

**FEATURES**

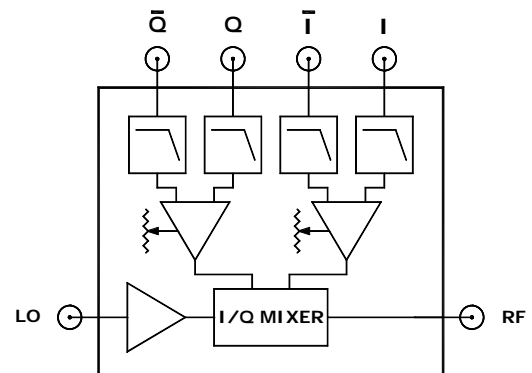
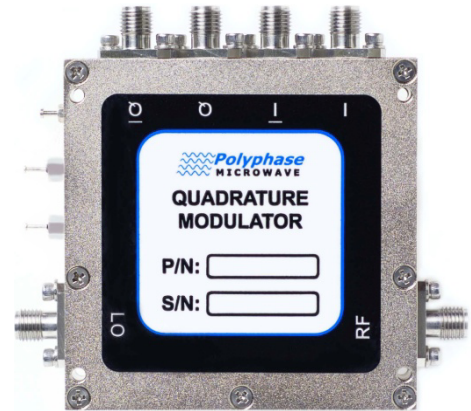
LO/RF Frequency:	9.0 – 12.0 GHz
Input IP3:	+23 dBm
Sideband Suppression:	-40 dBc
LO Leakage:	-45 dBm
LO Power:	+5 dBm
DC Power:	+5V @ 110 mA, -5V @ 40 mA

**DESCRIPTION**

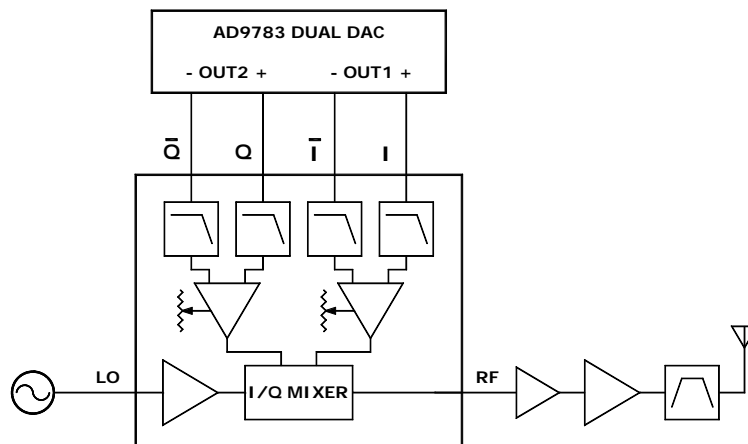
The AM90120A quadrature modulator is ideal for converting baseband I/Q modulation directly to RF. All bandpass RF modulation types are supported including BPSK, QPSK, QAM, OFDM, AM, FM, PM, FMCW, and pulsed Doppler.

In-stock units feature DC-300 MHz I/Q bandwidth. The LO leakage is factory nulled at the center LO frequency. Contact Polyphase Microwave for I/Q lowpass filter options or narrowband frequency optimization.

The AM90120A includes an I/Q mixer, LO amplifier, I/Q lowpass filters, and I/Q differential amplifiers. The AM90120A can be interfaced directly with single-ended or differential I/Q sources including most high-speed DACs. For more information, please refer to the **MODULATOR INTERFACING** section of this datasheet.



