20-30GHz SUB-HARMONICALLY PUMPED MIXER
GaAs Monolithic Microwave IC

Description

The CHM1290 is a MFC which integrates a self biased LO buffer amplifier and a sub-harmonically diodes mixer for 2LO suppression. It is usable both for up-conversion and down-conversion. It is designed for a wide range of applications, typically commercial communication systems for broadband local access (LMDS). The backside of the chip is both RF and DC grounds. This helps simplify the assembly process.

The circuit is manufactured with a pHEMT process, 0.25µm gate length, via holes through the substrate, air bridges and electron beam gate lithography. It is available in chip form.

Main Features

- Broadband performance: 20-30GHz
- 10dB conversion Loss
- 29dB 2LO to RF isolation
- -4dBm LO input power
- -3dBm input power 1dB compression
- Low DC consumption: 33mA@4.0V
- Chip size: 0.86x1.28x0.10mm

Main Characteristics

\[
\begin{array}{|c|c|c|c|c|}
\hline
\text{Symbol} & \text{Parameter} & \text{Min} & \text{Typ} & \text{Max} & \text{Unit} \\
\hline
F_{RF} & RF frequency range & 20 & 30 & & GHz \\
F_{LO} & LO frequency range & 10 & 15 & & GHz \\
F_{IF} & IF frequency range & DC & 6 & & GHz \\
L_{c} & Conversion Loss & 10 & 12 & & dB \\
\hline
\end{array}
\]

ESD Protection: Electrostatic discharge sensitive device. Observe handling precautions!
### Electrical Characteristics for Broadband Operation

**Tamb=+25°C, Vd=4.0V Id=33mA**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(F_{RF})</td>
<td>RF frequency range</td>
<td>20</td>
<td>30</td>
<td>GHz</td>
<td></td>
</tr>
<tr>
<td>(F_{LO})</td>
<td>LO frequency range</td>
<td>10</td>
<td>15</td>
<td>GHz</td>
<td></td>
</tr>
<tr>
<td>(F_{IF})</td>
<td>IF frequency range</td>
<td>DC</td>
<td>6</td>
<td>GHz</td>
<td></td>
</tr>
<tr>
<td>(L_c)</td>
<td>Conversion Loss</td>
<td>10</td>
<td>12</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>(P_{LO})</td>
<td>LO Input power</td>
<td>-4</td>
<td>8</td>
<td>dBm</td>
<td></td>
</tr>
<tr>
<td>(2xLO) Leak</td>
<td>2xLO Leakage (for (P_{LO}=-4dBm))</td>
<td>30</td>
<td>dBm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP1dB</td>
<td>Input power at 1dB gain compression</td>
<td>-3</td>
<td>0</td>
<td>3</td>
<td>dBm</td>
</tr>
<tr>
<td>LO Match</td>
<td>LO Matching</td>
<td>2.0:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RF Match</td>
<td>RF Matching</td>
<td>2.0:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IF Match</td>
<td>IF Matching</td>
<td>2.0:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sz</td>
<td>Chip size</td>
<td>1.1</td>
<td>mm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Id</td>
<td>Bias current</td>
<td>33</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Absolute Maximum Ratings

**Tamb.=+25°C**<sup>(1)</sup>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_d)</td>
<td>Drain bias voltage</td>
<td>5.0</td>
<td>V</td>
</tr>
<tr>
<td>(I_d)</td>
<td>Drain bias current</td>
<td>50</td>
<td>mA</td>
</tr>
<tr>
<td>(P_{in})</td>
<td>Maximum peak input power overdrive&lt;sup&gt;(2)&lt;/sup&gt;</td>
<td>10</td>
<td>dBm</td>
</tr>
<tr>
<td>(T_a)</td>
<td>Operating temperature range</td>
<td>-40 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>(T_{stg})</td>
<td>Storage temperature range</td>
<td>-55 to +155</td>
<td>°C</td>
</tr>
</tbody>
</table>

<sup>(1)</sup> Operation of this device above anyone of these parameters may cause permanent damage.

<sup>(2)</sup> Duration < 1s.
Typical on Wafer Measurements

**CHM1290 : Conversion Loss & Leakages**

- Parameters: $V_{ds} = 4.0V$, $I_{ds} = 33mA$, LO Power = -4dBm, IF Frequency = 1.0GHz

**Conversion Loss (dB)**

**Leakage @ LO & 2xLO (dBm)**
- $L_c(2\times LO+IF)$
- $L_c(2\times LO-IF)$
- $P_{LO @ RF}$
- $P_{2\times LO @ RF}$

**CHM1290 : Conversion LOSS**

- Parameters: $V_{ds} = 4.0V$, $I_{ds} = 33mA$, LO Power = -4dBm, IF Frequency = 2.0GHz

**Conversion Gain (dB)**

- RF Freq. = 22GHz
- RF Freq. = 30GHz
CHM1290 : Conversion Loss & Leakages

Vds = 4.0V, Ids = 33mA ; LO Power = 0dBm / IF Frequency = 1.0GHz

-25.0
-22.5
-20.0
-17.5
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0.0

LO Frequency ( GHz )

Conversion Loss ( dB )

-45
-40
-35
-30
-25
-20
-15
-10
-5
0
5

Leakage @ LO & 2xLO ( dBm )

Lc (2xLO+IF)
Lc (2xLO-IF)
P LO @ RF
P 2*LO @ RF

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Specifications subject to change without notice
Chip Assembly and Mechanical Data

Note: Supply feed should be bypassed. 25µm diameter gold wire is recommended

Bonding pad positions

(Chip thickness: 100µm. All dimensions are in micrometers)
Recommended ESD management

Refer to the application note AN0020 available at http://www.ums-gaas.com for ESD sensitivity and handling recommendations for the UMS products.

Ordering Information

Chip form: CHM1290-99F/00