T-65-13

Honeywell

Sensor Description

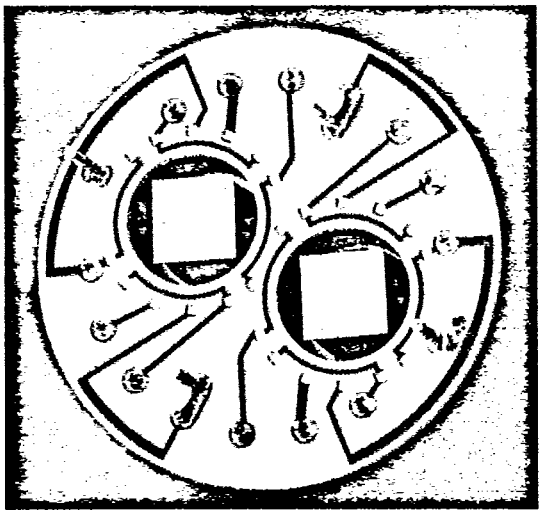
HIGH-PERFORMANCE PIEZORESISTIVE PRESSURE SENSORS

PRODUCT	PRESSURE RANGE	APPLICATION
• ST3000 Family	.4"H_20 to 6Kpsig (4 types) 1"H_20 to 500psi absolute (2 types)	Process control
• Dual Air Data Sensor (DADS)	3-41"Hg absolute	Commercial air data
• Digital Engine Pressure Ratio Transmitter (DEPRT)	3-126"Hg absolute	Military engine control

These devices are custom designs. Please call us for information on a product to your specifications using this or a similar technology.

GENERAL DESCRIPTION

The high-performance piezoresistive pressure sensors developed by SSEC interface to microprocessor-based industrial process control transmitters and aircraft controls. These devices are designed to have small noncompensatable errors, including pressure and thermal hysteresis, nonrepeatability, and long-term drift, which are major contributors to inaccuracy in microprocessor-based systems. Total noncompensatable error for this family is typically 0.02-0.04% of full scale. The silicon sensing chips feature full Wheatstone pressure bridges and single-resistor temperature sensors. The ST family of three devices contains two full pressure bridges for measuring static pressure and process variable pressure. The pressure sensing chips are thermal-electrically bonded to glass tubes which are mounted in custom housings for differential or absolute pressure measurement. The absolute sensors incorporate ultra-stable vacuum references.



Dual Air Data Sensor

HIGH-PERFORMANCE PIEZORESISTIVE PRESSURE SENSORS

THE SSEC SENSOR GROUP CHARTER

Develop and produce silicon-based sensors, and related devices based upon sensor technologies, which strategically leverage Honeywell products and systems.

SSEC SENSOR CAPABILITIES

Honeywell's Solid State Electronics Center (SSEC) is an established leader in the field of silicon-based sensors, a technology which offers unique advantages for building reliable, high-performance and cost-effective sensing devices. SSEC has developed silicon-based devices for magnetic field, pressure, acceleration, humidity, light, image, temperature, dew point, seismic, and acoustic sensing. The monolithic integrated sensor was pioneered at SSEC. This combines the disciplines of integrated circuit manufacturing and silicon-sensor fabrication to produce a sensor and associated linear signal processing on a single chip. SSEC's sensors—in production, developed, or under development—cover applications for automobiles, medicine, commercial and military avionics, industrial process control, jet and rocket engine control, munitions safety and arming, missile guidance, camera autofocus, depth sensing, battlefield command, satellites, antisubmarine warfare and residential and commercial energy control.

For more information on Sensor products, contact:

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Sensor Description

INTEGRATED PRESSURE TRANSDUCER

FEATURES

PERFORMANCE

- Pressure range: 0-15 psi
- Full scale span output: 4.0V
- Operating voltage: 5 VDC
- Operating temperature: -40°C-125°C
- Self-contained instrumentation amplifier and signal conditioning

