

HON HAI Precision IND.CO.,LTD.

5F-1,5,Hsin-An Road,
Hsinchu Science-Based Industrial Park,
Taiwan, R.O.C.

Tel: 886-3-5784975 Fax: 886-3-5783038

Thermal Measurement Test Report for T99X171T00

Prepared by Ken Huang
Test Engineer, HWQA Engineering Dept.

Checked by Kenji Chen
Supervisor, HWQA Engineering Dept.

Approved by Jy Deng
Manager, HWQA Engineering Dept.

Revision Change History

Revision	Description of Change	Date
1.0	Initial Release	03/21/2019

HON HAI PRECISION IND. CO., LTD.

Notice:

All rights reserved. Except for distribution within company that authorized by Foxconn, passing on and copying of this document, use and communication of its contents with the third party is not permitted without written authorization from HON HAI PRECISION IND. CO., LTD.

Contents

Contents 1

1. Purpose and Scope 2

2. Test Setup 2

 2.1 Equipment 2

 2.2 Configuration 2

 2.3 Environment 2

 2.4 Thermal Test Setup 3

3. Test Procedure 3

4. Pass/Fail Criteria 3

5. Test Results 4

 5.1 IR image report 4

 5.2 Thermal profile measurement 4

 5.3 Test photographs 6

6. Test Result Conclusions 7

7. Configuration 7

1. Purpose and Scope

The scope of this test is to measure the thermal profile of T99X171T00. The test purpose is to demonstrate that the temperature of key components and housing when system operates in required ambient temperatures. The temperature of all measurement points should not be over the thermal specification.

2. Test Setup

2.1 Equipment

Though any equipment with high level of accuracy can be used, it is recommended that the following be used for consistency in results. Include the model and calibration date and the following information:

Table 1: Setup Information¹

Item	Equipment Name	Description
1	Thermocouple	T-type
2	Thermocouple attachment	Thermal glue: LOCTITE 384 Accelerator: LOCTITE 7387
3	Data acquisition unit	KEITHLEY 2700+7700 DMM Data Acquisition, Data logging System
4	Infrared thermal images	FLUKE Ti32
5	Environmental chamber	TERCHY MHF-408L

2.2 Configuration

Table 2: Information of DUT in thermal test

	Items	HW Version	Part Number	Software Version
1	Main Board	005	T99X171T00	4.9.113

2.3 Environment

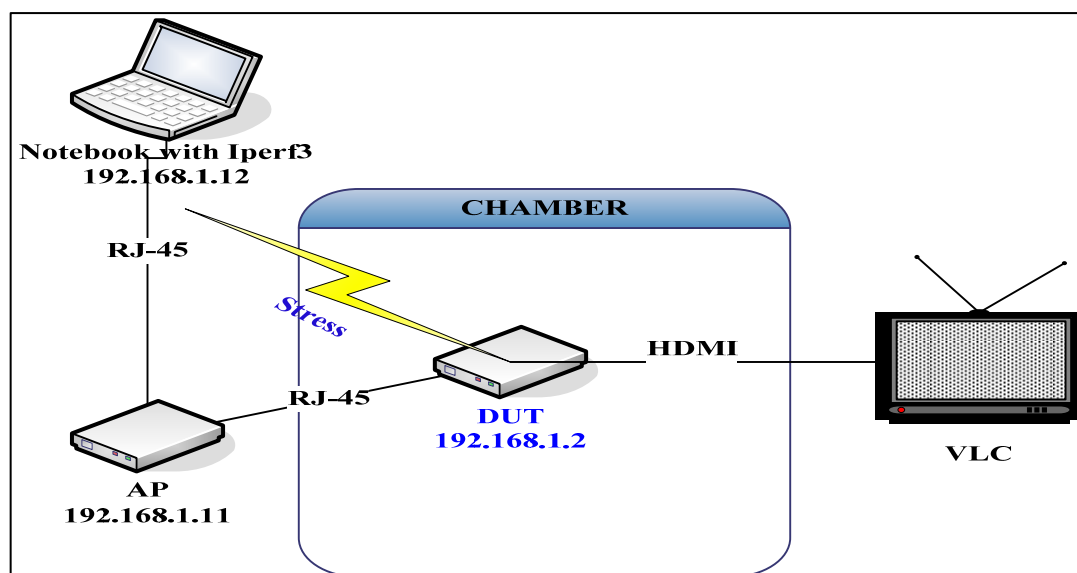
Table 3: Test environmental requirements²

Ambient temp. for testing	25°C ~ 50°C
Place mode	Horizontal stand
Air flow inside chamber	Put the DUT inside the baffle box to simulating actual environment at higher temperature setting in stationary air flow environment. The baffle box is to prevent chamber airflow influence.

