SUPLET®

# Technical Specification

## DC-DC Converter，Half-Brick

# LDGH700-48S50GPS Series

**36Vdc to 75Vdc Input；50Vdc / 14A Output**

## RoHS Compliant


## Applications

- Distributed Power Architectures
- Wireless Networks
- RF amplifier
- Broadband/CATV amplifier

## Options

- Remote On/Off logic
- Trim logic

## Features

- Compliance with RoHS10 EU Directive 2011/65/EU & 2015/863/EU
- Delivers up to 14A output current
- High efficiency, typ.94% at 48Vin half load
- Low output ripple and noise
- Exceptional thermal performance
- Industry standard "Half-brick" footprint
- Fixed switching frequency (270 kHz typical)
- Remote Sense
- Input under voltage lockout
- Output over voltage protection
- Over temperature protection
- Output over current protection
- Short circuit protection
- Adjustable output voltage (25Vdc~57.6Vdc)
- Meets the voltage and current requirements for ETSI 300-132-2 and complies with and licensed for Basic Insulation rating per IEC60950-1

## Description

LDGH700-48S50GPS series are half-brick DC/DC converters that provide high efficiency single output. They can operate from 36Vdc to 75Vdc input and 50V/14A output. The output can be trimmed from (25Vdc~57.6Vdc) of normal output voltage. The remote control option is negative logic. The converter turns on when the REM pin is at logic low and turns off when it at logic high, both are referenced to -Vin. The converter is off when the REM pin is left open. The output voltage trim option is positive. The output voltage will increase when the TRIM pin connected to +S pin and decrease when it connected to -S pin. The output voltage will increase when the TRIM pin connected to +S pin and decrease when it connected to -S pin.

## Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only, functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect the device reliability.

| Parameter | Units | Specifications | | Notes & conditions |
|---|---|---|---|---|
| | | Min. | Max. | |
| Input Voltage | Vdc | 0 | 80 | Continuous |
| | | 0 | 100 | Transient (100ms) |
| Base Plate Operating Temperature | ℃ | -40 | 100 | |
| Ambient Temperature | ℃ | -40 | 85 | |
| Storage Temperature | ℃ | -55 | 125 | |
| Operating Humidity | RH(%) | - | 90 | Non-condensing |
| Storage Humidity | RH(%) | - | 90 | Non-condensing |
| Operating Altitude | m | 0 | 3000 | |
| Storage Altitude | m | 0 | 3000 | |

## Electrical Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and normal temperature conditions. Additional Cin=470uF capacitor, Cout=1000uF capacitor with low ESR.

### Input Characteristics

| Parameter | Units | Specifications | | | Notes & conditions |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Operating Input Voltage | Vdc | 36 | 48 | 75 | |
| Maximum Input Current | A | - | - | 22.5 | 100% load<br>Vin=36V |

| | | | | | |
|---|---|---|---|---|---|
| No load Input Current | mA | - | - | 200 | No load<br>Full Input Voltage |
| Standby Input Current | mA | - | 10 | 100 | |
| Input Reflected Ripple Current Peak-to-Peak | mA | - | 150 | 300 | 12 μH source impedance, add 470μF electrolytic and 1μF ceramic capacitor at input |
| Recommended External Input Capacitance | μF | 470 | - | - | Low ESR capacitor recommended |
| Input Filter Component Value | μF/uH | - | 14/0.33 | - | |
| Inrush Transient | $A^2S$ | - | 1 | - | |
| Recommended Input Fuse | A | - | - | 40 | |

## Remote Control Characteristics

| Parameter | Units | Specifications | | | Notes & conditions |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Logic Low Voltage | Vdc | -0.3 | - | 0.8 | Converter guaranteed logic high when REM pin is left open |
| Logic High Voltage | Vdc | 3.5 | - | 20 | |

## Output Characteristics

| Parameter | Units | Specifications | | | Notes & conditions |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Output Voltage Set Point | Vdc | 49.5 | 50 | 50.5 | Vin=Vin(nom); Io=Io(max) |
| Output Current | A | - | - | 14 | Vin=Vin(min) to Vin(max)<br>Total output power is no more than 700W |
| Line Regulation | %Vo | - | 0.4 | 1 | Vin=Vin(min) to Vin(max)<br>Io=Io(nom) |
| Load Regulation | %Vo | - | 0.4 | 1 | Vin=Vin(nom) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Total Output Voltage Range | | Vdc | 48.5 | 50 | 51.5 | Over sample, line, load, temperature & life |
| Output Voltage Precision | | %Vo | - | 1.5 | 3 | Vin=Vin(min) to Vin(max)<br>Io=0 to Io(max) |
| Output Voltage Adjustment Range | | Vdc | 25 | - | 57.6 | Rated power<br>Io=0 to Io(max), see figure 11 |
| Remote Sense Compensation | | %Vo | - | - | 10 | |
| Output Current Limit inception | | %Io | 110 | - | 150 | Ambient Temperature 25℃, Hiccup mode<br>Automatic recovers |
| External Output Capacitance | | μF | 1000 | - | 4400 | ESR<200mΩ at -40℃, recommend 2~3PCS KY, KZE and KZH series aluminum capacitors in parallel |
| Temperature Coefficient | | ppm/℃ | - | - | 200 | Ambient Temperature<br>-40℃~85℃ |
| Dynamic Response | Overshoot Range | mV | - | 350 | 700 | 25%-50%-25%&50%-75%-50% Io(max)<br>di/dt=0.1A/μS |
| | Recovery Time | μS | - | 100 | 500 | |
| Ripple and Noise | | mVp-p | - | 100 | 250 | Measured with 10μF Tantalum external and 1μF ceramic capacitor at output, 100%load, 20MHz bandwidth |
| | | mVRMS | - | 50 | 100 | |
| Turn-on Delay Time | | ms | 200 | 400 | 800 | Time from instant at which Vin=Vin(min) until Vo=10% of Vo(nom) |
| Turn-on Rise Time | | ms | - | 100 | 300 | Time for Vo to rise from 10% of Vo(nom) to 90% of Vo(nom) |
| Output Voltage Overshoot | | %Vo | - | - | 5 | |

