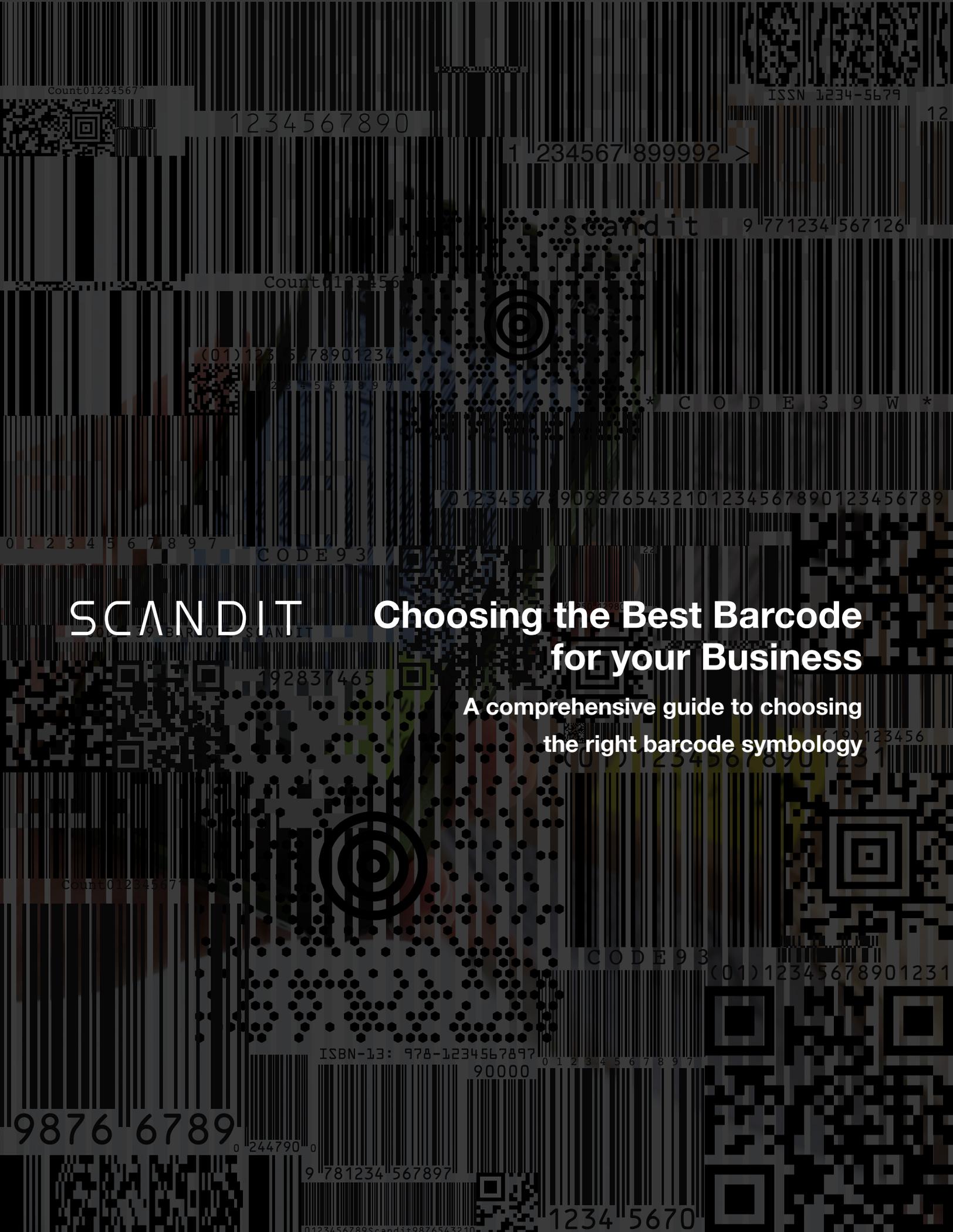
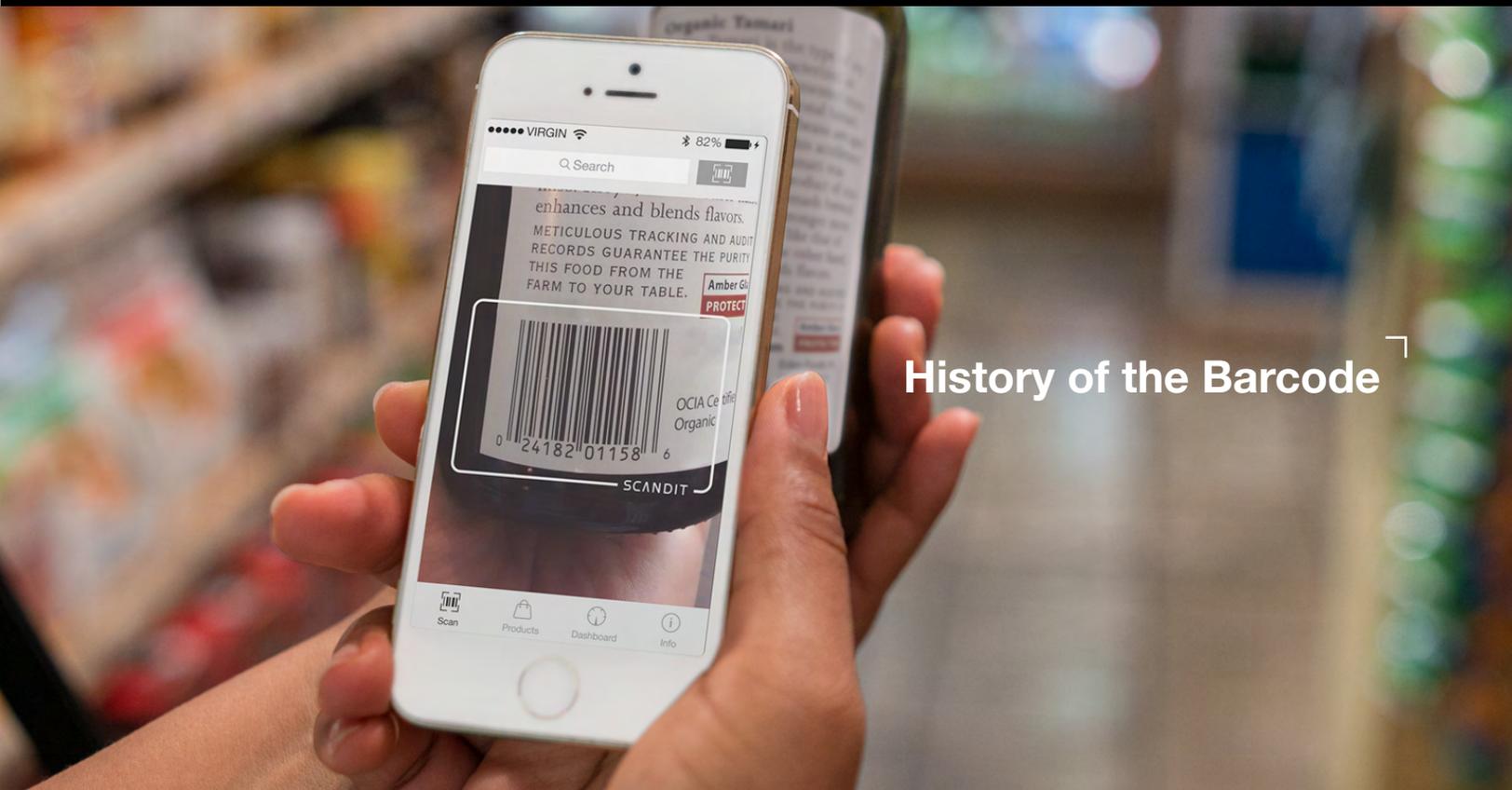