¹ Include this table in this test report. Be sure to report any deviation from this table in the test report.

² Add multiple 'Environmental Requirements' tables into the Test Report if necessary. Record the set conditions for each test completed (i.e. External ambient temp, relative humidity range, and mounting method).

2.4 Thermal Test Setup



3. Test Procedure

1. Ensure the DUT can operate continuously for up to 6 hours without failures or errors.
2. Photograph the test setup and the location of the thermocouples.
3. DUT powered down and cooled to ambient conditions, and then start recording temperature readings.
4. All readings must be the same, within the range of 2°C reading accuracy.
5. Power on and confirm that the DUT is functioning properly.
6. Apply thermal load as documented in 2.5 Test Setup. Record power consumptions of DUT with loading. If the CPU utilization and memory usage information is applicable, also must be recorded.
7. Monitor the temperature readings until steady-state³ has been reached for both components and chamber temperature.
8. Record temperature readings.
9. Functional exercising during thermal test:
 - a). DUT connected to AP
 - b). Using command to control PC.
 - c). LAN to LAN using Iperf3 to do the throughput (D/S: 50MBytes, U/S: 400Mbits)
 - d). Set VLC with TV to keep the VLC Show on going.

4. Pass/Fail Criteria

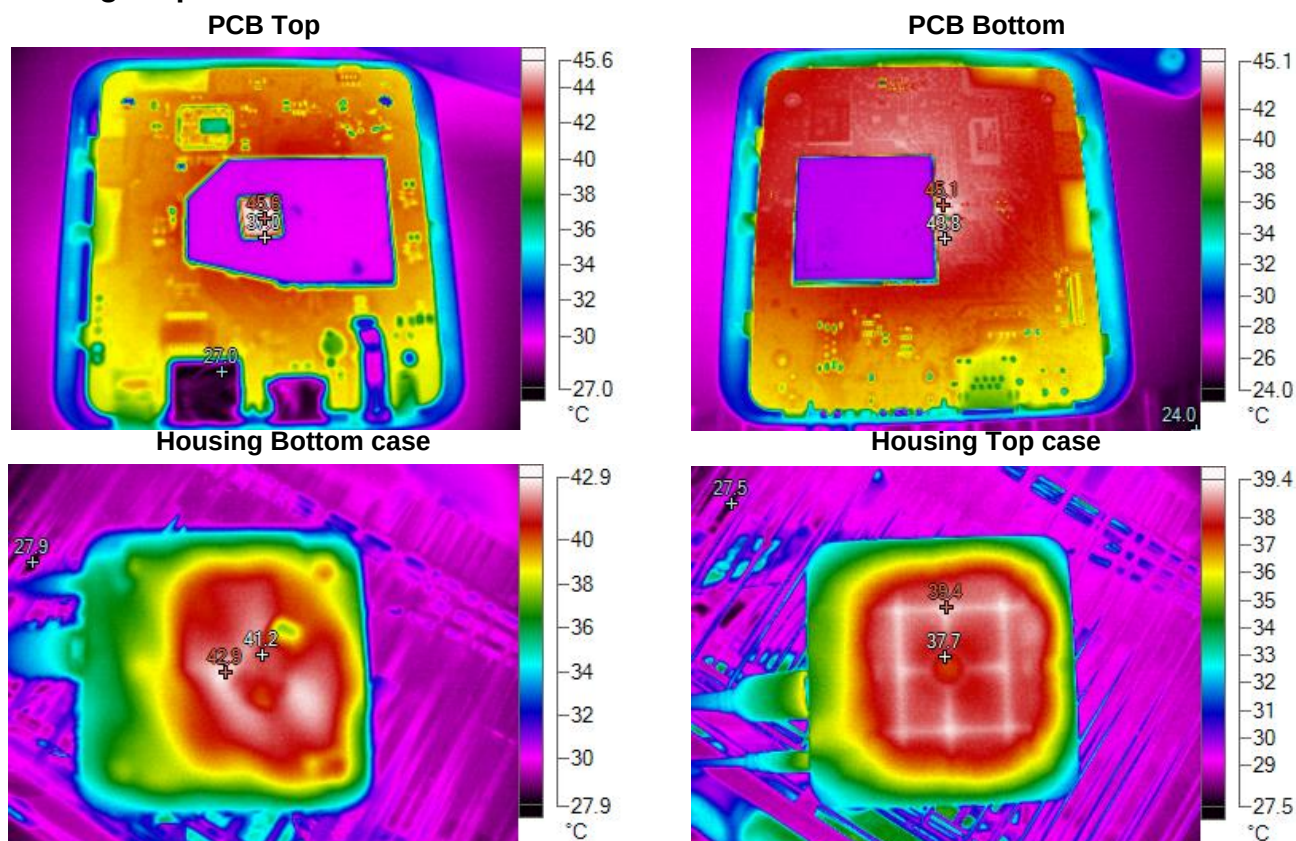
Table 4: Pass/Fail Criteria

Ambient Temp.		Criteria
Condition 1	50°C	1. The component surface temperature should meet component specification. 2. AL capacitor's lifetime > MTBF or product lifetime 3. IC chip's Temp.: Follow IC formula ($T_j = T_c + \theta_{jc} \cdot P$) and T_j has 90% de-rating for judgment. 4. Housing Top < Reference Box + 15°C 5. Housing Bottom < Reference Box + 15°C
Condition 2	25°C	1. The component surface temperature should meet component specification. 2. AL capacitor's lifetime > MTBF or product lifetime 3. IC chip's Temp.: Follow IC formula ($T_j = T_c + \theta_{jc} \cdot P$) and T_j has 90% de-rating for judgment. 4. Housing Top < Reference Box + 15°C 5. Housing Bottom < Reference Box + 15°C

³ Recommended definition of Steady-State: Three consecutive temperature readings for each thermocouple with less than a 1°C temperature rise. Each of these three consecutive temperature readings must be 15 minutes apart. This is a guideline and since some chamber temperatures can fluctuate more than 1°C, this must be taken into consideration.

5. Test Results

5.1 IR image report



Remark:

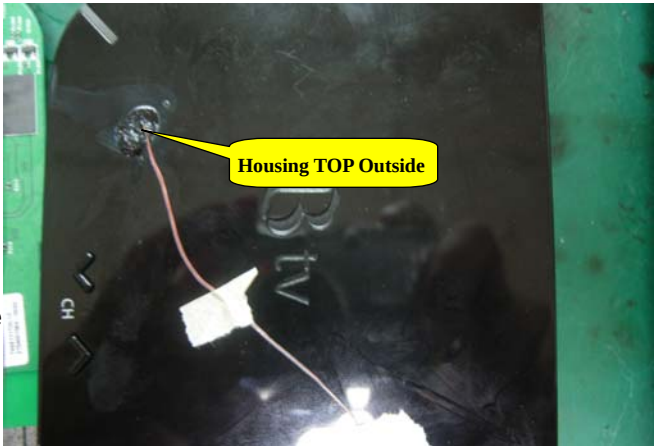
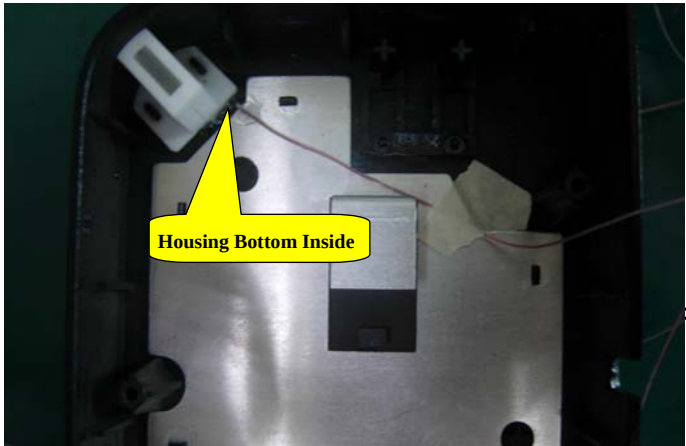
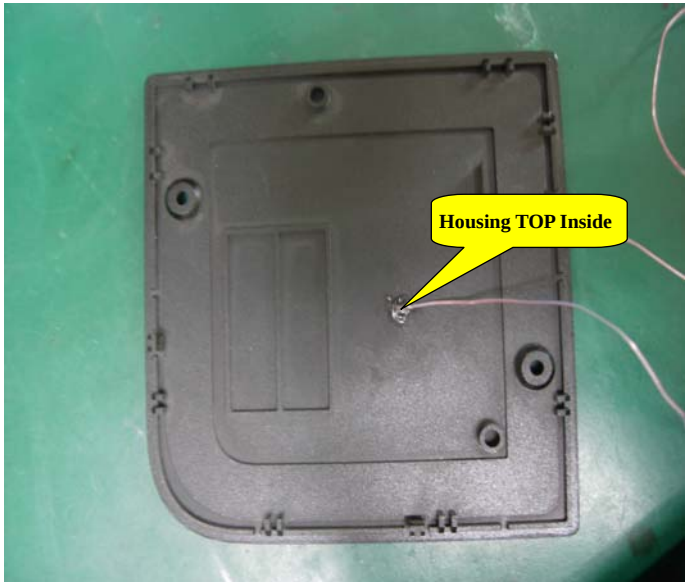
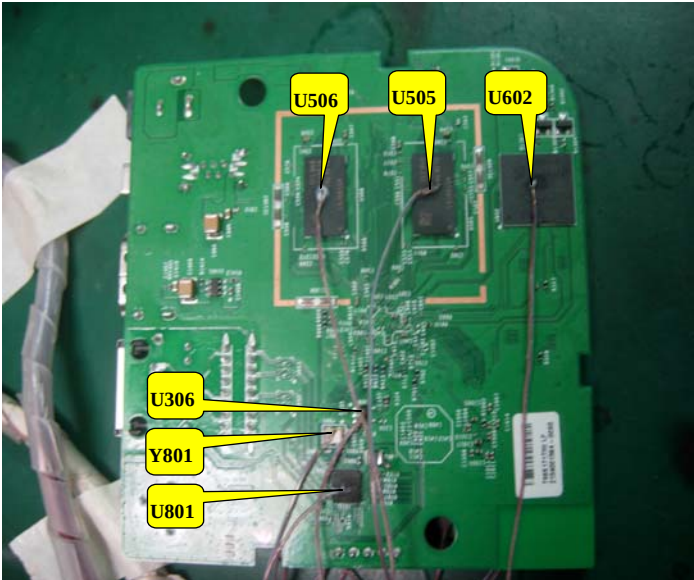
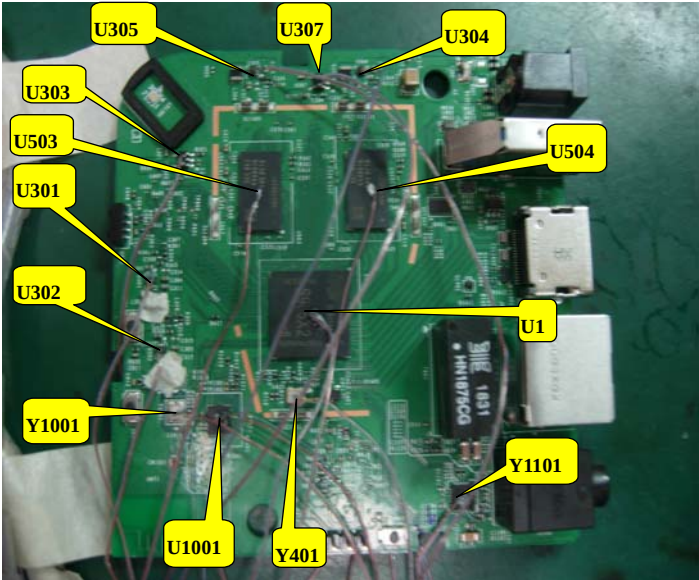
1. Scan angle, direction, index are the impacting factors of IR images.
2. Above IR image, only for temperature relative scale reference only.
3. Please check the actual tested temperature by test result.

