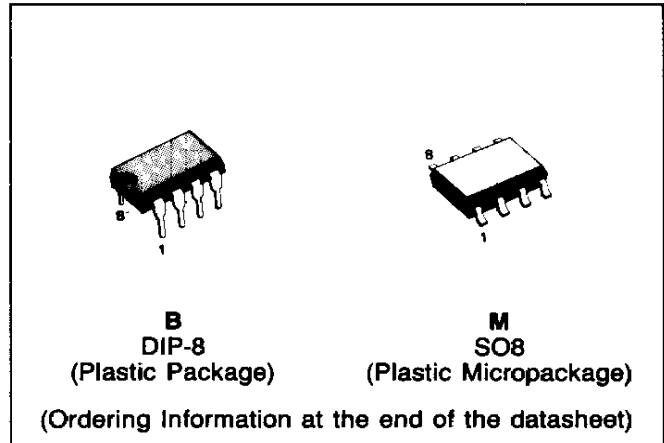


256 BIT (16 x 16) SERIAL NMOS EEPROM

- SINGLE SUPPLY READ/WRITE/ERASE OPERATIONS (5V ± 10%)
- TTL COMPATIBLE
- 16 x 16 READ/WRITE MEMORY
- LOW STANDBY CURRENT
- LOW COST SOLUTION FOR NON VOLATILE ERASE AND WRITE MEMORY
- RELIABLE FLOTOX PROCESS
- EXTENDED TEMPERATURE RANGE

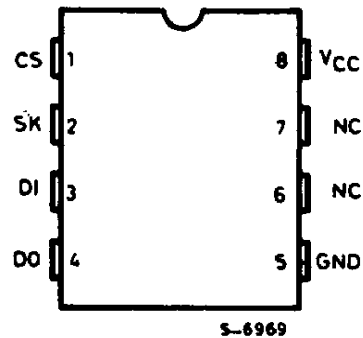


DESCRIPTION

The M9306 is a 256 bit non-volatile sequential access memory manufactured using SGS-THOMSON FLOATING GATE process. It is a peripheral memory designed for data storage and/or timing and is accessed via a simple serial interface.

The device contains 256 bits organized as 16 x 16. The M9306 has been designed to meet application requiring up to 10000 E/W cycles per word. Written information has at least 10 years data retention. A power down mode allows consumption to be decreased.