SCANDIT

# Choosing the Best Barcode for your Business

A comprehensive guide to choosing the right barcode symbology





## History of the Barcode

### **The history of the barcode is a tale of evolution.**

What began as an attempt to automate the grocery store checkout experience has evolved into an entire industry of automation and data capture that has taken the world by storm—revolutionizing many standard business processes that we still use today.

In 1948, while studying at Drexel University, Bernard Silver and Norman Woodland began to design a system that could automate the grocery store checkout process. Inspired by Morse Code, Silver and Woodland adapted technology from optical soundtracks and film projectors to read lines of varying width—similar to the dots and dashes of Morse Code—when printed on paper. Shortly afterwards, they filed a patent for what would one day become one of the most recognized symbols on Earth: the barcode. That patent was finally approved in the Fall of 1952, but it would be years still before the barcode caught on.

While several barcodes and systems were developed over the next 22 years, it wasn't until 1974 when the Universal Product Code, or UPC, was introduced. The UPC was then scanned for the first time in a small supermarket in Troy, Ohio on a pack of Wrigley's chewing gum.

Since then, the barcode has grown up quite a bit as new systems and symbologies have been developed and implemented across industries throughout the world. The barcode scanner itself has also transformed as newer technologies and form factors have been made available to manufacturers. From the original stationary checkout barcode scanner, to handheld scanner guns, to mobile computers and now smartphones, the barcode scanner has evolved to provide enterprises with many options to choose from to improve business processes. With mobile devices such as smartphones, tablets and wearables now able to scan barcodes at enterprise-grade performance levels, the future of the barcode scanner and barcode symbologies will continue to grow and adapt to meet business needs.

**In this comprehensive guide,** we'll explore the most common types of barcode symbologies, how and why they're being used and provide industry recommendations for a variety of top barcode scanning usage scenarios to better help you decide which barcode type is right for your business.

# The Barcode Timeline <sup>1</sup>

**1948** This year marked the beginning of the current barcode when two college students, Joseph Woodland and Bernard Silver, overheard a request made to the dean of their school at a local food fair.

**1952** Woodland and Silver are issued a patent for the first barcode product. The patent was later purchased by Philco and later sold to RCA.

**1967** The barcode is adopted as a standard by the Association of American Railroads and is used on the entire fleet of equipment.

**1972** Dr. David Allais develops the Interleaved 2 of 5 code. This is a code which consists of numbers only and can be as long as needed in order to store the encoded information.

**1974** The Code 39 was produced by Dr. David Allais. Code 39 is the first alphanumeric barcode symbology.

**1994** The Checkerboard symbology Data Matrix is invented, and the first barcode software for mobile computing is also invented.

**2005** Airlines implement one-dimensional barcodes on passenger boarding passes, increasing efficiency of check-in procedures.

