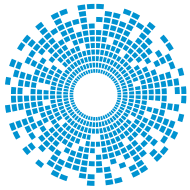
ModICE®

Laboratory Qualification

Revision B - March 2009



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Laboratory Qualification - Rev B

PURPOSE

The purpose of this Laboratory Qualification Test is to evaluate the performance of the ModICE Connector System when subjected to the test sequence using the methods defined in Cinch Performance Specification PS-323

REVISION HISTORY

Revision	Date	Comment
-	January 2006	Original Release
A	July 2008	Added Solar Radiation / UV Exposure
B	March 2009	Added Breather Validation

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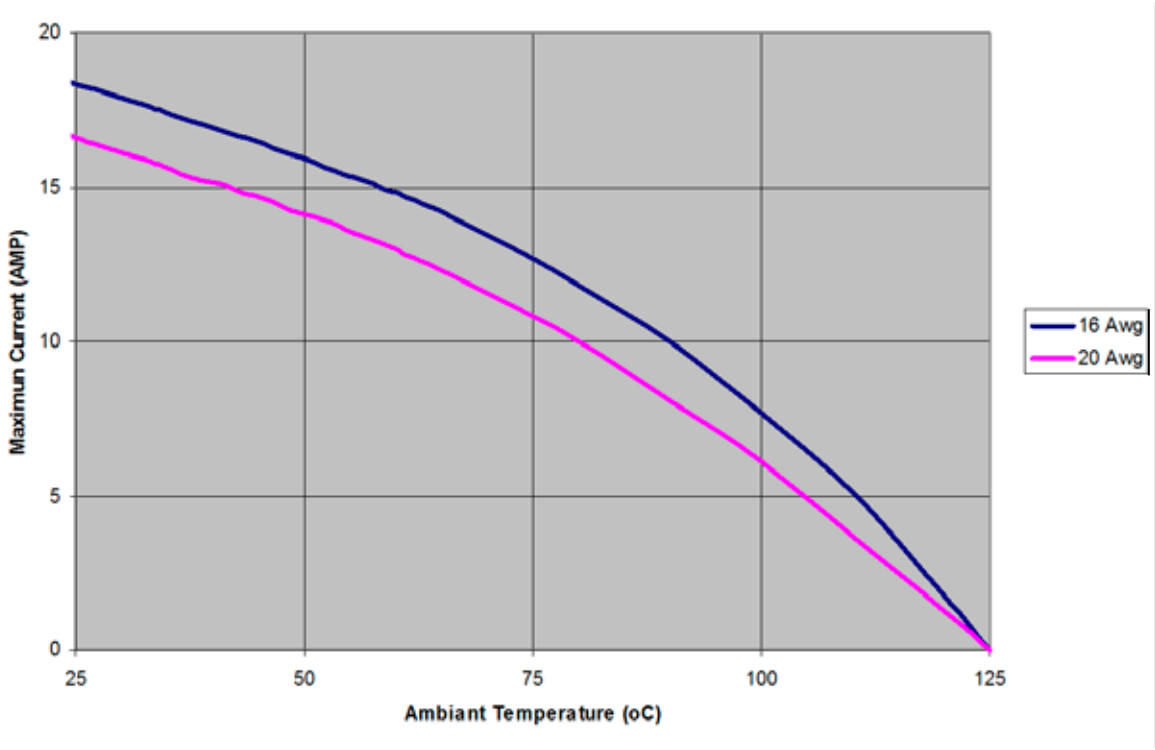
Current vs. Temperature Derating Curves



Current Cycling Test

Visual Inspection – Initial

All samples were found to be acceptable.

Current Cycling

Connector enclosure SE and LE systems mated to harness were cycled for 500 hours (45 minutes “ON” and 15 minute “OFF”) using 10 amps of current. All positions were loaded with a wire size of 16 GXL; 20 positions were monitored continuously.

Contact Resistance – Initial

All readings met the 10.0mΩ Max. requirement.

Group Average : 2.17 mΩ

Group Max : 2.37 mΩ

Group Min : 1.92 mΩ

Std Dev : 0.12 mΩ

Contact Resistance – After Current Cycling

All readings met the 10.0mΩ Max. requirement.

Group Average : 2.63 mΩ

Group Max : 3.54 mΩ

Group Min : 2.20 mΩ

Std Dev : 0.39 mΩ

Visual Inspection – Post Current Cycle

All samples were found to be acceptable.

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Temperature Life

Visual Inspection – Initial

All samples were found to be acceptable.

Contact Resistance – Initial

All readings met the 10 mΩ Max. requirement.

SE Enclosure

Group Average : 1.66 mΩ
Group Max : 2.08 mΩ
Group Min : 1.47 mΩ
Std Dev : 0.15 mΩ

LE Enclosure

Group Average : 1.65mΩ
Group Max : 2.14 mΩ
Group Min : 1.47 mΩ
Std Dev : 0.12 mΩ

Insulation Resistance – Initial

Per MIL-STD-1344 Test @ 500 VDC
All samples met requirement: IR > 5000 MΩ

Temperature Life Test

Per SAE/USCAR-2 , para. 5.6.3.
Connector enclosure SE and LE systems mated to harness were exposed to 125°C for 1008 hours.

