8289
BUS ARBITER

- Provides Multi-Master System Bus Protocol
- Synchronizes 8086/8088 Processors With Multi-Master Bus
- Provides Simple Interface With 8288 Bus Controller
- Four Operating Modes For Flexible System Configuration
- Compatible with Intel Bus Standard MULTIBUS™
- Provides System Bus Arbitration For 8089 IOP In Remote Mode

The Intel 8289 Bus Arbiter is a 20-pin, 5-volt-only bipolar component for use with medium to large 8086/8088 multi-master/multiprocessing systems. The 8289 provides system bus arbitration for systems with multiple bus masters, such as an 8086 CPU with 8089 IOP in its REMOTE mode, while providing bipolar buffering and drive capability.

BLOCK DIAGRAM

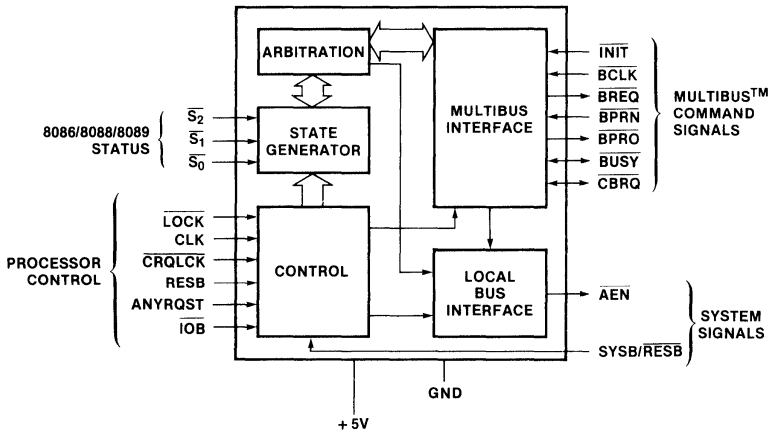


Figure 1. Block Diagram.

PIN DIAGRAM

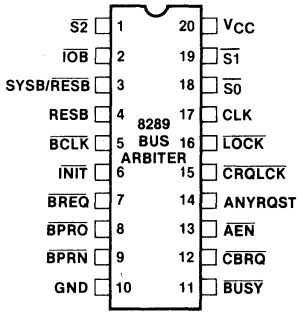


Figure 2. Pin Diagram.

FUNCTIONAL PINOUT

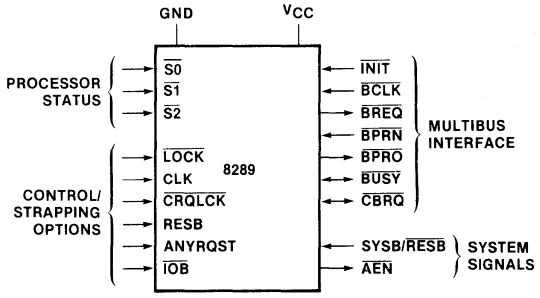


Figure 3. Functional Pinout.

FUNCTIONAL DESCRIPTION

The 8289 Bus Arbiter operates in conjunction with the 8288 Bus Controller to interface 8086/8088/8089 processors to a multi-master system bus (both the 8086 and 8088 are configured in their max mode). The processor is unaware of the arbiter's existence and issues commands as though it has exclusive use of the system bus. If the processor does not have the use of the multi-master system bus, the arbiter prevents the Bus Controller (8288), the data transceivers and the address latches from accessing the system bus (e.g. all bus driver outputs are forced into the high impedance state). Since the command sequence was not issued by the 8288, the system bus will appear as "Not Ready" and the processor will enter wait states. The processor will remain in Wait until the Bus Arbiter acquires the use of the multi-master system bus whereupon the arbiter will allow the bus controller, the data transceivers, and the address latches to access the system. Typically, once the command has been issued and a data transfer has taken place, a transfer acknowledge (XACK) is returned to the processor to indicate "READY" from the accessed slave device. The processor then completes its transfer cycle. Thus the arbiter serves to multiplex a processor (or bus master) onto a multi-master system bus and avoid contention problems between bus masters.

ARBITRATION BETWEEN BUS MASTERS

In general, higher priority masters obtain the bus when a lower priority master completes its present transfer cycle. Lower priority bus masters obtain the bus when a higher priority master is not accessing the system bus. A strapping option (ANYRQST) is provided to allow the arbiter to surrender the bus to a lower priority master as though it were a master of higher priority. If there are no other bus masters requesting the bus, the arbiter maintains the bus so long as its processor has not entered the HALT State. The arbiter will not voluntarily surrender the system bus and has to be forced off by another master's bus request, the HALT State being the only exception. Additional strapping options permit other modes of operation wherein the multi-master system bus is surrendered or requested under different sets of conditions.

PRIORITY RESOLVING TECHNIQUES

Since there can be many bus masters on a multi-master system bus, some means of resolving priority between bus masters simultaneously requesting the bus must be provided. The 8289 Bus Arbiter provides several resolving techniques. All the techniques are based on a priority concept that at a given time one bus master will have priority above all the rest. There are provisions for using parallel priority resolving techniques, serial priority resolving techniques, and rotating priority techniques.

