

Features

- Fast Read Access Time - 100 ns
- Low Power CMOS Operation
 - 100 μ A max. Standby
 - 30 mA max. Active at 5 MHz
- Wide Selection of JEDEC Standard Packages
 - 32-Lead 600-mil PDIP and Cerdip
 - 32-Lead 450-mil SOIC (SOP)
 - 32-Lead TSOP
- 5 V \pm 10% Supply
- High Reliability CMOS Technology
 - 2,000 V ESD Protection
 - 200 mA Latchup Immunity
- Rapid Programming - 50 μ s/byte (typical)
- Two-Line Control
- CMOS and TTL Compatible Inputs and Outputs
- Integrated Product Identification Code
- Industrial and Commercial Temperature Ranges

**8 Megabit
(1M x 8)
UV Erasable
CMOS
EPROM**

Description

The AT27C080 chip is a low-power, high-performance 8,388,608 bit ultraviolet erasable and electrically programmable read only memory (EPROM) organized as 1M x 8 bits. The AT27C080 requires only one 5-V power supply in normal read mode operation. Any byte can be accessed in less than 100 ns, eliminating the need for speed reducing WAIT states on high-performance microprocessor systems.

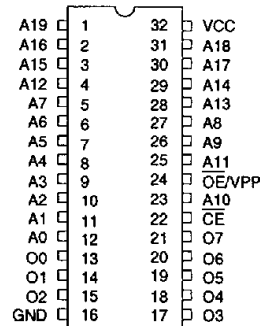
Atmel's 0.8-micron scaled CMOS technology provides for significantly lower active power consumption than competing designs. Power consumption is typically 10 mA in active mode and less than 10 μ A in standby mode.

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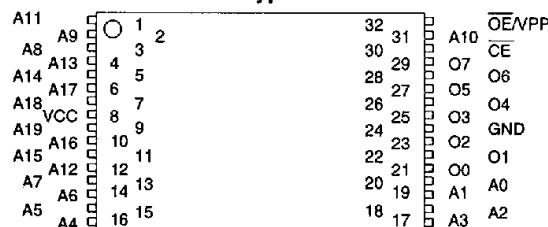
Pin Configurations

Pin Name	Function
A0-A19	Addresses
O0-O7	Outputs
CE	Chip Enable
OE	Output Enable

CDIP, PDIP, SOIC Top View



TSOP Top View
Type 1





Description (Continued)

The AT27C080 comes in a choice of packages, including; one time programmable (OTP) plastic PDIP, SOIC (SOP), and TSOP, as well as windowed ceramic Cerdip. All devices feature two-line control (\overline{CE} , \overline{OE}) to give designers the flexibility to prevent bus contention.

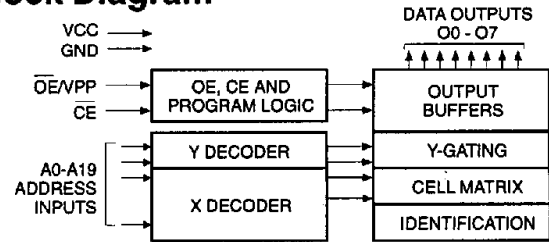
With high density 1M byte storage capability, the AT27C080 allows firmware to be stored reliably and to be accessed by the system without the delays of mass storage media.

Atmel's 27C080 has additional features to ensure high quality and efficient production use. The Rapid Programming Algorithm reduces the time required to program the part and guarantees reliable programming. Programming time is typically only 50 μ s/byte. The Integrated Product Identification Code electronically identifies the device and manufacturer. This feature is used by industry standard programming equipment to select the proper programming algorithms and voltages.

Erase Characteristics

The entire memory array of the AT27C080 is erased (all outputs read as V_{OH}) after exposure to ultraviolet light at a wavelength of 2537 \AA . Complete erasure is assured after a minimum of 20 minutes exposure using 12,000 μ W/cm² intensity lamps spaced one inch away from the chip. Minimum erase time for lamps at other intensity ratings can be calculated from the minimum integrated erasure dose of 15 W \cdot sec/cm². To prevent unintentional erasure, an opaque label is recommended to cover the clear window on any UV erasable EPROM which will be subjected to continuous fluorescent indoor lighting or sunlight.

