The 2500W isolated bi-directional DC/DC converter is capable of power conversion between a 300 ~ 450 Vdc high voltage (HV) bus and a 28 ~ 58.4 Vdc low voltage (LV) bus. The converter supports current control via CAN for step-up and step-down conversions.

Contents

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Features

- Isolated bidirectional DC/DC conversion in current mode / voltage mode
- 300 ~ 450 Vdc HV range, 28 ~ 58.4 Vdc LV range
  - HV → LV Power: 2500W typical, 2500 W full range(Step-Down conversion)
  - HV ← LV Power: 2500W typical, 2500 W full range (Step-Up conversion)
- Efficiency: 97% max; full range 90% min.
- -40 ~ 60 ℃ operation temperature range
- Comprehensive monitoring and protection based on CAN bus communication

☐ SMPS Adaptor (Wall-Mount)
☐ SMPS Adaptor (Desktop)
☐ Open Frame
■ SMPS Unit (With Metal Case)
☐ SMPS Unit (With Plastic Case)
☐ Others

Applications

Energy storage systems
Industrial applications with batteries

Model List

PLD2500-BDGA400-48

Input / Output Characteristics of Step-Down Conversion Mode

All data tested at 25 ℃ ambient temperature, unless otherwise specified.

Input Characteristics (HV side input characteristics)

Input	Description / Condition / Note	Min.	Typ.	Max.
Voltage	HV side can stand voltages up to 500 Vdc	300 Vdc	410 Vdc	450 Vdc
Current**	Continuous operation	4.6 A	6.6 A	5.9 A
Inrush Current			10 A	20 A
OVP*		460±10 Vdc		
OVP Recovery	Hysteresis band：20.0 Vdc (typ.)	440±10 Vdc		
UVP*		290±10 Vdc		
UVP Recovery	Hysteresis band: 10.0 Vdc (typ.)	310±10 Vdc		
OCP*	1.15 full load, ±10%	7 A		
SCP*		Yes		

* Latch with fault reporting via CAN. Last 5 faults can be recorded on the MCU flash. Faults can be cleared via CAN.

** When Vin = 300V, the Vo range is limited to 28~45V, and the max Po is 1250W.

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Output Characteristics (LV side output characteristics)

Output	Description / Condition / Note	Min.	Typ.	Max.
Voltage	Resting: 48 Vdc, Operating: 51.2 Vdc	28 Vdc	51.2 Vdc	58.4 Vdc
Voltage Accuracy	Full scale accuracy:	±0.58 Vdc		
Current	Full range, refer to Fig.1	50 A	50 A	42.8 A
Power	Refer to Fig.2, De-rating	2500 W		
Ripple / Noise*	@ 51.2 Vdc / 29.3 A	120 mVp-p		
On-off Control	Controlled by CAN	Yes		
Turn-on Delay	After CAN enable signal is applied ， max	1 s		
Turn-on Overshoot	max	5%		
Dynamic Response time**	max	1 s		
Output	Description / Condition / Note	Typ.		
Efficiency	@ 410 Vdc, 51.2 Vdc, ≥ 50% Load;	97%		
OVP***		62.2±0.8 Vdc		
OVP Recovery	Hysteresis：5 Vdc (typ.)	57.2±0.8Vdc		
UVP***		25.2±0.8 Vdc		
UVP Recovery	Hysteresis: 5 Vdc (typ.)	30.2±0.8 Vdc		
OCP***	1.15 full load, ±10%	51.8 A		
SCP*		Yes		
OTP***	Baseplate temperature, ≥ 2 s	85±5℃ min.		
OTP Recovery	Hysteresis band: 10℃ (typ.)	75±5℃ min.		

* Measured at the output edge of power supply, measuring setup described below. Measurements will be made with an oscilloscope set to 20 MHz-bandwidth limit. The outputs will be bypassed with one 0.1 μF ceramic cap (type X7R) and one 10 μF (low ESR) electrolytic capacitor.

** Controlled via CAN, the converter can be operated either in current mode or voltage mode (in both directions) of the output, and the power can be transferred in either direction. The converter is able to respond to changes in current set-point, voltage set-point, or power transfer direction within 1 sec.

*** Latch with fault reporting via CAN. Fault can be cleared via CAN.

Input / Output Characteristics of Step-Up Conversion Mode

All data tested at 25 ℃ ambient temperature, unless otherwise specified.