**TYPICAL APPLICATION: DIRECT CONVERSION TRANSMITTER**



## ELECTRICAL SPECIFICATIONS

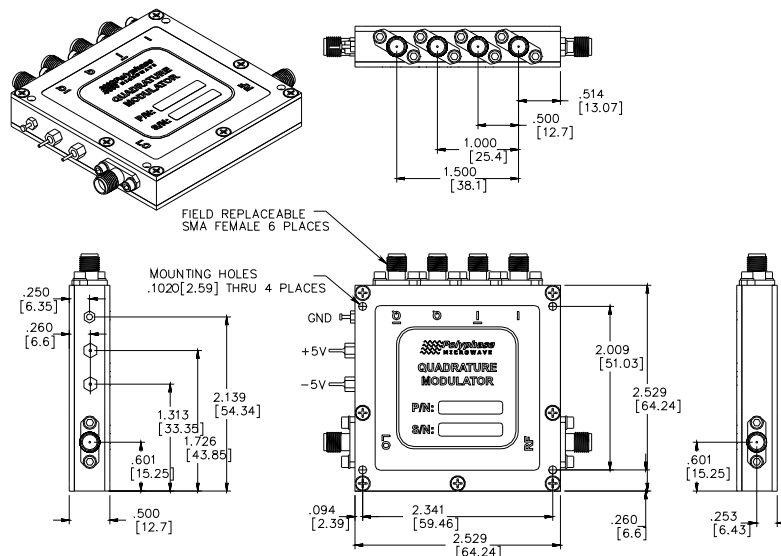
Test Conditions: +25°C, LO = +5 dBm, I/Q inputs = 0 dBm total @ 100 kHz unless otherwise noted.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
LO/RF Frequency Range		9.0		12.0	GHz
+5V DC Supply Range		+4.9	+5.0	+5.2	V
-5V DC Supply Range		-5.2	-5.0	-4.9	V
+5V DC Supply Current			110		mA
-5V DC Supply Current			40		mA
LO Power		+3	+5	+7	dBm
LO VSWR			1.5:1		Ratio
RF VSWR			2.5:1		Ratio
I/Q Baseband Filter Bandwidth <sup>1</sup>	<3 dB Flatness	DC		300	MHz
I/Q Baseband Filter Stop Band <sup>1</sup>	>25 dB Rejection	450		5000	MHz
I/Q Input Differential Input Impedance			100		Ω
I/Q Input Common-Mode Range	100 Ω Diff. Source	-2.5		+2.5	V
I/Q Input Differential-Mode Range	100 Ω Diff. Source	-1		+1	V
Conversion Loss			8.0	10.0	dB
Input IP3	2-Tone, Δf = 1 MHz		+23		dBm
Output P1dB			+4		dBm
LO Leakage at RF Port	No RF input drive		-45	-25	dBm
Sideband Suppression <sup>2</sup>			-40	-25	dBc
Amplitude Imbalance		-0.3	±0.1	+0.3	dB
Quadrature Phase Error		-5	±1	+2	Degree
Output Noise Level	10 MHz Offset		-162		dBm/Hz
Operating Temperature Range		-40		+85	°C
LO/RF/IQ Input Power w/o Damage				+16	dBm

Notes:

1. Standard lowpass filters. Contact factory for other options.
2. For upper sideband operation:  $I = \cos()$ ,  $\bar{I} = -\cos()$ ,  $Q = \sin()$ ,  $\bar{Q} = -\sin()$

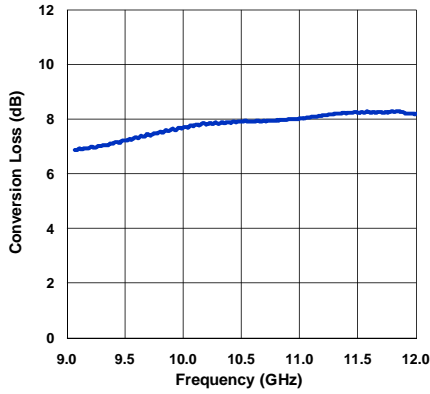
## DIMENSION DRAWING



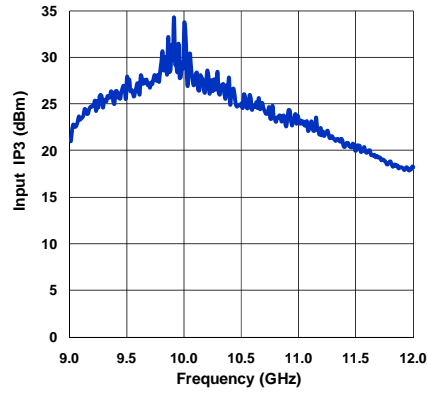
**TYPICAL PERFORMANCE CHARACTERISTICS**

Standard Test Conditions: +25°C, LO = +5 dBm, I/Q inputs = 0 dBm total @ 100 kHz.