PACKAGING

- Absolute pressure reference
- Low-cost plastic package

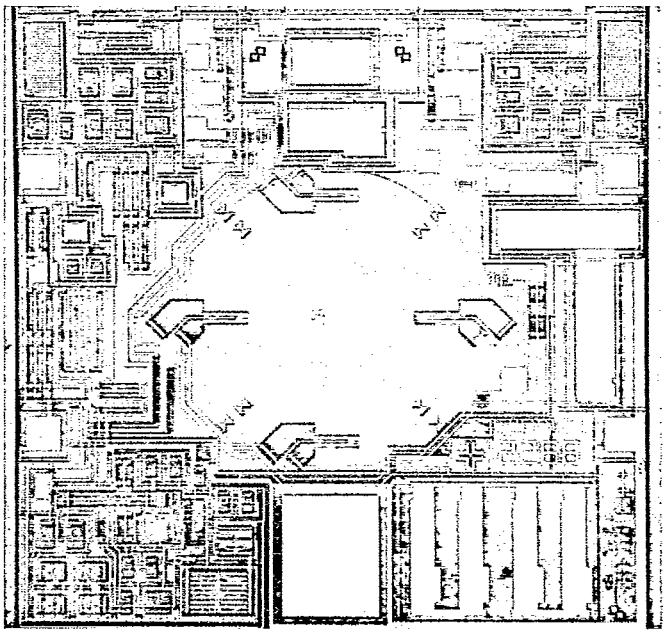
OTHER

- Developed in late 1970s
- World's first fully integrated monolithic pressure transducer

This device is a custom design. Please call us for information on a product to your specifications using this or a similar technology.

GENERAL DESCRIPTION

The Integrated Pressure Transducer (IPT) is a fully integrated 109 x 109-mil silicon chip with a 46-mil circular pressure sensitive diaphragm. The IPT is the first totally integrated pressure transducer to combine linear bipolar circuits, thin film trim technology and piezoresistive pressure sensing on a single chip. The pressure sensor is configured in a Wheatstone bridge which produces a differential voltage signal proportional to the applied pressure. This signal is then conditioned on-chip to give a 0.5 to 4.5V single ended pressure output signal with a supply voltage of +5 VDC.



Integrated Pressure Transducer Chip

INTEGRATED PRESSURE TRANSDUCER

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Sensor Description

INTEGRATED SI ACCELEROMETER DIE

FEATURES

PERFORMANCE

- Sensitivity: Approximately 1.0 mV/dyne-cm/bridge
- Cross axis sensitivity: negligible
- Long-term bias drift: <50μV/year

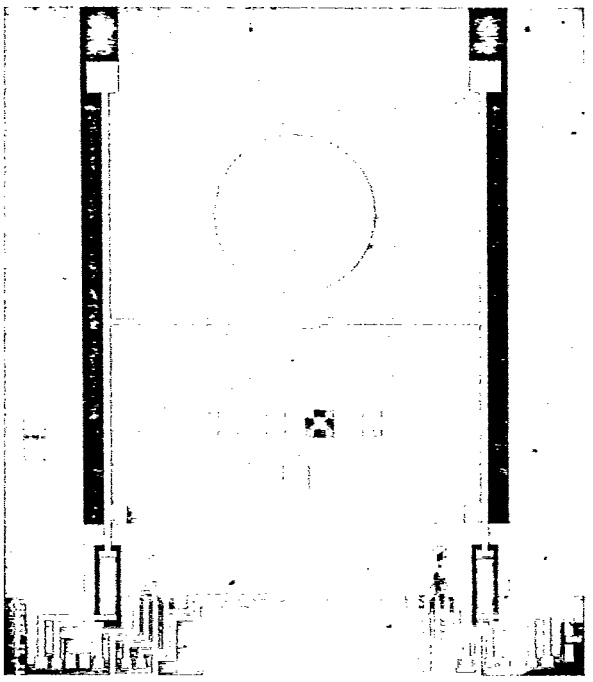
SPECIAL PROVISIONS

- Output is provided by two full piezoresistive Wheatstone bridges
- Temperature indication is provided by a stress-insensitive resistor with a TCR of approximately 2500 ppm/°C
- A stable conductor circuit is provided for force-rebalance inputs

This device is a custom design. Please call us for information on a product to your specifications using this or a similar technology.

GENERAL DESCRIPTION

The ISA die is a key component within the assembly of precision accelerometers used for inertial navigation systems. Highly sensitive and stable piezoresistive sensing elements accurately detect error signals in the accelerometer's servo system. A temperature-sensitive resistor provides a signal for compensation purposes. Mechanically stable non-metallic conductors provide a path to the accelerometer's pendulum for force rebalance signals. The die is fabricated by using IC-type processes to generate the bias detectors and conductors, electroetching to produce thin strain producing flexures, and laser milling to form the accelerometer pendulum.