Parallel Priority Resolving

The parallel priority resolving technique uses a separate bus request line ($\overline{BREQ}$) for each arbiter on the multi-master system bus, see Figure 4. Each $\overline{BREQ}$ line enters into a priority encoder which generates the binary address of the highest priority $\overline{BREQ}$ line which is active. The binary address is decoded by a decoder to select the corresponding $\overline{BPRN}$ (Bus Priority In) line to be returned to the highest priority requesting arbiter. The arbiter receiving priority ($\overline{BPRN}$ true) then allows its associated bus master onto the multi-master system bus as soon as it becomes available (i.e., the bus is no longer busy). When one bus arbiter gains priority over another arbiter it cannot immediately seize the bus, it must wait until the present bus transaction is complete. Upon completing its transaction the present bus occupant recognizes that it no longer has priority and surrenders the bus by releasing $\overline{BUSY}$. $\overline{BUSY}$ is an active low "OR" tied signal line which goes to every bus arbiter on the system bus. When $\overline{BUSY}$ goes inactive (high), the arbiter which presently has bus priority ($\overline{BPRN}$ true) then seizes the bus and pulls $\overline{BUSY}$ low to keep other arbiters off of the bus. See waveform timing diagram, Figure 5.

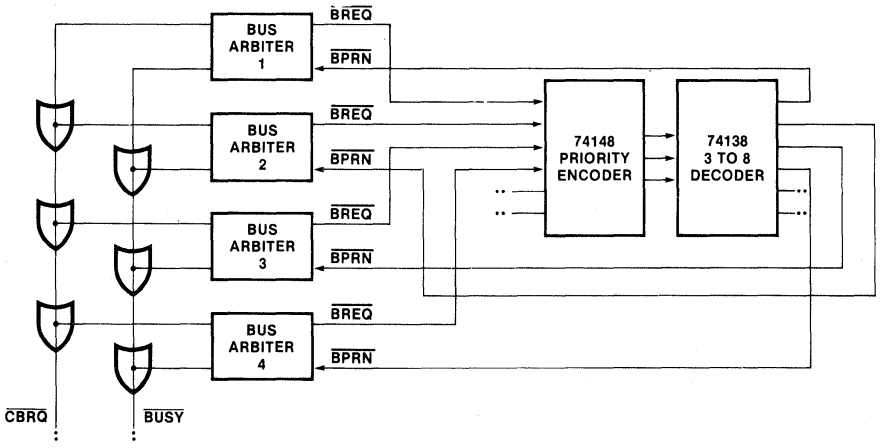
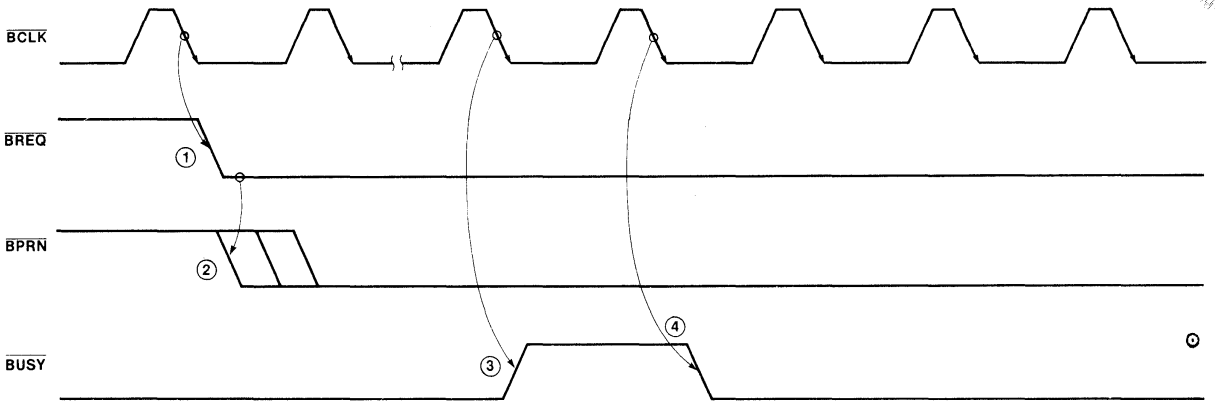


Figure 4. Parallel Priority Resolving Technique.



① HIGHER PRIORITY BUS ARBITER REQUESTS THE MULTI-MASTER SYSTEM BUS.
② ATTAINS PRIORITY.
③ LOWER PRIORITY BUS ARBITER RELEASES BUSY.
④ HIGHER PRIORITY BUS ARBITER THEN ACQUIRES THE BUS AND PULLS BUSY DOWN.

Figure 5. Higher Priority Arbiter obtaining the Bus from a Lower Priority Arbiter.

Note that all multi-master system bus transactions are synchronized to the bus clock (BCLK). This allows the parallel priority resolving circuitry or any other priority resolving scheme employed to settle.

Serial Priority Resolving

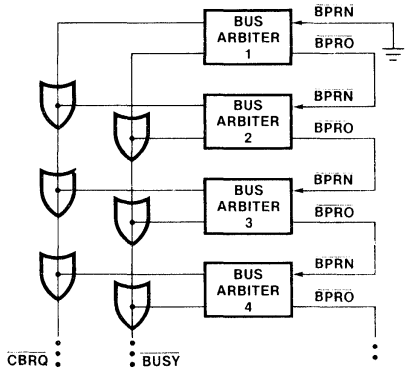
The serial priority resolving technique eliminates the need for the priority encoder-decoder arrangement by daisy-chaining the bus arbiters together, connecting the higher priority bus arbiter's $\overline{BPRO}$ (Bus Priority Out) output to the $\overline{BPRN}$ of the next lower priority. See Figure 6.

Rotating Priority Resolving

The rotating priority resolving technique is similar to that of the parallel priority resolving technique except that priority is dynamically re-assigned. The priority encoder is replaced by a more complex circuit which rotates priority between requesting arbiters thus allowing each arbiter an equal chance to use the multi-master system bus, over time.

WHICH PRIORITY RESOLVING TECHNIQUE TO USE

There are advantages and disadvantages for each of the techniques described above. The rotating priority resolving technique requires substantial external logic to implement while the serial technique uses no external logic but can accommodate only a limited number of bus arbiters before the daisy-chain propagation delay exceeds the multi-master's system bus clock ($\overline{BCLK}$). The parallel priority resolving technique is in general a good compromise between the other two techniques. It allows for many arbiters to be present on the bus while not requiring too much logic to implement.



