



What is around the STM32 ARM® Cortex™-M3?

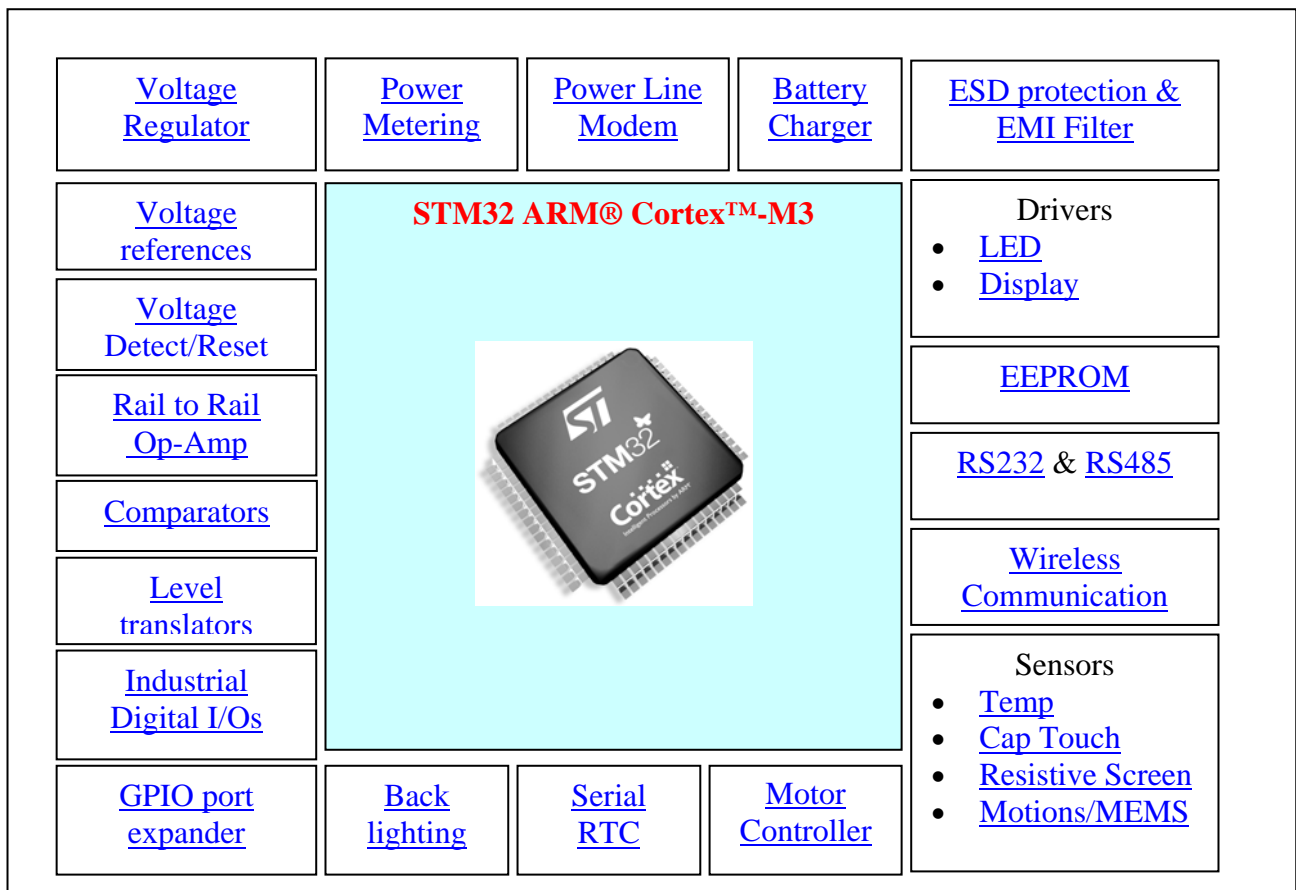
1) INTRODUCTION

Applications using the STM32 ARM® Cortex™-M3 need to use external devices such as voltage regulators, buffers, level translators, etc. to achieve the application functionality.

This document describes examples of external devices, which meet the STM32 ARM® Cortex™-M3 requirements.

- Complementary devices or devices providing improved function.
- Application oriented devices.

