

Am27S02/Am27S03

64-Bit Inverting-Output Bipolar RAM



Am27S02/Am27S03

Advanced Micro Devices

DISTINCTIVE CHARACTERISTICS

- Fully decoded 16 word x 4-bit low-power Schottky RAMS
- Ultra-Fast Version: Address access time 25 ns
- Internal ECL circuitry for optimum speed/power performance over voltage and temperature
- Output preconditioned during write to eliminate write recovery glitch
- Available with open-collector outputs (Am27S02) or with three-state outputs (Am27S03)
- Pin-compatible replacements for 3101A, 74S289, (use Am27S02); for 74S189, (use Am27S03)

GENERAL DESCRIPTION

The Am27S02 and Am27S03 are 64-bit RAMs built using Schottky diode clamped transistors in conjunction with internal ECL circuitry and are ideal for use in scratch pad and high-speed buffer memory applications. Each memory is organized as a fully decoded 16-word memory of 4 bits per word. Easy memory expansion is provided by an active-LOW chip select (CS) input and open-collector OR-tieable outputs (Am27S02) or three-state outputs (Am27S03). Chip selection for large memory systems can be controlled by active-LOW output decoders such as the Am74S138.

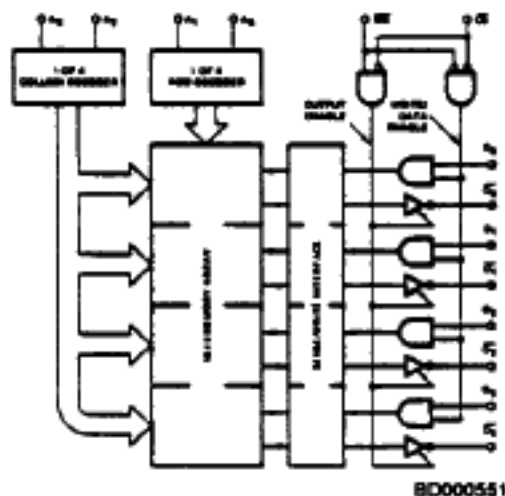
An active-LOW Write line (\overline{WE}) controls the writing/reading operation of the memory. When the chip select and write

lines are LOW the information on the four data inputs D_0 to D_3 is written into the addressed memory word and preconditions the output circuitry so that correct data is present at the outputs when the write cycle is complete. This preconditioning operation ensures minimum write recovery times by eliminating the "write recovery glitch."

Reading is performed with the chip select line LOW and the write line HIGH. The information stored in the addressed word is read out on the four inverting outputs \overline{O}_0 to \overline{O}_3 .

During the writing operation or when the chip select line is HIGH the four outputs of the memory go to an inactive high impedance state.

BLOCK DIAGRAM



MODE SELECT TABLE

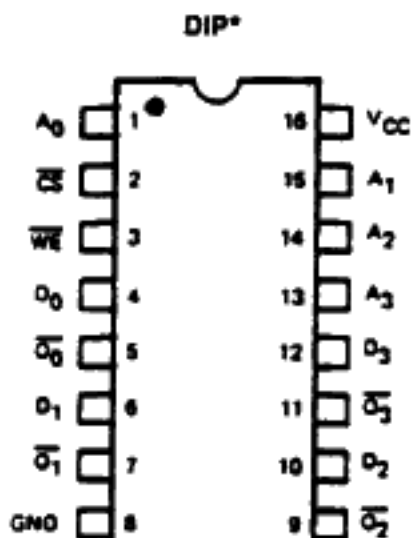
| Input | | Data Output Status $\overline{O}_0 - \overline{O}_3$ | Mode |
|-------|----|--|----------|
| CS | WE | | |
| L | L | Output Disabled | Write |
| L | H | Selected Word (Inverted) | Read |
| H | X | Output Disabled | Deselect |