THE NUMBER OF ARBITERS THAT MAY BE DAISY-CHAINED TOGETHER IN THE SERIAL PRIORITY RESOLVING SCHEME IS A FUNCTION OF BCLK AND THE PROPAGATION DELAY FROM ARBITER TO ARBITER. NORMALLY, AT 10 MHz ONLY 3 ARBITER MAY BE DAISY-CHAINED.

Figure 6. Serial Priority Resolving.

8289 MODES OF OPERATION

There are two types of processors in the 8086 family. An Input/Output processor (the 8089 IOP) and the 8086/8088 CPUs. Consequently, there are two basic operating modes in the 8289 bus arbiter. One, the $\overline{IOB}$ (I/O Peripheral Bus) mode, permits the processor access to both an I/O Peripheral Bus and a multi-master system bus. The second, the RESB (Resident Bus mode), permits the processor to communicate over both a Resident Bus and a multi-master system bus. An I/O Peripheral Bus is a bus where all devices on that bus, including memory, are treated as I/O devices and are addressed by I/O commands. All memory commands are directed to another bus, the multi-master system bus. A Resident Bus can issue both memory and I/O commands, but it is a distinct and separate bus from the multi-master system bus. The distinction is that the Resident Bus has only one master, providing full availability and being dedicated to that one master.

The $\overline{IOB}$ strapping option configures the 8289 Bus Arbiter into the $\overline{IOB}$ mode and the strapping option RESB configures it into the RESB mode. It might be noted at this point that if both strapping options are strapped false, the arbiter interfaces the processor to a multi-master system bus only (see Figure 7). With both options strapped true, the arbiter interfaces the processor to a multi-master system bus, a Resident Bus, and an I/O Bus.

In the $\overline{IOB}$ mode, the processor communicates and controls a host of peripherals over the Peripheral Bus. When the I/O Processor needs to communicate with system memory, it does so over the system memory bus. Figure 8 shows a possible I/O Processor system configuration.

The 8086 and 8088 processor can communicate with a Resident Bus and a multi-master system bus. Two bus controllers and only one Bus Arbiter would be needed in such a configuration as shown in Figure 9. In such a system configuration the processor would have access to memory and peripherals of both busses. Memory mapping techniques are applied to select which bus is to be accessed. The SYSB/$\overline{RESB}$ input on the arbiter serves to instruct the arbiter as to whether or not the system bus is to be accessed. The signal connected to SYSB/$\overline{RESB}$ also enables or disables commands from one of the bus controllers.

A summary of the modes that the 8289 has, along with its response to its status lines inputs, is summarized in Table 1.

*In some system configurations it is possible for a non-I/O Processor to have access to more than one Multi-Master System Bus, see 8289 Application Note.

	Status Lines From 8086 or 8088 or 8089			IOB Mode Only	RESB (Mode) Only		IOB Mode RESB Mode		Single Bus Mode
					$\overline{IOB}$ = High RESB = High		$\overline{IOB}$ = Low RESB = High		$\overline{IOB}$ = High RESB = Low
	$\overline{S2}$	$\overline{S1}$	$\overline{S0}$	$\overline{IOB}$ = Low	SYSB/$\overline{RESB}$ = High	SYSB/$\overline{RESB}$ = Low	SYSB/$\overline{RESB}$ = High	SYSB/$\overline{RESB}$ = Low	
I/O COMMANDS	0	0	0	x	✓	x	x	x	✓
	0	0	1	x	✓	x	x	x	✓
	0	1	0	x	✓	x	x	x	✓
HALT	0	1	1	x	x	x	x	x	x
MEM COMMANDS	1	0	0	✓	✓	x	✓	x	✓
	1	0	1	✓	✓	x	✓	x	✓
	1	1	0	✓	✓	x	✓	x	✓
IDLE	1	1	1	x	x	x	x	x	x

NOTES:
1. X = Multi-Master System Bus is allowed to be Surrendered.
2. ✓ = Multi-Master System Bus is Requested.

Mode	Pin Strapping	Multi-Master System Bus	
		Requested**	Surrendered*
Single Bus Multi-Master Mode	$\overline{IOB}$ = High RESB = Low	Whenever the processor's status lines go active	HLT + TI • CBRQ + HPBRQ†
RESB Mode Only	$\overline{IOB}$ = High RESB = High	SYSB/$\overline{RESB}$ = High • ACTIVE STATUS	(SYSB/$\overline{RESB}$ = Low + TI) • CBRQ + HLT + HPBRQ
IOB Mode Only	$\overline{IOB}$ = Low RESB = Low	Memory Commands	(I/O Status + TI) • CBRQ + HLT + HPBRQ
IOB Mode RESB Mode	$\overline{IOB}$ = Low RESB = High	(Memory Command) • (SYSB/$\overline{RESB}$ = High)	((I/O Status Commands) + SYSB/$\overline{RESB}$ = LOW)) • CBRQ + HPBRQ† + HLT

NOTES:
*$\overline{LOCK}$ prevents surrender of Bus to any other arbiter, $\overline{CRQLCK}$ prevents surrender of Bus to any lower priority arbiter.
**Except for HALT and Passive or IDLE Status.
†HPBRQ, Higher priority Bus request or $\overline{BPRN}$ = 1.
1. $\overline{IOB}$ Active Low.
2. RESB Active High.
3. + is read as "OR" and • as "AND."
4. TI = Processor Idle Status $\overline{S2}$, $\overline{S1}$, $\overline{S0}$ = 111
5. HLT = Processor Halt Status $\overline{S2}$, $\overline{S1}$, $\overline{S0}$ = 011

Table 1. Summary of 8289 Modes, Requesting and Relinquishing the Multi-master system bus.