Input Characteristics (LV side input characteristics)

Input	Description / Condition / Note	Min.	Typ.	Max.
Voltage	Resting: 48 Vdc, Operating: 51.2 Vdc	28 Vdc	51.2 Vdc	58.4 Vdc
Current**	Continuous operation	43.7 A	50dc	45.5 A
Inrush Current	@ 51.2 Vdc input, Highly depend on cable impedance		120A	
OVP*		62.2±0.8 Vdc		

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OVP Recovery	Hysteresis band：5.0 Vdc (typ.)	57.2±0.8Vdc
UVP*		25.2±0.8 Vdc
UVP Recovery	Hysteresis band: 5.0 Vdc (typ.)	30.2±0.8 Vdc
OCP*	1.15*full load, ±10%	57.5 A
SCP*		Yes

* Latch with fault reporting via CAN. Last 5 faults can be recorded on the MCU flash. Faults can be cleared via CAN.

** When Vin = 28V, the Vo range is limited to 300~410V, and the max Po is 1100W

Output Characteristics (HV side output characteristics)

Output	Description / Condition / Note	Min.	Typ.	Max.
Voltage	Resting: 48 Vdc, Operating: 51.2 Vdc	300 Vdc	410 Vdc	450 Vdc
Voltage Accuracy	Full scale accuracy: ±9 Vdc		±2.0%	
Current	Refer to Fig.4	6.6 A	6.1 A	5.6 A
Power	Refer to Fig.5, De-rating		2500 W	
Ripple / Noise*	@ 410 Vdc / 7.3 A		4.0 Vp-p	
On-off Control	Controlled by CAN		Yes	
Turn-on Delay	After CAN enable signal is applied	1 s		
Turn-on Overshoot	max	5%		
Dynamic Response time**	max	1 s		
Efficiency	@ 51.2 Vdc, 410 Vdc, ≥ 50% Load;		97%	
OVP***		460±10 Vdc		
OVP Recovery***	Hysteresis band：10.0 Vdc (typ.)	440±10 Vdc		
UVP***		290±10 Vdc		
UVP Recovery***	Hysteresis band: 10.0 Vdc (typ.)	310±10 Vdc		
OCP***	1.15*full load, ±10%	7.6 Adc		
SCP			Yes	
OTP***	Baseplate temperature, ≥ 2 s	85±5℃		
OTP Recovery	Hysteresis: 10 ℃ (typ.)	75±5℃		

* Measured at the output edge of power supply, measuring setup described below. Measurements will be made with an oscilloscope set to 20 MHz-bandwidth limit. The outputs will be bypassed with one 0.1 μF ceramic cap (type X7R) and one 10 μF (low ESR) electrolytic capacitor.

** Controlled via CAN, the converter can be operated either in current mode or voltage mode (in both directions) of the output, and the power can be transferred in either direction. The converter is able to respond to changes in current set-point, voltage set-point, or power transfer direction within 1 sec.

*** Latch with fault reporting via CAN. Faults can be cleared via CAN.

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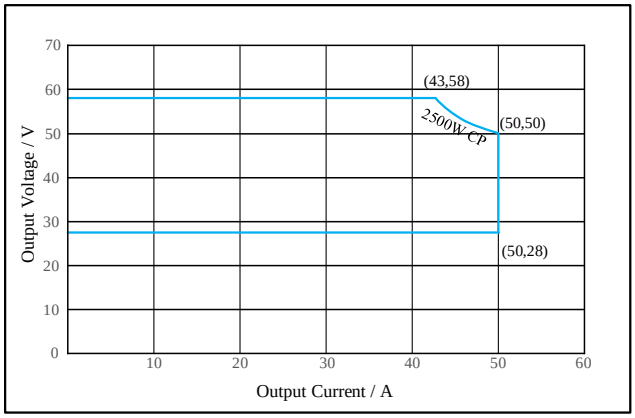
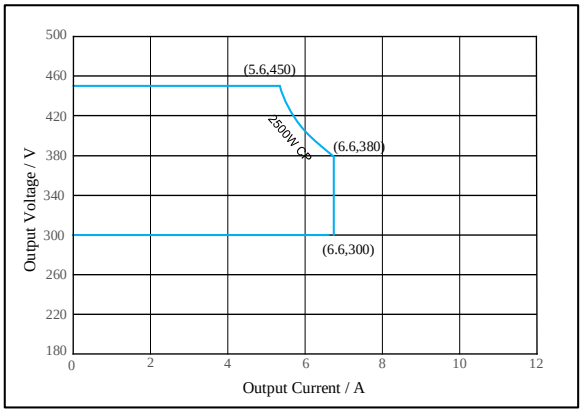
Performance Curve