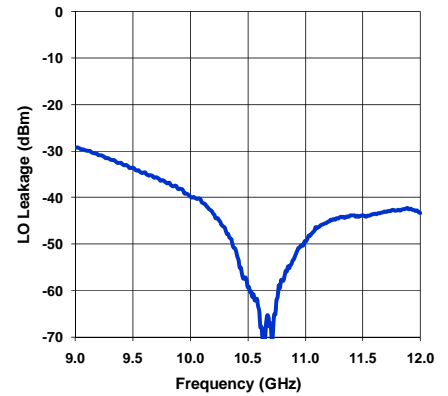
**Conversion Loss**



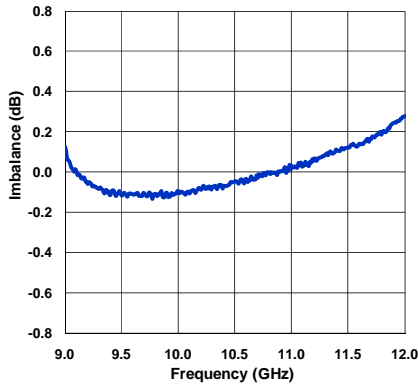
**Input IP3**



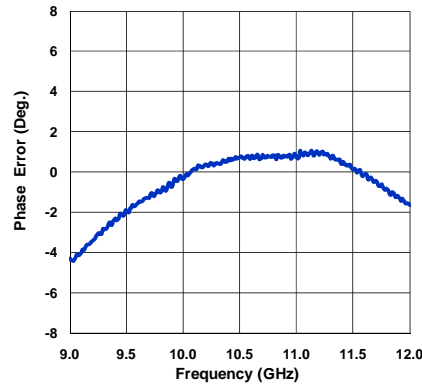
**LO Leakage at RF Port**



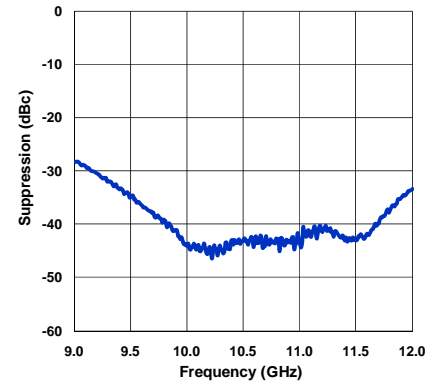
**Amplitude Imbalance**



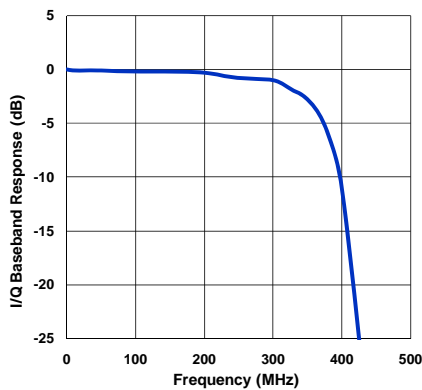
**Quadrature Phase Error**



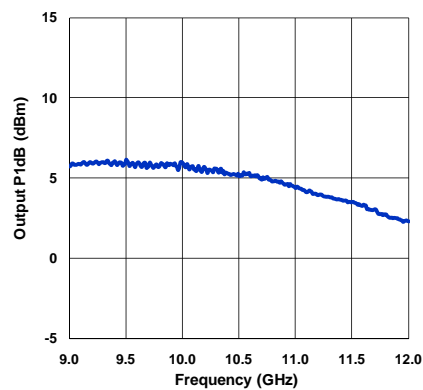
**Sideband Suppression**



**I/Q Baseband Response**



**Output P1dB**



## MODULATOR INTERFACING

### I/Q INPUTS

The AM90120A is designed for easy interfacing to both single-ended and differential I and Q sources. The modulator's I and Q inputs are differential with 100  $\Omega$  input impedance. The I/Q common-mode voltage range (DC bias) is -2.5 V to +2.5 V. The differential-mode voltage range is -1 V to +1 V. Internal lowpass filters set the modulator's I/Q baseband 3 dB bandwidth to 300 MHz. Contact the factory for other available filter bandwidths.

