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## Overview

This reference design integrates Zilog's ZAURA RF 868MHz Wireless Module onto an LED Driver Base Power Board to create an LED Driver Demonstration Board designed to showcase the features and performance of an inductor-based light-emitting diode (LED) driver with active power factor correction (PFC) and a microcontroller (MCU). This reference design can be used as a basis for developing systems that can control fluorescent lighting installations.

On its own, without the ZAURA RF Wireless Module attached, the LED Driver Base Power Board functions as a demonstration board, providing current to power an LED string. However, the LED Driver Base Power Board cannot control LED brightness because the source of the PWM pulses required to perform this operation is generated by the Z8F2480 MCU on the RF Module.

In combination, the LED Driver Base Power Board with the Module attached, all controlled by a hand-held remote control device, enable RF communication to turn LEDs on and off, and to adjust the brightness of these LEDs within a 10%–100% range. To prevent damage to the LEDs in the event of overheating, the MCU can, for example, monitor the temperature of an LED board, decreasing the brightness of the LEDs if the temperature of the board exceeds a preset threshold.<sup>1</sup>

For purposes of demonstrating RF control, the hand-held ZAURA RF Remote Control device is also included with this reference design. See the [Remote Control Operation](#) section on page 10 for a description of this remote control device.

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- **Note:** If you wish to develop RF remote control software, Zilog recommends purchasing the [ZAURA RF Wireless 868MHz Module Development Kit](#), because the hand-held ZAURA RF Remote Control device included with this reference design uses the same hardware and software libraries as this development kit.
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## Features

This LED Driver with ZAURA Control reference design features the following elements:

- LED Driver Base Power Board
- ZAURA RF 868MHz Wireless Module

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1. This LED Driver with ZAURA Control Reference Design does not include an LED Board.

- Controls LED brightness from a remote source
- 90VAC to 130VAC input
- A thermal protection mechanism can easily be added to decrease the LED brightness as temperature exceeds user defined threshold levels

## Required Items Not Supplied

To run an LED demonstration, the following items will be required in addition to the contents of this reference design.

- One 3-wire AC cord/cable
- One LED target board
- Soldering equipment
- One thermistor (optional)

## Discussion

The LED Driver Demonstration Board is simply comprised of the LED Driver Base Power Board with Zilog's ZAURA RF Wireless Module affixed to it, as shown in Figure 1 (the Module is located on the right side of the figure). The LED Driver Base Power Board is a two-layer surface-mount board that provides easy probe access points to all LED Driver inputs and outputs, allowing the user to quickly connect and measure electrical characteristics and waveforms. The ZAURA RF Wireless Module is a four-layer board featuring an MCU, an RF transceiver, an antenna and passive components.



**Figure 1. LED Driver with ZAURA Control Demonstration Board**

The LED Driver Base Power Board and attached ZAURA Module are powered from a single-phase AC line with a 90–130 V voltage range. The LED Driver Base Power Board provides approximately 20W of output power to drive 24–26 LEDs connected to two parallel strings with 12–13 LEDs per string; common DC current is 500mA at full brightness.

The dimensions of the LED Driver Base Power Board are 7.4" (L) x 1.4" (W) x 1.2" (H). A block diagram of the Board is shown in Figure 2.

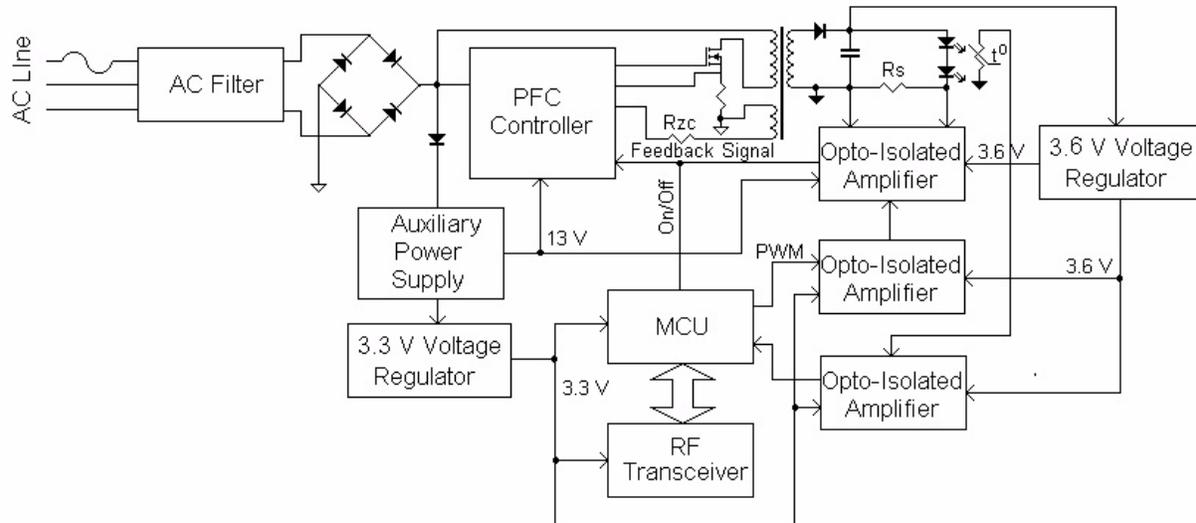


Figure 2. LED Driver with ZAURA Control Demonstration Board Block Diagram



**Warning:** The ZAURA RF 868MHz Wireless Module and the primary section of the LED Driver Base Power Board are electrically connected to an AC power source. If any measurements will be performed on the LED Driver Base Power Board, a power supply with an isolation transformer should be used to avoid electrical shock. The Board contains high voltage points ranging up to 400V. Persons working with the Board should be fully qualified to work with high voltage devices. The low-voltage secondary section of the LED Driver Base Power Board is isolated from the AC line.

## LED Driver Base Power Board

The LED Driver Base Power Board, shown in Figure 3, contains a PFC Controller U1 (L6562A, FAN7527B, or any other direct replacement) with switch Q1 (IXTP7N60P) and transformer T1. An auxiliary power supply with a depletion-mode MOSFET Q2 (IXTA08N50D2) provides approximately 13V to start the PFC from Standby Mode, as well as power to the MCU when in Standby Mode.

Voltage regulator U9 (XC6216B33ER) provides 3.3V to power the MCU and the primary side of the optoisolator U4 (LIA130). A voltage detector U8 (XC6120) stops the PFC in the event of a load disconnect when output voltage on the transformer's T1 secondary winding exceeds its threshold. The PFC resumes operation when voltage falls below this threshold, with a delay determined by an R16, C20, R5, C25 network time constant. Voltage doubler D4, ZD5, C14, R9 provides power to the PFC, the MCU, and the secondary side of optocouplers U2 (LIA130) and U5 (LOC117) at normal PFC operation.



Figure 3. LED Driver Base Power Board, Top View

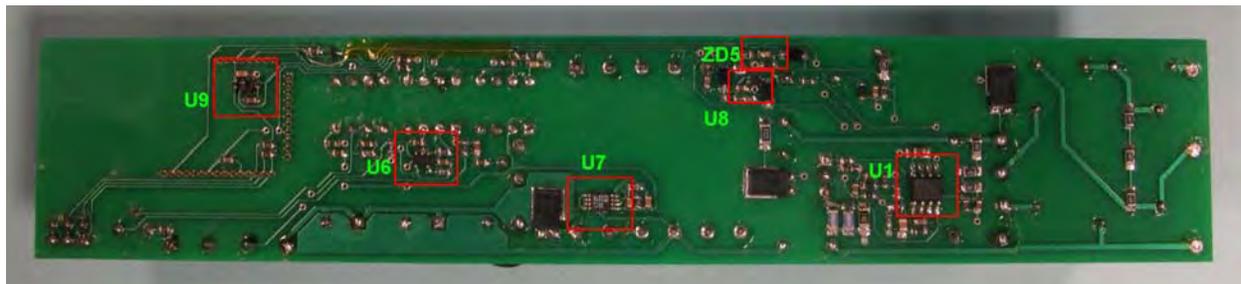


Figure 4. LED Driver Base Power Board, Bottom View

For more information about the functions and characteristics of the PFC Controller's surrounding components, see the [L6562A Transmission-Mode PFC Controller data sheet](#) from ST Micro and the [FAN7527B Power Factor Correction Controller data sheet](#) from Fairchild Semiconductor.

The primary side of the LED Driver Base Power Board contains a power filter U3 (FPP-01), which decreases electrical noise generated by the LED Driver Demonstration Board into the AC net. The secondary part of the LED Driver contains diode D1 (S4PJ), filtering capacitors C2–C4, and voltage regulator U7 (LT3010) to drive the primary side of optocouplers U2 and U5, and to drive the operational amplifier U6 (MCP6410).

A separately-mounted LED Board is connected to the LED Driver Base Power Board by four wires. Two of these wires drive LED+ and LED–; the other two wires are used to measure the temperature at TCR and GND. Figure 5 provides an example.

