Zilog - Z8L18020FSG Datasheet

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Applications of Embedded - Microprocessors

Embedded microprocessors are utilized across a broad spectrum of applications, making them indispensable in

Details	
Product Status	Active
Core Processor	Z8L180
Number of Cores/Bus Width	1 Core, 8-Bit
Speed	20MHz
Co-Processors/DSP	-
RAM Controllers	DRAM
Graphics Acceleration	No
Display & Interface Controllers	-
Ethernet	-
SATA	-
USB	-
Voltage - I/O	3.3V
Operating Temperature	0°C ~ 70°C (TA)
Security Features	-
Package / Case	80-BQFP
Supplier Device Package	80-QFP
Purchase URL	https://www.e-xfl.com/product-detail/zilog/z8l18020fsg

PIN IDENTIFICATION

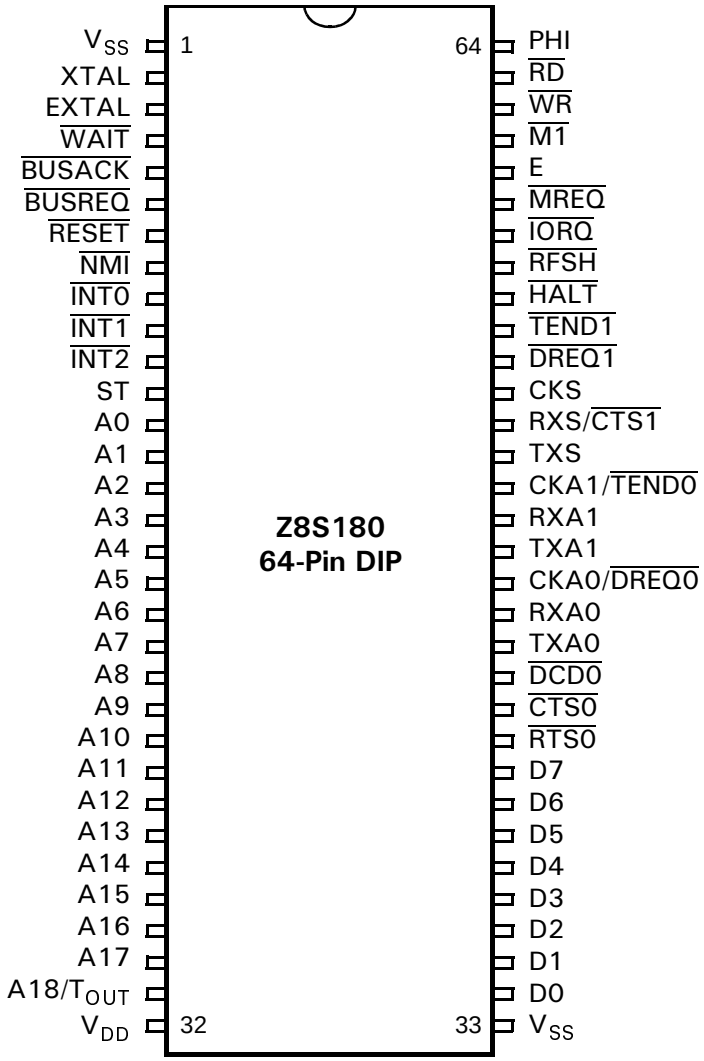


Figure 2. Z8S180 64-Pin DIP Pin Configuration

PIN IDENTIFICATION (Continued)

Table 2. Pin Status During RESET, BUSACK, and SLEEP Modes (Continued)

Pin Number and Package Type					Pin Status		
QFP	PLCC	DIP	Default Function	Secondary Function	RESET	BUSACK	SLEEP
76	4	3	EXTAL		IN	IN	IN
77	5	4	$\overline{\text{WAIT}}$		IN	IN	IN
78	6	5	$\overline{\text{BUSACK}}$		High	OUT	OUT
79	7	6	$\overline{\text{BUSREQ}}$		IN	IN	IN
80	8	7	$\overline{\text{RESET}}$		IN	IN	IN

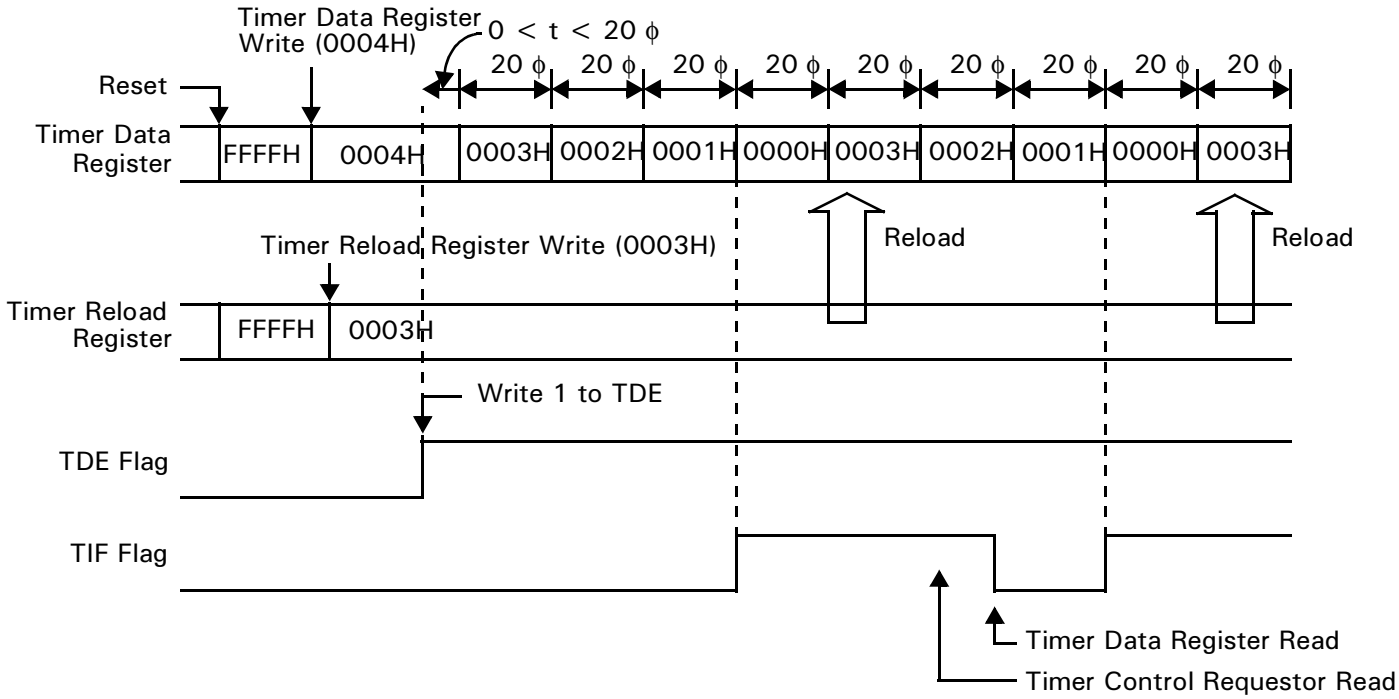


Figure 5. Timer Initialization, Count Down, and Reload Timing

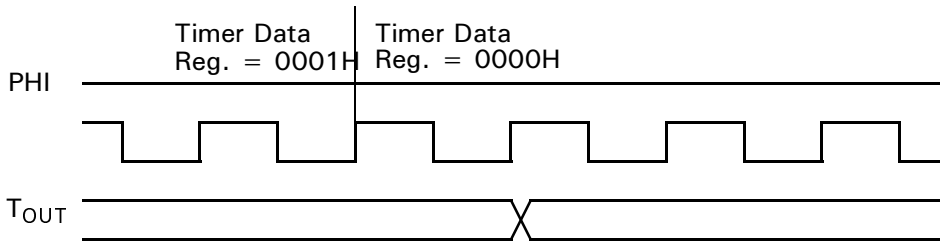


Figure 6. Timer Output Timing

Clocked Serial I/O (CSI/O). The CSI/O channel provides a half-duplex serial transmitter and receiver. This channel can be used for simple high-speed data connection to another microprocessor or microcomputer. TRDR is used for both CSI/O transmission and reception. Thus, the system design must ensure that the constraints of half-duplex operation are met (Transmit and Receive operation cannot occur simultaneously). For example, if a CSI/O transmission is attempted while the CSI/O is receiving data, a CSI/O does not work.

