

ABOUT DATA MATRIX SYMBOLOGY

- Developed in 1989 by I.D. Matrix (now CI Matrix)
- Historically read using expensive, complicated, modified vision systems (hindering its adoption)
- AIMI specification released Nov. 1996
- Adopted by EIA as the code for small part marking (spec #EIA 706)
- AIAG
 - ◆ Small part marking



Data Matrix code

AIMI recommends Data
Matrix ECC 200 for all new
applications

WHY DATA MATRIX IS USED

- Very reliable code
 - ◆ Readable using low cost methods
 - ◆ Readable if damaged or torn
 - ◆ Readable if printed poorly
 - ◆ Can be read using thermal transfer and laser etching marking methods applied to components
- Small size allows for improved component traceability



DATA MATRIX INFORMATION CAPACITY

- Capacity is a function of data type
 - ◆ 1556 Bytes
 - ◆ 2335 ASCII Characters
 - ◆ 3116 Numeric Digits

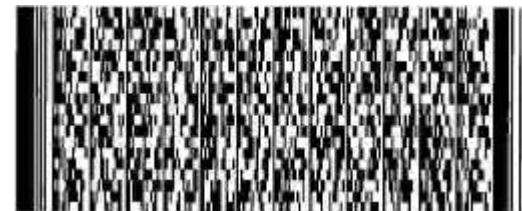
THE DATA MATRIX DIFFERENCE

COMPARING 1D LINEAR, STACKED LINEAR, AND 2D MATRIX CODES

- **50 characters, 10 mil linear—Code 39**



- **500 characters, 10 mil stacked linear—PDF 417**



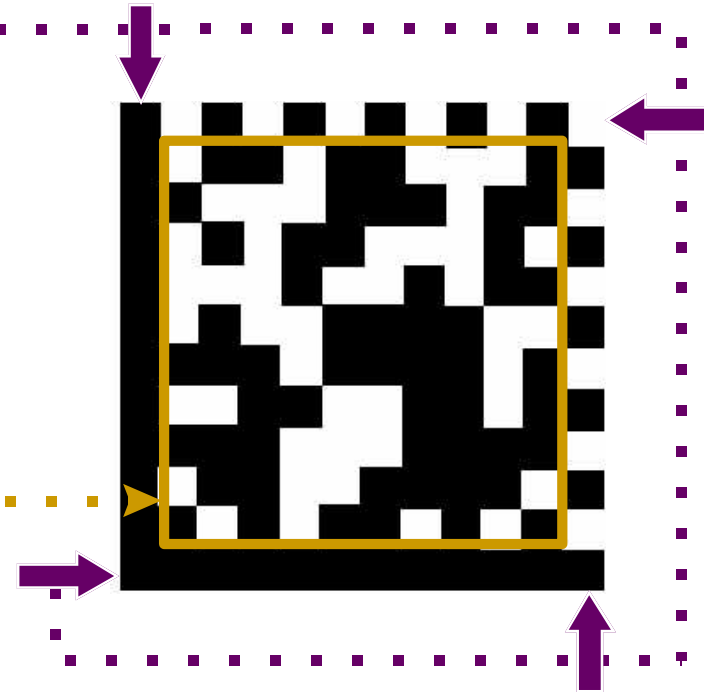
- **500 characters, 10 mil 2D matrix—Data Matrix ECC 200**



