

# Am9114/9124

1024 x 4 Static RAM

Am9114/9124

## DISTINCTIVE CHARACTERISTICS

- Low operating and standby power
- Access times down to 200 ns
- Am9114 is a direct plug-in replacement for 2114
- Am9124 pin and function compatible with Am9114 and 2114, plus  $\overline{CS}$  power-down feature
- High output drive—4.0-mA sink current @ 0.4 V  
—Am9124, 3.2-mA sink current @ 0.4 V—Am9114
- TTL-identical input/output levels

## GENERAL DESCRIPTION

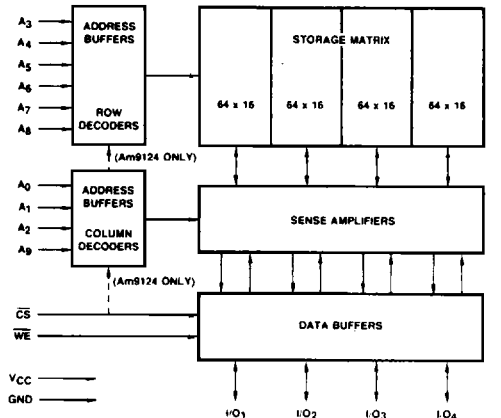
The Am9114 and Am9124 are high-performance, static, N-Channel, read/write, random-access memories organized as 1024 x 4. Operation is from a single 5-V supply, and all input/output levels are identical to standard TTL specifications. Low-power versions of both devices are available with power savings of over 30%. The Am9114 and Am9124 are the same except that the Am9124 offers an automatic  $\overline{CS}$  power-down feature.

The Am9124 remains in a low-power standby mode as long as  $\overline{CS}$  remains HIGH, thus reducing its power requirements.

The Am9124 power decreases from 368 mW to 158 mW in the standby mode, and the Am91L24 from 262 mW to 105 mW. The  $\overline{CS}$  input does not affect the power dissipation of the Am9114.

Data readout is not destructive and the same polarity as data input.  $\overline{CS}$  provides for easy selection of an individual package when the outputs are OR-tied. The outputs of 4.0 mA for Am9124 and 3.2 mA for Am9114 provides increased short-circuit current for improved capacitive drive.

## BLOCK DIAGRAM



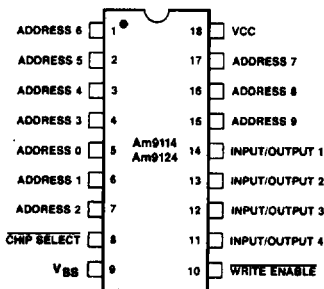
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## PRODUCT SELECTOR GUIDE

Part Number		Am9114/91L14 & Am9124/91L24		Am9114/91L14
Speed Indicator		B	C	E
Maximum Access Time (ns)		450	300	200
0 to +70°C	I <sub>CC</sub> (mA)	Standard	70	70
		Low-Power	50	50
	I <sub>PD</sub> (mA) (Note 1)	Standard	30	30
		Low-Power	20	20
-55 to +125°C	I <sub>CC</sub> (mA)	Standard	80	80
		Low-Power	60	60
	I <sub>PD</sub> (mA) (Note 1)	Standard	33	33
		Low-Power	22	22

Notes: 1. Am9124/91L24 only.

### CONNECTION DIAGRAM Top View

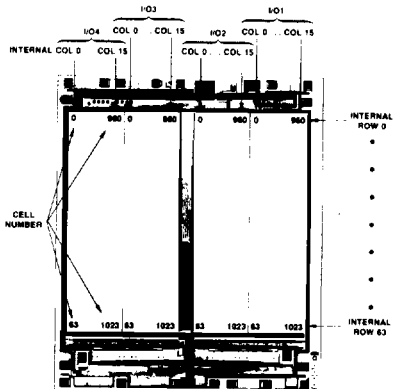


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Note: Pin 1 is marked for orientation.

