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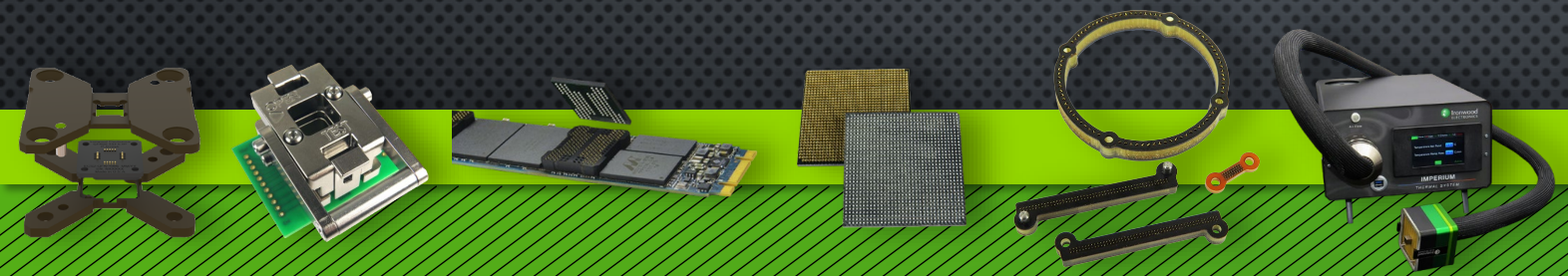
Ironwood ELECTRONICS



INTRODUCTION TO IRONWOOD

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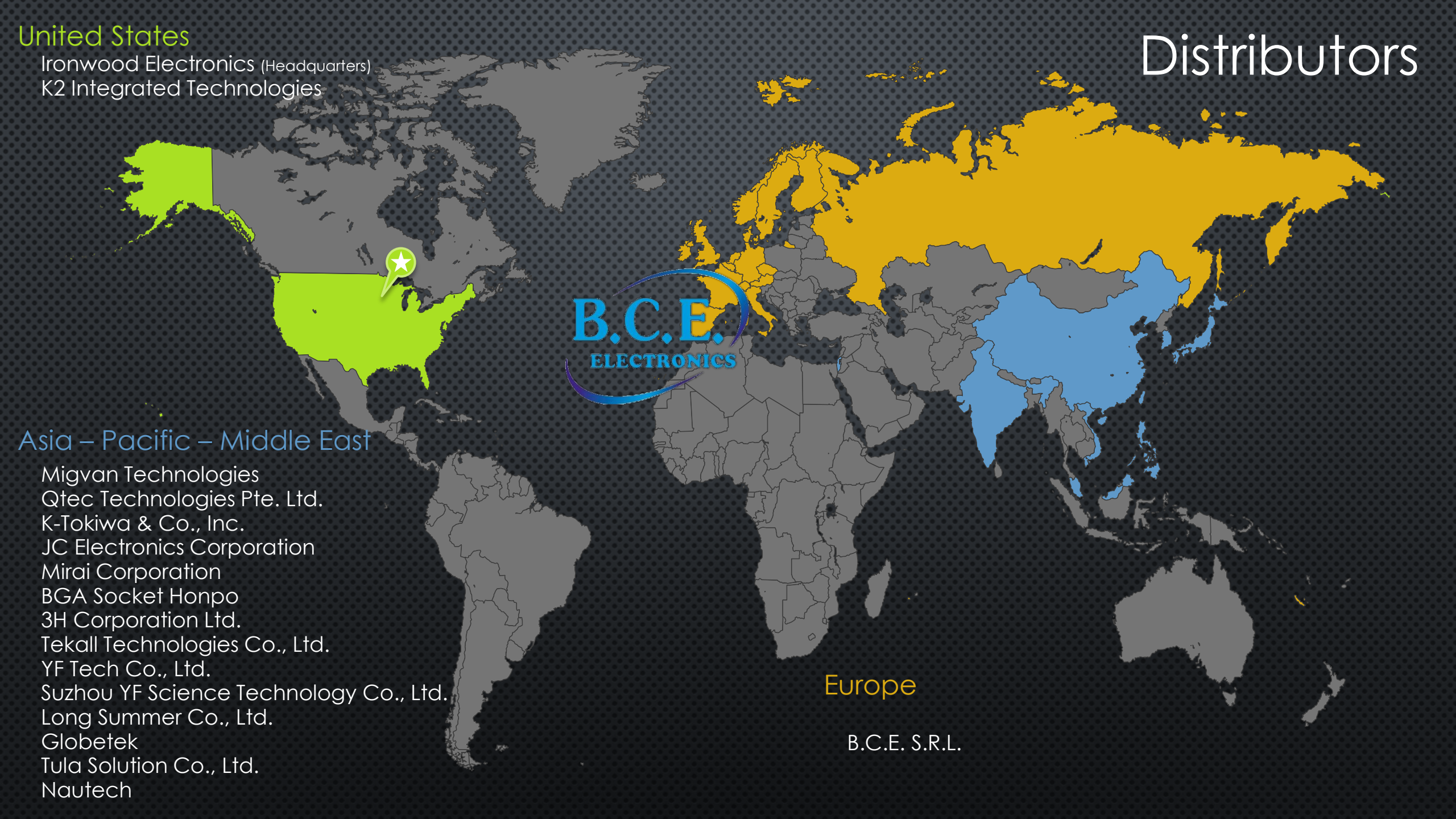
Ironwood ELECTRONICS

- Ironwood Established in 1986
- Located in Eagan Minnesota
- 75 Employees
- 100,000 Sockets built
  1M+ adapters built

Distributors



United States

Ironwood Electronics (Headquarters)
K2 Integrated Technologies

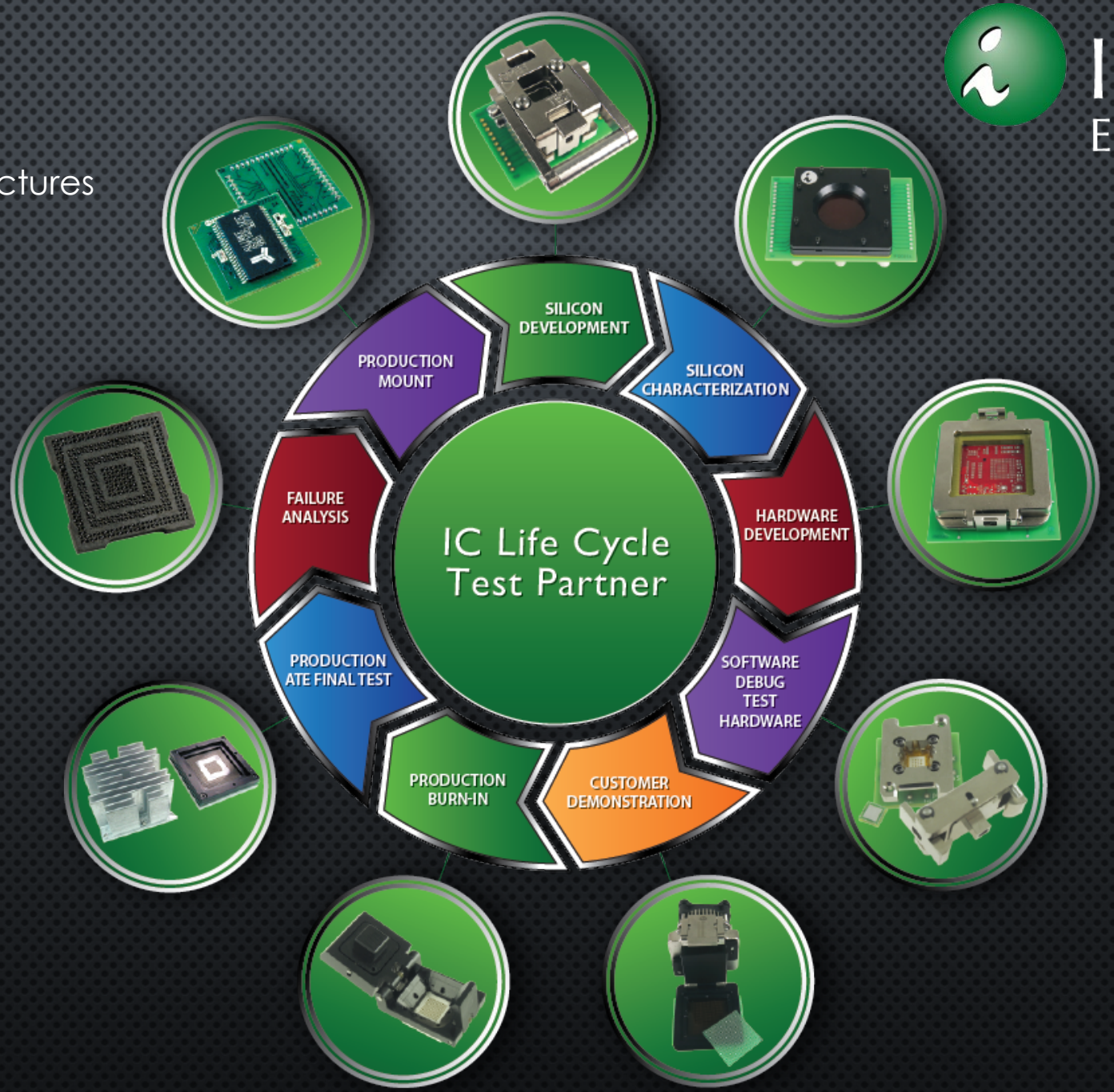
Asia – Pacific – Middle East

Migvan Technologies
Qtec Technologies Pte. Ltd.
K-Tokiwa & Co., Inc.
JC Electronics Corporation
Mirai Corporation
BGA Socket Honpo
3H Corporation Ltd.
Tekall Technologies Co., Ltd.
YF Tech Co., Ltd.
Suzhou YF Science Technology Co., Ltd.
Long Summer Co., Ltd.
Globetek
Tula Solution Co., Ltd.
Nautech

Europe

B.C.E. S.R.L.