The presented devices are not the only options ST can offer, but rather a starting point.





Complementary devices or devices providing improved function

2) Voltage Regulators

The voltage regulator is probably the device that is used with the majority of applications.

The STM32 ARM® Cortex™-M3 requires a 2.0-3.6V operating voltage supply (VDD), with a total current up to 150mA (included the I/O current). Depending on the application requirements, it is possible to use either a linear or a switching voltage regulator.

The following are just a few of the many voltage regulators ST offers:

Linear:

- [LD3985](#) :150mA
- [LD2985](#) :150mA
- [LK112S](#): 200mA
- [L4931](#): 250mA
- [KFxxB](#): 500mA, SO-8 or DPAK
- [LD39080](#): 800mA, PPAK, DFN8
- [STLQ50xx](#): 50mA, Iq=3µA, low drop,SOT23
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Switching Step-down

- [ST2S06A33](#): Dual 500mA, 3.3V + ADJ
- [L5980](#): 700mA, VFQFPN8
- [L6928](#): 800mA, MSOP8
- [ST1S03](#): 1.5A, DFN6
- [ST1S10](#): 3A Synchronous, DFN8

Switching Step-up

- [L6920DB](#): 750mA, MSOP8

3) Voltage Detectors and Resets

The STM32 ARM Cortex has an embedded reset at 1.9V and a programmable voltage detector that will work fine in many applications. But some applications need a tighter voltage that the one offer by the STM32 (+/-5% accuracy) ST offers a family of voltage detectors that will meet your specific requirements

- [STM1061](#) : low power voltage detectors +/-2% accuracy

4) Serial RTCs

The STM32 ARM Cortex has an embedded timer to make a Real Time Clock.

An external RTC can be necessary for instance in portable applications with a voltage range from 3.6V to 4.2v, where the RTC can be connected directly to the battery while the system is off. Such as rechargeable lithium batteries, where the common charged voltages is 4.2V. As the STM32 can withstand only up to 3.6V, an external component is necessary.

- [M41T62](#) : I²C RTC, operating Voltage range from 1.3V to 4.4V, QFN16

5) Output buffering

The STM32 ARM® Cortex™-M3 GPIOs (general purpose input/outputs) can sink or source up to ±8 mA, and sink +20 mA (with a relaxed VOL). The number of I/O pins which can drive current in the user application must be limited in order to respect the device's absolute maximum ratings:

- The sum of the currents sourced by all the I/Os on VDD, plus the maximum Run consumption of the MCU sourced on VDD, cannot exceed the absolute maximum rating IVDD =150mA
- The sum of the currents sunk by all the I/Os on VSS plus the maximum Run consumption of the MCU sunk on VSS cannot exceed the absolute maximum rating IVSS =150mA.

Applications that need to either sink or source more than 150mA have to use external buffer to provide the additional current.

Buffer6:

- 16 bit: [74VCX16244](#), [74LCX16244](#), [74ALVCH16244](#)
- 8 bit :[74LCX244](#)
- Single gate: [74LX1G07](#), [74LX1G70](#)
- [ULN200x](#): 7 Darlington Array to drive triacs/relays



6) Voltage references for ADC

An external low power voltage reference can be used to maintain ADC accuracy independent of vcc variation such as in battery-powered applications.

- [TS431](#): adjustable shunt reference from 1.24V to 6V, SOT23-5, TO-92
- [TS432](#): adjustable shunt reference from 1.24 to 10V, SOT23-3

7) Rail-to-rail op-amp for increased ADC resolution accuracy

Rail-to-rail op-amps are useful to amplify an analog input so that the entire ADC resolution can be used for measurements. ADC Analog input is 0V to 2.4V if an external reference is used, otherwise it is 0V to VCC.

