Presentation Outline

- HISTORY & ORGANIZATION
- SOLUTIONS
- TECHNOLOGY
Who is Ricoh?

Founded in 1936

108,000+ Employees Worldwide

200 countries and territories

Worldwide sales of (JPY 2,236.9 billion) year end March 2014

Industry leader in document management

Worldwide certification
Certification number: IS 85241

Operating companies across EMEA have local certifications for ISO Quality and Environmental management (ISO9001 and ISO14001)

Details as of March 31, 2014
Ricoh Europe

Headquarters in London and Amstelveen

20 operating companies across EMEA (sales subsidiaries)

Revenues to 31 March 2014: JPY 519.4 Billion

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History

1978~ 1985~
Exxon / Dataproducts
- Expander pusher construction
- Fill before fire
- Multi pulse
- Dampening pulse
- Interlace print
- Phase change ink
- High temperature adhesives

1990~
Hitachi
- Stacked D_{33} Piezo
- Inert electroformed filter
- Flow through chamber
- Non-wet coating
- Punched SST nozzle, chamber & restrictor
- Optically aligned positioning pins

2004~
- Silicon ink path
- Double density Piezo sticks
- Custom driver IC
- High density electrical connection

One of the longest histories of ink jet market participation > 30 years!
Conducted fundamental ink jet development
Developed many ink jet patents
Licensed patents to others at a profit
Ricoh IJ Group Roles

Ricoh Co. Ltd.
Document IJ printers
(Desktop, wide format & continuous form)
Industrial inkjet technology OEM Sales
Japan, China & Taiwan

Ricoh Industry
(RI)
Industrial inkjet print head manufacturing

RPSA
Industrial inkjet print head manufacturing
OEM Sales World Wide

RICOH GROUP IJ TECHNOLOGY FOUNDATION
(R&D, IJ head, Ink & media, Drive electronics, Imaging, IJ peripherals)
The Latest Design

More rigid parts (shorter Piezo stick & smaller chamber) for higher resonant frequencies

Stacked Piezo stick for lower drive voltage and denser package

Smaller chamber for higher acoustic frequencies and denser package

Metallic diaphragm separates ink and Piezo stick

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>High nozzle density</td>
<td>Up to 150npi</td>
</tr>
<tr>
<td>High frequency</td>
<td>Resonant up to 120kHz</td>
</tr>
<tr>
<td>Corrosion resistant</td>
<td>Most ink types supported</td>
</tr>
<tr>
<td>Temperature range</td>
<td>Up to 80° C</td>
</tr>
<tr>
<td>Low voltage</td>
<td>15V-28V</td>
</tr>
</tbody>
</table>
Recently announced **MH2830 Print Head**

- All Stainless Steel construction
- 384 nozzles
- 27 pL native drop size
- Flow Through Technology

**What was “old” is “new” again!**
Flow Through design then:

Ink Manifold in

“In Easy” solvent inks

Ink Manifold out

More to get air out of system
MH2830 - Flow Through Technology

**Standard Model**
- Pressure chamber
- Supply restrictor
- Nozzle

**Flow Through Model**
- Supply manifold
- Return manifold
- Return restrictor

NEW
**How it works**

This diagram shows how flow through chamber primes. The ink flows continuously during jetting.

**Benefits**

- Prime with little waste
- Prevent pigments from settling
- Self recovery potential from air ingestion
- Prevent ink from drying at nozzles
- Keep system temperature homogeneous

**Suitable applications**

- “Difficult” inks
  - Ceramic
  - Glass
  - Metallic
  - Beads
  - Chips
- Highly loaded
- Large pigments
- Drying inks
- Single pass system
  - Tile
  - Label
  - Package
  - Textile
  - “Industrial”