- MARKETS SERVED
  - Semiconductor Manufactures
    - Memory
    - RF
    - Digital / Analog
    - Microprocessors / Microcontrollers
  - OEM
  - Military Aerospace
  - Telecommunications
  - Consumer Products



Ironwood ELECTRONICS

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Company History & Milestones

Ironwood ELECTRONICS

Established 1986

PGA Adapters 1988

QFN Adapters 1990

BGA Adapters 1995

SG Elastomers 1998

Spring Pin Sockets 2001

ISO Certified 2003

Diamond Particle 2004

Silver Particle 2009

Stamped Spring Pins 2010

GT Elastomers 2011

Low Force GT 2014

New Owner David Struyk 2016

Thermal Sockets- Heat Pipes 2018

GRYPPER Sockets Acquisition 2019

Thermal Unit IMPERIUM 2022

BTB Connectors 2023

ATE Production Test 2024

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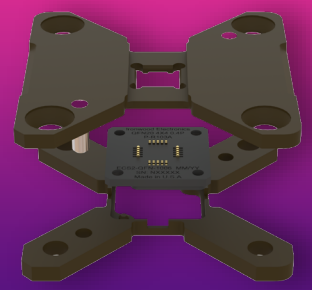
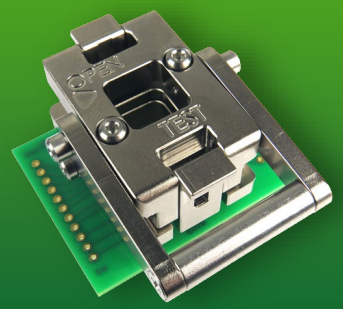
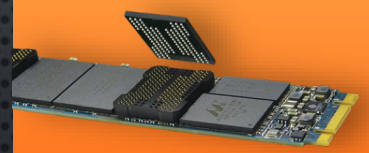
ATE PRODUCTION TEST



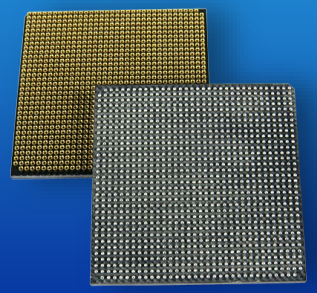
SOCKETS



GRYPPER



ADAPTERS



HIGH SPEED BTB CONNECTORS

IMPERIUM

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A HEICO COMPANY

Ironwood ATE PicoRaptor Cartridge flexibility & performance

- Drop into existing footprint
- Short wipe
- X, Y & Z compatible to existing technologies
- One frame, for multiple pin & pitch devices
- Multiple cartridges into single frame

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PICORAPTOR RIGID ATE CARTRIDGE

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PICO RAPTOR RIGID CONTACT

MECHANICAL SPECIFICATIONS	PicoRaptor-1	PicoRaptor-2
Contact Pin Uncompressed Height (mm)	0.95	1.6
Contact Compliance (mm)	0.2	0.2
Contact Tip Coplanarity (mm)	±0.05*	±0.05
Gram Force per Contact (g)	30 ± 10	*20~40g
Wipe Length (mm)	0.09 ~ 0.12	*0.1
Number of Insertion - Laminated Housing	≥6M	≥6M
Number of Insertion - Pin (Mattte Tin.). Number of Insertion - Pin (NiPd)	200 - 300K *	300K ~ 500K*
Number of Insertion - Elastomer	~200K	*300K ~ 400K
Operating Temperature	-45 ~ 155 °C	-45 ~ 155 °C
Socket Frame	Torlon 5030 or Equivalent	Torlon 5030 or Equivalent
Contact Cartridge	Cirlex® Polyimide	Cirlex® Polyimide
Pin Material	BeCu - NiAu	BeCu - NiAu

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PICO RAPTOR RIGID CONTACT

ELECTRICAL SPECIFICATION	PicoRaptor-1	PicoRaptor-2
Self Inductance (nH)	0.62	0.76**
Mutual Inductance (nH)	0.23	0.46**
Ground Capacitance (pF)	0.06	0.15**
Mutual Capacitance (pF)	0.085	0.11**
S21 (Insertion Loss/Bandwidth)	- 1db @ 35.4GHz++	-1db @ 18GHz**
S11 (Return Loss/Bandwidth)	- 20dB @ 7.8 GHz++	- 20dB @ 3GHz**
S41 (Crosstalk /Bandwidth)	- 20dB @ 15.8GHz ++	- 20dB @ 12GHz**
Contact DC Resistance (mΩ)	≤ 25	≤ 25
Curent Carrying Capacity (A) Duty Cycle 100% (20° rise)	6	9A**
Current Leakage (pA) @ 10V	≤1	≤1

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8 DESIGN FEATURES

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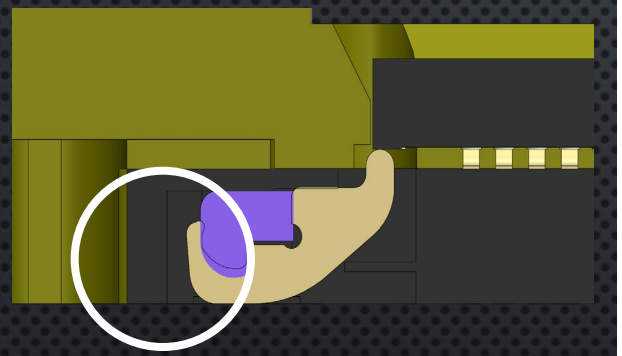
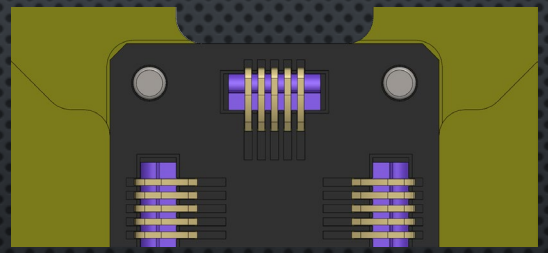
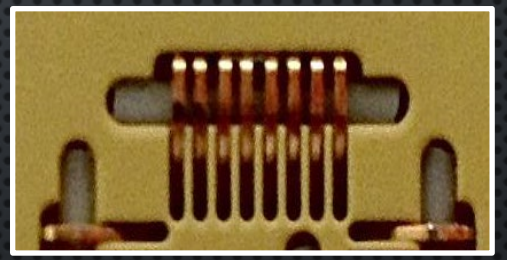
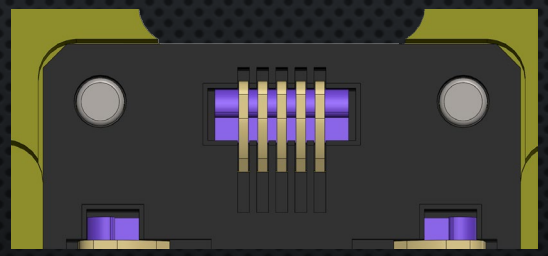
Feature #1 – No pin engagement to the back wall

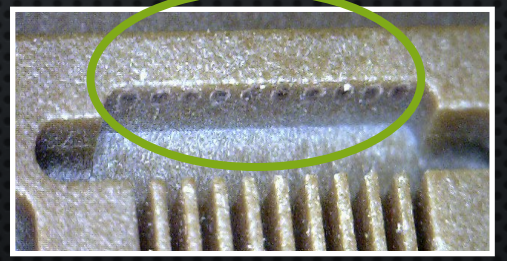


- Sustainable specification & FPY can be achieved
- Longer housing lifespan; ≥6M insertion (≥200% longer lifespan than typical socket housing)
- It maximizes contact pin & elastomer lifespan









