SUPLET® **Technical Specification**

DC-DC Converter，Eighth-Brick

LDFE300-48S28CS Series

36Vdc to 75Vdc Input；28Vdc / 11A Output

RoHS Compliant

Features

- Compliance with RoHS10 EU Directive 2011/65/EU & (EU)2015/863
- Delivers up to 11A output current
- High efficiency up to 94%
- Low output ripple and noise
- Exceptional thermal performance
- Industry standard "Eighth-brick" footprint
- Remote On/Off positive logic
- Remote Sense
- Fixed switching frequency (550 kHz typical)
- Input under voltage lockout
- Output over voltage protection
- Over temperature protection
- Output over current protection
- Short circuit protection
- Adjustable output voltage (14Vdc~33Vdc)
- Meets IEC/UL/EN60950-1

Applications

- Distributed Power Architectures
- Wireless Networks
- Access and Optical Network Equipment
- Enterprise Networks
- Latest generation IC's (DSP, FPGA, ASIC) and Microprocessor powered application

Options

- Remote On/Off logic
- Trim logic
- Baseplate version for heatsink attachment

Description

LDFE300-48S28CS series are Eighth-brick DC/DC converters that provide high efficiency single output. They can operate from 36Vdc to 75Vdc input and 28V/11A output. The output can be trimmed from (14Vdc~33Vdc) of normal output voltage. The remote control option is positive logic. The converter turns off when the REM pin is at logic low and turns on when it at logic high, both are referenced to -Vin. The converter is on 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.

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)
Operating Temperature	℃	-40	85	Ambient Temperature
Base Plate Operating Temperature	℃	-40	100	
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=330uF capacitor, Cout=470uF capacitor with low ESR.

Input Characteristics

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Operating Input Voltage	Vdc	36	48	75	Converter guaranteed whole specification at input voltage range of 35 ~ 75V
Maximum Input Current	A	-	-	11	Vin=Vin(min) to Vin(max) Full load

No load Input Current	mA	-	-	200	Vin=Vin(min) to Vin(max) No load
Standby Input Current	mA	-	30	60	
Input Reflected Ripple Current Peak-to-Peak	mA	-	-	300	12 μH source impedance, add 470μF electrolytic and 1μF ceramic capacitor at input
Recommended External Input Capacitance	μF	330	-	-	Recommended ESR<1200mΩ at -40℃
Inrush Transient	A^2S	-	1	-	
Recommended Input Fuse	A	-	15	30	

Remote Control Characteristics

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Logic Low Voltage	Vdc	-0.3	-	1.2	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	27.72	28	28.28	Vin=Vin(nom); half load
Output Current	A	-	-	11	Vin=Vin(min) to Vin(max) Total output power is no more than 300W
Line Regulation	mV	-	-	140	Vin=Vin(min) to Vin(max) Io=Io(nom)
Load Regulation	mV	-	-	140	0~100% load, Vin=Vin(nom)
Output Voltage Precision	%Vo	-	1.5	3	Vin=Vin(min) to Vin(max) Io=0 to Io(max)

Output Voltage Adjustment Range	Vdc	14	-	33	Po=0~300W, See figure 11 and 12
Remote Sense Compensation	V	-	-	1.5	
Output Current Limit inception	A	12	-	17	Ambient Temperature 25℃, Hiccup mode Automatic recovers
External Output Capacitance	μF	470	-	3300	ESR<350mΩ at -40℃, recommend 2~3PCS KY, KZE and KZH series aluminum capacitors in parallel
Temperature Coefficient	ppm/℃	-	-	200	Ambient Temperature -40℃~85℃
Dynamic Response	mV	-	300	600	25%~50%~75%load step, di/dt=2.5A/μS
	μs	-	100	200	
	mV	-	600	1200	0~50%~100%load step, di/dt=2.5A/μS
	ms	-	-	2	
Ripple and Noise Peak to peak	mV	-	100	280	Measured with 10μF Tantalum external and 1μF ceramic capacitor at output, 100%load, 20MHz bandwidth
Turn-on Delay Time	ms	-	8	30	Time from instant at which Vin=Vin(min) until Vo=10% of Vo(nom)
Turn-on Rise Time	ms	-	8	30	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-off Threshold	Vdc	30	-	33	
	Turn-on Threshold	Vdc	31	-	34	

