Dense-Pac Microsystems, Inc.

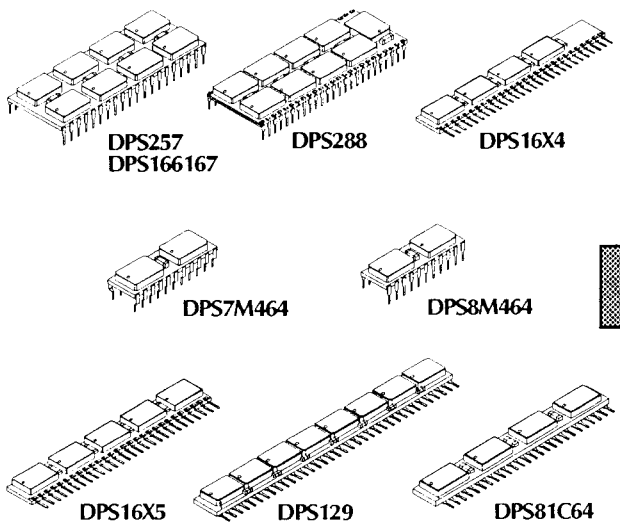
16KX1 BASED

CMOS SRAM FAMILY

DESCRIPTION:

The Dense-Pac 16KX1 Based family consists of fully static CMOS random access memories organized as described below.

These memories are ideally suited for use in large computers, signal processors or battery backup hand held computers. They provide both high speed and low power consumption.

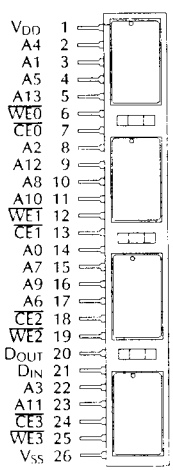


FEATURES:

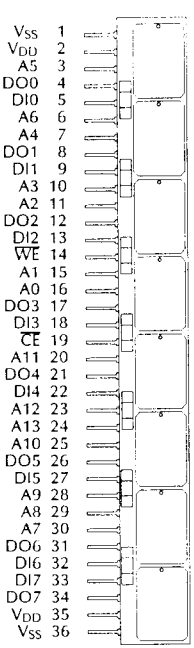
- Organizations Available:
  - DPS81C64 - 64K X 1
  - DPS7M464 - 16K X 4
  - DPS166167 - 128K X 2, 256K X 1
  - DPS8M464 - 16K X 4
  - DPS16X4 - 16K X 4
  - DPS16X5 - 16K X 5
  - DPS129 - 16K X 8
  - DPS257 - 16K X 16, 32K X 8, 64K X 4
  - DPS288 - 16K X 18, 32K X 9
- Single +5V Operation (± 10% Tolerance)
- Fast Access Times: 25, 35 or 45ns (max.) Except for the DPS166167, Which has Access Times of 50, 70, or 90ns (max.)
- Specifications Available Guaranteed Over Full Military Temperatures (-55° to +125°C)
- Low Operating Power
- Completely Static Operation - No Clock or Refresh Required
- TTL Compatible Inputs/Outputs
- Three State Output
- Standard Packages:
  - 22-Pin DIP - DPS7M464,DPS8M464
  - 26-Pin SIP - DPS81C64
  - 28-Pin SIP - DPS16X4, DPS16X5
  - 36-Pin SIP - DPS129
  - 40-Pin DIP - DPS257, DPS166167
  - 50-Pin DIP - DPS288

PIN NAMES	
A0-A15	Address Inputs
D_{IN}, DI0-DI17	Data Input
D_{OUT}, DO0-DO17	Data Output
I/O0-I/O15	Data Input/Output
$\overline{CE}$, $\overline{CE0}$-$\overline{CE17}$	Chip Enables
$\overline{WE}$, $\overline{WE0}$-$\overline{WE17}$	Write Enables
V_{DD}	Power (+5V)
V_{SS}	Ground
NC	No Connect

MODULE PIN-OUT DIAGRAMS

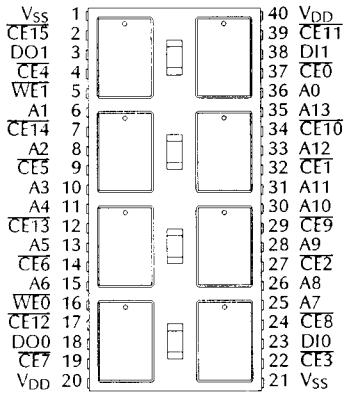


DPS81C64

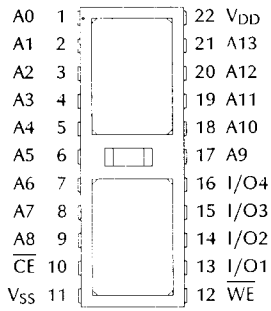


DPS129

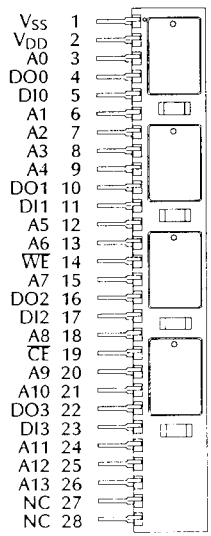
MODULE PIN-OUT DIAGRAMS (Continued)



