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# 3KW On-Grid Solar Inverter

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## 1 Introduction

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### 1 Introduction

The implementation of main control for 3KW On-Grid solar inverter reference design using an Infineon 16-bit microcontroller XE162FL.

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### 2 System Overview

The 3KW Solar Inverter is based on the Infineon 16-bit microcontroller application design. Its main control include: DC/DC boost PWM signal generation; DC/AC Inverter SPWM signal generation; PV voltage and current detection and protection control; Grid voltage and current and zero crossing signal detection and protection; MPPT and anti-islanding control algorithm; RS-232 and RS-485 communication interface control; LCD display control and system fault detection control and protection (Figure 1).

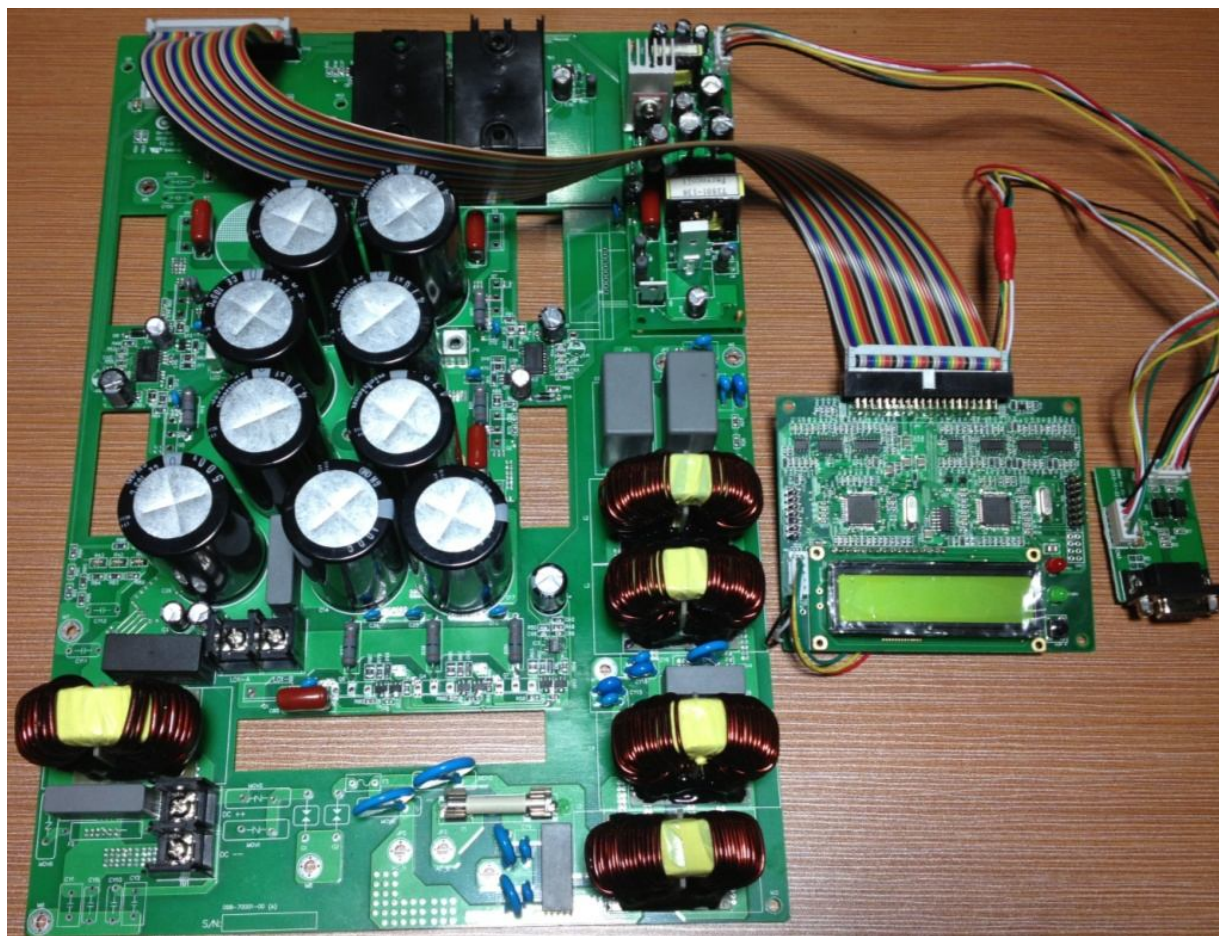
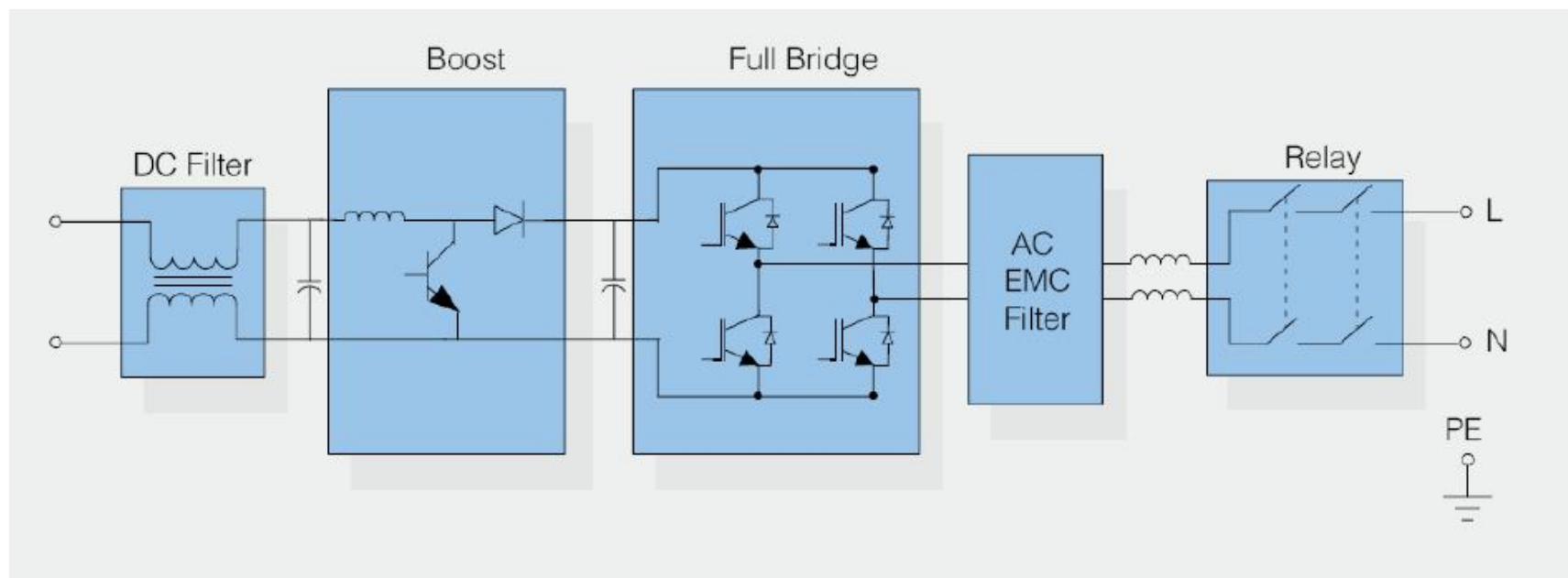


