CAT3649AGEVB

CAT3649 Evaluation Board User's Manual

ON Semiconductor®

EVAL BOARD USER'S MANUAL

Introduction

This document describes the CAT3649 evaluation board for the ON Semiconductor CAT3649 6−Channel Quad−Mode LED Driver with an Ambient Light Sensor circuit, NOA1211, that can control the LEDs intensity proportionally with the ambient light intensity.

The functionality and major parameters of the CAT3649 can be evaluated with the CAT3649 evaluation board.

A detailed description and electrical characteristics are available in the CAT3649 and NOA1211 datasheets.

Board Hardware

The evaluation board contains one CAT3649 in an application circuit driving a total of six LEDs and one NOA1211. The Ambient Light Sensor is connected to the LED driver via the C8051F321 microcontroller, which is illustrated in Figure 2.
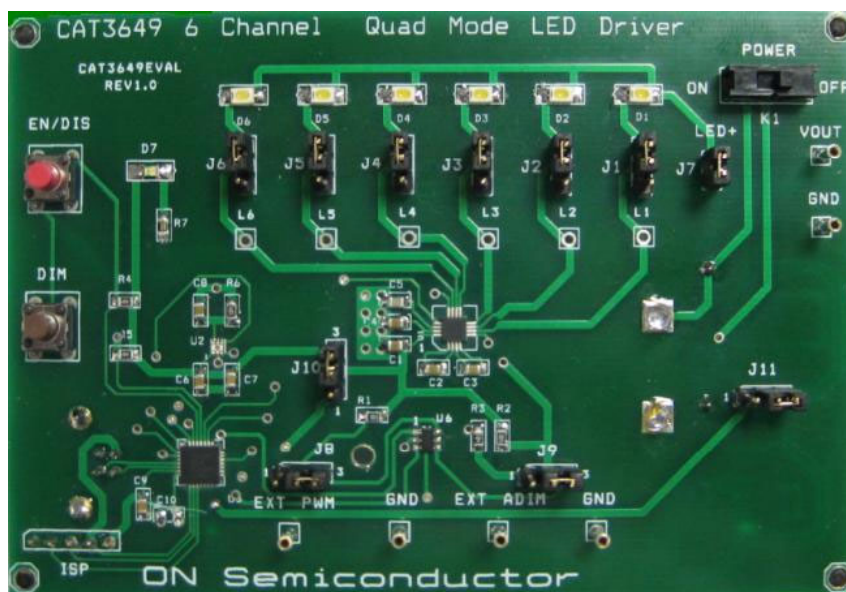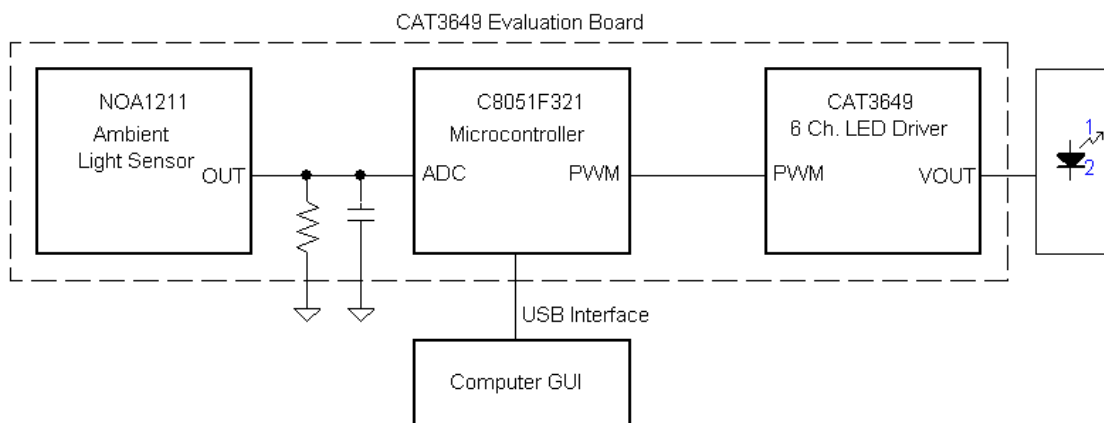

