GDQ54S12B-4A DC-DC Converter

Technical Manual

Issue 02

Date 2021-09-03

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About This Document

Purpose

This document describes the GDQ54S12B-4A DC-DC converter, including its electrical specifications, features, applications, and communication.

The figures provided in this document are for reference only.

Intended Audience

This document is intended for:

- Sales personnel
- Technical support engineers
- System engineers
- Software engineers
- Hardware engineers

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.

Symbol	Description
NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Issue 02 (2021-09-03)

This issue is the second release.

- Added **6.2 Thermal Considerations**.

Issue 01 (2021-03-25)

This issue is the first release.

Contents

About This Document ii

1 Safety Information 1

1.1 General Safety 1

1.2 Personnel Requirements 3

1.3 Electrical Safety 4

2 Product Overview 5

3 Schematic Diagram 7

4 Electrical Specifications 8

4.1 Absolute maximum ratings 8

4.2 Input 8

4.3 Output 9

4.4 Efficiency 10

4.5 Protection 11

4.6 Dynamic Characteristics 12

4.7 Insulation Characteristics 12

4.8 Other Characteristics 13

5 Product Structure Overview 14

5.1 Dimensions 14

5.2 Pin Distribution 15

5.3 Pin Application 16

6 Characteristic Curves 18

6.1 Efficiency and Power Dissipation Curves 18

6.2 Thermal Considerations 18

7 Typical Waveforms 20

7.1 Turn-on/Turn-off 21

7.2 Output Voltage Dynamic Response 22

7.3 Output Voltage Ripple 23

7.4 Output Voltage Rise Time 23

8 Input Anti-resonance Method 24

9 Protection Characteristics 25

10 Product Packaging, Storage, and Transportation.....26

A EMC Specifications.....28

1 Safety Information

1.1 General Safety

Statement

Before installing, operating, and maintaining the device, read this document and observe all the safety instructions on the device and in this document.

The statements in the document do not cover all the safety instructions. They are only supplements to the safety instructions. Huawei will not be liable for any consequence caused by the violation of general safety requirements or design, production, and usage safety standards.

Ensure that the converter is used in environments that meet its design specifications. Otherwise, the converter may become faulty, and the resulting malfunction, component damage, personal injuries, or property damage are not covered under the warranty.

Follow local laws and regulations when installing, operating, and maintaining the converter. The safety instructions in this document are only supplements to local laws and regulations.

Huawei will not be liable for any consequences of the following circumstances:

- Although the device has passed security and compatibility tests, the radio frequency and magnetic fields emitted from electronic devices may have a negative impact on the operation of other electronic devices.The device may affect normal operation of implanted medical appliances or personal medical appliances, such as pacemakers, cochlear implants, and hearing aids. If such appliances are used, consult the appliance manufacturer about the restrictions for using the device.
- Operation beyond the conditions specified in this document.
- Installation or use in environments which are not specified in relevant international or national standards.
- Unauthorized modifications to the product or software code or removal of the product.

- Failure to follow the operation instructions and safety precautions on the product and in this document.
- Equipment damage due to force majeure, such as earthquakes, fire, and storms.
- Damage caused during transportation by the customer.
- Storage conditions that do not meet the requirements specified in this document.
- Do not drop, squeeze, or pierce the converter. Protect the converter from external high pressure to prevent internal short circuits and overheating.
- Do not disassemble, refit, or insert foreign objects into the converter. Do not expose the converter to water or other liquids. Doing so may lead to short circuits, overheating, fire, or electric shocks.
- Use and store the product within the temperature range stipulated in the specifications.
- Do not expose the converter to heat sources such as direct sunlight, radiators, microwave ovens, ovens, or water heaters.
- If the converter is damaged, cracked, or wet, stop using it. Continuing to use it may lead to electric shocks, short circuits, or fire.
- Dispose of the converter in accordance with local regulations. Do not dispose of it as normal household waste. Follow local regulations on disposal of the converter and its accessories. Support proper collection and recycling.
- Keep the converter dry. Do not use the PSU in a dusty or damp place. Otherwise, the converter may be faulty. Do not splash water on the converter. Keep the PSU far away from fire sources. Do not ignite the converter.
- Do not operate the converter with wet hands. Otherwise, electric shocks may occur.

General Requirements

DANGER

- Before performing operations on the converter, power it off to prevent accidents caused by live-line working.
- Do not alter or repair the converter.
- The voltage inside the converter is high. Do not open it.
- Prevent any foreign objects from entering the shell.
- Do not use the converter in a damp place or in an area where moisture or condensation may occur.
- Do not touch the converter when it is powered on or just powered off. The hot surface can cause scalds.
- Only qualified personnel are allowed to install and operate the converter.
- The converter does not contain parts that need to be maintained. The internal fuse may be disconnected if an internal fault occurs.
- If any damage or fault occurs during installation or operation, power off the converter immediately and return it to the manufacturer for inspection or repair.
- Strictly comply with local regulations and ensure that cables are correctly connected.
- Condensation or frost is not allowed during the use of the converter.
- When the converter is operating, do not use it beyond the ambient temperature range.

Personal Safety

- Do not alter, disassemble, or remove the shell of the converter.
- If there is a probability of personal injury or converter damage during operations on the converter, immediately stop the operations, report the case to the supervisor, and take feasible protective measures.
- Before the installation is completed or confirmed by professionals, do not power on the converter.

1.2 Personnel Requirements

- Personnel who plan to install, operate or maintain the converter must receive thorough training, understand all necessary safety precautions, and be able to correctly perform all operations.
- During the installation, operation, and maintenance of the converter, no collision or drop is allowed.
- During the secondary assembly of the converter, do not introduce conductive foreign objects.

1.3 Electrical Safety

Operation Requirements

WARNING

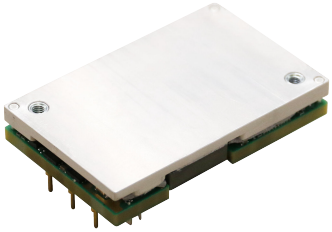
Failure to follow the operating procedures may cause personal injury or even death.

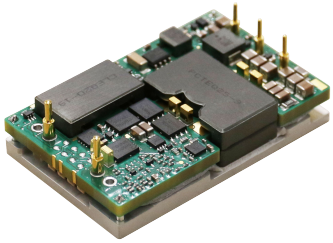
- Before installing or removing the converter, disconnect the upstream power supply to the converter.
- Before powering on the converter, ensure that the converter cables are correctly connected.
- If the converter has multiple inputs, disconnect all the inputs to completely power it off before operating the converter.
- Only qualified personnel are allowed to perform operations to prevent electric shocks.
- Before making electrical connections, disconnect the upstream power supply to the converter if people may contact energized components.
- Do not open, alter, or repair the product as the voltage inside the product is high.
- To ensure safety, connect the shell ground and the device ground reliably. When installing the device, install the PE cable first. When uninstalling the device, remove the PE cable last.
- Do not operate the converter with wet hands. Otherwise, electric shocks may occur.
- If any damage or fault occurs during installation or operation, power off the converter immediately and return it to the manufacturer for inspection or repair.
- In case of emergency, remove the power plug from the power outlet to completely cut off the power supply.