- [TS185x](#): 1.8V input/output rail-to-rail, Low power single, dual and quad op-amp, Icc 120µA
- [TS187x](#): 1.8V input/output rail-to-rail, Low power single, dual and quad op-amp, GBP 1.6MHz
- [TSV91x](#): Single dual and quad, I/O rail-to-rail, 1pA input bias current, GBP 8MHz, SOT23-5
- [TS922A](#): Rail-to-rail high output current dual op-amp, 80mA Iout, Offset voltage 900µV
- [TS95x](#): Single dual and quad, I/O Rail-to-Rail, Low Power Op-Amp, GBP 3MHz
- [TS507](#): High precision rail-to-rail, ultra low offset voltage 100µA max, SOT23-5

8) RS232 interfaces @ 3V

The STM32 ARM® Cortex™-M3 handles the RS232 protocol, but it needs an external interface to set the correct signal electrical levels:

- [ST3222Exx](#): 2 Drivers & 2 Receivers, ±15KV ESD protection
- [ST3232Exx](#): 2 Drivers & 2 Receivers, ±15KV ESD protection
- [ST3243Exx](#): 3 Drivers & 5 Receivers, ±15KV ESD protection

9) RS485 interfaces @ 3V

The STM32 ARM® Cortex™-M3 handles the RS485 protocol, but it is needs an external interface to set the signal electrical levels:

- [ST3485E](#): 1 Transceiver, ±15KV ESD protection
- [ST485AB](#): 1 Transceiver, very high speed, low power RS485, ±4kESD protection
- [ST1480A](#): 1 Transceiver, ±15KV ESD protection

10) Comparators

- [TS7211](#): Single BiCMOS rail-to-rail micro-power comparator, push-pull output
- [TS7221](#): Single BiCMOS rail-to-rail micro-power comparator, open drain output
- [TS86x](#): rail to rail micro-power BiCMOS comparators family (single, dual & quad), push-pull output
- [TS3021/2](#): Rail-to-rail 1.8V high-speed comparators (single dual), push-pull output



11) Level translators

The STM32 ARM® Cortex™-M3 logic inputs are 5 volt tolerant, so a level translator is not needed for a 5V input signal. Due to the input thresholds, a level translator is necessary with a 1.8V input signal.

The outputs of the STM32 can be configured as open drain and, depending on the reference voltage of the external pull-up, it is possible to create a level translator, but the output current capability is low. Using a level translator increases the current capability.

1.8V to 5.0V

- [ST2329](#): 2-bit Dual Supply Level Translator, 1.8V to 5V
- [ST2349](#): 4-bit Dual Supply Level Translator, 1.8V to 5V
- [ST2378E](#): 8-bit Dual Supply Level Translator, 1.71V to 5.5V, 15KV ESD protection, no direction pin

3.0V to 5.0V

- [74LVXC3245](#): 8-bit dual supply level translator, 2.7V to 5.5V.

1.8V to 3.0V

- [74VCX1632245](#): 16-bit dual supply Level Translator 1.8V to 3V.

12) ESD protection

USB

- [USBLC6-2](#): Very low capacitance ESD protection for USB2.0.
- [USBUF01P6](#): EMI filter and line termination for USB upstream ports (low and full speed)

RS232/RS485

- [ESDA25B1](#): Transil™ array for bidirectional ESD protection, 25V breakdown, RS232
- [ESDA25-4BP6](#): Transil™ array for bidirectional ESD protection, 25V breakdown, RS232
- [ESDA14V2BP6](#): Transil™ array for bidirectional ESD protection, 14.2V breakdown, RS485

I/O

- [ESDA5V3SC](#): Quad Transil™ array for ESD protection, 5.3V breakdown

13) EEPROM

I²C

- [M24xxx](#): Serial I²C EEPROM, 1Kbit to 1Mbit, 1.8V to 5.5V

SPI

- [M95xxx](#): Serial I²C EEPROM, 1Kbit to 1Mbit, 1.8V to 5.5V





Application Oriented Devices

14) Backlight

- [STCS1](#): Linear Single channel constant current LED driver
- [STLD20](#): 4 white LED boost power supply
- [STLD40](#): 10 white LED boost power supply
- [STOD1412](#): AMOLED (Active Matrix Organic LED) display power supply
- [STOD2540](#): PMOLED (Passive Matrix Organic LED) display power supply

15) LED driver

If a great amount of external LEDs have to be driven then:

24 bit

- [STP24DP05](#): 24-bit constant current LED driver with outputs error detection r (datasheet available on st.com end of May 08)

16 bit

- [STP16CP05](#): 16-bit constant current LED driver
- [STP16CPS05](#): 16-bit constant current LED driver with auto power saving
- [STP16DP05](#): 16-bit constant current LED driver with outputs error detection