Figure 1. CAT3649 Evaluation Board
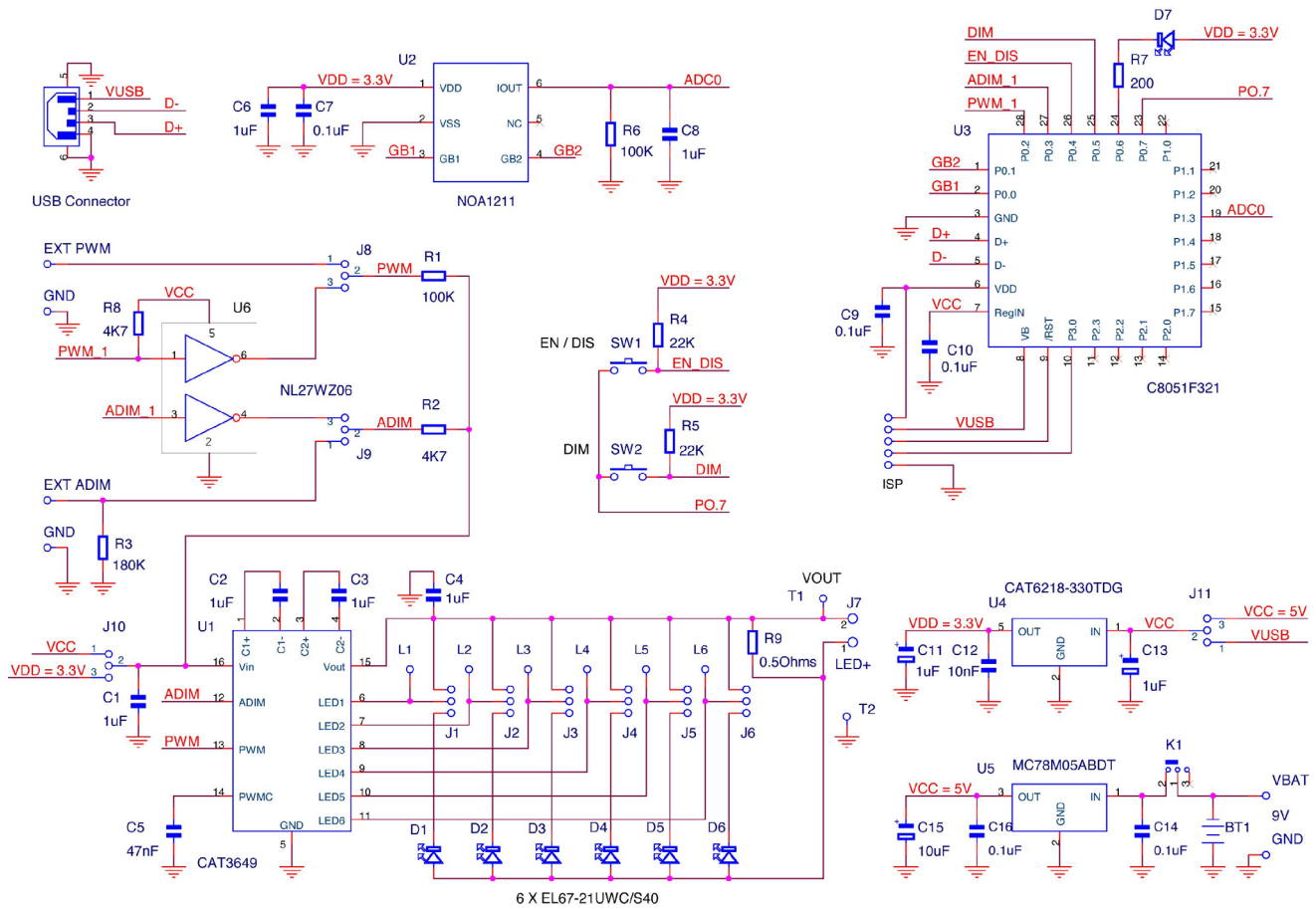

Figure 2. Ambient Light Sensor Mode Block Diagram

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Figure 3. CAT3649AGEVB Board Schematic