Woodland and Silver file for a patent describing both the linear and bull's eye type barcode systems. **1949**

The National Association of Food Chains first utilized barcode technology because they wanted a faster way to check out customers. **1966**

Computer Identics Corp., started by David Collins, is the first company whose entire line of products is based on barcode technology. **1969**

Committee on Uniform Grocery Product Code suggests that bar code technology should be used on products throughout the United States. **1973**

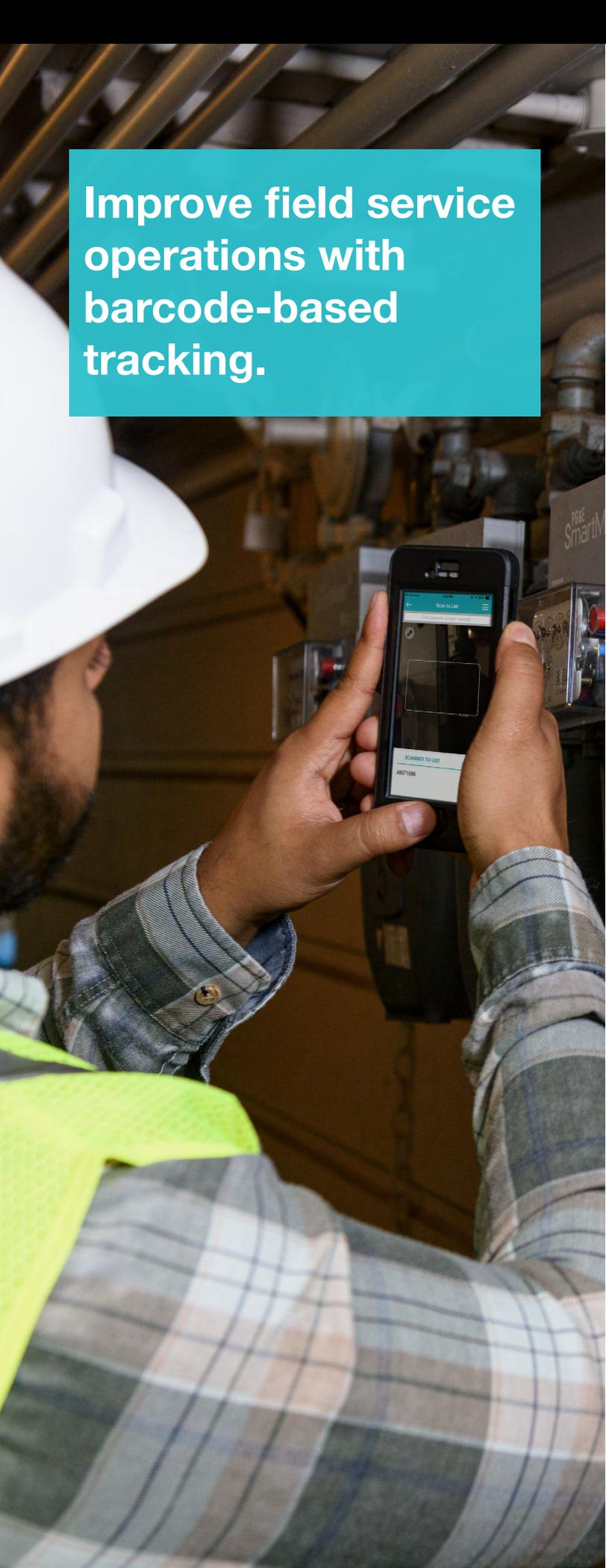
Symbol Technologies launches the first handheld scanner. **1982**

QR codes were registered in Japanese Industrial Standards. The codes were also adopted as the standard two-dimensional symbol. **1999**

Mobile phones are equipped with the technology to allow two-dimensional bar codes which can be used as electronic boarding passes. **2008**

## Present Day

Today, mobile barcode scanning is rapidly being adopted to enhance processes across industries. As mobile hardware such as smartphones, tablets and wearable devices continue to improve, more enterprises are relying on camera-based barcode scanning software for business operations. Mobile barcode scanning solutions provide today's enterprise with cost-effective, high performance alternatives to traditional barcode scanners that are able to leverage mobile capabilities such as GPS, email, telephone and other line-of-business applications.



Improve field service operations with barcode-based tracking.

## Benefits of Using Barcodes to improve standard business processes <sup>2</sup>

### Improve Operational Efficiency:

Many businesses require employees to manually input or record information to process orders, inventory, purchases or lists as part of their daily workflows. By integrating barcode scanning into these processes, enterprises can more accurately retrieve and record information, making it easier for employees to process information quickly. It can take a significant amount of time to manually track materials, assets, and other moving parts within an organization, but barcodes are a valuable tool for improving operational efficiency across your workforce.

### Prevent Human Errors:

Let's face it: humans make mistakes. When employees have to manually enter information, mistakes are going to happen—and these mistakes cost companies money. By utilizing barcodes, companies can help lower instances of human error and turn complicated data input into a streamlined process.

### Cut Costs:

For businesses, it's all about the bottom line. No matter if your company implements barcode scanning for individual departments or organization-wide, barcodes can help save time, reduce errors and ultimately cut costs in the process. The results: improved efficiency without breaking the bank.

### Update Data in Real Time:

For many businesses, real-time updates are critical to standard operations. Using barcodes, these operations can be streamlined, allowing data updates in real time from a single scan. This gives employees immediate access to data, keeping your business agile and in the know.

# Common business processes where barcode scanning increases efficiency



## Manufacturing

Warehouse Management  
Inventory Control  
Shipping and Receiving  
Product Tracking



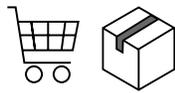
## Government

Asset Management  
Postal Delivery  
Citation Tracking/Processing  
Data Collection



## Healthcare

Patient Identification and Safety  
Pharmacy Care  
Specimen Tracking  
Document Tracking



## Retail & Wholesale

Clienteling  
POS (mPOS)  
Shipping and Receiving  
Order Entry  
Stock-Taking  
Inventory Management

