# Am9122/Am91L22

256x4 Static RAM

Advanced Micro Devices

## DISTINCTIVE CHARACTERISTICS

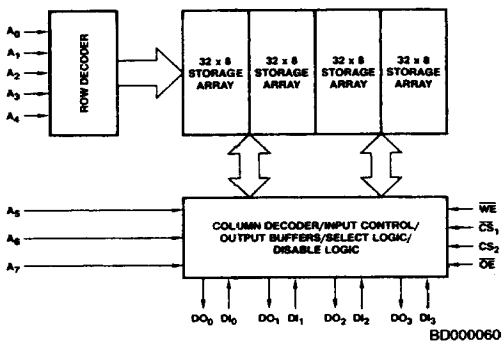
- High-performance replacement for 93422/93L422
- Fast access times — as low as 25 ns
- Low-power dissipation
  - Low power: 440 mW (Commercial)
    495 mW (Military)
- Single 5-volt power supply — ±10% tolerance both Commercial and Military

## GENERAL DESCRIPTION

The Am9122/Am91L22 Series is a MOS pin-for-pin and functional replacement for the 93422/93L422 bipolar memories. These devices are high-performance, low-power, 1024-bit, static, read/write random access memories. They offer a wide range of access times including versions as fast as 25 ns. Each memory is implemented as 256 words by 4 bits per word. This organization permits efficient design of small memory systems and allows finer resolution of incremental memory depth.

The Am9122/91L22 employs an output enable and two chip enable inputs to give the user better data control. High noise immunity, high output drive (4 TTL loads) and TTL logic voltage levels allow easy conversion from bipolar to MOS. 10% power supply tolerances give better margins in the memory system.

## BLOCK DIAGRAM

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## MODE SELECT TABLE

| Inputs | | | | | Outputs | Mode |
|---|---|---|---|---|---|---|
| $\overline{OE}$ | $\overline{CS_1}$ | $CS_2$ | $\overline{WE}$ | $D_0-D_3$ | | |
| X | H | X | X | X | Hi-Z | Not Selected |
| X | X | L | X | X | Hi-Z | Not Selected |
| L | L | H | H | X | $O_0-O_3$ | Read Stored Data |
| X | L | H | L | L | Hi-Z | Write "0" |
| X | L | H | L | H | Hi-Z | Write "1" |
| H | L | H | H | X | Hi-Z | Output Disabled |
| H | L | H | L | L | Hi-Z | Write "0" (Output Disabled) |
| H | L | H | L | H | Hi-Z | Write "1" (Output Disabled) |

H = HIGH Voltage
L = LOW Voltage
X = Don't Care (HIGH or LOW)
Hi-Z = High Impedance

## PRODUCT SELECTOR GUIDE

| Part Number | | Am9122-25 | Am9122-35 | Am91L22-35 | Am91L22-45 |
|---|---|---|---|---|---|
| Maximum Access Time (ns) | | 25 | 35 | 35 | 45 |
| Maximum Operating Current (mA) | 0° to +70°C | 120 | 120 | 80 | 80 |
| | −55° to +125°C | N/A | 135 | N/A | 90 |


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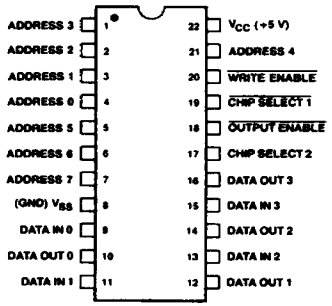
## CONNECTION DIAGRAM
### Top View

### DIPs

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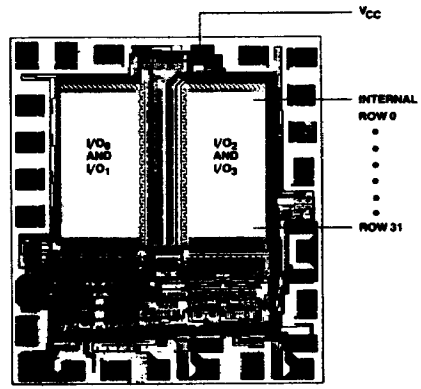
Note: Pin 1 is marked for orientation.

