

MS51 Series BSP User Guide

Based on Keil uVision4 and PK51 Development Kit V9.52
 For NuMicro® 8051 Family

Directory Information

Please extract the “MS51_Series_BSP_Keil_V1.00.004.zip” file firstly and confirm the following content of this BSP folder.

MS51DA9AE_MS51BA9AE_MS51IA9AE	BSP for MS51DA9AE and MS51BA9AE. 8KB Flash APROM share with 4KB LDRROM 256 Byte RAM, 1024 Byte XRAM In TSSOP14 , MSOP10 and SOP8 package
MS51FB9AE_MS51XB9AE_MS51XB9BE	BSP for MS51FB9AE, MS51XB9AE and MS51XB9BE. 16KB Flash APROM share with 4KB LDRROM 256 Byte RAM, 1024 Byte XRAM In TSSOP20 and QFN20 package
MS51FC0AE_MS51XC0BE_MS51EB0AE_MS51EC0AE_MS51TC0AE_MS51PC0AE	BSP for MS51FC0AE, MS51XC0BE, MS51EB0AE, MS51EC0AE, MS51TC0AE and MS51PC0AE. 16KB Flash APROM share with 4KB LDRROM of MS51EB0AE 256 Byte RAM, 2048 Byte XRAM In QFN20 package 32KB Flash APROM share with 4KB LDRROM of others 256 Byte RAM, 2048 Byte XRAM In QFN33, LQFP32, TSSOP28, TSSOP20 and QFN20 package

Each folder listed above with following content folders

Document\	Driver reference manual and revision history.
Library\	Device driver header and source files.
SampleCode\	Driver sample code.

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1 .\Document\

MS51DA9AE_MS51BA9AE_Series_BSP_Keil_Revision_History.pdf

This document shows the revision history of MS51DA9AE_MS51BA9AE_BSP_Keil.

OR

MS51FB9AE_MS51XB9AE_MS51XB9BE_BSP_Keil_Revision_History.pdf

This document shows the revision history of MS51FB9AE_MS51XB9AE_MS51XB9BE_BSP_Keil.

OR

MS51FC0AE_MS51XC0BE_MS51EB0AE_MS51EC0AE_MS51TC0AE_MS51PC0AE_BSP_Keil_Revision.pdf

This document shows the revision history of MS51FC0AE_MS51XC0BE_MS51EB0AE_MS51EC0AE_MS51TC0AE_MS51PC0AE_BSP_Keil.

2 .\Library\

Device\	MS51 series flash device header file.
Startup\	A51 startup file and executable file.
StdDriver\	All peripheral driver header and source files.

3 .\SampleCode\

ISP\	Sample codes for In-System-Programming LDROM boot loader source code.
RegBased\	Demonstrate the usage of MS51 series MCU peripheral driver.
Template\	A project template for MS51 series MCU

4 .\SampleCode\ISP

ISP_I2C	In-System-Programming Sample code through I2C interface.
ISP_UART0	In-System-Programming Sample code through UART0 interface.
SP_UART1	In-System-Programming Sample code through UART1 interface.

5 .\SampleCode\RegBased

ADC_Bandgap	Configure band-gap as ADC input channel and show ADC conversion result in ADCRH and ADCRL register.
ADC_Bandgap_VDD	Calculate the real V_{DD} value of the device system based on the difference between the pre-stored ADC conversion result values when V_{DD} is 3.072V and the system converted band-gap value.
ADC_Continuous	Configure ADC as continuous mode. Define convert result storage in XRAM area. When ADC interrupt means continuous sample finished print all the result from UART0 TXD.
ADC_GPIO_Trig	Demonstrate how to use GPIO to start ADC initial setting and show the conversion result in ADCRH and ADCRL register.
ADC_Multi_channel	Demonstrate how to regularly sample from different ADC input channel.
ADC_PWM_Trig	Demonstrate how to use each of PWM timer period timeout to trigger ADC conversion.
ADC_Simple	Start ADC conversion by triggering ADCS bit [ADCCON0.6] and check the flag register ADCF bit [ADCCON0.7] to confirm if a conversion is finished.
Fsys_ModifyHIRC	Call the library file "sys.c" to modify system setting as 16 MHz or 24 MHz and check clock out pin to confirm if Fsys is modified. The MS51 HIRC can be selected within 16 MHz or 24 MHz.
Fsys_Select_ECLK	Change the MS51 initial setting of system clock from HIRC to the external clock input. The MS51 external clock input ranges from 4 MHz to 24 MHz.
GPIO_ClockOut	Show the MS51 system clock and output from CLKO pin.
GPIO_Input_Output	Toggle each MS51 GPIO pin output from high to low after 200ms delay.
GPIO_PowerDown_BODdisable	Show how to disable MS51 Burn-out detect function and into power down mode. This project is special for measure the

