High Speed Hair Dryer Solution Based on PY32M070

Introduction

This note will help customers to understand the basic principles and technical parameters of high speed hair dryer.

Table1. Applicable Products

Type	Product Series
Micro Controller Series	PY32M070

Contents

1   Overview of the Scheme

With the launch of Dyson's high-speed hair dryer in 2016, more and more companies are entering this field. Traditional hair dryers using DC motors are noisy, short-lived and limited by the larger size and weight of the motor, making it difficult to design a beautifully styled blow dryer, which no longer meets the market's new demands.

Therefore, Puya Semiconductor in order to meet the solution to such problems, launched a high-speed blow dryer based on PY32M070 chip control, compared with the traditional hair dryer, Puya Semiconductor's scheme has the following advantages: high balance accuracy, to achieve the motor work is a low vibration; motor noise is low, no metal rattles, stable control; intelligent thermostat, overload protection; anionic moisturising, increase the moisture of the hair, de-frizzing; Compact and lightweight, easy to carry and use.

The Puya solution uses three-phase sensorless FOC control with 220V voltage, maximum power of 1600W, and maximum speed up to 110,000 RPM. Sensorless FOC motor control is one of the popular motor control methods at present, which regulates three-phase currents in the motor winding to achieve the purpose of high efficiency and low noise operation of the motor. In the control process, PY32M070 chip can achieve stable control of motor speed operation through self-developed algorithms.

Puya Semiconductor launched a high-speed hair dryer scheme with adaptive motor algorithms, can effectively compatible with different types of motors, with low loss, smooth operation, low BOM cost and other advantages, perfect security protection mechanism, support for over-voltage protection, undervoltage protection, over-current protection, over-temperature protection, high-performance master control resources so that this power tool program has a very high cost-effective, to provide customers with customized mass production total-solution.

Features of high-speed blower based on PY32M070:

➢ Fast start, accelerates from 0 to 100,000 rpm in 400ms, speeds down to 0 in 350ms.

➢ High sinusoidal current waveform, low high-frequency noise and low current harmonic components

➢ The PWM frequency has a wide range of 15~30kHz to meet the low-frequencyrequirements of IPM modules.

➢ Puya sensorless FOC motor starting algorithm with 100% starting success rate.

➢ Adaptive control of the heating wire throwing wave, half-wave and full-wave heating can be controlled.

➢ Over-current, over-temperature, under-voltage, over-voltage, stall, blocking, disconnection, short circuit protection.

