25	9/7.5
9C0336-120		80-160	15/20	18/25	9/7.5
9C0336-240		160-320	15/20	18/25	9/7.5
90337-DC	4.0-8.0	DC-600	15/20	18/25	9/7.5
90337-30		20-40	15/20	18/25	9/7.5
90337-60		40-80	15/20	18/25	9/7.5
90337-120		80-160	15/20	18/25	9/7.5
90337-240		160-320	15/20	18/25	9/7.5
9B0420-DC	7.0-16.0	DC-1000	10/16	12/18	13/10
9B0420-60		40-80	10/16	12/18	13/10
9B0420-120		80-160	10/16	12/18	13/10
9B0420-240		160-320	10/16	12/18	13/10
9B0420-480		320-640	10/16	12/18	13/10
9B0420-750		500-1000	10/16	12/18	13/10
90338-DC	8.0-12.4	DC-600	12/16	17/22	11/9
90338-30		20-40	12/16	17/22	11/9
90338-60		40-80	12/16	17/22	11/9
90338-120		80-160	12/16	17/22	11/9
90338-240		160-320	12/16	17/22	11/9
90339-DC	12.4-18.0	DC-600	10/15	12/17	12/9.5
90339-30		20-40	10/15	12/17	12/9.5
90339-60		40-80	10/15	12/17	12/9.5
90339-120		80-160	10/15	12/17	12/9.5
90339-240		160-320	10/15	12/17	12/9.5

(1) Measurements made at 30 MHz IF for DC coupled models and at IF band center for octave units
(2) Carrier suppression is relative to desired output. *Approximately .5 dB degradation @ +95°C.

Specifications subject to change without notice.

Mechanical Specifications

Balanced, Quadrature and Single Sideband Modulators

Model No.	Figure No.	A		B		C		D		E		F		Weight	
		in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	oz	gm
70664	1	3.00	76	3.00	76	2.75	70	1.40	36	1.50	38	–	–	5.9	167
70665	1	2.35	60	2.35	60	2.10	53	1.41	36	1.17	30	–	–	3.5	99
70666	1	2.35	60	2.35	60	2.10	53	1.41	36	1.17	30	–	–	3.8	108
70667	1	2.35	60	2.35	60	2.10	53	1.41	36	1.17	30	–	–	3.6	102
70668	1	2.35	60	2.35	60	2.10	53	1.41	36	1.17	30	–	–	3.6	102
70669	1	2.35	60	2.35	60	2.10	53	1.41	36	1.17	30	–	–	3.6	102
90334-DC	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90334-30	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90334-60	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90335-DC	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90335-30	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90335-60	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90335-120	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90336-DC	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90336-30	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90336-60	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90336-120	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90336-240	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
9C0336-DC	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
9C0336-30	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
9C0336-60	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
9C0336-120	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
9C0336-240	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90337-DC	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90337-30	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90337-60	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90337-120	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90337-240	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	8.3	235
90338-DC	2	3.00	76	2.50	64	2.75	70	2.40	61	1.50	38	1.00	25	7.1	201
90338-30	2	3.00	76	2.50	64	2.75	70	2.40	61	1.50	38	1.00	25	7.1	201
90338-60	2	3.00	76	2.50	64	2.75	70	2.40	61	1.50	38	1.00	25	7.1	201
90338-120	2	3.00	76	2.50	64	2.75	70	2.40	61	1.50	38	1.00	25	7.1	201
90338-240	2	3.00	76	2.50	64	2.75	70	2.40	61	1.50	38	1.00	25	7.1	201
90339-DC	2	3.00	76	2.50	64	2.75	70	2.40	61	1.50	38	1.00	25	7.1	201
90339-30	2	3.00	76	2.50	64	2.75	70	2.40	61	1.50	38	1.00	25	7.1	201
90339-60	2	3.00	76	2.50	64	2.75	70	2.40	61	1.50	38	1.00	25	7.1	201
90339-120	2	3.00	76	2.50	64	2.75	70	2.40	61	1.50	38	1.00	25	7.1	201
90339-240	2	3.00	76	2.50	64	2.75	70	2.40	61	1.50	38	1.00	25	7.1	201
9B0420-DC	2	4.00	102	2.60	66	3.75	95	3.10	79	1.40	36	1.00	25	9.9	281
9B0420-60	2	4.00	102	2.60	66	3.75	95	3.10	79	1.40	36	1.00	25	9.9	281
9B0420-120	2	4.00	102	2.60	66	3.75	95	3.10	79	1.40	36	1.00	25	9.9	281
9B0420-240	2	4.00	102	2.60	66	3.75	95	3.10	79	1.40	36	1.00	25	9.9	281
9B0420-480	2	4.00	102	2.60	66	3.75	95	3.10	79	1.40	36	1.00	25	9.9	281
9B0420-750	2	4.00	102	2.60	66	3.75	95	3.10	79	1.40	36	1.00	25	9.9	281
90450-DC	3	4.20	107	2.70	69	3.96	101	3.44	87	2.00	51	1.00	25	10.9	312
260015	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	5.5	156
260016	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	5.5	156
260017	2	3.00	76	2.90	74	2.75	70	2.40	61	1.90	48	1.00	25	5.5	156
260018	2	3.00	76	2.90	64	2.75	70	2.40	61	1.90	38	1.00	25	4.7	133
260019	2	3.00	76	2.90	64	2.75	70	2.40	61	1.90	38	1.00	25	4.7	133
260270	2	4.10	104	2.64	67	3.86	98	3.40	86	1.40	36	1.00	25	6.8	191

