

## Arduboy2 Library

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# Chapter 1

## Arduboy2 Library

The [Arduboy2](#) library is maintained in a git repository hosted on [GitHub](#) at:

<https://github.com/MLXXXp/Arduboy2>

The [Arduboy2](#) library is a fork of the [Arduboy library](#), which provides a standard *application programming interface* (API) to the display, buttons and other hardware of the Arduino based [Arduboy miniature game system](#).

The name [Arduboy2](#) doesn't indicate that it's for a new "next generation" of the Arduboy hardware. The name was changed so it can coexist in the Arduino IDE with the current *Arduboy* library, without conflict. This way, existing sketches can continue to use the *Arduboy* library and class, without changes, while new sketches can be written (or old ones modified) to use and take advantage of the capabilities of the [Arduboy2](#) class and library.

For notes on the differences between the [Arduboy2](#) library and the original *Arduboy* library, and for information on migrating a sketch currently using the *Arduboy* library, see the sections at the end of this document.

### Library documentation

Comments in the library header files are formatted for the [Doxygen](#) document generation system. The HTML files generated using the configuration file *extras/Doxyfile* can be found at:

<https://MLXXXp.github.io/documents/Arduino/libraries/Arduboy2/Doxygen/html/index.html>↵

A generated PDF file can be found at:

<https://MLXXXp.github.io/documents/Arduino/libraries/Arduboy2/Doxygen/pdf/Arduboy2.pdf>↵

### Installation

The [Arduboy2](#) library can be installed using the Arduino IDE Library Manager:

- In the Arduino IDE select from the menus: Sketch > Include Library > Manage Libraries...
- In the Library Manager *Filter your search...* field enter *arduboy2*.
- Click somewhere within the [Arduboy2](#) entry.
- Click on the *Install* button.

For more library installation information see

[Installing Additional Arduino Libraries - Using the Library Manager](#)

## Start up features

The *begin()* function, used to initialize the library, includes features that are intended to be available to all sketches using the library (unless the sketch developer has chosen to disable one or more of them to free up some code space):

### The boot logo

At the start of the sketch, the **ARDUBOY** logo scrolls down from the top of the screen to the center.

The RGB LED lights red then green then blue while the logo is scrolling. (If your Arduboy is one of those that has the RGB LED installed incorrectly, then it will light blue then off then red).

A user settable *unit name* of up to 6 characters can be saved in system EEPROM memory. If set, this name will be briefly displayed at the bottom of the boot logo screen, after the logo stops scrolling down. This feature is only available if the [Arduboy2](#) class is used, not the [Arduboy2Base](#) class. This is because it requires the text display functions, which are only available in the [Arduboy2](#) class.

Once the logo display sequence completes, the sketch continues.

For developers who wish to quickly begin testing, or impatient users who want to go strait to playing their game, the boot logo sequence can be bypassed by holding the *RIGHT* button while powering up, and then releasing it. Alternatively, the *RIGHT* button can be pressed while the logo is scrolling down.

### "Flashlight" mode

If the *UP* button is pressed and held when the Arduboy is powered on, it enters *flashlight* mode. This turns the RGB LED fully on, and all the pixels of the screen are lit, resulting in a bright white light suitable as a small flashlight. (For an incorrect RGB LED, only the screen will light). To exit *flashlight* mode the Arduboy must be restarted.

*Flashlight* mode is also sometimes useful to allow uploading of new sketches, in case the sketch currently loaded uses a large amount of RAM which creates a bootloader problem.

### Audio mute control

Pressing and holding the *B* button when powering on will enter *System Control* mode. The RGB LED will light blue (red for an incorrect LED) to indicate that you are in *system control* mode. You must continue to hold the *B* button to remain in this mode. The only *system control* function currently implemented is *audio mute control*.

Pressing the *UP* button (while still holding *B*) will set a flag in system EEPROM indicating *audio enabled*. The RGB LED will flash green once (off for an incorrect LED) to indicate this action.

Pressing the *DOWN* button (while still holding *B*) will set the flag to *audio disabled* (muted). The RGB LED will flash red once (blue for an incorrect LED) to indicate this action.

Releasing the *B* button will exit *system control* mode and the sketch will continue.

Note that the audio control feature only sets a flag in EEPROM. Whatever code actually produces the sound must use the *audio.enabled()* function to check and honor the mute state. Audio libraries written with the Arduboy system in mind, such as the available *ArduboyPlaytune* and *ArduboyTones*, should do this. However, be aware that for some sketches, which don't use the [Arduboy2](#) or other compliant library and generate sounds in their own way, this method of muting sound may not work.

## Using the library in a sketch

As with most libraries, to use [Arduboy2](#) in your sketch you must include its header file at the start:

```
#include <Arduboy2.h>
```

You must then create an [Arduboy2](#) class object:

```
Arduboy2 arduboy;
```

Naming the object *arduboy* has become somewhat of a standard, but you can use a different name if you wish.

To initialize the library, you must call its *begin()* function. This is usually done at the start of the sketch's *setup()* function:

```
void setup()
{
  arduboy.begin();
  // more setup code follows, if required
}
```

The rest of the [Arduboy2](#) functions will now be available for use.

If you wish to use the [Sprites](#) class functions you must create a [Sprites](#) object:

```
Sprites sprites;
```

Sample sketches have been included with the library as examples of how to use it. To load an example, for examination and uploading to the Arduboy, using the Arduino IDE menus select:

File > Examples > [Arduboy2](#)

More information on writing sketches for the Arduboy can be found in the [Arduboy Community Forum](#).

## Audio control functions

The library includes an [Arduboy2Audio](#) class. This class provides functions to enable and disable (mute) sound and also save the current mute state so that it remains in effect over power cycles and after loading a different sketch. It doesn't contain anything to actually produce sound.

The [Arduboy2Base](#) class, and thus the [Arduboy2](#) class, creates an [Arduboy2Audio](#) class object named *audio*, so a sketch doesn't need to create its own [Arduboy2Audio](#) object.

Example:

```
#include <Arduboy2.h>

Arduboy2 arduboy;

// Arduboy2Audio functions can be called as follows:
arduboy.audio.on();
arduboy.audio.off();
```

## Ways to make more code space available to sketches

### Sound effects and music

If you want your sketch to have sound, then using the *ArduboyTones* library will be more code efficient than using *ArduboyPlaytune* or most other sound libraries compatible with the Arduboy. *ArduboyTones* even produces less code than the `Arduino built in tone()` function. You'll have to decide on the appropriate library or functions you use to generate sound, based on the features required and how much memory you want it to use.

### Remove the text functions

If your sketch doesn't use any of the functions for displaying text, such as *setCursor()* and *print()*, you can remove them. You could do this if your sketch generates whatever text it requires by some other means. Removing the text functions frees up code by not including the font table and some code that is always pulled in by inheriting the *Arduino Print* class.

To eliminate text capability in your sketch, when creating the library object simply use the *Arduboy2Base* class instead of *Arduboy2*:

For example, if the object will be named *arduboy*:

Replace

```
Arduboy2 arduboy;
```

with

```
Arduboy2Base arduboy;
```

### Remove boot up features

As previously described, the *begin()* function includes features that are intended to be available to all sketches during boot up. However, if you're looking to gain some code space, you can call *boot()* instead of *begin()*. This will initialize the system but not include any of the extra boot up features. If desired, you can then add back in any of these features by calling the functions that perform them. You will have to trade off between the desirability of having a feature and how much memory you can recover by not including it.

A good way to use *boot()* instead of *begin()* is to copy the code from the body of the *begin()* function, in file *Arduboy2.cpp*, into your sketch and then edit it to retain the *boot()* call and any feature calls desired.

As of this writing, the *begin* function is:

```
void Arduboy2Base::begin()
{
    boot(); // raw hardware

    blank(); // blank the display

    flashlight(); // light the RGB LED and screen if UP button is being held.

    // check for and handle buttons held during start up for system control
    systemButtons();

    audio.begin();

    bootLogo();

    // wait for all buttons to be released
    do {
        delay(50);
    } while (buttonsState());
}
```



To incorporate it into your sketch just keep *boot()* and whatever feature calls are desired, if any. Comment out or delete the rest. Remember to add the class object name in front of each function call, since they're now being called from outside the class itself. If your sketch uses sound, it's a good idea to keep the call to *audio.begin()*.

For example: Let's say a sketch has its own code to enable, disable and save the *audio on/off* setting, and wants to keep the *flashlight* function. In *setup()* it could replace *begin()* with:

```
arduboy.boot(); // raw hardware

// *** This particular sketch clears the display soon, so it doesn't need this:
// blank(); // blank the display

arduboy.flashlight(); // light the RGB LED and screen if UP button is being held.

// check for and handle buttons held during start up for system control
// systemButtons();

arduboy.audio.begin();

// bootLogo();

// wait for all buttons to be released
do {
  delay(50);
} while (arduboy.buttonsState());
```

This saves whatever code *blank()*, *systemButtons()* and *bootLogo()* would use.

There are a few functions provided that are roughly equivalent to the standard functions used by *begin()* but which use less code space.

- *bootLogoCompressed()*, *bootLogoSpritesSelfMasked()* and *bootLogoSpritesOverwrite()* will do the same as *bootLogo()* but will use *drawCompressed()*, or *Sprites* class *drawSelfMasked()* or *drawOverwrite()*, functions respectively, instead of *drawBitmask()*, to render the logo. If the sketch uses one of these functions, then using the boot logo function that also uses it may reduce code size. It's best to try each of them to see which one produces the smallest size.
- *bootLogoText()* can be used in place *bootLogo()* in the case where the sketch uses text functions. It renders the logo as text instead of as a bitmap (so doesn't look as good).
- *safeMode()* can be used in place of *flashlight()* for cases where it's needed to allow uploading a new sketch when the bootloader "magic key" problem is an issue. It only lights the red RGB LED, so you don't get the bright light that is the primary purpose of *flashlight()*.

## What's different from Arduboy library V1.1

A main goal of *Arduboy2* is to provide ways in which more code space can be freed for use by large sketches. Another goal is to allow methods other than the *tunes* functions to be used to produce sounds. *Arduboy2* remains substantially compatible with *Arduboy library V1.1*, which was the latest stable release at the time of the fork. *Arduboy2* is based on the code targeted for Arduboy library V1.2, which was still in development and unreleased at the time it was forked.

Main differences between *Arduboy2* and Arduboy V1.1 are:

- The *ArduboyTunes* subclass, which provided the *tunes.xxx()* functions, has been removed. It's functionality is available in a separate *ArduboyPlaytune library*. By removing these functions, more code space may become available because interrupt routines and other support code was being compiled in even if a sketch didn't make use them. Another benefit is that without the automatic installation of timer interrupt service routines, other audio generating functions and libraries, that need access to the same interrupts, can now be used. Removal of the *tunes* functions is the main API incompatibility with Arduboy V1.1. Sketches written to use *tunes* functions will need some minor modifications in order to make them work with *Arduboy2* plus ArduboyPlaytune, *ArduboyTunes*, or some other audio library.

- Arduboy library V1.1 uses timer 1 for the *tunes* functions. This causes problems when attempting to control the Arduboy's RGB LED using PWM, such as with *setRGBled()*, because it also requires timer 1. Since the *tunes* functionality has been removed from [Arduboy2](#), there are no problems with using the RGB LED (except those caused by the RGB LED being incorrectly installed). Of course, using an external library that uses timer 1, such as *ArduboyPlaytune*, may reintroduce the problems. However, using a library that doesn't use timer 1, such as *ArduboyTones*, is now an option.
- The code to generate text output, using *setCursor()*, *print()*, etc., can be removed to free up code space, if a sketch doesn't use any text functions. The [Arduboy2](#) class includes the text functions but using the [Arduboy2Base](#) class instead will eliminate them. With text functions included, the font table and some support functions are always compiled in even if not used. The API for using text functions is the same as Arduboy V1.1 with some additional functions added:
  - *setTextColor()* and *setTextBackground()* allow for printing black text on a white background.
  - *getCursorX()* and *getCursorY()* allow for determining the current text cursor position.
  - The *clear()* function will now reset the text cursor to home position 0, 0.
- A new feature has been added which allows the *audio on/off* flag in system EEPROM to be configured by the user when the sketch starts. The flag is used by the Arduboy and [Arduboy2 audio](#) subclass, along with external sound functions and libraries, to provide a standardized sound mute capability. See the information above, under the heading *Audio mute control*, for more details.
- The *color* parameter, which is the last parameter for most of the drawing functions, has been made optional and will default to WHITE if not included in the call. This doesn't save any code but has been added as a convenience, since most drawing functions are called with WHITE specified.
- A new function *digitalWriteRGB()* has been added to control the RGB LED digitally instead of using PWM. This uses less code if just turning the RGB LEDs fully on or off is all that's required.
- The *beginNoLogo()* function is not included. This function could be used in Arduboy V1.1 in place of *begin()* to suppress the displaying of the ARDUBOY logo and thus free up the code that it required. Instead, [Arduboy2](#) allows a sketch to call *boot()* and then add in any extra features that *begin()* provides by calling their functions directly after *boot()*, if desired.
- The *ArduboyCore* and *ArduboyAudio* base classes, previously only available to, and used to derive, the *Arduboy* class, have been made publicly available for the benefit of developers who may wish to use them as the base of an entirely new library. This change doesn't affect the existing API.

As of version 2.1.0 functionality from the [Team A.R.G. Arglib](#) library has been added:

- The sprite drawing functions, collision detection functions, and button handling functions that Team A.R.G. incorporated from the [ArduboyExtra](#) project. The *poll()* function was renamed *pollButtons()* for clarity. The [Sprites](#) class doesn't require a parameter for the constructor, whereas in *Arglib* a pointer to an Arduboy class object is required.
- The *drawCompressed()* function, which allows compressed bitmaps to be drawn. Saving bitmaps in compressed form may reduce overall sketch size.

Team A.R.G. has now migrated all of their games and demos to use the [Arduboy2](#) library.

## Migrating a sketch from Arduboy library V1.1 to [Arduboy2](#)

Since the [Arduboy2](#) library can coexist in the Arduino IDE alongside the Arduboy library V1.1, a currently working sketch that uses Arduboy V1.1 doesn't have to be migrated to [Arduboy2](#). However, if you want to switch a sketch to [Arduboy2](#) for further development, in order to take advantage of any of the changes and enhancements, it's generally relatively easy.

The [Arduboy2](#) library, for the most part, is compatible with Arduboy library V1.1 but migrating a sketch to [Arduboy2](#) will require some small changes, and more so if it uses the *tunes* functions, such as *tunes.tone()* or *tunes.playScore()*.

## Required changes

The first thing to do is change the `include` for the library header file:

```
#include <Arduboy.h>
```

becomes

```
#include <Arduboy2.h>
```

If it was "Arduboy.h" (in quotes), it's still better to change it to `<Arduboy2.h>` (in angle brackets).

The same thing has to be done with creating the library object. (If the object name isn't *arduboy*, keep whatever name is used.):

```
Arduboy arduboy;
```

becomes

```
Arduboy2 arduboy;
```

If the sketch doesn't use any *tunes* functions, there's a good chance this is all that has to be done to make it compile.

### Sketch uses only *tunes.tone()* for sound

If the sketch has sound but only uses *tunes.tone()*, solutions are:

#### Solution 1: Switch to using Arduino *tone()*

An easy change is to use the Arduino built in *tone()* function. You can add a function to the sketch that wraps *tone()* so that it works like *tunes.tone()*, like so:

```
// Wrap the Arduino tone() function so that the pin doesn't have to be
// specified each time. Also, don't play if audio is set to off.
void playTone(unsigned int frequency, unsigned long duration)
{
  if (arduboy.audio.enabled() == true)
  {
    tone(PIN_SPEAKER_1, frequency, duration);
  }
}
```

You then change all *tunes.tone()* calls to *playTone()* calls using the same parameter values. For example:

```
arduboy.tunes.tone(1000, 250);
```

becomes

```
playTone(1000, 250);
```

### Solution 2: Switch to using the ArduboyTones library

Changing to the *ArduboyTones* library is slightly more complicated. The advantage is that it will generate less code than using *tone()* and will also allow you to easily enhance the sketch to play tone sequences instead of just single tones. *ArduboyTones* can also play each tone at either normal or a higher volume.

You have to add an include for the *ArduboyTones* header file:

```
#include <ArduboyTones.h>
```

You then have to create an object for the *ArduboyTones* class and pass it a pointer to the *Arduboy2* *audio.enabled()* function. This must go after the creation of the *Arduboy2* object, like so:

```
Arduboy2 arduboy;  
ArduboyTones sound(arduboy.audio.enabled);
```

You then change all *Arduboy* *tunes.tone()* calls to *ArduboyTones* *tone()* calls using the same parameter values. For example:

```
arduboy.tunes.tone(1000, 250);
```

becomes

```
sound.tone(1000, 250);
```

See the *ArduboyTones* README file for more information on installing and using it.

### Solution 3: Switch to using the ArduboyPlaytune library.

See the following for how to do this:

#### Sketch uses *tunes.playScore()*

If the sketch uses *tunes.playScore()*, probably the easiest solution is to use the *ArduboyPlaytune* library. *ArduboyPlaytune* is essentially the code that was in the *Arduboy* V1.1 *tunes* subclass, which has been removed from *Arduboy2*. It's been cleaned up and a few enhancements have been added, but all the *Arduboy* V1.1 *tunes* functions are available.

You have to add an include for the *ArduboyPlaytune* header file:

```
#include <ArduboyPlaytune.h>
```

You then have to create an object for the *ArduboyPlaytune* class and pass it a pointer to the *Arduboy2* *audio.enabled()* function. This must go after the creation of the *Arduboy2* object, like so:

```
Arduboy2 arduboy;  
ArduboyPlaytune tunes(arduboy.audio.enabled);
```

The sound channels must then be initialized and assigned to the speaker pins. This code would go in the *setup()* function:

---

```
// audio setup
tunes.initChannel(PIN_SPEAKER_1);
#ifdef AB_DEVKIT
// if not a DevKit
tunes.initChannel(PIN_SPEAKER_2);
#else
// if it's a DevKit
tunes.initChannel(PIN_SPEAKER_1); // use the same pin for both channels
tunes.toneMutesScore(true);      // mute the score when a tone is sounding
#endif
```

If you name the `ArduboyPlaytune` object *tunes* as shown above, then you just have to remove the `Arduboy` object name from any *tunes* calls. For example:

```
arduboy.tunes.playScore(mySong);
```

becomes

```
tunes.playScore(mySong);
```

See the [ArduboyPlaytune library](#) documentation for more information.

If you don't need to play scores containing two parts, and don't require tones to be played in parallel with a score that's playing, then as an alternative to using *ArduboyPlaytune* you may wish to consider switching to *ArduboyTones*. This may require a bit of work because any *ArduboyPlaytune* scores would have to be converted to *ArduboyTones* format. It would involve changing note numbers to frequencies. This could be simplified by using the provided *NOTE\_* defines. Also, durations would have to be converted, including adding silent "rest" tones as necessary.

The benefit of using *ArduboyTones* would be reduced code size and possibly easier addition of new sequences without the need of a MIDI to Playtune format converter.

Sketch uses the *beginNoLogo()* function instead of *begin()*

The *beginNoLogo()* function has been removed. Instead, *boot()* can be used with additional functions following it to add back in desired boot functionality. See the information above, under the heading *Remove boot up features*, for more details. Assuming the object is named *arduboy*, a direct replacement for *beginNoLogo()* would be:

```
arduboy.boot();
arduboy.blank();
arduboy.flashlight();
arduboy.audio.begin();
```



## Chapter 2

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-----  
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## Chapter 3

# Hierarchical Index

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## Chapter 6

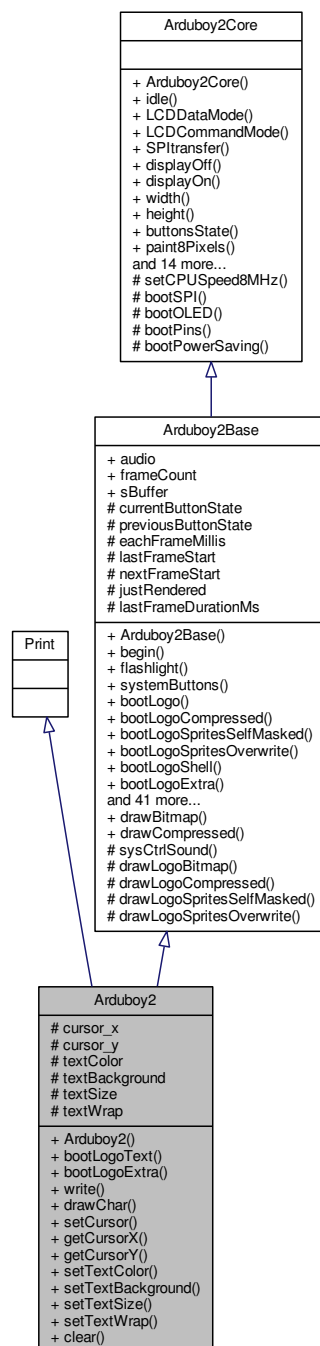
# Class Documentation

### 6.1 Arduboy2 Class Reference

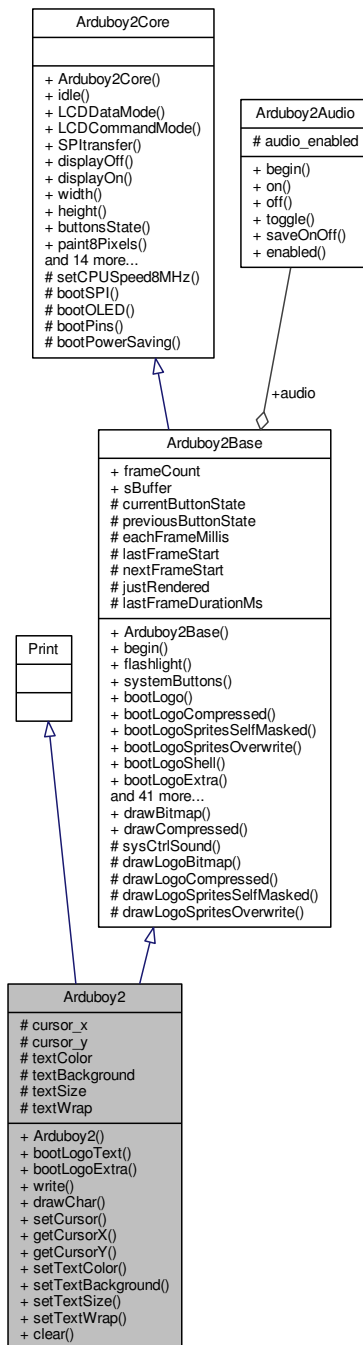
The main functions provided for writing sketches for the Arduboy, *including* text output.

```
#include <Arduboy2.h>
```

Inheritance diagram for Arduboy2:



Collaboration diagram for Arduboy2:



## Public Member Functions

- void [bootLogoText](#) ()  
*Display the boot logo sequence using printed text instead of a bitmap.*
- virtual void [bootLogoExtra](#) ()  
*Show the unit name at the bottom of the boot logo screen.*
- virtual size\_t [write](#) (uint8\_t)

- Write a single ASCII character at the current text cursor location.*

  - void `drawChar` (int16\_t x, int16\_t y, unsigned char c, uint8\_t color, uint8\_t bg, uint8\_t size)

*Draw a single ASCII character at the specified location in the screen buffer.*
- void `setCursor` (int16\_t x, int16\_t y)

*Set the location of the text cursor.*
- int16\_t `getCursorX` ()

*Get the X coordinate of the current text cursor position.*
- int16\_t `getCursorY` ()

*Get the Y coordinate of the current text cursor position.*
- void `setTextColor` (uint8\_t color)

*Set the text foreground color.*
- void `setTextBackground` (uint8\_t bg)

*Set the text background color.*
- void `setTextSize` (uint8\_t s)

*Set the text character size.*
- void `setTextWrap` (bool w)

*Set or disable text wrap mode.*
- void `clear` ()

*Clear the display buffer and set the text cursor to location 0, 0.*
- void `begin` ()

*Initialize the hardware, display the boot logo, provide boot utilities, etc.*
- void `flashlight` ()

*Turn the RGB LED and display fully on to act as a small flashlight/torch.*
- void `systemButtons` ()

*Handle buttons held on startup for system control.*
- void `bootLogo` ()

*Display the boot logo sequence using `drawBitmap()`.*
- void `bootLogoCompressed` ()

*Display the boot logo sequence using `drawCompressed()`.*
- void `bootLogoSpritesSelfMasked` ()

*Display the boot logo sequence using the `Sprites` class `drawSelfMasked()` function.*
- void `bootLogoSpritesOverwrite` ()

*Display the boot logo sequence using the `Sprites` class `drawOverwrite()` function.*
- void `bootLogoShell` (void(\*drawLogo)(int16\_t))

*Display the boot logo sequence using the provided function.*
- void `display` ()

*Copy the contents of the display buffer to the display.*
- void `display` (bool clear)

*Copy the contents of the display buffer to the display. The display buffer can optionally be cleared.*
- void `drawPixel` (int16\_t x, int16\_t y, uint8\_t color=`WHITE`)

*Set a single pixel in the display buffer to the specified color.*
- uint8\_t `getPixel` (uint8\_t x, uint8\_t y)

*Returns the state of the given pixel in the screen buffer.*
- void `drawCircle` (int16\_t x0, int16\_t y0, uint8\_t r, uint8\_t color=`WHITE`)

*Draw a circle of a given radius.*
- void `fillCircle` (int16\_t x0, int16\_t y0, uint8\_t r, uint8\_t color=`WHITE`)

*Draw a filled-in circle of a given radius.*
- void `drawLine` (int16\_t x0, int16\_t y0, int16\_t x1, int16\_t y1, uint8\_t color=`WHITE`)

*Draw a line between two specified points.*
- void `drawRect` (int16\_t x, int16\_t y, uint8\_t w, uint8\_t h, uint8\_t color=`WHITE`)

