Cinch

DOCUMENT
TR 686

Document	TR - 686
Customer	**Various**
Customer Specification	
Customer Drawing	**None**
Reference Specification	
Cinch Part Number	
380 02 00 XXX	

TITLE: CIN::APSE Product Specifications & Test Report

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Approved By:

Revision	Date	Revised By	Approved By	Remarks
A	9/22/03			Initial Release

1.0 SCOPE:

The purpose of this report is to consolidate test data from various LGA socket qualification testing establishing minimum performance specification for CIN::APSE technology.

2.0 SUBJECT PARTS:

Following Cinch LGA sockets with various I/O counts were tested.
Cinch Part Numbers:

380 – 02 – 20 – 187
380 – 02 – 20 – 242
380 – 20 – 20 - 298
380 – 02 – 20 – 241

3.0 TEST CONDITIONS:

Temperature: 20 ° C to 30 ° C (68 F – 86 F)
Relative Humidity: 30 % - 80%
Barometric Pressure: 24 to 31 inches of Mercury (.081 to .104 Map)

4.0 REFERENCE DOCUMENTS:

4.1.1 Cinch Drawings for parts listed in section 2.0
4.1.2 MI-STD-1344 Test Methods for Electrical Testing.
4.1.3 EIA – 364 Electrical Connectors Test Procedures
4.1.4 Contech Research test reports # 96304-35 , 202716 A Rev.1.1, 98089
4.1.5 Cinch LAB # 429

5.0 CONNECTOR SPECIFICATIONS AND QUALIFICATION TEST PARAMETERS:

5.1 Mechanical

TEST DESCRIPTION	CONNECTOR SPECIFICATIONS	QUALIFICATION TEST PARAMETERS
5.1.1 Visual Examination	Connectors shall meet the design requirement of the product drawings. There shall be no evidence of physical damage, swelling, blistering, distortion, etc.	Visually inspect all connectors per EIA-364-18 using 10X-power microscope.
5.1.2 Durability	Shall meet a minimum of 25 cycles of removing and reinserting the CPU from the LGA socket insulator without physical damage and meet LLCR requirements as per 3.1	Test per EIA–364 09. Insertion and removal tool may be used to avoid damage to CIN::APSE contacts.
5.1.3 Random Vibration	No signal discontinuities greater than 10 nano-seconds.	Test fully compressed system Per EIA-364-28 Test Conditions: Amplitude = 5.36g, Frequency = 10-500 HZ Duration = One hour per axis, total 3-axis.
5.1.4 Mechanical Shock	No signal discontinuities greater than 10 nano-seconds and meet LLCR requirements as per 3.1	Test fully compressed system per EIA-364- 27 Test Conditions: Peak Shock Value = 50G, Duration of Shock =11 msec. Waveform = ½ Sine, Velocity = 11.3 ft/second, 18 shock total

5.2 Electrical

TEST DESCRIPTION	CONNECTOR SPECIFICATIONS	QUALIFICATION TEST PARAMETERS
5.2.1 Low Level Contact Resistance (LLCR)	Individual Contacts: 10 mΩ maximum ΔR Single Daisy Chain Pairs: 20 mΩ maximum ΔR After exposure.	Test fully compressed connectors per MIL-STD-1344 Method 3002: Test Current 100 mA maximum, Open Circuit Voltage: 20 mV
5.2.2 Dielectric withstanding voltage	250 VDC Dielectric Withstanding Voltage with 1-minute hold. There shall be no flash or voltage breakdown.	Test fully compressed connectors per MIL-STD-1344, Method 3001. A minimum of 10 pairs of adjacent contact positions randomly selected shall be tested.
5.2.3 Current Rating	Shall meet the minimum current rating of 1.0 Amp.	Test fully compressed connectors and gradually Increase current in 0.5 Increment up to maximum current to establish maximum 30 ° C rise
5.2.4 Insulation Resistance	5000 MΩ minimum at 100 VDC.	Test fully compressed connectors per MIL-STD-1344, Method 3003. A minimum of 10 pairs of adjacent contact positions randomly selected shall be tested.
5.2.5 Contact Inductance	Individually tested contacts shall be less than 1 nano-Henry (nH) .	Test fully compressed connectors to simulate actual application. Test up to 3 GHz.

