TouchGFX optimized graphic framework software expansion for STM32Cube

X-CUBE-TOUCHGFX

TouchGFX GENERATOR

STM32CubeMX plugin

Graphic HW and SW configuration and project generation

TouchGFX DESIGNER

TouchGFX PC tool

Graphic application development and simulation

TouchGFX ENGINE

TouchGFX embedded library

Optimized and Hardware accelerated graphic library
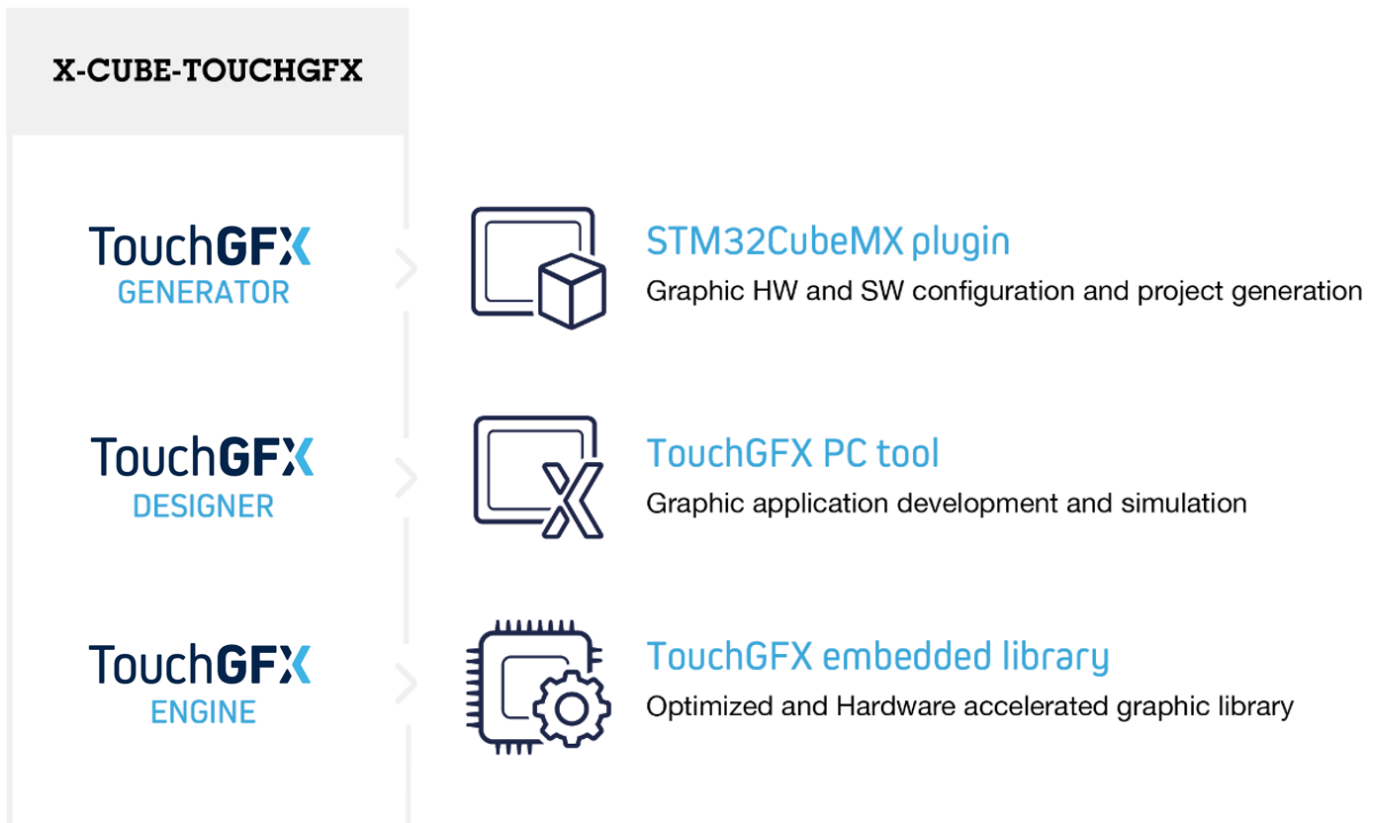
Product status link
X-CUBE-TOUCHGFX

