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Clock Gen Click

PID: MIKROE-4113

Clock Gen Click offers an ideal replacement for crystals, crystal oscillators, VCXOs, phase-locked loops (PLLs), and fanout buffers in cost-sensitive applications. This click features the Si5351A from Silicon Labs, an I2C configurable clock generator based on a PLL + high resolution MultiSynth fractional divider architecture which can generate any frequency up to 200 MHz on each of its outputs with 0 ppm error. The Si5351A is capable of generating synchronous or free-running non-integer related clock frequencies at each of its outputs (CLK0, CLK1, and CLK2), enabling one device to synthesize clocks for multiple clock domains in a design. It eliminates the need for higher cost, custom pullable crystals while providing reliable operation over a wide tuning range. The Si5351C offers the same flexibility but synchronizes to an external reference clock.

Clock Gen Click is supported by a mikroSDK compliant library, which includes functions that simplify software development. This Click board™ comes as a fully tested product, ready to be used on a system equipped with the mikroBUS™ socket.

How does it work?

Clock Gen click features the Si5351A, a versatile I2C programmable clock generator that is ideally suited for replacing crystals, crystal oscillators, VCXOs, PLLs, and buffers. The Si5351A consists of an input stage, two synthesis stages, and an output stage. The input stage accepts an external crystal (XTAL on XA and XB pins). The first stage of synthesis multiplies the input frequencies to an high-frequency intermediate clock, while the second stage of synthesis uses high resolution MultiSynth fractional dividers to generate the desired output frequencies. Additional integer division is provided at the output stage for generating output frequencies as low as 2.5 kHz. Crosspoint switches at each of the synthesis stages allows total flexibility in
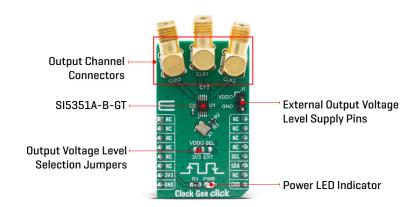
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routing any of the inputs to any of the outputs. Because of this high resolution and flexible synthesis architecture, the Si5351A is capable of generating synchronous or free-running non-integer related clock frequencies at each of its outputs, enabling one device to synthesize clocks for multiple clock domains in a design.

The Si5351A uses a fixed-frequency standard AT-cut crystal as a reference to the internal oscillator. The output of the oscillator can be used to provide a free-running reference to one or both of the PLLs for generating asynchronous clocks. The output frequency of the oscillator operates at the crystal frequency of 25 MHz. Internal load capacitors are provided to eliminate the need for external components when connecting a crystal to the Si5351A. The total internal XTAL load capacitance (CL) can be selected to be 0, 6, 8, or 10 pF.

The Si5351A uses two stages of synthesis to generate its final output clocks. The first stage uses PLLs to multiply the lower frequency input references to a high-frequency intermediate clock. The second stage uses high resolution MultiSynth fractional dividers to generate the required output frequencies. Only two unique frequencies above 112.5 MHz can be simultaneously output. For example, 125 MHz (CLK0), 130 MHz (CLK1), and 150 MHz (CLK2) is not allowed. Both PLLs are locked to the same source (XTAL). The crosspoint switch at the input of the second stage allows any of the MultiSynth dividers to connect to PLLA or PLLB. This flexible synthesis architecture allows any of the outputs to generate synchronous or non-synchronous clocks, with spread spectrum or without spread spectrum, and with the flexibility of generating non-integer related clock frequencies at each output. Frequencies down to 2.5 kHz can be generated by applying the R divider at the output of the Multisynth.

All output drivers generate CMOS level outputs with a single output voltage supply pin (VDDO) allowing a different voltage signal level (1.8, 2.5, or 3.3 V) at the output banks. The output voltage level selection can be chosen by moving an SMD jumper labeled as VDDO SEL to an appropriate position (3V3 or EXT). If 3V3 is chosen, the VDDO is supplied by the board, otherwise, an external supply must be connected to the voltage level supply pin.

This Click Board™ uses the I2C communication interface. It is designed to be operated only with 3.3V logic levels. A proper logic voltage level conversion should be performed before the Click board™ is used with MCUs with logic levels of 5V.

