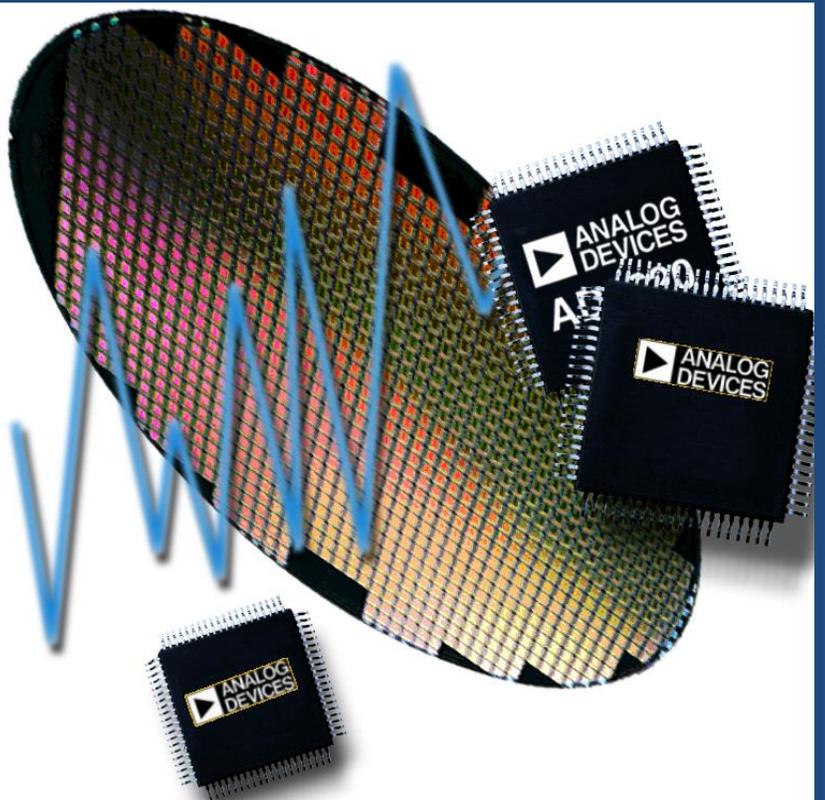


# Analog Devices Welcomes Hittite Microwave Corporation

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:** 3L ST89

**Package Style:** 3 Lead Plastic SOT89 Package

**QTR:** 10002

**Rev:** 02

HMC311ST89  
HMC452ST89  
HMC453ST89  
HMC454ST89  
HMC475ST89  
HMC478ST89  
HMC479ST89  
HMC480ST89  
HMC481ST89  
HMC482ST89  
HMC580ST89  
HMC589ST89  
HMC599ST89  
HMC636ST89  
HMC639ST89  
HMC740ST89  
HMC741ST89  
HMC789ST89



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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*

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## 1.0 Introduction

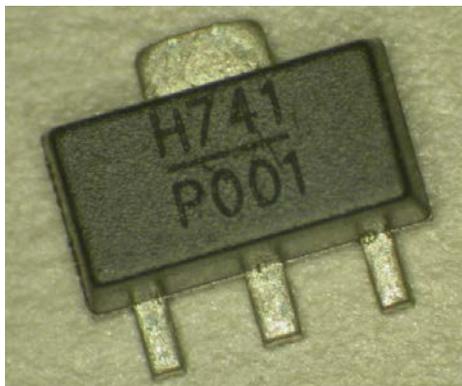
This qualification procedure is designed to satisfy the package reliability requirements for the 3 lead SOT89 surface mount plastic encapsulated package. The testing is designed to simulate the worst-case environments the product may experience during assembly, test and life in the end user application. The device is electrically tested to the appropriate catalog specifications. The HMC741ST89E was selected to qualify the SOT89 surface mount plastic encapsulated family of packages.

## 1.1 General Description

The 3L SOT89 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 G770 or equivalent epoxy encapsulating compound. The leads are available finished with either 85/15 SnPb or 100% Matte Sn plating.

The HMC741ST89E used as the qualification test vehicle is an InGaP Heterojunction Bipolar Transistor (HBT) Gain Block MMIC SMT amplifier covering 0.05 to 3 GHz. Packaged in an industry standard SOT89, the amplifier can be used as a cascadable 50 Ohm RF or IF gain stage as well as a PA or LO driver with up to +18.5 dBm output power. The HMC741ST89E offers 20 dB of gain with a +42 dBm output IP3 at 200 MHz, and can operate directly from a +5V supply. The HMC741ST89E exhibits excellent gain and output power stability over temperature, while requiring a minimal number of external bias components.

