SUPLET® **Technical Specification**

DC-DC Converter, Eighth-Brick

LDFE75-48S12WCPS Series

18 Vdc to 75Vdc Input; 12Vdc / 6.25A Output

RoHS Compliant

Feature

- Compliance with RoHS6 EU Directive 2011/65/EU
- Delivers up to 6.25A output current
- High efficiency: typ.92% at 24Vin, half load
- Low output ripple and noise
- Exceptional thermal performance
- Industry standard "eighth-brick" footprint
- High reliability
- Remote On/Off negative logic
- Fixed switching frequency (350 KHz typical)
- Input under voltage lockout
- Output over voltage protection
- Output over current protection
- Over temperature protection
- Short circuit protection
- Meets the voltage and current requirements for ETSI 300-132-2 and licensed for Basic Insulation rating per IEC60950-1 2005

Applications

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

Options

- Remote On/Off logic
- Trim logic
- Baseplate version for heat sink attachment

Description

LDFE75-48S12WCPS series power module is an eighth -brick DC/DC converter that provides a high efficiency single output. It can operate from 18Vdc to 75Vdc input and 12V/6.25A output. The remote control option is negative logic. The converter turns off when the REM pin is at logic high and turns on when it at logic low, both are referenced to -Vin. The converter is off when the REM pin is left open. The output voltage trim logic is positive. The output voltage will increase when the TRIM pin is connected to “+S” and decrease when connected to “-S”.

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
Storage Temperature	℃	-55	125	
Operating Humidity	RH(%)	10	90	Non-condensing
Storage Humidity	RH(%)	10	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 room temperature conditions.

Input Characteristics

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Operating Input Voltage	V	18	24/48	75	
Maximum Input Current	A	-	-	5.5	100% load Vin=18V
No load Input Current	mA	-	100	-	No load Full Input Voltage

Input Reflected Ripple Current Peak-to-Peak	mA	-	80	-	12 μH source impedance, add 47μF (ESR<0.7Ω) aluminum electrolytic capacitor
Inrush Transient	A^2S	-	-	1	
Recommended Input Fuse	A	-	-	10	

Remote Control Characteristics

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Turn on voltage	V	0	-	0.7	Converter guaranteed off when REM pin is left open
Turn off voltage	V	2.4	-	18	

Output Characteristics

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Output Voltage Set Point	V	11.88	12.0	12.12	
Output Current	A	-	-	6.25	Vin=Vin(min) to Vin(max) Total output power is less than 75W
Line Regulation	%Vo	-	0.1	0.2	Vin=Vin(min) to Vin(max) Io=Io(nom)
Load Regulation	%Vo	-	0.2	0.5	Vin=Vin(nom)
Output Voltage Precision	%Vo	-	-	1	Vin=Vin(min) to Vin(max) Io=0 to Io(max)
Output Voltage Adjustment Range[1]	%Vo	-10	-	5	Vin=Vin(min) to Vin(max) Io=0 to Io(max)
Remote Sense Compensation	%Vo	-	-	5	% of Vo(nom) Compensation includes trim
Output Current Limit inception	%Io	110	-	160	25℃
External Load Capacitance	μF	0	-	2000	Vin=Vin(min) to Vin(max) Io=0 to Io(max)

Temperature Coefficient	ppm/℃	-	-	200	-40℃-85℃
Dynamic Response	%Vo/μs	-	-	±5.0/200	25%-50%-25%,50%-75%-50% Io(max),di/dt=2.5A/μs with 220μF external capacitor
Ripple and Noise	mVp-p	-	200	-	20MHz bandwidth, with 10uF electrolytic capacitor and 1uF ceramic capacitor in parallel at output,100% load
Turn-on Delay Time	ms	-	15	-	Time from instant at which Vin=Vin(min) until Vo=10% of Vo(nom)
Turn-on Rise Time	ms	-	15	-	Time for Vo to rise from 10% of Vo(nom) to 90% of Vo(nom)

Note:

1. Trim-up range is limited below 5% at low line and full load.

Protection Characteristics

Parameter		Units	Specifications			Notes & conditions
			Min.	Typ.	Max.	
Input Undervoltage Lockout	Turn-off Threshold	V	15	16	17	
	Turn-on Threshold	V	16	17	18	
	Hysteresis	V	1	-	-	
Output Overvoltage Protection		V	13.2	-	14.5	Under the converter's maximum allowable output power. Hiccup Mode
Short Circuit Protection		Hour	4	-	-	Hiccup Mode Automatic recovery
Output Over Current Protection		A		YES		Hiccup Mode Automatic recovery
Over Temperature Protection		℃	-	110	-	Automatic recovery See OTP section
Over Temperature Protection Hysteresis		℃	-	10	-	

General Specifications

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Efficiency	%	-	92	-	25℃,Vin=24V,100% load
	%	-	93	-	25℃,Vin=24V, 50% load
Switching Frequency	KHz	-	350	-	Fixed frequency
MTBF	Hour	3,200,000			Telcordia SR332, Issue 3, 40℃
FIT		312.5			10^9/MTBF
Thermal Stability Time	min	-	30	-	
Weight	g	-	33	-	
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-Case	Vdc	1050	-	-	Test duration 1 minute, leak current less than 10mA
	Output-Case	Vdc	500	-	-	Test duration 1 minute, leak current less than 10mA
Isolation Resistance		MΩ	10	-	-	Normal air pressure, 500Vdc, the isolation resistance is no less than 10 MΩ

Isolation capacitance	pF	-	2200	-	

Characteristic Curves

Efficiency

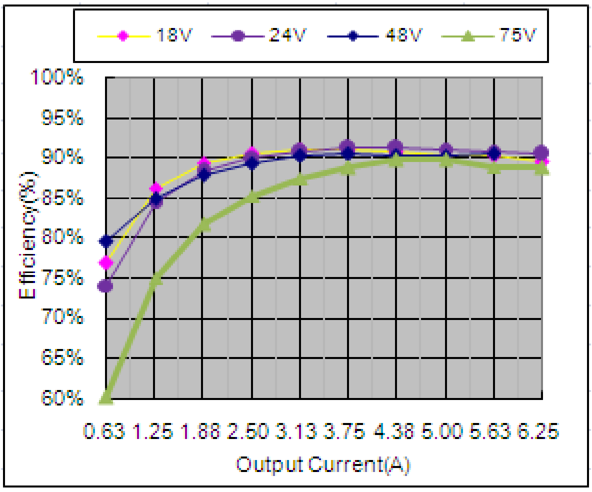


Figure1.Converter Efficiency Vs. Output Current @25℃

Derating

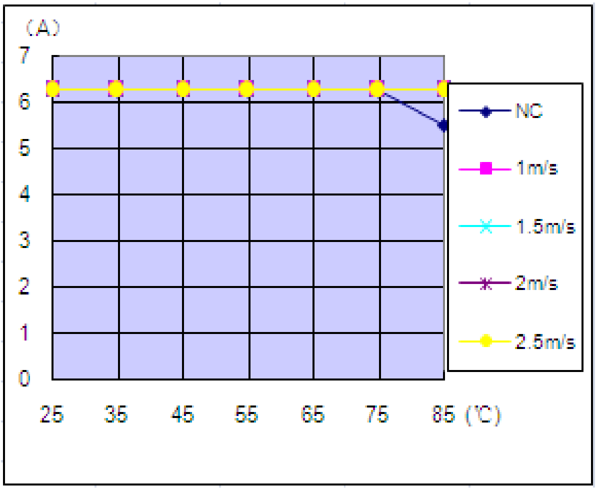
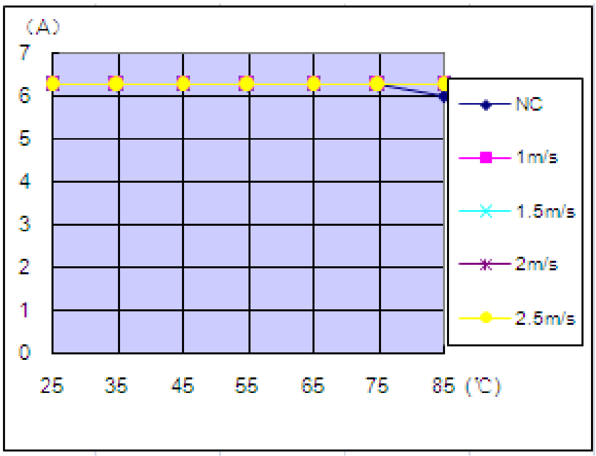