*Draw a rectangle of a specified width and height.*

- void `drawFastVLine` (int16\_t x, int16\_t y, uint8\_t h, uint8\_t color=`WHITE`)  
*Draw a vertical line.*
- void `drawFastHLine` (int16\_t x, int16\_t y, uint8\_t w, uint8\_t color=`WHITE`)  
*Draw a horizontal line.*
- void `fillRect` (int16\_t x, int16\_t y, uint8\_t w, uint8\_t h, uint8\_t color=`WHITE`)  
*Draw a filled-in rectangle of a specified width and height.*
- void `fillScreen` (uint8\_t color=`WHITE`)  
*Fill the screen buffer with the specified color.*
- void `drawRoundRect` (int16\_t x, int16\_t y, uint8\_t w, uint8\_t h, uint8\_t r, uint8\_t color=`WHITE`)  
*Draw a rectangle with rounded corners.*
- void `fillRoundRect` (int16\_t x, int16\_t y, uint8\_t w, uint8\_t h, uint8\_t r, uint8\_t color=`WHITE`)  
*Draw a filled-in rectangle with rounded corners.*
- void `drawTriangle` (int16\_t x0, int16\_t y0, int16\_t x1, int16\_t y1, int16\_t x2, int16\_t y2, uint8\_t color=`WHITE`)  
*Draw a triangle given the coordinates of each corner.*
- void `fillTriangle` (int16\_t x0, int16\_t y0, int16\_t x1, int16\_t y1, int16\_t x2, int16\_t y2, uint8\_t color=`WHITE`)  
*Draw a filled-in triangle given the coordinates of each corner.*
- void `drawSlowXYBitmap` (int16\_t x, int16\_t y, const uint8\_t \*bitmap, uint8\_t w, uint8\_t h, uint8\_t color=`WHITE`)  
*Draw a bitmap from a horizontally oriented array in program memory.*
- uint8\_t \* `getBuffer` ()  
*Get a pointer to the display buffer in RAM.*
- void `initRandomSeed` ()  
*Seed the random number generator with a random value.*
- void `setFrameRate` (uint8\_t rate)  
*Set the frame rate used by the frame control functions.*
- bool `nextFrame` ()  
*Indicate that it's time to render the next frame.*
- bool `nextFrameDEV` ()  
*Indicate that it's time to render the next frame, and visually indicate if the code is running slower than the desired frame rate. **FOR USE DURING DEVELOPMENT***
- bool `everyXFrames` (uint8\_t frames)  
*Indicate if the specified number of frames has elapsed.*
- int `cpuLoad` ()  
*Return the load on the CPU as a percentage.*
- bool `pressed` (uint8\_t buttons)  
*Test if the specified buttons are pressed.*
- bool `notPressed` (uint8\_t buttons)  
*Test if the specified buttons are not pressed.*
- void `pollButtons` ()  
*Poll the buttons and track their state over time.*
- bool `justPressed` (uint8\_t button)  
*Check if a button has just been pressed.*
- bool `justReleased` (uint8\_t button)  
*Check if a button has just been released.*
- bool `collide` (Point point, Rect rect)  
*Test if a point falls within a rectangle.*
- bool `collide` (Rect rect1, Rect rect2)  
*Test if a rectangle is intersecting with another rectangle.*
- uint16\_t `readUnitID` ()  
*Read the unit ID from system EEPROM.*
- void `writeUnitID` (uint16\_t id)  
*Write a unit ID to system EEPROM.*

- uint8\_t `readUnitName` (char \*name)  
*Read the unit name from system EEPROM.*
- void `writeUnitName` (char \*name)  
*Write a unit name to system EEPROM.*
- bool `readShowUnitNameFlag` ()  
*Read the "Show Unit Name" flag in system EEPROM.*
- void `writeShowUnitNameFlag` (bool val)  
*Write the "Show Unit Name" flag in system EEPROM.*

## Static Public Member Functions

- static void `drawBitmap` (int16\_t x, int16\_t y, const uint8\_t \*bitmap, uint8\_t w, uint8\_t h, uint8\_t color=`WHITE`)  
*Draw a bitmap from an array in program memory.*
- static void `drawCompressed` (int16\_t sx, int16\_t sy, const uint8\_t \*bitmap, uint8\_t color=`WHITE`)  
*Draw a bitmap from an array of compressed data.*
- static void `idle` ()  
*Idle the CPU to save power.*
- static void `LCDDDataMode` ()  
*Put the display into data mode.*
- static void `LCDCommandMode` ()  
*Put the display into command mode.*
- static void `SPItransfer` (uint8\_t data)  
*Transfer a byte to the display.*
- static void `displayOff` ()  
*Turn the display off.*
- static void `displayOn` ()  
*Turn the display on.*
- static uint8\_t `width` ()  
*Get the width of the display in pixels.*
- static uint8\_t `height` ()  
*Get the height of the display in pixels.*
- static uint8\_t `buttonsState` ()  
*Get the current state of all buttons as a bitmask.*
- static void `paint8Pixels` (uint8\_t pixels)  
*Paint 8 pixels vertically to the display.*
- static void `paintScreen` (const uint8\_t \*image)  
*Paints an entire image directly to the display from program memory.*
- static void `paintScreen` (uint8\_t image[], bool clear=false)  
*Paints an entire image directly to the display from an array in RAM.*
- static void `blank` ()  
*Blank the display screen by setting all pixels off.*
- static void `invert` (bool inverse)  
*Invert the entire display or set it back to normal.*
- static void `allPixelsOn` (bool on)  
*Turn all display pixels on or display the buffer contents.*
- static void `flipVertical` (bool flipped)  
*Flip the display vertically or set it back to normal.*
- static void `flipHorizontal` (bool flipped)  
*Flip the display horizontally or set it back to normal.*
- static void `sendLCDCommand` (uint8\_t command)

- Send a single command byte to the display.*
- static void [setRGBled](#) (uint8\_t red, uint8\_t green, uint8\_t blue)  
*Set the light output of the RGB LED.*
- static void [digitalWriteRGB](#) (uint8\_t red, uint8\_t green, uint8\_t blue)  
*Set the RGB LEDs digitally, to either fully on or fully off.*
- static void [digitalWriteRGB](#) (uint8\_t color, uint8\_t val)  
*Set one of the RGB LEDs digitally, to either fully on or fully off.*
- static void [boot](#) ()  
*Initialize the Arduboy's hardware.*
- static void [safeMode](#) ()  
*Allow upload when the bootloader "magic number" could be corrupted.*
- static void [delayShort](#) (uint16\_t ms) `__attribute__((noinline))`  
*Delay for the number of milliseconds, specified as a 16 bit value.*

## Public Attributes

- [Arduboy2Audio](#) `audio`  
*An object created to provide audio control functions within this class.*
- uint16\_t [frameCount](#)  
*A counter which is incremented once per frame.*

## Static Public Attributes

- static uint8\_t [sBuffer](#) [(HEIGHT \* WIDTH)/8]  
*The display buffer array in RAM.*

### 6.1.1 Detailed Description

The main functions provided for writing sketches for the Arduboy, *including* text output.

This class is derived from [Arduboy2Base](#). It provides text output functions in addition to all the functions inherited from [Arduboy2Base](#).

#### Note

A friend class named *Arduboy2Ex* is declared by this class. The intention is to allow a sketch to create an *Arduboy2Ex* class which would have access to the private and protected members of the [Arduboy2](#) class. It is hoped that this may eliminate the need to create an entire local copy of the library, in order to extend the functionality, in most circumstances.

#### See also

[Arduboy2Base](#)

Definition at line 1151 of file Arduboy2.h.

### 6.1.2 Member Function Documentation

#### 6.1.2.1 void Arduboy2Core::allPixelsOn ( bool on ) [static],[inherited]

Turn all display pixels on or display the buffer contents.

#### Parameters

<i>on</i>	<code>true</code> turns all pixels on. <code>false</code> displays the contents of the hardware display buffer.
-----------	---

Calling this function with a value of `true` will override the contents of the hardware display buffer and turn all pixels on. The contents of the hardware buffer will remain unchanged.

Calling this function with a value of `false` will set the normal state of displaying the contents of the hardware display buffer.

#### Note

All pixels will be lit even if the display is in inverted mode.

#### See also

[invert\(\)](#)

Definition at line 375 of file `Arduboy2Core.cpp`.

#### 6.1.2.2 void Arduboy2Base::begin ( ) [inherited]

Initialize the hardware, display the boot logo, provide boot utilities, etc.

This function should be called once near the start of the sketch, usually in `setup()`, before using any other functions in this class. It initializes the display, displays the boot logo, provides "flashlight" and system control features and initializes audio control.

#### Note

To free up some code space for use by the sketch, [boot\(\)](#) can be used instead of `begin()` to allow the elimination of some of the things that aren't really required, such as displaying the boot logo.

#### See also

[boot\(\)](#)

Definition at line 34 of file `Arduboy2.cpp`.

#### 6.1.2.3 void Arduboy2Core::blank ( ) [static],[inherited]

Blank the display screen by setting all pixels off.

All pixels on the screen will be written with a value of 0 to turn them off.

Definition at line 353 of file `Arduboy2Core.cpp`.



#### 6.1.2.4 void Arduboy2Core::boot ( ) [static],[inherited]

Initialize the Arduboy's hardware.

This function initializes the display, buttons, etc.

This function is called by `begin()` so isn't normally called within a sketch. However, in order to free up some code space, by eliminating some of the start up features, it can be called in place of `begin()`. The functions that `begin()` would call after `boot()` can then be called to add back in some of the start up features, if desired. See the README file or documentation on the main page for more details.

See also

[Arduboy2Base::begin\(\)](#)

Definition at line 76 of file `Arduboy2Core.cpp`.

#### 6.1.2.5 void Arduboy2Base::bootLogo ( ) [inherited]

Display the boot logo sequence using `drawBitmap()`.

This function is called by `begin()` and can be called by a sketch after `boot()`.

The Arduboy logo scrolls down from the top of the screen to the center while the RGB LEDs light in sequence.

If the RIGHT button is pressed while the logo is scrolling down, the boot logo sequence will be aborted. This can be useful for developers who wish to quickly start testing, or anyone else who is impatient and wants to go straight to the actual sketch.

This function calls `bootLogoExtra()` after the logo stops scrolling down, which derived classes can implement to add additional information to the logo screen. The `Arduboy2` class uses this to display the unit name.

See also

[begin\(\)](#) [boot\(\)](#) [Arduboy2::bootLogoExtra\(\)](#) [bootLogoShell\(\)](#) [Arduboy2::bootLogoText\(\)](#)

Definition at line 105 of file `Arduboy2.cpp`.

#### 6.1.2.6 void Arduboy2Base::bootLogoCompressed ( ) [inherited]

Display the boot logo sequence using `drawCompressed()`.

This function can be called by a sketch after `boot()` as an alternative to `bootLogo()`. This may reduce code size if the sketch itself uses `drawCompressed()`.

See also

[bootLogo\(\)](#) [begin\(\)](#) [boot\(\)](#)

Definition at line 115 of file `Arduboy2.cpp`.

### 6.1.2.7 void Arduboy2::bootLogoExtra ( ) [virtual]

Show the unit name at the bottom of the boot logo screen.

This function is called by [bootLogoShell\(\)](#) and [bootLogoText\(\)](#).

If a unit name has been saved in system EEPROM, it will be displayed at the bottom of the screen. This function pauses for a short time to allow the name to be seen.

The name is not displayed if the "Show Unit Name" flag is not set.

#### Note

This function would not normally be called directly from within a sketch itself.

#### See also

[readUnitName\(\)](#) [writeUnitName\(\)](#) [bootLogo\(\)](#) [bootLogoShell\(\)](#) [bootLogoText\(\)](#) [writeShowUnitNameFlag\(\)](#) [begin\(\)](#)

Reimplemented from [Arduboy2Base](#).

Definition at line 1162 of file [Arduboy2.cpp](#).

### 6.1.2.8 void Arduboy2Base::bootLogoShell ( void(\*)(int16\_t) drawLogo ) [inherited]

Display the boot logo sequence using the provided function.

#### Parameters

<i>drawLogo</i>	A reference to a function which will draw the boot logo at the given Y position.
-----------------	--

This common function executes the sequence to display the boot logo. It is called by [bootLogo\(\)](#) and other similar functions which provide it with a reference to a function which will do the actual drawing of the logo.

The prototype for the function provided to draw the logo is:

```
void drawLogo(int16_t y);
```

The y parameter is the Y offset for the top of the logo. It is expected that the logo will be 16 pixels high and centered horizontally. This will result in the logo stopping in the middle of the screen at the end of the sequence. If the logo height is not 16 pixels, the Y value can be adjusted to compensate.

#### See also

[bootLogo\(\)](#) [boot\(\)](#)

Definition at line 147 of file [Arduboy2.cpp](#).

**6.1.2.9 void Arduboy2Base::bootLogoSpritesOverwrite ( ) [inherited]**

Display the boot logo sequence using the [Sprites](#) class `drawOverwrite()` function.

This function can be called by a sketch after `boot()` as an alternative to `bootLogo()`. This may reduce code size if the sketch itself uses [Sprites](#) class functions.

See also

[bootLogo\(\)](#) [begin\(\)](#) [boot\(\)](#) [Sprites](#)

Definition at line 135 of file `Arduboy2.cpp`.

**6.1.2.10 void Arduboy2Base::bootLogoSpritesSelfMasked ( ) [inherited]**

Display the boot logo sequence using the [Sprites](#) class `drawSelfMasked()` function.

This function can be called by a sketch after `boot()` as an alternative to `bootLogo()`. This may reduce code size if the sketch itself uses [Sprites](#) class functions.

See also

[bootLogo\(\)](#) [begin\(\)](#) [boot\(\)](#) [Sprites](#)

Definition at line 125 of file `Arduboy2.cpp`.

**6.1.2.11 void Arduboy2::bootLogoText ( )**

Display the boot logo sequence using printed text instead of a bitmap.

This function can be called by a sketch after `boot()` as an alternative to `bootLogo()`.

The Arduboy logo scrolls down from the top of the screen to the center while the RGB LEDs light in sequence.

This function is the same as `bootLogo()` except the logo is printed as text instead of being rendered as a bitmap. It can be used to save some code space in a case where the sketch is using the [Print](#) class functions to display text. However, the logo will not look as good when printed as text as it does with the bitmap used by `bootLogo()`.

See also

[bootLogo\(\)](#) [boot\(\)](#) [Arduboy2::bootLogoExtra\(\)](#)

Definition at line 1120 of file `Arduboy2.cpp`.

**6.1.2.12 uint8\_t Arduboy2Core::buttonsState ( ) [static],[inherited]**

Get the current state of all buttons as a bitmask.

Returns

A bitmask of the state of all the buttons.

The returned mask contains a bit for each button. For any pressed button, its bit will be 1. For released buttons their associated bits will be 0.

The following defined mask values should be used for the buttons:

`LEFT_BUTTON`, `RIGHT_BUTTON`, `UP_BUTTON`, `DOWN_BUTTON`, `A_BUTTON`, `B_BUTTON`

Definition at line 449 of file `Arduboy2Core.cpp`.

**6.1.2.13 bool Arduboy2Base::collide ( [Point](#) *point*, [Rect](#) *rect* ) [inherited]**

Test if a point falls within a rectangle.

**Parameters**

<i>point</i>	A structure describing the location of the point.
<i>rect</i>	A structure describing the location and size of the rectangle.

**Returns**

`true` if the specified point is within the specified rectangle.

This function is intended to determine if an object, whose boundaries are defined by the given rectangle, is in contact with the given point.

**See also**

[Point Rect](#)

Definition at line 1021 of file Arduboy2.cpp.

**6.1.2.14** `bool Arduboy2Base::collide ( Rect rect1, Rect rect2 )` `[inherited]`

Test if a rectangle is intersecting with another rectangle.

**Parameters**

<i>rect1, rect2</i>	Structures describing the size and locations of the rectangles.
---------------------	---

**Returns**

`true` if the first rectangle is intersecting the second.

This function is intended to determine if an object, whose boundaries are defined by the given rectangle, is in contact with another rectangular object.

**See also**

[Rect](#)

Definition at line 1027 of file Arduboy2.cpp.

**6.1.2.15** `int Arduboy2Base::cpuLoad ( )` `[inherited]`

Return the load on the CPU as a percentage.

**Returns**

The load on the CPU as a percentage of the total frame time.

The returned value gives the time spent processing a frame as a percentage the total time allotted for a frame, as determined by the frame rate.

This function normally wouldn't be used in the final program. It is intended for use during program development as an aid in helping with frame timing.

**Note**

The percentage returned can be higher than 100 if more time is spent processing a frame than the time allotted per frame. This would indicate that the frame rate should be made slower or the frame processing code should be optimized to run faster.

**See also**

[setFrameRate\(\)](#) [nextFrame\(\)](#)

Definition at line 250 of file Arduboy2.cpp.

**6.1.2.16 void Arduboy2Core::delayShort ( uint16\_t ms ) [static],[inherited]**

Delay for the number of milliseconds, specified as a 16 bit value.

**Parameters**

<i>ms</i>	The delay in milliseconds.
-----------	----------------------------

This function works the same as the Arduino `delay()` function except the provided value is 16 bits long, so the maximum delay allowed is 65535 milliseconds (about 65.5 seconds). Using this function instead of Arduino `delay()` will save a few bytes of code.

Definition at line 474 of file Arduboy2Core.cpp.

**6.1.2.17 void Arduboy2Core::digitalWriteRGB ( uint8\_t red, uint8\_t green, uint8\_t blue ) [static],[inherited]**

Set the RGB LEDs digitally, to either fully on or fully off.

**Parameters**

<i>red, green, blue</i>	Use value RGB_ON or RGB_OFF to set each LED.
-------------------------	--

The RGB LED is actually individual red, green and blue LEDs placed very close together in a single package. This 3 parameter version of the function will set each LED either on or off, to set the RGB LED to 7 different colors at their highest brightness or turn it off.

The colors are as follows:

RED_LED	GREEN_LED	BLUE_LED	COLOR
-----	-----	-----	-----
RGB_OFF	RGB_OFF	RGB_OFF	OFF
RGB_OFF	RGB_OFF	RGB_ON	Blue
RGB_OFF	RGB_ON	RGB_OFF	Green
RGB_OFF	RGB_ON	RGB_ON	Cyan
RGB_ON	RGB_OFF	RGB_OFF	Red
RGB_ON	RGB_OFF	RGB_ON	Magenta
RGB_ON	RGB_ON	RGB_OFF	Yellow
RGB_ON	RGB_ON	RGB_ON	White

**Note**

Many of the Kickstarter Arduboy2s were accidentally shipped with the RGB LED installed incorrectly. For these units, the green LED cannot be lit. As long as the green led is set to off, turning on the red LED will actually light the blue LED and turning on the blue LED will actually light the red LED. If the green LED is turned on, none of the LEDs will light.

**See also**

[digitalWriteRGB\(uint8\\_t, uint8\\_t\) setRGBled\(\)](#)

Definition at line 409 of file Arduboy2Core.cpp.

**6.1.2.18** `void Arduboy2Core::digitalWriteRGB ( uint8_t color, uint8_t val )` `[static], [inherited]`

Set one of the RGB LEDs digitally, to either fully on or fully off.

**Parameters**

<i>color</i>	The name of the LED to set. The value given should be one of RED_LED, GREEN_LED or BLUE_LED.
<i>val</i>	Indicates whether to turn the specified LED on or off. The value given should be RGB_ON or RGB_OFF.

This 2 parameter version of the function will set a single LED within the RGB LED either fully on or fully off. See the description of the 3 parameter version of this function for more details on the RGB LED.

**See also**

[digitalWriteRGB\(uint8\\_t, uint8\\_t, uint8\\_t\) setRGBled\(\)](#)

Definition at line 423 of file Arduboy2Core.cpp.

**6.1.2.19** `void Arduboy2Base::display ( )` `[inherited]`

Copy the contents of the display buffer to the display.

The contents of the display buffer in RAM are copied to the display and will appear on the screen.

**See also**

[display\(bool\)](#)

Definition at line 980 of file Arduboy2.cpp.

#### 6.1.2.20 void Arduboy2Base::display ( bool *clear* ) [inherited]

Copy the contents of the display buffer to the display. The display buffer can optionally be cleared.

## Parameters

<i>clear</i>	If <code>true</code> the display buffer will be cleared to zero. The defined value <code>CLEAR_BUFFER</code> should be used instead of <code>true</code> to make it more meaningful.
--------------	--

Operation is the same as calling `display()` without parameters except additionally the display buffer will be cleared if the parameter evaluates to `true`. (The defined value `CLEAR_BUFFER` can be used for this)

Using `display(CLEAR_BUFFER)` is faster and produces less code than calling `display()` followed by `clear()`.

## See also

[display\(\)](#) [clear\(\)](#)

Definition at line 985 of file `Arduboy2.cpp`.

#### 6.1.2.21 `void Arduboy2Core::displayOff ( )` `[static]`, `[inherited]`

Turn the display off.

The display will clear and be put into a low power mode. This can be used to extend battery life when a game is paused or when a sketch doesn't require anything to be displayed for a relatively long period of time.

## See also

[displayOn\(\)](#)

Definition at line 278 of file `Arduboy2Core.cpp`.

#### 6.1.2.22 `void Arduboy2Core::displayOn ( )` `[static]`, `[inherited]`

Turn the display on.

Used to power up and reinitialize the display after calling `displayOff()`.

## Note

The previous call to `displayOff()` will have caused the display's buffer contents to be lost. The display will have to be re-painted, which is usually done by calling `display()`.

## See also

[displayOff\(\)](#)

Definition at line 289 of file `Arduboy2Core.cpp`.

#### 6.1.2.23 `void Arduboy2Base::drawBitmap ( int16_t x, int16_t y, const uint8_t * bitmap, uint8_t w, uint8_t h, uint8_t color = WHITE )` `[static]`, `[inherited]`

Draw a bitmap from an array in program memory.



## Parameters

<i>x</i>	The X coordinate of the top left pixel affected by the bitmap.
<i>y</i>	The Y coordinate of the top left pixel affected by the bitmap.
<i>bitmap</i>	A pointer to the bitmap array in program memory.
<i>w</i>	The width of the bitmap in pixels.
<i>h</i>	The height of the bitmap in pixels.
<i>color</i>	The color of pixels for bits set to 1 in the bitmap. If the value is INVERT, bits set to 1 will invert the corresponding pixel. (optional; defaults to WHITE).

Bits set to 1 in the provided bitmap array will have their corresponding pixel set to the specified color. For bits set to 0 in the array, the corresponding pixel will be left unchanged.

Each byte in the array specifies a vertical column of 8 pixels, with the least significant bit at the top.

The array must be located in program memory by using the PROGMEM modifier.

Definition at line 786 of file Arduboy2.cpp.

**6.1.2.24** `void Arduboy2::drawChar ( int16_t x, int16_t y, unsigned char c, uint8_t color, uint8_t bg, uint8_t size )`

Draw a single ASCII character at the specified location in the screen buffer.

## Parameters

<i>x</i>	The X coordinate, in pixels, for where to draw the character.
<i>y</i>	The Y coordinate, in pixels, for where to draw the character.
<i>c</i>	The ASCII value of the character to be drawn.
<i>color</i>	the foreground color of the character.
<i>bg</i>	the background color of the character.
<i>size</i>	The size of the character to draw.

The specified ASCII character is drawn starting at the provided coordinate. The point specified by the X and Y coordinates will be the top left corner of the character.

## Note

This is a low level function used by the `write()` function to draw a character. Although it's available as a public function, it wouldn't normally be used. In most cases the Arduino `Print` class should be used for writing text.

## See also

`Print write() setTextColor() setTextBackground() setTextSize()`

Definition at line 1217 of file Arduboy2.cpp.

**6.1.2.25** `void Arduboy2Base::drawCircle ( int16_t x0, int16_t y0, uint8_t r, uint8_t color = WHITE )` `[inherited]`

Draw a circle of a given radius.

## Parameters

<i>x0</i>	The X coordinate of the circle's center.
<i>y0</i>	The Y coordinate of the circle's center.
<i>r</i>	The radius of the circle in pixels.
<i>color</i>	The circle's color (optional; defaults to WHITE).

Definition at line 344 of file Arduboy2.cpp.

**6.1.2.26** `void Arduboy2Base::drawCompressed ( int16_t sx, int16_t sy, const uint8_t * bitmap, uint8_t color = WHITE )`  
 [static],[inherited]

Draw a bitmap from an array of compressed data.

## Parameters

<i>sx</i>	The X coordinate of the top left pixel affected by the bitmap.
<i>sy</i>	The Y coordinate of the top left pixel affected by the bitmap.
<i>bitmap</i>	A pointer to the compressed bitmap array in program memory.
<i>color</i>	The color of pixels for bits set to 1 in the bitmap. (optional; defaults to WHITE).

Draw a bitmap starting at the given coordinates from an array that has been compressed using an algorithm implemented by Team A.R.G. For more information see: <https://github.com/TEAMarg/drawCompressed>  
<https://github.com/TEAMarg/Cabi>

Bits set to 1 in the provided bitmap array will have their corresponding pixel set to the specified color. For bits set to 0 in the array, the corresponding pixel will be left unchanged.

The array must be located in program memory by using the PROGMEM modifier.

Definition at line 875 of file Arduboy2.cpp.

**6.1.2.27** `void Arduboy2Base::drawFastHLine ( int16_t x, int16_t y, uint8_t w, uint8_t color = WHITE )` [inherited]

Draw a horizontal line.

## Parameters

<i>x</i>	The X coordinate of the left start point.
<i>y</i>	The Y coordinate of the left start point.
<i>w</i>	The width of the line.
<i>color</i>	The color of the line (optional; defaults to WHITE).

Definition at line 540 of file Arduboy2.cpp.

**6.1.2.28** `void Arduboy2Base::drawFastVLine ( int16_t x, int16_t y, uint8_t h, uint8_t color = WHITE )` [inherited]

Draw a vertical line.

## Parameters

<i>x</i>	The X coordinate of the upper start point.
<i>y</i>	The Y coordinate of the upper start point.
<i>h</i>	The height of the line.
<i>color</i>	The color of the line (optional; defaults to WHITE).

Definition at line 530 of file Arduboy2.cpp.

**6.1.2.29** `void Arduboy2Base::drawLine ( int16_t x0, int16_t y0, int16_t x1, int16_t y1, uint8_t color = WHITE )`  
[inherited]

Draw a line between two specified points.

