



### Table of Contents

Items	Content	Page Number
1.	Abstract	3
2.	Introduction	3
3.	Description	3
4.	SETUP REQUIREMENTS	5
5.	Connections	6
6.	Check list before turning ON the board	7
7.	Turn ON Procedure	7
8.	Jumper Settings	8
9.	SCHEMATICS	9
10.	BILL OF MATERIAL	11
11.	Board layout	13
12.	Board images	14
13.	Troubleshoot	14
14	Additional information	15
15	Emulator Software	17
16	Installation instructions	17
17	Getting started	18
18	Software features	19
19	Execution instructions	21
20	LED Tests	24
21	Engineering Tab – features	29
22	Micro controller setup using Arduino	34



### 1. ABSTRACT

This user manual describes the functionality and characteristics of the AL5887 RGB LED driver using demo board which is an I2C/SPI bus controlled, 36 channel, constant current LED driver. This user manual includes hardware and software setup instructions, schematic diagram, bill of materials, printed-circuit board layout drawings and demo board images.

#### 2. INTRODUCTION

This demo board characterizes the features of AL 5887 RGB LED driver. The main goal is to exercise vivid LED effects by communicating through I2C/SPI. This demo board has an additional feature of providing supply to the LEDs using power bank connected through USB Type-C (J350) connector and supply voltage to led driver through micro USB connector(J407).



Figure 2: Image of Demo Board

#### 3. DESCRIPTION

The demo board consists of the following major components:

#### 3.1. AL5887 RGB LED driver

The AL5887 is a 36 channel RGB LED driver with integrated color mixing and brightness control. This driver is comprised of 36 programmable LED current channels each with internal 12-bit PWM for color and brightness control through SPI or I2C digital interface. This is ideal for up to 12 RGB LED modules lighting applications with 3 programmable banks (A B C) for software control of each color. The global output current of all 36 channels can be set up by an



external resistor. Each channel current can digitally be configured up to 70mA under the thermal limitation of the package.

Features of the AL5887 are controlled via programmable SPI/I2C digital interface. Supports 400Khz I2C and 2MHz SPI interface. Using a dedicated INT\_SEL pin, SPI/I2C protocol can be selected. The AL5887 has a 30 kHz, 12-Bit PWM generator for each channel, as well as independent color mixing and brightness control registers for each RGB module to enable vivid LED effects with zero audible noise. Provision for connecting up to 4 devices using two external hardware address pins. Ultra low quiescent current with four modes of operation (shutdown, standby, normal and power save mode).

#### 3.2. FT4222H USB to I2C/SPI Interface

FT4222H is a high speed USB to Quad-SPI/I 2C interface Device Controller. This requires an external Crystal (12 MHz) for the internal PLL to operate. This contains SPI/ I 2C configurable interfaces. The SPI interface can be configured in master mode with single, dual, or quad bits' data with transfer or in slave mode with single bit data width transfer. The I 2C interface can be configured in master or slave mode.

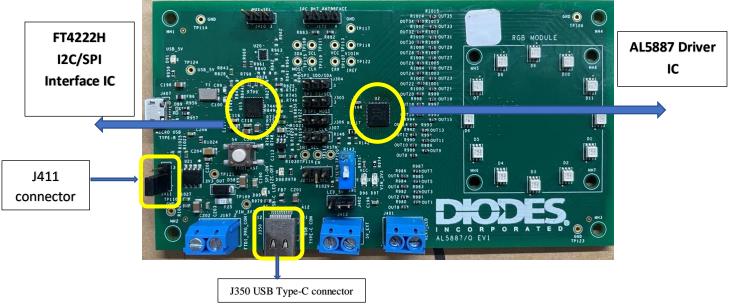


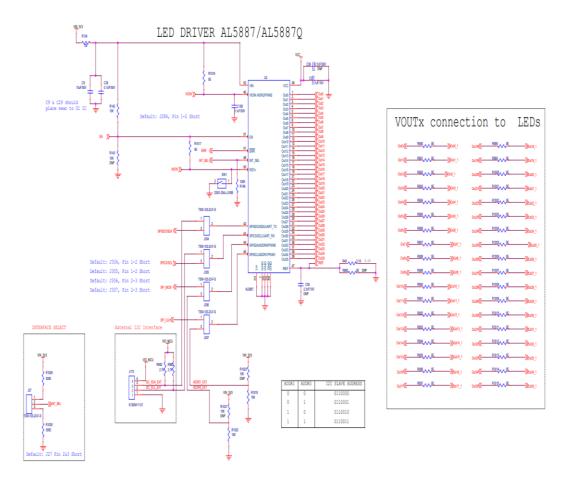
Figure 3: Image of demo board representing AL5887 IC and FT4222H IC

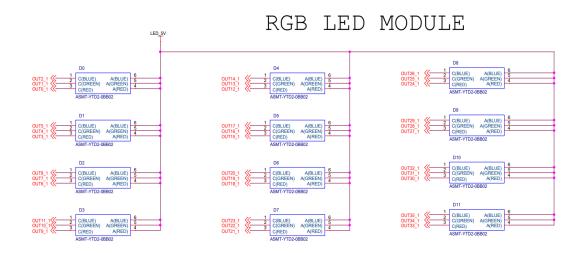
The demo board has an additional feature i.e., the demo board can powered up through USB to micro USB Type-B connector(USB\_VBUS) connected at J407 connector and short 2-3 pins of the J411 connector. The LED can be powered up by conneting battery bank through USB Type-C connector(J350) and short 2-3 pins of the J402 connector. For this setup refer jumper settings given below in table3.



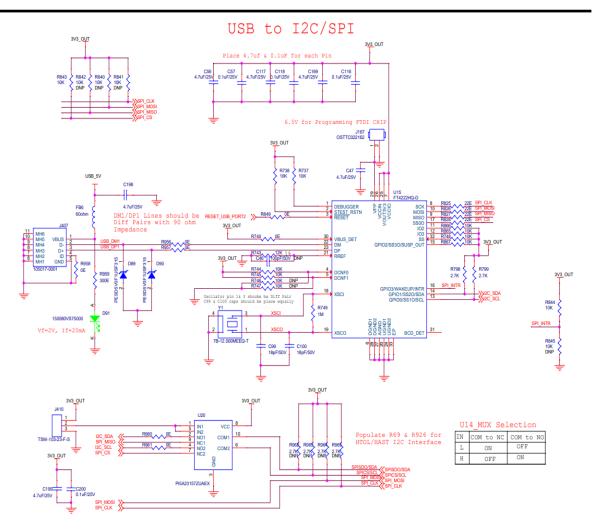
### 4. SCHEMATICS

The schematic of the AL5887 RGB LED driver demo board is as shown below.

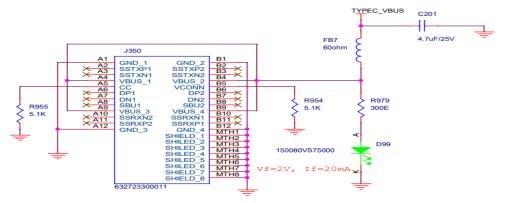




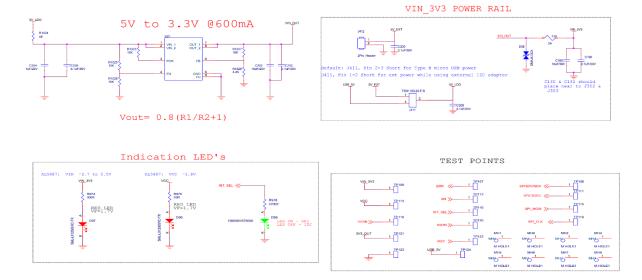




TYPE C: BATTERY BANK INPUT







### 5. BILL OF MATERIAL

The components used in the demo board are listed below with their part numbers.