Figure2. Available load current Vs. ambient temperature and airflow for the module mounted horizontally,24Vin



Figur3. Available load current Vs. ambient temperature and airflow for the module mounted horizontally,48Vin

Output ripple & noise

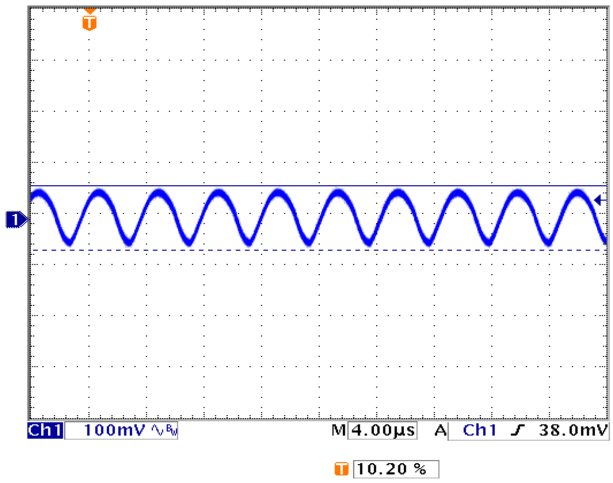


Figure4.Output voltage ripple (Vin=48V/Io=6.25A,20MHz bandwidth@25℃)

Dynamic Response

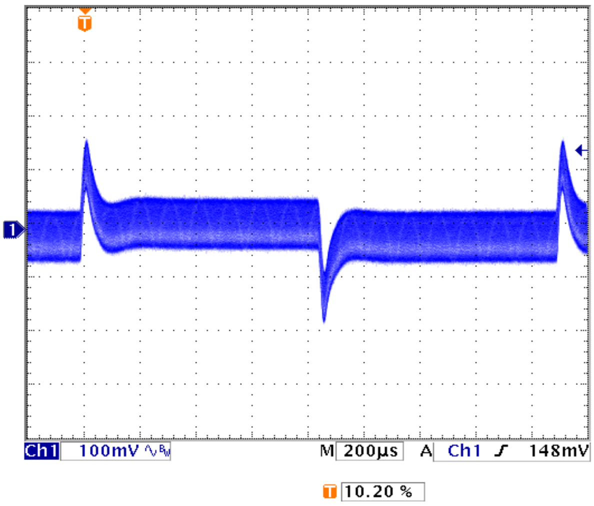


Figure5.Vin=48V/Vo=12V,25%-50%-25%load,2.5A/µs @25℃, with 220µF external capacitor

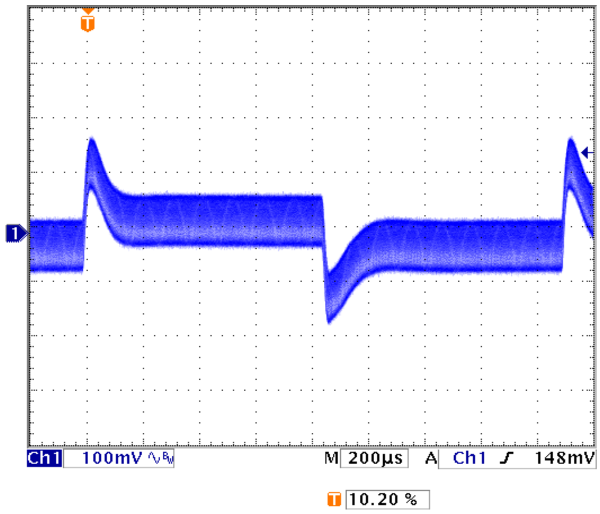


Figure6.Vin=48V/Vo=12V,50%-75%-50%load,2.5A/µs @25℃, with 220µF external capacitor

