Getting started with PSOC™ Automotive Multitouch Gen6L/XL CYATx16 touch controllers

About this document

Scope and purpose

This application note describes how to use the PSOC™ Automotive Multitouch Gen6L and Gen6XL (CYATx16) families of touch controllers. The document provides required tools, bring-up procedure, and applications details.

Intended audience

This document is intended for anyone who wants to use the PSOC™ Automotive Multitouch Gen6L and Gen6XL (CYATx16) touch controllers.

Associated part family

- CYAT6165x family (Gen6L for sliders)
- CYAT7165x family (Gen6L for trackpads)
- CYAT8165x family (Gen6L for touchscreens)
- CYAT8168x family (Gen6XL)

Key points

- Describes the bring-up workflow for the PSOC™ Automotive Multitouch Gen6L and Gen6XL touch controllers
- Explains required software tools, evaluation kits, and host interfaces used during initial setup and debugging
- Demonstrates procedure for communication verification, application startup, and basic touchscreen validation
- Provides design-relevant guidance for tuning, troubleshooting, and build to production

About this product family

Product family

Infineon's PSOC™ Automotive Multitouch Gen6L and Gen6XL families provides an excellent user experience with single-chip touchscreen controllers and robust electromagnetic performance compliant with automotive standards. Gen6L supports high-performance infotainment displays up to 8.5 inches. Gen6XL extends support up to 15 inches and adds features like thick-glove operation, water rejection, and a low-power CAPSENSE™ button.

Target applications

- Touchpads and sliders
- Displays

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Abbreviations

Abbreviation	Expansion
BCP	Bridge Control Panel
EVK	Evaluation kit
I2C	Inter-Integrated Circuit
MDA	Multitouch Debug Assistant
MQA	Multitouch Quickstart Assistant
MTA	Multitouch Tuning Assistant
MTK	Manufacturing Test Kit
POST	Power On Self-Test
TTBridge	Touch Tuning Bridge
TTE	Touch Tuning Executive
TTHE	Touch Tuning Host Emulator

1 Introduction

This document provides instructions for getting started with the PSOC™ Automotive Multitouch Gen6L (CYATx165x) and Gen6XL (CYAT8168x) touch controllers.

A touch controller is a device used to determine the position of one or more touches (finger) over a display accurately, quickly, and at low power and cost.

PSOC™ Automotive Multitouch Gen6 is a programmable touch controller containing a 48-MHz Arm® Cortex®-M0+ CPU, similar to other PSOC™ Automotive Multitouch Gen7 and PSOC™ Automotive Multitouch Gen8 touch controllers.

The PSOC™ Automotive Multitouch Gen6 families consists of four main families, each with the following package options:

- PSOC™ Automotive Multitouch Gen6L slider (CYAT6165x) supports the 56-QFN and 64-TQFP packages
- PSOC™ Automotive Multitouch Gen6L trackpad (CYAT7165x) supports the 56-QFN package
- PSOC™ Automotive Multitouch Gen6L touchscreen (CYAT8165x) supports the 64-TQFP and 100-TQFP packages
- PSOC™ Automotive Multitouch Gen6XL (CYAT8168x) supports the 100-TQFP and 128-TQFP packages

The main application of the PSOC™ Automotive Multitouch Gen6 device is touch sensing and processing. The touch application performs operations, such as sensing the change in capacitance on the surface of a touch screen, determining the location of one or more fingers, and reporting the touch information to the host system.

Each touch scan consists of operations, such as driving waveforms across Tx sensors, acquisition of signals from Rx sensors, filtering, touch mode (finger or glove) detection, tracking touch, and reporting touch.

Configuring the touch screen subsystem to achieve the desired touch sensitivity and performance is called “tuning” and is project-dependent. The tuning process is covered in *AN200156 - CYAT6165X/8165X/8168X touchscreen controller tuning best practices* [4].