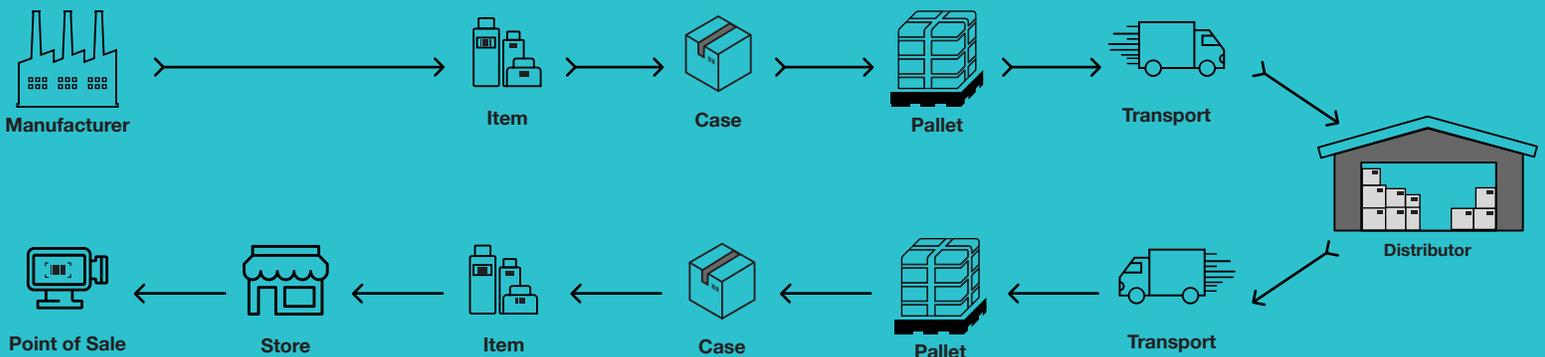


## Transportation & Logistics

Inventory, Shipping, Receiving, & Picking  
Proof-of-Delivery  
Asset/Package Tracking  
Transportation Asset Tracking  
Ticketing  
Field Service

## The Use of Barcodes Throughout the Supply Chain<sup>3</sup>

Barcodes are used to label, track, trace and sell goods as they move through the supply chain. A product barcode is generally scanned by manufacturers, distributors, wholesalers and retailers before eventually reaching the consumer at the point of sale. From the factory to the sales floor, barcodes help improve the standard business processes used at every level of the supply chain.





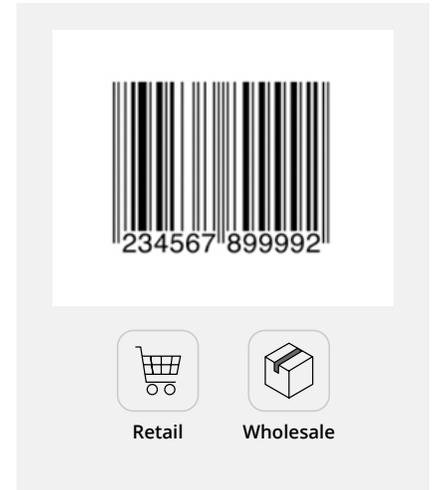
# One-Dimensional (1D) Barcode Types

Barcodes representing data in the widths (lines) and the spacings of parallel lines such as Code128, Code 39, and UPC, are referred to as Linear or 1D (one-dimensional) barcode symbologies.

## UPC CODE

<b>INDUSTRY:</b>	RETAIL, WHOLESALE DISTRIBUTION
<b>VARIATIONS:</b>	UPC-A, UPC-E
<b>COMMON USE CASES:</b>	POS, INVENTORY MANAGEMENT, ORDER ENTRY

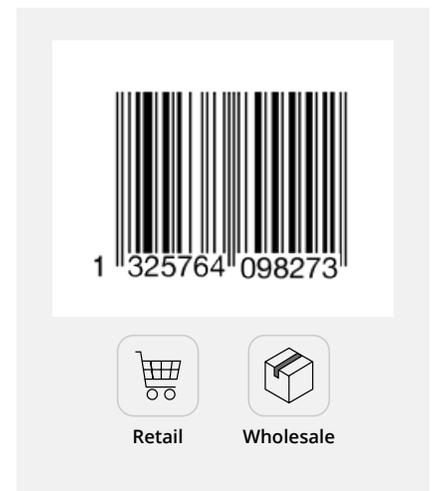
UPC barcodes are used to label and scan consumer goods at retail points-of-sale around the world—mainly in the United States, but also in the United Kingdom, Australia, New Zealand and other countries. The UPC-A variation encodes 12 numerical digits while UPC-E is a smaller variation, which encodes only 6 numerical digits.



## EAN CODE

<b>INDUSTRY:</b>	RETAIL, WHOLESALE DISTRIBUTION
<b>VARIATIONS:</b>	EAN-13, EAN-8, JAN-13, ISBN, ISSN
<b>COMMON USE CASES:</b>	POS, INVENTORY MANAGEMENT, ORDER ENTRY

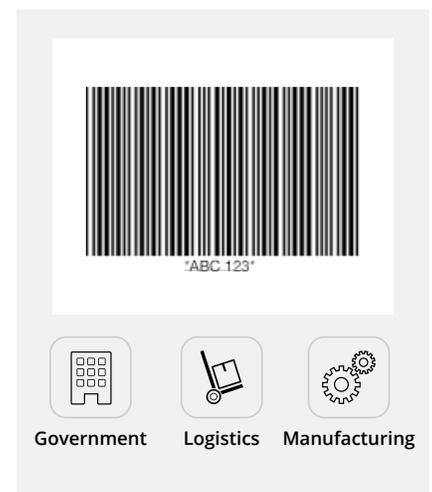
EAN barcodes are also used to label consumer goods worldwide for point-of-sale scanning, primarily in Europe. They look very similar to UPC codes, and the main distinction is their geographical application. While EAN-13 (comprising 13 digits) is the default form factor, you'll find EAN-8 (covering 8 digits) barcodes on products where only limited space is available, like small candies.



