



PROGRAMMING AMD's CMOS EPROMs

This section contains information on programming AMD CMOS EPROM devices, using AMD's fast Flashrite™ programming algorithm.

FLASHRITE PROGRAMMING METHODOLOGY

AMD EPROMs are shipped from the factory fully erased. Thus, on delivery, or after device erasure, these devices have all bits in the "1" or "high" state. The programming process sets the programmed bits to the "0" or "low" state. Bit locations may be programmed individually or in blocks, and in any order.

Programming Operation

Figure 1 shows AMD's Flashrite programming algorithm. This algorithm efficiently programs the device using 100 μ s programming pulses, giving each address only as many pulses as necessary to reliably program the data.

The device enters the programming mode when 12.75 \pm 0.25 V is applied to the V_{PP} pin, \overline{CE} and \overline{PGM}^* are at V_{IL} , and \overline{OE} is at V_{IH} . The data to be programmed

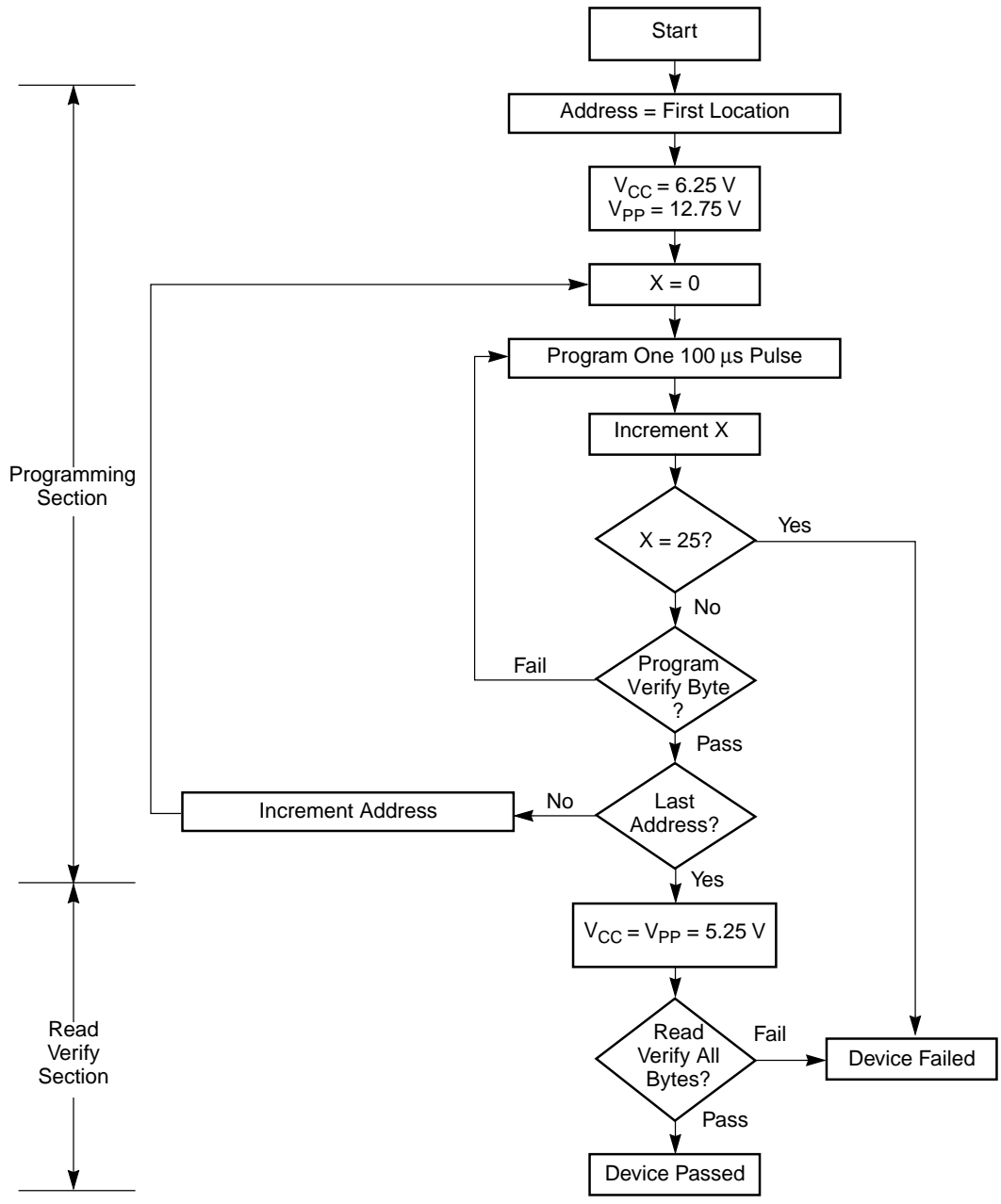
** Not all devices have the \overline{PGM} pin.*