5.2 Thermal profile measurement

No.	Location	Description	25°C	50°C	Pass Criterion	Result
1	U301	TLV62569DRLR (0.9V) –CPU	49.8	68.6	$T_j < 135^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 68.6 + 51 \cdot 0.191$ $= 78.341 < 135$ $(T_j * 90\%, 150 * 90\%)$
2	U302	TLV62569DRLR (0.841V) –GPU & core	49.6	69.8	$T_j < 135^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 69.8 + 51 \cdot 0.191$ $= 79.541 < 135$ $(T_j * 90\%, 150 * 90\%)$
3	U305	TLV62569DRLR (3.3V) –System	47	67.9	$T_j < 135^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 67.9 + 51 \cdot 0.191$ $= 77.641 < 135$ $(T_j * 90\%, 150 * 90\%)$
4	U304	TLV62569DRLR (1.2V) –DDR4	46.2	67.8	$T_j < 135^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 67.8 + 130 \cdot 0.191$ $= 77.541 < 135$ $(T_j * 90\%, 150 * 90\%)$
5	U303	FP6188-18S5 (1.8V) –eMMC	48.1	69.1	$T_j < 135^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 69.1 + 130 \cdot 0.191$ $= 93.93 < 135$ $(T_j * 90\%, 150 * 90\%)$
6	U306	FP6188-18S5 (1.8V) –System	52.8	72.7	$T_j < 135^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 72.7 + 130 \cdot 0.191$ $= 97.53 < 135$ $(T_j * 90\%, 150 * 90\%)$

7	U307	FP6188-25S5 (2.5V) -DDR4	46	66.9	$T_j < 135^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 66.9 + 130 \cdot 0.191$ $= 91.73 < 135$ (T_j *90%, 150*90%)
8	U1	S905X2-J CPU	48.3	71	$T_j < 94.5^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 71 + 5.36 \cdot 0.5821$ $= 74.120056 < 94.5$ (T_j *90%, 105*90%)
9	U504	H5AN4G6NBJR-XNC	50.2	70.1	$T_c < \text{spec. } 95^{\circ}\text{C}$	Pass
10	U506	H5AN4G6NBJR-XNC	50.9	70.4	$T_c < \text{spec. } 95^{\circ}\text{C}$	Pass
11	U503	H5AN8G6NCJR-XNC	51.2	71.4	$T_c < \text{spec. } 95^{\circ}\text{C}$	Pass
12	U505	H5AN8G6NNCR-XNC	50.4	69.6	$T_c < \text{spec. } 95^{\circ}\text{C}$	Pass
13	U602	KLMAG1JETD-B041	48.1	68.2	$T_j < 112.5^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 68.2 + 2 \cdot 0.2802$ $= 68.7604 < 112.5$ (T_j *90%, 125*90%)
14	U1001	CYW20704	50.2	70.2	$T_j < 92.7^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 70.2 + 61.21 \cdot 0.0002$ $= 70.212242 < 92.7$ (T_j *90%, 103*90%)
15	Y1001	20MHz	49.1	69.2	$T_j < 105^{\circ}\text{C}$	Pass
16	U801	RTL8211F-CG	49.1	69.7	$T_j < 112.5^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 69.7 + 100 \cdot 0.0438$ $= 74.08 < 112.5$ (T_j *90%, 125*90%)
17	Y401	24MHz	49.9	69.9	$T_c < \text{spec. } 105^{\circ}\text{C}$	Pass
18	Y801	25MHz	25.2	68.4	$T_c < \text{spec. } 105^{\circ}\text{C}$	Pass
19	U1101	TLV320ADC3101IRGET	43.4	64.4	$T_j < 94.5^{\circ}\text{C}$	Pass $T_j = T_c + \theta_{jc} \cdot P = 64.4 + 34.1 \cdot 0.100$ $= 67.81 < 94.5$ (T_j *90%, 105*90%)
20	Top Housing Inside	NA	38.4	59.3	NA	NA
21	Top Housing Outside	NA	37.5	58.1	$T_c < \Delta t \ 15^{\circ}\text{C}$	Pass
22	Bottom Housing Inside	NA	42.8	64.7	NA	NA
23	Bottom Housing Outside	NA	39.6	62.1	$T_c < \Delta t \ 15^{\circ}\text{C}$	Pass
24	Reference Box	NA	25	50	NA	NA

5.3 Test photographs



6. Test Result Conclusions

The thermal test result were passed by vertical mode of 25°C, 50°C.

7. Configuration

The thermal pad TIM (K = 3 W/mk) changed to Laird T-Flex 700 series (K = 5 W/mk)

Laird T-Flex 700 series (K = 5 W/mk)