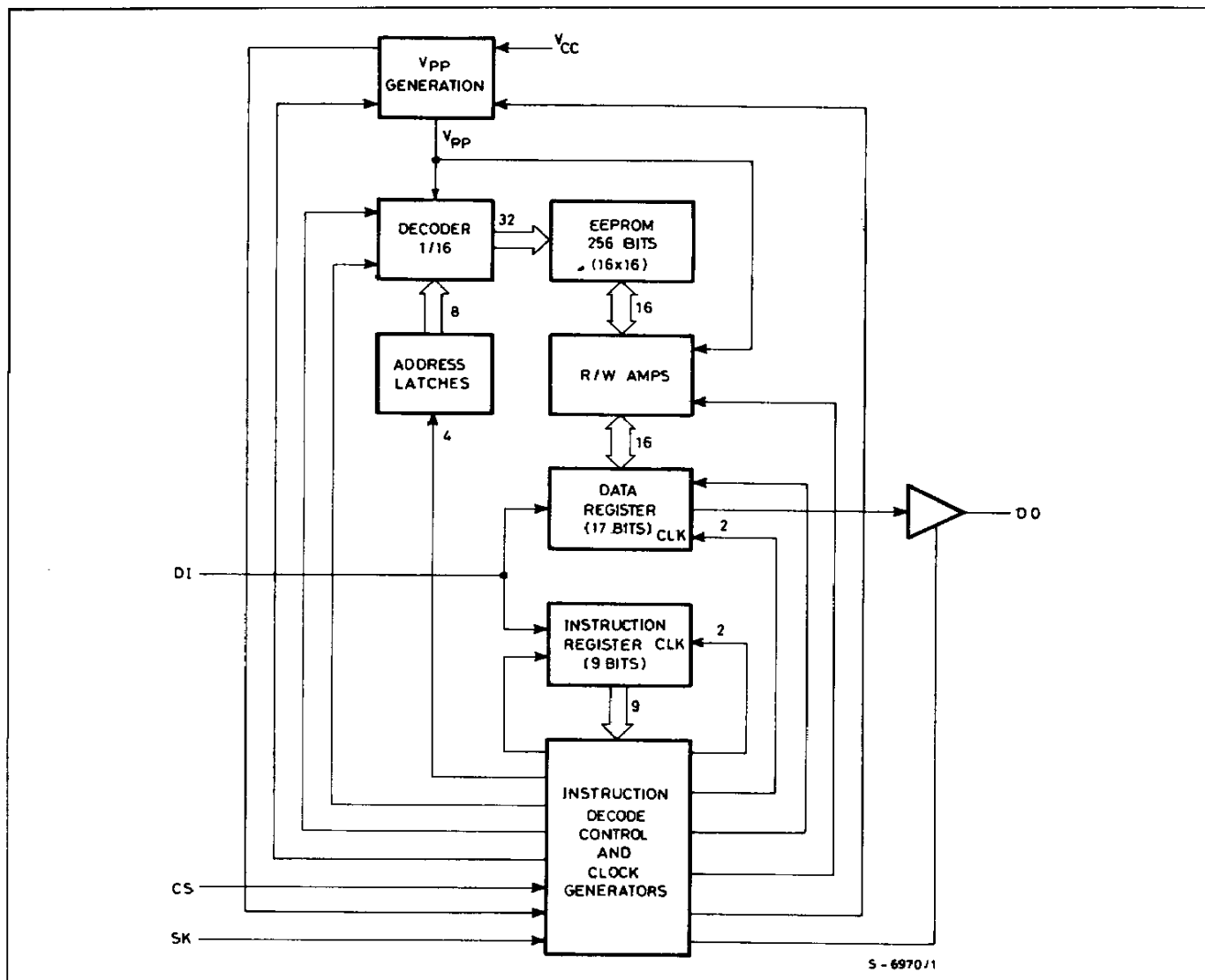
PIN CONNECTIONS



PIN NAMES

| | |
|-----------------|--------------------|
| CS | CHIP SELECT |
| SK | SERIAL DATA CLOCK |
| DI | SERIAL DATA INPUT |
| DO | SERIAL DATA OUTPUT |
| V _{CC} | POWER SUPPLY |
| GND | GROUND |

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Values | Unit |
|-----------|---|------------------------|----------|
| V_I | Voltage Relative to GND | +6V to -0.3 | V |
| T_{amb} | Ambient Operating Temperature: standard extended | 0 to +70 -40 to +85 | °C °C |
| T_{stg} | Ambient Storage Temperature | -65 to +125 | °C |

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability (except for T_{amb})

ELECTRICAL CHARACTERISTICS (0°C to +70°C, for standard Temperature/ -40°C to +85°C for extended Temperature, $V_{CC} = 5V \pm 10\%$ unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--|--|---|------------------------|------|---------------------|---------------|
| V_{CC} | Operating Voltage | | 4.5 | | 5.5 | V |
| I_{CC1} | Operating Current | $V_{CC} = 5.5V, CS = 1$ | | 1.5 | 5 | mA |
| I_{CC2} | Standby Current | $V_{CC} = 5.5V, CS = 0$ | | 1.2 | 3 | mA |
| I_{CC3} | E/W Operating Current | $V_{CC} = 5.5V$ | | 2.5 | 6 | mA |
| V_{IL} V_{IH} | Input Voltage Levels | | -0.1 2.0 | | 0.8 $V_{CC} + 1$ | V |
| V_{OL} V_{OH} | Output Voltage Levels | $I_{OL} = 2.1 \text{ mA}$ $I_{OH} = -400 \mu\text{A}$ | 2.4 | | 0.4 | V |
| I_{LI} | Input Leakage Current | $V_{IN} = 5.5V$ | | | 10 | μA |
| I_{LO} | Output Leakage Current | $V_{OUT} = 5.5V, CS = 0$ | | | 10 | μA |
| | SK Frequency | | | | 250* | KHz |
| | SK Duty Cycle | | 25 | | 75 | % |
| t_{CSS} t_{CSH} t_{DIS} t_{DIH} | Input Set-Up and Hold Times: CS DI | | 0.2 0 0.2 0.2 | | | μs |
| t_{PD1} t_{PD0} | Output Delay DO | $C_L = 100 \text{ pF}$ $V_{OL} = 0.8V,$ $V_{OH} = 2.0V$ | | | 0.5 0.5 | μs |
| $t_{E/W}$ | Erase/Write Pulse Width | | 5 | | 30 | ms |
| t_{CS} | Min CS Low Time (Note 1) | $C_L = 100 \text{ pF}$ | | | 1 | μs |

* The maximum SK Frequency is 500 KHz when SK Duty Cycle is as 50%

Note: 1. CS must be brought low for a minimum of $1\mu\text{s}$ (V_{CS}) between consecutive instruction cycles.

