Active Doubler
2.5 - 6.0 / 5.0 - 12.0 GHz

Features
- Octave Bandwidth Operation
- +16 dBm Output Power
- -35 dBc Fundamental Leakage
- +5 V, 125 mA Bias
- Lead-Free 4 mm 24-lead QFN Package
- 100% RF, DC and Output Power Testing
- RoHS* Compliant and 260°C Reflow Compatible

Description
The XX1002-QH is a 2.5 - 6.0 / 5.0 - 12.0 GHz QFN active doubler that delivers +16 dBm of output power. The device combines an active doubler with an output buffer amplifier that delivers constant power over a range of input powers. The device has excellent rejection of the fundamental and harmonic products and requires a single positive bias supply.

This device uses MACOM’s GaAs HBT device technology to ensure high reliability and uniformity. The device comes in a low-cost 4 mm QFN surface mount plastic package offering excellent RF and thermal properties and is RoHS compliant.

This device is specifically designed for point-to-point radio applications and is well suited for other telecom applications such as SATCOM and VSAT.

Functional Block Diagram

Pin Configuration

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Function</th>
<th>Pin No.</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>RF In</td>
<td>22</td>
<td>VCC</td>
</tr>
<tr>
<td>16</td>
<td>RF Out</td>
<td>25</td>
<td>Paddle3</td>
</tr>
</tbody>
</table>

2. MACOM recommends connecting unused package pins to ground.
3. The exposed paddle centered on the package bottom must be connected to RF and DC ground.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>XX1002-QH-0G0T</td>
<td>tape and reel</td>
</tr>
<tr>
<td>XX1002-QH-EV1</td>
<td>evaluation module</td>
</tr>
</tbody>
</table>

1. Reference Application Note M513 for reel size information.

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Electrical Specifications: Input Freq. = 2.5 - 6.0 GHz (unless otherwise noted), $T_A = 25^\circ C$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Frequency Range</td>
<td>GHz</td>
<td>5</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>dB</td>
<td>-</td>
<td>-15</td>
<td>-</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>dB</td>
<td>-</td>
<td>-7</td>
<td>-</td>
</tr>
<tr>
<td>Saturated Output Power</td>
<td>dBm</td>
<td>+13</td>
<td>+16</td>
<td>-</td>
</tr>
<tr>
<td>RF Input Power</td>
<td>dBm</td>
<td>-3</td>
<td>-</td>
<td>+3</td>
</tr>
<tr>
<td>Fundamental Leakage (Input Freq. = 2.5 - 4.25 GHz)</td>
<td>dBc</td>
<td>-</td>
<td>-35</td>
<td>-23</td>
</tr>
<tr>
<td>Third Harmonic Leakage</td>
<td>dBc</td>
<td>-</td>
<td>-30</td>
<td>-</td>
</tr>
<tr>
<td>Fourth Harmonic Leakage</td>
<td>dBc</td>
<td>-</td>
<td>-20</td>
<td>-</td>
</tr>
<tr>
<td>Bias Voltage</td>
<td>VDC</td>
<td>-</td>
<td>+5.0</td>
<td>+5.5</td>
</tr>
<tr>
<td>Supply Current (Quiescent)</td>
<td>mA</td>
<td>-</td>
<td>102</td>
<td>140</td>
</tr>
</tbody>
</table>

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>+6 V</td>
</tr>
<tr>
<td>Supply Current</td>
<td>200 mA</td>
</tr>
<tr>
<td>Input Power</td>
<td>+10 dBm</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +165°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-55°C to +85°C</td>
</tr>
<tr>
<td>Junction Temperature$^4,5$</td>
<td>+150°C</td>
</tr>
</tbody>
</table>

4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. MACOM does not recommend sustained operation near these survivability limits.
6. Operating at nominal conditions with $T_J \leq +150^\circ C$ will ensure $MTTF > 1 \times 10^6$ hours.
7. $Junction\ Temperature\ (T_J) = T_C + \Theta_{JC} \times (V \times I)$
   Typical CW thermal resistance ($\Theta_{JC}$) = 77°C/W

Biasing

The device is operated by biasing $VCC = 5\ V$ which will draw typically 102 mA quiescent / 125 mA under RF drive. The device requires by-passing as shown in the recommended layout with $C1 = 1\ nF$ and $C2 = 1\ \mu F$.

Parts List

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>1 nF</td>
<td>0402</td>
</tr>
<tr>
<td>C2</td>
<td>1 µF</td>
<td>0805</td>
</tr>
</tbody>
</table>
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Typical Performance Curves

(x2) Output Power

Fundamental Leakage

(3xFin) Harmonic Suppression

Fundamental Suppression

(4xFin) Harmonic Suppression
Typical Performance Curves

**Input Return Loss (S11)**

![Graph showing the Input Return Loss (S11) across different frequencies.]

**Output Return Loss (S22)**

![Graph showing the Output Return Loss (S22) across different frequencies.]

**Fundamental Rejection**

![Graph showing the Fundamental Rejection across different frequencies.]

**(2xFin) Output Power**

![Graph showing the Output Power for different frequencies and temperatures.]

**(3xFin) Rejection**

![Graph showing the Rejection for different frequencies and temperatures.]

**(4xFin) Rejection**

![Graph showing the Rejection for different frequencies and temperatures.]

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MTTF

XX1002-QH: MTTF hours vs. Package Base Temperature
Vcc=5.0V, Icc=125mA

XX1002-QH: Tch (max) vs. Package Base Temperature
Vcc=5.0V, Icc=125mA

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Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these Class 0 (200 V HBM) devices.
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XX1002-QH

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