**Figure 1: Typical SOT89 Package**



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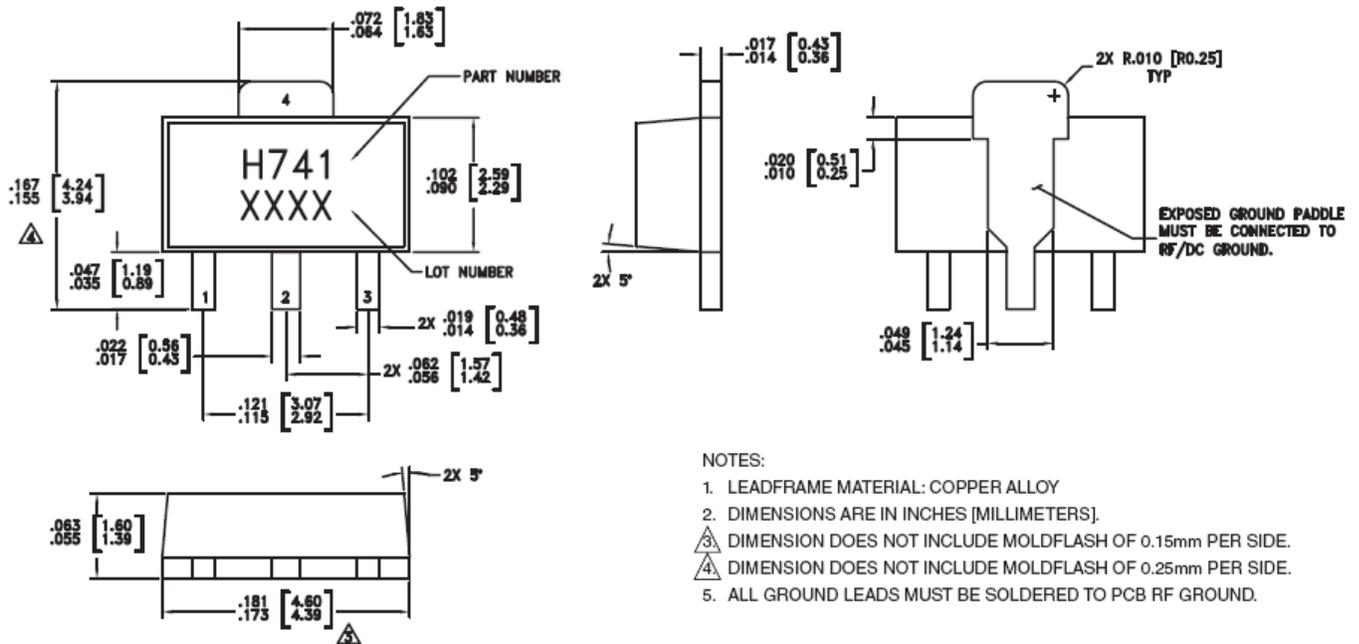
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Figure 2: SOT89 Package Outline Drawing



NOTES:

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS].
3. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
4. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
5. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

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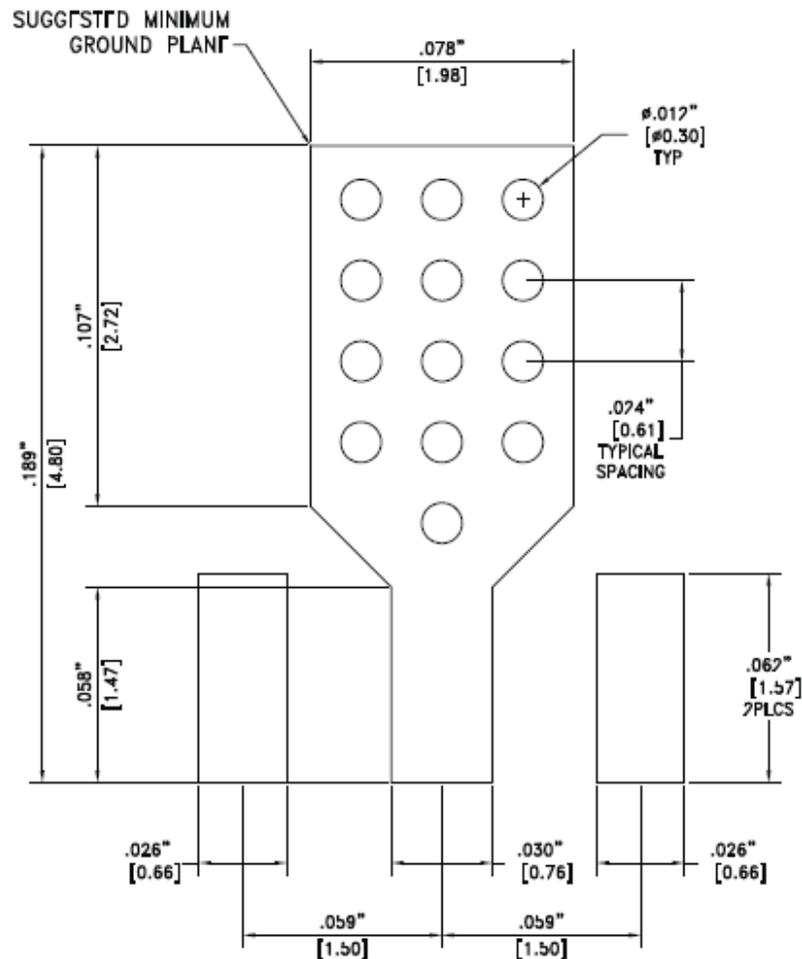
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Figure 3: Suggested PCB Land Pattern