Block Diagram



Absolute Maximum Ratings*

Temperature Under Bias	-55°C to +125°C
Storage Temperature.....	-65°C to +150°C
Voltage on Any Pin with Respect to Ground.....	-2.0 V to +7.0 V ⁽¹⁾
Voltage on A9 with Respect to Ground	-2.0 V to +14.0 V ⁽¹⁾
V _{PP} Supply Voltage with Respect to Ground.....	-2.0 V to +14.0 V ⁽¹⁾
Integrated UV Erase Dose.....	7258 W \cdot sec/cm ²

*NOTICE: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Notes:

1. Minimum voltage is -0.6 V dc which may undershoot to -2.0 V for pulses of less than 20 ns. Maximum output pin voltage is $V_{CC}+0.75$ V dc which may overshoot to +7.0 V for pulses of less than 20 ns.

Operating Modes

Mode \ Pin	\overline{CE}	$\overline{OE/V_{PP}}$	Ai	V _{CC}	Outputs
Read	V _{IL}	V _{IL}	Ai	V _{CC}	DOUT
Output Disable	X	V _{IH}	X ⁽¹⁾	V _{CC}	High Z
Standby	V _{IH}	X	X	V _{CC}	High Z
Rapid Program ⁽²⁾	V _{IL}	V _{PP}	Ai	V _{CC}	DIN
PGM Verify	V _{IL}	V _{IL}	Ai	V _{CC}	DOUT
PGM Inhibit	V _{IH}	V _{PP}	X	V _{CC}	High Z
Product Identification ⁽⁴⁾	V _{IL}	V _{IL}	A9=V _H ⁽³⁾ A0=V _{IH} or V _{IL} A1-A19=V _{IL}	V _{CC}	Identification Code

- Notes: 1. X can be V_{IL} or V_{IH}.
2. Refer to Programming characteristics.
3. V_H = 12.0 \pm 0.5 V.

4. Two identifier bytes may be selected. All Ai inputs are held low (V_{IL}), except A9 which is set to V_H and A0 which is toggled low (V_{IL}) to select the Manufacturer's Identification byte and high (V_{IH}) to select the Device Code byte.

D.C. and A.C. Operating Conditions for Read Operation

		AT27C080			
		-10	-12	-15	-20
Operating Temperature (Case)	Com.	0°C - 70°C	0°C - 70°C	0°C - 70°C	0°C - 70°C
	Ind.	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C
	Mil.		-55°C - 125°C	-55°C - 125°C	-55°C - 125°C
V _{CC} Power Supply		5 V ± 10%	5 V ± 10%	5 V ± 10%	5 V ± 10%

3

D.C. and Operating Characteristics for Read Operation

Symbol	Parameter	Condition	Min	Max	Units
I _{LI}	Input Load Current	V _{IN} = 0 V to V _{CC}	Com., Ind.	±1	μA
			Mil.	±5	μA
I _{LO}	Output Leakage Current	V _{OUT} = 0 V to V _{CC}	Com., Ind.	±5	μA
			Mil.	±10	μA
I _{SB}	V _{CC} ⁽¹⁾ Standby Current	I _{SB1} (CMOS), $\overline{CE} = V_{CC} \pm 0.3$ V		100	μA
		I _{SB2} (TTL), $\overline{CE} = 2.0$ to V _{CC} + 0.5 V		1	mA
I _{CC}	V _{CC} Active Current	f = 5 MHz, I _{OUT} = 0 mA, CE = V _{IL}	Com.	30	mA
			Ind., Mil.	40	mA
V _{IL}	Input Low Voltage		-0.6	0.8	V
V _{IH}	Input High Voltage		2.0	V _{CC} +0.5	V
V _{OL}	Output Low Voltage	I _{OL} = 2.1 mA		.45	V
V _{OH}	Output High Voltage	I _{OH} = -100 μA		V _{CC} -0.3	V
		I _{OH} = -2.5 mA		3.5	V
		I _{OH} = -400 μA		2.4	V

Notes: 1. V_{CC} must be applied simultaneously or before \overline{OE}/V_{PP} , and removed simultaneously or after \overline{OE}/V_{PP} .

