Embedded in Life

An IXYS Company

## Z8051 Series 8-Bit Microcontrollers

# Z51F3220

## Product Specification

PS029902-0212

PRELIMINARY

**Warning:** DO NOT USE THIS PRODUCT IN LIFE SUPPORT SYSTEMS.

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# Revision History

Each instance in this document's revision history reflects a change from its previous edition. For more details, refer to the corresponding page(s) or appropriate links furnished in the table below.

| Date | Revision Level | Description | Page |
|---|---|---|---|
| Feb 2012 | 02 | Removed references to 28-pin SOP package. | All |
| Jan 2012 | 01 | Original Zilog issue. | All |

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# Z51F3220

## CMOS SINGLE-CHIP 8-BIT MICROCONTROLLER WITH 12-BIT A/D CONVERTER

## 1. Overview

### 1.1 Description

The Z51F3220 is advanced CMOS 8-bit microcontroller with 32k bytes of Flash. This is powerful microcontroller which provides a highly flexible and cost effective solution to many embedded control applications. This provides the following features : 32k bytes of Flash, 256 bytes of IRAM, 768 bytes of XRAM , general purpose I/O, basic interval timer, watchdog timer, 8/16-bit timer/counter, 16-bit PPG output, 8-bit PWM output, 10-bit PWM output, watch timer, buzzer driving port, SPI, USI, 12-bit A/D converter, LCD driver, on-chip POR, LVR, LVI, on-chip oscillator and clock circuitry. The Z51F3220 also supports power saving modes to reduce power consumption.

| Device Name | Flash | XRAM | IRAM | ADC | I/O PORT | Package |
|---|---|---|---|---|---|---|
| Z51F3220FNX | 32k bytes | 768 bytes | 256 bytes | 16 channel | 42 | 44-pin MQFP |
| Z51F3220SKX | | | | 12 channel | 30 | 32-pin SOP |

## 1.2 Features

- **CPU**
  - 8 Bit CISC Core (8051 Compatible)
- **ROM (Flash) Capacity**
  - 32k Bytes
  - Flash with self read/write capability
  - On chip debug and In-system programming (ISP)
  - Endurance : 100,000 times
- **256 Bytes IRAM**
- **768 Bytes XRAM**
  - (27 Bytes including LCD display RAM)
- **General Purpose I/O (GPIO)**
  - Normal I/O : 9 Ports
    (P0[2:0], P5[5:0])
  - LCD shared I/O : 33 Ports
    (P0[7:3], P1, P2, P3, P4)
- **Basic Interval Timer (BIT)**
  - 8Bit × 1ch
  - **Watch Dog Timer (WDT)**
  - 8Bit × 1ch
  - 5kHz internal RC oscillator
- **Timer/ Counter**
  - 8Bit × 1ch (T0), 16Bit × 2ch (T1/T2)
  - 8Bit × 2ch (T3/T4) or 16 Bit × 1ch (T3)
- **Programmable Pulse Generation**
  - Pulse generation (by T1/T2)
  - 8Bit PWM (by T0)
  - 6-ch 10Bit PWM for Motor (by T4)
- **Watch Timer (WT)**
  - 3.91mS/0.25S/0.5S/1S/1M interval at 32.768kHz
- **Buzzer**
  - 8Bit × 1ch
- **SPI 2**
  - 8Bit × 1ch
- **USI0/1 (UART + SPI + I2C)**
  - 8Bit UART × 2ch, 8Bit SPI × 2ch and I2C × 2ch
- **12 Bit A/D Converter**
  - 16 Input channels
- **LCD Driver**
  - 21 Segments and 8 Common terminals
  - Internal or external resistor bias
  - 1/2, 1/3, 1/4, 1/5, 1/6 and 1/8 duty selectable
  - Resistor Bias and 16-step contrast control
- **Power On Reset**
  - Reset release level (1.4V)
- **Low Voltage Reset**
  - 14 level detect (1.60V/ 2.00V/ 2.10V/ 2.20V/ 2.32V/ 2.44V/ 2.59V/ 2.75V/ 2.93V/ 3.14V/ 3.38V/ 3.67V/ 4.00V/ 4.40V)
- **Low Voltage Indicator**
  - 13 level detect (2.00V/ 2.10V/ 2.20V/ 2.32V/ 2.44V/ 2.59V/ 2.75V/ 2.93V/ 3.14V/ 3.38V/ 3.67V/ 4.00V/ 4.40V)
- **Interrupt Sources**
  - External Interrupts
    (EXINT0~7, EINT8, EINT10, EINT11, EINT12) (12)
  - Timer(0/1/2/3/4) (5)
  - WDT (1)
  - BIT (1)
  - WT (1)
  - SPI 2 (1)
  - USI0/1 (6)
  - ADC (1)
- **Internal RC Oscillator**
  - Inernal RC frequency: 16MHz ±0.5% ($T_A$= 25℃)
- **Power Down Mode**
  - STOP, IDLE mode
- **Operating Voltage and Frequency**
  - 1.8V ~ 5.5V (@32 ~ 38kHz with X-tal)
  - 1.8V ~ 5.5V (@0.4 ~ 4.2MHz with X-tal)
  - 2.7V ~ 5.5V (@0.4 ~ 10.0MHz with X-tal)
  - 3.0V ~ 5.5V (@0.4 ~ 12.0MHz with X-tal)
  - 1.8V ~ 5.5V (@0.5 ~ 8.0MHz with Internal RC)
  - 2.0V ~ 5.5V (@0.5 ~ 16.0MHz with Internal RC)
  - Voltage dropout converter included for core
- **Minimum Instruction Execution Time**
  - 125nS (@ 16MHz main clock)
  - 61μS (@t 32.768kHz sub clock)
- **Operating Temperature:** – 40 ~ + 85℃
- **Oscillator Type**
  - 0.4-12MHz Crystal or Ceramic for main clock
  - 32.768kHz Crystal for sub clock
- **Package Type**
  - 44 MQFP-1010
  - 32 SOP
  - 28 SOP
  - Pb-free package

