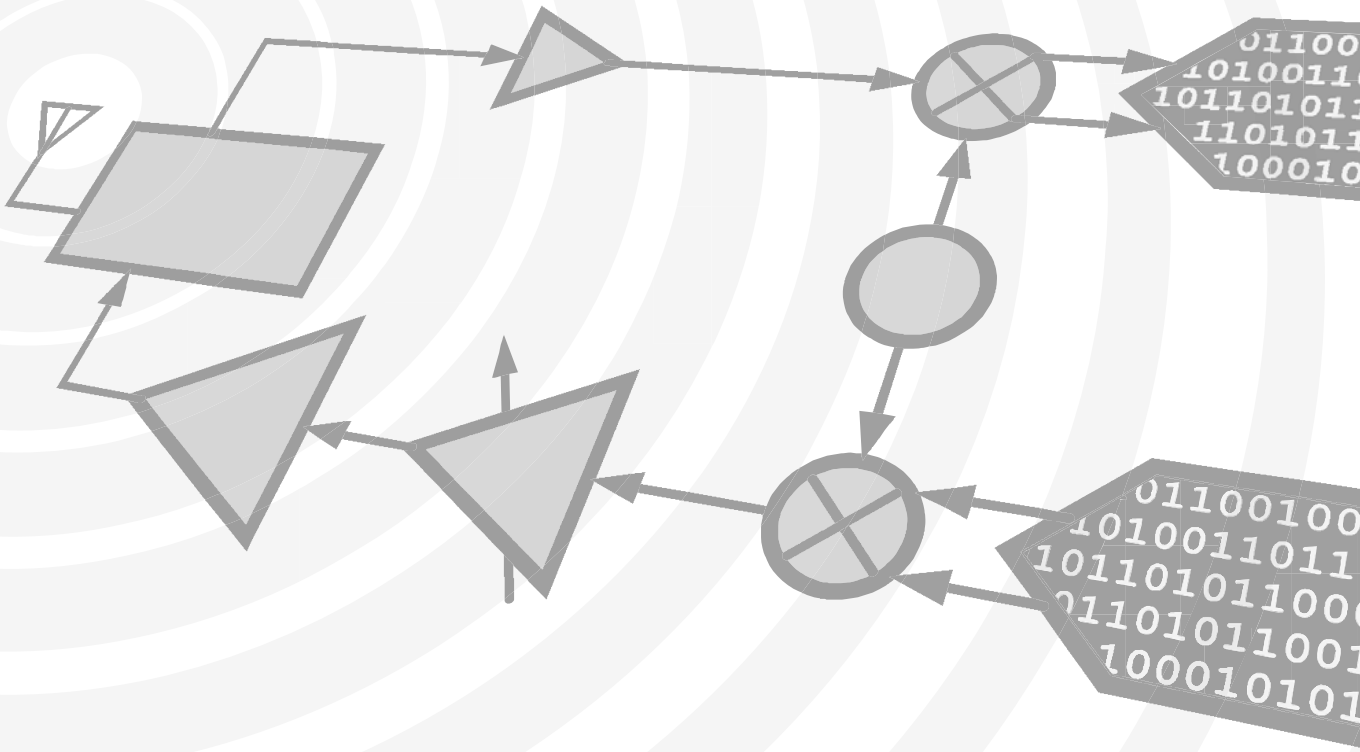
ANALOG DEVICES

Hittite MICROWAVE PRODUCTS FROM ANALOG DEVICES

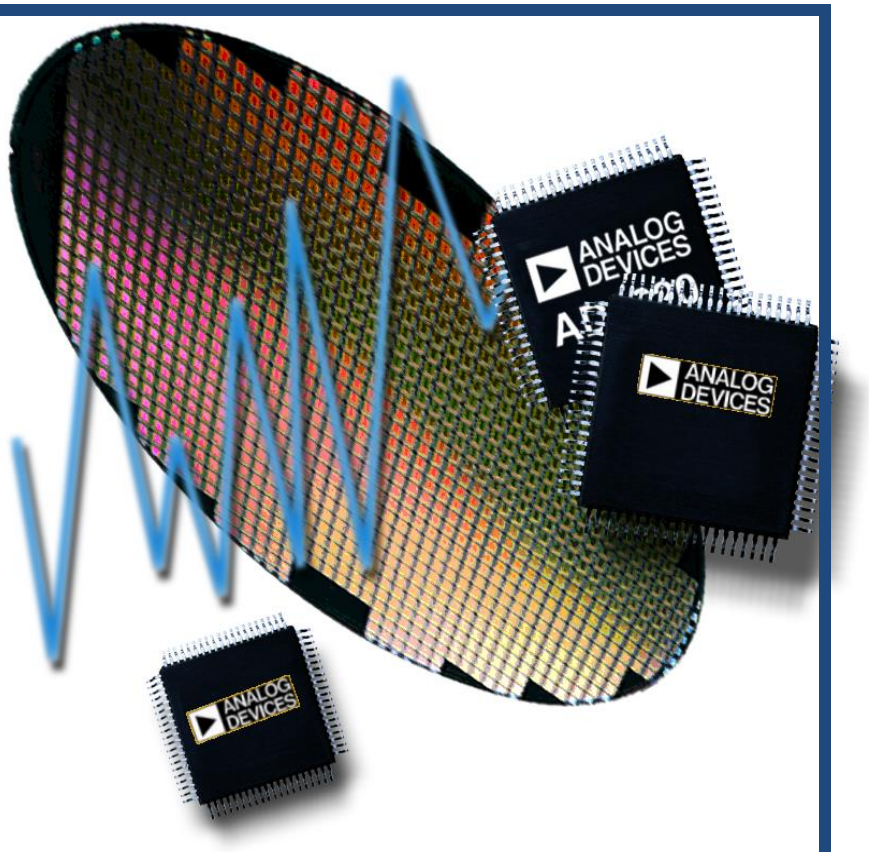
Analog Devices Welcomes Hittite Microwave Corporation

NO CONTENT ON THE ATTACHED DOCUMENT HAS CHANGED



www.analog.com

www.hittite.com



Reliability Report

Report Title: Qualification Test Report

Report Type: See Attached

Date: See Attached

QUALIFICATION TEST REPORT

Wafer Process: PHEMT-E

QTR: 11014
Rev: 04

HMC756
HMC757
HMC949
HMC950
HMC952
HMC965
HMC995

Note: This qualification was designed to evaluate the pHEMT-E process. The package type is only specific to the LP4 which was tested by the HMC757LP4. Other package qualifications are available at www.Hittite.com.

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QUALIFICATION TEST REPORT

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Introduction

This Reliability test is designed to satisfy the reliability requirements designated by Hittite Microwave Corporation for Hittite's PHEMT-E process. The testing is devised to simulate exposure to environments the product may experience during assembly, test, and life in the end user application. The pass/fail criteria are dependent upon DC and critical RF parameters determined by the appropriate catalog specifications. A complete data sheet for the HMC757LP4E can be found at www.hittite.com.

General Description of Qualification Vehicle

The HMC757LP 4E is a three stage GaAs pHEMT MMIC 1 Watt Power Amplifier which operates between 16 and 24 GHz. The HMC757LP 4E provides 20.5 dB of gain, and 27.5 dBm of saturated output power and 21% PAE from a +5V supply. The RF I/Os are DC blocked and matched to 50 Ohms. The 4x4mm plastic package eliminates the need for wire bonding, and is compatible with surface mount manufacturing techniques.

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Sample Selection: All devices used were from finished goods and met acceptance test requirements.

Reliability Tests:

Initial Characteristics – 70 Devices were electrically tested at room temperature for DC and critical RF parameters.

High Temperature Operating Life (HTOL) – 70 Devices were subjected to 1000 hours of accelerated operating life test. The devices were biased at 5V, 400mA per unit (2.0W) on product evaluation boards in a convection oven set at 125°C. Figures 1 through 3 show the evaluation board used for the HTOL testing.

Post Stress Electrical Test – 70 Post 1000 hour HTOL devices were electrically tested at room temperature for DC and critical RF parameters.