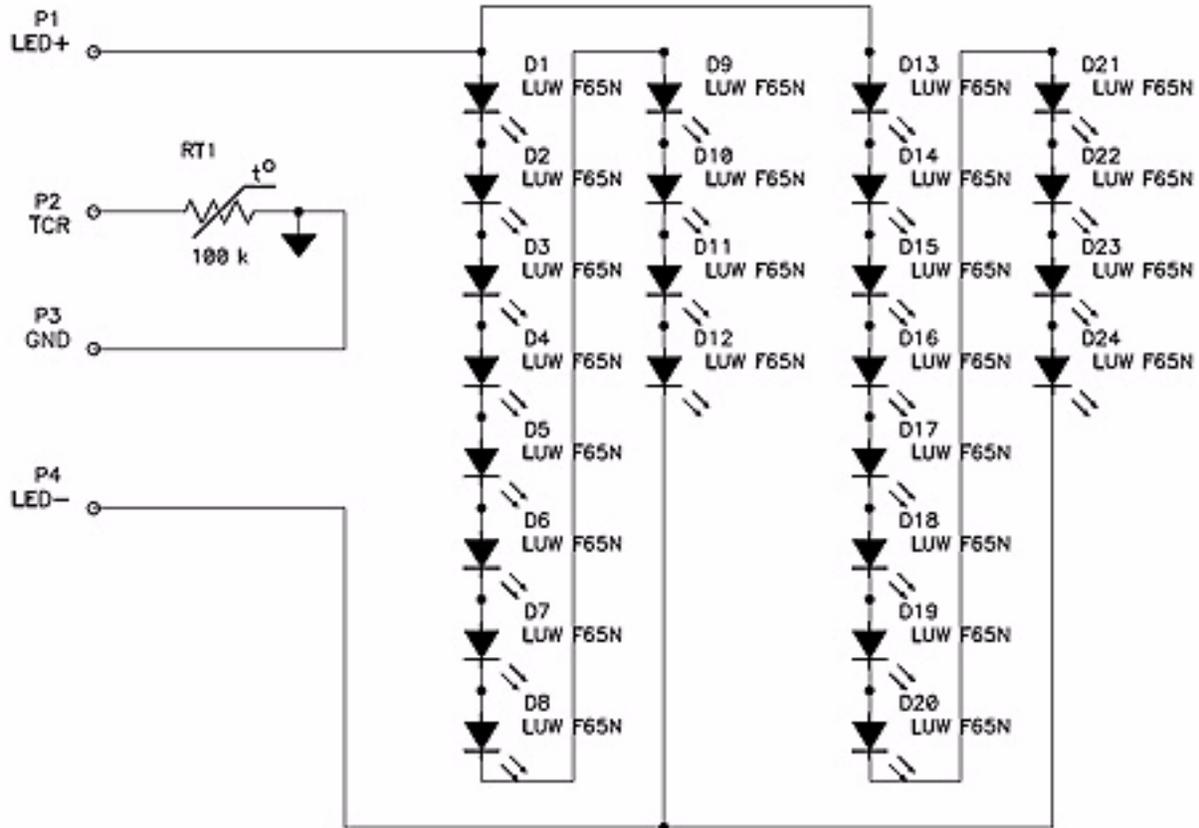


Figure 5. Example: Schematic Diagram of an LED Board

Op-amp U6 converts voltage drops across a thermistor into a signal that the MCU recognizes as the LED Board temperature. This thermistor should be connected between the TCR and GND terminals shown in Figure 5. Resistor R28 is an LED current sensor; signals from this resistor and resistor R29 determine the feedback signal that is applied to PFC Controller U1 through optocoupler U2 to maintain a stable LED current. Variable resistor R17 adjusts the maximum LED current value, while resistor R29 adjusts the minimum LED current.

► **Note:** Zilog does not recommend decreasing LED brightness below 10% of the maximum value, because the PFC may become unstable or shut off completely due to very low load.

## ZAURA RF Wireless Module

The ZAURA RF Wireless 868MHz Module, shown in Figure 6, features a Z8F2480 MCU<sup>2</sup> U14 (in a 44-pin QFN package), an RF transceiver U2 (SX1211), an antenna, and

passive components required by the transceiver for proper operation. For more information about the functions and characteristics of these components, refer to the [ZAURA RF Wireless Modules Product User Guide \(PUG0030\)](#); also see the [Getting Started with ZAURA RF Control Application Note \(AN0336\)](#).

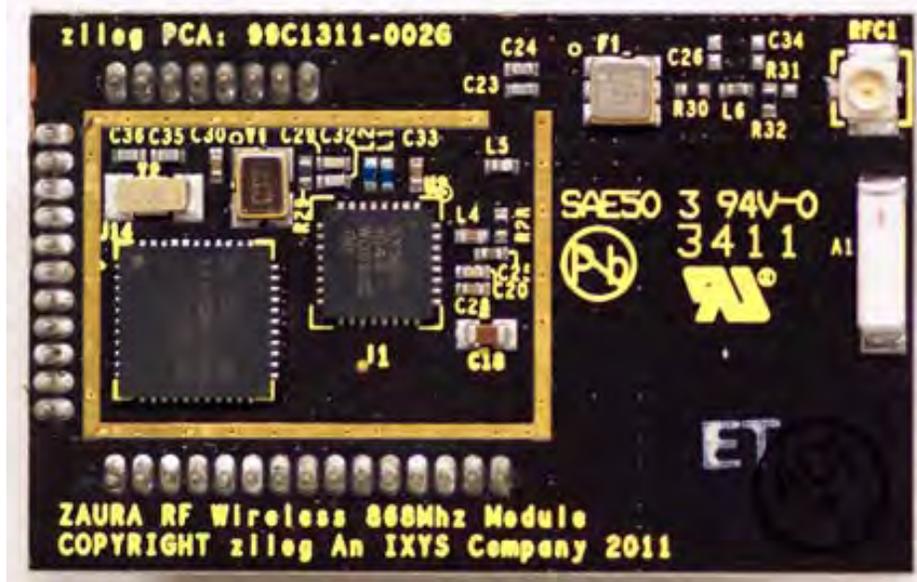


Figure 6. ZAURA RF Wireless Module

## Principles of Operation

After power-up, an auxiliary power supply provides approximately 13V to start the PFC Controller and the MCU. As soon as the PFC Controller becomes active, the LED Driver Base Power Board provides a maximum preset output current, the auxiliary power supply is disabled, and power to the PFC Controller and the MCU is delivered from the transformer's secondary winding. The MCU then awaits commands from the ZAURA RF Remote Control device. These commands allow the PFC Controller to be turned on and off, and to set LED current in a range determined by resistors R17 and R29.

To turn the PFC Controller off, the MCU sets a MOSFET Q3 gate to logic Low. As a result, 3.3V from voltage regulator U9 is applied to a PFC feedback network, setting the PFC into an overvoltage protection mode and disabling it. During this state, the auxiliary power supply provides power to the PFC and the MCU. If a command to turn the PFC on from the ZAURA RF Remote Control device is recognized, the MCU sets the Q3 gate to logic High, and the PFC returns to normal operation mode, with the LED current equal to the value set prior to the PFC being turned off.

To set LED current in a range determined by resistors R17 and R29, the MCU generates PWM pulses (with a duty cycle in the range 0%–100%) in 16 steps according to com-

2. The Z8F2480 MCU is a member of Zilog's Z8 Encore! XP family of 8-bit microcontrollers.

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mands from the ZAURA RF Remote Control device. These steps allow the user to sequentially decrease or increase LED brightness.

These PWM pulses from the MCU apply to the primary side of optocoupler U4, integrate on the secondary side by the R29, R39, R37, C15 network, and result in a voltage drop at LED current sense resistor R28 to form a PFC feedback signal. If no PWM pulses are applied, the feedback signal represents the only voltage drop across LED current sense resistor R28, divided by R17. In this case, LED current is at its maximum value.

PWM pulses with duty cycles greater than zero increase the PFC feedback signal and proportionally decrease the LED current required to hold the feedback signal at the same level. Resistors R17 and R29 change the proportion between the LED current and PWM signals which, respectively, changes the LED current at the same PWM duty cycle.

## LED Driver Software Operation

When the MCU comes out of reset, it calls the `ZAURA_RF_Init()` API from the ZAURA RF Wireless Library to initialize the RF Controller. The `ZAURA_RF_Conf.c` file contains variables referenced by the ZAURA RF Wireless Library to establish a radio configuration compatible with the ZAURA RF Remote Control (50kbps data rate, binary FSK signal centered at 866.2MHz with 100KHz frequency deviation and modulation index 4). This configuration ensures that commands sent by the Remote can be received by the LED Driver. After the radio has been configured, the LED Driver is activated (the PFC is turned on) and set to its maximum brightness (the PWM duty cycle is set to 0%). The PWM signal generated by the MCU has a frequency of approximately 1.024KHz, with up to 33 PWM duty cycle settings that can range from 0% to 100% in increments of approximately 3%. Commands from the ZAURA RF Remote Control instruct the LED Driver to use PWM settings from 0% to 100% in increments of approximately 6%.

The software then enters an infinite loop in which the radio and MCU are placed into a low-power state to conserve energy and to periodically wake up to listen for RF commands from the ZAURA RF Remote Control. Approximately every 220ms, the MCU returns to active mode and calls the `ZAURA_RF_Set_State` API to enable reception of RF packets. When the radio is in receive mode, the firmware waits approximately 22ms for a command from the ZAURA RF Remote Control. If a command is not received, the radio and MCU return to low power mode until the next 220ms wake-up interval. If an RF command is received, the `PktHandler()` routine retrieves the packet from the ZAURA RF Wireless Library and calls the `LedCtrlUpdate()` routine to adjust the PWM level and PFC signal, as appropriate. Every time one of the unreserved buttons on the ZAURA RF Remote is pressed, it transmits 11 small RF packets (each less than 2ms in duration) every 20ms, matching the receive periodicity of the LED Driver software.

Every 5 RF wake-up periods (approximately every 1.1 seconds), the LED Driver samples the voltage on the Temperature Control (TC) input thermistor to determine if the LED Driver board temperature has exceeded a safe level. As LED board temperature rises, thermistor resistance (and voltage) decrease. The default setting of the software is such that if the voltage on the TC input falls below approximately one volt (1V), the LED Driver will set the PWM signal to a 100% duty cycle (minimum current), which allows the board to cool. When the thermistor voltage rises above the threshold, the PWM duty cycle

returns to its normal value. The LED Driver software can be modified to accommodate a gradual current reduction. For more information about this topic, please refer to the comments within the `ADC_PWM.h` header file and to the `InitializeTempTable` routine in the `main.c` file.

## Setup, Configuration and Use

This section describes how to set up, configure and operate the LED Driver with ZAURA Control.



**Warning:** The ZAURA RF 868MHz Wireless Module and the primary section of the LED Driver Base Power Board are electrically connected to an AC power source. If any measurements will be performed on the LED Driver Base Power Board, a power supply with an isolation transformer should be used to avoid electrical shock. The Board contains high voltage points ranging up to 400V. Persons working with the Board should be fully qualified to work with high voltage devices. The low-voltage secondary section of the LED Driver Base Power Board is isolated from the AC line.

Figure 7 shows the connections to the 3-wire AC cord/cable and LED Target Board.

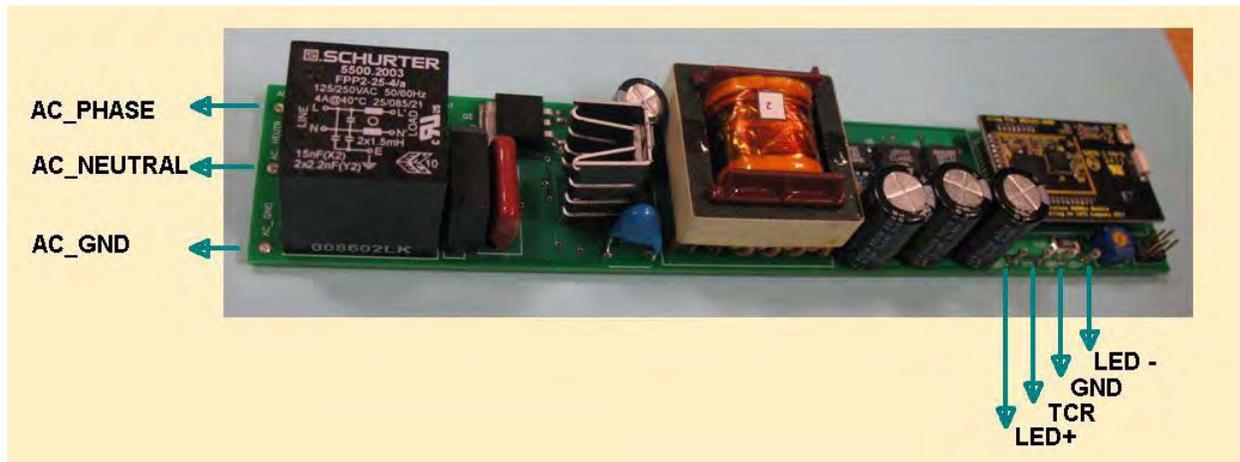


Figure 7. Connections

► **Note:** The LED- and GND terminals are not equal. Connecting the LED cathodes to GND instead of to an LED- terminal may disable the LED Driver Base Power Board due to the resulting lack of a feedback signal.