## CODE 39

<b>INDUSTRY:</b>	GOVERNMENT, MANUFACTURING, LOGISTICS
<b>COMMON USE CASES:</b>	IDENTIFICATION, ASSET TRACKING, SHIPPING & RECEIVING

Code 39 barcodes (or Code 3 of 9) are used to label goods across many industries, and are often found in the manufacturing industry and the U.S. Department of Defense. It allows the use of both digits and characters, and its name originates in the fact that it could only encode 39 characters—though in its most recent version the character set has been increased to 43. It's similar to, but not as compact as, the Code 128 barcode. Code 39 barcodes have an optional checksum and we recommend you utilize it.



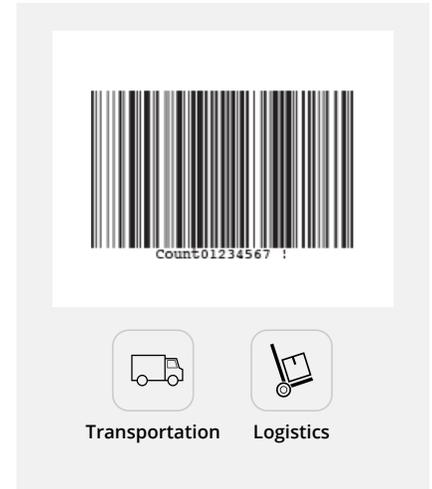


# One-Dimensional (1D) Barcode Types

## CODE 128

<b>INDUSTRY:</b>	TRANSPORTATION, LOGISTICS
<b>COMMON USE CASES:</b>	PRODUCT IDENTIFICATION, INVENTORY MANAGEMENT, SHIPPING & RECEIVING, ASSET TRACKING

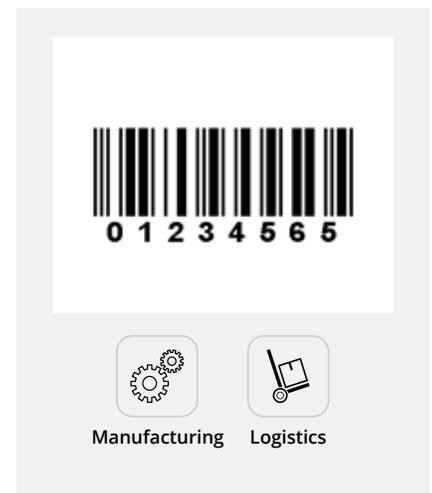
Code 128 barcodes are compact, high-density codes used in logistics and transportation industries for ordering and distribution. They're geared toward non-POS products, like when supply chain applications label units with serial shipping container codes (SSCC). Code 128 barcodes are powerful and can store diversified information because they support any character of the ASCII 128 character set. Code 128 barcodes contain a checksum (compared to standard Code 39), which prevents incorrect reads.



## ITF (INTERLEAVED 2 OF 5)

<b>INDUSTRY:</b>	MANUFACTURING, LOGISTICS
<b>COMMON USE CASES:</b>	PRODUCT IDENTIFICATION, ASSET TRACKING, INVENTORY MANAGEMENT

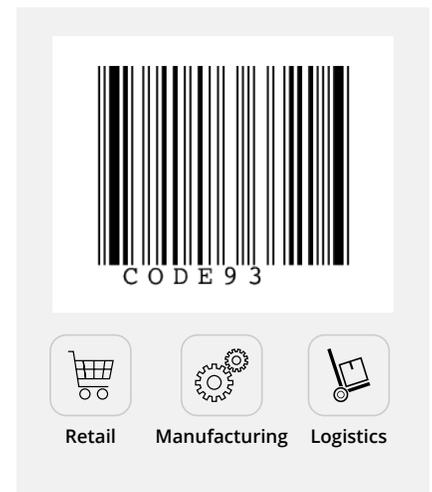
ITF (or Interleaved 2 of 5) barcodes are used to label packaging materials across the globe. Because they can deal with high printing tolerances, they are good for printing on corrugated cardboard and other packaging materials. ITF barcodes encode 14 numeric digits and use the full ASCII set. ITF barcodes have an optional checksum and we recommend you utilize it.



## CODE 93

<b>INDUSTRY:</b>	RETAIL, MANUFACTURING, LOGISTICS
<b>COMMON USE CASES:</b>	PRODUCT IDENTIFICATION, ASSET TRACKING & MANAGEMENT, POSTAL DELIVERY

Code 93 barcodes are used in logistics to identify packages in retail inventory, label electronic components, and even provide supplementary delivery information for the Canadian Post. Like Code 39, Code 93 comes with full ASCII support, but it improves upon and complements Code 39. It enables additional security within the barcode itself, and its high density and compact size makes its labels 25% shorter than barcodes produced in Code 39.



