

INS8255 Programmable Peripheral Interface

General Description

The INS8255 is a programmable peripheral interface contained in a standard, 40-pin dual-in-line package. The chip, which is fabricated using N-channel silicon gate technology, functions as a general-purpose parallel input/output interface in National Semiconductor's 8080 microcomputer family. The functional configuration of the INS8255 is programmed by the system software so that normally no external logic is required to interface peripheral devices.

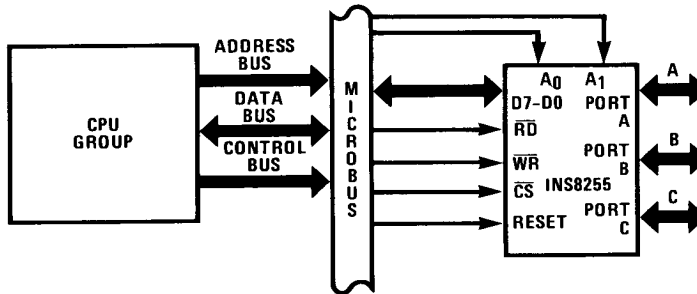
The INS8255 has three basic modes of operation that can be selected by the system software. In the first mode (Mode 0), the INS8255 provides simple input and output operations for three 8-bit ports. Data is simply written to or read from a specified port (Port A, B or C) without the use of "handshaking" signals. In the second mode (Mode 1), the INS8255 enables the transfer of input/output data to or from a specified 8-bit port (Port A or B) in conjunction with strobes or "handshaking" signals. Ports A and B use the lines of Port C in this mode to generate or accept the "handshaking"

signals with the peripheral device. In the third mode (Mode 2), the INS8255 enables communications with a peripheral device or structure via one bidirectional 8-bit bus port (Port A). "Handshaking" signals are provided over the lines of Port C in this mode to maintain proper bus flow discipline.

Features

- Outputs Source 1 mA at 1.5 Volts
- 24 Programmable Input/Output Pins
- Direct Bit Set/Reset Capability
- TTL Compatible
- Reduces System Component Count
- MICROBUS™* Compatible

INS8255 MICROBUS Configuration



Typical Diagram of MODE 0 operation. The 8 bit ports A, B, C are defined by the user's program to be either an input or an output from/to the peripherals.

S-601 *Rev* *ORIG*
 003644
T-3644 *NSC*

*Trademark, National Semiconductor Corp.

DC Electrical Characteristics

$T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$; $V_{CC} = +5\text{V} \pm 5\%$; $V_{SS} = 0\text{V}$

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
V_{IL}	Input Low Voltage			0.8	V	
V_{IH}	Input High Voltage	2.0			V	
V_{OL}	Output Low Voltage			0.4	V	$I_{OL} = 1.6\text{mA}$
V_{OH}	Output High Voltage	2.4			V	$I_{OH} = -50\mu\text{A}$ ($-100\mu\text{A}$ for D.B. Port)
$I_{OH}^{(1)}$	Darlington Drive Current		2.0		mA	$V_{OH} = 1.5\text{V}$, $R_{EXT} = 390\Omega$
I_{CC}	Power Supply Current		40		mA	

NOTE:

1. Available on 8 pins only of ports B and C. Selected randomly.

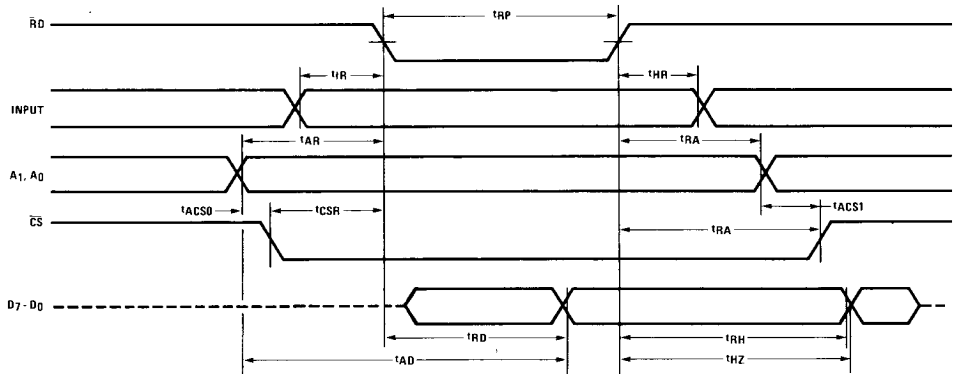
Handwritten notes:
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AC Electrical Characteristics