Insulation Resistance – After Temperature Life

Per MIL-STD-1344 Test @ 500 VDC
All samples met requirement: IR > 1000 MΩ

Insulation Resistance of the heat sink – After Temperature Life

Per SAE/USCAR-2, para. 5.5.1.
Test @ 500 VDC, between adjacent Mosfets
All samples met requirement: IR > 20 MΩ

Contact Resistance – Final

All readings met the 10 mΩ Max. requirement.

SE Enclosure

Group Average : 2.03 mΩ
Group Max : 3.34 mΩ
Group Min : 1.62 mΩ
Std Dev : 0.34 mΩ

LE Enclosure

Group Average : 2.08mΩ
Group Max : 3.48 mΩ
Group Min : 1.67 mΩ
Std Dev : 0.42 mΩ

Visual Inspection – Post Temperature Life

All samples were found to be acceptable without any damage.

Flame Resistance

ModICE Headers
Material: 30% Glass Reinforced, Flame retardant, lubricated high performance polyamide resin
Rated at minimum thickness UL94-V0

ModICE Enclosure
Material: 30% Glass Fiber Reinforced, Polybutylene terephthalate alloy resin
Rated to UL94-HB, IEC 60695-11-10 HB at 0.75mm

Vibration

Visual Inspection – Initial
All samples were found to be acceptable.

Contact Resistance – Initial
All readings met the 10 mΩ Max. requirement.
Daisy chain circuit wired in series measured through PCB.
Group Average : 3.29 mΩ
Group Max : 4.40 mΩ
Group Min : 2.57 mΩ
Std Dev : 0.57 mΩ

Vibration

Per MIL-STD 1344, Method 2005, Condition III.

Sinusoidal vibration between frequencies of 10 to 2000 Hz with a peak G level of 15 Gs. The vibration was applied in each of the 3 perpendicular axis while continuity was being monitored.

Entire frequency range was traversed in 20 minutes and was repeated 24 times per axis for a total of 24 hours of sinusoidal vibration.

Contact Resistance – Initial
There was no lost of continuity greater than one microsecond and no mechanical damage to the samples.

Contact Resistance – After Vibration

All readings met the 10 mΩ Max. requirement.

Group Average : 3.44 mΩ

Group Max : 4.77 mΩ

Group Min : 2.62 mΩ

Std Dev : 0.59 mΩ

Visual Inspection – Final
All samples were found to be acceptable.

Mechanical Shock

Visual Inspection – Initial

All samples were found to be acceptable.

Mechanical Shock

Per SAE J2030, Para. 6.14.

Connector enclosure SE and LE systems mated to harness were subjected to 5 half sine pulse of 50 Gs and a duration of 11 millisecond. This was applied in each 2 perpendicular axes for a total of 20 pulses

Continuity Monitoring

There was no lost of continuity greater than one microsecond and no mechanical damage to the samples.

Visual Inspection – Final

All samples were found to be acceptable.

Salt Spray

Visual Inspection – Initial

All samples were found to be acceptable.

Insulation Resistance – Initial

Per MIL-STD-1344 Test @ 500 VDC

All samples met requirement: IR > 5000 MΩ

Salt Spray Test

Per ASTM B-117-73

Connector enclosure SE and LE systems mated to harness were exposed to a salt spray environment (5% NaCl) for a period of 96 hours.

Insulation Resistance – After Salt Spray

Per MIL-STD-1344 Test @ 500 VDC

All samples met requirement: IR > 1000 MΩ

Visual Inspection – Final

All samples were found to be acceptable.

Temperature Humidity Cycling

Visual Inspection – Initial
All samples were found to be acceptable.

Contact Resistance – Initial
All readings met the 10 mΩ Max. requirement.

SE Enclosure
Group Average : 1.77 mΩ
Group Max : 2.18 mΩ
Group Min : 1.57 mΩ
Std Dev : 0.15 mΩ

LE Enclosure
Group Average : 1.78 mΩ
Group Max : 2.11 mΩ
Group Min : 1.55 mΩ
Std Dev : 0.14 mΩ

Insulation Resistance – Initial
Per MIL-STD-1344 Test @ 500 VDC
All samples met requirement: IR > 5000 MΩ

Temperature Humidity Cycling Test
Per SAE/USCAR-2 , para. 5.6.2.
40 - 8 hrs cycles : -40ºC, +85°C with 85% RH, +125°C
Connector enclosure SE and LE systems mated to harness were subjected to a total 320 hour test.

Insulation Resistance – After Temperature Humidity Cycling
Per MIL-STD-1344 Test @ 500 VDC
All samples met requirement: IR > 1000 MΩ

Contact Resistance – Final
All readings met the 10 mΩ Max. requirement.