	power down current of MS51.
I2C_Read_EEPROM	Show how to use MS51 as master to read external connect EEPROM by I ² C bus.
IAP_AP_program_AP_Dataflash	Demonstrate how MS51 APROM is used as Data Flash to implement erase / program / read verify function. All APROM memory can be used as Data Flash.
IAP_AP_program_LD	Demonstrate how MS51 IAP runs in APROM to program LDROM and implements erase / program / read verify function. Firstly, user needs to confirm if the LDROM is enabled through CONFIG setting.
IAP_Dataflash_EEPROM_Mode	Simulate Data Flash as EEPROM mode by calling the library file "eeprom.c". This process includes read data and storage in RAM / modify value / erase Data Flash / copy new value from RAM to Data Flash.
IAP_LD_Program_AP	Demonstrate how MS51 IAP runs in LDROM to program APROM and implements erase / program / read verify function.
IAP_program_Config	Demonstrate using MS51 IAP command to modify CONFIG bytes.
IAP_Read_UCID	Demonstrate using MS51 IAP command to read the unique customer ID (UCID). Only for customer special order MS51 MCU. One UCID is only for one customer.
IAP_Read_UID	Demonstrate using MS51 IAP command to read the Unique code of MS51. The UID value of each MS51 is different.
INT0_Ext_Interrupt	Perform MS51 external interrupt pin INT0 enabled initial setting.
INT1_Ext_Interrupt	Perform MS51 external interrupt pin INT1 enabled initial setting.
ISP_UART0	Standard ISP protocol process boot loader source code. Communication with UART0 for NuMicro ISP Programming Tool.
ISP_UART1	Standard ISP protocol process boot loader source code. Communication with UART1 for NuMicro ISP Programming Tool.
Pin_Interrupt	Demonstrate how to wake up MS51 from Idle / Power-down mode through external interrupt input by enabling MS51 pin interrupt function.
PWM0_DeadTime	Configure PWM as Complementary mode. Control 3 pairs output, set each 2 channel PWM output as same duty and insert dead time.

PWM0_Independent	Configure PWM as independent mode. Each PWM channel outputs independently and each PWM channels output with different duty and interrupt enabled.
PWM0_Synchronous	Configure PWM as Synchronous mode. Each PWM0 channel 0/2/4 outputs different duty and PWM0 channel 1/3/5 duty following 0/2/4 setting.
PWM0123_GroupStart	Configure PWM0/1/2/3 as independent mode and start with same time.
PWM123_Independent	Configure PWM0/1/2/3 as independent mode each channel duty is different.
PWM_INT	Configure PWM one channel output with falling edge trig interrupt enable initial setting.
PWM_Simple	Configure PWM as Independent mode. Only set one channel output.
PWM_Synchronous	Configure PWM as Synchronous mode. Set PWM Channel 0/2/4 output with independent duty value. PWM1/3/5 outputs follow PMW 0/2/4 setting.
SPI_Flash_Read_Write	Connect MS51 with W25Q16BV SPI Flash and set it as master to read and write data sample code.
SPI_Master	Configure SPI as master transmit and receive data. Check flag as transmit one byte finish condition.
SPI_Slave_Interrupt	Configure SPI as slave transmit and receive data. Enable interrupt function when slave is receive data.
SPI_Slave_Polling	Configure SPI as slave transmit and receive data. Check flag as received one byte finish condition.
Timer0_mode_0_Interrupt	Configure Timer 0 as mode 0,13-bit timer with interrupt enabled initial setting.
Timer0_mode_1_Interrupt	Configure Timer 0 as mode 1, 16-bit timer with interrupt enabled initial define.
Timer0_mode_2_Interrupt	Configure Timer 0 as mode 2, 8-bit timer with auto reload function and interrupt enabled initial setting.
Timer01_mode_3_Interrupt	Configure Timer 0 mode 3 as two separated timer initial settings with interrupt enabled. Timer0 counter value register high byte TH0 overflow will set the register flag bit TF1 as 1