ESD

- When installing, operating, and maintaining the converter, comply with the ESD protection regulations and wear the ESD clothing, gloves, and wrist strap.
- When holding the converter, hold its edge without touching any components. Do not touch the components with your bare hands.
- Package the removed converter with ESD packaging materials before storing or transporting it.

2 Product Overview





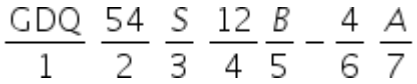
Product Description

The GDQ54S12B-4A is a new generation isolated DC-DC converter that uses an industry standard quarter-brick structure, featuring high efficiency and power density with low output ripple and noise. It operates from an input voltage range of 36 V to 75 V, and provides the rated output voltage of 12 V as well as the maximum output current of 54 A.

Features

- Efficiency: 95.5% (T_A = 25°C; V_{in} = 36 V, 50% load)
- Length x Width x Height: 57.9 mm x 36.8 mm x 13.4 mm (2.28 in. x 1.45 in. x 0.53 in.)
- Weight: 85 g
- Input undervoltage protection
- Auxilary undervoltage protection
- Output overcurrent protection (hiccup mode)
- Output short circuit protection (hiccup mode)
- Output overvoltage protection (hiccup mode)
- Overtemperature protection (self-recovery)
- Remote on/off
- UL certification
- UL 62368-1, IEC 62368-1, EN 62368-1, GB4943-1 compliant
- RoHS6 compliant

Model Naming Convention



1 — 48 V input, high performance, digital control, standard quarter-brick

2 — Output current: 54 A

3 — Single output

4 — Output voltage: 12 V

5 — With a baseplate

6 — Pin length: 4.8 mm

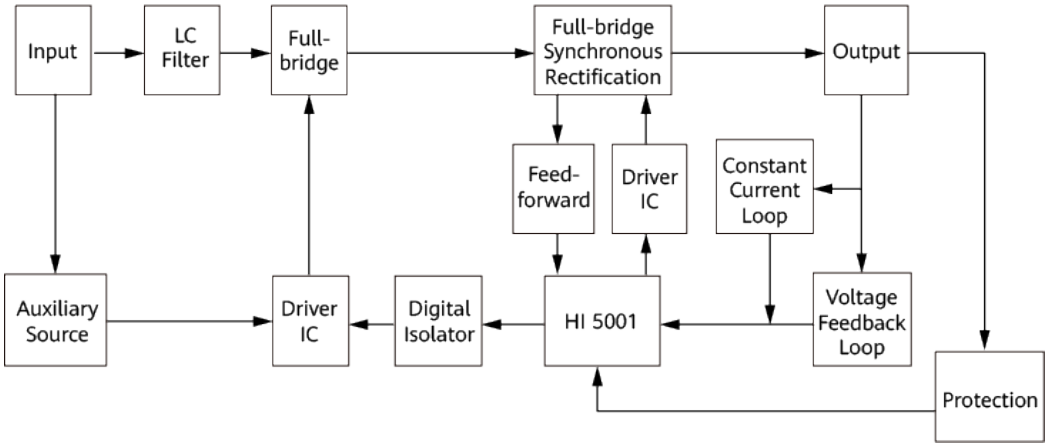
7 — Version

Applications

Widely used in telecom, industrial, instrument monitoring, and test equipment applications

3 Schematic Diagram

Figure 3-1 Internal schematic diagram of the converter



4 Electrical Specifications

4.1 Absolute maximum ratings

Table 4-1 Absolute maximum ratings

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Input voltage • Continuous • Transient (100 ms)	- - -	- - -	- 80 100	- V V	- - -
Operating temperature (T_A)	–40	-	85	°C	-
Storage temperature	–55	-	125	°C	-
Relative humidity	10	-	95	% RH	Non-condensing
External voltage applied to ON/OFF	-	-	12	V	-
External voltage applied to PMBus	-	-	3.6	V	-
Altitude	-	-	5000	m	-

4.2 Input

Table 4-2 Input specification

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Operating input voltage	36	48	75	V	-
Maximum input current	-	-	35	A	V_{in} = 0–75 V, I_{out} = I_{onom}

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
No-load loss	-	8	11	W	V_{in} = 48 V, I_{out} = 0 A, T_A = 25°C
Input capacitance	440	680	-	µF	Aluminum electrolytic capacitor
Response to input transient	-	1.5	2.0	V	0.5 V/µs input transient, V_{in} = 43–75 V, 100% load
	-	-	3.0	V	0.5 V/µs input transient, V_{in} = 36–75 V, 100% load

4.3 Output

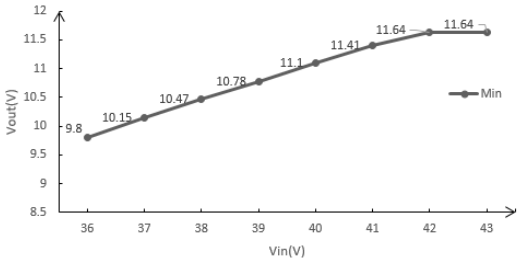
Table 4-3 Output specification

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Output voltage setpoint	11.88	12.00	12.12	V	T_A = 25°C, V_{in} = 48 V, I_{out} = 50% I_{onom}
Output voltage	11.64	-	12.36	V	V_{in} = 43–75 V, I_{out} = I_{onom}
	9.80	-	12.36	V	V_{in} = 36–43 V, I_{out} = I_{onom} (see **Note**)
Output current	0	-	54	A	-
Output power	0	-	650	W	-
Line regulation	–0.5	-	0.5	% V_{out}	V_{in} = 43–75 V; I_{out} = I_{onom}
	–17		17	% V_{out}	V_{in} = 36–43 V; I_{out} = I_{onom}
Load regulation	–3	-	3	% V_{out}	V_{in} = 48 V; I_{out} = I_{omin} – I_{onom}
Output voltage regulation precision	–5	-	5	%	V_{in} = 43–75 V; I_{out} = I_{omin} – I_{onom}
	–18	-	18	%	V_{in} = 36–43 V; I_{out} = I_{omin} – I_{onom}
Output temperature coefficient	–0.02	-	0.02	%/°C	T_A = –40°C to +85°C, V_{in} = 48 V, V_{out} = 12 V, I_{out} = 54 A
Output external capacitance	660	-	6000	µF	SMD aluminum solid capacitor or chip aluminum capacitor, ESR < 30 mΩ.
Ripple and noise (peak to peak)	-	180	500	mV	Oscilloscope bandwidth: 20 MHz.
Output voltage overshoot	-	-	5	%	Full range of V_{in}, I_{out}, and T_A

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Output voltage delay time	-	50	100	ms	From V_{in} to 10% V_{out}
Output voltage rise time	-	50	100	ms	V_{in} = 43–75 V, from 10% V_{out} to 90% V_{out}, see **7.4 Output Voltage Rise Time**.
Switching frequency	-	180	-	kHz	-

NOTE

- The relation curve of the V_{in} = 36–43 V and V_{out} (steady state).