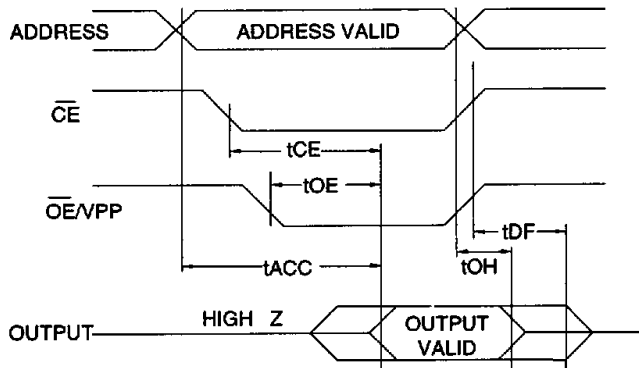
A.C. Characteristics for Read Operation

			AT27C080							
			-10		-12		-15		-20	
Symbol	Parameter	Condition	Min	Max	Min	Max	Min	Max	Min	Max
t _{ACC} ⁽⁴⁾	Address to Output Delay	$\overline{CE} = \overline{OE}/V_{PP}$ = V _{IL}	Com., Ind.	100	120	150	200			ns
			Mil.		120	150	200			ns
t _{CE} ⁽³⁾	\overline{CE} to Output Delay	$\overline{OE}/V_{PP} = V_{IL}$		100	120	150	200			ns
t _{OE} ^(3,4)	\overline{OE}/V_{PP} to Output Delay	$\overline{CE} = V_{IL}$		35	35	40	60			ns
t _{DF} ^(2,5)	\overline{OE}/V_{PP} or \overline{CE} High to Output Float			30	35	40	50			ns
t _{OH}	Output Hold from Address, \overline{CE} or \overline{OE}/V_{PP} , whichever occurred first		0	0	0	0			ns	

Notes: 2, 3, 4, 5 - see AC Waveforms for Read Operation.



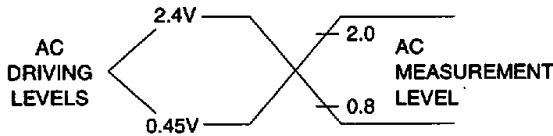
A.C. Waveforms for Read Operation ⁽¹⁾



Notes:

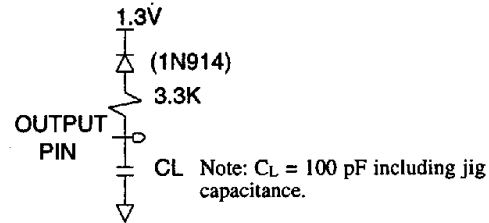
1. Timing measurement references are 0.8 V and 2.0 V. Input AC driving levels are 0.45 V and 2.4 V, unless otherwise specified.
2. t_{DF} is specified from \overline{OE}/V_{PP} or \overline{CE} , whichever occurs first. Output float is defined as the point when data is no longer driven.
3. \overline{OE}/V_{PP} may be delayed up to $t_{CE}-t_{OE}$ after the falling edge of \overline{CE} without impact on t_{CE} .
4. \overline{OE}/V_{PP} may be delayed up to $t_{ACC}-t_{OE}$ after the address is valid without impact on t_{ACC} .
5. This parameter is only sampled and is not 100% tested.