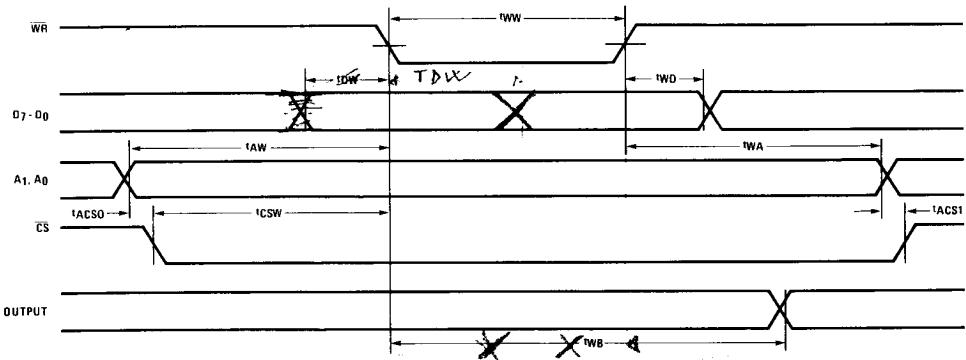
$T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$; $V_{CC} = +5\text{V} \pm 5\%$, $V_{SS} = 0\text{V}$

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
t _{WW}	Pulse Width of \overline{WR}	400			ns	
t _{DW}	Time D.B. Stable before \overline{WR}	50			ns	
t _{WD}	Time D.B. Stable after \overline{WR}	35			ns	
t _{AW}	Time Address Stable before \overline{WR}	20			ns	
t _{WA}	Time Address Stable after \overline{WR}	20			ns	
t _{CSW}	Chip Select on to \overline{WR}	20			ns	
t _{WB}	Delay from \overline{WR} to Output			500	ns	
t _{RP}	Pulse Width of \overline{RD}	405			ns	
t _{IR}	\overline{RD} Set-Up Time	10			ns	
t _{HR}	Input Hold Time	100			ns	
t _{RD}	Delay from $\overline{RD} = 0$ to System Bus			295	ns	<i>Entered</i>
t _{RH}	Delay from $\overline{RD} = 1$ to System Bus			150	ns	
t _{HZ}	$\overline{RD} = 0$ to TRI-STATE [®] of Bus Drivers	10		150	ns	
t _{AR}	Time Address Stable before \overline{RD}	50			ns	
t _{CSR}	Time \overline{CS} Stable before \overline{RD}		70		ns	
t _{AK}	Width of \overline{ACK} Pulse	500			ns	
t _{ST}	Width of \overline{STB} Pulse	500			ns	
t _{PS}	Set-Up Time for Peripheral	60			ns	
t _{PH}	Hold Time for Peripheral	180			ns	
t _{RA}	Hold Time, Address Bus Trailing Edge to \overline{RD}	0			ns	
t _{RC}	Hold Time for \overline{CS} after $\overline{RD} = 1$	5			ns	
t _{AD}	Address Bus Valid to Data Valid			400	ns	
t _{KD}	Time from $\overline{ACK} = 1$ to Output Floating	20		480	ns	
t _{WO}	Time from $\overline{WR} = 1$ to $\overline{OBF} = 0$			650	ns	
t _{AO}	Time from $\overline{ACK} = 0$ to $\overline{OBF} = 1$			450	ns	
t _{SI}	Time from $\overline{STB} = 0$ to \overline{IBF}			450	ns	
t _{RI}	Time from $\overline{RD} = 1$ to $\overline{IBF} = 0$			360	ns	
t _{ACS0}	Address Bus Valid to \overline{CS}	0			ns	
t _{ACS1}	Address Change to \overline{CS} OFF	0			ns	

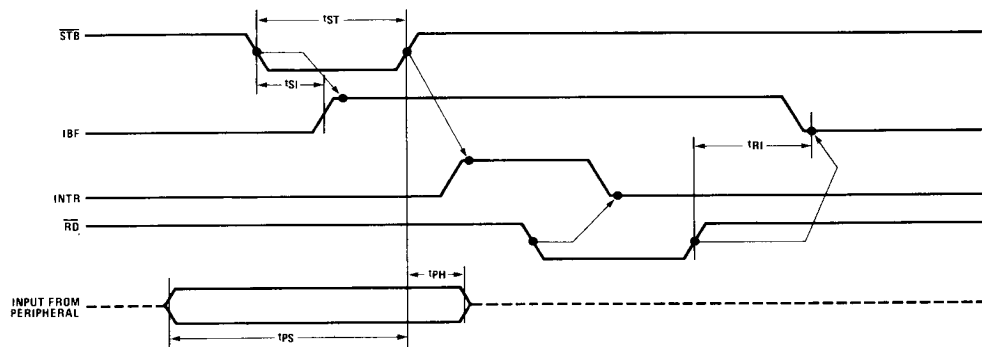
Timing Waveforms



Mode 0 (Basic Input)

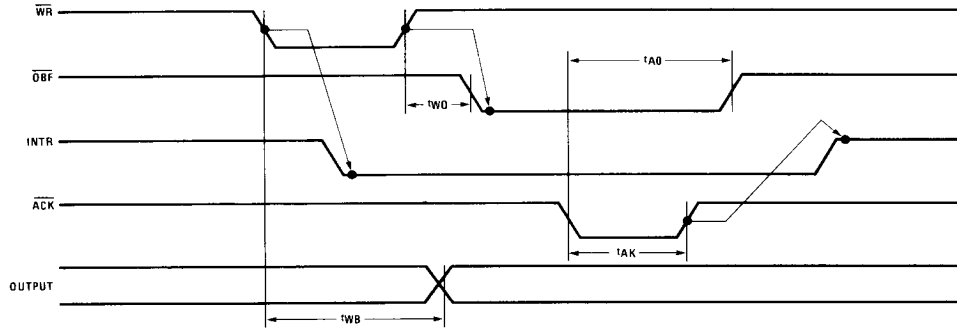


Mode 0 (Basic Output)

