

# ITT OVERVIEW



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# A Multi-Industry Market Leader

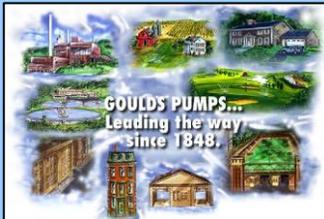


**ITT Industries**  
Steve R. Loranger, President  
and Chief Executive Officer

2002 Sales \$4,999

## Fluid Technology

Largest pump manufacturer worldwide



2002 Sales \$1,960

## Defense Electronics & Services

A leader in high technology electronic systems and services



2002 Sales \$1,510

## Electronic Components

A leading supplier of connectivity and interface solutions



2002 Sales \$584

## Motion & Flow Control

Leading supplier of shock absorbers, and brake materials

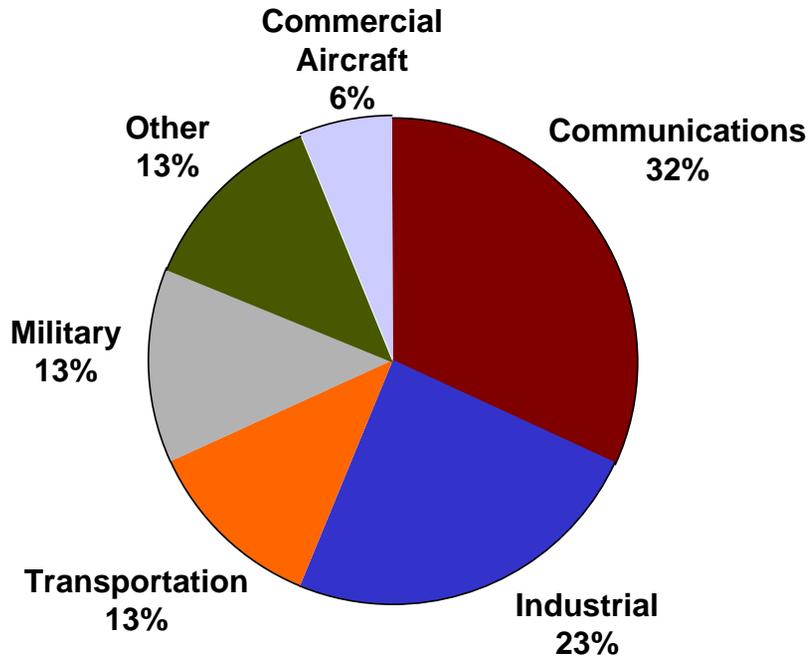


2002 Sales \$936

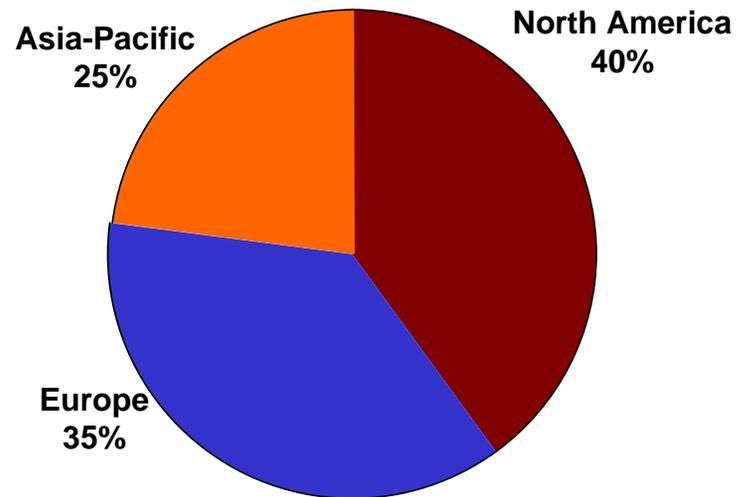
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# Serving diverse markets and regions

## End Markets



## Regions



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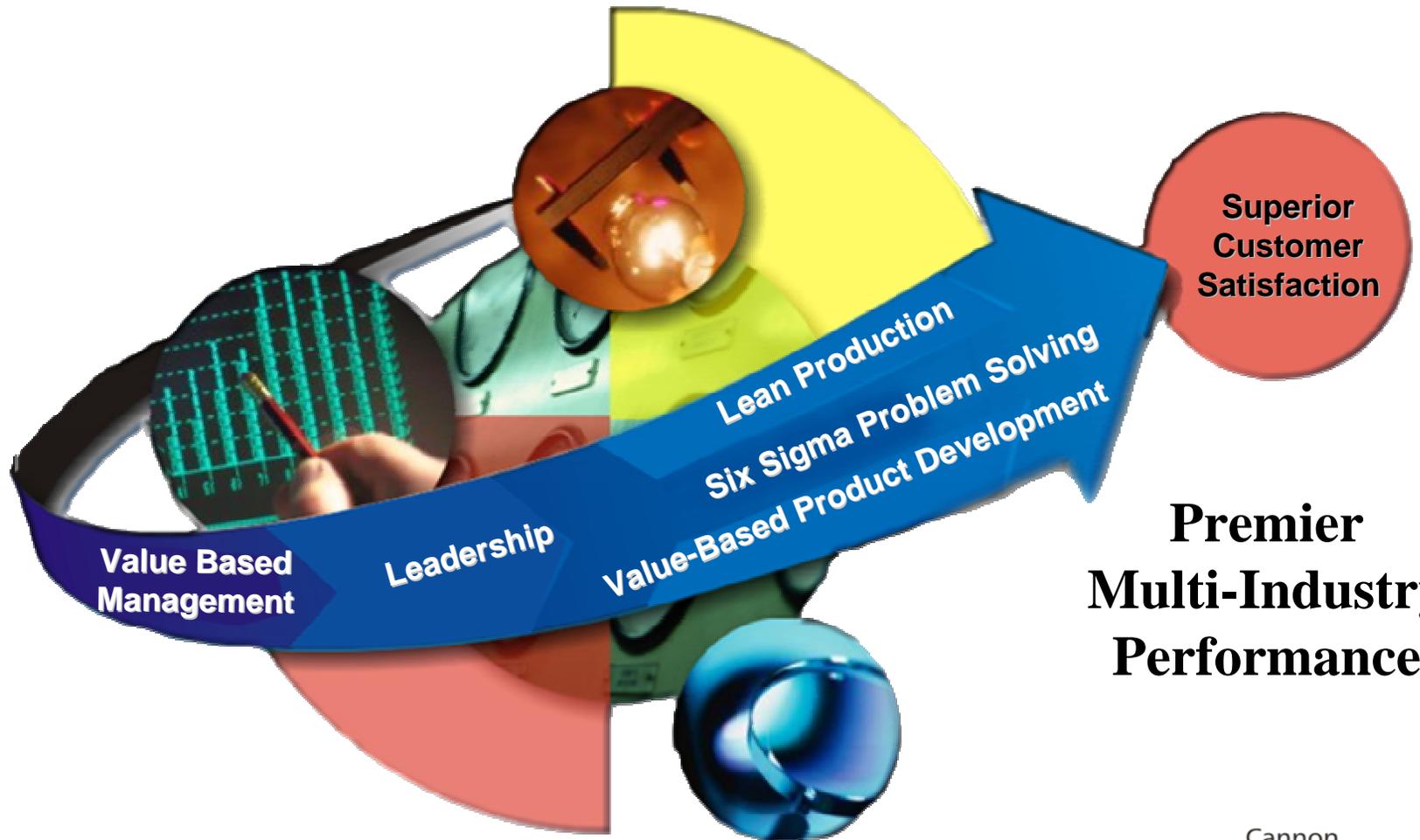
# Strong global manufacturing and R&D presence



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# Our Strategies: Operational Excellence

The Overarching Strategy for all Continuous Improvement



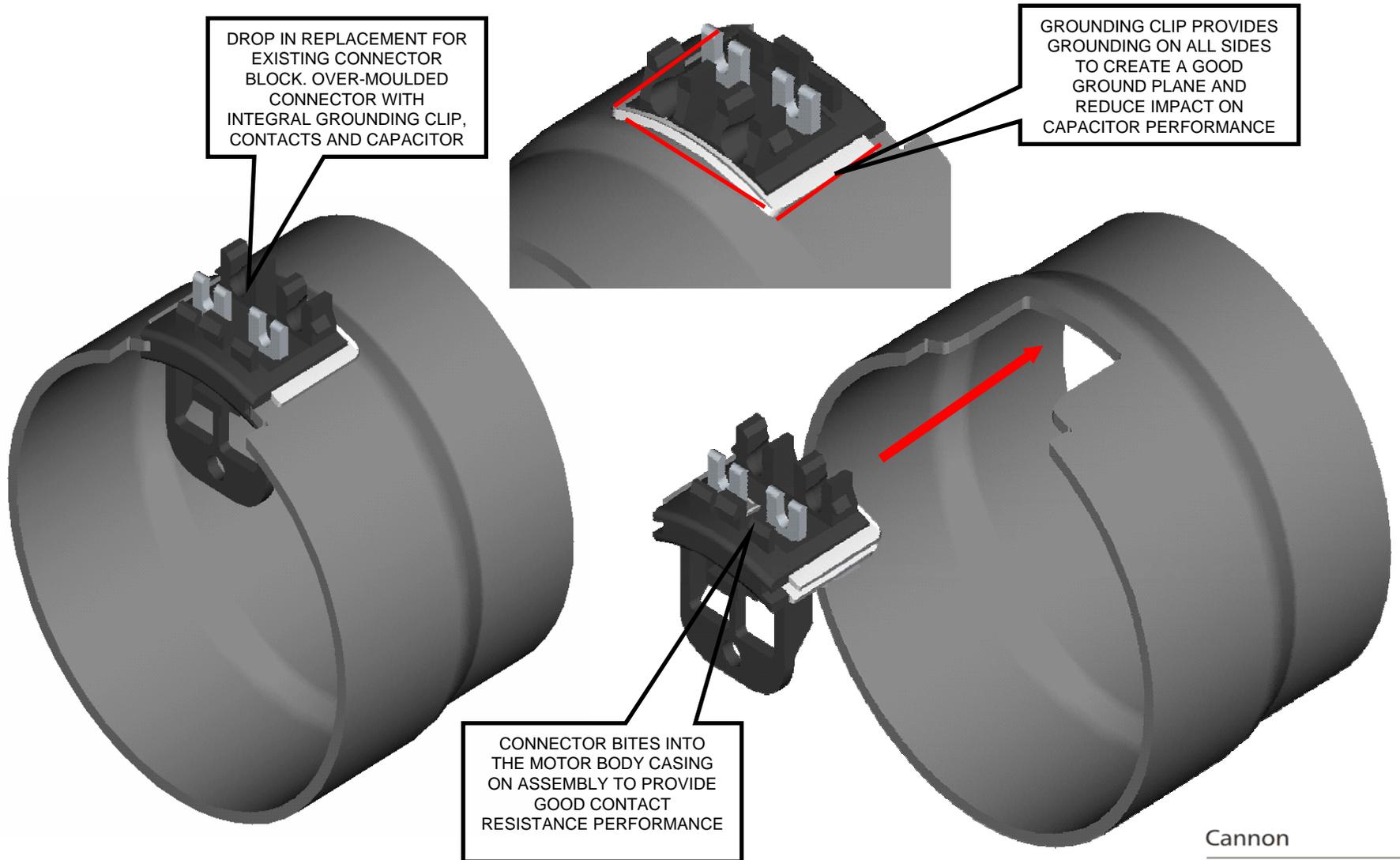
**Premier  
Multi-Industry  
Performance**

