MULTIGIG RT* Power Modules

1. INTRODUCTION

1.1. Purpose

Testing was performed on Tyco Electronics MULTIGIG RT* Power Modules to determine their conformance to the requirements of Product Specification 108-2062, Revision C.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of MULTIGIG RT Power Modules. Testing was performed at the Engineering Assurance Product Testing Laboratory between 19May02 and 03Sep02. The test file number for this testing is CTL B025258-014. This documentation is on file at and available from the Engineering Assurance Product Test Laboratory.

1.3. Conclusion

The MULTIGIG RT Power Modules listed in paragraph 1.5 conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-2062, Revision C.

1.4. Product Description

MULTIGIG RT Power Modules provide high current, separable, board-to-board connections for use with the MULTIGIG RT product family or in other applications. Vertical receptacles and right angle plug headers are available in 2 or 4 positions on 3.6 mm spacing with up to 3 levels of connection sequencing. Vertical receptacle modules are designed for finger probe protection. ACTION PIN* press-fit contacts eliminate the need for soldering to printed circuit boards.

1.5. Test Specimens

Test specimens were representative of normal production lots. Specimens identified with the following part numbers were used for test:

Test Group	Quantity	Part Number	Description
1,2,3,4,5	48	1410271-7	4 position right angle header assembly, with mid & short contact tabs
	48	1410270-1	4 position vertical receptacle assembly
	40	60-474130-1	Vertical receptacle board (mother)
	40	60-474131-1	Right angle plug board (daughter)

Figure 1

1.6. Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

- Temperature: 15 to 35˚C
- Relative Humidity: 25 to 75%

* Trademark
| Indicates change

1.7. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)				
	1	2	3	4	5
	Test Sequence (b)				
Initial examination of product	1	1	1	1	1
Low level contact resistance, circuit	4,7	4,7,9,12	2,5,7,10	2,5,7,9,12,14,16,19	
Low level resistance, compliant pin	5,8	5,13	3,11	3,10,17	
Insulation resistance		14			
Withstanding voltage		15			
Vibration			8		
Mechanical shock			9		
Durability		6	4	4,18(c)	
Mating force	2,10	2,17	13		
Unmating force	3,9	3,16	12		
Contact retention					4
Compliant pin insertion					2
Compliant pin retention	11	18	14	20	3
Minute disturbance				15	
Thermal shock		10			
Humidity/temperature cycling		11			
Temperature life with electrical load	6				
Mixed flowing gas				6(d),8(d),11(e),13(e)	
Dust contamination		8	6		
Final examination of product	12	19	15	21	5

NOTE

(a) See paragraph 1.5.
(b) Numbers indicate sequence in which tests are performed.
(c) Perform 100 cycles of durability before, and 100 cycles after mixed flowing gas testing.
(d) Exposure interval of 5 days with specimens unmated.
(e) Exposure interval of 5 days with specimens mated.

Figure 2

2. SUMMARY OF TESTING

2.1. Initial Examination of Product – All Test Groups

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance was issued by Product Assurance. Where specified, specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. Low Level Contact Resistance - Test Groups 1, 2, 3 and 4

All low level resistance measurements were less than 5 milliohms initially and had a maximum change in resistance (ΔR) of less than 5 milliohms after testing.

Test Group	Number of Data Points	Condition	Contact Resistance		
			Min	Max	Mean
1	32	Initial	0.498	1.713	0.898
	32	After temperature life (ΔR)	-0.309	1.684	0.133
2	32	Initial	0.680	2.071	1.023
	32	After durability (ΔR)	-0.409	0.674	-0.076
	32	After dust (ΔR)	-1.491	-0.044	-0.385
	32	After humidity/temperature cycling (ΔR)	-1.508	-0.014	-0.394
3	32	Initial	0.674	4.910	1.423
	32	After durability (ΔR)	-2.637	0.261	-0.377
	32	After dust (ΔR)	-4.293	-0.026	-0.771
	32	After vibration and shock (ΔR)	-1.491	-0.044	-0.385
4	32	Initial	0.621	4.799	1.102
	32	After durability (ΔR)	-3.225	0.115	-0.266
	32	After 5 days MFG, unmated (ΔR)	-4.022	0.004	-0.328
	32	After 10 days MFG, unmated (ΔR)	-4.220	0.098	-0.347
	32	After 15 days MFG, mated (ΔR)	-4.199	0.000	-0.415
	32	After 20 days MFG, mated (ΔR)	-4.175	0.020	-0.421
	32	After minute disturbance (ΔR)	-4.199	0.027	-0.436
	32	After 100 durability cycles (ΔR)	-4.204	0.001	-0.482

NOTE All values in milliohms

Figure 3

2.3. Low Level Compliant Pin Resistance - Test Groups 1, 2, 3 and 4

All low level compliant pin resistance measurements were less than 1 milliohm initially and all compliant pin change in resistance (ΔR) values were less than 1 milliohm after testing.