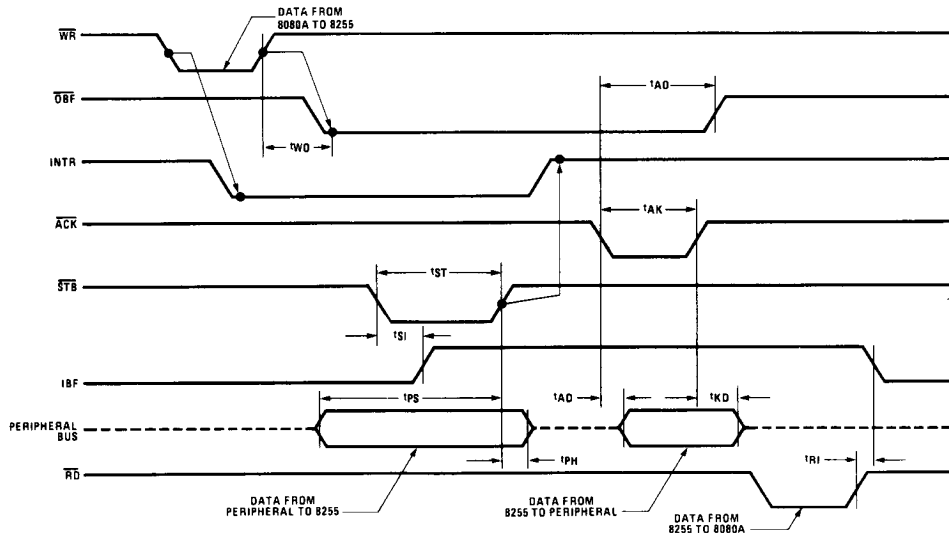


Mode 1 (Strobed Input)

Timing Waveforms (cont'd.)



Mode 1 (Strobed Output)



Mode 2 (Bidirectional)

INPUT/OUTPUT SIGNALS

Data (D₇-D₀) Bus, Pins 27-34: This bus comprises eight TRI-STATE® input/output lines. The bus provides bi-directional communication between the INS8255 and the INS8080A. Data is routed to or from the internal data bus buffer upon execution of an OUT or IN Instruction, respectively, by the INS8080A. In addition, control words and status information are transferred through the data bus buffer.

Port A (PA₇-PA₀), Pins 37-40, 1-4: This 8-bit input/output port forms one 8-bit data output latch/buffer and/or one 8-bit data input latch.

NOTE

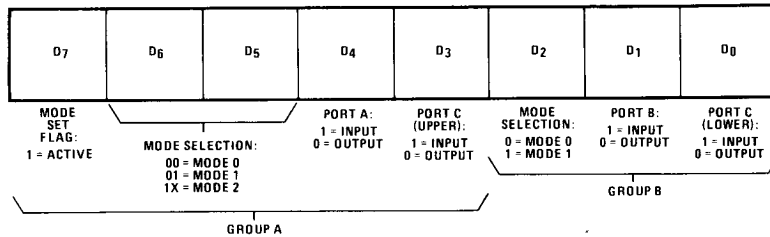
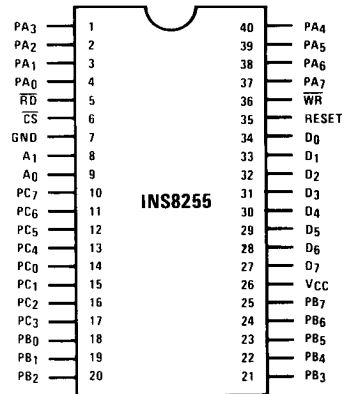
The system software uses a Mode Definition Control Word (see figure) as the second byte of OUT Instruction(s) to program the functional configuration of Ports A through C. Whenever the mode is changed, all output registers (and status flip-flops) are reset.

Port B (PB₇-PB₀), Pins 18-25: This 8-bit input/output port forms one 8-bit data output latch/buffer or one 8-bit data input buffer.

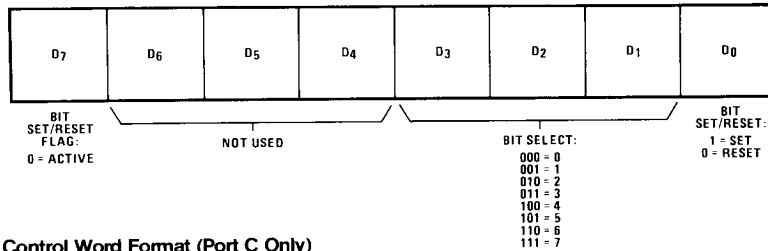
Port C (PC₇-PC₀), Pins 10-17: This 8-bit input/output port forms one 8-bit data output latch/buffer or one 8-bit data input buffer. The port can be split into two 4-bit ports under the mode control. Each of these 4-bit ports contains a 4-bit latch that may be used for the control and status signals, in conjunction with Ports A

and B. The system software includes a Bit Set/Reset Control Word (see figure) for setting or resetting any of the eight bits of Port C. When Port C is being used as a status/control for Port A or B, the Port C bits can be set or reset by using the Bit Set/Reset Control Word as the second byte of OUT Instruction(s).

