IEEE
Welcome to Quell
A HEICO COMPANY
www.EESeal.com
Scott Lindberg

Mr. Lindberg is the Vice President at Quell Corporation, Albuquerque, NM. Scott has been in electronics industry for over 30 years and previously worked in the semiconductor industry as VP of Sales & Marketing Operations for Microsemi Corporation. Throughout his career he has served on many boards and committees and occupied most of the executive committee positions for the Electronics Representative Association (ERA). He became a Certified Professional Manufacturer’s Representative (CPMR) early in the program and then became a member and officer for the Board of Governors that has oversight of the program. He also was a member of the executive committee of the Manufacturer’s Representative Educational Research Foundation (MRERF). Lindberg received a B.A. degree in Business Administration from the University of New Mexico.
Content

• About Quell
• Silicone Rubber Packaging Technology
  • How it works
    • EMI Filtering, ESD Protection, etc.
• Applications
• Where to get more information
About US...

- Quell’s mission is to provide the best niche product, delivery, quality & service available in the EMI/ESD/TVS suppression market
- 12,000 sq. ft. facility in Albuquerque
- 50+ dedicated Quellians
- Quality Management System registered to:
  - ISO 9001:2015
  - AS9100D
- Proudly made in the USA
History...

- 1994 – Founded Metatech Commercial Products Div - ABQ
- 1995 – Applied for EESeal® Patent
- 2003 – Quell Corporation spun-off from Metatech
- 2009 – AS9100 quality certification
- 2012 – Expansion into new 12,000 sq ft facility
- 2013 – Over 1,000,000 EESeals® sold
- 2014 – Manufacturers Representatives & Distributors
- 2015 – EESeal+, EESeal Inside the connector
- 2016 – Patent received for EESeal+®
- 2019 – Acquired by HEICO Corporation
EESeal® is our Silicone Rubber Packaging Technology.

- EESeal’s® unique elastomeric body & adaptive interconnect system* suspends, isolates & protects discrete electrical components
  - Entire assembly can radically change shape and size in response to external forces
  - Individual components and interconnections move as body changes shape while maintaining electrical and mechanical integrity
  - Body acts as conformal coat & electrical isolation for suspended components
  - Natural compressive forces exploited to create re-usable electrical contacts that can withstand extreme abuse
    - Severe misalignments, vibration, wrong pin sizes...
  - Environmental seal created for the host location

* US Pat 5,686,697
EESeal® is our Silicone Rubber Packaging Technology.

• EESeal inserts into any connector in seconds
  – no soldering
  – no tools required

• Multiple Uses
  – EMI/RFI Filtering
  – Transient Protection
  – Add pull up resistors
  – Short pins, redistribute power
  – Add Grounding - Short coax shields

* US Pat 5,686,697
Patented **EESeal® Design** is Unique...

No “brittle” spring metal contacts (e.g., BeCu)

- Designed to accommodate severe misalignment and mismatch

- Will not be over “sprung” by any overstress during installation or use
EESeal® “At Home” at the Connector Interface

Cross Section of EESeal®
After It’s Seated in a Connector

Installed in MIL-C-38999-Type Connector
Typical **EESeal**® Construction

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Voltage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PWR</td>
<td>40V</td>
<td>DC</td>
</tr>
<tr>
<td>2</td>
<td>PWR_RTN</td>
<td>0V</td>
<td>DC</td>
</tr>
<tr>
<td>3</td>
<td>MODE</td>
<td>5V</td>
<td>Static</td>
</tr>
<tr>
<td>4</td>
<td>GAIN</td>
<td>5V</td>
<td>Static</td>
</tr>
<tr>
<td>5</td>
<td>POL</td>
<td>5V</td>
<td>Static</td>
</tr>
<tr>
<td>6</td>
<td>USBP</td>
<td>5V</td>
<td>12MHz</td>
</tr>
<tr>
<td>7</td>
<td>USBN</td>
<td>5V</td>
<td>12MHz</td>
</tr>
<tr>
<td>8</td>
<td>CONTROL</td>
<td>5V</td>
<td>Static</td>
</tr>
<tr>
<td>9</td>
<td>CONTROL_RTN</td>
<td>0V</td>
<td>Static</td>
</tr>
<tr>
<td>10</td>
<td>LVL_MIDDE</td>
<td>5V</td>
<td>Static</td>
</tr>
<tr>
<td>11</td>
<td>LVL</td>
<td>5V</td>
<td>Static</td>
</tr>
<tr>
<td>12</td>
<td>SDVP</td>
<td>+/- 1V</td>
<td>12MHz</td>
</tr>
<tr>
<td>13</td>
<td>SDYN</td>
<td>+/- 1V</td>
<td>12MHz</td>
</tr>
<tr>
<td>14</td>
<td>232_RX</td>
<td>+/- 15V</td>
<td>1.5MHz</td>
</tr>
<tr>
<td>15</td>
<td>232_TX</td>
<td>+/- 15V</td>
<td>1.5MHz</td>
</tr>
<tr>
<td>16</td>
<td>232_RTN</td>
<td>0V</td>
<td>DC</td>
</tr>
<tr>
<td>17</td>
<td>G_LOCK</td>
<td>5V</td>
<td>Static</td>
</tr>
</tbody>
</table>
Typical EESeal® Construction
EESeal® in Action...