Start-up

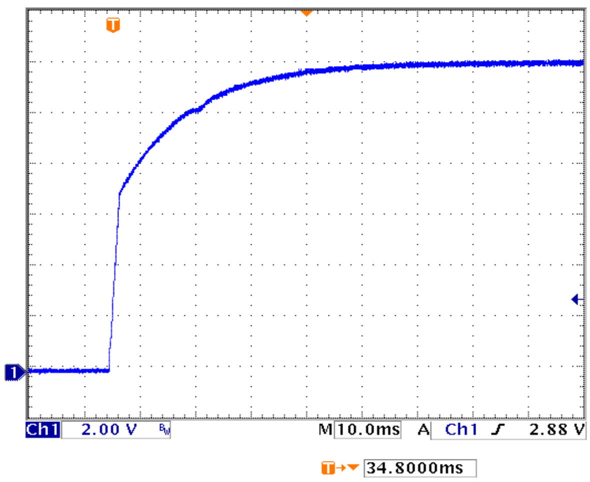


Figure7.Start-up (Vin=48V/Io=6.25A@25℃)

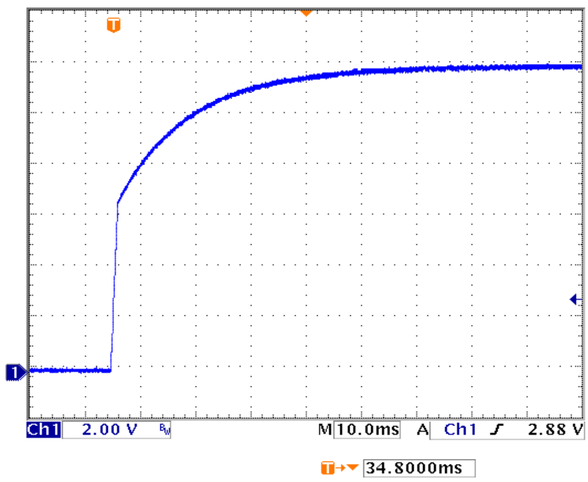
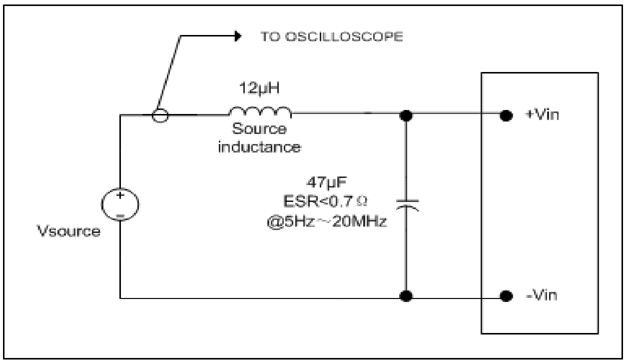


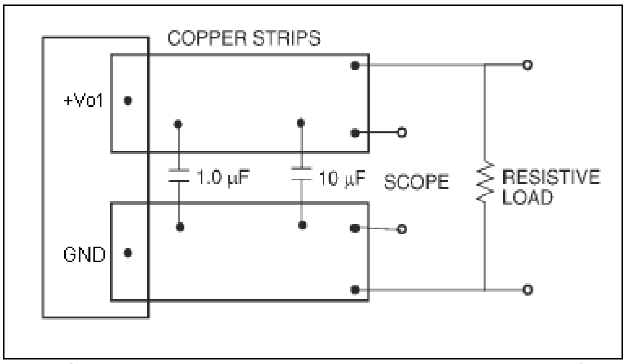
Figure8. Start-up (Vin=48V/Io=0@25℃)

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.

Figure9. Input Reflected Ripple Current Test Setup



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

Figure10. 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 Figure9 a 47μF electrolytic capacitor(ESR<0.7Ω @5Hz～20MHz) , 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., *UL*60950, *CSA* C22.2, No. 60950-00, and VDE 0805:2001-12 (IEC60950-1 2005).

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

For Basic Insulation models, 1500Vdc is applied from Vin to Vo to 100% of outgoing production.

- The output may be considered SELV. Output voltages will remain within SELV limits even with internally generated non-SELV voltages. Single component failure and fault tests were performed in the power converters.
- One pole of the input and one pole of the output are to be grounded, or both circuits are to be kept floating, to maintain the output voltage to ground voltage within ELV or SELV limits.