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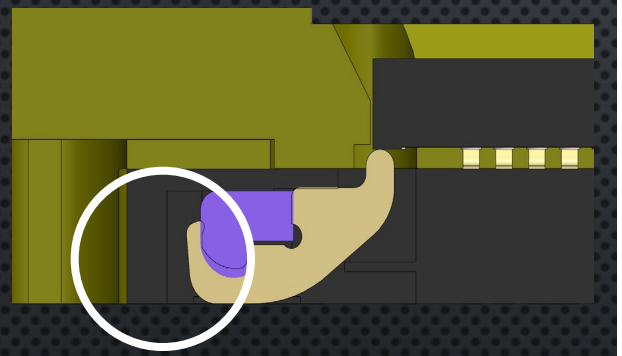
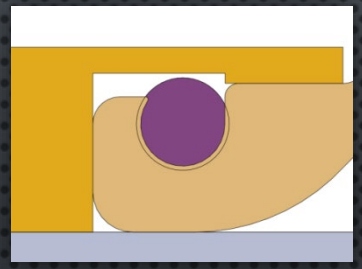
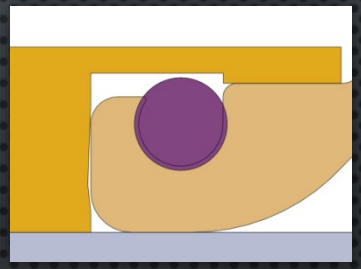
No Pin Engagement with Back-Stopper
Benefit : No Wearing of housing wall



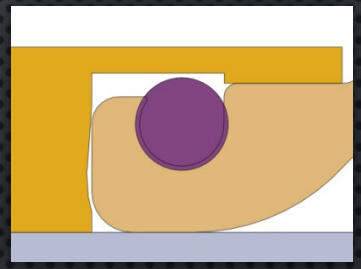
Progressive deterioration of the housing back-stopper



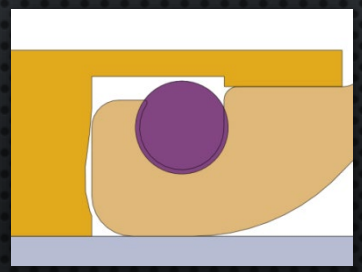
Starting Position



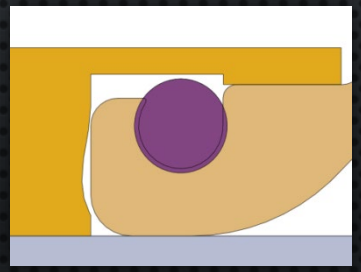
500k Cycles



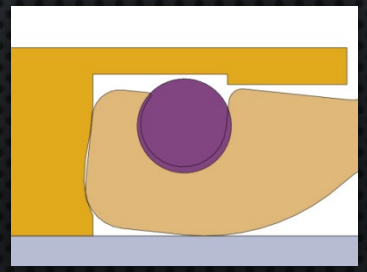
1000k Cycles



1500k Cycles



2000k Cycles



End Position*

When wearing occurs, contact force is compromised creating Cres to increase.

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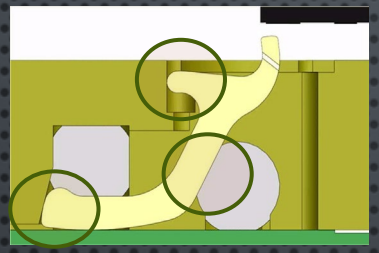
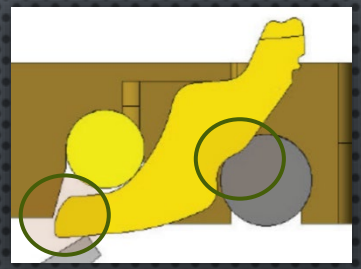
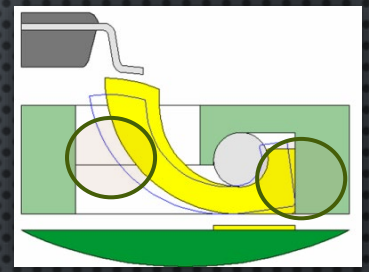
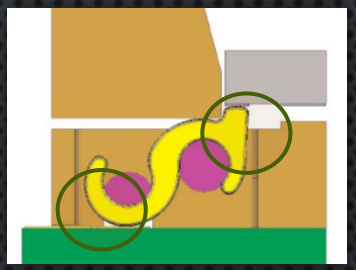
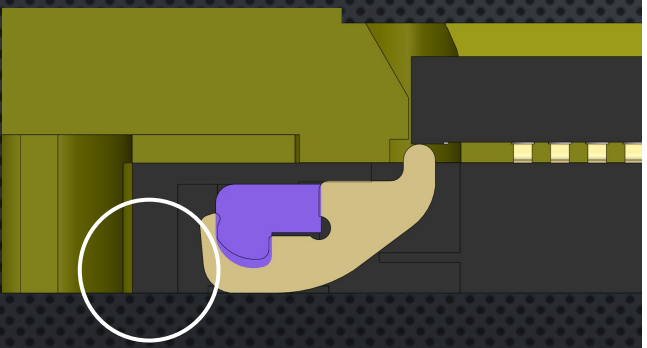
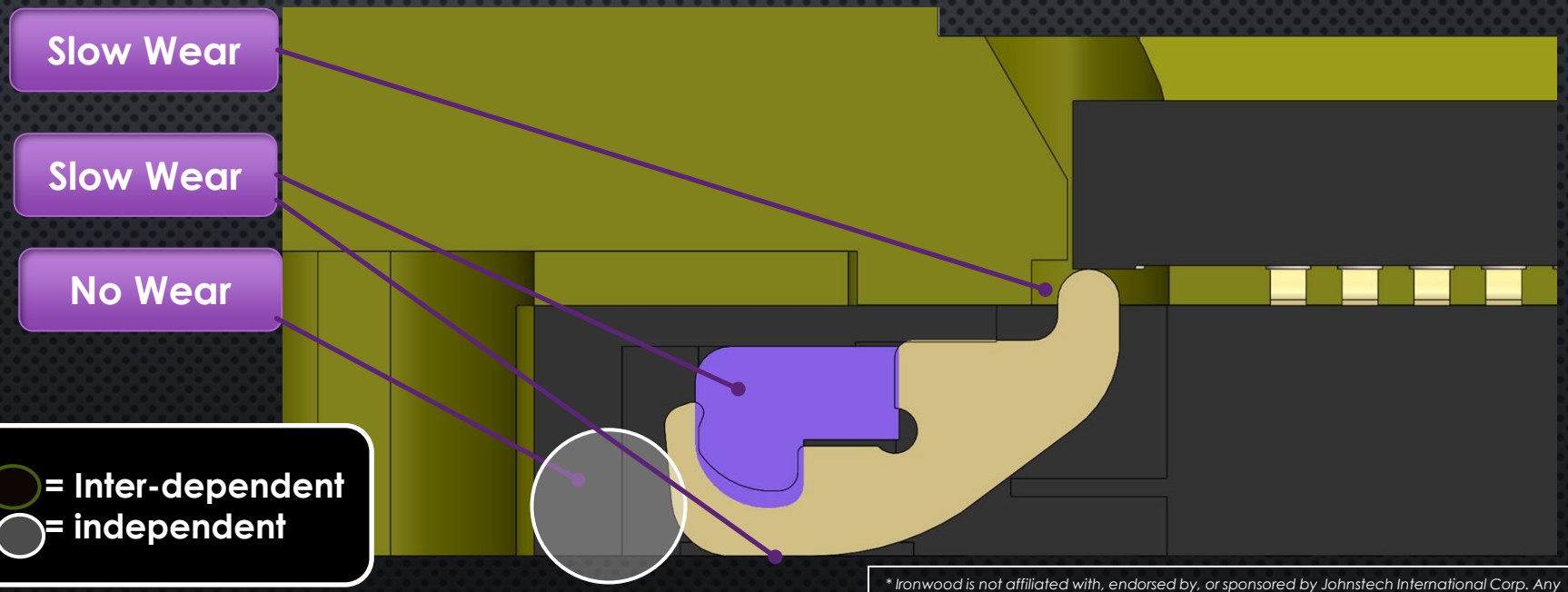
Where are the wear points?

*All images are sourced from the internet





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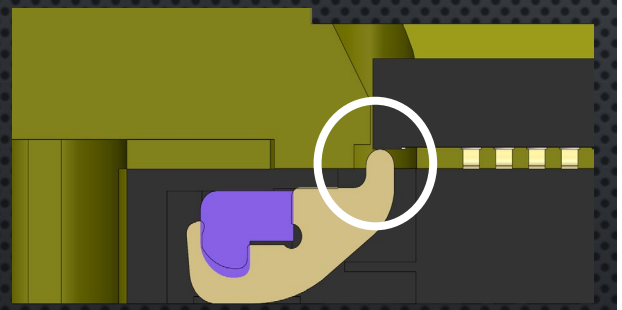
Feature #2 – Short Wipe Technology

PicoRaptor has 0.10mm wiping length compared to typical 0.17~0.22mm



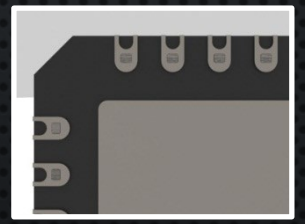
Benefit

- Less debris generation leads to less cleaning
- Optimizes lifespan of pin's contact tip due to bigger contact area (≥60% longer lifespan than typical contact pin)
- Longer MTBA, MTBR and MTBF
- Ideal for chamfered corner pad, short pad and wettable flank pad/dimple pad
- Shorter wiping length retain more solderability area
- Ideal for multiple testing insertion