## METALLIZATION AND PAD LAYOUT

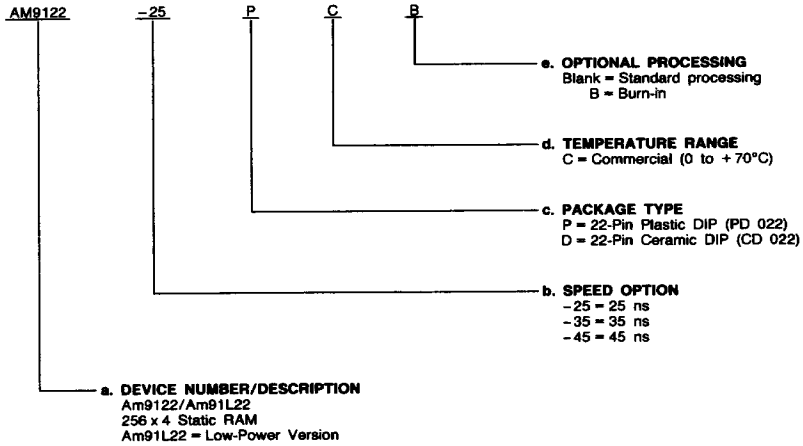
| Address Designators | |
|---|---|
| External | Internal |
| $A_0$ | $A_0$ |
| $A_1$ | $A_1$ |
| $A_2$ | $A_2$ |
| $A_3$ | $A_3$ |
| $A_4$ | $A_4$ |
| $A_5$ | $A_5$ |
| $A_6$ | $A_6$ |
| $A_7$ | $A_7$ |



## ORDERING INFORMATION

### 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 | |
|---|---|
| AM9122-25 | DC, DCB, PC, PCB |
| AM91L22-35 | |
| AM9122-35 | |
| AM91L22-45 | |

**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 valid combinations, and to obtain additional data on AMD's standard military grade products.

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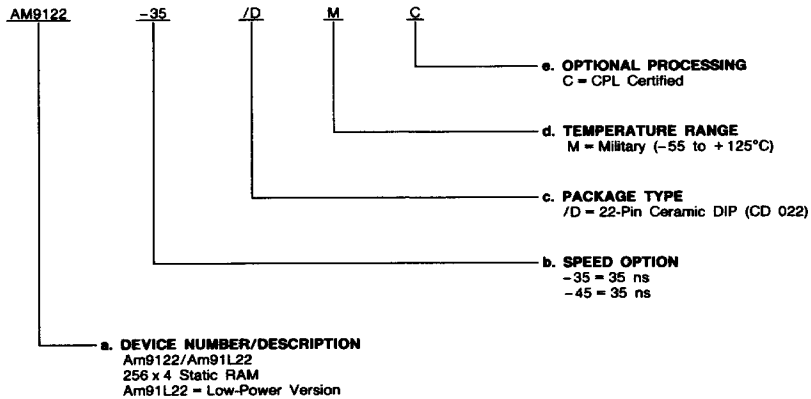
## MILITARY ORDERING INFORMATION

### CPL Products

AMD products for Aerospace and Defense applications are available in several packages and operating ranges. CPL (Controlled Products List) products are processed in accordance with MIL-STD-883C, but are inherently non-compliant because of packages, solderability, or surface treatment exceptions to those specifications. 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 | |
|---|---|
| AM9122-35 | /DMC |
| AM91L22-45 | |

**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 valid combinations.

**Group A Tests**

Group A tests consist of Subgroups 1, 2, 3, 7, 8, 9, 10, 11.

## PIN DESCRIPTION

**$A_0 - A_7$ Address (Input)**
The 8 address inputs select one of the 256 4-bit words in the RAM.

**$\overline{CS_1}$ Chip Select 1 (Input)**

**$CS_2$ Chip Select 2 (Input)**
$\overline{CS_1}$ is active LOW and $CS_2$ is active HIGH. The device can be accessed only when both Chip Selects are active. If either Chip Select is not active, the device is deselected and the outputs will be in a high-impedance state.

**$\overline{WE}$ Write Enable Input**
$\overline{WE}$ controls read and write operations. When $\overline{WE}$ is HIGH and $\overline{OE}$ is LOW, data will be present at the data outputs. When $\overline{WE}$ is LOW, data present on the data inputs will be written into the selected memory location. The data outputs will be in a high-impedance state.

**$\overline{OE}$ Output Enable (Input)**
$\overline{OE}$ controls the state of the data outputs in conjunction with Chip Select and $\overline{WE}$.

**$DI_0 - DI_3$ Data IN (Input)**
Data inputs to the RAM.

**$DO_0 - DO_3$ Data Out (Output)**
Data output from the RAM. The data output will be in a high-impedance state when either Chip Select is not active or $\overline{OE}$ is HIGH or $\overline{WE}$ is LOW.

