SUPLET®

Technical Specification

DC-DC Converter，Full-Brick

LDM1000-48S50CGS Series

36Vdc to 75Vdc Input；50Vdc/20A Output

RoHS Compliant

Features

- Compliance with RoHS10 EU Directive 2011/65/EU & 2015/863/EU
- Delivers up to 20A output current
- High efficiency, typ. 94.5% at Vout half load
- Low output ripple and noise
- Exceptional thermal performance
- Industry standard "Full-brick" footprint
- Turn on monotonicity
- Remote On/Off logic
- Switching frequency (240 KHz typical)
- Remote Sense
- Input under voltage lockout
- Input over voltage protection
- Output over voltage protection
- Output over current protection
- Over temperature protection
- Short Circuit Protection
- Adjustable output voltage (25V-57.6V)
- Meets the voltage and current requirements for ETSI 300-132-2 and complies with Basic Insulation rating per IEC60950-1

Applications

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

Options

- Output Current Monitoring

Description

LDM1000-48S50CGS series are full brick DC/DC converters that provide high efficiency single output. It can operate from 36Vdc to 75Vdc input and 50V/20A output. The output can be trimmed from 25V to 57.6V. The remote control option is current mode. The converter turns off when the REM pin has not current and turns on when current is 2-5mA. The converter is off when the REM pin is left open. The output voltage will increase when the Vo1 pin is connected to “+S” and decrease when TRIM pin connected to “-S”. Standard features include remote on/off, remote sense, output voltage adjustment, over voltage, over current and over temperature protection.

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the power module. 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 power module reliability.

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Input Voltage	Vdc	0	-	80	Continuous
		0	-	100	Transient(100ms)
Operating Ambient Temperature	℃	-40	-	85	
Base Plate Operating Temperature	℃	-40	-	100	
Storage Temperature	℃	-55	-	125	Ambient temperature
Operating Humidity	RH(%)	0	-	95	Non-condensing
Storage Humidity	RH(%)	0	-	95	Non-condensing
Operating Altitude	m	0	-	4,000	
Storage Altitude	m	0	-	4,000	

Electrical Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and normal temperature conditions. Additional Cin=2*470μF(CHEMICON \\ EKY-101ELL471MM25S for reference), Cout=4*680μF(CHEMICON \\ EKY-800ELL681MM25S for reference)

Input Characteristics

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Operating Input Voltage	Vdc	36	48	75	Converters guaranteed whole specification at input voltage range of 35 ~ 75V.
Maximum Input Current	A	-	-	32	100% load Vin=Vin(min) to Vin(max)
No load Input Current	mA	-	250	500	no load Vin=Vin(min) to Vin(max)
Standby Input Current	mA	-	20	50	
Input Reflected Ripple Current	mAp-p	-	200	360	5Hz~20MHz, See Figure2
	mA rms	-	100	180	
Recommended External Input Capacitance	μF	470	2*470	-	Low ESR capacitor recommended
Input Filter Component Value	μF/uH/ uF	-	13.2/0.56/ 30.8	-	
Inrush Transient	A^2S	-	0.5	1	
Recommended Input Fuse	A	-	40	60	

Remote Control Characteristics

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Turn on current	mA	2	-	5	Converter will be damaged when exceeded 5mA
Turn off current	mA	0	-	0.2	Converter guaranteed off when REM pin is left open or no current

Output Characteristics

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Output Voltage Set point Range	Vdc	49.50	50.00	50.50	Vin=Vin(nom) Io=0A
Total Output Voltage Range	Vdc	49.00	50.00	51.00	Over sample, line, load, temperature, life
Output Current	A	0	-	20	Pout_ max=1000W
Output Voltage Precision	%Vo	-	1.5	2.0	Vin=Vin(min) to Vin(max) Io=0 to Io(max)
Line regulation	%Vo	-	0.5	1	Vin=Vin(min) to Vin(max) Io=Io(max)
Load Regulation	%Vo	-	0.2	0.5	Vin=Vin(nom) Io=0 to Io(max)
Output Voltage Adjustment Range	Vdc	25	-	57.6	Pout_max=1000W Io=0 to Io(max)
Remote Sense Compensation	V	-	-	1.5	
Output Current Limit	A	22	-	29	
External Load Capacitance	μF	1000	4*680	5000	It recommends to use 4*680 capacitance ESR<160mΩ at -40℃
Temperature Coefficient	ppm/℃	-	-	200	Ambient Temperature -40℃ to 85℃ Io= Io(max)
Dynamic Response	mV/μS	-	375/100	750/250	25%-50%-25% Io(nom) and 50%-75%-50% Io(nom) di/dt=2.5A/μS, test with 1000uF capacitor
	mV /μS	-	750/200	1500/600	1 A /2.25 ms-15A/2.75ms di/dt=1.5A/μS, test with 4*680uF capacitor
Ripple and Noise	mVp-p	-	150	300	20MHz bandwidth, See Figure 3

