Application Note

Crimzon® MCU Peripherals

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Abstract

Zilog has been the leading total solution provider to the Universal Remote Control market for many years. Zilog's popular Z86L88 microcontroller family powers over hundred millions remote controls in the world. Zilog has now taken a further step, arriving at the next generation of highly integrated, cost effective Crimzon® Low Voltage family of microcontrollers.

This application note discusses the enhanced peripherals of the Zilog's new ZLP32300 microcontroller, which provide key advantages in battery operated applications including Universal Remote Control solutions. It also discusses the new low and high battery voltage detection modules, along with the synchronized T8 and T16 timers.

Family Overview

With one of the broadest device databases available today, Zilog's Crimzon Low Voltage Microcontrollers (MCUs) offer the design flexibility required to create a wide variety of Infrared products. Zilog's comprehensive and continuously updated Infrared database (IrDB) of Infrared remote control codes supports the latest consumer electronic products on the market. Zilog's advanced data compression algorithms in turn allow to include more device data in the available ROM memory. In addition, Zilog's IR microcontrollers can be easily integrated into your end solutions, allowing for fast design cycle times.

Zilog's broad range of cost-effective, low-power IR microcontrollers provide the ability to meet the requirements of a range of device footprints: 20-pin, 28-pin, 40-pin, and 48-pin in DIP, SOIC and SSOP, respectively. Memory is available in sizes from 4 KB to 64 KB in the ROM version, as well as from 8 KB to 32 KB in the OTP version, providing the system designer with a high degree of flexibility in selecting the best product for the end application.

The Crimzon Low Voltage MCU is based on Zilog's popular Z8® flexible register-to-register 8-bit architecture. Furthermore, extensive on-chip integration of application-specific features minimizes the number of required external components, PCB board area and design cycle time, respectively. The Z8-based software code modules are easily reusable from project to project, allowing for easy upgrades and minimizing the overhead for code re-development. Finally, in the Z8 architecture, the interrupts manage each peripheral function with a simple service routine.

Crimzon ZLP32300 Low-Voltage OTP Overview

The ZLP32300 is an OTP-based member of the MCU family of IR microcontrollers. With 237 bytes of general-purpose RAM, 2.0 V to 3.6 V operating voltage range, high and low voltage detection, and up to 32 KB of OTP memory, Zilog's CMOS microcontrollers offer fast execution cycles, efficient use of memory, sophisticated interrupts, input/output bit manipulation capabilities, automated pulse generation/reception, and internal key-scan pull-up transistors.

- Up to 32 KB OTP
- Low power consumption – 6 mW (typical)
- 2.0-3.6 V operating voltage range
- Three standby modes:
  - STOP – 2 µA (typical)
  - HALT – 0.8 mA (typical)
  - Low voltage
- Intelligent counter/timer architecture
- One programmable 8-bit counter/timer with two capture registers and two load registers
- One programmable 16-bit counter/timer with one 16-bit register pair and one 16-bit load register pair
- Programmable input glitch filter for pulse reception
- Six priority interrupts
  - Three external
  - Two assigned to counter/timers
  - One low-voltage detection interrupt
- Low battery voltage detection
- High battery voltage detection
- Programmable Watchdog Timer /Power-On Reset (WDT/POR) circuits
- Two independent comparators with programmable interrupt polarity