is applied in parallel on the data input/output pins (8- or 16-bits wide, depending on device organization). The "programming" section of the algorithm should be performed with $V_{CC} = 6.25$ V to assure that each EPROM bit is programmed to a sufficiently high threshold voltage.

A program verify should be performed on the programmed bits to determine that they were correctly programmed. After each pulse is applied to an address, the data at that address is program verified. Valid data should appear on the output pins. If the data is not fully programmed, additional pulses are applied until either the data is fully programmed or until the maximum pulse count is reached. This process is repeated in sequence for each address to be programmed. Refer to the waveform diagrams for the specific device to determine required input levels for program verification.

Read Verify Operation

After the final address is programmed, a read verify on the entire EPROM is performed at $V_{CC} = V_{PP} = 5.25$ V.



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Figure 1. Flashrite Programming Flowchart

DC CHARACTERISTICS

Table 1 shows the DC programming characteristics for all AMD CMOS EPROM devices.

Table 1. DC Programming Characteristics ($T_A = +25 \pm 5 \text{ }^\circ\text{C}$)

Parameter Symbol	Parameter Description	Test Conditions	Min	Max	Unit
I_{LI}	Input Current (All Inputs)	$V_{IN} = V_{IL}$ or V_{IH}		1.0	μA
V_{IL}	Input LOW Level		-0.5	0.8	V
V_{IH}	Input HIGH Level		$0.7 V_{CC}$	$V_{CC} + 0.5$	V
V_{OL}	Output LOW Voltage During Verify	$I_{OL} = 2.1 \text{ mA}$		0.45	V
V_{OH}	Output HIGH Voltage During Verify	$I_{OH} = -400 \mu\text{A}$	2.4		V
V_H	A9 Auto Select Voltage		11.5	12.5	V
I_{CC3}	V_{CC} Supply Current (Program & Verify)			50	mA
I_{PP2}	V_{PP} Supply Current (Program)	$\overline{CE} = V_{IL}, \overline{OE} = V_{IH}$		30	mA
V_{CC1}	Flashrite Supply Voltage		6.00	6.50	V
V_{PP1}	Flashrite Programming Voltage		12.5	13.0	V

Notes:

- V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP} .
- When programming an AMD CMOS EPROM, a $0.1 \mu\text{F}$ capacitor is required across V_{PP} and ground to suppress spurious voltage transients which may damage the device.
- Programming characteristics are sampled but not 100% tested at worst-case conditions.

AC PROGRAMMING CHARACTERISTICS

Table 3 and Figure 2 show the AC programming characteristics and waveforms for the following AMD EPROM devices: Am27C64, Am27C128, Am27C010,

Am27C1024, Am27C020, Am27C2048, and Am27LV010.

