NBM2256 Bubble Memory

General Description

National Semiconductor's NBM2256 is a low cost, non-volatile, highly reliable solid state memory that uses magnetic bubble technology. The NBM2256 has the form of a dual-in-line package complete with the required in-plane rotating field coils and permanent magnet bias structure.

The package has a magnetic shield around it to protect the data from externally induced magnetic fields. The magnetic materials are so chosen that data integrity is guaranteed over a wide temperature range.

The NBM2256 memory module has a nominal* capacity of 256k bits organized as 256 storage loops each having 1024 storage locations. The storage loops have an input track with a swap gate on one side and an output track with a replicate gate on the other. The input track is serviced by a generator and the output track leads into a sensing area where bubbles are stretched to produce a signal large enough to be discriminated reliably using standard electronic circuitry.

In addition to storage area there is one more storage loop which can be used for the purpose of storing defective loop information and/or the address reference locations.

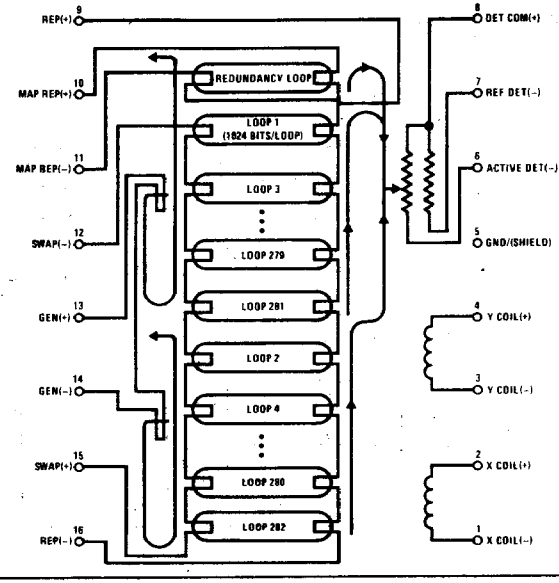
The NBM2256 Bubble Memory can operate asynchronously up to its maximum operating frequency, can be started and stopped at will and does not lose data when power is disconnected.

*A usable number physically there are more loops to impart defect tolerancy

Features

- ☐ Solid State
- ☐ Non-Volatile
- ☐ High Density
- ☐ Low Power
- ☐ Redundant Storage Loops
- ☐ Page-Oriented Access
- ☐ Sequential Read/Write
- ☐ Start/Stop Capability
- ☐ Modular Capacity
- ☐ On-Chip Error Map

Chip Organization



4

General Specifications

Capacity	256K bits
Bubble Size	$\leq 3\mu m$
Chip Size	$\leq$ 100K mil^2
Shift Rate	$\geq$ 100kHz
Average Access Time	< 7m sec.
Power Dissipation	< 1 Watt
Magnetic Shielding	> 20 Oe
Operating Temperature	0°C to 70°C (case)

Applications

- ☐ Microcomputer Mass Storage
- ☐ Word Processing Terminals
- ☐ Stored Program Controllers
- ☐ Measurement and Test Equipment
- ☐ Electronic Disc Applications
- ☐ Point-of-Sale Terminals
- ☐ Operating System Storage
- ☐ Fast Auxiliary Storage

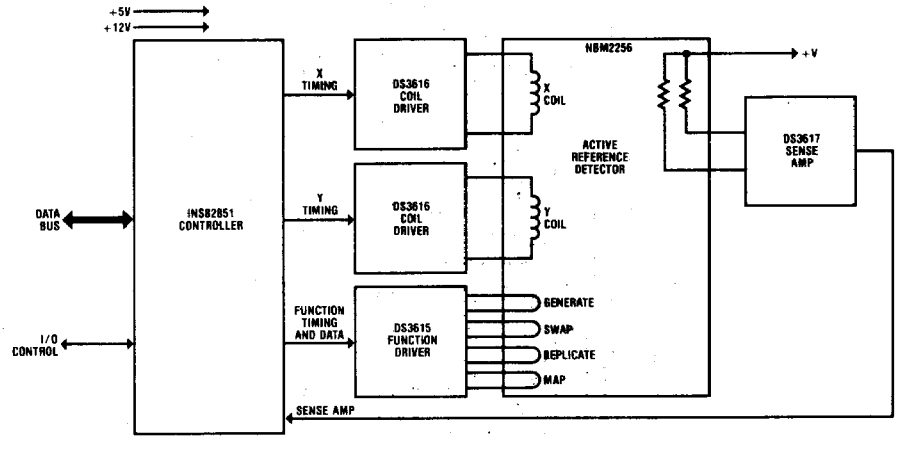
Functions

A "write" operation requires current pulsing the generators sequentially according to the data pattern desired and then pulsing the swap gate when the data block propagates and aligns with the transfer-in ports of the storage loops. A "read" operation consists of pulsing the replicate gate at the proper time when the required data block is at the transfer-out/replicate port. Since data is replicated, a true non-destructive read operation is performed which does not require storing back the data block as in the case of major/minor loop organization. The replicated data block then is sequentially propagated through the detectors to be sensed electronically. A data modifying operation is similar to the "write" operation since "true swap" gates used exchange the new data block with the old one in one step. The old data block is discarded by propagating through the guard rails. The swap gates also eliminate the necessity of sustaining power for a duration longer than the swap operation in the event of power failure.

What are magnetic bubbles

Magnetic bubbles are tiny cylindrical magnetic domains which are formed in a thin magnetic layer when a stabilizing magnetic field of optimum

National's Magnetic Bubble Module and Required Interface — A Functional Block Diagram



magnitude is applied orthogonally to the magnetic layer. This magnetic layer is grown by liquid phase epitaxy techniques over a non-magnetic substrate.

The cylindrical magnetic domains can be moved over in a controlled manner with the aid of an in-plane rotating field by the creation of attracting manetic poles in a soft magnetic layer such as Permalloy. These domains can be created and destroyed at will by using magnetic fields generated by current-carrying conductors. The absence or presence of a domain can be used to denote binary information ("0", "1") used in digital computers. The detection of the cyclindrical domains is performed by their interaction with a magneto-resistive element whose change in resistance is converted into a voltage by forcing a constant current through the element.

Applications

Magnetic bubble memories are presently used in portable terminals, as message recorders in telephone systems and as floppy disc replacements where the environment is hazardous to rotating memories. In addition, they are being considered for microprocessor mass storage applications, in word processing machines, in point-of-sale terminals where the small number of terminals can not justify a rotating memory, in data communication links, in programmable calculators, in diagnostic data logging for large computers, and in military and airborne applications where reliability is of prime importance. They are also being considered as cache between main memory and large capacity disc files to improve performance of the total system.

Physical Dimensions inches (millimeters)