190-245GHz 50-70mW Solid-state Power Amplifier in 250nm InP HBT

Summary of the Amplifier

- 190-245GHz Solid-Stage Power Amplifier.
- Typical 23-30dB $S_{21}$ gain from 190-250GHz.
- Typical output power $P_{out}$ between 190-245GHz is 50-70mW at 0dBm input power $P_{in}$.
  - $P_{out}$ for frequencies $> 245$GHz remains high.
  - $P_{out,\text{max}}$ @ 250GHz = 42mW, @ 255GHz = 37mW, @ 260GHz = 31mW, @ 265GHz = 22mW.
- DC power dissipation = 1.60W (no RF drive).
  - At $P_{out} = P_{\text{sat}}$, DC currents increase by 4-6%.
- No DC blocking capacitors between the MMIC and RF pads. Appropriate transitions required.
- Finished thickness: 3-mil, with thru-substrate vias for mode suppression within the InP substrate.
- InP MMIC die dimensions: 1.92mm $\times$ 0.80mm (± 0.01mm)

Description

The Teledyne Scientific T04 3S4C-G1-P1 MMIC is a three-gain-stage SSPA that produces 50-70mW RF output power between 190-245GHz for RF input powers between -16dBm to 2dBm.

TABLE 1. DC Bias Specifications

<table>
<thead>
<tr>
<th>Bias</th>
<th>Parameters/Conditions</th>
<th>Target Voltage (V)</th>
<th>Max Voltage (V)</th>
<th>Bias Current (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{C1}$</td>
<td>Common-emitter HBT bias</td>
<td>1.70</td>
<td>1.80</td>
<td>290</td>
</tr>
<tr>
<td>$V_{C2}$</td>
<td>Collector Bias, common-base HBT</td>
<td>1.70</td>
<td>1.75</td>
<td>333</td>
</tr>
<tr>
<td>$V_{E2}$</td>
<td>Emitter Bias, common-base HBT</td>
<td>-1.12</td>
<td>-1.15</td>
<td>350</td>
</tr>
</tbody>
</table>

Summary of the RF Electrical Characteristics

Small-signal S-parameters of a representative T04 3S4C-G1-P1 SSPA.
190-245GHz SSPA, ID: T04 3S4C-G1-P1

206-225GHz operation

\[ P_{\text{out}} \text{ vs. } P_{\text{in}} \text{ (linear format) at different frequencies (206-244GHz).} \]

230-244GHz operation

\[ P_{\text{out}}, \ \text{Gain, and PAE vs. } P_{\text{in}} \text{ at 190.8, 210, 230, and 244GHz Operation.} \]

Contact Information for TSC SSPA information, queries, and assistance:
Zach Griffith, Teledyne Scientific Company, zgriffith@teledyne.com, 805-373-4104

Ordering information:
Part ID: T04 3S4C-G1-P1, ECCN: 3A001.b.2.h, Description: G-band PA, 190-245GHz, 50-70mW \( P_{\text{out}} \)