8 Bit

- [STP08CP05](#): 8-bit constant current LED driver
- [STP08DP05](#): 8-bit constant current LED driver with outputs error detection

16) LED Display Driver

- [STLED316S](#): 6-digit LED controller with key scan

17) VFD Display Driver

- [STFPC311](#): VFD controller/Driver, 12 seg/16 Dig to 20 Seg/8 Dig, SPI protocol
- [STFPC320](#): VFD controller/Driver, 12 seg/16 Dig to 20 Seg/8 Dig, I²C protocol
- [STM86312](#): VFD controller/Driver, 11 Seg/11 Dig to 16 seg/4 Dig, SPI protocol

18) GPIO port expander

- [STMPE801](#): 8-bit port expander, I²C
- [STMPE2403](#): 1.8V, 24-bit port expander, Keypad, PWM controller, I²C (1.8V to 3.3V)
- [STMPE2401](#): 1.8V, 24-bit port expander, Keypad, PWM controller, I²C (1.8V to 3.3V)

19) Capacitive Touch Sensor

- [STMPE821](#): 8 channel cap-sensing, I²C
- [STMPE1208](#): 12 channel cap-sensing + 12 GPIO, I²C

20) Resistive Screen Controller

- [STMPE811](#): 8-bit port expander with touch screen controller, 12bit ADC, I²C



21) Temperature sensor

The STM32 ARM® Cortex™-M3 has an internal temperature sensor, which generate a voltage proportional to the variation in temperature. The conversion range is between $2\text{ V} < V_{DDA} < 3.6\text{ V}$. The temperature sensor is internally connected to the ADC_IN16 input channel, which is used to convert the sensor output voltage into a digital value. However, those applications that require a remote temperature sensor can use:

- [STCN75](#): Digital temperature sensor, thermal watchdog, I²C
- [STDS75](#): Digital temperature sensor, thermal watchdog, I²C
- [STLM20](#): Precision analog temperature sensor
- [STLM75](#): Digital temperature sensor, thermal watchdog, I²C
- [STTS75](#): Digital temperature sensor, thermal watchdog, I²C

22) Smart card interface

- [ST8004](#): Analog interface for asynchronous 3V and 5V smart cards.
- [ST8024](#): Analog interface for asynchronous 3V and 5V smart cards

23) Audio Amplifier

The STM32 ARM® Cortex™-M3 can be used to generate an audio signal in PWM format, but the device doesn't have the capability to drive directly a speaker (power limitation). Using an external audio amplifier it is possible to filter the signal and add enough power to drive a speaker up to 1.2W.

- [TS92x](#): Rail-to-rail high output current (80mA) operational amplifier series
- [TS419 & TS421](#): 360mW mono audio amplifier with active high/low standby mode
- [TS486 & TS487](#): 100mW stereo headphone amplifier with active low/high standby mode
- [TS4975](#): 100mW stereo headphone amplifier with digital volume control via I²C bus
- [TS4890](#): 1W mono audio power amplifier with standby active low
- [TS4871](#): 1W mono audio power amplifier with standby active high
- [TS4990](#): 1.2W mono audio power amplifier with active low standby mode
- [TS4985](#): 2x1.2W stereo audio power amplifier with dedicated standby pin

To reach an output power of up to 3W it is possible to use an external Class D audio amplifier such as:

- [TS4962M](#): 3W filter-free class D audio power amplifier
- [TS2007](#): 3W filter-free Class D audio power amplifier with 6-12dB fixed gain select

Microphone preamplifier

- [TS472](#): Very low noise microphone preamplifier, 2V biased output, active low standby mode

24) Motor Controller

Low voltage monolithic motor driver

- [L6208](#): DMOS driver for bipolar stepper motor
- [L620x](#): DMOS dual full bridge driver
- [L6219](#): Stepper Motor Driver family
- [L6235](#): DMOS driver for three-phase brushless dc motor
- [L6226Q](#): Dual full bridge driver for bipolar stepper or 2xDC motor in VFQFPN 5x5
- [L6227Q](#): Dual full bridge driver for bipolar stepper or 2xDC motor in VFQFPN 5x5 with PWM controller