DESIGNATOR	VALUE	PART NUMBER	REMARKS
C3	1uF/10V	C0805C105K8RACTU	
C9,C189	10uF/50V	GMC31X7R106K50NT	
C29,C190	0.1UF/50V	08055C104KAT4A	
C36	0.1UF/50V	08055C104KAT4A	DNP
C38	2.2nF/10V	8.85012E+11	DNP
C46	100pF/50V	CL21C101JBANNNC	DNP
C47,C56,C117,C169,C198,	4.7uF/25V	CGA4J1X7R1E475M125AE	
C199,C201			
C57,C116,C118,C200	0.1uF/25V	CL10B104MB8NNNC	
C99,C100	18pF/50V	06035A180JAT4A	
C112	1uF/10V	GRM21BR71A105KA01L	
C113	10nF/50V	06035C103KAT4A	
C168,C196,C203,C206,C207,	0.1uF/50V	CL10B104MB8NNNC	
C208,C209			
C202	10uF/25V	CL31B106KAHVPNE	
C204	1uF/25V	C1206C105M3RAC7800	
D1,D2,D3,D4,D5,D6,D7,D8,	ASMT-YTD2-0BB02	ASMT-YTD2-0BB02	
D9,D10,D11,D0			
D58	SMAJ6.0CA	SMAJ6.0CA	
D89,D90	PESD5V0F1USF315	PESD5V0F1USF315	
D91,D98,D99	150080VS75000	150080VS75000	
D96,D97	SML-LX1206SRC-TR	SML-LX1206SRC-TR	
FB6,FB7	60ohm	BLM21PG600SH1D	
F25	2A	0685T2000-01	
J27,J304,J305,J306,J307,	TSW-103-23-F-S	TSW-103-23-F-S	
J402,J410,J411			
J167	OSTTC022162	OSTTC022162	
J172	61300411121	61300411121	
J350	6.32723E+11	6.32723E+11	
J401,J412	2Pin_Header	OSTTC022162	
J407	105017-0001	105017-0001	
MH1,MH2,MH3,MH4,MH5,MH6,	M HOLE1		not neccesa
MH7.MH8			



R49	2.1K	RQ73C1J2K1BTD	
R134,R1016,R1017	0E	RMCF0805ZT0R00	
R142,R737,R744,R745	10K	RC0603FR-7W10KL	
	10K	RC0005FR-7WT0RL	
.R843,R844,R856,			
R865,R866,R1019,R1020,			
R1021,R1022,R1023,R1025,			
R1021,R1022,R1023,R1023,			
R1627	100K	RCA0603100KFKEAHP	
R738,R867	100K	RC0603FR-7W10KL	
R740,R849,R956,R957,	0E	RC0603JR-070RL	
R/40,R649,R950,R957, R958,R960,R961,R980,R981,	UE	RC0003JR-070RL	
R982,R983,R984,R985,R986,			
R987,R988,R989,R990,R991,			
R992,R993,R994,R995,R996,			
R997,R998,R999,R1000,			
R1001,R1002,R1003,R1004,			
R1005,R1006,R1007,R1008,			
R1009,R1010,R1011,R1012,			
R1013,R1014,R1015,R1024			
R743	12K	RT0603DRD0712KL	
R749	1M	RN73H1JTTD1004B25	
R798, R799, R882, R883,	2.7K	RMCF0603FT2K70	
R825,R826,R827,R828	22E	CRGCQ0603F22R	
R954,R955	5.1K	RMCF0603JT5K10	
R959,R974,R979,R1029,	300E	ESR03EZPJ301	
R1030			
R975	20R	RNCP0603FTD20R0	
R978	2700E	ERJ-PB3D2701V	
R1026	15K	SG73S1JTTD1502F	
R1028	3.3K	CRGH0603F3K3	
SW1	DS01-254-L-01BE	DS01-254-L-01BE	
S4	FSM2JSMAATR	FSM2JSMAATR	
TP106,TP110,TP114,TP117	5124	5124	not neccesary
TP107,TP108,TP109,TP111,	TEST POINT		not neccesary
TP112,TP113,TP115,TP116,			
TP118,TP119,TP120,TP121,			
TP122,TP123,TP124			
U2	AL5887	AL5887	
U15	FT4222HQ-D	FT4222HQ-D	
U18	TLV840MADL29DBVR	TLV840MADL29DBVR	
U20	PI5A23157ZUAEX	PI5A23157ZUAEX	
U21	AP7165-SPG-13	AP7165-SPG-13	
Y1	7B-12.000MEEQ-T	7B-12.000MEEQ-T	
R143,R1020,R1021,R840,R841,R842,R74 6,R747,R845	10 <b>K</b>	RC0603FR-7W10KL	DNP
R860	0E	RC0603JR-070RL	DNP
R962,R963,R964,R965	2.7K	RMCF0603FT2K70	DNP



#### 6. SETUP REQUIREMENTS

The user will get following contents along with the demo board:

- Demo board.
- Demo board user manual.
- Emulator Software.
- Emulator software user manual.

#### 6.1.Software:

Emulator Software:

Emulator is a standalone application developed using LabVIEW 2019 to support AL5887 LED driver testing. Features of AL5887 are controlled via SPI/I2C interface. Minimum system requirements for execution of Emulator software are given below

Item No.	Description	Specification/Requirement
1.	OS	Windows 7/10
2.	RAM	4GB or above
3.	Disk space	250MB approx

Refer emulator software user manual for installing emulator software in PC/Laptop.

#### **6.2.Hardware setup:**

- We need DC power supply with 5V/5A, as the max. current consumed when all the LEDs with full brightness is approx. 1.5A.
- PC/Laptop in which Emulator software is installed.
- A USB to Micro USB Type-B connecting cable from PC/Laptop to Demo board.
- Arrange the setup as shown in the figure below.

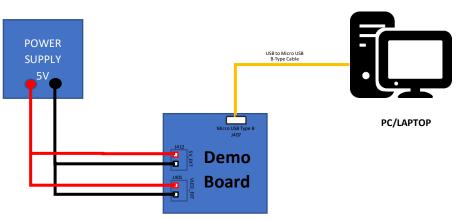


Figure 4: Basic hardware setup representation



### HARDWARE SETUP:

### 7. Connections

- Connect  $V_{IN}$  (5V) to J412 (5V\_Ext) connector. Ensure Vin less than 5.5V
- Connect V<sub>LED</sub> (5V) to J401 (VEXT\_LED) connector or a Battery bank via Type C Connector(J350). Place appropriate jumper at J402.
- Place the jumpers as per the **default** jumper settings given in the Table.1 below to communicate via I2C communication.

CONNECTOR	DUDDOGE	DEFAULT CONNECTION with I2C
CONNECTOR	PURPOSE	and External Supply to RGB LEDs
J304	SPISDO/SDA	PIN 2-3 SHORT
J305	SPICS/SCL	PIN 2-3 SHORT
J306	SPI_MOSI	PIN 1-2 SHORT
J307	SPI_CLK	PIN 1-2 SHORT
J27	INTERFACE SELECT	PIN 2-3 SHORT: I2C
J402	LED_5V POWER RAIL	PIN 2-3 SHORT: VEXT_LED
J411	VIN_3V3 POWER RAIL	PIN 1-2 SHORT: 5V_EXT
J410	MUX SELECTION	PIN 1-2 SHORT: I2C

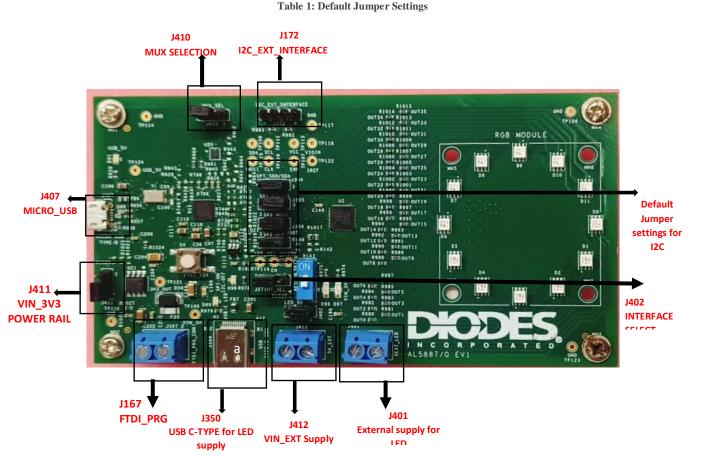


Figure 5: Demo board representing all the Connectors and Jumpers.



• The slave address selection resistor table is given below. Solder / De-solder resistors to change the configuration

ADDR1	ADDR0	I2C SLAVE	RESISTOR ARRANGEMENT		Remarks
		ADDRESS	MOUNT	REMOVE	
0	0	0110000	R1019, R1022	R1020, R1021	Default
0	1	0110001	R1019, R1021	R1020, R1022	
1	0	0110010	R1020, R1022	R1019, R1021	
1	1	0110011	R1020, R1021	R1019, R1022	

#### Table 2: Address selection table

- Connect USB to Micro USB connector at J407 to establish communication (I2C/SPI) from GUI.
- To communicate with AL5887 using external I2C bus (not from GUI), refer jumper setting table (Table .3)

### 8. Check list before turning ON the board

- Ensure that  $V_{IN}$  given at J412 is less than 5.5V to avoid device damage.
- Ensure LED External supply  $V_{LED}$  given at J401 is not exceeding 5V.
- Make sure the jumper settings are changed as given in Table 3 and for default settings refer Table 1.
- Check the RESETN switch (SW1) is in OFF condition.