For all input sources, other than DC MAINS, where the input voltage is between 60 and 75Vdc (Classified as TNV-2 in Europe), the following must be adhered to, if the converter's output is to be evaluated for SELV:

- One Vin pin and one Vo pin are to be reliably earthed, or both the input and output pins are to be kept floating.
- Another SELV reliability test is conducted on the whole system, as required by the safety agencies, on the combination of supply source and the subject module to verify that under a single fault, hazardous voltages do not appear at the module's output.

The power module has ELV (extra-low voltage) outputs when all inputs are ELV.All flammable materials used in the manufacturing of these modules are rated 94V-0, and UL60950A.2 for reduced thicknesses.

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 10A. 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. We also provide positive logic remote On/Off, turns the module on during logic high voltage and off 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 11). A logic low is V_{REM} = 0 V to 0.7 V. During logic high, the maximum V_{REM} voltage generated by the power module is 18V.

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.

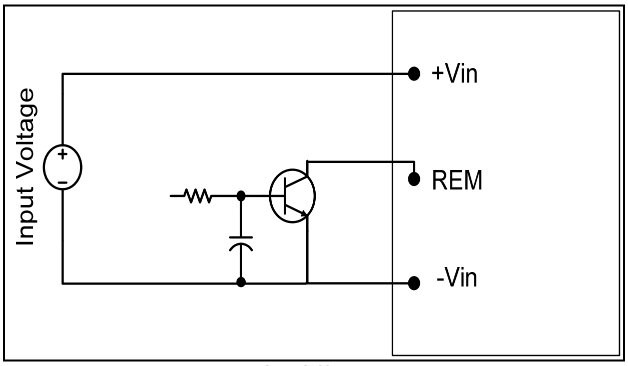


Figure11. Remote On/Off Implementation

Remote Sense

Remote sense minimizes the effects of distribution losses by regulating the voltage at the remote sense connections (see Figure 12). The voltage between the remote sense pins and the output terminals must not exceed the output voltage sense range (<10% Vo(nom)). The voltage between the $+V_O1$ 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, at the same time 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.

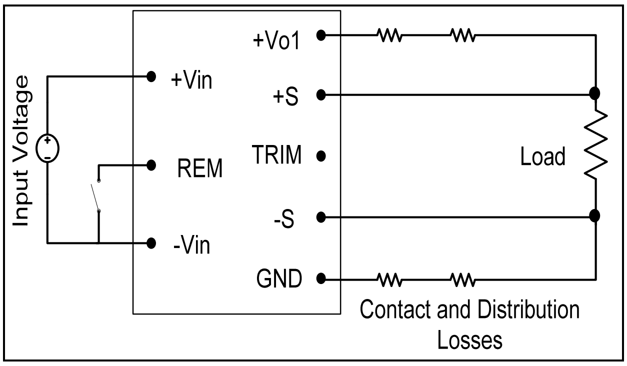


Figure12. Circuit Configuration for Remote Sense

Output Voltage Programming

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.

$$R_{trimup} = \left(\frac{5.11 * (100 + \Delta) * 12 - 626}{1.225 * \Delta} - 10.22 \right) k\Omega$$

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

$$\Delta = \left| \frac{V_{trimup} - V_{OUT}}{V_{OUT}} \times 100 \right|$$

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

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

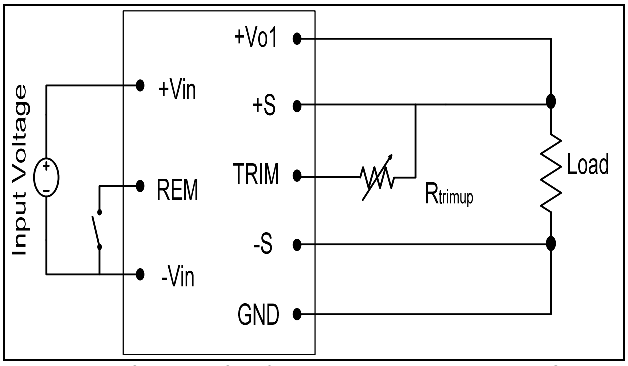


Figure13. Circuit Configuration to Increase Output Voltage.