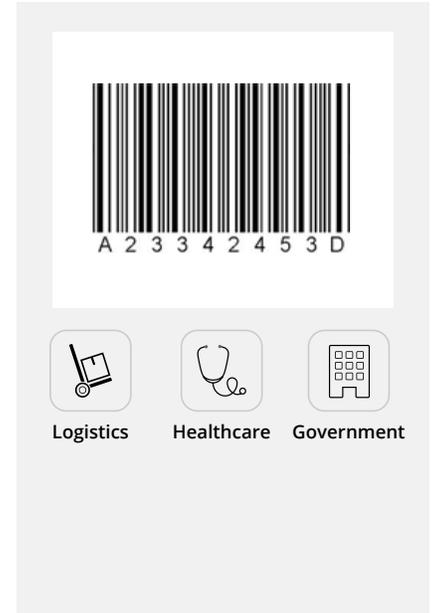


# One-Dimensional (1D) Barcode Types

## CODABAR

<b>INDUSTRY:</b>	LOGISTICS, HEALTHCARE, GOVERNMENT
<b>VARIATIONS:</b>	CODEABAR, AMES CODE, NW-7, MONARCH, CODE 2 OF 7, RATIONALIZED CODABAR, ANSI/AIM BC3-1995, USD-4
<b>COMMON USE CASES:</b>	PRODUCT/PATIENT IDENTIFICATION, ASSET TRACKING & MANAGEMENT, POSTAL DELIVERY

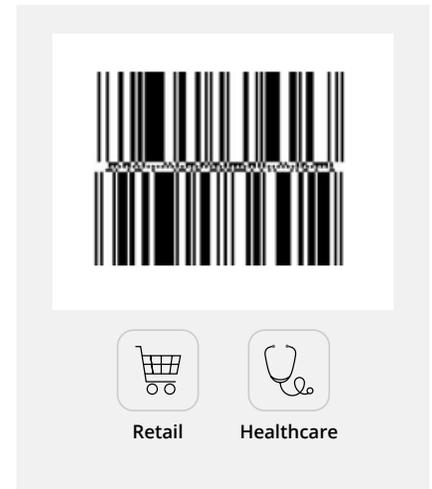
Codabar barcodes are used by logistics and healthcare professionals, including U.S. blood banks, FedEx, photo labs and libraries. Its main benefit is that it is easy to print and can be produced by any impact style printer, even a typewriter. Therefore, a user can create many Codabar codes using consecutive numbers without the use of a computer. It was designed to be readable when printed from dot matrix printers for multi-part forms. Codabar is a discrete, self-checking symbology that encodes up to 16 different characters with an additional 4 start/stop characters.



## GS1 DATABAR

<b>INDUSTRY:</b>	RETAIL, HEALTHCARE
<b>VARIATIONS:</b>	GS1 DATABAR OMNIDIRECTIONAL, TRUNCATED, STACKED, STACKED OMNIDIRECTIONAL, EXPANDED, EXPANDED STACKED, LIMITED
<b>COMMON USE CASES:</b>	POS, PRODUCT IDENTIFICATION, ASSET TRACKING

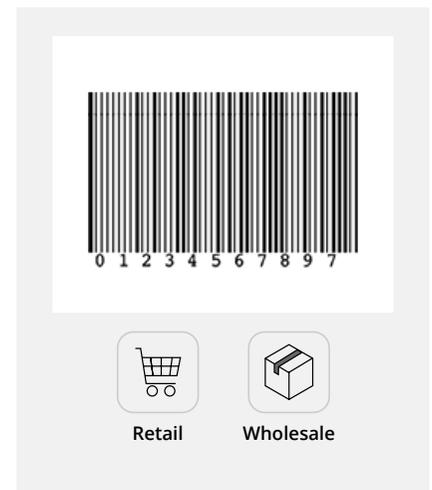
GS1 DataBar barcodes (formerly known as Reduced Space Symbology) are used by retail outlets to identify consumer coupons, produce and perishables, as well as small objects in the healthcare industry. They are more compact than typical consumer-facing barcodes. GS1 DataBar was introduced in 2001 and became the mandated barcode type for retail coupons in the US.



## MSI PLESSEY

<b>INDUSTRY:</b>	RETAIL, WHOLESALE DISTRIBUTION
<b>COMMON USE CASES:</b>	PRODUCT IDENTIFICATION, INVENTORY MANAGEMENT

MSI Plessey (or Modified Plessey) barcodes are used for inventory management in retail environments, such as labeling supermarket shelves. It is not recommended to use MSI Plessey barcodes without using one of the optional checksums.