	mVrms	-	75	150	
Turn-on Delay Time	ms	200	400	800	Time from instant at which Vin=Vin(nom) until Vo=10% of Vo(nom)
Turn-on Rise Time	ms	30	80	150	Time for Vo to rise from 10% 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	Io=0 to Io(max)
	Turn-off Threshold	Vdc	31	-	34	
	Hysteresis	Vdc	0.5	-	3	
Input Over Voltage Protection		Vdc	76	-	86	Io=0 to Io(max) Automatic recovery
Output Over Voltage Protection		Vdc	58	-	65	Under the converter's maximum allowable output power, hiccup
Output Over Current Protection		A	-	Yes	-	Hiccup Mode Automatic recovery
Short Circuit Protection		Hour	4	-	-	Hiccup Mode Automatic recovery
Over Temperature Protection		℃	100	110	120	See OTP section Automatic recovery
Over Temperature Protection Hysteresis		℃	2	5	10	

General Specifications

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Efficiency	%	91	93	-	Vin=Vin(nom) Io=Io(max),aluminum baseplate temperature 25℃
	%	92.5	94.5	-	Vin=Vin(nom) Io=50%Io(max), aluminum baseplate temperature 25℃
Switching Frequency	KHz	200	240	280	Vin=Vin(nom); Io=Io(max);
MTBF	Hour	1,500,000			Telcordia SR332, 40℃
FIT		666.7			10^9/MTBF
Thermal Stability Time	min	-	30	-	
Weight	g	130	160	190	
AUX	Vdc	6	-	12	Iout, AUX≤20mA
IOG	Open-collector, low-impedance output when normal operation and high-impedance when abnormal. Add external power supply and resistance in application				
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

Parameter		Units	Specifications			Notes & conditions
			Min.	Typ.	Max.	
Isolation Voltage	Input-Output	Vdc	1500	-	-	1500Vdc test duration 1 minute, leakage current less than10mA, no arcing or breakdown
	Input-Base plate	Vdc	1050	-	-	1050Vdc test duration 1 minute, leakage current less than 10mA, no arcing or breakdown
	Output-Base plate	Vdc	500	-	-	500Vdc test duration 1 minute, leakage current less than 10mA, no arcing or breakdown
Isolation Resistance		MΩ	10	-	-	
Isolation Capacitance (Input-Output)		nF	-	8.8	-	Input to output

Characteristic Curves

Efficiency

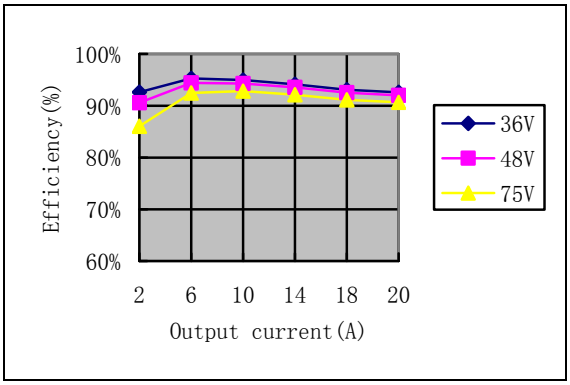


Figure1. Converter Efficiency Vs. Output Current@25℃

Derating

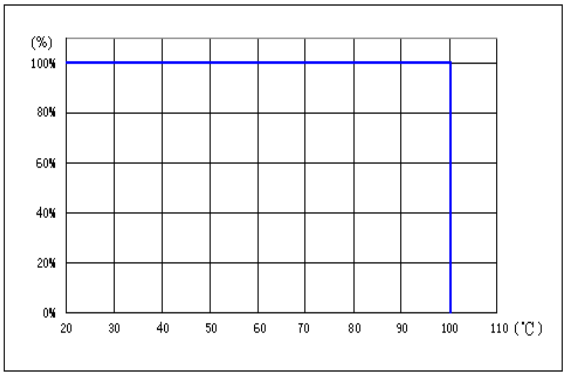


Figure2. Output power derating curve, load current Vs. aluminum baseplate temperature,48Vin