Integrated SI Accelerometer Die

INTEGRATED SI ACCELEROMETER DIE

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PERMALLOY MAGNETIC SENSORS

FEATURES

- Permalloy (NiFe) Thin Film on Silicon Substrate
- Magnetic Sensitivity Varied by Design:
  - 10^{-4} to 40 Gauss Magnetoresistor Bridge Designs
  - 100 Microgauss or Better Resolution with Feedback
- Frequency Range from dc to Several Megahertz
- Custom Packaging Available
- Compact (10kΩ Permalloy Bridge Die Area is ≈10mm²)
- Discrete Sensor or Integrated with Signal Conditioning Circuitry (hybrids also)
- Low Power–as Low as 0.1mW in Some Applications
- Operational Temperature Range: -55 to 200°C

APPLICATIONS

- Solid State Compassing: (0.08 amp/meter typical resolution)
  - Automotive, Marine, Industrial, Aircraft, and Space Commercial or Military
- Signature Detection: (0.008 to 0.8 amp/meter typical resolution)
  - Traffic and Vehicle Control
  - Mine Detection and Weapon Fuzing Systems
  - Metal Detection: Mining, Recreational, Separation, Security
- Anomaly Detection: (0.0001 to 40,000 amp/meter typical resolution)
  - Proximity Detection
  - Position: Rotational, Angular, Linear, Non-contact
  - Anomaly Mapping

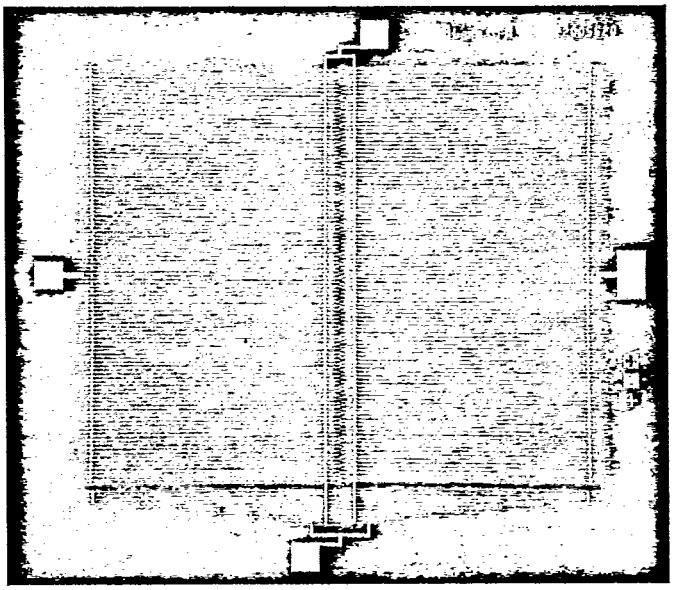
GENERAL DESCRIPTION

Magnetoresistive sensors provide an excellent means of measuring both linear and angular position and displacement. Permalloy thin films deposited on a silicon substrate in various resistor bridge configurations provide highly predictable outputs when subjected to magnetic fields. Low cost, high sensitivity, small size, noise immunity, and reliability are advantages over mechanical or other electrical alternatives. Highly adaptable and integratable, these sensors solve a variety of problems in custom applications.

Honeywell's magnetoresistive sensors consist of Permalloy (NiFe) thin film deposited onto a silicon substrate patterned to form the four legs of a Wheatstone resistor bridge. The magnetoresistive characteristic of the Permalloy causes resistivity changes in the bridge legs induced by the presence of external magnetic fields. This causes a corresponding delta voltage output. Through the degree of bridge imbalance represented by the delta voltage, precise magnetic field information can be derived. Design options can provide directional information as well as field magnitude.

The high sensitivity of Honeywell's magnetoresistive sensors can be combined with Honeywell's custom linear or circuit array technologies. The resulting magnetometers provide a powerful sensing capability in an exceedingly small package. Whether in hybrid form, or fully integrated, these magnetometers provide the benefits of a highly sensitive magnetic sensor complete with temperature compensation, signal conditioning, trimming capability, and improved signal-to-noise ratios. The semi-custom nature of Honeywell's linear array technology can significantly reduce development and fabrication time shortening your time to market. Our magnetometer line is highly adaptive, and can be fully conditioned for custom applications.

