AP9A108

128K x 8 High Output Drive, High-Speed CMOS Static RAM with 2V Data Retention

Features

- Drives a 150 pF load vs. 30 pF industry-standard load
- Fast access times: 10, 12, 15 and 20 ns
- 2V/250 µA standby
- Fast output enable (t_{DOE}) for cache applications
- Low active power: 350 mW at 20 ns
- Low standby power
- Fully static operation, no clock or refresh required
- TTL-compatible inputs and outputs
- Single +5V power supply
- Packaged in industry standard 32-Pin SOJ and 32-pin TSOP[1]

Functional Description

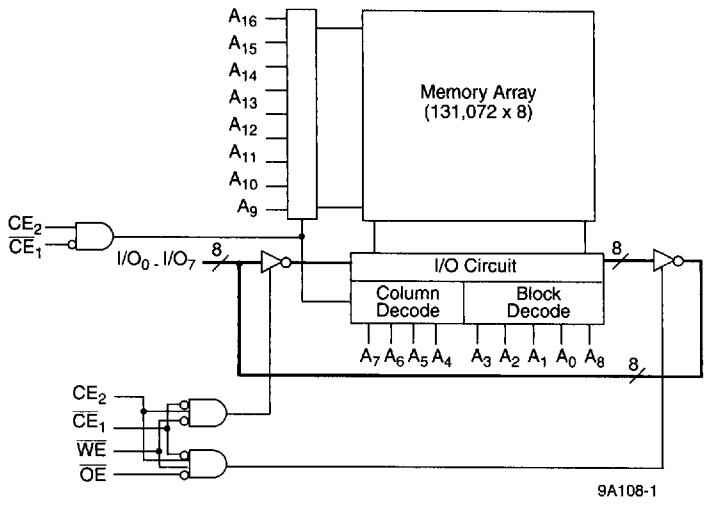
The Aptos AP9A108 is a high speed, low power, 128K word by 8-bit CMOS static RAM. It is fabricated using Aptos' high-performance CMOS, double metal technology. This highly reliable process coupled with innovative circuit design techniques, yields access times as fast as 10 ns (Max).

When Chip Enable ($\overline{CE}_1$) is HIGH, or CE_2 is LOW, the device assumes a standby mode at which the power dissipation can be reduced down to 50 µW (Typ.) at CMOS input levels at 2V V_{CC}.

Easy memory expansion is provided by using asserted LOW $\overline{CE}_1$, asserted HIGH CE_2, and asserted LOW Output Enable inputs ($\overline{OE}$). The asserted LOW Write Enable ($\overline{WE}$) controls both writing and reading of the memory.

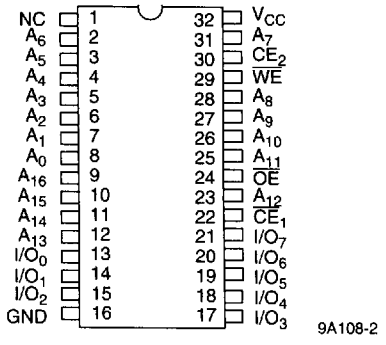
The AP9A108 is pin-compatible with other 128K x 8 SRAMs in the SOJ, and TSOP package.

Block Diagram

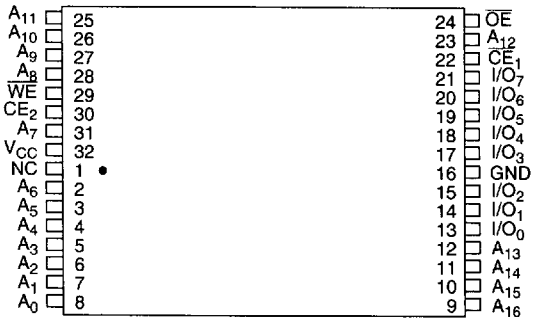


Pin Configurations

32-Pin SOJ
TOP VIEW



32-Pin TSOP
TOP VIEW



Selection Guide

	AP9A108-10	AP9A108-12	AP9A108-15	AP9A108-20
Maximum Access Time (ns)	10	12	15	20
Maximum Operating Current (mA)	100	90	85	70
Maximum Standby Current (mA)	15	15	15	15

Note:

1. 10 ns device available in SOJ, only.

