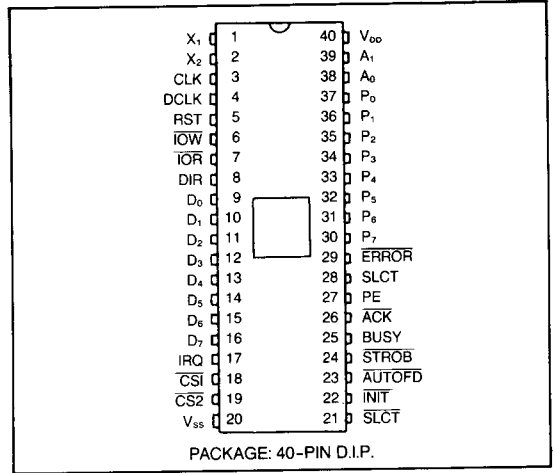


Printer Adapter Interface (PAI)

FEATURES

- Fits Popular Centronics Printer Interface
- Programmable parallel printer interface
- Completely TTL-compatible I/O
- Reduces system package count
- User-controlled interrupt request
- Fully compatible with Z-80 and 8086 microprocessor family
- High current, direct drive printer interface pins
- On-chip oscillator can be used to generate 1.5 MHz to 20 MHz oscillation
- Baud rate generation for serial communication
- Single 5V supply
- Low power CMOS

PIN CONFIGURATION



GENERAL DESCRIPTION

The COM82C11, Printer Adapter Interface (PAI), fabricated with a silicon gate CMOS process, offers parallel port interface between the CPU and the printer, and is especially suitable to printer adapter for industry-standard personal computers.

The COM82C11 can directly connect to a parallel printer connector. Printer data bus pins can each source 2.6 mA and sink 24 mA. Each of the four printer control pins can source 500µA and sink 7mA. The COM82C11 fits the well-

known Centronics printer interface.

The PAI is also suitable for a personal computer interface board which contains RS-232C interface or display interface. The on-chip oscillator and ÷10 divider can be used to offer the BAUD-rate clock with RS-232C interface or the dot clock with monochrome display interface.

The user can use the Data Bus, IOR, IOW, IRQ, CS1 and CS2 pins to interface the PAI with 8086 or Z-80 microprocessors.

