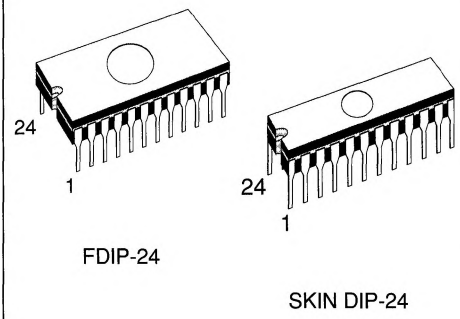
SGS-THOMSON MICROELECTRONICS

M27HC641

64K (8K x 8) CMOS UV EPROM

PRELIMINARY DATA

- ULTRA FAST ACCESS TIME : 35, 45, 55 ns.
- A REPROGRAMMABLE DEVICE FOR DIRECT REPLACEMENT OF BIPOLAR PROM.
- LOW POWER "CMOS" CONSUMPTION :
  - Operating current 60 mA Max
  - Standby current 30 mA Max
- PROGRAMMING VOLTAGE 12.50V.
- ELECTRONIC SIGNATURE FOR AUTOMATED PROGRAMMING.



FDIP-24

SKIN DIP-24

(Ordering Information at the end of the datasheet)

DESCRIPTION

The M27HC641 is an ultra high speed 65,536 (organized 8,192 x 8) bit ultraviolet erasable and reprogrammable CMOS EPROM.

Access time value and pin out make it ideal for Bipolar PROM replacement, with the advantage of lower power consumption and reprogrammability.

It is housed in a 24 pin Ceramic Frit Seal Window package, either 300 or 600 mils wide.

The transparent lid allows the user to expose the chip to ultraviolet light to erase the bit pattern. A new pattern can then be written to the device by following the programming procedure.

PIN FUNCTIONS

A0-A10	ADDRESS INPUT
O0-O7	DATA INPUT/OUTPUT
$\overline{CE}$ / V_{PP}	CHIP SELECT / V_{PP}
V_{CC}	+ 5V POWER SUPPLY
GND	GROUND

Figure 1 : Pin Connection

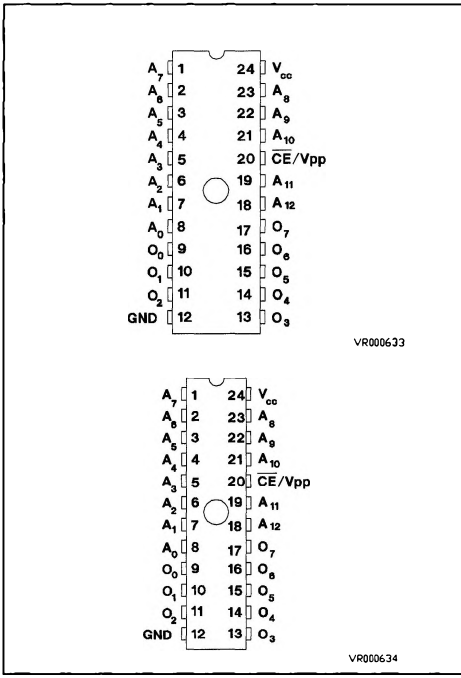
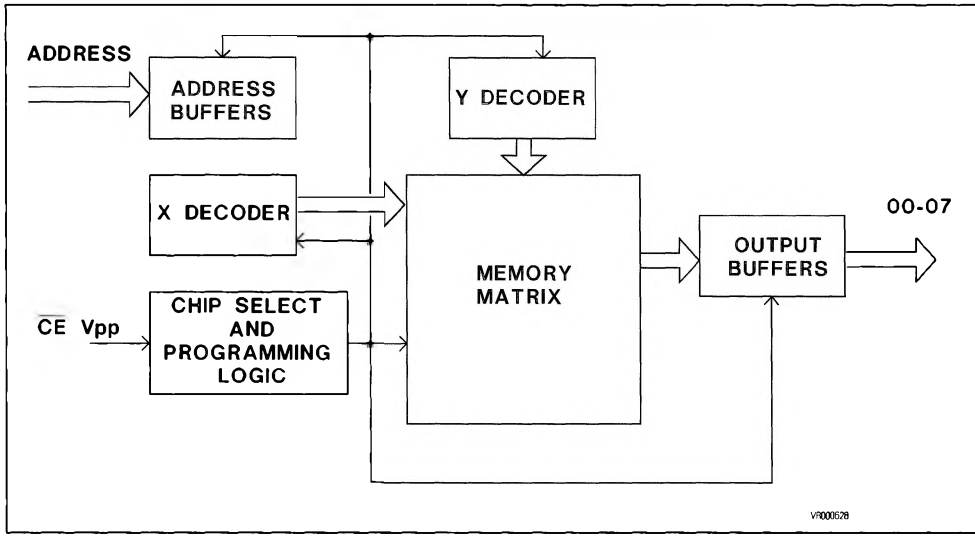


