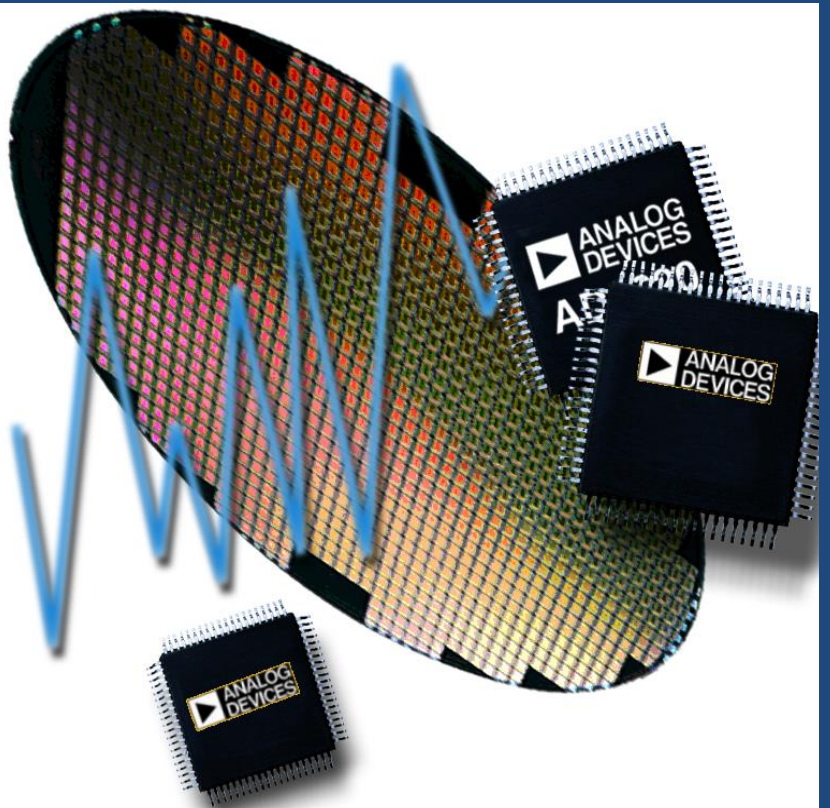


Analog Devices Welcomes Hittite Microwave Corporation

NO CONTENT ON THE ATTACHED DOCUMENT HAS CHANGED





Reliability Report

Report Title:	Qualification Test Report
Report Type:	See Attached
Date:	See Attached

QUALIFICATION TEST REPORT

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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- *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*

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1.0 Introduction

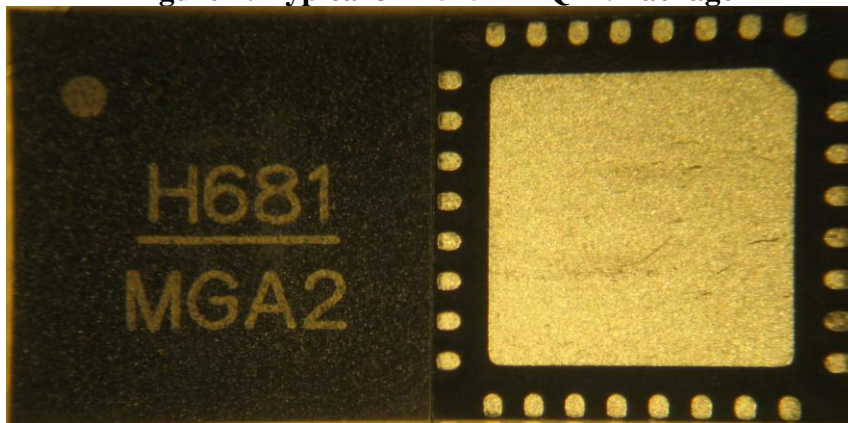
This qualification procedure is designed to satisfy the package reliability requirements for the 32 lead 5x5mm QFN surface mount plastic encapsulated package. The testing is designed to simulate the worst-case environments the product may experience during assembly, test and life in the end user application. 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