4.4 Efficiency

Table 4-4 Efficiency specification

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
100% load	93.5	94.5	-	%	T_A = 25°C, V_{in} = 48 V
50% load	94	95	-	%	
20% load	92	94	-	%	
100% load	92	94	-	%	T_A = 25°C, V_{in} = 36 V
50% load	94.5	95.5	-	%	
100% load	92	94	-	%	T_A = 25°C, V_{in} = 75 V
50% load	93	94	-	%	

4.5 Protection

Table 4-5 Input Protection

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Input undervoltage protection	-	-	-	-	-
Startup threshold	32	34	36	V	-
Shutdown threshold	30	32	34	V	-
Hysteresis	1	2	3	V	-
Auxiliary input undervoltage protection	-	-	-	-	-
Startup threshold	25.5	28.0	31.5	V	-
Shutdown threshold	22.5	26.0	29.5	V	-
Hysteresis	0.7	1.9	3.0	V	-

Table 4-6 Output Protection

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Output overcurrent protection	82.5	-	105	A	Hiccup mode
Output short circuit protection	-	-	-	-	Hiccup mode, and system reports OVP protection Short circuit impedance is not less than 100 milliohms.
Output overvoltage protection	13.2	-	16	V	Hiccup mode, and system reports OVP protection
Overtemperature protection threshold	105	120	130	°C	Self-recovery; the overtemperature protection hysteresis is obtained by measuring the temperature of the PCB near the temperature sensor.
Overtemperature protection hysteresis	5	-	-	°C	

4.6 Dynamic Characteristics

Table 4-7 Dynamic characteristics

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Overshoot amplitude	-	-	600	mV	V_{in} = 43–75 V, current change rate: 0.1 A/μs, T = 5 ms, load: 25%–50%–25%; 50%–75%–50%
Overshoot recovery time	-	-	200	μs	
Overshoot amplitude	-	-	1200	mV	V_{in} = 43–75 V, current change rate: 1 A/μs, T = 5 ms, load: 25%–50%–25%; 50%–75%–50% (additional 1000 μF load capacitor)
Overshoot recovery time	-	-	500	μs	

NOTE

Larger than 80% load step, there is no special standard.

4.7 Insulation Characteristics

Table 4-8 Insulation characteristics

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Input to output insulation voltage	-	-	1500	V DC	Basic insulation, leakage current < 1 mA, altitude = 3000 m, without arc or breakdown
Input to baseplate insulation voltage	-	-	750	V DC	
Output to baseplate insulation voltage	-	-	750	V DC	
Input to output insulation voltage	-	-	1500	V DC	Functional insulation, leakage current < 1 mA, altitude = 5000 m, without arc or breakdown
Input to baseplate insulation voltage	-	-	750	V DC	
Output to baseplate insulation voltage	-	-	750	V DC	

4.8 Other Characteristics

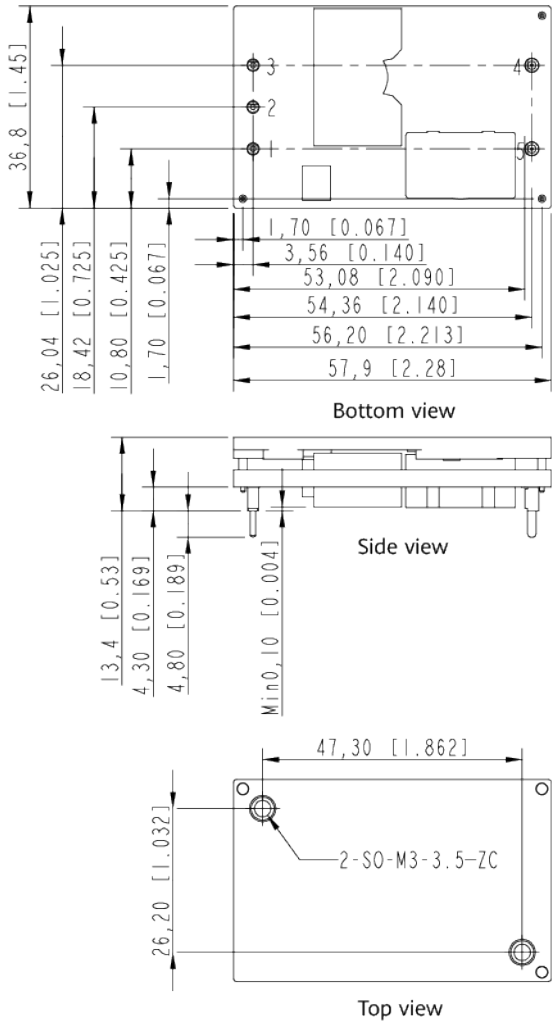
Table 4-9 Other characteristics

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Remote On/Off voltage low level	–0.7	-	1.2	V	Negative logic
Remote On/Off voltage high level	3.5	-	12	V	
On/Off current low level	-	-	1	mA	-
On/Off current high level	-	-	-	μA	
Mean time between failures (MTBF)	-	2.5	-	Million hours	Telcordia, SR332 Method 1 Case 3; 80% load, normal input/rated output; 300 LFM; T_A = 40°C.

5 Product Structure Overview

5.1 Dimensions

Figure 5-1 Dimensions

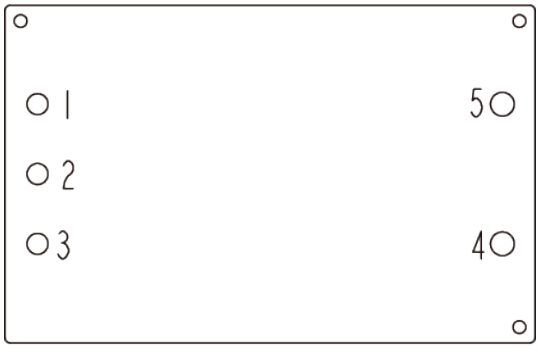


NOTE

1. All dimensions in mm [in.].

   Tolerances: x.x ± 0.5 mm [x.xx ± 0.02 in.]; x.xx ± 0.25 mm [x.xxx ± 0.010 in.].
2. Pins 1–3 are 1.00 ± 0.05 mm [0.040 ± 0.002 in.] diameter with 2.00 ± 0.10 mm [0.080 ± 0.004 in.] diameter standoff shoulders. Pins 4–5 are 1.50 ± 0.05 mm [0.060 ± 0.002 in.] diameter with 2.50 ± 0.10 mm [0.098 ± 0.004 in.] diameter standoff shoulders. Pins 8–15 are 0.50 ± 0.05 mm [0.020 ± 0.002 in.] diameter standoff shoulders.
3. M3 screw used to bolt unit is baseplate to other surfaces (such as heats ink) must not exceed 4.0 mm [0.157 in] depth blow the surface of baseplate.
4. Components will vary between models.