Figure 2 : Block Diagram



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_I	Input or Output voltages with respect to ground	-0.6 to +7.0	V
V_{PP}	Supply voltage with respect to ground	-0.6 to +14.0	V
V_{A9}	Voltage on A9 with respect to ground	-0.6 to +13.5	V
V_{CC}	Supply voltage with respect to ground	-0.6 to +7.0	V
T_{bias}	Temperature range under bias	-10 to +125	°C
T_{stg}	Storage temperature range	-65 to +150	°C

NOTE : Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is 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.

OPERATING MODES

MODE	$\overline{CE}$ / V_{PP}	A9	OUTPUT
READ / PROGRAM VERIFY	L	X	D_{OUT}
PROGRAM	V_{PP}	X	D_{IN}
STANDBY / PROGRAM INHIBIT	H	X	HIGH Z
ELECTRONIC SIGNATURE	L	V_H	CODE

NOTE : X = Don't care ; V_H = 12V ± 0.5V ; H = High ; L = Low. V_{PP} = 12.5V (see programming section).

READ OPERATION
DC AND AC CONDITIONS

SELECTION CODE	F1	F6
Operating Temperature Range	0°C to +70°C	-40°C to +85°C
SELECTION CODE (Example for 0°C to 70°C Oper. Temp. Range)	**35XF1, 45XF1, 55XF1**	**45F1, 55F1**
V_{CC} Power Supply (1)	5V ± 5%	5V ± 10%

NOTE : "F" stands for ceramic package.

DC AND OPERATING CHARACTERISTICS

Symbol	Parameter	Test Condition	Values		Unit
			Min	Max	
I_{LI}	Input leakage current	V_{IN} = 0 V to V_{CC}	- 10	10	uA
I_{LO}	Output leakage current	V_{IN} = 0 V to V_{CC}	- 10	10	uA
I_{CC1}	V_{CC} Active Current	$\overline{CE}$ = V_{IL}, I_{OUT} = 0 mA (F = 20 MHz)		60	mA
I_{CC2}	V_{CC} Standby Current-TTL	$\overline{CE}$ = V_{IH}		20	mA
V_{IL}	Input Low Voltage		- 0.3	0.5	V
V_{IH}	Input High Voltage		2.2	V_{CC} + 1.0	V
V_{OL}	Output Low Voltage	I_{OL} = 16.0 mA		0.5	V
V_{OH}	Output High Voltage	I_{OH} = -4.0 mA	2.4		V

AC CHARACTERISTICS

Symbol	Parameter	Test Condition	27HC641						Unit
			-35		-45		-55		
			Min	Max	Min	Max	Min	Max	
T_{ACC}	Address to Output Delay	$\overline{CE}$ = V_{IL}		35		45		55	ns
T_{CE}	$\overline{CE}$ to Output Delay	$\overline{CE}$ = V_{IL}		20		25		25	ns
T_{DF} (2)	$\overline{CE}$ High to Output Float	$\overline{CE}$ = V_{IL}	0	20	0	25	0	25	ns
T_{OH}	Output Hold from Address or $\overline{CE}$	$\overline{CE}$ = V_{IL}	0		0		0		

CAPACITANCE(3)

(TA = 25°C, f = 1 MHz)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V		4	6	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V		8	12	pF

NOTES :
1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP}.
2. This parameter is only sampled and not 100 % tested. Output Float is defined as the point where data is no longer driven (see timing diagram).
3. This parameter is only sampled and not 100 % tested.

