Evaluation Kit CeraPlas™ HF

Driver for CeraPlas™ series

Series/Type:	**Evaluation Kit - CeraPlas™ HF Cold Plasma Source**
Ordering code:	**Z63000Z2910Z 1Z61**
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Version:	5

EPCOS AG is a TDK Group Company.

Preliminary data

Content of evaluation kit / CeraPlas™ HF cold plasma source

- Driver circuit for CeraPlas™ series
- CeraPlas™ HF with Package, with wires and two pins connector
- Copy of Datasheet for CeraPlas™ HF and the user guide for the driver circuit

Specifications/Features

- 24 V single supply
- Approximately 4.5 W CeraPlas™ input power by default, selectable from approx. 2 W to 7 W by software
- Driver supports CeraPlas™ HF
- Automatic frequency control with resolution in the range of mHz
- Phase control with resolution of at least 1°

Introduction

The CeraPlas™ driving circuit is intended to show the operating principle of CeraPlas™. A unique control algorithm is used to drive the CeraPlas™ at its maximum efficiency under any conditions.

The driving circuit can be operated by a set of jumper or alternatively via COM-Port commands using an RS232-adapter and an additional graphical user interface which is multi-platform software for adjusting CeraPlas™ to your specific application.

Connection Setup

As shown in Fig.1 all possible interfaces are described. For running the CeraPlas™ the first time the following steps has to be done to accomplish a stable ignition of the plasma:

1. Plug in the CeraPlas™ to the green connector and tighten the screws to establish a good electrical connection
2. Plug in the green connector to the socket on the driving circuit
3. Connect a stabilized 24V +- 5% power supply with at least 500 mA current rating
4. Configure the Input power by shorten the user inputs 2-3 like in Tab. 2
5. Shorten User Input 1 by using a jumper to switch on the CeraPlas™

Since the voltage is applied the driver sends out different light pattern by using the build-in LED:

Standby (CeraPlas™ is turned off):

LED is blinking – the amount of pulses correlates to the current operating mode.

Active (CeraPlas™ is running):

LED is blinking each 280 ms for 140 ms.

Alternatively, the CeraPlas™ can also be controlled using the serial RS232-interface, see below for the connection and commands.

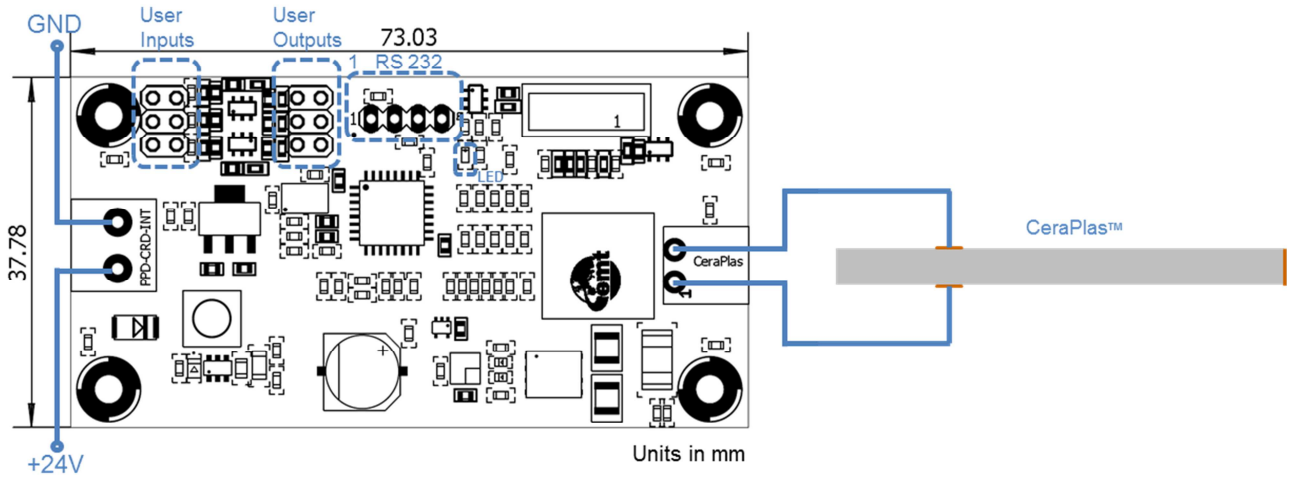


Fig. 1. CeraPlas™ driving circuit connection setup.