#### 9. Turn ON Procedure

- 1. Turn on the External 5V power supply given at connector J412 and check for the power on indication at LED D97(RED LED).
- 2. Check LED D96 lit on the board which indicates AL5887 LDO output supply.
- 3. Power ON LED Supply (Either External 5V supply on J401 or Battery Bank).
- 4. Open GUI in Desktop/Laptop and run the exe file shared along with this manual.
- Connect USB to Micro USB connector between desktop/Laptop to Demo Board Connector (J407).
- 6. Operate LEDs from GUI using the controls given. Refer emulator software manual shared along with this manual.



#### **10. Jumper Settings**

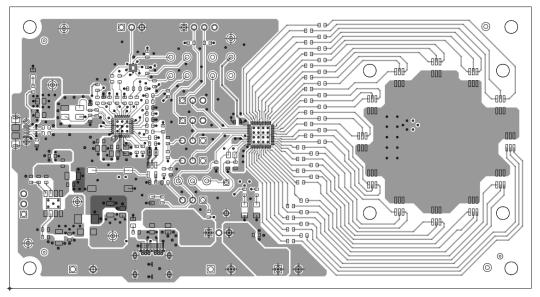
Connect the jumpers as per user requirement and connection table is given below.

CONNECTOR	PURPOSE	CONNECTION
J304	I2C_SDA_EXT	PIN 1-2 SHORT
	SPISDO/SDA	PIN 2-3 SHORT
J305	I2C_SCL_EXT	PIN 1-2 SHORT
	SPICS/SCL	PIN 2-3 SHORT
J306	SPI_MOSI	PIN 1-2 SHORT
	ADDR0_EXT	PIN 2-3 SHORT
J307	SPI_CLK	PIN 1-2 SHORT
	ADDR1_EXT	PIN 2-3 SHORT
J27	INTERFACE SELECT	PIN 1-2 SHORT: SPI
		PIN 2-3 SHORT: I2C
J402	LED_5V POWER RAIL	PIN 1-2 SHORT: TYPEC_VBUS
		PIN 2-3 SHORT: VEXT_LED
J411	VIN_3V3 POWER RAIL	PIN 1-2 SHORT: 5V_EXT
		PIN 2-3 SHORT: USB_5V
J410	MUX SELECTION	PIN 1-2 SHORT: I2C
		PIN 2-3 SHORT: SPI

#### Table 3: Jumper connection table.

#### **11. BOARD LAYOUT**

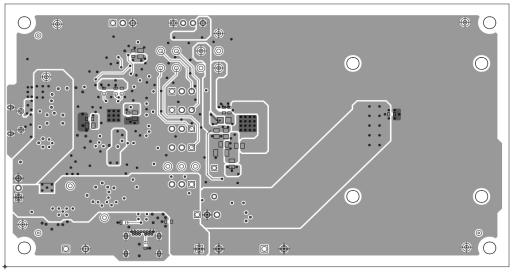
The following images are the top layer and bottom layer gerber images of demo board.



TOP LAYER

Figure 5: TOP LAYER





BOTTOM LAYER

Figure 6: BOTTOM LAYER

#### **12. BOARD IMAGES**

The following images are top view, bottom view of the demo board and few LED effects performed using demo board.



Figure 7: TOP VIEW



Figure 8: BOTTOM VIEW

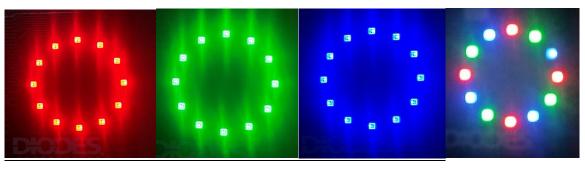


Figure9: Shows various LED effects, starting from right, a. RED, b. GREEN, c. BLUE, d. mixture of RGB



#### 13. EXTERNAL I2C INTERFACE USING DEMO BOARD:

Using demo board with external I2C interface, the way to communicate is as shown below.

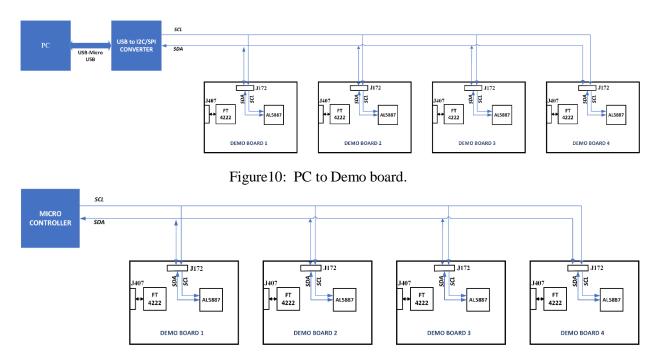


Figure11: Micro controller to Demo board

Follow the steps mention below to set jumper settings while using external I2C interface,

Step 1: Set the following jumper settings.

CONNECTOR	PURPOSE	CONNECTION
J27	INT_SEL	PIN 2-3 SHIORT
J304	I2C_SDA_EXT	PIN 1-2 SHORT
J305	I2C_SCL_EXT	PIN 1-2 SHORT
J410	MUX_SELECTION	PIN 1-2 SHORT: FOR I2C

Step 2: Set slave address, refer Table 2 to set address.

**Step 3**: Connect demo board to PC or Micro controller as shown in figure10 &11 at J172 connector and the connections are as follows,

CONNECTOR	PIN	PURPOSE
J172	2	I2C_SDA_EXT
J172	3	I2C_SCL_EXT
J172	4	GND

#### **14. TROUBLESHOOT:**

• Current Limit:

If board is drawing excess current, remove the resistor R134, then check for the cause.

• Verify the following test points to ensure the required voltage levels.



- i) VIN\_3V3 3.3V (TP 109)
- ii) EN 3.3V (TP 112)
- iii) VCC 1.8V (TP 113)
- iv)  $3V3_V_{OUT} 3.3V (TP 121)$
- v) RSTn 3.3V (TP 120)
- vi)  $V_{IOIN} 3.3V (TP 118)$
- vii) GND 0V (TP 123)
- viii) ERR (TP 107)
- ix) INT\_SEL 3.3V (TP 116)
- x) IREF 0.7V (TP 122)
- To verify the communication, reconnect the cable. Probe oscilloscope on the following test points,
  - 1. SPISDO / SDA TP108
  - 2. SPICS / SCL TP111
  - 3. SPIMOSI TP115
  - 4. SPICLK TP119
- If LEDs are not glowing, then check the LED supply and also check LED behavior using multi meter.
- For open and short, read the register data using GUI and check for corresponding fault bit value. If any fault bit is set high. Then check the corresponding channel is open / short.

### **15. Additional Information:**

### **15.1 Device functional modes:**

- Normal mode: The AL5887 device enters the NORMAL mode when Chip\_EN (register) = 1. ICC is 5 mA (typical). The voltage at IREF test point (TP122) should be 696mV – 704mV.
- Power save mode: Automatic power-save mode is enabled when register bit Power\_Save\_EN = 1 (default) and all the LEDs are off (both color and brightness registers = 00H) for a duration of >30 ms. Almost all analog blocks are powered down in powersave mode. If any I2C/SPI command to the device occurs, the AL5887 device returns to NORMAL mode.



- 3. Shutdown mode: The device enters into SHUTDOWN mode from all states on VIN power down or when EN = Low > 25ms. I<sub>CC</sub> is < 1 µA (max).
- 4. Standby mode: The device enters the STANDBY mode when Chip\_EN (register bit) = 0. In this mode, all the OUTx are shut down, but the registers retain the data and keep it available via I2C/SPI. STANDBY is the low-power-consumption mode, when all circuit functions are disabled. ICC is 15 μA (maximum).
- 5. Thermal shutdown mode: The device automatically enters the THERMAL SHUTDOWN mode when the junction temperature exceeds 160°C (typical). In this mode, all the OUTx outputs are shut down. If the junction temperature decreases below 150°C (typical), the device returns to the NORMAL mode.

