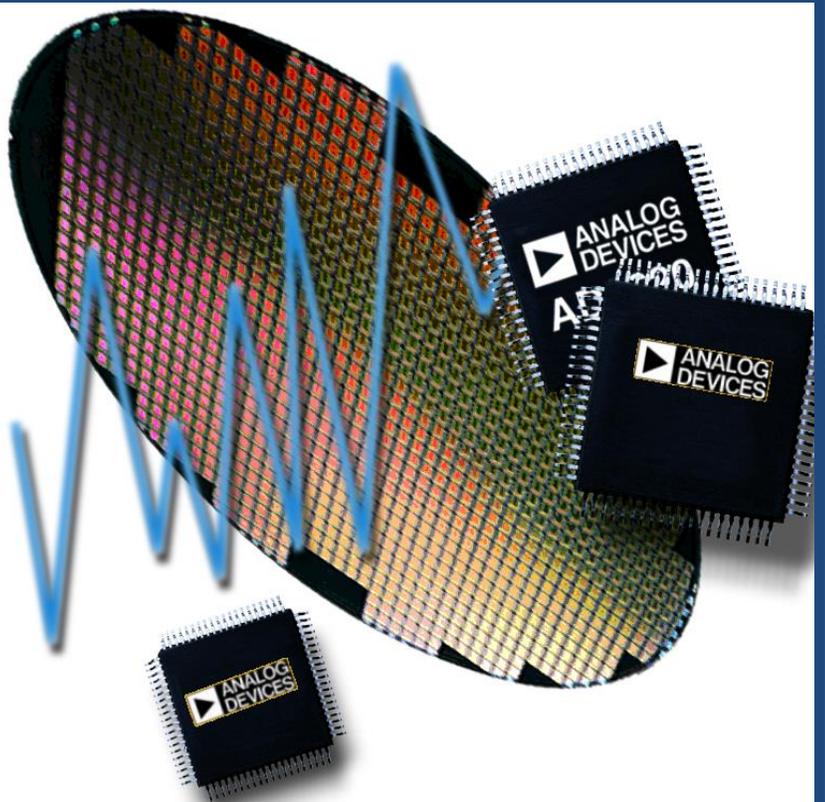


Analog Devices Welcomes Hittite Microwave Corporation

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: 6L LP2, 16L LP3

Package Style: 16L 3x3mm QFN Package

Product: HMC424LP3E

QTR: 11003

Rev: 02

HMC536LP2	HMC461LP3	HMC716LP3
HMC546LP2	HMC467LP3	HMC717LP3
HMC646LP2	HMC468LP3	HMC720LP3
HMC652LP2	HMC470LP3	HMC721LP3
HMC653LP2	HMC491LP3	HMC722LP3
HMC654LP2	HMC492LP3	HMC723LP3
HMC655LP2	HMC493LP3	HMC758LP3
HMC656LP2	HMC494LP3	HMC759LP3
HMC657LP2	HMC495LP3	HMC794LP3
HMC658LP2	HMC496LP3	HMC799LP3
HMC667LP2	HMC500LP3	HMC800LP3
HMC788LP2	HMC539LP3	HMC801LP3
HMC311LP3	HMC540LP3	HMC802LP3
HMC344LP3	HMC541LP3	HMC860LP3
HMC345LP3	HMC547LP3	HMC862LP3
HMC346LP3	HMC548LP3	HMC902LP3
HMC347LP3	HMC561LP3	HMC903LP3
HMC348LP3	HMC593LP3	HMC905LP3
HMC356LP3	HMC604LP3	HMC916LP3
HMC369LP3	HMC605LP3	HMC917LP3
HMC372LP3	HMC616LP3	HMC948LP3
HMC373LP3	HMC617LP3	HMC976LP3
HMC375LP3	HMC618LP3	HMC981LP3
HMC376LP3	HMC630LP3	HMC712LP3C
HMC382LP3	HMC631LP3	HMC1090LP3
HMC408LP3	HMC662LP2	HMC1060LP3
HMC415LP3	HMC668LP3	
HMC424LP3	HMC669LP3	
HMC425LP3	HMC674LP3	
HMC427LP3	HMC675LP3	
HMC441LP3	HMC676LP3	
HMC451LP3	HMC713LP3	

Hittite Microwave Corporation is committed to:

- 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

QUALIFICATION TEST REPORT

Package Type: 6L LP2, 16L LP3

Package Style: 16L 3x3mm QFN Package

Product: HMC424LP3E

QTR: 11003

Rev: 02

HMC455LP3

HMC715LP3

1.0 Introduction

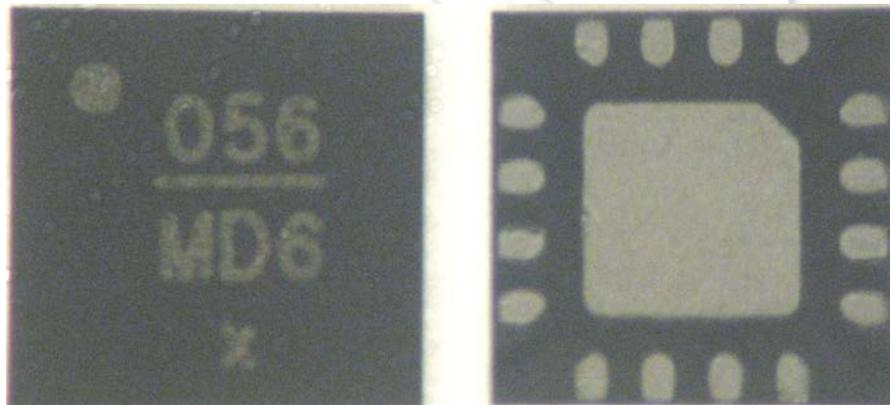
This qualification procedure is designed to satisfy the product and package reliability requirements for the HMC424LP4E16 lead 3x3mm QFN surface mount plastic encapsulated package assembled at ASE in Korea. The testing is designed to simulate the worst-case environments the product may experience during assembly, test and life in the end user application. The device was electrically tested to the appropriate catalog specifications.

1.1 General Description

The 16L 3x3mm 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 HMC424LP3 & HMC424LP3E are broadband 6-bit GaAs IC digital attenuators in low cost leadless surface mount packages. Covering DC to 13 GHz, the insertion loss is less than 4 dB typical. The attenuator bit values are 0.5 (LSB), 1, 2, 4, 8, and 16 dB for a total attenuation of 31.5 dB. Attenuation accuracy is excellent at ± 0.5 dB typical step error with an IIP3 of +32 dBm. Six control voltage inputs, toggled between 0 and -5V, are used to select each attenuation state. A single Vee bias of -5V allows operation at frequencies down to DC.

Figure 1: Typical 16L 3x3mm QFN Package



Hittite Microwave Corporation is committed to:

- 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

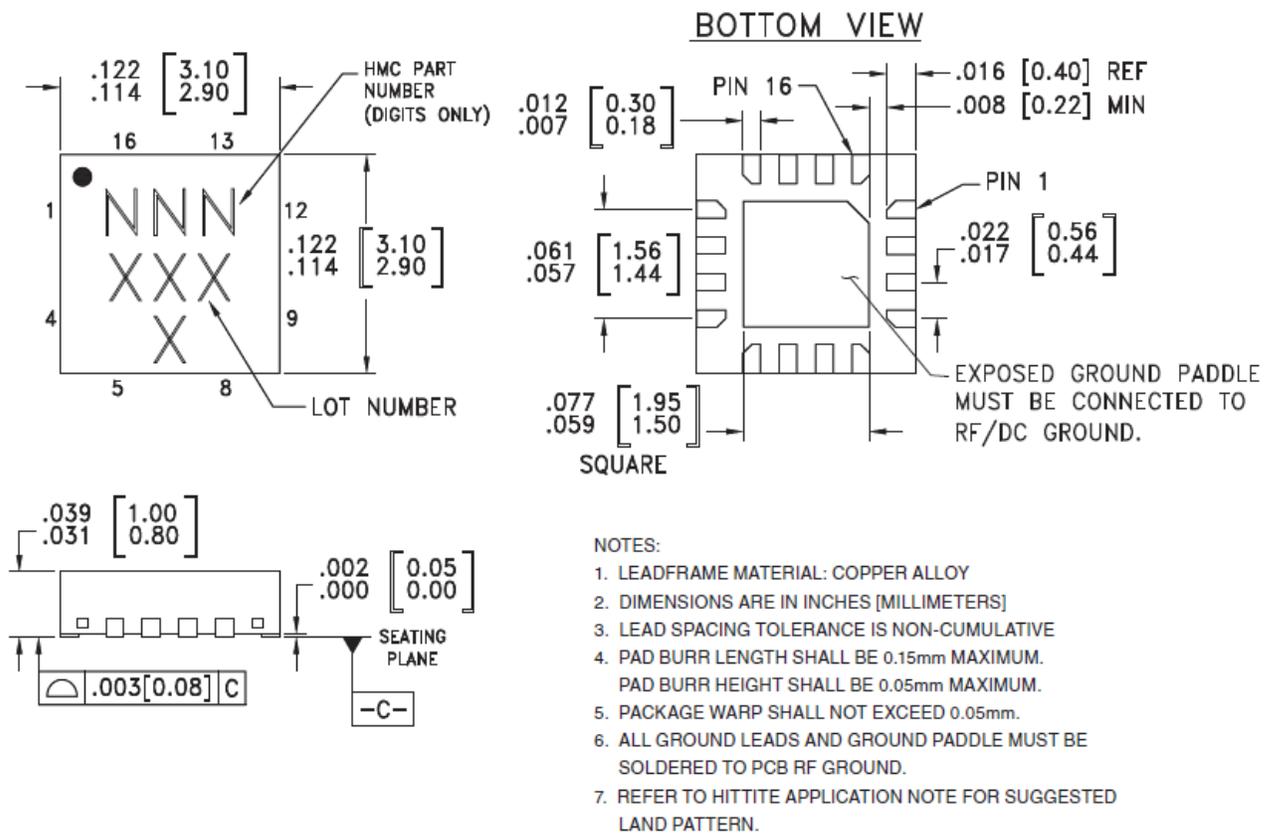
QUALIFICATION TEST REPORT

Package Type: 6L LP2, 16L LP3
Package Style: 16L 3x3mm QFN Package
Product: HMC424LP3E

QTR: 11003
Rev: 02

Figure 2: 16L 3x3mm QFN Package Outline Drawing

Outline Drawing



Hittite Microwave Corporation is committed to:

- 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

QUALIFICATION TEST REPORT

Package Type: 6L LP2, 16L LP3

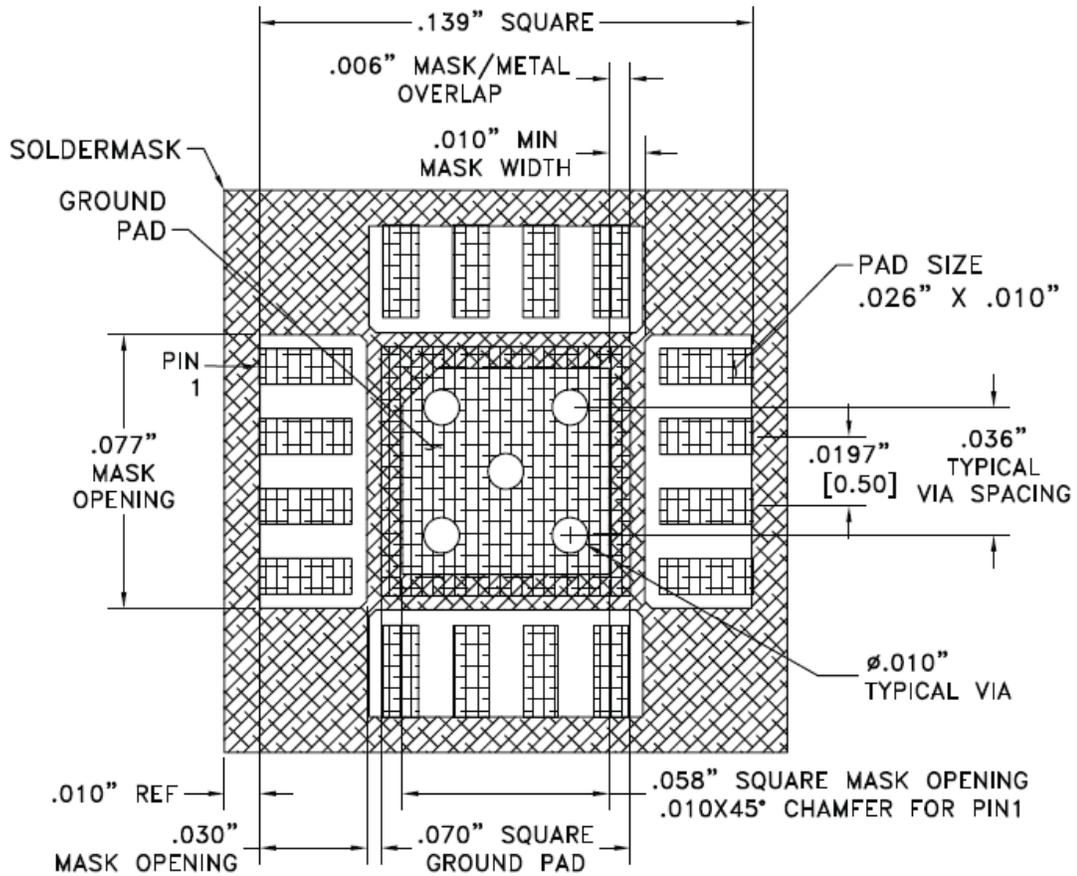
Package Style: 16L 3x3mm QFN Package

Product: HMC424LP3E

QTR: 11003

Rev: 02

Figure 3: Suggested PCB Land Pattern



Hittite Microwave Corporation is committed to:

- 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

QUALIFICATION TEST REPORT

Package Type: 6L LP2, 16L LP3
Package Style: 16L 3x3mm QFN Package
Product: HMC424LP3E

QTR: 11003
Rev: 02

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 Relevant Failures	
3.1.5	Autoclave	80	80	Complete	
3.1.6	Post Autoclave Electrical Test	80	80	Pass/No Relevant Failures	

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

Hittite Microwave Corporation is committed to:

- 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

QUALIFICATION TEST REPORT

Package Type: 6L LP2, 16L LP3

Package Style: 16L 3x3mm QFN Package

Product: HMC424LP3E

QTR: 11003

Rev: 02

3.0 Test Procedures

3.1 Package Environmental Tests

These tests are designed to demonstrate that the HMC424LP3E utilizing the 16L3x3mm QFN surface mount plastic encapsulated package assembled at ASE, Korea is capable of maintaining the specified parameters throughout their useful life under rated operating conditions.