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## Powering the LED Driver Base Power Board

The LED Driver Base Power Board should be powered from a single-phase AC source with voltage in the 90V to 130V RMS range. If any measurements will be performed on the primary side of the LED Driver Base Power Board, an insulated power source should be used to avoid the potential hazards of electrical shock and damage to the Board.



**Warning:** The Board contains high voltage points ranging up to 400V. Persons working with the Board should be fully qualified to work with high voltage devices. The low-voltage secondary section of the LED Driver Base Power Board is isolated from the AC line.

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The AC line should be connected according the markings on the Board using soldering equipment, as follows:

- AC phase (black wire) to AC\_PHASE terminal
- AC neutral (white wire) to AC\_NEUTRAL
- AC ground (green wire) to AC\_GND

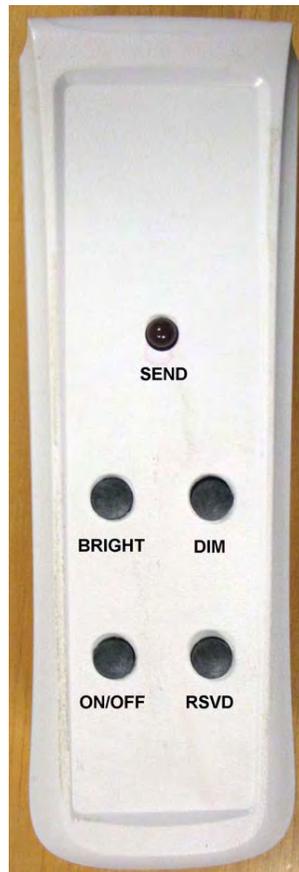
The secondary side of the LED Driver Base Power Board is insulated from the AC line. A load (such as an LED board) should be connected to the LED Driver Base Power Board before powering it up, as follows:

- Connect the positive terminals (anodes) of an LED string(s) to the LED+ terminal
- Connect the negative terminals (cathodes) of an LED string(s) to the LED– terminal
- *Optional:* connect a thermistor between the TCR and GND terminals

After powering up with a delay time of approximately half a second (~0.5s), the Board wakes up and provides maximum output current.

## Remote Control Operation

The ZAURA RF Remote, shown in Figure 8, is the hand-held RF remote control device that conveniently controls the ZAURA RF Module.



**Figure 8. Hand-Held ZAURA RF Remote Control Device**

► **Note:** The remote unit's RSVD button currently does not function; it is designated for future use.

Observe the following procedure to understand and use the remote unit.

1. Install two AA 1.5V batteries (included in the kit) inside the remote control device.
2. With the LED Driver Demonstration Board connected to an AC line, the LED initially illuminates at maximum brightness. At this initialization phase, brightness can only be decreased (adjusted downward).

3. The remote unit offers 16 brightness levels. Experiment with the **DIM** button to decrease the level of brightness, and with the **BRIGHT** button to increase the level of brightness.
4. Use the **ON/OFF** button to turn the LEDs off on the LED board. If the LED board is still connected to an AC line, the LED board remembers the last brightness level that was set, and it will automatically return to this level next time the board is turned on using the Remote.

## Setting the LED Current

The LED Driver Base Power Board is delivered with a factory-preset maximum current value of approximately 530mA and a minimum current value of approximately 53mA. An LED current value in this range may be set using the ZAURA RF Remote Control device provided in the kit.

The maximum LED current can be adjusted to an appropriate value by resistor R17, while minimum current value can be adjusted by resistor R29. However, the number of LEDs used in a string, plus the PFC Controller's settings, can limit maximum LED current. If more than 550mA of LED current are required for 12 LEDs in a string, the PFC setting should be adjusted with respect to the LED manufacturer's recommendations; see the appropriate documentation from the manufacturer.

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- **Note:** Zilog does not recommend setting the minimum LED current below 10% of the maximum value, because the PFC may become unstable or shut off completely due to very low load.
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## Downloading and Installing ZDSII

This RF Module project requires the ZDSII – Z8Encore! Integrated Development Environment. Observe the following procedure to download and install the ZDSII software.

1. Download the latest version of ZDSII for Z8 Encore! from the Downloadable Software category in [the Zilog Store](#).
2. Run the software installation file and follow the on-screen instructions to install ZDSII.

## Viewing and Rebuilding the RF Module Software

The source code/project is provided in this kit so that users can be familiar with the RF Module wireless control but are not expected to modify or change any parameters.

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- **Note:** If you wish to develop RF remote control software, Zilog recommends purchasing the [ZAURA RF Wireless 868MHz Module Development Kit](#), because the hand-held RF Remote included with this reference design uses the same hardware and software libraries as this development kit.
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1. Launch the ZDSII – Z8 Encore! application by navigating via the following default path:  
**Start → Programs → Zilog ZDS II\_Z8Encore!\_<version\_number> → ZDSII\_Z8Encore!<version\_number>**
2. From the **File** menu, select **Open Project**. The Open dialog box appears.
3. Browse to the RD0010\_LED folder which, by default, is located in the following path:  
C:\Program Files\Zilog\ZAURA\_RF\_Wireless\_<version\_number>\RD0010\_LED
4. Select the LedCtrl.zdsproj file from the RD0010\_LED folder, and click **Open** to display the initial ZDSII program screen. To view the source files, double-click the **Project Files** folder on the left side of the IDE interface. Double-click an individual file to open the file in the ZDSII file editor.
5. Select the 866p5\_MHz build configuration file from the ZDSII toolbar. This menu is highlighted in red in Figure 9.

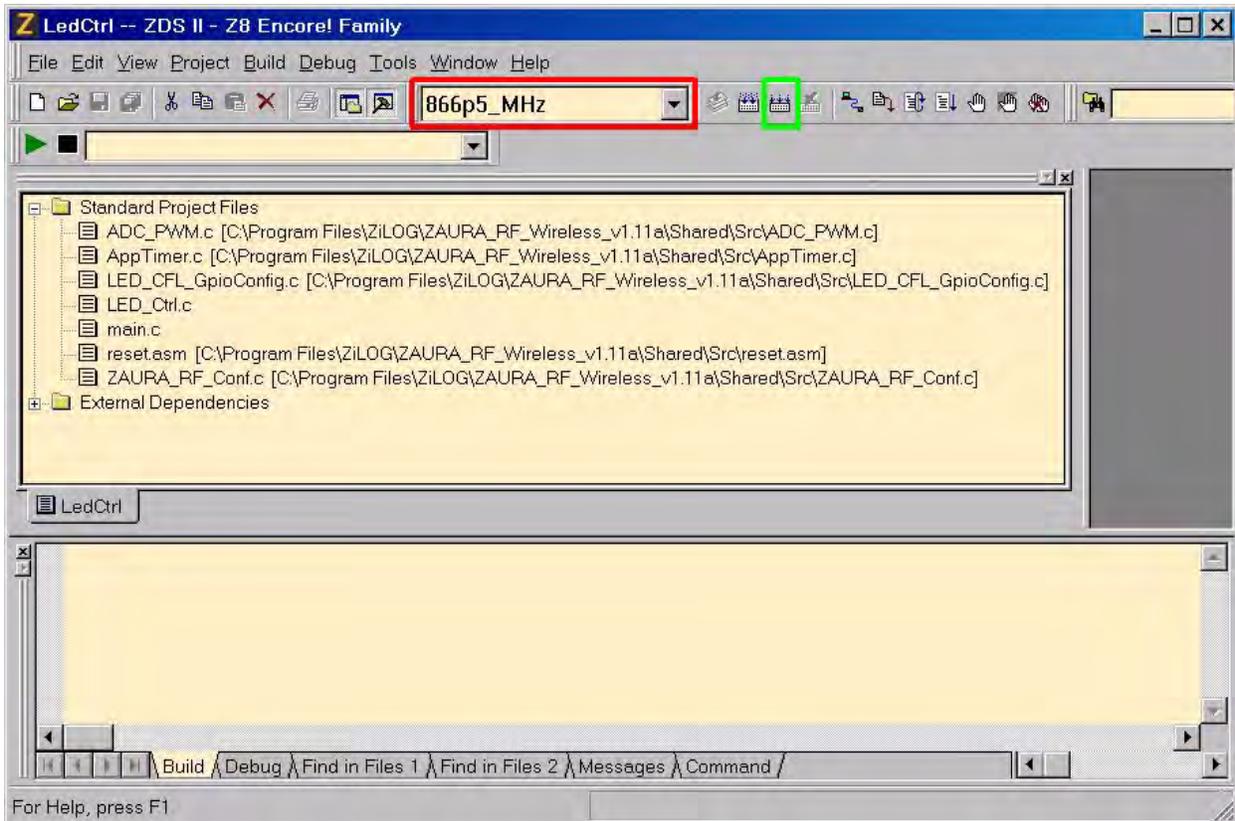


Figure 9. Build Mode Configuration

6. Click the **Rebuild All** toolbar icon, which is highlighted in green in Figure 9.

- When the rebuild is complete, a Build succeeded. message will appear, as highlighted in Figure 10.

