

File Name : ag1818 gamma trimster.doc

Date Last Modified : 8/27/2003 5:06:00 PM

Message

From: Rick Orlando [rorlando@alta-analog.com]
Sent: 8/27/2003 5:28:37 PM
To: Trevor Blyth [tblyth@att.net]
Subject: spec
Attachments: ag1818 gamma trimster.doc

Trevor,
Please review and comment.

Best Regards,
Rick O.



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Alta Analog, Inc.  
Adaptive Analog Solutions  
www.alta-analog.com

Rick Orlando  
(408)-353-5809  
(408)-499-8455(Cell)  
Rorlando@alta-analog.com

## Gamma TRIMSTER AG1818

### FEATURES

- Programmable Gamma Reference with Integrated Buffer
  - 18 Output Channels
  - Better than 0.1% accuracy
  - Output Range of 0 V to 13.5 Volts
  - 10 mAmp drive
  - 15 mV Resolution
- 8 Independent Banks of Gamma Values
  - Dynamic Gamma Correction Support
  - Application Gamma Selection
  - Hardware Bank Selection
  - Internal Bank Selection Damping
- Input Tracking Mode
- In System Programmable
  - Allows gamma to be changed once display is assembled
- Single Supply. 3 V or 5 V

### DESCRIPTION

The AG1818 is an programmable gamma reference generator with integrated output buffers to directly drive the source driver inputs.

18 outputs are provided with an with an output range of 0-13.5 volts and a drive capability of 10 mamps .

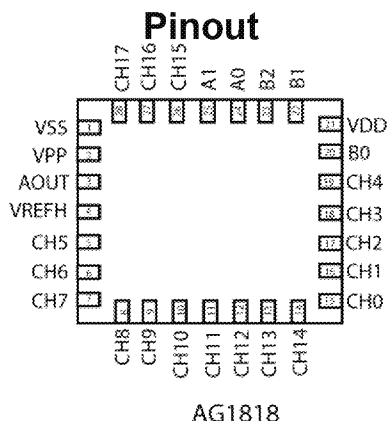
Each output is internally connected to an analog storage cell which can be written with analog values of 1024 step(10 Bit) resolution.

8 Independent banks of gamma voltages can be stored and selected through the address inputs A0-A2. This allows the gamma voltages to be changes for either dynamic gamma correction or application based gamma variation.

### OPERATION

During read mode, all channels continuously output their corresponding stored voltages based on the bank selected by the A0-A2 Address inputs. An internal damping circuit creates a slow transition between banks to prevent disruptive display artifacts caused by rapid transitions on the gamma reference voltages during operation.

An independent programming interface allows the device to be programmed insitu thus providing the ability to individually program or adjust the gamma reference voltages for an individual display. The device can also be programmed prior to mounting on the substrate.



