DYCONEX

ADVANCED CIRCUIT TECHNOLOGY

# DISCOVERING
# A WORLD OF EXCELLENCE

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# Medical Substrate Manufacturing

## The Interconnect Foundry Concept

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# CORPORATE VISION AND MISSION STATEMENT

| | |
|---|---|
| **Our Vision** | Become the world's leading **Interconnect Foundry** for complex high reliability printed circuit boards |

**Our Mission**

1. Provide **value** to our stakeholders through continuous **innovation** and outstanding **operational excellence**
2. Provide **enabling technologies** for complex high reliability PCB and microsystems solutions
3. Provide a **robust manufacturing process portfolio** enabling the manufacturing of advanced products with high **predictability** regarding **cost, yield** and **lead time**
4. Provide **world class design support** through unique **consultancy** capabilities and easy to access **design libraries**

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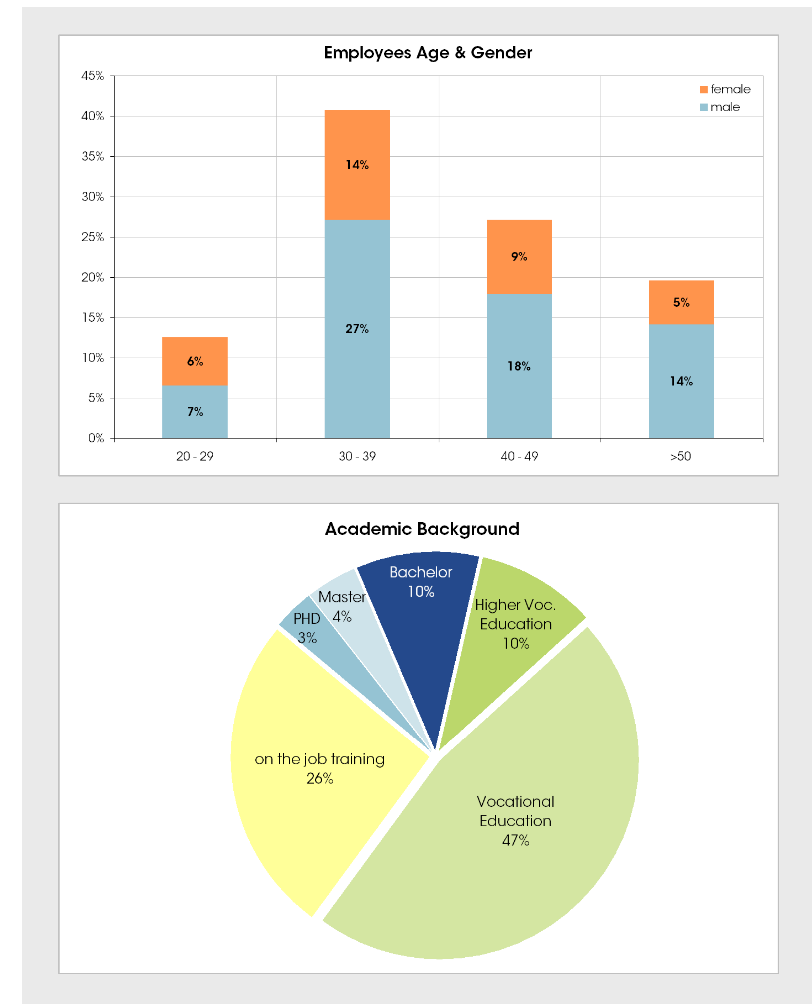
# THE DYCONEX FOUNDRY CONCEPT

- PROFESSIONAL SKILL
- EQUIPMENT
- IT INFRASTRUCTURE
- METHODOLOGY
- COMMITMENT TO QUALITY
- TECHNOLOGY
- STRATEGIC PARTNERING

# PROFESSIONAL SKILLS

- Hiring for culture, not only technical skill
  - Autonomous, creative, speedy and passionate
  - Proactive, dynamic, teamwork skills
  - Responsive to multicultural environments
- High level of technical expertise
- Systematic skills management



# MODULAR STATE OF THE ART EQUIPMENT

**PRODUCTION**

- Laser drilling
- Mechanical drilling
  – Standard drill & route
  – Customized X-Ray drilling equipment
  – 300k scalable Cubes
- Plasma etching & desmear
- Customized liquid resist deposition
- LDI
- Vacuum lamination