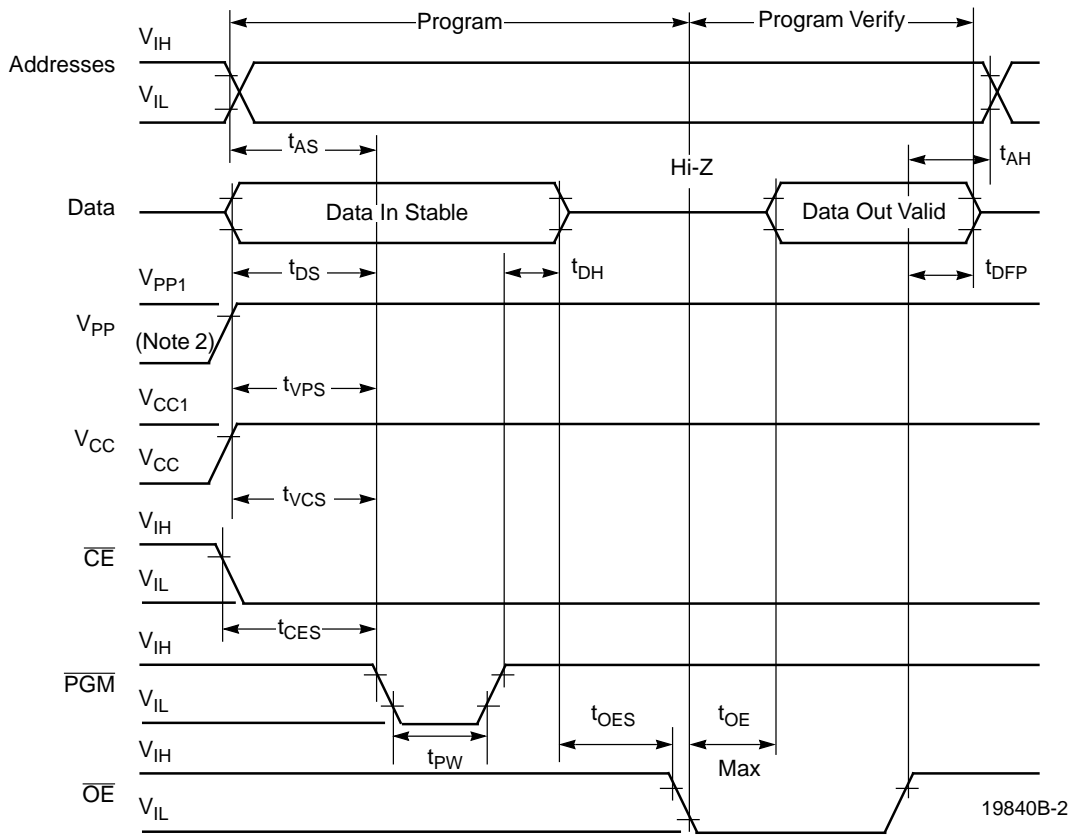
Table 2. AC Programming Characteristics ($T_A = +25 \pm 5^\circ\text{C}$) for Am27C64, Am27C128, Am27C010, Am27C1024, Am27C020, Am27C2048, and Am27LV010

Parameter Symbols		Parameter Description	Min	Max	Unit
JEDEC	Standard				
t_{AVEL}	t_{AS}	Address Setup Time	2		μs
t_{DZGL}	t_{OES}	$\overline{\text{OE}}$ Setup Time	2		μs
t_{DVEL}	t_{DS}	Data Setup Time	2		μs
t_{GHAX}	t_{AH}	Address Hold Time	0		μs
t_{EHDX}	t_{DH}	Data Hold Time	2		μs
t_{GHQZ}	t_{DFP}	Output Enable to Output Float Delay	0	130	ns
t_{VPS}	t_{VPS}	V_{PP} Setup Time	2		μs
t_{ELEH1}	t_{PW}	$\overline{\text{PGM}}$ Program Pulse Width	95	105	μs
t_{VCS}	t_{VCS}	V_{CC} Setup Time	2		μs
t_{ELPL}	t_{CES}	$\overline{\text{CE}}$ Setup Time	2		μs
t_{GLQV}	t_{OE}	Data Valid from $\overline{\text{OE}}$		150	ns

Notes:

1. The input timing reference level is 0.8 V for V_{IL} and 2 V for V_{IH} .
2. t_{OE} and t_{DFP} are characteristics of the device, but must be accommodated by the programmer.
3. When programming the above devices, a 0.1 μF capacitor is required across V_{PP} and ground to suppress spurious voltage transients which may damage the device.
4. Programming characteristics are sampled but not 100% tested at worst-case conditions.

AC PROGRAMMING CHARACTERISTICS



Notes:

1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP} .
2. The V_{PP} pin may be at V_{IL} , V_{IH} , V_{CC} , or V_{SS} before rising to V_{PP1} for programming.

