Hello, and welcome to this presentation of the STM32 Chrom-ART Accelerator™. It covers the features of this adaptive real-time accelerator block, which is widely used for graphic computing in the microcontroller.
The Chrom-ART accelerator offers true hardware acceleration for graphical operations.
The Chrom-ART accelerator is built around a 2D DMA engine for fast data copy with specific functions to support pixel format conversion as well as blending operations between two planes. It also provides specific modes for managing anti-aliased fonts.
The Chrom-ART accelerator will offload the CPU for most of the graphical operations with a one pixel per cycle throughput, integrated pixel format conversion and blending.
The Chrom-ART accelerator is fully integrated in graphical stacks making its software integration transparent to the user.
The Chrom-ART accelerator has four operating modes.
- Register-to-memory for rectangle filling operations,
- Memory-to-memory for 2D memory copy operations,
- Memory-to-memory with pixel format conversion for bitmap drawing with format conversion,
- Memory-to-memory with pixel format conversion and blending for bitmap or text drawing with transparency.

The user can program independently all the parameters for the source and the destination:
- The address of the layer including its size and position
- The color format
- The way transparency is managed.
Register-to-memory mode is used to fill a part or whole destination image with a specific color. The color value is set in a register of the output PFC.
Memory-to-memory mode is used to copy a part or whole source image into a part or whole destination image without changing the color format.
Memory-to-memory mode with pixel format conversion is used to do the same type of copy as Memory-to-memory mode but with a pixel format conversion. It can copy an RGB565 image into an RGB888 image without having to use the CPU.
Memory-to-memory mode with pixel format conversion and blending is used to blend a part or whole source image with a part or whole destination image with a different pixel format. This is widely used to draw bitmap icons having transparency or fonts.
For each foreground and background layer, the format can be programmed independently. Direct mode fetches the RGB or ARGB content directly from the memory. Indirect mode uses an intermediate color look-up table to determine the color to be used during the copy or blending operation. All the input color modes are transformed internally into ARGB8888 format to perform the blending operation.
Specific modes can be used to efficiently manage texts and fonts. Only the transparency value is stored in memory for rendering anti-aliased fonts. The color is added during the pixel format conversion process and can be programmed by the user. These modes are very efficient for storing high-quality bitmap fonts.
The output pixel format converter generates the color for the destination independently from the source. There is no indirect mode in output as this would imply to calculate a color look-up table (CLUT). Nevertheless, memory-to-memory operations without Pixel Format Conversion (PFC) can copy data independently of their formats.
The fully hardware blender allows to blend a foreground image and a background image with transparency. This can be used to draw bitmap images of any shape with a perfect rendering. 1 pixel is generated per cycle making this complex operation much more efficient than if it was done by the CPU. The resulting pixel can be coded independently from the source thanks to the output pixel format converter.
The output configuration defines the working area for the Chrom-ART operation. The address and the line offset parameters are used to select which sub-area of the output is concerned.
The background and foreground layers have their own configuration for address, line offset and color format. This defines which area of the foreground and background layers are targeted by the Chrom-ART operations.
The Chrom-ART accelerator has 6 interrupt sources to signal:
- Configuration errors
- CLUT transfer complete
- CLUT access error
- Watermark reached during a transfer
- Transfer complete
- Transfer error

No DMA trigger is used as the Chrom-ART accelerator embeds its own DMA.
The Chrom-ART accelerator is active in Run and Sleep modes. A Chrom-ART interrupt can cause the device to exit Sleep mode. In Stop mode, the Chrom-ART accelerator is frozen and its registers content is kept. In Standby mode, the Chrom-ART accelerator is powered-down and it must be reinitialized afterwards.
The Chrom-ART accelerator is widely used in any graphical application to compute the frame buffer without any CPU load and with a very efficient throughput. It can compose the whole scene with transparency and facilitate the management of animations. Text rendering is also accelerated, making it easy and efficient to manage anti-aliased fonts.
You can refer to the trainings related to the RCC and interrupts for additional information.

• Refer to these trainings related to this peripheral:
  • RCC (Chrom-ART clock control, Chrom-ART enable/reset)
  • Interrupts (Chrom-ART interrupt mapping)