#### **15.2 Current Setting for all channels:**

The maximum global output current for all 36 channels can be adjusted by the external resistor, RSET, as described below.

 $IMAX = KIREF * VIREF / RSET * [(Max_Current_Option/4) + (3/4)]$  .....(1) where, IMAX = Channel average current, Color Register=FF, Brightness Register=FF VREF= 0.7 V, RSET = External dimming resistor (2.1k $\Omega$  recommended), Max\_Current\_Option = 1 (default), KIREF = 21 + (N \* 3), is the current multiplication factor which can be programmed using 6-bit global dimming register G5:G0 (Address = 66H), which is analog dimming register and N is the decimal equivalent of G5 G4 G3 G2 G1 G0.

For example, if all global dimming register bits are 0, the N will be decimal equivalent of 100000 which is 32. Hence, KIREF = 21 + (32 \* 3) = 117.

using equation (1) above, for global dimming register setting of 000000H and

Max\_Current\_Option = 1, below is the table that shows IMAX variation with respect to the RSET.

R <sub>SET</sub> (KΩ)	I <sub>MAX</sub> (mA)	K <sub>IREF</sub>
2.1(Recommended)	39	117
14.7	5.57	117
36.5	2.24	117

Table 4: IMAX variation w.r.to Rset

Similarly, the below table shows IMAX range using global dimming at different RSET values

$R_{SET}(K\Omega)$	I <sub>MAX</sub> (mA)		
$\mathbf{K}_{SEI}(\mathbf{K}_{22})$	MIN	DEFAULT	MAX
2.1(Recommended)	7 39 70		70
14.7	1	5.57	10
36.5	0.4	2.24	4

Table 5: IMAX range using global dimming at different Rset values.

For more information on current setting refer data sheet.

#### **15.3 Brightness and Color register:**

The below table shows various values of brightness and color register w.r.t duty cycle.

Duty Cycle	Brightness Register(Hex)	Color Register(Hex)
10	2D	92
20	5F	8A
30	75	A9
40	81	CC
50	96	DC
60	B8	D6
70	CO	EF
80	EF	DC
90	F3	F3
100	FF	FF

Table 6: Brightness and Color Register Values.



### **Emulator Software**

Emulator is a standalone application developed using LabVIEW 2019 to support AL5887 LED driver testing. Features of AL5887 are controlled via SPI/I2C interface.

Minimum system requirements for execution of Emulator software are given below

#	Description	Specification/Requirement
1	OS	Windows 7/10
2	RAM	4GB or above
3	Required Disk space	250 MB approx.

Note: Requires Admin Rights for Installation and has to be run as Administrator.

#### **<u>16</u>** Installation instructions:

- 1. Download the latest Emulator software package from the Diodes Server.
- 2. Unzip Emulator\_Installer.zip.

The extracted folder will have the following files and folders.

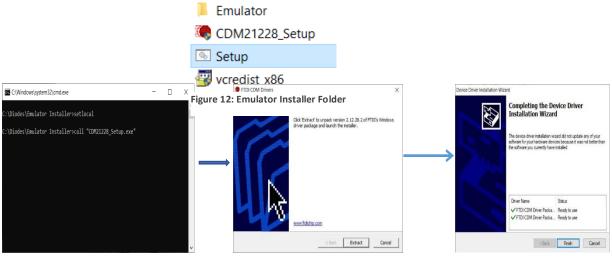


Figure 13: FTDI Driver installation

- 3. Click the **Setup.bat** and follow the on-screen instructions to complete the installation of FTDI Drivers.
- 4. Next **Microsoft Visual C++ 2010 x86 Redistributable** installation will begin automatically. Follow the on-screen instructions to complete the installation.



elcome to Microsoft Visual C++ 2010 x86 Redistributable Setup Please, accept the license terms to continue.	00		Installation Is Complete
MICROSOFT SOFTWARE LICENSE TERMS MICROSOFT VISUAL C++ 2010 RUNTIME LIBRARIES WITH SERVICE PACK 1	<u> </u>	Visual Studio	Microsoft Visual C++ 2010 x86 Redistributable has been installed.
These license terms are an agreement between Microsoft Corporation (or based on where you live, one of its affiliates) and you. Please read them. They apply to the software named above, I have read and accept the license terms.			You can check for more recent versions of this package of the <u>Microsoft Visual Studio</u> website.
Yes, send information about my setup experiences to Microsoft Corporation. For more information, read the Data Collection Policy.			

Figure 14: Microsoft Visual C++ 2010 x 86 Redistributable Installation

5. Emulator setup will be installed following Microsoft Visual C++ 2010 x86 Redistributable. Follow on screeninstructions and complete the installation and Restart the system when prompted

🕼 Emulator SW – 🗆 X	🔯 Emulator SW	- 🗆 X	🐙 Emulator SW	- 🗆 X
	Destination Directory Select the installation directories.		Installation Complete	
It is storgly isceneredid fely you eil al pogani beloe surring fils include. Applications fel a un file biologoand, such as vise scenere allifee, angle cause the installer to take longer flare seesge to complex	Al others will be installed in the following locations. To instal otherware into different location, club: the Bioware batton and relect another directory	3	The installer has finished updating your system.	
	Directory for Emulator SW C-Vhogram Res (dBV)Emulator_SW\	Вісига.		
Please wait while the installer initializes.				
	Directory for National Instruments products C:\Program Files (x86)/National Instruments\	Browse		
	Le color de la col	DILMUL.		
Cancel	KK Back N	set>>> Cancel	<< Back	Next >> Finish

Figure 15: Microsoft Visual C++ 2010 x 86 Redistributable Installation

#### 17 Getting started:

Run the Emulator software Emulator\_SW\_V2.7.exe

a) From **Start menu** by selecting the below icon.



Figure 16: Emulator SW EXE Icon

b) From C:\Program Files (x86)\Emulator\_SW\ Emulator\_SW\_V2.7.exe.



Config_Files	Emulator SW Configuration
📙 data	Device Selection AL5887
📕 Help	Mode Selection Online  Offline
📜 Logs	 Interface I2C Slave Address Mode
📕 Registry File	I2C 💌 x 30 * 100 KHz(Std Mode) 💌
Emulator_SW_V2.7.aliases	VALIDATE Validation Status
Emulator_SW_V2.7	
Emulator_SW_V2.7	© Diodes Incorporated. All Rights Reserved

Figure 17: Emulator SW Execution

Note: It is recommended to run the executable in Administrator Mode.

#### **<u>18</u>** Software Features – Configuration Screen

Emulator SW has two major modules namely **Configuration Screen** and **Emulator Screen**.

- 1. Configuration Screen allows users to
  - Select the Device under test and configure its Interface parameters.
  - Perform Device Validation based on device and Interface Configuration.
  - Mode Selection Either Online or Offline Mode.

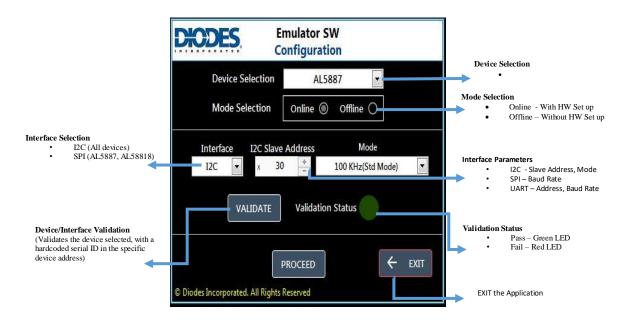


Figure 18: Emulator configuration screen

- 2. Emulator Screen has the following major features
  - Display the parameters configured in CONFIGURATION Screen.
  - LED Test Tab to display



- The Device Connection Status.
- The LED Annunciation in 2 different modes
  - 1. RGB Modules and
  - 2. Individual LEDs.