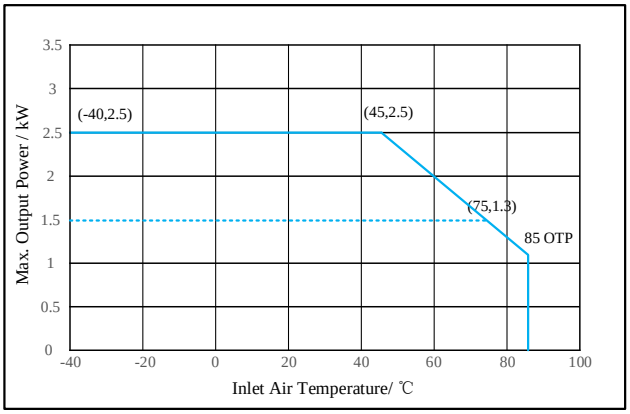
LV output I – V Characteristic



HV Output I – V Characteristic

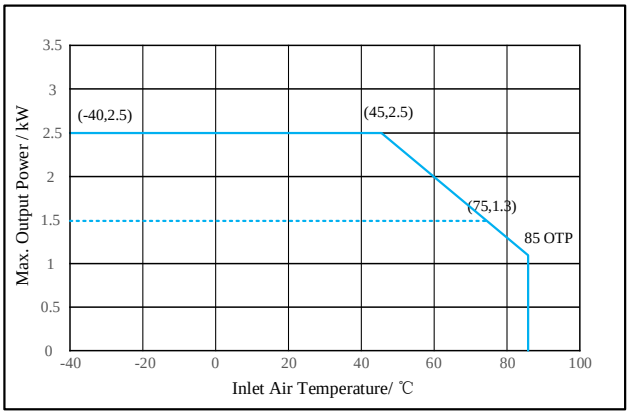


Output Power De-rating vs. Baseplate Temperature



The converter can maintain 2500 W full power operation when the Baseplate temperature is below 45℃. The output power will be de-rated automatically when the Baseplate temperature is higher than 45℃. The converter can maintain 1300 W full power operation when the Baseplate temperature is up to 75℃, and shut down when the Baseplate temperature is higher than 85℃.

Output Power De-rating vs. Baseplate Temperature



The converter can maintain 2300 W full power operation when the Baseplate temperature is below 45℃. The output power will be de-rated automatically when the Baseplate temperature is higher than 45℃. The converter can maintain 1300 W full power operation when the Baseplate temperature is up to 75℃, and shut down when the Baseplate temperature is higher than 85℃.

CAN Communication

CAN Parameters

- CAN 2.0 A/B – 11bit Mode (Tolerant of 29 – bit messages)
- Baud Rate: Selectable, 125/250/500 kbps (default is 500 kbps)