**Can work with “standard” ink system if flow through is not necessary**
GH2220

Precision Silicon fabrication techniques

New print head GH2220

Low cost industrial print head
Modified adhesive to enable solvent compatibility

Mass produced silicon fabrication = reduced manufacturing cost

Gen4 (MH2420) derived from this design specification
## Basic specification

<table>
<thead>
<tr>
<th>Head outline</th>
<th>GH2220</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong> [mm]</td>
<td>W62 × D21 × H 40.5</td>
</tr>
<tr>
<td><strong>Nozzle</strong></td>
<td>384</td>
</tr>
<tr>
<td><strong>Arrangement</strong> [Nozzle × row]</td>
<td>192 × 2</td>
</tr>
<tr>
<td><strong>Diameter</strong> [µm]</td>
<td>24.0+1.5/-1.0</td>
</tr>
<tr>
<td><strong>Resolution</strong> [dpi/row]</td>
<td>150</td>
</tr>
<tr>
<td><strong>Print Width</strong> [inch]</td>
<td>1.27</td>
</tr>
</tbody>
</table>

### Jetting Characteristic

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Velocity</strong></td>
<td>6～8m/s (Reco: 7m/s)</td>
</tr>
<tr>
<td><strong>Crosstalk</strong></td>
<td>≤20%</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>30-24kHz</td>
</tr>
<tr>
<td><strong>Grayscale</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>Drop size</strong> [pl]</td>
<td>3-21</td>
</tr>
</tbody>
</table>

### Others

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature control</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Ink</strong></td>
<td>Aqueous, Solvent</td>
</tr>
<tr>
<td><strong>Ink viscosity</strong></td>
<td>8±0.5 mPa·s(23℃)</td>
</tr>
<tr>
<td><strong>Ink surface tension</strong></td>
<td>25±1 mN/m(23℃)</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>Silicon/Plastic</td>
</tr>
<tr>
<td><strong>Piezo</strong></td>
<td>Stacked D_{33}</td>
</tr>
</tbody>
</table>

(Preliminary specification – subject to change)
Inkjet Head assembly

GH2220 assembly

Base
PZT
Frame
Diaphragm
Ink Pass Plate
Nozzle Plate
Nozzle Cover
### IJ Head Production Technology

#### Technology Outline

<table>
<thead>
<tr>
<th>Specification Requirements</th>
<th>Ni Electro Forming</th>
<th>High Precision Inkjet Nozzle Plate/Diaphragm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nozzle Plate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nozzle Diameter</td>
<td>24.0μm</td>
<td></td>
</tr>
<tr>
<td>Plate Thickness</td>
<td>31μm</td>
<td></td>
</tr>
<tr>
<td>Nozzle Pitch</td>
<td>169.3μm</td>
<td></td>
</tr>
<tr>
<td>Nozzle Amount</td>
<td>192 × 2 rows 384ch</td>
<td></td>
</tr>
<tr>
<td><strong>Diaphragm</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Film Thickness</td>
<td>3.0μm</td>
<td></td>
</tr>
<tr>
<td>Amount of Layer</td>
<td>3 layer plating film</td>
<td></td>
</tr>
<tr>
<td><strong>Common</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Ni (Nickel)</td>
<td></td>
</tr>
</tbody>
</table>

#### Configuration

**Nozzle Configuration**
- **Ink Ejection Surface**
- **Ink Inflow Surface**

**Diaphragm Configuration**
- **1st Layer**
- **2nd Layer**
- **3rd Layer**
- **PZT Joint**
- **Multi-layered Electro Forming Process**
## Specification

<table>
<thead>
<tr>
<th>Material</th>
<th>High precision, Flow Channel formation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon</td>
<td></td>
</tr>
</tbody>
</table>

- **Precision semiconductor fabrication technology**

- **Nozzle face**
- **Diaphragm face**
**Outline-1**

### Outline

- **Ink inlet**
- **Connector Cover**
- **Case (IC chip protection)**

### Electronic I/F

- **Non-ZIF type connector**
  1. Connect FFC cable into connector
  2. Turn down FFC cable and set connector cover

- **Prevent ink from going into connector**
- **No restrictions on cable length**

### Dimension

- **61.8 mm**
- **40.5**
- **21 mm**

- X direction reference point
- Z direction reference point
- Y direction reference point
Target markets