## Protection Characteristics

| Parameter | | Units | Specifications | | | Notes & conditions |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Input Under Voltage Lockout | Turn-on Threshold | Vdc | 30 | - | 33 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Turn-off Threshold | Vdc | 31 | - | 34 | |
| | Hysteresis | Vdc | 0.5 | - | 3 | |
| Output Over Voltage Protection | | Vdc | 58 | - | 65 | Under the converter's maximum allowable output power. Hiccup |
| Short Circuit Protection | | Hour | 4 | - | - | Hiccup Mode<br>Automatic recovery |
| Output Over Current Protection | | | - | Yes | - | Hiccup Mode<br>Automatic recovery |
| Over Temperature Protection | | ℃ | 100 | 110 | 120 | Automatic recovery<br>See OTP section |
| Over Temperature Protection Hysteresis | | ℃ | 2 | 5 | 10 | |

## General Specifications

| Parameter | Units | Specifications | | | Notes & conditions |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Efficiency | % | 91 | 93 | - | Vin=48V, 100%load<br>Ambient Temperature 25℃ |
| | | 92 | 94 | - | Vin=48V, 50%load<br>Ambient Temperature 25℃ |
| Switching Frequency | kHz | 220 | 270 | 320 | Vin=Vin(nom); Io=Io(max);<br>Fixed frequency |
| MTBF | Hour | - | 3,000,000 | - | Telcordia SR332, Issue 3, 2011, 40℃Ta |
| FIT | | - | 331 | - | $10^9$/MTBF |
| Thermal Stability Time | min | - | 30 | - | |
| Weight | g | 85 | 95 | 105 | |
| Safety | Compliant to IEC60950-1,UL60950-1,EN60950-1 and GB4943 | | | | |

| | |
|---|---|
| Vibration | IEC60068-2-6:10-500Hz sweep,0.75mm excursion,10g acceleration,10minutes in each 3 perpendicular directions |
| Transportation | ETS300019-1-2 |
| Shock | IEC60068-2-27:200g acceleration, duration 3 ms,6 drops in each 3 perpendicular directions |

## Isolation Specifications

<table>
<tr><th colspan="2" rowspan="2">Parameter</th><th rowspan="2">Units</th><th colspan="3">Specifications</th><th rowspan="2">Notes & conditions</th></tr>
<tr><th>Min.</th><th>Typ.</th><th>Max.</th></tr>
<tr><td rowspan="3">Isolation Voltage</td><td>Input-Output</td><td>Vdc</td><td>1500</td><td>-</td><td>-</td><td>Test duration 1 minute,<br>leak current less than 10mA</td></tr>
<tr><td>Input-Case</td><td>Vdc</td><td>1050</td><td>-</td><td>-</td><td>Test duration 1 minute,<br>leak current less than 10mA</td></tr>
<tr><td>Output-Case</td><td>Vdc</td><td>500</td><td>-</td><td>-</td><td>Test duration 1 minute,<br>leak current less than 10mA</td></tr>
<tr><td colspan="2">Isolation Resistance</td><td>MΩ</td><td>10</td><td>-</td><td>-</td><td>Normal air pressure, 500Vdc, the isolation resistance is no more than 10 MΩ</td></tr>
<tr><td colspan="2">Isolation Capacitance (Input-Output)</td><td>pF</td><td>3080</td><td>4400</td><td>-</td><td></td></tr>
</table>

## Characteristic Curves

### Efficiency

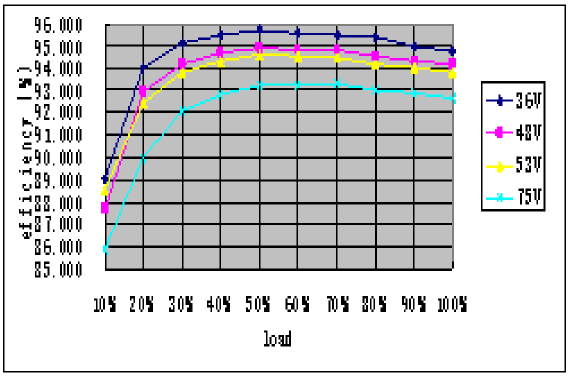



Figure1. Converter Efficiency Vs. Output Current@25℃

### Derating

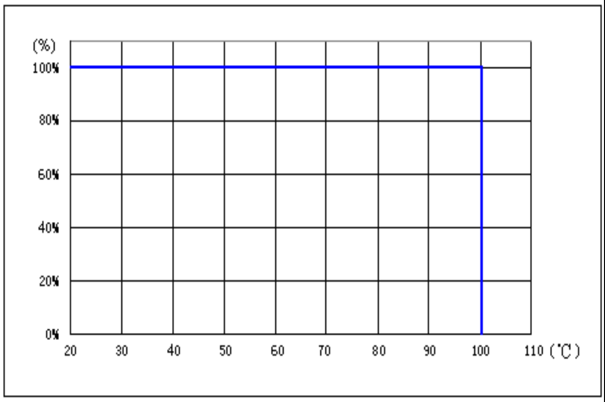



Figure2. Output power derating curve, load current Vs. aluminum baseplate temperature,48Vin

