

REV		REVISIONS										BY	CH	APP		
SPEC. NO.		SYM	DATE	CN	SHT	DESCRIPTION										
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PRELIMINARY

CUSTOMER PROCUREMENT SPECIFICATION

8/1/85 27HC64/27HC641 049064
64K UV ERASABLE RPOM

SHEET																
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DISTRIBUTION LIST		GENERAL INSTRUMENT MICROELECTRONICS GROUP		PLANT	
SUPERSEDES				MODULE	
SUPERSEDED BY				OPERATION	
		TITLE		CPS FOR CMOS 64K UV EPROM	
BY	WRITTEN	APPROVED		SHEET 1	OF 13
DATE	7/8/85	7/8/85		SPEC. NO.	REV 7/8/85

**GENERAL
INSTRUMENT**

27HC641 / 27HC641

65,536 Bit CMOS ERASABLE PROM

FEATURES

- . Organization - 8192 x 8
- . Low Power Dissipation:
 - 80mA Active Mode
 - 200uA Standby Mode
- . Single +5V \pm 10% Power Supply
- . Access Time:
 - 50ns max 27HC64-05
 - 70ns max 27HC64-07
 - 100ns max 27HC64-10
 - 150ns max 27HC64-15
- . Fast Programming Algorithm
- . Auto IDTM Identification Aids Automatic Programming
- . Fully Static Operation, No Clocks Required
- . All Inputs/Outputs Fully TTL Compatible
- . JEDEC Approved Pinout
- . Available in Wide Temperature Ranges:
 - Commercial (C) = 0° to 70°C
 - Industrial (I) = -40° to +85°C
 - Military (M) = -55°C to +125°C

27HC64

VPP	- 1	28	- VDD
A12	- 2	27	- PGM
A7	- 3	26	- NC
A6	- 4	25	- A8
A5	- 5	24	- A9
A4	- 6	23	- A11
A3	- 7	22	- OE
A2	- 8	21	- A10
A1	- 9	20	- CE
A0	- 10	19	- D7
D0	- 11	18	- D6
D1	- 12	17	- D5
D2	- 13	16	- D4
VSS	- 14	15	- D3

27HC641

A7	- 1	24	- VDD
A6	- 2	23	- A8
A5	- 3	22	- A9
A4	- 4	21	- A10
A3	- 5	20	- CE/Vpp
A2	- 6	19	- A11
A1	- 7	18	- A12
A0	- 8	17	- D7
D0	- 9	16	- D6
D1	- 10	15	- D5
D2	- 11	14	- D4
GND	- 12	13	- D3

DESCRIPTION

The 27HC64 and 27HC641 are high speed CMOS Ultra Violet light erasable electronically programmable Read Only Memories. They are organized as 8192 words by 8 bits per word and operate from a single +5 volt supply with a tolerance of \pm 10%.

The 27HC64 and 27HC641 feature a maximum access time of 50ns which is compatible with high speed microprocessors and are designed to utilize a fast programmable algorithm to reduce programming time.

The 27HC64 is packaged in a 28 pin dual-in-line package and the 27HC641 in a 24 pin dual-in-line package with quartz lids. This lid allows the user to erase the bit pattern, whereby a new pattern can then be written into the device.