• The EESeal “Quells” the frequencies needed to meet compliance. Fixes MIL-STD-461 Radiated Emissions Problems.
Typical **EESeal®** Attenuation
Single Capacitor – Pin to Shell
(ABC) Corporation – “WOW!!”
Parallel Capacitor Example

CHOMERICS TEST SERVICES

DCS
MIL-STD 461F RE 102-4 Army Ground Vertical Polarity

ENGINEERING TEST - 1
PC power - All cables attached

Typical EESeal® Attenuation ©2014 Quell Corporation 50ohm load and source

Amplitude (dBU/m)

Frequency (Hz)

Frequency (Hz)

Amplitude (dBU/m)
Typical EESeal® Construction

- 6 caps in Series-parallel network of 470nF 300wvdc capacitors (effectively 0.71uF) from pins A, G to the connector shell.
- 47nF 500wvdc capacitor from pins B, C, E, H to the connector shell.
- All other pins are not treated.
**EESeal® for Transient Protection**

- **TVS Diode Arrays**
  - ESD, IEC61000-4-2, ±30kV contact, ±30kV air
  - EFT, IEC61000-4-4, 40A (5/50ns)
  - Lightning, IEC61000-4-5, 8A (tP=8/20μs, SPHV12-C)
  - Low clamping voltage & Low leakage current

- **Varistors**
  - Multilayer ceramic construction technology
  - -55°C to +125°C operating temp. range
  - Operating voltage range VM(DC) = 5.5V to 120V
  - ESD rated to IEC61000-4-2, Level 4: Air Discharge 15KV and Contact Discharge 8KV
  - RoHS compliant

- **Others??**
  - We can incorporate virtually any 0402 or 0603 SMD
EESeal® for Lightning Protection

• Aircraft electronic boxes were sustaining lightning damage – resulting in aircraft grounding
• Box manufacturer needed to protect against 250A lightning on a ground return pin and approached Quell
• After several iterations, an EESeal® design with 15 MOVs in parallel successfully passed lightning test
• Box, with EESeal® installed, environmentally qualified to customer spec
• EESeal® retrofitted into fielded aircraft and EESeal® is now installed in all new production units
• Today, this commercial aircraft has 75-100 EESeals® on board - >92,989 ordered with no reports of failures (as of 02/18/2020)
Environmental Capabilities...

EESeal® Withstand **Extreme** Mechanical & Environmental Conditions

- Environmental and mechanical tests conducted by independent laboratories show that even severe environments do not affect the integrity of EESeal® FilterSeal EMI Filter Inserts or the host connectors*

  - **Shock**
    - MIL-STD-1344A Method 2004.1, Test Condition C (except 150g instead of 100g): 1/2 sine, 6 ms, 6 shocks/axis, total 3 axes

  - **Vibration**
    - MIL-STD-1344A Method 2005.1, Test Condition IV: 10-2000Hz, 20g, 4 hours/axis, total 3 axes and MIL-STD-810E paragraph 514.4: 3.75Hz @ 0.07g to 33.75Hz @ 2.5g to 500Hz @ 0.002g2/Hz, 4 hours/axis, total 3 axes

  - **Salt Spray**
    - Method 1001.1: 48 hr exposure at 95F

  - **Thermal Cycling**
    - RTCA/DO160C: -55C to +125C, 20 cycles

  - **Humidity Exposure**
    - RTCA/DO160C Category A: 95%RH @ 50C for 24hr, @ 30C for 24hr

*Nearly every EESeal insert is custom designed for your specific application and connector. Whenever a particular environmental feature is critical to your application, we recommend that you test the specific EESeal and connector combination to verify its suitability for your use.
Environmental Capabilities...

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- Environmental and mechanical tests conducted by independent laboratories show that even severe environments do not affect the integrity of EESeal® FilterSeal EMI Filter Inserts or the host connectors*.

  - **Temperature-Altitude**
    - MIL-STD-5400 4.6.2.3 Class 1A: -55°C to 125°C, 30,000 ft.
  
  - **Durability**
  
  - **Fluid Immersion**
    - MIL-STD-1344A Method 1016, Fluids a, c, d & e, with connectors mated: 5 minute immersion @ 85°C in each of Hydraulic Fluid, 2 Lubricating Oils & JP-5.
  
  - **Removal Re-Use Assessment**
    - 128pin EESeal completely removed from connector and re-inserted 12 times.
  
  - **Porosity**
    - MIL-STD-1344A Method 1017: Contacts exposed to 70% HNO₃ (concentrated reagent grade nitric acid) for 75 minutes at 23°C, 10 minutes in air @ 125°C, no corrosion observed.
  