Test Group	Number of Data Points	Condition	Compliant Pin Resistance		
			Min	Max	Mean
1 (receptacle)	32	Initial	0.173	0.319	0.249
	32	After temperature life (ΔR)	-0.308	-0.126	-0.225
1 (plug)	32	Initial	0.111	0.294	0.193
	32	After temperature life (ΔR)	-0.242	0.013	-0.140
2 (receptacle)	32	Initial	0.086	0.253	0.191
	32	After humidity/temperature cycling (ΔR)	-0.235	-0.083	-0.137
2 (plug)	32	Initial	0.197	0.258	0.226
	32	After humidity/temperature cycling (ΔR)	-0.245	-0.083	-0.172
3 (receptacle)	32	Initial	0.080	0.232	0.184
	32	After vibration and shock	-0.218	-0.004	-0.150
3 (plug)	32	Initial	0.211	0.326	0.257
	32	After vibration and shock	-0.285	-0.036	-0.189
4 (receptacle)	32	Initial	0.095	0.181	0.146
	32	After 10 days MFG, unmated (ΔR)	-0.150	0.011	-0.050
	32	After minute disturbance	-0.167	-0.033	-0.106
4 (plug)	32	Initial	0.119	0.202	0.156
	32	After 10 days MFG, unmated (ΔR)	-0.174	-0.078	-0.115
	32	After minute disturbance	-0.185	0.065	-0.083

NOTE All values in milliohms

Figure 4

2.4. Insulation Resistance - Test Group 2

All insulation resistance measurements were greater than 10000 megohms.

2.5. Withstanding Voltage - Test Group 2

No dielectric breakdown, flashover or leakage greater than 0.5 milliamperes occurred.

2.6. Vibration, Sinusoidal - Test Group 3

No discontinuities were detected during vibration testing. Following vibration testing, no cracks, breaks, or loose parts were visible on the specimens.

2.7. Mechanical Shock - Test Group 3

No discontinuities were detected during mechanical shock testing. Following mechanical shock testing, no cracks, breaks, or loose parts were visible on the specimens.

2.8. Durability - Test Groups 2, 3 and 4

No physical damage occurred as a result of mating and unmating the specimens 200 times.

2.9. Mating Force - Test Groups 1, 2 and 3

All mating force measurements were less than 20 N [4.5 lbf] per connector.

2.10. Unmating Force - Test Groups 1, 2 and 3

All unmating force measurements were less than 20 N [4.5 lbf] per connector.

2.11. Contact Retention - Test Group 5

All contacts withstood a force of 5 N [1.12 lbf] with no movement.

2.12. Compliant Pin Insertion - Test Group 5

All compliant pin insertion measurements were less than 50 N [11.2 lbf] average per pin.

2.13. Compliant Pin Retention - All Test Groups

All compliant pin retention measurements were greater than 13.34 N [3 lbf] average per pin.

2.14. Minute Disturbance - Test Group 4

No evidence of physical damage was visible as a result of subjecting each connector to a minute unmate/remate operation.

2.15. Thermal Shock - Test Group 2

No evidence of physical damage was visible as a result of exposure to thermal shock.

2.16. Humidity/temperature Cycling - Test Group 2

No evidence of physical damage was visible as a result of exposure to humidity/temperature cycling.

2.17. Temperature Life with Electrical Load - Test Group1

No evidence of physical damage was visible as a result of exposure to temperature life with electrical load.

2.18. Mixed Flowing Gas - Test Group 4

No evidence of physical damage was visible as a result of exposure to the pollutants of mixed flowing gas.

2.19. Dust Contamination - Test Groups 2 and 3

No evidence of physical damage was visible as a result of exposure to a dust environment.

2.20. Final Examination of Product - All Test Groups

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

3. TEST METHODS

3.1. Initial Examination of Product

A Certification of Conformance was issued stating that all specimens in this test package have been produced, inspected, and accepted as conforming to product drawing requirements, and manufactured using the same core manufacturing processes and technologies as production parts.

3.2. Low Level Contact Resistance

Contact resistance measurements at low level current were made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage. One set of voltage-current probes was applied to the printed circuit board thru-hole at the compliant pin end of the vertical receptacle contact. The other pair was applied to the printed circuit board thru-hole at the compliant pin end of the right angle header contact. Each measurement included the resistance of both compliant pin to board interfaces, the contact interface resistance, and the bulk resistance of both contacts.

3.3. Low Level Compliant Pin Resistance

Compliant pin resistance measurements at low level current were made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage. Current was applied at the interface end of a contact and the pad surrounding the thru-hole. One voltage probe was attached to the end of the contact protruding from the bottom of the thru-hole and the other was attached to the pad surrounding the thru-hole.

3.4. Insulation Resistance

Insulation resistance was measured between adjacent contacts of mated specimens. A test voltage of 500 volts DC was applied for 2 minutes before the resistance was measured.

3.5. Withstanding Voltage

A test potential of 1500 volts AC was applied between the adjacent contacts of mated specimens. This potential was applied for 1 minute and then returned to zero.