**$V_{CC}$ Power Supply +5 Volts**

**$V_{SS}$ Ground**

## 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
DC Voltage Applied to Outputs ..... −0.5 V to +7.0 V
DC Input Voltage ..... −0.5 V to +7.0 V
Power Dissipation ..... 1.0 W
DC Output Current ..... 20 mA

*Stresses above those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.*

## OPERATING RANGES (Note 2)

Commercial (C) Devices
Ambient Temperature ($T_A$) ..... 0 to +70°C
Supply Voltage ($V_{CC}$) ..... +4.5 V to +5.5 V

Military (M) Devices
Ambient Temperature ($T_A$) ..... −55 to +125°C
Supply Voltage ($V_{CC}$) ..... +4.5 V to +5.5 V

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

## DC CHARACTERISTICS over operating ranges unless otherwise specified (for CPL Products, Group A, Subgroups 1, 2, 3 are tested unless otherwise noted)

| Parameter Symbol | Parameter Description | Test Conditions | | Am91L22-35 Am91L22-45 | | | Am9122-25 Am9122-35 | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| $V_{OH}$ | Output HIGH Voltage | $V_{CC}$ = Min. | $I_{OH}$ = −5.2 mA | 2.4 | | | 2.4 | | | V |
| $V_{OL}$ | Output LOW Voltage | $V_{CC}$ = Min. | $I_{OL}$ = 8.0 mA | | | 0.4 | | | 0.4 | V |
| $V_{IH}$ | Input HIGH Voltage | | | 2.1 | | $V_{CC}$ | 2.1 | | $V_{CC}$ | V |
| $V_{IL}$ | Input LOW Voltage | | | −2.5 | | 0.8 | −2.5 | | 0.8 | V |
| $I_{IL}$ | Input LOW Current | $V_{CC}$ = Max., $V_{IN}$ = GND | | −10 | | | −10 | | | μA |
| $I_{IH}$ | Input HIGH Current | $V_{CC}$ = Max., $V_{IN}$ = $V_{CC}$ | | | | 10 | | | 10 | μA |
| $V_{CD}$ | Input Diode Clamp Voltage | | | | | Note 3 | | | Note 3 | V |
| $I_{OFF}$ | Output Current (Hi-Z) | $V_{OL} \leq V_{OUT} \leq V_{OH}$ Output Disabled | $T_A$ = Max. | −10 | | 10 | −10 | | 10 | μA |
| $I_{OS}$ | Output Short Circuit Current (Note 4) | $V_{CC}$ = Max., $V_{OUT}$ = GND | COM'L | | | −85 | | | −85 | mA |
| | | | MIL | | | −100 | | | −100 | |
| $I_{CC}$ | Power Supply Current | $V_{CC}$ = Max., $I_{OUT}$ = 0 mA | $T_A$ = 0°C | | | 80 | | | 120 | mA |
| | | | $T_A$ = −55°C | | | 90 | | | 135 | |
| $C_{IN}$ | Input Capacitance $V_{IN}$ = 0 V | $T_A$ = 25°C, f=1 MHz $V_{CC}$ = 4.5 V (Note 5) | | | 3 | 5 | | 3 | 5 | pF |
| $C_{OUT}$ | Output Capacitance $V_{OUT}$ = 0 V | | | | 5 | 8 | | 5 | 8 | |

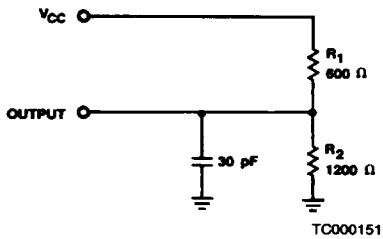
Notes:
1. Absolute Maximum Rating are intended for user guidelines and are not tested.
2. For test and correlation purposes, ambient temperature is defined as the "instant-ON" case temperature.
3. The NMOS process does not provide a clamp diode. However, the Am9122/91L22 is insensitive to −3 V DC input levels and −5 V undershoot pulses of less than 10 ns (measured at 50% point).
4. For test purposes, not more than one output at a time should be shorted. Short circuit test duration should not exceed 30 seconds.
5. These parameters are not 100% tested, but are evaluated at initial characterization and at any time the design is modified where capacitance may be affected.
6. Test conditions assume signal transition times of 10 ns or less, timing reference levels of 1.5 V, input pulse levels of 0 to 3.0 V and output loading of the specified $I_{OL}/I_{OH}$ and 30 pF load capacitance as in A under Switching Test Circuits.
7. Transition is measured at 1.5 V on the input to $V_{OH}$ − 500 mV and $V_{OL}$ + 500 mV on the outputs using the load shown in B. $C_L$ = 5 Pf.
8. $t_w$ measured at $t_{wsa}$ = Min.; $t_{wsa}$ measured at $t_w$ = Min.