CeraPlas™ Overload

If electrical conducting objects are brought close to the output of the CeraPlas™ arcing could occur. Continued arcing can cause permanent damage to the CeraPlas™.

In order to prevent continues arcing, the driving circuit senses the CeraPlas™' input signals. In case of an overload the CeraPlas™ is protected by being switched off for a couple of seconds. During the period of protection the LED is blinking.

RS232 Connector

The pin assignment of the RS232 pin header is not compatible with common RS232-to-USB cables (Tab.1), see for example FTDI TTL-232R-3V3, RS stock number 429-307. Take care to use an adapter with 3.3 V logic levels. Pins 2 and 6 (CTS# / RTS#) of the cable are not used in the current version of the driving circuit and can be left unconnected.

Pin	*Description*
1	not connected
2	Ground
3	TxD
4	RxD

Tab. 1. RS232 connector pin assignment on the driver circuit

Preliminary data

Using the User IOs

To get an impression of what the driving circuit can be deliver directly without PC connection four different kinds of power settings are predefined. User Input 1 is used for switching on the driver. All other presets are listed in Tab. 2.

User outputs 1 to 3 give the user the opportunity to enhance the functionality of the demo kit by attaching an external status LED or an additional fan for a continuous air flow which correlates to internal parameter, like CeraPlas™ is turned on. The levels of the User Outputs are depicted in Tab.3.

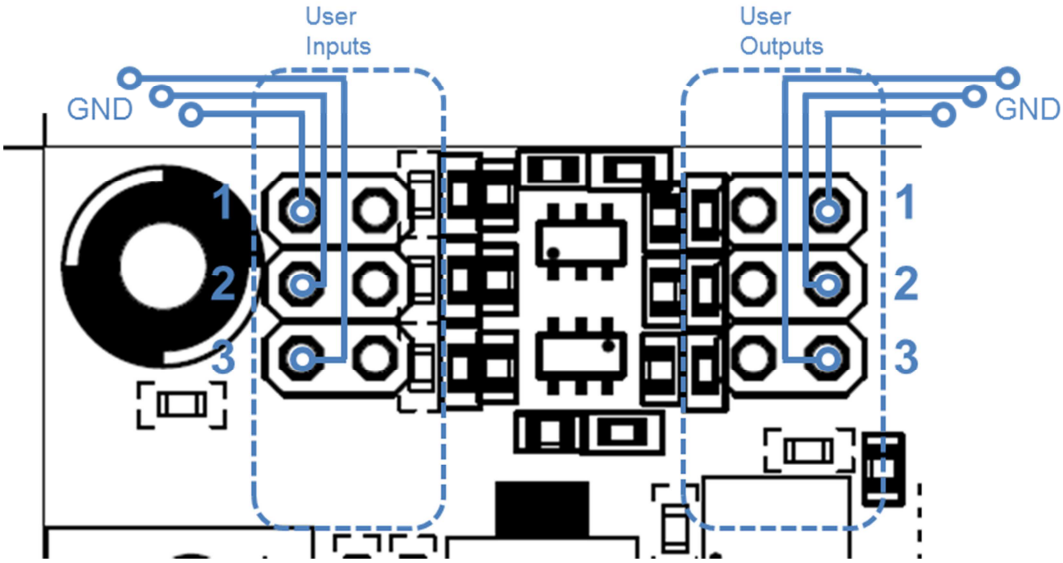
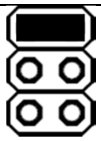


Fig. 2. CeraPlas™ driving circuit definition of the User IO.

Jumper setting of user inputs	*Driver presets*
	(Default Mode) CeraPlas™ Type = HF (45mm length) Frequency Range = 78-83kHz Power = 4.5 Watts Phase = 0° Mode = 4
	CeraPlas™ Type = HF (45mm length) Frequency Range =78-83kHz Power = 2 Watts Phase = 0° Mode = 2

Tab. 2. Presets of the Demokit User Input

User Output Pin	*Functionality*
1	Replica of the LED pattern
2	3.3V - if the output voltage to the CeraPlas™ is applied 0V - 10 seconds after CeraPlas™ is switched off
3	3.3V - if the resonance frequency of the CeraPlas™ is found and is constant

Tab. 3. Presets of the Demokit User Output

Preliminary data

Using the COM-Port

For using the COM-Port, please come in contact to TDK to get an additional user guide and a multi-platform software which will demonstrates the communication protocol. The guide includes all commands for using the CeraPlas™ Demokit in your software project.