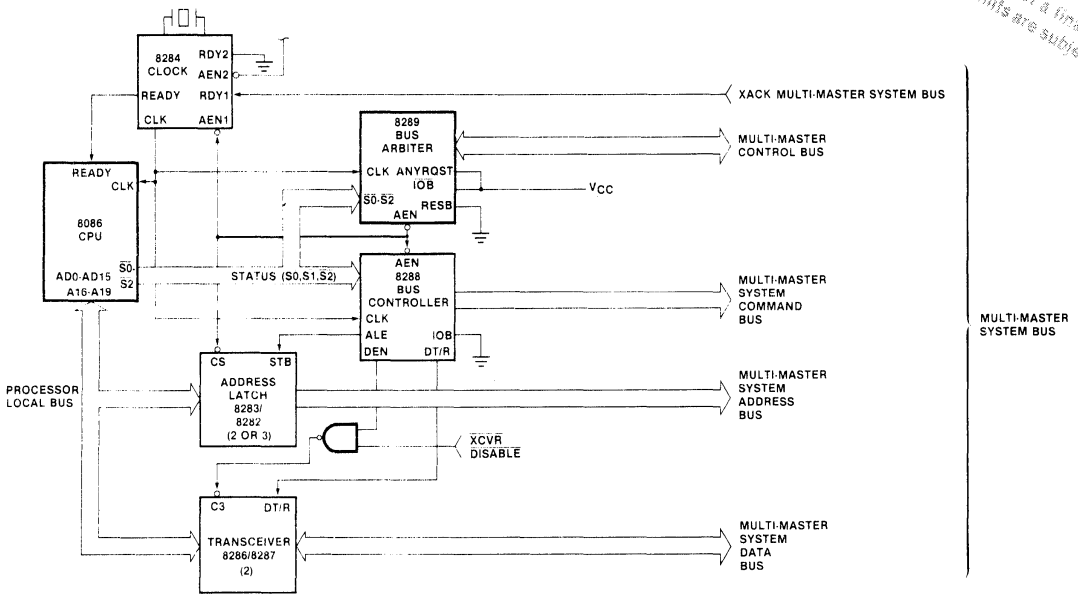


Figure 7. Typical Medium Complexity CPU System.