FIGURE 1 — BLOCK DIAGRAM

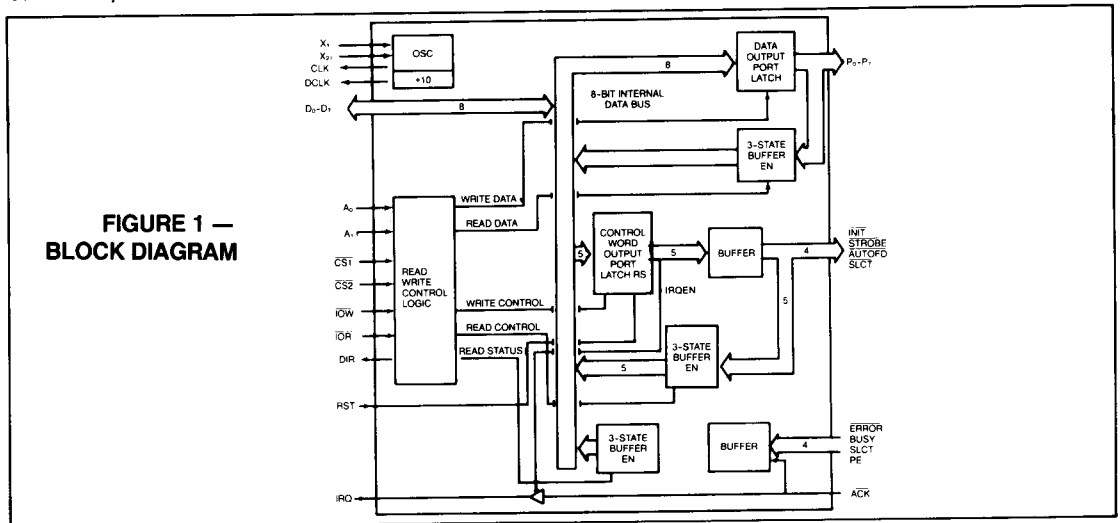


TABLE 1 — COM82C11 PIN DESCRIPTION

PIN NO.	SYMBOL	NAME	I/O	DESCRIPTION
1 2	X1 X2	Crystal In	I	X1, X2 are the pins to which a crystal (whose frequency is between 1.5 MHz and 20 MHz) is attached. A TTL clock can be used on Pin 2 (X ₂) through a pull up resistor. Pin 1 is left open.
3	CLK	Clock Out	O	A buffer oscillating clock output whose frequency is the same as the crystal.
4	DCLK	Divided Clock	O	A buffer clock output whose frequency is one-tenth that of Pin 3.
5	RST	Reset	I	An active high RESET pin. When activated, printer control outputs <u>STROB</u> , <u>AUTOFD</u> , <u>SLCT</u> are inactive, <u>INIT</u> is active, and IRO is disabled remaining high impedance.
6	<u>IOW</u>	I/O Write	I	A "Low" on this pin permits the CPU to write data or control words to the "PAI".
7	<u>IOR</u>	I/O Read	I	A "Low" on this pin permits the "PAI" to send data, control words or printer status to the CPU. It allows the CPU to read from the PAI.
8	DIR	Direction	O	This output pin is active high only when <u>CS1</u> , <u>CS2</u> and <u>IOR</u> are activated. It is low for all other cases. It indicates the direction of data transfer between CPU data bus and the PAI. When activated the PAI sends data, control words or printer status to CPU.
9 ~ 16	D0 ~ D7	System Data Bus	I/O	These bidirectional 8-bit data bus pins are connected to the system data bus. Data or control words are transmitted or received upon execution of input or output instructions by the CPU. Status information of the printer is also received through the data bus.
17	IRQ	Interrupt Request	Z/O	This is an interrupt request output pin, which is generated when <u>ACK</u> is activated low. This pin is enabled by writing D4 = 1 in the control word, and is high impedance when D4 = 0. When RST is activated, this pin is put into a high impedance state.
18 19	<u>CS1</u> <u>CS2</u>	Chip Select	I	When <u>CS1</u> = 0 and <u>CS2</u> = 0, it enables the communication between the CPU and the PAI.
20	V _{ss}	Ground		Power ground pin.
21	<u>SLCT</u>	Printer Select	O	When activated low, the printer is selected. This pin is programmable in bit D3 by writing a control command. Writing a one to D ₃ outputs a low on the <u>SLCT</u> pin.
22	<u>INIT</u>	Initiate	O	When activated low, the printer buffer is cleared. This pin is programmable in bit D2 by writing a control command and the PAI outputs D2 signal to this pin. The pulse width of the <u>INIT</u> must be more than 50 μs for initiation of the printer.
23	<u>AUTOFD</u>	Auto Feed	O	When this pin is low, the printer is fed automatically, one line after printing. This pin is programmable in <u>D1</u> by writing a control command. Writing a one to D1 outputs allow on the <u>SLCT</u> pin.
24	<u>STROB</u>	Data Strob	O	When activated low, the printer reads in the data on printer data bus P0 ~ P7. It synchronizes data strobe between PAI and printer. This pin is programmable in bit D0 by writing a control command, and writing a one to D0 outputs a low on the <u>SLCT</u> pin. Read-in of data is performed at the low level of this signal.
25	BUSY	Busy State	I	This is an output from the printer. A "High" indicates that the printer can't receive data "During Data Entry", "During Part of Paper Feed", "During Printer Error Status", "During Printing" or "In Off-Line State". The CPU can read this status in D7 by "Reading Status".
26	<u>ACK</u>	Acknowledge	I	This is an output from the printer. A "Low" indicates that data bus has been received and that the printer is ready to accept other data. The CPU can read this status in <u>D6</u> by a "Read Status" command.

TABLE 1 — COM82C11 PIN DESCRIPTION

PIN NO.	SYMBOL	NAME	I/O	DESCRIPTION
27	PE	Paper End	I	This is an output from the printer. A "High" indicates that the printer is out of paper. The CPU can read this status in D5 by a "Read Status" command.
28	SLCT	Printer Selected Status	I	This is always "High" unless the printer power is down. The CPU can read this status in D4 by a "Read Status" command.
29	ERROR	Error Status		This is an output from the printer. It is "Low" only when the printer is in error status as shown below: (1) Paper end status. (2) Abnormal motor operation. (3) Off-line state. The CPU can read this status in D3 by a "Read Status" command.
30 ~ 37	P0 ~ P7	Printer Data Bus	O	These output pins send out the data to the printer as specified by the CPU in a "Write Data" command. They are compatible with TTL logic level. The CPU can also "Read Back" the data which the CPU last wrote by a "Read Data" command.
38 39	A0 A1	Address	I	These input addresses in conjunction with \overline{IOR} , \overline{IOW} , $\overline{CS1}$ and $\overline{CS2}$ control the selection of one of the five commands.
40	V_{DD}	Power Supply		+5V.