Low end WFG

Textile DTG

Analogue to digital migration where price has been barrier

Textile R2R
<table>
<thead>
<tr>
<th>Model</th>
<th>Nozzles</th>
<th>NPI</th>
<th>row</th>
<th>Drop size</th>
<th>Mfg</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH1900</td>
<td>96</td>
<td>36</td>
<td>1</td>
<td>30/80pL</td>
<td>USA</td>
</tr>
<tr>
<td>MH1600</td>
<td>192</td>
<td>75</td>
<td>1</td>
<td>15/30/45pL</td>
<td>USA</td>
</tr>
<tr>
<td>MH2420</td>
<td>384</td>
<td>150</td>
<td>2</td>
<td>7pL</td>
<td>Japan</td>
</tr>
<tr>
<td>GH2220</td>
<td>384</td>
<td>150</td>
<td>2</td>
<td>3pL</td>
<td>Japan</td>
</tr>
<tr>
<td>MH2620</td>
<td>384</td>
<td>75</td>
<td>2</td>
<td>15/27pL</td>
<td>USA</td>
</tr>
<tr>
<td>MH2830 (Flowthrough)</td>
<td>384</td>
<td>75</td>
<td>2</td>
<td>27pL</td>
<td>USA</td>
</tr>
<tr>
<td>MH5420</td>
<td>1280</td>
<td>150</td>
<td>4</td>
<td>7pL</td>
<td>Japan</td>
</tr>
</tbody>
</table>
Printhead Driver Available

Provides analog drive pulses

OEM can concentrate on digital design
EV 1000 Evaluation Kit

Available for GH2220 as well as MH product lines

Comes complete with **analytical software and visualization tools**

**Adjustable voltage**, timing and temperature

Laboratory tool for ink – **print head optimization**

**Self contained.** Only need a PC to use.
2 x 600 dpi printheads become….

1 x 1200 dpi printhead module
In 1200 dpi head module, 2 units of MH5420 heads are coupled and present in one assembly.
Ricoh VC60000 is a perfect example of Ricoh technology applied to high-speed single-pass applications.

- **1200 x 1200dpi**
  - @50m/pm
- **600 x 600dpi**
  - @120m/pm

1200dpi module is an enabler for integration partners to speed up their development cycle and get to market more quickly.
Summary of OEM Support

Piezo inkjet print heads for industrial applications

Ink qualification services

Evaluation Kits

Inkjet Component Modules

Driver electronics
Inkjet Print Head Roadmap

### CY2012
- **Office**

### CY2013
- **Sign-graphics Textile**

### CY2014
- **MH**
  - 384 nozzles, 2 rows 150npi/row, 3-35pl

### CY2015
- **Label**
- **Package**

### CY2016
- **MH**
  - 384 nozzles, 2 rows 150npi/row, 3-35pl

### CY2017
- **MH**
  - 384 nozzles, 2 rows 150npi/row, 3-35pl

### CY2018
- **MH**
  - 384 nozzles, 2 rows 150npi/row, 3-35pl

#### Drop Size
- **Small drop**
- **Large drop**

#### Silicon
- **MEMS**
- **Thin Film**

#### Flowthrough
- **Ink type**
- **Viscosity**
  - 1200dpi

#### Naming rule

<table>
<thead>
<tr>
<th>Nozzles</th>
<th>Drop size</th>
<th>colors/FT</th>
<th>Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 : ≤192</td>
<td>≤4pl</td>
<td>0 : 1/-</td>
<td>0 : current</td>
</tr>
<tr>
<td>2 : 384</td>
<td>4 : 7pl</td>
<td>1 : 1/FT</td>
<td>1 : Rev.1</td>
</tr>
<tr>
<td>3 : 640</td>
<td>6 : 15pl</td>
<td>2 : 2/-</td>
<td></td>
</tr>
<tr>
<td>4 : 768</td>
<td>8 : 27pl</td>
<td>3 : 2/FT</td>
<td></td>
</tr>
<tr>
<td>5 : 1280</td>
<td>9 : 40pl</td>
<td>4 : 4/-</td>
<td></td>
</tr>
<tr>
<td>6 : 2560</td>
<td>10 : 62pl</td>
<td>5 : 4/FT</td>
<td></td>
</tr>
</tbody>
</table>

**Subject to change by discussion with customer**