Input Test Waveforms and Measurement Levels



$t_R, t_F < 20ns$ (10% to 90%)

Output Test Load

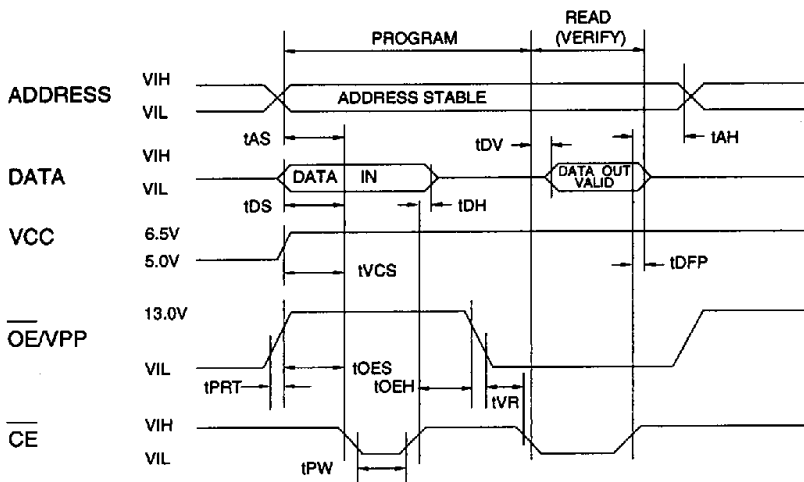


Pin Capacitance ($f = 1 MHz$ $T = 25^\circ C$) ⁽¹⁾

	Typ	Max	Units	Conditions
C_{IN}	4	8	pF	$V_{IN} = 0 V$
C_{OUT}	8	12	pF	$V_{OUT} = 0 V$

Notes: 1. Typical values for nominal supply voltage. This parameter is only sampled and is not 100% tested.

Programming Waveforms ⁽¹⁾



Notes:

1. The Input Timing Reference is 0.8 V for V_{IL} and 2.0 V for V_{IH} .
2. t_{OE} and t_{DFP} are characteristics of the device but must be accommodated by the programmer.

D.C. Programming Characteristics

$T_A = 25 \pm 5^\circ\text{C}$, $V_{CC} = 6.5 \pm 0.25\text{V}$, $\overline{OE}/V_{PP} = 13.0 \pm 0.25\text{V}$

Sym- bol	Parameter	Test Conditions	Limits		Units
			Min	Max	
I _{LI}	Input Load Current	V _{IN} =V _{IL} , V _{IH}		10	μA
V _{IL}	Input Low Level	(All Inputs)	-0.6	0.8	V
V _{IH}	Input High Level		2.0	V _{CC} +1	V
V _{OL}	Output Low Volt.	I _{OL} =2.1 mA		.45	V
V _{OH}	Output High Volt.	I _{OH} =-400 μA	2.4		V
I _{CC2}	V _{CC} Supply Current (Program and Verify)			40	mA
I _{PP2}	\overline{OE}/V_{PP} Current	$\overline{CE}=V_{IL}$		25	mA
V _{ID}	A9 Product Identification Voltage		11.5	12.5	V

A.C. Programming Characteristics

$T_A = 25 \pm 5^\circ\text{C}$, $V_{CC} = 6.5 \pm 0.25\text{V}$, $\overline{OE}/V_{PP} = 13.0 \pm 0.25\text{V}$

Sym- bol	Parameter	Test Conditions* (see Note 1)	Limits		Units
			Min	Max	
t _{AS}	Address Setup Time		2		μs
t _{OES}	\overline{OE}/V_{PP} Setup Time		2		μs
t _{OEH}	\overline{OE}/V_{PP} Hold Time		2		μs
t _{DS}	Data Setup Time		2		μs
t _{AH}	Address Hold Time		0		μs
t _{DH}	Data Hold Time		2		μs
t _{DFP}	\overline{CE} High to Out- put Float Delay	(Note 2)	0	130	ns
t _{VCS}	V _{CC} Setup Time		2		μs
t _{PW}	\overline{CE} Program Pulse Width	(Note 3)	47	53	μs
t _{DV}	Data Valid from \overline{CE}	(Note 2)		1	μs
t _{VR}	\overline{OE}/V_{PP} Recovery Time		2		μs
t _{PRT}	\overline{OE}/V_{PP} Pulse Rise Time During Programming		50		ns

