Am9044/9244

4096 x 1 Static RAM

DISTINCTIVE CHARACTERISTICS

- Low operating and standby power
- Access times down to 200 ns
- Am9044 is a direct plug-in replacement for 4044
- Am9244 pin and function compatible with Am9044 and 4044 plus $\overline{CS}$ power-down feature
- High output drive — 4.0 mA sink current @ 0.4 V
- TTL identical interface logic levels

GENERAL DESCRIPTION

The Am9044 and Am9244 are high-performance, static, N-Channel, read/write, random-access memories organized as 4096 x 1. 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 about 30%. The Am9044 and Am9244 are the same except that the Am9244 offers an automatic $\overline{CS}$ power-down feature.

The Am9244 remains in a low-power standby mode as long as $\overline{CS}$ remains HIGH, thus reducing its power requirements.

The Am9244 power decreases from 385 mW to 165 mW in the standby mode, and the Am92L44 from 275 mW to 110 mW. The $\overline{CS}$ input does not affect the power dissipation of the Am9044.

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 Am9244 and Am9044 provide increased short-circuit current for improved drive.

BLOCK DIAGRAM
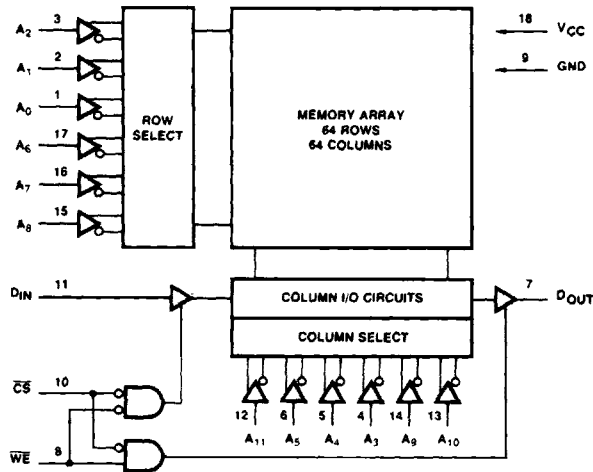
BD000091

PRODUCT SELECTOR GUIDE

Part Number			Am9044/90L44 and Am9244/92L44			
Speed Indicator			B	C	D	E
Maximum Access Time (ns)			450	300	250	200
0 to +70°C	I_{CC} (mA)	Standard	70	70	70	70
		Low-Power	50	50	50	–
	I_{PD} (mA) (Note 1)	Standard	30	30	30	30
		Low-Power	20	20	20	–
−55 to +125°C	I_{CC} (mA)	Standard	80	80	80	–
		Low-Power	60	60	–	–
	I_{PD} (mA) (Note 1)	Standard	33	33	33	–
		Low-Power	22	22	–	–

Notes: 1. Am9244/92L44 only.

CONNECTION DIAGRAM
Top View
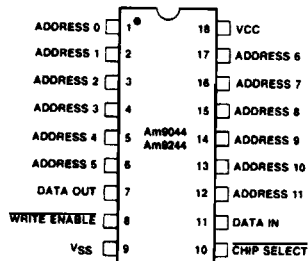
CD000141

Note: Pin 1 is marked for orientation.

