SGS-THOMSON MICROELECTRONICS

M9306

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

B
DIP-8
(Plastic Package)

M
SO8
(Plastic Micropackage)

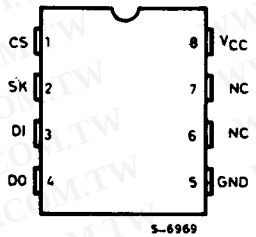
(Ordering Information at the end of the datasheet)

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.

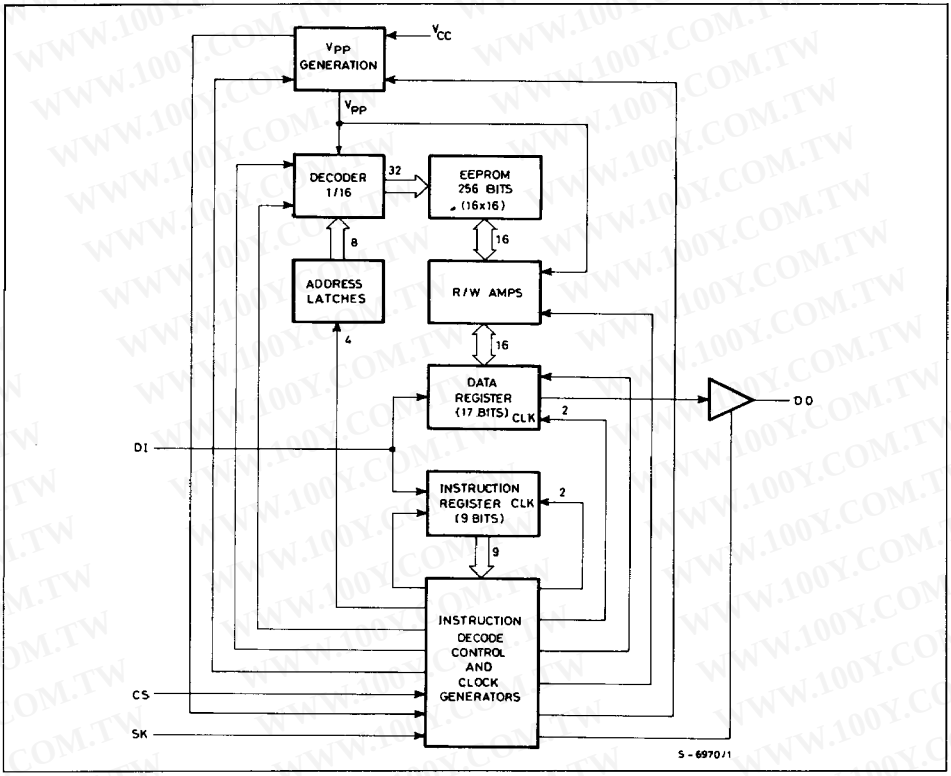
PIN CONNECTIONS



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 ± 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 mA I_{OH} = −400 µA	 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	%
	Input Set-Up and Hold Times:					
t_{CSS} t_{CSH}	CS		0.2 0			µs
t_{DIS} t_{DIH}	DI		0.2 0.2			
t_{PD1} t_{PD0}	Output Delay DO	CL = 100 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 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 1µs (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") preceds 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 ($t_{E/W}$) 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.