## Parameters

<i>x0,x1</i>	The X coordinates of the line ends.
<i>y0,y1</i>	The Y coordinates of the line ends.
<i>color</i>	The line's color (optional; defaults to WHITE).

Draw a line from the start point to the end point using Bresenham's algorithm. The start and end points can be at any location with respect to the other.

Definition at line 470 of file Arduboy2.cpp.

**6.1.2.30** `void Arduboy2Base::drawPixel ( int16_t x, int16_t y, uint8_t color = WHITE )` [inherited]

Set a single pixel in the display buffer to the specified color.

## Parameters

<i>x</i>	The X coordinate of the pixel.
<i>y</i>	The Y coordinate of the pixel.
<i>color</i>	The color of the pixel (optional; defaults to WHITE).

The single pixel specified location in the display buffer is set to the specified color. The values WHITE or BLACK can be used for the color. If the `color` parameter isn't included, the pixel will be set to WHITE.

Definition at line 283 of file Arduboy2.cpp.

**6.1.2.31** `void Arduboy2Base::drawRect ( int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t color = WHITE )`  
[inherited]

Draw a rectangle of a specified width and height.

## Parameters

<i>x</i>	The X coordinate of the upper left corner.
<i>y</i>	The Y coordinate of the upper left corner.
<i>w</i>	The width of the rectangle.
<i>h</i>	The height of the rectangle.
<i>color</i>	The color of the pixel (optional; defaults to WHITE).

Definition at line 521 of file Arduboy2.cpp.

**6.1.2.32** `void Arduboy2Base::drawRoundRect ( int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t r, uint8_t color = WHITE )`  
[inherited]

Draw a rectangle with rounded corners.

## Parameters

<i>x</i>	The X coordinate of the left edge.
<i>y</i>	The Y coordinate of the top edge.
<i>w</i>	The width of the rectangle.
<i>h</i>	The height of the rectangle.
<i>r</i>	The radius of the semicircles forming the corners.
<i>color</i>	The color of the rectangle (optional; defaults to WHITE).

Definition at line 649 of file Arduboy2.cpp.

**6.1.2.33** `void Arduboy2Base::drawSlowXYBitmap ( int16_t x, int16_t y, const uint8_t* bitmap, uint8_t w, uint8_t h, uint8_t color = WHITE )`  
[inherited]

Draw a bitmap from a horizontally oriented array in program memory.

## Parameters

<i>x</i>	The X coordinate of the top left pixel affected by the bitmap.
<i>y</i>	The Y coordinate of the top left pixel affected by the bitmap.
<i>bitmap</i>	A pointer to the bitmap array in program memory.
<i>w</i>	The width of the bitmap in pixels.
<i>h</i>	The height of the bitmap in pixels.
<i>color</i>	The color of pixels for bits set to 1 in the bitmap. (optional; defaults to WHITE).

Bits set to 1 in the provided bitmap array will have their corresponding pixel set to the specified color. For bits set to 0 in the array, the corresponding pixel will be left unchanged.

Each byte in the array specifies a horizontal row of 8 pixels, with the most significant bit at the left end of the row.

The array must be located in program memory by using the PROGMEM modifier.

**Note**

This function requires a lot of additional CPU power and will draw images slower than `drawBitmap()`, which uses bitmaps that are stored in a format that allows them to be directly written to the screen. It is recommended you use `drawBitmap()` when possible.

Definition at line 832 of file Arduboy2.cpp.

**6.1.2.34** `void Arduboy2Base::drawTriangle ( int16_t x0, int16_t y0, int16_t x1, int16_t y1, int16_t x2, int16_t y2, uint8_t color = WHITE )` `[inherited]`

Draw a triangle given the coordinates of each corner.

**Parameters**

<i>x0,x1,x2</i>	The X coordinates of the corners.
<i>y0,y1,y2</i>	The Y coordinates of the corners.
<i>color</i>	The triangle's color (optional; defaults to WHITE).

A triangle is drawn by specifying each of the three corner locations. The corners can be at any position with respect to the others.

Definition at line 675 of file Arduboy2.cpp.

**6.1.2.35** `bool Arduboy2Base::everyXFrames ( uint8_t frames )` `[inherited]`

Indicate if the specified number of frames has elapsed.

**Parameters**

<i>frames</i>	The desired number of elapsed frames.
---------------	---------------------------------------

**Returns**

`true` if the specified number of frames has elapsed.

This function should be called with the same value each time for a given event. It will return `true` if the given number of frames has elapsed since the previous frame in which it returned `true`.

For example, if you wanted to fire a shot every 5 frames while the A button is being held down:

```
if (arduboy.everyXframes(5)) {
    if arduboy.pressed(A_BUTTON) {
        fireShot();
    }
}
```

**See also**

[setFrameRate\(\)](#) [nextFrame\(\)](#)

Definition at line 193 of file Arduboy2.cpp.

**6.1.2.36** `void Arduboy2Base::fillCircle ( int16_t x0, int16_t y0, uint8_t r, uint8_t color = WHITE )` `[inherited]`

Draw a filled-in circle of a given radius.

#### Parameters

<i>x0</i>	The X coordinate of the circle's center.
<i>y0</i>	The Y coordinate of the circle's center.
<i>r</i>	The radius of the circle in pixels.
<i>color</i>	The circle's color (optional; defaults to WHITE).

Definition at line 426 of file Arduboy2.cpp.

**6.1.2.37** `void Arduboy2Base::fillRect ( int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t color = WHITE )` `[inherited]`

Draw a filled-in rectangle of a specified width and height.

#### Parameters

<i>x</i>	The X coordinate of the upper left corner.
<i>y</i>	The Y coordinate of the upper left corner.
<i>w</i>	The width of the rectangle.
<i>h</i>	The height of the rectangle.
<i>color</i>	The color of the pixel (optional; defaults to WHITE).

Definition at line 591 of file Arduboy2.cpp.

**6.1.2.38** `void Arduboy2Base::fillRoundRect ( int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t r, uint8_t color = WHITE )`  
`[inherited]`

Draw a filled-in rectangle with rounded corners.

#### Parameters

<i>x</i>	The X coordinate of the left edge.
<i>y</i>	The Y coordinate of the top edge.
<i>w</i>	The width of the rectangle.
<i>h</i>	The height of the rectangle.
<i>r</i>	The radius of the semicircles forming the corners.
<i>color</i>	The color of the rectangle (optional; defaults to WHITE).

Definition at line 664 of file Arduboy2.cpp.

**6.1.2.39** `void Arduboy2Base::fillScreen ( uint8_t color = WHITE )` `[inherited]`

Fill the screen buffer with the specified color.

## Parameters

<i>color</i>	The fill color (optional; defaults to WHITE).
--------------	---

Definition at line 600 of file Arduboy2.cpp.

**6.1.2.40** `void Arduboy2Base::fillTriangle ( int16_t x0, int16_t y0, int16_t x1, int16_t y1, int16_t x2, int16_t y2, uint8_t color = WHITE )` [inherited]

Draw a filled-in triangle given the coordinates of each corner.

## Parameters

<i>x0,x1,x2</i>	The X coordinates of the corners.
<i>y0,y1,y2</i>	The Y coordinates of the corners.
<i>color</i>	The triangle's color (optional; defaults to WHITE).

A triangle is drawn by specifying each of the three corner locations. The corners can be at any position with respect to the others.

Definition at line 683 of file Arduboy2.cpp.

**6.1.2.41** `void Arduboy2Base::flashlight ( )` [inherited]

Turn the RGB LED and display fully on to act as a small flashlight/torch.

Checks if the UP button is pressed and if so turns the RGB LED and all display pixels fully on. If the UP button is detected, this function does not exit. The Arduboy must be restarted after flashlight mode is used.

This function is called by `begin()` and can be called by a sketch after `boot()`.

## Note

This function also contains code to address a problem with uploading a new sketch, for sketches that interfere with the bootloader "magic number". This problem occurs with certain sketches that use large amounts of RAM. Being in flashlight mode when uploading a new sketch can fix this problem.

Therefore, for sketches that potentially could cause this problem, and use `boot()` instead of `begin()`, it is recommended that a call to `flashlight()` be included after calling `boot()`. If program space is limited, `safeMode()` can be used instead of `flashlight()`.

## See also

`begin()` `boot()` `safeMode()`

Definition at line 60 of file Arduboy2.cpp.

**6.1.2.42** `void Arduboy2Core::flipHorizontal ( bool flipped )` [static], [inherited]

Flip the display horizontally or set it back to normal.

## Parameters

<i>flipped</i>	<code>true</code> will set horizontal flip mode. <code>false</code> will set normal horizontal orientation.
----------------	---

Calling this function with a value of `true` will cause the X coordinate to start at the left edge of the display instead of the right, effectively flipping the display horizontally.

Once in horizontal flip mode, it will remain this way until normal horizontal mode is set by calling this function with a value of `false`.

## See also

[flipVertical\(\)](#)

Definition at line 387 of file `Arduboy2Core.cpp`.

**6.1.2.43** `void Arduboy2Core::flipVertical ( bool flipped )` `[static]`, `[inherited]`

Flip the display vertically or set it back to normal.

## Parameters

<i>flipped</i>	<code>true</code> will set vertical flip mode. <code>false</code> will set normal vertical orientation.
----------------	---

Calling this function with a value of `true` will cause the Y coordinate to start at the bottom edge of the display instead of the top, effectively flipping the display vertically.

Once in vertical flip mode, it will remain this way until normal vertical mode is set by calling this function with a value of `false`.

## See also

[flipHorizontal\(\)](#)

Definition at line 381 of file `Arduboy2Core.cpp`.

**6.1.2.44** `uint8_t* Arduboy2Base::getBuffer ( )` `[inherited]`

Get a pointer to the display buffer in RAM.

## Returns

A pointer to the display buffer array in RAM.

The location of the display buffer in RAM, which is displayed using `display()`, can be gotten using this function. The buffer can then be read and directly manipulated.

## Note

The display buffer array, `sBuffer`, is public. A sketch can access it directly. Doing so may be more efficient than accessing it via the pointer returned by `getBuffer()`.

## See also

[sBuffer](#)

Definition at line 990 of file `Arduboy2.cpp`.



#### 6.1.2.45 int16\_t Arduboy2::getCursorX ( )

Get the X coordinate of the current text cursor position.

##### Returns

The X coordinate of the current text cursor position.

The X coordinate returned is a pixel location with 0 indicating the leftmost column.

Definition at line 1261 of file Arduboy2.cpp.

#### 6.1.2.46 int16\_t Arduboy2::getCursorY ( )

Get the Y coordinate of the current text cursor position.

##### Returns

The Y coordinate of the current text cursor position.

The Y coordinate returned is a pixel location with 0 indicating the topmost row.

Definition at line 1266 of file Arduboy2.cpp.

#### 6.1.2.47 uint8\_t Arduboy2Base::getPixel ( uint8\_t x, uint8\_t y ) [inherited]

Returns the state of the given pixel in the screen buffer.

##### Parameters

<i>x</i>	The X coordinate of the pixel.
<i>y</i>	The Y coordinate of the pixel.

##### Returns

WHITE if the pixel is on or BLACK if the pixel is off.

Definition at line 337 of file Arduboy2.cpp.

#### 6.1.2.48 uint8\_t Arduboy2Core::height ( ) [static],[inherited]

Get the height of the display in pixels.

##### Returns

The height of the display in pixels.

##### Note

In most cases, the defined value `HEIGHT` would be better to use instead of this function.

Definition at line 296 of file Arduboy2Core.cpp.

#### 6.1.2.49 void Arduboy2Core::idle ( ) [static],[inherited]

Idle the CPU to save power.

This puts the CPU in *idle* sleep mode. You should call this as often as you can for the best power savings. The timer 0 overflow interrupt will wake up the chip every 1ms, so even at 60 FPS a well written app should be able to sleep maybe half the time in between rendering it's own frames.

Definition at line 262 of file Arduboy2Core.cpp.

#### 6.1.2.50 void Arduboy2Base::initRandomSeed ( ) [inherited]

Seed the random number generator with a random value.

The Arduino random number generator is seeded with a random value derived from entropy from the temperature, voltage reading, and microseconds since boot.

This method is still most effective when called after a semi-random time, such as after a user hits a button to start a game or other semi-random event.

Definition at line 255 of file Arduboy2.cpp.

#### 6.1.2.51 void Arduboy2Core::invert ( bool *inverse* ) [static],[inherited]

Invert the entire display or set it back to normal.

##### Parameters

<i>inverse</i>	<code>true</code> will invert the display. <code>false</code> will set the display to no-inverted.
----------------	--

Calling this function with a value of `true` will set the display to inverted mode. A pixel with a value of 0 will be on and a pixel set to 1 will be off.

Once in inverted mode, the display will remain this way until it is set back to non-inverted mode by calling this function with `false`.

Definition at line 368 of file Arduboy2Core.cpp.

#### 6.1.2.52 bool Arduboy2Base::justPressed ( uint8\_t *button* ) [inherited]

Check if a button has just been pressed.

##### Parameters

<i>button</i>	The button to test for. Only one button should be specified.
---------------	--

##### Returns

`true` if the specified button has just been pressed.

Return `true` if the given button was pressed between the latest call to `pollButtons()` and previous call to `pollButtons()`. If the button has been held down over multiple polls, this function will return `false`.

There is no need to check for the release of the button since it must have been released for this function to return `true` when pressed again.

This function should only be used to test a single button.

See also

[pollButtons\(\) justReleased\(\)](#)

Definition at line 1011 of file Arduboy2.cpp.

#### 6.1.2.53 `bool Arduboy2Base::justReleased ( uint8_t button )` [inherited]

Check if a button has just been released.

Parameters

<i>button</i>	The button to test for. Only one button should be specified.
---------------	--

Returns

`true` if the specified button has just been released.

Return `true` if the given button, having previously been pressed, was released between the latest call to `pollButtons()` and previous call to `pollButtons()`. If the button has remained released over multiple polls, this function will return `false`.

There is no need to check for the button having been pressed since it must have been previously pressed for this function to return `true` upon release.

This function should only be used to test a single button.

Note

There aren't many cases where this function would be needed. Wanting to know if a button has been released, without knowing when it was pressed, is uncommon.

See also

[pollButtons\(\) justPressed\(\)](#)

Definition at line 1016 of file Arduboy2.cpp.

#### 6.1.2.54 void Arduboy2Core::LCDCommandMode ( ) [static],[inherited]

Put the display into command mode.

When placed in command mode, data that is sent to the display will be treated as commands.

See the SSD1306 controller and OLED display documents for available commands and command sequences.

Links:

- <https://www.adafruit.com/datasheets/SSD1306.pdf>
- [http://www.buydisplay.com/download/manual/ER-OLED013-1\\_Series\\_Datasheet.pdf](http://www.buydisplay.com/download/manual/ER-OLED013-1_Series_Datasheet.pdf)

#### Note

This is a low level function that is not intended for general use in a sketch. It has been made public and documented for use by derived classes.

See also

[LCDDataMode\(\)](#) [sendLCDCommand\(\)](#) [SPITransfer\(\)](#)

Definition at line 218 of file Arduboy2Core.cpp.

#### 6.1.2.55 void Arduboy2Core::LCDDataMode ( ) [static],[inherited]

Put the display into data mode.

When placed in data mode, data that is sent to the display will be considered as data to be displayed.

#### Note

This is a low level function that is not intended for general use in a sketch. It has been made public and documented for use by derived classes.

See also

[LCDCommandMode\(\)](#) [SPITransfer\(\)](#)

Definition at line 213 of file Arduboy2Core.cpp.

**6.1.2.56** `bool Arduboy2Base::nextFrame ( )` [inherited]

Indicate that it's time to render the next frame.

**Returns**

`true` if it's time for the next frame.

When this function returns `true`, the amount of time has elapsed to display the next frame, as specified by `setFrameRate()`.

This function will normally be called at the start of the rendering loop which would wait for `true` to be returned before rendering and displaying the next frame.

example:

```
void loop() {
  if (!arduboy.nextFrame()) {
    return; // go back to the start of the loop
  }
  // render and display the next frame
}
```

**See also**

[setFrameRate\(\)](#) [nextFrameDEV\(\)](#)

Definition at line 198 of file Arduboy2.cpp.

**6.1.2.57** `bool Arduboy2Base::nextFrameDEV ( )` [inherited]

Indicate that it's time to render the next frame, and visually indicate if the code is running slower than the desired frame rate. **FOR USE DURING DEVELOPMENT**

**Returns**

`true` if it's time for the next frame.

This function is intended to be used in place of `nextFrame()` during the development of a sketch. It does the same thing as `nextFrame()` but additionally will light the yellow TX LED (at the bottom, to the left of the USB connector) whenever a frame takes longer to generate than the time allotted per frame, as determined by the `setFrameRate()` function.

Therefore, whenever the TX LED comes on (while not communicating over USB), it indicates that the sketch is running slower than the desired rate set by `setFrameRate()`. In this case the developer may wish to set a slower frame rate, or reduce or optimize the code for such frames.

**Note**

Once a sketch is ready for release, it would be expected that `nextFrameDEV()` calls be restored to `nextFrame()`.

**See also**

[nextFrame\(\)](#) [cpuLoad\(\)](#) [setFrameRate\(\)](#)

Definition at line 237 of file Arduboy2.cpp.

**6.1.2.58** `bool Arduboy2Base::notPressed ( uint8_t buttons )` [inherited]

Test if the specified buttons are not pressed.

**Parameters**

<i>buttons</i>	A bit mask indicating which buttons to test. (Can be a single button)
----------------	---

**Returns**

`true` if *all* buttons in the provided mask are currently released.

Read the state of the buttons and return `true` if all the buttons in the specified mask are currently released.

Example: `if (notPressed(UP_BUTTON) )`

**Note**

This function does not perform any button debouncing.

Definition at line 1000 of file `Arduboy2.cpp`.

#### 6.1.2.59 `void Arduboy2Core::paint8Pixels ( uint8_t pixels )` `[static],[inherited]`

Paint 8 pixels vertically to the display.

**Parameters**

<i>pixels</i>	A byte whose bits specify a vertical column of 8 pixels.
---------------	--

A byte representing a vertical column of 8 pixels is written to the display at the current page and column address. The address is then incremented. The page/column address will wrap to the start of the display (the top left) when it increments past the end (lower right).

The least significant bit represents the top pixel in the column. A bit set to 1 is lit, 0 is unlit.

Example:

`X = lit pixels, . = unlit pixels`

<code>blank()</code>	<code>paint8Pixels() 0xFF, 0, 0xF0, 0, 0x0F</code>
<code>v TOP LEFT corner (8x9)</code>	<code>v TOP LEFT corner</code>
<code>. . . . . (page 1)</code>	<code>X . . . X . . . (page 1)</code>
<code>. . . . .</code>	<code>X . . . X . . .</code>
<code>. . . . .</code>	<code>X . . . X . . .</code>
<code>. . . . .</code>	<code>X . . . X . . .</code>
<code>. . . . .</code>	<code>X . X . . . .</code>
<code>. . . . .</code>	<code>X . X . . . .</code>
<code>. . . . .</code>	<code>X . X . . . .</code>
<code>. . . . . (end of page 1)</code>	<code>X . X . . . . (end of page 1)</code>
<code>. . . . . (page 2)</code>	<code>. . . . . (page 2)</code>

Definition at line 301 of file `Arduboy2Core.cpp`.

#### 6.1.2.60 `void Arduboy2Core::paintScreen ( const uint8_t* image )` `[static],[inherited]`

Paints an entire image directly to the display from program memory.

## Parameters

<i>image</i>	A byte array in program memory representing the entire contents of the display.
--------------	---

The contents of the specified array in program memory is written to the display. Each byte in the array represents a vertical column of 8 pixels with the least significant bit at the top. The bytes are written starting at the top left, progressing horizontally and wrapping at the end of each row, to the bottom right. The size of the array must exactly match the number of pixels in the entire display.

## See also

[paint8Pixels\(\)](#)

Definition at line 306 of file Arduboy2Core.cpp.

6.1.2.61 `void Arduboy2Core::paintScreen ( uint8_t image[], bool clear = false ) [static],[inherited]`

Paints an entire image directly to the display from an array in RAM.

## Parameters

<i>image</i>	A byte array in RAM representing the entire contents of the display.
<i>clear</i>	If <code>true</code> the array in RAM will be cleared to zeros upon return from this function. If <code>false</code> the RAM buffer will remain unchanged. (optional; defaults to <code>false</code> )

The contents of the specified array in RAM is written to the display. Each byte in the array represents a vertical column of 8 pixels with the least significant bit at the top. The bytes are written starting at the top left, progressing horizontally and wrapping at the end of each row, to the bottom right. The size of the array must exactly match the number of pixels in the entire display.

If parameter `clear` is set to `true` the RAM array will be cleared to zeros after its contents are written to the display.

## See also

[paint8Pixels\(\)](#)

Definition at line 316 of file Arduboy2Core.cpp.

6.1.2.62 `void Arduboy2Base::pollButtons ( ) [inherited]`

Poll the buttons and track their state over time.

Read and save the current state of the buttons and also keep track of the button state when this function was previously called. These states are used by the [justPressed\(\)](#) and [justReleased\(\)](#) functions to determine if a button has changed state between now and the previous call to [pollButtons\(\)](#).

This function should be called once at the start of each new frame.

The [justPressed\(\)](#) and [justReleased\(\)](#) functions rely on this function.

example:

```
void loop() {
    if (!arduboy.nextFrame()) {
        return;
    }
    arduboy.pollButtons();

    // use justPressed() as necessary to determine if a button was just pressed
}
```

**Note**

As long as the elapsed time between calls to this function is long enough, buttons will be naturally debounced. Calling it once per frame at a frame rate of 60 or lower (or possibly somewhat higher), should be sufficient.

**See also**

[justPressed\(\)](#) [justReleased\(\)](#)

Definition at line 1005 of file Arduboy2.cpp.

#### 6.1.2.63 `bool Arduboy2Base::pressed ( uint8_t buttons )` [inherited]

Test if the specified buttons are pressed.

**Parameters**

<i>buttons</i>	A bit mask indicating which buttons to test. (Can be a single button)
----------------	---

**Returns**

`true` if *all* buttons in the provided mask are currently pressed.

Read the state of the buttons and return `true` if all the buttons in the specified mask are being pressed.

Example: `if (pressed(LEFT_BUTTON + A_BUTTON))`

**Note**

This function does not perform any button debouncing.

Definition at line 995 of file Arduboy2.cpp.

#### 6.1.2.64 `bool Arduboy2Base::readShowUnitNameFlag ( )` [inherited]

Read the "Show Unit Name" flag in system EEPROM.

**Returns**

`true` if the flag is set to indicate that the unit name should be displayed. `false` if the flag is set to not display the unit name.

The "Show Unit Name" flag is used to determine whether the system unit name is to be displayed at the end of the boot logo sequence. This function returns the value of this flag.

**See also**

[writeShowUnitNameFlag\(\)](#) [writeUnitName\(\)](#) [readUnitName\(\)](#) [Arduboy2::bootLogoExtra\(\)](#)

Definition at line 1083 of file Arduboy2.cpp.



#### 6.1.2.65 uint16\_t Arduboy2Base::readUnitID ( ) [inherited]

Read the unit ID from system EEPROM.

##### Returns

The value of the unit ID stored in system EEPROM.

This function reads the unit ID that has been set in system EEPROM. The ID can be any value. It is intended to allow different units to be uniquely identified.

##### See also

[writeUnitID\(\)](#) [readUnitName\(\)](#)

Definition at line 1035 of file Arduboy2.cpp.

#### 6.1.2.66 uint8\_t Arduboy2Base::readUnitName ( char \* name ) [inherited]

Read the unit name from system EEPROM.

##### Parameters

<i>name</i>	A pointer to a string array variable where the unit name will be placed. The string will be up to 6 characters and terminated with a null (0x00) character, so the provided array must be at least 7 bytes long.
-------------	--

##### Returns

The length of the string (0-6).

This function reads the unit name that has been set in system EEPROM. The name is in ASCII and can contain any values except 0xFF and the null (0x00) terminator value.

The name can be used for any purpose. It could identify the owner or give the unit itself a nickname. A sketch could use it to automatically fill in a name or initials in a high score table, or display it as the "player" when the opponent is the computer.

##### Note

Sketches can use the defined value `ARDUBOY_UNIT_NAME_LEN` instead of hard coding a 6 when working with the unit name. For example, to allocate a buffer and read the unit name into it:

```
// Buffer for maximum name length plus the terminator
char unitName[ARDUBOY_UNIT_NAME_LEN + 1];

// The actual name length
byte unitNameLength;

unitNameLength = arduboy.readUnitName(unitName);
```

##### See also

[writeUnitName\(\)](#) [readUnitID\(\)](#) [Arduboy2::bootLogoExtra\(\)](#)

Definition at line 1047 of file Arduboy2.cpp.

### 6.1.2.67 void Arduboy2Core::safeMode ( ) [static],[inherited]

Allow upload when the bootloader "magic number" could be corrupted.

If the UP button is held when this function is entered, the RGB LED will be lit and timer 0 will be disabled, then the sketch will remain in a tight loop. This is to address a problem with uploading a new sketch, for sketches that interfere with the bootloader "magic number". The problem occurs with certain sketches that use large amounts of RAM.

This function should be called after `boot ( )` in sketches that potentially could cause the problem.

It is intended to replace the `flashlight ( )` function when more program space is required. If possible, it is more desirable to use `flashlight ( )`, so that the actual flashlight feature isn't lost.

See also

[Arduboy2Base::flashlight\(\) boot\(\)](#)

Definition at line 245 of file Arduboy2Core.cpp.

### 6.1.2.68 void Arduboy2Core::sendLCDCommand ( uint8\_t *command* ) [static],[inherited]

Send a single command byte to the display.

Parameters

<i>command</i>	The command byte to send to the display.
----------------	--

The display will be set to command mode then the specified command byte will be sent. The display will then be set to data mode. Multi-byte commands can be sent by calling this function multiple times.

Note

Sending improper commands to the display can place it into invalid or unexpected states, possibly even causing physical damage.