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BIT MAP

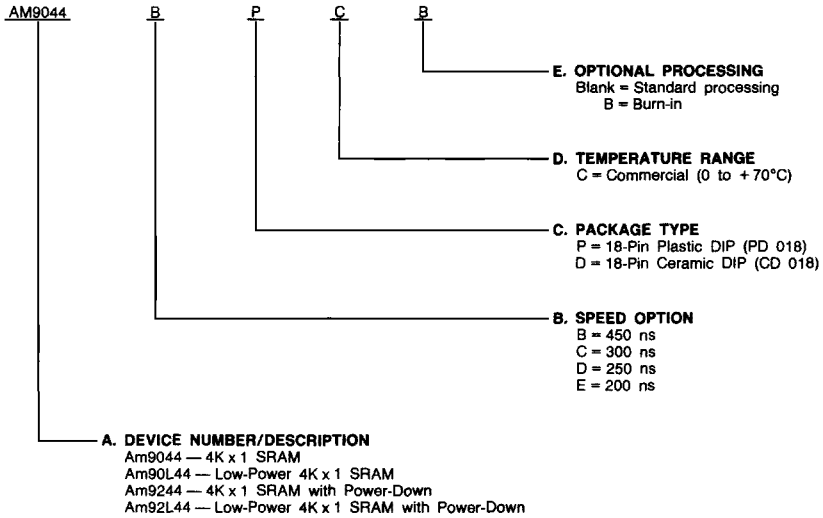| Address Designators	
External	Internal
A_0	A_2
A_1	A_1
A_2	A_0
A_3	A_8
A_4	A_9
A_5	A_{10}
A_6	A_3
A_7	A_4
A_8	A_5
A_9	A_7
A_{10}	A_6
A_{11}	A_{11}
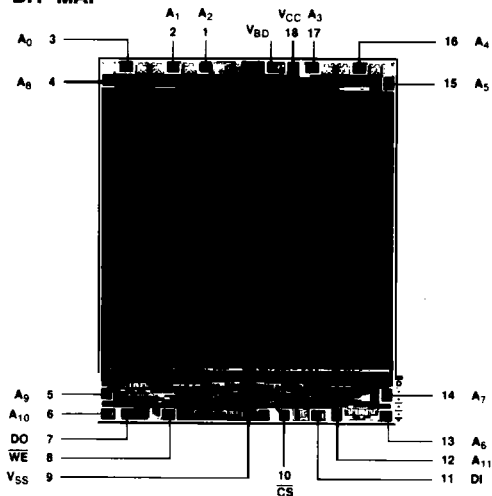
Die Size 0.137" x 0.167"

ORDERING INFORMATION (Con'td.)

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

AM9044   B   P   C   B

E. OPTIONAL PROCESSING
Blank = Standard processing
B = Burn-in

D. TEMPERATURE RANGE
C = Commercial (0 to +70°C)

C. PACKAGE TYPE
P = 18-Pin Plastic DIP (PD 018)
D = 18-Pin Ceramic DIP (CD 018)

B. SPEED OPTION
B = 450 ns
C = 300 ns
D = 250 ns
E = 200 ns

A. DEVICE NUMBER/DESCRIPTION
Am9044 — 4K x 1 SRAM
Am90L44 — Low-Power 4K x 1 SRAM
Am9244 — 4K x 1 SRAM with Power-Down
Am92L44 — Low-Power 4K x 1 SRAM with Power-Down

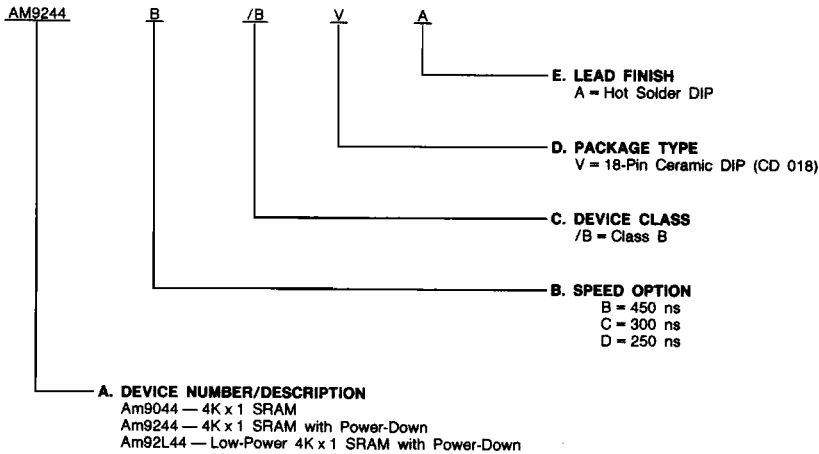| Valid Combinations	
AM9044B	
AM90L44B	
AM9244B	
AM92L44B	
AM9044C	
AM90L44C	
AM9244C	
AM92L44C	PC, PCB,
AM9044D	DC, DCB
AM90L44D	
AM9244D	
AM92L44D	
AM9044E	
AM90L44E	
AM9244E	
AM92L44E	