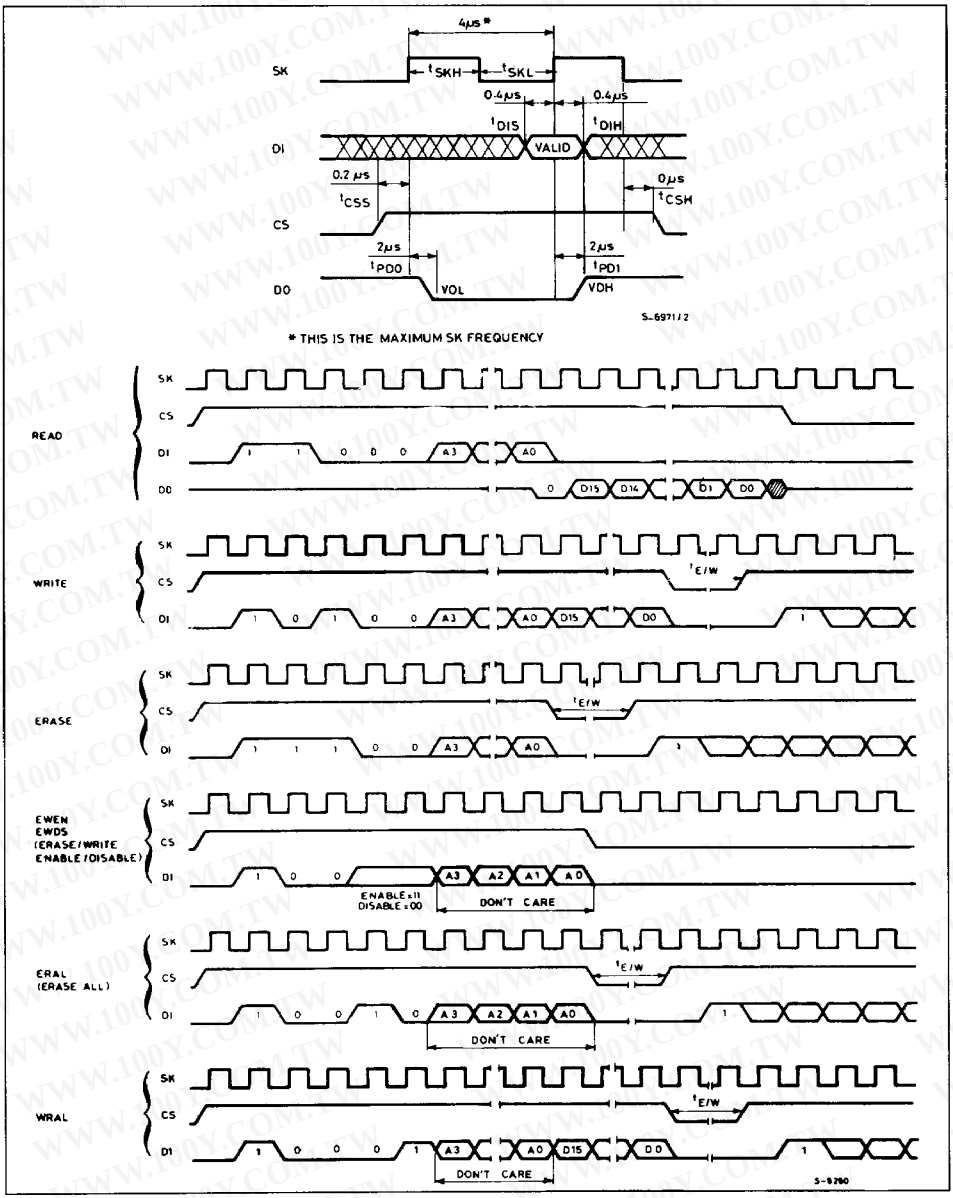
CHIP ERASE

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

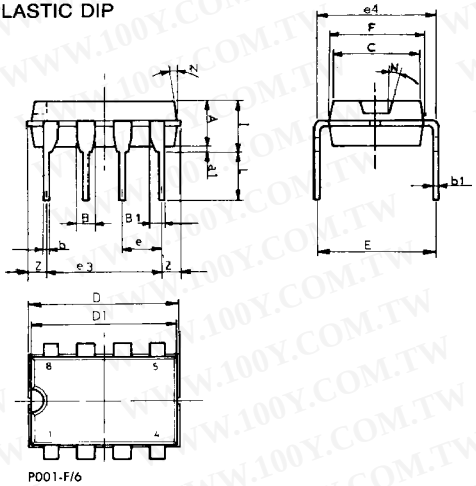


ORDERING INFORMATION

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

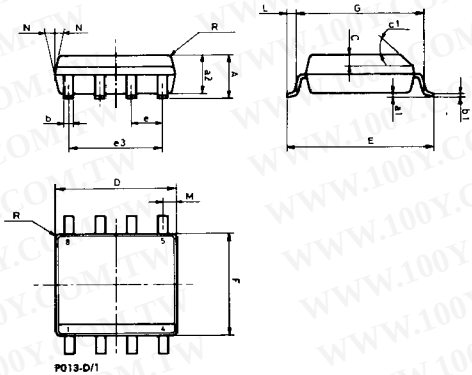
8-PIN PLASTIC DIP



PD01-F/6

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



P013-D/1

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	
e 3		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						