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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

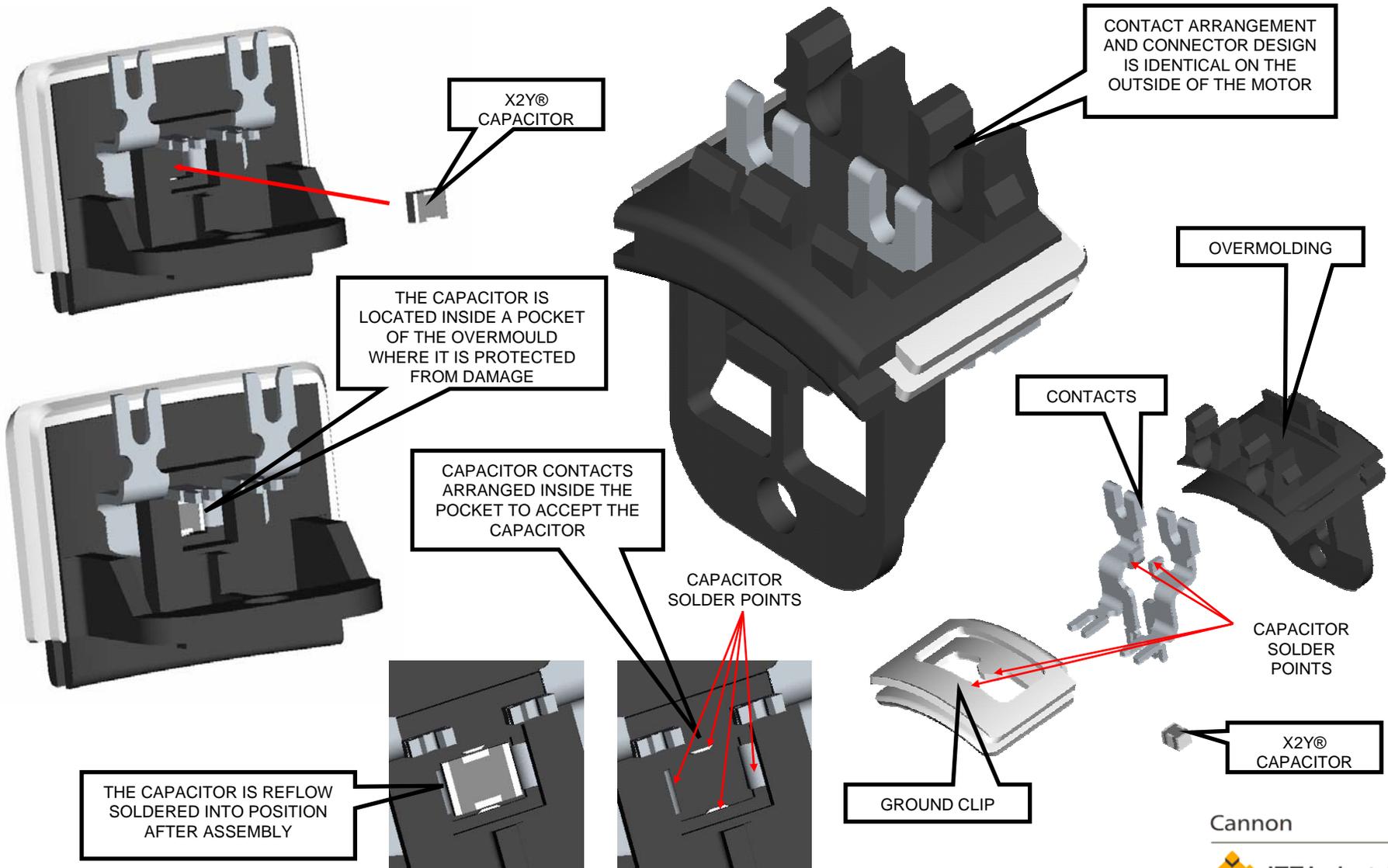
**Patents Pending**



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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

**Patents Pending**



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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

*Patents Pending*

## Concern over differential expansion

Differential expansion of the capacitor vs. the surrounding contacts, plastic and ground plate may cause fretting of the solder joints, resulting in failure.

## Solutions

1. Flexible silver loaded polymer pads on the capacitor
2. Compliant springs soldered to the capacitor
3. Capacitor press fitted into a sprung socket
4. Combination of the above

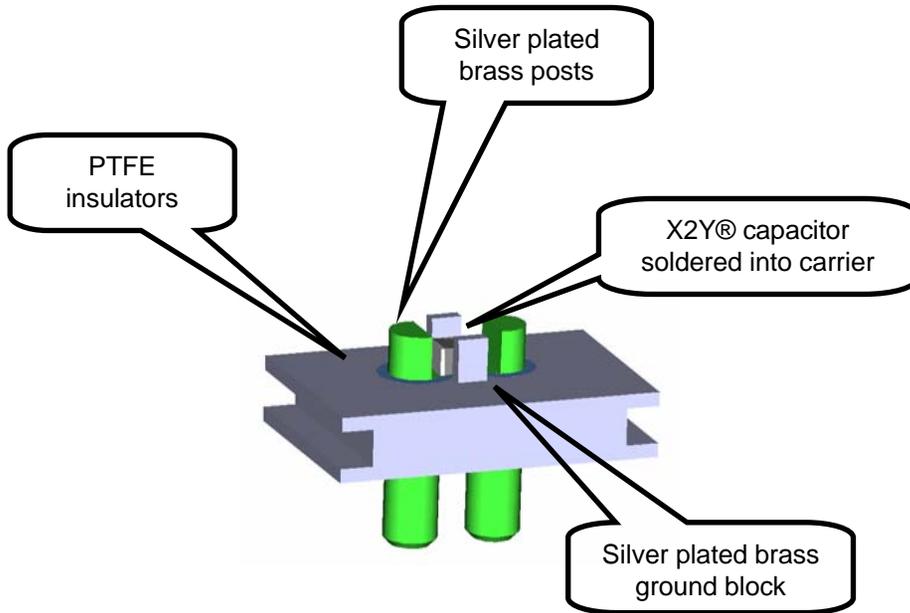
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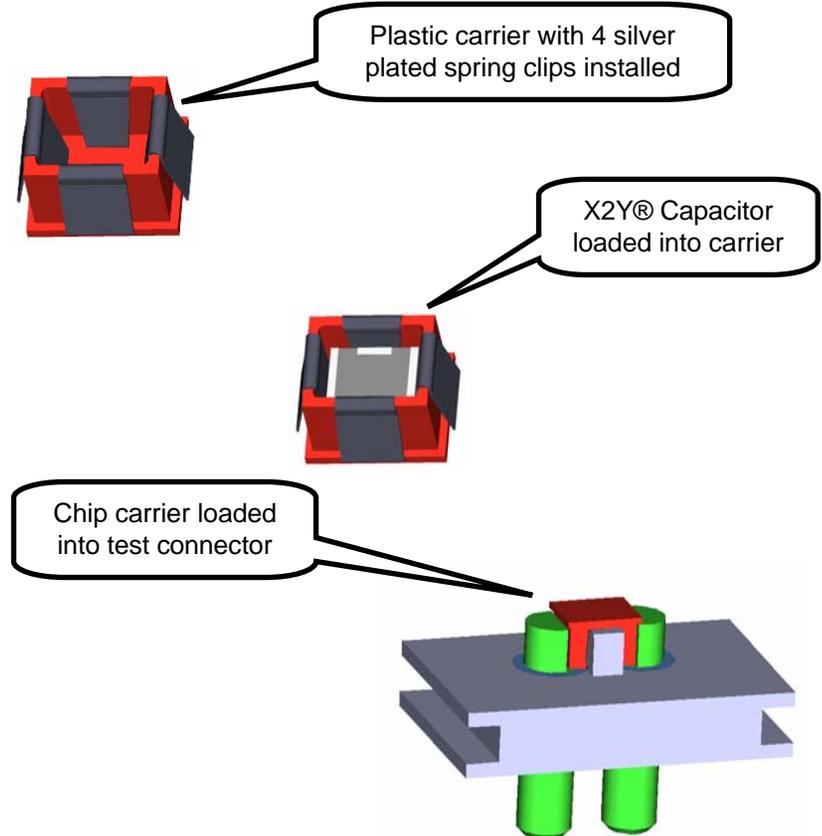
# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