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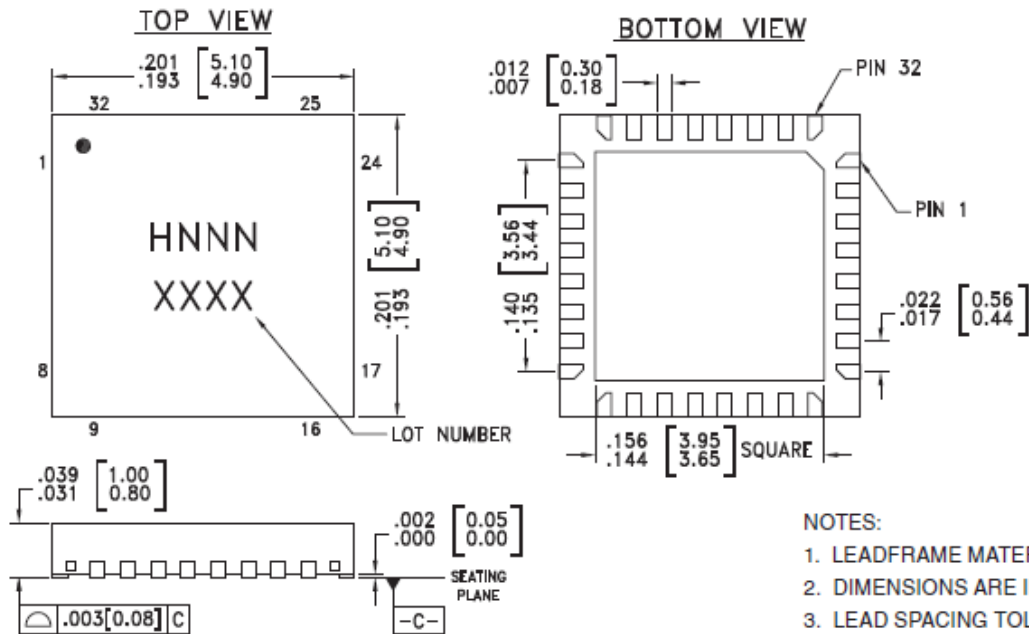
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Figure 2: 32L 5x5mm QFN Package Outline Drawing



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.

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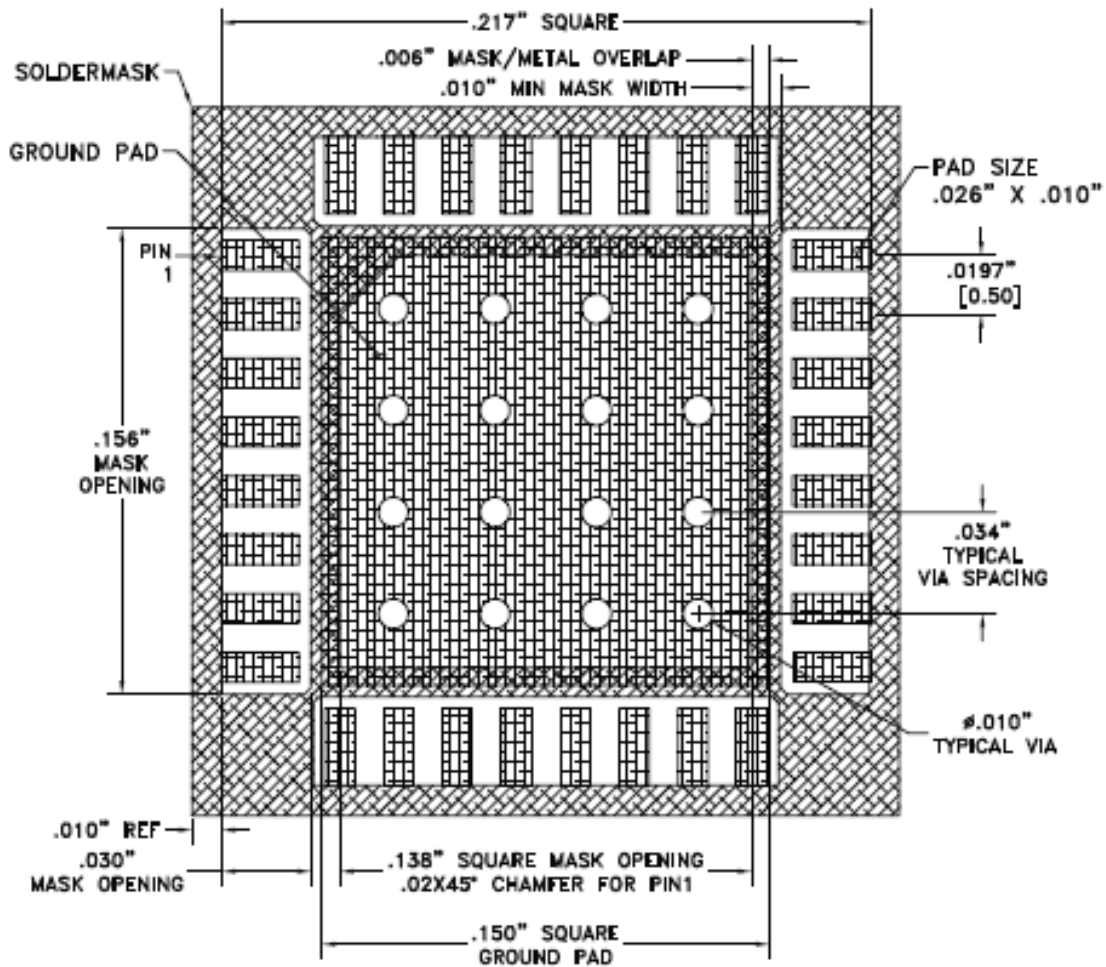
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Figure 3: Suggested PCB Land Pattern



