

FEATURES

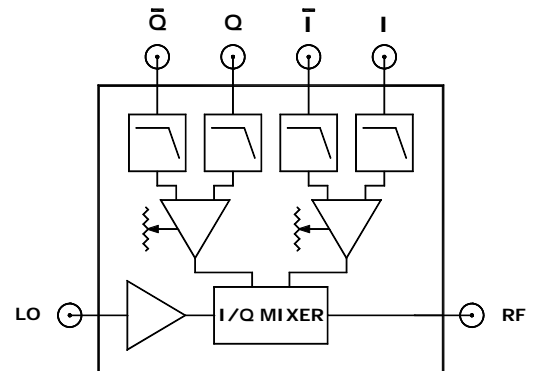
| | |
|-----------------------|---------------------------|
| LO/RF Frequency: | 11 – 14 GHz |
| Input IP3: | +23 dBm |
| Sideband Suppression: | -33 dBc |
| LO Leakage: | -35 dBm |
| LO Power: | +5 dBm |
| DC Power: | +5V @ 110 mA, -5V @ 40 mA |

DESCRIPTION

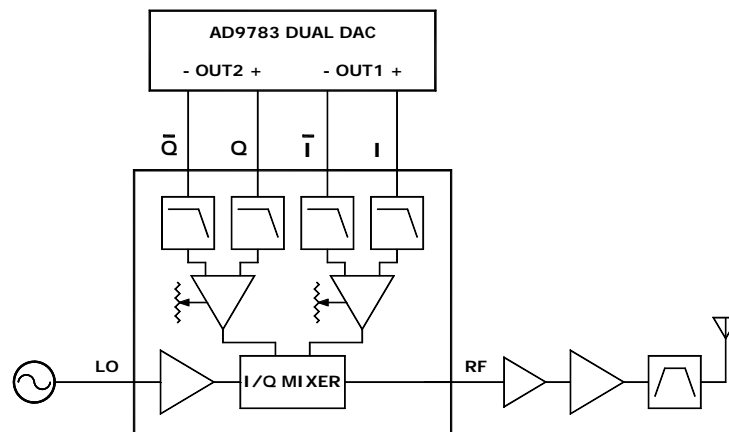
The AM110140N quadrature modulator is ideal for converting baseband I/Q modulation directly to RF. I and Q baseband inputs linearly modulate the local oscillator (LO) signal to produce a modulated RF output.

The AM110140N includes an I/Q mixer, LO amplifier, I/Q lowpass filters, and I/Q differential amplifiers. Field-adjustable potentiometers allow the user to null the modulator's LO leakage. The AM110140N is available as a caseless PCB with SMA female connectors and a screw-terminal DC power connector.

The AM110140N 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

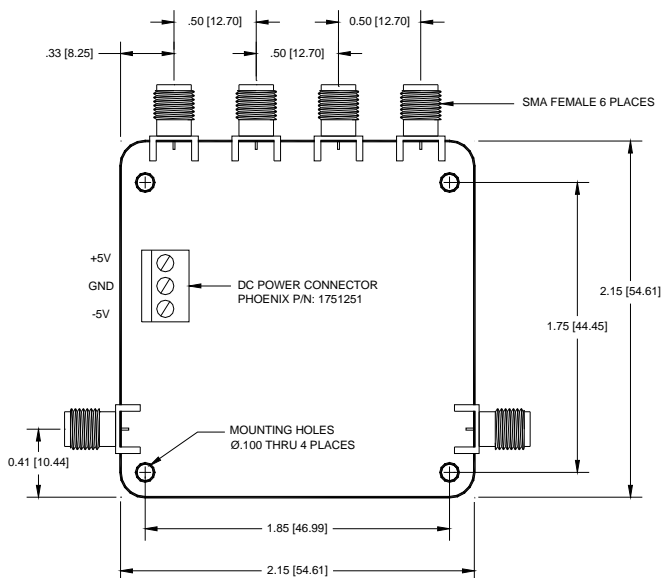
Test Conditions: +25°C, LO = +5 dBm, I/Q inputs = 0 dBm total @ 100 kHz unless otherwise noted.