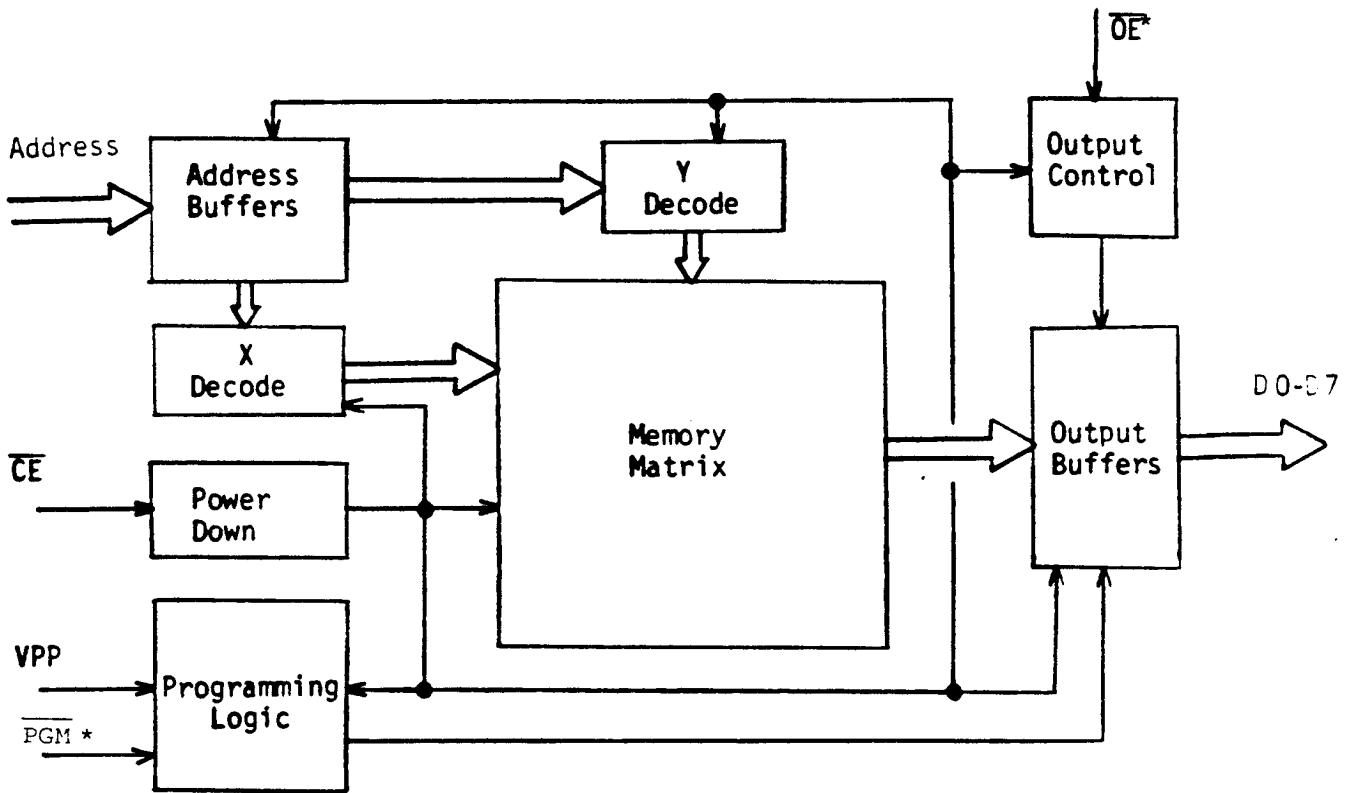
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BLOCK DIAGRAM



*These inputs on 27HC64 only.

MODES - 27HC64

MODES	\overline{CE}	\overline{OE}	VPP	A9	D0 - D7	\overline{PGM}
Read	VIL	VIL	VDD	X	Dout	VOH
Program	VIL	VIH	+12V	X	Din	VIL
Program Verify	VIL	VIL	+12V	X	Dout	VIH
Program Inhibit	VIH	X	+12V	X	High Z	X
Standby	VIH	X	VDD	X	High Z	X
Output Disable	VIL	VIH	VDD	X	High Z	VIH
Identity	VIL	VIL	VDD	+12V	Code	VIH

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27HC641

MODES	CE/Vpp	A9	D0 - D7
Read	VIL	X	DOUT
Program	+12V	X	DIN (see note)
Standby	VIH	X	High Z
Identify	VIL	+12V	Code

Note: See programming waveform for 27HC641.