**Patents Pending**

## Confidence testing



## Solder device



## Compliant device

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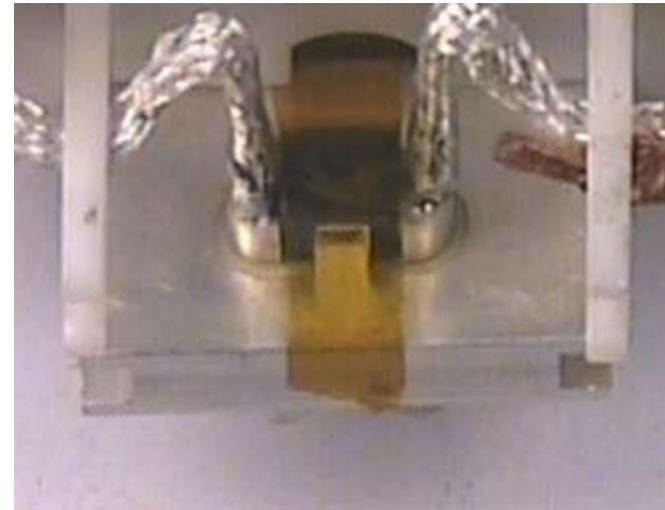
# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

*Patents Pending*

Photographs of connectors  
embedded in motors



Soldered device

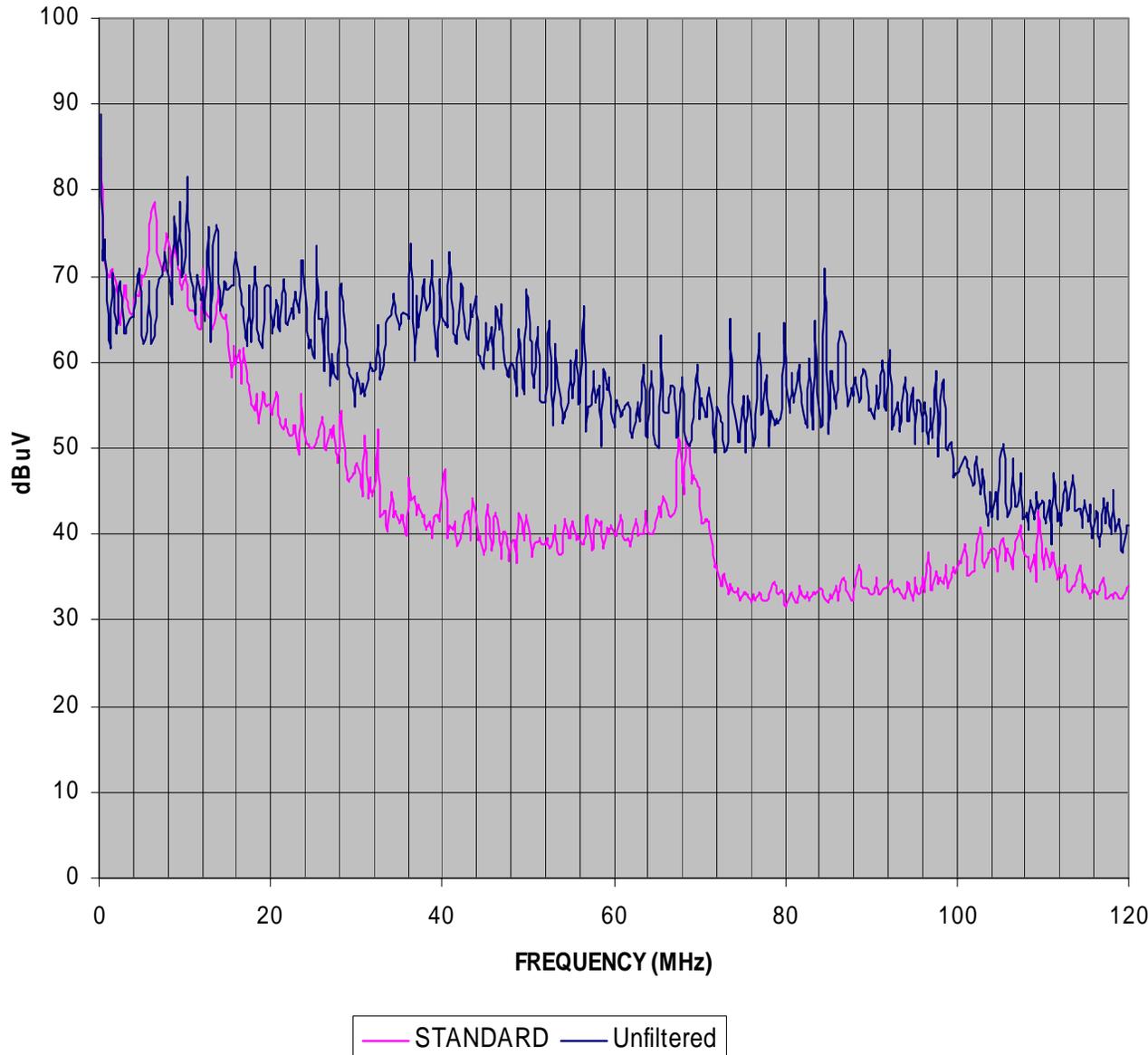


Compliant device

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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR



## BASELINE RESULTS

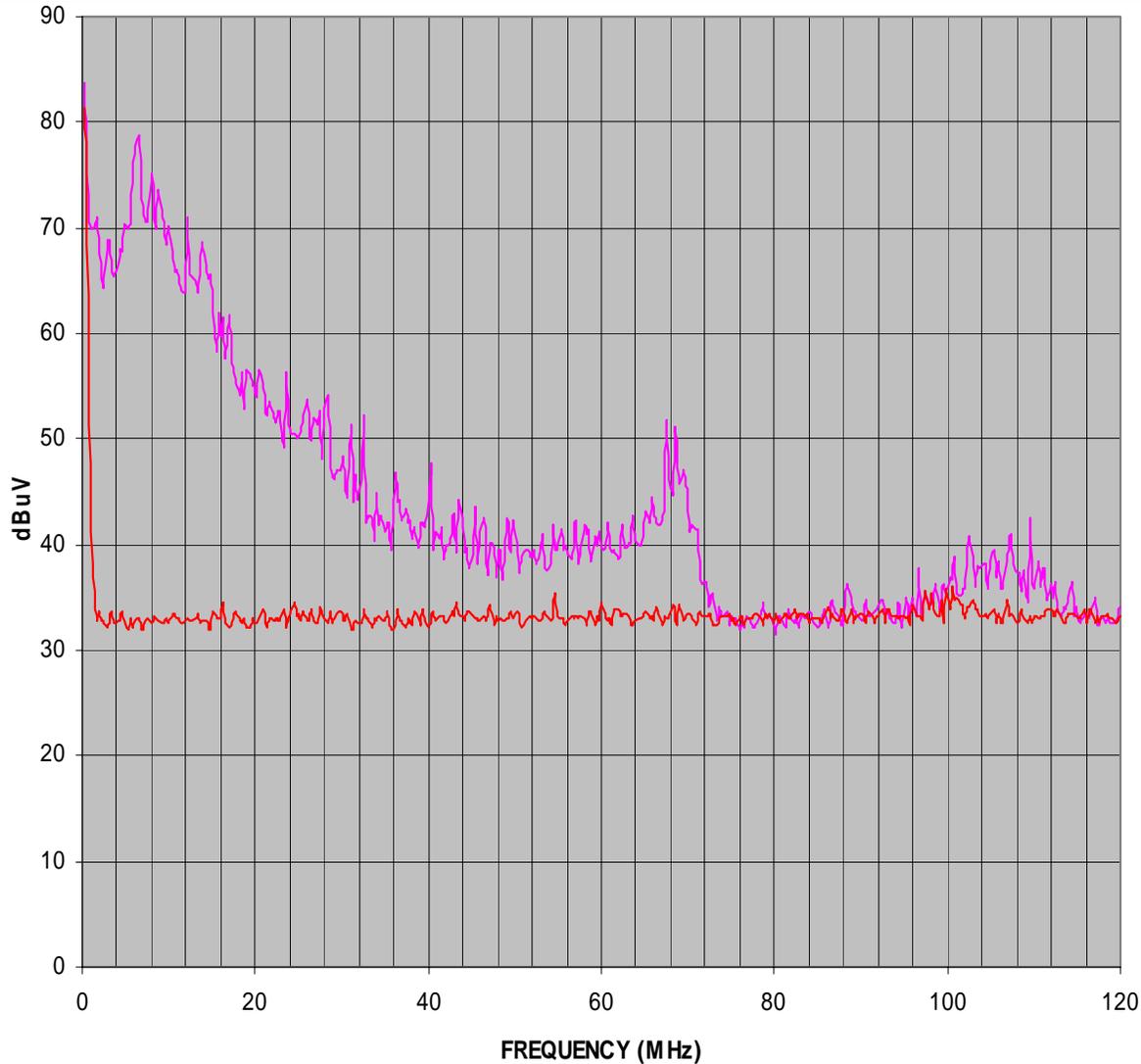
Comparison of original filtered and unfiltered motor.

Measurements made using a current probe around DC feed cable, and a spectrum analyser to detect variation in noise levels.

