MediPlas

Driver

Series/Type: **V 4.0**
Ordering code: **Z63000Z2910Z1Z83 (Prototype)**

Date: 2023-11-27
Version: 8

	**Note:** This product is a development sample and has prototype status only. *Cautions and warnings* and *Important notes* must be observed.

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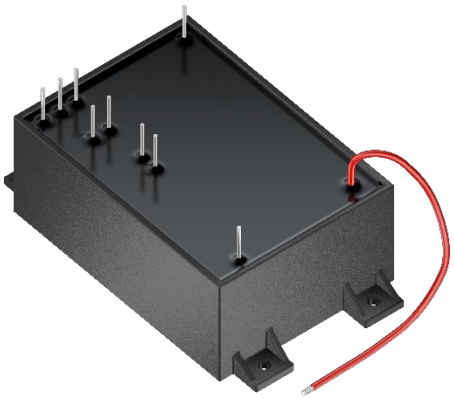
Intended use

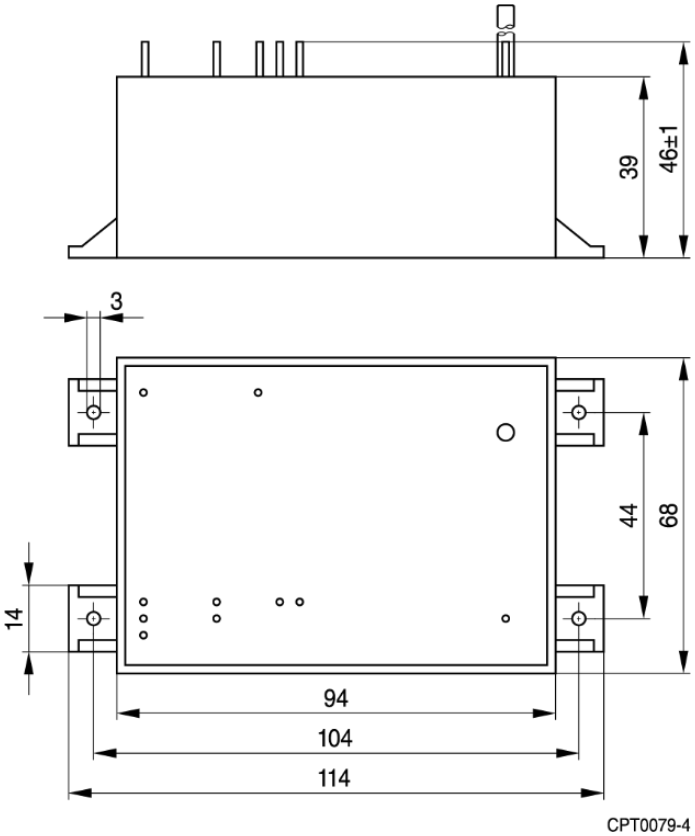
HV driver for DBD loads



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



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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

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Environmental

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

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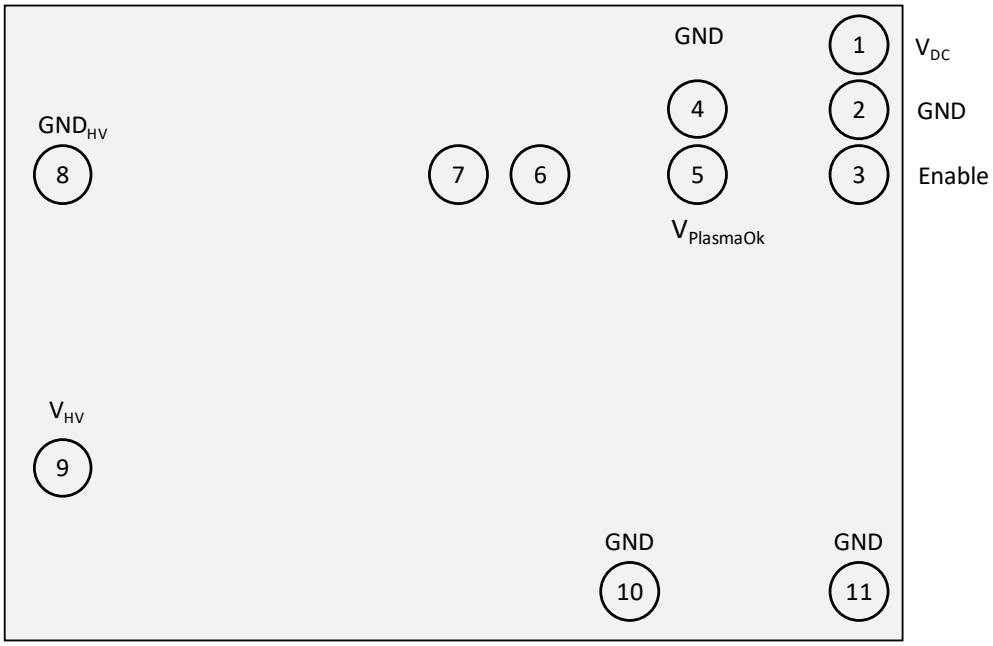
Pin configuration