MICROSCAN®

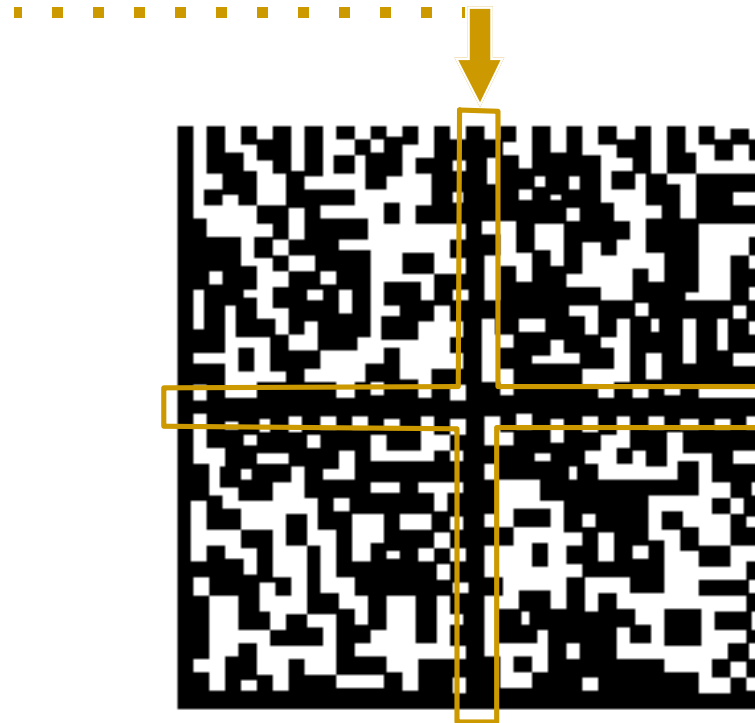
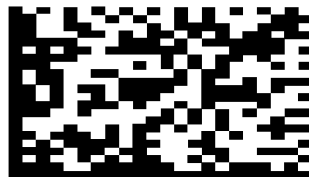
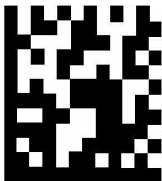
DATA MATRIX SYMBOL

- Structure Finder Pattern
 - ◆ the outermost rows and columns
 - ◆ composed of two solid lines and two alternating dark/light lines
 - ◆ used to define physical size, orientation, distortion and the number of rows and columns
- Data Region
 - ◆ the area inside the finder pattern
 - ◆ contains data and error correction code words



DATA MATRIX SYMBOL

- Symbol can have multiple data regions
 - ◆ Maximum capacity for a single data region
 - **88** numeric
 - **64** alpha/numeric
- Symbol shape can be square or rectangular



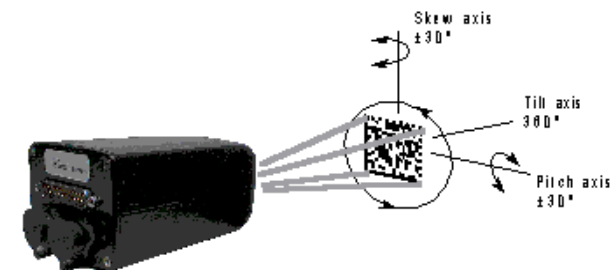
WHAT IS ECC 200?

- ECC stands for "error correction level"
 - ◆ Used for data redundancy instead of the bar height as in linear labels

DATA MATRIX CODE

THE CODE OF THE FUTURE

- 2D matrix codes capture the largest amount of data in by far the smallest footprint
 - ◆ 50 characters fit in 6 mm x 6 mm square
- Poorly printed codes or damaged labels are acceptable because of (Reed-Solomon) error correction
- Code is readable in 360 degrees using 2D CCD technology