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

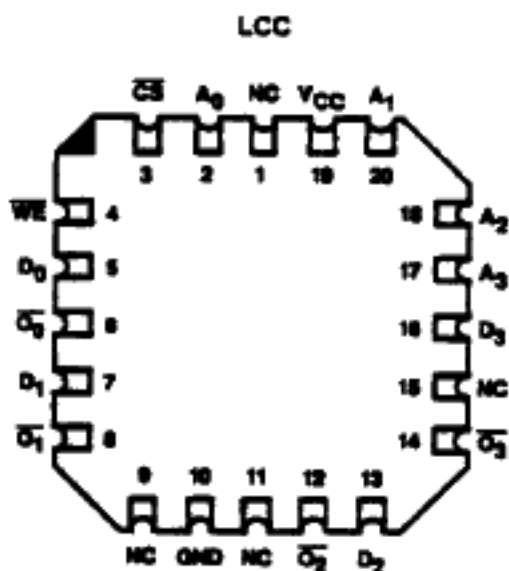
PRODUCT SELECTOR GUIDE

| Access Time | 25 ns | 30 ns | 35 ns | 50 ns |
|-------------------|----------|----------|---------|---------|
| I _{CC} | 70 mA | 70 mA | 70 mA | 70 mA |
| Temperature Range | C | M | C | M |
| Open Collector | Am27S02A | Am27S02A | Am27S02 | Am27S02 |
| Three State | Am27S03A | Am27S03A | Am27S03 | Am27S03 |

CONNECTION DIAGRAMS Top View



CD000831

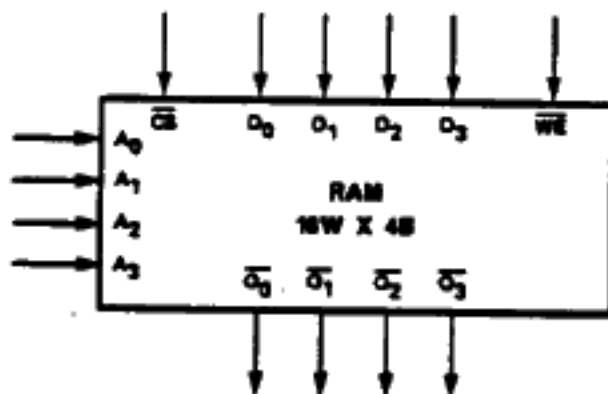


CD000891

*Also available in 16-Pin Ceramic Flatpack. Connections identical to DIPs.

Note: Pin 1 is marked for orientation.

LOGIC SYMBOL



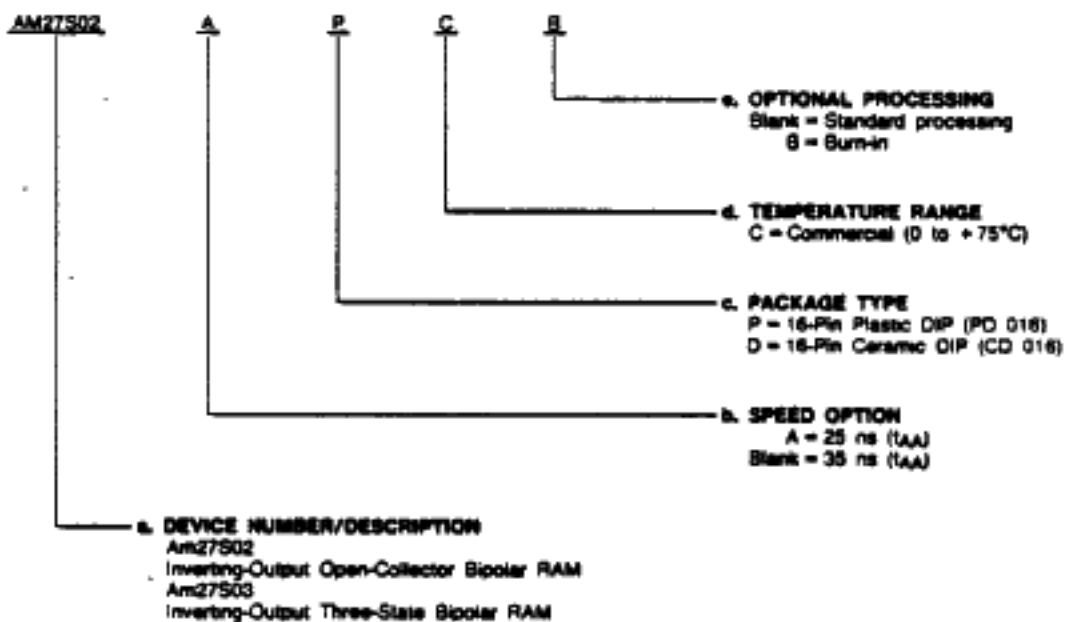
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ORDERING INFORMATION

