JR 11-3-94

DENSE-PAC MICROSYSTEMS

0.5 Megabit CMOS EEPROM

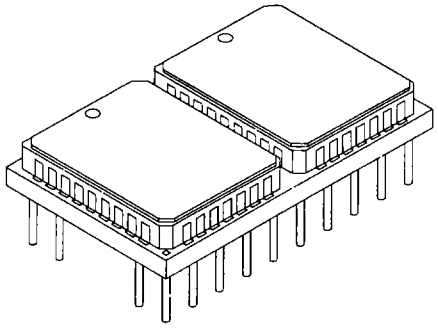
DPE32X16A

DESCRIPTION:

The DPE32X16A is a high-performance Electrically Erasable and Programmable Read Only Memory (EEPROM) module and may be organized as 32K X 16, or 64K X 8.

The module is built with two low-power CMOS 32K X 8 EEPROMs. The two chip enables are used for individual BW* selection. The DPE32X16A is ideally suited for those computer systems having 16-bit architectures.

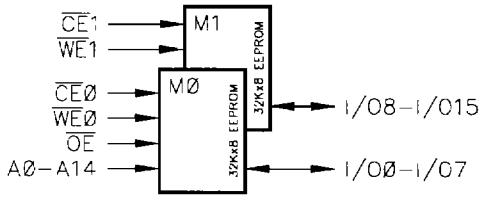
The DPE32X16A contains a 64-BW page register to allow writing of up to 64 BWs simultaneously. During a write cycle, the address and 1 to 64 BWs of data are internally latched, freeing the address and data bus for other operations. Following the initiation of a write cycle, the module will automatically write the latched data using an internal control timer. The end of a write cycle can be detected by $\overline{DATA}$ Polling of the most significant data bit in each byte. Once the end of a write cycle has been detected, a new access for a read or write can begin.



FEATURES:

- Fast Access Times: 55, 70, 90, 120, 150, 200, 250ns
- Automatic Page Write Operation:
  - Internal Address and Data Latches
  - Internal Control Timer
- Fast Write Cycle Times:
  - Page Write Cycle Time: 10ms maximum
  - 1 to 64 BW* Page Write Operation
- $\overline{DATA}$ Polling for END of Write Detection
- High Reliability CMOS Technology
  - Endurance: 10^4 Cycles
  - Data Retention: 10 years
- Single +5V Power Supply, ±10% Tolerance
- CMOS and TTL Compatible Inputs and Outputs
- Available with All Semiconductor Components Compliant to MIL-STD-883; Class B
- 40-Pin PGA (Grid Array) Package

FUNCTIONAL BLOCK DIAGRAM



PIN NAMES	
A0 - A14	Address Inputs
I/O0 - I/O15	Data In/Out
$\overline{CE0}$, $\overline{CE1}$	Chip Enables
$\overline{WE0}$, $\overline{WE1}$	Write Enables
$\overline{OE}$	Output Enable
V_{DD}	Power (+5V)
V_{SS}	Ground
N.C.	No Connect

* Byte or Word (BW)

PIN-OUT DIAGRAM

(TOP VIEW)

$\overline{CE0}$	1	I/O6	11	21	I/O7	31	VDD
A9	2	I/O5	12	22	I/O2	32	AØ
A10	3	I/O4	13	23	I/O1	33	A1
A11	4	I/O3	14	24	I/OØ	34	A2
A12	5	$\overline{OE}$	15	25	A3	35	A4
A13	6	$\overline{WE1}$	16	26	$\overline{WEØ}$	36	A5
A14	7	I/O14	17	27	I/O15	37	A6
N.C.	8	I/O13	18	28	I/O10	38	A7
N.C.	9	I/O12	19	29	I/O9	39	A8
VSS	10	I/O11	20	30	I/O8	40	$\overline{CE1}$

ABSOLUTE MAXIMUM RATINGS [1]			
Symbol	Parameter	Value	Unit
T_{STG}	Storage Temperature	-65 to +125	°C
T_{BIAS}	Temperature Under Bias	-55 to +125	°C
V_{DD}	Supply Voltage [2]	-0.5 to +7.0	°C
$V_{I/O}$	Input/Output Voltage [2]	-0.5 to +7.0	V

RECOMMENDED OPERATING RANGE [1]						
Symbol	Characteristic		Min.	Typ.	Max.	Unit
V_{DD}	Supply Voltage [4]		4.5	5.0	5.5	V
V_{IH}	Input HIGH Voltage		2.2		V_{DD}+0.3	V
V_{IL}	Input LOW Voltage		-0.1 [2]		0.8	V
T_A	Operating Temperature	C	0	+25	+70	°C
		I	-40	+25	+85	
		M/B	-55	+25	+125	

AC TEST CONDITIONS	
Input Pulse Levels	0V to 3.0V
Input Pulse Rise and Fall Times	5ns*
Input and Output Timing Reference Levels	1.5V

* Transition between 0.8V and 2.2V.