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

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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	$\frac{1.06\,ms \times EN_{PWM}}{0.01}$	-	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).

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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_DC_{UVLOT}	x	low	low
	V_DC> V_DC_{OVPT}	x	low	low
	V_DC_{UVLOT} <V_DC< V_DC_{OVPT}	low	low	low
ENABLED	V_DC_{UVLOT} <V_DC< V_DC_{OVPT}	high	low	low
	V_DC_{UVLOT} <V_DC< V_DC_{OVPT}	high	HV-out	low [2)]
	V_DC_{UVLOT} <V_DC< V_DC_{OVPT}	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_DC_{RP}	Reverse polarity input voltage	-60	-	+60	V	Auto recovery
V_DC_{OVPT}	Overvoltage protection threshold	27.8	30.0	32.5	V	Auto recovery
V_DC_{OVPH}	Overvoltage protection hysteresis	-	-3.7	-	V	
V_DC_{UVLOT}	Undervoltage lockout threshold	8.4	9.4	10.4	V	Auto recovery
V_DC_{UVLOH}	Undervoltage lockout hysteresis	-	-1.4	-	V	Auto recovery
T_{OVT}	Overtemperature protection	-	85	-	°C	Auto recovery
T_{OVTH}	Overtemperature protection hysteresis	-	10	-	°C	Auto recovery

Table 4: Electrical properties of protection functions

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Permissible load parameters

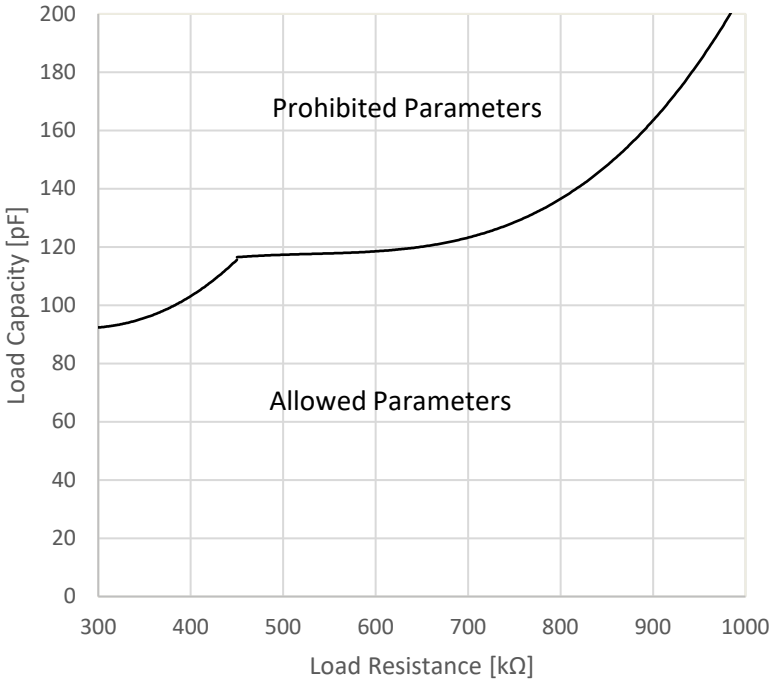

Figure 1: Range of permissible load parameters

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Input/output voltage dependency