Note: TRDR is not buffered. Performing a CSI/O transmit while the previous transmission is still in progress causes the data to be immediately updated and corrupts the transmit operation. Similarly, reading TRDR while a transmit or receive is in progress should be avoided.

OPERATION MODES

Z80 versus 64180 Compatibility. The Z8S180/Z8L180 is descended from two different "ancestor" processors, ZiLOG's original Z80 and the Hitachi 64180. The Operating Mode Control Register (OMCR), illustrated in Figure 8, can be programmed to select between certain Z80 and 64180 differences.

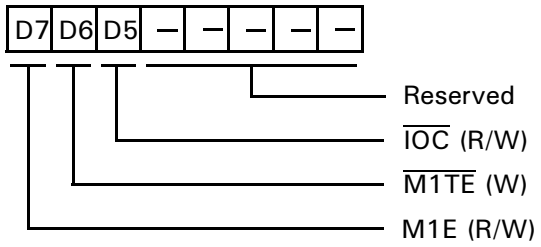


Figure 8. Operating Control Register (OMCR: I/O Address = 3EH)

M1E ($\overline{M1}$ Enable). This bit controls the $\overline{M1}$ output and is set to a 1 during RESET.

When M1E = 1, the $\overline{M1}$ output is asserted Low during opcode fetch cycles, Interrupt Acknowledge cycles, and the first machine cycle of an $\overline{NMI}$ acknowledge.

On the Z8S180/Z8L180, this choice makes the processor fetch a RETI instruction one time. When fetching a RETI from a zero-wait-state memory location, the processor uses three clock bus cycles. These bus cycles are not fully Z80-timing compatible.

When M1E = 0, the processor does not drive $\overline{M1}$ Low during the instruction fetch cycles. After fetching a RETI instruction with normal timing, the processor goes back and refetches the instruction using fully Z80-compatible cycles that include driving $\overline{M1}$ Low. This option may be required by some external Z80 peripherals to properly decode the RETI instruction. Figure 9 and Table 5 show the RETI sequence when M1E is 0.

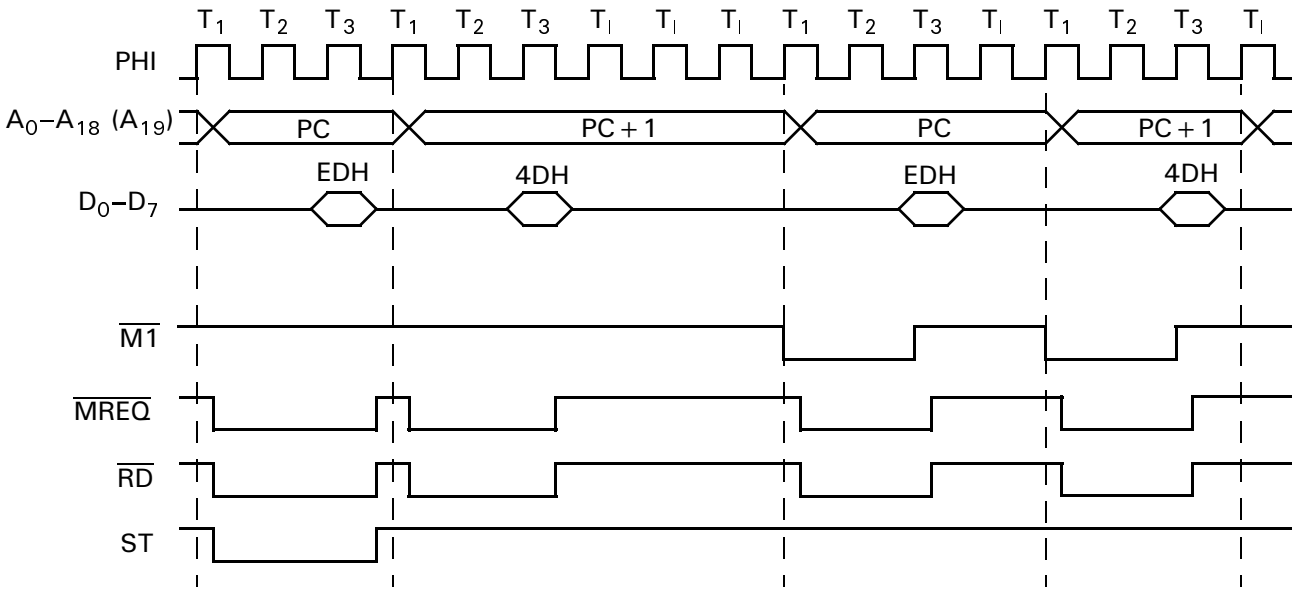


Figure 9. RETI Instruction Sequence with M1E = 0

OPERATION MODES (Continued)

The Z8S180/Z8L180 leaves HALT mode in response to:

- Low on $\overline{\text{RESET}}$
- Interrupt from an enabled on-chip source
- External request on $\overline{\text{NMI}}$
- Enabled external request on $\overline{\text{INT0}}$, $\overline{\text{INT1}}$, or $\overline{\text{INT2}}$

In case of an interrupt, the return address is the instruction following the HALT instruction. The program can either branch back to the HALT instruction to wait for another interrupt or can examine the new state of the system/application and respond appropriately.