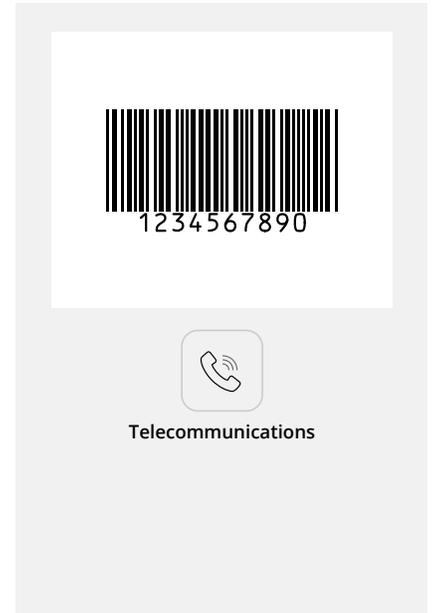


# One-Dimensional (1D) Barcode Types

## CODE 11

<b>INDUSTRY:</b>	TELECOMMUNICATIONS
<b>COMMON USE CASES:</b>	PRODUCT IDENTIFICATION, LABELING

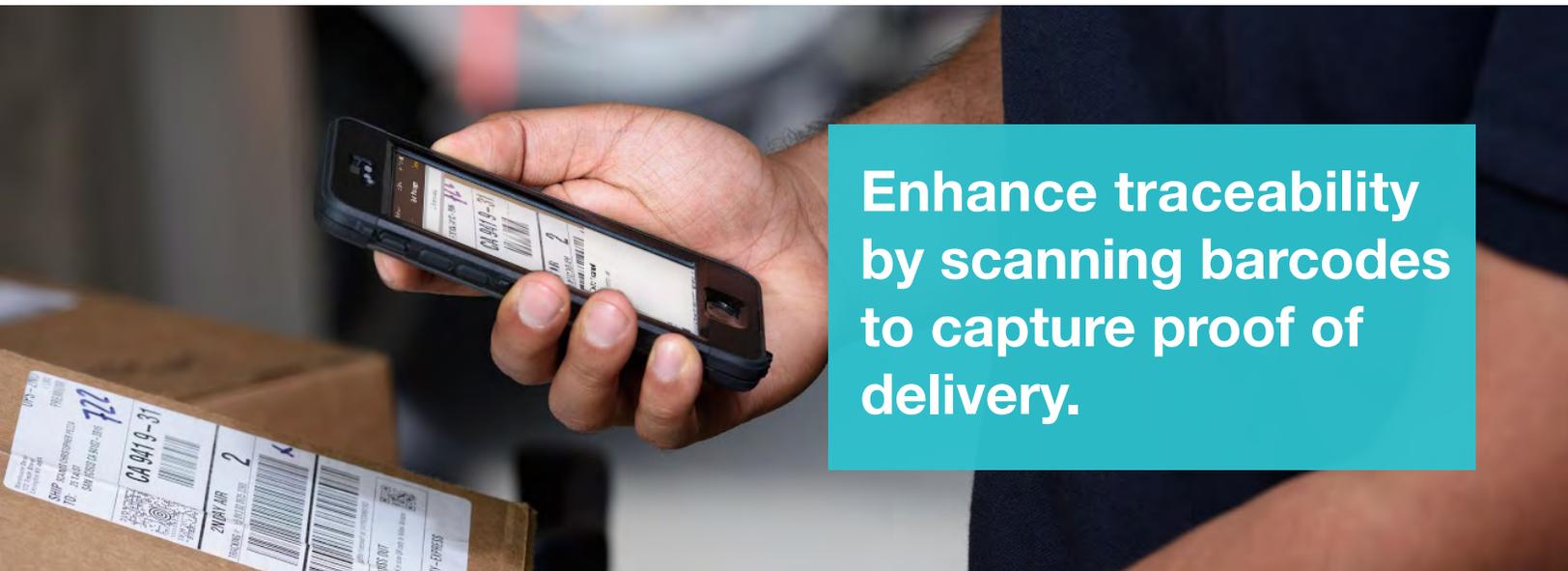
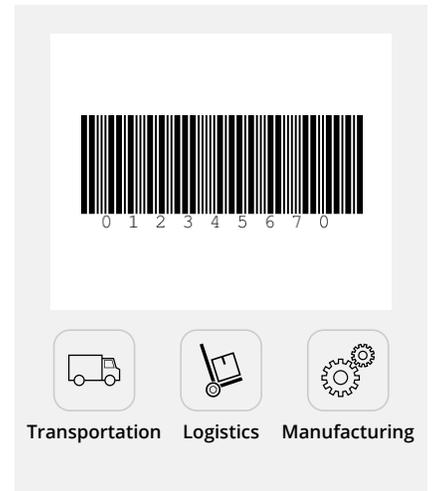
Code 11 barcodes, also known as USD-8 barcodes, are used in the telecommunications industry to label and identify equipment. The barcode data can encode numerical data, the dash and dot character, and supports variable length data content. For up to 10 data digits a single check digit is used, otherwise two check digits are used.



## CODE 25

<b>INDUSTRY:</b>	TRANSPORTATION, LOGISTICS, MANUFACTURING
<b>COMMON USE CASES:</b>	TICKETING, WAREHOUSE INVENTORY, BAGGAGE HANDLING

Code 25 is a legacy numerical barcode with limited data density. This makes it a somewhat inefficient code due to the amount of space required to encode a single digit. Despite its inefficiencies in space, Code 25 barcodes are simple to produce, and print well on materials like cardboard, making it a good barcode for uses in logistics and distribution.



**Enhance traceability by scanning barcodes to capture proof of delivery.**



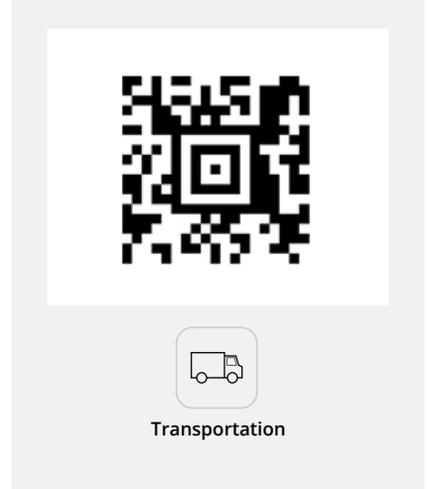
# Two-Dimensional (2D) Barcode Types

Two-dimensional (2D) barcodes, such as Data Matrix, PDF417, and QR Code, may have patterns of squares, dots, hexagons and other geometric patterns. While maintaining a fairly small size, these barcode types hold much more data than linear barcodes. 2D barcodes can hold hundreds of characters.

## AZTEC

<b>INDUSTRY:</b>	TRANSPORTATION
<b>COMMON USE CASES:</b>	TICKETING

Aztec codes are 2D barcodes used by the transportation industry, particularly for tickets and airline boarding passes. The barcodes can still be decoded even if they have bad resolution, making them useful both when tickets are printed poorly and when they're presented on a phone. In addition, they can take up less space than other matrix barcodes because they don't require a surrounding blank "quiet zone," unlike some other 2D barcode types.