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature..... -65°C to +150°C

Ambient Temperature with Power Applied..... -55°C to +125°C

V_{CC} Supply Relative to GND..... -1.0 V to +7.0 V

Voltage on Any Pin Relative to GND..... -0.5 V to V_{CC} +0.5 V

Short Circuit Output Current[2]..... ±50 mA

Power Dissipation..... 1.0 W

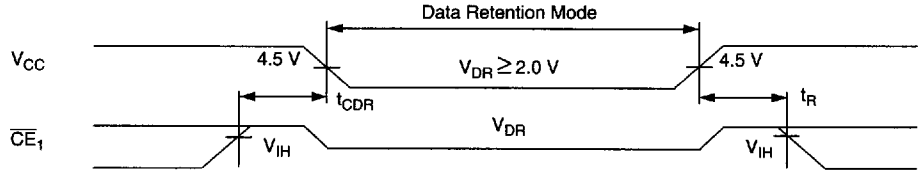
Electrical Characteristics Over the Operating Range (0 °C ≤ T_A ≤ 70 °C, V_{CC} = 5V ±10%) *-Commercial*

Symbol	Parameter	Test Conditions	9A108-10		9A108-12		9A108-15		9A108-20		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CC1}	Dynamic Operating Current	V_{CC} = Max., I_{OUT} = 0 mA, $\overline{CE}_1 = V_{IL}$ and $CE_2 = V_{IH}$, f=fmax		100		90		85		70	mA
I_{CC2}	Operating Current	V_{CC} = Max., I_{OUT} = 0 mA, $\overline{CE}_1 = V_{IL}$ and $CE_2 = V_{IH}$, f = 0		60		60		60		60	mA
I_{SB1}	TTL Standby Current -TTL Inputs	V_{CC} = Max., $V_{IN} = V_{IH}$ or V_{IL}, $\overline{CE}_1 \geq V_{IH}$ or $CE_2 = V_{IL}$, f=fmax		15		15		15		15	mA
I_{SB2}	CMOS Standby Current -CMOS Inputs	V_{CC} = Max., $\overline{CE}_1 \geq V_{CC}$ -0.2V, or $CE_2 \leq 0.2V$, $V_{IN} \geq V_{CC}$ -0.2V or $V_{IN} \leq 0.2$ V, f = 0		2		2		2		2	mA
I_{LI}	Input Leakage Current	GND ≤ V_{IN} ≤ V_{CC}	-1	1	-1	1	-1	1	-1	1	µA
I_{LO}	Output Leakage Current	GND ≤ V_{OUT} ≤ V_{CC}, Output Disabled	-1	1	-1	1	-1	1	-1	1	µA
V_{OH}	Output High Voltage	V_{CC} = Min., I_{OH} = - 4.0 mA	2.4		2.4		2.4		2.4		V
V_{OL}	Output Low Voltage	V_{CC} = Min., I_{OL} = 8.0 mA		0.4		0.4		0.4		0.4	V
V_{IH}	Input High Voltage		2.2	V_{CC} +0.5	2.2	V_{CC} +0.5	2.2	V_{CC} +0.5	2.2	V_{CC} +0.5	V
V_{IL}	Input Low Voltage [3]		-0.5	0.8	-0.5	0.8	-0.5	0.8	-0.5	0.8	V

Data Retention Characteristics

Symbol	Description	Test Conditions [4]	Min.	Max.	Unit
V_{DR}	V_{CC} for Data Retention		2.0		V
I_{CCDR}	Data Retention Current	$V_{CC} = V_{DR}$ = 2.0V, $\overline{CE}_1 \geq V_{CC}$-0.2V or $CE_2 \leq 0.2V$, $V_{IN} \geq V_{CC}$ -0.2V or $V_{IN} \leq 0.2$ V		250	µA
t_{CDR} [5]	Chip Deselect to Data Retention Time		0		ns
t_R [5]	Operation Recovery Time		t_{RC}		ns

Data Retention Wave Form



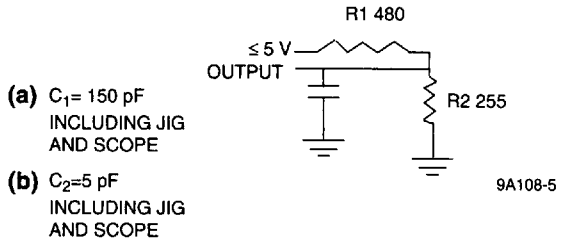
Capacitance [5]

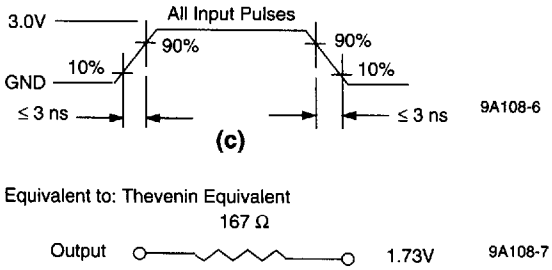
Symbol	Description	Max.	Unit
C_{IN}	Input Capacitance	5	pF
C_{IO}	I/O Capacitance	5	pF

Notes:

2. No more than one output should be shorted at one time. Duration of the short circuit should not exceed 30 seconds.
3. V_{IL} = -3.0 V for pulse width less than 3 ns.
4. No input may exceed V_{CC} +0.5V.
5. Tested initially and after any design or process changes that may effect these parameters.