Pin Configuration



Mode Definition Control Word Format



Bit Set/Reset Control Word Format (Port C Only)

Operating Modes

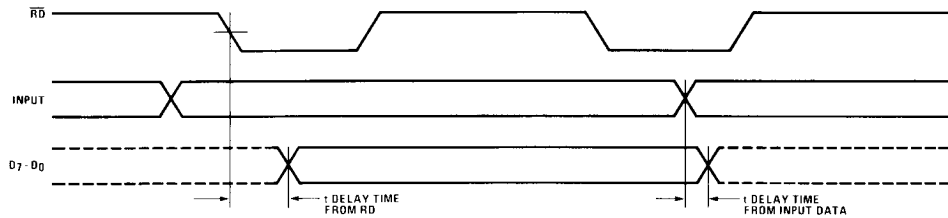
Mode 0 (Basic Input/Output)

In this mode, simple input and output operations for each of the three ports are provided. No "handshaking" is required; data is simply written to or read from a specified port.

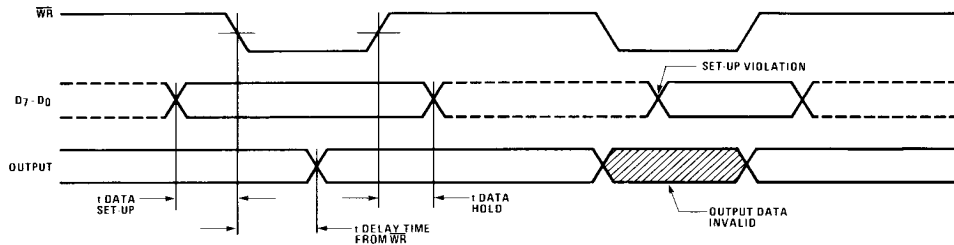
Mode 0 Port Definition Chart

No.	Control Word Bits								Group A		Group B	
	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀	Port A	Port C (Upper)	Port B	Port C (Lower)
0	1	0	0	0	0	0	0	0	OUTPUT	OUTPUT	OUTPUT	OUTPUT
1	1	0	0	0	0	0	0	1	OUTPUT	OUTPUT	OUTPUT	INPUT
2	1	0	0	0	0	0	1	0	OUTPUT	OUTPUT	INPUT	OUTPUT
3	1	0	0	0	0	0	1	1	OUTPUT	OUTPUT	INPUT	INPUT
4	1	0	0	0	1	0	0	0	OUTPUT	INPUT	OUTPUT	OUTPUT
5	1	0	0	0	1	0	0	1	OUTPUT	INPUT	OUTPUT	INPUT
6	1	0	0	0	1	0	1	0	OUTPUT	INPUT	INPUT	OUTPUT
7	1	0	0	0	1	0	1	1	OUTPUT	INPUT	INPUT	INPUT
8	1	0	0	1	0	0	0	0	INPUT	OUTPUT	OUTPUT	OUTPUT
9	1	0	0	1	0	0	0	1	INPUT	OUTPUT	OUTPUT	INPUT
10	1	0	0	1	0	0	1	0	INPUT	OUTPUT	INPUT	OUTPUT
11	1	0	0	1	0	0	1	1	INPUT	OUTPUT	INPUT	INPUT
12	1	0	0	1	1	0	0	0	INPUT	INPUT	OUTPUT	OUTPUT
13	1	0	0	1	1	0	0	1	INPUT	INPUT	OUTPUT	INPUT
14	1	0	0	1	1	0	1	0	INPUT	INPUT	INPUT	OUTPUT
15	1	0	0	1	1	0	1	1	INPUT	INPUT	INPUT	INPUT

BASIC INPUT TIMING
(D₇ - D₀ FOLLOWS INPUT, NO LATCHING)



BASIC OUTPUT TIMING
(OUTPUTS LATCHED)

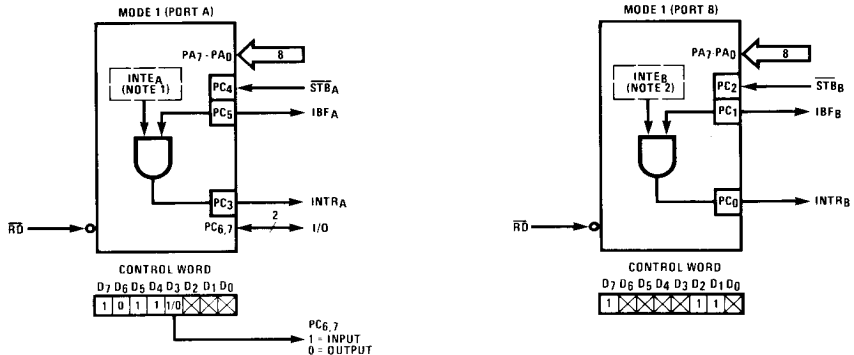


Mode 0 Timing

Operating Modes (cont'd.)