Typical wiping length 0.17~0.22mm

Short chamfered corner pads

***EZ* wiping length 50~100% shorter length**



Wettable flank pad/ Dimple pad

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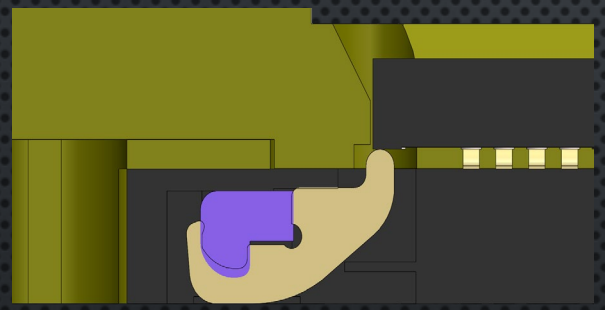
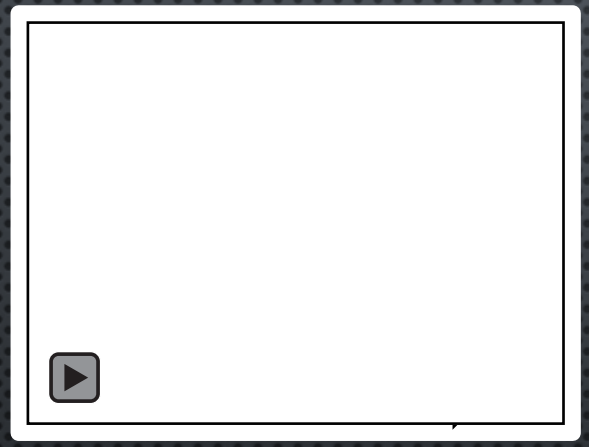
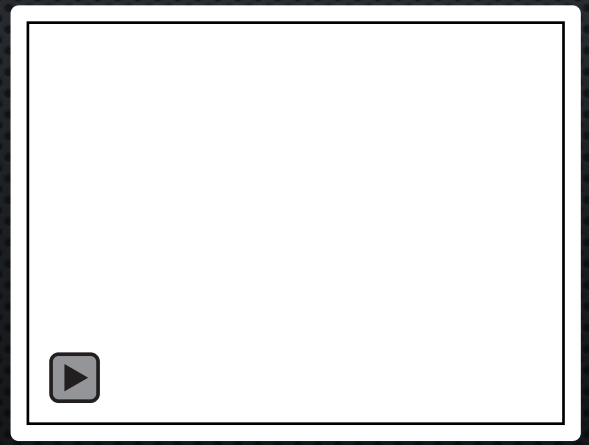
SWS (Short Wiping Stroke) Technology
Benefit : Slow Wearing

PicoRaptor has 0.10mm wiping length compared to typical 0.17~0.22mm





***PicoRaptor* SWS technology**



Typical wiping stroke

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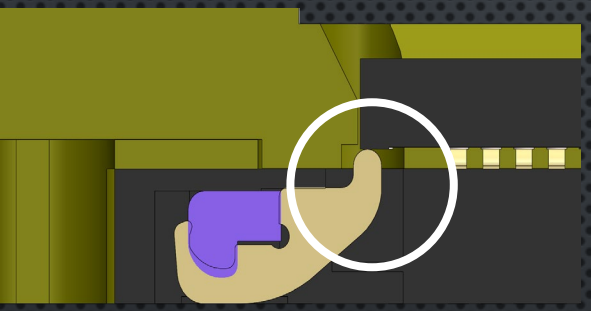
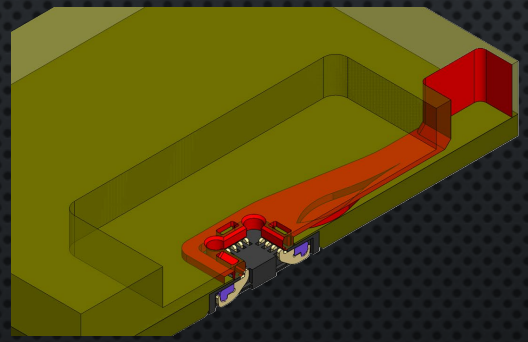
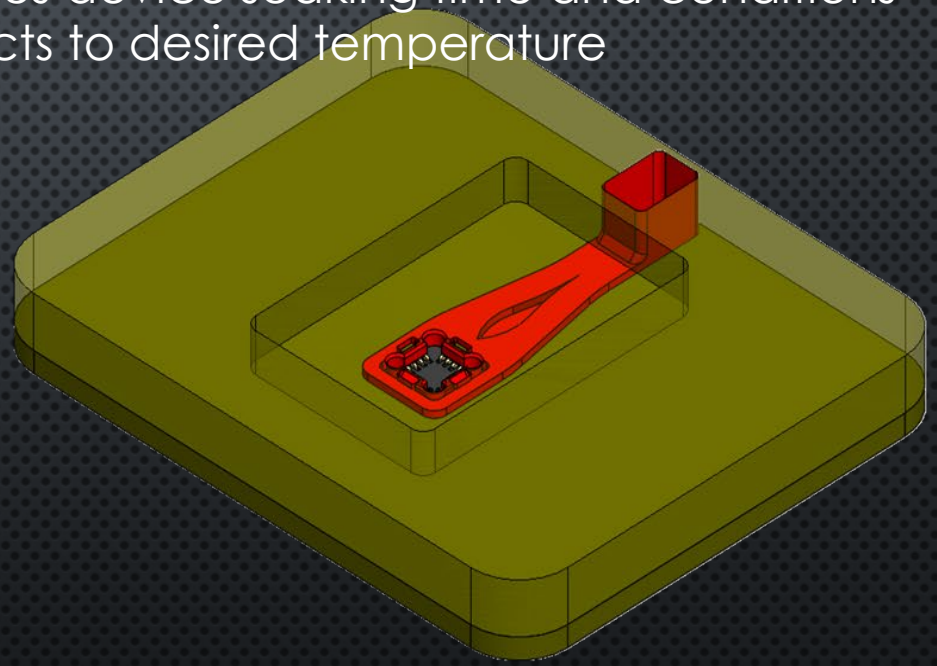
Feature #3 – AirTherm Air Flow





Benefit

- Enable temperature testing on DUTs with +/- 2◦C
- Reduces device soaking time and conditions contacts to desired temperature



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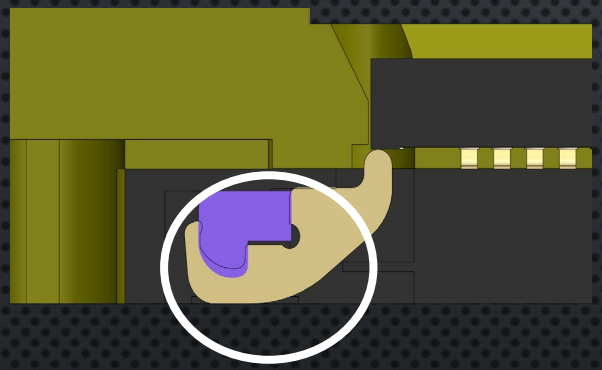
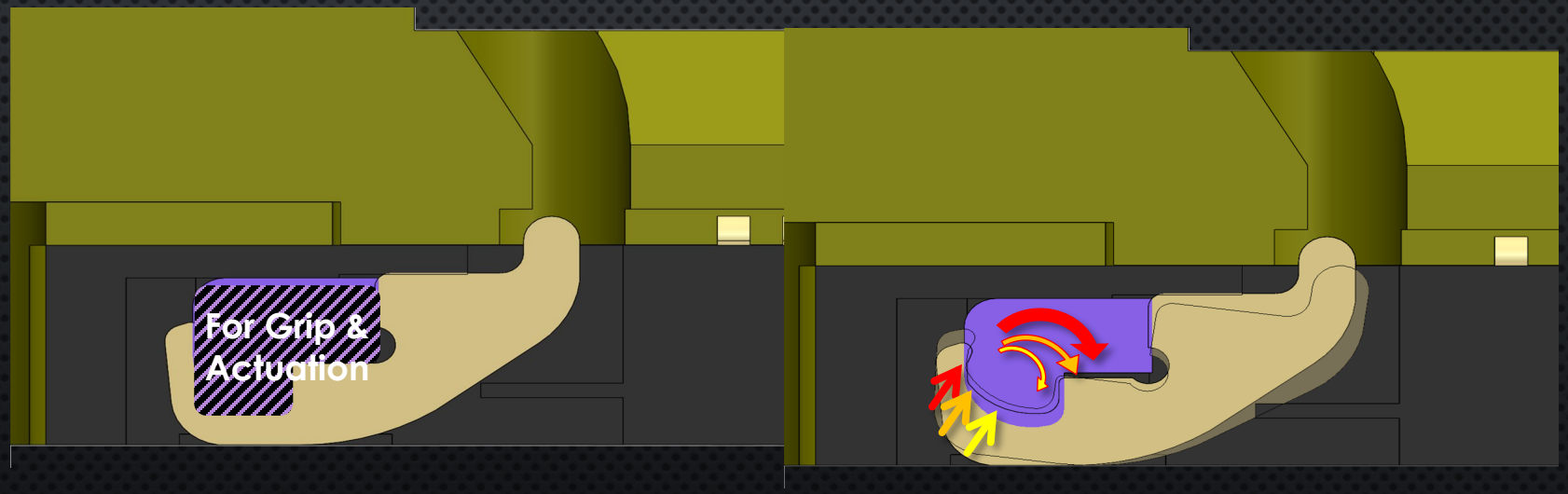
Feature #4 – P-Shaped Elastomer
Benefit : Single and Multifunction Elastomer
One elastomer for gripping and stress distribution



