



MediPlas

Driver

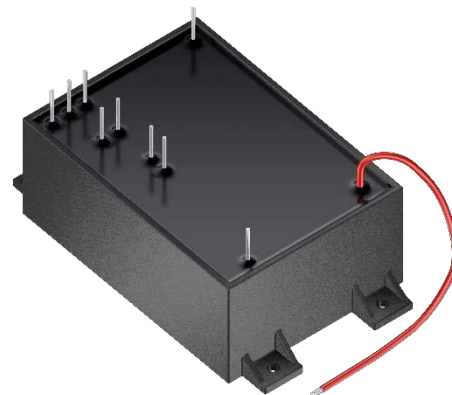
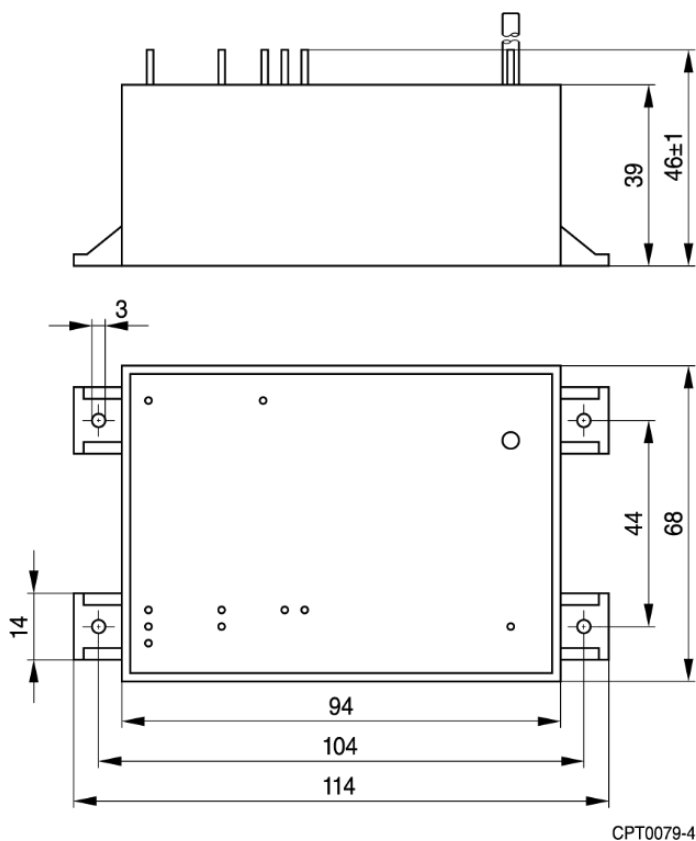
Series/Type: V 4.0
Ordering code: Z63000Z2910Z1Z83 (Prototype)
Date: 2023-04-06
Version: 7

Preliminary data
Intended use

HV driver for DBD loads

Features

- Compact
- Passive cooling
- Broad capacitance range of applicable loads
- Adjustable output voltage
- PWM power control input
- Process monitoring signal
- Overheating with auto recovery


