AND8482/D

CAT3649 Evaluation Board

Prepared by: Fabien Franc and Cornel Rotaru
ON Semiconductor

ON Semiconductor®

http://onsemi.com

APPLICATION NOTE

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.

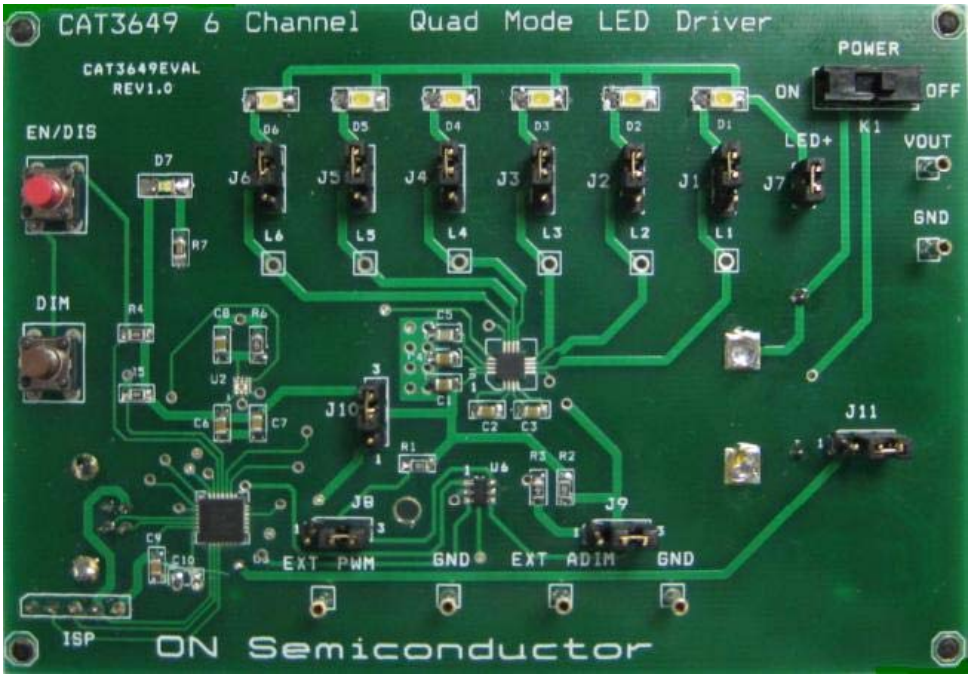

Figure 1. CAT3649 Evaluation Board

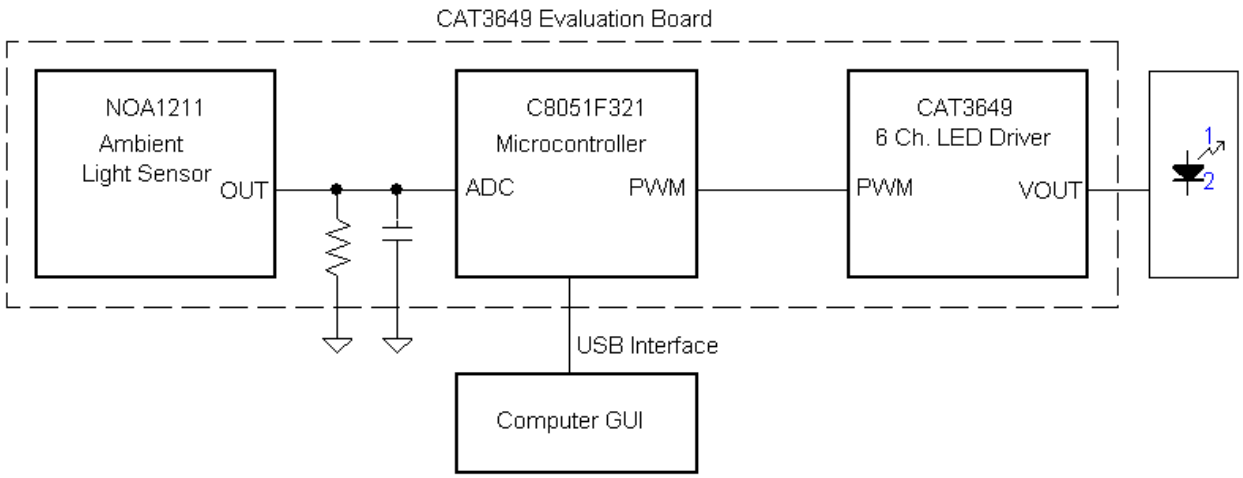

Figure 2. Ambient Light Sensor Mode Block Diagram

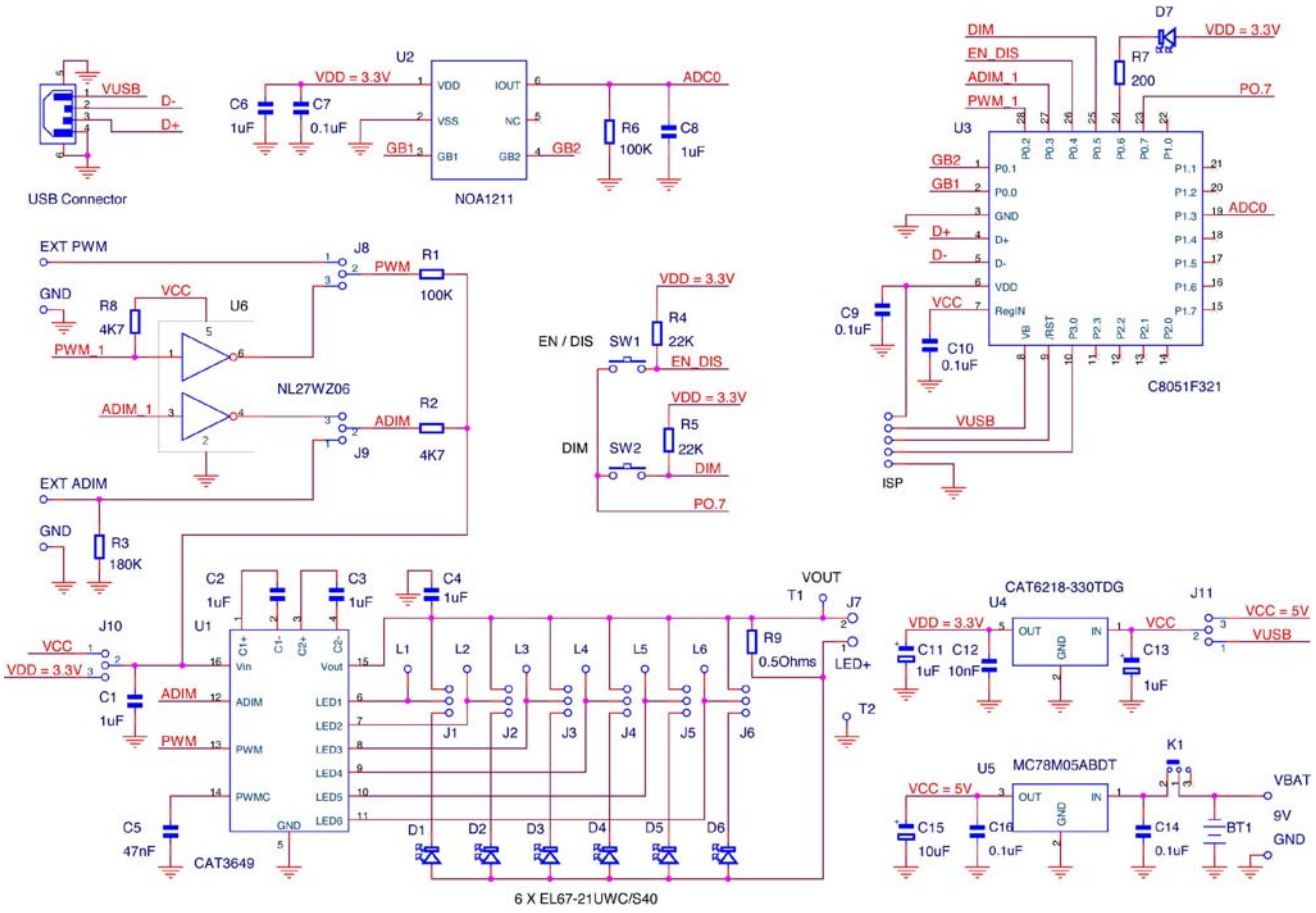

Figure 3. CAT3649EVAL Board Schematic

Table 1. CAT3649 EVAL BOARD LIST OF COMPONENTS

Name	Manufacturer	Description	Package	Part Number	Units
U1	ON Semiconductor	6 Channel LED Driver	TQFN16 3 x 3 mm	CAT3649	1
U2	ON Semiconductor	Ambient Light Sensor	CUDFN 1.6 x 1.6	NOA1211	1
U3	Silicon Laboratories	8 bit Microcontroller	MLP−28	C8051F321	1