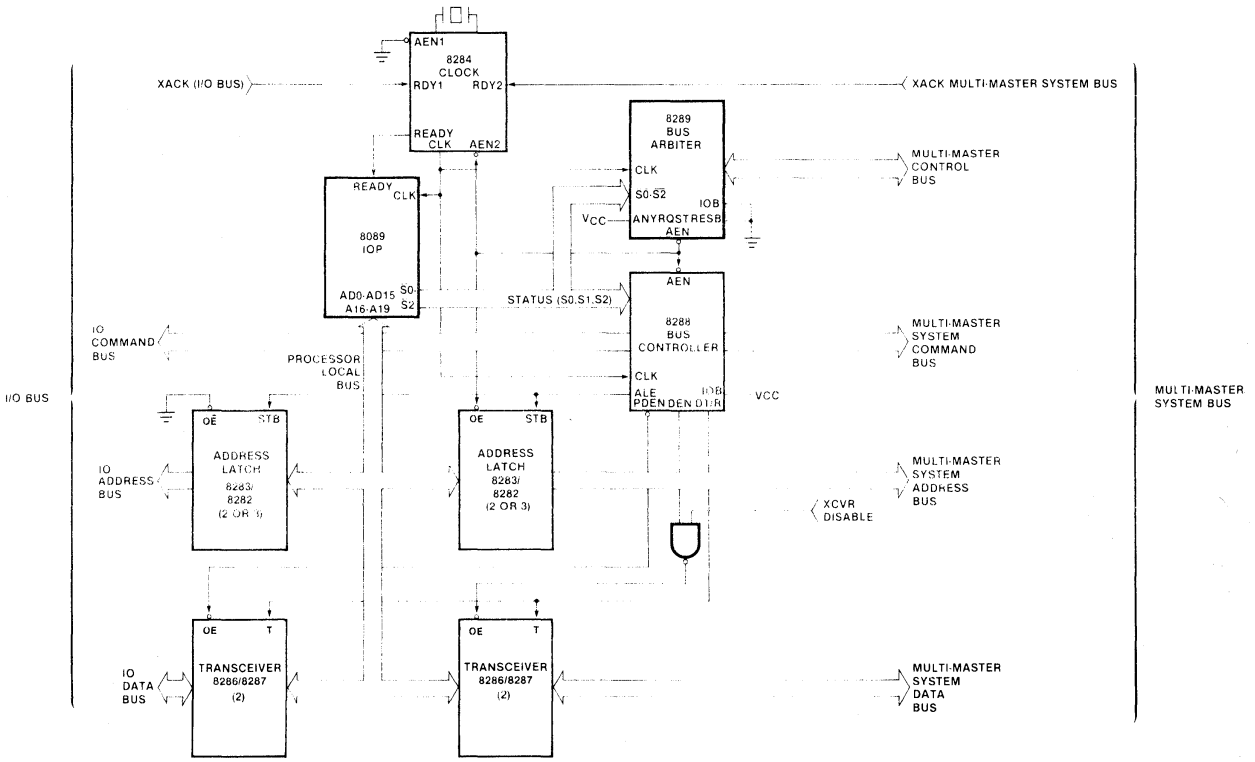
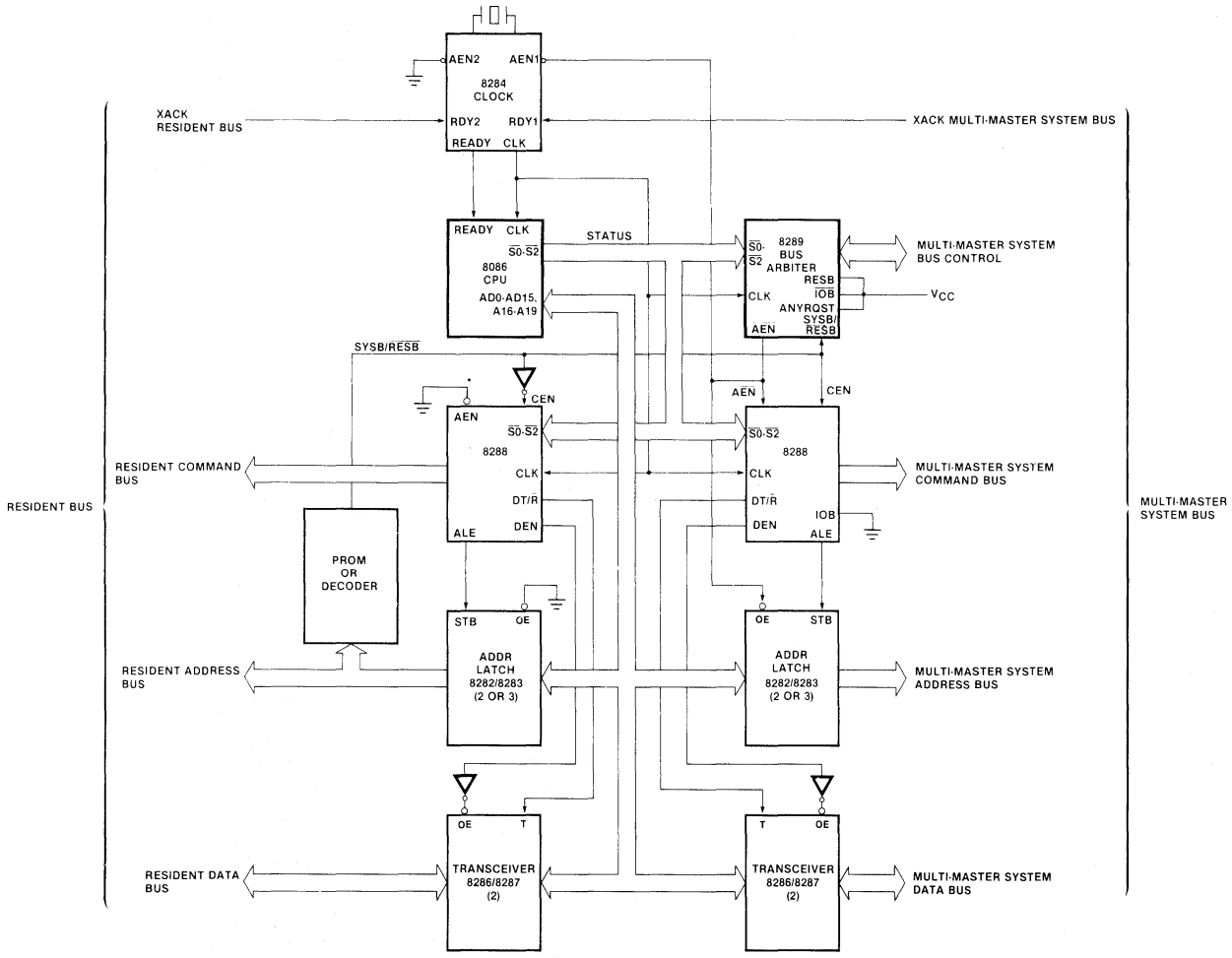


Figure 8. Typical Medium Complexity IOB System.



*BY ADDING ANOTHER 8289 ARBITER AND CONNECTING ITS AEN TO THE 8288 WHOSE $\overline{AEN}$ IS PRESENTLY GROUNDED, THE PROCESSOR COULD HAVE ACCESS TO TWO MULTI-MASTER BUSES.

Figure 9. 8289 Bus Arbiter Shown in System-Resident Bus Configuration.