SE Enclosure
Group Average : 2.29 mΩ
Group Max : 2.86 mΩ
Group Min : 1.75 mΩ
Std Dev : 0.21 mΩ

LE Enclosure
Group Average : 2.28 mΩ
Group Max : 3.20 mΩ
Group Min : 1.79 mΩ
Std Dev : 0.27 mΩ

Visual Inspection – Post Temperature Life
All samples were found to be acceptable without any damage.

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Chemical Compatibility

Visual Inspection – Initial

All samples were found to be acceptable.

Insulation Resistance – Initial

Per MIL-STD-1344 Test @ 500 VDC

All samples met requirement: IR > 5000 MΩ

Chemical Compatibility

Per SAE/USCAR-2, para. 5.6.4

Connector enclosure SE and LE systems mated to harness were immersed completely for 15 minutes into the test fluids listed below at the temperature specified. After immersion, connectors were air dried for a week and tested for insulation resistance.

SAE RM66-04 Brake Fluid @ 50°C

ASTM IRM-902 Oil @ 50°C

ASTM Fuel C Gasoline @ 25°C

ASTM Fluid 104 Engine Coolant @ 100°C

Citgo #33123 Auto Transmission Fluid @ 50°C

Windshield Washer Fluid @ 25°C

ASTM IRM-903 Power Steering Fluid @50°C

ASTM Diesel Fuel @ 25°C

ASTM E85 Ethanol Fuel @ 25°C

Insulation Resistance – After Chemical Test

Per MIL-STD-1344 Test @ 500 VDC

All samples met requirement: IR > 1000 MΩ

Visual Inspection – Post Chemical Compatibility

All samples were found to be acceptable without any damage.

Solar Radiation – UV Exposure

Visual Inspection – Initial

All samples were found to be acceptable.

Solar Radiation – UV Exposure

Per ISO 4892-2, part 2

Connector enclosure SE and LE systems mated to harness were exposed to 500 hours of solar radiation

Wave length 340 A UV

Back panel temperature 65°C

250 – 2 hr cycles of 102 min light and 18 min water spray

Visual Inspection – Post Solar Radiation

All samples were found to be acceptable with no external deterioration or gross color shift.

High Pressure Wash

Visual Inspection – Initial

All samples were found to be acceptable.

Insulation Resistance – Initial

Per MIL-STD-1344 Test @ 500 VDC

All samples met requirement: IR > 5000 MΩ

Contact Resistance - Initial

All readings met the 10 mΩ Max. requirement.

Group Average : 3.03 mΩ

Group Max : 3.81 mΩ

Group Min : 2.14 mΩ

Std Dev : 0.45 mΩ

High Pressure Wash

Per SAE J1455, section 4.5.3.

Connector enclosure SE and LE systems mated to harness were subjected to water from distance of 20-30 cm at a rate of 150 gal/hr (568 l/hr), with a source pressure of 1400 KPa (203 psi - 14 bar).

Water temperature 93°C.

Samples subjected to 375 cycles. One cycle consisted of the pressure washer being on for 3 sec and off for 3 sec.

Contact Resistance - After Pressure Wash

All readings met the 10 mΩ Max. requirement.

Group Average : 3.35 mΩ

Group Max : 3.94 mΩ

Group Min : 2.20 mΩ

Std Dev : 0.65 mΩ

Insulation Resistance – After High Pressure wash

Per MIL-STD-1344 Test @ 500 VDC

All samples met requirement: IR > 1000 MΩ

Final Inspection

There was no water intrusion after the exposure to high pressure wash.

Pressure Wash IP65

Visual Inspection – Initial

All samples were found to be acceptable.

Pressure Wash IP65

Per DIN40050 part 9.

Connector enclosure SE and LE systems mated to harness were subjected to water from distance of 2.5-3 m (approx. 9 ft) at a rate of 12.5 liters per minute (approx. 3.3 gal/min), with a source pressure of 30 KPa (4.35 psi - 0.3 bar).

The duration of the exposure was 3 minutes.

Final Inspection

There was no water intrusion after the exposure to pressure wash IP65.

Pressure Wash IP66

Visual Inspection – Initial

All samples were found to be acceptable.

Pressure Wash IP65

Per DIN40050 part 9.

Connector enclosure SE and LE systems mated to harness were subjected to water from distance of 2.5-3 m (approx. 9 ft) at a rate of 100 liters per minute (approx. 26 gal/min), with a source pressure of 100 KPa (14.5 psi - 1 bar).

The duration of the exposure was 3 minutes.

Final Inspection

There was no water intrusion after the exposure to pressure wash IP66.

Pressure Wash IP69K - Enclosure with and without Breather

Visual Inspection – Initial

All samples were found to be acceptable.

Pressure Wash IP69K

DIN40050 part 9.