Table 1. BILL OF MATERIALS*

Desig-nator	Qty	Description	Value	Toler-ance	Footprint	Manufacturer	Manufacturer Part Number	Substi-tution Allowed
U1	1	6 Channel LED Driver	-	-	TQFN16	ON Semiconductor	CAT3649HV3-GT2	No
U2	1	Ambient Light Sensor	-	-	3 x 3 mm	ON Semiconductor	NOA1211	No
U3	1	8 bit Microcontroller	-	-	CUDFN	Silicon Laboratories	C8051F321	Yes
U4	1	Low Dropout Regulator	(5 V to 3.3 V)	-	1.6 x 1.6	ON Semiconductor	CAT6218-330TDG	No
U5	1	5 V Voltage Regulator	-	-	MLP-28	ON Semiconductor	MC78M05ABDT	No
D1 to D6	6	White LED	-	-	SOT-223	Lite-On	LTW-150TK	Yes
D7	1	Red LED	-	-	DPAK-3	Everlight	EL17-215SURC	Yes
C1 to C4, C6, C8, C11, C13	8	Ceramic Capacitor	1 μF / 10 V, X7R	10%	1206	Kemet	C0805C105K9RACTU	Yes
C7, C9, C10, C16, C14	5	Ceramic Capacitor	100 nF	10%	0805	AVX	0805ZC104KAT2A	Yes
C5	1	Ceramic Capacitor	47 nF	10%	0805	AVX	08053C473KAT2A	Yes
C15	1	Tantalum Capacitor	10 μF/10V	10%	0805	Vishay	TM8R106K010UBA	Yes

*All products listed are Pb−free.

Table 1. BILL OF MATERIALS*

Desig-nator	Qty	Description	Value	Toler-ance	Footprint	Manufacturer	Manufacturer Part Number	Substi-tution Allowed
R1	1	SMD Resistor	1/8 W, 100 kΩ	1%	0805	Vishay	RL0805K100-1	Yes
R2	1	SMD Resistor	1/8 W, 4.7 kΩ	1%	1210	Vishay	RL0805K004.7-1	Yes
R3	1	SMD Resistor	1/8 W, 180 Ω	1%	0805	Vishay	RL0805K180-1	Yes
R4, R5	2	SMD Resistor	1/8 W, 22 kΩ	1%	0805	Vishay	RL0805K022-1	Yes
R6	1	SMD Resistor	1/8 W, 100 kΩ	1%	0805	Vishay	RL0805K100-1	Yes
R7	1	SMD Resistor	1/8 W, 200 Ω	1%	0805	Vishay	RL0805E200-1	Yes
R10	1	SMD Resistor	1/8 W, 0.5 Ω	1%	0805	Yageo	RL0805FR-070R5L	Yes
J1 to J6, J8 to J11	10	3-pin Header Connector, 0.1", Single Strip	-	-	1.54 mm x 4.62 mm	MMM	2303-6211TG	Yes
J7	1	2-pin Header Connector, 0.1", Single Strip	-	-	1.54 mm x 3.08 mm	MMM	2302-6211TG	Yes
ISP	1	5-pin Header Connector, 0.1", Single Strip	-	-	1.54 mm x 7.70 mm	MMM	2305-6211TG	Yes
T1 − T8	8	Pin Receptacle (Test Points)	-	-	1.54 mm x 1.54 mm	Mil-Max	Various	Yes
K1	1	Slide Switch, SPDT	-	-	11.60 mm x 4.00 mm	E-Switch	EG1218	Yes
SW1, SW2	2	Pushbutton	-	-	3.50 mm x 6.00 mm	Schukat	DTS31N	Yes
BTH	1	Battery Holder 9 V	-	-	53.90 mm x 29.60 mm	Keystone	1294K-ND	Yes

*All products listed are Pb−free.

Operating Procedure

The CAT3649EVAL board can be configured in two operating modes: stand−alone or PC−controlled.

In both operating modes, the supply source for the VIN rail is selected by the jumper J10 to be either 5 V or 3.3 V. Table 2 shows the configurations for jumper J10 to set the VIN voltage.