Note: The CPU can "Read Back" the control command it last wrote by reading the control word. There are \overline{STROB} , \overline{AUTOFD} INIT, \overline{SLCT} and \overline{IRQEN} on the data bus D0 ~ D7.

FUNCTIONAL DESCRIPTION

When reset is activated ($\overline{RST}=1$), $\overline{STROBE}=1$, $\overline{AUTOFD}=1$, \overline{PAI} offers five kinds of commands selected by A0, A1, \overline{IOW} , $\overline{INIT}=0$, $\overline{SLCT}=1$, and Interrupt Request "IRQ" is disabled. \overline{IOR} and $\overline{CS1}$, $\overline{CS2}$ as shown below:

Input						Output	Operation	
$\overline{CS1}$	$\overline{CS2}$	A1	A0	\overline{IOR}	\overline{IOW}	\overline{DIR}		
1	x	x	x	x	x	0*	PAI not activated.	
x	1	x	x	x	x	0*		
0	0	0	0	1	0	0	Write data to the printer.	
0	0	0	0	0	1	1	Read data on printer data bus.	
0	0	0	1	0	1	1	Read status from the printer.	
0	0	1	0	1	0	0	Write control word to the printer.	
0	0	1	0	0	1	1	Read control word on printer control bus.	
0	0	Others						(No operation.**)

Notes: * When $\overline{CS1} = 1$ or $\overline{CS2} = 1$, $\overline{DIR} = 0$, indicates that D0 ~ D7 remain "I/O Write" state even though internal data bus is not used.
** It is illegal to read anything when chip select is active and A0 = A1 = 1.

WRITE DATA to the PRINTER

Data on D0 ~ D7 are present on the P0 ~ P7 bus and sent to the printer. At the rising edge of \overline{IOW} , data is latched on the P0 ~ P7 bus until the next falling edge of \overline{IOW} .

READ DATA on PRINTER DATA BUS

At the falling edge of \overline{IOR} , data latched on P0 ~ P7 is set back to the CPU through D0 ~ D7. The CPU reads back the printer data.

READ STATUS from the PRINTER CPU reads the real-time status of the printer. The states are:

Data	$\overline{D7}$	D6	D5	D4	D3	D2	D1	D0
STATE	BUSY	\overline{ACK}	PE	SLCT	ERROR	—	—	—

Note: The BUSY state is inverted on D7.

WRITE CONTROL WORD to the PRINTER

CPU writes the control word to the printer. The control signals are:

Data Bus	D7	D6	D5	D4	D3	D2	D1	D0
CONTROL Signal	—	—	—	\overline{IRQEN}	\overline{SLCT}	\overline{INIT}	\overline{AUTOFD}	\overline{STROB}

The control signals are latched on printer control bus at the rising edge of \overline{IOW} .

Note: "Interrupt Request Enable (\overline{IRQEN})" is not present on any output pin, but enables the output pin IRQ when D4 = 1, and disables IRQ (high impedance) when D4 = 0. \overline{SLCT} , \overline{AUTOFD} and \overline{STROB} are inverted on D3, D1 and D0 individually.

READ CONTROL WORD on PRINTER CONTROL BUS

At the falling edge of \overline{IOR} , \overline{IRQEN} control bit \overline{SLCT} pin, \overline{INIT} pin, \overline{AUTOFD} pin and \overline{STROB} pin are sent back to the CPU on D4, D3, D2, D1 and D0 individually.

- When writing control words D4 = 0 ----- IRQ pin floating.
- When writing control words D4 = 1 ----- IRQ = ACK.

MAXIMUM GUARANTEED RATINGS*

Operating Temperature Range	0°C to +70°C
Storage Temperature Range	-65°C -150°C
Lead Temperature (soldering 10 sec.)	+300°C
Positive Voltage on any I/O Pin, with respect to ground	$V_{cc} + 0.3V$
Negative Voltage on any I/O Pin, with respect to ground	-0.3V
Maximum V_{cc}	+7V

* Stresses above those listed may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or at any other condition above those indicated in the operational sections of this specification is not implied.

NOTE: When powering this device from laboratory or system power supplies, it is important that the Absolute Maximum Ratings not be exceeded or device failure can result. Some power supplies exhibit voltage spikes or "glitches" on their outputs when the AC power is switched on and off. In addition, voltage transients on the AC power line may appear on the DC output. For example, the bench power supply programmed to deliver +5 volts may have large voltage transients when the AC power is switched on and off. If this possibility exists it is suggested that a clamp circuit be used.