	Hysteresis	Vdc	0.5	-	3	
Output Over Voltage Protection		Vdc	33	-	39	Under the converter's maximum allowable output power. Hiccup.
Short Circuit Protection		Hour	4	-	-	Hiccup Mode Automatic recovery
Output Over Current Protection			-	Yes	-	Hiccup Mode Automatic recovery
Over Temperature Protection		℃	100	110	125	Automatic recovery See OTP section
Over Temperature Protection Hysteresis		℃	2	10	18	

General Specifications

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Efficiency	%	91	93	-	Vin=48V, 100%load Ambient Temperature 25℃
		92	94	-	Vin=48V, 50%load Ambient Temperature 25℃
Switching frequency	kHz	-	550	-	Vin=Vin(nom); Io=Io(max); Fixed frequency
MTBF	Hour	-	2,800,000	-	Telcordia SR332, Issue 3, 2011, 40℃Ta
FIT		-	357	-	10^9/MTBF
Thermal Stability Time	min	-	30	-	
Weight	g	39	46	53	
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	-	-	Test duration 1 minute, leak current less than 10mA
	Input-Heatsink	Vdc	1050	-	-	Test duration 1 minute, leak current less than 10mA
	Output-Heatsink	Vdc	500	-	-	Test duration 1 minute, leak current less than 10mA
Isolation Resistance		MΩ	10	-	-	Normal air pressure, 500Vdc, the isolation resistance is no more than 10 MΩ
Isolation Capacitor (Input-Output)		pF	-	3000	-	

Characteristic Curve

Efficiency

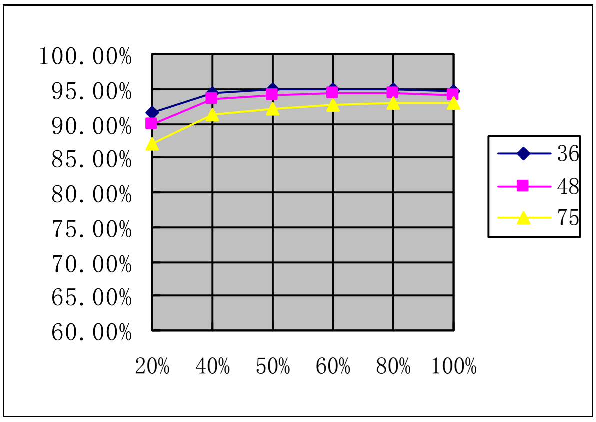


Figure1. Converter Efficiency Vs. Output Current @25℃

Derating

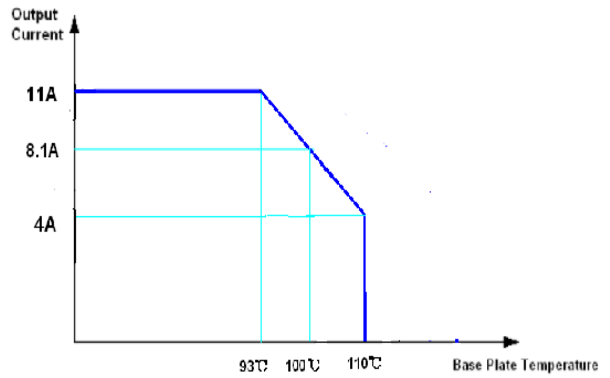


Figure2. Derating curve Vs. heat sink temperature without airflow for the module mounted horizontally on the external heat sink, 48Vin.