5.2 Pin Distribution



Top view

NOTE

When the converter is in use, the voltage of each pin must not exceed the value listed in Table **Table 5-1**. If the voltage exceeds the value listed in Table **5.2 Pin Distribution**, the converter may be damaged.

Table 5-1 Pin distribution

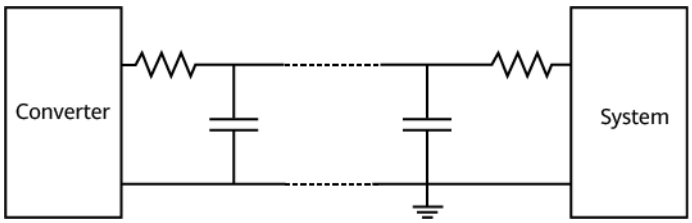
Pin No.	Pin name	Function	Absolute withstand voltage
1	V_{in} (+)	Converter input pin, positive	–0.3 V to 100 V/100 ms, V_{in} (–) as reference
2	On/Off	Converter remote on/off pin. For details about the application method, see **On/Off Pin**.	–0.7 V to 12 V, V_{in} (–) as reference
3	V_{in} (–)	Converter input pin, negative	
4	V_{out} (–)	Converter output pin, negative	-
5	V_{out} (+)	Converter output pin, positive	-

5.3 Pin Application

NOTE

- Do not short-circuit the output pins. Otherwise, the converter may fail after it is powered on.
- The output filter capacitor and ceramic capacitor should be placed close to the pins of the converter.
- Non-power traces must be far away from high-voltage and high-frequency signals. You are advised to add an RC filter circuit if possible.
- Ensure that the heat dissipation of the power MOS tube at the bottom of the converter is good during usage.

Figure 5-2 Recommended RC filter circuit diagram



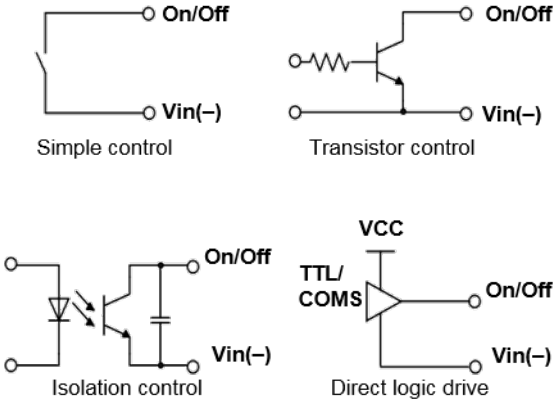
On/Off Pin

The main output of module can be turned on or turned off by On/Off signal.

On/Off Pin Level	Status
Low level [–0.7 V, 1.2 V]	On
High level [3.5 V, 12.0 V]	Off

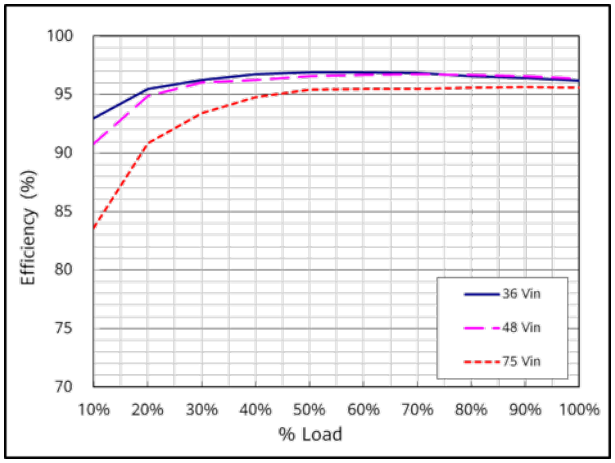
On/Off Signal	Max.
On/Off current (low level)	1 mA

Figure 5-3 Various circuits for driving the On/Off pin

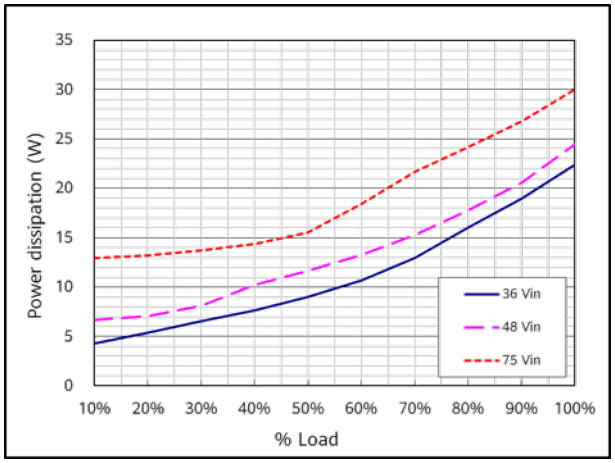


6 Characteristic Curves

6.1 Efficiency and Power Dissipation Curves



Efficiency curve
(T_A = 25°C; V_{in} = 36 V, 48 V, or 75 V)



Power dissipation curve
(T_A = 25°C; V_{in} = 36 V, 48 V, or 75 V)

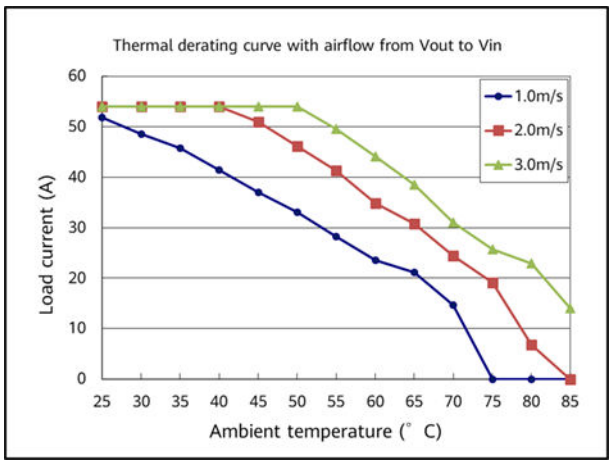
6.2 Thermal Considerations

Sufficient airflow should be provided to ensure reliable operating of the converter. Therefore, thermal components are mounted on the top surface of the converter to dissipate heat to the surrounding environment by conduction, convection, and radiation. Proper airflow can be verified by measuring the temperature at the surface of the converter.