AC Test Loads and Waveforms [6, 7]





Switching Characteristics Over the Operating Range [8, 9, 10, 11]

Parameter	Description	9A108-10		9A108-12		9A108-15		9A108-20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle										
t_{RC}	Read Cycle Time	10		12		15		20		ns
t_{AA}	Address Access Time		10		12		15		20	ns
t_{OHA}	Output Hold Time	3		3		3		3		ns
t_{ACE1}, t_{ACE2}	$\overline{CE}_1$, CE_2 Access Time		10		12		15		20	ns
t_{DOE}	$\overline{OE}$ Access Time		4		5		7		8	ns
t_{LZOE}	$\overline{OE}$ to Low-Z Output	0		0		0		0		ns
t_{HZOE} [7]	$\overline{OE}$ to High-Z Output		4		5		6		7	ns
t_{LZCE1}, t_{LZCE2}	$\overline{CE}_1$, CE_2 to Low-Z Output	3		3		3		3		ns
t_{HZCE1}, t_{HZCE2}	$\overline{CE}_1$, CE_2 to High-Z Output		4		6		8		9	ns
t_{PU}	$\overline{CE}_1$, CE_2 to Power Up	0		0		0		0		ns
t_{PD}	$\overline{CE}_1$, CE_2 to Power Down		10		12		15		20	ns
Write Cycle [12]										
t_{WC}	Write Cycle Time	10		12		15		20		ns
t_{SCE1}, t_{SCE2}	$\overline{CE}_1$, CE_2 to Write End	8		8		10		12		ns
t_{AW}	Address to Set-up Time to Write End	8		8		10		12		ns
t_{HA}	Address Hold to Write End	0		0		0		0		ns
t_{SA}	Address Set-up Time	0		0		0		0		ns
t_{PWE1} [13]	$\overline{WE}$ Pulse Width ($\overline{OE}$ =HIGH)	8		8		10		12		ns
t_{PWE2}	$\overline{WE}$ Pulse Width ($\overline{OE}$ =LOW)	10		12		12		15		ns
t_{SD}	Data Set-up to Write End	6		6		7		10		ns
t_{HD}	Data Hold from Write End	0		0		0		0		ns
t_{HZWE} [7]	$\overline{WE}$ LOW to High-Z Output		6		6		7		9	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z Output	2		2		2		2		ns

Notes:

6. Test conditions assume signal transition times of 3 ns or less, timing reference levels of 1.5 V, input pulse levels of 0 - 3.0 V and output loading specified in AC Test Loads and Waveforms *Figure (a)*.
7. Tested with the load in AC Test Loads and Waveforms *Figure (b)*. Transition is measured ±500mV from steady state voltage.
8. $\overline{WE}$ is HIGH for a Read Cycle.
9. The device is continuously selected. $\overline{OE}$, $\overline{CE}_1 = V_{IL}$, $CE_2 = V_{IH}$.
10. Address is valid prior to or coincident with $\overline{CE}_1$ LOW and CE_2 HIGH transitions.
11. I/O will assume the High-Z state if $\overline{OE} \geq V_{IH}$.
12. The internal write time is defined by the overlap of $\overline{CE}_1$ LOW, CE_2 HIGH and $\overline{WE}$ LOW. All signals must be in valid states to initiate a write, but any signal can be deasserted to terminate the Write. The Data Input Set-up and Hold timing are referenced to the rising or falling edge of the signal that terminates the write.
13. Tested with $\overline{OE}$ HIGH.

Pin Descriptions

A_0 - A_{16}: Address Inputs

These 17 address inputs select one of the 131,072 8-bit words in the RAM.

$\overline{CE}_1$: Chip Enable 1 Input

$\overline{CE}_1$ is asserted LOW. The Chip Enable is asserted LOW to read from or write to the device. If Chip Enable 1 is deasserted, the device is deselected and is in a standby power mode. The I/O pins will be in the high-impedance state when the device is deselected.

CE_2: Chip Enable 2 Input

CE_2 is asserted HIGH. The Chip Enable 2 is asserted HIGH to read from or write to the device. If CE_2 is deasserted, the device is deselected and is in a standby power mode. The I/O pins will be in the high-impedance state when the device is deselected.