Connector enclosure SE and LE systems mated to harness were subjected to water from distance of 10-15 cm at a rate of 14-16 litres per minute (approx. 4 gal/min), with a source pressure of 9000 KPa (1305 psi - 90 bar).

Water temperature was 80°C.

The duration of the exposure was 30 seconds on four sides (0°, 30°, 60°, 90°)

Final Inspection

There was no water intrusion after the exposure to high pressure wash IP69K.

Immersion IP67- Enclosure with and without Breather

Visual Inspection – Initial

All samples were found to be acceptable.

Immersion IP67

Per DIN40050 part 9.

Connector enclosure SE and LE systems mated to harness were immersed under 1 meter of water for 30 minutes.

Final Inspection

There was no water intrusion after immersion IP67.

Immersion – Modified SAE J2030

Visual Inspection – Initial

All samples were found to be acceptable.

Water Immersion After Temperature Exposure

Per SAE J2030 - modified

Connector enclosure SE and LE systems were placed in an air circulating oven at 85ºC for 1 hour temperature conditioning then immediately submerged under 3 feet (1 meter) of water for a duration of 30 minutes.

Insulation Resistance – After High Pressure wash

Per MIL-STD-1344 Test @ 500 VDC

All samples met requirement: IR > 1000 MΩ

Final Inspection

No water intrusion.

Immersion – Modified SAE J2030 - ModICE with Gortex Breather

Visual Inspection – Initial

All samples were found to be acceptable prior to testing.

Water Immersion After Temperature Exposure

Per SAE J2030 - modified

Connector enclosure SE and LE systems were placed in an air circulating oven at 85ºC for 1 hour temperature conditioning. The samples were removed from the oven and immediately submerged under 1 meter of water for a duration of 30 minutes. The samples were checked for moisture intrusion into the enclosures.

Final Inspection

No water intrusion into enclosure was observed.

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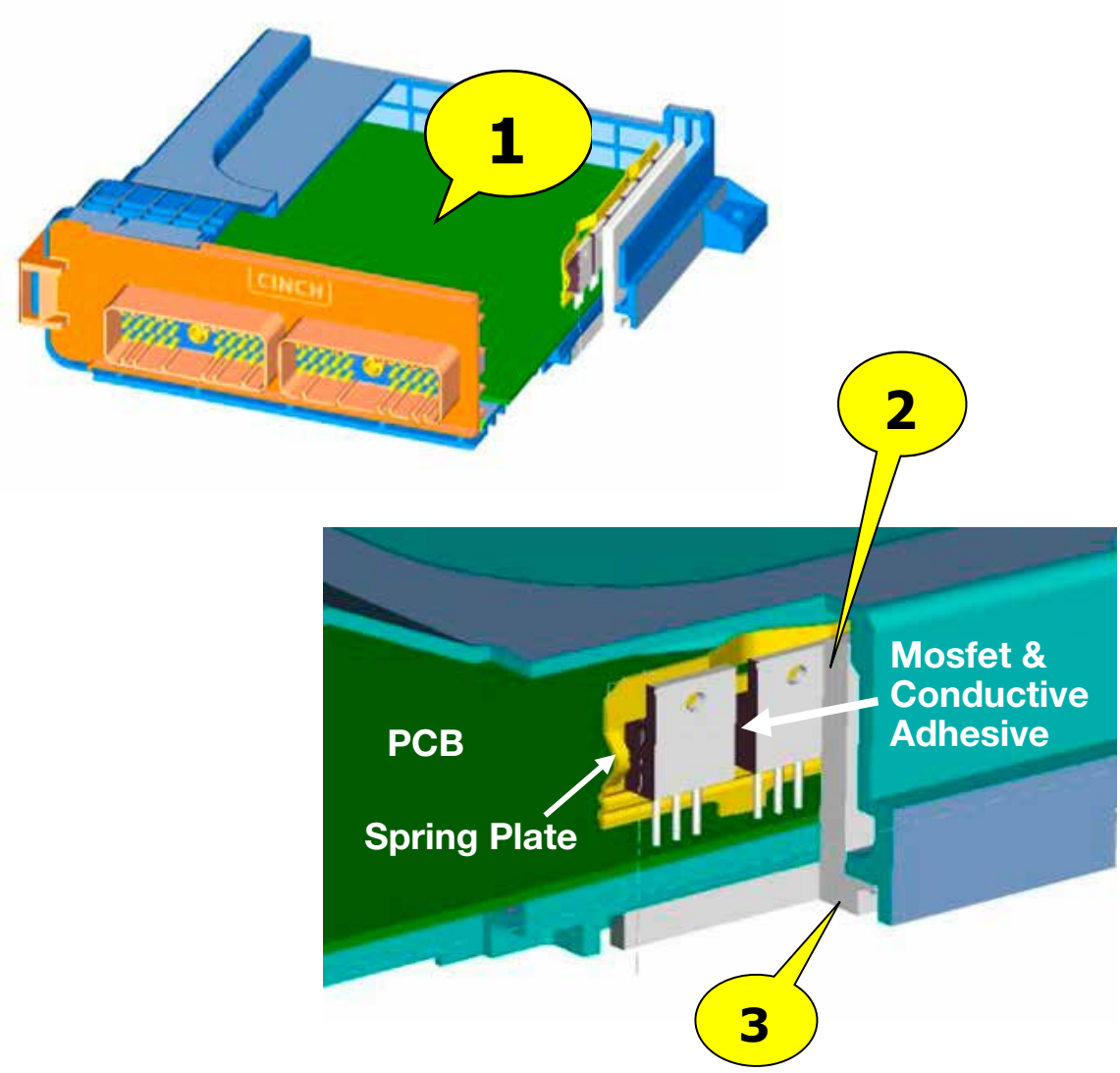
Heat Sink Heat Dissipation