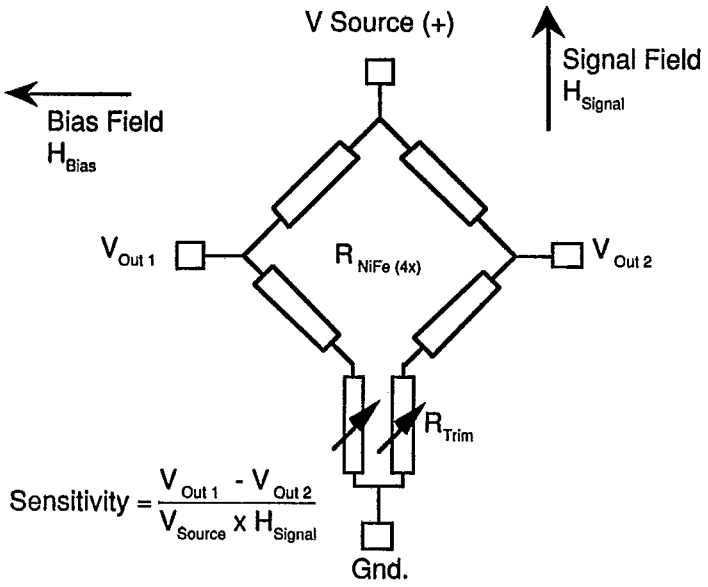
As stand alone devices, or coupled with Honeywell's linear array technology, these sensors provide versatile sensing capabilities. Possible applications include particulate separators, airport security, engine oil analysis, compassing systems, mine tracking, and traffic control.



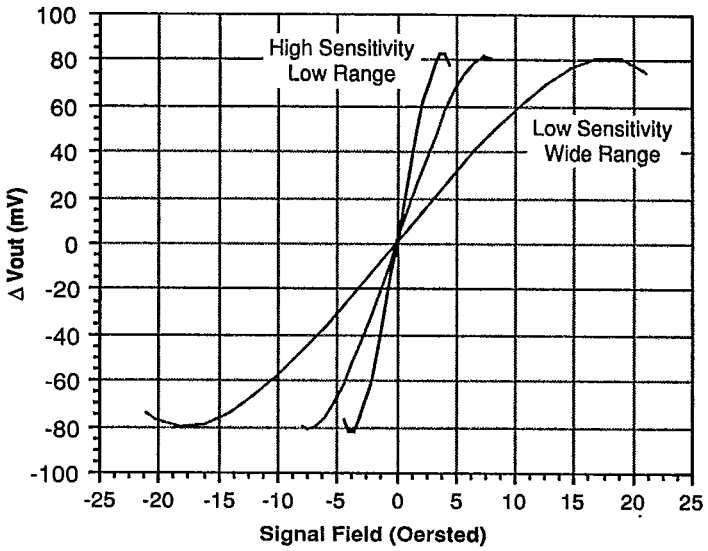
Example of a Custom Designed Discrete Magnetometer.

PERMALLOY MAGNETIC SENSORS

Permalloy Bridge



Output versus Signal Field



Shown above is a schematic representation of a Permalloy Wheatstone resistor bridge. The highlighted portion is the functional bridge consisting of four NiFe resistors of equal value. The trimming resistors (R_{Trim}), may be used to null the bridge output and establish a magnetic/electrical benchmark. With a bias field, the bridge is sensitive to field changes. The expression shows how magnetic sensitivity is derived. The graph of transfer functions (output voltage vs. signal field) shows the trade-off between sensitivity and usable signal field range for a few typical bridge designs. Sensitivity is represented by the curve slope. We can select an appropriate bridge design to meet the constraints of sensitivity, detectable field range, power, or size. These devices are custom designs. Please call us for information on a product to meet your specifications.

Characteristics of Typical Magnetometers

Application	Field Resolution	Field Range
Proximity Sensor	Saturated Mode	4-80 kA/m 50-1000 Oe
Magnetic Control	1 A/m	0.4-1.6 kA/m 5-20 Oe
Compassing	0.05 A/m	0-0.24 kA/m 0-3 Oe
Anomaly Detection	0.00001 A/m	Function of Feedback

Note: A/m = Ampere per meter, Oe = Oersted
79.58 Ampere per meter = 1 Oersted
1 Oersted is equivalent to 1 Gauss (in air)

Bridge resistances typically range from 1 kohm to 100 kohms depending on size and power requirements. Power is typically 0.1 to 50 mW, while size is typically 1 to 100mm². These are custom designs with significant trade-offs between field resolution and field range, and between power and size.