High voltage motor drives

- [L638x / L639x](#): HV half-bridge drivers
- [TD35x](#): Industrial IGBT/MOSFET driver with enhanced features
- IGBTs/PowerMOSFETs

25) MEMS

- [LIS302DL](#): 3-axis accelerometer, $\pm 2g/\pm 8g$, 8-bit resolution, I²C/SPI digital output interface
- [LIS3LV02DL](#): 3-axis accelerometer, $\pm 2g/\pm 6g$, 12-bit resolution, I²C/SPI digital output interface
- [LIS244AL](#): 2-axis accelerometer, $\pm 2g$, analog output
- [LIS344ALH](#): 3-axis accelerometer, $\pm 2g/\pm 6g$ /, analog output
- [LIS302SG](#): 3-axis accelerometer, $\pm 2g$, analog output

26) Battery Charger

- [L6924D](#): Battery Charger System for Li-Ion / Li-Polymer, VFQFPN16
- [STBC08](#): 800mA Standalone linear Li-Ion Battery charger with thermal regulation, DFN6
- [STC4054](#): 800mA Standalone linear Li-Ion Battery charger with thermal regulation, TSOT23-5L

27) Power Line Modem

- [ST7540](#): FSK power line transceiver, HTSSOP28
- [ST7538](#): FSK power line transceiver, TQFP44

28) Power Metering

- [STPM01](#): Programmable single phase energy metering IC with tamper detection, TSSOP20
- [STPM1x](#): Single phase energy metering IC with pulsed output and digital calibration, TSSOP20

29) Wireless Communication

- [SN260](#): ZigBee 802.15.4 network controller SOC STM32 connectivity via SPI
- [SPZB260](#): ZigBee 802.15.4 ZigBee Module STM32 connectivity via SPI
- [STLC2500D](#): Bluetooth V2.1 communication controller STM32 connectivity via SPI or UART
- [SPBT2563C1](#): Bluetooth class 1 module STM32 connectivity via SPI or UART

30) Digital Industrial I/Os

Current terminated digital input

- [CLT3-4B](#): Quad current limited over-voltage protected digital termination
- [PCLT-2A](#): Dual current limited over-voltage protected digital termination

Intelligent Industrial Power Switches

- [VN751PT](#): Single 2,5A / 36V fully protected high side switch in PPAK
- [VN751S](#): Single 2,5A / 36V fully protected high side switch in SO8
- [VN808CM](#): Octal 0,7A / 45V fully protected high side switch in PowerSO-36
- [VN808CM-32](#): Octal 1,0A / 45V fully protected high side switch in PowerSO-36
- [VNI4140K](#): Quad 0,7A / 41V fully protected high side switch in PowerSO-24 with extended diagnostic



APPENDIX

In addition to the single devices here presented, STMicroelectronics proposes a wide range of evaluation boards that may be used to perform a comprehensive evaluation of ST's products and solutions while reducing the customer development time.

These evaluation boards are classified as:

- product evaluation boards that help the customer to evaluate the features and performance of selected products,
- system evaluation boards that propose optimized and tested solutions for application design,
- sample and promotion kits that propose a selection of similar or complementary products.

These boards are intended solely for your evaluation, design and testing purposes.

Evaluation Boards Families

Product Evaluation Boards and Kits

- [Amplifier & Linear ICs](#)
- [Audio](#)
- [Imaging](#)
- [Power Management ICs](#)
- [Motion Sensors \(MEMS\)](#)
- [RF Power](#)

System Evaluation Boards

- Article I. [Audio](#)
- Article II. [Communication & Connectivity](#)
- Article III. [Factory Automation](#)
- Article IV. [Home Automation](#)
- Article V. [Home Appliance Control](#)
- Article VI. [Imaging](#)
- Article VII. [Lighting](#)
- Article VIII. [Metering](#)
- Article IX. [Motor Control](#)
- Article X. [PC Peripheral Interface](#)
- Article XI. [Power Supply & Power Management](#)
- Article XII. [Set Top Box](#)
- Article XIII. [Wired Connectivity](#)

Brochures and Products Guides

- [Evaluation boards : STMicroelectronics application support](#) (Brochure, PDF)
- [ST Evaluation Boards](#)

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