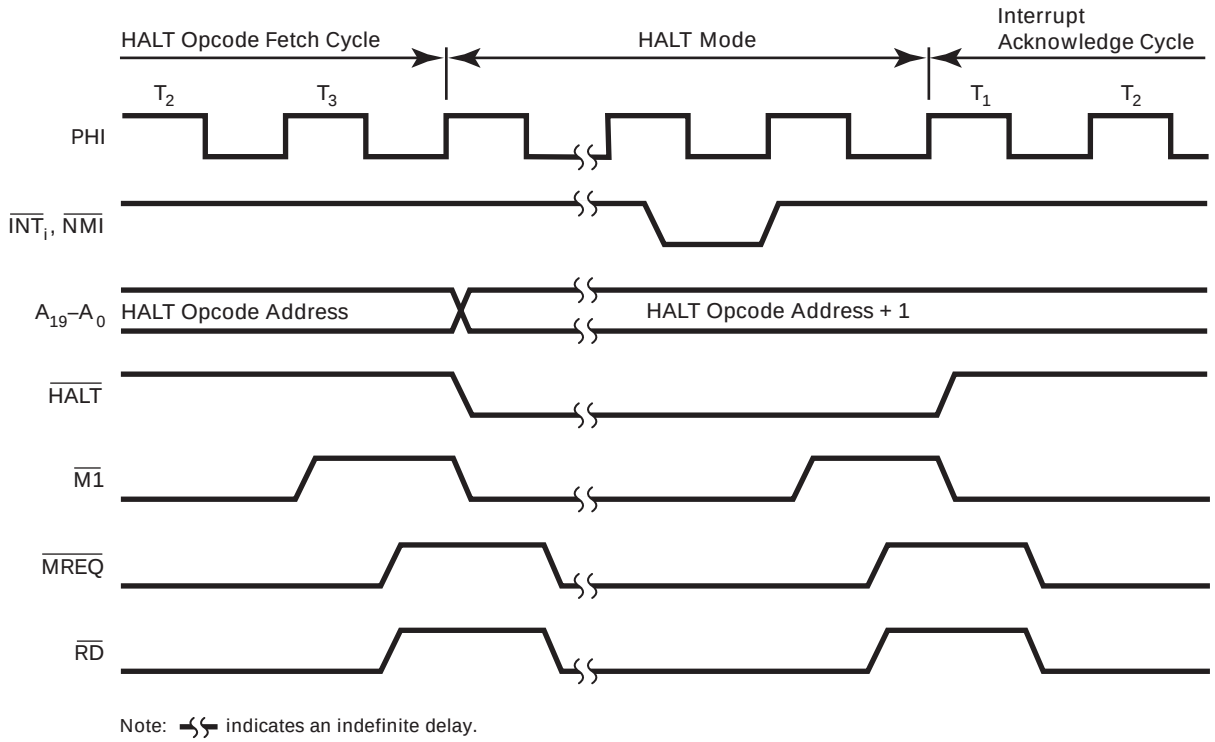


Figure 13. HALT Timing

SLEEP Mode. This mode is entered by keeping the IOSTOP bit (ICR5) and bits 3 and 6 of the CPU Control Register (CCR3, CCR6) all zero and executing the SLP instruction. The oscillator and PHI output continue operating, but are blocked from the CPU core and DMA channels to reduce power consumption. DRAM refresh stops, but interrupts and granting to an external Master can occur. Except when the bus is granted to an external Master, A19–0 and all control signals except $\overline{\text{HALT}}$ are maintained High. $\overline{\text{HALT}}$ is Low. I/O operations continue as before the SLP instruction, except for the DMA channels.

The Z8S180/Z8L180 leaves SLEEP mode in response to a Low on $\overline{\text{RESET}}$, an interrupt request from an on-chip source, an external request on $\overline{\text{NMI}}$, or an external request on $\overline{\text{INT0}}$, $\overline{\text{INT1}}$, or $\overline{\text{INT2}}$.

If an interrupt source is individually disabled, it cannot bring the Z8S180/Z8L180 out of SLEEP mode. If an interrupt source is individually enabled, and the IEF bit is 1 so that interrupts are globally enabled (by an EI instruction), the highest priority active interrupt occurs with the return address being the instruction after the SLP instruction. If an interrupt source is individually enabled, but the IEF bit is 0 so that interrupts are globally disabled (by a DI instruction), the Z8S180/Z8L180 leaves SLEEP mode by simply executing the following instruction(s).

DC CHARACTERISTICS—Z8S180

Table 6. Z8S180 DC Characteristics
V_{DD} = 5V ±10%; V_{SS} = 0V

Symbol	Item	Condition	Min	Typ	Max	Unit
V_{IH1}	Input H Voltage $\overline{RESET}$, EXTAL, $\overline{NMI}$		V_{DD} –0.6	—	V_{DD} +0.3	V
V_{IH2}	Input H Voltage Except $\overline{RESET}$, EXTAL, $\overline{NMI}$		2.0	—	V_{DD} +0.3	V
V_{IH3}	Input H Voltage CKS, CKA0, CKA1		2.4	—	V_{DD} +0.3	V
V_{IL1}	Input L Voltage RESET, EXTAL, NMI		–0.3	—	0.6	V
V_{IL2}	Input L Voltage Except RESET, EXTAL, NMI		–0.3	—	0.8	V
V_{OH}	Outputs H Voltage All outputs	I_{OH} = –200 µA	2.4	—	—	V
		I_{OH} = –20 µA	V_{DD} –1.2	—	—	
V_{OL}	Outputs L Voltage All outputs	I_{OL} = 2.2 mA	—	—	0.45	V
I_{IL}	Input Leakage Current All Inputs Except XTAL, EXTAL	V_{IN} = 0.5 ~ V_{DD} –0.5	—	—	1.0	µA
I_{TL}	Three State Leakage Current	V_{IN} = 0.5 ~ V_{DD} –0.5	—	—	1.0	µA
I_{DD}[1]	Power Dissipation (Normal Operation)	F = 10 MHz	—	25	60	mA
		20		30	50	
		33		60	100	
	Power Dissipation (SYSTEM STOP mode)	F = 10 MHz	—	2	5	
		20		3	6	
		33		5	9	
C_P	Pin Capacitance	V_{IN} = 0_V, f = 1 MHz T_A = 25°C	—	—	12	pF

Note:
1. V_{IHmin} = V_{DD}–1.0V, V_{ILmax} = 0.8V (All output terminals are at NO LOAD.) V_{DD} = 5.0V.

Table 7. Z8L180 DC Characteristics
V_{DD} = 3.3V ±10%; V_{SS} = 0V

Symbol	Item	Condition	Min	Typ	Max	Unit
V_{IH1}	Input H Voltage $\overline{RESET}$, EXTAL, $\overline{NMI}$		V_{DD} –0.6		V_{DD} +0.3	V
V_{IH2}	Input H Voltage Except $\overline{RESET}$, EXTAL, $\overline{NMI}$		2.0		V_{DD} +0.3	V
V_{IL1}	Input L Voltage RESET, EXTAL, NMI		–0.3		0.6	V
V_{IL2}	Input L Voltage Except RESET, EXTAL, NMI		–0.3		0.8	V
V_{OH}	Outputs H Voltage All outputs	I_{OH} = –200 µA	2.15			V
		I_{OH} = –20 µA	V_{DD} –0.6			V
V_{OL}	Outputs L Voltage All Outputs	I_{OL} = 4 mA			0.4	V
I_{IL}	Input Leakage Current All Inputs Except XTAL, EXTAL	V_{IN} = 0.5 ~ V_{DD} –0.5			1.0	µA
I_{TL}	Three State Leakage Current	V_{IN} = 0.5 ~ V_{DD} –0.5			1.0	µA
I_{DD1}	Power Dissipation (Normal Operation)	F = 20 MHz		30	60	mA
		4 MHz		4	10	
	Power Dissipation (SYSTEM STOP mode)	F = 20 MHz		5	10	
		4 MHz		2	5	
C_P	Pin Capacitance	V_{IN} = 0V, f = 1 MHz T_A = 25° C			12	pF

Note:
1. V_{IHmin} = V_{DD} –1.0V, V_{ILmax} = 0.6V (All output terminals are at NO LOAD.) V_{DD} = 3.0V.

CPU CONTROL REGISTER

CPU Control Register (CCR). This register controls the basic clock rate, certain aspects of Power-Down modes, and output drive/low-noise options (Figure 31).

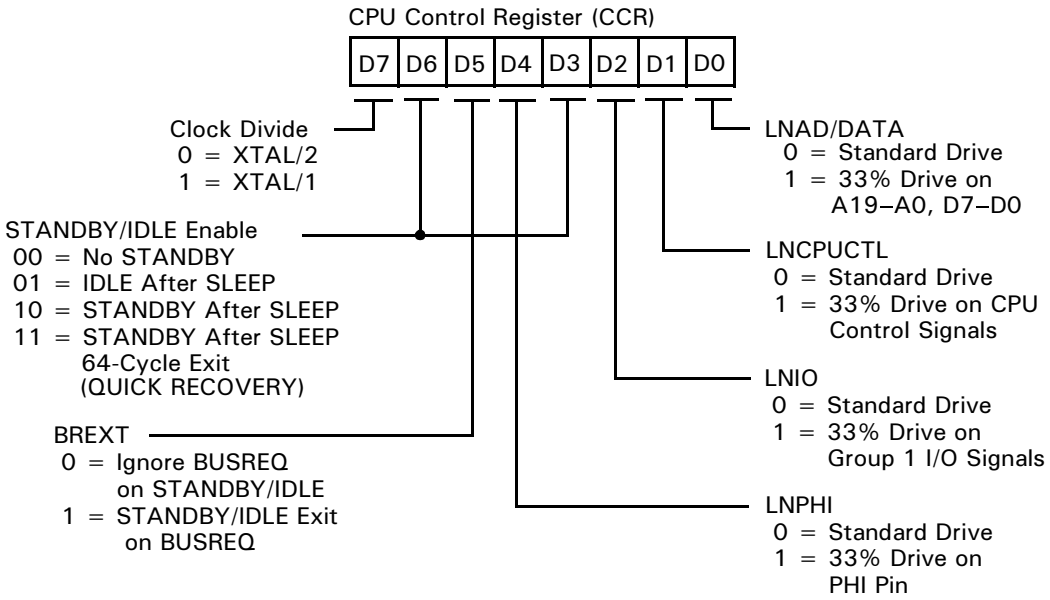


Figure 31. CPU Control Register (CCR) Address 1FH

Bit 7. Clock Divide Select. If this bit is 0, as it is after a RESET, the Z8S180/Z8L180 divides the frequency on the XTAL pin(s) by two to obtain its Master clock PHI. If this bit is programmed as 1, the part uses the XTAL frequency as PHI without division.