Figure 1 3KW Solar Inverter System Prototype

### 2.1 System Topology

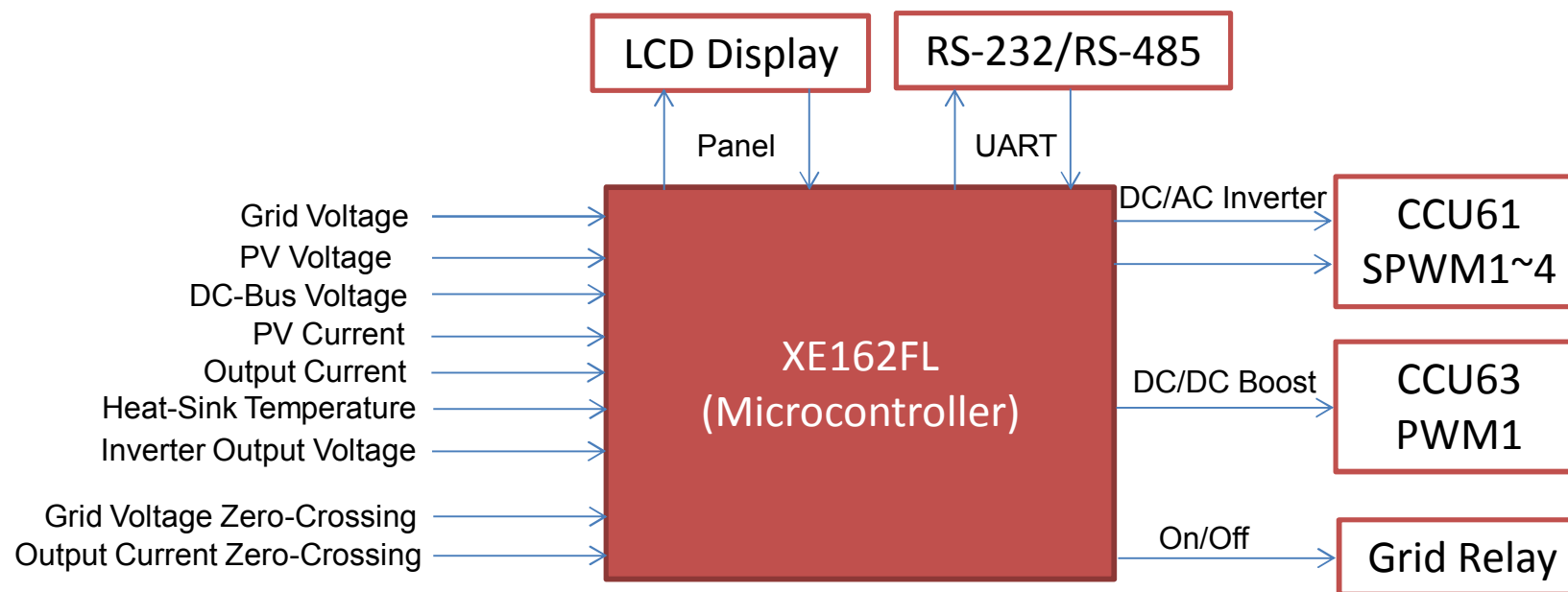


### 2.2 SPECIFICATIONS

MODELL	Solar3KW
INPUT(DC)	
Max. DC Power	3300W
Max. DC Voltage	500VDC
MPP Voltage Range	150VDC~450VDC
DC Nominal Voltage	370VDC
Number of MPP-Trackers/	1/A:1
Maximum Input Current	1 x 13A
OUTPUT(AC)	
AC Nominal Power	3000W
AC Grid Frequency	50Hz/60Hz
Nominal Output Current	13A
Nominal AC Voltage	230VAC
AC Voltage Range	184~270VAC
Power Factor @ Rated Power	>0.99
EFFICIENCY	
Maximum Efficiency (Reference)	97%
European Efficiency @ Nominal Voltage&100% Load(Reference)	95.5%
PROTECTION	
Grid Monitoring	Yes
AC Short Circuit Protection	Yes
DC Reverse-Polarity Protection	N.A
Ground Fault Monitoring	N.A