OUTPUT LOAD		
Load	C_L	Parameters Measured
1	100pF	except t_{DF}
2	5pF	t_{DF}

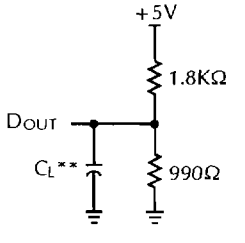
TRUTH TABLE				
Mode	$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	I/I Pin
Standby	H	X	X	HIGH-Z
Read	L	L	H	D_{OUT}
Write	L	H	L	D_{IN}
Write Inhibit	X	L	X	HIGH-Z
Write Inhibit	X	X	H	HIGH-Z

L = LOW H = HIGH X = Don't Care

CAPACITANCE [3]: T_A = 25°C, F = 1.0MHz				
Symbol	Parameter	Max.	Unit	Condition
C_{CE}	Chip Enable	15	pF	V_{IN} = 0V
C_{ADR}	Address Input	35		
C_{WE}	Write Enable	15		
C_{OE}	Output Enable	35		
$C_{I/O}$	Data Input/Output	25		

Figure 1. Output Load

** Including Probe and Jig Capacitance.



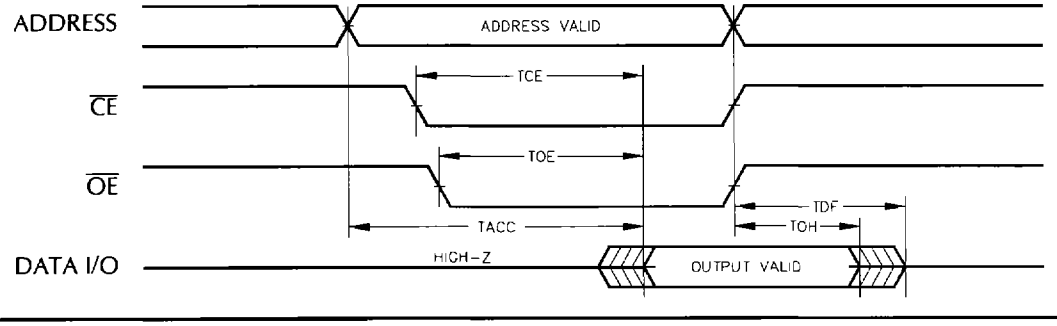
DC OPERATING CHARACTERISTICS: Over operating ranges									
Symbol	Characteristics	Test Conditions		X16		X8		Unit
				Min.	Max.	Min.	Max.	
I_{IN}	Input Leakage Current	V_{IN} = V_{DD} Max.		-10	+10	-10	+10	µA
I_{OUT}	Output Leakage Current	V_{OUT} = V_{DD} Max.		-10	+10	-20	+20	µA
I_{CC}	Operating Supply Current	$\overline{CE}$ = $\overline{OE}$ = V_{IL}, all I/O = 0mA, f = t_{RC} Min.	150 - 250ns		160		90	mA
			55 - 90ns		160		140	
I_{SB1}	V_{DD} Standby Current (TTL)	$\overline{CE}$ = V_{IH}	150 - 250ns		6		6	mA
			55 - 90ns		120		120	
I_{SB2}	V_{DD} Standby Current (CMOS)	$\overline{CE}$ = V_{DD} ± 0.3V	150 - 250ns		0.75		0.75	mA
			55 - 90ns		120		120	
V_{OL}	Output LOW Voltage	I_{OUT} = 2.1mA			0.45		0.45	V
V_{OH}	Output HIGH Voltage	I_{OUT} = -400µA		2.4		2.4		V