5. 3 Environmental

TEST DESCRIPTION	CONNECTOR SPECIFICATIONS	QUALIFICATION TEST PARAMETERS
5.3.1 Temperature Life	Connectors shall withstand Temperature Life exposure and meet LLCR requirements as per 3.1	Test fully compressed connectors per MIL-STD-1344. Method 1005, 960 hours exposure at +105°C
5.3.2 Temperature Humidity-Cycling	Connectors shall withstand Temperature Humidity- Cycling and meet LLCR requirements as per 3.1	Test fully compressed connectors test per MIL-STD-1344 Method 2002 40 continuous cycles, 8 hours each for a total of 960 hours of temperature/humidity cycling from +25°C to +65°C at 80-85% RH
5.3.3 Thermal Shock	Connectors shall withstand thermal shock and meet LLCR requirements as per 3.1	Test fully compressed connectors test per MIL-STD-1344, Method 1003. 10 cycles of -30°C to 105°C
5.3.4 Mixed Flowing Gas	Connectors shall be exposed to a corrosive atmosphere and meet LLCR requirements as per 3.1	Test fully compressed per EIA-364-65, 20 days, Class IIA (70% RH, 30°C).

5.3.5 Accelerated Thermal Cycling (ATC)	Connectors shall be exposed to accelerated Thermal Cycling (ATC) and meet LLCR requirements as per 3.1 1000 Cycles, 0°C to 100°C with continuous resistance monitoring and meet LLCR requirements as per 3.1	Test fully compressed connectors per EIA-364- 32, 1000 cycles with following conditions: Hot Extreme: 100°C Cold Extreme: 0° C Time at temp: 10 minutes. Ramp time to hot to cold and cold to hot: 10 minutes each for a total of 40 minutes per cycle.

6.0 QUALIFICATION GROUPS AND TEST SEQUENCE:

Test Type	Group I	Group II	Group III	Group IV	Group V	Group VI	Group VII	Group VIII
Visual Examination	1	1	1	1	1	1	1	1
Durability		3						
Mechanical Shock & Vibration	3							
Low Level Contact Resistance (LLCR)	2,4,	2,4,6	2,4,	4,6	2,4,	2, 4		
Dielectric Withstanding Voltage				2				
Insulation Resistance				3,7				
Temperature Life					3			
Temperature-Humidity Cycling				5				
Thermal Shock						3		
Mixed Flowing Gas			3					
Accelerated Thermal Cycling (ATC)		5						
Current Carrying Capacity							2	
Inductance								2

7.0 TEST RESULTS:

Test results reported are per group as defined in section 6.0.
Parts were examined with 10 X magnifications prior to testing.

7.1 Group 1

7.1.1 Shock and Random Vibration:

Test performed per EIA 364 – 27 and EIA 364 - 28

Initial Contact Resistance in (mΩ)

Ave.	Max.	Min.
46.7	54.5	37.5

Change in Contact Resistance Post Shock and Vibration in (mΩ)

Ave.
5.9

No damage - passed

7.2 Group 2

7.2.1 Durability:

Test performed per EIA 364 – 09 for 25 cycles.

Initial Contact Resistance in (mΩ)

Ave.	Max.	Min.
48.3	61.3	37.0

Change in Contact Resistance Post Durability in (mΩ)

Ave.
2.8

No damage – passed

7.2.2 Accelerated Thermal Cycling (ATC)

Test performed per EIA 364 – 32
Test performed for 1000 cycles for 40 minutes each cycle from 0 ° to 100 ° C

Change in Contact Resistance Post ATC in (mΩ)

Maximum change
1.3

No damage - passed

7.3 Group 3

7.3.1 Mixed flowing Gas:

Test performed per EIA 364 – 65 for 20 days

Initial Contact Resistance in (mΩ)

Ave.	Max.	Min.
53.3	63.0	36.5

Change in Contact Resistance post Mixed Gas Flow in (mΩ)

Ave.
-0.9

No damage - passed

7.4 Group 4

7.4.1 Dielectric Withstanding Voltage

Test performed per MIL-STD-1344 Method 3001

When specified test voltage is applied, all samples met the requirement.

7.4.2 Insulation Resistance

Test performed per MIL-STD-1344 Method 3003
Insulation resistance exceeded 50,000 megohms.

7.4.3 Temperature-Humidity Cycling

Test performed per MIL-STD-1344 Method 2002.2 between 25° C and 65° C at 80 to 85 % R.H. for 40 cycles for a total of 960 hours.