  - **Out-gassing**
    - ASTM E-595-07, TML <1%; CVCM <.01%, Post bake required.

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Our Next Generation - **EESeal +®**

- Conductive Silicone pin contacts and ground plane
  - Lowers contact resistance
  - Lowers Inductance
  - 45-50dB attenuation
  - Mitigation up do 20-40GHz

- Versions with...
  - Discrete Capacitors
  - Integral Capacitors
  - Discrete & Integral Capacitors

- Not 100% Environmentally Qualified
**EESeal® vs. EESeal +®**

Typical EESeal® Attenuation - ©2014 Quell Corporation
50ohm Load and source

![Graph showing attenuation vs. frequency for EESeal and EESeal+](image)

**Additional Attenuation**
EESeal® VS. EESeal+®

Graph showing attenuation in dB 50Ω against frequency from 100MHz to 10GHz for different capacitance values: 3pF, 4pF, 5pF, 10pF, 22pF, 47pF, and 82pF. The graph highlights the 5pF capacitance setting, comparing EESeal and EESeal+.
Attenuation plots of our 4.7nF filter with a 1” lead length to ground (green line), 2” lead length to ground (dark blue line), 3” lead length (gold line). The Blue is our standard part grounded to the connector shell. The brown line is the EESeal+® with about 0.5nH of inductance. The light blue line is a 200pF capacitor with a 2 inch lead.
High Frequency Attenuation Performance

• Baseline Scan

- 6-7.11FC (2.5pF)

~21db at 16GHz

Mighty Mouse connector
FILTERED SAVO CONNECTOR - RF ATTENUATION MEASUREMENT RESULTS

INSERTION LOSS VALUES OF THE FILTER, Only One Cap was Evaluated = 5 pF

<table>
<thead>
<tr>
<th>FREQ</th>
<th>2 MHz</th>
<th>30 MHz</th>
<th>50 MHz</th>
<th>100 MHz</th>
<th>200 MHz</th>
<th>3 GHz</th>
<th>5 GHz</th>
<th>10 GHz</th>
<th>20 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATTN</td>
<td>5 dBs</td>
<td>54 dBs</td>
<td>37 dBs</td>
<td>43 dBs</td>
<td>32 dBs</td>
<td>27 dBs</td>
<td>26 dBs</td>
<td>33 dBs</td>
<td>39 dBs</td>
</tr>
</tbody>
</table>

Electromagnetic Environmental Effects (E3) Team
EESeals® Inside...

- Allows for both sockets and pins
- Multiple EESeals
  - More capacitance
  - Higher voltage
  - Wider frequency capabilities
  - Invisible
**EESeal® Benefits...**

- **Custom!**
  - Matches your exact application
    - Application dependent
  - Pin to Pin, pin to shell, Capacitors, Resistors, ESD - MOV/diodes, shorts, opens, etc....
  - Every pin exactly the way you need it...
- No tooling
- Light weight
  - < 1 gram
- No additional space needed
- Field Installable/Replaceable (Retrofit)
- Custom labeling, colors, etc.
**EESeal® Benefits...**

- **Fast!**
  - FREE Samples in 24-48 hours.
  - Production orders in 6-8 weeks. ...or better if needed...

- **Cost!**
  - Competitively priced as a long-term, permanent solution vs. Filtered Connectors.
  - No redesign or schedule delays
  - Ease of assembly
100% Quality & Delivery...

Quality Audits:
- Boeing 2012 – Added to ASL
- NQA 2013 – Annual surveillance audit
- Northrop Grumman 2012 – Product Audit
- JLG 2013 – Automotive Standards
- JPL – Added to AVL
- SpaceX 2015
- Israeli Aircraft Industries - 2016
- Panasonic – 2016
- Honeywell - 2016
Where to use an EESeal®?

At ANY connector Interface.

• ANY style connector
  • MIL-Circular
  • MIL-C-38999, MIL-C-26482, MIL-C-5015, Mighty Mouse, & many others....
  • D-Subminiature
  • MDM/Micro D
  • ARINC
  • Plastic
  • Non-conductive connectors and more...

• Any Manufacturer
  • Molex, Deutsch, Souriau, Amp, etc.
Who uses **EESeals** ®?

- A Few Quell Customers...
What we need...

1. What is the connector p/n?
2. What are the frequency issues, scans and/or Capacitor values you would like?
3. What are the voltages on each of your pins?
4. What is the data rates on each pin? (RS422, ethernet, video, etc.)
5. Any transient or lightning specifications?
6. What is the best shipping address for your FREE EESeal samples?
Website...

- Free Sample Link
- Videos
Please reach out to **Brainard-Nielsen** at **rich@bnmsales.com** if you have a Quell EESeal applications...

**Thank You!!**

**Brainard-Nielsen Marketing, Inc.**
Thank you

Quell

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www.EESeal.com

Bring out the “Goodness.”