U4	ON Semiconductor	Low Dropout Regulator (5 V to 3.3 V)	SOT−223	CAT6218−330TDG	1
U5	ON Semiconductor	5 V Voltage Regulator	DPAK−3	MC78M05ABDT	1
D1 to D6	Lite−On	White LED	Size 1206	LTW−150TK	6
D7	Everlight	Red LED	Size 0805	EL17−215SURC	1
C1 to C4, C6, C8, C11, C13	Kemet	Ceramic Capacitor 1 μF / 10 V, X7R	Size 0805	C0805C105K9RACTU	8
C7, C9, C10, C16, C14	AVX	Ceramic Capacitor 100 nF	Size 0805	CVNF100K0805	5
C5	AVX	Ceramic Capacitor 47 nF	Size 0805	CVNF47K0805	1
C15	Vishay	Tantalum Capacitor 10 μF/10 V	Size 1210	CTUF010U10B	1
R1	Vishay	SMD Resistor 1/8 W, 100 kΩ, 1%	Size 0805	RL0805K100−1	1
R2, R8	Vishay	SMD Resistor 1/8 W, 4.7 kΩ, 1%	Size 0805	RL0805K004.7−1	3
R3	Vishay	SMD Resistor 1/8 W, 180 Ω, 1%	Size 0805	RL0805K180−1	1
R4, R5	Vishay	SMD Resistor 1/8 W, 22 kΩ, 1%	Size 0805	RL0805K022−1	2
R6	Vishay	SMD Resistor 1/8 W, 100 kΩ, 1%	Size 0805	RL0805K100−1	1
R7	Vishay	SMD Resistor 1/8 W, 200 Ω, 1%	Size 0805	RL0805E200−1	1
R9	Vishay	SMD Resistor 1/8 W, 1.2 kΩ, 1%	Size 0805	RL0805K001.2−1	1
R10	Yageo	SMD Resistor 1/8 W, 0.5 Ω, 1%	Size 0805	RL0805FR−070R5L	1
J1 to J6, J8 to J11	MMM	3−pin Header Connector, 0.1″, Single Strip		2303−6211TG	10
J7	MMM	2−pin Header Connector, 0.1″, Single Strip		2302−6211TG	1
ISP	MMM	5−pin Header Connector, 0.1″, Single Strip		2305−6211TG	1
T1 − T8	Mil−Max	Pin Receptacle (Test Points)			8
K1	E−Switch	Slide Switch, SPDT		EG1218	1
SW1, SW2	Schukat	Pushbutton		DTS31N	2
BTH	Keystone	Battery Holder 9 V		1294K−ND	1
K2	Schukat	USB Connector, 90°, Type B		USB−BP	1

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.