Dynamic Response

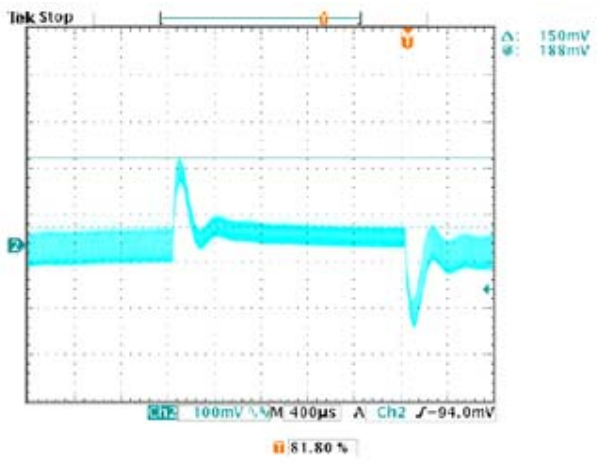


Figure3.Vin=48V/Vo=50V,25%-50%load. 2.5A/μS@25℃

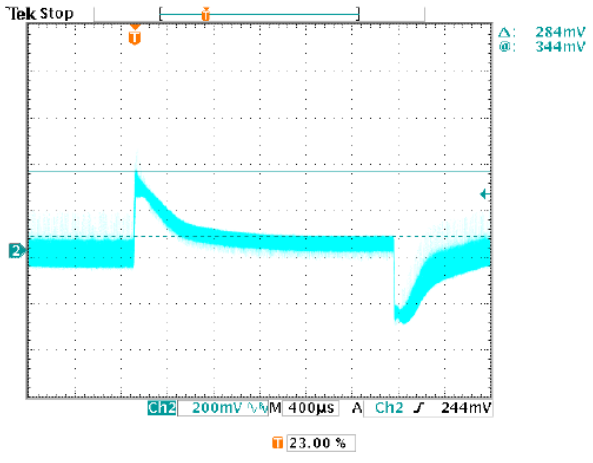


Figure4.Vin=36V/Vo=50V, 1A-15A, 2.5A/μS@25℃

Start-up

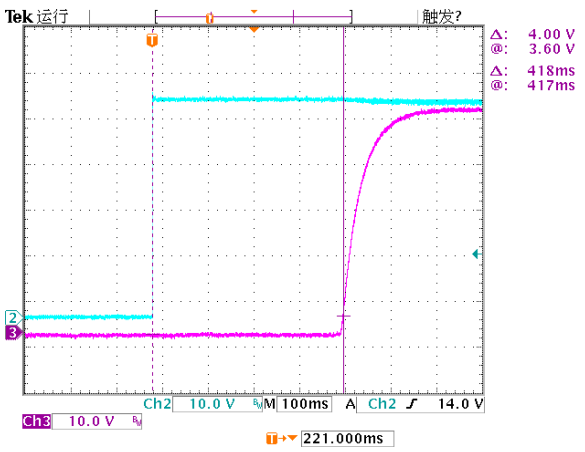


Figure5. Typical Start-up (Vin=48V,100% load@25℃)

Output ripple & noise

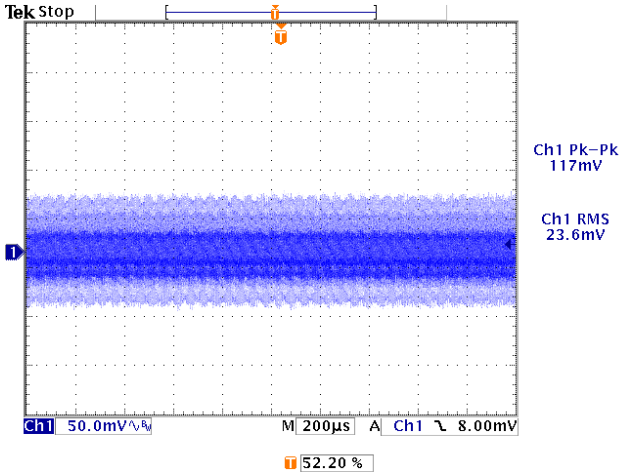
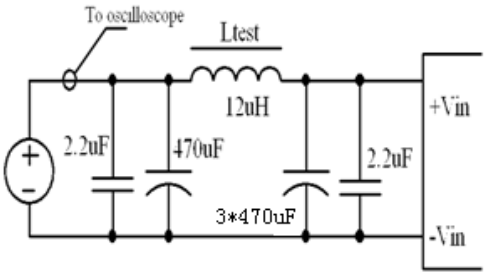