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 | |
|--------------------|---------------------|
| AM27S02 | PC, PCB, DC, DCB |
| AM27S02A | |
| AM27S03 | |
| AM27S0A | |

Valid Combinations

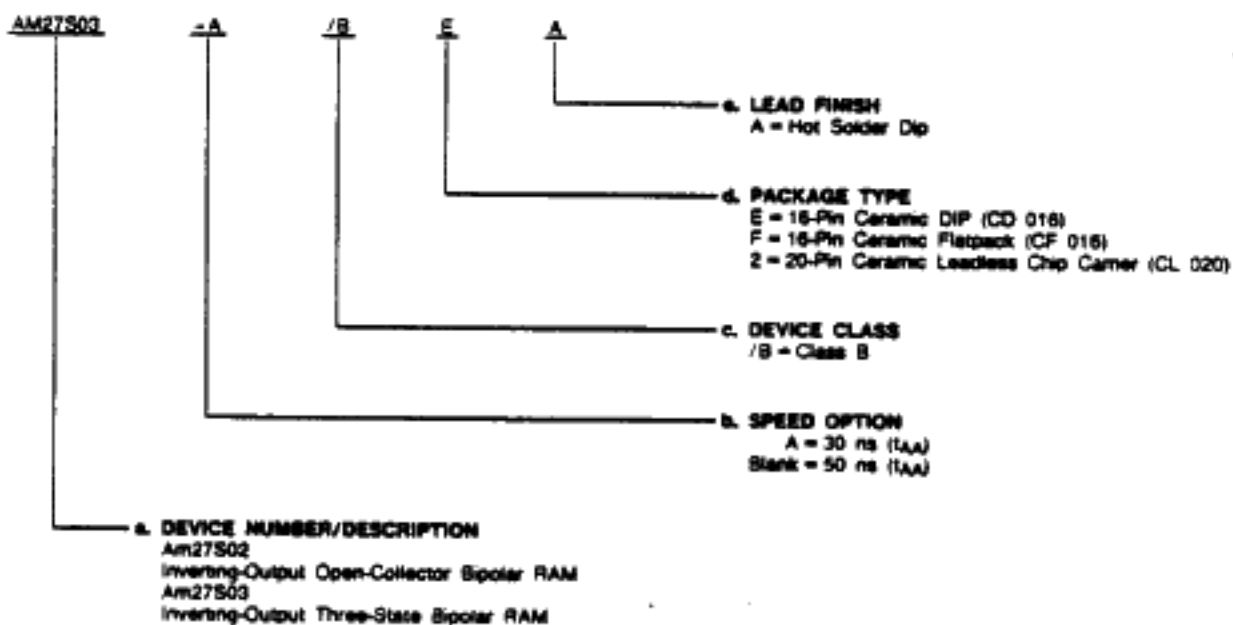
Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations, to check on newly released combinations, and to obtain additional data on AMD's standard military grade products.

MILITARY 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. 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

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.

| Valid Combinations | |
|--------------------|------------------|
| AM27S02 | /BFA, /BFA, /B2A |
| AM27S02A | |
| AM27S03 | |
| AM27S03A | |

Group A Tests

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

ABSOLUTE MAXIMUM RATINGS

| | |
|---|---------------------------------|
| 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 +V _{CC} Max. |
| DC Input Voltage | -0.5 V to +5.5 V |
| Output Current into Outputs | 20 mA |
| DC Input Current | -30 mA to +5 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

| | |
|------------------------|--------------------|
| Commercial (C) Devices | |
| Temperature | 0 to +75°C |
| Supply Voltage | +4.75 V to +5.25 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.