FUNCTIONAL DESCRIPTION

The input and output pins are controlled by separate serial formats. Seven 9-bit instruction can be executed. The instruction format as a logical "1" has a start bit, four bits as an op code, and four bits of address. The on-chip programming voltage generator allows the user to use a single power supply (V_{CC}). The serial output (DO) pin is valid only during the read mode. During all other modes the DO pin is in high impedance state, eliminating bus contention.

READ

The read instruction is the only instruction which outputs serial data on the DO pin. After a READ instruction is received, the instruction and address are decoded, followed by data transfer from the memory register into a 16 bit serial out shift register. A dummy bit (logical "0") precedes the 16 bit data output string. The output data changes during the high state of the system clock.

ERASE/WRITE ENABLE AND DISABLE

Programming must be preceded once by programming enable (EWEN) instruction. Programming remains enabled until a programming disable (EWDS) instruction in executed. The programming disable instruction is provided to protect against accidental data disturbance. Execution of a READ instruction is independent of both EWEN and EWDS instructions.

ERASE

Like most EEPROMs, the register must first be erased (all bits set to 1s) before the register can

be written (certain bits set to 0s). After an ERASE instruction is input, CS is dropped low. This falling edge of CS determines the start of programming. The register at the address specified in the instruction is then set entirely to 1s. When the erase/write programming time (t_{EW}) constraint has been satisfied, CS is brought up for at least one SK period. A new instruction may then be input, or a low power standby state may be achieved by dropping CS low.

WRITE

The WRITE instruction is followed by 16 bits of data which are written into the specified address. This register must have been previously erased. Like any programming mode, erase/write time is determined by the low state of CS following the instruction. The on chip high voltage section only generates high voltage during this programming mode, which prevents spurious programming during other modes. When CS rises to V_{IH} , the programming cycles ends. All programming mode should be ended with CS high for one SK period, or followed by another instruction.

CHIP WRITE

Entire chip can be written for ease of testing. Writing the chip means that all registers in the memory array have each bytes set as the byte sent with the instruction.

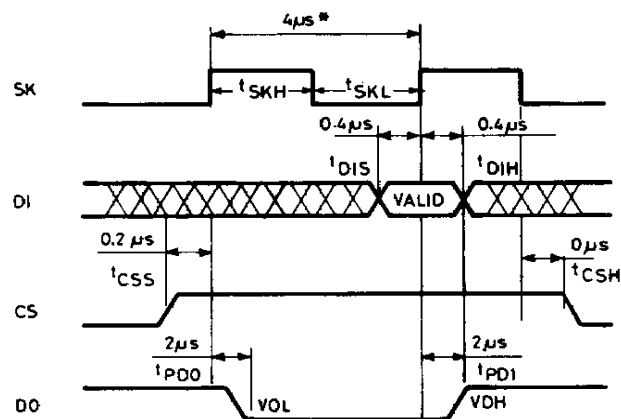
CHIP ERASE

Entire chip erasing is provided for ease of programming. Erasing the chip means that all registers in the memory array have each bit set to a 1. Each register is then ready for a WRITE instruction.