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READ MODE (See Timing Diagrams and AC Characteristics)

Read mode is accessed when:

- a) the $\overline{\text{CE}}$ pin (20) is low to power up (enable) the chip.
- b) the $\overline{\text{OE}}$ pin (22) is low to gate the data to the output pins. (27HC64 only)

For read operations, if the addresses are stable, the address access time (t_{ACC}) is equal to the delay from CE to output (t_{CE}). Data is transferred to the output after a delay (t_{OE}) from the falling edge of OE. (27HC64 only)

STANDBY MODE

The standby mode is defined when the $\overline{\text{CE}}$ pin is high and a program mode is not defined.

When these conditions are met, the supply current will drop from 90mA to 200uA.

OUTPUT ENABLE/Vpp (27HC64 only)

This feature eliminates bus contention in multiple bus microprocessor systems and the outputs go high impedance when the following conditions are true:

The $\overline{\text{OE}}$ pin is high and a program mode is not defined. When a +12V input is applied to this pin, it supplies the programming voltage (V_{pp}) to program the device

ERASE MODE

The memory matrix is erased to the all "1"'s state as a result of being exposed to Ultra Violet light. To ensure complete erasure a dose of 15 watt-second / cm^2 is required. This means that the device window must be placed within one inch and directly underneath an ultraviolet lamp with wavelength of 2537 Angstroms, intensity of 12000 watt-second / cm^2 for 20 minutes.

PROGRAMMING MODE (27HC64)

Programming takes place when both:

- a) V_{pp} is greater than 12V and
- b) The CE pin is low

Since the erased state is "1" in the array, programming of "0" is required. The address to be programmed is set via A0-A15 and the data to be programmed is presented to D0-D7. When data and address are stable, a low going pulse on the CE line programs that location. Fast programming techniques will be accepted by the chip.

Programming the 27HC641 takes place when the $\overline{\text{CE}}/V_{\text{pp}}$ pin is taken to 12.5V after address and data have settled. This programs the required "0"'s in the byte since the erased status is "1".

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PROGRAMMING (continued)

A 1 msec programming pulse will be given and the byte then verified. If the byte failed to verify, apply another 1 msec programming pulse and check the byte again. Continue applying 1 msec pulses until either the byte verifies or 25 pulses have been applied. If 25 pulses are applied and the byte still does not verify, fail the device. After the byte verifies, another 3 times the number of 1 msec pulses previously given will be applied; i.e., minimum each byte will receive is 4 x 1 msec programming pulses and maximum in the fast programming mode will be 100 x 1 ms pulses.

VERIFY (27HC64 only)

After the array has been programmed it must be verified to ensure all the bits have been correctly programmed. This mode is entered when all the following conditions are met:

- a) Vpp (pin 1) is greater than 12.0V
- b) the PGM line is high
- c) the OE line is low
- d) the CE line is low

Verifying the 27HC641 is done by taking the $\overline{\text{CE}}$ /Vpp pin to a low level after the address has settled and reading the data out.

INHIBIT

When programming multiple devices in parallel with different data, only $\overline{\text{CE}}$ need be under separate control to each device. By pulsing the PGM line low on a particular device (27HC64), that device will be programmed, all other devices with CE held high will not be programmed with the data although address and data will be available on their input pins; i.e., when a high level is present on CE (or PGM, 27HC64 only), the device is inhibited from programming

MANUFACTURERS IDENTITY

In this mode specific data is output identifying manufacturer as General Instrument, device type, where manufactured, etc. This mode is entered when pin 24 (A9) is taken up to between 11.5 - 12.5V. the row x-decoders become disabled internally and the ROM data held in four bytes can be output. The CE and OE lines on the 27HC64 must be at VIL (OE not required on 27HC641). A0 and A1 are used to access any of the four non-erasable bytes whose data appears on D0 through D7.

The General Instrument identify code is as follows:

Pin	A0	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Identity	(10)	(19)	(18)	(17)	(16)	(15)	(13)	(12)	(11)	Code
Manufacturer	VIL	0	0	0	1	1	1	1	1	1F
Device Type	VIH	0	0	0	0	1	0	0	0	08

*Code subject to change.