Specifications

Type	Clock generator

Applications	Audio/video equipment, gaming, printers, scanners, projectors, handheld instrumentation, laser range finder, residential gateways, network/communication, servers, storage, XO replacement.
On-board modules	Clock Gen Click uses the SI5351A-B-GT IC, a configurable clock generator, from Silicon Labs.
Key Features	Configurable clock generator with three outputs, freq generator from 2.5 kHz to 200 MHz, very low power consumption
Interface	I2C
Feature	No ClickID
Compatibility	mikroBUS™
Click board size	M (42.9 x 25.4 mm)
Input Voltage	3.3V

Pinout diagram

This table shows how the pinout on Clock Gen Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikro™ BUS		Pin	Notes
	NC	1	AN	PWM	16	NC	
	NC	2	RST	INT	15	NC	
	NC	3	CS	RX	14	NC	
	NC	4	SCK	TX	13	NC	
	NC	5	MISO	SCL	12	**SCL**	I2C Clock
	NC	6	MOSI	SDA	11	**SDA**	I2C Data
Power Supply	**3.3V**	7	3.3V	5V	10	NC	
Ground	**GND**	8	GND	GND	9	**GND**	Ground

Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
JP1	VDDO SEL	Left	Output voltage level selection 3V3/EXT, left position 3v3, right position External supply

Clock Gen Click electrical specifications

Description	Min	Typ	Max	Unit
Core Supply Voltage	3.0	3.3	3.6	V
Output Buffer Voltage	1.71	3.3	3.6	V

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Operating Temperature Range	-40	25	85	°C
Output Impedance	-	50	-	Ω

Software Support

We provide a library for the Clock Gen Click on our LibStock page, as well as a demo application (example), developed using MikroElektronika compilers. The demo can run on all the main MikroElektronika development boards.

Library Description

Library provides functions for communicating with device via I2C module, and many functions for user to easily set frequency of device.

Key functions:

- void clockgen_generic_write (uint8_t reg_adr, uint8_t write_data) - Function for I2C write to device
- uint8_t clockgen_generic_read (uint8_t reg_adr) - Function for I2C read from device
- void clockgen_set_frequency (uint8_t clk_num, uint8_t pll_num, uint32_t freq) - Function for setting frequency to device
- void clockgen_set_params (uint8_t clk_pll_num, clockgen_params_t *param_group) - Function for setting parameters to specific clock or pll
- void clockgen_setup_multisyinth (uint8_t clk_num, uint32_t divider, uint32_t num, uint32_t denom, uint8_t factor) - Function for setting OMD
- void clockgen_setup_pll (uint8_t pll, uint8_t mult, uint32_t num, uint32_t denom) - Function for setting FMD

Examples description

The application is composed of three sections :

- System Initialization - Initialization of I2C module
- Application Initialization - Configures device to default function that enables clock 0 and disables all others
- Application Task - Changes 4 different frequency i span of 5 seconds

The full application code, and ready to use projects can be found on our LibStock page.

Other mikroE Libraries used in the example:

- I2C
- UART

Additional notes and informations

Depending on the development board you are using, you may need USB UART click, USB UART 2 click or RS232 click to connect to your PC, for development systems with no UART to USB interface available on the board. The terminal available in all MikroElektronika compilers, or any other terminal application of your choice, can be used to read the message.

mikroSDK

Mikroe produces entire development toolchains for all major microcontroller architectures.
Committed to excellency, we are dedicated to helping engineers bring the project development up to speed and achieve outstanding results.

ISO 27001: 2013 certification of informational security management system.
ISO 14001: 2015 certification of environmental management system.
OHSAS 18001: 2008 certification of occupational health and safety management system.

ISO 9001: 2015 certification of quality management system (QMS).

This Click board™ is supported with mikroSDK - MikroElektronika Software Development Kit. To ensure proper operation of mikroSDK compliant Click board™ demo applications, mikroSDK should be downloaded from the LibStock and installed for the compiler you are using.

For more information about mikroSDK, visit the official page.

Resources

mikroBUS™

mikroSDK

Click board™ Catalog

Click Boards™

Downloads

Clock Gen click example on Libstock

SI5351 datasheet

Clock Gen click 2D and 3D files

Clock Gen click schematic