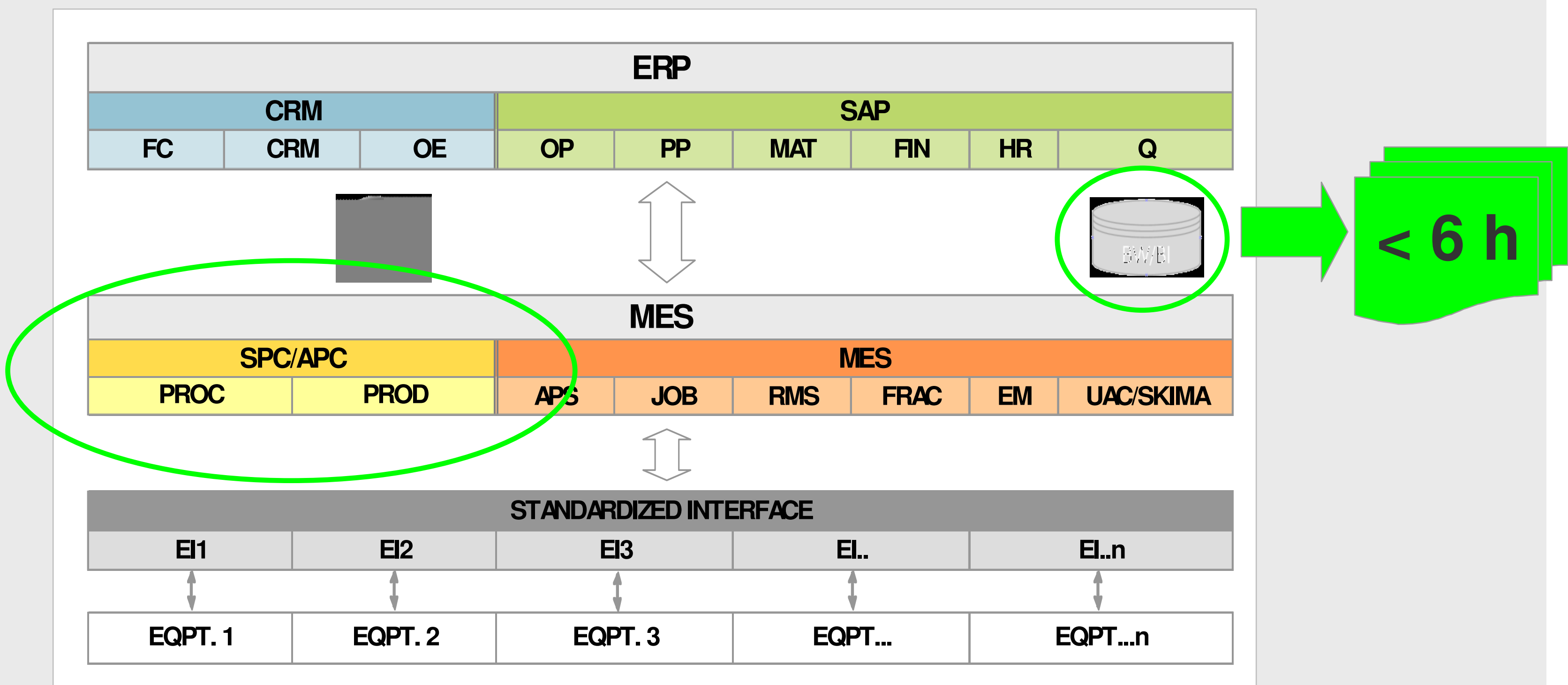
**METROLOGY / INSPECTION**

- AOI
- X-Ray test
- IMPEX CMM
- Mitutoyo CMM
- Ionic contamination
- Automated Cross Section
- AFI (in development)
- IST (planned)