Dynamic Response

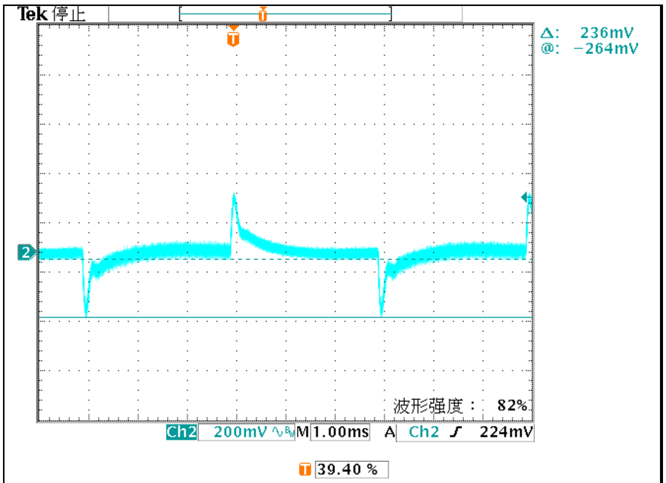


Figure3.Vin=48V/Vo=28V, 25%~50%load. 2.5A/μS@85℃

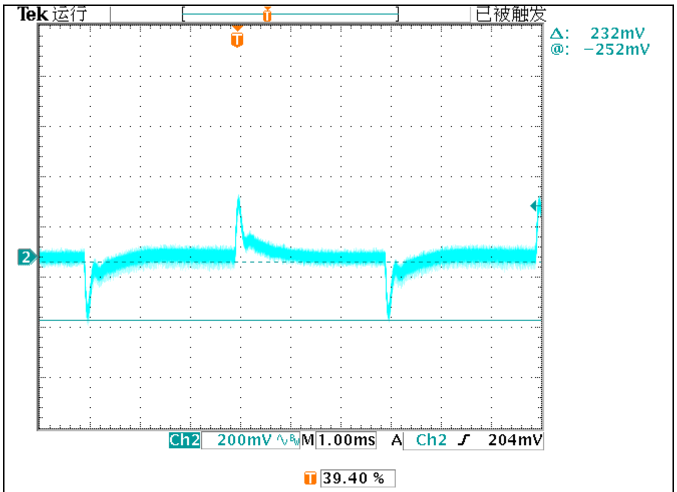


Figure4.Vin=48V/Vo=28V, 50%~75%load. 2.5 A/μS@85℃

Output ripple & noise

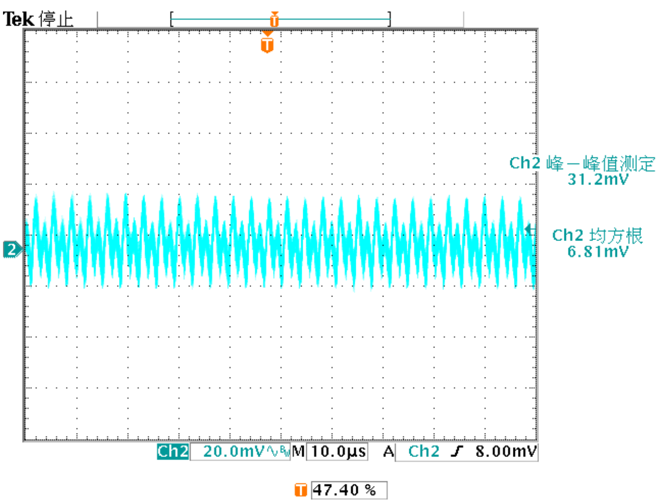


Figure5. Output ripple and noise @ Vin=48V, 100%load (20MHz bandwidth@85℃)

