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# Z89C6501ZEM

## ICEBOX™ FAMILY Z8®

### IN-CIRCUIT EMULATOR—C65

## HARDWARE FEATURES

### ■ Supported Devices

Package	Emulation	Programming
68-Pin PLCC	Z89165	N/A
68-Pin PLCC	Z89166	N/A
68-Pin PLCC	Z89C65	N/A
68-Pin PLCC	Z89C66	N/A

### ■ Real-Time Emulation

### ■ HP-16500 Logic Analysis System Interface Connector

### ■ ICEBOX Emulator Provides In-Circuit Program Debug Emulation

### ■ Z8 GUI Emulator Software

### ■ Windows-Based User Interface

### ■ RS-232 Connector

### ■ ICE Pod Connector for Emulation

## GENERAL DESCRIPTION

The Z89C6501ZEM is a member of Zilog's ICEBOX product family of in-circuit emulators providing support for the above listed Z8 microcontroller devices.

Zilog's in-circuit emulators are interactive, Window-oriented development tools, providing a real-time environment for emulation and debugging.

The emulator provides essential timing and I/O circuitry to simplify user emulation of the prototype hardware and software product.

Data entering and program debugging are performed by the monitor ROM and the host package, which communicates through RS-232C serial interface. The user program can be downloaded directly from the host computer through the RS-232C connector. User code may be executed through debugging commands in the monitor.

The Z89C6501ZEM emulator can be connected to a serial port (COM1, COM2, COM3, and COM4) of the host computer and uses Graphical User Interface (GUI) software.

## SPECIFICATIONS

### Operating Conditions

- Operating Temperature: 20°C, ±10°C
- Supply Voltage: +5.0 VDC, ± 5%
- Max. Oscillator Freq.: 20.48 MHz
- Max. DSP Internal Clock Oper. Freq.: 10 MHz
- Max. Z8 Internal Clock Oper. Freq.: 10 MHz
- Min. DSP Internal Clock Oper. Freq.: 1 MHz
- Min. Z8 Internal Clock Oper. Freq.: 1 MHz

### Power Requirements

+5.0 VDC @ 2.0A

### Dimensions

- Width: 6.25 in. (15.8 cm)
- Length: 9.5 in. (24.1 cm)
- Height: 2.5 in. (6.35 cm)

### Serial Interface

RS-232C @ 9600, 19200 (default), 28800, or 57600 Baud

## HOST COMPUTER

### Minimum Requirements

IBM PC (or 100-percent compatible) 386-based machine  
33 MHz  
4 MB RAM  
VGA Video Adapter  
Hard Disk Drive (1 MB free space)  
3.5-inch, High-Density (HD) Floppy Disk Drive  
RS-232C COM port  
Mouse or Pointing Device  
Microsoft Windows 3.1

The following changes to the Minimum Requirements are recommended for increased performance:

486- or Pentium-based machine  
66 MHz (or faster)  
8 MB of RAM (or more)  
SVGA Video Adapter  
Color Monitor  
Printer

## KIT CONTENTS

### Z89C65 Emulator

- Emulation Base Board includes:
  - CMOS Z86C9320PSC
  - 8K x 8 EPROM (Programmed with Debug Monitor)
  - 32K x 8 Static RAM
  - Three 64K x 4 Static RAM
  - RS-232C Interface
  - Reset Switch

- Z89C65 Emulation Daughterboard
  - Z86C5020GSE ICE Chip
  - Z89C0010GSC
  - Two 32K x 8 Static RAM
  - Two 100-Pin HP-16500A Logic Analyzer Interface Connectors
  - 60/80-Pin Target Connectors

### Cables/Pods

- Power Cable with Banana Plugs
- DB25 RS-232C Cable
- 68-Pin PLCC Emulation Pod Cable

### Host Software

- ZASM Cross-Assembler/MOBJ Object File Utilities
- Z8® GUI Emulator Software

### Miscellaneous

- 20-Pin DIP Jumper Block

### Documentation

- Emulator User Manual
- Z8 Cross-Assembler User's Guide
- Universal Object File Utilities (MOBJ)
- Registration Card
- Product Information

**Note:** The Z89C6501ZEM SL1850 Emulator **does not** support paged External ROM Access.

## LIMITATIONS

1. Breakpointing in interrupt service routine and single-stepping pass the IRET statement will cause global interrupts to be disabled.
2. Do not put breakpoint at address after Stop instruction. This will cause program counter to continue at that location after a Stop-Mode Recovery.
3. The C65 ICEBOX uses the Z86C50 ICE Chip; therefore, emulation at more than 12 MHz requires that the Expanded Register File (ERF) timing of the ICE Chip be slowed down to SCLK x 2. This is accomplished by loading value %01 to ICECON Register (Bank F, Register A) of the ICE Chip.
 

