



9769

Product Test Laboratory
FCI Electronics

825 Old Trail Road
Etters, PA 17319-

LABORATORY TEST REPORT: EL 2001-01-013

TESTED BY: Jim Anderson

REQUESTED BY: A. Vasbinder

DATES TESTED: 2/1/01 – 5/1/01

DATE: 5/3/01

REPORTED BY: Michael D. Stremmel _____
(Product Test Lab Engineer)

CC: W. Zahlit, J. Ceresa, Kitada, File

SUBJECT: QUALIFICATION TESTING OF 240 S.O. DIMM

PURPOSE:

This report documents the qualification testing of 240 S.O. DIMM to the product specification GS-12-120 Rev. D, 3/19/01.

SAMPLE DESCRIPTION:

240 position Dual Vertical S.O. DIMM with BGA Connector, p/n 63348-002

Connectors were soldered on test board p/n SK-38831 Rev. 4

Test Module Card, p/n SK-38801 Rev. 6

The samples were visually inspected and found to be suitable for testing.

All samples were received 1/8/01.

CONCLUSIONS:

The 240 position S.O. DIMM connector system successfully completed qualification testing for all test groups in accordance with the product specification GS-12-120 Rev. D, 3/19/01.

TESTS:

Table 1 shows the test plan that was used for the testing.

Table 1 – Test Plan

Test	Test Group									
	1	2	3	4	5	6	7	8	9	10
Visual Examination	1 10	1 9	1 7	1 7	1 3	1 6	1 3	1 5	1 4	1 5
Contact Resistance		2 4 6 8	2 4 6	2 4 6				2 4		2 4
Insulation Resistance	2 5 8									
Dielectric Withstanding Voltage	3 6 9									
Current Rating							2			
Capacitance									2	
Inductance									3	
Contact Retention						5				
Thermal Shock	7	3				2				
Humidity	4	5				3				
High Temp Life		7				4				
Corrosive Atmosphere			5					3		
Vibration				3						
Mechanical Shock				5						
Durability			3							
Resistance to Soldering Heat					2					
Thermal Cycling										3

Test Group 1: Thermal Shock & Humidity

Test Group 1 evaluated the integrity of the materials comprising the connector as well as the integrity of the assembled connector through thermal shock and humidity with temperature cycling exposure. Sample size consisted of 4 connectors, 10 adjacent and 10 opposing contacts from each connector. Thermal shock testing was performed in accordance with EIA 364-32; 5 thirty minute cycles from -55 C to +85 C. Steady-state humidity testing was performed in accordance with EIA 364-31 Method II. Test exposure consisted of 96 hours with RH of 95% and a temperature of 40 C.

Group 1 IR & DWV Results

Insulation resistance was performed in accordance with EIA 364-21, with a test voltage of 500 VDC. The insulation resistance of mated connectors is required to be at least 150 MΩ or greater after environmental exposure. Dielectric withstanding voltage was performed in accordance with EIA 364-20, with a test voltage of 500 volts for 60 sec. The leakage current is required to be less than 0.5 mA with no evidence of arc-over or insulation breakdown. After environmental exposure the minimum insulation resistance that was observed was 64 GΩ. The maximum leakage current that was observed was 4.9 nA. There was no evidence of arc-over or breakdown.

Test Group 2: Environmental Sequence

Test Group 2 evaluated the connector’s ability to resist spring relaxation over the projected life of the connector. Group 2 also evaluated the integrity of the materials comprising the connector as well as the integrity of the assembled connector through thermal shock and steady-state humidity exposure. Sample size consisted of 4 connectors, 240 positions per connector. Thermal shock testing was performed in accordance with EIA-364 Test Procedure 32; 5 thirty minute cycles from –55 C to +85 C. Steady-state humidity testing was performed in accordance with EIA-364 Test Procedure 31. Test exposure consisted of 96 hours with RH of 95% and a temperature of 40 C. High temperature life testing was performed in accordance with EIA-364 Test Procedure 17; +105 C for 500 hours.