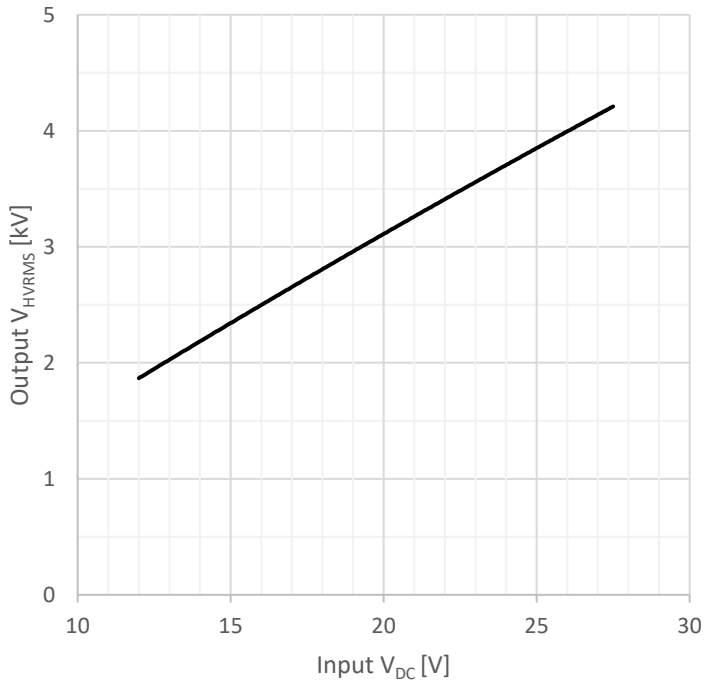

Figure 2: V_{HV} output voltage dependency of the input voltage

Input voltage dependency on output apparent power

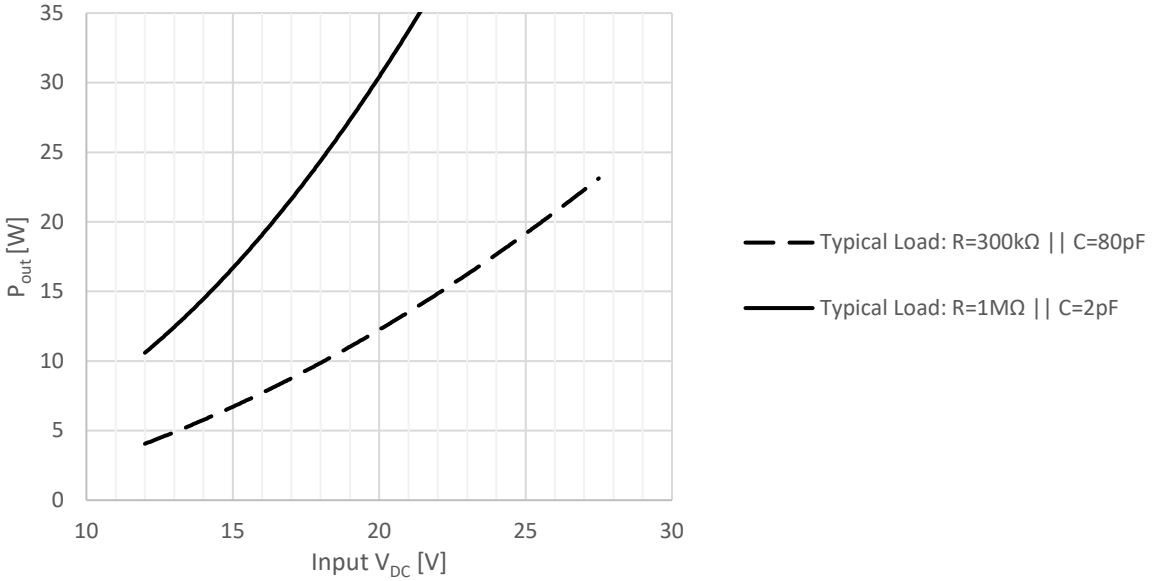

Figure 3: Output apparent power in dependence of the input voltage for typical loads

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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!

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	Only TECHNICALLY QUALIFIED SERVICE PERSONNEL familiar with the principles of electrical safety shall operate this supply. DO NOT EXPOSE THE POWER SUPPLY TO WATER, MOISTURE, OR DUSTY ENVIRONMENTS (pollution degree 2). Electrical safety must always be maintained.
	**Danger!** 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.
	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.
	**Danger!** Do not use the device in a flammable or explosive atmosphere.
	**Danger!** Do not operate the device if it is damaged.
	The device is designed for indoor use only. Splashing water and/or excessive humidity may cause the device to destruct or fail.
	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.
	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.

This listing does not claim to be complete, but merely reflects the experience of TDK.

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