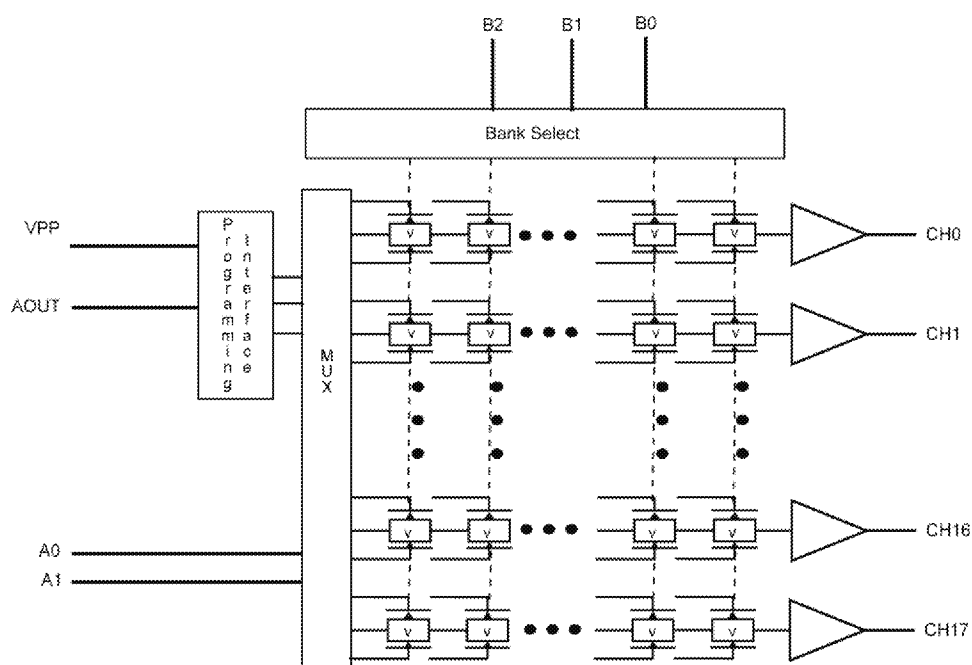
## PIN DESCRIPTIONS

| Name     | Description                 | Value Range  | Function                                                                                                                                   |
|----------|-----------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| VDD      | Digital Supply Input        | 3V to 5.5V   |                                                                                                                                            |
| CH0-CH17 | Analog Outputs              | 0V –VREF-0.1 | Analog Output Voltage Channels                                                                                                             |
| B0-B2    | Bank Select                 | CMOS Inputs  | Selects which output is placed in tracking mode or is written to during a write operation                                                  |
| VREFH    | Output High Level Reference | 5-13.5 Volts | Sets the highest voltage for the output channels.                                                                                          |
| AOUT     | Analog Output               | 0V-VREFH-0.1 | Outputs the current value of the selected channel of the selected bank during programming                                                  |
| VPP      | Programming Voltage         | 10-14Volts   | Provides the programing voltage and timings needed to program the analog memory cells. Also used to enter operating modes other than read. |
| A0-A1    | Address Inputs              | TTL          | Used to Select Programming Modes and Locations to be written                                                                               |
|          |                             |              |                                                                                                                                            |

## ELECTRICAL PARAMETERS

| Symbol      | Parameter                    |                | Min                 | Typ | Max                 | Units         | Condition                  |
|-------------|------------------------------|----------------|---------------------|-----|---------------------|---------------|----------------------------|
| $V_{IL}$    | Input Low Voltage            | A0-A2          |                     |     | $V_{DD} \times 0.3$ | V             |                            |
| $V_{IH}$    | Input High Voltage           | A0-A2          | $V_{DD} \times 0.7$ |     |                     | V             |                            |
| $V_{OLA}$   | Output Low Voltage           | AOUT, CH0-CH17 |                     |     | 0.1                 | V             | $I_{OL} = 10\text{mA}$     |
| $V_{OHA}$   | Output High Voltage          | AOUT, CH0-CH17 | $V_{REFH} - 0.1$    |     |                     | V             | $I_{OH} = -10\text{mA}$    |
| $I_{IL}$    | Input Leakage Current        |                |                     |     | $\pm 1.0$           | $\mu\text{A}$ |                            |
| $I_{DD}$    | $V_{DD}$ Current (Operating) |                |                     |     | 1.5                 | mA            | $R_{EXT} = \infty$         |
| $I_{SB}$    | $V_{DD}$ Current (Standby)   |                |                     |     | 10                  | $\mu\text{A}$ |                            |
| $I_{VREFH}$ | VREF Current                 |                |                     |     | 180                 | mA            |                            |
| VPP         | VPP Range                    |                | 10                  |     | 14                  | V             |                            |
| VAC         | Accuracy                     |                | 15                  |     |                     | mV            |                            |
| Vdrift      | Output Drift                 |                |                     |     | 5                   | MV            | 10 Years at 125 Deg C      |
| PSRR        | Power Supply Rejection Ratio |                | 45                  | 60  |                     | DB            | $V_{DD} = 3.3-5.5\text{V}$ |
| Tdamp       | Bank Switch Damp Time        |                | 1                   |     |                     | sec           |                            |

## BLOCK DIAGRAM(AG1818)



## Theory of Operation

### Read Mode

The AG1818 is designed to produce the gamma reference voltages needed for TFT LCD Applications. Analog nonvolatile memory cells are used to store the desired reference voltage. The output of these cells is internally buffered to allow for the high voltages and current needed to directly drive the reference inputs on the source drivers. The outputs can be programmed from 0.1 volts to 0.1 volts below the VREFH value.

The AG1818 can be programmed using a simple programming interface which allows the devices to be programmed once the device is mounted on the film during final panel test. This insures that the optimum gamma curve is used for each individual display and eliminates the need for re-work due to process variations.

Alternatively, the AG1818 can be programmed in mass prior to mounting. In this case, a programming interface is optional to simplify any re-work that might need to be done.

### Bank Switching

The AG1818 has a capacity to store and retrieve 8 independent banks or groups of reference voltages. This allows products to be configured after assembly based on the application requirements. This feature can also be used to switch between different gamma settings based on the information to be displayed for implementing dynamic gamma correction.

The A0-A2 inputs select which of the 8 banks are to be output. An internal circuit slows the transition time from one bank to another to 1 sec to insure a smooth transition.

#### **Programming Interface**

The AG1818 programming interface consists of four signals. The VPP is a high voltage input used to select the programming mode and also provides the high voltage pulses used to program the individual cells. The AOUT analog output is used to read the cell which is currently being programmed to verify the write operation. The A0 and A1 inputs are used to select the programming mode as well as the locations to be written to in conjunction with the B0-B2 inputs.

Details on the programming pulses and algorithm to be used to program the AG1818 is considered proprietary information and is available under non disclosure. A PC based programming interface will be available for prototyping and gamma optimization.