



Roobokart v3

Datasheet

CPU: STM32F401RE

The STM32F401RE devices are based on the high-performance 32-bit ARM®Cortex® -M4 RISC core that operates at a frequency of up to 84 MHz. Its Cortex-M4® core is equipped with a single-precision floating-point unit (FPU) that supports all ARM single-precision data processing instructions and data types. It also implements a comprehensive set of DSP instructions and a memory protection unit (MPU) that improves application security.

The STM32F401xD/xE incorporates integrated high-speed memory (512 Kbytes of Flash memory, 96 Kbytes of SRAM) and a wide range of advanced I/O and peripherals connected to two APB buses, two AHB buses, and one multi-bit 32-bit AHB bus matrix.

All devices offer a 12-bit ADC, a low-power RTC, six general-purpose 16-bit timers, including a PWM timer for motor control, two general-purpose 32-bit timers. They are also equipped with standard and advanced communication interfaces.

Features

- Core: ARM®32-bit Cortex-M4® CPU with FPU, Adaptive real-time accelerator (ART Accelerator™) allowing 0-wait state execution from Flash memory, frequency up to 84 MHz, memory protection unit, 105 DMIPS/1.25 DMIPS/MHz (Dhrystone 2.1), and DSP instructions
- Memories
 - up to 512 Kbytes of Flash memory
 - up to 96 Kbytes of SRAM
- Clock, reset and supply management
 - 1.7 V to 3.6 V application supply and I/Os
 - POR, PDR, PVD and BOR
 - 4-to-26 MHz crystal oscillator
 - Internal 16MHz factory-trimmed RC
 - 32 kHz oscillator for RTC with calibration
 - Internal 32 kHz RC with calibration
- Power consumption
 - Run: 146 µA/MHz (peripheral off)
 - Stop (Flash in Stop mode, fast wakeup time): 42 µA Typ @ 25°C; 65 µA max @ 25°C
 - Stop (Flash in Deep power down mode, fast wakeup time): down to 10 µA @ 25°C; 30 µA max @ 25°C
 - Standby: 2.4 µA @25°C / 1.7 V without RTC; 12 µA @85°C @1.7 V
 - V_{BAT} supply for RTC: 1 µA @25°C
- 1×12-bit, 2.4 MSPS A/D converter: up to 16 channels
- General-purpose DMA: 16-stream DMA controllers with FIFOs and burst support



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- Up to 11 timers: up to six 16-bit, two 32-bit timers up to 84 MHz, each with up to four IC/OC/PWM or pulse counter and quadrature (incremental) encoder input, two watchdog timers (independent and window) and a SysTick timer
- Debug mode
 - Serial wire debugging (SWD) & JTAG interfaces
 - Cortex-M4[®] Embedded Trace Macrocell™
- Up to 81 I/O ports with interrupt capability
 - Up to 78 fast I/Os up to 42 MHz
 - All I/O ports are 5 V-tolerant
- Up to 12 communication interfaces
 - Up to 3 x I²C interfaces (SMBus/PMBus)
 - Up to 3 USARTs (2 x 10.5 Mbit/s, 1 x 5.25 Mbit/s), ISO 7816 interface, LIN, IrDA, modem control)
 - Up to 4 SPIs (up to 42Mbit/s at $f_{CPU} = 84$ MHz), SPI2 and SPI3 with muxed full-duplex I²S to achieve audio class accuracy via internal audio PLL or external clock
 - SDIO interface
 - Advanced connectivity: USB 2.0 full-speed device/host/OTG controller with on-chip PHY
- CRC calculation unit
- 96-bit unique ID
- RTC: subsecond accuracy, hardware calendar
- All packages (WLCSP49, LQFP64/100, UFQFPN48, UFBGA100) are ECOPACK*2

INERTIAL SENSORS AND MAGNETOMETER: LSM303AGR

LSM303AGR is an ultra-low-power, high-performance embedded system with a 3-axis digital linear acceleration sensor and a 3-axis digital magnetic sensor.