Table 2. VIN SELECTION

J10	VIN
1 − 2	5 V
2 − 3	3.3 V

Stand−alone

In this configuration, only the "Analog dimming" function can be tested.

The Ambient Light Sensor (ALS) is disabled in this mode.

The jumper J11 must be set in (2−3) position for stand−alone operation power.

The jumpers J8 and J9 must be set to (2−3) position to use onboard pushbuttons EN/DIS and ADIM.

The evaluation board can be powered either from an on−board 9 V supply (9 V alkaline battery) or from an external supply applied between VBAT and GND test points (located on the bottom side of the board, near the pins for the battery holder).

The EN/DIS pushbutton allows the user to enable or to shutdown the CAT3649 device.

The DIM pushbutton allows the user to program the LED current in 32 discrete values. On each press on this pushbutton, the "ADIM" input receives a 50 μs pulse. On the rising edge of the pulse, the LED current is decreased by 3.2% from full scale.

The user can obtain the same effect by continuously holding the DIM pushbutton down. For each 0.4 second interval, the "ADIM" input of the device will receive a pulse.

PC Controlled

The CAT3649 EVAL board is equipped with a 8−bit microcontroller and can be connected to the PC via USB interface using a USB A/B type cable. This cable can be obtained from a local electronics supply store.

The jumper J11 must be set in (1−2) position for USB power operation.

The jumpers J8 and J9 must be set to (2−3) position to for control of EN/DIS, ADIM, and PWM via USB.

In this mode, the board is powered from the USB interface.

The GUI commands are described in the section "Graphical User Interface (GUI)".

Graphical User Interface (GUI)

After connecting the CAT3649 EVAL board to the PC via USB cable, the user can run the program CAT3649EVAL.exe.

If the program is started without the USB connection, the following message is displayed: "The CAT3649EVAL Board is not detected!".

The CAT3649 operating mode is selected by pressing one of the "check" buttons "PWM" or "ADIM".

PWM Operation Mode

At start−up, on the GUI is selected, automatically, the PWM mode of operation (as shown on Figure 4).

In this mode, the user can increase/decrease the LEDs intensity by moving the potentiometer cursor or by pressing the keys "−>" and "<−" on the keyboard after selection of the potentiometer.

Now, in the frame "CAT3649 Command Mode", the PWM Timing Diagram for a frequency of 300 Hz is displayed. The period of a pulse (3.3 ms) is the sum between "Ton" and "Toff".

ADIM Operation Mode

After pressing the "ADIM" button, the "ADIM" frame becomes enabled (Figure 5). In the "CAT3649 Command Mode" frame, the Timing Diagram is only a line that represents the low level on the ADIM input.

If the "EN/DIS" button is pressed, the device will be enabled. The red LEDs on the GUI and on the board will light.

The Timing Diagram represents, now, the high level on the ADIM input. (Figure 6).

At this moment, the LEDs intensity is at full scale.

If the "DIM" button is pressed for a short time a single pulse is applied to the "ADIM" input of the device.

If the "DIM" button is pressed continuously, at every 0.4 seconds, a pulse is applied to the device. (Figure 7).

If the "EN/DIS" button is pressed again, the device will be disabled. The red LEDs on the GUI and on the board will be off.

At this moment, on the ADIM input is at the low level. (Figure 8).

The LEDs intensity is zero.

Ambient Light Sensor NOA1211 Operation Mode

The Ambient Light Sensor NOA1211 can command the LEDs intensity using the microcontroller and the CAT3649.

If the option button "Select" of the frame of the Ambient Light Sensor is pressed while in PWM mode, the "Gain" frame will be enabled.

In this frame only the "Power Down" option is selected, because the "Ambient Light Sensor", at this moment, is off. (Figure 9).

The user can select one of the options "Medium" or "Low" corresponding at the LED's intensity level domain. (Figure 10). Depending of the light's intensity exposed to the sensor, the LEDs will light proportionally.

Operating mechanism is as follows:

The sensor outputs a current proportional to the ambient light. This current is converted to an output voltage by resistor R6. The output voltage is applied to the input of the 10−bit ADC (Analog to Digital Convertor) from the microcontroller.