AC OPERATING CONDITIONS AND CHARACTERISTICS - READ CYCLE: Over operating ranges [5, 6]																
No.	Symbol	Parameter	55ns		70ns		90ns		120ns		150ns		200ns		250ns		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
1	t_{ACC}	Address to Output Valid		55		70		90		120		150		200		250	ns
2	t_{CE}	Chip Enable to Output Valid		55		70		90		120		150		200		250	ns
3	t_{OE}	Output Enable to Output Valid		30		35		45		50		70		80		100	ns
4	t_{DF}	Chip Enable or Output Enable to Output Float [3]		30		35		45		50		55		55		55	ns
5	t_{OH}	Output Hold from Chip Enable, Output Enable, or Address, Whichever Occurs First	0		0		0		0		0		0		0		ns
6	t_{PUR}	Power-up to Read Operation		100		100		100		100		100		100		100	µs

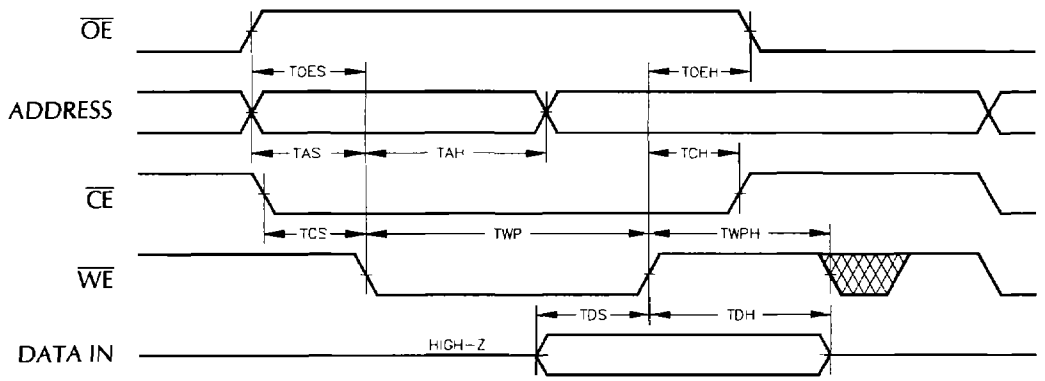
AC OPERATING CONDITIONS AND CHARACTERISTICS - WRITE CYCLE: Over operating ranges [5, 6]					
No.	Symbol	Parameter	Min.	Max.	Unit
7	t_{WC}	Write Cycle Time		10	ms
8	t_{AS}	Address Set-up Time *	0		ns
9	t_{AH}	Address Hold Time	50		ns
10	t_{CS}	Chip Select Set-up Time	0		ns
11	t_{CH}	Chip Select Hold Time	0		ns
12	t_{WP}	Write Pulse Width ($\overline{WE}$ or $\overline{CE}$)	100		ns
13	t_{DS}	Data Set-up Time	50		ns
14	t_{DH}	Data Hold Time	0		ns
15	t_{OES}	Output Enable Set-up Time	0		ns
16	t_{OEH}	Output Enable Hold Time	0		ns
17	t_{WPH}	Write Pulse Width High	50		ns
18	t_{BLC}	Byte Load Cycle Time	0.20	100	µs
19	t_{PUW}	Power-up To Write Operation		5	ms

* Valid for both Read and Write Cycles.

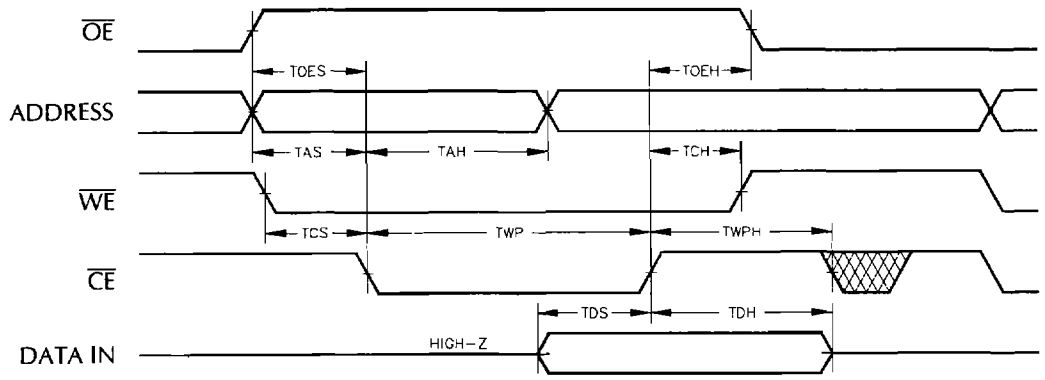
READ CYCLE



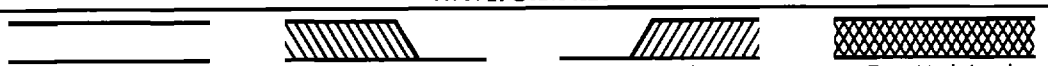
WRITE CYCLE 1: $\overline{WE}$ Controlled.