AC TEST CONDITIONS

Input Levels	:	0V and 3V
Reference Levels	:	1.5V

AC TESTING LOAD CIRCUIT

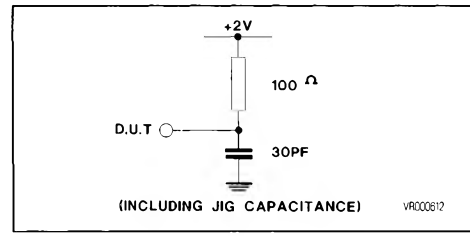
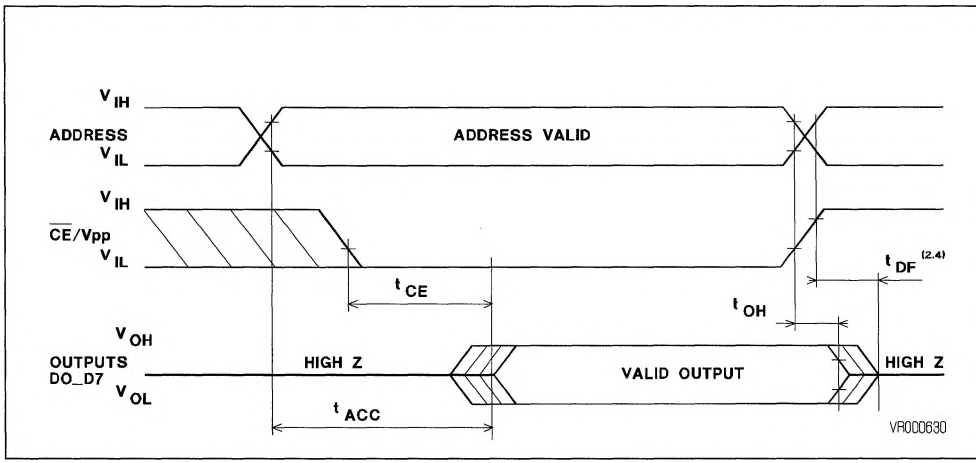


Figure 3 : AC Waveforms



DEVICE OPERATION

The modes of operation of the M27HC641 are listed in the Operating Modes table. A single 5V power supply is required in the read mode. All inputs are TTL levels except for Vpp and 12V on A9 for Electronic Signature.

READ MODE

The M27HC641 has one control function which must be logically active in order to obtain data at the outputs : Chip Enable ($\overline{CE}$/V_{PP}), active low. Assuming that the addresses are stable, the address access time (t_{ACC}) is equal to the delay from CE to output (t_{CE}).

STANDBY MODE

The M27HC641 has a standby mode which reduces the maximum active current from 60 mA to 20 mA. The M27HC641 is placed in the standby mode by applying a CMOS high signal to the $\overline{CE}$/V_{PP} input. When in the standby mode, the outputs are in a high impedance state.

PROGRAMMING

Caution : exceeding 14V on V_{PP} pin will permanently damage the M27HC641.

When delivered (and after each erasure for UV EPROM), all bits of the M27HC641 are in the "1" state. Data is introduced by selectively programming "0s" into the desired bit locations. Although only "0s" will be programmed, both "1s" and "0s" can be present in the data word. The only way to change a "0" to a "1" is by die exposition to ultraviolet light (UV EPROM). The M27HC641 is in the programming mode when $\overline{CE}$/V_{PP} input is at 12.50V. The data to be programmed is applied 8 bits in parallel, to the data output pins. The levels required for the address and data inputs are TTL. V_{CC} is specified to be 6.00V

FAST PROGRAMMING ALGORITHM

Fast programming algorithm rapidly programs M27HC641 using an efficient and reliable method. A flowchart is shown at the end of data sheet.

Two different pulses are used : Initial (1 ms) and overprogramming (3 X ms). A maximum of 25 "initial" pulses is allowed. A verify is done after each pulse, until a correct verify occurs. An overprogramming pulse is then applied, the lengh of which is 3 X ms, where X is the number of initial pulses reached. The entire sequence of programming and verification is done with V_{CC} at 6.0V (programming pulses with V_{PP} at 12.5V).

PROGRAM INHIBIT

Programming of multiple M27HC641s in parallel with different data is also easily accomplished. Except for $\overline{CE}$, all like inputs of the parallel M27HC641 may be common. A 12.5V level pulse applied to a M27HC641's $\overline{CE}/V_{pp}$ input will program that M27HC641. A TTL high level $\overline{CE}$ input inhibits the other M27HC641s from being programmed.

PROGRAM VERIFY

A verify (read) should be performed on the programmed bits to determine that they were correctly programmed. The verify is accomplished with $\overline{CE}$ at V_{IL} and V_{CC} at 5.00V.