The microcontroller converts the digital value, received from ADC, into a PWM signal applied to the CAT3649 LED Driver.

CAT3649 controls the six LEDs' intensity.

Status Box

This box displays various messages about the application status.

Figure 4. GUI – PWM Mode
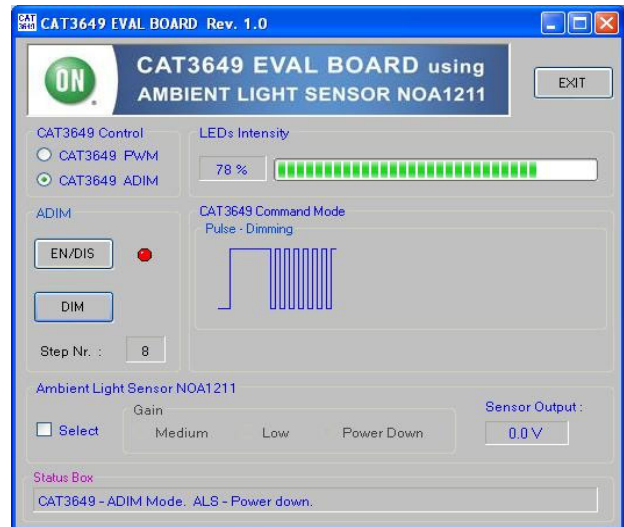
Figure 5. GUI – ADIM Mode

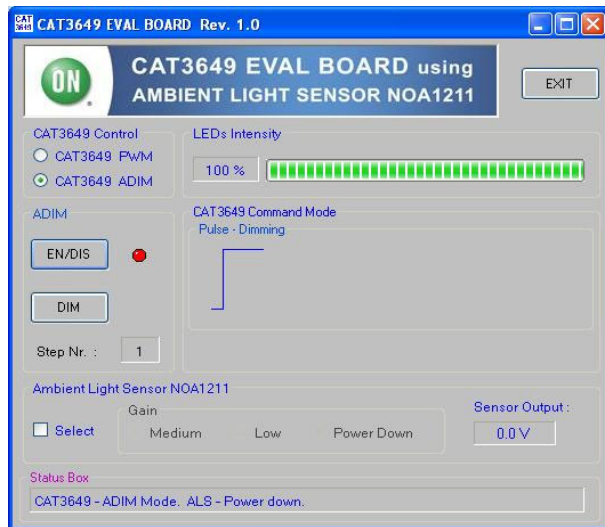Figure 6. GUI – ADIM Mode, Device Enabled

Figure 7. GUI – Pulses on ADIM Input
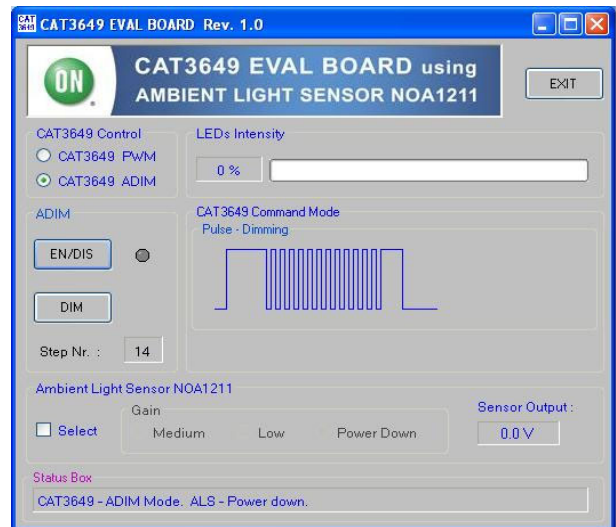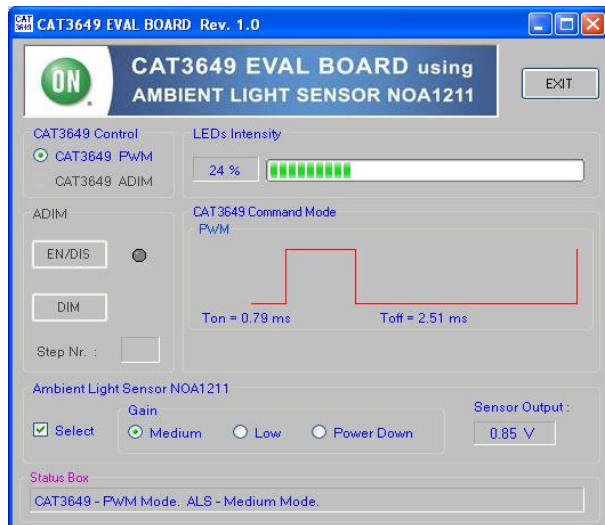