2 Software tools

The Infineon touch controllers are supported by a strong software ecosystem, which is constantly expanding. These tools are available on the PSOC™ Automotive Multitouch Gen6 webpage. For example, a few current and future tools are as follows:

- **Multitouch Quickstart Assistant (MQA):** A simple tool that requires only the panel size and key system-specific requirements, such as:
  - Touch controller product
  - Touch controller pinout
  - Blind build configuration for the first sample build
- **Multitouch Tuning Assistant (MTA):** Designed to achieve 90% of expert-level tuning performance in minutes, without requiring expert knowledge. This tool is currently in the final stage of development
- **Bridge Control Panel (BCP):** Installed along with either the Touch Tuning Host Emulator (TTHE) or the Manufacturing Test Kit (MTK). It provides a low-level interface for sending and receiving commands with the touch controller and supports higher-level tools, such as charts and variable monitoring
- **Touch Tuning Host Emulator (TTHE):** A low-level tool for tuning and host emulation. It supports detailed debugging and analysis of the touch controller, which can monitor sensors individually or across the entire panel-wide in 2D or 3D
- **Manufacturing Test Kit (MTK)/Touch Tuning Executive (TTE):** Recommended for use at each production stage to detect defects (or potential defects) early in the production line
- **Multitouch Debug Assistant (MDA):** A simplified tool that supports failure analysis for customers and manufacturing facilities. If it cannot automatically identify for failure, it collects the information needed by Infineon to assist with failure analysis in customer support cases

3 Evaluation kit (EVK)

The PSOC™ Automotive Multitouch Gen6XL Evaluation Kit (CY3290-CYAT8168X) webpage details the kit.

EVKs are also available for the PSOC™ Automotive Multitouch Gen7L (available upon request), PSOC™ Automotive Multitouch Gen7XL (available upon request), and PSOC™ Automotive Multitouch Gen8XL (available upon request) devices. Contact Infineon support for more information.

4 Product lifecycle stages

The section describes the product lifecycle from initial concept to mass production and identifies the tools available at each stage to simplify the process.

1. Initial concept: MQA
   - Recommends product, pinout, and blind build configurations
   - Requires only panel size and any project-specific requirements
2. Schematic design
   - Use touch controller pinout from MQA
   - Add passives as recommended in the device datasheet
   - Infineon will provide a schematic review. Open a customer support case on Infineon support
3. PCB layout and touchscreen design
   - Infineon will provide design reviews. Open a customer support case on Infineon support
4. First build
   - Use the touch HEX file provided by the MQA tool (Step 1)
   - See Bring-up of the touch controller section
   - Use an MTK configuration with very loose panel-wide limits (see MTK training)
5. Hardware bring-up (Bring-up of the touch controller) and initial tuning:
   - See the *AN200156 – CYAT6165X/8165X/8168X touchscreen controller tuning best practices* [4] application note
6. Subsequent builds
   - Retune and tighten the MTK limits as needed (see MTK training)
7. Final touch application
   - Retune and tighten the MTK limits as needed (see MTK training)
8. Mass production

5 Bring-up of the touch controller

The process provided in this section is not exhaustive. Assumptions are made to keep the process clear. If anything is not clear, see the user guide of the respective tools. For questions or persistent issues, contact Infineon support.

When the first build is available (whether this is the first system build, or a mock-up, or hand wired build), the touch controller should ideally function correctly. However, testing and debugging are often required.

This process assumes the device under test (DUT) is connected to a PC using a Touch Tuning Bridge (TTBridge). See the PSOC™ Multitouch Development Kit (CY3295-TTBRIDGE) for details. However, the same process can be performed using the system host controller and the recommended process are as follows:

1. Read from the touch controller
2. Start the touch application
3. Test the touchscreen

5.1 Read from the touch controller

The primary test is to verify the touch controller is functional. To do this, send a read command to the touch controller and ensure that the command is ACKed, and the data read is correct.