*A.C. Conditions of Test:

- Input Rise and Fall Times (10% to 90%) 20 ns
- Input Pulse Levels 0.45 V to 2.4 V
- Input Timing Reference Level 0.8 V to 2.0 V
- Output Timing Reference Level 0.8 V to 2.0 V

Notes:

1. V_{CC} must be applied simultaneously or before \overline{OE}/V_{PP} and removed simultaneously or after \overline{OE}/V_{PP} .
2. This parameter is only sampled and is not 100% tested. Output Float is defined as the point where data is no longer driven — see timing diagram.
3. Program Pulse width tolerance is 50 μsec ± 5%.

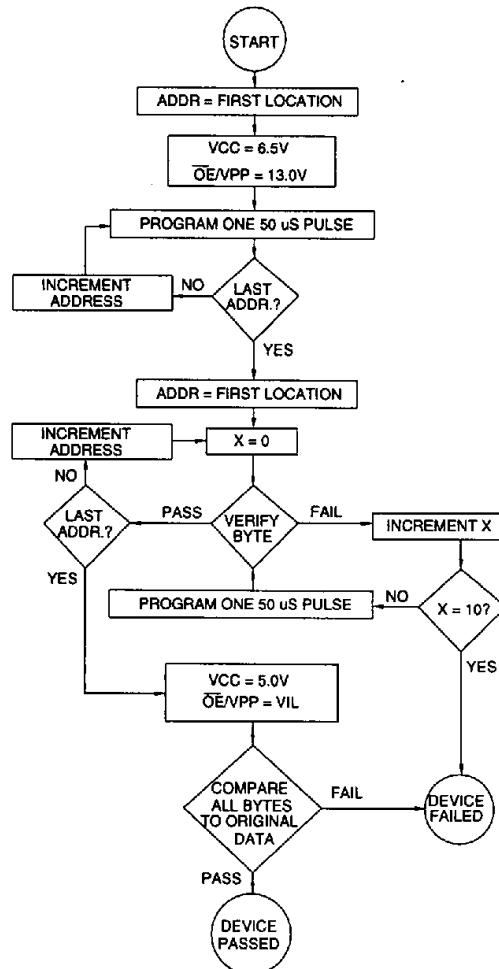
Atmel's 27C080 Integrated Product Identification Code

Codes	Pins								Hex Data	
	A0	O7	O6	O5	O4	O3	O2	O1		O0
Manufacturer	0	0	0	0	1	1	1	1	0	1E
Device Type	1	1	0	0	0	1	0	1	0	8A

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Rapid Programming Algorithm

A 50 μs \overline{CE} pulse width is used to program. The address is set to the first location. V_{CC} is raised to 6.5V and \overline{OE}/V_{PP} is raised to 13.0 V. Each address is first programmed with one 50 μs \overline{CE} pulse without verification. Then a verification/reprogramming loop is executed for each address. In the event a byte fails to pass verification, up to 10 successive 50 μs pulses are applied with a verification after each pulse. If the byte fails to verify after 10 pulses have been applied, the part is considered failed. After the byte verifies properly, the next address is selected until all have been checked. \overline{OE}/V_{PP} is then lowered to V_{IL} and V_{CC} to 5.0 V. All bytes are read again and compared with the original data to determine if the device passes or fails.