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## 2.0 Summary of Results

PARA	TEST	QTY IN	QTY OUT	PASS/FAIL	NOTES
3.1.1	Initial Electrical Test	159	159	Pass/No Failures	
3.1.2	MSL1 260°C Reflow Preconditioning (3 Passes)	159	159	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	79	79	Complete	
3.1.6	Post Autoclave Electrical Test	79	79	Pass/No Relevant Failures	
3.1.7	Lead Co-planarity	30	30	Pass/No Failures	
3.1.8	Physical Dimensions	30	30	Pass/No Failures	Note: Ground pad tab on package backside is shaped slightly different than Hittite's primary SOT89. This will not affect soldering.
3.2.1	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 SOT89 surface mount plastic encapsulated family of packages assembled at Cirtek, Manila, Philippines are capable of maintaining the specified parameters throughout their useful life under rated operating conditions. The HMC741ST89E was selected to qualify the SOT89 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** - 159 HMC741ST89E 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** – 159 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** - 79 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** - 79 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 Coplanarity** - 30 devices were measured for lead coplanarity. Coplanarity in excess of .004" (0.1 mm) was considered a reject. These devices need not be electrically functional. This test is performed at Hittite. There were no failures.

**3.2.2 Physical Dimensions** - 30 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. Note: Ground pad tab on package backside is shaped slightly different than Hittite's primary SOT89. This will not affect soldering.

**3.2.3 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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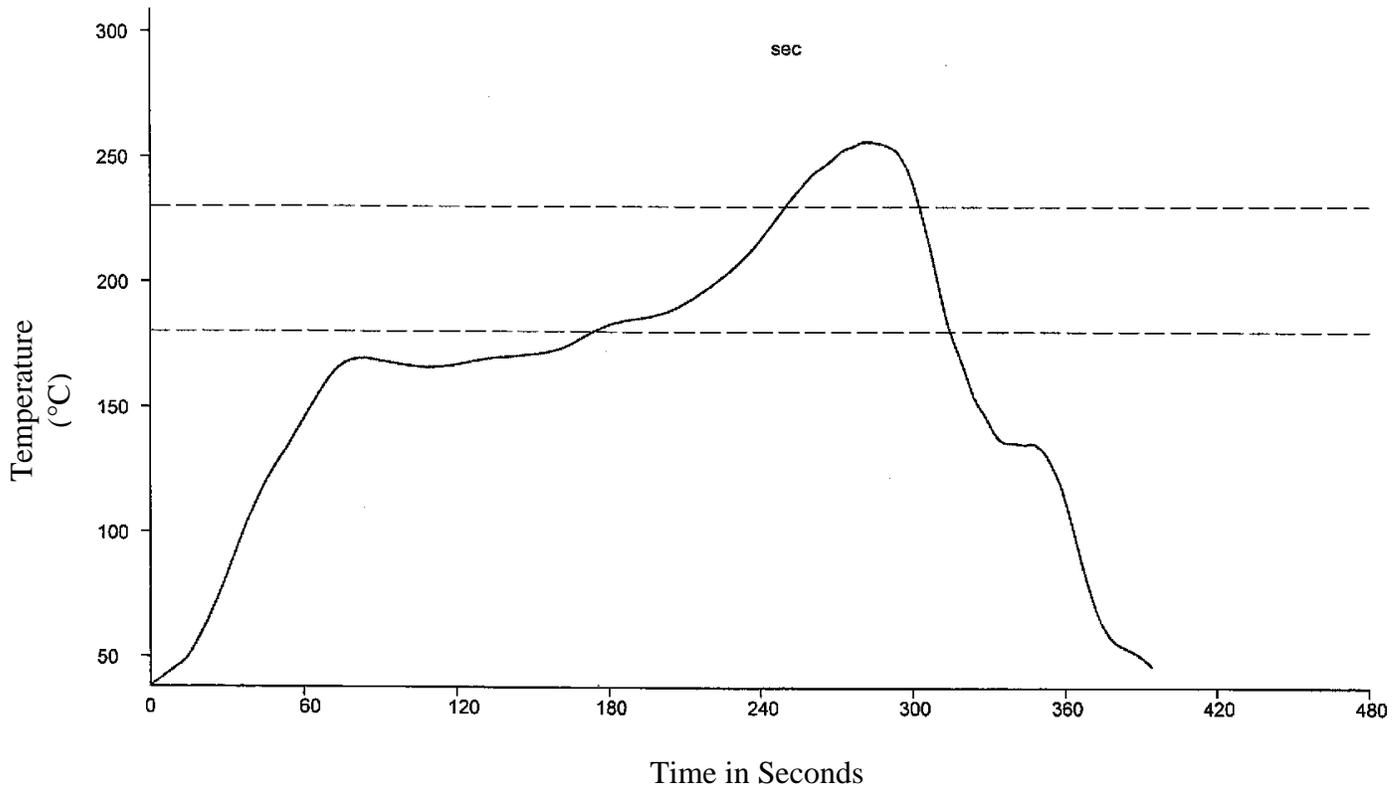
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Figure 4: 260°C Reflow Profile



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