It is recommended to use the Bridge Control Panel (BCP) software. Perform the following steps:

1. Connect the hardware
2. In BCP, select the TTBridge from the list of connected devices (middle of the bottom pane)
3. Configure the BCP for your communication setup:

a) In the **Protocol** pane at the bottom-right, select I2C/SPI

b) Go to **Tools** -> **Protocol Configuration** (available only if TTBridge is connected), and verify the settings

4. Power the TTBridge, if required
5. Send command

   `r 24 x x x x` (assumes SPI, or I2C using address 0x24)

   Ensure that the response should be 4 bytes with a "**+**" (ACK) after each; a trailing "**–**" indicates a NAK

   The typical response of the command is (the device is in the bootloader):

   ```
   r 24+ 01+ 01+ 01+ 01+ p
   ```

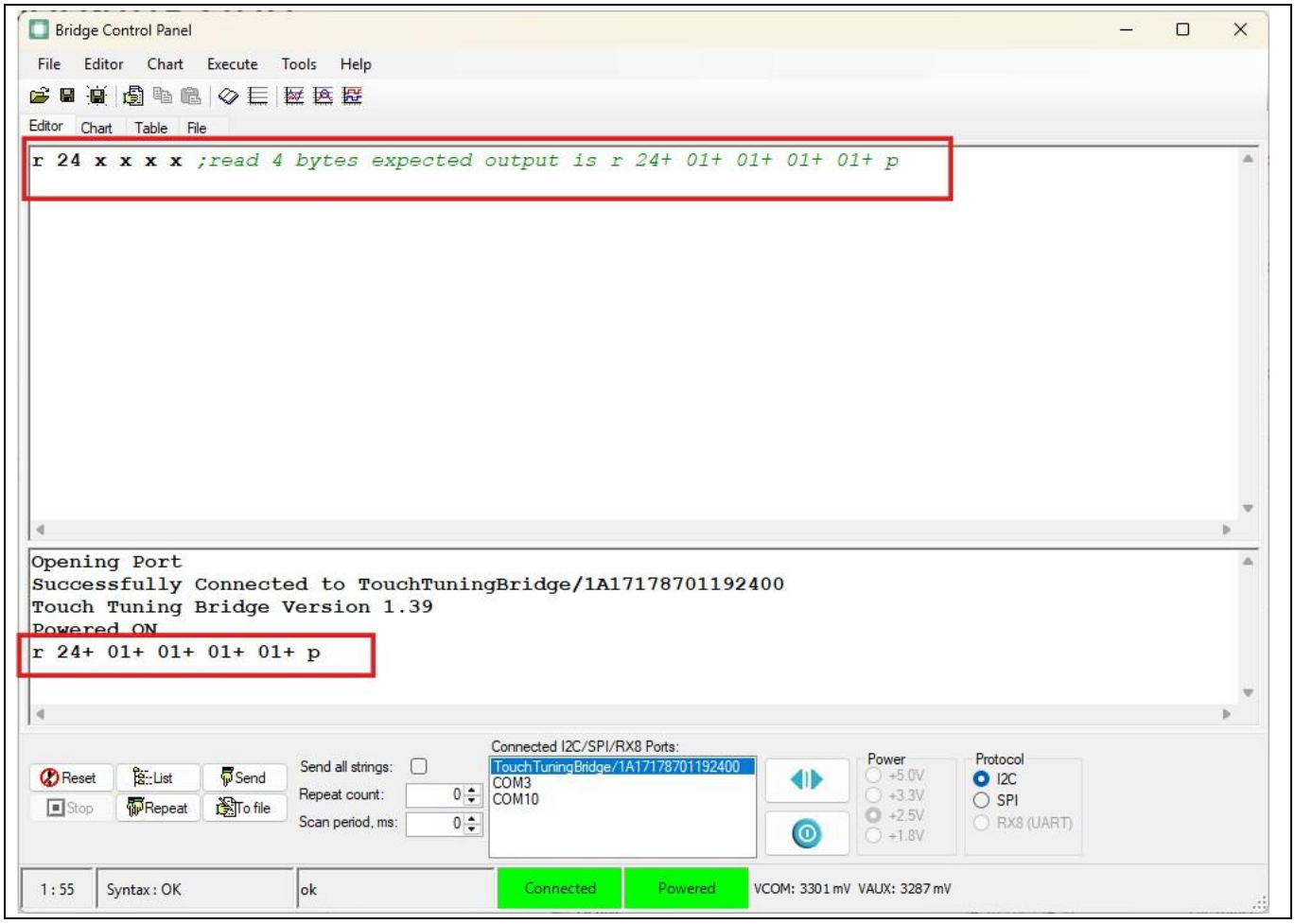

Figure 1 BCP-read command response from the touch controller

If the read command is not ACKed, perform a low-level debug by checking:

- Use a bus snooper (e.g., Beagle/Aardvark) to help with debug
- Touch controller power rails are at the correct levels and stable
- Signal continuity to the touch controller
- Expected pull-ups are enabled on communication lines, interrupt, and XRES signals
- No conflicts on the communication bus (TTBridge must be the only bus master)

5.2 Start the touch application

With communication established, start the touch application.

The touch controller has two applications: a bootloader and the touch application. It is possible to configure the touch controller to have no bootloader, or to auto exit the bootloader. For this process, it is assumed that there is a bootloader, and it is set to wait for a host command to exit. It is also possible to start the touch application in any mode. It is assumed that the configuration starts in **System Info** mode.

Use the BCP tool and issue the following command to exit the bootloader and start the application:

```
w 24 00 FF 01 3B 00 00 4F 6D 17
```

Read the response by sending the following command:

`r 24 x x`

The expected response is:

`r 24+ 10+ 00+ p`

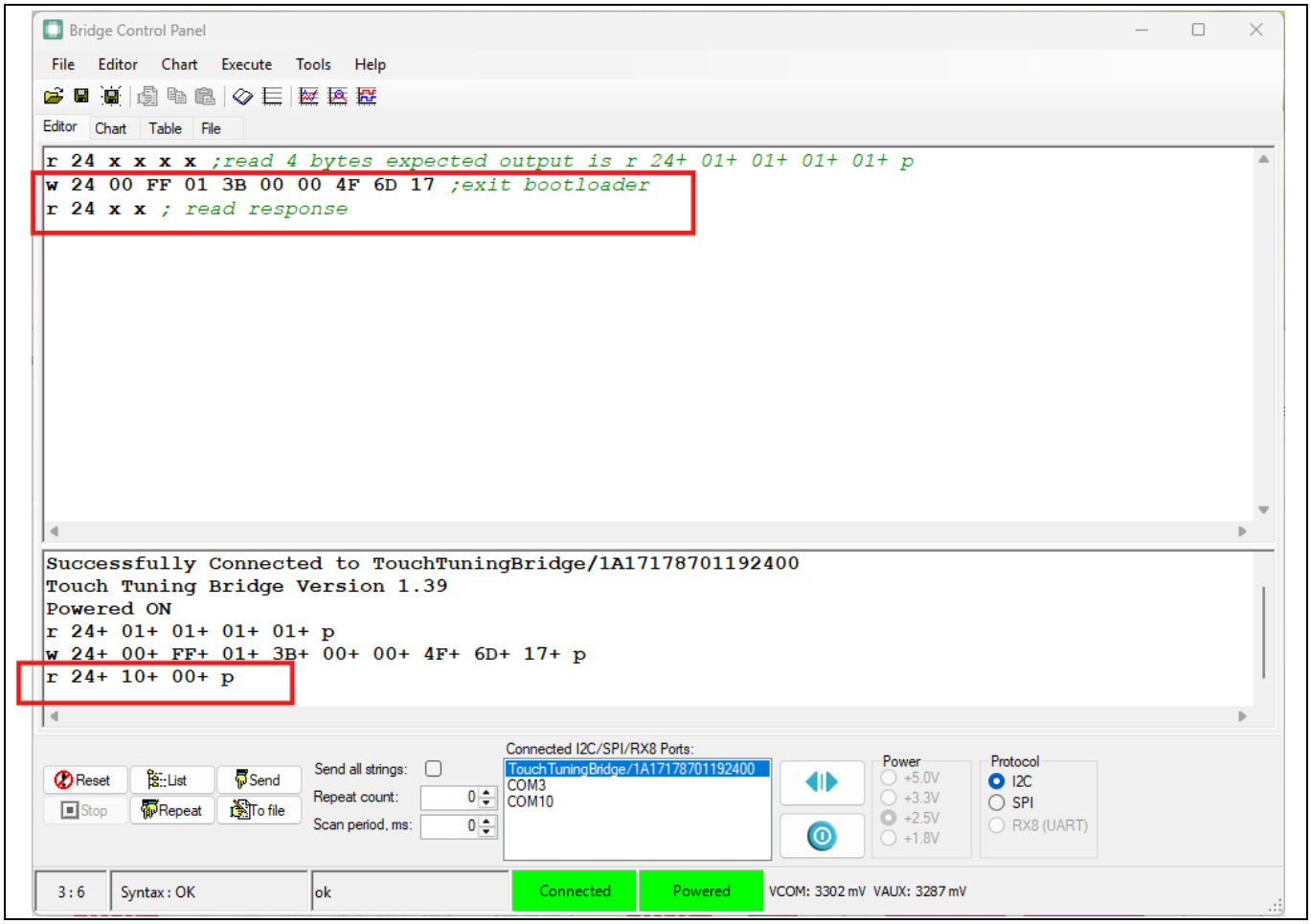

Figure 2 BCP response after issuing the exit bootloader command and confirming system information mode

Bits 6 to 4 of the byte 0x10 (001b) indicates that the touch controller is in **System Info** mode.

If the bytes read are NAKed, follow the debug process in described in Section 5.1.

If the response read is not as expected, read the error register using the following BCP commands:

- `w 24 FE`: Set the read pointer to the 2-byte error register
- `r 24 x x`: Read the 2-byte error register, and refer to the device reference manual for the details

5.3 Test the touchscreen

With the touch application running, test the touchscreen. For details, see the *AN200156 – CYAT6165X/8165X/8168X touchscreen controller tuning best practices* [4] application note.

The quickest and easiest method is to use the 2D heatmap mode in the Touch Tuning Host Emulator (TTHE). Set the heatmap mode to difference counts in the **Display Settings** and review the other display settings. Slowly move a touch from top to bottom and left to right, ensuring a consistent circular signal follows the expected touch location.

5 Bring-up of the touch controller

The TTHE project should have been created at the start of the project when using the MQA tool.