3.1.1 Initial Characteristics - 160 HMC424LP3E 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.

Hittite Microwave Corporation is committed to:

- *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*

QUALIFICATION TEST REPORT

Package Type: 6L LP2, 16L LP3

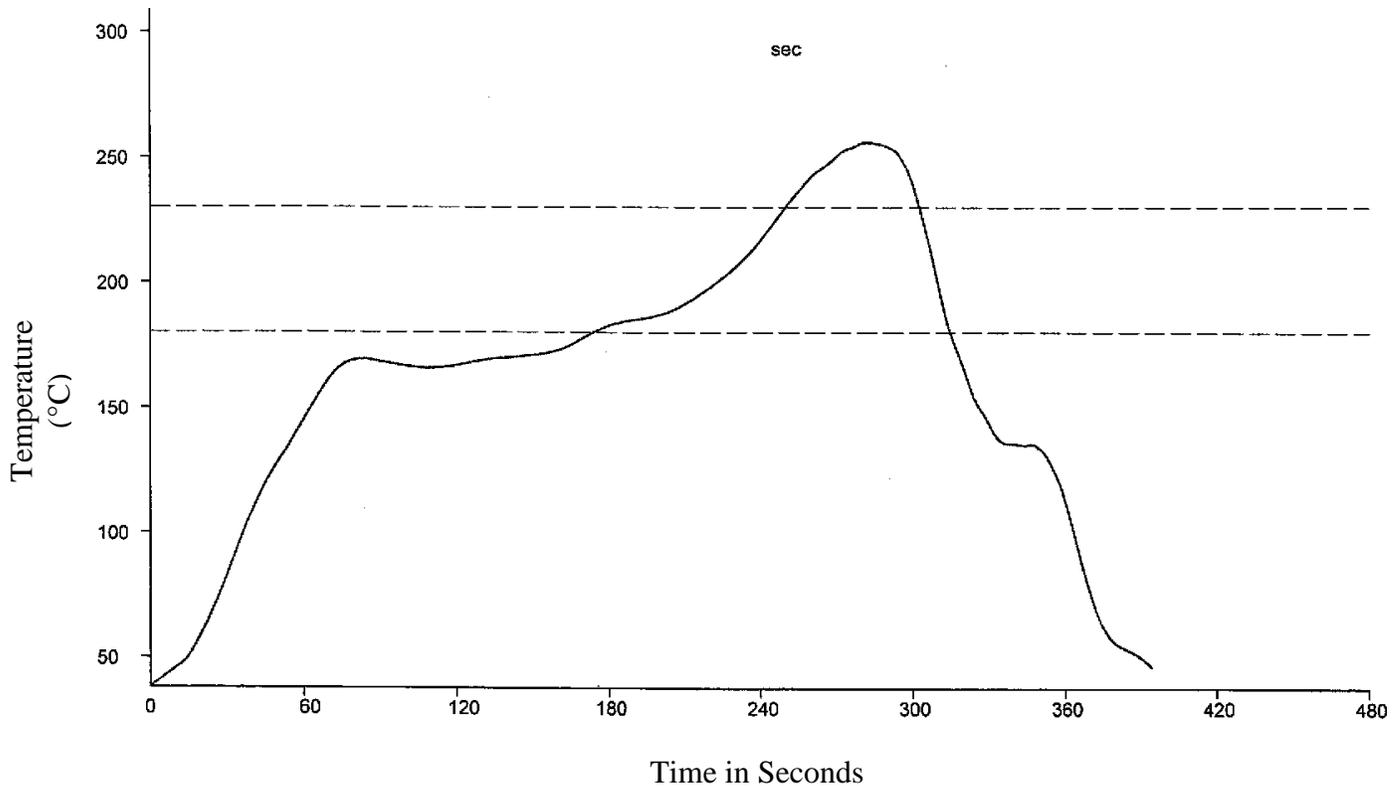
Package Style: 16L 3x3mm QFN Package

Product: HMC424LP3E

QTR: 11003

Rev: 02

Figure 4: 260°C Reflow Profile



Hittite Microwave Corporation is committed to:

- 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