**Example:**

```
PUSH RP
LD RP, #%0F
LD %A, #%01
POP RP
```
4. Changing drives in file download and load symbol dialog boxes is not anticipated by the GUI. Typing in the filename in a directory other than shown in "Path:" will result in "File not found". Changing the drive using the mouse is the workaround.
5. The initial blue Zilog screen will be distorted by other active windows. This only affects the appearance, not functionality, of the GUI.
6. Switching ICEBOXes without quitting the GUI is not supported.
7. The maximum symbols that can be loaded is 32768, provided that there is enough system resource (memory).
8. The ICEBOX breakpoint hardware does not distinguish between instruction and data fetches. When a breakpoint in the GUI is set, the breakpoint hardware triggers when the addresses match for either code or data fetches.

### Example:

```
000C    SRP    #%0
000E    LD     R4, #%0016
0010    LD     R5, @R4
0012    NOP
0013    JP     %000C
0016    NOP
```

Setting the breakpoint at %0016 and click GO.

**Result:** The code will break and stop at %0012.

**Note:** This will not happen when Animate Mode is on because the GUI is not using the hardware breakpoints when in Animate Mode.

9. Clicking on the HALT Button does not always Halt ICEBOX execution.
10. Single-stepping into the HALT instruction will cause an ICEBOX "Fatal Error".
11. Halting the program execution or breakpointing when interrupts are enabled will globally disable interrupts. If halting occurs, the program must be reset and started from address %000c hex.
12. Due to the limitation in the Z86C50 ICE Chip, a software work around for the interrupt vector fetching must be in place when configuring the emulator for ROMless emulation (Z89C66/166 emulation).
13. If the emulator is running a user code at full speed and the port window is opened: Switching to another application or minimizing the GUI (then restoring) will result in the following ICEBOX Communications Error message: "Emulator rejected command: target program is executing." This message may need to be cleared several times (as many as seven) before the GUI returns to normal operation.

**Workaround:** Always close the port window before leaving the GUI.

**LIMITATIONS (Continued)**

**Z89C65/165 ROM Emulation**

The Z89C65/165 ROM emulation has the **correct sequence** for vectored interrupts, shown as follows:

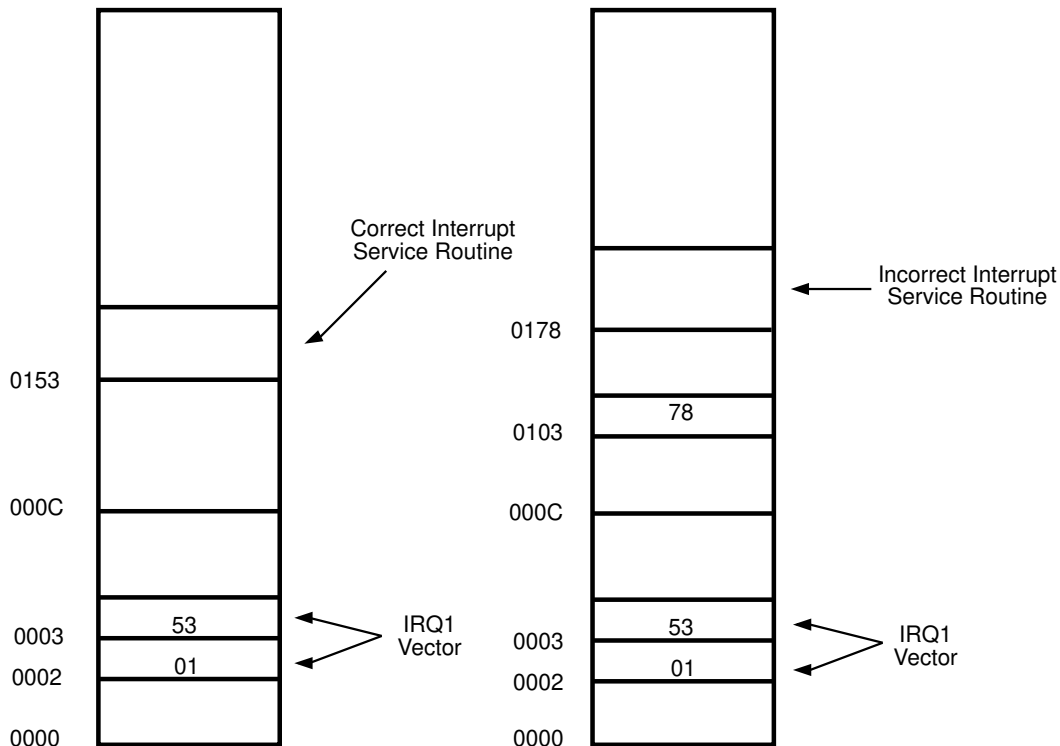
- Push Program Counter (PC) lower byte on stack
- Push PC upper byte on stack
- Push FLAG on stack
- Fetch the upper byte of vector
- Fetch the lower byte of vector
- Branch to service routine specified by vector