TABLE 2 — ELECTRICAL CHARACTERISTICS ($T_a = C^\circ -70^\circ C$, $V_{cc} = +5V \pm 5\%$, $C_i = 50pF$)

D.C. Characteristics

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS	COMMENTS
V_{IL}	Input Low Voltage	—	0.4	0.8	V	
V_{IH}	Input High Voltage	2.0	2.4	—	V	
V_{OL}	Output Low Voltage	—	0.4	0.5	V	$I_{OL} = \text{Max}$
V_{OH}	Output High Voltage	2.4	—	—	V	$I_{OH} = \text{Max}$
I_{IN}	Max. Input Current	—	—	± 10	μV	$V_{IN} = V_{cc}$ or GND
I_{OLD}	Output Sink Current					
	Printer Data Bus = 0	20	24	—	ma	$V_{OL} = 0.45V$
I_{OHD}	Output Source Current					
	Printer Data Bus = 1	2.0	2.6	—	ma	$V_{OH} = 3.0V$
I_{OLC}	Output Sink Current					
	Printer Control Bus = 0	7.0	—	—	ma	$V_{OL} = 0.45V$
I_{OHC}	Output Source Current					
	Printer Control Bus = 1	—	0.5	1.5	ma	$V_{OH} = 3.0V$
I_{FL}	Floating Pin Leakage	—	—	± 10	μa	$V_{FL} = V_{cc}$ or GND
I_{OP}	Operation Current	—	10	30	ma	

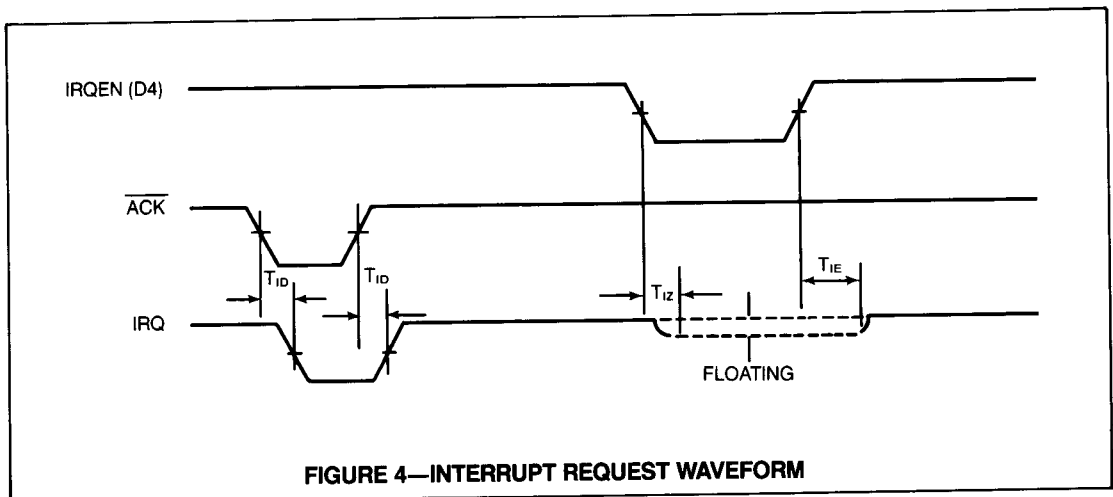
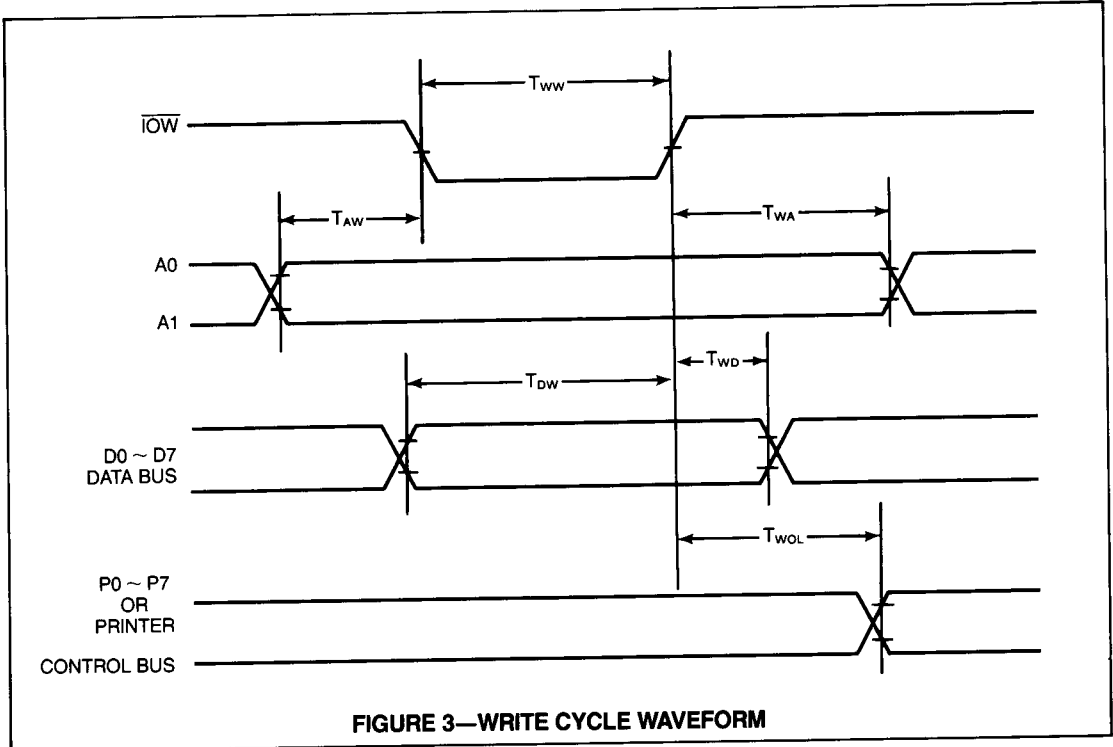
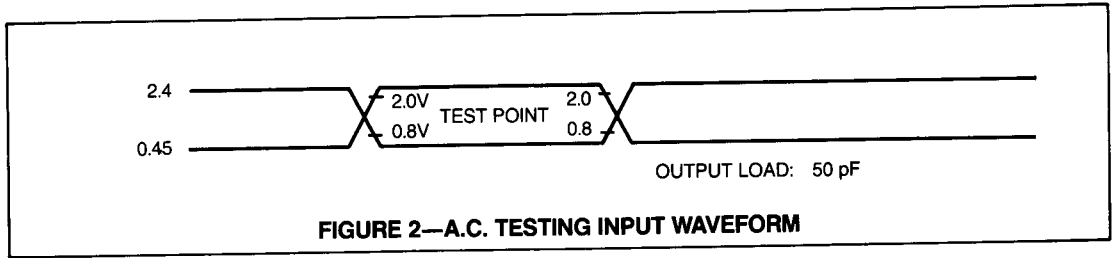
A.C. Characteristics