Features

- The LSM303AGR has a full scale linear acceleration of $\pm 2g/\pm 4g/\pm 8g/\pm 16g$ and a magnetic field dynamic range of ± 50 gauss.
- The LSM303AGR includes an I²C serial bus interface that supports standard, fast mode, fast plus mode, and high speed (100 kHz, 400 kHz, 1 MHz, and 3.4 MHz) and a standard SPI serial interface.
- The system can be configured to generate an interrupt signal for free fall, motion detection and magnetic field detection.
- Magnetic and accelerometer blocks can be enabled or put into off mode separately



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INERTIAL SENSORS: LSM6DSL

Characteristics

- The LSM6DSL is an integrated system comprising a 3D digital accelerometer and a 3D digital gyroscope that operates at 0.65 mA in high-performance mode and enables always-on low-power functions for an optimal motion experience for the consumer.
- LSM6DSL supports key operating system requirements, offering real, virtual and batch sensors with 4 kbytes for dynamic batch data.
- The various sensing elements are made using specialized micromachining processes, while the IC interfaces are developed using CMOS technology that allows the design of a dedicated circuit that is cut out to better fit the characteristics of the sensing element.
- The LSM6DSL has a full-scale acceleration range of $\pm 2/\pm 4/\pm 8/\pm 16$ and an angular velocity range of $\pm 125/\pm 245/\pm 500/\pm 1000/\pm 2000$ dps.

MOTOR CONTROL: STSPIN240

The STSPIN240 is a double-brushed DC motor driver that integrates a low RDS(ON) power stage into a small 3 mm x 3 mm QFN package. Both complete bridges implement an independent PWM current controller with fixed shutdown time. The device is designed to operate in battery-powered scenarios and can be forced into a zero-power state allowing for a significant increase in battery life. The device offers a full set of protection features including over-current, over-temperature and short-circuit protection.

PROXIMITY SENSORS: 3 VL53L3CX ToF with multi target detection

The VL53L3CX is STMicroelectronics' latest Time-of-Flight (ToF) product and incorporates ST's patented third-generation FlightSense technology. It combines a high-performance proximity and distance sensor, with multi-target distance measurements and automatic smudge correction. The device integrates a single array of photonic avalanche diodes (SPADs) and physical infrared filters to achieve the best performance in various ambient lighting conditions.

The VL53L3CX combines the advantages of a high-performance proximity sensor with excellent linearity at short distances, along with a range capacity of up to 5 m

Features



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- Fully integrated miniature module
 - Emitter: 940 nm invisible laser (VCSEL) and its analog driver
 - Low-power microcontroller running advanced digital firmware
 - Size: 4.4 x 2.4 x 1 mm
- Fast, accurate distance ranging
 - Histogram based technology
 - Up to 500 cm+ detection with full field of view (FoV)
 - Immune to cover glass cross-talk and fingerprint smudge at long distance with patented algorithms (direct ToF)
 - Dynamic fingerprint smudge compensation
 - Short distance, high accuracy linearity
 - Multi target detection and distance measurement
- Typical full FoV: 25 °
- Easy integration
 - Reflowable component
 - Part-to-part or generic shape crosstalk calibration available
 - Single power supply
 - Works with many types of cover glass materials
 - I²C interface (up to 1 MHz)
 - Xshutdown (reset) and interrupt GPIO to optimize ranging operation
 - C and Linux full set of software drivers for turnkey ranging

ENVIRONMENT LIGHT SENSOR: VD6283TX

The VD6283 (1.83 x 1.0 x 0.55 mm) is ST's new color sensor with advanced light flicker extraction. Light measurement is fast and accurate thanks to an individual ADC and a reading for each color channel. The VD6283 uses hybrid color filters with precise responses that allow accurate calculation of correlated color temperature (CCT) and Lux information. The VD6283 can be used for display brightness management or scene light correction.

Features

- Miniature optical module
 - 1.83 x 1.0 x 0.55 mm
 - Optical BGA, 6-balls, reflowable package
 - Operates with cover glass on top
- ALS operation with 6 independent channels
 - Advanced hybrid filters with high photocount response
 - Parallel sensing of all channels: red, green, blue, IR, clear, and visible
 - Operating conditions: 7 mLux to 30 kLux (green channel)
- Light flicker extraction
 - Innovative readout architecture to extract AC light flicker signal



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- From 100 Hz to 2 kHz frequency detection, sine or square wave
- Software driver provided by ST
- I2C interface up to 1 Mbit/s (Fast mode plus)
- 1.8 V power supply
- Low-power consumption
- Operating temperature -30 to 85 °C

USER INTERFACE

- Buzzer
- CPU Reset Button
- Programmable button
- Support LCD display on SPI bus
- Support SD card reader over SPI bus
- Standard Arduino(R) connector

CONNECTIVITY

Provision through special connectors for Bluetooth and Wifi modules

Line followers

4 IR sensors for the implementation of line following algorithms.