### SINGLE-ENDED I/Q DRIVE

The AM90120A can be driven with single-ended I/Q signals. Connect the single-ended I and Q sources directly to the modulator's I and Q inputs as shown in Figure 1. To minimize LO leakage, terminate the unused  $\bar{I}$  and  $\bar{Q}$  inputs with matched DC resistances to ground. The termination resistance should be chosen to provide the modulator's 4 I/Q input ports with identical resistance to ground at DC (0 Hz).

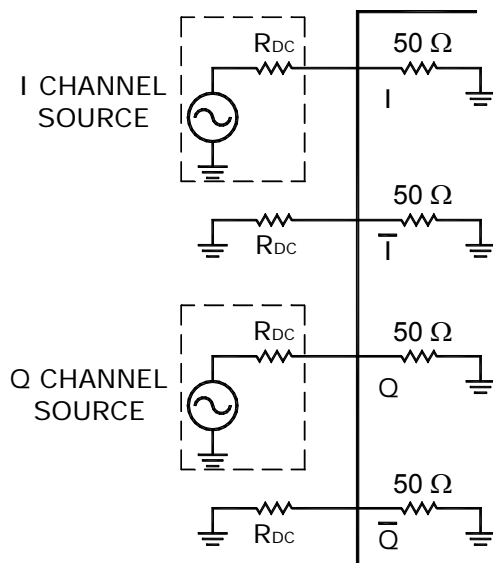


Figure 1. Single-Ended I/Q Drive

For example, if the I and Q input signals are provided by an arbitrary waveform generator having 50  $\Omega$  source impedance, the unused  $\bar{I}$  and  $\bar{Q}$  inputs should each be terminated with 50  $\Omega$  resistances to ground. If the I and Q input signals are AC-coupled then the  $\bar{I}$  and  $\bar{Q}$  inputs should be left open.

### DAC INTERFACING

The AM90120A is designed for direct connection to high-speed DACs having differential current-source outputs. One example is the Analog Devices AD9783, a dual 16-bit 500 MSPS DAC. Figure 2 shows the AD9783 DAC driving the AM90120A modulator. No external resistors, amplifiers, or filters are required.

When configured for 20 mA full-scale current, the AD9783 provides the AM90120A with 1 V<sub>p-p</sub> differential signals centered at a common-mode voltage of 500 mV.

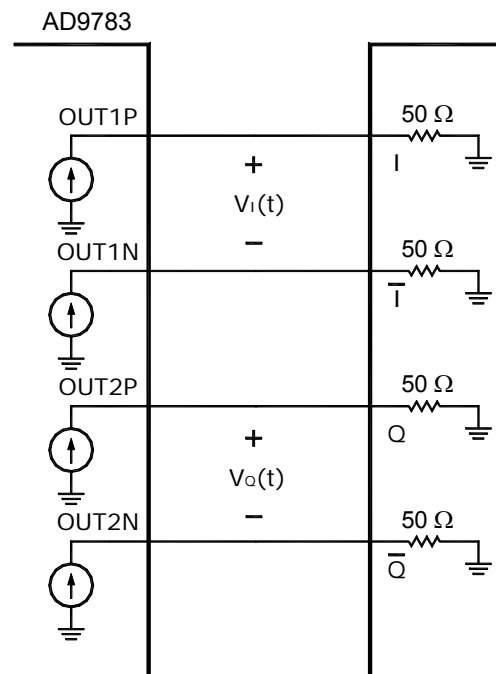


Figure 2. AD9783 Driving AM90120A