## Dynamic Response

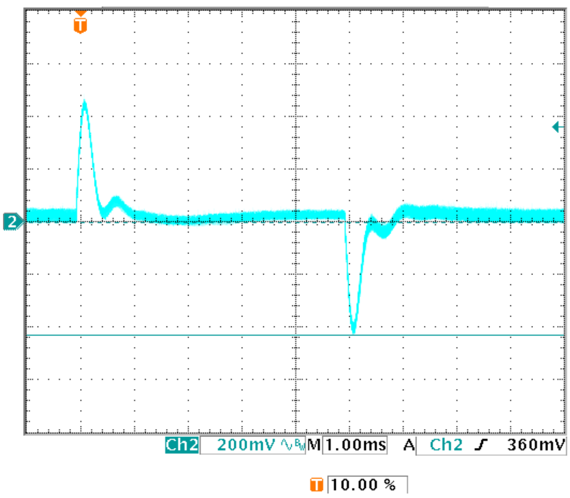



Figure3.Vin=48V/Vo=50V,25%-50%load.0.1A/μS@25℃

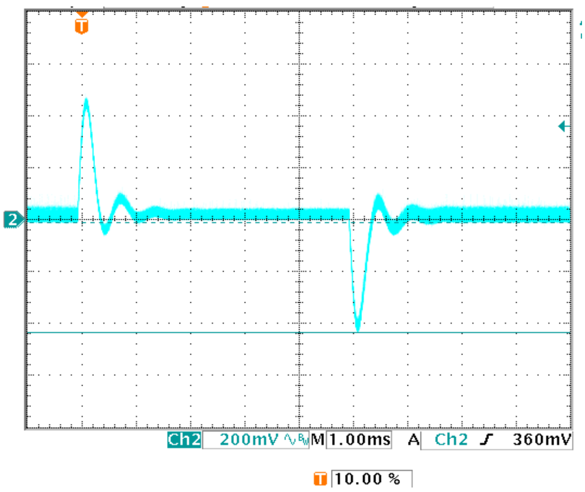



Figure4.Vin=48V/Vo=50V,50%-75%load,0.1A/μS@25℃

## Start-up

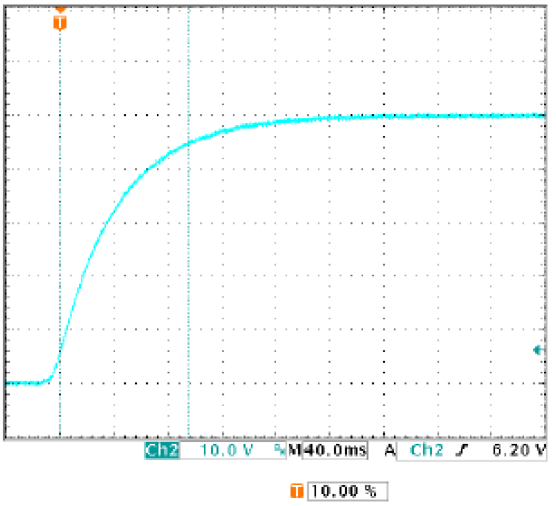



Figure5. Typical Start-up (Vin=48V,100% load@25℃)

## Output ripple & noise

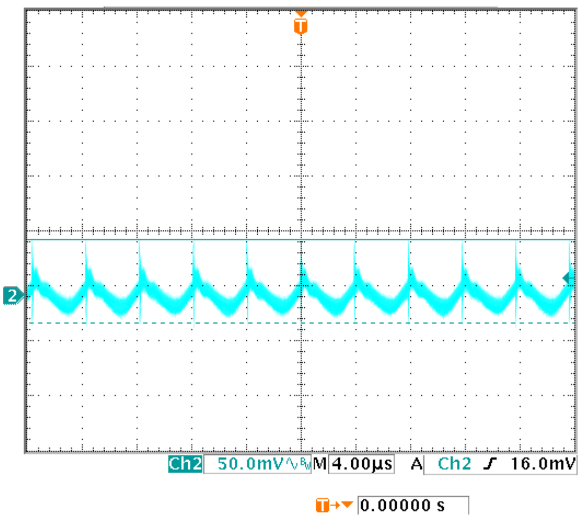
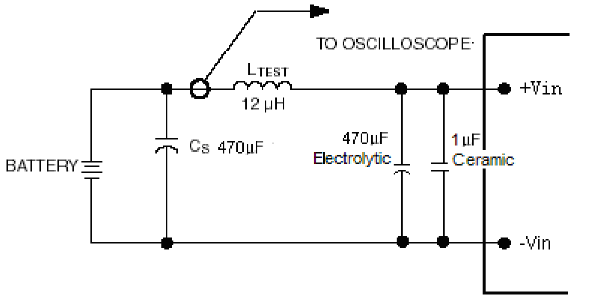


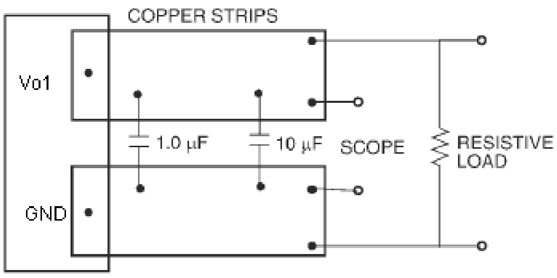

Figure6. Output ripple and noise @ Vin=48V, 100%load (20MHz bandwidth@25℃)

## Test Configurations




Note: Measure input reflected ripple current with a simulated source inductance of 12μH. The measurement points for input reflected ripple current is showed above.