Dimensional drawings in mm


Preliminary data
Specification
Electrical data

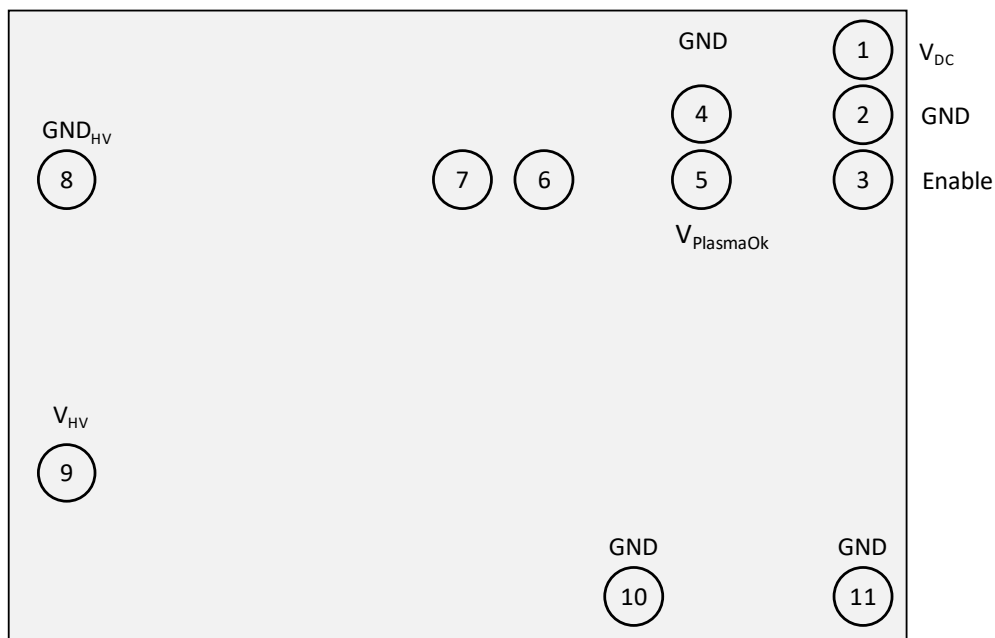
Output voltage range	2 ... 6 kV AC (proportional to input voltage)
Output frequency range	20 ... 40 kHz (auto resonant)
Input voltage range	12.0 ... 27.5 V DC
Maximal continuous input DC power	30 W
HV output connection	HV cable
Input/output connection	Pins Ø 1.3 mm
Protection functions	Reverse polarity (auto recovery) Input overvoltage (auto recovery) Input undervoltage (auto recovery) Overtemperature (auto recovery)
Control input: Enable	High-level input threshold: 2.0 ... 50 V Low-level input threshold: -0.3 ... 0.8 V (HV output control via PWM up to 100 Hz or DC ON/OFF)
Diagnostic output: PlasmaOk	PlasmaOk (attenuated analog feedback signal)
Steady state settling time	< 5 ms (load dependent)
Inrush current	6 A @ 30 V (< 500 µs); 40 A peak @ 30 V
Load capacitance range	2 ... 90 pF
Load resistance range	0.3 ... 1 MΩ
Stored energy	< 2.4 mJ

Dimensions and weight

Length	114 mm
Width	68 mm
Height	39 mm (without HV cable)
Cable length	160 ±5 mm
Mounting hole diameter	3 mm
Mounting hole spacing, length	104 mm
Mounting hole spacing, width	44 mm
Weight	~ 460 g

Preliminary data**Environmental**

Operating temperature range	5 ... 40 °C
Humidity	< 80%, non-condensing
Maximum operating altitude	3000 m

Preliminary data
Pin configuration


Pin no.	Name	Comments
1	V_{DC}	Supply voltage
2	GND	Ground potential (DC)
3	Enable	PWM or DC ON/OFF
4	GND	Ground potential (DC)
5	PlasmaOk	PlasmaOk signal voltage
6	Pin 1 for additional primary capacitance	Capacitance adjustment ¹⁾
7	Pin 2 for additional primary capacitance	Capacitance adjustment ¹⁾
8	GND_{HV}	Ground potential for high voltage
9	V_{HV}	High voltage
10	GND	Ground potential (DC)
11	GND	Ground potential (DC)

¹⁾ Primary capacitance to be matched to load capacitance for resonance frequency alignment

Table 1: Pin input and output description

Preliminary data
Control/diagnostic signals
V_{DC}

The “V_{DC}” input is the supply pin of the driver. Besides supplying the internal driver logic, the voltage level at “V_{DC}” also determines the amplitude of the high voltage output. The AC voltage amplitude “V_{HV}” is directly proportional to the “V_{DC}” voltage level (see Figure 2: V_{HV} output voltage dependency of the input voltage).