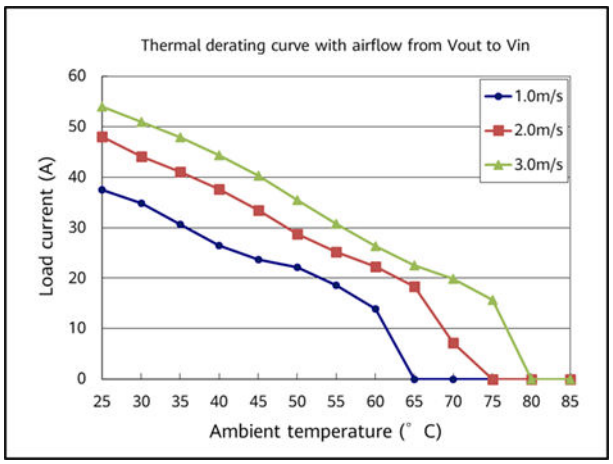
Heat sink requirements:

- V_{out} to V_{in}: dimensions (W x H x D): 36.8 mm x 10.0 mm x 57.9 mm; baseplate thickness: 2.0 mm; number of teeth: 9; teeth thickness: 1.8 mm; teeth spacing: 2.5 mm; material: Al6063-T5

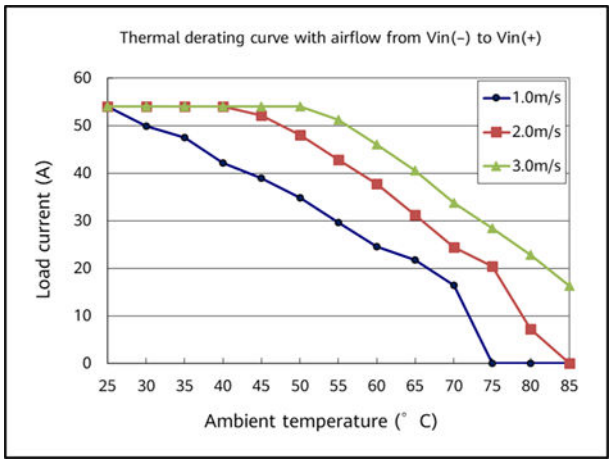
- V_{in} (–) to V_{in} (+): dimensions (W x H x D): 36.8 mm x 11.2 mm x 57.9 mm; baseplate thickness: 2.5 mm; number of teeth: 20; teeth thickness: 1.5 mm; teeth spacing: 1.5 mm; material: Al6063-T5
- The converter is mounted on a 270 mm x 270 mm, 35µm (1Oz), 16 layers' test PCB and is vertically positioned within the wind tunnel.



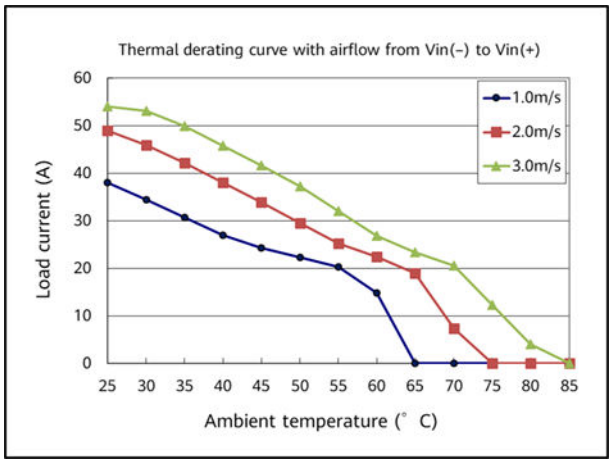
V_{in} = 53.5 V; V_{out} = 12.0 V, with heatsink



V_{in} = 53.5 V; V_{out} = 12.0 V, without heatsink



V_{in} = 53.5 V; V_{out} = 12.0 V, with heatsink



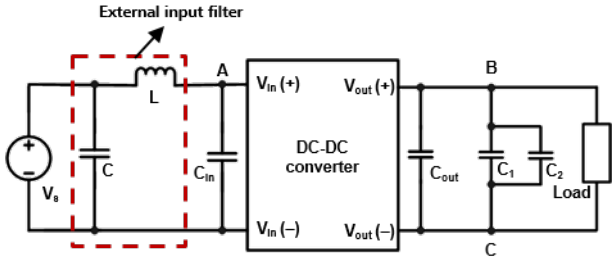
V_{in} = 53.5 V; V_{out} = 12.0 V, without heatsink

7 Typical Waveforms

NOTE

- During the test of input reflected ripple current, the input must be connected to an external input filter (including a 12 μH inductor and a 220 μF electrolytic capacitor), which is not required in other tests.
- Points B and C are for testing the output voltage ripple.

Figure 7-1 Test set-up diagram



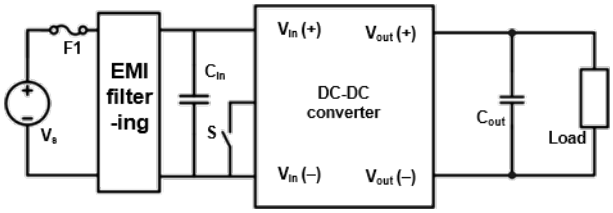
C_{in}: The 440 μF aluminum electrolytic capacitor is recommended.

C_{out}: The 660 μF SMD aluminum solid capacitor or chip aluminum capacitor is recommended (ESR < 30 mΩ).

C_1: The 0.1 μF ceramic capacitor is recommended.

C_2: The 10 μF aluminum electrolytic capacitor is recommended.

Figure 7-2 Typical circuit applications

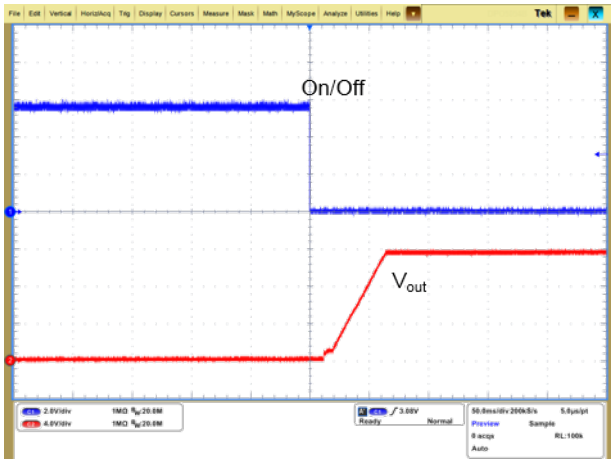


F_1: The 50 A fuse (fast-blow).

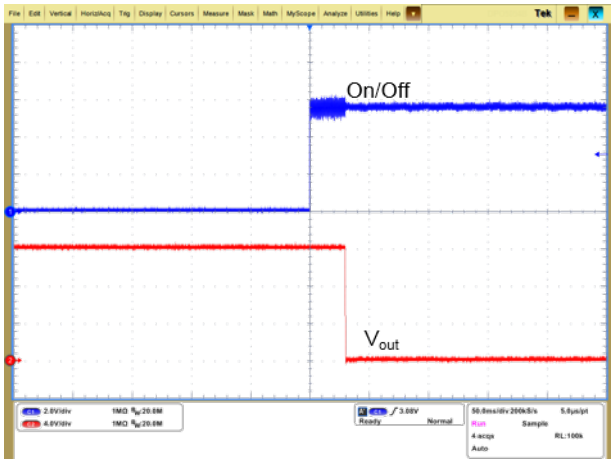
C_{in}: The 440 μF aluminum electrolytic capacitor is recommended.

C_{out}: The 660 μF SMD aluminum solid capacitor or chip aluminum capacitor is recommended (ESR < 30 mΩ).