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

PARA	TEST	QTY IN	QTY OUT	PASS/FAIL	NOTES
3.1.1	Initial Electrical Test	160	160	Pass/No Failures	
3.1.2	MSL1 260°C Reflow Preconditioning (3 Passes)	160	160	Complete	
3.1.3	Temperature Cycling	80	80	Complete	
3.1.4	Post Temperature Cycle Electrical Test	80	80	Pass/No Failures	
3.1.5	Autoclave	80	80	Complete	
3.1.6	Post Autoclave Electrical Test	80	80	Pass/No Failures	
3.2.1	Physical Dimensions	15	15	Pass/No Failures	
3.2.2	Solderability	15	15	Pass/No Failures	

All testing has been completed. There were no relevant failures.

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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.

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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.

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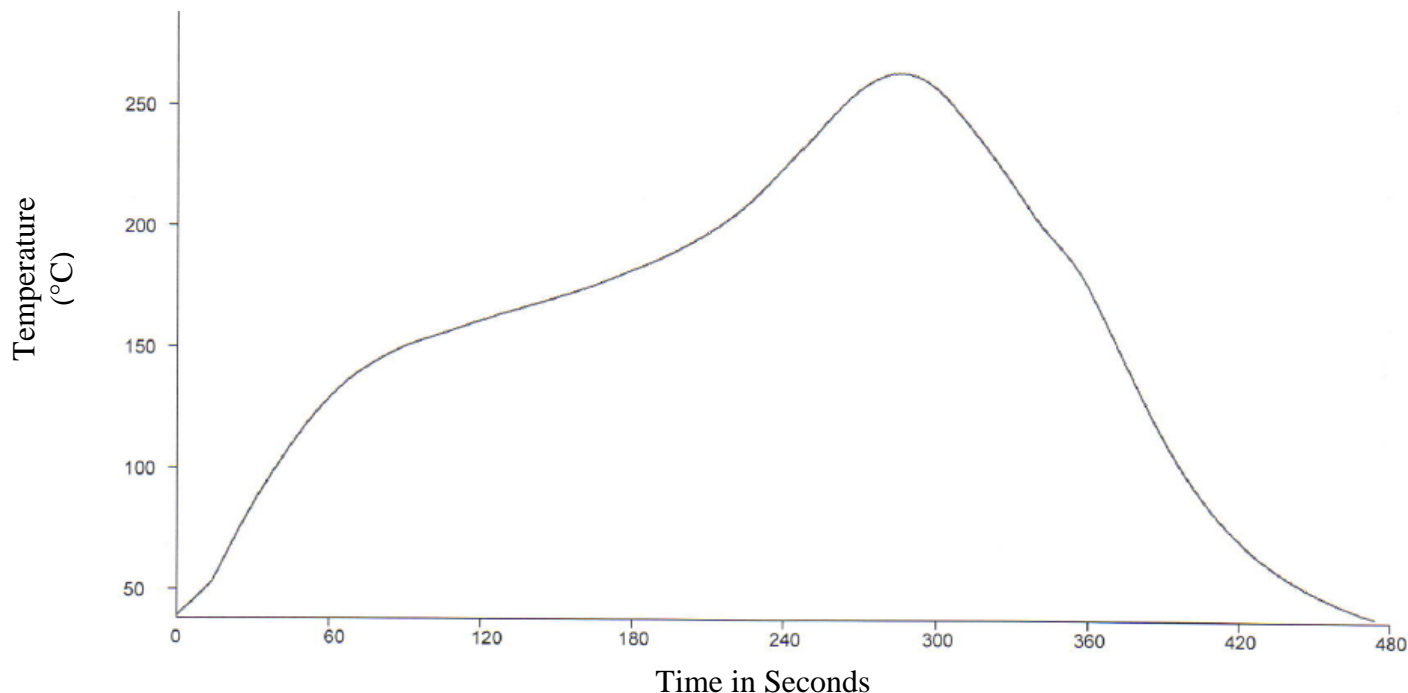
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Figure 4: 260°C Reflow Profile



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