Start-up

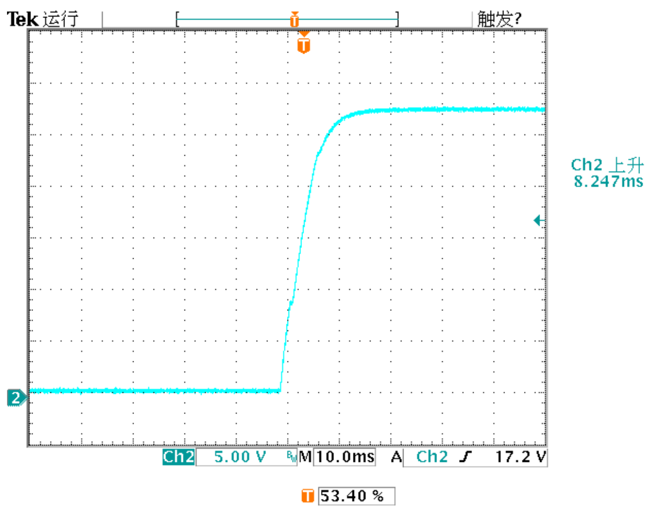
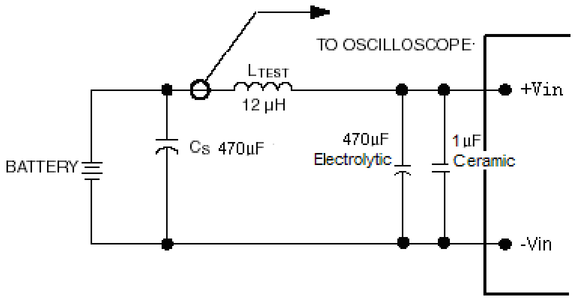


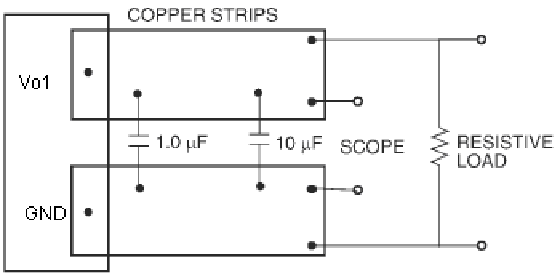
Figure6. Typical Start-up(Vin=75V,100% load@25℃)

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 and IEC60950-1, if the system in which the power module is to be used must meet safety agency requirements.

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 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 remote on or off via a system signal. This power module is positive logic version. When the REM pin is at logic low the power turns off and turns on at logic high. We also provide negative logic remote On/Off, turns the module on during logic low voltage and off during a logic high.

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 1.2 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.

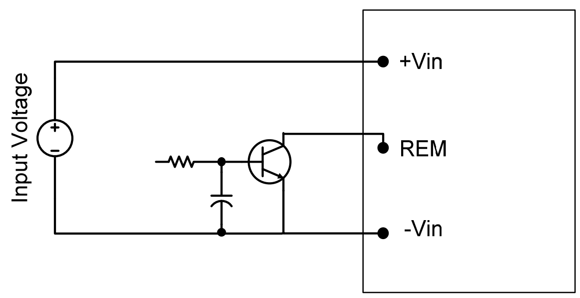


Figure9. Remote On/Off Implementation

Remote Sense

Remote sense minimizes the effects of distribution losses by regulating the voltage at the remote sense connections (see Figure10). 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.

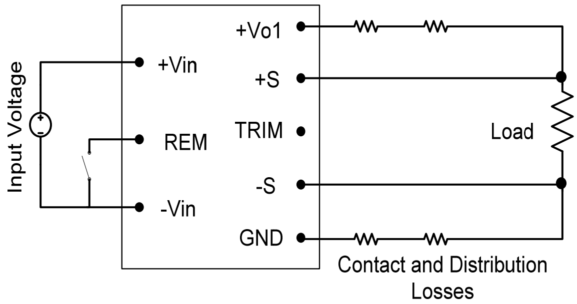


Figure10. Circuit Configuration for Remote Sense

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 and Figure 12.