Test Procedure

- 13.2 Volts
- Apply current by increment of 0.5 Amps
- Record temperature after 30 minutes at rated current

Temperature Probing Location

1. Middle of PCB – Inside Enclosure
2. On Heat Sink - Inside Enclosure - 3 Thermocouples per heat sink
3. On Mounting Plate - Outside Enclosure under middle of heat sink - 1 Thermocouple per heat sink



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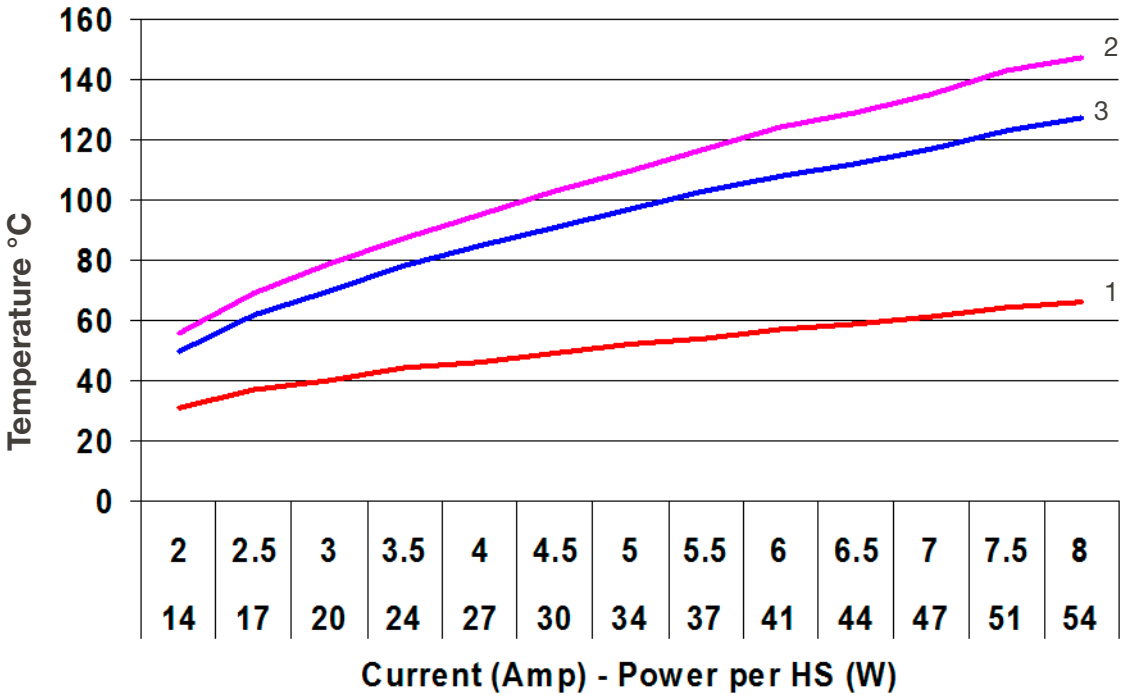
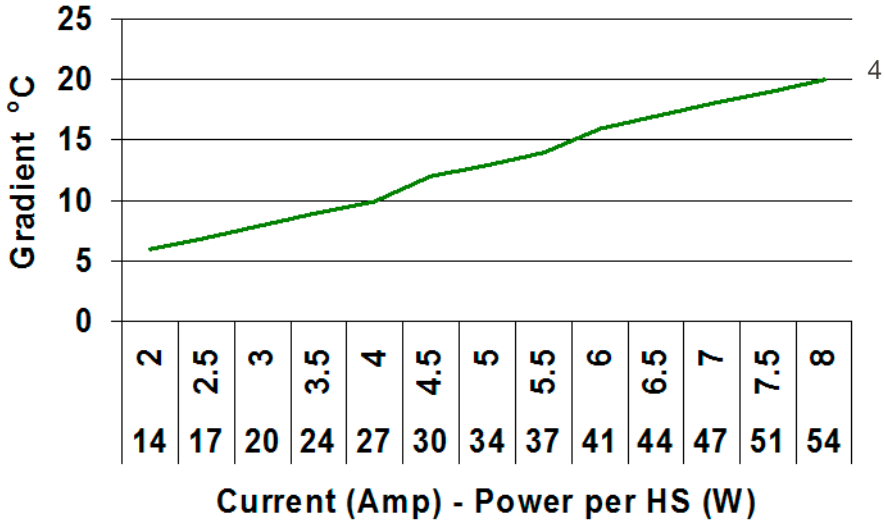
Heat Sink ModICE SE