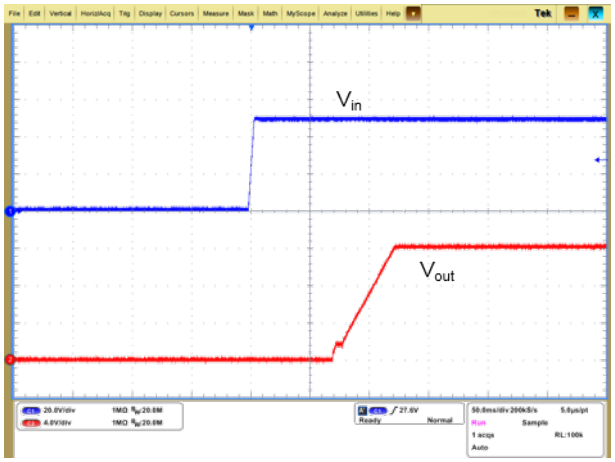
7.1 Turn-on/Turn-off



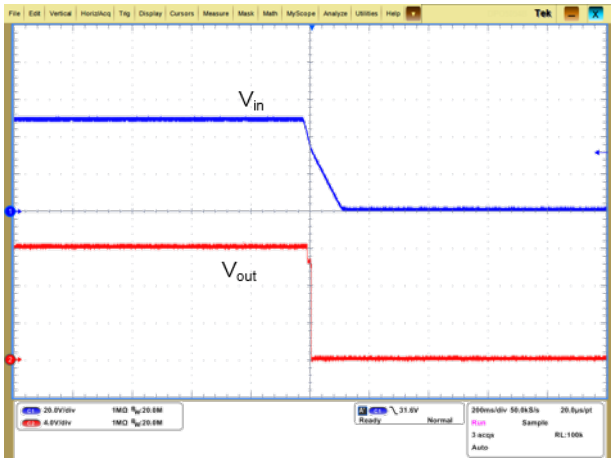
Startup from On/Off



Shutdown from On/Off

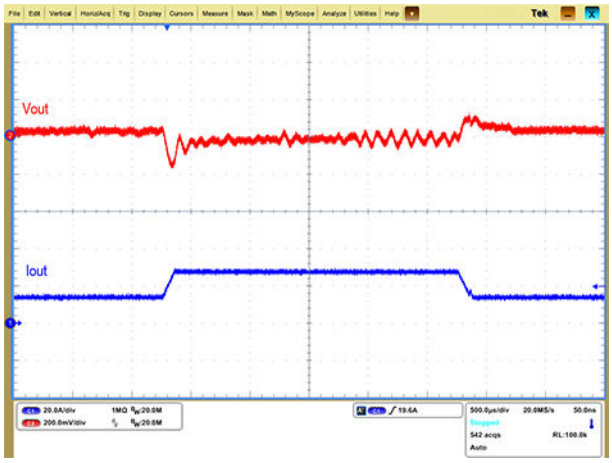


Startup by power-on

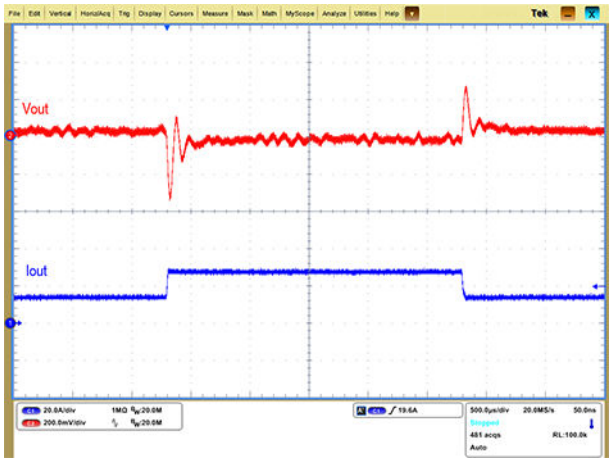


Shutdown by power-off

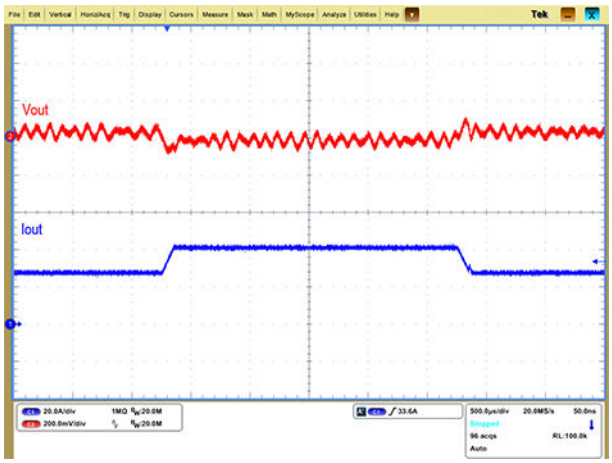
7.2 Output Voltage Dynamic Response



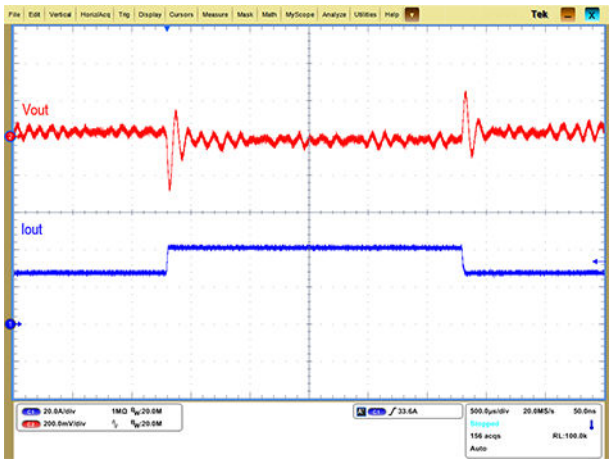
Output voltage dynamic response
(load: 25%–50%–25%, di/dt = 0.1 A/μs)



Output voltage dynamic response
(load: 25%–50%–25%, di/dt = 1 A/μs)

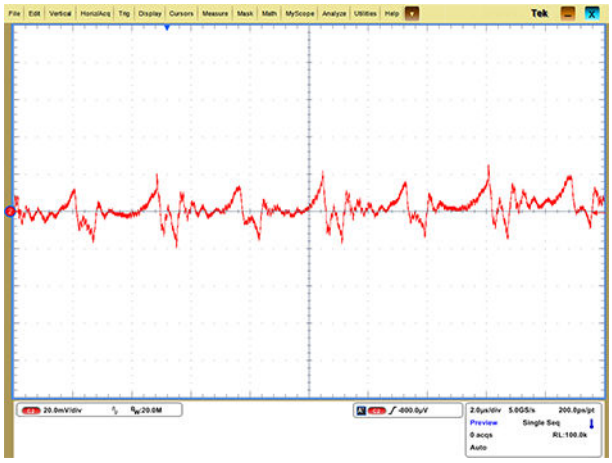


Output voltage dynamic response
(load: 50%–75%–50%, di/dt = 0.1 A/μs)