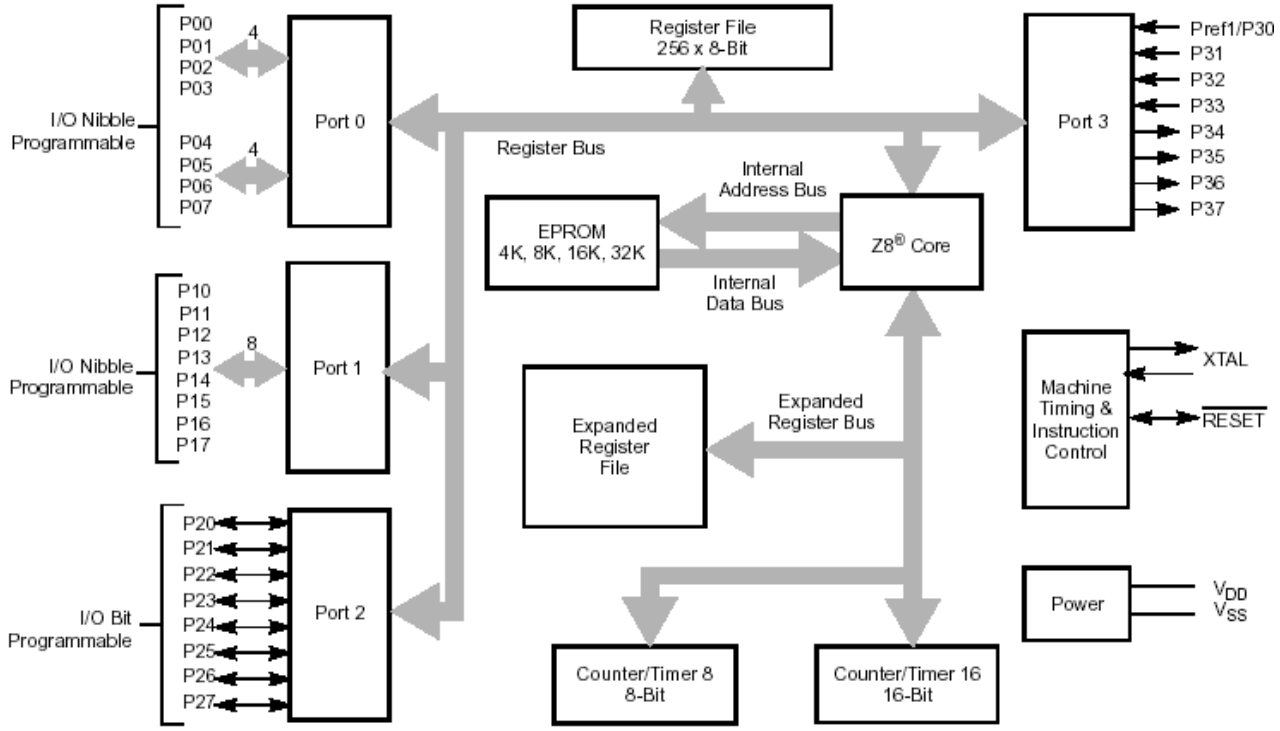

Figure 1. Block Diagram of ZLP32300

Discussion

High and Low Battery Voltage Detection

In battery operating devices, it is always required to monitor the battery voltage level. The Crimzon MCU has built-in, accurate voltage detection circuitry, with the low voltage detection (LVD) threshold at ~2.4 V, and the high voltage detection (HVD) threshold at ~2.7 V, respectively. In remote control or noisy applications, the Vcc voltage may bounce up to a few hundred mV. In this case, the Low Voltage Detection module alone can not be used to distinguish between noise and low battery voltage. For this reason, the Crimzon family also offers the High Voltage Detection module, hence ensuring that 'real' low battery voltage levels are detected in noisy environment.

In this scenario, if both HVD and LVD flags are set within the monitoring period, the battery voltage is in the correct range for proper operation. As indicated earlier, LVD may be triggered by noise only. However, if only the LVD flag is set but the HVD flag is clear for a period of time, this indicates a low battery voltage. In addition, HVD is used to detect a freshly replaced new (good) battery.

The software code shown below is an example on enabling and detecting the high and low voltage detection conditions:

```
;************************************
;* Input    : Vcc
;*
;* Output   : P0 display the LVD
             register
;************************************

LVD_IMAGE   .EQU    %A0     ;LVD image
                            register
            ld      rp,#%0D
            ld      lvd,#1  ;enable LVD
            nop
            nop
loop_LVD:
            ld      LVD_IMAGE,lvd
            ld      rp,#%0
            ld      p0,LVD_IMAGE
            ld      rp,#%0D
            jr      loop_LVD

;************************************
```

Table 1. Low-Voltage Detection Register-LVD(D)0Ch

Field	Bit Position			Description
	[7:0]			Reserved
	[2]	R	1	HVD flag set
			0	HVD flag reset
	[1]	R	1	LVD flag set
			0*	LVD flag reset
	[0]	R/W	1	Enable VD
			0*	Disable VD

*Default after POR

Voltage Detection and Flags

The Voltage Detection register (LVD, register 0Ch at the expanded register bank 0Dh) offers an option of monitoring the VCC voltage. Voltage Detection is enabled when bit 0 of LVD register is set. Once Voltage Detection is enabled, the VCC level is monitored in real time. The HVD flag (bit 2 of the LVD register) is set only if VCC is higher than VHVD. Alternatively, the LVD flag (bit 1 of the LVD register) is set only if VCC is lower than the VLVD.

When the Voltage Detection feature is enabled, the LVD flag also triggers the IRQ5 interrupt. The IRQ bit 5 latches the low voltage condition until it is cleared by instructions or via a reset action. The IRQ5 interrupt is served if it is enabled in the IMR register. Otherwise, bit 5 of IRQ register is latched as a flag only.