TouchGFX

STM32 Cube

DB4098 - Rev 3 - September 2020
For further information contact your local STMicroelectronics sales office.

www.st.com

Features

- Smartphone animations
  - TouchGFX (available as X-CUBE-TOUCHGFX Expansion Package) enables smartphone animations such as swipe, scroll, 3D effects, video playback, and others
  - Supports transparency, alpha-blending, anti-aliased fonts and kerning
  - Instant interaction from touch display or hard-keys at the user's choice
- Easy programing
  - TouchGFX Designer offers drag-and-drop programming with automatic code generation
  - More than 30 widgets (such as swipe container, animated image, shapes, clock, scroll list, and others)
  - Custom triggers and actions
  - Easy addition of own C++ developer code for the creation of any unique UI application
  - Support of a variety of IDEs such as IAR Systems IAR Embedded Workbench®, Arm® Keil® MDK, and GCC-based IDEs such as STM32CubeIDE
  - Easy interfacing with any C code using the *Model-View-Presenter* pattern
- Minimum CPU load and footprints
  - Taking full benefit of STM32 graphic hardware accelerators
  - Optimized library footprints requiring from 20 Kbytes of Flash memory and 10 Kbytes of RAM
  - Partial frame buffering minimizing graphic buffer sizes and enabling graphic UI support from lowest-cost STM32 options
  - Running with RTOS or on bare metal, supporting the STM32 microcontrollers based on the Arm® Cortex®-M0+, M3, M4, M33 and M7 processors
- Fast start of UI development
  - STM32 display kits are fully supported (one click) in TouchGFX Designer
  - TouchGFX Generator helps users start on their own STM32 hardware
  - Reference demo examples demonstrate achievable UI performance
- Part of STM32 ecosystem
  - TouchGFX Engine compiled library running on any STM32 microcontroller
  - Smooth interoperability with STM32Cube MCU Packages, STM32CubeMX and STM32CubeIDE
  - TouchGFX project examples using STM32CubeMX, STM32CubeIDE, and STM32Cube MCU Packages
- Support and documentation
  - TouchGFX knowledge base for technical literature
  - Active TouchGFX community for online support and graphical discussions
  - Videos and webinars addressing embedded graphic topics

Description

TouchGFX is an advanced, free-of-charge GUI optimized for STM32 microcontrollers. Taking advantage of the STM32 graphical hardware acceleration, architecture, and ecosystem, TouchGFX accelerates the HMI-of-Things revolution through the creation of stunning smartphone user interfaces on embedded devices ranging from simple low-color UI applications up to high-resolution and high-color UI applications.

TouchGFX is optimized for STM32 microcontrollers, needing only a limited amount of memory for running smooth GUIs.

The TouchGFX solution is distributed as an STM32Cube Expansion Package (X-CUBE-TOUCHGFX), which includes all TouchGFX software to hep users develop their UI application. TouchGFX interoperability within the STM32 ecosystem provides users with an easier and faster development process.

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1 Detailed description

1.1 Ordering information

X-CUBE-TOUCHGFX is available for free download from the *www.st.com* website.

1.2 What is STM32Cube?

STM32Cube is an STMicroelectronics original initiative to significantly improve designer's productivity by reducing development effort, time and cost. STM32Cube covers the whole STM32 portfolio.

STM32Cube includes:

- A set of user-friendly software development tools to cover project development from the conception to the realization, among which are:
  - STM32CubeMX, a graphical software configuration tool that allows the automatic generation of C initialization code using graphical wizards
  - STM32CubeIDE, an all-in-one development tool with peripheral configuration, code generation, code compilation, and debug features
  - STM32CubeProgrammer (STM32CubeProg), a programming tool available in graphical and command-line versions
  - STM32CubeMonitor (STM32CubeMonitor, STM32CubeMonPwr, STM32CubeMonRF, STM32CubeMonUCPD) powerful monitoring tools to fine-tune the behavior and performance of STM32 applications in real-time
- STM32Cube MCU and MPU Packages, comprehensive embedded-software platforms specific to each microcontroller and microprocessor series (such as STM32CubeF7 for the STM32F7 Series), which include:
  - STM32Cube hardware abstraction layer (HAL), ensuring maximized portability across the STM32 portfolio
  - STM32Cube low-layer APIs, ensuring the best performance and footprints with a high degree of user control over the HW
  - A consistent set of middleware components such as RTOS, USB, FAT file system, graphics and TCP/IP
  - All embedded software utilities with full sets of peripheral and applicative examples
- STM32Cube Expansion Packages, which contain embedded software components that complement the functionalities of the STM32Cube MCU and MPU Packages with:
  - Middleware extensions and applicative layers
  - Examples running on some specific STMicroelectronics development boards