Output voltage dynamic response
(load: 50%–75%–50%, di/dt = 1 A/μs)

7.3 Output Voltage Ripple

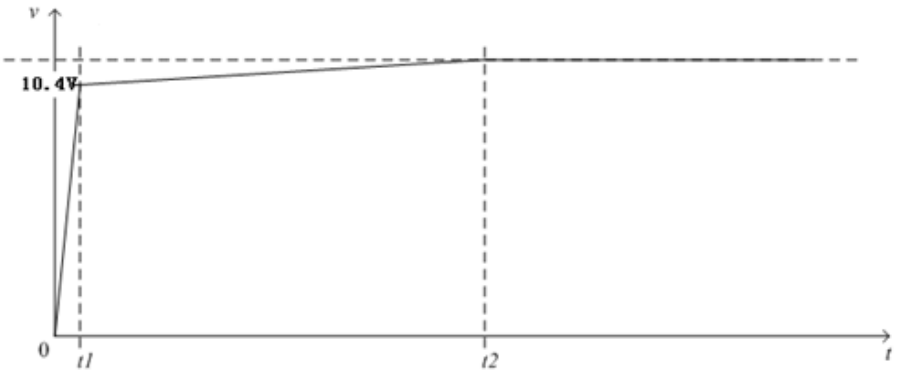


Output voltage ripple
(for points B and C in the test set-up diagram, V_{in} = 48 V, V_{out} = 12 V, I_{out} = 54 A)

7.4 Output Voltage Rise Time

When the rising slope of V_{in} is below 0.3 V/ms, V_{out} rises to 10.4 V within 100 ms and then rises to terminal value at the rate of 0.033 V/s.

The most time of [0, t1] is 100 ms, and most time of [t1, t2] is 50s.

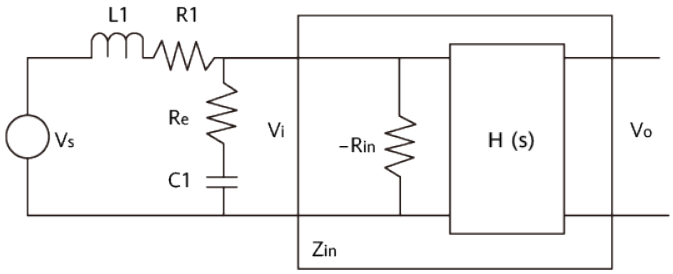


8 Input Anti-resonance Method

In the input remote power supply application, the parasitic inductor of the remote power supply cable and the input capacitor as well as the power brick may resonate, causing the power input voltage to be unstable. As a result, the PSU may experience a power outage due to undervoltage. Therefore, it is recommended that input capacitors be selected according to the input capacitor ESR conditions as shown in following figure.

Select the appropriate curve based on the application scenario, and ensure that the input capacitor ESR is within the upper and lower limits in the curve. Then there will be no input resonance.

Figure 8-1 Input resonance formula



V_s: input power voltage

L1: inductance of the line from the input power to the converter port

R1: resistance of the line from the input power to the converter port

C1: capacitance of the external capacitor

R_e: equicalent series resistance (ESR) of the external capacitor

Resonance does not happen if the following formulas are satisfied:

$R_e < R_{in}$; $R1 < R_{in}$

$$R_e > \frac{L1 - C1 \times R1 \times R_{in}}{C1 \times (R_{in} - R1)}$$

9 Protection Characteristics

- **Input Undervoltage Protection**

  The converter will shut down after the input voltage drops below the undervoltage protection threshold. The converter will start to work again after the input voltage reaches the input undervoltage recovery threshold. For the hysteresis, see **Table 4-5**.

- **Output Overvoltage Protection**

  When the output voltage exceeds the output overvoltage protection threshold, the converter will enter hiccup mode. When the fault condition is removed, the converter will automatically restart.

- **Output Overcurrent Protection**

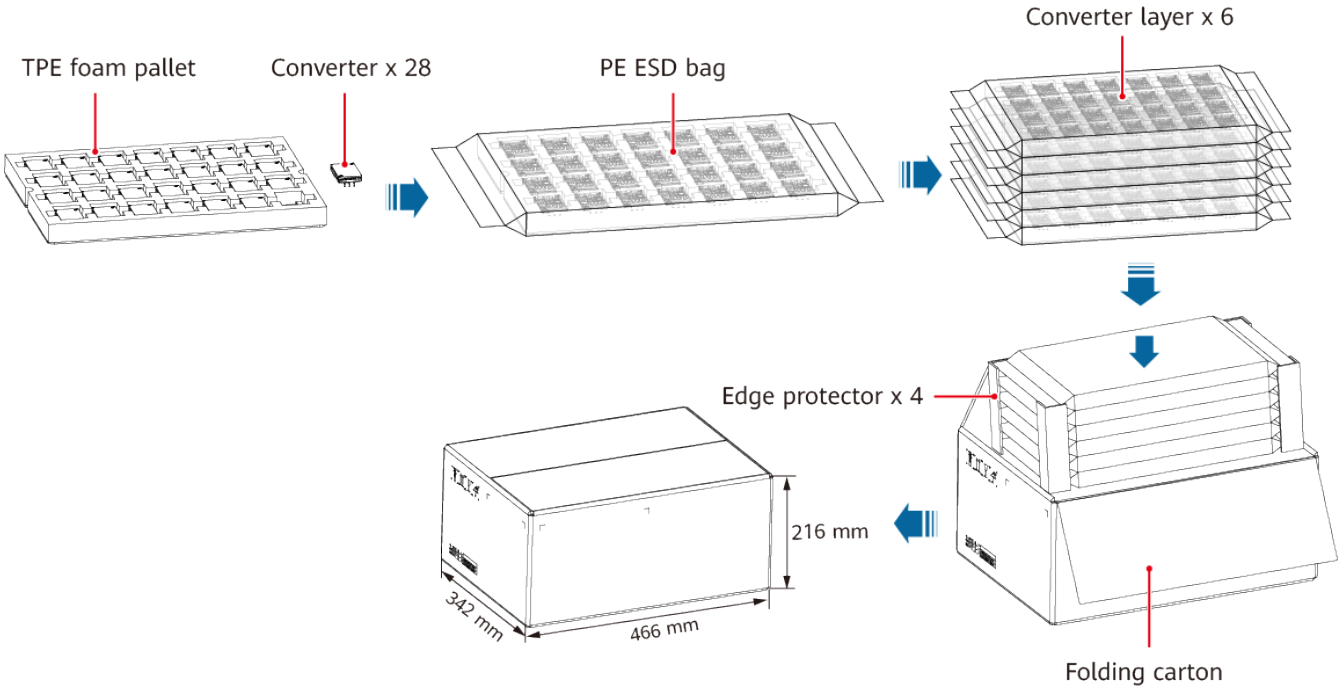
  The converter equipped with current limiting circuitry can provide protection from an output overload or short circuit condition. If the output current exceeds the output overcurrent protection setpoint, the converter enters hiccup mode. When the fault condition is removed, the converter will automatically restart.