PIN DEFINITIONS

Name	I/O	Function
V_{CC}		+5V supply ±10%
GND		Ground
$\overline{S0}$,$\overline{S1}$,$\overline{S2}$	I	STATUS INPUT PINS: These pins are the status input pins from an 8086, 8088 or 8089 processor. The 8289 decodes these pins to initiate bus request and surrender actions. (See Table 1)
CLK	I	CLOCK: This is the clock from the 8284 clock chip and serves to establish when bus arbiter actions are initiated.
$\overline{LOCK}$	I	LOCK: $\overline{LOCK}$ is a processor generated signal which when activated (low) serves to prevent the arbiter from surrendering the multi-master system bus to any other bus arbiter, regardless of its priority.
$\overline{CRQLCK}$	I	COMMON REQUEST LOCK: $\overline{CRQLCK}$ is an active low signal which serves to prevent the arbiter from surrendering the multi-master system bus to any other bus arbiter requesting the bus through the $\overline{CBRQ}$ input pin.
RESB	I	RESB: RESIDENT BUS is a strapping option to configure the arbiter to operate in systems having both a multi-master system bus and a Resident Bus. When it is strapped high the multi-master system bus is requested or surrendered as a function of the SYSB/$\overline{RESB}$ input pin. When it is strapped low the SYSB/$\overline{RESB}$ input is ignored.
ANYRQST	I	ANY REQUEST: ANYRQST is a strapping option which permits the multi-master system bus to be surrendered to a lower priority arbiter as though it were an arbiter of higher priority (i.e., when a lower priority arbiter requests the use of the multi-master system bus, the bus is surrendered as soon as it is possible). Strapping $\overline{CBRQ}$ low and ANYRQST high forces the 8289 arbiter to surrender the multi-master system bus after each transfer cycle. Note that when surrender occurs BREQ is driven false (high).
$\overline{IOB}$	I	IO BUS: $\overline{IOB}$ is a strapping option which configures the 8289 Arbiter to operate in systems having both an IO Bus (Peripheral Bus) and a multi-master system bus. The arbiter requests and surrenders the use of the multi-master system bus as a function of the status line, $\overline{S2}$. The multi-master system bus is permitted to be surrendered while the processor is performing IO commands and is requested whenever the processor performs a memory command. Interrupt cycles are assumed as coming from the peripheral bus and are treated as would be an IO command.
$\overline{AEN}$	O	ADDRESS ENABLE. $\overline{AEN}$ is the output of the 8289 Arbiter to the processor's address latches, to the 8288 Bus Controller and 8284 Clock Generator. $\overline{AEN}$ serves to instruct the Bus Controller and address latches when to tri-state their output drivers.
SYSB/$\overline{RESB}$	I	SYSTEM BUS/$\overline{RESIDENT}$ $\overline{BUS}$: SYSB/$\overline{RESB}$ is an input signal when the arbiter is configured in the S.R. Mode (RESB is strapped high) which serves to determine when the multi-master system bus is requested and when the multi-master system bus surrendering is permitted. The signal is intended to originate from some form of address mapping circuitry such as a decoder or PROM attached to the resident address bus. Signal transitions and glitches are permitted on this pin from ø1 of T4 to ø1 to T2 of the processor cycle. During the period from ø1 of T2 to ø1 of T4 only clean transitions are permitted on this pin (no glitches). If a glitch does occur the arbiter may capture or miss it, and the multi-master system bus may be requested or surrendered, depending upon the state of the glitch. The arbiter requests the multi-master system bus in the S.R. Mode when the state of the SYSB/$\overline{RESB}$ pin is high and permits the bus to be surrendered when this pin is low.
$\overline{CBRQ}$	I/O	COMMON BUS REQUEST: $\overline{CBRQ}$ is an input signal which serves to instruct the arbiter if there are any other arbiters of lower priority requesting the use of the multi-master system bus. The $\overline{CBRQ}$ pins (open-collector output) of all the 8289 Bus Arbiters which are to surrender the multi-master system bus upon request are connected together. The Bus Arbiter running the current transfer cycle will not itself pull the $\overline{CBRQ}$ line low. Any other arbiter connected to the $\overline{CBRQ}$ line can request the multi-master system bus. The arbiter presently running the current transfer cycle drops its $\overline{BREQ}$ signal and surrenders the bus whenever the

PIN DEFINITIONS (Cont'd)

Name	I/O	Function
		proper surrender conditions exist. Strapping $\overline{CBREQ}$ low and ANYRQST high allows the multi-master system bus to be surrendered after each transfer cycle. See the pin definition of ANYRQST.
$\overline{INIT}$	I	INITIALIZE: $\overline{INIT}$ is an active low multi-master system bus input signal which is used to reset all the bus arbiters on the multi-master system bus. After initialization, no arbiters have the use of the multi-master system bus.
$\overline{BCLK}$	I	BUS CLOCK: $\overline{BCLK}$ is the multi-master system bus clock to which all multi-master system bus interface signals are synchronized.
$\overline{BREQ}$	O	BUS REQUEST: $\overline{BREQ}$ is an active low output signal in the parallel Priority Resolving Scheme which the arbiter activates to request the use of the multi-master system bus.
$\overline{BPRN}$	I	BUS PRIORITY IN: $\overline{BPRN}$ is the active low signal returned to the arbiter to instruct it that it may acquire the multi-master system bus on the next falling edge of BCLK. $\overline{BPRN}$ indicates to the arbiter that it is the highest priority requesting arbiter presently on the bus. The loss of $\overline{BPRN}$ instructs the arbiter that it has loss priority to a higher priority arbiter.
$\overline{BPRO}$	O	BUS PRIORITY OUT: $\overline{BPRO}$ is an active low output signal which is used in the serial priority resolving scheme where $\overline{BPRO}$ is daisy chained to $\overline{BPRN}$ of the next lower priority arbiter.
$\overline{BUSY}$	I/O	BUSY: $\overline{BUSY}$ is an active low open collector multi-master system bus interface signal which is used to instruct all the arbiters on the bus when the multi-master system bus is available. When the multi-master system bus is available the highest requesting arbiter (determined by $\overline{BPRN}$) seizes the bus and pulls $\overline{BUSY}$ low to keep other arbiters off of the bus. When the arbiter is done with the bus it releases the $\overline{BUSY}$ signal permitting it to go high and thereby allowing another arbiter to acquire the multi-master system bus.

ABSOLUTE MAXIMUM RATINGS*

Temperature Under Bias . . . . . 0°C to 70°C
Storage Temperature . . . . . – 65°C to + 150°C
All Output and Supply Voltages . . . . . – 0.5V to + 7V
All Input Voltages . . . . . – 1.0V to + 5.5V
Power Dissipation . . . . . 1.5 Watt

COMMENT: Stresses above 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 above 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.