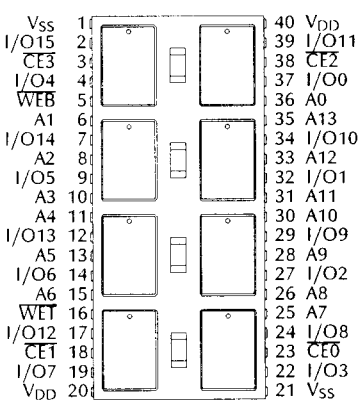
DPS166167



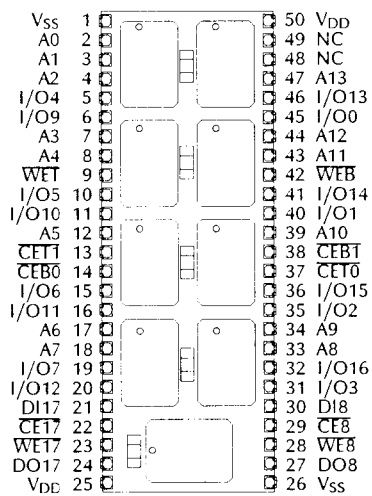
DPS7M464, DPS8M464



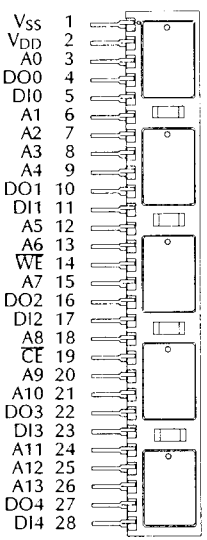
DPS16X4



DPS257

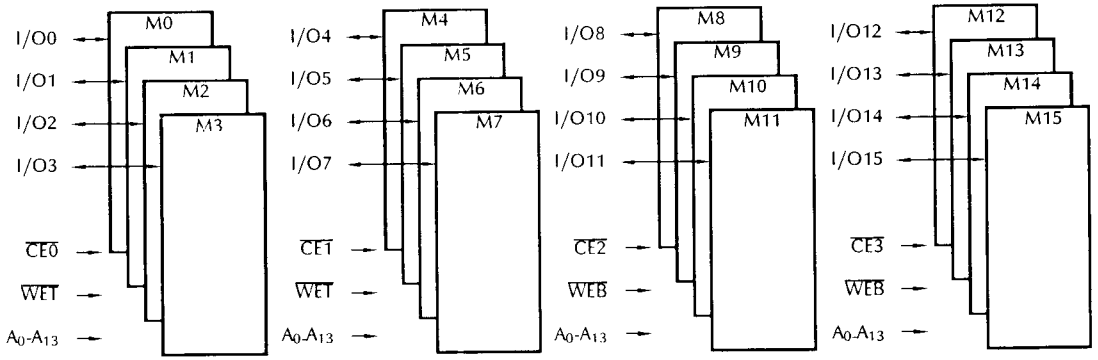


DPS288

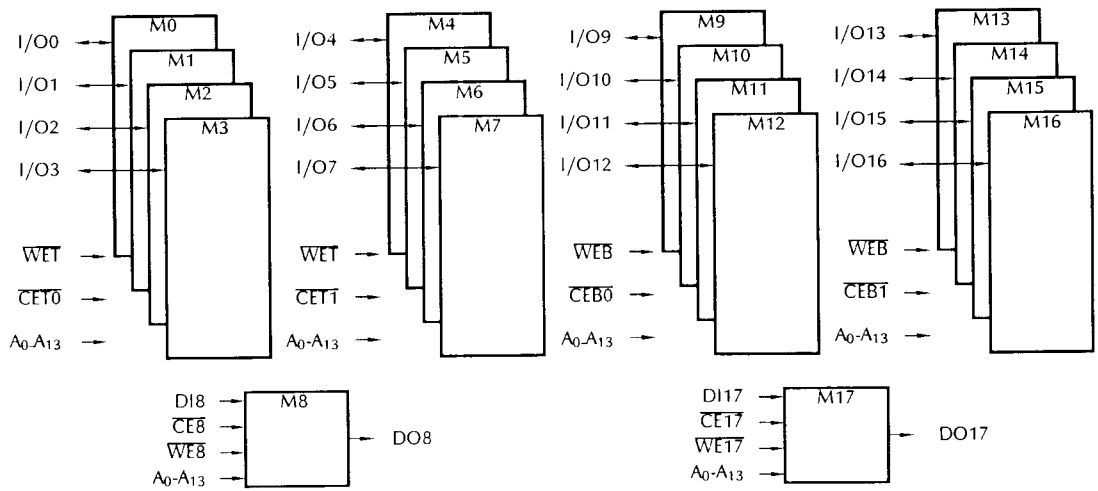


DPS16X5

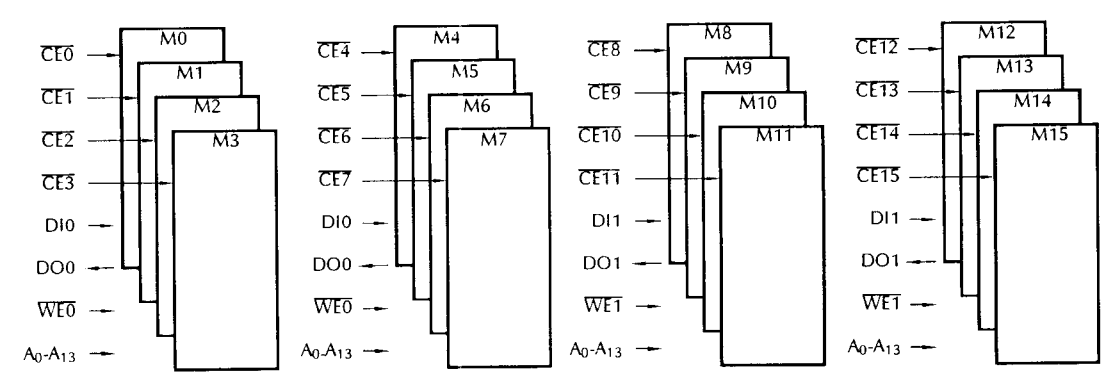
FUNCTIONAL BLOCK DIAGRAMS



DPS257

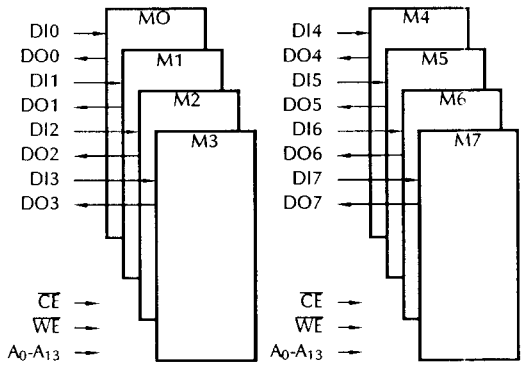


DPS288

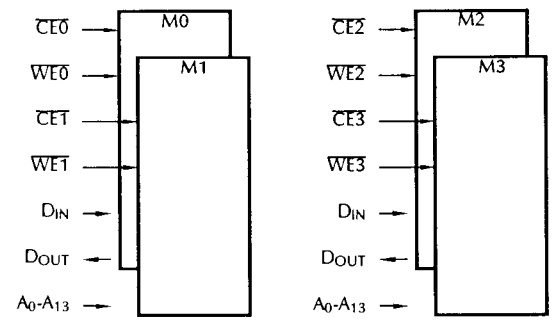


DPS166167

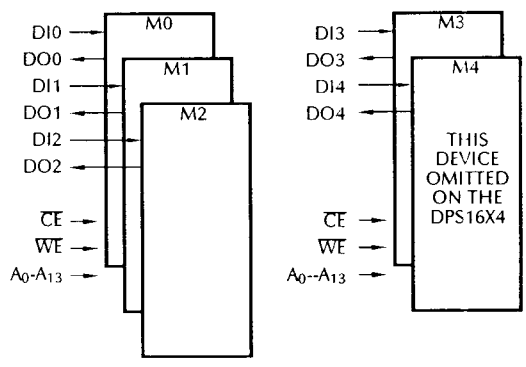
FUNCTIONAL BLOCK DIAGRAMS (Continued)



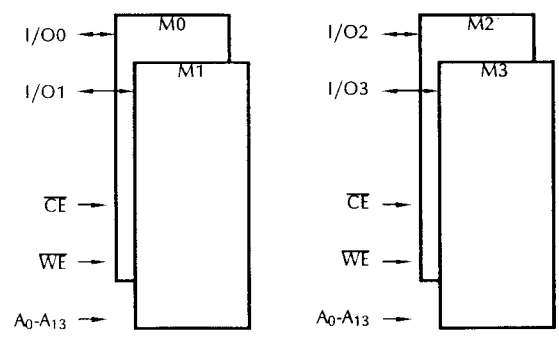
DPS129



DPS81C64



DPS16X4, DPS16X5



DPS7M464, DPS8M464

TRUTH TABLE

Mode	Chip Enable	Write Enable	Data In	Data Out	Power Level
Standby	HIGH	Don't Care	Don't Care	HIGH-Z	Standby
Read	LOW	HIGH	Don't Care	D_{OUT}	Active
Write	LOW	LOW	D_{IN}	HIGH-Z	Active

RECOMMENDED OPERATING RANGE[1]

Symbol	Characteristic	Min.	Typ.	Max.	Unit
V_{DD}	Supply Voltage	4.5	5.0	5.5	V
V_{IH}	Input HIGH Voltage	2.2		$V_{DD}+.5$	V
V_{IL}	Input LOW Voltage[2]	-1.0		0.8	V

ABSOLUTE MAXIMUM RATINGS[3]

Parameter	Value	Unit
Storage Temperature	-65 to +150	°C
Operating Temperature	-55 to +125	°C
Supply Voltage[1]	-0.5 to + 7.0	V