Enable

The CMOS compatible “Enable” input directly controls the high voltage output V_{HV}. V_{HV} can be activated by forcing the “Enable” pin to high state (> 2.0 V). Forcing the “Enable” to low state (< 0.80 V) will switch off “V_{HV}”. A PWM can be used to control the output power of the driver to stabilize the operating point (self-heating of the driver and/or the load). If remote control or the PWM feature are not needed, connect “Enable” to “V_{DC}” for continuous high voltage output operation. For electrical properties see Table 2: Electrical properties of “Enable” signal.

Parameters		Min.	Typ.	Max.	Unit
EN _{THH}	High-level input threshold	2.0	-	50	V
EN _{THL}	Low-level input threshold	-0.3	-	0.80	V
EN _{PWM}	PWM frequency	-	50	100	Hz
EN _D	Duty cycle	$\frac{1.06 \text{ ms} \times EN_{PWM}}{0.01}$	-	100	%
EN _{DEL}	Enable delay time	0.58	0.75	1.06	ms

Table 2: Electrical properties of the "Enable" signal

PlasmaOk

The "PlasmaOk" signal is proportional to the gap discharge intensity. It is only provided during active gap discharge cycles and is load and process dependent. When the "Enable" signal is in the HIGH state, the "PlasmaOk" signal shows an analog signal proportional to the “V_{HV}” gap discharge current. It is recommended to terminate the "PlasmaOk" signal with at least 100 kΩ. A smaller termination resistance will result in an attenuation of the signal level. If the "PlasmaOk" signal is not required, it can be left floating (e.g. non-discharging loads or if a feedback signal is not necessary).

Preliminary data
Driver states

Driver State	Inputs		Outputs	
	V _{DC}	Enable	V _{HV}	PlasmaOk
DISABLED	V _{DC} < 5.1V	x	low	low
	5.1V < V _{DC} < V _{DCUVLOT}	x	low	low
	V _{DC} > V _{DCOVPT}	x	low	low
	V _{DCUVLOT} < V _{DC} < V _{DCOVPT}	low	low	low
ENABLED	V _{DCUVLOT} < V _{DC} < V _{DCOVPT}	high	low	low
	V _{DCUVLOT} < V _{DC} < V _{DCOVPT}	high	HV-out	low ²⁾
	V _{DCUVLOT} < V _{DC} < V _{DCOVPT}	high	HV-out	Analog out ³⁾

²⁾ Expected behavior for non-discharging loads

³⁾ Expected behavior for gap discharging loads

Table 3: Driver states and their assignment to inputs and outputs

Protection functions

Parameters		Min.	Typ.	Max.	Unit	Reset
V _{DCRP}	Reverse polarity input voltage	-60	-	+60	V	Auto recovery
V _{DCOVPT}	Overvoltage protection threshold	27.8	30.0	32.5	V	Auto recovery
V _{DCOVPH}	Overvoltage protection hysteresis	-	-3.7	-	V	
V _{DCUVLOT}	Undervoltage lockout threshold	8.4	9.4	10.4	V	Auto recovery
V _{DCUVLOH}	Undervoltage lockout hysteresis	-	-1.4	-	V	Auto recovery
T _{OVT}	Overtemperature protection	-	85	-	°C	Auto recovery
T _{OVT} H	Overtemperature protection hysteresis	-	10	-	°C	Auto recovery