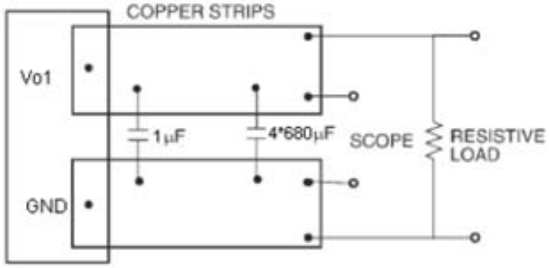
Figure6. Output ripple and noise @ Vin=48V, 100%load (20MHz bandwidth@25℃)

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 4*680 μF electrical capacitor. Position the oscilloscope probe between 51mm and 76mm (2 inch and 3 inch) 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, 3*470μF electrolytic capacitors and a 2.2μF 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 or equal to 75Vdc, 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.

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 30A. 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.

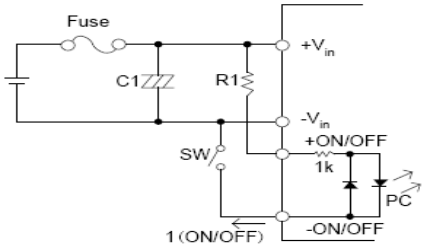
Feature Descriptions

Remote On/Off

The REM pin is used to turn the power converter on or off via a system signal. The remote control option is current-mode. The power turns off when the REM pin has not current or been left open and turns on when current is 2-5mA.

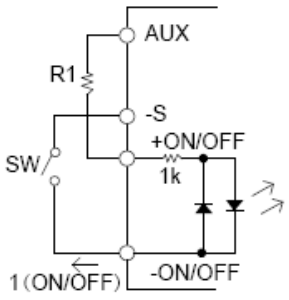
A remote ON/OFF control circuit is provided which is isolated from the input side and the output side.

Connection of remote ON/OFF terminal is as follows. As shown in the figure below, output voltage turns remote ON when current is made to flow through remote ON/OFF terminal. Remote ON/OFF terminal can be controlled by opening or closing connections (with switch or relay). Maximum source current for remote ON/OFF terminal is 5mA. Therefore, set current limiting resistor value such that this maximum source current value is not exceeded. Also, the allowable maximum reverse current flow is 5mA.



R1: Recommended resistor value: 18kΩ (1/2W)

Figure9.Connection of remote On/Off control (input side)



R1: Recommended resistor value: 2kΩ (1/2W)

Figure10.Connection of remote On/Off control (output side)

Note:

1. When wiring becomes long, connect a capacitor of about 0.1μF value between the +remote ON/OFF terminal and –remote ON/OFF terminal at a nearest distance.
2. Current limiting resistor can also be connected to the –remote ON/OFF terminal side.

Remote Sense

Remote sense minimizes the effects of distribution losses by regulating the voltage at the remote sense connections (see Figure 11). 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. +S and –S are the output voltage feedback section sampling and they can't be left open.

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, this 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.

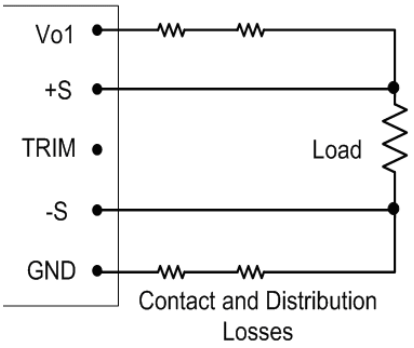


Figure11. Circuit Configuration for Remote Sense

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 12.

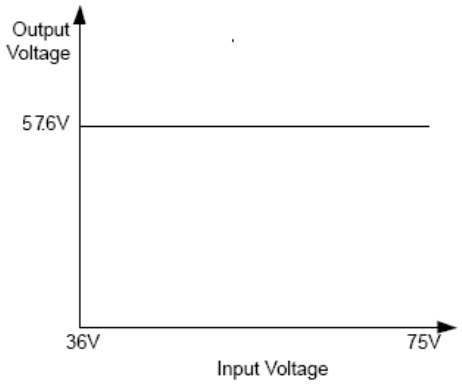


Figure12. Max. adjustable output voltage vs. input voltage

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 Figure13. 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 [k Ω]

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

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

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

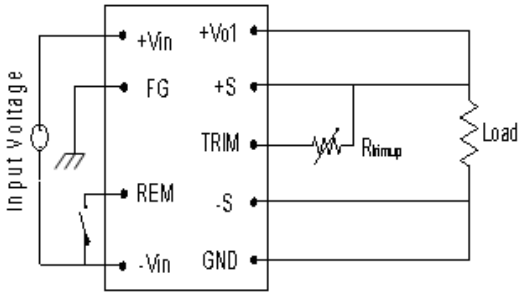


Figure13. Circuit Configuration to Increase Output Voltage.