### 3 Main Control Principle

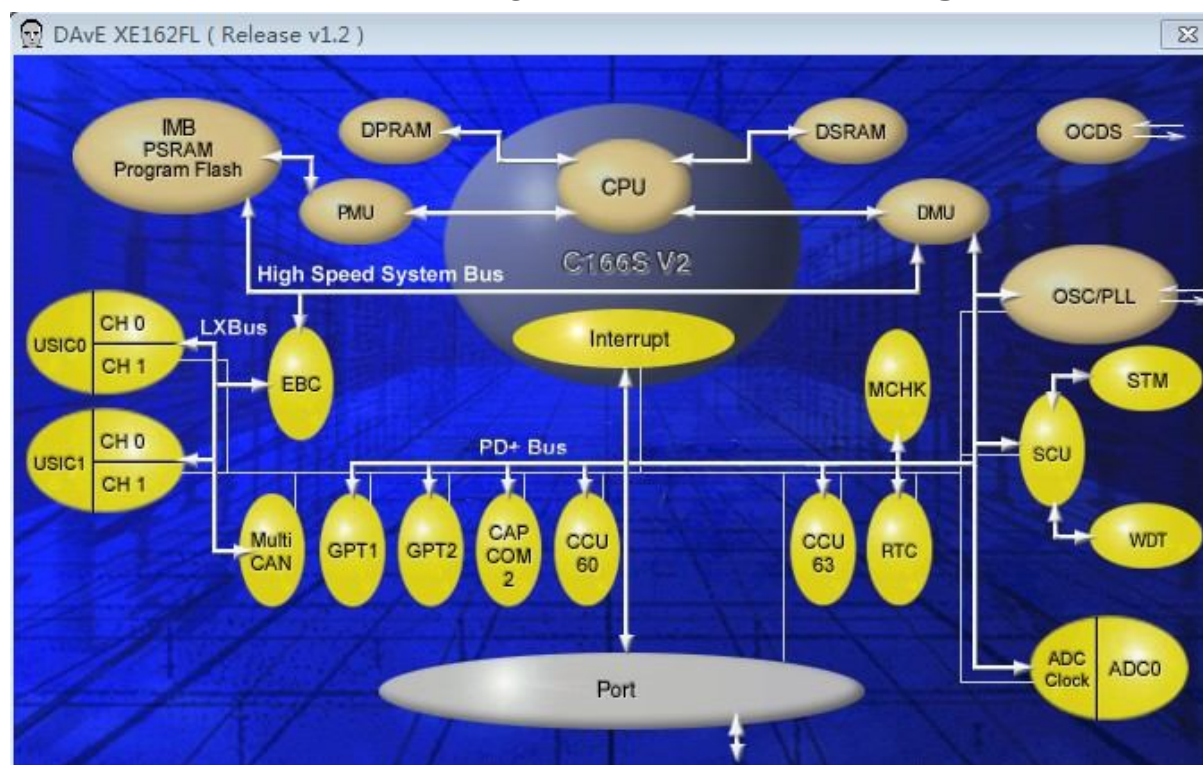
As introduced in the system overview section, an Infineon 16-bit microcontroller XE162FL is designed as the kernel of the main control circuit for the whole Solar Inverter system. The main control functions executed by microcontroller are briefly illustrated in Figure 2 .



**Figure 2 Main Control Functions Overview**

### 3.1 XE162FL Introduction

The resource of Infineon 16-bit microcontroller XE162FL utilized in this Solar Inverter reference design is illustrated in **Figure 3**