Definition at line 359 of file Arduboy2Core.cpp.

### 6.1.2.69 void Arduboy2::setCursor ( int16\_t *x*, int16\_t *y* )

Set the location of the text cursor.

Parameters

<i>x</i>	The X coordinate, in pixels, for the new location of the text cursor.
<i>y</i>	The Y coordinate, in pixels, for the new location of the text cursor.

The location of the text cursor is set the the specified coordinates. The coordinates are in pixels. Since the coordinates can specify any pixel location, the text does not have to be placed on specific rows. As with all drawing

functions, location 0, 0 is the top left corner of the display. The cursor location will be the top left corner of the next character written.

Definition at line 1255 of file Arduboy2.cpp.

#### 6.1.2.70 void Arduboy2Base::setFrameRate ( uint8\_t *rate* ) [inherited]

Set the frame rate used by the frame control functions.

##### Parameters

<i>rate</i>	The desired frame rate in frames per second.
-------------	--

Set the frame rate, in frames per second, used by `nextFrame()` to update frames at a given rate. If this function isn't used, the default rate will be 60.

Normally, the frame rate would be set to the desired value once, at the start of the game, but it can be changed at any time to alter the frame update rate.

See also

[nextFrame\(\)](#)

Definition at line 188 of file Arduboy2.cpp.

#### 6.1.2.71 void Arduboy2Core::setRGBled ( uint8\_t *red*, uint8\_t *green*, uint8\_t *blue* ) [static],[inherited]

Set the light output of the RGB LED.

##### Parameters

<i>red,green,blue</i>	The brightness value for each LED.
-----------------------	------------------------------------

The RGB LED is actually individual red, green and blue LEDs placed very close together in a single package. By setting the brightness of each LED, the RGB LED can show various colors and intensities. The brightness of each LED can be set to a value from 0 (fully off) to 255 (fully on).

##### Note

Certain libraries that take control of the hardware timers may interfere with the ability of this function to properly control the RGB LED. *ArduboyPlaytune* is one such library known to do this. The [digitalWriteRGB\(\)](#) function will still work properly in this case.

##### Note

Many of the Kickstarter Arduboy2s were accidentally shipped with the RGB LED installed incorrectly. For these units, the green LED cannot be lit. As long as the green led is set to off, setting the red LED will actually control the blue LED and setting the blue LED will actually control the red LED. If the green LED is turned fully on, none of the LEDs will light.

See also

[digitalWriteRGB\(\)](#)

Definition at line 394 of file Arduboy2Core.cpp.

#### 6.1.2.72 void Arduboy2::setTextBackground ( uint8\_t *bg* )

Set the text background color.

##### Parameters

<i>bg</i>	The background color to be used for following text.
-----------	---

Definition at line 1276 of file Arduboy2.cpp.

#### 6.1.2.73 void Arduboy2::setTextColor ( uint8\_t *color* )

Set the text foreground color.

##### Parameters

<i>color</i>	The color to be used for following text.
--------------	--

Definition at line 1271 of file Arduboy2.cpp.

#### 6.1.2.74 void Arduboy2::setTextSize ( uint8\_t *s* )

Set the text character size.

##### Parameters

<i>s</i>	The text size multiplier. Must be 1 or higher.
----------	--

Setting a text size of 1 will result in standard size characters which occupy 6x8 pixels (the result of 5x7 characters with spacing on the right and bottom edges).

The value specified is a multiplier. A value of 2 will double the size so they will occupy 12x16 pixels. A value of 3 will result in 18x24, etc.

Definition at line 1281 of file Arduboy2.cpp.

#### 6.1.2.75 void Arduboy2::setTextWrap ( bool *w* )

Set or disable text wrap mode.

## Parameters

<i>w</i>	<code>true</code> enables text wrap mode. <code>false</code> disables it.
----------	---

Text wrap mode is enabled by specifying `true`. In wrap mode, the text cursor will be moved to the start of the next line (based on the current text size) if the following character wouldn't fit entirely at the end of the current line.

If wrap mode is disabled, characters will continue to be written to the same line. A character at the right edge of the screen may only be partially displayed and additional characters will be off screen.

Definition at line 1287 of file `Arduboy2.cpp`.

#### 6.1.2.76 `void Arduboy2Core::SPITransfer ( uint8_t data ) [static],[inherited]`

Transfer a byte to the display.

## Parameters

<i>data</i>	The byte to be sent to the display.
-------------	-------------------------------------

Transfer one byte to the display over the SPI port and wait for the transfer to complete. The byte will either be interpreted as a command or as data to be placed on the screen, depending on the command/data mode.

## See also

[LCDDataMode\(\)](#) [LCDCommandMode\(\)](#) [sendLCDCommand\(\)](#)

Definition at line 232 of file `Arduboy2Core.cpp`.

#### 6.1.2.77 `void Arduboy2Base::systemButtons ( ) [inherited]`

Handle buttons held on startup for system control.

This function is called by [begin\(\)](#) and can be called by a sketch after [boot\(\)](#).

Hold the B button when booting to enter system control mode. The B button must be held continuously to remain in this mode. Then, pressing other buttons will perform system control functions:

- UP: Set "sound enabled" in EEPROM
- DOWN: Set "sound disabled" (mute) in EEPROM

## See also

[begin\(\)](#) [boot\(\)](#)

Definition at line 79 of file `Arduboy2.cpp`.

#### 6.1.2.78 `uint8_t Arduboy2Core::width ( )` `[static],[inherited]`

Get the width of the display in pixels.

##### Returns

The width of the display in pixels.

##### Note

In most cases, the defined value `WIDTH` would be better to use instead of this function.

Definition at line 294 of file `Arduboy2Core.cpp`.

#### 6.1.2.79 `size_t Arduboy2::write ( uint8_t c )` `[virtual]`

Write a single ASCII character at the current text cursor location.

##### Parameters

<code>c</code>	The ASCII value of the character to be written.
----------------	---

##### Returns

The number of characters written (will always be 1).

This is the Arduboy implemetation of the Arduino virtual `write()` function. The single ASCII character specified is written to the the screen buffer at the current text cursor. The text cursor is then moved to the next character position in the screen buffer. This new cursor position will depend on the current text size and possibly the current wrap mode.

Two special characters are handled:

- The newline character `\n`. This will move the text cursor to the start of the next line based on the current text size.
- The carriage return character `\r`. This character will be ignored.

##### Note

This function is rather low level and, although it's available as a public function, it wouldn't normally be used. In most cases the Arduino `Print` class should be used for writing text.

##### See also

[Print](#) [setTextSize\(\)](#) [setTextWrap\(\)](#)

Definition at line 1191 of file `Arduboy2.cpp`.

#### 6.1.2.80 `void Arduboy2Base::writeShowUnitNameFlag ( bool val )` `[inherited]`

Write the "Show Unit Name" flag in system EEPROM.

## Parameters

<i>val</i>	If <code>true</code> the flag is set to indicate that the unit name should be displayed. If <code>false</code> the flag is set to not display the unit name.
------------	--

The "Show Unit Name" flag is used to determine whether the system unit name is to be displayed at the end of the boot logo sequence. This function allows the flag to be saved with the desired value.

## See also

[readShowUnitNameFlag\(\)](#) [writeUnitName\(\)](#) [readUnitName\(\)](#) [Arduboy2::bootLogoExtra\(\)](#)

Definition at line 1088 of file `Arduboy2.cpp`.

**6.1.2.81** `void Arduboy2Base::writeUnitID ( uint16_t id )` [inherited]

Write a unit ID to system EEPROM.

## Parameters

<i>id</i>	The value of the unit ID to be stored in system EEPROM.
-----------	---

This function writes a unit ID to a reserved location in system EEPROM. The ID can be any value. It is intended to allow different units to be uniquely identified.

## See also

[readUnitID\(\)](#) [writeUnitName\(\)](#)

Definition at line 1041 of file `Arduboy2.cpp`.

**6.1.2.82** `void Arduboy2Base::writeUnitName ( char * name )` [inherited]

Write a unit name to system EEPROM.

## Parameters

<i>name</i>	A pointer to a string array variable containing the unit name to be saved. The string can be up to 6 characters and must be terminated with a null (0x00) character. It can contain any values except 0xFF.
-------------	---

This function writes a unit name to a reserved area in system EEPROM. The name is in ASCII and can contain any values except 0xFF and the null (0x00) terminator value. The newline character (LF, \n, 0x0A) and carriage return character (CR, \r, 0x0D) should also be avoided.

The name can be used for any purpose. It could identify the owner or give the unit itself a nickname. A sketch could use it to automatically fill in a name or initials in a high score table, or display it as the "player" when the opponent is the computer.

**Note**

Sketches can use the defined value `ARDUBOY_UNIT_NAME_LEN` instead of hard coding a 6 when working with the unit name.

**See also**

[readUnitName\(\)](#) [writeUnitID\(\)](#) [Arduboy2::bootLogoExtra\(\)](#)

Definition at line 1067 of file `Arduboy2.cpp`.

**6.1.3 Member Data Documentation****6.1.3.1 `Arduboy2Audio` `Arduboy2Base::audio` [inherited]**

An object created to provide audio control functions within this class.

This object is created to eliminate the need for a sketch to create an [Arduboy2Audio](#) class object itself.

**See also**

[Arduboy2Audio](#)

Definition at line 176 of file `Arduboy2.h`.

**6.1.3.2 `uint16_t` `Arduboy2Base::frameCount` [inherited]**

A counter which is incremented once per frame.

This counter is incremented once per frame when using the [nextFrame\(\)](#) function. It will wrap to zero when it reaches its maximum value.

It could be used to have an event occur for a given number of frames, or a given number of frames later, in a way that wouldn't be quantized the way that using [everyXFrames\(\)](#) might.

example:

```
// move for 10 frames when right button is pressed, if not already moving
if (!moving) {
    if (arduboy.justPressed(RIGHT_BUTTON)) {
        endMoving = arduboy.frameCount + 10;
        moving = true;
    }
} else {
    movePlayer();
    if (arduboy.frameCount == endMoving) {
        moving = false;
    }
}
```

This counter could also be used to determine the number of frames that have elapsed between events but the possibility of the counter wrapping would have to be accounted for.

**See also**

[nextFrame\(\)](#) [everyXFrames\(\)](#)

Definition at line 1091 of file `Arduboy2.h`.



### 6.1.3.3 `uint8_t Arduboy2Base::sBuffer` `[static], [inherited]`

The display buffer array in RAM.

The display buffer (also known as the screen buffer) contains an image bitmap of the desired contents of the display, which is written to the display using the `display()` function. The drawing functions of this library manipulate the contents of the display buffer. A sketch can also access the display buffer directly.

See also

[getBuffer\(\)](#)

Definition at line 1105 of file `Arduboy2.h`.

The documentation for this class was generated from the following files:

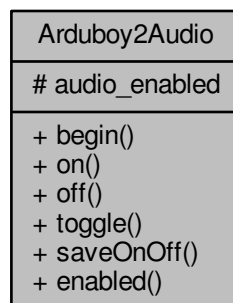
- `src/Arduboy2.h`
- `src/Arduboy2.cpp`

## 6.2 Arduboy2Audio Class Reference

Provide speaker and sound control.

```
#include <Arduboy2Audio.h>
```

Collaboration diagram for `Arduboy2Audio`:



### Static Public Member Functions

- static void `begin()`  
*Initialize the speaker based on the current mute setting.*
- static void `on()`  
*Turn sound on.*
- static void `off()`  
*Turn sound off (mute).*
- static void `toggle()`  
*Toggle the sound on/off state.*
- static void `saveOnOff()`  
*Save the current sound state in EEPROM.*
- static bool `enabled()`  
*Get the current sound state.*

### 6.2.1 Detailed Description

Provide speaker and sound control.

This class provides functions to initialize the speaker and control the enabling and disabling (muting) of sound. It doesn't provide any functions to actually produce sound.

The state of sound muting is stored in system EEPROM and so is retained over power cycles.

An [Arduboy2Audio](#) class object named `audio` will be created by the [Arduboy2Base](#) class, so there is no need for a sketch itself to create an [Arduboy2Audio](#) object. [Arduboy2Audio](#) functions can be called using the [Arduboy2](#) or [Arduboy2Base](#) `audio` object.

Example:

```
#include <Arduboy2.h>

Arduboy2 arduboy;

// Arduboy2Audio functions can be called as follows:
arduboy.audio.on();
arduboy.audio.off();
```

#### Note

In order for this class to be fully functional, the external library or functions used by a sketch to actually to produce sounds should be compliant with this class. This means they should only produce sound if it is enabled, or mute the sound if it's disabled. The `enabled()` function can be used to determine if sound is enabled or muted. Generally a compliant library would accept the `enabled()` function as an initialization parameter and then call it as necessary to determine the current state.

For example, the [ArduboyTones](#) and [ArduboyPlaytune](#) libraries require an `enabled()` type function to be passed as a parameter in the constructor, like so:

```
#include <Arduboy2.h>
#include <ArduboyTones.h>

Arduboy2 arduboy;
ArduboyTones sound(arduboy.audio.enabled());
```

#### Note

A friend class named *Arduboy2Ex* is declared by this class. The intention is to allow a sketch to create an *Arduboy2Ex* class which would have access to the private and protected members of the [Arduboy2Audio](#) class. It is hoped that this may eliminate the need to create an entire local copy of the library, in order to extend the functionality, in most circumstances.

Definition at line 73 of file [Arduboy2Audio.h](#).

### 6.2.2 Member Function Documentation

#### 6.2.2.1 void Arduboy2Audio::begin ( ) [static]

Initialize the speaker based on the current mute setting.

The speaker is initialized based on the current mute setting saved in system EEPROM. This function is called by [Arduboy2Base::begin\(\)](#) so it isn't normally required to call it within a sketch. However, if [Arduboy2Core::boot\(\)](#) is used instead of [Arduboy2Base::begin\(\)](#) and the sketch includes sound, then this function should be called after `boot()`.

Definition at line 49 of file [Arduboy2Audio.cpp](#).

### 6.2.2.2 `bool Arduboy2Audio::enabled ( ) [static]`

Get the current sound state.

#### Returns

`true` if sound is currently enabled (not muted).

This function should be used by code that actually generates sound. If `true` is returned, sound can be produced. If `false` is returned, sound should be muted.

#### See also

[on\(\)](#) [off\(\)](#) [toggle\(\)](#)

Definition at line 57 of file `Arduboy2Audio.cpp`.

### 6.2.2.3 `void Arduboy2Audio::off ( ) [static]`

Turn sound off (mute).

The system is configured to not produce sound (mute). This function sets the sound mode only until the unit is powered off. To save the current mode use [saveOnOff\(\)](#).

#### See also

[on\(\)](#) [toggle\(\)](#) [saveOnOff\(\)](#)

Definition at line 24 of file `Arduboy2Audio.cpp`.

### 6.2.2.4 `void Arduboy2Audio::on ( ) [static]`

Turn sound on.

The system is configured to generate sound. This function sets the sound mode only until the unit is powered off. To save the current mode use [saveOnOff\(\)](#).

#### See also

[off\(\)](#) [toggle\(\)](#) [saveOnOff\(\)](#)

Definition at line 12 of file `Arduboy2Audio.cpp`.

#### 6.2.2.5 void Arduboy2Audio::saveOnOff( ) [static]

Save the current sound state in EEPROM.

The current sound state, set by `on()` or `off()`, is saved to the reserved system area in EEPROM. This allows the state to carry over between power cycles and after uploading a different sketch.

##### Note

EEPROM is limited in the number of times it can be written to. Sketches should not continuously change and then save the state rapidly.

##### See also

[on\(\)](#) [off\(\)](#) [toggle\(\)](#)

Definition at line 44 of file Arduboy2Audio.cpp.

#### 6.2.2.6 void Arduboy2Audio::toggle( ) [static]

Toggle the sound on/off state.

If the system is configured for sound on, it will be changed to sound off (mute). If sound is off, it will be changed to on. This function sets the sound mode only until the unit is powered off. To save the current mode use [saveOnOff\(\)](#).

##### See also

[on\(\)](#) [off\(\)](#) [saveOnOff\(\)](#)

Definition at line 36 of file Arduboy2Audio.cpp.

The documentation for this class was generated from the following files:

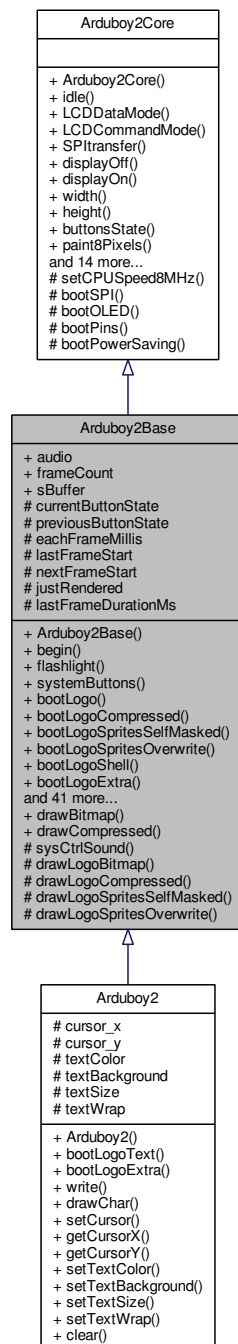
- [src/Arduboy2Audio.h](#)
- [src/Arduboy2Audio.cpp](#)

## 6.3 Arduboy2Base Class Reference

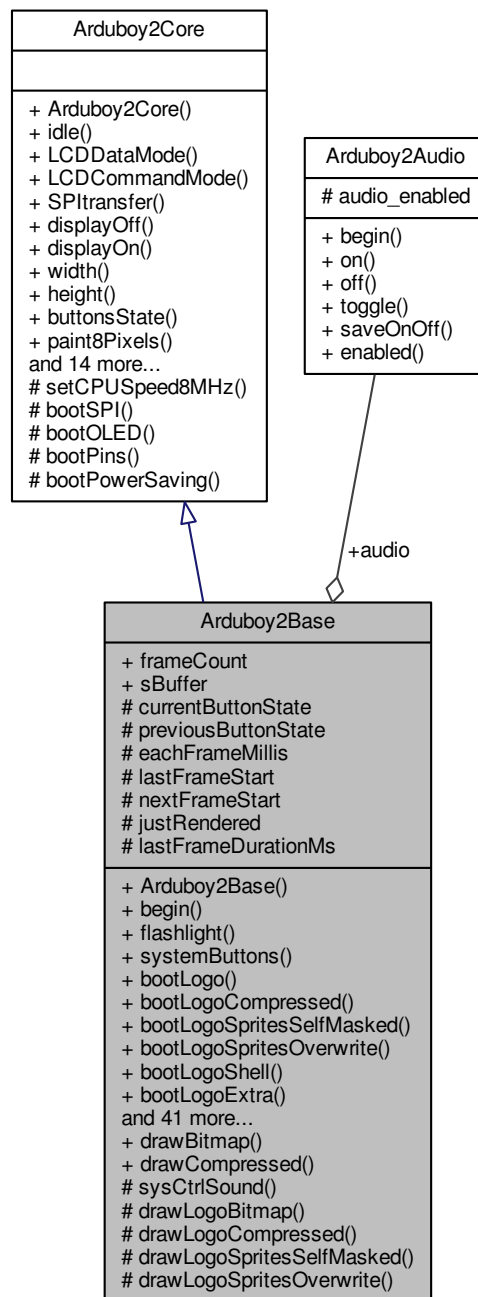
The main functions provided for writing sketches for the Arduboy, *minus* text output.

```
#include <Arduboy2.h>
```

Inheritance diagram for Arduboy2Base:



Collaboration diagram for Arduboy2Base:



## Public Member Functions

- void [begin](#) ()  
*Initialize the hardware, display the boot logo, provide boot utilities, etc.*
- void [flashlight](#) ()  
*Turn the RGB LED and display fully on to act as a small flashlight/torch.*
- void [systemButtons](#) ()

- Handle buttons held on startup for system control.*
- void `bootLogo ()`  
*Display the boot logo sequence using `drawBitmap()`.*
- void `bootLogoCompressed ()`  
*Display the boot logo sequence using `drawCompressed()`.*
- void `bootLogoSpritesSelfMasked ()`  
*Display the boot logo sequence using the `Sprites` class `drawSelfMasked()` function.*
- void `bootLogoSpritesOverwrite ()`  
*Display the boot logo sequence using the `Sprites` class `drawOverwrite()` function.*
- void `bootLogoShell (void(*drawLogo)(int16_t))`  
*Display the boot logo sequence using the provided function.*
- void `clear ()`  
*Clear the display buffer.*
- void `display ()`  
*Copy the contents of the display buffer to the display.*
- void `display (bool clear)`  
*Copy the contents of the display buffer to the display. The display buffer can optionally be cleared.*
- void `drawPixel (int16_t x, int16_t y, uint8_t color=WHITE)`  
*Set a single pixel in the display buffer to the specified color.*
- uint8\_t `getPixel (uint8_t x, uint8_t y)`  
*Returns the state of the given pixel in the screen buffer.*
- void `drawCircle (int16_t x0, int16_t y0, uint8_t r, uint8_t color=WHITE)`  
*Draw a circle of a given radius.*
- void `fillCircle (int16_t x0, int16_t y0, uint8_t r, uint8_t color=WHITE)`  
*Draw a filled-in circle of a given radius.*
- void `drawLine (int16_t x0, int16_t y0, int16_t x1, int16_t y1, uint8_t color=WHITE)`  
*Draw a line between two specified points.*
- void `drawRect (int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t color=WHITE)`  
*Draw a rectangle of a specified width and height.*
- void `drawFastVLine (int16_t x, int16_t y, uint8_t h, uint8_t color=WHITE)`  
*Draw a vertical line.*
- void `drawFastHLine (int16_t x, int16_t y, uint8_t w, uint8_t color=WHITE)`  
*Draw a horizontal line.*
- void `fillRect (int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t color=WHITE)`  
*Draw a filled-in rectangle of a specified width and height.*
- void `fillScreen (uint8_t color=WHITE)`  
*Fill the screen buffer with the specified color.*
- void `drawRoundRect (int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t r, uint8_t color=WHITE)`  
*Draw a rectangle with rounded corners.*
- void `fillRoundRect (int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t r, uint8_t color=WHITE)`  
*Draw a filled-in rectangle with rounded corners.*
- void `drawTriangle (int16_t x0, int16_t y0, int16_t x1, int16_t y1, int16_t x2, int16_t y2, uint8_t color=WHITE)`  
*Draw a triangle given the coordinates of each corner.*
- void `fillTriangle (int16_t x0, int16_t y0, int16_t x1, int16_t y1, int16_t x2, int16_t y2, uint8_t color=WHITE)`  
*Draw a filled-in triangle given the coordinates of each corner.*
- void `drawSlowXYBitmap (int16_t x, int16_t y, const uint8_t *bitmap, uint8_t w, uint8_t h, uint8_t color=WHITE)`  
*Draw a bitmap from a horizontally oriented array in program memory.*
- uint8\_t \* `getBuffer ()`  
*Get a pointer to the display buffer in RAM.*
- void `initRandomSeed ()`  
*Seed the random number generator with a random value.*

- void `setFrameRate` (uint8\_t rate)  
*Set the frame rate used by the frame control functions.*
- bool `nextFrame` ()  
*Indicate that it's time to render the next frame.*
- bool `nextFrameDEV` ()  
*Indicate that it's time to render the next frame, and visually indicate if the code is running slower than the desired frame rate. **FOR USE DURING DEVELOPMENT***
- bool `everyXFrames` (uint8\_t frames)  
*Indicate if the specified number of frames has elapsed.*
- int `cpuLoad` ()  
*Return the load on the CPU as a percentage.*
- bool `pressed` (uint8\_t buttons)  
*Test if the specified buttons are pressed.*
- bool `notPressed` (uint8\_t buttons)  
*Test if the specified buttons are not pressed.*
- void `pollButtons` ()  
*Poll the buttons and track their state over time.*
- bool `justPressed` (uint8\_t button)  
*Check if a button has just been pressed.*
- bool `justReleased` (uint8\_t button)  
*Check if a button has just been released.*
- bool `collide` (Point point, Rect rect)  
*Test if a point falls within a rectangle.*
- bool `collide` (Rect rect1, Rect rect2)  
*Test if a rectangle is intersecting with another rectangle.*
- uint16\_t `readUnitID` ()  
*Read the unit ID from system EEPROM.*
- void `writeUnitID` (uint16\_t id)  
*Write a unit ID to system EEPROM.*
- uint8\_t `readUnitName` (char \*name)  
*Read the unit name from system EEPROM.*
- void `writeUnitName` (char \*name)  
*Write a unit name to system EEPROM.*
- bool `readShowUnitNameFlag` ()  
*Read the "Show Unit Name" flag in system EEPROM.*
- void `writeShowUnitNameFlag` (bool val)  
*Write the "Show Unit Name" flag in system EEPROM.*

## Static Public Member Functions

- static void `drawBitmap` (int16\_t x, int16\_t y, const uint8\_t \*bitmap, uint8\_t w, uint8\_t h, uint8\_t color=`WHITE`)  
*Draw a bitmap from an array in program memory.*
- static void `drawCompressed` (int16\_t sx, int16\_t sy, const uint8\_t \*bitmap, uint8\_t color=`WHITE`)  
*Draw a bitmap from an array of compressed data.*
- static void `idle` ()  
*Idle the CPU to save power.*
- static void `LCDDDataMode` ()  
*Put the display into data mode.*
- static void `LCDCommandMode` ()  
*Put the display into command mode.*



- static void [SPITransfer](#) (uint8\_t data)  
*Transfer a byte to the display.*
- static void [displayOff](#) ()  
*Turn the display off.*
- static void [displayOn](#) ()  
*Turn the display on.*
- static uint8\_t [width](#) ()  
*Get the width of the display in pixels.*
- static uint8\_t [height](#) ()  
*Get the height of the display in pixels.*
- static uint8\_t [buttonsState](#) ()  
*Get the current state of all buttons as a bitmask.*
- static void [paint8Pixels](#) (uint8\_t pixels)  
*Paint 8 pixels vertically to the display.*
- static void [paintScreen](#) (const uint8\_t \*image)  
*Paints an entire image directly to the display from program memory.*
- static void [paintScreen](#) (uint8\_t image[], bool clear=false)  
*Paints an entire image directly to the display from an array in RAM.*
- static void [blank](#) ()  
*Blank the display screen by setting all pixels off.*
- static void [invert](#) (bool inverse)  
*Invert the entire display or set it back to normal.*
- static void [allPixelsOn](#) (bool on)  
*Turn all display pixels on or display the buffer contents.*
- static void [flipVertical](#) (bool flipped)  
*Flip the display vertically or set it back to normal.*
- static void [flipHorizontal](#) (bool flipped)  
*Flip the display horizontally or set it back to normal.*
- static void [sendLCDCommand](#) (uint8\_t command)  
*Send a single command byte to the display.*
- static void [setRGBled](#) (uint8\_t red, uint8\_t green, uint8\_t blue)  
*Set the light output of the RGB LED.*
- static void [digitalWriteRGB](#) (uint8\_t red, uint8\_t green, uint8\_t blue)  
*Set the RGB LEDs digitally, to either fully on or fully off.*
- static void [digitalWriteRGB](#) (uint8\_t color, uint8\_t val)  
*Set one of the RGB LEDs digitally, to either fully on or fully off.*
- static void [boot](#) ()  
*Initialize the Arduboy's hardware.*
- static void [safeMode](#) ()  
*Allow upload when the bootloader "magic number" could be corrupted.*
- static void [delayShort](#) (uint16\_t ms) \_\_attribute\_\_((noinline))  
*Delay for the number of milliseconds, specified as a 16 bit value.*

## Public Attributes

- [Arduboy2Audio](#) audio  
*An object created to provide audio control functions within this class.*
- uint16\_t [frameCount](#)  
*A counter which is incremented once per frame.*

## Static Public Attributes

- static uint8\_t `sBuffer` [(HEIGHT \* WIDTH)/8]  
*The display buffer array in RAM.*

### 6.3.1 Detailed Description

The main functions provided for writing sketches for the Arduboy, *minus* text output.