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|--|--------------------|------|-------|------|--------|
| LO/RF Frequency Range | | 11.0 | | 14.0 | GHz |
| +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 ¹ | <3 dB Flatness | DC | | 300 | MHz |
| I/Q Baseband Filter Stop Band ¹ | >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 | 10.5 | dB |
| Input IP3 | 2-Tone, Δf = 1 MHz | | +23 | | dBm |
| Output P1dB | | | +4 | | dBm |
| LO Leakage at RF Port | No RF input drive | | -35 | -25 | dBm |
| Sideband Suppression ² | | | -33 | -23 | dBc |
| Amplitude Imbalance | | -0.6 | ±0.2 | +0.6 | dB |
| Quadrature Phase Error | | -8 | ±2 | +5 | Degree |
| Output Noise Level | 10 MHz Offset | | -162 | | dBm/Hz |
| Operating Temperature Range | | 0 | | +50 | °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: $I = \cos(t)$, $\bar{I} = -\cos(t)$, $Q = \sin(t)$, $\bar{Q} = -\sin(t)$

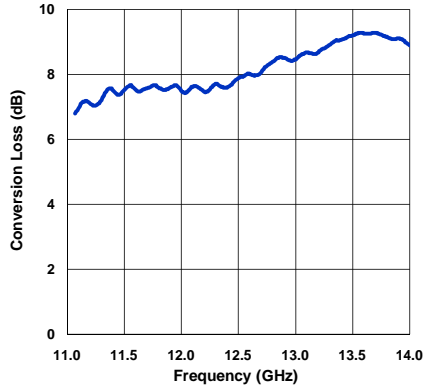
DIMENSION DRAWING



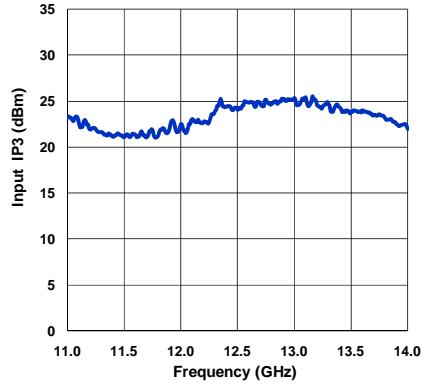
TYPICAL PERFORMANCE CHARACTERISTICS

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

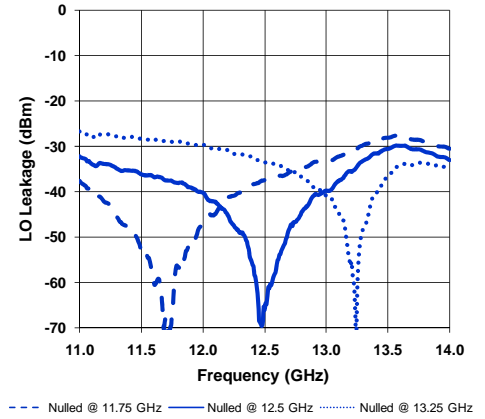
Conversion Loss



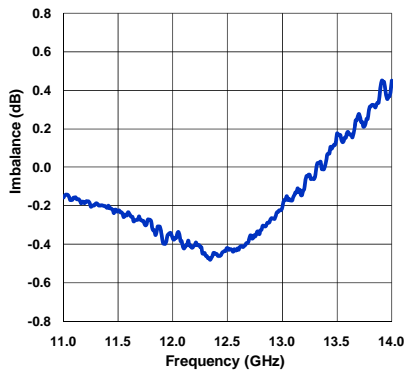
Input IP3



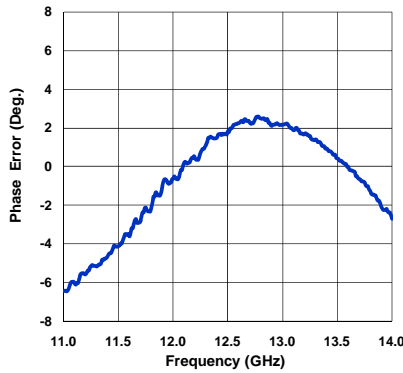
LO Leakage at RF Port



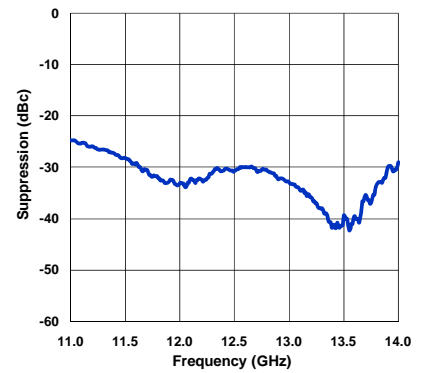
Amplitude Imbalance



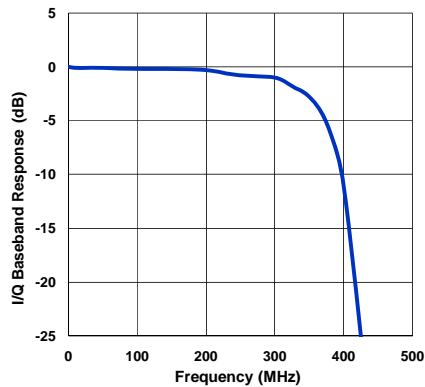
Quadrature Phase Error



