PWM_Buzzer_1
for KIT_AURIX_TC297_TFT
PWM controlled melody on Buzzer

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Scope of work

The GTM unit is used to play a PWM-controlled song with a piezo buzzer.

The generated PWM (Pulse-Width Modulation) signal is controlled by timer TOM1 of the GTM block. The signal drives the piezo buzzer via the pin 0 of the port 33.
Introduction

› The Generic Timer Module (GTM) is a modular timer unit designed to accommodate many timer applications.

› The Timer Output Module (TOM), which is part of the GTM, offers sixteen independent channels to generate output signals.

› The Clock Management Unit (CMU) is responsible for clock generation of the GTM. The Fixed Clock Generation (FXU), subunit of the CMU, provides five predefined non-configurable clocks for the TOM submodules.
Hardware setup

This code example has been developed for the board KIT_AURIX_TC297_TFT_BC-Step.

The piezo buzzer (1) is used for this example.
Initialization of PWM Buzzer

The initialization of the PWM Buzzer is done once in the setup phase by calling the function `initPWMBuzzer()`, which contains the following steps:

- Initialize the time constants by calling the service function `initTime()` from iLLD header file `Bsp.h`
- Enable the GTM by calling the function `IfxGtm_enable()`
- Enable the FXU clocks by calling the function `IfxGtm_Cmu_enableClocks()`
- Initialize the timer configuration with default values by calling the function `IfxGtm_Tom_Timer_initConfig()`
- Set the timer configuration variable `timerCfg` with the user defined values
- Initialize the timer through the iLLD function `IfxGtm_Tom_Timer_init()`
- Enable the GTM TOM channel 4 by calling the iLLD function `IfxGtm_Tom_Tgc_enableChannelsUpdate()`

All the functions used for the configuration of the PWM Buzzer are provided by the iLLD header `IfxGtm_Tom_Pwm.h`. 
Implementation

Configuration of the variable timerCfg

Setting of the timerCfg variable is done once in the setup phase in the function initPWMBuzzer() with the following steps:

- Set TOM1 as the timer for generating the PWM signal
  \[ \text{timerCfg.tom} = \text{IfxGtm_Tom_1} \]
- Set the channel 4 of TOM1 as the channel used for the timer
  \[ \text{timerCfg.timerChannel} = \text{IfxGtm_Tom_Ch_4} \]
- Select the clock source
  \[ \text{timerCfg.clock} = \text{IfxGtm_Tom_Ch_ClkSrc_cmosFxclk2} \]
- Set port and pin for PWM output
  \[ \text{timerCfg.triggerOut} = \&\text{IfxGtm_TOM1_4_TOUT22_P33_0_OUT} \]
- Enable TOM channel
  \[ \text{timerCfg.base.trigger.enabled} = \text{TRUE} \]
- Enable TOM channel output
  \[ \text{timerCfg.base.trigger.outputEnabled} = \text{TRUE} \]
- Starting PWM with rising edge
  \[ \text{timerCfg.base.trigger.risingEdgeAtPeriod} = \text{TRUE} \]
Implementation

Playing song

The song is played by repeatedly calling the function `playTone()` for each note, which contains the following steps:

1. Set the PWM frequency (in Hz) through the iLLD function `IfxGtm_Tom_Timer_setFrequency()`
2. Set the volume level by calling the function `setVolume()`. This is done by setting the PWM duty cycle with the function `IfxGtm_Tom_Timer_setTrigger()`
3. Start the timer with the iLLD function `IfxGtm_Tom_Timer_run()`
4. Wait until the end of the note through the service function `waitTime()`
5. Stop the timer with the iLLD function `IfxGtm_Tom_Timer_stop()`
Run and Test

After code compilation and flashing the device, listen to the Buzzer (1) which should play the sound from the game Super Mario.
AURIX™ Development Studio is available online:
https://www.infineon.com/aurixdevelopmentstudio
Use the „Import...“ function to get access to more code examples.

More code examples can be found on the GIT repository:
https://github.com/Infineon/AURIX_code_examples

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