This class is inherited by [Arduboy2](#), so if text output functions are required [Arduboy2](#) should be used instead.

#### Note

An [Arduboy2Audio](#) class object named `audio` will be created by the [Arduboy2Base](#) class, so there is no need for a sketch itself to create an [Arduboy2Audio](#) object. [Arduboy2Audio](#) functions can be called using the [Arduboy2](#) or [Arduboy2Base](#) `audio` object.

Example:

```
#include <Arduboy2.h>

Arduboy2 arduboy;

// Arduboy2Audio functions can be called as follows:
arduboy.audio.on();
arduboy.audio.off();
```

#### Note

A friend class named *Arduboy2Ex* is declared by this class. The intention is to allow a sketch to create an *Arduboy2Ex* class which would have access to the private and protected members of the [Arduboy2Base](#) class. It is hoped that this may eliminate the need to create an entire local copy of the library, in order to extend the functionality, in most circumstances.

#### See also

[Arduboy2](#)

Definition at line 160 of file `Arduboy2.h`.

### 6.3.2 Member Function Documentation

#### 6.3.2.1 void Arduboy2Core::allPixelsOn ( bool *on* ) [static],[inherited]

Turn all display pixels on or display the buffer contents.

##### Parameters

<i>on</i>	<code>true</code> turns all pixels on. <code>false</code> displays the contents of the hardware display buffer.
-----------	---

Calling this function with a value of `true` will override the contents of the hardware display buffer and turn all pixels on. The contents of the hardware buffer will remain unchanged.

Calling this function with a value of `false` will set the normal state of displaying the contents of the hardware display buffer.

**Note**

All pixels will be lit even if the display is in inverted mode.

**See also**

[invert\(\)](#)

Definition at line 375 of file `Arduboy2Core.cpp`.

**6.3.2.2 void Arduboy2Base::begin ( )**

Initialize the hardware, display the boot logo, provide boot utilities, etc.

This function should be called once near the start of the sketch, usually in `setup()`, before using any other functions in this class. It initializes the display, displays the boot logo, provides "flashlight" and system control features and initializes audio control.

**Note**

To free up some code space for use by the sketch, `boot()` can be used instead of `begin()` to allow the elimination of some of the things that aren't really required, such as displaying the boot logo.

**See also**

[boot\(\)](#)

Definition at line 34 of file `Arduboy2.cpp`.

**6.3.2.3 void Arduboy2Core::blank ( ) [static],[inherited]**

Blank the display screen by setting all pixels off.

All pixels on the screen will be written with a value of 0 to turn them off.

Definition at line 353 of file `Arduboy2Core.cpp`.

**6.3.2.4 void Arduboy2Core::boot ( ) [static],[inherited]**

Initialize the Arduboy's hardware.

This function initializes the display, buttons, etc.

This function is called by `begin()` so isn't normally called within a sketch. However, in order to free up some code space, by eliminating some of the start up features, it can be called in place of `begin()`. The functions that `begin()` would call after `boot()` can then be called to add back in some of the start up features, if desired. See the README file or documentation on the main page for more details.

**See also**

[Arduboy2Base::begin\(\)](#)

Definition at line 76 of file `Arduboy2Core.cpp`.

### 6.3.2.5 void Arduboy2Base::bootLogo ( )

Display the boot logo sequence using `drawBitmap()`.

This function is called by `begin()` and can be called by a sketch after `boot()`.

The Arduboy logo scrolls down from the top of the screen to the center while the RGB LEDs light in sequence.

If the RIGHT button is pressed while the logo is scrolling down, the boot logo sequence will be aborted. This can be useful for developers who wish to quickly start testing, or anyone else who is impatient and wants to go straight to the actual sketch.

This function calls `bootLogoExtra()` after the logo stops scrolling down, which derived classes can implement to add additional information to the logo screen. The `Arduboy2` class uses this to display the unit name.

See also

`begin()` `boot()` `Arduboy2::bootLogoExtra()` `bootLogoShell()` `Arduboy2::bootLogoText()`

Definition at line 105 of file `Arduboy2.cpp`.

### 6.3.2.6 void Arduboy2Base::bootLogoCompressed ( )

Display the boot logo sequence using `drawCompressed()`.

This function can be called by a sketch after `boot()` as an alternative to `bootLogo()`. This may reduce code size if the sketch itself uses `drawCompressed()`.

See also

`bootLogo()` `begin()` `boot()`

Definition at line 115 of file `Arduboy2.cpp`.

### 6.3.2.7 void Arduboy2Base::bootLogoShell ( void (\*)(int16\_t) drawLogo )

Display the boot logo sequence using the provided function.

Parameters

<i>drawLogo</i>	A reference to a function which will draw the boot logo at the given Y position.
-----------------	--

This common function executes the sequence to display the boot logo. It is called by `bootLogo()` and other similar functions which provide it with a reference to a function which will do the actual drawing of the logo.

The prototype for the function provided to draw the logo is:

```
void drawLogo(int16_t y);
```

The `y` parameter is the Y offset for the top of the logo. It is expected that the logo will be 16 pixels high and centered horizontally. This will result in the logo stopping in the middle of the screen at the end of the sequence. If the logo height is not 16 pixels, the Y value can be adjusted to compensate.

See also

[bootLogo\(\)](#) [boot\(\)](#)

Definition at line 147 of file `Arduboy2.cpp`.

#### 6.3.2.8 void Arduboy2Base::bootLogoSpritesOverwrite ( )

Display the boot logo sequence using the [Sprites](#) class `drawOverwrite()` function.

This function can be called by a sketch after `boot()` as an alternative to `bootLogo()`. This may reduce code size if the sketch itself uses [Sprites](#) class functions.

See also

[bootLogo\(\)](#) [begin\(\)](#) [boot\(\)](#) [Sprites](#)

Definition at line 135 of file `Arduboy2.cpp`.

#### 6.3.2.9 void Arduboy2Base::bootLogoSpritesSelfMasked ( )

Display the boot logo sequence using the [Sprites](#) class `drawSelfMasked()` function.

This function can be called by a sketch after `boot()` as an alternative to `bootLogo()`. This may reduce code size if the sketch itself uses [Sprites](#) class functions.

See also

[bootLogo\(\)](#) [begin\(\)](#) [boot\(\)](#) [Sprites](#)

Definition at line 125 of file `Arduboy2.cpp`.

#### 6.3.2.10 uint8\_t Arduboy2Core::buttonsState ( ) [static],[inherited]

Get the current state of all buttons as a bitmask.

Returns

A bitmask of the state of all the buttons.

The returned mask contains a bit for each button. For any pressed button, its bit will be 1. For released buttons their associated bits will be 0.

The following defined mask values should be used for the buttons:

`LEFT_BUTTON`, `RIGHT_BUTTON`, `UP_BUTTON`, `DOWN_BUTTON`, `A_BUTTON`, `B_BUTTON`

Definition at line 449 of file `Arduboy2Core.cpp`.

### 6.3.2.11 void Arduboy2Base::clear ( )

Clear the display buffer.

The entire contents of the screen buffer are cleared to BLACK.

See also

[display\(bool\)](#)

Definition at line 270 of file Arduboy2.cpp.

### 6.3.2.12 bool Arduboy2Base::collide ( Point *point*, Rect *rect* )

Test if a point falls within a rectangle.

Parameters

<i>point</i>	A structure describing the location of the point.
<i>rect</i>	A structure describing the location and size of the rectangle.

Returns

`true` if the specified point is within the specified rectangle.

This function is intended to determine if an object, whose boundaries are defined by the given rectangle, is in contact with the given point.

See also

[Point Rect](#)

Definition at line 1021 of file Arduboy2.cpp.

### 6.3.2.13 bool Arduboy2Base::collide ( Rect *rect1*, Rect *rect2* )

Test if a rectangle is intersecting with another rectangle.

Parameters

<i>rect1,rect2</i>	Structures describing the size and locations of the rectangles.
--------------------	---

Returns

`true` if the first rectangle is intersecting the second.

This function is intended to determine if an object, whose boundaries are defined by the given rectangle, is in contact with another rectangular object.

See also

[Rect](#)

Definition at line 1027 of file Arduboy2.cpp.

#### 6.3.2.14 int Arduboy2Base::cpuLoad ( )

Return the load on the CPU as a percentage.

Returns

The load on the CPU as a percentage of the total frame time.

The returned value gives the time spent processing a frame as a percentage the total time allotted for a frame, as determined by the frame rate.

This function normally wouldn't be used in the final program. It is intended for use during program development as an aid in helping with frame timing.

Note

The percentage returned can be higher than 100 if more time is spent processing a frame than the time allotted per frame. This would indicate that the frame rate should be made slower or the frame processing code should be optimized to run faster.

See also

[setFrameRate\(\)](#) [nextFrame\(\)](#)

Definition at line 250 of file Arduboy2.cpp.

#### 6.3.2.15 void Arduboy2Core::delayShort ( uint16\_t *ms* ) [static],[inherited]

Delay for the number of milliseconds, specified as a 16 bit value.

Parameters

<i>ms</i>	The delay in milliseconds.
-----------	----------------------------

This function works the same as the Arduino `delay()` function except the provided value is 16 bits long, so the maximum delay allowed is 65535 milliseconds (about 65.5 seconds). Using this function instead of Arduino `delay()` will save a few bytes of code.

Definition at line 474 of file Arduboy2Core.cpp.

#### 6.3.2.16 void Arduboy2Core::digitalWriteRGB ( uint8\_t *red*, uint8\_t *green*, uint8\_t *blue* ) [static],[inherited]

Set the RGB LEDs digitally, to either fully on or fully off.

**Parameters**

<i>red,green,blue</i>	Use value RGB_ON or RGB_OFF to set each LED.
-----------------------	--

The RGB LED is actually individual red, green and blue LEDs placed very close together in a single package. This 3 parameter version of the function will set each LED either on or off, to set the RGB LED to 7 different colors at their highest brightness or turn it off.

The colors are as follows:

RED_LED	GREEN_LED	BLUE_LED	COLOR
RGB_OFF	RGB_OFF	RGB_OFF	OFF
RGB_OFF	RGB_OFF	RGB_ON	Blue
RGB_OFF	RGB_ON	RGB_OFF	Green
RGB_OFF	RGB_ON	RGB_ON	Cyan
RGB_ON	RGB_OFF	RGB_OFF	Red
RGB_ON	RGB_OFF	RGB_ON	Magenta
RGB_ON	RGB_ON	RGB_OFF	Yellow
RGB_ON	RGB_ON	RGB_ON	White

**Note**

Many of the Kickstarter Arduboy2s were accidentally shipped with the RGB LED installed incorrectly. For these units, the green LED cannot be lit. As long as the green led is set to off, turning on the red LED will actually light the blue LED and turning on the blue LED will actually light the red LED. If the green LED is turned on, none of the LEDs will light.

**See also**

[digitalWriteRGB\(uint8\\_t, uint8\\_t\) setRGBled\(\)](#)

Definition at line 409 of file Arduboy2Core.cpp.

**6.3.2.17** void Arduboy2Core::digitalWriteRGB ( uint8\_t *color*, uint8\_t *val* ) [static],[inherited]

Set one of the RGB LEDs digitally, to either fully on or fully off.

**Parameters**

<i>color</i>	The name of the LED to set. The value given should be one of RED_LED, GREEN_LED or BLUE_LED.
<i>val</i>	Indicates whether to turn the specified LED on or off. The value given should be RGB_ON or RGB_OFF.

This 2 parameter version of the function will set a single LED within the RGB LED either fully on or fully off. See the description of the 3 parameter version of this function for more details on the RGB LED.

**See also**

[digitalWriteRGB\(uint8\\_t, uint8\\_t, uint8\\_t\) setRGBled\(\)](#)

Definition at line 423 of file Arduboy2Core.cpp.



#### 6.3.2.18 void Arduboy2Base::display ( )

Copy the contents of the display buffer to the display.

The contents of the display buffer in RAM are copied to the display and will appear on the screen.

See also

[display\(bool\)](#)

Definition at line 980 of file Arduboy2.cpp.

#### 6.3.2.19 void Arduboy2Base::display ( bool *clear* )

Copy the contents of the display buffer to the display. The display buffer can optionally be cleared.

Parameters

<i>clear</i>	If <code>true</code> the display buffer will be cleared to zero. The defined value <code>CLEAR_BUFFER</code> should be used instead of <code>true</code> to make it more meaningful.
--------------	--

Operation is the same as calling [display\(\)](#) without parameters except additionally the display buffer will be cleared if the parameter evaluates to `true`. (The defined value `CLEAR_BUFFER` can be used for this)

Using `display(CLEAR_BUFFER)` is faster and produces less code than calling [display\(\)](#) followed by [clear\(\)](#).

See also

[display\(\)](#) [clear\(\)](#)

Definition at line 985 of file Arduboy2.cpp.

#### 6.3.2.20 void Arduboy2Core::displayOff ( ) [static],[inherited]

Turn the display off.

The display will clear and be put into a low power mode. This can be used to extend battery life when a game is paused or when a sketch doesn't require anything to be displayed for a relatively long period of time.

See also

[displayOn\(\)](#)

Definition at line 278 of file Arduboy2Core.cpp.

### 6.3.2.21 void Arduboy2Core::displayOn ( ) [static],[inherited]

Turn the display on.

Used to power up and reinitialize the display after calling `displayOff()`.

#### Note

The previous call to `displayOff()` will have caused the display's buffer contents to be lost. The display will have to be re-painted, which is usually done by calling `display()`.

#### See also

[displayOff\(\)](#)

Definition at line 289 of file Arduboy2Core.cpp.

### 6.3.2.22 void Arduboy2Base::drawBitmap ( int16\_t x, int16\_t y, const uint8\_t \* bitmap, uint8\_t w, uint8\_t h, uint8\_t color = WHITE ) [static]

Draw a bitmap from an array in program memory.

#### Parameters

<i>x</i>	The X coordinate of the top left pixel affected by the bitmap.
<i>y</i>	The Y coordinate of the top left pixel affected by the bitmap.
<i>bitmap</i>	A pointer to the bitmap array in program memory.
<i>w</i>	The width of the bitmap in pixels.
<i>h</i>	The height of the bitmap in pixels.
<i>color</i>	The color of pixels for bits set to 1 in the bitmap. If the value is INVERT, bits set to 1 will invert the corresponding pixel. (optional; defaults to WHITE).

Bits set to 1 in the provided bitmap array will have their corresponding pixel set to the specified color. For bits set to 0 in the array, the corresponding pixel will be left unchanged.

Each byte in the array specifies a vertical column of 8 pixels, with the least significant bit at the top.

The array must be located in program memory by using the PROGMEM modifier.

Definition at line 786 of file Arduboy2.cpp.

### 6.3.2.23 void Arduboy2Base::drawCircle ( int16\_t x0, int16\_t y0, uint8\_t r, uint8\_t color = WHITE )

Draw a circle of a given radius.

#### Parameters

<i>x0</i>	The X coordinate of the circle's center.
<i>y0</i>	The Y coordinate of the circle's center.
<i>r</i>	The radius of the circle in pixels.
<i>color</i>	The circle's color (optional; defaults to WHITE).

Definition at line 344 of file Arduboy2.cpp.

**6.3.2.24** `void Arduboy2Base::drawCompressed ( int16_t sx, int16_t sy, const uint8_t * bitmap, uint8_t color = WHITE )`  
`[static]`

Draw a bitmap from an array of compressed data.

#### Parameters

<i>sx</i>	The X coordinate of the top left pixel affected by the bitmap.
<i>sy</i>	The Y coordinate of the top left pixel affected by the bitmap.
<i>bitmap</i>	A pointer to the compressed bitmap array in program memory.
<i>color</i>	The color of pixels for bits set to 1 in the bitmap. (optional; defaults to WHITE).

Draw a bitmap starting at the given coordinates from an array that has been compressed using an algorithm implemented by Team A.R.G. For more information see: <https://github.com/TEAMarg/drawCompressed>  
<https://github.com/TEAMarg/Cabi>

Bits set to 1 in the provided bitmap array will have their corresponding pixel set to the specified color. For bits set to 0 in the array, the corresponding pixel will be left unchanged.

The array must be located in program memory by using the PROGMEM modifier.

Definition at line 875 of file Arduboy2.cpp.

**6.3.2.25** `void Arduboy2Base::drawFastHLine ( int16_t x, int16_t y, uint8_t w, uint8_t color = WHITE )`

Draw a horizontal line.

#### Parameters

<i>x</i>	The X coordinate of the left start point.
<i>y</i>	The Y coordinate of the left start point.
<i>w</i>	The width of the line.
<i>color</i>	The color of the line (optional; defaults to WHITE).

Definition at line 540 of file Arduboy2.cpp.

**6.3.2.26** `void Arduboy2Base::drawFastVLine ( int16_t x, int16_t y, uint8_t h, uint8_t color = WHITE )`

Draw a vertical line.

#### Parameters

<i>x</i>	The X coordinate of the upper start point.
<i>y</i>	The Y coordinate of the upper start point.
<i>h</i>	The height of the line.
<i>color</i>	The color of the line (optional; defaults to WHITE).

Definition at line 530 of file Arduboy2.cpp.

**6.3.2.27** `void Arduboy2Base::drawLine ( int16_t x0, int16_t y0, int16_t x1, int16_t y1, uint8_t color = WHITE )`

Draw a line between two specified points.

#### Parameters

<i>x0,x1</i>	The X coordinates of the line ends.
<i>y0,y1</i>	The Y coordinates of the line ends.
<i>color</i>	The line's color (optional; defaults to WHITE).

Draw a line from the start point to the end point using Bresenham's algorithm. The start and end points can be at any location with respect to the other.

Definition at line 470 of file Arduboy2.cpp.

**6.3.2.28** `void Arduboy2Base::drawPixel ( int16_t x, int16_t y, uint8_t color = WHITE )`

Set a single pixel in the display buffer to the specified color.

#### Parameters

<i>x</i>	The X coordinate of the pixel.
<i>y</i>	The Y coordinate of the pixel.
<i>color</i>	The color of the pixel (optional; defaults to WHITE).

The single pixel specified location in the display buffer is set to the specified color. The values WHITE or BLACK can be used for the color. If the `color` parameter isn't included, the pixel will be set to WHITE.

Definition at line 283 of file Arduboy2.cpp.

**6.3.2.29** `void Arduboy2Base::drawRect ( int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t color = WHITE )`

Draw a rectangle of a specified width and height.

#### Parameters

<i>x</i>	The X coordinate of the upper left corner.
<i>y</i>	The Y coordinate of the upper left corner.
<i>w</i>	The width of the rectangle.
<i>h</i>	The height of the rectangle.
<i>color</i>	The color of the pixel (optional; defaults to WHITE).

Definition at line 521 of file Arduboy2.cpp.

**6.3.2.30** `void Arduboy2Base::drawRoundRect ( int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t r, uint8_t color = WHITE )`

Draw a rectangle with rounded corners.

#### Parameters

<i>x</i>	The X coordinate of the left edge.
<i>y</i>	The Y coordinate of the top edge.
<i>w</i>	The width of the rectangle.
<i>h</i>	The height of the rectangle.
<i>r</i>	The radius of the semicircles forming the corners.
<i>color</i>	The color of the rectangle (optional; defaults to WHITE).

Definition at line 649 of file Arduboy2.cpp.

**6.3.2.31** `void Arduboy2Base::drawSlowXYBitmap ( int16_t x, int16_t y, const uint8_t* bitmap, uint8_t w, uint8_t h, uint8_t color = WHITE )`

Draw a bitmap from a horizontally oriented array in program memory.

#### Parameters

<i>x</i>	The X coordinate of the top left pixel affected by the bitmap.
<i>y</i>	The Y coordinate of the top left pixel affected by the bitmap.
<i>bitmap</i>	A pointer to the bitmap array in program memory.
<i>w</i>	The width of the bitmap in pixels.
<i>h</i>	The height of the bitmap in pixels.
<i>color</i>	The color of pixels for bits set to 1 in the bitmap. (optional; defaults to WHITE).

Bits set to 1 in the provided bitmap array will have their corresponding pixel set to the specified color. For bits set to 0 in the array, the corresponding pixel will be left unchanged.

Each byte in the array specifies a horizontal row of 8 pixels, with the most significant bit at the left end of the row.

The array must be located in program memory by using the PROGMEM modifier.

#### Note

This function requires a lot of additional CPU power and will draw images slower than `drawBitmap()`, which uses bitmaps that are stored in a format that allows them to be directly written to the screen. It is recommended you use `drawBitmap()` when possible.

Definition at line 832 of file Arduboy2.cpp.

**6.3.2.32** `void Arduboy2Base::drawTriangle ( int16_t x0, int16_t y0, int16_t x1, int16_t y1, int16_t x2, int16_t y2, uint8_t color = WHITE )`

Draw a triangle given the coordinates of each corner.

**Parameters**

<i>x0,x1,x2</i>	The X coordinates of the corners.
<i>y0,y1,y2</i>	The Y coordinates of the corners.
<i>color</i>	The triangle's color (optional; defaults to WHITE).

A triangle is drawn by specifying each of the three corner locations. The corners can be at any position with respect to the others.

Definition at line 675 of file Arduboy2.cpp.

**6.3.2.33 bool Arduboy2Base::everyXFrames ( uint8\_t frames )**

Indicate if the specified number of frames has elapsed.

**Parameters**

<i>frames</i>	The desired number of elapsed frames.
---------------	---------------------------------------

**Returns**

`true` if the specified number of frames has elapsed.

This function should be called with the same value each time for a given event. It will return `true` if the given number of frames has elapsed since the previous frame in which it returned `true`.

For example, if you wanted to fire a shot every 5 frames while the A button is being held down:

```
if (arduboy.everyXframes(5)) {
    if arduboy.pressed(A_BUTTON) {
        fireShot();
    }
}
```

**See also**

[setFrameRate\(\)](#) [nextFrame\(\)](#)

Definition at line 193 of file Arduboy2.cpp.

**6.3.2.34 void Arduboy2Base::fillCircle ( int16\_t x0, int16\_t y0, uint8\_t r, uint8\_t color = WHITE )**

Draw a filled-in circle of a given radius.

**Parameters**

<i>x0</i>	The X coordinate of the circle's center.
<i>y0</i>	The Y coordinate of the circle's center.
<i>r</i>	The radius of the circle in pixels.
<i>color</i>	The circle's color (optional; defaults to WHITE).

Definition at line 426 of file Arduboy2.cpp.

**6.3.2.35** `void Arduboy2Base::fillRect ( int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t color = WHITE )`

Draw a filled-in rectangle of a specified width and height.

#### Parameters

<i>x</i>	The X coordinate of the upper left corner.
<i>y</i>	The Y coordinate of the upper left corner.
<i>w</i>	The width of the rectangle.
<i>h</i>	The height of the rectangle.
<i>color</i>	The color of the pixel (optional; defaults to WHITE).

Definition at line 591 of file Arduboy2.cpp.

**6.3.2.36** `void Arduboy2Base::fillRoundRect ( int16_t x, int16_t y, uint8_t w, uint8_t h, uint8_t r, uint8_t color = WHITE )`

Draw a filled-in rectangle with rounded corners.

#### Parameters

<i>x</i>	The X coordinate of the left edge.
<i>y</i>	The Y coordinate of the top edge.
<i>w</i>	The width of the rectangle.
<i>h</i>	The height of the rectangle.
<i>r</i>	The radius of the semicircles forming the corners.
<i>color</i>	The color of the rectangle (optional; defaults to WHITE).

Definition at line 664 of file Arduboy2.cpp.

**6.3.2.37** `void Arduboy2Base::fillScreen ( uint8_t color = WHITE )`

Fill the screen buffer with the specified color.

#### Parameters

<i>color</i>	The fill color (optional; defaults to WHITE).
--------------	---

Definition at line 600 of file Arduboy2.cpp.

**6.3.2.38** `void Arduboy2Base::fillTriangle ( int16_t x0, int16_t y0, int16_t x1, int16_t y1, int16_t x2, int16_t y2, uint8_t color = WHITE )`

Draw a filled-in triangle given the coordinates of each corner.

## Parameters

<i>x0,x1,x2</i>	The X coordinates of the corners.
<i>y0,y1,y2</i>	The Y coordinates of the corners.
<i>color</i>	The triangle's color (optional; defaults to WHITE).