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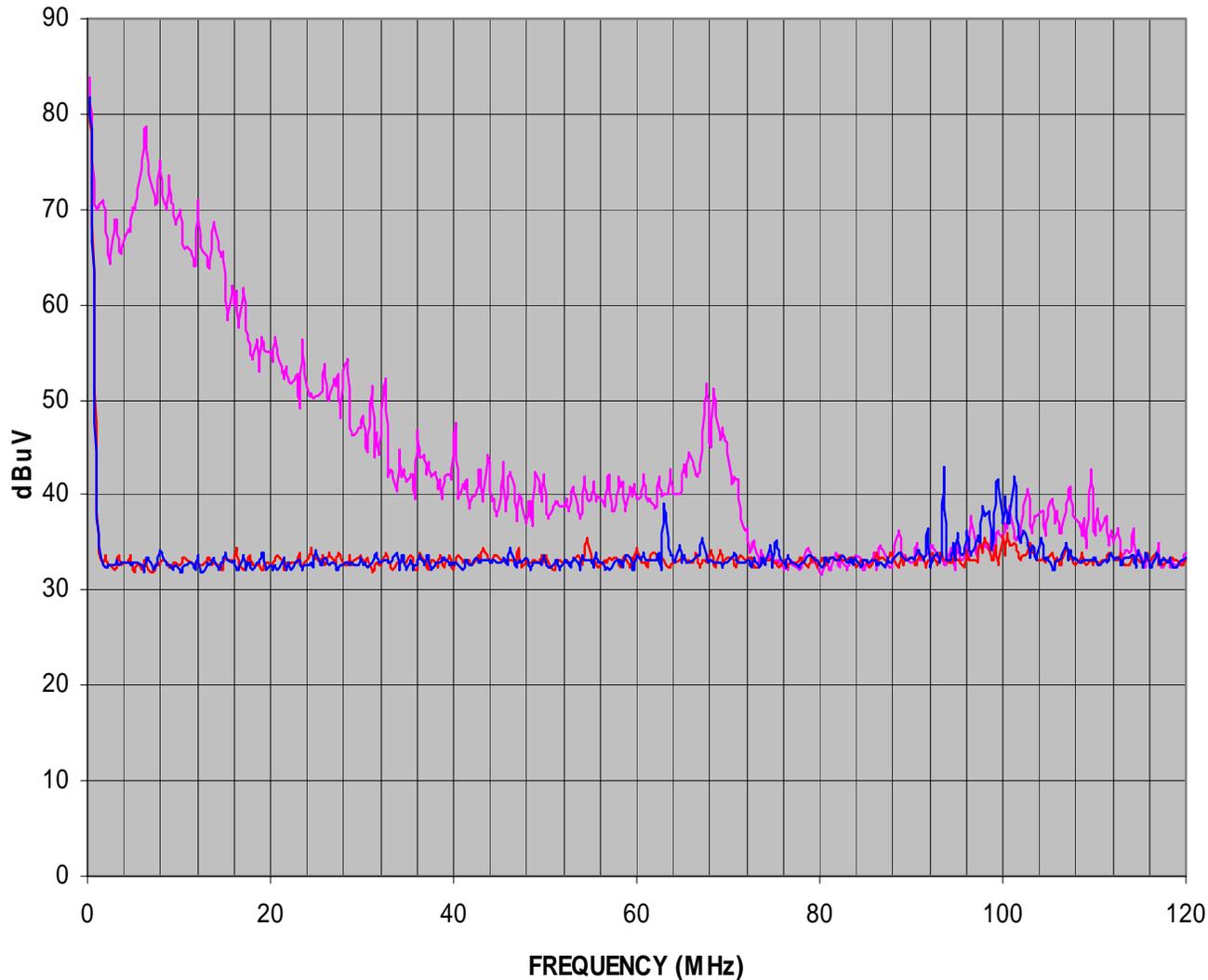
# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR



SOLDERED X2Y® CHIP vs  
BASELINE RESULTS

— STANDARD — Soldered X2Y 400nF CW

# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR



COMPLIANT X2Y®  
CHIP vs SOLDERED  
X2Y® CHIP vs  
BASELINE RESULTS

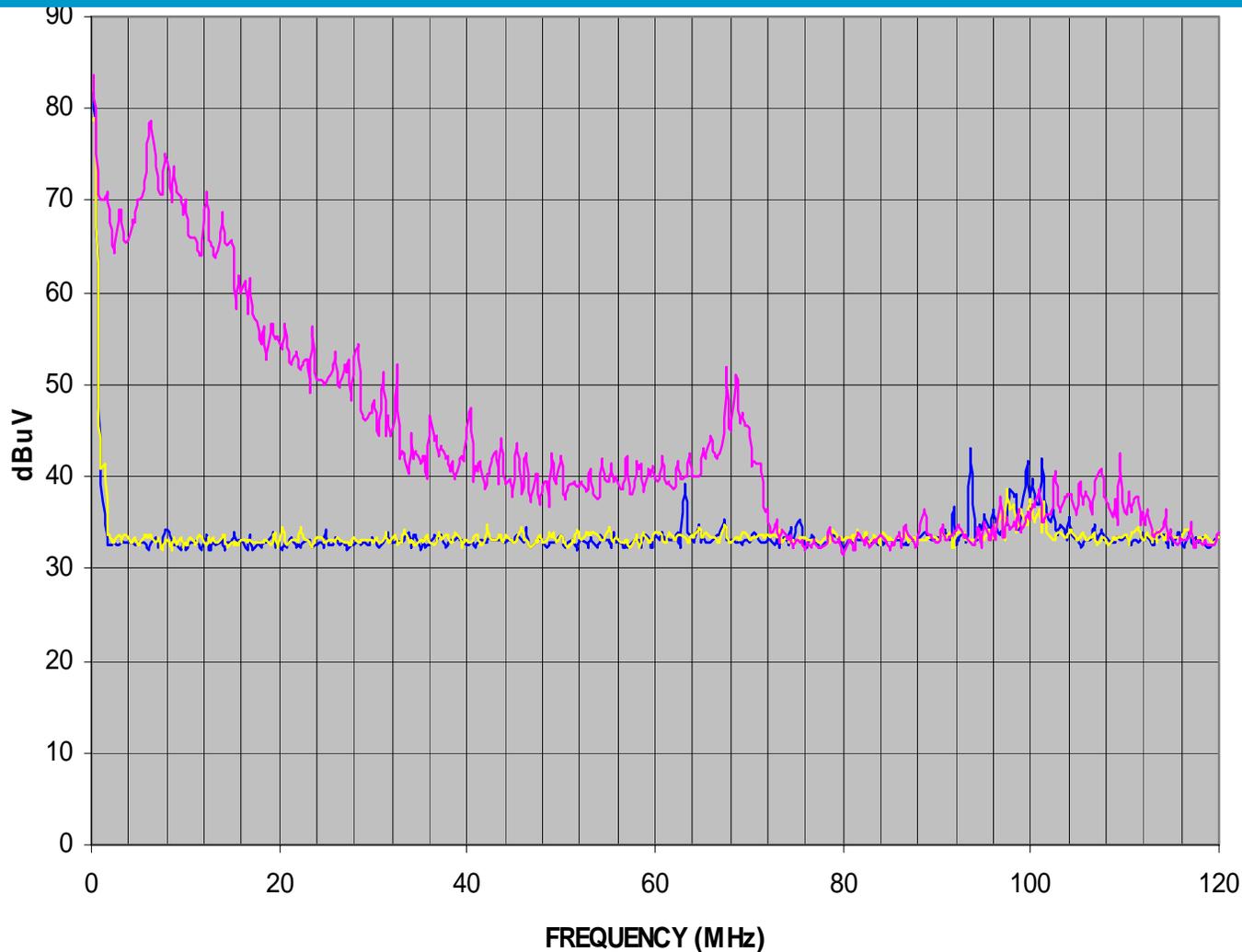
Compliant device shows  
slight increases in noise  
at certain frequencies.

— STANDARD — Soldered X2Y 400nF CW — Carrier X2Y 400nF CW

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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR



RETEST OF COMPLIANT X2Y® CHIP USING ADDITIONAL GROUNDING TAPE AROUND MOTOR CASE.