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**

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AM9244        B      /B      V      A
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E. LEAD FINISH
A = Hot Solder DIP

D. PACKAGE TYPE
V = 18-Pin Ceramic DIP (CD 018)

C. DEVICE CLASS
/B = Class B

B. SPEED OPTION
B = 450 ns
C = 300 ns
D = 250 ns

A. DEVICE NUMBER/DESCRIPTION
Am9044 — 4K x 1 SRAM
Am9244 — 4K x 1 SRAM with Power-Down
Am92L44 — Low-Power 4K x 1 SRAM with Power-Down

Valid Combinations	
AM9044B	
AM9244B	
AM92L44B	
AM9044C	
AM9244C	/BVA
AM92L44C	
AM9044D	
Am90L44D	
AM9244D	
AM92L44D	

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.

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PIN DESCRIPTION

$A_0 - A_{11}$ **Address Inputs (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.

D_{IN} **Data In (Input)**
This pin is used to enter data during write operations.

D_{OUT} **Data Out (Output, Three-State)**
The content of the selected memory location is presented on the Data Output line during read operations ($\overline{CS}$ LOW, $\overline{WE}$ HIGH). The line goes three-state during write operations.

V_{CC} **Power Supply**

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
All Signal Voltage with
Respect to Ground........................ −0.5 V to +7.0 V
Power Description .... 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 to +70°C
Supply Voltage .... +4.5 V to +5.5 V

Military (M) Devices
Temperature .... −55 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 = +75°C, +125°C and −55°C

DC CHARACTERISTICS over operating range unless otherwise specified*

Parameter Symbol	Parameter Description	Test Conditions			Min.	Max.	Units
I_{OH}	Output HIGH Current	V_{OH} = 2.4 V V_{CC} = 4.5 V	T_A = 70°C		−1.0		mA
			T_A = 125°C		−0.4		
I_{OL}	Output LOW Current	V_{OL} = 0.4 V	T_A = 70°C		4.0		mA
			T_A = 125°C		3.2		
V_{IH}	Input HIGH Voltage				2.0	V_{CC}	V
V_{IL}	Input LOW Voltage				−0.5	0.8	V
I_{IX}	Input Load Current	$V_{SS} \leqslant V_{IN} \leqslant V_{CC}$				10	μA
I_{OZ}	Output Leakage Current	$0.4V \leqslant V_O \leqslant V_{CC}$, Output Disabled	T_A = +70°C		−50	50	μA
			T_A = +125°C		−10	10	
I_{CC}	Operating Supply Current	V_{CC} = Max. $\overline{CS} \leqslant V_{IL}$ (9244/92L44 only)	T_A = 0°C	Standard devices		70	mA
				L devices		50	
			T_A = −55°C	Standard devices		80	
				L devices		60	
I_{PD}	Automatic $\overline{CS}$ Power-Down Current (9244/92L44 only)	V_{CC} = Max. $\overline{CS} \geqslant V_{IH}$	T_A = 0°C	9244		30	mA
				92L44		20	
			T_A = −55°C	9244		33	
				92L44		22	
C_I	Input Capacitance (Note 6)	Test Frequency = 1.0 MHz T_A = 25°C, All pins at 0 V				7.0	pF
C_O	Output Capacitance (Note 6)					7.0	

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. 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.
4. 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.
5. Chip Select access time (t_{CO}) is longer for the Am9244 than for the Am9044. The specified address access time will be valid only when $\overline{CS}$ is LOW soon enough for t_{CO} to elapse.
6. 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.