A triangle is drawn by specifying each of the three corner locations. The corners can be at any position with respect to the others.

Definition at line 683 of file Arduboy2.cpp.

## 6.3.2.39 void Arduboy2Base::flashlight ( )

Turn the RGB LED and display fully on to act as a small flashlight/torch.

Checks if the UP button is pressed and if so turns the RGB LED and all display pixels fully on. If the UP button is detected, this function does not exit. The Arduboy must be restarted after flashlight mode is used.

This function is called by `begin()` and can be called by a sketch after `boot()`.

## Note

This function also contains code to address a problem with uploading a new sketch, for sketches that interfere with the bootloader "magic number". This problem occurs with certain sketches that use large amounts of RAM. Being in flashlight mode when uploading a new sketch can fix this problem.

Therefore, for sketches that potentially could cause this problem, and use `boot()` instead of `begin()`, it is recommended that a call to `flashlight()` be included after calling `boot()`. If program space is limited, `safeMode()` can be used instead of `flashlight()`.

## See also

`begin()` `boot()` `safeMode()`

Definition at line 60 of file Arduboy2.cpp.

## 6.3.2.40 void Arduboy2Core::flipHorizontal ( bool flipped ) [static],[inherited]

Flip the display horizontally or set it back to normal.

## Parameters

<i>flipped</i>	<code>true</code> will set horizontal flip mode. <code>false</code> will set normal horizontal orientation.
----------------	---

Calling this function with a value of `true` will cause the X coordinate to start at the left edge of the display instead of the right, effectively flipping the display horizontally.

Once in horizontal flip mode, it will remain this way until normal horizontal mode is set by calling this function with a value of `false`.



See also

[flipVertical\(\)](#)

Definition at line 387 of file Arduboy2Core.cpp.

**6.3.2.41** `void Arduboy2Core::flipVertical ( bool flipped )` `[static], [inherited]`

Flip the display vertically or set it back to normal.

Parameters

<i>flipped</i>	<code>true</code> will set vertical flip mode. <code>false</code> will set normal vertical orientation.
----------------	---

Calling this function with a value of `true` will cause the Y coordinate to start at the bottom edge of the display instead of the top, effectively flipping the display vertically.

Once in vertical flip mode, it will remain this way until normal vertical mode is set by calling this function with a value of `false`.

See also

[flipHorizontal\(\)](#)

Definition at line 381 of file Arduboy2Core.cpp.

**6.3.2.42** `uint8_t* Arduboy2Base::getBuffer ( )`

Get a pointer to the display buffer in RAM.

Returns

A pointer to the display buffer array in RAM.

The location of the display buffer in RAM, which is displayed using [display\(\)](#), can be gotten using this function. The buffer can then be read and directly manipulated.

Note

The display buffer array, `sBuffer`, is public. A sketch can access it directly. Doing so may be more efficient than accessing it via the pointer returned by [getBuffer\(\)](#).

See also

[sBuffer](#)

Definition at line 990 of file Arduboy2.cpp.

**6.3.2.43** `uint8_t Arduboy2Base::getPixel ( uint8_t x, uint8_t y )`

Returns the state of the given pixel in the screen buffer.

**Parameters**

<i>x</i>	The X coordinate of the pixel.
<i>y</i>	The Y coordinate of the pixel.

**Returns**

WHITE if the pixel is on or BLACK if the pixel is off.

Definition at line 337 of file Arduboy2.cpp.

**6.3.2.44** `uint8_t Arduboy2Core::height ( )` *[static],[inherited]*

Get the height of the display in pixels.

**Returns**

The height of the display in pixels.

**Note**

In most cases, the defined value `HEIGHT` would be better to use instead of this function.

Definition at line 296 of file Arduboy2Core.cpp.

**6.3.2.45** `void Arduboy2Core::idle ( )` *[static],[inherited]*

Idle the CPU to save power.

This puts the CPU in *idle* sleep mode. You should call this as often as you can for the best power savings. The timer 0 overflow interrupt will wake up the chip every 1ms, so even at 60 FPS a well written app should be able to sleep maybe half the time in between rendering it's own frames.

Definition at line 262 of file Arduboy2Core.cpp.

**6.3.2.46** `void Arduboy2Base::initRandomSeed ( )`

Seed the random number generator with a random value.

The Arduino random number generator is seeded with a random value derrived from entropy from the temperature, voltage reading, and microseconds since boot.

This method is still most effective when called after a semi-random time, such as after a user hits a button to start a game or other semi-random event.

Definition at line 255 of file Arduboy2.cpp.

**6.3.2.47** `void Arduboy2Core::invert ( bool inverse )` *[static],[inherited]*

Invert the entire display or set it back to normal.

## Parameters

<i>inverse</i>	<code>true</code> will invert the display. <code>false</code> will set the display to no-inverted.
----------------	--

Calling this function with a value of `true` will set the display to inverted mode. A pixel with a value of 0 will be on and a pixel set to 1 will be off.

Once in inverted mode, the display will remain this way until it is set back to non-inverted mode by calling this function with `false`.

Definition at line 368 of file Arduboy2Core.cpp.

#### 6.3.2.48 `bool Arduboy2Base::justPressed ( uint8_t button )`

Check if a button has just been pressed.

## Parameters

<i>button</i>	The button to test for. Only one button should be specified.
---------------	--

## Returns

`true` if the specified button has just been pressed.

Return `true` if the given button was pressed between the latest call to `pollButtons()` and previous call to `pollButtons()`. If the button has been held down over multiple polls, this function will return `false`.

There is no need to check for the release of the button since it must have been released for this function to return `true` when pressed again.

This function should only be used to test a single button.

## See also

[pollButtons\(\)](#) [justReleased\(\)](#)

Definition at line 1011 of file Arduboy2.cpp.

#### 6.3.2.49 `bool Arduboy2Base::justReleased ( uint8_t button )`

Check if a button has just been released.

## Parameters

<i>button</i>	The button to test for. Only one button should be specified.
---------------	--

### Returns

`true` if the specified button has just been released.

Return `true` if the given button, having previously been pressed, was released between the latest call to `pollButtons()` and previous call to `pollButtons()`. If the button has remained released over multiple polls, this function will return `false`.

There is no need to check for the button having been pressed since it must have been previously pressed for this function to return `true` upon release.

This function should only be used to test a single button.

### Note

There aren't many cases where this function would be needed. Wanting to know if a button has been released, without knowing when it was pressed, is uncommon.

### See also

`pollButtons()` `justPressed()`

Definition at line 1016 of file `Arduboy2.cpp`.

#### 6.3.2.50 `void Arduboy2Core::LCDCommandMode( )` `[static]`, `[inherited]`

Put the display into command mode.

When placed in command mode, data that is sent to the display will be treated as commands.

See the SSD1306 controller and OLED display documents for available commands and command sequences.

Links:

- <https://www.adafruit.com/datasheets/SSD1306.pdf>
- [http://www.buydisplay.com/download/manual/ER-OLED013-1\\_Series\\_Datasheet.pdf](http://www.buydisplay.com/download/manual/ER-OLED013-1_Series_Datasheet.pdf)

### Note

This is a low level function that is not intended for general use in a sketch. It has been made public and documented for use by derived classes.

### See also

`LCDDataMode()` `sendLCDCommand()` `SPItransfer()`

Definition at line 218 of file `Arduboy2Core.cpp`.

### 6.3.2.51 void Arduboy2Core::LCDDDataMode ( ) [static],[inherited]

Put the display into data mode.

When placed in data mode, data that is sent to the display will be considered as data to be displayed.

#### Note

This is a low level function that is not intended for general use in a sketch. It has been made public and documented for use by derived classes.

#### See also

[LCDCommandMode\(\)](#) [SPItransfer\(\)](#)

Definition at line 213 of file Arduboy2Core.cpp.

### 6.3.2.52 bool Arduboy2Base::nextFrame ( )

Indicate that it's time to render the next frame.

#### Returns

`true` if it's time for the next frame.

When this function returns `true`, the amount of time has elapsed to display the next frame, as specified by [setFrameRate\(\)](#).

This function will normally be called at the start of the rendering loop which would wait for `true` to be returned before rendering and displaying the next frame.

example:

```
void loop() {  
  if (!arduboy.nextFrame()) {  
    return; // go back to the start of the loop  
  }  
  // render and display the next frame  
}
```

#### See also

[setFrameRate\(\)](#) [nextFrameDEV\(\)](#)

Definition at line 198 of file Arduboy2.cpp.

### 6.3.2.53 `bool Arduboy2Base::nextFrameDEV ( )`

Indicate that it's time to render the next frame, and visually indicate if the code is running slower than the desired frame rate. **FOR USE DURING DEVELOPMENT**

#### Returns

`true` if it's time for the next frame.

This function is intended to be used in place of `nextFrame()` during the development of a sketch. It does the same thing as `nextFrame()` but additionally will light the yellow TX LED (at the bottom, to the left of the USB connector) whenever a frame takes longer to generate than the time allotted per frame, as determined by the `setFrameRate()` function.

Therefore, whenever the TX LED comes on (while not communicating over USB), it indicates that the sketch is running slower than the desired rate set by `setFrameRate()`. In this case the developer may wish to set a slower frame rate, or reduce or optimize the code for such frames.

#### Note

Once a sketch is ready for release, it would be expected that `nextFrameDEV()` calls be restored to `nextFrame()`.

#### See also

`nextFrame()` `cpuLoad()` `setFrameRate()`

Definition at line 237 of file `Arduboy2.cpp`.

### 6.3.2.54 `bool Arduboy2Base::notPressed ( uint8_t buttons )`

Test if the specified buttons are not pressed.

#### Parameters

<i>buttons</i>	A bit mask indicating which buttons to test. (Can be a single button)
----------------	---

#### Returns

`true` if *all* buttons in the provided mask are currently released.

Read the state of the buttons and return `true` if all the buttons in the specified mask are currently released.

Example: `if (notPressed(UP_BUTTON))`

#### Note

This function does not perform any button debouncing.

Definition at line 1000 of file `Arduboy2.cpp`.

6.3.2.55 `void Arduboy2Core::paint8Pixels ( uint8_t pixels )` `[static], [inherited]`

Paint 8 pixels vertically to the display.

**Parameters**

<i>pixels</i>	A byte whose bits specify a vertical column of 8 pixels.
---------------	--

A byte representing a vertical column of 8 pixels is written to the display at the current page and column address. The address is then incremented. The page/column address will wrap to the start of the display (the top left) when it increments past the end (lower right).

The least significant bit represents the top pixel in the column. A bit set to 1 is lit, 0 is unlit.

Example:

```
X = lit pixels, . = unlit pixels
```

blank()	paint8Pixels() 0xFF, 0, 0xF0, 0, 0x0F
v TOP LEFT corner (8x9)	v TOP LEFT corner
. . . . . (page 1)	X . . . X . . . (page 1)
. . . . .	X . . . X . . .
. . . . .	X . . . X . . .
. . . . .	X . . . X . . .
. . . . .	X . X . . . .
. . . . .	X . X . . . .
. . . . .	X . X . . . .
. . . . . (end of page 1)	X . X . . . . (end of page 1)
. . . . . (page 2)	. . . . . (page 2)

Definition at line 301 of file Arduboy2Core.cpp.

**6.3.2.56** `void Arduboy2Core::paintScreen ( const uint8_t* image )` `[static],[inherited]`

Paints an entire image directly to the display from program memory.

**Parameters**

<i>image</i>	A byte array in program memory representing the entire contents of the display.
--------------	---

The contents of the specified array in program memory is written to the display. Each byte in the array represents a vertical column of 8 pixels with the least significant bit at the top. The bytes are written starting at the top left, progressing horizontally and wrapping at the end of each row, to the bottom right. The size of the array must exactly match the number of pixels in the entire display.

**See also**

[paint8Pixels\(\)](#)

Definition at line 306 of file Arduboy2Core.cpp.

**6.3.2.57** `void Arduboy2Core::paintScreen ( uint8_t image[], bool clear = false )` `[static],[inherited]`

Paints an entire image directly to the display from an array in RAM.



## Parameters

<i>image</i>	A byte array in RAM representing the entire contents of the display.
<i>clear</i>	If <code>true</code> the array in RAM will be cleared to zeros upon return from this function. If <code>false</code> the RAM buffer will remain unchanged. (optional; defaults to <code>false</code> )

The contents of the specified array in RAM is written to the display. Each byte in the array represents a vertical column of 8 pixels with the least significant bit at the top. The bytes are written starting at the top left, progressing horizontally and wrapping at the end of each row, to the bottom right. The size of the array must exactly match the number of pixels in the entire display.

If parameter `clear` is set to `true` the RAM array will be cleared to zeros after its contents are written to the display.

## See also

[paint8Pixels\(\)](#)

Definition at line 316 of file `Arduboy2Core.cpp`.

**6.3.2.58 void Arduboy2Base::pollButtons ( )**

Poll the buttons and track their state over time.

Read and save the current state of the buttons and also keep track of the button state when this function was previously called. These states are used by the [justPressed\(\)](#) and [justReleased\(\)](#) functions to determine if a button has changed state between now and the previous call to [pollButtons\(\)](#).

This function should be called once at the start of each new frame.

The [justPressed\(\)](#) and [justReleased\(\)](#) functions rely on this function.

example:

```
void loop() {
    if (!arduboy.nextFrame()) {
        return;
    }
    arduboy.pollButtons();

    // use justPressed() as necessary to determine if a button was just pressed
```

## Note

As long as the elapsed time between calls to this function is long enough, buttons will be naturally debounced. Calling it once per frame at a frame rate of 60 or lower (or possibly somewhat higher), should be sufficient.

## See also

[justPressed\(\)](#) [justReleased\(\)](#)

Definition at line 1005 of file `Arduboy2.cpp`.

**6.3.2.59 bool Arduboy2Base::pressed ( uint8\_t buttons )**

Test if the specified buttons are pressed.

**Parameters**

<i>buttons</i>	A bit mask indicating which buttons to test. (Can be a single button)
----------------	---

**Returns**

`true` if *all* buttons in the provided mask are currently pressed.

Read the state of the buttons and return `true` if all the buttons in the specified mask are being pressed.

Example: `if (pressed(LEFT_BUTTON + A_BUTTON))`

**Note**

This function does not perform any button debouncing.

Definition at line 995 of file `Arduboy2.cpp`.

**6.3.2.60 bool Arduboy2Base::readShowUnitNameFlag ( )**

Read the "Show Unit Name" flag in system EEPROM.

**Returns**

`true` if the flag is set to indicate that the unit name should be displayed. `false` if the flag is set to not display the unit name.

The "Show Unit Name" flag is used to determine whether the system unit name is to be displayed at the end of the boot logo sequence. This function returns the value of this flag.

**See also**

[writeShowUnitNameFlag\(\)](#) [writeUnitName\(\)](#) [readUnitName\(\)](#) [Arduboy2::bootLogoExtra\(\)](#)

Definition at line 1083 of file `Arduboy2.cpp`.

**6.3.2.61 uint16\_t Arduboy2Base::readUnitID ( )**

Read the unit ID from system EEPROM.

**Returns**

The value of the unit ID stored in system EEPROM.

This function reads the unit ID that has been set in system EEPROM. The ID can be any value. It is intended to allow different units to be uniquely identified.

**See also**

[writeUnitID\(\)](#) [readUnitName\(\)](#)

Definition at line 1035 of file `Arduboy2.cpp`.

**6.3.2.62 uint8\_t Arduboy2Base::readUnitName ( char \* name )**

Read the unit name from system EEPROM.

## Parameters

<i>name</i>	A pointer to a string array variable where the unit name will be placed. The string will be up to 6 characters and terminated with a null (0x00) character, so the provided array must be at least 7 bytes long.
-------------	--

## Returns

The length of the string (0-6).

This function reads the unit name that has been set in system EEPROM. The name is in ASCII and can contain any values except 0xFF and the null (0x00) terminator value.

The name can be used for any purpose. It could identify the owner or give the unit itself a nickname. A sketch could use it to automatically fill in a name or initials in a high score table, or display it as the "player" when the opponent is the computer.

## Note

Sketches can use the defined value `ARDUBOY_UNIT_NAME_LEN` instead of hard coding a 6 when working with the unit name. For example, to allocate a buffer and read the unit name into it:

```
// Buffer for maximum name length plus the terminator
char unitName[ARDUBOY_UNIT_NAME_LEN + 1];

// The actual name length
byte unitNameLength;

unitNameLength = arduboy.readUnitName(unitName);
```

## See also

[writeUnitName\(\)](#) [readUnitID\(\)](#) [Arduboy2::bootLogoExtra\(\)](#)

Definition at line 1047 of file `Arduboy2.cpp`.

### 6.3.2.63 void Arduboy2Core::safeMode ( ) [static],[inherited]

Allow upload when the bootloader "magic number" could be corrupted.

If the UP button is held when this function is entered, the RGB LED will be lit and timer 0 will be disabled, then the sketch will remain in a tight loop. This is to address a problem with uploading a new sketch, for sketches that interfere with the bootloader "magic number". The problem occurs with certain sketches that use large amounts of RAM.

This function should be called after `boot ( )` in sketches that potentially could cause the problem.

It is intended to replace the `flashlight ( )` function when more program space is required. If possible, it is more desirable to use `flashlight ( )`, so that the actual flashlight feature isn't lost.

## See also

[Arduboy2Base::flashlight\(\)](#) [boot\(\)](#)

Definition at line 245 of file `Arduboy2Core.cpp`.

### 6.3.2.64 void Arduboy2Core::sendLCDCommand ( uint8\_t command ) [static],[inherited]

Send a single command byte to the display.

**Parameters**

<i>command</i>	The command byte to send to the display.
----------------	--

The display will be set to command mode then the specified command byte will be sent. The display will then be set to data mode. Multi-byte commands can be sent by calling this function multiple times.

**Note**

Sending improper commands to the display can place it into invalid or unexpected states, possibly even causing physical damage.

Definition at line 359 of file Arduboy2Core.cpp.

**6.3.2.65 void Arduboy2Base::setFrameRate ( uint8\_t rate )**

Set the frame rate used by the frame control functions.

**Parameters**

<i>rate</i>	The desired frame rate in frames per second.
-------------	--

Set the frame rate, in frames per second, used by `nextFrame()` to update frames at a given rate. If this function isn't used, the default rate will be 60.

Normally, the frame rate would be set to the desired value once, at the start of the game, but it can be changed at any time to alter the frame update rate.

**See also**

[nextFrame\(\)](#)

Definition at line 188 of file Arduboy2.cpp.

**6.3.2.66 void Arduboy2Core::setRGBled ( uint8\_t red, uint8\_t green, uint8\_t blue ) [static],[inherited]**

Set the light output of the RGB LED.

**Parameters**

<i>red,green,blue</i>	The brightness value for each LED.
-----------------------	------------------------------------

The RGB LED is actually individual red, green and blue LEDs placed very close together in a single package. By setting the brightness of each LED, the RGB LED can show various colors and intensities. The brightness of each LED can be set to a value from 0 (fully off) to 255 (fully on).

**Note**

Certain libraries that take control of the hardware timers may interfere with the ability of this function to properly control the RGB LED. *ArduboyPlaytune* is one such library known to do this. The [digitalWriteRGB\(\)](#) function will still work properly in this case.

**Note**

Many of the Kickstarter Arduboy2s were accidentally shipped with the RGB LED installed incorrectly. For these units, the green LED cannot be lit. As long as the green led is set to off, setting the red LED will actually control the blue LED and setting the blue LED will actually control the red LED. If the green LED is turned fully on, none of the LEDs will light.

**See also**

[digitalWriteRGB\(\)](#)

Definition at line 394 of file *Arduboy2Core.cpp*.

**6.3.2.67** `void Arduboy2Core::SPItransfer ( uint8_t data ) [static],[inherited]`

Transfer a byte to the display.

**Parameters**

<i>data</i>	The byte to be sent to the display.
-------------	-------------------------------------

Transfer one byte to the display over the SPI port and wait for the transfer to complete. The byte will either be interpreted as a command or as data to be placed on the screen, depending on the command/data mode.

**See also**

[LCDDataMode\(\)](#) [LCDCommandMode\(\)](#) [sendLCDCommand\(\)](#)

Definition at line 232 of file *Arduboy2Core.cpp*.

**6.3.2.68** `void Arduboy2Base::systemButtons ( )`

Handle buttons held on startup for system control.

This function is called by [begin\(\)](#) and can be called by a sketch after [boot\(\)](#).

Hold the B button when booting to enter system control mode. The B button must be held continuously to remain in this mode. Then, pressing other buttons will perform system control functions:

- UP: Set "sound enabled" in EEPROM
- DOWN: Set "sound disabled" (mute) in EEPROM

**See also**

[begin\(\)](#) [boot\(\)](#)

Definition at line 79 of file *Arduboy2.cpp*.

### 6.3.2.69 `uint8_t Arduboy2Core::width ( )` [static],[inherited]

Get the width of the display in pixels.

#### Returns

The width of the display in pixels.

#### Note

In most cases, the defined value `WIDTH` would be better to use instead of this function.

Definition at line 294 of file `Arduboy2Core.cpp`.

### 6.3.2.70 `void Arduboy2Base::writeShowUnitNameFlag ( bool val )`

Write the "Show Unit Name" flag in system EEPROM.

#### Parameters

<i>val</i>	If <code>true</code> the flag is set to indicate that the unit name should be displayed. If <code>false</code> the flag is set to not display the unit name.
------------	--

The "Show Unit Name" flag is used to determine whether the system unit name is to be displayed at the end of the boot logo sequence. This function allows the flag to be saved with the desired value.

#### See also

[readShowUnitNameFlag\(\)](#) [writeUnitName\(\)](#) [readUnitName\(\)](#) [Arduboy2::bootLogoExtra\(\)](#)

Definition at line 1088 of file `Arduboy2.cpp`.

### 6.3.2.71 `void Arduboy2Base::writeUnitID ( uint16_t id )`

Write a unit ID to system EEPROM.

#### Parameters

<i>id</i>	The value of the unit ID to be stored in system EEPROM.
-----------	---

This function writes a unit ID to a reserved location in system EEPROM. The ID can be any value. It is intended to allow different units to be uniquely identified.

#### See also

[readUnitID\(\)](#) [writeUnitName\(\)](#)

Definition at line 1041 of file `Arduboy2.cpp`.

#### 6.3.2.72 void Arduboy2Base::writeUnitName ( char \* name )

Write a unit name to system EEPROM.

##### Parameters

<i>name</i>	A pointer to a string array variable containing the unit name to be saved. The string can be up to 6 characters and must be terminated with a null (0x00) character. It can contain any values except 0xFF.
-------------	---

This function writes a unit name to a reserved area in system EEPROM. The name is in ASCII and can contain any values except 0xFF and the null (0x00) terminator value. The newline character (LF, \n, 0x0A) and carriage return character (CR, \r, 0x0D) should also be avoided.

The name can be used for any purpose. It could identify the owner or give the unit itself a nickname. A sketch could use it to automatically fill in a name or initials in a high score table, or display it as the "player" when the opponent is the computer.

##### Note

Sketches can use the defined value `ARDUBOY_UNIT_NAME_LEN` instead of hard coding a 6 when working with the unit name.

##### See also

[readUnitName\(\)](#) [writeUnitID\(\)](#) [Arduboy2::bootLogoExtra\(\)](#)

Definition at line 1067 of file `Arduboy2.cpp`.

### 6.3.3 Member Data Documentation

#### 6.3.3.1 Arduboy2Audio Arduboy2Base::audio

An object created to provide audio control functions within this class.

This object is created to eliminate the need for a sketch to create an [Arduboy2Audio](#) class object itself.

##### See also

[Arduboy2Audio](#)

Definition at line 176 of file `Arduboy2.h`.

### 6.3.3.2 `uint16_t Arduboy2Base::frameCount`

A counter which is incremented once per frame.

This counter is incremented once per frame when using the `nextFrame()` function. It will wrap to zero when it reaches its maximum value.

It could be used to have an event occur for a given number of frames, or a given number of frames later, in a way that wouldn't be quantized the way that using `everyXFrames()` might.

example:

```
// move for 10 frames when right button is pressed, if not already moving
if (!moving) {
    if (arduboy.justPressed(RIGHT_BUTTON)) {
        endMoving = arduboy.frameCount + 10;
        moving = true;
    }
} else {
    movePlayer();
    if (arduboy.frameCount == endMoving) {
        moving = false;
    }
}
```

This counter could also be used to determine the number of frames that have elapsed between events but the possibility of the counter wrapping would have to be accounted for.

See also

[nextFrame\(\)](#) [everyXFrames\(\)](#)

Definition at line 1091 of file `Arduboy2.h`.

### 6.3.3.3 `uint8_t Arduboy2Base::sBuffer` `[static]`

The display buffer array in RAM.

The display buffer (also known as the screen buffer) contains an image bitmap of the desired contents of the display, which is written to the display using the `display()` function. The drawing functions of this library manipulate the contents of the display buffer. A sketch can also access the display buffer directly.

See also

[getBuffer\(\)](#)

Definition at line 1105 of file `Arduboy2.h`.