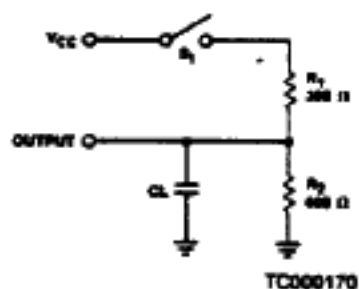
*Military products 100% tested at T_C = +25°C, +125°C, and -55°C.
(see note 5)

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

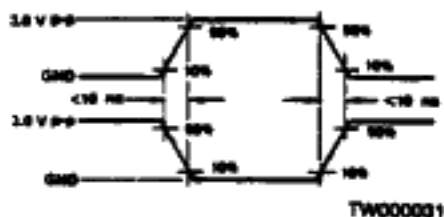
| Parameter Symbol | Parameter Description | Test Conditions | Am27S02/Am27S03 | | | Unit | | |
|-----------------------------|------------------------------|--|---|--------------|------|-------------|---------------|----------|
| | | | Min. | Typ. | Max. | | | |
| V _{OH} (Note 2) | Output HIGH Voltage | V _{CC} = Min., V _{IN} = V _{IH} or V _{IL} | I _{OH} = -5.2 mA I _{OH} = -2.0 mA | COM'L MIL | 2.4 | 3.0 | | V |
| V _{OL} | Output LOW Voltage | V _{CC} = Min., V _{IN} = V _{IH} or V _{IL} | I _{OL} = 18 mA I _{OL} = 20 mA | | | 350 -380 | 450 500 | mV |
| V _{IH} | Input HIGH Level | Guaranteed Input Logical HIGH Voltage for All Inputs (Note 3) | | | 2.0 | | | V |
| V _{IL} | Input LOW Level | Guaranteed Input Logical LOW Voltage for All Inputs (Note 3) | | | | | 0.8 | V |
| I _{IL} | Input LOW Current | V _{CC} = Max., V _{IN} = 0.40 V | WE, D ₀ -D ₃ , A ₀ -A ₃ CS | | | -15 -30 | -250 -250 | μA |
| I _{IH} | Input HIGH Current | V _{CC} = Max., V _{IN} = 2.7 V | | | | 0 | 10 | μA |
| I _{SC} (Note 2) | Output Short Circuit Current | V _{CC} = Max., V _{OUT} = 0.0 V (Note 4) | | | | -20 | -45 -90 | mA |
| I _{CC} | Power Supply Current | All Inputs = GND Outputs = Open V _{CC} = Max. | | | | | 50 70 | mA |
| V _{CL} | Input Clamp Voltage | V _{CC} = Min., I _{IN} = -18 mA | | | | | -0.85 -1.2 | V |
| I _{CEX} | Output Leakage Current | V _{CS} = V _{IH} or V _{IH} = V _{IL} V _{OUT} = 2.4 V, V _{CC} = Max. V _{CS} = V _{IH} or V _{IH} = V _{IL} V _{OUT} = 0.4 V, V _{CC} = Max. | | | | | 0 -40 | 40 μA |

- Notes: 1. Typical limits are at V_{CC} = 5.0 V and T_A = 25°C.
2. This applies to three-state devices only.
3. These are absolute voltages with respect to device ground pin and include all overshoots due to system and/or tester noise. Do not attempt to test these values without suitable equipment.
4. Not more than one output should be shorted at a time. Duration of the short circuit should not be more than one second.
5. Operating specifications with adequate time for temperature stabilization and transverse air flow exceeding 400 linear feet per minute. Conformance testing performance instantaneously where T_A = T_C = T_J.
θ_{JA} ≈ 50 °C/W (with moving air) for Ceramic DIP.
θ_{JA} ≈ 10-17°C/W for flatpack and leadless chip carrier.