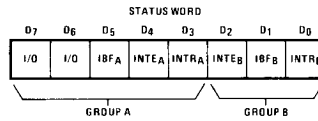
Mode 1 (Strobed Input/Output)

In this mode, a means for transferring input/output data to or from a specified port in conjunction with strobes or "handshaking" signals is provided. Port A and Port B use the lines on Port C to generate or accept these "handshaking" signals in Mode 1. The programmer can read the contents of Port C to test or verify the status of each peripheral device. Since no special instruction is provided in the INS8080A microcomputer system to read the Port C status information, a normal read operation must be executed to perform this function.

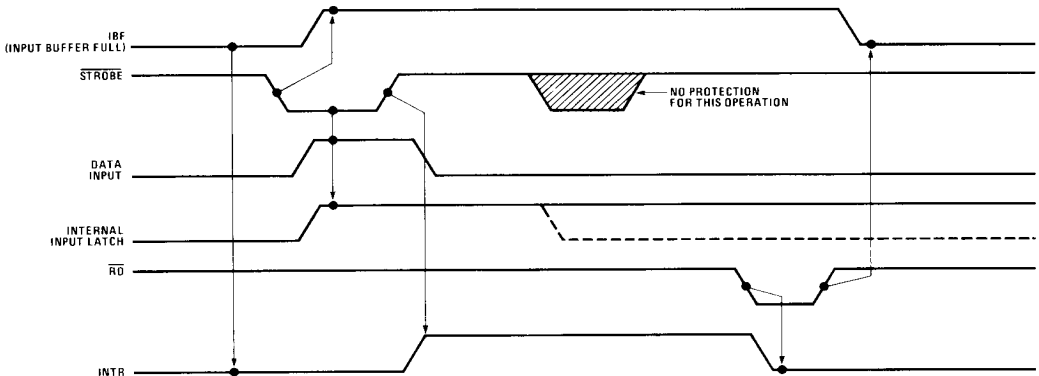


Notes:

1. $INTE_A$ is controlled by bit set/reset of PC_4 .
2. $INTE_B$ is controlled by bit set/reset of PC_2 .

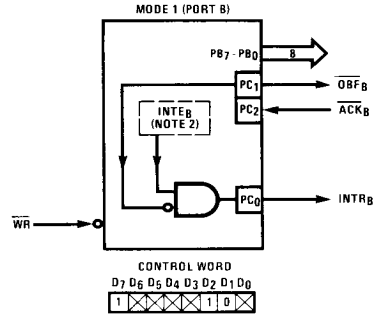
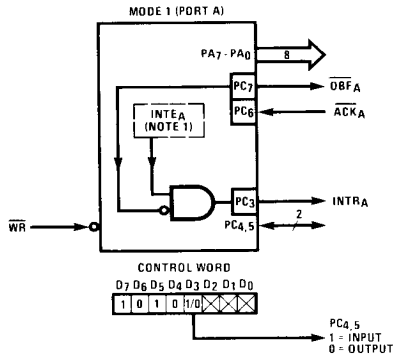


Mode 1 Input

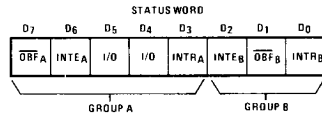


Mode 1 Input Timing

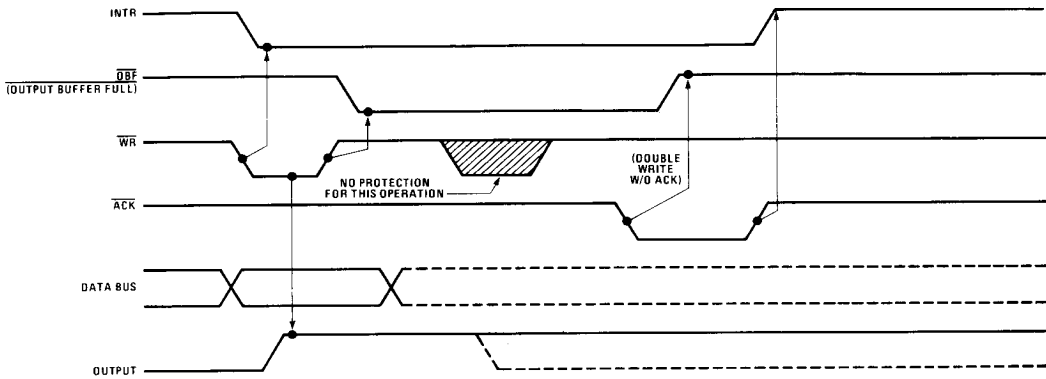
Operating Modes (cont'd.)