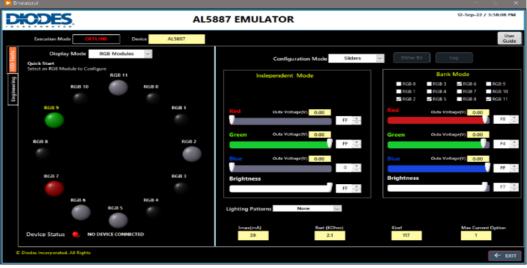


Figure 19: RGB Modules

D	Ð	ES.				AL	887 EMULATOR	12-Sep-22 / 3:58:27 PM
	Executio	m Mode	OFTLINE	Devic	e AL	5887		User Guide
Engineering ILED Tests	Quick Star	Display Moc		dual LEDs	4		Configuration Mode Sliders	Dither Bit Log
	Select an L	ED to Configu	ire				Independent Mode	Bank Mode
Engineering	R0 G0 B0 R0 G0 G0 G0 G0 G0	R1 G1 B1 R7 🜒 G7	#2 🔮 62 🔮 82 📢	R 3 G 3 B 3 R 9 G 9	R4 G4 B4 R 10 G 10	R5 65 85 81 81 611	Red     Outs Voltage(Y)     0.00       Green     Outs Voltage(Y)     0.00       FF     Image     FF       Brightness     0	RCB 0         RCB 3         ST RCB 2         RCB 3         RCB 3
	Device St	B7	NO DEVIC		B 10	5 🖗 11 📦	FF Lighting Patterns Nane 2	Elerer Max Current Option 117 1 C Exert



- Configure the LEDs to adjust the Color and Intensity in 2 different modes
  - 1. Sliders (Independent Mode and Bank Mode).
  - 2. Registers.
- Display following Lighting Patterns in RGB Modules Annunciation Mode
  - 1. Breathing effect



- 2. Mono color chasing effect
- 3. Dual color chasing effect and
- 4. Multi-color chasing effect.
- Engineering Tab to guide user on current settings and to Compute the OutX Voltage.

#### **<u>19</u>** Execution Instructions – Configuration Screen

- 1. Click the **Emulator\_SW\_V2.7.exe** to run the Emulator Application.
- 2. In the Configuration Screen, Select **AL5887** under Device Selection.
- If AL5887 chip and test hardware are available, select Mode as **Online.** Else, if hardware is not available, then skip to step 6.
- 4. Select the **Interface** (I2C/SPI), **Address**, **Mode** based on the hardware in use.
- 5. Once Configuration is complete, Select **VALIDATE** Button.

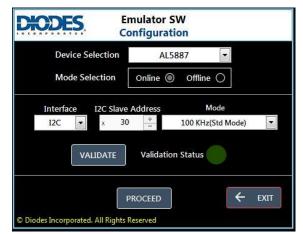


Figure 21 : Emulator Configuration Screen

Emulator SW verifies specific bits in the AL5887 Device Register.

- If values match, SW displays the validation status as PASS and navigates to the Emulator Screen.
- If values do not match, SW displays the validation Status as FAIL and alerts user with a message as given below.

**Note:** If Validation Failed, user shall choose among one of the below options

- User shall select MODIFY in the popup and re-visit step 4.
- User shall select PROCEED to continue using Emulator SW in OFFLINE Mode.
- User shall select ABORT to Quit the Application & to verify the Hardware.

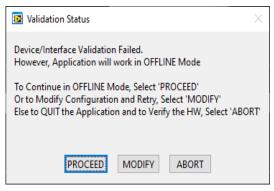


Figure 22: Validation status

6. If hardware is not available and if user prefers to use the SW in Offline Mode, select Mode as **OFFLINE.** 



	mulator SW onfiguration
Device Selection	AL5887
Mode Selection	Online 🔿 Offline 🔘
Interface I2C	
© Diodes Incorporated. All Rights	Reserved

Figure 23: Offline Mode Selection

7. Select PROCEED button to navigate/access the Emulator Screen.

D Er	nulator.vi						- 🗆 🗙
D	<b>HODES</b>	j.			AL	5887 EMULATOR	12-Sep-22 / 4:00:08 PM
	Execution Mod	e OFI	FLINE D	evice	AL5887		User Guide
ED Tests	Display Quick Start Select an RGB Moo		RGB Modules	>		Configuration Mode Sliders	Dither Bit Log
			RGB 11			Independent Mode	Bank Mode
Engineering		RGB 10		RGB 0			RGB 0         RGB 3         RGB 6         RGB 9           RGB 1         RGB 4         RGB 7         RGB 10           RGB 2         RGB 5         RGB 8         RGB 11
Ľ	RGB 9				RGB 1		
						Red         Outx Voltage(V)         0.00           0	Cutx Voltage(V) 0.00
						Green Outx Voltage(V) 0.00	Green Outx Voltage(V) 0.00
	RGB 8				RGB 2	0 +	0 +
						Blue Outx Voltage(V) 0.00	Blue Outx Voltage(V) 0.00
	RGB 7				RGB 3	Brightness	Brightness
						FF *	FF +
		RGB 6		RGB 4			
		•	RGB 5	•		Lighting Patterns None 🔍	
	Device Status	🔴 NK	DEVICE CONNECT	ED		Imax(mA) Rset (KOhm) 39 2.1	Kiref Max Current Option 117 1
•	Diodes Incorporated.	All Rights					← EXIT

Figure 24: Emulator Screen in Offline Mode

#### 20 LED Tests

### 20.1 Configuring LEDs in RGB Modules & Independent Mode

1. Select Display Mode as RGB Modules.



2. Select an RGB Module (Example: RGB8) and Adjust the Red/Green/Blue Sliders in Independent Mode to make adjustments to the colour and Intensity

жdes	į.		AL	5887 EMULATOR	12-5ep-22 / 4:00:08 PM
Execution Mor	OFFLINE	Device	AL5887		Uwr Guide
Displa Oakk Start Select on RSE Me	dule to Configure	Nodules 🖓		Configuration Mode Siders	Dither Bit Log Bank Mode
Displa Quick Start Select on HGB Mo	RGB 10	ĸ			RGB 0         RGB 3         RGB 6         RGB 9           RGB 1         RGB 4         RGB 7         RGB 10           RGB 2         RGB 5         RGB 8         RGB 11
RGB 9			RGB 1	Red Outer Voltage(1) 0.00	Red OverVallage(1) 800
RCB 8			RG8 2	Green Our Veitager(1) 800	Green Outriviation() 800 0 [] 10 000 Violation() 800 10 2 2
RGB 7			NSB 3 #	Brightness FF	Brightness
	RGB 6		84	Lighting Patterns None 🐷	line Max Current Option
Device Status		CONNECTED		39 2.1	117 1
© Diodes incorporated	Al lights				← D07

Figure 25: Configuring LEDs in RGB Modules & Independent Mode

3. Each RGB module can be configured to different Red/Blue/Green settings in independent Mode.

For instance, RGB1 to RED, RGB2 to GREEN and RGB8 to combination of RED+GREEN+BLUE and so on.

### 20.2 <u>LED Tests – Configuring LEDs in RGB Modules & Bank Mode</u>

- 1. Select Display Mode as **RGB Modules.**
- 2. Enable One/More Banks to enable RGBs in **Bank Mode.**
- 3. Move the Red/Green/Blue Slides under Bank Mode to adjust the colour and Intensity of the RGB Modules selected in Bank Mode.



Figure 26: Configuring LEDs in RGB Modules & Bank Mode

All RGBs selected in Bank Mode can be adjusted only to same color adjustments.

### 20.3 <u>LED Tests – Configuring LEDs in Individual LEDs & Independent Mode</u>

- 1. Select Display Mode as Individual LEDs.
- 2. Select an Individual LED (Example G2). Only Green Slider will be enabled in



Independent mode while Red and Blue will be greyed Out.

3. Adjust the Green Slider to vary the colour and Intensity of G2 LED.



Figure 27: Configuring LEDs in Individual LEDs & Independent Mode

Each LED can be configured to different Red/Blue/Green settings in independent Mode.

### 20.4 <u>LED Tests – Configuring LEDs in Individual LEDs & Bank Mode</u>

- 1. Select Display Mode as Individual LEDs.
- 2. Enable One/More Banks to enable RGBs in **Bank Mode.**
- 3. Move the Red/Green/Blue Slides under Bank Mode to adjust the colour and Intensity of the RGB Modules selected in Bank Mode.