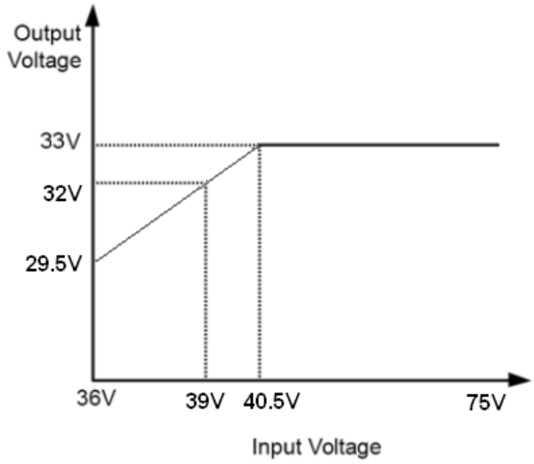


Figure11. Max. adjustable output voltage vs. input voltage @9A, 300W

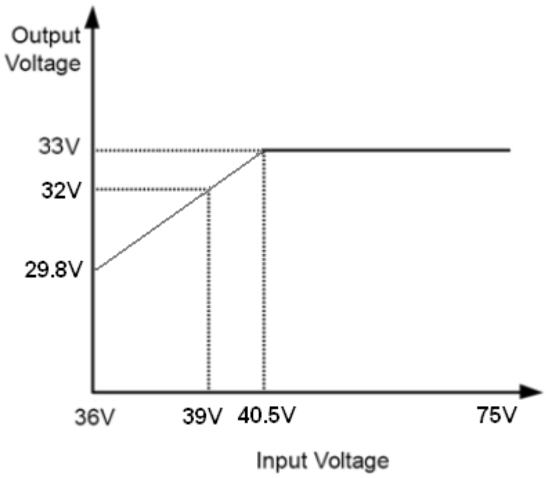


Figure12. Max. adjustable output voltage vs. input voltage @5A

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 figure 13. A trim resistor, R_{trimup}, is connected between the TRIM and +S.

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

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].

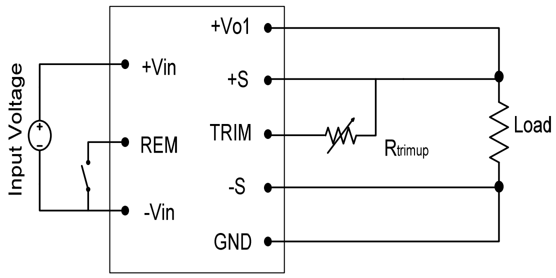


Figure13. Circuit Configuration to Increase Output Voltage.

Trimming beyond 33V is not an acceptable design practice, as this condition could cause unwanted triggering of the output over voltage 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 Figure.14), 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]

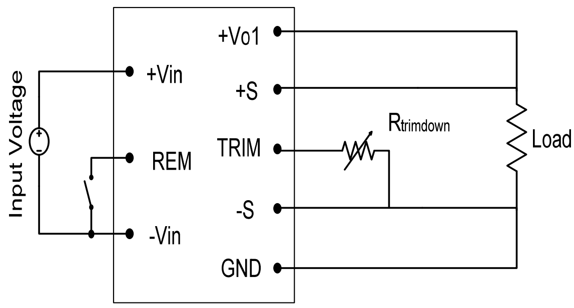


Figure14. Circuit Configuration to Decrease Output Voltage

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.

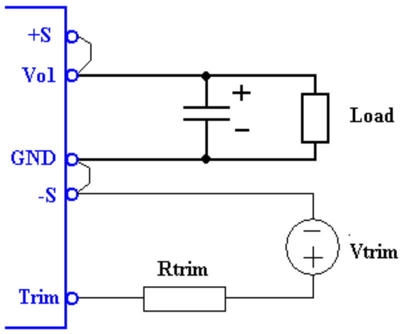


Figure15. Trim circuit by voltage mode

The relationship between Vtrim and Vo is described as below:

$$V_{trim} = \frac{(2 + \text{Rtrim}) * \text{Vout}}{22.581} - (1 + Rtrim) * 1.24$$

V_{nom} = Nominal value of output voltage, 28V

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

$$V_{trim} = 0.0886 * Vout - 1.24$$

The trim curve is shown as Figure 16.