**Figure7. Input Reflected Ripple Current Test Setup**




Note: Scope measurements should be made using a BNC socket with a 1μF ceramic capacitor and a 10μF tantalum capacitor. Position the oscilloscope probe between 51mm and 76mm (2in and 3in) from the module

**Figure8. Output Ripple and Noise Test Setup**

## Design Considerations

### Input filtering

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. For the test configuration in Figure7 a 470μF electrolytic capacitor and a 1μF ceramic capacitor, mounted close to the power module helps ensure stability of the unit.

## Safety Considerations

For safety-agency approval of the system in which the power module is used, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standard, i.e. UL60950-1, CAN/CSA-C22.2, No. 60950-1 and EN60950-1:2001(+A11) and IEC60950-1:2005, if the system in which the power module is to be used must meet safety agency requirements.

These converters have been evaluated to the spacing requirements for Basic Insulation, per the above safety standards.

For all input voltages, other than DC mains, where the input voltage is less than 60Vdc, if the input meets all of the requirements for SELV, the output is considered to remain with SELV limits. Signal component failure and fault tests were performed in the power converters.

If the input source is non-SELV (ELV or hazardous voltage greater than 60Vdc and less than or equal to 75Vdc), for the module's output to be considered as meeting the requirements for safety extra-low voltage (SELV), all of the following must be true.

- The input source is to be provided with reinforced insulation from any other hazardous voltage, including the AC mains.
- One $V_{IN}$ pin and one $V_{OUT}$ pin are to be grounded, or both the input and output pins are to be kept floating.
- The input pins of the module are not operator accessible.
- Another SELV reliability test is conducted on the whole system as required by the safety agencies, to verify that under a single fault, hazardous voltages do not appear at the module's output.

All flammable materials used in the manufacturing of these modules are rated 94V-0.

To preserve maximum flexibility, internal fusing is not included, however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a time delay fuse with a maximum rating of 40A. Based on the information provided in this data sheet on inrush energy and maximum dc input current, the same type of fuse with a lower rating can be used. Refer to the fuse manufacturer's data sheet for further information.

# Feature Descriptions

## Remote On/Off

The REM pin is used to turn the power converter remote on or off via a system signal. This power module is negative logic version. When the REM pin is at logic low the power turns on and turns off at logic high or left open. We also provide positive logic remote on/off, turns the module off during logic high or left open and on during a logic low.

To turn the power module on and off, the user must supply a switch to control the voltage between the REM pin and -Vin terminal (see Figure 9). A logic low is $V_{REM}$ =-0.3 to 0.8 V. During logic high, the maximum $V_{REM}$ voltage generated by the power module is 20V.

If not using the remote on/off feature, perform one of the following to turn the converter on:
For negative logic, short REM pin to -Vin.
For positive logic, leave REM pin open.

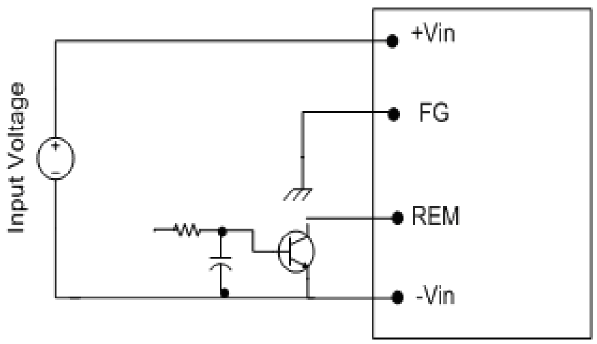



**Figure9. Remote On/Off Implementation**

## Remote Sense

Remote sense minimizes the effects of distribution losses by regulating the voltage at the remote sense connections (see Figure 10). The voltage between the remote sense pins and the output terminals must not exceed the output voltage sense range. The voltage between the +Vo1 and GND terminals must not exceed the minimum output overvoltage protection value shown in the Electrical Specifications table. This limit includes any increase in voltage due to remote sense compensation and output voltage programming (trim). If not using the remote sense feature to regulate the output at the point of load, then connect +S to $+V_O1$ and -S to GND.

Although the output voltage can be increased by both the remote sense and by the trim, the maximum increase for the output voltage is not the sum of both. The maximum increase is the larger of either the remote sense or the trim.

The amount of power delivered by the module is defined as the voltage at the output terminals multiplied by the output current. When using remote sense and trim, the output voltage of the module can be increased, which at the same time the output current would increase the power output of the module. Care should be taken to ensure that the maximum output power of the module remains at or below the maximum rated power.

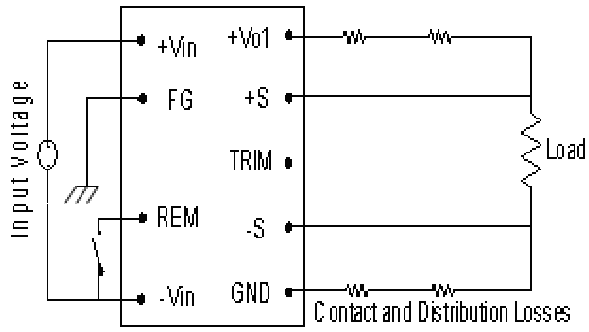



**Figure10. Circuit Configuration for Remote Sense**

## Output Voltage Programming

When trimming up, the output current should be decreased accordingly so as not to exceed the maximum output power and the minimum input voltage should be increased as shown in the Figure 11.