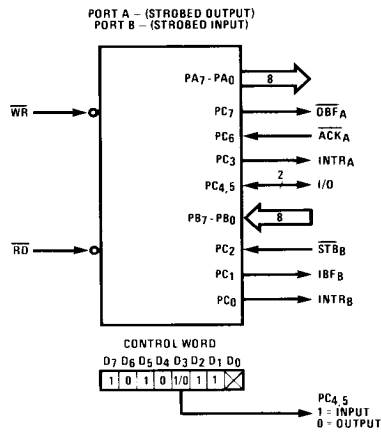
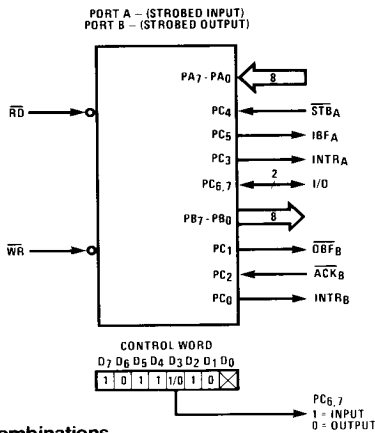
- Notes:**
1. INTE_A is controlled by bit set/reset of PC₆.
 2. INTE_B is controlled by bit set/reset of PC₂.



Mode 1 Output



Mode 1 Output Timing



Mode 1 Combinations

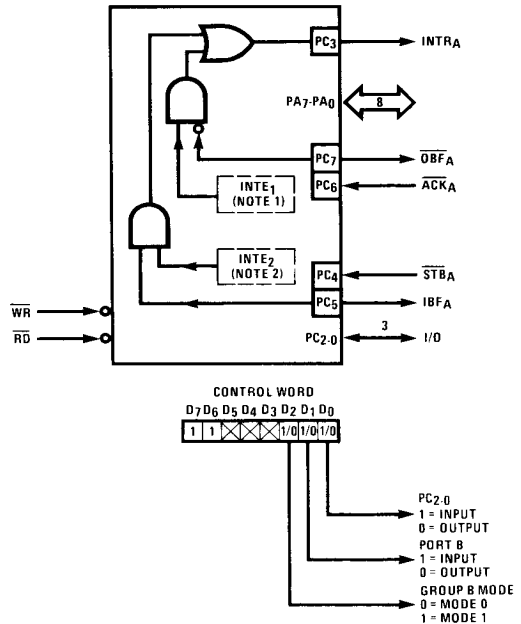
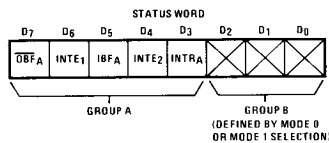
Operating Modes (cont'd.)

Mode 2 (Strobed Bidirectional Bus Input/Output)

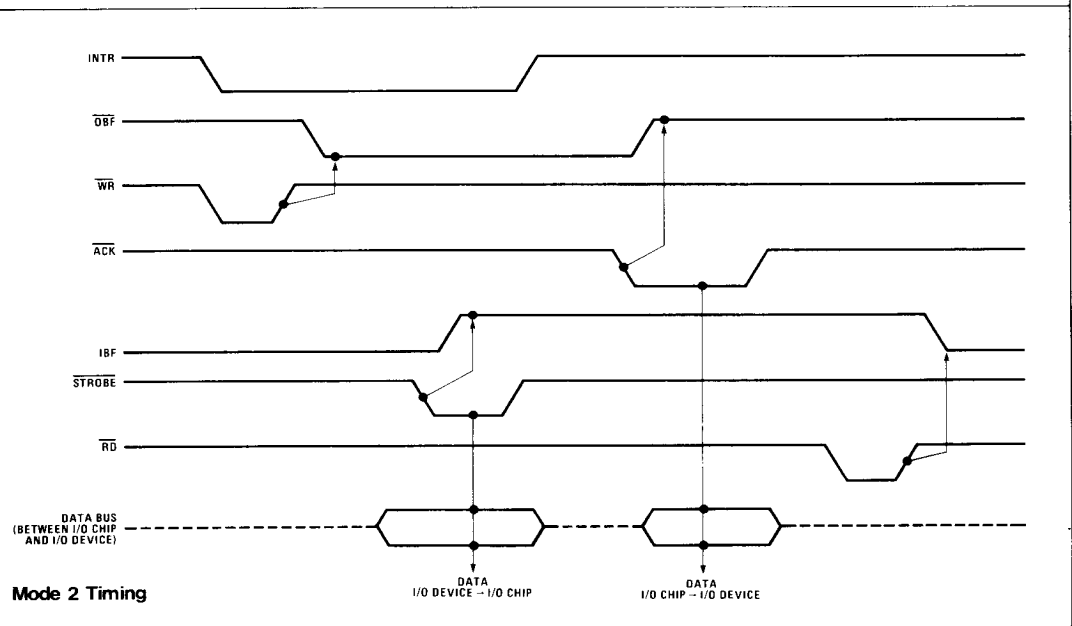
This mode enables communication with a peripheral device or structure on a single 8-bit bus for both transmitting and receiving data (bidirectional bus input/output). "Handshaking" signals are provided to maintain proper bus flow discipline in a manner similar to Mode 1. In addition, interrupt generation and enable/disable functions are available in Mode 2.

Notes:

1. $INTE_1$ is controlled by bit set/reset of PC_6 .
2. $INTE_2$ is controlled by bit set/reset of PC_4 .