Group 2 LLCR Results

Low Level Contact Resistance was measured in accordance with EIA 364-23. Table 2 summarizes the contact resistance performance before and after thermal shock, steady-state humidity, and high temperature life testing. The contact resistance must be less than 30.0 mΩ and less than 15.0 mΩ change after environmental exposure. The maximum contact resistance observed before exposure was 13.505 mΩ. The maximum change in contact resistance observed after exposure was 6.932 mΩ.

Table 2 – Change in Contact Resistance (mΩ)

	Initial	After Thermal Shock	After Humidity	After High Temp Life
Min	10.997	-0.886	-0.793	-0.332
Max	13.505	1.783	1.835	6.932
Average	12.037	0.068	0.120	1.054
Std Dev	0.689	0.175	0.184	0.746

Test Group 3: Corrosive Atmosphere & Durability

Test Group 3 evaluated the contacts ability to resist corrosion. Sample size consisted of 4 connectors with 240 contacts per connector. Durability testing was performed in accordance with the product specification GS-12-120 Rev D; 25 cycles at 2.0"/min cycling rate. Corrosive atmosphere testing was performed in accordance with EIA 364-65A, Condition II A. Samples were exposed mated with test cards for 20 days.

Group 3 LLCR Results

Table 3 summarizes the contact resistance performance before and after durability and corrosive atmosphere. The contact resistance must be less than 30.0 mΩ and less than 15.0 mΩ change after environmental exposure. The maximum contact resistance observed before exposure was 13.663 mΩ. The maximum change in contact resistance observed after exposure was 13.891 mΩ.

Table 3 – Change in Contact Resistance (mΩ)

	Initial	After Durability	After Corrosive Atmosphere
Min	10.766	-0.916	-0.954
Max	13.663	2.174	13.891
Average	12.135	0.279	0.152
Std Dev	0.713	0.200	0.539

Test Group 4: Shock & Vibration

Test Group 4 evaluated the mechanical integrity of the connector system through vibration and mechanical shock testing. Sample size consisted of four connectors. Samples were fixtured to eliminate relative motion between the test card and connector. Sinusoidal vibration testing was performed in accordance with EIA 364-28 (15 g peak, 10 – 2000 – 10 Hz, 20 min./sweep, 4 hours/axis).

Mechanical shock was performed after vibration using the same samples in accordance with EIA 364-27 (50 g, 11 ms ½ sine), 3 shocks in each direction, 18 shocks total.

Group 4 LLCR Results

Table 4 summarizes the contact resistance performance before and after mechanical shock and vibration. The LLCR measurements were performed for two contacts together to facilitate discontinuity monitoring during testing. The contact resistance of one contact must be less than 30.0 mΩ and less than 15.0 mΩ change after environmental exposure. The maximum contact resistance observed before exposure was 27.592 mΩ. The maximum change in contact resistance observed after exposure was 6.634 mΩ. Since two contacts were read together the resistances are slightly higher than normal, but all readings meet the specification.

Table 4 – Change in Contact Resistance (mΩ)

	Initial	After Vibration	After Shock
Min	13.343	-0.987	-0.845
Max	27.592	6.634	5.878
Average	26.017	-0.082	-0.022
Std Dev	1.254	0.414	0.441

Group 4 Discontinuity Results

Each part was wired in a series circuit to detect any discontinuities during the testing. No discontinuities greater than 1 μs were observed during vibration or mechanical shock.

Test Group 5: Resistance to Soldering Heat

Test Group 5 evaluated the materials ability to withstand the heat of soldering the connector to a board. Sample size consisted of 2 connectors. Samples were tested in accordance with EIA 364-56, Procedure 5, Level 2; 235 C for 30-35 seconds. Both samples were soldered to boards prior to testing. No flux or solder paste was used. Samples were required to experience no degradation, softening, or distortion of the insulating materials used and no cracking, crazing, loosening of terminals, or melting of housing. Both samples showed no signs of distortion to the material.