1. Middle of PCB
2. On Heat Sink
3. On Mounting Plate
4. Temp. Gradient 2-3



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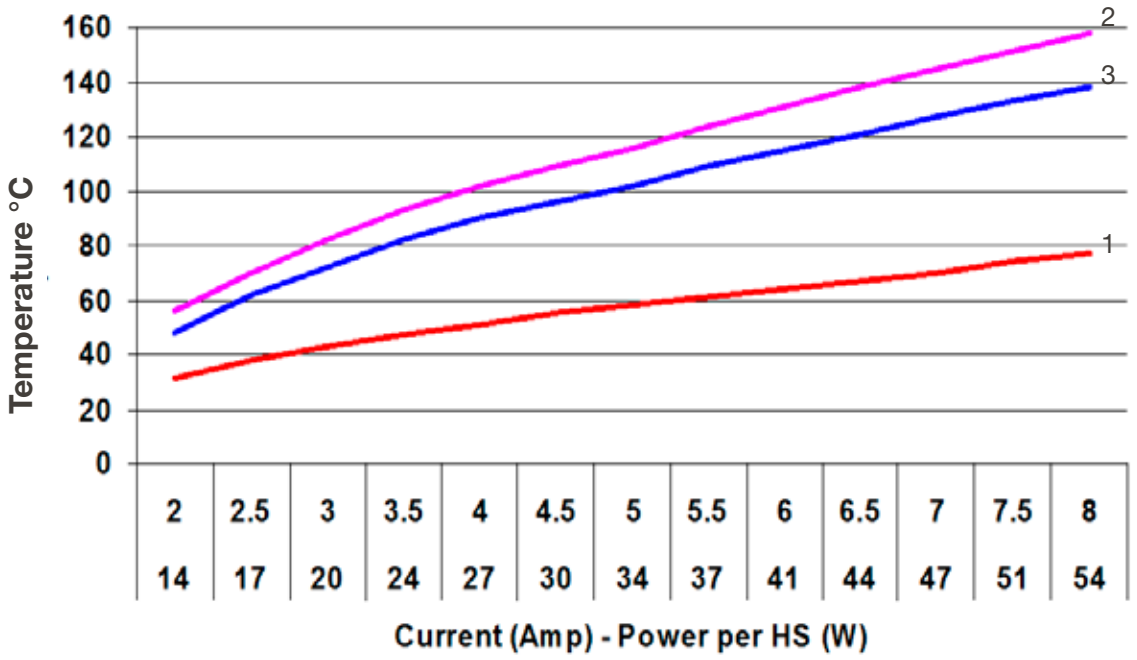
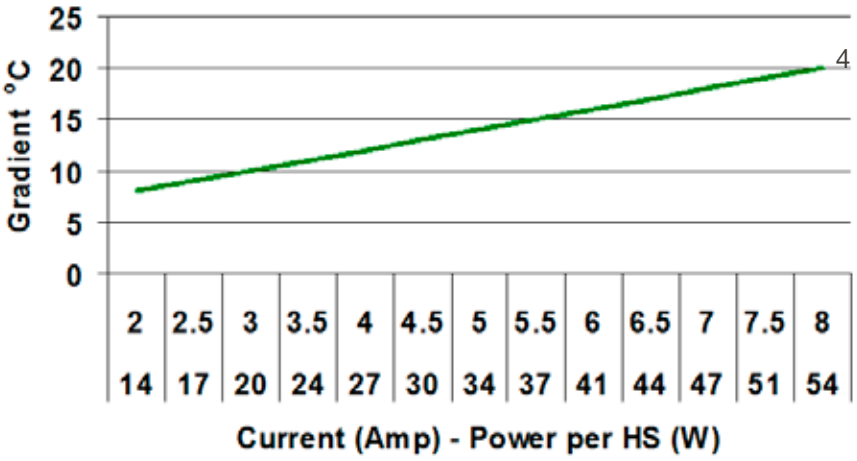
Heat Sink ModICE LE