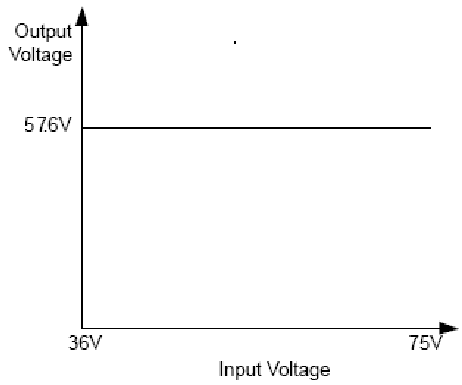



**Figure11. Max. adjustable output voltage vs. input voltage**

## Resistance adjustment mode

Output voltage trim allows the user to increase or decrease the output voltage set point of a module. This is accomplished by connecting an external resistor between the TRIM pin and either the +S or -S pins. If not using the trim feature, leave the TRIM pin open.

To increase the output voltage, refer to Figure12. A trim resistor, $R_{trimup}$, connect between the TRIM pin and +S pin.

$$R_{trimup} = \left(\frac{V_{nom}\times(100+\Delta)}{1.225\times\Delta} - \frac{(100+2\times\Delta)}{\Delta}\right)K\Omega$$

$R_{trimup}$ = Required value of trim-up resistor [kΩ]

$$\Delta = \left|\frac{V_{out}-V_{nom}}{V_{nom}}\times 100\right|$$

$V_{nom}$ = Nominal value of output voltage [V]

$V_{out}$ = Desired (trimmed) output voltage [V].

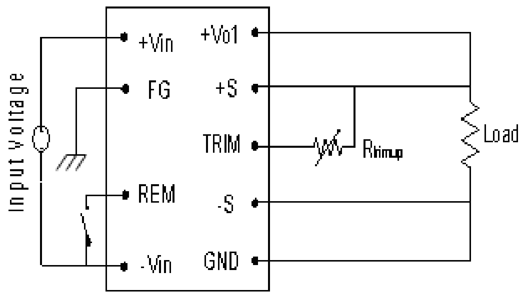



**Figure12. Circuit Configuration to Increase Output Voltage.**

Trimming beyond 57.6V is not an acceptable design practice, as this condition could cause unwanted triggering of the output overvoltage protection (OVP) circuit. When trimming up, care must be taken not to exceed the converter's maximum allowable output power.

To decrease the output voltage (see Figure13.), a trim resistor, $R_{trimdown}$, should be connected between the TRIM and -S, with a value of

$$R_{trimdown} = \left(\frac{100}{\Delta} - 2\right) \quad K\Omega$$

$R_{trimdown}$ = Required value of trim-down resistor [kΩ]

$$\Delta = \left|\frac{V_{out}-V_{nom}}{V_{nom}}\times 100\right|$$

$V_{nom}$ = Nominal value of output voltage [V]

$V_{out}$ = Desired (trimmed) output voltage [V]

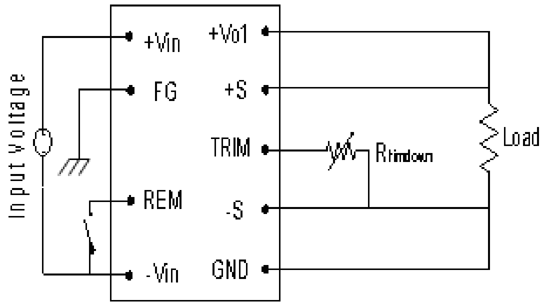



**Figure13. Circuit Configuration to Decrease Output Voltage**

## Voltage adjustment mode

The output voltage can also be trimmed by potential applied at the trim pin.

An external trim resistor is connected between trim pin and Vtrim. See Figure 14.

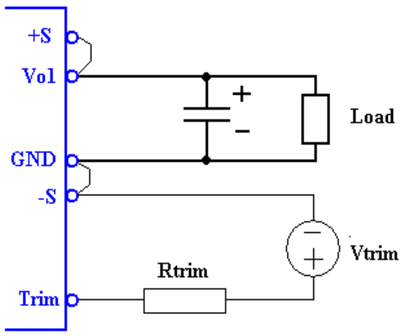



**Figure14. Trim circuit by voltage mode**

The relationship between Vtrim and Vo is described as below:

$$V_{trim} = \frac{(2+\text{Rtrim})*\text{Vout}}{40.32} - (1+Rtrim)*1.24$$

$V_{nom}$ = Nominal value of output voltage, 50V

$V_{out}$ = Desired (trimmed) output voltage [V]

$V_{trim}$ =The potential applied at the trim pin [V]
$R_{trim}$ =The external trim resistor [kΩ]

When Rtrim=0 kΩ

$$V_{trim} = 0.0496 * Vout - 1.24$$

The trim curve is shown as Figure 15.