Test Group 6: Contact Retention

Test Group 6 evaluated the retention force of the contact to the connector housing. Contact retention testing was performed on 20 contacts randomly selected from 2 connectors. Testing was performed after the connectors were exposed to a thermal shock, steady state humidity, and high temperature life sequence. Thermal Shock was performed in accordance with EIA 364-32, -55 to +85 C for 5 cycles. Humidity testing was performed in accordance with EIA 364-31 Method II, 40 C at 95% RH for 96 hours. High temperature life testing was performed in accordance with EIA 364-17, 105 C for 500 hours.

Group 6 Contact Retention Results

Table 5 summarizes the contact retention for each connector. The minimum requirement for the contact retention is 0.30 lbs. The minimum retention force that was observed was 0.90 lbs.

Table 5 – Contact Retention Results (lbs.)

	Sample 6.1	Sample 6.2
Min	0.90	0.97
Max	1.30	1.47
Average	1.138	1.165

Test Group 7: Current Rating

Samples were wired with every other contact (all odd numbered positions) in series. A thermal couple was inserted into a centrally located contact cavity on each daughter card slot, as well as one on an active trace on the motherboard. A test current of 0.5 Amps was applied and the ambient temperature as well as the connector temperatures were recorded for a period of approximately two hours. The temperature rise above ambient is required to be less than 30 C at any point in the system when powered at 0.5 Amps. Reference EL-1998-11-080K for results. The maximum temperature rise above ambient was 25 C. Table 6 summarizes the data for temperature rise at each point.

Table 6 – Current Rating Results (°C)

	Ambient Temperature	Temperature	T-Rise Observed
Card "A"	22	44	22
Card "B"	22	47	25
Mainboard	22	46	24

Test Group 8: Corrosive Atmosphere

Test Group 8 evaluated the contacts ability to resist corrosion. Sample size consisted of 2 connectors with 240 contacts per connector. Corrosive atmosphere testing was performed in accordance with EIA 364-65A, Condition II A. Samples were exposed mated with test cards for 20 days.

Group 8 LLCR Results

Table 7 summarizes the contact resistance performance before and after corrosive atmosphere testing. The contact resistance must be less than 30.0 mΩ and less than 15.0 mΩ change after environmental exposure. The maximum contact resistance observed before exposure was 13.513 mΩ. The maximum change in contact resistance observed after exposure was 1.016 mΩ.

Table 7 – Change in Contact Resistance (mΩ)

	Initial	After Corrosive Atmosphere
Min	11.133	-0.611
Max	13.513	1.016
Average	12.254	-0.166
Std Dev	0.686	0.186

Test Group 9: Electrical

Test Group 9 evaluated the electrical performance of the connector. Capacitance and Inductance testing was performed to evaluate the signal degradation of the connector. Capacitance testing was performed on 10 adjacent and 10 opposing contacts. Capacitance testing was performed in accordance with BUS-03-114. Inductance testing was performed using the loop inductance test method. The inductance of a single contact was performed in prior testing. Inductance testing was performed in accordance with BUS-03-113.

Group 9 Capacitance Results

Table 8 summarizes the capacitance of an unmated connector measured at 1 GHz and a voltage of 1 volt. The capacitance of a single contact is required to be less than 0.5 pF. The maximum capacitance observed was 0.436 pF.

Table 8 – Capacitance (pF)

	Capacitance	
	ADJ	OPP
Min	0.419	0.325
Max	0.436	0.338
Average	0.425	0.330

Group 9 Inductance Results

Self inductance testing was performed using the TDR method. All contacts except the active contact were soldered to the ground plane of a PC board. A 50-ohm chip resistor was soldered between the contact position trace and ground. The input frequency used was 12 GHz. The inductance is required to be less than 1.5 nH. Reference EL 1998-09-029 for results. The measured inductance was 1.12 nH.

Inductance testing was also performed using the loop inductance method. Table 9 summarizes the loop inductance of an unmated connector measured at 1 GHz. The maximum loop inductance is required to be less than 5.0 nH. The maximum loop inductance observed was 4.48 nH.