1. Middle of PCB
2. On Heat Sink
3. On Mounting Plate
4. Temp. Gradient 2-3



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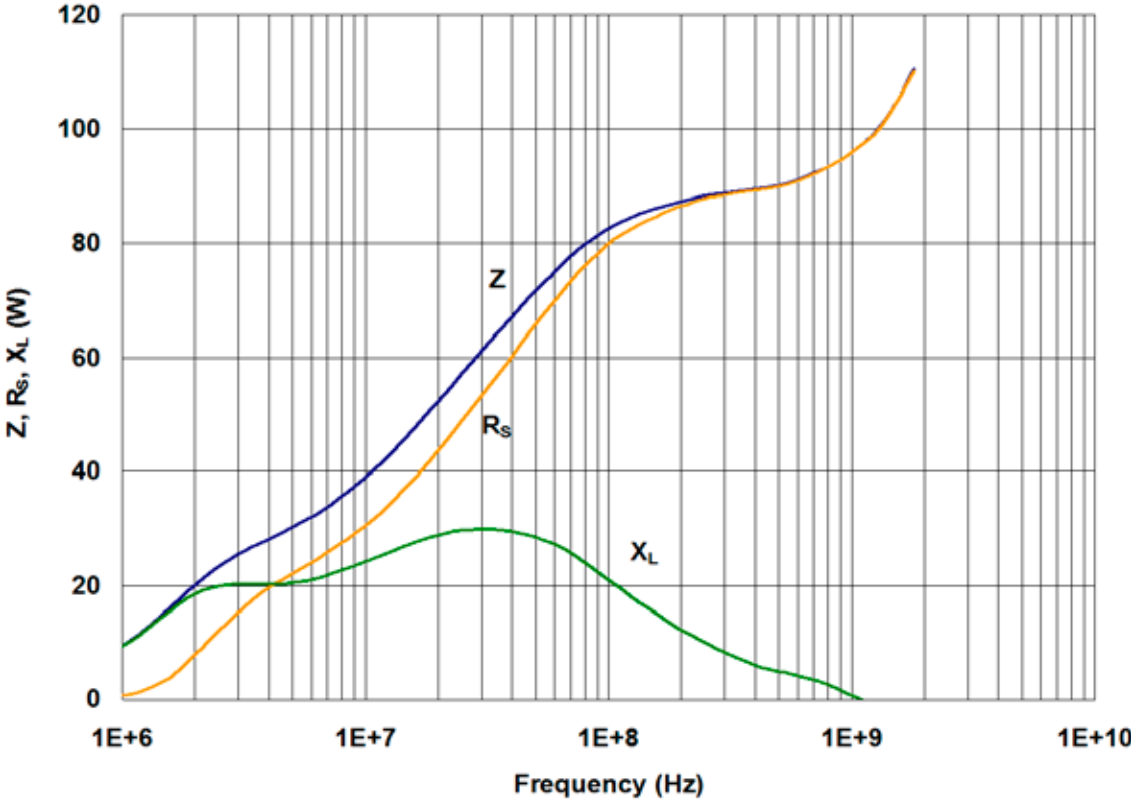
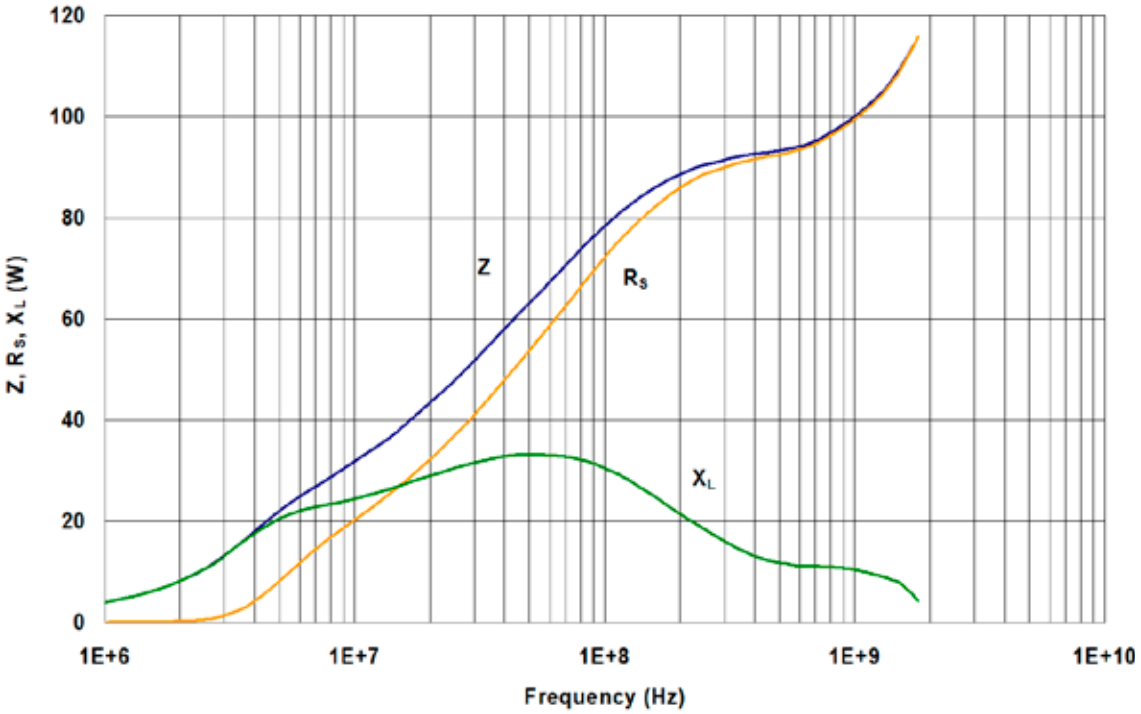
Filtering Ferrite Insertion Loss Curves