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
WRITE				
T_{WW}	Write Pulse Width	200	—	ns
T_{AW}	Address to \overline{IOW} Set-up Time	0	—	ns
T_{WA}	Address Hold Time after \overline{IOW}	20	—	ns
T_{DW}	Data to \overline{IOW} Set-up Time	70	—	ns
T_{WD}	Data Hold Time after \overline{IOW}	30	—	ns
T_{WOL}	$\overline{IOW} = 1$ to Data Latched	—	90	ns
READ				
T_{RR}	Read Pulse Width	300	—	ns
T_{DD}	DIR Delay after \overline{IOR}	—	35	ns
T_{AR}	Address to \overline{IOR} Set-up Time	0	—	ns
T_{RA}	Address Hold Time after \overline{IOR}	20	—	ns
T_{PR}	Printer Bus to \overline{IOR} Set-up Time	0	—	ns
T_{RP}	Printer Bus Hold Time after \overline{IOR}	0	—	ns
T_{RDS}	\overline{IOR} to D0 — D7 Output	—	70	ns
T_{RDR}	D0 — D7 Released after \overline{IOR}	—	30	ns

*Note: When CPU reads the printer's status, it is real-time state.

OTHERS

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
T_{RSW}	Reset Pulse Width	40	—	ns
T_{RSCH}	Reset to Control Bus = 1 (\overline{STROB} , \overline{AUTOFD} , \overline{SLCT}) Propagation Delay	—	150	ns
$T_{RSIN 1}$	Reset to Control Bus $\overline{INIT} = 0$ Propagation Delay	—	60	ns
$T_{RSIR 2}$	IRQ MIGH -z after RST	—	50	ns
T_{ID}	ACK to IRQ Propagation Delay	—	45	ns
T_{IZ}	IRQ Disable Time	—	50	ns
T_{IE}	IRQ Enable Time	—	50	ns
T_{RSIZ}	IRQ High-z after RST	—	50	ns
T_{DCKD}	CLK to OCLK Propagation Delay	—	10	ns