The documentation for this class was generated from the following files:

- [src/Arduboy2.h](#)
- [src/Arduboy2.cpp](#)

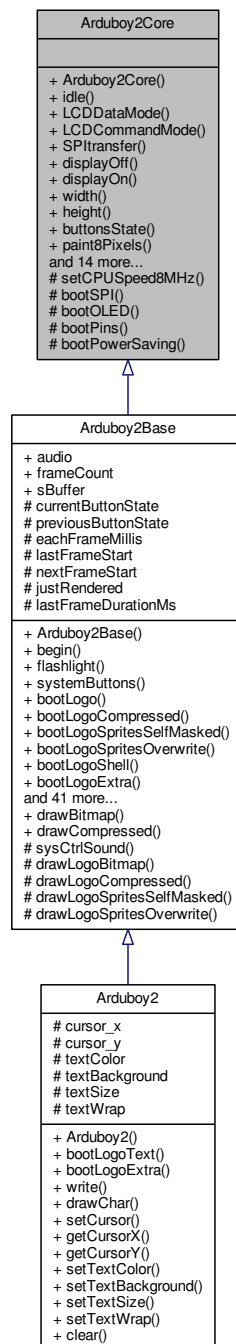


## 6.4 Arduboy2Core Class Reference

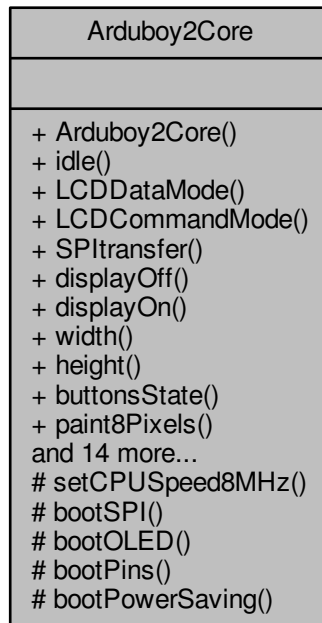
Lower level functions generally dealing directly with the hardware.

```
#include <Arduboy2Core.h>
```

Inheritance diagram for Arduboy2Core:



Collaboration diagram for Arduboy2Core:



## Static Public Member Functions

- static void [idle](#) ()  
*Idle the CPU to save power.*
- static void [LCDDDataMode](#) ()  
*Put the display into data mode.*
- static void [LCDCommandMode](#) ()  
*Put the display into command mode.*
- static void [SPItransfer](#) (uint8\_t data)  
*Transfer a byte to the display.*
- static void [displayOff](#) ()  
*Turn the display off.*
- static void [displayOn](#) ()  
*Turn the display on.*
- static uint8\_t [width](#) ()  
*Get the width of the display in pixels.*
- static uint8\_t [height](#) ()  
*Get the height of the display in pixels.*
- static uint8\_t [buttonsState](#) ()  
*Get the current state of all buttons as a bitmask.*
- static void [paint8Pixels](#) (uint8\_t pixels)  
*Paint 8 pixels vertically to the display.*
- static void [paintScreen](#) (const uint8\_t \*image)

- Paints an entire image directly to the display from program memory.*
- static void [paintScreen](#) (uint8\_t image[], bool clear=false)
- Paints an entire image directly to the display from an array in RAM.*
- static void [blank](#) ()
- Blank the display screen by setting all pixels off.*
- static void [invert](#) (bool inverse)
- Invert the entire display or set it back to normal.*
- static void [allPixelsOn](#) (bool on)
- Turn all display pixels on or display the buffer contents.*
- static void [flipVertical](#) (bool flipped)
- Flip the display vertically or set it back to normal.*
- static void [flipHorizontal](#) (bool flipped)
- Flip the display horizontally or set it back to normal.*
- static void [sendLCDCommand](#) (uint8\_t command)
- Send a single command byte to the display.*
- static void [setRGBled](#) (uint8\_t red, uint8\_t green, uint8\_t blue)
- Set the light output of the RGB LED.*
- static void [digitalWriteRGB](#) (uint8\_t red, uint8\_t green, uint8\_t blue)
- Set the RGB LEDs digitally, to either fully on or fully off.*
- static void [digitalWriteRGB](#) (uint8\_t color, uint8\_t val)
- Set one of the RGB LEDs digitally, to either fully on or fully off.*
- static void [boot](#) ()
- Initialize the Arduboy's hardware.*
- static void [safeMode](#) ()
- Allow upload when the bootloader "magic number" could be corrupted.*
- static void [delayShort](#) (uint16\_t ms) `__attribute__((noinline))`
- Delay for the number of milliseconds, specified as a 16 bit value.*

### 6.4.1 Detailed Description

Lower level functions generally dealing directly with the hardware.

This class is inherited by [Arduboy2Base](#) and thus also [Arduboy2](#), so wouldn't normally be used directly by a sketch.

#### Note

A friend class named *Arduboy2Ex* is declared by this class. The intention is to allow a sketch to create an *Arduboy2Ex* class which would have access to the private and protected members of the [Arduboy2Core](#) class. It is hoped that this may eliminate the need to create an entire local copy of the library, in order to extend the functionality, in most circumstances.

Definition at line 240 of file *Arduboy2Core.h*.

### 6.4.2 Member Function Documentation

#### 6.4.2.1 void Arduboy2Core::allPixelsOn ( bool on ) [static]

Turn all display pixels on or display the buffer contents.

#### Parameters

<i>on</i>	<code>true</code> turns all pixels on. <code>false</code> displays the contents of the hardware display buffer.
-----------	---

Calling this function with a value of `true` will override the contents of the hardware display buffer and turn all pixels on. The contents of the hardware buffer will remain unchanged.

Calling this function with a value of `false` will set the normal state of displaying the contents of the hardware display buffer.

#### Note

All pixels will be lit even if the display is in inverted mode.

#### See also

[invert\(\)](#)

Definition at line 375 of file `Arduboy2Core.cpp`.

#### 6.4.2.2 void Arduboy2Core::blank ( ) [static]

Blank the display screen by setting all pixels off.

All pixels on the screen will be written with a value of 0 to turn them off.

Definition at line 353 of file `Arduboy2Core.cpp`.

#### 6.4.2.3 void Arduboy2Core::boot ( ) [static]

Initialize the Arduboy's hardware.

This function initializes the display, buttons, etc.

This function is called by `begin()` so isn't normally called within a sketch. However, in order to free up some code space, by eliminating some of the start up features, it can be called in place of `begin()`. The functions that `begin()` would call after `boot()` can then be called to add back in some of the start up features, if desired. See the README file or documentation on the main page for more details.

#### See also

[Arduboy2Base::begin\(\)](#)

Definition at line 76 of file `Arduboy2Core.cpp`.

#### 6.4.2.4 `uint8_t Arduboy2Core::buttonsState ( ) [static]`

Get the current state of all buttons as a bitmask.

##### Returns

A bitmask of the state of all the buttons.

The returned mask contains a bit for each button. For any pressed button, its bit will be 1. For released buttons their associated bits will be 0.

The following defined mask values should be used for the buttons:

LEFT\_BUTTON, RIGHT\_BUTTON, UP\_BUTTON, DOWN\_BUTTON, A\_BUTTON, B\_BUTTON

Definition at line 449 of file Arduboy2Core.cpp.

#### 6.4.2.5 `void Arduboy2Core::delayShort ( uint16_t ms ) [static]`

Delay for the number of milliseconds, specified as a 16 bit value.

**Parameters**

<i>ms</i>	The delay in milliseconds.
-----------	----------------------------

This function works the same as the Arduino `delay()` function except the provided value is 16 bits long, so the maximum delay allowed is 65535 milliseconds (about 65.5 seconds). Using this function instead of Arduino `delay()` will save a few bytes of code.

Definition at line 474 of file `Arduboy2Core.cpp`.

#### 6.4.2.6 `void Arduboy2Core::digitalWriteRGB ( uint8_t red, uint8_t green, uint8_t blue ) [static]`

Set the RGB LEDs digitally, to either fully on or fully off.

**Parameters**

<i>red, green, blue</i>	Use value RGB_ON or RGB_OFF to set each LED.
-------------------------	--

The RGB LED is actually individual red, green and blue LEDs placed very close together in a single package. This 3 parameter version of the function will set each LED either on or off, to set the RGB LED to 7 different colors at their highest brightness or turn it off.

The colors are as follows:

RED_LED	GREEN_LED	BLUE_LED	COLOR
-----	-----	-----	-----
RGB_OFF	RGB_OFF	RGB_OFF	OFF
RGB_OFF	RGB_OFF	RGB_ON	Blue
RGB_OFF	RGB_ON	RGB_OFF	Green
RGB_OFF	RGB_ON	RGB_ON	Cyan
RGB_ON	RGB_OFF	RGB_OFF	Red
RGB_ON	RGB_OFF	RGB_ON	Magenta
RGB_ON	RGB_ON	RGB_OFF	Yellow
RGB_ON	RGB_ON	RGB_ON	White

**Note**

Many of the Kickstarter Arduboy2s were accidentally shipped with the RGB LED installed incorrectly. For these units, the green LED cannot be lit. As long as the green led is set to off, turning on the red LED will actually light the blue LED and turning on the blue LED will actually light the red LED. If the green LED is turned on, none of the LEDs will light.

**See also**

[digitalWriteRGB\(uint8\\_t, uint8\\_t\) setRGBled\(\)](#)

Definition at line 409 of file `Arduboy2Core.cpp`.

#### 6.4.2.7 `void Arduboy2Core::digitalWriteRGB ( uint8_t color, uint8_t val ) [static]`

Set one of the RGB LEDs digitally, to either fully on or fully off.

## Parameters

<i>color</i>	The name of the LED to set. The value given should be one of RED_LED, GREEN_LED or BLUE_LED.
<i>val</i>	Indicates whether to turn the specified LED on or off. The value given should be RGB_ON or RGB_OFF.

This 2 parameter version of the function will set a single LED within the RGB LED either fully on or fully off. See the description of the 3 parameter version of this function for more details on the RGB LED.

## See also

[digitalWriteRGB\(uint8\\_t, uint8\\_t, uint8\\_t\) setRGBled\(\)](#)

Definition at line 423 of file Arduboy2Core.cpp.

#### 6.4.2.8 void Arduboy2Core::displayOff ( ) [static]

Turn the display off.

The display will clear and be put into a low power mode. This can be used to extend battery life when a game is paused or when a sketch doesn't require anything to be displayed for a relatively long period of time.

## See also

[displayOn\(\)](#)

Definition at line 278 of file Arduboy2Core.cpp.

#### 6.4.2.9 void Arduboy2Core::displayOn ( ) [static]

Turn the display on.

Used to power up and reinitialize the display after calling [displayOff\(\)](#).

## Note

The previous call to [displayOff\(\)](#) will have caused the display's buffer contents to be lost. The display will have to be re-painted, which is usually done by calling [display\(\)](#).

## See also

[displayOff\(\)](#)

Definition at line 289 of file Arduboy2Core.cpp.

#### 6.4.2.10 void Arduboy2Core::flipHorizontal ( bool *flipped* ) [static]

Flip the display horizontally or set it back to normal.

#### Parameters

<i>flipped</i>	<code>true</code> will set horizontal flip mode. <code>false</code> will set normal horizontal orientation.
----------------	---

Calling this function with a value of `true` will cause the X coordinate to start at the left edge of the display instead of the right, effectively flipping the display horizontally.

Once in horizontal flip mode, it will remain this way until normal horizontal mode is set by calling this function with a value of `false`.

#### See also

[flipVertical\(\)](#)

Definition at line 387 of file `Arduboy2Core.cpp`.

6.4.2.11 `void Arduboy2Core::flipVertical ( bool flipped ) [static]`

Flip the display vertically or set it back to normal.

#### Parameters

<i>flipped</i>	<code>true</code> will set vertical flip mode. <code>false</code> will set normal vertical orientation.
----------------	---

Calling this function with a value of `true` will cause the Y coordinate to start at the bottom edge of the display instead of the top, effectively flipping the display vertically.

Once in vertical flip mode, it will remain this way until normal vertical mode is set by calling this function with a value of `false`.

#### See also

[flipHorizontal\(\)](#)

Definition at line 381 of file `Arduboy2Core.cpp`.

6.4.2.12 `uint8_t Arduboy2Core::height ( ) [static]`

Get the height of the display in pixels.

#### Returns

The height of the display in pixels.

#### Note

In most cases, the defined value `HEIGHT` would be better to use instead of this function.

Definition at line 296 of file `Arduboy2Core.cpp`.



#### 6.4.2.13 void Arduboy2Core::idle ( ) [static]

Idle the CPU to save power.

This puts the CPU in *idle* sleep mode. You should call this as often as you can for the best power savings. The timer 0 overflow interrupt will wake up the chip every 1ms, so even at 60 FPS a well written app should be able to sleep maybe half the time in between rendering it's own frames.

Definition at line 262 of file Arduboy2Core.cpp.

#### 6.4.2.14 void Arduboy2Core::invert ( bool *inverse* ) [static]

Invert the entire display or set it back to normal.

##### Parameters

<i>inverse</i>	<code>true</code> will invert the display. <code>false</code> will set the display to no-inverted.
----------------	--

Calling this function with a value of `true` will set the display to inverted mode. A pixel with a value of 0 will be on and a pixel set to 1 will be off.

Once in inverted mode, the display will remain this way until it is set back to non-inverted mode by calling this function with `false`.

Definition at line 368 of file Arduboy2Core.cpp.

#### 6.4.2.15 void Arduboy2Core::LCDCommandMode ( ) [static]

Put the display into command mode.

When placed in command mode, data that is sent to the display will be treated as commands.

See the SSD1306 controller and OLED display documents for available commands and command sequences.

Links:

- <https://www.adafruit.com/datasheets/SSD1306.pdf>
- [http://www.buydisplay.com/download/manual/ER-OLED013-1\\_Series\\_Datasheet.pdf](http://www.buydisplay.com/download/manual/ER-OLED013-1_Series_Datasheet.pdf)

##### Note

This is a low level function that is not intended for general use in a sketch. It has been made public and documented for use by derived classes.

##### See also

[LCDDataMode\(\)](#) [sendLCDCommand\(\)](#) [SPItransfer\(\)](#)

Definition at line 218 of file Arduboy2Core.cpp.

#### 6.4.2.16 void Arduboy2Core::LCDDDataMode ( ) [static]

Put the display into data mode.

When placed in data mode, data that is sent to the display will be considered as data to be displayed.

##### Note

This is a low level function that is not intended for general use in a sketch. It has been made public and documented for use by derived classes.

##### See also

[LCDCommandMode\(\) SPItransfer\(\)](#)

Definition at line 213 of file Arduboy2Core.cpp.

#### 6.4.2.17 void Arduboy2Core::paint8Pixels ( uint8\_t *pixels* ) [static]

Paint 8 pixels vertically to the display.

##### Parameters

<i>pixels</i>	A byte whose bits specify a vertical column of 8 pixels.
---------------	--

A byte representing a vertical column of 8 pixels is written to the display at the current page and column address. The address is then incremented. The page/column address will wrap to the start of the display (the top left) when it increments past the end (lower right).

The least significant bit represents the top pixel in the column. A bit set to 1 is lit, 0 is unlit.

Example:

X = lit pixels, . = unlit pixels

```

blank()                                paint8Pixels() 0xFF, 0, 0xF0, 0, 0x0F
v TOP LEFT corner (8x9)                v TOP LEFT corner
. . . . . (page 1)                      X . . . X . . . (page 1)
. . . . .                                X . . . X . . .
. . . . .                                X . . . X . . .
. . . . .                                X . . . X . . .
. . . . .                                X . X . . . .
. . . . .                                X . X . . . .
. . . . .                                X . X . . . .
. . . . .                                X . X . . . .
. . . . . (end of page 1)                X . X . . . . (end of page 1)
. . . . . (page 2)                      . . . . . (page 2)

```

Definition at line 301 of file Arduboy2Core.cpp.

#### 6.4.2.18 void Arduboy2Core::paintScreen ( const uint8\_t\* *image* ) [static]

Paints an entire image directly to the display from program memory.

## Parameters

<i>image</i>	A byte array in program memory representing the entire contents of the display.
--------------	---

The contents of the specified array in program memory is written to the display. Each byte in the array represents a vertical column of 8 pixels with the least significant bit at the top. The bytes are written starting at the top left, progressing horizontally and wrapping at the end of each row, to the bottom right. The size of the array must exactly match the number of pixels in the entire display.

## See also

[paint8Pixels\(\)](#)

Definition at line 306 of file Arduboy2Core.cpp.

#### 6.4.2.19 void Arduboy2Core::paintScreen ( uint8\_t image[], bool clear = false ) [static]

Paints an entire image directly to the display from an array in RAM.

## Parameters

<i>image</i>	A byte array in RAM representing the entire contents of the display.
<i>clear</i>	If <code>true</code> the array in RAM will be cleared to zeros upon return from this function. If <code>false</code> the RAM buffer will remain unchanged. (optional; defaults to <code>false</code> )

The contents of the specified array in RAM is written to the display. Each byte in the array represents a vertical column of 8 pixels with the least significant bit at the top. The bytes are written starting at the top left, progressing horizontally and wrapping at the end of each row, to the bottom right. The size of the array must exactly match the number of pixels in the entire display.

If parameter `clear` is set to `true` the RAM array will be cleared to zeros after its contents are written to the display.

## See also

[paint8Pixels\(\)](#)

Definition at line 316 of file Arduboy2Core.cpp.

#### 6.4.2.20 void Arduboy2Core::safeMode ( ) [static]

Allow upload when the bootloader "magic number" could be corrupted.

If the UP button is held when this function is entered, the RGB LED will be lit and timer 0 will be disabled, then the sketch will remain in a tight loop. This is to address a problem with uploading a new sketch, for sketches that interfere with the bootloader "magic number". The problem occurs with certain sketches that use large amounts of RAM.

This function should be called after [boot\(\)](#) in sketches that potentially could cause the problem.

It is intended to replace the `flashlight()` function when more program space is required. If possible, it is more desirable to use `flashlight()`, so that the actual flashlight feature isn't lost.

See also

[Arduboy2Base::flashlight\(\) boot\(\)](#)

Definition at line 245 of file Arduboy2Core.cpp.

#### 6.4.2.21 void Arduboy2Core::sendLCDCommand ( uint8\_t *command* ) [static]

Send a single command byte to the display.

##### Parameters

<i>command</i>	The command byte to send to the display.
----------------	--

The display will be set to command mode then the specified command byte will be sent. The display will then be set to data mode. Multi-byte commands can be sent by calling this function multiple times.

##### Note

Sending improper commands to the display can place it into invalid or unexpected states, possibly even causing physical damage.

Definition at line 359 of file Arduboy2Core.cpp.

#### 6.4.2.22 void Arduboy2Core::setRGBled ( uint8\_t *red*, uint8\_t *green*, uint8\_t *blue* ) [static]

Set the light output of the RGB LED.

##### Parameters

<i>red, green, blue</i>	The brightness value for each LED.
-------------------------	------------------------------------

The RGB LED is actually individual red, green and blue LEDs placed very close together in a single package. By setting the brightness of each LED, the RGB LED can show various colors and intensities. The brightness of each LED can be set to a value from 0 (fully off) to 255 (fully on).

##### Note

Certain libraries that take control of the hardware timers may interfere with the ability of this function to properly control the RGB LED. *ArduboyPlaytune* is one such library known to do this. The [digitalWriteRGB\(\)](#) function will still work properly in this case.

##### Note

Many of the Kickstarter Arduboy2s were accidentally shipped with the RGB LED installed incorrectly. For these units, the green LED cannot be lit. As long as the green led is set to off, setting the red LED will actually control the blue LED and setting the blue LED will actually control the red LED. If the green LED is turned fully on, none of the LEDs will light.

See also

[digitalWriteRGB\(\)](#)

Definition at line 394 of file Arduboy2Core.cpp.

#### 6.4.2.23 void Arduboy2Core::SPITransfer ( uint8\_t *data* ) [static]

Transfer a byte to the display.

##### Parameters

<i>data</i>	The byte to be sent to the display.
-------------	-------------------------------------

Transfer one byte to the display over the SPI port and wait for the transfer to complete. The byte will either be interpreted as a command or as data to be placed on the screen, depending on the command/data mode.

See also

[LCDDataMode\(\)](#) [LCDCommandMode\(\)](#) [sendLCDCommand\(\)](#)

Definition at line 232 of file Arduboy2Core.cpp.

#### 6.4.2.24 uint8\_t Arduboy2Core::width ( ) [static]

Get the width of the display in pixels.

##### Returns

The width of the display in pixels.

##### Note

In most cases, the defined value `WIDTH` would be better to use instead of this function.

Definition at line 294 of file Arduboy2Core.cpp.

The documentation for this class was generated from the following files:

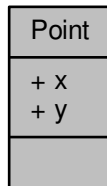
- [src/Arduboy2Core.h](#)
- [src/Arduboy2Core.cpp](#)

## 6.5 Point Struct Reference

An object to define a single point for collision functions.

```
#include <Arduboy2.h>
```

Collaboration diagram for Point:



### Public Attributes

- `int16_t x`
- `int16_t y`

### 6.5.1 Detailed Description

An object to define a single point for collision functions.

The location of the point is given by X and Y coordinates.

See also

[Arduboy2Base::collide\(Point, Rect\)](#)

Definition at line 111 of file Arduboy2.h.

### 6.5.2 Member Data Documentation

#### 6.5.2.1 `int16_t Point::x`

The X coordinate of the point

Definition at line 113 of file Arduboy2.h.

## 6.5.2.2 int16\_t Point::y

The Y coordinate of the point

Definition at line 114 of file Arduboy2.h.

The documentation for this struct was generated from the following file:

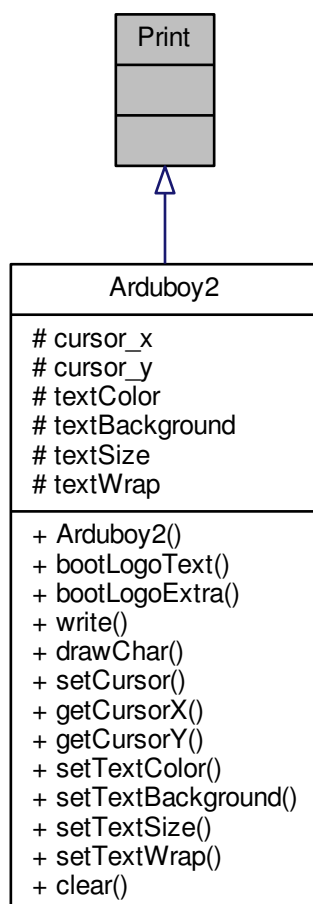
- [src/Arduboy2.h](#)

## 6.6 Print Class Reference

The Arduino `Print` class is available for writing text to the screen buffer.

```
#include <Arduboy2.h>
```

Inheritance diagram for `Print`:



Collaboration diagram for Print:



### 6.6.1 Detailed Description

The Arduino `Print` class is available for writing text to the screen buffer.

For an `Arduboy2` class object, functions provided by the Arduino `Print` class can be used to write text to the screen buffer, in the same manner as the Arduino `Serial.print()`, etc., functions.

`Print` will use the `write()` function to actually draw each character in the screen buffer.

See: <https://www.arduino.cc/en/Serial/Print>

Example:

```
int value = 42;

arduboy.println("Hello World"); // Prints "Hello World" and then moves the
                                // text cursor to the start of the next line
arduboy.print(value);           // Prints "42"
arduboy.print('\n');           // Moves the text cursor to the start of the next line
arduboy.print(78, HEX)         // Prints "4E" (78 in hexadecimal)
```

See also

[Arduboy2::write\(\)](#)

The documentation for this class was generated from the following file:

- [src/Arduboy2.h](#)

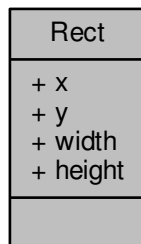


## 6.7 Rect Struct Reference

A rectangle object for collision functions.

```
#include <Arduboy2.h>
```

Collaboration diagram for Rect:



### Public Attributes

- `int16_t x`
- `int16_t y`
- `uint8_t width`
- `uint8_t height`

### 6.7.1 Detailed Description

A rectangle object for collision functions.

The X and Y coordinates specify the top left corner of a rectangle with the given width and height.

See also

[Arduboy2Base::collide\(Point, Rect\)](#) [Arduboy2Base::collide\(Rect, Rect\)](#)

Definition at line 95 of file `Arduboy2.h`.

### 6.7.2 Member Data Documentation

#### 6.7.2.1 `uint8_t Rect::height`

The height of the rectangle

Definition at line 100 of file `Arduboy2.h`.

#### 6.7.2.2 `uint8_t Rect::width`

The width of the rectangle

Definition at line 99 of file Arduboy2.h.

#### 6.7.2.3 `int16_t Rect::x`

The X coordinate of the top left corner

Definition at line 97 of file Arduboy2.h.

#### 6.7.2.4 `int16_t Rect::y`

The Y coordinate of the top left corner

Definition at line 98 of file Arduboy2.h.

The documentation for this struct was generated from the following file:

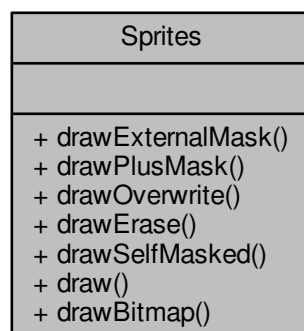
- [src/Arduboy2.h](#)

## 6.8 Sprites Class Reference

A class for drawing animated sprites from image and mask bitmaps.

```
#include <Sprites.h>
```

Collaboration diagram for Sprites:



## Static Public Member Functions

- static void `drawExternalMask` (int16\_t x, int16\_t y, const uint8\_t \*bitmap, const uint8\_t \*mask, uint8\_t frame, uint8\_t mask\_frame)  
*Draw a sprite using a separate image and mask array.*
- static void `drawPlusMask` (int16\_t x, int16\_t y, const uint8\_t \*bitmap, uint8\_t frame)  
*Draw a sprite using an array containing both image and mask values.*
- static void `drawOverwrite` (int16\_t x, int16\_t y, const uint8\_t \*bitmap, uint8\_t frame)  
*Draw a sprite by replacing the existing content completely.*
- static void `drawErase` (int16\_t x, int16\_t y, const uint8\_t \*bitmap, uint8\_t frame)  
*"Erase" a sprite.*
- static void `drawSelfMasked` (int16\_t x, int16\_t y, const uint8\_t \*bitmap, uint8\_t frame)  
*Draw a sprite using only the bits set to 1.*

### 6.8.1 Detailed Description

A class for drawing animated sprites from image and mask bitmaps.

The functions in this class will draw to the screen buffer an image contained in an array located in program memory. A mask can also be specified or implied, which dictates how existing pixels in the buffer, within the image boundaries, will be affected.

A sprite or mask array contains one or more "frames". Each frame is intended to show whatever the sprite represents in a different position, such as the various poses for a running or jumping character. By specifying a different frame each time the sprite is drawn, it can be animated.

Each image array begins with values for the width and height of the sprite, in pixels. The width can be any value. The height must be a multiple of 8 pixels, but with proper masking, a sprite of any height can be created.

For a separate mask array, as is used with `drawExternalMask()`, the width and height are not included but must contain data of the same dimensions as the corresponding image array.