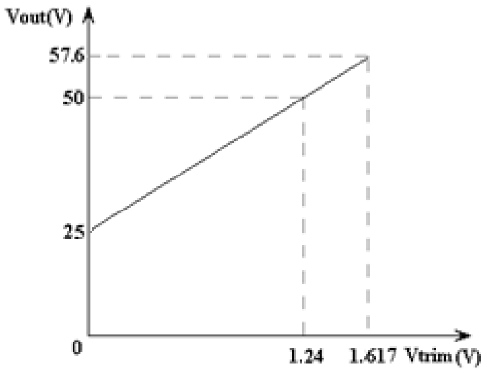



**Figure15. Trim curve when Rtrim=0 kΩ**

When Rtrim=1 kΩ

$$V_{trim} = 0.0744 * Vout - 2.48$$

The trim curve is shown as Figure 16.

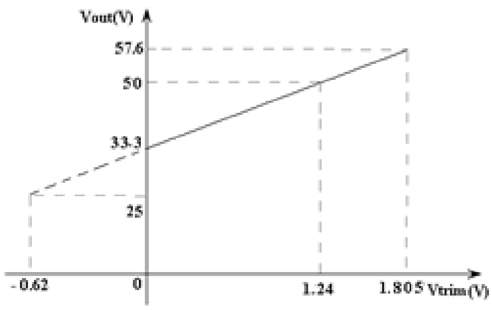



**Figure16. Trim curve when Rtrim=1kΩ**

When Rtrim=2 kΩ

$$V_{trim} = 0.0992 * Vout - 3.72$$

The trim curve is shown as Figure 17.

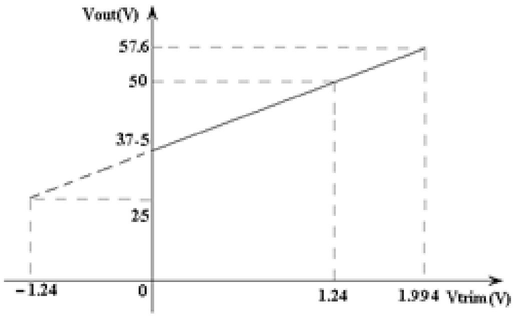



**Figure17. Trim curve when Rtrim=2 kΩ**

## Protection Features

### Output Over Current Protection

To provide protection in an output overload fault condition, the module is equipped with internal current limiting circuitry, and can endure current limiting continuously.
At the point of current limit inception, the unit enters hiccup mode. The unit is configured with the auto-restart function, it will remain in the hiccup mode as long as the overcurrent condition exists, it operates normally once the output current is reduced back into its specified range.

### Output Over Voltage Protection

The output over voltage protection consists of circuitry that monitors the voltage on the output terminals. When the output voltage exceeds the overvoltage protection threshold, the module will operate in a hiccup mode until overvoltage cause is cleared.

### Over Temperature Protection

To provide protection under certain fault conditions, the module is equipped with a thermal shutdown circuit. The module will shutdown when the Tref temperature exceeds OTP set value, but the thermal shutdown is not intended as a guarantee that the module will survive when the temperatures beyond its rating. The module will automatically restarts after it cools down.


**Figure18. Tref Temperature Measurement Location**

### Input Under Voltage Lockout

Input undervoltage lockout is standard with this converter, when input voltages below the input undervoltage lockout limit, the module operation is disabled. It will only begin to operate once the input voltage is raised above the undervoltage lockout turn-on threshold.

## Thermal Considerations

The power modules operate in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit.
Considerations include ambient temperature, airflow, module power dissipation, and the need for increased reliability. A reduction in the operating temperature of the module will result in an increase in reliability.

## Through-Hole Soldering Information

The product is intended for through-hole mounting in a PCB. When wave soldering is used, the temperature on the pins is specified to maximum 270 °C for maximum 10 seconds.

Maximum preheat rate of 4 °C/s and temperature of max 150 °C is suggested, when hands soldering care should be taken to avoid direct contact between the hot soldering iron tip and the pins for more than a few seconds in order to prevent overheating.

A no-clean (NC) flux is recommended to avoid entrapment of A no-clean (NC) flux is recommended to avoid entrapment of cleaning fluids in cavities inside of the DC/DC power module. The residues may affect long time reliability and isolation voltage.

## EMC Considerations

The Figure 19 shows a suggested configuration to meet the conducted emission limits of EN55022 Class B.

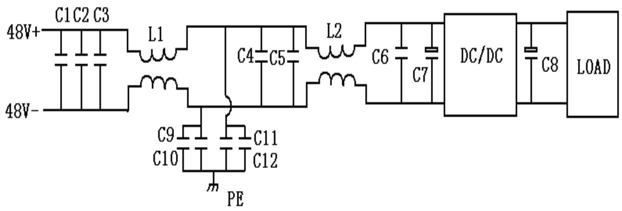
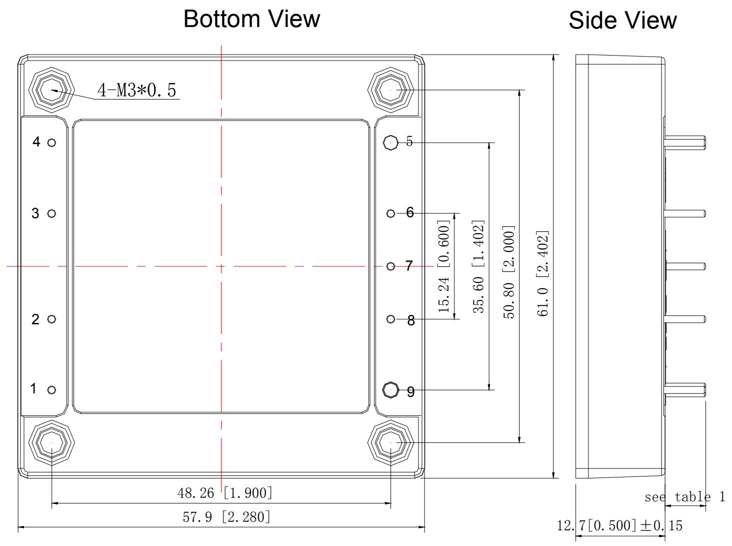