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 Figure14.), 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 [k Ω]

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

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

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

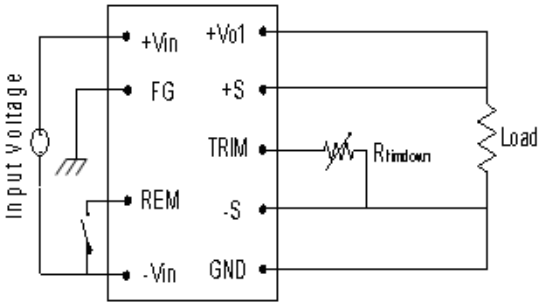


Figure14. Circuit Configuration to Decrease Output Voltage

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 15.

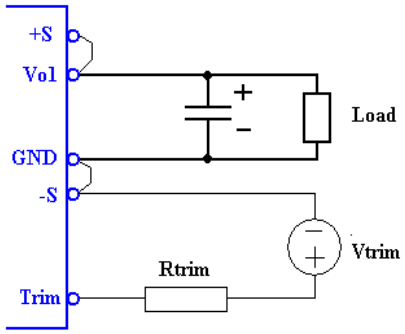


Figure15. Trim circuit by voltage mode

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 16.

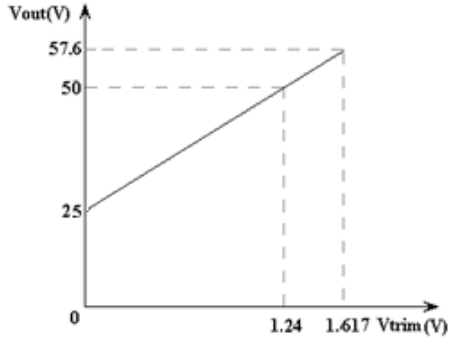


Figure16. Trim curve when Rtrim=0 kΩ

When Rtrim=1 kΩ

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

The trim curve is shown as Figure 17.

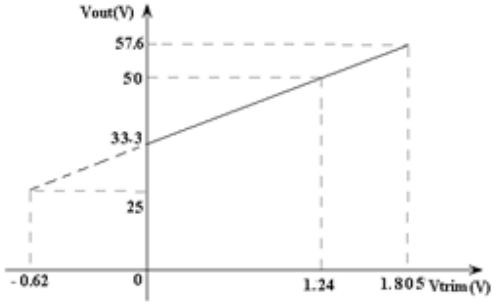


Figure17. Trim curve when Rtrim=1kΩ

When Rtrim=2 kΩ

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

The trim curve is shown as Figure 18.

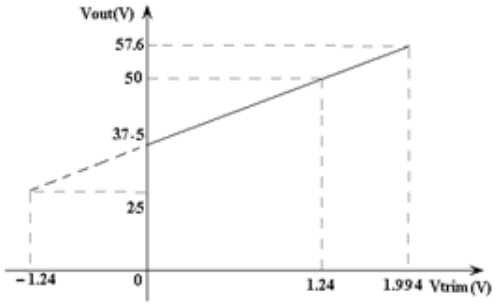


Figure18. Trim curve when Rtrim=2 kΩ

I.O.G

Output of this signal monitor is located at secondary side (output side) and is an open collector output. This signal is low when inverter is operating good and high when inverter stops or when inverter is operating abnormally. Ground for the IOG terminal is the-S terminal.

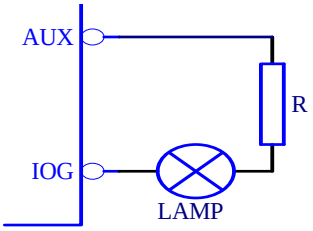


Figure19. IOG Application

Protection Features

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 over current 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 of the output terminals. If the output voltage exceeds the over-voltage protection threshold, then the module will operate in a hiccup mode until the 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 required temperature, 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.