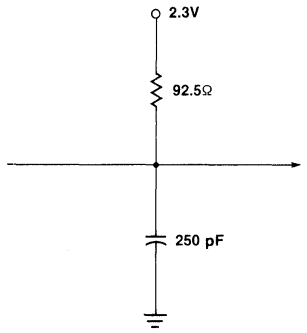
D.C. CHARACTERISTICS FOR THE 8289

CONDITIONS: $T_A = 0°$ to 70°C, $V_{CC} = 5V \pm 10\%$

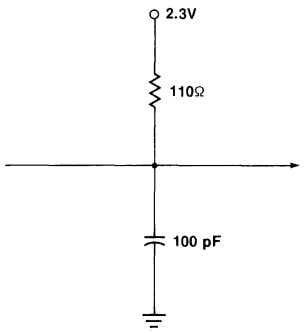
Symbol	Parameter	Min.	Max.	Units	Test Condition
V_C	Input Clamp Voltage		– 1.0	V	$V_{CC} = 4.50V$, $I_C = -5$ mA
I_F	Input Forward Current		– 0.5	mA	$V_{CC} = 5.50V$, $V_F = 0.45V$
I_R	Reverse Input Leakage Current		60	μA	$V_{CC} = 5.50$, $V_R = 5.50$
V_{OL}	Output Low Voltage				
	$\overline{BUSY}$, $\overline{CBRQ}$		0.45	V	$I_{OL} = 20$ mA, $C_L = 250$ pF 1)
	$\overline{AEN}$		0.45	V	$I_{OL} = 16$ mA, $C_L = 100$ pF 2)
	$\overline{BPRO}$, $\overline{BREQ}$		0.45	V	$I_{OL} = 10$ mA, $C_L = 60$ pF 3)
V_{OH}	Output High Voltage $\overline{BUSY}$, $\overline{CBRQ}$	Open Collector			
	All Other Outputs	2.4		V	$I_{OH} = 400$ μA
I_{CC}	Power Supply Current		165	mA	
V_{IL}	Input Low Voltage		.8	V	
V_{IH}	Input High Voltage	2.0		V	
Cin Status	Input Capacitance		25	pF	
Cin (Others)	Input Capacitance		12	pF	

TEST CIRCUITS:

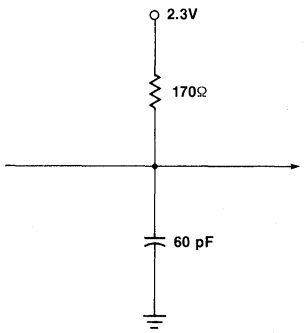
1) $\overline{BUSY}$, $\overline{CBRQ}$



2) $\overline{AEN}$



3) $\overline{BPRO}$, $\overline{BREQ}$



A.C. CHARACTERISTICS FOR THE 8289

CONDITIONS: $V_{CC} = 5V \pm 10\%$, $T_A = 0°C$ to $70°C$

Timing Requirements

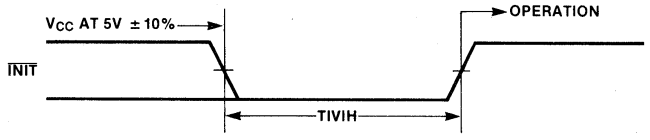
Symbol	Parameter	Min.	Max.	Unit
TCLCL	CLK Cycle Period	125		ns
TCLCH	CLK Low Time	65		ns
TCHCL	CLK High Time	35		ns
TSVCH	Status Active Setup	65	TCLCL-10	ns
TSHCL	Status Inactive Setup	50	TCLCL-10	ns
THVCH	Status Active Hold	10		ns
THVCL	Status Inactive Hold	10		ns
TBYSBL	$\overline{BUSY}$↑↓Setup to $\overline{BCLK}$↓	20		ns
TCBSBL	$\overline{CBRQ}$↑↓Setup to $\overline{BCLK}$↓	20		ns
TBLBL	$\overline{BCLK}$ Cycle Time	100		ns
TBHCL	$\overline{BCLK}$ High Time	30	.65[TBLBL]	ns
TCLLL1	$\overline{LOCK}$ Inactive Hold	20		ns
TCLLL2	$\overline{LOCK}$ Active Setup	40		ns
TPNBL	$\overline{BPRN}$↓↑to $\overline{BCLK}$ Setup Time	15		ns
TCLSR1	SYSB/$\overline{RESB}$ Setup	0		ns
TCLSR2	SYSB/$\overline{RESB}$ Hold	20		ns
TIVIH	Initialization Pulse Width	3 TBLBL + 3 TCLCL		ns