MICROSCAN®

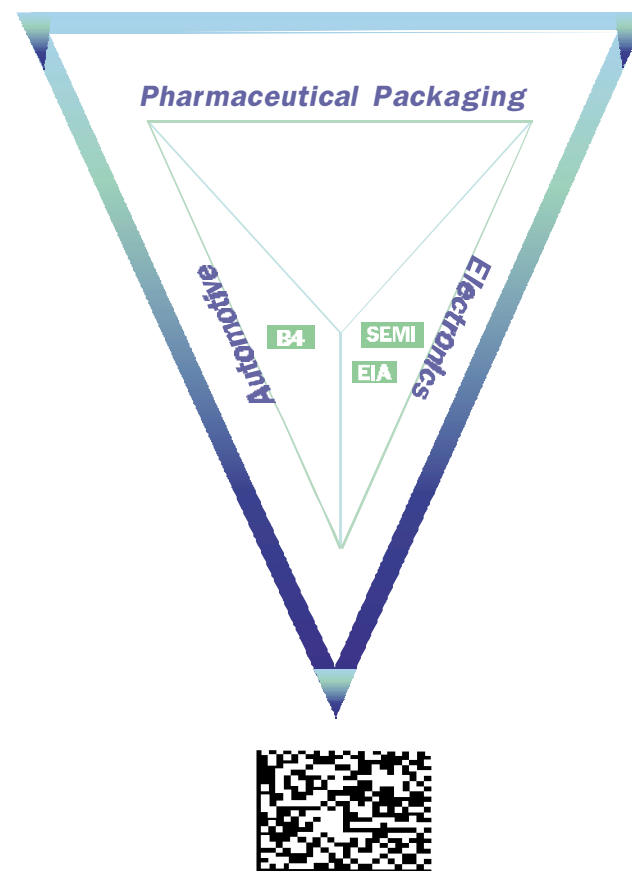
DATA MATRIX OVERVIEW

➤ Key Drawbacks

- ◆ Slower to process
- ◆ No room for human readable in small space
- ◆ Fixed focal distance

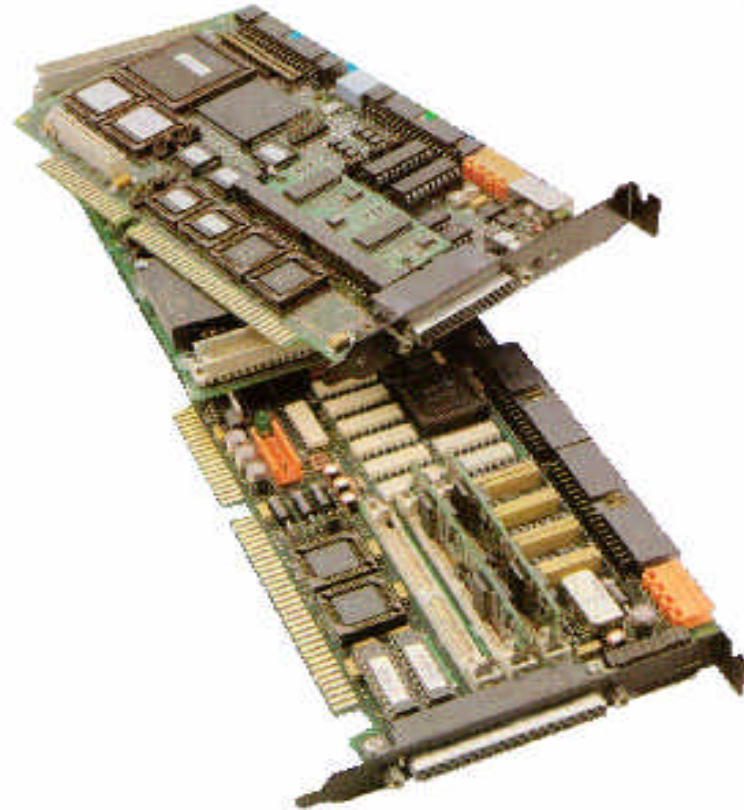
WHERE 2D SYMBOLS ARE USED

- Electronics Industry
 - ◆ Pagers/phones
 - ◆ PCBs
 - ◆ Hard disc drives
 - ◆ Semiconductors
- Automotive Industry
 - ◆ Automotive parts
- Pharmaceutical Packaging
 - ◆ Medicines
 - ◆ Lotions/Ointments/Cremes
 - ◆ Toothpaste
 - ◆ Shampoo/ Mouthwash



ELECTRONICS/SEMICONDUCTOR REQUIREMENTS

- Data
 - less than 20 digits
- Symbolologies
 - Data Matrix
 - QR code (Japan)
- Density
 - 5 mil (.005") to 7.5 mil (.0075")
- Speed
 - Static to 12 IPS (inches per second), typically slow



PRINTING METHODS

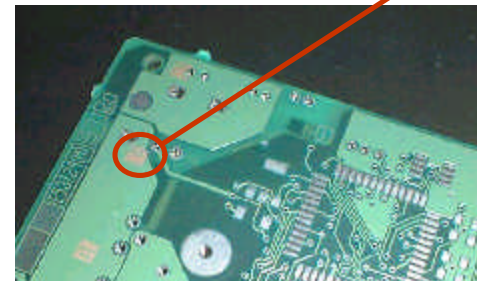
➤ Laser Etched

- ◆ Advantages: permanently attached, no labels, good print quality
- ◆ Disadvantages: expensive; equipment investment can reach