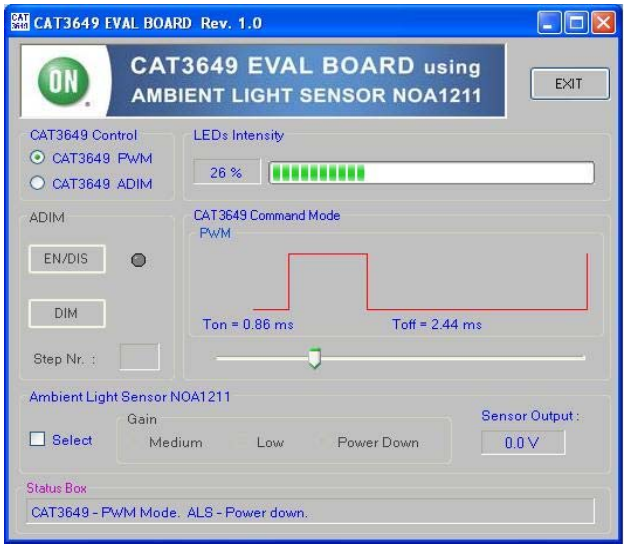

Figure 4. GUI – PWM Mode

Figure 5. GUI – ADIM Mode

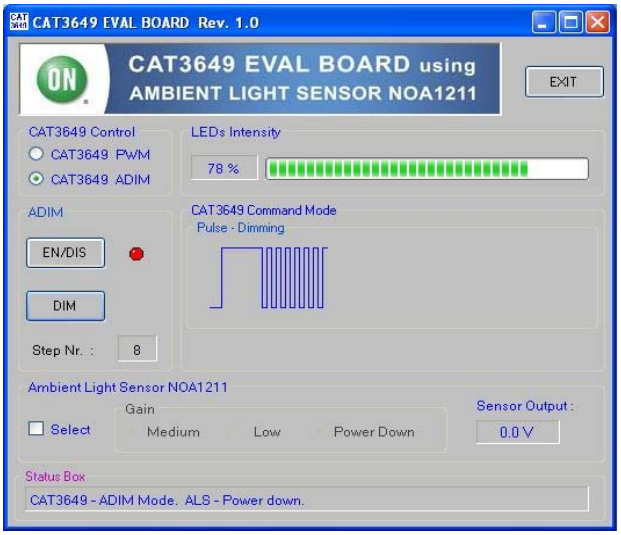

Figure 6. GUI – ADIM Mode, Device Enabled

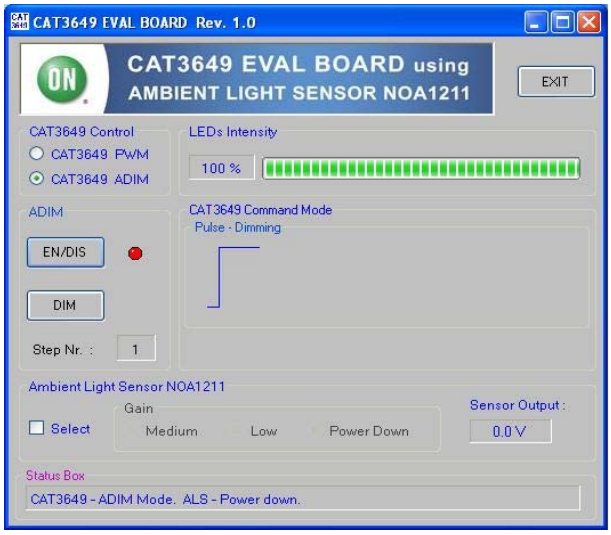

Figure 7. GUI – Pulses on ADIM Input

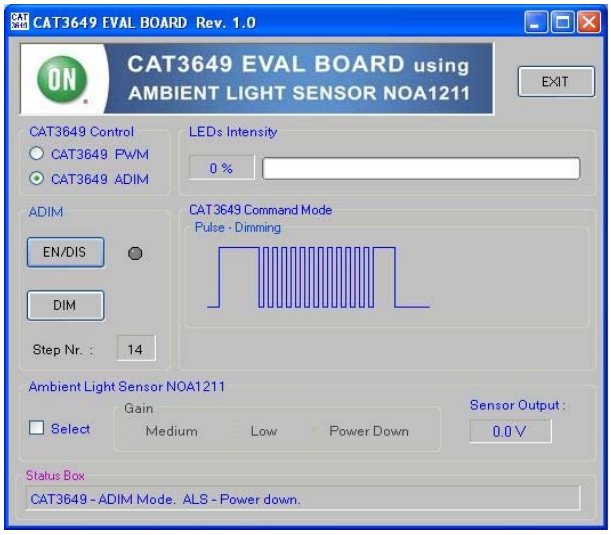

Figure 8. GUI – ADIM Shutdown Command

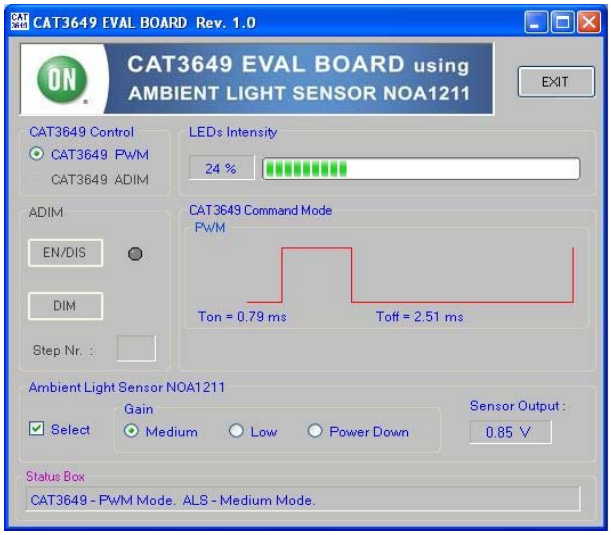

Figure 9. GUI – NOA1211 Selection

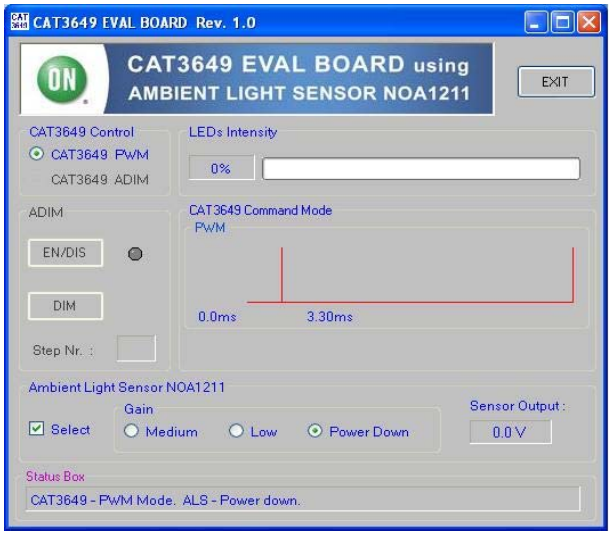

Figure 10. GUI – NOA1211 Power On

Test Procedure using the PC

Set−up

To power the CAT3649 EVAL board from the USB interface, place jumper J11 in the position (1−2).

Select the VIN of the CAT3649 circuit by the jumper J10 to either 3.3 V or 5 V (see Table 1).

Place the jumpers J8 and J9 in position (2−3).

Connect the USB cable between the PC and the CAT3649EVAL Board.

On the PC, run the program CAT3649EVAL.exe.

Operation Mode

Select from the “CAT3649 Control” frame the operation mode for CAT3649.

If the selected mode is PWM, move the cursor of the potentiometer. The LED intensity will change.

If the selected mode is ADIM, execute the operations listed under Stand Alone Mode, where the buttons “EN/DIS” and “DIM” are the GUI’s buttons with the same names.

If the “Ambient Light Sensor” frame with “Medium” or “Low” option is selected while in PWM mode, the white LEDs intensity will be proportional to the ambient light. This feature is off if the “Power Down” option is selected.