### BIT MAP

Address Designators	
External	Internal
A <sub>0</sub>	A <sub>9</sub>
A <sub>1</sub>	A <sub>8</sub>
A <sub>2</sub>	A <sub>7</sub>
A <sub>3</sub>	A <sub>0</sub>
A <sub>4</sub>	A <sub>1</sub>
A <sub>5</sub>	A <sub>2</sub>
A <sub>6</sub>	A <sub>3</sub>
A <sub>7</sub>	A <sub>4</sub>
A <sub>8</sub>	A <sub>5</sub>
A <sub>9</sub>	A <sub>6</sub>



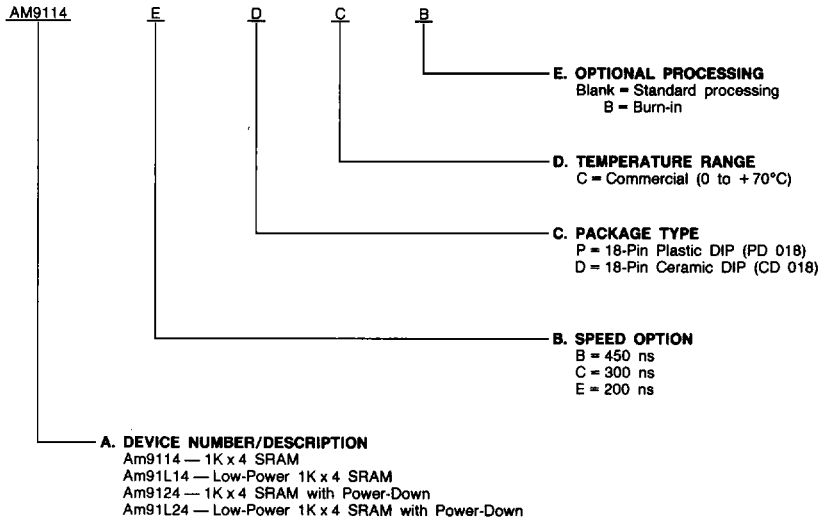
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## ORDERING INFORMATION (Cont'd.)

### Standard Products

AMD standard products are available in several packages and operating ranges. The order number (Valid Combination) is formed by a combination of:

- A. Device Number**
- B. Speed Option** (if applicable)
- C. Package Type**
- D. Temperature Range**
- E. Optional Processing**



Valid Combinations	
AM9114B	PC, PCB, DC, DCB
AM91L14B	
AM9124B	
AM91L24B	
AM9114C	
AM91L14C	
AM9124C	
AM91L24C	
AM9114E	
AM91L14E	

#### Valid Combinations

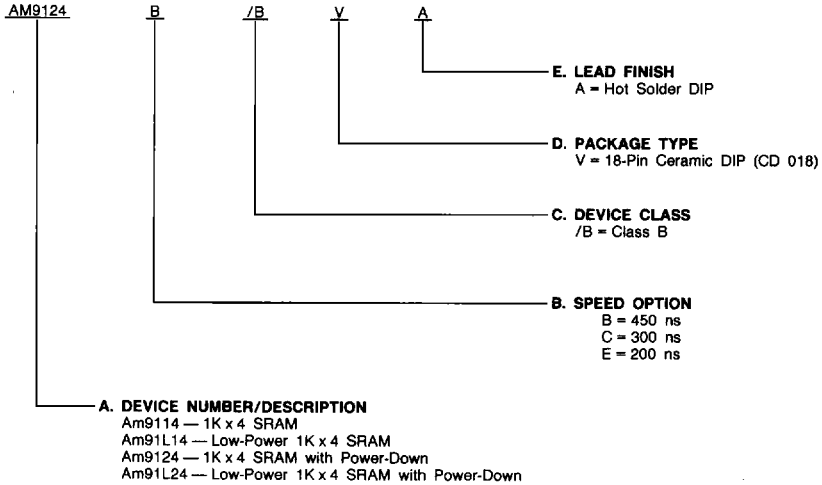
Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations, to check on newly released combinations, and to obtain additional data on AMD's standard military grade products.

# ORDERING INFORMATION

## APL Products

AMD products for Aerospace and Defense applications are available in several packages and operating ranges. APL (Approved Products List) products are fully compliant with MIL-STD-883C requirements. CPL (Controlled Products List) products are processed in accordance with MIL-STD-883C, but are inherently non-compliant because of package, solderability, or surface treatment exceptions to those specifications. The order number (Valid Combination) for APL products is formed by a combination of:

- A. Device Number**
- B. Speed Option** (if applicable)
- C. Device Class**
- D. Package Type**
- E. Lead Finish**



Valid Combinations	
AM9114B	/BVA
AM91L14B	
AM9124B	
AM91L24B	
AM9114C	
AM91L14C	
AM9124C	
AM91L24C	
AM9114E	
AM91L14E	

### Valid Combinations

Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations or to check for newly released valid combinations.