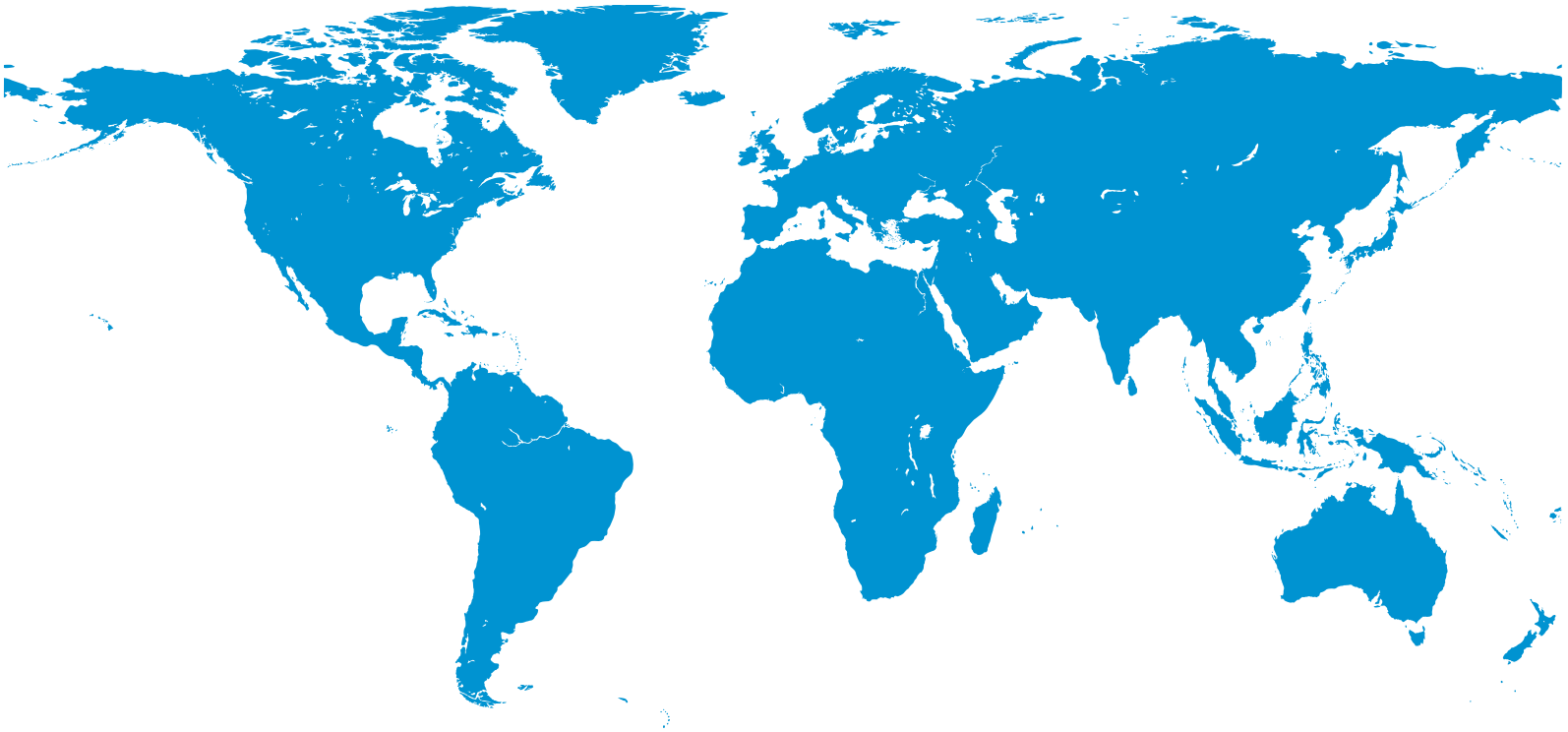




About Cinch Connectivity Solutions

In operation since 1917, Cinch supplies high quality, high performance connectors and cables globally to the Aerospace, Military/Defense, Commercial Transportation, Oil & Gas, High End Computer, and other markets. We provide custom solutions with our creative, hands on engineering and end to end approach.

Our diverse product offerings include: connectors, enclosures and cable assemblies utilizing multiple contact technologies including copper and fiber optics. Our product engineering and development activities employ cutting edge technologies for design and modeling, and our various technologies and expertise enable us to deliver custom solutions and products for our strategic partnerships.



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