SWITCHING TEST CIRCUIT



SWITCHING TEST WAVEFORM



KEY TO THE SWITCHING WAVEFORMS

| WAVEFORM | INPUTS | OUTPUTS |
|----------|----------------------------------|---|
| | MUST BE STEADY | WILL BE STEADY |
| | MAY CHANGE FROM H TO L | WILL BE CHANGING FROM H TO L |
| | MAY CHANGE FROM L TO H | WILL BE CHANGING FROM L TO H |
| | DON'T CARE: ANY CHANGE PERMITTED | CHANGING STATE UNKNOWN |
| | DOES NOT APPLY | CENTER LINE IS HIGH IMPEDANCE "OFF" STATE |

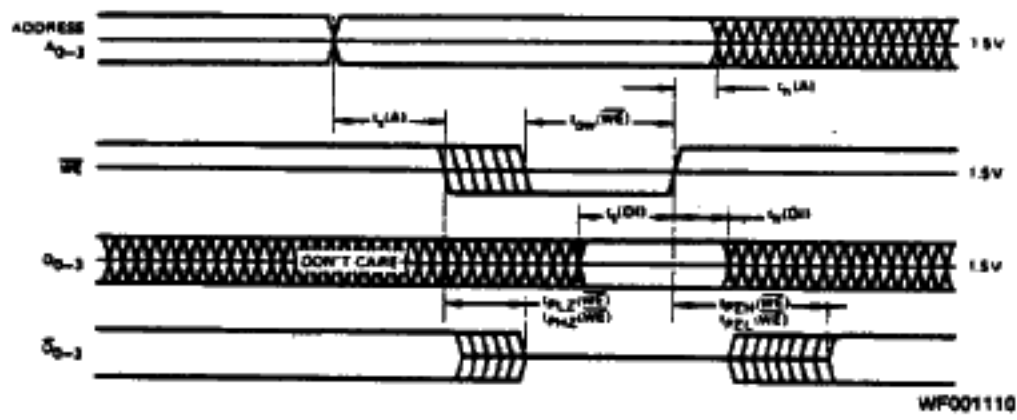
K5000010

SWITCHING CHARACTERISTICS over operating ranges unless otherwise specified*

| No. | Parameter Symbol | Parameter Description | Am27S02A/3A | | | | Am27S02/3 | | | | Units |
|-----|------------------|--|-------------|------|-------------|------|---------------|------|---------------|------|-------|
| | | | A C Devices | | A M Devices | | STD C Devices | | STD M Devices | | |
| | | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | |
| 1 | $t_{PLH}(A)$ | Delay from Address to Output | | 25 | | 30 | | 35 | | 50 | ns |
| 2 | $t_{PHL}(A)$ | | | | | | | | | | |
| 3 | $t_{PZH}(CS)$ | Delay from Chip Select (LOW) to Active Output and Correct Data | | 15 | | 20 | | 17 | | 25 | ns |
| 4 | $t_{PZL}(CS)$ | | | | | | | | | | |
| 5 | $t_{PZH}(WE)$ | Delay from Write Enable (HIGH) to Active Output and Correct Data (Write Recovery-See Note 1) | | 20 | | 25 | | 35 | | 40 | ns |
| 6 | $t_{PZL}(WE)$ | | | | | | | | | | |
| 7 | $t_s(A)$ | Setup Time Address (Prior to Initiation of Write) | 0 | | 0 | | 0 | | 0 | | ns |
| 8 | $t_h(A)$ | Hold Time Address (After Termination of Write) | 0 | | 0 | | 0 | | 0 | | ns |
| 9 | $t_s(DI)$ | Setup Time Data Input (Prior to Termination of Write) | 20 | | 25 | | 25 | | 25 | | ns |
| 10 | $t_h(DI)$ | Hold Time Data Input (After Termination of Write) | 0 | | 0 | | 0 | | 0 | | ns |
| 11 | $t_{pw}(WE)$ | MIN Write Enable Width Pulse to Insure Write | 20 | | 25 | | 25 | | 25 | | ns |
| 12 | $t_{PHZ}(CS)$ | Delay from Chip Select (HIGH) to inactive Output (HI-Z) | | 15 | | 20 | | 17 | | 25 | ns |
| 13 | $t_{PLZ}(CS)$ | | | | | | | | | | |
| 14 | $t_{PHZ}(WE)$ | Delay from Write Enable (LOW) to inactive Output (HI-Z) | | 20 | | 25 | | 25 | | 35 | ns |
| 15 | $t_{PLZ}(WE)$ | | | | | | | | | | |