WRITE CYCLE 2: $\overline{CE}$ Controlled.

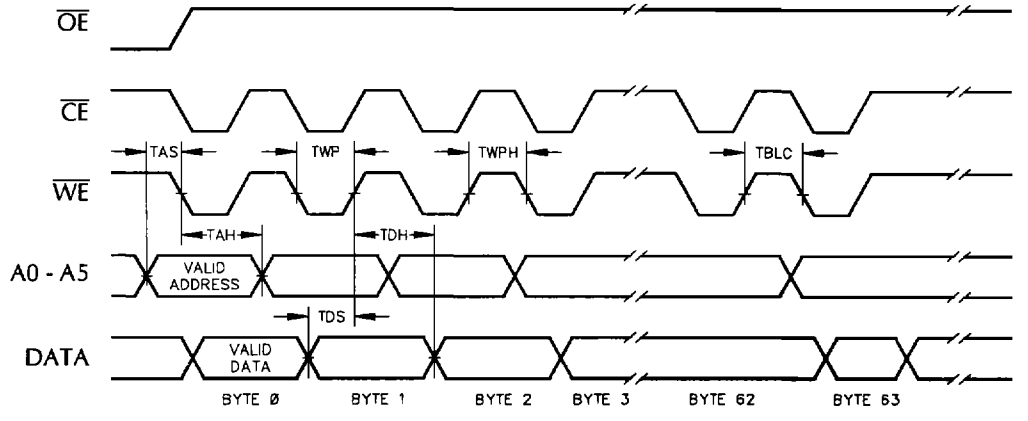


WAVEFORM KEY

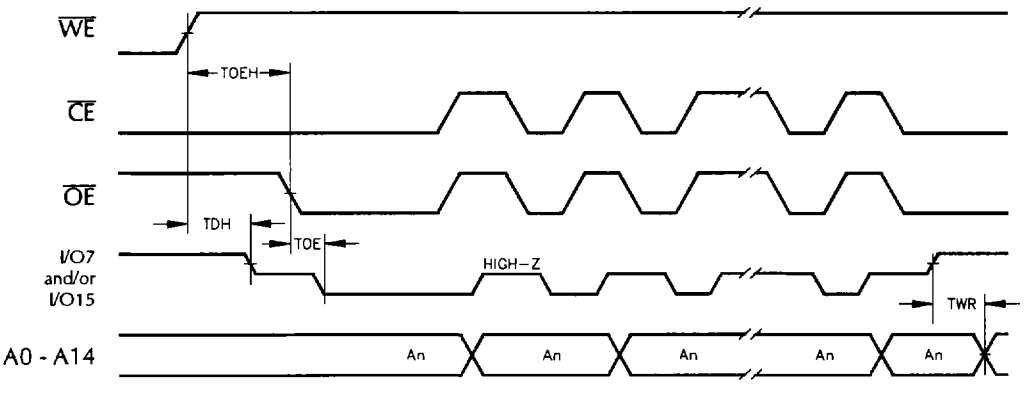


Data Valid	Transition from HIGH to LOW	Transition from LOW to HIGH	Data Undefined or Don't Care

PAGE MODE WRITE WAVEFORM



DATA POLLING WAVEFORM



DEVICE OPERATION

READ: The DPE32X16A is accessed like a Static RAM. When $\overline{CE}$ and $\overline{OE}$ are low and $\overline{WE}$ is high, the data stored at the memory location determined by address pins is asserted on the outputs. The outputs are put in the high impedance state whenever $\overline{CE}$ or $\overline{OE}$ is high. This dual line control gives designers flexibility in preventing bus contention.