**Figure19. EMC testing typical application circuit**

| components | parameters |
|---|---|
| C1 C2 C3 C4 C5 | 1uF SMD ceramic capacitor |
| C6 | 0.1uF SMD ceramic capacitor |
| L1 L2 | 470uH Common-mode inductance |
| C9 C10 C11 C12 | 0.22uF Isolation voltage SMD capacitor |
| C7 | 470μF electrolytic capacitor |
| C8 | 1000μF electrolytic capacitor |

## Outline Diagram



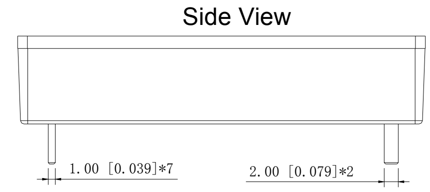




Table 1

| Pin options | Pin length |
|---|---|
| standard | 5.8(0.23) |
| Z1 | 2.8(0.11) |
| Z2 | 4.6(0.18) |
| Z3 | 3.6(0.14) |
| Z4 | 6.4(0.25) |

**Figure20. Outline Diagram**

Dimensions are in millimeters and (inches).

Tolerances: x.x mm ± 0.5 mm (x.xx in. ± 0.02 in.) [unless otherwise indicated]

x.xx mm ± 0.25 mm (x.xxx in. ± 0.010 in. )

## Pin Designations

| Pin No. | Symbol | Function |
|---|---|---|
| 1 | +Vin | Positive input voltage |
| 2 | REM | Remote control |
| 3 | FG | Case |
| 4 | -Vin | Negative input voltage |
| 5 | GND | Negative output voltage |
| 6 | -S | Negative remote compensation |
| 7 | TRIM | Output voltage trim |
| 8 | +S | Positive remote compensation |
| 9 | Vo1 | Positive output voltage |

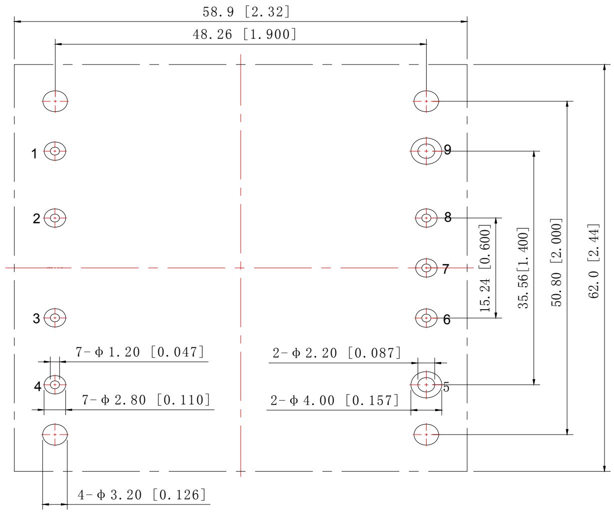



**Figure21. Recommended Pad Layout**

Dimensions are in millimeters and (inches).

Tolerances: x.x mm ± 0.5 mm (x.xx in. ± 0.02 in.) [unless otherwise indicated]

x.xx mm ± 0.25 mm (x.xxx in. ± 0.010 in. )

# Packaging Details

The power model is supplied as standard in the antistatic tray shown in Figure 22.