DC OPERATING CHARACTERISTICS: Over operating ranges

Symbol	Characteristics	Test Conditions		DPS129 Max.	DPS257 Max.	DPS288 Max.	DPS16X4 Max.	DPS16X5 Max.	Unit
I_{IN}	Input Leakage Current	$\overline{CE}=V_{IH}$ $V_{IN}=0.5V$ and 5.5V	M	±20	±20	±20	±20	±20	µA
			I	±20	±20	±20	±20	±20	
			C	±20	±20	±20	±20	±20	
I_{OUT}	Output Leakage Current (On Data Outputs)	$\overline{CE}=V_{IH}$ $V_{OUT}=0.V$ and 5.5V	M	±20	±20	±20	±20	±20	µA
			I	±20	±20	±20	±20	±20	
			C	±20	±20	±20	±20	±20	
I_{CCX18}	Operating Power Supply Current (X18 Mode)	$\overline{CE}=V_{IL}$ Output Open	M	-	-	925	-	-	mA
			I	-	-	895	-	-	
			C	-	-	805	-	-	
I_{CCX16}	Operating Power Supply Current (X16 Mode)	$\overline{CE}=V_{IL}$ Output Open	M	-	825	-	-	-	mA
			I	-	800	-	-	-	
			C	-	720	-	-	-	
I_{CCX9}	Operating Power Supply Current (X9 Mode)	$\overline{CE}=V_{IL}$ Output Open	M	-	-	600(465)	-	-	mA
			I	-	-	580(450)	-	-	
			C	-	-	520(405)	-	-	
I_{CCX8}	Operating Power Supply Current (X8 Mode)	$\overline{CE}=V_{IL}$ Output Open	M	415	535(415)	-	-	-	mA
			I	400	515(400)	-	-	-	
			C	360	465(360)	-	-	-	
I_{CCX5}	Operating Power Supply Current (X5 Mode)	$\overline{CE}=V_{IL}$ Output Open	M	-	-	-	-	260	mA
			I	-	-	-	-	250	
			C	-	-	-	-	225	
I_{CCX4}	Operating Power Supply Current (X4 Mode)	$\overline{CE}=V_{IL}$ Output Open	M	-	390(210)	-	210	-	mA
			I	-	375(200)	-	200	-	
			C	-	335(180)	-	180	-	
I_{CC2}	Dynamic Operating Supply Current	Min. Read Cycle Duty = 100%	M	465	925	1040	235	295	mA
			I	460	920	1035	230	290	
			C	410	815	915	210	260	
I_{SB1}	Standby Supply Current	$\overline{CE} \geq V_{IH}$ See Note 4	M	125	245	275	65	80	mA
			I	120	235	265	60	75	
			C	110	210	235	55	70	
I_{SB2}	Full Standby Supply Current	See Note 5	M	2500	5000	5625	1250	1570	µA
			I	450	900	1050	225	285	
			C	215	430	490	110	140	

DC OPERATING CHARACTERISTICS (Continued)

Symbol	Characteristics	Test Conditions		DPS7M464 Max.	DPS8M464 Max.	DPS81C64 Max.	DPS166167 Max.	Unit
I_{IN}	Input Leakage Current	$\overline{CE}=V_{IH}$ $V_{IN}=0.5V$ and 5.5V	M	±15	±15	±15	±20	µA
			I	±15	±15	±15	±20	
			C	±15	±15	±15	±20	
I_{OUT}	Output Leakage Current (On Data Outputs)	$\overline{CE}=V_{IH}$ $V_{OUT}=0.V$ and 5.5V	M	±15	±15	±15	±20	µA
			I	±15	±15	±15	±20	
			C	±15	±15	±15	±20	
I_{CCX4}	Operating Power Supply Current (X4 Mode)	$\overline{CE}=V_{IL}$ Output Open	M	210	210	-	-	mA
			I	200	200	-	-	
			C	180	180	-	-	
I_{CCX2}	Operating Power Supply Current (X2 Mode)	$\overline{CE}=V_{IL}$ Output Open	M	-	-	-	315(115)	mA
			I	-	-	-	305(105)	
			C	-	-	-	270(95)	
I_{CCX1}	Operating Power Supply Current (X1 Mode)	$\overline{CE}=V_{IL}$ Output Open	M	-	-	100(60)	280(65)	mA
			I	-	-	95(55)	270(55)	
			C	-	-	85(50)	240(50)	
I_{CC2}	Dynamic Operating Supply Current	Min. Read Cycle Duty = 100%	M	235	235	105(65)	325(125)	mA
			I	230	230	100(60)	275(115)	
			C	210	210	90(55)	280(105)	
I_{SB1}	Standby Supply Current	$\overline{CE} \geq V_{IH}$ See Note 4	M	65	65	65	245	mA
			I	60	60	60	235	
			C	55	55	55	210	
I_{SB2}	Full Standby Supply Current	See Note 5	M	1300	1300	1300	5000	µA
			I	2200	220	220	900	
			C	100	100	100	425	

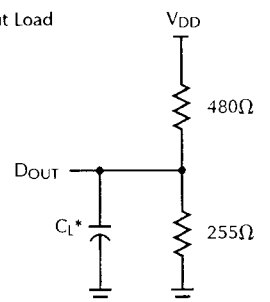
NOTE: Dense-Pac has other specialized suppliers that may provide better D.C. Characteristics. Data retention furnished upon request (2V & 3V modes). Values in parentheses are valid when all inputs are at CMOS levels.