Ordering Information

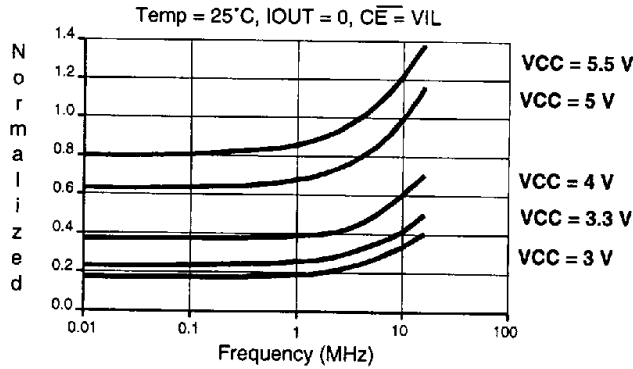
 = Advance Information

tACC (ns)	Icc (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
100	30	0.1	AT27C080-10DC	32DW6	Commercial (0°C to 70°C)
			AT27C080-10PC	32P6	
			AT27C080-10TC	32T	
			AT27C080-10RC	32R	
120	30	0.1	AT27C080-12DC	32DW6	Commercial (0°C to 70°C)
			AT27C080-12PC	32P6	
			AT27C080-12TC	32T	
			AT27C080-12RC	32R	
120	40	0.1	AT27C080-12DI	32DW6	Industrial (-40°C to 85°C)
			AT27C080-12PI	32P6	
			AT27C080-12TI	32T	
			AT27C080-12RI	32R	
			AT27C080-12DM	32DW6	Military (-55°C to 125°C)
150	30	0.1	AT27C080-15DC	32DW6	Commercial (0°C to 70°C)
			AT27C080-15PC	32P6	
			AT27C080-15TC	32T	
			AT27C080-15RC	32R	
150	40	0.1	AT27C080-15DI	32DW6	Industrial (-40°C to 85°C)
			AT27C080-15PI	32P6	
			AT27C080-15TI	32T	
			AT27C080-15RI	32R	
			AT27C080-15DM	32DW6	Military (-55°C to 125°C)
200	30	0.1	AT27C080-20DC	32DW6	Commercial (0°C to 70°C)
			AT27C080-20PC	32P6	
			AT27C080-20TC	32T	
			AT27C080-20RC	32R	
200	40	0.1	AT27C080-20DI	32DW6	Industrial (-40°C to 85°C)
			AT27C080-20PI	32P6	
			AT27C080-20TI	32T	
			AT27C080-20RI	32R	
			AT27C080-20DM	32DW6	Military (-55°C to 125°C)

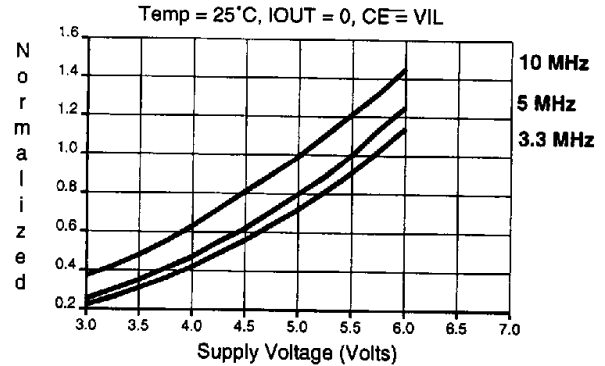
Package Type	
32DW6	32 Lead, 0.600" Wide, Windowed, Ceramic Dual Inline Package (Cerdip)
32P6	32 Lead, 0.600" Wide, Plastic Dual Inline Package OTP (PDIP)
32R	32 Lead, 0.450" Wide, Plastic Gull Wing Small Outline OTP (SOIC)
32T	32 Lead, Plastic Thin Small Outline Package OTP (TSOP)