If an external oscillator is used in divide-by-one mode, the minimum pulse width requirement provided in the AC Characteristics must be satisfied.

Bits 6 and 3. STANDBY/IDLE Control. When these bits are both 0, a SLP instruction makes the Z8S180/Z8L180 enter SLEEP or SYSTEM STOP mode, depending on the IOSTOP bit (ICR5).

When D6 is 0 and D3 is 1, setting the IOSTOP bit (ICR5) and executing a SLP instruction puts the Z8S180/Z8L180 into IDLE mode in which the on-chip oscillator runs, but its output is blocked from the rest of the part, including PHI out.

When D6 is 1 and D3 is 0, setting IOSTOP (ICR5) and executing a SLP instruction puts the part into STANDBY mode, in which the on-chip oscillator is stopped and the part allows 2^{17} (128K) clock cycles for the oscillator to stabilize when it restarts.

When D6 and D3 are both 1, setting IOSTOP (ICR5) and executing a SLP instruction puts the part into QUICK RECOVERY STANDBY mode, in which the on-chip oscillator is stopped, and the part allows only 64 clock cycles for the oscillator to stabilize when it restarts.

The latter section, HALT and LOW POWER modes, describes the subject more fully.

Bit 5 BREXT. This bit controls the ability of the Z8S180/Z8L180 to honor a bus request during STANDBY mode. If this bit is set to 1 and the part is in STANDBY mode, a BUSREQ is honored after the clock stabilization timer is timed out.

Bit 4 LNPHI. This bit controls the drive capability on the PHI Clock output. If this bit is set to 1, the PHI Clock output is reduced to 33 percent of its drive capability.

ASCI REGISTER DESCRIPTION

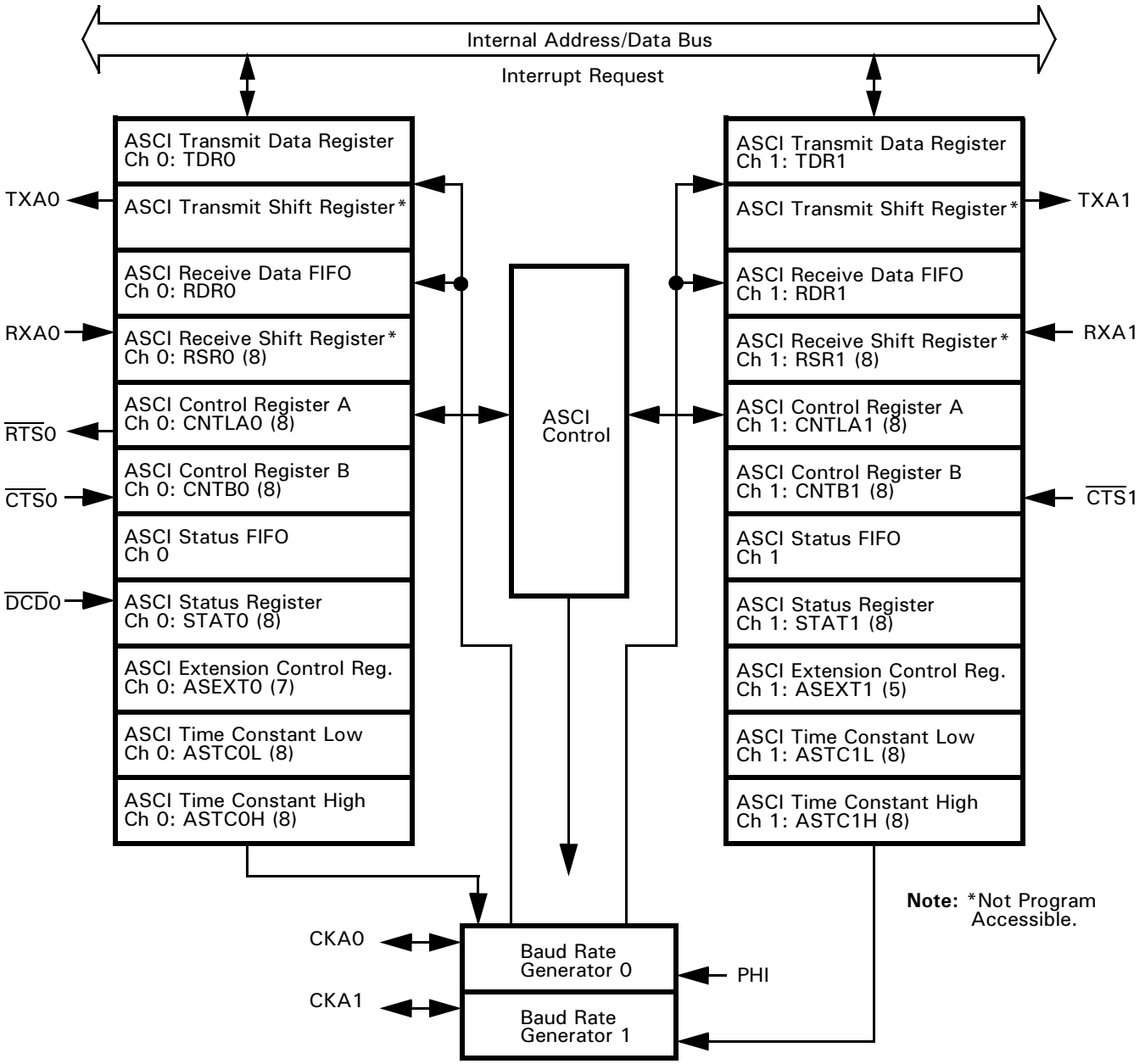


Figure 32. ASCI Block Diagram

ASCI Transmit Shift Register 0,1. When the ASCI Transmit Shift Register (TSR) receives data from the ASCI Transmit Data Register (TDR), the data is shifted out to the TXA pin. When transmission is completed, the next byte (if available) is automatically loaded from TDR into TSR and the next transmission starts. If no data is available for transmission, TSR idles by outputting a continuous High level. This register is not program-accessible

ASCI Transmit Data Register 0,1 (TDR0, 1: I/O address = 06H, 07H). Data written to the ASCI Transmit Data Register is transferred to the TSR as soon as TSR is empty. Data can be written while TSR is shifting out the previous byte of data. Thus, the ASCI transmitter is double buffered.

ASCI CHANNEL CONTROL REGISTER A (Continued)

vious contents of TDRE are held. TE is cleared to 0 in IOSTOP mode during RESET.

$\overline{\text{RTS0}}$: Request to Send Channel 0 (Bit 4 in CNTLA0 Only). If bit 4 of the System Configuration Register is 0, the $\overline{\text{RTS0}}$/TXS pin exhibits the $\overline{\text{RTS0}}$ function. $\overline{\text{RTS0}}$ allows the ASCI to control (start/stop) another communication devices transmission (for example, by connecting to that device's $\overline{\text{CTS}}$ input). $\overline{\text{RTS0}}$ is essentially a 1-bit output port, having no side effects on other ASCI registers or flags.

Bit 4 in CNTLA1 is used.

CKA1D = 1, CKA1/$\overline{\text{TEND0}}$ pin = $\overline{\text{TEND0}}$

CKA1D = 0, CKA1/$\overline{\text{TEND0}}$ pin = CKA1

These bits are cleared to 0 on reset.