ELECTRICAL CHARACTERISTICS

MAXIMUM RATINGS

VDD and input voltages w.r.t. VSS -0.6 to +6.25V
 Vpp voltage w.r.t. Vss during programming -0.6 to +14V
 Voltage on pin 24 w.r.t. Vss -0.6 to +13.5V
 Storage temperature -65 deg. C to +150 deg. C
 Ambient temperature with power applied -65 deg. C to +125 deg. C

DC CHARACTERISTICS (Read Mode)

VDD = +5V \pm 10%,
 TAMB = -55 to +125 deg. C
 Vpp = +12.5 \pm 0.5V

PARAMETER	SYM	MIN	MAX	UNITS	CONDITIONS
<u>Inputs</u>					
Address lines A0-A12					
Data lines(program mode) D0-D7					
PGM, CE & OE					
Logic "1"	VIH	2.0	VDD+1	V	
Logic "0"	VIL	-0.1	0.9	V	
Leakage	IIL	-10	10	uA	VIN = 0 to VDD
Input Capacitance	CIN	0	6	pF	VIN = 0V TAMB=25 deg C f = 1MHz
Programming Voltage	Vpp	12.0	13.0	V	
<u>Outputs</u>					
In read/verify mode D0-D7					
Logic "1"	VOH	2.4	-	V	IOH = -4 mA
Logic "0"	VOL		0.4	V	IOL = 9 mA
Leakage	IOL	-10	10	uA	VIN = 0 to VDD
<u>Power Supply Current</u>					
<u>Active</u>					
VDD	IDD		90	mA	CMOS Levels f=20MHz VDD = 5.5V OE = CE = Vcc + 1 to Vcc -0.3
VPP (When Programming)	IPP		30	mA	Vpp = 12.5 nom
(Read Mode)			100	uA	Vpp = 5.5V
<u>Standby</u>					
Total VDD & Vpp	IDD(S)		200	uA	CE=VIH OE=VIL Vpp=VDD=5.5V
Output Capacitance	COUT		12	pf	VOUT = 0V TAMB = 25 deg C f = 1MHz

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AC CHARACTERISTICS

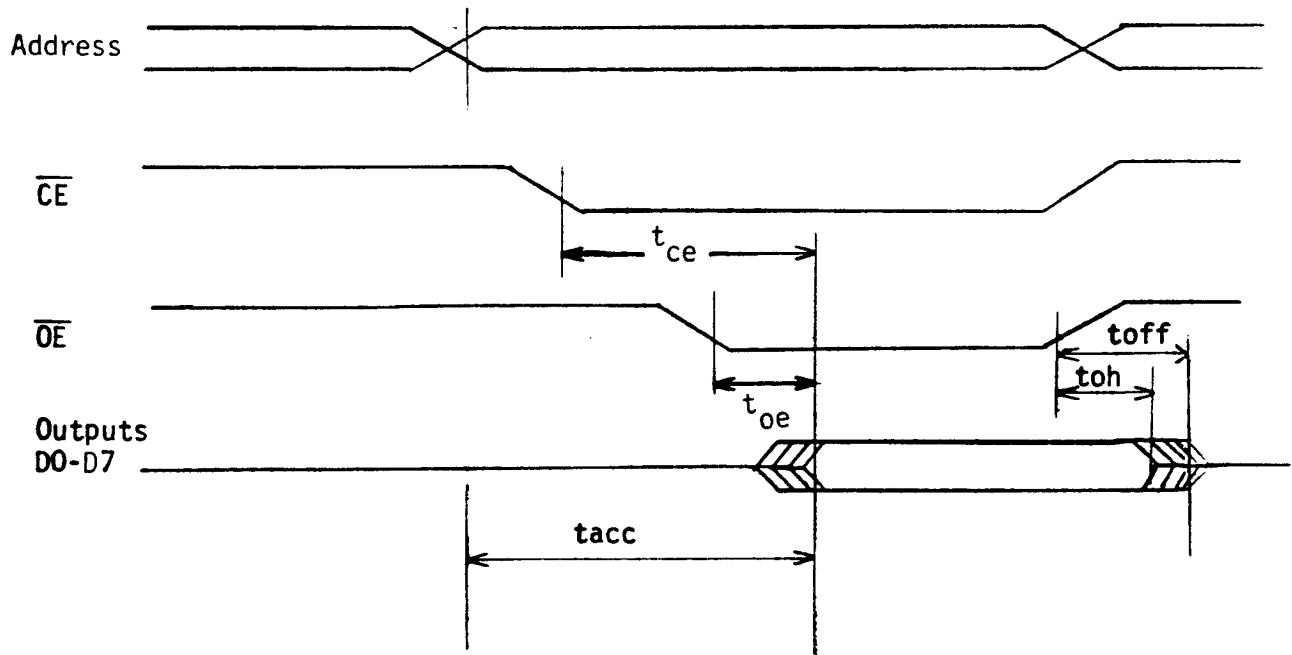
TA: Commercial (C) = 0°C to 70°C
 Industrial (I) = -40°C to +95°C
 Military (M) = -55°C to +125°C

Output Load = 1 TTL load + 100pF

Note: 27HC64-05 only available at 0° to 70° rating.

Symbol	Parameter	27HC64-05		27HC64-07		27HC64-10		27HC64-15		Units	Test Condition
		Min	Max	Min	Max	Min	Max	Min	Max		
tACC	Address to Output Delay		50		70		100		150	ns	$\overline{CE} = \overline{OE} = VIL$
tCE	\overline{CE} to Output Delay		50		70		100		150	ns	$\overline{OE} = VIL$
tOE	\overline{OE} to Output Delay		25		30		40		70	ns	$\overline{CE} = VIL$
tOFF	\overline{OE} to /OP High Impedance		25		30		40		50	ns	$\overline{CE} = VIL$
tOH	Output Hold from Addresses, \overline{CE} or \overline{OE} , whichever occurred first	0		0		0		0		ns	$\overline{CE} = \overline{OE} = VIL$

READ WAVEFORMS FOR 27HC64



DC PROGRAMMING CHARACTERISTICS

TA = 0 to 70°C, Vdd = 6.0 ± 0.25V, Vpp = 12.5 ± 0.5V

SYMBOL	PARAMETER	MIN	MAX	UNITS	CONDITIONS (See Note 1)
ILI	Input Current (All Inputs)		10	µA	VIN = VIL or VIH
VIL	Input Low Level (All Inputs)	-0.1	0.8	V	
VIH	Input High Level	2.0	Vdd+1	V	
VOL	Output Low Voltage During Verify		0.45	V	IOL = 2.1 mA
VOH	Output High Voltage During Verify	2.4		V	IOH = -400 µA
Idd2	Vdd Supply Current (Program & Verify)		30	mA	
Ipp2	Vpp Supply Current (Program)		30	mA	CE = VIL
VID	A9 Product Identification Voltage	11.5	12.5	V	

Notes: (1) Vdd must be applied simultaneously or before Vpp and removed simultaneously or after Vpp.

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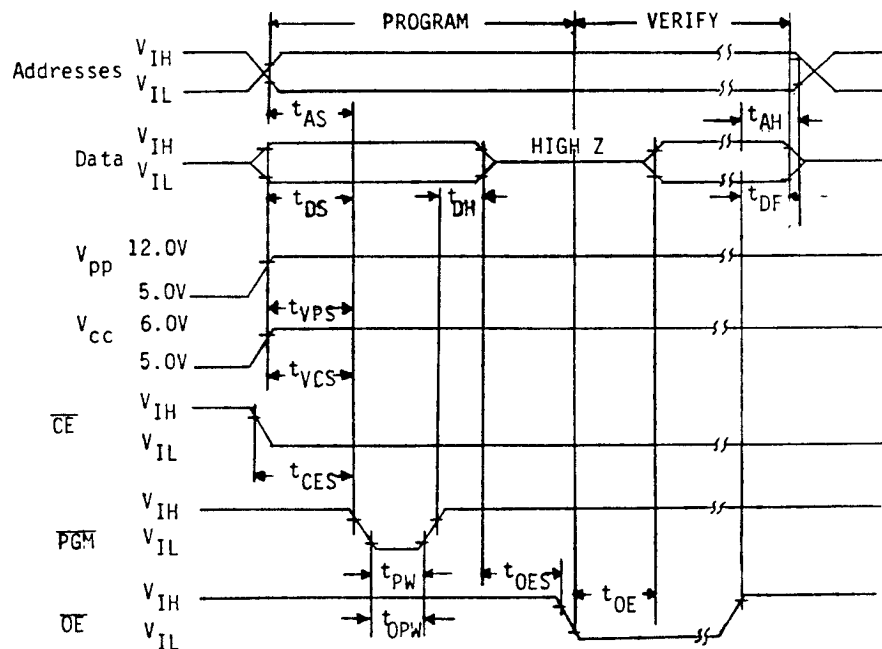
AC CHARACTERISTICS - 27HC64

Conditions: 0 to +70°C, V_{dd} = 6.0 ± 0.25V, V_{pp} = 12.5 ± 0.5V

Program, Program Verify, and Program Inhibit Modes

PARAMETER	SYM	MIN	TYP	MAX	UNITS
Address Set-Up Time	t _{AS}	2			us
Data Set-Up Time	t _{DS}	2			us
Data Hold Time	t _{DH}	2			us
Address Hold Time	t _{AH}	0			us
Float Delay	t _{DF}	0		130	ns
V _{dd} Set-Up Time	t _{VCS}	2			us
Program Pulse Width	t _{PW}	0.95	1	1.05	ms
\overline{CE} Set-Up Time	t _{CES}	2			us
OE Set-Up Time	t _{OES}	2			us
V _{pp} Set-Up Time	t _{VPS}	2			us
Overprogram Pulse Width	t _{OPW}	2.95		79.75	ms
Data Valid from OE	t _{OE}			150	ns

PROGRAM MODE



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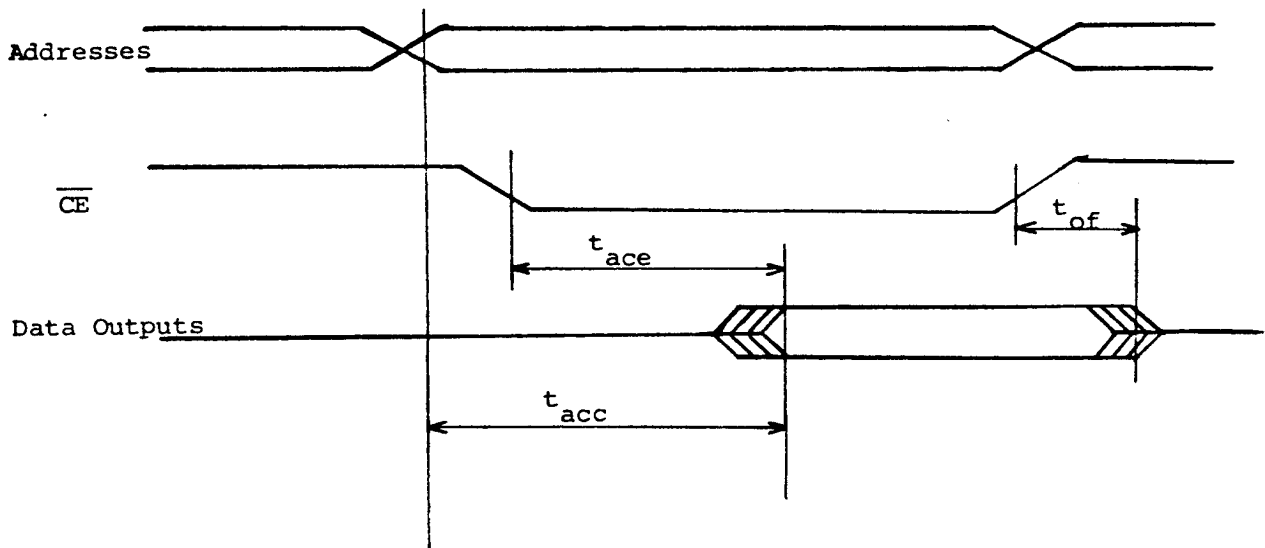
AC CHARACTERISTICS - 27HC641