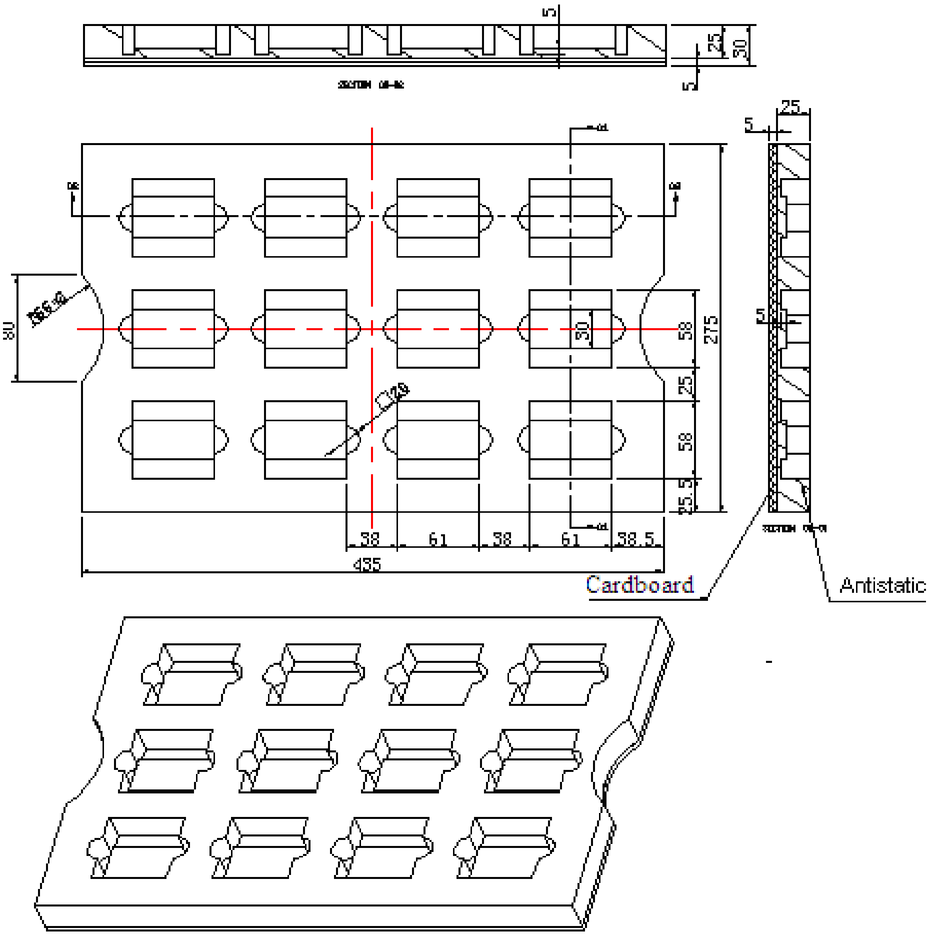
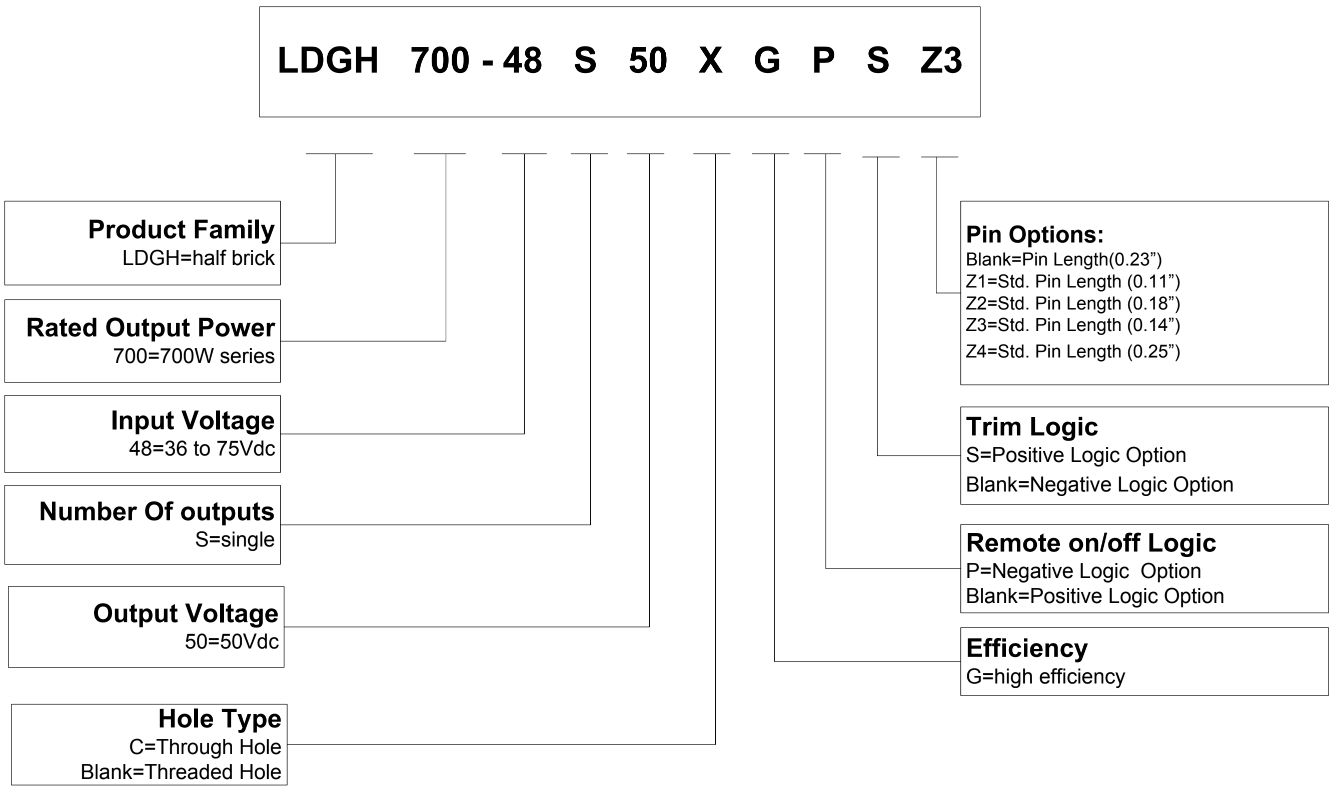



**Figure22. Packaging Tray Diagram**

**Tray Specifications**

| | |
|---|---|
| Material | PPE ,antistatic |
| Surface resistance | <$10^{10}$Ohm |
| Bakability | The trays can be baked at maximum125℃ for 48 hours maximum |
| Tray capacity | 12products/tray |
| Box capacity | 72 products 6 full trays/box |

## Naming Rules On Models




## Part number example

| Part Number | Input voltage | Output voltage | Max Output Current | Remote on/off logic | Pin Length |
|---|---|---|---|---|---|
| LDGH700-48S50GPSZ3 | 36-75V | 50V | 14A | Negative | 0.14'' |
| LDGH700-48S50CGSZ3 | 36-75V | 50V | 14A | Positive | 0.14'' |

## For more information please contact Shenzhen Suplet Co., Ltd.

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