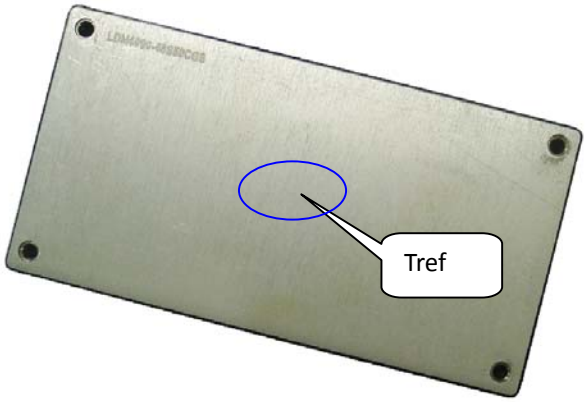


Figure 20 Tref Temperature Measurement Location

Input Under Voltage Lockout

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

Input Over Voltage Protection

The input over voltage protection mode is auto-recovery, the power module will shut down when the input voltage higher than the IOVP threshold, and will recovery when the input voltage go back to lower than the IOVP threshold.

Thermal Consideration

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.

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. 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 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 21 shows a suggested configuration.

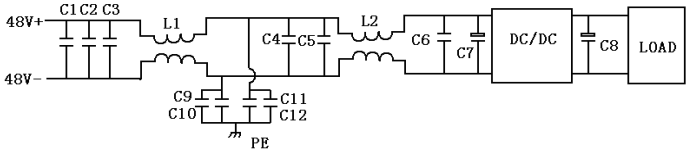


Figure21 .EMC testing typical application circuit

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	2*470μF electrolytic capacitor
C8	4*680μF electrolytic capacitor