TA: Commercial (C) = 0°C to 70°C
 Industrial (I) = -40°C to +85°C
 Military (M) = -55°C to +125°C

Note: 27HC641-05 is only available in commercial temperature range.

Symbol	Parameter	27HC641-05		27HC641-07		27HC641-10		27HC641-15		Test Condition
		Min	Max	Min	Max	Min	Max	Min	Max	
t _{ACC}	Address to Output Delay		50		70		100		150	$\overline{CE} = \overline{OE} = V_{IL}$
t _{ACE}	\overline{CE} to Output Delay		45		60		80		130	$\overline{OE} = V_{IL}$
t _{OF}	\overline{OE} to Output High Impedance									$\overline{CE} = V_{IL}$

READ WAVEFORMS FOR 27HC641



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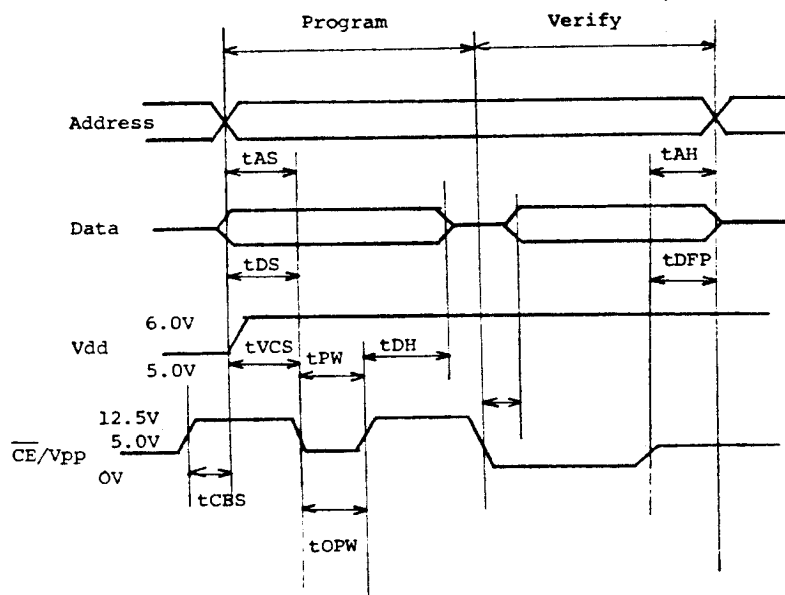
AC CHARACTERISTICS - 27HC641

Program Mode

Conditions: 0 to 70°C, Vdd = 6.0 ± 0.25V, Vpp = 12.5 ± 0.5V

SYMBOL	PARAMETER	MIN	MAX	UNITS
tAS	Address Set-Up Time	2		us
tDS	Data Set-Up Time	2		us
tCES	$\overline{\text{CE}}$ Set-Up Time	2		us
tAH	Address Hold Time	0		us
tDH	Data Hold Time	2		ns
tDFP	O/P Float Delay	0	130	ns
tVCS	Vcc Set-Up Time	2		us
tPW	Program Pulse Width	0.95	1.05	ms
tOPW	Over Program Pulse Width	2.95	78.75	ms
tOC	O/P Valid from $\overline{\text{CE}}$		150	ns