CAPACITANCE[6]: T_A = 25°C, F=1.0MHz								
Parameter/ Symbol	Address C_{ADR}	$\overline{CE}$ C_{CE}	$\overline{WE}$ C_{WE}	Data In/Out $C_{I/O}$	Data In C_{IN}	Data Out C_{OUT}	Unit	Conditions
Part No.	Max.	Max.	Max.	Max.	Max.	Max.		
DPS129	80	70	70	-	20	20	pF	V_{IN} = 0V
DPS257	120	40	50	80	-	-		
DPS288	150	40	50	80	25	25		
DPS16X4	40	20	20	-	20	20		
DPS16X5	50	25	25	-	20	20		
DPS81C64	40	20	8	-	20	22		
DPS7M464	25	20	20	15	-	-		
DPS8M464	25	20	20	15	-	-		
DPS166167	120	40	40	-	80	80		

AC TEST CONDITIONS	
Input Pulse Levels	0.5V to 2.5V
Input Pulse Rise and Fall Times	5ns
Input and Output Timing Reference Levels	0.8V and 2.2V

OUTPUT LOAD		
Load	C_L	Parameters Measured
1	30pF	except t_{EHQZ}, t_{ELQX}, t_{WLQZ} and t_{WHQZ}
2	5pF	for t_{EHQZ}, t_{ELQZ}, t_{WLQZ} and t_{WHQZ}

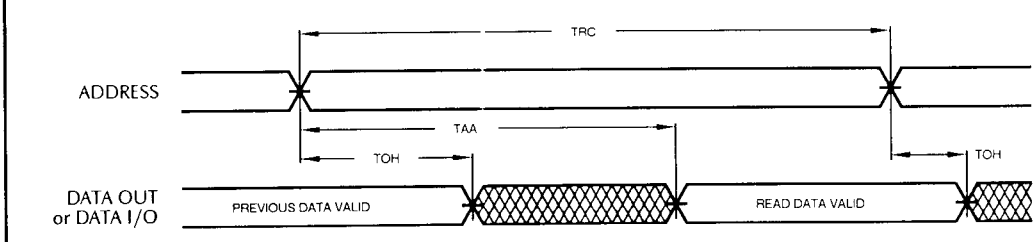
Figure 1. Output Load



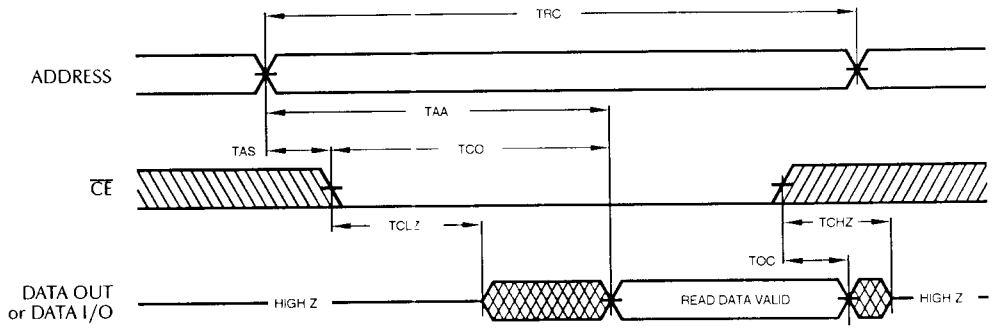
*Including jig and scope capacitance

AC OPERATING CONDITIONS AND CHARACTERISTICS - READ CYCLE: Over operating ranges									
No.	Symbol	Parameter	-25		-35		-45		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
1	t_{RC}	Read Cycle Time	25		35		45		ns
2	t_{AA}	Address Access Time		25		35		45	ns
3	t_{CO}	Chip Enable to Output Valid		25		35		45	ns
4	t_{OH}	Output Hold from Address Change	5		5		5		ns
5	t_{CLZ}	Chip Enable to Output in LOW-Z [7,8]	5		5		5		ns
6	t_{CHZ}	Chip Enable to Output in HIGH-Z [7,8]	0	25	0	25	0	25	ns
7	t_{OH}	Output Hold from Chip Enable	0	10	0	10	0	10	ns

READ CYCLE 1: Address Controlled. $\overline{WE}$ is HIGH, $\overline{CE}$ is LOW



READ CYCLE 2: $\overline{CE}$ Controlled. $\overline{WE}$ is HIGH.