Figure 8. GUI – ADIM Shutdown Command
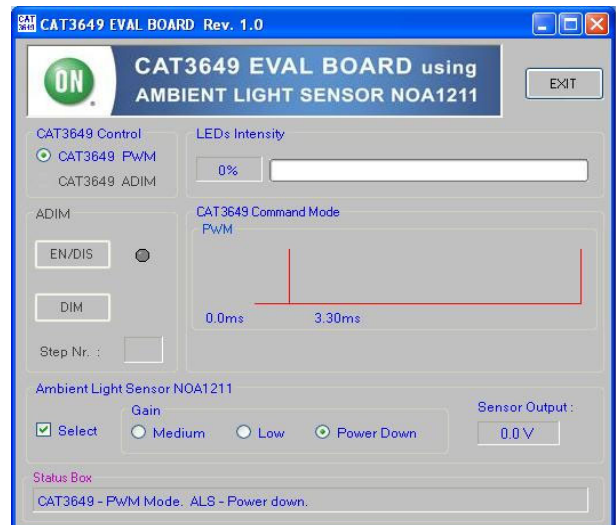

Figure 9. GUI – NOA1211 Selection

Figure 10. GUI – NOA1211 Power On

CAT3649AGEVB

TEST PROCEDURE FOR THE CAT3649AGEVB EVALUATION BOARD

1. Set the switch K1 in "OFF" position.
2. Verify that shunts are installed on jumpers J1 to J6 in the top position.
3. Verify that a shunt is installed on jumper J7.
4. Set a jumper shunt on the header-pin connector J11 in (1,2) position.
5. Set a jumper shunt on the header-pin connector J8 in (2,3) position.
6. Set a jumper shunt on the header-pin connector J9 in (2,3) position.
7. Set a jumper shunt on the header-pin connector J10 in (1,2) position.
8. Connect the "CAT3649EVAL" board to the PC through a USB serial interface cable.
9. Run the program "CAT3649 EVAL.exe". On the PC's screen appears the CAT3649EVAL GUI. The "CAT3649 EVAL" board will be powered up.
10. On the GUI, move the potentiometer cursor. On the board, the light intensity of the LEDs will change proportionally.
11. On the GUI, select the "Ambient Light Sensor" frame and then, the "Medium Gain" button. On the board, the light intensity of the LEDs will change proportionally with the ambient light.
12. On the GUI, unselect the "Ambient Light Sensor" frame.
13. On the GUI, select the CAT3649 ADIM and then, "EN/DIS" button. On the board the red LED and the white LEDs will light.
14. On the GUI, select the "DIM" button. On the board, the LEDs light intensity will decrease. At each selection of the "DIM" button, the LEDs light intensity will decrease.
15. On the GUI, select the "EN/DIS" button. On the board the red LED and the white LEDs will not light.
16. Push the "EXIT" button on the GUI.
17. Disconnect the USB interface cable from PC and "CAT3649 EVAL" board.
18. Insert a 9V battery in the battery holder.
19. Set a jumper shunt on the header-pin connector J11 in (2,3) position.
20. On the board, set the switch K1 in "ON" position.
21. On the board, push the "EN/DIS" button. The red LED and the white LEDs will light.
22. On the board, push the "DIM" button. the LEDs light intensity will decrease. At each selection of the "DIM" button, the LEDs light intensity will decrease.
23. On the board, push the "EN/DIS" button. The red LED and the white LEDs will not light.
24. On the board, set the switch K1 in "OFF" position.

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