INSTRUCTION SET

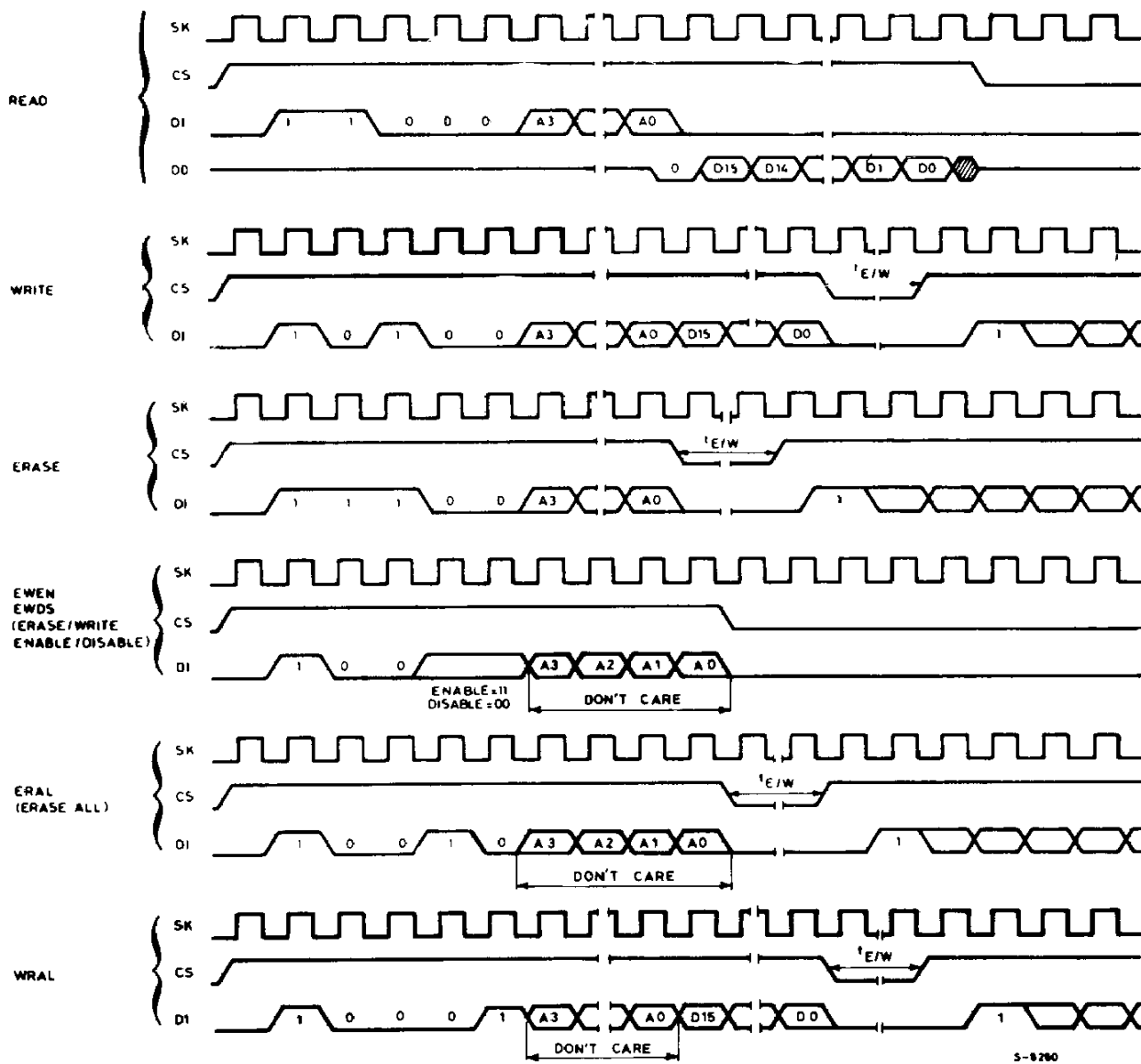
| Instruction | SB | Op Code | Address | Data | Comments |
|-------------|----|---------|----------|--------|-------------------------|
| READ | 1 | 10XX | A3A2A1A0 | | Read register A3A2A1A0 |
| WRITE | 1 | 01XX | A3A2A1A0 | D15-D0 | Write register A3A2A1A0 |
| ERASE | 1 | 11XX | A3A2A1A0 | | Erase register A3A2A1A0 |
| EWEN | 1 | 0011 | X X X X | | Erase/write enable |
| EWDS | 1 | 0000 | X X X X | | Erase/write disable |
| ERAL | 1 | 0010 | X X X X | | Erase all registers |
| WRAL | 1 | 0001 | X X X X | D15-D0 | Write all registers |