PROGRAMMING WAVEFORMS FOR 27HC641

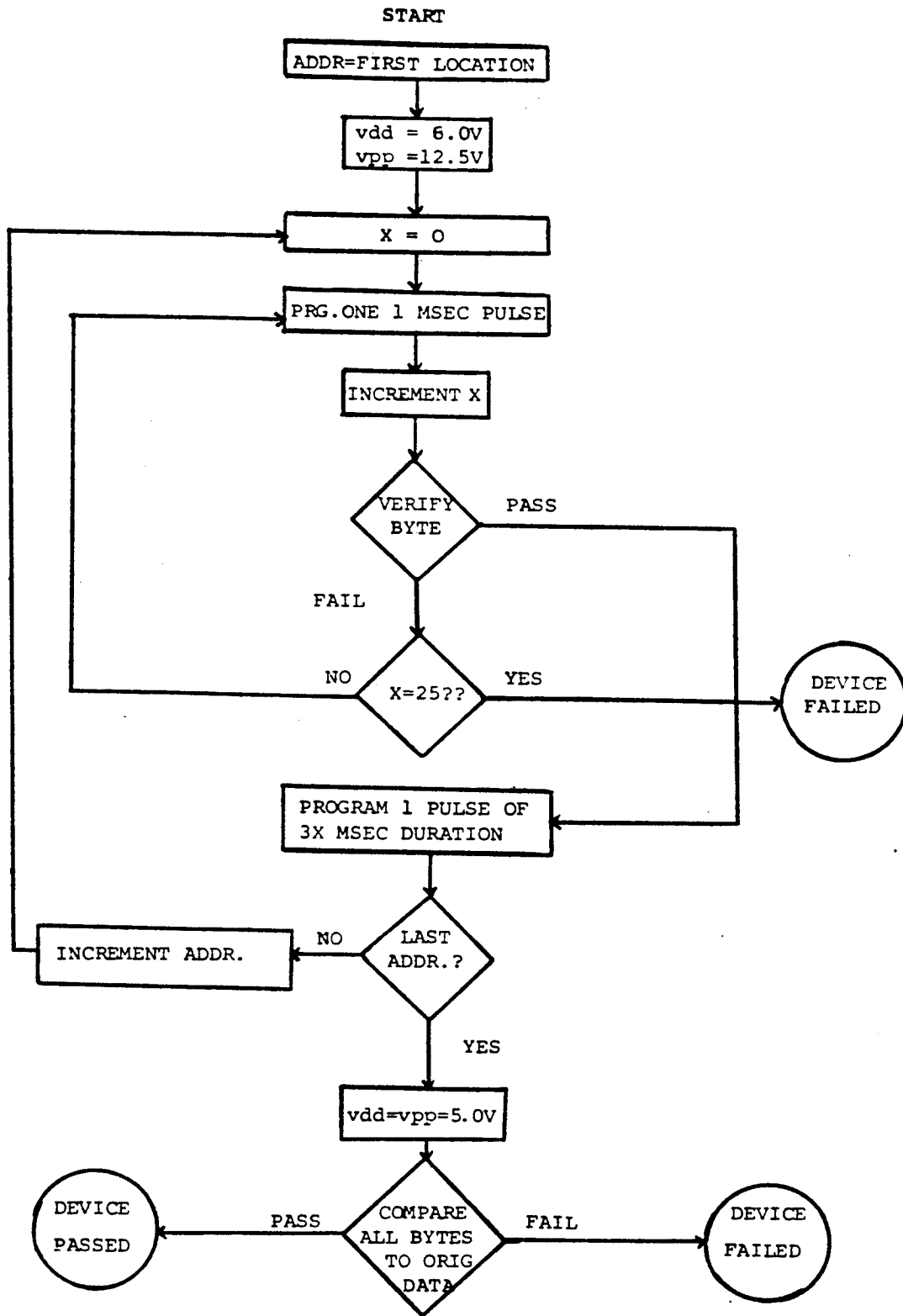


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