# FULLY INTEGRATED IT INFRASTRUCTURE

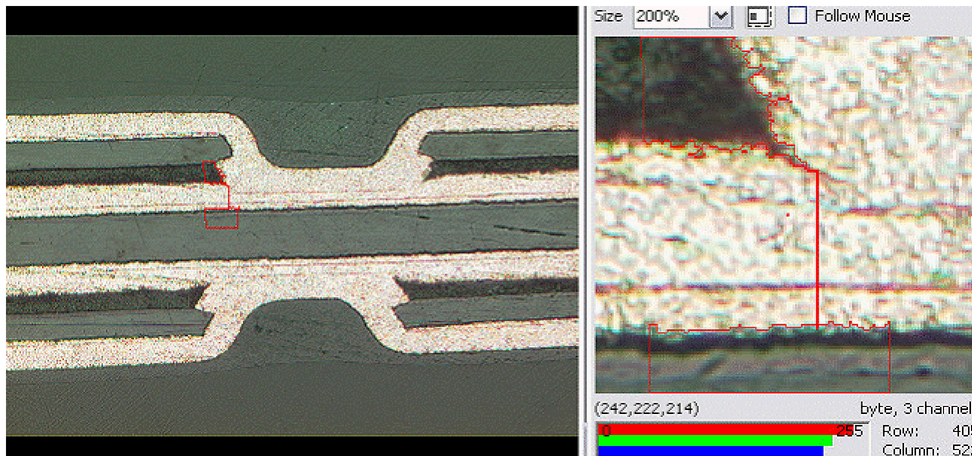
## 4-Layer integrated IT architecture

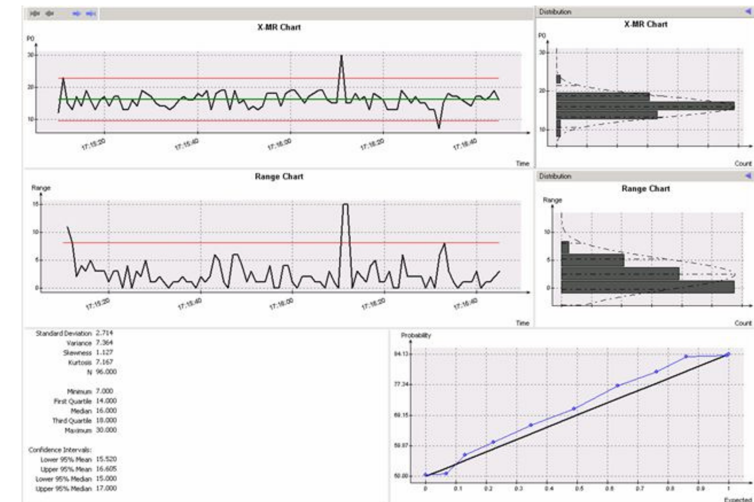
- Top-Down vertical integration from ERP to Equipment with MES-Integrated SPC
- Extensive electronic workflow management
- Real time data availability and full print-level traceability
- Paperless fab within 2 years

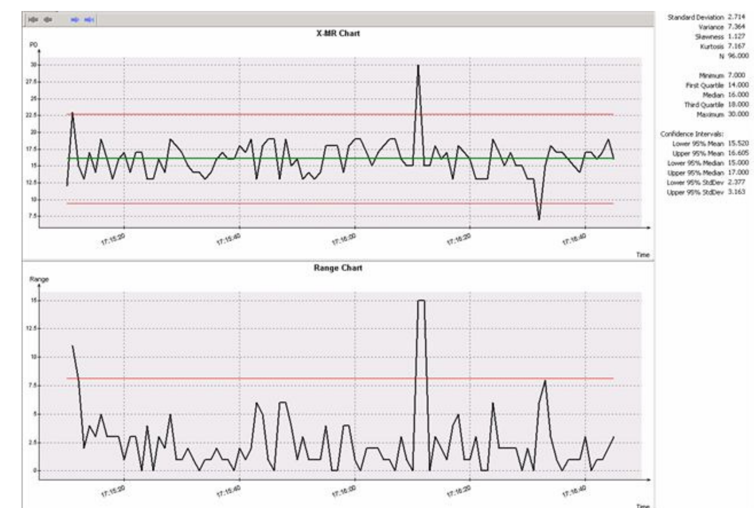


# METHODOLOGY

- FMEA
- Integrated SPC / APC
- System backed CAPA-Process
- Electronic Workflow Management
- Focus on automated inspections (MS / AFI)
- Systematic Problem Solving (8D, Kepner Tregoe)
- Data collection, analysis and retrieval capability



# LEADING MATERIAL & PROCESS TECHNOLOGY

- Early supplier involvement
- Continuous assessment of new materials
- Biocompatible materials & build-ups
- 3D-integration / Miniaturization
- Application specific build-ups (i.e. High Frequ.)
- Alternative interconnect (i.e. MID, etc.)
- Alternative / multiple surface finishes
- Alternative processing techniques (plasma Gen II ?)