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CAN Details

Refer to the document file： DC/DC CAN Packets

<table>
<tr><th rowspan="2">ID</th><th rowspan="2">Packet Name</th><th rowspan="2">Message Direction</th><th rowspan="2">Periodicity</th><th rowspan="2">DLC</th><th colspan="64">Bit</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th><th>18</th><th>19</th><th>20</th><th>21</th><th>22</th><th>23</th><th>24</th><th>25</th><th>26</th><th>27</th><th>28</th><th>29</th><th>30</th><th>31</th><th>32</th><th>33</th><th>34</th><th>35</th><th>36</th><th>37</th><th>38</th><th>39</th><th>40</th><th>41</th><th>42</th><th>43</th><th>44</th><th>45</th><th>46</th><th>47</th><th>48</th><th>49</th><th>50</th><th>51</th><th>52</th><th>53</th><th>54</th><th>55</th><th>56</th><th>57</th><th>58</th><th>59</th><th>60</th><th>61</th><th>62</th><th>63</th></tr>
<tr><td>0x300</td><td>DCDC CTRL</td><td>System ↦ DCDC</td><td>As needed but no more than once per 200ms</td><td>8</td><td colspan="8">Mode</td><td colspan="16">debug mode</td><td colspan="16">Hi-side Voltage Command
10mV / bit</td><td colspan="16">Lo-side Current Command
5 mA / bit</td><td colspan="8">Hi-Side Current Limit
70 mA / bit</td></tr>
<tr><td>0x301</td><td>DCCD STAT</td><td>DCDC ↦ System</td><td>200ms when active</td><td>8</td><td colspan="8">Stat</td><td colspan="8">0</td><td colspan="8">Lo-Side Voltage
0.1V / bit</td><td colspan="16">Hi-side Voltage
10mV / bit</td><td colspan="16">Lo-side Current
5mA / bit</td><td colspan="8">Hi-Side Current
70 mA / bit</td></tr>
<tr><td>0x302</td><td>TEMPERATURE & FAULTS</td><td>DCDC ↦ System</td><td>1000ms when active</td><td>8</td><td colspan="8">Controller Temp
1 °C / bit
offset:128</td><td colspan="8">Base Plate Temp
1 °C / bit
offset:128</td><td colspan="16">Faults</td><td colspan="16">Latched Faults
(same fields as Faults but latched. Cleared same as “Active Faults”)</td><td colspan="16">Actual Output Power
0.1W / bit</td></tr>
<tr><td>0x303</td><td>EXECUTE</td><td>System ↦ DCDC</td><td>As needed but no more than once per 200ms</td><td>2</td><td colspan="8">CMD</td><td colspan="8">~CMD</td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td></tr>
<tr><td>0x304</td><td>VERSION</td><td>DCDC ↦ System</td><td>sent when required</td><td>8</td><td colspan="8">DC/DC HW
Version Major</td><td colspan="8">DC/DC HW
Version Minor</td><td colspan="8">DC/DC HW
Version Patch</td><td colspan="8">DC/DC HW
Version Internal</td><td colspan="8">DC/DC FW
Version Major</td><td colspan="8">DC/DC FW
Version Minor</td><td colspan="8">DC/DC FW
Version Patch</td><td colspan="8">DC/DC FW
Version Internal</td></tr>
<tr><td>0x305</td><td>CONFIG</td><td>System ↦ DCDC</td><td>As needed but no more than once per 1000ms</td><td>2</td><td colspan="8">KeyValue</td><td colspan="8">New config</td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td></tr>
<tr><td>0x306</td><td>CONFIG ACK</td><td>DCDC ↦ System</td><td>sent after 0x305</td><td>1</td><td colspan="8">New config ACK</td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td><td colspan="8"></td></tr>
<tr><td>0x307</td><td>DEBUG INFO</td><td>DCDC ↦ System</td><td>200ms</td><td>8</td><td colspan="16">ADC_I_LV_M_A
5mA/bit</td><td colspan="16">ADC_I_LV_M_B
5mA/bit</td><td colspan="8">dutyA/phaseA</td><td colspan="8">dutyB/phaseB</td><td colspan="8">ENA/ENB</td><td colspan="8">Trip Zone Flag</td></tr>
</table>

NOTE

- When writing the field CMD you must also write the field ~CMD with the bit-wise inversion of the value in CMD
- Operation to set (or update) Voltage and Current set points:

1) Write DCDC CTRL (0x300) with fields set as desired

2) Write EXECUTE (0x303) with the fields CMD = UPDATE

- To clear a fault condition:

1) Read DCDC STAT (0x301). Note whether the bit “Active Fault” in the field “Stat” is asserted. If this bit is set, then it will latch asserted.

2) Read TEMPERATURE & FAULTS (0x302) until all bits in the field “Faults” are clear. The field “Latched Faults” will latch faults that may assert and clear quickly.

3) [Optional] Update the parameters in DCDC CTRL (0x300) if they are different than what was last sent

4) Write EXECUTE (0x303) with the field CMD = UPDATE AND CLR FAULTS to clear the “Active Fault” bit in the field “Stat” of DCDC STAT (0x301) and will also clear latched faults in the field “Latched Faults” of TEMPERATURE & FAULTS (0x302)