➤ Silk Screen

- ◆ Advantages: good for printing duplicate information, semi-permanent
- ◆ Disadvantages: no flexibility in changing information



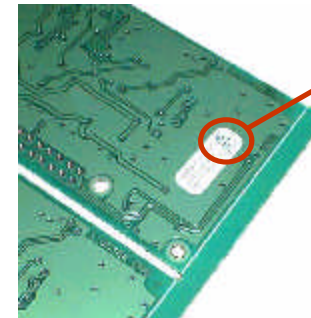
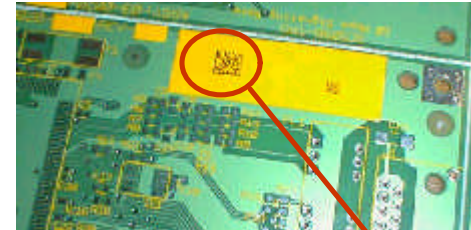
PRINTING METHODS

➤ Ink Jet

- ◆ Advantages: semi-permanent, no labels
- ◆ Disadvantages: poor print quality, expensive equipment

➤ Thermal Transfer

- ◆ Advantages: good print quality, low cost equipment
- ◆ Disadvantages: laborious task of applying labels, not permanent



ADVANTAGES

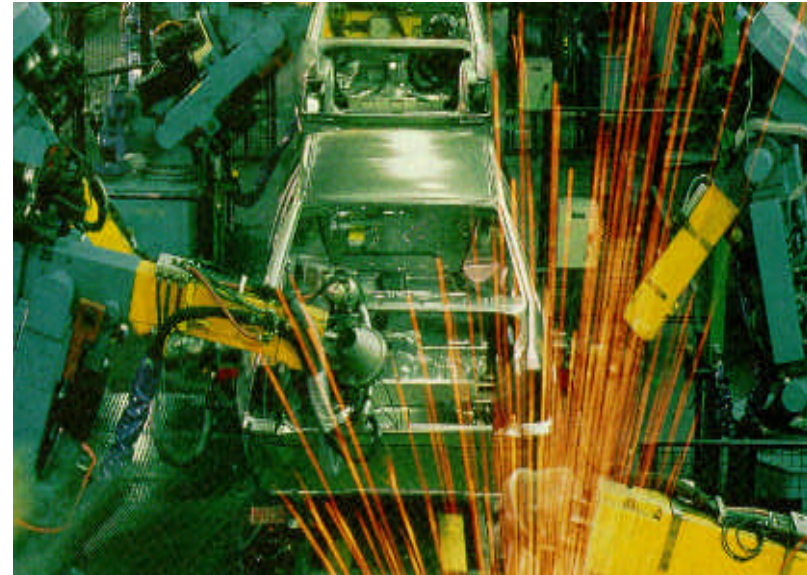
- Permanent marking survives manufacturing processes
- Same data in a smaller footprint (PCBs)
- Ability to track at the component level



REQUIREMENTS

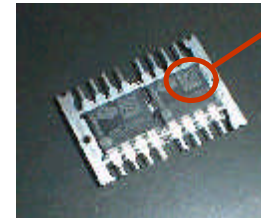
➤ Requirements

- ◆ **Data**
 - less than 20 characters
- ◆ **Symbologies**
 - Data Matrix
 - QR code (Japan)
- ◆ **Density**
 - 5 mil (.005") to 10 mil (.001")
- ◆ **Speed**
 - Static to 20 IPS



PRINTING METHODS

- Dot Peen (indent marking)
 - ◆ Advantages: permanently attached, no labels
 - ◆ Disadvantages: poor contrast
- Laser Etched
 - ◆ Advantages: permanently attached, no labels, good print quality
 - ◆ Disadvantages: expensive; equipment investment



PRINTING METHODS

➤ Ink Jet

- ◆ Advantages: semi-permanent, no labels
- ◆ Disadvantages: poor print quality (round spot), expensive equipment