Typically system requirements define the sensitivity and range of a magnetic sensor, as well as constrain the power dissipation and physical size of the device. From this, Honeywell sensor designers define an electrical bridge bias and select the appropriate bridge resistance and geometry to meet those requirements. The design is evaluated using advanced simulation models that accurately characterize the various bridge structures. Our manufacturing team uses statistical process control and design of experiments to deliver high reliability sensors that meet the system requirements. Finally, our Total Quality Management program complies with MIL-I-38535 (General Specification for Integrated Circuits Manufacturing) to maintain repeatable devices for the duration of the program.

When combined with Honeywell's custom design or semi-custom linear array circuit technology, the sensor element can be compensated for temperature and power supply variations. On-chip amplification, impedance matching, or digital outputs eliminate system interfacing noise concerns. These smart magnetometers are very sensitive, highly adaptive, and signal conditioned to meet a wide range of system requirements. Please call us for specific information on your application.

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Sensor Description

ZINC OXIDE ACOUSTIC SENSOR

FEATURES

PERFORMANCE
- Sensitivity: 86 db relative to 1V/µbar
- Power Drain: 10 µA at 5V
- Frequency Range: .1 Hz to 10 KHz
- A-Weighted Noise Level: 64 db
  (1 KHz SPL Equivalent Noise Pressure)

PACKAGING
- Ported 16-Pin TO-8 header

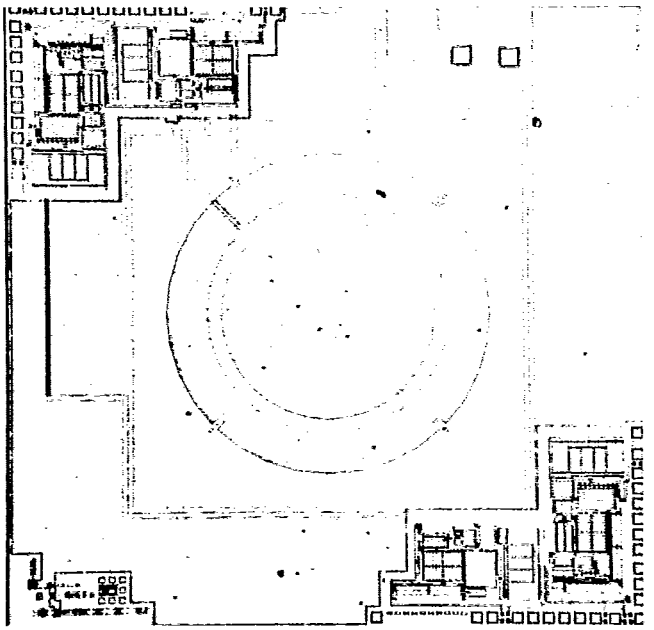
OTHER
- On-chip Signal Conditioning
- Temperature Compensated

This device is a custom design. Please call us for information on a product to your specifications using this or a similar technology.

GENERAL DESCRIPTION

The piezoelectric acoustic sensor is a fully integrated 250 x 250-mil chip with a 125-mil diameter diaphragm of micromachined silicon. A ZnO thin film capacitor fabricated on the Si diaphragm serves as the acoustic transducer for the device. A MOS input operational amplifier is provided on the chip for signal conditioning. Due to the unique sensor geometry, temperature effects are negligible. Additional electronics can easily be integrated into this device for increased levels of functionality such as tailoring of the frequency response characteristics.

The sensor responds to the dynamic pressure waves of an acoustic input. Such waves deflect the silicon diaphragm upon which the piezoelectric ZnO capacitor is fabricated. The electrodes of the capacitor develop a modulated charge signal which follows the dynamic pressure waveform. This signal is conditioned with on-chip electronics to provide a low impedance bipolar output.



Piezoelectric Acoustic Sensor

ZINC OXIDE ACOUSTIC SENSOR

HONEYWELL/S S E C 38E D 4551872 0000688 3 HON3

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Sensor Description

ZINC OXIDE SEISMIC SENSOR

FEATURES

PERFORMANCE
- Sensitivity - Bandwidth Product: 12,600 mV-Hz/g
- Ranges: 200 g to 15,000 g (depending on proof mass selected)
- Dynamic Range: 10^5