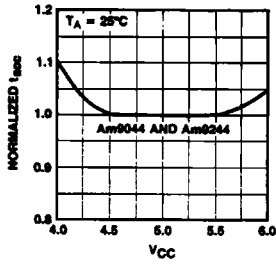*See last page of this spec for Group A Subgroup Testing information.

TYPICAL DC and AC CHARACTERISTICS
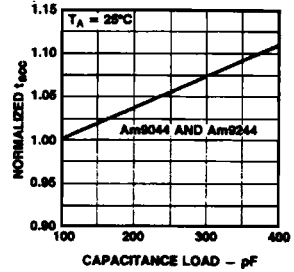
Normalized Supply Current Versus Supply Voltage
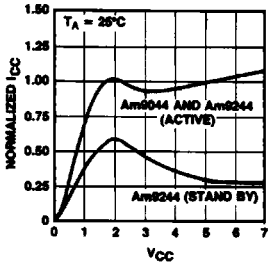
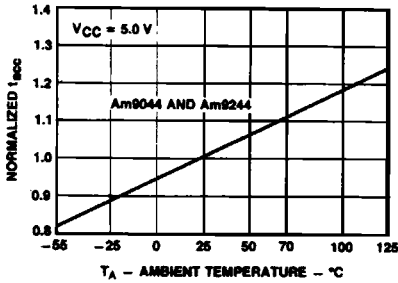

OP000891

Normalized Access Time Versus Supply Voltage

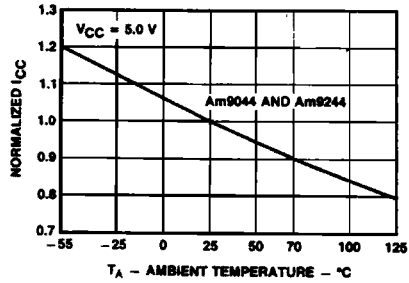

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Normalized Access Time Versus Output Loading

OP000911

Normalized Access Time Versus Ambient Temperature

OP000921

Normalized Supply Current Versus Ambient Temperature

OP000931

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SWITCHING CHARACTERISTICS over operating range unless otherwise specified* (Notes 3 – 6)

| No.	Parameter Symbol	Parameter Description		B devices Min.	B devices Max.	C devices Min.	C devices Max.	D devices Min.	D devices Max.	E devices Min.	E devices Max.	Units
Read Cycle												
1	t_{RC}	Address Valid to Address Do Not Care Time (Read Cycle Time)		450		300		250		200		
2	t_A	Address Valid to Data Out Valid Delay (Address Access Time)			450		300		250		200	
3	t_{CO}	Chip Select LOW to Data Out Valid (Note 5)	Am9044		100		100		70		70	ns
			Am9244		450		300		250		200	
4	t_{CX}	Chip Select LOW to Data Out On (Note 6)		10		10		10		10		
5	t_{OTD}	Chip Select HIGH to Data Out Off (Note 6)			100		80		60		60	
6	t_{OHA}	Address Unknown to Data Out Unknown Time		20		20		20		20		
Write Cycle												
7	t_{WC}	Address Valid to Address Do Not Care Time (Write Cycle Time)		450		300		250		200		
8	t_W	Write Enable LOW to Write Enable HIGH Time (Note 4)	Am9044	200		150		100		100		
			Am9244	250		200		150		150		
9	t_{WR}	Write Enable HIGH to Address Do Not Care Time		0		0		0		0		
10	t_{OTW}	Write Enable LOW to Data Out Off Delay (Note 6)			100		80		60		60	
11	t_{DW}	Data In Valid to Write Enable HIGH Time		200		150		100		100		
12	t_{DH}	Write Enable HIGH to Data In Do Not Care Time		0		0		0		0		ns
13	t_{AW}	Address Valid to Write Enable LOW Time		0		0		0		0		
14	t_{PD}	Chip Select HIGH to Power LOW Delay (Am9244 only Note 6)			200		150		100		100	
15	t_{PU}	Chip Select LOW to Power HIGH Delay (Am9244 only Note 6)		0		0		0		0		
16	t_{CW}	Chip Select LOW to Write Enable HIGH Time (Note 4)	Am9044	200		150		100		100		
			Am9244	250		200		150		150		
17	t_{WO}	Write Enable HIGH To Output Turn On (Note 6)			100		100		70		70	