LCP Etched Conductor Profile

60µm trace on LCP

## CERTIFICATE

**TEST ITEM:**

**Dyconex Muster LCP**

**PM09/003_4, LCP Charge BMJS**

**TESTS PERFORMED ACCORDING TO ISO 10993**

**Test for in vitro cytotoxicity – ISO 10993-5**

**RESULTS:**

**The test item Dyconex Muster LCP PM09/003_4, LCP Charge BMJS was investigated in a cytotoxicity test according to ISO 10993-5. Extracts of the test item were investigated. No cytotoxic effects were obtained in the XTT cytotoxicity test.**

**Therefore, Dyconex Muster LCP PM09/003_4, LCP Charge BMJS do not have a cytotoxic potential.**

**Harlan Cytotest Cell Research GmbH**
**Dr. Albrecht Poth**

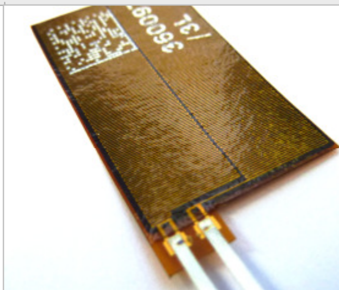
**Date: December 09, 2009**

# ENABLING TECHNOLOGY

## CONDUCTORS

**COMPENDIUM**

- Copper conductors with excellent electric conductivity
- Surface finishes for different interconnect technologies
- Conductors as resistive structures or sensor electrodes



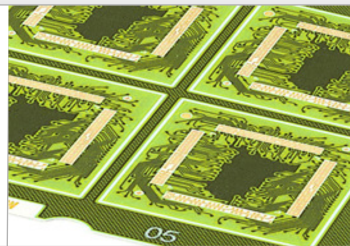
**DYB STATUS**

- Production capability for multilayer ultra-fine line FPC
- Surfaces for soldering, bonding, welding, ....
- Resistive structures for high power energy dissipation
- Conductors for alternative interconnect technologies

## MATERIALS

**COMPENDIUM**

- New materials enable the design and manufacture of increasingly complex circuits for greater functional capacity and miniaturization, while maintaining high reliability through quality and consistency



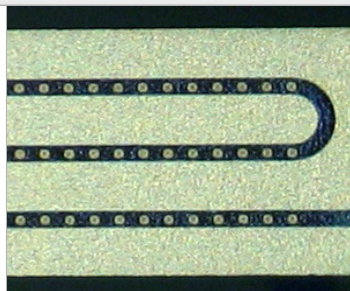
**DYB STATUS**

- The identification and qualification of innovative materials is an established process
- DYCONEX offers a wide range of dedicated base materials, surface finishes and surface protections.

## MICROFLUIDICS

**COMPENDIUM**

- High volume production of micro-fluidic substrates for in-vitro or microarray diagnostics
- Fabrication of micro-fluidic substrates with integrated electrodes using well established PCB production process



**DYB STATUS**

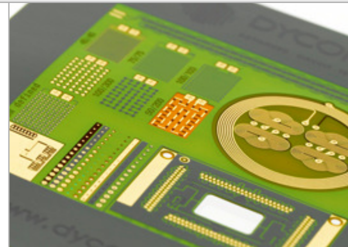
- Plasma etch based volume production process established and running
- Channel widths down to 50 microns and heights up to 20 microns
- Applicable to a wide variety of base materials

# ENABLING TECHNOLOGY

## ULTRA FINE LINE TECHNOLOGY

COMPENDIUM

- Lines & Spaces below 50 µm are categorized to be ultra-fine
- Driving force for feature size reduction is the increase of component functionality as well as the reduction of form factors



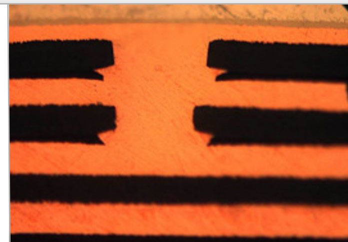
- Production: L/S=40/45µm; Via/Pad=50/140µm
- R&D: L&S=20/30µm; Via/Pad=25/150µm
- Dielectric/Cu thickness=25/5µm
- State of the art equipment and further investment into ultra fine line capability

DYB STATUS

## STACKED VIAS

COMPENDIUM

- Stacking of filled vias in order to increase feature density, controlled heat dissipation and to achieve planar surfaces