EPROM Product Characteristics for AT27Cxxx Series Parts

NORMALIZED SUPPLY CURRENT vs. FREQUENCY

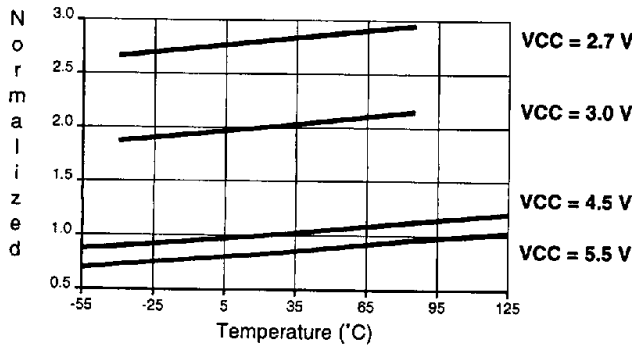


NORMALIZED SUPPLY CURRENT vs. VOLTAGE

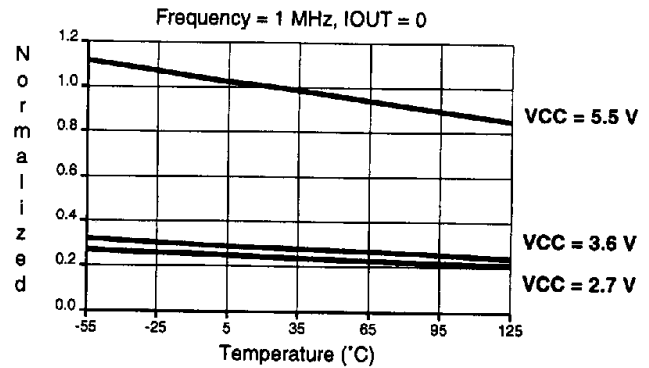


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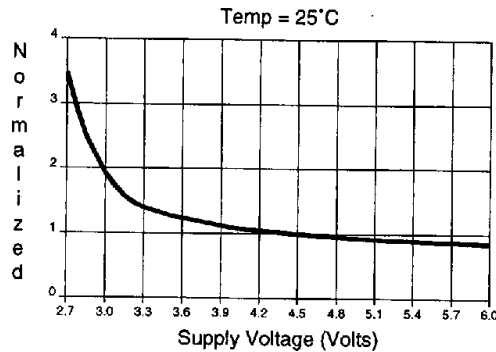
NORMALIZED ACCESS TIME vs. TEMPERATURE



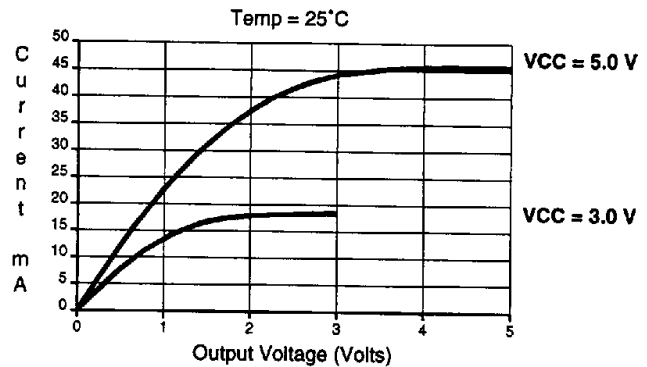
NORMALIZED SUPPLY CURRENT vs. TEMP.



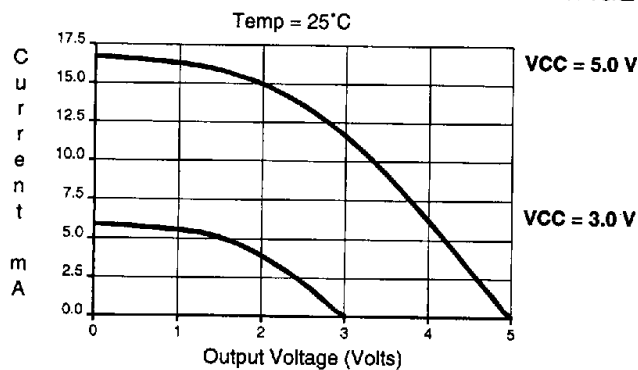
NORMALIZED ACCESS TIME vs. SUPPLY VOLTAGE



OUTPUT SINK CURRENT vs. OUTPUT VOLTAGE



OUTPUT SOURCE CURRENT vs. OUTPUT VOLTAGE



DELTA ACCESS TIME vs. LOAD CAPACITANCE