Benefit

- No dropping of the pin
- Generates high gram force
- Insurance of contact & consistent Cres
- Sustainable test performance
- Longer MTBA, MTBR & MTBF



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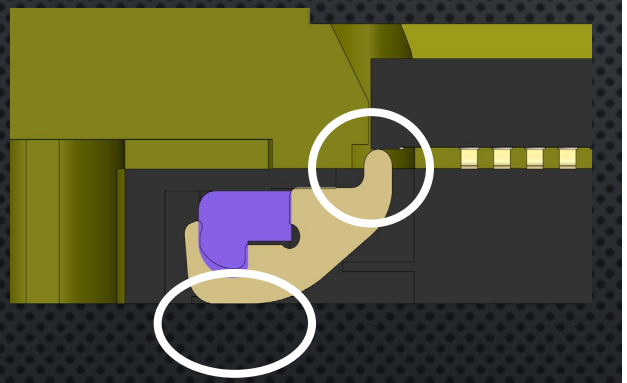
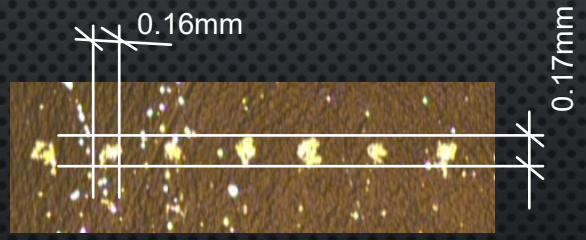
Feature #5– ACF (Adv. Contact Finishing) Technology
Benefit : Slow Wearing

Finer contact finishing has less cavity for debris accumulation at contact tip of DUT & less abrasive to loadboard



Benefit

- Loadboard friendly
- Less cleaning frequency
- Less cost of loadboard repair
- Longer MTBA, MTBR & MTBF



Digging level stays at Level 0 – Gold after 1M cycles (Note: In house testing)

Customer Reference:-

- Digging level 0 – Gold
- Digging level 1 – Nickel
- Digging level 2 – Copper
- Digging level 3 – FR4

EZ's ACF

Competitor pin

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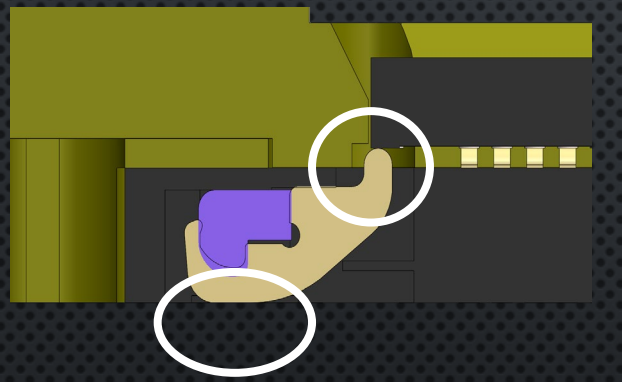
Feature #5– ACF (Adv. Contact Finishing) Technology

Benefit : Slow Wearing – Customer report *after 960,000 insertions*

Finer contact finishing has less cavity for debris accumulation at contact tip of DUT & less abrasive to loadboard



[redacted]

Failure Analysis Report

Colorado Springs Facility

Failure Analysis Request #: 2200030 N/A NONE	Requester: [redacted]	Requester Contact #'s: Phone 1034/Pager
FAB Part #: unknown	Engineer: [redacted]	Engineer Contact #'s: Phone 1034/Pager
Part Name/Generic: unknown	Wafer Lot #: unknown	Date Code:
DATE REQUEST RECEIVED: 1/21/2020	DATE REQUEST COMPLETED: 1/22/2020	DATE REQUEST NEEDED: 3/20/2020

Work Requested: *Procedures wanted*

Depth of the contactor scrubs in copper plate.
(8 scrub marks)

Problem: *Issue impacting material*

New boards with probe mark scrubs

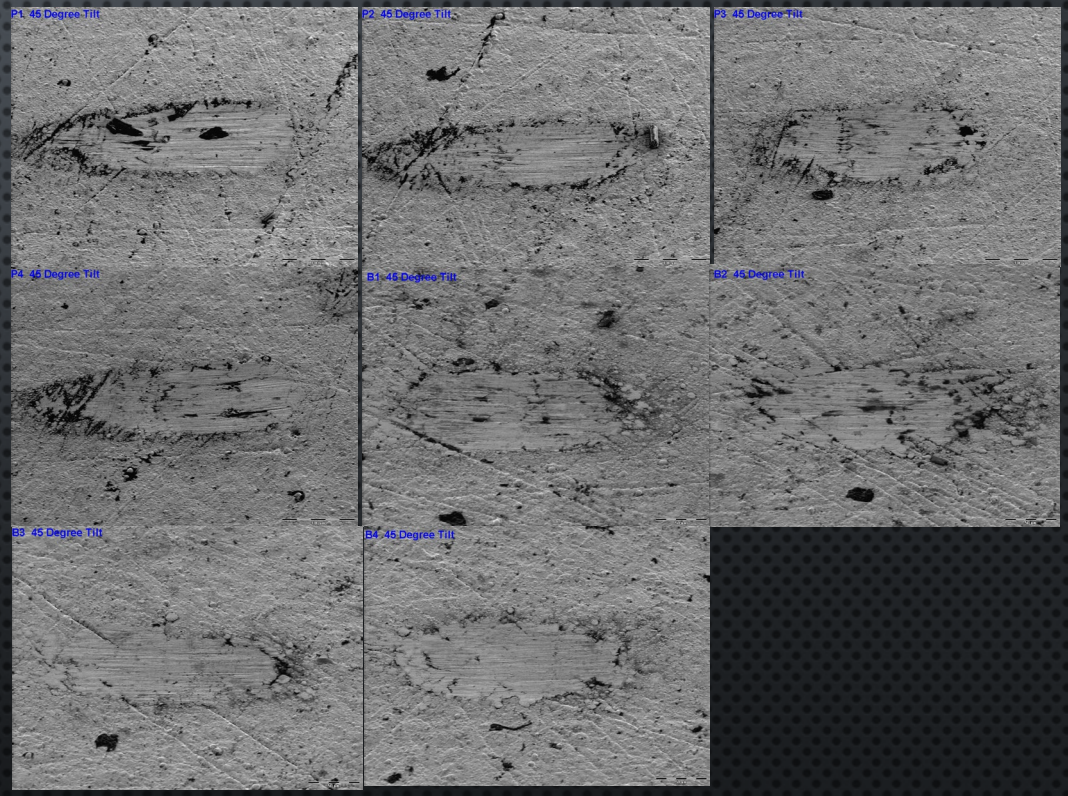
Analysis Notes *Analysis Procedure*

Took sem images at a 45 degree tilt.

Analysis Results *Summary of Findings*

The probe marks appear to be very shallow and the depth could not be measured. See attached photos.

Analyst1: [redacted]	**Hours:** 2
Phone# 1284	**Pager#**
Analyst2:	**Hours:**
Phone#	**Pager#**