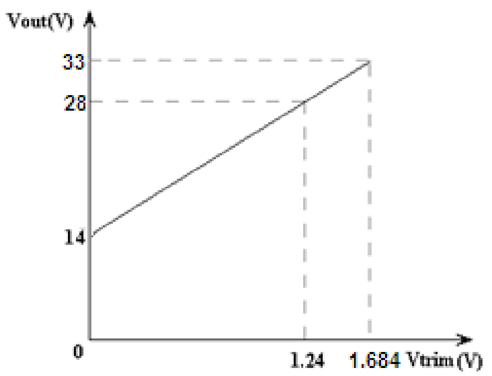


Figure16. Trim curve when Rtrim=0 kΩ

When Rtrim=1 kΩ

$$V_{trim} = 0.1329 * Vout - 2.48$$

The trim curve is shown as Figure 17.

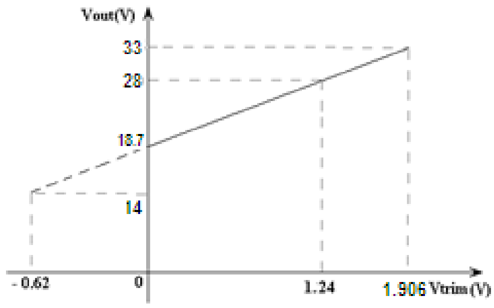


Figure17. Trim curve when Rtrim=1kΩ

When Rtrim=2 kΩ

$$V_{trim} = 0.1771 * Vout - 3.72$$

The trim curve is shown as Figure 18.

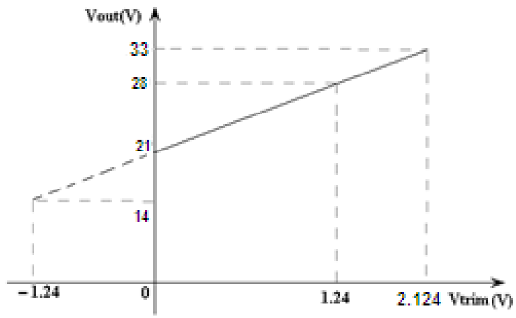


Figure18. Trim curve when Rtrim=2 kΩ

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.

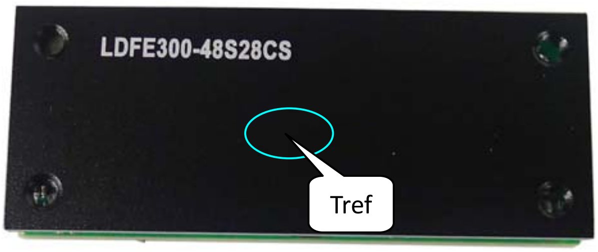


Figure 19 Tref Temperature Measurement Location

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 20 shows a suggested configuration to meet the conducted emission limits of EN55022 Class B.

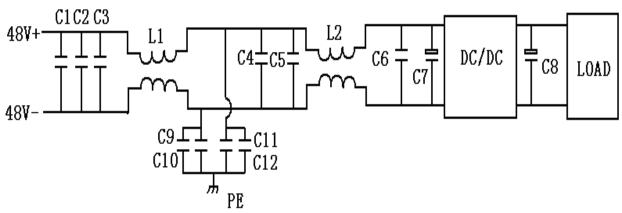


Figure20. EMC testing typical application circuit

components	parameters
C1 C2 C3 C4 C5	1μF SMD ceramic capacitor
C6	0.1μF SMD ceramic capacitor
L1 L2	720μH Common-mode inductance
C9 C10 C11 C12	0.22μF Isolation voltage SMD capacitor
C7	1000μF electrolytic capacitor
C8	1000μF electrolytic capacitor

