

Zephyr RTOS Porting Report for BGM220P (EFR32BG22C224F512IM40)

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Project Overview

This project involves manually porting the **BGM220P** board (based on **EFR32BG22C224F512IM40 SoC**) to **Zephyr RTOS v4.2.0-rc1**.

It includes:

- Custom board configuration
 - Custom SoC support
 - Kconfig and Device Tree integration
 - GPIO control app (my_led_app)
 - Build and Kconfig troubleshooting
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Folder and File Structure Created

Custom Board Folder

Path: zephyr/boards/arm/bgm220p/

- bgm220p.dts
- bgm220p_defconfig
- bgm220p.yaml
- bgm220p-pinctrl.dtsi

SoC Support

Path: zephyr/soc/silabs/silabs_s2/efr32bg22/

- Kconfig.soc
- Kconfig.defconfig
- Kconfig.defconfig.series
- Kconfig.defconfig.efr32bg22c224f512im40
- Kconfig.series
- Kconfig

Path: zephyr/soc/arm/silabs/

- Kconfig.soc
- Kconfig.series
- Kconfig.defconfig

Application

Path: zephyrproject/my_led_app/

- prj.conf
 - CMakeLists.txt
 - src/main.c
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Kconfig Integration

zephyr/soc/arm/Kconfig.soc

```
source "soc/arm/silabs/Kconfig.soc"  
source "soc/arm/Kconfig.series"
```

zephyr/soc/arm/silabs/Kconfig.soc

```
source "soc/silabs/silabs_s2/Kconfig.soc"  
source "soc/arm/silabs/efr32bg22/Kconfig.soc"  
source "soc/arm/silabs/Kconfig.series"
```

zephyr/soc/silabs/silabs_s2/efr32bg22/Kconfig.soc

```
config SOC_SERIES_EFR32BG22  
    bool "EFR32BG22 Series MCU"  
    select SOC_FAMILY_EFR32  
    select HAS_SILABS_GECKO  
  
config SOC_EFR32BG22C224F512IM40  
    bool "EFR32BG22C224F512IM40"  
    select SOC_SERIES_EFR32BG22  
  
config NUM_IRQS  
    default 47  
  
config SYS_CLOCK_HW_CYCLES_PER_SEC  
    default 38400000  
...
```

zephyr/soc/silabs/silabs_s2/efr32bg22/Kconfig.defconfig

```
if SOC_EFR32BG22C224F512IM40

config SOC
    default "efr32bg22c224f512im40"

config SOC_SERIES
    default "efr32bg22"

config ARCH
    default "arm"

config SERIAL
    default y
config CONSOLE
    default y
config UART_CONSOLE
    default y
config GPIO
    default y
config MAIN_STACK_SIZE
    int
    default 2048

endif
```

Error History and Fixes

Initial Errors:

- undefined symbol: SOC_SERIES_EFR32BG22
- undefined symbol: SOC_EFR32BG22C224F512IM40
- undefined symbol: SERIAL, GPIO, UART_CONSOLE
- DTS not included or not found
- Kconfig not parsed due to missing symbols

Fixes Applied:

- Corrected Kconfig inclusion paths in soc/arm/Kconfig.soc and zephyr/Kconfig
 - Created proper Kconfig.defconfig for the SoC with all required symbols
 - Cleaned and rebuilt (rm -rf build/ ~/.cache/zephyr)
 - Ensured DTS paths were referenced correctly
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Application Configuration

prj.conf

```
CONFIG_GPIO=y
CONFIG_SERIAL=y
CONFIG_CONSOLE=y
CONFIG_UART_CONSOLE=y
CONFIG_MAIN_STACK_SIZE=2048
```

src/main.c

```
#include <zephyr/kernel.h>
#include <zephyr/drivers/gpio.h>

#define LED_PORT DT_LABEL(DT_NODELABEL(gpioa))
#define LED_PIN 5

void main(void)
{
    const struct device *dev = device_get_binding(LED_PORT);
    gpio_pin_configure(dev, LED_PIN, GPIO_OUTPUT);

    while (1) {
        gpio_pin_toggle(dev, LED_PIN);
        k_sleep(K_SECONDS(30));
    }
}
```

Current Status (as of July 10, 2025)

- Board DTS and pinctrl loaded
 - Kconfig paths mostly resolved
 - SOC_SERIES_EFR32BG22 is still shown as undefined
 - Root cause: Kconfig.defconfig may not be sourced early in the tree
 - Potential fix: check zephyr/Kconfig, soc/Kconfig, or boards/Kconfig
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TODO / NEXT STEPS

- Fix SOC_SERIES_EFR32BG22 undefined symbol
 - Test LED blink on actual hardware
 - Flash and verify toggle on PA05 (LED0)
 - Push changes to GitHub and document further
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