TIMING DIAGRAMS



S-697112

* THIS IS THE MAXIMUM SK FREQUENCY



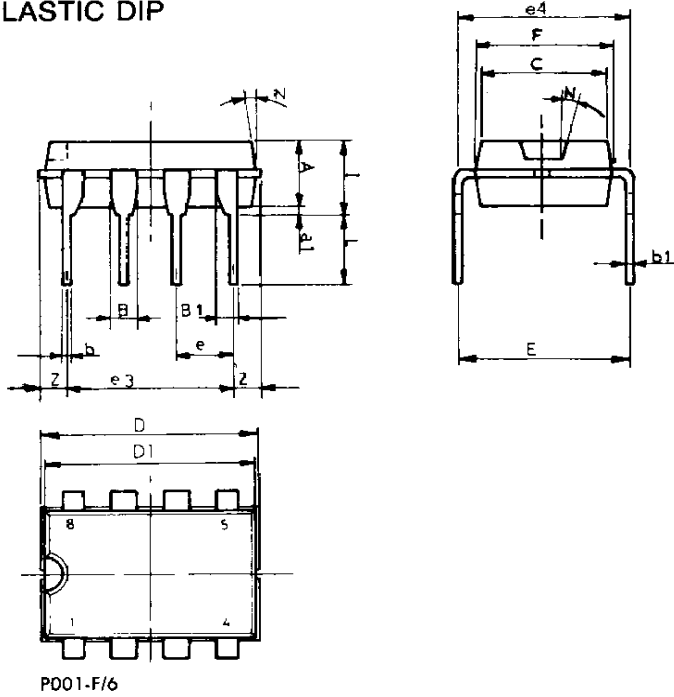
S-8280

ORDERING INFORMATION

| Part Number | Max Frequency | Supply Voltage | Temp. Range | Package |
|-------------|---------------|----------------|---------------|---------|
| M9306B1 | 250 KHz | 5V ± 10% | 0° to +70°C | DIP-8 |
| M9306B6 | 250 KHz | 5V ± 10% | -40° to +85°C | DIP-8 |
| M9306M1 | 250 KHz | 5V ± 10% | 0° to +70°C | SO8 |
| M9306M6 | 250 KHz | 5V ± 10% | -40° to +85°C | SO8 |

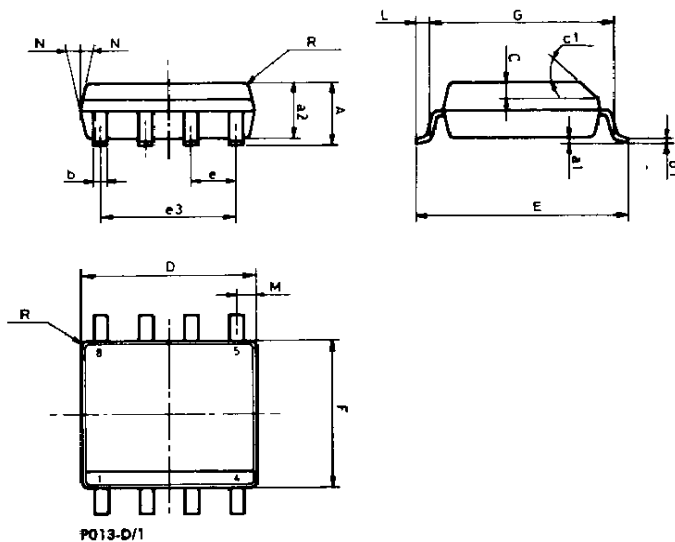
PACKAGE MECHANICAL DATA

8-PIN PLASTIC DIP



| Dim. | mm | | | inches | | |
|------|------|------|------|--------|-------|-------|
| | Min | Typ | Max | Min | Typ | Max |
| A | | | | | | |
| a1 | 0.70 | | | 0.028 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| B1 | 0.91 | | 1.04 | 0.036 | | 0.041 |
| b | | 0.50 | | | 0.02 | |
| b1 | 0.38 | | 0.50 | 0.015 | | 0.020 |
| C | | | | | | |
| D | | | 9.80 | | | 0.386 |
| D1 | | | | | | |
| E | | 8.90 | | | 0.350 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 7.62 | | | 0.300 | |
| e4 | | | | | | |
| F | | | 7.10 | | | 0.280 |
| I | | | 4.80 | | | 0.189 |
| L | | 3.30 | | | 0.130 | |
| N | | | | | | |
| Z | 0.44 | | 1.60 | 0.017 | | 0.063 |

8-LEAD PLASTIC MICROPACKAGE



| Dim. | mm | | | inches | | |
|------|------|------|-------|--------|-------|-------|
| | Min | Typ | Max | Min | Typ | Max |
| A | | | 2.00 | | | 0.079 |
| a1 | 0.10 | | 0.20 | 0.004 | | 0.008 |
| a2 | | | 1.70 | | | 0.067 |
| b | | 0.40 | | | 0.016 | |
| b1 | | 0.20 | | | 0.008 | |
| C | | | | | | |
| c1 | | | | | | |
| D | | | 5.08 | | | 0.200 |
| E | | | 6.30 | | | 0.248 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 3.81 | | | 0.150 | |
| F | 4.10 | | 4.30 | 0.161 | | 0.169 |
| G | 4.90 | | | 0.193 | | |
| L | 0.25 | | | 0.010 | | |
| M | | | 0.635 | | | 0.025 |
| N | | | | | | |
| R | | | | | | |