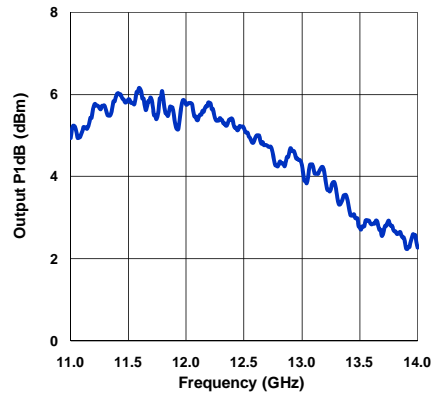
Sideband Suppression



I/Q Baseband Response



Output P1dB



MODULATOR INTERFACING

I/Q INPUTS

The AM110140N 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 $-2.5\ \text{V}$ to $+2.5\ \text{V}$. The differential-mode voltage range is $-1\ \text{V}$ to $+1\ \text{V}$. 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 AM110140N can be driven with single-ended I/Q signals having $50\ \Omega$ source impedance. Connect the single-ended I and Q signals directly to the modulator's I and Q inputs as shown in Figure 1. Leave the unused \bar{I} and \bar{Q} inputs open (do not terminate) for optimum LO leakage performance.

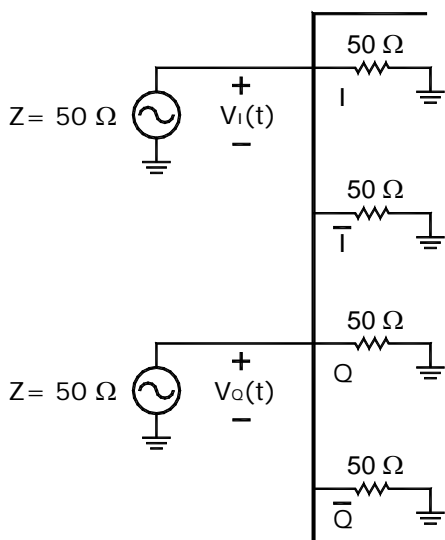


Figure 1. Single-Ended I/Q Drive

Any DC offsets present on single-ended input signals will result in increased LO leakage. Single-ended I and Q signals should be maintained within the voltage range of $-2.5\ \text{V}$ to $+2.5\ \text{V}$.

DAC INTERFACING

The AM110140N 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 AM110140N modulator. No external resistors, amplifiers, or filters are required.

When configured for 20 mA full-scale current, the AD9783 provides the AM110140N with $1\ \text{V}_{\text{p-p}}$ differential signals centered at a common-mode voltage of 500 mV.

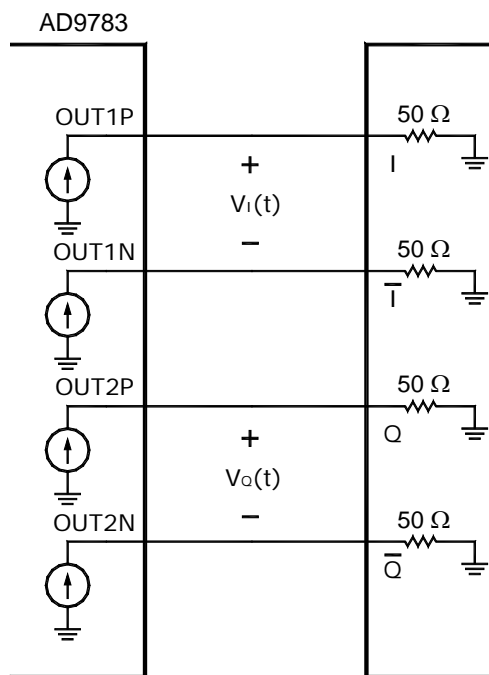


Figure 2. AD9783 Driving AM110140N