Figure 2. Flashrite Programming Algorithm Waveform for Am27C64, Am27C128, Am27C010, Am27C1024, Am27C020, Am27C2048, and Am27LV010

AC PROGRAMMING Characteristics (Continued)

Table 3 shows the AC programming characteristics and waveforms for the following devices: Am27C256, Am27C040, Am27C400, and Am27C4096. Figure 3

applies only to the Am27C040. Figure 4 applies to the Am27C256, Am27C400, and Am27C4096.

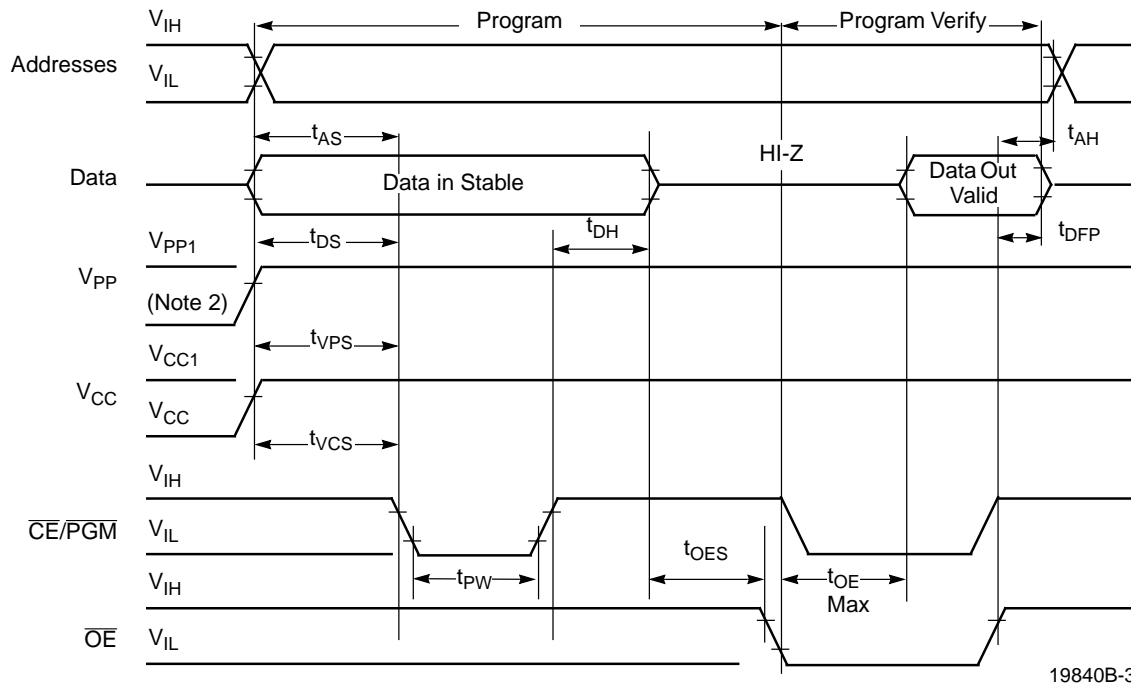
Table 3. AC Programming Characteristics ($T_A = +25 \pm 5^\circ\text{C}$) for Am27C256, Am27C040, Am27C400, and Am27C4096

Parameter Symbols		Parameter Description	Min	Max	Unit
JEDEC	Standard				
t_{AVEL}	t_{AS}	Address Setup Time	2		μs
t_{DZGL}	t_{OES}	$\overline{\text{OE}}$ Setup Time	2		μs
t_{DVEL}	t_{DS}	Data Setup Time	2		μs
t_{GHAX}	t_{AH}	Address Hold Time	0		μs
t_{EHDX}	t_{DH}	Data Hold Time	2		μs
t_{GHQZ}	t_{DFP}	Output Enable to Output Float Delay	0	130	ns
t_{VPS}	t_{VPS}	V_{PP} Setup Time	2		μs
t_{ELEH1}	t_{PW}	$\overline{\text{PGM}}$ Program Pulse Width	95	105	μs
t_{VCS}	t_{VCS}	V_{CC} Setup Time	2		μs
t_{GLQV}	t_{OE}	Data Valid from $\overline{\text{OE}}$		150	ns

Notes:

1. The input timing reference level is 0.8 V for V_{IL} and 2 V for V_{IH} .
2. t_{OE} and t_{DFP} are characteristics of the device, but must be accommodated by the programmer.
3. When programming the above devices, a 0.1 μF capacitor is required across V_{PP} and ground to suppress spurious voltage transients which may damage the device.
4. Programming characteristics are sampled but not 100% tested at worst-case conditions.