D Em	ulator.vi							
D	Đ	ES.				AL	5887 EMULATOR	12-Sep-22 / 4:00:38 PM
	Executio	on Mode	OFFLINE	Devie	e AL	5887		User Guide
ED Tests	Quick Star			dual LEDs	~		Configuration Mode Sliders	V Dither Bit Log
n pr	Select an L	ED to Configu					Independent Mode	Bank Mode
Engineering	RO			R 3	R4			RGB 0         RGB 3         RGB 6         RGB 9           RGB 1         RGB 4         RGB 7         RGB 10           RGB 2         RGB 5         RGB 8         RGB 11
	GO		G2	G 3	G 4	GS	Red Outx Voltage(V) 0.00	Red Outx Voltage(V) 0.00
	B 0	B1	B 2	B 3	84	B 5	Green Outx Voltage(V) 0.00	Green Outx Voltage(V) 0.00
	R 6		R 8	R 9	R 10	R 11	Blue Outx Voltage(V) 0.00	Blue Outx Voltage(V) 0.00
			G 8	G 9	G 10	G 11	Brightness	Brightness
	B 6	B 7	B 8	B 9	B 10	B 11	Lighting Patterns None	
	Device St	tatus 😑	NO DEVIC	E CONNECTED			Imax(mA) Rset (KOhm) 39 2.1	Kiref Max Current Option 117 1
•	Diodes Incorp	iorated. All Rig	hts					← EXIT

Figure 28: Configuring LEDs in Individual LEDs & Bank Mode

All LEDs selected in Bank Mode can be adjusted only to same color adjustments.

### 20.5 <u>LED Tests – Notes on Display Mode</u>



1. Adjustments made to LEDs in RGB Modules Mode will be reflected in Individual LEDs mode and vice versa.

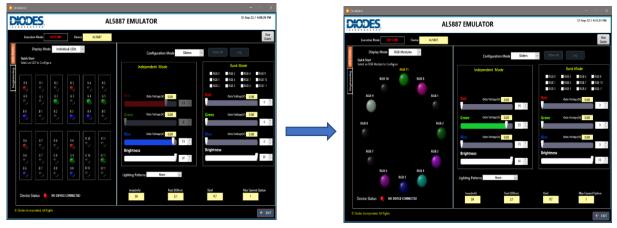


Figure 29: LED Changes in Individual LEDs & RGB Modules

### 20.6 <u>LED Tests – Lighting Patterns</u>

Emulator SW displays following Lighting Patterns in RGB Modules Annunciation Mode

- Breathing effect Displays LEDs in Red color with a breathing effect.
- Mono color chasing effect Displays LEDs in one color that cycles from RGB0-RGB11.
- Dual color chasing effect Displays LEDs in two colors that cycles from RGB0-RGB11.
- Multi-color chasing effect Displays LEDs in multiple colors that cycles from RGB0-RGB11.
- None LED lighting Pattern is disabled.

Except in breathing effect, the colors keep changing during each cycle. Select a lighting pattern from the drop down to simulate the pattern.

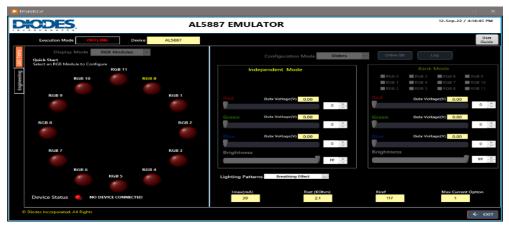
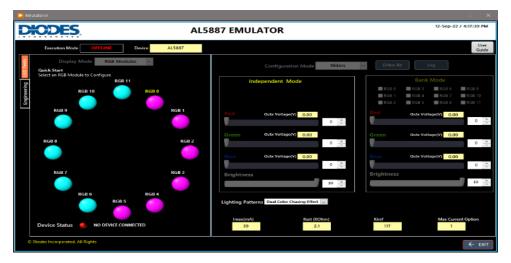


Figure 30: Breathing Effect



DICIDES	AL5	887 EMULATOR	L .		12-Sep-22	2 / 4:15:46 PM
Execution Mode OFFLINE Dev	ALS887					User Guide
Display Mode RGB Modules Quick Start Select an RGB Module to Configure	< l	Config	mettion Mode Sliders	Dither Bit		
		Independen	t Mode		Bank Mode	
600)	RGB 0			RG8 0	RGB 3 RGB 6	RGB 9
					RGB 4 RGB 7	RGB 10
				RGB 2	RGB 5 RGB 8	RGB 11
RGB 9	RGB 1	Red Outx Vol	0.00 (V)	Red	Outx Voltage(V) 0.00	3
		U.S. S.	0 +			•
		Green Outx Vol	0.00		Outx Voltage(V) 0.00	
RGB 8	RGB 2	Green Old Vo	0.00	Green	Outor Voltage (V) 0.00	0 *
		V.	· ·	v		
		Blue Outx Vol	0.00		Outx Voltage(V) 0.00	5
			0			•
RGB 7	RGB 3	Brightness		Brightness		
			FF 📑			FF +
RGE 6	RGB 4					
RG8 5		Lighting Patterns Mon	Color Chaning S 🗸			
		Imax(mA)	Rset (KOhm)	Kiref	Max Curr	ent Option
Device Status 🥚 NO DEVICE CONNECTE	D	39	2.1	117	1	

Figure 316 : Mono Colour Chasing



#### Figure 32: Dual Colour Chasing

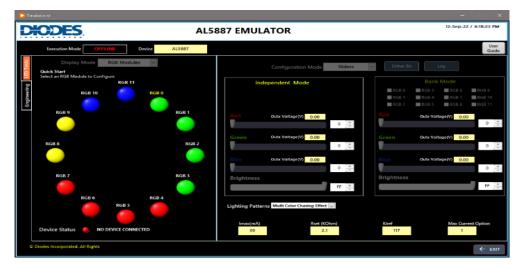


Figure 33: Multi-Colour Chasing



#### 20.7 <u>LED Tests – Configuring LEDs using Register Configuration Mode:</u>

- 1. Select Configuration Mode as **Registers.**
- 2. Modify the Register Value(s) in the Table either bits D0-D7 or Hex data.

(For Instance: LED\_CONFIG1 (0x03). This register enables/disables BANK mode of RGB8 to RGB11. Let us here enable RGB10 and RGB11).

3. When values of a register are modified, the applicable Register(s) will be highlighted in Blue colour indicating the value change. But these values are yet to be applied to the device and GUI.

LED_CONFIG1	0x3			1	1	0	0	С

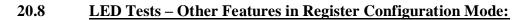
4. Select **WRITE REGISTRY** to apply the values to the AL5887 and GUI. Once applied, the highlight is disabled.

Ż	ODES				AL58	87 EMULATOR									11/	30/2022 / 1	2:47:07 PM	S.
	Execution Mode	OFFLI		Device	AL5887												User Guide	
0 Tests	Display Mor Quick Start		RGB Modules	( ¢ )		Configu	ration Mo	ode	Regist	ters	K .					eserved Bits		
	Select an RGB Module to	o Configu				Register Name	Address	07	D6	05	04	D3	02	01	DO	Hex data		
Bu			RGB 11			DEVICE CONFIG0	0x0		1		-		-	-		40	-11	
5	RGB			RGB 0		DEVICE CONFIGT	Dx3	1	1.00	1	1		1	1	0	85		
21	NGD	10		NOB U		LED. CONFIGE	0x2	0	0	0	0	0	0	0	0	0	-11	
Ē						LED CONFIG1	0x3					0	0	0	0	0	1	6
-						BANK BRIGHTNESS	0x4	1	1	1	1	1	1	1	1	FF		6.
	RGB 9				RGB 1	BANK A COLOR	0:5	1	1	1	1	1	1	1	1	FF	- 10	
						BANK & COLOR	Ox6	1	1	1	1	1	1	1	1	FF	11	
						BANK_C_COLOR	0x7	1	1	1	1	1	1	1	1	FF		
						RGB0_BRIGHTNESS	Bx8	. 1	1	1	1	1	1	1	1	FF.		
					2.2.42 Aug.2	RGB1_BRIGHTNESS	0x9	1	1	1	1	1	1	1	1	FF		
	RGB 8				RGB 2	RGB2_BRIGHTNESS	0xA	1	1	1	1	1	1	1	1	FF		
						RGB3_BRIGHTNESS	0x8	1	1	1	1	1	1	1	1	FF.		<b>.</b>
						RGB4_BRIGHTNESS	0xC	1	1	1	1	1	1	1	1	FF:		Not.
						RGB5_BRIGHTNESS	0xD	1	1	1	1	1	1	1	1	FF		
						RGB6_BRIGHTNESS	0xE	1	31	1	1	1	1	1	1	FF		
	RGB 7				RGB 3	RGB7_BRIGHTNESS	OxF	1	1	1	1	1	1	1	1	FF		
						RGB8_BRIGHTNESS	0x10	1	1	1	1	1	1	1	1	FF		
	·					RGB9_BRIGHTNESS	0x11	1	1	1	1	1	1	1	1	FE	-	
						RGB10_BRIGHTNESS RGE11_BRIGHTNESS	0x12	1	1	1	1	1	1	1	1	   F	-	
	RGB	16		RGB 4			(0x13				1	1.		1	1			
			RGB 5			RD_COLOR GD_COLOR	0x14 0x15	0	0	0	0	0	0	0	0	0	- 1	
						BD_COLOR	0x15 0x16	0	0	0	0	0	0	0	0	0		
						BU_CULUN	101.10	U	ų	ų	v	- <b>U</b> .C.	U.	U		Ų	1.0	
	Device Status 🤞	NO DE	VICE CONNECT	TD		WRITE REGISTRY		EAD RE	GISTRY		104	D FROM	M FILE	Т	DOP	DRT TO FILE		

Figure 34: Register Configuration Mode

- Reserved Bits are greyed out in the Register Table.
- Please refer to datasheet for register and bit details.