Following the width and height values for an image array, or the from the beginning of a separate mask array, the array contains the image and/or mask data for each frame. Each byte represents a vertical column of 8 pixels with the least significant bit (bit 0) at the top. The bytes are drawn as 8 pixel high rows from left to right, top to bottom. When the end of a row is reached, as specified by the width value, the next byte in the array will be the start of the next row.

Data for each frame after the first one immediately follows the previous frame. Frame numbers start at 0.

Definition at line 53 of file Sprites.h.

### 6.8.2 Member Function Documentation

**6.8.2.1** void Sprites::drawErase ( int16\_t x, int16\_t y, const uint8\_t \* *bitmap*, uint8\_t *frame* ) [static]

"Erase" a sprite.

#### Parameters

<i>x,y</i>	The coordinates of the top left pixel location.
<i>bitmap</i>	A pointer to the array containing the image frames.
<i>frame</i>	The frame number of the image to erase.

The data from the specified frame in the array is used to erase a sprite. To "erase" a sprite, bits set to 1 in the frame will set the corresponding pixel in the buffer to 0. Frame bits set to 0 will remain unchanged in the buffer.

```
image  before  after
```

```
.....  .....  .....
..0..   .....  .....
00.00   .....  .....
..0..   .....  .....
.....  .....  .....
```

```
image  before  after
```

```
.....  00000  00000
..0..   00000  00.00
00.00   00000  ..0..
..0..   00000  00.00
.....  00000  00000
```

Definition at line 20 of file Sprites.cpp.

**6.8.2.2** `void Sprites::drawExternalMask ( int16_t x, int16_t y, const uint8_t * bitmap, const uint8_t * mask, uint8_t frame, uint8_t mask_frame ) [static]`

Draw a sprite using a separate image and mask array.

#### Parameters

<i>x,y</i>	The coordinates of the top left pixel location.
<i>bitmap</i>	A pointer to the array containing the image frames.
<i>mask</i>	A pointer to the array containing the mask frames.
<i>frame</i>	The frame number of the image to draw.
<i>mask_frame</i>	The frame number for the mask to use (can be different from the image frame number).

An array containing the image frames, and another array containing corresponding mask frames, are used to draw a sprite.

Bits set to 1 in the mask indicate that the pixel will be set to the value of the corresponding image bit. Bits set to 0 in the mask will be left unchanged.

```
image  mask  before  after
```

```
.....  .000.  .....  .....
..0..   00000  .....  ..0..
00.00   00.00  .....  00.00
..0..   00000  .....  ..0..
.....  .000.  .....  .....
```

```
image  mask  before  after
```

```
.....  .000.  00000  0...0
..0..   00000  00000  ..0..
00.00   00000  00000  00.00
..0..   00000  00000  ..0..
.....  .000.  00000  0...0
```

Definition at line 9 of file Sprites.cpp.

6.8.2.3 void Sprites::drawOverwrite ( int16\_t x, int16\_t y, const uint8\_t\* *bitmap*, uint8\_t *frame* ) [static]

Draw a sprite by replacing the existing content completely.

## Parameters

<i>x,y</i>	The coordinates of the top left pixel location.
<i>bitmap</i>	A pointer to the array containing the image frames.
<i>frame</i>	The frame number of the image to draw.

A sprite is drawn by overwriting the pixels in the buffer with the data from the specified frame in the array. No masking is done. A bit set to 1 in the frame will set the pixel to 1 in the buffer, and a 0 in the array will set a 0 in the buffer.

```
image  before  after
```

```
.....  .....  .....
..0..   .....  ..0..
00.00   .....  00.00
..0..   .....  ..0..
.....  .....  .....
```

```
image  before  after
```

```
.....  00000   .....
..0..   00000   ..0..
00.00   00000   00.00
..0..   00000   ..0..
.....  00000   .....
```

Definition at line 15 of file Sprites.cpp.

**6.8.2.4** `void Sprites::drawPlusMask ( int16_t x, int16_t y, const uint8_t* bitmap, uint8_t frame )` `[static]`

Draw a sprite using an array containing both image and mask values.

## Parameters

<i>x,y</i>	The coordinates of the top left pixel location.
<i>bitmap</i>	A pointer to the array containing the image/mask frames.
<i>frame</i>	The frame number of the image to draw.

An array containing combined image and mask data is used to draw a sprite. Bytes are given in pairs with the first byte representing the image pixels and the second byte specifying the corresponding mask. The width given in the array still specifies the image width, so each row of image and mask bytes will be twice the width value.

Bits set to 1 in the mask indicate that the pixel will be set to the value of the corresponding image bit. Bits set to 0 in the mask will be left unchanged.

```
image  mask   before  after
```

```
.....  .000.   .....  .....
..0..   00000   .....  ..0..
00.00   00.00   .....  00.00
..0..   00000   .....  ..0..
.....  .000.   .....  .....
```

```
image  mask   before  after
```

```
.....  .000.  00000   0...0
..0..   00000  00000   ..0..
00.00   00000  00000   00.00
..0..   00000  00000   ..0..
.....  .000.  00000   0...0
```

Definition at line 30 of file Sprites.cpp.

**6.8.2.5** `void Sprites::drawSelfMasked ( int16_t x, int16_t y, const uint8_t* bitmap, uint8_t frame )` `[static]`

Draw a sprite using only the bits set to 1.

#### Parameters

<i>x,y</i>	The coordinates of the top left pixel location.
<i>bitmap</i>	A pointer to the array containing the image frames.
<i>frame</i>	The frame number of the image to draw.

Bits set to 1 in the frame will be used to draw the sprite by setting the corresponding pixel in the buffer to 1. Bits set to 0 in the frame will remain unchanged in the buffer.

```
image  before  after
```

```
.....  .....  .....
..0..   .....  ..0..
00.00   .....  00.00
..0..   .....  ..0..
.....  .....  .....
```

```
image  before  after
```

```
.....  00000  00000  (no change because all pixels were
..0..   00000  00000  already white)
00.00   00000  00000
..0..   00000  00000
.....  00000  00000
```

Definition at line 25 of file Sprites.cpp.

The documentation for this class was generated from the following files:

- [src/Sprites.h](#)
- [src/Sprites.cpp](#)





## Chapter 7

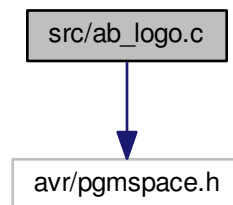
# File Documentation

### 7.1 src/ab\_logo.c File Reference

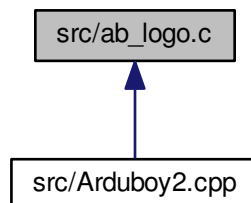
The ARDUBOY logo bitmap.

```
#include <avr/pgmspace.h>
```

Include dependency graph for ab\_logo.c:



This graph shows which files directly or indirectly include this file:



### 7.1.1 Detailed Description

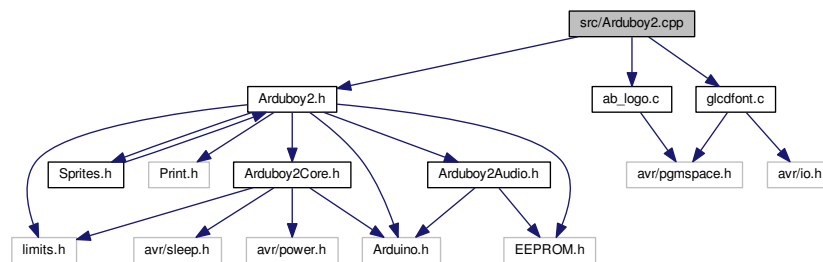
The ARDUBOY logo bitmap.

## 7.2 src/Arduboy2.cpp File Reference

The [Arduboy2Base](#) and [Arduboy2](#) classes and support objects and definitions.

```
#include "Arduboy2.h"
#include "ab_logo.c"
#include "glcdfont.c"
```

Include dependency graph for Arduboy2.cpp:



### 7.2.1 Detailed Description

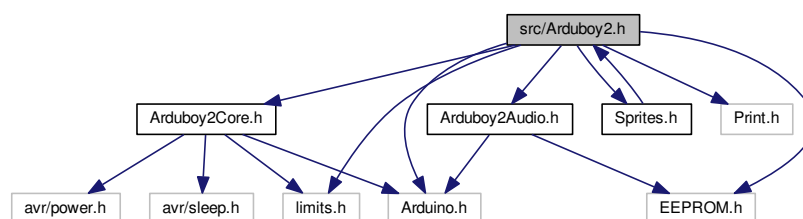
The [Arduboy2Base](#) and [Arduboy2](#) classes and support objects and definitions.

## 7.3 src/Arduboy2.h File Reference

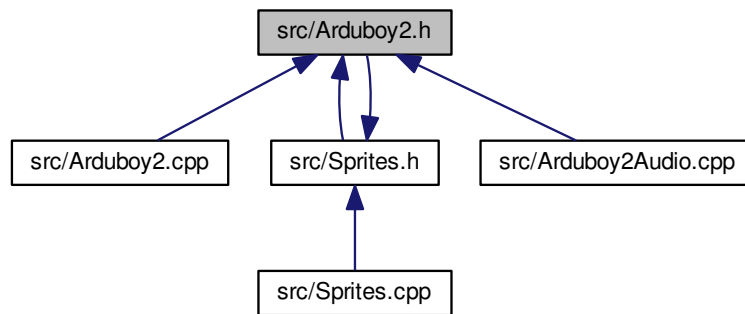
The [Arduboy2Base](#) and [Arduboy2](#) classes and support objects and definitions.

```
#include <Arduino.h>
#include <EEPROM.h>
#include "Arduboy2Core.h"
#include "Sprites.h"
#include <Print.h>
#include <limits.h>
#include "Arduboy2Audio.h"
```

Include dependency graph for Arduboy2.h:



This graph shows which files directly or indirectly include this file:



## Classes

- struct [Rect](#)  
*A rectangle object for collision functions.*
- struct [Point](#)  
*An object to define a single point for collision functions.*
- class [Arduboy2Base](#)  
*The main functions provided for writing sketches for the Arduboy, minus text output.*
- class [Arduboy2](#)  
*The main functions provided for writing sketches for the Arduboy, including text output.*

## Macros

- #define [ARDUBOY\\_LIB\\_VER](#) 40002  
*Library version.*
- #define [ARDUBOY\\_UNIT\\_NAME\\_LEN](#) 6
- #define [EEPROM\\_STORAGE\\_SPACE\\_START](#) 16  
*Start of EEPROM storage space for sketches.*
- #define [BLACK](#) 0
- #define [WHITE](#) 1
- #define [INVERT](#) 2  
*Color value to indicate pixels are to be inverted.*
- #define [CLEAR\\_BUFFER](#) true

### 7.3.1 Detailed Description

The [Arduboy2Base](#) and [Arduboy2](#) classes and support objects and definitions.

## 7.3.2 Macro Definition Documentation

### 7.3.2.1 `#define ARDUBOY_LIB_VER 40002`

Library version.

For a version number in the form of x.y.z the value of the define will be  $((x * 10000) + (y * 100) + (z))$  as a decimal number. So, it will read as xxxyyyzz, with no leading zeros on x.

A user program can test this value to conditionally compile based on the library version. For example:

```
1 // If the library is version 2.1.0 or higher
2 #if ARDUBOY_LIB_VER >= 20100
3   // ... code that make use of a new feature added to V2.1.0
4 #endif
```

Definition at line 35 of file Arduboy2.h.

### 7.3.2.2 `#define ARDUBOY_UNIT_NAME_LEN 6`

The maximum length of the unit name string.

Definition at line 38 of file Arduboy2.h.

### 7.3.2.3 `#define BLACK 0`

Color value for an unlit pixel for draw functions.

Definition at line 70 of file Arduboy2.h.

### 7.3.2.4 `#define CLEAR_BUFFER true`

Value to be passed to `display()` to clear the screen buffer.

Definition at line 83 of file Arduboy2.h.

### 7.3.2.5 `#define EEPROM_STORAGE_SPACE_START 16`

Start of EEPROM storage space for sketches.

An area at the start of EEPROM is reserved for system use. This define specifies the first EEPROM location past the system area. Sketches can use locations from here to the end of EEPROM space.

Definition at line 60 of file Arduboy2.h.

7.3.2.6 `#define INVERT 2`

Color value to indicate pixels are to be inverted.

BLACK pixels will become WHITE and WHITE will become BLACK.

## Note

Only function `Arduboy2Base::drawBitmap()` currently supports this value.

Definition at line 81 of file `Arduboy2.h`.

7.3.2.7 `#define WHITE 1`

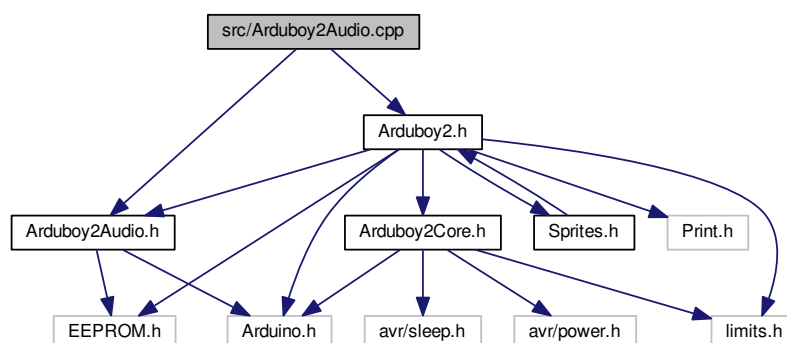
Color value for a lit pixel for draw functions.

Definition at line 71 of file `Arduboy2.h`.

7.4 `src/Arduboy2Audio.cpp` File Reference

The `Arduboy2Audio` class for speaker and sound control.

```
#include "Arduboy2.h"
#include "Arduboy2Audio.h"
Include dependency graph for Arduboy2Audio.cpp:
```



## 7.4.1 Detailed Description

The `Arduboy2Audio` class for speaker and sound control.

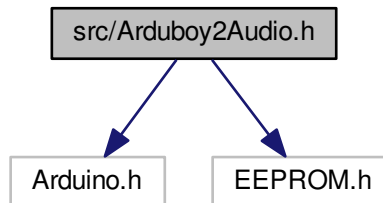
## 7.5 src/Arduboy2Audio.h File Reference

The [Arduboy2Audio](#) class for speaker and sound control.

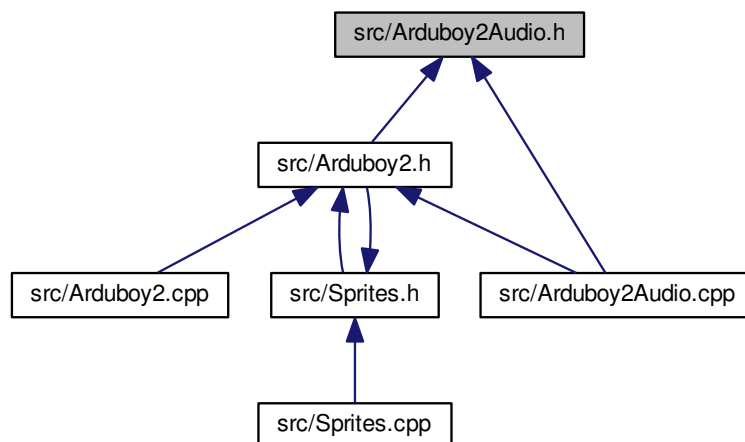
```
#include <Arduino.h>
```

```
#include <EEPROM.h>
```

Include dependency graph for Arduboy2Audio.h:



This graph shows which files directly or indirectly include this file:



### Classes

- class [Arduboy2Audio](#)  
*Provide speaker and sound control.*

#### 7.5.1 Detailed Description

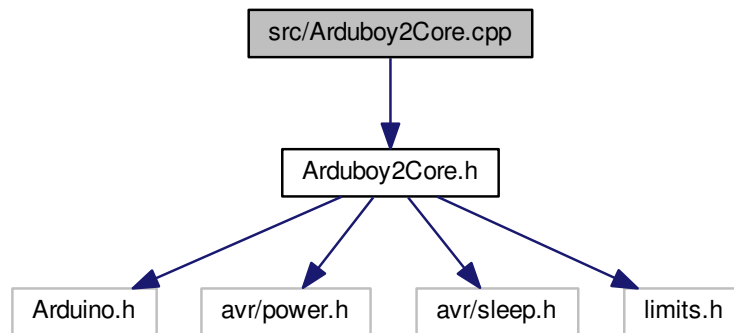
The [Arduboy2Audio](#) class for speaker and sound control.

## 7.6 src/Arduboy2Core.cpp File Reference

The [Arduboy2Core](#) class for Arduboy hardware initialization and control.

```
#include "Arduboy2Core.h"
```

Include dependency graph for Arduboy2Core.cpp:



### 7.6.1 Detailed Description

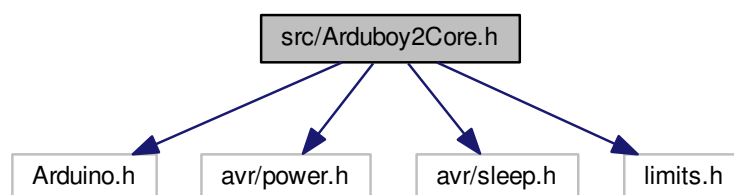
The [Arduboy2Core](#) class for Arduboy hardware initialization and control.

## 7.7 src/Arduboy2Core.h File Reference

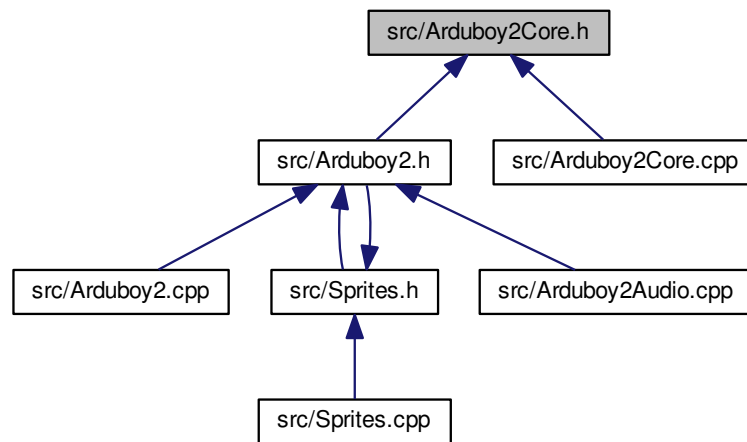
The [Arduboy2Core](#) class for Arduboy hardware initialization and control.

```
#include <Arduino.h>
#include <avr/power.h>
#include <avr/sleep.h>
#include <limits.h>
```

Include dependency graph for Arduboy2Core.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [Arduboy2Core](#)

*Lower level functions generally dealing directly with the hardware.*

## Macros

- `#define RGB_ON LOW`
- `#define RGB_OFF HIGH`
- `#define RED_LED 10`
- `#define GREEN_LED 11`
- `#define BLUE_LED 9`
- `#define LEFT_BUTTON_BV(5)`
- `#define RIGHT_BUTTON_BV(6)`
- `#define UP_BUTTON_BV(7)`
- `#define DOWN_BUTTON_BV(4)`
- `#define A_BUTTON_BV(3)`
- `#define B_BUTTON_BV(2)`
- `#define PIN_SPEAKER_1 5`
- `#define PIN_SPEAKER_2 13`
- `#define WIDTH 128`
- `#define HEIGHT 64`

### 7.7.1 Detailed Description

The [Arduboy2Core](#) class for Arduboy hardware initialization and control.



## 7.7.2 Macro Definition Documentation

### 7.7.2.1 `#define A_BUTTON_BV(3)`

The A button value for functions requiring a bitmask

Definition at line 78 of file Arduboy2Core.h.

### 7.7.2.2 `#define B_BUTTON_BV(2)`

The B button value for functions requiring a bitmask

Definition at line 79 of file Arduboy2Core.h.

### 7.7.2.3 `#define BLUE_LED 9`

The pin number for the blue color in the RGB LED.

Definition at line 61 of file Arduboy2Core.h.

### 7.7.2.4 `#define DOWN_BUTTON_BV(4)`

The Down button value for functions requiring a bitmask

Definition at line 77 of file Arduboy2Core.h.

### 7.7.2.5 `#define GREEN_LED 11`

The pin number for the green color in the RGB LED.

Definition at line 60 of file Arduboy2Core.h.

### 7.7.2.6 `#define HEIGHT 64`

The height of the display in pixels

Definition at line 221 of file Arduboy2Core.h.

### 7.7.2.7 `#define LEFT_BUTTON_BV(5)`

The Left button value for functions requiring a bitmask

Definition at line 74 of file Arduboy2Core.h.

#### 7.7.2.8 `#define PIN_SPEAKER_1 5`

The pin number of the first lead of the speaker

Definition at line 105 of file Arduboy2Core.h.

#### 7.7.2.9 `#define PIN_SPEAKER_2 13`

The pin number of the second lead of the speaker

Definition at line 106 of file Arduboy2Core.h.

#### 7.7.2.10 `#define RED_LED 10`

The pin number for the red color in the RGB LED.

Definition at line 59 of file Arduboy2Core.h.

#### 7.7.2.11 `#define RGB_OFF HIGH`

For digitally setting an RGB LED off using `digitalWriteRGB()`

Definition at line 36 of file Arduboy2Core.h.

#### 7.7.2.12 `#define RGB_ON LOW`

For digitally setting an RGB LED on using `digitalWriteRGB()`

Definition at line 35 of file Arduboy2Core.h.

#### 7.7.2.13 `#define RIGHT_BUTTON_BV(6)`

The Right button value for functions requiring a bitmask

Definition at line 75 of file Arduboy2Core.h.

#### 7.7.2.14 `#define UP_BUTTON_BV(7)`

The Up button value for functions requiring a bitmask

Definition at line 76 of file Arduboy2Core.h.

#### 7.7.2.15 `#define WIDTH 128`

The width of the display in pixels

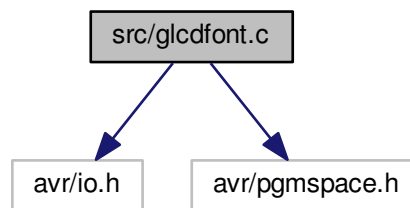
Definition at line 220 of file Arduboy2Core.h.

## 7.8 src/glcdfont.c File Reference

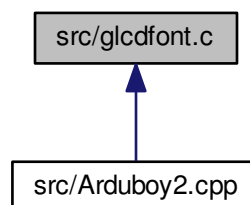
The font definitions used to display text characters.

```
#include <avr/io.h>
#include <avr/pgmspace.h>
```

Include dependency graph for glcdfont.c:



This graph shows which files directly or indirectly include this file:



### 7.8.1 Detailed Description

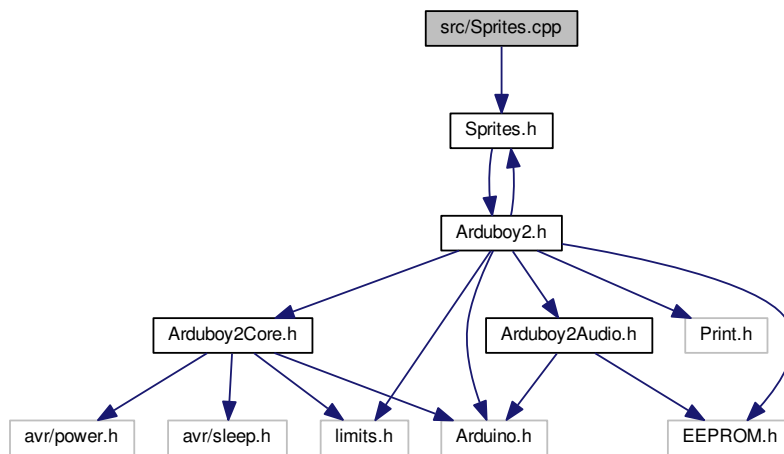
The font definitions used to display text characters.

## 7.9 src/Sprites.cpp File Reference

A class for drawing animated sprites from image and mask bitmaps.

```
#include "Sprites.h"
```

Include dependency graph for Sprites.cpp:



### 7.9.1 Detailed Description

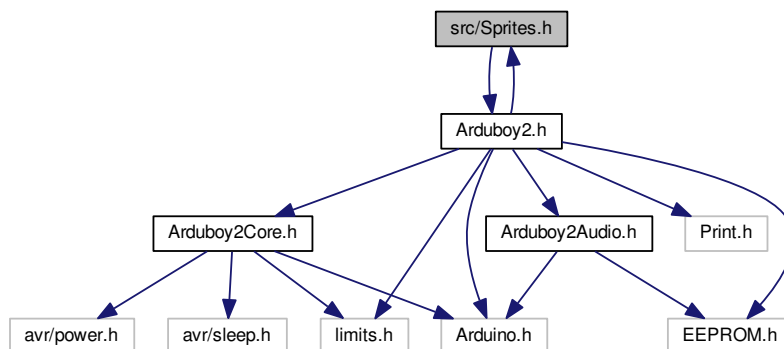
A class for drawing animated sprites from image and mask bitmaps.

## 7.10 src/Sprites.h File Reference

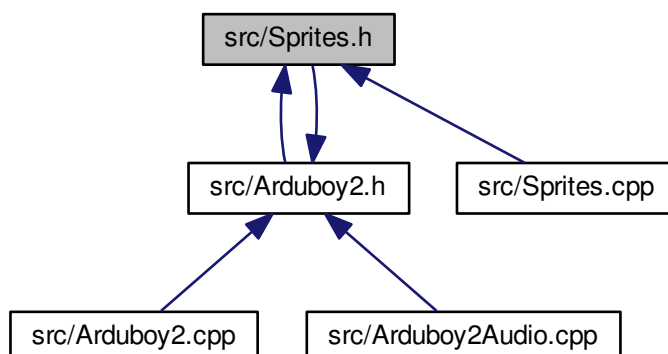
A class for drawing animated sprites from image and mask bitmaps.

```
#include "Arduboy2.h"
```

Include dependency graph for Sprites.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [Sprites](#)

*A class for drawing animated sprites from image and mask bitmaps.*

### 7.10.1 Detailed Description

A class for drawing animated sprites from image and mask bitmaps.



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