MPBR/EFR: Multiprocessor Bit Receive/Error Flag Reset (Bit 3). When multiprocessor mode is enabled (MP in CNTLB = 1), MPBR, when read, contains the value of the MPB bit for the most recent receive operation. When written to 0, the EFR function is selected to reset all error flags (OVRN, FE, PE and BRK in the ASEXT Register) to 0. MPBR/EFR is undefined during RESET.

MOD2, 1, 0: ASCI Data Format Mode 2,1,0 (bits 2–0).

These bits program the ASCI data format as follows.

MOD2

= 0→7 bit data

= 1→8 bit data

MOD1

= 0→No parity

= 1→Parity enabled

MOD0

= 0→1 stop bit

= 1→2 stop bits

The data formats available based on all combinations of MOD2, MOD1, and MOD0 are indicated in Table 9.

Table 9. Data Formats

MOD2	MOD1	MOD0	Data Format
0	0	0	Start + 7 bit data + 1 stop
0	0	1	Start + 7 bit data + 2 stop
0	1	0	Start + 7 bit data + parity + 1 stop
0	1	1	Start + 7 bit data + parity + 2 stop
1	0	0	Start + 8 bit data + 1 stop
1	0	1	Start + 8 bit data + 2 stop
1	1	0	Start + 8 bit data + parity + 1 stop
1	1	1	Start + 8 bit data + parity + 2 stop

ASCI0 requests an interrupt when $\overline{DCD0}$ goes High. RIE is cleared to 0 by RESET.

$\overline{DCD0}$: Data Carrier Detect (Bit 2 STAT0). This bit is set to 1 when the pin is High. It is cleared to 0 on the first READ of STAT0 following the pin's transition from High to Low and during RESET. When bit 6 of the ASEXT0 register is 0 to select auto-enabling, and the pin is negated (High), the receiver is reset and its operation is inhibited.

$\overline{CTS1E}$: Clear To Send (Bit 2 STAT1). Channel 1 features an external $\overline{CTS1}$ input, which is multiplexed with the receive data pin RSX for the CSI/O. Setting this bit to 1 selects the CTS1 function; clearing the bit to 0 selects the RXS function.

TDRE: Transmit Data Register Empty (Bit 1). TDRE = 1 indicates that the TDR is empty and the next transmit data byte is written to TDR. After the byte is written to TDR, TDRE is cleared to 0 until the ASCI transfers the byte from TDR to the TSR and then TDRE is again set to 1. TDRE is set to 1 in IOSTOP mode and during RESET. On ASCI0, if the $\overline{CTS0}$ pin is auto-enabled in the ASEXT0 register and the pin is High, TDRE is reset to 0.

TIE: Transmit Interrupt Enable (Bit 0). TIE should be set to 1 to enable ASCI transmit interrupt requests. If TIE = 1, an interrupt is requested when TDRE = 1. TIE is cleared to 0 during RESET.

ASCI TRANSMIT DATA REGISTERS

Register addresses 06H and 07H hold the ASCI transmit data for channel 0 and channel 1, respectively.

ASCI Transmit Data Registers Channel 0

Mnemonic TDR0
Address 06H

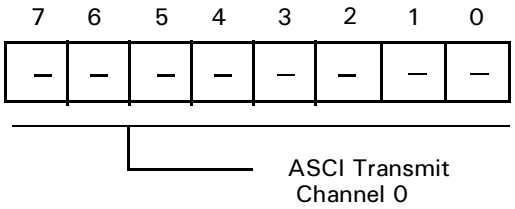


Figure 36. ASCI Register

ASCI Transmit Data Registers Channel 1

Mnemonic TDR1
Address 07H

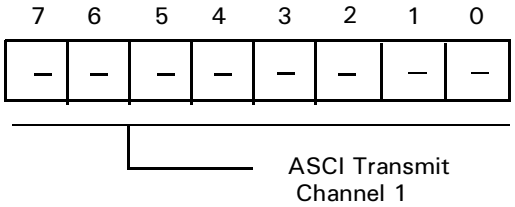


Figure 37. ASCI Register

TIMER CONTROL REGISTER

The Timer Control Register (TCR) monitors both channels (PRT0, PRT1) TMDR status. It also controls the enabling and disabling of down-counting and interrupts, and controls the output pin A18/T_{OUT} for PRT1.

Bit	7	6	5	4	3	2	1	0
	TIF1	TIF0	TIE1	TIE0	TOC1	TOC0	TDE1	TDE0
	R	R	R/W	R/W	R/W	R/W	R/W	R/W

Figure 46. Timer Control Register (TCR: I/O Address = 10H)

TIF1: Timer Interrupt Flag 1 (Bit 7) . When TMDR1 decrements to 0, TIF1 is set to 1. This condition generates an interrupt request if enabled by TIE1 = 1. TIF1 is reset to 0 when TCR is read and the higher or lower byte of TMDR1 is read. During RESET, TIF1 is cleared to 0.

TIF0: Timer Interrupt Flag 0 (Bit 6). When TMDR0 decrements to 0, TIF0 is set to 1. This condition generates an interrupt request if enabled by TIE0 = 1. TIF0 is reset to 0 when TCR is read and the higher or lower byte of TMDR0 is read. During RESET, TIF0 is cleared to 0.

TIE1: Timer Interrupt Enable 1 (Bit 5). When TIE0 is set to 1, TIF1 = 1 generates a CPU interrupt request. When TIE0 is reset to 0, the interrupt request is inhibited. During RESET, TIE0 is cleared to 0.

TOC1, 0: Timer Output Control (Bits 3, 2). TOC1 and TOC0 control the output of PRT1 using the multiplexed A18/T_{OUT} pin as indicated in Table 12. During RESET, TOC1 and TOC0 are cleared to 0. If bit 3 of the IAR1B register is 1, the T_{OUT} function is selected. By programming TOC1 and TOC0, the A18/T_{OUT} pin can be forced High, Low, or toggled when TMDR1 decrements to 0.

Table 12. Timer Output Control

TOC1	TOC0	Output	
0	0	Inhibited	The A18/T_{OUT} pin is not affected by the PRT
0	1	Toggled	If bit 3 of IAR1B is 1, the A18/T_{OUT} pin is toggled or set Low or High as indicated
1	0	0	
1	1	1	

TDE1, 0: Timer Down Count Enable (Bits 1, 0). TDE1 and TDE0 enable and disable down-counting for TMDR1 and TMDR0, respectively. When TDEn (n = 0,1) is set to 1, down-counting is stopped and TMDRn is freely read or written. TDE1 and TDE0 are cleared to 0 during RESET and TMDRn does not decrement until TDEn is set to 1.

ASCI EXTENSION CONTROL REGISTER CHANNEL 0 AND CHANNEL 1

The ASCI Extension Control Registers (ASEXT0 and ASEXT1) control functions that have been added to the ASCIs in the Z8S180/Z8L180 family. All bits in this register reset to 0.

ASCI Extension Control Register 0 (ASEXT0 I/O Address = 12H)

Bit	7	6	5	4	3	2	1	0
	Reserved	DCD0 Disable	CTS0 Disable	X1	BRG0 Mode	Break Enable	Break	Send Break

ASCI Extension Control Register 1 (ASEXT1 I/O Address = 13H)

Bit	7	6	5	4	3	2	1	0
	Reserved	Reserved	Reserved	X1	BRG1 Mode	Break Enable	Break	Send Break

Figure 47. ASCI Extension Control Registers, Channels 0 and 1

DCD0 Disable (Bit 6, ASCI0 Only). If this bit is 0, then the $\overline{\text{DCD0}}$ pin auto-enables the ASCI0 receiver, such that when the pin is negated/High, the Receiver is held in a RESET state. If this bit is 1, the state of the $\overline{\text{DCD}}$-pin has no effect on receiver operation. In either state of this bit, software can read the state of the $\overline{\text{DCD0}}$ pin in the STAT0 register, and the receiver interrupts on a rising edge of $\overline{\text{DCD0}}$.