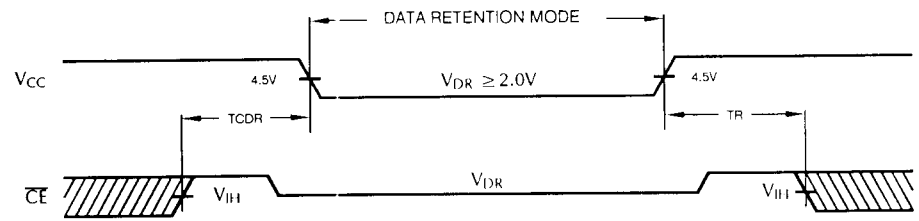
2

AC OPERATING CONDITIONS AND CHARACTERISTICS - WRITE CYCLE: Over operating ranges [9, 10]

No.	Symbol	Parameter	-25		-35		-45		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
8	t_{WC}	Write Cycle Time	25		35		45		ns
9	t_{AW}	Address Valid to End of Write	20		30		35		ns
10	t_{CW}	Chip Enable to End of Write	20		30		35		ns
11	t_{DW}	Data Valid to End of Write	20		20		20		ns
12	t_{DH}	Data Hold Time	0		0		0		ns
13	t_{WP}	Write Pulse Width	20		20		25		ns
14	t_{AS}	Address Setup Time*	0		0		0		ns
15	t_{AH}	Address Hold Time	0		0		0		ns
16	t_{WZ}	Write Enable to Output in HIGH-Z	0	20	0	25	0	25	ns
17	t_{WLZ}	Write Enable to Output in LOW-Z	0	20	0	25	0	25	ns

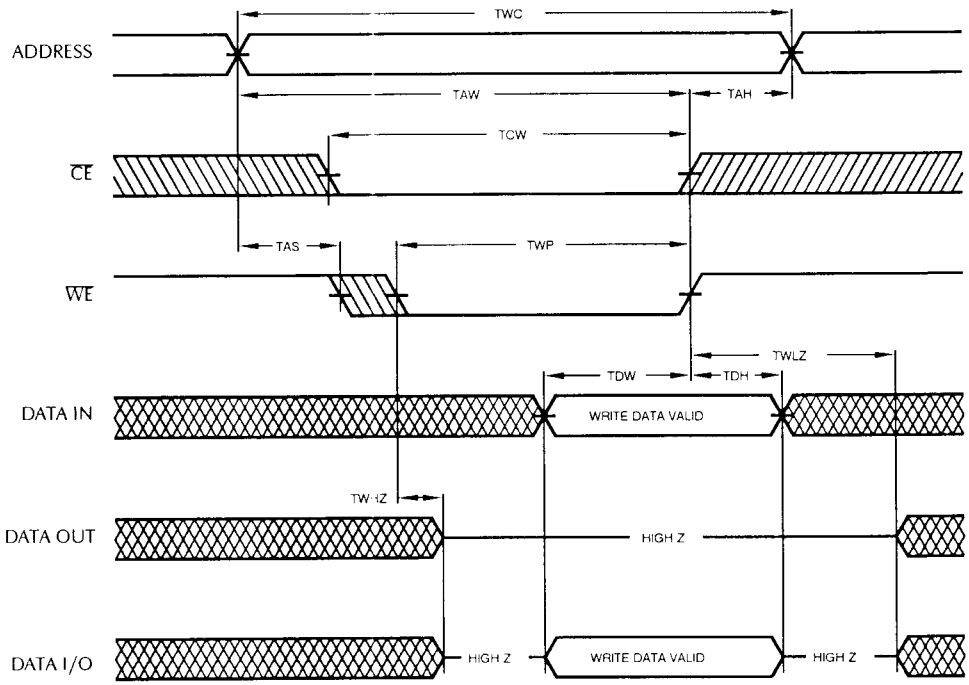
* Valid for both read and write cycles.