3.6. Vibration, Sinusoidal

Mated specimens were subjected to sinusoidal vibration, having a simple harmonic motion with an amplitude of 0.06 inch, double amplitude or 10 gravity units (g's peak) whichever is less. The vibration frequency was varied uniformly between the limits of 10 and 500 Hz and returned to 10 Hz in approximately 15 minutes. This cycle was performed 8 times in each of 3 mutually perpendicular planes for a total vibration time of 6 hours. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.7. Mechanical Shock

Mated specimens were subjected to a mechanical shock test having a half-sine waveform of 30 gravity units (g's peak) and a duration of 11 milliseconds. Three shocks in each direction were applied along the 3 mutually perpendicular planes for a total of 18 shocks. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.8. Durability

Specimens were mated and unmated 200 times at a maximum rate of 500 cycles per hour.

3.9. Mating Force

The force required to mate individual specimens was measured using a tensile/compression device and free floating fixture with a maximum rate of travel of 12.7 mm [.5 in] per minute.

3.10. Unmating Force

The force required to unmate individual specimens was measured using a tensile/compression device and free floating fixture with a maximum rate of travel of 12.7 mm [.5 in] per minute.

3.11. Contact Retention

While supporting the housing of the specimens, an axial force of 5 N [1.12 lbf] was applied at a rate of 2.54 mm [.1 in] per minute to the end of the contact in the mating direction.

3.12. Compliant Pin Insertion

The force required to insert the compliant pins of an individual connector assembly into a printed circuit board at a rate of 12.7 mm [.5 in] per minute was measured. The average force per pin was calculated.

3.13. Compliant Pin Retention

The force required to remove the compliant pins of an individual connector assembly from a printed circuit board at a rate of 12.7 mm [.5 in] per minute was measured. The average force per pin was calculated.

3.14. Minute Disturbance

Test specimens were subjected to a minute disturbance by manually unmating and mating each connector pair a distance of approximately 0.1 mm [.004 in].

3.15. Thermal Shock

Mated specimens were subjected to 5 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55 and 105˚C. The transition between temperatures was less than 1 minute.

3.16. Humidity/temperature Cycling

Mated specimens were exposed to 10 cycles of humidity/temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25 and 65˚C twice while maintaining high humidity (Figure 5).

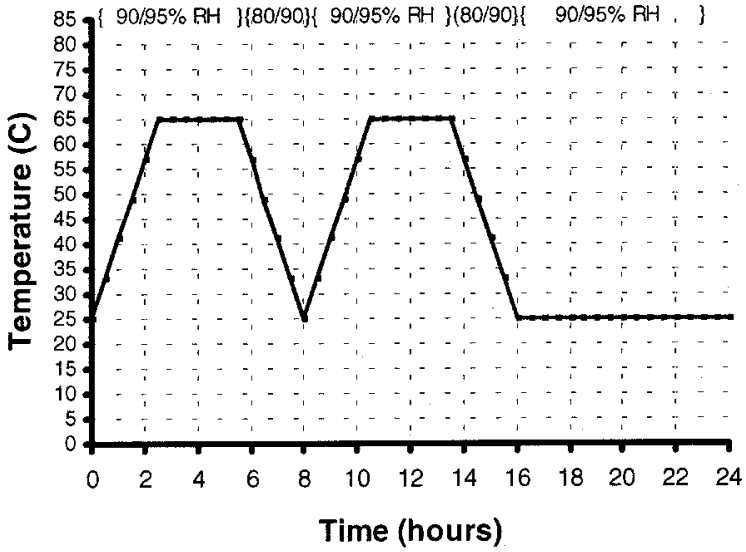

Figure 5
Typical Humidity/Temperature Cycling Profile

3.17. Temperature Life with Electrical Load

Mated specimens were placed in an oven and energized with a DC current of 21.5 amperes while monitoring the internal temperature of the specimens. The temperature of the oven was then increased until the average internal temperature of the specimens stabilized at 105˚C. The specimens were maintained in this manner for 500 hours.

3.18. Mixed Flowing Gas, Class IIA

Mated specimens were exposed for 20 days to a mixed flowing gas Class IIA exposure. Class IIA exposure is defined as a temperature of 30˚C and a relative humidity of 70% with the pollutants of Cl_2 at 10 ppb, NO_2 at 200 ppb, H_2S at 10 ppb, and SO_2 at 100 ppb. Specimens were preconditioned with 10 cycles of durability.

3.19. Dust Contamination

Each half of unmated specimens were exposed to a dust mixture which conformed to Composition #1 (benign) as described in EIA Standard TP-91. After drying the dust for one hour at 50˚C, a quantity of dust equal to 9 grams per cubic foot of chamber area was placed in the dust chamber. The connectors were suspended vertically in the chamber with their long axis parallel to the direction of air flow. The chamber was then sealed and the air and dust within recirculated for 1 hour at a flow rate of 360 cubic feet per minute. The specimens remained in the chamber for an additional hour and when removed were tapped on a wooden surface 5 times at a rate of 25.4 mm [1 in] per second to remove excess dust.

3.20. Final Examination of Product

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.