$\overline{OE}$: Output Enable Input

The Output Enable input is asserted LOW. If the Output Enable is asserted LOW while $\overline{CE}_1$ is asserted (LOW), CE_2 is asserted (HIGH) and $\overline{WE}$ is deasserted (HIGH), data from the SRAM will be present on the I/O pins. The I/O pins will be in the high-impedance state when $\overline{OE}$ is deasserted.

$\overline{WE}$: Write Enable Input

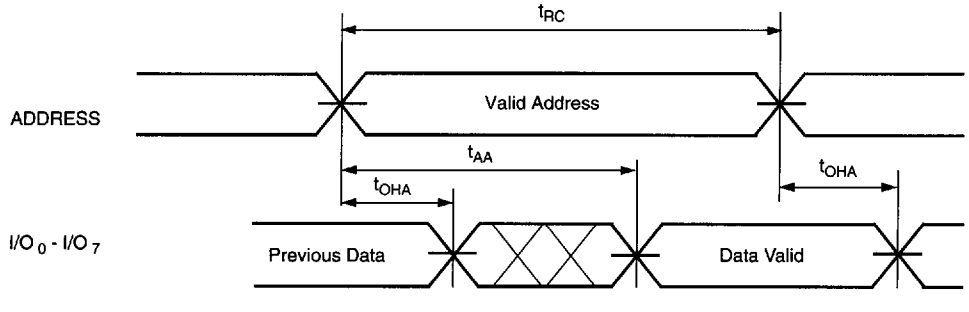
The Write Enable input is asserted LOW and controls read and write operations. When $\overline{CE}_1$ and $\overline{WE}$ are both asserted (LOW) and CE_2 is asserted (HIGH) input data present on the I/O pins will be written into the selected memory location.

I/O_0 - I/O_7: Common Input/Output Pins

GND: Ground

Switching Waveforms

Read Cycle No. 1 ($\overline{CE}_1$ = LOW, CE_2 = HIGH, $\overline{OE}$ = LOW, $\overline{WE}$ = HIGH)



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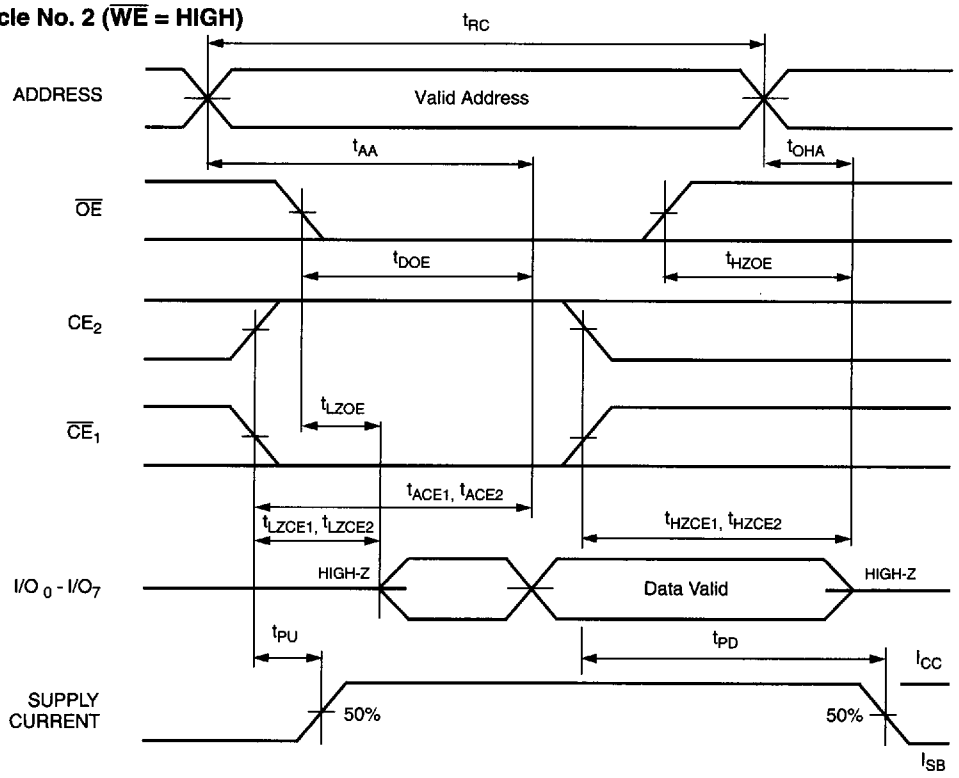
Read Cycle No. 2 ($\overline{WE}$ = HIGH)