DATA RETENTION TIMING

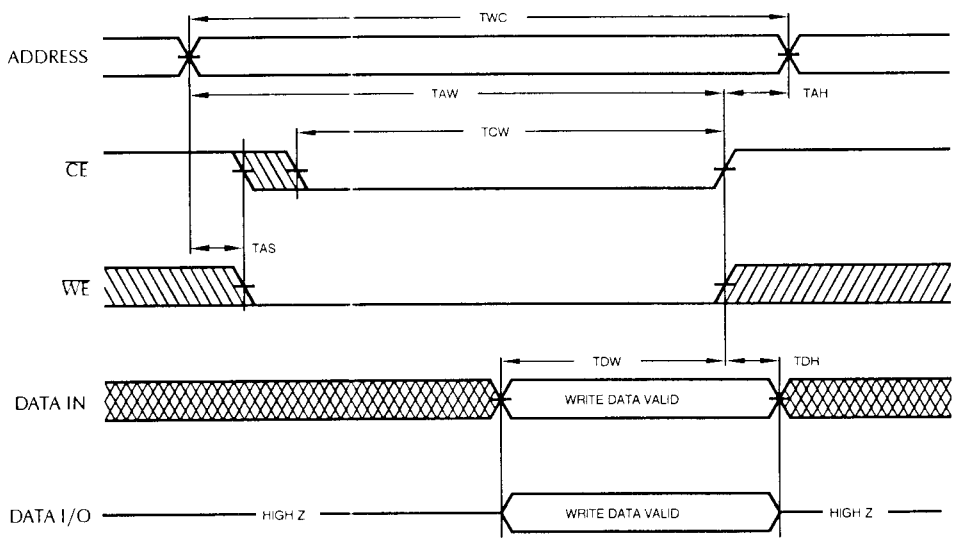


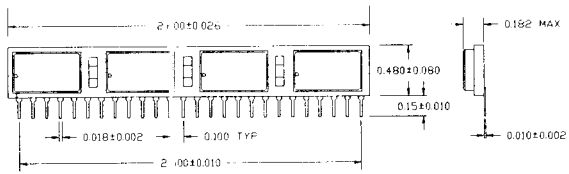
WAVEFORM KEY

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

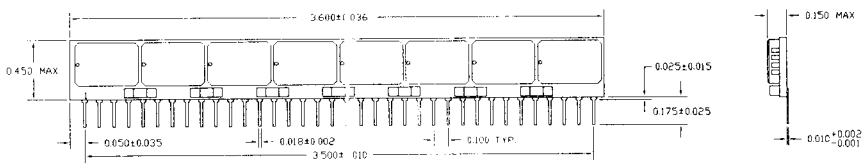


WRITE CYCLE 2: $\overline{CE}$ Controlled.

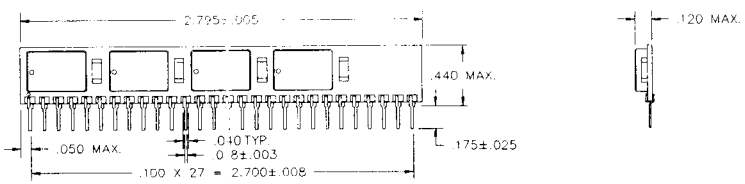




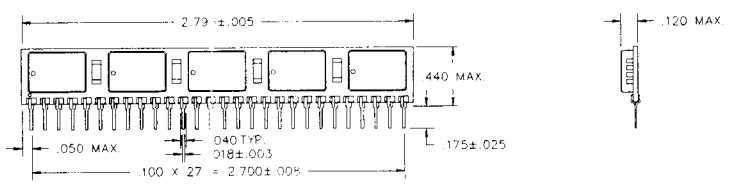
DPS81C64



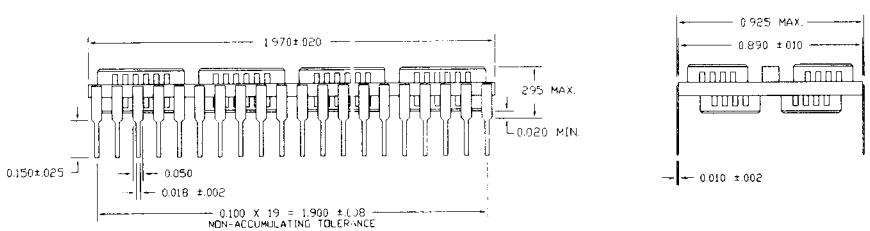
DPS129



DPS16X4

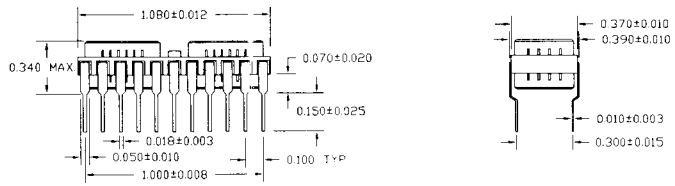


DPS16X5

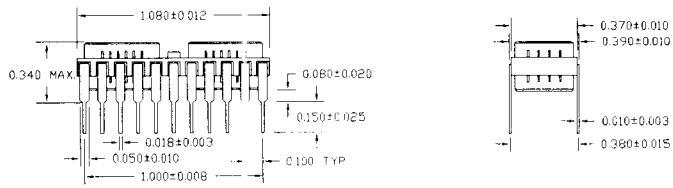


DPS166167, DPS257

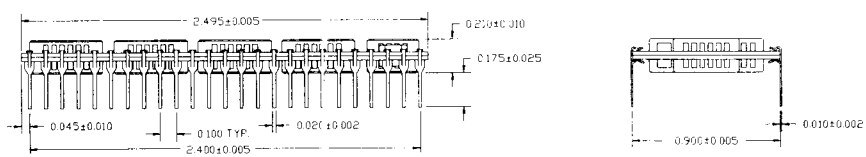
MECHANICAL DIAGRAMS (Continued)



DPS7M464



DPS8M464



DPS288

NOTES:

1. All voltages are referenced to V_{SS} pin = 0V.
2. -3.0V min. for pulse width less than 20ns. (V_{IL} min. = 5.0V at DC level).
3. Stresses greater than those listed under **ABSOLUTE MAXIMUM RATINGS** may cause permanent damage to the device. This is a stress rating only and the functional operation of this 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 measured with Chip Enable ($\overline{CE}$) at V_{IL} max. and inputs at valid TTL levels (V_{IL} max. or V_{IH} min.).
5. This parameter is measured with input levels either $\geq V_{DD}$ -0.2V or $\leq$ 0.2V, including $\overline{CE}$ which must be $\geq V_{DD}$ -0.2V. This condition results in a significant reduction in current to the input buffer circuitry, and consequently a lower overall current level.
6. This parameter is sampled but not 100% tested.
7. Transition is measured at the point of $\pm$ 100mV from steady state voltage.
8. This parameter is measured with specified loading in Figure 1, Output Load.
9. When $\overline{CE}$ is low and $\overline{WE}$ is HIGH the I/O pins are in the output state so that the input signals of opposite phase to the outputs must not be applied.
10. The outputs are in a high impedance state when $\overline{WE}$ is LOW.