AC PROGRAMMING CHARACTERISTICS

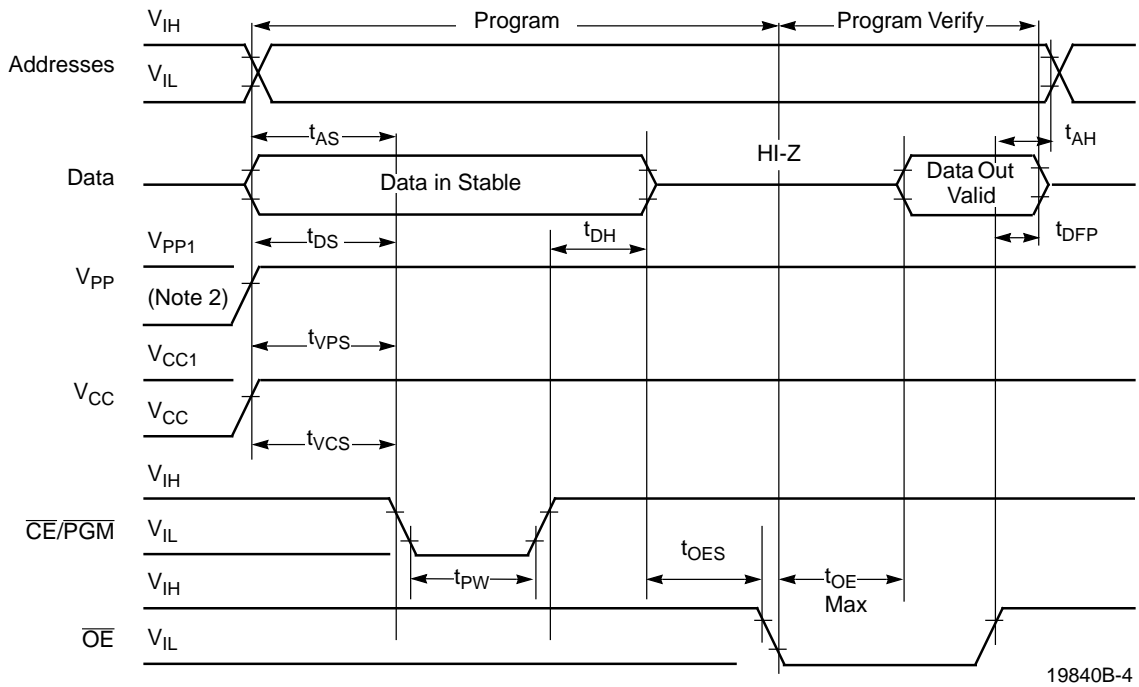


Notes:

1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP} .
2. The V_{PP} pin may be at V_{IL} , V_{IH} , V_{CC} , or V_{SS} before rising to V_{PP1} for programming.

Figure 3. Flashrite Programming Algorithm Waveform for Am27C040

AC PROGRAMMING CHARACTERISTICS



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Notes:

1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP} .
2. The V_{PP} pin may be at V_{IL} , V_{IH} , V_{CC} , or V_{SS} before rising to V_{PP1} for programming.

Figure 4. Flashrite Programming Algorithm Waveform for Am27C400, Am27C4096, and Am27C256

AC PROGRAMMING CHARACTERISTICS (CONTINUED)

Table 4 and Figure 5 show the AC programming characteristics and waveforms for the Am27C512.