## QR CODE

<b>INDUSTRY:</b>	RETAIL, MANUFACTURING
<b>COMMON USE CASES:</b>	PRODUCT IDENTIFICATION, INVENTORY MANAGEMENT

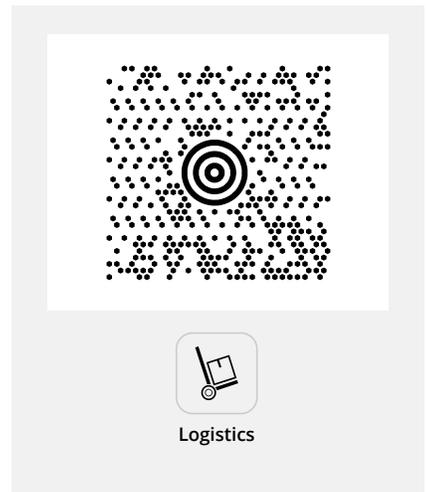
QR codes are 2D matrix barcodes with a strong consumer focus, often used in tracking and marketing such as advertisements, magazines, and business cards. They are free to use, flexible in size, have a high fault tolerance and have fast readability, though they can't be read with a laser scanner. QR codes support four different modes of data: numeric, alphanumeric, byte/binary and Kanji. QR code growth began in Japan and use continues to grow today.



## MAXICODE

<b>INDUSTRY:</b>	LOGISTICS
<b>COMMON USE CASES:</b>	SHIPMENT TRACKING

MaxiCodes are 2D barcodes used in the logistics industry for tracking and managing shipments of packages. The MaxiCode was originally created by UPS to standardize shipment tracking in 1992, and is often referred to as the "bird's eye" or "target" barcode. It has been standardized under ISO/IEC 16023 and supports encoding of a Structured Carrier Message or data extended in ASCII. This information is protected with a strong Reed-Solomon error correction code, allowing it to be read even if a portion of the symbol is damaged.



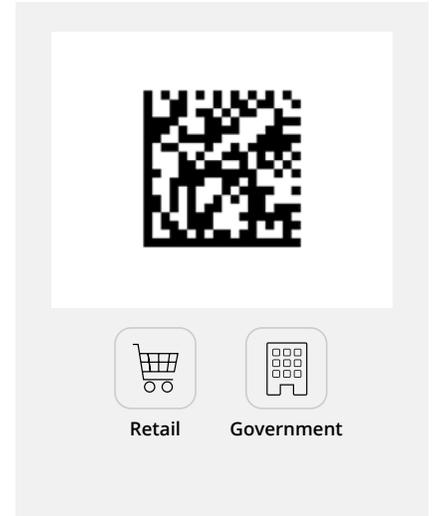


# Two-Dimensional (2D) Barcode Types

## DATA MATRIX CODE

<b>INDUSTRY:</b>	RETAIL, GOVERNMENT
<b>VARIATIONS:</b>	MICRO-DATAMATRIX
<b>COMMON USE CASES:</b>	PRODUCT IDENTIFICATION, ASSET TRACKING, DOCUMENT TRACKING

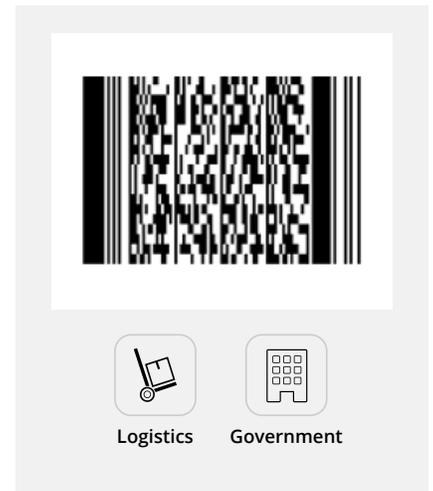
Data Matrix codes are 2D barcodes used to label small items, goods and documents. Their tiny footprint makes them ideal for small products in logistics and operations. In fact, the US Electronic Industries Alliance (EIA) recommends that they be used to label small electronic components. Similar to QR codes, they have high fault tolerance and fast readability.



## PDF417

<b>INDUSTRY:</b>	LOGISTICS, GOVERNMENT
<b>VARIATIONS:</b>	TRUNCATED PDF417, MICRO PDF417
<b>COMMON USE CASES:</b>	IDENTIFICATION, ASSET TRACKING

PDF417 codes are 2D barcodes used in applications that require the storage of huge amounts of data, such as photographs, fingerprints, signatures, text, numbers and graphics. They can hold over 1.1 kilobytes of machine-readable data, making them much more powerful than other 2D barcodes. Like QR codes, PDF417 barcodes are public domain and free to use.





## Sources

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1 QR Readers, Barcode Technology Timeline, [QRreaders.net](http://QRreaders.net)

2 Barcode News, How Barcodes Increase Efficiency, [barcode.com](http://barcode.com)

3 Open Product Data, Who is Hiding Behind the Barcode?, <http://product.okfn.org/2013/10/16/who-is-hiding-behind-the-barcode/>

## About Scandit

Scandit is the leading enterprise mobility and data capture company, specializing in barcode scanning solutions that transform business processes across industries including healthcare, logistics, manufacturing and retail. Through its software technologies and cloud services, Scandit empowers organizations to rapidly build, deploy and manage mobile apps for smartphones, tablets and wearable devices. The resulting solutions offer a lower total cost of ownership than traditional, dedicated devices.

Scandit's solutions portfolio includes patented, software-based optical data capture technology, an innovative iPhone Case and rapidly deployable enterprise mobile apps. Built on its 'Flow' Mobile Application Development Platform (MADP) for Data Capture, the company's cloud-based mobility solutions are enabling business transformation for thousands of businesses worldwide, including top brands Cardinal Health, Coop, Louis Vuitton, The Home Depot, NASA, and Verizon Wireless.

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