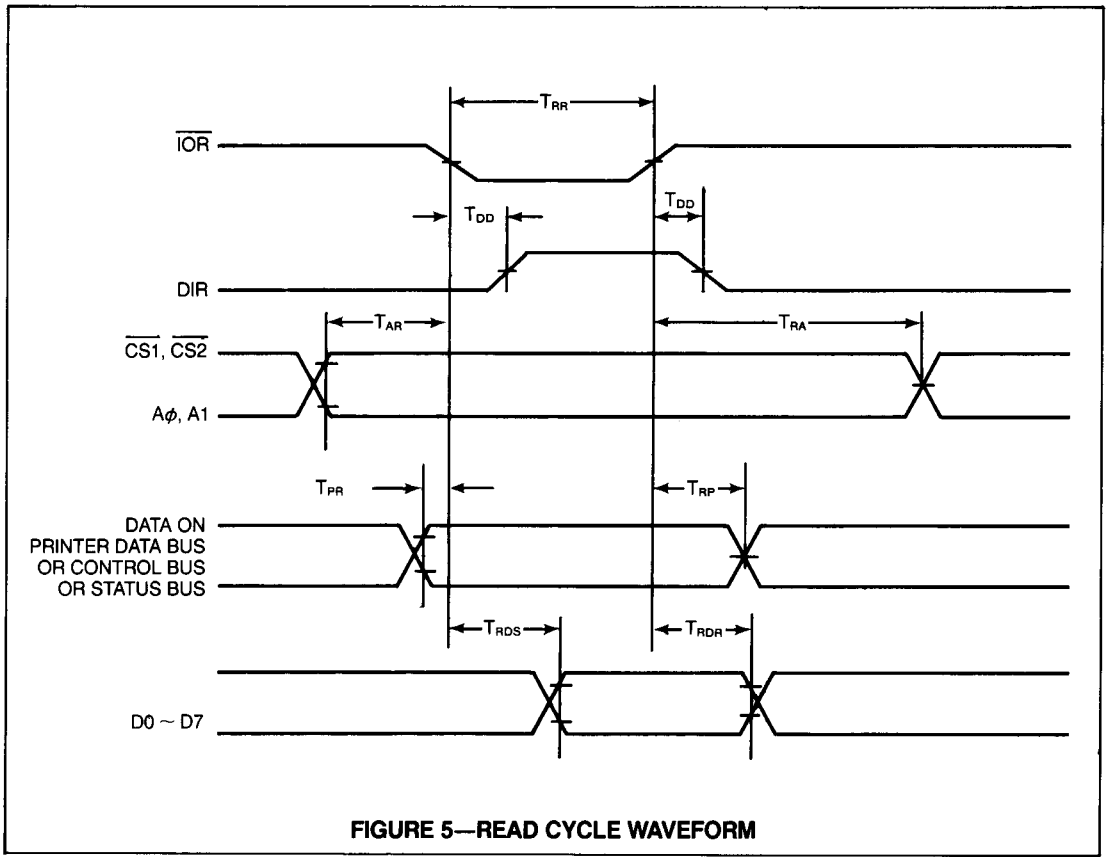


FIGURE 5—READ CYCLE WAVEFORM

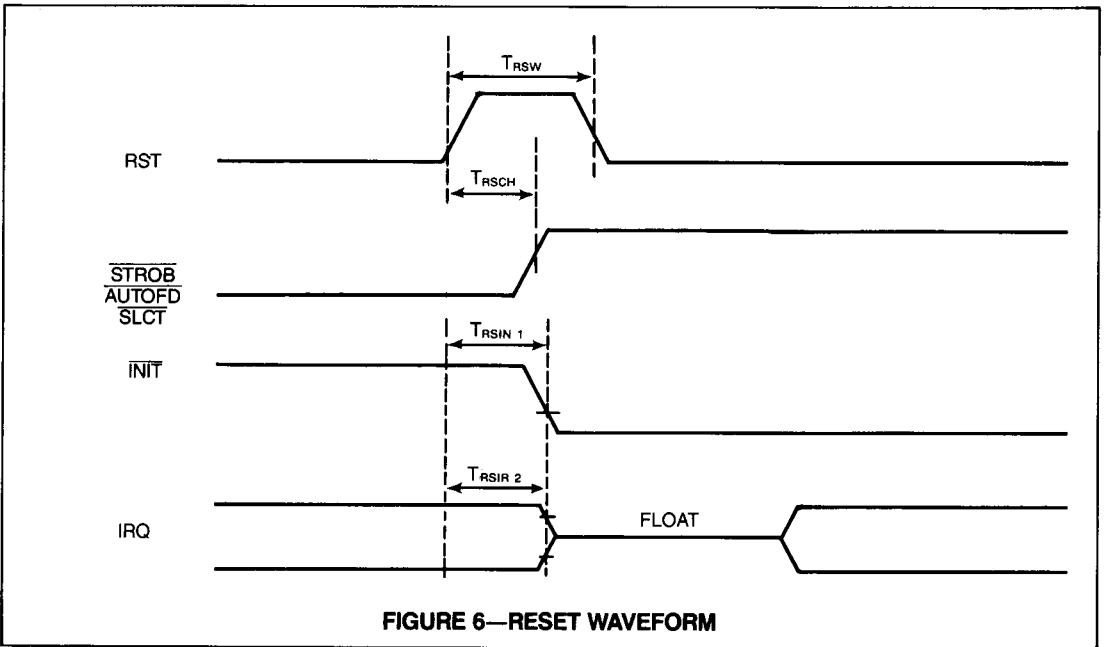
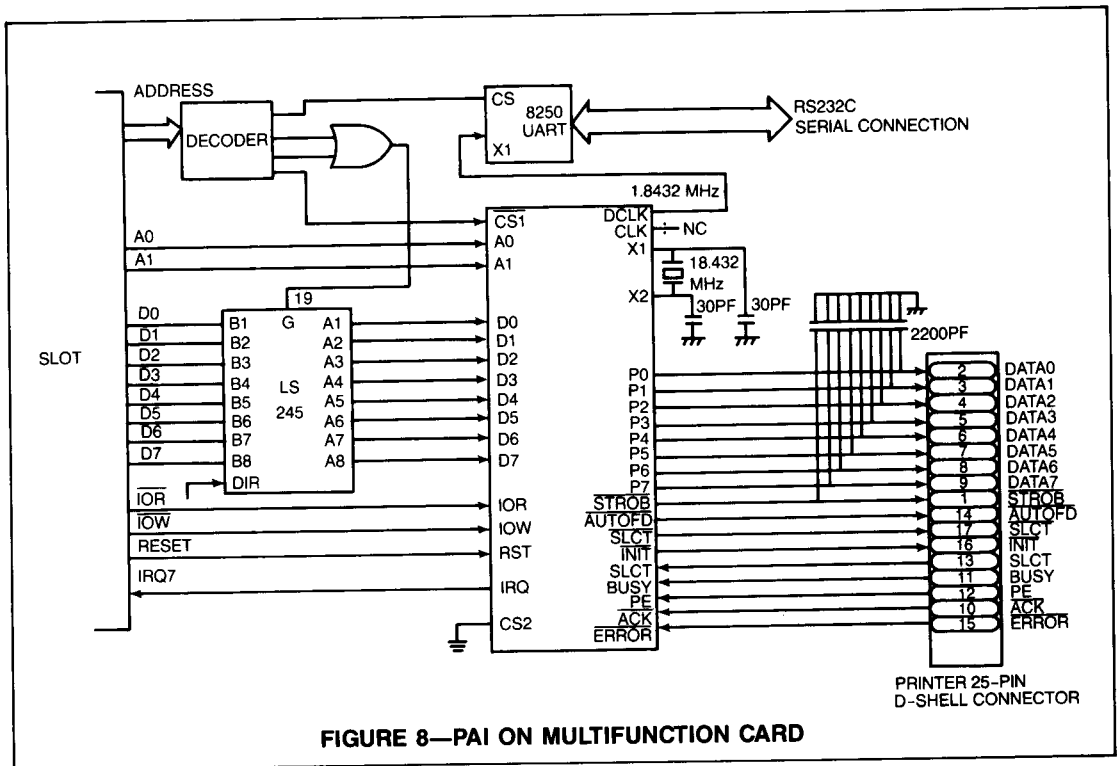