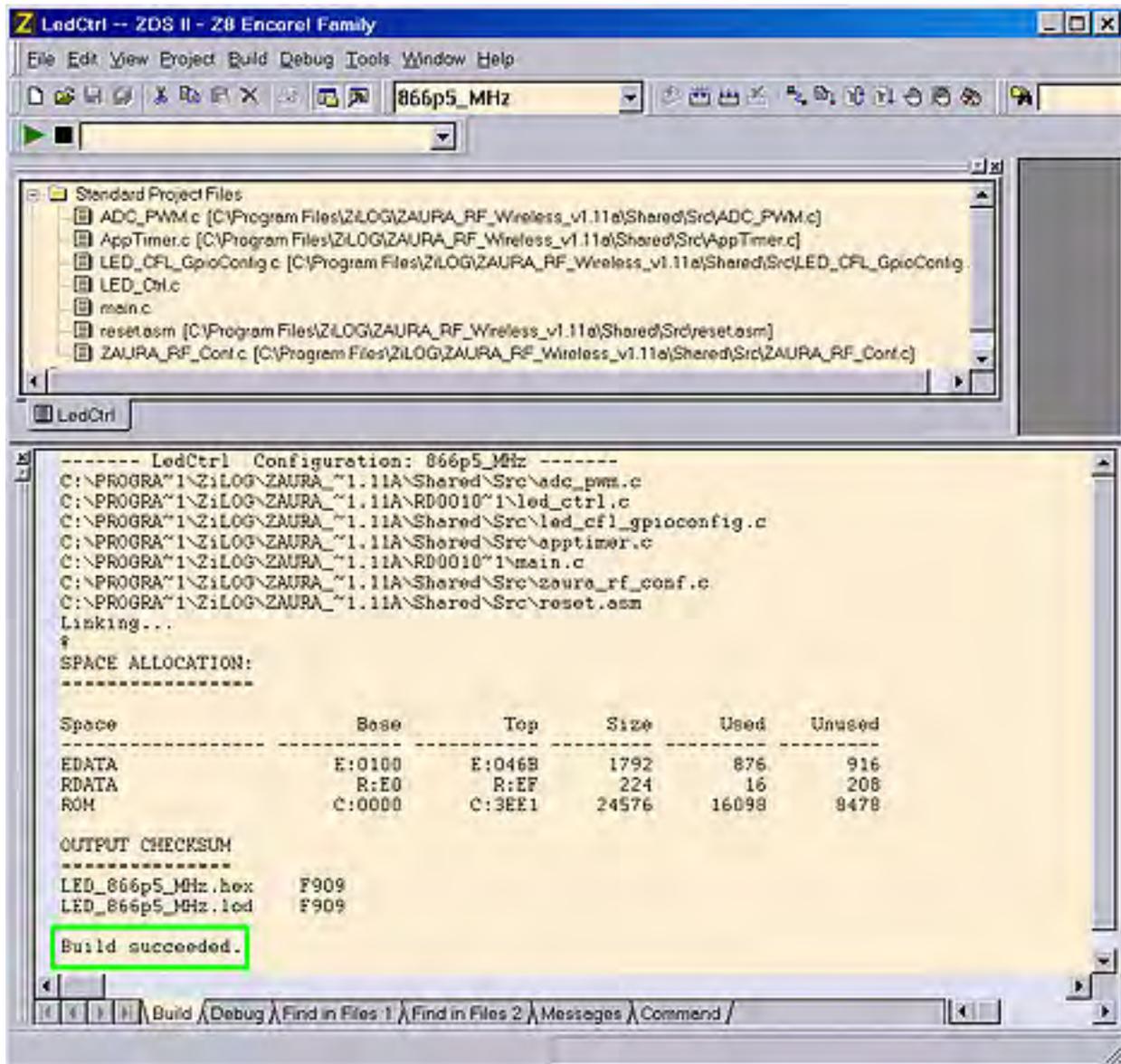


Figure 10. A Successful Build

- If your PC is running the Windows 7 or Vista operating system, your build may not succeed due to possible file folder Properties settings. For a solution to this problem, please see [Appendix C. Troubleshooting an Unsuccessful Build](#) on page 28.

## Electrical Specifications

Figures 11 and 12 show waveforms for the operation of the PFC Controller during Normal Mode; i.e., when the LED Driver Base Power Board is operating properly at nominal load.

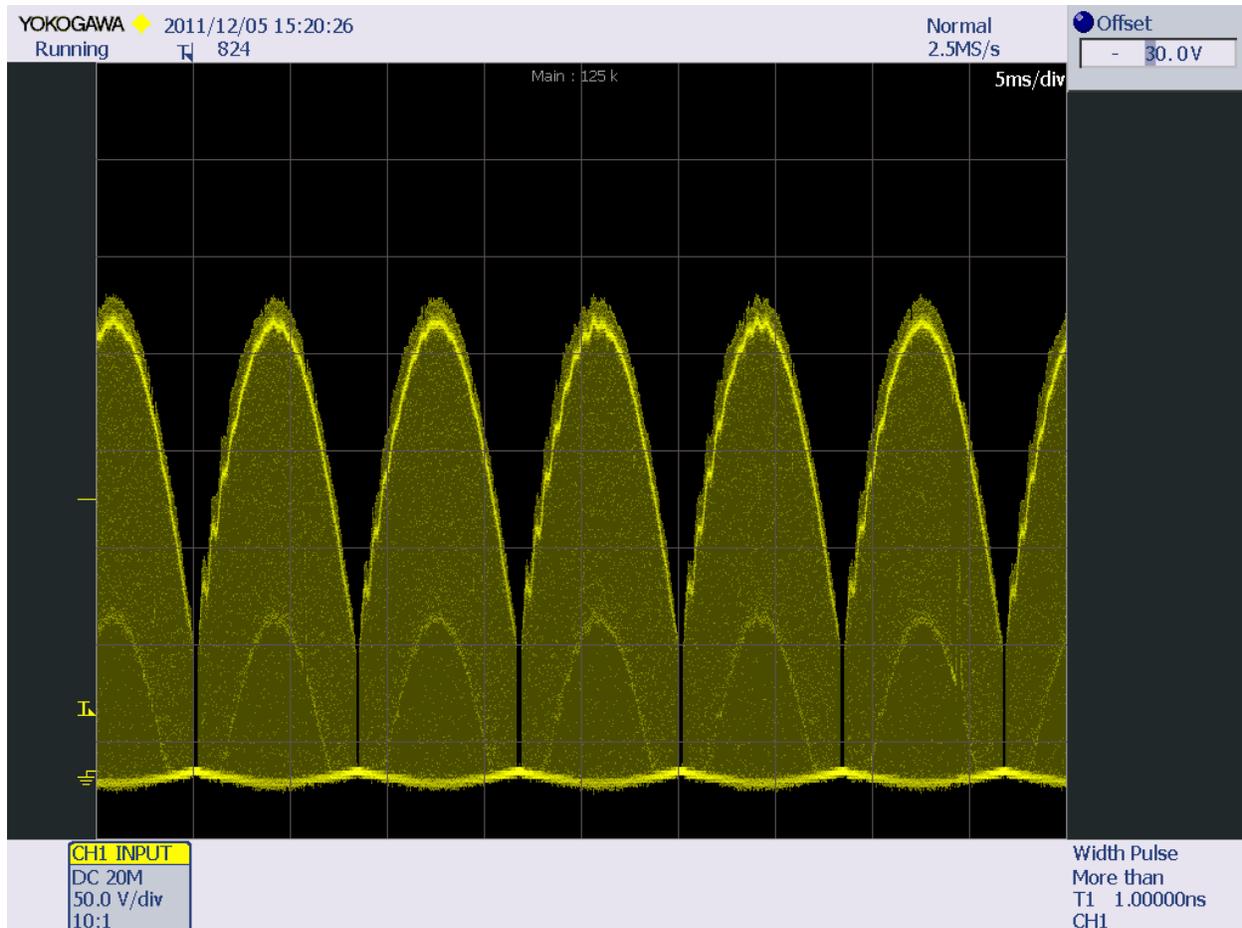


Figure 11. Voltage at Q1 Drain (Pin 3 of T1)

Figure 12 demonstrates the LED Driver Base Power Board's output voltage during normal operation.

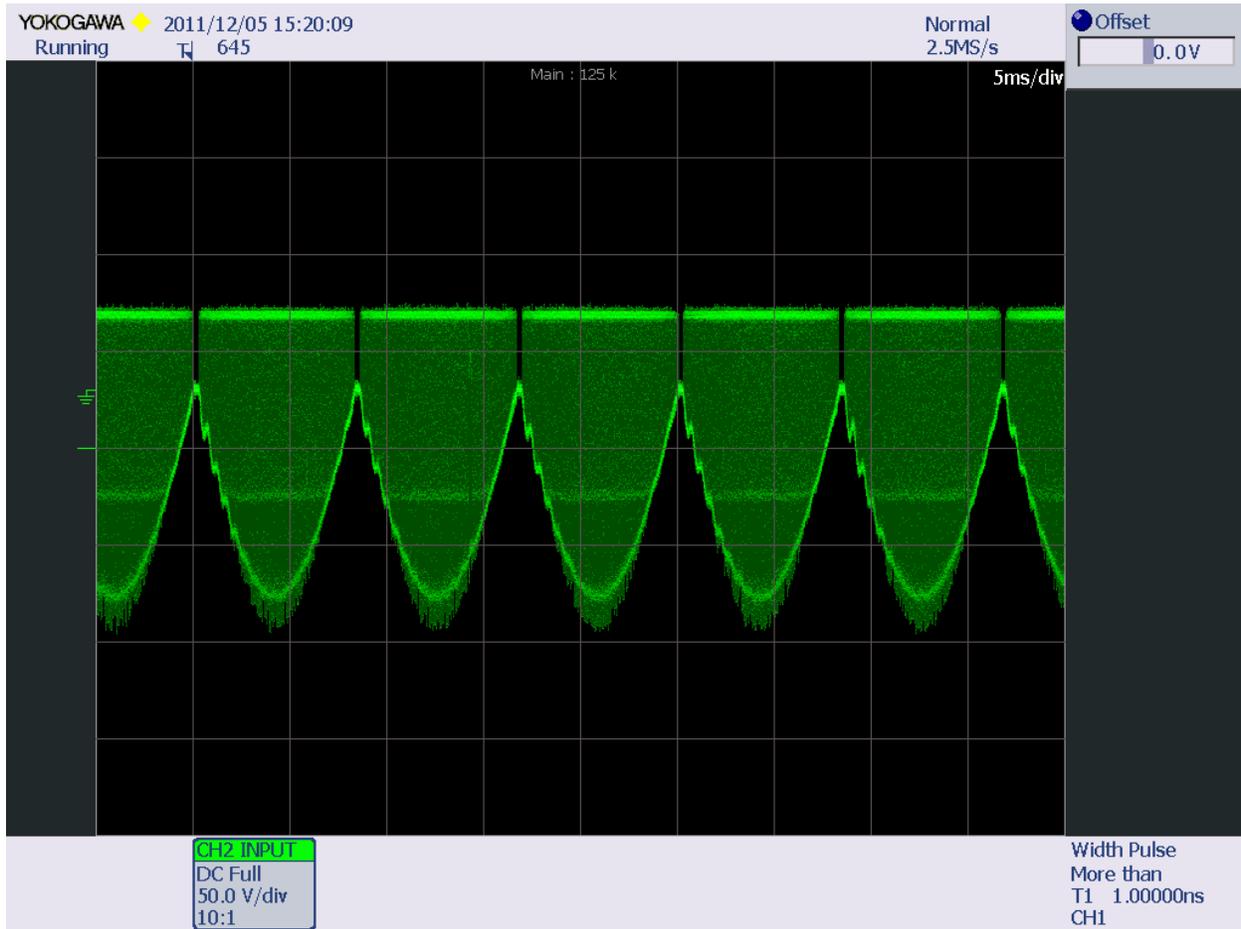


Figure 12. Voltage at T1 Secondary Winding (Pin 12)

Figure 13 demonstrates the stability of the LED Driver Base Power Board's output voltage during normal operation.

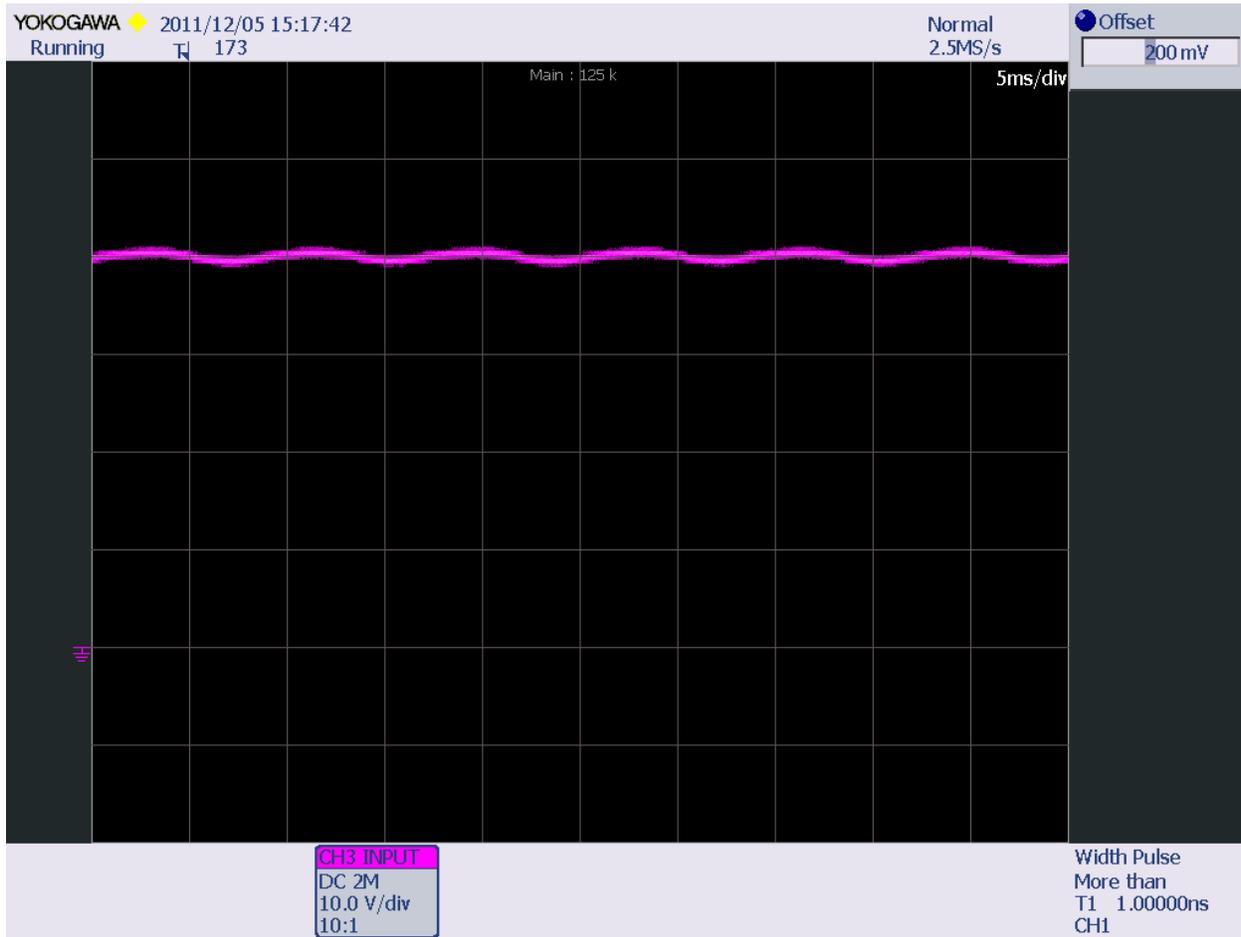


Figure 13. AC Output Voltage Noise During Normal Operation

Figure 14 represents the linearity of the LED Driver Base Power Board's brightness control operation.

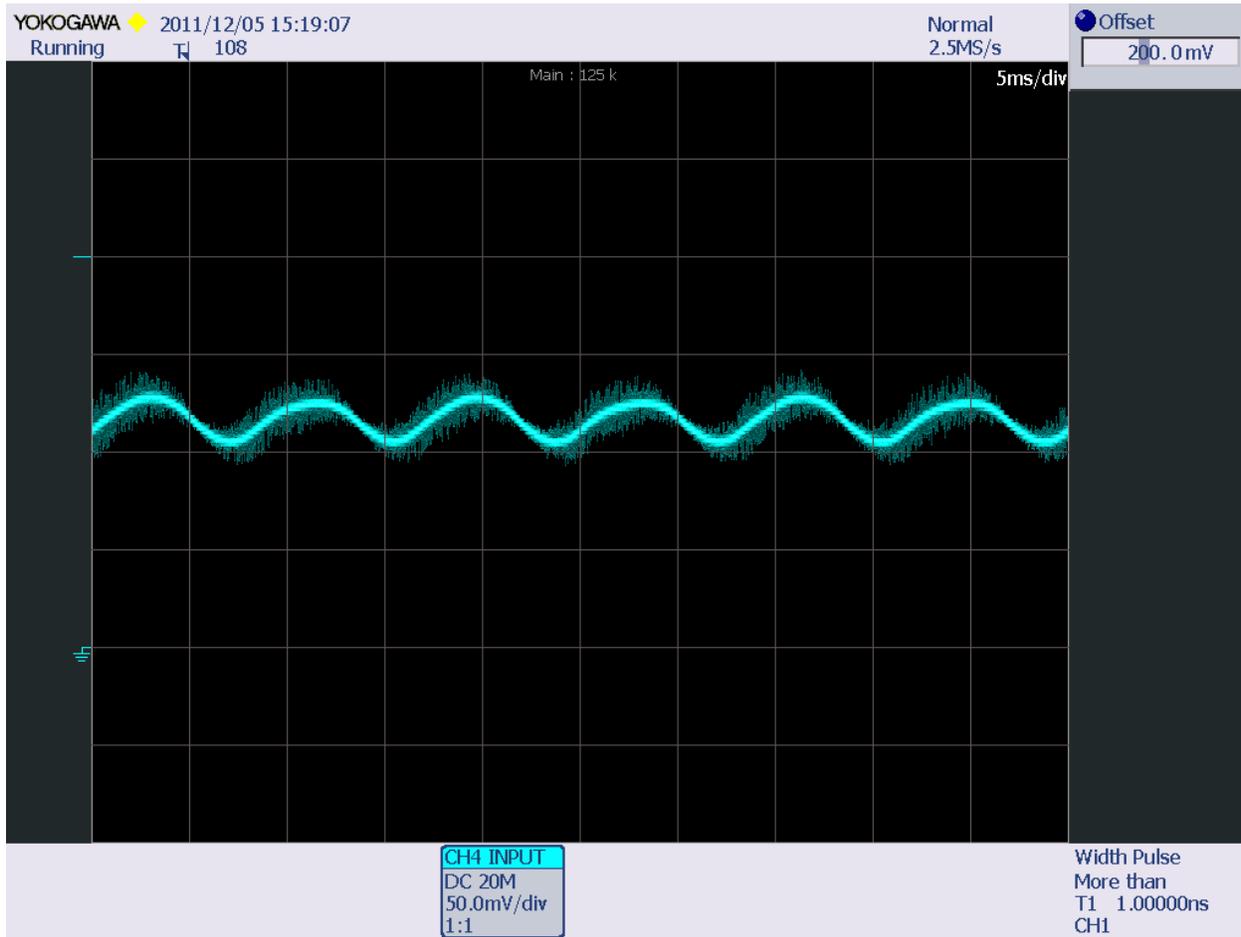


Figure 14. LED Current Noise at Full Brightness (50mV/div = 250mA)

Figure 15 graphs the drop in current consumption as the level of dimming increases.

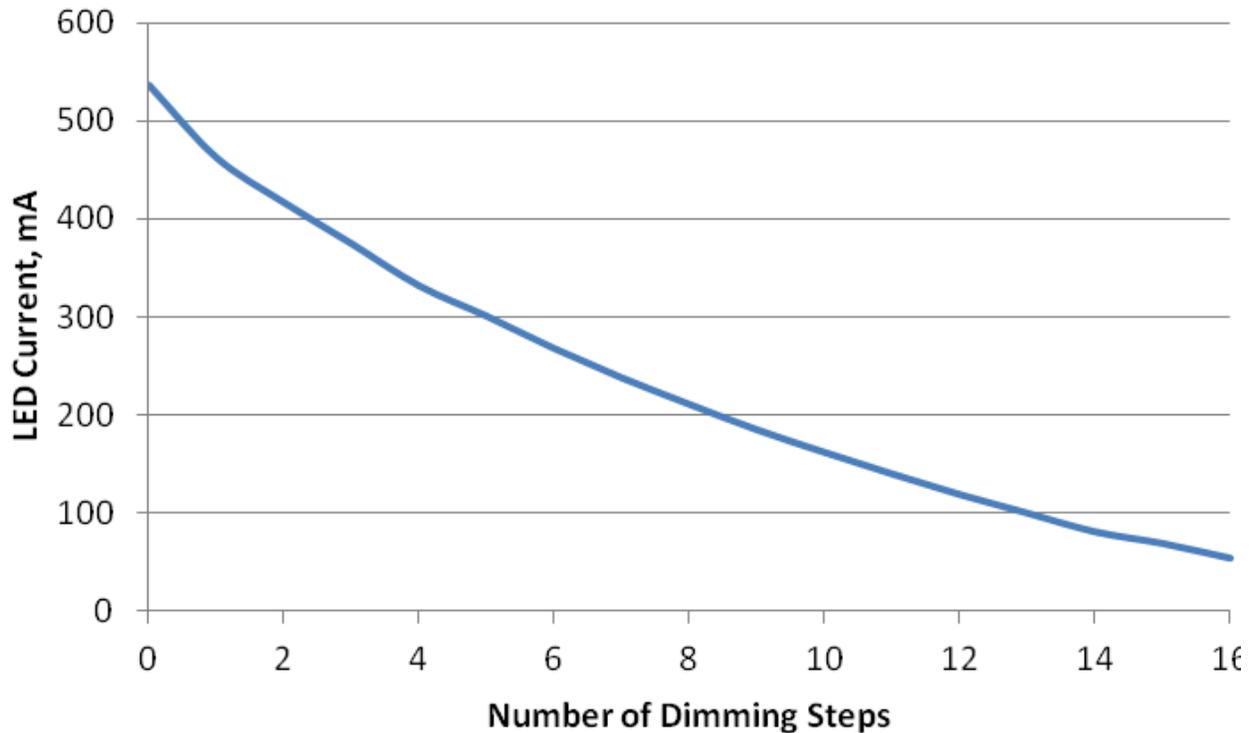


Figure 15. LED Brightness Control as a Function of LED Current vs. Number of Dimming Steps

## Ordering Information

The products associated with this LED Driver with ZAURA Control Reference Design are available as a kit and can be purchased from the Zilog Store – simply click the Store Product ID listed in Table 1.

Table 1. LED Driver with ZAURA Control Reference Design Ordering Information

Part Number	Description	Store Product ID
ZRD0010F868ZRD	LED Driver with ZAURA Control Reference Design	<a href="#">RD10013</a>

## Kit Contents

The LED Driver with ZAURA Control Reference Design contains the following elements:

- LED Driver Base Power Board
- ZAURA RF Wireless 868MHz Module (affixed to the Base Board)

- ZAURA RF Remote Control device

The ZAURA RF Wireless 868MHz Module and the ZAURA RF Remote Control device are preprogrammed by Zilog during their manufacture.

## Software and Documentation

Upon installation, the software and documentation for this reference design will be located in the following directories.

```
<Installation directory>
  \Conf
  \Docs
  \Inc
  \Lib
  \Shared
  \RD0010_LED
    |___ Boards
```

## Related Documentation

The documents associated with the LED Driver with ZAURA Control Reference Design are listed in Table 2. Each of these documents can be obtained from the Zilog website by clicking the link associated with its Document Number.

**Table 2. LED Driver with ZAURA Control Reference Design Documentation**

Document Number	Description
<a href="#">RD0010</a>	This LED Driver with ZAURA Control Reference Design document
<a href="#">AN0336</a>	Getting Started with ZAURA RF Control Application Note
<a href="#">PUG0030</a>	ZAURA RF Wireless Modules Product User Guide
<a href="#">RM0060</a>	ZAURA RF Wireless Library Programmer's Reference Manual
<a href="#">UM0235</a>	ZAURA RF Module Shell User Manual

## Appendix A. Schematic Diagrams

Figure 16 shows a schematic diagram of the LED Driver Base Power Board.

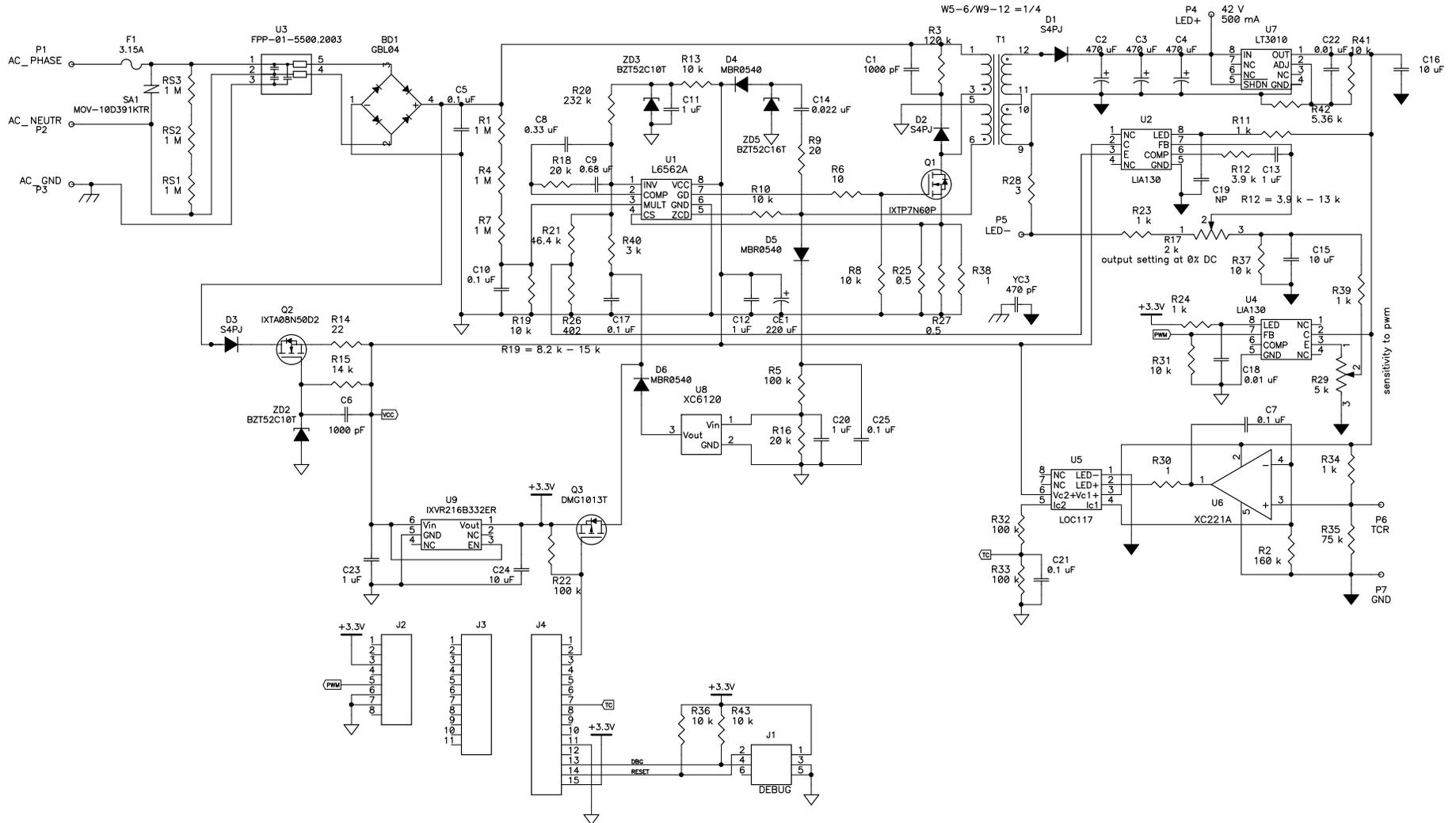


Figure 16. LED Driver Base Power Board Schematic Diagram

Figures 17 and 18 show schematic diagrams of the ZAURA RF 868MHz Wireless Module.