HMC757LP4E Evaluation Test Board

Figure 1: Eval Board Top View

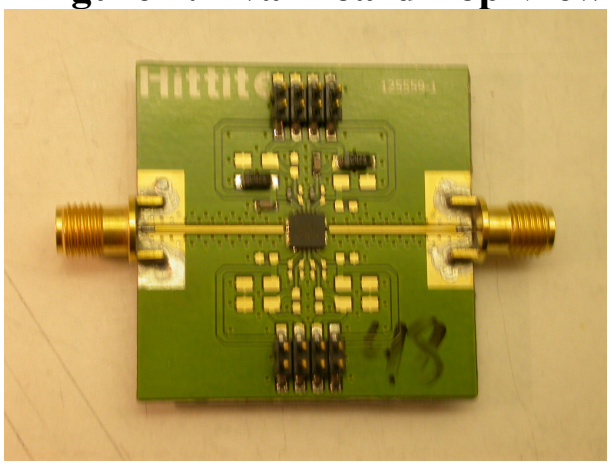


Figure 2: Eval Board Bottom View

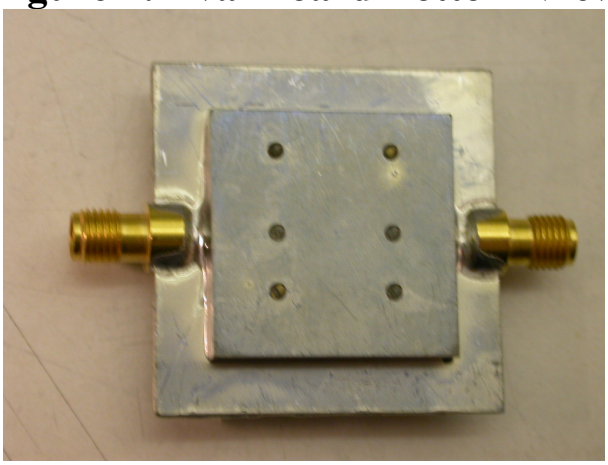
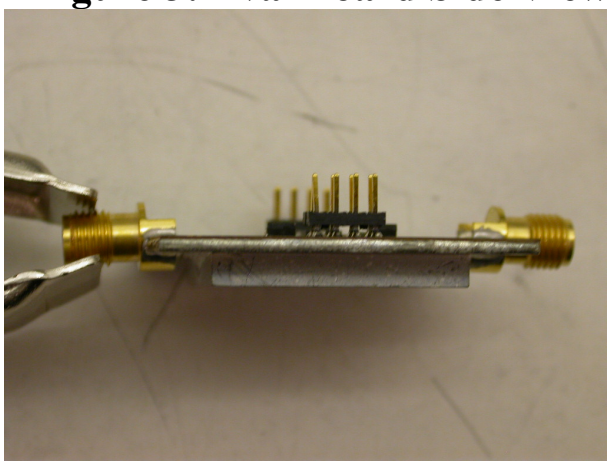


Figure 3: Eval Board Side View



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Summary of Results/Conclusions

All testing is complete. The device meets the requirements for Hittite Reliability Testing.

TEST	QTY IN	QTY OUT	PASS/FAIL	NOTES
Initial Electrical Characterization	70	70	Pass	
1000 hour of RF HTOL	70	70	Completed	
Post HTOL Electrical Test	70	70	Pass	

Failure rate (FIT) calculations using 85°C as the device maximum use temperature and 125°C as the device HTOL temperature resulted in a FIT rate of 472 FIT or a MTTF of 4.88×10^6 hours (559 years) at a 90% confidence level (CL). See Appendix for FIT / MTTF calculations.

Appendix

FIT / MTTF Calculation

Stress conditions:

Qty of Parts Tested = 70
Stress Ambient Temp = 125°C
Max Use Ambient Temp = 85°C
Activation Energy = 1.3eV

Acceleration Factor (AF): $$AF = \exp\left[\left(\frac{E_A}{k}\right)\cdot\left(\left(\frac{1}{T_{USE}}\right)-\left(\frac{1}{T_{STRESS}}\right)\right)\right]$$, AF=69.7

Calculating the Upper Confidence Bound Failure Rate at 90% CL:

$$\lambda_{CL} = \frac{\chi^2_{\%CL,2f+2}\cdot 10^9}{2\cdot t\cdot ss\cdot AF}$$, at 90% CL,

$\lambda_{90\%} = \frac{4.80*109 \quad 2*1000*70*69.7}{} = 472$ FIT, or $4.88\text{x}10^6$ hours at the maximum use temp of 85°C