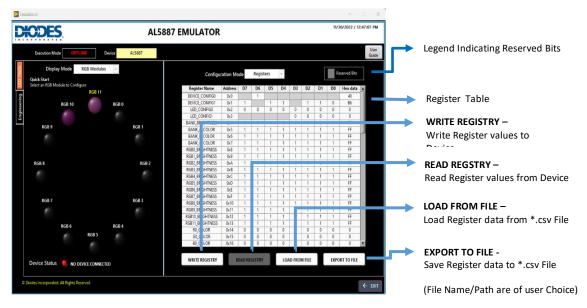


Figure 35: Register Configuration Mode Features

21 Engineering Tab –

21.1 Features:

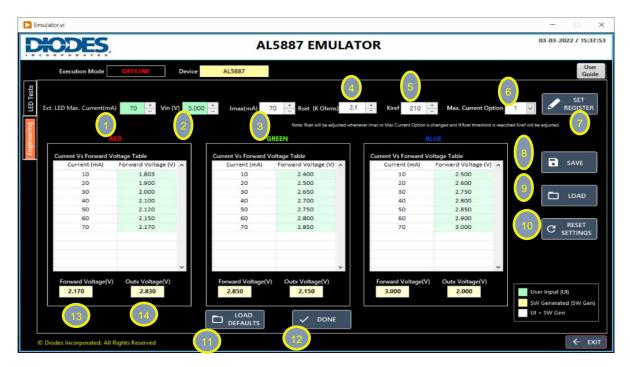


Figure 36: Engineering Tab Features



**Engineering Tab** – Serves as a guide in computing the Current configuration and Outx Voltage.

- Ext.LED Max Current(mA). Recommended Value <= 70 mA SW Alerts user when value entered is > 70 mA.
- 2. Input Voltage Vin(V) Default is 5 V.
- 3. **Imax Value** The channel LED current amplitude when PWM control is turned on.
- 4. External Dimming Resistor/Rset. (2.1K to 36K discrete values based on standard resistor chart).
- Kiref Current Multiplication Factor.
   Default value is 117. Acceptable values 21-210.
- 6. **Max. Current Option** Either  $0 (3/4^{\text{th}} \text{ of } -) \text{ or } 1$ .
- 7. **SET REGISTER** Write/Update Global Dimming Register and Max Current Option.
- 8. **SAVE** Save Configuration to \*.ini File of User Choice.
- 9. **LOAD** Load Configuration from \*.ini File of User Choice.
- 10. RESET SETTINGS Resets all fields to initial condition .
- 11. **LOAD DEFAULTS** Updates Forward Voltage Value as 1 in Current Vs Forward Voltage Table.
- 12. DONE Enables User Input and SW Generated parameters.
- 13. **Forward Voltage** Computed based on interpolation from Current Vs Forward Voltage table defined by the use.
- 14. Outx Voltage computed as Vin Forward Voltage.

This is auto-updated by SW whenever Imax is adjusted .

### Formula to calculate current settings : IMAX = KIREF \* VIREF /RSET \* [ (Max\_Current\_Option/4)+(3/4)].

### 21.2 <u>Engineering Tab – Using Default File to populate the parameters:</u>

1. Select **Engineering** Tab.

Note : Ext LED Max.Current(mA) and LOAD Button will be enabled by default.

2. Select LOAD button and choose 'default.ini' file.



Emulator.vi			- 🗆 x
DIODES	AL5887 EMULA	TOR	03-03-2022 / 15:37:36
	vice ALS887		User Guide
왕의 Brt. LED Max. Current(mA) 0 - Vin (V)	S.000 ( Imas(mA) 70 Rat. (X Ohmd 2	J Graf 210 Max. Current Option 1	- SET
	Note Stat withe adjusted wh GREEM	enever linax or Max Current Option is changed and Hitset Breshold is reacched G	of will be adjusted.
Currenti Vo. Forward: Voitage Table Current (mA) Porward Voitage (V) A	Current Viz Forward Voltage Table Current (mA) - Forward Voltage (V) - A	Current VS Forward Voltage Toble Current (mA) Perward Voltage (V) A	
Forward Voltage(V) Outs Vohage(V) 0.000	Forward Voltage(V) Outor Voltage(V) 0.000 0.000		User Input (UI) SW Generated (SW Gen)
			Ut + SW Gen
C Diodes Incorporated. All Rights Reserved			← EXIT

Figure 37: Engineering Tab - default screen

- 3. Emulator will display a pop-up indicating 'Configuration Uploaded'.
- 4. All the fields will be auto-populated by the Emulator as shown below.

Execution Mode	OFFLINE	Device	AL5887					U
Ext. LED Max. Current(m/	A) 70 + Vin	<b>V)</b> 5.000	+ - Imax(mA) 7	0 + Rset (K Ohm	2.1	+ Kiref 210	Max. Current Option	n 1 🔽 🖍 SET REGISTE
			G	Note: Raet will be adj	sted whene	wer Imax or Max Current Option is a	changed and if Rset threshold is re	acched Eref will be adjurted.
								۲
Current Vs Forward V Current (mA)	oltage Table Forward Voltage (V		Current Vs Forward Vo Current (mA)	Forward Voltage (V)	<u>^</u>	Current Vs Forward Vo Current (mA)	Forward Voltage (V)	SAVE
10	1.803		10	2.400	~	10	2.500	_
20	1.900		20	2.500		20	2.600	
30	2.000		30	2.650		30	2.750	
40	2,100		40	2 700		40	2,800	LOAD
50	2.120		50	2.750		50	2.850	
60	2.150		60	2.800		60	2.900	I
70	2.170		70	2.850		70	3.000	C RESET
		v			$\sim$		v	
Forward Voltage(V	) Outx Voltage(V)		Forward Voltage(V)	Outx Voltage(V)		Forward Voltage(V)	Outx Voltage(V)	
2.170	2.830		2.850	2.150		3.000	2.000	User Input (UI)
	21050			2.150				
								SW Generated (SW Ge
								UI + SW Gen

Figure 38: Engineering Tab - default values loaded

### Note:

- By default, once file is loaded,

Imax, Rset, Kiref, Max Current are set to 70, 2.1, 210, 1 respectively. Also, Forward Voltage and Outx Voltages are calculated for current Imax values.



- Now, User shall make modifications to the current parameters to check how the changes impact other associated parameters.
- SET REGISTER will update Global Dimming Bits (Kiref) and Max Current Option.
- Register Table in LED Tests
  - a) Brightness of selected LEDs in LED Tests and
  - b) AL5887 HW if connected in Online Mode.

#### 21.3 Engineering Tab – Instructions to compute Outx Voltage:

1. Select **Engineering** Tab.

Note : EXT LED Max.Current (mA) and LOAD Button will be enabled by default.

2. Enter the **EXT LED Max.Current** Value (To be updated based on datasheet and is recommended to be less than 70 mA).

When entered, multiple fields are enabled automatically as in the screenshot below.