Trimming beyond 105% of the rated output voltage 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 Figure.14), a trim resistor, $R_{trimdown}$, should be connected between the TRIM and -S, with a value of

$$R_{trimdown} = \left(\frac{511}{\Delta} - 10.22\right) k\Omega$$

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

$$\Delta = \left|\frac{V_{trimdown} - V_{OUT}}{V_{OUT}} \times 100\right|$$

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

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

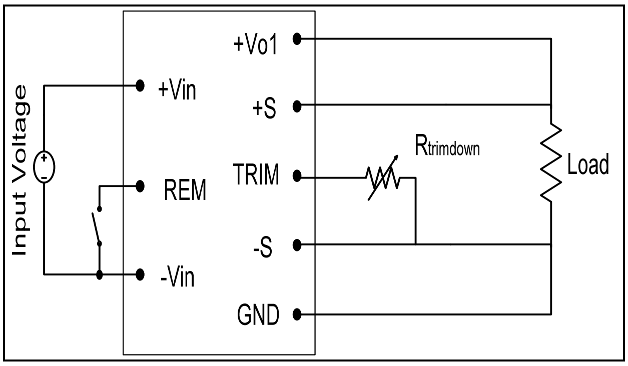


Figure14. Circuit Configuration to Decrease Output Voltage

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 overcurrent condition exists, it operates normally once the output current is reduced back into its specified range.

Output Over Voltage Protection

The output overvoltage 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 heatsink 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.

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.

Heat Transfer via Convection

Increased airflow over the module enhances the heat transfer via convection. Thermal derating curves showing the maximum output current that can be delivered at different local ambient temperature (TA) for airflow conditions ranging from natural convection.

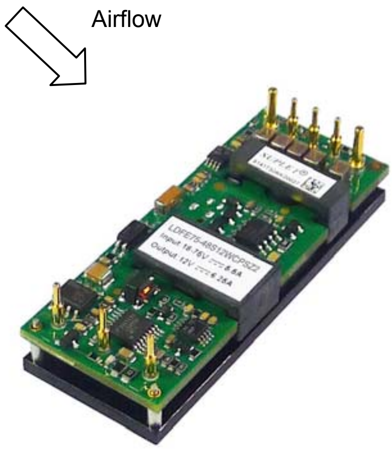


Figure15. Recommended Airflow Direction

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 cleaning fluids in cavities inside of the DC/DC power module. The residues may affect long time reliability and isolation voltage.

Electromagnetic Compatibility (EMC)

The Figure 16 shows a suggested configuration to meet the conducted emission limits of EN55022 Class A.

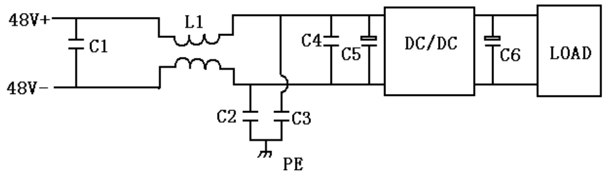


Figure16. Recommended EMC application

Component	Specifications
C1	SMD ceramic capacitor-1uF
C4	SMD ceramic capacitor-0.1uF
L1	Magnetic material-1320uH-+-25%
C2 C3	Film through-hole mounted safety capacitor-0.1uF
C5	Electrolytic capacitor-100uF
C6	Electrolytic capacitor-470uF