ORDERING INFORMATION FOR NON-RESTRICTED PARTS

Part Number	Access Time	Temperature	Part Number	Access Time	Temperature
DPS129-25C	25ns	0 to 70°C	DPS129-35C	35ns	0 to 70°C
DPS129-45C	45ns	0 to 70°C	DPS129-25I	25ns	-40 to 85°C
DPS129-35I	35ns	-40 to 85°C	DPS129-45I	45ns	-40 to 85°C
DPS129-25M	25ns	-55 to 125°C	DPS129-35M	35ns	-55 to 125°C
DPS129-45M	45ns	-55 to 125°C			
DPS257-25C	25ns	0 to 70°C	DPS257-35C	35ns	0 to 70°C
DPS257-45C	45ns	0 to 70°C	DPS257-25I	25ns	-40 to 85°C
DPS257-35I	35ns	-40 to 85°C	DPS257-45I	45ns	-40 to 85°C
DPS257-25M	25ns	-55 to 125°C	DPS257-35M	35ns	-55 to 125°C
DPS257-45M	45ns	-55 to 125°C			
DPS288-25C	25ns	0 to 70°C	DPS288-35C	35ns	0 to 70° C
DPS288-45C	45ns	0 to 70°C	DPS288-25I	25ns	-40 to 85°C
DPS288-35I	35ns	-40 to 85°C	DPS288-45I	45ns	-40 to 85°C
DPS288-25M	25ns	-55 to 125°C	DPS288-35M	35ns	-55 to 125°C
DPS288-45M	45ns	-55 to 125°C			
DPS166167-50C	50ns	0 to 70°C	DPS166167-70C	70ns	0 to 70°C
DPS166167-90C	90ns	0 to 70°C	DPS166167-50I	50ns	-40 to 85°C
DPS166167-70I	70ns	-40 to 85°C	DPS166167-90I	90ns	-40 to 85°C
DPS166167-50M	50ns	-55 to 125°C	DPS166167-70M	70ns	-55 to 125°C
DPS166167-90M	90ns	-55 to 125°C			

ORDERING INFORMATION FOR RESTRICTED PARTS: See Note Below

Part Number	Access Time	Temperature	Part Number	Access Time	Temperature
DPS16X4-25C	25ns	0 to 70°C	DPS16X4-35C	35ns	0 to 70°C
DPS16X4-45C	45ns	0 to 70°C	DPS16X4-25I	25ns	-40 to 85°C
DPS16X4-35I	35ns	-40 to 85°C	DPS16X4-45I	45ns	-40 to 85°C
DPS16X4-25M	25ns	-55 to 125°C	DPS16X4-35M	35ns	-55 to 125°C
DPS16X4-45M	45ns	-55 to 125°C			
DPS16X5-25C	25ns	0 to 70°C	DPS16X5-35C	35ns	0 to 70°C
DPS16X5-45C	45ns	0 to 70°C	DPS16X5-25I	25ns	-40 to 85°C
DPS16X5-35I	35ns	-40 to 85°C	DPS16X5-45I	45ns	-40 to 85°C
DPS16X5-25M	25ns	-55 to 125°C	DPS16X5-35M	35ns	-55 to 125°C
DPS16X5-45M	45ns	-55 to 125°C			
DPS7M464-25C	25ns	0 to 70°C	DPS7M464-35C	35ns	0 to 70°C
DPS7M464-45C	45ns	0 to 70°C	DPS7M464-25I	25ns	-40 to 85°C
DPS7M464-35I	35ms	-40 to 85°C	DPS7M464-45I	45ns	-40 to 85°C
DPS7M464-25M	25ns	-55 to 125°C	DPS7M464-35M	35ns	-55 to 125°C
DPS7M464-45M	45ns	-55 to 125°C			
DPS8M464-25C	25ns	0 to 70°C	DPS8M464-35C	35ns	0 to 70°C
DPS8M464-45C	45ns	0 to 70°C	DPS8M464-25I	25ns	-40 to 85°C
DPS8M464-35I	35ns	-40 to 85°C	DPS8M464-45I	45ns	-40 to 85°C
DPS8M464-25M	25ns	-55 to 125°C	DPS8M464-35M	35ns	-55 to 125°C
DPS8M464-45M	45nd	-55 to 125°C			
DPS81C64-25C	25ns	0 to 70°C	DPS81C64-35C	35ns	0 to 70°C
DPS81C64-45C	45ns	0 to 70°C	DPS81C64-25I	25ns	-40 to 85°C
DPS81C64-35I	35ns	-40 to 85°C	DPS81C64-45I	45ns	-40 to 85°C
DPS81C64-25M	25ns	-55 to 125°C	DPS81C64-35M	35ns	-55 to 125°C
DPS81C64-45M	45ns	-55 to 125°C			

NOTE: Parts built on special request - minimum quantity required and 12 week delivery normal.

Dense-Pac Microsystems, Inc.

7321 Lincoln Way • Garden Grove, California 92641-1428

(714) 898-0007 • (800) 642-4477 (Outside CA) • FAX: (714) 897-1772

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