- Notes: 1. Output is preconditioned to data in during write to insure correct data is present on all outputs when write is terminated. (No write recovery glitch.)
2. $t_{PLH}(A)$ and $t_{PHL}(A)$ are tested with S_1 closed and $C_L = 50\text{ pF}$ with both input and output timing referenced to 1.5 V.
3. For open collector, all delays from Write Enable (WE) or Chip Select (CS) inputs to the Data Output (DOUT), $t_{PLZ}(WE)$, $t_{PLZ}(CS)$, $t_{PZL}(WE)$ and $t_{PZL}(CS)$ are measured with S_1 closed and $C_L = 30\text{ pF}$ and with both the input and output timing referenced to 1.5 V. $t_{PZH}(WE)$ and $t_{PZH}(CS)$ are measured with S_1 open, $C_L = 50\text{ pF}$ and with both the input and output timing referenced to 1.5 V. $t_{PZL}(WE)$ and $t_{PZL}(CS)$ are measured with S_1 closed, $C_L = 50\text{ pF}$ and with both the input and output timing referenced to 1.5 V. $t_{PHZ}(WE)$ and $t_{PHZ}(CS)$ are measured with S_1 open and $C_L \leq 5\text{ pF}$ and are measured between the 1.5 V level on the input to the $V_{OH} - 500\text{ mV}$ level on the output. $t_{PLZ}(WE)$ and $t_{PLZ}(CS)$ are measured with S_1 closed and $C_L \leq 5\text{ pF}$ and are measured between the 1.5 V level on the input and the $V_{OL} + 500\text{ mV}$ level on the output.

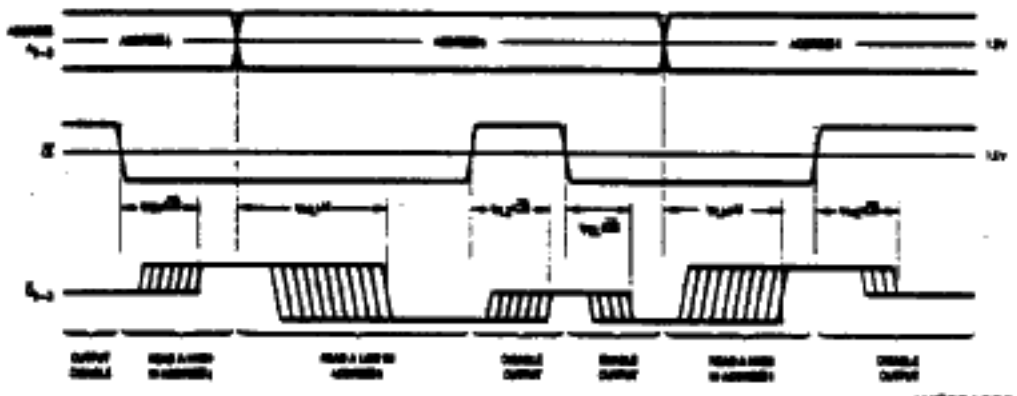
SWITCHING WAVEFORMS



WF001110

Write Mode

Write Cycle Timing. The cycle is initiated by an address change. After $t_1(A)$ min, the write enable may begin. The chip select must also be LOW for writing. Following the write pulse, $t_3(A)$ min must be allowed before the address may be changed again. The output will be inactive (floating for the Am27S03) while the write enable is (WE) LOW.



WF001200

Read Mode

Switching delays from address and chip select inputs to the data output. For the Am27S03 disabled output is "OFF", represented by a single center line. For the Am27S02, a disabled output is HIGH.