## PIN DESCRIPTION

**A<sub>0</sub> - A<sub>9</sub> Address Inputs**

The address input lines select the memory location from which to read or write.

**$\overline{CS}$  Chip Select (Input, Active LOW)**

The  $\overline{CS}$  line selects the memory device for active operation.

**$\overline{WE}$  Write Enable (Input, Active LOW)**

When both  $\overline{CS}$  and  $\overline{WE}$  are LOW, data on the input lines is written to the location presented on the address input lines.

**I/O<sub>1</sub> - I/O<sub>4</sub> Data In/Out Bus (Bidirectional)**

These lines provide the path for data to be written to or read from the selected memory location.

**V<sub>CC</sub> Power Supply**

**V<sub>SS</sub> Ground**

**TABLE 1. SUPPLY CURRENT ADVANTAGE OF Am9124**

Configuration	Part Number	Worst Case Current (mA at 0°C)	
		100% Duty Cycle	50% Duty Cycle
2K x 8	9114	280	280
	91L14	200	200
	9124	200	160
	91L24	140	110
4K x 12	9114	840	840
	91L14	600	600
	9124	480	420
	91L24	330	285
8K x 16	9114	2240	2240
	91L14	1600	1600
	9124	1120	1040
	91L24	760	700

## ABSOLUTE MAXIMUM RATINGS (Note 1)

Storage Temperature .....	-65 to +150°C
Ambient Temperature with Power Applied .....	-55 to +125°C
Supply Voltage .....	-0.5 V to +7.0 V
Signal Voltages with Respect to Ground .....	-0.5 V to +7.0 V
Power Dissipation .....	1.0 W
DC Output Current .....	10 mA

The products described by this specification include internal circuitry designed to protect input devices from damaging accumulations of static charge. It is suggested nevertheless, that conventional precautions be observed during storage, handling and use in order to avoid exposure to excessive voltages.

## OPERATING RANGES (Note 2)

Commercial (C) Devices	
Temperature .....	0°C to +70°C
Supply Voltage .....	+4.5V to +5.5 V
Military (M) Devices*	
Temperature .....	-55°C to +125°C
Supply Voltage .....	+4.5 V to +5.5 V

Operating ranges define those limits between which the functionality of the device is guaranteed.

\*Military products 100% tested at  $T_C = +25^\circ\text{C}$ ,  $+125^\circ\text{C}$  and  $-55^\circ\text{C}$

## DC CHARACTERISTICS over operating range unless otherwise specified\*

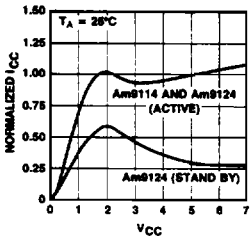
Parameter Symbol	Parameter Description	Test Conditions		Min.	Max.	Units	
$I_{OH}$	Output HIGH Current	$V_{CC} = +4.5V$ $V_{OH} = 2.4V$	91(L)14 91(L)24	-1.0 -1.4		mA	
$I_{OL}$	Output LOW Current	$V_{OL} = 0.4V$	$T_A = 70^\circ\text{C}$ $T_A = +125^\circ\text{C}$	3.2 4.0 2.4 3.2			
$V_{IH}$	Input HIGH Voltage			2.0	$V_{CC}$		V
$V_{IL}$	Input LOW Voltage			-0.5	0.8		
$I_{IX}$	Input Load Current	$V_{SS} \leq V_{IN} \leq V_{CC}$			10	$\mu\text{A}$	
$I_{OZ}$	Output Leakage Current	$V_{SS} \leq V_O \leq V_{CC}$ , Output Disabled	$T_A = 0$ to $+70^\circ\text{C}$ $T_A = -55$ to $+125^\circ\text{C}$	-10 -50	10 50		
$I_{OS}$	Output Short Circuit Current	(Note 3)	91(L)14C 91(L)24C 91(L)14M 91(L)24M		75 95 75 115	mA	
$I_{CC}$	Operating Supply Current	$V_{CC} = \text{Max.}$ $\overline{CS} \leq V_{IL}$	$T_A = 0^\circ\text{C}$ $T_A = -55^\circ\text{C}$		70 50 80 60		mA
$I_{PD}$	Automatic $\overline{CS}$ Power Down Current (9124/L24 only)	$V_{CC} = \text{Max.}$ $\overline{CS} \geq V_{IH}$	$T_A = 0^\circ\text{C}$ $T_A = -55^\circ\text{C}$		9124 91L24 9124 91L24	30 20 33 22	
$C_{iN}$	Input Capacitance	(Note 7)	$f = 1.0$ MHz, $T_A = 25^\circ\text{C}$ , All pins at 0 V		7	pF	
$C_{iO}$	I/O Capacitance				7		