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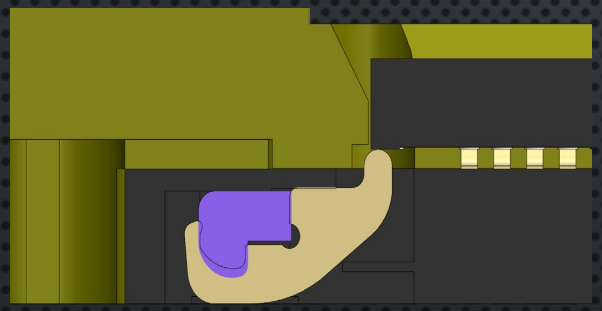
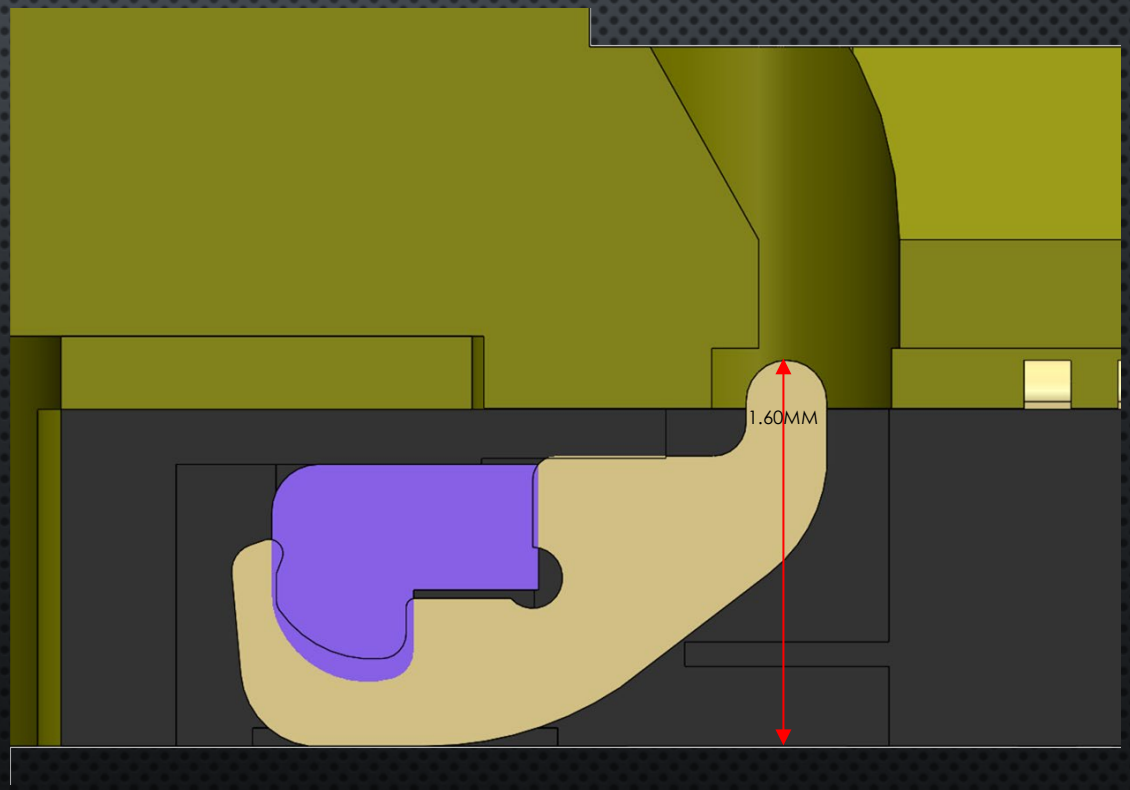
Feature Design Feature #6 XYZ Compatible with market platform
Benefit: Minimal or zero hardware investment
Plug & Play





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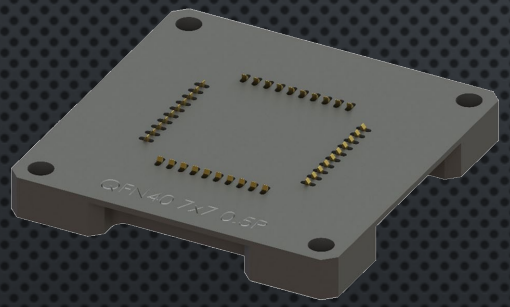
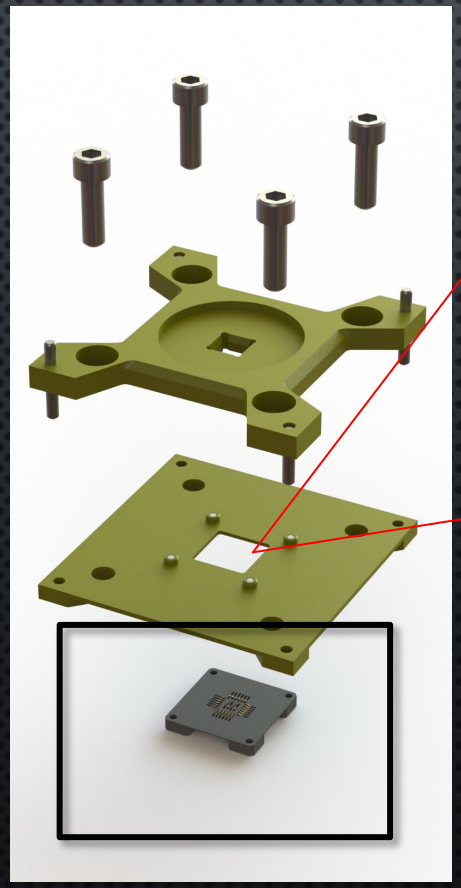
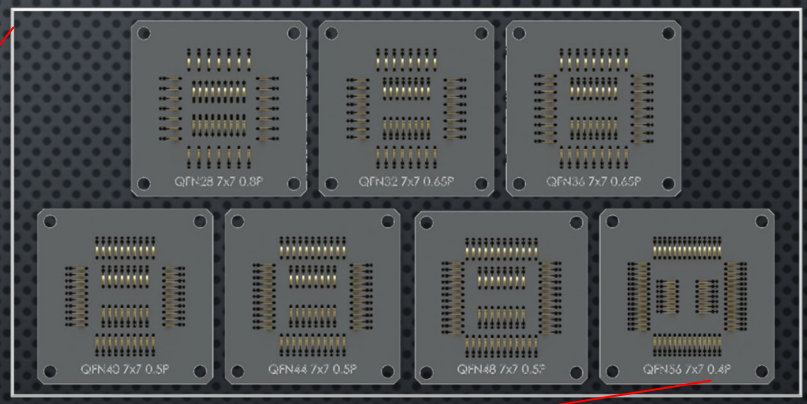
Design Feature #7 : 1 Frame for multiple devices & pitch, as long as, package is same size & pad design is compatible
Benefit: increased throughput, lower acquisition cost







Device Body Size, mm (D x E)	Lead Pitch, mm	Lead Count
7 x 7	0.80	28
	0.65	32
	0.65	36
	0.50	40
	0.50	44
	0.50	48
	0.40	56

Interchangeable Cartridges can be utilized with different handlers

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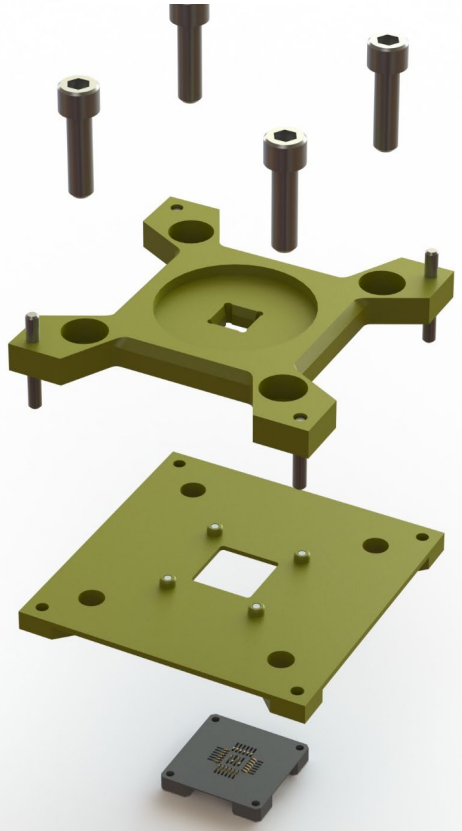
Seiko Epson



Mounting Screws
(Socket to PCB)

Alignment Plate for
different handler

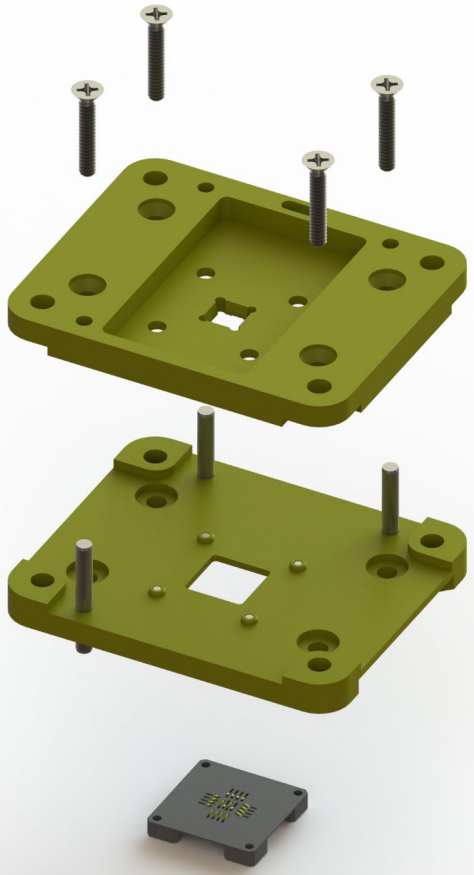
Socket Frame for
different handler

Contact Set
QFN24 4x4 0.5P

OR

Contact Set
QFN16 4x4 0.65P

Rasco



Both contact set with similar package size are interchangeable, as long as, outline and alignment holes are identical.