Improvement in noise levels when copper tape is used to improve grounding

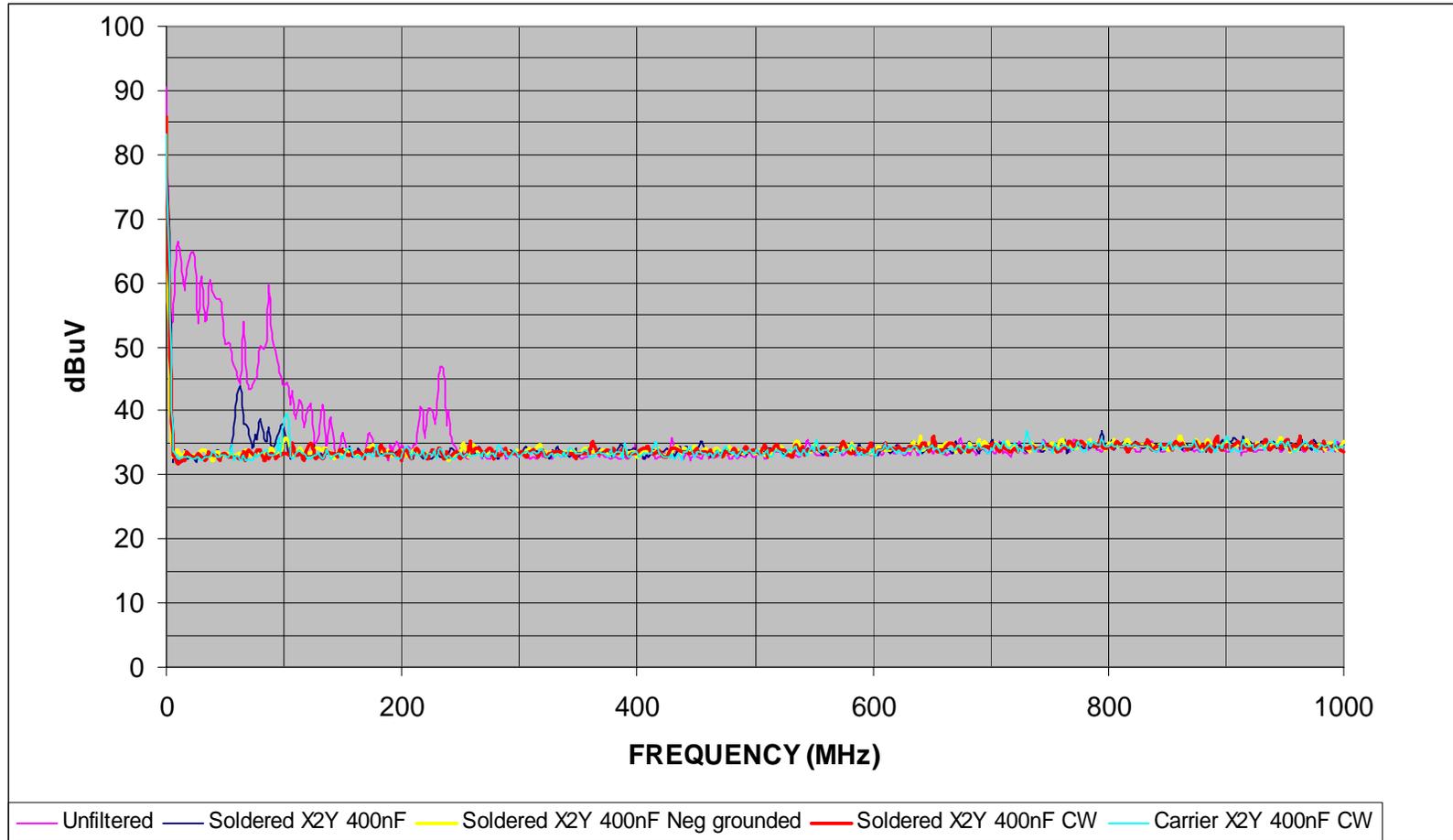
Carrier X2Y 400nF CW Carrier X2Y 400nF CW + Tape STANDARD

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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

GRAPH SHOWING TEST RESULTS TO 1GHz



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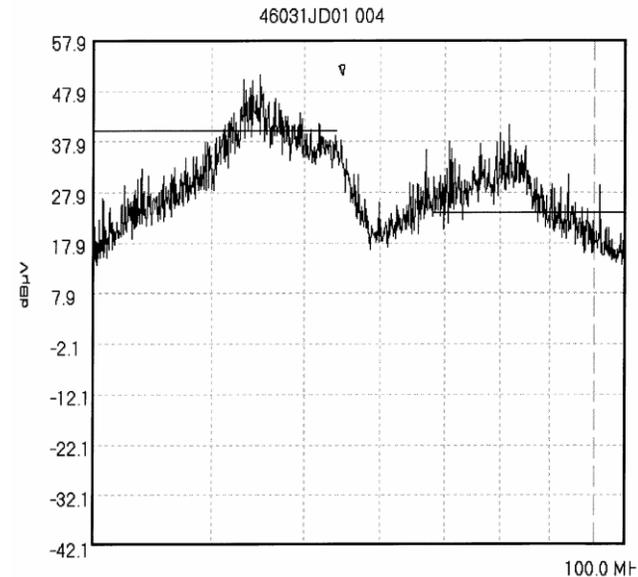
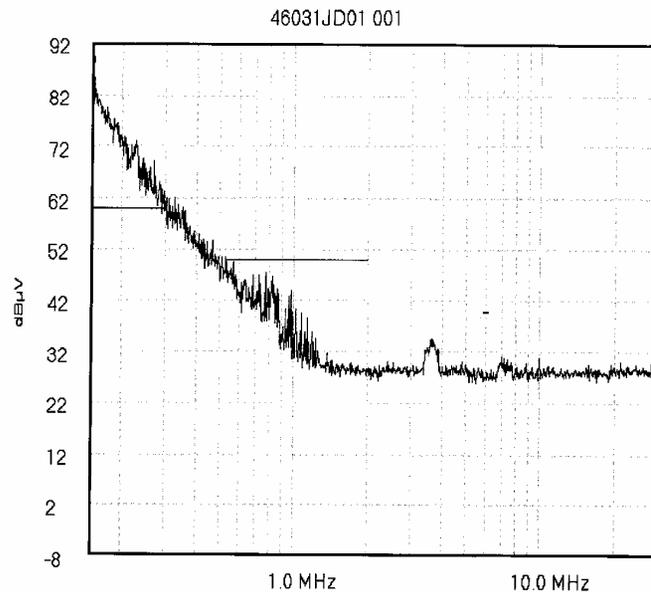
# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

## CISPR 25 Test Results

- Using chip carrier device
- Radiated emission results
- Conducted emission results
- Running under 'no load' condition
- Tests conducted by Radio Frequency Investigation

# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

## Compliant device w/ X2Y®, conducted emissions



| Class | Levels in dB(μV)        |                         |                        |                      |                       |
|-------|-------------------------|-------------------------|------------------------|----------------------|-----------------------|
|       | 0.15MHz<br>to<br>0.3MHz | 0.53MHz<br>to<br>2.0MHz | 5.9MHz<br>to<br>6.2MHz | 30MHz<br>to<br>54MHz | 68MHz<br>to<br>108MHz |
| 1     | 100                     | 82                      | 64                     | 64                   | 48                    |
| 2     | 90                      | 74                      | 58                     | 58                   | 42                    |
| 3     | 80                      | 66                      | 52                     | 52                   | 36                    |
| 4     | 70                      | 58                      | 46                     | 46                   | 30                    |
| 5     | 60                      | 50                      | 40                     | 40                   | 24                    |

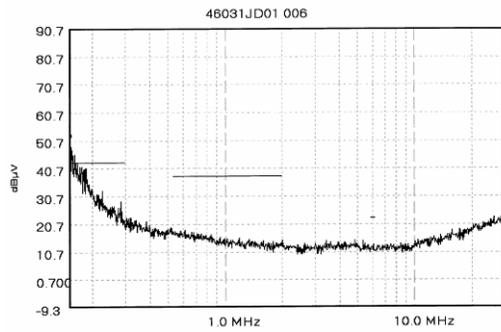
Broadband Conducted emissions as per table 6 of CISPR 25

This part passes at level 5 from 0.53MHz up to 108MHz

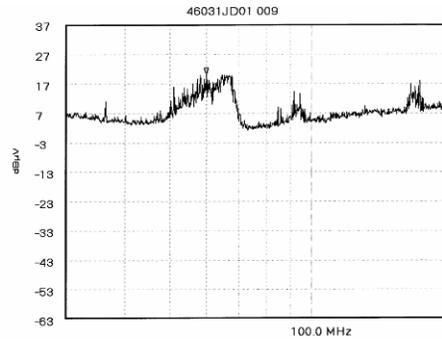
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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

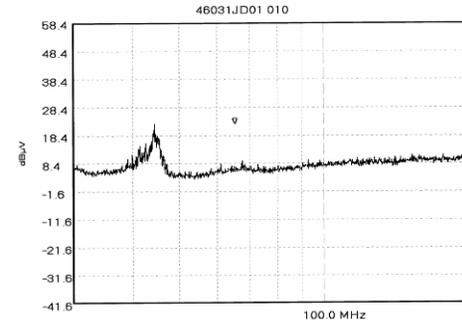
## Compliant device w/ X2Y®, radiated emissions



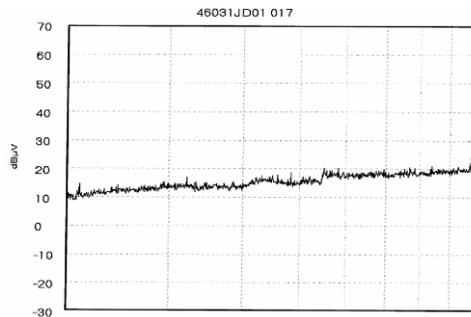
150kHz-30MHz



HORIZONTAL  
30-200MHz



VERTICAL  
30-200MHz

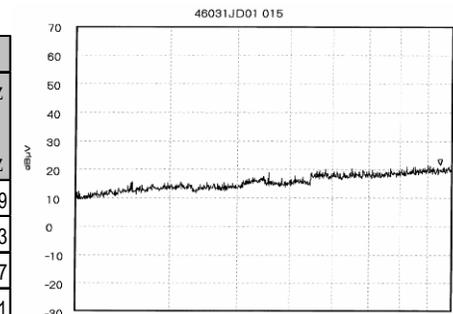


HORIZONTAL  
200-1000 MHz

| Class | Levels in dB(µV) |              |              |             |              |              |              |              |
|-------|------------------|--------------|--------------|-------------|--------------|--------------|--------------|--------------|
|       | 0.15MHz          | 0.53MHz      | 5.9MHz       | 30MHz       | 68MHz        | 142MHz       | 380MHz       | 820MHz       |
|       | to<br>0.3MHz     | to<br>2.0MHz | to<br>6.2MHz | to<br>54MHz | to<br>108MHz | to<br>175MHz | to<br>512MHz | to<br>960MHz |
| 1     | 83               | 70           | 47           | 47          | 36           | 36           | 43           | 49           |
| 2     | 73               | 62           | 41           | 41          | 30           | 30           | 37           | 43           |
| 3     | 63               | 54           | 35           | 35          | 24           | 24           | 31           | 37           |
| 4     | 53               | 46           | 29           | 29          | 18           | 18           | 25           | 31           |
| 5     | 43               | 38           | 23           | 23          | 12           | 12           | 19           | 25           |

Broadband Radiated emissions as per Table 10 of CISPR 25

Worst case values taken from both horizontal and vertical measurements



VERTICAL  
200-1000 MHz

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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

## CISPR 25 Test Results summary

The compliant device w/ X2Y®, passed at level 5 except at the 0.15MHz to 0.30MHz frequencies on conducted emissions.