2 Application Block Diagram
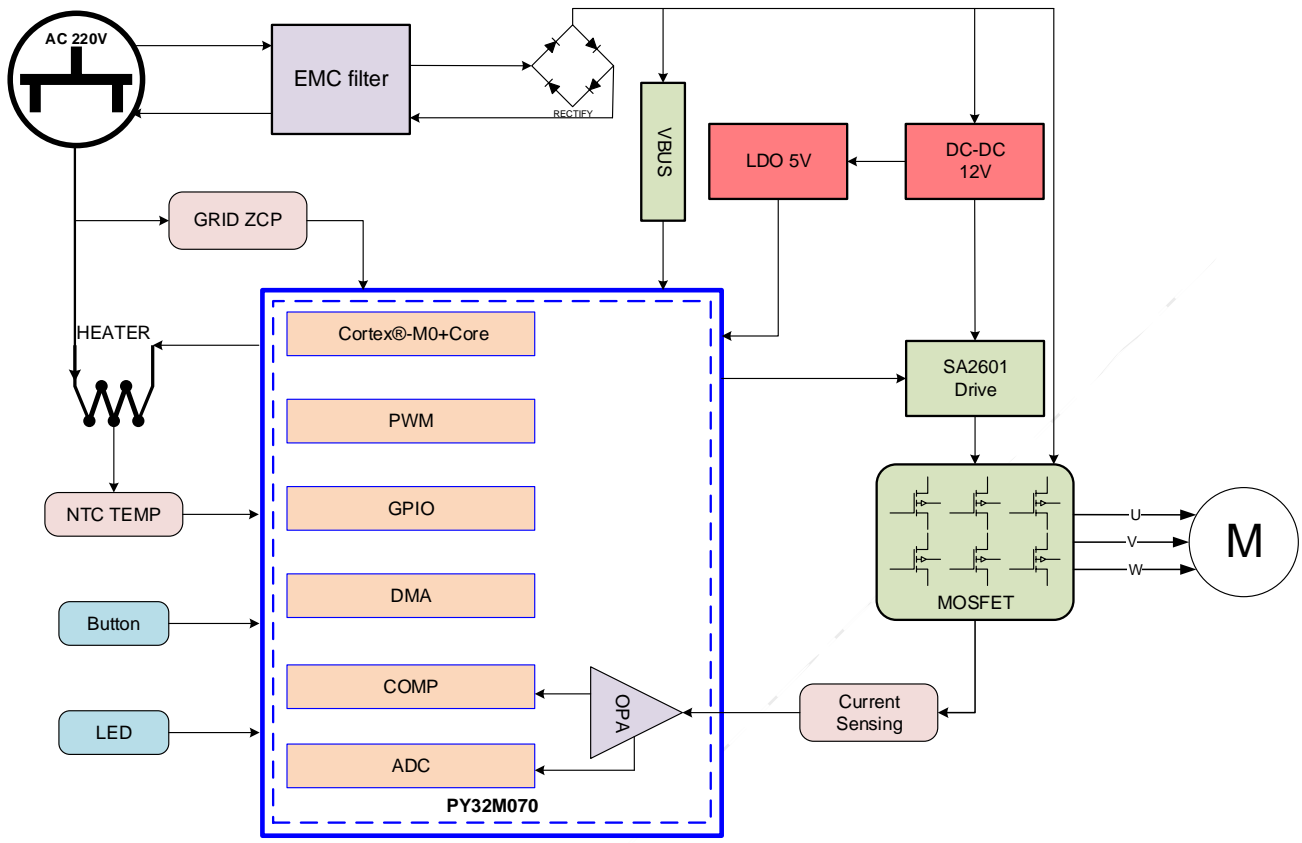
3   PY32M070 Series MCUs

The main control MCU is based on PY32M070 series microcontroller, which has balanced processing performance, absolute stability performance, rich peripheral interface and reliable safety performance. It provides mainstream solutions for various motor application scenarios and meets the requirements of high reliability and stability of motors.

PY32M070 series MCUs can be widely used in a variety of motor scenarios, such as motor control systems for electric boarders, fascia guns, high-speed blowers, violent fans, water pumps, pumps, electric toothbrushes, massagers, and so on.

- ➢ 32-bit ARM® Cortex® - M0+
- ➢ Maximum 128 Kbytes flash memory
- ➢ Maximum 16 Kbytes SRAM
- ➢ Up to 72 MHz operating frequency
- ➢ Two built-in operational amplifiers
- ➢ Communication interface: SPI *2, USART *4, I2C *2
- ➢ Provides a 12-bit ADC, 3 comparators, an advanced timer (TIM1), 8 general-purpose timers (TIM2/TIM3/TIM14/TIM15/TIM16/TIM17/TIM6/TIM7)
- ➢ Operating voltage: 1.7 V ~ 5.5 V
- ➢ Operating temperature range: -40 ~ 105°C

4 Technical Parameters

Motor Specifications	Hall-less three-phase BLDC motors
Control Method	FOC Sensorless String Wave
Grid Voltage Zero Crossing Detection	Resolution 40us
H-bridge Control Mode	Complementary PWM
PWM Frequency	25kHz
Electric Frequency Range	100~1800Hz
Input Voltage	AC 220V±20% / 110V±20%
Operating Current	1A
Highest Power	1600W
Maximum Speed	11,0000RPM
Current Sampling Method	Single Shunt Sampling
Initial Position Detection	Strong Drag Adaptive
Starting Method	Torque ring acceleration
Protective Function	Over-current, over-temperature, undervoltage, over-voltage, stall, blocking,disconnection, short-circuit protection
Development Software	Keil C

5 Puya's High-Speed Hair Dryer HMI

In order to facilitate the debugging of high-speed wind turbine, Puya Semiconductor has launched the PC HMI software: Puya High-speed Hair Dryer HMI-V1.00, on which the user can observe the running status of the motor in real time and detect the time of the motor starting and stopping. Users can also download the code and set parameters through this software, which greatly improves the speed of debugging.

6 PCBA
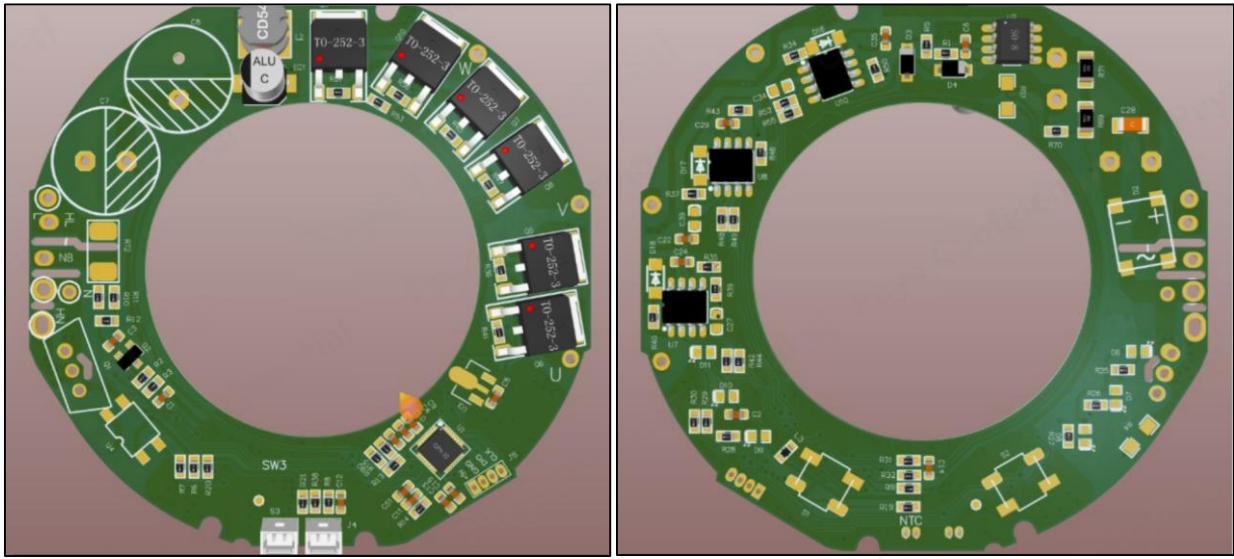
7 Version History

Revision	Dates	Changes
V1.0	2024.3.12	Initial release

Puya Semiconductor Co., Ltd.