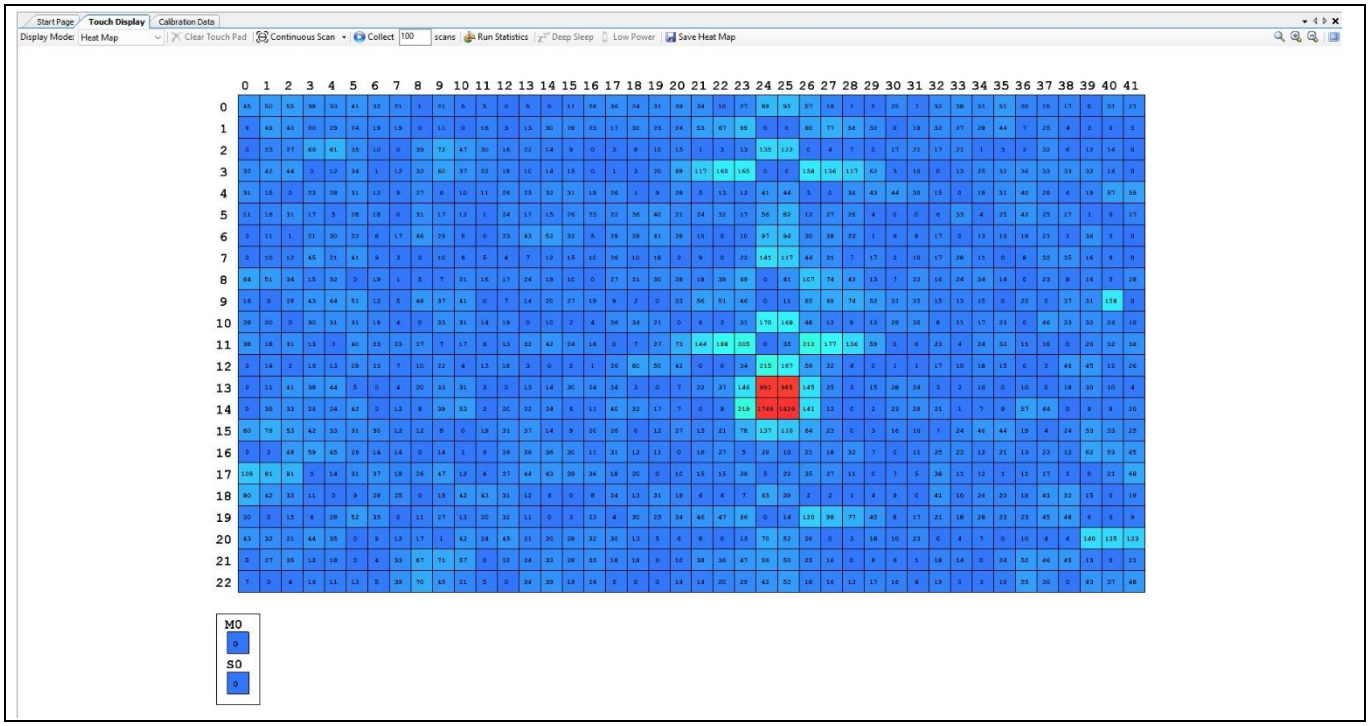

Figure 3 2D heatmap output in TTHE showing expected touch signal behavior during touchscreen testing

A few common issues at this stage:

- If not using the MQA-generated TTHE configuration, disable all advanced features for initial bring-up (glove, low-power look for touch, water rejection, wet finger tracking, auto recalibration, hover, charger armor, burst noise mitigation, POST, SD detection, etc.)
- Ensure a low-noise environment (avoid fluorescent lights, industrial machinery, etc.). Recalibrate and rebaseline (under **TTHE** > **Device**)
- Heatmap rotated or reversed on one or both axes:
  - Heatmap shows the physical connectors. Reporting coordinates can be easily flipped, see **TTHE** > **Flash Parameters** > **Device Setup** > **XY_AXES_FLIP_ROTATE_CFG** > 3 options
  - To reverse the heatmap, swap the pinout, see **TTHE** > **View** > **Project Configuration Wizard…**
- Single (or group of) sensors missing:
  - Check the TTHE project pinout (**TTHE** > **View** > **Project Configuration Wizard…**) is configured correctly for the hardware
  - Try multiple touchscreens, as sensors break easily

References

[1] Infineon Technologies AG: *AN50467 – PSOC™ Automotive Multitouch touchscreen controller module design best practices*; Available online

[2] Infineon Technologies AG: *PSOC™ Automotive Multitouch generation 6XL datasheet*; Available online

[3] Infineon Technologies AG: *CYAT6165X/8165X/8168X, PSOC™ Automotive Multitouch touchscreen controller reference manual*; Available online

[4] Infineon Technologies AG: *AN200156 - CYAT6165X/8165X/8168X touchscreen controller tuning best practices*; Available online

[5] Infineon Technologies AG: *PSOC™ Automotive Multitouch generation 6L datasheet*; Available online

[6] Infineon Technologies AG: *PSOC™ Automotive Multitouch generation 6L slider datasheet*; Available online

Revision history

Document revision	Date	Description of changes
**	2026-06-02	Initial release

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