CTS0 Disable (Bit 5, ASCI0 Only). If this bit is 0, then the $\overline{\text{CTS0}}$ pin auto-enables the ASCIO transmitter, in that when the pin is negated/High, the TDRE bit in the STAT0 register is forced to 0. If this bit is 1, the state of the $\overline{\text{CTS0}}$ pin has no effect on the transmitter. Regardless of the state of this bit, software can read the state of the $\overline{\text{CTS0}}$ pin the CNTLB0 register.

X1 (Bit 4). If this bit is 1, the clock from the Baud Rate Generator or CKA pin is taken as a 1X-bit clock (sometimes called *isochronous mode*). In this mode, receive data on the RXA pin must be synchronized to the clock on the CKA pin, regardless of whether CKA is an input or an output. If this bit is 0, the clock from the Baud Rate Generator or CKA pin is divided by 16 or 64 per the DR bit in the CNTLB register, to obtain the actual bit rate. In this mode, receive data on the RXA pin is not required to be synchronized to a clock.

BRG Mode (Bit 3). If the SS2–0 bits in the CNTLB register are not 111, and this bit is 0, the ASCI Baud Rate Generator divides PHI by 10 or 30, depending on the PS bit in CNTLB, and factored by a power of two (selected by the SS2–0 bits), to obtain the clock that is presented to the transmitter and receiver and output on the CKA pin. If SS2–0 are not 111, and this bit is 1, the Baud Rate Generator divides PHI by twice the sum of the 16-bit value (programmed into the Time Constant registers) and 2. This mode is identical to the operation of the baud rate generator in the ESCC.

Break Enable (Bit 2). If this bit is 1, the receiver detects BREAK conditions and report them in bit 1, and the transmitter sends BREAKs under the control of bit 0.

Break Detect (Bit 1). The receiver sets this read-only bit to 1 when an all-zero character with a Framing Error becomes the oldest character in the Rx FIFO. The bit is cleared when software writes a 0 to the EFR bit in CNTLA register, also by RESET, by IOSTOP mode, and for ASCI0, if the $\overline{\text{DCD0}}$ pin is auto-enabled and is negated (High).

Send Break (Bit 0). If this bit and bit 2 are both 1, the transmitter holds the TXA pin Low to send a BREAK condition. The duration of the BREAK is under software control (one of the PRTs or CTCs can be used to time it). This bit resets to 0, in which state TXA carries the serial output of the transmitter.

DMA SOURCE ADDRESS REGISTER CHANNEL 0

The DMA Source Address Register Channel 0 specifies the physical source address for channel 0 transfers. The register contains 20 bits and can specify up to 1024 KB memory addresses or up to 64-KB I/O addresses. Channel 0 source can be memory, I/O, or memory mapped I/O. For I/O, bits 17–16 of this register identify the Request Handshake signal.

DMA Source Address Register, Channel 0 Low

Mnemonic SAR0L
Address 20H

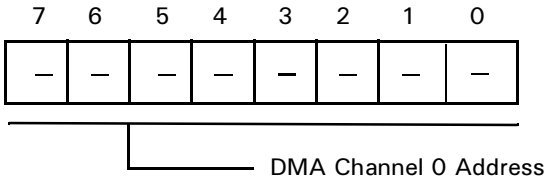


Figure 55. DMA Source Address Register 0 Low

DMA Source Address Register, Channel 0 High

Mnemonic SAR0H
Address 21H

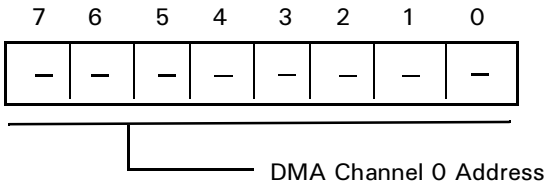


Figure 56. DMA Source Address Register 0 High

DMA Source Address Register Channel 0B

Mnemonic SAR0B
Address 22H

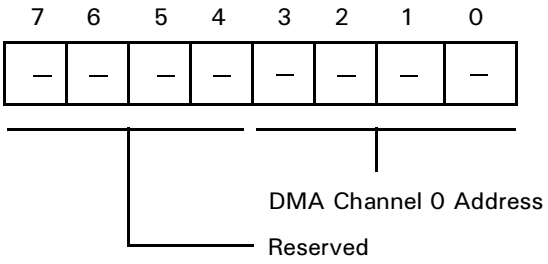


Figure 57. DMA Source Address Register 0B

If the source is in I/O space, bits 1–0 of this register select the DMA request signal for DMA0, as follows:

Bit 1 (A17)	Bit 0 (A16)	DMA Transfer Request
0	0	DREQ0 (external)
0	1	RDRF (ASCI0)
1	0	RDRF (ASCI1)
1	1	Reserved

DMA MEMORY ADDRESS REGISTER CHANNEL 1

The DMA Memory Address Register Channel 1 specifies the physical memory address for channel 1 transfers. The address may be a destination or a source memory location. The register contains 20 bits and may specify up to 1024 KB memory addresses.

DMA Memory Address Register, Channel 1L

Mnemonic MAR1L
Address 28H

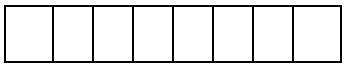


Figure 65. DMA Memory Address Register, Channel 1L

DMA Memory Address Register, Channel 1H

Mnemonic MAR1H
Address 29H

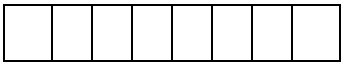


Figure 66. DMA Memory Address Register, Channel 1H

DMA Memory Address Register, Channel 1B

Mnemonic MAR1B
Address 2AH

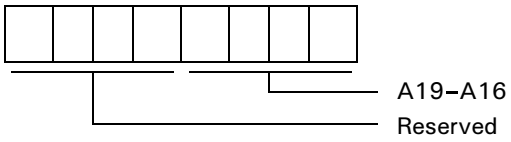


Figure 67. DMA Memory Address Register, Channel 1B

DMA STATUS REGISTER

The DMA Status Register (DSTAT) is used to enable and disable DMA transfer and DMA termination interrupts. DSTAT also indicates DMA transfer status, Completed or In Progress.

DMA Status Register

Mnemonic DSTAT
Address 30H

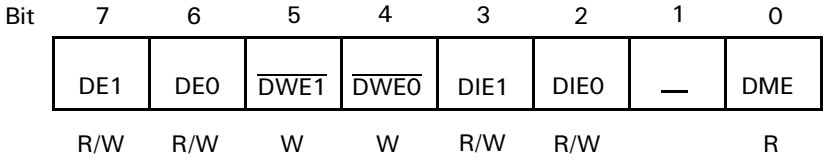


Figure 71. DMA Status Register (DSTAT: I/O Address = 30H)

DE1: DMA Enable Channel 1 (Bit 7). When DE1 = 1 and DME = 1, channel 1 DMA is enabled. When a DMA transfer terminates (BCR1 = 0), DE1 is reset to 0 by the DMAC. When DE1 = 0 and the DMA interrupt is enabled (DIE1 = 1), a DMA interrupt request is made to the CPU.

To perform a software WRITE to DE1, $\overline{\text{DWE1}}$ should be written with a 0 during the same register WRITE access. Writing DE1 to 0 disables channel 1 DMA, but DMA is restartable. Writing DE1 to 1 enables channel 1 DMA and automatically sets DMA Main Enable (DME) to 1. DE1 is cleared to 0 during RESET.

DE0: DMA Enable Channel 0 (Bit 6). When DE0 = 1 and DME = 1, channel 0 DMA is enabled. When a DMA transfer terminates (BCR0 = 0), DE0 is reset to 0 by the DMAC. When DE0 = 0 and the DMA interrupt is enabled (DIE0 = 1), a DMA interrupt request is made to the CPU.