ELECTRONIC SIGNATURE

The Electronic Signature mode allows the reading out of a binary code from an EPROM that will identify its manufacturer and type. This mode is intended for use by programming equipment to automatically match the device to be programmed with its corresponding programming algorithm. This mode is functional in the 25°C ± 5°C ambient temperature range that is required when programming the M27HC641. To activate this mode, the programming equipment must force 11.5V to 12.5V on address line A9 of the M27HC641. Two identifier bytes may then be sequenced from the device outputs by toggling address line A0 from V_{IL} to V_{IH}. All other address lines must be held at V_{IL} during Electronic Signature mode. Byte 0 (A0=V_{IL}) represents the manufacturer code and byte 1 (A0=V_{IH}) the device identifier code. For the SGS-THOMSON M27HC641, these two identifier bytes are given here below, and can be read-out on outputs O0 to O7.

ERASURE OPERATION (applies for UV EPROM)

The erasure characteristics of the M27HC641 is such that erasure begins when the cells are exposed to light with a wavelength shorter than approximately 4000 Angstrom. It should be noted that sunlight and some type of fluorescent lamps have wavelengths in the 3000-4000 Å range. Research shows that constant exposure to room level fluorescent lighting could erase a typical M27HC641 in about 3 years, while it would take approximately 1 week to cause erasure when exposed to direct sunlight. If the M27HC641 is to be exposed to these types of lighting conditions for extended periods of time, it is suggested that opaque labels be put over the M27HC641 window to prevent unintentional erasure. The recommended erasure procedure for the M27HC641 is exposure to short wave ultraviolet light which has wavelength 2537 Å. The integrated dose (i.e. UV intensity x exposure time) for erasure should be a minimum of 15 Wsec/cm2. The erasure time with this dosage is approximately 15 to 20 minutes using an ultraviolet lamp with 12000 µW/cm2 power rating. The M27HC641 should be placed within 2.5 cm (1inch) of the lamp tubes during the erasure. Some lamps have a filter on their tubes which should be removed before erasure.

ELECTRONIC SIGNATURE MODE

IDENTIFIER	PINS									
	A0	O7	O6	O5	O4	O3	O2	01	O0	Hex
MANUFACTURER CODE	V_{IL}	0	0	1	0	0	0	0	0	20
DEVICE CODE	V_{IH}	0	0	0	0	0	0	0	1	01

NOTE : A9 = 12V ± 0.5V ; $\overline{CE}$ = VIL ; A1 to A8 = A10 = V_{IL}

PROGRAMMING OPERATION

(T_A = 25°C ± 5°C, V_{CC} = 6.00V ± 0.25V, V_{PP} = 12.50 ± 0.25V) (1)

DC AND OPERATING CHARACTERISTICS

Symbol	Parameter	Test Condition	Values		Unit
			Min	Max	
I_{LI}	Input Leakage Current	V_{IN} = 0V to V_{CC}	-10	10	µA
V_{IL}	Input Low Voltage		-0.1	0.5	V
V_{IH}	Input High Voltage		2.2	V_{CC}+0.5	V
V_{OL}	Output Low Voltage	I_{OL} = 2.1 mA		0.45	V
V_{OH}	Output High Voltage	I_{OH} = - 400 uA	2.4		V
I_{CC2}	V_{CC} Active Current			60	mA
I_{PP2}	V_{PP} Active Current	$\overline{CE}$ = V_{IL}		60	mA
V_{ID}	A9 Electronic Signature Voltage		11.5	12.5	V

AC CHARACTERISTICS

Symbol	Parameter	Test Condition	Values		Unit
			Min	Max	
t_{AS}	Address Setup Time		2		µs
t_{DS}	Data Setup Time		2		µs
t_{AH}	Address Hold Time		0		µs
t_{DH}	Data Hold Time		2		µs
$t_{DFP(2)}$	Chip Enable Output Float Delay		0	130	µs
t_{VCS}	V_{CC} Setup Time		2		µs
t_{PW}	$\overline{CE}$ Initial Program Pulse Width		0.95	1.05	ms
t_{OPW}	Overprogram Pulse Width		2.85	78.75	ms
t_{CE}	Data Valid from $\overline{CE}$			100	ns

NOTES : 1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP}.
2. This parameter is only sampled and not 100 % tested.
Output Float is defined as the point where data is no longer driven (see timing diagram).