Outline Diagram

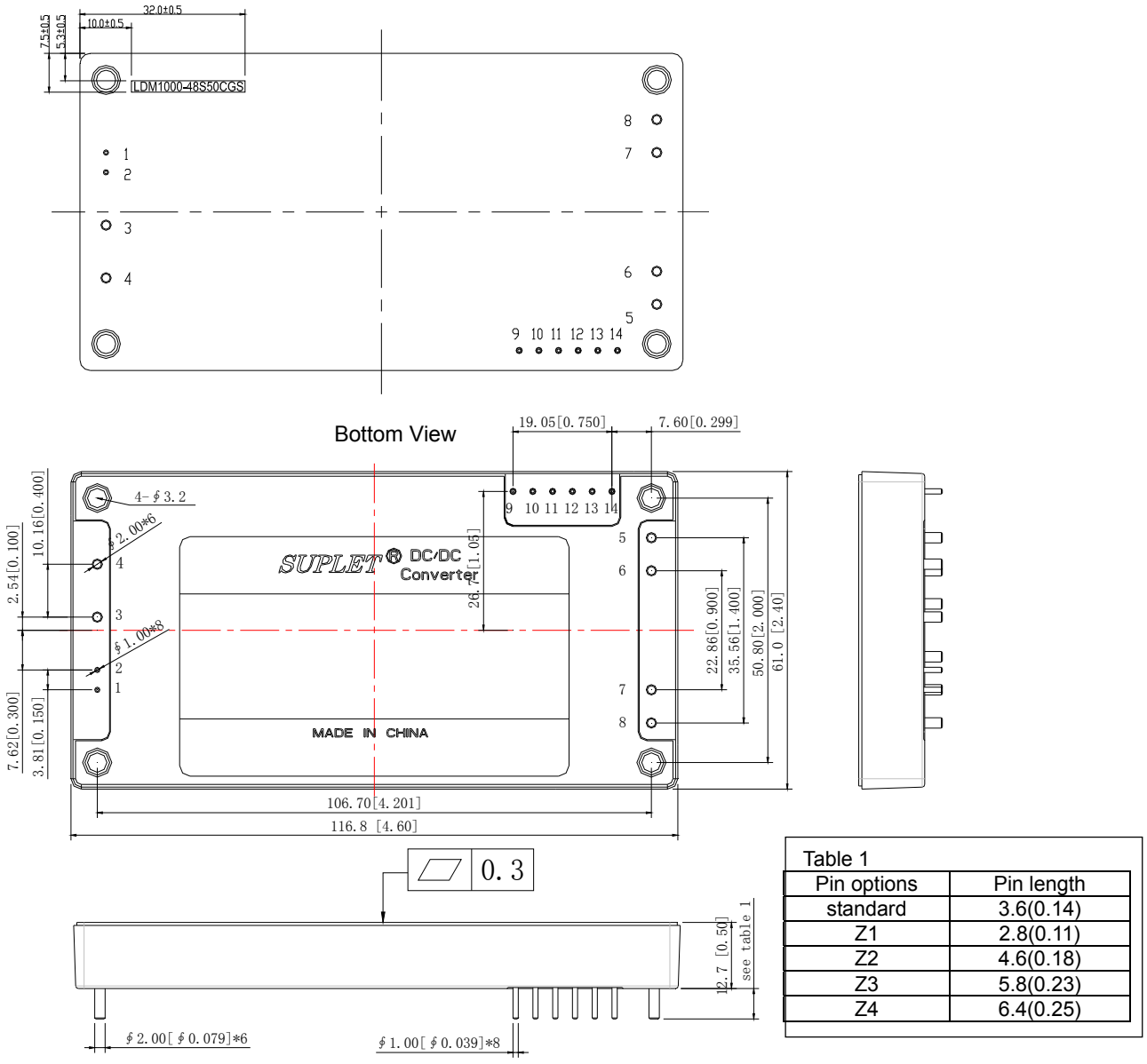


Table 1

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

Figure 22. 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	Pin No.	Symbol	Function
1	+REM	Positive remote control	8	Vo1	Positive output voltage
2	-REM	Negative remote control	9	AUX	Auxiliary power supply
3	+Vin	Positive input voltage	10	IOG	Inverter operation good signal
4	-Vin	Negative input voltage	11	NC	No connection
5	GND	Negative output voltage	12	TRIM	Output voltage trim
6	GND	Negative output voltage	13	+S	Positive remote compensation
7	Vo1	Positive output voltage	14	-S	Negative remote compensation

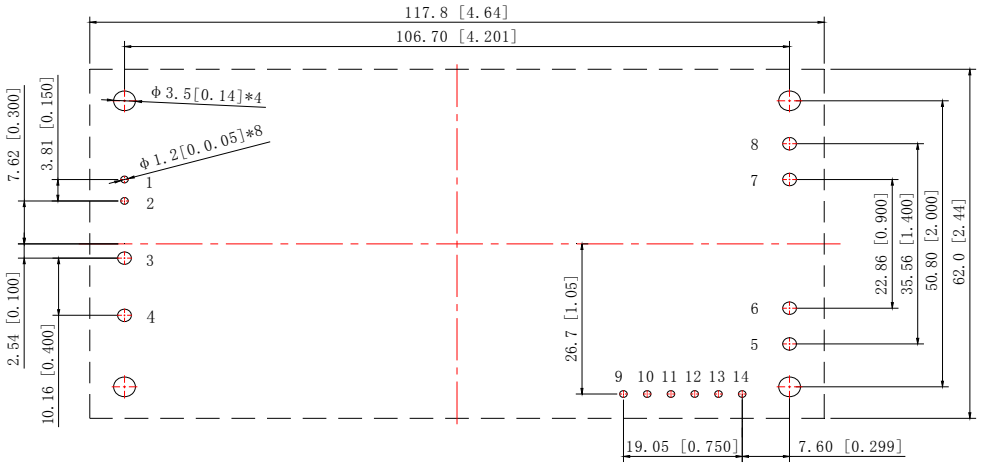


Figure23. Recommended Pad Layout

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 Figure24.