Timing Responses

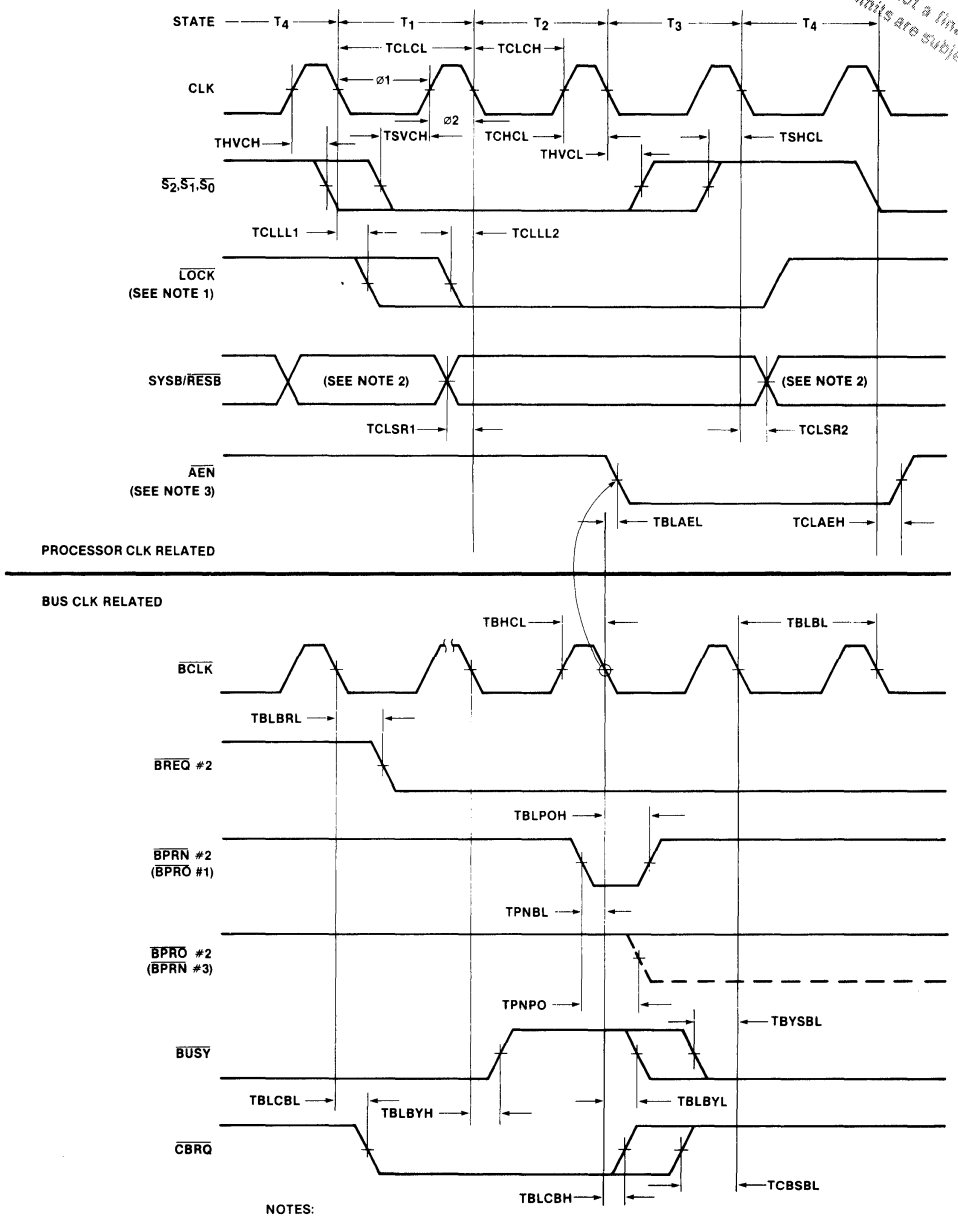
Symbol	Parameter	Min.	Max.	Unit	Loading
TBLBRL	$\overline{BCLK}$ to $\overline{BREQ}$ Delay↓↑		35	ns	
TBLPOH	$\overline{BCLK}$ to $\overline{BPRO}$↓↑ (See Note 1)		40	ns	
TPNPO	$\overline{BPRN}$↓↑to $\overline{BPRO}$↓↑Delay (See Note 1)		25	ns	
TBLBYL	$\overline{BCLK}$ to $\overline{BUSY}$ Low		60	ns	
TBLBYH	$\overline{BCLK}$ to $\overline{BUSY}$ Float (See Note 2)		35	ns	
TCLAEH	CLK to $\overline{AEN}$ High		65	ns	
TBLAEL	$\overline{BCLK}$ to $\overline{AEN}$ Low		40	ns	
TBLCBL	$\overline{BCLK}$ to $\overline{CBRQ}$ Low		60	ns	
TBLCBH	$\overline{BCLK}$ to $\overline{CBRQ}$ Float (See Note 2)		35	ns	

↓↑ Denotes that spec applies to both transitions of the signal.
NOTE 1: BCLK generates the first BPRO wherein subsequent BPRO changes lower in the chain are generated through BPRN.
NOTE 2: Measured at .5V above GND.

INITIALIZATION: (INIT can be either pulsed or held low through power up)



8289 TIMING DIAGRAM



NOTES:
1. LOCK ACTIVE CAN OCCUR DURING ANY T STATE, AS LONG AS THE RELATIONSHIPS SHOWN ABOVE WITH RESPECT TO THE CLK ARE MAINTAINED. LOCK INACTIVE HAS NO CRITICAL TIME AND CAN BE ASYNCHRONOUS.
   -CRQLCK HAS NO CRITICAL TIMING AND IS CONSIDERED AN ASYNCHRONOUS INPUT SIGNAL
2. GLITCHING OF SYSB/RESB PIN IS PERMITTED DURING THIS TIME. AFTER ø 2 OF T1, AND BEFORE ø1 OF T4, ONLY CLEAN TRANSITIONS ARE ACCEPTED.
3. AEN LEADING EDGE IS RELATED TO BCLK, TRAILING EDGE TO CLK. THE TRAILING EDGE OF AEN OCCURS AFTER BUS PRIORITY IS LOST.

ADDITIONAL NOTES:

The signals related to CLK are typical processor signals, and do not relate to the depicted sequence of events of the signals referenced to BCLK. The signals shown related to the BCLK represent a hypothetical sequence of events for illustration. Assume 3 bus arbiters of priorities 1, 2 and 3 configured in serial priority resolving scheme as shown in Figure 6. Assume arbiter 1 has the bus and is holding busy low. Arbiter #2 detects its processor wants the bus and pulls low BREQ#2. If BPRN#2 is high (as shown), arbiter #2 will pull low CBRQ line. CBRQ signals to the higher priority arbiter #1 that a lower priority arbiter wants the bus. [A higher priority arbiter would be granted BPRN when it makes the bus request rather than having to wait for another arbiter to release the bus through CBRQ].** Arbiter #1 will relinquish the multi-master system bus when it enters a state not requiring it (see Table 1), by lowering its BPRO#1 (tied to BPRN#2) and releasing BUSY. Arbiter #2 now sees that it has priority from BPRN#2 being low and releases CBRQ. As soon as BUSY signifies the bus is available (high), arbiter #2 pulls BUSY low on next falling edge of BCLK. Note that if arbiter #2 didn't want the bus at the time it received priority, it would pass priority to the next lower priority arbiter by lowering its BPRO #2 [TPNPO].

**Note that even a higher priority arbiter which is acquiring the bus through BPRN will momentarily drop CBRQ until it has acquired the bus.