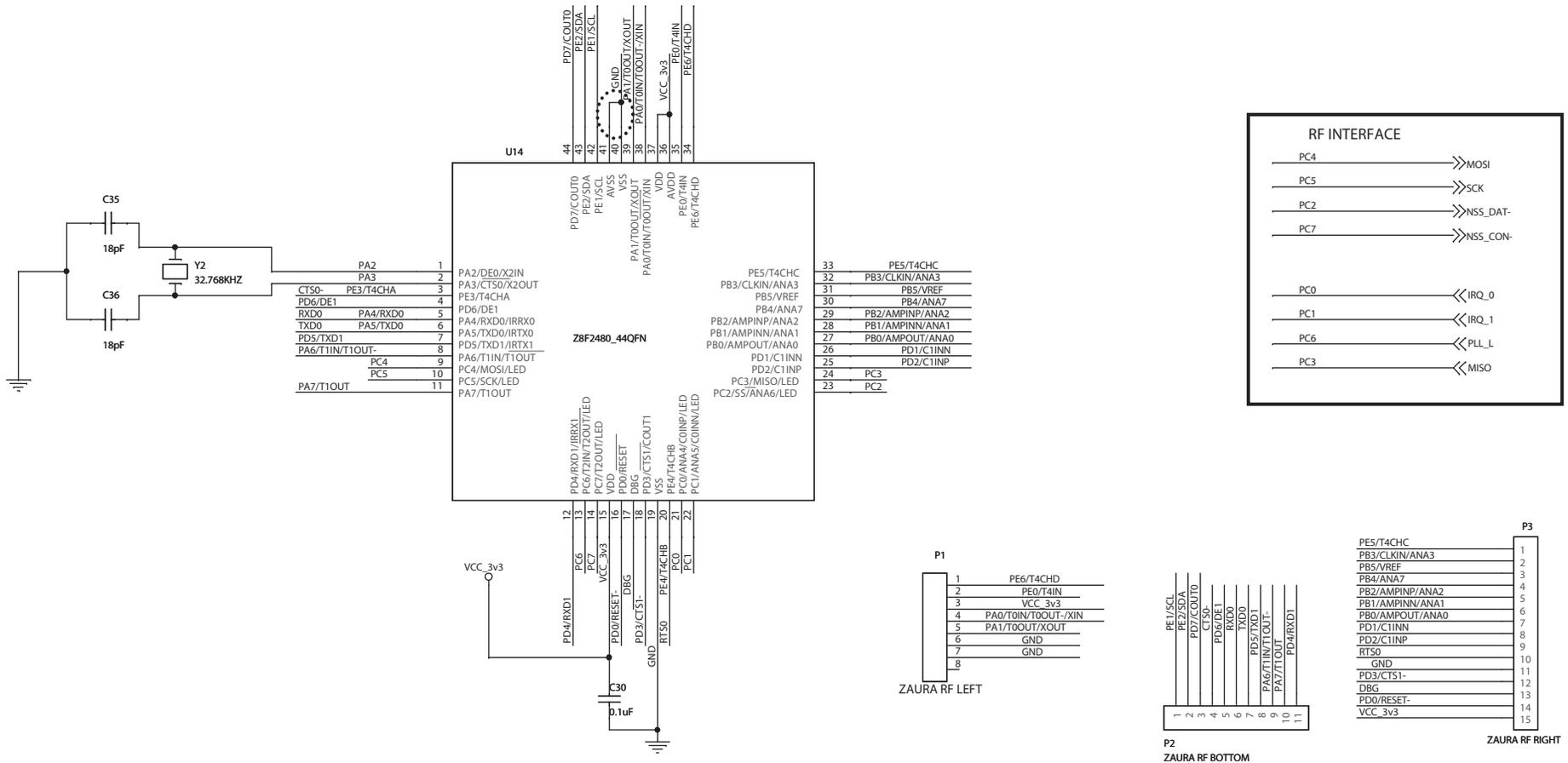


Figure 17. ZAURA RF 868MHz Wireless Module Schematic Diagram, #1 of 2

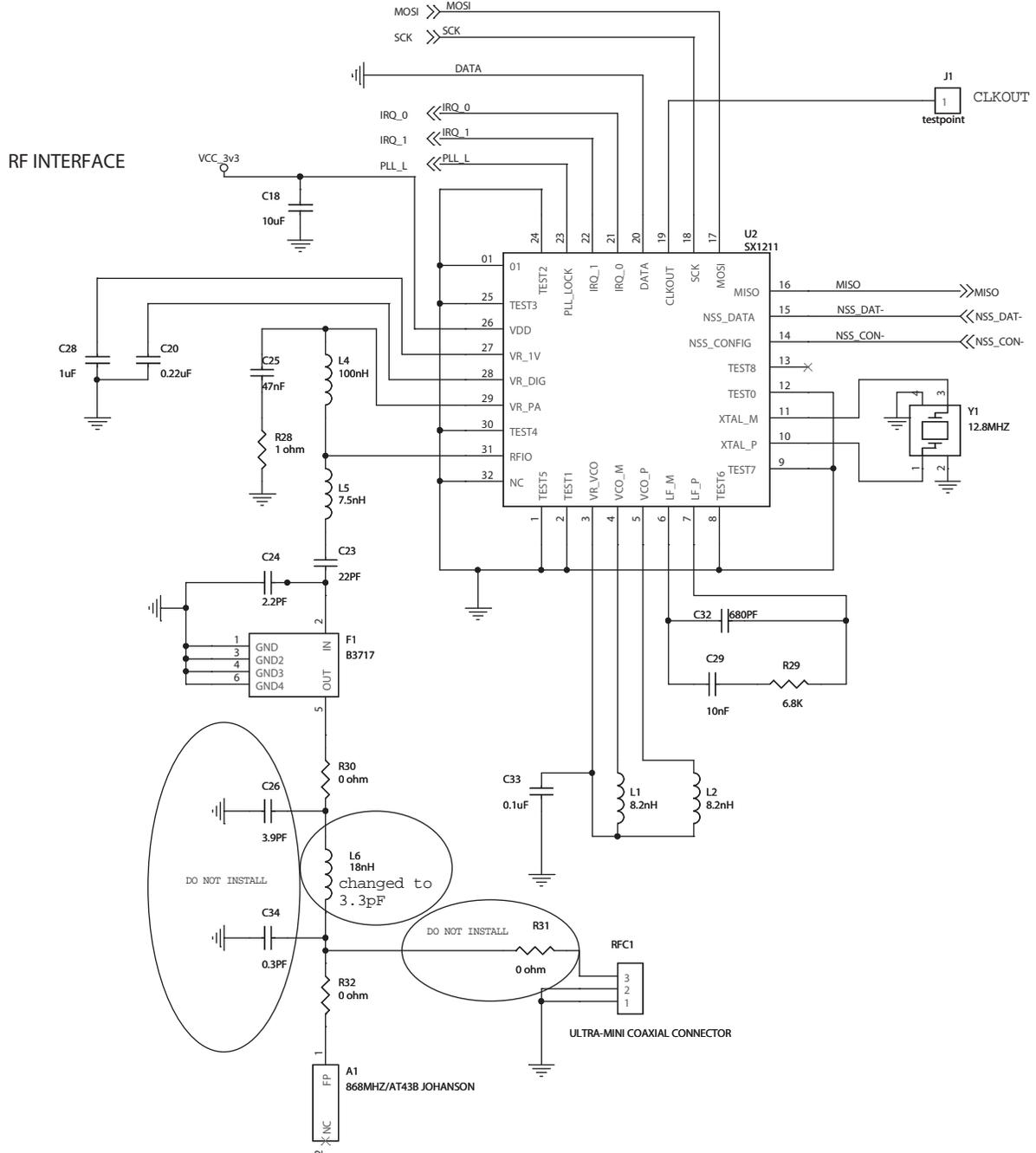


Figure 18. ZAURA RF 868MHz Wireless Module Schematic Diagram, #2 of 2



Figure 21 displays a top-side assembly diagram of the ZAURA RF Wireless Module.

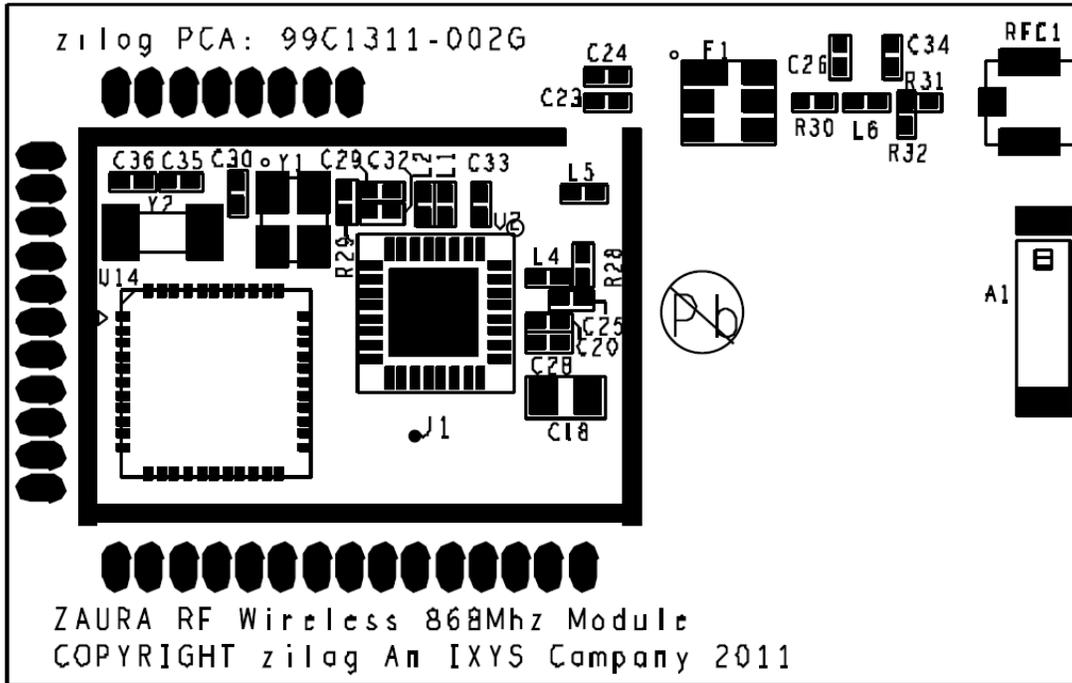


Figure 21. ZAURA RF 868MHz Wireless Module Components, Top Layer

Table 3 lists the components that comprise the LED Driver Base Power Board.

**Table 3. LED Driver Base Power Board List of Materials**

Count	Reference Designator	Value	Description	Manufacturer
1	BD1	GBL04	GBL04	Vishay
1	C1	1000pF	DEBE33A102ZC1B	Murata
1	CE1	220 $\mu$ F	UVZ1E221MED	Nichicon
3	C2–C4	470 $\mu$ F	UVZ1J471MHD	Nichicon
1	YC3	470pF	DE2B3KY471KB3BM02	Murata
1	C5	0.1 $\mu$ F	ME104K2J150B050S	RFE International
1	C22	0.01 $\mu$ F	0603ZC105KAT2A	AVX
2	C18, C19	0.01 $\mu$ F	06035C104KAT2A	AVX
1	C14	0.022 $\mu$ F	GRM188R71H223KA01D	Murata
6	C7, C10, C13, C17, C21, C25	0.1 $\mu$ F	06035C104KAT2A	AVX
1	C8	0.33 $\mu$ F	06036C334KAT2A	AVX
1	C11, C20, C23	1 $\mu$ F	06035C105KAT2A	AVX
2	C15, C16	10 $\mu$ F	0603ZC105KAT2A	AVX
1	C6	1000pF	06035C102KAT2A	AVX
1	C9	0.68 $\mu$ F	0805YC684KAT2A	AVX
1	C12	1 $\mu$ F	08053C105KAT2A	AVX
3	D1–D3	S4PJ	Diode SP4PJ	Vishay
3	D4, D5, D6		Diode MBR0540.	Fairchild
1	F1	3.15A	Fuse MQ 5	Bel Fuse Inc.
1	J1		Header 8624-10-89-2061	Molex
1	J2		Socket Strip SMS-108-02-G-S	Samtec
1	J3		Socket Strip SMS-111-02-G-S	Samtec
1	J4		Socket Strip SMS-115-02-G-S	Samtec
1	Q1		IXTP7N60P	IXYS Corp.
1	Q2		IXTA08N50D2	IXYS Corp.
1	Q3		DMP2123L	Diodes Inc.
6	P31–P6		1001-0-15-01-30-02-04-0	Mill-Max.
1	R30	1 $\Omega$	CRCW06031R00FSTA	Vishay
5	R11, R23, R24, R34, R39	1K $\Omega$	CRCW06031001FSTA	Vishay
1	R40	3.01K $\Omega$	CRCW06033011FSTA	Vishay
1	R42	5.36K $\Omega$	CRCW06035361FSTA	Vishay
2	R6, R12	10 $\Omega$	CRCW060310R0FSTA	Vishay
9	R8, R10, R13, R19, R31, R36, R37, R43, R41	10K $\Omega$	CRCW060320R0FSTA	Vishay

Table 3. LED Driver Base Power Board List of Materials (Continued)

Count	Reference Designator	Value	Description	Manufacturer
1	R15	14K $\Omega$	CRCW06031402FSTA	Vishay
1	R18	20K $\Omega$	CRCW06034701FSTA	Vishay
1	R16	30.1 K $\Omega$	CRCW06031003FSTA	Vishay
1	R21	46.4K $\Omega$	CRCW06034642FSTA	Vishay
1	R35	75K $\Omega$	CRCW06037502FSTA	Vishay
4	R5, R22, R32, R33	100K $\Omega$	CRCW06031003FSTA	Vishay
1	R2	160K $\Omega$	CRCW06031603FSTA	Vishay
1	R20	232K $\Omega$	CRCW06032323FSTA	Vishay
1	R26	402 $\Omega$	CRCW0603402RFSTA	Vishay
6	R1	1M $\Omega$	CRCW08051004FSTA	Vishay
1	R9, R14	22 $\Omega$	CRCW060320R0FSTA	Vishay
1	R25, R27, R38	1 $\Omega$	CRCW12061R00FSTA	Vishay
1	R3	120K $\Omega$	CRCW12061203FSTA	Vishay
1	R28	3 $\Omega$	CRCW25123R00FSTA	Vishay
1	R17	2K $\Omega$	Potentiometer CT6EP	Copal Electronics
1	R29	5K $\Omega$	Potentiometer CT6EP	Copal Electronics
1	SA1		MOV-10D391KTR	Bourns
1	T1		EPC3130-6-S-LF	PCA Electronics Inc.
1	U1		L6562	ST Micro
2	U2, U4		LIA130	IXYS Corp.
1	U3		FPP-01 5500.2003	Schurter Electronic Components
1	U5		LOC117	IXYS Corp.
1	U6		XC221A1200	Torex
1	U7		LT3010EMS8E#PBF	Linear Technology
1	U8		XC6120C332HR	Torex
1	U9		IXVR216B332ER	IXYS Corp.
1	ZD2		BZT52C10T	Diodes Inc.
1	ZD3		BZT52C20T	Diodes Inc.
1	ZD5		BZT52C16T	Diodes Inc.

