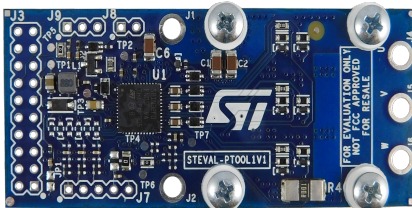# Compact reference design for low voltage brushless power tools based on STSPIN32F0B

Features

- 7 V - 45 V motor voltage rating supported
- Recommended for power tools supplied from 2S to 6S batteries
- Output current up to 15 Arms
- STSPIN32F0B advanced 3-phase motor controller tailored for single-shunt applications
- STL180N6F7 60 V, 1.9 mΩ N-channel power MOSFET
- Ultra-low standby current below 1μA thanks to an external turn-on/off trigger
- Heat sink for improved power dissipation
- Extremely compact footprint (70 mm x 30 mm)
- Input connector for Hall effect sensors and encoder
- Plug-and-play capability through six-step firmware with Hall effect sensor feedback
- Six-steps sensorless control available through dedicated BEMF sensing circuitry and sensorelss / sensored Field Oriented Control
- Speed regulation through an external trimmer
- Protections: thermal shutdown, UVLO, overcurrent and reverse biasing of power stage outputs
- SWD debug interface and direct firmware update (DFU) via UART

Description

This STEVAL-PTOOL1V1 compact 70 mm x 30 mm reference design board is tailored for low voltage power tools driven by 3-phase brushless motors, supplied by 2S to 6S batteries. The design is based on the STSPIN32F0B controller and STL180N6F7 (or STL220N6F7) Power MOSFET.

The board is ready for sensorelss and sensored FOC, and can be configured for six-step sensorless control through available BEMF sensing circuitry. The accompanying six-step STSW-PTOOL1V1 firmware uses position feedback from Hall effect sensors, with debugging and programming capability available through the SWD interface and the direct firmware update feature.
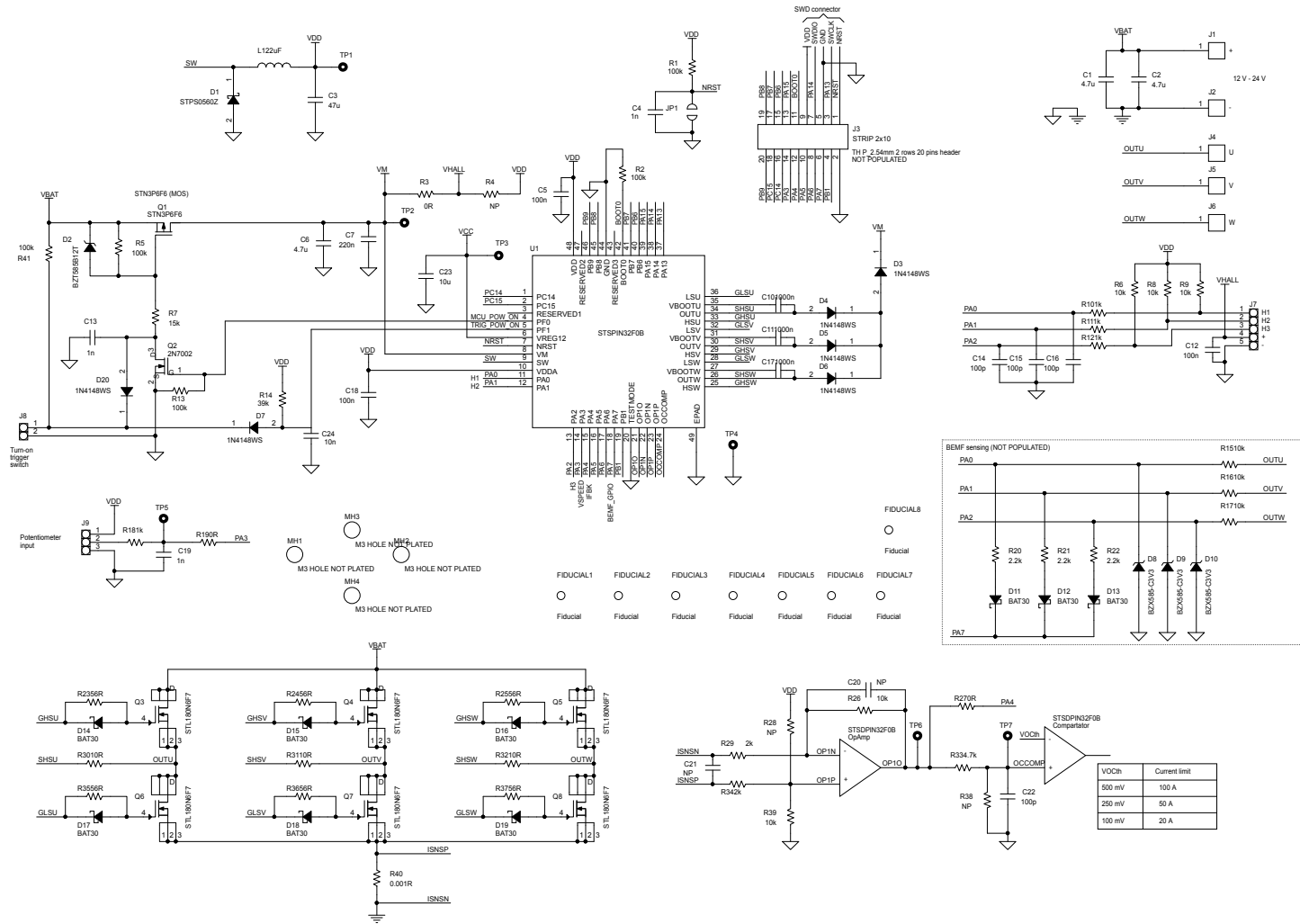
The board can deliver up to 15 A continuous current, thanks also to the optimal thermal dissipation provided by an embedded heatsink. It embeds a fast power-on circuit that connects and disconnects the battery, allowing standby consumption below 1 μA for extended battery duration. Several protection features are included, such as thermal shutdown, undervoltage lockout, overcurrent protection with programmable threshold and reverse biasing of power stage outputs.

This reference design is predominately intended for power tools, but is very suitable for any battery-powered application involving similar architecture, rating and performance. A potentiometer input for speed variation is available.

Product summary	
Reference design based on STSPIN32F0B for power tools driven by LV BLDC motors	STEVAL-PTOOL1V1
Reference firmware for low voltage three-phase brushless DC motors with STEVAL-PTOOL1V1	STSW-PTOOL1V1
N-channel 60 V STripFET F7 Power MOSFET in PowerFLAT 5x6 package	STL180N6F7
Advanced single shunt BLDC controller with embedded STM32 MCU	STSPIN32F0B
N-channel 60 V STripFET F7 Power MOSFET in PowerFLAT 5x6 package	STL220N6F7

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For further information contact your local STMicroelectronics sales office.

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1 Schematic diagrams

Figure 1. **STEVAL-PTOOL1V1 schematic diagram**

Revision history

Table 1. Document revision history

Date	Version	Changes
22-Sep-2020	1	Initial release.

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