**Figure 3 XE162FL Overview (DAvE Interface)**



## 4 States Diagram and Flow Chart

### 4.1 States Diagram

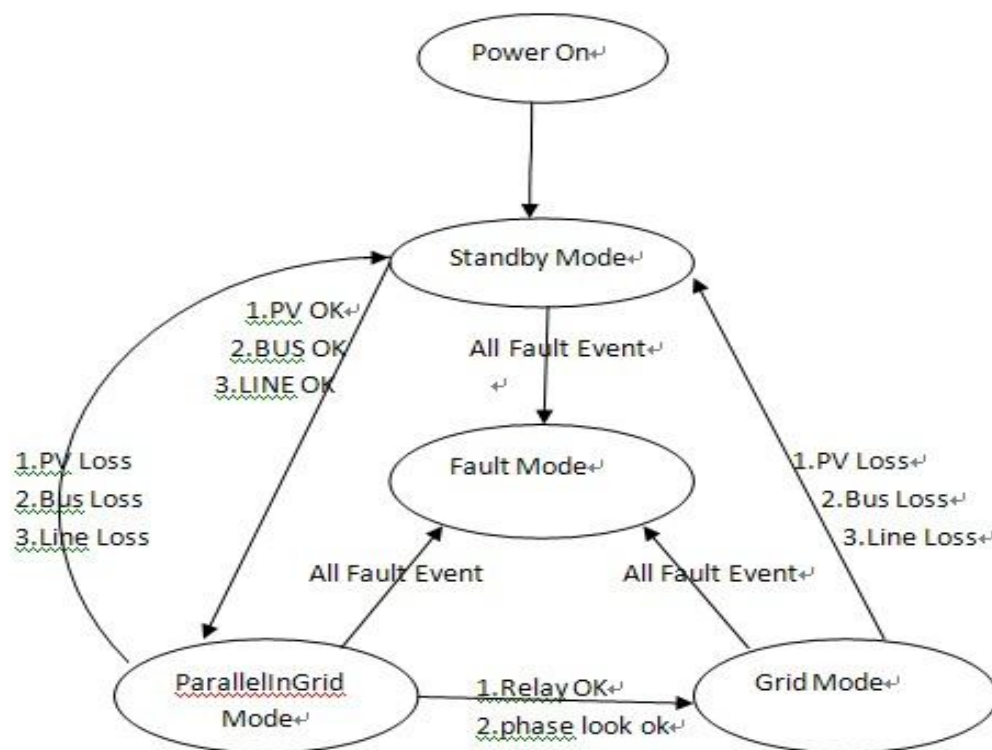


Figure 4 States Diagram



## 4 States Diagram and Flow Chart

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### 4.2 Flow chart

In this reference design, the software includes OS, Tasks, drivers and function modules. The OS is simple operating system, has two functions, one is task scheduling, the other is event processing, can support 16 tasks. At present, the three tasks are designed:

- . States machine task
- . Communication task
- . Miscellaneous task

The modules initialization and functions implementation of CCU6, ADC, URAT, GPT, CAPCOM2, etc. belong to driver. The function modules include algorithm implementation, common library and ISR. Such as boost control algorithm, inverter control algorithm, mppt algorithm, phase lock algorithm, island detecting, line detecting etc.