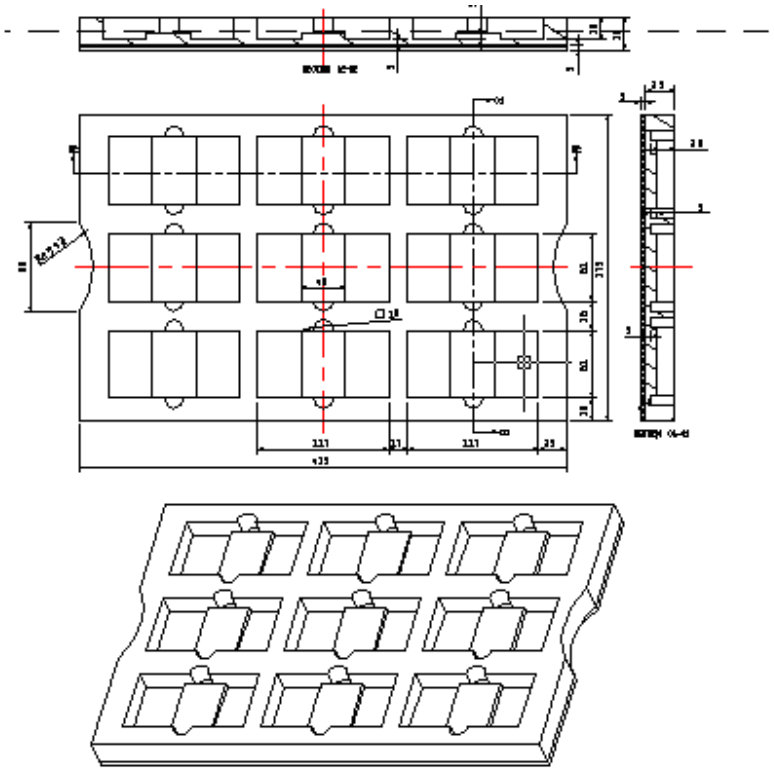
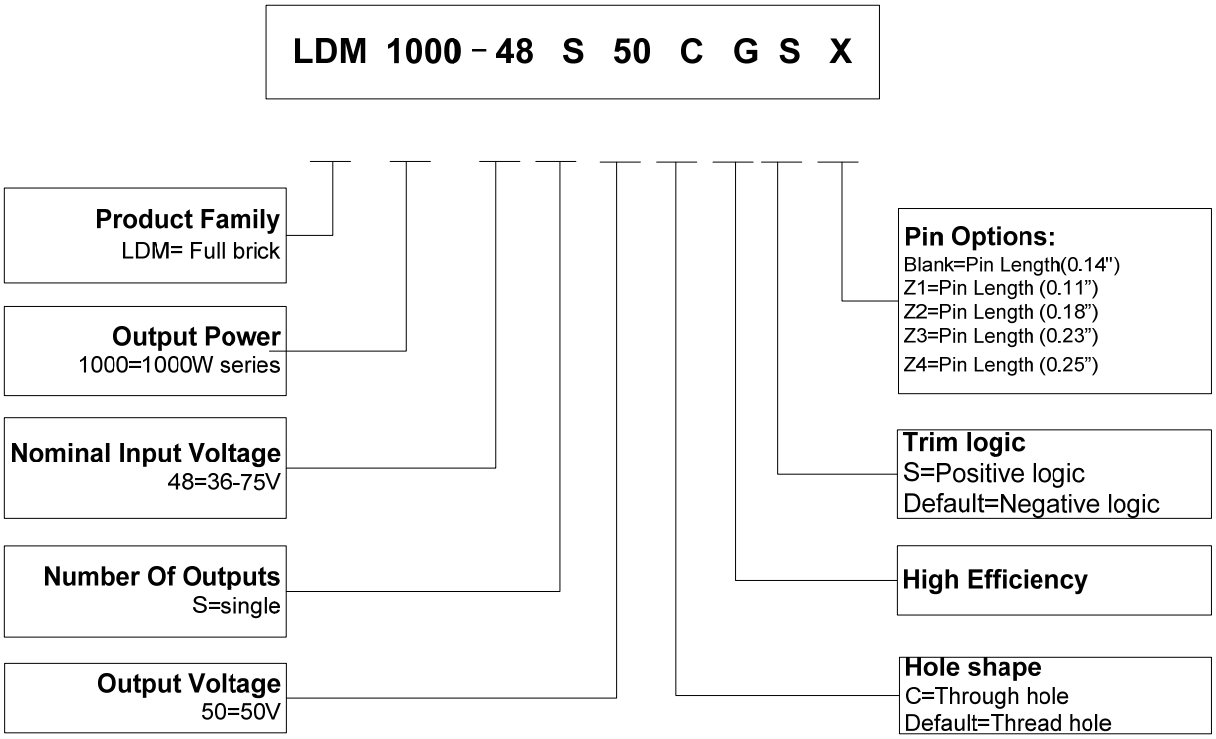


Figure24. Packaging Tray Diagram

Tray Specifications

Material	PPE ,antistatic
Surface resistance	$<10^{10}$Ohm
Bakability	The trays can be baked at maximum125℃ for 48 hours maximum
Tray capacity	9products/tray
Box capacity	54 products 6 full trays/box

Naming Rules On Models



Part number example

Part Number	Input voltage	Output voltage	Max Output Current	Pin Length
LDM1000-48S50CGS	36-75V	50V	20A	0.14”
LDM1000-48S50CGSZ1	36-75V	50V	20A	0.11”
LDM1000-48S50CGSZ3	36-75V	50V	20A	0.23”

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