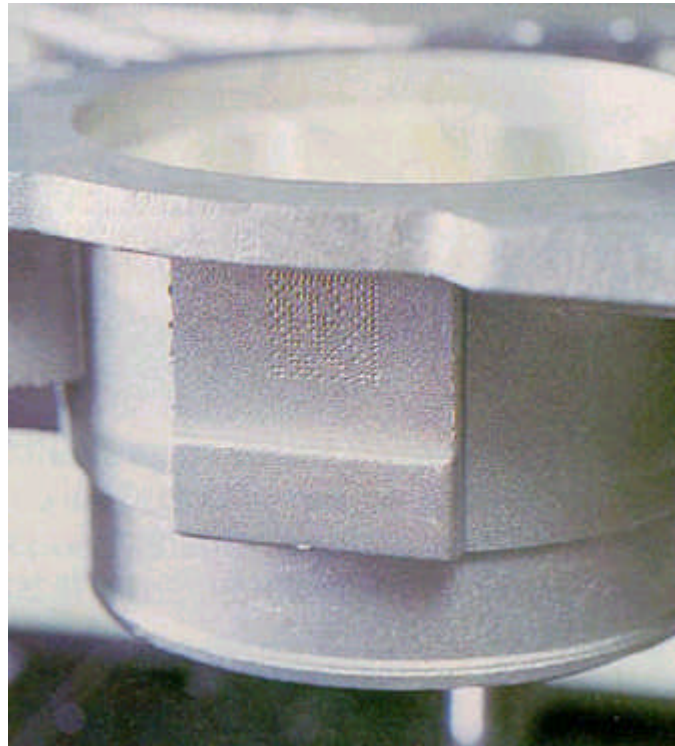
➤ Thermal Transfer

- ◆ Advantages: good print quality (square print pixel), low cost equipment, black on white contrast
- ◆ Disadvantages: laborious task of applying labels, media expensive, not permanent

Automotive

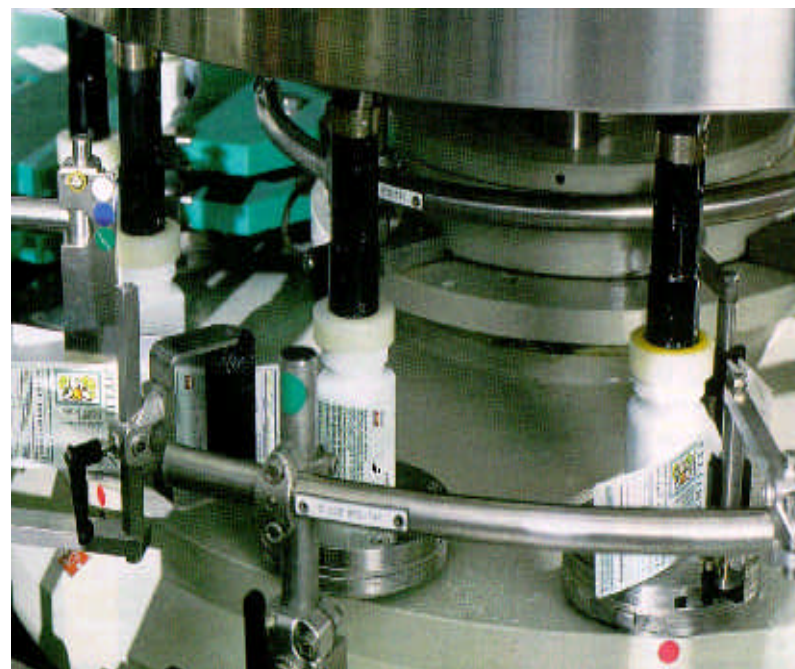
ADVANTAGES

- Permanent identification of parts (part license plate)
- Space restricted parts
- Defective part traceability



REQUIREMENTS

- Data
 - ◆ less than 100 digits (lot code, manufacturer, manufacture date)
- Symbolologies
 - ◆ Data Matrix
- Density
 - ◆ 7.5 mil (.0075") to 15 mil (.0015")
- Speed
 - ◆ 20 to 120 IPS



PRINTING METHODS

➤ Ink Jet

- ◆ Advantages: semi-permanent, no labels
- ◆ Disadvantages: poor print quality, expensive equipment

➤ Thermal Transfer

- ◆ Advantages: good print quality, low cost equipment, black on white contrast
- ◆ Disadvantages: laborious task of applying labels, not permanent



ADVANTAGES

- Portable database
- Orientation independent
- Small package marking