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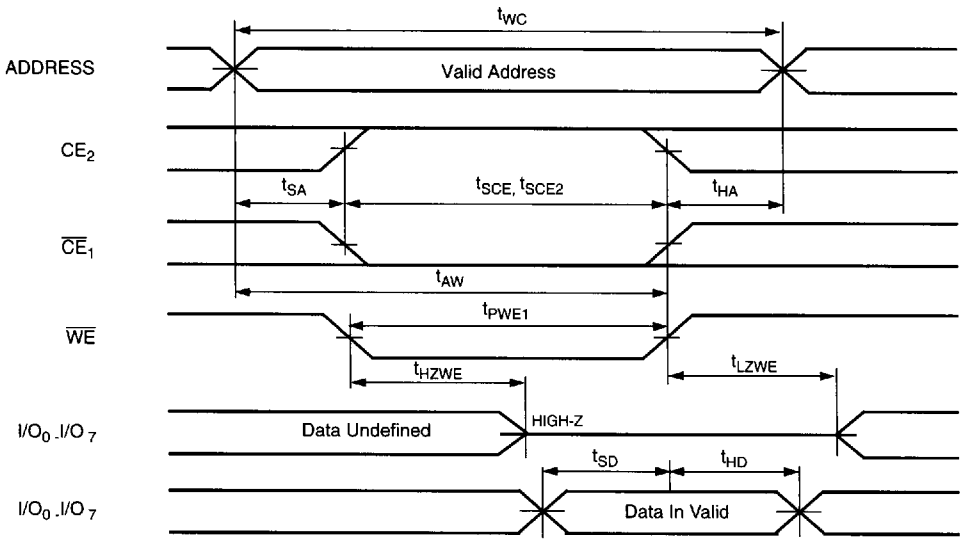
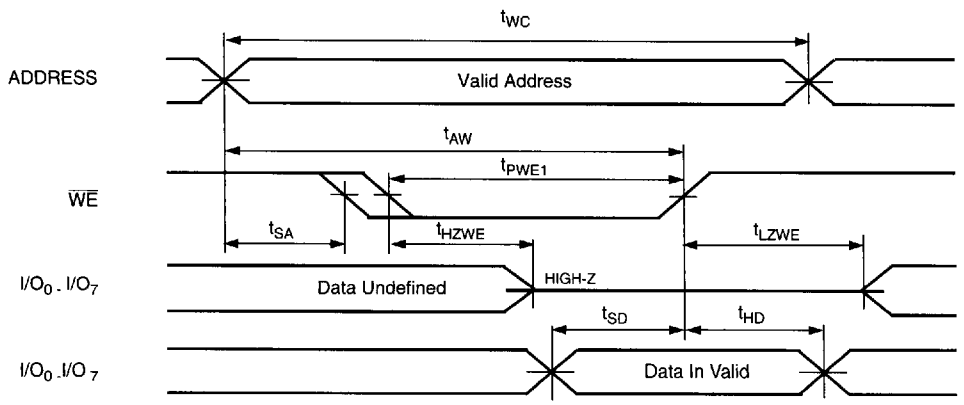
Switching Waveforms (continued)

Write Cycle No.1 ($\overline{CE}_1$, or CE_2 controlled, $\overline{OE}$ is HIGH or LOW: $\overline{CE}_1$ or CE_2 Terminates Write)



9A108-10

Write Cycle No.2 ($\overline{WE}$ controlled, $\overline{OE}$ is HIGH, $\overline{CE}_1$ is LOW, and CE_2 is HIGH: $\overline{WE}$ Terminates Write)



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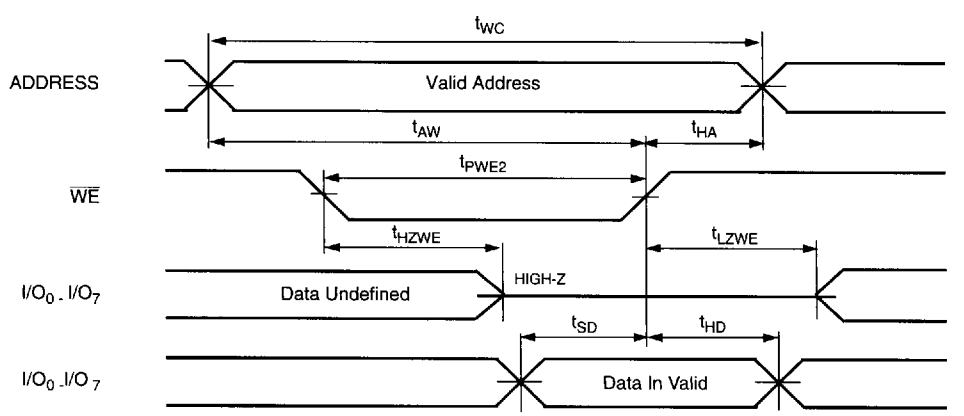
Write Cycle No.3 ($\overline{WE}$ controlled, $\overline{OE}$ is LOW, CE_2 is HIGH, $\overline{CE}_1$ is LOW: $\overline{WE}$ Terminates Write)