Outline Diagram

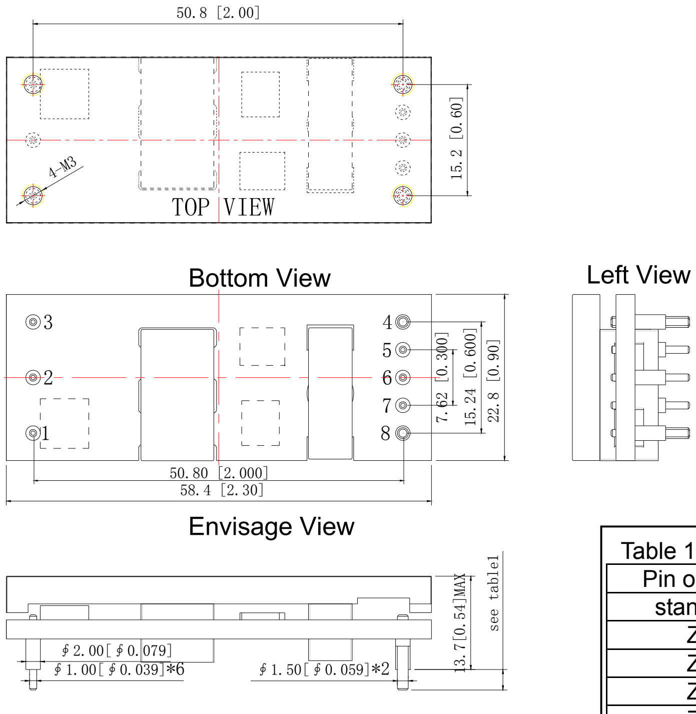


Figure17. Outline Diagram

Table 1

Pin options	Pin length
standard	3.60(0.142)
Z1	2.80(0.110)
Z2	4.57(0.180)
Z3	5.80(0.228)
Z4	6.35(0.250)

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 ± 0.25mm (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

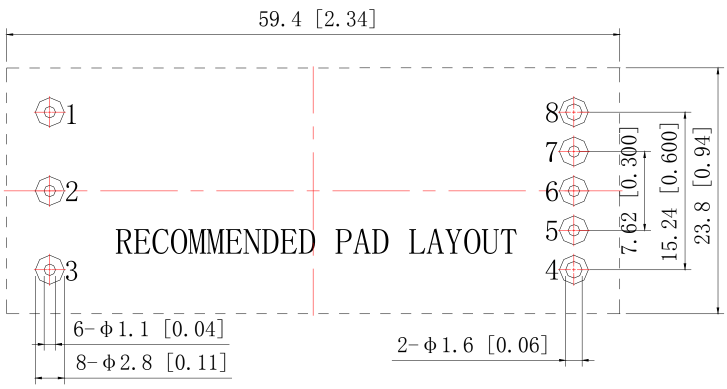


Figure18. Recommended Pad Layout

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 ± 0.25mm (x.xxx in. ± 0.010 in)

Packaging Details

The power model is supplied as standard in the antistatic tray shown in Figure 19.