D E	mulator.vi								- X
D	HODES.		AL	5887 EMUL	ATO	DR		0.	3-03-2022 / 15:39:15
	Execution Mode	OFFLINE Device	AL5887						User Guide
Engineering LED Tests	Ext. LED Max. Current(mA	) 70 + Vin (V) 5.0	000 <mark>+</mark> Imax(mA) 7	0 + Rset (K Ohms)	2.1	+ Kiref 210	<ul> <li>Max. Current Option</li> </ul>	1 🗸	SET REGISTER
gineering	RI	Đ	G	Note: Rset will be adjuste	d wheneve		changed and if Rset threshold is reacc	hed Kiref will be a	gusted.
5	Current Vs Forward Vo		Current Vs Forward V			Current Vs Forward Ve			
	Current (mA)	Forward Voltage (V) 🔺	Current (mA)	Forward Voltage (V)		Current (mA)	Forward Voltage (V) 🔺		SAVE
	10		10			10			
	20		20			20			
	30		30			30			
	40		40			40		l	
	50		50			50			
	60		60			60		ſ	RESET
	70		70			70			C SETTINGS
								L L	Serritos
		~		~			~		
	Forward Voltage(V) 0.000	Outx Voltage(V) 0.000	Forward Voltage(V)	Outx Voltage(V) 0.000		Forward Voltage(V) 0.000	Outx Voltage(V)		Input (UI) enerated (SW Gen)
				V DONE				UI +	5W Gen
	© Diodes Incorporated. All F	lights Reserved							← exit

Figure 39: Engineering Tab, LED Current Updated

3. Update Vin if the values used are different from the default 5V.

4. Manually Enter the Forward Voltage(s) for each current Value based on real LED I-V characteristics for RED, GREEN and BLUE Table.

Note:

- Load defaults button auto-populates the blank table fields with a default value 1.0V.
- **Reset settings** will reset all the fields to Step #1



RUED			A	5887 EMULA	TOK		
Execution Mode	OFFLINE	Device	AL5887				G
Ext. LED Max. Current(m	A) 70 + Vin (	V) 5.000	- Imax(mA)		21 Erel 210	Max. Current Option	REGIST
				REEN			
Current Vs Forward	Voltage Table		Current Vs Forward \	/oltage Table	Current Vs Forward	/oltage Table	
Current (mA)	Forward Voltage (V	) ^ (	Current (mA)	Forward Voltage (V) A	Current (mA)	Forward Voltage (V)	SAVE:
10	1.000		10	1.000	10	1.000	
20	1.000		20	1.000	20	1.000	
30	1.000		30	1.000	30	1.000	LOAD
40	1.000		40	1.000	40	1.000	
50	1.000		50	1.000	50	1.000	
60	1.000		60	1.000	60	1.000	6
70	1.000		70	1.000	70	1.000	C RESET
		~		~		~	
Forward Voltage(V			Forward Voltage(V	and the second designed and the second se	Forward Voltage(V	and the second se	
0.000	0.000		0.000	0.000	0.000	0.000	User input (UI)
							SW Generated (SW G
		6	LOAD	and the second second second			UI + SW Gen
			DEFAULTS	V DONE			

Figure 40: Engineering Tab, default Forward voltages loaded

5. Once the Current Vs Forward Voltage Table values have been entered, select **DONE** button.

Note: Current Configuration Parameters will be disabled until DONE is selected.

6. All the fields will be enabled now.

	ES	AL	5887 EMULA	TOR		- D ×
Execution Execution Ext. LED Max. C	h Mode OFFLINE De	vice AL5887				User Guide
Ext. LED Max. C	Current(mA) 70 + Vin (V)	5.000 Imax(mA)	70 Rset (K Ohms) Z		Max. Current Option	SET REGISTER
-			REEN			
Current Vs	Forward Voltage Table	Current Vs Forward V	foltage Table	Current Vs Forward V	oltage Table	
Curren	nt (mA) Forward Voltage (V) A	Current (mA)	Forward Voltage (V) 🔺	Current (mA)	Forward Voltage (V)	SAVE
1	0 1.000	10	1.000	10	1.000	
2	0 1.000	20	1.000	20	1.000	
3	0 1.000	30	1.000	30	1.000	
4	0 1.000	40	1.000	40	1.000	L cons
5	0 1.000	50	1.000	50	1,000	
6	0 1.000	60	1.000	60	1.000	States and a subscription of the
7	0 1.000	70	1.000	70	1.000	
Forward	Voltage(V) Outx Voltage(V)	Forward Voltage(V	) Outx Voltage(V)	Forward Voltage(V	) Outs Voltage(V)	
1.000	and the second se	1.000	4.000	1.000		User Input (UI) SW Generated (SW Gen)
						Ul + SW Gen
	orated. All Rights Reserved					← EXIT

Figure 41: Engineering Tab, all the fields enabled



#### Note:

- Imax will be set to a value equivalent EXT LED Max.Current Max or to a max 70 mA by default. Rset and Kiref will be adjusted based on the Imax Value. Max. Current Option will be set to 0 by default.
- Now, User shall make modifications to the current parameters to check how the changes impact other associated parameters.
  - SET REGISTER will update Global Dimming Bits (K<sub>iref</sub>) and Max Current Option in
  - a) Register Table in LED Tests
  - b) Brightness of selected LEDs in LED Tests and
  - c) AL5887 HW if connected in Online Mode.

7. Select **SAVE** and provide a new file name to save the current configuration for future use.



#### 22 Micro Controller setup – Using the Arduino board as an example

The AL5887 Demo board can easily be connected to a  $\mu$ C of your choice. Below is an example of an Arduino setup.

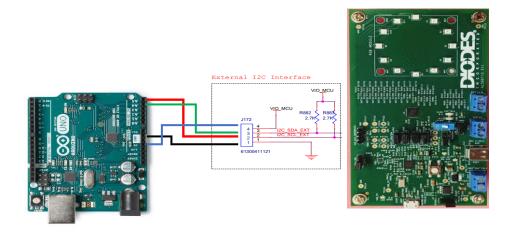


Figure 42: Wiring diagram from Arduino board to Demo board through external I2C interface

Signal	Arduino UNO R3	AL5887 DEMO
SCL	A5	J172 pin 2
SDA	A4	J172 pin 3
VIO	5V	J172 pin 4
GND	GND	J172 pin 1

Table 7: Arduino I2C connections

```
22.3 Example code:
```

```
/*
    Author: Diodes INC */
/*
     Date: 4/1/2023
                      */
/* Company: Diodes Incorporated */
#include<Wire.h>
#define I2C_Addr 0x30 // I2C address
// main function that allows us to communicate with the chip
void writeByte(uint8_t deviceAddress, uint8_t registerAddress, uint8_t registerData) {
 Wire.beginTransmission(deviceAddress); // sends device address and starts communication
 Wire.write(registerAddress);
                                 // sends register address
 Wire.write(registerData);
                               // sends register data
 Wire.endTransmission();
                                // stops communication
}
// put your setup code here, to run once:
void setup() {
 Wire.begin();
 Wire.setClock(200000); // set I2C to run at 200kHz
```



initialize();

### AL5887EV1 EVB User Guide

```
}
// put your main code here, to run repeatedly:
void loop() {
 mode1(); // change this to whatever mode is desired
}
void initialize() { // setup the board
 writeByte(I2C_Addr, 0x00, 0x40); // write a 1 to CHIP_EN
 writeByte(I2C_Addr, 0x38, 0xFF); // write a 1 to CHIP_EN
 writeByte(I2C_Addr, 0x00, 0x40); // write a 1 to CHIP_EN
 for (uint8_t i = 0x08; i <= 0x13; i++) { // start at first brightness register and go to the last
  writeByte(I2C_Addr, i, 0x80); // write all brightness to half
 }
 for (uint8_t i = 0x14; i <= 0x37; i++) { // start at first color register and go to the last
  writeByte(I2C_Addr, i, 0x00); // write all color to 0
 }
}
/* Spin and Fade */
void mode1() {
 for (uint8_t i = 0; i < 12 ; i++) {
  writeByte(I2C_Addr, 0x14 + i * 3, 0x80); // write half color to red leds
  delay(100); // add a 0.1s delay before turning on the next LED
 }
 for (uint8_t j = 0; j < 12; j++) {
  writeByte(I2C_Addr, 0x16 + j * 3, 0x80); // write half color to blue leds
  delay(100);
 }
 for (uint8_t k = 0; k < 12; k++) {
  writeByte(I2C_Addr, 0x15 + k * 3, 0x80); // write half color to green leds
  delay(100);
 }
 for (uint8_t m = 1; m <= 16; m++) {
  uint8_t brightness = 128 - m * 8; // start decreasing the brightness
  for (uint8_t n = 0x08; n <= 0x13; n++) {
   writeByte(I2C_Addr, n, brightness);// write updated brightness to brightness registers
  }
  delay(100);
 }
 for (uint8_t p = 0x14; p <= 0x37; p++) {
  writeByte(I2C_Addr, p, 0x00);
 }
 for (uint8_t q = 0x08; q <= 0x13; q++) {
  writeByte(I2C_Addr, q, 0x80);
 }
 delay(500);
```





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