Table 4: Electrical properties of protection functions

Preliminary data

Permissible load parameters

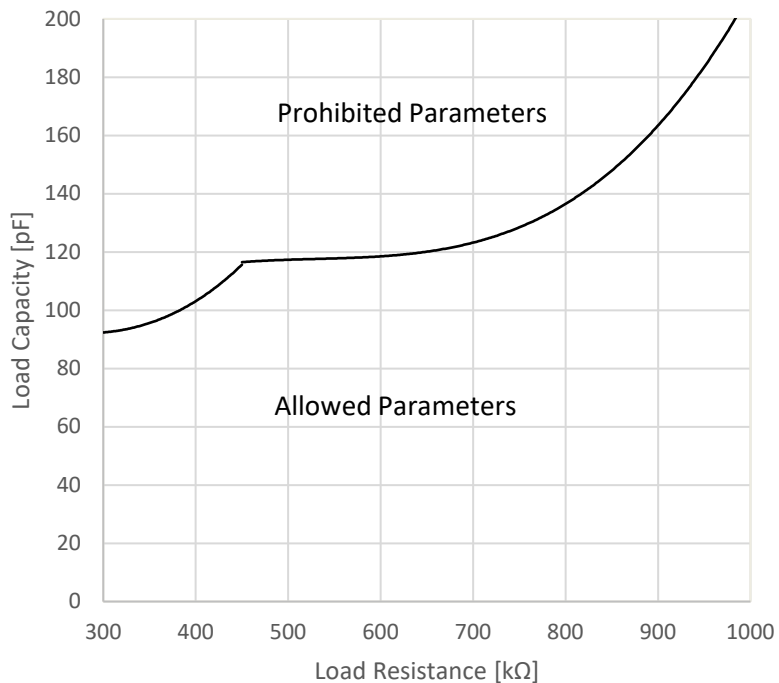


Figure 1: Range of permissible load parameters

Preliminary data

Input/output voltage dependency

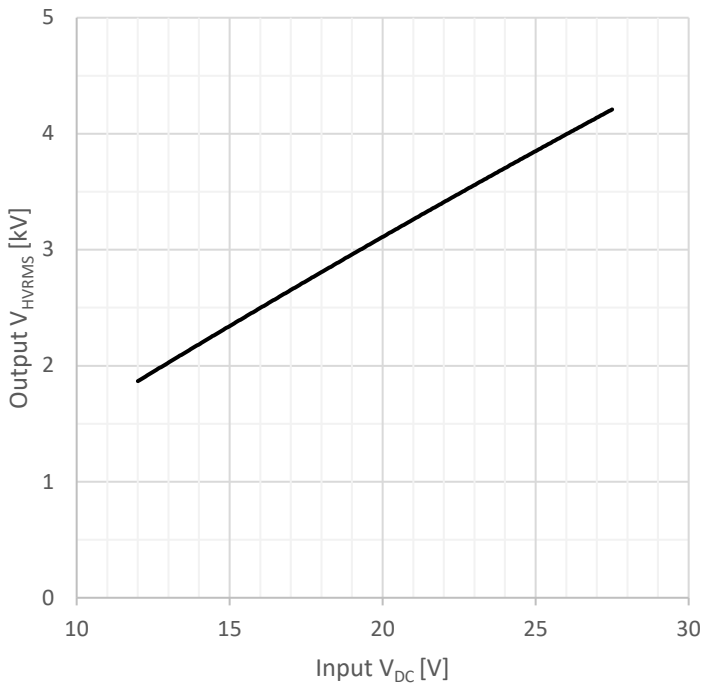


Figure 2: V_{HV} output voltage dependency of the input voltage

Input voltage dependency on output apparent power

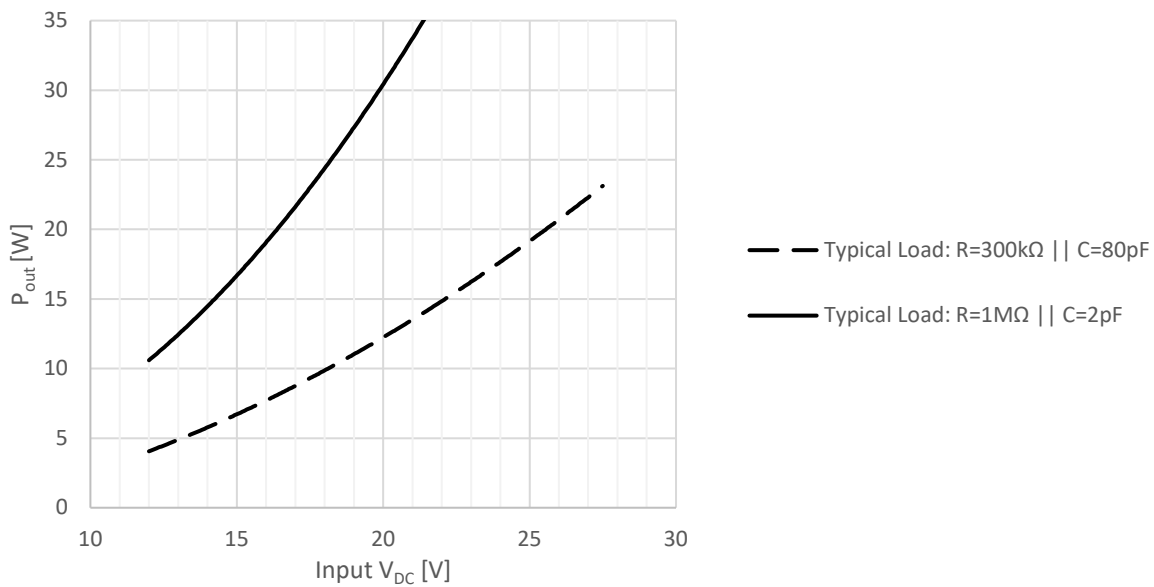











Figure 3: Output apparent power in dependence of the input voltage for typical loads

Preliminary data

Troubleshooting

- 1) Turn OFF supply voltage on “V_{DC}”.
- 2) Check if “V_{DC}” and “Enable” are correctly connected to the driver.
- 3) Check if “V_{HV}” and “GND_{HV}” are correctly connected to the load.
- 4) Check if one of the protection functions is active (see Table 4: Electrical properties of protection functions)
- 5) Check whether the load has a short circuit or the maximum permissible load parameters are exceeded (see Figure 1: Range of permissible load parameters).
- 6) Check “PlasmaOk” signal termination and connection to external signal measuring device/processing unit (see Control/diagnostic signals).
- 7) Turn ON supply voltage on “V_{DC}”. Do not exceed maximum supply voltage of 27.5 V.
- 8) Increase supply voltage until an analog output voltage is measurable on “PlasmaOk” during “Enable” high phases. A “PlasmaOk” signal is only detectable at active gap discharges. Do not exceed the maximum DC power consumption of 30 W!

Preliminary data
Cautions and warnings

	<p>Important! The products delivered are engineering samples, which are not intended for commercial use in series products of the purchaser. TDK assumes no warranty. Any use is at the sole risk of the purchaser. In case of any questions, please contact TDK.</p>
	<p>Only TECHNICALLY QUALIFIED SERVICE PERSONNEL familiar with the principles of electrical safety should operate this supply. The power supply SHOULD NOT BE EXPOSED TO WATER OR MOISTURE OR DUSTY ENVIRONMENTS (pollution degree 2). Electrical safety must be always maintained.</p>