## 4.3 Main Flow Chart

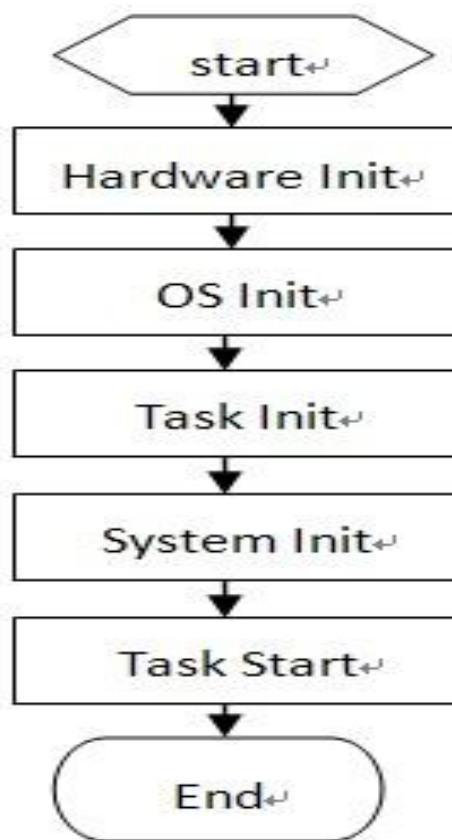


Figure 5 Main Flow Chart



4.4 SPWM Interrupt Routine Flow Chart

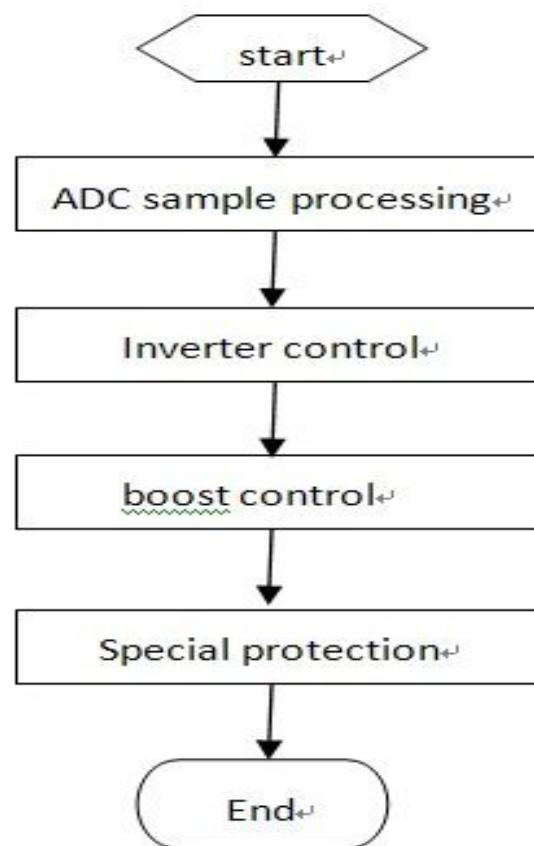
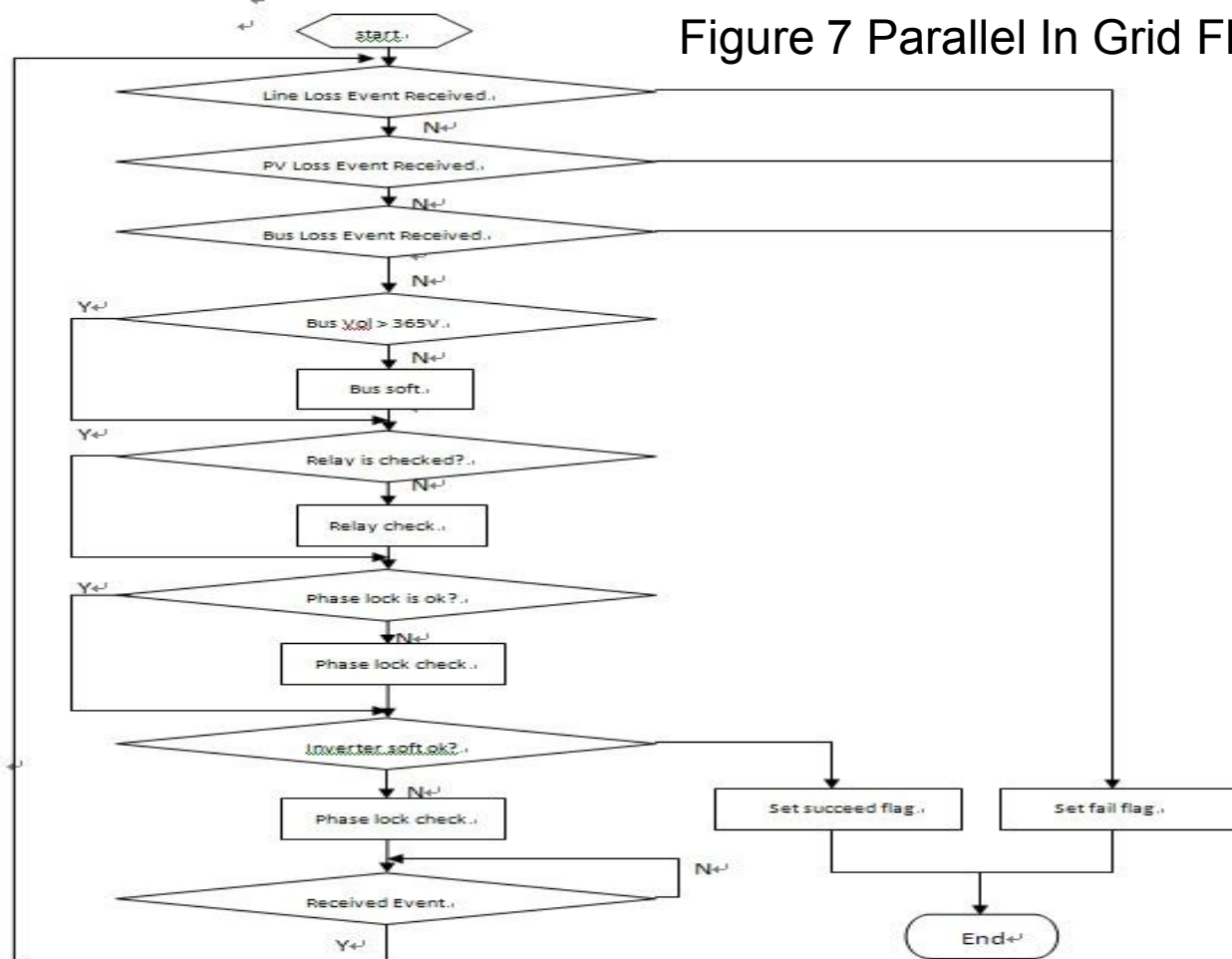


Figure 6 SPWM Interrupt Routine Flow Chart

## 4.5 Parallel In Grid Flow Chart

Figure 7 Parallel In Grid Flow Chart



## 5 Experiment Results

Figure 8 shows the measured voltage and Current waveform with Parallel Grid .