## 1.3 Ordering Information

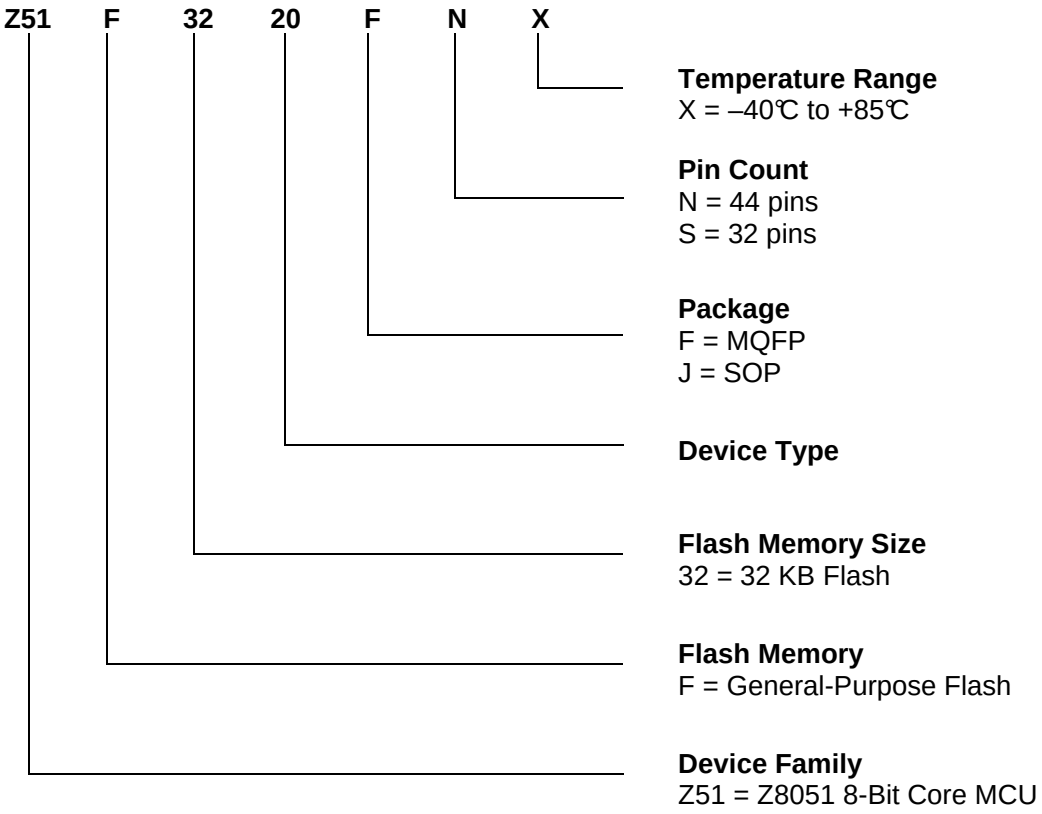
**Table 1-1 Ordering Information of Z51F3220**

| Device Name | ROM Size | IRAM Size | XRAM Size | Package |
|---|---|---|---|---|
| Z51F3220FNX | 32k bytes Flash | 256 bytes | 768 bytes | 44-pin MQFP |
| Z51F3220SKX | | | | 32-pin SOP |

### 1.3.1 Part Number Suffix Designation

Zilog part numbers consist of a number of components, as indicated in the following example.

**Example:** Part number Z51F3220FNX is an 8-bit MCU with 32 KB of Flash memory and 1 KB of RAM in a 44-pin MQFP package and operating within a –40°C to +85°C temperature range. In accordance with RoHS standards, this device has been built using lead-free solder.




## 1.4 Development Tools

### 1.4.1 Compiler

We do not provide the compiler. Please contact the third parties.

The core of Z51F3220 is Mentor 8051. And, device ROM size is smaller than 32k bytes. Developer can use all kinds of third party's standard 8051 compiler.