Key Features	ATE PicoRaptor Cartridge Benefits
Single Multifunctional Elastomer	Easy Installation, Inventory and Cost Reduction, Consistent / Controlled Contact Motion, Consistent Cres, Longer MTBA
Short Electrical Length	Superior Signal Performance
No Contact Pin Engagement with Back Wall of Socket Housing	No Wearing of the Socket Housing, Extended Lifespan
SWS (Short Wiping Stroke) Technology	Ideal for Short Pads, Chamfered Corner Pads, Wettable Flank, and Step Cut Styles
ACF (Advanced Contact Finishing) Technology	Loadboard Friendly, Minimizes Debris, Prolonged Cleaning
AirTherm Air Flow	Conditions Contact pins to desired temperature
ATE Cartridge Technology	Same Frame for Multiple Pin count & Multiple Pitch cartridges equates to cost & inventory reduction & Quick change to reduce downtime

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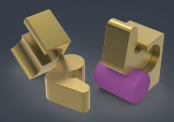
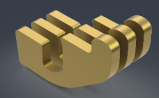
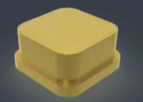
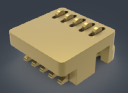
GROUND BLOCK OPTIONS

Bell Contact (BC)	Hinged Contact Insert (HCI)	*PicoRaptor*	Ground Block with/without Pin
≥ 2x2	≥ 3x3	≥ 5x5	≥ 2x2 (With BC) ≥ 3x3 (With HCI) ≥ 5x5 (With *EZ*)
			 

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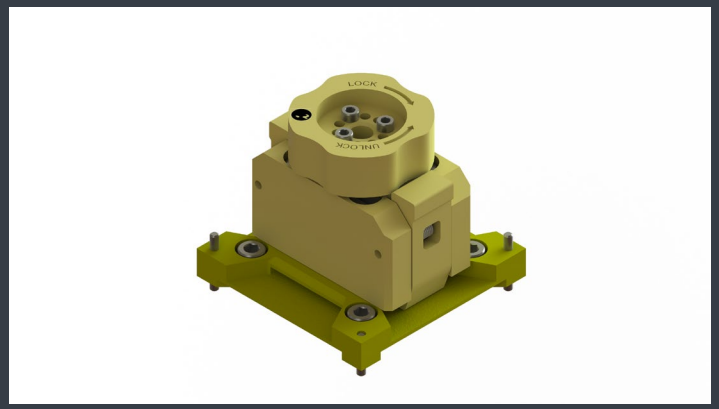
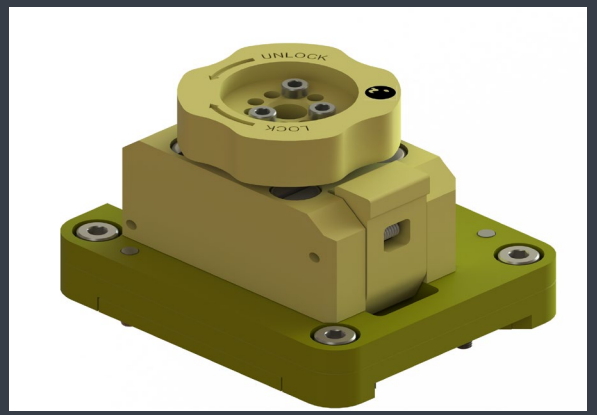
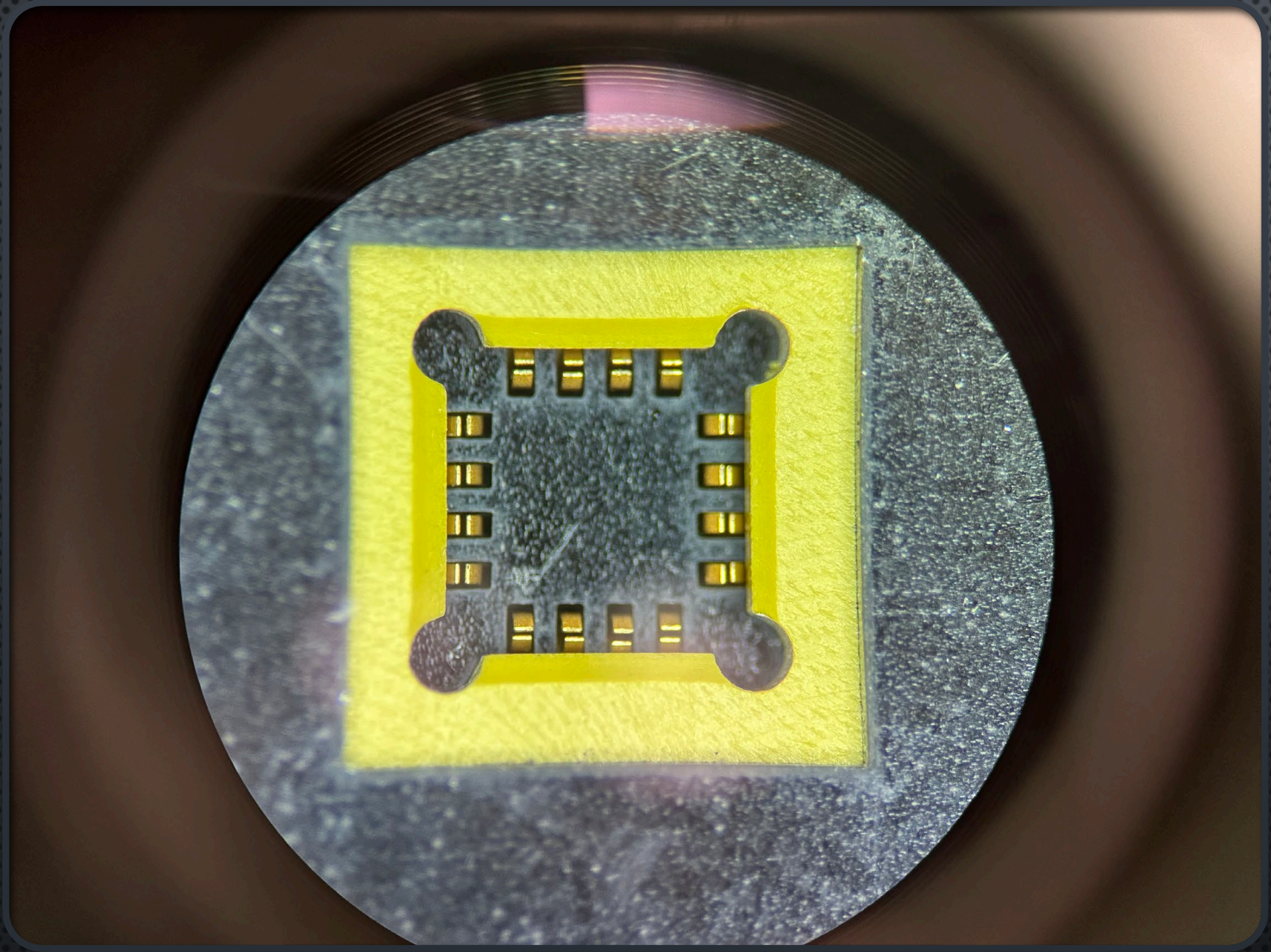
MANUAL ACTUATOR OPTIONS

Hinged Single latch ball bearing Z actuated



Double Latch ball bearing Z actuated





COMING SOON!

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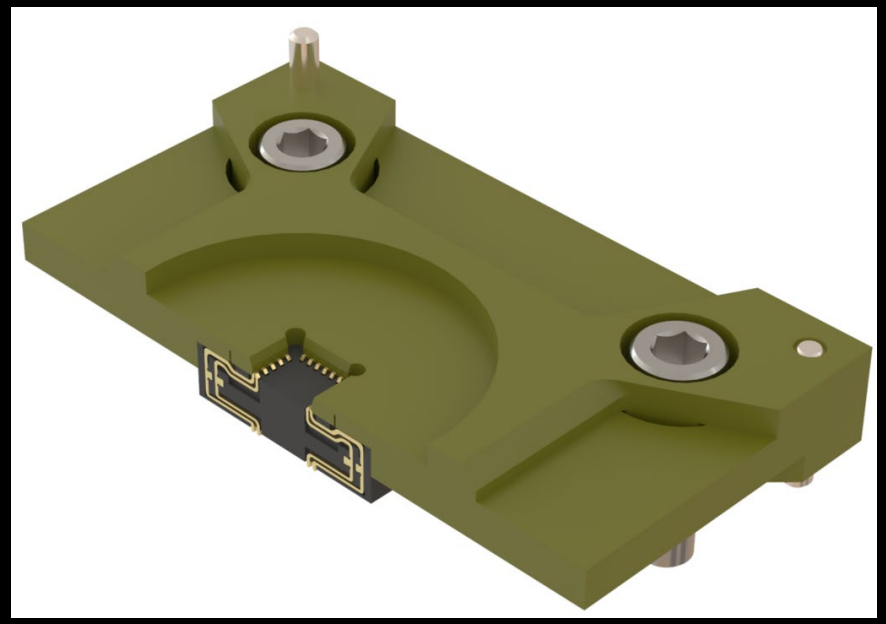