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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

Connector design proposal for next step

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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

*Patents Pending*

## Ground plate

Progression stamped from  
steel strip, tin/silver plated

Tabs lock onto either side of  
motor casing for good grounding

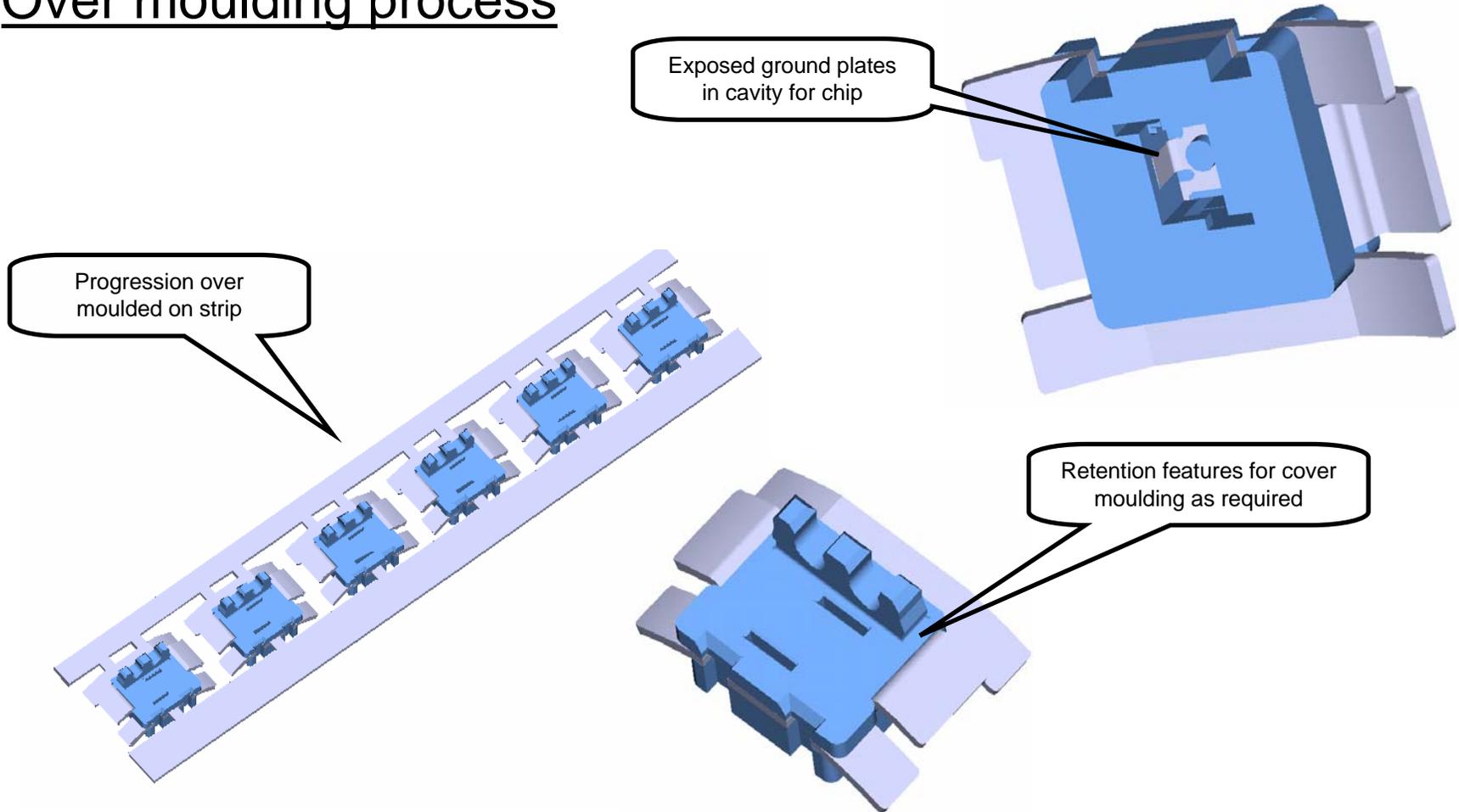
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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

**Patents Pending**

## Over moulding process



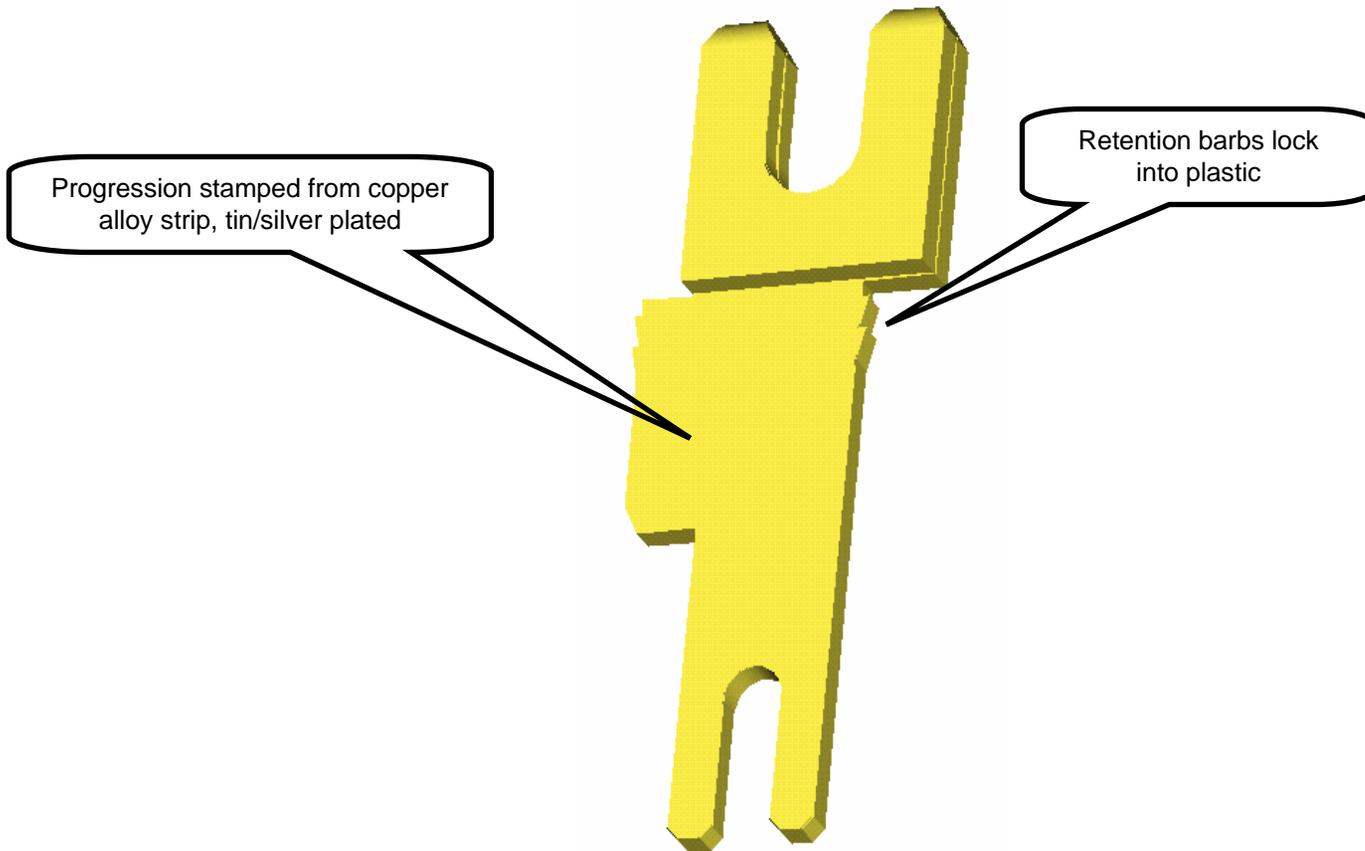
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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

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## Contact (x 2)