### 1.4.2 OCD Emulator and Debugger

The OCD (On Chip Debug) emulator supports Zilog's 8051 series MCU emulation.

The OCD interface uses two-wire interfacing between PC and MCU which is attached to user's system. The OCD can read or change the value of MCU internal memory and I/O peripherals. And the OCD also controls MCU internal debugging logic, it means OCD controls emulation, step run, monitoring, etc.

The OCD Debugger program works on Microsoft-Windows NT, 2000, XP, Vista (32bit) operating system.

If you want to see more details, please refer to OCD debugger manual. You can download debugger S/W and manual from our web-site.

Connection:

- SCLK (Z51F3220 P01 port)
- SDATA (Z51F3220 P00 port)

OCD connector diagram: Connect OCD with user system

### 1.4.3 Programmer

Single programmer:

PGMplus USB: It programs MCU device directly.

OCD emulator: It can write code in MCU device too, because OCD debugging supports ISP (In System Programming).

It does not require additional H/W, except developer's target system.

Gang programmer:

It programs 8 MCU devices at once.

So, it is mainly used in mass production line.

Gang programmer is standalone type, it means it does not require host PC, after a program is downloaded from host PC to Gang programmer.


**Figure 1.1 StandAlone Gang8 (for Mass Production)**

## 2. Block Diagram

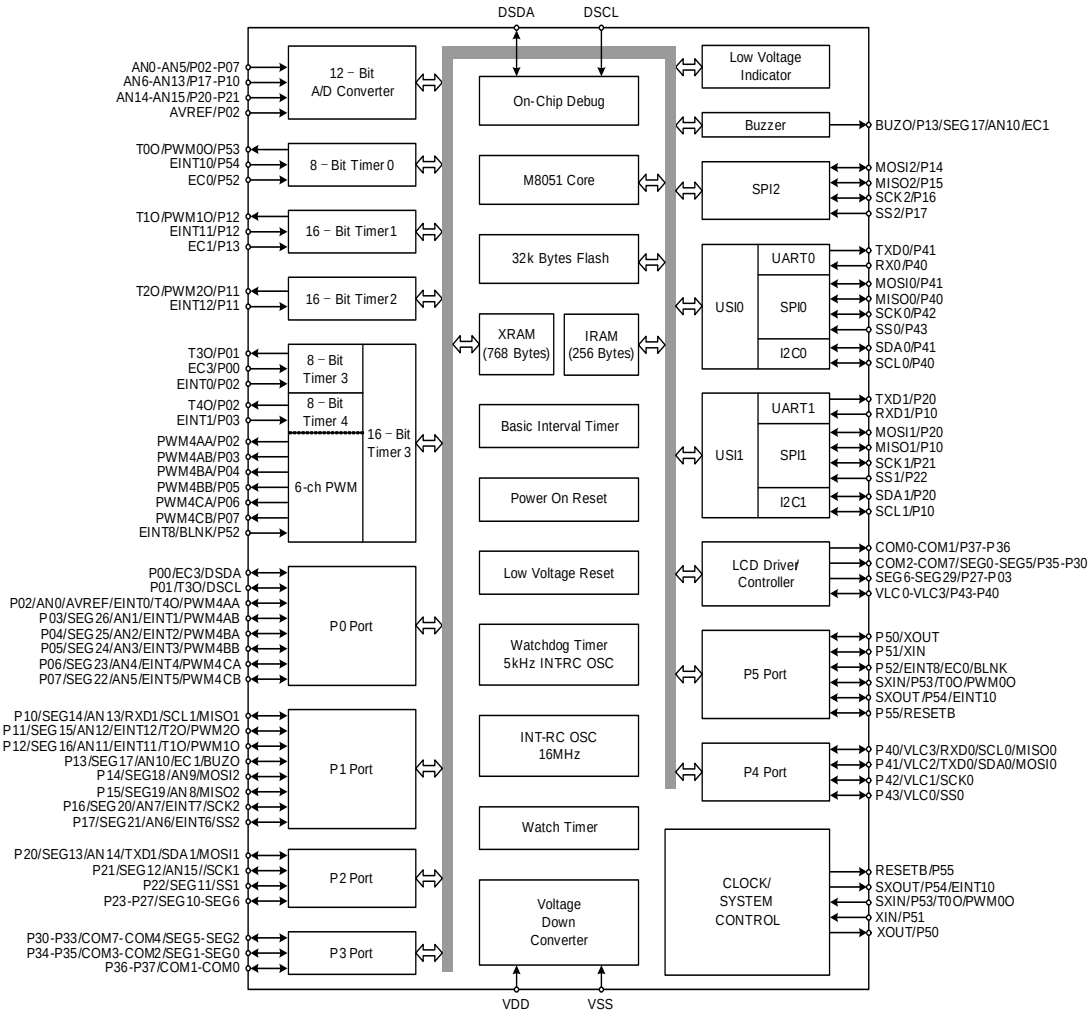



**Figure 2.1 Block Diagram**

NOTE) The P14–P17, P23–P25, P34–P37, and P43 are not in the 32-pin package.