1.3 How does this package complement STM32Cube?

The X-CUBE-TOUCHGFX Expansion Package is composed of three main tools:

- TouchGFX Engine:

  The TouchGFX compiled library runs on any STM32 microcontroller with any RTOS or bare metal. TouchGFX Engine enables smartphone animations on limited memory resource hardware.
- TouchGFX Designer:

  A state-of-the-art graphical designer tool for creating, managing and building user's graphic applications. The WYSIWYG software includes different widgets, triggers and actions, making it faster and easier to create unique UIs. TouchGFX Designer supports the user in easy management of image formats, multiple languages and fonts.

- TouchGFX Generator:

  TouchGFX Generator supports users in their smooth generation of TouchGFX projects for their custom hardware based on any STM32 MCU, making them ready to develop their UI applications in TouchGFX Designer. Available as an STM32CubeMX plugin, TouchGFX Generator helps users to configure their TouchGFX project related software and hardware peripherals. It generates a full and custom TouchGFX project based on the selected graphic settings, IDE and latest STM32Cube MCU Package. For external components unknown to STM32CubeMX such as displays, touch controllers or external memories, a template is generated helping the users to add their own code.

Figure 1 shows how X-CUBE-TOUCHGFX is integrated in the STM32 ecosystem to develop an embedded UI faster, easier and cheaper.

Figure 1. STM32 graphics ecosystem
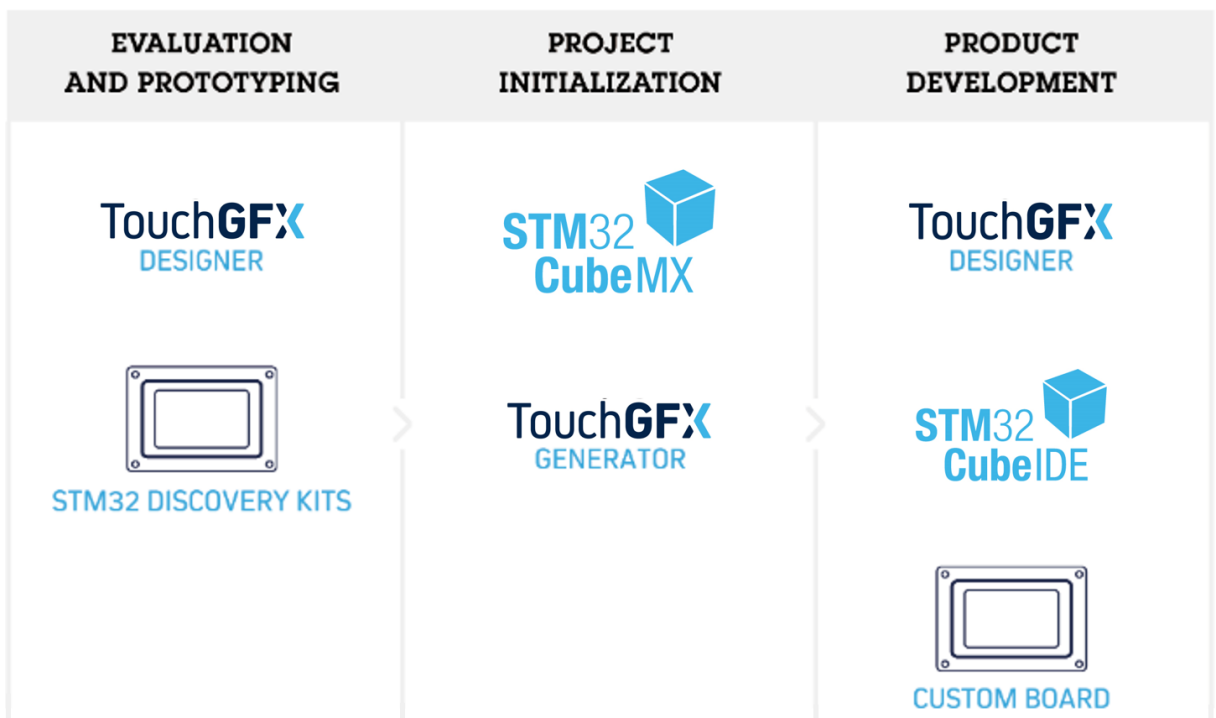
Prototyping using STM32 evaluation kits