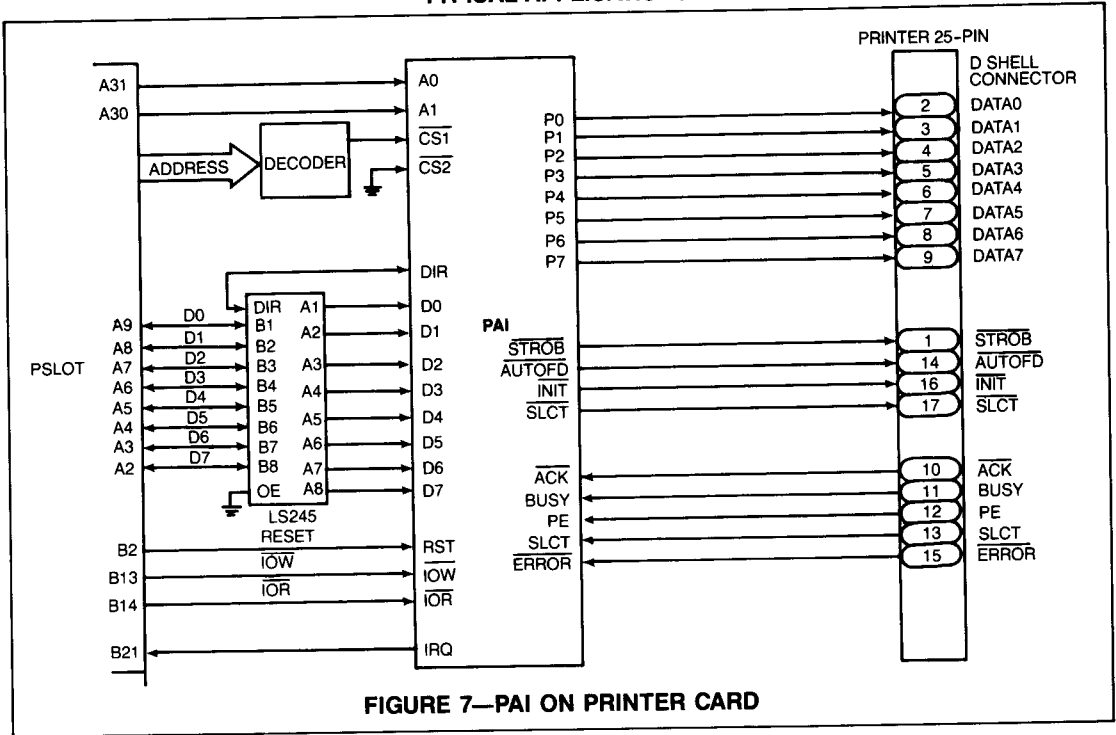
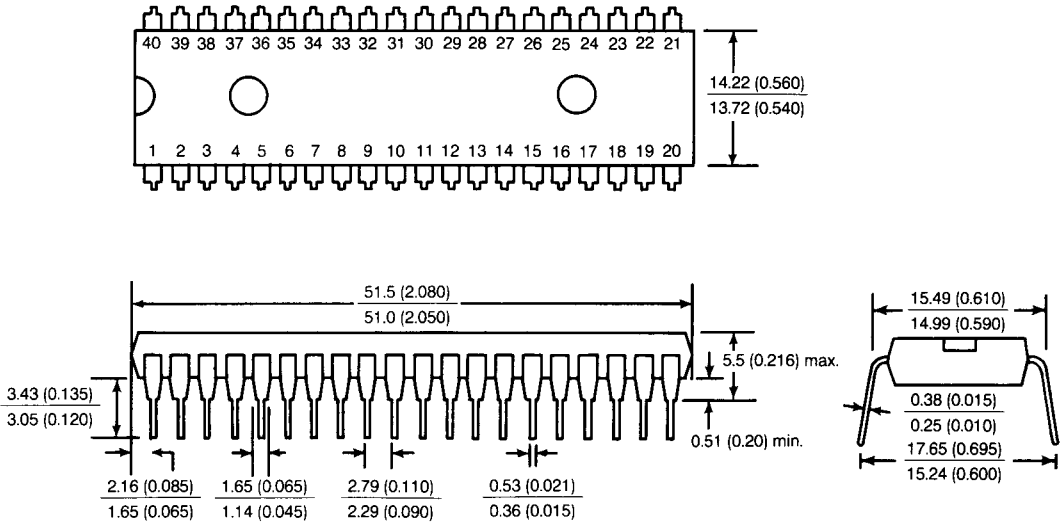


FIGURE 6—RESET WAVEFORM

TYPICAL APPLICATIONS



PACKAGE INFORMATION - MILLIMETER (INCH)
40 LEAD PLASTIC DIP



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