Table 4 lists the components that comprise the ZAURA RF 868MHz Wireless Module.

**Table 4. ZAURA RF Wireless Module List of Materials**

Count	Reference Designator	Value	Description	Manufacturer
1	A1	868MHz	Antenna 0868AT43B0020 ACX	Johanson Technology Inc.
1	C18	10 $\mu$ F	Cap, 10 $\mu$ F, 6.3V, X5R, 20%, Ceramic chip, 0603 SMT	TDK
1	C20	0.22 $\mu$ F	Cap, 0.22 $\mu$ F, 10V, +/-10%, X5R, Ceramic chip, 0402 SMT	Murata
1	C23	22pF	Cap, 22pF, 25V, Ceramic chip, C0G, 0402 SMT	AVX
1	C24	2.2pF	Cap, 2.2pF, 25V, Ceramic chip NP0, 0402 SMT	TDK
1	C25	47nF	Cap, 47000pF (47nF), 16V, -20%,+80%, Y5V, 0402 SMT	Murata
1	C28	1 $\mu$ F	Cap, 1 $\mu$ F, 6.3V, 10%, X5R, Ceramic chip, 0402 SMT	Murata
1	C29	10nF	Cap,10000pF(10nF), 16V, 10%, X7R, 0402 SMD	Yageo
2	C30, C33	0.1 $\mu$ F	Cap,0.1 $\mu$ F, 16V, X7R, 10%, Ceramic chip, 0402 SMT	Murata
1	C32	680pF	Cap, 680pF, 50V, +/- 5%, C0G, 0402 SMT	TDK
2	C35, C36	18pF	Cap, 18pF, 50V, Ceramic chip, 5%, C0G, 0402 SMT	TDK
1	F1		Filter Saw 866.5MHz SMD	Epcos Inc.
2	L1, L2	8.2nH	Inductor, Wire Wound, Power, 8.2nH, 0402 SMD	Murata
1	L4	100nH	Inductor, Wire Wound, RF, 100nH, 5%, 0402 SMD	Coilcraft
1	L5	7.5nH	Inductor, 7.5nH, Multilayer, 5%, 0402	TDK
1	L6	3.3pF	Cap, 3.3pF, 50V, Ceramic chip, S, 0402 UHI Q SMT	Johanson Technology Inc.
1	P1		Connector, Header/Pin, 1x8, 1.27mm, Single Row	Samtec
1	P2		Connector, Header/Pin, 1x11, 1.27mm, Single Row	Samtec
1	P3		Connector, Header/Pin, 1x15, 1.27mm, Single Row	Samtec
1	RFC1		Connector, Receptacle, Ultra-Mini Coax, SMD	Hirose Electric
1	R28	1	Resistor, 1.00 $\Omega$ , 1/16W, 1%, 0402 SMD	Yageo
1	R29	6.8K $\Omega$	Resistor, 6.8K $\Omega$ , 1/16W, 5%, 0402 SMD Vishay/Dale.	Vishay
2	R30,R32	0	Resistor, 0.0 $\Omega$ , 1/10W, 0402 SMD Panasonic	ECG
1	U2		TRX 868/915/955 FSK/OOK TQFN32	Semtech
1	U14		Z8F2480_44QFN	Zilog
1	Y1		Crystal 12.8MHz, 3.2 mm X 2.5mm	Ecera
1	Y2		XTAL,32.768 kHz, SMD, 12.5pF	Abracon Corp.

## Appendix C. Troubleshooting an Unsuccessful Build

If you are using the Windows 7 or Vista operating system, your build may not succeed due to possible file folder protection settings. If you encountered error or warning messages after performing a Rebuild All operation on the `LedCtrl.zdsproj` project, it may be necessary to change the folder properties. Please observe the following procedure.

1. Navigate to `C:\Program Files\Zilog`, right-click the `ZAURA_RF_Wireless_v1.11a` file, and select **Properties**.
2. In the `ZAURA_RF_Wireless_v1.11a` Properties dialog that appears, click the **Security** tab.
3. In this Security window, click the **Edit...** button; Figure 23 provides an example.

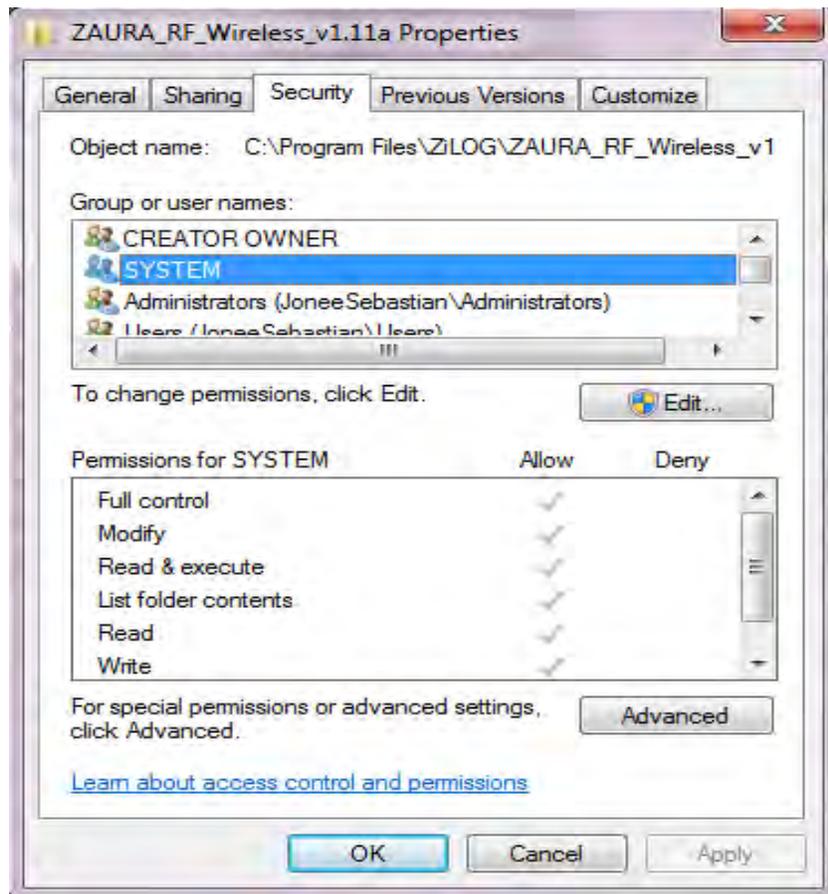
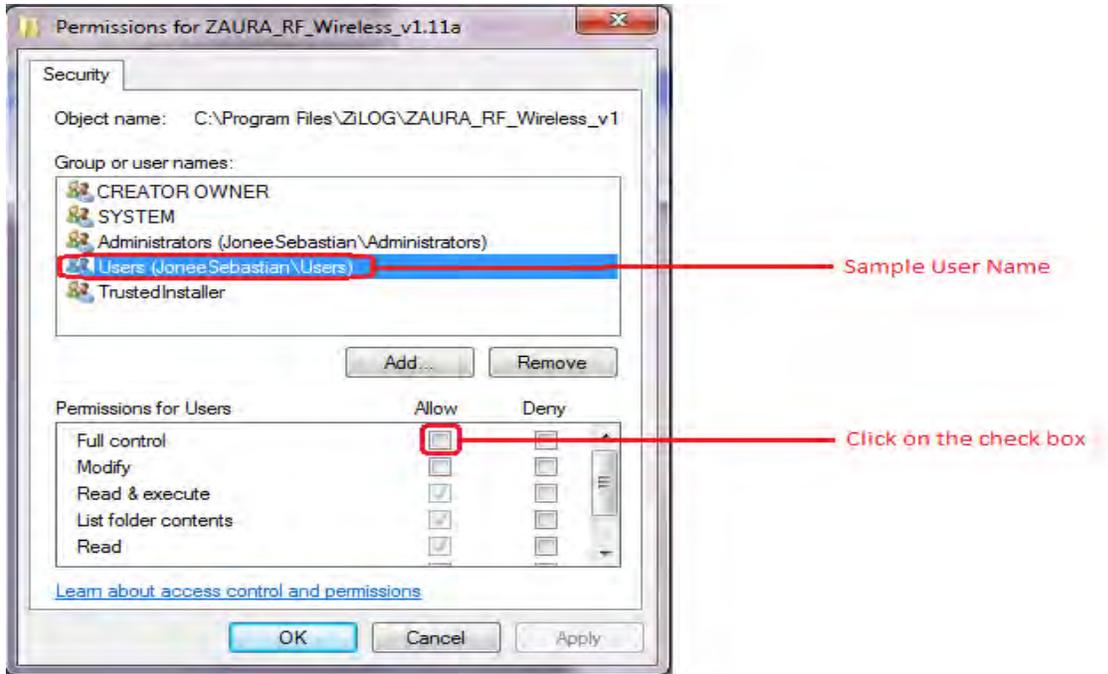


Figure 22. The Security Tab of the `ZAURA_RF_Wireless_v1.11a` Properties Dialog

4. The `ZAURA_RF_Wireless_v1.11a` file's Security dialog will appear. In the **Group or user names:** panel, click to select your **Users** name, as indicated in Figure 23.



**Figure 23. Setting Full Control Permissions in the Security Dialog**

5. In the Permissions for Users panel, select the **Full control** checkbox, also indicated in Figure 23.
6. Click the **Apply** button to apply your changes, then click the **OK** button to save your changes and close the Permissions dialog.
7. Click **OK** to close the ZAURA\_RF\_Wireless\_v1.11a Properties dialog.
8. Return to [Step 6](#) on page 12 to repeat the Rebuild All operation on the LedC-tr1.zdsproj; the rebuild should succeed.

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## Customer Support

To learn more about this product, find additional documentation, get your technical questions answered or report issues, please contact [esales@zilog.com](mailto:esales@zilog.com).



**Warning:** DO NOT USE THIS PRODUCT IN LIFE SUPPORT SYSTEMS.

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