	<p>Danger due to high voltage! Always ensure that the high voltage parts are connected correctly. Do not open the device. If the device is damaged, disconnect the voltage supply and contact the manufacturer.</p>
	<p>Do not touch the device and connecting cables during operation. All parts of the device can carry high voltages during operation. After disconnecting the supply voltage, wait at least one minute and make sure by measurement that the input capacitors are discharged before touching the device.</p>
	<p>Do not use the device in a flammable or explosive atmosphere.</p>
	<p>Do not operate the device if it is damaged.</p>
	<p>The device is designed for indoor use only. Splashing water and/or excessive humidity may cause the device to destruct or fail.</p>
	<p>Never attempt to operate the power supply in any manner not described in this manual. Never remove DANGER and WARNING labels from the device. Replace lost or damaged labels immediately.</p>
	<p>When operating this device with plasma reactors (intended use), high EMI with other devices can/will occur. When used with a plasma reactor, it is recommended to keep the connecting cables short and shield both devices accordingly.</p>

Preliminary data

Display of ordering codes for TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.** Detailed information can be found on the Internet at www.tdk-electronics.tdk.com/orderingcodes.

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

6. Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply**.
7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard**. The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements ("CSR") TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System**. For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

Important notes

8. The trade names EPCOS, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, InsuGate, LeaXield, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap, XieldCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

Release 2022-07