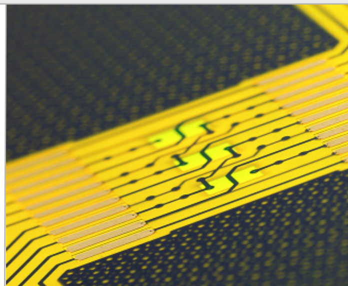
- Filled via and stacked via processes available
- Further process enhancement activities ongoing

DYB STATUS

## EMBEDDED COMPONENTS

COMPENDIUM

- Embedding of active and/or passive components in to printed circuit boards
- Main advantages are: miniaturization, better RF properties, higher robustness & reliability
- Various competing technologies



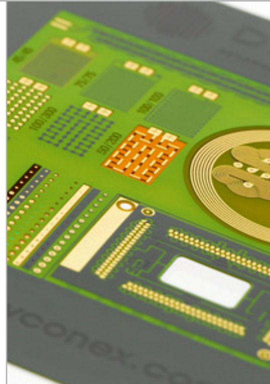
- Demonstrator of precision resistor embedded in 4 layer flex substrate built
- Feasibility studies on embedding technologies for active devices under way

DYB STATUS

# DYCONEX PRODUCT PORTFOLIO

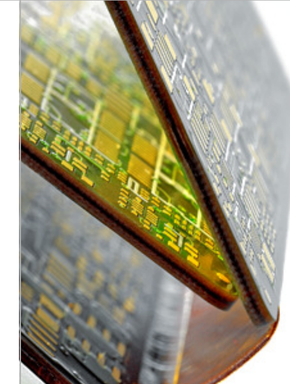
## FLEXIBLE SUBSTRATES

- From single / double layers to multilayer High Density FPC with up to 8 layers
- Ultra-High Density flex cables with 16 micron pitch
- Low moisture, high-temp polyimide foils
- Flying leads and folded edge connector layout
- Tight bend radii for flex-to-install



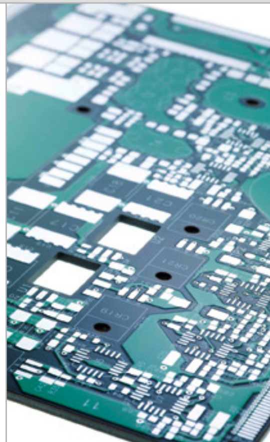
## RIGID-FLEX & FLEX RIGIDIZED SUBSTRATES

- Flex circuits with stiffener for single sided assembly & conventional rigid-flex build-ups
- Wrap-around board technology with embedded metal heat spreader, CTE compensation
- High performance adhesives for highest reliability



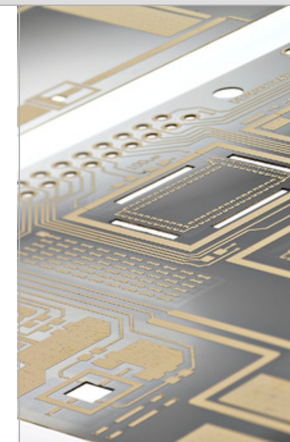
## RIGID SUBSTRATES

- Up to 22 layers, selection of thin materials
- Mechanical and laser drilled micro vias
- Thermal management
- Impedance control on defined signal layers
- Very high temperature performance for harsh environment /difficult use conditions



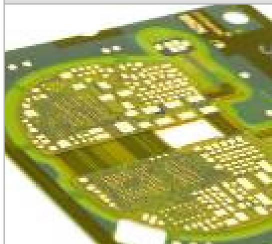
## LIQUID CRYSTAL POLYMER SUBSTRATES (LCP)

- Production capability up to 6 layers
- High hermeticity for biomedical implants
- Near hermetic sealing for microwave packaging and high frequency applications
- Embedded cavities, windows and slots for stacked die packaging
- Continuous high temperature operation (>200°C)
- Attachable to Covar & other heat spreaders



# STRATEGIC PARTNERING : The Micro Systems Technologies Group

## **DYCONEX AG**, Switzerland

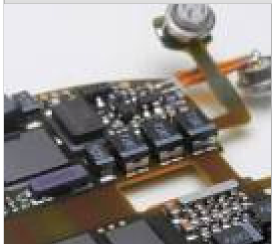


- High-reliability and high-performance HDI / microvia PCBs
- Flex, rigid-flex, rigid