Figure 4 : Programming Flowchart

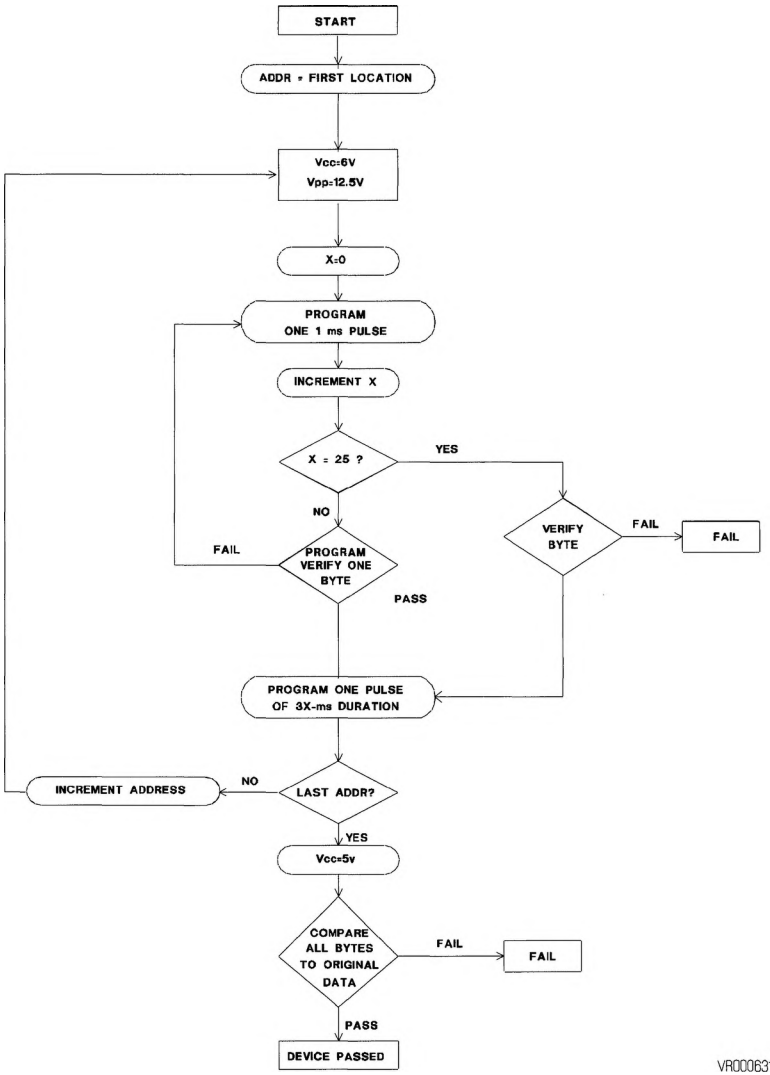
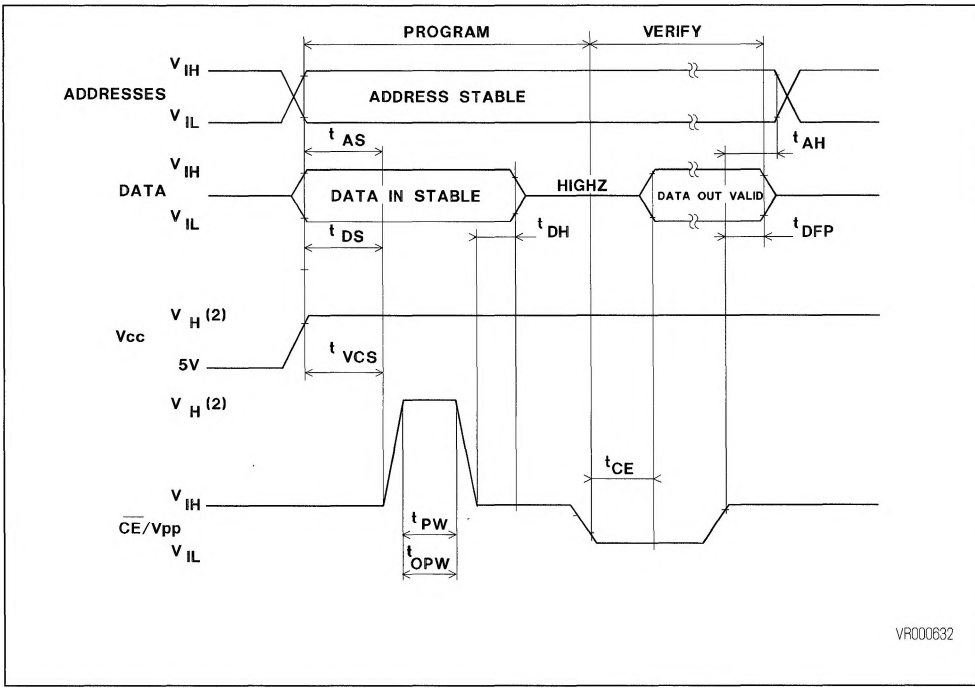