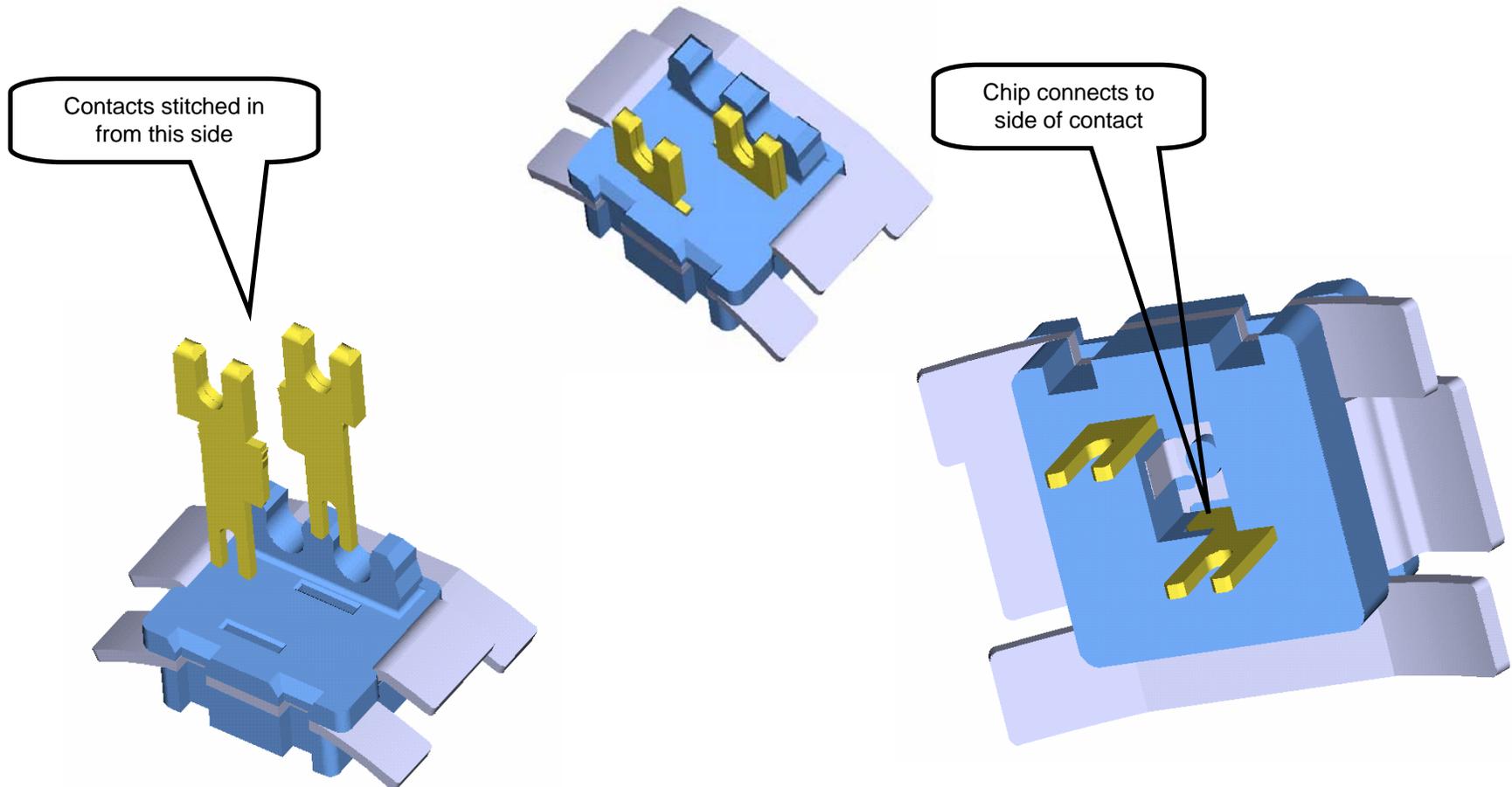


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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

*Patents Pending*

## Contact assembly



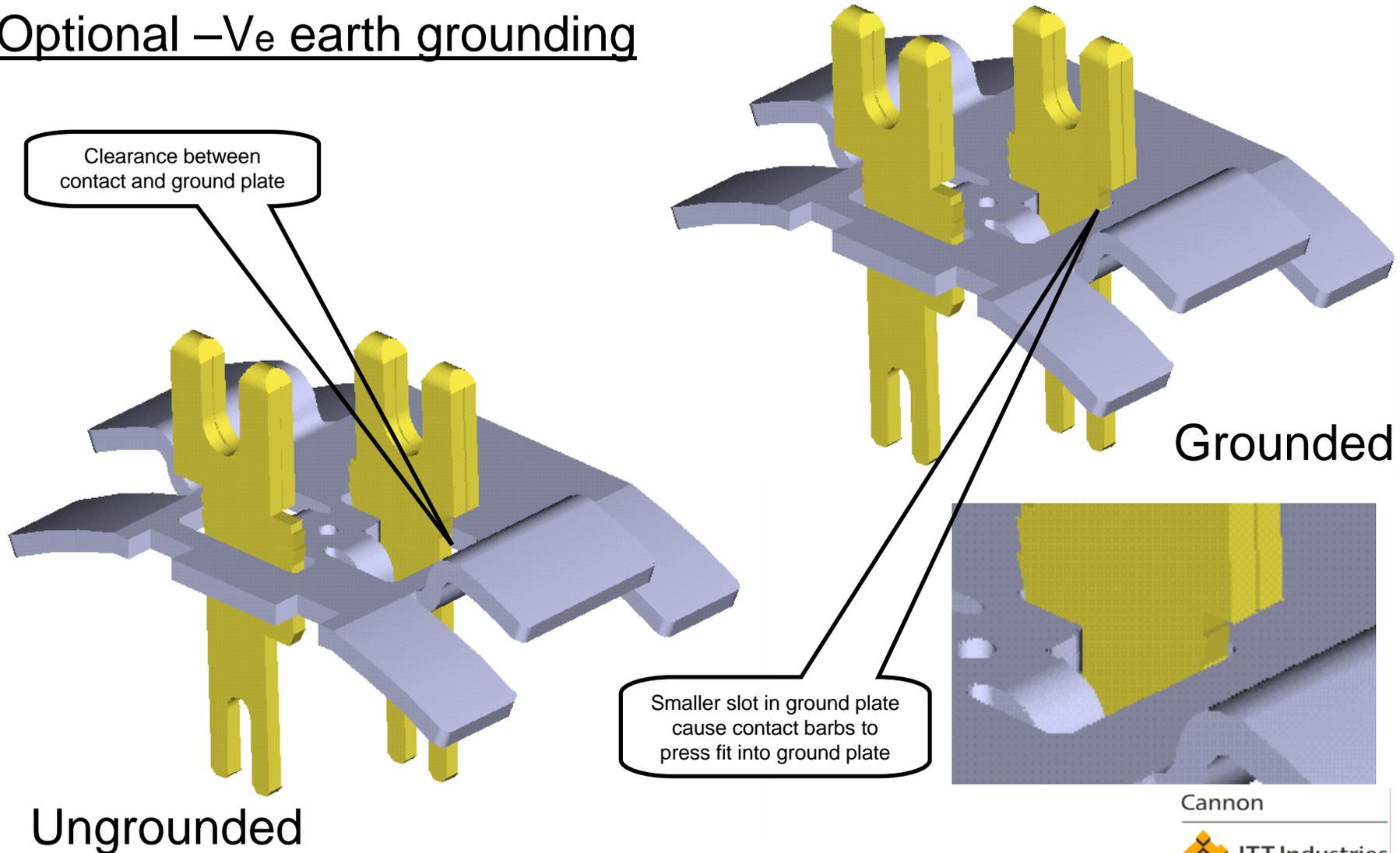
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## Optional $-V_e$ earth grounding

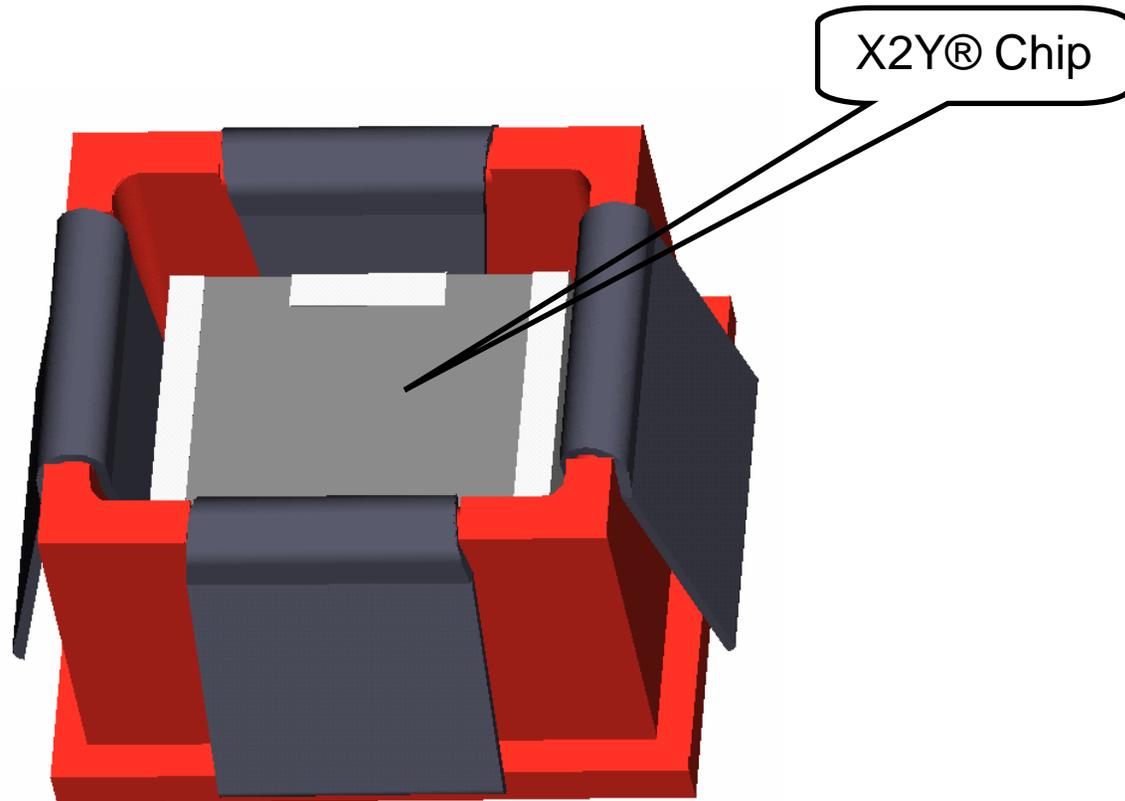


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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