- Notes: 1. Absolute Maximum Ratings are intended for user guidelines and are not tested.  
 2. For test and correlation purposes, ambient temperature is defined as the stabilized case temperature.  
 3. For test purposes, not more than one output at a time should be shorted. Short-circuit test duration should not exceed 30 seconds. Actual testing is performed for only 5 ms.  
 4. Test conditions assume signal transition times of 10 ns or less, timing reference levels of 1.5 V and output loading of one standard TTL gate plus 100 pF.  
 5. The internal write time of the memory is defined by the overlap of  $\overline{CS}$  LOW and  $\overline{WE}$  LOW. Both signals must be LOW to initiate a write and either signal can terminate a write by going HIGH. The data input setup and hold timing should be referenced to the rising edge of the signal that terminates the write.  
 6. Chip Select access time ( $t_{CO}$ ) is longer for the Am9124 than for the Am9114. The specified address access time will be valid only when Chip Select is low soon enough for  $t_{CO}$  to elapse.  
 7. These parameters are not 100% tested, but are evaluated at initial characterization and at any time the design is modified where these parameters may be affected.

\*See the last page of this spec for Group A Subgroup Testing information.

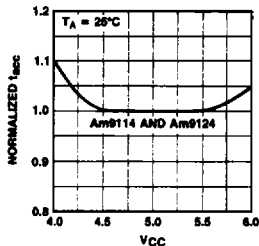
## TYPICAL DC and AC CHARACTERISTICS

**Normalized Supply Current Versus Supply Voltage**



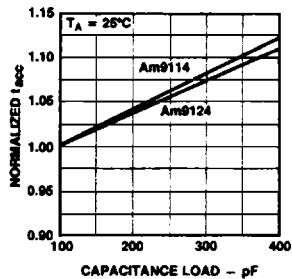
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**Normalized Access Time Versus Supply Voltage**



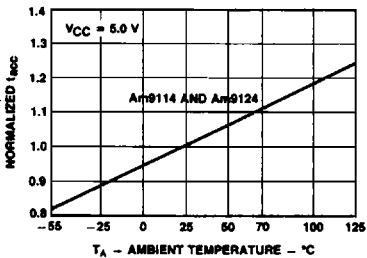
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**Normalized Access Time Versus Output Loading**