1. Start from TouchGFX Designer, choosing one out-of-the-box supported STM32 display kit, in combination with a new or prebuilt demonstration application
2. Generate the full project with full board support package including STM32Cube software and external component drivers

STM32-based custom board

1. Start from STM32CubeMX by installing TouchGFX Generator as additional software
2. Configure the selected MCU hardware features and the TouchGFX software framework
3. Generate the project for a preferred IDE and compiler

2   License

X-CUBE-TOUCHGFX is delivered under the *Mix Ultimate Liberty+OSS+3rd-party V1* software license agreement (SLA0048).

The software components provided in this package come with different license schemes as shown in the tables below.

Framework

Table 1. Framework software component license agreements

Third-party component	Information	Version	Format	License terms Link to license terms
Penner Easing Equations	Robert Penner's easing equations are Open Source under the BSD License	Not applicable	Not applicable	robertpenner.com/ easing_terms_of_use.html

Designer

The third-party components in Table 2 are used by the TouchGFX Designer.

Note: *None of these components is present in the generated user product code.*

Table 2. Designer software component license agreements

Third-party component	Information	Version	Format	License terms Link to license terms
CompareNETObjects	Microsoft Public License (MS-PL)	3.05.0.0	Binary	Microsoft Public License (MS-PL)
log4net	Apache License 2.0	2.0.5	Binary	Apache License 2.0
MoreLinq	The MIT License (MIT)	1.4.0	Binary	The MIT License
Newtonsoft.json	Copyright © 2007 James Newton-King The MIT License (MIT)	9.0.1	Binary	The MIT License
NPOI	Apache License 2.0	2.1.3.1	Binary	Apache License 2.0
Extended.Wpf.Toolkit	Microsoft Public License (MS-PL)	2.9.0	Binary	Microsoft Public License (MS-PL)
ManyConsole	The MIT License (MIT)	0.4.2.20	Binary	github.com/fschwiet/ ManyConsole/blob/ master/LICENSE.txt
NUnit	Copyright © 2002-2012 Charlie Poole Copyright © 2002-2004 James W. Newkirk, Michael C. Two, Alexei A. Vorontsov Copyright © 2000-2002 Philip A. Craig	3.7.0	Binary	nunit.org/docs/2.6.1/ license.html
Sharp Zip Lib	Modified GPL	0.86.0	Binary	icsharpcode.github.io/ SharpZipLib/
Ndesk Options	www.ndesk.org/Options The MIT License (MIT)	0.2.1	Binary	The MIT License
FuzzySharp	The MIT License (MIT) Copyright © 2018g	2.0.2	Binary	github.com/JakeBayer/ FuzzySharp

Hardware abstraction layer (HAL)

The third-party components in Table 3 are used for HAL related source code. They can be downloaded for demonstration boards from various vendors.

Table 3. HAL software component license agreements

Third-party component	Information	Version	Format	License terms Link to license terms
HAL related source code	In case of the various header files provided by silicon manufacturers and tool vendors that define processor specific memory addresses and utility macros, the users must ensure license conditions are adhered to for any use other than compilation of the TouchGFX demonstration and examples applications.	Not applicable	Not applicable	Not applicable

Tools

The third-party components in Table 4 are used for the build environment and converter tools included in X-CUBE-TOUCHGFX.