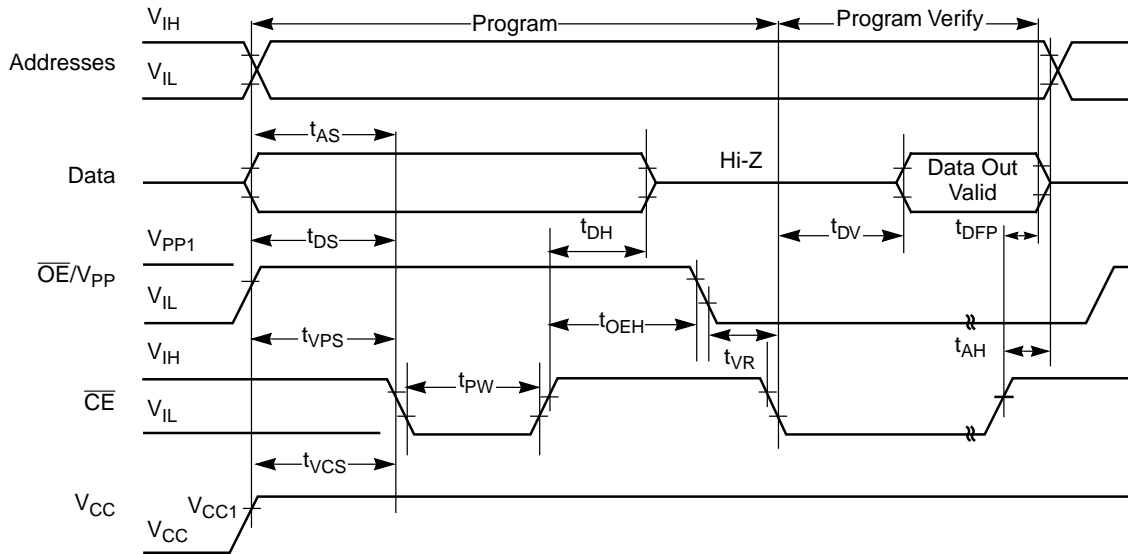
Table 4. AC Programming Characteristics ($T_A = +25 \pm 5 \text{ }^\circ\text{C}$) for Am27C512

Parameter Symbols					
JEDEC	Standard	Parameter Description	Min	Max	Unit
$t_{A\text{VEL}}$	t_{AS}	Address Setup Time	2		μs
$t_{D\text{VEL}}$	t_{DS}	Data Setup Time	2		μs
t_{GHAX}	t_{AH}	Address Hold Time	0		μs
t_{EHDX}	t_{DH}	Data Hold Time	2		μs
t_{EHQZ}	t_{DFP}	Chip Enable to Output Float Delay	0	130	ns
t_{VPS}	t_{VPS}	V_{PP} Setup Time	2		μs
t_{ELEH}	t_{PW}	\overline{CE} Program Pulse Width	95	105	μs
t_{VCS}	t_{VCS}	V_{CC} Setup Time	2		μs
t_{ELQV}	t_{DV}	Data Valid from \overline{OE}		150	ns
t_{EHGL}	t_{OEH}	\overline{OE}/V_{PP} Hold Time	2		ns
t_{GLEL}	t_{VR}	\overline{OE}/V_{PP} Recovery Time	2		ns

Notes:

1. The input timing reference level is 0.8 V for V_{IL} and 2 V for V_{IH} .
2. t_{OE} and t_{DFP} are characteristics of the device, but must be accommodated by the programmer.
3. When programming the above devices, a 0.1 μF capacitor is required across V_{PP} and ground to suppress spurious voltage transients which may damage the device.
4. Programming characteristics are sampled but not 100% tested at worst-case conditions.

AC PROGRAMMING CHARACTERISTICS (CONTINUED)



Note: V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP} .

Figure 5. Flashrite Programming Algorithm Waveform for Am27C512

THIRD-PARTY PROGRAMMING SUPPORT
Recommended Vendors

The following is a list of popular programmer manufacturers that support AMD devices. It is not intended to be an all-inclusive list. Additional vendors may become available; contact your local AMD representative for the latest information. Please contact your programmer manufacturer for details of support and their latest software revisions.

Advin Systems	Elan Digital Systems Ltd	System General
BP Microsystems	Logical Devices	
Data I/O Corporation	Stag Microsystems	

REVISION SUMMARY FOR SECTION 5, PROGRAMMING

Programming Methodology: Rewrote section.

AC Programming Characteristics: Added table and figure references to section (formerly Switching Programming Characteristics). Organized into more defined sections.

Added Note 3 to all figures.

The waveforms for the Am27C040 are shown in Figure 3. The waveforms for the Am27C400, Am27C4096, and Am27C256 are shown Figure 4.

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