

**Important Notice**

**Restrictions in Use**

IDT's ZLED7020KIT-D1 Demo Kit hardware is designed for ZLED7020 demonstration, evaluation, laboratory setup, and module development only. The ZLED7020KIT-D1 Demo Kit hardware must not be used for module production or production test setups.

**Disclaimer**

IDT shall not be liable for any damages arising out of defects resulting from

- (i) delivered hard- and software
- (ii) non-observance of instructions contained in this manual and in any other documentation provided to user, or
- (iii) misuse, abuse, use under abnormal conditions or alteration by anyone other than IDT.

To the extent permitted by law, IDT hereby expressly disclaims and user expressly waives any and all warranties, whether express, implied or statutory, including, without limitation, implied warranties of merchantability and of fitness for a particular purpose, statutory warranty of non-infringement and any other warranty that may arise by reason of usage of trade, custom or course of dealing.

**Contents**

1	Kit Contents .....	2
2	Kit Description .....	2
2.1.	Overview.....	2
2.2.	Power Supply.....	2
2.3.	Interface.....	3
2.4.	Key Demo board features and benefits.....	3
2.5.	Circuit Operation.....	5
2.6.	Schematic Diagram .....	5
3	Ordering Information .....	6
4	Related Documents.....	6
5	Glossary .....	6
6	Document Revision History.....	6

**List of Figures**

Figure 2.1	ZLED7020KIT-D1 Demo Board (Top View) .....	3
Figure 2.2	ZLED7020KIT-D1 Schematic Diagram.....	5

**List of Tables**

Table 2.1	DC Input Voltages.....	4
-----------	------------------------	---

## 1 Kit Contents

The ZLED7020KIT-D1 Demo Kit consists of the following parts:

- ZLED7020-D1 Demo Board VX.x
- Five ZLED7020 samples, SOT89-5 package
- *ZLED7020KIT-D1 Demo Kit Start-up Information*
- *Kit Disclaimer*

The ZLED7020KIT-D1 Demo Kit is fully assembled and ready for immediate operation.

## 2 Kit Description

### 2.1. Overview

The ZLED7020KIT-D1 Demo Kit provides a quick and easy method for evaluating the ZLED7020 within its basic application circuit. Reading the *ZLED7020 Data Sheet* before using the Demo Kit is recommended for understanding the operation of the ZLED7020 and the Demo Board.

The ZLED7020 continuous-mode inductive step-down converter is one of ZLED family of high brightness, high current LED control ICs. It can efficiently drive a single LED or multiple series-connected LEDs from a voltage input higher than the LED voltage ( $V_{in} = 6$  to 40 VDC). It provides an adjustable output current (1.2A maximum), which is set via an external resistor and controlled by the ZLED7020's integrated high-side output current-sensing circuit. An external control signal (DC voltage or a PWM waveform) on the ADJ pin can be used to linearly adjust the output for either continuous or gated-output current.

The output can be turned off by applying a voltage lower than 0.2V to the ADJ pin, which puts the ZLED7020 in a low-current standby state.

The ZLED7020 IC is designed for LED current drive applications of up to 1.2A. The main features of ZLED7020 driver are:

- Up to 1.2A output current.
- Wide input voltage range: 6V to 40V.
- Internal 40V 1.2A NDMOS switch.
- High efficiency ( > 90% possible).
- Up to 1MHz switching frequency.

The Demo Board contains a standard 4-pin terminal connector to allow the user to easily connect and supply a LED's board. The Demo Board also has two LED power pads (LED+ and LED-) to provide more flexibility in supplying a power LED or LED string. A 33uH shielded inductor was chosen to set nominal frequency around 300kHz. The shielded inductor is selected to minimize radiated EMI. The layout with any switching regulator is crucial to minimize radiated EMI. This reference design keeps the critical track lengths to a minimum. Ground has been maximized around critical areas.

Figure 2.1 shows the top view of the populated kit PCB.

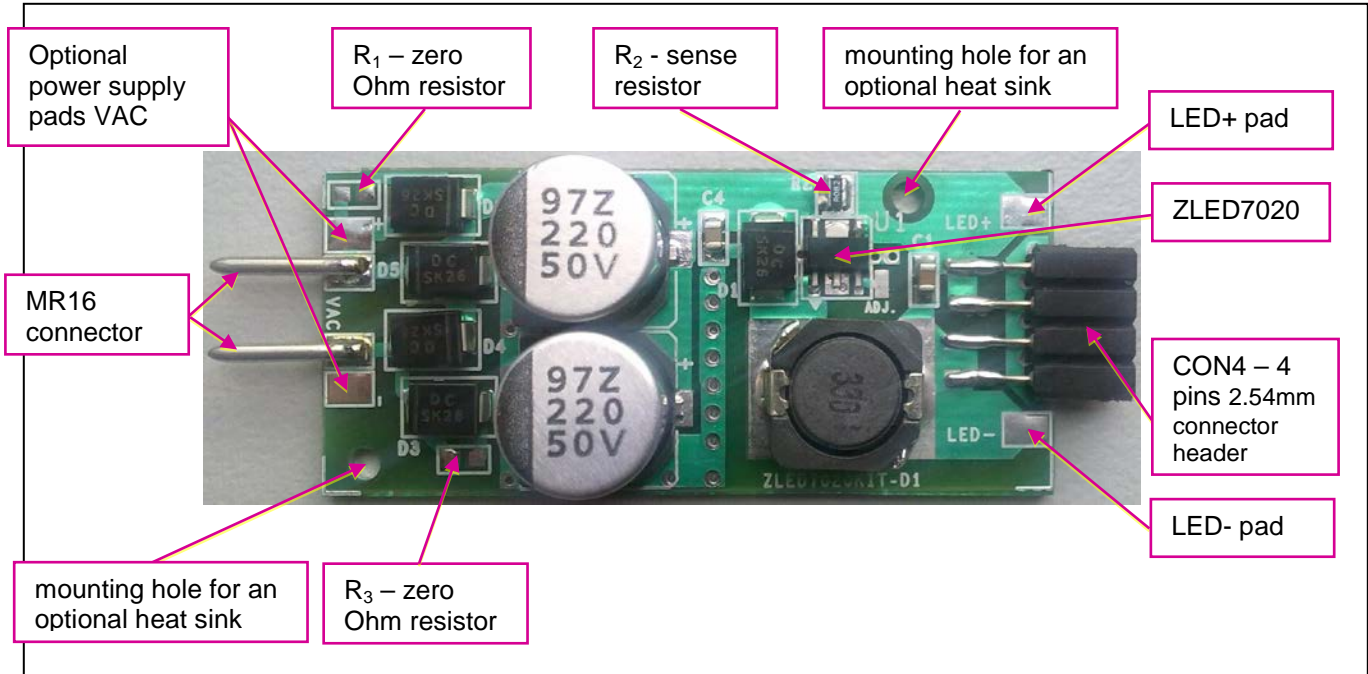
### 2.2. Power Supply

The board requires basically 12V, or above for LED strings, AC or DC power supply. Referring to circuit schematics at Figure 2.2, the shortcut solder joints could be used at R1 and R3, utilizing a zero ohm resistor in order to enable the pure DC operation.

**Care has to be taken in this case, since the system is not reverse polarity protected!**

The power supply is provided via a standard MR16 connector. In addition, there are two pads for an optional way of supplying the Demo Board.

**Figure 2.1 ZLED7020KIT-D1 Demo Board (Top View)**



### 2.3. Interface

MR16 – Standard male connector for power supply with wide input voltage range 6V to 40V.

VAC 3, 4 – Pads for an optional way of power supply.

CON4 – Standard 2.54mm female header with the following pins:

1, 2 – LED+ Positive pole of the ZLED7020 driver supply voltage.

3, 4 – LED- Negative pole of the ZLED7020 driver supply voltage.

ADJ – puts the ZLED7020 driver in a low current stand-by state.

### 2.4. Key Demo Board Features and Benefits

- Wide input voltage range.
- Standard 4 pins 2.54mm header for attaching of LEDs and additional duplicate smd pads (LED- , LED+).
- Standard MR16 contact pins and additional duplicate smd pads for power supply.
- Coils footprint designed for various types of coils.
- 3.0mm holes for mounting of an optional heat sink.
- SMD pad for driving of the adjust terminal (ADJ).
- Solder jumpers for by-passing of the bridge rectifier (R1 and R3) in case of usage of an external DC supply.
- All devices SMD and on one side (TOP).
- Maximized power ground copper at top and bottom sides with thermal vias for good heat distribution.
- Easy heat sink attaching option (according to the exploitation conditions demands) at the bottom side.
- Bottom side without solder mask for better thermal contact with heat sink if attached.

- Track connecting R2 (current sense resistor) to ZLED7020 as short as possible (being sense tracks).
- The filter capacitor C1 is connected as close as possible to the LED output pins.
- The freewheeling current path is as short as possible to ensure system precision and efficiency.

## 2.5. Circuit Operation

Circuit operation has been evaluated taking into account maximum output current. The reference current is set to a maximum 1.2A but can be adjusted to any lower value by changing the sense resistor R2 according to the formula:

$$I_{ref} = 0.1 / R2, [A]$$

For R2 = 0.082 -> Iref = 1.2A

For detailed calculations, please refer to the ZLED7020 datasheet.

In *Table 2.1* the data related to the system supplied with DC voltage ranges from 7 V to 30 V. For these tests the Schottky bridge was by-passed.

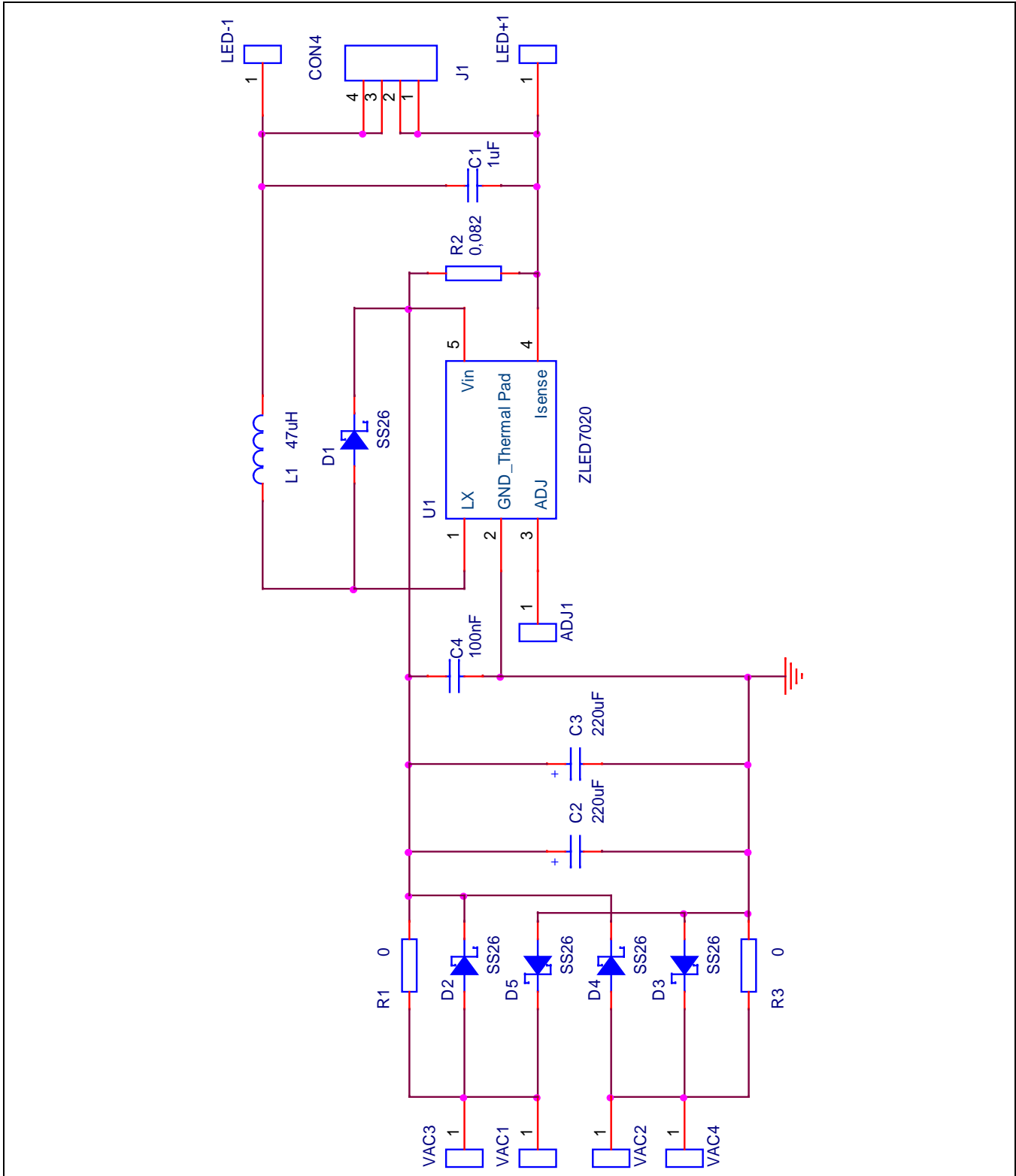
**Table 2.1 DC Input Voltages**

Uin [V]	Iin [A]	Uout [V]	Iout [A]	Pin [W]	Pout[W]	Efficiency [%]
7,00	0,824	4,171	1,184	5,768	4,938464	85,6
8,00	0,709	4,107	1,182	5,672	4,854474	85,6
9,00	0,632	4,102	1,182	5,688	4,848564	85,2
10,00	0,569	4,083	1,183	5,69	4,830189	84,9
12,00	0,473	4,046	1,182	5,676	4,782372	84,3
15,00	0,38	4,038	1,182	5,7	4,772916	83,7
20,00	0,289	4,033	1,185	5,78	4,779105	82,7
24,00	0,244	4,025	1,187	5,856	4,777675	81,6
30,00	0,198	4,019	1,191	5,94	4,786629	80,6

*Note: with by-passed bridge rectifier*

## 2.6. Schematic Diagram

Figure 2.2 ZLED7020KIT-D1 Schematic Diagram



### 3 Ordering Information

Product Sales Code	Description
ZLED7020KIT-D1	ZLED7020KIT-D1 Demo Kit V1.0 incl. 5 IC samples

### 4 Related Documents

Document
ZLED7020 Datasheet

Visit IDT's website [www.IDT.com](http://www.IDT.com) or contact your nearest sales office for the latest version of these documents.

### 5 Glossary

Term	Description
LED	Light Emitted Diode
MR16	Multifaceted Reflector
NDMOS	N-type Double-Diffused Metal–Oxide–Semiconductor
PCB	Printed Circuit Board
PWM	Pulse Width Modulation
SOT89-5	Small Outline Transistor

### 6 Document Revision History

Revision	Date	Description
1.0	May 12, 2010	Initial release
	May 10, 2016	Changed to IDT branding.

## IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD-PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers who are designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only to develop an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third-party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising from your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Disclaimer Rev.1.01 Jan 2024)

### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

### Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

### Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit [www.renesas.com/contact-us/](http://www.renesas.com/contact-us/).