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Truth Table

Mode	$\overline{WE}$	$\overline{CE_1}$	CE_2	$\overline{OE}$	I/O	I_{CC}
Standby	X	H	X	X	High-Z	I_{SB1}, I_{SB2}
Standby	X	X	L	X	High-Z	I_{SB1}, I_{SB2}
Selected/Output Disabled	H	L	H	H	High-Z	I_{CC1}, I_{CC2}
Read	H	L	H	L	D_{OUT}	I_{CC1}, I_{CC2}
Write	L	L	H	X	D_{IN}	I_{CC1}, I_{CC2}

Ordering Information

Speed	Part Number	Package Name	Package Type	Temperature Range
10	AP9A108-10VC	V32.1	32-Pin (400-Mil) Small Outline J-Bend	Commercial
12	AP9A108-12VC	V32.1	32-Pin (400-Mil) Small Outline J-Bend	
	AP9A108-12TC	T32.2	32-Pin Thin Small Outline Package	
15	AP9A108-15VC	V32.1	32-Pin (400-Mil) Small Outline J-Bend	
	AP9A108-15TC	T32.2	32-Pin Thin Small Outline Package	
20	AP9A108-20VC	V32.1	32-Pin (400-Mil) Small Outline J-Bend	
	AP9A108-20TC	T32.2	32-Pin Thin Small Outline Package	

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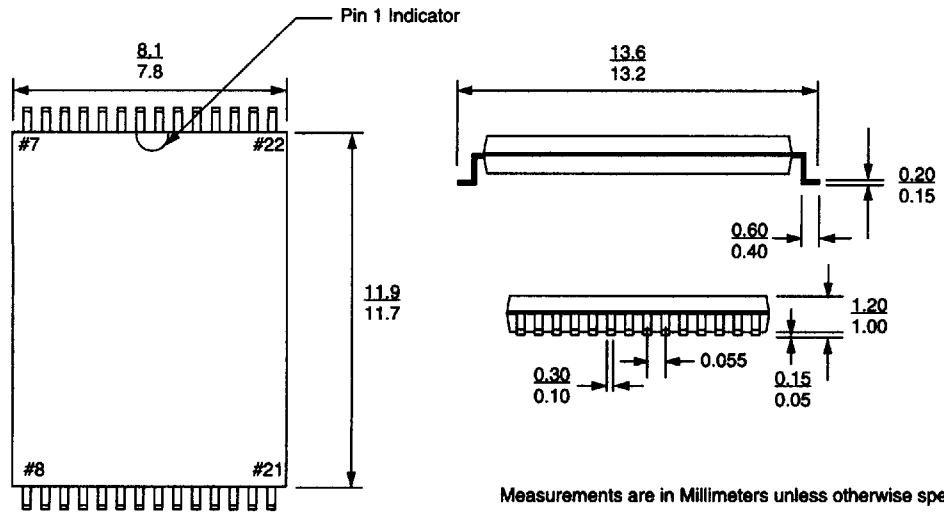
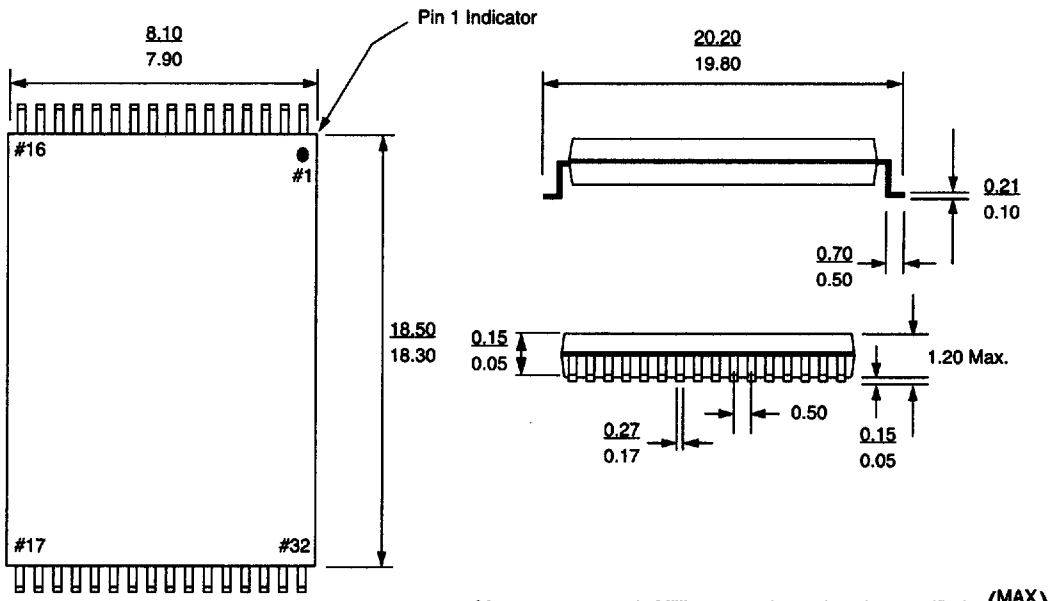
T28.1 - 28-Pin Thin Small Outline Package (TSOP)