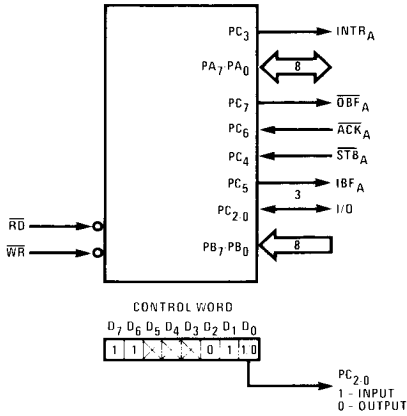


Mode 2

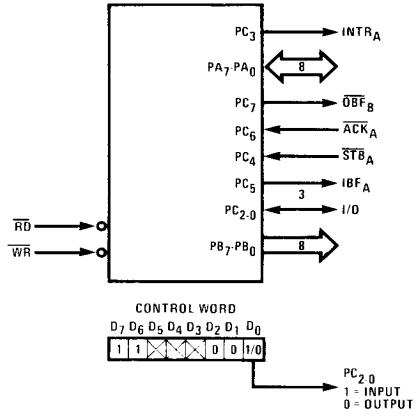


Operating Modes (cont'd.)

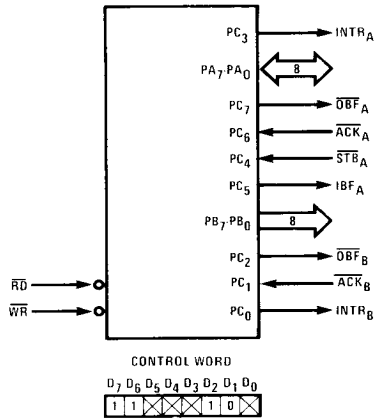
MODE 2 AND MODE 0 (INPUT)



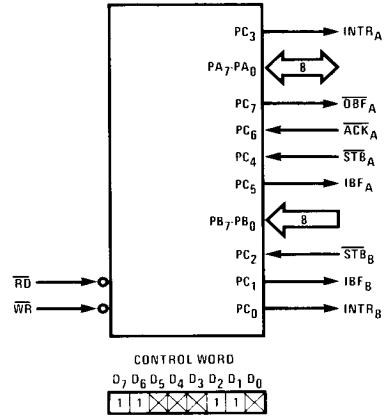
MODE 2 AND MODE 0 (OUTPUT)



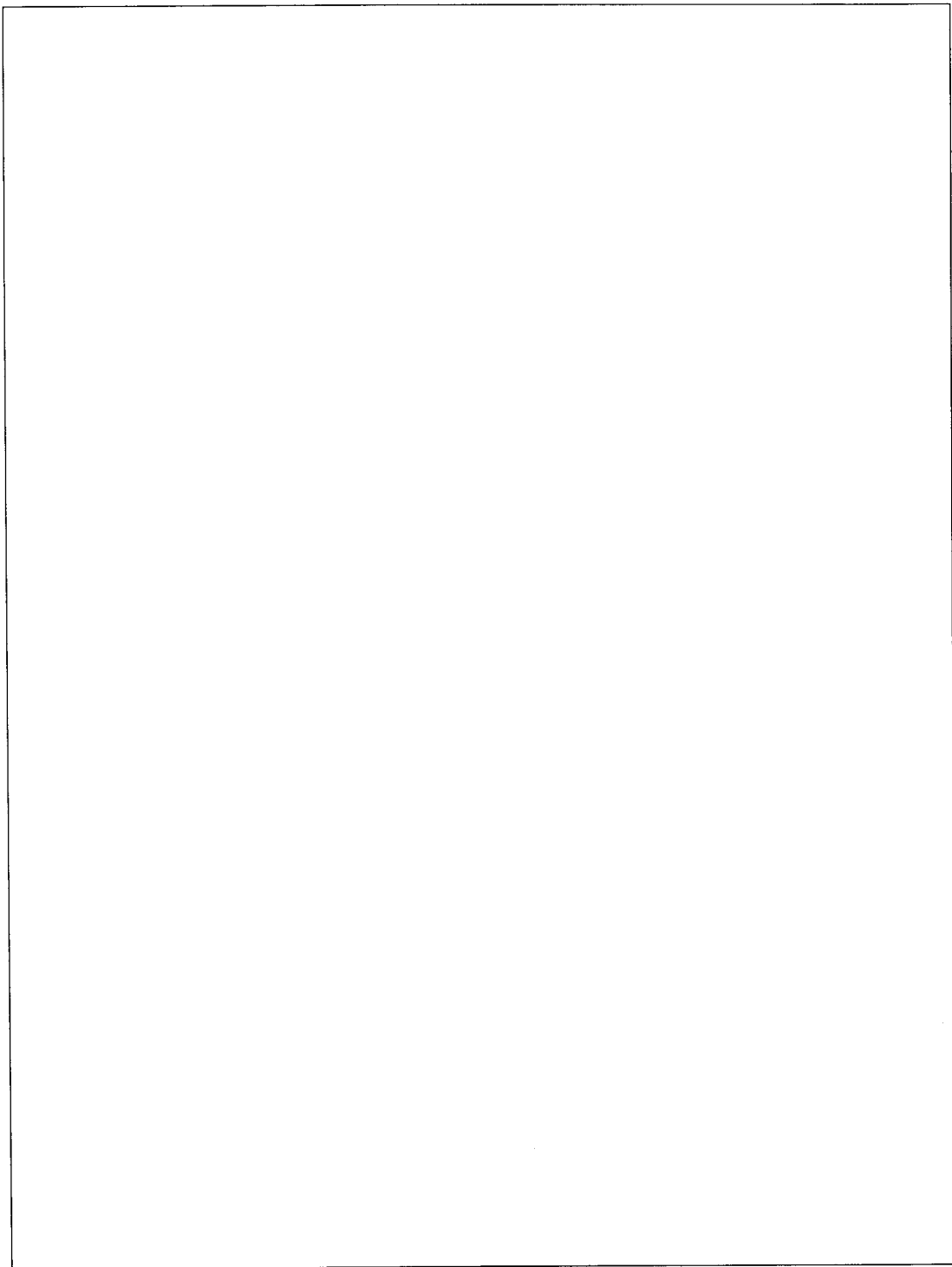
MODE 2 AND MODE 1 (OUTPUT)