WRITE: A low pulse on the $\overline{WE}$ or $\overline{CE}$ input with $\overline{CE}$ or $\overline{WE}$ low *(respectively)* and $\overline{OE}$ high initiates a write cycle. The address is latched on the falling edge of $\overline{CE}$ or $\overline{WE}$, whichever occurs last. The data is latched by the first rising edge of $\overline{CE}$ or $\overline{WE}$. Once a BW* write has been started it will automatically time itself to completion.

PAGE WRITE MODE: The page write operation of the DPE32X16A allows 1 to 64 BWs of data to be loaded into the device and then simultaneously written during the internal programming period. After the first data BW has been loaded into the device, successive BWs may be loaded in the same manner. Each new BW to be written must have its high to low transition on $\overline{WE}$ (or $\overline{CE}$) within 100µs of the low to high transition of $\overline{WE}$ (or $\overline{CE}$) of the preceding BW. If a high to low transition is not detected within 100µs of the last low to high transition, the load period will end and the internal programming period will start. A6 to A14 specify the page address. The page address must be valid during each high to low transition of $\overline{WE}$ (or $\overline{CE}$). A0 to A5 are used to specify which BWs within the page are to be written. The BWs may be loaded in any order and may be changed within the same load period. Only BWs which are specified for writing will be written; unnecessary cycling of other BWs within the page does not occur.

$\overline{DATA}$ POLLING: The DPE32X16A features $\overline{DATA}$ Polling to indicate the end of a write cycle. During a byte or page write cycle an attempted read of the last byte written will result in the compliment of the written data on I/O7 and/or I/O15. Once the the write cycle has been completed, true data is valid on all outputs, and the next cycle may begin. $\overline{DATA}$ Polling may begin at any time during the write cycle.

* Byte or Word

ORDERING INFORMATION

DP E 32 X 16 A – XX X

PREFIX	TYPE	MEMORY DEPTH	DESIG	MEMORY WIDTH	PACKAGE	SPEED	GRADE

GRADE:
- C COMMERCIAL 0°C to +70°C
- I INDUSTRIAL –40°C to +85°C
- M MILITARY –55°C to +125°C
- B* MIL–PROCESSED –55°C to +125°C

SPEED:
- 55 55ns
- 70 70ns
- 90 90ns
- 12 120ns
- 15 150ns
- 17 170ns
- 20 200ns
- 25 250ns

PACKAGE:
- A 40–PIN PGA MODULE

DESIG:
- MODULE WITHOUT SUPPORT LOGIC

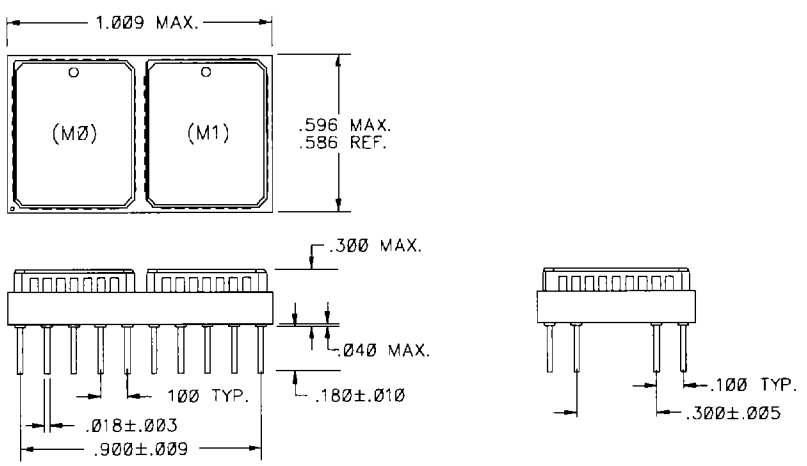
TYPE:
- CMOS EEPROM

* B grade modules are constructed with 883 devices.

NOTES:

1. All voltages are with respect to V_{SS}.
2. -1.0V min. for pulse width less than 20ns (V_{IL} min. = -0.3V at DC level).
3. Stresses greater than those 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 reliability.
4. This parameter is guaranteed and not 100% tested.
5. Transition is measured at the point of ±500mV from steady state voltage.
6. When $\overline{OE}$ and $\overline{CE}$ are LOW and $\overline{WE}$ is HIGH, I/O pins are in the output state; and input signals of opposite phase to the outputs must not be applied.
7. The outputs are in a high impedance state when $\overline{WE}$ is LOW.

MECHANICAL DIAGRAMS



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