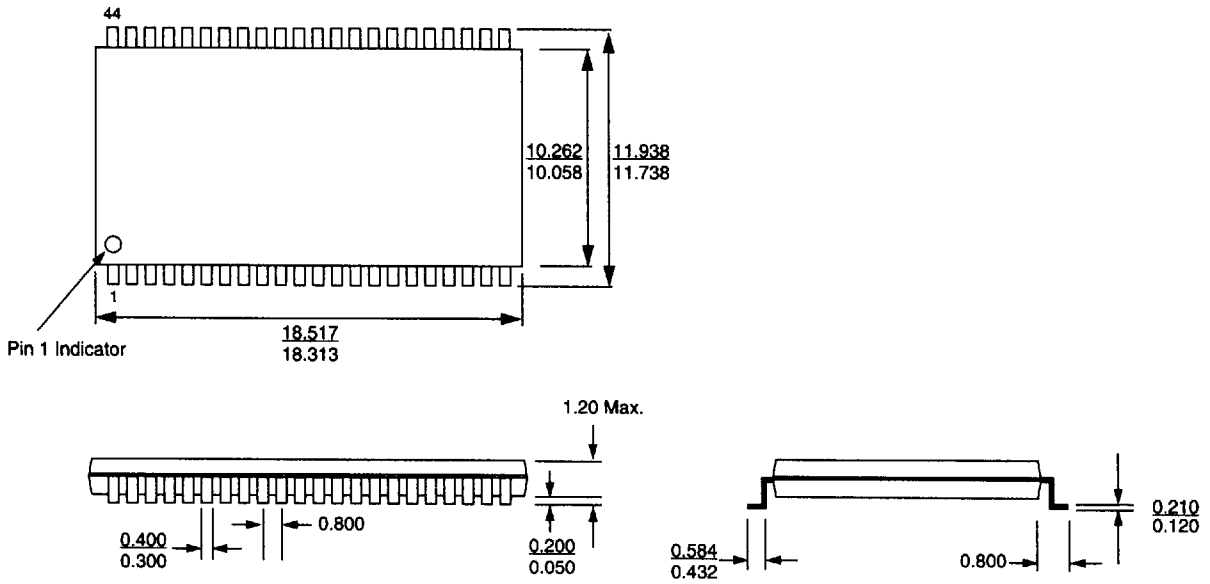
Measurements are in Millimeters unless otherwise specified. (MAX/MIN)

T32.1 - 32-Pin Thin Small Outline Package (TSOP)



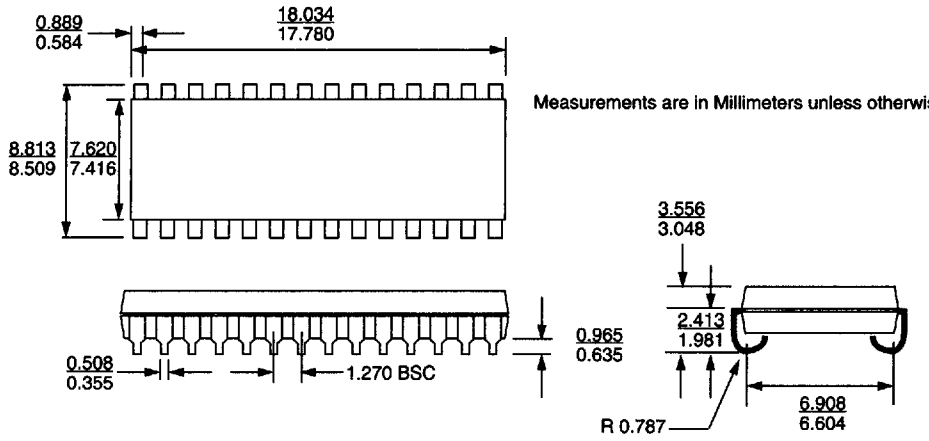
Measurements are in Millimeters unless otherwise specified. (MAX/MIN)

