Single phase inverter schematic

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This Instructable explores the use of Dialog"s GreenPAK(TM) CMICs in power electronics applications and will demonstrate the implementation of a single-phase inverter using various control methodologies. Different parameters are used to determine the quality of the single-phase inverter. An important parameter is Total Harmonic Distortion (THD). THD is a measurement of the harmonic distortion in a signal and is defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.

Below we described steps needed understand how the solution has been programmed to create the single-phase inverter. However, if you just want to get the result of programming, download GreenPAK software to view the already completed GreenPAK Design File. Plug the GreenPAK Development Kit to your computer and hit program to create the single-phase inverter.

A power inverter, or inverter, is an electronic device or circuitry that changes direct current (DC) into alternating current (AC). Depending upon the number of phases of the AC output, there are several types of inverters.

DC is the unidirectional flow of electric charge. If a constant voltage is applied across a purely resistive circuit, it results in a constant current. Comparatively, with AC, the flow of electric current periodically reverses polarity. The most typical AC waveform is a sine wave, but it can also be a triangular or square wave. In order to transfer electrical power with different current profiles, special devices are required. Devices that convert AC into DC are known as rectifiers and devices that convert DC into AC are known as inverters.

There are two main topologies of single-phase inverters; half-bridge and full-bridge topologies. This application note focusses on the full-bridge topology, since it provides double the output voltage compared to the half-bridge topology.

In a full-bridge topology 4 switches are needed, since the alternating output voltage is obtained by the difference between two branches of switching cells. The output voltage is obtained by intelligently switching the transistors on and off at particular time instants. There are four different states depending upon which switches are closed. The table below summarizes the states and output voltage based on which switches are closed.

To maximize the output voltage, the fundamental component of the input voltage on each branch must be 180? out of phase. The semiconductors of each branch are complementary in performance, which is to say when one is conducting the other is cut-off and vice versa. This topology is the most widely used for inverters. The diagram in Figure 1 shows the circuit of a full-bridge topology for a singlephase inverter.

The Insulated Gate Bipolar Transistor (IGBT) is like a MOSFET with the addition of a third PNjunction. This allows voltage-based control, like a MOSFET, but with output characteristics like a BJT regarding high loads and low saturation voltage.

The Pulse Width Modulation (PWM) Block is a useful block that can be used for a wide range of applications. The DCMP/PWM Block can be configured as a PWM Block. The PWM block can be sourced through FSM0 and FSM1. PWM IN+ pin is connected to FSM0 whereas IN- pin is connected to FSM1. Both FSM0 and FSM1 provides 8-bit data to PWM Block. PWM time period is defined by the time period of FSM1. The duty cycle for the PWM block is controlled by the FSM0.

There are different control methodologies that can be used to implement a single-phase inverter. One such control strategy includes a PWM-based square wave for the single-phase inverter.

A GreenPAK CMIC is used to generate periodic switching patterns in order to conveniently convert DC into AC. The DC voltages are fed from the battery and the output obtained from the inverter can be used to supply the AC load. For the purpose of this application note the AC frequency has been set to 50Hz, a common household power frequency in many parts of the world. Correspondingly, the period is 20ms.

The above switching patterns can be conveniently produced using a PWM block. The PWM time period is set by the time period of FSM1. The time period for FSM1 must be set to 20ms corresponding to 50Hz frequency. The duty cycle for the PWM block is controlled by the data sourced from FSM0. In order to generate the 50% duty cycle, the FSM0 counter value is set to be 128.