Stop Procedure

Press the “EXIT” button from the GUI.

Disconnect the USB cable from the PC and the CAT3649EVAL Board.

Test Procedure in Stand Alone Mode

Set−up

Place K1 slider in “Power off” position.

Place jumper J11 in the position (2−3).

Select the VIN of the CAT3649 circuit by the jumper J10 to either 3.3 V or 5 V (see Table 1).

Place the jumpers J8 and J9 in position (2−3).

Put a 9 V battery in the battery holder or connect a 9 V external power supply to the test points VBAT and GND.

Place K1 slider in “Power on” position.

Operation Mode

Push the “EN/DIS” button. The red LED and the six white LEDs will be lit.

Push for a short time the “DIM” button. The white LED’s intensity will decrease.

Push and hold the “DIM” button. The white LED’s intensity will decrease at each 0.4 seconds.

Remove the header of the jumper J7.

Measure with a voltmeter the voltage across the pins of the jumper J7.

Divide this voltage value by 0.5 ohms (resistor R10). The resulting total current (for six LEDs) should match to the dimming step.

Push the “EN/DIS” button. The red LED and the six white LEDs will be off.

Stop Procedure

Place K1 slider in “Power off” position.

Disconnect the external power supply, if this was used, or remove the battery from battery holder.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5773−3850

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative