Analog Devices Welcomes Hittite Microwave Corporation

NO CONTENT ON THE ATTACHED DOCUMENT HAS CHANGED
Report Title: Qualification Test Report
Report Type: See Attached
Date: See Attached
Package Type: 32L LP5
Package Style: 32L 5x5mm QFN Package

QTR: 10009
Rev: 05

HMC340LP5    HMC590LP5    HMC890LP5
HMC462LP5    HMC591LP5    HMC892LP5
HMC463LP5    HMC619LP5    HMC893LP5
HMC464LP5    HMC625HFLP5  HMC894LP5
HMC465LP5    HMC625LP5    HMC900LP5
HMC486LP5    HMC626LP5    HMC907LP5
HMC487LP5    HMC627LP5    HMC920LP5
HMC489LP5    HMC632LP5    HMC926LP5
HMC490LP5    HMC637LP5    HMC928LP5
HMC507LP5    HMC640LP5    HMC935LP5
HMC508LP5    HMC677LP5    HMC943LP5
HMC509LP5    HMC681LP5    HMC952LP5G
HMC510LP5    HMC698LP5    HMC965LP5
HMC511LP5    HMC699LP5    HMC972LP5
HMC512LP5    HMC707LP5    HMC993LP5
HMC513LP5    HMC708LP5    HMC995LP5G
HMC514LP5    HMC734LP5    HMC1030LP5
HMC515LP5    HMC735LP5    
HMC529LP5    HMC7357LP5G   
HMC530LP5    HMC742HFLP5  
HMC531LP5    HMC742LP5    
HMC534LP5    HMC795LP5    
HMC582LP5    HMC797LP5    
HMC583LP5    HMC881LP5    
HMC584LP5    HMC882LP5    

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- Supplying products of the highest quality
- Advance in state-of-the-art technology that supports our products
- Enhance our competitive position with superior product standards

Hittite’s employees recognize the responsibility to:
- Take the initiative to ensure product quality
- Create an environment where the highest standards are maintained
- Continue to improve quality practices
1.0 Introduction

This qualification procedure is designed to satisfy the package reliability requirements for the 32 lead 5x5mm QFN surface mount plastic encapsulated package. The testing is designed to simulate the worst-case environments the product may experience during assembly, test and life in the end user application. The device is electrically tested to the appropriate catalog specifications. The HMC681LP4E was selected to qualify the 5x5mm QFN surface mount plastic encapsulated family of packages.

1.1 General Description

The 32L 5x5mm QFN package uses a copper alloy lead frame. The lead frame is silver plated internally to enable gold wire bonding. The MMIC device is attached to the paddle using conductive epoxy. The device interconnection is performed using 1 mil gold ball bonds. The part is encapsulated using Sumitomo EME G700 or equivalent epoxy encapsulating compound. The leads are finished with 100% Matte Sn plating.

The HMC681LP5(E) is a digitally controlled variable gain amplifier which operates from DC to 1 GHz, and can be programmed to provide anywhere from 13.5 dB, to 45 dB of gain, in 0.5 dB steps. The HMC681LP5(E) delivers noise figure of 2.8 dB in its maximum gain state, with output IP3 of up to +36 dBm in any state. This serially controlled digital VGA incorporates off chip AC ground capacitors for near DC operation, making it suitable for a wide variety of RF and IF applications. The HMC681LP5(E) is housed in a RoHS compliant 5x5 mm QFN leadless package, and provides the user with a highly integrated solution. This functionality is also available with parallel control as the HMC626LP5(E).

Figure 1: Typical 32L 5x5mm QFN Package
Figure 2: 32L 5x5mm QFN Package Outline Drawing

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NOTES:
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM.
   PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE
   SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED
   LAND PATTERN.
Figure 3: Suggested PCB Land Pattern

NOTES:
1. DIMENSIONS ARE IN INCHES [MILLIMETERS].
2. PAD WIDTH SHOWN IS FOR SOLDERING ONLY. BEYOND SOLDERING AREA ALL CONDUCTORS THAT CARRY RF AND MICROWAVE SIGNALS SHOULD HAVE 50 OHM CHARACTERISTIC IMPEDANCE.
3. SOLDERMASK ON FAR SIDE SHOULD TENT OR PLUG VIA HOLES.