**SWITCHING CHARACTERISTICS** over operating ranges unless otherwise specified (for CPL Products, Group A, Subgroups 9, 10, 11 are tested unless otherwise noted) (Notes 6, 7, 8)

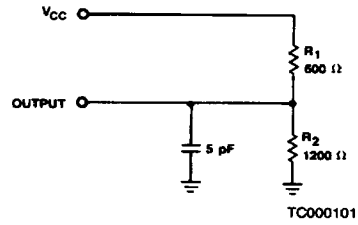
| No. | Parameter Symbol | Parameter Description | Am9122-25 | | Am91L22-35 Am9122-35 | | Am91L22-45 | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min. | Max. | Min. | Max. | Min. | Max. | |
| 1 | $t_{ACS}$ | Chip Select Time | | 15 | | 25 | | 30 | ns |
| 2 | $t_{ZRCS}$ | Chip Select to Hi-Z (Note 5 & 7) | | 20 | | 30 | | 30 | ns |
| 3 | $t_{AOS}$ | Output Enable Time | | 15 | | 25 | | 30 | ns |
| 4 | $t_{ZROS}$ | Output Enable to Hi-Z (Note 5 & 7) | | 20 | | 30 | | 30 | ns |
| 5 | $t_{AA}$ | Address Access Time | | 25 | | 35 | | 45 | ns |
| 6 | $t_{ZWS}$ | Write Disable to Hi-Z (Note 5 & 7) | | 20 | | 30 | | 35 | ns |
| 7 | $t_{WR}$ | Write Recovery Time | | 20 | | 25 | | 40 | ns |
| 8 | $t_W$ | Write Pulse Width (Note 8) | 15 | | 25 | | 30 | | ns |
| 9 | $t_{WSD}$ | Data Setup Time Prior to Write | 5 | | 5 | | 5 | | ns |
| 10 | $t_{WHD}$ | Data Hold Time After Write | 5 | | 5 | | 5 | | ns |
| 11 | $t_{WSA}$ | Address Setup Time (Note 8) | 5 | | 5 | | 10 | | ns |
| 12 | $t_{WHA}$ | Address Hold Time | 5 | | 5 | | 5 | | ns |
| 13 | $t_{WSCS}$ | Chip Select Setup Time | 5 | | 5 | | 5 | | ns |
| 14 | $t_{WHCS}$ | Chip Select Hold Time | 5 | | 5 | | 5 | | ns |

Notes: See notes following DC Characteristics table.

## SWITCHING TEST CIRCUITS

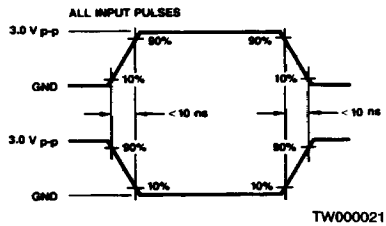



A



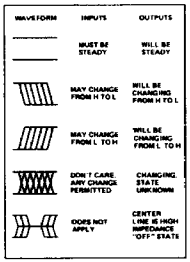

B

## SWITCHING TEST WAVEFORM



## SWITCHING WAVEFORMS

### KEY TO SWITCHING WAVEFORMS

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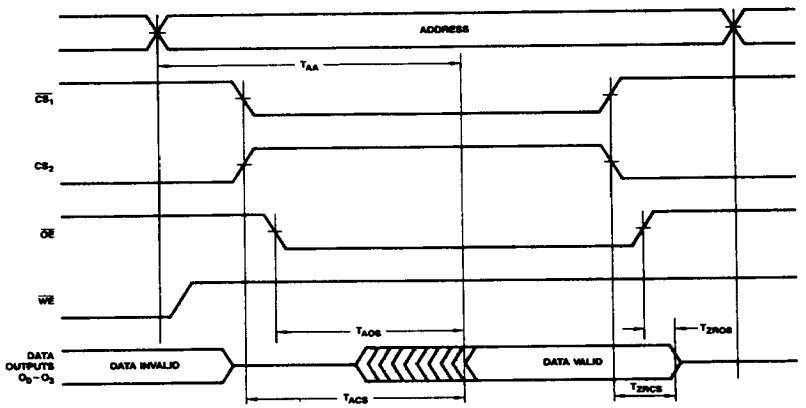