*Patents Pending*

Chip carrier

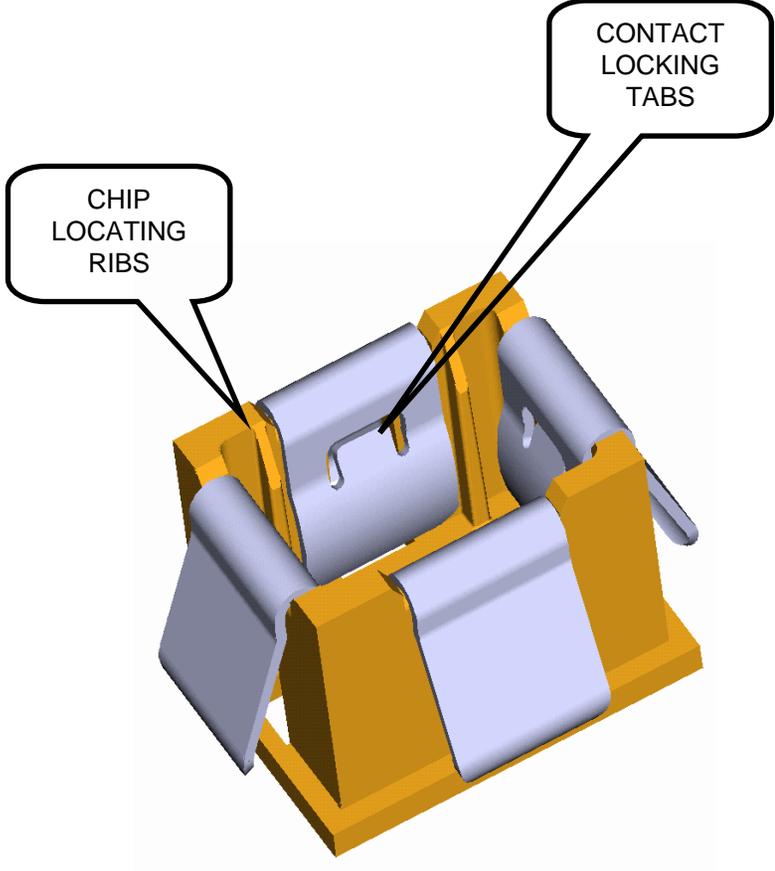
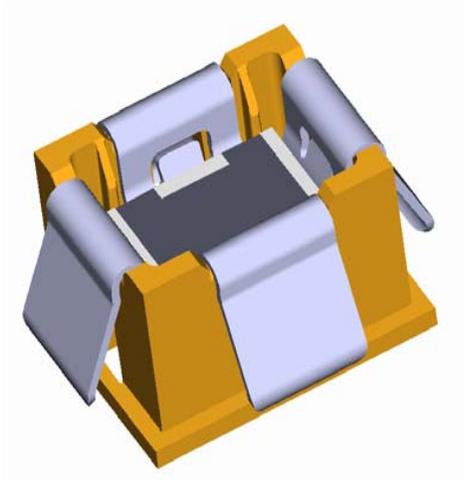


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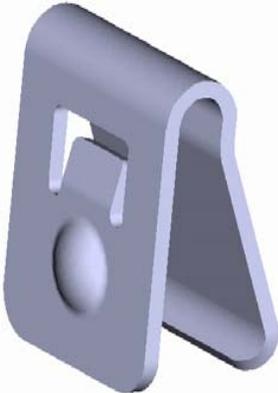
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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

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CONTACT STYLE 1



CONTACT STYLE 2



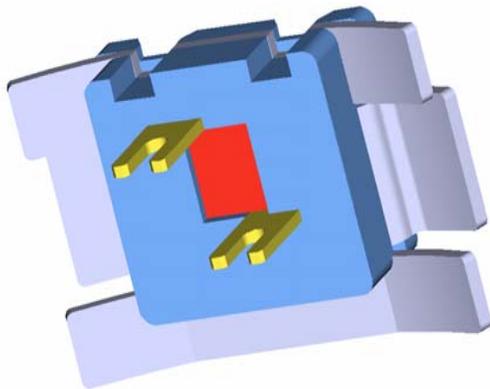
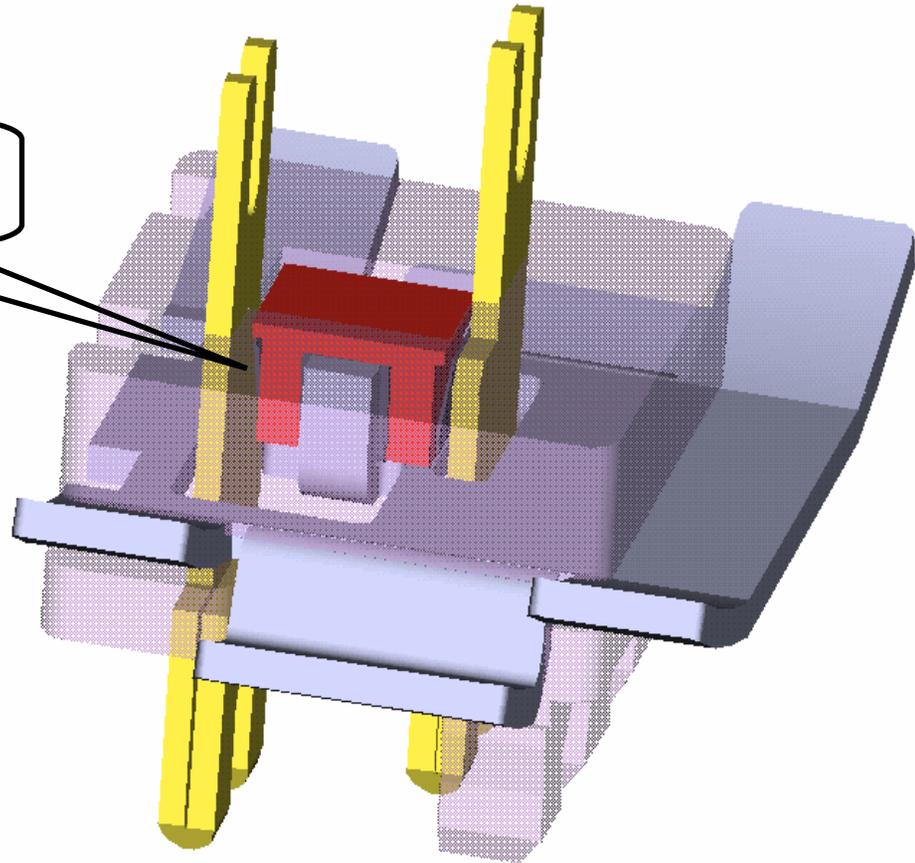
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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

*Patents Pending*

## Chip carrier assembly

X2Y® Chip carrier loaded into cavity. Compliant contacts mate with ground and power contacts



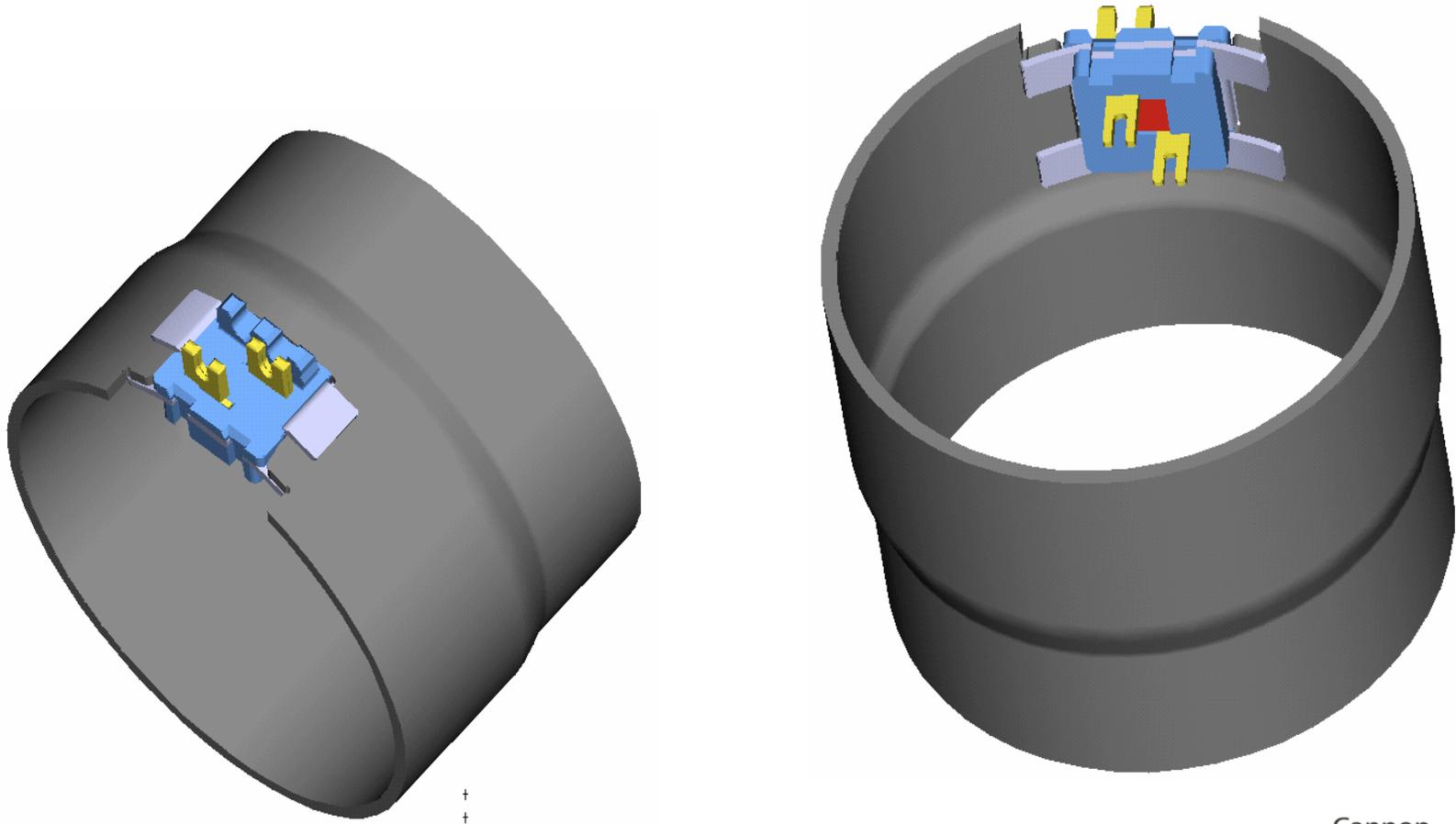
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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

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## Assembly into motor housing



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# MOTOR CONNECTOR WITH INTEGRAL CAPACITOR

Thank You

For more information please contact us:

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