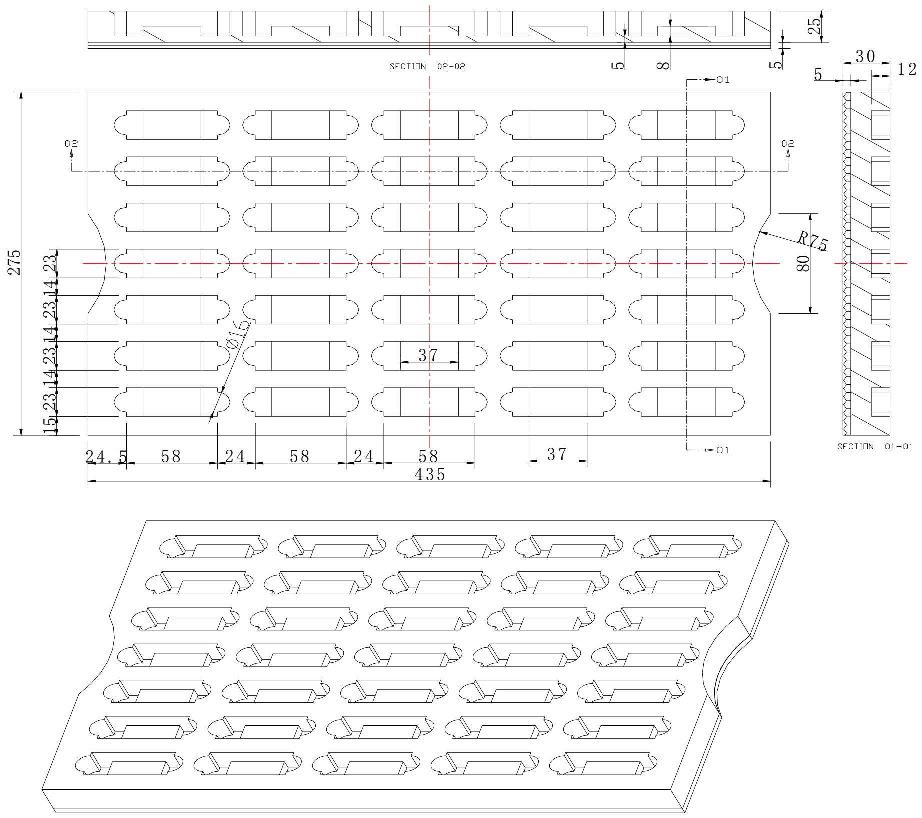
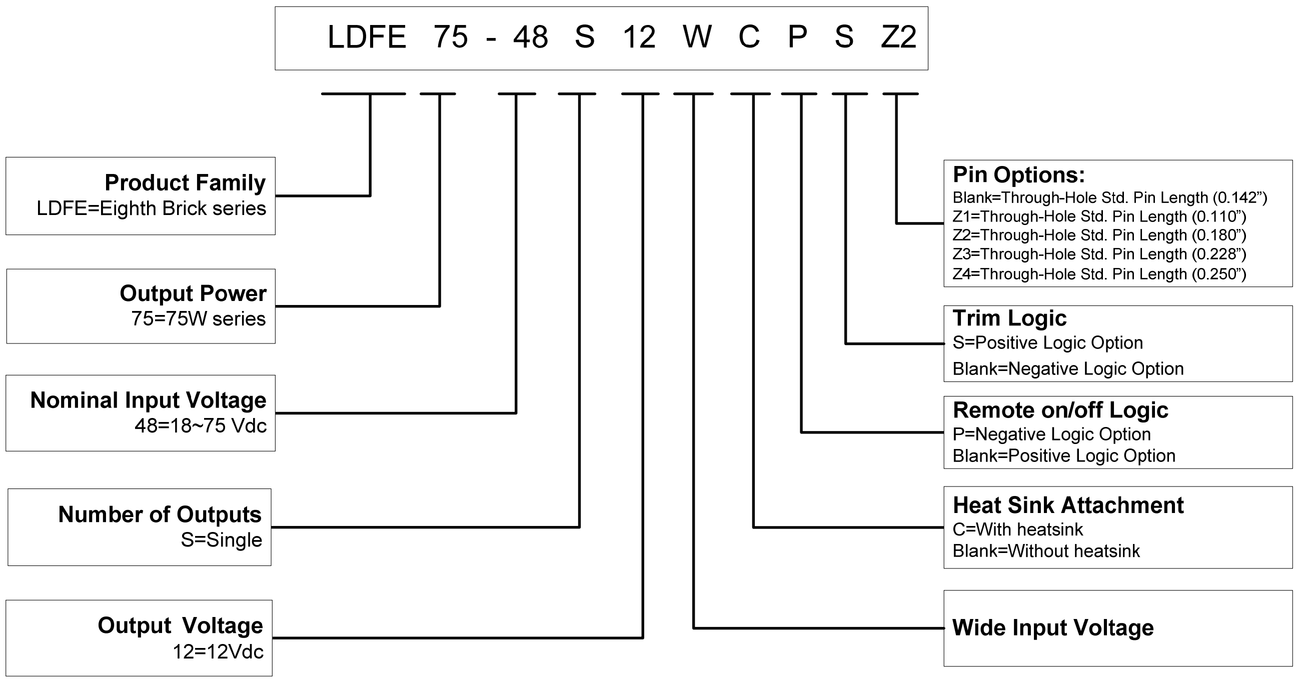


Figure19. Packaging Tray Diagram

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



Part number example

Part Number	Input voltage	Output voltage	Max Output Current	Remote on/off logic	Pin Length
LDFE75-48S12WCPS	18-75V	12V	6.25A	Negative	0.142''
LDFE75-48S12WCPSZ1	18-75V	12V	6.25A	Negative	0.110''
LDFE75-48S12WCPSZ2	18-75V	12V	6.25A	Negative	0.180"

For more information please contact SUPLET Co., Ltd.

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