Note: *Voltage detection is automatically disabled in the Stop mode.*

T8 and T16 Synchronized Timers

Zilog has added CTR3 register to enhance the T8 and T16 timers. With this new register, the T8 and T16 timers can now be enabled simultaneously and synchronized. They provide a complete carrier

pulse at the beginning of the T16 timer clock. This CTR3 register was used in the Z86L99 and now is also available in the Crimzon family.

Bit 7 of CTR3 is used to enable and disable T16 timer.

Bit 6 of CTR3 is used to enable and disable T8 timer.

Bit 5 of CTR3 is used to synchronize the T8 and T16 timers. If T8 is left free running to generate the carrier, when T16 turns HIGH, T8 can synchronize with the T16 pulse. As a result, a complete carrier pulse is obtained.

T8 and T16 timers can also be used as independent timers. Both offer time out flags for you to poll. They can also generate an interrupt request if enabled.

Watchdog Timer and Power-On Reset Timer

The Watchdog Timer and the Power-On Reset timer are now more independent of temperature and voltage, as compared to the Z86L88 family. Furthermore, the Watchdog Timer consumes much less power and exhibits more precise timing characteristics.

Summary

The new Crimzon family of application-specific microcontrollers (ZLP32300/ZLR32300/ ZLR16300) provides for realization of highly integrated, cost effective solutions for Infrared remote control as well as a broad range of other intelligent control applications. These devices offer advanced voltage detection circuitry to monitor the battery voltage in various operating modes. The combination of 8-bit and 16-bit patented timers greatly enhances your capability to generate and capture Infrared signals. They also used as general purpose timers with little software overhead. Moreover, the MCU's set of two comparators enable you to detect different voltage levels or to realize zero-crossing detection for AC waveforms.

The ZLP32300 offers a very cost effective OTP solution for pilot runs or small volume production. It also reduces the supply chain logistics significantly, as compared to the mask ROM production. In this case, the end user can program the OTP 'on demand' and hence avoid the delays associated with the masking of the ROM devices.

You can also take advantage of the new support tools and features including the C-compiler, trace buffer and event triggering. In addition, the evaluation board provides a full set of peripherals entailing the EEPROM, the learning remote circuitry and test points. These in turn enable you to complete your designs in a much shorter time period.

The Crimzon family of MCU's is fully compatible (hardware and firmware) with the Z86L88 family. In case additional technical support is needed, please feel free to contact Zilog's Technical Support Group at: http://support.zilog.com/support/custom_login.asp.

References

The documents associated with Crimzon MCUs available on www.zilog.com are provided below:

- *ZLR16300 Product Brief* (PB0121)
- *ZLR16300 Product Brief* (PB0121)
- *ZLR16300 Product Specification* (PS0214)
- *ZLR32300 Product Specification* (PS0226)
- *ZLR32300 Product Brief* (PB0120)
- *ZLR32300 Product Specification* (PS0208)
- *Z8 User Manual* (UM0016)
- *ZDS II—Crimzon and Z8 GP User Manual* (UM0164)
- *ZLP128ICE01ZEM User Manual* (UM0184)
- *ZLP323ICE01ZAC Product Brief* (PB0200)
- *Crimzon RC Bullet Quick Start Guide* (QS0037)
- *Crimzon RC Bullet Product User Guide* (PUG0021)

- *ZLP12800100ZACG Crimzon Development Board Accessory Kit Product User Guide* (PUG0024)
- *ZCRMZNICE01ZACG 20-Pin Accessory Kit Product User Guide* (PUG0028)
- *ZCRMZNICE02ZACG 40/48-Pin Accessory Kit Product User Guide* (PUG0029)
- *ZCRMZNICE01ZEMG Crimzon In-Circuit Emulator User Manual* (UM0217)

Table 2. Glossary

Term/Abbre-viation	Definition
UIR	Universal Remote Control
IR	Infrared
MCU	Microcontroller
OTP	One Time Programmable
ROM	Read Only Memory
ICEBOX	In-Circuit-Emulator Box
ZDS	Zilog Developer Studio
IDE	Integrated Development Environment
LED	Light Emitting Diode
PCB	Printed Circuit Board
WDT	Watchdog Timer
FPGA	Field Programmable Gate Array

Appendix A—Glossary

Definitions for terms and addreviations used in this application note are listed in Table 2.

 Warning: DO NOT USE IN LIFE SUPPORT

LIFE SUPPORT POLICY

ZILOG'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF ZILOG CORPORATION.

As used herein

Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

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