Outline Diagram

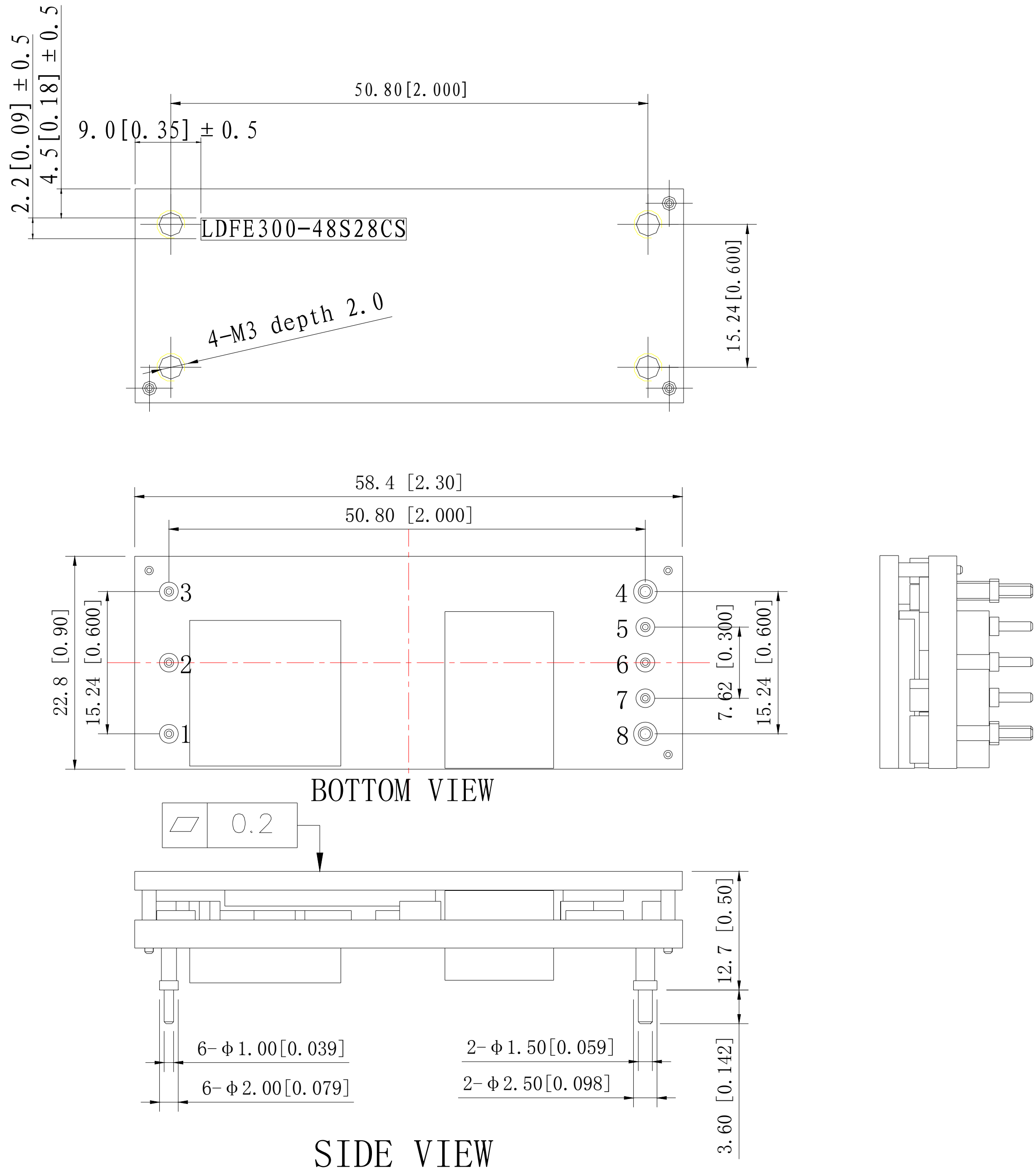


Figure21. Outline Diagram

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	-Vin	Negative input voltage
4	GND	Negative output voltage
5	-S	Negative remote compensation
6	TRIM	Output voltage trim
7	+S	Positive remote compensation
8	+Vo1	Positive output voltage

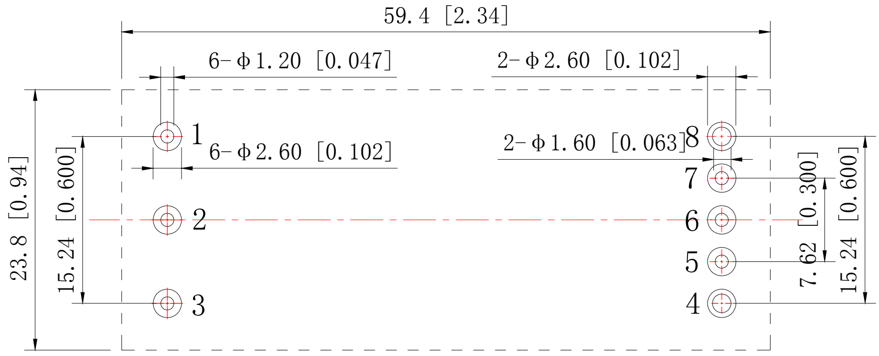


Figure22. Recommended Pad Layout

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 23.