To perform a software WRITE to DE0, $\overline{\text{DWE0}}$ should be written with 0 during the same register WRITE access. Writing DE0 to 0 disables channel 0 DMA. Writing DE0 to 1 enables channel 0 DMA and automatically sets DMA Main Enable (DME) to 1. DE0 is cleared to 0 during RESET.

$\overline{\text{DWE1}}$: DE1 Bit Write Enable (Bit 5). When performing any software WRITE to DE1, this bit should be written with 0 during the same access. $\overline{\text{DWE1}}$ always reads as 1.

$\overline{\text{DWE0}}$: DE0 Bit Write Enable (Bit 4). When performing any software WRITE to DE0, this bit should be written with 0 during the same access. $\overline{\text{DWE0}}$ always reads as 1.

DIE1: DMA Interrupt Enable Channel 1 (Bit 3). When DIE0 is set to 1, the termination channel 1 DMA transfer (indicated when DE1 = 0) causes a CPU interrupt request to be generated. When DIE0 = 0, the channel 0 DMA termination interrupt is disabled. DIE0 is cleared to 0 during RESET.

DIE0: DMA Interrupt Enable Channel 0 (Bit 2). When DIE0 is set to 1, the termination channel 0 of DMA transfer (indicated when DE0 = 0) causes a CPU interrupt request to be generated. When DIE0 = 0, the channel 0 DMA termination interrupt is disabled. DIE0 is cleared to 0 during RESET.

DME: DMA Main Enable (Bit 0). A DMA operation is only enabled when its DE bit (DE0 for channel 0, DE1 for channel 1) and the DME bit is set to 1.

When $\overline{\text{NMI}}$ occurs, DME is reset to 0, thus disabling DMA activity during the $\overline{\text{NMI}}$ interrupt service routine. To restart DMA, DE– and/or DE1 should be written with a 1 (even if the contents are already 1). This condition automatically sets DME to 1, allowing DMA operations to continue.

Note: DME cannot be directly written. The bit is cleared to 0 by $\overline{\text{NMI}}$ or indirectly set to 1 by setting DE0 and/or DE1 to 1. DME is cleared to 0 during RESET.

DMA/WAIT CONTROL REGISTER

The DMA/WAIT Control Register (DCNTL) controls the insertion of wait states into DMAC (and CPU) accesses of memory or I/O. Also, the register defines the Request signal for each channel as level or edge sense. DCNTL also sets the DMA transfer mode for channel 1, which is limited to memory to/from I/O transfers.

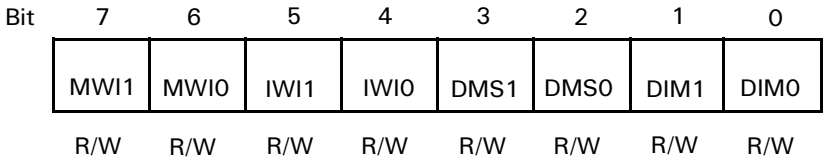


Figure 73. DMA/WAIT Control Register (DCNTL: I/O Address = 32H)

MWI1, MWI0: Memory Wait Insertion (Bits 7–6). This bit specifies the number of wait states introduced into CPU or DMAC memory access cycles. MWI1 and MWI0 are set to 1 during RESET.

MWI1	MWI0	Wait State
0	0	0
0	1	1
1	0	2
1	1	3

IWI1, IWI0: I/O Wait Insertion (Bits 5–4). This bit specifies the number of wait states introduced into CPU or DMAC I/O access cycles. IWI1 and IWI0 are set to 1 during RESET.

IWI1	IWI0	Wait State
0	0	1
0	1	2
1	0	3
1	1	4

Note: These wait states are added to the 3-clock I/O cycle that is used to access the on-chip I/O registers. It is equally valid to regard these as 0 to 3 wait states added to a 4-clock external I/O cycle.

DMS1, DMS0: DMA Request Sense (Bits 3–2). DMS1 and DMS0 specify the DMA request sense for channel 0 and channel 1 respectively. When reset to 0, the input is level sense. When set to 1, the input is edge sense. DMS1 and DMS0 are cleared to 0 during RESET.

DMSi	Sense
1	Edge Sense
0	Level Sense

Typically, for an input/source device, the associated DMS bit should be programmed as 0 for level sense. The device takes a relatively long time to update its Request signal after the DMA channel reads data (in the first of the two machine cycles involved in transferring a byte).

An output/destination device takes much less time to update its Request signal after the DMA channel starts a WRITE operation to it (the second machine cycle of the two cycles involved in transferring a byte). With zero-wait state I/O cycles, a device cannot update its request signal in the required time, so edge sensing must be used.

A one-wait-state I/O cycle also does not provide sufficient time for updating, so edge sensing is again required.

DIM1, DIM0: DMA Channel 1 I/O and Memory Mode (Bits 1–0). Specifies the source/destination and address modifier for channel 1 memory to/from I/O transfer modes. DIM1 and DIM0 are cleared to 0 during RESET.

Table 17. Channel 1 Transfer Mode

DIM1	DMI0	Transfer Mode	Address Increment/Decrement
0	0	Memory→I/O	MAR1 +1, IAR1 fixed
0	1	Memory→I/O	MAR1 –1, IAR1 fixed
1	0	I/O→Memory	IAR1 fixed, MAR1 +1
1	1	I/O→Memory	IAR1 fixed, MAR1 –1

CA3–CA0:CA (Bits 7–4). CA specifies the start (Low) address (on 4-KB boundaries) for Common Area 1. This condition also determines the most recent address of the Bank Area. All bits of CA are set to 1 during RESET.

BA3–BA0 (Bits 3–0). BA specifies the start (Low) address (on 4-KB boundaries) for the Bank Area. This condition also determines the most recent address of Common Area 0. All bits of BA are set to 1 during RESET.

OPERATION MODE CONTROL REGISTER

The Z8S180/Z8L180 is descended from two different ancestor processors, ZiLOG's original Z80 and the Hitachi 64180. The Operating Mode Control Register (OMCR) can be programmed to select between certain differences between the Z80 and the 64180.

Operation Mode Control Register

Mnemonic OMCR
Address 3EH

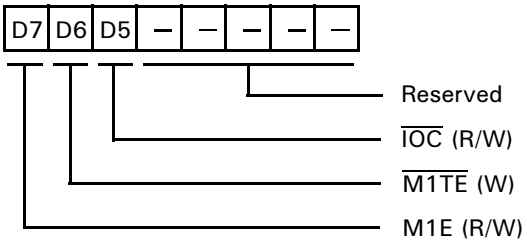


Figure 81. Operating Control Register (OMCR: I/O Address = 3EH)

M1E ($\overline{M1}$ Enable). This bit controls the $\overline{M1}$ output and is set to a 1 during reset.

When M1E = 1, the $\overline{M1}$ output is asserted Low during the opcode fetch cycle, the $\overline{INT0}$ acknowledge cycle, and the first machine cycle of the $\overline{NMI}$ acknowledge.

On the Z8S180/Z8L180, this choice makes the processor fetch one RETI instruction. When fetching a RETI from zero-wait-state memory, the processor uses three clock machine cycles that are not fully Z80-timing-compatible.

When M1E = 0, the processor does not drive $\overline{M1}$ Low during instruction fetch cycles. After fetching one RETI instruction with normal timing, the processor returns and refetches the instruction using Z80-compatible cycles that drive $\overline{M1}$ Low. This timing compatibility may be required by external Z80 peripherals to properly decode the RETI instruction.