Specifications subject to change without notice.
Contact Anaren for latest outline details.

Outline Drawings

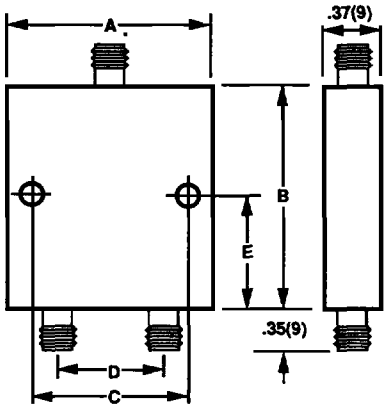


Figure 1

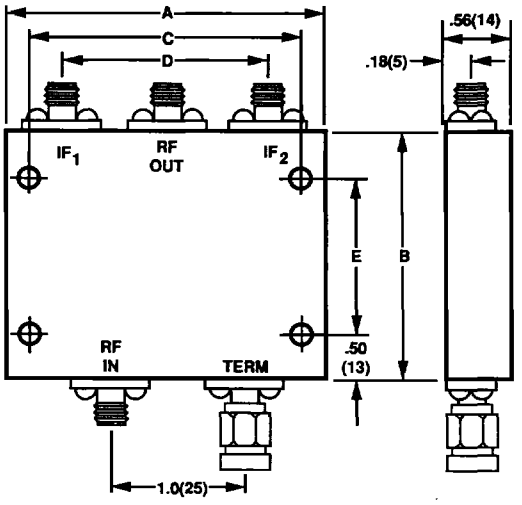


Figure 2

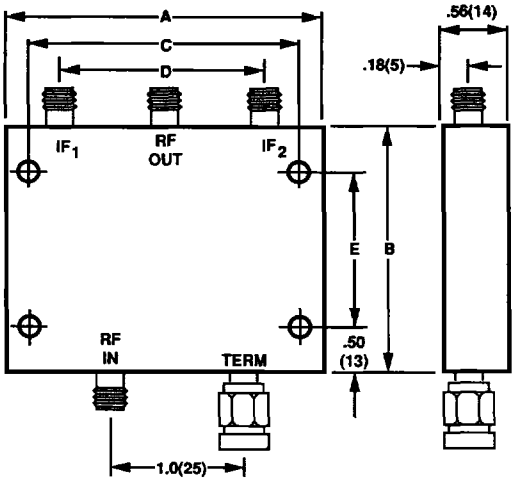


Figure 3

All dimensions in inches and (mm)
Connectors: SMA, Female, per MIL-C-39012
Mounting Hole Dia.: .145 ± .005 (3.7 ± .1)