	(Timer1 overflow flag).
Timer1_mode_0_Interrupt	Configure Timer 1 as mode 0, 13-bit timer with interrupt enabled initial setting.
Timer1_mode_1_Interrupt	Configure Timer 1 as mode 1, 16-bit timer with interrupt enabled initial setting.
Timer1_mode_2_Interrupt	Configure Timer 1 as mode 2, 8-bit timer with auto reload function and interrupt enabled initial setting.
Timer2_AutoReload_Capture	Configure Timer 2 as one channel input capture with interrupt enabled initial setting. Timer 2 capture interrupt vector is different to the Timer 2 overflow interrupt.
Timer2_AutoReload_Delay	Configure Timer 2 as auto reload delay setting with interrupt enabled initial setting.
Timer3	Configure Timer 3 as auto reload mode initial setting and interrupt enabled.
UART0_Interrupt_RW	Configure UART0 transfer including transmit and receive with interrupt enabled.
UART0_Printf	Demonstrate printf instruction based on transmit from UART0 TXD pin.
UART1	Configure UART1 transmit and receive initial setting and enable interrupt subroutine.
UART1_Printf	Demonstrate printf instruction based on transmit from UART1 TXD pin. Include how to modify putchar.c file.
UART2	Configure SC0 as UART2 transfer including transmit and receive with interrupt enabled.
UART3	Configure SC1 as UART3 transfer including transmit and receive with interrupt enabled.
UART4	Configure SC2 as UART4 transfer including transmit and receive with interrupt enabled.
WakeupTimer_Interrupt	Enable wake-up timer with interrupt function. Main loop enters Power-down mode after initial setting, and once WKT timeout, MS51 will wake up and then jump into interrupt subroutine to toggle GPIO output.

Watchdog_Interrupt	Demonstrate Watchdog Timer (WDT) initial setting with interrupt enabled, and Watchdog Timer reset function disabled. The WDT counter overflow will jump into WDT interrupt subroutine.
Watchdog_Reset	Demonstrate Watchdog Timer reset initial setting and include the library file "Watchdog.c" to call Enable / Disable WDT reset subroutine. Set P0.0 as high level to disable WDT reset function; otherwise, keep WDT reset enabled.

Based on the features of the different product these project is not necessarily included in folder of .\SampleCode\RegBased.

6 REVISION HISTORY

Date	Revision	Description
2019.1.29	1.00.001	Initial release.
2019.6.27	1.00.002	1. Added MS51DA9AE_MS51BA9AE_BSP_Keil folder 2. Modified MS51_16K_BSP_Keil_V1.00 folder name to MS51FB9AE_MS51XB9AE_MS51XB9BE_BSP_Keil
2019.11.27	1.00.003	Added MS51FC0AE_MS51XC0BE_MS51EC0AE_MS51TC0AE_MS51PC0AE_BSP_Keil
2021.08.25	1.00.004	Added SPI_Master, SPI_Slave_interrupt, SPI_Slave_polling, in all folder. Modified SPI_Flash_Read_Write in all folder. Added spi.c , spi_flash.c in all library. Added ISP folder for UART, I2C boot loader source code. Added SFR page control for PWM4/PWM5 in MS51DA9AE_MS51BA9AE_BSP_Keil folder

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