**Z89C66/166 ROMless Emulation**

The Z89C66/166 ROMless emulation has the **incorrect sequence** for vectored interrupts. This sequence is shown as follows:

- Push PC lower byte on stack
- Push PC upper byte on stack
- Push FLAG on stack
- Fetch the upper byte of vector
- Write the upper byte of vector to high byte of PC
- Fetch lower byte of vector according to the modified PC
- Branch to service routine specified by vector

The following figures illustrate the vectored interrupt operation for ROM and ROMless emulation, respectively.



**Z8 Program Memory  
Z89C65/165 ROM Emulation**

**Z8 Program Memory  
Z89C66/166 ROMless Emulation**

**Note:** The Incorrect Vectored Interrupt emulation only applies to the emulator. The Z89C66/166 device does not exhibit this problem.

**Vectored Interrupt Operation for ROM and ROMless Emulation**

## Software Work Around for ROMless Emulation

```
***Emulator Vector Fixes***
```

```
***Locate in ROM @ %0000***
```

```
.ORG %0000
```

```
.WORD IRQ0_JP
.WORD IRQ1_JP
.WORD IRQ2_JP
.WORD IRQ3_JP
.WORD IRQ4_JP
.WORD IRQ5_JP
```

```
;Locate in ROM @ %7F00***
```

```
.EXTERN IRQ0_ISR
.EXTERN IRQ1_ISR
.EXTERN IRQ2_ISR
.EXTERN IRQ3_ISR
.EXTERN IRQ4_ISR
.EXTERN IRQ5_ISR
```

```
.ORG %7F00
```

```
.WORD IRQ0_JP
.WORD IRQ1_JP
.WORD IRQ2_JP
.WORD IRQ3_JP
.WORD IRQ4_JP
.WORD IRQ5_JP
```

```
IRQ0_JP:    JP    IRQ0_ISR    ;P32 Input-IRQ0 Service Routine
IRQ1_JP:    JP    IRQ1_ISR    ;P33 Input-IRQ1 Service Routine
IRQ2_JP:    JP    IRQ2_ISR    ;P31 Input-IRQ2 Service Routine
IRQ3_JP:    JP    IRQ3_ISR    ;Internal-DSP Activated
IRQ4_JP:    JP    IRQ4_ISR    ;T0 Timer-IRQ4 Service Routine
IRQ5_JP:    JP    IRQ5_ISR    ;T1 Timer-IRQ5 Service Routine
```

## PRECAUTION LIST

1. All Z8 control registers are write only unless stated otherwise.
2. Power Supply ramp-up/rise time must be such that when minimum power-on reset time ( $T_{POR}$ ) expires, then the  $V_{CC}$  must be in the supported specified operating range of the device.
3. Check the  $T_{POR}$  and  $T_{WDT}$  specifications of the device that you wish to emulate. The actual specification may differ from the ICE chip specifications.
4. The general-purpose registers after Power-On Reset or at initial emulator use will be different than the actual device. The emulator self test will always leave the same values in the general-purpose registers, while the real device will have a random/undefined value in the general-purpose registers.
5. The Emulator cannot be operated while performing ESD/EMI testing on the target board.
6. GUI software versions prior to 3.00 are incompatible with hardware containing BOOTROM 3.00. The GUI software may still boot, but will fail at some later point of the session.
7. The status color bar in OTP dialog box will be cleared in the area where a new window opens on top of it.
8. For 386 PCs, set the baud rate to 19.2K or less because Windows' communication driver does not guarantee "reliable" operation at more than 9600 baud. Selecting a high baud rate on some slower 386 machines may crash the Windows environment.
9. If DSP programs and Z8 programs are to be executed concurrently, the DSP program must be started first, then the Z8 program.

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