Initial Contact Resistance in (mΩ)

Ave.	Max.	Min.
59.0	66.9	52.7

Change in Contact Resistance Post Humidity in (mΩ)

Ave.
13.2

No damage - passed

7.4.3 Insulation Resistance

Insulation resistance exceeded 50,000 megohms after humidity exposure.

7.5 Group 5

7.5.1 Temperature Life

Test performed per MIL-STD-1344 Method 1005.1 at 105° C for 960 hours.

Initial Contact Resistance in (mΩ)

Ave.	Max.	Min.
64.5	80.4	56.6

Change in Contact Resistance Post Temperature Life in (mΩ)

Ave.
1.4

No damage - passed

7.6 Group 6

7.6.1 Thermal Shock

Test performed per MIL-STD-1344 Method 1003.1 from –30° C to 100° C for 100 cycles

Initial Contact Resistance in (mΩ)

Ave.	Max.	Min.
15.9	31.8	8.6

Change in Contact Resistance Post Thermal Shock in (mΩ)

Ave.
-2.6

No damage - passed

7.7 Group 7

7.7.1 Current Carrying Capacity

Test performed per Cinch Connector LAB – 429 set up instructions.
Apply current 0.5 Amp increment to .020 dia CIN::APSE contact on 1.00 mm centerline. Record for max. current applied and 30° C° temperature rise.

30° C temperature rise was recorded when 6.5 Amp was passed through CIN::APSE contact

7.8 Group 8

Following methodology and measurement systems were used

7.8.1 Methodology

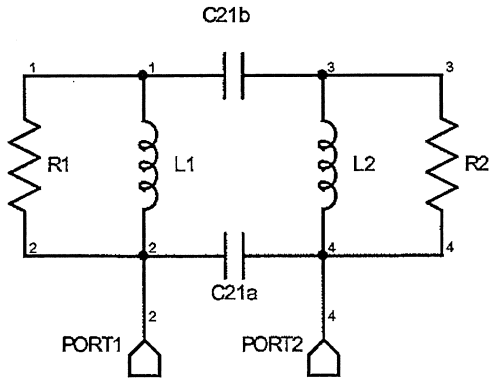
The LGA socket was mounted onto a custom PCB, designed to exhibit low parasitic and allow the use of coplanar probes. A second PCB (called surrogate package) with measurement standard pattern was mounted inside each socket. This allows pins to be measured under three conditions (open, shorted and thru). The Eagleware Genesys/Testlink software was then used to extract an equivalent-circuit model, which is SPICE compatible.

7.8.2 Measurement System

All measurements were taken using a high-frequency measurement system. This consists of a Hewlett-Packard 8753ES network analyzer & GGB Picoprobes™ 450μm pitch. The HP8753ES is a frequency domain instrument. The measurements are taken as scattering parameters (a.k.a. S-parameters). For this work the full 2-port calibration was used. The GGB Picoprobes provide a high-quality 50Ω path from the network analyzer and cables to the DUT.

7.8.3 Equivalent-Circuit model

Figure 1 shows the topology used to model the LGA socket.



LGA socket equivalent-circuit diagram

Element Definitions:

L_1, L_2:	Button self-inductance
M_{21}:	mutual inductance between adjacent pins
R_1, R_2:	shunt-resistance of inductors L1 and L2, used to model high frequency loss due to skin effect and dielectric loss
C_{21a}:	mutual capacitance between adjacent pins (PCB side)
C_{21b}:	mutual capacitance between adjacent pins (LGA side)

Element Values
The 1mm LGA socket model is valid from DC to 3.05 GHz. In other words, the socket will work at higher frequency than 3.05 GHz, however, the equivalent circuit model was extracted based on the optimization between measurement and simulation plots up to 3.05 GHz. The measured and modeled transmission response agrees within 1 dB. Models were extracted for three types of pins: adjacent field pins, edge pins and corner pins.

7.8.4 Test Results:

CIN::APSE contact	L_1 & L_2 (nH)	M_{21} (nH)	R_1 & R_2(Ω)	C_{21a}(pF)	C_{21b}(pF)
Field Adjacent	0.42	0.09	200	0.02	0.02
Edge Adjacent	0.70	0.22	200	0.02	0.03
Corner Adjacent	0.75	0.29	200	0.02	0.03
Diagonal Adjacent	0.54	0.01	200	0.03	0.02