Table 9 – Loop Inductance (nH)

	Loop Inductance
Min	4.34
Max	4.48
Average	4.42

Test Group 10: Thermal Cycling

Test Group 10 evaluated the connector’s solder joints ability to withstand the creep or stress relaxation enhanced fatigue failure mechanism.. Thermal cycling testing was performed in accordance with the Product Specification, GS-12-120, Rev D; 0 to 100 C, 15 min dwells, 5 C/min ramp rate, for 1000 cycles.

Group 10 LLCR Results

Each sample was wired into 4 individual circuits. The overall contact resistance was then monitored every 10 minutes for the duration of the test. Each circuit was required to have less than a 100% change in the total resistance at any point during the testing. The highest change that was observed was 24.1%. Table 10 shows the percent change in the contact resistance. The unstable readings that were observed were a result of the measuring equipment. A small time allotment was made for each measurement, and if the reading had not become stable in that time period, it registered to the equipment as an unstable reading.

Table 10 – % Change in Contact Resistance

	Sample 10.1				Sample 10.2			
	Circuit 1	Circuit 2	Circuit 3	Circuit 4	Circuit 1	Circuit 2	Circuit 3	Circuit 4
Max	0.3	0.4	0.4	24.1	0.3	0.4	0.5	0.6
Min	-71.5	-28.2	-34.8	-28.6	-29.1	-63.1	-28.2	-74.2
Average	-33.2	-14.2	-14.2	0.5	-14.7	-16.1	-14.1	-15.5

# Unstable	53	0	0	0	0	3	0	0
------------	----	---	---	---	---	---	---	---

EQUIPMENT:

ITEM NAME	MANUFACTURERS NAME	V.G. NUMBER	CALIBRATION DUE DATE
Temperature Cycling Chamber	CSZ	VG 7028	4/18/02
Dry Heat Oven	Blue M	VG 6930	4/18/02
Humidity Chamber	Blue M	VG 6466	5/01
Humidity Chamber	Thermotron	VG 6475	5/01
Thermal Shock Chamber	Thermotron	VG 6931	5/01
Chart Recorder	Molytek	VG 6983	5/01
Dew Point		VG 7217	9/01
Air Flow Con		VG 6938	N/A
Gas Flow Con		VG 6939	N/A
Perm Rack		VG 6944	3/02
Tension / Compression Machine	Instron	VG 6461	8/01
Tension / Compression Machine	Instron	VG 6464	8/01
Cell (1000 lbs)	Instru-Met	VG 6449	CBU
Cell (110 lbs)	Instru-Met	VG 6962	CBU
Weight (10 lbs)		VG 6253	5/01
Weight (1 lbs)		VG 6258	5/01
Weight (10 lbs)		VG 6260	5/01
Weight (20 lbs)		VG 6842	5/01
Weight (20 lbs)		VG 6845	5/01
Signal Conditioner	Unholtz-Dickie	VG 6927	3/01
Sine Control	Unholtz-Dickie	VG 6928	3/01
Vibration Controller	Unholtz-Dickie	VG 6929	3/01
Vibrator	Unholtz-Dickie	SN 499	Not Calibrated
Accelerometer	Unholtz-Dickie	VG 6957	3/02
Discontinuity Monitor		VG 6090	5/23/01
Shock Machine	Avex	SN ED0107	n/a
Charge Amplifier	Endevco	VG 6926	7/01
Digital Oscilloscope	Hi-Techniques	VG 6924	7/01
Low Pass Filter	Krohn-Hite	VG 6925	7/01
Accelerometer	Columbia	VG 6961	7/01
Ohmmeter	Keithley	VG 6851	7/01
Ohmmeter	Keithley	VG 7024	8/01
Switch Box	Keithley	VG 7145	N/A
Switch Box	Keithley	VG 6833	N/A
Switch Box	Keithley	VG 7100	N/A
Dielectric Analyzer	Vitrex	VG 6978	6/26/01
Temp / Humidity Recorder	Dickson	VG 7172	7/6/01
Impedance Analyzer	HP	VG 6101	6/29/01
Convection Oven		VG 7156	Not Calibrated
Thermal Profiler		VG 7617	6/30/01
Microscope		VG 5919	3/31/01