PACKAGING
- 16-Pin TO-8 header

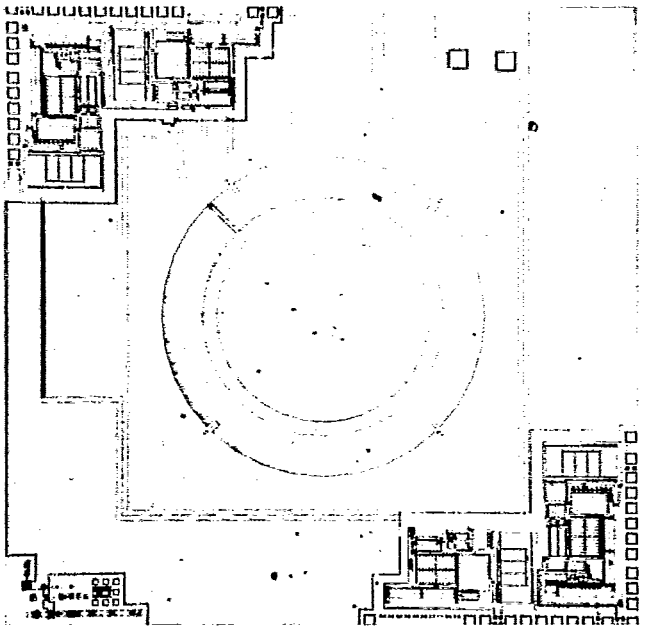
OTHER
- On-chip Signal Conditioning
- Temperature Compensated

This device is a custom design. Please call us for information on a product to your specifications using this or a similar technology.

GENERAL DESCRIPTION

The piezoelectric seismic sensor is a fully integrated 250 x 250-mil chip incorporating a 125-mil diameter diaphragm of micromachined silicon with integral proof mass. A ZnO thin film capacitor fabricated on the diaphragm serves as the transducer for the device. A MOS high impedance amplifier is provided on the chip for signal conditioning. Due to the unique sensor geometry, temperature effects are negligible. Additional electronics can easily be integrated into this device for increased levels of functionality such as tailoring of the frequency response characteristics.

The sensor responds to the forces generated by a seismic input. This input deflects the silicon diaphragm upon which the piezoelectric ZnO capacitor is fabricated. The electrodes of the capacitor develop a modulated charge signal which follows the seismic waveform. This signal is conditioned with on-chip electronics to provide a low impedance bipolar output.



Zinc Oxide Seismic Sensor

ZINC OXIDE SEISMIC SENSOR

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Product Description

THIN FILM MEMORY

FEATURES

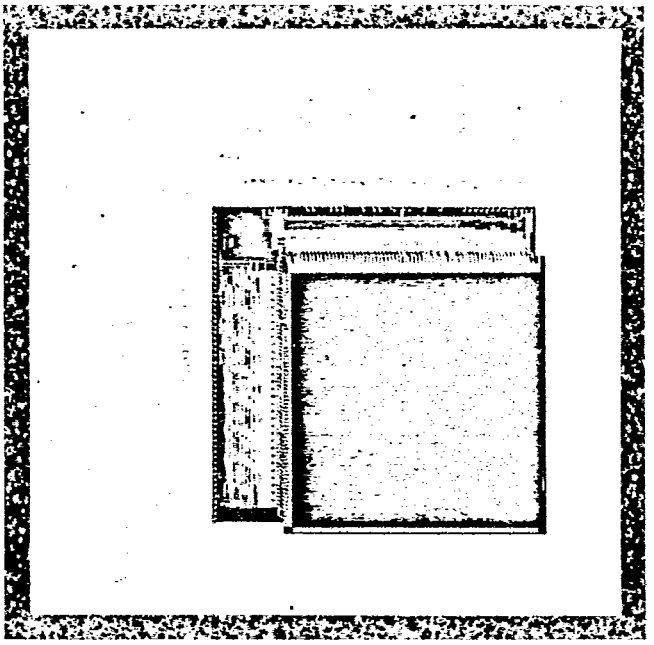
PERFORMANCE

- Non-Destructive Read Out (NDRO)
- 2K Non-volatile RAM
- Permalloy (NiFe) memory element
- Rad Hard to 2 x 10^{11} rad(Si)/sec
- Real time read-write times of 250 ns
- ADB-1 Bipolar Technology
- Magneto-Inductive Read Out
- Flexible—Configurable to satisfy system requirements

This device is a custom design. Please call us for information on a product to your specifications using this or a similar technology.

GENERAL DESCRIPTION

This memory product is the equivalent of a plated wire memory in terms of performance and operating characteristics. It differs in physical size; being much smaller, has much less mass, and consumes less power. These differences are achieved by using integration circuit fabrication procedures to form the memory array. Developed for Honeywell's Space and Strategic Avionics Division, Clearwater, Florida.



TFM with 128 x 16 Bit Words of Rad-Hard Non-Volatile NDRO Memory with Read-Write Electronics.

THIN FILM MEMORY

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