MODE 2 AND MODE 1 (INPUT)



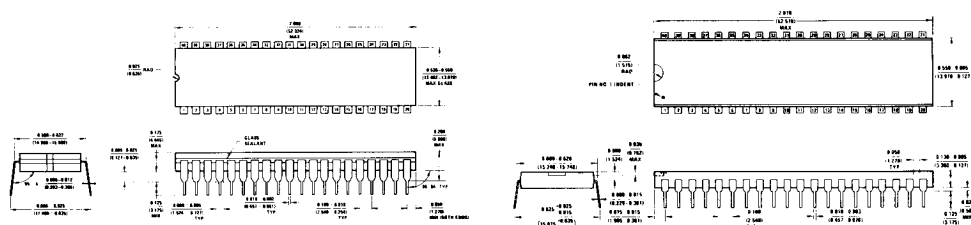
Mode 2 Combinations



Mode Definition Summary Table

Port Bits	Mode 0		Mode 1		Mode 2
	IN	OUT	IN	OUT	Group A Only
PA ₀	IN	OUT	IN	OUT	Bidirectional \updownarrow Bidirectional
PA ₁	IN	OUT	IN	OUT	
PA ₂	IN	OUT	IN	OUT	
PA ₃	IN	OUT	IN	OUT	
PA ₄	IN	OUT	IN	OUT	
PA ₅	IN	OUT	IN	OUT	
PA ₆	IN	OUT	IN	OUT	
PA ₇	IN	OUT	IN	OUT	
PB ₀	IN	OUT	IN	OUT	(Mode 0 or Mode 1 only)
PB ₁	IN	OUT	IN	OUT	
PB ₂	IN	OUT	IN	OUT	
PB ₃	IN	OUT	IN	OUT	
PB ₄	IN	OUT	IN	OUT	
PB ₅	IN	OUT	IN	OUT	
PB ₆	IN	OUT	IN	OUT	
PB ₇	IN	OUT	IN	OUT	
PC ₀	IN	OUT	INTR _B	INTR _B	I/O
PC ₁	IN	OUT	IBF _B	$\overline{\text{OBF}}_B$	I/O
PC ₂	IN	OUT	STB _B	$\overline{\text{ACK}}_B$	I/O
PC ₃	IN	OUT	INTR _A	INTR _A	INTR _A
PC ₄	IN	OUT	STB _A	I/O	STB _A
PC ₅	IN	OUT	IBF _A	I/O	IBF _A
PC ₆	IN	OUT	I/O	$\overline{\text{ACK}}_A$	$\overline{\text{ACK}}_A$
PC ₇	IN	OUT	I/O	$\overline{\text{OBF}}_A$	$\overline{\text{OBF}}_A$

Physical Dimensions



Ceramic Dual-in-Line Package [Cerdip (J)]
Order Number INS8255J

Plastic Dual-in-Line Package (N)
Order Number INS8255N



National Semiconductor Corporation
2900 Semiconductor Drive
Santa Clara, CA 95051
Tel. (408) 737-5000
TWX. (910) 339-9240

National Semiconductor GmbH
Eisenheimerstrasse 61/11
8000 Munchen 21
West Germany
Tel. (089) 576091
Telex. 05-22772

NS International Inc., Japan
Miyake Building
1-9 Yotsuya, Shinjuku-ku 160
Tokyo, Japan
Tel. (03) 355-3711
TWX. 232-2015 NSCJ-UJ

National Semiconductor (Hong Kong) Ltd.
8th Floor
Cheung Kong Electronic Bldg
4 Hing Yip Street
Kwun Tong
Kowloon, Hong Kong
Tel. 3-899235
Telex. 43866 NSEHK HX
Cable. NATSEMI

NS Electronics Do Brasil
Avda Brigadeiro Faria Lima 844
11 Andar, Conjunto 1104
Jardim Paulistano
Sao Paulo, Brasil
Telex. 1121008 Cabine Sao Paulo

NS Electronics Pty. Ltd.
Cnr. Stud Rd. & Min. Highway
Bayswater, Victoria 3153
Australia
Tel. 03-729-6333
Telex. 32096

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