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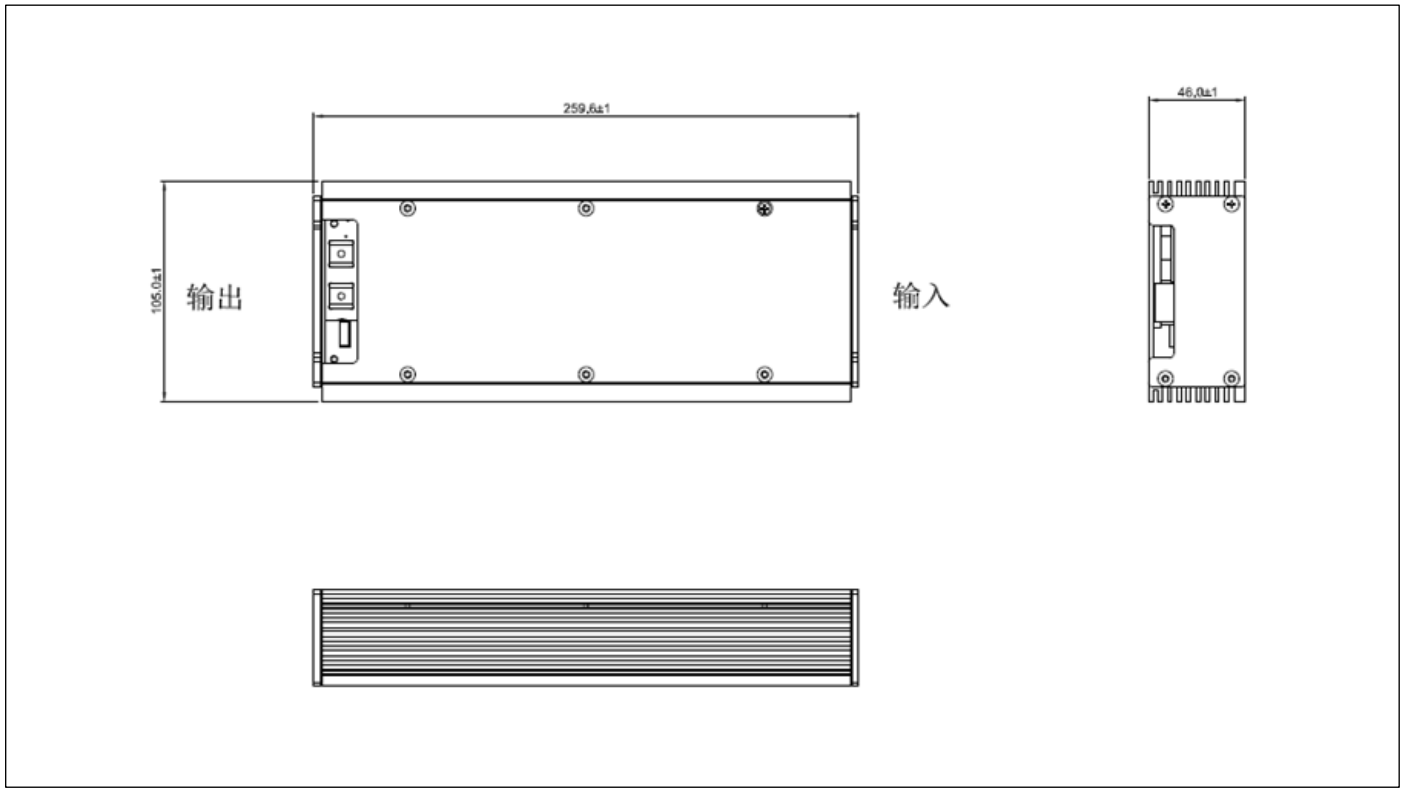
Mechanical Specification

Dimension and Outline Drawing

(unit: mm)



Power & Signal Port

Name	Pin	Definition
Signal	1	CAN _L
	2	CAN_H
	3	WAKEUP
	4	GND
	5	12V (0.2A)

*The instructions will be shipped with the goods.

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Environmental Requirements

The power supply shall operate normally, and sustain no damage as a result of the environmental conditions listed in this section.

Item	Description / Condition / Note	Min.	Typ.	Max.
Ambient temperature	Ambient operation temperature	-40℃		+60℃
Baseplate temperature	operation temperature refer to Fig.2 and Fig.5, Derating	-40℃		+85℃
Storage temperature		-40℃		+85℃
Humidity	Non-condensing			95%
Altitude		0 m		2000 m
Vibration*	Physical abuse per EN 60068-2-6*			
Odor	No odor or health-harming gas release			

* Frequency: 10~55Hz

Amplitude: double, 0.35mm

Sweep frequency No.10

Time per direction (3 directions): 45min.

Safety & EMC Compliance

1. Comply with EN60335-2-29, EN61180-1, 60335-1, IEC/TS 62196-4.
2. Primary to Secondary insulation: 2500Vac 5mA max/60second.
3. Primary to Earth insulation: 2500Vac 5mA max/60second.
4. Insulation Resistance: 2MΩ minimum from primary to secondary by adding 500Vdc 60s test voltage.

Isolation

Isolation	Input Wires	Output Wires	Enclosure
Input Wires	Not applicable	2500Vac	2500Vac
Output Wires	2500Vac	Not applicable	2500Vac
Enclosure	2500Vac	2500Vac	Not applicable

The instructions will be shipped with the goods.

Revision History

Change Date	Rev.	Description of Change		
		Item	From	To
2023.05.15	V1.0			

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