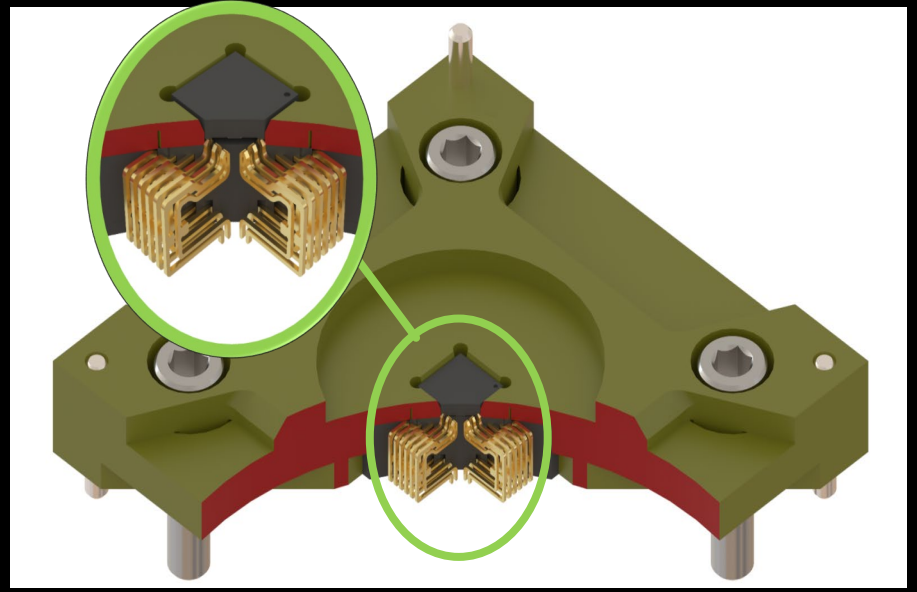

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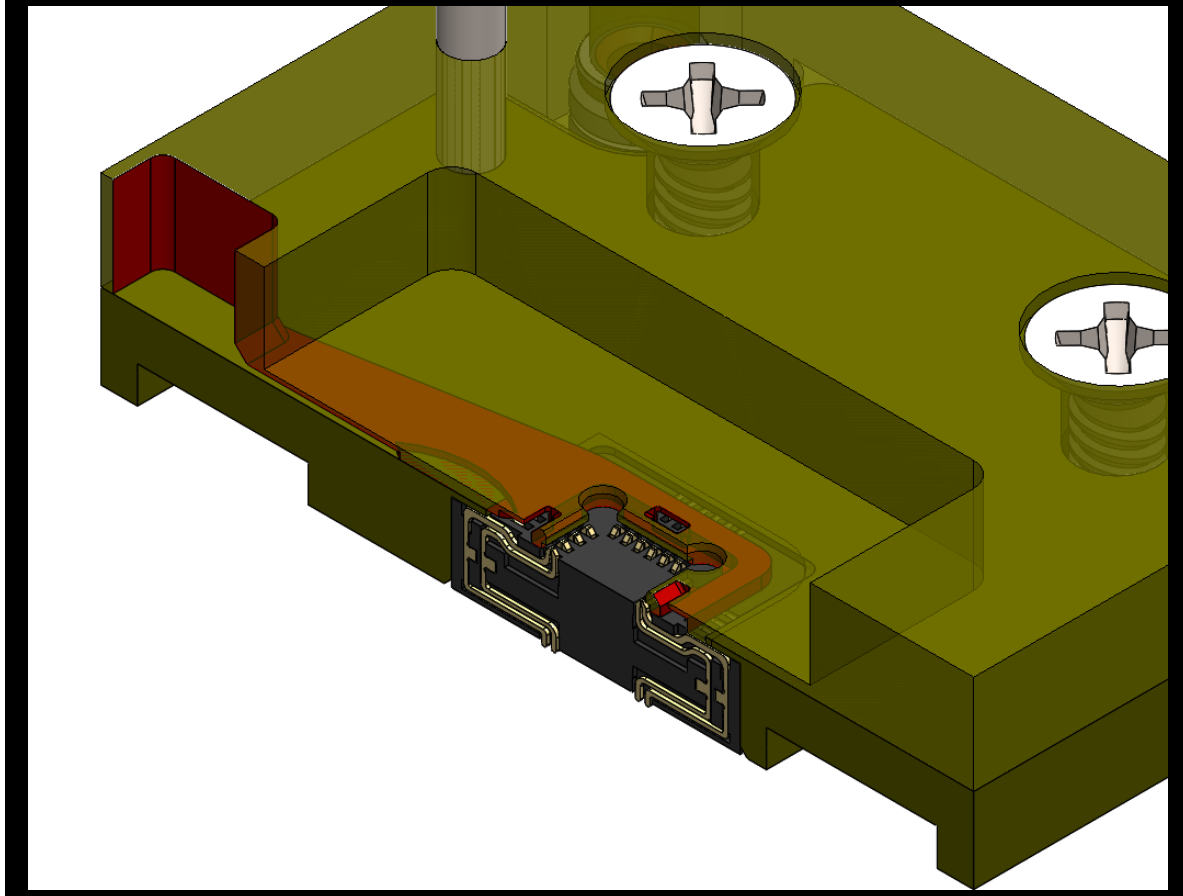
Coming Soon!



Coming Soon!

BENEFITS OF CANTILEVER VS SPRING PINS

- Disposable cartridge
- Rebuildable cartridge
- Spring Probe platform Compatible
- Configurable:
  - Non Kelvin
  - Kelvin
  - Selectable Kevin
- Same height as spring pin
- Wiping motion to remove oxides
- Single piece for consistent CRes & excellent for high current testing
- Longer lifespan then spring pins
- No board wear, bottom pin is locked into cartridge
- Optional AirTherm air flow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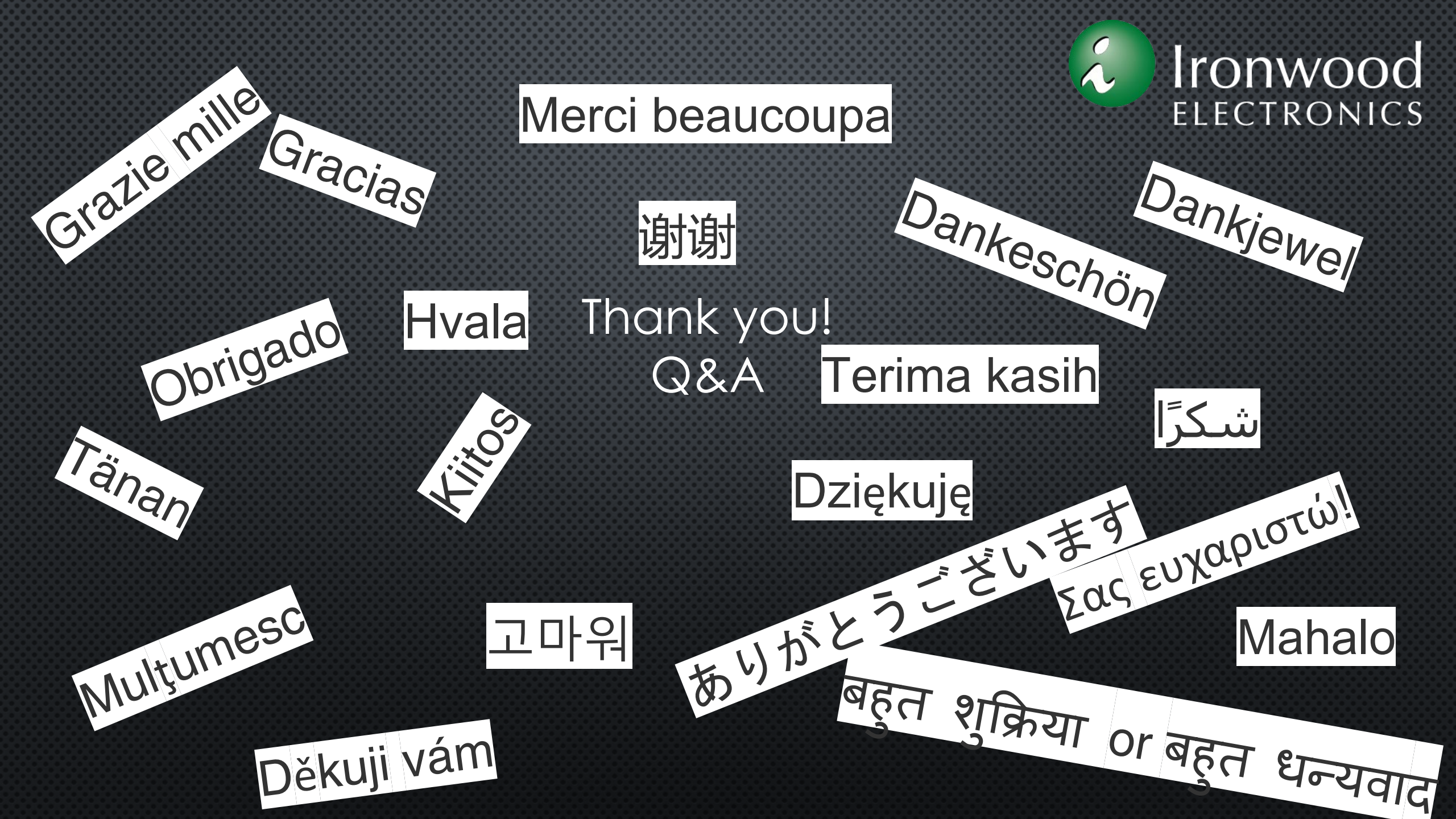
0.2 mm
0.2 mm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Merci beaucoupa
Grazie mille
Gracias
谢谢
Dankeschön
Dankjewel
Thank you!
Q&A
Hvala
Obrigado
Terima kasih
شكرًا
Tänan
Kiitos
Dziękuję
ありがとうございます
Σας ευχαριστώ!
Mulţumesc
고마워
Mahalo
बहुत शुक्रिया or बहुत धन्यवाद
Děkuji vám

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SYSTEM CERTIFICATION ISO 9001 SGS

Thank you