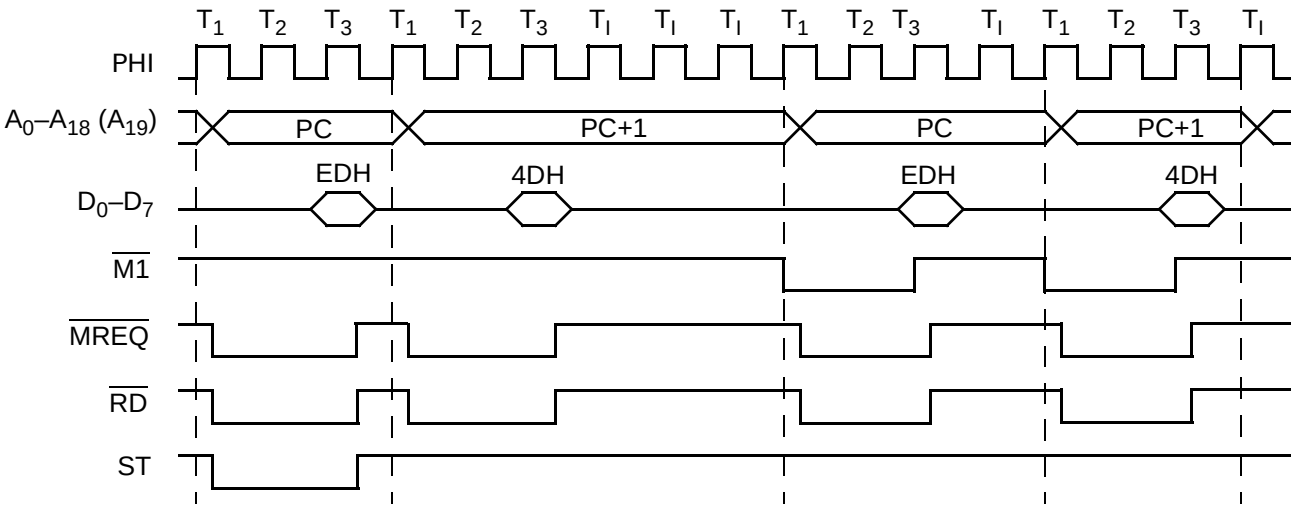


Figure 82. RETI Instruction Sequence with M1E = 0

I/O CONTROL REGISTER

The I/O Control Register (ICR) allows relocation of the internal I/O addresses. ICR also controls the enabling and disabling of IOSTOP mode (Figure 83).

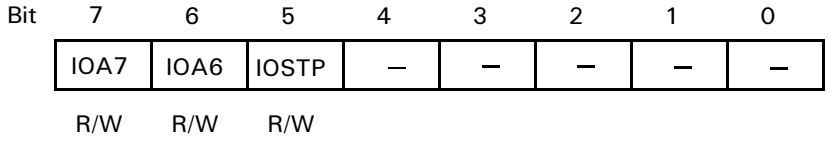


Figure 83. I/O Control Register (ICR: I/O Address = 3FH)

IOA7, 6: I/O Address Relocation (Bits 7,6). IOA7 and IOA6 relocate internal I/O as indicated in Figure 84.

Note: The high-order 8 bits of 16-bit internal I/O address are always 0. IOA7 and IOA6 are cleared to 0 during RESET.

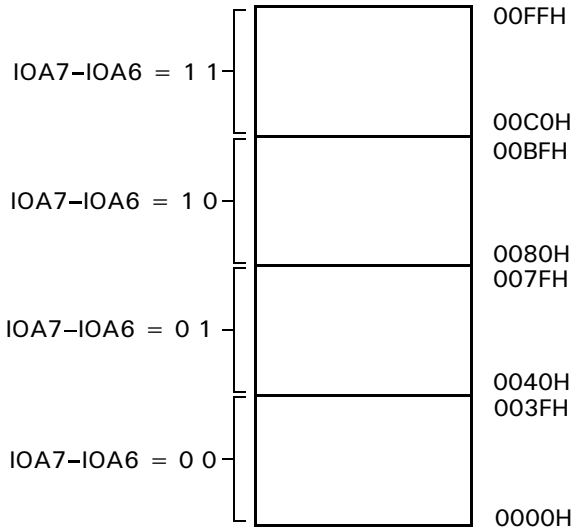
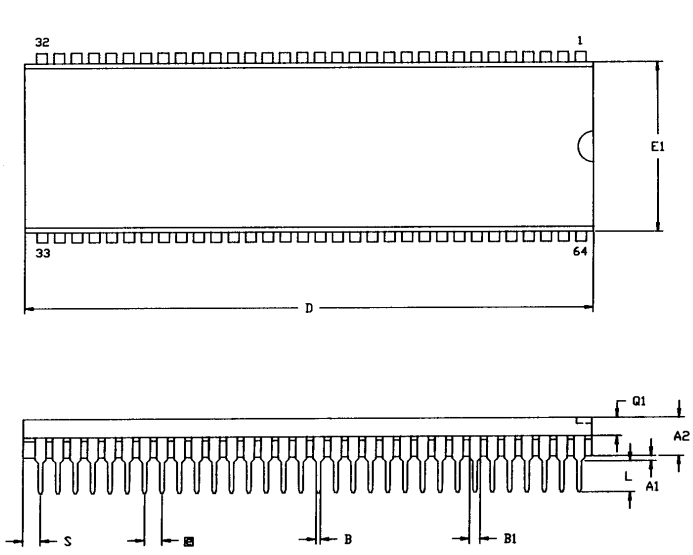


Figure 84. I/O Address Relocation

IOSTP: IOSTOP Mode (Bit 5). IOSTOP mode is enabled when IOSTP is set to 1. Normal I/O operation resumes when IOSTP is reprogrammed or RESET to 0.

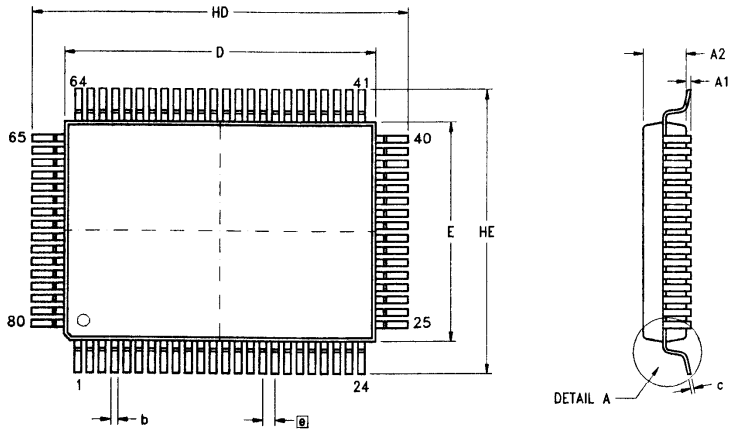
PACKAGE INFORMATION



SYMBOL	MILLIMETER		INCH	
	MIN	MAX	MIN	MAX
A1	0.38	1.07	.015	.042
A2	3.68	3.94	.145	.155
B	0.38	0.53	.015	.021
B1	0.94	1.09	.037	.043
C	0.23	0.38	.009	.015
D	57.40	58.17	2.260	2.290
E	18.80	19.30	.740	.760
E1	16.76	17.27	.660	.680
e	1.78 TYP		.070 TYP	
eA	19.30	20.32	.760	.800
L	3.18	3.81	.125	.150
Q1	1.65	1.91	.065	.075
S	1.02	1.78	.040	.070

CONTROLLING DIMENSIONS : INCH

Figure 85. 64-Pin DIP Package Diagram



SYMBOL	MILLIMETER		INCH	
	MIN	MAX	MIN	MAX
A1	0.10	0.30	.004	.012
A2	2.60	2.80	.102	.110
b	0.30	0.45	.012	.018
c	0.13	0.20	.005	.008
HD	23.70	24.15	.933	.951
D	19.90	20.10	.783	.791
HE	17.70	18.15	.697	.715
E	13.90	14.10	.547	.555
e	0.80 TYP		.0315 TYP	
L	0.70	1.10	.028	.043

NOTES:
1. CONTROLLING DIMENSIONS: MILLIMETER
2. MAX COPLANARITY: .10 / .004

Figure 86. 80-Pin QFP Package Diagram