Notes: See notes following DC Characteristics table.

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

SWITCHING WAVEFORMS
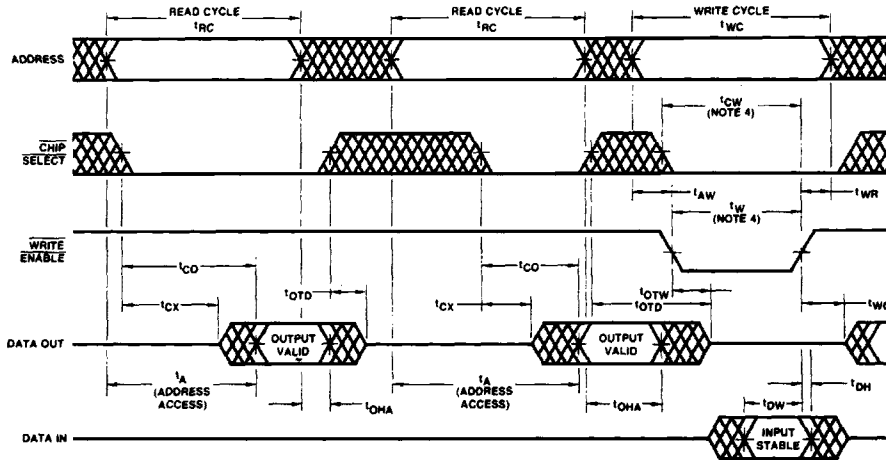
WF000191
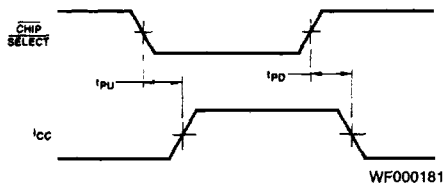
WF000181

Power-Down Waveform (Am9244 only)

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GROUP A SUBGROUP TESTING

DC CHARACTERISTICS

Parameter Symbol	Subgroups
I_{OH}	1, 2, 3
I_{OL}	1, 2, 3
V_{IH}	7, 8
V_{IL}	7, 8
I_{IX}	1, 2, 3
I_{OZ}	1, 2, 3
I_{CC}	1, 2, 3
I_{PD}	1, 2, 3

SWITCHING CHARACTERISTICS

Parameter Symbol	Subgroups	Parameter Symbol	Subgroups
t_{RC}	7, 8, 9, 10, 11	t_{OTW}	7, 8, 9, 10, 11
t_A	7, 8, 9, 10, 11	t_{DW}	7, 8, 9, 10, 11
t_{CO}	7, 8, 9, 10, 11	t_{DH}	7, 8, 9, 10, 11
t_{CX}	7, 8, 9, 10, 11	t_{AW}	7, 8, 9, 10, 11
t_{OTD}	7, 8, 9, 10, 11	t_{PD}	7, 8, 9, 10, 11
t_{OHA}	7, 8, 9, 10, 11	t_{PU}	7, 8, 9, 10, 11
t_{WC}	7, 8, 9, 10, 11	t_{CW}	7, 8, 9, 10, 11
t_W	7, 8, 9, 10, 11	t_{WO}	7, 8, 9, 10, 11
t_{WR}	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.