Figure 5 : Programming Waveforms



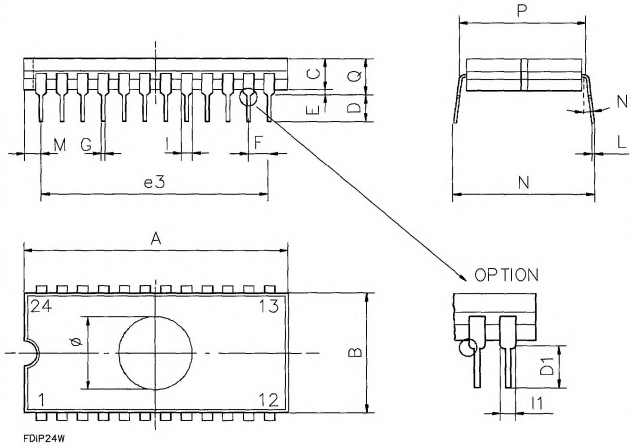
NOTES : 1. t_{DFP} is a characteristic of the device but must be accommodated by the programmer.
2. V_{CC} = 6.0 ± 0.25V, $\overline{CE}$ / V_{PP} = 12.5 ± 0. V for fast programming algorithm.

ORDERING INFORMATION (UV EPROM)

Part Number	Access Time	Supply Voltage	Temp. Range	Package
M27HC641-45XF1	45 ns	5V ± 5%	0°C to +70°C	FDIP24-W 600 mils
M27HC641-35XFS1	35 ns	5V ± 5%	0°C to +70°C	FDIP24-W 300 mils
M27HC641-45XFS1	45 ns	5V ± 5%	0°C to +70°C	FDIP24-W 300 mils
M27HC641-45FS1	45 ns	5V ± 10%	0°C to +70°C	FDIP24-W 300 mils
M27HC641-55XFS1	55 ns	5V ± 5%	0°C to +70°C	FDIP24-W 300 mils

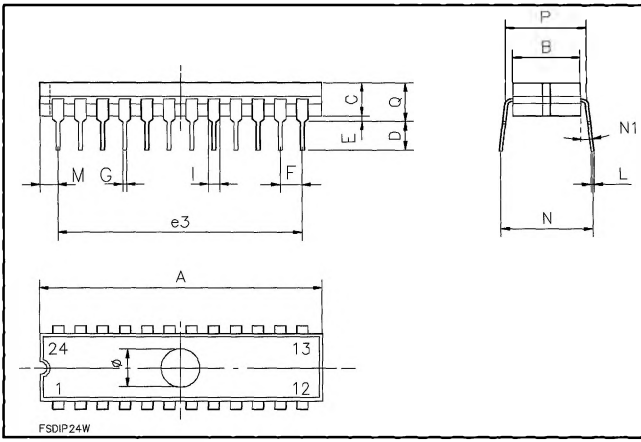
PACKAGE MECHANICAL DATA - UV EPROM

Figure 6 : 24-PIN CERAMIC DIP BULL'S EYE



Dim.	mm			inches		
	Min	Typ	Max	Min	Typ	Max
A			32.00			1.259
B	13.05		13.36	.514		.526
C	3.90		5.08	.154		.200
D	3.00			.118		
D1	3.40			.134		
E	0.50		1.78	.020		.070
e3		27.94			1.10	
F	2.29		2.79	.090		.110
G	0.40		0.55	.016		.022
I	1.17		1.42	.046		.056
I1	1.27		1.52	.050		.060
L	0.22		0.31	.009		.012
M	1.52		2.49	.060		.098
N						
N1	0°		10°	0°		10°
P	15.40		15.80	.606		.622
Q			5.71			.225
Ø	6.86		7.36	.270		.290

Figure 7 : 24-PIN CERAMIC DIP BULL'S EYE - SKINNY - 300 MILS



Dim.	mm			inches		
	Min	Typ	Max	Min	Typ	Max
A			32.00			1.259
B			7.80			.307
C						
D	3.40			.134		
E	0.50		1.78	.020		.070
e3		27.94			1.10	
F	2.29		2.79	.090		.110
G	0.40		0.55	.016		.022
I	1.27		1.52	.050		.060
L	0.22		0.31	.009		.012
M	0.51		1.27	.020		.050
M						
N1	0°		10°	0°		10°
P	7.90		8.13	.311		0.320
Q			5.71			.225
Ø	4.24		4.39	.167		.173