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2.0 Summary of Results

<table>
<thead>
<tr>
<th>PARA</th>
<th>TEST</th>
<th>QTY IN</th>
<th>QTY OUT</th>
<th>PASS/FAIL</th>
<th>NOTES</th>
</tr>
</thead>
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<tr>
<td>3.1.1</td>
<td>Initial Electrical Test</td>
<td>160</td>
<td>160</td>
<td>Pass/No Failures</td>
<td></td>
</tr>
<tr>
<td>3.1.2</td>
<td>MSL1 260°C Reflow Preconditioning (3 Passes)</td>
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<td>160</td>
<td>Complete</td>
<td></td>
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<tr>
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<td>Temperature Cycling</td>
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<td>80</td>
<td>Complete</td>
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<tr>
<td>3.1.4</td>
<td>Post Temperature Cycle Electrical Test</td>
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<td>80</td>
<td>Pass/No Failures</td>
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<tr>
<td>3.1.5</td>
<td>Autoclave</td>
<td>80</td>
<td>80</td>
<td>Complete</td>
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</tr>
<tr>
<td>3.1.6</td>
<td>Post Autoclave Electrical Test</td>
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<td>Pass/No Failures</td>
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<tr>
<td>3.2.1</td>
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<td>Pass/No Failures</td>
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<tr>
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<td>Solderability</td>
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<td>15</td>
<td>Pass/No Failures</td>
<td></td>
</tr>
</tbody>
</table>

All testing has been completed. There were no relevant failures.
3.0 Test Procedures

3.1 Package Environmental Tests

These tests are designed to demonstrate that the 32L5x5mm QFN surface mount plastic encapsulated family of packages are capable of maintaining the specified parameters throughout their useful life under rated operating conditions. The HMC681LP4E was selected to qualify the 5x5mm QFN surface mount plastic encapsulated family of packages. The results of these tests qualify by similarity all other product using the same package.

3.1.1 Initial Characteristics - 160 HMC681LP4E devices were electrically tested for DC and critical RF parameters. These tests are performed at ambient temperature (+25°C). This test was performed at Hittite. There were no failures in this test.

3.1.2 MSL1 260°C Reflow Preconditioning – 160 devices from 3.1.1 were subjected to 168 hours at 85°C/85% RH then a reflow simulation at a peak temperature of 260°C for 3 passes (see Figure 1 for profile).

3.1.3 Temperature Cycle - 80 devices from 3.1.2 were subjected to 500 cycles of non-operating temperature cycling from -65°C to 150°C. This test is performed at Hittite.

3.1.4 Final Electrical Test - 80 devices from 3.1.3 were electrically tested at ambient temperature to DC and critical RF parameters. Any out of specification parameter is considered a failure. This test was performed at Hittite. There were no relevant failures in this test.

3.1.5 Autoclave - 80 devices from 3.1.2 were subjected to 96 hours of humidity (100%), temperature (121°C) and pressure (15 PSIG). This test is performed at Hittite using an Espec environmental chamber.

3.1.6 Final Electrical Test - 80 devices from 3.1.5 were electrically tested at ambient temperature to DC and critical RF parameters. Any out of specification parameter is considered a failure. This test was performed at Hittite within 48 hours after removal from the chamber. There were no relevant failures in this test.
3.2 Package Mechanical Tests

3.2.1 Physical Dimensions - 15 devices were measured to the requirement of the data sheet package outline drawing. These devices need not be electrically functional. Any out of specification parameter is considered a failure. This test is performed at Hittite. There were no failures.

3.2.2 Solderability - 15 devices were subjected to the steam aging and solderability test in accordance with MIL-STD-883 Method 2003. These devices need not be electrically functional. This test was performed at Hittite. There were no failures.
Figure 4: 260°C Reflow Profile

![Graph showing the 260°C Reflow Profile with Temperature (°C) on the y-axis and Time in Seconds on the x-axis. The profile shows a rise, peak, and decline in temperature over time.]