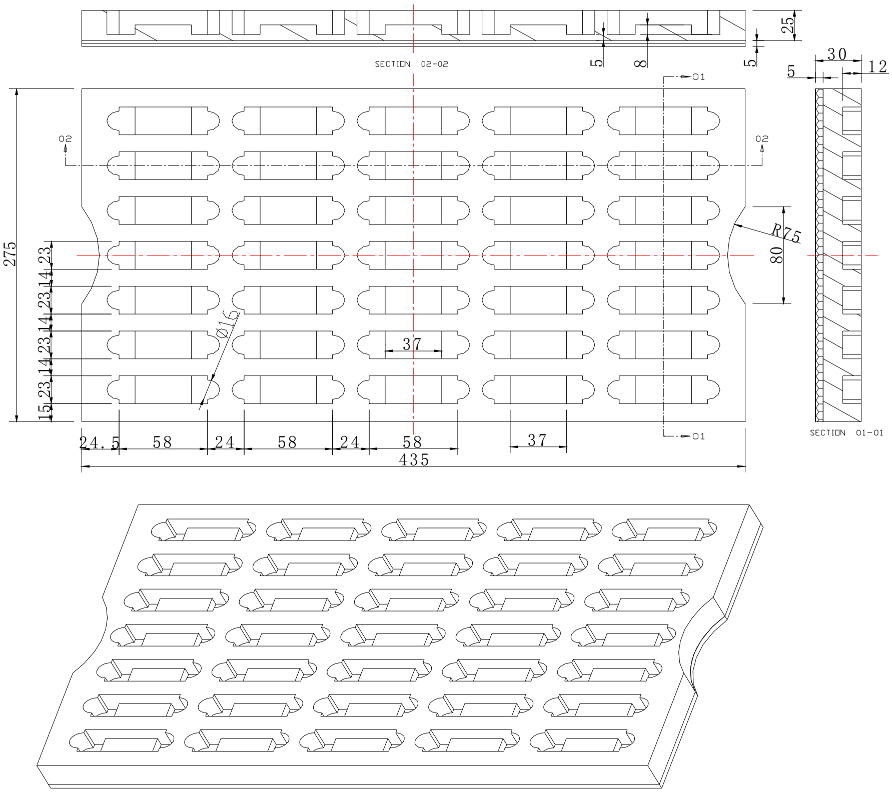


Figure23. Packaging Tray Diagram

Tray Specifications

Material	PPE ,antistatic
Surface resistance	$<10^{10}$Ohm
Bakability	The trays can be baked at maximum125℃ for 48 hours maximum
Tray capacity	35 products/tray
Box capacity	175 products 5 full trays/box

Naming Rules On Models

LDFE 300 - 48 S 28 C X S X

Product Family
LDFE=Eighth Brick

Output Power
300=300W series

Nominal Input Voltage
48=36~75 Vdc

Number of Outputs
S=Single

Output Voltage
28=28Vdc

Pin Options:
Blank=Through-Hole Std. Pin Length (0.142”)
Z1=Through-Hole Std. Pin Length (0.110”)
Z2=Through-Hole Std. Pin Length (0.180”)
Z3=Through-Hole Std. Pin Length (0.228”)
Z4=Through-Hole Std. Pin Length (0.250”)

Trim Logic
S=Positive Logic Option
Blank=Negative Logic Option

Remote on/off Logic
P=Negative Logic Option
Blank=Positive Logic Option

Heat Sink Attachment
C=With heatsink
Blank=Without heatsink

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

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