The additional functionalities which are listed below can be achieved when a communication between the driver and a PC will be established.

- Measurement of 3 different temperatures by using PT-100 sensors
- Different power and phase settings
- Remote Access
- Control multiple drivers in parallel

Measurement of the CeraPlas™ Input Power

The output stage of the CeraPlas™ driving circuit is outlined in Fig.2. The current is internally measured via a 0.1 Ω shunt resistor at the low side (v_{cur} , pin next to +24 V). One way to measure the CeraPlas™ input power is to connect a oscilloscope probe to each of the output pins with respect to GND. Do not directly connect any CeraPlas™ pins to GND! The corresponding voltage at the CeraPlas™ is $v_{CeraPlas} = v_{vol} - v_{cur}$, whereas the current at the CeraPlas™ is $i_{CeraPlas} = v_{cur} / 0.1\Omega$.

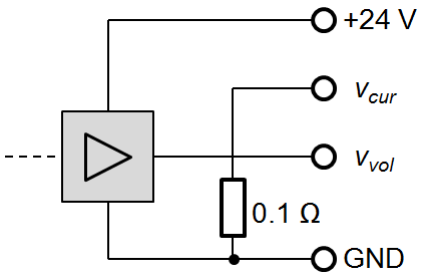


Fig. 2. Output stage of the CeraPlas™ driving circuit.

Preliminary data

Cautions for Using the CeraPlas™ Driving Circuit

- At high power and long operating time overheating of the driving circuit is possible
- At high power and long operating time additional cooling of the driving circuit may be necessary
- Avoid electrical conducting materials near (less than 20 mm, sharp tips less than 30 mm) the output side of the CeraPlas™. In this case arcing could occur, yielding high transformer power and transformer failure.
- Discharging towards an electrical conducting material near the output side of the transformer can lead to overheating of the transformer even if the load is isolated.
- High voltage hazard! The output side of the transformer can reach voltages of up to 20 kV!
- Take special care of the toxicity of ozone! Use a ventilation system to remove the ozone. Depending on air-flow around the output of the transformer the ozone concentration can reach very high values!
- Use air or inert gases only! Do not use flammable working gases!
- EPCOS is not responsible for any harm during operating and testing of CeraPlas™!

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Contact details

The Netherlands

Elektrostraat 17
NL-7483 PG Haaksbergen

T: +31 (0)53 573 33 33
F: +31 (0)53 573 33 30
E: nl@texim-europe.com

Belgium

Zuiderlaan 14 bus 10
B-1731 Zellik

T: +32 (0)2 462 01 00
F: +32 (0)2 462 01 25
E: belgium@texim-europe.com

UK & Ireland

St. Mary's House, Church Lane
Carlton Le Moorland
Lincoln LN5 9HS

T: +44 (0)1522 789 555
F: +44 (0)845 299 22 26
E: uk@texim-europe.com

Germany North

Bahnhofstrasse 92
D-25451 Quickborn

T: +49 (0)4106 627 07-0
F: +49 (0)4106 627 07-20
E: germany@texim-europe.com

Germany South

Martin-Kollar-Strasse 9
D-81829 München

T: +49 (0)89 436 086-0
F: +49 (0)89 436 086-19
E: germany@texim-europe.com

Austria

Warwitzstrasse 9
A-5020 Salzburg

T: +43 (0)662 216 026
F: +43 (0)662 216 026-66
E: austria@texim-europe.com

Nordic region

Sdr. Jagtvej 12
DK-2970 Hørsholm

T: +45 88 20 26 30
F: +45 88 20 26 39
E: nordic@texim-europe.com

Italy

Via Matteotti 43
IT-20864 Agrate Brianza (MB)

T: +39 (0)395 967 226
F: +39 (0)395 967 226
E: italy@texim-europe.com

General information

info@texim-europe.com
www.texim-europe.com