Note: *None of these components is present in the generated user product code.*

Table 4. Tools software component license agreements

Third-party component	Information	Version	Format	License terms Link to license terms
Libpng	libpng version 1.6.37 - April 14, 2019 Copyright © 2018 Cosmin Truta Copyright © 1998-2002,2004,2006-2018 Glenn Randers-Pehrson Copyright © 1996-1997 Andreas Dilger Copyright © 1995-1996 Guy Eric Schalnat, Group 42, Inc. This code is released under the libpng license (refer to *License terms*). Authors and maintainers: • libpng versions 0.71, May 1995, through 0.88, January 1996: Guy Schalnat • libpng versions 0.89, June 1996, through 0.96, May 1997: Andreas Dilger • libpng versions 0.97, January 1998, through 1.6.35, July 2018: Glenn Randers-Pehrson • libpng version 1.6.36, December 1, 2018: Cosmin Truta • libpng version 1.6.37, April 14, 2019: The PNG Reference Library Authors	1.6.37	Binary	www.libpng.org/pub/png/src/libpng-LICENSE.txt

Third-party component	Information	Version	Format	License terms Link to license terms
MinGW	Minimalist GNU for Windows®. Collection of tools for compiling, linking, and others.	7.3.0	Binary	www.mingw.org/license and sourceforge.net/p/mingw/mingw-org-wsl/ci/21762bb4a1bd0c88c38eead03f59e8d994349e83/tree/LICENSE
MSYS	Minimal SYStem. A collection of tools for MinGW.	1.0	Binary	No online version. Refer to Minimal SYStem.
Ruby	Interpreter for the Ruby programming language. Used by the text conversion process.	1.9.3p484	Binary	www.ruby-lang.org/en/about/license.txt
FreeType	Library for interacting with fonts. Used by the text conversion process.	2.10.2	Binary	git.savannah.gnu.org/cgit/freetype/freetype2.git/tree/docs/FTL.TXT
zlib	Library for extracting zip files. Used by the image and font conversion process.	1.2.11	Binary	www.zlib.net/zlib_license.html
SDL	Library for drawing windows on Windows® and Linux®. Used for the PC Simulator.	2.0.4.0	Binary	Not available
bundler	Ruby Gem. Various tools for interacting with Excel® files, and supporting tasks.	1.12.5	Source	The MIT License
mini-portile		0.5.2	Source	
nokogiri		1.6.1-x86-mingw32	Source	
parallel		1.9.0	Source	
rake		0.9.2.2	Source	
roo		2.7.1	Source	
ruby-ole		1.2.11.7	Source	
thor		0.19.1	Source	
rdoc		3.9.5	Source	github.com/ruby/rdoc/blob/master/LICENSE.rdoc
rubyzip		1.1.0	Source	www.ruby-lang.org/en/about/license.txt
nlohmann_json	JSON for Modern C++. Copyright © 2013-2020 Niels Lohmann. The MIT License (MIT). Used by the image conversion process.	3.9.1	Source	github.com/nlohmann/json/releases

Demonstrations and examples

The third-party components in Table 5 are used by various TouchGFX demonstrations and examples that can be downloaded by the TouchGFX Designer.

Table 5. Demonstrations and examples software component license agreements

Third-party component	Information	Version	Format	License terms / Link to license terms
FreeRTOS™	Amazon Web Services, Inc. FreeRTOS™ is used in TouchGFX demonstration applications only.[1]	10.2.1	Not applicable	The MIT License
Cortex®-M CMSIS	Arm limited	5.4.0	Source	BSD-3-Clause
STM32xxxx CMSIS	STMicroelectronics	STM32H7xx CMSIS: 1.7.0 STM32F7xx CMSIS: 1.2.4	Source	BSD-3-Clause
HAL STM32xx	STMicroelectronics	STM32H7: 1.7.0 STM32F7: 1.2.7	Source	BSD-3-Clause
Board support package (BSP)	STMicroelectronics	STM32H7B3I-DK: 1.0.0 STM32H750B-DK: 2.0.0 STM32F746G-DK: 2.0.2	Source	BSD-3-Clause
Project examples	STMicroelectronics	Not applicable	Source	Ultimate Liberty (source release)

1. *Not included in TouchGFX framework. If the licensee uses and embeds FreeRTOS™ or other RTOS into final products, it is the licensee's full responsibility to ensure compliance with the relevant license terms for the selected software.*

Minimal SYStem

www.mingw.org/wiki/msys/

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Earnie.

Earnie@users.sf.net

Revision history

Table 6. Document revision history

Date	Version	Changes
13-Jan-2020	1	Initial release.
1-Jul-2020	2	Updated license version in *License*. Updated *What is STM32Cube?*
23-Sep-2020	3	Added *Minimum CPU load and footprints* in Features. Updated Designer software component license agreements and Tools software component license agreements.

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