T44.1 - 44-Pin (400-Mil) Thin Small Outline Package (TSOP)



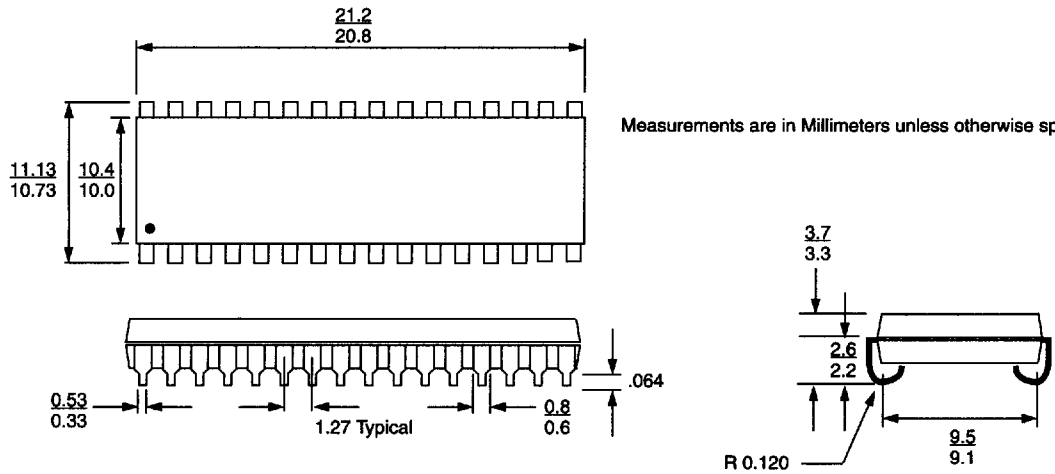
Measurements are in Millimeters unless otherwise specified. (MAX/MIN)

V28.1 - 28-Pin (300-Mil) Small Outline J-Bend (SOJ)



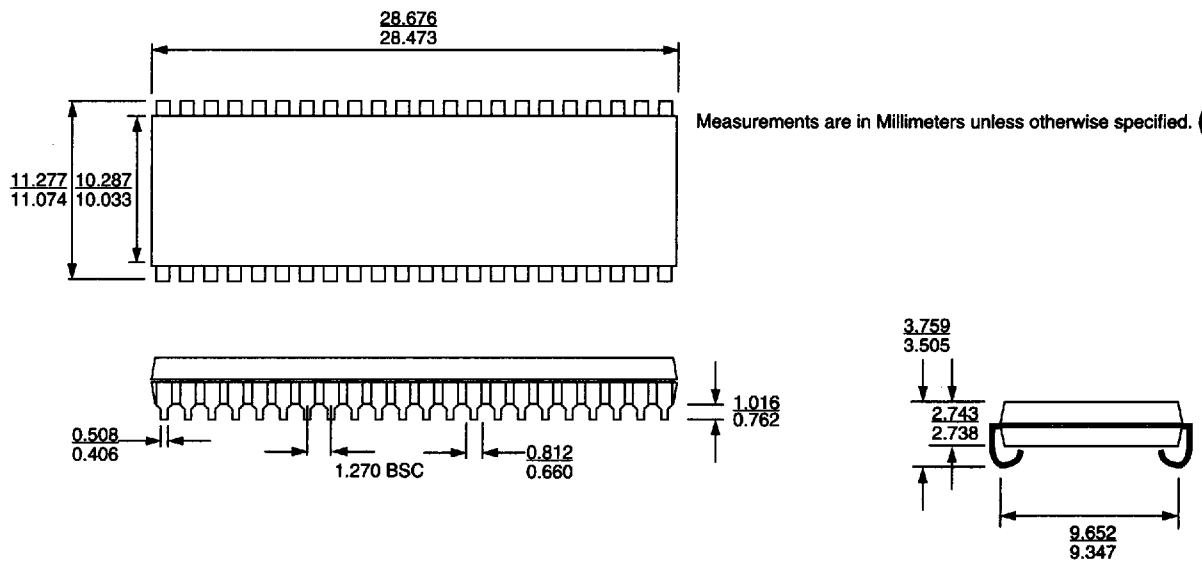
Measurements are in Millimeters unless otherwise specified. (MAX/MIN)

V32.1 - 32-Pin (400-Mil) Small Outline J-Bend (SOJ)



Measurements are in Millimeters unless otherwise specified. (MAX/MIN)

V44.1 - 44-Pin (400-Mil) Small Outline J-Bend (SOJ)



Measurements are in Millimeters unless otherwise specified. (MAX/MIN)