- **Overtemperature Protection**

  A temperature sensor on the converter senses the average temperature of the converter. It protects the converter from being damaged at high temperatures. When the temperature exceeds the overtemperature protection threshold, the output will shut down. It will allow the converter to turn on again when the temperature of the sensed location falls by the value of the overtemperature protection hysteresis.

10 Product Packaging, Storage, and Transportation

Figure 10-1 Product packaging



Storage Requirements

The product must be stored in a dry and well-ventilated warehouse where the temperature ranges from –55°C to +125°C, the relative humidity is not greater than 95%, and no corrosive gas exists.

Transportation Requirements

During transportation, the product must be securely placed in a packing case. The packing case must comply with related international standards and be printed with marks such as "Handle with care" and "Keep dry". The packing case containing the product can be transported by any means. The packing case must be protected against rains, snows, and mechanical impact during transportation.

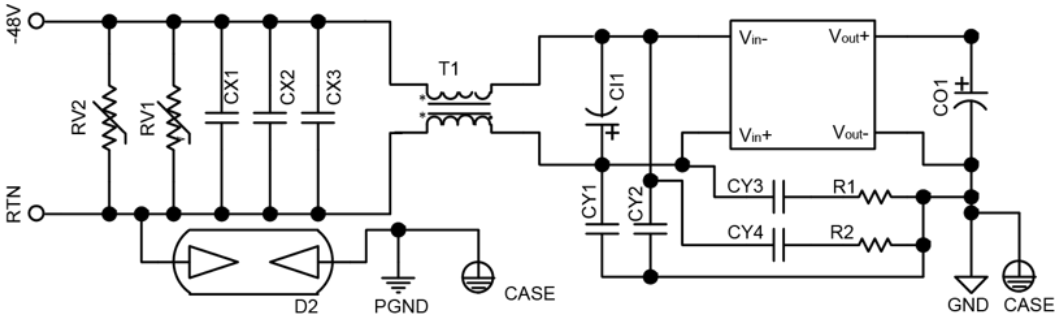
Enclosure Protection

Table 10-1 Enclosure protection level

Item	Requirement
Enclosure protection level	IP20 (normal maintenance surface)

A EMC Specifications

Figure A-1 EMC test set-up diagram



RV1, RV2: Varistor, 100 V, 4500 A

CI1: Aluminum electrolytic capacitor, 100 V, 420 µF and ceramic capacitor, 7 x 4.7 µF, 100 V

CX1, CX2, CX3: Metalized film capacitor, 1 µF, 275 V

CY3, CY4: Chip multilayer ceramic capacitor, 22 nF, 1000 V

T1: Common mode inductor, single phase, 400 µH

D2: Gas discharge tube, 90 V, 10 kA

CO1: Non-solid radial lead aluminum electrolytic capacitor, 2 x 470 µF

CY1, CY2: Metalized film capacitor, 0.1 µF, 275 V

R1, R2: Chip thick film resistor, 1 W, 1 Ω

Table A-1 EMC specifications

Parameter	Conditions	Criterion
Conducted emission (CE)	DC Input	EN 55032, class A (6 dB)
Surges	DM 1 kV/CM 2 kV	IEC/EN 61000-4-5, criterion B
DC voltage dips, short interruption, variation	40%/70%/0%	EN 61000-4-29, criterion B
	80%/120%	EN 61000-4-29, criterion A

NOTE

This is a class A product. In residential areas, this product may cause radio interference. Therefore, users may be required to take appropriate measures.

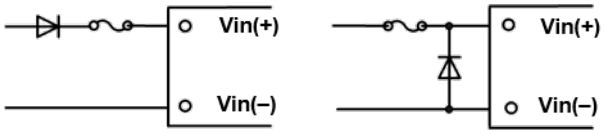
Recommended Fuse

The converter has no internal fuse. To meet safety requirements, a 50 A fuse is recommended.

Recommended Reverse Polarity Protection Circuit

Reverse polarity protection is recommended under installation and cabling conditions where reverse polarity across the input may occur.

Figure A-2 Recommended reverse polarity protection circuits



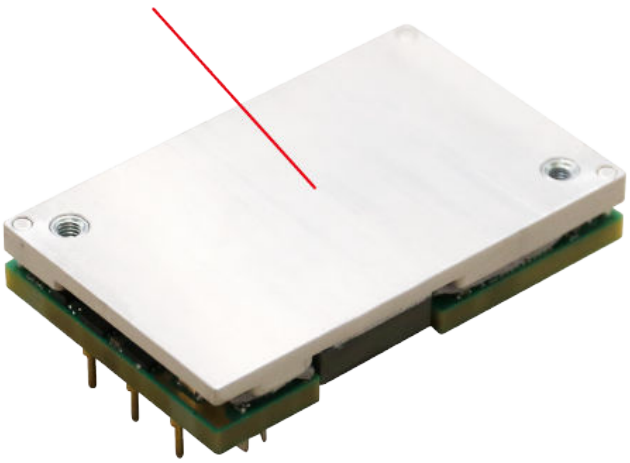
Qualification Testing

Parameter	Condition
Highly accelerated life test	Low temperature limit: –60°C; high temperature limit: 110°C; vibration limit: 40 G; temperature change rate: 40°C per minute; vibration frequency range: 10–10000 Hz; axes of vibration: X/Y/Z
Thermal humidity bias	Maximum input voltage; 85°C; 85% RH; 1000 operating hours under lowest load power
High temperature operation bias	Rated input voltage; operating temperature between +45°C and +55°C; airflow rate = 0.5–5 m/s, 1000 operating hours; 50% to 80% full load
Power and temperature cycling test	Rated input voltage; ambient temperature between –40°C and +85°C; airflow rate = 0.5–5 m/s, 1000 cycles; 50% full load

Thermal Test Point

Decide proper airflow to be provided by measuring the temperature at the middle of the baseplate shown in **Figure A-3** to protect the converter against overtemperature. The overtemperature protection threshold is obtained based on this thermal test point.

Figure A-3 Thermal test point



Power Dissipation

The converter power dissipation is calculated based on efficiency. The following formula reflects the relationship between the consumed power (P_d), efficiency (η), and output power (P_o): $P_d = P_o (1 - \eta)/\eta$.

MSL Rating

Store and transport the converter as required by the moisture sensitivity level (MSL) rating 1 specified in the IPC J-STD-020D/033. The surface of a soldered converter must be clean and dry. Otherwise, the assembly, test, or even reliability of the converters will be negatively affected.

Mechanical Consideration

Installation

Although the converter can be mounted in any direction, free airflow must be available.

Soldering

The converter supports standard wave soldering and hand soldering.

1. For wave soldering, the converter pins can be soldered at 260°C for less than 7 seconds.
2. For hand soldering, the iron temperature should be maintained at 350°C to 420°C and applied to the converter pins for less than 10 seconds.

The converter can be rinsed using the isopropyl alcohol (IPA) solvent or other suitable solvents.