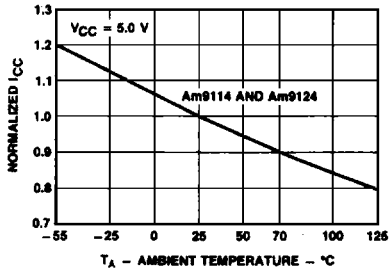
OP000551

**Normalized Access Time Versus Ambient Temperature**



OP000201

**Normalized Supply Current Versus Ambient Temperature**



OP000211

**SWITCHING CHARACTERISTICS** over operating range unless otherwise specified (Notes 4-6)\*

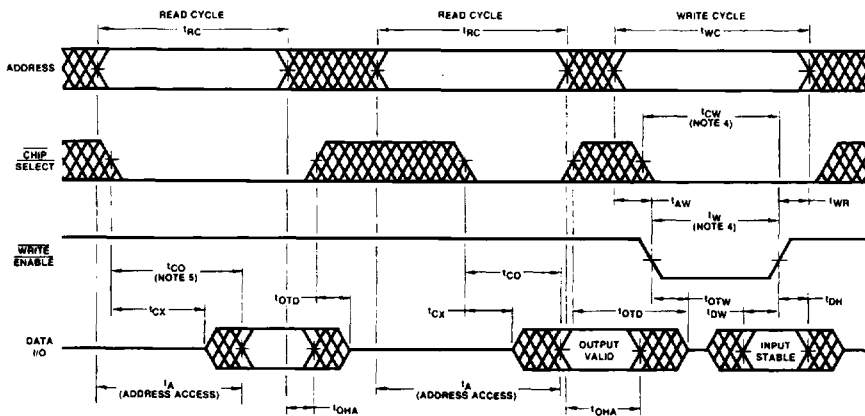
No.	Parameter Symbol	Parameter Description	B Devices		C Devices		E Devices		Units
			Min.	Max.	Min.	Max.	Min.	Max.	
<b>Read Cycle</b>									
1	t <sub>RC</sub>	Address Valid to Address Do Not Care Time (Read Cycle Time)	450		300		200		ns
2	t <sub>A</sub>	Address Valid to Data Out Valid Delay (Address Access Time)		450		300		200	ns
3	t <sub>CO</sub>	Chip Select LOW to Data Out Valid (Note 6)	Am9114	120		100		70	ns
			Am9124	420		280		185	ns
4	t <sub>CX</sub>	Chip Select LOW to Data Out On	10		10		10		ns
5	t <sub>OTD</sub>	Chip Select HIGH to Data Out Off		100		80		60	ns
6	t <sub>OHA</sub>	Address Unknown to Data Out Unknown Time	50		50		50		ns
<b>Write Cycle</b>									
7	t <sub>WC</sub>	Address Valid to Address Do Not Care Time (Write Cycle Time)	450		300		200		ns
8	t <sub>W</sub>	Write Enable LOW to Write Enable HIGH Time (Note 5)	Am9114	200		150		120	ns
			Am9124	250		200		150	ns
9	t <sub>WR</sub>	Write Enable HIGH to Address Do Not Care Time	0		0		0		ns
10	t <sub>OTW</sub>	Write Enable LOW to Data Out Off Delay		100		80		60	ns
11	t <sub>DW</sub>	Data In Valid to Write Enable HIGH Time	200		150		120		ns
12	t <sub>DH</sub>	Write Enable HIGH to Data In Do Not Care Time	0		0		0		ns
13	t <sub>AW</sub>	Address Valid to Write Enable LOW Time	0		0		0		ns
14	t <sub>PD</sub>	Chip Select HIGH to Power LOW Delay (Am9124 only) (Note 7)		200		150		100	ns
15	t <sub>PU</sub>	Chip Select LOW to Power HIGH Delay (Am9124 only) (Note 7)	0		0		0		ns
16	t <sub>CW</sub>	Chip Select LOW to Write Enable HIGH Time (Note 5)	Am9114	200		150		120	90
			Am9124	250		200		150	ns

Notes: See notes following DC Characteristics table

\*See the last page of this spec for Group A Subgroup Testing information.

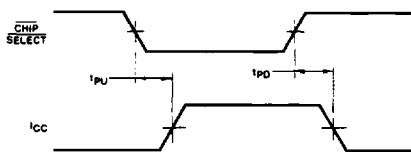


## SWITCHING WAVEFORMS



WF000171

### Power-Down Waveform (Am9124 Only)



WF000181

## GROUP A SUBGROUP TESTING

### DC CHARACTERISTICS

Parameter Symbol	Subgroups
I <sub>OH</sub>	1, 2, 3
I <sub>OL</sub>	1, 2, 3
V <sub>IH</sub>	7, 8
V <sub>IL</sub>	7, 8
I <sub>Ix</sub>	1, 2, 3
I <sub>OZ</sub>	1, 2, 3
I <sub>OS</sub>	1, 2, 3
I <sub>CC</sub>	1, 2, 3
I <sub>PD</sub>	1, 2, 3

### SWITCHING CHARACTERISTICS

Parameter Symbol	Subgroups	Parameter Symbol	Subgroups
t <sub>RC</sub>	7, 8, 9, 10, 11	t <sub>WR</sub>	7, 8, 9, 10, 11
t <sub>A</sub>	7, 8, 9, 10, 11	t <sub>OTW</sub>	7, 8, 9, 10, 11
t <sub>CO</sub>	7, 8, 9, 10, 11	t <sub>DW</sub>	7, 8, 9, 10, 11
t <sub>CX</sub>	7, 8, 9, 10, 11	t <sub>DH</sub>	7, 8, 9, 10, 11
t <sub>OTD</sub>	7, 8, 9, 10, 11	t <sub>AW</sub>	7, 8, 9, 10, 11
t <sub>OHA</sub>	7, 8, 9, 10, 11	t <sub>PD</sub>	7, 8, 9, 10, 11
t <sub>WC</sub>	7, 8, 9, 10, 11	t <sub>PU</sub>	7, 8, 9, 10, 11
t <sub>W</sub>	7, 8, 9, 10, 11	t <sub>CW</sub>	7, 8, 9, 10, 11

### MILITARY BURN-IN

Military burn-in is in accordance with the current revision of MIL-STD-883, Test Method 1015, Conditions A through E. Test Conditions are selected at AMD's option.