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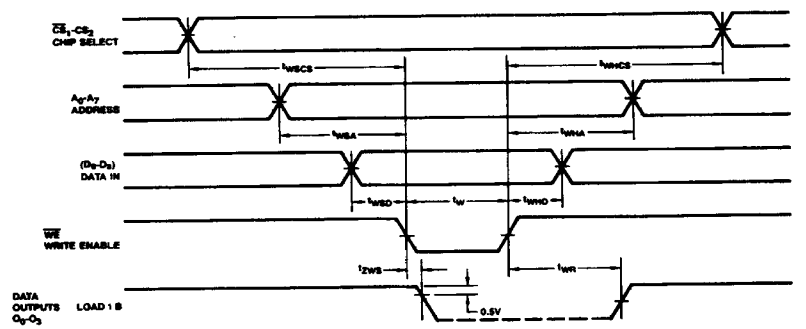
**Read Mode**

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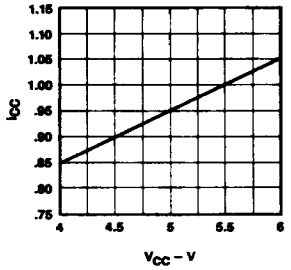
**Write Mode**

(All above measurements implemented to 1.5 V unless otherwise stated.)

Note: Timing diagram represents one solution which results in an optimum cycle time. Timing may be changed in various applications as long as the worst-case limits are not violated.

## TYPICAL PERFORMANCE CURVES

**Normalized $I_{CC}$ versus Supply Voltage**

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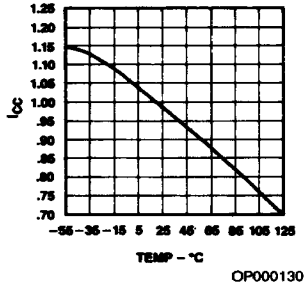
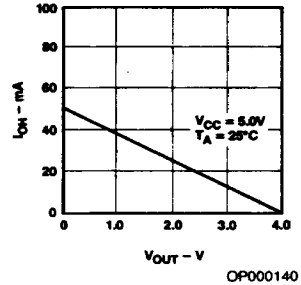
**Normalized $I_{CC}$ versus Ambient Temperature**



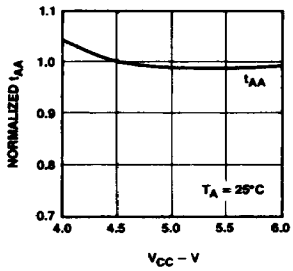

OP000130

**Output Source Current versus Output Voltage**



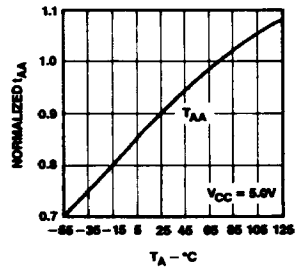

OP000140

**Normalized Access Time versus Supply Voltage**



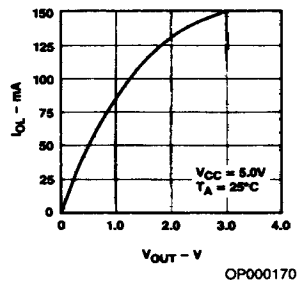

OP000150

**Normalized Access Time versus Ambient Temperature**



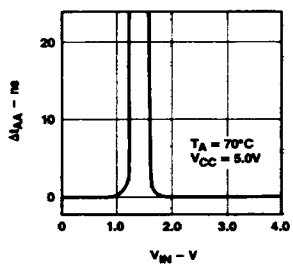

OP000160

**Output Sink Current versus Output Voltage**



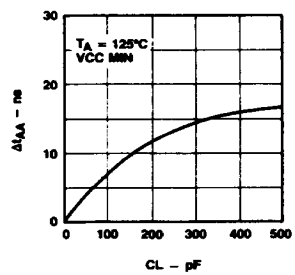

OP000170

**Access Time Change versus Input Voltage**




OP000180

**Access Time Change versus Output Loading**




OP000190