## **Litronik GMBH**, Germany

- Lithium-Iodine based batteries for IPGs
- Lithium Manganese Dioxide based batteries for IPGs and ICDs/CRT-Ds

## **Micro Systems Engineering GmbH**, Germany



- Complex LTCC substrates
- Advanced assembly and packaging technologies
- Electronic modules

## **BTS Feedthroughs**, Germany

- Circular or linear feedthroughs for hermetical sealing
- Ceramic for implant cans
- Glass for battery cans

## **Micro Systems Engineering, Inc.**, USA

- ASIC design and test
- Electronic module and system design, system integration
- SMD assembly and test

## **VascoMed GmbH**, Germany

- Catheter technology
- Temporary pacemaker leads
- Leads for neurostimulation
- Lead extraction systems

# Summary

- **High Performance Interconnect solutions require :**
  - Materials & processes
  - Skill and culture
  - State of the art equipment
  - Integrated Infrastructure
  - Robust processes
  - Commitment to quality
  - Dedication to capable innovation and technology leadership

⇨ **a comprehensible, integrated business model :**

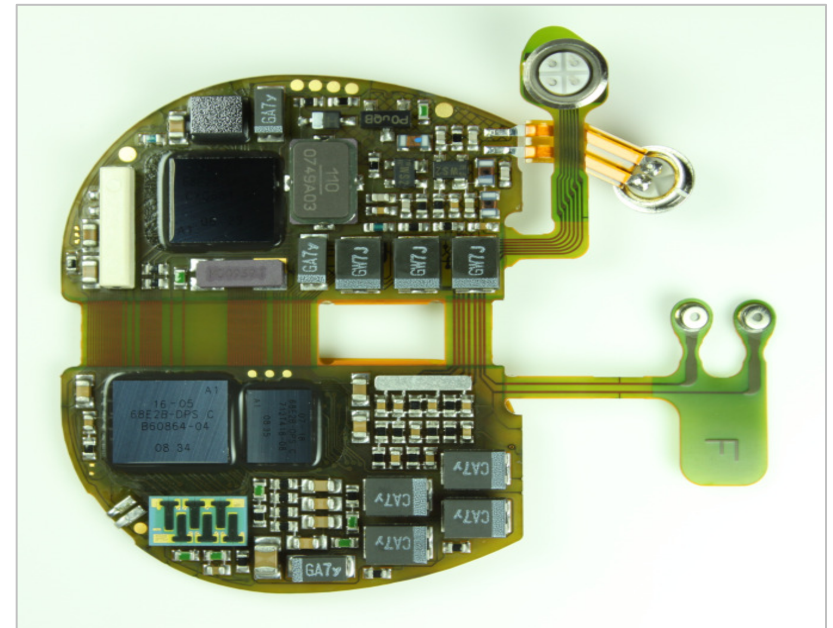
**THE INTERCONNECT FOUNDRY CONCEPT**

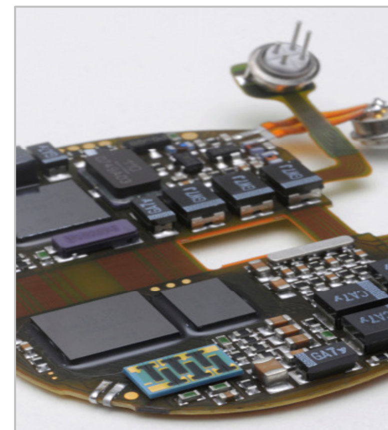
**Quality will ultimately pay for itself, ...**

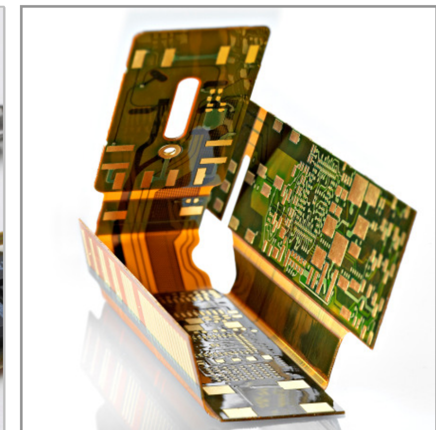
**... but it does NOT come for free!!**

**High Performance Interconnect ...**

**... Is NOT a Commodity !!**







# THANK YOU FOR YOUR ATTENTION!

## QUESTIONS?